NATIONAL WILDLIFE FEDERATION * AMERICAN RIVERS

Science Advisory Board Review Panel
Attn: Dr. Thomas Armitage, Designated Federal Officer (DFO)
EPA Science Advisory Board Staff Office (1400 R)
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

Re: National Wildlife Federation & American Rivers Comments on *Connectivity of Streams and Wetlands to Downstream Waters*: Docket ID No. EPA-HQ-OA-2013-0582

As National Wildlife Federation's wetlands policy expert, and on behalf of National Wildlife Federation and American Rivers, I respectfully submit for your consideration these comments on the report, ***Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*** **("Connectivity Report").**

I. The Final Connectivity Report should provide the best available science on the connectivity of wetlands, streams, and open waters to downstream rivers, lakes, and estuaries.

The Environmental Protection Agency's effort to compile the best available science on the connectivity of wetlands and streams is essential to inform the central water policy question of which waters warrant protection in order to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" – the goal of the 1972 Clean Water Act. We value the rigorous scientific peer review underway by the Science Advisory Board (SAB) and the SAB panel of external scientist peer-reviewers.

When the Supreme Court considered the policy question of which waters were "waters of the U.S.," Justice Kennedy, author of the pivotal concurring opinion in *Rapanos*, was clearly asking for the scientific evidence of connectivity to inform the Court's line-drawing, consistent with the goals of the Clean Water Act. Several justices recognized the important functions and connections of wetlands in a watershed context, but Justice Kennedy wanted more specific evidence of how these wetlands affect downstream waters.

Thanks to the draft report's thorough science synthesis, and the SAB peer review, the final Connectivity Report should provide the best available scientific evidence of connectivity and effect for the policy makers and the courts to apply Justice Kennedy's "significant nexus" test:

> [W]etlands possess the requisite nexus, and thus come within the statutory phrase "navigable waters," if the wetlands, either alone or in combination with similarly situated lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as "navigable." When, in contrast, wetlands' effects on water quality are speculative or insubstantial, they fall outside the zone fairly encompassed by the statutory term "navigable waters." *Rapanos v. United States* 126 S. Ct. 2208, 2248 (2006).

However, it is not the charge of the science review panel to limit, withhold, or discount scientific evidence of connectivity based on more subjective regulatory line-drawing with respect to degrees of significance, isolation, and groundwater-versus-surface water connectivity. To preserve the integrity of the scientific peer review, we urge the SAB science panel to ignore industry-led calls to stray from the science review and wade into the policy realm of drawing regulatory jurisdictional lines. The best available scientific evidence of stream and wetland connectivity and effects will be invaluable to the policy makers and the public in the course of the "waters of the U.S." rulemaking.

We urge the science panel to remain focused on the SAB charge to ensure the clarity and technical accuracy of the EPA report overall and its conceptual framework, and to ensure that the literature cited, the findings, and the conclusions reflect the best available science with respect to the connectivity and effects of streams, floodplain wetlands and open-waters, and "unidirectional" wetlands and open-waters located outside of floodplains.

II. The Draft Connectivity Report is generally clear, technically accurate, and largely comprehensive in its literature review.

The draft report is clear and technically accurate in its framework for assessing connectivity. We support the focus on material transport as central to the framework: that streams and wetlands "fundamentally affect river structure and function by altering transport of various types of materials to the river." We also find clear, accurate, and helpful the statement that these altering effects depend on "two key factors: (1) connectivity (or isolation) between streams, wetlands, and rivers that enables (or prevents) the movement of materials between the system components; and (2) functions within streams and wetlands that supply, remove, transform, provide refuge for, or delay transport of materials." *Connectivity Report* at 1-4.

The scientific evidence of connectivity (or isolation) and wetland and stream functions will be essential in applying Justice Kennedy's significant nexus test. Justice Kennedy explains that wetlands perform important ecological functions, such as pollutant filtering and flood retention and "it may be the *absence* of an interchange of waters prior to the dredge and fill activity that makes protection of the wetlands critical to the statutory scheme." *Rapanos* at 2245-46 (emphasis added).

We strongly support the framework's adoption of two important principles for assessing connectivity and effects to downstream waters: 1) identification of the watershed as the appropriate scale to assess connectivity and effects; and 2) recognition that to understand connectivity and effects downstream, "the effects of small water bodies in a watershed need to be considered in aggregate." *Connectivity Report* at 1-14. Understanding the scientific evidence of connectivity and effects in the aggregate and in a watershed context is central to the application of Justice Kennedy's significant nexus test which calls for evaluation of wetlands connectivity and effects downstream "either alone or in combination with similarly situated lands in the region."

The Connectivity Report thoroughly documents and supports its conclusion that "[a]ll tributary streams, including perennial, intermittent, and ephemeral streams, are physically, chemically, and biologically connected to downstream rivers via channels and associated alluvial deposits where water and other materials are concentrated, mixed, transformed, and transported." *Connectivity Report* at 1-3. We commend EPA on its thorough examination of the literature with respect to ephemeral stream connectivity, particularly in the arid southwest.

This conclusion with regard to all tributary streams is fully consistent with and relevant to Justice Kennedy's significant nexus test. Justice Kennedy suggests the current definition of tributary "may well provide a reasonable measure of whether specific minor tributaries bear a sufficient nexus with other regulated waters to constitute 'navigable waters' under the Act." *Rapanos* at 2249. As to tributaries, Justice Kennedy only expresses concern about categorically extending jurisdiction, without more supporting evidence, to all *wetlands* that are adjacent to *any* waters that meet the regulatory definition of tributaries. *Id.*

We also believe the scientific evidence supports the report's conclusion with respect to floodplain wetlands and open-waters that: "[w]etlands and open-waters in landscape settings that have bidirectional hydrologic exchanges with streams or rivers (e.g., wetlands and open-waters in riparian areas and floodplains) are physically, chemically, and biologically connected with rivers" through multiple processes, and that they "serve an important role in the integrity of downstream waters because they also act as sinks by retaining floodwaters, sediment, nutrients, and contaminants that could otherwise negatively impact the condition or function of downstream waters." *Connectivity Report* at 1-3.

The scientific evidence also demonstrates that shallow groundwater connections serve as hydrologic connections between surface waters and should be considered in assessing connectivity and effects on downstream waters. This principle is scientifically sound and widely accepted as legally sound as well.[1]

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[1] *See, Healdsburg*, 496 F.3d at 1000 (citing to underground hydrologic connections as a basis for establishing a significance nexus between two bodies under Justice Kennedy's standard); *United States v. Banks*, 115 F.3d 916, 921 (11th Cir. 1997) (finding that wetlands that were at least one half mile from navigable waters were jurisdictional due to a hydrologic connection that "was primarily through groundwater, but also occurred through surface water during storms"); *United States v. Tilton*, 705 F.2d 429 (11th Cir. 1983) (finding that wetlands with rare surface water connections, but demonstrated ecological and subsurface hydrological connections, were jurisdictional); *see also, Idaho Rural Council v. Bosma,* 143 F. Supp. 2d 1169, 1180 (D. Id. 2001) ("[T]he interpretive history of the CWA only supports the unremarkable proposition with which all courts agree – that the CWA does not regulate 'isolated/nontributary' groundwater which has no affect on surface water. It does not suggest that Congress intended to exclude from regulation discharges into hydrologically connected groundwater which adversely affect surface water. For these reasons, the Court finds that *the CWA extends federal jurisdiction over groundwater that is hydrologically connected to surface waters that are themselves waters of the United States.*") (emphasis added) (citations omitted); *Quivira v. EPA*, 765 F.2d 126 (10th Cir. 1985) (arroyo with continuous groundwater connection and occasional surface water connection to downstream jurisdictional waters protected under the Act); *Washington Wilderness Coalition v. Hecla*, 870 F. Supp. 983, 990 (E.D. Wash. 1994) ("[S]ince the goal of the CWA is to protect the quality of surface waters, any pollutant which enters such waters, whether directly or through groundwater, is subject to regulation by NPDES permit."); *Sierra Club v. Colorado Refining Company*, 838 F. Supp. 1428, 1434 (D. Colo. 1993) (where the Judge stated that, "I conclude that the Clean Water Act's preclusion of the discharge of any pollutant into 'navigable waters' *includes such discharge which reaches 'navigable waters' through groundwater.*") (emphasis added) (citations omitted); *McClellan Ecological Seepage Situation v. Weinberger*, 707 F. Supp. 1182, 1196 (E.D.Ca. 1988), *vacated and remanded on other grounds, M.E.S.S. v. Perry*, 47 F.3d 325 (9th Cir. 1995), *cert.*

III. The Final Connectivity Report should be strengthened and clarified with respect to wetlands and open-waters located outside of floodplains.

The draft report compiles compelling scientific evidence supporting the conclusion that "uni-directional" wetlands and open-waters located outside of floodplains (e.g., many prairie potholes, vernal pools, and playa lakes) "provide numerous functions that can benefit downstream water quality and integrity" and "affect the condition of downstream waters if a surface or shallow subsurface water connection to the river network is present." *Connectivity Report* at 1-3-4.

However, we question the report's statement that there is not sufficient evidence, based on the literature, to evaluate the degree of connectivity or the downstream effects of wetlands in unidirectional landscapes. In our opinion, the report includes more than enough scientific literature to establish the connectivity and downstream effects of unidirectional wetlands, at least in certain unidirectional landscape settings on a regional or watershed basis. Specifically, the science can at least be summarized as establishing that unidirectional wetlands outside of riparian/floodplain areas, when considered as a class, have a more than insubstantial aggregate effect on the chemical, physical, and biological integrity of downstream waters. Moreover, the several categories of unidirectional waters discussed in the report have an even more substantial collective impact. We ask that the final report clarify this point.

The importance of providing for science-based, categorical – versus case-by-case -- findings of connectivity for categories of uni-directional waters cannot be overstated. The scientific evidence for such categorical findings exists and should be accurately reflected in the final report's findings and conclusions. Moreover, while the draft report allows for case-by-case findings of connectivity, the final report should expose the fact that case-by-case connectivity analysis is extremely time and resource intensive and simply impractical in many cases. Realistically, if left to case-by-case analysis, many uni-directional waters -- and their demonstrated ecological influence on downstream waters -- will continue to be discounted, degraded, and destroyed. The integrity of downstream waters will suffer as a result.

The final report should place additional emphasis on the scientific evidence that downstream effects arise from both: 1) surface water *isolation preventing flood flows and material transport*; and 2) ditching and channelization that *exacerbate flood flows and sediment and pollution transport* by artificially connecting wetlands that previously lacked surface water connections to downstream waters. Again, as Justice Kennedy notes, in *Rapanos,* wetlands perform important ecological functions, such as pollutant filtering and flood retention and "it may be the *absence* of an interchange of waters prior to the dredge and fill activity that

denied, 516 U.S. 807 (1995) (where the Court found that discharges to groundwater could be regulated under the Act if "discharges from the waste pits have an effect on surface waters of the United States" and it could be established that the groundwater was "naturally connected to surface waters that constitute 'navigable waters' under the Clean Water Act").

makes protection of the wetlands critical to the statutory scheme." *Rapanos* at 2245-46 (emphasis added).

IV. The Final Connectivity Report should include additional citations to relevant scientific reports demonstrating wetland and stream connectivity.

We hope that the final report will recognize that the scientific evidence of wetland and stream connectivity and isolation will continue to emerge over time, and that decisions with respect to the influence of these waters on downstream waters should be based on the most recent scientific evidence available. In addition, while the draft report is limited to peer-reviewed published scientific literature, we hope that the final report will recognize the wealth of scientific evidence of connectivity (and isolation) that exists as non-published but scientifically-sound grey literature.

Below, we list for consideration additional scientific citations that we consider relevant to wetland and stream connectivity and isolation. We hope the final report will incorporate these citations as appropriate and account for future scientific evidence to come.

A. Additional scientific evidence that ditches connecting directly or indirectly to the tributary system often contribute substantial amounts of pollution and flood water to downstream waters.

Carlisle, D.M., Meador, M.R., Short, T.M., Tate, C.M., Gurtz, M.E., Bryant, W.L. Falcone, J.A., and Woodside, M.D. 2013. *The quality of our Nation's waters – Ecological health in the Nation's streams, 1993-2005*: U.S. Geological Survey Circular 1391, 120 pp., http://pubs.usgs.gov/circ/1391/. (USGS Circular 1391)

"Flowing water is the defining feature of streams, yet streamflows across the Nation have been modified by land and water management, leading to reduced stream health. Annual high or low flows were modified in 86 percent of the almost 3,000 streams assessed by NAWQA across the Nation (chapter 4). Streamflows are modified by a variety of land- and water-management activities, including reservoirs, diversions, subsurface tile drains, groundwater withdrawals, wastewater inputs, and removal of vegetated land cover in the watershed." (at 8)

"In urban areas (Urban Stream) impervious surfaces, such as pavement, lead to increased storm runoff and higher and more variable peak streamflows, which scour the streambed and degrade the stream channel; reduced infiltration to groundwater may also lead to diminished streamflows during dry periods when groundwater is the main source of streamflow." (at 28)

"As watersheds urbanize (Urban Stream), some segments of streams are cleared, ditched, and straightened to facilitate drainage and the movement of floodwaters. These modifications increase stream velocity during storms, which can transport large amounts of sediment, scour stream channels, and remove woody debris and other natural structures that provide habitats for stream organisms. In addition, culverts and ditches can be barriers to aquatic organisms that need to migrate throughout the stream network. Humans can alter natural stream temperature through changes in the amount and density of the canopy provided by riparian trees. In some extreme cases, streams through urban areas are routed through conduits and completely buried." (at 29)

Schottler, S.P., Ulrich, J., Belmont, P., Moore, R., Lauer, J.W., Engstrom, D.R., Almendinger, J.E. 2013. *Twentieth century agricultural drainage creates more erosive rivers.* Hydrol. Process. (2013) at http://onlinelibrary.wiley.com/doi/10.1002/hyp.9738/abstract.

"Artificial drainage was identified as the largest driver of increased flow. The majority of the increase in flow was attributed to changes in water residence time on the landscape and subsequent reductions in ET resulting from installation of artificial drainage networks. This conclusion is supported by the strong correlation between the amount of wetland/depressional areas lost and increase in excess annual water yield in the 21 watersheds."

"Rivers that had significant increases in annual flow volume experienced channel widening of 10-40%, whereas rivers with no flow increase had no change in channel width."

"This set of observations leads to the conclusion that the installation of artificial drainage has created more erosive rivers. The sediment eroded during widening represents an increase in a major non-field source..."

Conservation Effects Assessment Project (CEAP), July 2012. *Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Upper Mississippi River Basin.* USDA, NRCS, 187 pp. at http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042093.pdf

"About 47 percent of cropped acres require additional nutrient management to address excessive levels of nitrogen loss in subsurface flow pathways, most of which returns to surface water through drainage ditches, tile drains, natural seeps, and groundwater return flow." (at 9 and throughout; Figure 80 at 123)

Conservation Effects Assessment Project (CEAP), February 2011. *Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Chesapeake Bay Region.* USDA, NRCS, 158 pp. at http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042076.pdf

"About 62 percent of cropped acres have a high or moderate treatment need to address excessive levels of nitrogen loss in subsurface flow pathways, most of which returns to surface water through drainage ditches, tile drains, natural seeps, and groundwater return flow." (at 11; Figure 82).

Dr. Robert Magnien, *Miles of Ditches have Altered Delmarva Peninsula Hydrology,* Chesapeake Bay Journal April 1999 at http://www.bayjournal.com/article.cfm?article=2128 (last checked 10.31.13).

***See also* 2011 Ducks Unlimited Guidance Comments, appendices, and literature cited (attached) at 15-24; 42-60, including:**

"In most cases, when a pothole is drained or filled, the water that would have otherwise been retained in the basin is shunted to a ditch or other conveyance, and much more rapidly than when the wetland was intact makes its way to a navigable waterway. The significant nexus between the intact pothole and the nearest navigable water, described best as the "absence of [direct] hydrologic connection," then becomes apparent as the altered flow pattern brings more water, carrying more sediment, nutrients and other pollutants, much more rapidly, to the navigable water and downstream communities, farms, and other riverside landowners."

Citing Yang et al 2008 (70% wetland loss in a northeast PPR watershed associated with a 31% increase in area draining downstream, which was associated with a 30% increase in stream flow and an 18% increase in peak flow).

Citing Johnson et al (1997) (33% of the drained wetlands in the flood-prone Vermillion River, SD watershed flowed into artificial drainage ditches, and that a quantity of water equivalent to about half of the river's annual flow could be stored by restoring those wetlands.)

B. Additional scientific evidence of groundwater-surface water connections

USGS Circular 1391, *supra:*

"Water withdrawals for irrigation from streams and aquifers in arid areas have lowered groundwater and surface-water levels in many regions (Jackson and others, 2001)." (at 55)

"During the irrigation season (for example, August), streamflow in the Snake River fluctuates widely over its length in response to diversions, irrigation return flows, and groundwater discharge (Clark and others, 1998)." (at 56)

C. Additional scientific evidence of connectivity/isolation effects of "uni-directional" wetlands on downstream waters

***See* 2011 Ducks Unlimited Guidance Comments, appendices, and literature cited (attached) at 15-24; 42-60, including:**

"Hey (1992) estimated that as a result of approximately two-thirds of the original potholes having been lost through drainage, the region has lost 20-30 million acre-feet of water storage capacity due to drainage of approximately two-thirds of the original potholes."

Citing Ludden et al. (1983)(small basins in the Devil's Lake watershed in North Dakota could store 72% of the total runoff from a 2-year frequency flood and approximately 41% of the total runoff from a 100-year frequency flood).

Citing Hann and Johnson (1968) (depressional areas in north central Iowa could store more than one-half inch of precipitation runoff within their individual watersheds.)

Citing Gleason et al (2007) (found that restoring 25% of the restorable wetlands in west central MN would increase flood storage by 27-32%, and a 50% restoration would increase storage by 53-63%. If these wetlands were natural wetlands and what was under consideration was the impact of their removal, these results provide a sense of the magnitude of impacts on downstream waters, i.e., the significance of the nexus, as a result of the lost flood storage capacity).

Citing Kurz et al (2007) (modeled peak flow reductions associated with artificial storage of precipitation on flooded agricultural lands in the Red River valley and estimated that flood stages like those of the flood of 1997 on the Red River could have been reduced by 2-5 feet at Grand Forks.)

"Yang et al's (2008) study of the Broughton Creek watershed demonstrated that a 31% increase in nitrogen and phosphorus load from the watershed and a 41% increase in sediment loading was associated with wetland loss in the watershed. Thus, when as a result of ditching or filling wetlands the retention time of water is shortened or eliminated and its associated biochemical processes are significantly altered, the cleansing function of the former wetland is lost or degraded and there are direct negative impacts on the quality of receiving navigable waters. Similarly, water retained in a pothole is cleansed of much of its load of pollutants before it enters groundwater and flows laterally to other areas and other waters, or downward into deeper aquifers."

Citing Goldhaber et al (2011); Cowdery et al (2008); Blann et al (2009).

"Duffy and Kahara (2011) showed that wetlands restored by the Wetland Reserve Program in the Central Valley of California provided flood storage of 3195 million cubic meters in 2008. They also documented that, in the aggregate, that the palustrine, riparian, and vernal pool wetlands in the region provided flood storage of 4159, 2182, and 2140 cubic meters, respectively. Thus, loss of wetlands in this region would ultimately increase flood flows in navigable rivers like the Sacramento and San Joaquin."

See also Duffy and Kahara (2011) (Wetland Reserve Program wetlands in the California Central Valley removing substantial amounts of nitrate-nitrogen).

"The increased flood flow that is directly associated with the loss of wetlands from across watersheds and regions (e.g., Brun et al. 1981) is an important factor in streambank erosion. This kind of erosion is a significant water quality problem in many areas downstream of physically non-proximate wetlands in the United States, contributing significantly to sediment pollution loads, including navigable waters. *See also,* Bellrose et al. (1983) and Mills et al. (1966)."

"Fennessy and Craft (2011) estimated that wetlands conserved or restored through Farm Bill programs in the Upper Midwest reduced the region's contribution of nitrogen, phosphorus, and sediment to the Mississippi River by 6.8%, 4.9%, and 11.5%, respectively. Given that excess nitrogen is widely accepted as the primary cause of the hypoxic zone (Moreau et al 2008), these wetlands clearly exhibit a significant nexus and provided significant benefit to the Mississippi River and Gulf of Mexico."

D. Additional scientific evidence that intermittent and ephemeral headwater streams throughout the West contribute cold, clean water to larger perennial tributaries and provide important habitat for fish and other aquatic species.

Stefferud & Steffrud, "Fish Movement through Intermittent Stream Channels: A Case History Study" (2007), *available at* http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/intermittentStreams.pdf (last visited 11.5.13).

Wigington, et al. "Coho Salmon Dependence on Intermittent Streams," (2006), *available at* http://www.roguebasinwatersheds.org/files/intermittent%20streams%20and%20coho.pdf (last visited 11.5.13).

USGS, Water Quality in the South Platte River: Colorado, Nebraska & Wyoming 1992-1995, Circular 1167 at 18 (1998) at http://pubs.usgs.gov/circ/circ1167/ (last visited 11.5.13).

CONCLUSION

Thank you in advance for making these comments and the attached and referenced 2011 Ducks Unlimited Guidance Comments available for the panel's consideration. If you have any questions regarding this letter, please contact me at goldmancarterj@nwf.org.

Respectfully Submitted,

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