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COLORADO RIVER BASIN WATER SUPPLY & DEMAND STUDY

by Carla Jerly, Terry Fulp, and Pam Adams (US Bureau of Reclamation)

INTRODUCTION

Spanning parts of the seven states of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming (Basin States), the Colorado River Basin (Basin) is one of the most critical sources of water in the western United States (West). The Colorado River and its tributaries provide water to over 30 million people for municipal use and supply water used to irrigate nearly four million acres of land. Basin water is also the lifeblood for at least 15 Native American tribes, seven National Wildlife Refuges, four National Recreation Areas, and 11 National Parks. Hydropower facilities along the Colorado River provide more than 4,200 megawatts of generating capacity, helping meet the power needs of the West and offset use of fossil fuels. The Colorado River is vital to Mexico to meet both agricultural and municipal water needs.

It is essential to understand that the natural water supply of the Basin is highly variable year-to-year. The ability to capture water basin-wide during years in which supply is greater than demand resulted in meeting most of the resource needs throughout the 20th-century — although localized shortages routinely occurred, particularly in the headwaters areas during times of drought.

Throughout the 20th-century, the challenges and complexities of ensuring a sustainable water supply and meeting future demand in the over-allocated Colorado River system were recognized. These challenges have been systematically documented in studies conducted by the US Bureau of Reclamation (Reclamation) and the Basin States over the past 60 years. Concerns regarding the reliability of the Colorado River system to meet the future needs of Basin water uses in the 21st-century are heightened, given the likelihood of increasing demand for water throughout the Basin, coupled with projections of reduced supply due to climate change.

Colorado river system water management includes:

- Water allocations and deliveries for municipal, industrial, and agricultural use
- Hydroelectric power generation
- Recreation
- Fish, wildlife, and their habitats (including candidate, threatened, and endangered species)
- Water quality, including salinity
- Flow and water-dependent ecological systems
- Flood control

Colorado Basin Study

Future Imbalances

Technical Foundation

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COLORADO RIVER BASIN WATER SUPPLY & DEMAND STUDY

A comprehensive Colorado River Basin Water Supply and Demand Study (Study) is currently underway. Water users in the Basin are working together to envision what the curves of supply and demand may be over the next 50 years in order to quantify the range of magnitude of future imbalances. The Study is being conducted by Reclamation and agencies representing the Basin States. The Study will define future supply and demand imbalances in the Basin over the next 50 years, assess the reliability of the system to meet the needs of the Basin resources, and assess options and strategies to resolve those imbalances.

The Study will not result in a decision being made as to how future imbalances will be addressed. Rather, the Study is building a common technical foundation that will frame the range of imbalances that may be faced in the future and identify a range of solutions that may be considered to resolve those imbalances.

The Study is part of the Basin Study Program under the Department of the Interior's WaterSMART Program. The Study is being conducted over a two and half year-period (January 2010 to July 2012).

Adapted from: Colorado River Basin Supply & Demand Study, Interim Report #1, USBR, June 2011

Colorado Basin Study

Phases

Interim Report

Stakeholder Involvement

Supply Projections

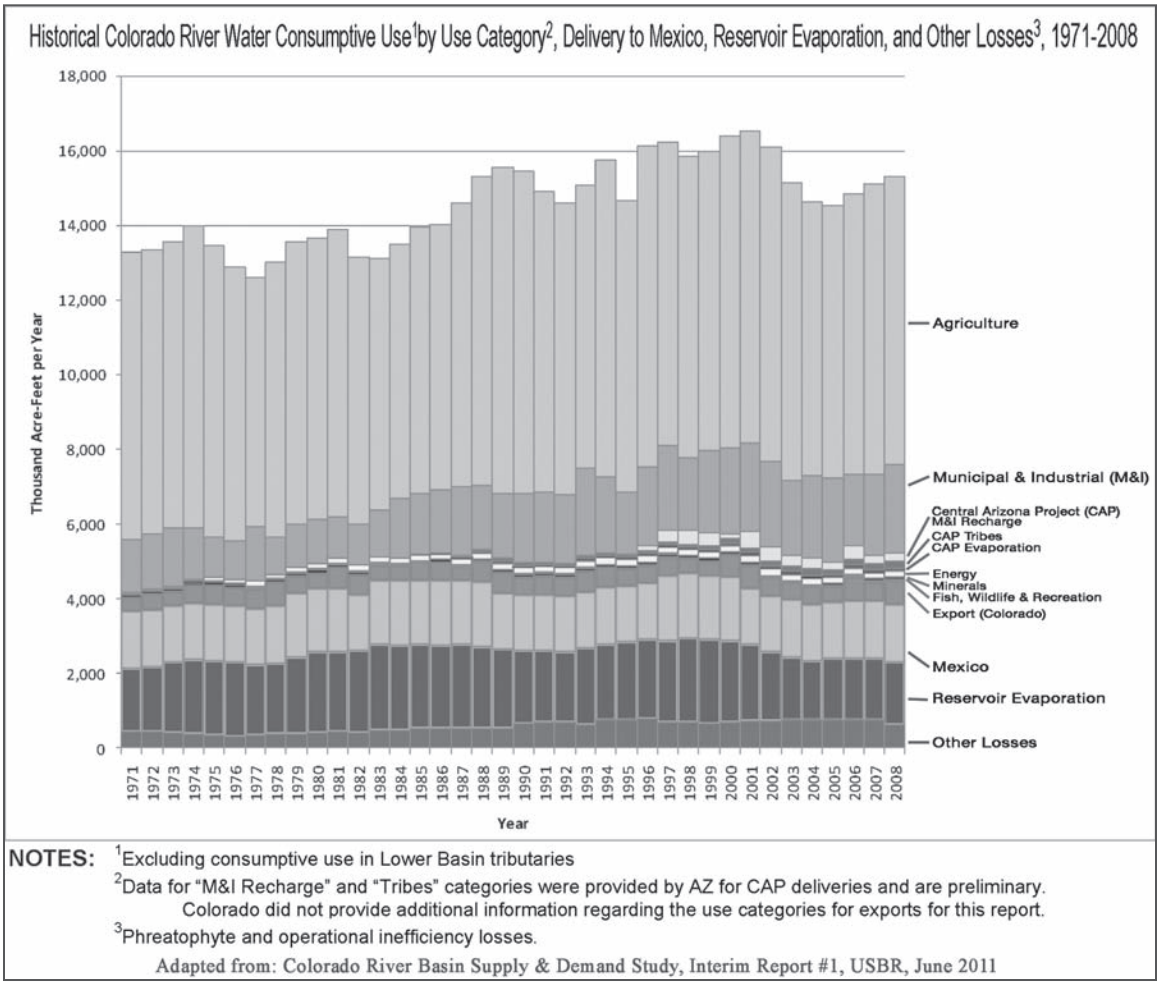
The Study's four major phases include:

- Water Supply Assessment
- Water Demand Assessment
- System Reliability Analysis
- Development and Evaluation of Opportunities for balancing supply and demand.

Due to the inherent complexities of the Study and the many diverse interests and perspectives throughout the Basin, a dynamic reporting approach reflecting continuous technical developments and the ongoing input of stakeholders has been adopted. This approach consists of the issuance of interim reports, which are "snapshots" of the Study's progress as of a particular date. The "*Colorado River Basin Water Supply and Demand Study, Interim Report No. 1*" — which documents the progress of the Study through January 31, 2011 — is the first interim report to be issued for the Study. Published in June 2011, Interim Report No. 1 is available online at: www.usbr.gov/lc/region/programs/crbstudy/report1.html

The Study is being conducted in collaboration with stakeholders throughout the Basin whose participation and input are critical to the Study's success. Interests are broad and include: Native American tribes and communities; agricultural users; purveyors of municipal and industrial water; power users; and environmental groups. Through the Study's outreach efforts, many interested parties have been involved and others are encouraged to do so. A variety of options for involvement exist and range from attending public meetings and informational webinars to participating directly in the development of work products through the Study's technical sub-teams. Additional information is provided on the Study website: www.usbr.gov/lc/region/programs/crbstudy.html.

This article describes the approach the Study has undertaken to incorporate uncertainty and presents the resulting water supply projections. This is followed by an overview of the water demand storylines currently being considered, concluding with ongoing work and expectations with regard to the Study schedule over the next year.



NOTES: [1]Excluding consumptive use in Lower Basin tributaries

[2]Data for "M&I Recharge" and "Tribes" categories were provided by AZ for CAP deliveries and are preliminary. Colorado did not provide additional information regarding the use categories for exports for this report.

[3]Phreatophyte and operational inefficiency losses.

Adapted from: Colorado River Basin Supply & Demand Study, Interim Report #1, USBR, June 2011

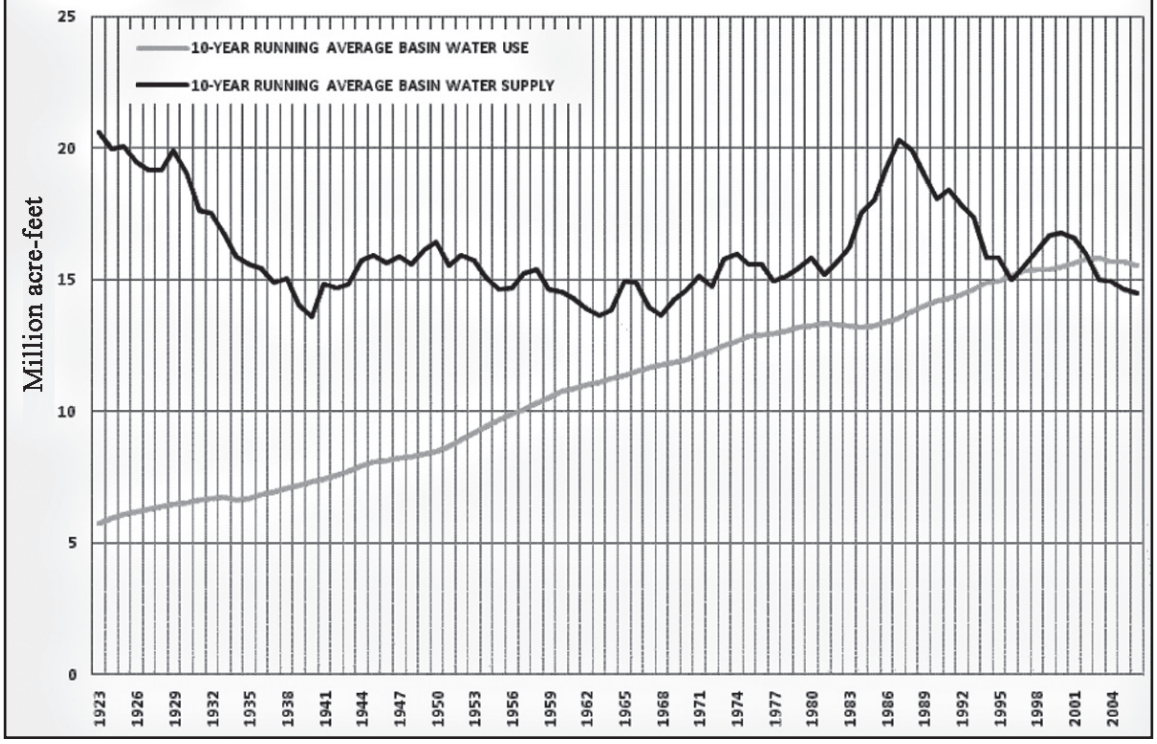
Colorado Basin Study

Storage Projection

Lake Powell and Lake Mead

Lake Powell and Lake Mead, with a combined storage capacity of about 50 million acre-feet (MAF) or 83 percent of the total storage capacity on the Colorado River Basin (Basin), experienced some relief this year as above average snowpack accumulated in many parts of the Upper Basin beginning at the end of last year. This reprieve was welcome as the past 11 years, from 2000-2010, marked the lowest 11-year average in the over 100-year historical natural flow (inflow corrected for upstream reservoir regulation and upstream depletions) record. By the end of this year the storage at Lake Powell and Lake Mead is projected to be 68 and 57 percent of capacity, respectively. Fortunately, on October 1, 1999, at the onset of this historic drought, the combined storage of Lake Powell and Lake Mead was at 95 percent. Because these two reservoirs were essentially full, nearly all deliveries in the Basin were met during the past 11 years despite the worst drought in nearly a century.

FIGURE 1 Historical 10-Year Running Average Colorado River Basin Supply & Use



Existing Imbalance

Figure 1 presents the 10-year running average of historical supply and use in the Basin. For much of the 11-year drought period, use was greater than the supply. This figure clearly illustrates that an imbalance of supply and use currently exists in the Basin. This imbalance will grow in the future if demands continue to increase and the projected reductions in supply due to the climate change are realized.

Approach: Incorporate Uncertainty

Scenario Planning

The amount of uncertainty associated with projecting the state of the Colorado River system over the next fifty years is overwhelming. There are, in fact, an infinite number of ways the future could unfold and therefore considering a narrow view of the future would be insufficient.

The Study has adopted a scenario planning approach in order to frame what a wide range of futures of supply and demand might look like. This approach has resulted in four plausible future scenarios with respect to future supply and four plausible future scenarios with respect to future demand on the Basin.

These scenarios were developed with involvement from many Basin stakeholders. An important aspect of the scenario development process was the identification of the critical uncertainties that impact one of the key questions that the Study is exploring: What is the reliability of the Colorado River system to meet the needs of the Basin resources over the 50 years? "Critical uncertainties" are the driving forces of the uncertainty that are deemed to be the most important and the most uncertain. These are presented in Table 1.

Critical Uncertainties Affecting Water Supply and Water Demand		General Driving Force Category
Water Supply	Changes in streamflow variability and trends	Natural Systems
	Changes in climate variability and trends	
Water Demand	Changes in population and distribution	Demographics & Land Use
	Changes in agricultural land use	
	Changes in agricultural water use efficiency	Technology & Economics
	Changes in municipal and industrial water use efficiency	
	Changes in water needs for energy generation	
	Changes in institutional and regulatory conditions	Social & Governance
	Changes in flow-dependent ecosystem needs for Endangered Species Act-listed species	
	Changes in other flow-dependent ecosystem needs	
	Changes in social values affecting water use	
	Changes in water availability due to tribal water use and settlement of tribal water rights claims	

TABLE 1

The critical uncertainties were grouped according to those that will most affect water supply and those that would most affect water demand. This grouping enabled the development of four scenarios for water supply and four scenarios for water demand. In future phases of the Study, the four supply scenarios will be used in a combination with each demand scenario to assess the reliability of the system over the next 50 years. A result of this combination is that many futures will be represented; there are 16 possible combinations given four supply and four demand scenarios. The key is to find a manageable yet informative set of scenarios to inform the system reliability and development of options and strategies. It is likely that some combinations will not need to be fully analyzed because they may be uninformative, duplicative or illogical.

CLIMATE CHANGE IMPACTS

Projected Percent Differences
for
Selected Colorado River Sub-Basins
Resulting from Temperature & Precipitation Changes

Upper Basin Wyoming	Precipitation		
Temperature		-10%	+10%
	+1°F	8.7%	4.1%
	+2°F	13.6%	10.7%
	+3°F	22.5%	17.4%
	+4°F	29.6%	24.4%
	+5°F	37.1%	31.6%

Upper Basin Utah	Precipitation		
Temperature		-10%	+10%
	+1°F	7.0%	3.5%
	+2°F	10.9%	8.8%
	+3°F	18.0%	14.2%
	+4°F	23.7%	19.8%
	+5°F	29.8%	25.8%

Upper Basin Colorado	Precipitation		
Temperature		-10%	+10%
	+1°F	9.5%	2.8%
	+2°F	15.2%	9.0%
	+3°F	22.5%	15.3%
	+4°F	29.4%	21.8%
	+5°F	36.4%	28.6%

Upper Basin Arizona	Precipitation		
Temperature		-10%	+10%
	+1°F	3.727%	3.703%
	+2°F	7.477%	7.452%
	+3°F	11.219%	11.195%
	+4°F	15.094%	15.069%
	+5°F	19.080%	19.056%

Lower Basin Arizona	Precipitation		
Temperature		-10%	+10%
	+1°F	5.1%	1.9%
	+2°F	8.6%	5.4%
	+3°F	12.3%	8.9%
	+4°F	16.0%	12.5%
	+5°F	19.7%	16.2%

Lower Basin Utah	Precipitation		
Temperature		-10%	+10%
	+1°F	5.8%	2.5%
	+2°F	10.1%	6.7%
	+3°F	14.6%	11.1%
	+4°F	19.1%	15.4%
	+5°F	23.7%	19.8%

Lower Basin Nevada	Precipitation		
Temperature		-10%	+10%
	+1°F	6.3%	3.3%
	+2°F	11.1%	8.1%
	+3°F	16.1%	13.0%
	+4°F	21.3%	18.1%
	+5°F	26.5%	23.1%

As expected, adjustments to the meteorological inputs of the evapotranspiration model used in the Consumptive Uses & Losses reporting resulted in changes to irrigation demands throughout the Colorado River Basin. Temperature increases and precipitation decreases resulted in increases in water demand while precipitation increases resulted in irrigation demand reductions. In general, a 1°F change in temperature resulted in greater demand requirements than a 5% adjustment in precipitation. In areas where precipitation currently plays a minimal role in the satisfaction of irrigation demand, temperature differences will play a majority role.

Adapted from: Colorado River Basin Supply & Demand Study, Interim Report #1, USBR, June 2011

Colorado Basin Study

Traditional Scenario

Paleo Scenarios

Climate Uncertainty

Global Climate Model

Supply Scenarios

Realizations Projected

Water Supply Scenarios

Two critical uncertainties in the Study's Natural Systems category — i.e., streamflow and climate variability — form the basis of the four water supply scenarios. Each scenario encompasses a different trajectory as to how changes in streamflow variability and trends, and changes in climate variability and trends, may unfold.

The first scenario, titled Observed Resampled, encompasses what was once a traditional scenario in water planning studies — i.e., the idea that the future will be essentially the same as the past. This scenario is informed through the observed historical natural flow record, which is approximately 100 years in length.

The second (Paleo Resampled) and third (Paleo Conditioned) scenarios assume that the future will have an expanded variability informed by paleo-reconstructed stream flow records (Meko et al., 2007). The term "Paleo" in these scenarios refers to the use of streamflow records reconstructed from tree-ring chronologies in quantifying the scenario. The Meko et al. reconstructed streamflow record being used in these scenarios dates from 762-2005 for 1,244 years of record. Included in this record is increased variability and longer wet and dry periods than have occurred in the approximate 100-year historical observed record.

The above three scenarios are products of a research and development program that Reclamation's Lower Colorado Region began in 2004 and have been applied by Reclamation in the past (see Appendix N of the Interim Guidelines Final EIS). These three scenarios address the critical uncertainty related to stream flow variability and trends, but do not specifically address the critical uncertainty related to climate variability and trends. Thus, standing alone they would not provide a broad enough range for future supply scenarios.

A fourth supply scenario — derived from **g**lobal **c**limate **m**odel (GCM) projections of precipitation and temperature — was added. The Downscaled GCM Projected scenario was derived from 112 future climate projections used in the Intergovernmental Panel on Climate Change Fourth Assessment Report, subsequently bias corrected and statistically downscaled, obtained from the Lawrence Livermore National Laboratory under the World Climate Research Program's Coupled Model Intercomparison Project Phase 3 (Maurer et al., 2007). These future climate projections were input to the Variable Infiltration Capacity hydrologic model (Christensen and Lettenmaier, 2007) to simulate natural flow. There are biases and uncertainties that are introduced throughout the process to develop natural flow projections from GCM projections. Investigations are ongoing to quantify the effect of these biases on the natural flow projections under this scenario. The themes of the water supply scenarios are summarized in Table 2.

TABLE 2 Water Supply Scenarios

Title	Theme
Observed Resampled	future hydrologic trends and variability are similar to the past approximately 100 years
Paleo Resampled	future hydrologic trends and variability are represented by reconstructions of streamflow for a much longer period in the past (nearly 1,250 years) that show expanded variability
Paleo Conditioned	future hydrologic trends and variability are represented by a blend of the wet-dry states of the longer paleo-reconstructed period (nearly 1,250 years), but magnitudes are more similar to the observed period (about 100 years)
Downscaled GCM Projected	future climate will continue to warm with regional precipitation and temperature trends represented through an ensemble of future downscaled GCM projections

These four supply scenarios have been quantified. For each scenario there are multiple realizations or sequences that are projected to occur. In the Observed Resampled scenario, these realizations are generated by cycling through the observed record, thus the term re-sampled in the title, and it generates approximately 100 realizations (Ouarda et al., 1997). This same technique is applied to generate the Paleo Resampled scenario, which consists of over 1200 realizations. The Paleo Conditioned scenario is generated from a technique that blends the wet and dry states of the paleo record with the magnitudes of the observed record (Prairie et al., 2008) and is comprised of 1000 realizations. The Downscaled GCM Projected scenario is comprised of 112 realizations.

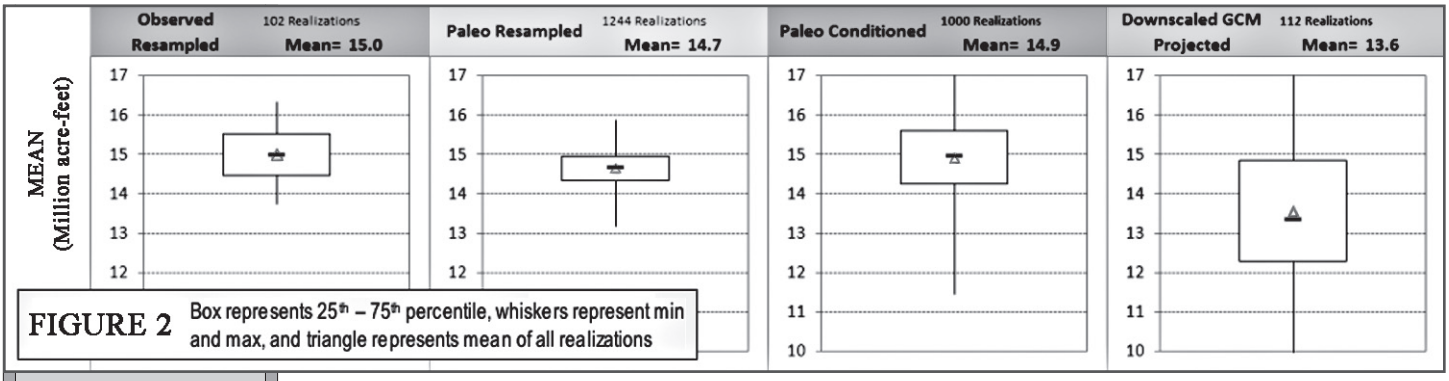


Figure 2 – Summary of Projections of Natural Flow at Lees Ferry

Colorado Basin Study

Variability

Figure 2 compares the future projections of the natural flow under each scenario. In the figure, mean annual flow at Lees Ferry over the Study period (2011-2060) is compared.

The Paleo Conditioned and the Downscaled GCM Projected scenarios have increased variability compared to the other two scenarios, as indicated by the width of the inter-quartile range and the maximums and minimums. Notably, the Downscaled GCM Projected scenario has a mean of about 13.6 million acre-feet or nine percent less than the other scenarios. There is the most variability in this scenario as well with means ranging from 10 to 17 million acre-feet.

Table 3 compares deficit and surplus statistics under each scenario averaged over the Study period. For the purpose of the Study, a deficit (surplus) period is defined by a period when the two-year running mean is below (above) the long-term average of the observed record at Lees Ferry or 15 million acre-feet. The 2-year running mean as opposed to a single year was selected because one year of above average flow in the system does not necessarily break a prolong drought or deficit in the Basin.

Table 3
Summary of Deficit and Surplus Spells at Lees Ferry

TABLE 3	Water Supply Scenario			
Statistic	Observed Resampled	Paleo Resampled	Paleo Conditioned	Downscaled GCM Projected
Frequency of Deficit lasting 5 years or longer	22%	30%	25%	40%
Frequency of Surplus lasting 5 years or longer	28%	15%	18%	<1%

Deficit/Surplus Projections

Under the Downscaled GCM Projected scenario, deficit periods lasting at least five years are projected to occur 40 percent of the time over the next 50 years. This is almost twice as much as seen in the Observed Resampled scenario and 10 percent more than in the Paleo Resampled scenario. In terms of surplus periods, these are most likely to occur under the Observed Resampled scenario, about the same under the two Paleo scenarios, and rarely occur under the Downscaled GCM Projected scenario.

Water Demand Scenarios

The critical uncertainties displayed in Table 1 under the categories related to demand were used to develop the demand scenarios. Parameters, or variables that describe the behavior of the critical uncertainty, were identified — e.g. irrigation efficiency is a parameter in the critical uncertainty changes in agricultural water use efficiency — and logical ranges of how the parameters could change over time were explored. This process included participation from a diverse range of stakeholders and resulted in the development of narrative descriptions of four scenarios, or storylines. The themes associated with the storylines currently under consideration are presented in Table 4. Unlike the water supply scenarios, the demand scenarios have not been quantified to date, although that work is ongoing.

Table 4
Water Demand Storyline Themes

TABLE 4 Water Demand Scenarios	
Title	Theme
Current Trends	growth, development patterns, and institutions continue along recent trends
Economic Slowdown	low growth with emphasis on economic efficiency
Expansive Growth	economic resurgence (population and energy) and current preferences toward human and environmental values
Enhanced Environment and Healthy Economy	expanded environmental awareness and stewardship with growing economy

Colorado Basin Study

Water Demand

System Reliability

Options & Strategies

CONCLUSION

ONGOING & UPCOMING WORK

As the Study progresses, the next step is to quantify the water demand scenarios. This step is currently ongoing and entails quantifying the trajectories of key parameters affecting the demand-related critical uncertainties. For example, quantifying future irrigated acreages would be important in order to compute the resulting water demand from the critical uncertainty changes in agricultural land use.

As the water demand scenarios are quantified, they will be combined with water supply scenarios and used to project system reliability. System reliability will be indicated by the performance of multiple metrics, also developed with a wide range of stakeholder input, representing six major resource categories in the Basin: Water Deliveries, Electrical Power Resources, Water Quality, Flood Control, Recreational Resources, and Ecological Resources. The performance of these metrics, under plausible futures of water supply and demand, will indicate the size of the imbalance and will support the development of options and strategies.

Although much has been accomplished through the Study, much work remains to be done. It is anticipated that a second interim report will be released this October. Also during the fall, the fourth phase of the Study, the development of options and strategies, will be initiated. In this phase, options and strategies will be developed and tested to gauge their effectiveness in addressing the projected imbalances. The final report for the Study is scheduled to be published in July 2012.

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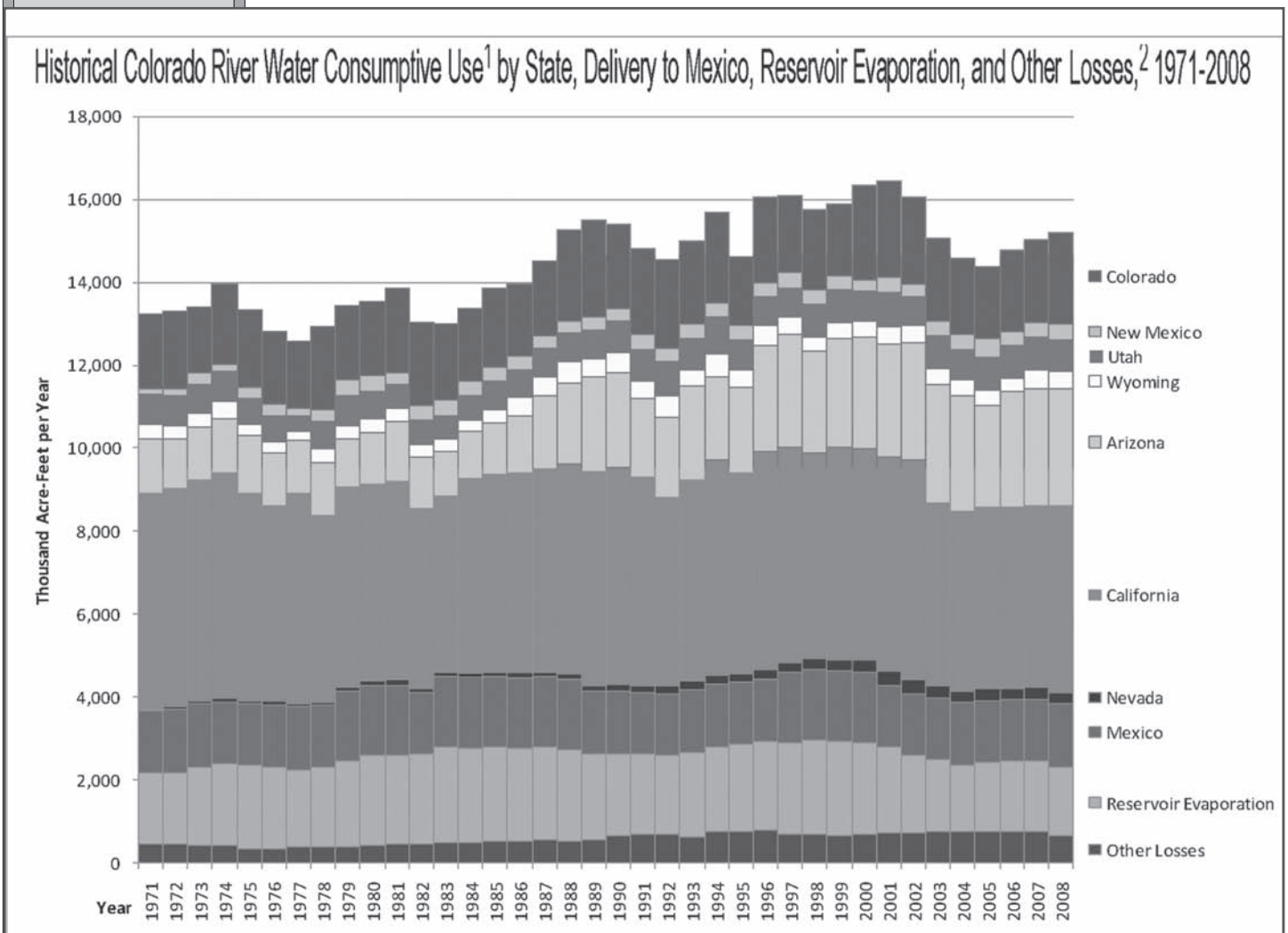

Adapted from: Colorado River Basin Supply & Demand Study, Interim Report #1, USBR, June 2011

Colorado Basin Study

Reclamation website:
T he "*Colorado River Basin Water Supply and Demand Study, Interim Report No. 1*" is available online: www.usbr.gov/lc/region/programs/crbstudy.html
Comments are welcome through the process described at this website.

Carly Jerla is a Hydrologic Engineer with the Lower Colorado Region of the Bureau of Reclamation. In that role, Carly leads the Region's research and development of modeling applications and decision support for water operations and planning at the University of Colorado's Center for Advanced Decision Support for Water and Environmental Systems. She played an instrumental role in the Secretary of the Interior's 2007 decision implementing guidelines for the operation of Lake Powell and Lake Mead through 2026, assisting various stakeholder groups in the development and analysis of alternatives to be considered in the NEPA process. She has a M.S. degree from the University of Colorado and a B.S. degree from Carnegie Mellon University.

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Tribal Water Settlements

INDIAN WATER SETTLEMENTS

OUTLOOK FOR THE 112TH CONGRESS AND BEYOND

by Ryan A. Smith, Brownstein Hyatt Farber Schreck, LLP (Washington, DC)

INTRODUCTION

Congressional Approval

Indian water settlements are complex, obscure, and frequently expensive. To make matters worse, they require congressional approval before they can become enforceable. Consequently, once a tribe settles its water rights claims with the relevant local parties, it must then face the daunting task of moving its settlement through the federal legislative process — which can and does take years.

The looming federal budget deficit and current ban on "earmarks" have made it even more challenging to advance an Indian water settlement through Congress. Given these challenges, in order for an Indian water settlement to have any chance of becoming law, as a threshold matter it cannot increase the federal deficit. Moreover, settlement parties must be able to distinguish their settlement from an "earmark" and demonstrate to congressional members that their settlement's value warrants its federal price tag.

For the most part, these concepts are new. Consequently, proponents of Indian water settlements will be forced to reexamine their approach to these important settlements.

INDIAN WATER RIGHTS

Western water law is complicated. Indian water law is even more complicated.

***Winters* Doctrine**

In the majority of the western United States, the doctrine of prior appropriation applies and provides that water rights are established at the time water is put to beneficial use. Water rights for Indian reservations, however, are based on the *Winters* doctrine, which provides that when the federal government creates an Indian reservation, it also reserves water to fulfill the purposes of the reservation. *Winters v. United States*, 207 U.S. 564, 576-577 (1908). These reserved water rights cannot be lost due to non-use, *Hackford v. Babbit*, 14 F.3d 1457, 1461, n. 3 (10th Cir. 1994).

Tribal Priority

The priority date of reserved water rights is the date the reservation was created by executive order, treaty, or by Congress. *See Cappaert v. United States*, 426 U.S. 128, 138 (1976); *Arizona v. California*, 373 U.S. 546, 598-600 (1963). Where a preexisting tribal use of the waters at issue existed before the creation of the reservation (such as for instream flows for fisheries), the priority date is time immemorial. *See United States v. Adair*, 723 F.2d 1394 (9th Cir. 1983), *cert denied*, 467 U.S. 1252 (1984). Because most western Indian reservations were created in the 1800s and early 1900s, tribes generally have senior water rights to non-Indian water users. Historically, however, very few tribes have had the financial resources to assert and develop their water rights. As a result, many non-Indian water users have become reliant on tribal water.

Over the last several decades, conflicts between Indian and non-Indian users have increased as tribes have started to assert and develop their water rights. Fortunately, there has also been a trend in recent years to resolve these conflicts through negotiated settlements as opposed to litigation.

Compromise

Generally, as part of an Indian water settlement, a tribe agrees to forego a significant percentage of its claimed water rights in consideration for water-related infrastructure funding. The value of the amount of water a tribe forgoes may be worth thousands of dollars per acre-foot. In exchange for this funding, the tribe also waives its water rights claims against the federal and state non-Indian parties. In doing so, the settlements resolve some of the largest outstanding water claims in the West, avoid decades of litigation, provide certainty to the local non-Indian water users regarding their future water supplies, and fund needed tribal water supply projects.

Because the settlements generally require federal funding to become enforceable, Congress must approve them. Congress is also required to approve an Indian water settlement under the Non-Intercourse Act (25 U.S.C. § 177). Reaching a settlement among the parties is very challenging. Obtaining congressional approval of the settlement is equally, if not more challenging.

Tribal Water Settlements

Settlements Act

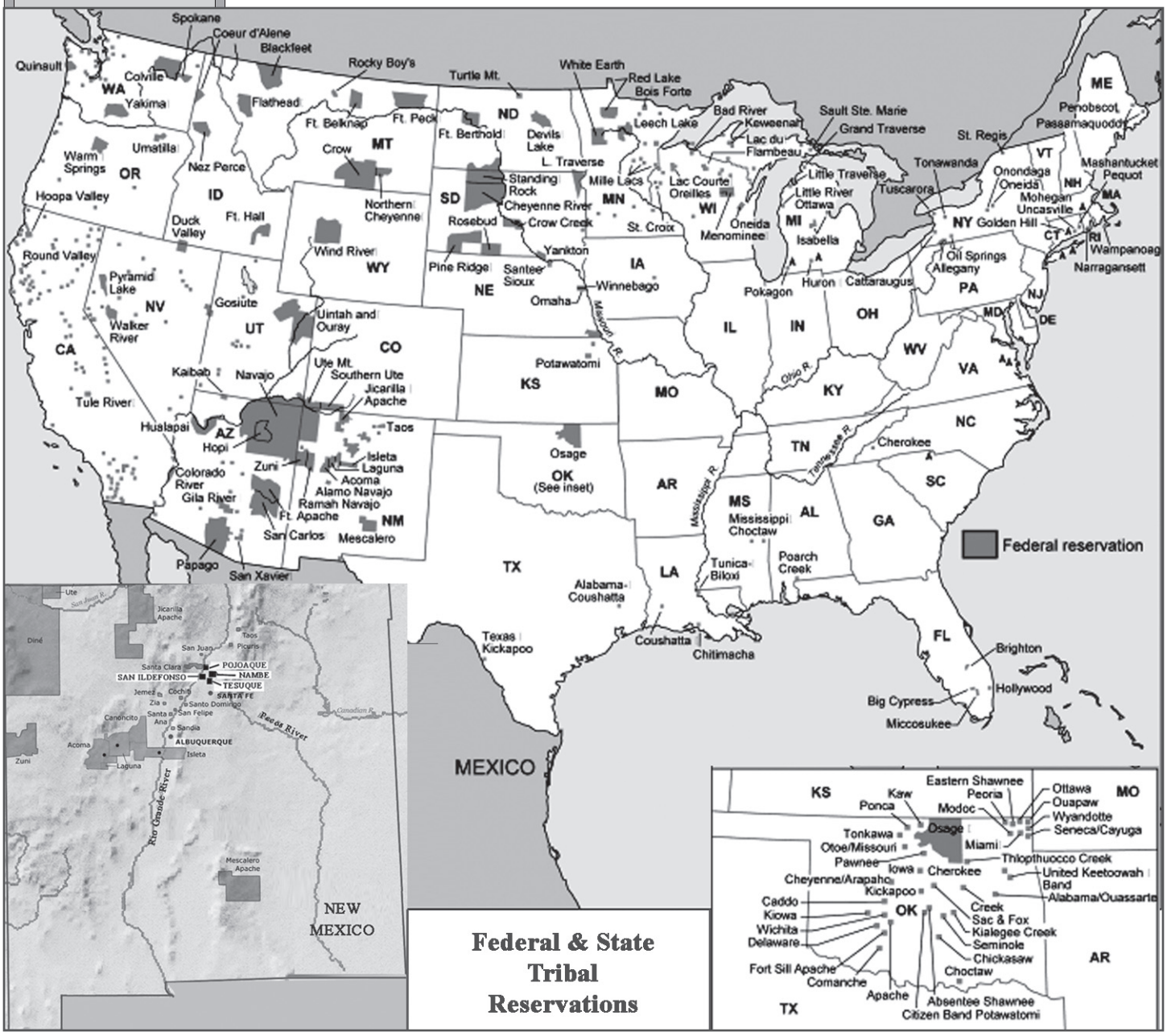
WATER SETTLEMENTS IN THE 111TH CONGRESS

In November 2010, Congress passed four Indian water settlements totaling approximately $1 billion as part of the Claims Resolution Act of 2010 (the "Settlements Act"). Pub. L. No. 111-291.

The four water settlements included in the settlements act are:

- White Mountain Apache Tribe Water Rights Quantification Act (Arizona)
- Crow Tribe Water Rights Settlements Act (Montana)
- Aamodt Litigation Settlement Act (New Mexico)
- Taos Pueblo Indian Water Rights Settlements Act (New Mexico)

These four settlements will provide permanent water supplies to the White Mountain Apache Tribe, the Crow Tribe, the Taos Pueblo, and the Aamodt case pueblos, including the Pojoaque, Tesuque, San Ildefonso, and Nambe pueblos in New Mexico. More specifically, they "will build and improve reservation water systems, rehabilitate irrigation projects, construct a regional multi-pueblo water system, and codify water-sharing arrangements between Indian and neighboring communities." Press Release, Department of the Interior, Salazar: *Settlement Agreement with First Americans Mark Historic Progress in Reconciliation, Empowerment* (Dec. 8, 2010).



Tribal Water Settlements

"PAYGO" Provisions

"Discretionary" & "Direct" Spending

PAYGO Offset

New Settlement Model

Bipartisan Support

But for the unique way the settlements were drafted and packaged, they would have never become law. A critically important aspect of the Settlements Act is the fact that it complied with the Pay-As-You-Go (PAYGO) Act. Pub. L. No. 111-139 (2010). PAYGO requires that any direct spending and revenue provisions in a bill not increase the federal deficit. There are two types of federal spending: "discretionary" and "direct". Discretionary spending is controlled by annual appropriations acts, which fund "routine activities commonly associated with such federal government functions as running executive branch agencies, congressional offices and agencies, and international operations of the government." D. Andrew Austin, and Mindy Levit, Cong. Research Serv., Title I, *Trends in Discretionary Spending*, CRS Report RL34424, 1 (June 10, 2009). A bill with discretionary spending merely authorizes an appropriation. It does not actually appropriate any funds. On the other hand, direct spending is generally established in permanent law and "includes federal government spending on entitlement programs as well as other budget outlays controlled by laws other than appropriation acts." D. Andrew Austin, and Mindy Levit, Cong. Research Serv., *Mandatory Spending Since 1962*, CRS Report, RL33074, p. 1 (Feb. 16, 2010). If direct spending is included in a bill, the funding becomes available automatically. Direct spending (unlike discretionary spending) is not contingent on the annual appropriations process.

The Settlements Act contained both discretionary and direct spending. In order to comply with PAYGO, all of the direct spending in the legislation was "offset" — which means that the direct spending authorized in the settlements was matched either by a commensurate reduction in existing direct spending programs or by an increase in revenue to the United States Treasury. For example, the Settlements Act: (1) reduces federal direct spending by approximately $4.9 billion from 2011-2020 by reforming the Unemployment Compensation Program; and (2) increases revenue to the US Treasury by approximately $2 billion by extending Customs Users Fees for a certain period of time. (The bill also includes other savings.) The Congressional Budget Office estimated that the Settlements Act will reduce the federal deficit by $1 million within the 10-year budget window notwithstanding the direct spending contained in the bill. *Estimate of the situation Pay-As-You-Go effects for H.R. 4783, the Claims Resolution Act of 2010*, as passed by the Senate on November 19, 2010, (available at www.cbo.gov/ftpdocs/119xx/doc11977/hr4783.pdf). This process, in essence, means that the savings in the bill coupled with the increase in revenue to the US Treasury was $1 million greater than the amount of direct spending authorized in the legislation.

Additionally, in order to address the budgetary concerns of a few key Senators, the discretionary spending authorized in the Settlements Act was offset by reducing existing discretionary spending elsewhere. Specifically, the Settlements Act reduced the existing authorization level for Indian water settlements contained in Title VI of the Tom Lantos and Henry J. Hyde United States Global Leadership Against HIV/AIDS, Tuberculosis, and Malaria Reauthorization Act of 2008 (Pub. L. No. 110-293 (2008); Title VI of the law authorized $1 billion for congressionally approved Indian water settlements.

Never before has legislation authorizing an Indian water settlement offset direct spending and discretionary spending. Given the current budget climate, this approach may be the new model on how to fund Indian water settlements.

Another factor that contributed to the passage of the Settlements Act was its bipartisan congressional support in both the House and the Senate. Sen. Kyl (R-AZ), Sen. McCain (R-AZ), Rep. Kirkpatrick (D-AZ), Rep. Shadegg (R-AZ), Rep. Flake (R-AZ), Rep. Pastor (D-AZ), Rep. Grijalva (D-AZ), Rep. Giffords (D-AZ), Rep. Mitchell (D-AZ), and Rep. Franks (R-AZ) sponsored the White Mountain Apache Tribe's water settlement; Sen. Tester (D-MT), Sen. Baucus (D-MT), and Rep. Rehberg (R-MT) sponsored the Crow settlement; and Sen. Bingaman (D-NM), Sen. Udall (D-NM), Rep. Lujan (D-NM), and Rep. Heinrich (D-NM) sponsored the Aamodt and Taos settlements. The settlements also eventually had Administration support, but only after a number of changes were made to the settlements to satisfy its concerns.

Finally, the water settlements were attached to two other settlements strongly supported by the Administration — the Cobell lawsuit brought by Native Americans and the Pigford II discrimination lawsuit brought by African-American farmers. Because both of these settlements were priorities of President Obama, the sponsors had assistance from the Administration in moving the Settlements Act.

Without the combination of factors discussed above, the package of water settlements would probably not have become law.

Tribal Water Settlements

NEW CHALLENGES FACING INDIAN WATER SETTLEMENTS

THE 112TH AND FUTURE CONGRESSES FACE NEW BUDGET CLIMATE

In the era of budget cuts and the newly-imposed Republican ban on "earmarks," the future of Indian water settlements in the 112th Congress and future Congresses appears to be uncertain, at best. As discussed below, however, a few things are clear — settlements must be budget neutral, the earmark issue must be overcome, and the parties must be able to assign a value to their settlement.

Budget Neutral

Settlements Must be Budget Neutral

Given the current budget climate and the fact that the Settlements Act was budget neutral, it is very unlikely that the House Majority or the Senate Minority would support any bill that increases the federal deficit. Consequently, if direct spending is included in settlement legislation, it must be offset by decreasing direct spending or increasing revenue somewhere else in the budget. If authorizations for appropriations (discretionary spending) are included in the settlement legislation, an existing authorization must be decreased to offset the new discretionary spending.

Quid-Pro-Quo

Indian Water Settlements Are Not "Earmarks"

SETTLEMENT PARTIES MUST BE READY TO EXPLAIN WHY

Early in the 112th Congress, Republicans imposed a ban on "Congressionally Directed Spending" or "earmarks." "Congressionally Directed Spending" is defined in the Senate as "a provision or report language included primarily at the request of a Senator providing, authorizing, or recommending a specific amount of discretionary budget authority, credit authority, or other spending authority for a contract, loan, loan guarantee, grant, loan authority, or other expenditure with or to an entity, or targeted to a specific State, locality or Congressional district, other than through a statutory or administrative formula-driven or competitive award process." Standing Rules of the Senate, Rule XLIV, paragraph 5(a). The House definition is virtually the same. Rules of the House of Representatives, Rule XXI, clause 9(e).

Certain members of Congress have argued that water settlements are earmarks because they authorize spending for a particular tribe in a specific state. Anti-earmark groups such as the Citizens Against Government Waste, however, have rejected this argument because of the unique legal nature of Indian water settlements. Talking Points Memo, 11/24/10, available at: http://tpmdc.talkingpointsmemo.com/2010/11/did-jon-kyl-score-a-200m-earmark-three-days-after-ban.php. Indeed, as noted, the federal government is receiving something of value — i.e., the waivers — in consideration for the funding authorized in the settlement. Moreover, tribes generally give up a significant percentage of their water rights in return for federal funding — there is a quid-pro-quo for the funding authorized in the settlements.

Benefits At Risk

If Congress refuses to pass these settlements as a result of earmark reform, the federal government and non-Indian parties will no longer be able to settle Indian water claims and will be forced to remain mired in endless litigation. Additionally, if these claims are not settled, courts could award tribes more federal dollars and water than they would have received through congressionally-approved settlements, leading to increased costs to the US taxpayer, further conflicts with local non-Indian water users, and potential major disruptions of non-Indian water supplies.

Net Benefits Issues

Parties Must be Able to Assign a Value to Their Settlement

Recently, the Chairman of the Natural Resources Committee, US Representative Doc Hastings (R-WA), stated "[a]s part of the future of Indian water settlement bills, Congress will be asked to spend hundreds of millions of dollars, depending on the settlement in question. In these times of fiscal austerity, *Congress will need to know whether the amounts it is being asked to authorize are good not only for tribal and nearby non-tribal interests, but also for the American taxpayer*." Neal Kirby, (Chairman Hastings' Interview with the Tribal Business Journal Natural Resources Comm. 2/6/11) available at: http://naturalresources.house.gov/Blog/?postid=223699 (emphasis added).

Rep. Hastings' comment touches on a point raised by the Chairman of the House Subcommittee on Water and Power, Rep. Tom McClintock (R-CA). In 2010, then-ranking member McClintock asked the US Department of Justice (DOJ) whether the four water settlements included in the Settlements Act represent a net benefit to taxpayers when balanced against the "consequences and cost of litigation." Although it is a valid question, DOJ understandably did not directly answer Mr. McClintock's question because it presumably did not want to admit any potential liability to the tribes. Instead, in a response to McClintock dated January 19, 2010, DOJ stated that the consequences and costs of litigation "are not susceptible to quantification." DOJ was correct inasmuch as it is nearly impossible to assign a dollar value to a settlement based solely on the potential liability of the federal government.

Therefore, in determining the proper amount of funding for an Indian water settlement, Congress should not limit its analysis to the potential liability of the United States. As discussed in more detail below, it should also consider the federal government's trust relationship with tribes, water needs in Indian Country, the impact Indian water claims have on non-Indian communities, and the value of the water the tribe is giving up in the settlement.

Tribal Water Settlements

TRUST RELATIONSHIP WITH TRIBES AND THE FEDERAL GOVERNMENT

The federal government has a trust relationship with Indian tribes and, as a result, owes tribes certain federal duties. This trust responsibility extends to the protection, development, and management of tribal resources, including water. *See Pyramid Lake Paiute Tribe vs. Morton*, 354 F. Supp. 252, 257 (D.D.C. 1972); *Pyramid Lake Paiute Tribe. v. U.S. Department of the Navy*, 898 F. 2d 1410 (9th Cir. 1990).

Reclamation Policy

The Indian policy of the US Bureau of Reclamation states as follows:

Trust resources: The United States government has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian Tribes or Indian individuals by treaties, statutes, and executive orders. Reclamation, as a federal executive agency, shares this responsibility.

Trust asset protection: Reclamation will carry out its activities in a manner that protects trust assets and avoids adverse impacts when possible. When Reclamation cannot avoid adverse impacts, it will provide appropriate mitigation or compensation.

Water rights: The Department of the Interior's policy is to attempt to resolve Indian reserved water rights claims through negotiated settlements rather than litigation when feasible. Reclamation actively supports and participates in the Department's settlement negotiation and implementation activities.

Indian Policy of the Bureau of Reclamation, www.usbr.gov/native/naao/policies/policy.html (last visited Aug. 2, 2011.

Federal Responsibilities

Given the federal government's unique trust obligation to tribes and their resources, federal funding for Indian water settlements is an appropriate exercise of the federal government's trust responsibility. *See* Bonnie G. Colby, John E. Thorson & Sarah Britton, *Negotiating Tribal Water Rights Fulfilling Promises in the Arid West*, 14 (2005) (quoting current Bureau of Reclamation Commissioner Michael Connor, who was then majority staff counsel, US Senate Energy and Natural Resources Committee).

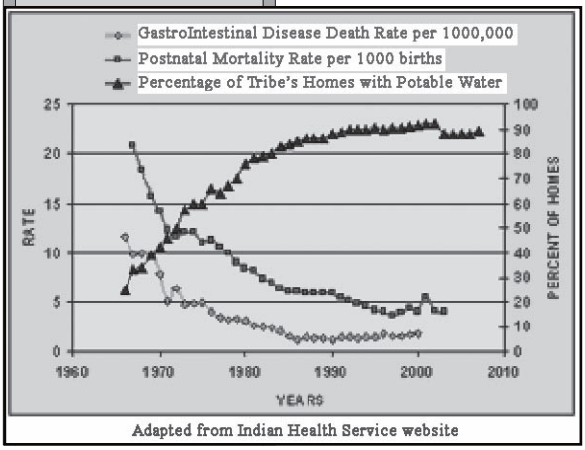
DRINKING WATER CRISIS IN INDIAN COUNTRY

Water Treatment Crisis

Indian water settlements also play a vital role in meeting the United States' policy of addressing the drinking water crisis in Indian Country. Congress has found that: "Indian people suffer an inordinately high incidence of disease, injury, and illness directly attributable to the absence of or inadequacy of (safe water supply systems)." 25 U.S.C. §1632(a)(2). According to the United States Indian Health Service (IHS), "[s]afe and adequate water supply and/or waste disposal facilities are lacking in approximately 12% of American Indian and Alaska Native homes, compared to 1% of homes for the U.S. general population." IHS fact sheets, available at http://info.ihs.gov/SafeWater.asp (last visited Aug. 2, 2011). A recent cost-benefit analysis cited by IHS indicates that for every dollar IHS spends on sanitation facilities to serve eligible existing homes, at least a twentyfold return in health benefits is achieved. *Id.*

Supply Systems

In some areas of Indian Country, deficiencies in adequate water supply or waste disposal are as high as 30%. Bureau of Reclamation, *North Central Arizona Water Supply Study*, 13-14 (October 2006). As a result, many tribal members do not have a reliable source of clean drinking water, and in many cases, must haul water from miles away to their homes. According to the Bureau of Reclamation, "[m]any of the water haulers rely on non-potable water sources for their water supply and/or unsanitary tanks for the transport and storage of water." *Id.*



Adapted from Indian Health Service website

Congress has expressly stated that "it is in the interest of the United States, and it is the policy of the United States, that all Indian communities and Indian homes, new and existing, be provided with safe and adequate water supply systems and sanitary sewage waste disposal systems as soon as possible." 25 U.S.C. § 1632(a)(5). Since most water settlements provide funding for tribal water supply systems, they present a unique opportunity for the federal government to implement this policy while at the same time receiving the benefit of the waivers provided in the settlements.

Water settlements also potentially decrease the long-term costs associated with fighting the diseases that result from having inadequate water supply systems. Indeed, Congress has specifically found that: "[t]he long-term cost to the United States of treating and curing such disease, injury, and illness is substantially greater than the short-term cost of providing such (water) systems…." *Id.* at §1632(a)(3).

Tribal Water Settlements

Reclamation Projects

Water Valuation

Uphill Battle

IMPACT ON NON-INDIAN WATER USERS

Congress should also consider the impact that Indian water rights claims have on non-Indian water users. Federal reclamation policy in the early 1900s encouraged the settlement of the West by non-Indians and the development of arid lands. The National Water Commission observed that "with few exceptions the [Reclamation] projects were planned and built by the federal government without any attempt to define, let alone protect, prior rights that Indian tribes might have had in the waters used for the projects." Colby et al., *Negotiating Tribal Water Rights Fulfilling Promises in the Arid West*, 16 (quoting US National Water Commission, *Water Policies for the Future*, 474-475 (Water Information Center, 1973)). As a result, tribes frequently have been unable to fully use their water rights, whereas non-Indians have become reliant on the water reserved for the tribes. *Id.* In large part, federal policies have created these conflicts over water between tribes and non-Indian water users. Accordingly, it should have a role in resolving them.

By settling the tribal claims, the non-Indian water users receive certainty regarding future supplies. Since the tribes generally settle for less water than the amount they may be legally entitled to, any impact to non-Indian water users is mitigated.

THE VALUE OF THE TRIBAL WATER

Finally, Congress should consider the value of the water the tribe is giving up as part of its settlement. For instance, the United States, on behalf of the White Mountain Apache Tribe and in its capacity as trustee of the tribe's reserved water rights, filed claims in the Gila River Adjudication in Arizona to approximately 180,000 acre-feet of water annually from the Salt River system based on the tribe's *Winters* rights. S. Rep. No. 111-119, at 35 (2010). As part of the White Mountain Apache Tribe's settlement, the tribe agreed to quantify its water rights at 99,000 acre-feet annually. The value of the water at issue is approximately $6,000 an acre-foot. *Id.* Therefore, the potential value of the water that the tribe gave up equaled approximately $480 million, which was far greater than the funding authorized in the tribe's settlement. (This figure, however, assumes that the tribe would have been successful in asserting its claims in the ongoing adjudication.) Accordingly, the value of the water-related claims the tribe gives up as part of its settlement is an essential factor that Congress should consider.

From the tribe's perspective, it is important to note that the White Mountain Apache Tribe only agreed to quantify its water rights for an amount less than the 180,000 acre-feet per year because its settlement authorized federal funding for, among other things, a dam, reservoir and water delivery system. Therefore, the tribe wisely gave up a portion of its paper water rights in return for a dependable and adequate "wet" water supply.

CONCLUSION

Indian water settlements are vital to water management in the West. They provide certainty to water users, allow tribes to waive water-related claims against the federal and state parties, avoid decades of litigation, and provide desperately needed water supply infrastructure for tribes. Despite their importance, settlements face an uphill battle in Congress.

In order to make the settlements more palatable to Congress, Indian water settlements must be, at a minimum, budget-neutral. The parties will also have to convince members of Congress that their particular water settlement is beneficial to US tax payers and not an "earmark." Finally, the settlement parties will need to educate members of Congress as to how these settlements resolve significant water disputes while simultaneously playing a vital role in addressing the drinking water crisis in Indian Country and meeting the federal government's trust responsibility.

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Hydraulic Fracturing

Increased Attention

Citizen Complaints

Production Technique

HYDRAULIC FRACTURING DEBATE

THE LONG AND WINDING ROAD TOWARDS REGULATION

by Bruce Baizel, Senior Staff Attorney, Earthworks (Durango, CO)

Introduction

The subject of hydraulic fracturing has risen from obscurity to newspaper headlines in a matter of a few years. In just the past year, this hydrocarbon and geothermal production enhancement technique has been the subject of a CSI television episode, a children's coloring book, and a nomination for an Oscar. The debate about whether and how hydraulic fracturing will be regulated has seen a considerable amount of back and forth between the players. This article attempts to capture the main shifts in the debate.

For more than a decade now, I have been working as staff attorney for a nonprofit organization that focuses on addressing the impacts of mineral and oil and gas extraction. Many of my days have begun with calls from landowners saying something along the lines of "a drilling rig showed up, they began drilling — and what happened to my water well?" In the 1990s, citizen complaints in Alabama and the San Juan river basin in southwestern Colorado revolved around geysering in their wells, blackened water, and odors. In west central Colorado and in Wyoming, 2-BE, a chemical used by natural gas producers, showed up in water wells. More recently, the image of tap water on fire, popularized in the film *Gasland*, has become symbolic of impacts to water that have been linked to oil and gas development.

The wave of media coverage from New York City to Texas to California has not been triggered solely by natural gas drilling, but revolves more specifically around the production technique known as hydraulic fracturing. This technique involves the pressurized application of fluids and proppants into a geologic formation for the purpose of creating fractures in that formation to facilitate the flow, and therefore production of, hydrocarbons. Proppants are sized particles mixed with fracturing fluid to hold fractures open after a hydraulic fracturing treatment. They may be naturally occurring sand grains, or they may be man-made or specially engineered, such as resin-coated sand or high-strength ceramic materials like sintered bauxite.

Currently, more than 90% of all new oil and natural gas wells in the U.S. are hydraulically fractured.

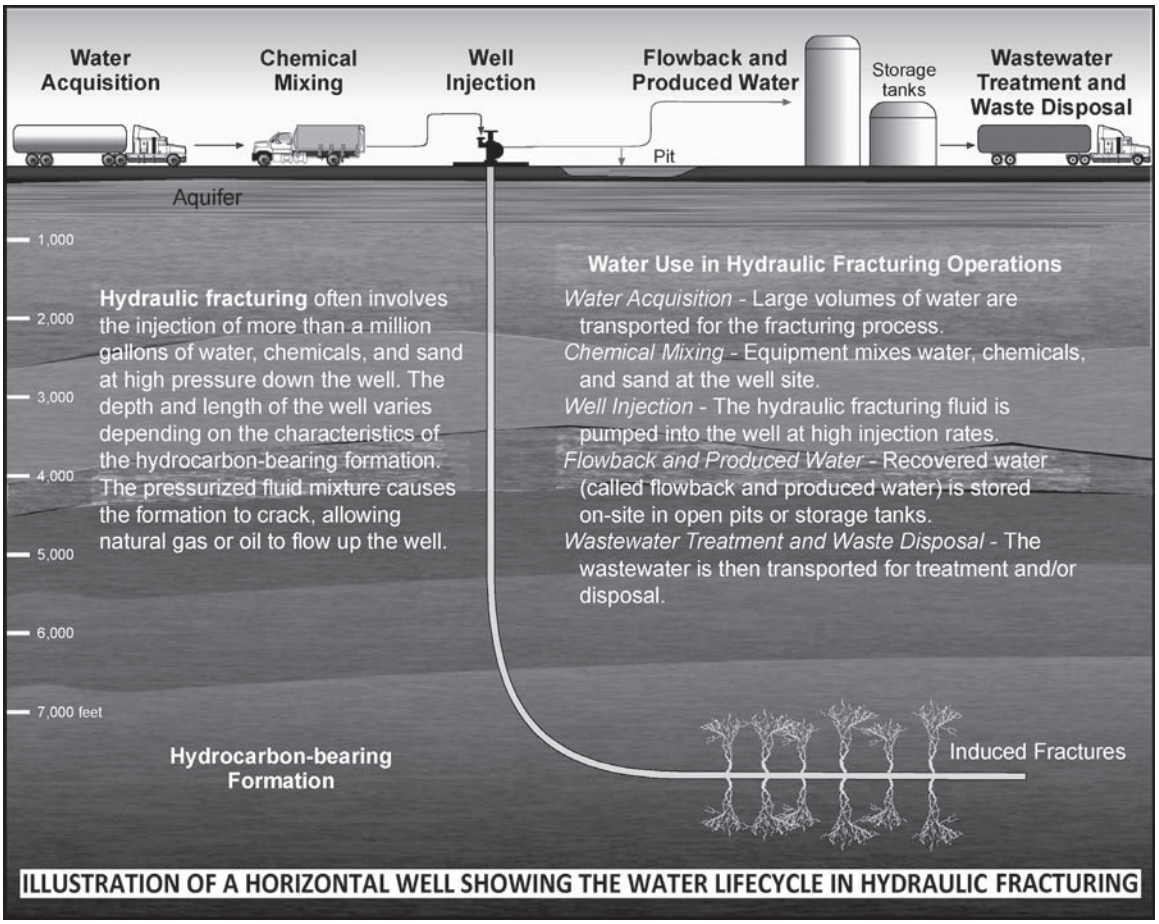

ILLUSTRATION OF A HORIZONTAL WELL SHOWING THE WATER LIFECYCLE IN HYDRAULIC FRACTURING

Hydraulic Fracturing

Act I: "Hydraulic Fracturing Is Not Injection."

Horizontal Drilling

The hydraulic fracturing technique itself is not new, as it saw its first commercial use in 1949. Natural gas production in the US peaked in the early 1970s and even a significant expansion in the use of hydraulic fracturing in coalbed methane formations in the 1980s did not overcome the drop from that peak. In essence, the "easy" to produce natural gas is gone. However, in the past eight to ten years, companies figured out how to combine hydraulic fracturing with the ability to drill wells that reached more than a mile horizontally from the initial vertical wellbore. This allowed the companies to more economically produce natural gas that had been tied up in the relatively tight shale formations that are present in many parts of the country — including regions that had not previously seen oil and gas extraction. In doing so, the companies were moving into close proximity to many more people, and many more sources of drinking water. This close proximity has been the trigger for the rise of awareness about "hydraulic fracturing."

Information Gap

When those phone calls from citizens came in to our office, we began looking for potential causes and links. We quickly found that there was little publicly available information about hydraulic fracturing: whether on the length or direction of the induced fractures, the movement of the introduced fluids in the formations, or how much of the fluid was recovered. For example, estimates of fluid recovery ranged from 10 to 90%. And there was absolutely no information about the contents of the fluids used in hydraulic fracturing.

Drinking Water Regulation

This absence of science and data mirrored the absence of regulation of hydraulic fracturing. In 1974, the federal Safe Drinking Water Act (SDWA) authorized the US Environmental Protection Agency (EPA) to regulate underground injection wells in order to protect drinking water sources. Recognizing that cleanup was not always possible, Part C of the SDWA stressed prevention of contamination to ensure safe drinking water supplies. The prevention of contamination was further emphasized in 1984, when legislation was passed that banned injection well disposal of hazardous waste unless operators could demonstrate that the waste would not migrate for as long as it remained hazardous. So EPA developed Underground Injection Control (UIC) regulations to prevent hazardous and nonhazardous wastes from contacting USDWs. [Editor's Note: USDWs are defined broadly to include all fresh water aquifers unless they have been specifically exempted from protection. A USDW may be in current use as a source of drinking water, but that is not necessary. A USDW is simply any aquifer which contains fewer than 10,000 mg/l total dissolved solids and is currently being used as a drinking water source or which is of sufficient volume and adequate quality to be a future source for a public water system (25 or more connections).]

Underground Injection (*LEAF*) Decision

Hydraulic fracturing, however, was not included within the UIC regulations — until the *LEAF* decision turned the oil and gas world upside down in 1997. The *LEAF* decision held that hydraulic fracturing activities constitute underground injection under Part C of the Safe Drinking Water Act (*Legal Environmental Assistance Foundation, Inc., v. U.S. EPA*, 118 F.3d 1467, 1478 (11th Cir., 1997)). In short, the 11th Circuit injected hydraulic fracturing back into the SDWA. The immediate practical result of the decision was that the State of Alabama developed rules covering hydraulic fracturing in its shallow coalbed methane fields. The longer term result of the *LEAF* decision was to ignite a political battle over regulation of hydraulic fracturing.

Act II: "Hydraulic Fracturing Has No Risk"

Part 1: The 2004 EPA Report on Hydraulic Fracturing: Risk and Politics, But No Science

EPA Study Limitations

In response to the *LEAF* decision, EPA undertook a look at hydraulic fracturing. In 2004, the agency's report on the subject concluded that "the injection of hydraulic fracturing fluids into coalbed methane wells poses little or no threat to Underground Sources of Drinking Water." U.S. EPA, June 2004, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs.* EPA Document #816-R-04-003, p. ES-16. However, there were a number of limitations with the report. EPA had undertaken a literature review and interviewed numerous people around the country, but it carried out no studies or modeling to help understand the mechanics and consequences of hydraulic fracturing. The report addressed only hydraulic fracturing in coalbed methane formations and did not consider fracturing in tight sandstones or shales or in formations where the target hydrocarbon was oil, such as the Bakken or the Eagle Ford. The review did, however, document the injection of known toxic fracturing chemicals into USDWs at concentrations that exceed water quality standards. The report also noted that hydraulic fractures can and do extend "out of zone" or formation; that is, when the fractures go vertically into the geologic formation above or below the formation containing the hydrocarbons, or horizontally beyond the intended area to be fractured. In the *Garza* case, discussed below, the hydraulic fractures crossed a property boundary, thus raising the issue of trespass.

Voluntary Diesel Agreement

In parallel with the report, the EPA also negotiated a voluntary agreement in 2003 with the three largest service companies — Halliburton Energy Services, Inc., Schlumberger Technology Corp., and BJ Services Co. — who carried out the majority of hydraulic fracturing operations in the US. Under this agreement, the companies committed not to use diesel when fracturing in coalbed methane formations.

Hydraulic Fracturing

Exemption in 2005

Part 2: The 2005 Energy Policy Act Exemption: Overturning the *LEAF* Decision (or most of it)

With EPA's conclusion of "little or no risk" and the voluntary agreement with the three service companies in hand, Congress passed § 322 under the oil and gas title of the Energy Policy Act of 2005. This section amended the SDWA so that "the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fraction operations" was excluded from SDWA regulation by EPA. While this undid the *LEAF* decision (other than for the use of diesel), the heavy role of politics, including White House involvement, in passage of the legislation and the continued hints that hazardous chemicals were being used in hydraulic fracturing kept the issue from disappearing.

Hazardous Waste

Part 3: Red Flags in the Data

The focus of those concerned about the impacts of hydraulic fracturing on water quality then shifted to state level efforts to understand what was actually in drilling and fracturing fluids. First up was New Mexico's revision of its rules for managing oil and gas waste.

During 2007 testimony as part of this rulemaking, New Mexico Oil Conservation Division staff summarized their sampling results stating that "[e]xcept for the statutory RCRA exemption, these pits would have been determined to contain characteristically hazardous waste." The testimony went on to point out that "17 constituents were present in the OCD pit fluid samples at concentrations that exceed the WQCC Ground Water 3103 Standards." See www.earthworksaction.org/pubs/15vonpitsamplingpgm.pdf. ("WQCC" refers to the New Mexico Water Quality Control Commission).

At almost the same time, sampling by industry as part of rulemaking process in Colorado also showed that well sites in nearly every producing field in Colorado had elevated levels of constituents of concern.

Health Impacts Database

A parallel nongovernmental effort to evaluate the potential health impacts from drilling and fracturing fluids led to development of a database built from the Occupational Safety and Health Administration (OSHA) Material Safety Data Sheets and Toxic Resource Inventory reports. After several years, this effort showed that "toxic chemicals are used during both the fracturing and drilling phases of gas operations, that there may be long term health effects that are not immediately recognized, and that waste evaporation pits may contain numerous chemicals on the Superfund list." *Natural Gas Operations from a Public Health Perspective*, Theo Colborn, Carol Kwiatkowski, Kim Schultz, Mary Bachran — Accepted for publication in the International Journal of Human and Ecological Risk Assessment, September 4, 2010. Available at: www.endocrinedisruption.com/chemicals.introduction.php .

Fracturing Chemicals

More recently, a US House committee reported that between 2005 and 2009, the 14 leading oil and gas service companies "used more than 2,500 hydraulic fracturing products containing 750 chemicals and other components. Overall, these companies used 780 million gallons of hydraulic fracturing products — not including water added at the well site — between 2005 and 2009. Some of the components used in the hydraulic fracturing products were common and generally harmless, such as salt and citric acid. Some were unexpected, such as instant coffee and walnut hulls. And some were extremely toxic, such as benzene and lead. Appendix A lists each of the 750 chemicals and other components used in hydraulic fracturing products between 2005 and 2009." US House of Representatives, Committee on Energy & Commerce (Minority Staff), *Chemicals Used in Hydraulic Fracturing*, 4/16/11, page 1.

Diesel Use

A year earlier, committee members had found that service companies Halliburton and BJ Services had used diesel and other known toxic chemicals in hydraulic fracturing injection operations in at least 15 states in 2005, 2006 and 2007. BJ Services agreed this was "in violation of the MOA [Memorandum of Agreement with EPA]." Waxman, H. and Markey, E. February 19, 2010. Memorandum to Members of the Subcommittee on Energy and Environment Re: *Examining the Potential Impact of Hydraulic Fracturing*, p.2, http://democrats.energycommerce.house.gov/Press_111/20100218/hydraulic_fracturing_memo.pdf.

These Congressional inquiries showed just how extensively forms of diesel were still being used. Between 2005 and 2009, the service companies used 32.2 million gallons of diesel fuel or "diesel-containing fluids" (at least 30% diesel fuel) in hydraulic fracturing operations. Diesel-containing fluids were used most frequently in Texas, which accounted for half of the total volume injected, 16 million gallons. The companies injected at least one million gallons of diesel-containing fluids in Oklahoma (3.3 million gallons), North Dakota (3.1 million gallons), Louisiana (2.9 million gallons), Wyoming (2.9 million gallons), and Colorado (1.3 million gallons).

Act III: "Hydraulic Fracturing Is Carried Out Safely"

Part 1: Fracture uncertainty: hydraulic fracturing as art or science?

Fracture Control?

In essence, hydraulic fracturing uses fluids under pressure to break the rock in the formation, causing mini-earthquakes. What is less clear is the extent to which the companies can control where and how far the fractures run. Industry's claim is that they have an economic incentive to manage the fractures — if they go too far or move out of formation, then they are paying for the fluid lost to areas that do not produce hydrocarbons. Yet, I have heard many times from industry representatives that managing the fracturing process is more an art than a science.

Hydraulic Fracturing

Imprecision

The imprecision of the fracturing process has been captured by the Texas Supreme Court, where they noted that "[e]stimates of [fracture] distances are dependent on available data and are at best imprecise. Clues about the direction in which fractures are likely to run horizontally from the well may be derived from seismic and other data, but virtually nothing can be done to control that direction; the fractures will follow Mother Nature's fault lines in the formation." *Coastal Oil & Gas Corp. et al. v. Garza Energy Trust, et al.,* NO. 05-046 (Sept. 28, 2006) at: www.supreme.courts.state.tx.us/historical/2008/aug/050466.htm.

Well-to-Well Migration

In addition to examples of fractures running as much as 3000 feet out of a fracture zone, there is information that shows that communication can and does occur between hydraulic fracturing operations conducted in shale formations. Communication, in this sense, means an activity in one well resulting in a reaction in another well, although the exact connection may not be known. Not only does this increase the potential for issues such as well blowouts, it also presents the potential for movement of fracturing fluids up uncemented or poorly cemented wells and into aquifers. The most well documented example of this comes from shale gas wells in British Columbia, Canada. The British Columbia Oil and Gas Commission identified a number of incidents where fluids and substances from hydraulic fracturing operations migrated into other gas wells, and in some cases, resulted in the migration of fracturing fluids back to the surface. Some of the incidents involved communication between a hydraulic fracturing operation and a well being drilled nearby, while others were fracture stimulations that impacted adjacent producing wells.

Part 2: Fluid Uncertainty

Fracturing Fluid Recovery

The second part of the debate about the safety of hydraulic fracturing centers around uncertainty related to the fluids used in fracturing. In a 2010 presentation to the Quebec government, ALL Consulting stated that 70 to 85 % of injected fracturing fluid is at least initially left in the formation. Over time, more of the injected fluids are expected to return to the surface via produced water from the formation, but the final recovery volume of fluids is not known because companies are required to report neither the volume of fluid that flows back to the surface nor the estimated volume of fluid that remains in the formation following a hydraulic fracturing treatment. Produced water is water from underground formations that is brought to the surface during gas production.

Fluid Composition?

The second area of uncertainty centers on the exact nature of the fracturing fluids. Until very recently, there was no requirement that service companies report what was in the fluids. This meant that a water well owner wanting to establish baseline conditions for water chemistry, or emergency responders wanting to know how to treat someone who had been exposed to fracturing fluids, had no way of knowing what to look for or where to get that information. In response to this lack of disclosure, states such as Colorado, Wyoming, Texas, Montana and Arkansas have all begun requiring some sort of disclosure for fracturing fluids (see discussion below).

Part 3: Causation

Analyzing Interactions

When those citizens call our office about impacts to their water well — such as a recent landowners who said that damage to their water well had occurred at exactly the same time as adjacent hydraulic fracturing operations — there are few well developed investigative techniques for analyzing interactions extending thousands of feet below ground surface. As noted by a former Colorado county oil and gas inspector, the primary method used by the industry and third party investigators to examine the question of causation is water chemistry. Scientists sample and analyze the constituents in water proximal to oil and gas wells and in some cases the same compounds that are sought in commercial gas wells, namely hydrocarbons, are found. While this condition suggests a possible connection between the gas wells and groundwater contamination, it does not prove that gas well development caused the contamination. Jordan, J., "*Proving Whether or not Contamination is Caused by Oil and Gas Operations*", 2011, accepted for publication by the Pennsylvania Bar Association. Manuscript on file with author.

Contamination Causation

This has certainly been true for some high profile individual cases — Amos in Colorado, Pavillion in Wyoming and Bainbridge in Ohio, among others. For example, in Pavillion, after hydraulic fracturing of nearby natural gas wells, residents experienced drinking water with strong odors that turned black, and tasted bad. EPA subsequently found contamination in 11 water wells, including toxic chemicals that can be found in hydraulic fracturing fluids, and has said further tests are needed to determine the source of contamination. *See* EPA Pavillion, references.

Proximity Correlation

Correlative evidence has also been reported in two recent broader scale studies of methane contamination of water wells. Duke University researchers, looking at aquifers overlying the Marcellus and Utica shale formations of northeastern Pennsylvania and upstate New York, found systematic evidence for methane contamination of drinking water associated with shale gas extraction. In active gas-extraction areas (defined as one or more gas wells within 1 km), average and maximum methane concentrations in drinking-water wells increased with proximity to the nearest gas well. *See* Duke University: Osborn et al., 2011, references.

Similarly, a University of Wyoming professor found a temporal trend of increasing methane in groundwater samples over the last seven years that is coincident with the increased number of gas wells installed in a portion of west central Colorado. Concurrent with the increasing methane concentration was an increase in groundwater wells with elevated chloride (derived from produced water) that can be

Hydraulic Fracturing

correlated to the number of gas wells. Thyne, G., *Review of Phase II Hydrogeologic Study*, prepared for Garfield County, SBS LLC, 12/20/2008, www.garfield-county.com/oil-gas/mamm-creek-phase-I-II-conclusions-dr-thyne.aspx. Clearly, the question of whether hydraulic fracturing can be carried out safely is not a settled issue.

Act IV: Looking ahead - What to Do, What to Do?

Industry in Flux

For an industry that has operated largely as it wanted to for decades, the current flux represented in the debate about hydraulic fracturing is extraordinary. Splits among states, within the industry, and between local, regional, and national environmental groups can all be seen. In general, there are three approaches to the issue of hydraulic fracturing that are vying to be heard.

Approach 1: Ban It!

Bans

Largely situated in eastern states, there are a number of jurisdictions that have taken formal positions to completely ban the use of hydraulic fracturing within their jurisdictional boundaries or watersheds. The State of New Jersey, New York City, Pittsburgh and Morgantown are the most highly visible here in the US, but there are also tribal governments and local township boards from Maryland to upstate New York that have taken similar positions. Outside the US, France has passed legislation to ban the use of hydraulic fracturing, and both Quebec and parts of South Africa have passed moratoria on its use in some form.

There are significant issues of pre-emption and mineral owner rights that loom largely unresolved for this approach to hydraulic fracturing.

Approach 2: State's Rule!

State Regulation

Coming from states that have longer histories with oil and gas development, there is a strong voice for continuing with a state-based regulatory regime, albeit a strengthened one vis-à-vis hydraulic fracturing. Beginning with Colorado in 2008, and its first of its kind chemical inventory rule (Rule 205), states have begun to review their oil and gas rules as they relate to hydraulic fracturing. Colorado's rule requires that operators maintain an inventory by wellsite of all chemicals used in all drilling operations, including hydraulic fracturing. Colorado has recently announced that it will add a disclosure requirement to its rules later this year.

Disclosure Rule

Colorado was followed by Wyoming, which revised its regulations in 2010 to require that the operator or service company provide to the agency, for each stage of the well stimulation program, the chemical additives, compounds, and concentrations or rates proposed to be mixed and injected. The Wyoming disclosure rule provides for 'confidentiality protection' upon written request for "proprietary information" about the fracturing fluids used. Wyoming Stimulation regulation, Chapter 3, Section 45 at: http://wogcc.state.wy.us/rules-statutes.cfm; *See* also *TWR* #79, Water Briefs.

Texas Requirements

More recently, Texas passed the first state legislative mandate for chemical disclosure of fracturing fluids. Under H.B. 3328, operators are required to post water volumes used and each chemical ingredient that requires a Material Safety Data Sheet to a public website. For other chemicals, the legislation requires the operator to provide a list to the Texas Railroad Commission (TRC). As in Wyoming, the legislation allows for shielding of "proprietary" information through a trade secret claim process. TRC will soon be initiating a rulemaking process to add the mandated disclosure provisions into the agency rules.

Trade Secret

Montana has also proposed new regulations mandating disclosure of fracturing fluids. Additive type, chemical compound name, and concentration of each additive will be posted to a public website. Under a trade secret portion of the rules, the operator or service contractor may withhold the chemical product from the agency. Montana draft disclosure rules available at: http://bogc.dnrc.mt.gov/Frac.asp.

Unresolved Issues

The state regulation proponents look to transparency, improved well construction, and locational restrictions to ensure prevention of water contamination during hydraulic fracturing operations. Among unresolved issues for this approach are questions of enforcement capacity, trade secret exemptions to disclosure, and the uncoordinated nature, and general lack, of appropriate waste management regimes for hydraulic fracturing (and drilling) wastes. For example, in the Marcellus region, Ohio is currently the end location for most of the waste generated in Pennsylvania; Louisiana largely sends its waste to Texas; and Colorado sends a significant portion of its wastes to New Mexico and Utah.

In general, industry prefers this approach, as it wants to avoid federal regulation, although there are certainly operators within the industry who do not see any need for strengthened rules, but simply better enforcement of existing state regulations.

Approach 3: A Federal Floor

SDWA Exemption

Beginning a couple of years ago, a third approach became more visible — one that called for removal of the various federal environmental exemptions enjoyed by the industry, including the SDWA exemption for hydraulic fracturing. This coalesced into several federal pieces of legislation, including the so-called FRAC Act, which would mandate public disclosure of hydraulic fracturing chemicals and remove the SDWA exemption. FRAC Act: see H.R. 1084, S.587, introduced June 2009. The act currently has 57 sponsors in the House and 10 for the Senate version, although the national political climate likely means the legislation will not move much further during this session of Congress. As the profile of hydraulic fracturing has grown larger, other federal efforts have sprung into being over the past year. EPA has laid out its study plan for taking the first broad scientific look at hydraulic fracturing, both in terms of case

Disclosure

Hydraulic Fracturing

Bruce Baizel is the Staff Attorney for Earthworks, a nonprofit organization that works with communities to address the impacts of mineral and energy extraction. Based in Durango, Colorado, Bruce has worked on oil and gas issues throughout North America, at local, state, national and international levels. He helped develop the language for the federal FRAC Act and has drafted state, county and city legislation and ordinances regulating oil and gas, including model regulations for Montana, Colorado and New Mexico. Currently, Bruce is in the thick of the local, state and federal discussions surrounding hydraulic fracturing. He is one of three environmental representatives on the board of directors of the national multi-stakeholder organization STRONGER (i.e., the State Review of Oil and Natural Gas Environmental Regulations). Prior to joining Earthworks and the Oil & Gas Accountability Project, Bruce was legal counsel for Diné CARE, a Navajo environmental organization on the Navajo Nation. He was a co-founder and director of community programs for Round River Conservation Studies during the 1990s. Bruce and his family live on a small ranch where they raise goats, a few cows and generate about one-third of the electricity they use from a wind turbine and solar panels.

study histories and in looking at the fracturing process, start to finish. The first version of this report is due in 2012. (*See* Orford, TWR #85; EPA Draft Plan available at: http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711.pdf).

EPA is also developing guidelines for permits under the SDWA for the use of diesel in hydraulic fracturing — the one area not exempted by the 2005 legislation, perhaps as early as the end of this year (EPA diesel guidance, available at: http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydroout.cfm#diesel).

The Department of Energy has set up a subcommittee to make recommendations on how to make the hydraulic fracturing process safer (*see* www.energy.gov/news/10309.htm).

The Department of Interior is also considering changes to its policies for oil and gas development on federal lands that would address some of the concerns about hydraulic fracturing (DOI/BLM website: www.blm.gov/wo/st/en/info/newsroom/2011/april/NR_04_01_2011.html).

The issues facing those pushing for federal standards are numerous — ranging from the practicality of federal management of a chemical disclosure website and database to the question of the need for a permit for every hydraulic fracturing operation.

Final Thoughts

The conflicting themes in the public debates over hydraulic fracturing reflect the many and varied interests involved. At the moment, the range of issues having a bearing on water remain complex and without clear resolution: confidentiality of chemical products vs. public disclosure, zones of presumption and acceptable baseline water testing parameters, the functionality of nontoxic fracturing fluids, and the sources, availability and cost of the millions of gallons of water needed during hydraulic fracturing operations. Exciting and challenging times, indeed!

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The views expressed here represent the author's and are not necessarily those of Earthworks.

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WATER BRIEFS

EXPERIMENTAL POPULATION WA
ESA FISH DESIGNATION PROPOSED

On July 19, NOAA Fisheries released an advance notice of proposed rulemaking (ANPR) on a proposal under the Endangered Species Act (ESA) to authorize a nonessential experimental population of upper Columbia spring-run Chinook in the Okanogan River and its tributaries. The agency will consider the best available information to determine if reintroduction of Chinook salmon is biologically feasible and will promote conservation of ESA-listed upper Columbia spring-run Chinook. The ANPR identifies policy and technical issues for consideration and evaluation, and solicits comments on them. NOAA will consider and address all substantive comments received by Sept. 19, 2011.

For additional detail regarding the designation of an "experimental population" see the article entitled "*ESA Experimental Population: NMFS's First Proposed Designation a Win-Win for Water Users and Steelhead*" by David Filippi and Kirk Maag of Stoel Rives law firm in *The Water Report* #89.
For info: Eric Murray, 503/ 231-2378, Eric.Murray@noaa.gov or www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/Section-10-Permits/Okanogan.cfm

EXEMPT WELLS DECISION WA
LAND USE RULING

Washington State's Supreme Court (Court) has issued an important decision concerning exempt wells and housing developments in *Kittitas County v. E. Wash. Growth Mgmt. Hearings Bd.*, No. 84187-0 (July 28, 2011)(*Kittitas County*). In a defeat for Kittitas County and developers, the Court ruled that Kittitas County's (County's) subdivision regulations failed to protect water resources as required by the state's Growth Management Act (GMA), among other land use issues in the case.

In Washington, if the proposed use does not exceed 5,000 gallons per day for domestic, group domestic, or industrial purposes, or if irrigation is for non-commercial purposes or less than 1/2 acre in area, the use is permit-exempt and does not require a water right permit. One of the issues in the case was whether the County's decisions were allowing developers to use the well exemption to serve multiple homes in a housing development, which is illegal. Beginning in July 2009, an emergency Department of Ecology (Ecology) groundwater rule halted new groundwater withdrawals in Upper Kittitas County (west of Indian John Hill) unless they are fully mitigated to offset impacts to senior water rights. Mitigation occurs when the applicant provides mitigation water to offset the use, generally by purchasing a share of a senior water right to avoid adversely affecting existing water rights (irrigation or instream).

The Court relied on its previous decision in *Dep't of Ecology v. Campbell & Gwinn, LLC*, 146 Wn.2d 1, 43 P.3d 4 (2002) (*Campbell & Gwinn*). "In *Campbell & Gwinn*, this court interpreted the permit exemption of RCW 90.44.050 and held that commonly owned developments are not exempt and therefore must comply with the established well permitting process if the total development uses more than 5,000 gallons of water per day. 146 Wn.2d at 4." *Kittitas County* at 36. The Court went on to note that "[T]he record before the Board included evidence of water shortages in the county and subdivision applications that allegedly evade the law under this court's interpretation of RCW 90.44.050 (requiring a permit to withdraw groundwater) in *Campbell & Gwinn* by relying on multiple exempt wells." *Id.*

The correlation of county land use regulation and water resource protection by the state agency (Ecology) was also addressed by the Court. Stating first that "[A]t times, Petitioners seem to argue that the County is entirely preempted from adopting regulations related to the protection of groundwater resources, authority it suggests rests entirely with Ecology." *Id.* at 37. The Court held that "[I]n fact, several relevant statutes indicate that the County must regulate to some extent to assure that land use is not inconsistent with available water resources. The GMA directs that the rural and land use elements of a county's plan include measures that protect groundwater resources. RCW 36.70A.070(1), (5)(c)(iv)." *Id.* at 38

The respective roles of the county and the state water resources agency were further clarified by the Court. "In recognizing the role of counties to plan for land use in a manner that is consistent with the laws regarding protection of water resources and establishing a permitting process, we do not intend to minimize the role of Ecology. Ecology maintains its role, as provided by statute, and ought to assist counties in their land use planning to adequately protect water resources." *Id.* at 40. "To interpret the County's role under RCW 58.17.110 to only require the County to assure water is physically underground effectively allows the County to condone the evasion of our state's water permitting laws. This could come at a great cost to the existing water rights of nearby property owners, even those in adjoining counties, if subdivisions and developments overuse the well permit exemption, contrary to the law." *Id.* at 40-41.

The decision clearly applies to all counties in Washington as they implement regulations to protect water resources and address the specific issue of exempt wells. The Court's discussion of land use regulation and counties' duties under Washington's Growth Management Act is also instructive for similar situations arising in other states. *See Bates, TWR* #88.
For info: Case available at: www.courts.wa.gov/opinions/?fa=opinions.disp&filename=841870MAJ; Center for Environmental Law & Policy: www.celp.org/exemptwells/overview.html

WATER REUSE REPORT WEST
WESTERN STATES WATER COUNCIL

The Western States Water Council (WSWC) has released a report entitled "*Water Reuse in the West: State Programs and Institutional Issues*" (July 2011), compiled by Nathan Bracken, Legal Counsel. WSWC states that water reuse can provide a reliable supply of water to help address growing water demands. The practice is also becoming more practical and cost-effective given the scarcity of fresh water supplies, the abundance of wastewater created by growing populations, and increasingly stringent wastewater discharge requirements. While many states have expressed an interest in reusing water, a number of legal, institutional, and societal constraints potentially hinder reuse.

The report consists primarily of narrative summaries that discuss the results of a survey circulated in 2010 to each state that is a member of WSWC. Although the terms and concepts associated with water reuse vary significantly across the West, "water reuse" for the purpose of this report refers to surface and/or groundwater that is used, treated or reconditioned, and then used again. It does not

WATER BRIEFS

address water that is merely reused on a specific site without being treated or reconditioned.

For each state, the report contains information pertaining to: (1) its laws and regulations governing reuse; (2) available funding options for reuse projects; (3) legal, political, technical, and institutional issues that encourage or discourage reuse; and (4) specific state efforts to encourage reuse or overcome barriers. A number of states also provided information on their existing water reuse projects.

The summaries show that the extent to which reuse occurs and the factors that encourage or impede it vary considerably depending upon the circumstances of each state. Some states have highly developed regulatory programs specific to reuse, while others may not have any programs and may lack a statutory or regulatory definition for the practice. Nevertheless, states reported various common barriers, including inflexible and duplicative regulations, concerns about how to protect senior water rights, lack of funding, and health concerns among the general public. Common efforts to encourage reuse involve state funding mechanisms, public outreach, and state-sponsored workgroups to identify and overcome barriers. In general, the most effective state efforts appear to be those carried out at the direction of a governor or state legislature, and include significant collaboration with stakeholders to develop laws, regulations, and policies aimed at encouraging reuse, according to the report.

For info: Report available at WSWC website: www.westgov.org/wswc/publicat.html

PUBLIC TRUST DOCTRINE NV

NAVIGABLE WATERWAYS

The Nevada Supreme Court (Court) on July 7 expressly adopted the Public Trust Doctrine and determined how it applies in Nevada in *Lawrence v. Clark County*, No. 54165 (July 7, 2011), 127 Adv. Op. 32. "This appeal concerns whether state-owned land that was once submerged under a waterway can be freely transferred to respondent Clark County, or whether the public trust doctrine prohibits such a transfer. Generally, under the public trust doctrine, a state holds the banks and beds of navigable waterways in trust for the public and subject to restraints on alienability." *Id*. at 1-2. Thus, if the land is found to be protected by the Public Trust Doctrine (PTD), it cannot be conveyed from the state of Nevada to Clark County.

The Court unequivocally stated, "We expressly adopt the public trust doctrine in Nevada." The Court reversed the district court and sent the case back to that court for "determinations as to whether the disputed land was submerged beneath navigable waters at the time of Nevada's statehood, how it became dry land [whether by reliction or avulsion], and, if necessary, whether its transfer accords with the public's interest in it." *Id*. at 2. The district court had determined that the land in question (330 acres of land adjacent to the Colorado River) was not subject to the PTD because it was not within the current channel of the Colorado River.

As noted by the Court in a quote from the seminal case of *Illinois Central Railroad v. Illinois*, 146 U.S. 387, 452 (1892), lands that were under navigable waters at the time of statehood are "held in trust for the people of the State that they may enjoy the navigation of the waters, carry on commerce over them, and have liberty of fishing therein freed from the obstruction or interference of private parties." The Court also noted that such lands are not necessarily perpetually held in trust, but that "in effecting transfers, the public interest is always paramount" and that control of the State is never lost *except* as to parcels that are used in promoting the interests of the public or can be disposed of without any substantial impairment of the public interest in the lands and waters remaining. *Id*. at 6. In reviewing transfers under this exception, the key for public trust property is whether the transfer satisfies "the state's special obligation to maintain the trust for the use and enjoyment of present and future generations." *Id*. at 22, quoting from *Arizona Center for Law v. Hassell*, 837 P.2d 158, 170 (Ariz. Ct. App. 1991).

"If, on remand, the district court finds that the disputed land was beneath navigable waters and became dry through avulsion, the district court must then determine whether the portions of the [law] conveying those lands to Clark County contravene the public trust." *Lawrence* at 25.

The Court discusses PTD in detail, including earlier Supreme Court holdings concerning the Doctrine, PTD principles in the Nevada Constitution and statutes, and PTD principles inherent from limitations on the state's sovereign power. The decision provides thorough coverage of the Court's rationale in adopting PTD and, thus, is worthwhile reading for both Nevada water professionals and those in other states.

For info: Case available at: www.nevadajudiciary.us/

TRIBAL FISH ACCORD WA

FEDERAL AGENCIES MOA

The Bonneville Power Administration (BPA), along with the US Army Corps of Engineers (Corps), and the US Bureau of Reclamation (Reclamation), is proposing to enter into a new ten-year Columbia Basin Fish Accord with the Kalispel Tribe of Washington (Tribe). The proposed Accord will provide nearly $40 million in BPA funding to deliver substantial benefits for listed and non-listed fish — including bull trout, west slope cutthroat trout, and mountain whitefish. The fish and wildlife projects include $2.5 million for wildlife habitat acquisitions to address wildlife impacts associated with Albeni Falls Dam, predator management, operational solutions to address impacts of Albeni Falls Dam, and habitat and hatchery improvements in the area of Lake Pend Oreille and the Tribe's Reservation along the Pend Oreille River (about 55 miles north of Spokane, Washington).

The proposed Accord acknowledges the Tribe's resource management expertise and its commitment to fish and wildlife and provides for the Tribe's greater participation in decisions that affect its interests. The provisions address the shared interest of the Tribe, Corps, and BPA in operations at Albeni Falls Dam and the protection of the natural resources of the Pend Oreille River and its tributaries.

BPA initiated a 30-day public comment period on the proposed Accord on July 1, 2011. Following an assessment of comments, a Record of Decision will be prepared for the administrator's signature.

For info: April Pierre, Kalispel Tribe, 509/ 999-6705; Michael Milstein, BPA, 503/ 230-4215; Scott Lawrence, Corps, 206/ 764-6896; Additional information including the MOA available at: www.salmonrecovery.gov/ColumbiaBasinFishAccords/KalispelTribe.aspx

WATER BRIEFS

WATER PLANNING OR AGENCY RECOMMENDED ACTIONS

Several state agencies in Oregon have been developing the state's first Integrated Water Resources Strategy (IWRS) and have recently produced a set of draft "Recommended Actions" for public review and comment. These "Recommended Actions" address a dozen water-related issues, including water supply and water quality, energy, infrastructure, climate change, management, public health, and more. The Oregon Water Resources Department (OWRD) is the lead agency for the IWRS.

The "Recommended Actions" — designed to help Oregon communities understand and meet their current and future water needs — were developed from 11 open houses held in communities throughout Oregon. Community members were asked to identify the most pressing issues they face when it comes to water. Participants identified a number of water quantity, water quality, and ecosystem concerns. To help address these problems, they offered a variety of suggestions, including improving water policies, programs, and partnerships, as well as funding and education. Based on this input, as well as help from a number of advisory groups, the state developed the "Recommended Actions."

The public is invited to review the draft Recommended Actions and respond with ideas and suggestions by August 31, 2011. Oregon's first Integrated Water Resources Strategy is scheduled for publication and adoption in 2012.

For Info: Alyssa Mucken, OWRD, 503/ 986-0911 or muckenam@wrd.state.or.us; "Actions" available at: www.wrd.state.or.us/ (click on "Project Page")

USE IT OR LOSE IT KS

OGALLALA AQUIFER & CONSERVATION

More than 400 Kansans from across the state joined Governor Sam Brownback in Colby, Kansas on July 21 for a discussion on the future of the Ogallala Aquifer. The purpose of the Governor's Economic Summit on the Future of the Ogallala Aquifer was to seek input from stakeholders on the individual's role and how the state can support local stakeholders in reaching their goals. The Ogallala Aquifer is the main source of water for all uses in the Western third of the state. Counties located above the Ogallala Aquifer account for roughly 2/3 of the state's agricultural economic value.

At the Summit, the Governor led a roundtable discussion that focused on incentives aimed at conserving and extending the life of the aquifer while also enhancing the Western Kansas economy. One issue discussed at the Summit was the "use it or lose it" concept in Kansas water law as a possible disincentive for conservation. The fear that water users sometimes raise is that water rights may be lost due to non-use if the rights are not used to the full extent of the water rights. This fear could lead to use of water at times it is not actually needed, simply to avoid any risk of forfeiture. The Governor was quoted at the Summit as saying that the "use it or lose it" requirement is outdated and should be eliminated.

Water law in all the western states does require that water right owners beneficially use their rights in order to avoid forfeiture of those rights, usually at least once during a five-year period. The legal standard, however, differs from the perception or interpretations of the "use it or lose it" requirement in that one must *beneficially* use the water — using water for irrigation or any other use when it is not actually needed is not "beneficial use" and thus would not protect the user against an assertion of forfeiture.

For info: Sherriene Jones-Sontag, Office of the Governor, 785/ 368-7138 or media@ks.gov; Katie Ingels, Kansas Water Office, 785/ 296-0877 or Katie.Ingels@kwo.ks.gov

INTERBASIN TRANSFER NV

LAND USE AUTHORITY

On July 7, the Nevada Supreme Court (Court) upheld a decision by Washoe County (County) that denied a water transfer from one hydrographic basin to another, despite the approval of the Nevada State Engineer of the transfer. *Redrock Valley Ranch v. Washoe County*, No. 55695, 127 Nev., Adv. Op. 38 (July 7, 2011).

Redrock Valley Ranch, LLC (RVR) proposed to export water from one hydrographic basin to another, with both basins lying within the County. The Nevada State Engineer (State Engineer) had approved the interbasin transfer request, but the County declined to grant RVR a special use permit for the pipelines, pump houses, and other infrastructure needed for the water exportation plan. The district court upheld the denial of the special use permit. RVR appealed, contending that the "inconsistent positions taken by Washoe County, together with the State Engineer's approval of the transfer applications, required Washoe County to grant RVR's special use permit application." *Adv. Op*. at 2.

After a hearing, the State Engineer issued a ruling approving RVR's transfer applications as to 855 **a**cre-**f**eet **a**nnually (afa) of water, subject to submission of a monitoring and mitigation plan. The ruling also approved transfer of an additional 418 afa of water (total of 1,273 afa), if RVR met certain conditions. "As required by NRS 533.370, the State Engineer made findings that these changes in use would not conflict with existing rights or protectable interests in domestic wells, or threaten to prove detrimental to the public interest." *Id*. at 2-3. RVR in the meantime entered into an agreement with the Truckee Meadows Water Authority (TMWA) giving TMWA a right of first refusal to purchase RVR's transferable water rights and requiring RVR to apply to the County for a special use permit for the water transfer facilities.

The County's Development Code requires five findings for a special use permit to issue, with the fourth required finding being that "issuance of the permit will not be significantly detrimental to the public health, safety or welfare; injurious to the property or improvements of adjacent properties; or detrimental to the character of the surrounding area…". Washoe County Code § 1 10.810.30.1. After a public hearing, the Washoe County Board of Adjustment denied the special use permit application, determining that the fourth finding could not be made. RVR appealed the Board's denial to the Washoe County Commission. The Commission, citing "policy conflicts, noise, community character, public health, and property value issues," denied RVR's appeal. The Commission "stated that it could not find…that issuance of the permit would 'not be significantly detrimental to the public health, safety or welfare; injurious to the property or improvements of adjacent properties; or detrimental to the character of the surrounding area.'" *Id*. at 6.

WATER BRIEFS

Eventually, the Court concluded that "the State Engineer's ruling neither preempted nor precluded Washoe County from denying RVR's application for a special use permit for the reasons it did and that substantial relevant evidence supported Washoe County's denial of the special use permit. NRS 533.370 vests the State Engineer with authority to decide whether to reject or approve an application for an interbasin transfer of groundwater. This statute works in tandem with other 'Nevada water law statutes [that] define separate roles for the State Engineer and Washoe County'; it does not preempt Washoe County's authority over political, social, and economic decisions relating to water. *Pyramid Lake Paiute Tribe v. Washoe Co*., 112 Nev. 743, 749-50, 918 P.2d 697, 701-02 (1996)." *Id*. at 7-8. The Court then quoted from *Serpa v. County of Washoe*, 111 Nev. 1081, 1085, 901 P.2d 690, 693 (1995): "A county may limit water use 'as long as those restrictions are consistent with the relevant long-term comprehensive plans, Nevada law, and notions of public welfare.'" *Id*. at 8.

Addressing the potential conflict between the County and the State Engineer, the Court stated: "Here, the Washoe County Commission limited the bases for denying the permit to policy conflicts, noise impacts, changes to community character, public health issues, and lowering of property values. It determined that adequate, less risky water supply alternatives existed to the plan RVR proposed. Although the public presented concerns that fell within the State Engineer's purview, such as impacts to existing wells, the State Engineer's ruling did not, and could not, limit Washoe County's ability to reject the special use permit for the social and economic reasons discussed above, which are separate and distinct from the issues addressed by the State Engineer." *Id*. at 9.

For info: Case available at: www.nevadajudiciary.us/

WATER INFRASTRUCTURE US

HUGE INVESTMENTS NEEDED

The Western Governor's Association has accepted a report on strategies to address water infrastructure needs prepared by the Western States Water Council (Council). The report addresses identifying, prioritizing and financing water-related infrastructure needs related to flood control, agricultural, municipal and industrial water supply and wastewater treatment, water quality protection, water conservation and reuse, and navigation.

The report notes that there is a growing and increasingly serious need for collaboration and leadership at all levels of government to address water infrastructure needs and find the necessary funding. An American Society of Civil Engineers' (ASCE) Report Card gives the Nation's drinking and wastewater infrastructure a grade of D-, its dams a D, and its levees and inland waterways a D-. This raises public safety and health concerns, as well as a looming specter of future water infrastructure repair, rehabilitation and replacement costs. "The estimated five-year investment need for all infrastructure repairs and rehabilitation is $2.2 trillion," said Patrick Natale, ASCE Executive Director. Discussing the US Army Corps of Engineers' projects, Steve Stockton, Director of Civil Works for the Corps noted that "[R]oughly $100 billion is needed to repair levee systems, while $125 billion is required to replace the current navigation lock system."

However, figures from the Associated General Contractors of America show that of the approximately $135 billion in construction-related federal stimulus spending, only $21 billion was directed towards water and wastewater projects.

For info: Report available on the Council's website: www.westgov.org/wswc/publicat.html

NITROGEN & PHOSPHORUS US

NUMERIC WATER QUALITY CRITERIA

Over the last 50 years, the amount of nitrogen and phosphorus pollution entering our waters has escalated dramatically, and is becoming one of America's costliest and most challenging environmental problems. In many parts of the country, nitrogen and phosphorus pollution negatively impacts human health, aquatic ecosystems, the economy, and people's quality of life. EPA has developed a new and improved website about nitrogen and phosphorus pollution to provide the public with information about this type of pollution — where it comes from, its impacts on human health and aquatic ecosystems, and actions that people can take to help reduce it.

EPA's new website also includes updated information on states' progress in developing numeric water quality criteria for nutrients as part of their water quality standards regulations. EPA is providing technical guidance and tools to help states develop numeric nutrient criteria for their water bodies.

To facilitate state and local efforts to reduce nutrient pollution, EPA released a new Nitrogen and Phosphorus Pollution Data Access Tool. The goal of the tool is to support states in their nitrogen and phosphorus analyses by providing the most current data available on: the extent and magnitude of nitrogen and phosphorus pollution; water quality problems related to this pollution; and potential pollution sources in a format that is readily-accessible and easy-to-use. With this comprehensive data, EPA, the states, and other stakeholders will be able to more quickly gather additional, less-accessible data and develop effective source reduction strategies for nitrogen and phosphorus.

For info: EPA website: www.epa.gov/nutrientpollution/

BiOp REJECTED AGAIN NW

COLUMBIA RIVER PLAN INADEQUATE

On August 2, US District Court Judge James Redden ruled that the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service failed for the third time in ten years to produce a legal and scientifically adequate plan to protect imperiled Columbia-Snake River salmon from extinction. Judge Redden's decision addresses the validity of the 2008 and 2010 Biological Opinions issued by NOAA Fisheries to the US Army Corps of Engineers and the US Bureau of Reclamation (Federal Defendants) under Section 7 of the Endangered Species Act (ESA). *National Wildlife Federation v. National Marine Fisheries*, D.Or., No. CV01-00640-RE, Opinion and Order (August 2, 2011). "Section 7 requires Federal Defendants to 'insure' that the operation of the Federal Columbia River Power System ('FCRPS'), which is comprised of 14 sets of hydroelectric dams, powerhouses, and associated reservoirs, 'is not likely to jeopardize the continued existence' of any species listed under the Act." *Slip Op*. at 2.

Judge Redden held: "[F]ederal Defendants have failed, however, to

WATER BRIEFS

identify specific mitigation plans to be implemented beyond 2013. Because the 2008/2010 BiOp's no jeopardy conclusion is based on unidentified habitat mitigation measures, NOAA Fisheries' opinion that FCRPS operations after 2013 will not jeopardize listed species is arbitrary and capricious." *Id*. Later in the decision, Judge Redden specifically found that "[H]ere, NOAA Fisheries improperly relies on habitat mitigation measures that are neither reasonably specific nor reasonably certain to occur, and in some cases not even identified." *Id*. at 11. Judge Redden showed his obvious displeasure with the actions and proposed actions of the federal agencies at page 16-17 of the opinion: "It is one thing to identify a list of actions, or combination of potential actions, to produce an expected survival improvement and then modify those actions through adaptive management to reflect changed circumstances. It is another to simply promise to figure it all out in the future…Coupled with the significant uncertainty surrounding the reliability of NOAA Fisheries' habitat methodologies, the evidence that habitat actions are falling behind schedule, and the benefits are not accruing as promised, NOAA Fisheries' approach to these issues is neither cautious nor rational."

Judge Redden ordered the federal agencies to fund and implement the existing 2008/2010 BiOp since it "provides some protection for listed species through 2013," to file annual implementation reports with the court, and to continue spilling water over dams to help migrating juvenile salmon. *Id*. at 17, 21 and 22. In addition, Judge Redden required NOAA Fisheries to produce a new biological opinion by January 1, 2014 "that reevaluates the efficacy of the RPAs [reasonable prudent alternatives] in avoiding jeopardy, identifies reasonably specific mitigation plans for the life of the biological opinion, and considers whether more aggressive action, such as dam removal and/or additional flow augmentation and reservoir modifications are necessary to avoid jeopardy." *Id*. at 20.

For info: Opinion available at: www.salmonrecovery.gov/Files/2011.MSJ Opinion and Order.FCRPS.PDF

MERCURY CONTAMINATION AZ

FISH CONSUMPTION ADVISORY

The Arizona Department of Environmental Quality (ADEQ), in association with the Arizona Game and Fish Department and the Arizona Department of Health Services, has issued a fish consumption advisory recommending that people not eat certain fish caught from a 51-mile stretch of Tonto Creek in Gila County.

Tissue samples of fish caught from Tonto Creek recently, and analyzed by ADEQ, contain elevated levels of mercury. The consumption advisory recommends the public not eat smallmouth and largemouth bass, green sunfish and black bullhead catfish caught from this stretch of Tonto Creek. The advisory recommends that common carp caught from this section should not be consumed by children under six years and be limited to one eight ounce (uncooked weight) fish serving per month for those between six and 16 years and two eight ounce (uncooked weight) fish serving per month for all those over 16 years.

The advisory does not limit the consumption of trout taken from Tonto Creek or the use of this waterbody for fishing, bird watching, swimming or other recreational uses.

Mercury in the environment can come from various sources and can cause numerous health problems when ingested, most notably its toxicity to the central nervous system. Infants and pregnant or nursing mothers are considered most at risk to possible health effects. Mercury is quickly absorbed by bacteria in sediments and passed along via the food chain to living organisms. Fish can accumulate elevated levels of mercury when larger fish consume smaller fish and insects which have become contaminated, a process called bioaccumulation.

In addition to Tonto Creek, fish consumption advisories remain in place for the following waterbodies in Arizona: Lake Pleasant, Roosevelt Lake, Arivaca Lake, Alamo Lake, Parker Canyon Lake, Upper Lake Mary, Lower Lake Mary, Lyman Lake, Pena Blanca Lake, Coors Lake, Soldier Lake, Soldier Annex Lake and Long Lake.

For info: ADEQ website: www.azdeq.gov/environ/water/assessment/download/fish-0711.pdf

TREATMENT INNOVATION US

CALIFORNIA & TEXAS STUDY PROJECTS RECLAMATION WATERSMART PROGRAM

The US Bureau of Reclamation (Reclamation) recently announced that four projects have been awarded $2.09 million to accelerate the adoption and use of innovative advanced water treatment technologies that increase usable water supplies. Demonstrating the feasibility of new treatment methods for impaired waters is one of the strategies of Reclamation's WaterSMART Program to work toward a sustainable water future.

Four pilot and demonstration projects were selected that address the technical, economic and environmental issues of treating and using brackish groundwater, seawater, impaired waters or otherwise creating new water supplies within a specific locale.

THE FOUR PROJECTS INCLUDE:

- Los Angeles Department of Public Works will receive $499,232 to treat arsenic-laden waters to meet drinking water standards. The full-scale project could potentially produce 36,000 acre-feet of treated water annually, or about 98 percent of the projected water imbalance in the immediate area.
- The City of Glendale in California will receive $400,000 to evaluate two treatment technologies to remove hexavalent chromium from the local impaired groundwater source in the cities of Glendale and Los Angeles.
- Los Angeles Department of Water and Power will receive $598,000 to test the ability of a biological treatment process to remove nitrates, perchlorate and volatile organic compounds from the groundwater in the area. The full-scale project will provide 77,438 acre-feet of treated water annually; reducing the city's need for imported water from the California State Water Project.
- Loving County in Texas will receive $600,000 to study treating brackish groundwater with wind powered vapor compression technology. The funding will be used to examine the ability of this technology to provide a local, sustainable water source.

For info:
WaterSMART website: www.usbr.gov/WaterSMART.

CALENDAR

August 15-17 NC
ASIWPCA Annual Meeting 2011, Charleston. Francis Marion Hotel. For info: Ass'n of State & Interstate Water Pollution Control Administrators, www.asiwpca.org/

August 16 WEB
Exempt Wells & the Bounds Case Webinar, WEB. 2-3pm. For info: Water Systems Council, 202/ 625-4387 or https://student.gototraining.com/492k4/catalog/7344658842665048064

August 17 WEB
Exempt Wells & the Bounds Case Webinar, WEB. 2-3pm. For info: Water Systems Council, 202/ 625-4387 or https://student.gototraining.com/492k4/catalog/7344658842665048064

August 17 AZ
Drivers of Household Water Conservation in a Decade of Drought (WRRC Brown Bag), Tucson. Sol Resnick Conf. Rm., 350 N. Campbell Ave. For info: Jane Cripps, Water Resources Research Center, 520/ 621-2526 or jcripps@cals.arizona.edu

August 17 CA
2011 Regulatory Summit: Managing Water Quality in Today's Regulatory Environment, Pasadena. Hilton Hotel. Sponsored by Ass'n of California Water Agencies. For info: www.acwa.com/events/

August 17 MT
Governor's Drought Advisory Committee Meeting, Helena. Rm. 111, DEQ Metcalf Bldg. For info: Jess Aber, OWRD, jaber@mt.gov or http://drought.mt.gov/

August 17 OR
Advancing Sustainable Manufacturing in Oregon Conference, Portland. Kells Meeting Room, 112 SW 2nd Ave. For info: www.oeconline.org/sust-mfg

August 19-20 CA
2011 Coho Confab, Smith River. For info: Michael Furniss, 707/ 340-3474 or mfurnissAfs.fed.us

August 21-25 CA
10th Annual StormCon Conference & Exposition, Anaheim. Anaheim Mariott. For info: www.instreamflowcouncil.org/flow2011

August 21-27 Sweden
World Water Week: Responding to Global Changes - Water in an Urbanizing World, Stockholm. For info: www.worldwaterweek.org/

August 22 CA
Draft Policy for Toxicity Assessment & Control Staff Workshop, Sacramento. Cal-EPA Bldg., 1001 I Street. Sponsored by State Water Resources Control Board. For info: www.swrcb.ca.gov/water_issues/programs/state_implementation_policy/tx_ass_cntrl.shtml

August 23-25 MT
Settlement of Indian Reserved Water Rights Claims Symposium, Billings. Crown Plaza Hotel. Sponsored by Western States Water Council and Native American Rights Fund. For info: www.westgov.org/wswc

August 24 WEB
Talking About Water: Vocabulary & Images that Support Informed Decisions about Water Recylcling & Desalination Webinar, WEB. For info: http://watereuse.org/

August 25 WA
Columbia River Toxics Reduction Working Group Meeting, Spokane. Dept. of Ecology. For info: Mary Lou Soscia, EPA, 503/ 326-5873 or Soscia.Marylou@epamail.epa.gov

August 25-26 CO
Colorado Water Law Conference, Denver. For info: CLE International, 800/ 873-7130 or website: www.cle.com

August 25-26 CA
CEQA Conference, San Francisco. Hotel Nikko. For info: CLE International, 800/ 873-7130 or website: www.cle.com

August 25-26 FL
Land Use Law Conference, Tampa. Sheraton Riverwalk. For info: CLE International, 800/ 873-7130 or website: www.cle.com

August 26 CO
Hydraulic Fracturing Conference, Denver. Grand Hyatt. For info: CLE International, 800/ 873-7130 or website: www.cle.com

August 26 CA
GIS for Watershed Analysis: Intermediate Course, Davis. UC Davis, Plant & Environmental Sciences. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

September 7 CA
Wetlands Regulation & Mitigation Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

September 7 WA
Flood Plain Development & Endangered Species Protection Luncheon, Seattle. Red Lion on Fifth Avenue, 11:30am-1pm. For info: Sue Moir, NEBC, 503/ 227-6361, sue@nebc.org or www.nebc.org

September 9 OR
Oregon Environmental Cleanup: Portland Harbor & Beyond Seminar, Portland. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220 or hduncan@elecenter.com

September 11-14 AZ
Watereuse Symposium, Phoenix. Sheraton Wild Horse Pass Resort. For info: http://watereuse.org/symposium

September 12-13 FL
Aquifer Recharge Conference, Orlando. Crowne Plaza Airport. Sponsored by American Ground Water Trust. For info: www.agwt.org/events/2011/2011FL_ASR_Program.pdf

September 13-14 WA
2nd Annual Pacific Northwest Climate Science Conference, Seattle. UW - Kane Hall. For info: http://cses.washington.edu/cig/outreach/pnwscienceconf2011/

September 13-16 MT
Sustaining the Blue Planet: Global Water Education Conference, Bozeman. Holiday Inn. For info: Project Wet Foundation, 406/ 585-2236 or http://events.r20.constantcontact.com/register/event?oeidk=a07e317dzobbd64a500&llr=68kelrcab

September 14 OR
Portland Summer Mixer, Portland. Perkins Coie, 1120 NW Couch Street, 10th Floor. Sponsored by Northwest Environmental Business Council. For info: Sue Moir, NEBC, 503/ 227-6361, sue@nebc.org or www.nebc.org

September 14 WEB
Montana Hydrology Webcast, WEB. 10am-11:30am. For info: Montana Water Center: http://watercenter.montana.edu/training/decisions/default.htm

September 14 CA
California Water Storage Workshop, Sacramento. Cal-EPA Bldg., 1001 I Street. Sponsored by California Water Commission. For info: www.cwc.ca.gov/

September 14-18 MT
21st North American Diatom Symposium, Polson. Flathead Lake Biological Station. For info: Dennis Vander Meer, dvandermeer@rhithron.com

September 15-16 TX
Texas Water Law Conference, Austin. Omni Hotel at Southpark. For info: CLE International, 800/ 873-7130 or website: www.cle.com

September 15-16 NJ
Groundwater Contamination & Vapor Intrusion Cases Seminar, Newark. Sheraton Newark Airport Hotel. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

September 16 NY
International Water Summit: Building a Global Awareness & Education Campaign, New York. United Nations. For info: www.chroniclesgroup.org/watersummit/

September 16 CO
Conservation Easements Conference, Denver. Grand Hyatt. For info: CLE International, 800/ 873-7130 or website: www.cle.com

September 16-18 CO
22nd Headwaters Conference, Gunnison. Western State College. Hosted by Center for Environmental Studies, Western State College. For info: WSC, 970/ 943-3450 or www.western.edu/headwaters

September 18-21 WA
Pacific Northwest Clean Water Ass'n Annual Conference & Exposition, Vancouver. Hilton Vancouver. For info: Nan Cluss, 208/ 455-8381 or nancluss@pncwa.org

September 18-20 AZ
Watersheds Near & Far: Response to Changes in Climate & Landscape - 2011 Annual Symposium of the Arizona Hydrological Society, Flagstaff. HighCountry Conf. Ctr. For info: www.azhydrosoc.org/2011_symposium.html

September 18-21 AK
International Symposium on Erosion & Landscape Evolution, Anchorage. Sponsored by American Society of Agricultural & Biological Engineers. For info: Sharon McKnight, ASABE, 269/ 932-7033, mcknight@asabe.org or www.asabe.org/meetings/erosion2011/index.htm

September 18-21 Canada
Mine Closure 2011 Conference, Lake Louise. Fairmount Chateau. For info: Brad Kuchera, brad_kuchera@golder.com or www.mineclosure2011.com

September 19-21 UT
Partnering with Beaver in Restoration Design Course, Logan. Utah State University. For info: Gentri Green, USU, 435/ 850-9029 or gentri.green@usu.edu

September 20-22 MT
Effective Fundraising for Watershed Groups & Conservation Districts Training, Paradise Valley. Bbar. For info: MWCC, info.mwcc@gmail.com or www.mtwatersheds.org

September 22 CA
Continuing Legal Education for Water Professionals, San Diego. Hotel Solamar. Sponsored by Ass'n of California Water Agencies. For info: www.acwa.com/events/

September 22 MT
Governor's Drought Advisory Committee Meeting, Helena. Rm. 111, DEQ Metcalf Bldg. For info: Jess Aber, OWRD, jaber@mt.gov or http://drought.mt.gov/

September 22-23 ID
Idaho Water Law Conference, Boise. Owyhee Plaza Hotel. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

September 22-23 CA
2011 ACWA Continued Legal Education for Water Professionals, San Diego. Hotel Solamar. Sponsored by Ass'n California Water Agencies. For info: www.acwa.com

September 23 OR
Solar Installation Seminar, Portland. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

September 24-28 GA
Meeting Competing Demands with Finite Groundwater Resources 2011 Annual Forum, Atlanta. Marriott-Atlanta Marquis. Sponsored by Ground Water Protection Council. For info: www.gwpc.org/home/GWPC_Home.dwt

September 25-29 Brazil
Adaptive Water Management: Looking to the Future - XIV IWRA World Water Congress, Porto de Galinhas. For info: www.worldwatercongress.com/en/

September 26-30 WV
Strategic Conservation Using a Green Infrastructure Approach Conference, Shepherdstown. National Conservation Training Center. For info: Katie Allen, Conservation Leadership Network, 304/ 876-7925 or www.conservationfund.org

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

CALENDAR

(continued from previous page)

September 27-29 NV
2011 Truckee River Symposium, Reno. Desert Research Institute. For info: Tina Triplett, NWRA, 775/ 473-5473 or www.nvwra.org

September 27-29 OR
Rainwater Harvesting & Stormwater Control: 2011 ARCSA Conference, Portland. Monarch Hotel & Conf. Ctr. Sponsored by American Rainwater Catchment Systems Ass'n. For info: www.arcsa.org/

September 27-29 MT
78th Annual Fall Water School for Water & Wastewater Operators & Managers, Bozeman. MSU. Organized by Montana Environmental Training Center, Montana DEQ, Montana Water Center & MSU College of Engineering. For info: Barb Coffman, METC, 406/ 265-3763 or metc@msun.edu

September 28 WEB
Floodplain & Riparian Issues WEBCAST, WEB. For info: Montana Water Center: http://watercenter.montana.edu/training/decisions/default.htm

September 29-30 MT
Montana Water Law Seminar - 11th Annual, Helena. Great Northern Hotel. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

October 3-5 WS
2011 Urban Water Sustainability Leadership Conference, Milwaukee. For info: lloken@CWAA.us

October 4 WA
Perspective on Water Quality Issues Across Washington State - AWRA-WA Annual Conference, Seattle. Seattle University Student Center. For info: AWRA-WA: http://earth.golder.com/waawra/ASP/Home.asp

October 4-6 NE
Exploring a Collaborative Approach to Groundwater Protection Conference, Omaha. For info: www.groundwater.org/pe/conference.html

October 5 WA
Wetlands in Washington Seminar, Seattle. Washington Convention Ctr. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

October 5-7 MT
2011 Annual Montana Water Conference: Montana's Water Resources - Adapting to Changes in Supply & Demand, Great Falls. Hilton Garden Inn; Field Trip: 10/5. Sponsored by AWRA-Montana Section. For info: Steve Guettermann, stephen.guettermann@montana.edu

October 5-7 ID
Western States Water Council Fall Meeting, Idaho Falls. For info: WSWC, www.westgov.org

October 5-7 NV
WaterSmart Innovations Conference & Exposition, Las Vegas. For info: www.WaterSmartInnovations.com

October 6-8 AZ
Stream Restoration Course, Tucson. For info: Tory Syracuse, 520/ 396-3266, tsyracuse@watershedmg.org or http://watershedmg.org

October 12-13 MT
Wetland Regulations Training: Understanding Federal, State & Local Regulationsand the Permitting Process in Montana Workshop, Bozeman. MSU. Limited to 50. For info: Steve Guettermann, stephen.guettermann@montana.edu

October 12-14 CA
Northern California Tour: Sacramento Valley, Sacramento. For info: Water Education Foundation, 916/ 444-6240 or www.watereducation.org

October 13-14 OR
Environmental Law: The Year in Review - Environmental & Natural Resources Section Annual CLE, Troutdale. McMenamins Edgefield. For info: www.osbar.org

October 13-14 OR
OWRC Water Law Seminar, Bend. Seventh Mt. Resort. For info: Anita Winkler, Oregon Water Resources Congress, 503/363-0121 or www.owrc.org/

October 14 CA
California Environmental Quality Act Conference, Santa Monica. DoubleTree Guest Suites. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

October 15-19 CA
WEFTEC: 84th Annual Water Environment Federation Technical Exhibition & Conference, Los Angeles. For info: Water Environment Federation, 800/ 666-0206 or WEFTEC website: www.weftec.org

October 16-19 RI
Association of Metropolitan Water Agencies Annual Meeting, Newport. For info: www.amwa.net/cs/2011AM

October 17-19 Indonesia
The World Energy Congress, Nusa Dua, Bali. For info: http://wreeec2011bali.com/web/main/step1

October 18-19 OK
Oklahoma Governor's Water Conference, Oklahoma City. For info: www.owrb.ok.gov/news/waterconference.php

October 18-19 WA
Washington Future Energy Conference, Seattle. Presented by Northwest Environmental Business Council & WA Dept. of Commerce. For info: Sue Moir, NEBC, 503/ 227-6361, sue@nebc.org or www.nebc.org