

## Water Rights, Water Quality & Water Solutions 💋 in the West

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## AQUIFER STORAGE & RECOVERY



NEW FEDERAL INITIATIVES - EPA TO DEVELOP GUIDANCE

by Dr. Cat Shrier, Watercat Consulting LLC (Washington, DC)

## INTRODUCTION

The US Environmental Protection Agency (EPA) will be developing guidance for the application of underground injection control (UIC) regulations for aquifer storage and recovery (ASR) systems using injection wells. EPA's plans were announced by Ann Codrington, Prevention Branch Chief in the Drinking Water Protection Division, Office of Ground Water and Drinking Water at EPA headquarters in Washington, DC, during a January 26, 2010, meeting of state UIC permitting agencies. EPA development of this guidance was recommended at a May 2009 national ASR "Experts Meeting" — as previously reported by your author (see Shrier, *TWR* #64).

ASR replenishes the water in an aquifer. While **a**quifer **re**charge (AR) is typically used only to increase the water supply in an aquifer, ASR serves two purposes: 1) storing water in the ground; and 2) recovering the stored water for use. ASR wells have been used primarily for drinking water supplies, though also for other uses including irrigation and ecosystem restoration projects.

EPA's initial UIC program was primarily focused on protecting groundwater from the underground disposal of wastes, as opposed to regulating the underground storage of water that typically meets water quality standards. UIC permitting staff have, at times, viewed ASR as a source of pollution — for instance where leaching of metals had occurred or the presence of chlorine byproducts had increased.

Until recently, EPA headquarters largely remained silent on questions regarding ASR — treating ASR systems as "experimental" and of limited application. As reflected in its commitment to developing guidance, however, EPA has now recognized ASR as a management approach that is becoming mainstream and national in scope.

In order for ASR to be more fully and safely utilized as part of a sustainable water strategy, clear procedures for permitting are needed. EPA's steps towards improved clarity on the application of the UIC regulations may help to provide that clarity. Unfortunately, EPA currently does not have the resources to dedicate to a full review of ASR practices and comprehensive development of guidance. Other federal and state activities, both past and present (see below), may help with this effort. Some agencies have considerable experience with appropriate monitoring and management measures as well as "best permitting practices." They have developed a range of proven practices that ensure the protection of underground sources of drinking water under a range of ASR operating conditions.

Determining guidance that reflects the best current water management and permitting practices will require input from state agency and EPA regional personnel with experience developing and implementing permits for ASR sites, as well as input from other state and federal agencies involved in water management. While there is currently no



has been one national ASR survey commissioned by the American Water Works Association (Shrier 2002) as well as several reviews of ASR usage by various ASR consulting practices and at least one text book (e.g. Pyne 2009). A review of these surveys of ASR usage suggests that, while the total amount of water stored in ASR systems may not be large, there are a significant number of municipal water suppliers throughout the United States who are using ASR as a strategic part of their water supply portfolios. ASR has been used extensively throughout the United States, particularly in the West, where 13 of the 17 contiguous western states have operational ASR facilities, with new facilities under development in Wyoming and New Mexico (see Figure 1). In several major population centers throughout the country, at least a portion of the water supply is provided by water that has been stored in an aquifer, whether on a seasonal basis or as "drought protection." ASR systems may be created to serve portions of municipal service areas where surface water supplies may not be available, as is the case in Phoenix, Arizona, and Colorado Springs, Colorado. ASR systems are also being operated to serve multiple purposes, not only serving as water supplies but also to maintain groundwater levels, prevent salt water intrusion, or provide protection from contaminant plumes. Thus, use of ASR is often an important conjunctive water management tool for sustainable water supplies.

## SAFE DRINKING WATER & ASR

## Endangerment

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The Safe Drinking Water Act (SDWA) was enacted by Congress in 1974, and amended in 1986 and 1996, as a law to protect sources of drinking water, including both surface and groundwater. EPA was required under the SDWA to develop minimum federal requirements to prevent contamination of underground sources of drinking water (USDWs) from injection wells. USDWs are regulated either by EPA or those States or Tribes that have been awarded primary enforcement responsibility ("primacy") within their jurisdictions. Regulation by states operating under primacy agreements must be at least as stringent as federal regulation, and can be more stringent. Congress provided the framework for protecting drinking water sources in the SDWA and EPA promulgates the pertinent federal rules. In many cases, EPA has delegated authority to manage the UIC Program to states. These "primacy states" may implement the UIC Program so long as they meet applicable federal requirements as overseen by EPA.

As concerns ASRs, substantial legal issues arise from the SDWA's definition of the "endangerment" of public water supply and public health. A strict interpretation may appear to preclude certain preferred water management options. Changing the law would require Congressional action (considered unlikely) and changing the regulations would require EPA rulemaking (difficult but perhaps more feasible). THE LAW AND REGULATION DEFINING ENDANGERMENT:

- THE LAW: Section (§) 1421(d)(2) of the SDWA defines the term endangerment as follows: "Underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such comtaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons."
- THE REGULATION: Developed to implement the requirements to protect USDWs (Part C of the SDWA), the UIC regulations specify the statutory requirements further and read, at 40 Code of Federal Regulations § 144.12(a), as follows: "No owner or operator shall construct, operate, maintain, convert, plus, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons."

ASR injection wells are classified as "Class V" wells, which are defined by the types of fluids they do not receive, such as: industrial or hazardous waste disposal fluids (which are received by Class I wells and Class IV wells, the latter of which are now banned); oil and gas production fluids (received by Class II wells); or solution mining fluids (received by Class III wells). (NOTE: Class I, II, and III wells only inject wastes into deep aquifers "beneath the lowermost USDW.") EPA's UIC program completed a study (1999) on Class V wells and came up with 22 different categories of Class V wells, including ASR and artificial recharge wells.

	Class V wells are "authorized by rule" under EPA's UIC regulations and primacy regulations. As
ASR	such, an operator potentially need not apply for a permit, so long as: 1) the owner or operator submits
	inventory information to the regulatory agency; and 2) the injection activity does not allow movement
Permit Need	of fluid containing any contaminant which might cause a violation of primary drinking water standards
	endangerment however the UIC regulating agency is authorized to ask for additional information or take
	additional SDWA-authorized actions — including requiring a permit.
	As stated in SDWA § 144.82(A)(2):
	"If the Director of the UIC Program in your State or EPA Region learns that your injection activity
	may endanger USDWs, he or she may require you to close your well, require you to get a permit, or
	require other actions listed in 144(c), (d), or (e). Sections 144.12(d) and (e) authorize additional actions if the Class V well is otherwise adversely affecting the health of persons or if there is an imminent or
	substantial endangerment to the health of persons."
	ASR injection wells are "not prohibited" if the injection activity does not cause "endangerment." Most
Point of	ASR injection wells receive treated, potable water that meets National Primary Drinking Water regulations
Injection	at the point of injection. During the 1999 Class V study, EPA found no reported cases of contamination
mjection	from ASR injection activities, although beneficial changes to the receiving aquifer were noted, including
	FPA has also noted endangerment issues such as dissolution of metals (including arsenic, manganese
Endangerment	and iron) reported on the East Coast and in the Midwest, and potential issues regarding radionuclides and
Issues	disinfection by-products.
	As noted, both EPA and UIC primacy states have the authority to require the owner or operator of a
	Class V well to apply for and obtain an individual or area UIC permit if they deem it advisable in order to
	protect USD ws. (40 CFR $\S$ 144.25(a)(5)). In any event, owners and operators of Class V were must sublim the appropriate inventory information within a specified timeline to the state or federal administering
	agency. (40 CFR §144.26).
	ASR REGULATION: AN OVERVIEW
	STATE-TO-STATE DIFFERENCES & OTHER CURRENT ISSUES
Program	of an "apples-to-apples" comparison of state and EPA regional UIC permitting for ASR throughout
Comparison	the country. It was thought that more information was needed on specific issues such as: constituent
*	mobilization (e.g. metals leaching); point of compliance; pilot testing requirements; and the regulation of
	water quality standards exceedences. A survey matching this description has recently been completed and
	a summary of survey findings follows this article. The survey was completed by Colorado School of Mines
	when combined with analysis and input by persons knowledgeable of ASR permitting practices and ASR
	use as part of sustainable water management, will be a valuable input for the development of guidance by
	EPA headquarters.
	The survey documents some of the variability in the methods of application of UIC to ASR in different
State-to-State	states. This variability has occurred, in part, due to separate primacy states developing separate programs.
Variability	staff often with little involvement by EPA headquarters. In some states without primacy there are
vallability	strong state groundwater protection regulatory programs working in conjunction with formal or informal
	cooperative agreements between the state agency and EPA regional office (e.g., Arizona or California). In
	such cases, state or regional agencies may perform most of the actual review and oversight of groundwater
	protection monitoring and management measures for ASR facilities.
"Primacy"	Primacy has been beneficial for safe use of ASR in many cases, in that it enables state groundwater protection agencies to apply local knowledge of both geology and pertinent regulations (e.g. water right and
Benefits	state-specific groundwater recharge or aquifer storage regulations) in the development of ASR programs.
&	In some cases, however, the lack of clarity regarding the application of UIC regulations to ASR has created
Complications	delays in permitting. Some UIC permitting programs permit projects in a manner that characterizes
	recharged water as "effluent discharge" or disposal of a pollutant, rather than as a form of drinking water
	storage. Such situations can create a high level of uncertainty for permit applicants, sometimes resulting
	In the familie of a project that is simply due to a lack of funds to cover an extended permitting process.
	permitting process, for the Roseville site near Sacramento, where disinfection byproducts were detected in
	pilot testing.

ASR	As noted, states with primacy a is at least as stringent as EPA standa drinking water standard compliance	uthority are required to implement UIC permitting in a manner that ards. A strict interpretation of UIC's application to ASR may require at all times and at all places. This may include compliance at the
Point of Compliance	wellhead rather than at the edge of a of water quality is allowed to occur managers to take advantage of wate — such as attenuation of microconta of disinfection byproducts due to m	a "zone of attenuation" — i.e. a discrete area in which the equilibration over time. Disallowing such zones negates the opportunity for water r quality improvements that can occur during subsurface storage aminants in reclaimed water ASR systems (Carrollo 2005), or removal icobiota activity within the aquifer (CSIRO 2006).
Exceedence Response	exceedences. In some cases, primac specific to ASR. In other cases, par Florida and Wisconsin), state agence clarification on whether UIC progra for exceedences to occur during pilo in a fashion that ensures that contan	cy states have developed their own groundwater protection regulations ticularly in states that have faced arsenic mobilization issues (e.g. ies and EPA regional offices have pressed EPA headquarters for ms can allow for compliance at the edge of a "zone of attenuation" or of testing so long as impacts to groundwater are limited and remediated hinants do not enter public water supplies.
	FED EPA's plans to develop ASR pro current and future users of this techn that there is little funding or staff cu Other ongoing and new ASR-re	<b>ERAL ASR-RELATED INITIATIVES</b> ogram guidelines has many potentially beneficial ramifications for nology. However, during the January announcement meeting EPA noted irrently available to support the development efforts. elated developments within federal agencies can help this process
	progress. Existing agency experience SDWA protections can be applied to This understanding will support wat under conditions made increasingly <b>USGS: National Water Census</b>	ce and knowledge should inform a stronger understanding of how ASR through UIC in a safe, consistent, and comprehensible manner. ter providers striving to meet increasing demands for water supply challenging by ongoing regional droughts and climate change.
Water Census	The upcoming US Geological S an accounting of aquifer storage pro Water Act, the USGS Water Census decades. USGS has a long history of early well recharge investigations, w about water security. USGS conduc cities such as Walla Walla, Washing (Brown 1963); and Amarillo, Texas numerous studies of individual region Antalona Vallay, California	Survey (USGS) national Water Census will provide, for the first time, ojects throughout the United States. As authorized under the SECURE will be the first national census of water use and availability in three of providing local and regional studies on ASR, including several of the which were developed following World War II, in part, due to concerns eted early well recharge studies in conjunction with several Western ton (Price 1961); Salem, Oregon (Foxworthy 1970); Portland, Oregon (Moulder and Frazor 1957). More recently, USGS has conducted ons and their uses of ASR — ranging from Florida to New Jersey to
Water Availability	The SECURE Water Act author program elements to be considered the Water Census, if properly funder characteristics that may impact UIC the permitting process.	rization has specifically identified artificial recharge as one of the in developing water availability national indicators. Consequently, d, could be designed to support an improved understanding of aquifer permitting approaches, and thus support developing increased clarity in
		<b>Reclamation: ASR Demonstration Projects</b>
		Another federal agency with extensive experience working
A Typica	ASR Cross-Section	with water providers that use ASR is the US Bureau of Reclamation



Another federal agency with extensive experience working with water providers that use ASR is the US Bureau of Reclamation (Reclamation). Reclamation's High Plains States Groundwater Demonstration Project was critical to the development of ASR throughout the West. Originally proposed for the Ogallala or High Plains Aquifer, the High Plains State Ground Water Demonstration Program Act of 1983 was amended to include projects in all 17 Western states under the Reclamation programs. Four of the fourteen demonstration projects under this program were ASR projects (i.e. Seattle's Highline Wellfield (WA); Willows Water District (CO); City of Wichita's Equus Beds (KS); Salt Lake City Water Conservancy District (UT – reorganized as the Jordan Valley Water Conservancy Project). Reclamation has supported several other ASR projects through demonstration projects and other grant funding, including systems that use reclaimed water under the Title XVI Water Reuse and Recycling grant program.

## The WaterSMART Initiative

Sustainability Strategy

ASR

## Water/Energy Integration

## Conjunctive Management

## Watershed Planning

## **Federal** Support Team

USGS and Reclamation are both bureaus within the US Department of Interior (Interior), which recently announced the creation of a cohesive set of programs establishing a new water sustainability

strategy for the United States called the "WaterSMART Initiative" (SMART standing for Sustain and Manage America's Resources for Tomorrow). On February 22, 2010, Secretary of the Interior Ken Salazar signed a Secretarial Order issued under the authority of Section 2 of Reorganization Plan No. 3 of 1950 (64 Stat. 1262), as amended; the SECURE Water Act (P.L. 111-11, Subtitle F, Sections 9501 - 9510); and Executive Order 13514 on Federal Leadership in Environmental, Energy and Economic Performance. WaterSMART intends to pursue a sustainable water supply for the nation by:

• establishing a framework to provide federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the sustainable use of all natural resources coordinating the water conservation activities of the various Interior bureaus and offices

Through WaterSMART, Interior is streamlining the programs of its various member agencies (including USGS, Reclamation, and US Fish and Wildlife Service) and coordinating with other federal agencies. Among other things, the effort aims to ensure that water providers and water users have access to a full array of management tools for "conjunctive" water management (i.e. management of surface water and groundwater in combination). The WaterSMART initiative was recently kicked off in the Colorado River Basin — where ASR has been used extensively.

WaterSMART expands several programs previously only available to Western states to the entire country. This includes Reclamation's Challenge Grants, which are operating under an expanded budget as well. This program will provide a means by which Interior can apply its understanding of conjunctive water management. Interior is well aware that aquifer storage can be used both to increase the availability of storage capacity for water supplies and maintain groundwater levels and quality. WaterSMART has been created, in part, to facilitate understanding by other agencies, such as EPA, of the needs for regulations that support a more sustainable water strategy. Thus, support for EPA's ASR guidance development may fall within the mission of this program, including use of the Water Census and various Reclamation programs. [See: http://doi.gov/news/pressreleases/upload/WaterSMARTOrder.pdf]

### US Army Corps: Collaborative Relationships for Sustainable Water

An additional federal effort that may assist in the development of sound ASR practices and uses is the US Army Corps of Engineers' (Corps') "Building Strong Collaborative Relationships for a Sustainable Water Resources Future." This study was developed, in part, to inform the current update to the Principles and Guidelines used by the Corps, as well as other federal agencies, to evaluate potential water projects. The study included an extensive review of collaborative, stakeholder-driven watershed planning and state "water vision" development in each of the 50 states, as well as multi-state river basin commissions. In many states, an important aspect of watershed planning has been conjunctive water management. Conjunctive management has included many examples of aquifer recharge to maintain groundwater levels, as well as surface water flows through increased baseflow from recharged alluvial aquifers. The Corps has been involved regionally in projects involving ASR that focus on one of the Corps' three core missions (navigation, flood control, and ecosystem restoration). In particular, the Corps has been extensively involved in ASR studies for Everglades Restoration. Historically, the Corps has had only limited involvement in groundwater recharge and management. Recently, however, the Corps has begun to view groundwater management and aquifer recharge as an important part of collaborative watershed planning. The Corps recognizes the need for its Principles and Guidelines to have the flexibility to recommend the "best projects" - which may include ASR.

## WestFAST: Federal Liaisons

Particularly in Western States, questions regarding ASR use and regulation may be addressed with support by the Western States Federal Agency Support Team (WestFAST) — which is a collection of federal agency employees assigned to serve as liaisons to the Western States Water Council. WestFAST currently includes nine federal agencies: Reclamation, USGS, Bureau of Land Management, US Fish & Wildlife Service, US Forest Service, Natural Resources Conservation Service, EPA, National Oceanic and Atmospheric Administration, and the Corps. The National Aeronautics and Space Administration and US Department of Energy are under consideration for additional liaison positions.

The Western Sates Water Council is an organization consisting of representatives appointed by the governors of 18 western states to support cooperation and communication on water issues among western states and with federal agencies. The Council has provided analysis of ASR practices (Willardson and Johnson 1990), including reviews of legal and economic aspects of ASR, that should help inform the development of guidance.

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## ASR Regulation

## AQUIFER STORAGE & RECOVERY REGULATION

A SURVEY OF UIC-ASR REGULATION IN DIFFERENT STATES

**Edited/Condensed from:** Review of Existing Methods for Addressing Compliance with Endangerment Law Under the Safe Drinking Water Act in Permitting of Aquifer Storage and Recovery Wells. Colorado School of Mines, Department of Environmental Science and Engineering Independent Study, produced by Chase Hahn **Editors' Note:** The following article is a condensed version of excerpts taken from an Independent Study prepared by Chase Hahn, Colorado School of Mines, in consultation with the Ground Water Protection Council and Watercat Consulting LLC (December 2009) and mentioned in the preceding article. The more information rich original Study is available upon request from your editors at: thewaterreport@hotmail.com

UIC Programs: EPA, State, Tribal & Joint



## **Select State Programs**

Under the Federal UIC Program, States are required to submit proposed State UIC Programs for review and approval. Once approved, the State assumes primary enforcement authority. There are currently 37 States and territories that have been given enforcement authority over Class V wells.

Nine State UIC Programs are reviewed below. The parameters of review include examinations of State regulations associated with underground injections and of how the State is demonstrating compliance with the endangerment requirements of the SDWA and the federal UIC Program. Arizona is the only nonprimacy state reviewed; however, the State water quality agency has extensive water quality protections under the Aquifer Protection Permit program.

## Arizona

## Arizona – EPA Region IX

Source - EPA website: www.epa.gov/safewater/uic/primacy.html

Arizona uses aquifer storage extensively throughout the State, and regulates well recharge (which requires UIC permitting) and basin recharge (does not require UIC permitting) under the same program. **UIC Program** 

Arizona is not a UIC primacy State. Therefore, EPA Region IX administers the program. As noted, Class V injection wells are authorized by rule under the federal program. Owners and operators are required to submit appropriate inventory information to EPA, and EPA reserves the right to require the owner or operator to obtain a permit. ASR wells are already subject to State permits under other State programs, however, and EPA regularly reviews the facilities which are permitted under the applicable State programs to verify compliance with applicable federal regulations.

### **State Permitting**

Two State agencies are associated with the permitting of ASR wells — the Arizona Department of Environmental Quality (ADEQ) and the Arizona Department of Water Resources (ADWR). Projects must demonstrate compliance with applicable water quality standards included in Arizona Administrative Code (AAC), Title 18, Chapter 11, Article 4.

ADWR deals primarily with issues associated with water rights. An ASR owner or operator must obtain an underground storage facility permit from ADWR for the storage of water, as well as a recovery well permit to construct and operate the recovery well. Arizona Revised Statue (ARS), Title 45, Chapter 3.1. ADWR can issue a permit when, among other things, the facility:

- is not in a location that will promote either the migration of a contaminant plume or the migration of a poor quality groundwater area so as to cause unreasonable harm; and
- is not in a location that will result in pollutants being leached to the groundwater table so as to cause unreasonable harm, or is not in a location that will result in pollutants being leached to the groundwater table so as to cause unreasonable harm, if the proposed water storage at the underground storage facility is exempt from the requirement for an aquifer protection permit under Section 49-250, Subsection B, Paragraph 12, 13 or 24. For any facility exempt under Section 49-250, Subsection B, Paragraph 24, the director of water resources, after consultation with the director of the department of environmental quality, may include in the permit any requirements, including operation, maintenance, monitoring, record keeping, reporting, contingency plan or remedial action requirements, as the director of water resources deems necessary. ARS 45-811.01(5).

<ul> <li>(APP) from ADEQ in order to discharge into the aquifer, ARS § 49, Chapter 2, Artick 3 and AC 18, Chapter 9, Underground water storage facilities are considered to be "discharging facilities," ARS § 49-241(A). ASR wells are permitted under individual permits. While some facilities are exempt from having to obtain this permit, in such cases the applicable requirements will generally be included in the storage and/or recovery permit issued by AWDR in consultation with ADEQ.</li> <li><b>Arizona</b></li> <li>Arizona</li> <li>Arizona Farther Consultation with ADEQ.</li> <li><b>Injection Requirements</b></li> <li>As part of the Aquifer Protection Permit program, ADEQ may prescribe discharge limitations based on considerations included in the Stafe 9, 40-24.</li> <li><b>Notarize Requirements</b></li> <li>The State's Aquifer Protection Program allows ADEQ to establish aquifer quality limits (AQLs) in an individual permit. An AQL is defined sci." permit limitation set for aquifer quality mensured at the point of compliance that either represents an Aquifer Water Quality Standard or, if an Aquifer Water Quality Standard for a pollutant is exceeded in a aquifer at the the inte of permit issues, represents the anabient water quality for thar pollutant: accellation an aquifer at the the director of ADEQ establish points of Compliance not further than any of the following: the poperty boundary, any point of an existing or reasuably foresceable future entiting water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-245).</li> <li>For non-hazardous sublatants: "the point of compliance must be so located as to ensure protection of all current and reasonably foresceable future exists of the Aquifer Protection Permit any any given case is at the discentry of the Aquifer Protection Permit and Aquifer Water Quality Standards.</li> <li>ADFQ determinas whether there is a need for monitoring and the frequency of monitoring is determined by the Department in on</li></ul>		Where well recharge is used, the facility will also be required to obtain an Aquifer Protection Permit
<ul> <li>Programs</li> <li>9. Inderground water storage facilities are considered to be "discharging facilities." Ack 89: 49-24(4). Ask 94-24(4). As</li></ul>	ASR	(APP) from ADEQ in order to discharge into the aquifer. ARS § 49, Chapter 2, Article 3 and AAC 18, Chapter
<b>PolyIality Weils are permitted under individual permits.</b> While some inclutes are exempt from having to Obtain this permit, in such cases the applicable requirements will generally be included in the storage and/or recovery permit issued by AWDR in consultation with ADEQ. <b>Arizona</b> As part of the Aquifer Protection Permit program, ADEQ may prescribe discharge initiations based on considerations included in Attes 8 49-243. <b>Motions included in Attes Quality Standards included in AcX CI8-11-06.</b> Effluent quality monitoring may be required under the associated source facility's wastewater reclamation permit. <b>Motions Requirements</b> The State's Aquifer Protection Pergma allows ADEQ to establish aquifer quality limits (AQLs) in an individual permit. An AQL is obtical as: a "permit limitation so for angliquatity monitoring may be required under the associated source facility's wastewater reclamation permit. <b>Motions Requirements</b> The State's Aquifer Protection Pergma allows ADEQ to establish aquifer quality limits (AQLs) in an individual permit. As avoid to softwate Quality Standard or, fan Aquifer Water Quality Standard for a pollutant is exceeded in an aquifer at the time of permit issues, represensis the ambient water quality for than pollutant. "AAC R18-9-101(3).         For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foresceable future eases of the aquifer," ARS § 49-24(3).         The non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of the cherein restrictions. Also, "The actual aced for monitoring and the frequency of the Aquifer Protection Permit and Aquifer Water Quality Standards."	Programs	9. Underground water storage facilities are considered to be "discharging facilities." ARS § 49-241(A). ASR
<ul> <li>Arizona</li> <li>Arizona</li> <li>Injection Requirements</li> <li>Approximation of the consultation with ADEQ.</li> <li>Injection Requirements</li> <li>As part of the Aquifer Protection Permit program, ADEQ may prescribe discharge limitations based on consideration included in ARS § 49-243 — including the use of water from the aquifers. In the discharge limitations has do no consideration with a capiters. The discharge limits in a reviewed draft permit were equivalent to the Aquifer Water Quality Standards included in AAC R18-11-406. Effluent quality monitoring may be required under the associated source facility's watewater reclamation permit.</li> <li>Monitoring Requirements</li> <li>The State's Aquifer Protection Program allows ADEQ to establish aquifer quality measured at the point of compliance that either property foundary; suppoint of an Aquifer Water Quality Standard for a pollutant is exceeded in an aquifer at the time of permit issuance, represents the ambient water quality for that pollutant. "AAC R18-9-101(3).</li> <li>For hazardous substances, the stantes require that the director of ADEQ establish points of compliance not further than any of the following: the priority boundary; sup point of an existing or reasonably foreseable future uses as its at discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions included in the Aquifer Protection Permit and Aquifer Water Quality Standards."</li> <li>ADEQ determines whether there is a need for monitoring no start of applicable with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards."</li> <li>ADEQ determines whether there is a need for monitoring is distributed in the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards."</li> <li>ADEQ determines whether there is a need for</li></ul>	Tiograms	wells are permitted under individual permits. While some facilities are exempt from having to obtain this
<ul> <li>Arizona</li> <li>Piniction Requirements</li> <li>As part of the Aquifer Protection Permit program, ADEQ may prescribe discharge limitations based on considerations included in ASS § 49-234 — including the use of water from the aquifers in the discharge limitations based on considerations included in ASS § 49-234 — including the use of water from the aquifers in the discharge limitation based on considerations included in the ASS § 49-234 — including the use of water Pint 1-406. Effluent quality monitoring may be required under the associated source facility's wastewater reclamation permit.</li> <li>Monitoring Requirements</li> <li>The Shuc's Aquifer Protection Program allows ADEQ to establish aquifer quality measured at the point of compliance that either represents an Aquifer Water Quality Standard or, if an Aquifer Water Quality Standard for a pollutant is exceeded in an aquifer at the time of permit issuance, represents the ambient water quality for that pollutant." AAC R18-9-101(3).</li> <li>For the anaryoot the following: the property boundary, any point of an existing or reasonably foresceedele future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-234).</li> <li>For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foresceedele future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-243).</li> <li>The determination of the boundary in any given case is at the discretion of the ADEQ, subject to the cide restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards.</li> <li>ADEQ determines whether there is a need for monitoring and the frequency of the following:</li> <li>A violation of a discharge</li></ul>		permit, in such cases the applicable requirements will generally be included in the storage and/or recovery
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<ul> <li>considerations included in ARS § 49-243 — including the use of water from the aquifers in the discharge impact area and the existing quality of the water in the aquifers. The discharge limits in a reviewed draft permit were equivalent to the Aquifer Water Quality Shudards included in AAC R181-14-06. Effluent quality monitoring may be required under the associated source facility's wastewater reclamation permit.</li> <li>Monitoring Requirements</li> <li>The Stuck's Aquifer Protection Program allows ADEQ to establish aquifer quality measured at the point of compliance that either represents an Aquifer Water Quality Stundard or, if an Aquifer Water Quality Standard for a pollutant is exceeded in an aquifer at the time of permit instance, represents the ambient water quality for that pollutant." AAC R18-9-101(3).</li> <li>The tracardous substances, the statutes require that the director of ADEQ establish points of compliance that either represents the statutes require that the director of ADEQ establish points of compliance not permit instance, represents the analytic reasonably foresceable future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-245).</li> <li>For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foresceable future uses of the aquifer." ARS § 49-24(3)</li> <li>The determination of the boundary in any given case is at the discretion of the AdDEQ, subject to the cide restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions of the AdQUEP reduce there is a need for monitoring the streament of the Aquifer Protection Permit and Aquifer Water Quality Standards.</li> <li>ADFQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit requalitions (AAC R18-9), an indivi</li></ul>	Arizona	As part of the Aquifer Protection Permit program ADEO may prescribe discharge limitations based on
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<ul> <li>provident to the Aquifer Water Quality Standards included in AAC E18-11-406. Effluent quality inonitoring may be required under the associated source facility's watewater reclamation permit. Monitoring Requirements         The State's Aquifer Protection Program allows ADEQ to establish aquifer quality limits (AQLs) in an individual permit. An AQL is defined as: "a permit limitation set for aquifer quality measured at the point of compliance that either represents an Aquifer Water Quality Standard for a pollutant is exceeded in an aquifer at the time of permit issuance, represents the ambient water quality for that pollutant." AAC R18-9-101(3).     </li> <li>For hazardous substances, the statutes require that the director of ADEQ establish points of compliance not further than any of the following: the property boundary; any point of an existing or reasonably foreseeable future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-2443).     Tor non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foreseeable future uses of the aquifer." ARS § 49-244(3).     The determination of the boundary in any given case is at the discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions of the Aquifer Protection Permit and with applicable Aquifer Water Quality Standards, "ADEQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit and Water Quality Standards, and, if so, how frequently monitoring must occur.     Metals Leaching Issues: None reported in association with existing ASRs.     Endance Issue Induce Aquifer Protection Permit regulations (AAC R18-9), an individual permit is required to contain a contingency</li></ul>		area and the existing quality of the water in the aquifers. The discharge limits in a reviewed draft permit were
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<ul> <li>For hazardours substances, the statutes require that the director of ADEQ establish points of compliance not further than any of the following: the property boundary; any point of an existing or reasonably foreseeable future diriking water source; or seven hundred fifty feet from the edge of the pollutant management are (ARS § 49-245).</li> <li>For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foreseeable future uses of the aquifer." ARS § 49-244(3)</li> <li>The determination of the boundary in any given case is at the discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions included in the Aquifer Protection Permit and with applicable Aquifer Water Quality Standards."</li> <li>ADEQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards, and, if so, how frequently monitoring must occur.</li> <li>Metals Leaching Issues: None reported in association with existing ASRs.</li> <li>Endagerment and Non-Compliance Issues</li> <li>Under the Aquifer Protection Permit condition</li> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of an Aquifer Water Quality Standard or an AqL</li> <li>A violation of an Aquifer Mater Quality Standard or an AqL</li> <li>A violation of an Aquifer Mater Quality Standard or an AqL</li> <li>A violation of an Aquifer Mater Quality Standard or an AqL</li> <li>A violation of an Aquifer Mater Quality Standard or an AqL</li> <li>A violation o</li></ul>		that pollutant "AAC R18-9-101(3))
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<ul> <li>future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS § 49-245).</li> <li>For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foresceable future uses of the aquifer." ARS § 49-244(3)</li> <li>The determination of the boundary in any given case is at the discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions included in the Aquifer Protection Permit and Aquifer Water Quality Standards."</li> <li>ADEQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards, and, if so, how frequently monitoring must occur.</li> <li>Metals Leaching Issues: None reported in association with existing ASRs.</li> <li>Endangerment and Non-Compliance Issues</li> <li>Under the Aquifer Protection Permit regulations (AAC R18-9), an individual permit is required to contain a contingency plan that defines the actions to be taken if a discharge results in any of the following:         <ul> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of an Aquifer Water Quality Standard or an AQL.</li> <li>A violation of an optimer Water Quality Candard or an AQL.</li> <li>An aler tevel is exceeded</li> </ul> </li> <li>An aler tevel is exceeded</li> <li>Delaware is reported to have two existing facilities in operation. One facility was approved to operate in January 2004 after a 10-year testing facilities in operation. One facility was approved to operate in January 2004 after a 10-year testing period.</li></ul>		not further than any of the following: the property boundary; any point of an existing or reasonably foreseeable
<ul> <li>\$49-245). For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of all current and reasonably foreseeable future uses of the aquifer." ARS § 49-244(3) The determination of the boundary in any given case is at the discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions included in the Aquifer Protection Permit and with applicable Aquifer Water Quality Standards." ADEQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards, and, if so, how frequently monitoring must occur. Metals Leaching Issues: None reported in association with existing ASRs. Endangerment and Non-Compliance Issues Under the Aquifer Protection Permit regulations (AAC R18-9), an individual permit is required to contain a contingency plan that defines the actions to be taken if a discharge results in any of the following: A violation of a discharge limitatio A violation of a discharge limitatio A violation of an other permit condition A violation of any other permit condition A violation of any other permit condition A ni miniment and substantial endangerment to the public health or the environment AAC R18-9-A204(A) Contingency plan responses depend on the type of violation and include (but are not limited to) inspection, additional sampling, and corrective action. The plan must contain emergency response provisions when addressing an imminent and substantial endangerment to public health and the environment. Delaware = EPA Region III Delaware is reported to have two existing facilities in operation. One facility was approved to operate in January 2004 after a 10-year testing period. The other facility is currently in the process of completing applicable site testing. UDE Program Delaware is reporte</li></ul>		future drinking water source; or seven hundred fifty feet from the edge of the pollutant management area (ARS
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<ul> <li>all current and reasonably foreseeable future uses of the aquifer. "AKS § 49-244(3)</li> <li>The determination of the boundary in any given case is at the discretion of the director of the ADEQ, subject to the cited restrictions. Also, "The actual need for monitoring and the frequency of monitoring is determined by the Department in order to assure compliance with the conditions included in the Aquifer Protection Permit and with applicable Aquifer Water Quality Standards." ADEQ determines whether there is a need for monitoring to ensure compliance with the conditions of the Aquifer Protection Permit and Aquifer Water Quality Standards, and, if so, how frequently monitoring must occur.</li> <li>Metals Leaching Issues: None reported in association with existing ASRs.</li> <li>Endangerment and Non-Compliance Issues</li> <li>Under the Aquifer Protection Permit regulations (AAC R18-9), an individual permit is required to contain a contingency plan that defines the actions to be taken if a discharge results in any of the following:         <ul> <li>A violation of an Aquifer Water Quality Standard or an AQL</li> <li>A violation of any other permit condition</li> <li>An alert level is exceeded</li> <li>An alert level is exceeded</li> <li>An alert level is exceeded</li> <li>An imminent and substantial endangerment to the public health or the environment AAC R18-9-A204(A)</li> </ul> </li> <li>Contingency plan responses depend on the type of violation and include (but are not limited to) inspection, additional sampling, and corrective action. The plan must contain emergency response provisions when addressing an imminent and substantial endangerment to public health and the environment.</li> <li>Delaware is reported to have two existing facilities in operation. One facility was approved to operate in January 2004 after a 10-year testing period. The other facility is currently in the process of completin</li></ul>		For non-hazardous pollutants: "the point of compliance must be so located as to ensure protection of
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from violating "any primary drinking water regulation under 40 CFR Part 142" or "otherwise adversely		from violating "any primary drinking water regulation under 40 CFR Part 142" or "otherwise adversely

	[affecting] the health of persons." Applicants for a permit have the burden of showing that these requirements
ASR	are met. §122.24(a). If DNREC determines that violation of §124.24(a) may occur, DNREC may: require the
Programs	injector to obtain an individual permit; order the injector to take such actions (including closure) as may be
	Permitting
	ASR facilities are authorized through individual permits which contain conditions, limitations, and requirements that are specific to the individual facility as well as conditions applicable to all permits as specified in §122. An ASR applicant is initially given a permit to "test for the suitability of the well for future use as an aquifer storage and recovery well." This initial permit authorizes the pilot phase testing of a planned facility and includes a requirement to submit a final report upon completion of injection activities. Once the facility has completed the pilot phase testing of the facility, which may extend beyond the time frame of the initially authorized injection permit, the applicant may apply for and receive a permit for continued operation.
	UIC Permits for ASR wells do not authorize the withdrawal of stored water; therefore, ASR facilities are also required to obtain water well allocation permits.
	Injection Requirements
Delaware	In a reviewed permit (UIC Permit #5R21-01-04N), injection is limited to potable water. The permit requires the company to "ensure that all primary and secondary drinking water standards…will be met by the injected water prior to injection to the ASR well." However, only select injectate parameters are required to be monitored under the UIC permit, including: flow; pH; free chlorine; water level; conductivity; fluoride; and chloride.
	Monitoring Requirements
	The reviewed UIC Permit includes discussion of an ASR monitoring system which consists of six groundwater monitoring wells. Groundwater monitoring is required at each of the groundwater monitoring wells on a weekly basis for the following parameters: fluoride; chloride; pH; specific conductivity; water level; and temperature. Additionally, monitoring of the recovered water at the ASR well is required on a monthly basis for the parameters listed above as well as: total iron; total hardness; and alkalinity. A more rigorous sampling plan is required during the pilot phase, presumably to determine both the suitability of the well for ASR and the limits of sampling that will be required under the final permit. Compliance with the reviewed permit does not "constitute a defense to any action brought under…the Safe Drinking Water Act (SDWA) or the State of Delaware "Regulations Governing Public Drinking Water Systems." Permit #5R21-01-04N, Condition BB.
	Delaware has not reported any issues with metals leaching in relation to ASRs. State UIC Regulations are extremely limited in discussions of compliance with metals concentrations in groundwater and monitoring of metals at approved ASRs. Review of pilot phase UIC Permit #5R21-10-06N shows that a more rigorous metals
	monitoring plan is required for recovered water, presumably for determining the need for metals monitoring in the final authorization of the facility
	Endangerment and Non-Compliance Issues
	A UIC permittee is required to notify DNREC of any noncompliance with the permit. There are no specific water quality limitations associated with the permit beyond ensuring that the injectate meets primary and secondary drinking water standards. Therefore, noncompliance issues will be generally limited to operational noncompliances as opposed to exceedances of groundwater contaminant levels. In response to noncompliances and potential endangerment of the public health, safety or welfare, DNREC retains the right to modify, revoke, or terminate the permit.
	Florida – EPA Region IV
Florida	Florida has approximately 100 individual ASR wells currently operating. Due to the subsurface geology, many of the wells located in Florida are experiencing noncompliance with applicable drinking and groundwater regulations. Specifically, high levels of arsenic are present in some stored and recovered water.
	Florida is a UIC primacy State. The Florida Department of Environmental Protection (FDEP) is responsible for managing the UIC Program. The UIC Regulations are located in Chapter 62-528 of the Florida Administrative Code (FAC).
	Florida UIC Regulations State that "injection of wastes underground shall not adversely interfere with any designated use of ground water as specifiedor cause violations of water quality standards in underground sources of drinking water." Rule 62-528.110(2), FAC.
	are classified as Group 7 wells, which are wells "associated with an aquifer storage and recovery facility where surface water or ground water is injected and stored for later recovery for potable or nonpotable use" (Rule 62-528.300(1)(e)7, FAC).

ASR

Programs

Florida

## Permitting

Florida uses a two permit system to authorize the construction and operation of Class V wells. Owners and operators must first obtain a Construction/Clearance Permit. If the applicant is able to demonstrate that the operation of the well will not adversely impact an underground source of drinking water, FDEP will "issue an authorization to use a Class V well, which is non-renewable and non-expiring" for certain listed wells, including Group 7 wells, when the fluid being injected meets Florida primary and secondary drinking water quality standards. Rule 62-528.635(4), FAC and the minimum criteria contained in Rule 62-520.400, FAC (Rule 62-528.635(4)(b)). If the applicant is not able to meet these requirements, the applicant is required to obtain an **Operation Permit.** 

Due to the nature of operating ASR wells, as well as to the geology of Florida's aquifers and the resulting arsenic contamination problems associated with existing ASR facilities, most if not all Group 7 wells in Florida will be required to obtain Operation Permits because of their potential to violate State standards listed in, inter alia, Chapter 62-550, FAC, or minimum criteria contained in Rule 62-520.400, FAC (Rule 62-528.640(1)(b)). Currently, only three ASR systems have received an Operation Permit, since the applicants have not been able to demonstrate that operation of the wells will not adversely impact underground sources of drinking water. **Injection Requirements** 

State UIC Regulations state that "pretreatment for fluids injected through existing wells shall be performed if necessary to ensure that the injected fluid does not violate the applicable water quality standards..." (Rule 62-528.610(3), FAC). In most cases, the applicable water quality standards are the primary and secondary drinking water quality standards for public water systems. The primary exception to the listed water quality standards sets the representative natural background quality as the relevant standard if the concentration for any listed constituent in the natural background quality of the ground water is greater than the stated maximum (or less than the minimum, in the case of pH). Rule 62-520, FAC.

Specific requirements associated with the injected fluid are limited. Some permits include conditions that strictly limit the injection fluid to specified source waters with certain treatments as required by the associated specific condition. Some source waters have existing standards that must be met prior to their discharge from the associated facility to the injection well (e.g., water reclamation facilities) and therefore specific limits are not included in the associated permit. Pretreatment of injection fluids is only required "if necessary" as determined by FDEP based on the source water and the conditions of the receiving aquifer.

### **Monitoring Requirements**

Monitoring is required in UIC Regulations for Group 7 wells except when the injection fluids meet the primary and secondary drinking water standards (and minimum criteria contained in Rule 62-520.400, FAC) and have been processed through a permitted drinking water treatment facility. The frequency of monitoring is determined by FDEP based on the location of the well, the nature of the injected fluid, and applicable requirements associated with Wastewater Treatment Facilities.

Even if monitoring is not required, the permittee must perform initial or periodic testing of the Class V well if site-specific factors or operational testing indicate that there is a threat to underground sources of drinking water (Rule 62-528.635(5), FAC).

### **Metals Leaching Issues**

Florida is currently experiencing issues with arsenic leaching out of geologic formations into groundwater. Exceedances seem to occur less frequently and consistently in storage zone monitor wells than in injection and recovery wells. However, it is believed that exceedances more than a few feet from ASR wells are minimal. Data also indicate that arsenic levels in recovered water are lower for facilities that have been in operation for a longer time and/or have formed and maintained an adequate buffer zone. It is therefore believed that increased arsenic levels may be temporary.

Arsenic levels in the recovered water do not necessarily pose a public health and welfare problem when placed in the public drinking water system, since arsenic can be removed from the water through existing drinking water treatment processes. The primary issues are therefore violation of the applicable groundwater standards established for the specific aquifer and potential adverse effects to persons.

### **Endangerment and Non-Compliance**

As noted, numerous ASR systems in Florida are experiencing issues with arsenic levels. Because of Florida's lack of natural reservoirs and the increasing need for potable water, closure of ASR wells that experience exceedances is not preferred. Additionally, existing water treatment processes are capable of removing arsenic to acceptable levels prior to introduction into the public drinking water system.

FDEP is taking enforcement actions that allow systems to continue operation while addressing compliance issues. Enforcement actions are rendered through an Administrative Order and/or a Consent Order.

A reviewed Administrative Order requires the permittee to submit reports addressing testing results when arsenic levels exceed the applicable drinking water standard, as well as a discussion of whether there is indication that arsenic levels are decreasing enough to allow the facility to come into compliance over time. FDEP can require certain changes to the facility and/or ASR system including, but not limited to, changes to monitoring requirements and frequency, addition of monitoring wells, and the implementation of a treatment

ASR Program	program to reduce the amount of arsenic leaching into the groundwater. The Administrative Order addresses arsenic exceedances affecting groundwater off-site. In this instance, the permittee must prepare an inventory of water wells within a determined "Area of Review" and develop provisions for alternate water supply for water wells within that area as determined on a case-by-case basis. The facility may also be required to sample off-site wells within the "Area of Review" and/or install additional monitoring wells.
Kansas	Kansas – EPA Region VII
	Kansas currently has four ASR wells, all operated by the City of Wichita Water Department. These wells are authorized under a single permit and are permitted for the purpose of "storage and later recovery of the groundwater and to form a hydraulic barrier to a known brine plume" (KS Permit No. KS-05-079-001). Kansas also has 30 additional ASR wells under consideration. <b>UIC Program</b>
	Kansas is a UIC primacy State. The Kansas Department of Health and Environment (KDHE) is responsible for managing the UIC Program. The UIC Regulations are located in Chapter 28, Article 46 of the Kansas Administrative Regulations. These UIC regulations generally reference 40 CFR 124, 144, and 146, though a minimal number of State-specific regulations are included. There are no specific regulations regarding ASR wells. <b>Permitting</b>
	Owners and operators are required to obtain permits for the construction and operation of ASR wells.
	Injection Requirements KS Permit No. KS-05-079-001 states that "injection shall not cause degradation of the ambient water" in the aquifer receiving the injection. In order to comply with this requirement, the permittee is required to monitor numerous parameters in the injection water and report results every month. Parameters that must meet specified limits at the point of injection are limited to: pH; chloride; atrazine; arsenic; total coliform 3; nitrate; and E. coli. Additionally, monitoring of a more expansive listing of constituents is required on an annual basis, though no specific limitations apply to these constituents. Monitoring Requirements
	The permittee is required to implement a relatively extensive monitoring plan. A network of monitoring wells must be installed around each of the injection wells.
	<ul> <li>Specifically, the monitoring plan includes:</li> <li>Baseline Sampling – Sampling of the monitoring well network and all accessible domestic wells within one-quarter mile of the recharge/recovery wells and recharge basin to provide a baseline</li> <li>Initial Operation Sampling – Sampling of the entire monitoring well network on a quarterly basis for the first year of operation and semi-annually for the second year of operation</li> <li>Continued Operation Sampling – Sampling of select monitoring wells (upgradient and downgradient) on</li> </ul>
	<ul> <li>an annual basis</li> <li>Static Fluid Levels – Gauging of the entire monitoring well network prior to any injection to provide a baseline as well as each December at the conclusion of a calendar year's recharge operation, with the data being used to generate piezometric surface maps</li> </ul>
	• Fluid Levels – Automated gauging of the fluid levels in the entire monitoring well network on a frequency not to exceed six hours. The groundwater levels are not to exceed a minimum separation distance of 10 feet bgs
	<ul> <li>Post Closure Sampling – Sampling of the entire monitoring well network and all accessible domestic wells within one-quarter mile of the recharge/recovery wells and recharge basin within 30 days of notification that the injection project has terminated</li> </ul>
	Metals Leaching Kansas is not currently experiencing issues with arsenic or any other metals in groundwater associated with ASR wells. Introduction of ASR has resulted in the reduction of arsenic concentrations in the recovered water due to dilution.
	<b>Endangerment and Non-Compliance</b> In case of a noncompliance, the permittee shall submit "a written description of the noncompliance with the operating limitations…occurring during the month being reported and a detailed description of corrective action to prevent recurrence of the noncompliance" with the required monthly monitoring report. KS Permit No. KS-05-079-001.
	As noted, KDHE has required the implementation of an extensive groundwater monitoring plan in the vicinity of the injection wells. As stated in the reviewed permit, "if the results of the monitoring indicate endangerment or potential endangerment of the public health, public safety or the environment, KDHE may require the permittee to submit a corrective action plan and schedule for implementation to KDHE for review and consideration for approval. Corrective action may include the requirement to cease the recharge operation."

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	New Jersey – EPA Region II
ASR	New Jersey has approximately 30 ASR systems in operation within the State.
Drograma	UIC Program
Frograms	New Jersey is a UIC primacy State and the New Jersey Department of Environmental Protection (NJDEP)
	is responsible for administering the program. The State of New Jersey's UIC Regulations are included in Title
	7, Chapter 14A, Subchapter 8 of the New Jersey Administrative Code (NJAC 7:14A-8). The UIC Regulations
Now	disallow permits when a Class V well "may cause or allow movement of fluid containing any contaminant into
	underground sources of drinking water, and the presence of that contaminant may adversely affect the health of
Jersey	persons." NJAC 7:14A-8.4(a)(2).
	Permitting
	NJDEP reserves the right to require any owner or operator of a Class V injection well to apply for and
	obtain a UIC permit. NJDEP is currently permitting the discharge associated with ASR under individual UIC
	permits (NJAC 7:14A-8.8). Permits contain a general requirements section, a section including limits and
	monitoring requirements and a specific requirements section. Specific requirements may include implementing
	a NIDEP-approved plan describing a Ground Water Protection Program (GWPP). The GWPP must include
	provisions showing that the operation of any and all regulated units does not contravene the Ground Water
	Quality Standards (NIAC 7.9C)(GWOS) and must demonstrate compliance with all other applicable rules
	and regulations related to protection of ground water. Minimum GWPP requirements may include a detailed
	monitoring program a sampling schedule, a specification of actions to be taken if a statistically significant
	monitoring program, a sampling schedule, a specification of actions to be taken if a statistically significant
	Injection Doquiromonts
	There are no specific injection requirements included in the State's LIIC Degulations with record to Class
	V wells. The injected fluid is generally required to others to ground water quality standards set by the UIC
	weeks. The injected fluid may be required to adhere to ground water quality standards set by the UIC
	program. The injected fluid may be required to adhere to primary and secondary drinking water standards as
	well, but under a separate permit. In certain instances the ground water quality standards are actually more
	stringent than the primary and secondary drinking water standards.
	New Jersey's ground water quality standards define different classifications for ground water and therefore
	different standards may apply to the facility depending on the class of the receiving ground water. Additionally,
	New Jersey has an anti-degradation policy that protects "existing ground water quality that is better than criteria
	from significant degradation." NJAC 7:9C-1.8(a).
	Sampling may be required for specific constituents in the injected water on a monthly basis. The injected
	water must meet the applicable ground water quality standards.
	Monitoring Requirements
	There are no specific monitoring requirements included in the State's UIC Regulations with regard to Class
	V wells. The review permit states that the monitoring program must be capable of facilitating an evaluation of
	the discharge to the ground water resources of the State.
	Metals Leaching Issues
	New Jersey is reportedly not experiencing issues with the leaching of metals into the ground water from the
	surrounding geologic formations.
	Endangerment and Non-Compliance Issues
	New Jersey requires compliance with applicable ground water quality standards in addition to drinking
	water rules.
	For Class V wells, if NJDEP learns that a Class V well may cause a violation of the State primary drinking
	water rules (NJAC 7:10) or any ground water quality standards (NJAC 7:9C), NJDEP must require a permit and
	order the owner or operator of the injection well to take such actions (including closure of the well) as may be
	necessary to prevent violation and/or take enforcement action (NJAC. 7:14A-8.4). The facility may be allowed
	to resume operations once NJDEP determines that the situation has been resolved. Additionally: "the reviewed
	permit includes conditions that require the recharge operations to cease if monitoring shows that either the water
	being injected or the ground water is exceeding the parameters listed in the permit."
	Oregon – EPA Region X
	Oregon is currently operating approximately 20 ASR projects. A majority of these facilities are operating
Oregon	under "limited licenses" which are permits that license the use of water for ASR testing purposes. Once the
	facility has completed its ASR testing program, the operator may apply for a permanent ASR Permit. One
	facility has received a permanent ASR permit.
	UIC Program
	Oregon is a UIC primacy State and the Oregon Department of Environmental Quality (ODEQ) is

responsible for administering the program, though ASR facilities must also obtain permits from the Oregon

ASR Programs	<ul> <li>Water Resources Department (OWRD). Oregon's UIC Regulations are included in Chapter 340, Division 44 of the Oregon Administrative Rules (OAR).</li> <li>Oregon's UIC Regulations prohibit any injection system from being in violation of either the federal Safe Drinking Water Act or State groundwater quality protection requirements under OAR 340-040. Owners and or operators of an injection system have the burden of showing that these requirements are met. OAR 340-044-0014(1).</li> <li>ASR wells are authorized by rule under UIC on a case-by-case basis. They must meet certain requirements, which include determining that injection will "not cause the direct or indirect movement of contaminants into groundwater if the resulting concentration of that contaminant may cause a violation of any primary drinking water regulation under the federal Safe Drinking Water Act or may exceed background groundwater concentrations." OAR 340-044-018(4).</li> <li>Permitting</li> <li>As noted, ASR wells are permitted by rule by ODEQ under OAR 340-044-018. Additionally, ASR</li> </ul>
	administers two types of permits for ASR facilities. The first permit is referred to as a "Limited License" and allows for the use of water for ASR testing purposes. Once the facility has completed its ASR testing program under a limited license, the facility may apply for a permanent ASR permit. Although these licenses
	and permits are administered by OWRD, the regulations require that OWRD seek ODEQ and Oregon Health Division assistance, which may include recommending conditions to be included in the limited license and permit (OAR 690-350-0010(7)).
	Injection Requirements
	Injection water quality is regulated under OWRD regulations (OAR 690-350) which are specific to ASR
	Injection source water for ASR must comply with either drinking water standards or the maximum
	measurable levels established by the Oregon Environmental Quality Commission regulations, whichever is
Oracca	stricter. Requirements shall be placed in either the limited license or the permit to minimize the concentration
Oregon	of constituents in the injection source water that are not naturally present in the aquiter. The regulations also state if certain regulated contaminants are detected in the injection source water at
	greater than 50 percent of the established levels, the ASR limited license or permit may require the permittee to
	employ technically feasible, practical and cost-effective methods to minimize concentration of such constituent.
	Constituents that have a secondary contaminant level or constituents that are associated with disinfection of the water may be injected into the aquifer up to the established standards (OAR 690-350-0010(6))
	Monitoring Requirements
	The ASR regulations include conditions for reporting and monitoring ASR project aquifer impacts and
	For constituents reasonably expected to be found in the injection source water (OAR 690-350-0020(5)(J) and $-0030(6)(f)(A)$ ). Water quality sampling is required for the injection water, water in associated wells, and water withdrawn from storage. Monitoring addresses both water quantity issues and protecting the rights of other
	water users. Metals Leaching Issues
	Though it is an issue of concern in some areas of the State, Oregon has thus far had no major leaching of
	metals associated with ASR.
	Endangerment and Non-Compliance State UIC Regulations include the following:
	If an injection activity has the potential to cause or causes a violation of primary drinking water
	regulations, adversely impacts groundwater quality or otherwise adversely affects human health or the
	environment, the owner operator of the injection system shall: (a) Take all appropriate action including closure of the injection system if necessary to prevent the
	violation;
	(b) Apply for and obtain a permit if the injection activity was previously authorized by rule; and (c) Be subject to enforcement action if appropriate. (OAR 340-044-0014(2)).
	With regard to Class V ASR wells, OWRD regulations state:
	"If during the course of ASR testing [ASR operations] a constituent which is regulated
	is detected above the level prescribed in the limited license [permit], the licensee shall stop
	injection activities immediately and notify the department." (OAR 690-350-0020(5)(i)(F) and
	-0030(6)(e)(F)).

## Texas – EPA Region VI

Texas has three ASR systems with approximately 25 individual ASR wells currently operating.

## UIC Program

Programs

ASR

Texas

Texas is a UIC primacy State and the Texas Commission on Environmental Quality (TCEQ) is responsible for administering the program. UIC Regulations are located in Title 30, Chapter 331 of the Texas Administrative Code (TAC). State UIC regulations disallow injection wells that would result in "the movement of fluid that would result in the pollution of an underground source of drinking water." A permit or authorization by rule must include terms and conditions reasonably necessary to protect fresh water from pollution. 30 TAC §331.5(a).

The State defines an underground source of drinking water as:

An "aquifer" or its portions:

(A) Which supplies drinking water for human consumption; or

(B) In which the groundwater contains fewer than 10,000 milligrams per liter total dissolved solids; and (C) Which is not an exempted aquifer.

30 TAC §331.2(107)

State UIC Regulations include standards that are specific to Class V wells and additional requirements that are specific to aquifer storage wells.

## Permitting

Class V wells are authorized by rule. In order to obtain authorization, the owner or operator of the Class V well must submit the inventory information required for review, modification, and approval by TCEQ (TAC 30 §331.10(a)). The owner or operator of a Class V well must obtain approval prior to construction, conversion, or operation of the well (TAC 30 §331.10(d)). Owners and operators of ASR wells must also maintain compliance with the provisions contained in Subchapter H (Standards for Class V Wells) and Subchapter K (Additional Requirements for Class V Aquifer Storage Wells). Although Class V wells are generally authorized by rule, TCEQ "may require the owner or operator of an injection well authorized by rule to apply for and obtain an injection well permit" TAC 30 §331.9(c).

TCEQ has a two phase authorization system for ASR wells. The first phase of the authorization system requires the submission of the above-mentioned inventory information. Once approval has been received the operator is allowed to construct the well and begin operation. Upon completion of the ASR well, the applicant must submit a report to TCEQ with additional information which includes but is not limited to: formation fluid analyses; injection fluid analyses; hydrogeological modeling with supporting data, predicting mixing zone characteristics and injection fluid movement and quality; along with any other information TCEQ may determine to be necessary for the protection of USDWs. Once the information has been reviewed and determined to be acceptable, TCEQ will give final authorization to the project.

The two systems currently operating in the State of Texas are authorized by rule and were not required to obtain permits.

### **Injection Requirements**

Injected water must be treated to the applicable State drinking water standards prior to being injected (TAC 30 §331.184(e)).

## **Monitoring Requirements**

With regard to all Class V wells, the State of Texas' UIC regulations state:

For any Class V injection well, any required sampling must be done at the point of injection or as specified in a permit issued by TCEQ. TAC 30 §331.132(g).

Additional monthly monitoring is required for ASR wells, including: average injection rates; injection and retrieval volumes; average injection pressures; water quality analyses of injected water; and other information as determined by TCEQ as "necessary for the protection of underground sources of drinking water." TAC 30 §331.185(a).

For ASR wells that are authorized by rule, including the two currently operating systems, monitoring associated with endangerment is limited to monitoring of the injected water. TCEQ may require additional monitoring under a permit if it deems it necessary based on information provided during the first phase of the project prior to final authorization.

## **Metals Leaching**

Facilities currently operating within the State are reportedly not experiencing issues with metals leaching from the subsurface into the stored water.

### **Endangerment and Non-Compliance**

UIC Regulations are somewhat limited in their discussion of responses to endangerment and noncompliance issues. TCEQ may require the owner or operator to obtain a permit for wells that are not in compliance. The owner or operator of any Class V well can be prohibited from injecting if in noncompliance.

## ASR Programs

Utah

## Utah – EPA Region IX

Utah has five ASR systems in various stages of operation and application, including: two systems that are currently active; one system that is going through the analysis process; one system that is in the pilot phase; and one system that is in the application process.

## **UIC Program**

Utah is a UIC primacy State and the Utah Department of Environmental Quality (UDEQ) is responsible for administering the program. UIC Regulations are included in the Utah Administrative Code (UAC) Title R317-7. These Regulations define underground sources of drinking water as defined in the Federal UIC Regulations. UAC R317-7-7-2.5.

Underground injections are prohibited unless they are authorized by a permit or authorized under the State's UIC Regulations. Underground injections are prohibited if: they would violate any primary drinking water regulation (40 CFR part 141 and Utah Primary Drinking Water Standards R309-200-5); adversely affect human health; or cause a violation of any State groundwater quality rules. Permit applicants have the burden of showing that these requirements are met. UAC R317-7-5.3.

State Ground Water Quality Protection regulations define classes for ground water based on their dissolved solids levels, existing water quality, and the ground water's importance to the surrounding human and wildlife populations. Each of these classes is afforded different levels of protection which apply to facilities that discharge or would probably discharge to ground water. If the background concentration exceeds the ground water quality standard, a facility may not cause an increase over background. UAC R317-6-6.2.B.

Class V ASR wells are permitted by rule under the Ground Water Quality Protection regulations as discussed in the following section. The State's UIC Regulations do not contain any regulations specific to ASR wells.

### Permitting

Although Class V wells are authorized by rule, UDEQ may require any owner or operator to apply for and obtain an individual or area permit (UAR R317-7-6.4.A). The existing facilities have been required to obtain permits. Injection wells must also comply with any ground water rules that may be promulgated by the Utah Water Quality Board. Wells and facilities that are regulated under the UIC program are considered to be permitted by rule under the Ground Water Quality Protection regulations. UAR R317-6-6.2.A.8. **Injection Requirements** 

The UIC Regulations do not include any specific requirements for Class V wells with regard to injection requirements. However, specific requirements are included in the permits.

One existing permit reviewed for this study requires injected water to meet all Federal and State Maximum Contaminant Levels (MCLs) for drinking water as well as State Ground Water Quality Standards. Injected water must also meet a maximum Total Dissolved Solids (TDS) standard based on the class designation of the receiving aquifer.

### **Monitoring Requirements**

The UIC Regulations do not include any specific requirements for Class V wells with regard to ground water monitoring requirements. The point of compliance is at the injection well upon withdrawal of the stored water. In one reviewed permit, Utah did not require monitoring wells downgradient or upgradient of the injection well.

In the reviewed permit, a comprehensive water quality analysis of the injectate is required every five years for listed constituents which include: inorganics; nitrate/nitrite; asbestos; volatile organic compounds (VOCs); pesticides; radionuclides; total trihalomethanes (TTHMs); haloacetic acids (HAA5); disinfectants and their byproducts; turbidity; and total coliform. The injectate must be analyzed annually for an abbreviated list of constituents which is limited to: TTHMs; HAA5; disinfectants and their byproducts; turbidity; and total coliform.

Metals Leaching Issues: None reported with regard to existing ASRs.

## Endangerment and Non-Compliance

If UDEQ determines that any Class V well may cause a violation of primary drinking water rules the UIC Regulations mandate: requiring a permit; ordering the injector to take such actions, including closure, as necessary to prevent violation; or appropriate enforcement action. Similar strictures apply if adverse health effects are determined (UAR R317-7-5.5 and 5.6).

The reviewed permit contains specific measures that must be taken to mitigate any violation. These required measures include: taking immediate action to prevent or mitigate the violation, including the cessation of injection (as necessary); conducting remedial investigations to determine the extent and impact of the contamination (if ordered by UDEQ); submitting a plan for corrective action to UDEQ (if requested) and implementing such plan if UDEQ approves. Utah UIC Permit No. UTU-27-IP-88A335D, Part II(A)(5).

## ASR Programs

## Wisconsin – EPA Region V

There is one permitted ASR facility in Wisconsin. One other facility attempted to acquire a permit, but did not proceed past the pilot phase due to an inability to lower arsenic levels to below state standards.

## UIC Program

Wisconsin

Wisconsin is a UIC primacy State. The Wisconsin Department of Natural Resources (WDNR) is responsible for administering the program. The State of Wisconsin's UIC Regulations are included in the Wisconsin Administrative Code (WAC) § NR 815. Any aquifer or groundwater, or portion of any aquifer or groundwater, located within the jurisdictional boundaries of the State is an underground source of drinking water. WAC § NR 815.05.

Wisconsin's UIC regulations strictly prohibit the construction of Class I, II, and III injection wells (WAC § NR 815.06). Construction of injection wells is limited to select Class IV injection wells (wells associated with remediation projects) and select Class V wells as allowed by administrative rule or by approval of WDNR or another designated regulatory agency.

The use of ASR wells is allowed under the State's *Requirements for the Operation and Design of Community Water Systems* (WAC § NR 811). Wisconsin has created specific regulations that are associated with ASR. WAC § NR 811, Subchapter XIV – Aquifer Storage and Recovery.

## Permitting

Wisconsin does not have a typical permit system for ASR wells. An applicant intending to construct and operate an ASR system must receive separate approval for both the construction of the ASR system and the operation of the ASR well. Additionally, ASR projects are only allowed to be constructed by municipal water systems and injection is limited to treated drinking water. WAC § NR 811.87.

## **Injection Requirements**

Wisconsin requires that the injected water meet primary drinking water standards at all times. Groundwater quality standards (NR 140) must be also be met prior to injection. If WDNR determines it to be technically unfeasible to treat to the groundwater standards it may allow for exceedances. At no time, though, is the injection allowed to exceed primary drinking water standards and may not contain any substance at a concentration that exceeds a State or federal health advisory prior to underground injection. WAC § NR 811.88.

### **Monitoring Requirements**

Applicants must submit a proposed compliance and monitoring plan that lists all sampling parameters and provides details of: monitoring schedules; monitoring locations; sampling methods; and quality assurance techniques that will be followed to ensure compliance. The plan must provide for testing of the water that is to be injected, stored, and recovered through each ASR well and for the groundwater present at monitoring wells. ASR site protocol is ultimately determined by WDNR following review of the applicants pilot study report or system development study report and associated documents. WAC § NR 811.93(5)(e).

Wisconsin provides for a "point of standards" application, which is defined as "the specific location, depth or distance from a facility, activity or practice at which the concentration of a substance in groundwater is measured for purposes of determining whether a preventive action limit or an enforcement standard has been attained or exceeded (NR 140.05(15))." For a sample permit, this point of standards limit was determined to be 1,200 feet from an aquifer storage and recover well and any other well that is not part of the ASR system and that is within 1,200 feet of an aquifer storage recover well. WAC § NR 140.22(1m).

### **Metals Leaching Issues**

Wisconsin requires that subsurface water in any portion of a displacement zone stay below the enforcement standards for select metals (including iron, manganese, copper, lead, and fluoride) and below the preventive action limits for certain other substances. WAC § NR 140. WDNR may grant exemptions for background concentrations that attain or exceed the specified limits.

Wisconsin's one ASR facility (Oak Creek) is reportedly experiencing problems with Manganese leaching out of the aquifer into the subsurface water. It may cease operations due to an inability to maintain compliance. **Endangerment and Non-Compliance** 

Wisconsin has established groundwater quality standards (WAC § NR 140) using two sets of groundwater concentration limits — "preventive action limits" and "enforcement standards" — for numerous chemicals and metals.

The standards established a system for evaluation and response to activities affecting subsurface water when a subsurface water is determined to have attained or exceeded a preventive action limit or enforcement standard. Operators must notify the State within a specified period of time of any attainment or exceedance of a limit or standard. WDNR is required to assess the cause and significance of the concentration of concern. WDNR will specify an appropriate response that will be designed and implemented to prevent any new releases of the substance from traveling beyond the applicable points of standards application. Responses include, but are not limited to: requiring the installation and sampling of groundwater monitoring wells; requiring a change in the monitoring plan; a revision of the operational procedures; or closure of a facility, practice or activity. **FOR ADDITIONAL INFORMATION:** Full Report available upon request from: thewaterreport@hotmail.com

For Additional Information, Full Report available upon request from, the waterreport@hotinan.com

ASR	EXEMPT WELLS IN THE WEST COMPLICATIONS & COMPROMISES
Regulation	by Nathan Bracken, Western States Water Council
Needs & Strategies Report	<b>INTRODUCTION</b> There are over a million exempt domestic and livestock wells located throughout the West. Although these wells are an important source of water for a large number of water users, they also pose significant regulatory and administrative challenges that have the potential to impact the sustainability of water supplies, surface flows, and water quality. In June 2008, the Western Governors' Association (WGA) and the Western States Water Council (WSWC) issued a report entitled <i>Water Needs and Strategies for a Sustainable Future: Next Steps</i> , which contained recommendations on how the states and federal government should address the ever-increasing challenges associated with water management in the West. <i>Next Steps</i> recommended that states "examine their related laws and institutions and evaluate the merits of[permitting and monitoring] exempt domestic and livestock wells as user a function.
Exempt Wells Study	<ul> <li>part of water rights regulatory schemes."</li> <li>The WSWC's Legal Committee subsequently commissioned "<i>Exempt Well Issues in the West</i>" – a report which examines:</li> <li>Statutory and regulatory authority among WSWC member states regarding exempt domestic and livestock wells</li> <li>Ways in which these wells can complicate or compromise water resources allocation, administration, and</li> </ul>
	<ul> <li>Quality</li> <li>Specific challenges WSWC member states are facing with respect to exempt wells</li> <li>Relative costs and benefits associated with monitoring wells that are currently exempt</li> <li>Potential approaches to mitigate the adverse impacts of exempt wells</li> </ul>
Groundwater Exemptions	<b>STATUTORY &amp; REGULATORY AUTHORITY</b> Excepting Utah and California, every WSWC member state exempts certain groundwater uses from its permitting and/or adjudication procedures. Although the specifics of these exemptions vary for each state, they generally allow landowners to withdraw small amounts of water for domestic or livestock purposes without obtaining a permit or subjecting their use to adjudication, monitoring, or reporting requirements. These exemptions typically restrict the amount of water that a well owner can withdraw (per minute, per day, per year, etc.) or limit the amount of acreage to which the water can be applied. The amount of water that can be withdrawn or used also varies from state to state. Most of these exemptions allow landowners to install exempt wells
Protests Limited	without providing notice to other water users and do not give other water users the option or ability to contest the installation of an exempt well. Many states enacted these exemptions decades ago with the belief that small domestic and stock uses were de minimis and were not worth the time or money needed to permit and regulate them. [Editor's Note: Washington State is engaged in a dispute over stockwater exemptions for large, commercial uses such as feedlots and dairies. See Osborn, <i>TWR</i> #71].
Subdivision Use	In most states, landowners who install an exempt well must comply with the well-drilling requirements that govern the construction of nonexempt wells. Many states also require landowners to file well logs or to register their exempt wells, but the information that states require varies, with some states requiring little information and others requiring detailed reports and logs that describe the location, capacity, and construction of exempt wells. Some states also have laws or regulations that specifically apply to exempt well use in subdivisions — most do not. Some states have laws and regulations that do not specifically apply to exempt wells, but nevertheless limit or regulate their use in subdivisions. The full Report — " <i>Exempt Well Issues in the West</i> " — describes the laws and regulations that specifically and indirectly govern exempt well use in detail (access information appears below).
Exempt from "No Injury" Rule	<b>EXEMPT WELLS: COMPLICATIONS &amp; COMPROMISES</b> IMPACTS TO WATER RESOURCES ALLOCATION, ADMINISTRATION & WATER QUALITY Exempt wells have the potential to cause a number of water quantity and quality problems. Most notably, there is a general understanding that the cumulative effect of many exempt wells can equal the impact of a single large withdrawal. Exempt wells, however, are not subject to the "no injury" aspects of western water law's priority system or susceptible to monitoring and reporting requirements. A related concern is that most exemptions do not prevent landowners from installing exempt wells in closed basins and aquifers that are hydrologically connected to streams and wetlands with impaired surface flows. Such use in these areas may adversely impact surface flows, riparian habitats, aquifers, and senior water rights.

## Exempt Wells

Exempt Wells in Washington State 1940, 1970, 2007





## The Water Report

From an administrative perspective, there appears to be a general lack of knowledge across the West regarding the number of exempt wells in each state, the location of those wells, and the amount of water they withdraw. Many states also appear to lack the administrative resources needed to monitor exempt wells and to determine their impact, which has the potential to hinder state water plans and conservation efforts. Perhaps the single most common administrative challenge is the preference of some developers to use exempt wells to supply their subdivisions with water as a way of circumventing the permitting process needed to build community or public water systems. In some cases, developers install hundreds of wells in dense, concentrated subdivisions. There are numerous cases where these "exempt" subdivisions are located in "closed" basins where water supplies are already limited to such an extent that additional water rights are no longer being granted. [Editor's Note: Montana example, see Water Briefs, *TWR* #70].

Exempt wells can pose threats to water quality and be conduits for pollutants. Most domestic exempt wells are shallow, which makes them susceptible to nitrates, pesticides, and other contaminants that are located close to the land surface. In addition, well owners generally lack the knowledge and experience needed to properly maintain their wells or manage water quality threats. They may also install their wells in improper locations that are too close to pollutants, such as septic tanks and mixing zones. Exempt wells in coastal areas can exacerbate seawater intrusion in sensitive aquifers by increasing withdrawals and lowering water tables.

## EXEMPT WELLS CHALLENGES TO WSWC MEMBER STATES

The impact of exempt wells varies across the West and depends upon a number of factors, including: water availability; the specific provisions of a state's exemption; a state's population; and the amount of growth that a state is experiencing. This means that exempt wells do not pose significant challenges in every western state. However, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, and Washington have all experienced substantial challenges with respect to exempt wells (see full Report for details).

## MONITORING EXEMPT WELLS: COSTS & BENEFITS

There are a number of methods that states can use to monitor wells that are currently exempt, including: 1) installing meters; 2) requiring self-reporting; 3) using aerial photography; and 4) using satellite (Landsat) imagery. The relative costs and benefits will depend upon the method used to monitor exempt wells and the individual circumstances of each state. The Report discusses the pros and cons associated with each of the above monitoring methods.

In general, the primary benefit of monitoring exempt wells is that water resources managers will have more information regarding exempt well use. They can use this information to: create more accurate water plans; implement conservation measures; and administer water rights. Monitoring may also provide exempt well users with an incentive to ensure that their withdrawals do not exceed the limits of their state's exemptions.

However, every monitoring method will require some administrative costs to collect and interpret the data it generates. When considering the costs and benefits associated with whether and how to monitor exempt wells, states should consider a number of factors.

EXEMPT WELL MONITORING CONSIDERATIONS INCLUDE:

- Some reports indicate that most exempt wells do not use more water than the allowable amount, which means that monitoring would do little to curtail existing exempt use.
- Monitoring alone will not stop developers and other landowners from installing new exempt wells.
- Metering and self-reporting only shows the amount of water that the wells withdraw and not the amount of water those wells actually consume through outdoor irrigation and other consumptive uses.

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- Monitoring methods will be ineffective if a state does not have sufficient data regarding the location and number of its exempt wells.
- Each monitoring method will entail some type of initial or continuing expense that the state or exempt users will need to pay, and there may be political opposition to methods that assess fees to existing exempt well users or raise taxes to pay for increase administrative costs.

## MITIGATING ADVERSE IMPACTS OF EXEMPT WELLS

The viability of an approach to mitigate the adverse impact of exempt wells will depend upon the individual circumstances of each state. Nevertheless, from a general perspective, even if existing wells are grandfathered, repealing the exemptions or drastically reducing an exemption's flow rate and volume withdrawal limit on a statewide basis will likely be infeasible in most states. Specifically, there appears to be significant public resistance to this approach and it is likely that most states currently do not have the political capital needed to revoke their exemptions. From an administrative standpoint, many states may not have sufficient information to locate and permit existing wells, and revoking an exemption could overwhelm state permitting agencies with applications for small groundwater uses. Further, this approach could increase the cost of desired development in rural areas and closed basins, could potentially increase the demand for public water supplies, and would not prevent grandfathered wells from withdrawing water.

Instead, the Report recommends that states consider modifying their exemptions or adopting measures that specifically address their individual concerns regarding exempt wells. For example, if a state is concerned about exempt well use in subdivisions, it could modify its exemption to limit the types of developments and subdivisions that can use exempt wells, or modify the procedures used to approve subdivisions so that such "exempt" subdivisions are not installed without a determination that there is sufficient water available and that such development will not impair water quality.

OTHER EXEMPT WELL POLICY OPTIONS INCLUDE:

- Limiting the number and type of exempt uses
- · Imposing restrictions on exempt well use in areas where water supplies are limited
- Requiring limits for consumption rather than withdrawals
- · Encouraging voluntary metering and reporting
- · Ensuring that exempt wells are properly constructed
- Instituting better recordkeeping procedures
- · Banning the installation of new exempt wells in areas where community systems are available

Each of these approaches has its limitations, but the general concept of modifying an exemption to mitigate specific adverse impacts will be less costly and more politically and administratively feasible than a total ban or drastic restriction on all new exempt uses. States may also be able to lessen political opposition to mitigation approaches by collaborating with stakeholders and interested parties to create negotiated solutions that address the adverse impacts of exempt wells but allow for responsible use of the exemptions. Moreover, the old adage "an ounce of prevention is worth a pound of cure" is applicable to exempt wells, and efforts to mitigate the impacts of existing exempt wells are likely more costly and administratively and politically difficult than prospective measures that prevent future adverse impacts.

### CONCLUSION

The debate over exempt wells is unlikely to subside as the demand for water in the West continues to grow. However, exempt wells may not pose a problem in every western state because exemptions, population growth, and water availability vary greatly across the West. In some states, the benefits that exempt wells provide, especially in allowing desired growth in rural areas, may outweigh their impacts. On the other hand, impacts from exempt wells may be too costly for other states *not* to curtail or limit their use. Therefore, there is no "one size fits all" approach for addressing exempt well use, and each state's individual circumstances will determine how and whether it will address this issue.

Editor's Note: This article was based on the Executive Summary of "Exempt Well Issues in the West" which was previously published as part of a law review article by Environmental Law, Volume 40, Issue 1 (Lewis & Clark Law School). The complete article is highly recommended. The article goes into detail regarding the statutory and regulatory authority regarding exempt wells and exempt well drilling in the western states. It also discusses how exempt wells can complicate or compromise water resources allocation, administration, and quality. In addition, it addresses the specific challenges WSWC member states face with respect to exempt wells; relative costs and benefits of monitoring wells that are currently exempt; and potential approaches to mitigate the adverse impacts of exempt wells. Complete Article AVAILABLE AT: www.lclark.edu/livewhale/download/?id=4541

### For Additional Information:

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See also: The WATER REPORT WEBSITE: www.thewaterreport.com ("Index of Articles" > "Exempt Wells")

Vadose Zone Recharge	USING VADOSE ZONE RECHARGE WELLS THE ARIZONA EXPERIENCE
	by Floyd L. Marsh of Lockwood, Andrews and Newnam, Inc. (Phoenix, AZ) and Gary G. Small of HydroSystems, Inc. (Phoenix, AZ)
Renewable Resource	<b>INTRODUCTION</b> Reclamation of water supplies in Arizona entails sustainable management of the water resource while considering this supply a renewable resource. Typical reclamation projects implemented by municipalities conjunctively use both direct reuse for meeting irrigation demands and indirect reuse through recharge to store, accrue, and recover stored water credits to sustain future supplies. This article provides an overview of design and implementation challenges of three recent and ongoing projects in rapidly growing central Arizona municipalities. In each case, reuse and recharge of reclaimed water supplies is a major emphasis of municipal water supply and infrastructure management.
	<b>RECHARGE WELL TECHNOLOGY: AN OVERVIEW</b> Recharge well technology serves as an efficient method to directly augment a water source by recharging various water sources into underground storage for future recovery. Types of recharge wells are typically classified as: vadose zone recharge wells; injection wells; and <b>a</b> quifer <b>s</b> torage and <b>r</b> ecovery (ASR)
Vadose Zone	<ul> <li>wells. Each well type has distinct design characteristics and applications.</li> <li>Vadose zone recharge wells, the topic of this article, are the simplest and least expensive of the three types. Vadose zone refers to the generally unsaturated subsurface strata of gravels, sands and silts that are located above an existing water table. Vadose zone recharge wells are typically a 48-inch back-filled borehole 150 to 180 feet in depth providing indirect recharge via gravity flow into this zone. Alternatively, injection wells are typically deeper direct conduits that inject water under pressure into the water table. ASR wells are also deeper conduits for recharging water into the water table or a deep aquifer for storage and subsequent recovery through the same well. Hence, the principal distinction between an ASR well and both the vadose zone and injection well is that an ASR well is in essence a dualuse well providing both recharge and recovery, typically at greater depths. Each recharge type has specific advantages and adaptability to site specific hydrogeological and environmental conditions as well as project needs and costs. One common advantage of recharge wells, compared to other recharge technologies such as surface infiltration, is the smaller footprint of land area necessary to accomplish recharge.</li> </ul>
Growth	<b>CITY OF SURPRISE</b> With a 2008 population of 104,000 with estimates to exceed 180,000 by 2020, the City of Surprise (Surprise) is the second fastest-growing municipality in the greater Phoenix metropolitan area. Approximately 20 miles northwest of Phoenix in Maricopa County, Surprise is the seventh largest city in the Phoenix metropolitan area. With a new home completed almost every three hours (2008 data) and a population once estimated to cross 500,000 at build-out by 2050, Surprise was one of the fastest growing cities in the state through 2008. Surprise leaders realized that this anticipated growth, combined with surface water allocations and groundwater regulatory limits, would place a tremendous strain on the its water resources in the future
	When Surprise initiated a comprehensive Water Resources Master Plan in 2002, reclaimed water was one of the renewable resources identified that would allow it to maintain adequate future water supplies to meet demands. This renewable supply consisted of the use of treated wastewater effluent (also known as reclaimed water supplies) from its wastewater plants.
Wastewater Treatment Expansion	Surprise envisions that by build-out a significant quantity of this treated wastewater effluent would be utilized, either by direct reuse for irrigation purposes or indirectly through recharge to store the reclaimed water resource and replenish Surprise's groundwater supply. To implement this plan and maintain compliance with permits required for plant discharge, local officials decided to expand Surprise's wastewater treatment capacity at the Surprise South Water Reclamation Plant (SSWRP) from 7.2 million gallons per day (MGD) to 16.3 MGD in five phases of expansion. However, this also presented a significant water resource management challenge.

	Much of the reclaimed water su	nnlies from the SSWRP in excess of direct irrigation demands were
Vadose Zone Recharge	stored in recharge infiltration basins basins and the cost of land in Arizor resulting from physical plugging, du organic materials. As a result, Surp reclaimed water supply increasing fi	— an expensive option considering the surface area occupied by these ma. Additionally, these recharge basins also had low infiltration rates the to high levels of total suspended solids (TDS) composed mostly of rise looked for an alternative recharge method to manage the projected rom growth.
Well Cluster	Finding a Solution In May 2006, a team of consult engineering and program manageme HydroSystems, Inc. (HSI), a Phoeni hydrogeologic applications, recomm recharge" technology to achieve Sur This technology, evolved from a adapted for site specific hydrogeolog the vadose zone. Reclaimed water, denitrification, is then recharged into clay, sand, gravel and silt layers late As noted vadose zone recharged	ants from Lockwood, Andrews & Newnam, Inc. (LAN), a planning, ent firm headquartered in Houston with a Phoenix office, and x-based firm specializing in groundwater recharge and other nended a solution to Surprise. This team proposed a new "vadose zone prise's water resource management goals. the more common Maxi IV dry well for stormwater disposal and gical conditions, uses a cluster of specially designed wells installed into treated to Class A+ quality levels using advanced filtration methods and o vadose zone wells. From the wells, the water percolates through the rally and vertically into the groundwater aquifer.
Water Credits	and the permitting requirements in A approach is the most efficient and co Arizona, a water provider can also a recover those credits through future Surprise awarded the contract to planning and civil engineering servi permitting, and DLT&V Systems Er instrumentation and control systems existing supervisory control and dat	Arizona are suited for this type of technology. Furthermore, this ost-effective way to recharge water into the underground system. In occrue credits by storing reclaimed water supplies using this technology, pumping, and enhance its water supply portfolio. To the team. LAN was selected to provide overall project management, ces, HSI was chosen for vadose zone recharge evaluation design and ngineering (DLT&V) was chosen to design the necessary electrical, and to integrate operation and control of the recharge project into the a <b>a</b> cquisition (SCADA) located at the SSWRP.
Phased-In Approach	The Solution: Vadose Zone Recha To utilize these projected reclair SSWRP and its subsequent recharge corresponding with ongoing expanse Accordingly, after the initial ph locations in the Surprise service area currently completing expansion to 1 approximately 32 vadose zone wells location will consist of five vadose v	<b>rge</b> med water supplies and balance the volume of the discharge from the s, Surprise decided to design and install the vadose zone wells in phases, ion of the SSWRP. ase, wells will be installed in up to four phases at two different a. The first location, immediately adjacent to the SSWRP and 6.3 MGD, has an estimated recharge capacity of 10 MGD and includes s. Due to current capital budget limitations, the first phase at this initial wells and three subsequent phases will include 10 each for phases two
Land Surface	Land Surface	and three, and seven wells in a final phase, respectively. Other project
HSJ11ydroSystems Inc.	13' x 8' x 6" Reinforced Concrete Slab with #4 4" PVC SCH 80 Injection Line 12" SCH 40 PVC Blank well casing Filter Fabric Sleeve 48" Diameter Borehole Clean Gravel (3/4" Minus) 12" SCH 40 PVC perforated casing (100 slot) 4" PVC Orifice Box w/ 4x10" Rubber Centralizer	elements include associated delivery pipeline, booster pump station modifications and an electrical instrumentation (SCADA) control system. Installation of prefiltration to further improve water quality by removal of TSS may also be considered and added to the recharge system. The second location, the Surprise Recreation Campus Recharge Facility (SRCRF) site located near the new Municipal Center, is approximately four miles from the SSWRP. It will have an estimated recharge capacity of 5 MGD and will include approximately 21 recharge wells. As with the initial location, this site will require delivery pipelines, booster pump station modifications, and an electrical instrumentation (SCADA) control system tied to the initial site. In September 2006, following initial project planning, Surprise and the consultant team started the design phase of the project. After evaluating site specific data, including geologic cross-sections and determining the groundwater flow direction at the two sites, the project team designed the vadose wells according to the site-specific soil and subsurface geologic conditions to maximize well recharge
Surprise Tennis Cent	er Vadose Zone Recharge Facility	capacity in the most cost-effective approach.

Vadose Zone	Each recharge well will be drilled to approximately 180 feet in depth and 48 inches in diameter using a bucket auger tool. The depth of groundwater in Surprise normally ranges from 300 to 500 feet. This means
Recharge	that the recharged water from the vadose zone wells will permeate through a minimum of 120 feet of sand, clay, gravel and silt — a process known as "water polishing" or "natural attenuation" — before reaching the groundwater table, thereby being purified further through natural soil percolation.
Natural Attenuation	The permitting agencies see this natural attenuation as a real advantage because of the additional treatment that the water undergoes in the strata. To achieve economy of space, the recharge wells will be placed along a rectangular perimeter with each well spaced just 100 feet apart from each other, yet
Smaller Footprint	minimizing interference between adjacent wells. This also allows the wells to be tested individually or in clusters, based on additional design or operational modifications after performance testing as may be desirable. The footprint of a vadose well is so small that an entire group of wells can be accommodated on a few acres compared to several acres that would be needed for recharge basins.
	<b>Project Challenges: Effective Solutions</b> With design and construction activities involving ongoing expansion of the SSWRP and the vadose zone recharge well project happening simultaneously, one of the critical project management challenges for Surprise and the project team was to coordinate different design activities. Planning had to anticipate construction of both components without interrupting the plant operations, while also maintaining project milestones. The scale and technological complexity of this project presented additional design integration and implementation challenges. Keeping the initial schedule for design was daunting and maintaining the focus of the complete project team was key to success as the project team wrapped up bidding and began construction.
Collaborative Process	To tackle these issues seamlessly, Surprise and the project team worked collaboratively on each aspect of the project. Biweekly project team meetings and regular site visits, in addition to individual task meetings, were scheduled to facilitate project understanding and evaluate impacts of existing infrastructure on well system design. Detailed project schedules, progress reports, and billing reports were maintained on a monthly basis to track and monitor design activities. In addition, the project team also kept Surprise staff informed and involved on a real time basis — including the managers, designers, engineers and operators — on the design, technological aspects, construction, and testing and operating procedures of the vadose recharge technology and proposed filtration systems. This tight-knit, fully integrated team was a key hallmark of the project's success.
Well Lifespan	Water Quality of Recharged Water A major issue that the team addressed during the project was the quality of the water that was to be recharged through the vadose wells. While vadose wells are less land-intensive and economical to install, they cannot be easily rehabilitated like other recharge technologies. Therefore, well lifespan is estimated to be only five to 10 years before replacement wells are necessary. Consequently, the water being recharged into the vadose wells has to be filtered to a very high level to minimize clogging due to particulates such as TSS and total organic carbons (TOC). In addition to reducing the initial infiltration rates, these solid organic materials also reduce the useful life span of a well.
Biological Plugging	The biggest challenge in most cases is microbiology — biological plugging caused by total organic carbons. One of the things discovered from the project team's experience designing and operating recharge wells was that typical reclaimed water has a high load of nutrients and this allows the bacteria already in the soil to flourish. Thus, disinfection and filtration at the surface helps to ensure that the water injected into these wells is of a very high quality. Surprise's reclaimed water is already considered high quality Class A+ by the State environmental quality agency, with suspended particles greater than 10 microns filtered out just prior to the plant discharge. The water being recharged through the vadose zone recharge wells has to be filtered to remove particulates such as TSS and maintained as high quality Class A+ to lower nutrient content (NO3-N) and include disinfection to prevent biological clogging.
TSS Removal	Due to permitting requirements, and to increase performance and longevity of the recharge wells by reducing clogging from TSS in the water source, Surprise's recharge sites require significant removal of TSS down to five microns at 95 % removal if possible. Various filtering systems were researched and evaluated and one manufacturer's filter was actually performance tested using the reclaimed source water discharging from the Special Planning Area 1 (SPA1) to the SSWRP (SPA1 is one of six geographic planning areas; SSWRP provides wastewater treatment for flows from SPA 1). However, due to high capital and long-term operational cost considerations of an effective filter system, and in the absence of a performance guarantee for removal efficiency and efficient back flush intervals in the delivery contract, Surprise elected not to proceed with any of the filtration systems considered.

	The design team, however, devised a solution to the TSS issue. A unique feature of this recharge
Vadose Zone Recharge Reservoir Cover	project is the alternative application of a reservoir cover to preserve quality of the reclaimed water supply. The City's reclaimed water is already high quality Class A+ water, but prior to being pumped into the recharge system this quality deteriorates with exposure to the environmental elements of open air existing storage reservoirs during post-treatment storage. As an alternative to the additional filtration considered initially, and subsequent to the final design phase, the City elected to proceed using a floating geomembrane cover to preserve reclaimed water quality and extend performance and life of the recharge wells. Following further value engineering, a design decision was made to install such a cover during the initial phase of recharge well installation on the smaller five million gallon (MG) storage reservoir connected to the booster pump facility. This smaller storage reservoir was in turn operationally isolated from the ten MG reservoir using a large TideFlex flexible valve to avoid mixing of water quality between the two reservoirs. The prevention of water quality deterioration will help to reduce future clogging of the vadose zone recharge wells and extend the period before well replacement is required. The reservoir cover used for this application is made of a high density polyethylene (HDPE) geomembrane fabric that floats on the water surface and is also supported by an existing baffle system in the reservoir. It includes air vents and a submersible sump pump system to remove water off the cover surface. A Layfield Environmental Systems Corporation 40 millimeter geomembrane enviro-liner cover was evaluated for this application and installed on the reservoir. The reservoir cover has an installed surface area of slightly less than 200,000 square feet.
Surface Infiltration	<b>Facility Operation, Project Schedule and Funding</b> When completed and operational, the facility will use a multiple-step process to recharge the water from the SSWRP. That portion of the reclaimed water generated at the SSWRP not diverted for some direct reuse is diverted into two temporary and interconnected storage reservoirs, with a total capacity of approximately 15 million gallons. The supply of higher quality reclaimed water stored in the smaller five MG covered and isolated reservoir is then delivered to the complex of recharge wells through a closed system, pressurized using three booster pumps into a separate reclaimed pipeline connected to a common piping manifold connecting the wells. Reject water resulting from occasional flushing of the delivery lines will be diverted to an existing adjacent City sewer main and recirculated through the SSWRP for reuse. Yet another feature of this recharge facility is the conjunctive operation of the well system with two existing surface infiltration basins. The existing and future recharge wells are designed to operate as the base load to recharge flows from the SSWRP. However, when a pre-determined pressure from the pumping facility is exceeded indicating that flow capacity into the well system is maximized, the reclaimed flows exceeding the total well capacity operating at the time are diverted to the infiltration basins serving as secondary recharge facilities. Hence, the system operates conjunctively and recharge of reclaimed water supplies is maximized under such conditions. Construction of the first phase of the project (five recharge wells plus the reclaimed water delivery system), which cost approximately \$4.22 million, began in September 2008 and was completed in early 2009. System startup and well performance testing followed construction and receipt of all project permits.
Storage Credits	The initial phase is currently fully operational and accruing to Surprise future storage credits toward a renewable water supply. Phases two, three and four, estimated to cost approximately \$9 million, will be completed in the next two to three fiscal years with the fourth phase slated for June 2011 completion, depending upon future budget availability. At completion of the initial three phases at the SSWRP location, additional vadose zone recharge wells will be designed and installed at the second location, the Surprise Recreation Center Campus site.
Costs	Costs of this project have been funded in large part by wastewater customer user-rates and fees, as well as contributions from development related fees. By merging reclaimed water quality management with an advanced recharge approach, Surprise is achieving dual objectives of implementing effluent management and using reclaimed water to sustain future groundwater water supplies. The design-construction services team of Lockwood, Andrews and Newnam (LAN), HydroSystems Inc (HSI), and DLTV System Engineering (DLTVSE), assisted by Archer Western Contractors as the CMAR contractor, supported Surprise through project planning, design and construction.

	CITY OF GLENDALE RECHARGE FACILITY EXPANSION
Vadose Zone	Project Description
Recharge	The City of Glendale (Glendale) has existing facility permits allowing for expansion of eight
Keenarge	additional recharge wells at the Arrowhead Ranch Water Reclamation Facility to recharge reclaimed water
Project Scope	supplies. The same project design team for the Surprise recharge system was selected to design, install and
Project Scope	performance test four additional valoes zone recharge wells and associated infrastructure for this second
	phase of the project. The project consisted of associated facilities including evaluation of intration systems
	integration of system operation and monitoring into Glandala's existing voter reelemation facility SCADA
	The scope of this project included evaluation and recommendations for rehabilitating or retrofitting
	existing recharge wells, plus evaluation and selection of filtration technology for improvement of reclaimed
	supplies delivered to recharge wells — to enhance recharge capacity and extend well life. The following
	section summarizes design, permitting and operational challenges of integrating expansion of this new
	facility with an existing recharge well system, reclaimed distribution pipeline, and booster station facility.
	Project delivery was shifted to a Construction Manager at Risk (CMAR) project at 60 percent design
	and the expansion phase is now completed awaiting start up and performance testing (expected to be
CMAR	completed by May 2010). CMAR is a an alternative project delivery method in which the construction
Project	contractor is involved in and contributes to project design at a certain stage (percentage complete out
	of 100% final plans). For this involvement and influence on design plans and their constructability, the
	contractor submits a guaranteed maximum price, since the construction uncertainties are removed or at
	avoid change orders costing more money based on interpretation and complexity of the design
	The LAN team provided the design installation and construction management on four of these
Recharge	additional recharge wells, including 800 linear feet of 20-inch delivery pipeline and booster pump station
Capacity	modifications. Utilizing the CMAR delivery method, this expansion has added recharge capacity of three
	to five MGD to the existing recharge facility. Additional project details include the following, related to
	design costs and construction schedule:
	• Design Costs: \$710,000 (design and construction management effort)
	• Construction Dates: Commenced June 2009 and completed March 2010
	• Final Construction Costs: \$1.772 million
	The Glendale project also had specific design and permitting issues associated with implementation
	of this second expansion phase. The initial phase of the project was the first in the state to use ASR
ASR	technology as one component for recharge of treated wastewater and reclaimed water. In addition to an
Component	ASR well, this phase experimented with a combination of typical vadose zone recharge wells, deeper
	than normal vadose zone wells, a hybrid vadose zone well, and ASR well and injection wells. Due to
	local hydrogeology and substandard water quality issues involving large inorganic material in municipal
	wastewater flows passing through the reclamation plant sand filter system, only the initial conventional
Water Quality	depth vadose zone wells performed satisfactorily. All the other well technologies either plugged easily due
Issues	to the reclaimed water quality or were not suitable for the local hydrogeological conditions — and thus
	experienced reduced recharge rates following minimal operation. This diminished capacity created the
	Weter Reclamation Plant
	Another objective of the recharge system was to provide equivalent redundancy for an effluent
	recovery distribution line that was used to distribute reclaimed supplies for seasonal irrigation of turf and
System	golf course demands. This system redundancy is necessary in the event that this line needs to be taken out
Redundancy	of service for any significant maintenance or failure. Hence, vadose zone wells became the technology
	of choice, when designed and operated properly for local site conditions, to expand recharge capacity for
	the project needs. Site specific design improvements and addition of filtration to provide removal of large
	inorganic materials and reduce premature well clogging were techniques used to meet these challenges.
	Examples of the inorganic materials that slip through the existing sand filters include small pieces of plastic
	wrappers, adhesive stickers on fruits and vegetables, band aids, etc.
	Additional design considerations involved with this project included: 1) integration of the operation
Design	and control of new recharge facilities (four new vadose zone wells) with the existing irrigation reuse
Considerations	in an existing multi-nump hooster station facility to ensure adequate numping capacity and integrated
	operation of all project features, including the effluent recovery line. The engineering solution to meet
	r

these design challenges was based on a hydraulic analysis of the complete booster station and zoning off

Vadose Zone Recharge	specific pumps of certain capacity to meet the needs of individual requirements (see <i>Detail</i> immediately below). The assumption was that the new recharge wells would be used to recharge a base load of the available reclaimed supply on a continuous basis and the existing underperforming wells will be used for the additional surplus supplies up to limits of their total capacity. Future phases of vadose zone recharge
	wells will be designed and installed based on performance of the second phase wells to meet the ultimate
Pump	redundancy requirement as capital budgets allow.
Analysis	(Detail: To optimize operation of the integrated system (old and four new wells) the better-performing
Integrated	new wells will be operated continuously using a combination of existing pumps to recharge the initial reclaimed water flow (i.e. base load) to their full capacity with dedicated (specifically isolated/connected by design) pumping capacity. The existing (eight) well system will recharge the balance of the reclaimed
System	water flow at any given time, with the same pumps operating up to the combined capacities of the existing
System	wells. Any flow left over after that would be pumped to the effluent recovery distribution line for storage
	in lakes for subsequent irrigation use. Thus, the two well systems will operate conjunctively (in tandem) with the new wells. The new wells will be used for the bulk of the flow and be supplemented as necessary by the existing wells. Both systems are served by dedicated pumps in an existing multi-pump booster
	station. Reconfiguration of the existing booster station to accommodate this conjunctive operation required significant engineering analysis of the pump characteristic curves and redesign of piping and valving to make this solution work.)
	Another group of challenges were not engineering or design in nature. These included: permitting
Non Design	delays created by the manpower and resource limitations of one of the oversight regulatory agencies
Non-Design	(after the requirement for additional permit amendment was determined): the underfunding of meeting
Challenges	the total redundancy aspects of the project: and the belated shifting to CMAR which impacted efficient
	labor use. For the most part, these issues are avoidable with proactive project planning from conception to
	completion when resources are not constrained. Such a situation however is next to ideal and experience
	demonstrates that it almost never occurs in projects of this complexity
	demonstrates that it annost never occurs in projects of this complexity.
	OUFFN CREEK, REUSE & RECHARCE FEASIBILITY STUDY
	Project Description
	This planning level appraisal study conducted by I AN focused on feasibility of reclaimed water reuse
	and recharge options available to the Town of Queen Creek (Queen Creek) Arizona. Through a three party
Marlt's Deather	intergovernmental agreement (IGA). Queen Creek and two adjacent municipalities share in the design
Iviuiti-Party	construction, and future expansion and operation of the Greenfield Water Reclamation Plant, which became
Agreement	operational in November 2006. At an ultimate capacity of 52 MGD. Queen Creek owns eight MGD of
	treatment capacity and the corresponding flow of Class A+ reclaimed water from this regional facility.
	which is co-owned with the Town of Gilbert (Gilbert) and the City of Mesa, Arizona. Oueen Creek must
	master plan and install infrastructure necessary to put this supply to use or lose permanent access to it.
	This study identified and evaluated the feasibility of options for reusing reclaimed water supplies.
Reuse Options	These options included direct reuse for irrigation of parks, medians, and other landscaped areas and indirect
1	reuse through recharge, storage, and recovery. Advantages, disadvantages and estimated costs of each
	ontion identified were evaluated
	The study identified a requirement for a \$23 million infrastructure investment for reuse and recharge
	of the reclaimed supplies. This infrastructure requirement identified the potential for up to 15 vadose
	zone recharge or deep injection wells and two recovery wells as the recharge component. Additional site
	specific investigation will be required to plan and design the final recharge system. This project summary
	highlights implementation and funding challenges faced by Oueen City as the project proceeds toward
	design and construction.
Hydraulic	A conceptual level hydraulic model was also developed and performed to validate sizing and operation
Model	of the proposed reuse infrastructure. The study identified a requirement for a \$23-\$25 million infrastructure
	investment to implement direct reuse and recharge of the reclaimed water supplies in order to manage and
	maintain control of this sustainable supply
	Project Challenges and Issues
	Although not of a technical or project design nature a number of notantial challenges and issues were
	nevertheless identified that Oueen Creek would encounter in future implementation of rause and real-
Contract	of its available realigned water supplies. Drimary among these is a contractually hinding maximizer of
Provision	of its available rectained water supplies. Frimary among these is a contractually binding provision of
	the three-party intergovernmental agreement (IGA) governing construction, expansion and operation of
	the Greenfield Regional Water Reclamation Plant that accepts its wastewater flows and produces Queen
	Creek's current and future reclaimed water supplies. That provision proclaims that Queen Creek (or any
	party to the agreement) that "cannot or does not accept delivery or otherwise dispose of its share of its

## Vadose Zone Recharge Forfeiture Clause Groundwater Contamination Floyd Marsh, Manager, Water Resources Programs and Reuse and Recharge Practice Leader for Lockwood, Andrews and Newnam. Inc (LAN), Phoenix, Arizona, has 30 years experience in master planning and implementing reuse and recharge projects in Arizona, both as a municipal water manager and a consulting project manager. His role in municipal water resources planning and water supply development, which includes the Scottsdale Water Campus, was with the City of Scottsdale as Water Resources Director through 2001. Gary Small, President and Principal of HydroSystems, Inc. (HSI), also located in Phoenix, Arizona, has more than 30 years experience in conducting hydrogeological programs involving groundwater development, water supply assessment and implementing successful recharge projects in Arizona and the Southwest. HSI is a 15 year old firm specializing in groundwater management and water recharge solutions.

reclaimed wastewater..." flows downstream of the plant discharge forfeits that share to the Lead Agent (Gilbert in this case), who has the right and the sole discretion to utilize or dispose of the water supply as it deems in its best interest. Furthermore, the relinquishing party not taking delivery can be assessed by the Lead Agent the expenses incurred, including costs of infrastructure necessary to deliver or dispose of the forfeited supply in any manner. Hence, Gilbert could legally take control of the supply for its use and require that Queen Creek underwrite the cost of delivery wherever Gilbert desired.

This "use it or lose it" provision is triggered upon the start of phase 2 plant expansion, which is based on an assessment of when current plant capacity will be reached that requires the expansion be completed. Whether and how this provision might be invoked among the parties as a practical matter is uncertain, but it is of sufficient concern to motivate Queen Creek to conduct this feasibility level study of infrastructure requirements and conceptual level costs to implement a solution prior to phase 2 plant expansion. With growth currently curtailed by the economic slowdown, the next plant expansion is being pushed out into the future — allowing more time for implementation of a solution by Queen Creek. Prudent action, hwoever, is still imperative to control and manage this reclaimed water resource.

Additional challenges identified in this feasibility study that Queen Creek faces in implementing future water reclamation and recharge program include:

- Recharge facility siting and permitting is impacted by an environmental groundwater contamination plume from an EPA SuperFund site at the nearby former Williams Air Force Base due to potential influence on plume migration
- Transmission pipeline routing through an older rural community with narrow right-of-way corridors and utility conflicts will limit alignment options
- Funding challenges will be problematic due to high capital construction costs, limited funding sources, and revenue streams to implement infrastructure requirements

Although significant impediments, these challenges can be overcome with advance planning and creative approaches to funding alternatives, including the consideration of public-private partnerships.

## CONCLUSION

With increases in growth and corresponding demands on available resources, water reclamation in the West has been evolving and is rapidly becoming a necessity in sustainable water management. Reclaimed water supplies are indeed a renewable and sustainable supply that keeps growing with population increases. In addition, management of these supplies through recharge wells that create underground storage for future recovery is an effective technology when applied on a project and site specific basis.

As illustrated by the three municipal reclaimed water projects reviewed, even with the same regulatory and policy framework, each water reclamation recharge project has site specific demands ranging from design parameters to facility permits, including system start up and ultimate operations. The project owner must be aware of the variables and their impacts, and accommodate these challenges into implementation and long-term operation. Matching project scope and operational goals with budget, in most cases, is the ultimate challenge for sustainable water management using the vadose zone recharge technology.

The Surprise portion of this article is adapted from prior articles published in January 2008 Public Works Magazine and April 2008 WaterWorld.

For Additional Information: Floyd L. Marsh, FLMarsh@lan-inc.com; Gary G. Small, gary@ hydrosystems-inc.com

**Statutory Citations:** Water management in Arizona, including reclaimed water supplies, involves a complex system of rules and institutional authorities that differ for each type and source of water. For additional information regarding statutes and regulations governing reclaimed water reuse and recharge in Arizona, the reader is referred to the Arizona Revised Statues (ARS) as follows: ARS Title 45, Sections 801.01-898.01, Chapter 3.1, Articles 1-6, for recharge; and ARS Title 49, Sections 104 (B) (13) and 49-141; AAC 9, Articles 6 and 7 and 18 ACC 11, Article 3, for reclaimed water reuse.

LINKS FOR OVERSIGHT AGENCIES INCLUDE: www.azdeq.gov/environ/water/permits/reclaimed.html www.azwater.gov/AzDWR/WaterManagement/Recharge/default.htm

## WATER BRIEFS

### KLAMATH "TAKINGS" OR OWNERSHIP OF WATER RIGHTS

### by David Moon, Editor

The Oregon Supreme Court recently issued its decision in a "takings" case brought by Klamath Basin farmers and irrigation districts against the federal government. In *Klamath Irrigation Dist. v. United States*, (No. S056275) (Or. Mar. 11, 2010), the Court held that the plaintiffs (water users) *may* have an equitable property interest in a water right to which the United States holds legal title under the on-going Klamath Basin Adjudication. The decision did keep alive the plaintiffs' ability to pursue their takings claim, with a decision on the definitive question of whether or not the plaintiffs have an "equitable or beneficial property interest in the water right to which the United States holds legal title" to be made by the federal courts.

The plaintiffs sought compensation for the Bureau of Reclamation's (Reclamation's) decision to terminate the delivery of water to plaintiffs during the drought of 2001 to make water available for three species of endangered fish. Plaintiffs action in the US Court of Federal Claims alleged that the US had taken their property in violation of the Fifth Amendment and, alternatively, that the US had breached its contractual obligation to deliver water to them. Following an appeal from the Court of Federal Claims (summary judgment decision), the US Court of Appeals for the Federal District requested the Oregon Supreme Court (Court) to provide guidance on three state law questions related to the takings claim, which that court believed should be answered by the Oregon court.

To understand the decision it is important to understand the plaintiffs' position regarding the property interest they are asserting. "Plaintiffs accordingly assumed, for the purposes of their federal takings claim, that the United States holds legal title to the water rights, and they elected to proceed in the federal action solely on the theory that they hold an equitable or beneficial interest in the water rights, which the government took when it refused to deliver water to them in 2001."

The decision turned on a 1905 Oregon statute that granted the US the ability to appropriate all the then-unappropriated water in the basin for Reclamation's Klamath Project, as well as the Reclamation contracts held by the plaintiffs. In answer to the first question before the Court — "does that [1905] statute preclude irrigation districts and landowners from acquiring a beneficial or equitable property interest in the water right acquired by the United States?" — the Court found that the statute does not preclude plaintiffs from acquiring such an interest. The Court also held that the under the 1905 statute it was not necessary for a party to obtain a formal written release from the US to have acquired an equitable or beneficial property interest in the water right that the US appropriated.

The effect of a general stream adjudication under the McCarran Amendment that is underway in the Klamath Basin was at issue in the third question, where the Court decided: "To the extent that plaintiffs assert only an equitable or beneficial property interest in the water right to which the United States claims legal title in the Klamath Basin adjudication, plaintiffs are not 'claimants' who must appear in that adjudication or lose the right. As a general rule, equitable or beneficial property interests in a water right to which someone else claims legal title are not subject to determination in a state water rights adjudication." Thus, the Klamath Basin Adjudication does not deprive the water users of the ability to pursue their taking claim in federal court.

Finally, the Court answered the second question, to a degree, but then kicked the issue back to the federal court for a definitive answer that will turn on the plaintiffs' contracts with Reclamation. "Under Oregon law, whether plaintiffs acquired an equitable or beneficial property interest in the water right turns on three factors: whether plaintiffs put the water to beneficial use with the result that it became appurtenant to their land, whether the United States acquired the water right for plaintiffs' use and benefit, and, if it did, whether the contractual agreements between the United States and plaintiffs somehow have altered that relationship. In this case, the first two factors suggest that plaintiffs acquired a beneficial or equitable property interest in the water right to which the United States claims legal title, but we cannot provide a definitive answer to the court's second question because all the agreements between the parties are not before us."

Once the case returns to federal court, the decision will undoubtedly be determined by the relationship between the water users and Reclamation, and the contract language of the Klamath Project: "...in deciding the respective property interests of the appropriator and the user of a water right, this court has looked not only to beneficial use but also to the relationship between the parties, as well as any contractual agreements between them." The Court did state, however, its view regarding the federal government's intent: "However, the Court's decision in *Nevada v. United States* persuades us that the United States holds the water right that it appropriated pursuant to the 1905 Oregon act for the use and benefit of the landowners." Further, the Court found: "That consistent recognition of the relationship created by the Reclamation Act persuades us that, as a matter of state law, the relationship between the United States and plaintiffs is similar to that of a trustee and beneficiary."

The ultimate question for the plaintiffs — should they be compensated for the alleged "taking" by the federal government — was not answered in this case. In footnote 17, the Court stated: "In answering the Federal Circuit's second question, we address only whether plaintiffs acquired a beneficial or equitable property interest under state law. The question whether that state property interest, if acquired, gives rise to a federal takings claim is a matter of federal law that goes beyond the scope of the court's questions, and we do not address it."

For info: Complete case available at: www.publications.ojd.state.or.us/S056275a.htm

## GROUNDWATER SYSTEM CA

"California's water system is facing a series of challenges affecting water availability, reliability, and delivery. Groundwater management is one of the state's most critical liquid assets — a key component of both local and statewide efforts to better manage water supply and water quality in the state." (LAO Report, Executive Summary). The California Legislative Analyst's Office (LAO) recommends in a report issued March 24 that California must re-evaluate the way groundwater is managed in the state if the resource is to achieve its full potential as a reliable source of water. "Liquid Assets: Improving Management of the State's Groundwater Resources," recommends a series of actions to be phased in over a period of time to address groundwater issues, including establishing active management areas where the potential for overdraft is highest and bringing science and law together to better reflect the interconnection of surface water and groundwater. LAO is California's nonpartisan fiscal and policy advisor.

Though groundwater storage and conjunctive use have the potential to play a major role in meeting California's water needs, statewide water management is hampered by the lack of regulation or monitoring of groundwater, according to the report. "Management of groundwater supplies — to the extent that it does occur

- resides mainly at the local level and thus, by its very nature, does not address water needs from a statewide perspective," the report says.

The report includes sections that provide more background on the state's current approach to groundwater management; address current issues with groundwater management, including the impact of water quality on water supply; address the disconnect between the law and science of groundwater; and review other states' approaches to groundwater management.

Specifically, the report recommends that the Legislature: (1) Phase in a more comprehensive groundwater monitoring system to allow the state to focus funding and technical assistance efforts in the areas of greatest need; (2) Establish Active Management

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Areas (a defined geographic area where specific rules are established to govern the withdrawal and use of groundwater), in circumstances where groundwater overdraft potential or the extent of pollution problems are the highest; (3) Bring science and law together to modernize groundwater law to accurately reflect the physical interconnection of surface water and groundwater; and (4) Consider phasing in statewide groundwater permitting over a multiyear period, based on data from expanded monitoring requirements, while maintaining local control over implementation of permitting to the extent possible. For info: Report available at: www.lao. ca.gov/laoapp/PubDetails.aspx?id=2242

## TCEQ ESA SUIT

FRESHWATER INFLOWS TO REFUGE On March 11, The Aransas Project (TAP) filed a federal lawsuit in the US District Court for the Southern District of Texas against several officials of the Texas Commission on Environmental Quality (TCEQ) in their official capacities for illegal harm and harassment of Whooping Cranes at and adjacent to Aransas National Wildlife Refuge in violation of the US Endangered Species Act (ESA). TCEQ is the lead environmental agency for the state of Texas. The "harm that the Whooping Cranes have experienced is a direct result of TCEQ's failed oversight of its water rights permit programs in the Guadalupe River Basin where too much water is being taken out of the Guadalupe and San Antonio Rivers, especially during low flow conditions," according to TAP attorney Jim Blackburn. The defendants named in the suit in their official capacities are the three TCEQ Commissioners, the agency's Executive Director, and the TCEQ's South Texas Watermaster.

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The Aransas-Wood Buffalo flock of Whooping Cranes that winters on the Texas coast is the only natural wild flock remaining in the world. The flock has increased from 16 birds in the early 1940s to a high of 270 in the spring of 2008. The 2008-2009 year was the worst in recent history for the Whooping Crane, with a death toll of 57 birds, a staggering loss of 21.4% of the flock of which 23 deaths, or 8.5% of the flock, occurred in Texas during their winter at Aransas. The lack of freshwater inflows to the bays from the Guadalupe and San Antonio Rivers, especially during times of low flows, resulted in very high salinity levels and depleted food and water sources for the Cranes.

TAP also asserted that scientific evidence strongly indicates that during lower flow conditions the full use of existing water rights in the Guadalupe River Basin (Basin), which are granted and overseen by TCEQ, will worsen the condition of the Whooping Cranes if fully utilized. These existing water rights are beyond the reach of both the environmental flows process established by the Texas Legislature under Senate Bill 3 and the Edwards Aquifer **Recovery Implementation Program** — neither of which offers the authority or scope to protect the Cranes or to remedy the over-allocation of water resources that already exists in this basin, according to TAP.

Causing harm, harassment, or death of the protected Cranes is illegal under ESA. To remedy the violations of ESA caused by TCEQ's administration of the state's water permit program in the Basin, TAP seeks an injunction to prohibit TCEQ from approving or processing new or pending water rights permits in the Basin until the court can oversee the development, approval, and implementation of a Habitat Conservation Plan for the Whooping Cranes. TAP is seeking a Habitat Conservation Plan under ESA.

Another twist to the controversy was pointed out in TAP's press release, which noted that actions by the Guadalupe-Blanco River Authority (GBRA) since the filing of TAP's Notice of Intent to Sue demonstrated the need for legal action. During that time period, GBRA — without seeking public comment and on an accelerated timetable — lengthened the term of an existing contract with Exelon that ties up more than 24 billion gallons of water annually from the Guadalupe River for a proposed nuclear plant. For info: TAP website: http:// thearansasproject.org/; TCEQ website: www.tceq.state.tx.us/

## HEALTH RISK DATA

EPA WEBSITE LAUNCHED

The US Environmental Protection Agency (EPA) recently unveiled a new website with a searchable database of scientific studies and other information used to develop EPA's environmental risk assessments. The Health and Environmental Research Online (HERO) database includes more than 300,000 scientific articles as well as references and data from the Integrated Risk Information System (IRIS), a database that supports critical agency policymaking for chemical regulation. **For info:** EPA website at: www.epa. gov/hero

### RECLAIMED WATER BRIGHTWATER SYSTEM SUPPORT

A court decision was recently handed down in Washington that strongly supports King County's reclaimed wastewater system and allows it to sell and distribute reclaimed water from its Brightwater Project. In Cedar River Water and Sewer, et al. v. King County et al., Case No. 08-2-11167-4 (Feb. 5, 2010), Superior Court for the State of Washington, County of Pierce, Judge Felnagle granted King County's summary judgment motion in its entirety and dismissed (with prejudice) the plaintiffs' cross-motion and "plaintiffs' claims related to King County's authority to distribute and sell reclaimed water ... including plaintiffs' claims that the cost of the 'backbone' cannot be charged to the Water Quality Fund." Order, p. 3.

At issue in the case was the "backbone" — a pipeline system for the distribution of reclaimed waster from Brightwater - and whether or not King County had the legal authority to build the "backbone" and charge the costs of its construction to the "Water Quality Fund" (WQF). Plaintiffs primarily argued that King County was not legally authorized to operate a water utility and thus, its distribution and sale of reclaimed water was "ultra vires and illegal." The plaintiffs also asserted that even if King County were so authorized, the WQF should not bear the costs of building the "backbone" infrastructure needed for the distribution and sale of reclaimed water - but rather than King County's general fund

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## WATER BRIEFS

should bear the cost.

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Basically, King County argued that the plaintiffs' reliance on the "Sewerage, Water and Drainage Systems" statute, RCW 36.94 et seq. was incorrect and that the governing statute that provided it with express and implied authority to sell and distribute reclaimed wastewater is the "Reclaimed Water Use Act," RCW 90.46 et seq. As King County's Motion noted, "Producing reclaimed water without distributing and selling it would deny ratepayers the benefit of proceeds from sales of reclaimed water - an odd position for plaintiffs to take, when they are claiming to be acting for the benefit of ratepayers." Motion, pp. 2-3. King County also argued that it has statutory authority to perform "water pollution abatement" functions under RCW 35.58.050, .200, including the power to "construct" facilities for "water quality improvement," "pipelines," and all other necessary "equipment and accessories." RCM 35.58.200(2). Motion, p. 20.

The Judge ruled from the bench in open court and thus did not provide any specific explanation for his ruling. Nonetheless, since it was an order on a summary judgment motion, it means that he found that the plaintiffs' claims should be dismissed as a matter of law, rather than proceeding to trial on the claims.

**For info:** David Moon, Editor, 541/ 485-5350 or thewaterreport@hotmail. com; See also Hummel, *TWR* #46

## EXEMPT WELLS HEARING MT APPROPRIATION RULES

On March 15, the Montana Department of Natural Resources and Conservation (DNRC) announced the appointment of a hearings officer and a schedule for submitting briefs and public comment on water appropriation rules governing exempt wells in Montana. "The use of exempt wells is an issue of statewide importance, with statewide implications," said DNRC Director Mary Sexton. "This briefing and public hearing process will allow formal input from all interested parties." DNRC Deputy Director Joe Lamson will serve as hearings officer and will make the final determination on the issue.

In December 2009, the Western Environmental Law Center on behalf of five petitioners requested DNRC to make a ruling on whether the combined appropriations rule governing exempt wells is consistent with applicable law. Petitioners additionally requested DNRC adopt a new definition of the rule. Sexton said DNRC would refrain from taking up the amendment request until a determination is made on the declaratory ruling, which is expected in July, 2010. "This process may not be the final step in determining the appropriate use of exempt wells," Sexton said. "Further court or legislative action made be necessary to ensure we have clarification of the term 'combined appropriation."

Opening Briefs and Position Statements are due at DNRC's Water Resources Division Hearings Unit by 5 p.m. on April 30, with Responses due by 5 p.m. on June 4. The Public Hearing is scheduled for 9 a.m. on June 17, 2010, in Room 303 of the State Capitol, in Helena.

**For info:** Mary Sexton, DNRC Director, 406/444-2074 or http://dnrc.mt.gov/

## NEVADA WATER RIGHTS NV AGENCY SEEKING INPUT

The Nevada Division of Water Resources (NDWR) dealt with the fallout from the January 28, 2010, Nevada Supreme Court decision in Great Basin Water Network, et al. v. State Engineer and Southern Nevada Water Authority, 126 Nev., Advance Opinion 2 (2010), in part by holding a legislative workshop aimed at soliciting stakeholder's input and potential draft language for a change in state law. As noted in the March 3 Notice of the Workshop, there is no statutory basis for a formal hearing on the matter. The State Engineer also stated in the Notice that his office would consider input on the following issues: protection of existing water rights; the status of pending applications; preservation of priorities; and application of the protect period provisions.

NDWR's website concerning the Nevada Supreme Court decision includes links to the decision itself, workshop written comments received, several versions of suggested legislative language, and post-workshop comments from several interested parties. **For info:** NDWR website: http://water. nv.gov/hearings/supremecourt.cfm

## WATER BRIEFS

### WATER CONSERVATION CA STATE WATER RESOURCES PLAN

California has released the final 20x2020 Water Conservation Plan. In February 2008, Governor Schwarzenegger set a goal of a twenty percent reduction in statewide per capita water use by 2020 and asked state agencies to develop an aggressive plan to achieve the goal. The draft of this plan served as a basis for legislation that was enacted in November 2009 to incorporate into law (SB X7 7) the goal to achieve a 20 percent reduction in urban per capita water use in California by 2020. Urban water suppliers are required to establish water conservation targets for the years 2015 and 2020. One of the alternative approaches specified in the law that water suppliers can use for their local targets is based on the regional targets in the April 30, 2009 draft 20x2020 Water Conservation Plan. The regional targets in the final plan are the same as in the draft. For info: Rich Mills, SWRCB, 916/ 341-5739 or rmills@waterboards. ca.govor; Plan is available on the State Water Resources Control Board website: www.waterboards.ca.gov/water issues/ hot topics/20x2020/index.shtml

## GROUNDWATER LIMITS WA EMERGENCY RULE EXTENDED

With mitigation water available for purchase from a senior water right holder, and with state and county officials studying the effectiveness of a domestic water reserve program for upper Kittitas County, the Washington Department of Ecology (Ecology) has extended an emergency rule that currently limits new groundwater withdrawals in the upper county. New groundwater uses are allowed when the water use is fully mitigated to offset impacts to senior water rights and protect streamflows.

Ecology Director Ted Sturdevant extended the rule for another 120 days on Tuesday, March 23, 2010. New groundwater withdrawals were first halted in July 2009 because of concerns about the impact groundwater pumping in upper Kittitas County has on the total water supply for the Yakima River Basin. The rule was due to expire March 25.

The US Bureau of Reclamation anticipates senior surface water supplies will be rationed this irrigation season. It will be the fifth time water has been rationed to senior water users since 2000. "We're looking at another likely drought this year," Sturdevant said. "Allowing new, uncontrolled drilling into the very groundwater that folks downstream rely on - but won't get this year — just doesn't make sense. We're in discussion with the county, and I'm hopeful we can develop a long-term solution soon that provides predictability and balances a finite water supply across competing needs."

Mitigation water is now available for purchase from Suncadia Resort through a water-banking program that allows for development along much of the I-90 corridor in upper Kittitas County. Ecology is working with Suncadia to process water-budgetneutral requests for prospective home builders and homeowners. Approval of water-budget-neutral requests would provide these property owners the mitigation they need to obtain building permits this year, and would be the first transactions using the Upper Kittitas Water Exchange. In the meantime, state and county officials are still negotiating a water management agreement, including an innovative domestic water reserve program that would allow development to occur through a water leasing program. A successful reserve program would protect homeowners and fish runs during dry years, and protect the long-term agriculture economy. For info: Joye Redfield-Wilder, Ecology, 509/ 575-2610, jred461@ecy. wa.gov or www.ecy.wa.gov/programs/ wr/cwp/wtrxchng.html

## DRINKING WATER

STRICTER EPA REGULATIONS

In a March 22nd speech, EPA Administrator Lisa Jackson announced the Agency is developing a broad new set of strategies to enhance public health protection from contaminants in drinking water. EPA is seeking a new approach to expand public health protection for drinking water by going beyond the traditional framework that addresses contaminants one at a

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time. EPA will focus on four principles that will provide greater protection of drinking water: address contaminants as a group rather than one at a time so that enhancement of drinking water protection can be achieved costeffectively; foster development of new drinking water technologies to address health risks posed by a broad array of contaminants by engaging private innovators, entrepreneurs and small businesses to improve drinking water treatment technology; use the authority of multiple statutes - such as pesticide and chemicals laws — to help protect drinking water; and partner with states and local partners to share more complete and up-to-date data from monitoring and analysis at public water systems (PWS).

"The plan doesn't require more regulation — it uses existing regulations more efficiently and effectively. Our vision is a way forward that facilitates greater collaboration between government, communities and industry; one that provides cleaner flowing water through a faster flow of information; and one that accelerates innovation across the board. That innovation will promote new jobs, and help us develop new technologies to meet the needs of rural, urban and other water-stressed communities," Jackson said in her speech.

Jackson commented that "so far, we've done a good job of looking at unregulated contaminants. But we are identifying new contaminants in drinking water at a much faster rate than we are addressing them. What slows us down is a process that looks at each individual contaminant, one at a time. With more than 80,000 chemicals identified in the Toxic Substances Control Act — and science providing new information every day - we're not keeping pace with the increasing knowledge we have about chemicals... We will be working with you and others in the drinking water community to determine how we define these groups, what technologies are best suited to addressing certain groups, and how we can use grouping to make our systems faster and more effective." For info: www.epa.gov/safewater/sdwa/ dwstrategy.html

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## **CALENDAR**

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#### April 12-16 WA Wetland Delineation Intensive Course, Seattle. Edmonds Conference Ctr. Sponsored by UW College of Engineering. For info: www.

engr.washington.edu/epp/cee/wet.html April 13-16 TX

#### Texas Water 2010 Conference, Corpus Christi. For info: TWinfo@tawwa.org, 512/251-9101 or www.texas-water.com/ contactus.html

#### April 14

Climate Change Policy Speech by Gov. Kulongoski, Eugene. UO Law School, Rm 175. For info: Abbie Stillie, Wayne Morse Center, astilie@uoregon.edu

#### April 14-15

**Global Marine Renewable Energy** Conference (3rd Annual), Seattle. Bell Harbor Int'l Convention Ctr. For info: www. globalmarinerenewable.com/

#### April 15

When Will the Reservoirs Run Dry: Looming Water Crisis in the SW (Brownbag), Tucson. UA Integrated Learning Ctr., Rm. 140, 4-5pm. Presented by Water Resources Research Center (UA). For info: Sustainable Water Resources Management in Site Design & Development Course

#### April 15

Introduction to Phytoremediation & Plant/ Groundwater Interactions Course, Denver. For info: National Ground Water Ass'n, 800/ 551-7379 or www.ngwa.org

#### April 15

WA NEBC Olympic Chapter Pub Mixer, Seattle. Pike Brewery. For info: Sue Moir, NEBC, 503/ 227-6361, sue@nebc.org or www.nebc.org

#### April 15 CA Sustainable Water Resources Management in Site Design & Development Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu

<u>April 15-16</u> DC Energy & Climate Ministerial of the Americas, Washington. For info: DOE: www. energy.gov/news2009/8251.htm

CO April 15-16 Guidelines for Groundwater Legal Consultation Course, Denver. For info: National Ground Water Ass'n, 800/ 551-7379 or www.nvwra.org/events

#### April 16

The US & Tribal Nations: An Evolving Relationship Guided by Domestic & Int'l Law Lecture, Moscow & Boise. ASUI-Kibbie Activity Center & UI Boise Water Ctr. Guests: Larry Echo Hawk & Rebecca Tsosie. For info: Helen Albertson-Ploucha, hap@uidaho.edu or www.uidaho.edu/law

#### April 17

WA Earth Day @ Longfellow Creek: Restoring the Duwamish Watershed Event, West Seattle. Brandon Street Natural Area, 29th Ave, SW & SW Brandon St. For info: http:// pugetsound.org/events/duwamishalive

#### April 18-20

FL Waste to Fuels Conference & Trade Show, Jacksonville. For info: www.waste-to-fuels.org

#### April 20

Practicioner's Guide to Isotope Hydrology Course, Webinar. For info: National Ground Water Ass'n, 800/ 551-7379 or www.ngwa.org

#### April 20-21

Certified Erosion & Sediment Control Lead Training Course, Seattle. NWETC Headqtrs, 650 South Orcas Street. For info: NWETC, 206/762-1976 or www.nwetc.org/

#### April 21

GoGreen '10: Cultivating Sustainable Business Conference, Seattle. For info: http:// seattle.gogreenconference.net

#### April 21

OR

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City/County Water Study Phase II Report & Implementation Status Brownbag, Tucson. WRRC, 350 N. Campbell Ave., 4:15-5:30pm. Presented by Water Resources Research Center (UA). For info: WRRC, 520/ 621-9591, wrrc@cals.arizona.edu or http://cals.arizona edu/azwater

#### April 21-22

WA Certified Erosion & Sediment Control Lead Training Course, Seattle. NWETC Headqtrs, 650 South Orcas Street. For info: NWETC, 206/ 762-1976 or www.nwetc.org/

#### April 21-22

Future Energy Conference: Business of Renewable Energy & Efficiency in the NW, Portland. Oregon Convention Center. Presented by NW Environmental Business Council & NW Energy Efficiency Council. For info: Sue Moir, NEBC, 503/ 227-6361, sue@ nebc.org or www.futureenergyconference.com

#### April 22

FishTails & Cocktails Celebration & Silent Auction, Denver. Oxford Hotel Grand Ballroom. Sponsord by Colorado Water Trust. For info: www.coloradowatertrust.org

#### April 22

CERCLA & MTCA Conference, Seattle. For info: Holly Duncan, Environmental Law Education Center, 503/282-5220, hduncan@ elecenter.com or www.elecenter.com

#### <u>April 22</u>

Santa Ana River Watershed 2010: Working Together for a Sustainable Future Conference, Anaheim. Convened by Santa Ana Watershed Project Authority. For info: Jean Nordmann, 916/444-6240, jnordmann@ watereducation.org or www.watereducation. org/conferences

#### <u>April 23-25</u> BC, Canada

7th Annual Fisheries & Marine Ecosystems Graduate Conference, Camp Howdy. For info: http://fameconference.org

#### April 24-25

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Oregon AgFest, Salem. Oregon State Fairgrounds. For info: http://oragfest.com

#### April 25-29

<u>CO</u> Seventh National Monitoring Conference: Monitoring from the Summit to the Sea, Denver. Sponsored by National Water Quality Monitoring Council. For info: Conf. website: http://acwi.gov/monitoring/

#### April 26

Fundamental Contaminant Chemistry Course, Seattle, NWETC Headotrs, 650 South Orcas Street, For info: NWETC, 206/762-1976 or www.nwetc.org/

#### April 26-27

Global Water Summit 2010: Transforming the World of Water, Paris. Marriott Rive Gauche. For info: www.globalwaterintel.com/

#### April 26-28 NV Environmental Law: Protection of Native American Natural Resources Conference, Las Vegas. For info: Falmouth Institute: www. falmouthinstitute.com/

#### WA April 26-30

WA Contaminant Chemistry, Transport, Fate & Remediation in Soil & Groundwater Course, Seattle. EOS Alliance HQ, 650 Orcas Street. Split Day Courses Available. For info: NWETC, 206/762-1976 or www.nwetc.org/

#### April 27 MT

Water Rights: What You Need to Know Workshop, Missoula. Sponsored by Montana Watercourse & DNRC. For info: Janet Bender-Keigley, 406/994-6671, jkeigley@montana. edu or www.mtwatercourse.org

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### April 27

2010 Water Year Update & Overview of Water Related Climate Change Adaptation Efforts Meeting, Bellevue. City Center Bldg., 500 108th Ave. N.E., 11:30am. AWRA-WA Luncheon. For info: http://earth.golder.com/ waawra/ASP/Home.asp

#### April 27-28

**Contaminant Site Assessments for Remedial** Investigations Course, Seattle. NWETC Headqtrs, 650 South Orcas Street. For info: NWETC, 206/ 762-1976 or www.nwetc.org/

#### April 28

Hot Topics in Water & Climate Policy Brownbag Speech - Benjamin Grumbles, ADEO Director, Tucson. WRRC, 350 N. Campbell Ave., 4:15-5:30pm. Presented by Water Resources Research Center (UA). For info: Jane Cripps, WRRC, 520/ 621-9591 x55 or jcripps@cals.arizona.edu

#### April 28 Stream & Wetland Ecology Basic Training,

Everett. NW Stream Center, Snohomish County's McColum Park. Sponsored by Adopt-A-Stream Foundation. For info: ASA, 425/ 316-8592 or aasf@streamkeeper.org

#### April 28-30

Managing Agricultural Landscapes for **Environmental Quality II Conference,** Denver. Renaissance Denver. Sponsored by Soil & Water Conservation Society. For info: www.swcs.org/

#### April 29

Sustainable Water Resources Management in Site Design & Development Course. Sacramento, Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu

### April 29

Engineering in a Climate of Change: Making the Lakes Great Conference, Toronto. MaRS Discovery Dist. For info: www.ospeclimatechange.ca/

#### April 29-30

Climate Change Regulation Seminar, Washington. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars. com, or website: www.lawseminars.com

#### April 29-30

Applications of Monitored Natural Attenuation for Remediation of Hydrocarbons in Soil and Groundwater Course, Seattle, NWETC Headatrs, 650 South Orcas Street, For info: NWETC, 206/762-1976

## or www.nwetc.org/

April 29-30 CA Coastal Law Conference, Los Angeles. For info: CLE International, 800/ 873-7130 or website: www.cle.com

#### April 29-30

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Wyoming Water & Energy Development Law Seminar, Cheyenne. For info: CLE International, 800/ 873-7130 or website: www. cle.com

#### April 29-30

Due Diligence in Natural Resources Transactions, Westminster. Sponsored by Rocky Mt. Mineral Law Foundation. For info: www.rmmlf.org

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#### May 3-4

Climate Change in Alaska Seminar, Anchorage, For info: Law Seminars Int'l. 800/ 854-8009, email: registrar@lawseminars.com. or website: www.lawseminars.com

### May 3-4

Fundamentals of Groundwater Geochemistry Course, Portland. For info: National Ground Water Ass'n, 800/ 551-7379 or www.ngwa.org

#### May 4-5 TN AMTA Technology Transfer Workshop, Knoxville. Marriott Hotel. Sponsored by

American Membrane Technology Ass'n. For info: www.amtaorg.com

#### May 4-5 TX **TCEO's Environmental Trade Fair &** Conference, Austin. Austin Convention Ctr. Presented by Texas Commisison on

Environmental Quality. For info: www.tceq. state.tx.us/assistance/events/etfc/etf.html

#### May 4-5 WA Hydrology & Basic Hydraulics Program, Bellevue. Sponsored by UW Engineering. For

info: www.engr.washington.edu/epp/transpeed/ hyd.html

#### CA May 4-7 2010 Assn. of California Water Agencies Spring Conference & Exhibition, Monterey.

Portola Plaza & Marriot Hotels. For info: ACWA, 916/441-4545 or website: www. acwa.com

#### May 4-7

Sustainability of Montana's Water Resources Conference, Kalispell. Hilton Garden Inn. Joint Conference for Montana Section of AWWA and Montana Water Environment Assn. For info: www.montanaawwa.org/conference.htm

#### Mav 5 Montana Wetland Council Meeting, Helena.

Lee Metcalf Bldg., 1520 East Sixth. For info: Lynda Saul, lsul@mt.gov

### May 5

org/events/events.aspx

org/living-future/10

extension.ucdavis.edu

May 11-13

May 5-7

<u>May 5-7</u>

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CA Salmonid Biology Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/752-0881 or http://extension.ucdavis.edu

Arizona Water Assoc. 83rd Annual Conf.

Glendale Hotel & Spa. For info: www.azwater.

Living Future unConference & Tradeshow,

& Exposition, Glendale. Renasissance

Seattle. For info: www.cascadiagbc.

Mitigation Measure Development &

Monitoring Course, Sacramento. Sutter

Davis Extension, 800/752-0881 or http://

Square Galleria, 2901 K Street. For info: UC

Headwaters to Ocean (H2O) - 9th Annual

H2O Conference, Long Beach. Hilton Hotel.

For info: www.coastalconference.org/



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#### (continued from previous page)

OR May 12 Oregon DEQ Public Hearing: TMDL for Upper Klamath & Lost River Subbasins, Klamath Falls. Oregon Institute of Technology, College Union Auditorium, 3201 Campus Drive. For info: Steve Kirk, DEQ, 541/633-2023, kirk.steve@deq.state.or.us or www.deg.state.or.us/WQ/TMDLs/klamath. htm#upks

#### May 13

Oregon Wetlands Seminar, Portland. World Trade Center, 121 SW Salmon. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www. theseminargroup.net

#### May 13-14

Idaho Water Law Seminar -- POSTPONED to 9/20-9/21, Boise. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@ lawseminars.com, or website: www. lawseminars.com

#### May 13-14

Law of the Colorado River Seminar. Reno. Grand Sierra Resort. For info: CLE International, 800/ 873-7130 or website: www. cle com

#### May 14

Advanced Sediment Conference, Portland. For info: Holly Duncan, Environmental Law Education Center, 503/282-5220, hduncan@ elecenter.com or www.elecenter.com

#### May 16-21 OR **Building Blocks of Floodplain Management** Conference, Oklahoma City. Sponsored by Assn of State Floodplain Managers. For info: ASFPM, 608/ 274-0123 or registration@ floods.org

#### May 18-20

Bridging Conservation & Recreation 2010: RMS & NARRP Symposium, Portland. Red Lion Hotel on the River. For info: www.rivermanagement.org/symposium-2010/home.htm

#### May 19-20

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Upstream Fish Passage - Fish Behavioral, Engineering & Related Considerations Course, Yakima, Yakima Vallev Museum. 2105 Tieton Dr. For info: NWETC, 206/ 762-1976 or www.nwetc.org/

### <u>May 19-21</u>

Developing a Sustainable Ground Water Management Policy Forum, Tahoe City. For info: National Ground Water Ass'n, 800/ 551-7379 or www.ngwa.org

#### May 20-21

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

#### May 20-21

California Water Law Conference, San Francisco. For info: CLE International, 800/ 873-7130 or website: www.cle.com

#### May 21 WA Water Right Transfers in Washington Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@

theseminargroup.net, or website: www. theseminargroup.net

#### <u>May 21-24</u>

National River Rally 2010 Conference, Snowbird. For info: Katherine Luscher, River Network, 503/ 542-8384, www.rivernetwork. org/

#### May 24-25 14th Annual Water Reuse & Desalination

Research Conference, Tampa. Grand Hyatt Tampa Bay. Sponsored by Water ReUse Association. For info: WRA website: www watereuse.org/ May 25 CA

#### Overview of Water Law & Policy in California, Sacramento, Sutter Square Galleria, 2901 K Street, For info: UC Davis Extension, 800/752-0881 or http://extension. ucdavis.edu

#### May 25-26

**Energy Resources & Produced Waters** Conference: Water Quality, Management, Treatment & Use, Laramie. Hilton Garden Inn, UW Conference Ctr. Sponsored by UW's School of Energy Resrouces & the Ruckelshaus Institute of Environment & Natural Resources. For info: uwyo.edu/enr

#### May 25-27 FL 2010 National Environmental Partnership Summit, Orlando, For info: www. environmentalsummit.org

May 26-27 WA **Construction Site Erosion & Pollution** Control, Shoreline. For info: UW Engineering website: www.engr.washington.edu/epp/cee/ wet.html

#### May 27

Fisheries & Hatcheries: Legal & Regulatory Frameworks Seminar, Seattle. Red Lion Hotel on 5th. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup. net, or website: www.theseminargroup.net

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June 3

#### May 28

WA Project Permitting Strategies Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

#### June 2-3 WA Community Energy Roadmap Conference, Bellevue. Meydenbauer Center. For info: www. communityenergyroadmap.com

<u>WA</u> June 2-3 **Community Energy Roadmap:** Planning, Policy & Projects Conference, Bellevue. Meyenbauer Ctr. For info: www. communityenergyroadmap.com

### June 2-3

Successful CEQA Compliance Intensive Seminar, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu

#### June 2-4 CO Past, Present & Future of Our Public Lands: NRLC 2010 Martz Summer Conference. Boulder. UC Law School. Sponsored by Natural Resources Law Center. For info: NRLC. 303/492-1286, nrlc@colorado.edu or www.colorado.edu/law/nrlc

June 2-4 WA Model Toxics Control Act Series Course, Seattle. NWETC Headqtrs, 650 South Orcas Street. For info: NWETC, 206/ 762-1976 or www.nwetc.org/

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Habitat Conservation Planning Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or http://extension.ucdavis.edu