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Also a State Comment

(Submitted late)

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JUL 29 2003

EXEC. SECRETARIAT

July 3, 2003

Linda J. Fisher, Acting Administrator
US Environmental Protection Agency
1101A USEPA Headwaters
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

The Honorable R. L. Brownlee
Acting Assistant Secretary
of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310

Re: California Response to the "Advanced Notice of Proposed Rulemaking on the Definition of 'Waters of the United States'." (ANPRM)

Dear Acting Administrator Fisher and Acting Assistant Secretary Brownlee:

We are writing to express great concern with the efforts now underway to alter the regulatory definition of "waters of the United States." We object to any effort to narrow the definition to essentially eviscerate the protections afforded a broad range of wetlands and riparian areas, headwater systems, and other waters in California that are currently protected under the provisions of the Clean Water Act (CWA). We urge you to uphold and enforce the Clean Water Act and the existing, longstanding regulatory definition of "waters of the United States."

As you know, the Supreme Court in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001) (SWANCC) narrowly held that the protection of the CWA did not extend to 17 acres of seasonal ponds used as habitat by migratory birds in Cook County, Illinois. The federal agencies entrusted with implementation of the CWA have subsequently construed the decision as continuing protection of many tributary streams, vernal pools, prairie potholes and other related waters. The 4th, 7th, and 9th Circuits have also adopted this interpretation of the law, finding that SWANCC is a narrow decision with a narrow holding that does not have a broad effect upon CWA jurisdiction. (See *United States v. Interstate General Co.*, *United States v. Krilich*, and *Headwaters, Inc. v. Talent Irrigation District*, respectively.)

Despite the limited holding of SWANCC, on January 10, 2003, the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers (Corps) issued the ANPRM and associated guidance threatening to make significant regulatory changes to narrow the definition of "waters of the United States". This strained interpretation of the SWANCC decision is informed by neither legal nor scientific necessity. It flies squarely in the face of the effective arguments presented by U.S. Department of Justice attorneys in court appearances since SWANCC, and it turns its back on Congress' expressed intent to "restore and maintain

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the chemical, physical, and biological integrity of the nation's waters." Moreover, we find it very disturbing that the joint guidance document directs field staff not to assert CWA jurisdiction over isolated waters based on any of the factors listed in the "Migratory Bird Rule." The federal agencies thereby choose to limit federal jurisdiction beyond what the Supreme Court found necessary, and inappropriately call into question whether CWA jurisdiction can now be predicated on the other Commerce Clause factors; i.e., use of waters by interstate/foreign travelers, presence of fish sold in interstate commerce, and use of water for industries in interstate commerce.

The potential regulatory changes implicit in the ANPRM would result in elimination of many waters that comprise habitat for an extraordinary diversity of fish, birds, and other biota in California, and would further jeopardize our already vanishing vernal pools and other wetlands. Based on GIS projections developed collaboratively by our state agencies, California waters potentially affected by the proposed rule change include 77,371 acres of isolated wetlands. California's population is projected to increase by nearly a third by the year 2020, and much of this growth will occur where the potentially affected waters are located. It is clear to us that the proposed withdrawal of federal regulatory responsibility will result in severe losses of sensitive waters and the biota which depend on them. Many of these plant and animal species are already listed under state and federal endangered species acts. California is fortunate among all the states in ranking first in biodiversity and in endemism. Less fortunately, we rank second (behind only Hawaii) in the percent of our species which are at risk.¹ A high percentage of these at-risk species are associated with wetlands and riparian areas, including those potentially affected by the proposed redefinition of federal waters.

"Isolated" waters generally provide the same functions as do similar, indisputably jurisdictional waters. As noted above, the proposed expansive interpretation of the SWANCC decision would result in loss of wetlands, riparian areas, headwater systems, and other waters in California. This is entirely inconsistent with the major investments the state and federal governments are making in restoring and acquiring wetlands, riparian areas, and headwater streams. For example, the California Wildlife Conservation Board during the time period covering January 1991 to February 2003 has invested \$159,292,300 in restoring and acquiring 244,000 acres of wetlands habitat and \$424,403,000 in restoring and acquiring 174,600 acres of riparian habitat statewide. Many other state agencies, including the State Coastal Conservancy and State Parks, have invested tens of millions of dollars in acquiring and restoring wetlands and riparian habitat over the same time period. In recent years, California has obligated over \$2.5 million of CWA section 319 grant funds to wetland and riparian restoration. The state has spent \$50 million of State Revolving Funds for flood management projects with major wetland and riparian restoration components, with an additional \$10 million of State Proposition 13 bond funds spent for the same purpose. Very substantial additional investments are being made throughout California by the CALFED Program and private conservancy organizations. To allow the destruction of these resources on one hand while spending public and private funds to restore and protect them on the other is illogical at best.

¹ Nature Conservancy, *States of the Union: Ranking America's Biodiversity*, April 2002.

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California has historically relied on the Corps' protection of wetlands under CWA section 404 and has not established an independent wetland permitting program. Federal abdication in this important field would represent a dramatic shift in responsibility. We are certain that it would cause irreparable harm to the potentially affected waters. As with many other states, California will not be able to comprehensively replicate the Corps' regulatory role in the foreseeable future because of its current budget crisis. It is also completely unrealistic to expect local planning authorities to shoulder this responsibility. The entirely foreseeable result would be dramatic impacts to the potentially affected waters; e.g., loss of their functions in supporting biodiversity, removing pollutants, attenuating floodflows, and providing habitat connectivity; and resulting degradation of the chemical, physical, and biological integrity of the navigable waters.

On March 13, 2003, the California State Water Resources Control Board (SWRCB) submitted to the federal agencies a legal, technical, economic, and programmatic analysis of the potential impact of the proposed redefinition of federal waters. We concur with this analysis, support its recommendations, and herewith include it with our own comments (Attachment). However, we wish to amplify the SWRCB's recommendation that the federal agencies "modify delineation protocols for riparian areas to recognize the dynamic nature of Western dryland hydrologic regimes, and the associated effect on riparian location and function." For the same hydrologic reasons cited by the SWRCB, even those Western riparian areas which are within CWA jurisdiction often do not receive the higher level of protection given to wetlands because they fail to meet the hydric soil and/or hydrology criteria. We reiterate that in the West these riparian areas, although inundated relatively infrequently, are as important as wetlands in supporting onsite biodiversity, removing pollutants, storing flood waters, and providing habitat connectivity. We concur with the National Academy of Sciences (NAS) that "...existing legal and management protection of the ecological functions and values of riparian areas is inadequate".² We, therefore, recommend that the federal agencies ask the NAS to review whether the current protocols used to delineate jurisdictional waters and wetlands adequately protect riparian functions and values in the Western United States, and to subsequently revise the protocols as appropriate.

We also note that narrowing the definition of federal waters would roll back federal protection well beyond the limited scope of the SWANCC decision. As acknowledged in the ANPRM, the proposed revisions to existing regulation would affect jurisdiction under all sections of the CWA, including sections 401, 402, 404, and other sections which for over 30 years have provided the bedrock foundation of regulatory protection of the nation's waters. The proposed rulemaking would strike at the root of CWA authority and, in this sense, could hardly be more radical. We urge you to uphold and enforce the existing, longstanding

² National Academy of Sciences. 2002. *Riparian Areas: Functions and Strategies for Management*. National Academy Press, 2102 Constitution Avenue, N. W., Washington, D. C. 20418.

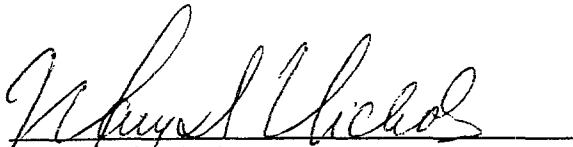
Linda J. Fisher, Acting Administrator
The Honorable R. L. Brownlee
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regulatory definition of "waters of the United States" and the proven federal-state partnership which it supports.

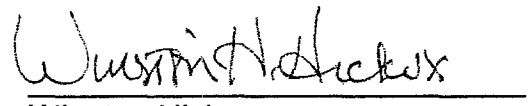
California's economic and intangible wealth is founded, directly and indirectly, on the extraordinary natural environment which we are privileged to enjoy and conserve. We firmly believe that environmental quality and economic prosperity are not at odds. Rather, they are indissolubly linked. We believe that to pursue perceived immediate economic advantage for a narrow sector of the business community at the cost of serious and irreversible environmental degradation is shortsighted and unwise, at best, and will cause substantial economic disadvantage in the long term.

We hope that we have been able to provide you with a better understanding of the potentially serious implications for the State of California, and we ask that the federal agencies continue to recognize the longstanding regulatory definition of "waters of the United States" and to not undermine basic protections in the Clean Water Act.

Yours sincerely,



Mary D. Nichols
Secretary, California Resources Agency



Winston Hickox
Secretary, California
Environmental Protection Agency

Attachment: Comment on Advanced Notice of Proposed Rulemaking on Definition of
"Waters of the United States"

cc: (See Page Five)

Linda J. Fisher, Acting Administrator
The Honorable R. L. Brownlee
July 3, 2003
Page Five

cc: The Honorable Barbara Boxer
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The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.swrcb.ca.gov.

MAR 13 2003

Water Docket Staff
Water Docket Mail Code 4101T
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

Attn: Docket ID No. OW-2002-0050.

Dear Staff:

COMMENT ON ADVANCED NOTICE OF PROPOSED RULEMAKING ON DEFINITION OF "WATERS OF THE UNITED STATES"

Thank you for the opportunity to comment on the January 10, 2003 "Advance Notice of Proposed Rulemaking On Definition Of 'Waters Of The United States'" (ANPRM). The ANPRM responds to the 2001 U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC)* and requests comment on (1) whether commerce clause factors currently listed in federal regulation should continue as a basis for Clean Water Act (CWA) jurisdiction and (2) whether federal regulations should define "isolated waters," and if so how. In answering these questions the ANPRM suggests that the public provide information on projected environmental impacts, functions and values of waters that may be affected, projected impacts on commerce, other regulatory changes which should be made, the availability of state programs to protect affected waters, and the effect on TMDLs. As noted in our February 10, 2003 request for an extension of the comment period for the ANPRM, the inter-related nature of the above questions precludes a comprehensive response within the time available.

The *SWANCC* decision threw uncertainty over the use of the commerce clause to determine CWA jurisdiction over a poorly defined set of "isolated" waters. In clarifying this issue we believe it is legally and scientifically essential to refer to the overarching Objective of the CWA: "... to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." We respond to the two specific questions posed in the ANPRM from this perspective and broadly indicate how the proposed redefinition of "waters of the United States" could affect California's waters, economy, and water quality programs.

Our comments are enclosed. In summary, we recommend for legal, technical, economic, and programmatic reasons that the federal agencies maintain jurisdiction over the broadest scope of waters consistent with the *SWANCC* decision. We further recommend that any reduction in

California Environmental Protection Agency

MAR 13 2003

cc: (Continued)

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STATE OF CALIFORNIA
State Water Resources Control Board

COMMENT ON ADVANCED NOTICE OF PROPOSED RULEMAKING ON
DEFINITION OF "WATERS OF THE UNITED STATES"

March 13, 2003

The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) have promulgated a January 10, 2003 "Advance Notice of Proposed Rulemaking On Definition Of 'Waters Of The United States'" (ANPRM). The ANPRM responds to the 2001 U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC)* and requests comment on (1) whether commerce clause factors currently listed in federal regulation should continue as a basis for Clean Water Act (CWA) jurisdiction and (2) whether federal regulations should define "isolated waters," and if so how. In answering these questions the ANPR suggests that the public provide information on projected environmental impacts, functions, and values of waters that may be affected, projected impacts on commerce, other regulatory changes which should be made, the availability of state programs to protect affected waters, and the effect on TMDLs.

The *SWANCC* decision threw uncertainty over the use of the commerce clause to determine CWA jurisdiction over a poorly defined set of "isolated" waters. In clarifying this issue we believe it is legally and scientifically essential to refer to the overarching Objective of the CWA: "... to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."ⁱ We respond to the two specific questions posed in the ANPRM from this perspective and broadly indicate how the proposed redefinition of "waters of the United States" could affect California's waters, economy, and water quality programs.

POTENTIALLY AFFECTED CALIFORNIA WATERS

We expect that California's waters could be heavily affected by the proposed redefinition of jurisdictional waters. California's climate and hydrologic regimes range from coastal rain forest to inland desert. Many parts of the State are arid or semi-arid, and mountain ranges cover much

PROPOSED DEFINITION OF "ISOLATED" WATERS" AND COMMERCE CLAUSE BASES FOR JURISDICTION UNDER THE CWA

1. Isolated Waters

In the *SWANCC* decision the Supreme Court noted that in *United States v. Riverside Bayview Homes, Inc.* (1985) 474 U.S. 121, 106 S.Ct. 455, it "recognized that Congress intended the phrase 'navigable waters' to include 'at least some waters that would not be deemed 'navigable' under the classical understanding of that term.'" (531 U.S. 159, 171.)

"We found that Congress' concern for the protection of water quality and aquatic ecosystems indicated its intent to regulate wetlands inseparably bound up with the 'waters' of the United States. It was the significant nexus between the wetlands and 'navigable waters' that informed our reading of the CWA in *Riverside Bayview Homes.*" (*SWANCC*, 531 U.S. at 167 (internal quotes and citations omitted).)

According to the Supreme Court, the extent to which non-navigable waters are reached by the CWA act is largely "informed" by the "nexus between" the water at issue and the "navigable waters." Equally clear is statutory language dictating that the purpose of the statute is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (33 U.S.C. § 1251(a). See 531 U.S. at 166.) Any definition of the term "isolated waters" must be viewed in this context. While the jurisdictional reach of the statute may be informed by whether the water to be protected is navigable, the purpose of the CWA is to ensure the tripartite integrity of those waters. California thus proposes that the Corps and EPA define the term "isolated waters" as follows:

"Isolated waters" are those waters which, individually or cumulatively, have no affect on the chemical, physical, or biological integrity of the navigable waters (including their tributaries and adjacent wetlands), and whose loss would not diminish the chemical, physical, or biological integrity of the navigable waters (including their adjacent wetlands or tributaries).

The commerce clause factors currently listed in federal regulations should continue as a basis for Clean Water Act jurisdiction to protect isolated, intrastate, non-navigable waters if:

- i. The water has been designated by the State or United States as an Outstanding Natural Resource Water;
- ii. The water has been designated by the State or the United States as a water whose protection is important for the protection of regional, statewide, or national economic interests; or
- iii. There is a significant nexus between the water and a significant and demonstrable commerce interest that would be impaired if the water was not protected (e.g., tourism, drinking water supply, etc.).

Outstanding Natural Resource Waters are national resources that engender intrastate, interstate, and foreign commerce. Where a state or the federal government has designated a water as important for the protection of broad economic interests, the commerce authority should be exercised. Finally, by limiting other commerce nexi to "significant and demonstrable" commercial interests, the federal agencies implement the Supreme Court's holding that commercial connections not be attenuated, but be clear.

3. Other Bases for CWA Jurisdiction

While Congress may have a particular jurisdictional ground in mind when it chooses to regulate, nowhere is Congress required to identify all Constitutional bases for an enactment before it promulgates legislation. The CWA's reach over "waters of the United States" beyond navigable waters is justified not only when there are significant effects on commercial interests, but when other national or federal interests are implicated. California thus recommends that the Corps and EPA exert federal jurisdiction under the CWA in the following additional circumstances:

Clean Water Act jurisdiction should extend to isolated, non-navigable, intrastate waters when there is a significant nexus between the water and a significant and demonstrable federal interest that would be impaired if the water was not protected (e.g., protection of federal lands, abiding by treaties to which the United States is a party, etc.).

associated impairment of beneficial uses. Isolated wetlands are also often important aquifer recharge areas, whereas wetlands adjacent to waters of the U.S are typically groundwater discharge areas. Loss of the recharge function of isolated wetlands could dewater such adjacent wetlands and reduce baseflow in streams, changing their hydrologic regimes and temperatures.

3. Biological Integrity.

We interpret the term "biological integrity" to mean that the biological processes and diversity and abundance of organisms associated with a waterbody are within the ranges historically supported by that water. Non-adjacent wetlands and headwater streams play several important roles in maintaining the biological integrity of waters of the United States. First, as noted above, potentially affected waters can play an important role in maintaining the chemical and physical integrity of jurisdictional waters. Impairment of chemical or physical integrity will almost inevitably reduce biological integrity. Second, potentially affected waters can support the survival of animals and plants, which also use and contribute to the biodiversity of navigable waters. (*SWANCC* found that presence of migratory birds is an insufficient nexus with navigable waters to establish that Congress intended federal jurisdiction to attach. The *SWANCC* decision, however, did not consider the role of the water in maintaining the biological integrity of navigable waters.) Third, potentially affected waters can provide habitat connectivity^v necessary to the survival of biota which also use and add to the biodiversity of navigable waters.

Finally, aside from their role in supporting the biological integrity of waters of the U.S., potentially affected waters play a very important contribution to California biodiversity in their own right, providing unique habitats for many species, of which a large number are endemic, and a significant proportion of which are on federal and/or State endangered species lists.

POTENTIAL NEGATIVE ECONOMIC EFFECTS

Loss of aquatic integrity often causes economic impairment. Foreseeable adverse economic consequences include:

this partnership would cause significant program disruption, additional state costs, potential lapses in regulation, and an eventual reduction of federal funding support.

1. CWA Section 402 Programs.

Loss of federal jurisdiction over potentially affected waters would affect CWA section 402 NPDES regulation of municipal, industrial, stormwater, and confined animal discharges to those waters. In California, many such discharges are to ephemeral and intermittent ("effluent-dominated") streams. Most of the new urban growth projected for California is located in headwater areas. We have at least two concerns. First, states would no longer have the firm criteria set forth in 40 C.F.R. 131.10 to determine how beneficial uses are to be designated, applied, and modified. It would be difficult for California to protect beneficial uses for the potentially affected waters which would be exempt from these regulations. Second, any effluent discharged to an ephemeral or intermittent stream will eventually drain to navigable waters. Impeding the ability of states to protect water quality in ephemeral streams would jeopardize the chemical, physical, and biological integrity of downstream rivers, lakes, wetlands, estuaries, and coastal regions. This would exacerbate the difficulties of formulating TMDL plans in the downstream jurisdictional waters, and would likely lead to additional waterbodies being listed as "impaired" under CWA section 303(d).

2. CWA Section 401 and 404 Programs.

California has no "wetland permitting program" as such. The State relies on CWA section 401 as its primary CWA tool to protect wetlands, supported by state fish and wildlife protection authorities. Under CWA section 401, we have historically relied on the U.S. Army Corps of Engineers' (Corps) CWA section 404 program, and have not established independent wetland regulation. The State has no statewide definition of "wetlands," no policy analog to the CWA section 404(b)(1) guidelines, no consultation process with federal agencies to assure protection of federally listed endangered or threatened species, and no statewide wetland beneficial use designations to protect wetland functions such as pollutant removal, floodwater storage, and habitat connectivity. The State's existing programs do not replicate the Corps' protection of the potentially affected waters, and expanding these programs in the foreseeable future is unlikely given the State's budget crises. If funding were made available, preparing environment documentation for and adopting regulations and

iii The transport and transformation of chemicals in ecosystems, known as biogeochemical cycling, involves a great number of interrelated physical, chemical, and biological processes. The unique and diverse hydrological conditions in wetlands markedly influence biogeochemical processes. The standing water or intermittent flooding of wetlands causes some processes to be more dominant in wetlands than in either upland or deep aquatic ecosystems. More nutrients in wetlands are tied up in organic deposits and are lost from ecosystem cycling as peat deposits and/or organic export. This process of "carbon sequestration" helps counteract global warming by moderating human-caused increases in atmospheric carbon dioxide. Wetlands are also very effective in removing excess nutrients and other pollutants from aquatic systems, through chemical transformation, plant uptake, deposition, and other mechanisms. See:

S. Mark Dennison and James F. Berry, *Wetlands: Guide to Science, Law and Technology*, Noyes Publications, Park Ridge, New Jersey, 1993.

J. William Mitsch and James G. Gosselink, *Wetlands* (2nd edition), Van Nostrand Reinhold, New York, 1993.

iv A recent nationwide study demonstrated the role of headwater streams in maintaining the chemical integrity of navigable waters. Most of California's runoff is channeled through the ephemeral or intermittent headwater streams where these transformations occur. See J. P. Peterson, W. M. Wollheim, P. J. Mulholland, J. R. Webster, J. L. Meyer, J. L. Tank, E. Marti, W. B. Bowdwn, H. M., Valett, A. E. Hershey, W. H. McDowell, W. K. Dodds, S. K. Hamilton, S. Gregory, D. D. Morrall, "Control of Nitrogen Export from Watersheds by Headwater Streams," *Science* 292:86-88, 2001, April: "... the most rapid uptake and transformation of inorganic nitrogen occurred in the smallest streams ... headwater streams typically export downstream less than half of the input of dissolved inorganic nitrogen from their watersheds ... Small streams may be the most important in regulating water chemistry in large drainages because their large surface-to-volume ratios favor rapid N uptake and processing. Yet small streams are endangered because they are the most vulnerable to human disturbance such as diversion, channelization, and elimination in agricultural and urban environments. Restoration and preservation of small stream ecosystems should be a central focus of management strategies to ensure maximum N processing in watersheds, which in turn will improve the quality of water delivered to downstream lakes, estuaries, and oceans." (Peterson, 2001.)

v "Habitat connectivity" refers to the need for plant and animal populations to have some mobility over the landscape, i.e., to avoid becoming "isolated" or "disjunct." Such mobility may occur at the level of the individual organism (e.g., a bird or turtle traveling between separated wetlands) and/or of the population (e.g., a plant species colonizing a new wetland through seed dispersal); and over different time scales. In recent decades a large body of research has demonstrated that such "isolated" populations face a high probability of eventual extinction, even if their immediate habitats are spared. In general, the smaller such an isolated population, the more quickly it will die out. Urban development typically fragments habitat by creating artificial landscapes which are movement barriers for most species. Unless mitigation measures are taken, isolated, non-viable populations are created as buildings, roads, and landscaping cut off lines of movement.

In the context of wetlands, "habitat connectivity" refers to three related phenomena:

Vincent J. Burke and J. Whitfield Gibbons, "Terrestrial Buffer Zones and Wetland Conservation: A Case Study of Freshwater Turtles in a Carolina Bay," *Conservation Biology* 9(6), 1995, pp. 1365-1369;

C. Kenneth Dodd, Jr. and Brian S. Cade, "Movement Patterns and the Conservation of Amphibians Breeding in Small Temporary Wetlands" *Conservation Biology* 12(2), 1998, pp. 331-339;

Raymond D. Semlitsch, "Biological Delineation of Terrestrial Buffer Zones for Pond Breeding Salamanders," *Conservation Biology* 12(4), 1997, pp. 1113-1119.

Regarding the ecological relationship between separated wetlands, see for example:

C. Scott Findley and Jeff Houlahan, "Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands," *Conservation Biology* 11(4), 1997, pp. 1000-1009;

Lisa A. Joyal, Mark McCollough, and Malcom L. Hunter, Jr., "Landscape Ecology Approaches to Wetland Species Conservation: A Case Study of Two Turtle Species in Southern Maine," *Conservation Biology* 15(6), 2001, pp. 1755-1762;

Raymond D. Semlitsch and J. Russell Bodie, "Are Small, Isolated Wetlands Expendable?" *Conservation Biology* 12(5), 1998, pp. 1129-1133;

National Research Council, *op. cit.*, 2001, p. 42;

Nature Conservancy, *op. cit.*, July 2000, p. 10.

Two recent reports comprehensively review observed effects of global change on plant and animal range shifts, advancement of spring events, and other responses. See:

Terry L. Root, Jeff T. Price, Kimberly R. Hall, Stephen H. Schneider, Cynthia Rosenzweig, and Alan Pounds, "Fingerprints of Global Warming on Wild Animals and Plants," *Science* 421(2), January 2003, pp. 57-60.

Camille Parmesan and Gary Yohe, "A Globally Coherent Fingerprint of Climate Change Impacts Cross Natural Systems," *Science* 421:2, January 2003, pp. 37-42.

^{vi} Replicating the pollutant removal functions of natural wetlands is expensive. On February 4, 2003, the California State Water Resources Control Board approved a grant of \$1.2 million to enlarge a wetland area behind Prado Dam in Riverside County. The wetland was planted and is maintained to filter contaminants from the Santa Ana River. In recent years California has allocated large sums for wetland restoration under CWA section 319 and other grant programs.

^{vii} For the value of headwater streams to salmon and trout, see:

Don C. Erman and Vernon M Hawthorne, "The quantitative importance of an intermittent stream in the spawning of rainbow trout," *Transactions of the American Fisheries Society* 105(6), 1976, pp. 675-681.

N.P Peterson and L.M.Reid, "Wall-base channels: their evolution, distribution, and use by juvenile coho salmon in the Clearwater River, Washington," in: J.M. Walton and D.B. Houston, eds: *Proceedings of the Olympic Wild Fish Conference. 23-25 March 1983*, Port Angeles, 1984.