The Water Report™

Water Rights, Water Quality & Water Solutions in the West

In This Issue:

Upcoming Stories:

Hydro Relicensing: Tribal Concerns

Reclamations' WaterSMART Program

ESA Floodplain Protections

& More!

AQUIFER STORAGE AND RECOVERY

ADVANTAGES, CHALLENGES, APPLICATIONS & APPROACHES FOR EXPANDING ASR IN THE WEST

by Walter Burt, RG, and Jeff Barry, RG, GSI Water Solutions, Inc. (Portland, Oregon)

INTRODUCTION

Substantial population growth and other competing uses are continuing to increase demands on water resources in the American West. Throughout the region, meeting these demands is typically constrained by uneven water availability due to seasonal availability that does not correspond to users' demand patterns.

According to the US Census Bureau, the West is projected to grow nearly twice the national average over the next 30 years. This high population growth, coupled with additional competing demands for water — such as allocation for ecosystems and climate change impacts — promises to further accentuate water delivery imbalances. The US Army Corps of Engineers (USACE) has identified over a dozen areas in the West where the increase in competing water uses is likely to result in severe shortages relative to demands (USACE IWR, 2007; www.iwr.usace.army.mil/docs/iwrreports/2007-R-03.pdf).

The rapid growth of interest in groundwater recharge applications, and of "**a**quifer **s**torage and **r**ecovery" (ASR) in particular, has been accompanied by a proliferation in papers and publications on the topic since David Pyne published "*Groundwater Recharge and Wells*" in 1995. *The Water Report* (*TWR*) has published several articles on various aspects of ASR and groundwater recharge. Cat Shrier has authored articles on the prospects for ASR development in the western United States (see *TWRs* #8, #59, #64 and #74), including one based in part on a report she prepared for the American Water Works Association (AWWA) that summarized a survey and analysis of ASR systems and regulatory programs in the US (AWWA, 2002). Shrier's work included a description of common reasons for use of ASR in the West, a history of ASR development in the United States and a summary of the development of institutional and regulatory frameworks for ASR in Western states. Shrier more recently described a number of recent developments related to ASR, including development of guidance for application of the **u**nderground **i**njection **c**ontrol (UIC) regulations for ASR systems stemming from the US Environmental Protection Agency (EPA) ASR "Experts Meeting" in 2009, and other ASR-related federal initiatives. A survey by Chase Hahn of UIC-related ASR regulations in different states was presented in the same edition (*TWR* #74). Other articles have described various activities related to ASR and groundwater recharge, including vadose zone injection, the porosity storage technology, and reuse. This article takes a more introductory approach than prior articles published in *TWR*, providing a summary of the advantages of ASR, descriptions of uses illustrating the broad spectrum of current and developing applications of the technology through several case studies, and concluding remarks regarding challenges to developing ASR projects and how to overcome these challenges.

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

Editors: David Light
David Moon

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

Subscription Rates:
$249 per year
Multiple subscription rates
available.

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

BACKGROUND

The American West is distinguished by a marked seasonality in the climate and hydrology, even in the coastal regions. The majority of precipitation falls in the winter and spring, when demand for most water uses is at a minimum, followed by a dry season when municipal and irrigation demands are at a peak and stream flows are low. Figure 1 illustrates the differences in timing between typical precipitation, river runoff, and water demands in the West. The figures shows hydrographs for two rivers: precipitation predominantly falls as rain in one, whereas the headwaters and tributaries of the second example receive large amounts of snow. Note how the high flows in the snowmelt-dominated system occur later in the dry season due to the storage effect of the snowpack. Diminished snowpack storage under climate change scenarios would result in earlier runoff in many western watersheds.

Surface storage traditionally has been used to mitigate this imbalance by capturing and storing water during periods of surplus for later use during dry periods when demand exceeds supply. However, fewer opportunities for new or expanded surface storage exist. In many cases, large traditional surface storage projects are infeasible for a number of reasons. Such conditions are increasingly driving water planners and managers towards using integrated approaches to meet current and future water needs. Various permutations of artificial groundwater recharge and recovery, including ASR, have become a key part of the storage component of these efforts on both local and regional levels.

Early artificial groundwater recharge and recovery projects initially were developed in response to local water supply quantity and quality needs — usually by municipal water utilities. Although the majority of projects to date have been implemented to address specific municipal supply issues, new and innovative applications of groundwater recharge for agriculture, industrial, and environmental uses are in both planning and implementation stages. Some of these efforts are being incorporated into larger-scale integrated water resource management strategies, such as water banking. The Western States Water Council as well as federal agencies including the General Accounting Office, US Bureau of Reclamation,

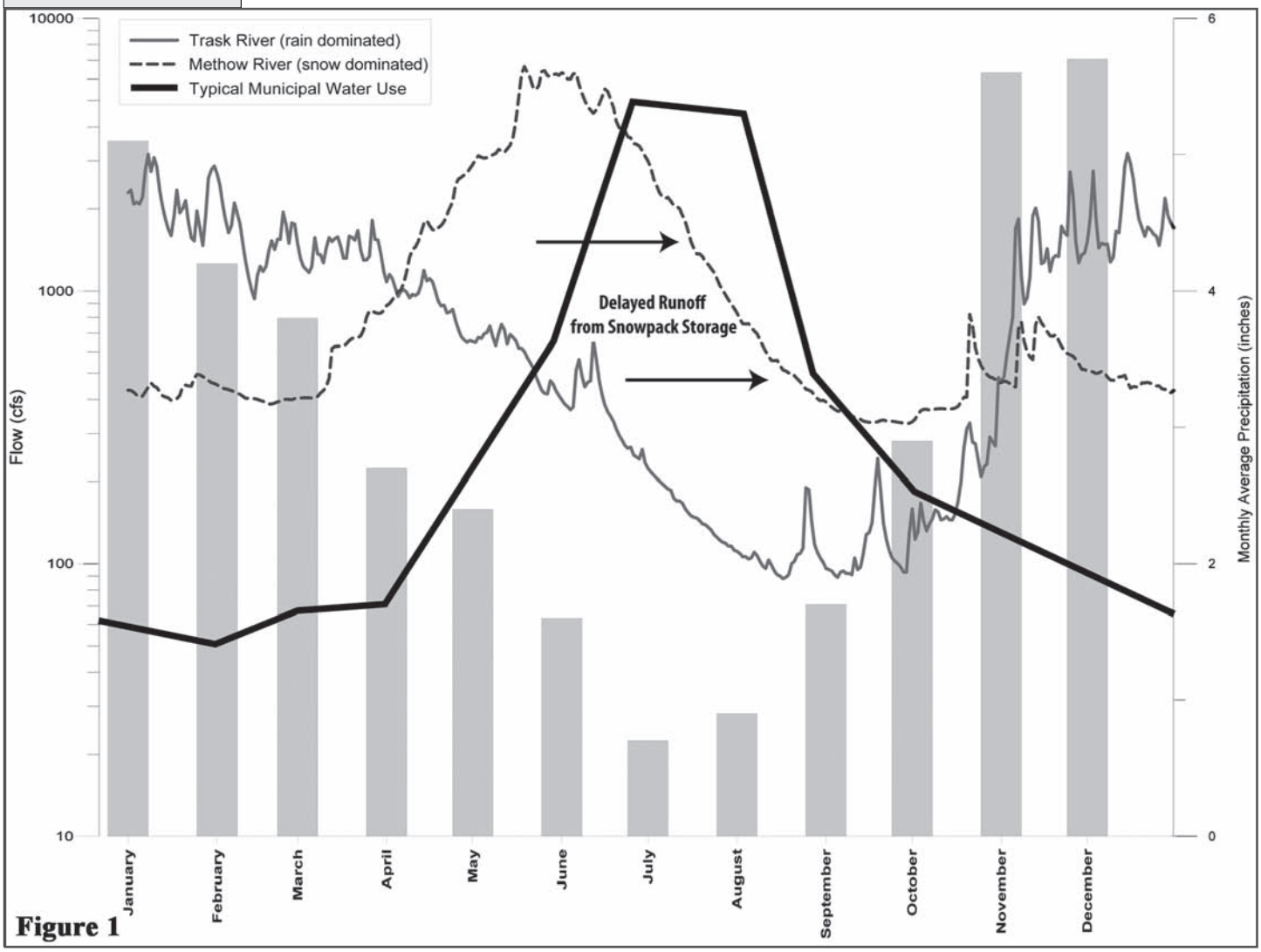


Figure 1

ASR

Infiltration Basins

Injection Wells

US Environmental Protection Agency and USACE all have identified artificial groundwater recharge and recovery as an important component in addressing future water supply planning in the West and other parts of the country.

The two most common methods for storing water in aquifers are through ground surface infiltration facilities (such as spreading basins) and injection wells. Infiltration basins are relatively low cost, can recharge large volumes of water, and provide ancillary filtration and treatment of the recharge water. However, they require sufficient land area, permeable surface characteristics and an unconfined aquifer with suitable storage characteristics. Use of injection wells allows storage of large quantities of water in deep, confined aquifers in areas where there is insufficient room for infiltration ponds or conditions are not favorable for recharge and storage of large volumes of water in shallow, unconfined aquifers.

AQUIFER STORAGE AND RECOVERY (ASR)

ASR Defined

The term "**a**quifer **s**torage and **r**ecovery" (ASR), coined in 1982 by David Pyne, refers to a particular groundwater recharge and recovery application employing injection and recovery wells. ASR is commonly defined as direct injection of treated water into a suitable storage aquifer using a well, and recovery of the water through the same well (Pyne, 1995) — although several variations on this basic technique have been employed.

The ASR Concept

Storage

The concept of ASR involves storing high quality water in a suitable aquifer via wells to be recovered at a later date when needed (see Figure 1). Strictly defined, ASR involves injecting water through a well and recovering the water through the same well, although in some instances stored water is recovered using other wells. As water is injected into a well, the injected water displaces native groundwater and creates a mound or zone of increased water level around the well. Storage occurs as a result of filling previously unsaturated pore spaces (in an unconfined aquifer) or by increasing groundwater pressure (within a confined aquifer). The water level (pressure) change caused by pumping or injection in a confined aquifer commonly extends over a relatively large area (more than 0.5 mile). Figure 2 schematically illustrates the concept of how ASR works.

Delivery Flexibility

The basic function of ASR is to store large volumes of water in the subsurface when surplus water is available from existing surface or groundwater sources and to make this stored water available for use during times of need — for instance, when other water is not available for diversion or the user's water source has insufficient capacity to meet demands. In other words, ASR is not in itself a new source. It is a management tool that expands the delivery flexibility of existing sources to address times of peak demand. In addition to simple storage, ASR may also provide a bridge to building an additional water source or water treatment capacity as well as other ancillary benefits which are discussed below.

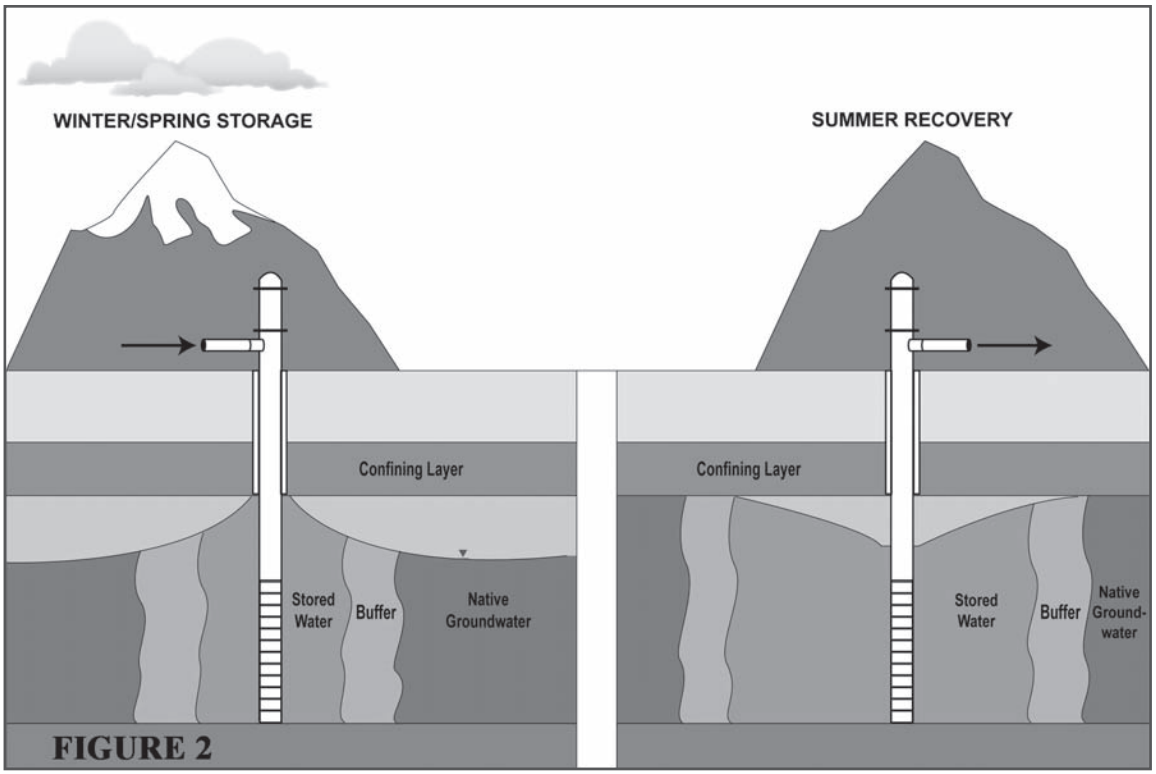


FIGURE 2

ASR

Water Quality Improvement

Storage Zone

Cost Comparison

Smaller Footprint

Cooler Water

Groundwater Improvement

Project Uncertainties

Advantages of ASR

ASR offers certain benefits over traditional methods of water storage (e.g., storage tanks and reservoirs). Larger volumes of water can be stored underground, generally at lower cost. Many environmental drawbacks and other problematic impacts associated with the development of large surface storage facilities can be avoided.

Injection of treated surface water may also improve the quality of water produced by the recovery well. This occurs because the high quality treated water is typically oxygen-saturated and commonly displaces the native groundwater away from the well. The oxygenated water may thus create a highly oxidized buffer zone within the aquifer matrix. This buffer zone reduces the conditions conducive to the dissolution of certain objectionable "redox-sensitive" constituents in some native groundwater — such as manganese. Over time, a storage zone is developed that may consist primarily of a high percentage of treated surface water. The outer portion of the storage zone consists of a mixture of native groundwater and stored surface water. This mixed water is commonly left in the aquifer as a buffer zone between native groundwater and high quality stored water. Figure 2 illustrates generalized ASR storage and mixing zones.

Common additional advantages of ASR as a water management tool include:

- Less storage cost: The capital costs to store water using ASR generally are significantly less than building new above-ground storage reservoirs. David Winship of the City of Beaverton, Oregon, has conducted detailed cost/benefit analyses comparing ASR with conventional surface storage. A summary of these analyses excerpted from Eaton and Others (2009), shows that the capital cost to develop a five **m**illion **g**allons a **d**ay (mgd) ASR facility is approximately $2.95 million per mgd. This compares favorably with the $6M/mgd capital cost to develop an additional five mgd of conventional water supply capacity from an existing surface water source (assuming 500 **m**illion **g**allons (MG) of storage capacity). When annual operation and maintenance (which is more expensive for ASR) is included in the analysis, ASR was shown to have a benefit/cost ratio of 1.26 over the conventional source.
- Smaller footprint and investment: In many cases ASR is cost effective at different scales because of the relatively large amount of water that can be stored from a small system footprint and investment. Single ASR wells commonly can store 100 to 200 MG and recover the stored water at rates of one to five mgd or more. Conversely, ASR systems using single wells with recoverable volumes of 10 to 20 MG at rates of 100 to 200 **g**allons **p**er **m**inute (gpm) are currently being tested for municipal use in the City of Dallas, Oregon and for irrigation at Liberty High School in Hillsboro, Oregon. At the other end of the spectrum, the City of Las Vegas operates an ASR system with a total recovery capacity of over 100 mgd (nearly 70,000 **g**allons **p**er **m**inute (gpm)).
- Evaporation savings: ASR storage is not subject to the evaporative losses associated with reservoirs, although some migration and leakage of stored water may occur.
- Cooler water: Recovered water from an ASR facility is often cooler in the summer than water from primary surface water sources, which is an added benefit to summertime users.
- Less environmental impact: ASR systems generally have a significantly lower environmental impact than surface reservoirs.
- Greater security: Because ASR stores water in the subsurface, the supply is more secure from tampering.
- Less surface water use: ASR provides ancillary environmental benefits by reducing withdrawals of water from primary surface water sources in the summer. This is beneficial to fish and other aquatic life.
- Aquifer benefits: ASR not only does not deplete the native groundwater resource, it is often managed to provide a restoration of groundwater levels in aquifers that have experienced long-term decline as a result of heavy pumping necessary to meet growing urban and agricultural water needs.
- Groundwater improvement: ASR can benefit the quality of the groundwater supply by displacing poor quality groundwater with higher quality water. This improves native groundwater quality through aquifer conditioning and, in coastal areas, may also prevent the influx of seawater.

ASR Challenges

While ASR provides many advantages, some significant challenges may also exist.

Challenges for ASR include:

- Uncertainties: Early in project development, the feasibility and ultimate capacity of an ASR system may be highly uncertain — which can be challenging for decision makers. A significant commitment in time and expenditure often is necessary before it can be determined whether ASR is feasible and whether a system will have the storage and recovery capacity to meet users' needs.

ASR

Varying Regulation

- Varying regulation: In certain states, the ASR permitting pathway is not well established. Permitting may carry a high degree of uncertainty in terms of cost and outcome. It may vary from region to region within the same state. Some western states have a decentralized ASR permitting process (e.g., California) and each region may have a different level of comfort with permitting ASR projects.
- Disinfection chemicals: Most states have an antidegradation policy prohibiting the introduction of disinfection chemicals and associated disinfection by-products (commonly present in treated drinking water) into aquifers.
- Chemical reactions: Subsurface conditions may also adversely affect the quality of injected water through chemical reactions with the aquifer matrix, particularly during early injection cycles, before the matrix is "conditioned."
- Hydrogeology: Certain hydrogeologic conditions may limit the size of the storage zone and render ASR infeasible, even on a relatively small scale.
- Well clogging: Some amount of well clogging occurs during ASR and, if unmitigated, can result in loss of production capacity.

Access Protection

- Storage access: In some states, there is no legal mechanism to protect stored water from being captured by other users.
- Determining recoverable water: The amount of stored water that is lost and the amount that can be recovered is difficult to determine without field testing.
- Impacts to other users: Recovery of stored water may negatively impact other nearby groundwater users.

"Fatal Flaw" Assessment

Each of these challenges results in risk and uncertainty that must be constrained and managed in order for the water purveyor to be willing to make the investment in an ASR project. The approach taken by most water managers to assess the risks and associated challenges is to complete a thorough preliminary "fatal flaw" assessment (feasibility study). It is also advisable to discuss all potential issues with concerned regulatory agencies prior to moving forward with significant capital expenditures.

ASR USES - CASE STUDIES & EXAMPLES

Management Tool

ASR provides a water management tool that has been used to address a relatively wide range of problematic water supply issues. As noted, these issues typically center on securing and storing high quality water during periods of water availability for later use and/or improving the quality of an existing groundwater supply source. There are, however, additional reasons for using ASR.

A number of the leading reasons for implementing ASR are discussed below. Project examples and case studies are provided for further illustration. The reader is referred to Shrier (*TWR*#8, 2004), the NRC (2008) and Pyne (2005) for more detailed discussion of motivations for developing ASR systems around the US and internationally (see references, following the article).

Banking Options

Insufficient Water Availability During High Demand/Low Availability Periods

Enhancing water availability is a primary reason that most ASR systems in the West have been developed. Imbalances between available supply and demand in the West usually occur seasonally, and thus many ASR systems are operated on an annual recharge and recovery cycle. It should be noted, however, that ASR systems can also be designed to manage for longer term climatic cycles — for instance, "banking" stored water during wet periods for multiple years to use as drought mitigation.

Seasonal water imbalances can occur for several reasons, including:

Seasonal Imbalances

- Area streams are fully allocated (a circumstance often coupled with minimum instream flow requirements). Consequently, water rights are not available for diversion during the dry season. Water may only be available for diversion during the spring and fall "shoulder" seasons (i.e., the periods on either side of the irrigation season when a water right authorizes diversion, but the crops do not require water). Shoulder seasons are generally relatively short periods of time prior to planting and after harvest, and depend on the year's climate conditions, area crop types, and the authorized period of use.

Closed Basins

- Existing groundwater resources are being depleted and are closed to further appropriation, and a surface source is not available during the dry season. Our first case study example — Madison Farms and McCarty Ranches in north-central Oregon (see next page) — developed the first ASR systems for agricultural use in the US for this reason.
- Existing surface storage is insufficient and new conventional surface storage is not feasible due to cost or environmental considerations.

ASR

Groundwater Restrictions

First Agricultural ASR

Shallow Alluvial Groundwater

Nitrate Issues

Case Study: Madison Farms and McCarty Ranches

— Agricultural ASR Application Using Riverbank Filtration for Source Water Treatment

Madison Farms and McCarty Ranches are two large neighboring farming operations located in the Butter Creek area, near the town of Echo, within eastern Oregon's Umatilla Basin. Historically, these two farming operations have depended on groundwater pumped from deep, confined, Columbia River Basalt Group (CRBG) aquifers to irrigate crops. Extensive regional pumping combined with little recharge to the deep aquifers have resulted in groundwater level declines of up to 500 feet in areas within the basin. In Oregon, water use is restricted when pumping of groundwater in an aquifer exceeds the long-term natural recharge and a "Critical Groundwater Area" is declared under Oregon Revised Statutes (ORS) 537.730. The Oregon Water Resources Department (OWRD) declared a Critical Groundwater Area in Butter Creek in 1986. This action curtailed groundwater use by restricting additional appropriation of groundwater and limiting existing groundwater users to significantly reduced pumping allocations based on the seniority of their water rights. With no alternative irrigation supply available, this curtailment severely limited Madison Farms' and McCarty Ranches' ability to supply irrigation water to over 1,100 acres of cropland. As a result, both operations obtained a "limited license" from OWRD and developed the first ASR systems for agricultural uses in the United States. A limited license provides temporary authorization to conduct ASR pilot testing necessary to fully develop an ASR system in the State of Oregon (ORS 537.534). The ASR operations divert shallow alluvial groundwater recharged by flood irrigation and Butter Creek, a small, ephemeral stream, and store it in the basalt aquifer for use during the irrigation season (see Figure 3). Diversion of source water from a shallow alluvial collector well provides sufficient filtration of microorganisms and viruses present in surface water to meet state and federal drinking water standards, eliminating the need for cost-prohibitive water treatment systems.

The ASR limited license from OWRD for both operations allows injection of ASR source water at nitrate concentrations up to 9.5 mg/L, which is higher than the typical ASR standard for nitrate of 5 mg/L (half of the federal/state drinking water quality standard of 10 mg/L). A higher nitrate water quality standard was allowed because no other viable ASR source water was available. Moreover, the 9.5 mg/L standard is still below the federal and state drinking water standards for nitrate of 10 mg/L. As a condition to the ASR limited license, an in-line nitrate analyzer was required to continuously monitor nitrate concentrations during injection to ensure that no water exceeding the 9.5 mg/L standard is injected into the basalt aquifer. Interestingly, following injection into the deep CRBG aquifer, recovered water nitrate concentrations quickly reduce to below analytical non-detection limits after a few days of storage. This reduction in nitrate concentration has been determined to be related to microbiological denitrification of nitrate to nitrogen gas. This occurs because the CRBG aquifer is "suboxic" (i.e., contains low oxygen content). Suboxic conditions thermodynamically favor an environment for denitrifying bacteria.

Both ASR facilities have been in operation since 2006, cumulatively recharging, storing, and recovering approximately 400 MG (1300 acre-feet) of water for irrigation annually.

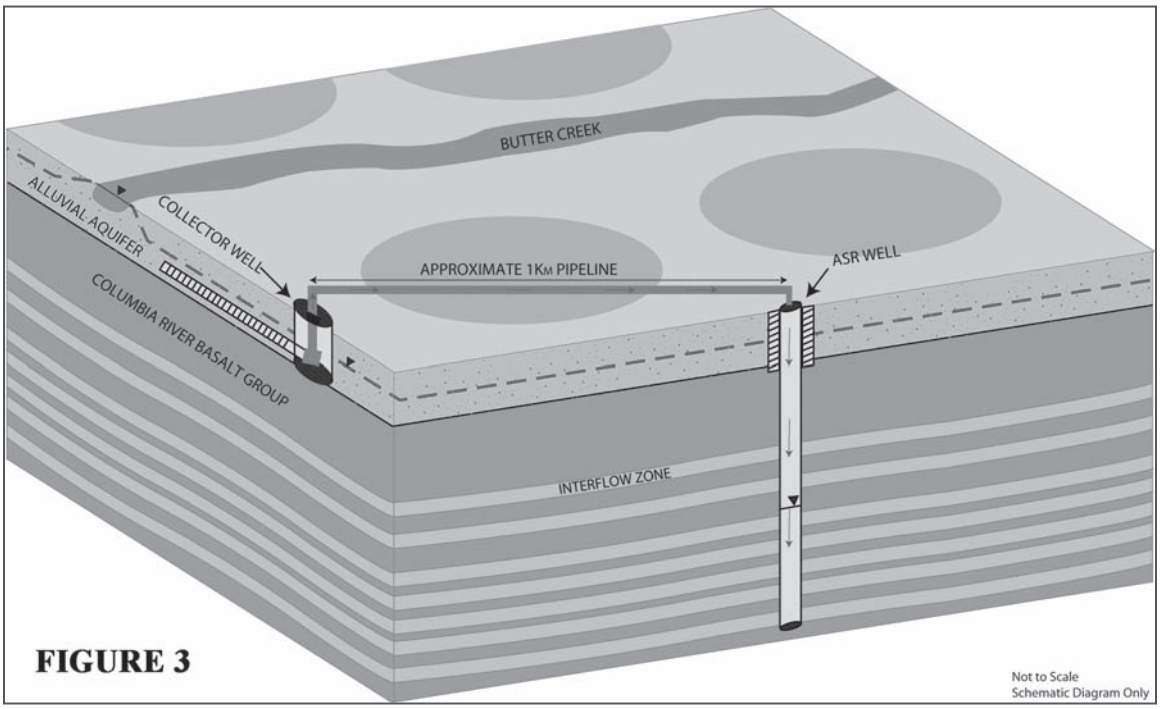
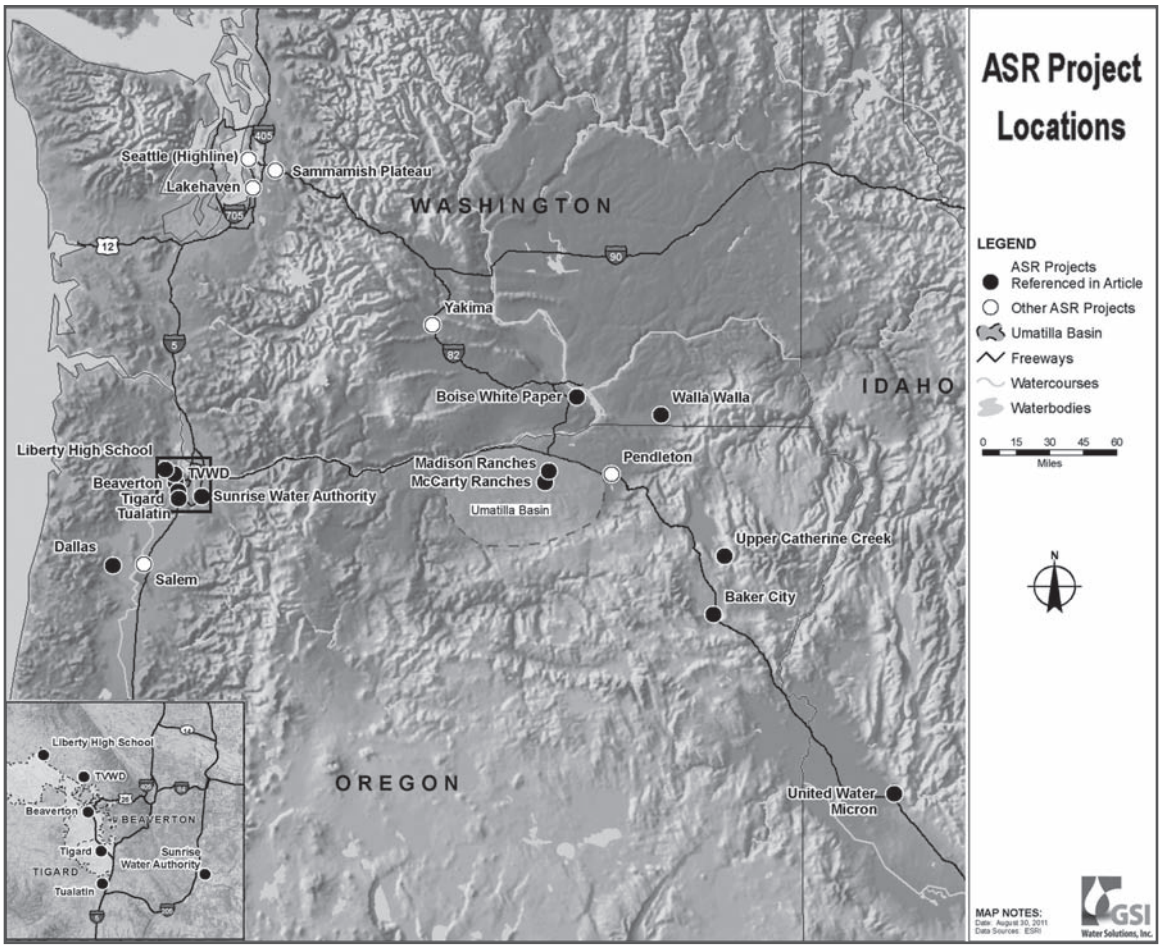


FIGURE 3

ASR



Peak Demand "Bridge"

Defer or Reduce Infrastructure Expansion

ASR is commonly used to "bridge" the period between when peak demands begin to exceed system capacities (e.g., source or treatment plant) and when the next capacity increase can be brought on-line by shifting infrastructure capacity to non-peak times. This concept is illustrated in Figure 4, which shows a typical demand curve with the peak exceeding the maximum supply capacity. Storage using ASR during the off-peak season can be used to meet peak demands. ASR can provide an interim time for infrastructure expansion or potentially defer the need for such expansion for long periods. This is a primary reason for the rapid growth in ASR systems in western Oregon, including the cities of Beaverton, Tigard and Tualatin, the Tualatin Valley Water District (TVWD) and the Joint Water Commission (JWC).

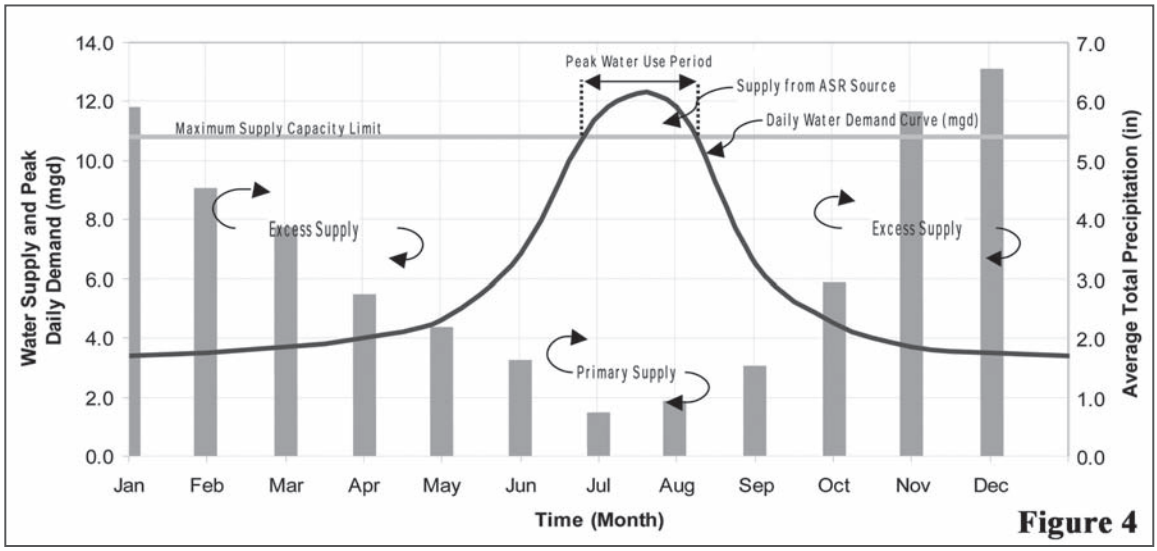


Figure 4

ASR

Demand Peaks

Site Screening

Saltwater Intrusion

Aquifer Recharge

Flow & Temperature Improvements

Emergency Supply

Case Study: The Joint Water Commission (JWC)

— ASR as Regional Water Supply Diversification and Bridging Strategy

The JWC, comprised of the Cities of Hillsboro, Beaverton, and Forest Grove, and the Tualatin Valley Water District (TVWD), is the second largest water provider in Oregon, serving water to over 400,000 people primarily in Washington County, west of Portland. The primary source of supply to JWC is the Tualatin River and stored water from Scoggins and Barney Reservoirs, which is diverted and treated at the JWC's 75 mgd water treatment plant and then delivered to member agencies via several miles of large diameter transmission lines.

Cities in this area have experienced rapid population growth and increased industrial demand for water due to an influx of technology firms. Growth rates in the region are projected to continue to exceed national averages. Major expansion of the surface water supply has proven challenging from both a cost (~$1 Billion) and schedule standpoint (>20 years). As a result, three members of the JWC (Cities of Hillsboro, Beaverton, and TVWD) have identified ASR as a key supply alternative and supply bridging strategy to meet demand peaks. JWC members, including the City of Beaverton and TVWD, currently have operational ASR systems with approximately eight mgd capacity. This ASR water is used to meet peak demands during the summer and also provides an emergency supply. The JWC is leveraging the experience gained from operating these existing systems to develop an additional 18 mgd of supply during peak demand periods. The JWC has completed a rigorous site screening process and is evaluating alternative strategies for integrating ASR into the JWC and member systems to minimize long-term costs for capital improvements, Operations & Maintenance (O&M), and energy (pumping). Test drilling of several sites is in progress with the intent of completing several production wells and beginning pilot testing in the near future.

Groundwater Resources Management

ASR is used to maintain or restore groundwater levels in depleted aquifers by leaving some amount of stored water in the aquifer to provide a sustainable future supply. Related applications involve maintaining pressure in the aquifer to curtail land subsidence and maintain the quality of the groundwater resource by providing a barrier to saltwater intrusion.

Case Study: The Umatilla Basin Recharge Project

— Managing Water Resources Sustainably for Agricultural, Municipal, Domestic and Habitat Purposes

The Umatilla Basin Recharge Project is a recent, large-scale, state-funded project combining surface recharge and ASR to address a wide range of water resource issues in the Umatilla Basin (see Amali, *TWR* #60). The issues being addressed include: curtailed groundwater pumping for irrigation; future domestic and municipal supply; and protecting enhanced flows in the Umatilla River.

The Umatilla Basin is one of Oregon's top food-producing areas. Significant groundwater level declines in the basin threaten the future viability of agriculture, as well as domestic and municipal supply in large areas of the basin — with serious economic implications. OWRD has identified more than 600 square miles of critical groundwater areas within the basin where wells no longer can be used for irrigation or other uses. Thousands of acres of farmland have been taken out of production. Additionally, surface water in the basin is fully allocated or is needed to protect threatened fish species.

The Umatilla Basin Water Commission, with funding from OWRD, is assessing the feasibility of recharging the shallow alluvial aquifer using Umatilla River and Columbia River water to benefit agricultural pumping and enhance stream flow in the Umatilla River during the summer months. Some of the infiltrated surface water will be recovered from the shallow alluvial aquifer after sufficient residence time and filtration to meet water quality criteria. The recovered water that is not used for direct irrigation will then be injected into deep CRBG aquifers to restore groundwater levels and allow continued pumping. Some stored water will be allowed to flow in the shallow aquifer system and discharge to the Umatilla River where it will improve stream flow and water temperature. Shallow aquifer recharge pilot testing results and leveraging the knowledge gained from the Madison Farms and McCarty Ranches ASR systems, indicates that 50,000 to 100,000 acre-feet can be stored and recovered from the alluvial and CRBG aquifers. The first stage of the project has been constructed (up to 10,000 acre-feet per year). Additional stages will be added as funding becomes available.

Emergency Water Supply

An ASR system can provide reliable backup emergency supply in case of an interruption in the primary water supply. The City of Walla Walla, Washington, has an ASR system that provides an emergency supply in case of a forest fire in the City's surface supply watershed. At least one technology firm on the West Coast has explored using ASR to provide emergency cooling water at a data storage center in the event of interruption of its primary supply due to a large magnitude earthquake.

Case Study: Baker City, Oregon, ASR Project

— Providing Both Emergency and Peak-Demand Supply

Baker City, Oregon, relies primarily on surface water from high mountain springs and snowmelt for its water supply. During the spring, the surface water source is periodically turbid, so the City must rely on a backup water supply well. In addition, this well is the only emergency supply available if there is a fire in the watershed. The volcanic aquifer tapped by this well cannot support long-term pumping; pumping rates

ASR

Quantity & Quality Improvement

Stream Flow Enhancement

Flow Timing

drop off significantly and water quality degrades after only a couple of weeks of pumping. ASR has been implemented by the City as a means of augmenting natural recharge to the aquifer so the well can sustain pumping through the peak summer months or in case it is needed in an emergency, such as a fire in the watershed. ASR pilot testing began in the winter of 2005 and up to 200 MG is stored and recovered each year at a rate of 1,200 gpm. Operation of the ASR system has shown that ASR has significantly improved the production and quality from the City's well with no adverse impacts.

Instream Habitat Improvement

While ASR has generally been considered to provide environmental benefits by shifting withdrawals from surface water to higher flow periods, the technology more recently is being developed to provide direct environmental benefits. These benefits include using the stored water to enhance flows in highly over-appropriated streams or during droughts. While not specifically developed for this purpose, Walla Walla's ASR system has been used to augment the flow in Mill Creek during a drought year. Several ASR programs are being planned or developed with ecosystem restoration specifically in mind. These range in scale from the Comprehensive Everglades Restoration Plan (CERP) in Florida with a full build-out capacity of 1,600 mgd, to the upper Catherine Creek flow enhancement project in northeast Oregon with a planned capacity of up to 6.5 mgd to restore flow in a highly appropriated stream that hosts threatened salmonid species.

Case Study: Upper Catherine Creek Stream Flow Enhancement Project

— ASR for Stream Flow Enhancement Using Riverbank Filtration to Treat Source Water

The Upper Catherine Creek Flow Enhancement Project provides an example of an ASR project specifically intended to enhance flows in a flow deficient stream hosting high priority salmonid populations. The Grande Ronde Model Watershed (GRMW) completed an OWRD-funded pre-feasibility fatal flaw analysis to evaluate the use of shallow alluvial sediment and/or Columbia River Basalt aquifers to store winter flows from Catherine Creek. The stored water will be returned to the creek in the summer when stream flows are insufficient to sustain fish habitat and passage (AP/GSI, 2010). The Bonneville Power Authority (BPA) is providing funding and technical assistance for the GRMW to complete a technical feasibility study and develop design parameters for the diversion and ASR system. The project concept involves a combination of factors, including: using riverbank filtration to divert surface water during the winter months to naturally treat source water to acceptable water quality standards; injection into an underlying basalt aquifer; recovery of the water; and discharge of the water back to the creek during low flow periods (Figure 5). Water will be returned to the creek during a four-month period in the summer and early fall at rates of up to 10 **c**ubic **f**eet per **s**econd (cfs), or approximately 6.5 mgd.

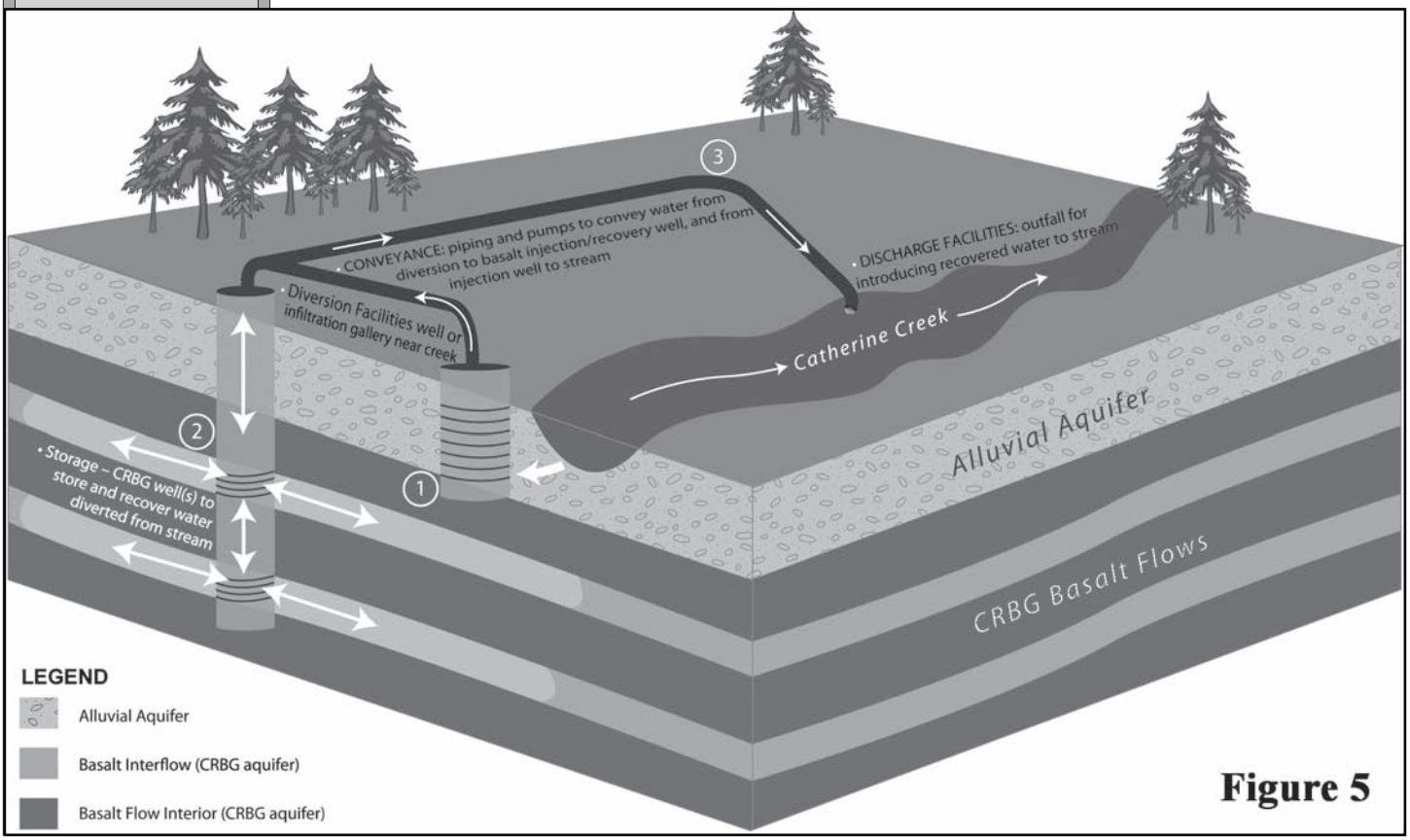


Figure 5

ASR

Oxidizing Conditions

Improve Water Quality

Besides providing a mechanism for storing high-quality source water, the injected water is typically oxygen-saturated. The injected water thus creates oxidizing conditions in the aquifer around the well that can improve the overall quality of recovered mixtures of native groundwater and stored water. This dynamic can even improve native groundwater, particularly after multiple cycles of injection and recovery.

Examples: Sunrise Water Authority and United Water of Idaho

For example, native groundwater in the ASR storage aquifer used by Sunrise Water Authority (SWA) in northwest Oregon contains manganese concentrations that exceed state and federal aesthetic standards. In addition to experiencing 100 percent recovery of the stored water volume during the first two cycles of ASR operation, SWA observed a significant improvement in the quality of the recovered water. Similarly, United Water of Idaho operates an ASR system in Boise specifically designed to reduce the concentrations of manganese, arsenic and uranium present in groundwater produced by a number of its wells.

Thermal Benefits

Industrial Uses

Several industrial applications of ASR have been developed over the past 10 years. Micron Technologies in Boise, Idaho, developed ASR capabilities initially as a mitigation measure, but also has realized significant water quality benefits. A thermal ASR project is currently under development at the Boise White Paper plant in Wallula, Washington, to store cold water for use in the plant in the summer. This project has the added benefit of reducing plant withdrawals from the Columbia River during dry months.

Case Study: Boise White Paper Thermal Storage and Recovery Project

— Thermal Storage and Recovery (TSR) for Industrial Use and Summer Stream Flow Benefits

Reduced Cooling Costs

The Boise White Paper thermal storage and recovery project is an example of a recent innovative permutation of ASR. The Boise White Paper plant, located in Wallula, Washington, diverts water from the Columbia River year-round for use in plant processes. Summertime water temperatures commonly approach 70 degrees Fahrenheit, whereas wintertime water temperatures frequently are less than 40 degrees Fahrenheit. These wide temperature ranges create thermal inefficiencies in plant operations. In addition, Boise White Paper spends an estimated $500,000 per year on energy to chill the water diverted in the summer months. Furthermore, diversions during the summer reduce Columbia River flows, which is a concern to the Washington State Department of Ecology (Ecology) because of its ongoing efforts to improve flows for endangered fish. Boise White Paper, with Ecology funding, is developing an ASR system to store treated and cold Columbia River water diverted during winter months in a highly-confined aquifer within the Columbia River Basalt Group (CRBG) for use during the summer to reduce cooling costs (Figure 6). The highly-confined nature of the CRBG aquifers would also allow stacked thermal reservoirs that would also allow storage of heated "non-contact" water (water that has been solely used for cooling and has not been in contact with other plant processes). However, only cold temperature water storage is being contemplated by Boise White Paper at this time.

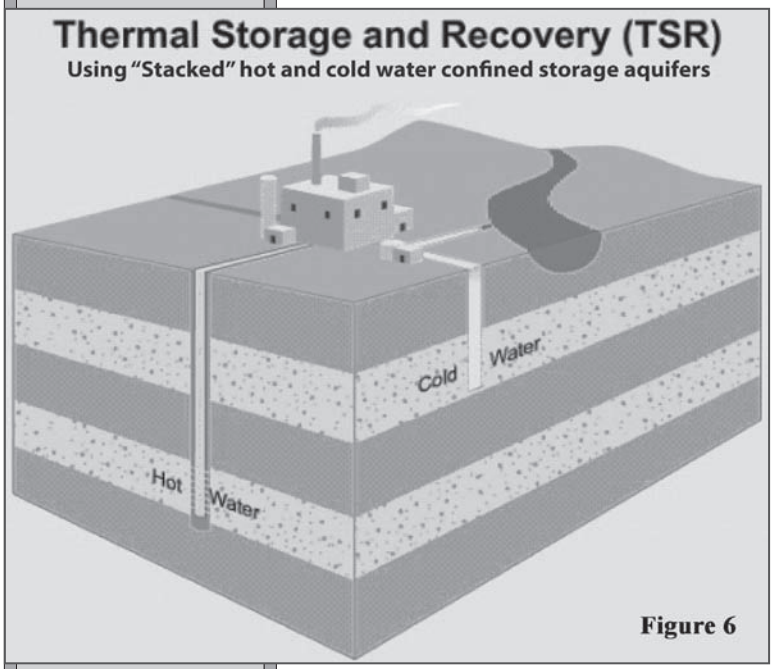


Figure 6

Thermal modeling indicates that the stored water will remain sufficiently cool even though the temperature of the native groundwater is 80 degrees Fahrenheit. The plant will save on water cooling costs within the system and reduce withdrawals from the Columbia River by approximately three mgd during the low flow summer months. A feasibility study has been completed and a pilot project is under development. Results from the pilot project are expected in 2012.

Wastewater Source

Storage of Highly Treated Wastewater/Stormwater

ASR projects using highly treated wastewater as source water are being developed in portions of the United States for aquifer recharge and for a barrier to salt water intrusion (e.g., Groundwater Replenishment Project, Orange County Water District — see Markus, *TWR* #69). This is also being done internationally in aquifers that have naturally poor quality where there is a need for a non-potable water source (e.g., wetlands restoration, irrigation). One such project is in Melbourne, Australia at the Rossdale ASR demonstration project.

APPROACHES FOR EXPANDING ASR APPLICATION IN THE WEST

Clearly there is a significant need to utilize underground storage as one tool for addressing the critical future water supply needs in the West. As we have discussed, there are a number of challenges to developing ASR projects that have been experienced in Oregon, Washington, California, and Idaho. Some of the challenges are technical and some are more institutional or political. From our experience developing more than 15 ASR projects in the West and observing the experience of others, we have identified several approaches that should be considered for addressing the challenges and reducing the risk and uncertainty to water providers who are considering developing ASR or groundwater banking projects. The following table includes a list of the more significant challenges to further development of ASR projects in the West and several suggested approaches to addressing the challenges.

Approaches to Addressing Challenges for Expanding ASR Development in the West

Challenge/Concern	Approaches to Addressing the Challenge
Technical	
Source water contains constituents that violate State groundwater anti-degradation policy	Demonstrate through pilot testing that concentrations are reduced through geochemical and biological processes. Utilize large body of published and unpublished work regarding fate of disinfection chemicals. Establish compliance points in the aquifer that allows for natural "treatment" near the ASR well. Dechlorinate source water. Develop legislation that allows for either an exemption for disinfection chemicals and byproducts (e.g., Oregon) or a process for assessing risk and larger public benefits.
Amount of water that can be stored	Hydrogeologic characterization as part of a feasibility study. Aquifer testing to identify aquifer characteristics and boundaries. Identify potential for loss of stored water to springs, surface water, other aquifers, and other users. Perform groundwater modeling. Perform pilot testing.
Amount of water that can be recovered	Hydrogeologic characterization as part of a feasibility study. Aquifer testing to identify aquifer characteristics and boundaries. Water quality analysis and signature identification. Perform groundwater modeling. Perform pilot testing to assess hydraulic response in the aquifer relative to baseline condition.
Injury to neighboring users	Identify all nearby users. Perform an impact analysis during the feasibility study. Engage the affected public early in the process to understand concerns.
Well clogging that results in loss of injection efficiency and production capacity	Perform detailed source water characterization for variations in turbidity and water quality with time at the injection site. Assess biological and geochemical clogging potential by performing source water sampling in the distribution system near the ASR site and perform geochemical modeling during feasibility study. Identify aquifers that may be subject to clogging. Design ASR well screen and filter pack to reduce clogging potential. Periodically flush distribution lines near ASR site prior to recharge. Install automated turbidity monitoring equipment upstream of ASR well and install automatic injection shutoff valve. Perform baseline step-drawdown tests prior to injection and then periodically thereafter to identify changes. Monitor injection efficiency using specific capacity measurements and perform periodic backflushing as needed.
Adequacy of infrastructure to deliver source water to ASR well and convey recovered water to users	Perform hydraulic modeling of distribution system. Determine adequacy of system to deliver water to and from the ASR site at desired pressure.
Protection of peak and ecological flows in the stream when diverting water for ASR	Perform screening analysis during feasibility study. Meet with agencies responsible for protecting peak and ecological flows early in the project.
Institutional	
Multiple agencies responsible for permitting	Gain acceptance state-wide for a uniform permitting protocol and identify consistent agency leads who will work on permitting projects. Establish a permitting protocol through legislation and rule making. Encourage agencies to identify a single agency lead and develop a guideline for how ASR projects can be permitted with input from other interested agencies and the public.
Stored water protection from capture by other users	Identify dimensions of storage zone and work with agency responsible for permitting new wells to restrict development in these zones. Establish groundwater storage overlay zone. Gain cooperation of all significant users within or near the storage zone. Ensure local benefits that are legally enforceable.
Conflicts between users over diversion of water from stream or recovery of water from storage	Transparent and early public information process. Identify users who may be in conflict and talk to them. Design project to reduce impacts. Coordinate with state agency responsible for water allocation during feasibility study process.

ASR

Water Supply Options

CONCLUSIONS

Rapid population growth, and imbalances between water availability and demand have strained the ability of water managers to provide sufficient water to meet the demands of all users in many parts of the western United States. Projected impacts of climate change add an additional layer of uncertainty with regard to the availability and timing of supplies. In response, water resource managers are increasingly taking integrated and multi-faceted approaches to planning for future needs using a full spectrum of available options. The growth in the use and applications of ASR illustrates its promise as an effective tool for helping address a diversity of water needs in the face of increased future demands due to expected growth in the West. However, a number of technical and institutional challenges affect managers' ability to employ the technology to its full potential while still addressing regulatory needs.

The necessity of developing and retaining a full set of promising water supply options dictates that the water managers, researchers, the regulatory community, and all other stakeholders continue to tackle these challenges.

For Additional Information: Walt Burt, GSI Water Solutions, 503/ 239-8799 x108 or WBurt@gsiws.com
Jeff Barry, GSI Water Solutions, 503/ 239-8799 x102 or JBarry@gsiws.com

Your authors' would like to thank the following for their contributions to this article:
Niki Iverson, Water Resources Manager, City of Hillsboro, Oregon
Jason Melady, GSI Water Solutions, Inc.
Larry Eaton, GSI Water Solutions, Inc.
Russell McGlothlin, Brownstein, Hyatt, Farber, Schreck (Attorneys)

References

Anderson Perry & Associates (AP) and GSI Water Solutions, Inc. (GSI), 2010. *Upper Catherine Creek Storage Feasibility Study.* Unpublished consultant report prepared for the Grande Ronde Model Watershed and Oregon State Department of Water Resources.

AWWA (American Water Works Association). 2002. *Survey and Analysis of Aquifer Storage and Recovery (ASR) Systems and Associated Regulatory Programs in the United State*s.

Eaton, L.G., J. Melady and T. Tolan, 2009. *Successful implementation of ASR in basalt-hosted aquifers in the Pacific Northwest of the United States.* Boletín Geológico y Minero,120 (2): 131-156

Hahn, C., 2010. *Aquifer Storage & Recovery Regulation, A Survey of UIC-ASR Regulation in Different States. The Water Report* #74.

Pyne, R. D. G. *Groundwater Recharge and Wells: A Guide to Aquifer Storage Recovery.* Lewis Publishers, CRC Press. 1995.

Pyne, R. David G. (2005) *Aquifer Storage Recovery: A Guide to Groundwater Recharge Through Wells, 2nd Ed*., ASR press, Gainesville, FL, USA.

Shrier, C.J., 2004. *Aquifer Storage Recovery, Expanding Possibilities in the Western United States. The Water Report* #8.

Shrier, C.J., 2010. *Aquifer Storage & Recovery, New Federal Initiatives – EPA to Develop Guidance. The Water Report* #74.

US Army Corps of Engineers (USACE) Institute for Water Resources (IWR), 2006. *Water Resources Outlook, U.S. Water Demand, Supply and Allocation: Trends and Outlook.* Publication 2007-R-3

Walter Burt is a Senior Hydrogeologist and Operations Manager for GSI Water Solutions in Portland, Oregon, with over 21 years of professional experience. Mr. Burt specializes in managing municipal water resource development and groundwater supply projects. His expertise includes: well siting studies; well impact studies; aquifer storage and recovery (ASR) evaluations; ASR policymaking; design, assessment, and rehabilitation of water wells; technical reporting; and integrating regional and local hydrogeological information with project objectives to develop practical solutions to water supply projects. Mr. Burt holds an MS in Hydrology (University of Idaho) and a BA in Environmental Sciences/Geology (Middlebury College). He is a Registered Geologist in the State of Oregon and a Licensed Geologist and Hydrogeologist in Washington State.

Jeff Barry is a Senior Hydrogeologist and is Business Development Director for GSI Water Solutions in Portland, Oregon, with over 27 years of professional experience. Mr. Barry provides senior review of hydrogeologic and groundwater resource projects. He is an expert in aquifer storage and recovery technology. His work includes conducting production and collector well siting, design, installation, rehabilitation, and testing, as well as dewatering projects and wellfield capacity, and siting studies and permitting. Jeff is knowledgeable about state regulatory programs related to groundwater protection and water rights. He frequently presents technical concepts to both regulatory and public audiences, and provides technical expertise to support permitting and litigation. Mr. Barry holds an MS in Hydrogeology (University of Nevada-Reno) and a BS in Natural Resources Planning (Humboldt State University). He is a Registered Geologist and Certified Water Rights Examiner in the State of Oregon and a Licensed Geologist and Hydrogeologist in Washington State.

Water & Development

WATER RESOURCES REGULATION & DEVELOPMENT

GROUNDWATER, FLOODPLAINS, AND "WATERS OF THE UNITED STATES"

by Robert D. Anderson, Fennemore Craig (Phoenix, AZ)

INTRODUCTION

Since the real estate slump began in 2006, the entitlement and development of residential subdivisions and larger master-planned communities has come to a screeching halt. One of the obvious consequences of this for experienced real estate practitioners and developers alike is the lack of regular contact with Federal, state and local regulatory programs that affect the nature and timing of development. Thus, as the industry emerges from the "slumber" of the past several years, practitioners and developers may be surprised to learn that while the real estate industry was asleep, the regulatory agencies that they must deal with were not. Perhaps nowhere is this more apparent than in the world of water resources.

Regulatory Changes

Three examples of the changing regulatory landscape in the water resource world come to mind: (1) challenges with relying on groundwater as a source for demonstrating an assured and adequate water supply under standards administered by the Arizona Department of Water Resources (ADWR) and changes in federal regulation, including: (2) new standards for protection of endangered species that apply to floodplain map revisions issued by Federal Emergency Management Agency (FEMA); and (3) evolving standards of jurisdiction and mitigation affecting permits issued by the US Army Corps of Engineers (Corps) under Section 404 of the federal Clean Water Act (CWA).

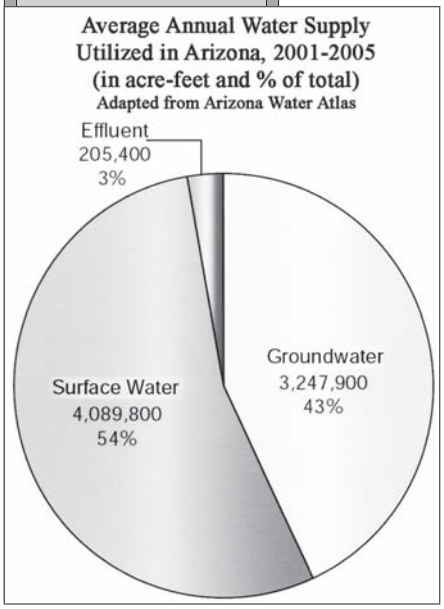
CHANGES IN ARIZONA WATER REGULATION

Groundwater and Assured Water Supply

"Assured Water Supply"

Since the State of Arizona's adoption of the Groundwater Management Act in 1980, developers of residential subdivisions within Active Management Areas (AMA) have had to demonstrate, prior to platting and securing a public report, that there is an assured water supply for the proposed development. Reduced to its essentials, "assured water supply" means that there is a sufficient supply of water for the proposed use for 100 years. ARIZ. REV. STAT. §45-576.J (West Supp. 2010). There are numerous technical requirements that must be met, including showing that water will be of adequate quality and that the use will be consistent with the management plan and achievement of the management goal for the AMA. *Id.* There are two basic methods for demonstrating an assured water supply: either secure service from a municipal water provider that has been "designated" by ADWR as having an assured water supply, or, if the provider is not designated, securing a certificate of assured water supply from ADWR. *Id.*, §45-576.A. Outside of AMAs, developers are required to identify the "adequacy" of the proposed water supply, whether by securing water service from a provider that has been designated, or by obtaining a water adequacy report from ADWR prior to platting. *Id.*, §45-108.

Technical Requirements



Groundwater is commonly used as a source of supply for assured and adequate water supply determinations, and the challenges to using groundwater for this purpose are increasing. Statewide, groundwater represents a major source of supply for all water uses, supplying over 3.2 million **a**cre-**f**eet (AF) annually or 43% of total supplies for the period 2001-2005. Arizona Water Atlas, Executive Summary at p. 50, 53 (ADWR, Sept. 2010). Many areas of the state are characterized by deep basin-fill aquifers that literally hold millions of acre-feet of groundwater in storage. Little Colorado River Plateau basin aquifers, for example, are estimated to hold in excess of 500 million AF. *Id.* at 15. In the planning areas comprising the AMAs, groundwater in storage is estimated to exceed 180 million AF. *Id.* at 17. While extensive groundwater pumping raises sustainability, subsidence and water quality concerns, groundwater continues to be the significant, and often the only, source of supply for new development in many areas of the state. For a concise summary of the "parade of horribles" that will occur as groundwater tables drop, see Rita Pearson Maguire, *Patching the Holes in the Bucket: Safe Yield and the Future of Water Management in Arizona*, 49 Arizona Law Review 1 (2007).

Arizona's Groundwater Code (Code) establishes significant restrictions on using groundwater for assured water supply purposes. For example, the Code generally requires that for groundwater to be used in several of the AMAs, it must be replenished through membership in the Central Arizona Groundwater Replenishment District. Ariz. Admin.

Water & Development

Depth Criteria (Limits)

Code § R12-15-722.A (2007); Ariz. Rev. Stat. §45-576.01 (West Supp. 2007). One of the restrictions of increasing importance is the depth criteria imposed by ADWR's rules. If groundwater is the source of supply, the assured water supply applicant must produce a hydrology study that demonstrates that the water necessary to support the development is "physically available." *Id*., §45-576.J.; Ariz. Admin. Code § R12-15-716.B (2007). The study must also show that the withdrawal of groundwater will not reduce depth to groundwater below certain specified depths. *Id*., § R12-15-716.B.2. For the Phoenix, Tucson and Prescott AMAs, the withdrawal depth limit is 1000 feet below land surface. The Pinal AMA specifies a 1100 foot limit and outside the AMAs is limit is 1200 feet. *Id.* (It is important to emphasize that this is a limitation on supplies that can be counted as available for assured water supply purposes; there is no legal restriction on actually pumping groundwater from below these depths and many aquifers are far deeper than these limits.) These depth limitations, coupled with sophisticated computer modeling of groundwater demands, are likely to lead to even more severe restrictions on using groundwater for assured water supply purposes.

Phoenix AMA Designations: Modeling and Availability

Hydrology Model

On Thursday, July 15, 2010 a rather nondescript notice appeared on the pages of the *Arizona Business Gazette* announcing the opportunity to comment on pending applications to modify designations of assured water supply for eleven municipal water providers in Maricopa and Pinal County. The notice announced that the applications all relied on a single "numerical" hydrology model, which is essentially a computer simulation of aquifer conditions over 100 years based on expected water demands over that timeframe. What was not immediately apparent from the notice, but would be apparent from the report prepared by ADWR summarizing the model results, was that the pending decision to approve these applications would, in effect, allocate all or almost all of the remaining groundwater in the Phoenix area for assured water supply purposes. *See* Wesley, Hipke, *A Salt River Groundwater Flow Model Application – 100-Year Predictive Scenarios Used For The Determination of Physical Availability in the Phoenix Active Management Area*, Modeling Report No. 22 (ADWR, July 2010 (hereinafter, the "SRV Designation Model") — please note: it is our understanding that this study was updated and modified before the final designations were approved, so quantities of groundwater quoted in this article may have changed.) This result stems from a combination of more sophisticated, regional hydrology models and ADWR policy.

Remaining Groundwater Allocated

Modeling has been used since the inception of the assured water supply program to determine whether depth-to-water criteria will be met for applicants relying on groundwater as a source of supply. In the early years of the program, relatively simple analytical models were used to determine the depth-to-water after 100 years of pumping.

Early Models

See, e.g., ADWR, *Interim Information and Guidelines for Demonstration of Assured Water Supplies Within Designated Active Management Areas Pursuant to A.R.S. §45-576* (Sept. 8, 1982). The basic model would begin with current depth-to-water at wells that would serve the proposed use, then add in regional existing and projected future demands (often in the form of an assumed

Water & Development

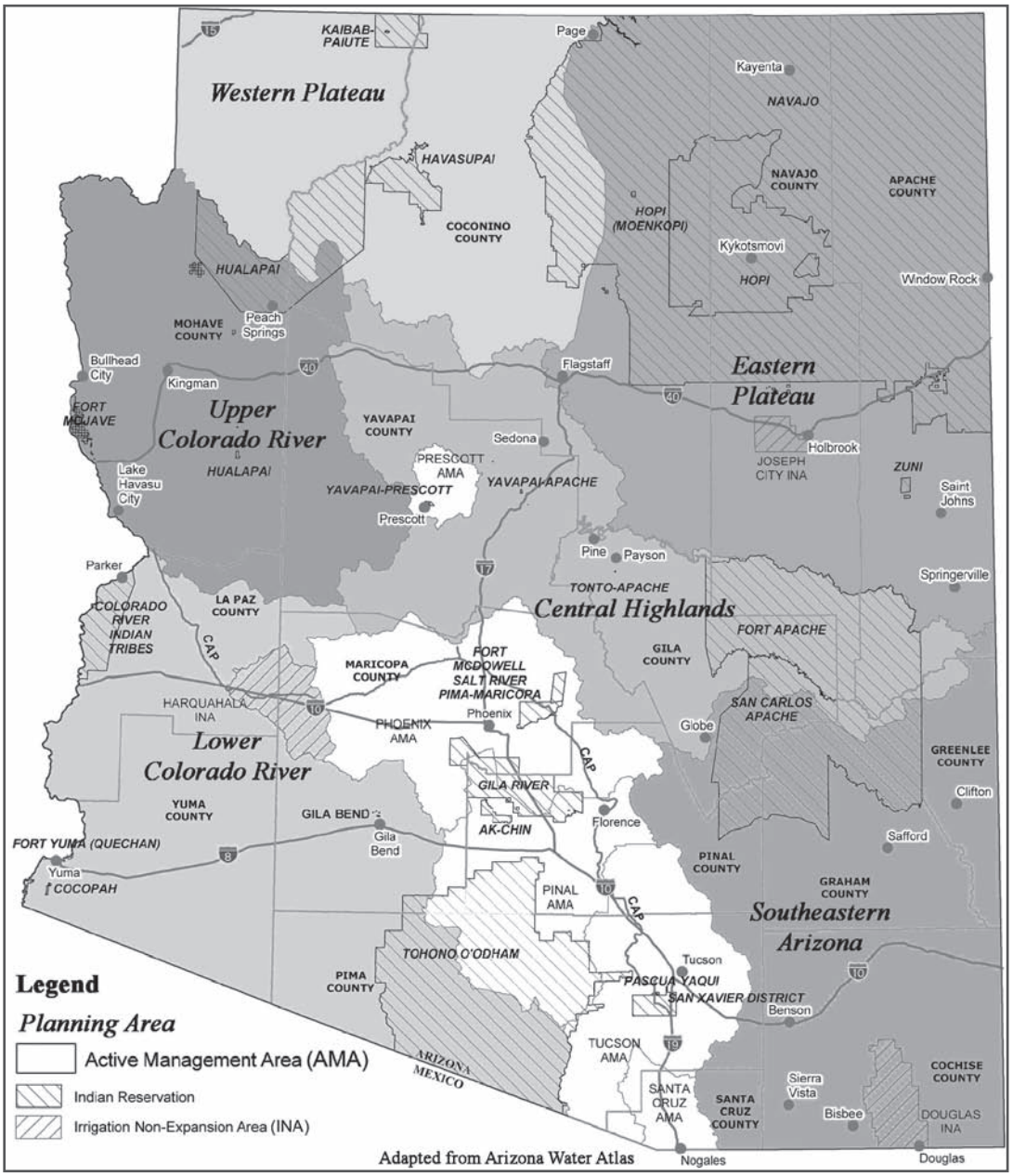
regional groundwater decline provided by ADWR), and then the demands of the proposed use itself. The groundwater was deemed to be physically available if, after 100 years of simulated pumping from wells proposed to serve the use, the depth-to-water did not exceed regulatory limits. *See also* Decision and Order of the Department of Water Resources, *In the Matter of the Application of Sun Lakes Marketing for a Certificate of Assured Water Supply* (July 2, 1986), p. 8 (discussing the "Theis Method"). This approach — measuring depth-to-water after 100 years at wells that will serve the proposed use — was eventually codified when ADWR adopted its assured water supply rules in 1995. Ariz. Admin. Code § R12-15-716. B.2 (2007): "The Director shall calculate the projected 100-year depth-to-static water level by adding the following *for the area where groundwater withdrawals are proposed to occur*…" (emphasis added).

Favored ADWR Approach

With advances in computer capabilities and knowledge of underlying aquifer conditions around the state, groundwater modeling has become substantially more sophisticated, to the point where the favored approach by ADWR is to use these regional "numeric" groundwater models. See *Draft Proposed Changes to the Arizona Department of Water Resources Assured and Adequate Water Supply Physical Availability Rules and Substantive Policy Statement regarding Hydrologic Studies Demonstrating Physical Availability of Groundwater for AAWS Supply Applications*, at pp. 19-21 (ADWR March 24, 2010) (hereafter the "Hydro Guidelines"). The Hydro Guidelines have not been formally adopted by ADWR but reflect, as far as we can tell, existing agency practice and policy. These regional models theoretically make it possible to predict depth-to-water in wells throughout an entire groundwater basin, not just the wells subject to a pending assured water supply application.

Regional Models

Arizona AMAs



Water & Development

Off Site Impacts Policy

Reduce or Mitigate

Model Assumptions

Requests Reduced

Complete Allocation

Negative Impact Standard

Outside AMAs

This new capability has lead to a major shift in ADWR policy. Instead of just looking at depth-to-water from wells subject to a particular assured water supply application, ADWR is considering offsite impacts on prior assured water supply approvals in the region. The new test, embodied in proposed ADWR policy (which reflects current ADWR practice), is that a new application "cannot cause the 100-year depth-to-static water level of any previously issued [assured water supply] determination to drop below the maximum allowable 100-year depth–to-static water level or known depth of the source aquifer." *Id*. at 31. The policy further clarifies that this negative impact can be measured *at a single well*:

> If the 100-year drawdown analysis for an [assured water supply] application indicates that a well associated with a municipal provider that serves a use that is included in a determination of [assured water supply] is impacted such that the water level at the well exceeds the maximum allowable 100-year depth-to-static water level or that the water level reaches the bottom of the aquifer (goes dry) during the 100-year period, the applicant must reduce its own projected groundwater demands or move its wells to mitigate the impacts to the provider's well. If the applicant is unable to mitigate its impacts on the well, the applicant must seek an alternative water supply. *Id*. at 32.

The debate is just starting on the accuracy of these models and what they are reasonably capable of predicting. While they are the best tools that we have for predicting long-term aquifer conditions, they convey a sense of accuracy that may not be supported by the underlying study. For example, huge assumptions are made about long-term withdrawal, use, and recharge patterns across an enormous geographic area, with extraordinarily deep aquifers. The East Salt River Valley Subbasin, for example, covers over 1,710 square miles, while the West Valley encompasses over 1300 square miles. The thickness of the aquifers within these subbasins ranges from less than 100 feet at the basin margins to over 10,000 feet. *Third Management Plan for the Phoenix Active Management Area*, at p. 2-10, 2-11 (ADWR 1999). Assuming that a model on this scale accurately predicts impacts to a single well a century from now is a significant leap, with enormously complex policy implications.

The SRV Designation Model demonstrates how this new standard plays out. A number of cities had designations up for review and ADWR chose to process them as a group and to run the model itself. SRV Designation Model at p. 1. As a result, the model addresses huge water demands of a large geographic area (most of the urbanized Phoenix metropolitan area is included) over a 100-year period. *Id*., Tables 7, 8, 11, 14, 15, and 17. ADWR began with "Scenario 1," which utilized build-out projected groundwater demands provided by the applicants (approximately 450,000 AF per year) and found that there were substantial numbers for "dry cells" (wells going dry) plus areas where depth-to-water exceeded the 1000-foot limit. *Id.,* Table 7 and 8; p. 39. ADWR adjusted the model by reducing expected demands and adjusting other assumptions until the depth-to-water criterion ostensibly was met under "Scenario 4." This reduced groundwater demands to about 260,000 AF per year in the year 2108, the end of the model analysis period. *Id.* at pp. 72-74. The fact that the applicants' water demands were pared back so substantially indicates that ADWR allocated all the groundwater it thought it could and still approve the designation requests. It is important to emphasize that the cities generally have substantial renewable water supply portfolios, including in varying amounts: Central Arizona Project water; Salt River Project water; and reclaimed water (i.e., treated wastewater). The designations allocated available groundwater supplies.

It makes one wonder what groundwater is left for future applicants. While there remain millions of acre-feet of groundwater in storage in the AMA, it would appear that application of the negative impact standard puts most if not all of the remaining supplies off limits for assured water supply purposes. Obviously, future applications will be viewed on their own merits and the ADWR policy driving this availability — or lack thereof — of additional groundwater supplies is as yet only a draft which has not been formally adopted as policy or rule. Nevertheless, future applicants for assured water supply in the Phoenix AMA clearly have substantial hurdles in front of them to prove the availability of groundwater supplies. Moreover, the standards applied here affect the entire assured and adequate water supply programs (*i.e.,* they apply in other AMAs and also apply for adequacy studies outside the AMAs), and the move to large, regional groundwater models also is a state-wide trend. Thus, the hurdles to demonstrating the availability of groundwater in the Phoenix AMA are likely to be encountered in other AMAs and even outside the AMAs.

Mandatory Water Adequacy Outside the AMAs

Another example of the increasing challenges of relying on groundwater as a source of supply for development is the changes to the water adequacy requirements outside AMAs. The statute defined "adequate water supply" in essentially the same terms as "assured water supply" ("at least" 100 years of supply), without reference to management goals and plans for the AMA. *Id*., § 45-108.I.1 (West Supp. 2010). Prior to 2007, however, a developer was not required to actually demonstrate that the water supply was adequate to serve a proposed use, but only disclose the status of the supply. Ariz. Rev. Stat. §45-108

Water & Development

Inadequacy Report

City/County Authority

Mandatory Adequacy Requirements

Potential Changes

Flood Hazard Mapping

FEMA Standards

Stormwater Control

(West Supp. 2010). *See also* Water Adequacy Program Summary (ADWR, Nov. 2001), available from ADWR's website at: www.azwater.gov/azdwr/WaterManagement/AAWS/documents/WADSumm_000.pdf. In fact, developments outside AMAs are commonly platted based on a statement of inadequacy, as an inadequate report can be obtained with little effort from ADWR. If you do not provide any information about available supplies, ADWR will give you an inadequate report. Arizona Water Atlas, Vol. 1, Executive Summary, p. 45. Approximately 30% of platted lots are subject to inadequacy findings. The vast majority of these are based on lack of data. *Id*. Table 1-8.

In 2006, the Director of ADWR convened the Statewide Water Advisory Group (SWAG) composed of about 50 citizens and government officials to discuss water management and planning issues for the State as a whole. One of the core issues SWAG sought to tackle was the problem of water supplies outside AMAs. The lack of a strong assured water supply-type regulatory structure was seen as a contributing factor. One significant proposal to emerge out of SWAG was SB 1575, a bill which when enacted would afford counties and municipalities the opportunity to make a water adequacy demonstration mandatory, *i.e.,* require the developer to demonstrate that the water supply for the proposed development is adequate before allowing platting and sale of lots. *See* 2007 Ariz. Sess. Laws, 1st reg. sess., ch. 240, §1, 2; *codified at* Ariz. Rev .Stat. §45-9-463.01 (2008)(cities and towns); *id*. §45-11-806.01.F (West Supp. 2010)(counties). The statute provides complicated exemption provisions that would allow subdivisions to be platted and lots sold even without a demonstration of adequacy. *Id.* §9-463.01.K (2008); *id.*, §11-806.01.G. (West Supp. 2010); *id.,* §45-108.02, .03 (West Supp. 2010).

More specifically, the statute now allows counties to require water adequacy through regulation adopted by a unanimous vote of the board of supervisors. *Id.,* §45-11-806.01.F (West Supp. 2010). Such actions would make the adequacy requirement apply in all platting jurisdictions in the county. A city or town located in a county that has not adopted such a regulation may require the same by ordinance. No super majority is required. *Id*., §45-9-463.01 (2008). According to ADWR's website, Cochise and Yuma Counties have adopted the provision county-wide, and the Towns of Clarkdale and Patagonia have adopted the provision by ordinance. *See* www.azwater.gov/azdwr/WaterManagement/AAWS/documents/List_of_Mandatory_Adequacy_Jurisdictions_2-17-09_000.pdf. The door is open for other jurisdictions to adopt this requirement.

This is a significant change for development outside AMAs. First of all, the "mandatory adequacy" requirement is now a jurisdiction-by-jurisdiction determination, and one that can change in a relatively short period of time through adoption of regulations or ordinances by local governments. So even if you hold or are considering purchasing property in non-mandatory jurisdictions, the potential for that to change is significant. Moreover, once property is located in a mandatory adequacy jurisdiction, it will be necessary to demonstrate available water supplies in order to subdivide that property. Many new subdivisions outside AMAs have traditionally relied on groundwater as a source of supply but because of the lack of stringent water supply demonstrations, have not had to prove up the long-term reliability of those supplies. As we have seen with the evolution of groundwater models and ADWR policy, that can be quite a challenge.

CHANGES IN FEDERAL REGULATION

Floodplains and Endangered Species

Another area where standards have been changing is in the National Flood Insurance Program (NFIP) and specifically in the administrative process affecting mapping of flood hazard areas. NFIP was passed by Congress in 1968 and established an insurance program to ameliorate disaster responses in flood prone areas. National Flood Insurance Act of 1968, Pub. L. No. 90-448, § 1303(c), 82 Stat. 572 (codified in various sections of 42 U.S.C. §§ 4001-4128)(2003). The premise of the program was simple — communities would qualify for nationally-subsidized flood insurance if they adopted and enforced local floodplain ordinances to regulate development in the floodplains. *National Wildlife Federation v. FEMA*, 345 F. Supp. 1151, 1154-55 (W.D. Wash. 2004). As a result of NFIP, the Federal Emergency Management Agency (FEMA) was given the responsibility of mapping flood hazard areas (called Flood Insurance Rate Maps or FIRM) and establishing national minimum standards for regulating development in such areas. *See* generally National Flood Insurance Program – Program Description (FEMA, August 1, 2002) (hereinafter the "NFIP Program Description") at: www.fema.gov/library/viewRecord.do?id=1480. Given the rather expansive nature of floodplain mapping, it is not unusual to encounter floodplains in the course of subdivision or larger scale development. A common approach to development is to design drainage structures and fill activities to control and convey stormwater from high intensity events around and through proposed development. In many cases, whether through fill or structural protections, the land as developed no longer is at significant risk of flooding and therefore can be removed from the floodplain, and the FIRM revised accordingly.

Water & Development

Map Revision

Key ESA Protections

Section 9 "Take"

Section 7 Consultation

Section 10 Compliance

FEMA Decisions

Approach Changes

Applicant's Burden

The map revision process has several steps:

- the developer applies to FEMA for a **c**onditional **l**etter **o**f **m**ap **r**evision (CLOMR) by showing FEMA the proposed solution for removing property from the floodplain
- FEMA issues the CLOMR
- the project is constructed
- upon completion, as-built plans are submitted to FEMA, which issues a final **l**etter **o**f **m**ap **r**evision (LOMR)

Another process is available for map revisions where refined hydrology information can be used to revise flood hazard zone boundaries. The mapping process is described generally in the NFIP Program Description, *pp.* 5-12.

Enter the federal Endangered Species Act (ESA). ESA was passed in 1973 to provide protections to species of wildlife and plants listed as endangered or threatened pursuant to rulemaking procedures set forth in the Act. 16 U.S.C. § 1531 (2000). The key protections from landowner and developer standpoints are: (1) the prohibition under Section 9 of the Act against "take" of listed species of wildlife and related protections afforded to listed plants; and (2) the requirement that federal agencies consult with the US Fish & Wildlife Service (USFWS) and/or the National Marine Fisheries Services (NMFS: as to certain fresh and salt water species) to ensure that the agencies' actions do not jeopardize the continued existence of a listed species or adversely modify critical habitat. *Id*, § 1538(a)(1)(B)(take prohibition); *id.,* § 1538(a)2) (plant protections); *id.*, § 1536(a)(2); 50 C.F.R. Part 17 (2009)(lists of endangered species and critical habitat); *id.* Part 402 (consultation regulations). Since Arizona species are under USFWS jurisdiction, not NMFS, we will refer to USFWS from here forward. Section 9 of the ESA applies to any action that results in a take, whether federal or non-federal, private or governmental. Section 7 only applies to actions carried out, authorized or funded by federal agencies. With the massive expansion of federal programs (both regulatory and others) over the past three decades, this Section 7 obligation has become more and more pervasive and now affects many ostensibly private actions that only peripherally involve federal authority.

In order to comply with Section 7 of the ESA, FEMA must determine that its actions will not jeopardize the continued existence of listed species or adversely modify critical habitat. The consultation regulations provide that consultation is complete if USFWS concurs in writing that the project is not likely to adversely affect a listed species or critical habitat. 40 C.F.R. §402.14(b)(2009). Projects which result in take are directed to comply with Section 10, which involves an internal Section 7 consultation between the permit issuing and endangered species units within USFWS. *See Habitat Conservation Planning and Incidental Take Permit Processing Handbook,* at pp. 1-6; 6-12 to 6-16 (US Dept. of Interior, Fish & Wildlife Service, et al. November 1996). It is safe to conclude that a project covered by an issued Section 10 permit would meet Section 7 standards from FEMA's standpoint.

In the past, FEMA processed map revisions without paying much attention to ESA. In FEMA's view, map revision decisions were ministerial based on technical information and did not influence actions on the ground that could affect listed species. *National Wildlife Federation*, 345 F. Supp. at 1173. NFIP Program Description (at page 13) mentions endangered species but places the onus on local jurisdictions to ensure that development complies with ESA generally, with no mention of FEMA's obligations under Section 7. Environmental groups, on the other hand, asserted that NFIP itself encouraged development in floodplains and actions to eliminate and control those floodplains, all to the harm of listed species. *Id.*

Litigation in a number of states was launched and, from the environmentalists' standpoint, was successful in getting FEMA to change its approach to ESA requirements. In Washington State, for example, FEMA lost the *National Wildlife Federation* case and proceeded to consult with the USFW and NMFS over affects of floodplain development on a number of listed species, including endangered salmon and killer whale populations. (*See* Letter from D. Robert Lohn, NMFS, to Mark Eberlein, FEMA, regarding ESA Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the on-going NFIP carried out in the Puget Sound area (Sept. 22, 2008), available at: http://online.nwf.org/site/DocServer/NMFS_Puget_Sound_nfip-final-bo.pdf?docID=10561. The result was a lengthy biological opinion that, as implemented by FEMA, requires applicants for map revisions to incorporate considerations to protect listed species on project development and requires local jurisdictions to develop ordinances to protect listed species from floodplain development. *Id.* Similar litigation has occurred in Florida in *Florida Key Deer v. Paulson*, 522 F.3d 1133 (11th Cir. 2008).

FEMA has now done something of an about face and decided that — litigation or not — it is going to implement more elaborate procedures to ensure that processing of map revisions ostensibly complies with ESA. On August 18, 2010, FEMA issued *Procedure Memorandum 64 – Compliance with the Endangered Species Act (ESA) for Letters of Map Change* (available at: www.fema.gov/plan/prevent/fhm/gs_memos.shtm). The memorandum places the onus on the applicant for a map revision to demonstrate to FEMA that the project complies with ESA. *Id.* The memorandum includes an attachment entitled: "*Guidance for*

Water & Development

Compliance with the Endangered Species Act for Conditional Letters of Map Change" ("CLOMR ESA Guidance") that explains this process. It directs the applicant to secure from USFWS a letter confirming that the proposed project either has no effect on listed species, or if there is an effect, that it is not likely to adversely affect the species. If there is an effect, it requires the applicant to obtain compliance through the ESA Section 10 process. *Id.*

Gap in FEMA Memorandum

FEMA has taken an interesting approach that minimizes FEMA's own involvement and essentially shifts the burden to the private applicant. Under USFWS/NMFS procedures, consultation is required to occur between the federal action agency (here FEMA) and USFWS, although there is a limited role for private non-federal applicants. 40 C.F.R. §402.08 (2009)(designation of non-federal representatives). Consultation does conclude with a finding of no effect or a finding "not likely to adversely affect" in writing by USFWS so in that sense, the memo is consistent with substantive ESA requirements. There is a gap in *Procedure Memorandum 64*, however, in how projects that have adverse affects on listed species that do not rise to a level of take and therefore would not require a Section 10 permit from USFWS/NMFS should be treated. The ESA CLOMR Guidance is simply silent on this point. These actions would presumably still be subject to a Section 7 consultation between FEMA and USFWS since projects that have an adverse effect are subject to formal consultation, which concludes with issuance of a biological opinion. *See* 50 C.F.R. §402.14 (2009).

ESA Compliance Required

In any event, ESA compliance is now going to be required for many if not all map revision submittals to FEMA. This has the potential for substantial delays, particularly in Southern Arizona where the Pima pineapple cactus, a listed plant species, is commonly encountered. As more species are listed, the risk of delay and of having to substantively modify a proposed project to reduce or mitigate for impacts to endangered species becomes more prominent.

"Waters of the US" and Section 404 Permits

"Waters of the US"

Section 404 of the Clean Water Act (CWA), 33 U.S.C. §1344, requires a permit from the US Army Corps of Engineers (Corps) for discharging "dredged or fill material" to "navigable waters." The requirement was enacted in 1972 as part of comprehensive amendments to the Federal Water Pollution Control Act. 33 U.S.C. §1251 (2001). As noted, the statute regulates "navigable waters" and defines such waters as "waters of the United States." *Id*., §502(7). The Corps and the US Environmental Protection Agency (EPA), which has oversight responsibility for Section 404 and is responsible for administering the balance of the CWA, have adopted a regulatory definition of "waters of the United States" that includes essentially any wetlands or surface water which affects interstate commerce. 33 C.F.R. § 328.3(a) (2010).

Expansive View

The definition includes "intermittent streams," and early case law concluded that waters of the United States include "normally dry arroyos through which water may flow, where such water will ultimately end up in public waters such as a river or stream…. ." *U.S. v. Phelps Dodge Corp.*, 391 F. Supp. 1181, 1187 (D. Ariz. 1975). As a result, the Corps and EPA took a very expansive view of their authority and generally found dry washes to be included in "waters of the United States" and therefore subject to the CWA, including those as small as a foot in width.

SWACC* & *Rapanos

The validity of this rule has been called into question twice in the last decade by the US Supreme Court in the cases of *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, 531 U.S. 675 (2001) (*SWANCC*) and *Rapanos v. U.S*., 126 S. Ct. 2208 (2006). *SWANCC* held that the CWA did not extend to "isolated" waters (*i.e.*, waters with no significant nexus to downstream **t**raditional **n**avigable **w**aters (TNWs)) and *Rapanos* expanded on the significant nexus test. *See* Glick, *TWR* #87. As a result, the status of ephemeral waters in Arizona in particular are open to question, given the relationship of ephemeral waters to downstream waters and the lack of TNWs within the state.

2008 Guidance

One would think that the status of jurisdiction would have settled down since *Rapanos* was decided in 2006, but the situation remains fluid (pardon the pun), in part because the *lack* of development activity has meant that there have been relatively few jurisdictional determinations to apply the significant nexus standard. The Corps and EPA developed guidance in 2007 (amended in 2008) that attempted to outline its interpretation of the *Rapanos* decision. *See* CWA Guidance to Implement the U.S. Supreme Court Decision for the *Rapanos* and *Carabell* Cases (EPA and Corps, June 2007, amended December 2008)("2008 Guidance": available at www.usace.army.mil/cw/cecwo/reg/cwa_guide/cwa_guide.htm). Because of the uncertainty and technical difficulties in applying the 2008 Guidance in general and the significant nexus standard in particular, the Corps issued a regulatory guidance letter in 2008 that allowed landowners or project proponents to utilize a "**p**reliminary **j**urisdictional **d**etermination" (PJD) as a basis for permitting a project. The PJD process basically allows the project proponent to consent to jurisdiction over all waters on the project site, thereby avoiding the *Rapanos* significant nexus determination. Regulatory Guidance Letter No. 08-02 (U.S. Army Corps of Engineers June 26, 2008). My personal experience is that a number of projects have utilized the PJD process because of the perception that it is faster and less controversial.

Preliminary Jurisdictional Determination

Water & Development

Navigability Definition

There is also continuing confusion regarding the status of TNWs in the state. Arizona has historically had few waters that could be considered navigable in the traditional sense (capable of carrying goods in interstate commerce). EPA and the Corps have applied an extraordinarily broad definition of navigability that has resulted in waters, like certain effluent-dominated reaches of the Santa Cruz River, being considered a TNW. *See* Eric Meltzer, *Santa Cruz is Ruled Navigable*, Ariz. Daily Star 12/5/08, http://azstarnet.com/news/local/govt-and-politics/article_863a17f7-d423-5c9e-ba84-78ec09a8e662.html, citing Letter from Benjamin Grumbles, EPA, to John Paul Woodley, Corps (December 3, 2008)(on file with author); cf. Report, Findings and Determination of the Navigability of the Santa Cruz River from the Mexican Border to the Confluence with the Gila River (Arizona Navigable Streams Adjudication Commission, Oct. 18, 2006) (finding the Santa Cruz non-navigable at statehood). The National Association of Home Builders, Southern Arizona Home Builders Association and Home Builders Association of Central Arizona are challenging EPA's determination on the Santa Cruz River. *National Home Builders Association v. EPA*, Civ. No. 09-cv-00548-RMU (D.D.C., filed March 23, 2009). By memorandum opinion, the case was dismissed on August 18, 2010 and is on appeal.

Proposed Revision

The federal agencies have done little to correct this confusion. Almost three years into implementing the 2008 Guidance, EPA and the Corps proposed a major revision to that guidance which if finalized, will substantially change the way jurisdictional waters are delineated, particularly in Arizona. *See Proposed Clean Water Protection Guidance*, 76 Fed. Reg. 25579 (May 2, 2011) (Draft Guidance). The Draft Guidance states: "The agencies expect, based on relevant science and recent field experience, that under the understandings stated in this draft guidance, the extent of waters over which the agencies assert jurisdiction under the CWA *will increase compared to the extent of waters over which jurisdiction has been asserted under existing guidance*, though certainly not to the full extent that it was typically asserted prior to the Supreme Court decisions in *SWANCC* and *Rapanos*." Draft Guidance at p. 3 (emphasis added). Two salient provisions — the Draft Guidance's expanded approach to "similarly situated" waters and its novel approach to "interstate waters" show just how much jurisdiction could expand under the Draft Guidance if finalized. [Also discussed in the May 2011 edition of *The Water Report* (see Glick, *TWR*#87.]

"Similarly Situated" Waters

The single greatest change in the Draft Guidance over the 2008 Guidance is its approach to "similarly situated" waters. Justice Kennedy, in his concurring opinion in *Rapanos*, stated: "[W]etlands possess the requisite nexus, and thus come within the statutory phrase 'navigable waters,' if the wetlands, *either alone or in combination with similarly situated lands in the region*, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.' When, in contrast, wetlands' effects on water quality are speculative or insubstantial, they fall outside the zone fairly encompassed by the statutory term 'navigable waters.'" *Rapanos, supra,* 547 U.S. at 780, 126 S.Ct. at 2248. The 2008 Guidance chose to aggregate all wetlands along the same "relevant reach" of a tributary, but not to aggregate tributaries or all wetlands within a particular watershed. 2008 Guidance at p. 10.

Tributaries Aggregation

The Draft Guidance takes a substantially different approach. Here, similarly situated waters include those of the same regulatory or resource type (*e.g.,* tributaries). The "region" is the geographic area that drains through a single point of entry to the nearest downstream TNW or interstate water. The Draft Guidance states that the agencies "have an obligation to evaluate waters in terms of how they interrelate and function as ecosystems rather than as individual units." Draft Guidance at p. 10. In Arizona, where we have very large water bodies that do not qualify as TNWs (e.g., the Hassayampa River), the aggregation of all tributaries above the mouth of such a waterbody means that all of those tributaries, regardless of size or distance from the TNW are likely to be considered to have a significant nexus.

Pollutant Transport (Nexus)

The Draft Guidance comes close to saying that all tributaries are jurisdictional because they are collectively presumed to have a nexus: "If it can be demonstrated that the tributary has a bed and bank, and an OHWM [**o**rdinary **h**igh **w**ater **m**ark], and is part of a tributary system to a traditional navigable water or an interstate water, and, therefore, can transport pollutants, flood waters or other materials to a traditional navigable water or interstate water, then the agencies would generally expect that the tributary, along with the other tributaries in the watershed (the 'similarly situated' waters), can be demonstrated to have a significant nexus with the downstream traditional navigable water or interstate water. This expectation is based on the significant harm that pollutants can have on the physical, chemical, or biological integrity of the downstream traditional navigable water or interstate water. The presence of a bed and bank and an OHWM are physical indicators of flow and it is likely that flows through all of the tributaries collectively in a watershed with the above characteristics are sufficient to transport pollutants, or other materials downstream to the traditional navigable water or interstate water in amounts that would significantly affect its chemical, physical or biological integrity." *Id.* at p. 13-14. The agencies also note that: "Within a single point of entry watershed, over a period of time there will probably be multiple jurisdictional determinations. While field staff will have to make case-specific determinations, they may use information used in previous determinations, and the agencies would generally expect that if a significant nexus has been established for one water in the watershed, then other similarly situated waters in the watershed would also be found to have a significant nexus, because under Justice Kennedy's test, similarly situated waters in the region should be evaluated together." *Id.* at p. 9.

Nexus Established

Water & Development

Robert Anderson chairs the Natural Resources and Endangered Species Practice Group at Fennemore Craig, PC. He practices in the areas of environmental, natural resources and water law, focusing on water resources, water quality (including storm water and wetlands), and endangered species. He advises clients on environmental and water issues, including permitting and compliance issues associated with mining and industrial concerns, renewable energy projects, master planned communities, residential developments, and other natural resources concerns. He authored the chapter on endangered species for the Arizona Environmental Law Manual and is listed in Best Lawyers in America ®, Environmental Law as well as Chambers USA, Leading Lawyers for Business.

Another significant change the Draft Guidance makes — and one that represents a huge potential increase in jurisdiction — is the treatment of interstate waters. First, the Draft Guidance provides that all interstate waters ("streams crossing state boundaries") are automatically jurisdictional, with no analysis of their relationship to TNWs, and are jurisdictional "upstream and downstream of such boundary for the entire length that the water is of the same stream order." Draft Guidance at p. 7. The treatment of interstate waters in the Draft Guidance stems from the fact that the EPA and Corps' definition of "Waters of the US" includes interstate waters as a category of regulated waters and this provision has never been subject to Supreme Court scrutiny or serious challenge. *See*, *e.g.*, 33 C.F.R. § 328.3(a)(2); 40 C.F.R. § 230.3(s)(2). There is in fact very little law on the status of these waters as a separate class. This is a substantive addition to past guidance, which was largely silent on the status of interstate waters.

Where the agencies make a huge leap with little (if any) judicial support is to extend jurisdiction to *tributaries* of interstate waters based on a significant nexus. Draft Guidance at p. 7. The significant nexus standard was of course enunciated in both *SWANCC* and *Rapanos* (Kennedy) but only as to the relationship to TNWs. Under the Draft Guidance, a stream is considered tributary to an interstate water if it flows directly or indirectly (i.e., via other tributaries) into the reach determined to be an interstate water — and if it thereby qualifies as a tributary to an interstate water, it is jurisdictional (i.e. subject to the CWA) as long as it has a significant nexus to the interstate water. This broad interpretation of significant nexus means that essentially any tributary of any water that crosses a state line is jurisdictional.

The Draft Guidance is, of course, just a draft at this point. However, its ultimate adoption and application (assuming courts agree with the agencies) will essentially turn the jurisdictional clock back to the pre-*Rapanos* days, at least with regard to ephemeral tributaries.

CONCLUSION

These are just a few examples of what is happening in the regulatory world while the real estate industry has been "slumbering." The requirements for developing property have not eased to reflect the drop in development pressure. If anything, they have increased. Anyone involved with a new development project should not be surprised if you suddenly find that things have changed. They have.

For Additional Information:
Robert Anderson, Fennemore Craig, 602/ 916-5455 or RANDERSO@FCLAW.com

An earlier version of this article appeared in the Spring 2011 edition of the Arizona State Bar's Real Property Journal and this updated version is printed with the kind permission of the Journal.

Sardis Lake Litigation

Stream Adjudication

Present & Future Use

Transbasin Export

WATER RIGHTS & REGULATORY AUTHORITY ISSUES

CHICKASAW AND CHOCTAW NATIONS FILE LAWSUIT OPPOSING WATER TRANSFER

by David Moon, Editor

The controversy over the use of water from Sardis Lake has resulted in federal litigation. The Chickasaw Nation and Choctaw Nation of Oklahoma (Nations) filed a Complaint in federal district court on August 18th seeking to prevent the State of Oklahoma from approving any export of water from the "Treaty Territory" — at least until a general stream adjudication under the federal McCarran Amendment to determine tribal water rights has taken place. The impetus for the lawsuit was the proposed transfer of water from the Oklahoma Water Resources Board to Oklahoma City from Sardis Lake. For more details regarding the background and Sardis Lake issues, see Moon, *TWR* #79 and #80; and Greetham, *TWR* #82.

The Nations believe that the lawsuit is necessary to protect water rights guaranteed to them by the Treaty of Dancing Rabbit Creek, Act of Sept. 30, 1830, 7 Stat. 333 (1830 Treaty). The suit names the Governor, the Oklahoma Water Resources Board (OWRB) and its Executive Director J.D. Strong, Oklahoma City, and the Oklahoma City Water Utility Trust. *Chickasaw Nation and Choctaw Nation v. Mary Fallin, et al*., Case No. CIV-11-927-C (August 18, 2011).

The Nations are seeking "declaratory and injunctive relief to protect their federal rights — including their present and future use water rights, regulatory authority over water resources, and [the] right to be immune from state law and jurisdiction." Complaint, pp.1-2. The Nations assert that their rights under the 1830 Treaty, and the 1866 Treaty of Washington, Act of Apr. 28, 1866, 14 Stat. 769 (Treaty Territory), are "prior and paramount to any water rights or regulatory authority claimed by the Defendants and are protected by the disclaimer of authority over Indian rights and property on which Congress conditioned Oklahoma's statehood in the Oklahoma Enabling Act, Act of June 16, 1906, 34 Stat. 267 ('Oklahoma disclaimer') as well as other controlling federal law." *Id.* at 2. The relief is sought to bar "unilateral state-law action in furtherance of any transbasin export of our waters." Letter of Bill Anoatubby (Governor of the Chickasaw Nation) and Gregory Pyle (Chief of the Choctaw Nation) to Gov. Fallin (August 18, 2011).

Sardis Lake Litigation

Homeland Purpose

Instream Flows

McCarran Amendment

Oklahoma Disclaimer

Fee Simple Title

Water Rights Unajudicated

Regulatory Authority

Trust & Transfers

Nations' Water Claims: Homeland Purposes and "Fee Simple" Title

The Complaint set forth a general statement of the Nations' water claims: "The Plaintiff Nations depend on the Treaty Territory's water resources to fulfill the homeland purposes of their Treaties, which purposes include providing an environment with clean and healthy rivers and stream, abundant upland and aquatic resources, pursuing economic development and self-sufficiency, and meeting the present and future needs of communities throughout their homeland." The Complaint stated that the water resources "subject to the Plaintiff Nations' water rights" — including water stored in Sardis Reservoir and Atoka Lake, as well as the free flowing waters of the Kiamichi Basin and other river systems located within the Treaty Territory — "are critical to the maintenance of the instream flows on which the environment, habitats, and communities of the Treaty Territory rely, and are a key element of the local economy." *Id*. at 2-3.

The Nations' legal position rests primarily on their assertion of federal rights derived from related Treaties with the US (including their right to be free from the exercise of state jurisdiction), the Oklahoma disclaimer, and the McCarran Amendment, 43 U.S.C. §666 (1952). "The McCarran Amendment provides the only means authorized by Congress for any state to adjudicate tribal federal law water rights. State administrative proceedings on permit applications for single users, such as that initiated by the Water Trust for Kiamichi Basin waters, are contrary to the purposes and objectives of the McCarran Amendment." *Id*. at 5.

The McCarran Amendment provides a limited waiver of federal sovereign immunity for purposes of bringing federal water rights into a comprehensive, general stream adjudication in which the rights of all competing claimants are determined (adjudicated) by a state court. The waiver does not subject the US or other federal interests to private lawsuits to decide priorities between the US and a particular claimant. *Dugan v. Rank*, 372 U.S. 609, 618-619 (1963). The Supreme Court in *United States v. District Court in and for Eagle County*, 401 U.S. 520 (1971), held that the waiver of sovereign immunity under the McCarran Amendment includes a waiver for the adjudication of federal "reserved water rights," including water rights held for national parks, national forests, and other federally reserved lands. The Supreme Court later ruled that Indian reserved rights (rights reserved to fulfill the purposes of the reservation) were also subject to McCarran Amendment adjudications. *See Colo. River Water Conservation Dist. v. United States*, 424 U.S. 800, 809–11 (1976); *Arizona v. San Carlos Apache Tribe*, 463 U.S. 545, 564 (1983).

The Oklahoma Disclaimer refers to the Act of Congress of June 16, 1906, § 1, 34 Stat. 267, which required as a precondition to the formation of the State of Oklahoma that the residents of the state *disclaim any authority* to interfere with "the rights of person or property pertaining to the Indians" or "to limit or affect the authority of the Government of the United States to make any law or regulation respecting such Indians, their lands, property or other rights… ."

As noted above, the Nations assert that water rights were guaranteed to them by the Treaty of Dancing Rabbit Creek (1830 Treaty). One distinct trait of this Treaty, which set aside the new homeland for the Choctaw Nation, was that the grant of land specifically conveyed title to the land in "fee simple to them and their descendants" rather than simply reserving a reservation for the Nation. Later, the Chickasaw Nation was granted a "Chickasaw District" within the Choctaw Nation's grant of land and was guaranteed rights of homeland ownership and occupancy to the Chickasaw Nation "on the same terms that the Choctaws now hold it, except the right of disposing of it, (which is held in common with the Choctaws and Chickasaws)…" under the 1837 Treaty of Doaksville, Act of Jan. 17, 1837, 11 Stat. 537, art. 1. This "fee simple" transfer stands in stark contrast to the usual situation for Indian tribes in the West, where reservation lands were not transferred by fee simple title and water right claims are based on fulfilling the purpose of the reservation. The 36-page Complaint contains a comprehensive history of the Nations and the state of Oklahoma relevant to the issues of the case.

The "waters of the Treaty Territory" as set forth in the Complaint are vast and include multiple storage facilities (both federal and private). The McCarran Amendment comes into play because "[N]either the waters stored in the three federal and one non-federal facilities specifically referenced above, nor the vast majority of the other surface and groundwater resources of the Treaty Territory, stored or free flowing, have been adjudicated or otherwise allocated." *Id*. at 15-16.

Based on the 1830 Treaty, the Nations are also asserting that their "sovereign estate also includes the stream beds and banks within their treaty territory. *Choctaw Nation*, 397 U.S. at 634-35; see also *Brewer-Elliott Oil & Gas Co. v. United States*, 260 U.S. 77, 82-83 (1922); *compare Montana v. United States*, 450 U.S. 544, 555 n.5 (1981) (emphasizing unique status of the American Indian tribal nations of Indian Territory in this regard)." The Complaint then asserts that such ownership "includes the power to regulate the use of those waters" and that "those rights were granted to the Plaintiff Nations before Oklahoma became a State… ." *Id*. at 17.

Trust Property and Transfer of Tribal Property

Federal jurisdiction of the case is asserted in part under the Act of Congress of April 26, 1906, § 27, 34 Stat. 137, 148, (Act of 1906), which provides that the Nations' property "shall be held in trust by the United States for the use and benefit of the Indians respectively comprising each of the said tribes… ."

Another important issue in the case revolves around the Indian Non-Intercourse Act, 25 U.S.C. § 177. That Act precludes any transfer, alienation, or sale of tribal property without express federal authorization.

Sardis Lake Litigation

Water Rights Retained

State Authority

State v. Federal Authority

Unilateral Action Preempted

Water as Commodity

Unique Water Rights

The Nations noted in the Complaint that the Act of 1906 allotted the Nations' lands to individuals (tribal and non-tribal alike), resulting in much of their sovereign estate being lost. However, the Nations assert that "Congress made no provision for allotment to diminish the Nation's water rights held by virtue of their treaties and the Removal-era homeland-for-homeland transaction among the federal and tribal sovereigns. Instead, those interests not alienated under the 1906 Act were retained by the United States in trust for the Plaintiff Nations' benefit. *See id.* § 27; *accord* 25 U.S.C. § 1779(7); *Choctaw Nation*, 397 U.S. at 627."

The Nations have also asserted jurisdiction is proper in federal court "because the Plaintiff Nations' claims also arise under federal common law, which denies Oklahoma any civil-adjudicatory and/or civil-regulatory jurisdiction over matters arising in Indian country or otherwise against or affecting the sovereign interests of federally recognized Indian tribes or their property except and only insofar as expressly authorized by federal statute." *Id.* at 8.

Plenary Jurisdiction and Authority of the State Versus Federal Authority

The Nations are concerned with assertions by officials representing the State of Oklahoma that the State has "unilateral authority to control the withdraw and export of water from the Treaty Territory pursuant to permits issued in state administrative proceedings as well as the right to sell that water outside the Treaty Territory and even, with State legislative approval, out-of-state. Defendants' actions demonstrate their flawed conclusion that they have complete license to execute each element of this plan unconstrained by the Plaintiff Nations' Treaty-protected rights to and regulatory authority over Treaty Territory water resources." *Id.* at 3-4. The Nations assert that this reliance on state-based authority is invalid and contrary to federal law. This clash of state versus federal authority looms large as the case progresses.

The Nations asserted that their rights to "Treaty Territory water resources" and regulatory authority over those resources is "prior and paramount to any water rights claimed by or derived from the Defendants in the Treaty Territory under state law" and that federal law preempts interference with the Nations' rights. "Accordingly, the Defendants cannot simply disregard the existence of those rights as they act in furtherance of their own assertion of dominion and control so that such resources might be severed and exported from their natural hydrologic systems and Plaintiff Nations' Treaty Territory…If the Defendants succeed in unilaterally selling Treaty Territory water resources, the Plaintiff Nations' ability to protect and enforce their water rights would be severely prejudiced." *Id.* at 4. The argument against "piecemeal diminishment" of the Nations' water rights through state administrative proceedings on permit applications is based on the limitations imposed by the McCarran Amendment and a further assertion that to participate in such state proceedings, the "Nations would have to relinquish their Treaty right to be free from the application of state jurisdiction and waive their sovereign immunity. Any process that requires an Indian tribe to relinquish one treaty right in order to protect others is unjust and violates federal law." *Id.* at 5.

The essence of the case is best summed up by the Complaint's view of the Defendant's plan. "Since the Defendants do not, in fact, possess such unilateral authority, they may not use the Plaintiff Nations' Treaty Territory as a 'water farm' and convert tribal water resources into a commodity controlled by them, as is their manifest plan. Such actions violate federal law by seeking the unlawful withdrawal, export, and sale of Treaty Territory water resources at such time, under such conditions, in such amounts, and to such persons or entities (including those out-of-state) as the Defendants unilaterally determine to allow. Such unilateral action by the Defendants violates and is preempted by federal law." *Id.* at 24.

Conclusion: Government to Government Talks Versus Litigation

In a letter to the Attorney General of Oklahoma, E. Scott Pruit, on August 18th, one of the Nations' attorneys, Michael Burrage, began the letter by noting that the "Chickasaw and Choctaw Nations have for years pressed for government-to-government talks with Oklahoma's state government leaders on critical issues relating to the ownership and control of water resources…Unfortunately, the State has never meaningfully responded to the Nations' outreach or otherwise offered real engagement." Burrage also asserted that the State is committed to "a view of water resources as a simple commodity that can be summarily exported from one economy, environment, and culture to another without regard for the attendant local consequences." Burrage expressed frustration with Oklahoma City's government, asserting that their "parochial and aggressive actions have triggered substantial interregional conflict" and that it has "expressly rejected tribal and regional interests in favor of affirming its narrow determination to seek *state*-law control over tribal water resources." (emphasis in original).

At this point, the parties are headed into long, contentious, and undoubtedly expensive litigation. This article has briefly laid out some of the myriad of issues that arise from the Complaint. It is particularly impossible to predict how the courts will ultimately rule on the issues, since the Nations are asserting Treaty water rights that are unlike federal reserved rights for Indian tribes that have previously been adjudicated in the western United States.

For info: Complaint & related documents at: www.choctawnation.com/news-room/water-policy/ Stephen Greetham, Chickasaw Nation's Counsel, 580/ 272-5236 or Stephen.Greetham@chickasaw.net; Tribal Water Issues & Recommendations (OWRB) available at: www.owrb.ok.gov/supply/ocwp/ocwp.php

WATER BRIEFS

BASIN OF ORIGIN **CA**

FEDERAL JUDGE DENIES CLAIM

On July 29, Judge Oliver Wanger in an 88-page decision granted the defendants' motions for summary judgment and denied all the plaintiff's claims for relief in *Tehama-Colusa Canal Authority v. U.S. Dept. of the Interior, et al*, No. 1:10-cv-0712 OWW DLB, (E.D. Cal. Jul. 29, 2011). The Tehama-Colusa Canal Authority's (Authority) "Basin of Origin" lawsuit asserted that the US Bureau of Reclamation (Reclamation) was not operating the Central Valley Project (CVP) in accordance with state or federal law. In particular, the Authority (plaintiff) asserted that a California state area of origin priority statute compelled Reclamation to provide 100% of the Authority's allocated CVP contractual water supply before any water could be exported to other CVP water users south of the Sacramento-San Joaquin Delta (i.e. outside the basin of origin; *see* CWC §§11460-11465). The Authority consists of 16 water districts that deliver water to 150,000 acres of irrigated agriculture throughout four northern California counties.

Judge Wanger upheld Reclamation's implementation of the shortage provisions of federal water service contracts under the federal Administrative Procedure Act (APA), 5 U.S.C. §§ 706(1) and 706(2) and rejected preferential treatment for the Authority. Under those provisions — which the Judge referred to as "unambiguous contract terms" — all the water users with non-priority CVP water service contracts are subject to a pro rata reduced allocation of water during Conditions of Shortage. *Id.* at 88. The Judge's decision was based on the finding that in contrast to the state statute, when the "parochial state CVP became a federally authorized and funded project…Congress unequivocally expressed its intent that it created the CVP to benefit all the people of the Central Valley, Federal Act of 1950, § 4 (compelling coordinated operation of CVP 'as will effectuate the fullest economic utilization of land and water resources of the Central Valley of California for the widest possible public benefit')." The Judge concluded that the "ratable reduced allocation of CVP water among all non-priority CVP water service contracts during Conditions of Shortage achieves the widest possible public benefit intended by the CVP authorizing legislation." *Id.* at 87.

The Judge's findings also address: statutory interpretation; federal contract law; validation judgments for contracts; and "equitable estoppel" — among other issues.

For info: Decision available at: www.courthousenews.com/2011/08/09/wetlands.pdf

CWA SECTION 404 **US**

ASSUMPTION HANDBOOK

In August, the Association of State Wetland Managers, Inc. (ASWM) and the Environmental Council of the States (ECOS) released a new *Clean Water Act Program Assumption Handbook for States and Tribes*. In 2010, ASWM and ECOS convened a national workgroup to facilitate state and tribal "assumption" of the Section 404 Program. This handbook is a product of that workgroup. It is intended to provide concise information to states and tribes interested in 404 program assumption about how a state or tribal 404 program operates, the basic legal requirements for program assumption, and the process of applying, including submitting a complete application to EPA for program approval.

Section 404 of the federal Clean Water Act defines a permitting program for dredge and fill activities in wetlands and other waters of the US. Section 404 also allows a state or tribe to administer its own permit program to regulate these activities in lieu of the federal program for most nontidal waters, given approval from the EPA.

For info: Handbook available at: http://aswm.org/pdf_lib/cwa_section_404_program_assumption.pdf

DRAWDOWN UPHELD **WA**

RECLAMATION PROJECT APPROVED

On August 19, the Ninth Circuit Court of Appeals (Court) held that Reclamation had taken a "hard look" and "genuinely scrutinized the environmental consequences of its proposed action" as required under the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.* The Court decided that "its own close look at the record persuades us that Reclamation was keenly aware of, and appropriately discharged, this duty when it prepared the drawdown project analysis." *Center for Environmental Law and Policy, et al. v. United States Bureau of Reclamation*, Case No. 1035646 (August 19, 2011), Opinion at 11128.

The proposed project involves a drawdown of Washington's Lake Roosevelt of up to 82,500 acre-feet annually for irrigation in the Odessa Subarea, industries and cities water needs, and to augment instream flows for fishery purposes. Lake Roosevelt, formed by Grand Coulee Dam, serves a variety of purposes, including irrigation, navigation, flood control, power generation, recreation, and fish management. "Lake Roosevelt is operated by Reclamation and other federal agencies in cooperation with state agencies…The lake typically holds about 5 million acre-feet of water. Water levels in the lake are, however, routinely lowered twice a year — once in early spring for flood control, and again in summer to increase downstream flow in the Columbia River. Water levels also fluctuate on a daily basis as a result of power generating operations at the Grand Coulee Dam. In addition, the government diverts 2.65 million acre-feet of water from Lake Roosevelt every year to irrigate farmland in Washington state." *Id.*

Reclamation eventually applied to Washington's Department of Ecology (Ecology) for two secondary use water permits to allow it to withdraw water from Lake Roosevelt and Ecology issued the permits on December 1, 2008. Reclamation issued a final Environmental Assessment (EA) analyzing the drawdown project in June 2009 and also issued a Finding of No Significant Impact (FONSI) memorializing its finding that "implementation of [the drawdown project] and associated environmental commitments would have no significant impact on the quality of the human environment or the natural resources in the affected area." The Center for Environmental Law and Policy and other groups (collectively "CELP") challenged Reclamations timeliness preparing the EA and also the adequacy with respect to cumulative effects, indirect effects, and reasonable alternatives.

The Court noted that judicial review of agency decisions under NEPA is governed by Section 706 of the APA, and thus, the agency's action will be upheld unless it is "arbitrary, capricious, an abuse of discretion, or otherwise

WATER BRIEFS

not in accordance with law." (quoting 5 U.S.C. § 706(2)(A)). The Court also referred to the standard that it must defer to any agency decision that is fully informed and well-considered, "but we will not overlook 'a clear error of judgment;" *Id.* at 11131.

The Court observed that "CELP's most significant challenge on appeal is to the cumulative effects analysis in the EA." Although the Court did agree with CELP that the "portion of the EA exclusively devoted to cumulative effects is conclusory and unenlightening" it went on to note that "reading the EA as a whole reveals that Reclamation understood and accounted for the cumulative effects of past projects." The Court also pointed out that "although Reclamation took several steps toward implementing the drawdown project before drafting the EA, it scrupulously adhered to NEPA's timing requirements." *Id.* Ultimately, the Court held that Reclamation's actions did not violate NEPA under the "arbitrary and capricious" standard noted above.

For info: Decision at: www.ca9.uscourts.gov/opinions/

ESA HABITAT SW

FLYCATCHER CRITICAL HABITAT

On August 12, the US Fish & Wildlife Service (USFWS) proposed 2,090 stream miles as protected critical habitat for the endangered southwestern willow flycatcher. If finalized, the proposal would substantially increase protection for the neotropical songbird over a previous designation of 730 stream miles in 2005 that was challenged by the Center for Biological Diversity. The critical habitat is being revised following a settlement agreement stemming from the legal challenges to the 2005 designation.

USFWS is still considering excluding 779 stream miles it says are "already being managed to accommodate or advance flycatcher recovery through Habitat Conservation Plans, tribal management, and other partnerships." USFWS is seeking input on the proposal through October 14, 2011. USFWS is also preparing a draft economic analysis and environmental assessment of the proposed critical habitat that will be released for public review at a later date.

The proposed designation includes numerous important and well-known rivers, including the San Gabriel, Ventura, San Diego, Virgin, Colorado, Little Colorado, Gila, Rio Grande, and San Pedro. The flycatcher was listed as an endangered species in 1995. According to a 2007 survey, there are roughly 1,299 territories spread across the species range with substantial populations on the upper Gila River and middle Rio Grande in New Mexico, Roosevelt Lake and the lower San Pedro in Arizona and numerous scattered locations in California.

For info: Jeff Humphrey, USFWS, 602-242-0210 x222; USFWS website: www.fws.gov/southwest/es/arizona/southwes.htm

SUCTION DREDGE MINING CA

MORATORIUM EXTENDED TO 2016

In July, California Governor Jerry Brown signed AB 120, which extends the current moratorium on suction dredge mining until June 30, 2016 or until the State adopts new rules that fully mitigate all significant impacts caused by mining and pays for the program. Suction dredge mining involves gas-powered pumps floating on rivers that suck water and gravel through a hose to mine for gold. California law requires that new mining regulations mitigate all significant impacts on water quality, wildlife, and cultural/historical resources. It also establishes a fee structure so that taxpayers won't have to pay to administer suction dredge mining regulations after June, 2016.

For info: AB 120 at: www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0101-0150/ab_120_bill_20110726_chaptered.pdf

MUNICIPAL WATER RIGHTS MT

HISTORIC USE V. GROWING CITIES

On August 17, a Montana district court (court) ruled against the Town of Manhattan (Town) in its lawsuit against the Montana Department of Natural Resources & Conservation (DNRC). The court rejected the Town's assertion that under the "Growing Cities Doctrine" (aka Growing Communities Doctrine), the Town will inevitably grow, as will its demand for water and that "its existing pre-1973 Water Right Claims for municipal use include water for future uses." *Town of Manhattan v. DNRC*, Cause No. DV-09-872C (8/17/11), Order, p. 4.

The Town had applied to DNRC for a "Change Application" under Montana law to add additional points of diversion for wells that were being added to its water system and to expand the place of use. DNRC identified deficiencies in the Town's Application and requested "evidence of how the Town's water rights were historically used prior to July 1, 1973, pursuant to Admin. R. Mont. 36.12.1902." *Id.* at 3. Montana is currently going through a general stream adjudication in order to adjudicate all pre-1973 water rights in the state (Montana did not adopt a permit system for water rights until 1973). The Preliminary Temporary Decree in the adjudication "provides that the flow rate and volume for municipal rights were decreed for the claimed amount, not actual use, and were subject to being reduced in the final adjudication." *Id.* at 3.

DNRC argued that "the historic use requirement (including the pattern and extent of use) is consistent with the Department's authority under the Montana Water Use Act…and necessary to evaluate the mandated criteria an applicant must prove to change an existing right pursuant to § 85-2-402, MCA. The Department further contends that evidence of historic use is necessary to ensure that other water users are not adversely affected and that the Town does not expand its water right through the guise of a change (i.e., create a new water use with a senior priority date)." *Id.* at 4.

As noted by the court, "the Town contends that historic use does not apply to municipal water rights because such rights include a future use component." The Town relied on a Colorado case, *City of Denver v. Sherriff*, 105 Colo. 193, 96 P.2d 836 (1939). *Id.* at 14-15. The Montana court, however, found that it "cannot ignore the noticeable absence of a statute similar to the Colorado statute, which is central to City of Denver's conclusion permitting future use for a large municipality." *Id.* at 15-16.

The court also found persuasive various rulings from Montana's Water Court that "repeatedly concluded that Montana water law does not recognize a future use exception for municipal water rights and confirmed that beneficial use is the basis, measure and limit of a Montana water right." *Id.* at 17.

For info: Order available at: www.belgrade-news.com/pdf_9f87a0ee-ca88-11e0-8e01-001cc4c002e0.html

WATER BRIEFS

RECLAIMED WASTEWATER AZ
HOPI TRIBE SUES OVER SNOWMAKING

On August 19th, the Hopi Tribe (Tribe) filed a lawsuit against the City of Flagstaff (City) in Arizona Superior Court in Coconino County challenging the City's decision in September 2010 not to amend or cancel the contract for the sale of reclaimed wastewater to the Arizona Snowbowl ski resort (Snowbowl) for snowmaking.

The lawsuit states that the City's contract to sell 1.5 million gallons of reclaimed wastewater per day to Snowbowl is illegal because it violates several Arizona laws that govern the proper use of reclaimed wastewater. The contract provides for the use of reclaimed wastewater in a mountain setting where runoff and overspray cannot be prevented, as Arizona law requires. Additionally, restrictions on limiting human contact with wastewater cannot be met, and harm to the unique alpine environment in the area, including rare animals and plants, cannot be prevented. The Tribe also asserts that the contract is illegal under Arizona law because it will result in unreasonable environmental degradation and will further deplete limited drinking water resources. The Tribe further maintains that the reclaimed water use will infringe on the Tribe's reserved water rights.

The Tribe lost a previous lawsuit in federal court that asserted snowmaking would violate tribal religious freedoms, when the 9th Circuit Court of Appeals upheld the US Forest Service's approval of Snowbowl's plans. *See* Water Briefs, *TWR* #38, #60 and #65*;* Moon *TWR* #55.

Reclaimed wastewater is water that has been used and processed through the City's wastewater system. The City's sale of reclaimed wastewater to the Snowbowl will cover a portion of the San Francisco Peaks with artificial snow made from reclaimed wastewater. The Tribe seeks a judicial order prohibiting performance of the contract to sell reclaimed wastewater to Snowbowl.
For info: Hopi Tribe, 928/ 734-3107 or www.hopi-nsn.gov/

BAY DELTA CONSERVATION CA
ENVIRONMENTAL REVIEW SCHEDULED

In August, the US Department of the Interior (DOI), the US Department of Commerce, and the California Natural Resources Agency announced that the agencies have agreed to a schedule for completing an effects analysis and a combined environmental impact statement/environmental impact report (EIR/EIS) as part of the Bay Delta Conservation Plan (BDCP) by June 2012; and to a suite of alternatives for evaluating a proposed project.

The San Francisco Bay Delta Estuary is a large, complex estuarine ecosystem in California. It has been substantially altered by dikes, levees, channelization, pumps, human development, introduced species, dams on its tributary streams, and contaminants. The Delta supplies water from California's wetter northern regions to the drier southern regions and also serves as habitat for many species, some of which are threatened and endangered. The restoration of water exacerbated tensions over water allocation in recent years, and has led to various attempts to develop comprehensive plans to both provide reliable water supplies and to protect the ecosystem. One of these plans is the BDCP.

State and federal water officials laid out a broad range of alternatives that are being evaluated in order to enable the California Department of Water Resources to identify a proposed project that will serve as the basis for federal and state permit applications and environmental review. Those alternatives include a variety of conveyance facilities with capacities ranging from 3,000 to 15,000 cubic feet per second. A range of proposals for habitat restoration is also under consideration.

It was noted that the alternatives under consideration by the State for purposes of the BDCP effects analysis will not necessarily be the same as the alternatives considered in the EIR/EIS prepared in compliance with state and federal environmental laws.

In addition, water contractors will be considering financial commitments of varying amounts for BDCP in the coming months.

The BDCP is a conservation plan for the Sacramento-San Joaquin River Delta, and falls under the federal Endangered Species Act and California Natural Communities Conservation Planning Act. The BDCP is intended to help meet California's co-equal goals for Delta management: water supply reliability and ecosystem restoration. The public draft BDCP, while still under development, includes a set of actions to redesign and re-operate state and federal water projects in the Delta and to restore native fish, wildlife and plant habitat; and address other ecological stressors in the Delta such as invasive plant species, barriers to fish migration, and predation of native fish.

The BDCP environmental review process is being conducted by five State and federal agencies. The California Department of Water Resources is the state lead agency under CEQA, while the Bureau of Reclamation, US Fish and Wildlife Service, and the National Marine Fisheries Service are serving as the federal co-leads under NEPA.

The EIR/EIS is also being developed in close coordination with the California Department of Fish and Game, the US Environmental Protection Agency, and the US Army Corps of Engineers. These agencies will analyze BDCP proposed actions and alternatives to those actions, including alternative water conveyance options, in fulfillment of multiple state and federal permitting processes.
For info: Richard Stapler, California Natural Resources, 916/ 653-9402 or richard.stapler@resources.ca.gov

BAY DELTA CONSERVATION CA
NRC SCIENCE USE REVIEW FINAL

The National Research Council's Report, "*A Review of the Use of Science and Adaptive Management in California's Draft Bay Delta Conservation Plan*," determines that the plan is incomplete in a number of important areas and identifies key scientific and structural gaps that, if addressed, could lead to a more successful and comprehensive final BDCP. The Report finds the plan is thus far missing the type of structure usually associated with current planning methods in which the goals and objectives are specified, alternative measures for achieving the objectives are introduced and analyzed, and a course of action is identified based on analytical optimization of economic, social, and environmental factors. The Report underscores the importance of a credible and a robust BDCP in addressing the various water management problems that beset the Delta. A stronger, more complete, and more scientifically credible BDCP that effectively integrates and utilizes science could enable a range of solutions to California's chronic water problems.

The Report is available for download (PDF) or purchase online.
For info: www.nap.edu/catalog.php?record_id=13148#toc

CALENDAR

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. High Country 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 OR
Conservation Easements/Water Quality & Toxics Seminar, Sisters. Aspen Lakes Golf Course. Sponsored by Water for Life & Schroeder Law Offices. For info: Helen Moore, WFL, 503/ 375-6003 or helen.moore@waterforlife.net

September 20-22 DC
Consequences of Global Climate Change: Water Quality Impacts, Ecological Impacts & Nonlinear Responses Discussion, Washington. EPA, 1201 Constitution Avenue NW, Rm. 1153. Also on WEB; Register in Advance. For info: Michael Hiscock, hiscock.michael@epeogov or https://www3.gotomeeting.com/register/223362878

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

September 21 AZ
Riparian Preservation & Restoration Listening Session: Small-scale Projects in Tucson & Pima County (Brownbag), Tucson. Sol Resnick Conf. Rm., 350 N. Campbell Ave., 3:30-4:30pm. For info: Jane Cripps, Water Resources Research Center, 520/ 621-2526 or jcripps@cals.arizona.edu

September 22 WA
Implementing the National Flood Plain Insurance - ESA Species & Critical Habitat Dinner, Seattle. Pyramid Ale House, 1201 1st Ave. South. Sponsored by AWRA-WA Section. For info: http://earth.golder.com/waawra/ASP/Home.asp

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

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

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 CA
California Water Projects & Urban Water Supplies Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

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

September 28 WA
Risk-Screening Environmental Indicators Tool Workshop, Seattle. Sponsored by EPA & Ecology. For info: Gabriela Carvalho, EPA, 206/ 553-6698 or Carvalho.Gabriela@epa.gov

September 29 CA
Understanding the Sacramento-San Joaquin Delta: An Overview of Delta Governance & Regulation Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

September 29 WA
Risk-Screening Environmental Indicators Tool Workshop, Olympia. Sponsored by EPA & Ecology. For info: Gabriela Carvalho, EPA, 206/ 553-6698 or Carvalho.Gabriela@epa.gov

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

September 30 OR
Risk-Screening Environmental Indicators Tool Workshop, Portland. Sponsored by EPA & Ecology. For info: Gabriela Carvalho, EPA, 206/ 553-6698 or Carvalho.Gabriela@epa.gov

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 OR
GoGreen '11 Portland: Cultivating Sustainable Business Conference, Portland. Gerding Theater at the Armory, 128 NW Eleventh Ave. For info: www.portland.gogreenconference.net

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 7 OR
21st Century Water Law Conference, Portland. Lewis & Clark Law School. For info: Environmental Law Review, 503/ 768-6716, slachin@lclark.edu or http://go.lclark.edu/fall/water/law/symposium

October 12-13 NE
Water Law Conference & Symposium: Climate, Water and Ecosystems--Shaping the Great Plains, Lincoln. Downtown Holiday Inn. Sponsored by UNL Water Center: Conference on 10/12 & Symposium on 10/13. For info: Lorrie Benson, UNL Water Center, 402/ 472-3471 or

October 12-13 MT
Wetland Regulations Training: Understanding Federal, State & Local Regulations and 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 OR
OWRC Water Law Seminar, Bend. Seventh Mt. Resort. For info: Anita Winkler, Oregon Water Resources Congress, 503/363-0121 or www.owrc.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)

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 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 ID
From Vision to Reality: Enhancing the Lower Boise River Workshop, Boise. Washington Group Plaza, 720 Park Blvd.. For info: Idaho Rivers United, www.idahorivers.org

October 18 CA
Changing Our Perspective: New Ways of Thinking About the Delta Forum, Sacramento. Haggin Oaks Golf Complex. Sponsored by Sacramento-San Joaquin Delta Conservancy & Water Education Foundation. For info: WEF, 916/ 444-6240, feedback@watereducation.org or www.watereducation.org

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

October 18-19 WA
Washington Future Energy Conference, Seattle. Washington Convention Ctr. 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

October 19 WA
Source Control Seminar, Seattle. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220 or hduncan@elecenter.com

October 20 WA
Financing Renewable Energy Seminar, Seattle. Washington Convention Ctr. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

October 21 OR
Smart Grid: Today's Regulation & Tomorrow's Technology Conference, Portland. U of O White Stag Block, 70 NW Couch. For info: http://cubpolicycenter.org/smartgrid

October 22-29 CO
Interdisciplinary Climate Change Research Symposium: DISCCRS VI, Colorado Springs. La Foret Conference Ctr. For info: http://disccrs.org/disccrsposter.pdf

October 24-25 OK
2011 Water Conference: Integrating Technology, Social Entrepreneurship & Behavior Change, Norman. Sponsored by UO OUTREACH. For info: http://conferenceservices.ou.edu/Waterconference_2011/

October 25 CA
California Water Storage Workshop 2, Sacramento. Cal-EPA Bldg., 1001 I Street. Sponsored by California Water Commission. For info: www.cwc.ca.gov/

October 25 OR
Conservation Easements/Water Quality & Toxics Seminar, Burns. Harney Co. Community Ctr. Sponsored by Water for Life & Schroeder Law Offices. For info: Helen Moore, WFL, 503/ 375-6003 or helen.moore@waterforlife.net

October 25-27 BC
2011 Salish Sea Ecosystem Conference, Vancouver. Sheraton Wall Centre. Co-hosted by Environment Canada & Puget Sound Partnership. For info: www.salishseaconference.org/

October 27-28 UT
Utah Water Law Conference, Salt Lake City. Hotel Monaco. For info: CLE International, 800/ 873-7130 or website: www.cle.com

October 27-28 NV
Tribal Water Law Seminar, Las Vegas. Aria Resort & Casino. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

October 28 CA
Water Planning for Commercial, Residential & Industrial Development: Creating Defensible Water Supply Seminar, Santa Monica. Sheraton Delfina. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

October 31 CO
Upper Colorado River Basin Water Forum, Grand Junction. Colorado Mesa University. For info: Hannah Holm, 970/ 683-1133, hholm@mesastate.edu or www.mesastate.edu/WaterCenter