The Water Report™
Water Rights, Water Quality & Water Solutions in the West

In This Issue:

Upcoming Stories:

Water Transfers

Science & Water Policy

Colorado River Management

& More!

YAKIMA RIVER BASIN INTEGRATED WATER PLAN

STRANGE BEDFELLOWS TAKE RISKS, FIND COMMON GROUND

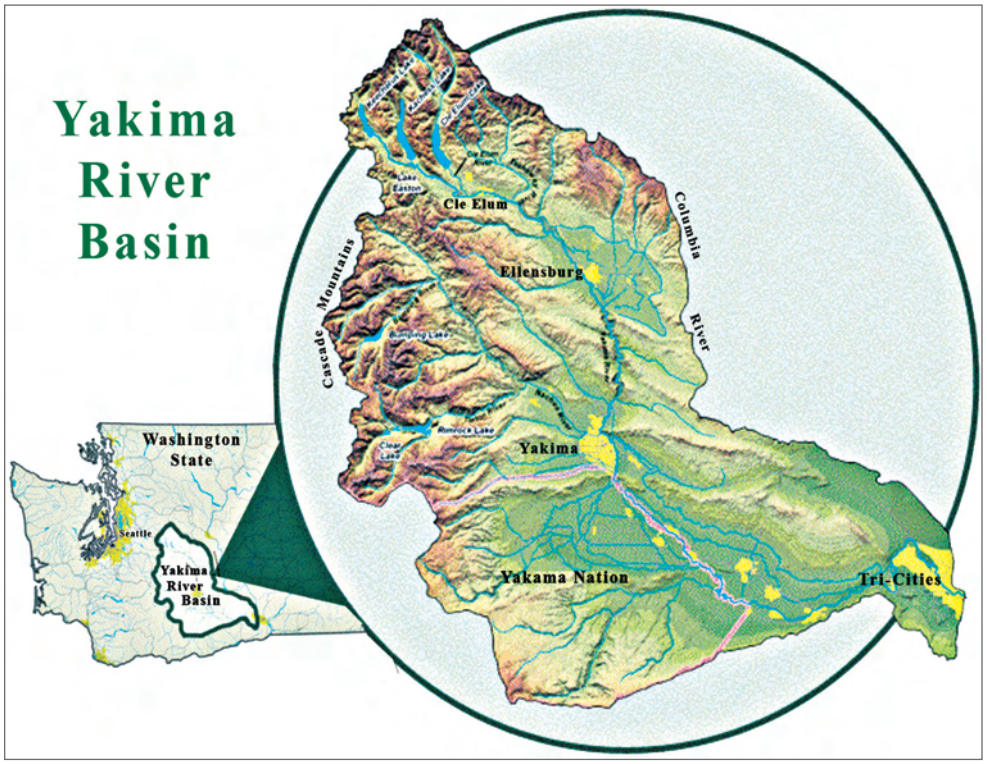
by Steve Malloch, National Wildlife Federation and Michael Garrity, American Rivers

INTRODUCTION

As with almost every major river basin in the American West, the Yakima River Basin (Basin) has a history of instituting ambitious water schemes in pursuit of economic development. As is also all too typical, this development came with many initially unconsidered costs: environmental degradation; long-ignored but resurgent tribal treaty rights; litigation; and, most recently, concern — even in this reliably conservative river basin — about an increasingly uncertain climate future.

In an effort to go beyond the decades of water conflicts spawned by this history, the Basin is now also home to another ambitious plan — the Yakima Basin Integrated Water Resources Management Plan (Yakima Plan) — designed to secure a healthy future for the Basin's fish, farms, forests, and families. The Yakima Plan is the result of an array of interests in the Basin recognizing that digging entrenched positions still deeper is unlikely to result in a satisfactory resolution for anyone.

The Yakima River is located on the arid east side of Washington state, nestled between the Cascade Mountain crest and the Columbia River.



Yakima Basin Plan

Ag Economy

Yakama Nation Treaty Rights

Reclamation Project

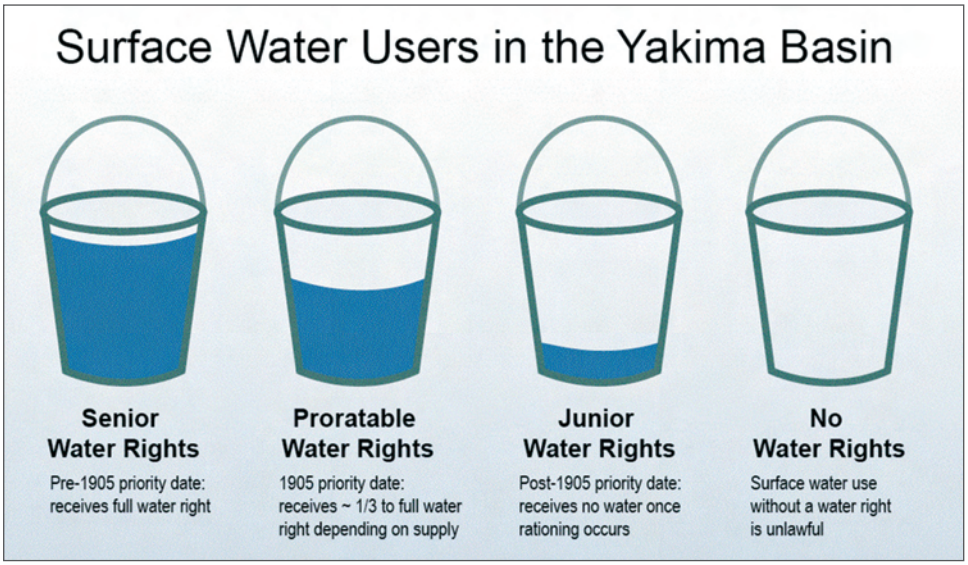
1945 Consent Decree

Water development in the Basin has worked spectacularly well to grow crops and the Basin's agricultural economy. There are roughly 500,000 acres of irrigated land in the 6,155 square mile basin, supporting an agricultural economy valued at $3.4 billion. Average annual water supply is about 3.3 million acre-feet, with deliveries of about 1.7 million acre-feet. Notable crops include: apples; sweet cherries; most of the hops grown in the US; wine grapes; along with dairy and beef cattle, timothy hay exported to feed exotic horses, and a variety of other crops (despite the recent change in Washington laws, there appears to be no discernable marijuana crop — as yet).

One theme in the Basin's story concerns the Confederated Tribes and Bands of the Yakama Nation, whose treaty rights — ratified in 1859 — include traditional rights to hunt and fish. Annual pre-development salmon runs in the Basin are estimated to have included from 300,000 to 960,000 fish. Subsequent to irrigation and other development, sockeye, summer Chinook, and coho were extirpated. The average annual returns for all salmonids during the 1980s dropped to as low as 8,000 — roughly one percent of pre-development levels. Thus, while treaty rights to fish were left intact, there were no fish left to catch. This situation was untenable for the Yakama Nation and also a critical indicator of the Basin's degraded environment.

Another theme, and one directly related to the decline of the fishery, is repeated rounds of irrigation development. Starting in the 1850s, private (eventually including railroad-sponsored) irrigation projects were built. By the turn of the century irrigation fully consumed the Yakima River's natural flow. The next phase was the 1905 authorization of the Bureau of Reclamation's (Reclamation's) Yakima Project, which claimed all unappropriated water to augment supplies through construction of five main storage reservoirs. The associated dams were all built without fish passage. This sealed the fate of sockeye salmon and blocked access to higher elevation, cold-water spawning habitat for spring chinook, coho, and steelhead, as well as isolating bull trout populations above or below the dams.

A *1945 Consent Decree* created an unusual water rights structure in the Basin (the decree was issued in *Kittitas Reclamation District v. Sunnyside Valley Irrigation District,* Civil Action No. 21 (Eastern District of Washington, Southern Division, Jan. 1945)). Pursuant to the *1945 Consent Decree*, Reclamation annually determines the Total Water Supply Available (TWSA). Pre-1905 rights amounting to about half of the Basin's surface water rights receive their full water supply before junior right holders receive any. Next up are users whose rights date to the1905 Reclamation appropriation. These rights are termed "proratable" and are cut back equally in any shortage. Post-1905 rights receive no water if the proratable rights are shorted and there is a "call" (i.e., a senior water right owner requests regulation of junior users so that the senior user receives the full amount of their right). The most senior rights holders thus had little concern about their water supplies because they historically have never been shorted. However, the largest and most economically productive water districts rely in large part on proratable rights. Prior to the regionally historic 1977 drought, proration was of only modest concern for the Reclamation irrigators — there had not yet been a serious shortage of water that resulted in significant proration. Since the Seventies, however, there have been seven years where proratable rights holders received less than 70% of their water, the threshold irrigators see as causing very serious economic pain.



The Water Report
(ISSN 1946-116X)
is published monthly by
Envirotech Publications, Inc.
260 North Polk Street,
Eugene, OR 97402

Editors: David Light
David Moon

Phone: 541/ 343-8504
Cellular: 541/ 517-5608
Fax: 541/ 683-8279
email:
thewaterreport@yahoo.com
website:
www.TheWaterReport.com

Subscription Rates:
$299 per year
Multiple subscription rates available.

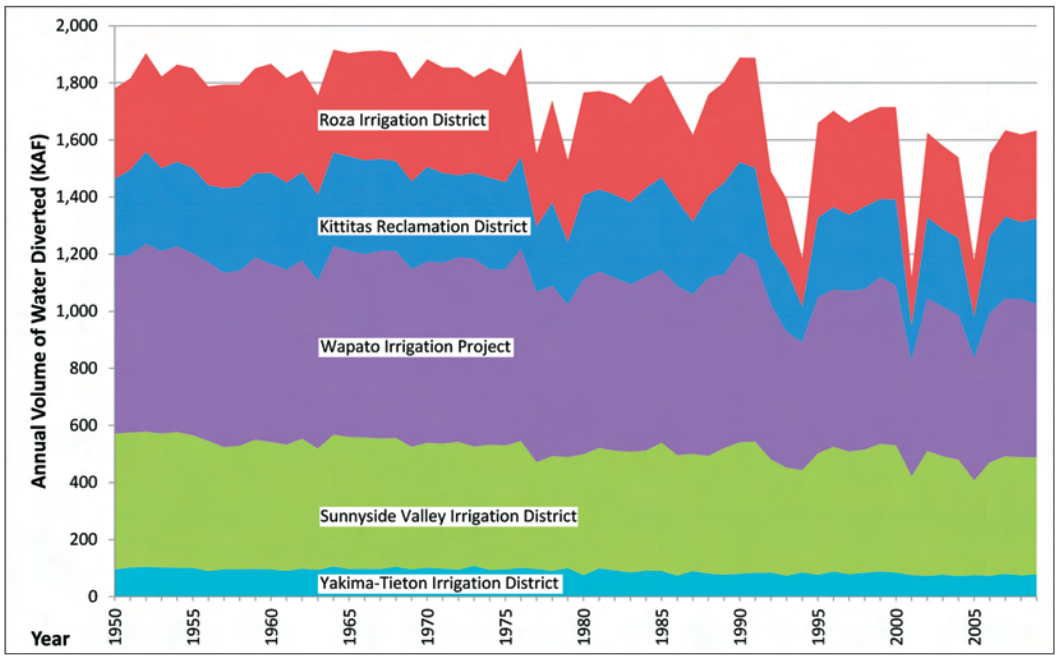
Postmaster: Please send address corrections to
The Water Report,
260 North Polk Street,
Eugene, OR 97402

Yakima Basin Plan

Enhancement Project

The 1977 drought prompted renewed interest in new storage to improve the reliability of the proratable supply. Federal legislation in 1979 and then 1984 authorized what is known as the Yakima River Basin Water Enhancement Project (YRBWEP) Phase I, which included a focus on installing fish screens and fish passage at irrigation facilities in the middle and lower parts of the Basin. After additional severe droughts in 1992 and 1993, YRBWEP Phase II was implemented in 1994. Phase II focused on water conservation and efficiency along with some habitat acquisition and restoration. It has resulted in significant system improvements and continues as funding allows.

Water Diversions



Black Rock Project

Proponents of YRBWEP Phase I and Phase II envisioned this work as preparing for a Phase III that would include significant additional storage. In 2003, Congress authorized a feasibility study for new surface supplies involving a transbasin diversion of Columbia River water into the Basin coupled with development of a 1.3 million acre-foot off-stream storage facility known as the Black Rock Project. The Black Rock proposal foundered in 2008, due to a cost/benefit analysis that concluded the project returned only 13 cents on the dollar and had significant potential to speed the movement of radioactive groundwater at the Hanford Nuclear Reservation Superfund cleanup site towards the Columbia River.

The State of Washington, urged on by the unusual alliance exhibited in a joint comment letter from the Yakama Indian Nation and Roza Irrigation District, as well as separate input from conservation organizations, concluded that the process followed in developing Black Rock would not satisfy State requirements that a broader range of alternatives be evaluated. In an Environmental Impact Statement (EIS), the State developed the nucleus of what became the Yakima Plan by balancing fishery improvements, better water management, and supply enhancements.

Climate Change & Storage Capacity

At the same time, concern was growing in the Basin about the effects of climate change. Both fish and farms rely upon the low to mid-elevation Cascade Range snowpack — the so-called "sixth storage reservoir." Due to projected reductions in snowpack and earlier melt-off, modeling conducted by the University of Washington's Climate Impacts Group (CIG) concluded that the Basin will become subject to increasingly severe instream and out-of-stream water shortages. The CIG scenarios show the chances of severe water shortages (now about 14% per year) doubling by as soon as 2020 and becoming much higher thereafter.

For such a thoroughly "plumbed" river system, the Yakima is surprisingly sensitive to loss of snowpack. Compared to many other developed agricultural river basins in the West, Basin storage is quite limited compared to annual flow — a condition made possible by the historically reliable and abundant Cascade snowpack. About 30% of the Yakima's average annual runoff can be stored in reservoirs. This is much less than major rivers in California, where 67% to more than two times annual flow can be stored, and far less than the major storage systems of the Colorado River or the Missouri River, where several times annual runoff can be stored (see Table).

TABLE
Western Rivers Impounded Runoff Index
(Surface Storage divided by average annual flow)

Yakima River, WA	30%
Sacramento River, CA	80%
American River, CA	67%
Tuolumne River, CA	194%
Stanislaus River, CA	293%
Yuba River, CA	75%
Feather River, CA	129%
San Joaquin River, CA	120%
Merced River, CA	101%
Trinity River, CA	206%
Missouri River	222%
Colorado River	492%
Columbia River	28%

Reclamation Basin Studies

Reclamation Basin Studies are being conducted on selected river basins or sub-basins in the 17 Western US Reclamation States.
Each Basin Study must include at least these four basic components:

- Projections of water supply and demand within the basin, or improvements on existing projections, taking into consideration the impacts of climate change;
- Analysis of how existing water and power infrastructure and operations will perform in the face of changing water realities such as population increases and climate change;
- Development of structural and nonstructural options to improve operations and infrastructure to supply adequate water in the future;
- A trade-off analysis of the options identified and findings and recommendations as appropriate. Such analysis simply examines all proposed alternatives in terms of their relative cost, environmental impact, risk, stakeholder response, or other attributes common to the alternatives. The analysis can be either quantitative or qualitative.

The Studies are funded and conducted jointly by Reclamation and local/regional cost-share partners.

Thus far Reclamation has initiated 17 studies, which are in various stages of development and completion, these include the following: Los Angeles Basin (California); Pecos River Basin (New Mexico); Republican River Basin (Colorado, Kansas and Nebraska); Sacramento-San Joaquin Rivers Basin (California); Upper Washita River Basin (Oklahoma); Hood River Basin (Oregon): Klamath River Basin (California/Oregon); Lower Rio Grande Basin (TX); Santa Fe Basin (NM/CO); Henry's Fork of the Snake River Basin (ID); Niobrara River Basin (NE); Santa Ana River Watershed Basin (CA); Southeast California Regional Basin (CA); Truckee River Basin (CA/NV); Colorado River Basin (AZ/CA/CO/NV/NM/UT/WY); St. Mary and Milk River Basins Study (MT); Yakima River Basin (WA).

For Info: www.usbr.gov/WaterSMART/bsp/studies.html

Comprehensive assessment of water supply and demand in selected major watersheds was authorized under the Federal SECURE Water Act of 2009. The Act directed Reclamation to focus on river basins or sub-basins in the 17 Western Reclamation States where imbalances in water supply and demand exist or are projected. The Yakima Basin was selected as one of the first three basins to be comprehensively studied in terms of long-term water supply, long-term water demands, climate change, and environmental issues.

From the outset, the Yakima Basin Study was designed and conducted to gather information to develop a "Comprehensive Water Resource Management Implementation Plan" for the Basin (see www.usbr.gov/WaterSMART/bsp/docs/fy2009/Yakima%20River.pdf).

Basin stakeholders recognized that they had to work together. They already had extensive information developed as a result of the divisive Black Rock project as well as extensive fisheries recovery planning and knowledge of water conservation developed under YRBWEP Phases 1 and 2. As a result, the Yakima Plan moved relatively quickly to a basic set of agreements hammered out by an unusually broad set of agricultural, tribal, environmental, and governmental (federal, state, and local) stakeholders. The "*Yakima Basin Study/ Proposed Integrated Water Resources Management Plan*" was released in April, 2011 (*see*: www.usbr.gov/pn/programs/yrbwep/2011integratedplan/plan/integratedplan.pdf) followed by a Programmatic Environmental Impact Statement in March 2012 (*see*: www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf).

Yakima Basin Plan

Plan Elements

Dams & Fish

YAKIMA BASIN INTEGRATED WATER RESOURCES MANAGEMENT PLAN

The Yakima Plan consists of seven elements intended to restore the Basin's native fisheries and improve the reliability of instream and out-of-stream water supplies in the face of climate change and population growth. Those elements are: 1) Fish Passage; 2) Structural and Operational Changes; 3) Surface Water Storage; 4) Groundwater Storage; 5) Habitat Protection and Enhancement; 6) Enhanced Water Conservation; and 7) Market Reallocation of Water.

Fish Passage

All five of Reclamation's major water supply dams in the Basin (Keechulus, Kachess, Cle Elum, Bumping, and Tieton/Rimrock) were built between 1910 and 1933. None included fish passage. Even when Keechelus Dam was rebuilt for safety reasons in the early 2000s, fish passage was not added. The Yakama Nation and the Washington Department of Fish and Wildlife (WDFW) initiated litigation to force Reclamation to include fish passage in the rebuild. Reclamation refused due to the agency's then-current policy not to include environmental measures in dams' safety repairs because to do so could put funding for such projects at risk. In 2006, however, a settlement was reached. The settlement included commitments to: an assessment of fish passage at all five major Basin water supply reservoirs; interim juvenile fish passage at Cle Elum Dam; and a feasibility study of passage at Cle Elum and Bumping Reservoir dams. The Yakima Plan builds on that settlement, calling for the installation of fish passage at all five of the headwaters dams to allow threatened steelhead, spring chinook, coho, and sockeye access to the Basin's extensive and cold high-elevation habitat. Access to this clean, cold habitat will greatly benefit all four of these anadromous species. Sockeye stand to benefit in the largest numbers, as they require rearing in lakes and have not had access to any of them since the early 20th century. Until an experimental sockeye reintroduction program got underway at Cle Elum Reservoir, the last time a sockeye had been seen in the Basin was 1933.

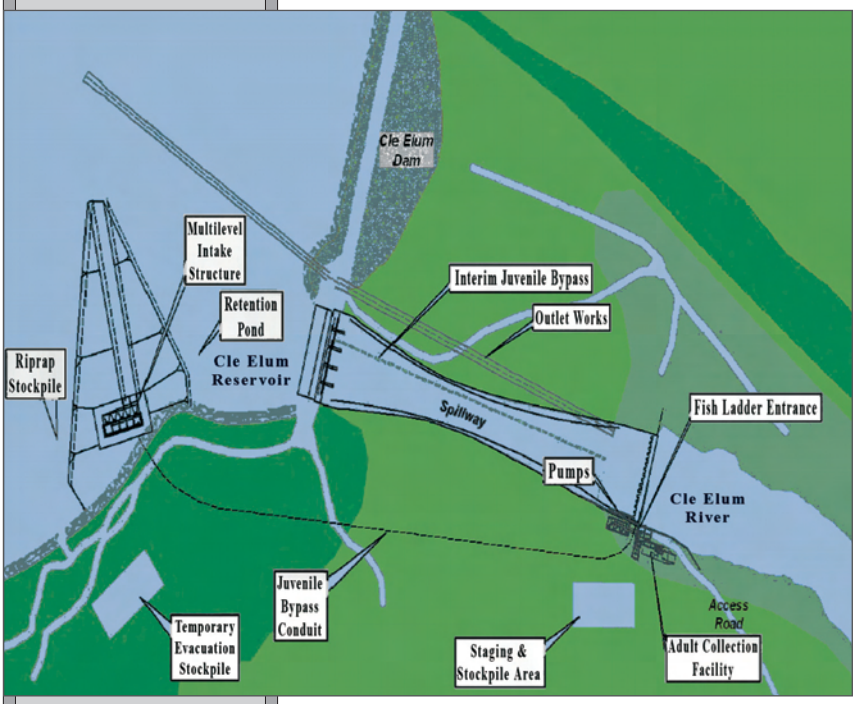
Members of the YRBWEP Workgroup

Federal Agencies	***Washington State Agencies***
Bureau of Reclamation	Department of Ecology
National Marine Fisheries Service	Department of Agriculture
U.S. Fish and Wildlife Service	Department of Fish & Wildlife
U.S. Forest Service[1]	
	Local Governments
Yakama Nation	Benton County
Yakama Nation Natural Resources	Kittitas County
Yakima/Klickitat Fisheries Project	Yakima County
	City of Yakima
Irrigated Agriculture	
Kennewick Irrigation District	***Other Stakeholders***
Kittitas Reclamation District	American Rivers
Roza Irrigation District	National Wildlife Federation[2]
Sunnyside Valley Irrigation District	Yakima Basin Fish & Wildlife Recovery Board
Yakima-Tieton Irrigation District	Yakima Basin Storage Alliance

[1]Joined Workgroup in 2012 [2]Alternate for American Rivers

Basin Plan

The Basin's resident bull trout (listed under the federal Endangered Species Act (ESA)) also stand to benefit from the fish passage element of the Yakima Plan, as existing populations are isolated above the headwaters dams. This isolation prevents genetic interchange among the Basin's bull trout.



Fish passage in the Yakima plan will include both juvenile and adult passage facilities. Juvenile passage will be designed to allow for downstream out-migration at various reservoir levels so as to ensure a natural migratory window as the reservoirs begin to be drawn down during the spring.

The Yakima Plan prioritizes fish passage at Cle Elum Dam and this project is already receiving federal and state funding for design work. The order and timing of fish passage at other dams remains subject to negotiation about the overall phasing-in of Plan implementation. To gain the access to the most river miles of habitat, passage priorities are Tieton (36.8 miles), Cle Elum (29.4 miles), Keechelus (up to 16.8 miles), Bumping (5-6 miles), and Kachess (2.4 miles). Cle Elum was chosen to proceed ahead of Tieton due to the technical complexity and expense of designing and constructing juvenile (downstream) fish passage at Tieton, although restoring access to the Tieton system is vital to meeting the promise of the Yakima Plan. The Yakima Plan also calls for installing fish passage for bull trout into Clear Lake, a small reservoir in the Tieton River drainage.

Facility Changes Proposed

Structural and Operational Changes to Existing Dams and Irrigation Facilities

The Yakima Plan includes several changes to existing dams and irrigation facilities for the benefit of river flows and salmon and steelhead habitat.

Facility changes include:

- Reduced (or "subordinated") water diversions for hydropower production at Roza and Chandler diversion dams on the Yakima River mainstem. This will help restore flows below these facilities for the benefit of salmon and steelhead.
- Construction of a pipeline between Keechelus and Kachess reservoirs. This pipeline will allow for more natural flow levels in the 11 mile river reach between Keechelus and Kachess reservoirs for the benefit of salmon and steelhead. This will also allow Kachess to refill more quickly after it is drawn down further in drought years pursuant to the Kachess "inactive storage" proposal discussed below.
- Raising Cle Elum Dam three feet in order to increase storage in the Reservoir by nearly 15,000 acre-feet.
- Improvements to the Kittitas Reclamation Canal that will reduce leakage, unblock fish passage barriers created by irrigation infrastructure, and allow for flow improvements in Kittitas Valley creeks.
- Piping and lining the Wapatox canal could allow for consolidation of diversions, which may allow for the removal of a diversion dam from the Naches River.

Storage Increases

Surface Water Storage

The Yakima Plan calls for significantly increasing the Basin's surface storage by: accessing inactive storage at the existing Kachess Reservoir; expanding Bumping Reservoir; and building the new off-channel Wymer dam and reservoir:

- Kachess inactive storage will tap Kachess Reservoir below the existing dam outlet so that 200,000 acre-feet of water could be accessed during drought conditions.
- Bumping Reservoir will be expanded from 34,500 acre feet to 200,000 acre-feet. The additional water will be used to provide drought year supplies and more natural flows during the out-migration of juvenile salmon and steelhead. This proposal was reduced from a larger 458,000 acre-foot expansion in order to protect the bulk of bull trout spawning habitat in Deep Creek and to ensure a higher probability of refill. The reservoir will be expanded by building a new dam about 3/4 of a mile downstream of the existing dam at Bumping Reservoir. The expanded reservoir's footprint will be about 3,500 acres, up from roughly 1,500 acres today. The Bumping Reservoir expansion is the most politically controversial component of the Yakima Plan, as it will inundate: about 980 acres of old growth forest; three-quarters of a mile of bull trout spawning habitat in Deep Creek; private cabins leased from the Forest Service; and a campground. The Bumping Reservoir expansion remains in the Yakima Plan in part to provide managed storage to meet fishery goals in the Naches arm of the Yakima River system. It is also about half as expensive as the Wymer Dam proposal for the same amount of new storage.

Yakima Basin Plan

New Dam

Wymer Dam and reservoir will be built on Lmuma Creek, a small tributary of the mainstem Yakima River that flows into the Yakima in the Lower Yakima Canyon between Ellensburg and Selah. The 162,500 acre foot reservoir will be filled by pumping from the Yakima River, most likely from just above the mouth of Wymer Creek. The water will be stored behind a 450-foot high dam. The reservoir will have a footprint of about 1,400 acres, including 1,055 acres of shrub steppe habitat. Half of the water stored at Wymer will be used to improve flows for salmon and steelhead; the other half will be used to improve the reliability of the water supply for existing irrigators. If Wymer Reservoir is able to supply the Roza Irrigation Canal directly, it could allow for the removal of Roza Dam from the mainstem Yakima River.

Groundwater Storage

Groundwater Recharge

The Yakima Plan proposes several projects to recharge the Basin's aquifers and groundwater. The idea is to capture water during high flow periods (while still allowing for the environmental benefits of peak flow). Depending on the project, the captured water can be stored for later out-of-stream use or allowed to passively return to the river to improve flows and cool summer water temperatures for the benefit of salmon.

Habitat Protection and Enhancement

Habitat Restoration

In addition to the separate fish passage elements, the Yakima Plan includes numerous actions to improve the quality and quantity of habitat for the Basin's anadromous and resident fish populations — as well as enhancing protections for significant blocks of privately and publicly owned lands.

The Plan proposes to spend $450 million on habitat restoration, including significant restoration of the Yakima River's floodplain in the Ellensburg, Selah, and Yakima areas as well as extensive tributary restoration. Much of this restoration work is outlined in the Yakima Subbasin Plan and the Yakima Steelhead Recovery Plan.

Private Lands

The protection and enhancement provisions of the Plan's habitat element include protecting 70,000 acres of private land that is a high priority for conservation purposes and has a nexus with the goals and impacts of the Yakima Plan. This includes 15,000 acres of shrub steppe land in the Yakima Canyon or possibly near the lower Yakima, at least 10,000 acres of Plum Creek lumber company's forest lands in the central Cascade Mountains (currently in a "checkerboard" pattern with federal ownership), and 46,000 acres of private forest lands in the Teanaway River basin. The Teanaway watershed has long been identified by the environmental community as a high priority conservation target. The Teanaway River is a free-flowing tributary of the upper Yakima that is a very high priority for steelhead, spring chinook, coho, and bull trout restoration — but only if the land is protected from future development. It is also prime habitat for an array of wildlife, including a recently arrived wolfpack, and is heavily used for recreation.

Federal Lands

The Plan also proposes to enhance protections for much of the Basin's upper watersheds (mostly federal land) through new wilderness and wild and scenic river designations as well as improved management for the benefit of fish, wildlife, and stream flows on US Forest Service lands in a manner that is compatible with a variety of recreational activities.

Enhanced Water Conservation

The enhanced water conservation element of the Yakima Plan includes agricultural, municipal, and domestic water conservation measures.

Agricultural Conservation

Agricultural conservation under the Plan will save up to 170,000 acre-feet of water in wet years, which will both extend existing water supplies and improve flows for salmon and steelhead in several reaches of the Yakima and Naches rivers. Types of agricultural conservation projects to be funded include: lining or piping existing canals and laterals; constructing re-regulating reservoirs on irrigation canals; installing gates and automation on irrigation canals; improving water measurement and accounting systems; installing higher efficiency irrigation systems on-farm; and implementing irrigation management systems to reduce seepage, evaporation, and operational spills. As noted above, these kinds of projects are already being accomplished as federal funding allows — the previously initiated Yakima River Basin Water Enhancement Project promises to greatly expand the funding for implementation of water conservation throughout the agricultural lands of the Basin as well as the scope of where the projects occur (*see*: www.ecy.wa.gov/programs/wr/cro/yakimabasin.html).

Municipal & Domestic Use

The Yakima Plan will allow for access to new water supplies by municipal and domestic users. However, to access this water these users will need to demonstrate that they met efficiency standards identified by a multi-stakeholder advisory body.

Market Reallocation of Water

Water Market

The water marketing element of the Yakima Plan will build on existing efforts in the Basin to reallocate existing water supplies through a water market and/or water bank. Under this program, water rights are purchased, sold, or leased on a temporary or permanent basis to improve out-of-stream water supply and instream flow conditions — especially during drought years. The Plan proposes to increase the amount of water moved from low-value annual crops to higher-value perennial crops and reduce the delay for

Yakima Basin Plan

Law & Policy Changes

such transactions. This will occur in two phases (both of which will require more fleshing out). The first phase will involve a near-term effort to build on the Basin's existing water market by providing additional administrative and technical support to encourage more transactions. The second phase will require more substantial changes to law and policy to facilitate more inter-irrigation district water exchanges in addition to the intra-district exchanges that are more common in the Basin today. The initial goal for this program is to market up to 60,000 acre-feet. However, as the price of water increases and institutional barriers are reduced, some parties are estimating that much more water will be marketed on a temporary basis during low-water years.

RESULTS

As the Yakima Plan is implemented it will bring significant on-the-ground benefits in terms of a more reliable water supply and significantly improved fisheries and overall environmental health. There are also economic benefits from both the fisheries and out-of-stream water supply elements.

Fisheries Benefits

On the fisheries side, the Plan is projected to increase escapement of salmon and steelhead to their spawning grounds from a mid-range estimate of 26,828 annually without the Yakima Plan to 225,350 with it — a ten-fold improvement. The range of salmon and steelhead numbers without the plan is 12,139-91,580 compared to 132,215-401,154 with it. The biggest component of the restored fishery will be sockeye; with access to all five reservoirs, between about 110,000 and 250,000 sockeye are projected to return to the Basin each year. Other fish species will benefit from the Plan as well. Threatened bull trout will be able to migrate above and below the reservoir dams for the first time in about a century, reconnecting physically and genetically isolated populations. Other resident trout — including rainbow and westslope cutthroat — will benefit from restored floodplain, riparian, and stream habitat and healthier flows in tributary streams and the mainstem of the Yakima River.

Water User Benefits

On the out-of-stream water user side, the Yakima Plan will help protect proratable irrigators from the impacts of drought and the impending effects of climate change, greatly increasing the likelihood that even in dry years they will have at least 70% of their full allotment of water — the level needed for their economic viability. In addition, municipal and domestic water rights will be more secure and able to meet growth in water demand over time.

THE ECONOMICS

Probable Costs

While the Yakima Plan is a terrific piece of political work that finely balances the many competing interests and priorities, it is also expensive. In 2012 dollars, the most probable cost is estimated at $4.2 billion (with a range of from $3.2 to $5.4 billion), which when reduced to present value nets a current cost of $3.12 billion. The major water supply elements in undiscounted 2012 dollars are: Wymer Reservoir and conveyance ($1.4 billion); Bumping Reservoir expansion ($571 million); and the Kachess inactive storage plus the Keechelus to Kachess pipeline ($476 million). Water conservation projects are estimated at $427 million. Fishery recovery and enhancement costs include passage at the six reservoirs ($433 million) and mainstem/tributary restoration ($480 million).

Benefits

However, these costs are far outweighed by the benefits — primarily the fishery benefits. In October of this year, Reclamation released a preliminary economic analysis that found the economic benefits are more than double the costs of the project (see www.usbr.gov/pn/programs/yrbwep/2011integratedplan/plan/framework.pdf).

Reduced to present value and 2012 dollars, Reclamation found that total benefits range from $6.2 to $8.6 billion, resulting in a benefit cost ratio of at worst 1.4 to 1 and at best 3.2 to 1. Restoring the fishery is the overwhelming benefit of the project. Using a "willingness to pay" approach the present value of fishery restoration is $6.2 billion, 7.75 times the irrigation benefit of $800 million and 15.7 times the domestic and municipal water supply benefit of $395 million. The preliminary cost allocation analysis placed $2.44 billion of cost on ecological restoration, $729 million on irrigation, and $31 million on municipal and domestic water supply. These numbers are preliminary because Reclamation based them on a programmatic analysis rather than the usual project-specific analysis. As each specific project is proposed, Reclamation will presumably perform project specific economic analysis.

Funding Questions

So who's going to pay for this? As this article goes to press, the news stories are all about the "fiscal cliff" and the struggles of the federal government to raise revenue and cut spending. Clearly, the old model of 90% or more subsidy for Reclamation water projects make no sense. The assumption of most participants in Yakima Plan is that there will be some federal money — but that much, perhaps most, of the funding will have to be a combination of beneficiary, state, and local funding. In other words, water users will be paying substantially for the project, along with some spreading of the public costs of environmental restoration on the counties and the state. The balance of payment is an active topic of discussion, and presumably Congress and the Administration (particularly the Office of Management and Budget) will have strong opinions.

Yakima Basin Plan

In addition, this $4 billion dollar program will not and could not be built immediately. The Yakima Plan sets up a series of projects that will be tackled over time — perhaps three or four decades. That makes the $4 billion dollar project a still ambitious, but much more manageable target. Of course time also raises the thorny issue of sequencing — how to create groups of projects that address enough of the interests to keep the political coalition together. This is also is a topic of serious current discussion.

THE NEED FOR A NEW COMPREHENSIVE APPROACH

Tenuous Status Quo

Yakima Plan participants recognize that the existing situation increasingly does not work for any of the Basin's interests. Agriculture dependent on a proratable water supply is facing increasingly frequent severe shortages. Fishery restoration has made modest progress from the 8,000 fish average returns of the 1980's to around 25,000 now. However, this is far short of restoration of healthy abundant runs that biologists and recreationalists desire and the Yakama Nation seeks to fulfill its Treaty rights — and climate change puts even these tenuous current conditions at risk. Basin interests recognize that something has to change.

Way Forward

The result is that each set of Basin interests has acknowledged the legitimacy of other's interests. The only way forward is to take steps that, in a balanced way, move all interests to better positions. Make no mistake, the Yakima Plan is at its heart a political document. It reflects an outline of a possible way forward where a series of steps can be taken whereby each step makes all of the interests better off. As obstacles arise, the Plan will need to adapt to reach politically and technically feasible solutions — all premised on the goal of making everyone better off.

In many respects, Reclamation succeeded in its mandate to develop a robust agricultural economy in the West. However, readers of *The Water Report* know all too well that in fulfilling that mission the environmental tradeoffs could be devastating. One result was that practically every major river system in the West is now run as much by Endangered Species Act biological opinions as by water managers. Reclamation has struggled with new missions of water management and environmental stewardship and is preparing for the challenges to water resources that climate change presents.

Broad-Based Approach

In the Yakima Basin, Reclamation is party to a broad-based new approach being crafted to supply solutions to a broad set of problems. Yakima has relatively modest surface storage because of its reliable snowpack. As the snowpack dwindles, additional storage will be needed for both fish and farmers. There is general agreement that it makes sense to first make the best use of existing infrastructure. This includes accessing inactive storage and then building economically justifiable new or expanded storage, assuming that the Bumping Lake expansion and Wymer Dam proposal withstand National Environmental Policy Act and Endangered Species Act scrutiny. At the same time, these projects will be embedded in an overarching program of environmental restoration — this is not the approach of the old dam building era.

As is undoubtedly true for most Yakima Plan participants, discussions inside your authors' organizations — American Rivers and National Wildlife Federation — have been, shall we say, vigorous. However, the outcome has been a general recognition that in the Yakima there is an opportunity to accomplish a project with enormous environmental benefits — starting with restoring hundreds of thousands of salmon to a river that essentially lost its fish. This is a project that has embedded climate adaptation at its core and aimed at doing what is needed to have the condition of the fish, farms, forests, and families of the Basin be sustained and improved in light of the changes to hydrology that climate change is bringing. The Plan is an opportunity to rectify some of the damage inherent in Reclamation's earlier mission. The Basin is already a thoroughly "plumbed" system. Environmental progress here requires new engineering along with a suite of restoration and protection measures. Rather than write the Basin off, our organizations are willing to consider adding to that plumbing.

Project Sequencing

We also have a firm belief that the Yakima Plan is going about the situation in the right way. On the water side, a tremendous amount of conservation has already been accomplished and more is hard-wired into the Plan. Preliminary plans for sequencing the infrastructure projects are appropriate, as we make best use of existing infrastructure (e.g. the Kachess Lake inactive storage proposal) before we would build new or expanded surface water storage (the Wymer and Bumping proposals). The enormous restoration and protection included in the Yakima Plan is why we're willing to support the Plan as a whole even though we would likely oppose some of its specific elements in isolation.

It is not only that environmental restoration and protection are embedded in the project, it is that they are part of a comprehensive approach that is the only way the project makes any sense.

Comprehensive Approach

For instance, conservation, efficiency, and marketing are essential parts of the solution — but they do not provide fish passage at the major dams, and they do not fund the habitat work needed to restore the fishery. They also do not address the fact that Yakima has modest surface storage compared to its water supply and water demand. Without the reality of climate change and the reduction in water storage provided by snow pack, conservation, efficiency and marketing might be enough; but with climate change, they are not enough. We also believe that as the high cost of new water supplies is factored into the thinking of Basin interests, marketing, conservation, and efficiency will look much more attractive, and may reduce the need to do some of the infrastructure projects.

A decade ago, the conservationist approach to the Yakima would have been to address water needs though conservation, efficiency, and marketing, do the fishery restoration, and call it a day. With climate change, that approach is no longer enough. We need to augment water storage to make up for loss of snow pack. We need to have water supplies that can be managed for fish. We need to align how watershed land is managed so that it supports water retention, water temperature, and habitat goals. We live in an increasingly complicated world, and for the Basin, that means that "just doing the fishery part" now involves coordinating water supply and land management.

Land acquisition and protection fit into a water project in several ways:

- Fishery restoration requires good habitat, and proper management of land in the watershed is needed for that habitat. The Teanaway acquisition is a great example — it is the best major riverine salmon restoration prospect, but cannot be done without resolving ownership in a way that supports conservation. Further, the US Forest Service needs to manage its land to support fisheries.
- Almost all of the water in the system is ultimately runoff. How the land is managed will affect the timing, amount, and quality of the runoff. While land management for water supply timing, snowpack retention, and quality is far from a perfected art, as climate change effects are increasingly apparent, it is increasingly important. The Yakima Plan is a test case for integrating land management (particularly National Forests) with water systems (especially Bureau of Reclamation projects). As a result of the Yakima Plan, the Forest Service is now engaging with the Bureau of Reclamation on several SECURE Water Act basin plans — evidence that the Yakima is already changing the frame of reference for watershed issues and climate change. Additionally, the Forest Service is expected to release a new policy on water in the coming months, which may serve to shape land protection for water ecosystem services projects.
- Impacts from some components of the Yakima Plan will need to be further addressed. Projects like the Bumping Reservoir expansion will require project-specific analysis and project-specific mitigation in the form of land acquisition and protection beyond that included in the Yakima Plan's present habitat protection and enhancement element.

CONCLUSION

IS THE YAKIMA PLAN A MODEL FOR THE WEST?

The most important lesson of the Yakima Plan is that the interests realized they had to work together to accomplish anything. Putting aside historical enmity is undeniably difficult, but likewise undeniably necessary if progress is to be made. At a critical point in the process leading to the Yakima Plan, the Yakama Nation and Roza Irrigation District put aside historical positions and found common ground on a key issue, which was critical in leading to a broadly supported approach.

The second main lesson is that the Yakima Plan is not a water project. Rather it is a comprehensive fishery restoration project, an ecosystem sustainability project, a long term economic sustainability project and a hybrid land-water-climate adaptation project that has elements of a traditional water project.

In order to address our current problems and prepare for the radically different conditions that disruption of the climate brings, we need to work together and think broadly. That is the model the Yakima Plan represents for the West. While some may see new or expanded water storage as the preeminent feature of the Yakima Plan, we see it as a targeted solution that is one component of a much larger strategy to meet the specific needs of the Yakima Basin's fisheries and agricultural industry.

Other river basins can learn from the Yakima model, but that lesson needs to be tailored to the needs of each basin. For instance, additional storage likely makes much less sense in the Colorado River Basin, where little water ever reaches the Gulf of California, or in California, where Delta problems result from reduced outflow, or in other Columbia Basin tributaries that can meet fisheries and irrigation needs with smaller changes to existing systems.

What's replicable about the Yakima Plan is the process and the comprehensive approach — one that involves reaching out to historical adversaries and in taking a broad view of the Yakima Basin's environment, economics, and future climate.

For Additional Information:
Steve Malloch, National Wildlife Federation, 206/ 577-7827 or mallochs@nwf.org
Michael Garrity, American Rivers, 206/ 852-5583 or mgarrity@americanrivers.org

For more information on the Yakima Basin Integrated Plan,
please visit www.yakimaforever.org and www.ecy.wa.gov/programs/wr/cwp/YBIP.html.

American Rivers website: www.americanrivers.org
National Wildlife Federation website: www.nwf.org

Steven Malloch joined the National Wildlife Federation in 2008, as Senior Western Water Program Manager. Steve's responsibility at NWF is creating a program that links providing habitat for fish and wildlife with adapting water systems to climate disruption. Prior to joining NWF, he consulted with foundations and NGO's on water policy and campaigns, served as Executive Director for the Western Water Alliance, and worked as Washington DC counsel for Trout Unlimited's Western Water Project. Before shifting to the non-profit sector, Steve practiced environmental law and litigation in San Francisco with Graham & James. Steve started his career in water as a hydrogeologist, working on water supply and contamination projects primarily in the Western US. His degrees are in geology and law from the University of California at Davis, and an MS in Water Resources Administration from the University of Arizona. He is admitted to the bar in Washington and California.

Michael Garrity is American Rivers' Washington State Conservation Director. He joined American Rivers in 2000, working out of its Washington, DC, headquarters on American Rivers long-running campaign to restore Snake River salmon. Michael moved back home to the Puget Sound area in 2003 to work for American Rivers' Northwest Regional Office, where he works on a variety of water management and fish/river restoration issues in the Columbia and Puget Sound basins. Michael earned a BA in history at the UW before attending law school at Boalt Hall at UC Berkeley.

Pipeline Projects

Storage Facilities

Shifting Focus

PIPE DREAMS

WATER SUPPLY PIPELINE PROJECTS IN THE WEST

by Denise Fort, University of New Mexico Law School
&
Barry Nelson, Natural Resources Defense Council

INTRODUCTION

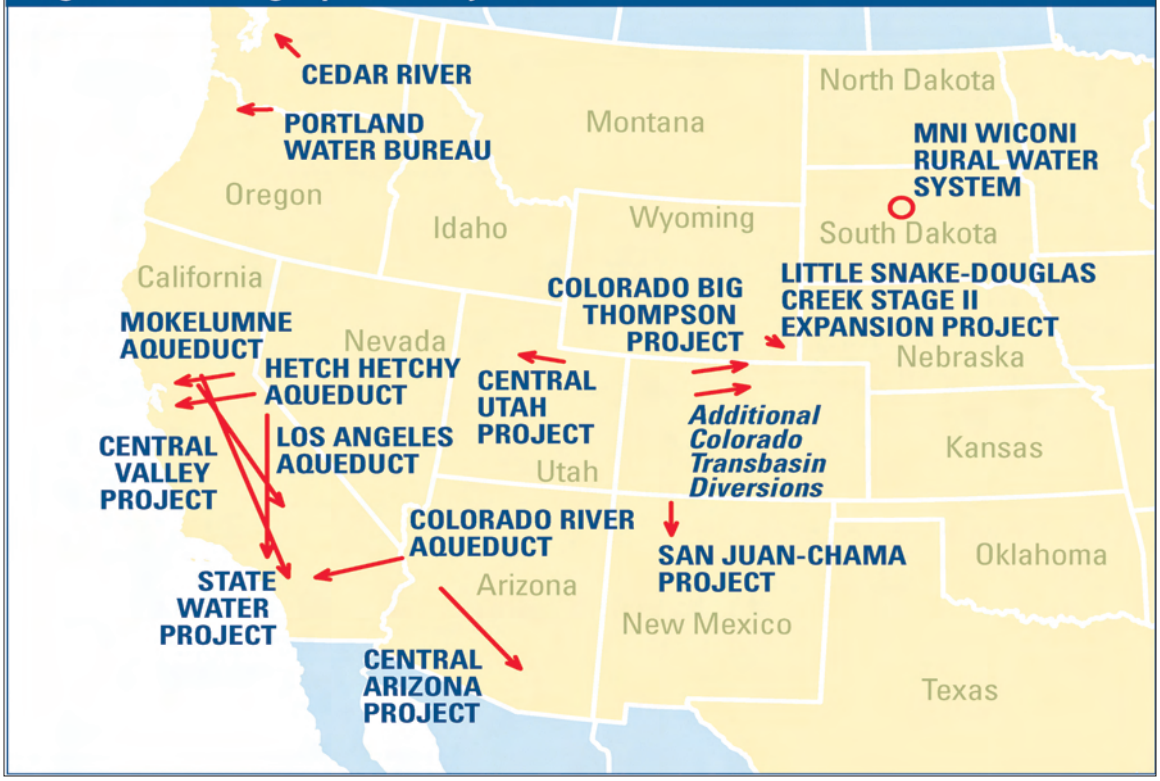
Large-scale water supply conveyance pipelines have long been an important tool for addressing water needs in the western United States. These pipelines have traditionally been used as a component in complex water projects constructed to capture, store, and move water to serve urban and agricultural users. Traditional water projects have long been designed to tap into major sources of water, frequently through the construction of surface storage projects and associated pipelines, canals, and pumping stations. Indeed, dams have often been the most well-known and expensive features of large water projects, which often came at high economic and environmental costs.

In the last century, reservoirs and associated pipelines and aqueducts were the dominant strategy for providing water in the western United States. The US Bureau of Reclamation (Reclamation) alone lists 339 dams among its project facilities. The US Army Corps of Engineers (Corps) and state and local water agencies have constructed hundreds of additional facilities. California's State Water Project includes 34 storage facilities and more than 700 miles of pipelines and canals. These projects made possible the development of many large western cities and extensive irrigated agriculture. In the last 20 years, the construction of new dams has slowed to a trickle for a variety of reasons, including the lack of available "new" water, the growing costs of these projects, and a public that is more protective of its rivers.

The western water landscape has changed dramatically in recent years. This is a factor that should be seriously considered by water managers as they design solutions to meet the needs of the coming century. Today, the new conditions facing water managers in the West may guide us to new solutions. Indeed, many managers are shifting focus to groundwater storage, water recycling, and a suite of water efficiency tools. A number of water interests, however, continue to propose a new generation of large-scale water conveyance projects around the West — some of which may be significantly less reliable than past projects, raising important questions around their level of cost-effectiveness and sustainability.

Editors' Note: This article is a highly abridged version of "Pipe Dreams: Water Supply Pipeline Projects in the West" — which was released by the Natural Resources Defense Council (NRDC) in June of this year. The 46-page original document is replete with extensive endnotes and appendices that our format did not allow us to include. Those wishing a more detail and extensive backup documentation are encouraged to download the original document, which is available at: www.nrdc.org/water/management/pipelines-project.asp.

Figure 1: Existing Pipeline Projects



Pipeline Projects

Supply Vulnerability

Water/Energy Nexus

Alternatives

Some of the new water conveyance projects described in this report could increase the water supply vulnerability, over the long-term, of communities that rely upon them. For example, for proposed projects for which groundwater is key, it is important to note that in many parts of the West, groundwater is withdrawn more quickly than natural recharge can replenish the supply. Such groundwater mining is inherently unsustainable. Other proposed pipeline projects would tap into surface water supplies from rivers that are already under stress from existing users. In addition, climate change and other factors suggest that water from some sources will be less reliable during the driest years and over the long-term. With more stress on water sources, the competition from established users, often with older priority dates, suggests more conflict in the future for some proposed projects. When evaluating proposed projects, it is important to remember that water conveyance projects can only generate reliable water supplies if they tap into reliable water sources. In short, water projects that rely on unreliable sources could lead to future shortages for the very communities that pay for these expensive facilities.

In addition, the energy costs of proposed conveyance projects can be enormous, requiring the commitment of massive quantities of power (and, except in rare cases, greenhouse gas emissions) to pump and move water to the location where it would be used. An acre-foot (af) of water weighs more than 1,360 tons. Therefore, the energy costs associated with moving water are extraordinarily high. Nonetheless, federal, state, and local water agencies continue to propose new pipeline projects, often with little analysis of energy requirements and usually without incorporating the use of renewable energy.

Today, water managers have a range of alternatives to new pipeline projects, including urban and agricultural water-use efficiency, voluntary water transfers, water recycling, improved groundwater management, and more. The success of efficiency efforts can be seen today across the West. Many of these less environmentally disruptive alternatives are more reliable, more affordable, less vulnerable to climate change impacts, and less energy intensive than traditional water development projects.

PIPELINE PROJECTS: EXISTING AND IN DEVELOPMENT

Pipelines and aqueducts have been a familiar part of the landscape in the western US for more than a century. Many of these projects involve surface reservoirs and transbasin diversions. The American West is noteworthy in the history of water development, because the West was where the world first learned how to build dams on large river systems. In addition, the West still contains some of the most ambitious water engineering projects on the globe (see Figure 1 and Table A). (A summary of the existing projects listed on the next page can be found in the full Report's Appendix A.)

Table A. Existing Major Pipeline Project in the West

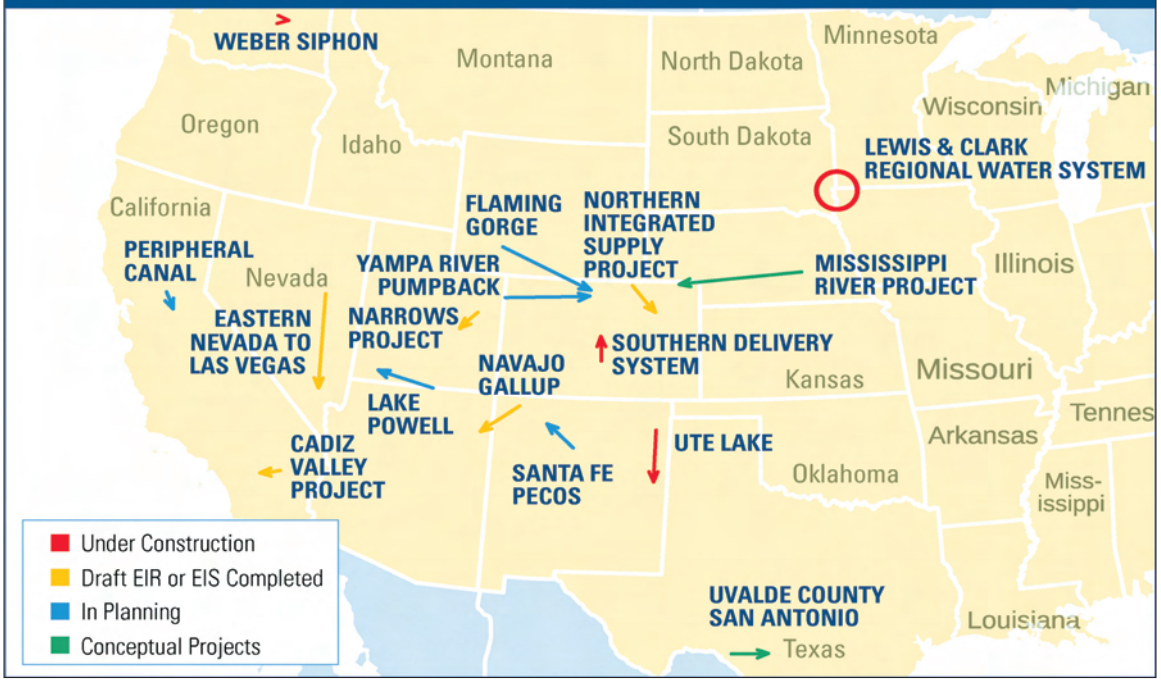
Project	Delivery Volume (afy)	Transbasin Diversion	Length (mi)
Little Snake-Douglas Creek Project, WY	21,000	Yes	21 miles diversion pipeline; 113 miles of delivery pipeline
The Colorado-Big Thompson Project, CO	213,000	Yes	35 miles of tunnels; 95 miles of canals
Additional Colorado Transbasin Diversions, CO. Grand River Ditch, Harold D. Roberts Tunnel, Homestake Tunnel, Moffat Water Tunnel and Twin Lakes Tunnel	150,000	Yes	56.6 miles of tunnels
San Juan-Chama Project, NM	86,210	Yes	27 miles of tunnels
Central Utah Project, UT	218,000	Yes	More than 200 miles of aqueducts, tunnels, and canals
Central Arizona Project, AZ	1,500,000	Yes	335 miles of aqueducts, 15 miles of tunnels
Colorado River Aqueduct, CA	1,200,000	Yes	242 miles of aqueduct; 63 miles of canals; 92 miles of tunnels; 84 miles of buried conduit and siphons
Los Angeles Aqueduct, CA	254,000	Yes	223 miles of canal and pipelines—first aqueduct. 137 miles—second aqueduct
California State Water Project, CA	2,400,000	Yes	700 miles of pipelines and canals
Central Valley Project, CA	5,300,000	Yes	500 miles of canals, conduits, tunnels, and related facilities
Hetch Hetchy Aqueduct, CA	165,000	No. Transfer to a different sub-basin	160 miles of pipeline
Mokelumne Aqueduct, CA	364,000	No. Transfer to a different sub-basin	91 miles of pipeline
Portland Water Bureau, OR	132,000	No. Transfer to a different sub-basin	26 miles of pipeline
Cedar River, WA	103,500	No	56 miles of pipelines
Mni Wiconi Rural Water System, SD	Projected 8,591–12,474	No	4,400 miles of pipelines

Pipeline Projects

Proposed Projects

In recent years, a host of new water conveyance pipeline projects have been proposed by western water managers and entrepreneurs. (Please see Figure 2 and Table B. Appendix B also includes a summary of the 15 proposed projects presented in Table B, which are at various stages of planning and construction.)

Figure 2: Projects in the Pipeline



Strategies

PROPOSED MAJOR PIPELINE PROJECTS IN THE WEST

In April of 2012, Reclamation's Colorado River Basin Water Supply and Demand Study released a summary of more than 140 options that have been submitted by stakeholders to help resolve water supply and demand imbalances. Thirty-one percent of the options received by Reclamation included increasing available supply through a range of strategies such as new pipelines, desalination in Southern California and Mexico, water recycling, cloud seeding, and watershed management. The list of pipeline-related options includes proposals to import water from rivers including the Snake, the Columbia, the Clark's Fork of the Yellowstone River, the Missouri, the Mississippi, and the Bear. Many of these proposals appear to be at a conceptual level.

No Storage Included

There is a critical difference between most of the proposed pipeline projects summarized here and many of those built in the past century. Most of the pipeline projects in the past were constructed as part of larger water projects. In particular, most of the existing projects were built in conjunction with surface storage projects on major river systems. These earlier surface storage projects produced relatively reliable sources of water for pipelines and aqueducts to carry to distant users. By comparison, most of the new generation of pipeline projects do not include new surface storage facilities. This change is, to a large extent, the result of the far less abundant water sources that this new generation of pipeline projects propose to tap into.

Critical Issues

Together, these new pipeline proposals represent a significant new phase in western water policy, which present critical issues that must be closely examined before new projects and those under development are pursued further. Key issues include: 1) sustainability of water sources, including environmental impacts, existing uses, and climate change; 2) transbasin diversions; 3) potential alternatives, including water use efficiency; 4) renewable and conventional energy use; and 5) the role of federal agencies.

SUSTAINABILITY of WATER SOURCES

As noted, most of the proposed pipeline projects summarized in this report are associated with far less abundant water. The fact that only three of these proposed projects include new proposed surface storage facilities is primarily because of a realization that there is limited additional surface water yield to capture in the basins into which these projects would tap.

Some of the proposed systems would carry water from groundwater basins that provide questionable long-term yield. Others would carry surface water from basins that are already undergoing severe water stress. For example, several of these projects would tap into the Colorado River and existing Colorado River Basin storage projects (e.g. Flaming Gorge and Lake Powell) that are in long-term decline. The

Pipeline Projects

Table B. Projects in the Pipeline

Colorado River Basin Projects	Delivery Volume (afy)	Transbasin Diversion	Project Cost	Length (mi)
Flaming Gorge Pipeline, WY and CO	250,000	Yes	$6 BB	500
Lake Powell Pipeline Project, AZ and UT	100,000	No	$1.064 BB	158
Yampa River Pumpback, CO	300,000	Yes	$3.2 BB to Front Range $3.9 BB to Denver	250
Gallup-Navajo Pipeline Project, NM	35,893	Yes	$864 MM	260
Narrows Project	5,400	Yes	$40.3 MM	16.8
Total Proposed New Colorado River Diversions	**691,293**			
Other Western Projects				
Southern Delivery System, CO	52,900	No	$1.1 BB	62
Ute Lake Pipeline Project, NM	16,450	No	$500 MM	87.5 miles of transmission pipelines, 94.8 miles of lateral pipelines
Santa Fe-Pecos Pipeline, NM	6,600	Yes	Unknown	150
Eastern Nevada to Las Vegas Pipeline, NV	84,000 (SNWA projects a maximum capacity of 217,655)	Yes	$3.5 BB	300
Cadiz Valley Water Conservation, Recovery and Storage Project, CA	50,000	Yes	$536 MM	43
Peripheral Canal/Tunnel, CA	Uncertain	Yes	$12 BB	37
Weber Siphon, WA	30,000	No	$48 MM	<2
Lewis and Clark Regional Water System, SD, IA, and MN	24,770	No	$433.85 MM	337
Mississippi River/Ogallala Aquifer, various states	Unknown	Yes	Unknown	Unknown
Northern Integrated Supply Project, CO	40,000	No	$490 MM	36 to 62
Uvalde County – San Antonio Pipeline Project, TX	40,000	Yes	$250 MM	67 to 75

proposed Mississippi River project is certainly a fundamentally different proposal from the rest of the projects located in the more arid West. That project, however, faces a wide range of additional challenges.

Reliable Sources

As the West pursues ever more distant sources of water, the issue of sustainability looms over the search for new water supplies. Water projects can only generate reliable water supplies if they tap into reliable sources.

The sustainability of water supplies in the West should be confronted by policymakers in a far more focused fashion than it has to date. The hot spots seeking reliable supplies — such as Los Angeles, Las Vegas, and Phoenix, and other major metropolitan areas — are well known, but medium, small, and even rural areas are now confronting significant potential shortages of water.

Meeting water needs is challenged by population growth, groundwater mining, competing demands for water from different sectors, ecosystem degradation, and increasingly from the effects of climate change. There is increasing evidence that water use across much of the West, particularly the Southwest, is significantly out of balance.

Supply v. Demand

Reliability of Surface Water Sources

Many surface water sources in the West are under severe stress as a result of existing uses. Because the entire flow of the Colorado and the Rio Grande Rivers are captured upstream, these large rivers often run dry before they reach the sea. As a result, there is no remaining "new" water to be captured in these systems. Indeed, existing supplies are predicted to decline. Reclamation recently determined that the long-term average supply in the Colorado River Basin is less than recent average water use and this imbalance is projected to increase in the future. As indicated by Table B, recently proposed new pipeline projects represent a total additional potential demand of more than 690,000 af annually on the Colorado River. (These are not the only proposals that would increase diversions from the Basin. Two other water development projects in Colorado that do not involve new pipelines, the Windy Gap Firming Project and the Moffatt Collection System Project, would further increase transbasin diversions by 33,000 af and 18,000 af per year, respectively.)

Because there is no "new" water to capture in the Colorado River Basin, surface-storage projects would not increase the net amount of water available for use. As a result, in the short-term, these additional proposed Colorado River Basin diversions would likely result in further reductions of stored water in a basin that has faced a dramatic reduction in storage over the past decade. In the long-term, such projects may increase the pressure on the supplies currently used by others. Simply put, where there is no available new supply, the water diverted by new projects must come from somewhere. This issue is perhaps most clear in the Colorado River Basin, but it could be a challenge facing proposed projects in other basins.

Pipeline Projects

Groundwater Depletion

Groundwater Mining

Aquifers are used by many cities in the US and represent the source for about 20% of the nation's freshwater withdrawals. Groundwater has allowed the growth of western cities and enabled agriculture in areas far removed from available surface waters. In the arid West, many aquifers are being mined, and as they are drawn down current users will join those looking for alternative water supplies. For example, in the past 50 years, California's Tulare Lake Basin has suffered from more than 60 million af of cumulative overdraft. The Ogallala Aquifer, which extends northward from Western Texas to South Dakota, is in a state of overdraft and could be depleted in only a few decades if withdrawals continue unabated.

The US Geologic Survey (USGS) has determined that declining groundwater levels is a widespread phenomenon around the nation. As shown in Figure 2 and explained in Table B, the Cadiz Valley project proposes to extract up to 50,000 acre-feet per year (afy) — ten times one estimate of long-term recharge. The Las Vegas pipeline would also lead to long-term declines in groundwater elevations.

If proposed pipeline projects tap into groundwater in an unsustainable manner, these projects could lead to increased water usage, followed by an inevitable reduction in supply. Thus, these projects could increase future water shortages.

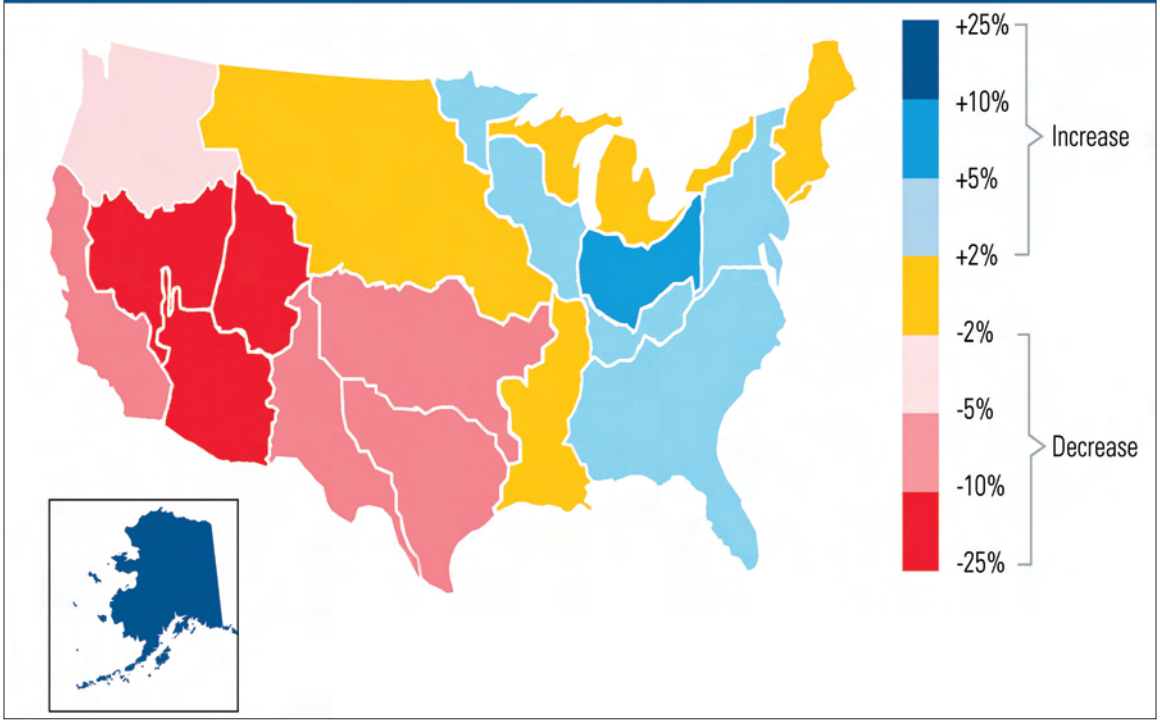
This trend toward transbasin projects that rely on groundwater represents a reversal of an historic pattern of development. Projects like the Central Arizona Project, the Central Valley Project, and California's State Water Project were designed in part to provide surface water to replace unsustainable groundwater pumping. Today, as those surface sources begin to hit limits, some proposed pipeline projects are turning back to groundwater sources.

Increased Water Demands

Climate Change

Climate change will have a range of impacts on water supplies in the West. Higher temperatures will increase losses of water through increased evaporation and transpiration, which will affect agricultural irrigation and urban landscapes. In both cases, increased temperatures will increase water demands, unless there are changes in current management practices.

Figure 3: U.S. Climate Change Science Program Projections for Reductions in Flows By Mid Century

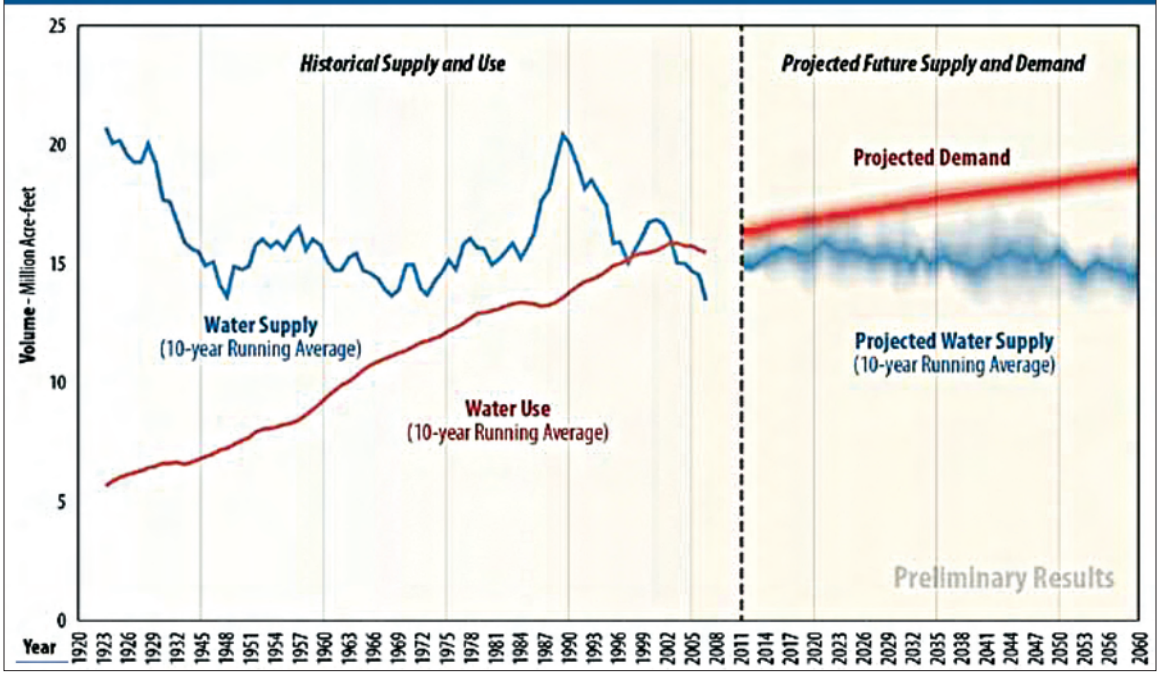


Extreme Events

Changes in precipitation patterns and, in some locations, total precipitation, are also expected to reduce available water supplies in much of the West. Climate change could also result in more frequent prolonged dry periods and severe droughts. Additionally, unless current practices change, industrial cooling could require increased water quantities due to increased atmospheric and water temperatures.

Pipeline Projects

Figure 4: Future Potential Colorado River Basin Shortages Projected by the U.S. Bureau of Reclamation Colorado River Basin Study



Projected Shortages

Runoff Decline

The US Climate Change Science Program (USCCSP) has projected that the Colorado River Basin is likely to face a decline in runoff of -10 to -25% by mid-century as a result of climate change impacts (see Figure 3). Reclamation has adopted a relatively conservative approach, projecting a 9% decline in water availability by mid-century (see Figure 4). Reclamation has concluded recently that, by mid century, the Colorado River may suffer a shortfall of 3.5 million acre feet (maf) or more annually "particularly when considering potential changes in climate." This trend of increasing demand and decreasing supply in the Colorado River Basin is shown in Figure 4.

These potential climate change effects extend across much of the West. According to an analysis undertaken for the Natural Resources Defense Council (NRDC), more than 1,000 counties — one-third of the counties in the nation — are likely to suffer from high to extreme water stress, when considering the results of climate change. Another 1,100 counties were predicted to suffer from moderate water stress. These counties include much of the West. Finally, climate change may reduce water availability in groundwater basins in parts of the West.

Climate Change Analysis

In short, climate change may decrease the potential water available from both surface and groundwater sources in the West. Each of the proposed projects discussed here is at a different stage in development. Nonetheless, the treatment of the challenges posed by climate change for these projects was mixed and, in general, lacked detail and adequate analysis.

Several of these documents simply mention that climate change could have an impact on the project, without further analysis, while several of the projects analyzed include only a brief summary of the range of impacts suggested by different climate models

Bay-Delta Plan

Only the analysis for the Peripheral Canal included quantified estimates of impacts on water availability for the proposed project. The Bay-Delta Conservation Plan (BDCP), which is analyzing a complex project (see Appendix B), including a large proposed tunnel, recently released an administrative draft Effects Analysis (EA) that includes a significant investigation of the likely impacts of climate change on the Bay-Delta system. These impacts include a general drying trend, changes in the mix of rain and snowpack, sea level rise, and increased temperatures. The administrative draft EA includes significant quantified reductions in future water yields from the preliminary proposed project as the result of climate change impacts, including changes in hydrology and sea level rise. This analysis has been greatly facilitated by California's extensive adaptation planning on climate issues. A more detailed appendix on potential climate change impacts is expected to be released by BDCP in the near future.

Addressing Risks

Predicting the likely impacts of climate change on water supply availability is more difficult in some parts of the West. Even in these areas, however, projects can address this risk — by analyzing a range of scenarios, presenting the bulk of the conclusions of scientific analyses, and analyzing the relative confidence of estimates from the scientific community regarding impacts on water availability.

Pipeline Projects

Preparedness Planning

State Level Water and Climate Adaptation Planning

In April of 2012, NRDC released a report, Ready or Not: An Evaluation of State Climate and Water Preparedness Planning, which evaluates the efforts of all 50 states to prepare adaptation strategies to address the likely impacts of climate change on water resources. The report includes four preparedness categories to compare progress made among states. Those categories include states that have undertaken comprehensive adaptation planning, states with fragmented adaptation planning, states with limited adaptation efforts, and those with no adaptation planning. Of the 17 western states, the report concludes that only three — California, Oregon, and Washington — are among the nation's most prepared states, and adaptation planning efforts have stalled in some areas in one of those states (Oregon). On the other hand, 13 western states have done nothing or very little to prepare for water-related climate impacts. Those states include Arizona, Kansas, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming. It is noteworthy that most of the states in the Interior West — where the impacts of climate on water supply may be most profound — have done little to prepare. Indeed, five of the seven Colorado River Basin states are identified among the states in the last two categories.

Comprehensive state adaptation planning addresses a broad range of the potential impacts of a warming climate on aquatic ecosystems, water supply, and other water resources. Many of those issues are central to the evaluation of proposed pipeline projects. Clearly, addressing all of those issues comprehensively at the project level is more difficult without a broad state-wide adaptation framework. Thus, the lack of adaptation planning in most western states makes it more difficult to adequately evaluate the climate issues related to proposed new conveyance projects.

Water User Risks

Water User Impacts

There are several ways in which poorly conceived pipeline projects could affect water users. First, in fully-appropriated river systems, additional diversions will increase pressure on existing water users. This risk is very clear today on some river systems, such as the Colorado. Second, using groundwater from mined basins to support new urban growth is a recipe for a future crisis; by definition a mined basin will not provide a secure water supply. In California, which lacks state-wide groundwater management, and in other states with less than fully protective groundwater management, such additional pumping could threaten existing water users. Third, water users who would rely on poorly conceived pipeline projects could face unreliable supplies and future cost increases.

Low Level Conditions

Biodiversity

The declining health of aquatic ecosystems highlights the need to protect remaining functioning ecosystems and to restore rivers. Especially in the western United States, wildlife species rely heavily upon aquatic habitats.

The decline of aquatic-dependent species is partly or wholly due to low-flow conditions in many river systems. In river systems such as the Rio Grande, Colorado, Klamath, Owens, San Francisco Bay-Delta, and many others, increasing municipal and agricultural diversions have led to significant ecosystem impacts. Proposed projects that would increase diversions from already imperiled ecosystems should carefully examine likely current and future constraints to protect aquatic ecosystems. Poorly planned projects could cause additional impacts on already degraded ecosystems, such as the San Francisco Bay-Delta. Such supplies could also prove to be unreliable in the long-term because of the likelihood of additional future regulatory constraints.

Urban Growth

Population Growth in the West

The western United States has grown at an explosive rate over the last two decades. In the 1990's the population of the western United States grew by 19.7%, and an additional 13.7% since 2000. The growth has primarily occurred in what have been dubbed "urban archipelagos," such as Denver, Boise, Albuquerque, Las Vegas, Phoenix, and Tucson. In the past decade, large metropolitan areas have grown at more than twice the rate of "micro" areas (those with an urban area population between 10,000 and 50,000 residents).

This growth is forecasted to continue through the 21st century, with Nevada's population projected to increase 23% by 2030, Colorado's population projected to increase by 55% by 2040, Arizona's population to increase nearly 100% by 2050, and Utah's population to increase by over 110% by 2050. California's population is also projected to increase 60% by 2050. Pressure will continue to grow for reliable water supplies for municipal and industrial uses as western states become more and more populated.

Pipeline Projects

Transbasin Conflicts

Transbasin Diversions

Many of the existing and proposed projects described in this report involve or would involve transbasin diversions, which move water across hydrologic basins. Transbasin diversions are an ongoing source of conflict in western water policy. A community that loses significant water supplies can face a constrained future and the bitter political divisions over existing transbasin diversions reflect that understanding.

Before legislatures and courts gave a voice to smaller communities, their opposition may not have been viewed as significant by project proponents, but circumstances have changed. Even a relatively small pipeline from a rural area on the Pecos River to Santa Fe, New Mexico is being opposed by citizens in the area of origin. As water resources become more constrained across the West, conflict around transbasin diversions can be expected to increase, and will likely have important implications for potential investments in this kind of traditional water development.

Some pipeline projects that transport water to distant users rely on rights that are relatively junior in seniority, yet also supply urban water uses that can be less flexible than agricultural uses. Thus, new transbasin diversion projects may present a rising number of significant challenges, as they increase reliance on imported water, increase the challenges involved in bringing river and groundwater basins into balance and increase the vulnerability of western communities and economies.

POTENTIAL ALTERNATIVES, INCLUDING WATER USE EFFICIENCY

"Least Cost First"

Increasingly, alternative approaches, particularly water use efficiency, may provide more reliable and cost-effective strategies to meet future water supply needs. In designing water supply solutions, a range of actions should be considered, with a focus on the most affordable, effective solutions. As water managers evaluate ways to meet new needs, they should consider adopting a "least cost first" approach to water supply investments, similar in concept to California's energy loading order. Such a loading order approach focuses investments on the most cost-effective and environmentally preferable solutions before turning to investments that are less cost-effective and more environmentally damaging.

Efficiency Analysis

Analysis of the projects revealed that most had very limited analysis of efficiency as a project alternative or component. Curiously, water conservation, as an alternative to the Cadiz Valley groundwater pumping project, was rejected because the region to be served by the project is already aggressively pursuing conservation measures. Analysis of the project ignored the fact that some Southern California water agencies are planning major additional investments in conservation and other tools — and that additional cost effective investments are possible. Other examples of poor or inadequate analysis or consideration of water efficiency alternatives include:

Navajo-Gallup

- Navajo-Gallup: Analysis for this project concluded that water use levels were already so low (110 **g**allons **p**er **c**apita per **d**ay [gpcd] where piped water is available and 10 to 20 gpcd where water is hauled, among the lowest levels in the Southwest), that efforts to further increase conservation and efficiency were simply unachievable. The analysis did not include an evaluation of agricultural water conservation alternatives.

Lake Powell

- Lake Powell Pipeline: The alternatives analysis included a very limited analysis of conservation potential, despite per capita water use as high as 430 gpcd.

Narrows Project

- Narrows Project: The Draft Environmental Impact Statement (DEIS) for the project states that 270 gpcd are "required" for Sanpete County, Utah. This level of per capita usage is assumed to remain unchanged, and that the region will see a 3% annual population growth rate until 2050. The discussion of alternatives includes a modest discussion of agricultural water conservation and no discussion of opportunities to reduce per capita water use in the municipal and industrial sector, despite very high per capita water use.

Perhaps most striking of all of the project analyses reviewed is that for the Peripheral Canal; the current evaluation of alternatives does not include an analysis of water use efficiency, water recycling, or other tools.

Only the Southern Delivery System included significant analysis of conservation alternatives. All alternatives evaluated for this project include a conservation component, perhaps in recognition that water resources in Colorado are already heavily tapped.

Efficiency Shift

The growing importance of efficiency was highlighted by the National Research Council, which determined that the potential for new surface storage in the Colorado River basin is "limited," and that "declining prospects for traditional water supply projects are perhaps more correctly seen not as an end to 'water projects' but as part of a shift toward nontraditional means for enhancing water supplies and better managing water demands." Overall, water management is transitioning from traditional water development to a focus on improving water use efficiency.

Pipeline Projects

Efficient Techniques

Agricultural Efficiency

In the West, agriculture continues to be the dominant consumer of water, continuing patterns that were established many decades ago. Increasing agricultural water efficiency can be achieved by modernizing farming techniques.

Water efficient farming techniques include:

- Weather-based irrigation scheduling that uses local weather information to determine the amount of water needed
- Regulated deficit irrigation (inducing water stress in crops with drought-tolerant life stages, sometimes increasing crop quality while reducing irrigation amounts)
- Switching from gravity or flood irrigation to sprinkler or drip irrigation systems
- Switching to less water intensive crops

The Pacific Institute has estimated that these strategies can result in annual savings of nearly 700,000 af in California. Such savings also could provide for dry-year or permanent transfers to urban water users and the environment. In some areas, long-term or dry-year fallowing can also provide water for other uses, through voluntary transfers. Implementing efficiency measures could also result in significant savings by avoiding the cost of additional water development.

Urban Options

Urban Water Use Efficiency

Many studies have documented the potential water savings from investments in urban efficiency.

Examples of urban water efficiency gains include:

- Upgrading homes that have old, inefficient devices to higher efficiency fixtures (low-flow toilets and showerheads, aerating faucets, low-use appliances)
- Alterations in commercial/industrial water use (installation of water efficient devices)
- Conversion of lawns and gardens to xeriscaping
- Residential metering and sub-metering
- Leak detection
- Rate structures that better communicate and capture the value of water (e.g., block rate pricing wherein lower rates are charged for low to moderate use, creating a direct and immediate economic incentive)

Applying these efficiencies in California alone has been estimated to result in water savings of 320,000 af per year, 2,300 GWh electricity savings per year, and 86.8 million therms of natural gas savings per year.

Leaking Pipes

One obvious efficiency to be gained is in fixing leaks in delivery systems. According to the Congressional Budget Office, many drinking water systems lose as much as 20% of treated drinking water each year due to leaks in piping networks. One summary of the failing infrastructure for water delivery and treatment systems reports that an estimated 50 major main breaks and 500 stoppages occur for every 1,000 miles of pipe each year, amounting to an estimated 50,000 breaks and 500,000 stoppages annually in the US. In 2009, Southern California Edison submitted a report to the California Public Utility Commission of the potential water supply benefits of leak reduction in California, which estimated that 870,000 af is lost annually to leaks, and that 350,000 af could be cost-effectively recovered through leak reduction efforts.

LID Systems

Urban efficiency can also be increased through Low Impact Development (LID, or green infrastructure) to mimic natural infiltration systems by capturing and reusing stormwater runoff. Runoff diversion and capture prior to discharge to surface waters can be used either to replenish groundwater supplies through infiltration or for gray water uses, like landscape irrigation and toilet flushing. NRDC has estimated that more than 400,000 af of water could be developed through LID investments in California by 2030. In California, most runoff from urban areas is discharged into the ocean. In the Interior West, the capture of rainwater is being recognized as a useful conservation practice, despite some concerns. In Colorado and Utah, legislation was passed in 2009 making it legal for homeowners to capture rainwater.

Rainwater Capture

Recycling & Reuse

Wastewater recycling and reuse is another method to reduce the use of imported water. Recycled water is a viable alternative to imported water for uses that range from irrigating golf coursesor crops, to recharging groundwater, and even to firefighting. The National Research Council recently released a report that carefully endorses recycling of wastewater, noting the many cities where it is now practiced. The California Department of Water Resources has estimated that 0.9 to 1.4 million af of recycled water could be developed in California by 2030. By way of comparison, the annual water use of the Los Angeles is less than 0.7 million af per year.

Downstream LID Impacts

It is important to note that water recycling and LID can reduce downstream flows. Therefore, their potential to produce "new" water varies across the West, with the greatest potential in areas where urban runoff and treated wastewater are discharged to the ocean.

Pipeline Projects

City Use Improvements

Examples

Replenishment System

Environmental Benefits

Instream Flows

Return Flows

Examples of Benefits of Water Use Efficiency and Other Tools

Across the nation, there are many examples of successful water use efficiency programs. For example, the Pacific Institute has examined the water use of 100 municipal agencies that rely on Colorado River water and determined that, between 1990 and 2008, per capita water use in these agencies declined, on average, by 1% per year during this period. Per capita water use in some cities declined far more, including Albuquerque (38% reduction), Southern Nevada (31%), Phoenix (30%), and San Diego (29%). Twenty-eight of these agencies reduced their total water deliveries, despite increases in population.

Additional water use efficiency examples across include:

- Goleta (CA): Future water shortages from population growth and an insufficient water source prompted Goleta to establish a water efficiency program that emphasized plumbing retrofits, including high efficiency toilets, high-efficiency showerheads, and increased rates. The program resulted in a 30% drop in total district water use, a 50% drop in per capita water use, and the city was able to delay a wastewater treatment plant expansion.
- Seattle (WA): The ten-year goal of the Seattle Water Partnership, which was launched in 2000, is to reduce per capita consumption 1% year and achieve a total savings of 11 million gallons per day (33.75 af) by the end of 2010, at a total cost of $55 million dollars. By the end of 2010, the program had achieved cumulative savings of 9.56 mgd from residential, commercial and institutional customers at a cost of $35 million — results that are more cost-effective than anticipated.
- Orange County (CA): This community uses advanced treatment technologies to purify wastewater, then allows it to percolate into the groundwater basin for later use as potable water. The Groundwater Replenishment System facility, which cost $481 million to build, is the largest water recycling facility in the world, producing 70 million gallons per day (214 af). Orange County is planning to expand this project to 100 million gallons per day (306 af). This system uses approximately one-third the energy that would be required to desalinate seawater. *See* Markus, *TWR* #59.

These examples demonstrate that investments in efficiency and other water supply tools are proven, cost effective approaches to meeting water supply needs that should be evaluated as a part of planning for any proposed pipeline project.

Water Use Efficiency Gains Bring Important Environmental Benefits

Water use efficiencies can help ameliorate the stresses of overuse and curb further degradation of rivers in a number of ways. For instance, by reducing runoff from agricultural lands, efficiency improvements can lessen pesticides, fertilizers, salts, and fine sediments from surface erosion that can contaminate surface and groundwater sources, increase treatment costs for downstream users, and degrade fish and wildlife habitat.

Water conservation can, under some circumstances, also increase the amount of water left in the stream — also referred to as instream flows.

Instream flows are environmentally important for:

- Removing fine sediments that can cement river substrate and smother fish and invertebrate eggs and larvae
- Maintaining suitable levels of water temperature, dissolved oxygen, and water chemistry
- Establishing stream morphology, including the formation and maintenance of river bars and riffle-pool sequences
- Maintaining riparian communities, preventing riparian vegetation from invading the channel and altering stream form and function
- Flushing waste products and pollutants; and allowing and supporting fish passages and migrations

Investments in water use efficiency can also alter the timing of instream flow, contributing important environmental benefits. Although some withdrawn water may eventually flow back to a stream system via surface runoff or groundwater percolation, there is a lag time between when the water is withdrawn and when it flows back into the river. This timing can be important because the natural life cycles of many aquatic and riparian species are adapted to either avoid or exploit annual and seasonal variations in flows.

Finally, diversions from waterways can pose a direct threat to fish and wildlife populations. By compensating for lower diversion levels, water efficiency measures can benefit fish and wildlife.

It is important to note that all efficiency investments may not provide the above benefits. Increasing water use efficiency can reduce water use, leaving more water available to meet instream flow needs. However, wastewater reuse and increases in efficiency that increase consumptive use and reduce return flows can have the effect of reducing downstream flows. An affirmative program to protect instream flows is a necessary component of sustainable water management.

Pipeline Projects

Energy Benefits

Water Use Efficiency and Energy Use Efficiency Benefits

Efficiencies gained in water use frequently result in efficiencies gained in energy use. This relationship is highlighted in a 2011 report by the US Government Accountability Office (GAO), which evaluated energy efficiency reductions via improvements in the urban water lifecycle, from capture and pre-treatment to delivery, use, post-treatment, and discharge.

The GAO report detailed gains to be made in the following areas:

- Process optimization (implementing monitoring and control systems, modifying pumping operations, and reconfiguring aeration systems)
- Infrastructure improvements (equipment upgrades, including right-sizing equipment, and improving maintenance and leak detection)
- Water conservation
- Better energy management, beginning with energy audits of treatment facilities
- Improved advanced treatment options to lessen energy intensive processes such as ultraviolet disinfection
- Redesigning systems to better integrate drinking water, wastewater, and stormwater management
- Use of renewable energy in operations

CO2 Reduction

California has also investigated the energy benefits of improvements in the water sector. As a result, the state has included energy and greenhouse gas reductions from the water sector in the state's greenhouse gas reduction strategy. In that plan, the California Air Resources Board concluded that the water sector can contribute 4.8 million metric tons of carbon dioxide (CO2) emissions reduction by 2020, with 1.4 million metric tons of that reduction coming from water use efficiency, and 2.0 million metric tons coming from water system energy efficiency. The latter conclusion also suggests opportunities for water projects and water agencies to install system improvements, such as in-conduit hydropower facilities and efficient pumps to reduce energy consumption.

In-Conduit Hydropower

ENERGY USE — CONVENTIONAL AND RENEWABLES

Pumping & Treating

The energy costs of capturing, storing, treating, and delivering water are very large. Pumping and treating water for industrial and urban uses consumes between two and three percent of the world's energy, and can cost up to half of a municipality's total operating budget in developing countries. In the United States, one estimate is that upwards of 13% of the total energy consumption is water related. Energy consumption for water delivery and wastewater treatment is typically 30 to 60% of U.S. city energy bills. The California Energy Commission has concluded that in California 19% of electricity use, 30% of non-power plant related natural gas, and 88 million gallons of diesel fuel are consumed annually for water related uses. Pipelines frequently require substantial amounts of energy to pump and transport water to out-of-basin users. For example, in California, the State Water Project's electricity use represents the largest single consumer of electricity, amounting to two to three percent of the state's entire electricity consumption.

The use of energy to pump water great distances has another significant consequence in that the production of conventional energy requires copious amounts of water.

Water/Energy Connections

Energy and water are thus interrelated. We use energy to access many water sources, and vice versa. For example, water is diverted for electricity production at dams for hydroelectric power generation, and to cool thermoelectric power plants, which represent the single largest source of water withdrawals in the US. In addition, water is used in accessing some natural gas deposits and would be used in refining oil shale. Energy is also used to treat water for use, heat it, and treat wastewater for disposal. If new water sources, such as saline waters, are tapped into, energy costs associated with treatment will rise. Advanced treatment, recharge, and reuse also have associated energy costs, although not necessarily higher than imported supplies. Developing technologies to reduce the energy costs of these processes is important, as is conserving water — the surest way to reduce energy use.

Energy Consumption Analysis

Analysis of the proposed pipeline projects covered in this paper reveal that despite the significant energy costs of water projects, many did not include a well-developed analysis of energy consumption. For example, the Ute Lake Pipeline Project effects analysis (EA) does not include a detailed discussion of the project's potential energy use. The document does include a discussion of the potential to include renewable energy facilities in the document. To date, the project applicants have chosen not to pursue renewable power facilities related to the project.

The DEIS for the Narrows Project does not include a discussion of the project's energy requirements.

The Cadiz Valley Project appears not to include total energy costs to reach end users. A draft EIR for the project was released in December of 2011. In it, the project is estimated to use 3,112 kWh/MG of water delivery (or 1,014 kWh/af). This number includes groundwater pumping and the energy required to

Pipeline Projects

pump water to the Colorado River Aqueduct (CRA). This total, however, does not include the energy cost to pump the water through the Colorado River Aqueduct to users in Southern California. The document acknowledges that the energy used by the CRA is significant — 6.138 kWh/MG at full capacity. Water from the Cadiz project would not, however, be conveyed the full length of the CRA. The document does not quantify the amount of energy that would be required to convey water through part of the CRA to end users.

Total Energy Requirements

A number of project documents, such as those for the Yampa River Pumpback and the Lake Powell Pipeline, include peak energy requirements, rather than total annual energy requirements and per acre-foot energy requirements. Only a few projects analyzed projected factors including total energy use, per acre-foot energy requirements, and associated greenhouse gas emissions. Very few projects addressed all of these issues. The per-acre-foot energy requirement is particularly important to understand the potential for long-term fluctuations in water costs as a result of changes in electricity prices.

The Lewis and Clark Regional Water System is projected to use, at completion, 24.2 GWh/y. These energy numbers are derived from the project's Engineering Report analysis of operating costs, which does not summarize these energy demands, nor does it include a separate discussion of energy use. The project's federal Finding of No Significant Impact does not include an analysis of energy use.

Project Analysis

Other projects that did not adequately analyze projected energy use include:

- Northern Integrated Supply Project: projected to result in an energy demand between 0.85 and 1.45 MWh/af.
- Southern Delivery System: would require 4.63 MWh/af upon delivery. The energy required to meet 2046 water demands is projected to average 671 GWh per day, or 245 GWh per year. This per acre-foot energy requirement is approximately equivalent to the energy cost of desalinated seawater and approximately 50% more than the energy required to pump water from the Bay-Delta to Southern California. This system would demand the equivalent of the average daily per capita residential electricity use of over 12,500 Coloradans.

Las Vegas Pipeline

- Las Vegas Pipeline: The June 2011 BLM DEIS prepared for the project indicates that the proposed pumping facilities will require the continuous use of 97.2 MW of power, including 51.9 MW for groundwater wells and associated facilities. Power for the project would be provided by the Silverhawk Generating Station, a natural gas-powered facility with a capacity of 520 MW, 25% of which is owned by the Southern Nevada Water Authority (SNWA). The DEIS concludes that this electrical generation will result in the release of 327,000 tons of carbon dioxide per year — equal to the emissions from the electricity use of 35,000 homes. The document adds that these energy requirements and greenhouse gas emissions may be reduced through the use of solar power and in-conduit generating turbines. These estimates do not include energy use per acre-foot.

Bay-Delta Proposal

- Peripheral Canal: BDCP concluded recently that the preliminary proposed project (15,000 cfs tunnel project) would result in increased energy demands for pumping ranging from 2,027 to 2,319 GWh/y. This compares with current net CVP energy use for water pumping of 814 GWh/y and SWP net energy use for pumping of 6,327 GWh/y. Thus, the project would represent nearly a one- third increase in combined energy use.

BDCP is pursuing a "dual conveyance" approach to pumping, in which some CVP and SWP water would be pumped through a new canal or tunnel, and other water would continue to be pumped from existing CVP and SWP diversion points in the South Delta. As indicated above, water pumped through a new tunnel would require a significant amount of additional energy. This would add to SWP's already large energy footprint, particularly for Delta water delivered to Southern California.

In short, many of these proposed projects would be very energy intensive. It is important to note that, in contrast, some water use efficiency alternatives can save significant amounts of energy.

Federal Role in the Energy/Water Connection

Reclamation Facilities

The federal government currently does not compile information on energy use by water projects, except for the quantity of hydropower from Reclamation projects that is used to deliver federal water. There is limited information on current and proposed projects concerning the substantial amount of energy consumed by these facilities.

Some pipeline projects require large amounts of energy. The use of fossil fuels to provide this energy could increase greenhouse gas emissions, contributing to the very warming that threatens western water supplies. President Obama ordered federal agencies to create inventories of their greenhouse gas emissions under Executive Order 13514 (October 5, 2009) and the Guidance on Federal Greenhouse Gases Accounting and Reporting (October 6, 2010). However, the Department of Interior has not included in its inventory the greenhouse gas emissions that result from its water facilities or the projects that Reclamation funds.

Pipeline Projects

The federal government is also required by the National Environmental Policy Act (NEPA) to provide environmental reviews of major federal actions that significantly affect the quality of the environment. Unfortunately this NEPA review is sometimes not sufficiently probing with respect to water alternatives or the use of renewable energy to power conventional facilities. For example, the Navajo-Gallup EIS does not include the use of renewable energy in its list of alternatives.

Renewable Power

Renewables and Water Project Energy Use

Using renewable sources to provide at least some of the energy needed to move water would be beneficial. Much of the western US receives abundant sunshine and wind. As a result, the West has significant potential for the development of renewable energy sources, which significantly reduce greenhouse gas emissions. However, renewable energy projects must be carefully designed and selected. It is important to note that solar technologies have very different water requirements. For example, dry-cooled thermoelectric solar can require some make up water for boiler systems and water to wash heliostats. Wet-cooled solar, on the other hand, has dramatically greater water requirements. As a result, the California Energy Commission has adopted a policy that represents a de facto prohibition on wet cooling for solar facilities in California's desert regions, except in very limited circumstances. In addition, large-scale wind, solar, and transmission facilities must be cited carefully to avoid environmental impacts.

When determining whether wind or solar energy should be used, cost may be a controlling factor. In 2009, renewable energy accounted for 8% of total US energy consumption. Of that percentage, only 9% was from wind, and 1% was from solar energy (the remainder is provided by hydropower, biomass, and geothermal sources). Although wind energy accounts for more energy production than solar in the US, solar energy technology is improving rapidly. Large-scale solar adoption is becoming more feasible all of the time.

Renewable energy sources, such as photovoltaic solar, wind, and in-conduit hydropower to help power water projects are increasingly being pursued across the world.

Renewables & Water Projects

Examples renewable energy use for water projects include:

- California water agencies are currently the largest customer group for solar installations, with 20 MW of generation in operation or under construction, and nearly 50 MW in the proposal stage.
- The Palmdale Water District (CA), which uses a 950 kW wind turbine at its water treatment facility, provides the majority of the energy required for operation of the facility. The district has installed a solar array system at its facilities to offset power costs.
- The Las Vegas Valley Water District operates solar photovoltaic systems at six reservoirs and pumping station sites since June 2007, with a combined capacity of 3.1 MW. The system cost $23.4 million to build and is being paid back through annual energy savings of approximately $725,000 and through the sale of renewable energy credits to local electric utilities, yielding a payback period of 11.6 years for a system with a projected lifetime of 35 years.
- The largest seawater desalination project in the Southern Hemisphere opened in 2006 in Perth, Australia, with a daily capacity of 140,000 cubic meters. The facility is powered by energy from a wind farm, making the facility the largest desalination project in the world whose energy needs are provided by renewable sources.

Renewables, Storage, and Grid Integration

It is important to note that many renewable energy sources (e.g., wind and solar) are not continuous. Combining these sources could help some water agencies use renewable power to meet water pumping needs. In either case, it could be useful to have the ability to store renewable power for later use. The primary technology to achieve this end is pumped storage.

Pumped Storage

Some existing water projects have utilized pumped storage projects — traditionally designed to allow water projects to generate and sell power during peak demand periods and pump water from a lower reservoir to a higher one when power is less expensive. Such projects could be designed to smooth out the peaks in wind and solar power production by pumping water during daylight hours and periods of high winds. When energy is needed during times of high demand, water in the higher elevation reservoir would be released to generate electricity.

New Projects

Few new pumped storage facilities have been built since the 1990s, but with the recent increased focus on renewable energy sources, pumped storage is again being pursued. Permitting for three new systems is underway in Oregon, the largest of which will have a 500 MW capacity and storage potential of 16,000 MWh. Similar projects are being evaluated in California, Wyoming, Hawaii, and elsewhere. Other newer technologies are emerging to store energy from renewables, including the use of compressed air, molten salt, concrete, and ice.

Pipeline Projects

The use of renewable power or pumped storage should not be used as justification for unsustainable or un-economic water projects. Instead, existing water pipelines and future pipeline projects should be designed to include renewable power as a source.

THE ROLE of FEDERAL AGENCIES

Federal agencies, including Reclamation and the Corps, have long played a central role in the planning and development of water projects. In addition to the role of federal agencies in issuing permits and in energy issues, several current federal activities have important implications for proposed pipeline projects.

Proposed Guidelines

Federal Principles and Guidelines

In December 2009, the White House CEQ issued the "Proposed National Objectives, Principles and Standards for Water and Related Resources Implementation Studies." These Principles and Guidelines serve as the foundation of federal water planning efforts, and have been largely unchanged for more than 25 years. The original Principles and Guidelines guide the work of Reclamation, the Corps, the Natural Resources Conservation Service, and the Tennessee Valley Authority. The revised draft document is expanded in scope and is intended to cover all federal agencies that undertake water resource projects.

The Principles and Guidelines document does not yet address the full range of issues related to potential federal involvement in proposed water pipeline projects. The draft Principles and Guidelines document does not use the word "energy" once. It does, however, list some of its goals as to "protect and restore…the environment while encouraging sustainable economic development" and to avoid "adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts." The incorporation of the issues discussed in this report would provide valuable guidance for federal agencies that evaluate and fund water projects.

Cost Analysis

Federal Financing

With the high cost and diminished yield of traditional water development, alternative water supply strategies are increasingly cost-effective, including water recycling, improved groundwater management, urban stormwater capture, and particularly urban and agricultural water use efficiency. Many of these projects are now more cost effective than some traditional water development projects. There is no single rule governing how much the federal government will contribute to states and local governments to assist in the financing of pipeline projects, or for other means of providing water. There has been an assumption among many state and local leaders that the federal government will be involved in some fashion in large-scale water projects, although this funding may be ad hoc.

Funding Role

The federal government's traditional role in funding water infrastructure in the West, and its emerging role in funding new pipeline projects, encourages infrastructure solutions such as pipeline projects, rather than more cost-effective solutions such as water use efficiency. There is a federal interest in resolving Native American water rights claims and addressing endangered species issues where there is no clear responsible party.

Through Reclamation's Title XVI program and water conservation programs, that agency has begun moving away from its traditional role as a dam-builder. Reclamation's role is likely to increasingly focus on efficiency and reuse strategies. Many proposed projects lack a clear nexus to strong federal interests to justify funding from federal taxpayers. In some cases, however, the federal involvement is based on resolving Native American water rights claims and addressing endangered species issues where there is no clear responsible party. However, there is no federal interest in projects that place additional stress on over-allocated surface supplies or over-tapped groundwater basins.

ESA & Tribal Issues

Colorado River Basin Water Supply and Demand Study

This analysis revealed that the Colorado River Basin is the focus of the largest concentration of proposed pipeline projects in the West. Specifically, Appendix B summarizes five proposals for new pipelines to divert water from the Colorado River and another seven proposals to divert water into the Basin. Many of these proposed projects are large individually. In addition, the cumulative impact of these projects could be significant.

Reclamation Study

Reclamation's Colorado River Basin Water Supply and Demand Study is now scheduled for completion in November of 2012. That effort is working to characterize the water management challenges facing the Basin. It is not yet clear if the Basin Study effort will continue or what other planning efforts will continue the effort begun by the Basin Study. Whatever the forum, it is important that the projects and issues identified in this report, including potential cumulative impacts, be addressed carefully.

Pipeline Projects

Pipeline Priorities

State & Local Considerations

Demand Management Options

RECOMMENDATIONS

NRDC recommends that local, state, and federal agencies utilize the following approach in investigating and pursuing proposed pipeline projects:

- New water supply projects in the West should be designed to reduce, rather than increase, the current imbalances in water use — such as groundwater overdraft and over-committed surface water sources.
- A beneficiary pays approach to the financing of water projects is the best way to internalize the costs of water projects and encourage efficient water use.
- Energy for future pipeline projects should be provided through investments in renewable energy sources. (Such use of renewable power, however, should not justify uneconomic and unsustainable projects.) Water agencies should also invest in renewable sources to provide the energy required for existing pipeline projects, such as California's State Water Project.
- Proposed pipeline projects should include an analysis of all of the following issues:
  - The reliability of proposed water sources, including existing demand, current constraints on proposed surface sources, the sustainability of proposed groundwater pumping, dry-year reliability, ecosystem health, and likely changes in hydrology and demand caused by climate change.
  - Potential impacts to existing water users and communities.
  - Potential impacts of proposed new transbasin diversions on water use in the basin of origination.
  - The capital and operating cost of the proposed project, in comparison with the benefits. (This should include an analysis of the external costs of proposed projects, such as environmental impacts.)
  - The alternatives to the project, particularly urban and agricultural water use efficiency, water recycling, urban stormwater capture, and voluntary water transfers. Water managers should consider adopting a "least cost first" approach to water supply investments, similar in concept to California's energy loading order.
  - Energy use and energy sources, including per acre-foot and total annual energy use.
  - Potential new greenhouse gas emissions.

Local Agencies

Local agencies have the ability to pursue and invest in a broad range of water solutions. In addition to considering general recommendations above, local agencies should ensure that rate payers are provided with information regarding the above issues and the range of alternatives before water utilities make decisions on proposed projects.

State Agencies

State agencies often play critical roles in studying financing and implementing water supply projects. In addition to considering the general recommendations above, state agencies should ensure the following:

- Where proposed projects could have impacts to other water users and across state lines, state water agencies should actively investigate the issues summarized above, in collaboration with tribal governments, environmentalists, and other stakeholders.
- All western states should undertake ambitious and comprehensive efforts to prepare for the potential impacts of climate change on water resources. Such adaptation planning efforts, as discussed in NRDC's report *Ready or Not: An Evaluation of State Climate and Water Preparedness Planning*, will allow significantly improved evaluations of proposed new conveyance projects and available alternatives.
- Scarce state water supply funding should be focused on the most affordable and reliable projects — those that increase the efficiency of water use and re-use.

Federal Agencies

Reclamation and the Corps finance and manage water storage and power on many major western rivers. Federal environmental laws affect water policy, as does federal management of tribal water. One of the most important roles in the next decades will be in helping to determine how the western United States will respond to the pressures bearing on western water resources. Simply put, the federal government can encourage local communities to manage demand and support research into new water technologies, or it can provide federal funding for water pipelines across great distances to water stressed communities. The latter approach may, in many cases, prove more costly, more environmentally damaging and less reliable in the long-term. We suggest a more clearly defined and limited federal role.

Pipeline Projects

Federal Priorities

In addition to considering the recommendations above, federal agencies should ensure the following:

- Federal funds should be focused on projects where there is a strong federal nexus, such as resolving Native American water rights claims and addressing endangered species issues where there is no clear responsible party.
- Scarce federal water supply funding should also be focused on the most affordable and reliable projects — those that increase the efficiency of water use and reuse. Federal agencies should no longer fund traditional water development, particularly in regions where such additional traditional development would be unsustainable.
- Given the large number of proposed projects to divert water from the Colorado River, as well as into the Basin, Reclamation's Colorado River Basin Water Supply and Demand Study and subsequent efforts should address the cumulative potential impacts of the potential projects summarized in this report.
- President Obama's Executive Order on Greenhouse Gasses mandates that agencies seek means of reducing their carbon emissions. One of the stated goals of the Order is to "make reduction of greenhouse gas emissions a priority for Federal agencies." Federal agencies, particularly Reclamation and the Corps, should implement this Executive Order with respect to their water responsibilities by reporting the energy use and associated greenhouse gas emissions of projects that they fund.
- The new Principles and Guidelines for Water and Land Related Resources that are under development by federal agencies should address the issues discussed in this paper, to give decision-makers a more complete understanding of proposed projects. In particular, these principles should address the energy issues raised by water projects, including proposed pipeline projects.

Research for Pipe Dreams provided by: Kelly Coplin, Natural Resources Defense Council and Sharon Wirth, University of New Mexico Law School

For Additional Information:
Denise Fort, University of New Mexico Law School, FORTDE@law.unm.edu
Barry Nelson, Natural Resources Defense Council, BNelson@nrdc.org

Denise Fort is a Professor of Law at the University of New Mexico School of Law and Director of the School's Utton Center. She writes about environmental law, water policy, river restoration, and climate policy. She chaired the Western Water Policy Review Advisory Commission, by appointment of President Clinton, which prepared a seminal report on western water policy. Fort also served as Director of New Mexico's Environmental Improvement Division, as an attorney with New Mexico PIRG and Southwest Research and Information Center, and as Executive Director of Citizens for a Better Environment (CA). She was a member of the National Research Council's Water, Science, and Technology Board and participates in NRC reports. She has worked in public finance as the Secretary of Finance and Administration for New Mexico and an assistant Attorney General in the Taxation and Revenue Department of the state.

Barry Nelson is a senior policy analyst for NRDC's water program in San Francisco. He focuses on protecting the environment by studying water management policies and their effects on rivers, estuaries, fisheries, wildlife, humans, and wild places. He promotes policies that can meet human needs for water while helping to restore damaged aquatic ecosystems and fisheries, and that reduce the water management impacts of global warming. He has worked for many years to restore and protect the San Francisco Bay-Delta estuary and the San Joaquin River, and has played leading roles in the passage of landmark state and federal water reform legislation, including the Central Valley Project Improvement Act (1992) and the Delta Reform Act (2009). He has also researched oil shale development and the resulting negative impact on Colorado River Basin water supplies. Prior to coming to NRDC in 1999, he was the executive director of Save The Bay in Oakland, California. He has degrees in rhetoric and economics from the University of California at Berkeley.

WATER BRIEFS

INTERSTATE COMPACT OK/TX

SOLICITOR GENERAL'S OPINION

On November 30, the U.S. Solicitor General filed an Amicus Brief for the US recommending that the US Supreme Court review the case of *Tarrant Regional Water District v. Rudolf John Herrmann, et al*., No. 11-889, U.S.Sup. Ct. (2012). Tarrant Regional Water District (Tarrant) sued Oklahoma in January 2007, after the Oklahoma Water Resources Board denied Tarrant's applications to divert water from three locations in Oklahoma as part of a long-term water supply for north central Texas. *See TWR* #36, #58 and #64. At issue in this case is Tarrant's application to appropriate 310,000 acre-feet of surface water from the Kiamichi River, an Oklahoma tributary of the Red River. The Red River Compact apportions water between the states of Oklahoma, Texas, Arkansas and Louisiana. Act of Dec. 22, 1980, Pub. L. No. 96-564, 94 Stat. 3305. Tarrant seeks to divert water from the tributary stream in Oklahoma because the mainstem of the Red River is highly saline and thus not useful as a potable water source.

Tarrant's lawsuit against the state of Oklahoma was dismissed by an Oklahoma federal district court and the 10th U.S. Circuit Court of Appeals upheld the dismissal. Last April, the US Supreme Court (Supreme Court) invited the Solicitor General to file a brief to express the views of the US.

Tarrant has alleged that "Oklahoma statutes place impermissible burdens on interstate commerce in violation of the Commerce Clause and are preempted by the Compact's grant of 'equal rights' to the use of Reach II, Subbasin 5 water to all four compacting States." Solicitor General's Brief at 5. Other Oklahoma statutes regarding the appropriation of water are also at issue. *Id*. at 6. The Solicitor General noted in the beginning of its Discussion section of the brief, "[T]he question whether respondents may enforce state laws that effectively prohibit petitioner from diverting any water in Reach II, Subbasin 5 of the Red River Basin in Oklahoma for use in Texas turns on an interpretation of the [Red River] Compact and its preemptive effect." *Id*. at 10. "Because of the important interests at stake and the practical impact that the court of appeals' decision apparently would have on water planning in a major urban area in Texas, the Court should grant certiorari to resolve that specific issue." *Id*.

Ultimately, the Solicitor General concluded that the Supreme Court should grant certiorari and review the case. "Although there is not a circuit conflict on the issues presented, this case implicates important state interests protected by an interstate compact, and the court of appeals' decision has potentially great practical consequences for the availability of water in a major urban area in Texas. Those concerns justify this Court's review." *Id*. at 17.

The Solicitor General also delves into the question of the Supreme Court's "original and exclusive jurisdiction" over controversies between states, given that Tarrant is not the state of Texas: "In claiming that respondents are depriving Texas water users of Texas's ability to use its lawful share of water of an interstate river, petitioner [Tarrant] asserts a substantial sovereign interest of Texas that would fall squarely within what is ordinarily the exclusive jurisdiction of this Court had the suit been brought by Texas itself against Oklahoma." *Id*.

The Solicitor General's Brief contains interesting points regarding several other factual and legal issues in the case. For example, "factual and legal questions regarding how much water is available at any given time for the compacting States to divide equally among themselves" could be an issue. "The United States is currently involved in litigation over the asserted rights of the Choctaw and Chickasaw Nations to water within their historic treaty territory, which includes areas encompassed by Reach II, Subbasin 5 and other subbasins flowing into Subbasin 5. See *Oklahoma Water Res. Bd v. United States et al.,* No. 5:12-cv-00275-W (W.D. Okla.). The Compact expressly states that '[n]othing in this Compact shall be deemed to impair or affect the powers, rights, or obligations of the United States, or those claiming under its authority, in, over and to water of the Red River Basin.' § 2.07, 94 Stat. 3306. Accordingly, water rights of the Tribes may be relevant to the amount of excess water available." *Id*. at 20.

For info: Solicitor General's Brief available at: www.justice.gov/osg/briefs/2012/2pet/6invit/2011-0889.pet.ami.inv.pdf

TRIBAL WATER COMPACT MT

PROPOSED SETTLEMENT RELEASED

The Confederated Salish and Kootenai Tribes (CSKT), the State of Montana, and the US (collectively the Parties) have been working for several years to develop a water rights settlement that will quantify the water rights of the Confederated Salish & Kootenai Tribes on and off the Flathead Indian Reservation (Reservation) and provide for the administration of water rights on the Reservation. On November 8, the Parties released a proposed Water Rights Compact (Compact). The Parties also released a proposed Unitary Administrative and Management Ordinance (Ordinance) with minor changes based on public comments. The Parties are seeking public comment on both documents and held public meetings in late November and early December to explain the proposed Compact and Ordinance and answer questions.

A Summary of the proposed Compact and Ordinance dated November 8 is recommended reading. That summary states that the settlement intends to: protect verified existing uses as those rights are ultimately decreed by the Water Court or permitted by the Department of Natural Resources and Conservation; protect existing Tribal uses, including traditional Tribal cultural and religious uses; establish a process to permit new uses such as domestic, stock, wetlands, municipal, hydropower, industrial, commercial, and agricultural uses; provide legal protection for post-1996 domestic wells and permits that are currently in limbo; recognize instream flow rights on and off the Reservation; establish modern, science-based irrigation water allocation for the Flathead Irrigation Irrigation Project (FIIP); provide funding for improved water measurement and water supply forecasting; provide additional water resources for the Reservation from the

WATER BRIEFS

Flathead River; provide funding for habitat and FIIP improvements; provide process for changes to existing water uses; and provide more local control than litigation, and other benefits with significantly lower expenditures of time, money and social disruption.

The Parties plan to consider revisions based on the public comment. The Montana Reserved Water Rights Compact Commission will meet on December 19, 2012 to decide whether to submit the Compact to the Legislature for approval. The final Compact and Ordinance would be submitted to the 2013 session of the Montana Legislature for ratification through the enactment of State legislation. Both the US Congress and CSKT would need to approve the settlement. After the three Parties act to approve the settlement, it would be submitted to the Montana Water Court for final approval.

For info: Document and information available at the Compact Commission website: www.dnrc.mt.gov/rwrcc/Compacts/CSKT/Default.asp

PRIORITY REGULATION TX

BRAZOS RIVER CALL

On November 19, in response to a priority call by Dow Chemical Company on November 14, the executive director of the Texas Commission on Environmental Quality (TCEQ) issued an Order and notified certain junior water-right holders in the Brazos River Basin below Possum Kingdom Lake with a priority date of 1942 or later that their right to divert water is immediately suspended. Suspended water rights include those with a priority date of 1942 or later, term, and temporary water-right permits in the Brazos River Basin below Possum Kingdom Lake.

In order to protect public health and welfare, water rights with municipal uses, domestic uses, or for power generation have not been suspended at this time. Landowners with property adjacent to the Brazos River may also continue to divert water for domestic and livestock use as part of their inherent riparian rights. These actions are guided by Texas Water Code Section 11.053, 30 Texas Administrative Code Chapter 36, and the priority doctrine in Texas law. The most senior water rights are served first during times of drought with domestic and livestock uses superior to any appropriated rights (preference over other uses).

For info: Andrea Morrow, TCEQ, 512/239-5011; Drought info at: www.tceq.texas.gov/response/drought

WATER TRANSFERS WEST

WESTERN GOVERNORS' REPORT

On December 3rd, the Western Governors released a report, *Water Transfers in the West: Projects, Trends, and Leading Practices in Voluntary Water Trading*, which provides an overview on how the region can help meet growing demands for water with voluntary market-based sales and leases of water rights. In our January issue, *The Water Report* will publish a major article by the authors of that report to provide additional details.

A water transfer, as defined in this report, is a voluntary agreement that results in a change in the type, period of use, or place of use of a water right. Water transfers can take the form of a sale, lease, or donation and can move water among agricultural, municipal, industrial, energy, and environmental uses. Water transfers are one component of a suite of tools Western water managers can use to meet new demands from changes in farming practices, energy development, and urbanization.

"There is no magic wand or silver bullet when it comes to meeting water supply, only well-informed decision making," said Jennifer Gimbel, Director of the Colorado Water Conservation Board. "This report will help states learn from each other's experiences with water transfers in order to make the best decisions for each state's water future." Water transfers provide a means to "re-purpose" existing water resources for new uses. Since agriculture users hold many of the West's senior water rights, the Governors passed a policy in 2011 advocating that states "identify and promote innovative ways to allow water transfers from other uses...while avoiding or mitigating damages to agricultural economies and communities." The report also addresses ways to mitigate impacts to the environment.

Water Transfers in the West highlights successful transfers and innovative practices to allow Western states to learn from their collective experiences. The report also recognizes that each state's individual circumstances will determine how it should address transfers. It addresses only transfers within states, and not interstate transfers.

For info: Report available at: westgov.org/water

STORAGE TO RETENTION CA

WATER SUPPLY OPTIONS

The California Roundtable on Water and Food Supply (CRWFS) released its latest report, *From Storage to Retention: Expanding California's Options for Meeting Its Water Needs* on November 13. The report builds on earlier work focused on agricultural water stewardship, and argues for an expansion of approaches to storing water that increase supply reliability for specialty crop agricultural production and other beneficial uses, while protecting ecosystem health. Management approaches must support a broad range of options, including ecologically sound large-scale reservoirs, a patchwork of on-farm ponds, expanded soil capacity to retain water, and improvements in groundwater recharge, among others. The report highlights both a conceptual shift in water management — that it argues is a necessary underpinning of effective water storage — and recommends a set of priority actions that constitute high-leverage opportunities to improve California's water storage capacity and management.

CRWFS is a consensus-based forum to uncover obstacles, identify solutions, and take action to enhance water security for specialty crop agriculture, the public, and the environment. CRWFS' membership represents a broad and balanced cross-section of stakeholders.

The Report notes four key principles to ensure effective water retention: 1) Storage integrates all hydrological components affecting

WATER BRIEFS

water availability, movement, and retention to improve supply reliability for evolving needs; 2) Comprehensive, timely, accurate, accessible, and transparent data and resulting information about water resources is an essential foundation for effectively managing storage; 3) An effective storage system requires the coordination of policies and regulations, activities, oversight, and accountability of all government agencies to meet local, regional, and statewide needs simultaneously; and 4) Water storage and retention for improved water supply reliability and watershed health is facilitated by the availability of new sources of financial support that allow investment in quantified outcomes.

To achieve an effective and flexible water storage system, CRWFS maintains that society must broaden its view of what constitutes a storage reservoir to support a "retention" approach to storage — one that holds as much water as possible in the landscape for later use, while maintaining healthy ecosystems. To be more resilient and better prepared for future variations in supply, California must take advantage of all storage opportunities throughout the system that meet the goals of reliable water supply and ecosystem restoration. CRWFS asserts that valuable aspects of water storage tend to be overlooked in terms of their ability to contribute to the availability and reliability of water supplies. In particular, California's agricultural lands play an important role in the storage infrastructure — the value of working lands in helping to sequester water for later use while achieving many benefits, such as food security, flood management, and habitat restoration, represents a critical missed opportunity for improving water security.

For info: Report available at: http://aginnovations.org/articles/view/storage/

STREAMLINED APPLICATION NV WATER & WASTEWATER SYSTEMS

Rural communities in need of funding for new water systems or wastewater treatment systems can send in one request to have their initial project reviewed by three separate agencies. The NV Water and Wastewater Review Committee of Infrastructure for Nevada Communities (INC) developed a single, pre-application form, which is now approved for use by the Nevada Department of Environmental Protection, the Governor's Office of Economic Development Community Development Block Grant Program, and USDA Rural Development. All three agencies have loans and grants available to improve water and wastewater systems, but the application procedures can be complicated. With the new pre-application form, an initial review of a proposal can be completed and the community pointed in the right direction in terms of which program funds they are eligible for, and how the different funds might meet their needs.

The pre-application form for water systems and wastewater treatment improvements is available on the Nevada Department of Environmental Protection website at http://ndep.nv.gov/bffwp/nwwpa.htm.

For info: Shane Hastings, USDA, 775/ 887-1222 x110, Daralyn Dobson, State Revolving Loan Fund, 775/ 687-9489 or Des Craig, Governor's Office of Economic Development, 775/ 687-9918

LOGGING ROADS RUNOFF US NEW EPA RULE ON STORMWATER

On December 3rd, the US Supreme Court heard oral argument on the issue of Clean Water Act jurisdiction over stormwater runoff from logging roads and whether or not a National Pollutant Discharge Elimination System (NPDES) permit is required for such discharges. The case is on appeal from *Northwest Environmental Defense Center v. Brown*, 640 F.3d 1063 (9th Cir. 2011), which held that because the stormwater runoff from two roads in question is collected by and then discharged from a system of ditches, culverts, and channels, it is a point source discharge of industrial stormwater for which an NPDES permit is required.

Chief Justice Roberts expressed frustration during oral argument that EPA, on the previous Friday, had issued revised Phase I stormwater regulations to clarify that an NPDES permit is *not* required for stormwater discharges from logging roads. EPA noted that it did not intend for logging roads to be regulated as industrial facilities and has revised its stormwater regulations to clarify the Agency's intent. *See* 40 CFR 122.26(b)(14).

EPA believes that stormwater discharges from forest roads, including logging roads, should be evaluated under section 402(p)(6) of the Clean Water Act because that section allows for a broad range of flexible approaches that are better suited to address the complexity of forest road ownership, management, and use. EPA added language to existing stormwater regulations to clarify that, for the purposes of assessing whether stormwater discharges are "associated with industrial activity," the only facilities under Standard Industrial Code (SIC) code 2411 that are "industrial" are: rock crushing, gravel washing, log sorting, and log storage. Discharges of stormwater from silviculture activities other than the four activities identified above do not require an NPDES permit.

EPA also noted that it is not proposing to regulate stormwater discharges from forest roads at this time. In response to the partial remand under *Environmental Defense Center v. US EPA*, 344 F.3d 832 (9th Cir. 2003), EPA is reviewing available information on the water-quality impacts of stormwater discharges from forest roads, which include logging roads, as well as existing practices to control those discharges and is considering a range of options to address such discharges, which could include designating a subset of stormwater discharges from forest roads for regulation under the Agency's section 402(p) rulemaking authority. EPA noted that it "maintains its consistent position of over 30 years that stormwater discharges from thousands of miles of forest roads can be effectively addressed by best management practices (BMPs). Discharges from forest roads can seriously degrade forest streams and rivers, but these discharges can be successfully controlled through BMPs, such as grading and seeding road surfaces and designing road drainage structures to discharge runoff in small

WATER BRIEFS

quantities to off-road areas that are not hydrologically connected to surface waters."
For info: http://cfpub.epa.gov/npdes/stormwater/forestroads.cfm

WATER LEASING CO
PILOT PROGRAM

The Colorado Water Trust (CWT) and the Colorado Water Conservation Board (CWCB) are touting a program to lease water to benefit streamflows during drought conditions. During a summer of record-low streamflows, CWT successfully utilized a never-before-used law to add water to over 190 stream and river miles. The pilot program, entitled *Request for Water 2012*, was CWT's voluntary, market-based approach to rewatering streams. CWCB, an agency within the Department of Natural Resources, was created in 1937 to provide policy direction on water issues.

CWT worked closely with CWCB to negotiate three formal water leases though the state administrative approval process. Two additional leases were put in place but not exercised this season. In May, the Upper Yampa Water Conservancy District offered to lease 4,000 acre-feet (AF) of stored water in Stagecoach Reservoir to CWT and the CWCB to increase flows in the Yampa River. The three parties signed a one-year lease to release 26.7 cubic feet per second (cfs) for 75 days. The lease allowed for flexible management if conditions on the Yampa improved or deteriorated. Aspen Shorefox in early May offered three water rights totaling 40 cfs from the Bunte Highline Ditch for lease. The water, typically diverted from Willow Creek, was leased to benefit four instream flow rights on the Colorado River, to which Willow Creek is tributary; all four instream flow water rights were water short in 2002.

Coyote River Ranch offered to lease 2 cfs that would otherwise have been diverted from Deep Creek, a tributary to the Colorado River. Reducing the acreage it irrigated this summer, the ranch entered into a ten-year lease with CWT and the CWCB to benefit the 0.5 mile decreed instream flow water right on Deep Creek. The Bureau of Land Management (BLM) acquired the Thompson Pump No. 2 water right from a private party and assumed management of the water right in 1999. The 13.8 cfs water right diverts from the Colorado River to irrigate hay meadows and BLM offered the 13.8 cfs water right for lease available for use in 3 out of 10 years.

CWT's *Request for Water* program catalyzed a water lease between Colorado Parks & Wildlife (CPW) and CWCB, resulting in CWCB's lease of 3,000 AF of water out of Big Beaver Reservoir on the White River. CPW released water from the reservoir at a rate of 20 cfs from August 30th to October 3rd to keep some water flowing in the White River and to lower the temperature. Without the 20 cfs release, the White River would have been dry in some reaches.
For info: Amy Beatie, CWT, 720/ 570-2897 or www.coloradowatertrust.org; Linda Bassi, CWCB, 303/ 866-3204 or www.cwcb.state.co.us

NONPOINT SOURCE US
EPA GUIDELINES & GRANTS

EPA recently released draft Nonpoint Source Program and Grants Guidelines for States and Territories for review and comment. The revised guidelines provide states and territories with a framework to use section 319 Clean Water Act grant funds to effectively implement their state nonpoint source management programs. The guidelines provide updated program direction, an increased emphasis on watershed project implementation in watersheds with impaired waters, and increased accountability measures. They also emphasize the importance of states updating their nonpoint source management programs to ensure that section 319 funds are targeted to the highest priority activities. The comment period closes December 14 at COB.
For info: http://water.epa.gov/polwaste/nps/cwact.cfm

DELTA PLAN FINAL DRAFT CA

On November 30, the Delta Stewardship Council posted its Final Draft Delta Plan as well as making available for public review and comment two documents that will inform its ultimate decision on the Plan and associated regulations. The other documents released are a Recirculated Draft Programmatic Environmental Impact Report (new Volume 3), and draft regulations based on policies contained in the Final Draft Delta Plan.

According to the Council, when completed, the Delta Plan and its regulations will: create a single blue print for state and local agencies' action to provide a more reliable water supply for California and restore the Delta ecosystem; create new rules for significant state and local agency actions occurring wholly or partly within the Delta, with the Council as an appellate body to enforce those rules in a fair and timely manner; create a unified science initiative and improved accountability to achieve the co-equal goals in the Delta; and create an effective interagency coordination body to implement the Delta Plan.

There is a 45-day public review period, with comments on the plan due January 14, 2013. It is anticipated that the Delta Plan and regulations will be adopted by the Council in Spring 2013, and that the regulations will take effect in Summer 2013.
For info: Documents at: http://deltacouncil.ca.gov/; Eric Alvarez, Council, 916/ 445-5383 or eric.alvarez@deltacouncil.ca.gov

GROUNDWATER IMPACT US
CONTRIBUTOR TO STREAMFLOW

The USGS released a study on November 26th demonstrating that groundwater is a greater contributor to streamflow than calculated by the most commonly used technique. *Quantifying Components of the Hydrologic Cycle in Virginia using Chemical Hydrograph Separation and Multiple Regression Analysis* (SIR 2011-5198). For decades, hydrologists have used only the changing water levels and flow rates, a graphical hydrograph separation or GHS method, in streams to try to estimate the base-flow component. However, many individual studies during that period that used chemical tracers during isolated storm events suggested that the

WATER BRIEFS

graphical method was underestimating the groundwater component of streamflow.

In the study, a broad-spatial scale method was applied that uses specific conductance in addition to flow rates, a chemical hydrograph separation or CHS method, for estimating stream base flows and the components of the water budget in watersheds. This is the first time scientists have demonstrated that the GHS methods are routinely biased and underestimate the groundwater contribution. USGS' study covered a broad region and examined many months of continuous data to help ensure the accuracy of its findings. The CHS method in Virginia gave an average groundwater component in streams of 70 percent, versus 60 percent by the GHS method.

"Unlike the CHS method with specific conductance, other chemical tracer methods that have been used on individual storm events are too costly to be used over this large of a spatial scale and time period," said Ward Sanford, hydrologist and lead author of the study, "but the CHS method is not well suited for all locations, for example, in streams where there are impoundments of water in reservoirs. This is also a groundbreaking study because it can serve as a model for a national-scale study that estimates water budget components in other states."

Both surface water and groundwater in Virginia are allocated based on long and short-term estimates of water availability. Sanford noted that application of the CHS method in Virginia highlighted the components of the water budget in different counties and watersheds, and can be used for better management and planning of surface water and groundwater. For example, Sanford said, the method could help improve water management in the face of persistent droughts, or could improve models of water quality changes, in response to land and farming-management practices, as well as best management practices.

New tools, including national climate data sets with a resolution of less than one mile, and cost-effective specific-conductance probes for base-flow separation, are now available for any state in the country, and can be used to assess long-term water availability, as demonstrated in this study in Virginia. Such assessments will be valuable for water resource managers at the state, county and local planning levels.
For info: Ward Sanford, USGS, 703/ 648-5882; Study at: http://pubs.usgs.gov/sir/2011/5198/

DRINKING WATER SOURCES US

AGRICULTURAL CONSERVATION

The collaboration toolkit *Protecting Drinking Water Sources through Agricultural Conservation Practices* is now available online. The toolkit offers effective steps that source water protection professionals working at the state level can take to build partnerships with USDA's Natural Resources Conservation Service (NRCS) to get more agricultural conservation practices on the ground to protect sources of drinking water. Developed by the Source Water Collaborative, a group composed of 23 organizations working together to protect sources of drinking water, with support from EPA and in consultation with NRCS, the toolkit includes insightful tips and highlights specific opportunities states can take advantage of immediately. In addition, the Source Water Collaborative is working with the National Association of Conservation Districts to develop a locally-focused supplement to the toolkit to provide a step-by-step process for collaborating with conservation districts.
For info: www.sourcewatercollaborative.org/swp-usda/

REALLOCATION STUDY US

MISSOURI RIVER RESERVOIRS

The Missouri River Municipal & Industrial Water Storage Reallocation Study (authorized by Section 216 of the 1970 Flood Control Act) will systemically and comprehensively examine whether some amount of the storage included in the US Army Corps of Engineers' six mainstem Missouri River reservoirs for authorized project purposes may be allocated solely to municipal and industrial water supply. The study will also examine the effects of such a reallocation on the authorized purposes and operations of the mainstem reservoirs. The study area will include the six mainstem reservoirs and the Missouri River proper from Fort Peck Reservoir (Fort Peck, Montana) to St. Louis, Missouri.
For info: www.nwo.usace.army.mil/Missions/CivilWorks/Planning/PlanningProjects/

PERCHLORATE SITE CA

EPA CLEANUP

In early December, EPA began excavating areas of perchlorate-contaminated soil on and around a residential property in Barstow, CA. The residential site had been occupied by the former owner of Mojave Pyrotechnics, Inc., a defunct pyrotechnics manufacturing company that operated in the 1980's.

EPA will remove approximately 1100 tons of contaminated soil, down three feet into the ground — the equivalent of 50 truckloads. The soil will be disposed of at the U.S. Ecology landfill. The excavated areas will be capped with a layer of plastic and then backfilled with clean soil. The removal action may take up to three weeks to complete.

EPA has collected a total of 340 soil samples from 70 locations to determine the areas of contamination. Data from these samples shows two areas, the garden and trash pile areas, within the northwestern parcel of the site with perchlorate levels in the soil that exceed the EPA's Regional Screening Levels of 55 mg/kg. Because these areas with elevated levels are readily accessible to on-site residents, future workers and the casual trespasser and are a potential source of further groundwater contamination, the agency determined that the contaminated soil needed to be removed to ensure the protection of public health.

EPA is working closely with the Regional Water Quality Control Board on its work in Barstow. The Water Board is the lead agency on the ongoing groundwater investigation associated with this site that began in 2010.
For info: www.epaosc.org/MRPS

CALENDAR

December 14-16 NV
Colorado River Water Users Ass'n Conference, Las Vegas. Caesar's Palace. For info: http://www.crwua.org/AboutUs/2011AnnualConference.aspx

December 18 CA
GIS for Watershed Analysis: Intermediate Course, Davis. UC Davis, 1137 Lab, Plant & Enviromental Sciences. Sponsored by UC Davis Extension. For info: http://extension.ucdavis.edu

January 7 OR
Oregon Water Quality Conference, Portland. For info: Environmental Law Education Center: www.elecenter.com/

January 9 OR
Oregon Water Utilities Council Legislative Symposium: "Meeting Oregon's Water Needs", Salem. Salem Convention Ctr., 200 Commercial Street, 8-5pm. For info: Niki Iverson, 503/ 615-6770, nikii@ci.hillsboro.or.us or http://events.r20.constantcontact.com/register/event?oeidk=a07e6igb1we180325e7&llr=fdcbrhjab

January 11 WA
SEPA & NEPA Seminar, Seattle. WA State Convention Ctr. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com or www.lawseminars.com

January 22-24 FL
Underground Injection Control Conference 2013, Sarasota. Lido Hotel. Sponsored by Ground Water Protection Council. For info: www.gwpc.org/events

January 23 CA
Beyond the Water Wars: Cooperative Management Solutions for a Shared Resource (Symposium), Davis. UC Davis. Sponsored by California Water Law Symposium. For info: www.waterlawsymposium.com/

January 24-25 WA
19th Annual Endangered Species Act Seminar, Seattle. Red Lion Hotel on 5th. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 28-30 AZ
Energy, Utility & Environment Conference 2013, Phoenix. Phoenix Convention Ctr. For info: www.euec.com

February 1 CA
GIS for Watershed Analysis: Advanced Course, Davis. UC Davis, 1137 Lab, Plant & Enviromental Sciences. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu/

February 4-8 WA
12th Annual RRNW Stream Restoration Symposium, Stevenson. Skamania Lodge. Sponsored by River Restoration Northwest. For info: www.rrnw.org/

February 5 CA
Investing in California's Water Seminar, Santa Monica. Sheraton Delfina. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 6 CA
CEQA Update, Issues & Trends Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu/

February 6 CA
Ecological & Environmental Mitigation Banking Seminar, Santa Monica. Sheraton Delfina. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 8 CA
Hydraulic Fracking Seminar, Santa Barbara. Bacara Resort & Spa. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 10-13 CA
IECA Annual Conference - Environmental Connection: The World's Largest Soil & Water Event, San Diego. Town & Country Resort & Convention Ctr. Sponsored by International Erosion Control Ass'n. For info: www.ieca.org/conference/annual/ec.asp

February 14-15 DC
Natural Resources Damages Seminar, Washington. Thurman Arnold Bldg. For info: Law Seminars Int'l, 800/ 854-8009, registrar@lawseminars.com or www.lawseminars.com

February 20 CA
Low Impact Development - Biorention Design Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu/

February 21-22 Ontario
2013 Stormwater & Urban Water Systems Modeling Conference, Toronto. Marriott Courtyard Toronto Brampton. For info: www.chiwater.com/Training/Conferences/conferencetoronto.asp

February 21-22 NV
2013 Family Farm Alliance Annual Meeting & Conference, Las Vegas. Monte Carlo Resort. For info: www.familyfarmalliance.org

February 22 OR
The Freshwater Trust Annual Gala & Auction, Portland. For info: www.freshwatertrust.org

February 27-28 GA
12th Annual Wetlands & Water Law Update, Atlanta. Hyatt Regency. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 28-March 3 OR
Earth: Too Big to Fail: PIELC Environmental Law Conference 2013, Eugene. University of Oregon. For info: www.pielc.org

March 1 IN
Great Lakes Natural Resource Goverance Symposium, Indianapolis. Indiana University School of Law. Call for Papers in October. For info: http://indylaw.indiana.edu/programs/ENR/symposium.htm

March 2 CA
Land Use Planning for Non-planners, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu/

March 5 AZ
Water Security From the Ground Up: 2013 Annual Conference, Tucson. Student Union Memorial Ctr. Sponsored by Water Resources Research Ctr. For info: Jane Cripps, WRRC, 520/ 621-2526, jcripps@cals.arizona.edu or http://ag.arizona.edu/azwater/

March 8 CA
Annual California Land Use Law Review & Update Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu/

March 10-13 AZ
Water Utility Management Conference, Glendale. Renaissance Phoenix Glendale Hotel. Sponsored by American Water Works Ass'n & Water Education Foundation. For info: www.awwa.org/conferences/

The Water Report
Water Rights, Water Quality & Water Solutions in the West
260 N. Polk Street • Eugene, OR 97402

CALENDAR

(continued from previous page)

March 14 GA
Endangered Species Act Seminar, Atlanta. Cobb Galleria Centre. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

March 16-20 Portugal
Transboundary Water Management Across Borders & Interfaces: Present & Future Challenges Conference, Aveiro. University of Aveiro. For info: http://ibtwm.web.ua.pt/congress/

March 20-22 FL
Design-Build for Water/ Wastewater Conference, Orlando. Hilton Walt Disney World. For info: www.dbia.org/conferences/waterww/2013/default

March 25-27 MO
Agricultural Hydrology & Water Quality II: 2013 AWRA Spring Specialty Conference, St. Louis. Hilton Ballpark Hotel. Sponsored by American Water Resources Ass'n. For info: www.awra.org/meetings/Spring2013/

March 27-28 NV
Climate Change Science for Effective Resource Management & Public Policy in the Western United States Workshop, Las Vegas. University of Nevada Las Vegas Student Union. For info: Dr. Lynn Fenstermaker, 702/ 862-5412, Lynn.Fenstermaker@dri.edu or http://epscorspo.nevada.edu/

April 2-5 ID
The Water Opportunity Show, Indianapolis. Indiana Convention Ctr. For info: http://s36.a2zinc.net/clients/wqa/wqa13/public/enter.aspx

April 3-5 CO
Western States Water Council Spring (171st) Council Meeting, Denver. Sheraton Hotel Downtown. For info: www.westgov.org/wswc/meetings.html

April 7-10 TN
Sustainable Water Management Conference, Nashville. Loew's Vanderbilt Hotel. Sponsored by American Water Works Ass'n. For info: www.awwa.org/conferences/

April 8-12 Germany
Industrial GreenTec 2013 Fair, Hannover. For info: Ulli Hammer, uhammer@hfusa.com or www.hfusa.com

April 9-12 TX
Texas Water 2013 Conference, Galveston. Moody Gardens Hotel & Convention Ctr. Sponsored by Texas Section AWWA. For info: http://www.texas-water.com/home.html

April 16-19 Spain
12th International UFZ-Deltares Conference on Groundwater-Soil-Systems & Water Resource Manaagement (AquaConSoil 2013), Barcelona. For info: www.aquaconsoil.org/AquaConSoil2013/Start.html

April 17 OR
The Future of Water Supply & Management in the Pacific NW Seminar, Portland. TENTATIVE. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

April 23 WA
9th Washington Hydrogeology Symposium, Tacoma. Hotel Murano. For info: http://depts.washington.edu/uwconf/hydrogeo/