

Managing Our Water Resources for People, the Economy, and Nature:



It's All Connected

Sandra Fallon

*National Environmental Services Center
Training Specialist*

Water's interconnectedness to everything in our lives could hardly be more vividly illustrated than by water pollution emergencies that left two U.S. cities without drinking water. A half million people in the Toledo, Ohio area lost their drinking water for three days in August 2014 due to harmful toxins released by an algae bloom in Lake Erie, the city's water source. Earlier in the year, a chemical spill into West Virginia's Elk River just upstream from the area's drinking water treatment plant brought much of the capital city Charleston and surrounding areas to a screeching halt, forcing businesses and schools to close, causing hospitals to find alternative water supplies, and leaving 300,000 residents in nine counties without tap water.

In both cases, the drinking water source was contaminated by nearby activities. In Toledo, a main culprit was phosphorus (a fertilizer ingredient) that made its way into Lake Erie from rainwater running off farmlands. In Charleston, an industrial chemical leaked from its storage tank and into the river. As a result, questions are being raised about the impact of industrial, agricultural, and other activities on drinking water sources, and how to better protect our water.

That concept—protecting and managing water resources in a way that takes all water needs into account, and ensures that enough clean, safe water is available to meet those needs—is key. It represents a shift in the way we in the United States think about and manage water to meet the wide variety of competing demands—drinking water for household needs, crop irrigation, economic and energy needs, recreational uses, and supporting aquatic life in rivers, streams, and lakes. One approach, called Integrated Water Resource Management (IWRM), offers promise.

Changing the Way We Think About Water

Peter Gleick writes in *The Changing Water Paradigm: A Look at Twenty-first Century Water Resources Development* (2000) that humans have always managed water resources by capturing, storing, cleaning, and redirecting water to meet their needs and reduce vulnerability to natural but unpredictable changes in river flows and rainfall. Early irrigation canals allowed farmers to grow crops in drier areas and for longer periods. The growth of cities required water to be brought in from distant locations and was made possible by developments in civil engineering and hydrology. Modern-day industrial societies “routinely and dramatically modify the hydrologic cycle through unprecedented construction of massive engineering projects for flood control, water supply, hydro-power, and irrigation.”

Water management decisions have traditionally been based on projected population, per-capita water demand, agricultural production, and economic productivity factors, says Gleick. Because these were expected to grow, the need for water was expected to increase. These needs were typically met by finding and developing new sources of water, and storing it in reservoirs or transferring it via pipelines, sometimes from one river basin to another. This supply-side approach has had unquestionable benefits. Food production in most developed countries has kept up with population growth, water sup-



plies are clean and reliable, and water-related diseases have been eliminated. But the money required for large-scale water development and engineering projects has been enormous. Other costs, often hidden, include “the destruction of ecosystems, loss of fish species, dislocation of human populations, inundation of cultural sites, disruption of sedimentation processes, and contamination of water sources.”

More recently, changing social, environmental, and economic values are transforming how we think about managing water, says Gleick. Ideas like incorporating ecological values into water decisions, meeting basic human needs for water services, and breaking the ties between economic growth and water use are increasing in priority.

Integrated Water Resource Management—A Sustainable Approach to Protecting and Managing Water Resources

The American Water Resources Association (AWRA)—a non-profit professional association advancing water resource management, education, and research—agrees that a narrow focus on water supply development without considering social or ecosystem impacts is no longer adequate. The U.S. Army Corps of Engineers (USACE), whose mission includes providing water resources planning and management services to maintain the nation’s waterways, points out that when “a single water-use purpose overrides all other objectives or purposes, solutions may only satisfy narrow interests with limited benefits.” AWRA and USACE both encourage sustainable water management approaches like IWRM.

The IWRM concept has been around for a long time. The 1933 Tennessee Valley Authority is an early example, with its successes and failures, and its focus on integrating power production, navigation, and flood control, while simultaneously addressing erosion, recreation, and public health. IWRM has attracted international attention primarily since the United Nation’s 1992 Earth Summit in Rio de Janeiro, which called upon nations to address the dual problems of environmental destruction and the need for sustainable development (meeting current needs without sacrificing our future). The IWRM guidelines adopted at that conference (called the “[Dublin Guiding Principles](#)”)—emphasize managing water resources as an integral part of a country’s social and economic development, and are used as a basis for defining IWRM today.

The Global Water Partnership, a not-for-profit network of almost 3,000 partner organizations in 169 countries to improve water resource management, provides one of the most often cited definitions. “IWRM is a process that promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.”

Although there are many variations on this IWRM definition, AWRA has identified four key concepts underlying the approach:

- ***“The goal of IWRM is to manage water sustainably.*** Water management must balance the multiple objectives of different interests with consideration for economic development, social equity and the environment as well as current and future generations.
- ***Coordination is required for integration.*** Integrate water management between and within levels of government and other organizations, with recognition of the respective roles of each.
- ***Encourage participation.*** Involve the local public and stakeholders from all water use sectors.
- ***Resources are connected.*** Holistic management recognizes the interconnectedness of land and water, surface water and groundwater, water quantity and water quality, freshwater and coastal waters, and rivers and the broader watershed.”



Most U.S. states have developed traditional water resource management plans. Despite increasing national and international recognition of the need for integrated management of water resources, IWRM implementation has been slow. However, some states, or regions within and across state lines, are implementing integrated strategies.

The Delaware River Basin Commission: Implementing IWRM for More than 50 Years

A government agency called the Delaware River Basin Commission began cleaning up one of the nation's most polluted rivers in the early 1960s, long before the U.S. established the Environmental Protection Agency or the Clean Water Act to help prevent water contamination. The Delaware River flows from New York's Catskill Mountains to the Delaware Bay and into the Atlantic Ocean, and is shared by New York, Pennsylvania, New Jersey, and Delaware. Its basin provides water for more than 15 million people and supports diverse land uses: rural communities and a world-class trout fishery in the upper basin; huge cities and ports in the lower basin; and growing pressures from population growth and Marcellus shale gas development in the headwaters (source of the river).



The Delaware Water Gap from Kittatinny Beach Access, Delaware Water Gap National Recreation Area.

Photo by Susan Owens, Delaware River Basin Commission (DRBC).

After years of court battles dating back to the 1930s over New York City's diversion of the Delaware River for its drinking water needs, along with other problems like water pollution and a record flood in the 1950s, everyone involved realized the need to bring the states and the federal government together to manage the water. In 1961 an Act of Congress mandated the formation of the DRBC and marked the first time federal and state governments functioned as equal partners to plan, develop, and regulate a river basin (watershed).

DRBC's long-time Executive Director, Carol Collier (1998-2014), points out that the Commission's early focus on examining issues and needs on a geographic basis, and looking at how the watershed worked as a whole, instead of from one state to another, continues today. That can be a complex and challenging process. For one thing, "federal water laws enacted beginning in the 1970s, and the subsequent regulations, have been fragmented in their approach, focusing on wastewater control, wetlands, stormwater, and drinking water supplies as separate rather than interrelated issues. Along the way, we've lost the idea that it's all 'one water.' IWRM emphasizes the 'one water' concept, and brings together all aspects of water management that have been segmented by laws and regulations."



JFK signing the Delaware Basin Compact "seated left to right: Governors Robert Meyner of New Jersey, Elbert Carvel of Delaware, and David Lawrence of Pennsylvania joined President John F. Kennedy at the White House on November 2, 1961, to participate in a ceremonial signing of the Delaware River Basin Compact.

Photo from the Delaware River Basin Commission (DRBC) archives.

The DRBC has many success stories. Philadelphia now recognizes the cost-effectiveness of maintaining a clean water source by working with upstream partners to keep livestock pollution and wastewater contamination out of the water in the first



place. New York City no longer diverts water that in the past reduced the amount flowing downstream, which, along with droughts, harmed fish populations and allowed salt water from the ocean to migrate upstream from the Delaware Bay, threatening Philadelphia's and some of New Jersey's drinking water supplies. The DRBC has also helped prevent groundwater depletion and balance competing uses of limited water resources. One of its most forward-thinking initiatives was the Special Protection Waters Program. This Program requires any new or expanding municipal or industrial wastewater plant that discharges wastewater into waterways to show no measurable change to the existing water quality. This has created the longest stretch of anti-degradation, or high-quality, waters in the U.S.

The DRBC is comprised of four state governors and a U.S. Army Corps of Engineers officer, who represents the U.S. President and all federal agencies. Each of these five commissioners has an equal vote; most decisions require a majority vote. Managing the water resources on a watershed basis has at times required each state and the federal government to relinquish some sovereign authority. "The Commissioners support the Special Protection Waters Program which requires water quality standards in the Delaware River to be higher than some of their own state standards," says Collier. "And there are a lot of compromises on water supplies. Everyone recognizes the need for human uses as well as for conservation, flood mitigation, and in-stream needs for fisheries. Without this group working together, there's no way shared solutions would come about."



Yakima River, Washington.

The Yakima River Basin IWRM Plan: Collaborating to Address the Lack of Water

In Washington's arid Yakima River Basin, everyone needs water but there's not enough to go around. Farmers haven't been able to get all they need to irrigate crops, growing communities need more drinking water for residents, and the basin's streams lack adequate water flows to sustain fish and wildlife, which is needed to support the Yakama Nation tribal members' traditional reliance on these resources.

Yakima County Commissioner Mike Leita says "water is even more precious than oil here. Its importance cannot be underestimated for agriculture, economic vitality, habitat restoration, and the Yakama Nation's needs for restoring salmon runs, which is an important part of its heritage." The Yakima Valley stretches across three counties—and touches a fourth—contributing over \$3 billion annually to Washington's agricultural economy. It ranks first nationally in the production of apples, mint, winter pears, and hops. Historically, the basin was the second largest producer of salmon and steelhead runs in the larger Columbia River System.

All of these interests rely on the same water supplies. But water rights in the state of Washington, which determine a person or organization's right to use water, are over-appropriated. More surface water has been allotted through water rights than is actually flowing in streams and rivers. Combined with frequent droughts since the 1990s, and

declining snowpack that historically feeds streams and rivers, this south-central region of the state is water-strapped. "During the 2005 drought, farmers got only 38 percent of their water allotment. If farmers lose an orchard, it won't come back for several years. That has huge economic consequences," says Leita.





“Talk about western water wars, the Yakima Basin has it all,” says Philip Rigdon, the Yakama Nation’s Director of Natural Resources. “For more than 35 years, different interests have been fighting in the courts over endangered species, water rights, treaty rights, restoration of salmon runs and fish habitat, in-stream water needs, and out-of-stream needs.” After decades of battling with the Roza Irrigation District, Rigdon says the Yakama Nation and the Irrigation District decided to move beyond their differences and come to the table. The fundamental issue: farmers need water in the fields, the Yakama Nation wants water in the steams. “We realized that continued fighting wouldn’t help us restore salmon populations, and it wouldn’t help the Irrigation District get enough water to support agriculture. We had to change the approach.” They signed a joint letter to the Washington State Department of Ecology (DOE) and the federal Bureau of Reclamation, the two organizations that had been leading efforts to address Yakima Basin water problems, saying the region needed a new, integrated approach for sharing its limited water resources.

“What made that letter profound,” says Derek Sandison, Director of the Washington DOE Office of the Columbia River, “is that the Yakama Nation and the Roza Irrigation District did not get along. It opened up a lot of eyes. Many of the basin’s stakeholders—irrigators, environmental groups, tribal and federal, state, county, and local government representatives—who had been trying to solve their water problems for years, were sitting on the sidelines. Although most didn’t think plans at the time for a new reservoir to store additional water in the basin would work, no one had any answers.”

Sandison had been leading DOE’s efforts in the basin to conduct studies and find solutions. “The joint letter said we were missing the point; that we were planning in a vacuum and failing to look at the issues in a comprehensive way. Just adding water to the basin wouldn’t solve the problems—a new reservoir wouldn’t address lack of fish passage (the ability of fish to swim upstream to their spawning grounds due to blockage by dams, culverts, and bridges), other water storage needs, habitat restoration, or enhanced water conservation to improve the amount of water flowing in streams. It didn’t address trading or selling water rights, or the storage of water in underground aquifers. The letter recommended an integrated approach that looked at everything. It changed the dynamic.”



With a new focus on an integrated approach, people came off the sidelines, according to Sandison. Many were still dubious, but enthusiastic. And, they had study fatigue from the mountain of environmental impact and other studies conducted over 30 or more years, with few tangible results. The feeling was, “enough studies, it’s time to act.” Everyone realized no one would win if people didn’t move beyond their differences. The result? Stakeholders worked from 2009 to 2011 developing the Yakima River Basin IWRM Plan, which identifies a comprehensive approach to water resources and ecosystem restoration improvements in the basin. (<http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/Map-letter.pdf>.) The plan addresses seven elements: reservoir fish passage, structural and operational changes to existing facilities, surface water storage, groundwater storage, habitat/watershed protection and enhancement, enhanced water conservation, and market reallocation.



Achieving Compromise

“At one point, we had been sitting at the table for over a year, with the impasse being present in everyone’s mind,” says Commissioner Leita. “A key turning point came when each person was willing to genuinely listen to differing perspectives—instead of thinking only of their own counter arguments.” In addition to truly listening, compromises had to be made. “I’m a private rights guy,” says Leita, “and I agreed to the government purchasing over 50,000 acres of private land to protect Yakima River headwaters.”



Environmental stakeholders compromised as well. American Rivers’ Michael Garrity said his organization endorsed water storage projects, even though they’ll flood existing valleys and 1000 acres of old growth forests. “We had to be convinced that estimates for water storage needs in the basin were legitimate. Although American Rivers’ main goals were better management through improved water markets (for trading and selling rights) and water conservation, we were willing to consider a different approach that would improve salmon populations, habitat, and flow problems in Yakima River tributaries. The bottom line for American Rivers was, ‘Is it the only way to achieve results in the basin?’ Our support of new dams was as unusual as the irrigators and county commissioners supporting fish passage, and protecting head waters and a wild and scenic designation in the headwaters.”

What made the process work? Getting major stakeholders to the table, and getting agreement on the problem definition, says Sandison. “Without a well defined problem, there will be no solution. It takes a while. Our workgroup also had to understand the comprehensive nature of the problem, ask ‘How much water do we really need?’ and realize that no individual would get everything they wanted.” Garrity agrees. “It was important to acknowledge the legitimacy of interests outside environmental or irrigators’ primary interests. There had to be a willingness to take the long-term view, to put things on the table to get the other side’s buy-in, and to make concessions for your solution.”

Commissioner Leita says there are still people who think the Yakima River Basin IWRM plan goes too far, does not go far enough, or is too expensive. And the price tag is high, at \$3.5 - \$4 billion for a phased project over 30 years. The first \$131 million was appropriated in January 2013 by the Washington State Legislature. “From the County Commission perspective, we believe the plan will be successful, despite its price tag. While it may not be the ultimate solution, it’s a significant solution. The interest groups recognize that the integrated approach benefits everyone; the whole plan is greater than the sum of its parts.” Garrity concurs. “The scale of the integrated plan is larger than American Rivers’ would normally support, but it’s needed to address the scale of the problem. And it delivers amazing environmental benefits for fish passage, habitat, and stream flows.”

Commissioner Leita says there are still people who think the Yakima River Basin IWRM plan goes too far, does not go far enough, or is too expensive. And the price tag is high, at \$3.5 - \$4 billion for a phased project over 30 years. The first \$131 million was appropriated in January 2013 by the Washington State Legislature. “From the County Commission perspective, we believe the plan will be successful, despite its price tag. While it may not be the ultimate solution, it’s a significant solution. The interest groups recognize that the integrated approach benefits everyone; the whole plan is greater than the sum of its parts.” Garrity concurs. “The scale of the integrated plan is larger than American Rivers’ would normally support, but it’s needed to address the scale of the problem. And it delivers amazing environmental benefits for fish passage, habitat, and stream flows.”

Implementing IWRM in the U.S.

The AWRA recognizes Yakima River Basin’s watershed-level approach as demonstrating “the benefits of planning at the appropriate level of governance and incorporating all interests in the planning process.” It also acknowledges the DRBC as an effective multi-state approach that addresses water quality and groundwater issues, and planning for future, changing conditions. (Several other approaches to IWRM are provided at the end of this article.)



BUILDING A FUTURE FOR WATER, WILDLIFE AND WORKING LANDS

YAKIMA RIVER BASIN INTEGRATED WATER RESOURCE MANAGEMENT PLAN



IWRM is promoted by many agencies and organizations, but as AWRA notes, there is no national vision or policy about how best to use, protect, fund, or manage our water resources. In the meantime, IWRM decisions will be left to state, regional, watershed/river basin, and local entities.

Developing effective IWRM plans is challenging, and will have greater chance for success if fundamental frameworks are in place. Policies and legislation that facilitate planning and authorize funding are key. An effective organizational structure for the IWRM effort, whether it's an enforcement authority or a workgroup that supports and coordinates planning, is important, and will involve more than one entity. Building institutional capacity to manage water resources will require educating the public, stakeholders, and water professionals. And accessing and using a broad array of management instruments—water assessments, planning, demand management, conflict resolution, social change strategies, regulatory and economic instruments, and information management—will help increase chances of implementation.

Human rights and water justice perspectives are integral considerations for water management solutions as well. In her 2013 book, *Blue Future: Protecting Water and People Forever*, Maude Barlow, a pre-eminent advocate for water as a human right, calls for a “new water ethic” in decision-making. This ethic puts water squarely at the center of all policies and practices. She suggests that if we take into account the impacts to water from our food, energy, economic, trade, and other policies and practices, our actions will be very different. It's imperative to remember that water is a human right, it is a public trust, and we must be careful stewards of it. In a world where safe, affordable, and accessible water should be available for everyone, it is not. Barlow advises against considering water solely for our convenience or profit. It is the source of all life. It belongs to



Case Studies in
Integrated Water Resources Management:
From Local Stewardship to National Vision



the world's 3 billion poor with no running water, the 2.5 billion who live in water-stressed areas, as well as to the earth, the ecosystem, other species, and to future generations.

IWRM has its critics. Concerns include the lack of a clear IWRM definition; the difficulty of moving from concept to implementation; the complexity of water issues, water management, and jurisdiction; the multitude of issues and interests that require integration; the current lack of clear successes at any level except the micro, or small-scale level; and the lack of existing measures to determine success or failure.

Although IWRM can be complex and demanding to develop and implement, the problems to be solved remain complex and demanding as well. Whether the problem is water pollution that contaminates tap water, a polluted or diverted river, or a lack of water, the threats are increasing. Protecting and managing water resources in an equitable way, that ensures safe, affordable, accessible water for everyone, will likely require setting aside differences and coming to a genuine understanding of the social, environmental, economic, and justice interests that benefit all. Philip Rigdon's reflection about his tribe's involvement in the Yakima River Basin plan perhaps says it best. "There is only so much water available. For us, everyone has a right to a certain amount. If we do not work together, the needs of the whole basin won't be met. It's essential to move together in partnership for the greater good."

References

American Water Resources Association. Case Studies in Integrated Water Resources Management: From Local Stewardship to National Vision. (November 2012). Bateman, B., Rancier, R., Eds. <http://www.awra.org/committees/AWRA-Case-Studies-IWRM.pdf>

Barlow, M. (2013). Blue Future: Protecting Water for People and the Planet Forever. The New Press, New York.

Barlow, M. (October 1, 2013). Interview with Paul Moist, National President, Canadian Union of Public Employees, about Blue Future: Protecting Water and People Forever. Organized by Octopus Books. <http://www.youtube.com/watch?v=fG92ZCjkQds>

Biello, D. (August 8, 2014). "Deadly algae are everywhere, thanks to agriculture." Scientific American. <http://www.scientificamerican.com/article/deadly-algae-are-everywhere-thanks-to-agriculture/>

Biswas, A.K. (March, 2008). "Integrated water resource management: Is it working?" In Water Resources Development. Vol. 24, No.1, 5-22. <http://thirdworldcentre.org/iwrmjournal.pdf>

Gleick, P.H. (March 2000). "The changing water paradigm: A look at twenty-first century water resources development." Water International, Vol. 25, No. 1, pp. 127-138. International Water Resources Association. http://www.unc.edu/~charack/pdf/Gleick_Article.pdf

Global Water Partnership Technical Advisory Committee (TAC). (2000). Integrated Water Resources Management, TAC Backgrounds Papers, No. 4 (p. 22). Stockholm, Sweden. [http://www.gwp.org/Global/ToolBox/Publications/Background%20papers/04%20integrated%20Water%20Resources%20Management%20\(2000\)%20English.pdf](http://www.gwp.org/Global/ToolBox/Publications/Background%20papers/04%20integrated%20Water%20Resources%20Management%20(2000)%20English.pdf)

Sandison, D. (October 29, 2013). Testimony before the U.S. House of Representatives. Derek Sandison, Director, Office of Columbia River, Washington Department of Ecology. <http://docs.house.gov/meetings/II/II13/20131029/101457/HMTG-113-II13-Wstate-SandisonD-20131029.pdf>

Snellen, W.B., Schrevel, A. (October 2004). "IWRM: for sustainable use of water, 50 years of international experience with the concept of integrated water management." Background document to the FAO/Netherlands Conference on Water for Food and Ecosystems. For Ministry of Agriculture, Nature and Food Quality, The Netherlands. http://www.fao.org/ag/wfe2005/docs/iwrm_background.pdf

The Blue Planet Project Website. The Right to Water. <http://www.blueplanetproject.net/index.php/home/water-movements/the-right-to-water-is-the-right-to-life/>

United Nations. (January 31, 1992). The Dublin Statement on Water and Sustainable Development. International Conference on Water and the Environment. <http://www.un-documents.net/h2o-dub.htm>



U.S. Army Corps of Engineers (January 2014). Building Strong Collaborative Relationships for a Sustainable Water Resources Future: Understanding Integrated Water Resource Management (IWRM). <http://aquadoc.typepad.com/files/iwrm-report-jan2014.pdf>

U.S. Army Corps of Engineers. Watertoolbox. us. Federal Support Toolbox for Integrated Water Resources Management. State Water Plans. <http://www.watertoolbox.us/intro/f?p=689:46:0::NO>

Tools for Developing IWRM Plans

Global Water Partnership. Integrated Water Resources Management Toolbox. <http://www.gwp.org/en/ToolBox/>

United Nations. Integrated Water Resource Management Website. <http://www.un.org/waterforlifedecade/iwrm.shtml>

U.S. Army Corps of Engineers. Watertoolbox. us. Federal Support Toolbox for Integrated Water Resources Management. <http://www.watertoolbox.us/intro/f?p=689:1>

Sample IWRM Plans and Strategies

American Water Resources Association. Case Studies in Integrated Water Resources Management: From Local Stewardship to National Vision. (November 2012). Bateman, B., Rancier, R., Eds. <http://www.awra.org/committees/AWRA-Case-Studies-IWRM.pdf>

California Department of Water Resources. (April 2013). Strategic Plan for the Future of Integrated Regional Water Management in California: Development Approach. http://www.water.ca.gov/iwrm/stratplan/documents/DWR_BrochureV2.0_Web.pdf

California Department of Water Resources. Strategic Plan for the Future of IWRM Webpage. <http://www.water.ca.gov/iwrm/stratplan/>

Delaware River Basin Commission Website. <http://www.state.nj.us/drbc/>

State of Oregon, Oregon Water Resources Department. (August 2012). *Oregon's Integrated Water Resources Strategy*. http://www.oregon.gov/owrd/LAW/docs/IWRS_Final.pdf

State of Oregon, Oregon Water Resources Department. Integrated Water Resources Strategy Website. http://www.oregon.gov/owrd/pages/law/integrated_water_supply_strategy.aspx

Yakima Basin Integrated Water Resource Management Plan Website. <http://www.ecy.wa.gov/programs/wr/cwp/YBIP.html>

U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Region and State of Washington, Department of Ecology, Central Regional Office. (March 2012). Yakima River Basin Integrated Water Resource Management Plan: Final Programmatic Environmental Impact Statement - Benton, Kittitas, Klickitat and Yakima Counties. Ecology Publication Number: 12-12-002: <http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf>

National Environmental Services Center
NESC Assistance. Solutions. Knowledge.

"The National Environmental Services Center is a federally funded program that provides free and low-cost information; a comprehensive website; technical assistance via toll-free telephone; magazines and newsletters; training; and educational products specifically designed to address drinking water and wastewater issues of concern to small and rural communities."

Website: <http://www.nesc.wvu.edu/>
Phone: 800-624-8301

Published October 2014