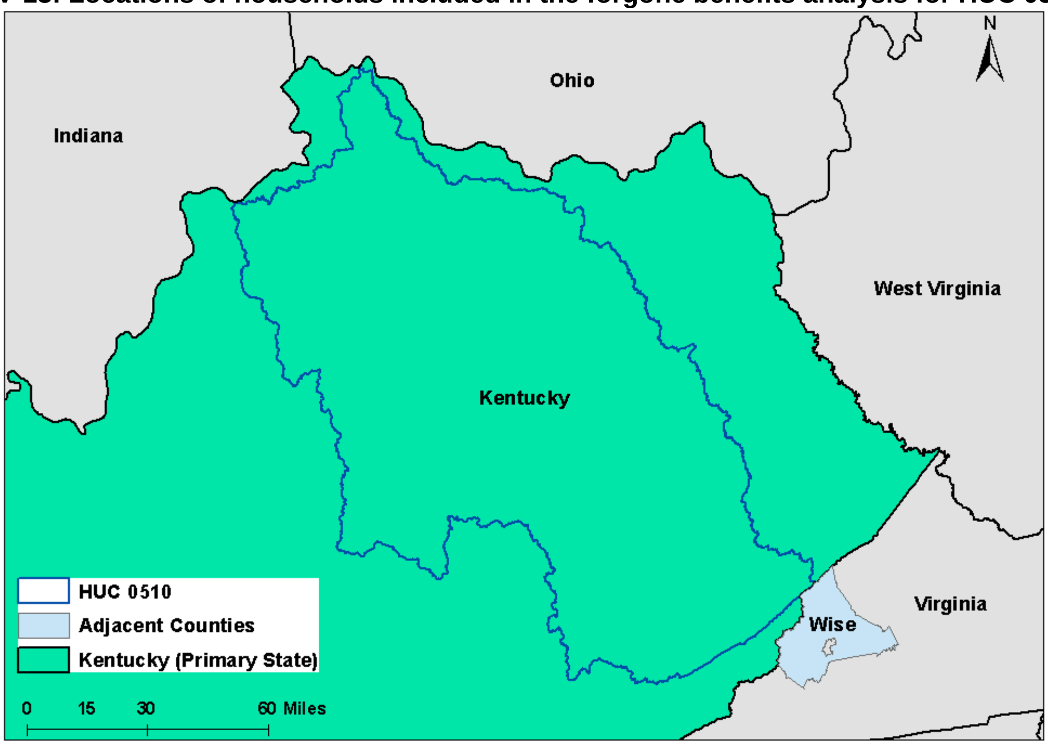
hydrologic, biogeochemical, and ecological water management services and enhance habitats for several different species (University of California Association of Natural Resource Extension Professionals, 2014).

The agencies calculated per acre estimates for the four different wetland types by dividing the WTP values by 500, the number of acres respondents were told to value in the survey. The agencies used the minimum and maximum WTP values for the four types of wetlands to derive low ($0.006/acre) and high ($0.038/acre) per acre WTP values, respectively. As noted above, the agencies estimated the total wetland and riparian area lost due to reduced mitigation requirements by (1) multiplying linear feet values provided in the ORM2 database by an average width of 50 feet and converting square feet to acres and (2) adding this value to the estimated annual loss of wetland acreage obtained from the ORM2 database based on mitigated impacts for relevant permits. The agencies then estimated annual forgone benefits by multiplying per acre WTP estimates by the total annual number of impact acres (sum of wetland acres and linear feet converted to acres) potentially affected by the proposed rule and the number of households that value required mitigation.

To determine the number of households that value the required mitigation, the agencies applied a similar methodology to the one used in Blomquist and Whitehead (1998). The survey population included all Kentucky households as well as households in four cities outside of, but bordering, western Kentucky: Evansville, IN; Clarksville, TN; Carbondale, IL; and Cape Girardeau, MO. Following Blomquist and Whitehead (1998), the agencies applied the household WTP value to all households in the watershed's primary state (Ohio for HUC 0509; Kentucky for HUC 0510) as well as households in areas adjacent to the watershed (Figure IV-11; Figure IV-12). Given that future location of 404 impacts is uncertain, the agencies used population in all counties within the affected watershed and counties adjacent to the watershed to determine potentially affected population residing outside of Kansas where the majority of 404 impacts occurred between 2011-2015.

Figure IV-12: Locations of households included in the forgone benefits analysis for HUC 0509.

Figure IV-13: Locations of households included in the forgone benefits analysis for HUC 0510.



The agencies calculated an annualized forgone benefit value based on forgone benefits from 2020 to 2039 (Eq. IV-1):

$$WTP_{Annualized} = \left(\sum_{T=2020}^{2039} \frac{HWTP_Y \times HH_Y}{(1+i)^{Y-2017}}\right) \times \left(\frac{i \times (1+i)^n}{(1+i)^{n+1} - 1}\right) \quad \textbf{Eq. IV-1}$$

Where:

$WTP_{Annualized}$	=	Annualized forgone benefit value in 2017 dollars
$HWTP_Y$	=	Annual household WTP in *Start Year* dollars for the required mitigation in year (*Y*)
HH_Y	=	Number of affected households in year (*Y*)
T	=	Year when benefits are realized
i	=	Discount rate (3 percent)
n	=	Number of periods for annualization (20 years for this analysis)

To estimate the number of affected households in future years, the agencies used projected population changes from 2015 to 2040 (Kentucky State Data Center, 2016; Ohio Development Services Agency, 2018; University of Virginia, 2017; West Virginia University, 2014) divided by the average number of people per household (U.S. Census Bureau, 2015).

Table IV-16 and Table IV-17 provide estimated annualized forgone benefits from lost mitigation requirements in the Ohio River Basin under different state response scenarios, with three percent and seven percent discount rates, respectively. HUC 0509 includes mitigation requirements in Kentucky, Ohio, and Indiana. Scenario 0 includes mitigation requirements in all three states. Under Scenarios 1, 2, and 3, only mitigation requirements in Kentucky are included. All mitigation requirements in HUC 0510 occur in Kentucky, which is not expected to regulate waters above the federal level under any scenarios. The estimated forgone benefits for HUC 0510 thus remain the same under all scenarios. Annualized forgone benefits for the Ohio River Basin under Scenario 0 range from a low of $ 0.50 million to a high of $4.52 million, while the total present value (TPV) of forgone benefits during the 2020-2039 study period ranges from $10.06 million to $90.47 million. For Scenarios 1, 2, and 3, annualized forgone benefits range from a low of $0.27 million to a high of $2.44 million, and TPV ranges from $5.43 million to $48.89 million. Similar to the estimates of avoided costs, these estimates are subject to uncertainty and limitations that are discussed in Section IV.B.4 of this report.

Table IV-16: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Ohio River Basin resulting from the proposed definitional change, by policy scenario (3% Discount Rate)

HUC	# Affected Households in 2020[3]	Scenario 0[1]		Scenario 1[1]		Scenarios 2 & 3[1,2]	
		Low	High	Low	High	Low	High
0509	5,170,870	$0.55	$3.65	$0.24	$1.57	$0.24	$1.57
0510	1,866,005	$0.13	$0.88	$0.13	$0.88	$0.13	$0.88
Total	**7,036,875**	**$0.68**	**$4.52**	**$0.37**	**$2.44**	**$0.37**	**$2.44**

[1] Estimated changes in average mitigation required per year are presented in Table IV-12. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 3% discount rate.

[2] Scenarios 2 and 3 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

Table IV-17: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Ohio River Basin resulting from the proposed definitional change, by policy scenario (7% Discount Rate)

HUC	# Affected Households in 2020[3]	Scenario 0[1]		Scenario 1[1]		Scenarios 2 & 3[1,2]	
		Low	High	Low	High	Low	High
0509	5,170,870	$0.41	$2.70	$0.17	$1.16	$0.17	$1.16
0510	1,866,005	$0.10	$0.64	$0.10	$0.64	$0.10	$0.64
Total	**7,036,875**	**$0.50**	**$3.34**	**$0.27**	**$1.80**	**$0.27**	**$1.80**

[1] Estimated changes in average mitigation required per year are presented in Table IV-12. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 7% discount rate.

[2] Scenarios 2 and 3 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

IV.B.2.2.3 Section 311

The Middle Ohio watershed (HUC 0509) includes a total of 32 FRP facilities across Indiana, Kentucky, Ohio, and West Virginia according to geospatial analysis of the EPA's internal database of FRP facilities. As noted in section II.C, the high resolution NHD data are not sufficiently complete or detailed in many parts of the United States to identify ephemeral streams that may change jurisdictional status under the proposed rule. These limitations apply to the watersheds in the Ohio River basin, as the high-resolution NHD data do not differentiate ephemeral streams in this region. For this reason, and since planning requirements consider proximity to *any* jurisdictional waters or wetlands as one factor in determining FRP applicability to a given facility, the agencies used the presence of perennial waters and wetlands abutting those waters as indication that FRP plan owners would reach the same FRP applicability determination under the proposed rule, *i.e.*, the proposed rule would have no impact on section 311 applicability to these facilities.

Of the total of 32 FRP planholders in the Middle Ohio watershed, the agencies found 30 FRP facilities with at least one perennial stream within a half-mile of the facility. The remaining two facilities are located in proximity to a wetland whose Cowardin codes indicate a perennial flow regime. Thus, the planholders would likely reach the same FRP applicability determination when assessing their facility's potential for a discharge to waters of the United States under the proposed rule given the proximity to waters within CWA jurisdiction within the planning distance.

There are six FRP facilities in the Kentucky-Licking watershed (HUC 0510), all in Kentucky. The geospatial analysis shows that all six facilities are located in close proximity to perennial streams (within a half-mile) as mapped in the high resolution NHD, in addition to also having other streams and wetlands in proximity. The presence of jurisdictional waters within the half-mile planning distance of the facilities suggests that the FRP determination would remain the same under the proposed rule even if some other waters within this radius become non-jurisdictional.

As described in Section IV.A.3, changes in the jurisdictional status of certain streams and wetlands may lead owners of some oil handling facilities to conclude that they do not pose a reasonable potential for a discharge of oil to waters of the United States. The agencies do not have sufficiently detailed information, such as facility coordinates, about facilities that prepared and maintain SPCC plans in the Ohio River watersheds to assess the potential impacts of the proposed rule on the universe of regulated facilities in the two case study watersheds.

Neither Indiana, Ohio, nor West Virginia have state-specific requirements for spill plans. Kentucky has established state-specific requirements for oil and gas facilities under 401.KAR.5:090, Control of Water Pollution from Oil and Gas Facilities. The state requirements specify that operators must develop and implement SPCC Plans "*when required under 40 CFR part 112.*" (emphasis added) Therefore, to the extent that some SPCC planholders forgo implementing the prevention measures required under SPCC, the risk of spills to ephemeral streams and other non-jurisdictional waters may increase.

Historical spill data provide limited illustration of the potential impacts. Between 2001 and 2017, EPA FOSCs oversaw responses to 31 oil spills affecting waters within the two case study watersheds. The resources affected in these incidents range from unnamed drainage ditches that flow into perennial or intermittent waterbodies to large traditional navigable waters such as the Ohio River. In one incident,[119] the discharge affected a dry creek bed but posed a threat to tributaries of the Ohio River. The EPA FOSC deployed to oversee the incident response noted that "response taken in the aftermath of the spill were effective in containing the migration of product to the immediate area downgradient of the wreck." In several incidents, the oil travelled along drainage paths before reaching a larger waterbody.

It is uncertain whether the FOSC determination to intervene due to impacts or threat to "waters of the United States" would have been different for these and other similar incidents under the proposed rule,

[119] http://www.epaosc.org/LewisUS25Spill

particularly in cases where the waters in the immediate path of the release are ephemeral streams or non-abutting wetlands.

IV.B.2.3 Potential Environmental Impacts

IV.B.2.3.1 Water Quality

To evaluate the potential water quality impacts of the proposed rule, the agencies developed models of the selected case study watersheds using the Soil and Water Assessment Tool (SWAT) (Nietsch et al. 2011). Each model encompasses roughly one 4-digit HUC watershed and delineates subbasins and reaches at the resolution of 12-digit HUCs. Land uses within each watershed are based on the 2006 National Land Cover Database (NLCD; Fry et al, 2011),[120] the 2011-2012 Cropland Data Layer (U.S. Department of Agriculture, 2015), as well as wetlands represented in the NWI. The SWAT model represents wetlands through both land cover (as provided in hydrologic response units, or HRUs) and as distinct hydrologic features within the subbasins. The SWAT models represent two main categories of wetlands in each subbasin: abutting wetlands that are hydrologically connected to the main reach of a subbasin, and non-abutting wetlands without a direct connection. The agencies used two HRU groups to represent each of the wetland land cover types, and two SWAT hydrologic features, ponds and wetlands, to represent the hydrology of the two wetland groups. The SWAT pond function was configured to represent non-abutting wetlands hydrology by specifying the aggregated subbasin area and depth of non-abutting wetlands according to the NWI data. In subbasins that include actual ponds, the wetland area was added to the ponds area since only one pond per subbasin is currently supported in SWAT. Abutting wetlands hydrology was represented by the SWAT wetlands function. By configuring the model this way, the agencies can distinguish the two wetland categories in modeling the impacts. As described below, the modeled scenarios address changes in the jurisdictional status of certain wetlands abutting streams with ephemeral flow regimes and riparian areas of ephemeral streams. The sensitivity analysis included in Appendix E also addresses changes to non-abutting wetlands. Table IV-18 describes the two models used for the Ohio River basin case study.

The agencies used estimates of potential changes in section 404 permits requiring mitigation of wetland impacts under the proposed rule (see Section IV.B.1.2.2 for details) to also specify scenario inputs for SWAT. These inputs include net changes in the number of wetland acres (including riparian areas) within each watershed due to forgone mitigation activities based on the analysis of the ORM2 permit data. They also include the associated changes in water storage and pollutant removal capacity provided by the wetlands. As discussed in Section IV.B.1.2.1, estimated changes in permitted point source discharges under section 402 are very small and the agencies therefore did not model incremental pollutant loads entering reaches within each watershed; existing point source loads were kept constant across the scenarios. The agencies further assumed no state-level regulation of waters potentially affected by the proposed rule (*i.e.*, Scenario 0).

[120] The 2006 NLCD is the most current data EPA pre-processed and incorporated into the Hydrologic and Water Quality System (HAWQS) to streamline the development of SWAT models for national-level analyses. EPA is in the process of updating HAWQS to incorporate the NCLD 2011 data and the agencies may be able to use these data in future analyses of this rulemaking.

Table IV-18: Summary of SWAT models used to estimate water quality impacts of the proposed rule in the Ohio River basin

Model characteristics	HUC 0509 Middle Ohio	HUC 0510 Kentucky-Licking
Total watershed area (square-miles)[1]	10,754	3,706
Number of HUC12 subbasins and reach segments modeled[2]	346	106
Average annual precipitation (in/year)	48.8	52.4
Baseline land use distribution:		
% developed	6.3%	2.3%
% agriculture	28.1%	44.7%
% forested	61.7%	51.3%
% water	3.0%	1.5%
% wetlands	0.9%	0.2%
Unmitigated stream and wetland impacts[3] under the proposed rule over 20 years (acres)	481.1	145.2
Unmitigated stream and wetland impacts[3] under the proposed rule over 20 years (% of baseline acres)	0.8%	2.9%

[1] The watershed area is based on the SWAT model and may differ from the description in the introduction to Section IV.B due to the omission or inclusions of HUC12 subbasins within the scope of each watershed as delineated in SWAT.

[2] For HUC 0509, reach-level predictions also include contributions from upstream watersheds HUCs 0503, 0505, 0506, 0507, 0508, and 0510.

[3] Unmitigated wetland impacts are based on permitted permanent impacts requiring mitigation and affecting wetlands abutting ephemeral streams from 2011-2015. Following the approach described in Section IV.B.1.2.2, the agencies assumed a width of 50 feet for permitted impacts provided in linear feet in the ORM2 database. For watershed HUC 0509, the values in this table include only impacts in HUC12s subbasins of HUC 0509 and do not include impacts within the catchment of upstream tributaries which may also affect reach-level predictions in HUC 0509.

IV.B.2.3.1.1 CWA Program Impacts

The agencies simulated the watershed response to land use changes over a 20-year period, based on permitted activities shown in the ORM2 database in 2011-2015, under both the baseline (without the proposed rule) and policy scenario (with the proposed rule). The differences between model predictions for these two scenarios illustrate the potential effects of the proposed rule on HUC12 reaches downstream from potentially affected waters. The watershed model enables the agencies to look at the impacts of changes occurring within each subbasin immediately draining to the reach concurrently with cumulative effects from areas of the watershed upstream of the reach. For HUC 0509, the upstream reaches include impacts from changes modeled in HUC 0510 since this watershed drains to a tributary of the Middle Ohio River.

Table IV-19 shows the predicted wetland impacts in HUCs 0509 and 0510 specified in the SWAT model. These inputs are derived from the same analysis of the ORM2 404 permit data described in Section IV.B.2.2.2 and used in estimating cost savings and forgone benefits under the 404 program. The impacts differ from the values reported under Section IV.B.2.2.2 because of differences in the temporal scope of the analysis and geographical extent of the SWAT watershed. First, while Section IV.B.1.2.2 reports impacts over the five-year period of 2011-2015 or as annual averages, SWAT models use as inputs impacts projected over a 20-year period, which are calculated by multiplying impacts in 2011-2015 by four. Second, while the SWAT models approximately cover the extent of HUC 0509 and HUC 0510 watersheds, the boundaries do not match exactly and the SWAT models omit some HUC12 subbasins with permit impacts in the 404 data (although these HUC12 subbasins may be represented in a different SWAT model); in particular, of 5.1 acres of permanent impacts reported in the ORM2 404 database in HUC 0510, 2.8 acres (54 percent) are located in subbasins of the SWAT model for that watershed (these 2.8 acres become 11.1 acres when projected over 20 years). Similarly, only a fraction of linear impacts in the relevant HUC12 watersheds in the section 404 data is captured within the geographical extent of the SWAT model. Overall, subbasins in the SWAT model encompass about half (47 percent) of the permanent impacts reported in the section 404 data for HUC 0510. This means that while the SWAT model results can provide further understanding of the forgone benefits analyzed in Section IV.B.1.2.2, the two analyses should not be compared directly.

Table IV-19: Summary of 404 program activities in Ohio River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers permanent impacts only.

Type of Potentially Affected Resource[2]	Permanent Impacts (Acres)	Permanent Impact (Linear Feet)	Total[1] Permanent Impacts (Acres)	Temporary Impact (Acres)	Temporary Impact (Linear Feet)	Total[1] Temporary Impacts (Acres)
HUC 0509						
Wetland abutting ephemeral stream	57.2	0	57.2	2.9	0	2.9
Ephemeral stream[3]	0.0	369,323	423.9	0	12,036	13.8
Total	**57.2**	**369.323**	**481.1**	**2.9**	**12,036**	**16.8**
HUC 0510						
Wetland abutting ephemeral stream	11.1	0	11.1	0.1	0	0.1
Ephemeral stream[3]	0.0	116,804	134.1	0.0	7,844	9.0
Total	**11.1**	**116,804**	**145.2**	**0.1**	**7,844**	**9.1**

[1] Represents the sum of impacts reported in acres and impacts reported in linear feet, assuming a width of 50 feet for linear impacts.

[2] See Table IV-8 for criteria used to identify affected resources that may change jurisdiction under the proposed rule.

[3] Represents forgone mitigation for impacts to riparian areas of ephemeral streams, assuming a total buffer 50 feet wide.

The ORM2 database measures authorized impacts as either areas or lengths. Following the approach in Section IV.B.1.2.2, the agencies assumed a width of 50 feet (total) for stream impact measured in linear feet and calculated the equivalent affected area. For the analysis described below, the agencies considered only forgone mitigation of permanent impacts, but temporary impacts may also require mitigation and the mitigation actions may have permanent effects. Appendix E provides the results of a sensitivity analysis that includes a wider (100 feet) riparian area for linear projects affecting ephemeral streams, forgone mitigation of temporary impacts presented in Table IV-19, and forgone mitigation of impacts to non-abutting wetlands.

The modeling baseline assumes continued regulation of some ephemeral streams and adjacent wetlands under the CWA, based on requirements contained in section 404 permits issued in 2011-2015 to mitigate permanent impacts to these waters. Not all ephemeral and intermittent streams are jurisdictional under the

2015 Rule (only those streams that meet the 2015 Rule's definition of "tributary" are jurisdictional). "Isolated" and non-perennial waters typically require a significant nexus test or other review to determine jurisdiction under pre-2015 practice. The agencies used issued 404 permits to develop inputs for the baseline scenario and therefore all waters affected by permitted activities were deemed to be jurisdictional under the definition of "waters of the United States" in effect at the time the permit was issued. This includes the ephemeral streams in Table IV-19. The modeling baseline assumes that future projects of a similar character as those in the ORM2 data set would get similar requirements over the next 20 years. Thus, under the assumed modeling baseline, a developer that permanently affects a wetland abutting ephemeral streams may be required to mitigate those impacts, for example by creating an equivalent wetland or purchasing corresponding credits, such that the wetland functions are maintained. The same would be true for stream impacts. For the purpose of modeling this scenario in SWAT, therefore, the agencies assume no net change in wetland or stream area, *i.e.*, mitigation actions replace affected waters on a one-to-one basis. While projects requiring 404 permits are diverse, for the SWAT analysis, the agencies further assume that permanent wetland and stream impacts arise from projects that increase developed areas, such as industrial development, low density residential areas, roads, etc., and replace wetlands with a mix of pervious and impervious surfaces. Conversely, the agencies assume that wetlands created through compensatory mitigation are placed on available agricultural land within the same subbasin. As such, the net effect of the modeled baseline is less agricultural land and more developed land (and not net change in wetland areas).

The agencies modelled this scenario in SWAT by increasing the areas of hydrologic response units (HRUs)[121] with developed land uses by the amount equivalent to the mitigation requirements in Table IV-19, and decreasing the areas of HRUs with agricultural land uses by the same amount. First, the agencies distributed the total changes in wetland areas across HUC12 subbasins within the watershed in proportion to existing wetland areas for those subbasins where development was also present in the SWAT model.[122] Then, the agencies applied the absolute change in acres to other land uses within each subbasin as appropriate depending on the Baseline or Policy scenario (*i.e.*, developed areas, agricultural land). Finally, within any given land use category in a HUC12 subbasin, the agencies distributed the subbasin-level change to individual HRUs in proportion to their existing area share.

In addition, because the SWAT model represents wetlands through both land use and as distinct hydrologic features within the subbasins, the agencies also adjusted the size of these features in the SWAT model to represent the scenario. Specifically, the agencies adjusted the dimensions of the two main types of wetlands in SWAT to account for the proposed policy changes and proportionally reduced the size of the catchment of each wetland.

[121] HRUs are the smallest spatial unit of analysis in the SWAT model. They are defined as unique combinations of subbasin, land use, soil, and slope within the modeled watershed.

[122] The agencies considered assigning changes in wetland areas based strictly on the HUC12 subbasins where each 404 permit was located but encountered instances where the HUC12 where the permitted activity was recorded did not have wetland land uses in the SWAT watersheds, or had fewer wetland acres than implied by mitigation activities over the 20-year analysis period. Rather than omitting some permitted activities or reassigning the permitted activities to other subbasins in an *ad hoc* manner, the agencies instead matched the total permitted activities at the HUC4 level and distributed them to the subbasins in proportion to modeled wetland land uses in subbasins where developed areas also exist.

The estimated changes due to the proposed rule are relatively small, as compared to both the total area of the watershed and the area of the affected land use type. Thus, mitigation requirements summarized in Table IV-19 total 481.1 acres in watershed 0509 and 145.2 acres in watershed 0510, which translates into 0.11 and 0.27 percent increases in the amount of development in HUC 0509 and HUC 0510, respectively, and 0.02 percent and 0.01 percent decrease in the total agricultural land in the two watersheds. The calculations are applied to each HUC12 subbasin and the magnitude of impacts therefore varies across the watersheds, as summarized in Table IV-20, which includes statistics for the subbasin with the largest absolute change.

Table IV-20: Summary of land use changes in Ohio River Basin SWAT watersheds resulting from 404 permits with permanent impacts to waters potentially affected by the proposed rule and with mitigation requirements, under baseline scenario

Land use	HUC12 Subbasins (largest absolute change)[1]		Total watershed (all subbasins)[1]	
	acres	% of existing land use	Acres	% of existing land use
HUC 0509				
Developed area	20.8	2.44%	481.1	0.11%
Agricultural area	-20.8	-0.15%	-481.1	-0.02%
HUC 0510				
Developed area	6.3	4.20%	145.2	0.27%
Agricultural area	-6.3	-0.43%	-145.2	-0.01%

[1] The number of subbasins with specified changes under the scenario is 300 in HUC 0509 (out of a total of 346 HUC12 subbasins in the watershed), and 84 in HUC 0510 (out of 106 subbasins).

The modeled Policy scenario accounts for the permanent reduction in wetland areas due to the removal of mitigation requirements for projects affecting ephemeral streams and non-abutting wetlands. The net effect of the scenario is a reduction in wetland and stream riparian areas due to forgone mitigation. Similar to the Baseline scenario described above, the agencies assumed that permitted projects result in increased developed land uses in the watershed, but this time the increase is accompanied by a net reduction in wetland areas. The agencies assumed that incremental development within each subbasin is of the same character as the existing developed land use (*e.g.*, if 70 percent of the development within the subbasin consists of low-density development, then 70 percent of the increase is assumed to be low density development). The agencies mapped the changes presented in Table IV-19 to the SWAT wetland land uses and wetland features.[123] Table IV-21 summarizes the changes by land use type. As described above, the agencies also adjusted the dimensions of SWAT wetlands to correspond to the estimated reduction in wetland and stream area within each subbasin. The potential effect of the proposed rule is thus two-fold: (1) changes in runoff/recharge and response to precipitation due to the changes in land cover, and (2) reduction in water storage and nutrient and sediment removal capacity.

[123] For the sensitivity analysis that includes impact to non-abutting wetlands, the agencies specified the changes in SWAT based on the type of wetland potentially affected by the proposed rule. Changes to wetlands abutting ephemeral streams and riparian areas were mapped to the woody wetland (WETF) land uses in SWAT and to the SWAT wetlands whereas changes to non-abutting wetlands were mapped to emergent/herbaceous wetland (WETN) land uses and to the SWAT ponds. Wetlands and ponds are standard SWAT modeling features defined at the level of individual subbasins.

Table IV-21: Summary of land use changes in Ohio River Basin SWAT watersheds resulting from 404 permits with permanent impacts to waters potentially affected by the proposed rule and with mitigation requirements, under Policy scenario

Land Use	HUC12 Subbasins (subbasin with largest absolute change)[1]		Total Watershed (all subbasins)[1]	
	acres	% of existing land use	acres	% of existing land use
HUC 0509				
Developed area	20.8	2.44%	481.1	0.11%
Wetland area[2]	-20.8	-1.05%	-481.1	-0.82%
HUC 0510				
Developed area	6.3	4.20%	145.2	0.27%
Wetland area[2]	-6.3	-3.64%	-145.2	-2.86%

[1] The number of subbasins with specified changes under the scenario is 300 in HUC 0509 (out of a total of 346 HUC12 subbasins in the watershed), and 84 in HUC 0510 (out of 106 subbasins).

[2] The difference between the percent of wetland land use affected in an individual HUC12 subbasin and for the overall watershed is due to the distribution of changes among HUC12 subbasins that have both existing wetland and developed areas. Some subbasins with wetland areas do not see changes under the modeled scenarios because they lack corresponding existing developed areas to increase. For example, in watershed HUC 0510, 89 of the 106 subbasins have existing wetlands. Of these 89 subbasins, 84 also have developed areas. The agencies distributed total wetland changes among these 84 subbasins in proportion to their existing wetland areas.

IV.B.2.3.1.2 Changes in Water Balance and Constituent Transport

Comparing SWAT outputs for the Policy scenario with those for the Baseline scenario indicates the potential net impacts of the proposed rule on the watershed and receiving streams. Those impacts – in terms of land use changes and wetland area – are first felt at the HUC12 subbasin level as changes in runoff, recharge, groundwater flows, and pollutant loadings delivered to the receiving reach. Table IV-22 summarizes changes in basin-level annual average water balance and constituent transport in the two watersheds. Table IV-23 and Table IV-24 summarize changes between the policy and baseline scenarios across subbasins within the two watersheds. Appendix D provides more detailed outputs.

Table IV-22: Summary of basin-level annual average water balance and constituent transport in Ohio River Basin SWAT watersheds

Parameter	HUC 0509				HUC 0510			
	Baseline	Policy	Change	% Change	Baseline	Policy	Change	% Change
Precipitation (mm)	1,239.00	1,239.00	0.00	0.0%	1,331.80	1,331.80	0.00	0.0%
Surface runoff (mm)	183.22	183.22	0.00	0.0%	357.12	357.12	0.00	0.0%
Lateral flow (mm)	218.70	218.69	-0.01	0.0%	78.03	78.30	0.27	0.3%
Groundwater flow (mm)	40.03	40.02	-0.01	0.0%	61.88	61.74	-0.14	-0.2%
Water yield (mm)	495.14	495.11	-0.03	0.0%	524.75	524.80	0.05	0.0%
Evapotranspiration (mm)	738.80	738.90	0.10	0.0%	739.90	739.90	0.00	0.0%
Sediment loading (ton/ha)	2.410	2.410	0.000	0.0%	1.17	1.18	0.010	0.9%
Organic N (kg/ha)	2.360	2.360	0.000	0.0%	7.008	7.010	0.002	0.0%
Organic P (kg/ha)	0.267	0.267	0.000	0.0%	0.582	0.583	0.001	0.2%

Table IV-22: Summary of basin-level annual average water balance and constituent transport in Ohio River Basin SWAT watersheds

Parameter	HUC 0509				HUC 0510			
	Baseline	Policy	Change	% Change	Baseline	Policy	Change	% Change
NO_3 in surface runoff (kg/ha)	0.954	0.954	0.000	0.0%	2.637	2.638	0.001	0.0%
NO_3 in lateral flow (kg/ha)	1.019	1.019	0.000	0.0%	0.593	0.593	0.000	0.0%
Soluble P yield (kg/ha)	0.137	0.137	0.000	0.0%	0.192	0.192	0.000	0.0%
NO_3 leached (kg/ha)	0.494	0.494	0.000	0.0%	2.535	2.535	0.000	0.0%
P leached (kg/ha)	0.009	0.009	0.000	0.0%	0.021	0.021	0.000	0.0%

Table IV-23: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 0509.

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	277	8	0.03	0.01	-0.18	0.50
Surface runoff (mm/yr)	151	142	0.00	0.00	-0.17	0.05
Lateral flow (mm/yr)	29	257	-0.01	0.00	-0.45	0.03
Groundwater flow (mm/yr)	8	285	-0.01	0.00	-0.23	0.01
Total water yield (mm/yr)	2	286	-0.03	-0.01	-0.62	0.01
Sediment yield (ton/ha/yr)	267	23	0.000	0.000	0.000	0.008
Organic N (kg/ha/yr)	280	15	0.000	0.000	0.000	0.008
Organic P (kg/ha/yr)	280	14	0.000	0.000	0.000	0.001
NO_3 in surface runoff (kg/ha/yr)	273	22	0.000	0.000	0.000	0.002
Soluble P (kg/ha/yr)	275	21	0.000	0.000	0.000	0.000

1 Total number of SWAT HUC12 subbasins is 346. Some modeled subbasins show no change in annual average values and are not included in the counts above.

Table IV-24: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 0510.

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	0	0	0.00	0.00	0.00	0.00
Surface runoff (mm/yr)	7	80	-0.20	-0.20	-1.00	0.06
Lateral flow (mm/yr)	84	0	0.27	0.30	0.00	1.02
Groundwater flow (mm/yr)	21	69	-0.09	-0.03	-3.65	4.30
Total water yield (mm/yr)	52	42	0.07	0.00	-2.12	3.69
Sediment yield (ton/ha/yr)	92	2	0.004	0.002	0.000	0.028
Organic N (kg/ha/yr)	88	7	0.002	0.001	-0.023	0.022
Organic P (kg/ha/yr)	78	17	0.000	0.000	-0.001	0.002
NO_3 in surface runoff (kg/ha/yr)	87	8	0.001	0.001	-0.005	0.008
Soluble P (kg/ha/yr)	40	55	0.000	0.000	0.000	0.001

1 Total number of SWAT HUC12 subbasins is 106. Some modeled subbasins show no change in annual average values and are not included in the counts above.

The direction of the changes is generally consistent with current understanding of wetland functions. Wetlands have been shown to play an important role in the biogeochemical cycling and removal of nutrients and in trapping suspended sediment. They also serve to buffer the response to storms by storing and slowly releasing surface water. Thus, all else being equal, increasing the amount of developed land within the watershed increases impervious cover, the amount of runoff generated in response to storm events, and associated nutrient and sediment loads. Accordingly, overall watershed results show an increase in lateral flow, decrease in groundwater flows, and increase in sediment, nitrogen, and phosphorus loads. The changes are relatively small (all less than one percent and many found to result in no change), which follows from the relatively small changes in land use and wetland storage specified for the policy scenario.

IV.B.2.3.1.3 Impacts to Streams

Changes within the immediate subbasin contributing to each reach affect the flow regime and water quality within the streams at the scale of HUC12 subbasins. The significance of these changes depends on their magnitude relative to other stream inputs such as point sources or contributions from upstream catchments.

The agencies compared SWAT model predictions for the Policy and Baseline scenarios to estimate changes in nutrient and sediment loadings to HUC12 streams, changes in runoff and subsurface flows, and instream constituent concentrations resulting from changes in both loads and flow regimes. Table IV-25 summarizes the direction and relative magnitude of mean annual changes over all reaches modeled in the two watersheds. Table IV-26 summarizes changes in mean annual loadings delivered to the outlet of each watershed. These results reflect the contributions from all upstream reaches and their respective catchments, as well as intervening instream processes modeled in SWAT, such as sediment deposition in stream channels and reservoirs. For HUC 0509, the results reflect changes within both the subbasins within the scope of the watershed, as well as those in HUC 0510 through tributary inputs.[124] More detailed results are included in Appendix D.

As shown in the two tables, the SWAT model outputs suggest that the proposed rule would increase nutrient and sediment loads in streams. This increase follows from the combined effects of reduced stream and wetland functions, as modeled in SWAT via the two wetland types, and land use changes described in the previous section. The relative magnitude of the changes at the scale of HUC12 reaches is attenuated by "background" contributions from point sources to these same reaches – which, in the context of this analysis, likely are not affected by the policy – and from upstream HUC12 reaches – which may or may not be affected by the policy, depending on whether the agencies modeled the changes

[124] SWAT model runs for HUC 0509 incorporate simulated flows and delivered loads at the outlet of HUC 0510 for each scenario (baseline and policy). The model run assumes no change in the contributions of other tributaries (HUCs 0503, 0505, 0506, 0507, and 0508), even though these tributaries would also see changes from forgone mitigation for some projects within the immediate catchments that affected resources that change jurisdictional status under the proposed rule. Omission of these impacts from the analysis of HUC 0509 understates the estimated impacts of the proposed rule on HUC 0509 reaches.

explicitly (*e.g.*, the agencies modeled changes in HUC 0510, but not changes affecting other tributaries to HUC 0509).

Table IV-25: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Ohio River Basin

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Absolute and Percent Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
HUC 0509							
Annual TN load (kg/yr)	300	12	105.5	4.5	0.01%	0.00%	0.11%
Annual TP load (kg/yr)	293	18	7.1	0.4	0.01%	0.00%	0.05%
Annual sediment load (kg/yr)	143	168	6.6	0.0	0.00%	0.00%	0.45%
Mean daily flow (cms)	13	298	-0.001	0.000	-0.01%	0.00%	0.01%
HUC 0510							
Annual TN load (kg/yr)	94	6	359.3	52.1	0.04%	0.03%	4.67%
Annual TP load (kg/yr)	90	10	20.4	3.5	0.03%	0.02%	3.10%
Annual sediment load (kg/yr)	64	36	18.2	0.0	0.04%	0.01%	4.22%
Mean daily flow (cms)	64	35	0.003	0.000	0.02%	0.00%	1.91%

1 Total number of reaches is 346 in HUC 0509 and 106 in HUC 0510. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table IV-26: Predicted changes in annual average loads delivered to the outlet of Ohio River Basin SWAT watersheds

Parameter	Baseline	Policy	Change	% Change
HUC 0509				
Annual TN load (kg/yr)	280,583	280,616	33	0.01%
Annual TP load (kg/yr)	79,524	79,526	2	0.00%
Annual sediment load (ton/yr)	2,227,544	2,227,541	-3	0.00%
HUC 0510				
Annual TN load (kg/yr)	8,683,858	8,686,931	3,072	0.04%
Annual TP load (kg/yr)	714,981	715,123	142	0.02%
Annual sediment load (ton/yr)	156,983	157,203	221	0.14%

On average across the modeled reaches, the proposed rule is predicted to increase mean daily flows, loadings, and concentrations slightly as compared to the baseline. While the direction of the changes suggests that reducing CWA jurisdiction under the proposed rule could have some adverse impacts, the magnitude of these changes is small and often zero at the HUC12 spatial resolution explicitly addressed in the SWAT model.

IV.B.2.3.2 Drinking Water

According to the EPA's Safe Drinking Water Information System (SDWIS) database, 29 community water systems get their source water from intakes located within the scope of the Middle Ohio SWAT watershed (HUC 0509) and 15 community water systems get their water from sources located in the Kentucky-Licking SWAT watershed (HUC 0510).

Results from the SWAT analysis show that daily suspended sediment concentration would increase in reaches with drinking water intakes in HUC 0509 and HUC 0510 as a result of forgone mitigation of ephemeral stream and non-abutting wetland impacts.[125] The estimated changes in average daily sediment concentration range from zero to 0.3 percent in HUC 0509, with an average increase of 0.05 percent. Changes in HUC 0510 range from less than -0.1 percent to 0.1 percent, with an average of 0.02 percent. Public water systems (PWS) use a variety of treatment processes to remove sediment through filtration and the addition of coagulants. Studies of drinking water treatment costs show that increased sediment loadings, and increased pollutants bound to these sediments, are likely to increase operation costs to the affected PWS (Dearmont, McCarl, & Tolman, 1998; Holmes, 1998; McDonald, Weber, Boucher, & Shemie, 2016). Given the small predicted changes in sediment loadings, the agencies did not estimate the potential change in drinking water treatment costs.

Table IV-27: Impacts to modeled reaches with public drinking water intakes under the proposed rule in the Ohio River Basin SWAT watersheds

SWAT Watershed HUC4	Number of community water systems	Number of intakes	Number of people served	Change in daily suspended sediment concentration		
				Min	Mean	Max
0509	29	49	1,375,475	-0.03%	0.02%	0.45%
0510	15	17	290,235	-0.06%	0.03%	0.25%
Total	**44**	**66**	**1,665,710**			

Source: EPA analysis of SDWIS (2017) data. Based on intakes located in the HUC12 subbasins within the scope of SWAT models for HUC 0509 and HUC 0510. The analysis assumes that intakes are located on the main stem within each HUC12. If intakes are instead located on a tributary to the main stem, the impacts may be lower or greater than those presented here, depending on forgone mitigation within the catchment of the relevant tributary.

IV.B.2.3.3 Dredging for Water Storage and Navigation

The SWAT models identify 11 reservoirs within the Middle Ohio watershed (HUC 0509) and one reservoir in the Kentucky-Licking SWAT watershed (HUC 0510).[126] Reservoirs serve many functions, including storage of drinking and irrigation water supplies, flood control, hydropower supply, and recreation. Streams can carry sediment into reservoirs, where it can settle and cause buildup of silt layers over time. Sedimentation reduces reservoir capacity (Graf et al. 2010) and the useful life of reservoirs unless measures such as dredging are taken to reclaim capacity (Clark, et al., 1985).

SWAT model runs predict increases in sediment deposition in reservoirs, calculated as the difference between fluxes in minus fluxes out of the reservoirs, by an average of 684 tons per year, a 0.1 percent increase from the baseline sediment deposition of 515,463 tons per year in HUC 0509. In HUC 0510,

[125] There are 49 surface water intakes within the scope of SWAT model HUC 0509 and 17 intakes within the scope of SWAT model HUC 0510.

[126] The SWAT watersheds include reservoirs identified in the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

sediment depositions are expected to increase by eight tons per year, a less than 0.1 percent increase from the baseline sediment flux of 57,025 tons per year (see Table IV-28 for detail).

Table IV-28: Summary of predicted net sediment depositions in reservoirs in the Ohio River Basin (tons/year) in 2040

HUC4	Number of reservoirs[1]	Net annual sediment deposition in reservoirs		Change relative to baseline	
		Baseline	Policy	Tons/year	Percent
0509	11	516,659	516,993	333	0.06%
0510	1	57,034	57,071	37	0.06%
Total	**12**	**573,693**	**574,064**	**370**	**0.06%**

[1] Reservoirs modeled in SWAT watersheds, based on the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

SWAT model outputs provide the estimated difference in annual sediment deposition relative to the baseline in 2040. Annual deposition is assumed to increase or decrease linearly throughout the analysis period until it equals the estimated 2040 value. For example, in the policy scenario (no mitigation and with land use change), the annual sediment deposition increases each year, increasing the cumulative change in sediment deposited in the reservoir relative to the baseline. Once the reservoir is dredged, the cumulative change relative to the baseline is reset, as it is assumed that the reservoir is dredged to the same level it would have been previously. The cumulative change in sediment will then begin to rise again at an increasing rate until the subsequent dredge. This pattern continues according to the dredging frequency until the end of the analysis period.

The frequency of reservoir dredging is highly site-specific, depending on many factors including the average sediment concentration of the influent river or stream, the flow regime, the size of the reservoir and excess storage capacity, and any sediment routing practices. For this analysis, the agencies chose a general frequency of reservoir dredging based on information presented by the Corps in a Final Dredged Material Management Plan and Environmental Impact Statement for reservoirs in Washington (U.S. Army Corps of Engineers, 2002). The report states that "dredging cycles may vary from 2 to 10 years" (U.S. Army Corps of Engineers, 2002, p. 66). A dynamic programming simulation of effective sediment management in reservoirs found that once the capacity of a reservoir reaches its steady state, sediment dredging should be practiced annually, assuming a constant unit cost of dredging (Kawashima, 2007, p. 4).[127] Given potential economies of scale that could result in a lower unit cost, the agencies used a dredging cycle of five years and the national average unit cost of dredging ($13.76 per cubic yard) to estimate a potential increase in dredging costs of reservoirs.[128] Detailed description of the methodology used in this analysis is presented in Appendix K of Benefit Cost Analysis of the Steam Electric Effluent

[127] Because site specific studies of dredging cycles for reservoirs are not available, the agencies synthesized information from two available studies to inform their assumption regarding dredging frequency in the Ohio River Basin case studies. Given that reservoir sedimentation is a common problem across the United States and all states use standard strategies to maintain reservoir capacity (*i.e.*, reduce sediment yield from upstream, route sediments, and remove sediment deposits), the agencies believe that it is reasonable to use studies of dredging cycles from other locations in the U.S. (Randle et al., 2017).

[128] The agencies used the national average unit cost of dredging from the analysis of USACE Dredging Information System Data for the U.S. from 1998-2018. Dredging costs were converted to 2017 U.S. dollars using the Construction Cost Index.

Limitations Guidelines and Standards for Steam Electric Power Generating Point Source Category (U.S. EPA 2015a).

Table IV-29: Annualized dredging cost changes in Ohio River Basin (2017$ thousands)

HUC4	Increase in Annual Sediment (cubic yards) (2040)	3% Discount Rate ($/year)			7% Discount Rate ($/year)		
		Low	Medium	High	Low	Medium	High
0509	333	$1.7	$1.8	$1.9	$1.3	$1.5	$1.6
0510	37	$0.2	$0.2	$0.2	$0.1	$0.2	$0.2
Total	**370**	**$1.9**	**$2.0**	**$2.1**	**$1.4**	**$1.7**	**$1.8**

Increased reservoir sedimentation due to forgone mitigation of section 404 project impacts on ephemeral streams is expected to generate additional annualized dredging costs of $1,802 with a three percent discount rate, or $1,468 with a seven percent discount rate in HUC 0509. In HUC 0510, the estimated increase in reservoir sedimentation is expected to generate additional annualized dredging costs of $200 with a three percent discount rate, or $163 with a seven percent discount rate. These estimates are subject to uncertainty. For example, some states may implement erosion controls in the upstream watershed to reduce the rate of sedimentation in the affected reservoirs instead of sediment dredging (Randle et al., 2017). The cost associated with erosion control strategies may be greater or lower than the estimated dredging costs. Also, more frequent dredging may lead to higher annualized costs due to the discounting effect. See Section IV.B.4 for more detail on uncertainties in this analysis.

IV.B.2.3.4 Ecosystem Services Provided by Wetlands and Ephemeral Streams

In reviewing the Draft Connectivity Report entitled "Connectivity of Streams and Wetlands to Downstream Waters: A Review of the Scientific Evidence,"[129] EPA's Science Advisory Board (SAB) found that "[t]he literature review provides strong scientific support for the conclusion that ephemeral, intermittent, and perennial streams exert a strong influence on the character and functioning of downstream waters and that tributary streams are connected to downstream waters," at the same time the SAB stressed that "the EPA should recognize that there is a gradient of connectivity."[130] The SAB recommended that "the interpretation of connectivity be revised to reflect a gradient approach that recognizes variation in the frequency, duration, magnitude, predictability, and *consequences* of physical, chemical, and biological connections."[131] As the preamble to the proposed rule describes, the SAB found perennial and intermittent streams have a greater probability to impact downstream waters compared to ephemeral streams.

[129] U.S. EPA. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (External Review Draft)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R11/098B, September 2013.

[130] Letter to Gina McCarthy. October 17, 2014. SAB Review of the Draft EPA Report Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence. Page 3.

[131] *Id*. at 2 (emphasis added).

The agencies recognize that waters within a watershed are connected along such a gradient and that the degree of connectivity among aquatic components varies along a continuum from highly connected to highly isolated (U.S. EPA 2015b). Although isolated, ephemeral streams and isolated wetlands support various ecosystem services. For example, ephemeral streams, including dry channels, have a role in supporting biodiversity. Their functions may vary depending on stream phases: water flow, pools, and dry bed. Occasional flow in ephemeral streams provides opportunities for aquatic organism dispersal. Pools may provide habitat for amphibians, snails, and insects and drinking water for wild animals, particularly during droughts (Stubbington et al. 2017). Several amphibian species found in the study area, such as the four-toed salamander, wood frog, and Ohio's state amphibian the spotted salamander, breed primarily in ephemeral wetlands not hydrologically connected to the stream network (or vernal pools), where there are fewer predators than in permanent waterbodies (Kern, Nassar, C., & Dorcas, 2013; Semlitsch & Skelly, 2007). Ephemeral streams in the Middle Ohio (HUC 0509) and Kentucky-Licking (HUC 0510) watersheds also provide habitat for state-listed threatened and endangered species, including streamside salamander listed as endangered in West Virginia and red salamanders listed as endangered in Indiana (Schneider, 2010; IUCN SSC Amphibian Specialist Group, 2014; Niemiller, et al., 2006).

IV.B.3 Case Study 2: Lower Missouri River Basin

This case study area encompasses the area along the border of Nebraska and Kansas, stretching into Colorado on the west and touching the Missouri River on the east. The Republican River and Kansas River watersheds lie mainly within the High Plains and Central Great Plains ecoregions. There are several climate zones in the area, ranging from mild mid-latitude and humid to dry steppe climates. Summers are typically hot, and winters can be mild to severe. Annual precipitation ranges from 305 to 940 mm (12 to 37 inches). Most streams in the area are intermittent, and a few are perennial. Land is primarily used for cropland. Other uses include land for grazing as well as oil and gas production (CEC, 2011).

Figure IV-13 and Figure IV-14 show maps of the HUC 1025 and HUC 1027 case study watersheds, respectively. The Republican River is a tributary to the Kansas River and therefore the outlet of watershed HUC 1025 flows into HUC 1027, along with contributions from HUC 1026.

Figure IV-14: Map of HUC 1025 – Republican River Basin showing high-resolution NHD water features and NWI wetlands in relation to state boundaries, populated areas, and major roads.

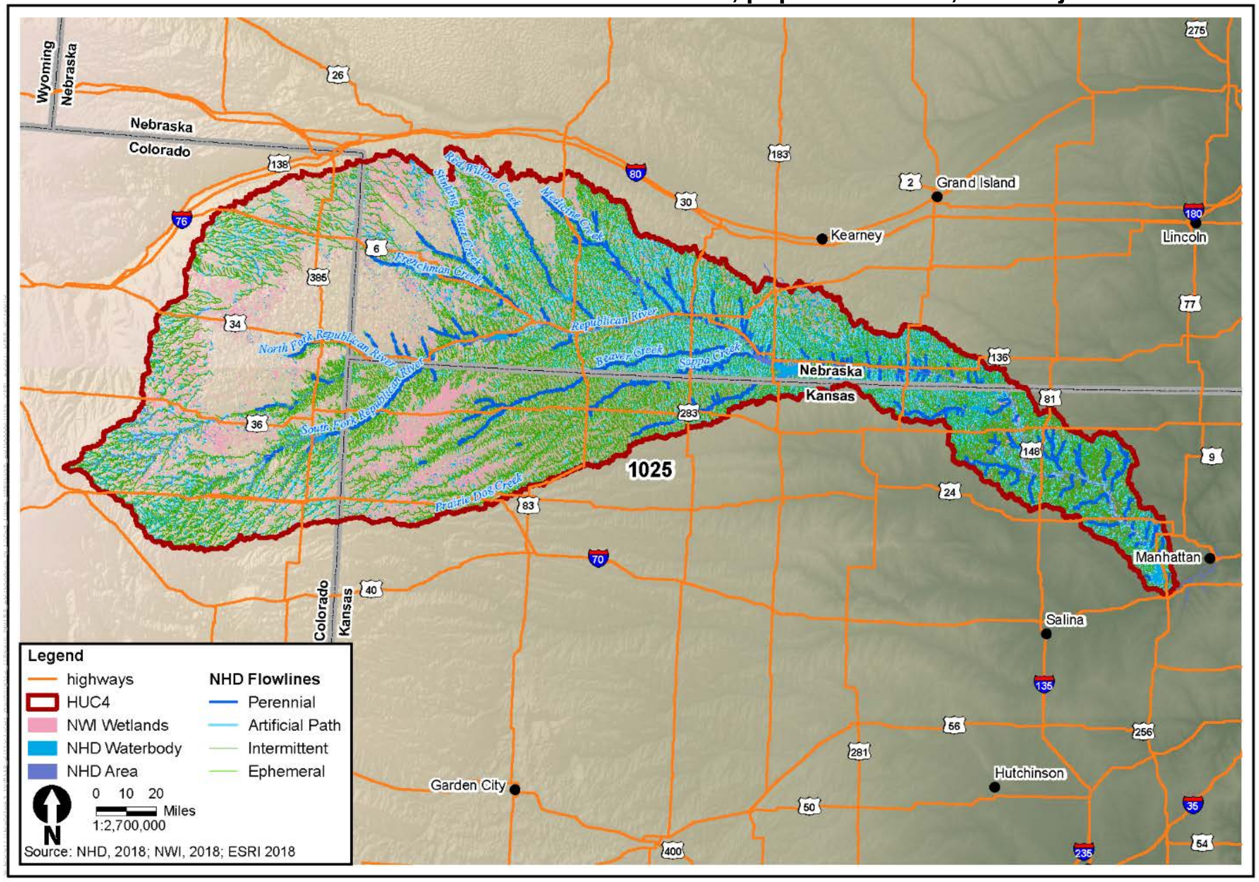
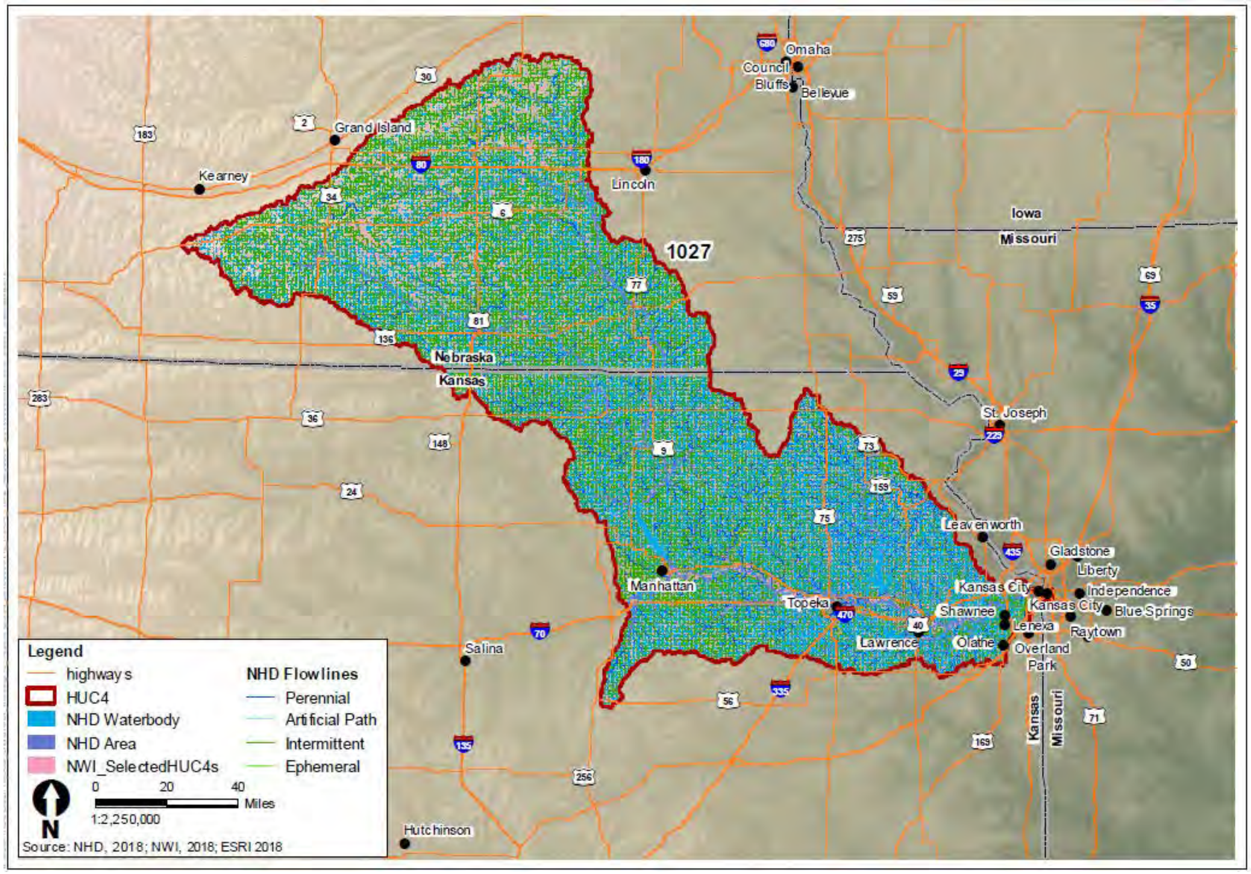


Figure IV-15: Map of HUC 1027 – Kansas River Basin showing high-resolution NHD water features and NWI wetlands in relation to state boundaries, populated areas, and major roads.



IV.B.3.1 Aquatic Resources Characteristics

Table IV-30 summarizes the hydrography within the case study watersheds in terms of the number of stream miles in each flow category and acres of non-abutting abutting wetlands based on the agencies' geospatial analysis[132] of the high resolution NHD and the NWI. As presented in the table, 77 to 86 percent of all stream miles within the two watersheds are either ephemeral or intermittent, and 11 to 17 percent of all wetland acres are non-abutting (*i.e.*, not touching, intersecting, or adjacent per the proposed rule to high resolution NHD streams).[133] As was the case for the Ohio River basin, the NHD data within the study areas generally do not differentiate streams according to their flow regime, which explains the very small number of ephemeral reach miles, relative to the total number of reach miles. To overcome this limitation in the analyses of program impacts, the agencies therefore again relied on information available in permits and in the NWI data to identify impacts to ephemeral streams, wetlands abutting ephemeral streams, and non-abutting wetlands.

[132] *See* Resource and Programmatic Assessment, Section I: Aquatic Resource Analysis for details.

[133] The agencies do not know how many wetlands that were determined to be "non-abutting" might have a direct hydrologic surface connection with a jurisdictional water and would thus be jurisdictional under the proposed rule.

Table IV-30: Hydrographic profile of case study watersheds in the Lower Missouri River Basin					
Feature type	Feature attributes	HUC 1025		HUC 1027	
		Miles or Acres	Percent of total	Miles or Acres	Percent of total
Streams (miles)	**Total**	40,561	100%	37,933	100%
	Perennial	2,339	6%	5,361	14%
	Intermittent	35,031	86%	29,362	77%
	Ephemeral	1	0%	11	0%
	Artificial path	2,407	6%	2,819	7%
	Other[1]	784	2%	380	1%
Wetlands (acres)	**Total**	356,673	100%	398,436	100%
	Abutting	242,234	68%	325,484	82%
	Non-abutting	114,439	32%	72,951	18%

[1] Includes canal, ditches, aqueducts, and other features without attributes.

The values are based on the agencies' geospatial analysis of NHD and NWI data and reflect gaps in NHD stream attributes.

IV.B.3.2 Program Changes

IV.B.3.2.1 Section 402

Table IV-31 presents the number of NPDES permits issued in the Lower Missouri River Basin by the most common industry categories. The number of permits issued in the two case study watersheds includes 538 individual permits and 1,940 general permits. Twenty-eight permits in the Lower Missouri River Basin have at least one discharge near an ephemeral stream (3 individual and 25 general permits).[134] Based on the permits with SIC codes, the most common industry requiring NPDES permits with at least one discharge near an ephemeral stream in the Lower Missouri River Basin include aggregate mining (15 permits) and construction and development (4 permits).

Table IV-31: Section 402 individual permits (SIC codes in parentheses) issued in case study watersheds in the Lower Missouri River Basin						
Industry category	Individual permits[1]			General permits[1]		
	Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]		Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]	
		Number of permits	Percent of all permits		Number of permits	Number of permits
HUC 1025						
Sewerage Systems (4952)	34	0	0%	8	1	13%
Aggregate Mining[3]	3	0	0%	21	15	71%
Construction and Development[4]	0	0	0%	47	4	9%
Ready-Mixed Concrete (3273)	0	0	0%	4	1	25%

[134] Note that none of the permits the agencies reviewed for this watershed affected waters with the code "R4SBJ." All permits shown in Table IV-31 as having a discharge point near ephemeral streams affect waters with a Cowardin code "R4SBA."

Table IV-31: Section 402 individual permits (SIC codes in parentheses) issued in case study watersheds in the Lower Missouri River Basin

Industry category	Individual permits[1]			General permits[1]		
	Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]		Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]	
		Number of permits	Percent of all permits		Number of permits	Number of permits
Petroleum Bulk Stations and Terminals (5171)	0	0	0%	1	1	100%
Other Categories[5]	70	0	0%	31	-	0%
Missing SIC Codes	6	2	33%	150	1	1%
Total	**113**	**2**	**2%**	**262**	**23**	**9%**
HUC 1027						
Sewerage Systems (4952)	161	0	0%	9	0	0%
Aggregate Mining[3]	24	0	0%	8	0	0%
Construction and Development[4]	1	0	0%	17	0	0%
Ready-Mixed Concrete (3273)	0	0	0%	12	0	0%
Petroleum Bulk Stations and Terminals (5171)	0	0	0%	2	0	0%
Other Categories[5]	140	0	0%	152	0	0%
Missing SIC Codes	99	1	1%	1,480	2	0%
Total	**425**	**1**	**0%**	**1,680**	**2**	**0%**
Total for both watersheds	**538**	**3**	**1%**	**1,942**	**25**	**1%**

[1] Source: EPA's ICIS-NPDES data, 2017. The facility permits included in the spatial analysis are limited to those for which the ICIS-NPDES database includes valid latitude/longitude coordinates. For permits with multiple SIC codes, only one SIC code was retained, with manufacturing industries prioritized, to avoid double-counting.

[2] The agencies used the Cowardin classification code in NWI to determine whether 402 discharges are likely to affect ephemeral streams (*i.e.*, the agencies interpreted Cowardin codes R4SBA and R4SBJ as ephemeral; *see* Section IV.B for more detail). All permits shown as having a discharge point near ephemeral streams affect waters with a Cowardin code R4SBA.

[3] Includes SIC Codes 1422, 1423, 1429, 1442, 1446, 1459, 1474, 1475, 1481, and 1499.

[4] Includes SIC Codes 1629, 1794, 6552, 1611, 1799, 1521, 1522, and 1623.

[5] Includes multiple categories, such as Asphalt Paving Mixtures and Blocks (2951), Animal Feeding Operations (211, 212, 213, 214, 219, 241, 251, 252, 253, 254, 259, 271, 272, and 279), Electric Services (4911), Industrial Domestic Wastewater Treatment (6513, 6514, 6515, 7011, 7032, 7033, 8211, 8221, 8641, and 8661), Industrial Organic Chemicals (2869), Motor Vehicle Parts, Used (5015), Refuse Systems (4953), Trucking Facilities (4212, 4231), and Water Supply (4941).

The majority of section 402 permit holders in the Lower Missouri River Basin have technology-based effluent limitations (TBELs), including sewage systems (secondary), aggregate mining, and construction and development. The ready-mixed concrete and petroleum bulk stations and terminals industries do not have national TBELs. For facilities in these two industry categories, effluent limitations are either water quality-based (WQBELs) for pollutants with applicable water quality standards, or TBELs based on the best professional judgement of the permit writer (U.S. EPA; 2011).

Of the three individual NPDES permits potentially affecting ephemeral streams, none (0) have WQBELs. Should the definition of "waters of the United States" change, a permittee subject to more stringent limits based on a WQBEL could request a revision of its WQBEL to account for potential dilution or attenuation of the pollutant(s) occurring between end-of-pipe and the point where the effluent enters jurisdictional waters. Under this scenario, the permittee may realize cost savings as compared to meeting the previous permit limits.

NPDES permits potentially affecting ephemeral waters (25 general and 3 individual) were issued in two states in the Lower Missouri River Basin (Colorado and Kansas). Colorado and Kansas are expected to regulate waters beyond the CWA under Scenario 2 (3) only.[135] All permits potentially affecting ephemeral waters thus drop from consideration under Scenario 2 (3). Section II.A describes potential state responses and different analytic scenarios in more detail.

NPDES permits issued under the ready-mixed concrete and petroleum bulk stations and terminals categories are not subject to national TBELs. In the Lower Missouri River Basin case study watersheds, two permits potentially affected by the proposed rule were issued in these categories from 2011-2015. Both of these permits were issued in Colorado and thus drop from consideration under Scenario 2 (3).

IV.B.3.2.2 Section 404

To estimate the effect of reduced mitigation requirements for non-abutting wetlands and ephemeral streams on potential cost savings and forgone benefits, the agencies used the approach described in Section IV.B.1.2.2. Table IV-32 summarizes section 404 permits issued in 2011-2015 within the Lower Missouri River Basin that required mitigation on RPWWN-type wetlands or ephemeral streams. As presented in the table, the agencies' geospatial analysis shows 40 permits in HUC 1025 and 57 permits in HUC 1027 issued by the Corps with impacts that required mitigation on waters potentially affected by the proposed changes to the definition of "waters of the United States." Permanent impacts resulting from 404 permits issued in 2011-2015 included annual averages of 0.1 acres and 6,646 linear feet in HUC 1025 and 0.9 acres and 7,873 linear feet in HUC 1027. In both case study watersheds, permit impacts occurred in Kansas and Nebraska. Kansas and Nebraska are likely to implement state regulations more stringent than the federal level (*i.e.*, impacts excluded in Scenarios 2 and 3).

Table IV-32: Section 404 permits issued in case study watersheds in the Lower Missouri River Basin (2011-2015)[1]

State	# Permitted Projects	# Permits with mitigation requirements potentially affected by proposed changes to the definition of "waters of the United States"[2]	Permanent impacts		Temporary impacts	
			Acres	Length Feet	Acres	Length Feet
HUC 1025						
CO	10	0	0.00	0	0.00	0
KS	207	38	0.63	33230	0.00	5005
NE	141	2	0.02	0	0.00	0
Total	**358**	**40**	**0.65**	**33,230**	**0.00**	**5,005**
Avg. per year	**72**	**8**	**0.13**	**6,646**	**0.00**	**1,001**

[135] Scenarios 2 and 3 are identical for the 402 program analysis.

Table IV-32: Section 404 permits issued in case study watersheds in the Lower Missouri River Basin (2011-2015)[1]

State	# Permitted Projects	# Permits with mitigation requirements potentially affected by proposed changes to the definition of "waters of the United States"[2]	Permanent impacts		Temporary impacts	
			Acres	Length Feet	Acres	Length Feet
HUC 1027						
KS	742	52	4.22	39,131	0.30	730
MO	1	0	0.00	0	0.00	0
NE	288	5	0.43	236	0.00	0
Total	**1031**	**57**	**4.65**	**39,367**	**0.30**	**730**
Avg. per year	**206**	**11**	**0.93**	**7,873**	**0.06**	**146**

[1] Values based on permits with mitigation requirements on waterways determined to be RPWWN-type wetlands or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services.

[2] Number of permits includes permits with mitigation requirements that potentially affect at least one water no longer jurisdictional under the CWA under the proposed rule.

Table IV-33 presents expected reductions in average annual mitigation requirements in the Lower Missouri River Basin under different likely state response scenarios following the proposed "waters of the United States" definitional changes. Section IV.B.1.2.2 provides detail on input data and the assumptions used in this analysis.

Table IV-33: Estimated changes in average mitigation required per year in the Lower Missouri River Basin, by policy scenario

State	Expected Reduction in Average Mitigation Acres per Year[1,2]			Expected Reduction in Average Mitigation Length Feet per Year[1,2]			Expected Reduction in Average Mitigation Riparian Acres per Year[1,2,3]		
	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3
HUC 1025									
KS	0.1	0.0	0.0	6,646	0	0	7.6	0.0	0.0
NE	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Total	**0.1**	**0.0**	**0.0**	**6,646**	**0**	**0**	**7.6**	**0.0**	**0.0**
HUC 1027									
KS	0.8	0.0	0.0	7,826	0	0.0	9.0	0.0	0.0
NE	0.1	0.0	0.0	47	0	0.0	0.1	0.0	0.0
Total	**0.9**	**0.0**	**0.0**	**7,873**	**0**	**0.0**	**9.0**	**0.0**	**0.0**

[1] Values based on permits with mitigation requirements on waterways determined to be RPWWN-type wetlands or ephemeral streams. Excludes permits issued for mitigation or restoration activities because these permits do not result in the loss of ecosystems services provided by wetlands and streams. Permanent acre and linear feet impacts provided in the ORM2 database are used to estimate mitigation requirements. The agencies assumed a 1:1 ratio for compensatory requirements based on the USACE guidance (U.S. Army Corps of Engineers 2014).

Table IV-33: Estimated changes in average mitigation required per year in the Lower Missouri River Basin, by policy scenario

State	Expected Reduction in Average Mitigation Acres per Year[1,2]			Expected Reduction in Average Mitigation Length Feet per Year[1,2]			Expected Reduction in Average Mitigation Riparian Acres per Year[1,2, 3]		
	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] Based on mitigation lengths where impacts in linear feet are converted to acres by multiplying total linear feet by an average width of 50 feet (25 feet on each side of the stream) and converting square feet to acres.

IV.B.3.2.2.1 Cost Savings

To estimate permit cost savings, the agencies determined the average number of individual and general 404 permits issued each year, based on permits issued from 2011 to 2015, that potentially affect only waters no longer considered "waters of the United States" under the proposed rule. The agencies then multiplied the annual average number of reduced individual and general permits by lower bound USACE estimates of permit costs (U.S. EPA and Department of the Army, 2015). The agencies used the lower bound estimate to avoid double-counting compensatory mitigation costs.

Table IV-34 shows the average number of reduced individual and general 404 permits, USACE unit application costs, and the estimated reduction in permit applications costs for individual and general 404 permits in the Lower Missouri River Basin under each scenario. The USACE unit cost estimates ($14,700 per individual permit; $4,400 per general permit) are adjusted from 1999$ to 2017$ using the CPI-U.

Permits affecting only RPWWN-type wetlands and ephemeral streams were issued in three states in HUC 1025 (Colorado, Kansas, and Nebraska) and two states in HUC 1027 (Kansas and Nebraska). Under Scenarios 0 and 1, the average annual reduction in 404 permit application costs for the Lower Missouri River Basin is approximately $0.26 million. Under Scenario 2, which includes permit reductions in Colorado, permit cost savings drop to less than $0.01 million. Under Scenario 3, permit cost savings drop to $0 since all states are expected to regulate waters beyond the CWA.

Table IV-34: Average annual reduction in 404 permit application costs in the Lower Missouri River Basin

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Scenario 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)
HUC 1025							
IP	$14,700	0.0	$0.00	0.0	$0.00	0.0	$0.00
GP	$4,400	21.0	$0.09	0.8	<$0.01	0.0	$0.00
Total		**21.0**	**$0.09**	**0.8**	**<$0.01**	**0.0**	**$0.00**

Table IV-34: Average annual reduction in 404 permit application costs in the Lower Missouri River Basin

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Scenario 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Rule	Estimated Reduction in Permit Costs (millions 2017$)
HUC 1027							
IP	$14,700	1.0	$0.01	0.0	$0.00	0.0	$0.00
GP	$4,400	34.6	$0.15	0.0	$0.00	0.0	$0.00
Total		**35.6**	**$0.17**	**0.0**	**$0.00**	**0.0**	**$0.00**
Both Watersheds							
IP		1.0	$0.01	0.0	$0.00	0.0	$0.00
GP		55.6	$0.24	0.8	<$0.01	0.0	$0.00
Total		**56.6**	**$0.26**	**0.8**	**<$0.01**	**0.0**	**$0.00**

[1] Includes permits estimated to only affect waters no longer jurisdictional under the CWA under the proposed rule.

[2] Scenarios 0 and 1 are combined because all values are identical.

To estimate annual cost savings from reduced mitigation requirements, the agencies multiplied the cost of each mitigation acre or linear foot (low and high estimates) by the expected reduction in annual mitigation requirements (Table IV-33), and summed the estimated cost savings for each scenario. The agencies estimated low and high per acre and liner foot mitigation costs for each state. Table IV-35 provides annual cost savings estimates from reduced mitigation requirements in the Lower Missouri River Basin under different policy scenarios. Annual mitigation cost savings under Scenarios 0 and 1 range from a low of $1.36 million to a high of $5.34 million. Cost savings drop to $0 under Scenarios 2 and 3 since Kansas and Nebraska, the two states where all mitigation requirement reductions occur in the two case study watersheds, are expected to regulate waters beyond CWA requirements.

Table IV-35: Annual cost savings (2017$) of reduced mitigation requirements in the Lower Missouri River Basin resulting from the proposed definitional change, by policy scenario

State	Cost Per Acre (2017$)		Cost Per Linear Foot (2017$)		Scenarios 0 & 1[1,2] (Millions 2017$)		Scenario 2[1] (Millions 2017$)		Scenario 3[1] (Millions 2017$)	
	Low	High	Low	High	Low	High	Low	High	Low	High
HUC 1025										
KS	$54,000	$105,400	$90	$360	$0.60	$2.41	$0.00	$0.00	$0.00	$0.00
NE	$54,000	$105,400	$90	$360	<$0.01	<$0.01	$0.00	$0.00	$0.00	$0.00
Total	-	-	-	-	**$0.61**	**$2.41**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
HUC 1027										
KS	$54,000	$105,400	$90	$360	$0.75	$2.91	$0.00	$0.00	$0.00	$0.00
NE	$54,000	$105,400	$90	$360	$0.01	$0.03	$0.00	$0.00	$0.00	$0.00
Total	-	-	-	-	**$0.76**	**$2.93**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Table IV-35: Annual cost savings (2017$) of reduced mitigation requirements in the Lower Missouri River Basin resulting from the proposed definitional change, by policy scenario

State	Cost Per Acre (2017$)		Cost Per Linear Foot (2017$)		Scenarios 0 & 1[1,2] (Millions 2017$)		Scenario 2[1] (Millions 2017$)		Scenario 3[1] (Millions 2017$)	
	Low	High	Low	High	Low	High	Low	High	Low	High
Both Watersheds										
Total	-	-	-	-	**$1.36**	**$5.34**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table IV-33. For each state, cost savings are calculated by multiplying the cost of each mitigation acre or linear foot (low and high estimates) by the expected reduction in annual mitigation requirements, and summing the acreage and linear feet values for each scenario.

[2] Scenarios 0 and 1 are combined because all values are identical.

Table IV-36 provides total annual 404 program cost savings estimated in the Lower Missouri River Basin resulting from the proposed rule, under each policy scenario. Total costs savings combine the estimated reduction in permit costs and mitigation requirements. Under Scenarios 0 and 1, estimated cost savings range from a low of $1.62 million to a high of $5.60 million. Estimated cost savings drop to less than $0.01 million under Scenario 2, which includes permit cost savings in Colorado. Under Scenario 3, total estimated cost savings drop to $0.

Table IV-36: Total annual estimated cost savings in the Lower Missouri River Basin (Millions 2017$)

HUC	Scenarios 0 & 1[1,2]		Scenario 2[2]		Scenario 3[2]	
	Low	High	Low	High	Low	High
1025	$0.70	$2.50	<$0.01	<$0.01	$0.00	$0.00
1027	$0.93	$3.10	$0.00	$0.00	$0.00	$0.00
Total	**$1.62**	**$5.60**	**<$0.01**	**<$0.01**	**$0.00**	**$0.00**

[1] Scenarios 0 and 1 are combined because all values are identical.

[2] Scenarios 0 and 1 include cost savings in Kansas, Nebraska, and Colorado. Scenario 2 includes cost savings in Colorado only. Since none of the 404 permits issued in Colorado between 2011 and 2015 with impacts to waters affected by the proposed rule had mitigation requirements, Scenario 2 only includes minimal permits cost savings. Under Scenario 3, cost savings drop to zero because all states in the case study region are expected to regulate waters beyond CWA requirements.

IV.B.3.2.2.2 Forgone Benefits

To estimate the forgone benefit value associated with reduced mitigation requirements for non-abutting wetlands and ephemeral streams, the agencies relied on per household WTP values for preventing wetland losses from Blomquist and Whitehead (1998). Blomquist and Whitehead (1998) values are appropriate for the Lower Missouri watershed because the wetland types are similar to those found in the original study region (*i.e.*, freshwater marsh, temporarily, seasonally or permanently flooded bottomland hardwood). In particular, Missouri wetlands are dominated by forested and shrub swamps subject to frequent flooding from Missouri and other local rivers (MO DNR 2016). Within the southern Nebraska portion of the Lower Missouri River watershed, wetland types include both freshwater marshes (such as those within the Platte River region sandhills) and forested wetlands/swamps (such as those near the

Central Platte River in south-central Nebraska; LaGrange, 2005). Certain southern Nebraska basin wetlands are dominated by row-crop agriculture, such as those located in the Southwest Playas and the Rainwater Basin, and others are dominated by forested wetlands, such as those located near the Lower Missouri River (U.S. EPA, 2015c). The National Wetlands Inventory (NWI) wetlands mapper indicates that both "forested and shrub wetlands" and "freshwater emergent wetlands" are present in the Lower Missouri River Basin case study area (U.S. FWS, 2018). The number of wetland acres considered in the valuation scenario (500 acres) is small enough to calculate reasonable per acre WTP estimates.

To determine the number of potentially affected households, the agencies applied a similar methodology to the one used in Blomquist and Whitehead (1998). The survey population included state households where the affected wetlands were located (*i.e.*, Kentucky in the original study) as well as households in four cities outside of, but bordering, western Kentucky: Evansville, IN; Clarksville, TN; Carbondale, IL; and Cape Girardeau, MO. Following Blomquist and Whitehead (1998), the agencies applied the household WTP value to all households in the state with the majority of the watershed's 404 impacts (Kansas for both HUC 1025 and 1027) as well as households in other counties within the watershed area and counties adjacent to the watershed (Figure IV-15; Figure IV-16). Given that future location of 404 impacts is uncertain, the agencies used population in all counties within the affected watershed and counties adjacent to the watershed to determine potentially affected population residing outside of Kansas where the majority of 404 impacts occurred between 2011-2015.

Figure IV-16: Locations of households included in the forgone benefits analysis for HUC 1025.

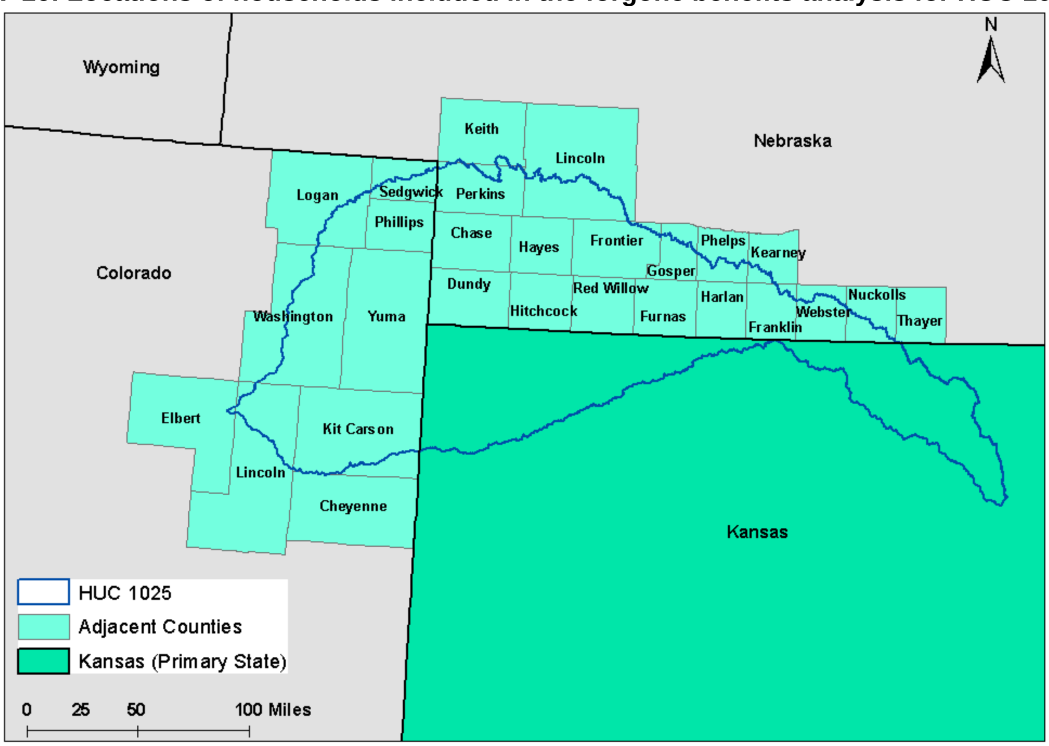
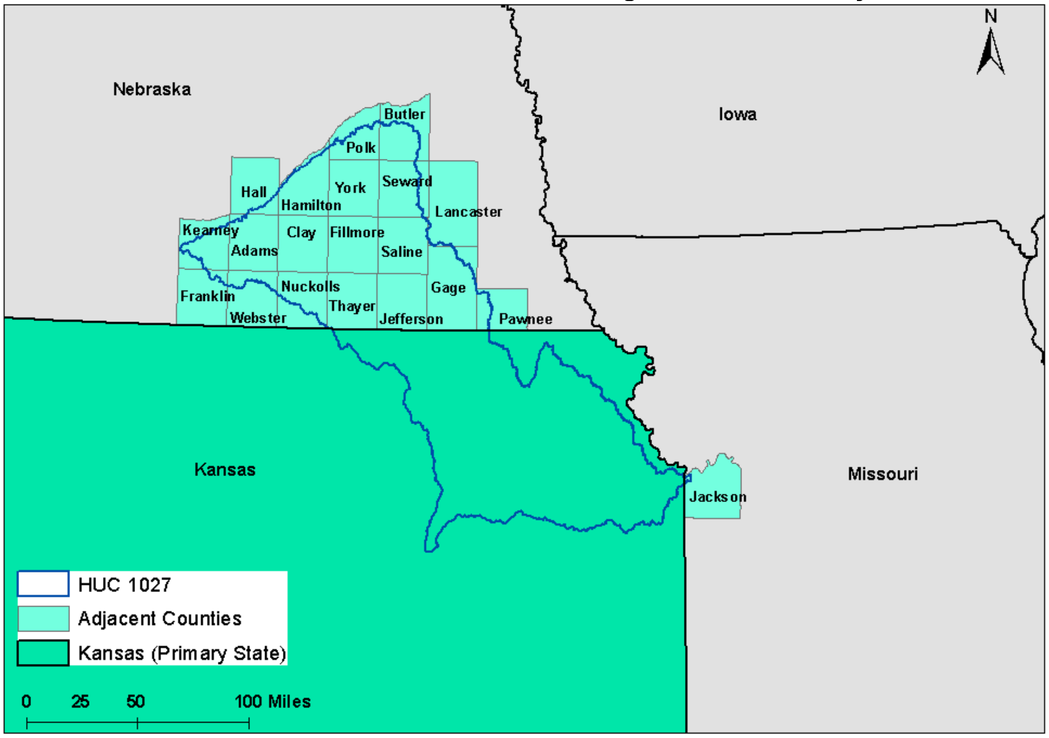


Figure IV-17: Locations of households included in the forgone benefits analysis for HUC 1027.



To estimate the number of affected households in future years, the agencies used projected population changes from 2015 to 2040 (CEDBR, 2016; State of Colorado, 2018; Missouri Office of Administration, 2008; Drozd and Deichert, 2015) divided by the average number of people per household (U.S. Census Bureau, 2015).

Table IV-37 and Table IV-38 provide estimated annualized forgone benefits from lost mitigation requirements in the Lower Missouri River Basin under different state response scenarios, with three percent and seven percent discount rates, respectively. Mitigation requirements for HUCs 1025 and 1027 occur in Kansas and Nebraska. Scenarios 0 and 1 include mitigation acres from both states. Annualized forgone benefits for the Lower Missouri River Basin under Scenarios 0 and 1 range from a low of $ 0.09 million to a high of $0.81 million, while the TPV of forgone benefits during the 2020-2039 study period ranges from $1.80 million to $16.25 million. Under Scenarios 2 and 3, the forgone benefits drop to $0 since both Kansas and Nebraska are expected to regulate waters beyond federal requirements.

Table IV-37: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin resulting from the proposed definitional change, by policy scenario (3% Discount Rate)

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Low	High	Low	High	Low	High
1025	1,264,605	$0.05	$0.30	$0.00	$0.00	$0.00	$0.00
1027	1,689,217	$0.08	$0.51	$0.00	$0.00	$0.00	$0.00
Total	**2,953,822**	**$0.12**	**$0.81**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table IV-33. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high:

Table IV-37: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin resulting from the proposed definitional change, by policy scenario (3% Discount Rate)

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Low	High	Low	High	Low	High

$0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 3% discount rate.

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

Table IV-38: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin resulting from the proposed definitional change, by policy scenario (7% Discount Rate)

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Low	High	Low	High	Low	High
1025	1,264,605	$0.03	$0.22	$0.00	$0.00	$0.00	$0.00
1027	1,689,217	$0.06	$0.38	$0.00	$0.00	$0.00	$0.00
Total	**2,953,822**	**$0.09**	**$0.60**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table IV-33. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 7% discount rate.

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

IV.B.3.2.3 Section 311

Six FRP facilities are located within the Republican River watershed (HUC 1025) and an additional 36 FRP facilities are located within the Kansas River watershed (HUC 1027). The high-resolution NHD data for the case study watersheds do not accurately depict the extent of ephemeral streams in those watersheds, as some might be mapped as intermittent while others are not mapped at all. Therefore, the agencies were not able to determine the type of waters located in proximity of these facilities. However, as noted in Section IV.B.1.2.3 for Case Study 1, a facility owner may determine that FRP requirements are applicable to the facility based on reasonable potential of an oil discharge (among other criteria) which means that proximity to any jurisdictional waters is a relevant consideration even if some other waters in the vicinity of the facility are not jurisdictional.

The agencies' analysis of the 42 facilities in the two case study watersheds identified five facilities without perennial or intermittent streams in the high-resolution NHD within a half-mile of the facility and only isolated water bodies visible on aerial photos. The proposed rule may affect the FRP applicability criteria for existing planholders by changing the inventory of resources considered within the half-mile planning distance and potentially leading facility owners to conclude that their facilities do not have a reasonable potential for an oil discharge to waters of the United States. Where FRP applicability changes, the facility owners may submit a request to EPA to reconsider FRP requirements.

EPA FOSCs responded to two incidents in the Kansas River watershed HUC 1027 between 2001 and 2017. The first incident[136] was associated with a vehicle accident that released petroleum into a ditch that flows into Piper Creek. The second incident,[137] a 10-inch diesel pipeline break, was determined upon FOSC evaluation not to affect waters of the United States. The FOSC and RP identified an intermittent creek approximately 150 yards south of the pipeline source of the spill, but the creek was completely dry at the time of the response and the extent of the diesel had been contained on land. The FOSC and RP agreed to check the creek periodically to verify that no diesel has traveled there. The information available for these spills suggests that the proposed rule would be unlikely to yield a different determination regarding the response or oversight.

IV.B.3.3 Potential Environmental Impacts and Costs

IV.B.3.3.1 Water Quality

The agencies assessed the potential water quality impacts of the proposed rule using the same methodology as described for the Ohio River basin watersheds. Table IV-39 describes the two SWAT models used for this second case study. Modeled wetland impacts for HUC 1025 represent a very small share of the existing acres of wetlands in the watershed and of the overall watershed size.

Table IV-39: Summary of SWAT models used to estimate water quality impacts of the proposed rule in the Missouri River basin

Model characteristics	HUC 1025	HUC 1027
	Republican River	Kansas River
Total watershed area (square miles)[1]	24,248.4	16,252.6
Number of HUC12 subbasins and reach segments modeled[2]	600	422
Average annual precipitation (in/year)	21.4	31.7
Baseline land use distribution:		
% developed	0.5%	2.0%
% agriculture	96.3%	85.5%
% forested	0.3%	5.1%
% water	0.6%	3.1%
% wetlands	2.3%	4.3%
Unmitigated stream and wetland impacts[3] under the proposed rule over 20 years (acres)	154.1	191.6
Unmitigated stream and wetland impacts[3] under the proposed rule over 20 years (% of baseline wetland acres)	0.04%	0.04%

[136] https://response.epa.gov/site/site_profile.aspx?site_id=8440

[137] https://response.epa.gov/site/site_profile.aspx?site_id=7346

Table IV-39: Summary of SWAT models used to estimate water quality impacts of the proposed rule in the Missouri River basin

Model characteristics	HUC 1025	HUC 1027
	Republican River	Kansas River

[1] The watershed area is based on the SWAT model and may differ from the description in the introduction to Section IV.B due to the omission or inclusions of HUC12 subbasins within the scope of each watershed as delineated in SWAT.

[2] For HUC 1027, reach-level predictions also include contributions from upstream watersheds HUCs 1025 and 1026.

[3] Unmitigated wetland impacts are based on permitted permanent impacts requiring mitigation and affecting wetlands abutting ephemeral streams and non-abutting wetlands. The agencies assumed a width of 50 feet for linear impacts. For watershed HUC 1027, the value includes only impacts in HUC12s subbasins of HUC 1025 and does not include impacts within the catchment of other upstream tributaries (HUC 1026) which may also affect reach-level predictions.

IV.B.3.3.1.1 CWA Program Impacts

Following the approach described in Section IV.B.1.3.1, the agencies used estimates potential changes in required mitigation for section 404 permits to specify changes in land use and wetland area in SWAT models. Table IV-40 shows the predicted impacts in HUCs 1025 and 1027 as defined in the SWAT model (*i.e.*, counting only permits that affected resources in HUC12 subbasins in the two SWAT HUC4 watersheds).

Table IV-40: Summary of 404 Program activities in Missouri River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers permanent impacts only.

Type of Potentially Affected Resource[2]	Permanent Impacts (Acres)	Permanent Impact (Linear Feet)	Total[1] Permanent Impacts (Acres)	Temporary Impact (Acres)	Temporary Impact (Linear Feet)	Total[1] Temporary Impacts (Acres)
HUC 1025						
Wetland abutting ephemeral stream	2.3	0	2.3	0.0	0.0	0.0
Ephemeral stream[3]	0.0	132,920	152.6	0.0	20,020	23.0
Total	**2.3**	**132,920**	**154.9**	**0.0**	**20,020**	**23.0**
HUC 1027						
Wetland abutting ephemeral stream	17.5	0	17.5	1.2	0.0	1.2
Ephemeral stream[3]	0.0	151,692	174.1	0.0	2,920	3.4
Total	**17.5**	**151,692**	**191.6**	**1.2**	**2,920**	**4.6**

[1] Represents the sum of impacts reported in acres and impacts reported in linear feet, assuming a width of 50 feet for linear impacts.

[2] See Table IV-8 for criteria used to identify affected resources that may change jurisdiction under the proposed rule.

[3] Represents forgone mitigation for impacts to riparian areas of ephemeral streams, assuming a total buffer 50 feet wide.

Table IV-41 and Table IV-42 summarize the changes specified for the baseline and policy scenarios, respectively.

Table IV-41: Summary of land use changes in Missouri River Basin SWAT watersheds resulting from 404 permits with permanent impacts to waters affected by the proposed rule and with mitigation requirements, under Baseline scenario

Watershed and Land use	HUC12 Subbasins (largest absolute change)[1]		Total watershed (all subbasins)[1]	
	acres	% of existing land use	Acres	% of existing land use
HUC 1025				
Developed area	2.4	0.26%	154.9	0.20%
Agricultural area	-2.4	-0.01%	-154.9	<-0.01%
HUC 1027				
Developed area	1.4	<0.01%	191.6	0.09%
Agricultural area	-1.4	<-0.01%	-191.6	<-0.01%

[1] The number of subbasins with specified changes under the scenario is 531 in HUC 1025 (out of a total of 600 HUC12 subbasins in the watershed), and 420 in HUC 1027 (out of 422 subbasins).

Table IV-42: Summary of land use changes in Missouri River Basin SWAT watersheds resulting from 404 permits with permanent impacts to waters affected by the proposed rule and with mitigation requirements, under Policy scenario

Watershed and Land Use	HUC12 Subbasins (subbasin with largest absolute change)[1]		Total Watershed (all subbasins)	
	acres	% of existing land use	acres	% of existing land use
HUC 1025				
Developed area	2.4	0.26%	154.9	0.20%
Wetland area[2]	-2.4	-0.06%	-154.9	-0.04%
HUC 1027				
Developed area	1.4	<0.01%	191.6	0.09%
Wetland area[2]	-1.4	-0.05%	-191.6	-0.04%

[1] The number of subbasins with specified changes under the scenario is 531 in HUC 1025 (out of a total of 600 HUC12 subbasins in the watershed), and 420 in HUC 1027 (out of 422 subbasins).

[2] The difference between the percent of wetland land use affected in an individual HUC12 subbasin and for the overall watershed is due to the distribution of changes among HUC12 subbasins that have both wetland and developed areas. Some subbasins with wetland areas do not see changes under the modeled scenarios because they lack corresponding existing developed areas to increase.

IV.B.3.3.1.2 Changes in Water Balance and Constituent Transport

Table IV-43 summarizes changes in basin-level annual average water balance and constituent transport in the two watersheds of the Missouri River basin. Table IV-45 and Table IV-46 summarize changes between the Policy and Baseline scenarios across subbasins within the two watersheds. Appendix D provides more detailed outputs.

Table IV-43: Summary of basin-level annual average water balance and constituent transport in Missouri River Basin SWAT watersheds

Parameter	HUC 1025				HUC 1027			
	Baseline	Policy	Change	% Change	Baseline	Policy	Change	% Change
Precipitation (mm)	543.50	543.50	0.00	0.0%	805.00	805.00	0.00	0.0%
Surface runoff (mm)	8.33	8.33	0.00	0.0%	82.88	82.88	0.00	0.0%
Lateral flow (mm)	0.09	0.09	0.00	0.0%	2.94	2.94	0.00	0.0%
Groundwater flow (mm)	2.44	2.44	0.00	0.0%	12.99	12.99	0.00	0.0%
Water yield (mm)	10.46	10.45	-0.01	-0.1%	98.96	98.96	0.00	0.0%
Evapotranspiration (mm)	533.90	533.90	0.00	0.0%	685.40	685.40	0.00	0.0%
Sediment loading (ton/ha)	0.120	0.120	0.000	0.0%	2.370	2.370	0.000	0.0%
Organic N (kg/ha)	0.310	0.310	0.000	0.0%	2.687	2.687	0.000	0.0%
Organic P (kg/ha)	0.040	0.040	0.000	0.0%	0.317	0.317	0.000	0.0%
NO_3 in surface runoff (kg/ha)	0.013	0.013	0.000	0.0%	0.008	0.008	0.000	0.0%
NO_3 in lateral flow (kg/ha)	0.001	0.001	0.000	0.0%	0.012	0.012	0.000	0.0%
Soluble P yield (kg/ha)	0.008	0.008	0.000	0.0%	0.102	0.102	0.000	0.0%
NO_3 leached (kg/ha)	0.116	0.116	0.000	0.0%	0.190	0.190	0.000	0.0%
P leached (kg/ha)	0.005	0.005	0.000	0.0%	0.016	0.016	0.000	0.0%

Table IV-44: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1025.

	Number of Subbasins by Direction of Change[1]		Absolute Change			
Model parameter	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	338	132	0.00	0.00	-0.01	0.03
Surface runoff (mm/yr)	52	482	0.00	0.00	-0.01	0.00
Lateral flow (mm/yr)	113	410	0.00	0.00	0.00	0.00
Groundwater flow (mm/yr)	3	286	0.00	0.00	-0.02	0.00
Total water yield (mm/yr)	33	497	0.00	0.00	-0.03	0.00
Sediment yield (ton/ha/yr)	131	329	0.000	0.000	0.000	0.000
Organic N (kg/ha/yr)	246	283	0.000	0.000	0.000	0.002
Organic P (kg/ha/yr)	258	270	0.000	0.000	0.000	0.000
NO_3 in surface runoff (kg/ha/yr)	302	227	0.000	0.000	0.000	0.000
Soluble P (kg/ha/yr)	273	256	0.000	0.000	0.000	0.000

[1] Total number of subbasins is 600. Some modeled subbasins show no change in annual average values and are not included in the counts above.

Table IV-45: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1027.

	Number of Subbasins by Direction of Change[1]		Absolute Change			
Model parameter	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	375	32	0.01	0.00	0.00	0.05
Surface runoff (mm/yr)	119	300	0.00	0.00	-0.02	0.09
Lateral flow (mm/yr)	200	197	0.00	0.00	0.00	0.00

Table IV-45: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1027.

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Groundwater flow (mm/yr)	6	414	0.00	0.00	-0.04	0.08
Total water yield (mm/yr)	17	403	-0.01	0.00	-0.03	0.07
Sediment yield (ton/ha/yr)	353	67	0.000	0.000	0.000	0.007
Organic N (kg/ha/yr)	366	54	0.000	0.000	0.000	0.002
Organic P (kg/ha/yr)	368	52	0.000	0.000	0.000	0.000
NO_3 in surface runoff (kg/ha/yr)	362	58	0.000	0.000	0.000	0.000
Soluble P (kg/ha/yr)	374	46	0.000	0.000	0.000	0.000

[1] Total number of subbasins is 422. Some modeled subbasins show no change in annual average values and are not included in the counts above.

IV.B.3.3.1.3 Impacts to Streams

Table IV-46 summarizes the direction and relative magnitude of mean annual changes over all reaches modeled in the two watersheds. Table IV-47 summarizes changes in mean annual loadings delivered to the outlet of each watershed. These results reflect the contributions from all upstream reaches and their respective catchments, as well as intervening instream processes modeled in SWAT, such as sediment deposition. For HUC 1027, the results reflect changes within both the subbasins within the scope of the watershed, as well as those in HUC 1025 through tributary inputs.[138] More detailed results are included in Appendix D.

As shown in the two tables, the SWAT model runs suggest that the proposed rule will increase nutrient and sediment loads in streams within the Missouri River basin. This increase follows from the combined effects of reduced wetland functions and land use change described in the previous section, but the relative magnitude of the changes impact is attenuated by "background" contributions from point sources – which, in the context of this analysis, are not affected by the policy – and from upstream reaches – which may or may not be affected by the policy, depending on the location.

Table IV-46: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Missouri River Basin

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
HUC 1025							
Annual TN load (kg/yr)	125	428	-3.8	-0.1	-0.01%	0.00%	0.01%
Annual TP load (kg/yr)	153	398	-0.5	0.0	-0.01%	0.00%	0.01%
Annual sediment load (kg/yr)	165	387	-0.5	0.0	-0.01%	0.00%	0.07%

[138] SWAT model runs for HUC 1027 incorporate simulated flows and delivered loads at the outlet of HUC 1025 for each scenario (baseline and policy). The model run assumes no change in the contributions of other tributaries (HUCs 1026).

Table IV-46: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Missouri River Basin

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
Mean daily flow (cms)	64	480	0.000	0.000	-0.01%	0.00%	0.01%
HUC 1027							
Annual TN load (kg/yr)	379	41	25.8	2.0	0.00%	0.00%	0.03%
Annual TP load (kg/yr)	380	40	6.7	0.4	0.00%	0.00%	0.03%
Annual sediment load (kg/yr)	231	189	5.2	0.1	0.00%	0.00%	0.29%
Mean daily flow (cms)	12	408	-0.001	0.000	-0.01%	-0.01%	0.04%

[1] Total number of reaches is 600 in HUC 1025 and 422 in HUC 1027. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table IV-47: Predicted changes in annual average loads delivered to the outlet of Missouri River Basin SWAT watersheds

Parameter	Baseline	Policy	Change	% Change
HUC 1025				
Annual TN load (kg/yr)	2,899,348	2,899,387	38	<0.01%
Annual TP load (kg/yr)	639,879	639,893	14	<0.01%
Annual sediment load (ton/yr)	174,827	174,746	-81	-0.05%
HUC 1027				
Annual TN load (kg/yr)	17,798,788	17,799,129	341	0.00%
Annual TP load (kg/yr)	3,790,102	3,790,203	101	0.00%
Annual sediment load (ton/yr)	2,755,694	2,755,818	124	0.00%

IV.B.3.3.2 Drinking Water

There is one public drinking water intake and one spring in the Republican River watershed (HUC 1025) and one infiltration gallery, 14 public drinking water intakes, and one spring in the Kansas River watershed (HUC 1027).

The SWAT runs predict very small changes (0.02 percent) in mean daily suspended sediment concentration in the reach used as the source for the sole drinking water intake in HUC 1025. The agencies did not quantify the changes in drinking water treatment costs but the small predicted changes in sediment concentrations are unlikely to result in material changes to these costs.

Table IV-48: Drinking Water Intakes in Lower Missouri River Study Areas

SWAT Watershed HUC4	Number of community water systems	Number of intakes	Number of people served	Change in daily suspended sediment concentration		
				Minimum	Mean	Maximum
1025	1	1	2.812	0.02%	0.02%	0.02%
1027	11	14	668,979	-0.02%	0.00%	0.03%
Total:	12	15	676,232			

Source: EPA analysis of SDWIS (2017) data.

IV.B.3.3.3 Dredging for Water Storage and Navigation

The SWAT models identify nine reservoirs within HUC 1025 and five reservoir in HUC 1027.[139] As shown in Table IV-49, the SWAT model runs predict small declines (less than 0.1 percent in HUC 1025 and less than 0.01 percent in HUC 1027) in sediment deposition in reservoirs in the watersheds, calculated as the difference between incoming sediment fluxes and outgoing fluxes.

Table IV-49: Summary of predicted net sediment depositions in reservoirs in the Missouri River Basin (tons/year) in 2040

HUC4	Number of reservoirs[1]	Net annual sediment deposition in reservoirs		Change relative to baseline[2]	
		Baseline	Policy	Tons/year	Percent
1025	9	14,979	14,970	-10	-0.07%
1027	5	6,804,648	6,804,568	-81	-0.00%
Total	14	6,819,627	6,819,538	-91	-0.00%

[1] Reservoirs modeled in SWAT watersheds, based on the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

[2] Changes may not correspond to the differences in sediment deposition due to rounding.

The agencies used the approach described in Section IV.B.1.3.3 for Case Study 1 to estimate the change in annualized dredging costs. The estimated change in dredging costs is negligible in both HUC 1025 and HUC 1027 at less than $500 per year overall across the two watersheds. See Section IV.B.4 for more detail on uncertainties in this analysis.

IV.B.3.3.4 Ecosystem Services Provided by Ephemeral Streams

In reviewing the Draft Connectivity Report entitled "Connectivity of Streams and Wetlands to Downstream Waters: A Review of the Scientific Evidence," [140] EPA's SAB found that "[t]he literature

[139] The SWAT watersheds include reservoirs identified in the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

[140] U.S. EPA. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (External Review Draft)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R11/098B, September 2013.

review provides strong scientific support for the conclusion that ephemeral, intermittent, and perennial streams exert a strong influence on the character and functioning of downstream waters and that tributary streams are connected to downstream waters," at the same time the SAB stressed that "the EPA should recognize that there is a gradient of connectivity."[141] The SAB recommended that "the interpretation of connectivity be revised to reflect a gradient approach that recognizes variation in the frequency, duration, magnitude, predictability, and *consequences* of physical, chemical, and biological connections."[142] As the preamble to the proposed rule describes, the SAB found perennial and intermittent streams have a greater probability to impact downstream waters compared to ephemeral streams.

The agencies recognize that waters within a watershed are connected along such a gradient and that the degree of connectivity among aquatic components varies along a continuum from highly connected to highly isolated (U.S. EPA 2015b). In Missouri, generally more isolated temporary streams such as intermittent and ephemeral streams far outnumber generally more connected perennial streams (see Table IV-30 for detail). Ephemeral streams in Missouri are located above the water table year-round and flows originate primarily from precipitation runoff (U.S. Army Corps of Engineers, 2013).

Although more isolated than perennial streams and adjacent wetlands, ephemeral streams and isolated wetlands support various ecosystem services. For example, in the Lower Missouri River Basin, temporary streams provide habitat to hundreds of species of insects, snails and other invertebrates that, in turn, provide food for amphibians, reptiles, birds, and mammals. Riparian vegetation surrounding temporary streams even when they appear dry often provide the only habitat for many wildlife species, particularly in agricultural landscapes (Dasho and DiStephano, 2011). Vegetation along the banks of temporary streams also filters runoff-related non-point source pollutants, such as nitrogen and phosphorus, and prevents the runoff of such pollutants into downstream reaches.

Species that rely on temporary streams are well adapted to the wet/dry cycle. For example, the eggs of some stoneflies sometimes remain dormant for several years until streams are rewetted. Other organisms have also developed wet/drought life cycles. Missouri salamanders often prefer temporary streams to perennial streams, burrowing into wetted stream bottoms when the stream dries (Dasho and Di Stephano, 2011). Amphibian species in the Lower Missouri River floodplain such as the eastern tiger salamander, smallmouth salamander, Great Plains toad, Woodhouse's toad, and Plains spadefoot toad rely on ephemeral waterbody habitats for reproduction (U.S. Army Corps of Engineers, Kansas City District, 2017). Ephemeral waterbodies also provide habitat to threatened and endangered species. Threatened in Kansas, the Strecker's chorus frog breeds in ephemeral pools where there are no predator fish present (Fort Hays State University, 2018; Kansas Department of Wildlife, Parks and Tourism, n.d.).

IV.B.4 Case Study 3: Rio Grande River Basin

This case study encompasses the length of the Pecos River from southeast of Santa Fe, New Mexico to the Texas-Mexico border where the Pecos River meets the Rio Grande. The Upper and Lower Pecos River watersheds are located within the Southwestern Tablelands ecoregion (CEC, 2011). According to

[141] Letter to Gina McCarthy. October 17, 2014. SAB Review of the Draft EPA Report Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence. Page 3.

[142] *Id*. at 2 (emphasis added).

CEC (2011), the ecoregion is characterized by dry mid-latitude stepped climate. Mean annual precipitation is 448 mm (17.6 inches). Water is generally scarce with streams mostly ephemeral and intermittent. Land use is mostly semiarid rangeland with ranching and livestock grazing the dominant land uses, and some oil and gas production.

Figure IV-17 and Figure V-14 show maps of the HUC 1306 and HUC 1307 case study watersheds, respectively.

Figure IV-18: Map of HUC 1306 – Upper portion of the Pecos River Basin showing NHD water features and NWI wetlands in relation to state boundaries, populated areas, and major roads.

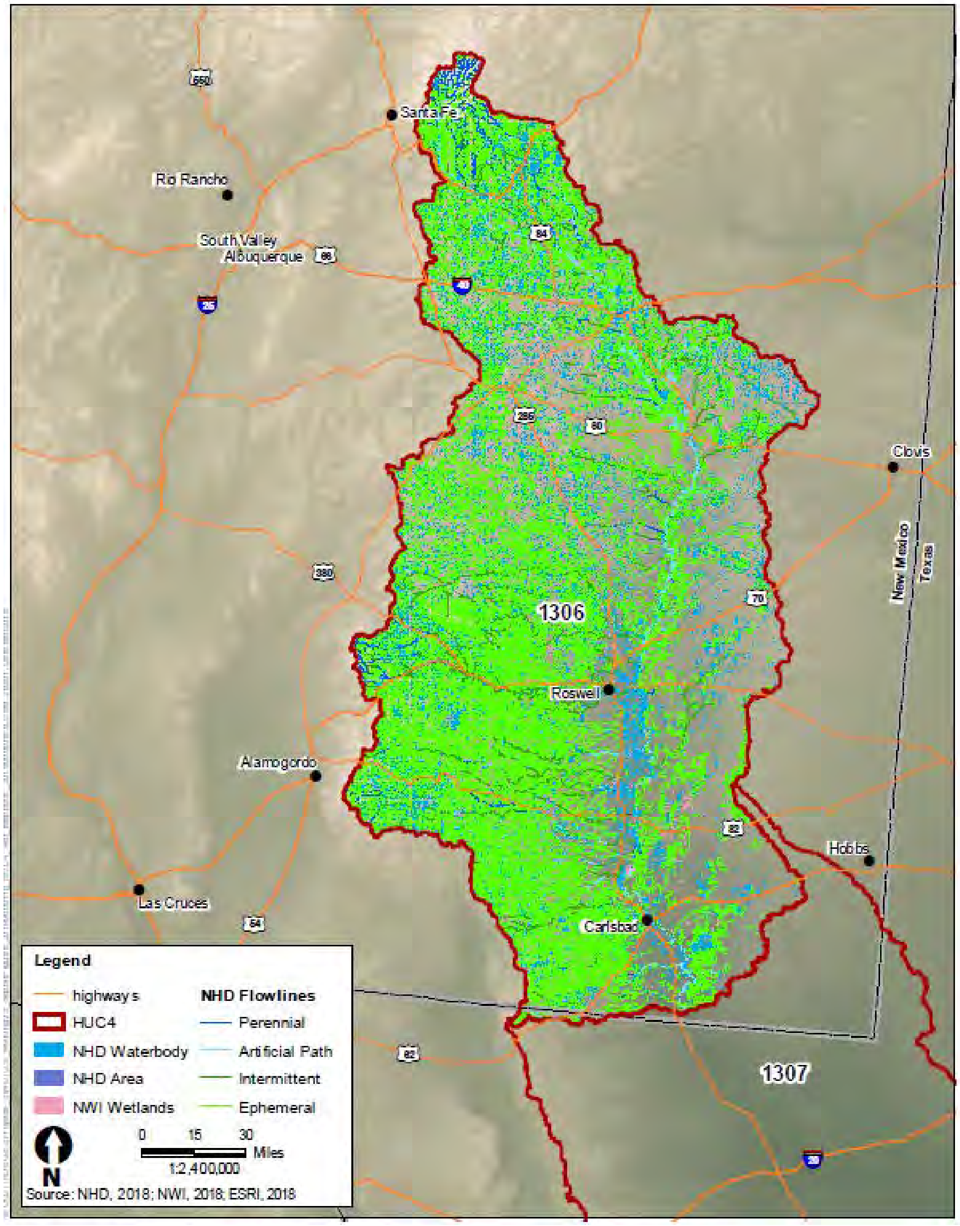
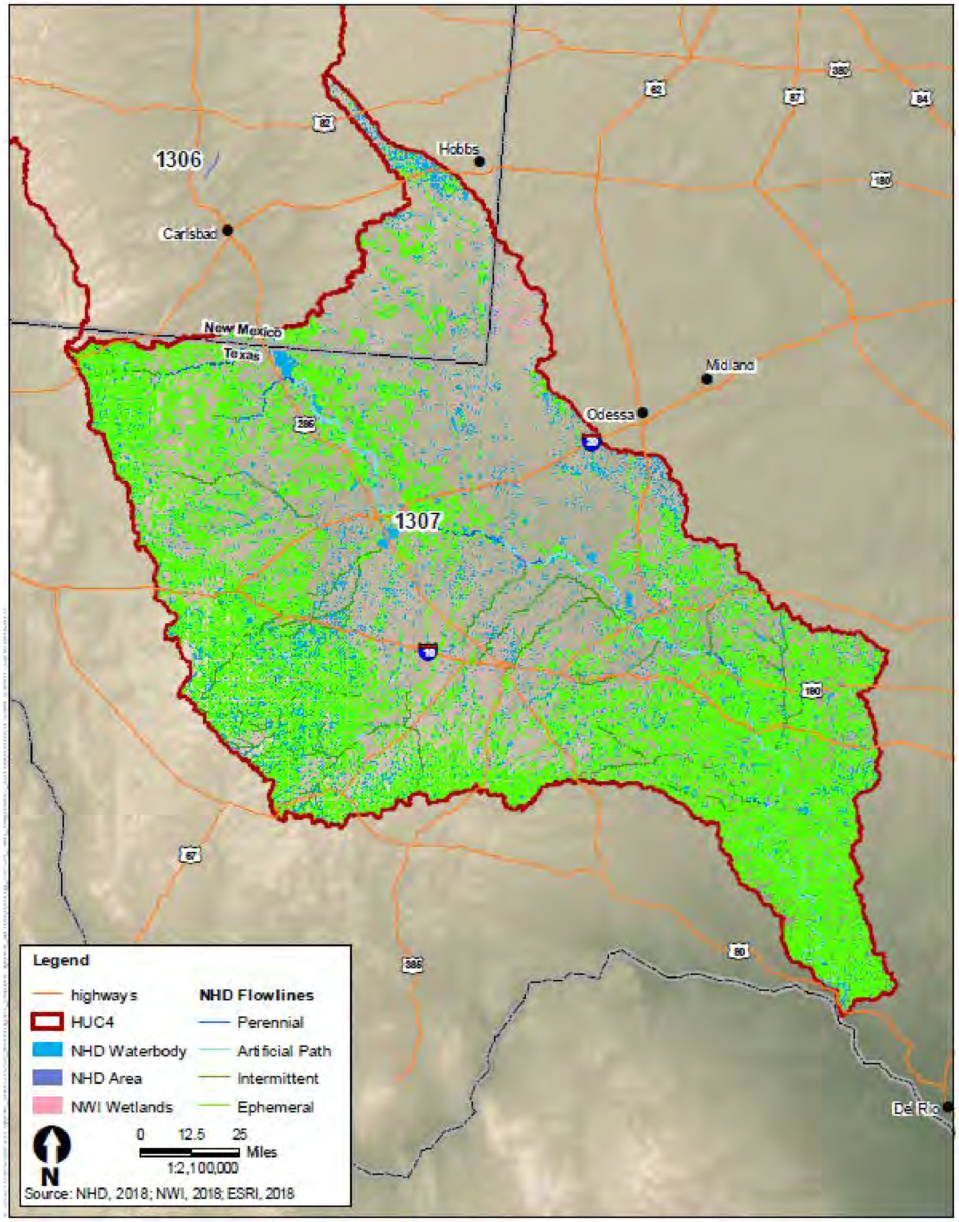


Figure IV-19: Map of HUC 1307 – Lower portion of the Pecos River Basin showing NHD water features and NWI wetlands in relation to state boundaries, populated areas, and major roads.



IV.B.4.1 Aquatic Resources Characteristics

Table IV-50 summarizes the hydrography within the case study watersheds. The data present the number of stream miles in each flow regime category, as well as acres of non-abutting and abutting wetlands according to the agencies' geospatial analysis of the high resolution NHD and the NWI.[143] The high resolution NHD data for this region differentiates stream attributes according to the stream flow regime.

143 The agencies note that this analysis may not capture those wetlands that are not abutting a jurisdictional water but have a direct hydrologic surface connection to a jurisdictional water in a typical year and would thus meet the proposed definition of "adjacent wetlands."

As presented in the table, 85 to 91 percent of stream miles within the two watersheds are ephemeral, and 34 to 62 percent of all wetland acres are non-abutting wetlands.

Table IV-50: Hydrographic profile of case study watersheds in the Rio Grande River Basin

Feature Type	Feature Attributes	HUC 1306		HUC 1307	
		Miles or acres	Percent of total	Miles or acres	Percent of total
Streams (miles)	**Total**	35,440	100%	25,436	100%
	Perennial	872	2%	126	0%
	Intermittent	2,210	6%	947	4%
	Ephemeral	30,164	85%	23,171	91%
	Artificial path	1,252	4%	744	3%
	Other[1]	943	3%	448	2%
Wetlands (acres)	**Total**	52,652	100%	17,353	100%
	Abutting	34,593	66%	6,666	38%
	Non-abutting	18,058	34%	10,688	62%

[1] Includes canal, ditches, aqueducts, and other feature without attributes.

The values are based on the agencies' geospatial analysis of NHD and NWI data and reflect gaps in NHD stream attributes.

IV.B.4.2 Program Changes

IV.B.4.2.1 Section 402

Table IV-51 presents the number of NPDES permits issued in the Rio Grande River Basin by the most common industry categories. The number of permits issued in the two case study watersheds includes 22 individual permits and 201 general permits. Based on the permits with SIC codes, the most common industries in the Rio Grande River Basin include aggregate mining, motor vehicle parts (used), animal feeding operations, sewage systems, scrap and waste materials, ready-mixed concrete, and industrial domestic wastewater treatment. The agencies estimated that one individual permit and six general permits in the Rio Grande River Basin have at least one discharge near an ephemeral stream. None of the permits affected by the rule have SIC codes available.

Table IV-51: Section 402 individual permits (SIC codes in parentheses) issued in case study watersheds in the Rio Grande River Basin

Industry category	Individual permits[1]			General permits[1]		
	Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]		Total number of NPDES permits[1]	Permits with discharge point near ephemeral streams[2]	
		Number of permits	Percent of all permits		Number of permits	Number of permits
HUC 1306						
Aggregate Mining[3]	0	0	0%	15	0	0%
Motor Vehicle Parts, Used (5015)	0	0	0%	9	0	0%
Animal Feeding Operations[4]	0	0	0%	6	0	0%
Scrap and Waste Materials (5093)	0	0	0%	6	0	0%

Table IV-51: Section 402 individual permits (SIC codes in parentheses) issued in case study watersheds in the Rio Grande River Basin

Industry category	Individual permits[1]			General permits[1]		
	Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]		Total number of NPDES permits[1]	Permits with discharge point near ephemeral streams[2]	
		Number of permits	Percent of all permits		Number of permits	Number of permits
Sewerage Systems (4952)	9	0	0%	1	0	0%
Other Categories[5]	6	0	0%	31	0	0%
Missing SIC Codes	0	0	0%	105	5	5%
Total	**15**	**0**	**0%**	**173**	**5**	**3%**
HUC 1307						
Industrial Domestic Wastewater Treatment[6]	2	0	0%	0	0	0%
Ready-Mixed Concrete (3273)	0	0	0%	3	0	0%
Aggregate Mining[3]	0	0	0%	2	0	0%
Animal Feeding Operations[4]	0	0	0%	2	0	0%
Sewerage Systems (4952)	3	0	0%	0	0	0%
Other Categories[5]	2	0	0%	0	0	0%
Missing SIC Codes	0	1	0%	21	1	5%
Total	**7**	**1**	**14%**	**28**	**1**	**4%**
Total for both watersheds	**22**	**1**	**5%**	**201**	**6**	**3%**

[1] Source: EPA's ICIS-NPDES data, 2017. The facility permits included in the spatial analysis are limited to those for which the ICIS-NPDES database includes latitude/longitude coordinates. For permits with multiple SIC codes, only one SIC code was retained, with manufacturing industries prioritized, to avoid double-counting.

[2] The agencies used the Cowardin classification code in NWI to determine whether 402 discharges are likely to affect ephemeral streams (*i.e.*, the agencies interpreted Cowardin codes R4SBA and R4SBJ as ephemeral; *see* Section IV.B for more detail).

[3] Includes SIC Codes 1422, 1423, 1429, 1442, 1446, 1459, 1474, 1475, 1481, and 1499

[4] Includes SIC Codes 211, 212, 213, 214, 219, 241, 251, 252, 253, 254, 259, 271, 272, and 279

[5] Includes Asphalt Paving Mixtures and Blocks (2951), Construction and Development (1629, 1794, 6552, 1611, 1799, 1521, 1522, and 1623), Trucking Facilities (4212, 4231), and Water Supply (4941)

[6] Includes SIC Codes 6513, 6514, 6515, 7011, 7032, 7033, 8211, 8221, 8641, and 8661

Only one individual NPDES permit potentially affects ephemeral streams (NPDES ID TX0076422), and this permit is subject to WQBELs.[144] Should the definition of "waters of the United States" change, a permittee subject to more stringent limits based on a WQBEL could request revision of its WQBEL to

[144] Some of the common industry categories in the Rio Grande River Basin have technology-based effluent limitations (TBELs), including aggregate mining, animal feeding operations, and sewage systems (secondary). The industrial domestic wastewater treatment, motor vehicle parts, scrap and waste materials, and ready-mixed concrete industries do not have national TBELs. For facilities in these four industry categories, effluent limitations are either water quality-based (WQBELs) for pollutants with applicable water quality standards, or TBELs based on the best professional judgement of the permit writer (U.S. EPA; 2011).

account for potential dilution or attenuation of the pollutant(s) occurring between end-of-pipe and the point where the effluent enters jurisdictional waters. Under this scenario, the permittee may realize cost savings as compared to meeting the previous permit limits.

NPDES permits for discharges near ephemeral waters were issued in one states in HUC 1306 (New Mexico) and two states in HUC 1307 (New Mexico and Texas). Based on potential state responses and analytic scenarios described in Section II.A.3, Texas is expected to protect waters beyond the CWA under Scenarios 2 and 3, while New Mexico is not anticipated to protect waters beyond the CWA under any scenarios.

The number of permits affected by the proposed rule in HUC 1306 remains constant under all scenarios since all permits for discharges near ephemeral streams are issued in New Mexico, which is not expected to regulate waters beyond the CWA under any scenario. The number of permits affected by the rule in HUC 1307 is reduced from 2 to 1 under Scenario 2 (3). As noted above, SIC codes are not available for the affected permits and therefore it is unknown whether these permits are based on TBELs or WQBELs and as a result the effects of the proposed rule on potential cost savings and changes in pollutant discharges are highly uncertain.

IV.B.4.2.2 Section 404

Table IV-52 summarizes section 404 permits issued in 2011-2015 within the Rio Grande River Basin that required mitigation on RPWWN-type wetlands or ephemeral streams. As presented in the table, the agencies' geospatial analysis shows one permit in HUC 1306 issued by the Corps with impacts that required mitigation on waters affected by the proposed "waters of the United States" definitional changes. The annual average permanent impacts resulting from 404 permits in HUC 1306 is 0.004 acres. Permit impacts occurred in New Mexico, a state that is only expected to implement state protections more stringent than CWA requirements under Scenario 3. From 2011-2015, no permits were issued in HUC 1307 that required mitigation on waters affected by the proposed rule.

Table IV-52: Section 404 permits issued in case study watersheds in the Rio Grande River Basin (2011-2015)

State	# Permitted Projects	# Permits with mitigation requirements affected by proposed changes to the definition of "waters of the United States" [1, 2]	Permanent impacts[1]		Temporary impacts[1]	
			Acres	Length Feet	Acres	Length Feet
HUC 1306						
NM	168	1	0.018	0.0	0.000	0.0
Total	**168**	**1**	**0.018**	**0**	**0.000**	**0**
Avg. per year	**34**	**0**	**0.004**	**0**	**0.000**	**0**

Table IV-52: Section 404 permits issued in case study watersheds in the Rio Grande River Basin (2011-2015)

State	# Permitted Projects	# Permits with mitigation requirements affected by proposed changes to the definition of "waters of the United States" [1, 2]	Permanent impacts[1]		Temporary impacts[1]	
			Acres	Length Feet	Acres	Length Feet
HUC 1307						
NM	39	0	0.000	0	0.000	0
TX	6	0	0.000	0	0.000	0
Total	**45**	**0**	**0.000**	**0**	**0.000**	**0**
Avg. per year	**9**	**0**	**0.000**	**0**	**0.000**	**0**

[1] Values based on permits with mitigation requirements on waterways determined to be RPWWN-type wetlands or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services. No 404 permits in HUC 1307 meet these requirements.

[2] Number of permits includes permits with mitigation requirements that potentially affect at least one water no longer jurisdictional under the CWA under the proposed rule.

IV.B.4.2.2.1 Cost Savings

To estimate permit cost savings, the agencies determined the average number of individual and general 404 permits issued each year, based on permits issued from 2011 to 2015, that affect only waters no longer protected as jurisdictional under the proposed rule. The agencies then multiplied the annual average number of reduced individual and general permits by lower bound USACE estimates of permit costs (U.S. EPA and Department of the Army, 2015). The agencies used the lower bound estimate to avoid double-counting compensatory mitigation costs.

Table IV-53 shows the average number of reduced individual and general permits, USACE unit application costs, and the estimated reduction in permit applications costs for individual and general permits in the Rio Grande River Basin under each scenario. The USACE unit costs estimates ($14,700 per individual permit; $4,400 per general permit) are adjusted from 1999$ to 2017$ using the CPI-U.

Permits affecting only RPWWN-type wetlands or ephemeral streams were issued in one state in HUC 1306 (New Mexico) and two states in HUC 1307 (New Mexico and Texas). Reduced permit costs remain constant at $0.11 million under Scenarios 0, 1, and 2. Under Scenario 3, permit cost savings drop to $0 since both states are expected to protect waters beyond the CWA.

Table IV-53: Average annual reduction in 404 permit application costs in the Rio Grande River Basin

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Scenario 0 & 1[1,2]		Scenario 2[1]		Scenario 3[1]	
		Annual Average Reduction in Permits with the Proposed Rule	Estimated Reduction in Permits Costs (millions 2017$)	Annual Average Reduction in Permits with the Proposed Rule	Estimated Reduction in Permits Costs (millions 2017$)	Annual Average Reduction in Permits with the Proposed Rule	Estimated Reduction in Permits Costs (millions 2017$)
HUC 1306							
IP	$14,700	0.0	$0.00	0.0	$0.00	0.0	$0.00
GP	$4,400	17.0	$0.07	17.0	$0.07	0.0	$0.00
Total		**17.0**	**$0.07**	**17.0**	**$0.07**	**0.0**	**$0.00**
HUC 1307							
IP	$14,700	0.0	$0.00	0.0	$0.00	0.0	$0.00
GP	$4,400	8.0	$0.04	8.0	$0.04	0.0	$0.00
Total		**8.0**	**$0.04**	**8.0**	**$0.04**	**0.0**	**$0.00**
Both Watersheds							
IP		0.0	$0.00	0.0	$0.00	0.0	$0.00
GP		25.0	$0.11	25.0	$0.11	0.0	$0.00
Total		**25.0**	**$0.11**	**25.0**	**$0.11**	**0.0**	**$0.00**

[1] Includes permits estimated to only affect waters no longer jurisdictional under the CWA under the proposed rule.

[2] Scenarios 0 and 1 are combined because all values are identical.

Because the average annual reduction in mitigation requirements is small in the Rio Grande River Basin (0.004 acres in HUC 1306; no reductions in HUC 1307), the annual cost savings from reduced mitigation requirements is negligible. To estimate annual cost savings from reduced mitigation requirements in HUC 1306, the agencies multiplied the expected reduction in annual mitigation requirements (0.004 acres) by low ($51,850) and high ($72,490) per acre estimates for New Mexico. Annual mitigation cost savings under Scenarios 0, 1, and 2 are significantly less than $0.01 million ($187 to $261). Mitigation cost savings drop to $0 under Scenario 3 since New Mexico, the state where all mitigation requirement reductions occur in the Rio Grande River Basin, is expected to protect waters beyond CWA requirements. Because mitigation cost savings are so small, the permit cost savings values presented in Table IV-53 represent total cost savings.

IV.B.4.2.2.2 Forgone Benefits

The agencies did not estimate the forgone benefit value of lost mitigation acres for the Rio Grande River Basin case study because none of the existing wetland valuation studies were conducted in the same geographic area or provided a good match for the affected resource characteristics. The meta-analysis of wetland valuation studies developed by Moeltner et al. (2018) was also based on a set of studies conducted in different geographic areas that valued the type of wetlands not typically present in the case study watershed (*e.g.*, fresh water marshes or forested seasonally or temporary flooded wetlands). Given that the estimated reduction in mitigation requirements in the case study area is very small (annual average of 0.004 acres), the expected value of forgone benefits is likely to be small as well.

IV.B.4.2.3 Section 311

The watershed encompasses the Edwards Plateau's inland oil production area around Odessa and Midland, Texas. There were approximately 49,800 active oil wells in the two watersheds in 2018, based on data the agencies obtained from the Texas Railroad Commission and New Mexico's Oil Conservation Division. Assuming that a facility corresponds to a tank battery with an average of four producing wells per tank battery,[145] this translates into an estimated 12,400 facilities that may be subject to SPCC requirements in the baseline if they have a reasonable expectation of a discharge to "waters of the United States." Additionally, the 2012 Census of Agriculture (USDA, 2014) shows approximately 20 million acres of land in farm production and 4,000 farm establishments in the two watersheds. Based on average annual fuel expenditures by size class in the Census, the agencies estimate that approximately 160 farms may be subject to SPCC requirements in the baseline if they also have a reasonable expectation of a discharge to "waters of the United States." The proposed rule could affect an unknown share of these facilities in cases where they no longer have a reasonable expectation of a discharge to a "water of the United States."

The high-resolution NHD data in these two watersheds include attributes that distinguish ephemeral streams from those with perennial or intermittent flow regimes. In addition, the agencies obtained data on the location of wells that may be associated with onshore oil production regulated under the SPCC program. The combination of these two datasets enabled the agencies to assess the potential impacts of the proposed rule on an important subset of SPCC-regulated facilities in this region and nationally. The agencies' analysis inventoried the NHD waters and NWI wetlands located within a half-mile distance of each well. The use of a half-mile radius was informed by the planning distance used in the FRP rule to identify resources that could be affected by an oil discharge; it is not a hard rule for determining SPCC applicability.

There are approximately 49,800 oil production wells in the upper and lower Pecos River watersheds (HUC 1306 and 1307). Of these wells, approximately 24,800 wells have water bodies, including wetlands, located within a half-mile of the well. For over half of those wells (13,800 wells), the only streams within the half-mile search radius are ephemeral (*i.e.*, there are no perennial or intermittent streams). Based on this analysis, and assuming that the geographical distribution of SPCC facilities is similar to that of the wells, the agencies estimate that 3,460 oil production facilities[146] within the watershed may be farther than a half-mile from any perennial or intermittent streams, and therefore may be less likely to have a reasonable potential to discharge to waters of the United States under the proposed rule. Facility owners that determine that their facility does not have a reasonable potential of a discharge may forgo preparing or maintaining an SPCC Plan in accordance with 40 CFR 112. As presented in Section IV.A.3.2 (*see* Table IV-6), the annualized cost of maintaining an SPCC Plan for a production

[145] The 4:1 ratio of wells per tank battery follows the approach EPA used for the Regulatory Impact Analysis for the 2008 Amendments to the Oil Pollution Prevention Regulations (40 CFR PART 112) (U.S. EPA, 2007)

[146] The agencies estimated the number of facilities by assuming an average of 4 wells per facility (13,846 wells / 4 wells per facility = 3,461 facilities).

facility ranges between $6,200 and $27,500. For a new facility, the annualized cost ranges between $40,900 and $523,700. The agencies did not have sufficient data to quantify the potential increase in oil spill risk from any change in the implementation of SPCC measures.

Table IV-54: Proximity of waters to active oil production wells in the Upper and Lower Pecos watersheds

HUC4	State	Number of active oil wells	Number of wells based on proximity to waters, including wetlands, (within a half-mile radius)	
			Any stream or wetland	Ephemeral stream only
1306	NM	13,565	6,104	4,116
	TX	0	0	0
	Total	13,565	6,104	4,116
	% of total	100%	45%	30%
1307	NM	7,115	3,137	1,611
	TX	29,083	15,551	8,119
	Total	36,198	18,688	9,730
	% of total	100%	52%	27%
Total		**49,763**	**24,792**	**13,846**
% of Total		**100%**	**50%**	**28%**

Based on geospatial analysis of oil well locations obtained from Texas Railroad Commission and New Mexico Oil Conservation Commission, relative to NHD and NWI features.

The two watersheds also count a total of 16 FRP facilities, four in HUC 1306 and 12 in HUC 1307. Two of these facilities have streams categorized as perennial or intermittent in the high resolution NHD within a half-mile of the facility. The other 14 facilities have only ephemeral streams or wetlands within a half-mile of the facility. Therefore, to the extent that the proposed rule makes ephemeral streams and certain non-abutting wetlands non-jurisdictional and these are the only resources within the FRP planning distance, the agencies anticipate that these facilities could potentially seek reconsideration of FRP applicability. If so, then there may be cost savings for these facilities from not having to maintain an FRP. As presented in Section IV.A.3.2, the costs of maintaining an FRP ranges from approximately $32,300 to $37,200 (*see* Table IV-7), The agencies did not have sufficient data to quantify the potential increase in oil spill risk, but analysis of the 14 facilities shows that they all have at least one million gallons of oil storage capacity and for at least 9 facilities, an oil discharge could impact sensitive environments, according to the harm criteria provided in EPA's FRP database. Sensitive environments are Plan-specific and include transportation routes, flora and fauna, and recreational areas.

EPA FOSCs did not respond to any oil spill incidents in the Upper and Lower Pecos watersheds between 2001 and 2017.

IV.B.4.3 Potential Environmental Impacts and Costs

IV.B.4.3.1 Water Quality

As described in Section IV.B.3.2, the agencies found the projected impacts of the proposed rule on the 404 and 402 programs to be small in the upper and lower Pecos River watersheds. Given this finding of minimal changes and the scale and scope of the SWAT model, the agencies did not model water quality impacts downstream from affected wetlands and streams. While the agencies did not quantify the impacts of these changes, in general, the agencies anticipate that forgone wetland mitigation in the Rio Grande watersheds could increase pollutant loads downstream from the affected areas. These changes may in turn increase sedimentation in reservoirs, increase the turbidity of source waters, and increase the potential for and magnitude of floods.

IV.B.4.3.2 Drinking Water

According to the EPA's SDWIS database, the Upper Pecos River watershed (HUC 1306) includes 30 public drinking water facilities, including four intakes, two reservoirs, and 23 springs. There are no public drinking water facilities (intakes, springs, or others) in the Lower Pecos watershed. As described in the previous section, higher sediment loads due to reduced wetlands could increase the turbidity of source water, but these effects are expected to be small given predicted 404 program impacts.

Table IV-55: Public drinking water intakes in the Upper and Lower Pecos watersheds

HUC4	Number of intakes	Number of people served	Potential impacts from proposed rule
1306	4	37,120	Not quantified
1307	0	0	Not quantified
Total	4	37,120	Not quantified

Source: EPA analysis of SDWIS (2017) data.

IV.B.4.3.3 Dredging for Water Storage and Navigation

The agencies did not quantify the impacts of the proposed rule on reservoir sedimentation. As described above, higher sediment loads due to reduced wetlands could increase sedimentation in downstream reservoirs, but these effects are expected to be small given predicted 404 program impacts.

IV.B.4.3.4 Ecosystem Services Provided Ephemeral Streams

In reviewing the Draft Connectivity Report entitled "Connectivity of Streams and Wetlands to Downstream Waters: A Review of the Scientific Evidence,"[147] EPA's SAB found that "[t]he literature review provides strong scientific support for the conclusion that ephemeral, intermittent, and perennial streams exert a strong influence on the character and functioning of downstream waters and that tributary streams are connected to downstream waters," at the same time the SAB stressed that "the EPA should recognize that there is a gradient of connectivity."[148] The SAB recommended that "the interpretation of connectivity be revised to reflect a gradient approach that recognizes variation in the frequency, duration, magnitude, predictability, and *consequences* of physical, chemical, and biological connections."[149] As the preamble to the proposed rule describes, the SAB found perennial and intermittent streams have a greater probability to impact downstream waters compared to ephemeral streams.

The agencies recognize that waters within a watershed are connected along such a gradient and that the degree of connectivity among aquatic components varies along a continuum from highly connected to highly isolated (U.S. EPA 2015b). In the semi-arid Upper and Lower Pecos watersheds (HUC 1306 and 1307), the majority of streams are ephemeral, falling toward the more isolated end of the connectivity gradient (see Table IV-50). Although these streams have different characteristics from generally more highly connected perennial streams that are in wetter environments, they perform similar hydrological and ecological functions, including moving water, sediments, and nutrients, providing connectivity within the watershed and habitat to wildlife (Levick et al. 2008).

Ephemeral streams in arid and semi-arid areas support a variety of ecosystem services. For example, ephemeral streams play an important role in replenishing groundwater in the arid West, which people in the study area heavily depend on for irrigation and drinking water supply (Levick, et al., 2008). One of the major sources of regional groundwater in the Rio Grande, for instance, is seepage from the Rio Grande, the Rio Puerco, and from the ephemeral Abo and Tijera Arroyos (U.S. EPA, 2015b).

Even during dry periods, water may always be present below the ground in ephemeral streams and accessible to a rich assemblage of plant and animal life. In arid areas ephemeral stream channels are easily recognizable by their dense corridor of vegetation that supports the disproportionately high biological diversity of desert environments relative to their total area (Warren and Anderson, 1985 as cited in Levick et al. 2008). Ephemeral stream channels (washes) with shallow ground-water zones are typically lined with trees including Fremont cottonwood, Arizona sycamore, Arizona ash, acacia, blue palo verde, or velvet mesquite and shrubs such as wolfberry or brickellbush (Hardy et al., 2004; Levick et al. 2008). Federally listed threatened plants such as Pecos sunflower also inhabit stream courses dependent on shallow groundwater (U.S. FWS 2005).

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[147] U.S. EPA. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (External Review Draft)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R11/098B, September 2013.

[148] Letter to Gina McCarthy. October 17, 2014. SAB Review of the Draft EPA Report Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence. Page 3.

[149] *Id*. at 2 (emphasis added).

Because ephemeral stream channels have a higher moisture content and more abundant vegetation than the surrounding areas, they support the greatest concentrations of wildlife in arid regions. Wildlife utilizes ephemeral stream channels with continuous vegetation for food sources, predator protection, breeding and nesting sites, shade, and movement corridors. Some species that depend on the microclimates provided by ephemeral streams cannot survive the harsh desert environment, and therefore cannot move to other suitable habitats if their homes are harmed (Levick, et al., 2008).

IV.B.5 Limitations and Uncertainty of Case Study Analyses

Several methodological and data limitations affect the case study analyses or contribute to uncertainty. These limitations are in addition to the limitations inherent to the data sources previously discussed in Section II.C. They include:

- **Case study locations may not be indicative of nationwide impacts**. 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 impacts of the proposed rule across the United States. Factors considered by the agencies in selecting among case study candidates prioritized locations for which primary wetland valuation studies were available and the states were less likely to continue to regulate newly non-jurisdictional waters. While these locations show that the proposed rule will have relatively small impacts, the 404 program data used in the later national analysis identify other watersheds where a significantly greater amount of mitigation occurred in 2011-2015 to address impacts of permitted activities. Therefore, cost savings, environmental impacts, and forgone benefits in these watersheds may be larger (or smaller) than estimated for the three case studies presented in this section. The agencies welcome comment on whether the three case studies are sufficient to illustrate the impacts of the proposed rule.

- **Available data provide only an incomplete inventory of existing projects and permits affecting ephemeral streams and other waters affected by the proposed rule**. The high resolution NHD data do not consistently differentiate stream attributes according to the stream flow regime, limiting the agencies' ability to identify activities or dischargers affecting these waters in the baseline. Because of this limitation, EPA relied primarily on information provided in program databases and/or NWI wetland attributes when determining the type of affected waters. The information provided in these alternative data sources was not always sufficient to categorize the flow regime; where this was the case, the agencies assumed that these waters are not ephemeral. This may have omitted relevant activities or permits from the analysis, which would understate the impacts of the proposed rule.

- **The analysis of the 402 program uses NWI data to estimate the flow regime of receiving waters**. To estimate which permitted discharges might be affected by the proposed rule, the agencies relied on 402 permit locational information and NWI data. The agencies used the Cowardin classification code assigned to the NWI resource closest to the coordinates of permitted outfalls to approximate the flow regime of the receiving waters. If the Cowardin classification code of the receiving water was either R4SBA (Riverine, Intermittent, Streambed, Temporarily Flooded) or R4SBJ (Riverine, Intermittent, Streambed, Intermittently Flooded), the permitted discharge was assumed to likely be to an ephemeral water. The agencies used NWI instead of NHD to assess flow regime of receiving waters because the NHD dataset does not consistently distinguish between intermittent and ephemeral streams nationwide. The use of NWI data may result in an underestimate of the number of 402 permits potentially discharging to ephemeral waters, as the NWI does not map all ephemeral streams and does not include a Water Regime Modifier for all streams, which was used to determine which streams mapped in the NWI were likely ephemeral. The agencies solicit comment regarding the assumptions and validity of the use of Cowardin Classification System codes R4SBA and R4SBJ to identify ephemeral features for use in the Case Study section 311 and section 402 analyses. More specifically, given the "Temporarily Flooded" category includes streams where surface water may be present for "a few weeks," and the "Temporarily Flooded" definition implies there may be times when the water table is above the ground surface, the agencies seek comment whether waters identified as "Temporarily Flooded" would more appropriately be classified as intermittent rather than ephemeral for purposes of the agencies' analyses. Additionally, the agencies seek comment whether the "Temporarily Flooded" category covers both intermittent and ephemeral streambeds and cannot be used to distinguish between the two for purposes of the agencies' analyses. Finally, given the Corps ORM2 database does not parse out "Riverine Intermittent" (R4) codes into ephemeral and intermittent features, but instead uses an entirely new "Riverine, Ephemeral" category (R6) to identify ephemeral aquatic resources, the agencies solicit comment whether it is appropriate to bifurcate the "Riverine Intermittent" subsystem into ephemeral and intermittent features for purposes of the agencies' analyses.

- **Projects permitted in 2011-2015 may not be representative of future projects**. For the case study analysis, the agencies assumed that projects permitted under the 404 program during the period of 2011-2015 are representative of projects that may be permitted over the next 20 years in terms of the type and location of the projects, extent and character of the affected resources, and mitigation requirements. In fact, future development patterns may follow different distributions and affect locations that the agencies did not consider for this analysis. The agencies welcome comments on whether it is reasonable to use past projects as indication of future development and activities.

- **The analysis focuses on compensatory mitigation as the main change under the 404 program.** The 404 permitting process promotes preventing impacts to waters through project location and design and only where those actions are not sufficient is mitigation of the unavoidable impacts necessary. For waters that are no longer jurisdictional, the incentive to prevent or limit impacts would no longer be present. As such, impacts to existing wetlands and streams may be larger than indicated by the impacts for permitted projects, thereby understating the impacts of the proposed rule. The agencies welcome data on the likely response of developers to reduced incentives to limit impacts.

- **The analysis of the 404 program considers forgone mitigation of permanent wetland impacts only**. The analysis of avoided costs, forgone benefits, and SWAT model scenarios incorporate the impacts of forgone mitigation for permanent impacts to wetlands and omit additional mitigation that may also be needed to compensate for temporary impacts. To the extent that mitigation of temporary impacts results in the permanent protection of wetlands, the analytic scenarios may understate the impacts of the proposed rule on cost savings, forgone benefits, and water quality. Appendix E provides results of a sensitivity analysis that includes forgone mitigation of temporary impacts, among other assumptions.

- **The analysis omits impacts on isolated (non-abutting) wetlands**. Some non-abutting wetlands may have previously been found to be jurisdictional following a significant nexus determination (*e.g.*, as adjacent wetlands) and thus mitigation actions were required if these wetlands were affected by 404 permitted activities. Categorically excluding these wetlands from jurisdictional waters may negatively affect habitats for a variety of species, including amphibians and water fowl, that rely on persistent waterbodies that are not directly located on the stream network. Appendix E provides results of a sensitivity analysis that includes forgone mitigation of impacts to non-abutting wetlands, among other assumptions.

- **The analysis of the 404 program relies on the ORM2 data on permanent impacts and the mitigation ratios to estimate changes in compensatory mitigation resulting from the proposed rule**. The agencies assumed that 404 permitted projects primarily affect Category III wetlands and streams. Category III water resources are defined as not rare or unique and usually plentiful in the watershed. The recommended compensatory ratios range from less than 1:1 to 1.5:1. If pristine or otherwise unique resources are affected the mitigation ratios could range from 2:1 for Category II wetlands to 3:1 for Category I wetlands. The estimated costs and benefits are likely to be understated if Category I and II wetlands are affected. In some cases, a mitigation ratio of less than 1:1 may be required; in such cases cost savings and forgone benefits are likely to be overstated. Although the agencies validated their assumptions based on statistical analysis of ORM2 data on 4,000 projects where the relationship between impacted acres and required mitigation acres could be isolated, this analysis excluded any projects where impacts or mitigation included linear feet values and any projects where some or all of the mitigation used credits or in-lieu fees. To the extent that excluded projects used significantly different mitigation ratios, the estimated costs savings and forgone benefits could be under- or overstated.

- **The 404 permit cost savings analysis relies on Corps' estimates of permit application costs.** The Corps estimated permit application costs based on a "typical" permit. The permit application cost savings analysis for the proposed rule only includes permits solely affecting waters that change jurisdictional status under the proposed rule (*e.g.*, ephemeral streams and RPWWN-type wetlands). Since the impacts of these permits are less than "typical" on average, the agencies used the lower bound estimate of the Corps' permit application cost range. The use of the lower bound estimate may underestimate costs for larger projects or for permits in high-cost regions. Any permits affecting both waters likely to remain jurisdictional and waters likely to no longer be jurisdictional under the proposed rule are not considered in the cost savings analysis. Cost savings may be greater than estimated by the agencies in cases where eliminating some waters from permitting requirements streamlines the process and reduces overall permit costs.

- **The analysis of forgone benefits associated with reduced mitigation requirements for ephemeral streams, typically expressed in linear feet, focuses on the total ecological impacts associated with reduced riparian areas**. As noted above, requirements for the riparian buffer width vary from state to state. The agencies assumed that a 25-foot buffer zone on each stream side (50 feet total) is required around ephemeral streams in the main analysis.[150] Because some states don't specify minimum requirements for a buffer zone, while others specify a minimum requirement of a 50-foot buffer, the agencies' estimate of the lost riparian area may be overstated for some locations and understated for others. Appendix E provides results of a sensitivity analysis that uses a 100 feet buffer (50 feet on either side), among other assumptions.

- **The value of forgone benefits from reduced riparian areas around ephemeral streams could be lower or higher compared to the WTP to avoid wetland losses, depending on the role of ephemeral streams and their riparian areas in a given watershed**. Valuation of reduced mitigation requirements for wetlands and riparian areas is based on benefit transfer from a study by Bloomquist and Whitehead (1998) that valued freshwater wetlands (including riparian). Given that riparian areas adjacent to ephemeral streams perform many of the characteristic ecological functions performed by true riparian areas adjacent to perennial and intermittent streams, but may not provide a full spectrum of ecological functions (Zaimes et al. 2007), the estimated forgone benefits for the reduction in riparian areas around ephemeral streams may be overstated.
- **Transfer error may occur when benefit estimates from a study site are adopted to forecast the benefits of a policy site.** Rosenberger and Stanley (2006) define transfer error as the difference between the transferred and actual, generally unknown, value. The wetland valuation study used in benefits transfer (*i.e.*, Bloomquist and Whitehead, 1998) focused on wetlands within the Ohio River Basin. Thus, it provides nearly a perfect match to the resource characteristics considered in the analysis of forgone benefits. However, it was conducted 20 years ago and public preferences for wetland protection may change over time. It provides a good, but not a perfect match for the Lower Missouri River case study. Although the wetland types valued in the original study are the same as in the Lower Missouri River case study area, public preferences for wetland preservation may differ across states and communities, for example, due to the difference in the baseline wetland area, the importance of wetland preservation at the watershed level, and other factors. Therefore, the estimated WTP values may under- or overstate the value of foregone benefits in the case study areas.
- **Potential hypothetical bias may be present in the source study used in benefits transfer**. Following standard benefit transfer approaches, this analysis proceeds under the assumption that the source study provides a valid, unbiased estimate of the welfare measure under consideration (cf. Moeltner et al. 2007; Rosenberger and Phipps 2007).
- **The effect of distance between the affected households and the affected wetlands was not explicitly included in the analysis.** Following the Bloomquist and Whitehead study (1998), the agencies assumed that all households in the state where wetland losses occur and households in the counties adjacent to the affected resources that reside in the neighboring state hold the same average WTP value for preventing wetland losses. The agencies would expect values for water quality improvements to diminish with distance (all else equal) between the home and affected water resources. This difference is implicitly captured in the average WTP reported in the original

[150] A 50 feet buffer zone on each stream side (100 feet total) was used in the sensitivity analysis.

study. If the distribution of households by distance is different at the policy site, the estimated value of forgone benefits could be biased either upward or downward.

- **Water quality modeling focuses on environmental impacts within the immediate watershed**. The scope of the water quality models covers the HUC4 watersheds where wetland changes occur. However, the impacts of land use changes and forgone ecosystem services are not limited to these watersheds. Changes in flows and nutrients and sediments fluxes may also affect downstream waters, including in states that continue broad protections of non-jurisdictional waters. As such, the analysis understates the potential impacts of the proposed rule.

- **Water quality modeling scenarios assume wetland impacts distributed across subbasins within a watershed.** As described in Section IV.B.1.3.1, the agencies distributed changes in 404 program impacts due to the policy among all subbasins within the SWAT watershed that had both existing wetlands and developed areas. This approach of distributing total watershed changes may understate localized hydrological and water quality impacts in cases where projects are concentrated in a few subbasins within a watershed. For example, in watershed HUC 0509, the ORM2 data show mitigated wetland impacts in 33 subbasins over 5 years, whereas the agencies distributed impacts over 300 subbasins over 20 years. For watershed HUC 0510, the ORM2 data show impacts in 11 subbasins, whereas the agencies distributed the impacts over 84 subbasins for modeling purposes. The agencies request comments on alternative assumptions and ways to distribute watershed-level changes that could better represent projected development over the coming decades.

- **The water quality models use a simplified representation of wetland functions in each watershed.** As described in Section IV.B.1.3.1, the SWAT models represent wetlands through both land cover (HRUs) and as distinct hydrologic features within the subbasins. The SWAT models represent two main categories of wetlands in each subbasin: abutting wetlands that are hydrologically connected to the main reach of a subbasin, and non-abutting wetlands without a direct connection. The analysis used two HRU groups to represent each of the wetland land cover types, and two SWAT hydrologic features, ponds and wetlands, to represent the hydrology of the two wetland groups. SWAT pond functions were configured to represent non-abutting wetlands hydrology by specifying the aggregated subbasin area and depth of non-abutting wetlands according to the NWI data. In subbasins that include actual ponds, the wetland area was added to the ponds area since only one pond per subbasin is currently supported in SWAT. Abutting wetlands hydrology was represented by the wetlands function of SWAT. By configuring the model this way, the agencies can distinguish the two wetland categories in modeling the impacts, but the modeling approach otherwise models the wetlands in a spatially aggregated manner that does not account for the exact location of the wetlands within each HUC12 subbasins. The agencies would appreciate comments on this approach for modeling non-abutting and abutting wetlands with SWAT.

- **The analysis used the distance between certain oil storage or production facilities and waters as an approximate indicator of reasonable potential for a discharge for the 311 program**. There is significant uncertainty in the universe of oil storage or production facilities that could be affected by a change in CWA jurisdictional scope. The SPCC rule does not require facility owners/operators to identify themselves to the EPA. While the agencies were able to use location data for equipment associated with a small subset of the SPCC-regulated universe (oil production wells) and FRP facilities, these data provide only partial insight into the reasonable potential for a discharge of oil to "waters of the United States" that determines SPCC and FRP applicability.

Appendix E presents the results of a sensitivity analysis that evaluate the effects of different assumptions regarding the scope of 404 program impacts:

- Non-abutting wetlands: The sensitivity analysis includes impacts to wetlands determined to be non-abutting based on the agencies' analysis of high-resolution NHD and NWI data, whereas the primary analysis described in this section assumes that these wetlands have no change in jurisdictional status.
- Scope of impacts: The sensitivity analysis includes both temporary and permanent impacts, as compared to permanent impacts only in the analysis described in this section.
- Width of assumed stream riparian buffer for linear impacts: The sensitivity analysis assumes a width of 100 feet, as compared to 50 feet for the primary analysis described in this section.

IV.B.6 Discussion of Case Study Analysis Findings

Table IV-56 to Table IV-58 summarize the findings of the Stage 2 analysis across the three case study areas. In general, annual avoided costs exceed annualized forgone benefits, but as discussed in Section IV.B.4 and noted in the summary tables, limitations of the data curtailed the agencies' ability to quantify or monetize some of the environmental effects and forgone benefits of the proposed rule.

Table IV-56: Scenario 0 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)			Annualized Forgone Benefits (2017$ millions)[1]	
	Low	High		Low	High
Ohio River Basin					
CWA 402	$0.0	$0.0		$0.0	$0.0
CWA 404 Permit Application	$0.41	$0.41		N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$8.18	$30.18		$0.68[2]	$4.52
CWA 404 Mitigation – Water Quality	N/A	N/A		*not monetized*	*not monetized*
CWA 404 – Reservoir Dredging	N/A	N/A		< $0.1[3]	< $0.1
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$8.59**	**$30.59**		**$0.68**	**$4.52**
Lower Missouri River Basin					
CWA 402	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 404 Permit Application	$0.26	$0.26		N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$1.36	$5.34		$0.12[4]	$0.81
CWA 404 Mitigation – Water Quality	N/A	N/A		*not monetized*	*not monetized*

Table IV-56: Scenario 0 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)			Annualized Forgone Benefits (2017$ millions)[1]	
	Low	High		Low	High
CWA 404 Mitigation – Reservoir Dredging	N/A	N/A		negligible[5]	negligible
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$1.62**	**$5.60**		$0.12	$0.81
Rio Grande River Basin					
CWA 402	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 404 Permit Application	$0.11	$0.11		N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	negligible[6]	negligible		*not monetized*	*not monetized*
CWA 404 Mitigation -Water Quality	N/A	N/A		*not quantified*	*not quantified*
CWA 404 Mitigation-Reservoir Dredging	N/A	N/A		*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$0.11**	**$0.11**		**$0.00**	**$0.00**
Total 3 Case Studies					
TOTAL (Monetized Categories)	**$10.32**	**$36.30**		**$0.80**	**$5.33**

[1]Annualized forgone benefits are estimated at a 3% discount rate.

[2] The estimated annualized forgone benefits from reduced mitigation requirements range from a low of $0.50 to a high $3.34 million at a 7% discount rate.

[3] Estimated increase in annualized dredging costs is $2.0 thousands with a three percent discount rate, or $1.6 thousands with a seven percent discount rate.

[4]Annualized forgone benefits from reduced mitigation requirements in the Lower Missouri River Basin range from a low of $0.09 million to a high of $0.60 million at a 7% discount rate.

[5] The estimated annual change in reservoir dredging costs range from -$465 to -$512.

[6] The estimated annual mitigation cost savings range from range of $187 to $261.

Table IV-57: Scenario 1 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)			Annual Forgone Benefits (2017$ millions)	
	Low	High		Low	High
Ohio River Basin					
CWA 402	$0.0	$0.0		$0.0	$0.0
CWA 404 Permit Application	$0.32	$0.32			
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$6.42	$15.93		$0.37[2]	$2.44
CWA 404 Mitigation -Water Quality	N/A	N/A		*not quantified*	*not quantified*
CWA 404 Reservoir Dredging	N/A	N/A		*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*

Table IV-57: Scenario 1 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)			Annual Forgone Benefits (2017$ millions)	
	Low	High		Low	High
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$6.74**	**$16.26**		**$0.37**	**$2.44**
Lower Missouri River Basin					
CWA 402	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 404 Permit Application	$0.26	$0.26		N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$1.36	$5.34		$0.12[3]	$0.81
CWA 404 Mitigation -Water Quality	N/A	N/A		*not quantified*	*not quantified*
CWA 404 Mitigation-Reservoir Dredging	N/A	N/A		*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$1.62**	**$5.60**		**$0.12**	**$0.81**
Rio Grande River Basin					
CWA 402	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 404 Permit Application	$0.11	$0.11		N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	negligible[4]	negligible		*not monetized*	*not monetized*
CWA 404 Mitigation -Water Quality	N/A	N/A		*not quantified*	*not quantified*
CWA 404 Mitigation-Reservoir Dredging	N/A	N/A		*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*		*not monetized*	*not monetized*
SUBTOTAL	**$0.11**	**$0.11**			
Total 3 Case Studies					
TOTAL (Monetized Categories)	**$8.47**	**$21.97**		**$0.49**	**$3.25**

[1]Annualized benefits are estimated at a 3% discount rate.

[2] The estimated forgone annualized benefits from reduced mitigation requirements in the Ohio River Basin range from a low of $0.27 to a high of $1.80 million at a 7% discount rate.

[3]Annualized forgone benefits from reduced mitigation requirements in the Lower Missouri River Basin range from a low of $0.09 million to a high of $0.60 million at a 7% discount rate.

[4]The estimated annual mitigation cost savings range from $187 to $261.

Table IV-58: Scenario 2 & 3 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)			Annual Forgone Benefits (2017$ millions)	
	Low	High		Low	High
Ohio River Basin					
CWA 402	$0.0	$0.0		$0.0	$0.0
CWA 404 Permit Application	$0.31	N/A		N/A	N/A

Table IV-58: Scenario 2 & 3 — Potential impacts, cost savings, and forgone benefits in the Case Study areas excluding the impact from states that may continue their baseline dredged/fill and surface water permitting practices

	Annual Avoided Costs (2017$ millions)		Annual Forgone Benefits (2017$ millions)	
	Low	**High**	**Low**	**High**
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$6.42	$15.93	$0.37[2]	$2.44
CWA 404 Mitigation -Water Quality	N/A	N/A	*not quantified*	*not quantified*
CWA 404 Reservoir Dredging	N/A	N/A	*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*	*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*	*not monetized*	*not monetized*
SUBTOTAL	**$6.73**	**$16.25**	**$0.37**	**$2.44**
Lower Missouri River Basin				
CWA 402	*not monetized*	*not monetized*	*not monetized*	*not monetized*
CWA 404 Permit Application	<$0.01	<$0.01	N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	$0.00	$0.00	$0.00	$0.00
CWA 404 Mitigation -Water Quality	N/A	N/A	*not quantified*	*not quantified*
CWA 404 Mitigation-Reservoir Dredging	N/A	N/A	*not quantified*	*not quantified*
CWA 311 Compliance	*not monetized*	*not monetized*	*not monetized*	*not monetized*
CWA 311 Compliance	*not monetized*	*not monetized*	*not monetized*	*not monetized*
SUBTOTAL	**<$0.01**	**<$0.01**	**$0.00**	**$0.00**
Rio Grande River Basin				
CWA 402	*not monetized*	*not monetized*	*not monetized*	*not monetized*
CWA 404 Permit Application	$0.11[3]	$0.11	N/A	N/A
CWA 404 Mitigation – Wetlands & Ephemeral Streams	negligible[4]	negligible	*not monetized*	*not monetized*
CWA 404 Mitigation – Water Quality	N/A	N/A	*not quantified*	*not quantified*
CWA 404 Mitigation – Reservoir Dredging	N/A	N/A	*not quantified*	*not quantified*
CWA 311 – FRP Requirements	*not monetized*	*not monetized*	*not monetized*	*not monetized*
CWA 311 – SPCC Requirements	*not monetized*	*not monetized*	*not monetized*	*not monetized*
SUBTOTAL	**$0.11**	**$0.11**		
Total 3 Case Studies				
TOTAL (Monetized Categories)	**$6.84**	**$16.36**	**$0.37**	**$2.44**

[1] Annualized forgone benefits are estimated at a 3% discount rate.
[2] The estimated forgone annualized benefits from reduced mitigation requirements in the Ohio River Basin range from a low of $0.27 million to a high of $1.80 million at a 7% discount rate.
[3] Estimated annual reduction in 404 permit application costs under Scenario 3 is zero.
[4] The estimated annual mitigation cost savings range from range of $187 to $261 under Scenario 2 and zero under Scenario 3.

IV.C Stage 2 Quantitative Assessment of National Impacts

The case studies demonstrate that data limitations constrain the agencies' ability to quantify and value the effects of the proposed rule on the section 402 and 311 programs, but that it is possible to consistently quantify and value at least some of the potential effects of the proposed rule on the 404 program. Accordingly, to evaluate the impacts of the Stage 2 rule, the agencies focused on 404 program impacts of the proposed rule for which data are sufficient to develop quantitative estimates at the national level. The approach incorporates the predicted state response under various scenarios (see Section III.C.1). Inputs for this analysis were derived using the same approach as described for the case studies (see Section IV.B.1.2.2), which relies on 404 permit data from the Corps' ORM2 database to identify aquatic resources and permits affected by the proposed rule. To estimate cost savings, the agencies used the same methodology described in Section IV.B.1.2.2.1. To estimate forgone benefits, the agencies used a meta function benefits transfer to value forgone wetland mitigation (see Section III.C.2).

National-level results of this analysis are summarized below. Table IV-59 presents national-level cost savings from reduced permit requirements. Table IV-60 presents national-level cost savings from reduced mitigation requirements. Table IV-61 presents total national-level cost savings (sum of permit cost savings and reduced mitigation requirement savings). Table IV-62 presents forgone benefit estimates based on annual WTP for wetlands under each of the state response scenarios. State-level estimates of cost savings and forgone benefits are provided in Appendix F.

As shown in the tables, the estimated cost savings from avoided permit applications and mitigation generally exceed forgone benefits of wetlands. This is true for all four state response scenarios the agencies analyzed and under most cost or WTP assumptions. For example, under Scenario 2, annual cost savings range between $112.5 million and $214.9 million (under low and high cost assumptions), compared to estimated forgone benefits of $41.7 million (based on mean WTP). One exception is Scenario 0 for which forgone benefits based on the 95th percentile of the WTP for wetlands are greater than the lower bound of estimated cost savings.

Table IV-59: National average annual reduction in 404 permit application costs

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)
Scenario 0[1,2]			
IP	$14,700	88	$1.3
GP	$4,400	5,758	$25.3
Total		**5,846**	**$26.6**
Scenario 1[1,3]			
IP	$14,700	41	$0.6
GP	$4,400	3,509	$15.4
Total		**3,550**	**$16.0**
Scenario 2[1,4]			
IP	$14,700	28	$0.4
GP	$4,400	2,323	$10.2
Total		**2,351**	**$10.6**
Scenario 3[1,5]			
IP	$14,700	10	$0.2
GP	$4,400	499	$2.2
Total		**509**	**$2.4**

[1] Annual average permit reductions based on permits issued in years 2011-2015 estimated to only affect RPWWN-type wetlands or ephemeral streams.

[2] Includes all states except Hawaii.

Table IV-59: National average annual reduction in 404 permit application costs

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)

[3] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Iowa, Idaho, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Montana, North Carolina, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, South Carolina, South Dakota, Texas, Utah, Wisconsin, West Virginia, and Wyoming

[4] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Idaho, Kentucky, Missouri, Mississippi, Montana, North Dakota, New Mexico, Oklahoma, South Carolina, South Dakota, Texas, Utah, and Wyoming

[5] Includes Arizona, Idaho, Kentucky, Mississippi, and South Dakota

Table IV-60: National average annual cost savings of reduced mitigation requirements resulting from the proposed definitional change

Unit	Annual Average Mitigation Reduction with Rule	Low (Millions 2017$)	High (Millions 2017$)
Scenario 0[1,2]			
Acres	973.9	$55.5	$120.7
LF	446,282	$154.3	$349.3
Total		**$209.9**	**$470.0**
Scenario 1[1,3]			
Acres	406.1	$22.4	$42.7
LF	311,025	$96.2	$206.9
Total		**$118.6**	**$249.7**
Scenario 2[1,4]			
Acres	272.5	$18.3	$32.3
LF	225,112	$83.6	$172.0
Total		**$101.9**	**$204.3**
Scenario 3[1,5]			
Acres	53.8	$3.0	$4.4
LF	74,661	$22.3	$55.8
Total		**$25.3**	**$60.2**

[1] Annual average mitigation reduction based on permits issued in years 2011-2015 with mitigation requirements on waterways determined to be RPWWN-type wetlands or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services. Cost savings are calculated by multiplying the cost of each mitigation acre or linear foot (low and high estimates) for each state by the expected reduction in annual mitigation requirements, and summing the state-level acreage and linear feet values for each scenario.

[2] Includes all states except Hawaii.

[3] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Iowa, Idaho, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Montana, North Carolina, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, South Carolina, South Dakota, Texas, Utah, Wisconsin, West Virginia, and Wyoming

[4] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Idaho, Kentucky, Missouri, Mississippi, Montana, North Dakota, New Mexico, Oklahoma, South Carolina, South Dakota, Texas, Utah, and Wyoming

[5] Includes Arizona, Idaho, Kentucky, Mississippi, and South Dakota

Table IV-61: Total national estimated annual cost savings (Millions 2017$)

Cost Type	Scenario 0[1]		Scenario 1[2]		Scenario 2[3]		Scenario 3[4]	
	Low	High	Low	High	Low	High	Low	High
Permit Cost Savings	$26.6	$26.6	$16.0	$16.0	$10.6	$10.6	$2.4	$2.4
Mitigation Cost Savings	$209.9	$470.0	$118.6	$249.7	$101.9	$204.3	$25.3	$60.2
Total	**$236.5**	**$496.6**	**$134.6**	**$265.7**	**$112.5**	**$214.9**	**$27.6**	**$62.6**

[1] Includes all states except Hawaii.

[2] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Iowa, Idaho, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Montana, North Carolina, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, South Carolina, South Dakota, Texas, Utah, Wisconsin, West Virginia, and Wyoming

[3] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Idaho, Kentucky, Missouri, Mississippi, Montana, North Dakota, New Mexico, Oklahoma, South Carolina, South Dakota, Texas, Utah, and Wyoming

[4] Includes Arizona, Idaho, Kentucky, Mississippi, and South Dakota

Table IV-62: Total national forgone benefit estimate of reduced mitigation requirements resulting from the proposed definitional change, by policy scenario

Scenario	Households	Annual Forgone Mitigation Acres	Mean WTP per household per acre (2017$)	Mean Estimate of Forgone Benefits (Millions 2017$)	Lower 5th WTP per household per acre (2017$)	Lower 5th Estimate of Forgone Benefits (Millions 2017$)	Upper 95th WTP per household per acre (2017$)	Upper 95th Estimate of Forgone Benefits (Millions 2017$)
Scenario 0[1,2]	115,994,247	1,486.2	$0.0231	$135.6	$0.0001	$0.7	$0.0453	$300.3
Scenario 1[1,3]	45,033,201	763.1	$0.0192	$46.8	$0.0001	$0.3	$0.0422	$104.0
Scenario 2[1,4]	32,455,035	530.9	$0.0211	$41.7	$0.0001	$0.2	$0.0463	$92.7
Scenario 3[1,5]	6,118,413	139.5	$0.0236	$6.9	$0.0001	<$0.1	$0.0504	$14.2

[1] Annual average mitigation reduction based on permits issued in years 2011-2015 with mitigation requirements on waterways determined to be RPWWN-type wetlands or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services.

[2] Includes all states except Hawaii.

[3] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Iowa, Idaho, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Montana, North Carolina, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, South Carolina, South Dakota, Texas, Utah, Wisconsin, West Virginia, and Wyoming

[4] Includes Alaska, Alabama, Arkansas, Arizona, Colorado, Delaware, Georgia, Idaho, Kentucky, Missouri, Mississippi, Montana, North Dakota, New Mexico, Oklahoma, South Carolina, South Dakota, Texas, Utah, and Wyoming

[5] Includes Arizona, Idaho, Kentucky, Mississippi, and South Dakota

V Regulatory Flexibility Act (RFA) Analysis

The Regulatory Flexibility Act (RFA, 5 U.S.C. et seq., Public Law 96-354), amended by the 1996 Small Business Regulatory Enforcement Fairness Act (SBREFA), requires the agencies to consider the economic impact that a new rule will have on small entities. The purpose of the RFA and SBREFA laws is to ensure that, in developing rules, agencies identify and consider ways to avoid undue impacts on small entities that will be affected by the regulation, whether as small entities that will be subject to regulatory requirements or as small governments that will be responsible for complying with or administering the regulation. While the RFA does not require an agency to minimize a rule's impact on small entities if there are legal, policy, factual, or other reasons for not doing so, it does require that agencies:

- Determine, to the extent feasible, the economic impact on small entities subject to the rule;
- Explore regulatory options for reducing any significant economic impact on a substantial number of such entities; and,
- Explain the ultimate choice of regulatory approach.

For any notice-and-comment rule it promulgates, the agencies must either certify that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities" ("SISNOSE") or prepare a Regulatory Flexibility Analysis if the Agency cannot make this certification. Small entities include small businesses and small organizations as defined by SBA, and governmental jurisdictions with populations of less than 50,000.

The proposed rule is not expected to have a significant economic impact on a substantial number of small entities under the RFA. This is a deregulatory action, that reduces the jurisdictional scope of the CWA and the burden on entities regulated under the CWA that are affected by this proposed rule, including small entities, is reduced compared to the 2015 Rule and pre-2015 practice. The agencies have therefore concluded that this action will relieve regulatory burden to small entities.

V.A Entities Regulated under Clean Water Act Programs

The proposed rule will directly affect entities regulated under the CWA that effect waters whose jurisdictional status will change. The agencies consider these direct effects because they effect how these entities comply with their CWA requirements. The potential impact of the proposed regulation on small entities is difficult to assess due to the lack of sufficient geospatial data identifying waters resources that will incur a jurisdictional change and resulting difficulty in identifying regulated activity that may be affected. The Small Business Administration (SBA) has developed size standards to carry out the purposes of the Small Business Act and are used for defining small entities under the RFA. The agencies reviewed available information on the type of entities that are regulated under the CWA section 311, 402, and 404 programs primarily affected by this proposed rule, with the purpose of identifying sectors with small entities that may incur impacts. The proposed rule is expected to result in fewer entities subject to these programs, and a reduced regulatory burden for a portion of the entities that will still be subject to these programs. As a result, small entities subject to these regulatory programs are unlikely to suffer adverse impacts due to compliance with the regulation.

Under the section 402 program, entities are covered by either an individual or general permit. The entities covered by an individual permit, whether public or private, discharge to waters of sufficient size to accommodate their effluent. Based on the results from the case study analyses, only a very small number of NPDES permitted facilities were identified as potentially discharging to a water that may be affected by the rule. The agencies presume that the results from the case study analyses likely hold for the rest of the country, and that most of these waters that have permitted discharges will be unaffected by the proposed regulation. Those individual permittees that do discharge to waters that experience a jurisdictional change will still require an individual permit but may actually experience a reduction in their regulatory burden if the stringency of their limits is modified by their permitting authority. Those entities whose activities are covered by a NPDES general permit are not likely to be affected by the proposed rule. General permits are generic documents intended for a specific type of activity that can impact water resources. Obtaining coverage under a general permit typically does not require a site-specific assessment, and so takes less time and effort than an equivalent individual permit. However, with a general permit to obtain coverage the entity must accept the terms of the permit as written, and without a site-specific assessment the jurisdictional status of water resources that may be affected by the proposed rule is not a factor. As a result, agencies do not anticipate that general permittees will be impacted by the proposed rule.[151] Small entities are a subset of these entities subject to general permits and they will be equally unaffected. [152]

Based on the lack of identified impacts in the three case study analyses, the agencies consider the effects on the regulated community of NPDES permit holders to be minimal to none. This finding extends to those NPDES permit holders that are small entities.

For the section 404 program, the proposed rule will reduce the number of waters under federal jurisdiction, and this will in turn reduce the amount of avoidance, minimization, and mitigation measures necessary to obtain section 404 permit coverage, as well as a reduction in the total number of future section 404 permits. Table V-1 provides a summary list of the NAICS categories that engage in projects requiring 404 permit coverage, based on a review of national 404 permit data from 2011 through 2015. The agencies expect that the reduction in future section 404 permit obligations will result in cost savings rather than cost increases. These reductions are expected to extend to the universe of small entities required to obtain 404 permit coverage approximately equal to their existing portion of the overall 404 regulatory burden. [153]

Table V-1: CWA 404 Program NAICS Categories

NAICS Codes	NAICS Industry Description
Subsector 111	Crop Production
Subsector 112	Animal Production and Aquaculture
Subsector 113	Forestry and Logging
Subsector 211	Oil and Gas Extraction

[151] An exception may occur in arid areas of the country where a significant portion of water features may change jurisdictional status do to the proposed rule. In these areas the NPDES authority may require fewer entities to obtain general permit coverage.

[152] See above EA tables for a discussion of the total estimated avoided costs. (For example Tables IV-56 and 57)

[153] See above EA tables for a discussion of the total estimated avoided costs. (For example Tables IV-56 and 57)

Table V-1: CWA 404 Program NAICS Categories	
NAICS Codes	**NAICS Industry Description**
Subsector 212	Mining (except Oil and Gas)
Subsector 213	Support Activities for Mining
Subsector 221	Utilities
Subsector 236	Construction of Buildings
Subsector 237	Heavy and Civil Engineering Construction

The section 311 program has two main components that address the risk and harm from oil spills: spill prevention and preparedness under the SPCC and FRP programs; and spill response under the National Contingency Plan. The proposed rule may result in some facilities no longer having a reasonable potential of a discharge to a water of the United States. Table V-2 lists the NAICS categories commonly regulated under the 311 program. For these facilities the compliance burden will be reduced unless they decide to voluntarily continue implementing their plan or are required to by state or tribal authorities. The agencies acknowledge that spill risks may increase for any of these facilities that reduce their future spill protection measures.

Table V-2: CWA 311 Program NAICS Categories	
NAICS Codes	**Category**
4227	Petroleum and Petroleum Products Wholesalers
2211	Electric Power Generation, Transmission, and Distribution
3241	Petroleum and coal products manufacturing
miscellaneous	Other Commercial Facilities
454311	Heating Oil Dealers
31-33	Manufacturing
Source: Renewal of Information Collection Request for the Implementation of the Oil Pollution Act Facility Response Plan Requirements (40 CFR PART 112) (EPA # 1630.12)	

Spill risk liabilities for states and tribes may increase if facilities decrease their future spill prevention measures, States and tribes may also be impacted by the proposed rule even if facility spill prevention measures do not change. For waters under federal jurisdiction, the Oil Spill Liability Trust Fund (OSLTF) is used to cover containment, clean-up, and remediation costs when a responsible party cannot be identified. For containment, clean-up, and remediation costs for spills affecting non-jurisdictional waters, states and tribes bear the financial burden when a responsible party cannot be identified. So even if the overall probability of a risk does not increase within a state or tribal jurisdiction, there will be an increased financial risk that corresponds to the change in waters with federal jurisdiction. However, for the purposes of the RFA, states and tribal governments are not considered small government entities.[154]

V.B Entities Impacted by Changes in Ecosystem Services

Narrowing the scope of federal jurisdiction under the CWA may result in a reduction in the ecosystem services provided by some waters, such as less habitat, increased flood risk, and higher pollutant loads. As a result, both public and private entities that rely on these ecosystem services may be adversely impacted,

[154] The RFA defines "small governmental jurisdiction" as the government of a city, county, town, township, village, school district, or special district with a population of less than 50,000 (5 U.S.C. section 601(5)).

albeit indirectly. For example, loss of wetlands can increase the risk of property damage due to flooding. To predict if there will be significant impacts to any given sector it is important to assess which sectors may be more impacted by changes in ecosystem services.

Increases in flood risk are likely to be specific to the watersheds where the wetland losses occur and are not expected to impact a specific group or business sector. Habitat loss can have a direct effect on recreational activities such as hunting, fishing, and bird watching, depending on the type of ecosystem and species affected (*e.g.*, NAICS Code: 114210- Hunting and Trapping). Businesses that serve hunters or anglers, localities that collect admission fees or licenses, and non-profit organizations that focus on recreating within or preserving natural habitats are examples of sectors that could be affected by habitat loss, many of which could be categorized as small. 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). In addition, increased pollutant loadings can lead to higher drinking water treatment costs for localities, and for businesses that require water treatment for their production process. Higher sediment loads can impact downstream communities by increasing the need for dredging to maintain reservoir capacity and for navigation, and by shortening the useful life infrastructure damaged by increased scouring.

Potential changes in ecosystem services will be project specific and difficult to reasonably predict given the uncertainty around the magnitude of potential changes due to the proposed rule. Based on the results from the three case study analyses, it is very likely that many of these reductions in services will be small, infrequent, and dispersed over wide geographic areas, thereby limiting the significance of the financial impacts on small organizations and governments and small entities within specific business sectors. In addition, states and tribes may already address waters potentially affected by a revised definition, thereby reducing forgone benefits. For example, many states have the goal of “no net loss of wetlands” directly incorporated into their regulations.

V.C Entities Impacted by Changes in Mitigation Demand

An economic sector that will be indirectly impacted by the proposed rule are mitigation banks, and companies that provide restoration services. Mitigations banks are often limited liability companies that have been authorized by a state or federal agency to generate credits that can be used to meet the demand for mitigation, driven by state and federal regulations. Restoration services are businesses that provide the range of services needed for mitigation efforts. There customers can be mitigation banks or permittees that meet their regulatory requirements through on-site or off-site mitigation. Although primarily a business sector, there are mitigation banks owned and managed by non-profit organizations and government entities, such as state transportation departments. Businesses involved in mitigation banking and providing ecological restoration services are not contained within a single economic sector as defined by the North American Industrial Classification System (NAICS). A survey of this restoration sector, conducted in 2014 showed that many of the businesses involved in this sector fall into five categories: Environmental Consulting (NAICS: 541620); Land Acquisition (NAICS: 237210); Planning, Design, and Engineering (NAICS: 541320, 541330); Site Work (earth moving, planting) (NAICS: 237210, 237990); and Monitoring (BenDor et al, 2015).

Impacts to the mitigation banking sector and more broadly to the restoration sector would not be the direct result of these businesses complying with the proposed rule, rather they would be the indirect result of other entities coming into compliance with proposed rule. Because fewer waters would be subject to CWA jurisdiction under the proposed rule than are subject to regulation under the 2015 Rule or current practice, there would be a reduction in demand for mitigation and restoration services, under the section 404 permitting program and a corresponding reduction in revenue for the businesses. However, assessing impacts to this sector is problematic, given that this sector lacks a SBA small business definition, and many of the businesses that fall within this sector are also classified under various other NAICs categories. Existing data on 404 permits maintained by the agencies, does not identify sufficient ownership and business arrangement information to determine the economic profile of mitigation bank ownership, nor does it identify specific entities involved in performing restoration work. In addition, States and Tribes may require mitigation for impacted waters no longer covered under the proposed rule, thereby reducing the future change in mitigation demand.

V.D Conclusion

Overall, the agencies consider the small entity impacts of the proposed regulation are neither significant nor substantial, based on the lack of any cost increase for those entities that must comply with regulations under the CWA sections 311, 402, and 404 programs. Impacts to the mitigation banking sector would not be the direct result of these businesses complying with the proposed rule, rather they would be the indirect result of other entities coming into compliance with proposed rule. Similarly, potential impacts to small localities, organizations, and businesses due to changes in ecosystem services are indirect effects. The agencies certify that this action will not have a significant economic impact on a substantial number of small entities under 5 U.S.C. § 605 (b) of the RFA. In making this determination, the impact of concern is any significant adverse economic impact on small entities. An agency may certify that a rule will not have a significant economic impact on a substantial number of small entities if the rule relieves regulatory burden, has no net burden or otherwise has a positive economic effect on the small entities subject to the rule. This is a deregulatory action, and the burden on all entities affected by this proposed rule, including small entities, is reduced compared to the 2015 Rule and pre-2015 practice. We have therefore concluded that this action will relieve regulatory burden to small entities.

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Appendix A: Mapped NHD Stream Mileage and NWI Wetland Acreage by State

Table A-1: Mapped NHD Stream Mileage and NWI Wetland Acreage by State: The numbers and percentages of streams and wetlands by category do not equate to a quantification of waters that will or will not be jurisdictional under the proposed rule nor do they equate to a quantification of waters that are or are not jurisdictional under the pre-2015 practice. The data are presented to illustrate the incomplete national coverage of the NHD data, particularly with regard to ephemeral streams.

State	NHD Streams								NWI Wetlands
	Perennial		Intermittent		Ephemeral[1]		Other[2]		
	Miles	% of Total	Miles	% of Total	Miles	% of Total	Miles	% of Total	Acres
AK	666,417	48%	18,624	1%	82	0%	700,893	51%	-
AL	48,075	23%	69,415	33%	0	0%	95,602	45%	4,203,980
AR	20,915	9%	89,091	40%	30	0%	111,599	50%	2,408,523
AZ	4,194	1%	35,305	7%	249,591	51%	202,384	41%	354,060
CA	44,290	7%	85,290	13%	213,359	34%	291,058	46%	3,028,618
CO	32,715	7%	151,915	34%	66,955	15%	197,296	44%	2,002,309
CT[3]	7,593	35%	1,892	9%	-	0%	12,035	56%	310,505
DC[3]	26	19%	6	4%	-	0%	103	76%	319
DE[3]	2,404	26%	1,112	12%	-	0%	5,838	62%	263,327
FL	19,337	12%	8,123	5%	2	0%	127,332	82%	12,183,132
GA[3]	44,081	23%	53,965	28%	-	0%	93,464	49%	6,548,298
HI									
IA	27,730	15%	72,310	39%	2,396	1%	82,259	45%	1,088,441
ID	54,355	30%	96,072	53%	8,551	5%	22,010	12%	1,324,822
IL	26,033	22%	78,490	65%	287	0%	15,676	13%	1,301,283
IN[3,4]	15,030	6%	33,453	13%	-	0%	217,363	82%	1,055,925
KS	19,065	10%	153,419	83%	316	0%	11,687	6%	1,899,863
KY	26,118	26%	59,695	60%	3	0%	13,133	13%	465,603
LA	34,365	25%	59,755	44%	24	0%	41,649	31%	8,028,273
MA[3]	8,519	51%	3,734	23%	-	0%	4,328	26%	695,752
MD[3]	13,399	53%	3,872	15%	-	0%	8,191	32%	814,720
ME	25,864	50%	13,413	26%	0	0%	12,893	25%	2,548,325

Table A-1: Mapped NHD Stream Mileage and NWI Wetland Acreage by State: The numbers and percentages of streams and wetlands by category do not equate to a quantification of waters that will or will not be jurisdictional under the proposed rule nor do they equate to a quantification of waters that are or are not jurisdictional under the pre-2015 practice. The data are presented to illustrate the incomplete national coverage of the NHD data, particularly with regard to ephemeral streams.

State	NHD Streams								NWI Wetlands
	Perennial		Intermittent		Ephemeral[1]		Other[2]		
	Miles	% of Total	Miles	% of Total	Miles	% of Total	Miles	% of Total	Acres
MI[3]	29,251	36%	15,136	18%	-	0%	37,753	46%	7,796,982
MN	26,461	26%	38,028	37%	1	0%	38,269	37%	10,854,648
MO[3]	22,323	12%	141,077	76%	-	0%	21,160	11%	1,386,533
MS[3]	24,376	15%	114,831	70%	-	0%	23,982	15%	3,968,569
MT	49,899	13%	304,329	78%	3,627	1%	32,901	8%	3,227,102
NC[4]	43,069	31%	49,442	35%	1	0%	47,726	34%	4,366,486
ND	5,926	7%	73,640	81%	0	0%	11,165	12%	1,508,999
NE	13,472	11%	98,408	77%	521	0%	15,144	12%	1,314,903
NH	8,281	44%	6,861	37%	3	0%	3,592	19%	310,193
NJ[3]	12,834	54%	1,064	4%	-	0%	10,081	42%	889,188
NM	7,124	3%	60,237	25%	156,822	66%	13,182	6%	363,015
NV	10,741	3%	26,141	8%	267,153	85%	11,487	4%	1,033,171
NY[3]	56,516	57%	20,921	21%	-	0%	21,236	22%	2,207,886
OH	26,905	29%	53,172	58%	9	0%	11,627	13%	538,919
OK	33,924	20%	115,235	69%	482	0%	17,777	11%	1,379,591
OR	77,102	24%	192,672	61%	23,402	7%	22,322	7%	1,895,761
PA[3]	43,800	51%	30,131	35%	-	0%	12,065	14%	544,458
RI[3]	1,224	62%	92	5%	-	0%	647	33%	60,714
SC[3]	25,819	33%	31,934	41%	-	0%	19,731	25%	3,932,560
SD	12,070	7%	135,766	82%	2,809	2%	13,957	8%	2,065,241
TN	68,240	60%	32,065	28%	254	0%	12,984	11%	1,165,666
TX	36,044	7%	346,494	65%	84,783	16%	62,472	12%	4,630,573
UT	15,117	8%	83,888	45%	71,561	39%	13,927	8%	758,798
VA	36,123	33%	55,846	51%	4	0%	17,581	16%	1,454,954

Table A-1: Mapped NHD Stream Mileage and NWI Wetland Acreage by State: The numbers and percentages of streams and wetlands by category do not equate to a quantification of waters that will or will not be jurisdictional under the proposed rule nor do they equate to a quantification of waters that are or are not jurisdictional under the pre-2015 practice. The data are presented to illustrate the incomplete national coverage of the NHD data, particularly with regard to ephemeral streams.

State	NHD Streams								NWI Wetlands
	Perennial		Intermittent		Ephemeral[1]		Other[2]		
	Miles	% of Total	Miles	% of Total	Miles	% of Total	Miles	% of Total	Acres
VT[3]	22,677	86%	11	0%	-	0%	3,757	14%	86,122
WA	69,058	29%	148,082	62%	2,330	1%	21,204	9%	959,626
WI[3]	27,876	32%	42,114	49%	-	0%	16,745	19%	6,868,324
WV	21,230	39%	27,505	50%	11	0%	6,220	11%	57,052
WY	34,404	12%	197,979	69%	35,683	12%	20,774	7%	1,852,425
WA	2,002,413	21%	3,532,050	37%	1,191,051	12%	2,828,260	30%	959,626

Source: Based on analysis of NHD at high resolution and NWI data. See Section II.C for a description of the limitations of the NHD and NWI data in fully characterizing the waters that may be potentially affected by the proposed changes to the definition of "waters of the United States." The numbers and percentages of streams and wetlands by category do not equate to a quantification of waters that will or will not be jurisdictional under the proposed rule nor do they equate to a quantification of waters that are or are not jurisdictional under the pre-2015 practice.

[1] The percentages for this category represent the percentages of streams in each state that the NHD at high resolution maps as ephemeral. Zero percent for this category does not mean that the state has no ephemeral streams. Ephemeral streams are not independently mapped in many states. Often ephemeral streams are mapped in the intermittent stream category or are not mapped at all, which results in an overstatement of intermittent streams and an understatement of ephemeral streams. This table is a summary of the available NHD data and is not likely to accurately represent the types of waters in any given state.

[2] Includes unclassified streams, artificial paths, canal, ditches, aqueducts, and other feature without attributes.

[3] NHD has no stream miles mapped as ephemeral for these states. See FN 1 above.

[4] NHD has a high percentage of streams that are not classified as perennial, intermittent, or ephemeral (unclassified streams) for these states.

Appendix B: Revised Step 1 Analysis – Additional Scenarios

Table B-1: Estimates of avoided costs and forgone benefits including the impacts from all states

	Annual Avoided Costs (2017$ millions)			Annual Forgone Benefits (2017$ millions)	
	Low	High		Low	High
CWA 402 CAFO Administration	$0.2	$0.2		$3.9	$6.8
CWA 402 CAFO Implementation	$6.3	$6.3			
CWA 402 Stormwater Administration	$0.3	$0.3		$30.0	$38.1
CWA 402 Stormwater Implementation	$30.3	$37.7			
CWA 404 Permit Application	$29.8	$74.7		$59.4	$59.4
CWA 404 Mitigation – Wetlands	$57.4	$159.7			
SUBTOTAL	$124.2	$278.9		$93.4	$104.4
CWA 311 Compliance	$13.1	$13.1		*not quantified*	*not quantified*
CWA 401 Administration	$0.8	$0.8		*not quantified*	*not quantified*
CWA 402 Pesticide General Permit Implementation	$3.4	$3.8		*not quantified*	*not quantified*
CWA 404 Mitigation – Streams	$23.3	$46.5		*not quantified*	*not quantified*
TOTAL	$164.9	$343.1		$93.4	$104.4

These results include the potential costs and benefits for all categories for all states.

Table B-2: Scenario 1a – Estimates of avoided costs and forgone benefits excluding the impact from states that may continue their baseline dredged/fill permitting practices and are likely to continue their baseline other surface water regulatory practices

	Annual Avoided Costs (2017$ millions)			Annual Forgone Benefits (2017$ millions)	
	Low	High		Low	High
CWA 402 CAFO Administration	$0.1	$0.1		$1.7	$3.0
CWA 402 CAFO Implementation	$2.8	$2.8			
CWA 402 Stormwater Administration	$0.1	$0.1		$14.2	$18.0
CWA 402 Stormwater Implementation	$14.3	$17.8			
CWA 404 Permit Application	$10.2	$25.5		$14.3	$14.3
CWA 404 Mitigation – Wetlands	$26.7	$42.1			
SUBTOTAL	$54.1	$88.5		**$30.2**	**$35.3**
CWA 311 Compliance	$7.3	$7.3		*not quantified*	*not quantified*
CWA 401 Administration	$0.4	$0.4		*not quantified*	*not quantified*
CWA 402 Pesticide General Permit Implementation	$1.8	$2.0		*not quantified*	*not quantified*
CWA 404 Mitigation – Streams	$14.0	$27.8		*not quantified*	*not quantified*
TOTAL	$77.7	$126.0		**$30.2**	**$35.3**

These results exclude the costs and benefits for section 404 permit applications and mitigation for states classified as response category 3 or 4 for regulation of dredged or fill material, and it excludes the costs and benefits for all other categories for states classified as response category 3 for other surface water regulation.

Appendix C: Current CWA Section 404 Permit Impacts by State

Table C-1: Authorized impact of CWA section 404 permits issued in 2011-2015, excluding mitigation type permits and permits affecting resources categorized as "ocean" or "tidal."

State	Permanent Impacts		Temporary Impacts (Per Year)		Mitigation Required (Per Year)		
	Acres	Length Feet	Acres	Length Feet	Acres	Length Feet	Permits Using Credits[1]
AK	4,003	78,117	261	17,294	306	10,886	52
AL	623	492,030	103	56,431	106	77,765	111
AR	763	460,637	46	171,979	191	35,702	53
AZ	357	34,970	35	8,631	5	0	16
CA	2,934	917,071	242	178,621	909	102,694	305
CO	329	346,971	41	37,438	31	3,952	35
CT	65	11,572	33	413	186	3,635	2
DE	81	26,185	4	823	64	221	1
FL	12,897	391,027	207	93,558	9,301	51,244	241
GA	880	354,335	33	16,514	23	558	233
HI	3	5,840	0	64	0	0	0
IA	726	848,952	19	19,074	145	13,447	26
ID	185	402,565	6	16,945	41	6,441	6
IL	561	872,731	116	46,765	191	36,610	41
IN	1,410	1,853,584	38	55,780	637	303,744	10
KS	313	1,177,940	38	40,795	28	55,620	34
KY	460	1,048,935	19	38,482	106	67,359	43
LA	7,189	338,458	1,031	162,411	1,424	17,184	246
MA	61	351,513	84	63,825	132	538	1
MD	2,898	612,839	25	32,609	40	25,732	4
ME	305	4,260	20	0	1,079	656	12
MI	299	224,696	21	20,747	19	254	0
MN	2,030	820,610	173	55,308	173	505	214
MO	286	535,159	44	1,553,311	88	14,052	39
MS	1,320	155,233	75	25,930	283	15,507	89
MT	162	342,901	5	12,995	64	34,335	7
NC	991	558,106	209	51,530	265	13,765	242
ND	468	206,064	76	23,163	63	31,646	16
NE	337	401,360	13	16,094	52	5,707	30
NH	144	9,024	4	230	149	0	9
NJ	64	13,346	24	4,945	5	15	1
NM	110	12,298	23	8,811	13	50	0
NV	55	28,466	7	2,069	11	2,377	1
NY	337	532,679	55	50,906	359	13,187	16
OH	485	697,993	37	38,712	196	144,507	64
OK	181	145,259	16	10,235	70	32,118	4
OR	516	1,056,724	35	31,093	72	1,776	52
PA	457	692,703	301	252,293	95	43,486	6
RI	12	501	7	0	1	200	0
SC	853	195,391	24	3,751	2,162	88,406	69
SD	245	319,605	11	16,511	43	1,673	10

Table C-1: Authorized impact of CWA section 404 permits issued in 2011-2015, excluding mitigation type permits and permits affecting resources categorized as "ocean" or "tidal."

State	Permanent Impacts		Temporary Impacts (Per Year)		Mitigation Required (Per Year)		
	Acres	Length Feet	Acres	Length Feet	Acres	Length Feet	Permits Using Credits[1]
TN	205	647,128	12	33,668	71	20,961	38
TX	2,965	1,226,870	793	256,874	1,451	283,408	381
UT	149	193,037	96	54,587	47	22,873	6
VA	1,545	629,912	455	138,279	239	145,197	107
VT	100	15,410	27	1,244	109	9	6
WA	450	150,438	69	98,635	225	60,594	25
WI	953	819,980	125	192,441	157	2,398	90
WV	130	444,982	34	85,090	21	90,871	21
WY	125	98,781	6	2,030	26	230	0

Source: EPA analysis of data from USACE ORM2 database (2018).

[1] Mitigation credits are the trading medium that is used to represent the ecological gains at mitigation bank sites. The number of credits available from a mitigation bank depends on the quantity and quality of the resources that are restored, created, enhanced, or preserved. The number of acres or linear feet per credit varies among and within U.S. Army Corps districts. This variability makes summing credits across regions inappropriate, so the number of permits utilizing mitigation credits is provided instead of total mitigation credits.

Appendix D: SWAT Modeling Results

This appendix presents more detailed outputs for selected SWAT model runs to illustrate modeled changes due to the proposed rule. The selected results are for the HUC 0510 SWAT model and supplement the summary results presented in Section IV.B.1.3.1.

Figure D-1 and Figure D-2 show time series of the hydrologic response and pollutant yields for an individual HUC12 subbasin (051001010101: Headwaters of the Licking River, KY, represented as subbasin 1 in SWAT model 0510). The figures show results over a six-year period based on historical weather conditions in 2010-2015. In this subbasin the proposed rule is predicted to result in the net reduction of approximately 3.7 percent of existing wetlands. The changes affect 0.5 acres of the 24,300-acre subbasin. The changes between the two scenarios are not discernible relative to the range of predicted values. Figure D-3 and Figure D-4 isolate the impacts of the Policy by plotting the *difference* between the two scenarios. As shown in the plots, the Policy tends to result in lower surface runoff during storm events (the increases tend to coincide with high flows in Figure D-1) and slightly lower groundwater flow. The higher peaks are accompanied by higher sediment, nitrate and soluble phosphorus yields.

Figure D-5 and Figure D-6 show time series of predicted in-stream variables at the outlet of SWAT watershed 0510.

Figure D-1: Precipitation and predicted hydrologic response of subbasin 051001010101: Headwaters of the Licking River, KY under the baseline (black) and policy (red) scenarios.

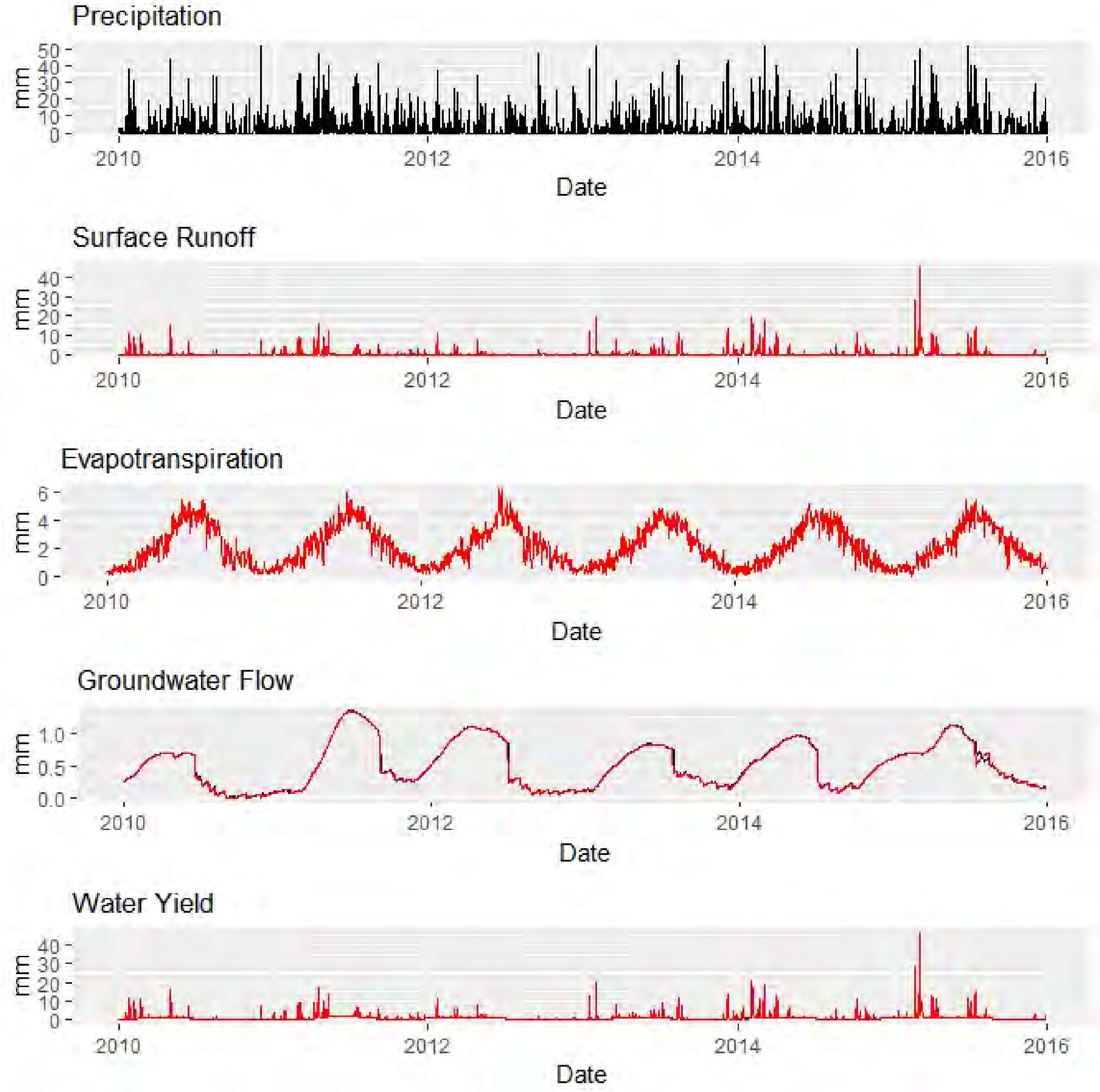


Figure D-2: Predicted sediment and nutrient yields in subbasin 051001010101: Headwaters of the Licking River, KY under the baseline (black) and policy (red) scenarios.

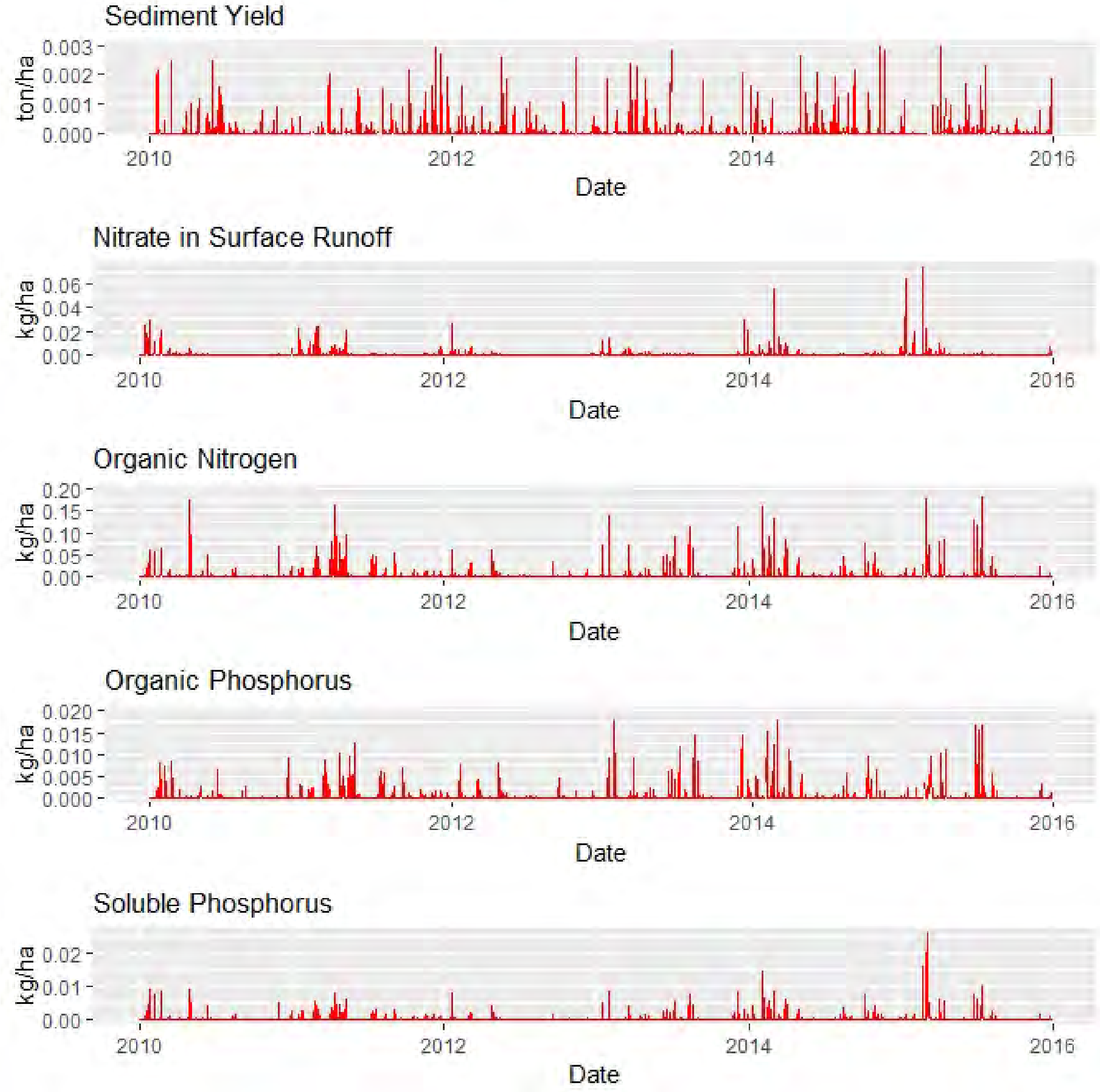


Figure D-3: Predicted *change* in hydrologic response of subbasin 051001010101: Headwaters of the Licking River, KY due to the Policy.

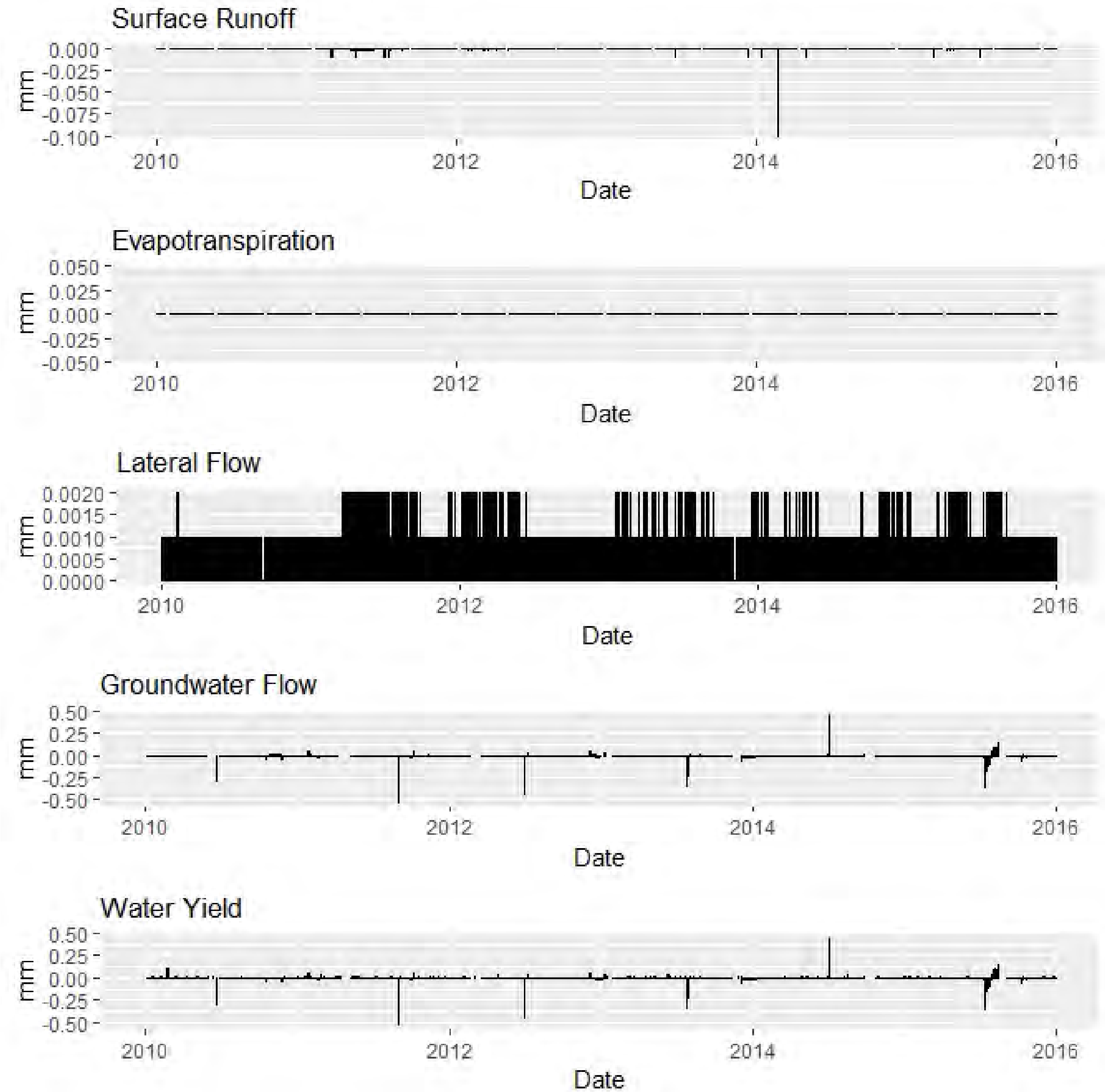


Figure D-4: Predicted *change* in sediment and nutrient yields of subbasin 051001010101: Headwaters of the Licking River, KY due to the Policy.

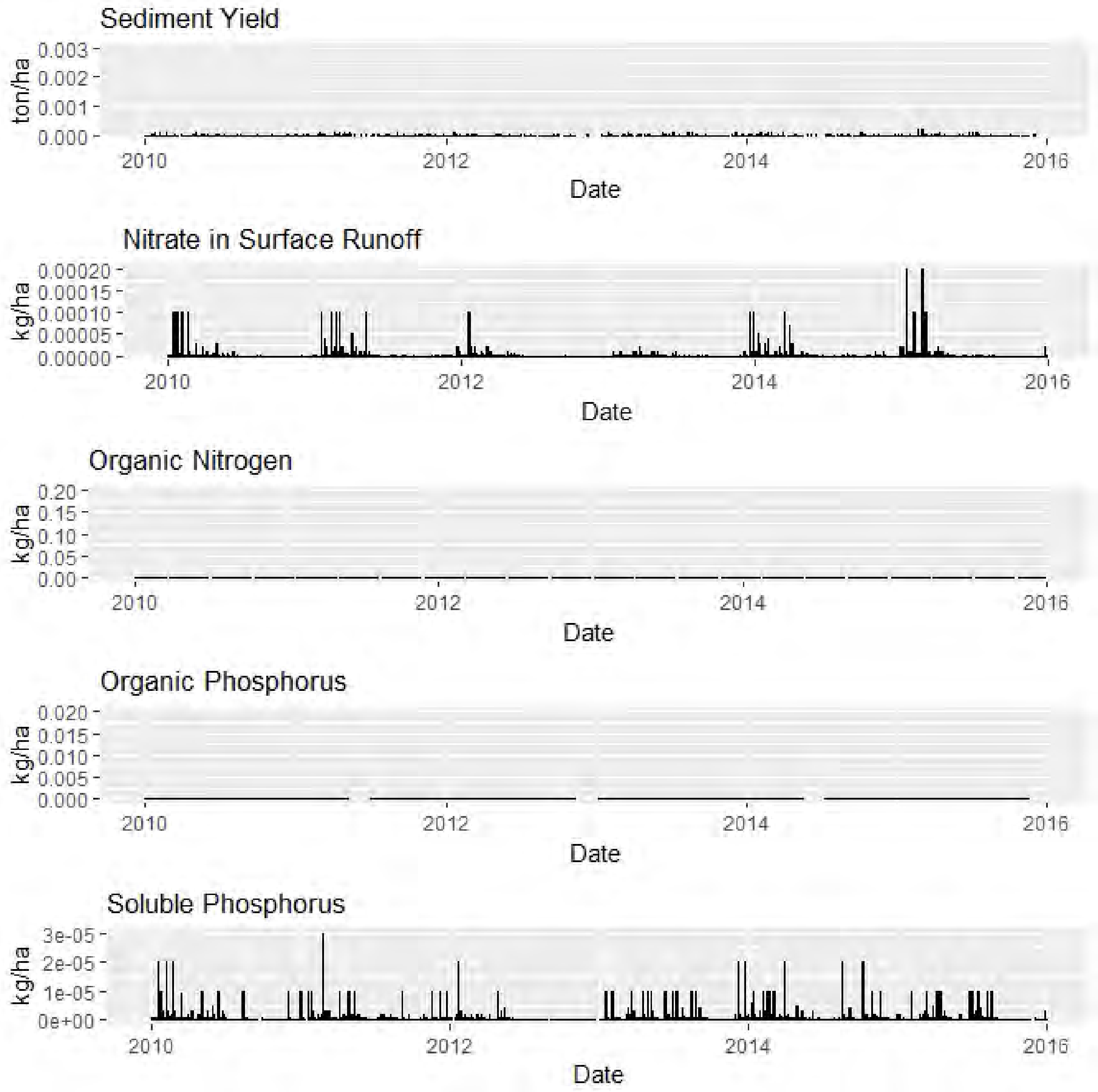


Figure D-5: Predicted daily stream flows and loads under the baseline (black) and policy (red) scenarios for the outlet of HUC 0510 (time series are generally superimposed).

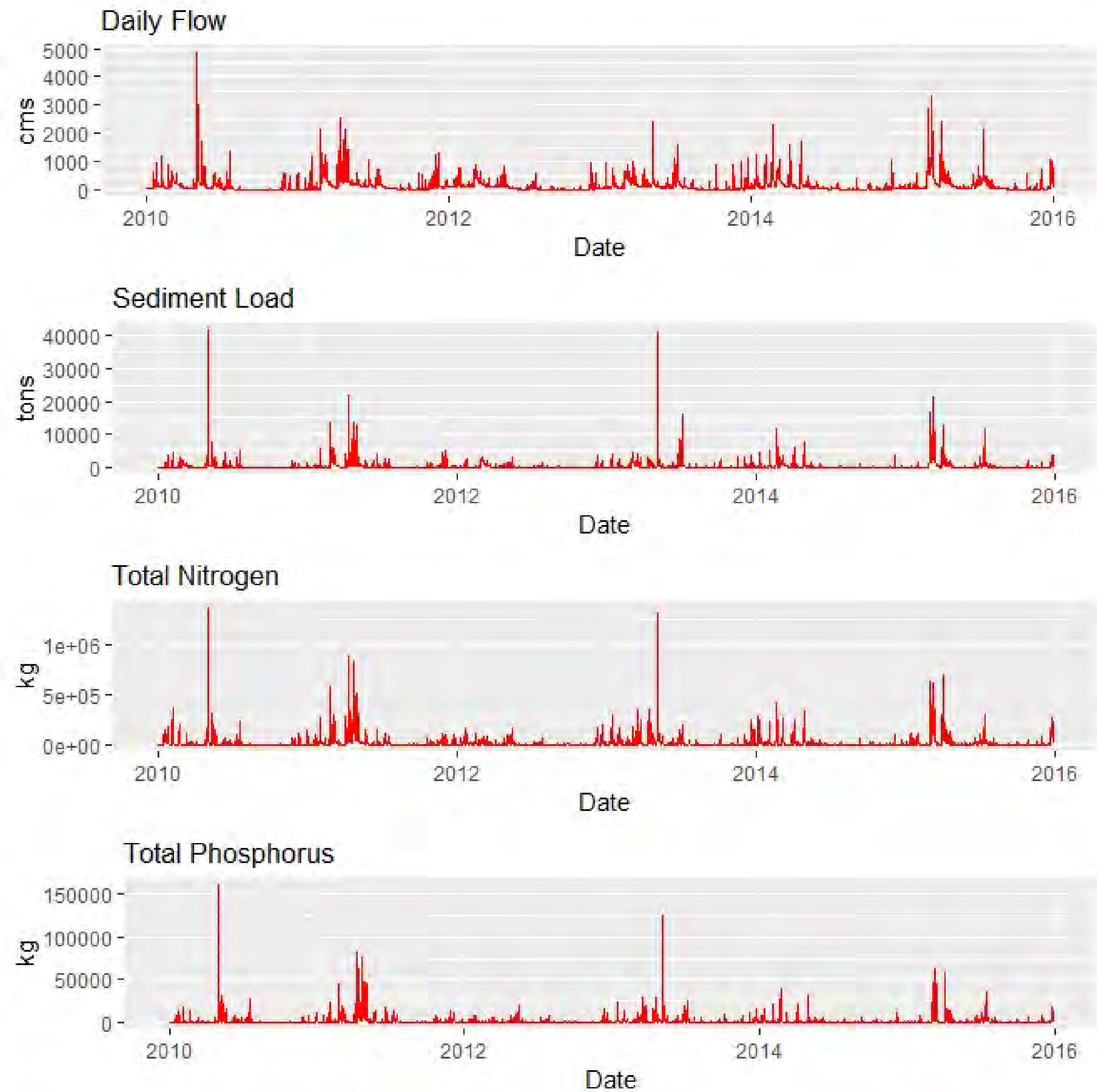
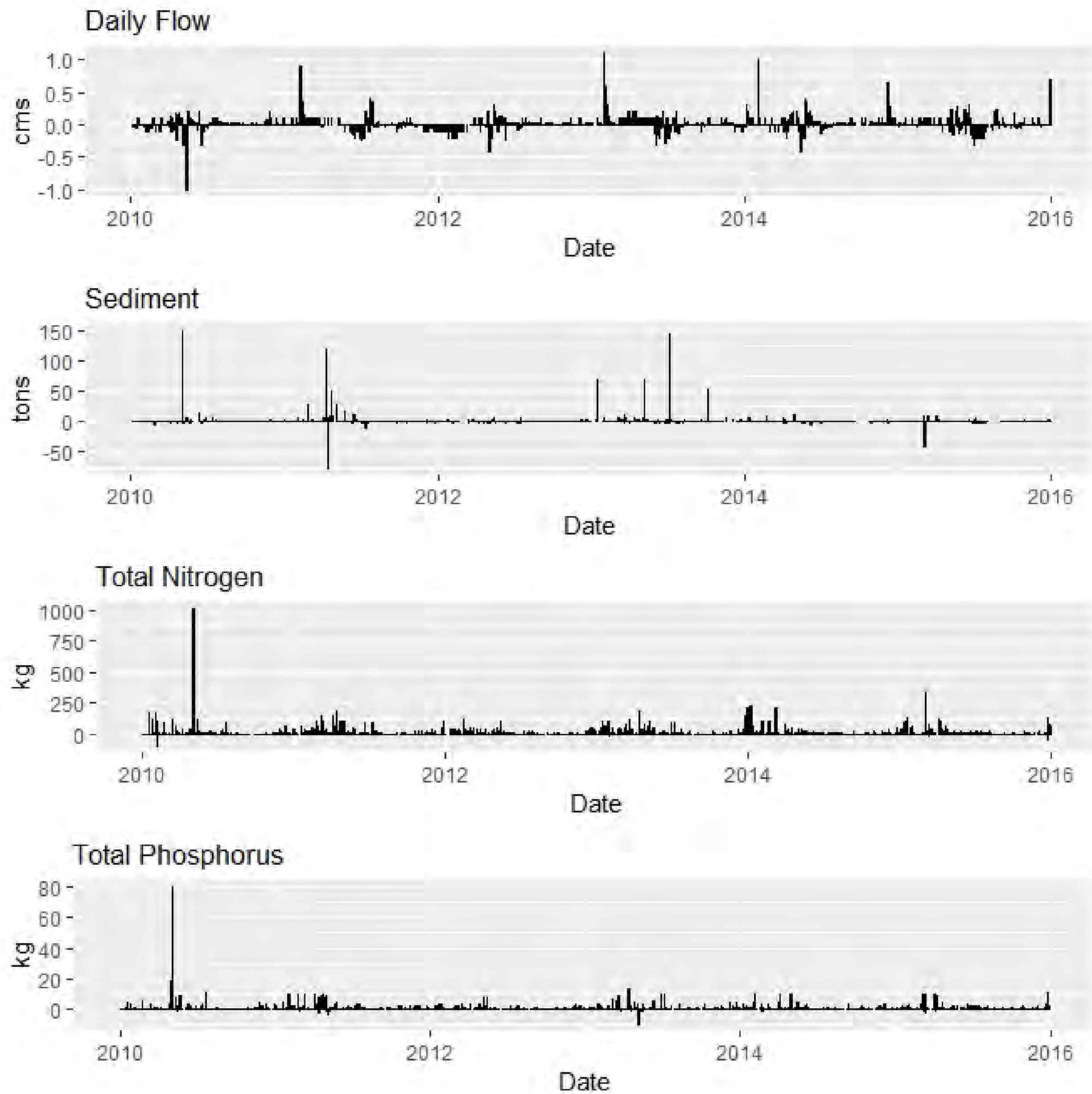


Figure D-6: Predicted *change* in daily stream flows and loads due to the policy scenarios at the outlet of HUC 0510.



Appendix E: Sensitivity Analyses

This appendix summarizes results of the agencies' sensitivity analysis to evaluate the effects of different assumptions regarding the scope of 404 program impacts:

- **Permits affected by proposed rule**: In the main analysis, the agencies relied solely on the Army Corps of Engineers' ORM2 database to identify 404 permits with mitigation requirements affecting waters that may no longer be jurisdictional under the proposed rule (ephemeral streams and RPWWN-type wetlands). In the sensitivity analysis, the agencies used an NHD-NWI adjacency analysis to account for the possibility of the proposed rule affecting additional non-abutting wetlands. The agencies used the following methodology to identify 404 permits affecting waters that may no longer be jurisdictional under the proposed rule:
    - **Ephemeral streams**: The Cowardin classes field in the Corps' ORM2 database includes information about river/stream type (perennial, intermittent, or ephemeral). The agencies classified any stream with a "Riverine, Ephemeral" (R6) class as an ephemeral stream. Whenever the Cowardin code field did not specify stream type, the agencies assumed that the stream would remain jurisdictional under the proposed rule, which could possibly result in an underestimation of potentially affected waters.
    - **Wetlands adjacent to but not directly abutting permanent waters**: The agencies used the water type field in the Corps' ORM2 database to select wetlands with a RPWWN water type. The RPWWN water type identifies wetlands that are adjacent to but do not directly abut relatively permanent waters.
    - **Additional non-abutting wetlands**: The agencies used latitude and longitude coordinates, provided in the ORM2 database, to locate waters affected by 404 permits on the NHD and NWI hydrographic networks. The agencies labeled wetlands not connected to an NHD reach as a non-abutting wetland. This methodology identified wetlands with several different water types, not just the RPWWN water type, as non-abutting.
- **Scope of impacts**: The sensitivity analysis includes both temporary and permanent impacts, as compared to permanent impacts only in the analysis described in Section IV.B
- **Width of assumed stream riparian buffer for linear impacts**: The sensitivity analysis assumes a width of 100 feet, as compared to 50 feet for the primary analysis described in Section IV.B.
- **Compensatory mitigation ratio**: The sensitivity analysis uses a 1.5:1 ratio for estimating cost savings from avoided wetland compensatory mitigation requirements (the agencies use the same 1:1 ratio used in the main analysis for estimating forgone benefits provided by wetlands and water quality impacts).

E.1 Case Study 1: Ohio River Basin

E.1.1 Section 402

Because the NHD data layer does not classify any streams as "ephemeral" in the Ohio River Basin region, the agencies did not perform a sensitivity analysis of section 402 program impacts using NHD data.

E.1.2 Section 404

Table E-1 summarizes section 404 permits issued in 2011-2015 within the two selected watersheds of the Ohio River Basin. The table includes permits that required mitigation and potentially affected ephemeral streams, non-abutting wetlands, or wetlands adjacent to but not directly abutting relatively permanent waters (RPWWN-type wetlands).

Table E-1: Section 404 permits issued in case study watersheds in the Ohio River Basin (2011-2015)[1]

State	# Permitted Projects	# Permits with mitigation requirements potentially affected by changes to the definition of "waters of the United States"[2]	Permanent impacts		Average Temporary impacts	
			Acres	Length Feet	Acres	Length Feet
HUC 0509						
IN	101	17	0.5	3,000	0.9	0
KY	226	15	4.5	41,122	0.0	0
OH	351	33	10.6	51,209	0.2	3,009
WV	141	0	0.0	0	0.0	0
Total	**819**	**65**	**15.6**	**95,331**	**1.1**	**3,009**
Avg. per year	**164**	**13**	**3.1**	**19,066**	**0.2**	**602**
HUC 0510						
KY	967	38	6.8	62,608	0.0	2,261
Total	**967**	**38**	**6.8**	**62608**	**0.0**	**2,261**
Avg. per year	**193**	**8**	**1.4**	**12,522**	**0.01**	**452**

[1] Values based on permits with mitigation requirements on waterways determined to be non-abutting wetlands, RPWWN-type wetlands, or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services.

[2] Number of permits includes permits with mitigation requirements that affect at least one water determined likely to no longer be jurisdictional under the CWA under the proposed rule.

Table E-2 presents expected reductions in average annual mitigation requirements in the Ohio River Basin under different likely state response scenarios following the proposed "waters of the United States" definitional changes.

Table E-2: Estimated changes in average mitigation required per year in the Ohio River Basin based on the sensitivity analysis methodology, by policy scenario[1,2]

State	Expected Reduction in Average Mitigation Acres per Year			Expected Reduction in Average Mitigation Length Feet per Year			Expected Reduction in Average Mitigation Riparian Acres per Year[3]		
	Scenario 0	Scenario 1	Scenarios 2 & 3	Scenario 0	Scenario 1	Scenarios 2 & 3	Scenario 0	Scenario 1	Scenarios 2 & 3
HUC 0509									
IN	0.3	0.0	0.0	600	0	0	1.4	0.0	0.0
KY	0.9	0.9	0.9	8,224	8,224	8,224	18.9	18.9	18.9
OH	2.2	0.0	0.0	10,844	0	0	24.9	0.0	0.0
Total	**3.3**	**0.9**	**0.9**	**19,668**	**8,224**	**8,224**	**45.2**	**18.9**	**18.9**
HUC 0510									
KY	1.4	1.4	1.4	12,974	12,974	12,974	29.8	29.8	29.8
Total	**1.4**	**1.4**	**1.4**	**12,974**	**12,974**	**12,974**	**29.8**	**29.8**	**29.8**

[1] Values based on permits with mitigation requirements on waterways determined to be non-abutting wetlands, RPWWN-type wetlands, or ephemeral streams. Excludes permits issued for mitigation or restoration activities because these permits do not result in the loss of ecosystems services provided by wetlands and streams. Permanent and temporary acre and linear feet impacts provided in the ORM2 database are used to estimate mitigation requirements. For this analysis, the agencies assumed a 1:1 ratio for compensatory requirements based on the USACE guidance (U.S. Army Corps of Engineers 2014).

[2] Scenarios 2 and 3 are combined because all values are identical.

[3] Based on mitigation lengths where impacts in linear feet are converted to acres by multiplying total linear feet by an average width of 100 feet (50 feet on each side of the stream) and converting square feet to acres.

Table E-3 compares the mitigation reduction estimates using the methodology described in Section IV.B and the sensitivity analysis methodology.

Table E-3: Comparison of annual average mitigation requirements in the Ohio River Basin between the main methodology and the sensitivity analysis methodology

Impact Type	Acres[1]		Linear Feet[2]		Stream Riparian Acres[3]		Total Acreage[4]	
	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity
HUC 0509								
Permanent	2.9	3.1	18,466	19,066	21.2	43.8	24.1	46.9
Temporary	0.0	0.2	0	602	0.0	1.4	0.0	1.6
Total	**2.9**	**3.3**	**18,466**	**19,668**	**21.2**	**45.2**	**24.1**	**48.5**
HUC 0510								
Permanent	1.0	1.4	12,458	12,522	14.3	28.7	15.3	30.1
Temporary	0.0	0.0	0	452	0.0	1.0	0.0	1.0
Total	**1.0**	**1.4**	**12,458**	**12,974**	**14.3**	**29.8**	**15.3**	**31.2**

[1] Sensitivity analysis includes permanent and temporary impact acres from RPWWN-type wetlands, non-abutting wetlands, and ephemeral streams. By contrast, the main analysis includes only permanent impact acres on RPWWN-type wetlands and ephemeral streams.

Table E-3: Comparison of annual average mitigation requirements in the Ohio River Basin between the main methodology and the sensitivity analysis methodology

Impact Type	Acres[1]		Linear Feet[2]		Stream Riparian Acres[3]		Total Acreage[4]	
	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity

[2] Sensitivity analysis includes permanent and temporary impact linear feet on riparian areas of non-abutting wetlands, RPWWN-type wetlands, and ephemeral streams. By contrast, the main analysis includes only permanent impact linear feet on riparian areas of RPWWN-type wetlands and ephemeral streams.

[3] Sensitivity analysis converts permanent and temporary linear feet impacts to acres using a 100-foot mitigation width (50 feet on each side). By contrast, the main analysis converts permanent linear feet impacts to acres using a 50-foot mitigation width (25 feet on each side).

[4] Sum of the acres and stream riparian acres fields.

Tables E-4, E-5, and E-6 present permit application cost savings, cost savings from reduced mitigation requirements, and total costs savings, respectively.

Table E-4: Average annual reduction in 404 permit application costs in the Ohio River Basin, based on the sensitivity analysis methodology[1,2]

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Scenario 0		Scenario 1		Scenarios 2 & 3	
		Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permits Costs (millions 2017$)	Annual Average Reduction in Permit with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)
HUC 0509							
IP	$14,700	0.2	<$0.01	0.0	$0.00	0.0	$0.00
GP	$4,400	36.2	$0.16	14.4	$0.06	5.4	$0.02
Total		**36.4**	**$0.16**	**14.4**	**$0.06**	**5.4**	**$0.02**
HUC 0510							
IP	$14,700	0.0	$0.00	0.0	$0.00	0.0	$0.00
GP	$4,400	63.0	$0.28	63.0	$0.28	63.0	$0.28
Total		**63.0**	**$0.28**	**63.0**	**$0.28**	**63.0**	**$0.28**
Both Watersheds							
IP		0.2	<$0.01	0.0	$0.00	0.0	$0.00
GP		99.2	$0.44	77.4	$0.34	68.4	$0.30
Total		**99.4**	**$0.44**	**77.4**	**$0.34**	**68.4**	**$0.30**

[1] Includes permits estimated to only affect waters no longer jurisdictional under the CWA under the proposed rule (*e.g.*, non-abutting wetlands, RPWWN-type wetlands, and ephemeral streams).

[2] Scenarios 2 and 3 are combined because all values are identical.

Table E-5: Annual cost savings (2017$) of reduced mitigation requirements in the Ohio River Basin based on the sensitivity analysis methodology, by policy scenario[1,2]

State	Cost Per Acre (2017$)		Cost Per Linear Foot (2017$)		Scenario 0 (Millions 2017$)		Scenario 1 (Millions 2017$)		Scenarios 2 & 3 (Millions 2017$)	
	Low	High	Low	High	Low	High	Low	High	Low	High
HUC 0509										
IN	$50,000	$71,000	$294	$636	$0.29	$0.60	$0.00	$0.00	$0.00	$0.00
KY	$110,016	$165,024	$300	$755	$3.85	$9.54	$3.85	$9.54	$3.85	$9.54
OH	$37,500	$216,000	$165	$1,350	$2.81	$22.66	$0.00	$0.00	$0.00	$0.00
Total	**-**	**-**	**-**	**-**	**$6.94**	**$32.80**	**$3.85**	**$9.54**	**$3.85**	**$9.54**
HUC 0510										
KY	$110,016	$165,024	$300	$755	$6.07	$15.03	$6.07	$15.03	$6.07	$15.03
Total	**-**	**-**	**-**	**-**	**$6.07**	**$15.03**	**$6.07**	**$15.03**	**$6.07**	**$15.03**
Both Watersheds										
Total	**-**	**-**	**-**	**-**	**$13.01**	**$47.83**	**$9.92**	**$24.57**	**$9.92**	**$24.57**

[1] Estimated changes in average mitigation required per year are presented in Table E-2. For each state, cost savings are calculated by multiplying the cost of each mitigation acre or linear foot (low and high estimates) by the expected reduction in annual mitigation requirements, summing the acreage and linear feet values for each scenario, and multiplying the total by 1.5. The agencies multiply the total by 1.5 to account for a compensatory mitigation requirement ratio of 1.5:1.

[2] Scenarios 2 and 3 are combined because all values are identical.

Table E-6: Total estimated annual cost savings in the Ohio River Basin, based on the sensitivity analysis methodology[1,2]

HUC	Scenario 0		Scenario 1		Scenario 2 & 3	
	Low	High	Low	High	Low	High
0509	$7.10	$32.96	$3.91	$9.60	$3.87	$9.56
0510	$6.34	$15.31	$6.34	$15.31	$6.34	$15.31
Total	**$13.45**	**$48.27**	**$10.26**	**$24.91**	**$10.22**	**$24.87**

[1] Scenarios 2 and 3 are combined because all values are identical.

[2] For HUC 0509, Scenario 0 includes cost savings in Indiana, Kentucky, Ohio, and West Virginia. Scenario 1 includes cost savings in Kentucky and West Virginia. Scenario 3 includes cost savings in Kentucky only. For HUC 0510, cost savings remain constant across all scenarios since all permits are issued in Kentucky, a state that is not likely to regulate waters above federal requirements.

Tables E-7 and E-8 provide estimated annualized forgone benefits from lost mitigation requirements in the Ohio River Basin under different state response scenarios, with three percent and seven percent discount rates, respectively.

Table E-7: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Ohio River Basin based on the sensitivity analysis methodology, by policy scenario (3% Discount Rate)[1,2]

HUC	# Affected Households in 2020[3]	Scenario 0		Scenario 1		Scenarios 2 & 3	
		Low	High	Low	High	Low	High
0509	5,170,870	$1.11	$7.35	$0.45	$3.00	$0.45	$3.00
0510	1,866,005	$0.27	$1.78	$0.27	$1.78	$0.27	$1.78
Total	**7,036,875**	**$1.37**	**$9.13**	**$0.72**	**$4.78**	**$0.72**	**$4.78**

[1] Estimated changes in average mitigation required per year are presented in Table E-2. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 3% discount rate.

[2] Scenarios 2 and 3 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

Table E-8: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Ohio River Basin based on the sensitivity analysis methodology, by policy scenario (7% Discount Rate)[1,2]

HUC	# Affected Households in 2020[3]	Scenario 0		Scenario 1		Scenarios 2 & 3	
		Low	High	Low	High	Low	High
0509	5,170,870	$0.82	$5.44	$0.33	$2.22	$0.33	$2.22
0510	1,866,005	$0.20	$1.31	$0.20	$1.31	$0.20	$1.31
Total	**7,036,875**	**$1.02**	**$6.75**	**$0.53**	**$3.53**	**$0.53**	**$3.53**

[1] Estimated changes in average mitigation required per year are presented in Table E-2. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 7% discount rate.

[2] Scenarios 2 and 3 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

E.1.3 Section 311

Because the NHD data layer does not distinguish between intermittent and ephemeral streams in the Ohio River Basin region, the agencies did not perform a sensitivity analysis of section 311 program impacts using NHD data.

E.1.4 Water Quality Modeling

As described in Section IV.B.1.3.1, the SWAT models do not coincide exactly with the watershed boundaries analyzed for the 404 program impacts. Table E-9 summarizes the impact of different assumptions on the sensitivity analysis inputs. Forgone mitigation in the sensitivity analysis is approximately twice that analyzed under the main analysis presented in Section IV.B.1.3.1.

Table E-9: Changes between 404 program impacts for the sensitivity scenario vs. primary scenario for the Ohio River Basin SWAT models based on permits issued 2011-2015 (5 Years)

	0509				0510			
	Area impacts to wetland abutting ephemeral stream (Acres)	Linear impacts to ephemeral stream (Acres)[1]	Area impacts to non-abutting wetlands (Acres)	Total	Area impacts to wetland abutting ephemeral stream (Acres)	Linear impacts to ephemeral stream (Acres)[1]	Area impacts to non-abutting wetlands (Acres)	Total
Total Primary Scenario	**14.3**	**106.0**	**0**	**120.3**	**2.8**	**33.5**	**0**	**36.3**
+ non-abutting wetlands	0.0	0.0	1.3	1.3	0.0	0.0	1.3	1.3
+ mitigation of temporary impacts	0.7	3.5	0.4	4.6	0.0	2.3	0.0	2.3
+ Widen buffer width (100 vs. 50 ft)	0	109.4	0	109.4	0	35.8	0	35.8
Total Sensitivity Scenario	**15.0**	**218.9**	**1.7**	**235.6**	**2.8**	**71.5**	**1.3**	**75.6**

[1] Linear impacts converted to areas by multiplying the lengths by 50 feet for the Primary Scenario (Main Analysis) and by 100 feet for the Sensitivity Scenario and applying a conversion factor (1 acre = 43,560 square feet).

Tables E-10 through E-15 present water quality modeling results for the sensitivity analysis, following the same format as used in Section IV.B for the main analysis.

Table E-10: Summary of 404 Program activities in Ohio River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers both permanent and temporary impacts.

Type of Potentially Affected Resource[2]	Permanent			Temporary			Total Impacts (Acres)
	Acres	Linear Feet	Total[1] Acres	Acres	Linear Feet	Total[1] Acres	
HUC 0509							
Wetland abutting ephemeral stream	62.5	0	62.5	4.4	0	4.4	64.0
Ephemeral stream	0.0	369,323	847.8	0.0	12,036	27.6	875.5
Total	**62.5**	**369,323**	**910.4**	**4.4**	**12,036**	**31.1**	**942.5**

Table E-10: Summary of 404 Program activities in Ohio River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers both permanent and temporary impacts.

Type of Potentially Affected Resource[2]	Permanent			Temporary			Total Impacts (Acres)
	Acres	Linear Feet	Total[1] Acres	Acres	Linear Feet	Total[1] Acres	
HUC 0510							
Wetland abutting ephemeral stream	16.3	0	16.3	0.1	0	0.1	16.4
Ephemeral stream	0.0	116,804	268.1	0.0	7,844	18.0	286.2
Total	**16.3**	**116,804**	**284.5**	**0.1**	**7,844**	**18.1**	**302.6**

[1] Represents the sum of impacts reported in acres and impacts reported in linear feet, assuming a width of 100 feet for linear impacts.

[2] See Table IV-8 for criteria used to identify affected resources that may change jurisdiction under the proposed rule.

Table E-11: Summary of basin-level annual average water balance and constituent transport in Ohio River Basin SWAT watersheds for the sensitivity scenario

Parameter	HUC 0509				HUC 0510			
	Baseline	Policy	Change	% Change	Baseline	Policy	Change	% Change
Precipitation (mm)	1,239.00	1,239.00	0.00	0.0%	1,331.80	1,331.80	0.00	0.0%
Surface runoff (mm)	183.22	183.21	-0.01	0.0%	357.12	357.11	-0.01	0.0%
Lateral flow (mm)	218.70	218.87	0.17	0.1%	78.03	78.51	0.48	0.6%
Groundwater flow (mm)	40.03	39.96	-0.07	-0.2%	61.88	61.63	-0.25	-0.4%
Water yield (mm)	495.14	495.08	-0.06	0.0%	524.75	524.75	0.00	0.0%
Evapotranspiration (mm)	738.80	738.90	0.10	0.0%	739.90	740.00	0.10	0.0%
Sediment loading (ton/ha)	2.410	2.420	0.010	0.4%	1.17	1.18	0.010	0.9%
Organic N (kg/ha)	2.360	2.361	0.001	0.0%	7.008	7.013	0.005	0.1%
Organic P (kg/ha)	0.267	0.267	0.000	0.0%	0.582	0.583	0.001	0.2%
NO_3 in surface runoff (kg/ha)	0.954	0.954	0.000	0.0%	2.637	2.639	0.002	0.1%
NO_3 in lateral flow (kg/ha)	1.018	1.019	0.001	0.1%	0.593	0.594	0.001	0.2%
Soluble P yield (kg/ha)	0.137	0.137	0.000	0.0%	0.192	0.192	0.000	0.0%
NO_3 leached (kg/ha)	0.494	0.494	0.000	0.0%	2.535	2.536	0.001	0.0%
P leached (kg/ha)	0.009	0.009	0.000	0.0%	0.021	0.021	0.000	0.0%

Table E-12: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 0509 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	283	11	0.06	0.02	-0.34	0.99
Surface runoff (mm/yr)	5	295	-0.16	-0.15	-0.68	0.10
Lateral flow (mm/yr)	291	9	0.17	0.16	-0.58	0.69

Table E-12: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 0509 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Groundwater flow (mm/yr)	2	300	-0.07	-0.04	-0.51	0.05
Total water yield (mm/yr)	2	291	-0.07	-0.03	-1.27	0.00
Sediment yield (ton/ha/yr)	302	0	0.003	0.000	0.000	0.034
Organic N (kg/ha/yr)	291	10	0.001	0.000	0.000	0.018
Organic P (kg/ha/yr)	284	17	0.000	0.000	0.000	0.002
NO_3 in surface runoff (kg/ha/yr)	284	17	0.000	0.000	0.000	0.004
Soluble P (kg/ha/yr)	190	111	0.000	0.000	0.000	0.000

[1] Total number of SWAT HUC12 reaches is 346. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-13: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 0510 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	84	0	0.05	0.02	0.00	0.43
Surface runoff (mm/yr)	8	81	-0.34	-0.34	-1.71	0.12
Lateral flow (mm/yr)	86	0	0.48	0.52	0.00	1.78
Groundwater flow (mm/yr)	11	80	-0.20	-0.10	-3.79	4.17
Total water yield (mm/yr)	35	59	0.02	-0.02	-2.90	3.60
Sediment yield (ton/ha/yr)	92	2	0.007	0.004	0.000	0.053
Organic N (kg/ha/yr)	90	5	0.005	0.004	-0.023	0.037
Organic P (kg/ha/yr)	89	6	0.000	0.000	-0.001	0.003
NO_3 in surface runoff (kg/ha/yr)	90	5	0.002	0.002	-0.005	0.018
Soluble P (kg/ha/yr)	41	54	0.000	0.000	-0.001	0.001

[1] Total number of SWAT HUC12 reaches is 106. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-14: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Ohio River Basin for the sensitivity scenario

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
HUC 0509							
Annual TN load (kg/yr)	312	3	235.7	11.9	0.03%	0.01%	0.22%
Annual TP load (kg/yr)	308	5	16.0	1.0	0.02%	0.01%	0.23%
Annual sediment load (kg/yr)	165	148	16.3	0.0	0.02%	0.00%	1.10%
Mean daily flow (cms)	13	300	-0.003	0.000	-0.01%	0.00%	0.06%

Table E-14: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Ohio River Basin for the sensitivity scenario

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
HUC 0510							
Annual TN load (kg/yr)	97	3	718.6	132.7	0.08%	0.07%	8.88%
Annual TP load (kg/yr)	96	4	40.7	9.9	0.06%	0.04%	5.91%
Annual sediment load (kg/yr)	58	42	31.7	0.0	0.06%	0.00%	6.19%
Mean daily flow (cms)	48	51	0.001	0.000	0.01%	0.00%	1.16%

[1] Total number of reaches is 346 in HUC 0509 and 106 in HUC 0510. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-15: Predicted changes in annual average loads delivered to the outlet of Ohio River Basin SWAT watersheds for the sensitivity scenario

Parameter	Baseline	Policy	Change	% Change
HUC 0509				
Annual TN load (kg/yr)	280,556	280,626	69	0.02%
Annual TP load (kg/yr)	79,523	79,527	4	<0.01%
Annual sediment load (ton/yr)	2,227,540	2,227,531	-9	<0.01%
HUC 0510				
Annual TN load (kg/yr)	8,683,306	8,689,948	6,642	0.08%
Annual TP load (kg/yr)	714,975	715,287	312	0.04%
Annual sediment load (ton/yr)	156,983	157,386	403	0.26%

E.1.5 Dredging for Water Storage and Navigation

Table E-16 presents predicted net sediment depositions in reservoirs in the Ohio River Basin for the sensitivity scenario. Costs under the sensitivity scenario are summarized in Table E-17.

Table E-16: Summary of predicted net sediment depositions in reservoirs in the Ohio River Basin (tons/year) in 2040 for sensitivity scenario

HUC4	Number of reservoirs[1]	Net annual sediment deposition in reservoirs		Change relative to baseline	
		Baseline	Sensitivity	Tons/year	Percent
0509	11	516,560	517,559	998	0.19%
0510	1	57,034	57,076	42	< 0.1%
Total	12	573,594	574,635	1040	0.18%

[1] Reservoirs modeled in SWAT watersheds, based on the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

Table E-17: Annualized Dredging Cost Changes in Ohio River Basin (2017$ thousands) for the Sensitivity Scenario

HUC4	Increase in Annual Sediment (cubic yards) (2040)	3% Discount Rate ($/year)			7% Discount Rate ($/year)		
		Low	Medium	High	Low	Medium	High
0509	998	$5.1	$5.4	$5.6	$3.8	$4.4	$4.8
0510	42	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Total	1040	$5.3	$5.6	$5.8	$4.0	$4.6	$5.0

E.2 Case Study 2: Lower Missouri River Basin

E.2.1 Section 402

Because the NHD data layer does not classify any streams as "ephemeral" in the Lower Missouri River Basin region, the agencies did not perform a sensitivity analysis of section 402 program impacts using NHD data.

E.2.2 Section 404

Table E-18 summarizes section 404 permits issued in 2011-2015 within the two selected watersheds of the Lower Missouri River Basin. The table includes permits that required mitigation and potentially affected ephemeral streams, non-abutting wetlands, or wetlands adjacent to but not directly abutting relatively permanent waters.

Table E-18: Section 404 permits issued in case study watersheds in the Lower Missouri River Basin (2011-2015)[1]

State	# Permitted Projects	# Permits with mitigation requirements potentially affected by proposed changes to the definition of "waters of the United States"[2]	Permanent impacts		Temporary impacts	
			Acres	Length Feet	Acres	Length Feet
HUC 1025						
CO	10	0	0.0	0	0.0	0
KS	207	39	0.9	33230	0.0	5005
NE	141	2	0.0	0	0.0	0
Total	**358**	**41**	**0.9**	**33,230**	**0.0**	**5,005**
Avg. per year	**72**	**8**	**0.2**	**6,646**	**0.0**	**1,001**
HUC 1027						
KS	742	67	17.1	39,131	3.1	730
MO	1	0	0.0	0	0.0	0
NE	288	10	0.8	236	3.4	0
Total	**1031**	**77**	**17.9**	**39,367**	**6.4**	**730**
Avg. per year	**206**	**15**	**3.6**	**7,873**	**1.3**	**146**

[1] Values based on permits with mitigation requirements on waterways determined to be non-abutting wetlands, RPWWN-type wetlands, or ephemeral streams. Excludes permits issued for mitigation or restoration activities because the main purpose of these activities is to restore or enhance ecosystem services provided by water resources as opposed to dredge and fill activities that lead to permanent or temporary losses of ecosystem services.

[2] Number of permits includes permits with mitigation requirements that potentially affect at least one water no longer jurisdictional under the CWA under the proposed rule.

Table E-19 presents expected reductions in average annual mitigation requirements in the Lower Missouri River Basin under different likely state response scenarios following the proposed "waters of the United States" definitional changes.

Table E-19: Estimated changes in average mitigation required per year in the Lower Missouri River Basin based on the sensitivity analysis methodology, by policy scenario[1,2]

State	Expected Reduction in Average Mitigation Acres per Year			Expected Reduction in Average Mitigation Length Feet per Year			Expected Reduction in Average Mitigation Riparian Acres per Year[3]		
	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3	Scenario 0 & 1	Scenario 2	Scenario 3
HUC 1025									
KS	0.2	0.0	0.0	7,647	0	0	17.6	0.0	0.0
NE	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Total	**0.2**	**0.0**	**0.0**	**7,647**	**0**	**0**	**17.6**	**0.0**	**0.0**
HUC 1027									
KS	4.0	0.0	0.0	7,972	0	0.0	18.3	0.0	0.0
NE	0.8	0.0	0.0	47	0	0.0	0.1	0.0	0.0
Total	**4.9**	**0.0**	**0.0**	**8,019**	**0**	**0.0**	**18.4**	**0.0**	**0.0**

[1] Values based on permits with mitigation requirements on waterways determined to be non-abutting wetlands, RPWWN-type wetlands, or ephemeral streams. Excludes permits issued for mitigation or restoration activities because these permits do not result in the loss of ecosystems services provided by wetlands and streams. Permanent and temporary acre and linear feet impacts provided in the ORM2 database are used to estimate mitigation requirements. The agencies assumed a 1:1 ratio for compensatory requirements based on the USACE guidance (U.S. Army Corps of Engineers 2014).

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] Based on mitigation lengths where impacts in linear feet are converted to acres by multiplying total linear feet by an average width of 100 feet (50 feet on each side of the stream) and converting square feet to acres.

Table E-20 compares the mitigation reduction estimates in the Lower Missouri River Basin using the methodology described in Section IV.B and the sensitivity analysis methodology.

Table E-20: Comparison of annual average mitigation requirements in the Lower Missouri River Basin between the main methodology and the sensitivity analysis methodology

Impact Type	Acres[1]		Linear Feet[2]		Stream Riparian Acres[3]		Total Acreage[4]	
	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity
HUC 0509								
Permanent	0.1	0.2	6,646	6,646	7.6	15.3	7.8	15.4
Temporary	0.0	0.0	0	1,001	0.0	2.3	0.0	2.3
Total	**0.1**	**0.2**	**6,646**	**7,647**	**7.6**	**17.6**	**7.8**	**17.7**
HUC 0510								
Permanent	0.9	3.6	7,873	7,873	9.0	18.1	10.0	21.7
Temporary	0.0	1.3	0	146	0.0	0.3	0.0	1.6
Total	**0.9**	**4.9**	**7,873**	**8,019**	**9.0**	**18.4**	**10.0**	**23.3**

[1] Sensitivity analysis includes permanent and temporary impact acres from RPWWN-type wetlands, non-abutting wetlands, and ephemeral streams. By contrast, the main analysis includes only permanent impact acres on RPWWN-type wetlands and ephemeral streams.

Table E-20: Comparison of annual average mitigation requirements in the Lower Missouri River Basin between the main methodology and the sensitivity analysis methodology

Impact Type	Acres[1]		Linear Feet[2]		Stream Riparian Acres[3]		Total Acreage[4]	
	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity	Main	Sensitivity

[2] Main analysis includes permanent impact linear feet on riparian areas of RPWWN-type wetlands and ephemeral streams. Sensitivity analysis includes permanent and temporary impact linear feet on riparian areas of non-abutting wetlands, RPWWN-type wetlands, and ephemeral streams.

[3] Sensitivity analysis converts permanent and temporary linear feet impacts to acres using a 100-foot mitigation width (50 feet on each side). By contrast, the main analysis converts permanent linear feet impacts to acres using a 50-foot mitigation width (25 feet on each side).

[4] Sum of the acres and stream riparian acres fields.

Tables E-21, E-22, and E-23 present permit application cost savings, cost savings from reduced mitigation requirements, and total costs savings, respectively.

Table E-21: Average annual reduction in 404 permit application costs in the Lower Missouri River Basin, based on the sensitivity analysis methodology[1,2]

Permit Type	Unit Costs from Corps NWP Analysis (2017$)	Scenarios 0 & 1		Scenario 2		Scenario 3	
		Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)	Annual Average Reduction in Permits with Proposed Rule	Estimated Reduction in Permits Costs (millions 2017$)	Annual Average Reduction in Permit with Proposed Rule	Estimated Reduction in Permit Costs (millions 2017$)
HUC 1025							
IP	$14,700	0.2	<$0.01	0.0	$0.00	0.0	$0.00
GP	$4,400	22.4	$0.10	1.0	<$0.01	0.0	$0.00
Total		**22.6**	**$0.10**	**1.0**	**<$0.01**	**0.0**	**$0.00**
HUC 1027							
IP	$14,700	2.0	$0.03	0.2	<$0.01	0.0	$0.00
GP	$4,400	40.0	$0.18	0.2	<$0.01	0.0	$0.00
Total		**42.0**	**$0.21**	**0.4**	**<$0.01**	**0.0**	**$0.00**
Both Watersheds							
IP		2.2	$0.03	0.2	<$0.01	0.0	$0.00
GP		62.4	$0.27	1.2	$0.01	0.0	$0.00
Total		**64.6**	**$0.31**	**1.4**	**$0.01**	**0.0**	**$0.00**

[1] Includes permits estimated to only affect waters no longer jurisdictional under the CWA under the proposed rule (*i.e.*, non-abutting wetlands, RPWWN-type wetlands, and ephemeral streams).

[2] Scenarios 0 and 1 are combined because all values are identical.

Table E-22: Annual cost savings (2017$) of reduced mitigation requirements in the Lower Missouri River Basin based on the sensitivity analysis methodology, by policy scenario[1,2]

State	Cost Per Acre (2017$)		Cost Per Linear Foot (2017$)		Scenarios 0 & 1 (Millions 2017$)		Scenario 2 (Millions 2017$)		Scenario 3 (Millions 2017$)	
	Low	High	Low	High	Low	High	Low	High	Low	High
HUC 1025										
KS	$54,000	$105,400	$90	$360	$1.05	$4.16	$0.00	$0.00	$0.00	$0.00
NE	$54,000	$105,400	$90	$360	<$0.01	<$0.01	$0.00	$0.00	$0.00	$0.00
Total	-	-	-	-	**$1.05**	**$4.16**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
HUC 1027										
KS	$54,000	$105,400	$90	$360	$1.40	$4.94	$0.00	$0.00	$0.00	$0.00
NE	$54,000	$105,400	$90	$360	$0.07	$0.16	$0.00	$0.00	$0.00	$0.00
Total	-	-	-	-	**$1.48**	**$5.10**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Both Watersheds										
Total	-	-	-	-	**$2.52**	**$9.26**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table E-19. For each state, cost savings are calculated by multiplying the cost of each mitigation acre or linear foot (low and high estimates) by the expected reduction in annual mitigation requirements, summing the acreage and linear feet values for each scenario, and multiplying the total by 1.5. The agencies multiply the total by 1.5 to account for a compensatory mitigation requirement ratio of 1.5:1.

[2] Scenarios 0 and 1 are combined because all values are identical.

Table E-23: Total estimated annual cost savings in the Lower Missouri River Basin, based on the sensitivity analysis methodology[1,2]

HUC	Scenarios 0 & 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
1025	$1.15	$4.26	<$0.01	<$0.01	$0.00	$0.00
1027	$1.68	$5.30	<$0.01	<$0.01	$0.00	$0.00
Total	**$2.83**	**$9.56**	**$0.01**	**$0.01**	**$0.00**	**$0.00**

[1] Scenarios 0 and 1 are combined because all values are identical.

[2] Scenarios 0 and 1 include cost savings in Kansas, Nebraska, and Colorado. Scenario 2 includes cost savings in Colorado only. Since none of the 404 permits issued in Colorado between 2011 and 2015 with impacts to waters affected by the proposed rule had mitigation requirements, Scenario 2 only includes minimal permits cost savings. Under Scenario 3, cost savings drop to zero because all states in the case study region are expected to regulate waters beyond CWA requirements.

Table E-24 and Table E-25 provide estimated annualized forgone benefits from lost mitigation requirements in the Lower Missouri River Basin under different state response scenarios, with three percent and seven percent discount rates, respectively.

Table E-24: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin based on the sensitivity analysis methodology, by policy scenario (3% Discount Rate)[1,2]

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1		Scenario 2		Scenario 3	
		Low	High	Low	High	Low	High
1025	1,264,605	$0.10	$0.68	$0.00	$0.00	$0.00	$0.00
1027	1,689,217	$0.18	$1.20	$0.00	$0.00	$0.00	$0.00

Table E-24: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin based on the sensitivity analysis methodology, by policy scenario (3% Discount Rate)[1,2]

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1		Scenario 2		Scenario 3	
		Low	High	Low	High	Low	High
Total	**2,953,822**	**$0.28**	**$1.88**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table E-19. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 3% discount rate.

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

Table E-25: Annualized forgone benefits (Millions 2017$) of lost mitigation requirements in the Lower Missouri River Basin based on the sensitivity analysis methodology, by policy scenario (7% Discount Rate)[1,2]

HUC	# Affected Households in 2020[3]	Scenarios 0 & 1		Scenario 2		Scenario 3	
		Low	High	Low	High	Low	High
1025	1,264,605	$0.08	$0.50	$0.00	$0.00	$0.00	$0.00
1027	1,689,217	$0.13	$0.88	$0.00	$0.00	$0.00	$0.00
Total	**2,953,822**	**$0.21**	**$1.38**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] Estimated changes in average mitigation required per year are presented in Table E-19. Forgone benefits are calculated for each scenario by multiplying total forgone mitigation values for each scenario (sum of acres and linear feet converted into acres) by the total number of affected households and the appropriate household WTP value (low: $0.006/acre; high: $0.038/acre). The agencies calculated forgone benefits for the years 2020-2039 and annualized values using a 7% discount rate.

[2] Scenarios 0 and 1 are combined because all values are identical.

[3] The agencies accounted for population growth and change in the number of households throughout the 2020-2039 study period.

E.2.3 Section 311

Because the NHD data layer does not distinguish between intermittent and ephemeral streams in the Lower Missouri River Basin region, the agencies did not perform a sensitivity analysis of section 311 program impacts using NHD data.

E.2.4 Water Quality Modeling

Table E-26 summarizes the impact of different assumptions on the sensitivity analysis inputs. Forgone mitigation in the sensitivity analysis is approximately twice that analyzed under the main analysis presented in Section IV.B.2.3.1.

Table E-26: Changes between 404 program impacts for the sensitivity scenario vs. primary scenario for the Missouri River Basin SWAT models based on permits issued 2011-2015 (5 Years)

	1025				1027			
	Area impacts to wetland abutting epheme-ral stream (Acres)	Linear impacts to epheme-ral stream (Acres)[1]	Area impacts to non-abutting wetlands (Acres)	Total	Area impacts to wetland abutting epheme-ral stream (Acres)	Linear impacts to epheme-ral stream (Acres)[1]	Area impacts to non-abutting wetlands (Acres)	Total
Total Primary Scenario	**0.6**	**38.1**	**0**	**38.7**	**4.4**	**43.5**	**0**	**47.9**
+ non-abutting wetlands	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7
+ mitigation of temporary impacts	0.0	5.7	0.0	5.7	0.3	0.8	6.1	7.3
+ Widen buffer width (100 vs. 50 ft)	0	43.9	0	43.9	0	44.4	0	44.4
Total Sensitivity Scenario	**0.6**	**87.8**	**0.0**	**88.4**	**4.7**	**88.7**	**12.8**	**106.2**

[1] Linear impacts converted to areas by multiplying the lengths by 50 feet for the Primary Scenario (Main Analysis) and by 100 feet for the Sensitivity Scenario and applying a conversion factor (1 acre = 43,560 square feet).

Tables E-27 through E-32 present water quality modeling results for the sensitivity analysis, following the same format as used in Section IV.B for the main analysis.

Table E-27: Summary of 404 Program activities in Lower Missouri River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers both permanent and temporary impacts.

Type of Potentially Affected Resource[2]	Permanent			Temporary			Total Impacts (Acres)
	Acres	Linear Feet	Total[1] Acres	Acres	Linear Feet	Total[1] Acres	
HUC 1025							
Wetland abutting ephemeral stream	2.3	0	2.3	0.0	0	0.0	2.3
Ephemeral stream	0	132,920	305.1	0.0	20,020	46.0	351.1
Total	**2.3**	**132,920**	**307.4**	**0.0**	**20,020**	**46.0**	**353.4**
HUC 1027							
Wetland abutting ephemeral stream	44.1	0	44.1	25.7	0	25.7	69.8

Table E-27: Summary of 404 Program activities in Lower Missouri River Basin SWAT models for permits with permanent or temporary impacts to waters potentially affected by the proposed rule and with mitigation requirements over 20-year analysis period. Modeled scenario considers both permanent and temporary impacts.

Type of Potentially Affected Resource[2]	Permanent			Temporary			Total Impacts (Acres)
	Acres	Linear Feet	Total[1] Acres	Acres	Linear Feet	Total[1] Acres	
Ephemeral stream	0.0	151,692	348.2	0	2,920	6.7	354.9
Total	**44.1**	**151,692**	**392.3**	**25.7**	**2,920**	**32.5**	**424.8**

[1] Represents the sum of impacts reported in acres and impacts reported in linear feet, assuming a width of 100 feet for linear impacts.

[2] See Table IV-8 for criteria used to identify affected resources that may change jurisdiction under the proposed rule.

Table E-28: Summary of basin-level annual average water balance and constituent transport in Lower Missouri River Basin SWAT watersheds for the sensitivity scenario

Parameter	HUC 1025				HUC 1027			
	Baseline	Policy	Change	% Change	Baseline	Policy	Change	% Change
Precipitation (mm)	543.50	543.50	0.00	0.0%	805.00	805.00	0.00	0.0%
Surface runoff (mm)	8.33	8.33	0.00	0.0%	82.88	82.88	0.00	0.0%
Lateral flow (mm)	0.09	0.09	0.00	0.0%	2.94	2.94	0.00	0.0%
Groundwater flow (mm)	2.44	2.44	0.00	0.0%	12.99	12.99	0.00	0.0%
Water yield (mm)	10.46	10.45	-0.01	-0.1%	98.96	98.96	0.00	0.0%
Evapotranspiration (mm)	533.90	533.90	0.00	0.0%	685.40	685.40	0.00	0.0%
Sediment loading (ton/ha)	0.120	0.120	0.000	0.0%	2.370	2.370	0.000	0.0%
Organic N (kg/ha)	0.310	0.310	0.000	0.0%	2.687	2.687	0.000	0.0%
Organic P (kg/ha)	0.040	0.040	0.000	0.0%	0.317	0.317	0.000	0.0%
NO_3 in surface runoff (kg/ha)	0.013	0.013	0.000	0.0%	0.008	0.008	0.000	0.0%
NO_3 in lateral flow (kg/ha)	0.001	0.001	0.000	0.0%	0.012	0.012	0.000	0.0%
Soluble P yield (kg/ha)	0.008	0.008	0.000	0.0%	0.102	0.102	0.000	0.0%
NO_3 leached (kg/ha)	0.116	0.116	0.000	0.0%	0.190	0.190	0.000	0.0%
P leached (kg/ha)	0.005	0.005	0.000	0.0%	0.016	0.016	0.000	0.0%

Table E-29: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1025 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	391	106	0.01	0.00	0.00	0.07
Surface runoff (mm/yr)	62	471	0.00	0.00	-0.03	0.00
Lateral flow (mm/yr)	126	401	0.00	0.00	0.00	0.00
Groundwater flow (mm/yr)	4	286	0.00	0.00	-0.14	0.00
Total water yield (mm/yr)	37	495	0.00	0.00	-0.14	0.00
Sediment yield (ton/ha/yr)	172	327	0.000	0.000	0.000	0.001
Organic N (kg/ha/yr)	288	244	0.000	0.000	0.000	0.002
Organic P (kg/ha/yr)	289	242	0.000	0.000	0.000	0.000
NO_3 in surface runoff (kg/ha/yr)	329	203	0.000	0.000	0.000	0.000

Table E-29: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1025 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Soluble P (kg/ha/yr)	329	202	0.000	0.000	0.000	0.000

[1] Total number of SWAT HUC12 reaches is 346. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-30: Estimated change in annual average subbasin water balance and constituent transport in SWAT watershed HUC 1027 for the sensitivity scenario

Model parameter	Number of Subbasins by Direction of Change[1]		Absolute Change			
	Increase	Decrease	Average	Median	Minimum	Maximum
Evapotranspiration (mm/yr)	0	0	0.00	0.00	0.00	0.00
Surface runoff (mm/yr)	238	181	0.00	0.00	0.00	0.09
Lateral flow (mm/yr)	3	0	0.00	0.00	0.00	0.00
Groundwater flow (mm/yr)	71	312	0.00	0.00	-0.04	0.08
Total water yield (mm/yr)	193	226	0.00	0.00	-0.02	0.08
Sediment yield (ton/ha/yr)	341	79	0.000	0.000	0.000	0.007
Organic N (kg/ha/yr)	242	178	0.000	0.000	0.000	0.002
Organic P (kg/ha/yr)	232	188	0.000	0.000	0.000	0.000
NO_3 in surface runoff (kg/ha/yr)	255	165	0.000	0.000	0.000	0.000
Soluble P (kg/ha/yr)	283	137	0.000	0.000	0.000	0.000

[1] Total number of SWAT HUC12 reaches is 106. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-31: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Lower Missouri River Basin for the sensitivity scenario

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change
HUC 1025							
Annual TN load (kg/yr)	146	409	1.9	-0.1	-0.01%	0.00%	0.28%
Annual TP load (kg/yr)	147	406	-0.3	0.0	-0.01%	0.00%	0.28%
Annual sediment load (kg/yr)	187	368	-1.1	0.0	-0.01%	0.00%	1.50%
Mean daily flow (cms)	71	477	0.000	0.000	-0.02%	-0.01%	0.01%
HUC 1027							
Annual TN load (kg/yr)	369	51	41.7	0.8	0.00%	0.00%	0.04%
Annual TP load (kg/yr)	379	41	10.2	0.2	0.00%	0.00%	0.04%
Annual sediment load (kg/yr)	318	102	7.6	0.3	0.00%	0.00%	0.04%
Mean daily flow (cms)	315	105	0.000	0.000	0.00%	0.00%	0.04%

Table E-31: Summary of predicted changes in loads transported by HUC12 reaches and in-stream concentrations within the SWAT watersheds for the Lower Missouri River Basin for the sensitivity scenario

Watershed and Parameter	Number of Reaches by Direction of Change[1]		Magnitude of Change				
	Increase	Decrease	Average Change	Median Change	Average % Change	Median % Change	Maximum % Change

[1] Total number of reaches is 346 in HUC 0509 and 106 in HUC 0510. Some modeled reaches show no change in annual average values and are not included in the counts above.

Table E-32: Predicted changes in annual average loads delivered to the outlet of Lower Missouri River Basin SWAT watersheds for the sensitivity scenario

Parameter	Baseline	Policy	Change	% Change
HUC 1025				
Annual TN load (kg/yr)	2,899,314	2,900,067	753	0.03%
Annual TP load (kg/yr)	639,885	640,026	142	0.02%
Annual sediment load (ton/yr)	174,826	174,767	-58	-0.03%
HUC 1027				
Annual TN load (kg/yr)	17,798,742	17,799,323	582	0.00%
Annual TP load (kg/yr)	3,790,097	3,790,239	142	0.00%
Annual sediment load (ton/yr)	2,755,689	2,755,715	26	0.00%

E.2.5 Dredging for Water Storage and Navigation

Table E-33 presents predicted net sediment depositions in reservoirs in the Lower Missouri River Basin for the sensitivity scenario. Costs under the sensitivity scenario are summarized in Table E-34.

Table E-33: Summary of predicted net sediment depositions in reservoirs in the Missouri River Basin (tons/year) in 2040 for sensitivity scenario

HUC4	Number of reservoirs[1]	Net annual sediment deposition in reservoirs		Change relative to baseline	
		Baseline	Sensitivity	Tons/year	Percent
1025	11	14,980	14,964	-16	-0.11%
1027	5	6,804,625	6,804,620	-5	-0.00%
Total	16	6,819,605	6,819,584	-21	-0.00%

[1] Reservoirs modeled in SWAT watersheds, based on the U.S. Army Corps of Engineers National Inventory of Dams as of October 2010.

Table E-34: Annualized Dredging Cost Changes in Missouri River Basin (2017$ thousands) for the Sensitivity Scenario

HUC4	Increase in Annual Sediment (cubic yards) (2040)	3% Discount Rate ($/year)			7% Discount Rate ($/year)		
		Low	Medium	High	Low	Medium	High
1025	-16	-$0.1	-$0.1	-$0.1	-$0.1	-$0.1	-$0.1
1027	-5	<-$0.1	<-$0.1	<-$0.1	<-$0.1	<-$0.1	<-$0.1
Total	**-21**	**-$0.1**	**-$0.1**	**-$0.1**	**-$0.1**	**-$0.1**	**-$0.1**

E.3 Case Study 3: Rio Grande River Basin

E.3.1 Section 402

Table E-35 presents the number of NPDES permits issued in the Rio Grande River Basin as well as permits with at least one discharge point near ephemeral waters by the most common industry categories. The number of permits with at least one discharge point near ephemeral waters is based on NHD high resolution categorizations instead of NWI Cowardin codes as used for the main analysis. As described in Section II.C, the agencies used NHD data from March 2017 for all states except California, which were September 2017 data.

Table E-35: Section 402 individual permits (SIC codes in parentheses) issued in case study watersheds in the Rio Grande River Basin

Industry category	Individual permits[1]			General permits[1]		
	Total number of NPDES permits	Permits with discharge point near ephemeral streams[2]		Total number of NPDES permits[1]	Permits with discharge point near ephemeral streams[2]	
		Number of permits	Percent of all permits		Number of permits	Number of permits
HUC 1306						
Sewerage Systems (4952)	9	1	11%	1	0	0%
Animal Feeding Operations[3]	0	0	0%	6	2	33%
Motor Vehicle Parts, Used (5015)	0	0	0%	9	7	78%
Aggregate Mining[4]	0	0	0%	15	6	40%
Construction and Development[5]	0	0	0%	5	2	40%
Other Categories[6]	6	0	0%	32	9	28%
Missing SIC Codes	0	0	0%	105	51	49%
Total	**15**	**1**	**7%**	**173**	**77**	**45%**
HUC 1307						
Industrial Domestic Wastewater Treatment[7]	2	0	0%	0	0	0%
Sewerage Systems (4952)	3	0	0%	0	0	0%
Aggregate Mining[4]	0	0	0%	2	1	50%
Ready-Mixed Concrete (3273)	0	0	0%	3	1	33%
Animal Feeding Operations[3]	0	0	0%	2	0	0%
Other Categories[6]	2	0	0%	0	0	-
Missing SIC Codes	0	0	-	21	10	48%
Total	**7**	**0**	**0%**	**28**	**12**	**43%**
Total for both watersheds	**22**	**1**	**5%**	**201**	**89**	**44%**

[1] Source: EPA's ICIS-NPDES data, 2017. The facility permits included in the spatial analysis are limited to those for which the ICIS-NPDES database includes latitude/longitude coordinates. For permits with multiple SIC codes, only one SIC code was retained, with manufacturing industries prioritized, to avoid double-counting.

[2] The agencies used FCODES in the NHD dataset to determine whether 402 discharges are likely to affect ephemeral streams.