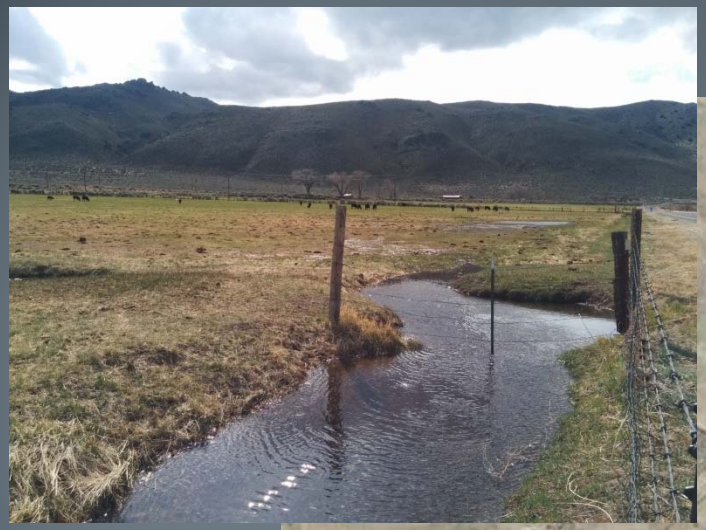
Groundwater Levels and Gradients in Churchill and Lyon County, Nevada



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David Smith - dwsmith@usgs.gov
USGS Nevada Water Science Center

Cooperators

Carson Water Subconservancy District

Churchill County

Lyon County

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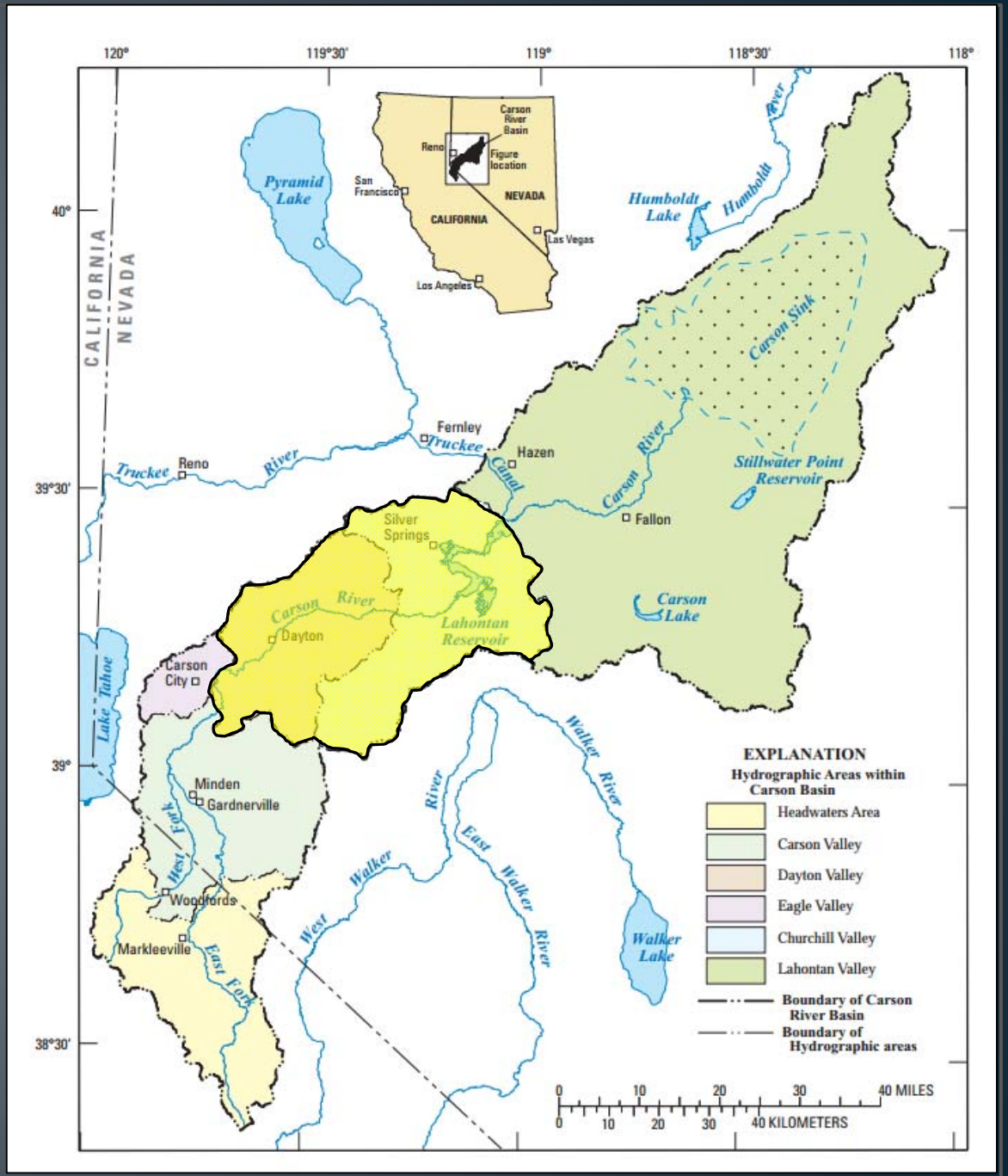
Study Area

- Dayton Valley & Churchill Valley
- (370 and 480 sq. mi)
  - Groundwater Municipal Supply

    Carson City, Mound House, Dayton, and Silver Springs
  - Domestic/Agricultural Wells

  - Rapid population growth



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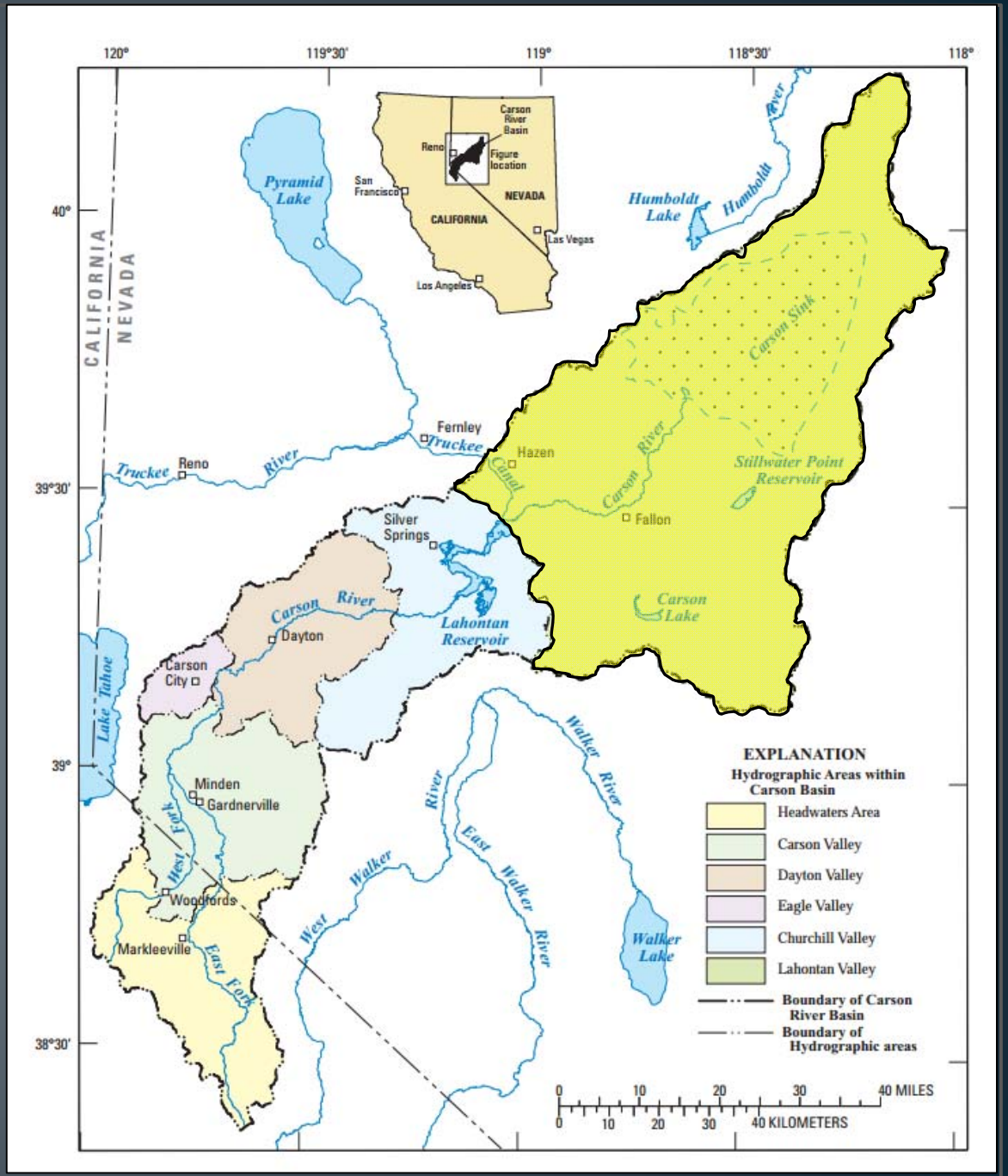
Study Area

- Lahontan Valley
  - (2022 sq. mi)
  - Churchill County
  - Basalt Aquifer Municipal Supply
    - City of Fallon
    - Fallon Paiute-Shoshone Tribe
    - Naval Air Station Fallon
  - Agriculture Canals and Drains Newlands Project



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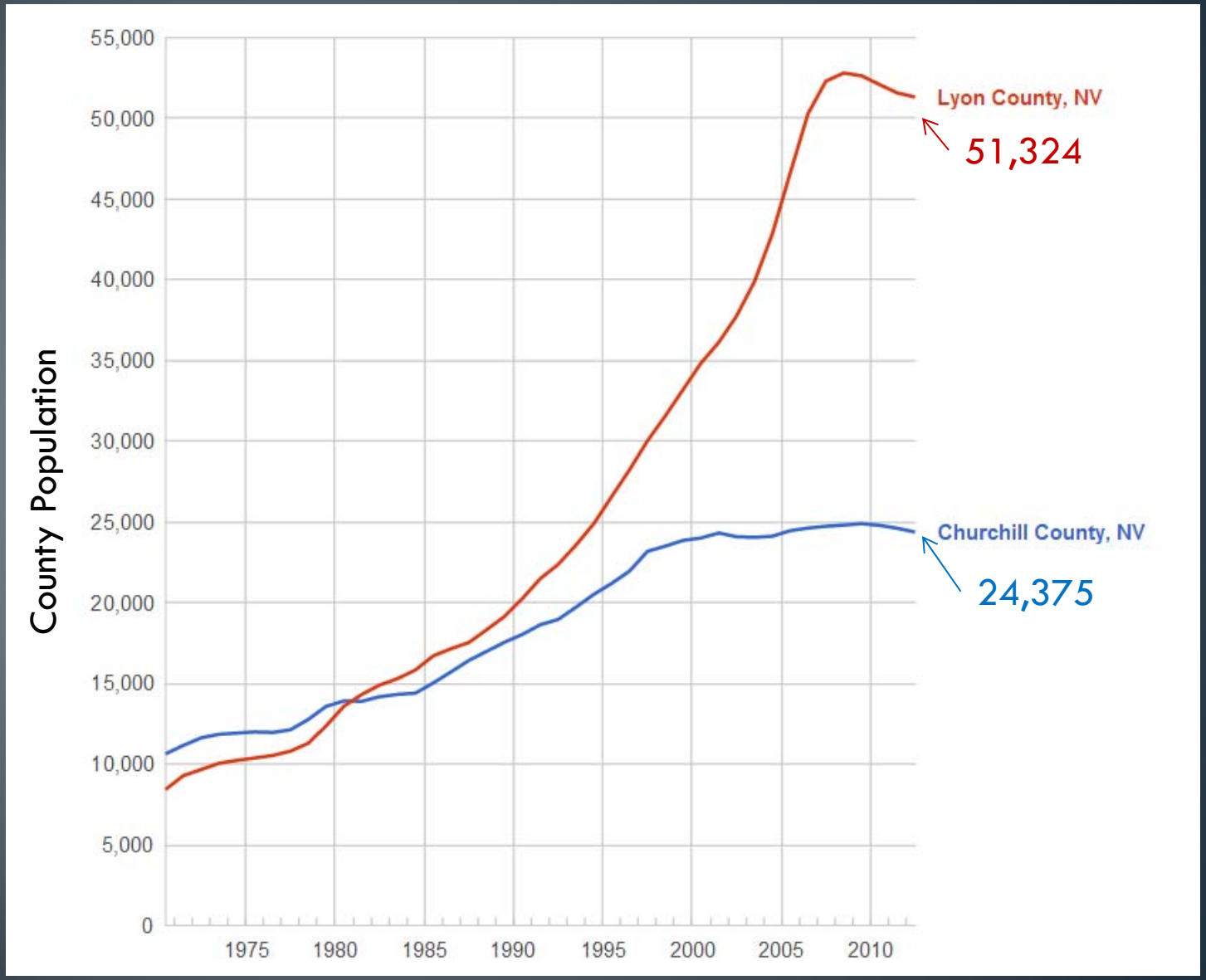
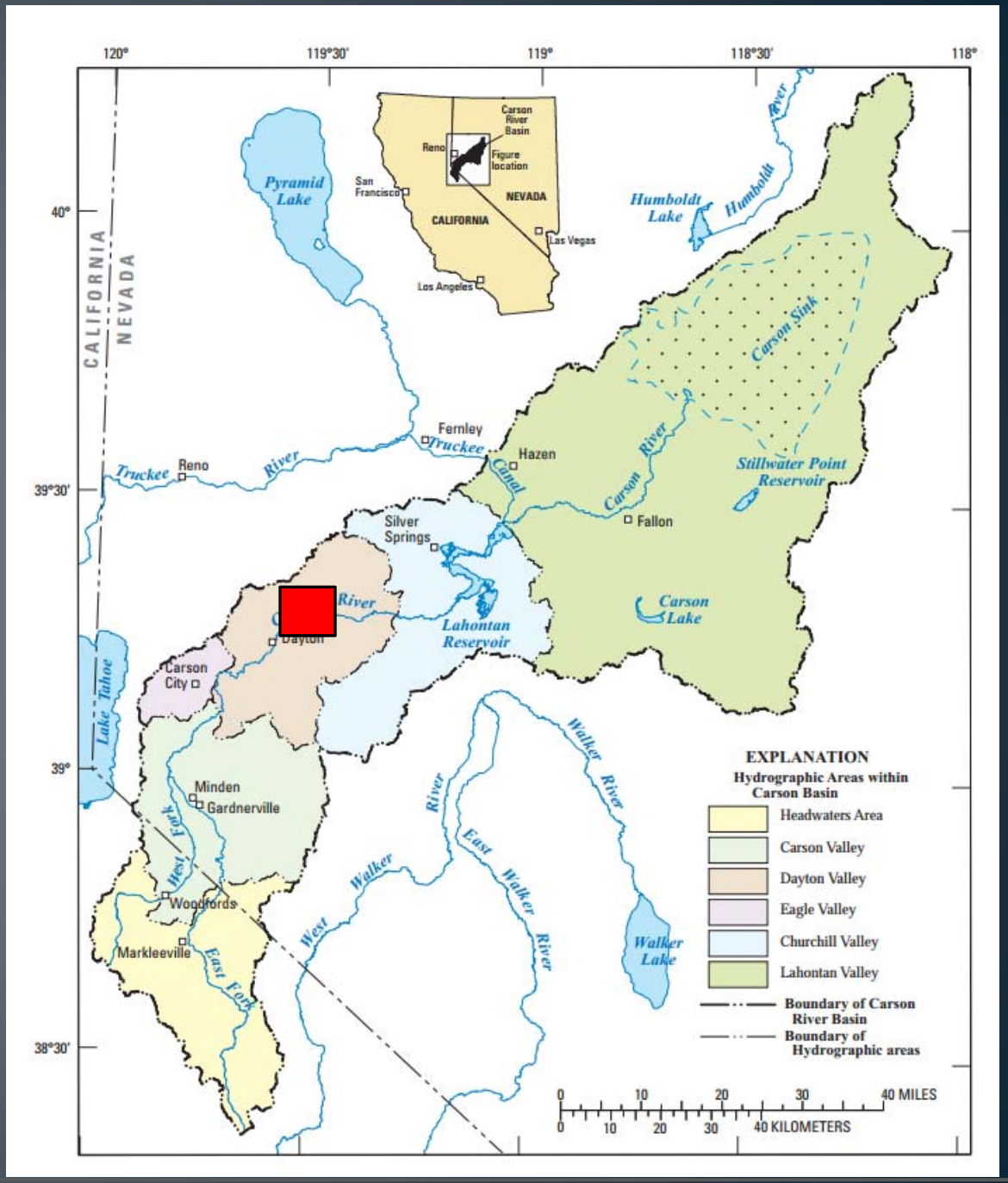
Population Growth



US Census (2012), google (2014)

Population Growth in Dayton Valley



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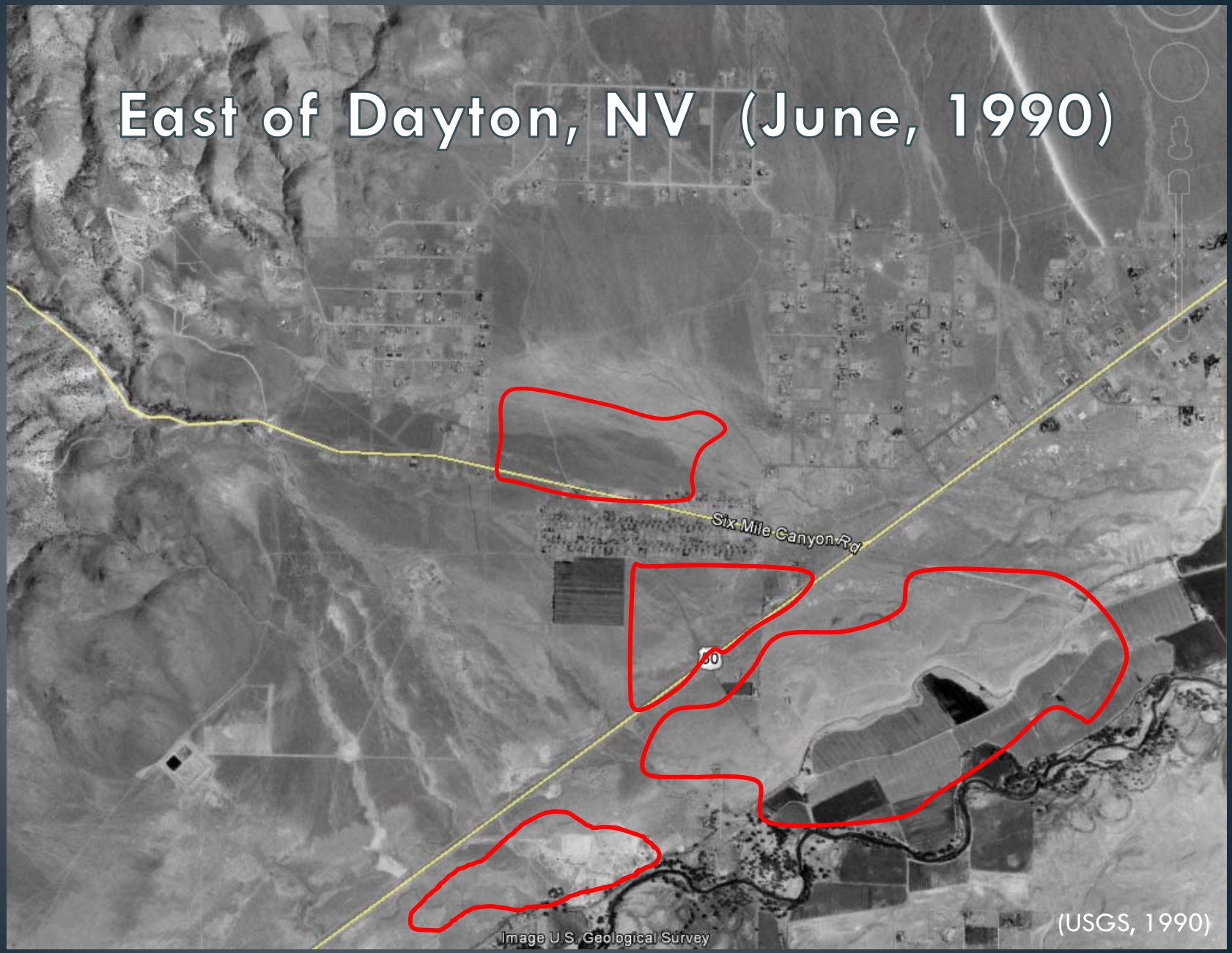
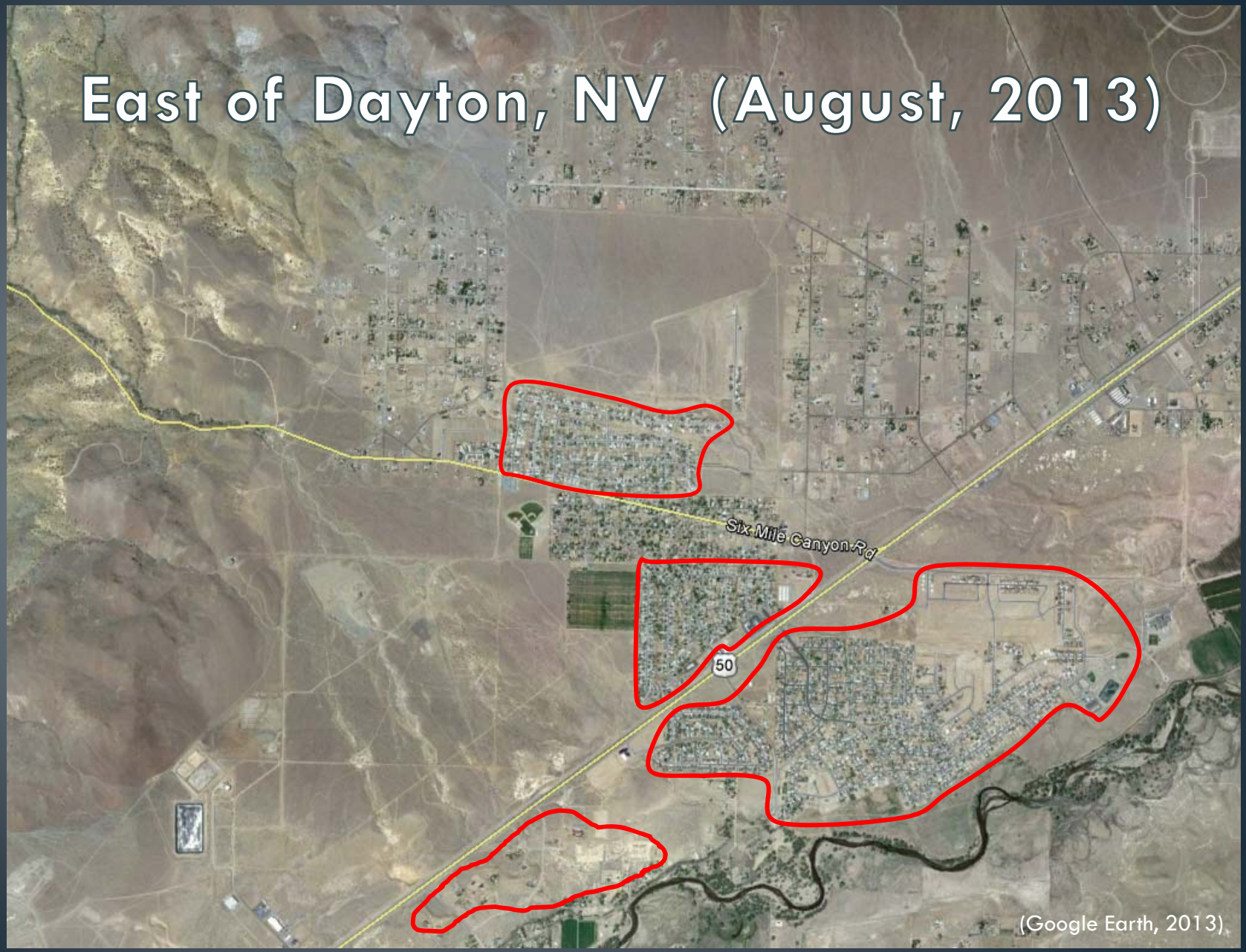
East of Dayton, NV (June, 1990)



(USGS, 1990)

East of Dayton, NV (August, 2013)



Groundwater and Carson River Flow

- Population growth and increased groundwater demand Carson River Basin
  - >30,000 acre-feet 1987-1992[1]
  - >50,000 acre-feet in 2004 [1]
- Changing land and water use throughout the Carson River basins
  - Conversion of Desert Land to Irrigated Agriculture (i.e. Newlands Project)
  - Irrigated Agriculture to Urban Areas (Groundwater Pumping)
  - Changing land-management practices (effluent irrigation)
  - Complex System: groundwater and surface-water interactions

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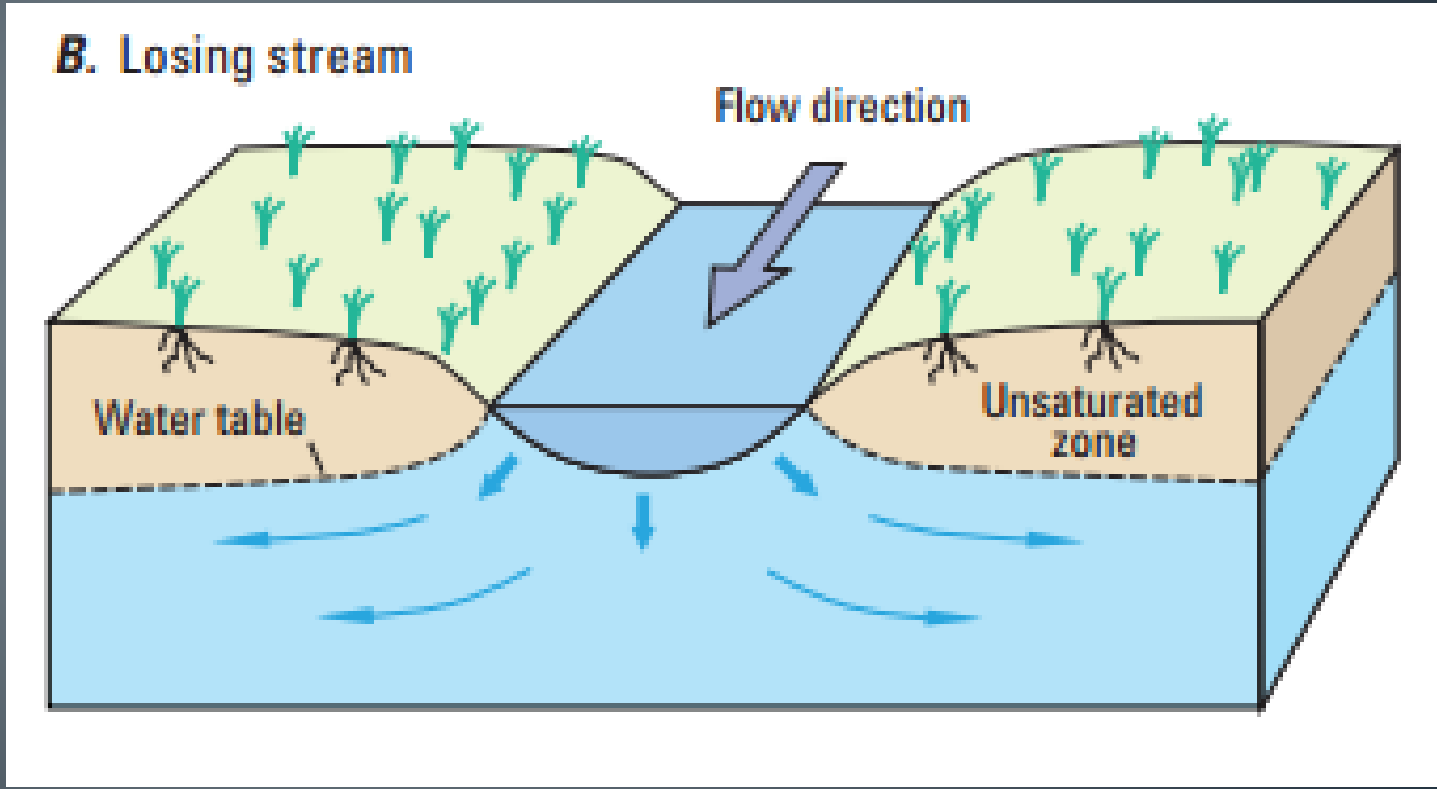
[1](Maurer and others, 2009)

Carson River connection to groundwater

[Gains and Losses]



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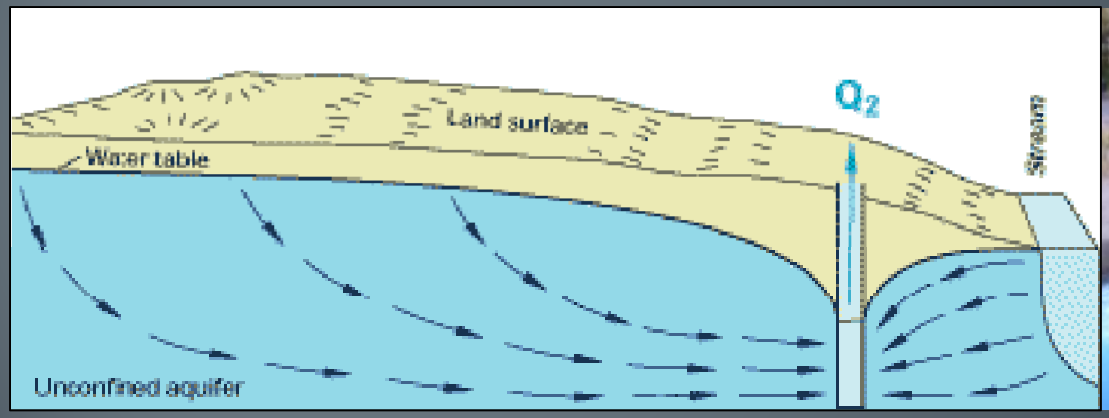
(Alley and others, 1999, Barlow and Leake, 2012)

Surface water loss from nearby pumping

(Q is flow out from pumping)



(Alley and others, 1999, Barlow and Leake, 2012)

Has groundwater pumping impacted Carson River Flows?

- USGS Report: Maurer, D.K., Paul, A.P., Berger, D.L., and Mayers, C.J., 2009, *Analysis of streamflow trends, ground-water and surface-water interactions, and water quality in the upper Carson River basin, Nevada and California*: U.S. Geological Survey Scientific Investigations Report 2008–5238.

- Conclusions
  - Influence of groundwater pumping on Carson River flow potentially masked by precipitation, changing land use/management.[1]
  - Effects of groundwater pumping during low flow conditions unknown[1]

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[1](Maurer and others, 2009)

USGS Middle Carson River Model, a tool to asses the potential effects of land use and water use on the Carson River

Carson River 2013

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USGS Dayton Valley Project

USGS Middle Carson River Basin Model (Eric Morway)

Collect hydrological data for model calibration in Dayton Valley

(1) Collect bulk precipitation data throughout the Dayton Valley

(2) Groundwater-levels, identify areas of gaining and losing reaches. Tape down to river stage, compare with monitoring well data.

(3) Collect annual water-quality sample monitoring, influence of septic tanks.

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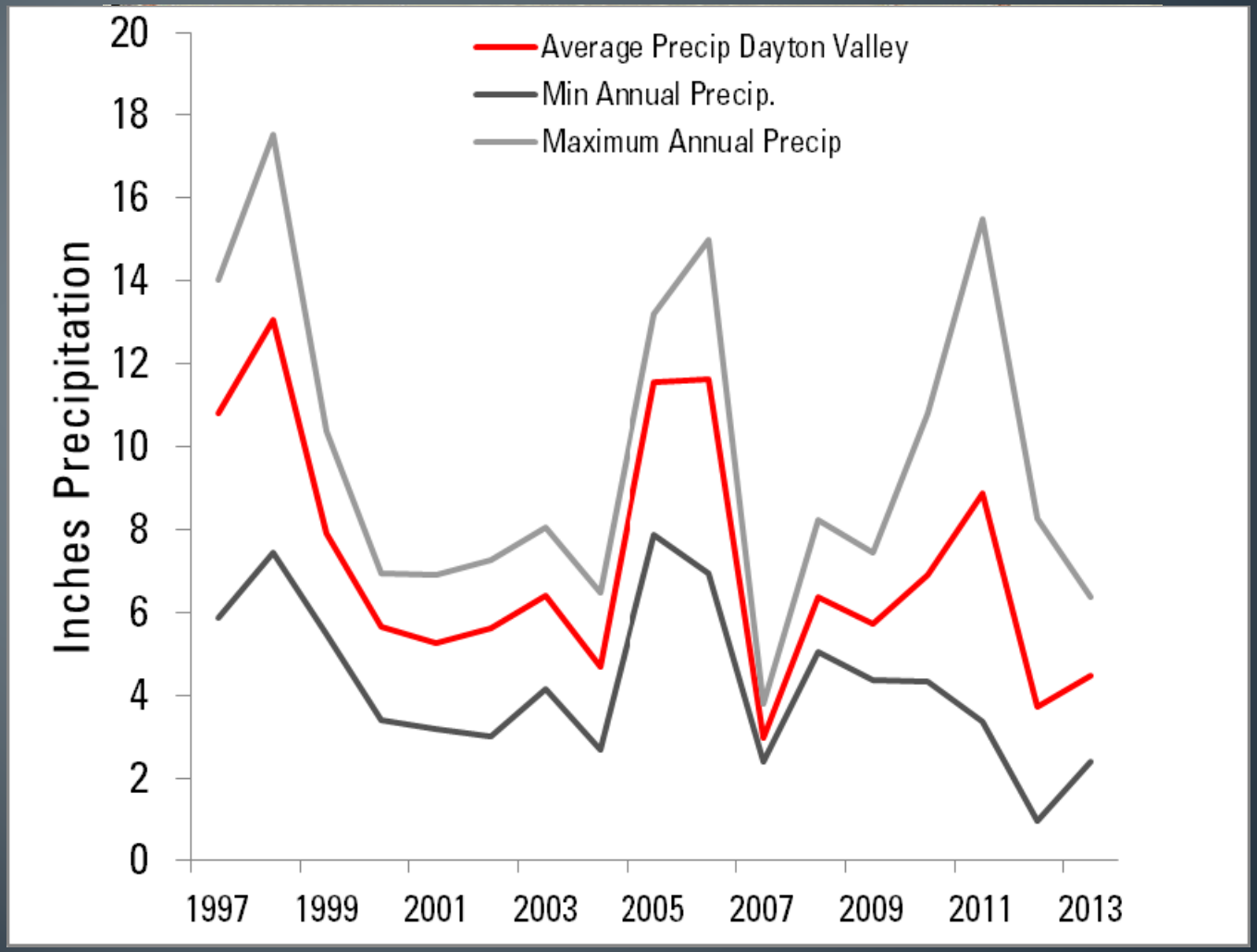
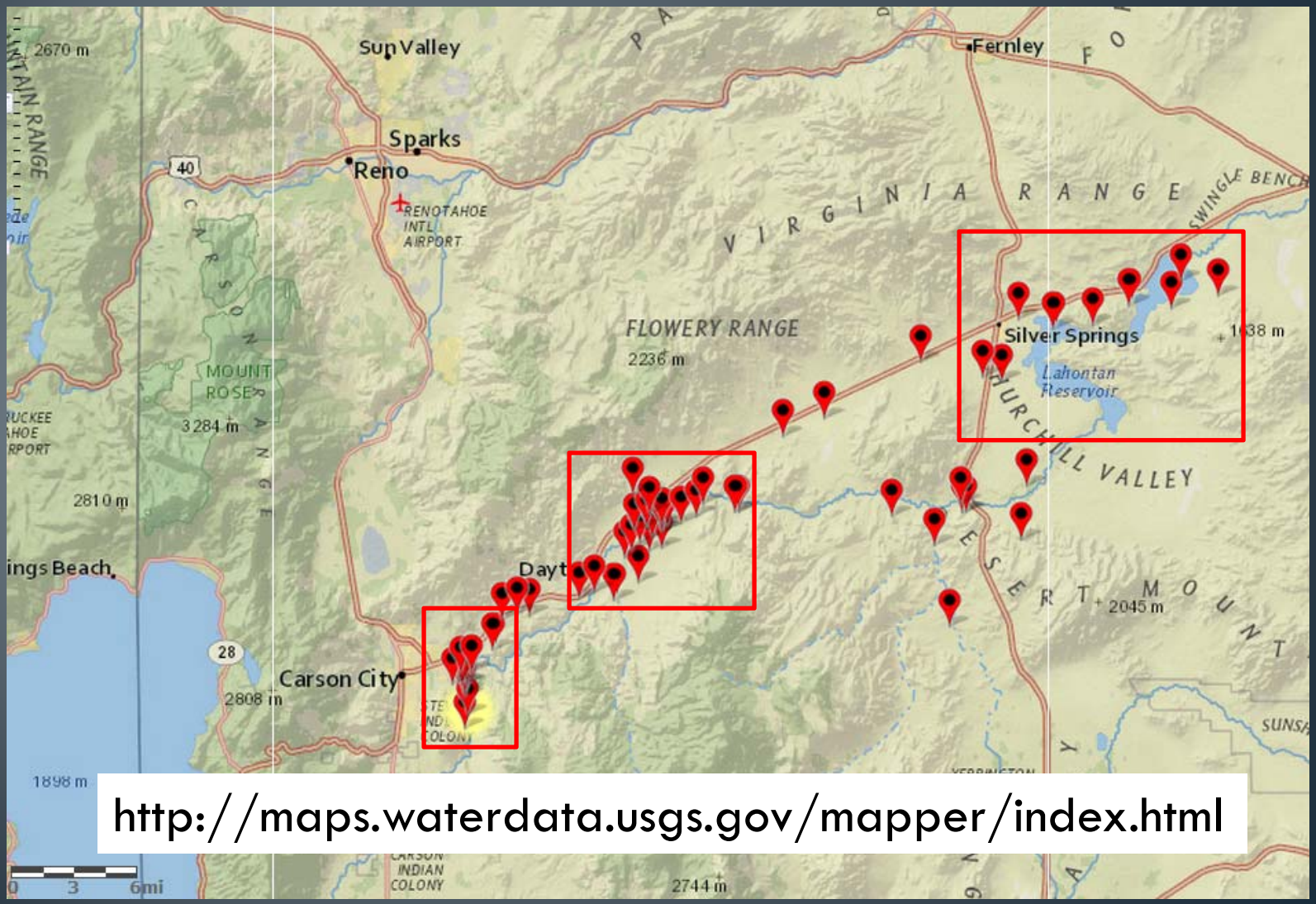
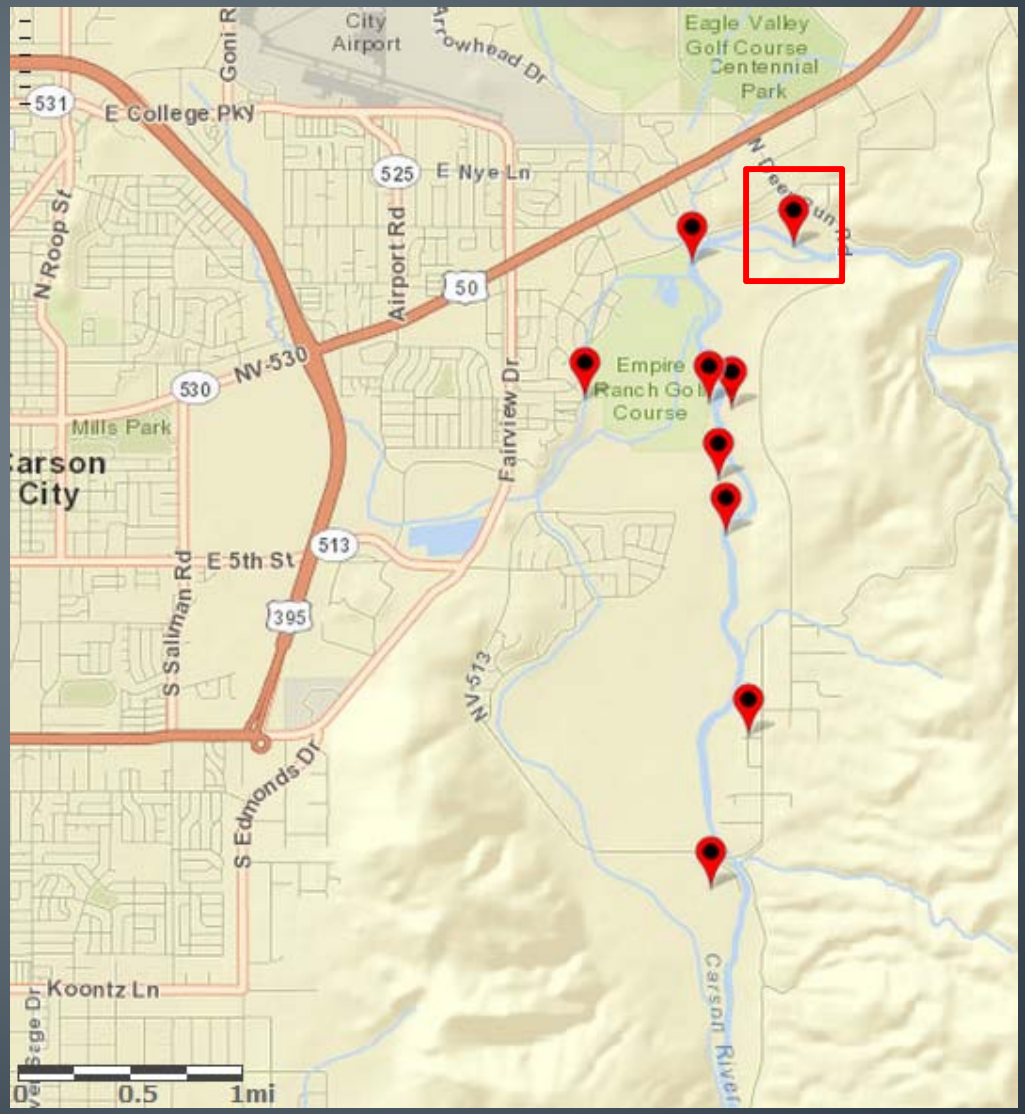
(1) Dayton Valley Annual Precipitation



(2) Groundwater & Surface Water Network



Carson River (East Carson City)



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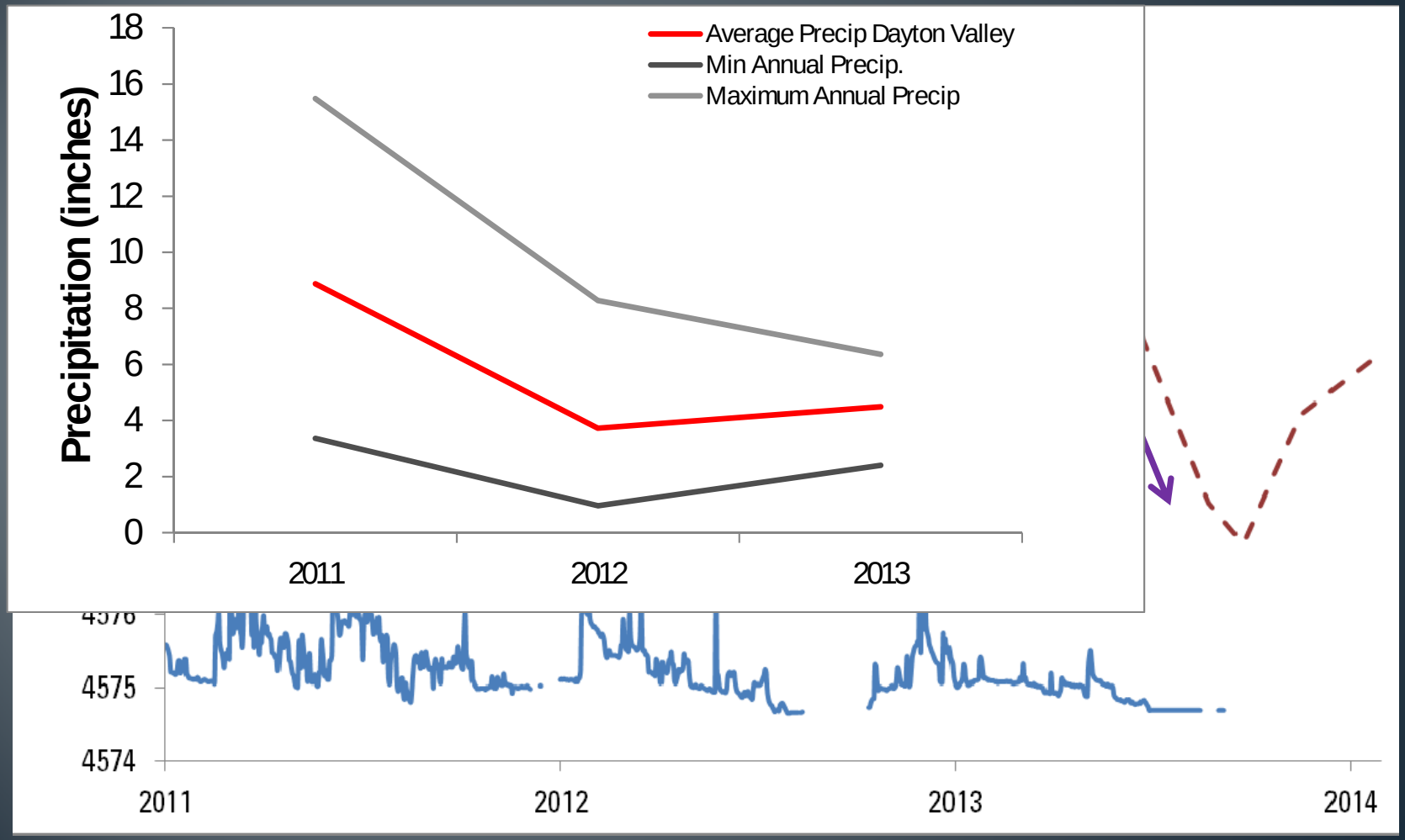
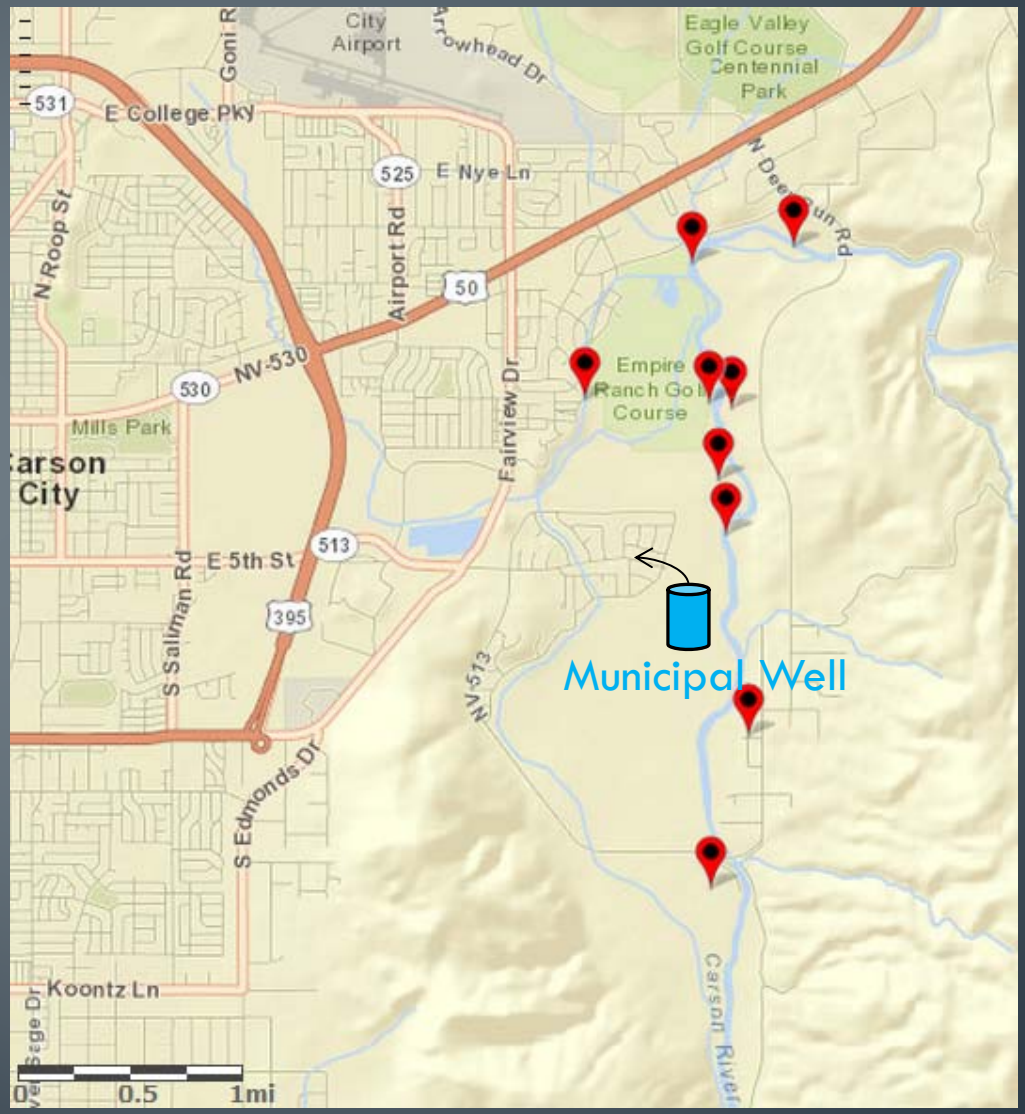
Carson River (East Carson City)



Carson River (East Carson City)



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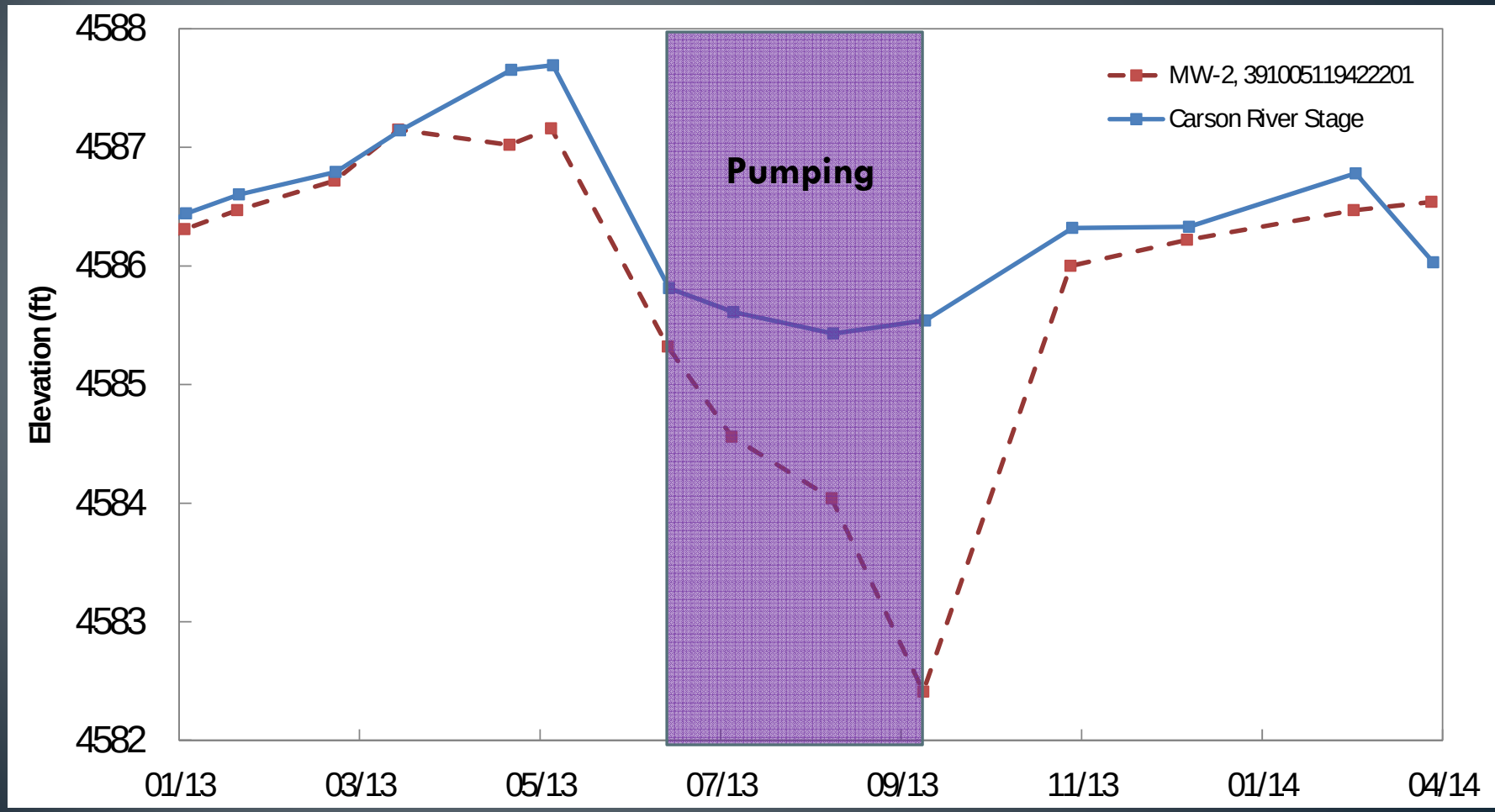
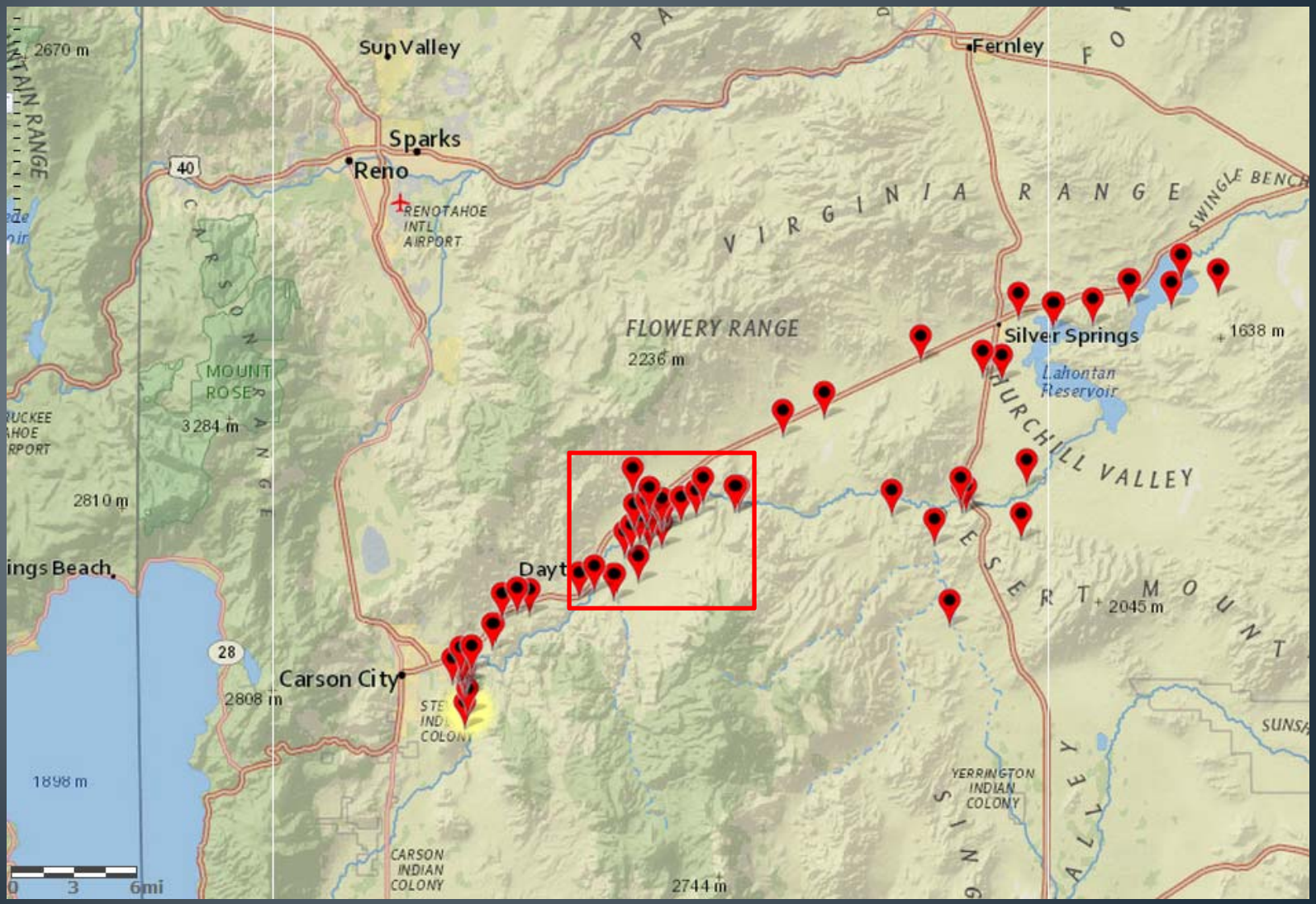
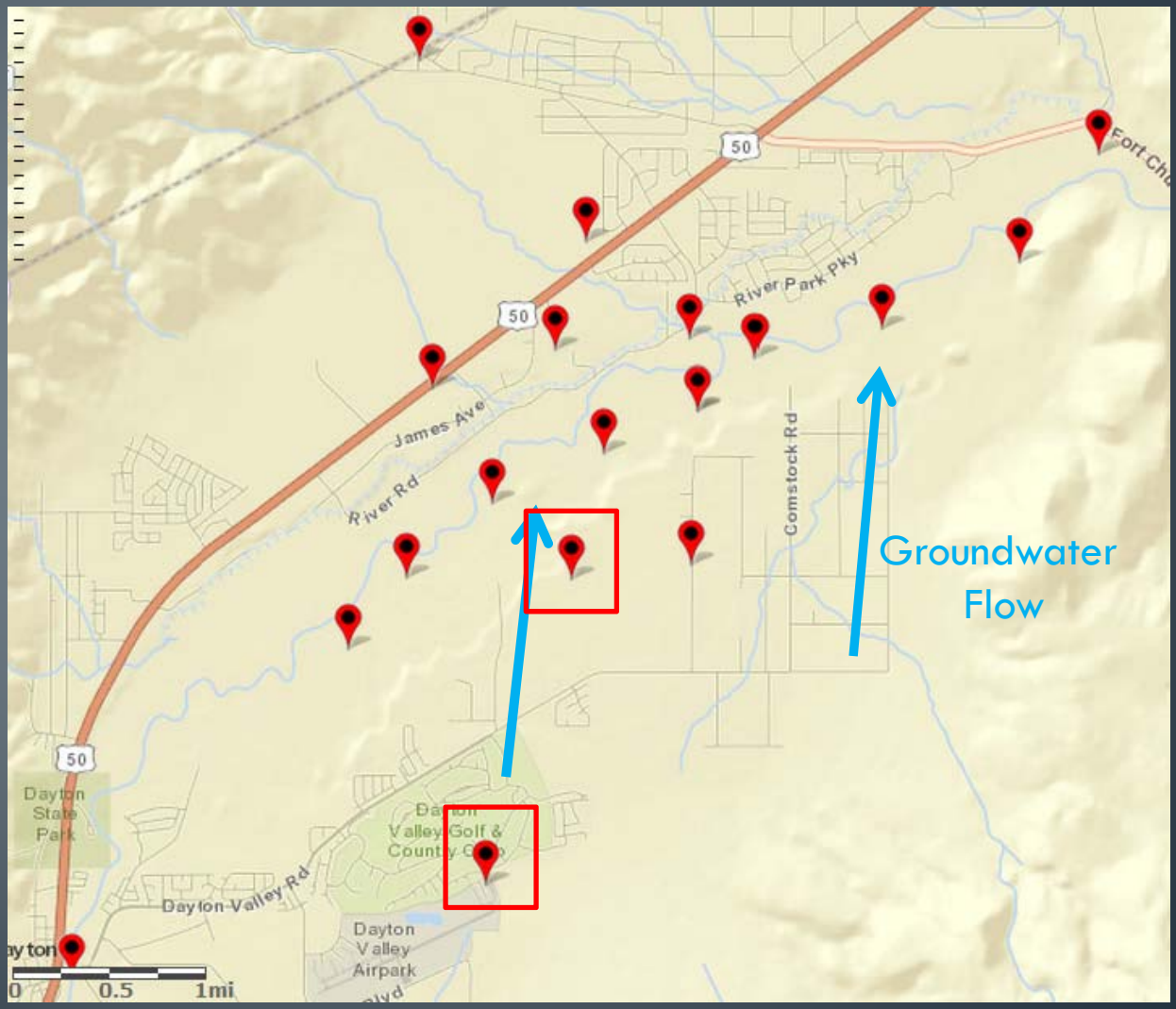
MW-2 (~1500ft from Municipal Well)



Groundwater & Surface Water Network



Carson River (Carson Plains)



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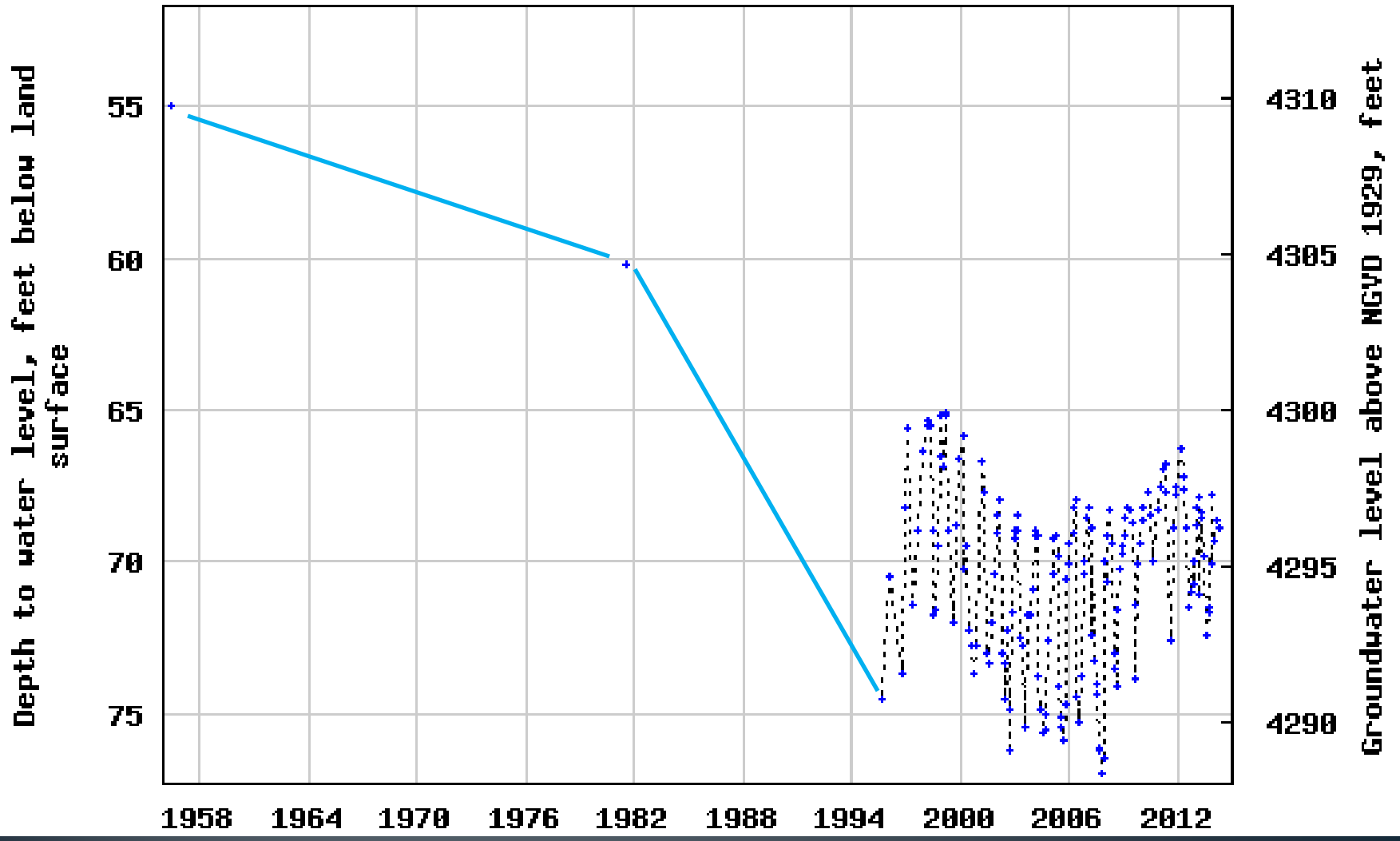
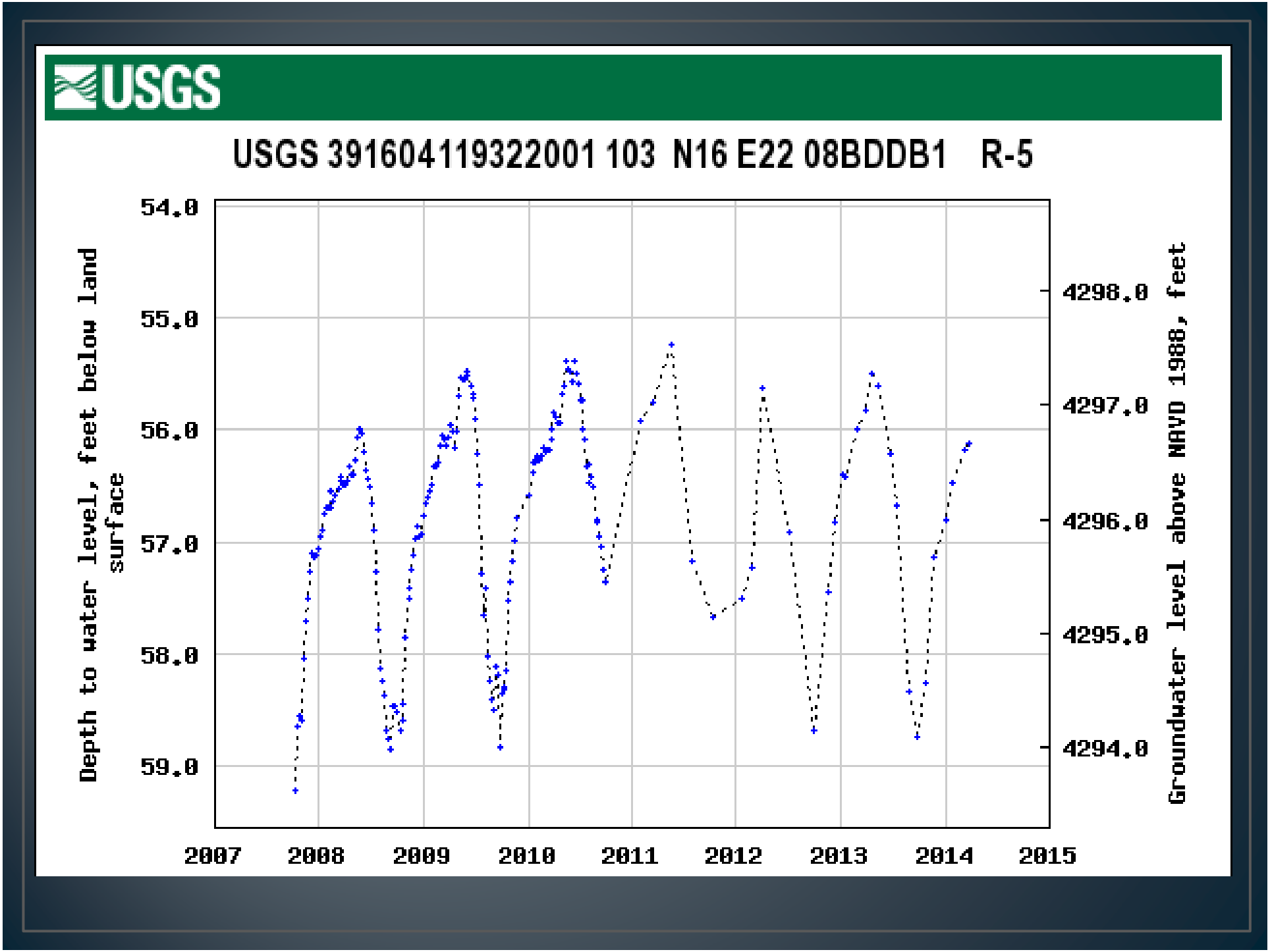
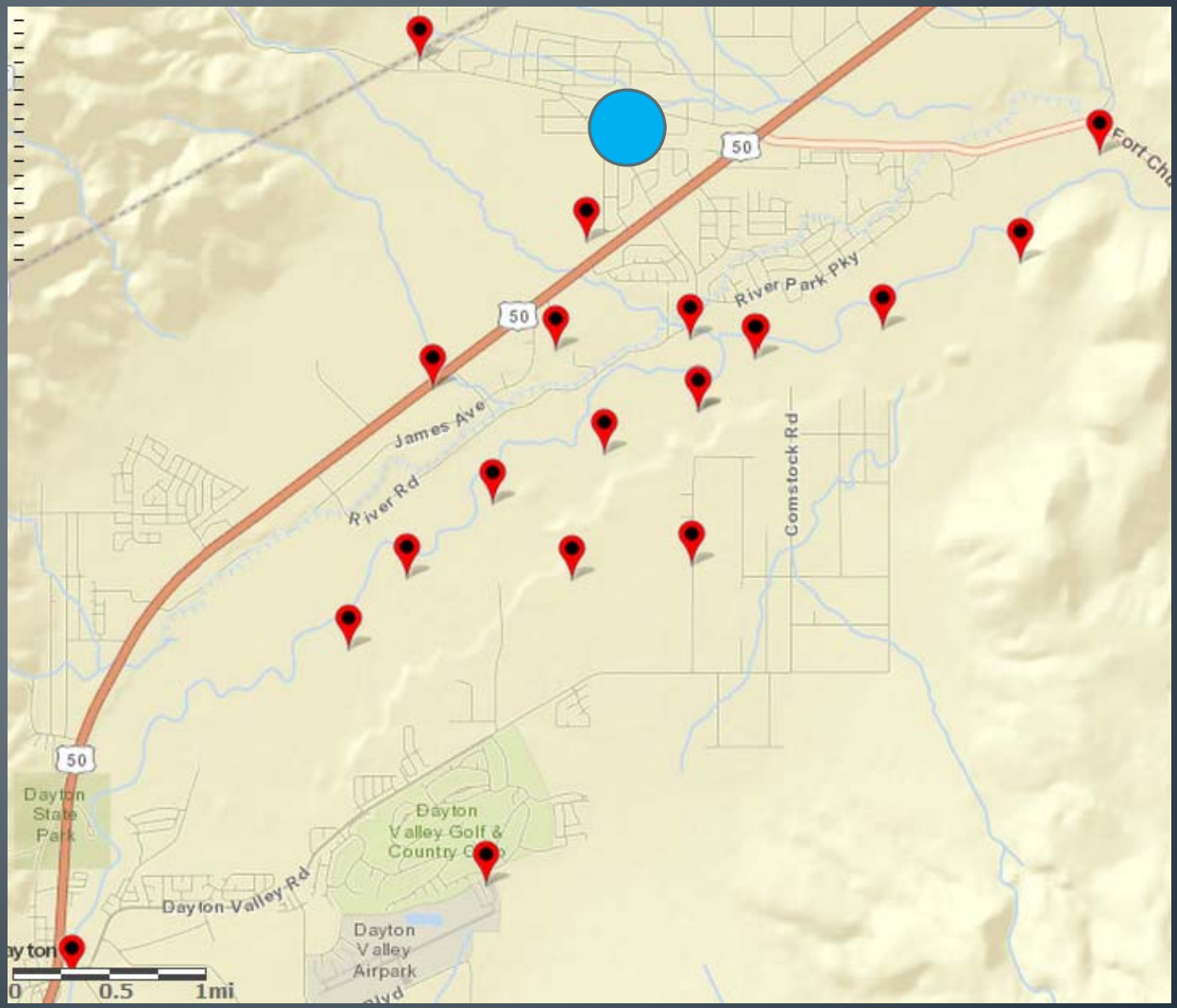
USGS

USGS 391429119325401 103 N16 E22 18DDDD1 GOLF COURSE




USGS
USGS 391604119322001 103 N16 E22 08BDDB1 R-5
Depth to water level, feet below land surface
54.0
55.0
56.0
57.0
58.0
59.0
Groundwater level above NAVD 1988, feet
4298.0
4297.0
4296.0
4295.0
4294.0
2007
2008
2009
2010
2011
2012
2013
2014
2015

(3) Groundwater quality



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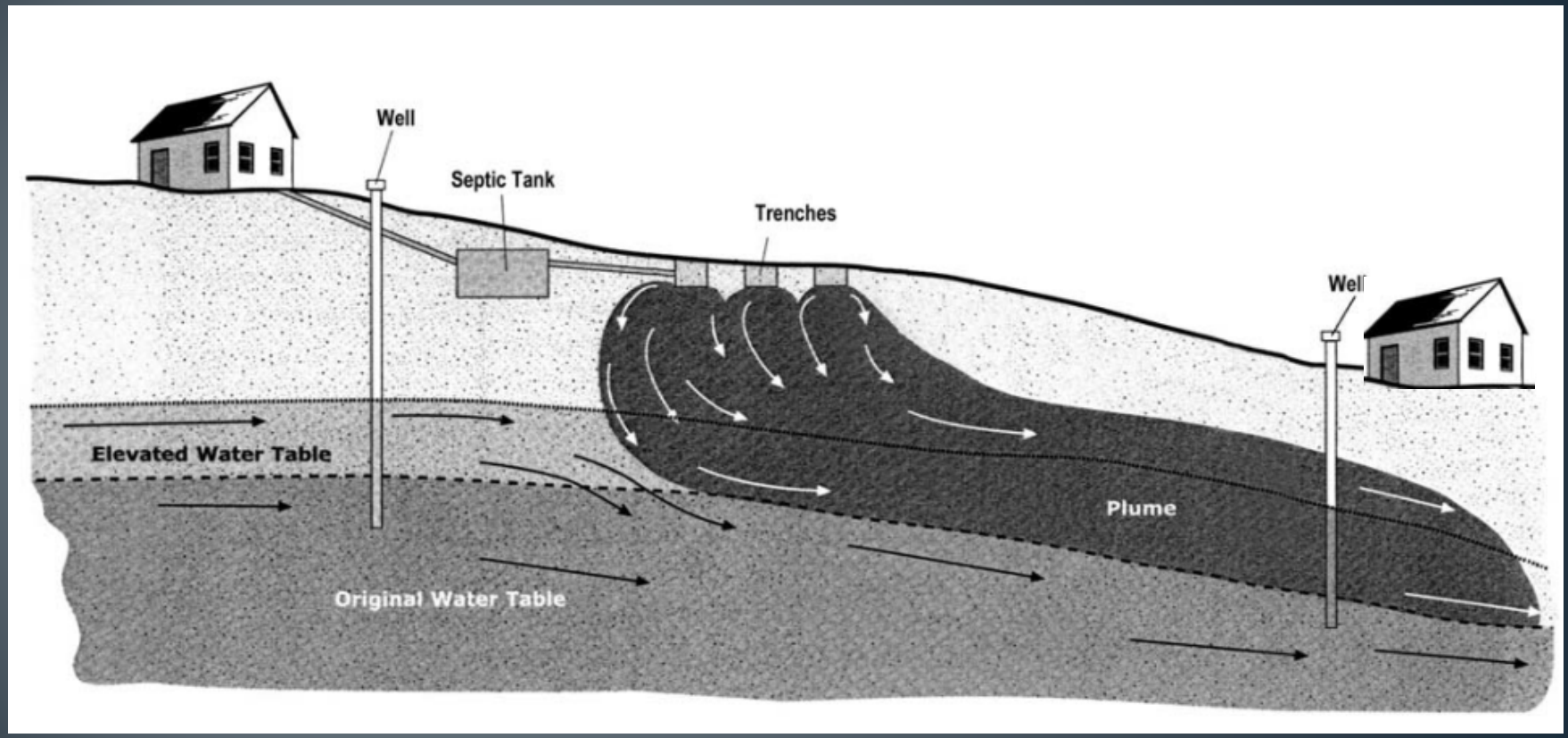
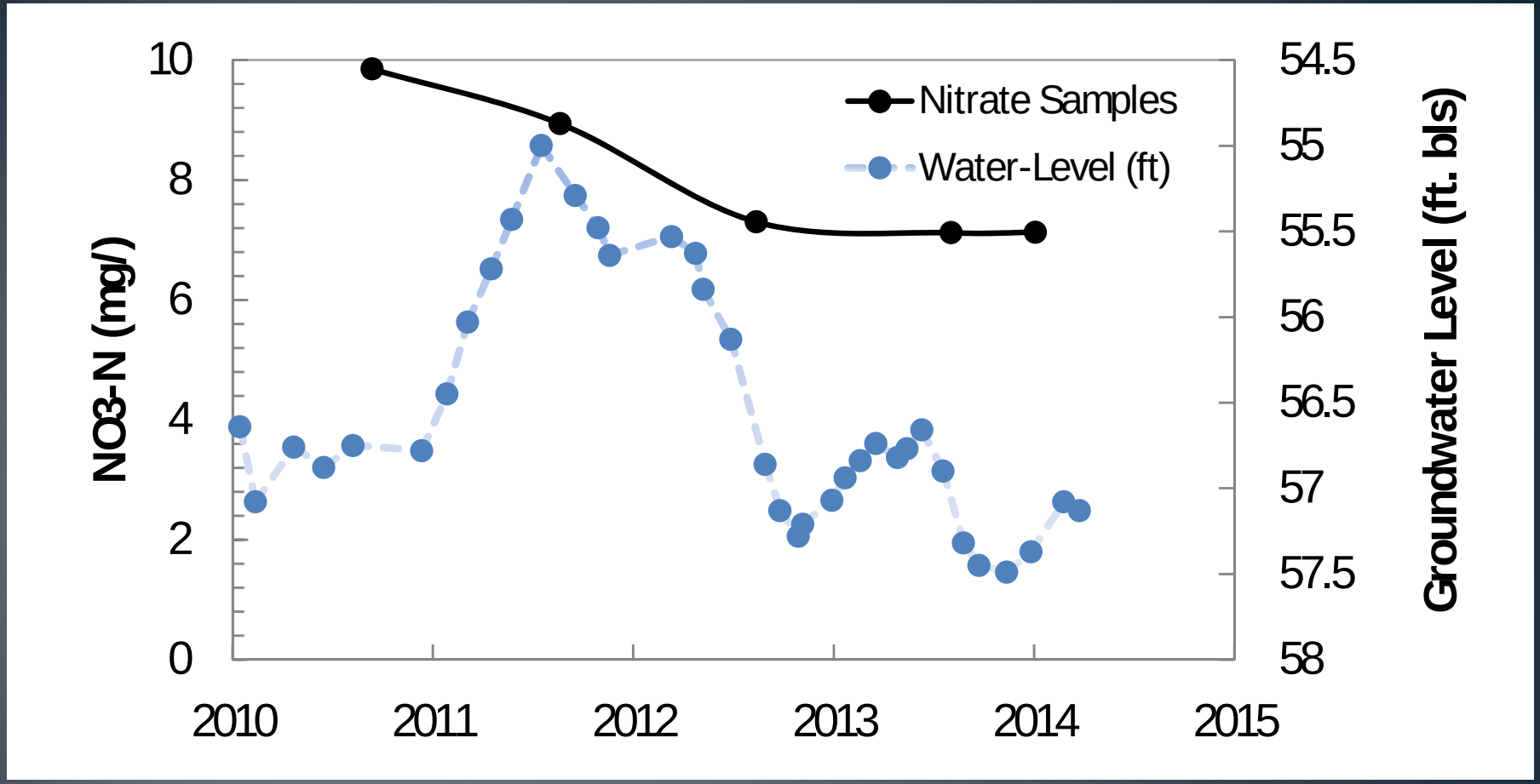
(2) Groundwater Quality and Septic Tanks



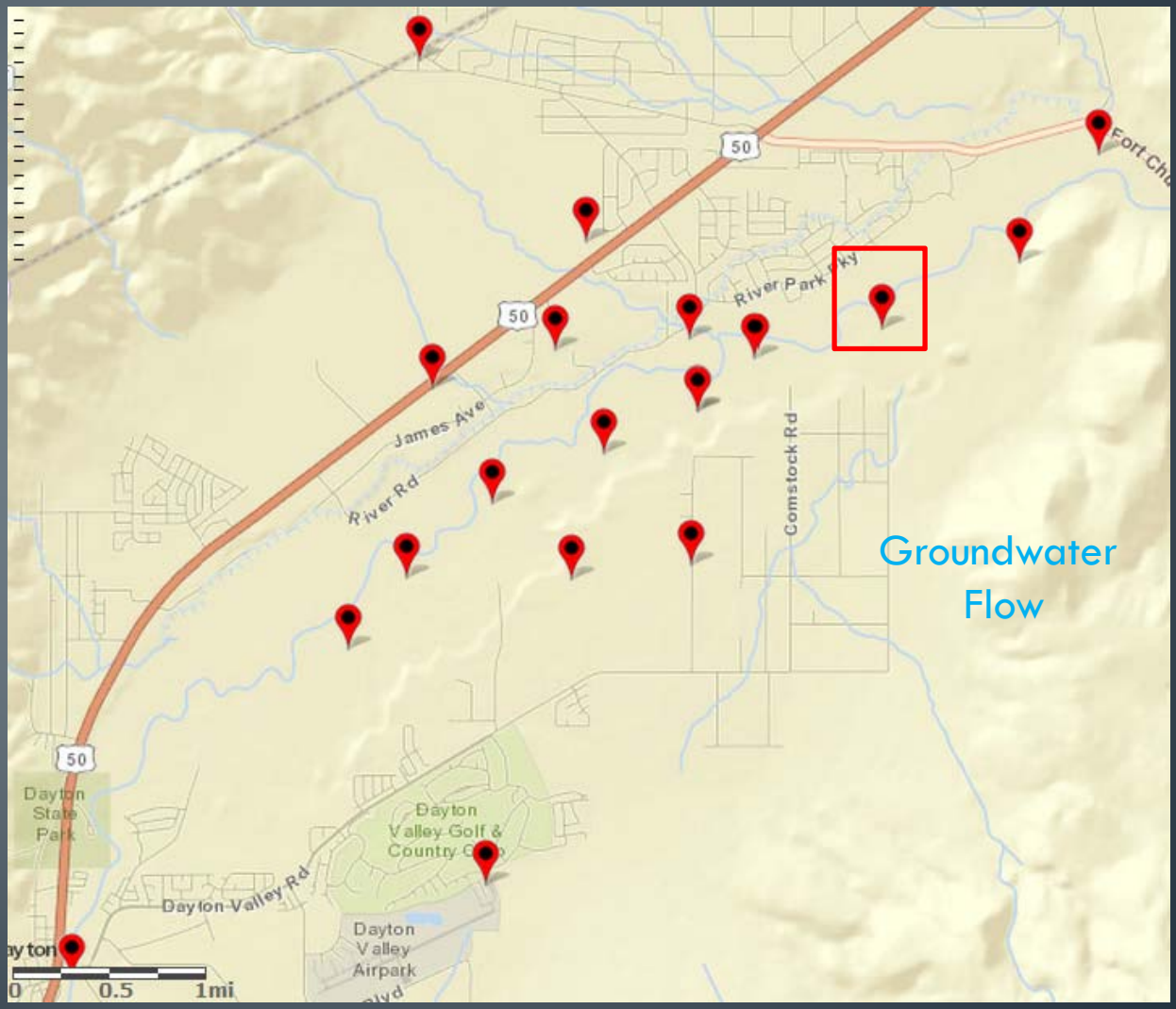
Ramon Naranjo USGS, discuss effects of septic tanks on groundwater

(USEPA,2002)



- Water-quality collected at 7 wells annually
  - Nitrogen and Oxygen Isotopes collected in 2014
    - Characterize nitrogen as mix of septic waste and soil nitrogen

Carson River (East of Dayton)



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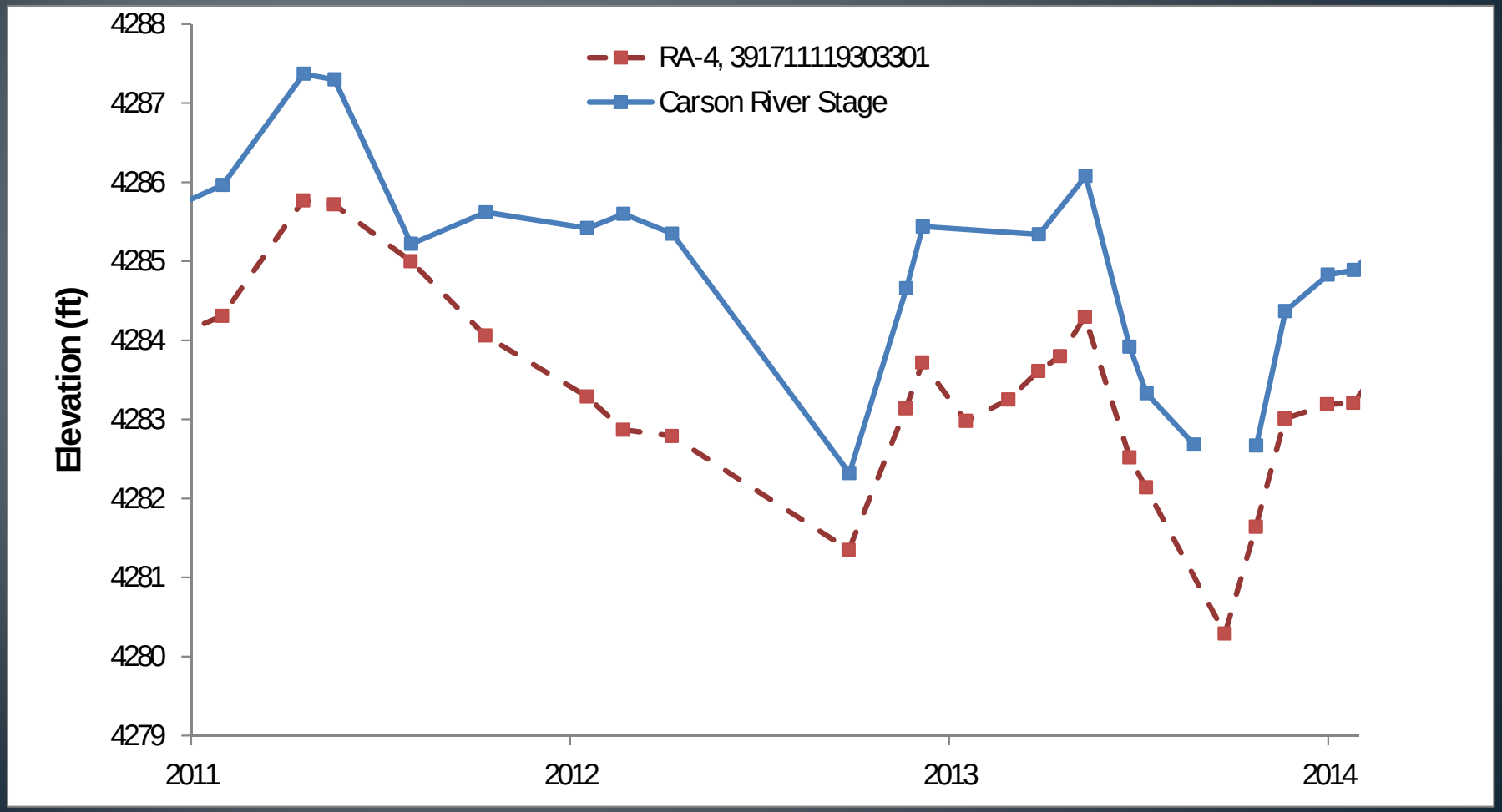
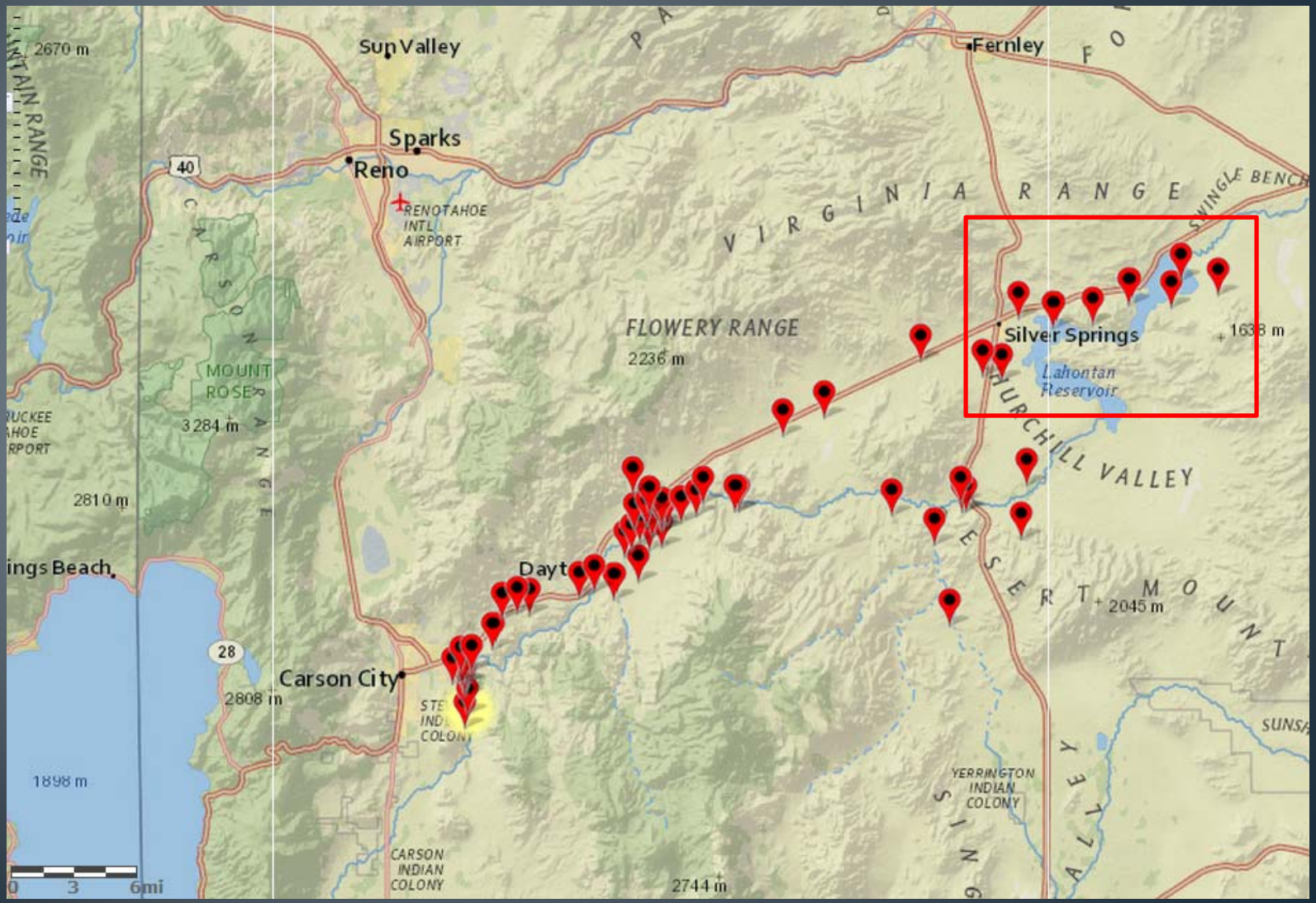
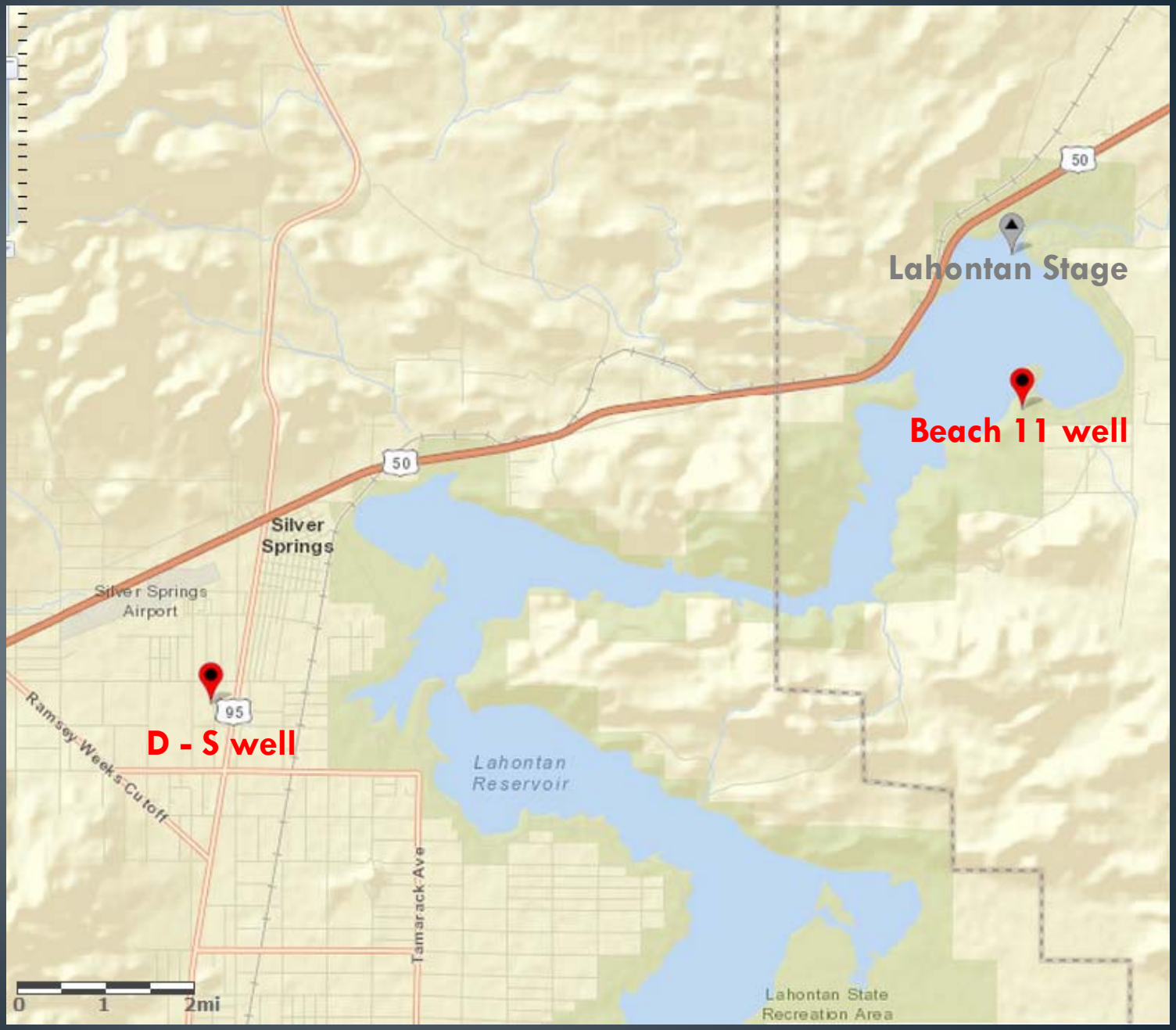
Diversion
Irrigation Dam
150
300ft

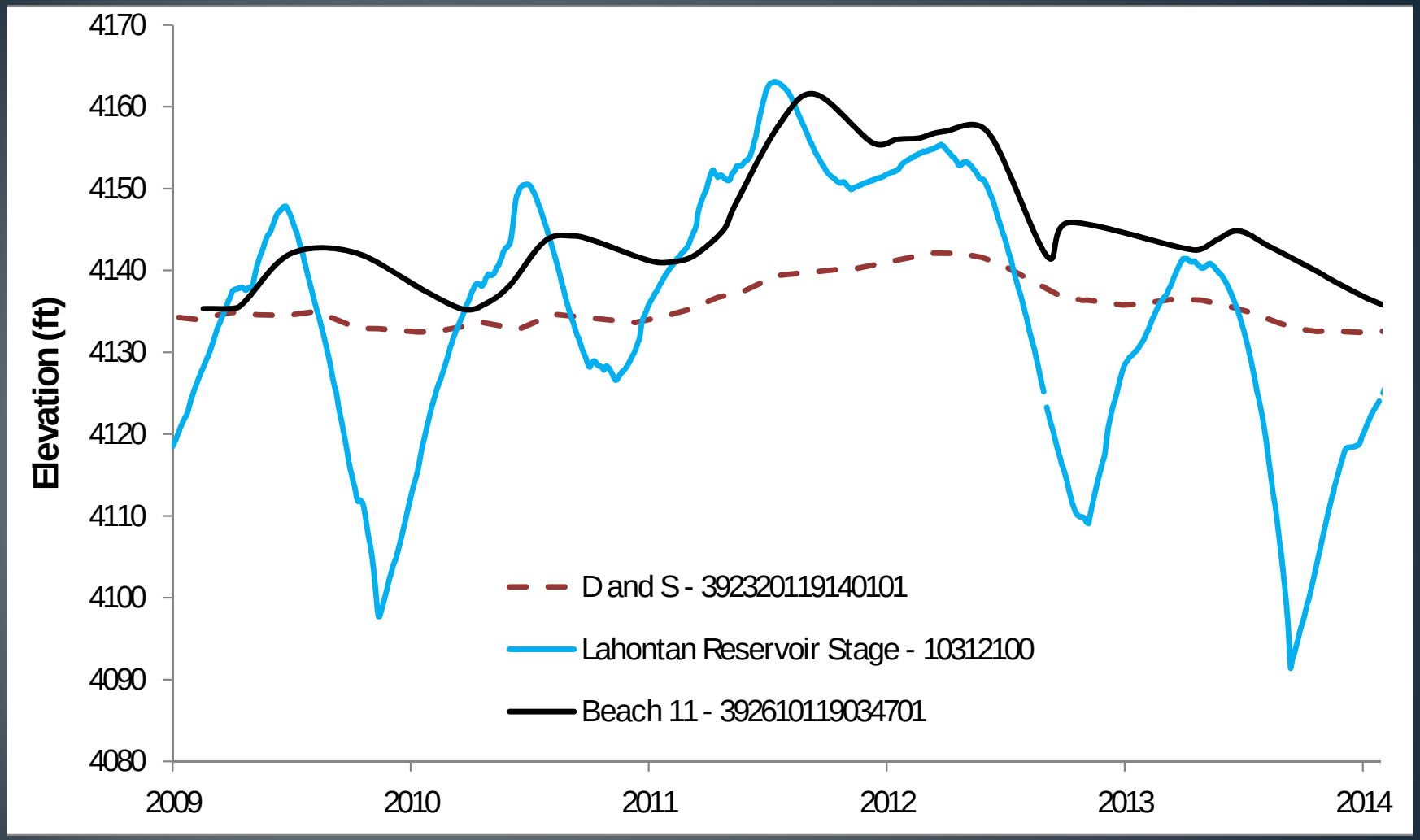
RA-4 (Influence from low head dam)



Groundwater & Surface Water Network




Lahontan Stage
Beach 11 well
D - S well
50
50
95
Silver Springs
Silver Springs Airport
Ramsey Weeks Cutoff
Tamarack Ave
Lahontan Reservoir
Lahontan State Recreation Area
0
1
2mi



- D and S well located ~ 2 miles away from Lahontan Reservoir

Project Goals

- Newlands Project (Churchill County) Monitoring
  - Monitor water-levels in areas of land-use
    - (water-rights and development)
  - Collect groundwater-quality annually
  - Monitor the Basalt Aquifer for water-levels and water-quality

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Carson Desert – Shallow Aquifer

- Shallow Aquifer (0-50ft depth below land surface)
  - Carson and Truckee River water, contributes to recharge
- Newlands Project Irrigation
    - 14,000 acres irrigated 1916 (Lee and Clark, 1916)
    - 63,597 acres irrigated (Bureau of Reclamation, 2013)
- Groundwater levels increased ~15 feet from 1904-1992
  - Increased groundwater recharge from irrigation (Canals, Laterals)
    - (Seiler and Allander, 1993)
- Monitor change in water-levels with removal of irrigation

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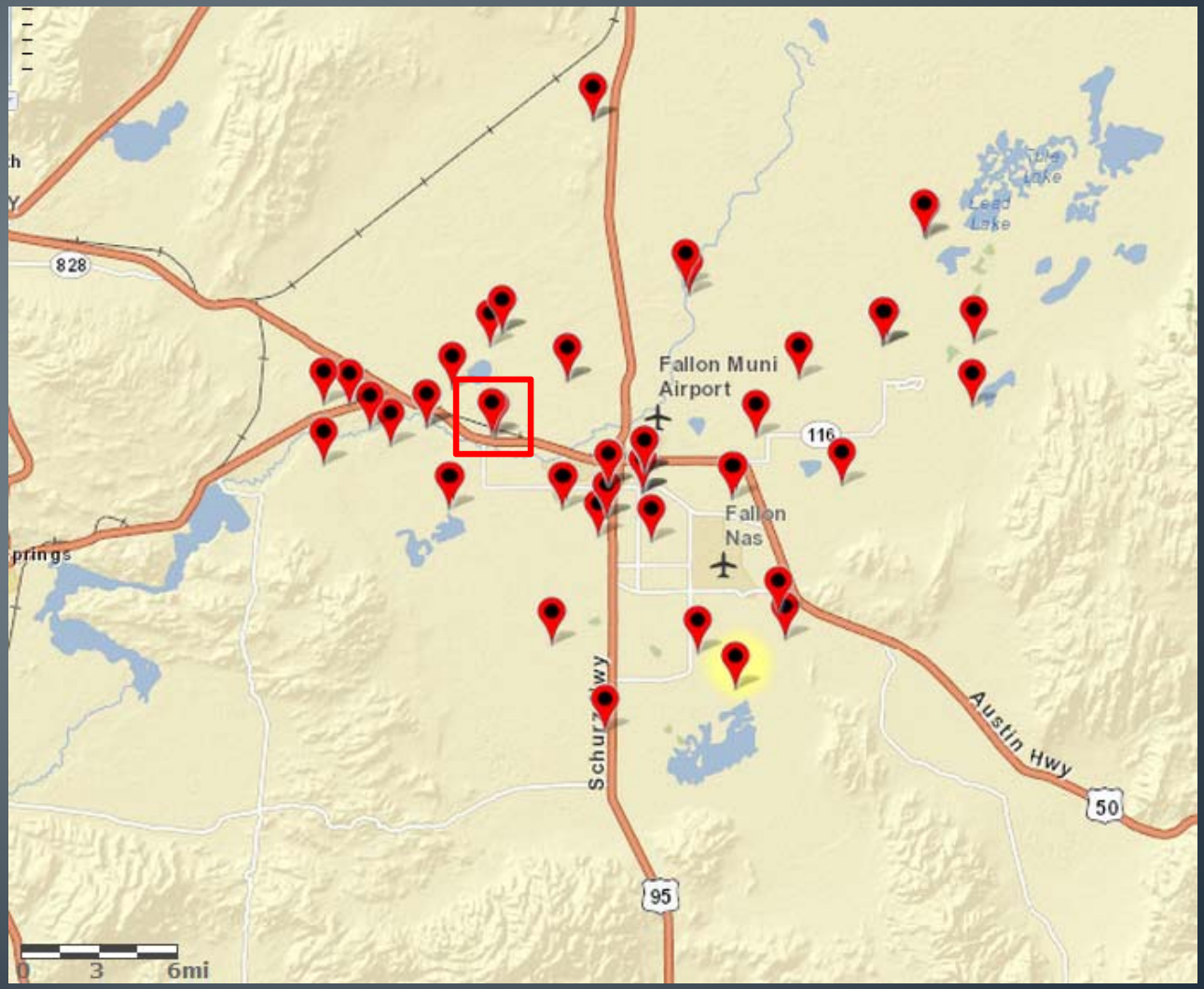
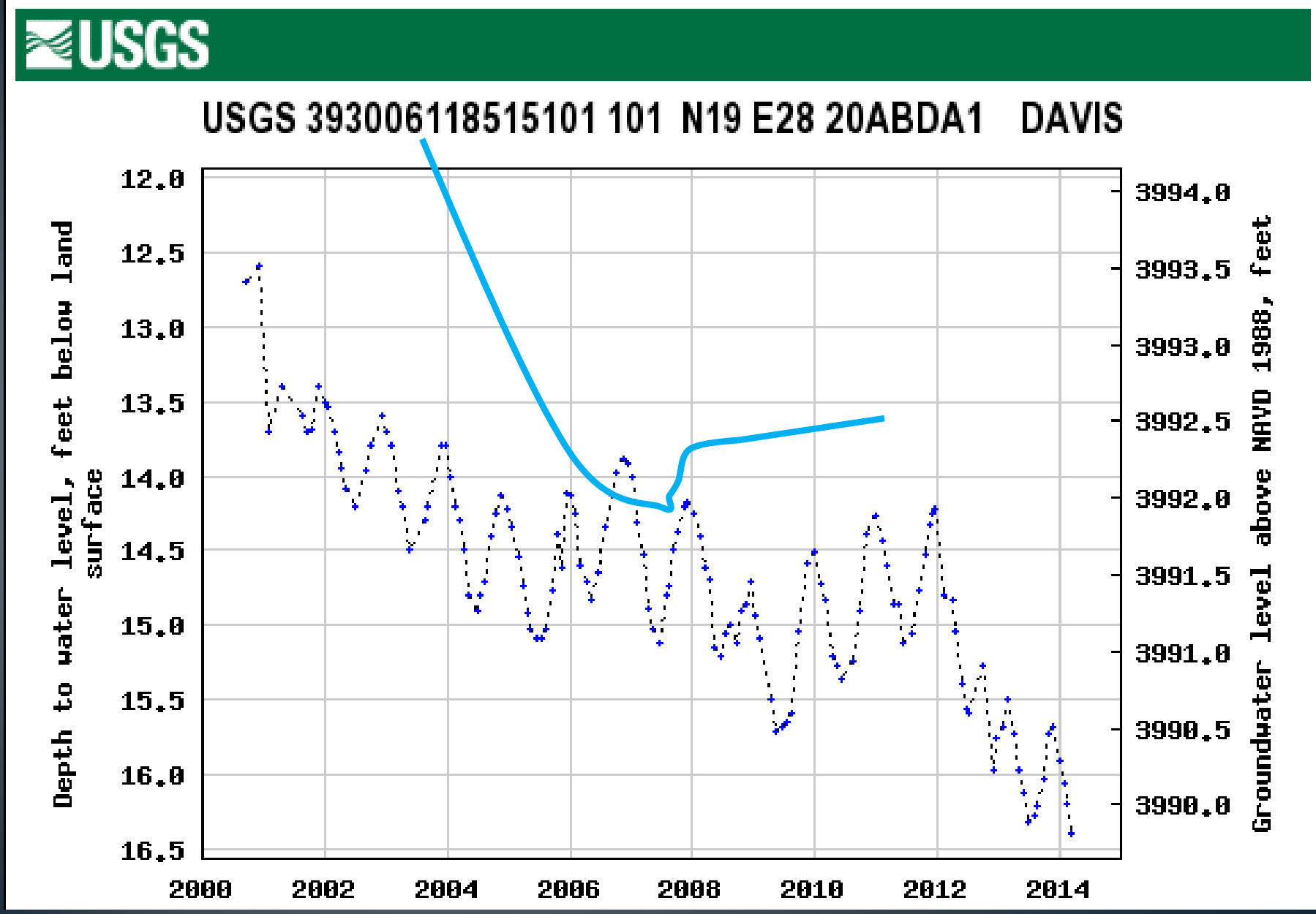
Newlands Project Area Network

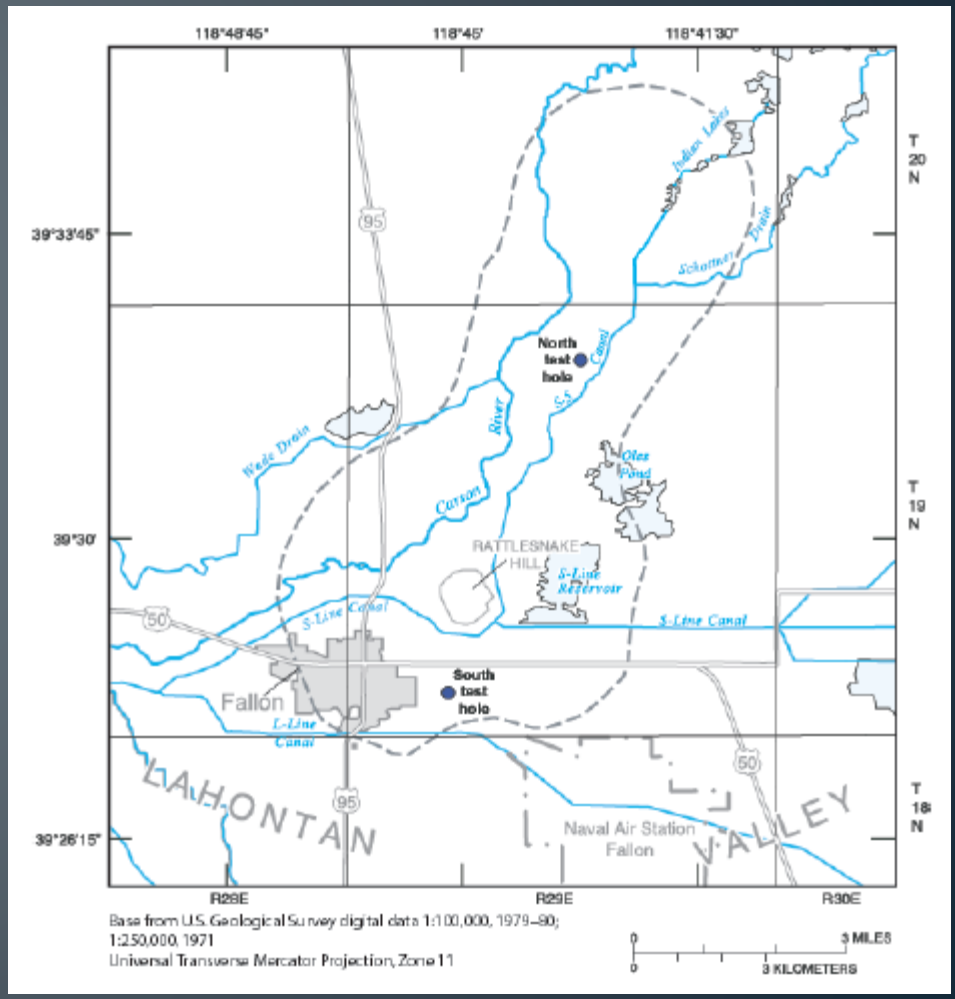



USGS
USGS 393006118515101 101 N19 E28 20ABDA1 DAVIS
Depth to water level, feet below land surface
Groundwater level above NAVD 1988, feet
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
3994.0
3993.5
3993.0
3992.5
3992.0
3991.5
3991.0
3990.5
3990.0
2000
2002
2004
2006
2008
2010
2012
2014

Basalt aquifer water-Levels and quality

- Permeable volcanic rock
- Municipal Supply
  - City of Fallon
  - Fallon Paiute-Shoshone Tribe
  - Naval Air Station Fallon

  History of declining water-levels



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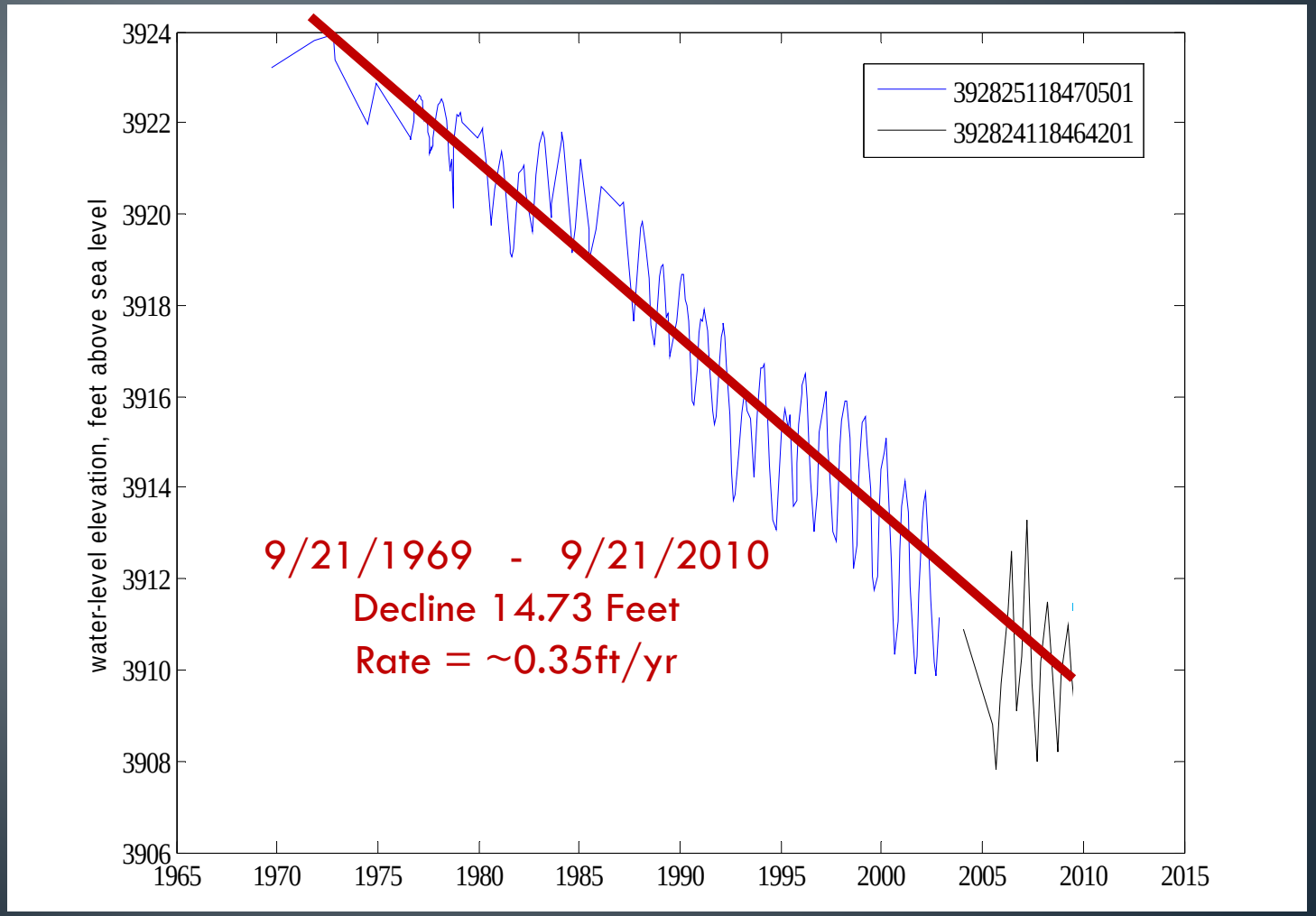
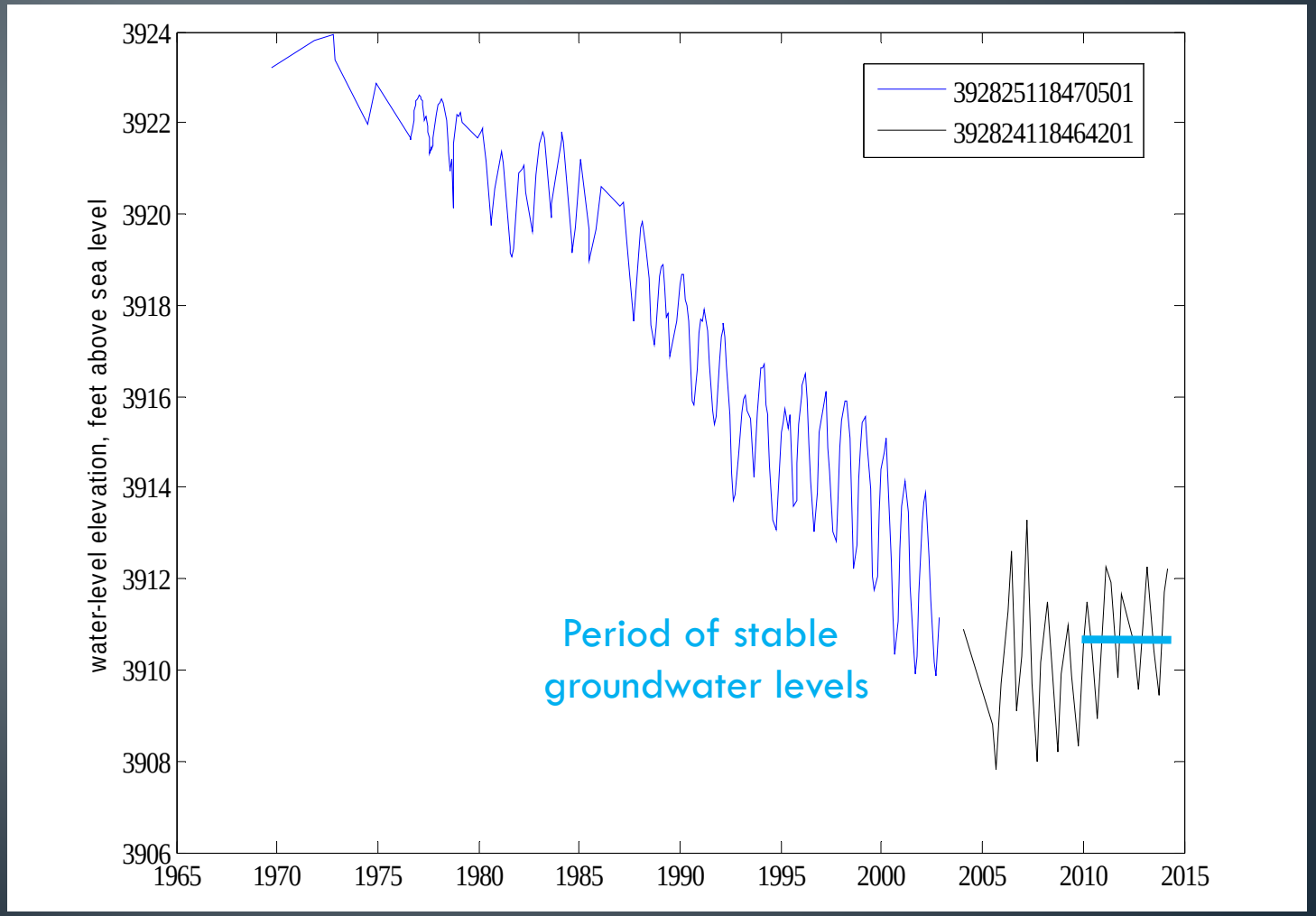
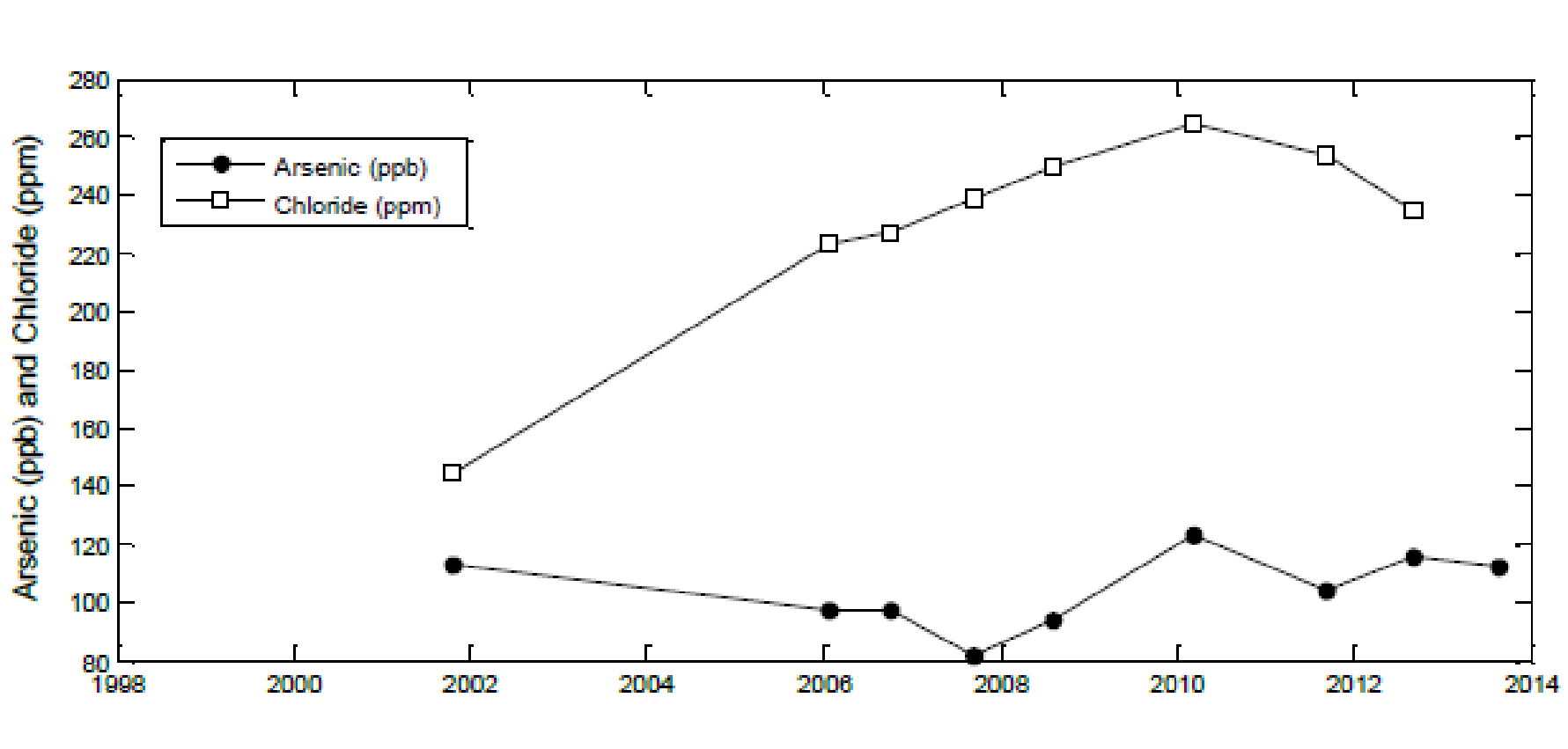
Basalt aquifer water-levels trends



Basalt aquifer water-levels trends



Basalt Aquifer water-quality



Project Summaries

Dayton Valley Project

- Spatially characterize the interaction between Carson River and groundwater
- Ongoing investigation of nitrates in groundwater
- Complex Surface water/Groundwater interactions
  - Data used and discussed in the Middle Carson River Model Report

Newlands Monitoring

- Potential stabilization of basalt aquifer water-levels
- Monitoring changing conditions in the shallow aquifer
- Ongoing collection of water-level and water-quality data

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