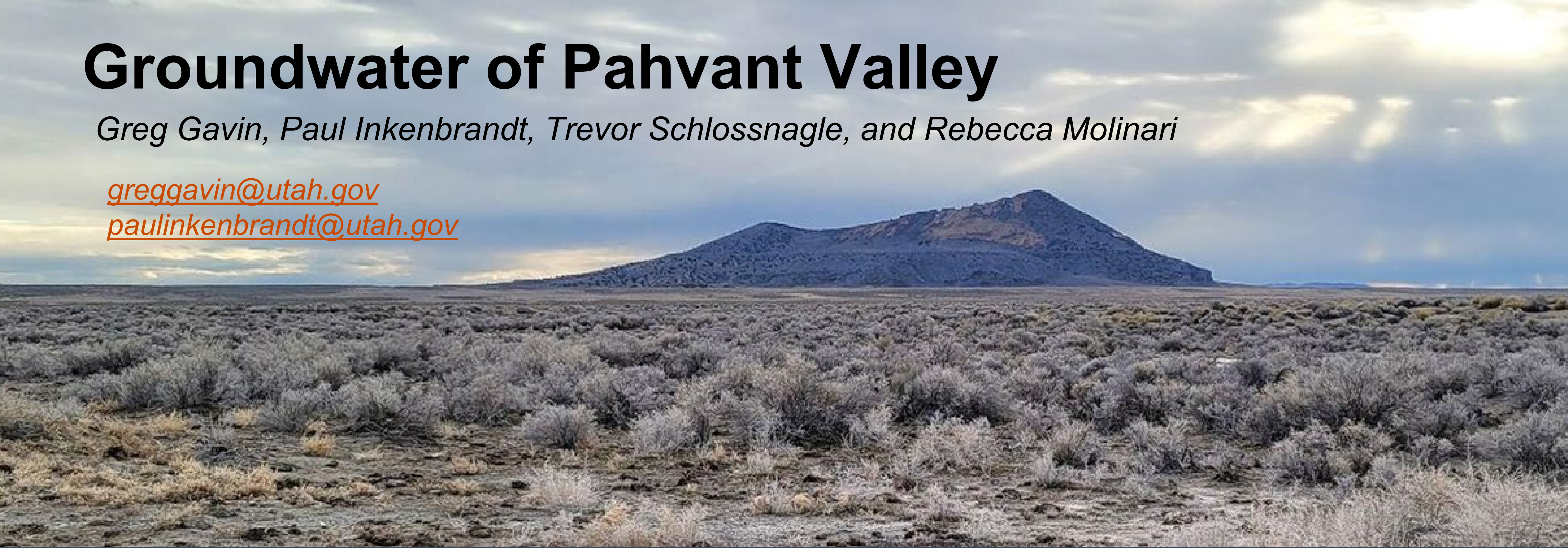


Groundwater of Pahvant Valley

Greg Gavin, Paul Inkenbrandt, Trevor Schlossnagle, and Rebecca Molinari

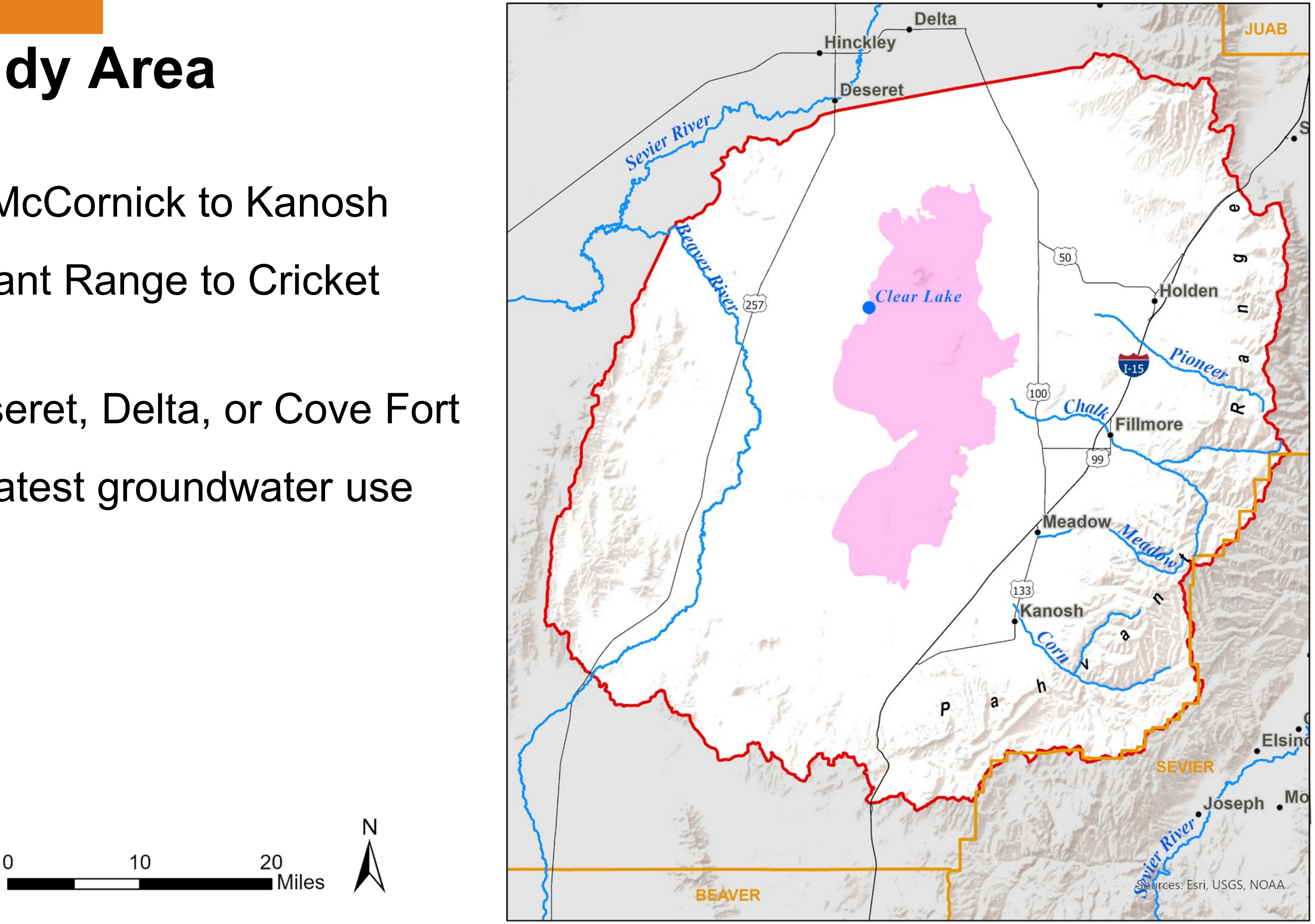
greggavin@utah.gov
paulinkenbrandt@utah.gov

Outline

- **Background**
  - Location, Motivation, Conceptual
- **Observed Impacts**
  - Water Levels, Clear Lake, Subsidence
- **Possible Drivers**
  - Climate, Management
- **Budget**
  - Storage Changes
  - Recharge

Background - Study Area

- Includes areas from McCornick to Kanosh
- East-west from Pahvant Range to Cricket Mountains
- Does not include Deseret, Delta, or Cove Fort
- Focus on area of greatest groundwater use and supply

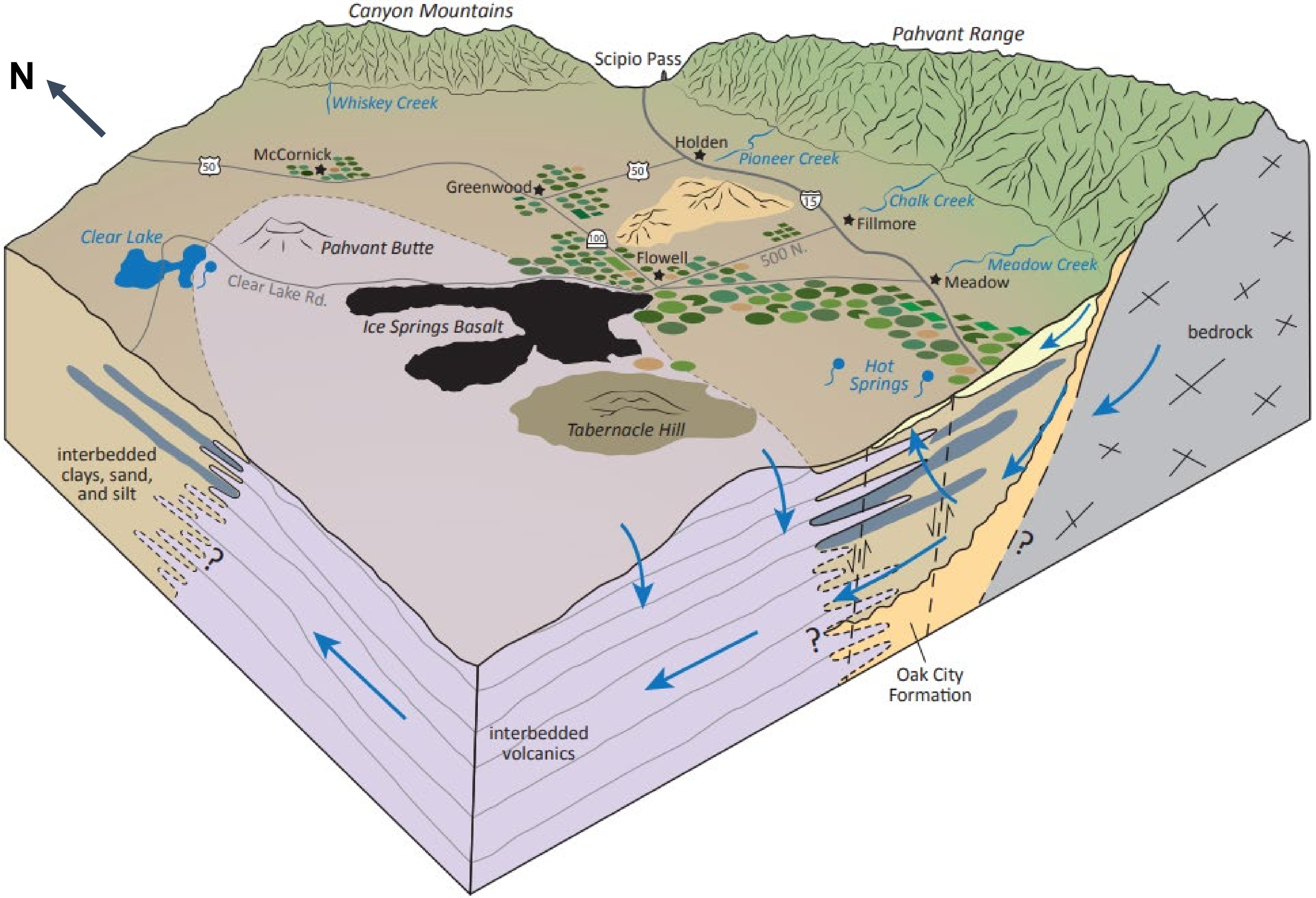


Background - Research Motivation

- Important Agricultural Area
- Regional declines in groundwater elevations
- Concerns about land subsidence
- Clear Lake WMA important bird refuge and recreation spot
- Securing groundwater for future generations

Background - Hydrogeology

- Groundwater Flows from Pahvant Range to NW
- Ends at Clear Lake
- Some slow underflow to Sevier
- Recharge in Alluvial Fans and Basalt
- More clay in west



Background - Previous Work

“Between the alluvial slope on the east and the lava fields on the west there is a belt of low level land in which the groundwater table is nearly at the surface. Here there are many springs and seeps, and wells obtain water at only slight depths.” -Meinzer, 1911

“The first artesian well to yield water in sufficient q… for irrigation was drilled in 1915 at the Brigham T… until 279 feet deep, … reported to have discharge… … ” -Dennis et al., 1946

“Water-level declines of more than 80 feet in some parts of Pahvant Valley are projected if ground-water withdrawals continue for 20 years at the 1977 rate of about 96,000 acre-feet.

“Fluctuations in the flow of Clear Lake Springs are caused both by natural variations in the quantity of recharge and by variations in the … pumped from an increasing numb… Mower, 1967

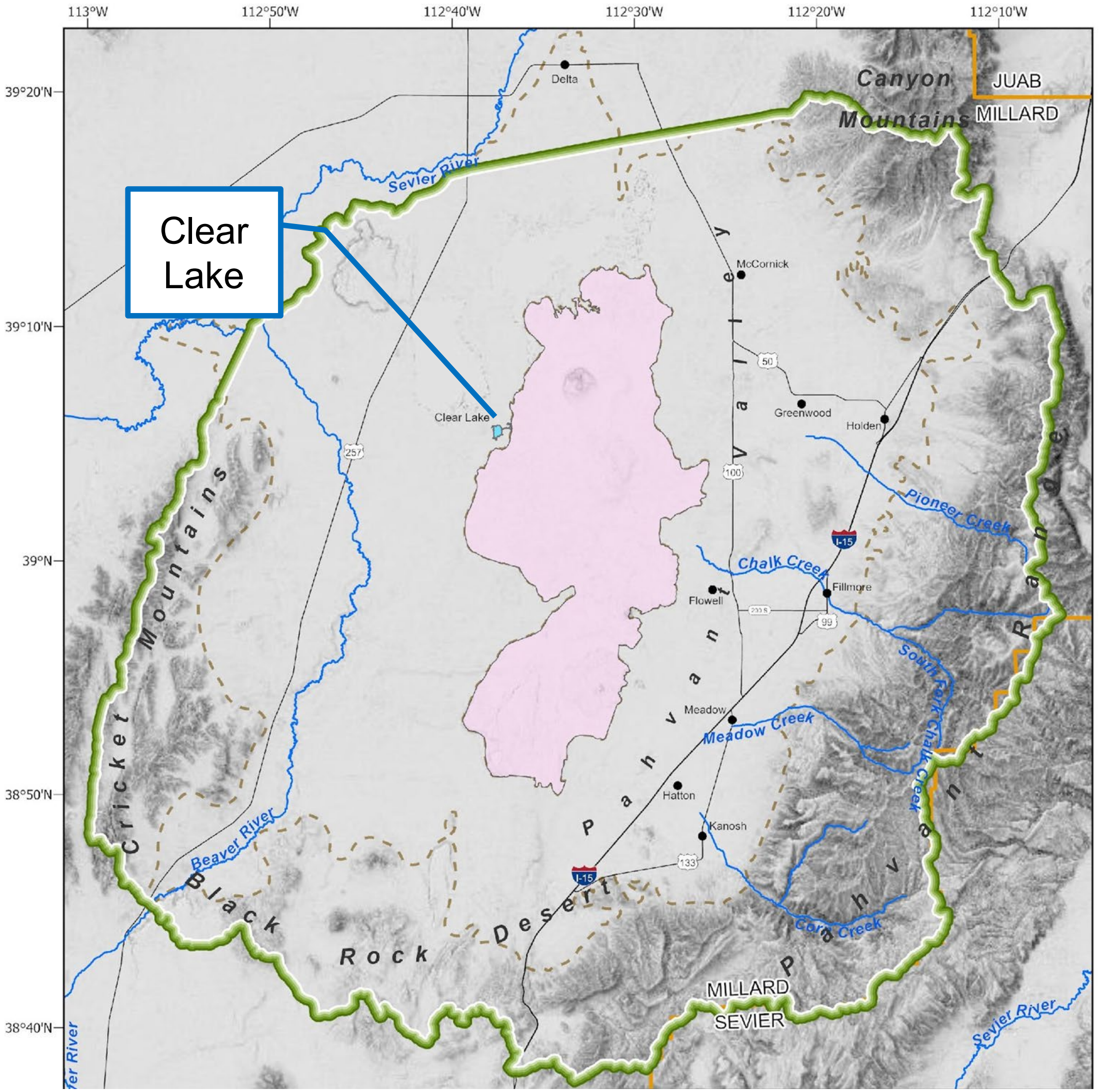
The elimination of recharge from … for 20 years is projected to cause … up to 8 feet near the canal.” - Ho…

Impacts - Clear Lake

- Only naturally occurring downgradient discharge point in Pahvant Valley

- Clear Lake is fed by the Ice Springs Basalt of the Volcanic aquifer

- Ecologically important



Impacts - Clear Lake

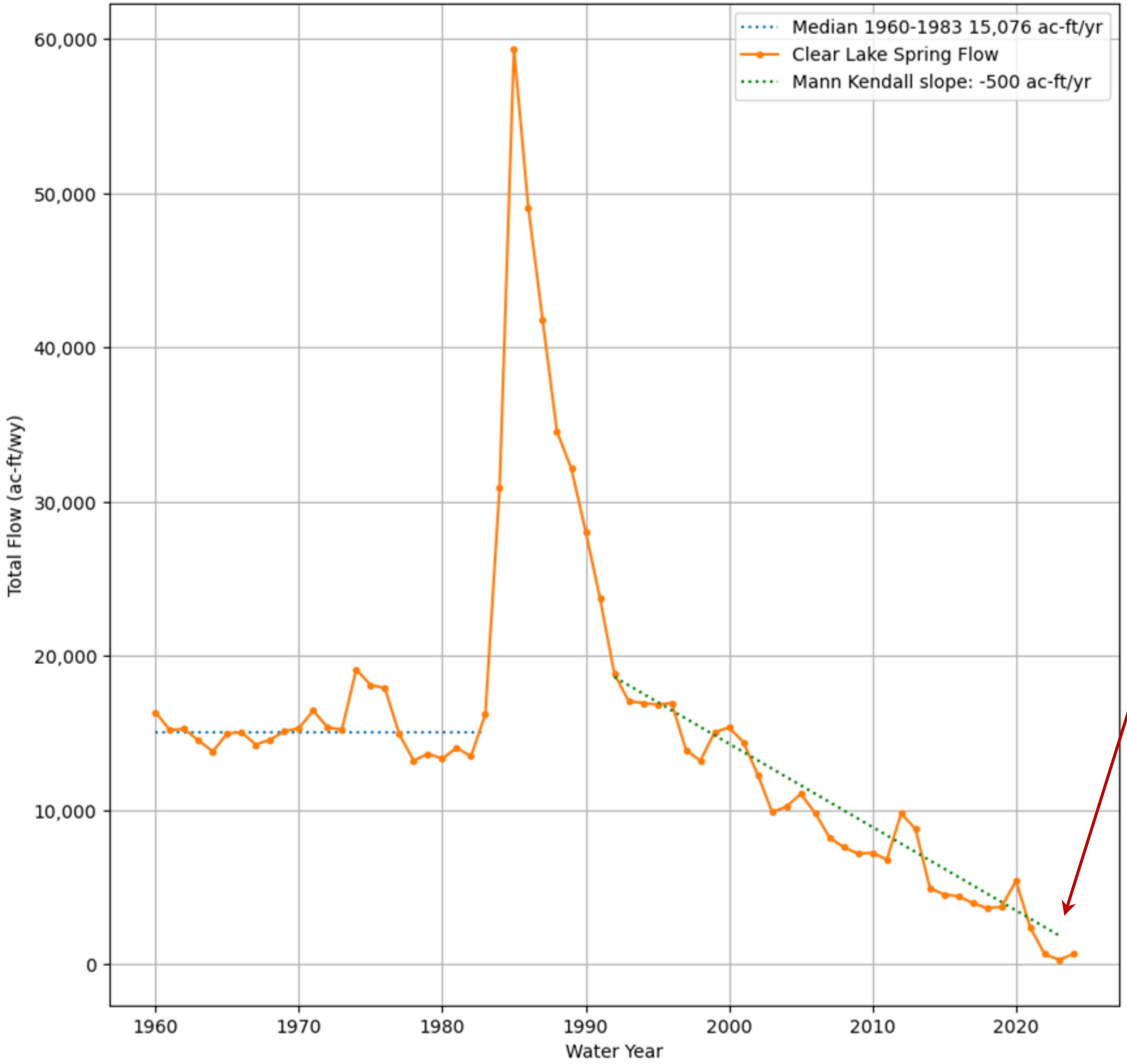
8/30/2022

7/29/2024

Least Chub (Iotichthys Phlegethontis)

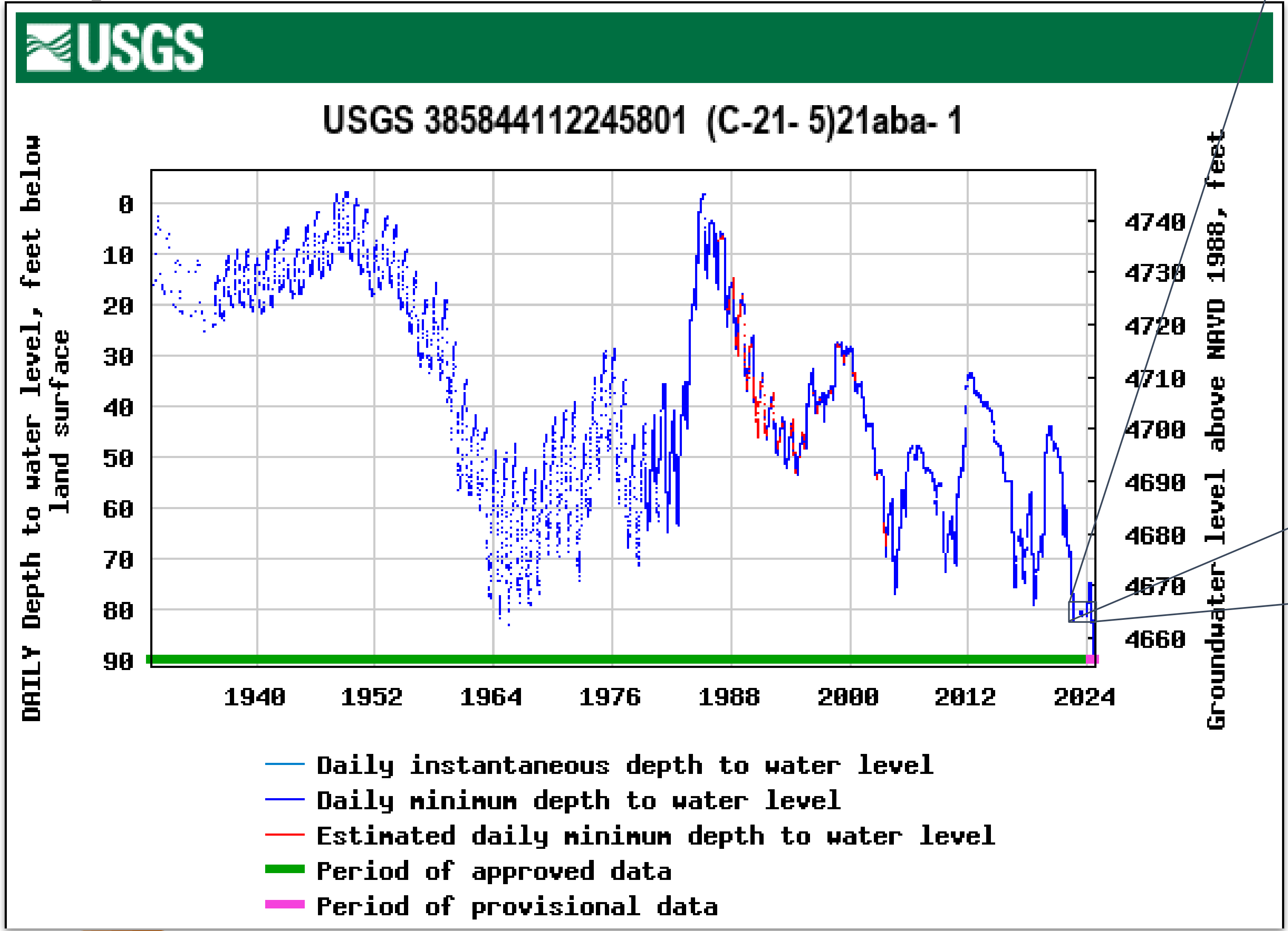
State conservation species

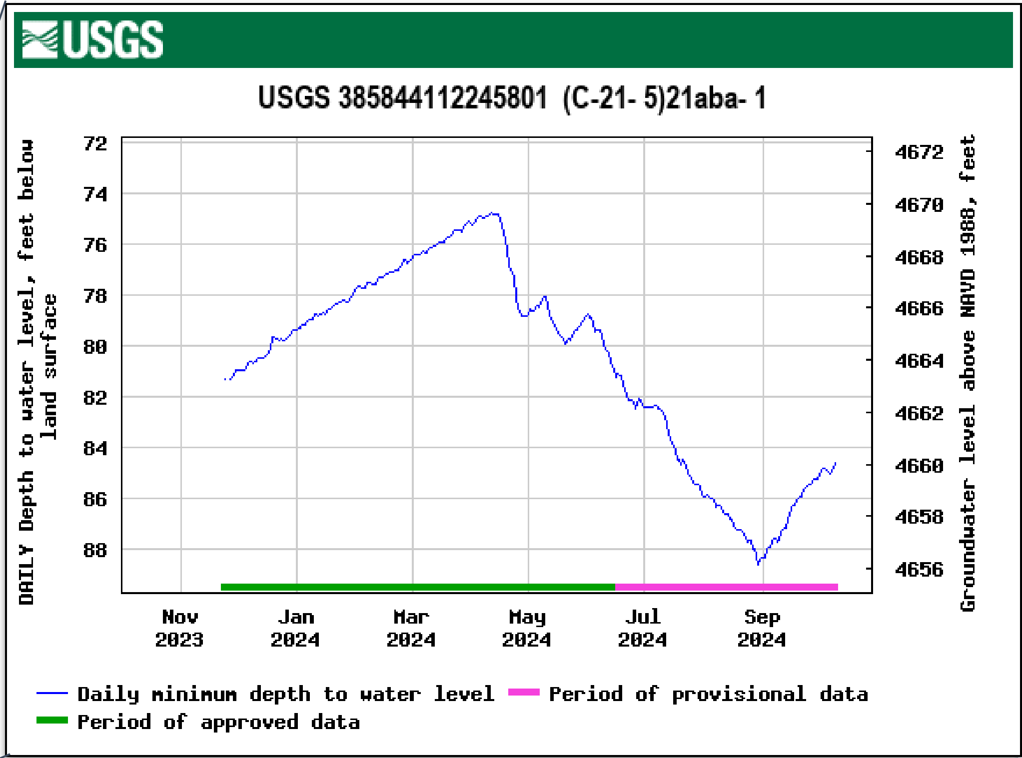
Impacts - Clear Lake



Management practices or climate signals?

Impacts - Groundwater Levels





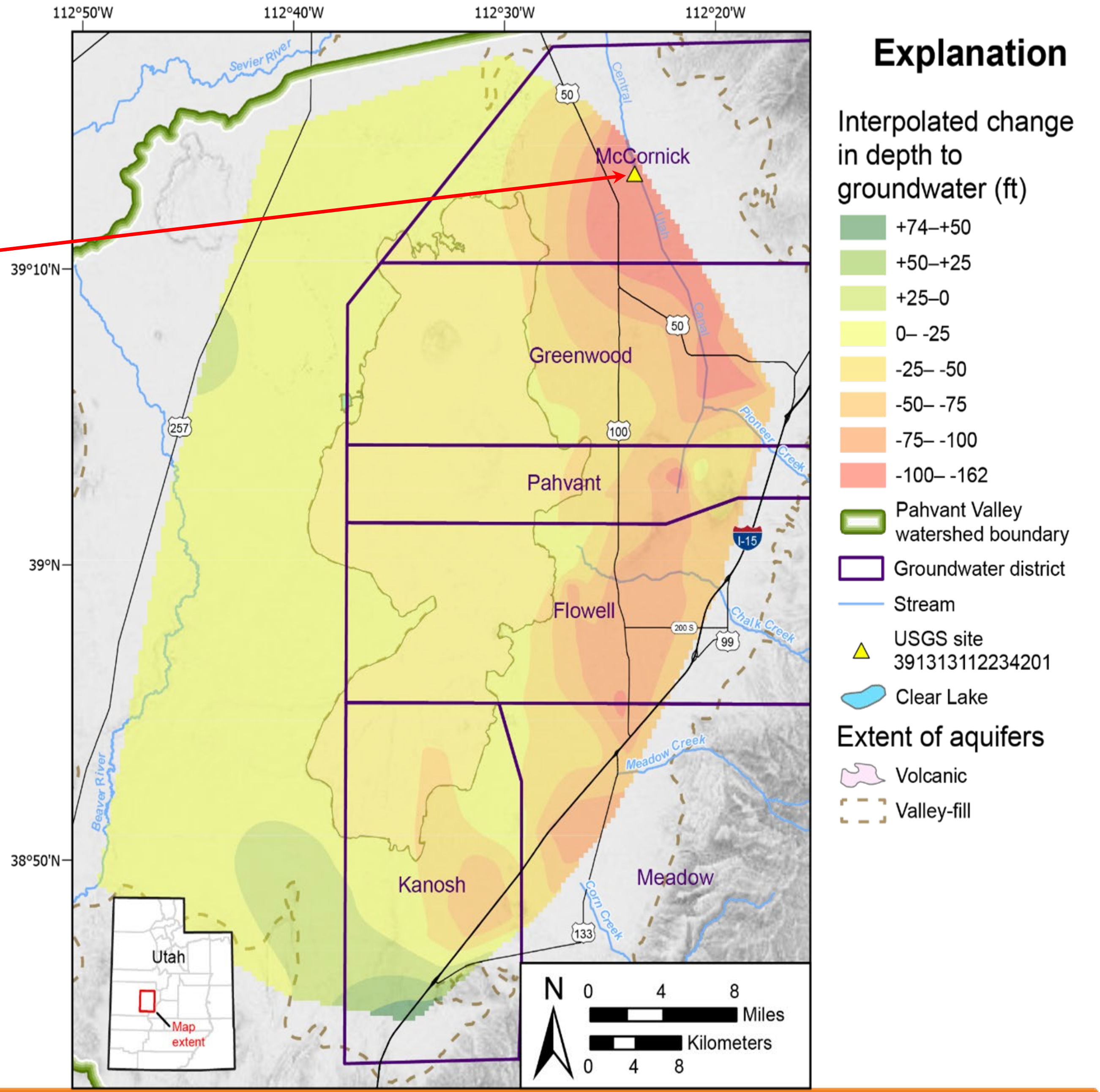
Well in eastern Flowell

Impacts - Groundwater Levels

1986 to 2022

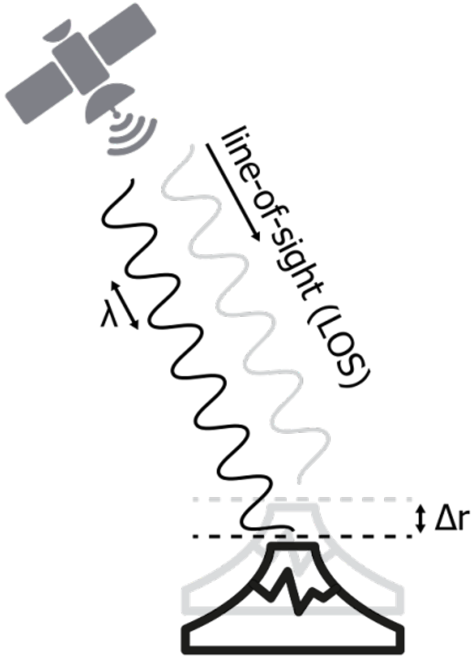
- Total decline in water level was 163 feet in USGS monitoring well site no. 391313112234201
- Valley-fill average regional decline of 26 feet

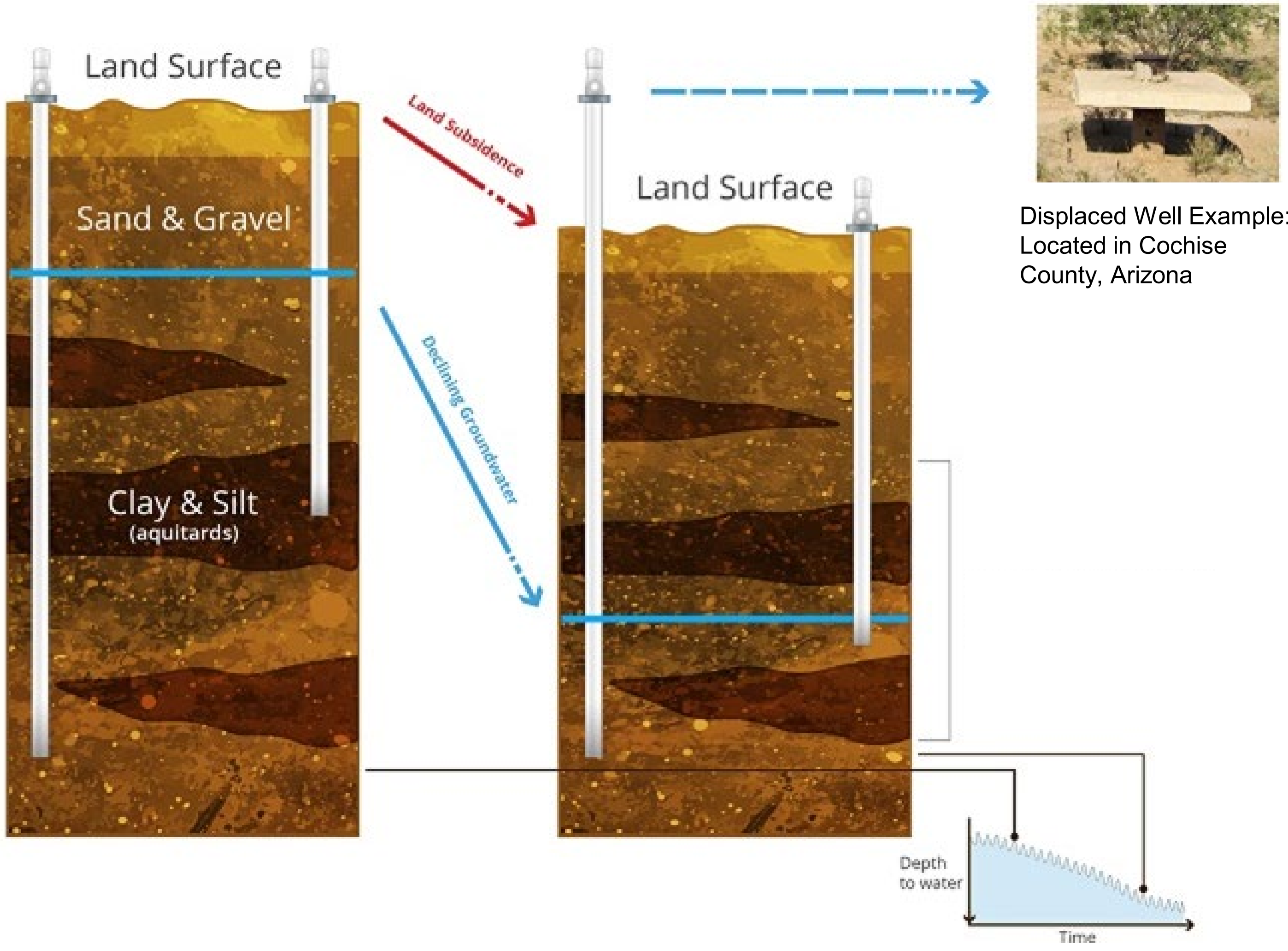
	Decline Rate (ft/yr)	Avg Decline (ft)
Flowell	-0.12	16
Greenwood	-0.39	31.5
Kanosh	-0.15	18.8
McCornick	-1.33	74.3
Meadow	-0.34	41.5
Pahvant	-0.12	14.8



Impacts - Subsidence

- Sinking of land caused by GW decline
- Seen in other parts of the West
- Can measure ground drop using satellites (InSAR)



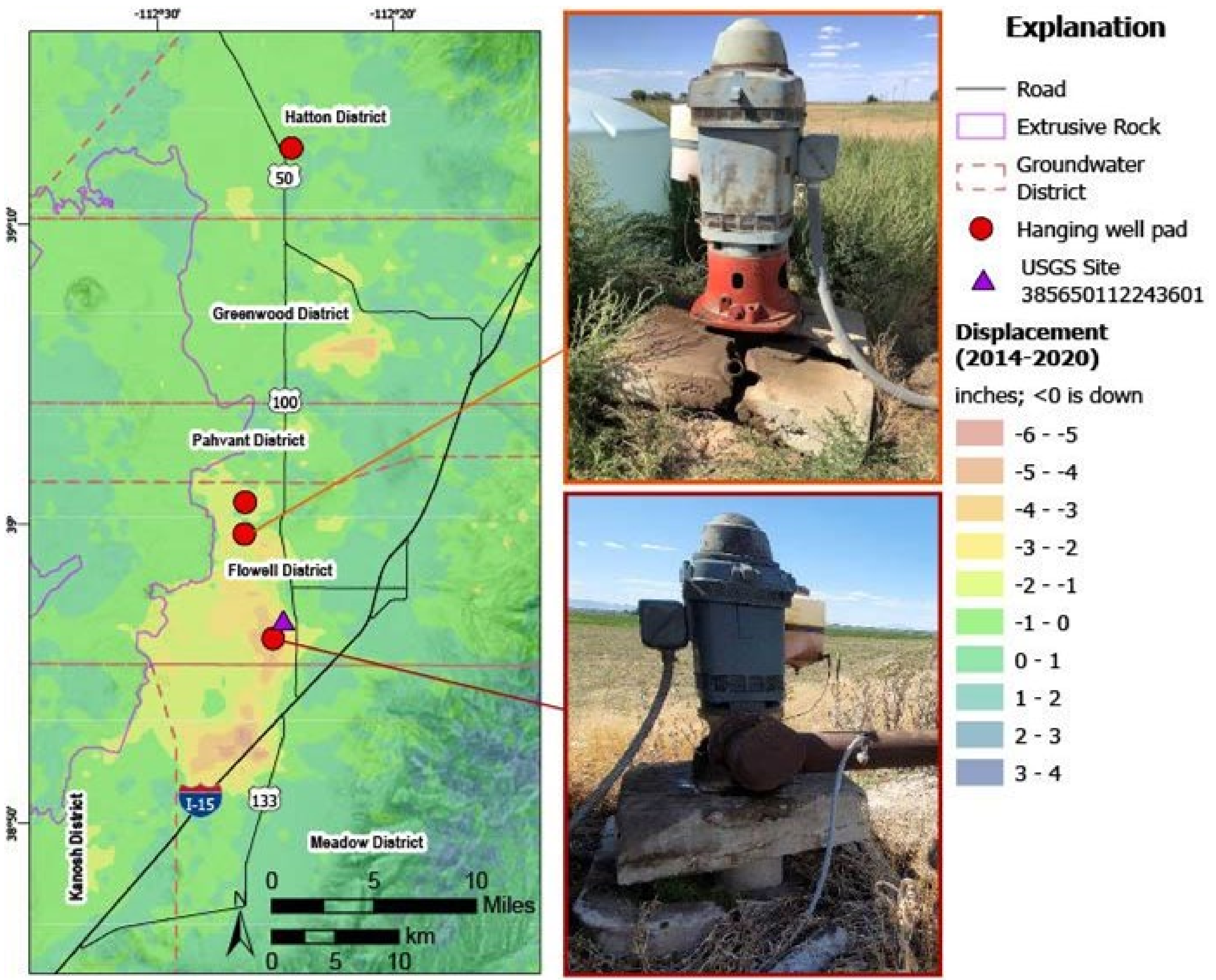


Displaced Well Example: Located in Cochise County, Arizona

Modified from Galloway et. al., 1999

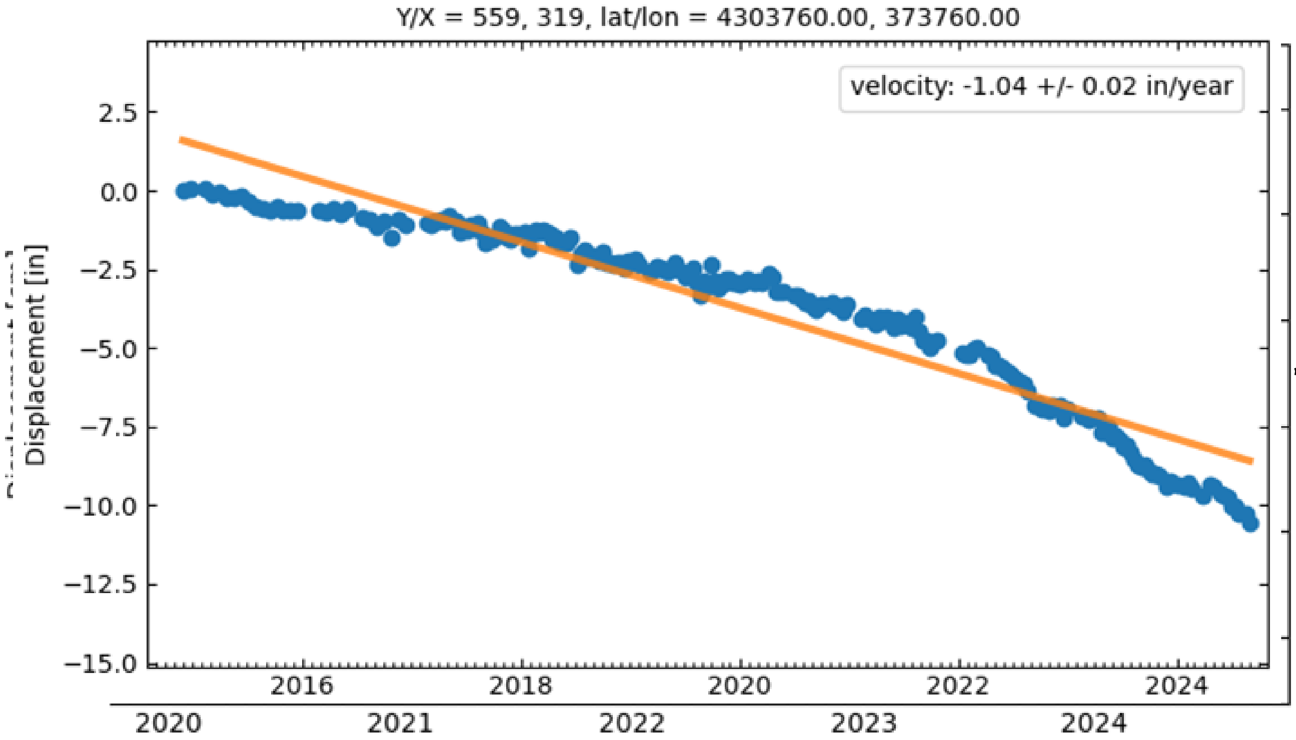
Impacts - Subsidence

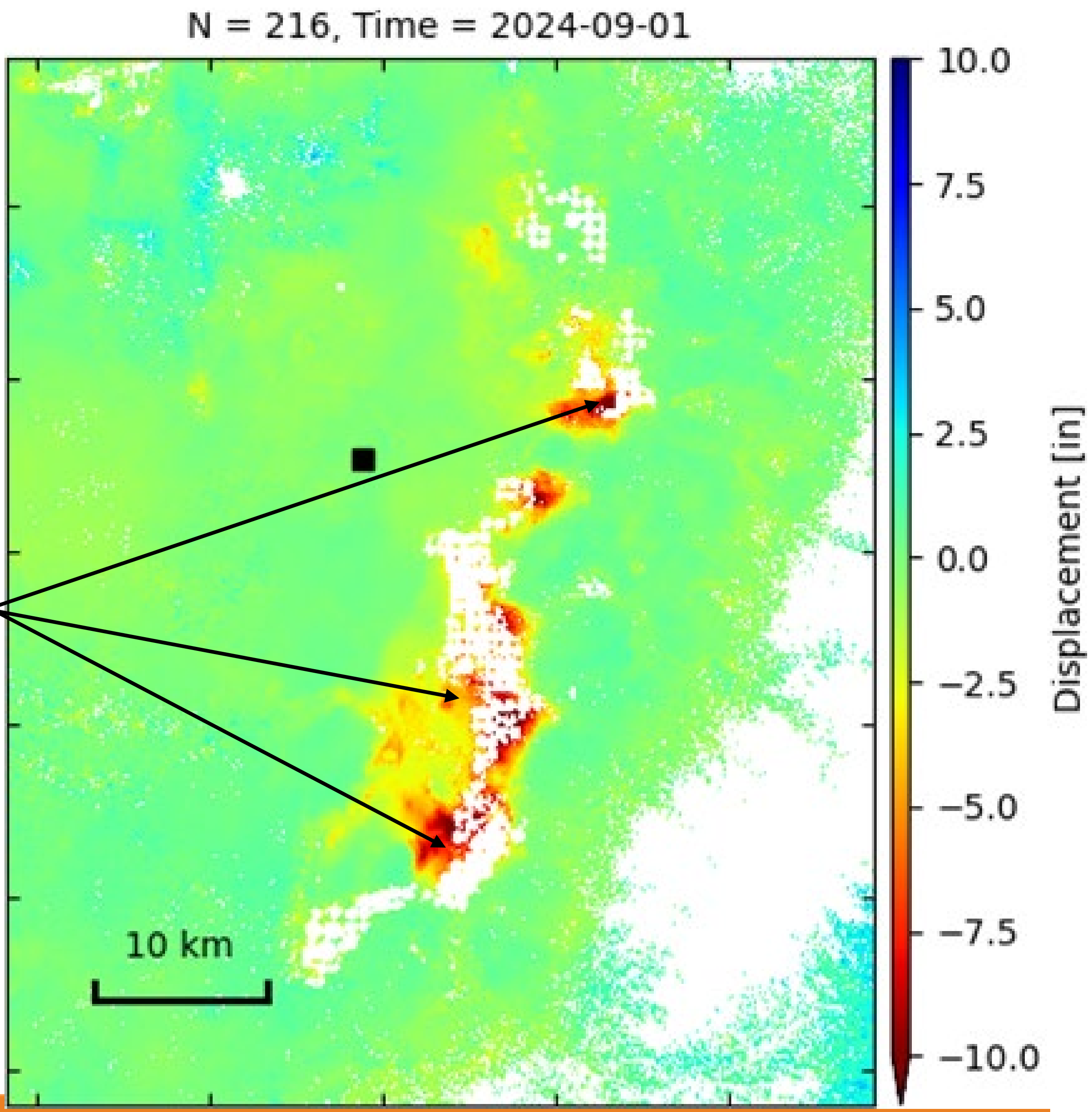
- Subsidence Measured by InSAR
- Floating well pads
- No fissures observed yet



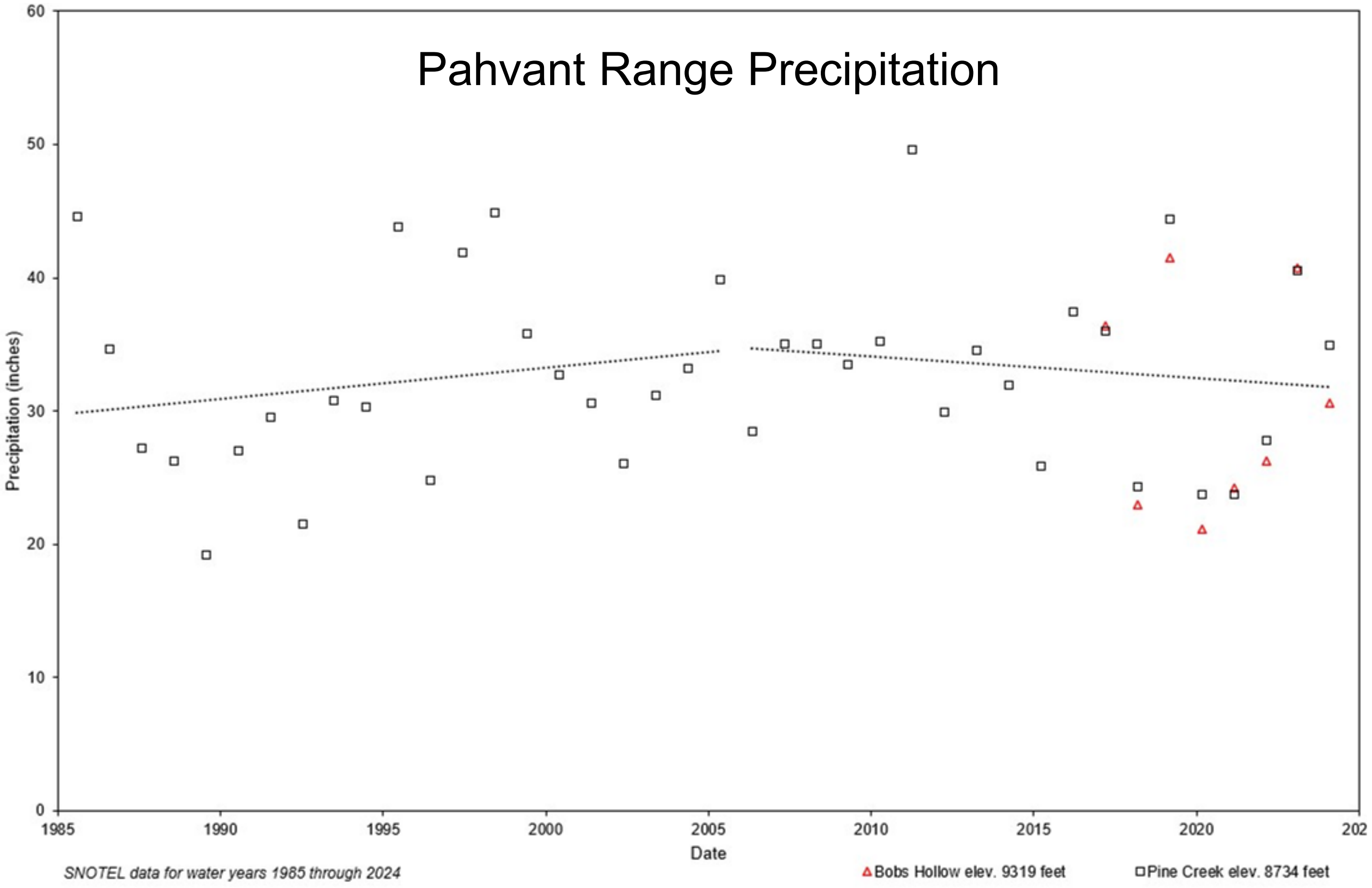
Impacts - Subsidence

Greenwood (North)
Flowell (Central)
Meadow (South Central)

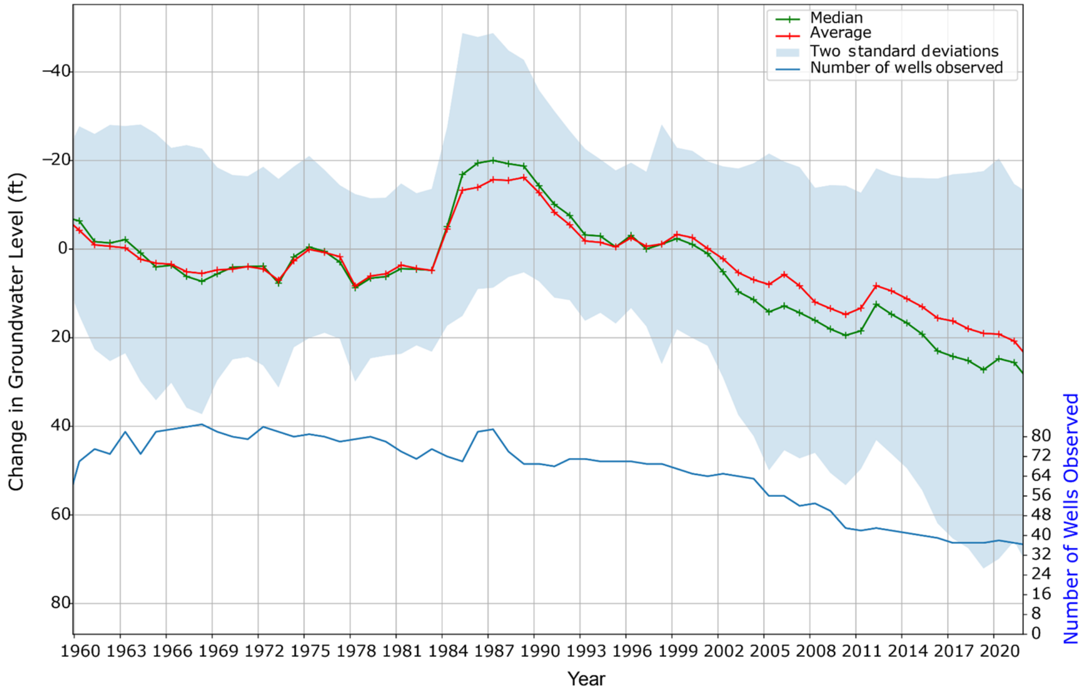




Drivers - Precipitation & Groundwater



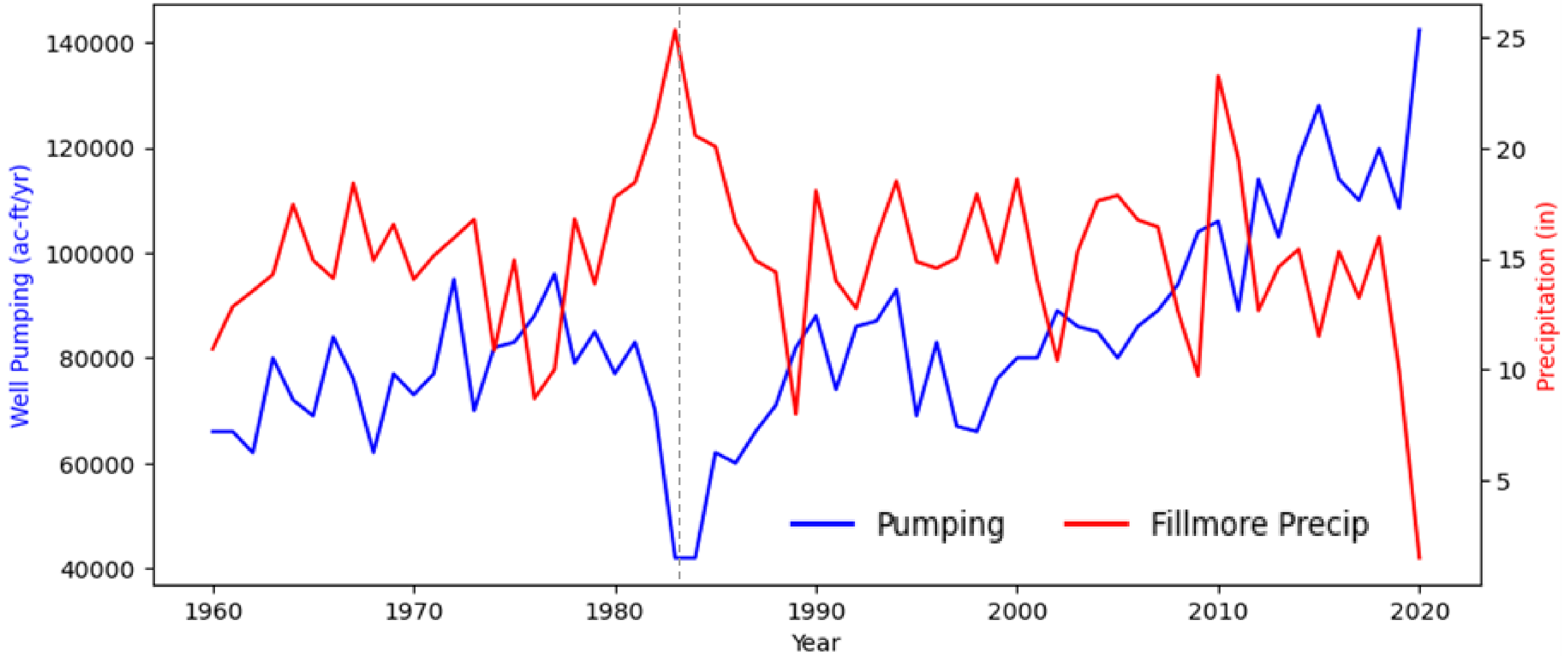
Yearly groundwater elevation change for valley-fill wells in Pahvant Valley



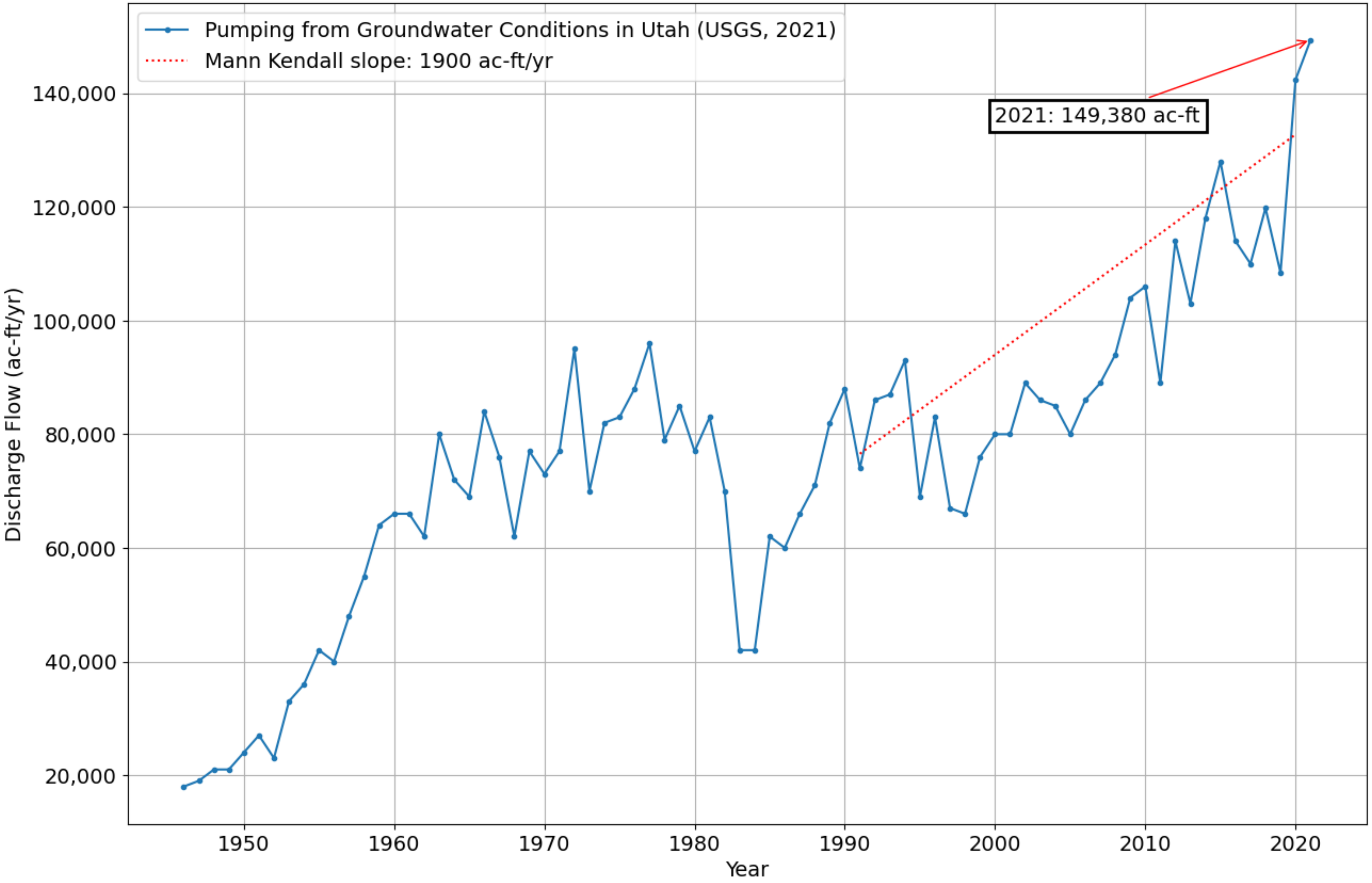
Drivers - Precipitation & Pumping

- What's the relationship between precip and pumping?
- ~1 yr lag between precip and pumping
- generally an inverse relationship
- as precip goes down, pumping generally goes up
- other variables are likely influencing pumping as well

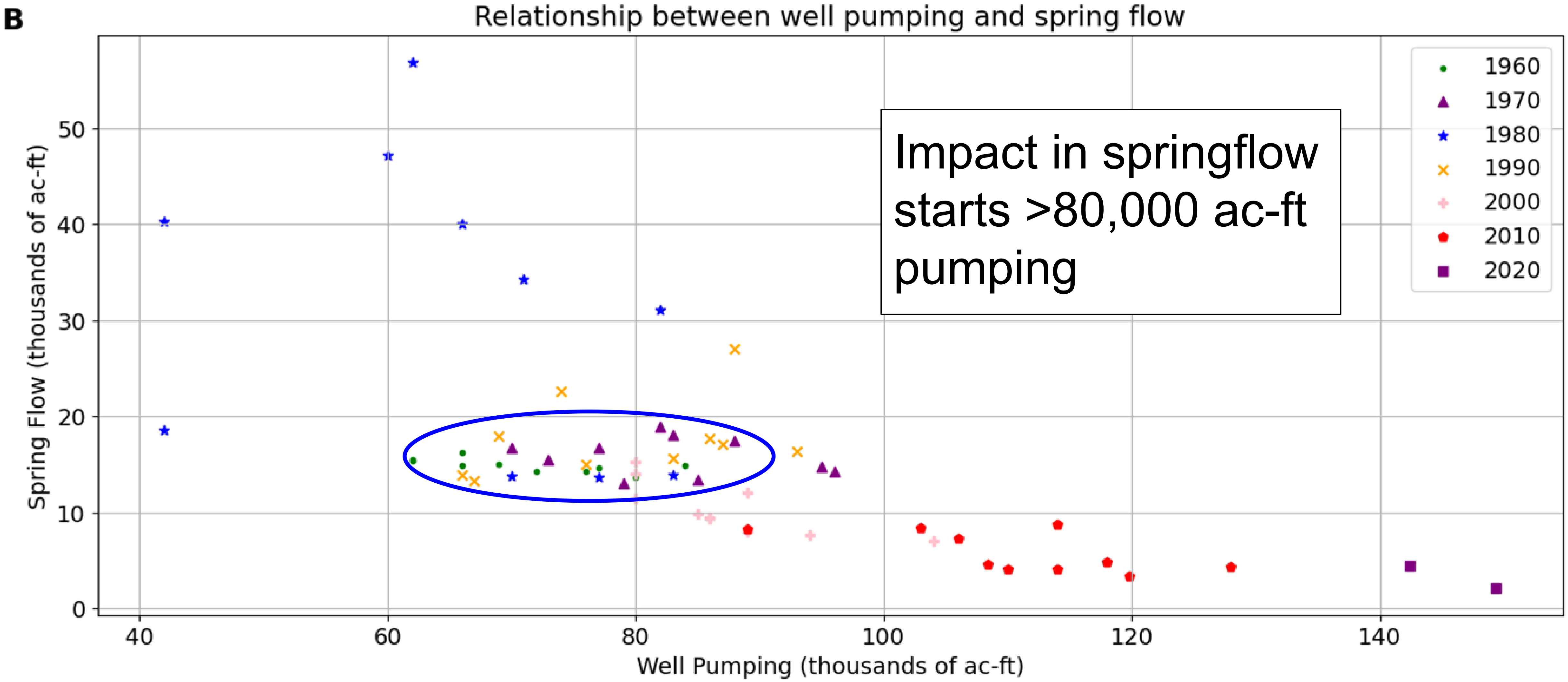
Fillmore WY precip vs Valley wide total pumpage



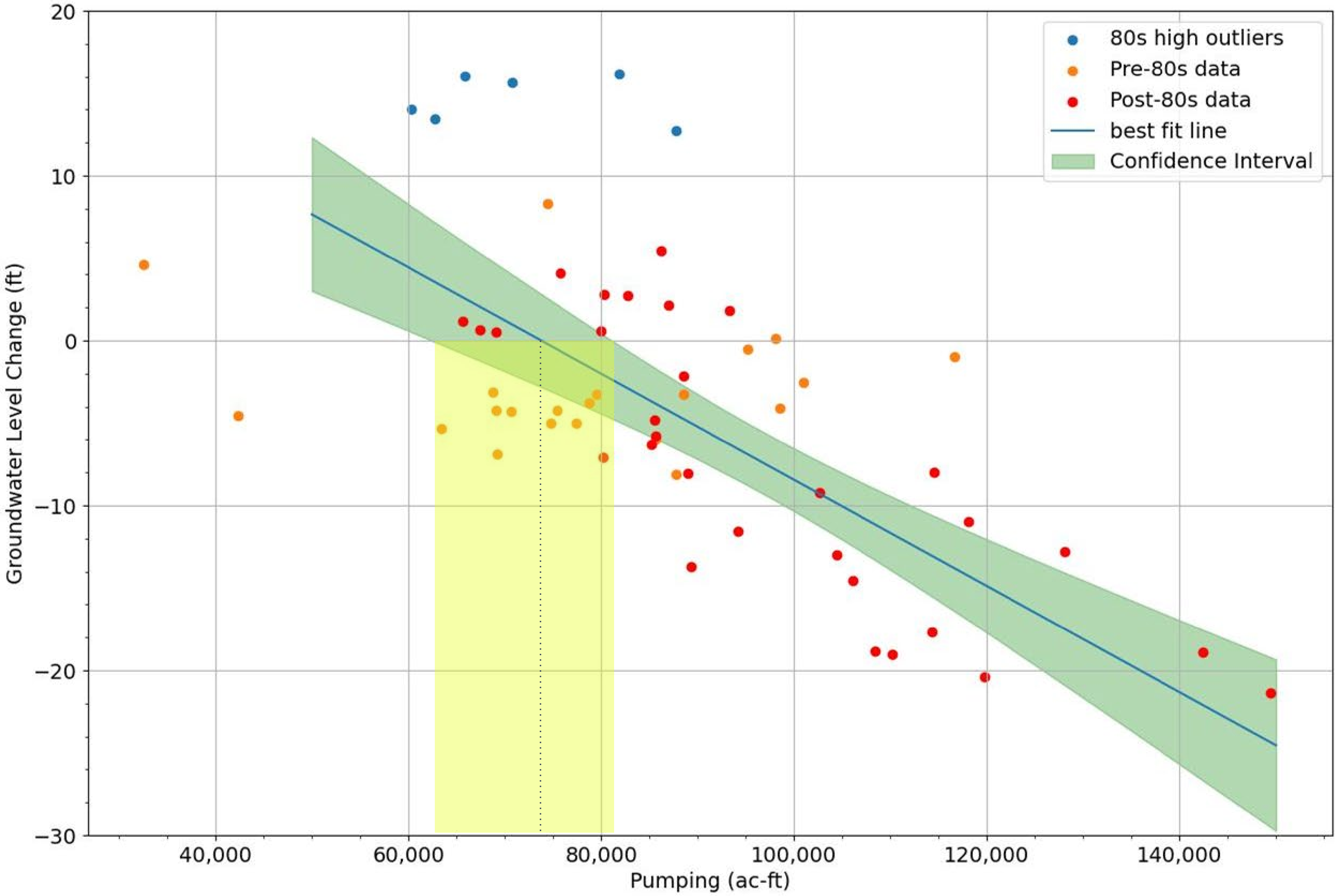
Drivers - Groundwater Pumping



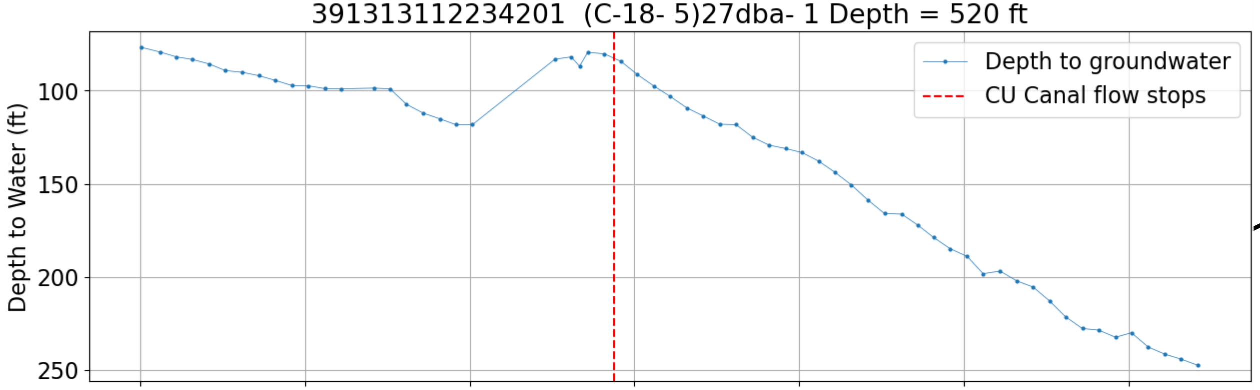
Drivers - Spring Flow & Pumping

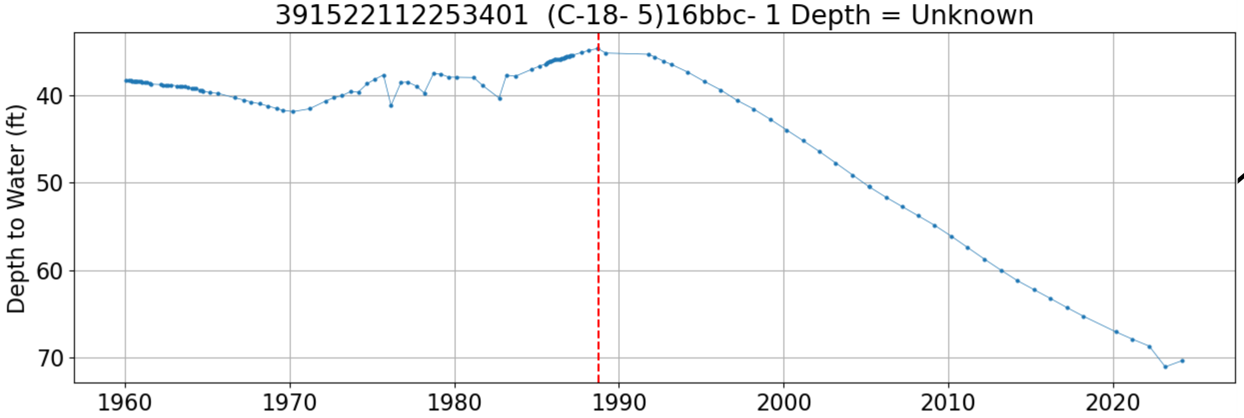


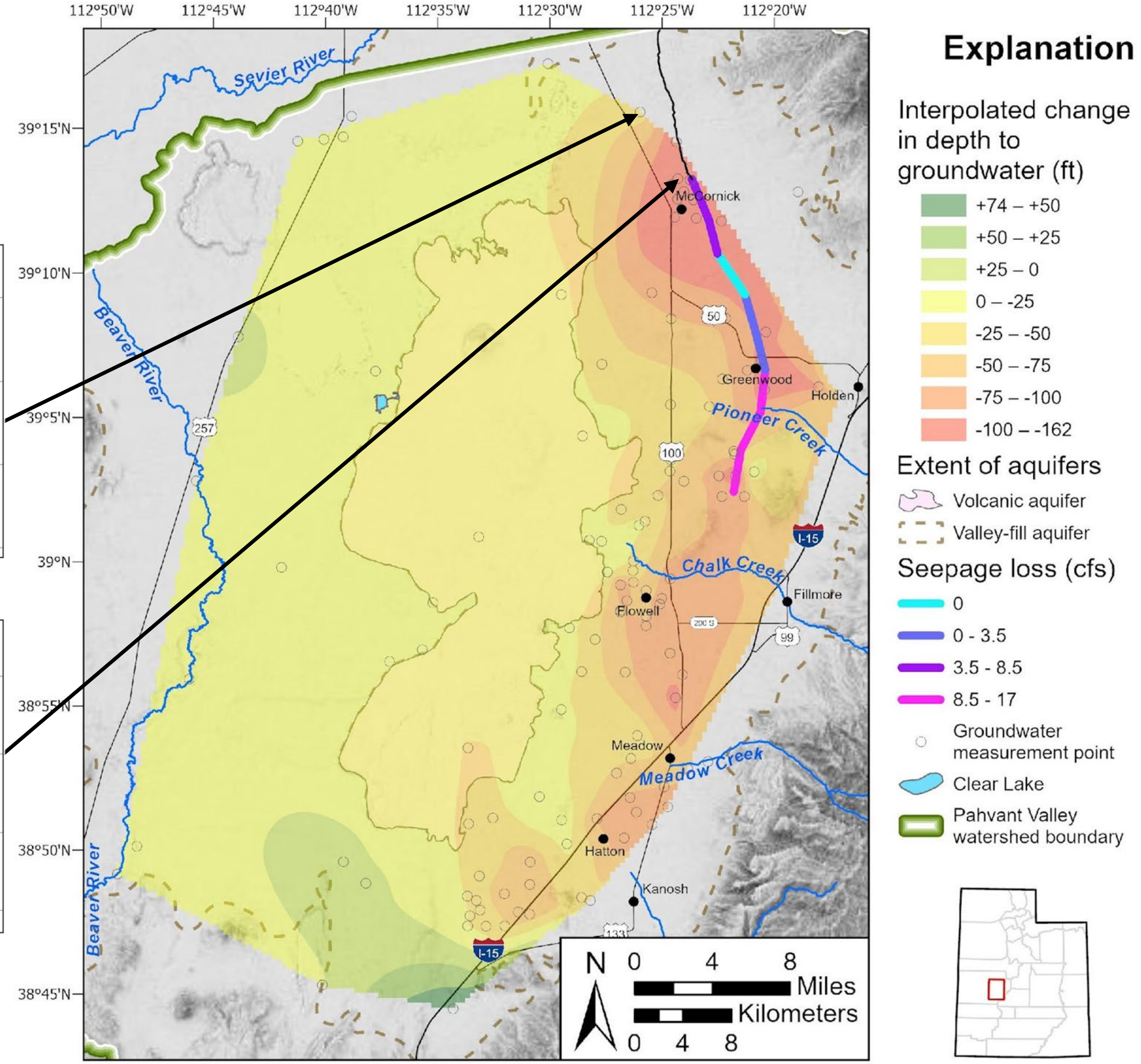
Drivers - Groundwater level change & Pumping



Drivers - Canal Changes

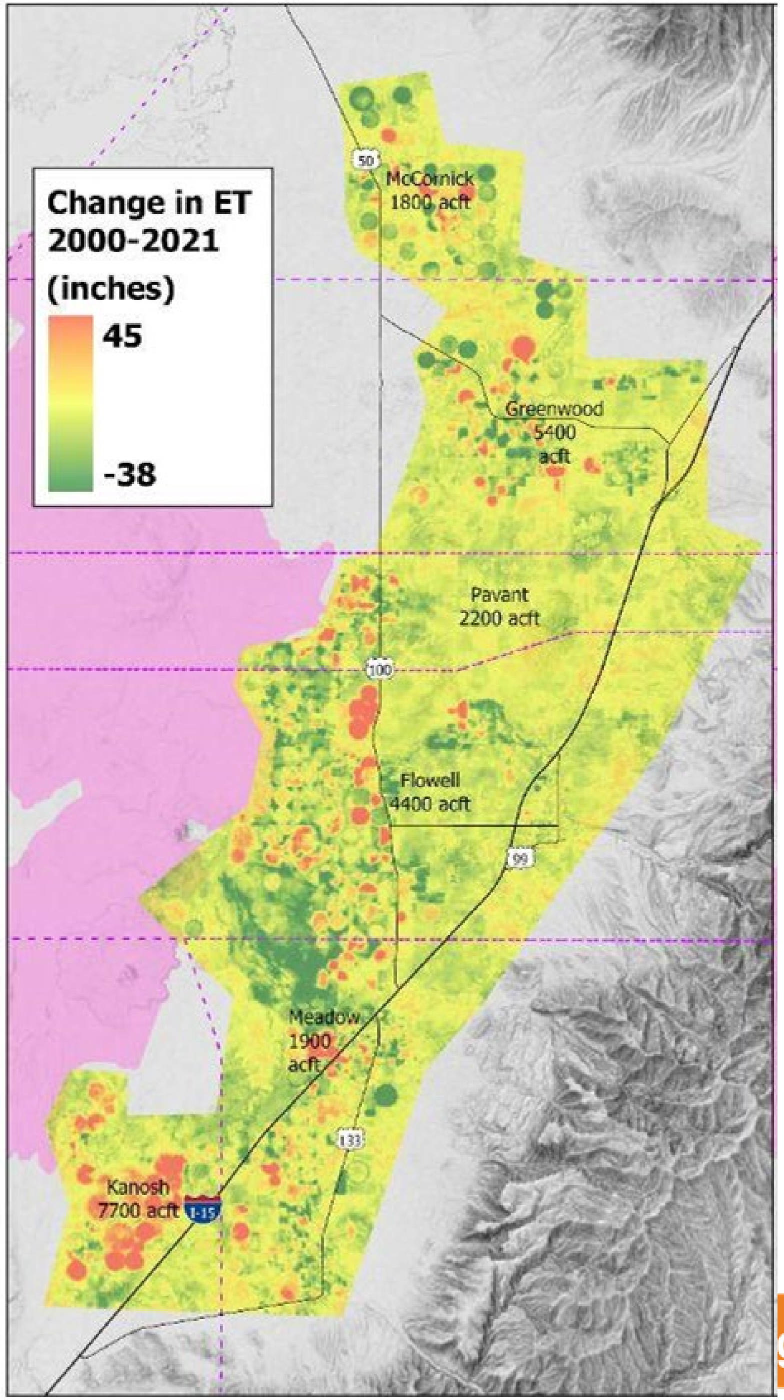




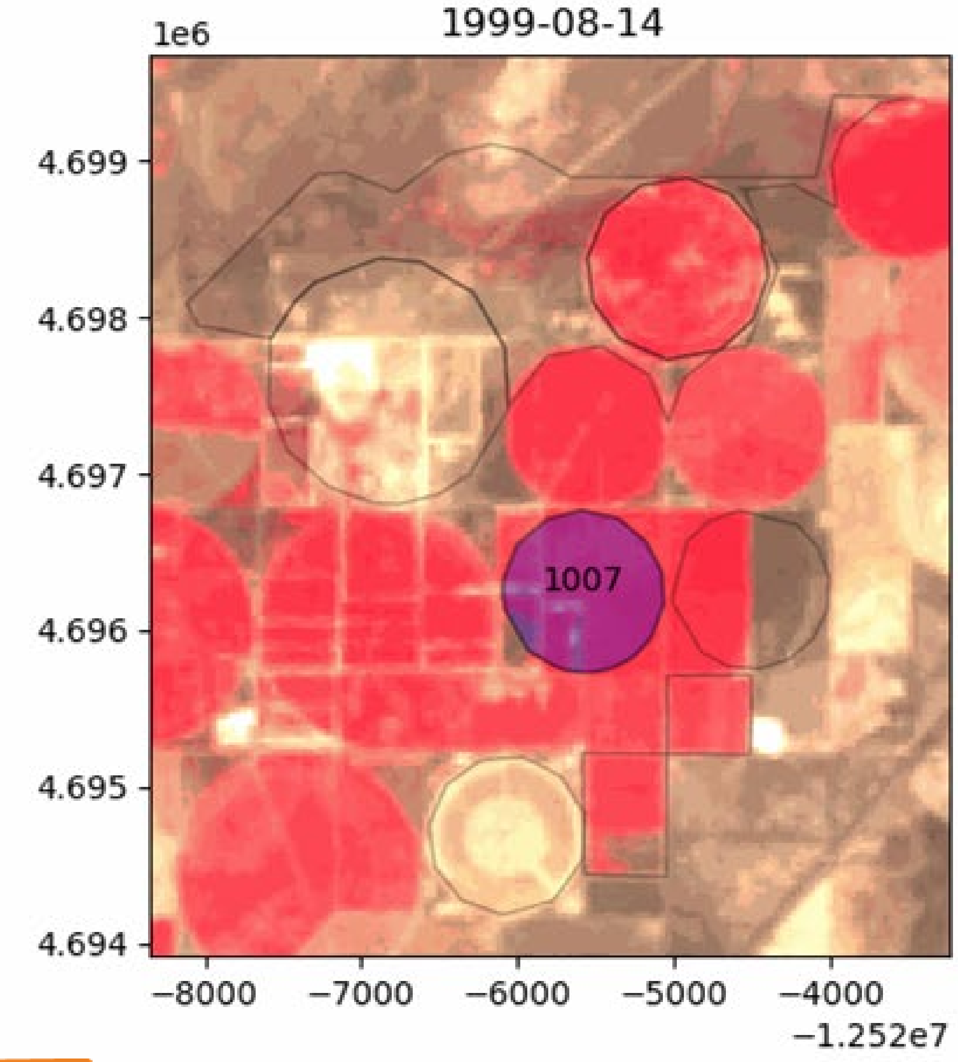


Drivers - Consumptive Use

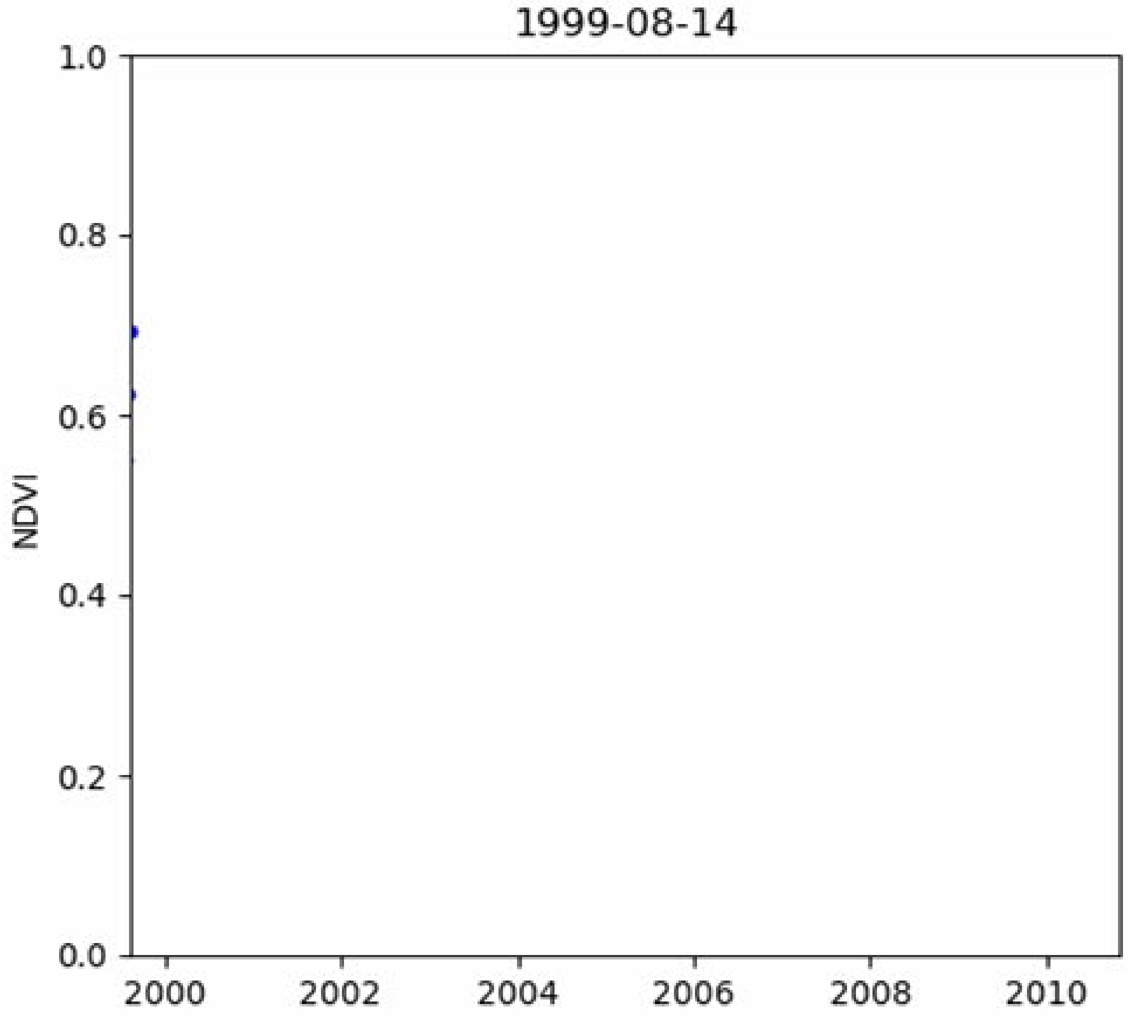
- Increase in greenness
- Increase in Evapotranspiration (ET)
- 20,000 ac-ft increase since 2000
- Denser, greener plots
- More consumptive use



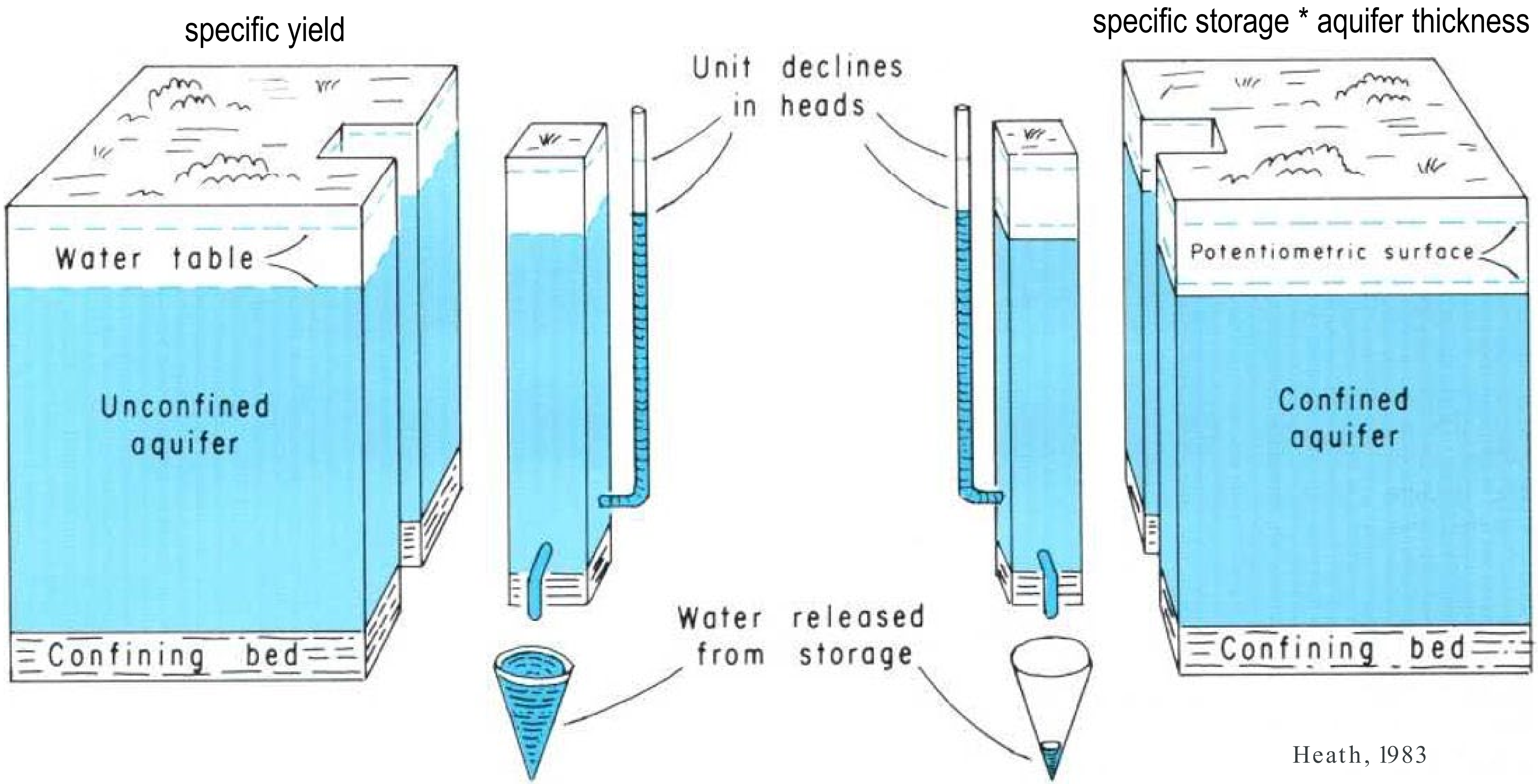
Drivers - Consumptive Use



Greenness at field 1007

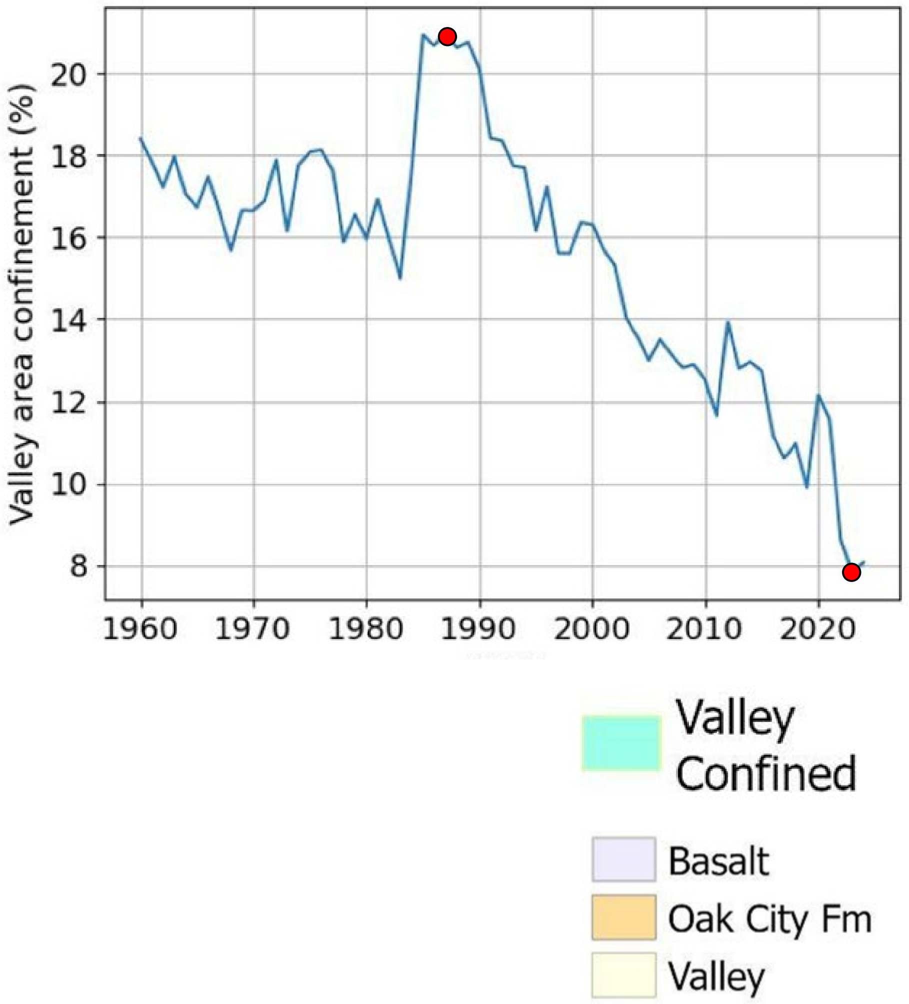


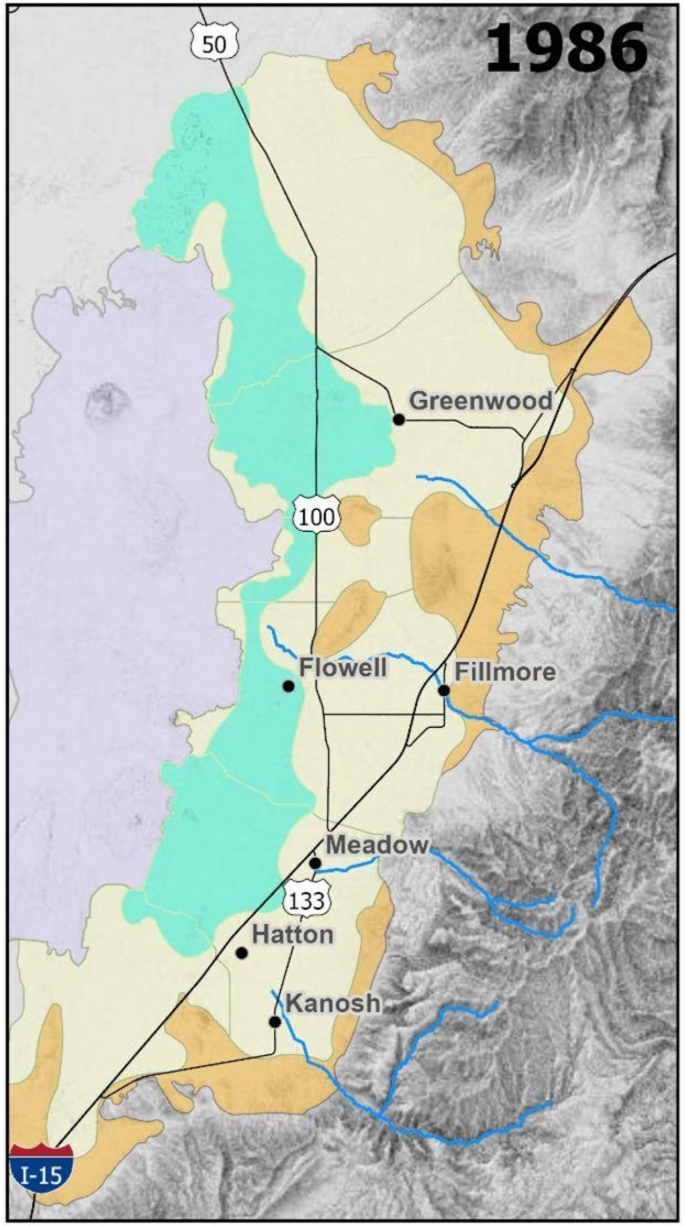
Budget - Storativity

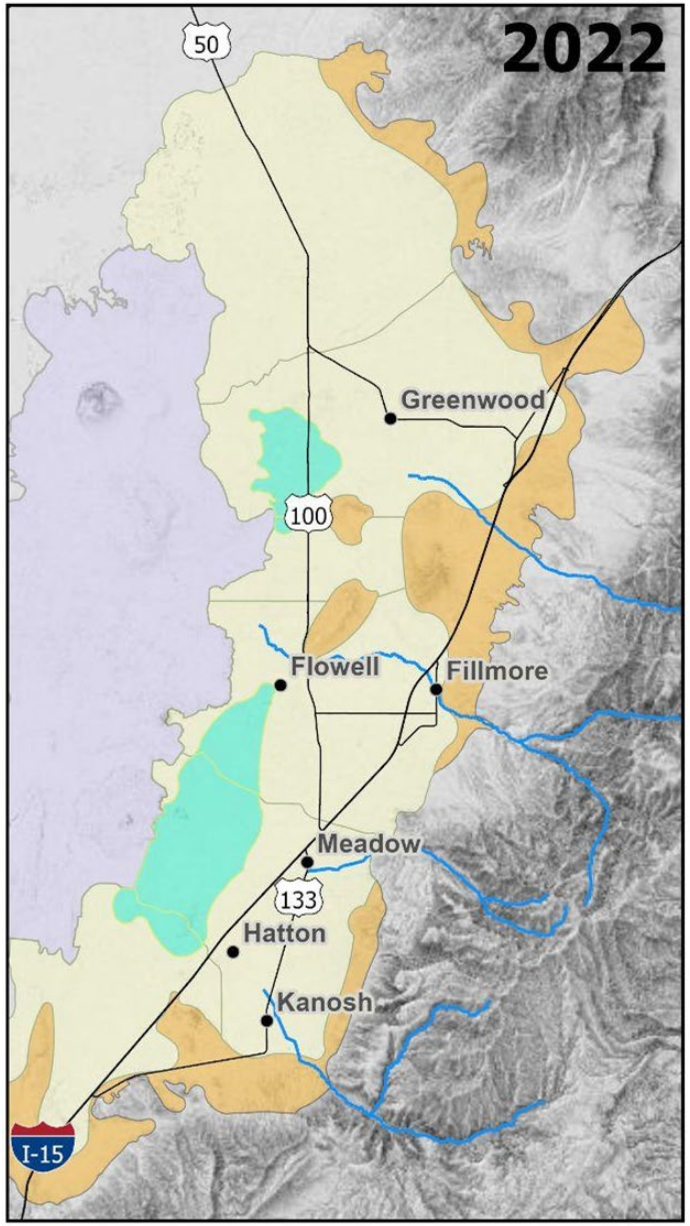


Heath, 1983

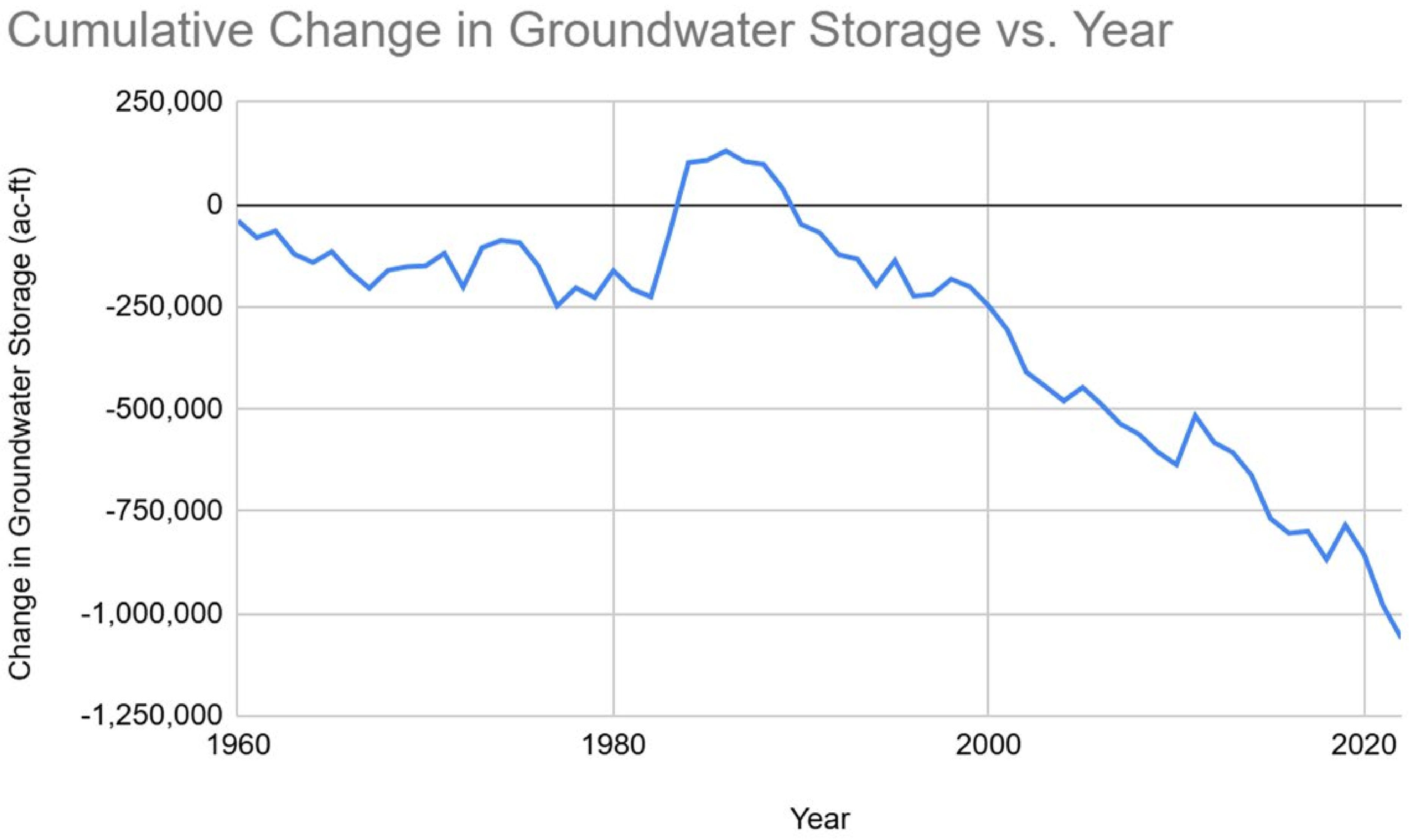
Budget - Confinement







Budget - Groundwater Storage

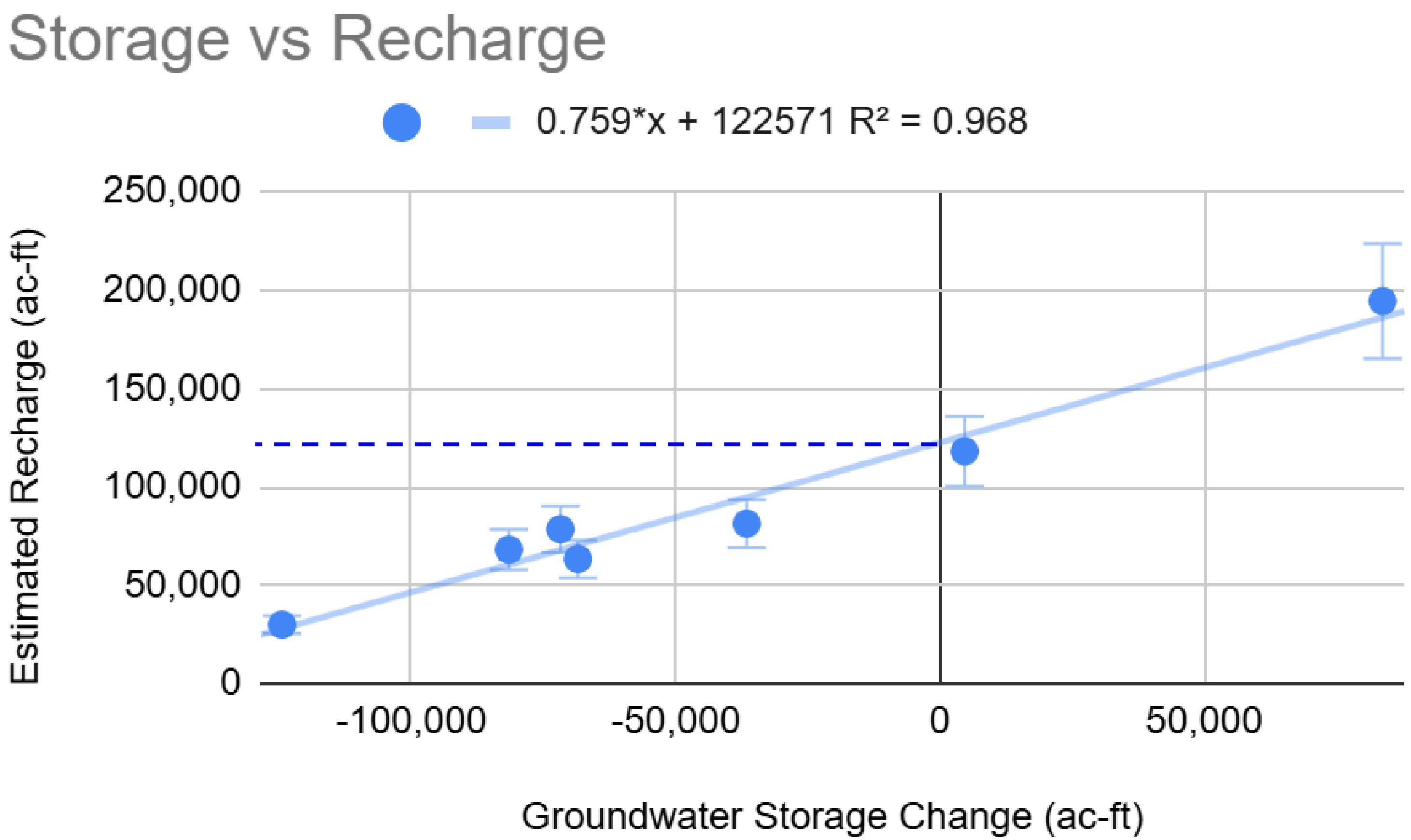


Budget - 2022

Category	Description	Mean (ac-ft)	Std. Dev (ac-ft)
Wells	Irrigation Wells	143,362	7881
	Stock Wells	26	2
	Domestic Wells	808	63
	Municipal Wells	1270	30
	Industrial Wells	137	15
	Total Wells	**145,603**	**7880**
Springs and Shallow Groundwater	Groundwater ET (includes Clear Lake Flow)	3917	1567
	Other Valley Springs	907	100
	Total Groundwater ET and Springs	**4824**	**1663**
	Total Discharge	**150,427**	**8056**
	Change In Storage	**-81,549**	**5539**
	Recharge	**68,878**	**9775**

Budget - Groundwater Recharge

Year	Discharge	Storage	Recharge
2016	117,981	-36,560	81,422
2017	113,451	4670	118,120
2018	131,941	-68,493	63,448
2019	110,699	83,764	194,463
2020	150,415	-71,810	78,605
2021	154,574	-124,475	30,099
2022	149,790	-81,549	68,241
AVG	**132,693**	**-42,065**	**90,628**
Med	**131,941**	**-68,493**	**78,605**

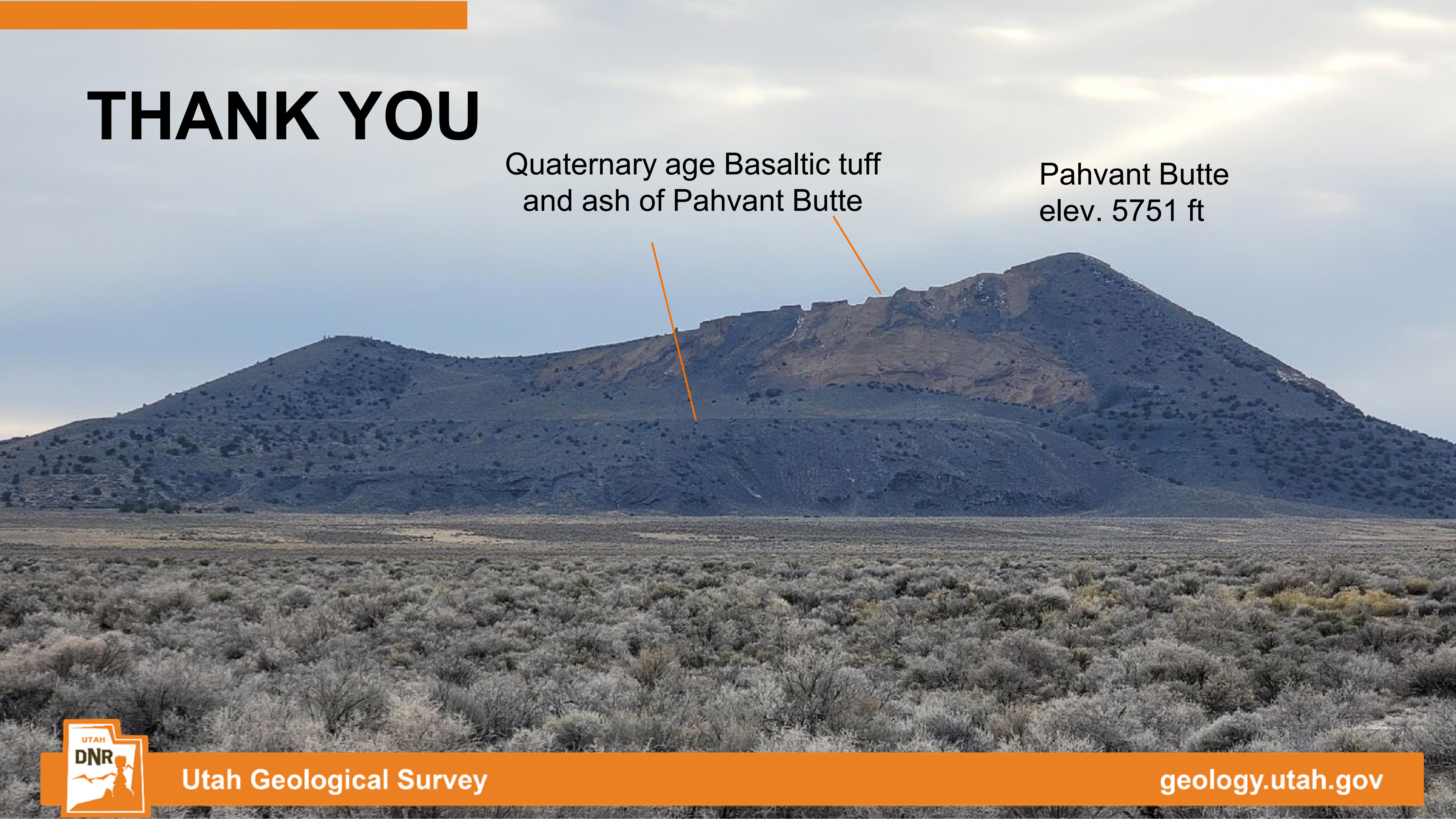


Summary

- Drivers
  - >60,000 ac-ft increase pumping 1990-present (avg 1900 ac-ft/yr)
  - 14,000 ac-ft from former Central Utah Canal stopped 1988
  - Dry years = less recharge and more pumping

- Impacts
  - 1 million ac-ft storage loss 1990-present
  - Clear Lake drying up (500 ac-ft/yr decrease)
  - Avg 26 ft groundwater level decline across region
  - Maximum groundwater decline of 163 feet in McCornick
  - >15 inches subsidence in past decade

THANK YOU


Quaternary age Basaltic tuff
and ash of Pahvant Butte
Pahvant Butte
elev. 5751 ft