Freshwater: Sustaining Use by Protecting Ecosystems

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Editor's Summary

The safety and abundance of the freshwater supply in the United States is threatened by water development infrastructure. Chemical pollution, physical modifications to aquatic ecosystems, and other factors continue to contribute to the degradation of U.S. rivers and water bodies. A number of policy changes will be necessary to secure these resources. For instance, smarter investments in these resources should be made, polluted runoff should be controlled, comprehensive aquatic ecosystem restoration and protection should be undertaken, and federal jurisdiction over aquatic ecosystems should be imposed.

In 2002, the United Nations Committee on Economic, Social, and Cultural Rights determined that access to water is a fundamental human right.[1] Yet billions of people around the world lack access to clean water and sanitation, and millions of people each year die of waterborne diseases.[2] Over a billion people lack access to an improved water supply within one kilometer of their homes, and over two-and-onehalf billion people have no access to modern sanitation.[3] Virtually the entire population of the United States, by contrast, has access to relatively safe drinking water and modern sanitation.[4] Nevertheless, freshwater resources and aquatic ecosystems in the United States face serious threats.[5] Global warming now poses new threats to those resources and ecosystems.

This Article addresses freshwater resources and ecosystems that depend on freshwater flows, such as rivers, streams, lakes, and inland wetands, as opposed to saltwater resources and ecosystems in the ocean, estuaries, and coastal waters. Freshwater also includes groundwater, water stored in underground aquifers but usually connected hydrologically to surface water systems. The Article summarizes the state of U.S. freshwater resources and ecosystems. It then evaluates changes in U.S. water law and policy since 2002, and presents policy recommendations to address the threats to the nation's water.

I. Assessment of U.S. Freshwater Resources and Ecosystems

A. Surface Water Quality

It is difficult to identify long-term trends in U.S. water quality based on the limited available data. Water quality standards, as well as methods and frequency of monitoring, have evolved and vary from state to state. Water quality and environmental conditions change with climate and other factors that are not directly related to land use or human sources of pollution. Because monitoring and assessment resources are inadequate, little or no information is available for many water bodies, or for all of the characteristics necessary to assess water quality fully.[6]

Notwithstanding these limitations, the data are sufficiently clear to show that U.S. rivers, lakes, wetlands, and other

1. U.N. Econ. & Soc. Council, Comm. on Econ., Soc. & Cultural Rights, Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social, and Cultural Rights. The Right to Water (E/C.12/2002/11) General cmt. 15, 29th Sess., Geneva, Nov. 26, 2002.
2. Meena Palaniappan et al., *Environmental Justice and Water, in* The World's Water 2006-2007, The Biennial Report on Freshwater Resources 117 (Peter H. Gleick ed., 2007).
3. *Id.* at 124.
4. Gleick, *supra* note 2, at 242, 251.
5. *See* Robert W. Adler, *Fresh Water, in* Stumbling Toward Sustainability 197 (John C. Dernbach ed., 2002).
6. *See* Robert M. Hirsch et al., *U.S. Geological Survey Perspective on Water-Quality Monitoring and Assessment*, 8 J. Envtl. Monit. 512 (2006).

water bodies remain seriously degraded due to chemical pollution, physical alterations to aquatic ecosystems, habitat loss and degradation, invasive species, and other factors. The U.S. Environmental Protection Agency (EPA) requires states to identify all water bodies that are impaired for one or more reasons.[7] According to EPA, in 2004, states reported a total of 38,886 impaired water bodies throughout the country, and a total of 64,581 causes of impairment.[8] Leading sources of impairment were pathogens, mercury, sediment, other metals, nutrients, oxygen depletion, pH levels, temperature, habitat alteration, polychlorinated biphenyls (PCBs), turbidity, pesticides, and salinity.[9]

The U.S. Geological Survey (USGS) conducts a monitoring and assessment program to provide baseline information on water pollutants such as pesticides, nutrients, volatile organic compounds (VOCs), and radon, as well as indicators of aquatic ecosystem health. These data cannot yet be used to evaluate more recent water quality trends because the decadal timeframes for the studies (1991-2001 and 2002-2012) have not elapsed. Still, the program does provide useful information to judge the quality of a scientifically selected sample of water bodies with a more consistent record than is possible using disparate sets of data from all 50 states.[10]

In the 51 study units assessed, USGS found that most water bodies were suitable for most common uses (such as swimming and other recreation, public drinking water supply, and support of fish and aquatic life), but also widely contaminated—especially in agricultural and urban areas—by nutrients, pesticides, VOCs and their breakdown products, and other chemicals.Water quality varied with land use and management, as well as natural variables such as geology, hydrology, soils, and climate.[11] Streams and groundwater in agricultural and urban regions almost always contained mixtures of contaminants (including pesticides, organic chemicals, and nutrients), often with seasonally high concentrations.[12] USGS found toxics such as mercury, pesticides, and PCBs in virtually all fish samples from urban streams, frequently at levels exceeding guidelines for the protection of human health and wildlife; and organochlorine compounds in sediments from most agricultural and urban watersheds, often in concentrations exceeding guidelines.[13]

Trends in chemical water pollution can also be gleaned from patterns in releases of toxic chemicals as reported in EPA's Toxic Release Inventory (TRI). Between 2001 and 2005, total releases of chemicals covered by the TRI decreased by 22 percent, largely due to reductions in releases to air and land. However, during the same period the release of TRI chemicals to underground injection wells and surface waters increased, by 7 percent and 3 percent, respectively.[14]

B. Threats to Human Health

The USGS detected toxic metals and organic chemicals in a large percentage of surface waters in urban and agricultural watersheds. Drinking water contaminants were also found widely in drinking water wells. In a survey of 3,497 wells, at least one VOC was detected in about 18 percent of all samples (623 well samples). Levels exceeding drinking water standards—the enforceable maximum contaminant levels (MCLs) established by EPA under the federal Safe Drinking Water Act[15]—were found in about one percent of all wells tested (45 samples out of the 623 in which VOCs were found).[16] In tests for microbiological contaminants from 22 basins, USGS found coliform bacteria and other pathogens in nearly 30 percent of all wells sampled, with higher frequency and generally higher contaminant levels in domestic as opposed to public water supply wells.[17]

U.S. public health officials have maintained statistics since 1920 on outbreaks of water-borne disease.[18] Over that period, modern sanitation and drinking water treatment have dramatically reduced the incidence of illnesses and deaths from water-borne pathogens.[19] Nevertheless, from 1991 to 2002 an average of 17 outbreaks per year due to inadequately treated water and distribution-system contamination were reported, and experts believe that many water-borne disease outbreaks are undetected or unreported.[20] Those outbreaks caused almost one-half million reported illnesses, and 73 reported deaths.[21]

Chemical and biological contaminants also continue to pose threats to consumers of freshwater fish. The 2004 EPA listing of fishing advisories around the United States indicates that the number of fish advisories continues to grow, although many of the new listings reflect improved monitoring for mercury and other contaminants.[22] The 2004 listing identifies 3,221 advisories, which collectively report contamination in more than one-third of the nation's total lake acreage, and about one-quarter of its total river miles (over 14 million lake acres and about 840,000 river miles).[23] Reported bioac-

7. 33 U.S.C. §1313(d).
8. U.S. EPA, 2004 National Assessment Database, *available at* http://www. epa.gov/waters/305b/index_2004.html (last visited June 6, 2007).
9. *Id.*
10. U.S. Geological Survey, Circular 1265, Water Quality of the Nation's Streams and Aquifers—Overview of Selected Findings, 1991-2001, at 2 (2004).
11. *Id.*
12. *Id.* at 8.
13. *Id.* at 14, 16.
14. U.S. EPA, Toxics Release Inventory Reporting Year 2005 Public Data Release, *available at* http://www.epa.gov/tri/tridata/tri05 (last visited June 7, 2007).
15. *See* 42 U.S.C. §300g-1(b)(1)(C).
16. U.S. Geological Survey, Fact Sheet 2006-3043, Volatile Organic Compounds in the Nation's Drinking-Water Supply Wells—What Findings May Mean to Human Health (Revised June 2006).
17. U.S. Geological Survey, Scientific Investigations Report 2006-5290, Microbial Quality of the Nation's Ground-Water Resources, 1993-1994, *available at* http://pubs.usgs.gov/sir/2006/5290/section1.html (last visited June 8, 2007).
18. Michael F. Craun et al., *Waterborne Outbreaks Reported in the United States*, 4 J. Water & Health (Supp. 2) 19 (2006).
19. Michael F. Craun et al., *Assessing Waterborne Risks: An Introduction*, 4 J. Water & Health (Supp. 2) 3 (2006).
20. *Id.*
21. Craun et al., *supra* note 18, at 22-23.
22. U.S. EPA, 2005 National Listing of Fish Advisories, Fact Sheet (Sept. 2005), *available at* www.epa.gov/waterscience/fish/advisories/fs2004.html (last visited June 6, 2007).
23. *Id.*

cumulative contaminants, which are stored in fish tissue and concentrate at higher levels over time, include mercury, PCBs, chlordane, dioxins, and DDT.[24] EPA detected mercury, PCBs, dioxins and related compounds, DDT, chlordane, and dieldrin in lake fish taken from 486 sites out of 500 lakes sampled from 2000 to 2003.[25]

C. Integrity of Aquatic Ecosystems

Chemical pollution has been the main focus of efforts to control water pollution. Significantly less attention has been paid to serious physical and hydrological changes and other adverse impacts to aquatic habitats.[26] In a recent survey of the nation's wadeable streams, the first in a series of evaluations that will later include rivers, lakes, and other surface waters, EPA concluded that 42 percent of the nation's stream length is in poor biological condition, 25 percent in fair condition, and only 28 percent in good biological condition (5 percent not assessed).[27] The most significant causes of impairment were nutrients, riparian disturbance, streambed sediments, and loss or alteration of in-stream fish habitat and riparian vegetation.[28]

Some progress has been made in protecting critical wetlands in the United States, although these gains should be interpreted with caution. After decades of steady losses in the acreage of wetlands identified by the U.S. Fish and Wildlife Service (FWS) in the National Wetlands Inventory program, FWS recently reported the first-ever net gain in wetlands acreage, with a national gain of nearly 200,000 acres of wetlands between 1998 and 2004.[29] These data reflect steady improvement, reversing a trend in which net wetlands acreage declined at a rate of almost half a million acres per year between the mid-1950s and the mid-1970s, about 290,000 acres a year from the mid-1970s to the mid-1980s, and about 58,000 acres a year between 1986 and 1997.[30] But net wetland acreage does not necessarily translate to the functions and values of wetlands. Most wetlands gains from 1998 to 2004 reflected artificial freshwater ponds created as mitigation for the loss of natural wetlands. Such open ponds typically do not provide the same range of wetland values and functions as the wetlands they replaced.[31]

Rivers and streams in urbanized areas exhibit some of the most serious ecological changes due to the impacts of urbanization on water quality and temperature, runoff timing and volumes, river and stream profiles, sediment flow and streambed composition and morphology, riparian vegetation, and other physical, chemical, and hydrological characteristics.[32] USGS studies of urban stream ecosystems throughout the United States indicate significant adverse ecological and hydrologic impacts even in areas of moderate urbanization (based on factors such as percent impervious cover in a watershed), although the degree of impact varied depending on climate, geology, topography, and other physical variables.[33] Hydrologic changes in urbanized areas may pose more substantial barriers to aquatic ecosystem restoration than chemical pollution.[34]

D. Water Supply

Compared to many countries, the United States has ample renewable freshwater resources.[35] Although total U.S. water withdrawals are much larger than in most other countries, on both an absolute and per capita basis,[36] the United States withdraws less than one-sixth of its renewable water supplies every year on a national basis (meaning *in theory* that those supplies could support a population six times as many people as the current U.S. population, assuming unrealistically that all of that water was available for use in the correct places, without causing dramatic environmental harm).[37] However, drought causes relative and often severe shortages in both western and eastern parts of the country[38] as increased population combined with high rates of water use strain regional water supplies.[39] Although drought in the United States does not lead to famines and the massive number of drought-related deaths that occur in other parts of the world, economists estimate that drought causes at least $6-8 billion in economic costs per year.[40]

E. Global Warming and Freshwater Resources

Scientists predict that global warming will have significant impacts on water resources around the world, including

24. *Id.*
25. U.S. EPA, Office of Water, Fact Sheet: 2005 Update, The National Study of Chemical Residues in Lake Fish Tissue, EPA-823-F-05-012 (2005).
26. *See* Robert W. Adler, *The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity*, 33 Envtl. L. 29-77 (2003).
27. U.S. EPA, Wadeable Streams Assessment: A Collaborative Survey of the Nation's Streams, EPA 841-B-06-002, at ES-5 (2006).
28. *Id.* at ES-6.
29. Thomas E. Dahl, U.S. Dep't of Interior, Status and Trends of Wetlands in the Conterminous United States 1998 to 2004, at 15 (2006).
30. *Id.*
31. *Id.* at 16-17.
32. Larry R. Brown et al., *Introduction to Effects of Urbanization on Stream Ecosystems*, 47 Amer. Fish. Soc. Symp. 1-2 (2005).
33. U.S. Geological Survey, Fact Sheet FS-042-02, Effects of Urbanization on Stream Ecosystems (2002); James F. Coles et al., U.S. Geological Survey, The Effects of Urbanization on the Biological, Physical, and Chemical Characteristics of Coastal New England Streams, Professional Paper 1695 (2004); Faith A. Fitzpatrick et al., *Urbanization Influences on Aquatic Communities in Northeastern Illinois Streams*, 2004 J. Am. Water. Res. Ass'n 461 (2004); Lori A. Sprague et al., U.S. Geological Survey, Effects of Urban Development on Stream Ecosystems Along the Front Range of the Rocky Mountains, Colorado and Wyoming, Fact Sheet 2006-3083 (2006).
34. Christopher P. Konrad & Derek B. Booth, *Hydrologic Changes in Urban Streams and Their Ecological Significance*, 47 Am. Fish. Soc. Symp. 157 (2005).
35. Gleick, *supra* note 2, at 223-27.
36. *Id.* at 232.
37. *Id.* at 224, 232.
38. *See* Robert W. Adler, Restoring Colorado River Ecosystems, A Troubled Sense of Immensity 114-15 (2007) (regarding drought in the Colorado River Basin); Susan S. Hutson et al., U.S. Geological Survey, Estimated Use of Water in the United States in 2000, Circular 1268 (2004); U.S. Geological Survey, Record Low Water Levels in May for Georgia Rivers (June 1, 2007), *available at* www.usgs.gov/newsroom/article.asp?ID=1687 (last visited June 8, 2007); U.S. Geological Survey, Record Low Water Levels in May for North Carolina Rivers (June 8, 2007), *available at* www.usgs.gov/newsroom/article.asp?ID=1690 (last visited June 8, 2007).
39. Heather Cooley, *Floods and Droughts,* in Gleick, *supra* note 2, at 91, 92.
40. *Id.* at 96-97.

the United States. Some areas will become wetter and others drier, leading to more frequent and more severe droughts and related famines in some regions, and higher flood risks in others.[41] For example, decreased runoff into reservoirs in the Colorado River basin could exacerbate droughts in a region that is already experiencing serious water shortages.[42] Shifts in temperature and precipitation are also expected to have serious adverse effects on water quality, as are ecological disruptions to fish, plant, and wildlife populations, blooms of nuisance algae, and losses or impairments to both coastal and inland wetlands.[43]

II. Programs and Policies to Protect Freshwater

Federal government laws and programs to protect and manage freshwater resources have not changed significantly for several decades. For example, the Clean Water Act (CWA), which governs federal and state programs to protect the chemical, physical, and biological integrity of surface waters, was last amended significantly in 1987. Likewise, the basic structure of the Safe Drinking Water Act has not changed substantially since 1986, although Congress adopted incremental changes in 1996.

EPA's current strategic plan to protect water resources reflects an approach of working within the existing statutory system.[44] For example, EPA recently adopted new regulations to protect drinking water from certain pathogens and disinfection byproducts.[45] Similarly, EPA adopted new rules to reduce pollution from concentrated animal feeding operations (CAFOs).[46] Although the CAFO rule was controversial in some respects and subject to litigation and subsequent changes, it does represent conceptual progress in trying to fill in the gaps between EPA's relatively stringent control of industrial and municipal sources of water pollution and the absence of significant controls on most kinds of agricultural pollution.

In many respects, EPA's approach is to try to do a better job of implementing its long-standing regulations and existing programs.[47] Those efforts show some improvement in program implementation even where actual gains in water quality and aquatic ecosystem health have not yet been documented. For example, since 2000 the states and EPA have completed over 20,000 total maximum daily loads (TMDLs), which are calculations of how much pollution particular water bodies can accept without exceeding water quality standards, and accompanying plans to clean up specific impaired water bodies around the country.[48] TMDLs are supposed to identify additional measures to reduce pollution from a combination of point and nonpoint sources so that water quality standards are met.[49] Whether TMDLs will achieve improvements in significant numbers of waterways, however, remains to be seen. In fact, EPA's current goal is to restore by 2012 only 2,250 out of the almost 40,000 impaired water bodies identified by the states.[50]

EPA continues to support local and regional watershed-based programs to protect and restore water bodies,[51] as do various nongovernmental organizations.[52] As a result, much of the progress in watershed protection since 2002 has occurred at the state, local, and private levels. Island County, Washington, for example, is preparing a more comprehensive water resources monitoring and protection initiative than required by federal law.[53] The county is implementing watershed protection efforts through a shoreline management plan, best management practices linked to a permitting process, and other end-use measures.[54] Private land trusts and other conservation organizations play an increasing role in protecting wetlands, riparian zones, and other critical aquatic areas. In its first five years, for example, Montana Wetlands Legacy conserved over 27,000 acres of wetlands and more than 800,000 acres of watershed lands through conservation easements, leases, cooperative agreements with landowners, and fee title acquisitions.[55] Programs to restore instream, riparian, and other aquatic habitats are being implemented throughout the country, with varying levels of success.[56]

As with other watershed-based restoration and protection initiatives, raw numbers of watershed restoration efforts do not necessarily translate to program effectiveness absent valid monitoring and assessment. A comprehensive review of over 38,000 restoration projects around the United States, for example, found that fewer than 10 percent included written documentation of effectiveness monitoring.[57]

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41. Intergovernmental Panel on Climate Change, Climate Change 2007: Impacts, Adaptation, and Vulnerability, Summary for Policymakers 5 (Apr. 2007).
42. *See* Adler, *supra* note 38, at 247; Kenneth Strzepek & Davis N. Yates, *Assessing the Effects of Climate Change on the Water Resources of the Western United States, in* Water and Climate in the Western United States (William M. Lewis Jr. ed., 2003).
43. N. LeRoy Poff et al., Pew Ctr. on Global Climate Change, Aquatic Ecosystems & Global Climate Change, Potential Impacts on Inland Freshwater and Coastal Wetland Ecosystems in the United States (2002).
44. *See* U.S. EPA, 2006-2011 Strategic Plan: Charting Our Course 35-57 (2006) [hereinafter EPA Strategic Plan] (Goal 2, Clean and Safe Water).
45. *Id.* at 38; 71 Fed. Reg. 4644 (Jan. 27, 2006).
46. EPA Strategic Plan, *supra* note 44, at 46; 68 Fed. Reg. 7175 (Feb. 12, 2003); *but see* Waterkeeper Alliance v. EPA, 399 F.3d 486 (3d Cir. 2005) (remanding to EPA for amendments).
47. *See* EPA Strategic Plan, *supra* note 44, at 42 (better implementation of existing policy for combined sewer overflows); 45-47 (better implementation of existing regulations using a watershed approach).
48. *Id.* at 47.
49. *See* 33 U.S.C. §1313(d).
50. *Id.*
51. *See* U.S. EPA, Handbook for Developing Watershed Plans to Restore and Protect Our Waters, EPA 841-B-05-005 (2005).
52. *See, e.g.,* Karen Cappiella et al., Ctr. for Watershed Prot., Using Local Watershed Plans to Protect Wetlands (2006).
53. *See* Paul Adamis & Joseph Eilers, Island County Dep't of Planning & Community Dev., Draft Water Quality Data Synthesis and Recommendations for a Surface Freshwater Monitoring Program, *available at* www.islandcounty.net/planning/IC-WQmonitorPlan_FinalDraft.pdf.pdf (last visited June 26, 2007).
54. *See* Island County's website, Planning Department page, at www.island county.net/planning (last visited June 26, 2007).
55. *See* Montana Wetlands Legacy website, www.wetlandslegacy.org (last visited June 26, 2007).
56. For case studies in the western United States, see, e.g., Montana State University's Wild Fish Habitat Initiative, *available at* www.wildfish. montana.edu/Cases/default.asp (last visited June 26, 2007).
57. E.S. Bernhardt et al., *Synthesizing U.S. River Restoration Efforts*, 308 Science 636-37 (2005).

III. Impact of the Judiciary

State, local, and private efforts to protect and restore wetlands and other aquatic ecosystems may become even more critical given recent decisions by federal courts that could reduce dramatically the scope of water bodies subject to regulation under the federal CWA. In 2001, the U.S. Supreme Court ruled in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* that CWA jurisdiction does not extend to ponds used as habitat by migratory birds but whose waters were isolated (not adjacent to or connected directly to rivers, streams, or other surface waters covered by the Act).[58] That decision led to confusion and differences among lower courts regarding the extent to which the CWA applies to water bodies with less direct connection to waters that meet the traditional test of navigability for purposes of federal authority under the Commerce Clause of the U.S. Constitution, although most lower courts read the 2001 decision narrowly.[59]

In 2006, however, in a fragmented decision in which no single opinion was joined by a majority of the justices, the Supreme Court decided two related cases in a way that further calls into question the scope of federal regulatory control over non-navigable waters, and that further confuses decisions by federal regulators and lower courts.[60] Writing for a plurality of four justices in *Rapanos v. United States*, Justice Scalia concluded that the CWA applies only to "relatively permanent, standing, or continuously flowing bodies of water" and only to wetlands with a "continuous surface water connection" to other waters of the United States.[61] In a concurring opinion, Justice Kennedy would find CWA jurisdiction over any water body with a "significant nexus" to navigable waters,[62] while four dissenting justices would find jurisdiction over a far broader scope of waterways, deferring to the professional and scientific judgments of the responsible federal agencies.[63] Given the highly divided nature of the decision, lower courts continue to disagree about the test to apply in deciding which waters are covered by the CWA.[64]

IV. Water Resource Policies

Water use and supply policies in the United States have also remained relatively constant since 2002. Most efforts to improve water efficiency and otherwise better manage water resources have evolved at the state and local levels, consistent with the historic policy of Congress that water resources are most appropriately left to state control.[65] Total freshwater use in the United States varied very little between 1985 and 2000 despite increased population, indicating improvements in water use efficiency over recent decades, especially in irrigated agriculture.[66] Some urban areas have also improved water efficiency dramatically,[67] although highly drought-prone regions could reap significant efficiency savings in both agricultural and urban areas using current technologies and prices.[68]

V. The Importance of Sustainable Freshwater and Aquatic Ecosystems

For a nation with virtually universal access to modern sanitation and potable freshwater at the turn of the faucet, it seems almost trite to assert that clean, adequate supplies of freshwater are essential to a sustainable lifestyle and economy. As suggested by the many ongoing and potential future problems discussed above, however, defining and achieving sustainability for those resources is a serious and complex issue.

In regard to freshwater for direct human use, sustainability suggests adequate—and adequately treated—supplies of water for all legitimate human economic uses, including agricultural, industrial, and municipal purposes. "Adequate supply" no longer means what it has in the past—that is, as much water as one can use, on demand, and at trivial costs. Rather, to reconcile population and economic growth with increasingly scarce water resources, the concept of sustainable water use must entail *sufficient* supplies to accomplish necessary and legitimate purposes, using the most efficient means possible.[69]

Moreover, those resources must be supplied in amounts and in ways that avoid the massive loss and degradation of freshwater aquatic ecosystems that has occurred in the past. Stated most simply, we must leave enough water, in the right places and at the right times, in the natural system to sustain healthy aquatic ecosystems. Sustainability of freshwater resources also demands that we continue to reduce all sources of water pollution to acceptable levels of risk to human health, to fish and aquatic life, and to the integrity of aquatic ecosystems. Likewise, that goal requires that we pay more attention to the physical as well as the chemical integrity of aquatic ecosystems, so that we can restore and protect aquatic and aquatic-dependent biodiversity and other resources.

VI. Policy Recommendations

Although U.S. residents enjoy enviable access to ample supplies of safe freshwater resources, pollution continues to pose risks to human health, aquatic ecosystems remain signifi-

58. Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001) [hereinafter *SWANCC*].
59. *Compare, e.g.,* United v. Deaton, 332 F.3d 698 (4th Cir. 2003), *cert. denied*, 124 S. Ct. 1874 (2004) (reading *SWANCC* narrowly and finding CWA jurisdiction over all waters with a hydrological connection to navigable waters), *with* In re Needham, 354 F.3d 340 (5th Cir. 2003) (finding CWA jurisdiction over only navigable waters and water bodies immediately adjacent thereto).
60. Rapanos v. United States, 126 S. Ct. 2208 (2006).
61. *Id.* at 2225-26.
62. *Id.* at 2236.
63. *Id.* at 2253.
64. *Compare, e.g.,* Northern Cal. River Watch v. City of Healdsburg, 457 F.3d 1023 (9th Cir. 2006) (finding CWA jurisdiction based on Justice Kennedy's "significant nexus" test), *with* United States v. Chevron Pipe Line Co., 437 F. Supp. 2d 605 (N.D. Tex. 2006) (rejecting CWA jurisdiction absent clear connection between oil spill and navigable water).
65. *See* 33 U.S.C. §1251(g).
66. Hutson et al., *supra* note 38, at 1-2.
67. *See, e.g.,* Southern Nevada Water Authority's aggressive water conservation programs, *available at* www.snwa.com/html/cons_index.html (last visited June 26, 2007).
68. *See* Adler, *supra* note 38, at 252-54.
69. *See* A. Dan Tarlock & Sarah B. Van de Wetering, *Western Growth and Sustainable Water Use: If There Are No "Natural Limits," Should We Worry About Water Supplies?*, 27 Pub. Land & Res. L. Rev. 33 (2006).

cantly impaired throughout the country and face increasing risks due to urbanization and other development, and water supplies will become increasingly scarce as population continues to grow and as global warming affects the amount and distribution of water supplies. The following four policy changes could enhance the sustainability of freshwater resources.

A. Make New, Smarter Investments in Water Resources

Although U.S. water supply and sanitation systems remain among the best in the world, many systems are aging and require significant repairs or upgrades, and growth will require additional investments. EPA's 2002 Gap Analysis Report stated that between 2000 and 2019, U.S. communities will have to spend approximately $100 billion on capital infrastructure for drinking water and $120 billion in wastewater infrastructure—almost a quarter of a trillion dollars over two decades.[70] Those investments are essential to maintain public health and other benefits. However, future investments should focus on sustainable uses of land and water. "Least-cost first" policies will promote investment in water conservation where it is more cost-effective than increasing supplies. Zoning requirements designed to ensure that water and sewer services are in place before development can occur will help to prevent sprawl, which ultimately imposes more strain on resources and aquatic ecosystems. Pricing policies that ensure that consumers pay the full costs of providing safe water, with lifeline rate exceptions for purposes of equity, will encourage new investments to be made as wisely as possible. It also makes sense to consider a twentyfirst century water supply and distribution system in which water used for household uses (drinking, bathing, cooking) is separate from outside irrigation water, so that the huge investment necessary to treat drinking water is not wasted on water that only irrigates lawns and golf courses. Likewise, more systems should be devised to divert treated gray water (household water from sinks and tubs that is only mildly contaminated, as opposed to wastewater flushed from toilets), recycled but treated sewage effluent, and stormwater runoff, for nondrinking water uses.

B. Control Polluted Runoff

Although pollution from industrial and municipal point sources (water pollution that enters waterways through pipes or other discrete conveyances) requires continued vigilance and additional standards and enforcement, runoff from more dispersed sources (often called "nonpoint sources") is still the leading source of water pollution in the United States. For the most part, those pollution sources remain subject to a patchwork of state and local control programs, most of which are voluntary or poorly enforced. Although watershed programs are a promising way to coordinate efforts to address all sources of impairments within watersheds, those programs will remain limited if the methods to address the largest remaining source of harm remain vague and largely unenforceable. A mandatory system of enforceable best practice standards for sources of runoff pollution remains the biggest gap in U.S. water pollution programs. Such standards should be sufficiently flexible to account for differences in climate, soils, topography, land uses, and other factors, but the inherent variability in conditions is not a sufficient reason to leave this major source of pollution unregulated.

C. Undertake Comprehensive Aquatic Ecosystem Restoration and Protection

Although the stated goal of the CWA is to restore the chemical, physical, and biological integrity of the nation's waters,[71] habitat loss and degradation and other causes beyond chemical pollution contribute widely to the significant ecological impairment of U.S. waterways. To date, CWA implementation has focused largely on chemical pollution. While the Act aspires to a broader focus on other forms of aquatic ecosystem restoration and protection, it lacks the kinds of specific programs or provisions to address those kinds of impairments as apply to chemical pollution. Those issues might be addressed more effectively through a separate, broadly focused aquatic ecosystem restoration and protection statute. Just as additional investment is needed in traditional water and wastewater infrastructure, the nation should invest in aquatic ecosystem restoration efforts that can produce healthier aquatic ecosystems, provide opportunities for skilled employment (such as riparian revegetation or restoration of natural stream channels), and generate significant economic returns in the form of reduced flooding, increased property values, and other benefits. Strategies for aquatic ecosystem restoration need to focus on the full range of chemical, physical, and biological impairments, including factors such as flow amounts and timing, instream and riparian habitat structure and quality, and invasive species, as well as more traditional forms of pollution.

D. Impose Comprehensive Federal Jurisdiction Over Aquatic Ecosystems

Despite the impressive array of state, local, and private conservation efforts, recent Supreme Court decisions that would eliminate an unknown but potentially large percentage of the nation's waters from CWA jurisdiction could eviscerate important federal safeguards and undermine the incentives for successful voluntary approaches to aquatic ecosystem restoration and protection. All components of aquatic ecosystems are integrally connected, via surface water, groundwater, and other hydrological and ecological connections. But some interpretations of the divided Supreme Court opinion in *Rapanos* would eliminate CWA jurisdiction over wetlands with no direct surface water connections to other waters, and many waterways in the western states that do not flow year-round. The concept of navigability as the defining line for federal jurisdiction under the Commerce Clause of the U.S. Constitution is a remnant of an era when the main federal

70. EPA Strategic Plan, *supra* note 44, at 39, 48.

71. 33 U.S.C. §1251(a).

purpose for protecting waters was interstate commerce and navigation, and has long outlived its purpose. Federal authority over watershed protection and restoration should be clarified to include the full range of aquatic ecosystem resources and their many other linkages to interstate commerce.

VII. Conclusion

The United States continues to enjoy some of the safest and most abundant supplies of freshwater in the world, and has built a nationwide system of infrastructure to deliver safe water to most of its citizens, and to treat wastewater properly before discharging it back into the environment. The sustainability of that luxury is by no means certain, and to date water development infrastructure has carried significant economic costs as well as human health risks and ecological harm. In order to attain sustainable water uses and to ensure healthy freshwater aquatic ecosystems, we can no longer afford to take water for granted.We need to understand that water is a limited rather than an infinite resource, and to strike a more reasonable balance between water systems as natural resources to be used and as natural ecosystems to be protected.