



ABSTRACT & POWERPOINT PRESENTATION

***Aquifer Storage and Recovery:
Implementation of a Drought Management Plan***

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Managed Aquifer Recharge Symposium
January 25-26, 2011
Irvine, California

Symposium Organizers:

- National Water Research Institute
- Orange County Water District
- Water Research Foundation

www.nwri-usa.org/rechargesymposium2011.htm

SAWS Aquifer Storage & Recovery: Implementation of a Drought Management Plan

Roberto Macias
Thomas Klein

In March of 2004, the San Antonio Water System (SAWS) completed the first phase of the Carrizo Aquifer Storage and Recovery (ASR) Program. Since then, SAWS has stored approximately 82,000 acre-feet of Edwards aquifer water in the Carrizo aquifer. The ASR system was originally designed for a seasonal cycle of nearly equal injection and recovery duration in order to help SAWS manage its quarterly pumping permits, however an above average rainfall during Summer of 2007 combined with a management decision to utilize ASR as a long term storage reservoir, has changed the way the Twin Oaks ASR facility is operated. Injection is the mode of operation for a majority of the calendar year and plant equipment sits idle for long periods of time until a decision is made to produce or recover stored water during times of drought.

This paper discusses the challenges faced by ASR plant operators as they are required to quickly respond to drought conditions and recover stored Edwards Aquifer water.

This change in drought management philosophy has introduced difficulties for the Twin Oaks plant operators beyond the normal day to day challenges of operating a drinking water treatment plant. Most facilities run year round 24 hours/day.

This facility runs only when the weather dictates it. How do you periodically exercise 36 well pumps without wasting excessive amounts of water? We do it.



ASR: Implementation of a Drought Management Plan

January 25 2011

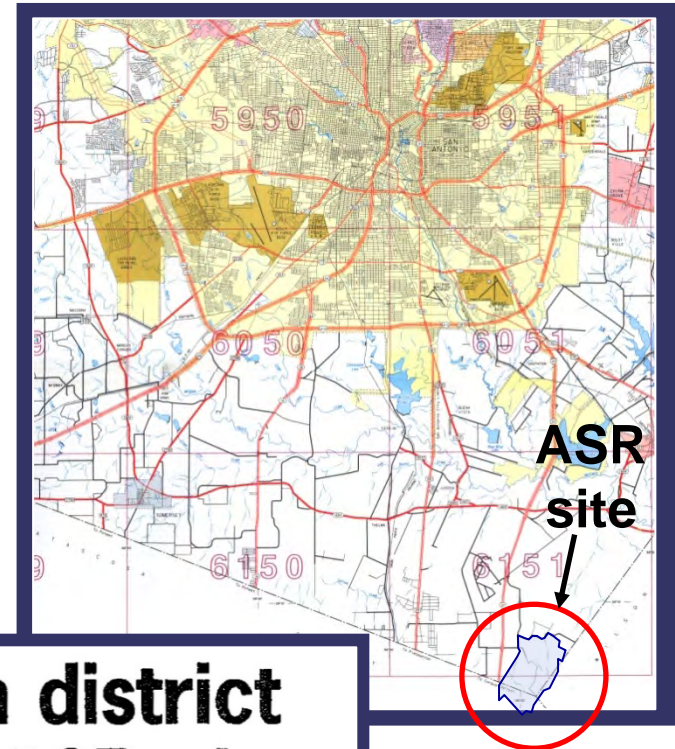
Managed Aquifer Recharge Symposium

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Plant Manager



Project History

- Part of SAWS' 50-Year Water Supply Plan, adopted in 1998
- 3,200 acres purchased in south Bexar, Atascosa, and Wilson counties in 2000 and 2001
- Original project concept was for Carrizo production only
- 2002 agreement with Evergreen Underground Water District limited Carrizo production to 6,400 af/year



Evergreen district approves ASR plan

By Becky Raabe
WGN Correspondent

11/27/02

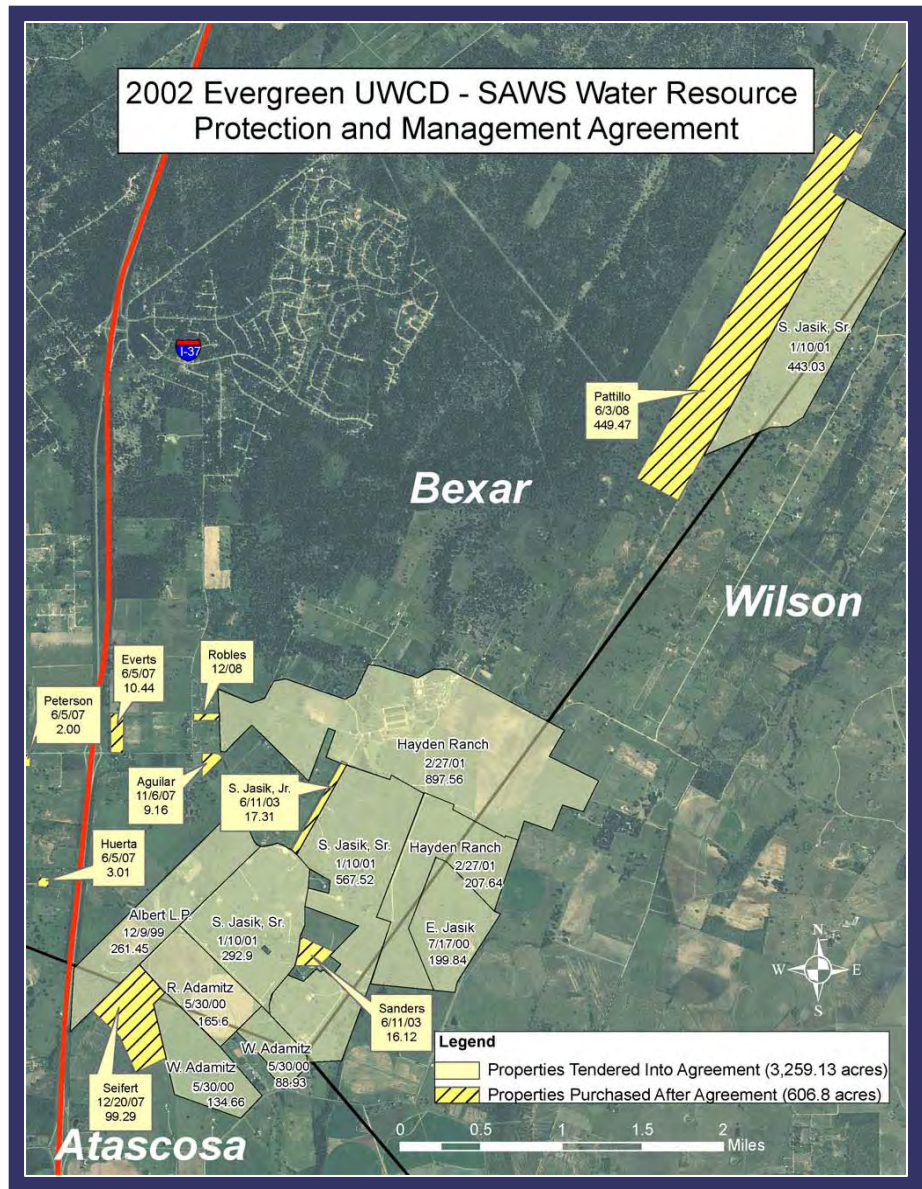
JOURDANTON — Evergreen Underground Water Conservation District directors voted Thursday to enter into an interlocal agreement with the San Antonio Water System for the “protection and management of SAWS’ aquifer storage and recovery project in southern Bexar County and the Carrizo-Wilcox Aquifer in southern Bexar County.”

The directors also voted to reject a petition requesting the annexation of a portion of southern Bexar County, located east of I-37, into the district.

The proposed annexation would have included the property where SAWS is conducting its aquifer storage and recovery project (ASR).

SAWS owns approximately 3,300 acres of land in southern Bexar County. on
SEE Evergreen, p. 7A

Properties Included in Water Resource and Management Agreement



Project History

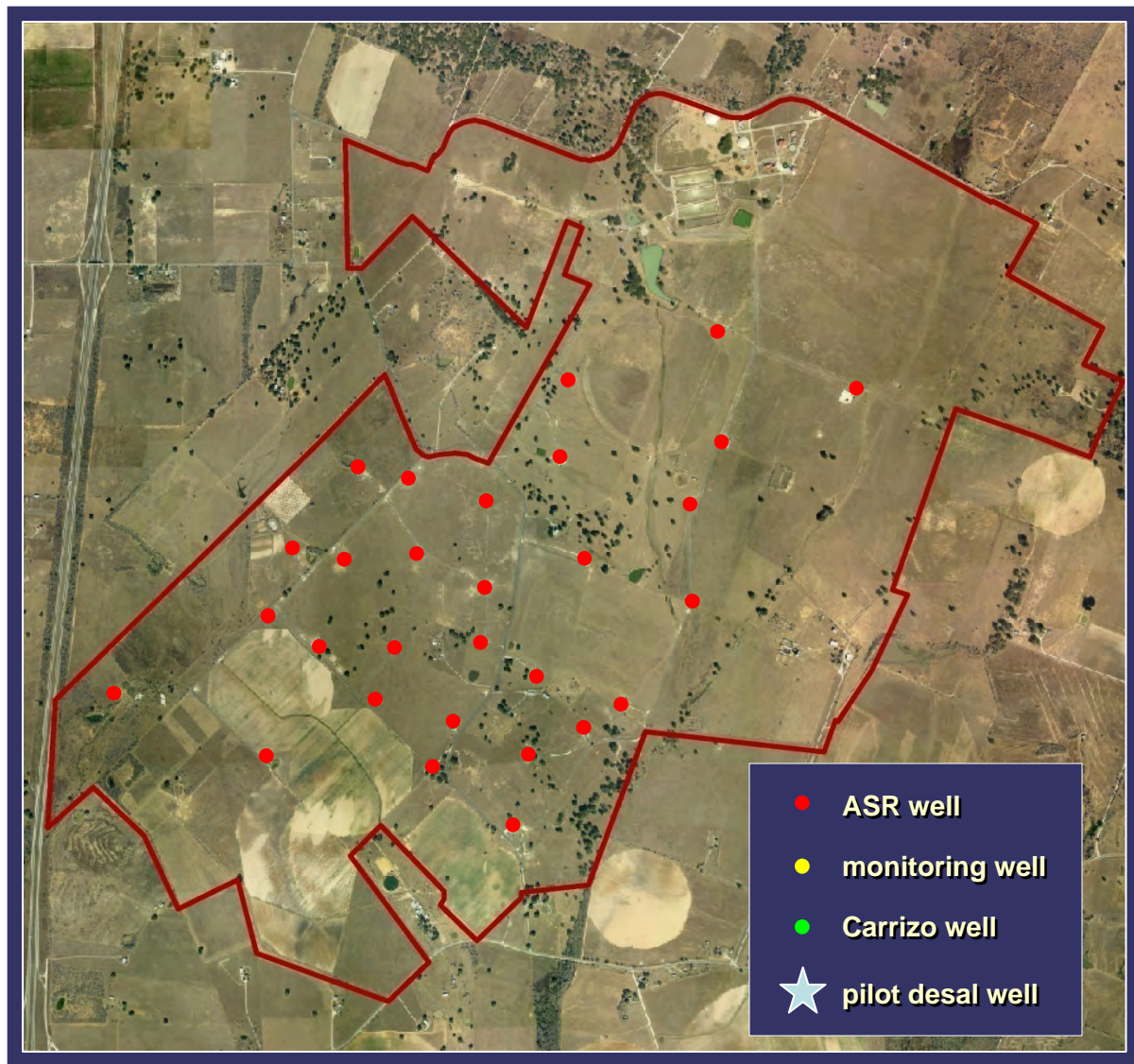
- Facility online in 2004
- Phase I included 17 wells and 30 mgd water treatment facility
- Phase II (completed 2009) included 12 additional wells to increase storage/recovery capacity to 64 mgd
- Phase IIA included local Carrizo wells
 - 7 wells for exclusive Carrizo production
- ≈ \$250,000,000 invested so far



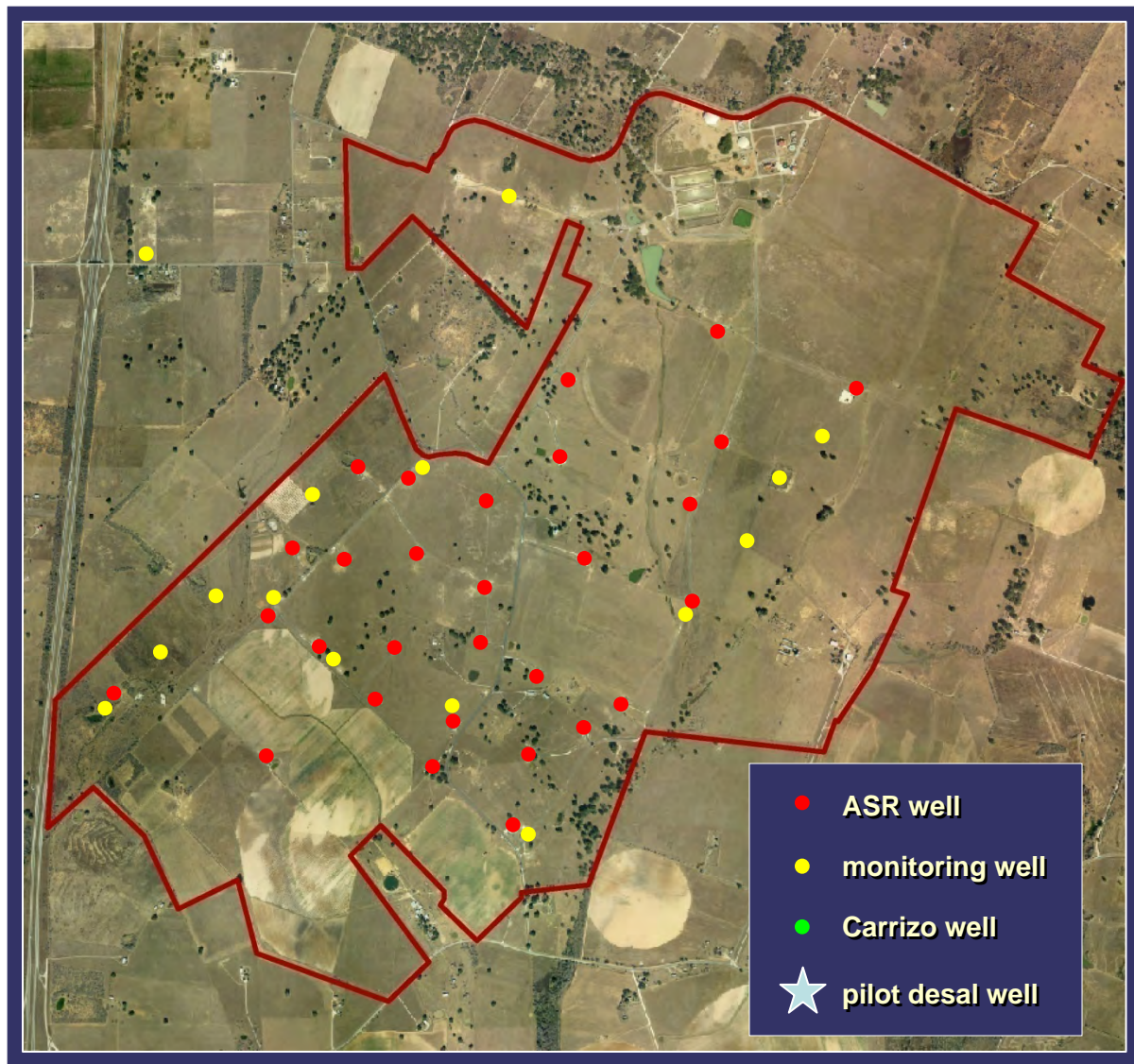
Changing Operational Plan

- Carrizo only
- Seasonal benefit
- Long-term storage
- Both seasonal benefit and long-term storage

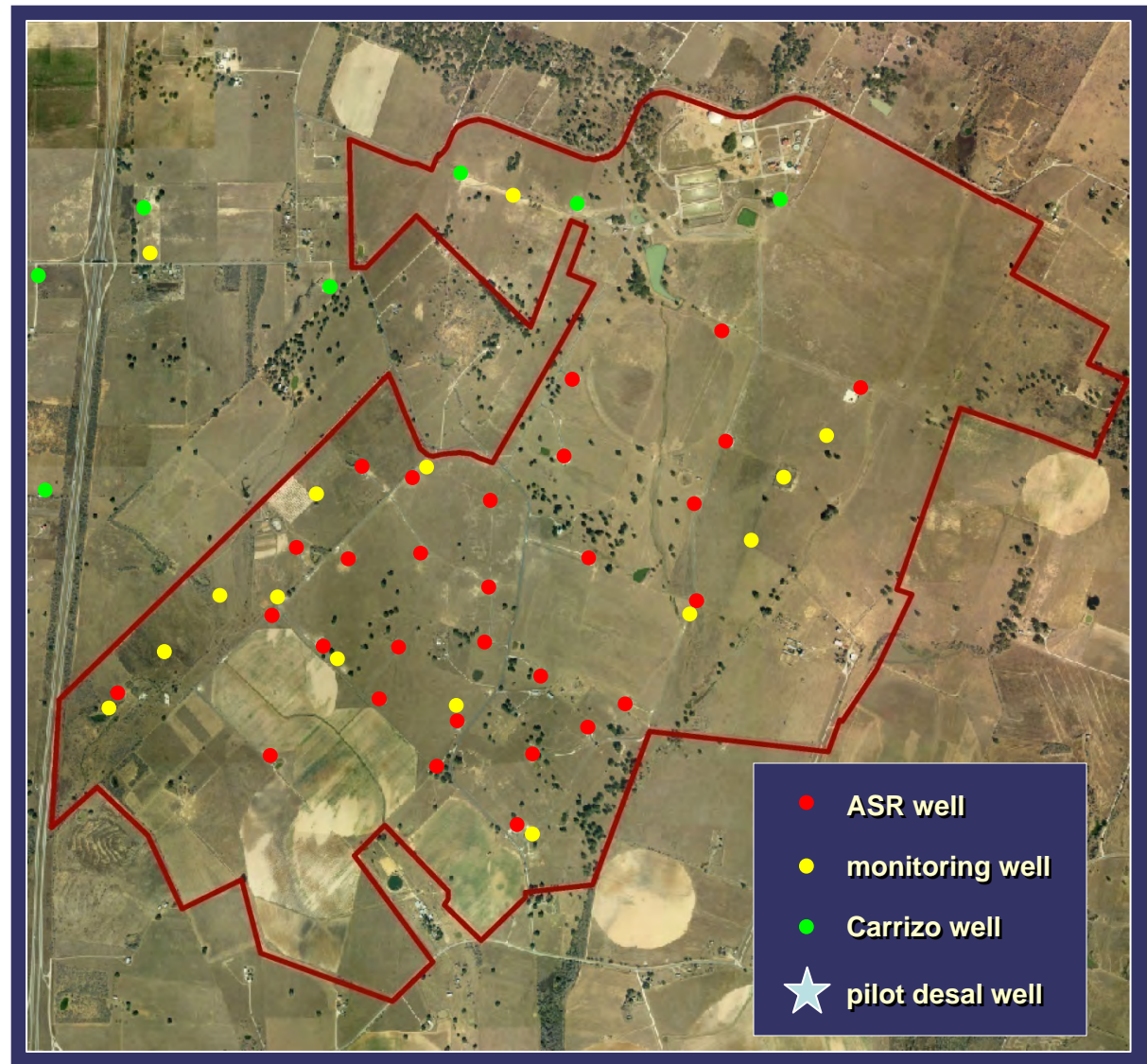
Well locations



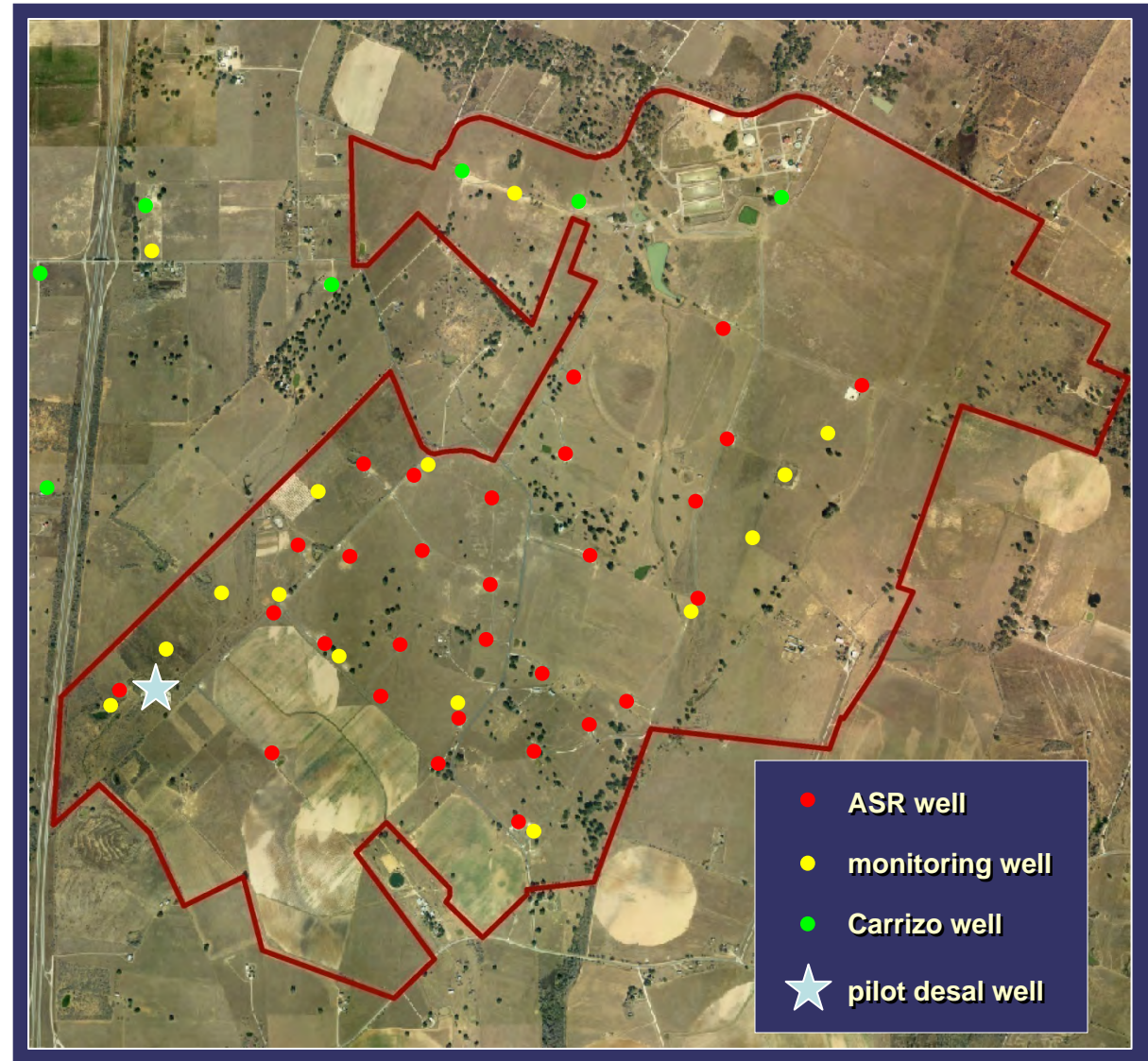
Well locations



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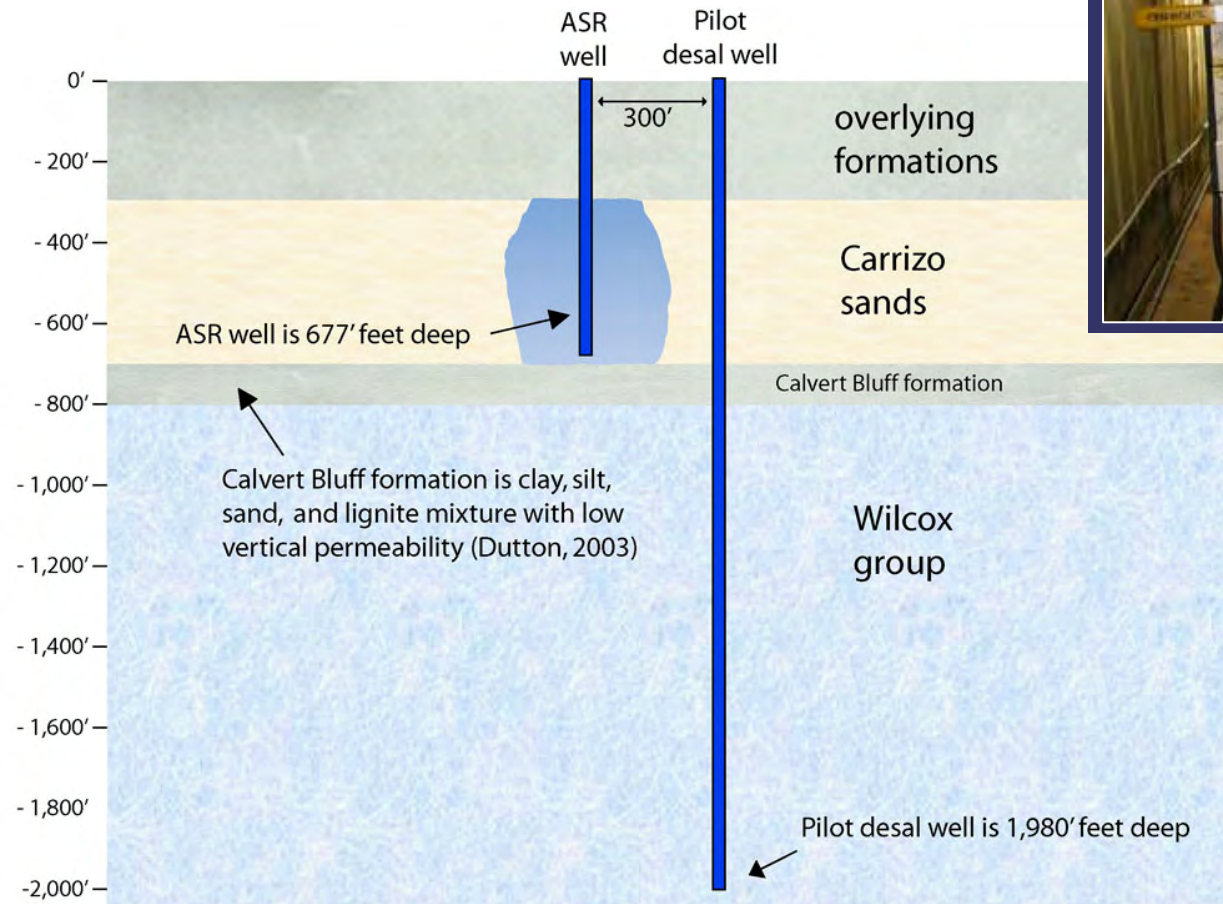


Well locations

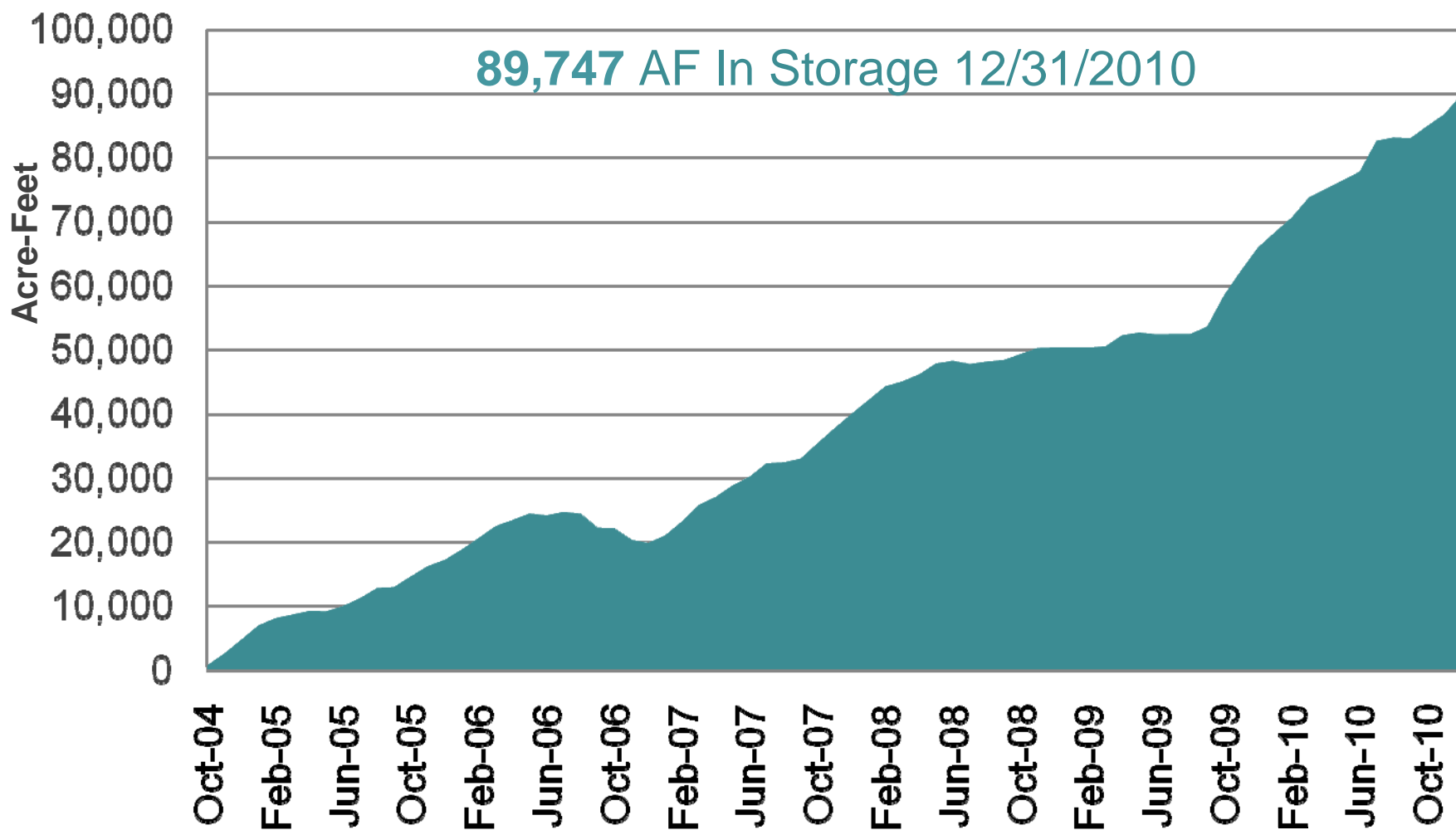


Current Work

Desalination Pilot Plant



Twin Oaks Aquifer Storage

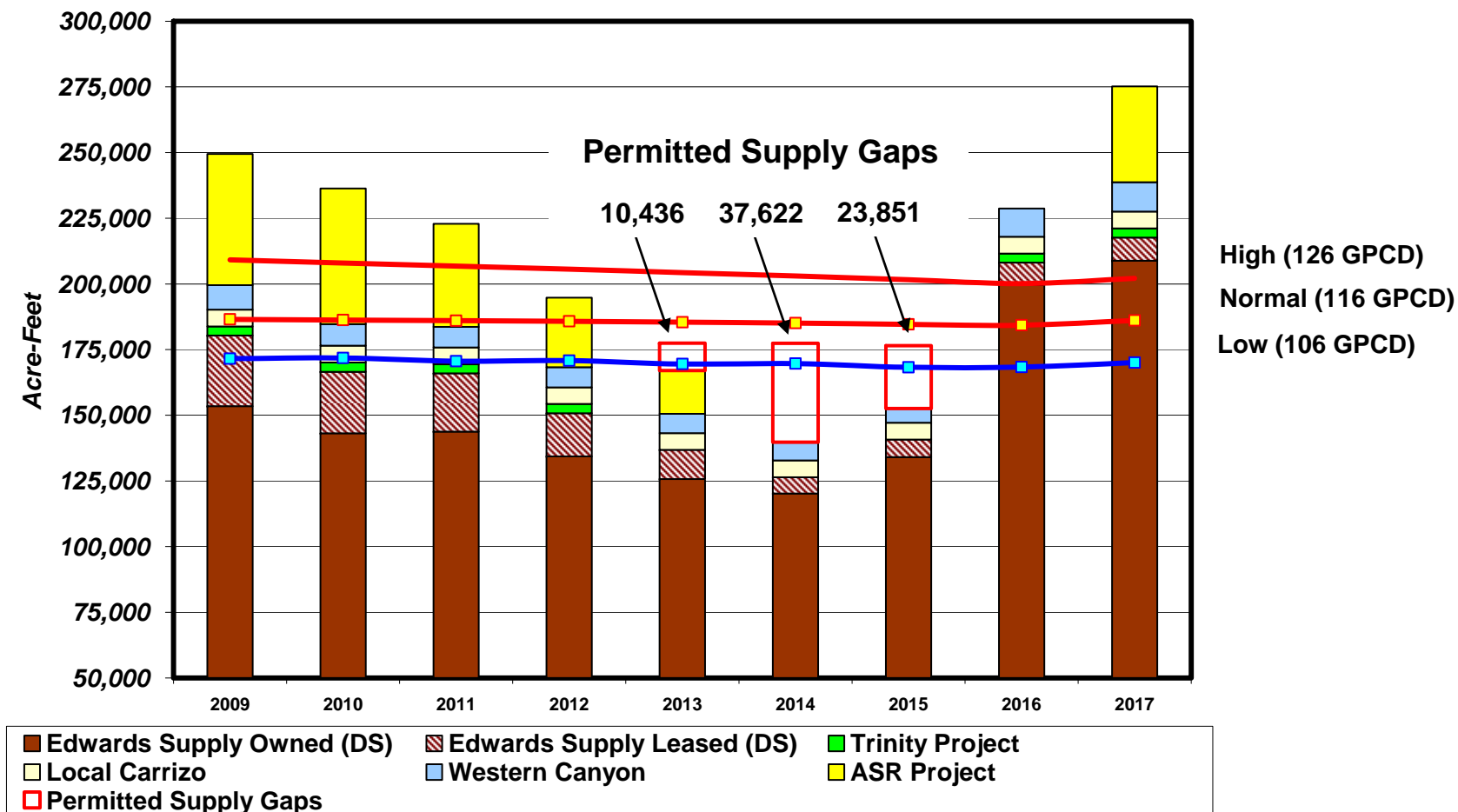


ASR Productive Activity: Annual Volumes By Type

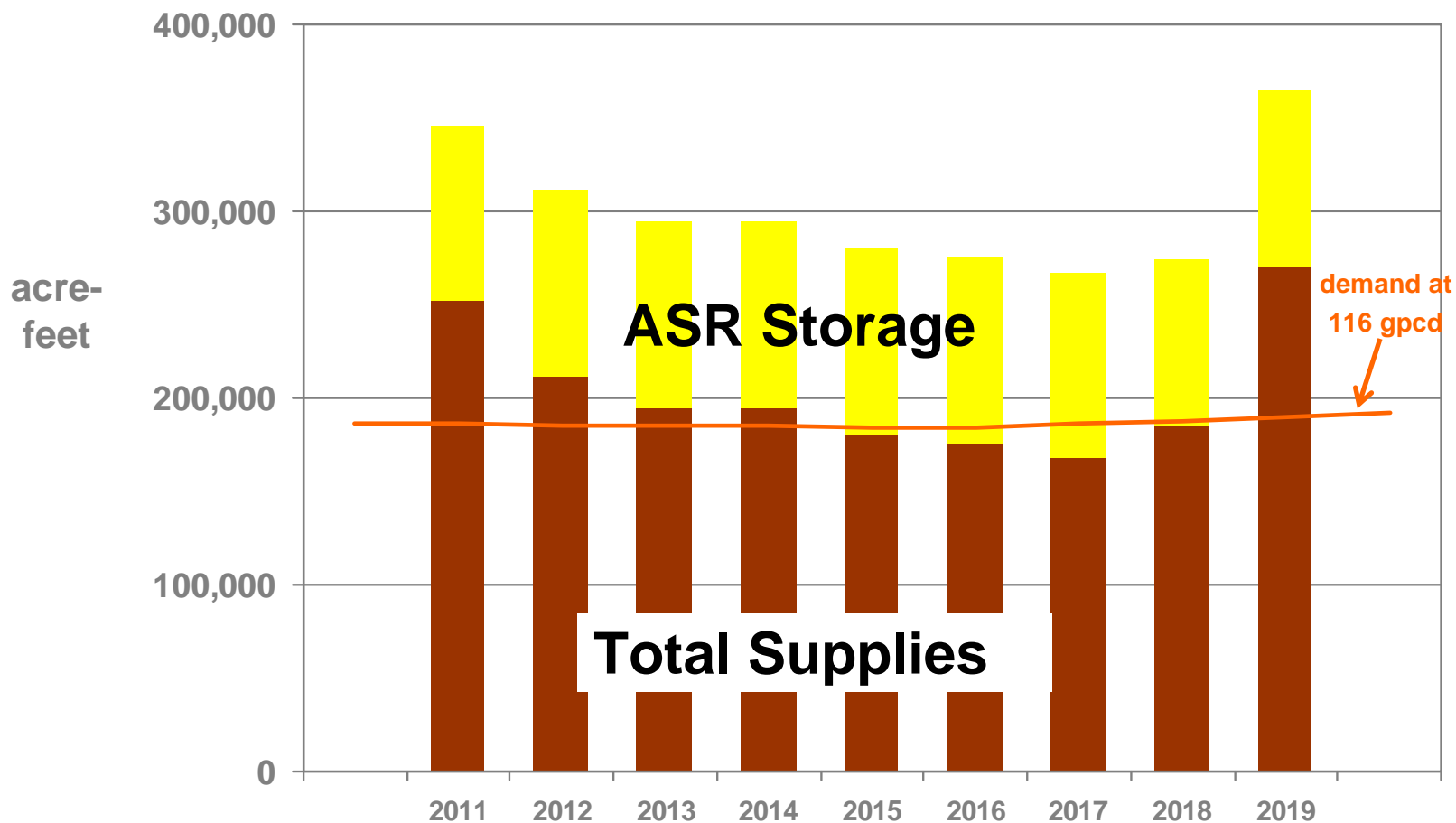
Year	Twin Oaks Recovery (acre-feet)	Twin Oaks Recharge (acre-feet)	Local Carrizo Pumpage (acre-feet)
2004	46	4,791	585
2005	961	13,399	0
2006	6,460	9,096	0
2007	451	20,580	0
2008	1,313	11,680	383
2009	1,429	17,029	5,934
2010	1,684	25,539	406

Existing Permitted Supplies

Drought of Record Impact Today (circa 2009)



ASR and Permitted Supply Gap



Difficulties in determining storage

- Carrizo sand formation is not flat, so water will move approx. 35' feet per year
- Irrigation wells in the area have an influence
- Formation is confined and already has water in it
- Porosity and thickness are not uniform
- Water does not recognize property boundaries

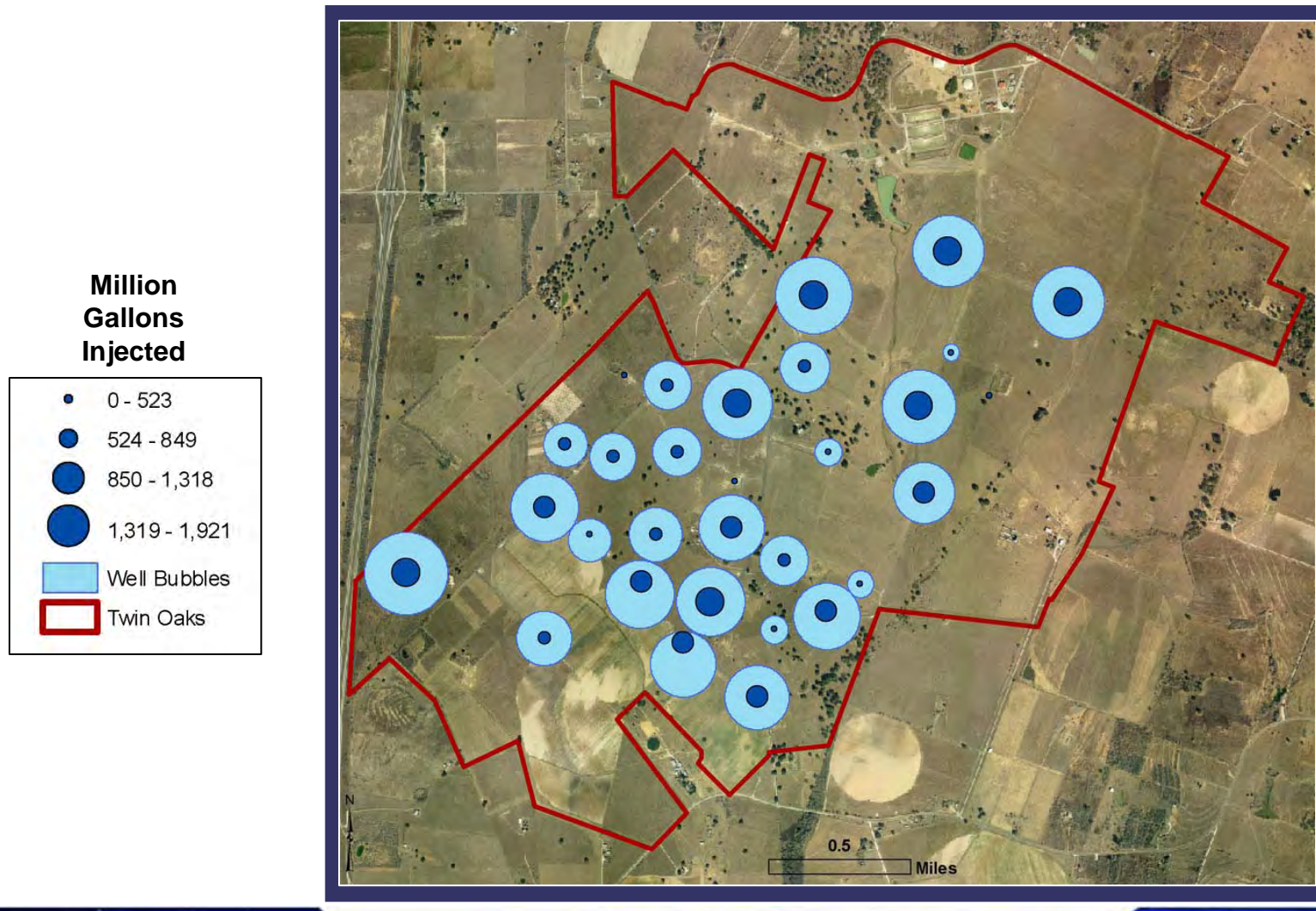
Storage Capacity and Recovery Capability Study

- RFQ pending for study to determine:
 - Total storage capacity
 - Maximum recovery capability
 - Optimal operations strategies
- Estimated time to complete study is 6 months
- Estimated cost: \$500,000 - not currently in the budget

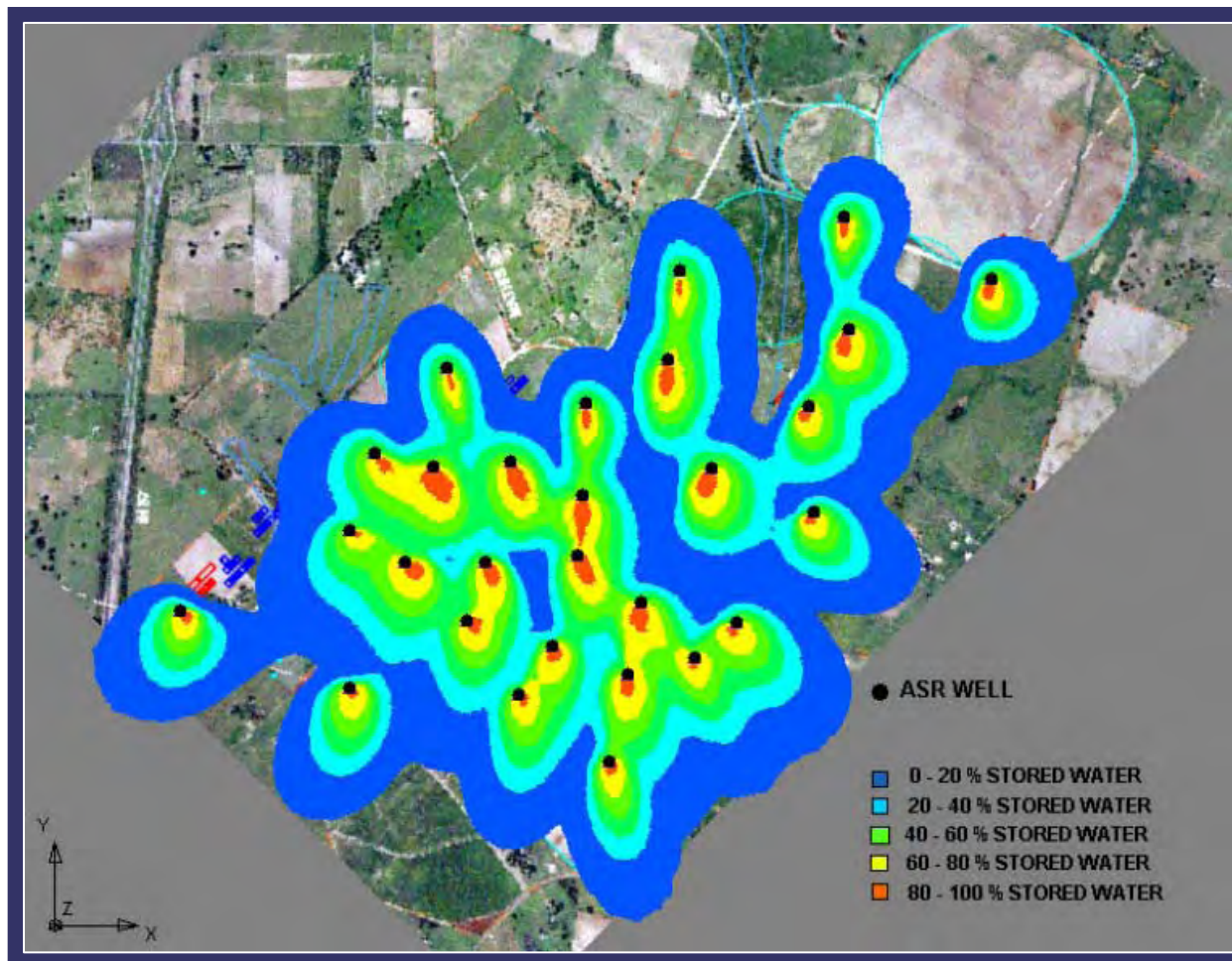
USGS activities

- Completed Scientific Investigations Report *Quality of Groundwater at and near an Aquifer Storage and Recovery Site, Bexar, Atascosa, and Wilson Counties, Texas, June 2004 - August 2008*
 - **"no trends that might have been caused by migration of injected Edwards aquifer water were observed"**
- Continued sampling of 15 off-site wells for water quality
- 1 ASR monitor well equipped with a water quality monitor
- 3-D model pilot study in progress (in next year's Joint Funding Agreement).
- Will assist in selection of possible new monitoring well site(s)

Storage volume by ASR well



Migration of stored water



From CH2MHill Technical Memorandum, South Bexar County ASR Recovery Assessment, Jan. 7, 2004

Mitigation program

- 240 wells investigated
- 101 wells where mitigation has been completed:
 - 33 wells had pumps lowered
 - 59 new wells drilled
 - 9 wells with no mitigation required

ASR highlights

- Project has exceeded all expectations
- Water quality does not degrade
- Amount of water available for storage and withdrawal has significant impacts on overall water supply plan

Moving forward with ASR

- May help with EARIP - concept under consideration
- Maintain bank in long-term storage
- Explore effective summer peak management strategies
- Plan for future studies to understand hydrodynamics of site



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