Comments from Dr. Emily Bernhardt – Outline to Guide Discussion of the Definition of Other Waters on a Case-by-Case Basis as Waters of the U.S.

(August 21, 2014)

Issues to discuss re:Q3

******text in ***green italics*** is excerpted from the rule with locations indicated. Emphasis in excerpts inserted by ESB.

I. Points where we should encourage authors of the rule to alter language to be consistent with SAB comments and the revised guidance.

A. Use of the terms/categorical distinctions "directional" and "bidirectional" was strongly discouraged by the SAB in comments on the connectivity guidance document because of the exclusive emphasis of these terms on hydrologic connections.

B. In a similar vein, although careful to describe connections beyond hydrologic ones, the rule text too often loses sight of the multiple dimensions of connectivity. This was an issue that the SAB pointed out in the guidance document as well.

The rule should scrupulously avoid confusing statements such as:

p. 22248 top of 2nd column

*"**Lack of connection** does not necessarily translate to lack of impact; even **when lacking connectivity**, waters can still impact chemical, physical, and biological conditions downstream. "*

and farther down in that same column

*"Wetlands that **lack surface connectivity** in a particular season or year can, nonetheless, be **highly connected** in wetter seasons or years."*

here, the authors clearly intend to make the point that an "other water" can have a significant nexus to a downstream water even without a surface water hydrologic connection or with only occasionally hydrologic connections but in both cases they implicitly support the idea that only surface water hydrologic connections matter. Text such as this must be modified to address 4-D connectivity.

II. Issues of Multiple Dependencies - the "other waters" must meet multiple criteria to be considered to have a significant nexus to downstream waters

The goal of the new rule is to simplify the regulatory process, yet in the case of "other waters" there are many critical decision steps that require further explanation/clarification.

"Other Waters" with a significant nexus must be:

A. **Not adjacent**

The definition of adjacency - adjacent waters are "in", while non-adjacent waters are "other". The way that this line is drawn is critically important in evaluating whether a water body is automatically protected as an adjacent/floodplain/riparian water or whether it requires further justification as an "other water" from ***p.22263*** *Adjacent. The term adjacent means bordering, contiguous or neighboring. Waters, including wetlands, separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are ''adjacent waters.''*

The rule authors asks for comment about how to define adjacency and specifically discount the idea of using the concept of flood risk maps. I*n SAB comments on the guidance we specifically recommended discussion of using flood return intervals and flood predictions to underpin the concept of adjacency*.

B. <u>In the region</u> of a downstream water

p. 22246, column 2, 2nd full paragraph

"A. In the Region

The agencies have determined that because the movement of water from watershed drainage basins to river networks and lakes shapes the development and function of these systems in a way that is critical to their long term health, the watershed is a reasonable and technically appropriate interpretation of Justice Kennedy's standard. "

Several panelists expressed concerns that the "watershed" unit pays insufficient attention to groundwater. How shall we ask the rule authors to incorporate this understanding?

- watershed vs. river basin - surface and shallow ground water
- "groundwater mediated interactions"

C. **Significantly impact the chemical, biological or physical integrity of a downstream (a)(1) through (a)(3) water**

The critical text to consider here is from p. 22214, 1st and 2nd columns

"When evaluating an ''other water'' individually or cumulatively for the presence of a significant nexus to an (a)(1) through (a)(3) water, there are a variety of factors that can be considered that will influence the chemical, physical, or biological connections the ''other water'' has with the downstream (a)(1) through (a)(3) water. The likelihood of a significant connection is greater with increasing size and decreasing distance from the identified (a)(1) through (a)(3) water, as well as with increased density of the ''other waters'' for ''other waters'' that can be considered in combination with similarly situated waters.

Evidence of <u>chemical connectivity</u> and the effect on waters can be found by identifying: Whether the properties of the water in question are similar or dissimilar to an identified (a)(1) through (a)(3) water; signs of retention, release, or transformation of nutrients or pollutants; and the effect of landscape position on the strength of the connection to the nearest ''water of the United States,'' and through it to an (a)(1) through (a)(3) water. In addition, relevant factors influencing chemical connectivity include hydrologic connectivity (see physical factors, below), surrounding land use and land cover, the landscape setting, and deposition of chemical constituents (e.g. acidic deposition).

Evidence of <u>physical connectivity</u> and the effect on (a)(1) through (a)(3) waters can be found by identifying evidence of physical connections, such as flood water or sediment retention (flood prevention). Presence of indicators of hydrologic connections between the other water and jurisdictional water are also indictors of a physical connection. Factors influencing physical connectivity include rain intensity, duration of rain events or wet season, soil permeability, and distance of hydrologic connection between the ''other water'' and the (a)(1) through (a)(3) water, depth from surface to water table, and any preferential flowpaths.

Evidence of <u>biological connectivity</u> and the effect on waters can be found by identifying: resident aquatic or semi-aquatic species present in the ''other water'' and the tributary system (e.g., amphibians, aquatic and semi-aquatic reptiles, aquatic birds); whether those species show life-cycle dependency on the identified aquatic resources (foraging, feeding, nesting, breeding, spawning, use as a nursery area, etc.); and whether there is reason to expect presence or *dispersal around the ''other water,'' and if so whether such dispersal extends to the tributary system or beyond or from the tributary system to the ''other water.'' Factors influencing biological connectivity include species' life history traits, species' behavioral traits, dispersal range, population size, timing of dispersal, distance between ''other water'' and an (a)(1) through (a)(3) water, the presence of habitat corridors or barriers, and the number, area, and spatial distribution of habitats. Non-aquatic species or species such as non-resident migratory birds that are not demonstrating a life cycle dependency on the identified aquatic resources are not evidence of biological connectivity for purposes of this rule. "*

D. **Similarly situated relative to previously defined "waters of the United States"**

from p.22263: *"Other waters, including wetlands, are* ***similarly situated*** *when they perform similar functions and are located sufficiently close together or sufficiently close to a ''water of the United States'' so that they can be evaluated as a single landscape unit with regard to their effect on the chemical, physical, or biological integrity of a water identified in paragraphs (a)(1) through (3) of this section."*

p. 22215, column 1, 2nd full paragraph specifically requests input on this issue.

"The agencies solicit comment on how the agencies propose to find ''other waters'' to be similarly situated in this proposed rule, whether other methods of identifying similarly situated ''other waters'' would be reasonable, and whether no ''other waters'' should be determined to be similarly situated. In each instance, the comments should address how the actions of the agencies would be consistent with the science, including any science not currently before the agencies, the CWA, and the caselaw. "

From individual comments, panelists seem reasonably content with the way the rule authors have handled this term conceptually, but individual panelists have offered many specific recommendations for methodological approaches on which to base such determinations. In addition to providing a convenient means of estimating the individual connectivity (and impact) of a single "other water", these categorical distinctions will be essential for assessing aggregated impacts.

The use of the word "close" implies that physical distance (or geographic isolation) is the most important aspect of this determination.

Increased emphasis should be placed on functional similarity and functional significance.

More attention could and should be devoted to the scale of the water bodies in question (their individual and aggregated volumes and area relative to the watershed or basin size).

III. Categorization of "Other Waters"

"The agencies seek comment on how they should categorize the remaining ''other waters.'' The agencies seek comment on whether these remaining ''other waters'' should be non- jurisdictional because they would lack a significant nexus to a traditional navigable water, interstate water, or the territorial seas. "

- from p. 22216, 3rd column, 3rd full paragraph

The text following this statement in the rule presents a series of possible approaches for determining whether an "other water" has a significant nexus to downstream waters. These options were summarized much more succinctly in a presentation to the SAB by David Evans (available on the SAB web portal)

OPTION 1: "Other waters" are similarly situated only in certain areas of the country (e.g. in certain ecoregions)

p.22216, 2nd column, 2nd full paragraph:

"If the agencies choose to determine by rule that ''other waters'' in certain ecoregions or other geographic boundaries are similarly situated, the agencies could also determine that waters not located in identified ecoregions or otherwise specifically identified areas are not similarly situated for purposes of establishing a significant nexus and jurisdiction. The agencies also request comment on whether ''other waters'' that are not found in identifiable mapped ecoregions or other areas should be analyzed individually on a case-specific basis for determining a significant nexus, and on whether or not case-specific analysis of whether there are similarly situated ''other waters'' in the area is advisable. "

OPTION 2: Certain subcategories of "other waters" as a class have a significant nexus

p. 22217, column 1, first full paragraph
"If waters are categorized as non- jurisdictional because of a lack of science available today, the agencies request comment on how to best accommodate evolving science in the future that could indicate a significant nexus for these ''other waters.'' Specifically, the agencies request comment as to whether this should be done through subsequent rulemaking, or through some other approach, such as through a process established in this rulemaking. "

→ This option is most consistent with the SAB report and comments on the guidance document
→ This section of the rule would be much improved by an increased emphasis on functional connections

OPTION 3: No "other waters" are similarly situated and all "other waters" must be evaluated individually

p. 22217, column 1, last paragraph,
"The agencies could determine that no ''other waters'' are similarly situated, and all significant nexus analyses would be made on a case-specific basis for each individual ''other water.'' The agencies expect that this likely would result in few if any other waters being found jurisdictional. "

OPTION 4: All "other waters" in the watershed are similarly situated
p.22217, column 2, 2nd full paragraph,
"The agencies seek comment that would inform a decision that these ''other waters'' in a single point of entry watershed perform similar functions and are located sufficiently close together or to a paragraph (a)(1) through (a)(5) water so that they can be aggregated and evaluated as a single landscape unit with regard to their effects on the nearest (a)(1) through (a)(3) water. Generally, the agencies anticipate that if the other waters in a single point of entry watershed are aggregated as a single unit, these waters would be determined to have a significant nexus and be jurisdictional. "

Special "similarly situated" waters - Rule authors suggest that

p.22250, section i:"...that prairie potholes, Carolina and Delmarva bays, pocosins, Texas coastal prairie wetlands, western vernal pools, and perhaps other categories of waters, either alone or in combination with ''other waters'' of the same type in a single point of entry watershed have a significant nexus and are jurisdictional."

INDIVIDUAL COMMENTS ON Q3 – COMPILED

Aldous

The agencies are correct that many types of water bodies that are not included as tributaries or adjacent waters may significantly affect the chemical, physical, and biological integrity of downstream waters. It is technically appropriate to aggregate similar waters for this analysis, as their effects on downstream waters are often only measurable in aggregate. It is also appropriate to aggregate waters based on proximity to one another as well as functional similarities.

Given that the science is constantly evolving, it is preferable to have an adaptive process for making jurisdiction determinations, rather than a list of waters that are defined as jurisdictional (or not) from the outset.

The agencies ask a number of questions related to how a significant nexus analysis should be done. The method ultimately selected for aggregating waters geographically (i.e., "in the region") and functionally (i.e., "similarly situated"), and for making a significant nexus determination, must be based primarily on hydrologic principles, because hydrology is the key ecosystem driver for most other processes. This must include both surface hydrologic processes as well as subsurface (i.e., shallow groundwater) processes occurring with the soils and within any shallow unconfined aquifers that serve to connect surface water bodies to one another. The latter is often implied (e.g., p. 22214, bottom of 1st column) but not explicitly discussed.

Using the "single point of entry" watershed based on NHD watersheds appears to be an appropriate approach. However, the agencies suggest that for regions where there are few previously-defined jurisdictional waters that 10-digit HUCs be used (p. 22212). If this is the case, some of those HUCs may not contain a jurisdictional water, and so how would a determination be made?

In proposing ways that "other waters" might be found to be "similarly situated", the agencies suggest using the Omernik Level III ecoregions (p. 22215). These are not appropriate for this type of analysis. Although they are based on a number of physical and biological parameters, these ecoregions reflect patterns in terrestrial vegetation across the country and are less predictive of aquatic habitat types (Higgins 2003; Higging et al. 2005). For example, in an ongoing project in the Crooked River Basin, Oregon, the five headwater spring/ephemeral stream types cluster by basin and surficial geology in terms of their discharge rates, water chemistry, and flora. This basin spans the Columbia Plateau and Blue Mountains ecoregions. Other springs within the Columbia Plateau ecoregion (but outside the Crooked Basin) are much different in all of the characteristics listed above (Aldous et al., unpublished data). A more appropriate approach for aggregating wetland types should be based on hydrologic principles. Alternatively, the agencies propose the Hydrologic Landscape Regions (HLR) approach for considering wetlands and waters to be similarly situated. This approach is based on hydrologic drivers rather than landscape patterns in terrestrial vegetation, and may be more appropriate. In the Crooked River Basin project listed above, the headwater spring/ephemeral stream types are closely correlated to Wigington and co-authors' (2013) HLR types (Aldous et al. unpublished data).

Ali

The approach put forward by the proposed rule, i.e. that waters not located in riparian and floodplain settings be assessed on a case-by-case basis, is well aligned with the EPA science report: while the presence of a nexus is not contested, the demonstration of its significance has to be made.

The draft rule mentions that the agencies "considered multiple approaches and options for how best to address whether ''other waters'' were jurisdictional under the CWA", including determining, "by rule, that ''other waters'' are similarly situated in certain areas of the country". I agree that ecoregions and hydrologic landscape regions (HLRs) could be used for aggregation purposes. Those concepts are widely used for research purposes and could become powerful regulatory tools by providing a scientific equivalent to the phrase "similarly situated" that was used in previous court rulings and decisions.

Still in relation to "other waters", the draft rule mentions that the agencies considered the possibility of determining "by rule that certain additional subcategories of waters would be jurisdictional rather than addressed with a case-specific analysis". The draft rule builds on the examples of "waters such as prairie potholes, Carolina and Delmarva bays, pocosins, Texas coastal prairie wetlands, and western vernal pools" that could be deemed jurisdictional, as a category, while "playa lakes in the Great Plains, even in combination with other playa lakes in a single point of entry watershed" would be considered non jurisdictional for they lack a significant nexus. I am a bit reluctant about this option and do not think that the currently available scientific literature supports that approach. The draft rule goes on to say that "the [EPA science] Report indicates that there is evidence of very strong connections in some subcategories that are not included as jurisdictional by rule" but there again, it is unclear to me whether that very qualitative terminology ("very strong") is a synonym for "significant". Having other groups or types of waters being determined jurisdictional by rule or category would only be possible if we could rank them according to the frequency and/or magnitude and/or duration with which they actively transfer materials (or prevent the transfer of materials) to downstream waters (see coarse schematic in Figure 1).

SEE FIGURE IN ALI's COMMENTS

Figure 1: Hypothesized/idealized ranking of other waters according to their nexus to downstream waters

While reviewing the EPA science report, the SAB panel discussed – at length – the issue of connectivity being a gradient rather than a dichotomous property, and the issue with "other waters" is that they can be on both extremes of the spectrum (or gradient), i.e. be strongly connected or strongly isolated from downstream waters depending on the prevailing conditions. This makes the assessment of "significant nexus" particularly difficult and until (or unless) rankings or classifications similar to the one hypothesized in Figure 1 are available, I do not think that it would be possible to determine that certain additional subcategories of waters are jurisdictional by rule.

Benda

The proposed rule states "…where effects will be analyzed in combination, the agencies will aggregate these effects…". This statement is unclear on its own and it raises the issues outlined in my comments in Question #1 about aggregate effects. This same issue comes up again in the proposed rule "…the agencies would assess the combined effects of similarly situated "other waters" in the region on the chemical, physical and biological integrity…".
The use of Level III ecoregions may be appropriate for their use in defining areas where "waters are similarly situated and aggregation could be used (Map A in docket). However, it might be prudent, unless a more comprehensive analysis is done, to not provide such lists. Rather, it might be best to provide the criteria upon which to consider "aggregation". However, the issue of "aggregation could be used" raises the complexities outlined in responses to Question #1. For example, how exactly would "aggregation" be done (e.g., conceptually, qualitatively or quantitatively)?

The term "landscape unit" is used in the context of aggregate effects and relates to similar hydrologic features and processes, or proximity of features. The EPA could consider using another term, rather than 'landscape unit' that is somewhat ambiguous, and in keeping with the science, may use terms such as similar hydrologic or geomorphic feature having similar processes.
The proposed rule in several areas raises the issue of a "desktop" analysis, presumably using remote sensing and digital data (including DEMs). The rule language might be strengthened if more definition or examples were provided of what constitutes a 'desktop analysis'.

Bernhardt

Having clarified the status of all tributaries and all waters adjacent to tributaries as waters of the United States, the authors are left with the challenge of determining what water bodies outside of these categories must also be protected in order to maintain the physical, biological and chemical integrity of downstream waters. The rule acknowledges that as water bodies become more distant from tributaries and rivers, the extent of their connectivity also declines. It would be useful for the rule to also mention that the size of these water bodies matters as well, small water bodies far from any flowing water system are more isolated (both hydrologically and via transfers of biota) than are large water bodies that are closer. I appreciate that the rule makes a strong case for considering that the aggregate effect of many minimally connected water bodies may be critical for maintaining the biological, chemical and physical integrity of water bodies in one or both of the previous, clearcut categories of jurisdictional waters. Many watersheds have a large number of non-floodplain wetlands that are collectively responsible for the maintenance of baseflows; the attenuation of floods; the production of organic material that fuels downstream food webs; and the trapping or removal of sediments, nutrients and contaminants that would otherwise contribute to the degradation of downstream water quality. Although individually these wetlands may each have minimal connections to downstream waters, the cumulative impact of these diffuse connections is tremendously important to the maintenance of downstream biota and ecosystem integrity. Historically, the destruction of wetlands has caused serious declines in the water quality of U.S. waters and it is crucial that our CWA works to prevent similar degradation in the future. I found the list of criteria that could be used to assess whether an "other water" was connected to downstream waters was comprehensive, reasonable, and well articulated. I found the text of the rule in this section very close in spirit, substance and argument to SRB panel discussion and recommendations on this issue.

Fennessy

This definition of other waters works conceptually, and it acknowledges the cumulative effects of wetlands and other waters on downstream water integrity on a watershed basis, but I wonder how it will be put into practice. Defining waters that, 'either alone or in combination with other waters similarly situated in the region significantly affect the chemical, physical, or biological integrity of waters of the U.S. in a way that is more than speculative or insubstantial', will need substantial guidance to operationalize its implementation in the field. When is an effect more than speculative or insubstantial? Adopting the framework suggested in the SAB Panel report would help address this by recognizing the gradient of connectivity and where thresholds may be crossed. And while evaluation of 'other waters' on a case-by-case basis (with no specified criteria) does not further the goal of providing regulatory predictability, in some cases the BPJ of agencies in the field will have to be relied upon. This again will require the development of methods to determine when a nexus is significant, including metrics based on hydrologic, chemical and biological connectivity. As it stands now, the draft rule stresses hydrologic connectivity with little recognition of other vectors of connectivity such as the movement of biota. A key question is where, along the gradient of connectivity, do the effects of other waters become significant?

Basing the definition on similarly situated waters, and their cumulative contribution to the integrity of downstream waters, is a sound approach. It is well established that wetlands that share a common hydrogeomorphic setting have similar functions and make similar contributions to downstream waters. I also support the recognition in the draft rule that other waters that lack 'bidirectional hydrologic exchanges' can have important effects on the integrity of downstream waters (pg 22223), however this should be reflected more fully in the working definitions provided.

Gooseff

I interpret this to mean that the other waters are those that are not neighboring. When this is the case, it seems the significant nexus concept provides two extreme opportunities to determine jurisdiction of a single other water body under the CWA – 1) assume all other waters are under jurisdiction of the CWA until otherwise proven to have no significant nexus [though may have some nexus regardless], and 2) assume all other waters are not under the jurisdiction of the CWA until otherwise proven to have a significant nexus to a covered water body. The approach of the new rule provides a reasonable intermediate, that a case-specific assessment must be made to determine whether and what sort of nexus may exist between the water bodies (physical, chemical, and/or biological), and how significant the nexus is. Connections between other water bodies and covered waters may be infrequent and may be invisible at the surface because of a groundwater-mediated exchange of mass and energy between the water bodies. This may indeed prove to be either significant or less than significant after assessment. In my opinion, the case-specific analysis still provides the opportunity for the determination to go either way, rather than de facto categorization (the two cases suggested above) that would have to be overturned to determine the true state of the other water body. Ultimately, the variety of these water bodies and the potential connection types, strengths, and frequencies will determine both whether and how significant any connection could be. This variety of possibilities makes it difficult if not impossible to broadly categorize connection type and significance.

Johnson

Based on the science and the SAB's panel findings, consideration must be given to both the presence and the absence of a significant hydrologic connection; furthermore, biological connections must also be considered in the criteria to establish a "significant nexus" (see comments and citations for CQ2). Biological factors that might be added to the potential criteria (i.e., increasing size and decreasing distance, increased density of the "other water" in similarly situated areas) might include evidence of genetic similarity in key biotic assemblages; evidence of transfer of biotic materials (e.g., propagules, disease vectors) among "other waters, similarly situated), evidence of biota (that contribute to biological integrity of downstream waters) that require the downstream waters to complete their life cycle (life cycle dependency). The science suggests that some non-resident migratory species may significantly influence downstream waters (a)(1)-(a)(3) waters through a significant transfer of disease vectors, nutrients or biomass (e.g., energy (Lowe et al. 2005; Norlin 1967; Mason and MacDonald 1982; Polis et al. 1997; Sabo and Power 2002; Baxter et al. 2005; Spinola et al. 2008; Pearse et al. 2011); the movement of nutrients by biota (McColl and Burger 1976; Johnston and Naiman 1987; Davis 2003; Vrtiska and Sullivan 2009); the introduction of disease vectors (Blanchong et al. 2006); and the provisioning of habitat essential for biological integrity and completion of life cycles of downstream species (Brooks et al. 1998; Miyazano et al. 2010; Julian et al. 2013)." Pg 53 SAB panel report) in addition to the examples listed.

It is exactly true that the determination of these waters may be resource-intensive. Thus it would behoove the agencies to establish a set of baseline criteria that would enable a hierarchically structured decision *framework that would first establish the potential for hydrologic connections via surface, shallow subsurface, or groundwater flowpaths. The SAB panel recognized that such connections occur across a gradient that varies through time. Yet hydrologic modeling and / or spatial modeling in conjunction with satellite remote sensing and aerial photography may provide the basis for determining the presence of physical connections over time frames that include long duration wet regimes (c.f. Winter and Rosenberry 1998). Such an empirical depiction of "connected" landscapes could form the starting point for further assessments that would be followed by more rigorous analyses of subsurface flow paths, and subsequently biological studies that would establish whether the observed connections meet the standard of a "significant nexus". While the SAB panel recognized that over space and time most water bodies are connect, they acknowledged that such connections may not significantly affect the integrity of jurisdictional waters (a)(1) – (a)(3) and thus would not meet the standard of a "significant nexus".*

Determine by rule that ''other waters'' are similarly situated in certain areas of the country.
Response: Ecoregions are not appropriate spatial units over which to determine the issues of whether or not a region is deemed to be "similar". Ecoregions were mainly developed based on terrestrial vegetation communities, in combination with soils and climate. These units are not meant to reflect hydrologic regions. The SAB panel recommended the use of Hydrologic Landscape Regions as a more appropriate base from which to delineate similar regions.

Determine by rule that certain additional subcategories of waters would be jurisdictional rather than addressed with a case-specific analysis, and that other subcategories of waters would be non-jurisdictional.
Response: Some specific wetland types and regions have been sufficiently well-studied to determine that they should be considered jurisdictional, e.g., Prairie Potholes, Carolina bays, coastal prairie wetlands. The agency should accelerate efforts to further establish the basis for such determinations for other classes of waters. I especially suggest that the in addition to western vernal ponds, that vernal ponds on the east coast and the upper Midwest be considered. Recent efforts to map vernal pools in northern Minnesota reveal that the density far exceeds previous estimates.

I do not support the proposal that remaining "other waters" automatically be classified as non-jurisdictional; rather, there should be an established protocol that establish the decision framework for such a decision. The more structured and spatially-relevant this decision framework can be, the fewer resources each case by case determination will require.

Kolm

This Rule is still reliant on distance and needs to be flow path oriented with spatial and temporal components! To clarify the connectivity of "other waters" to "waters of the US", the SAB recommends that a conceptual framework be established expressed as continuous hydrological (surface and subsurface), chemical, and biological flowpaths connecting watersheds from top to bottom, and therefore connecting other waters and wetlands to downgradient waters. The flowpath framework should highlight the four-dimensional nature of connectivity, because four-dimensional connectivity scaled in a habitat-to-catchment context is a foundational aspect of freshwater ecology (e.g., Ward 1989). The flux and transformation of water, materials, and organisms – which fundamentally control the integrity of downgradient freshwater ecosystems – occur at varying rates primarily determined by climate, geology, topographic relief, and biology and are expressed in terms of surface water and ground water storage and flow through the landscape (e.g., uplands, wetlands, lakes, rivers, and floodplains). Therefore, these flowpaths are inherently four-dimensional (i.e., longitudinal, lateral, vertical, and through time).

Page 22212:

The agencies also request comment and information below on how the science could support other approaches that could provide greater regulatory certainty regarding the jurisdictional status of ''other waters''

There are methods for quantification regarding connectivity of these types of systems specifically the "other waters" – both physical (fluids) and chemical (transport), and biological. Future efforts to assert jurisdiction over "other" waters connected through a shallow subsurface hydrologic connection or confined surface hydrologic connection regardless of distance and to quantify connectivity can be informed by the wide variety of conceptual models and quantitative tools that have been developed to evaluate the connectivity of both surface and subsurface hydrological systems in different settings, including non-floodplain wetlands. The standard approach involves first characterizing the surface and subsurface elements of landscapes. Important elements include climate, geology, topographic relief, and the amount, distribution and types of waters and wetlands. These elements can then be integrated to create a flowpath network that describes connectivity (Heath 1983; ASTM 1996; Kolm et al. 1996; Winter et al. 1998). This approach has been extended to biological connectivity and hydrogeomorphic (HGM) wetland classifications (e.g., Kolm et al. 1998). Of course, the approach to quantifying hydrologic connectivity is not identical across systems, and careful attention must be given to identifying the most appropriate techniques (Healy et al. 2007; Bracken et al. 2013) and metrics (Ali and Roy 2010).

Other examples can be found in the literature related to water quantity and quality modeling (Appel and Reilly 1994; Sun et al. 1997; Harbaugh 2005; Parkhurst et al. 2010; Cunningham and Schalk 2011), and integrated surface water ground water modeling (Markstrom et al. 2008; Ely and Kahle 2012; Huntington and Niswonger 2012; Woolfenden and Nishikawa 2014), sediment transport modeling (Nelson et al. 2003; McDonald et al. 2005), and watershed and biological/habitat/landscape modeling (Kinzel et al. 1999; Kinzel et al. 2005; Hunt et al. 2013). Approaches have also been developed to quantify linkages due to ground water movement and storage (Heath 1983) and the effects of "flood pulses" (Kolm et al. 1998). Likewise, the role of chemical movement and storage to ground water systems in floodplains has been quantified by flow and transport modeling (Winter et al. 1998; Markstrom et al. 2008; Woolfenden and Nishikawa 2014) as well as with steady-state and transient analyses that simulate temporal changes (Appel and Reilly 1994; Winter et al. 1998; Nelson et al. 2003; Conaway and Moran 2004; Harbaugh 2005; McDonald et al. 2005; Markstrom et al. 2008; Huntington and Niswonger 2012).

Page 22212:

Water sheds are used solely, the effects of regional groundwater systems or basins is ignored! Connectivity via regional groundwater systems needs to be considered! In general, the role of regional groundwater systems in neighboring systems is not addressed by this Rule and leaves the waters of the US vulnerable. The Rule focuses primarily on the site and subregional scales, and on watershed boundaries. This tends to either ignore or at least downplay the potential significance of regional-scale hydrologic connectivity, especially as it relates to ground water in adjacent and /or neighboring systems. This is a problem because regional ground water flows commonly interact with the surface environment at sinks and springs. For example, the Floridan aquifer underlies all of Florida as well as portions of Mississippi, Alabama, Georgia, and South Carolina and commonly interacts with the surface environment through sinks, springs, and outcrops (see Sun et al. 1997 and references therein). To provide a better understanding of ground water connectivity, and the way that ground water connectivity might vary spatially, the SAB recommends that the EPA also consider using the ASTM D5979-96 Standard Guide for Conceptualization and Characterization of Ground Water Systems (ASTM 1996; Kolm et al.

1996). To better characterize regional-scale ground water connectivity, the SAB recommends that the EPA also consider using findings from the U.S. Geological Survey Regional Aquifer Systems Analysis (RASA) Program. An understanding of regional ground water flow systems is critical to the understanding of four-dimensional hydrologic connectivity on both the local and regional scales. Understanding ground water flow in unique hydrogeologic settings, including the Floridan aquifer system (karst systems), the High Plains aquifer system (semi-arid systems), and the Snake River Plain and Rio Grande Rift aquifer systems (volcanic bedrock systems), is especially important. These and other unique hydrogeological settings are covered by the RASA Program (Sun et al. 1997).

To clarify the connectivity of other waters to "waters of the US", the SAB recommends that a conceptual framework be established expressed as continuous hydrological (surface and subsurface), chemical, and biological flowpaths connecting watersheds from top to bottom, and therefore connecting waters and wetlands to downgradient waters. The flowpath framework should highlight the four-dimensional nature of connectivity, because four-dimensional connectivity scaled in a habitat-to-catchment context is a foundational aspect of freshwater ecology (e.g., Ward 1989). The flux and transformation of water, materials, and organisms – which fundamentally control the integrity of downgradient freshwater ecosystems – occur at varying rates primarily determined by climate, geology, topographic relief, and biology and are expressed in terms of surface water and ground water storage and flow through the landscape (e.g., uplands, wetlands, lakes, rivers, and floodplains). Therefore, these flowpaths are inherently four-dimensional (i.e., longitudinal, lateral, vertical, and through time).

Ground water connectivity, in particular, could be better represented in the Rule. The U.S. Geological Survey (USGS) has published numerous reports and learning tools on ground water connectivity, including examples of flowpath frameworks expressed in block diagrams (Heath 1983, 1984; Winter et al. 1998), that contain flows through floodplains. Care should be taken not to imply that bedrock is impermeable because ground water flows through bedrock are important flowpaths that connect hydrologic landscapes over long distances and often across watershed boundaries (e.g., Roses et al. 1996).

Restated and note references: Using Hydrologic-Landscape Regions and Ecoregions as a basis for determining the connectivity of hydrologic and biologic systems to "waters of the U.S." is an excellent first step in understanding the holistic nature of these systems in any location when combined with the standard approach that involves characterizing the surface and subsurface elements of landscapes to determine flowpath networks at multiple temporal and spatial scales. Important elements include climate, geology, topographic relief, and the amount, distribution and types of waters and wetlands. These elements, in context with the HLRs and Ecoregions, can then be integrated to create a flowpath network that describes connectivity (Heath 1983; ASTM 1996; Kolm et al. 1996; Winter et al. 1998). This approach has been extended to biological connectivity and hydrogeomorphic (HGM) wetland classifications (e.g., Kolm et al. 1998).

Patten

Question 3 response. This description of a significant nexus of other waters that have to be considered on a case-specific basis requires a strict understanding of the actual connection that can be satisfied through relationships to other waters. Without the significant nexus which requires a thorough understanding of physical, chemical or biological connectivity, the connection will not hold. Thus, the qualifier of this condition is the need for scientific studies of each case and a general discussion of significant nexus in the policy and its supporting science is inadequate.

Bernhardt Comments

Rains

Type (a)(7) Waters: Other Waters

The Connectivity Report and other literature clearly establish that other waters can affect the chemical, physical, and biological integrity of downgradient waters, though they do so on a gradient from having negligible to important effects. The proposed rule therefore will treat these not as waters of the US by definition but, rather, as waters of the US on a case-by-case basis if there proves to be a significant nexus between the other wetland or group of wetlands and the chemical, physical, and biological integrity of downgradient waters. While the science supports this as a general approach, it will be important to carefully define what is meant by "case-by-case", and what happens following a case in which specific other wetland or group of wetlands are determined to be waters of the US.

The proposed rule defines a group of wetlands geographically, grouping wetlands only within a given watershed. The proposed rule then defines watershed as all land from which surface water could drain to the nearest single entry point to a type (a)(1)-(a)(3) water. Such a definition has some problems.

There could be innumerable groups on uplands directly adjacent to a linear type (a)(1)-(a)(3) water. Imagine, for example, a navigable river running along the toe of a hillslope with innumerable seeps and springs, each of which or small groups of which discharging at different single points of entry to the river. Further imagine that the seeps and springs are a single hydrologic system, recharging due to infiltration of precipitation at the ridgetop and expressing along a linear geologic contact that outcrops at a common elevation all along the hillslope. By the proposed definition of watershed, one might conclude that a significant nexus assessment would need to be conducted above every single point of entry, thereby conducting a significant nexus assessment many times over on the same hydrologic system. This would be a clear waste of effort, because a single, well-designed and well-conducted significant nexus assessment would likely suffice. And, if a single, well-designed and well-conducted significant nexus assessment would likely suffice in the case above, then the logical extension might be that a single, well-designed and well-conducted significant nexus assessment might also likely suffice for any single type of hydrologic system, if such a type of hydrologic system were well defined.

Consider, for example, vernal pools in the Sacramento Valley. Both east and west sides of the Sacramento Valley are draped with Pleistocene to Pliocene alluvial fans terminating at the Holocene basin floor along the Sacramento River. These alluvial fans are nearly level to undulating but gently slope toward the basin floor. They have well-developed drainage networks, being dissected by streams and rivers tributary to the Sacramento River. Major geologic formations include the Riverbank and Red Bluff formations, with the Riverbank formation being 130K-450K BP in age and the Red Bluff formation being 450K-1.08M BP in age (Helley and Harwood, 1985), both of which being old enough for substantive pedogenic processes to have occurred (Helley and Harwood, 1985; Smith and Verrill, 1998). The USDA–Natural Resources Conservation Service has mapped several soil series with silica- and iron-cemented duripans on these formations, including the Redding series. These formations are also old enough for substantive subaerial erosion to have occurred, so microtopographic relief also is well developed, with mound-depression topography and irregular to coherent and intermittent to seasonal drainage networks commonly connecting depressions to streams and rivers tributary to the Sacrament o River (Smith and Verrill, 1998). The vernal pools and swales that occur on these hardpan soils have been extensively studied (e.g., Rains et al. 2006; 2008). Wherever they occur, they have common hydrological, geochemical, and biological attributes and processes, with such attributes and processes a function of the *underlying geologic setting. This geologic setting does not only occur in a small, closely centered area – rather, this geologic setting repeats in mappable units all over both sides of the Sacramento Valley. If a significant nexus assessment is done on these types of vernal pools in one location, then it quite likely suffices for another similarly situated location.*

The summary of this is that case-by-case should not be defined simply by proximity. Such a definition is inconsistent with scientific understanding of the controls on hydrological, geochemical, and biological structure and function. Such a definition also would place an undue burden on the regulated public, who would be required to repeatedly perform significant nexus assessments on the same types of wetlands. It would therefore be better to have a clear pathway by which entire classes of wetlands can be determined to have a significant nexus with the chemical, physical, and biological integrity of downstream waters and can thereafter be considered waters of the US by definition.

Rodewald

The Connectivity Panel disagreed with the EPA Report's conclusion that the literature did not provide sufficient information to evaluate or generalize about the degree of connectivity or its downstream consequences. As such, the Panel requested better acknowledgement that the science does show that non-floodplain waters and wetlands can have strong and important impacts on the physical, chemical, and biological integrity of downstream waters.

The Connectivity Panel agreed that downstream consequences of waters and wetlands in non-floodplain settings will likely require a case-by-case evaluation that considers the magnitude, duration, frequency, predictability, and consequences of water, material, and biotic fluxes to downstream waters, and their impact on the integrity of downstream waters. An additional recommendation was to establish relevant guidelines identifying baseline temporal intervals that are likely to meaningfully connect non-floodplain wetlands and waters to downstream waters.

I'm unclear about the jurisdiction of wetlands that have a surface or subsurface water connection (italicized text from draft rule below). If a wetland in a non-floodplain setting has a connection to the river network, then is it a tributary or an "other water"? Or is seeing the connection effectively the "case-specific analysis" needed to make it jurisdictional?

Regarding wetlands and open waters located outside of floodplains and riparian areas, the Report finds that they provide many benefits to rivers, lakes, and other downstream waters. <u>If the wetland or open water has a surface or shallow subsurface water connection to the river network, it affects the condition of downstream waters. Where the wetland or open water is not connected to the river network through surface or shallow subsurface water</u>, the type and degree of connectivity varies geographically, topographically, and ecologically, such that the significance of the connection is difficult to generalize across the entire group of waters.

There was strong agreement among Panel members that connectivity assessments should explicitly consider aggregate and cumulative effects of wetland complexes. I was pleased to see that the rule provided guidance about how and when to aggregate with the phrase "<u>similarly situated</u>".

"Other waters'' will be evaluated either individually, or as a group of waters where they are determined to be similarly situated in the region. <u>Waters are similarly situated where they perform similar functions and are located sufficiently close together or when they are sufficiently close to a jurisdictional water. How these ''other waters'' are aggregated for a case-specific significant nexus analysis depends on the</u>

functions they perform and their spatial arrangement within the ''region'' or watershed. For other waters that perform similar functions, their landscape position within the watershed (i.e., the ''region'') relative to each other or to a jurisdictional water is generally the determinative factor for aggregating waters in a significant nexus analysis, which will focus on the degree to which the functions provided by those ''other waters'' affect the chemical, physical, or biological integrity of (a)(1) through (a)(3) waters and whether such effects are significant."

The similarly-situated case for aggregation requires similar functions, but what if there is a wetland complex where some wetlands are connected and others are important for storage due to lack of connection?

"A hydrologic connection is not necessary to establish a significant nexus, because, as Justice Kennedy stated, in some cases the lack of a hydrologic connection would be a sign of the water's function in relationship to the traditional navigable water, interstate water or the territorial seas. These functional relationships include retention of flood waters or pollutants that would otherwise flow downstream to the traditional navigable water, interstate water or the territorial seas."

I support the Agency's consideration of using subcategories that identify groups for which there is evidence of strong connections and thus should be jurisdictional.

I appreciate that they are trying to provide guidance on how to evaluate different kinds of connectivity, but these are largely describing how to identify the presence or absence of different "types" of connections, rather than the degree of those connections. (below)

p. 22214:

Evidence of chemical connectivity and the effect on waters can be found by identifying: Whether the properties of the water in question are similar or dissimilar to an identified (a)(1) through (a)(3) water; signs of retention, release, or transformation of nutrients or pollutants; and the effect of landscape position on the strength of the connection to the nearest ''water of the United States,'' and through it to an (a)(1) through (a)(3) water. In addition, relevant factors influencing chemical connectivity include hydrologic connectivity (see physical factors, below), surrounding land use and land cover, the landscape setting, and deposition of chemical constituents (e.g. acidic deposition).

Evidence of physical connectivity and the effect on (a)(1) through (a)(3) waters can be found by identifying evidence of physical connections, such as flood water or sediment retention (flood prevention). Presence of indicators of hydrologic connections between the other water and jurisdictional water are also indictors of a physical connection. Factors influencing physical connectivity include rain intensity, duration of rain events or wet season, soil permeability, and distance of hydrologic connection between the ''other water'' and the (a)(1) through (a)(3) water, depth from surface to water table, and any preferential flowpaths.

Evidence of biological connectivity and the effect on waters can be found by identifying: resident aquatic or semi-aquatic species present in the ''other water'' and the tributary system (e.g., amphibians, aquatic and semi-aquatic reptiles, aquatic birds); whether those species show life-cycle dependency on the identified aquatic resources (foraging, feeding, nesting, breeding, spawning, use as a nursery area, etc.); and whether there is reason to expect presence or dispersal around the ''other water,'' and if so whether such dispersal extends to the tributary system or beyond or from the tributary system to the ''other *water.'' Factors influencing biological connectivity include species' life history traits, species' behavioral traits, dispersal range, population size, timing of dispersal, distance between ''other water'' and an (a)(1) through (a)(3) water, the presence of habitat corridors or barriers, and the number, area, and spatial distribution of habitats. Non-aquatic species or species such as non-resident migratory birds that are not demonstrating a life cycle dependency on the identified aquatic resources are not evidence of biological connectivity for purposes of this rule"*

Rosi-Marshall

Response: The justification for "other waters" being evaluated on a "case by case" basis or as a group to determine the extent to which they have a significant nexus with downstream waters is well described in the proposed rule. I agree that considering groups of "similarly situated" waters and the extent to which they affect downstream waters in aggregate is justified and would alleviate the need for extensive "case by case" analysis. The approach to consider "similarly situated" systems and evaluate their connectivity as a group makes sense based on our ecological understanding of these systems, i.e. that similar systems in a region may act in similar ways and that not every water is unique. In addition, these systems should be considered in aggregate, as the degree to which they influence downstream waters will be more apparent when considered in aggregate.

The SAB Report provides additional information on how "other waters" should be defined and how they may be connected to downstream waters even when an apparent hydrologic surface flow is lacking. It is very important that the ideas put forward by the SAB in response to this section of the Connectivity Report be considered when making the final rule about "other waters". Although these systems may not be adjacent to downstream waters and therefore may lack an explicit surface water hydrologic connection, they may function, especially in aggregate, in ways that influence the biological and chemical integrity of downstream waters. These ideas are well developed in the SAB report and these ideas should be explicitly considered during the final rulemaking in regards to these "other waters".

Sullivan

Recognizing the myriad connections between non-floodplain and non-riparian waters and wetlands and downstream waters (via surface water, shallow subsurface flowpaths, shallow or deep ground water flowpaths, or through chemical and biological connections) with specific attention paid to the magnitude, duration, frequency, predictability, and consequences of these connections is critical to understanding that all water bodies are likely connected to some extent to downstream waters, although the degree of connectivity can vary widely. The proposed rule draws heavily on hydrological connections, and should weight other connections equally. For instance, there is growing scientific evidence regarding biological connections between non-floodplain wetlands and other water bodies and downstream waters, including the bulk exchange of materials via biota, biota as disease vectors, the movement of nutrients by biota. Other water bodies can also provide critical habitat, which can be essential for the life-cycle requirements of downstream species. There is some discussion of these points (e.g., 22214, 22222), but the full scope of biological connectivity is not fully established in the proposed rule (particularly relative to the role of biota as vectors of nutrients, contaminants, and other materials). For example, the proposed rule recognizes that even when hydrological connections are visibly absent, many waters still can influence downstream waters, yet states that "However, such circumstances would be uncommon" (22249). To the contrary, birds and other organisms can be key movers of nutrients, plants (seeds), and invertebrates between wetlands and downstream waters across ranges of spatial scales (e.g., Figuerola et al. 2003, Green et al. 2008).

I believe that the science is currently available (partially summarized starting 22250) to demonstrate that sufficient connectivity exists without a case-specific analysis for certain subcategories of "other waters" (22216) (e.g., prairie potholes, Carolina and Delmarva bays, pocosins, Texas coastal prairie wetlands, western vernal pools). However, I do not believe that the science is sufficiently developed to support a determination to exclude any groups of "other waters" (or subcategories thereof, e.g., Great Plains playa lakes) from jurisdictional status at this time in spite of the resource-intensive nature of a case-specific analytical approach. Before such determinations are made, additional research is required to establish degree of connectivity, analysis of spatial and temporal variability, and threshold levels of connectivity. This research will be a requisite step in further refining rules relative to the jurisdictional status of "additional other waters of the US" and in particular, if "categories of 'other waters' are similarly situated and have a significant nexus and are jurisdictional by rule, or that as a class they do not have such a significant nexus and might not be jurisdictional" (22216-22217). The best way to incorporate the developing science in the future is an excellent question; I look forward to Panel discussion on this point.

Determining if waters are "similarly situated" is a reasonable approach with scientific support (22247). Biotic community assemblage and presence/absence of species might be other metrics used to assess similarity, along with the factors currently provided as examples in the proposed rule (22213: habitat, water storage, sediment retention, pollution sequestration). Whereas analyzing the chemical, physical, and/or biological effects "other waters" perform in concert with other similarly situated water bodies is technically sound, supported by the science, and provides a basis for decision-making, water bodies that are disparate relative to their characteristics and function may also contribute to the cumulative effects of the water bodies in a region, and thus there may be cases wherein it is appropriate to analyze "other waters" in the aggregate (in contrast to a whole-scale statement indicating that it would be "inappropriate … to consider 'other waters' as 'similarly situated' if these 'other waters' are located in different landforms, have different elevation profiles, or have differ soil and vegetation characteristics …" (22213). Determining by rule that "other waters" are similarly situated in certain areas of the country is an intriguing idea, although my initial reaction is that Level 3 Ecoregions may be too broad of a classification. Additionally, human alteration of watersheds can alter the types of connections to downstream waters as well as the magnitude, frequency, duration, predictability, and consequences of these connections. How would variability stemming from the role of humans on the watershed landscape be captured within a regional approach?

Relative to a case-specific basis for other waters, the proposed rule correctly recognizes role of aggregate and temporal effects. This is a key point in relation to assessing whether a water body has a "significant nexus". Determining when (temporally) surveys will be conducted, what map scale will be used (although this point is somewhat addressed on 22212, 22226), and how aggregate effects will be determined is critical to appropriate assessment of these case-by-case situations. For example, many current databases do not represent the full extent and/or size of the drainage network. For additional comments on this point, see responses to Question #1. This topic is also addressed in the SAB Panel Report.

Tank

General Comment:
Given my expertise and familiarity with the science associated with the Connectivity Report, informing the proposed rule, I found the proposed definition of "other waters" to be accurate and clearly written.

Specific Comment:

Pg 22212, C1, P2, L14: In response to the request by the agencies for comments on the listing of "other waters", I am supportive of the rule as it stands whereby the agencies "do not propose to re-promulgate this list of ''other waters'' because it is unnecessary and has led to confusion where it has been incorrectly read as an exclusive list."

Pg22214, C3, P1, L2: In response to the request by the agencies for feedback on "the inclusion of subcategories of types of ''other waters,'' either alone or in combination with similarly situated waters, that can appropriately be identified as always lacking or always having a significant nexus", I suggest that Comments made through the SAB review of the Connectivity Report could provide suggestions appropriate for inclusion.

Valett

22211: 'other waters' and case-specific assessment - *I think the agencies have it right here. There is a clear need to address on a 'case-specific' basis the status of a water body designated as 'other'. In fact on page #22211, right column, 'other waters' are specifically defined as those that require assessment of a 'case-specific significant nexus determination'. The agencies clarify that they will remove an old list of 'others' to eliminate confusion (i.e., the mistaken notion that the list was exhaustive).*
The larger issue is whether 'similarly situated' water bodies need to be addressed individually or can be assessed as a 'landscape unit'(see page #22213. left column) in a cumulative context. This language appropriately embraces the cumulative effects of 'neighboring' waters, characteristic of dendritic drainages and 'watersheds' as a whole. I really like the use of 'landscape unit' as it suggests integrated function. The request to employ a 'landscape unit' approach is a tricky one, but one that seems like it can be operationalized (i.e., aggregation on a 'local' basis to establish the landscape unit).
22212-22213: 'in the region' and 'similarly situated' - *The agencies have correctly engaged in addressing this issue by clarifying their position on Justice Kennedy's use of 'in the region' and 'similarly situated'. With their approach, 'region' becomes synonymous with watershed (really catchment is the correct term). Later there appears to be recognition that 'regions' are larger things. Their interpretation does, however, keep the hydrologic linkage (i.e., and evident nexus) at the core of the distinction and that is a strength of the approach. Use of the NHD and HUC-10 tools are appropriate for designation as they are based on the same notion of 'watershed' delineation.*
The definition employed for 'similarly situated' waters is nicely rooted in function and appropriately employs the 'landscape unit' concept. While geographic proximity can be misleading (i.e., some things nearby may be disconnected while others afar remain fully integrated), it needs to be included in the use of the term as geographic proximity is the basis of the 'region' notion above and the notion of similarity employed here....even given the clear focus on function. Note, however, when the definition of 'similarly situated' is addressed (left column, bottom, 22213), it is rooted in characteristics of the terrestrial environment (soils, vegetation, landform). Given the emphasis that the SAB has placed on a 'flowpath' conceptual basis for the Water Body Connectivity report, I find it strange that 'hydrologic connectivity to each other or a jurisdictional water' arrives as a caveat...almost an afterthought. I would propose elevating it to the same level of importance as the terrestrial characteristics.
At the same time, the use of 'relatively homogenous soils, vegetation and landform' is a vague distinction. Soils and vegetation are notoriously heterogeneous at different scales. I'm not sure if this notion helps aggregate at all.

are or were navigable in fact or that could reasonably be so made.'' Id. at 759 (citing SWANCC, 531 U.S. at 167, 172).
''if the wetlands, either alone or in combination with similarly situated [wetlands] in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily

understood as 'navigable.' '' Id. at 780. In light of Rapanos and SWANCC, the ''significant nexus'' standard for CWA jurisdiction that Justice Kennedy's opinion applied to adjacent wetlands also can reasonably be applied to other waters such as ponds, lakes, and non-adjacent wetlands that may have a significant nexus to a traditional navigable water, an interstate water, or the territorial seas. ''The required nexus must be assessed in terms of the statute's goals and purposes. Congress enacted the [CWA] to 'restore and maintain the chemical, physical, and biological integrity of the Nation's waters' . . ..'' 547 U.S. at 779. It clear that Congress intended the CWA to ''restore and maintain'' all three forms of ''integrity,'' 33 U.S.C. 1251(a), so if any one form is compromised then that is contrary to the statute's stated objective. It would subvert the intent if the CWA only protected waters upon a showing that they had effects on every attribute of a traditional navigable water, interstate water, or territorial sea. Therefore, a showing of a significant chemical, physical, or biological affect should satisfy the significant nexus standard.

p.22263

(7) *Significant nexus.* The term *significant nexus* means that a water, including wetlands, either alone or in combination with other similarly situated waters in the region (i.e., the watershed that drains to the nearest water identified in paragraphs (a)(1) through (3) of this section), significantly affects the chemical, physical, or biological integrity of a water identified in paragraphs (a)(1) through (3) of this section. For an effect to be significant, it must be more than speculative or insubstantial. Other waters, including wetlands, are similarly situated when they perform similar functions and are located sufficiently close together or sufficiently close to a ''water of the United States'' so that they can be evaluated as a single landscape unit with regard to their effect on the chemical, physical, or biological integrity of a water identified in paragraphs (a)(1) through (3) of this section.

Aldous

The agencies are correct that many types of water bodies that are not included as tributaries or adjacent waters may significantly affect the chemical, physical, and biological integrity of downstream waters. It is technically appropriate to aggregate similar waters for this analysis, as their effects on downstream waters are often only measurable in aggregate. It is also appropriate to aggregate waters based on proximity to one another as well as functional similarities.

Given that the science is constantly evolving, it is preferable to have an adaptive process for making jurisdiction determinations, rather than a list of waters that are defined as jurisdictional (or not) from the outset.

The agencies ask a number of questions related to how a significant nexus analysis should be done. The method ultimately selected for aggregating waters geographically (i.e., "in the region") and functionally (i.e., "similarly situated"), and for making a significant nexus determination, must be based primarily on hydrologic principles, because hydrology is the key ecosystem driver for most other processes. This must include both surface hydrologic processes as well as subsurface (i.e., shallow groundwater) processes occurring with the soils and within any shallow unconfined aquifers that serve to connect surface water bodies to one another. The latter is often implied (e.g., p. 22214, bottom of 1st column) but not explicitly discussed.

Using the "single point of entry" watershed based on NHD watersheds appears to be an appropriate approach. However, the agencies suggest that for regions where there are few previously-defined jurisdictional waters that 10-digit HUCs be used (p. 22212). If this is the case, some of those HUCs may not contain a jurisdictional water, and so how would a determination be made?

In proposing ways that “other waters” might be found to be “similarly situated”, the agencies suggest using the Omernik Level III ecoregions (p. 22215). These are not appropriate for this type of analysis. Although they are based on a number of physical and biological parameters, these ecoregions reflect patterns in terrestrial vegetation across the country and are less predictive of aquatic habitat types (Higgins 2003; Higging et al. 2005). For example, in an ongoing project in the Crooked River Basin, Oregon, the five headwater spring/ephemeral stream types cluster by basin and surficial geology in terms of their discharge rates, water chemistry, and flora. This basin spans the Columbia Plateau and Blue Mountains ecoregions. Other springs within the Columbia Plateau ecoregion (but outside the Crooked Basin) are much different in all of the characteristics listed above (Aldous et al., unpublished data). A more appropriate approach for aggregating wetland types should be based on hydrologic principles. Alternatively, the agencies propose the Hydrologic Landscape Regions (HLR) approach for considering wetlands and waters to be similarly situated. This approach is based on hydrologic drivers rather than landscape patterns in terrestrial vegetation, and may be more appropriate. In the Crooked River Basin project listed above, the headwater spring/ephemeral stream types are closely correlated to Wigington and co-authors’ (2013) HLR types (Aldous et al. unpublished data).

Ali

The approach put forward by the proposed rule, i.e. that waters not located in riparian and floodplain settings be assessed on a case-by-case basis, is well aligned with the EPA science report: while the presence of a nexus is not contested, the demonstration of its significance has to be made.

The draft rule mentions that the agencies “*considered multiple approaches and options for how best to address whether ‘‘other waters’’ were jurisdictional under the CWA*”, including determining, “*by rule, that ‘‘other waters’’ are similarly situated in certain areas of the country*”. I agree that ecoregions and hydrologic landscape regions (HLRs) could be used for aggregation purposes. Those concepts are widely used for research purposes and could become powerful regulatory tools by providing a scientific equivalent to the phrase “similarly situated” that was used in previous court rulings and decisions.

Still in relation to “other waters”, the draft rule mentions that the agencies considered the possibility of determining “*by rule that certain additional subcategories of waters would be jurisdictional rather than addressed with a case-specific analysis*”. The draft rule builds on the examples of “*waters such as prairie potholes, Carolina and Delmarva bays, pocosins, Texas coastal prairie wetlands, and western vernal pools*” that could be deemed jurisdictional, as a category, while “*playa lakes in the Great Plains, even in combination with other playa lakes in a single point of entry watershed*” would be considered non jurisdictional for they lack a significant nexus. I am a bit reluctant about this option and do not think that the currently available scientific literature supports that approach. The draft rule goes on to say that “*the [EPA science] Report indicates that there is evidence of very strong connections in some subcategories that are not included as jurisdictional by rule*” but there again, it is unclear to me whether that very qualitative terminology (“very strong”) is a synonym for “significant”. Having other groups or types of waters being determined jurisdictional by rule or category would only be possible if we could rank them according to the frequency and/or magnitude and/or duration with which they actively transfer materials (or prevent the transfer of materials) to downstream waters (see coarse schematic in Figure 1).

Figure 1: Hypothesized/idealized ranking of other waters according to their nexus to downstream waters

While reviewing the EPA science report, the SAB panel discussed – at length – the issue of connectivity being a gradient rather than a dichotomous property, and the issue with "other waters" is that they can be on both extremes of the spectrum (or gradient), i.e. be strongly connected or strongly isolated from downstream waters depending on the prevailing conditions. This makes the assessment of "significant nexus" particularly difficult and until (or unless) rankings or classifications similar to the one hypothesized in Figure 1 are available, I do not think that it would be possible to determine that certain additional subcategories of waters are jurisdictional by rule.

Benda

The proposed rule states "…where effects will be analyzed in combination, the agencies will aggregate these effects…". This statement is unclear on its own and it raises the issues outlined in my comments in Question #1 about aggregate effects. This same issue comes up again in the proposed rule "…the agencies would assess the combined effects of similarly situated "other waters" in the region on the chemical, physical and biological integrity…".

The use of Level III ecoregions may be appropriate for their use in defining areas where "waters are similarly situated and aggregation could be used (Map A in docket). However, it might be prudent, unless a more comprehensive analysis is done, to not provide such lists. Rather, it might be best to provide the criteria upon which to consider "aggregation". However, the issue of "aggregation could be used" raises the complexities outlined in responses to Question #1. For example, how exactly would "aggregation" be done (e.g., conceptually, qualitatively or quantitatively)?

The term "landscape unit" is used in the context of aggregate effects and relates to similar hydrologic features and processes, or proximity of features. The EPA could consider using another term, rather than 'landscape unit' that is somewhat ambiguous, and in keeping with the science, may use terms such as similar hydrologic or geomorphic feature having similar processes.

The proposed rule in several areas raises the issue of a "desktop" analysis, presumably using remote sensing and digital data (including DEMs). The rule language might be strengthened if more definition or examples were provided of what constitutes a 'desktop analysis'.

Bernhardt

Having clarified the status of all tributaries and all waters adjacent to tributaries as waters of the United States, the authors are left with the challenge of determining what water bodies outside of these categories must also be protected in order to maintain the physical, biological and chemical integrity of downstream waters. The rule acknowledges that as water bodies become more distant from tributaries and rivers, the extent of their connectivity also declines. It would be useful for the rule to also mention that the size of these water bodies matters as well, small water bodies far from any flowing water system are more isolated (both hydrologically and via transfers of biota) than are large water bodies that are closer. I appreciate that the rule makes a strong case for considering that the aggregate effect of many minimally connected water bodies may be critical for maintaining the biological, chemical and physical integrity of water bodies in one or both of the previous, clearcut categories of jurisdictional waters. Many watersheds have a large number of non-floodplain wetlands that are collectively responsible for the maintenance of baseflows; the attenuation of floods; the production of organic material that fuels downstream food webs; and the trapping or removal of sediments, nutrients and contaminants that would otherwise contribute to the degradation of downstream water quality. Although individually these wetlands may each have minimal connections to downstream waters, the cumulative impact of these diffuse connections is tremendously important to the maintenance of downstream biota and ecosystem integrity. Historically, the destruction of wetlands has caused serious declines in the water quality of U.S. waters and it is crucial that our CWA works to prevent similar degradation in the future. I found the list of criteria that could be used to assess whether an "other water" was connected to downstream waters was comprehensive, reasonable, and well articulated. I found the text of the rule in this section very close in spirit, substance and argument to SRB panel discussion and recommendations on this issue.

Fennessy

This definition of other waters works conceptually, and it acknowledges the cumulative effects of wetlands and other waters on downstream water integrity on a watershed basis, but I wonder how it will be put into practice. Defining waters that, 'either alone or in combination with other waters similarly situated in the region significantly affect the chemical, physical, or biological integrity of waters of the U.S. in a way that is more than speculative or insubstantial', will need substantial guidance to operationalize its implementation in the field. When is an effect more than speculative or insubstantial? Adopting the framework suggested in the SAB Panel report would help address this by recognizing the gradient of connectivity and where thresholds may be crossed. And while evaluation of 'other waters' on a case-by-case basis (with no specified criteria) does not further the goal of providing regulatory predictability, in some cases the BPJ of agencies in the field will have to be relied upon. This again will require the development of methods to determine when a nexus is significant, including metrics based on hydrologic, chemical and biological connectivity. As it stands now, the draft rule stresses hydrologic connectivity with little recognition of other vectors of connectivity such as the movement of biota. A key question is where, along the gradient of connectivity, do the effects of other waters become significant?

Basing the definition on similarly situated waters, and their cumulative contribution to the integrity of downstream waters, is a sound approach. It is well established that wetlands that share a common hydrogeomorphic setting have similar functions and make similar contributions to downstream waters. I also support the recognition in the draft rule that other waters that lack 'bidirectional hydrologic exchanges' can have important effects on the integrity of downstream waters (pg 22223), however this should be reflected more fully in the working definitions provided.

Gooseff

I interpret this to mean that the other waters are those that are not neighboring. When this is the case, it seems the significant nexus concept provides two extreme opportunities to determine jurisdiction of a single other water body under the CWA – 1) assume all other waters are under jurisdiction of the CWA until otherwise proven to have no significant nexus [though may have some nexus regardless], and 2) assume all other waters are not under the jurisdiction of the CWA until otherwise proven to have a significant nexus to a covered water body. The approach of the new rule provides a reasonable intermediate, that a case-specific assessment must be made to determine whether and what sort of nexus may exist between the water bodies (physical, chemical, and/or biological), and how significant the nexus is. Connections between other water bodies and covered waters may be infrequent and may be invisible at the surface because of a groundwater-mediated exchange of mass and energy between the water bodies. This may indeed prove to be either significant or less than significant after assessment. In my opinion, the case-specific analysis still provides the opportunity for the determination to go either way, rather than de facto categorization (the two cases suggested above) that would have to be overturned to determine the true state of the other water body. Ultimately, the variety of these water bodies and the potential connection types, strengths, and frequencies will determine both whether and how significant any connection could be. This variety of possibilities makes it difficult if not impossible to broadly categorize connection type and significance.

Johnson

Based on the science and the SAB's panel findings, consideration must be given to both the presence and the absence of a significant hydrologic connection; furthermore, biological connections must also be considered in the criteria to establish a "significant nexus" (see comments and citations for CQ2). Biological factors that might be added to the potential criteria (i.e., increasing size and decreasing distance, increased density of the "other water" in similarly situated areas) might include evidence of genetic similarity in key biotic assemblages; evidence of transfer of biotic materials (e.g., propagules, disease vectors) among "other waters, similarly situated), evidence of biota (that contribute to biological integrity of downstream waters) that require the downstream waters to complete their life cycle (life cycle dependency). The science suggests that some non-resident migratory species may significantly influence downstream waters (a)(1)-(a)(3) waters through a significant transfer of disease vectors, nutrients or biomass (*e.g., energy (Lowe et al. 2005; Norlin 1967; Mason and MacDonald 1982; Polis et al. 1997; Sabo and Power 2002; Baxter et al. 2005; Spinola et al. 2008; Pearse et al. 2011); the movement of nutrients by biota (McColl and Burger 1976; Johnston and Naiman 1987; Davis 2003; Vrtiska and Sullivan 2009); the introduction of disease vectors (Blanchong et al. 2006); and the provisioning of habitat essential for biological integrity and completion of life cycles of downstream species (Brooks et al. 1998; Miyazano et al. 2010; Julian et al. 2013).*" Pg 53 SAB panel report) in addition to the examples listed.

It is exactly true that the determination of these waters may be resource-intensive. Thus it would behoove the agencies to establish a set of baseline criteria that would enable a hierarchically structured decision framework that would first establish the potential for hydrologic connections via surface, shallow subsurface, or groundwater flowpaths. The SAB panel recognized that such connections occur across a gradient that varies through time. Yet hydrologic modeling and / or spatial modeling in conjunction with satellite remote sensing and aerial photography may provide the basis for determining the presence of physical connections over time frames that include long duration wet regimes (c.f. Winter and Rosenberry 1998). Such an empirical depiction of "connected" landscapes could form the starting point for further assessments that would be followed by more rigorous analyses of subsurface flow paths, and subsequently biological studies that would establish whether the observed connections meet the standard of a "significant nexus". While the SAB panel recognized that over space and time most water bodies are connect, they acknowledged that such connections may not significantly affect the integrity of jurisdictional waters (a)(1) – (a)(3) and thus would not meet the standard of a "significant nexus".

Determine by rule that ''other waters'' are similarly situated in certain areas of the country.
Response: Ecoregions are not appropriate spatial units over which to determine the issues of whether or not a region is deemed to be "similar". Ecoregions were mainly developed based on terrestrial vegetation communities, in combination with soils and climate. These units are not meant to reflect hydrologic regions. The SAB panel recommended the use of Hydrologic Landscape Regions as a more appropriate base from which to delineate similar regions.

Determine by rule that certain additional subcategories of waters would be jurisdictional rather than addressed with a case-specific analysis, and that other subcategories of waters would be non-jurisdictional.
Response: Some specific wetland types and regions have been sufficiently well-studied to determine that they should be considered jurisdictional, e.g., Prairie Potholes, Carolina bays, coastal prairie wetlands. The agency should accelerate efforts to further establish the basis for such determinations for

other classes of waters. I especially suggest that the in addition to western vernal ponds, that vernal ponds on the east coast and the upper Midwest be considered. Recent efforts to map vernal pools in northern Minnesota reveal that the density far exceeds previous estimates.

I do not support the proposal that remaining "other waters" automatically be classified as non-jurisdictional; rather, there should be an established protocol that establish the decision framework for such a decision. The more structured and spatially-relevant this decision framework can be, the fewer resources each case by case determination will require.

Kolm

This Rule is still reliant on distance and needs to be flow path oriented with spatial and temporal components! To clarify the connectivity of "other waters" to "waters of the US", the SAB recommends that a conceptual framework be established expressed as continuous hydrological (surface and subsurface), chemical, and biological flowpaths connecting watersheds from top to bottom, and therefore connecting other waters and wetlands to downgradient waters. The flowpath framework should highlight the four-dimensional nature of connectivity, because four-dimensional connectivity scaled in a habitat-to-catchment context is a foundational aspect of freshwater ecology (e.g., Ward 1989). The flux and transformation of water, materials, and organisms – which fundamentally control the integrity of downgradient freshwater ecosystems – occur at varying rates primarily determined by climate, geology, topographic relief, and biology and are expressed in terms of surface water and ground water storage and flow through the landscape (e.g., uplands, wetlands, lakes, rivers, and floodplains). Therefore, these flowpaths are inherently four-dimensional (i.e., longitudinal, lateral, vertical, and through time).

Page 22212:

The agencies also request comment and information below on how the science could support other approaches that could provide greater regulatory certainty regarding the jurisdictional status of ''other waters''

There are methods for quantification regarding connectivity of these types of systems specifically the "other waters" – both physical (fluids) and chemical (transport), and biological. Future efforts to assert jurisdiction over "other" waters connected through a shallow subsurface hydrologic connection or confined surface hydrologic connection regardless of distance and to quantify connectivity can be informed by the wide variety of conceptual models and quantitative tools that have been developed to evaluate the connectivity of both surface and subsurface hydrological systems in different settings, including non-floodplain wetlands. The standard approach involves first characterizing the surface and subsurface elements of landscapes. Important elements include climate, geology, topographic relief, and the amount, distribution and types of waters and wetlands. These elements can then be integrated to create a flowpath network that describes connectivity (Heath 1983; ASTM 1996; Kolm et al. 1996; Winter et al. 1998). This approach has been extended to biological connectivity and hydrogeomorphic (HGM) wetland classifications (e.g., Kolm et al. 1998). Of course, the approach to quantifying hydrologic connectivity is not identical across systems, and careful attention must be given to identifying the most appropriate techniques (Healy et al. 2007; Bracken et al. 2013) and metrics (Ali and Roy 2010).

Other examples can be found in the literature related to water quantity and quality modeling (Appel and Reilly 1994; Sun et al. 1997; Harbaugh 2005; Parkhurst et al. 2010; Cunningham and Schalk 2011), and integrated surface water ground water modeling (Markstrom et al. 2008; Ely and Kahle 2012; Huntington and Niswonger 2012; Woolfenden and Nishikawa 2014), sediment transport modeling (Nelson et al.

2003; McDonald et al. 2005), and watershed and biological/habitat/landscape modeling (Kinzel et al. 1999; Kinzel et al. 2005; Hunt et al. 2013). Approaches have also been developed to quantify linkages due to ground water movement and storage (Heath 1983) and the effects of "flood pulses" (Kolm et al. 1998). Likewise, the role of chemical movement and storage to ground water systems in floodplains has been quantified by flow and transport modeling (Winter et al. 1998; Markstrom et al. 2008; Woolfenden and Nishikawa 2014) as well as with steady-state and transient analyses that simulate temporal changes (Appel and Reilly 1994; Winter et al. 1998; Nelson et al. 2003; Conaway and Moran 2004; Harbaugh 2005; McDonald et al. 2005; Markstrom et al. 2008; Huntington and Niswonger 2012).

Page 22212:

Water sheds are used solely, the effects of regional groundwater systems or basins is ignored! Connectivity via regional groundwater systems needs to be considered! In general, the role of regional groundwater systems in neighboring systems is not addressed by this Rule and leaves the waters of the US vulnerable. The Rule focuses primarily on the site and subregional scales, and on watershed boundaries. This tends to either ignore or at least downplay the potential significance of regional-scale hydrologic connectivity, especially as it relates to ground water in adjacent and /or neighboring systems. This is a problem because regional ground water flows commonly interact with the surface environment at sinks and springs. For example, the Floridan aquifer underlies all of Florida as well as portions of Mississippi, Alabama, Georgia, and South Carolina and commonly interacts with the surface environment through sinks, springs, and outcrops (see Sun et al. 1997 and references therein). To provide a better understanding of ground water connectivity, and the way that ground water connectivity might vary spatially, the SAB recommends that the EPA also consider using the ASTM D5979-96 *Standard Guide for Conceptualization and Characterization of Ground Water Systems* (ASTM 1996; Kolm et al. 1996). To better characterize regional-scale ground water connectivity, the SAB recommends that the EPA also consider using findings from the U.S. Geological Survey Regional Aquifer Systems Analysis (RASA) Program. An understanding of regional ground water flow systems is critical to the understanding of four-dimensional hydrologic connectivity on both the local and regional scales. Understanding ground water flow in unique hydrogeologic settings, including the Floridan aquifer system (karst systems), the High Plains aquifer system (semi-arid systems), and the Snake River Plain and Rio Grande Rift aquifer systems (volcanic bedrock systems), is especially important. These and other unique hydrogeological settings are covered by the RASA Program (Sun et al. 1997).

To clarify the connectivity of other waters to "waters of the US", the SAB recommends that a conceptual framework be established expressed as continuous hydrological (surface and subsurface), chemical, and biological flowpaths connecting watersheds from top to bottom, and therefore connecting waters and wetlands to downgradient waters. The flowpath framework should highlight the four-dimensional nature of connectivity, because four-dimensional connectivity scaled in a habitat-to-catchment context is a foundational aspect of freshwater ecology (e.g., Ward 1989). The flux and transformation of water, materials, and organisms – which fundamentally control the integrity of downgradient freshwater ecosystems – occur at varying rates primarily determined by climate, geology, topographic relief, and biology and are expressed in terms of surface water and ground water storage and flow through the landscape (e.g., uplands, wetlands, lakes, rivers, and floodplains). Therefore, these flowpaths are inherently four-dimensional (i.e., longitudinal, lateral, vertical, and through time).

Ground water connectivity, in particular, could be better represented in the Rule. The U.S. Geological Survey (USGS) has published numerous reports and learning tools on ground water connectivity, including examples of flowpath frameworks expressed in block diagrams (Heath 1983, 1984; Winter et al. 1998), that contain flows through floodplains. Care should be taken not to imply that bedrock is impermeable because ground water flows through bedrock are important flowpaths that connect hydrologic landscapes over long distances and often across watershed boundaries (e.g., Roses et al. 1996).

Restated and note references: Using Hydrologic-Landscape Regions and Ecoregions as a basis for determining the connectivity of hydrologic and biologic systems to "waters of the U.S." is an excellent first step in understanding the holistic nature of these systems in any location when combined with the standard approach that involves characterizing the surface and subsurface elements of landscapes to determine flowpath networks at multiple temporal and spatial scales. Important elements include climate, geology, topographic relief, and the amount, distribution and types of waters and wetlands. These elements, in context with the HLRs and Ecoregions, can then be integrated to create a flowpath network that describes connectivity (Heath 1983; ASTM 1996; Kolm et al. 1996; Winter et al. 1998). This approach has been extended to biological connectivity and hydrogeomorphic (HGM) wetland classifications (e.g., Kolm et al. 1998).

Patten

Question 3 response. This description of a significant nexus of other waters that have to be considered on a case-specific basis requires a strict understanding of the actual connection that can be satisfied through relationships to other waters. Without the significant nexus which requires a thorough understanding of physical, chemical or biological connectivity, the connection will not hold. Thus, the qualifier of this condition is the need for scientific studies of each case and a general discussion of significant nexus in the policy and its supporting science is inadequate.

Rains

Type (a)(7) Waters: Other Waters

The *Connectivity Report* and other literature clearly establish that other waters can affect the chemical, physical, and biological integrity of downgradient waters, though they do so on a gradient from having negligible to important effects. The proposed rule therefore will treat these not as waters of the US by definition but, rather, as waters of the US on a case-by-case basis if there proves to be a significant nexus between the other wetland or group of wetlands and the chemical, physical, and biological integrity of downgradient waters. While the science supports this as a general approach, it will be important to carefully define what is meant by "case-by-case", and what happens following a case in which specific other wetland or group of wetlands are determined to be waters of the US.

The proposed rule defines a group of wetlands geographically, grouping wetlands only within a given watershed. The proposed rule then defines watershed as all land from which surface water could drain to the nearest single entry point to a type (a)(1)-(a)(3) water. Such a definition has some problems.

There could be innumerable groups on uplands directly adjacent to a linear type (a)(1)-(a)(3) water. Imagine, for example, a navigable river running along the toe of a hillslope with innumerable seeps and springs, each of which or small groups of which discharging at different single points of entry to the river. Further imagine that the seeps and springs are a single hydrologic system, recharging due to infiltration of precipitation at the ridgetop and expressing along a linear geologic contact that outcrops at a common elevation all along the hillslope. By the proposed definition of watershed, one might conclude that a significant nexus assessment would need to be conducted above every single point of entry, thereby conducting a significant nexus assessment many times over on the same hydrologic system. This would be a clear waste of effort, because a single, well-designed and well-conducted significant nexus assessment would likely suffice. And, if a single, well-designed and well-conducted significant nexus assessment would likely suffice in the case above, then the logical extension might be that a single, well-designed and well-conducted significant nexus assessment might also likely suffice for any single type of hydrologic system, if such a type of hydrologic system were well defined.

Consider, for example, vernal pools in the Sacramento Valley. Both east and west sides of the Sacramento Valley are draped with Pleistocene to Pliocene alluvial fans terminating at the Holocene basin floor along the Sacramento River. These alluvial fans are nearly level to undulating but gently slope toward the basin floor. They have well-developed drainage networks, being dissected by streams and rivers tributary to the Sacramento River. Major geologic formations include the Riverbank and Red Bluff formations, with the Riverbank formation being 130K-450K BP in age and the Red Bluff formation being 450K-1.08M BP in age (Helley and Harwood, 1985), both of which being old enough for substantive pedogenic processes to have occurred (Helley and Harwood, 1985; Smith and Verrill, 1998). The USDA–Natural Resources Conservation Service has mapped several soil series with silica- and iron-cemented duripans on these formations, including the Redding series. These formations are also old enough for substantive subaerial erosion to have occurred, so microtopographic relief also is well developed, with mound-depression topography and irregular to coherent and intermittent to seasonal drainage networks commonly connecting depressions to streams and rivers tributary to the Sacrament o River (Smith and Verrill, 1998). The vernal pools and swales that occur on these hardpan soils have been extensively studied (e.g., Rains et al. 2006; 2008). Wherever they occur, they have common hydrological, geochemical, and biological attributes and processes, with such attributes and processes a function of the underlying geologic setting. This geologic setting does not only occur in a small, closely centered area – rather, this geologic setting repeats in mappable units all over both sides of the Sacramento Valley. If a significant nexus assessment is done on these types of vernal pools in one location, then it quite likely suffices for another similarly situated location.

The summary of this is that case-by-case should not be defined simply by proximity. Such a definition is inconsistent with scientific understanding of the controls on hydrological, geochemical, and biological structure and function. Such a definition also would place an undue burden on the regulated public, who would be required to repeatedly perform significant nexus assessments on the same types of wetlands. It would therefore be better to have a clear pathway by which entire classes of wetlands can be determined to have a significant nexus with the chemical, physical, and biological integrity of downstream waters and can thereafter be considered waters of the US by definition.

Rodewald

The Connectivity Panel disagreed with the EPA Report's conclusion that the literature did not provide sufficient information to evaluate or generalize about the degree of connectivity or its downstream consequences. As such, the Panel requested better acknowledgement that the science does show that non-floodplain waters and wetlands can have strong and important impacts on the physical, chemical, and biological integrity of downstream waters.

The Connectivity Panel agreed that downstream consequences of waters and wetlands in non-floodplain settings will likely require a case-by-case evaluation that considers the magnitude, duration, frequency, predictability, and consequences of water, material, and biotic fluxes to downstream waters, and their impact on the integrity of downstream waters. An additional recommendation was to establish relevant guidelines identifying baseline temporal intervals that are likely to meaningfully connect non-floodplain wetlands and waters to downstream waters.

I'm unclear about the jurisdiction of wetlands that have a surface or subsurface water connection (italicized text from draft rule below). If a wetland in a non-floodplain setting has a connection to the river network, then is it a tributary or an "other water"? Or is seeing the connection effectively the "case-specific analysis" needed to make it jurisdictional?

Regarding wetlands and open waters located outside of floodplains and riparian areas, the Report finds that they provide many benefits to rivers, lakes, and other downstream waters. If the wetland or open water has a surface or shallow subsurface water connection to the river network, it affects the condition of downstream waters. Where the wetland or open water is not connected to the river network through surface or shallow subsurface water, the type and degree of connectivity varies geographically, topographically, and ecologically, such that the significance of the connection is difficult to generalize across the entire group of waters.

There was strong agreement among Panel members that connectivity assessments should explicitly consider aggregate and cumulative effects of wetland complexes. I was pleased to see that the rule provided guidance about how and when to aggregate with the phrase "similarly situated".

"*Other waters'' will be evaluated either individually, or as a group of waters where they are determined to be similarly situated in the region. Waters are similarly situated where they perform similar functions and are located sufficiently close together or when they are sufficiently close to a jurisdictional water. How these ''other waters'' are aggregated for a case-specific significant nexus analysis depends on the functions they perform and their spatial arrangement within the ''region'' or watershed. For other waters that perform similar functions, their landscape position within the watershed (i.e., the ''region'') relative to each other or to a jurisdictional water is generally the determinative factor for aggregating waters in a significant nexus analysis, which will focus on the degree to which the functions provided by those ''other waters'' affect the chemical, physical, or biological integrity of (a)(1) through (a)(3) waters and whether such effects are significant."*

The similarly-situated case for aggregation requires similar functions, but what if there is a wetland complex where some wetlands are connected and others are important for storage due to lack of connection?

"*A hydrologic connection is not necessary to establish a significant nexus, because, as Justice Kennedy stated, in some cases the lack of a hydrologic connection would be a sign of the water's function in relationship to the traditional navigable water, interstate water or the territorial seas. These functional relationships include retention of flood waters or pollutants that would otherwise flow downstream to the traditional navigable water, interstate water or the territorial seas."*

I support the Agency's consideration of using subcategories that identify groups for which there is evidence of strong connections and thus should be jurisdictional.

I appreciate that they are trying to provide guidance on how to evaluate different kinds of connectivity, but these are largely describing how to identify the presence or absence of different "types" of connections, rather than the degree of those connections. (below) *p. 22214:*

Evidence of chemical connectivity and the effect on waters can be found by identifying: Whether the properties of the water in question are similar or dissimilar to an identified (a)(1) through (a)(3) water; signs of retention, release, or transformation of nutrients or pollutants; and the effect of landscape position on the strength of the connection to the nearest ''water of the United States,'' and through it to an (a)(1) through (a)(3) water. In addition, relevant factors influencing chemical connectivity include hydrologic connectivity (see physical factors, below), surrounding land use and land cover, the landscape setting, and deposition of chemical constituents (e.g. acidic deposition).

Evidence of physical connectivity and the effect on (a)(1) through (a)(3) waters can be found by identifying evidence of physical connections, such as flood water or sediment retention (flood prevention). Presence of indicators of hydrologic connections between the other water and jurisdictional water are also indictors of a physical connection. Factors influencing physical connectivity include rain intensity, duration of rain events or wet season, soil permeability, and distance of hydrologic connection between the ''other water'' and the (a)(1) through (a)(3) water, depth from surface to water table, and any preferential flowpaths.

Evidence of biological connectivity and the effect on waters can be found by identifying: resident aquatic or semi-aquatic species present in the ''other water'' and the tributary system (e.g., amphibians, aquatic and semi-aquatic reptiles, aquatic birds); whether those species show life-cycle dependency on the identified aquatic resources (foraging, feeding, nesting, breeding, spawning, use as a nursery area, etc.); and whether there is reason to expect presence or dispersal around the ''other water,'' and if so whether such dispersal extends to the tributary system or beyond or from the tributary system to the ''other water.'' Factors influencing biological connectivity include species' life history traits, species' behavioral traits, dispersal range, population size, timing of dispersal, distance between ''other water'' and an (a)(1) through (a)(3) water, the presence of habitat corridors or barriers, and the number, area, and spatial distribution of habitats. Non-aquatic species or species such as non-resident migratory birds that are not demonstrating a life cycle dependency on the identified aquatic resources are not evidence of biological connectivity for purposes of this rule"

Rosi-Marshall

Response: The justification for "other waters" being evaluated on a "case by case" basis or as a group to determine the extent to which they have a significant nexus with downstream waters is well described in the proposed rule. I agree that considering groups of "similarly situated" waters and the extent to which they affect downstream waters in aggregate is justified and would alleviate the need for extensive "case by case" analysis. The approach to consider "similarly situated" systems and evaluate their connectivity as a group makes sense based on our ecological understanding of these systems, i.e. that similar systems in a region may act in similar ways and that not every water is unique. In addition, these systems should be considered in aggregate, as the degree to which they influence downstream waters will be more apparent when considered in aggregate.

The SAB Report provides additional information on how "other waters" should be defined and how they may be connected to downstream waters even when an apparent hydrologic surface flow is lacking. It is very important that the ideas put forward by the SAB in response to this section of the Connectivity Report be considered when making the final rule about "other waters". Although these systems may not be adjacent to downstream waters and therefore may lack an explicit surface water hydrologic connection, they may function, especially in aggregate, in ways that influence the biological and chemical integrity of downstream waters. These ideas are well developed in the SAB report and these ideas should be explicitly considered during the final rulemaking in regards to these “other waters”.

Sullivan

Recognizing the myriad connections between non-floodplain and non-riparian waters and wetlands and downstream waters (via surface water, shallow subsurface flowpaths, shallow or deep ground water flowpaths, or through chemical and biological connections) with specific attention paid to the magnitude, duration, frequency, predictability, and consequences of these connections is critical to understanding that all water bodies are likely connected to some extent to downstream waters, although the degree of connectivity can vary widely. The proposed rule draws heavily on hydrological connections, and should weight other connections equally. For instance, there is growing scientific evidence regarding biological connections between non-floodplain wetlands and other water bodies and downstream waters, including the bulk exchange of materials via biota, biota as disease vectors, the movement of nutrients by biota. Other water bodies can also provide critical habitat, which can be essential for the life-cycle requirements of downstream species. There is some discussion of these points (e.g., 22214, 22222), but the full scope of biological connectivity is not fully established in the proposed rule (particularly relative to the role of biota as vectors of nutrients, contaminants, and other materials). For example, the proposed rule recognizes that even when hydrological connections are visibly absent, many waters still can influence downstream waters, yet states that “However, such circumstances would be uncommon” (22249). To the contrary, birds and other organisms can be key movers of nutrients, plants (seeds), and invertebrates between wetlands and downstream waters across ranges of spatial scales (e.g., Figuerola et al. 2003, Green et al. 2008).

I believe that the science is currently available (partially summarized starting 22250) to demonstrate that sufficient connectivity exists without a case-specific analysis for certain subcategories of “other waters” (22216) (e.g., prairie potholes, Carolina and Delmarva bays, pocosins, Texas coastal prairie wetlands, western vernal pools). However, I do not believe that the science is sufficiently developed to support a determination to exclude any groups of “other waters” (or subcategories thereof, e.g., Great Plains playa lakes) from jurisdictional status at this time in spite of the resource-intensive nature of a case-specific analytical approach. Before such determinations are made, additional research is required to establish degree of connectivity, analysis of spatial and temporal variability, and threshold levels of connectivity. This research will be a requisite step in further refining rules relative to the jurisdictional status of “additional other waters of the US” and in particular, if “categories of ‘other waters’ are similarly situated and have a significant nexus and are jurisdictional by rule, or that as a class they do not have such a significant nexus and might not be jurisdictional” (22216-22217). The best way to incorporate the developing science in the future is an excellent question; I look forward to Panel discussion on this point.

Determining if waters are “similarly situated” is a reasonable approach with scientific support (22247). Biotic community assemblage and presence/absence of species might be other metrics used to assess similarity, along with the factors currently provided as examples in the proposed rule (22213: habitat, water storage, sediment retention, pollution sequestration). Whereas analyzing the chemical, physical, and/or biological effects “other waters” perform in concert with other similarly situated water bodies is technically sound, supported by the science, and provides a basis for decision-making, water bodies that are disparate relative to their characteristics and function may also contribute to the cumulative effects of the water bodies in a region, and thus there may be cases wherein it is appropriate to analyze “other waters” in the aggregate (in contrast to a whole-scale statement indicating that it would be “inappropriate … to consider ‘other waters’ as ‘similarly situated’ if these ‘other waters’ are located in different landforms, have different elevation profiles, or have differ soil and vegetation characteristics …”

(22213). Determining by rule that "other waters" are similarly situated in certain areas of the country is an intriguing idea, although my initial reaction is that Level 3 Ecoregions may be too broad of a classification. Additionally, human alteration of watersheds can alter the types of connections to downstream waters as well as the magnitude, frequency, duration, predictability, and consequences of these connections. How would variability stemming from the role of humans on the watershed landscape be captured within a regional approach?

Relative to a case-specific basis for other waters, the proposed rule correctly recognizes role of aggregate and temporal effects. This is a key point in relation to assessing whether a water body has a "significant nexus". Determining when (temporally) surveys will be conducted, what map scale will be used (although this point is somewhat addressed on 22212, 22226), and how aggregate effects will be determined is critical to appropriate assessment of these case-by-case situations. For example, many current databases do not represent the full extent and/or size of the drainage network. For additional comments on this point, see responses to Question #1. This topic is also addressed in the SAB Panel Report.

Tank

General Comment:
Given my expertise and familiarity with the science associated with the Connectivity Report, informing the proposed rule, I found the proposed definition of "other waters" to be accurate and clearly written.

Specific Comment:
Pg 22212, C1, P2, L14: In response to the request by the agencies for comments on the listing of "other waters", I am supportive of the rule as it stands whereby the agencies "do not propose to re-promulgate this list of ''other waters'' because it is unnecessary and has led to confusion where it has been incorrectly read as an exclusive list."

Pg22214, C3, P1, L2: In response to the request by the agencies for feedback on "the inclusion of subcategories of types of ''other waters,'' either alone or in combination with similarly situated waters, that can appropriately be identified as always lacking or always having a significant nexus", I suggest that Comments made through the SAB review of the Connectivity Report could provide suggestions appropriate for inclusion.

Valett

22211: 'other waters' and case-specific assessment - I think the agencies have it right here. There is a clear need to address on a 'case-specific' basis the status of a water body designated as 'other'. In fact on page #22211, right column, 'other waters' are specifically defined as those that require assessment of a 'case-specific significant nexus determination'. The agencies clarify that they will remove an old list of 'others' to eliminate confusion (i.e., the mistaken notion that the list was exhaustive).
The larger issue is whether 'similarly situated' water bodies need to be addressed individually or can be assessed as a 'landscape unit'(see page #22213. left column) in a cumulative context. This language appropriately embraces the cumulative effects of 'neighboring' waters, characteristic of dendritic drainages and 'watersheds' as a whole. I really like the use of 'landscape unit' as it suggests integrated function. The request to employ a 'landscape unit' approach is a tricky one, but one that seems like it can be operationalized (i.e., aggregation on a 'local' basis to establish the landscape unit).
22212-22213: 'in the region' and 'similarly situated' - The agencies have correctly engaged in addressing this issue by clarifying their position on Justice Kennedy's use of 'in the region' and 'similarly situated'. With their approach, 'region' becomes synonymous with watershed (really catchment is the

correct term). Later there appears to be recognition that 'regions' are larger things. Their interpretation does, however, keep the hydrologic linkage (i.e., and evident nexus) at the core of the distinction and that is a strength of the approach. Use of the NHD and HUC-10 tools are appropriate for designation as they are based on the same notion of 'watershed' delineation.

The definition employed for 'similarly situated' waters is nicely rooted in function and appropriately employs the 'landscape unit' concept. While geographic proximity can be misleading (i.e., some things nearby may be disconnected while others afar remain fully integrated), it needs to be included in the use of the term as geographic proximity is the basis of the 'region' notion above and the notion of similarity employed here....even given the clear focus on function. Note, however, when the definition of 'similarly situated' is addressed (left column, bottom, 22213), it is rooted in characteristics of the terrestrial environment (soils, vegetation, landform). Given the emphasis that the SAB has placed on a 'flowpath' conceptual basis for the Water Body Connectivity report, I find it strange that 'hydrologic connectivity to each other or a jurisdictional water' arrives as a caveat...almost an afterthought. I would propose elevating it to the same level of importance as the terrestrial characteristics.

At the same time, the use of 'relatively homogenous soils, vegetation and landform' is a vague distinction. Soils and vegetation are notoriously heterogeneous at different scales. I'm not sure if this notion helps aggregate at all.