Revised Definition of "Waters of the United States"
Response to Comments Document

SECTION 16 – TECHNICAL SUPPORT DOCUMENT (TSD) AND OTHER SCIENCE

See the Introduction to this Response to Comments Document for a discussion of the U.S. Environmental Protection Agency and the U.S. Department of the Army's (hereinafter, the agencies') comment response process and organization of the eighteen sections.

16 TECHNICAL SUPPORT DOCUMENT AND OTHER SCIENCE

This topic includes comments related to the science supporting the proposed rule, specific to the Technical Support Document for the Proposed Rule, the 2015 EPA report *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*[1] (hereinafter, the "Science Report") and related literature, climate change science, the functions of multiple aquatic resources, and the role of science in this rulemaking. Comments on the science supporting individual categories of waters, such as tributaries, wetlands, and other water types, are in the Response to Comments sections for those specific topics.

16.1 Technical Support Document and the Science Report

16.1.1 Support for the Technical Support Document and the Science Report

Several commenters wrote in support of the *Technical Support Document for the Proposed "Revised Definition of 'Waters of the United States'" Rule* (Proposed Rule TSD) and the Science Report. More specifically:

- Several commenters remarked that the agencies should follow and incorporate the science outlined in the Science Report, and discussed the connections between tributaries, wetlands, and downstream waters, and the importance of headwaters, ephemeral and intermittent streams, "isolated" wetlands such as prairie potholes and vernal pools, and groundwater.
- One commenter expressed support for the Science Report and stated that the Report and continuing scientific research provide the basis for why some headwater tributaries, wetlands, and floodplains warrant protection as "waters of the United States."
- One commenter expressed support for the Science Report, explicitly referencing attributes of floodplains that support the vital ecosystem functions of riverine systems, including connectivity, variable flow/inundation, spatial extent, habitat, and structural diversity.
- One commenter expressed support for the agencies' respect for and application of accepted science in the Proposed Rule TSD. The commenter further stated that the proposed rule is an appropriate interim measure to guide the agencies' implementation of the Clean Water Act while they work to develop a new, updated definition of "waters of the United States" that addresses environmental justice and climate change concerns.
- One commenter expressed support for the tools included in the Proposed Rule TSD including remote sensing, United States Geological Survey (USGS) and topographical maps, aerial photography, gage data, satellite imagery, watershed studies, modeling tools, scientific literature, and more.

Agencies' Response: The agencies agree with commenters who stated that the Proposed Rule TSD and the Science Report provide a strong scientific basis for the rule. The agencies' interpretation of the Clean Water Act's scope in this final rule is informed by the best available peer-reviewed science, including on the connectivity and effects that streams, wetlands, and open waters have on the chemical, physical, and biological integrity of traditional navigable waters, the territorial seas, or interstate waters. See Section III of the

[1] U.S. Environmental Protection Agency. 2015. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (Final Report)*. EPA/600/R-14/475F. U.S. Environmental Protection Agency, Washington, D.C. ("Science Report").

Technical Support Document[2] for additional detail of the scientific literature and the agencies' reasoning in support of the final rule.

Regarding the comment on a subsequent rulemaking, in the preamble to the proposed rule, the agencies stated that they would consider changes through a second rulemaking that they anticipated proposing in the future, which would build upon the foundation of this rule. The agencies have concluded that this rule is durable and implementable because it is founded on the familiar framework of the 1986 regulations, fully consistent with the statute, informed by relevant Supreme Court decisions, and reflects the record before the agencies, including consideration of the best available science, as well as the agencies' expertise and experience implementing the pre-2015 regulatory regime. The agencies may consider further refinements in a future rule to address implementation or other issues that may arise.

The agencies also appreciate the comment expressing support for the tools included in the Proposed Rule TSD. As discussed in the Final Rule Preamble and in Section IV of the Technical Support Document, the agencies have identified a variety of implementation guidance, tools, and methods available for use to determine if a water is jurisdictional under the final rule. The agencies conclude that the final rule, together with the preamble and existing tools, provides sufficient clarity to allow consistent implementation of the final rule.

16.1.2 Criticisms of the Technical Support Document and the Science Report

Some commenters expressed concern with the Proposed Rule TSD or the Science Report.

- One commenter claimed that because the preamble to the proposed rule states that "[a]ll tributary streams, including perennial, intermittent, and ephemeral streams, are chemically, physically, and biologically connected to larger downstream waters via channels and associated alluvial deposits where water and other materials are concentrated, mixed, transformed, and transported" (86 FR 69390), that the agencies have implied that all ephemeral and intermittent streams are jurisdictional.
- One commenter argued that the Science Report and the Proposed Rule TSD do not scientifically support the unique geography and climate of Alaska. The commenter added that the maps and illustrations in the Science Report do not even depict Alaska.
- A few commenters stated that it is inappropriate for the agencies to draw conclusions about streamflow in the arid Southwest based on the San Pedro River study. One of these commenters suggested that the Science Report and the Proposed Rule TSD are overly broad and not especially relevant to determining jurisdiction, especially with respect to ephemeral drainages in the arid Southwest.

[2] Note that in this document, references to the *Technical Support Document for the Proposed "Revised Definition of 'Waters of the United States'" Rule* will be denoted as "Proposed Rule TSD" while references to the *Technical Support Document for the Final "Revised Definition of 'Waters of the United States'" Rule* will be denoted as "Technical Support Document."

- One commenter opined that most of the discussion and information in the Science Report and the Science Advisory Board's (SAB) review of the Science Report[3] "focused on 'streams' and there was very little consideration given to the dry ephemeral drainages of the arid West."
- One commenter opined that the agencies have failed to meaningfully respond to the SAB Review's numerous suggestions of ways to improve the Science Report. The commenter also critiqued the proposal by remarking that the agencies should address comments from the SAB Review by defining which connections are "significant" and providing metrics for determining whether connections establish a "significant nexus." The commenter also claimed that the lack of clarity in the proposed rule and Proposed Rule TSD around how to determine the significance of the various factors and functions "suggests that there is no gradient of hydrologic connection that would in fact be determined to be 'insubstantial and speculative.'"

Agencies' Response: The agencies disagree with commenters who stated that the rule is not supported by science. The agencies' interpretation of the Clean Water Act's scope in this final rule is informed by the best available peer-reviewed science, including on the connectivity and effects that streams, wetlands, and open waters have on the chemical, physical, and biological integrity of traditional navigable waters, the territorial seas, or interstate waters. The Science Report provides much of the scientific basis of the final rule, and the agencies were also informed by other sources of scientific information and literature, particularly for topics that were not addressed in the Science Report, and by their review of the scientific literature that had been published since the Science Report's publication. See Section III of the Technical Support Document for additional detail of the scientific literature and the agencies' reasoning in support of the final rule.

The agencies disagree that the proposed rule implied that all intermittent and ephemeral streams would be jurisdictional as tributaries. The agencies have made clear in the proposal and the final rule that streams must meet the agencies' longstanding interpretation of tributary to be assessed as paragraph (a)(3) tributaries, and that only those tributary streams that meet the relatively permanent standard or the significant nexus standard are jurisdictional as tributaries. Consistent with the pre-2015 regulatory regime and prior rules defining "waters of the United States," jurisdictional decisions under the final rule are made on a case-specific basis, with consideration of site-specific circumstances. See Final Rule Preamble Section IV.C.4 for additional discussion of the tributary provision under the final rule.

The agencies disagree with the commenter who stated that the Science Report and the Proposed Rule TSD do not scientifically support the unique geography and climate of Alaska, and with commenters who stated that the agencies' conclusions on ephemeral streams in the arid Southwest are overly board, including allegations that the agencies relied only on the San Pedro River. The agencies also disagree with the commenter who implied that ephemeral streams in the arid West are not "streams" and who claimed that the Science Report and SAB Review gave very little consideration to such ephemeral streams. The Science Report synthesized the available evidence from peer-reviewed studies

[3] U.S. Environmental Protection Agency Science Advisory Board. 2014. *SAB review of the draft EPA report* Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (October 17, 2014). EPA-SAB-15-001, U.S. Environmental Protection Agency, Washington, D.C. ("SAB Review").

in different climate-landscape settings to identify the range of functions provided by streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters in the United States. This included studies from Alaska and studies from the arid Southwest other than the San Pedro River study. Additionally, the San Pedro case study in Science Report Appendix Section B.5.4 does not focus solely on the San Pedro River itself but evaluates the entire tributary network within the San Pedro River Basin, including the Walnut Gulch sub-watershed. Walnut Gulch is a highly studied tributary of the San Pedro River, and Science Report Section 3 (Streams: Physical, Chemical, and Biological Connections to Rivers) also describes findings from Walnut Gulch. Furthermore, the Science Report also summarizes findings from other Southwestern tributaries. Goodrich *et al.* (2018),[4] which is cited in the Proposed Rule TSD and the Technical Support Document, provides additional citations and support regarding streams in the arid Southwest. In addition, in response to the SAB Review, more literature regarding the importance of episodic connections between ephemeral and intermittent streams and downstream waters was added to Appendix Section B.5 (Southwestern Intermittent and Ephemeral Streams) and Section 3 (Streams: Physical, Chemical, and Biological Connections to Rivers) of the final Science Report. These sections and others in the Science Report highlight consideration of scientific research on ephemeral streams in the arid West. Similarly, the SAB Review contains consideration of ephemeral streams in the arid West. The SAB Review states, "Important cumulative effects are exemplified by ephemeral flows in arid landscapes, low-frequency events that may nevertheless provide most of the subsidies to downgradient waters" (SAB Review at 22; citations omitted). The SAB Review also concluded "the review and synthesis of the literature describing connectivity of streams to downstream waters reflects the pertinent literature and is well grounded in current science. The 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." (SAB Review cover letter at 3). In addition, the agencies are not using the Science Report or the Technical Support Document to make categorical determinations in the final rule that tributaries, their adjacent wetlands, or waters evaluated under paragraph (a)(5) are jurisdictional based on the significant nexus standard. Consistent with the pre-2015 regulatory regime, jurisdictional decisions under the final rule are made on a case-specific basis, with consideration of site-specific circumstances.

The agencies disagree with the commenter who stated that the agencies had failed to address the SAB Review's suggestions to improve the Science Report. Though the SAB Review of the Science Report is outside the scope of this rulemaking, revisions were made to the final Science Report in response to the review, including Section 2.4.6, which is a summary of the literature on metrics and approaches for measuring connectivity and supplemented existing text in the draft report on estimating and understanding connectivity. These revisions did not have a significant bearing or effect on the report's overall assessment of connectivity or conclusions. Rather, the revisions ensure that the Science Report includes a more complete evaluation of the dynamics of connectivity and the available literature. Although outside the scope of this rulemaking, EPA's Response to

[4] Goodrich, D.C., W.G. Kepner, and L.R. Levick. 2018. "Southwestern intermittent and ephemeral stream connectivity." *Journal of the American Water Resources Association* 54(2): 400-422.

Comments from the SAB Review is also available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=296414.

The agencies also disagree with the commenter who claimed the agencies did not address comments from the SAB Review by defining in the rule what is "significant" and providing the agencies' approach for determining whether connections establish a "significant nexus." The definition of "significantly affect" in the final rule is derived from the objective of the Clean Water Act and is informed by and consistent with Supreme Court case law. It is also informed by the agencies' technical and scientific judgment and supported by the best available science regarding the functions provided by upstream waters to paragraph (a)(1) waters relevant to achieving the Clean Water Act's objective. The agencies disagree "that there is no gradient of hydrologic connection that would in fact be determined to be 'insubstantial and speculative.'" The agencies have established a definition of "significantly affect" in this rule, provided additional guidance on applying the significant nexus standard, and identified implementation tools and resources that will work together to provide clarity and further consistency in implementing the significant nexus standard. The agencies have concluded that these actions, along with the agencies' experience making determinations under the significant nexus standard, will increase the clarity and consistency of determinations of jurisdiction. The factors in the final rule are readily understood criteria that influence the types and strength of chemical, physical, or biological connections and associated effects on paragraph (a)(1) waters. Section IV.C.9.c of the Final Rule Preamble provides the agencies' general approach to implementing the definition of "significantly affect" for purposes of the significant nexus standard, including evaluation of the functions and factors. See Sections IV.C.4, IV.C.5, IV.C.6 of the Final Rule Preamble for additional information on how the agencies will implement the significant nexus standard for tributaries, adjacent wetlands and paragraph (a)(5) waters, respectively. See also the agencies' response to comments in Section 12.2.

The agencies recognize that regional differences in climate, geology, topography, soils, and other variables (such as vegetation and land use) mean that the functions and connections present in any given water (when considered alone or in combination with similarly situated waters in the region) will likely be a subset of those functions and connections identified in the Science Report. Furthermore, the agencies have clearly identified the specific functions and factors to be considered in a significant nexus determination under the rule. See the definition of "significantly affect" at paragraph (c)(6).

The agencies are deeply familiar with the variations in climate, geology, and terrain within and among watersheds and over time that affect the functions performed by streams, open waters, and wetlands and, therefore, the chemical, physical, and biological integrity of paragraph (a)(1) waters. The agencies' field staff have gained extensive familiarity and practical experience making decisions on jurisdiction based on the significant nexus standard, using national and regional field methods, literature, datasets, models, and tools that are required to make such determinations. The agencies' immersion in the science, along with the practical expertise developed through more than a decade of case-specific "significant nexus" determinations across the country, have helped the agencies determine which waters have a significant nexus and where to draw boundaries demarking the "waters of the United States." Further, based on the agencies' experience, many waters

under this rule will not have a significant nexus to paragraph (a)(1) waters, and thus will not be jurisdictional under the Clean Water Act.

16.1.3 General Comments on the Agencies' Use of Science

Many commenters offered general support for a rule that is supported by science.

- Several commenters requested that the agencies incorporate consensus-driven, evidence-based science in the rulemaking process.
- Several commenters stated that scientific support for the proposed rule should be one of the most important factors that the agencies rely on.
- One commenter supported the reliance on science to establish the proposed rule. They also wrote in support of extending the protection of water quality beyond pollutants to include hydrological effects, biological dependencies, and habitat needs.
- One commenter urged the agencies to develop a clear, science-based rule based on their expertise and the latest science on hydrologic and functional connectivity.
- One commenter asserted that strong regulations are needed now based on water quality information. They specifically mentioned lakes and ponds, rivers and streams, wetlands, and other waters.
- One commenter stated that the Science Report explains the importance of small or temporary streams and non-floodplain wetlands.
- A few commenters supported the watershed-scale approach in the proposed rule, relative to the 2020 NWPR, to ensure adequate protection of a broad array of ecosystem services. They discussed the importance of evaluating headwater streams, ephemeral streams, and wetlands lacking a surface connection in a watershed context.
- One commenter voiced their support for a broad approach to defining a linkage of a water or wetland to the chemical, physical, and biological integrity of a traditional navigable water by including both surface and shallow subsurface flow.
- One commenter stated that the science supports categorical protections to all tributaries, adjacent wetlands, and "other waters," and restoring cross references to "other waters" in the tributaries and adjacent wetlands categories.
- One commenter stated that the agencies must consider the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14's updated rainfall frequency values when defining the proper scope of jurisdiction.

Other commenters offered general comments that propose limiting or eliminating the use of science in defining "waters of United States."

- One commenter expressed concern that the agencies will use the Science Report to regulate waters beyond their authority.
- A few commenters argued that the proposed rule relies too much on science in a way that is not compatible with legal limitations and case law. They referenced the terms "connection" and "significant nexus" and stated that jurisdiction under the proposed rule is too broad.
- One commenter stated that the agencies should not consider the Science Report because interpretations of a statute must be founded on statutory text and not scientific studies.
- One commenter supported the use of relevant science to determine a definition of "waters of the United States," but also encouraged the agencies to "rebalance" the proposed rule and consider the use of science, case law, and statute when determining jurisdiction.

- One commenter wrote that it is not only important to base the definition of "waters of the United States" on science, but also on the constraints established by statute and judicial precedent. They further wrote that individual determinations should be based on real evidence and not assumptions or speculations.
- One commenter argued that the definition of "waters of the United States" must be grounded in a legal analysis of the limits on Clean Water Act jurisdiction reflected in the statute and Supreme Court case law.

Some commenters provided input on how science supports including certain categories of aquatic resources as "waters of the United States."

- One commenter wrote that adjacent and neighboring wetlands without a hydrological surface water connection and adjacent lakes and ponds that are not classified as tributaries should all be considered jurisdictional.
- One commenter wrote that the agencies should create additional categories of "waters of the United States" that do not require a case-specific analysis supported by scientific literature.
- One commenter requested that altered or urban rural waterbodies be clearly defined and protected, and stated that altered waterbodies still can carry nutrients, sediment, and pollution.

Some commenters discussed other scientific topics related to the Science Report.

- One commenter stated that the agencies need to incorporate the science of connectivity as described in the Science Report more completely into the rulemaking.
- Another commenter argued that the Science Report contained a conservative view of non-floodplain waters' downstream connectivity. The commenter further discussed the degrees of connectivity outlined in the Science Report.
- One commenter listed several examples from the Science Report and 2015 Clean Water Rule Technical Support Document to discuss how seemingly "geographically isolated" Texas coastal prairie wetlands can be collectively connected both geographically and hydrologically to downstream waters.
- One commenter stated that the Science Report and SAB Review are limited to examining the connectivity of waters with a significant nexus to downstream waters, and that the agencies should not use the significant nexus standard as a basis to categorically exclude all tributaries, adjacent wetlands, and "other waters" as jurisdictional waters in the definition because of this bias.

One commenter asserted that the agencies must address the corresponding frequency, duration, and water quality-based risk factors of short-term wet weather (*e.g.*, stormwater) events that should be applied to jurisdictional waters. The commenter also asked how the agencies will establish water quality standards and monitoring requirements for ephemeral streams under short-term wet weather conveyance conditions and recommended that statistical stormwater flow boundary conditions be evaluated for each of those cases.

One commenter opined that the agencies relied on only a subset of available scientific evidence and emphasized those aspects of the scientific record that support more expansive federal jurisdiction.

<u>Agencies' Response</u>: The agencies agree with commenters who offered general support for a rule that is supported by science. The agencies' interpretation of the Clean Water Act's

scope in this final rule is informed by the best available peer-reviewed science, including on the connectivity and effects that streams, wetlands, and open waters have on the chemical, physical, and biological integrity of traditional navigable waters, the territorial seas, or interstate waters. The Science Report provides much of the scientific basis of the final rule, and the agencies were also informed by other sources of scientific information and literature, particularly for topics that were not addressed in the Science Report, and by their review of the scientific literature that had been published since the Science Report's publication. See Section III of the Technical Support Document for additional detail regarding the scientific literature and the agencies' reasoning in support of the final rule.

The agencies agree with the commenter who stated that the Science Report explains the importance of small or temporary streams and non-floodplain wetlands. See Science Report Chapters 3, 4, and 6. The agencies acknowledge commenters who supported the watershed-scale approach to aggregation in the proposed rule and who advocated for evaluating waters in a watershed context. In implementing the significant nexus standard under the final rule, all tributaries and adjacent wetlands within the catchment area of the tributary of interest will be analyzed as part of the significant nexus analysis. See Section IV.C.4.c.iii of the Final Rule Preamble (discussing how to evaluate whether a tributary meets the significant nexus standard). The agencies acknowledge the comment regarding surface and shallow subsurface flow as an important connection. The agencies' final rule allows for consideration of an unbroken surface or shallow subsurface hydrologic connection to a jurisdictional water to demonstrate adjacency, consistent with longstanding practice. See Section IV.C.5 of the Final Rule Preamble (addressing the final rule's approach to adjacent wetlands). Separately, for purposes of the significant nexus standard, the agencies will consider "[h]ydrologic factors, such as the frequency, duration, magnitude, timing, and rate of hydrologic connections, including shallow subsurface flow" (paragraph (c)(6)(ii)(B) of the final rule regulatory text) when determining if a water has a material influence on traditional navigable waters, the territorial seas, or interstate waters. See Section IV.C.9 of the Final Rule Preamble (discussing the final rule's definition of "significantly affect"). The agencies appreciate the commenter who suggested that the agencies consider NOAA Atlas 14's updated rainfall frequency values and recognize that climate change is affecting storm frequency and intensity in some areas. However, the agencies disagree that data providing the historical frequency of rainfall events are appropriate for determining the proper scope of jurisdiction.

The agencies disagree with commenters who stated that the agencies will use the Science Report to regulate waters beyond their authority; that the agencies have relied on science in a way that is incompatible with legal limitations and case law; and that the agencies should not consider the science reviewed in the Science Report in defining "waters of the United States." See also the agencies' response to comments in Section 2.1 (addressing the agencies' reliance on the Clean Water Act's statutory objective in developing the final rule). While the agencies agree with commenters who stated that scientific evidence is important, the agencies also acknowledge that science is not the only factor that they must consider when defining "waters of the United States." As discussed in Final Rule Preamble Section IV.A, the agencies are finalizing a definition of "waters of the United States" that is within the agencies' authority under the Act; that advances the objective of the Clean Water Act; that establishes limitations that are consistent with the statutory text, supported by the scientific

record, and informed by relevant Supreme Court decisions; and that is both familiar and implementable. As the agencies charged with construing the statute, EPA and the Army Corps of Engineers must develop the outer bounds of the scope of the Clean Water Act. The agencies agree with commenters who stated that science alone cannot dictate where to draw the line defining "waters of the United States." But science is critical to understanding what scope of jurisdiction furthers Congress's objective to restore and maintain the chemical, physical, and biological integrity of the nation's waters and properly determining which waters are the subject of federal jurisdiction due to their effects on paragraph (a)(1) waters. Thus, the agencies disagree with the commenter who implied that the agencies' proposed rule did not properly balance science, case law, and the statute. The agencies have concluded that the rule establishes limits that appropriately draw the boundary of waters subject to federal protection.

The agencies appreciate comments providing input on how science supports including certain categories of aquatic resources as "waters of the United States." However, this final rule, unlike the 2015 Clean Water Rule, is not based on categorical significant nexus determinations. Instead, the final rule is founded on the longstanding and familiar 1986 regulations and includes a framework for applying the relatively permanent and significant nexus standards to certain categories of waters in the rule. See Final Rule Preamble Section IV.B.1 for a discussion of the agencies' conclusion that the 2015 Clean Water Rule, while designed to advance the objective of the Clean Water Act, is not the best alternative to meet the agencies' policy goals; see Final Rule Preamble Section IV.B for the agencies' consideration of alternatives to the final rule.

The agencies acknowledge the commenter who argued that the Science Report contained a conservative view of the downstream connectivity of non-floodplain waters. The agencies have concluded that the Science Report accurately synthesized the peer-reviewed, published scientific information that was available at the time of its publication regarding the connectivity and effects of non-floodplain waters on downstream waters. The agencies recognize that since the publication of the Science Report in 2015, the published literature has expanded scientific understanding and quantification of the functions of these waters that affect the integrity of larger waters, including traditional navigable waters, the territorial seas, and interstate waters, particularly in the aggregate. More recent literature (*i.e.*, 2014-present, as some literature from 2014 and 2015 may not have been included in the Science Report) has determined that non-floodplain wetlands can have demonstrable hydrologic and biogeochemical downstream effects, such as decreasing peak flows, maintaining baseflows, and performing nitrate removal, particularly when considered cumulatively. The Science Report's major conclusions state that "[e]valuations of individual [non-floodplain] wetlands or groups of wetlands, however, could be possible through case-by-case analysis," and the agencies' in the final rule will allow for such consideration on a case-by-case basis for such waters under other the (a)(4) adjacent wetlands category or the (a)(5) category for waters that do not meet the jurisdictional criteria under other categories of the final rule. Consistent with the pre-2015 regulatory regime, jurisdictional decisions under the final rule are made on a case-specific basis, with consideration of site-specific circumstances. Thus site-specific information, including any relevant literature (not limited to just the Science Report), would be considered.

The agencies acknowledge the commenter who stated that Texas coastal prairie wetlands can be collectively connected both geographically and hydrologically to downstream waters. Such information can be used for a case-specific analysis under the final rule of whether such waters meet either the relatively permanent standard or the significant nexus standard and are therefore "waters of the United States." See Final Rule Preamble Section IV.C for additional information on implementation of the final rule. With respect to the comment that the significant nexus standard should not be used as a basis to categorically exclude all tributaries, adjacent wetlands, or waters that do not meet the jurisdictional criteria under other categories of the final rule, the agencies are not using significant nexus standard to categorically exclude waters under this rule. The significant nexus standard does represent a limitation on the scope of jurisdictional waters. Thus tributaries, adjacent wetlands, or waters assessed under paragraph (a)(5) that do not meet the jurisdictional criteria under the final rule will be determined not to meet the standards established under the rule and will therefore not be "waters of the United States." Under the final rule, tributaries meeting either the relatively permanent standard or significant nexus standard are jurisdictional. Based on the agencies' longstanding exclusions and practice, the final rule establishes exclusions for certain waters and features under paragraph (b), where such waters and features are not paragraph (a)(1) waters, even if they otherwise meet the jurisdictional criteria to be impoundments, tributaries, adjacent wetlands, or paragraph (a)(5) waters. See Section IV.C. of the Final Rule Preamble for additional information about the categories of "waters of the United States" and exclusions under the final rule.

In regard to the commenter who asserted that the agencies must address the corresponding frequency, duration, and water quality-based risk factors of short-term wet weather conditions, the agencies agree that frequency and duration of surface flow are relevant to the significant nexus standard, as well as the relatively permanent standard. The agencies do not agree that frequency and duration of surface flow are the only factors relevant to the significant nexus standard, as demonstrated by the factors in the final rule's definition of "significantly affect" in paragraph (c)(6). Additionally, while water quality standards and monitoring requirements are outside the scope of this rulemaking, the agencies note that for many years EPA has reviewed and approved state water quality standards for ephemeral waters under Clean Water Act section 303(c), and authorized Tribes and States have developed water quality standards for broad classifications of waters, including ephemeral waters. In addition, as described in Final Rule Preamble Section IV.C.9.b, the Clean Water Act itself does not require that "waters of the United States" must be identified based on a quantitative or statistical thresholds.

The agencies disagree with the commenter who implied that the agencies have relied on only favorable evidence from the scientific record. The agencies have considered the totality of the scientific evidence. The Science Report, which forms much of the scientific basis for the final rule, is a peer-reviewed synthesis of over 1,300 peer-reviewed scientific articles, and the report's major conclusions are based on the totality of the scientific evidence. In addition, the agencies' assessment of the literature published since the report's release has found that the vast majority of the more recent literature was supportive of or augmented the report's conclusions. Literature provided to the agencies during the public comment period has been reviewed and incorporated where appropriate. See the agencies' response to comments in Section 16.2.2. The agencies found that the peer-reviewed literature

published since 2014 provided via public comments either do not address the report's conclusions or were supportive of the report's conclusions. See also Section I.C.vi and Appendix C3 of the Technical Support Document. Unlike in the 2015 Clean Water Rule, the agencies are not making any categorical determinations of significant nexus in the final rule. Rather, jurisdictional decisions under the final rule will be made on a case-specific basis with consideration of site-specific circumstances and site-specific information, including any relevant literature.

16.2 Review of the Scientific Literature Published Since the Release of the Science Report

16.2.1 Comments on the Review of Literature Published Since the Science Report's Release

A few commenters provided feedback on the agencies' review and summarization of scientific literature published since the Science Report's publication and discussion included in section II.C of the Technical Support Document for the proposed rule.

- One commenter remarked that since the 2015 Clean Water Rule, the agencies have identified more than 1,200 studies demonstrating connections between waters. They stated that nothing has been done to creditably challenge the agencies' own findings and evidence that support broad-based protections.
- One commenter argued that the agencies drew conclusions when reviewing the Science Report that were based solely on the review of abstract papers and this creates some uncertainty in the agencies' findings.
- One commenter argued that the proposed rule reflects scientific developments made since the Science Report which warrants an extended comment period prior to rulemaking.
- One commenter questioned the credibility of the agencies' use of science, given that the "same Agencies can publish such radically different rules in such a short [2015 to 2021] time with each iteration 'supported by the science.'"

Agencies' Response: The agencies agree with commenters who state that relevant literature published since the release of the Science Report supports the conclusions of that report, and that literature on ephemeral streams and non-floodplain wetlands has expanded the agencies' understanding of the functions by which these waters affect the integrity of larger bodies of water, particularly when evaluated in the aggregate. Section I.C.i of the Technical Support Document details the agencies' systematic review of abstracts (summaries) of 12,659 scientific papers on topics reviewed in the Science Report. The purpose of this effort was to screen new publications for information that may not have been considered in the Science Report or contained evidence that contradicted the major conclusions of that report. Systematic review avoids bias in the selection of literature to be screened and uses explicit, reproducible methods to evaluate findings. Section I.C.i of the Technical Support Document also summarizes results from the screened papers. This approach enabled the agencies to efficiently screen results from a large number of publications to search for new evidence relating to the Science Report. The scientific papers published since 2014 and reviewed by the agencies provided overwhelming support substantiating the findings and conclusions of the Science Report, and the use of systematic review increased confidence

that recent research does not contradict the main findings from that report (see Section I.C.i of the Technical Support Document).

The agencies disagree with the commenter who opined that the proposed rule reflects scientific developments made since the Science Report that warrant an extended comment period prior to rulemaking. Since the release of the Science Report, additional published peer-reviewed scientific literature has strengthened and supplemented the report's conclusions. The agencies' analysis of the scientific literature published since 2014 found overwhelming support for the major conclusions of the Science Report. The small number of papers that the agencies screened and found to individually "refute" or "neither support or refute" the major conclusions of the report have not provided sufficient evidence to contradict the synthesis of scientific literature in those major conclusions. In addition, the Administrative Procedure Act (APA) does not specify a minimum number of days for accepting comments on a proposed rule. The agencies complied with their obligation under the APA to provide a reasonable length of time for interested parties to comment on the proposed rule. See also the agencies' response to comments in Section 5.1 for responses to comments on the comment period.

The agencies acknowledge that, while the scientific foundation for the rulemaking has not changed from the 2015 Clean Water Rule, the definition of "waters of the United States" has changed multiple times. However, the agencies disagree with the commenter who questioned the credibility of the agencies' use of science in this rulemaking. The agencies agree that the 2015 Clean Water Rule was informed by the best available science and was designed to advance the objective of the Clean Water Act but decided against returning to the 2015 Clean Water Rule for the reasons set forth in Section IV.B.1 of the Preamble to the Final Rule. Following a careful review of the 2020 NWPR and its administrative record including the text, structure, and history of the Clean Water Act; relevant Supreme Court case law; concerns raised by co-regulators and stakeholders; and issues raised in ongoing litigation challenging the 2020 NWPR, the agencies concluded that the 2020 NWPR did not properly consider the extensive scientific evidence demonstrating the interconnectedness of waters and their downstream effects, thereby undermining Congress's objective to restore and maintain the chemical, physical, and biological integrity of the nation's waters. See Section II.B.iii of the Technical Support Document. The 2020 NWPR's exclusion of major categories of waters from the protections of the Clean Water Act, specifically in the definitions of "tributary" and "adjacent wetlands," runs counter to the scientific record demonstrating how such waters can affect the integrity of downstream waters. See Section II.B.i of the Technical Support Document. In contrast, the agencies have concluded that the final rule is informed by the best available science. As discussed in Final Rule Preamble Section IV.A, the agencies are finalizing a definition of "waters of the United States" that is within the agencies' authority under the Act; that advances the objective of the Clean Water Act; that establishes limitations that are consistent with the statutory text, supported by the scientific record, and informed by relevant Supreme Court decisions; and that is both familiar and implementable. Science alone cannot dictate where to draw the line defining "waters of the United States" but science is critical to understanding what scope of jurisdiction furthers Congress's objective to restore and maintain the chemical, physical, and biological integrity of the nation's waters and properly determining which waters are the subject of federal jurisdiction due to their effects on paragraph (a)(1) waters.

16.2.2 Consideration of Additional Relevant Science/Literature

As part of the notice and comment process, the agencies solicited comment on the scientific literature contained in Appendix C of the Proposed Rule TSD and requested the public provide additional scientific literature and references relevant to the Science Report's conclusions on the connectivity and effects of streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters on the chemical, physical, and biological integrity of larger downstream waters. Commenters provided 43 citations of peer-reviewed scientific literature that have been published since 2014 but were not included in the agencies' initial review (as discussed in Section II.C. of the Proposed Rule TSD) of literature published since 2014.

> **Agencies' Response: The agencies appreciate commenters who provided additional citations of scientific literature published since the Science Report's release. The agencies reviewed those citations submitted as part of the notice and comment process. Fifty-one references provided by commenters (see Table 1) were already included in Appendix C of the Proposed Rule TSD (*e.g.*, Cohen *et al*. 2016[5] and Rains *et al*. 2016[6]) and were not reviewed because they had already been screened by the agencies, as described further in section I.C.i. of the Technical Support Document. Other submitted references were determined to not meet the agencies' criteria (*i.e.*, they were not published in or after 2014, they were not peer-reviewed, or the agencies could not ascertain if the references had undergone peer review; see Table 2). Other references were determined to not be relevant to the conclusions of the Science Report (*i.e.*, the findings of the paper were outside the context described in Section I.C of the Technical Support Document). The agencies have considered such references for relevance to other aspects of the Technical Support Document and have included such relevant references where appropriate (*e.g.*, where they were relevant to implementation of the final rule).**
>
> **The agencies assessed 47 peer-reviewed citations published in or after 2014 that were submitted as part of the public comment process. The agencies were able to discern the appropriate and relevant aquatic system typology in 22 of the papers. The agencies were able to assess a conclusion on findings relevant to the Science Report in 13 of those 22 papers. In all 10 citations where sufficient information was available, the conclusions of the Science Report were substantiated by these scientific references. See Section I.C.vi and Appendix C3 of the Technical Support Document for additional information.**
>
> **The following tables list the literature published since 2014 that was provided to the**

[5] Cohen, M.J., I.F. Creed, L. Alexander, N.B. Basu, A.J.K. Calhoun, C. Craft, E. D'Amico, E. Dekeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, C.R. Lane, M. Lang, S.G. Leibowitz, D.B. Lewis, J. Marton, D.L. McLaughlin, D.M. Mushet, H. Raanan-Kiperwas, M.C. Rains, L. Smith, and S.C. Walls. 2016. "Do geographically isolated wetlands influence landscape functions?" *Proceedings of the National Academy of Sciences of the United States of America* 113(8): 1978-1986.

[6] Rains, M.C., S.G. Leibowitz, M.J. Cohen, I.F. Creed, H.E. Golden, J.W. Jawitz, P. Kalla, C.R. Lane, M.W. Lang, and D.L. McLaughlin. 2016. "Geographically isolated wetlands are part of the hydrological landscape." *Hydrological Processes* 30(1): 153-160.

agencies in response to their request in the Proposed Rule TSD. Table 1 lists the 44 citations provided to the agencies that was already cited in Appendix C1 of the Proposed Rule TSD.

Table 2 lists the 15 citations provided by commenters that did not meet the agencies' criteria for review. These references were determined to not meet the agencies' criteria because the publication date was unknown; the references were not peer-reviewed; or the agencies could not ascertain if the references had undergone peer review. If the agencies found that the citation did not meet one of the criteria, they may not have evaluated it for relevance to the Science Report. Note that some of these papers were cited in the Proposed Rule TSD (*e.g.*, regarding implementation or topics outside the scope of the Science Report) but were not cited in Appendix C1 of that document.

Table 3 contains the 34 citations provided to the agencies during the public comment period but for the which the agencies did not have sufficient information to discern system typology (*e.g.*, stream, non-floodplain wetlands and open waters, floodplain wetlands and open waters); the system typology was not applicable to the Science Report (*e.g.*, estuarine wetlands); or that were found not to be relevant to the conclusions of the Science Report. Note that if the agencies found that the system typology was not relevant or not discernible, they may not have also determined relevance to conclusions of the Science Report and vice versa. Note that some of these papers were cited in the Proposed Rule TSD (*e.g.*, regarding implementation or topics outside the scope of the Science Report) but were not cited in Appendix C1 of that document and thus were not part of the agencies' initial screening of peer-reviewed literature published since 2014.

Table 2 in Appendix C3 of the Technical Support Document contains the 13 references provided to the agencies during the public comment period that were peer-reviewed and published in or after 2014 and that the agencies found were relevant to the conclusions of the Science Report. See also Section I.C.vi and Appendix C of the Technical Support Document.

In addition, four references were provided to the agencies that were included in the list of 37 citations the agencies had identified in Appendix C2 of the Proposed Rule TSD as being potentially relevant to the conclusions of the Science Report, but that were not identified as part of the agencies' initial screening process (see Appendix C3 of the Technical Support Document). The agencies have since reviewed those additional citations for relevance to the conclusions of the Science Report. Of the four citations that were provided to the agencies in timely public comments and that were cited in Appendix C2 of the Proposed Rule TSD, one reference was found not have the relevant system topology and was found to not to be relevant to the conclusions of the report (Dages, C., A. Samouëlian, S. Negro, V. Storck, O. Huttel, and M. Voltz. 2015. "Seepage patterns of Diuron in a ditch bed during a sequence of flood events." *Science of The Total Environment* 537: 120-128. https://www.sciencedirect.com/science/article/pii/S0048969715304721). One refence as found to have relevant system typology but was found not to be relevant to the Science Report's conclusions (Gala, T.S., and D. Young. 2021. "Geographically Isolated Depressional Wetlands – Hydrodynamics, Ecosystem Functions and Conditions." *Applied Ecology and Environmental Sciences* 3 (4): 108-116. http://pubs.sciepub.com/.) Two references were found to have relevant system typology and were relevant to the

conclusions of the Science Report. In both cases, the agencies found that the references supported the major conclusions of the Science Report. The two citations are:

- **Gall, H.E., S.A. Sassman, B. Jenkinson, L.S. Lee, and C.T. Jafvert. 2015. "Comparison of export dynamics of nutrients and animal-borne estrogens from a tile-drained Midwestern agroecosystem."** ***Water Research*** **72: 162-173.**
- **Rau, G.C., L.J.S. Halloran, M.O. Cuthbert, M.S. Andersen, R.I. Acworth, and J.H. Tellam. 2017. "Characterising the dynamics of surface water-groundwater interactions in intermittent and ephemeral streams using streambed thermal signatures."** ***Advances in Water Resources*** **107: 354-369. https://www.sciencedirect.com/science/article/pii/S0309170817300891.**

Information about the agencies' review of additional literature published since 2014 is contained in Section I.C.vi and Appendix C of the Technical Support Document.

Table 1: References published since 2014 provided by commenters that were already cited in the Proposed Rule TSD Appendix C1

Table 1 Citations
Ameli, A.A., and I.F. Creed. 2017. "Quantifying hydrologic connectivity of wetlands to surface water systems." *Hydrol. Earth Syst. Sci.* 21: 1791-1808.
Calhoun, A.J.K., D.M. Mushet, K.P. Bell, D. Boix, J.A. Fitzsimons, and F. Isselin-Nondedeu. 2017. "Temporary wetlands: challenges and solutions to conserving a 'disappearing' ecosystem." *Biological Conservation* 211: 3-11.
Calhoun, A.J.K., D.M. Mushet, L.C. Alexander, E.S. DeKeyser, L. Fowler, C.R. Lane, M.W. Lang, M.C. Rains, S.C. Richter, and S.C. Walls. 2017. "The Significant Surface-Water Connectivity of 'Geographically Isolated Wetlands.'" *Wetlands* 37(4): 801-806.
Callahan, M.K., D.F. Whigham, M.C. Rains, K.C. Rains, R.S. King, C.M. Walker, J.R. Maurer, and S.J. Baird. 2017. "Nitrogen Subsidies from Hillslope Alder Stands to Streamside Wetlands and Headwater Streams, Kenai Peninsula, Alaska." *Journal of the American Water Resources Association* 53(2): 478-492.
Cheng, F.Y., and N.B. Basu. 2017. "Biogeochemical hotspots: Role of small water bodies in landscape nutrient processing." *Water Resources Research* 53(6): 5038-5056.
Cohen, M.J., I.F. Creed, L. Alexander, N.B. Basu, A.J.K. Calhoun, C. Craft, E. D'Amico, E. Dekeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, C.R. Lane, M. Lang, S.G. Leibowitz, D.B. Lewis, J. Marton, D.L. McLaughlin, D.M. Mushet, H. Raanan-Kiperwas, M.C. Rains, L. Smith, and S.C. Walls. 2016. "Do geographically isolated wetlands influence landscape functions?" *Proceedings of the National Academy of Sciences of the United States of America* 113(8): 1978-1986.
Colvin, S.A.R., S.M.P. Sullivan, P.D. Shirey, R.W. Colvin, K.O. Winemiller, R.M. Hughes, K.D. Fausch, D.M. Infante, J.D. Olden, K.R. Bestgen, R.J. Danehy, and L. Eby. 2019. "Headwater Streams and Wetlands are Critical for Sustaining Fish, Fisheries, and Ecosystem Services." *Fisheries* 44(2): 73-91.

Table 1 Citations
Craft, C., J. Vymazal, and L. Kropfelova. 2018. "Carbon sequestration and nutrient accumulation in floodplain and depressional wetlands." *Ecological Engineering* 114: 137-145.
Creed, I.F., C.R. Lane, J.N. Serran, L.C. Alexander, N.B. Basu, A.J.K. Calhoun, J.R. Christensen, M.J. Cohen, C. Craft, E. D'Amico, E. DeKeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, M. Lang, S.G. Leibowitz, D.B. Lewis, J. Marton, D.L. McLaughlin, H. Raanan-Kiperwas, M.C. Rains, K.C. Rains, and L. Smith. 2017. "Enhancing protection for vulnerable waters." *Nature Geosciences* 10 (11): 809-815. https://www.ncbi.nlm.nih.gov/pubmed/30079098.
Datry, T., A.J. Boulton, N. Bonada, K. Fritz, C. Leigh, E. Sauquet, K. Tockner, B. Hugueny, and C.N. Dahm. 2018. "Flow intermittence and ecosystem services in rivers of the Anthropocene." *Journal of Applied Ecology* 55(1): 353-364.
Datry, T., K. Fritz, and C. Leigh. 2016. "Challenges, developments and perspectives in intermittent river ecology." *Freshwater Biology* 61(8): 1171-1180.
Evenson, G.R., H.E. Golden, C.R. Lane, and E. D'Amico. 2015. "Geographically isolated wetlands and watershed hydrology: A modified model analysis." *Journal of Hydrology* 529: 240-256.
Fritz, K.M., et al. 2018. "Physical and Chemical Connectivity of Streams and Riparian Wetlands to Downstream Waters: A Synthesis." *Journal of the American Water Resources Association* 54: 323-345.
Golden, H.E., H.A. Sander, C.R. Lane, C. Zhao, K. Price, E. D'Amico, and J.R. Christensen. 2016. "Relative effects of geographically isolated wetlands on streamflow: a watershed-scale analysis." *Ecohydrology* 9(1): 21-38.
Golden, H.E., I.F. Creed, G. Ali, N.B. Basu, B.P. Neff, M.C. Rains, D.L. McLaughlin, L.C. Alexander, A.A. Ameli, J.R. Christensen, G.R. Evenson, C.N. Jones, C.R. Lane, and M.G. Lang. 2017. "Integrating geographically isolated wetlands into land management decisions." *Frontiers in Ecology and the Environment* 15(6): 319-327.
Goodrich, D.C., W.G. Kepner, and L.R. Levick. 2018. "Southwestern intermittent and ephemeral stream connectivity." *Journal of the American Water Resources Association* 54(2): 400-422.
Harvey, J., et al. 2019. "How Hydrologic Connectivity Regulates Water Quality in River Corridors." *Journal of the American Water Resources Association* 55(2): 369-381.
Hosen, J.D., A.W. Armstrong, and M.A. Palmer. 2018. "Dissolved organic matter variations in coastal plain wetland watersheds: The integrated role of hydrological connectivity, land use, and seasonality." *Hydrological Processes* 32(11): 1664-1681.
Lane, C.R., and B.C. Autrey. 2017. "Sediment accretion and accumulation of P, N and organic C in depressional wetlands of three ecoregions of the United States." *Marine & Freshwater Research*. 68(12): 2253-2265. https://www.ncbi.nlm.nih.gov/pubmed/30505203.

Table 1 Citations
Lane, C.R., and E. D'Amico. 2016. "Identification of Putative Geographically Isolated Wetlands of the Conterminous United States." *Journal of the American Water Resources Association* 52: 705-722.
Lane, C.R., S.G. Leibowitz, B.C. Autrey, S.D. LeDuc, and L.C. Alexander. 2018. "Hydrological, Physical, and Chemical Functions and Connectivity of Non-Floodplain Wetlands to Downstream Waters: A Review." *Journal of the American Water Resources Association* 54(2): 346-371.
Leibowitz, S. G., Mushet, D. M., & Newton, W. E. (2016). "Intermittent surface water connectivity: fill and spill vs. fill and merge dynamics." *Wetlands* 36(2), 323-342.
Leibowitz, S.G., P.J. Wigington, K.A. Schofield, L.C. Alexander, M.K. Vanderhoof, and H.E. Golden. 2018. "Connectivity of Streams and Wetlands to Downstream Waters: An Integrated Systems Framework." *Journal of the American Water Resources Association* 54(2): 298-322.
Leigh, C., A.J. Boulton, J.L. Courtwright, K.M. Fritz, C.L. May, R.H. Walker, and T. Datry. 2016. "Ecological research and management of intermittent rivers: an historical review and future directions." *Freshwater Biology* 61(8): 1181-1199.
Marton, J.M., I.F. Creed, D.B. Lewis, C.R. Lane, N.B. Basu, M.J. Cohen, and C.B. Craft. 2015. "Geographically Isolated Wetlands are Important Biogeochemical Reactors on the Landscape." *BioScience* 65(4): 408-418.
Mihelcic, J.R., and M. Rains. 2020. "Where's the Science? Recent Changes to Clean Water Act Threaten Wetlands and Thousands of Miles of Our Nation's Rivers and Streams." *Environmental Engineering Science* 37(3): 173-177.
Miller, J.O., T.F. Ducey, P.W. Brigman, C.O. Ogg, and P.G. Hunt. 2017. "Greenhouse Gas Emissions and Denitrification within Depressional Wetlands of the Southeastern US Coastal Plain in an Agricultural Landscape." *Wetlands* 37(1): 33-43.
Mushet, D.M., A.J.K. Calhoun, L.C. Alexander, M.J. Cohen, E.S. DeKeyser, L. Fowler, C.R. Lane, M.W. Lang, M.C. Rains, and S.C. Walls. 2015. "Geographically isolated wetlands: rethinking a misnomer." *Wetlands* 35: 423–431.
Neff, B.P., D.O. Rosenberry, S.G. Leibowitz, D.M. Mushet, H.E. Golden, M.C. Rains, J.R. Brooks, and C.R. Lane. 2020. "A Hydrologic Landscapes Perspective on Groundwater Connectivity of Depressional Wetlands." *Water* 12(1).
Perkin, J.S., K.B. Gido, J.A. Falke, K.D. Fausch, H. Crockett, E.R. Johnson, and J. Sanderson. 2017. "Groundwater declines are linked to changes in Great Plains stream fish assemblages." *Proceedings of the National Academy of Sciences* 114(28).

Table 1 Citations
Rains, M.C., S.G. Leibowitz, M.J. Cohen, I.F. Creed, H.E. Golden, J.W. Jawitz, P. Kalla, C.R. Lane, M.W. Lang, and D.L. McLaughlin. 2016. "Geographically isolated wetlands are part of the hydrological landscape." *Hydrological Processes* 30(1): 153-160.
Schofield, K.A., L.C. Alexander, C.E. Ridley, M.K. Vanderhoof, K.M. Fritz, B.C. Autrey, J.E. DeMeester, W.G. Kepner, C.R. Lane, S.G. Leibowitz, and A.I. Pollard. 2018. "Biota Connect Aquatic Habitats throughout Freshwater Ecosystem Mosaics." *Journal of the American Water Resources Association* 54(2): 372-399.
Serran, J.N., and I.F. Creed. 2016. "New mapping techniques to estimate the preferential loss of small wetlands on prairie landscapes." *Hydrological Processes* 30(3): 396-409.
Steen, V., S.K. Skagen, and B.R. Noon. 2018. "Preparing for an uncertain future: migrating shorebird response to past climatic fluctuations in the Prairie Potholes." *Ecosphere* 9(2).
Sullivan, S.M.P., M.C. Rains, and A.D. Rodewald. 2019. "Opinion: The proposed change to the definition of "waters of the United States" flouts sound science." *Proceedings of the National Academy of Sciences* 116(24).
Thorslund, J., M.J. Cohen, J.W. Jawitz, G. Destouni, I.F. Creed, M.C. Rains, P. Badiou, and J. Jarsjö. 2018. "Solute evidence for hydrological connectivity of geographically isolated wetlands." *Land Degradation & Development* 29(11): 3954-3962.
Walker, C.M., D.F. Whigham, I.S. Bentz, J.M. Argueta, R.S. King, M.C. Rains, C.A. Simenstad, C. Guo, S.J. Baird, and C.J. Field. 2021. "Linking landscape attributes to salmon and decision-making in the southern Kenai Lowlands, Alaska, USA." *Ecology and Society* 26(1).
Watson, K.B., T. Ricketts, G. Galford, S. Polasky, and J. O'Niel-Dunne. 2016. "Quantifying flood mitigation services: The economic value of Otter Creek wetlands and floodplains to Middlebury, VT." *Ecological Economics* 130: 16-24.
Welter, J.R., and S.G. Fisher. 2016. "The influence of storm characteristics on hydrological connectivity in intermittent channel networks: implications for nitrogen transport and denitrification." *Freshwater Biology* 61(8): 1214-1227.
Wohl, E. 2017. "The significance of small streams." *Frontiers of Earth Science* 11(3): 447-456.
Wu, Q., and C.R. Lane. 2016. "Delineation and Quantification of Wetland Depressions in the Prairie Pothole Region of North Dakota." *Wetlands* 36(2): 215-227.
Yarra, A.N., and D.D. Magoulick. 2018. "Stream permanence is related to crayfish occupancy and abundance in the Ozark Highlands, USA." *Freshwater Science* 37(1): 54-63.

Table 1 Citations
Yu, X., J. Hawley-Howard, A.L. Pitt, J.J. Wang, R.F. Baldwin, and A.T. Chow. 2015. "Water quality of small seasonal wetlands in the Piedmont ecoregion, South Carolina, USA: Effects of land use and hydrological connectivity." *Water Research* 73: 98-108.
Zhu, J., G. Sun, W.H. Li, Y. Zhang, G.F. Miao, A. Noormets, S.G. McNulty, J.S. King, M. Kumar, and X. Wang. 2017. "Modeling the potential impacts of climate change on the water table level of selected forested wetlands in the southeastern United States." *Hydrology and Earth System Sciences* 21(12): 6289-6305.

Table 2: List of the 14 citations provided by commenters that the agencies found did not meet the criteria for review[7]

Table 2 Citations	**Notes**
Beck, M., Mazor, R. D., Stein, E. D., Maas, R., De Mello, D., & Bram, D. 2017. Mapping of non-perennial and ephemeral streams in the Santa Ana Region. *California Coastal Water Research Project.*	Cannot discern if peer-reviewed
Cooper, D., Shaw, J., Wohl, E., Harry, D., Sutfin, N., Kampf, S., & Faulconer, J. 2015. *Watershed to Local Scale Characteristics and Function of Intermittent and Ephemeral Streams on Military Lands*. Colorado State University Fort Collins United States.	Not peer-reviewed
Emerton, L. 2016. Economic valuation of wetlands: total economic value. *The wetland book*, 1-6.	Cannot discern if peer-reviewed; book chapter; Not relevant (Economic study)
Guinessey, Elizabeth, et al. 2019. *A Literature Review: The Chemical, Physical and Biological Significance of Geographically Isolated Wetlands and Non-Perennial Streams in the Southeast*. Accessed at https://www.southernenvironment.org/wp-content/uploads/legacy/words_docs/Exhibit_A.pdf.	Cannot discern if peer-reviewed

[7] For purposes of Table 2, "not relevant" means that the agencies reviewed the papers for their relevance to questions related to the connectivity and/or effects of (a) ephemeral, intermittent, and perennial streams, (b) floodplain wetlands and open waters, or (c) non-floodplain wetlands and open waters and found that the citation was not relevant to such questions and thus was not relevant to the conclusions of the Science Report.

Table 2 Citations	**Notes**
Meyer, R., and A. Robertson. 2019. *Clean Water Rule spatial analysis: A GIS-based scenario model for comparative analysis of the potential spatial extent of jurisdictional and non-jurisdictional wetlands*. Saint Mary's University of Minnesota, Winona, Minnesota.	Not peer-reviewed
Monfils, M. J., Corace III, R. G., Forbes, A., River, U. M., & Venture, G. L. R. J. 2018. *Marsh bird response to hydrologic alteration and restoration of wetlands in the boreal hardwood transition*. Michigan Natural Features Inventory, Lansing, USA.	Cannot discern if peer-reviewed
Narayan, S., Beck, M. W., & Wilson, P. 2016. *Coastal Wetlands and Flood Damage Reduction: Using Risk Industry-based Models to Assess Natural Defenses in the Northeastern USA*. doi: 10.7291.	Cannot discern if peer-reviewed
Olden, J., & Lytle, D. 2015. *Hydroecology of Intermittent and Ephemeral Streams: Will Landscape Connectivity Sustain Aquatic Organisms in a Changing Climate?* SERDP Project RC-1724. University of Washington, Seattle, Washington.	Not peer-reviewed
Phelan, J., Jones, P., & Mathews, K. 2015. *Montana prairie wetlands and intermittent/ephemeral streams: hydrologic needs assessment for healthy watersheds*. Report prepared for the U.S. Environmental Protection Agency, Healthy Watersheds Program by RTI International, Research Triangle Park, North Carolina.	Not peer-reviewed
Schwarz, M. S., Davis, D. R., & Kerby, J. L. 2018. *An evaluation of agricultural tile drainage exposure and effects to wetland species and habitat within Madison Wetland Management District, South Dakota*. U.S. Fish and Wildlife Service contaminants report 6N61, Pierre, South Dakota.	Not peer-reviewed
Stromberg, J. C., Gallo, E. L., Lohse, K. A., Meixner, T., Moody, E. K., Sabo, J. L., & Setaro, D. L. 2015. *Structure and function of ephemeral streams in the arid and semiarid southwest: implications for conservation and management*. Arizona State University, Tempe, Arizona.	Not peer-reviewed
U.S. Environmental Protection Agency. "The National Rivers and Streams Assessment 2008/2009." https://www.epa.gov/sites/default/files/2016-03/documents/fact_sheet_draft_variation_march_2016_revision.pdf	No publication date; Not peer-reviewed; Not relevant
U.S. Environmental Protection Agency. "Stream Flows." *Report on the Environment*. https://cfpub.epa.gov/roe/indicator.cfm?i=29; can also navigate to this document through Docket ID No. EPA-HQ-OW-2021-0602-0329	No publication date; Not peer-reviewed; Not relevant

Table 2 Citations	Notes
U.S. Department of the Agriculture. 2017. "Role of Prior Converted Croplands on Nitrate Processing in Mid-Atlantic Agricultural Landscapes." https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=41460.wba	Cannot discern if peer reviewed
Wu, Q. 2018. "GIS and remote sensing applications in wetland mapping and monitoring." Pages 140-157 in *Comprehensive Geographic Information Systems*, Vol. 2. B. Huang, ed. Elsevier, Oxford, UK. DOI: 10.1016/B978-0-12-409548-9.10460-9.	Book chapter; Cannot discern if peer reviewed. Not relevant (focus on mapping, not effects)

Table 3: Citations provided during the comment period that were determined not to be relevant to the Science Report[8]

Table 3 Citations	Notes (Including Relevance to the Conclusions of the Science Report)
Barbier, E. B. 2015. "Valuing the storm protection service of estuarine and coastal ecosystems." *Ecosystem Services* 11: 32-38.	Addresses estuarine systems and valuation methods. Not relevant to connectivity and/or effects.
BenDor, T., Lester, T. W., Livengood, A., Davis, A., & Yonavjak, L. 2015. "Estimating the size and impact of the ecological restoration economy." *PloS one* 10(6): e0128339.	Economic study. Not relevant to connectivity and/or effects.

[8] For purposes of Table 3, "not relevant to connectivity and/or effects" means that the agencies reviewed the papers for their relevance to questions related to the connectivity and/or effects of (a) ephemeral, intermittent, and perennial streams, (b) floodplain wetlands and open waters, or (c) non-floodplain wetlands and open waters and found that the citation was not relevant to such questions and thus was not relevant to the conclusions of the Science Report. The relevant typology column denotes if the citation was found to be of a relevant system typology. Citations that were cited in other sections of the Proposed Rule TSD but that were not cited in Appendix C1 of that document are denoted with **.

Table 3 Citations	**Notes (Including Relevance to the Conclusions of the Science Report)**
Bergstrom, J. C., & Loomis, J. B. 2017. "Economic valuation of river restoration: An analysis of the valuation literature and its uses in decision-making." *Water Resources and Economics* 17: 9-19.	Economic study on river restoration valuation. Not relevant to connectivity and/or effects.
Bratt, A. R., Finlay, J. C., Hobbie, S. E., Janke, B. D., Worm, A. C., & Kemmitt, K. L. 2017). "Contribution of leaf litter to nutrient export during winter months in an urban residential watershed." *Environmental Science & Technology* 51(6): 3138-3147.	Nitrogen and phosphorus in urban watersheds. Not relevant to connectivity and/or effects.
Demaria, E. M., Palmer, R. N., & Roundy, J. K. 2016. "Regional climate change projections of streamflow characteristics in the Northeast and Midwest US." *Journal of Hydrology: Regional Studies* 5: 309-323.	Streamflow in Northeast and Midwest USA. Not specific to stream connectivity and/or effects. Not relevant to connectivity and/or effects.
Dhungel, S., Tarboton, D. G., Jin, J., & Hawkins, C. P. 2016. "Potential effects of climate change on ecologically relevant streamflow regimes." *River Research and Applications* 32(9): 1827-1840.	Climate change. Not relevant to connectivity and/or effects.
Flower, H., Rains, M., & Fitz, C. 2017. "Visioning the Future: Scenarios Modeling of the Florida Coastal Everglades." *Environmental Management* 60(5): 989-1009.	Resource typology (estuarine wetlands) is not applicable.
Flower, H., *et al*. 2019. "Shifting ground: landscape-scale modeling of biogeochemical processes under climate change in the Florida Everglades." *Environmental Management* 64(4): 416-435.	Climate change. Not relevant to connectivity and/or effects.
Flower, H., Rains, M., Lewis, D., & Zhang, J. Z. 2017. "Rapid and intense phosphate desorption kinetics when saltwater intrudes into carbonate rock." *Estuaries and Coasts* 40(5): 1301-1313.	Geological study of desorption kinetics in rocks. Not relevant to connectivity and/or effects.

Table 3 Citations	**Notes (Including Relevance to the Conclusions of the Science Report)**
Flower, H., Rains, M., Lewis, D., Zhang, J. Z., & Price, R. 2016. "Control of phosphorus concentration through adsorption and desorption in shallow groundwater of subtropical carbonate estuary." *Estuarine, Coastal and Shelf Science* 169: 238-247.	Mangrove ecotone of the Everglades. Resource typology (estuarine wetlands) is not applicable.
Flower, H., Rains, M., Lewis, D., Zhang, J. Z., & Price, R. 2017. "Saltwater intrusion as potential driver of phosphorus release from limestone bedrock in a coastal aquifer." *Estuarine, Coastal and Shelf Science* 184: 166-176.	Effects of salt intrusion on soluble reactive phosphorus bedrock. Not relevant to connectivity and/or effects.
Gosejohan, M. C., Weisberg, P. J., & Merriam, K. E. 2017. "Hydrologic influences on plant community structure in vernal pools of northeastern California." *Wetlands* 37(2): 257-268.	Not relevant to connectivity and/or effects.
Hiatt, D. L., *et al*. 2017. "Catchment-scale alder cover controls nitrogen fixation in boreal headwater streams." *Freshwater Science* 36(3): 523-532.	Not relevant to connectivity and/or effects.
Interis, M. G., & Petrolia, D. R. 2016. "Location, location, habitat: how the value of ecosystem services varies across location and by habitat." *Land Economics* 92(2): 292-307.	Economics of ecosystem services in oyster reef, salt marsh, and black mangrove. Not relevant to connectivity and/or effects.
Jenkins, C. N., Van Houtan, K. S., Pimm, S. L., & Sexton, J. O. 2015. "US protected lands mismatch biodiversity priorities." *Proceedings of the National Academy of Sciences* 112(16): 5081-5086.	Maps of biodiversity - vertebrates, fish, and trees and how they crosswalk with locations of protected lands. Not relevant to connectivity and/or effects.

Table 3 Citations	**Notes (Including Relevance to the Conclusions of the Science Report)**
Kaushal, S. S., McDowell, W. H., Wollheim, W. M., Newcomer Johnson, T. A., Mayer, P. M., Belt, K. T., & Pennino, M. J. 2015. "Urban evolution: The role of water." *Water* 7(8): 4063-4087.	Review/concept paper describing urban evolution. Not relevant to connectivity and/or effects.
Keiser, D. A., et al. 2021. "A water rule that turns a blind eye to transboundary pollution." *Science* 372(6539): 241-243.	Policy piece. Not relevant to connectivity and/or effects.
Keith, D. A., Ferrer-Paris, J. R., Nicholson, E., & Kingsford, R. T. 2020. *The IUCN Global Ecosystem Typology 2.0: Descriptive profiles for biomes and ecosystem functional groups*. IUCN, Gland, Switzerland.	Encyclopedic entry describing typologies of systems. Not relevant to connectivity and/or effects.
Kleindl, W. J., Rains, M. C., Marshall, L. A., & Hauer, F. R. 2015. "Fire and flood expand the floodplain shifting habitat mosaic concept." *Freshwater Science* 34(4): 1366-1382.	Fire and landscape variables affect floodplain patch dynamics. Not relevant to connectivity and/or effects.
Lalika, M. C., Meire, P., Ngaga, Y. M., & Sanga, G. J. 2017. "Willingness to pay for watershed conservation: are we applying the right paradigm?" *Ecohydrology & Hydrobiology* 17(1): 33-45.	Economic valuation and willingness to pay. Not relevant to connectivity and/or effects.
Levick, L., Hammer, S., Lyon, R., Murray, J., Birtwistle, A., Guertin, P., Goodrich, D., Bledsoe, B., & Laituri, M. 2018. "An ecohydrological stream type classification of intermittent and ephemeral streams in the southwestern United States." *Journal of Arid Environments* 155: 16-35.	Methodological paper for stream classification methods. Not relevant connectivity and/or effects
Mitsch, W. J., Bernal, B., & Hernandez, M. E. 2015. "Ecosystem services of wetlands." *International Journal of Biodiversity Science, Ecosystem Services & Management* 11(1): 1-4.	Introduction to a special issue. Not relevant to connectivity and/or effects.

Table 3 Citations	**Notes (Including Relevance to the Conclusions of the Science Report)**
Mittermeier, R. A., van Dijk, P. P., Rhodin, A. G., & Nash, S. D. 2015. "Turtle hotspots: an analysis of the occurrence of tortoises and freshwater turtles in biodiversity hotspots, high-biodiversity wilderness areas, and turtle priority areas." *Chelonian Conservation and Biology* 14(1): 2-10.	Regional turtle biodiversity hotspots at global scales. Not relevant to connectivity and/or effects.
Mushet, D. M. 2016. "Midcontinent prairie-pothole wetlands and climate change: an introduction to the supplemental issue." *Wetlands* 36(2): 223-228.	Introduction to a special section. Not relevant to connectivity and/or effects.
Pericak, A. A., Thomas, C. J., Kroodsma, D. A., Wasson, M. F., Ross, M. R., Clinton, N. E., Campagna, D. J., Franklin, Y., Bernhardt, E. S., & Amos, J. F. 2018. "Mapping the yearly extent of surface coal mining in Central Appalachia using Landsat and Google Earth Engine." *PloS one 13*(7): e0197758.	Mapping annual surface coal mining operations in southern Appalachia. Not relevant to connectivity and/or effects.
Poudel, J., Henderson, J. E., & Munn, I. A. 2016. "Economic contribution of hunting expenditure to the southern United States of America." *International Journal of Environmental Studies* 73(2): 236-254.	Economic impacts of hunting in the Southeast. Not relevant to connectivity and/or effects.
Powell, K. M., Wynn, J. G., Rains, M. C., Stewart, M. T., & Emery, S. 2019. "Soil indicators of hydrologic health and resilience in cypress domes of West-Central Florida." *Ecological Indicators* 97: 269-279.	Investigates soil health of wetlands. Not relevant to connectivity and/or effects.
Soria, M., Leigh, C., Datry, T., Bini, L. M., & Bonada, N. 2017. "Biodiversity in perennial and intermittent rivers: A meta-analysis." *Oikos* 126(8): 1078-1089.	Focus on biodiversity. Not relevant to connectivity and/or effects.
**Stanislawski, L. V., Survila, K., Wendel, J., Liu, Y., & Buttenfield, B. P. 2018. "An open source high-performance solution to extract surface water drainage networks from diverse terrain conditions." *Cartography and Geographic Information Science* 45(4): 319-328.	Methodological paper on mapping stream networks. Not relevant to connectivity and/or effects.

Table 3 Citations	**Notes (Including Relevance to the Conclusions of the Science Report)**
Stubbington, R., *et al*. 2019. "A comparison of biotic groups as dry-phase indicators of ecological quality in intermittent rivers and ephemeral streams." *Ecological Indicators* 97: 165-174.	Efficacy of biota assemblages for indicating headwater and ephemeral streams ecosystem health. Not relevant to connectivity and/or effects.
**U.S. Global Change Research Program. 2018. *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018. Accessed at https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.	Report on climate change. Not relevant to connectivity and/or effects.
van der Valk, A., & Mushet, D. M. 2016. "Interannual water-level fluctuations and the vegetation of prairie potholes: potential impacts of climate change." *Wetlands* 36(2): 397-406.	Effects of climate change on prairie pothole wetlands; Not relevant to connectivity and/or effects.
Woelfle-Erskine, C., Larsen, L. G., & Carlson, S. M. 2017. "Abiotic habitat thresholds for salmonid over-summer survival in intermittent streams." *Ecosphere* 8(2): e01645.	Focus was on in-stream effects. Not relevant to connectivity and/or effects (downstream).
Zipper, S. C., Hammond, J. C., Shanafield, M., Zimmer, M., Datry, T., Jones, C. N., Kaiser, K. E., Godsey, S. E., Burrows, Ryan M., Blaszczak, J. R., Busch, M. H., Price, A. N., Boersma, K. S., Ward, A. S., Costigan, K., Allen, G. H., Krabbenhoft, C. A., Dodds, W. K., Mims, M. C., Olden, J. D., Kampf, S. K., Burgin, A. J., & Allen, D. C. 2021. "Pervasive changes in stream intermittency across the United States." *Environmental Research Letters* 16(8): 084033.	Not relevant to connectivity and/or effects.

16.3 Climate Change

16.3.1 Effects of Climate Change in Specific Regions and Specific Aquatic Resource Types

Several commenters discussed how climate change has already impacted specific areas of the United States.

- Several commenters stated that flow regimes in the arid Southwest have already been altered due to climate change and that it is unlikely that flows of many ephemeral drainages will reach a traditional navigable water or downstream "permanent" waters in the future with the drying climate in the arid Southwest. They claimed that the proposed rule does not appear to have addressed this. One of these commenters stated, "Any final rule should clarify that drier conditions in the arid west, or rarer but more extreme weather events, should not be used as a justification to expand jurisdiction further."
- Another commenter stated that with changing climate patterns and more severe storm and drought events, resiliency is a priority for the state of North Carolina.
- One commenter stated that due to climate change, surface water drying will reduce groundwater recharge and thereby impact the future of drinking water supplies in Santa Fe County, New Mexico.
- One commenter stated that climate change and urbanization impacts are greatly increasing the flows and flashiness of the Cahaba River (Alabama) and its tributaries.
- One commenter discussed the importance of broad federal jurisdiction over streams and wetlands in the City and State of New York. They stressed that these aquatic resources play a large role in maintaining New York City's current level of resiliency to climate change and these aquatic resources are vulnerable to being lost due to development.

Several commenters discussed the effects of climate change, including extreme weather events, on aquatic resources, with some commenting on the need to protect such resources in light of climate change.

- One commenter stated that in the face of increasing effects from climate change, more and more streams are going dry part of the year, wetlands are drying, and pollutant loads to waters are increasing.
- A few commenters mentioned that the kinds of wetlands that have lost protections under prior rules are also at increased risk from climate change.
- One commenter stated that the effects of climate change will impact already biologically impaired rivers and streams unless there is greater protection.
- One commenter stated that waters with less than perennial flow are becoming more and more common and should be protected.
- One commenter stated that the rulemaking must consider climate change because ecosystem services provided by small streams, non-floodplain wetlands, ditches, and other waterbodies are essential for climate resilience, as well as the combined effects of climate change and urbanization on increased flows and flashiness in river systems.
- Another commenter argued that strong clean water protections are necessary to mitigate and adapt to the effects of a changing climate. They added that climate change is already causing widespread and varied harm to the nation's water resources.
- One commenter stated that with predicted more frequent extreme weather, increased flows and flashes, and loss of stormwater runoff control and delivery, greater protections will be needed for carbon storage, groundwater filtration, drought resilience, and aquatic habitat resources.

- Another commenter stated that it is critical to preserve wetlands because they serve as buffers against flooding and storm surges, as well as protecting seasonal streams which may often be dry but are needed for extreme weather events.
- Another commenter stated that the agencies should consider the adverse side effects that would be caused by removing protections for any waters at a time when climate change is already causing adverse impacts. The commenter further stated that fewer waters will be subject to the Clean Water Act due to climate change causing perennial streams to become intermittent, and intermittent streams to become ephemeral. They urged the agencies to thoroughly consider the effects of climate change in the final rule.
- One commenter stated that intact, healthy wetlands and headwater streams absorb precipitation and floodwaters, reduce the risk and severity of flooding, protect lives and livelihoods, and promote the goals behind the Clean Water Act, as well as the current administration's overarching climate resilience goals.

Agencies' Response: The agencies considered comments on the proposed rule discussing climate change. The agencies recognize and agree that climate change will have a variety of impacts, including on aquatic resources. The agencies also recognize the important roles that streams, wetlands, and other aquatic resources can play in climate change mitigation and adaptation. See Section II.C of the Technical Support Document. The agencies disagree with the commenter who stated that the agencies are using climate change to expand jurisdiction. When the agencies assess whether or not a water is a "water of the United States," consistent with longstanding practice, they do not assess future conditions based on potential climatic changes.

The agencies recognize that commenters had varying views on how climate change should or should not be considered in determining which waters should be federally protected as "waters of the United States." There are ways the agencies can consider a changing climate under the significant nexus standard, but only to the extent it is relevant to the evaluation of whether the subject waters significantly affect the chemical, physical, or biological integrity of paragraph (a)(1) waters. See Final Rule Preamble Section IV.C.9.c.ii for further discussion of how the agencies can consider a changing climate under the significant nexus standard consistent with the best available science.

16.3.2 Comments on the Use of Climate Change Science in Developing Policy

Several commenters submitted general comments on climate change.

- One commenter asserted that a final rule should not unduly burden efforts to reduce the greenhouse gas emissions that cause climate change, including construction of solar energy facilities.
- One commenter recommended additional guidance and streamlined permitting for projects located in jurisdictional waters which are proposed to mitigate climate change by building resiliency.
- One commenter stated they recognize that the burdens of environmental pollution fall disproportionately on minority, low-income, and indigenous populations and that climate change will exacerbate these existing environmental risks and associated health risks.

- One commenter stated they appreciate that the agencies acknowledge climate change in the proposed rule, but criticized the lack of proposed language that could have been included to address climate change.
- One commenter wrote that the preamble of the proposed rule discusses climate change but does not address how "waters of the United States" will be impacted by a changing climate.
- One commenter requested stronger protection for waterbodies that improve resilience to drought, wildfire, and flooding.
- Several commenters asserted that the agencies should use the significant amount of scientific information and advice obtained from experts, and the scientific understanding of upstream waters and climate change in particular, when creating the proposed rule.
- One commenter suggested that the agencies consider impacts of climate change and climate resiliency when developing a definition of "waters of the United States," and when listing examples of how flow regime and other ecosystem services related to significant nexus determinations.
- One commenter stated that climate-induced change in watershed hydrology increases society's reliance on the ecosystem services such as flood abatement, water quality, and baseflow maintenance. They also stated that to maintain climate resilience, as many of the nation's wetland and water resources that can provide such services should be protected as is practicable.

Agencies' Response: The agencies recognize and agree that climate change will have a variety of impacts, including on aquatic resources. The agencies also recognize the important roles that streams, wetlands, and other aquatic resources can play in climate change mitigation and adaptation. See Section II.C of the Technical Support Document.

The agencies recognize that commenters had varying views on how climate change should or should not be considered in determining which waters should be federally protected as "waters of the United States." There are ways the agencies can consider a changing climate under the significant nexus standard, but only to the extent it is relevant to the evaluation of whether the subject waters significantly affect the chemical, physical, or biological integrity of paragraph (a)(1) waters. See Final Rule Preamble Section IV.C.9.c.ii for a discussion of how the agencies can consider a changing climate under the significant nexus standard consistent with the best available science.

Regarding the recommendation for additional guidance, as with any final regulation, the agencies will consider developing new guidance to facilitate implementation of the final rule should questions arise in the field regarding application of the final rule. Nevertheless, the agencies conclude that the final rule, together with the preamble and existing tools, provides sufficient clarity to allow consistent implementation of the final rule. Comments regarding permitting are outside the scope of this rulemaking. The agencies agree with the commenter who stated that the burdens of environmental pollution can fall disproportionately on communities with environmental justice concerns. The agencies acknowledge that climate change may exacerbate environmental risks and associated health risks for those communities.

16.4 Comments on the Importance of Clean Water for Humans and Wildlife

16.4.1 Comments on the Importance of Clean Water to Humans

Several commenters discussed the importance of clean water to humans and stated that aquatic resources provide a variety of ecosystem services that benefit humans.

- One commenter discussed the water cycle and how the cycle can be altered by pumping or artificially injecting surface water into an aquifer. They questioned how this will impact waterways and the determination of the relatively permanent standard.
- One commenter requested that the agencies be mindful of the proposed rule's impact on source waters, specifically those used for drinking water. They recommended that the agencies include language to protect these vital resources.
- One commenter stated that ephemeral and headwater streams and wetlands not directly connected to streams and rivers are part of the critical natural structure that supplies clean drinking water, and that such aquatic resources should be protected.
- Several commenters emphasized that clean water is necessary to support tribal lifeways. They stated that a tribe's cultural, spiritual, and subsistence practices require much more fish, wildlife, and plants than the general population and that wetlands, small streams, and ephemeral waters play a critical role in this natural environment.
- One commenter discussed the need for protection of wetlands and ephemeral streams in large waterbodies such as the Mississippi River. They further outlined the effort to reduce nutrient pollution and how progress is hampered by the disruption of natural stream flows due to the loss of wetlands, stream channelization, and other actions.
- One commenter stated that science makes the importance of ephemeral streams and upstream waters to overall water quality clear. They further discussed the significant nexus standard and how it allows for the consideration of all adjacent wetlands.
- One commenter stressed the importance of protecting streams and wetlands, specifically in the Great Lakes ecoregion. They stated that it is important that stronger protections go along with recent funding efforts for restoration. They discussed the importance of flood mitigation, carbon sequestration, water recharge, water purification, and wildlife habitat with respect to climate change, drought, and clean and affordable drinking water.
- One commenter discussed the importance of providing protection for water supply. They requested that the agencies be mindful of the impact that the proposed rule has on source waters and finalize language that is protective of these resources.
- One commenter stated that clean water is vital to the health of communities, businesses, agriculture, and the natural environment, especially in the face of climate change and increased demand from a growing population.
- One commenter stated that there are many "non-traditional waters" in Missouri that are used for drinking water, agriculture, businesses, and recreation and that have not been consistently defined and protected as "waters of the United States" or at the state level.
- One commenter requested that the agencies go further than returning to the 1986 regulations and the "significant nexus" guidance, and argued that science demonstrating the connectivity of wetlands to traditional navigable waters is more compelling and critical every year.

Agencies' Response: The agencies agree with commenters who noted the importance of clean water, and that wetlands, streams, and open waters are well-known to provide a wide

variety of functions that translate into ecosystem services that benefit humans, including tribal customs and lifeways. However, it is also important to note that the agencies' significant nexus standard in the final rule is carefully tailored so that only particular types of functions provided by upstream waters can be assessed. A significant nexus analysis is limited to an assessment of only those functions identified in the final rule that have a nexus to the chemical, physical, or biological integrity of paragraph (a)(1) waters. Thus, there are some important functions provided by wetlands, tributaries, and paragraph (a)(5) waters that will not be assessed by the agencies when making jurisdictional decisions under this rule. See also Final Rule Preamble Section IV.C.9.b.i.

The agencies disagree with the commenter who requested that the agencies go further than returning to the 1986 regulations and the "significant nexus guidance." In this rule, the agencies are exercising their authority to interpret "waters of the United States" to mean the waters defined by the familiar 1986 regulations, with amendments to reflect the agencies' determination of the statutory limits on the scope of the "waters of the United States" informed by the text of the relevant provisions of the Clean Water Act and the statute as a whole, the scientific record, relevant Supreme Court precedent, and the agencies' experience and technical expertise after more than 45 years of implementing the longstanding pre-2015 regulations defining "waters of the United States." In developing the final rule, the agencies thoroughly considered alternatives to this rule, including the 2015 Clean Water Rule, and have concluded that this final rule best accomplishes the agencies' goals to promulgate a rule that advances the objective of the Clean Water Act, is consistent with Supreme Court decisions, is informed by the best available science, and promptly and durably restores vital protections to the nation's waters. See Section IV.B.1 of the Preamble to the Final Rule for further discussion of the agencies' grounds for concluding that the 2015 Clean Water Rule is not a suitable alternative to the final rule.

16.4.2 Comments on the Importance of Clean Water to Wildlife

Several commenters discussed the importance of clean water with respect to wildlife.

- One commenter stated that all subsurface waters should be regulated as part of "waters of the United States" under the Clean Water Act. They discussed how groundwater provides a "base flow" to rivers and streams, is an asset to bird habitat, and helps maintain fish and invertebrate populations during dry seasons.
- One commenter stated that prairie potholes and headwater streams are important habitat for trout and ducks and these areas need protection.
- One commenter stated that birds use lakes, tributaries, streams, ponds, "isolated" wetlands, prairie potholes, and other water bodies for breeding, nesting, and raising young and these areas should be protected.
- One commenter asserted that strong protections for clean water are critical to sustain fish and wildlife, as well as to enhance climate resilience.
- One commenter stated that headwater ecosystems, wetlands, and other waters provide habitat for many threatened species, specifically frogs and salamanders.
- A few commenters emphasized that intermittent and ephemeral streams, as well as seasonal and "isolated" wetlands, also provide critical habitat for a diverse array of species, including endangered and threatened species.

- Several commenters specifically noted the importance of freshwater habitats—riparian wetlands and depressional wetlands in particular—and clean water to resident and migratory birds.

  Agencies' Response: While the agencies recognize that clean water and associated wetland and aquatic resource habitats are critical resources for birds and humans, the agencies also acknowledge the Supreme Court's decision in *SWANCC*[9] finding that the use of "isolated" non-navigable intrastate ponds by migratory birds was not by itself a sufficient basis for the exercise of federal authority under the Clean Water Act. In this rule, the agencies are not protecting tributaries, adjacent wetlands, or paragraph (a)(5) waters based on their potential use as habitat for migratory birds. Rather, this rule includes tributaries, adjacent wetlands, and paragraph (a)(5) waters on a case-specific basis based on their importance to the integrity of traditional navigable waters, the territorial seas, and interstate waters where such waters meet either the relatively permanent standard or the significant nexus standard. As such, under the final rule, consideration of biological functions does not constitute an assertion of jurisdiction over a water based solely on its use by migratory birds. Rather, the agencies consider biological functions for purposes of significant nexus determinations under this rule only to the extent that the functions provided by tributaries, adjacent wetlands, and paragraph (a)(5) waters significantly affect the biological integrity of the traditional navigable waters, the territorial seas, or interstate waters, consistent with the objective of the Act. For example, the final rule's definition of "significantly affect" includes the following biological function that will be assessed as part of the significant nexus analysis related to integrity of the paragraph (a)(1) water: the provision of habitat and food resources for aquatic species located in waters identified in paragraph (a)(1). See also the agencies' response to comments in Section 16.4.1 regarding the importance of clean water to humans. See Section IV.C.7 of the Final Rule Preamble for further discussion of the jurisdictional status of groundwater.

16.5 Additional Literature Provided to the Agencies

Commenters also asked the agencies to consider other references, though those suggestions were not always specific to the solicitation of comment on the scientific literature contained in Appendix C of the Proposed Rule TSD (see the agencies' response to comments in Section 16.2.2), or did not likewise address the agencies' request for additional scientific literature and references relevant to the Science Report's conclusions on the connectivity and effects of streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters on the chemical, physical, and biological integrity of larger downstream waters. Additional citations provided to the agencies included:

- Audubon. 2020. "The Importance of Arizona's Ephemeral Streams. Attachment to Comments Submitted by Save the Scenic Santa Ritas. Docket ID No. EPA-HQ-OW-2021-0602-0556. https://www.regulations.gov/comment/EPA-HQ-OW-2021-0602-0556.
- Kline, J., T. Bernthal, M. Cain, A. Gries, R. Grasshoff, L. Jack, N. Larson, N. Miller, S. Peterson, & J. Wagner. 2021. *Wetlands and Waterways in Wisconsin: Navigating Changes to the Federal Waters of the United States (WOTUS) Rule*. Opportunities Now: An Analysis of Priority Issues and Actions for Wisconsin's Natural Resources. Wisconsin's Green Fire. Rhinelander, WI. Docket ID No. EPA-HQ-OW-2021-0602-0553. Available at: https://www.regulations.gov/comment/EPA-HQ-OW-2021-0602-0553.

[9] *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001) ("*SWANCC*")

- Lefebvre, L., *et al.* 2013. *Survey of OHWM Indicator Distribution Patterns across Arid West Landscapes*. ERDC/CRREL TR-13-2. U.S. Army Corps of Engineers, Hanover, NH.
- Levick, L. 2021. *Report to Save the Scenic Santa Ritas.* Attachment to Comments Submitted by Save the Scenic Santa Ritas. Docket ID No. EPA-HQ-OW-2021-0602-0556. https://www.regulations.gov/comment/EPA-HQ-OW-2021-0602-0556.
- Tennessee Department of Environment and Conservation, Division of Water Resources. 2020. *Guidance for Making Hydrologic Determinations.* Version 1.5. Available at https://www.tn.gov/content/dam/tn/environment/water/policy-and-guidance/dwr-nr-g-03-hydrologic-determinations%E2%80%9304012020.pdf.
- U.S. Environmental Protection Agency, Department of the Army, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. 1994. *Alaska Wetlands Initiative: Summary Report.* Available at: https://dec.alaska.gov/media/13267/1994-wetlands-initiative.pdf.

The following citation provided to the agencies was already cited in the Proposed Rule TSD and in the Science Report:

- Levick, L., *et al*. 2008. *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*. EPA/600/R-08/134 and ARS/233046. U.S. Environmental Protection Agency, Office of Research and Development and U.S. Department of Agriculture/Agricultural Research Service. Southwest Watershed Research Center, Washington, D.C. Available at https://www.epa.gov/sites/default/files/2015-03/documents/ephemeral_streams_report_final_508-kepner.pdf.

The following citation provided to the agencies was already cited in the Proposed Rule TSD:

- Lichvar, R.W., and S.M. McColley. 2008. *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States: A Delineation Manual.* ERDC/CRREL TR-08-12. U.S. Army Engineer Research and Development Center, Hanover, NH.

<u>Agencies' Response</u>: With respect to the citations and references commenters provided for consideration, the agencies have responded to the substantive comments received in Sections 1-18 of the agencies' response to comments, as well as in other locations in the administrative record for this rule. In doing so, the agencies have responded to the commenters' reference or citation as it was used to support the commenters' statements. The agencies have also considered references that were provided to the agencies in response to their request for additional literature relevant to the conclusions of the Science Report that had been published since 2014 but that was not included in the agencies' analysis in the Proposed Rule TSD (*e.g.*, literature that was not cited in Appendix C1 of the Proposed Rule TSD). The agencies' response to such literature is provided in Section 16.2.2.

In addition, the agencies have reviewed reports, citations, and other documents provided by commenters and have incorporated some of these references, as relevant and appropriate, into the final Technical Support Document for the rule. The agencies note that some of the citations provided to them were already cited in the Proposed Rule TSD.