

The Downstream Perspective ...

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Lyon / Churchill County Water Workshop

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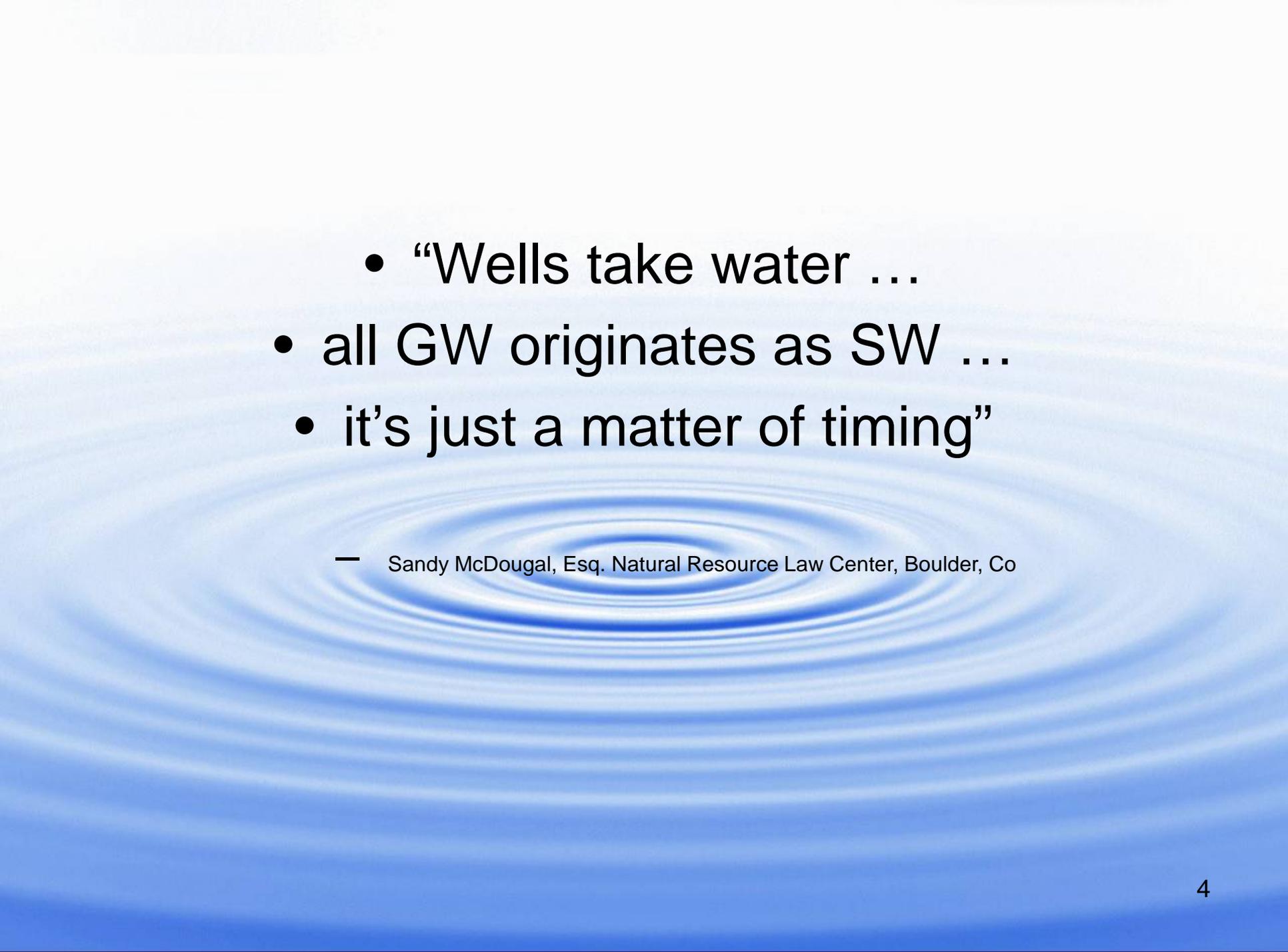
(775) 323-1804

Speakers

- Chris Mahannah, P.E. — *downstream perspective*
- Kip Allander, USGS — *GW Hydrology 101/Capture; summary of studies; Humboldt R. Capture modeling*
- Jason King, P.E. — State Engineer — *legislative changes; Humboldt R. Capture modeling, anticipated conjunctive use management*
- Mike Workman, P.E. — LY Co Utilities — *issues & challenges meeting demand; Churchill V growth challenges*
- Round Table Q & A

Objectives ...

create an educational open forum on upstream – downstream water issues to be discussed and gain a better understanding of science, positions & water rights administration to hopefully avoid or minimize conflicts.

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- “Wells take water ...
 - all GW originates as SW ...
 - it’s just a matter of timing”

— Sandy McDougal, Esq. Natural Resource Law Center, Boulder, Co

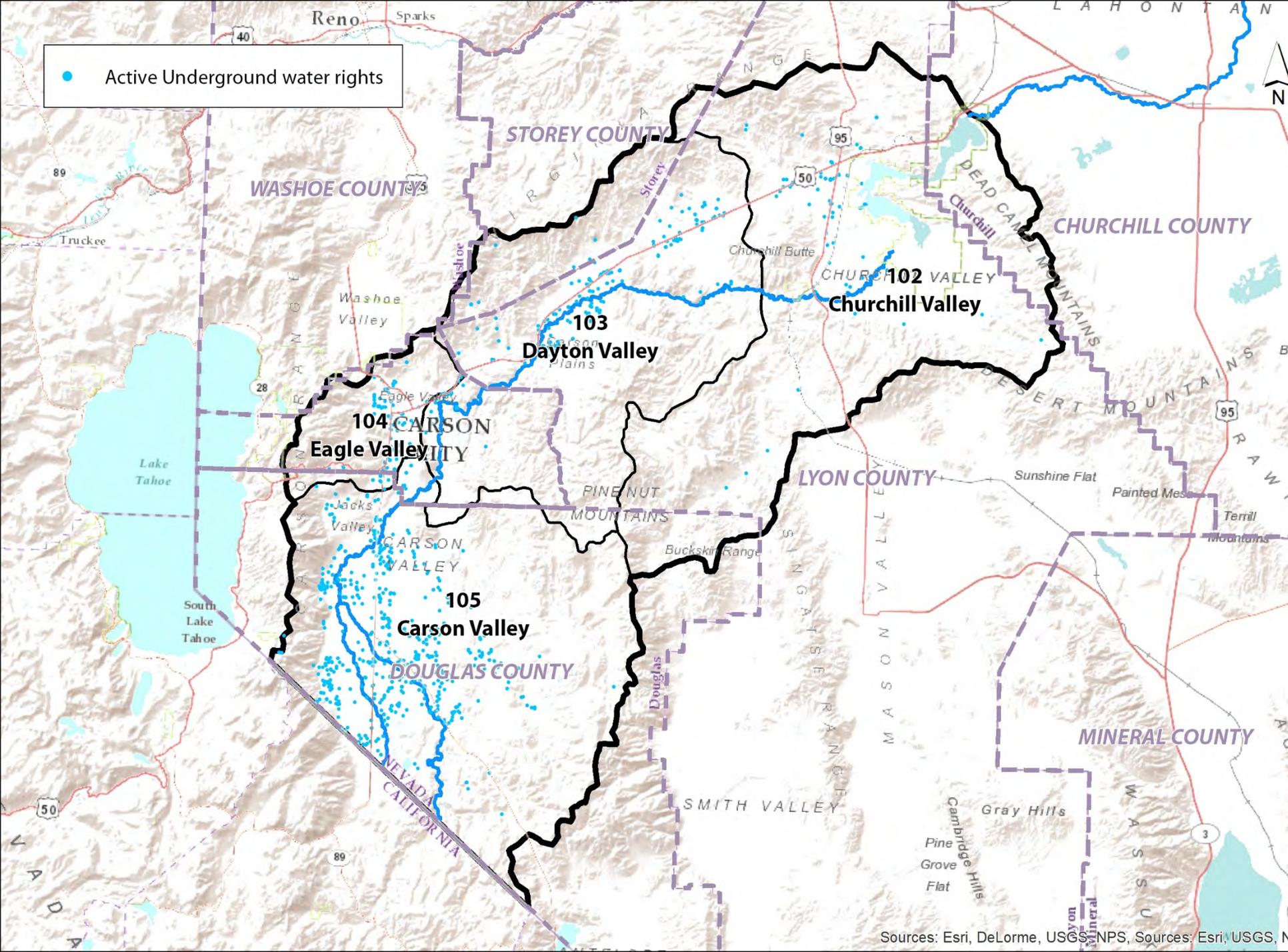
What keeps Jason up at Night?

1. Severely over-appropriated basins
2. Domestic wells
3. Conjunctive Management
4. Mitigation of impacts to avoid conflicts

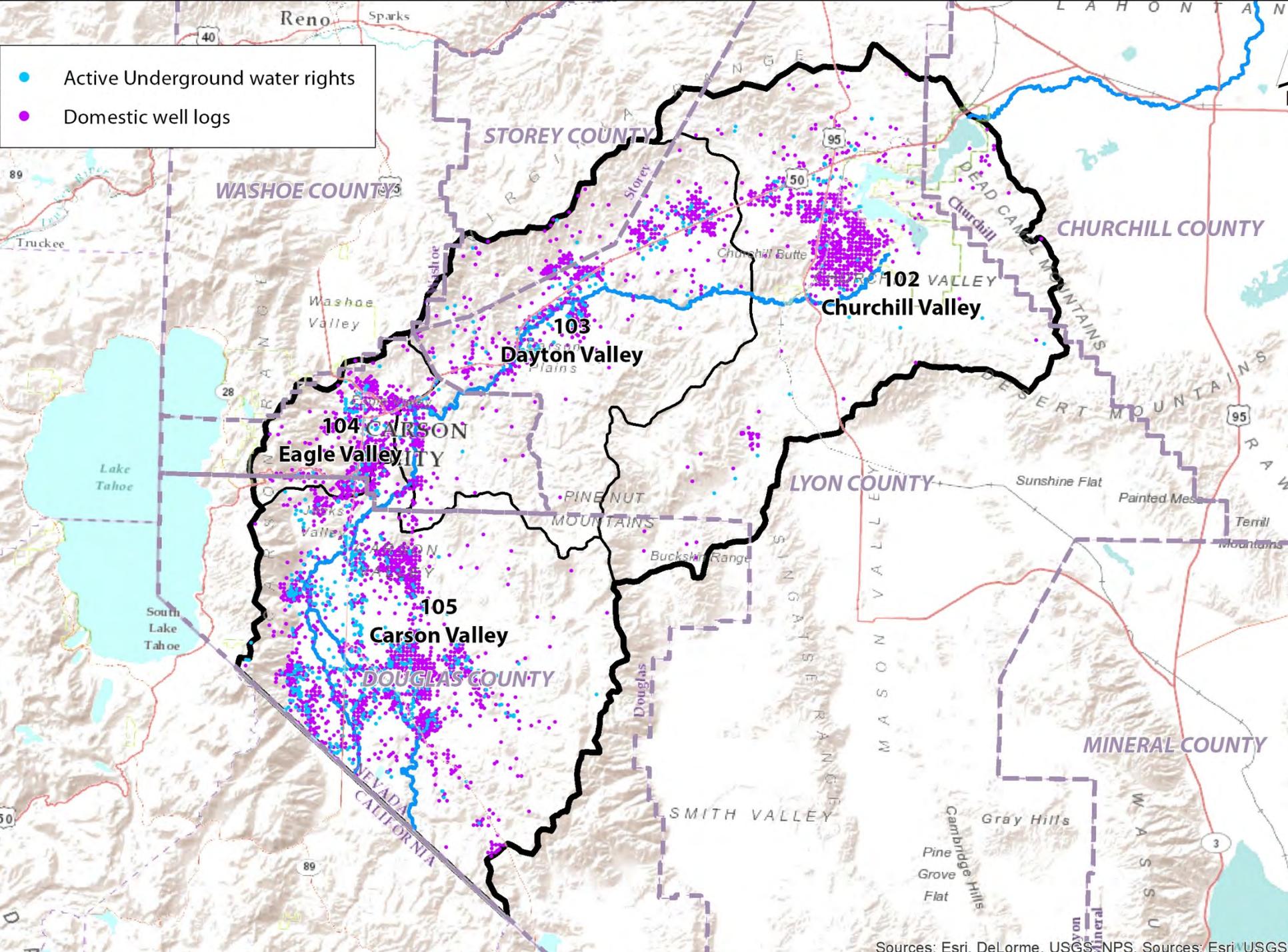
CARSON VALLEY WATERSHED COMMITTED UNDERGROUND RIGHTS VERSES PERENNIAL YIELD

BASIN #	NAME	PY	COMMITTED RIGHTS	% OVER APPROPRIATED
		AFA	AFA	
105	CARSON V	49,000	95,434	195%
104	EAGLE V	4,900	7,815	159%
103	DAYTON V	8,000	24,433	305%
102	CHURCHILL V	1,600	9,354	585%
	TOTALS	63,500	137,036	216%

● Active Underground water rights



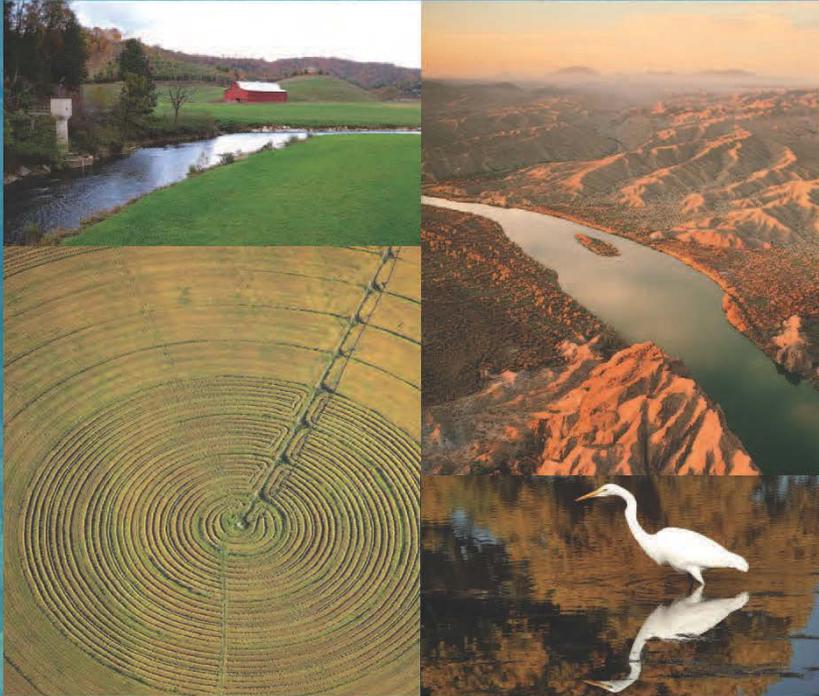
Sources: Esri, DeLorme, USGS, NPS, Sources: Esri, USGS, N



- Active Underground water rights
- Domestic well logs

Groundwater Resources Program

Streamflow Depletion by Wells—Understanding and Managing the Effects of Groundwater Pumping on Streamflow



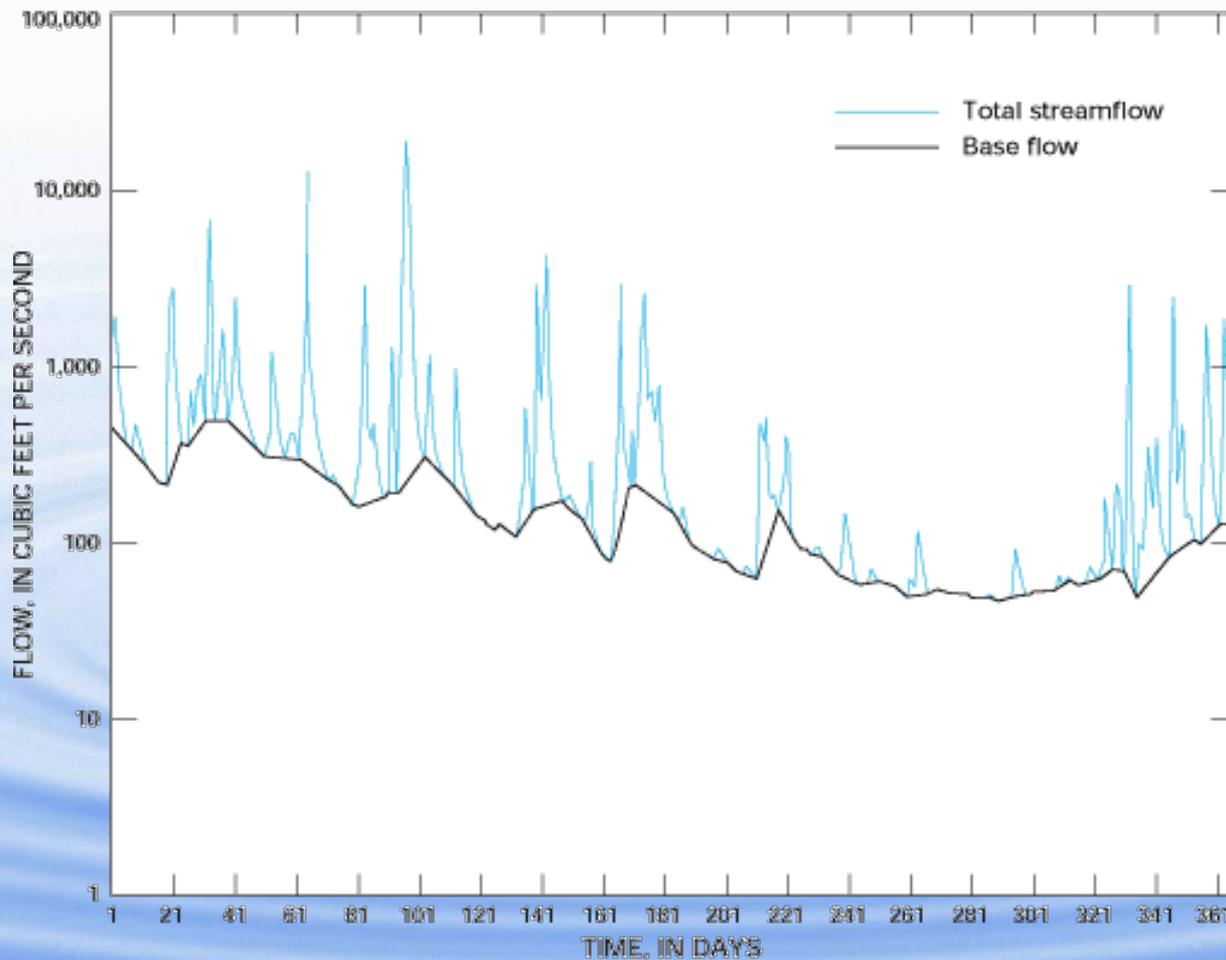
Circular 1376

<http://pubs.usgs.gov/circ/1376/>

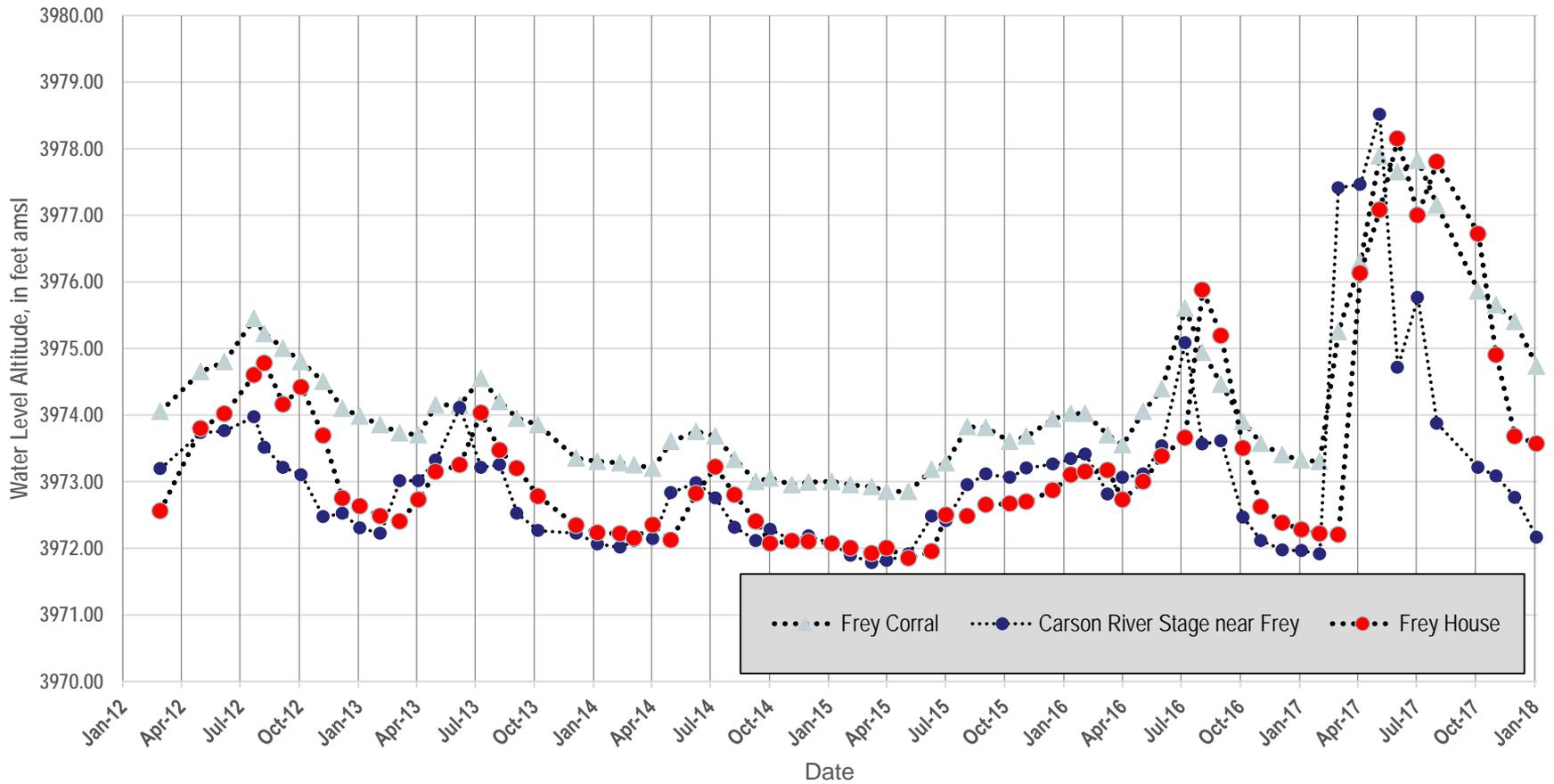
Acknowledgements:

- Stan Leake
- Dave Prudic
- Mike Strobel

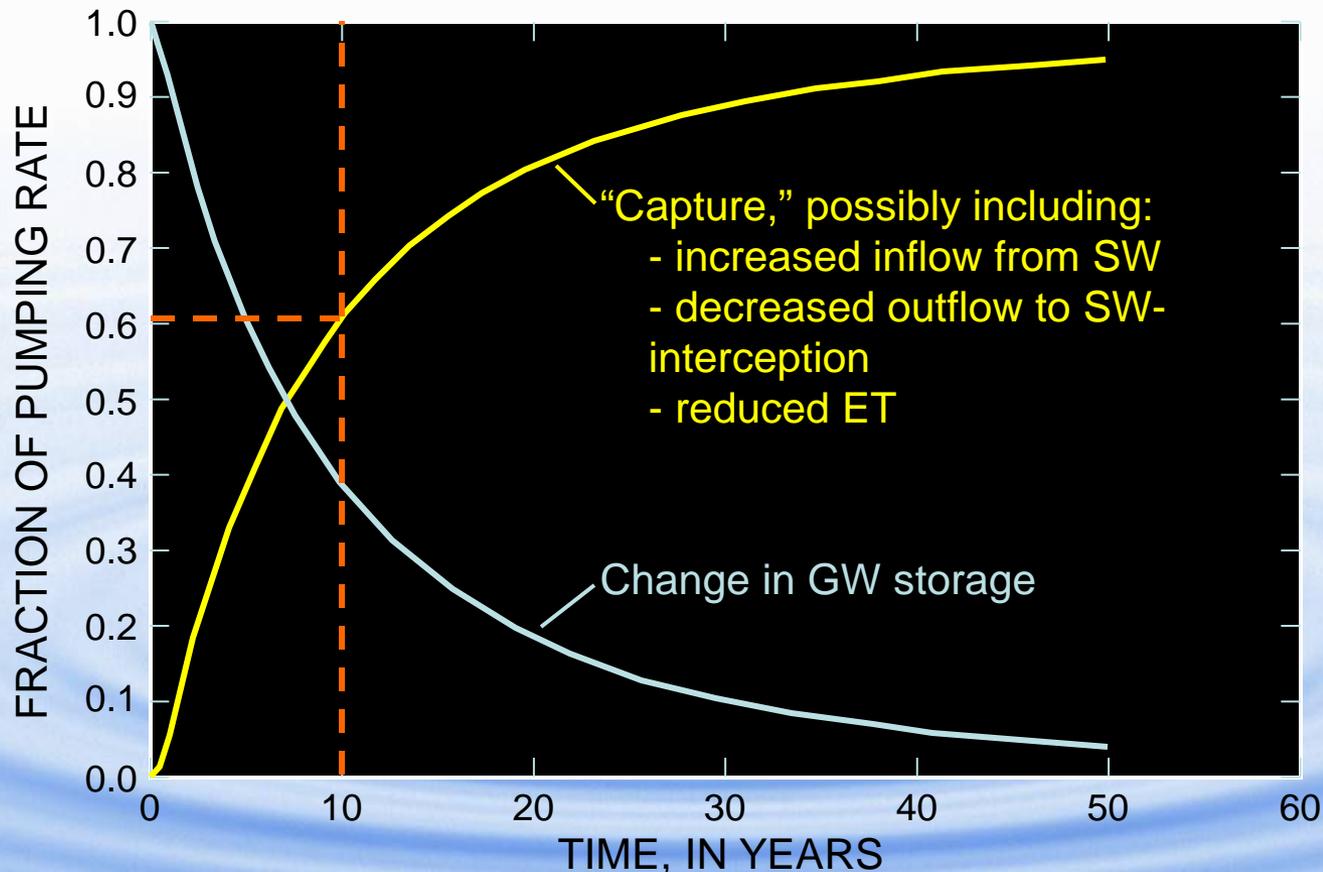
Baseflow – Ground-water contribution to streams



Frey Area Wells and Carson River Stage



Sources of Water to a Pumped Well

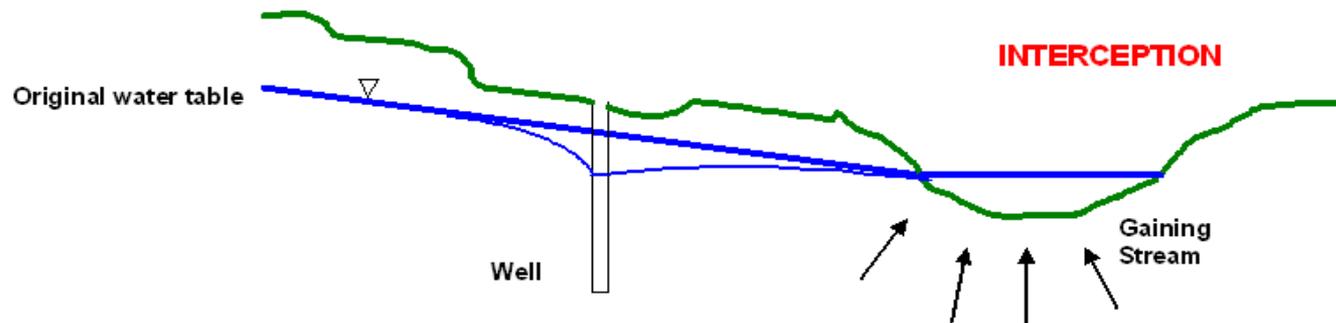
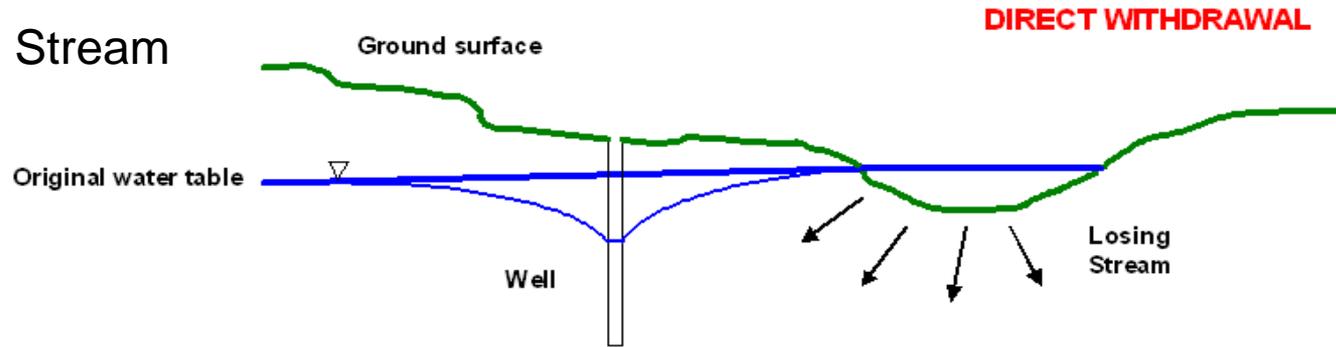


The timing of “capture” depends on

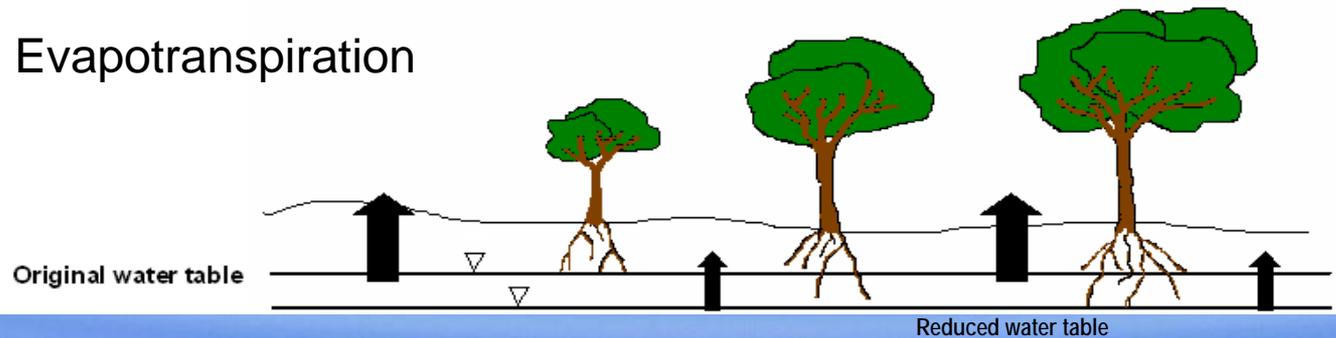
- Aquifer diffusivity (T/S)
- Distance to connected SW features

Typical Sources of Capture

Stream



Evapotranspiration



Capture

MANAGING WATER RESOURCES SYSTEMS: WHY "SAFE YIELD" IS NOT SUSTAINABLE

by Marios Sophocleous^a

Although major gaps in our understanding of soil and water ecosystems still exist, of more importance are the gaps between what is known and what is applied. One such gap is in the use of the concept of "safe yield" (SY) in ground-water management. Despite being repeatedly discredited in the literature, SY continues to be used in water-management policies, leading to continued ground-water depletion, stream dewatering, and loss of wetland and riparian ecosystems.

Traditionally, "safe yield" is defined as the amount and maintenance of a level of ground water without depletion of the amount of recharge. Thus, SY is the amount that is replenished by recharge. The concept of SY ignores discharge from the aquifer or equilibrium conditions, recharge is maintained by discharge from the aquifer. Consequently, if pumping equals recharge, the aquifer will eventually be depleted. This has happened in various locations across the Great Plains. Maps comparing the perennial streams in Kansas in 1900 and 1990 show a marked decrease in miles of stream in the third of the state. (For more information, see the volume by Sophocleous, 1997, "Development of Water Resources in the Great Plains," Geological Survey, Bulletin 239, in press.) The concept of SY is concerned about aquifer drawdown and surface-water depletion, both unrelated to the natural recharge rate. Despite its irrelevance, natural recharge is often used in ground-water policy to balance ground-water use under the banner of SY. Adopting such an attractive fallacy does not provide scientific credibility.

To better understand why "safe yield" is not sustainable yield, a review of hydrologic principles (concisely stated by Theis in 1940) is required. Under natural conditions, prior to development by wells, aquifers are in a state of approximate dynamic equilibrium: over hundreds of years, recharge equals discharge. Discharge from wells upsets this equilibrium by producing a loss from aquifer storage. A new state of dynamic equilibrium is reached only by an increase in recharge (induced recharge), a decrease in natural discharge, or a combination of the two. Initially, ground water pumped from the aquifer comes from storage, but ultimately it comes from induced recharge. The timing of this transition, which takes a long time by human standards, is a key factor in developing sustainable water-use policies. However, it is exceedingly difficult to distinguish between natural recharge and induced recharge to ascertain possible sustained yield. This is an area that needs further research. Calibrated stream-aquifer models could provide some answers in this regard.

^a Senior Scientist, Kansas Geological Survey, The University of Kansas, 1930 Constant Ave., Lawrence, Kansas 66047-3726. The views expressed here are the author's and not necessarily those of the AGWSE, NGWA, and/or the Ground Water Publishing Company.

The concept of sustainable yield has been around for many years, but a quantitative methodology for the estimation of such yield has not yet been perfected. A suitable hydrologic basis for determining the magnitude of possible development would be a

our streams, but when we do, we learn that the streams were more than just containers of usable water.

patches if they are not planned and implemented from an ecosystem and watershed perspective. Such a holistic approach, however, is fraught with difficulty. We cannot use a natural system without altering it, and the more intensive and efficient the use, the greater the alteration.

water-users' needs to the researchers. Delivering a journal publication to a manager's desk is not sufficient to ensure that research results are quickly put into practice. I believe this breakdown in communication accounts for the persistence of such misguided concepts as SY in ground-water management today. Researchers increasingly must cross the boundaries of their individual disciplines, and they must look to their clients—the managers and water users—for help in defining a practical context for research. A strong public education program is also needed to improve understanding of the nature and complexity of ground-water resources and to emphasize how this understanding must form the basis for operating conditions and constraints. This is the only way to positively influence, for the long term, the attitudes of the various stakeholders involved.

"Despite being discredited repeatedly in the literature, safe yield continues to be used as the basis of...water-management policies, leading to continued ground-water depletion, stream dewatering, and loss of wetland and riparian ecosystems."

"...if pumping equals recharge, eventually streams, marshes, and springs dry up"

Equilibrium is reached only by an increase in recharge (induced recharge), a decrease in natural discharge, or a combination of the two.

Because of the connection between the ground-water and surface-water systems,

The amount of pumping allowed without adverse consequences has little to do with annual recharge.

NV State Engineer positions

R5079 - 2001

- ‘... subsurface flow under the TR is not part of the water decreed pursuant to the Orr Ditch Decree, but is part of those waters counted as perennial yield of the GW system.
- many streams systems have some hydrologic connection to GW, based on the very fact that it starts as water falling on the surface of the land, in NV, the underground water and surface water have been managed under different statutory schemes for more than half a century. To change the policy set forth in that statutory scheme at this late date would upset the entire history of NV water law and would not be prudent.’

NV State Engineer positions

R2593 & 2630 - 1980

- UG application ‘... denied on the grounds that additional withdrawal of groundwater in close proximity to the Carson River, and in the concentrated well area north of the Carson River, would conflict with existing rights and be detrimental to the public interest.’



Discussing Water Rights, A Western Pastime

Other Solution ideas ...

- Acquire & retire surface rights: buy & dry
- Critical Management Areas (CMA): get over appropriated basins in balance – only solves some of the problem
- GW pumping curtailment or partial curtailment
- \$\$\$ Buyout – adverse socio-economic & environmental consequences
- Address Mining & Milling ‘temporary’ use and pit lake refilling & subsequent evaporation
- Metering: can’t monitor/regulate what isn’t measured