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Nevada Water Initiative

The bridge to Nevada's water security

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DRI

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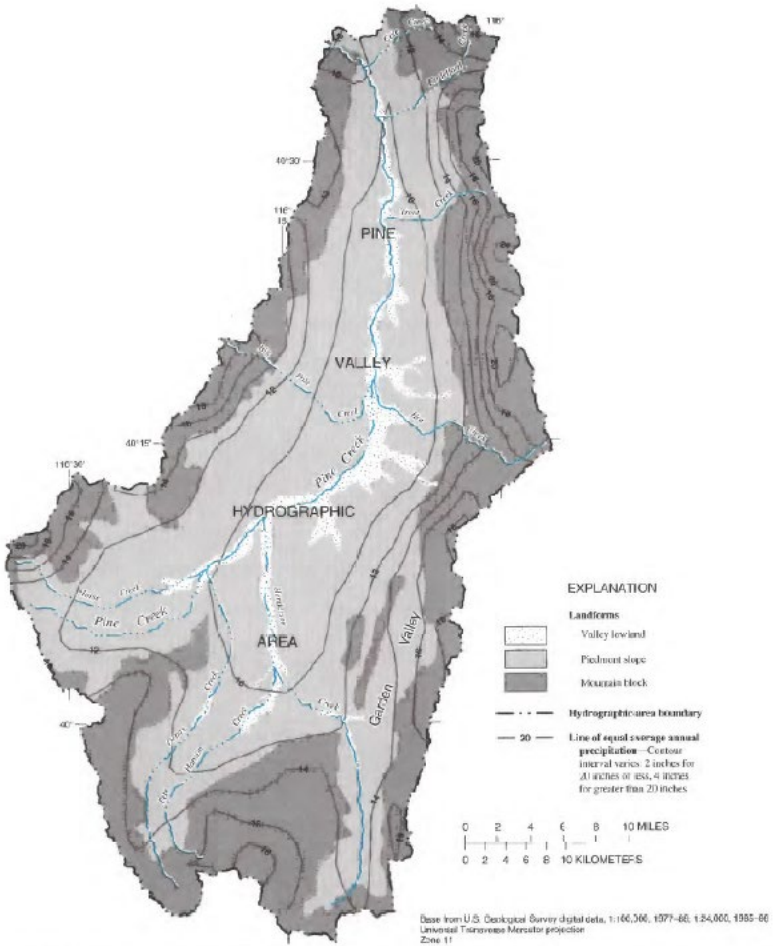
The bridge to Nevada's water security

Demonstration Basins: Pine Valley Stakeholders Update 1/7/2025

By David Smith



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Demonstration Basins: Project overview

1. **Estimate water budgets in Pine Valley for three years, water year 2024 to 2026**
   - ***Groundwater (GW) pumping (USGS&DRI), Evapotranspiration of groundwater (ETg) (DRI), measuring water resources (precip., groundwater, springs, and surface water)***

2. **Develop water-table map(s)**
   - ***Groundwater sites, routine monitoring, and water-level change map***
   - ***Valley fill and carbonate potentiometric surface maps***

3. **Characterize trends of groundwater (GW) and surface-water resources**
   - ***Pine Creek at Palisades gage, GW sites, and priority springs***

4. **Publish data in summary report in 4th year of the study (water year 2027)**
   - ***Update basin flow conceptual model***

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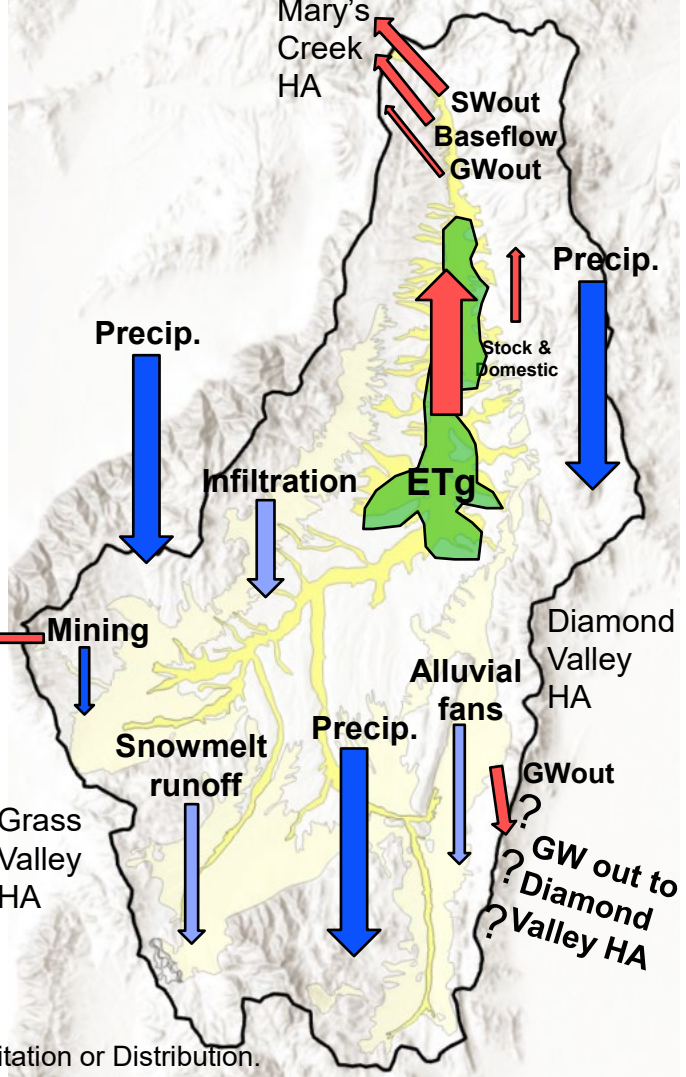
Preliminary Conceptual Model

- **Precipitation in** 326,000 acre-ft/yr (Berger, 2000)

- **Surface water out (runoff)** 2,500 acre-ft in 2024 (needs to be estimated)
- **Groundwater out**
  - **Pine Creek baseflow:** ~5,500 acre-ft/yr (needs to be estimated)
  - **Groundwater Subsurface flow:**
    - <1,000 acre-ft/yr (into Marys Creek HA)
  - **Stock+Domestic+Quasi-Municipal:** ~500 acre-ft/yr
  - **Crescent Valley Mining:** 1,400 acre-ft/yr Cortez-Pipeline drawdown from carbonate aquifer, re-apply losses to valley fill aquifer annually by Nevada State order 1284 (replace ~22,000 acre-ft over 16 years)
- **Groundwater in** ~1,400 acre-ft/yr Cortez-Pipeline

- **Evapotranspiration out ~**28,000 acre-ft/yr estimate (DRI, per comms, 2024)



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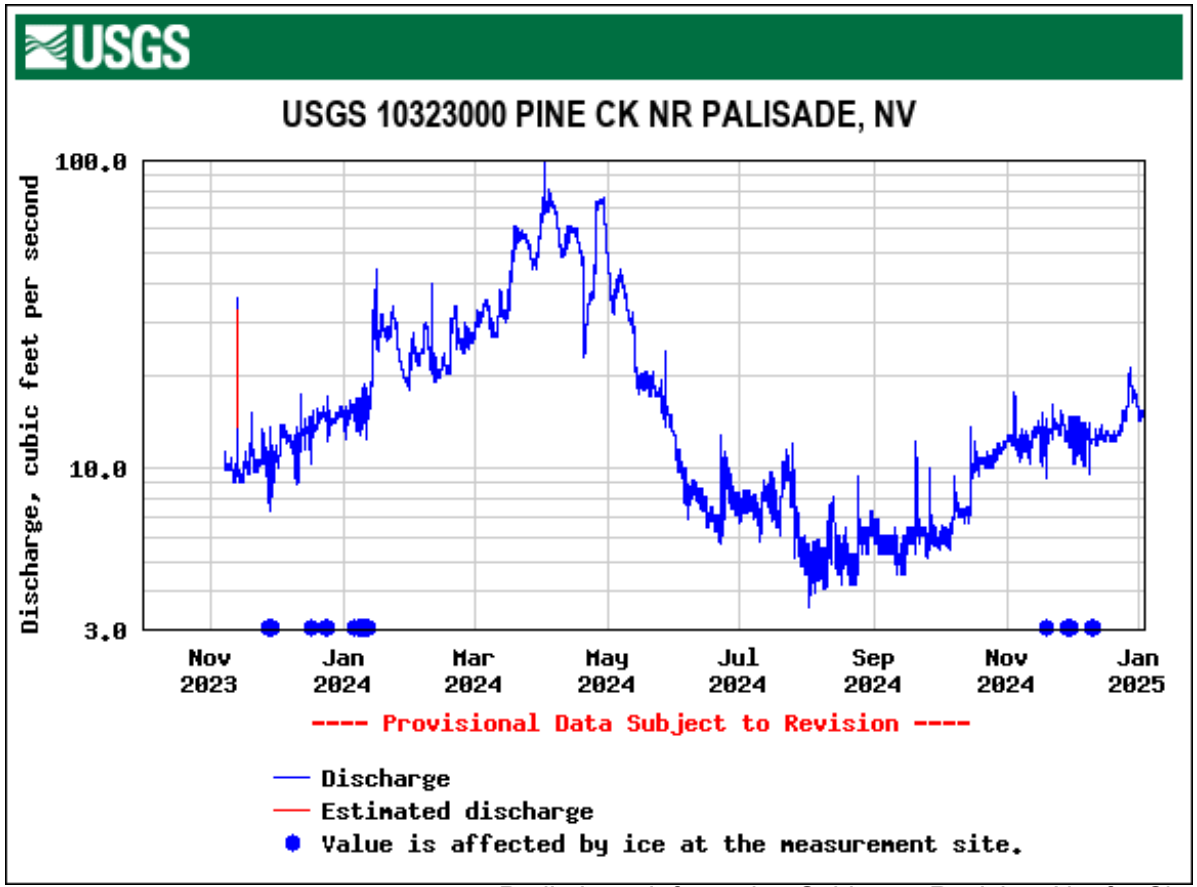
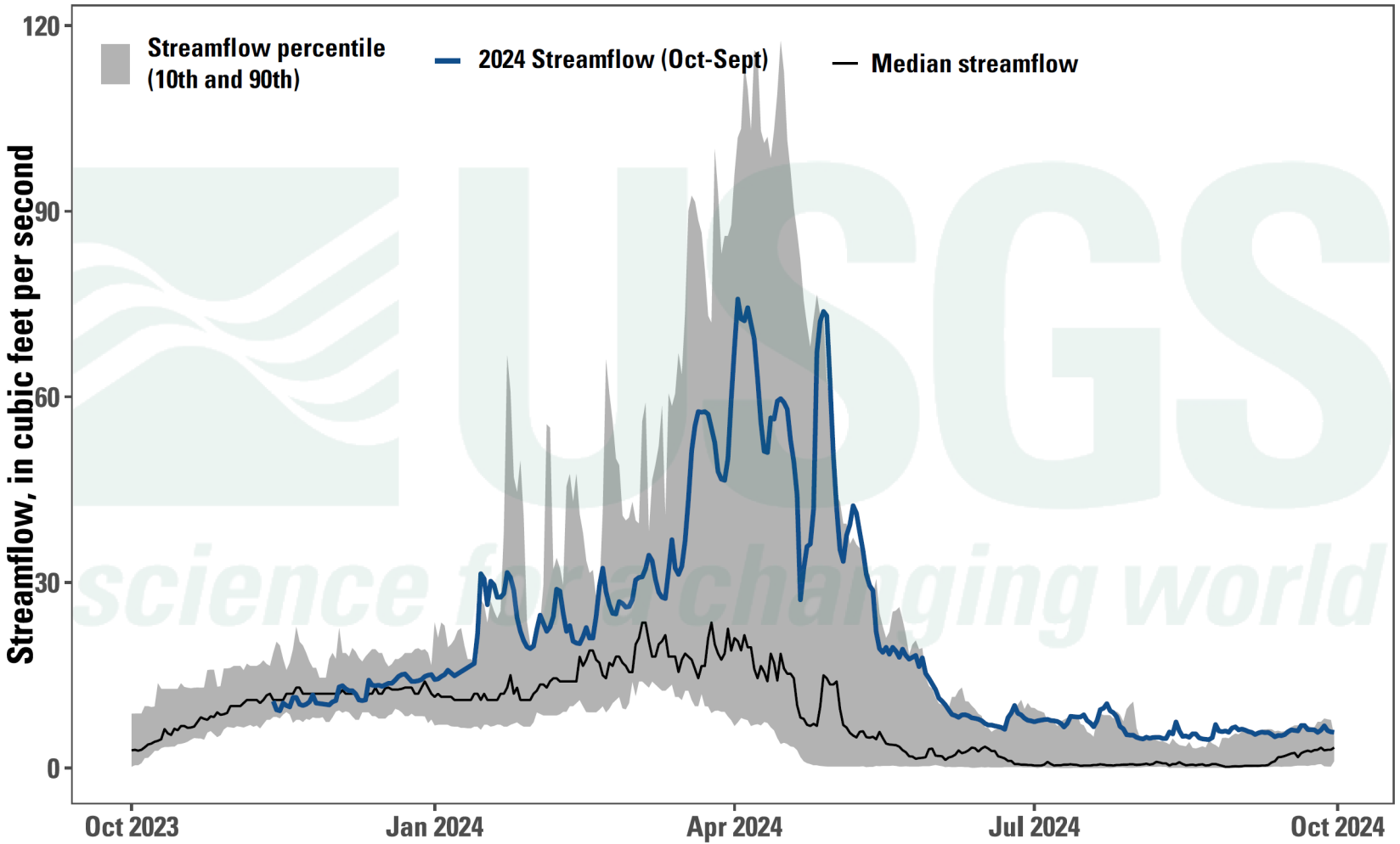
Pine Creek near Palisade, NV




10323000: PINE CK NR PALISADE, NV
Streamflow percentile (10th and 90th)
2024 Streamflow (Oct-Sept)
Median streamflow
Streamflow, in cubic feet per second
120
90
60
30
0
Oct 2023
Jan 2024
Apr 2024
Jul 2024
Oct 2024
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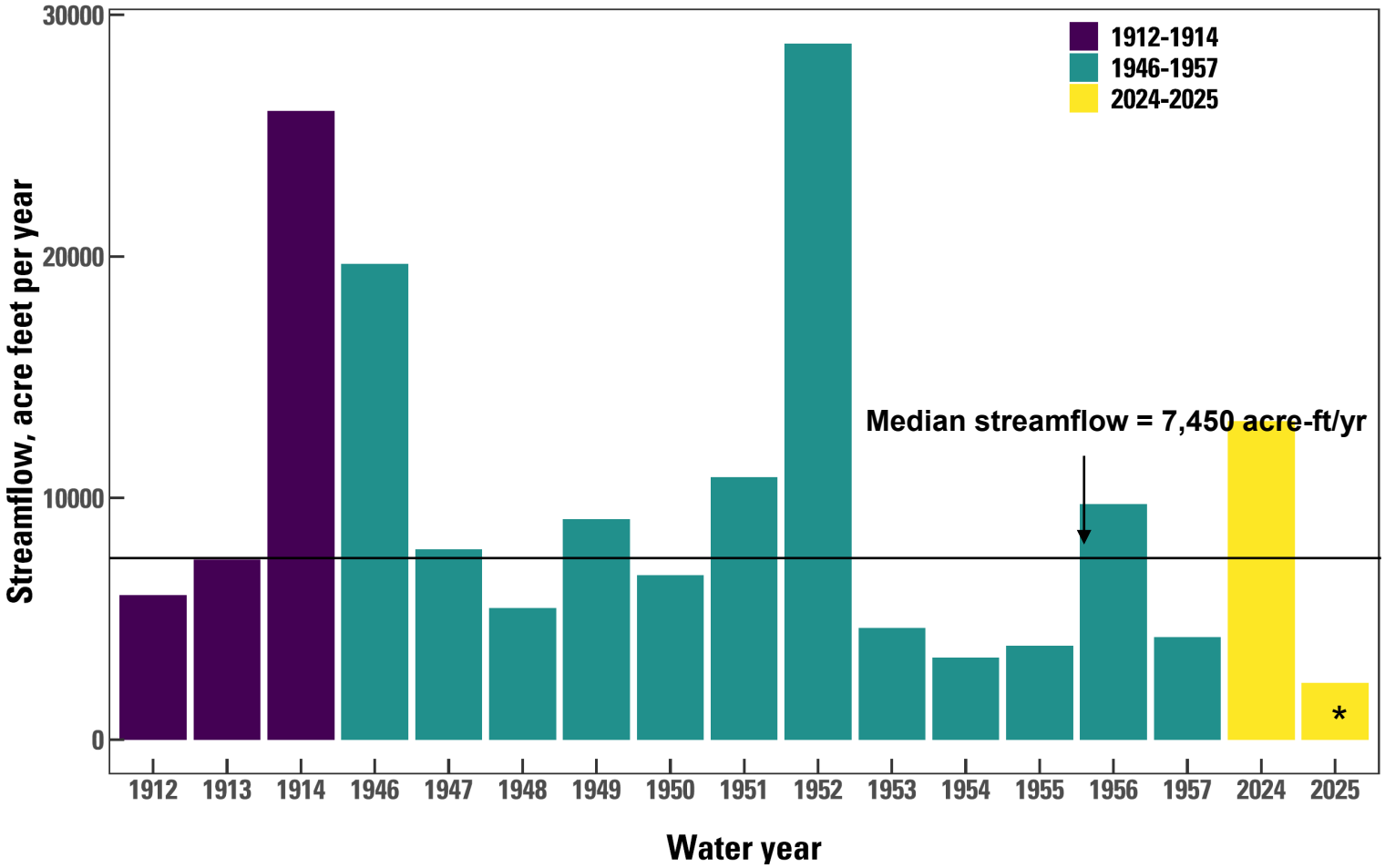

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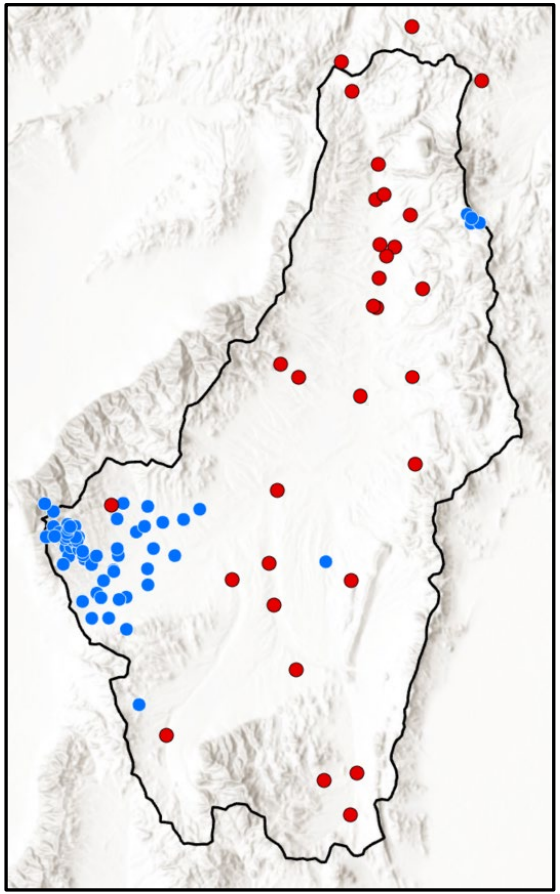
* Water year not complete

Groundwater

- **Potentiometric surface maps (update locations)**
  - **GW sites latitude, longitude, and altitude updates coming**
    - **~50 Active NDWR and NV Goldmines wells**
    - **USGS measuring 30 wells for seasonal changes in groundwater**
      Bi-annual measurements (Mar. and Oct.)



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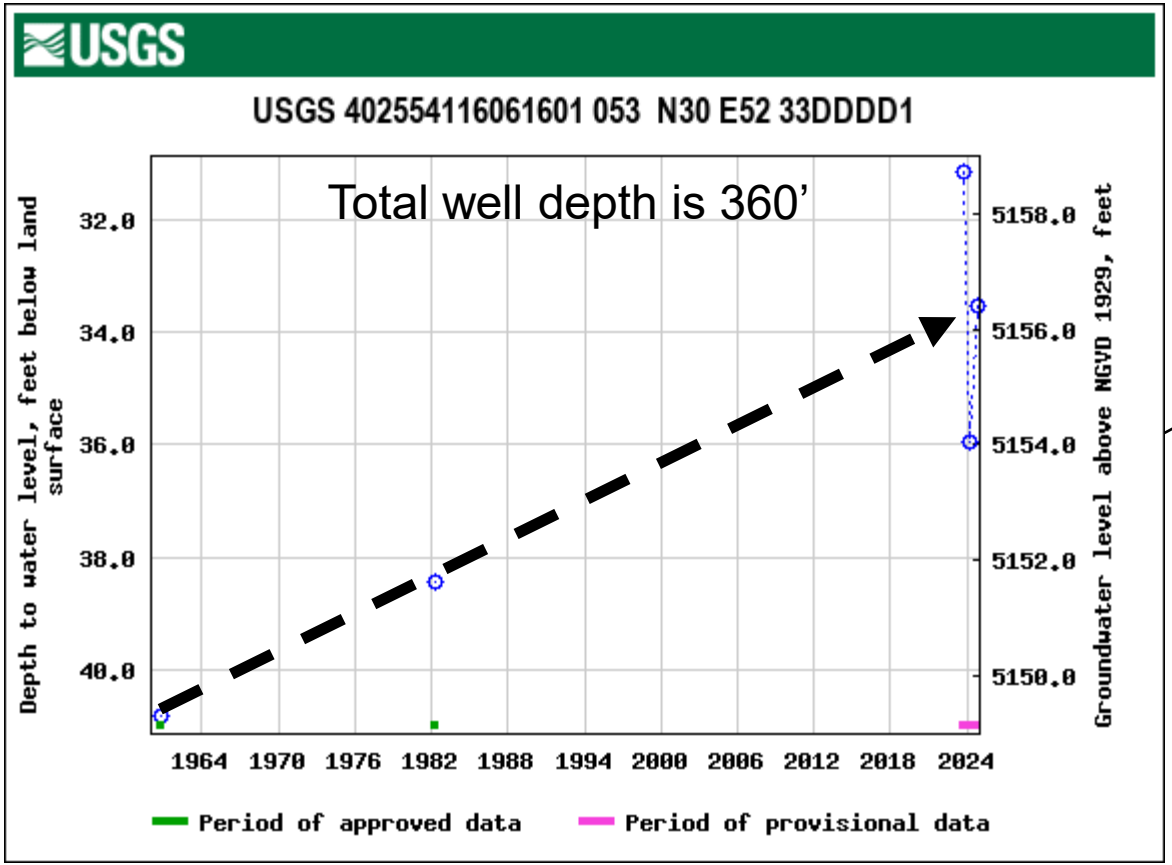
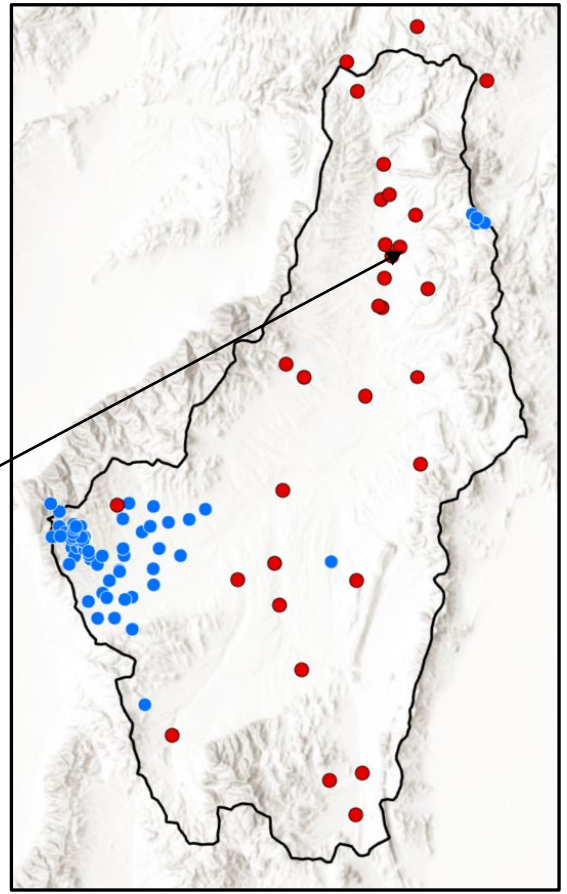
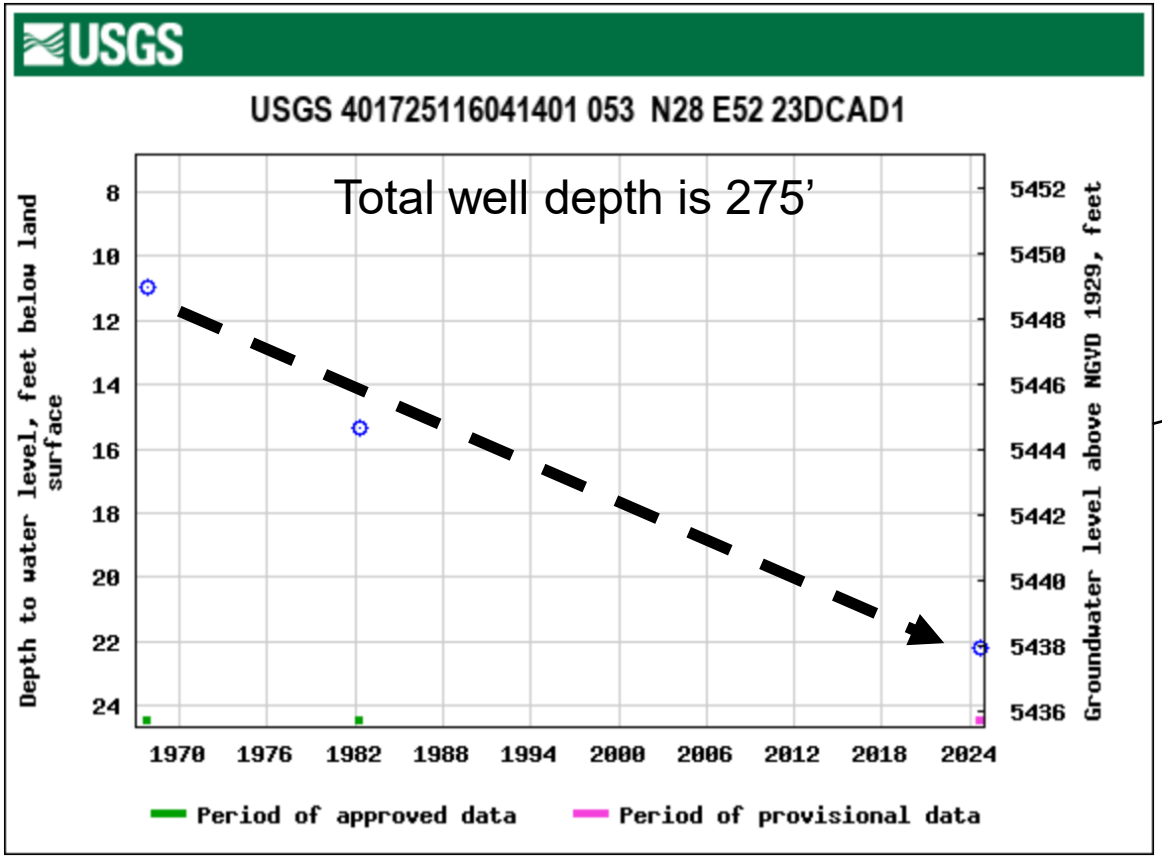
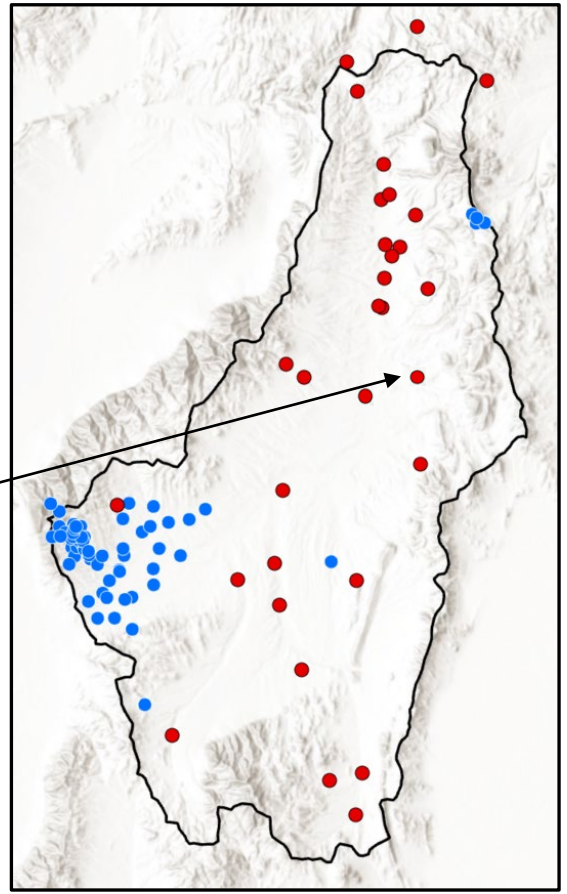
Groundwater





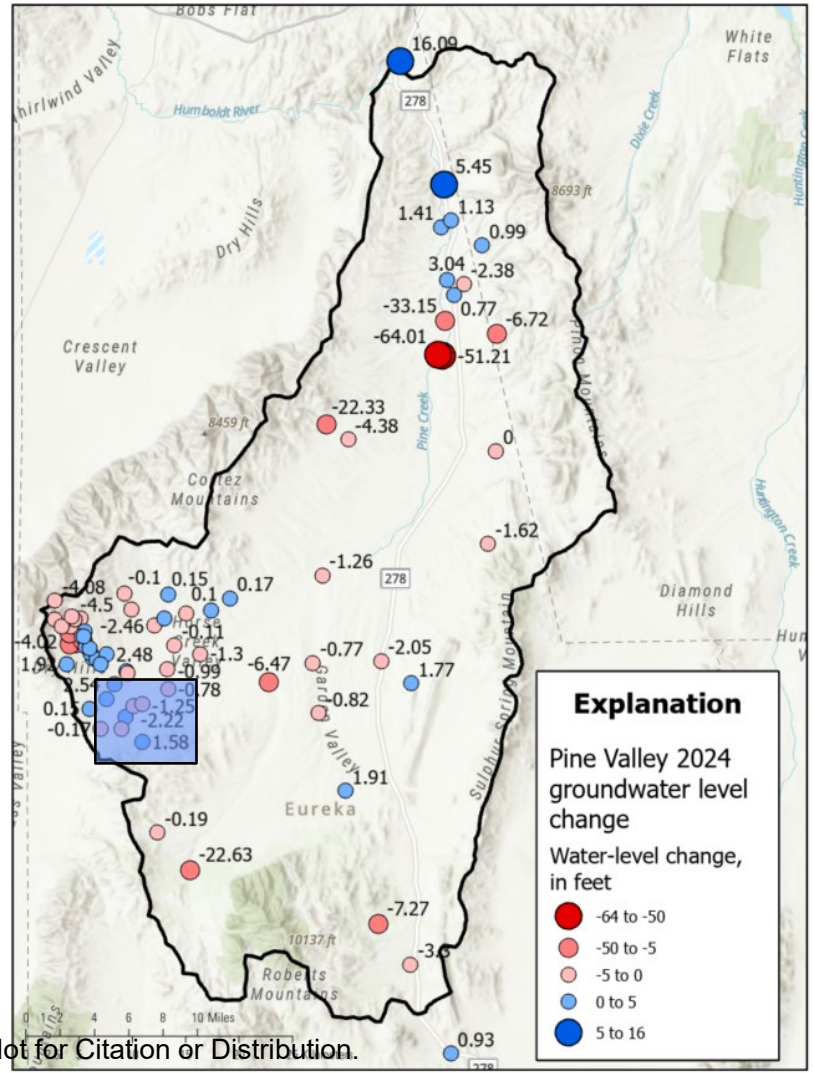
Groundwater





Water-level change: Mar-Oct 2024

- **Water-level change from March to October 2024**
  - **For NDWR sites, change is Mar. to July 2024**
  - **Network wells are generally stock or irrigation wells**
- **Largest water-level declines are from ag. and stock wells located in the north-central part of the valley.**
- **The water table is generally close to land surface after confluence of Hot and Pine Creeks.**
- **The water-table declines caused by nearby pumping wells may be impacting hydraulic connectivity with the Pine Creek and reducing conveyance efficiency.**



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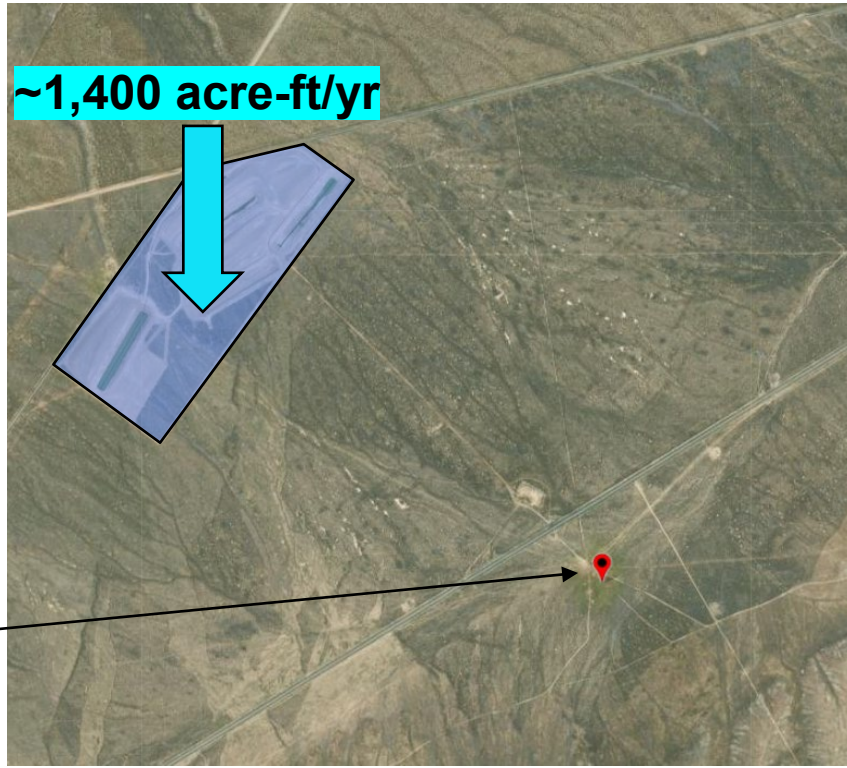
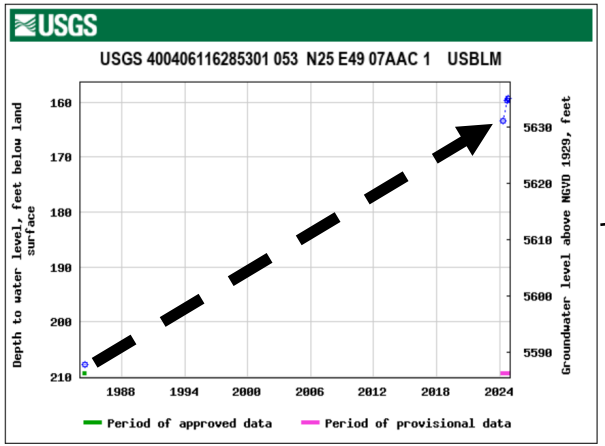
Progress to date: water-level change (Mar-Oct 2024)

- **A stock well downgradient from the rapid infiltration basins used by NV Goldmines to pump ~1,400 acre-ft/yr back into Pine Valley from Crescent Valley.**
- **Measurements show a ~50’ increase from 1984**
- **The stock well was drilled in 1949; the static water level was 194’ when drilled.**





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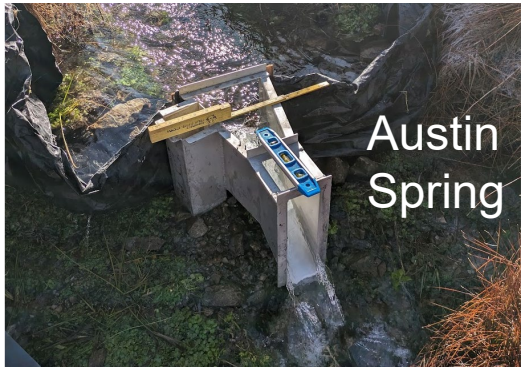
Springs (Highlights)

- **Trout Creek Spring**
  - Starting flowing in 2024
    - 0.25 cfs (115 gpm)
- **Hot Creek (Spring)**
  - Stable springflow quarterly measurements
  - Average flow ~6.5 cfs (~3,100 gpm)
- **Austin and Edwards Springs**
  - 3x measurements, flow rates similar in by NDWR in 2018, and USGS in 2023 and 2024.
    - Edwards – ~0.40cfs (180 gpm)
    - Austin – ~0.27cfs (120 gpm)
- **<u>Have we overlooked any spring locations, let's discuss locations after the presentation?</u>**



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Spring and streamflow (seepage runs or baseflow study)

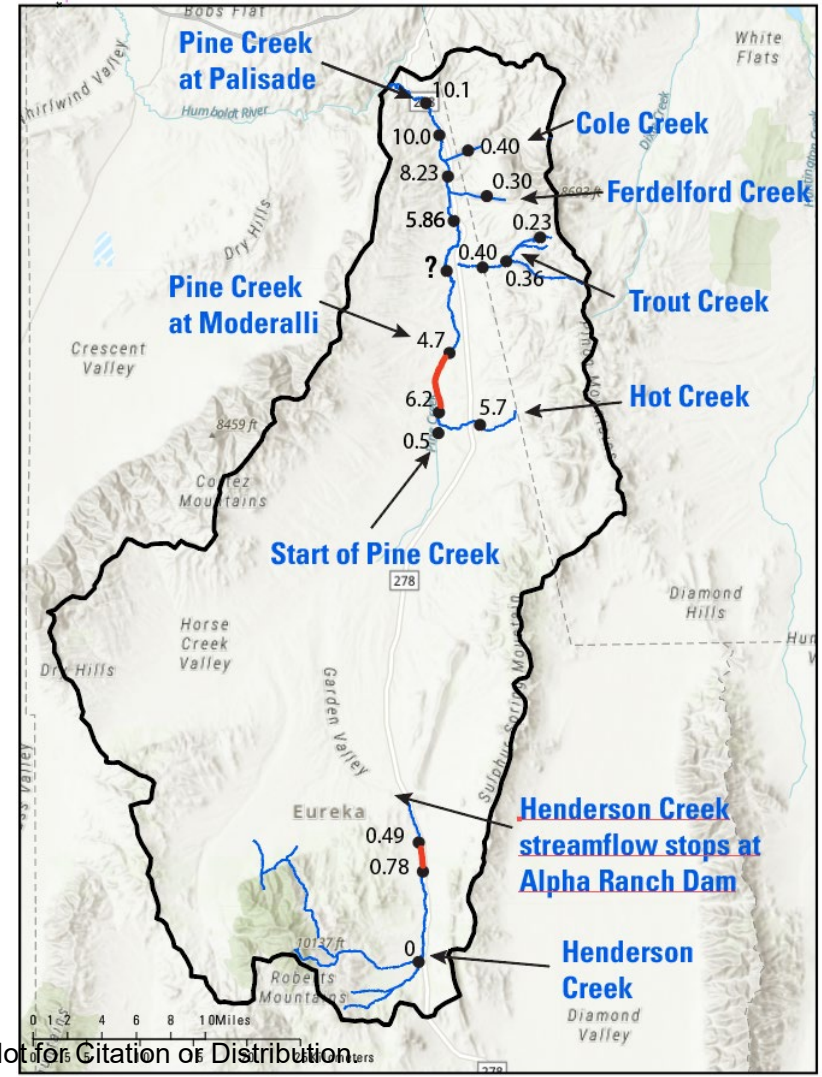
- **Seepage run – measure streamflow at multiple locations to characterize seepage of water into (gain) or out of (loss) a stream reach. Streamflow in cubic feet per second (cfs) is measured with a flume or velocity measurements with acoustics meters**

- **Example of Trout Creek on 10/22/2024**
  - **Trout Creek started flowing again in 2024**
  - **From source to confluence of North and South fork**
  - **Streamflow gain of 0.10 cfs (~38 percent gain) at the confluence of the N. and S. forks.**

USGS

Seepage runs

- Actively measuring spring and streamflow at as many drainages as possible in Pine Valley.
  - Streamflow
- We tried to collect flow at more locations, swampy areas and beaver dams prevent flow measurements
- Henderson Creek dry at gage, but gains flow and then starts to infiltrate prior to Alpha Ranch



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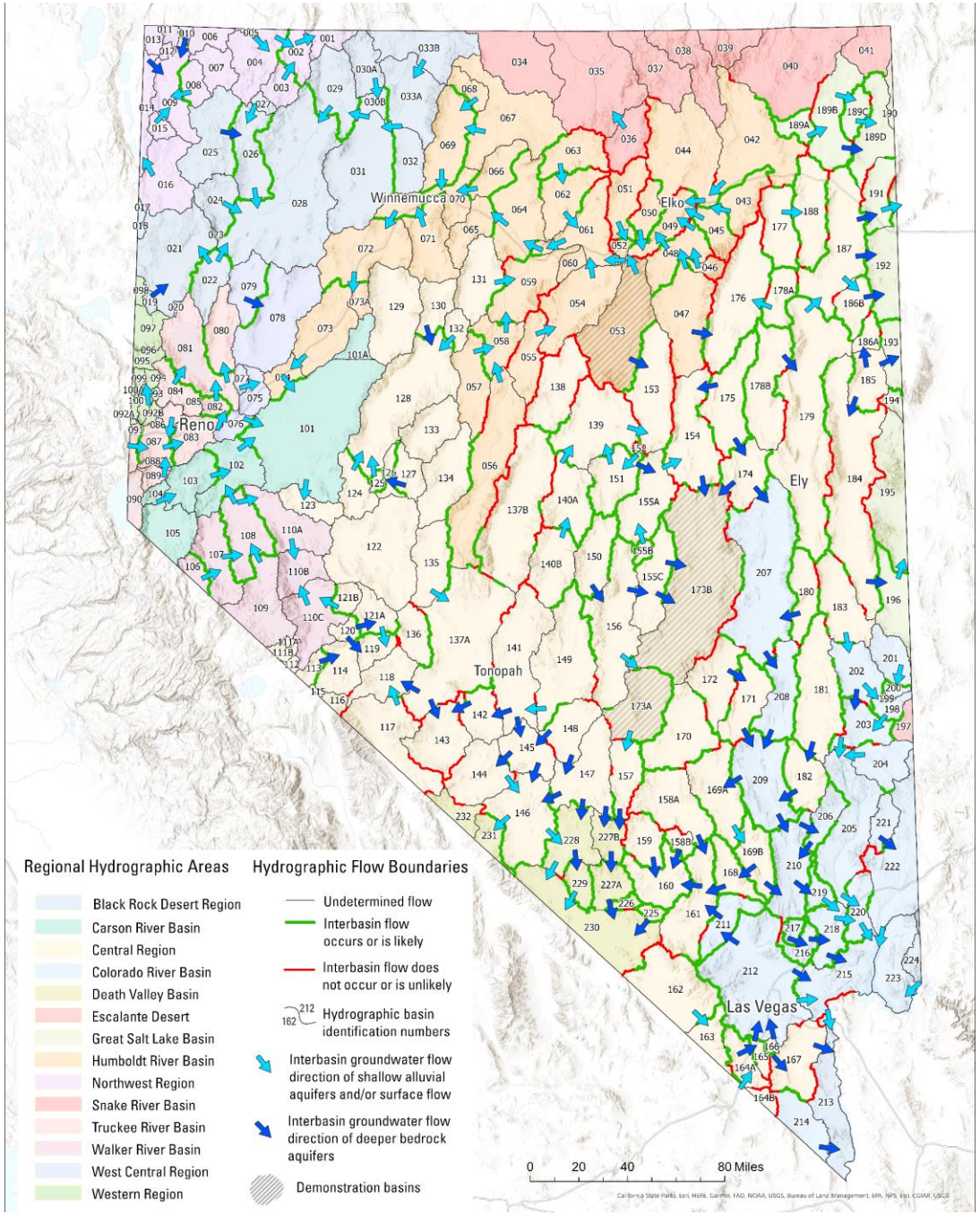
Nevada Water Resources Initiative: Investigating Interbasin Flow

Randy Paylor, rpaylor@usgs.gov

- In Nevada, subsurface flows between hydrographic basins are recognized across the state.
- Many interbasin flow estimates rely on old water budget components that are out of date.
- NDWR needs better data on interbasin flow in Nevada so the state can manage water resources using the best possible information.

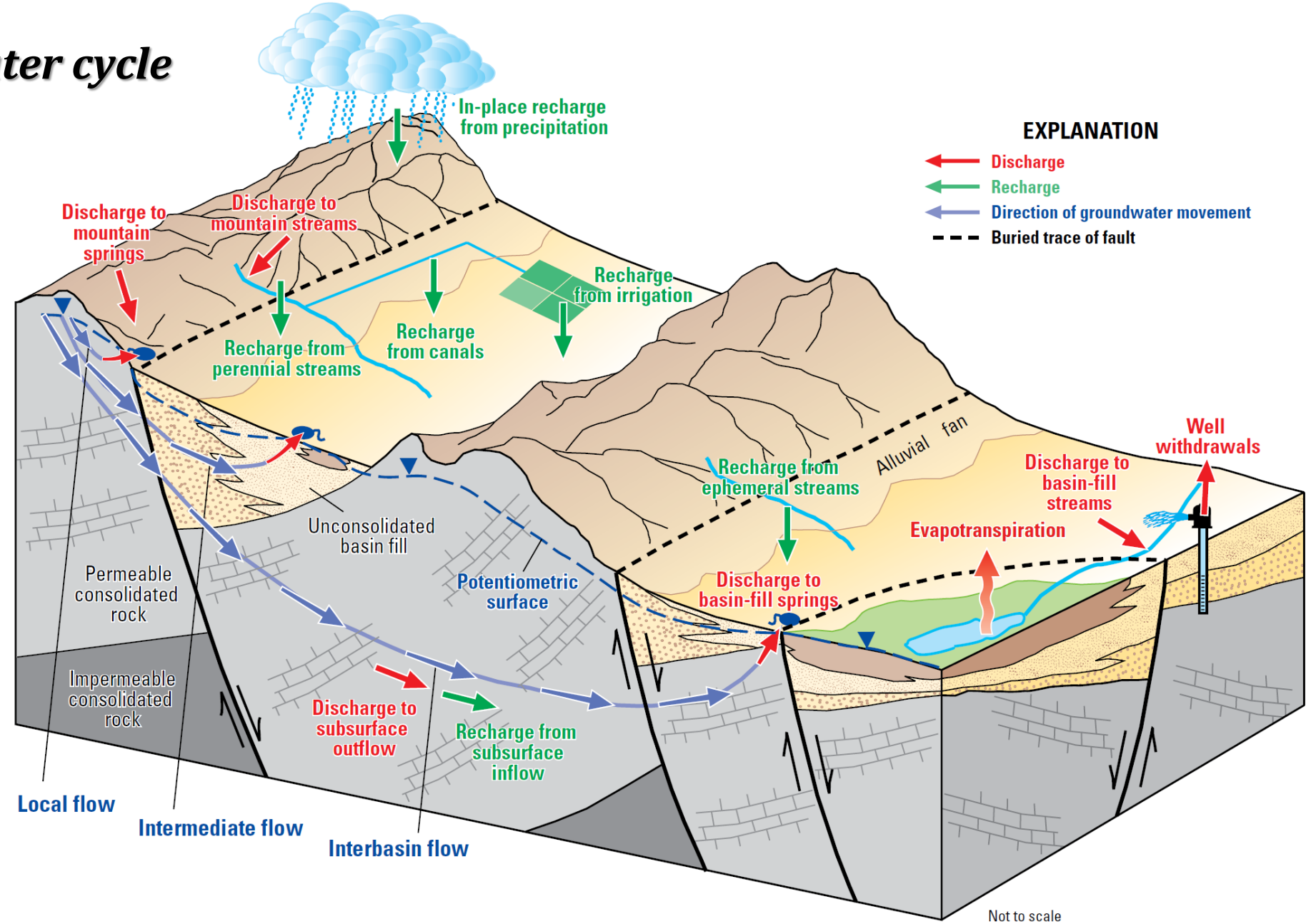


USGS/NDWR, 1960-1975; Rush, 1971; Harrill, 1988; Anning and Konieczki, 2005

U.S. Department of the Interior
U.S. Geological Survey

The Great Basin's water cycle

- Permeable limestone and volcanic rocks in mountain ranges can transmit water from one closed basin to another
- Groundwater flow between basins can take decades to centuries or more



Not to scale
Heilweil and Brooks, 2010.

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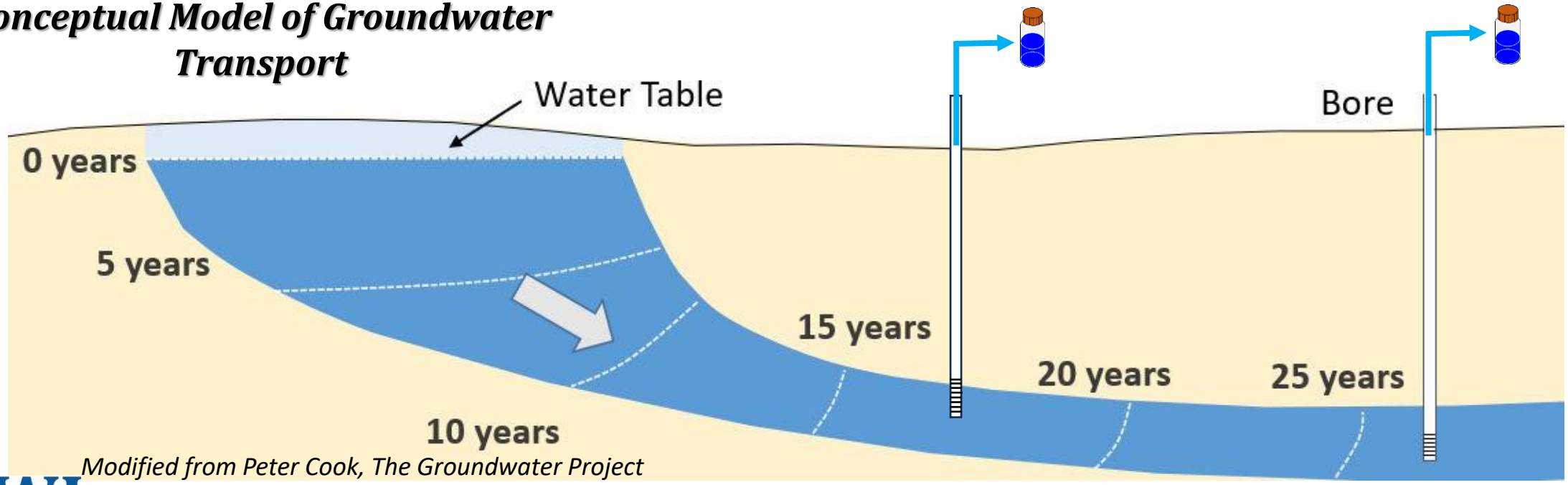
Sampling for Environmental Tracers

Taking water samples for environmental tracers allow us to:

1. Estimate **groundwater movement** using age tracers like carbon 14 and dissolved gasses**.**
2. Figure out **recharge temperature and elevation** using dissolved noble gasses.
3. Identify **recharge sources (snowmelt or monsoon)** from oxygen and hydrogen isotopes.
4. Evaluate **lithology along groundwater flow paths** using geochemistry (dissolved elements) and strontium isotopes.

Groundwater samples demonstrate geochemical evolution related to age, transport, and recharge source.

Conceptual Model of Groundwater Transport



Modified from Peter Cook, The Groundwater Project

Interbasin flow – Pine Valley

- Sampling is targeting estimated flow paths from previous studies.
- Estimates of interbasin flow from past studies vary, and our sampling will figure out if these connections are likely.

Estimated interbasin flow direction

0.7 - 4 Estimated interbasin flow, thousands of acre-feet per year

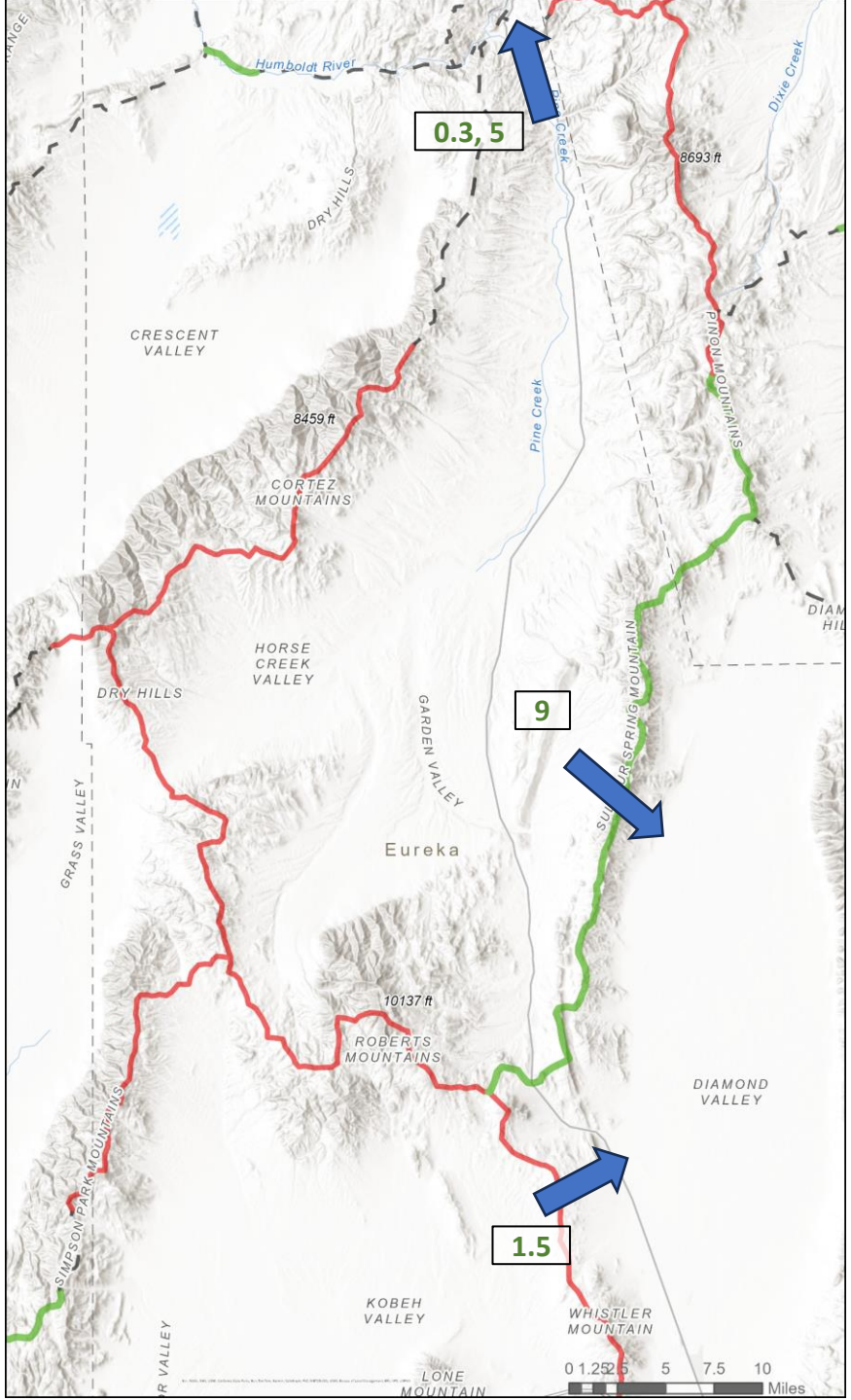
Basin boundary favorable to interbasin flow

Basin boundary unfavorable to interbasin flow

Boundary favorability undetermined

Estimated interbasin flow from previous work.

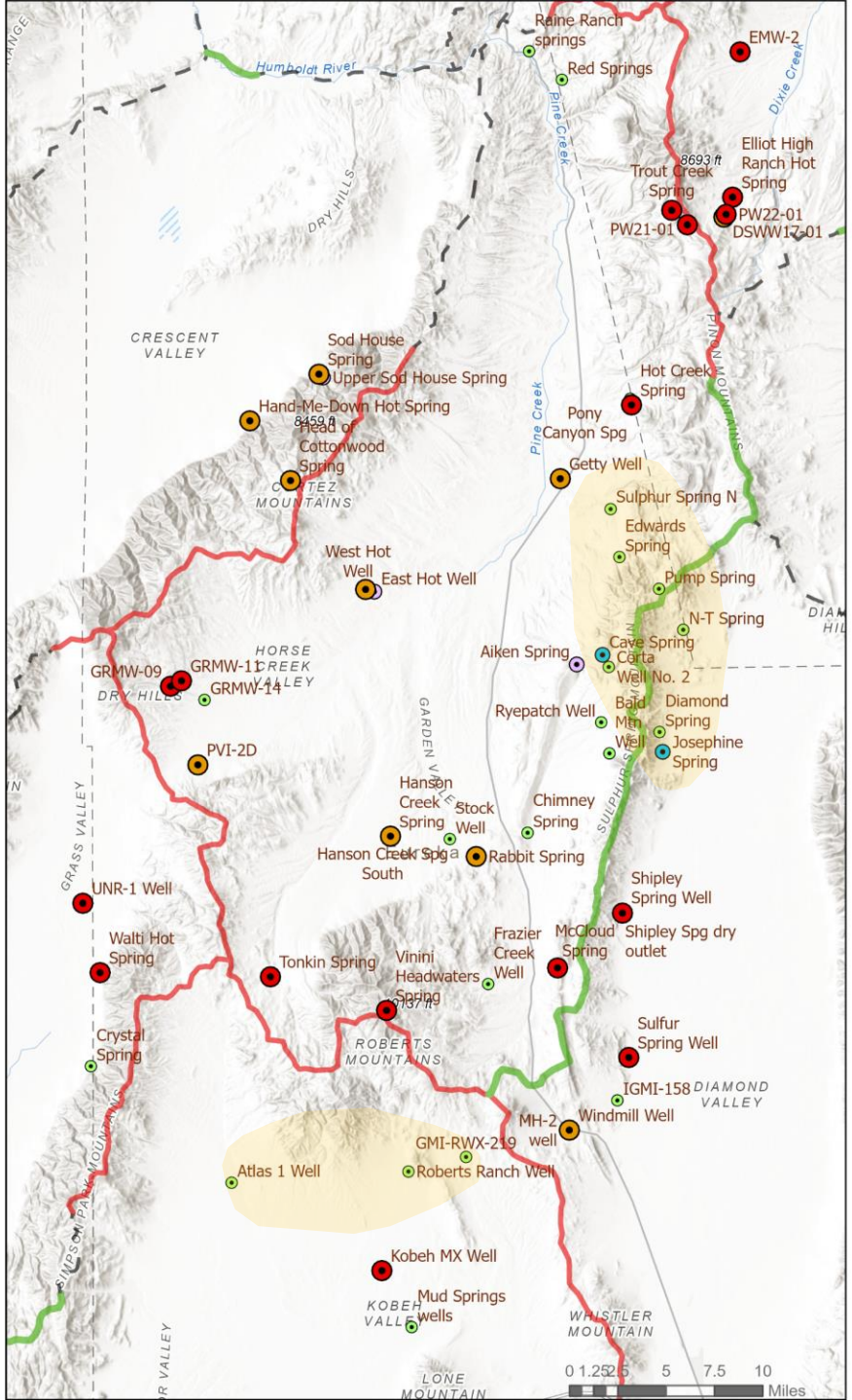
Eakin and others (1951); Rush and Everett (1966); Van Denburgh and Rush (1974); Harril and other (1988); Prudic and others (1995); Nichols (2001); Lopes and Evetts (2004)



Sites sampled – Pine Valley area

- 28 sites have been sampled in Pine Valley and surrounding areas so far.
- Locations in green are springs or wells we have visited and may still need to sample.

- Full sample suite
- Full suite minus dissolved gas
- Stable isotope samples
- Field parameters
- Reconned locations



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Example results – Pine Valley area

- Oxygen and hydrogen isotopes of water can be used to identify groundwater source areas.
- Preliminary results suggest distinct sources for groundwater in north and south Pine, and western Diamond Valley.

Oxygen isotopes

Lighter - higher elevation or more northern source

Heavier - lower elevation or more southern source

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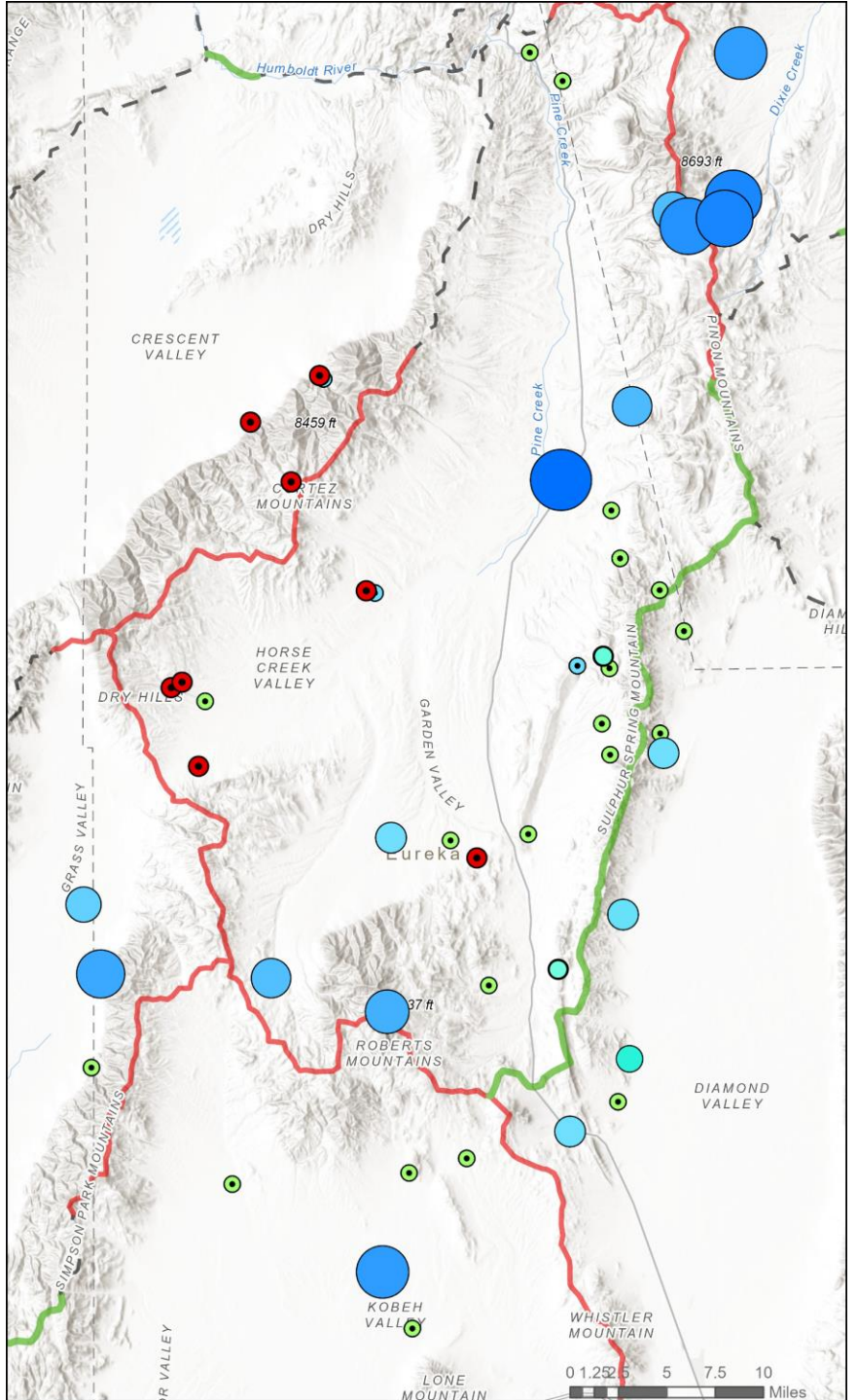


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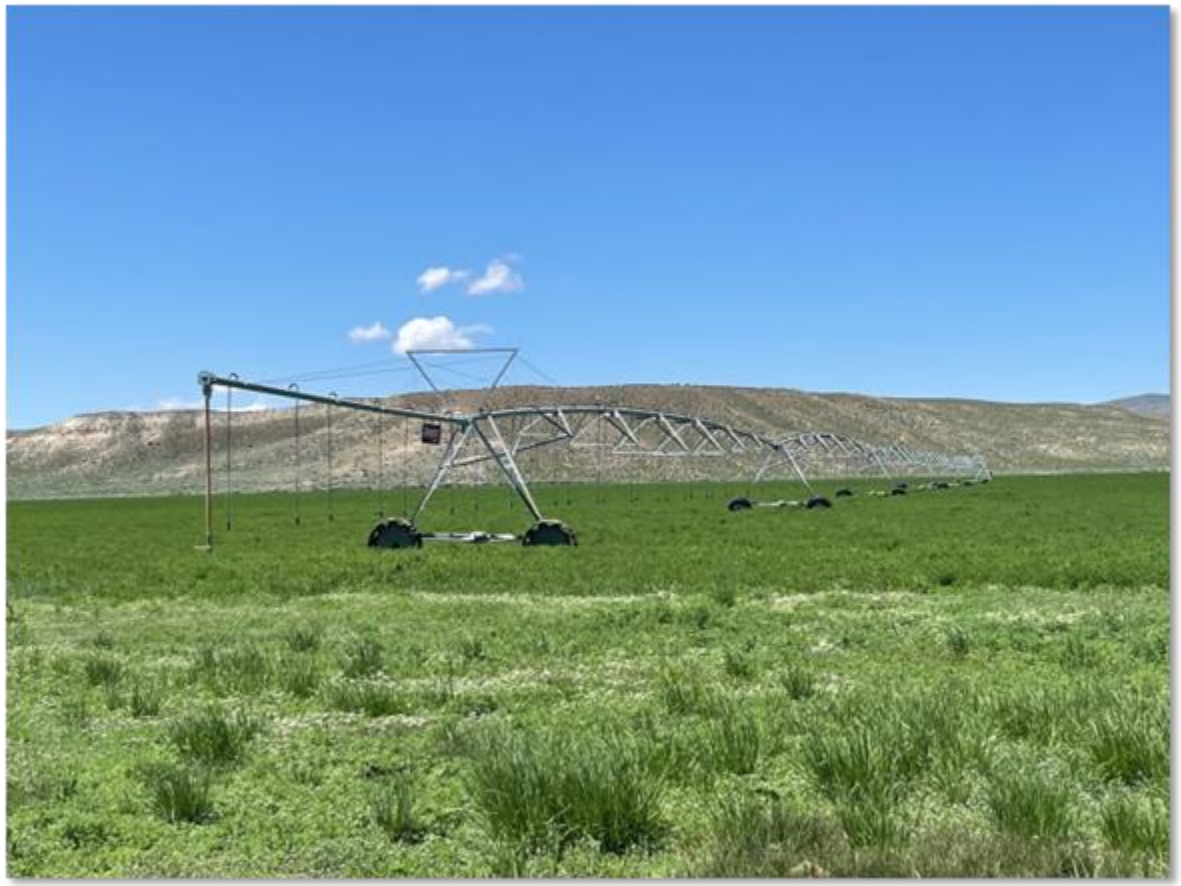
THE NEVADA WATER INITIATIVE

PROJECT ACTIVITIES

- DRI is developing and supporting statewide updates of
  - Agricultural Consumptive Use Inventory and Database
  - Groundwater Discharge Database
  - Meteorological and Hydrologic Monitoring
  - Recharge and Water Availability

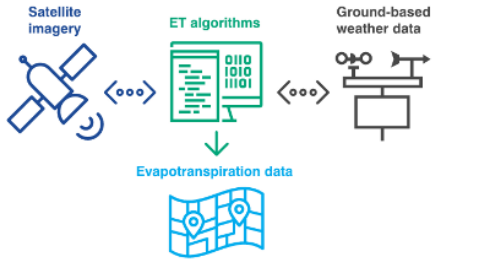
- *This information is fundamental for ensuring adequate water supplies, supporting economic development, and protecting existing rights and the environment.*



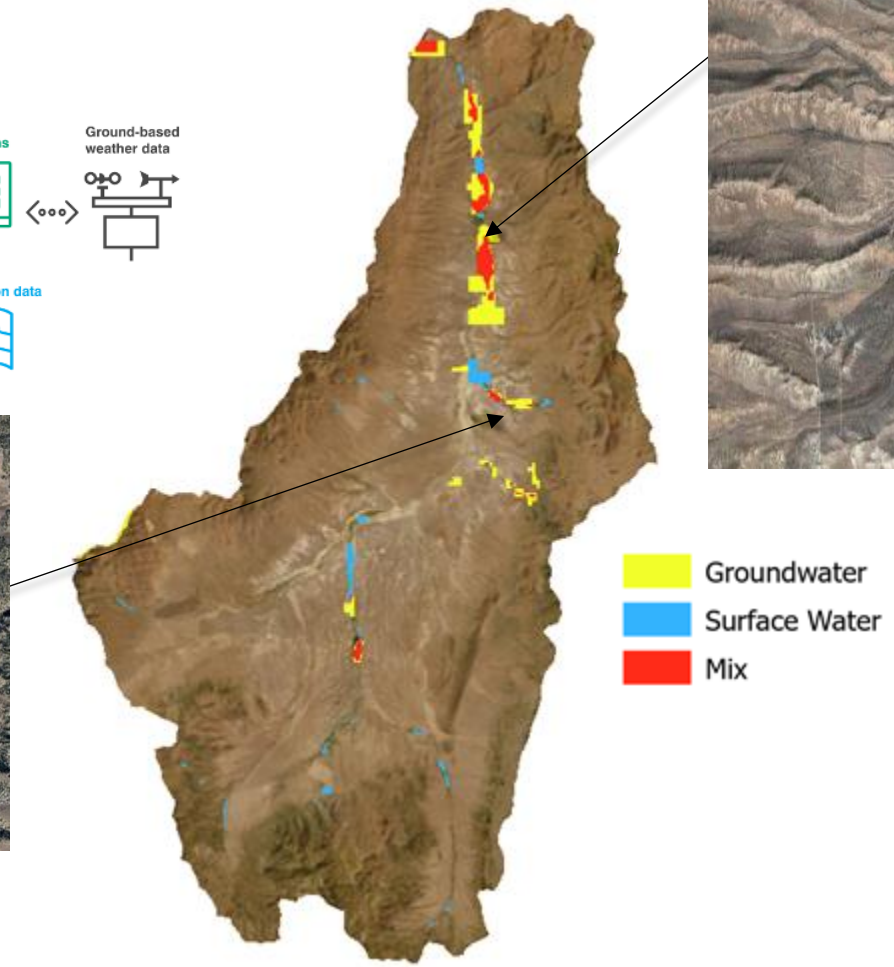
Pine Valley

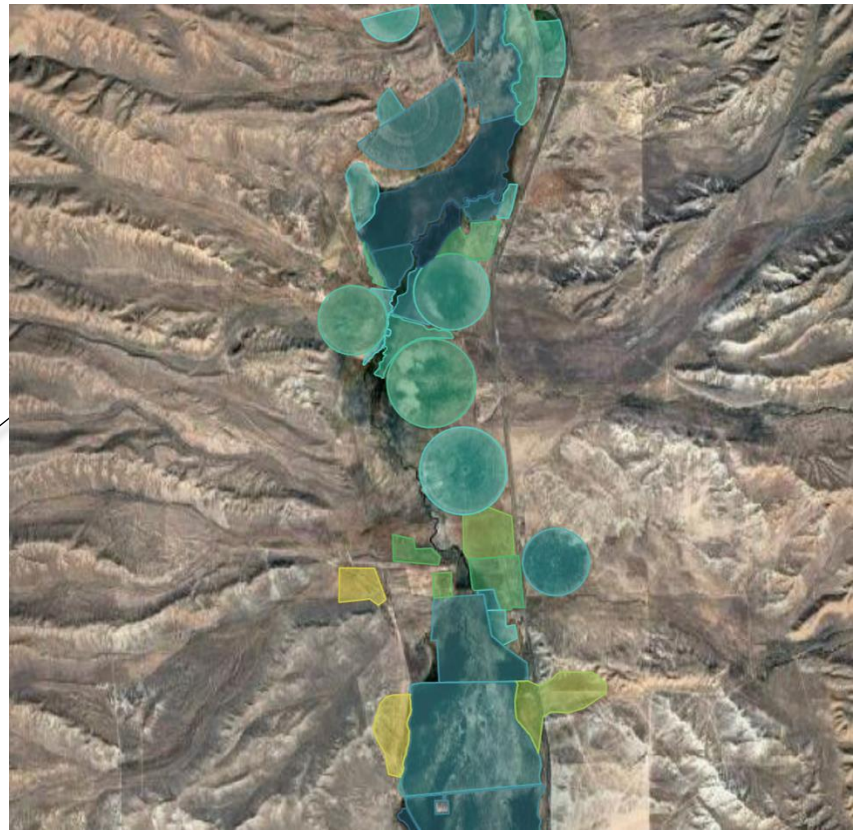
CONSUMPTIVE USE INVENTORY & DATABASE

- Comprehensive Consumptive Use Database
  - Through time (Landsat satellite archive 1985-pres.)
  - Field boundaries
  - Decree boundaries
  - Irrigation status mapping
  - Irrigation system type
  - Water source mapping
  - Water Use Database



Pine Valley





Pine Valley

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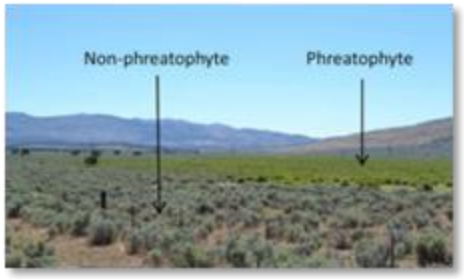
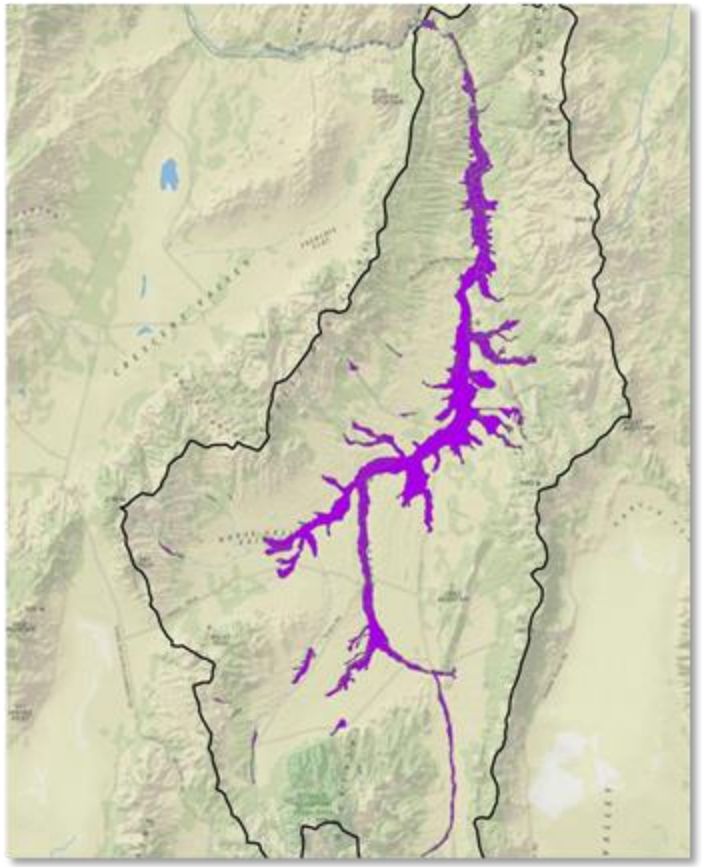
PHREATOPHYTE PLANT GROUNDWATER USE



- Update Groundwater Discharge and Water Budgets
  - Groundwater discharge from phreatophytes is used as a basis for determining groundwater budgets
  - Satellite and aerial imagery and field mapping used to revise the extent and amount of groundwater discharge
  - Constrain recharge estimates
  - Compare to previous estimates



"….discharge is of much more pragmatic concern than recharge."
- John Bredehoeft - USGS

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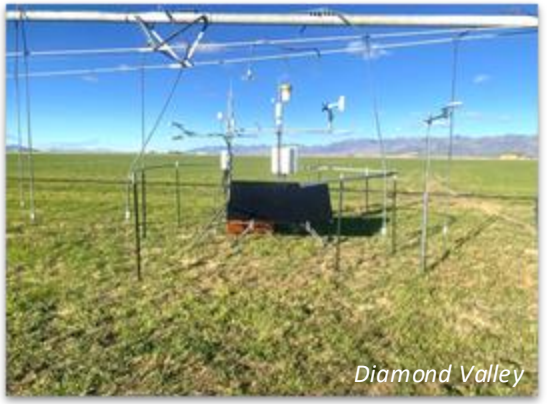
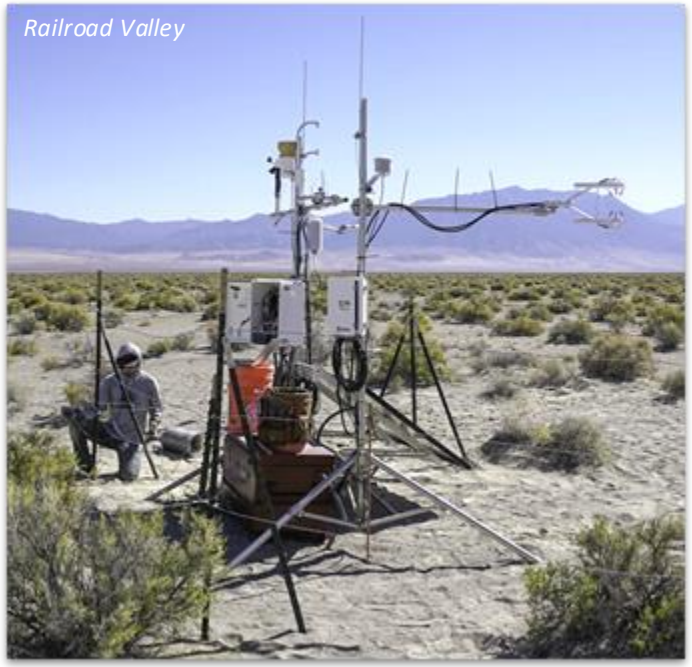
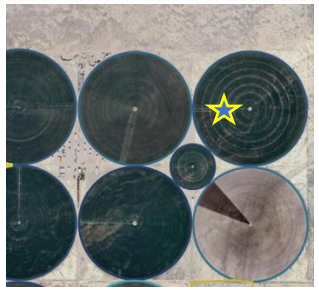
METEOROLOGICAL DATA AND MONITORING

- Monitoring weather and water use to compare with satellite-based water use, and support on-farm conservation, irrigation scheduling, and water use reporting.
- Upgrading Nevada Integrated Climate & Evapotranspiration Network (https://NICENet.dri.edu)







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METEOROLOGICAL DATA AND MONITORING

- Comparing gridded weather data products to local weather station data in region – NOAA Cooperative Observer Program


Pine Valley – NOAA Cooperative Observer


Pine Valley – NOAA Cooperative Observer

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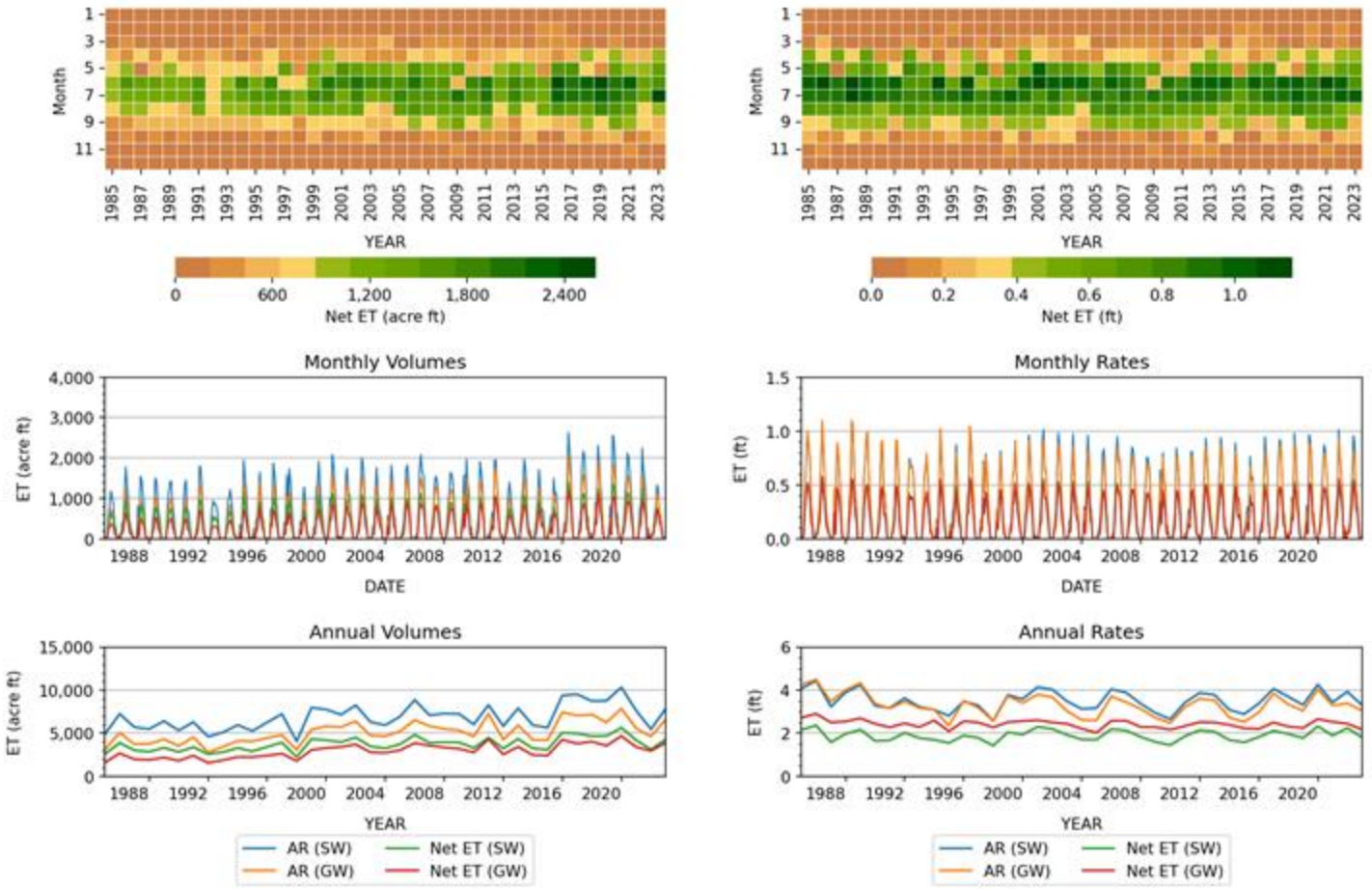
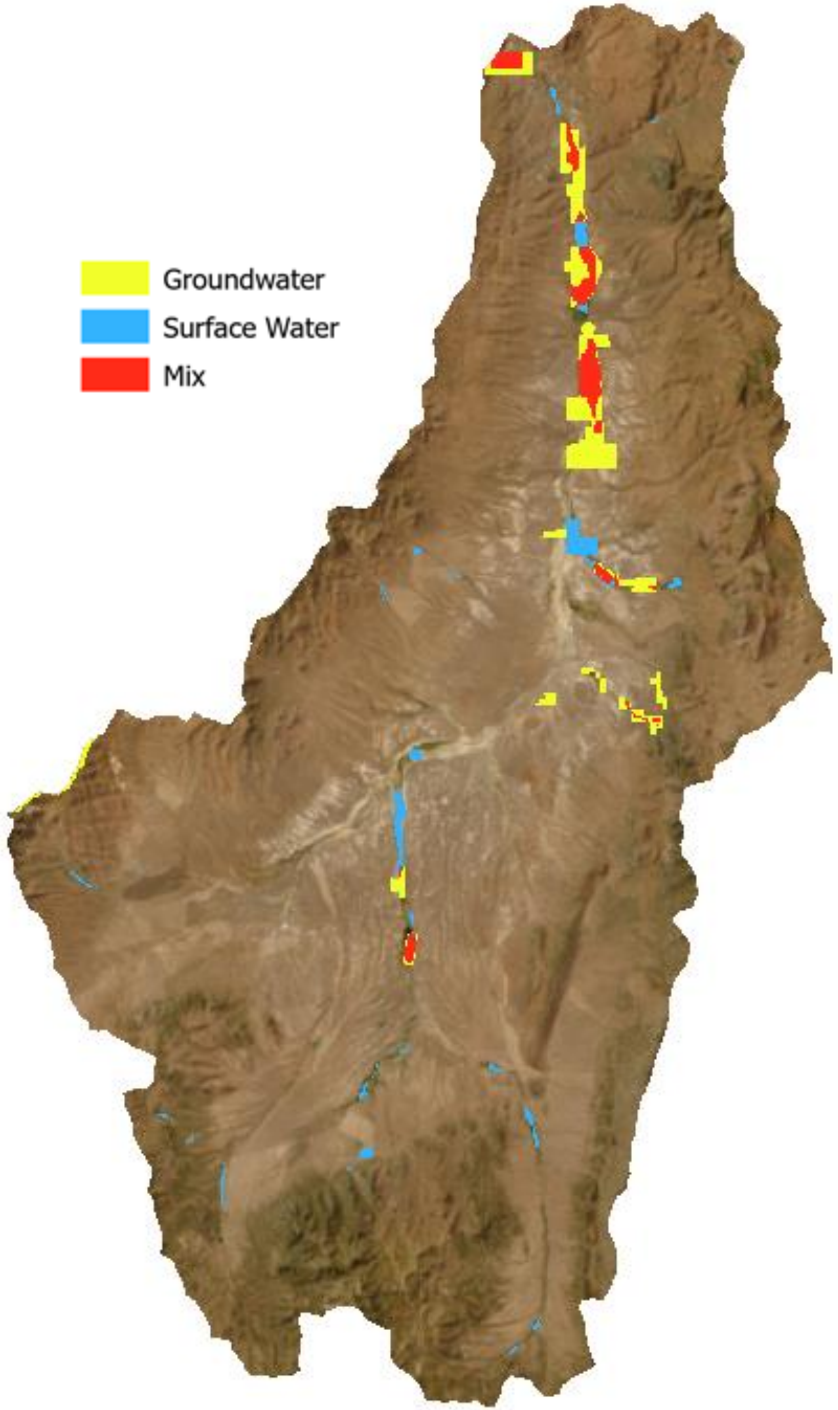
* PRELIMINARAY RESULTS * CONSUMPTIVE USE INVENTORY & DATABASE

Pine Valley



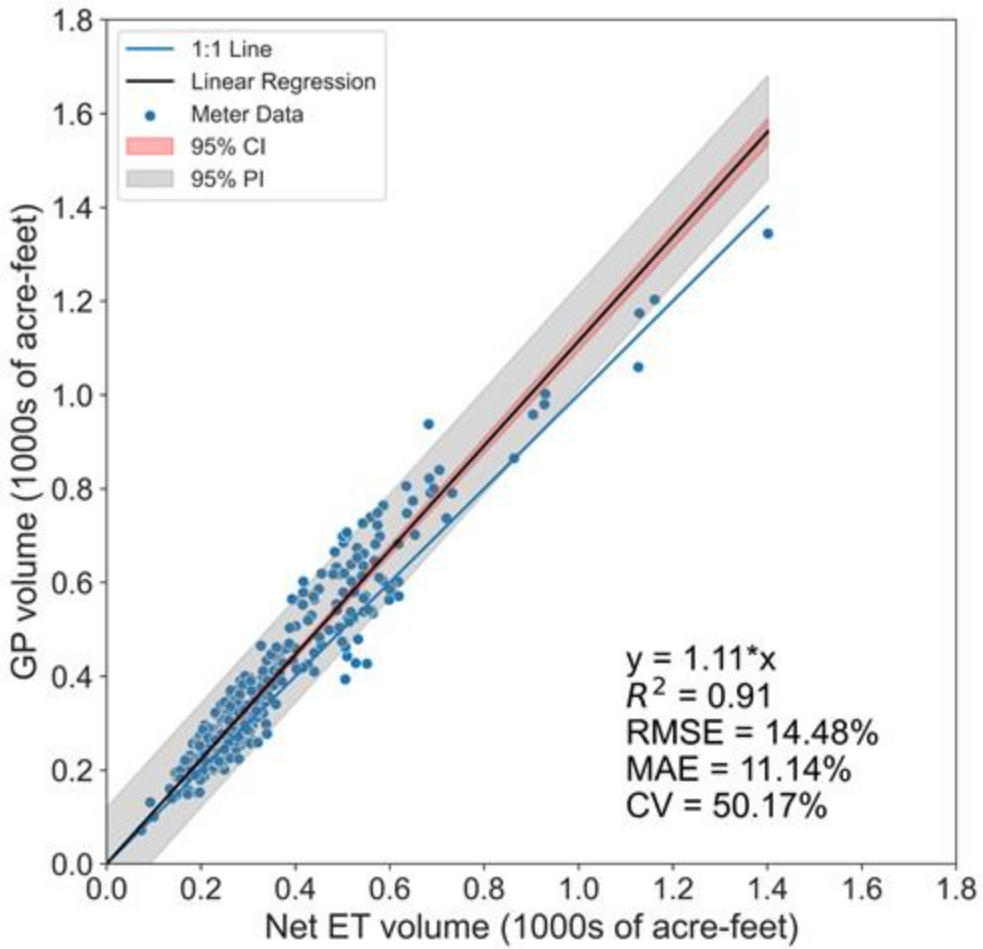


Mean groundwater use by period

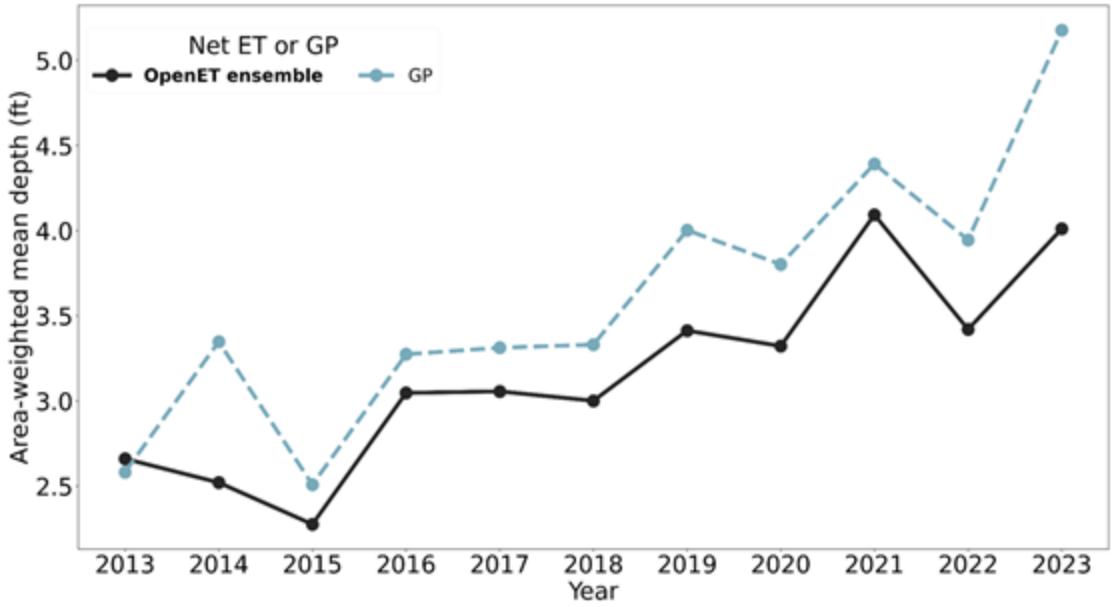
	Net ET (acre-ft)	AR (acre-ft)	Net ET (ft)	AR (ft)
1985-1994	2,015	3,821	2.54	3.68
2012-2023	3,442	5,920	2.39	3.28

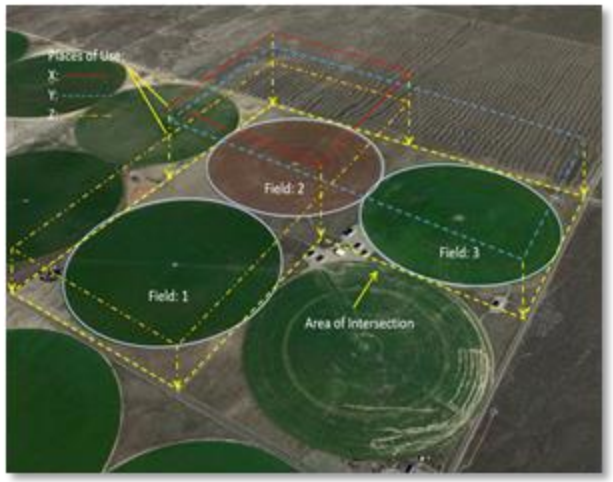
* PRELIMINARAY RESULTS *
CONSUMPTIVE USE INVENTORY & DATABASE

Diamond Valley



Humboldt River Basin





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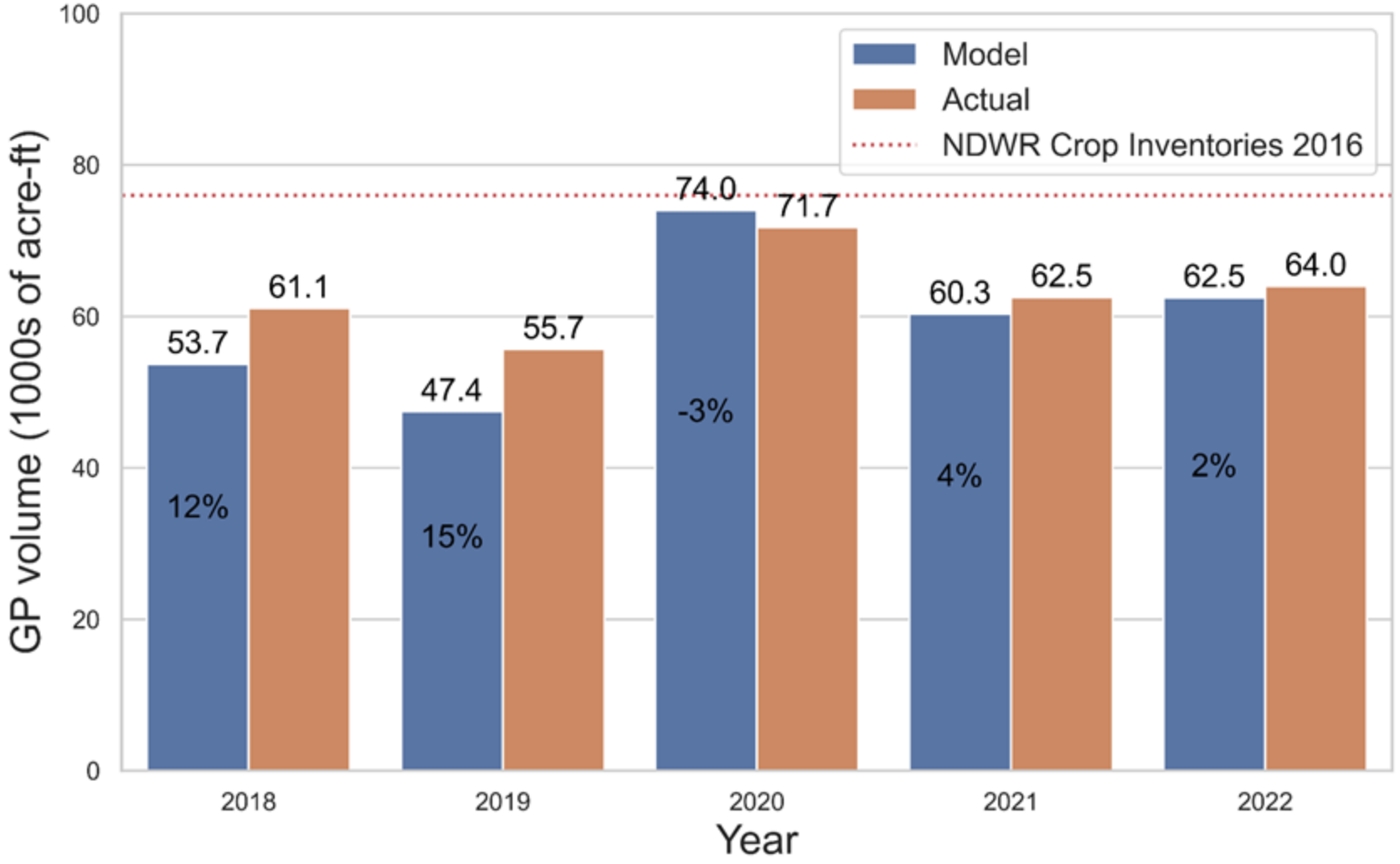
Agricultural Groundwater Pumping from Remote Sensing

Diamond Valley Basin Totals



Model estimates are within an avg. of ~7% of Actual (metered / reported) totals

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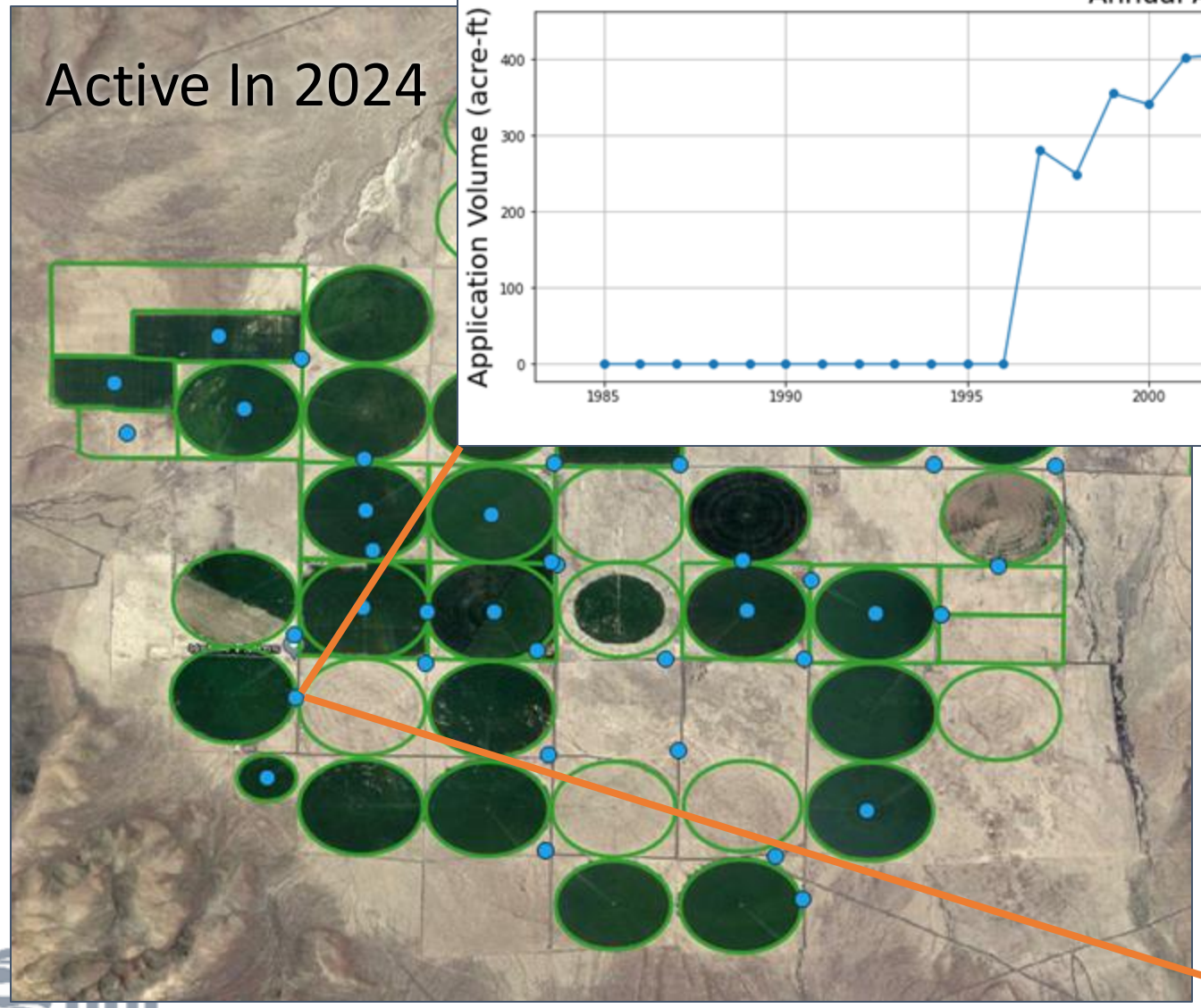
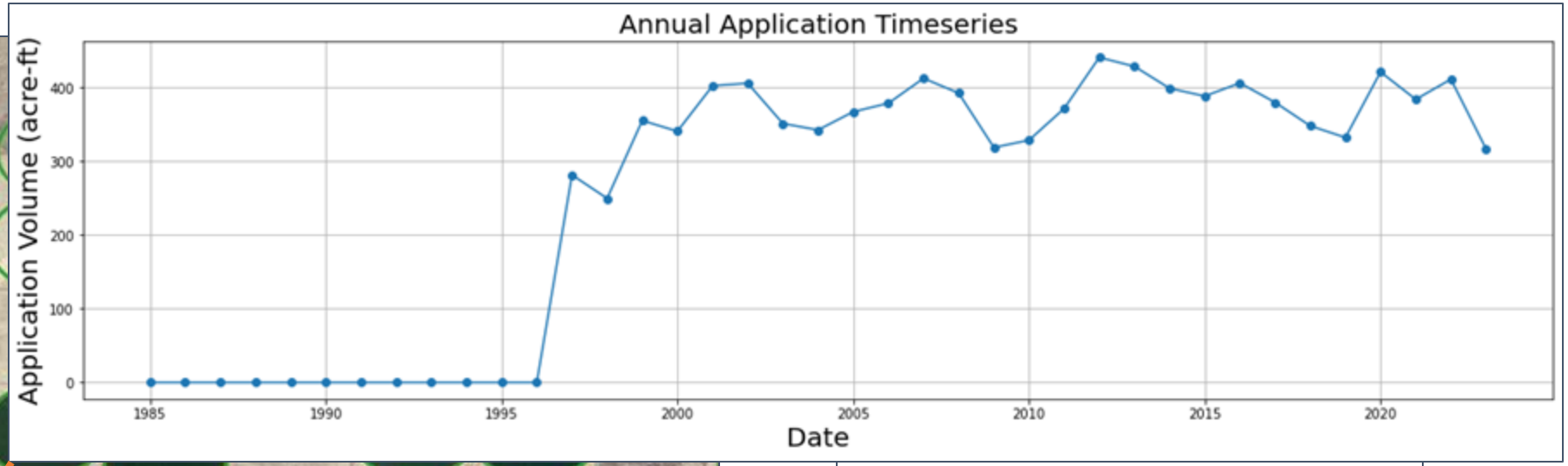
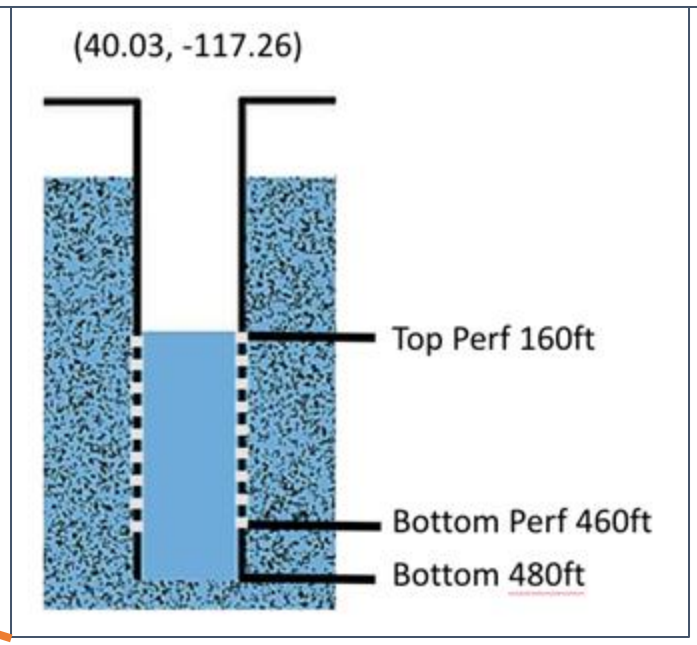
Desert Research Institute

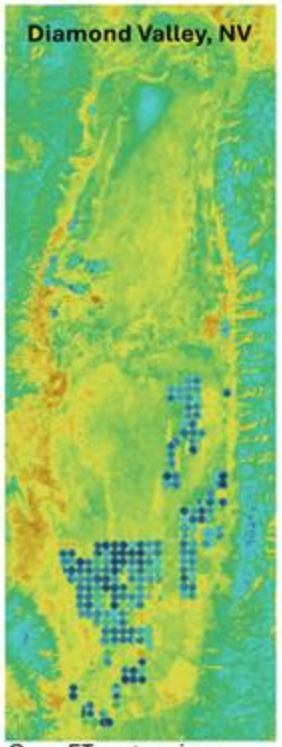
Mapping Application Rates back to Well







Agricultural Groundwater Pumping from Remote Sensing



OpenET raster view

Ott, Majumdar, Huntington, et al. (2024)

OpenET field view

Primary Datasets

- Field-scale actual ET from OpenET
- gridMET precipitation
- ET-Demands-derived effective precipitation
- Field boundaries & irrigation efficiencies

Las Vegas Valley scientists are using NASA satellites above the Earth to estimate groundwater in Nevada and throughout the West.

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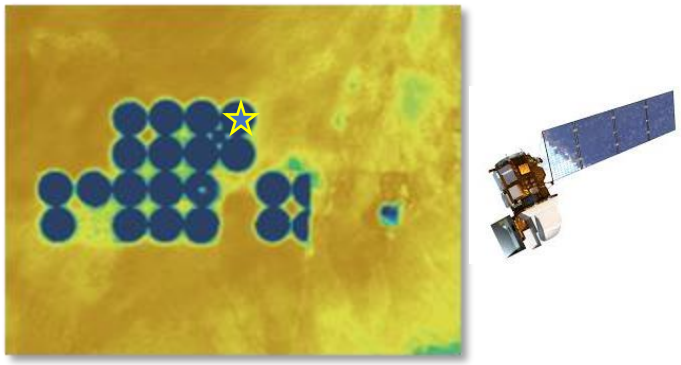
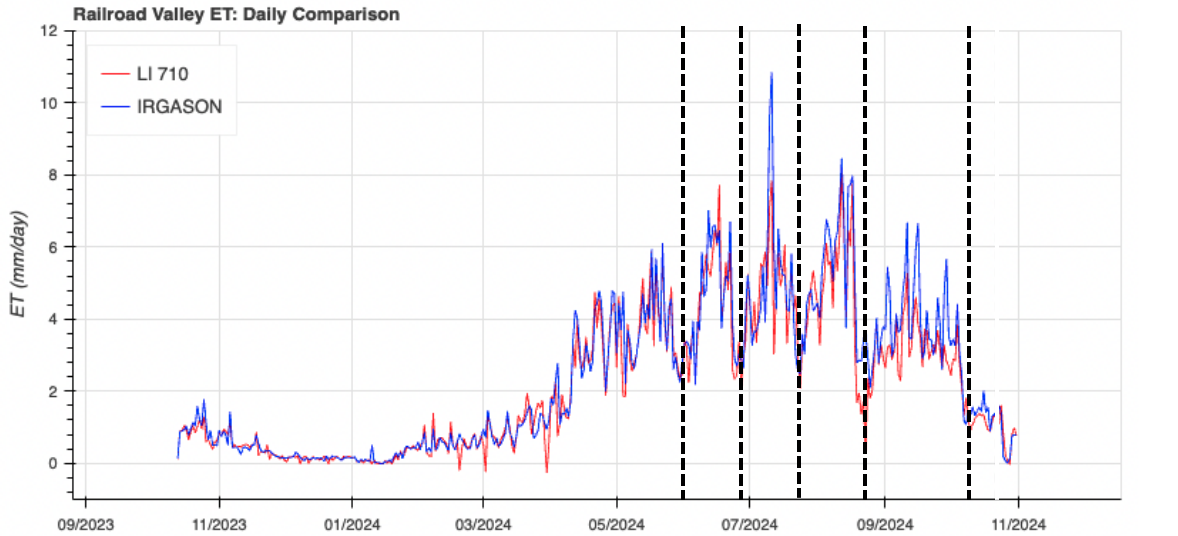
DRI Desert Research Institute

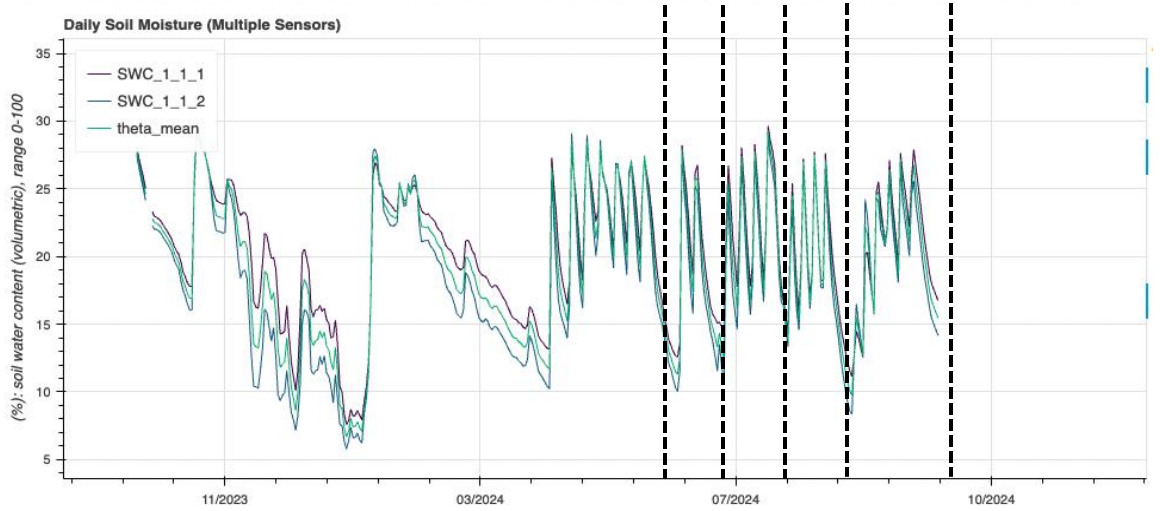
* PRELIMINARY RESULTS * - METEOROLOGICAL DATA AND MONITORING

- Comparison of two independent sensors look good
- LICOR-710 is $5K and IRGASON is $35K

Railroad Valley







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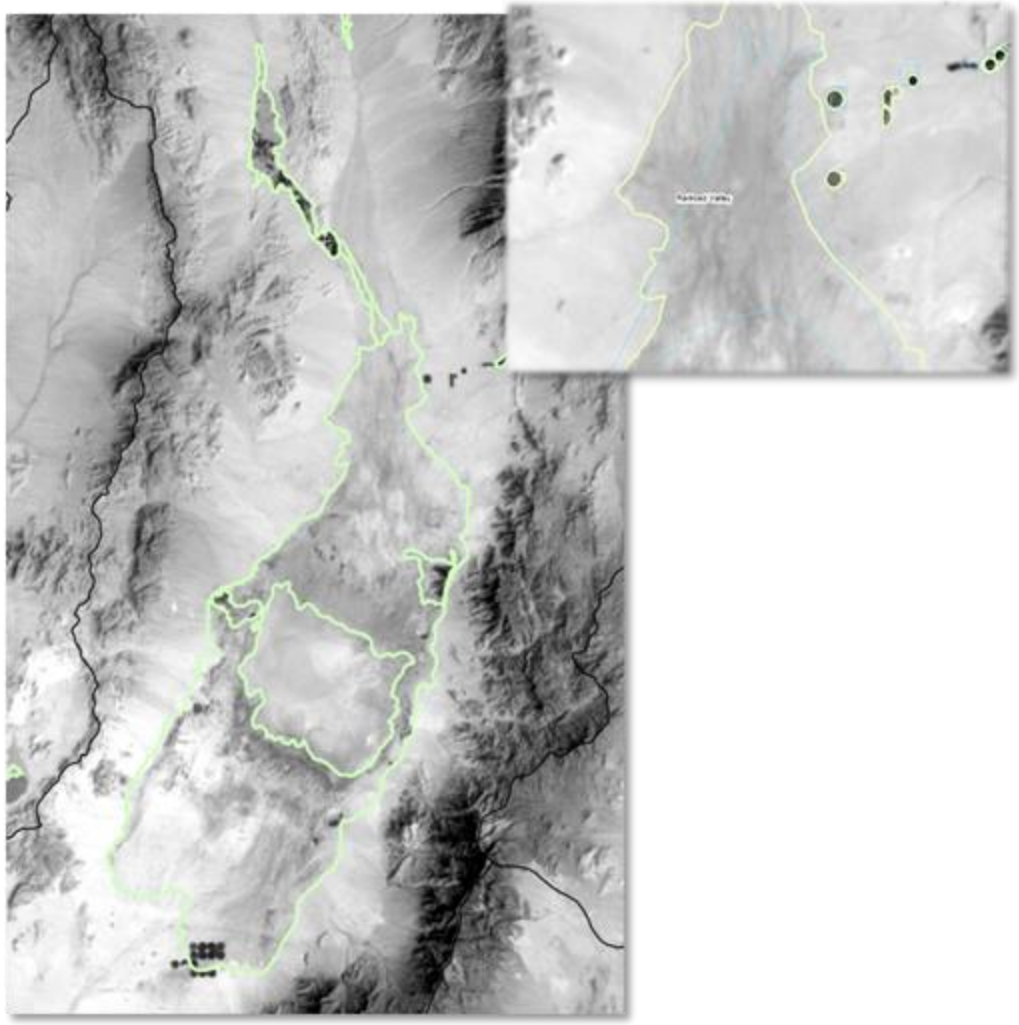
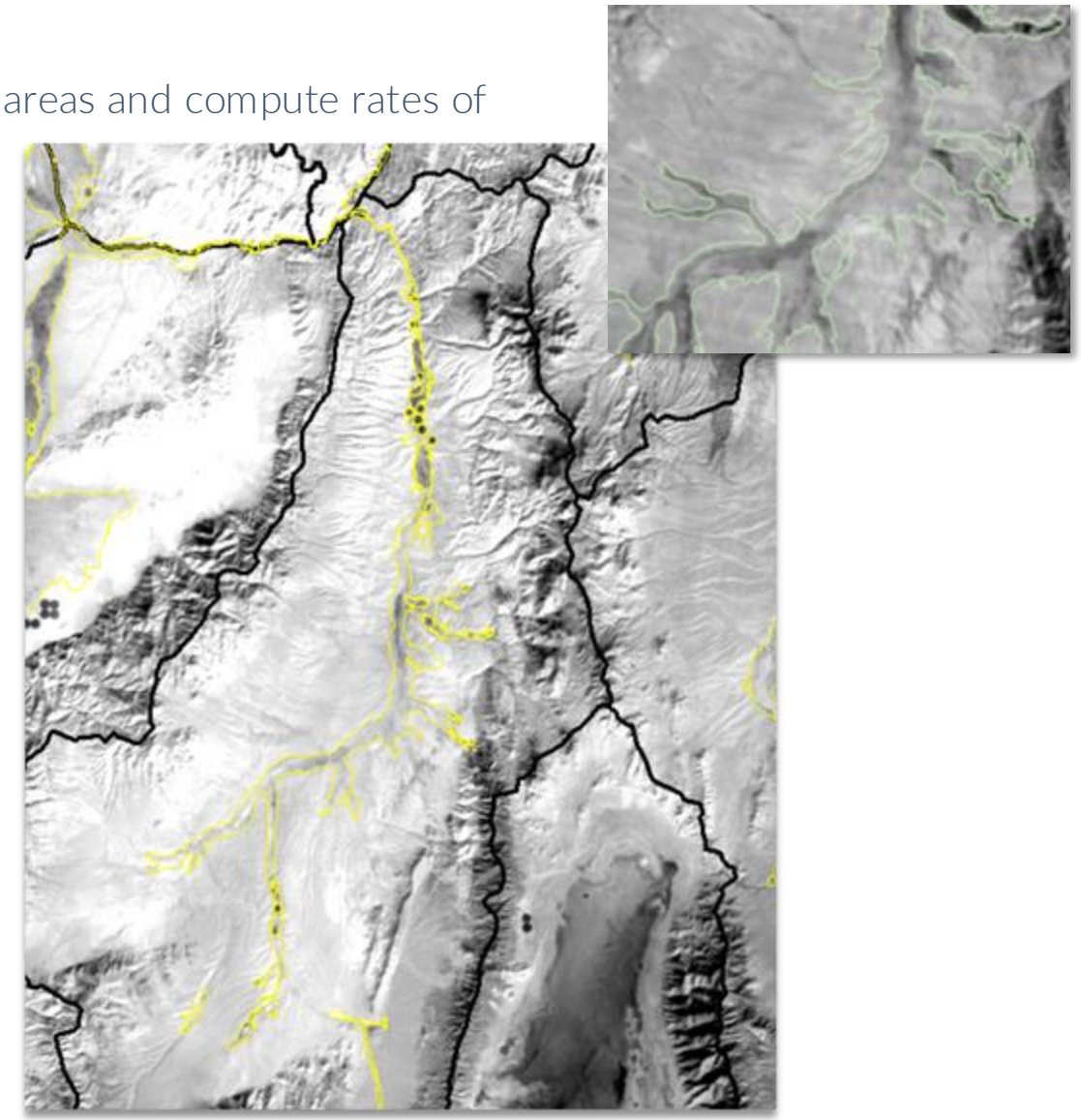
NWI Nevada Water Initiative

* PRELIMINARY RESULTS* GROUNDWATER DISCHARGE

- Update Groundwater Discharge and Water Budgets
  - Satellite and aerial imagery used to define groundwater discharge areas and compute rates of groundwater use by phreatophyte plants



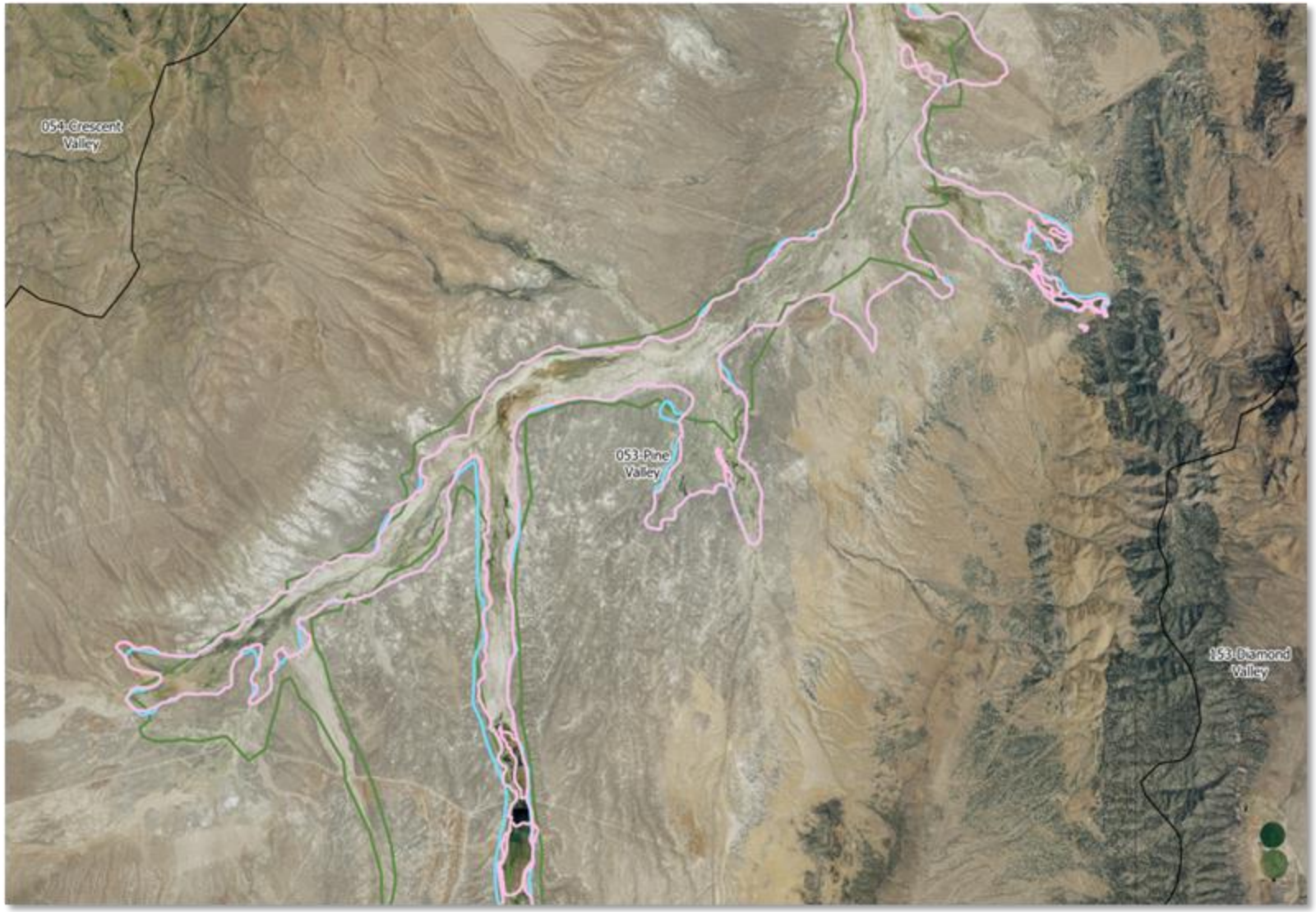
Railroad Valley



Pine Valley

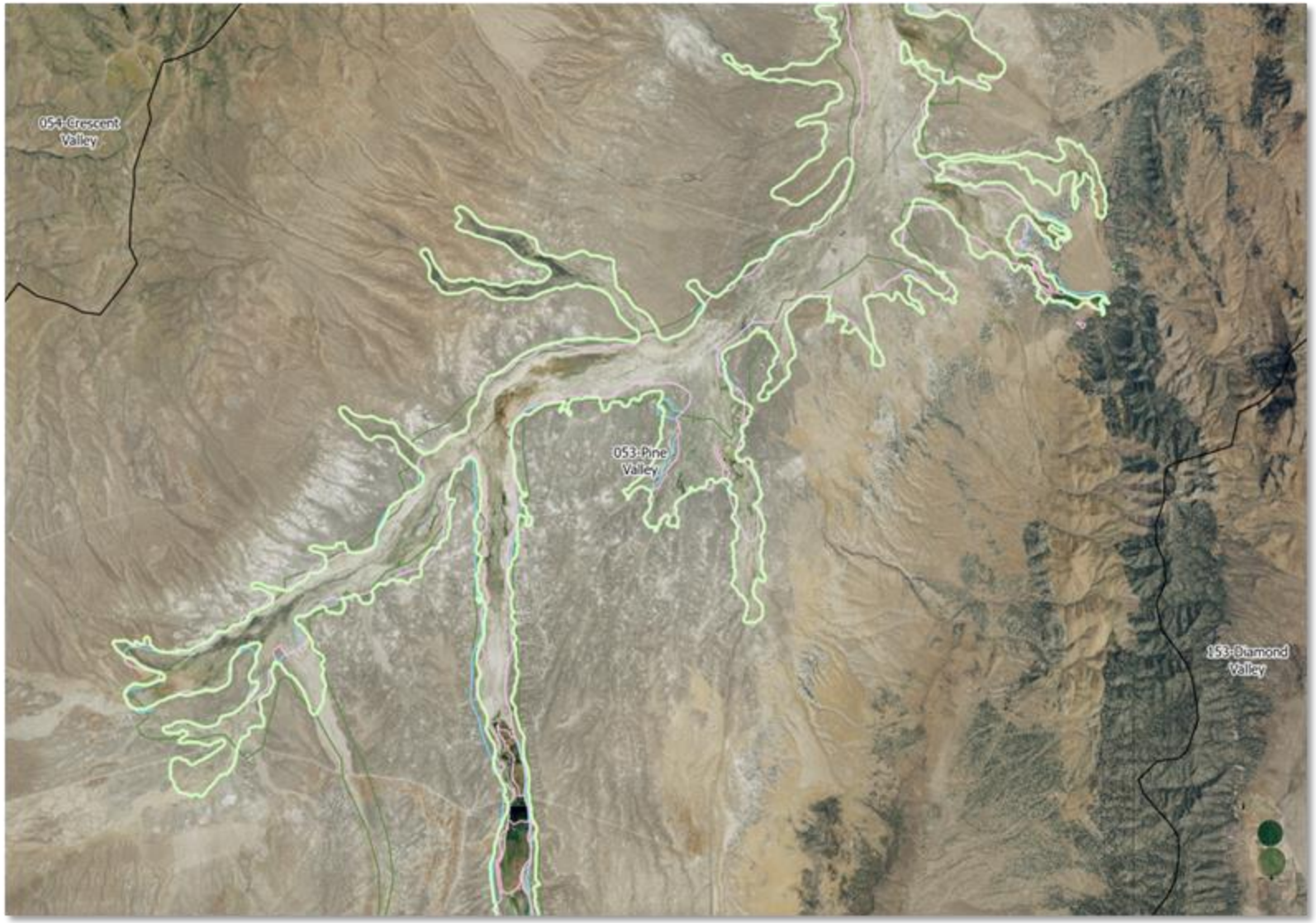
* PRELIMINARY RESULTS* GROUNDWATER DISCHARGE

- Update Groundwater Discharge and Water Budgets
  - Preliminary updates compared to previous work



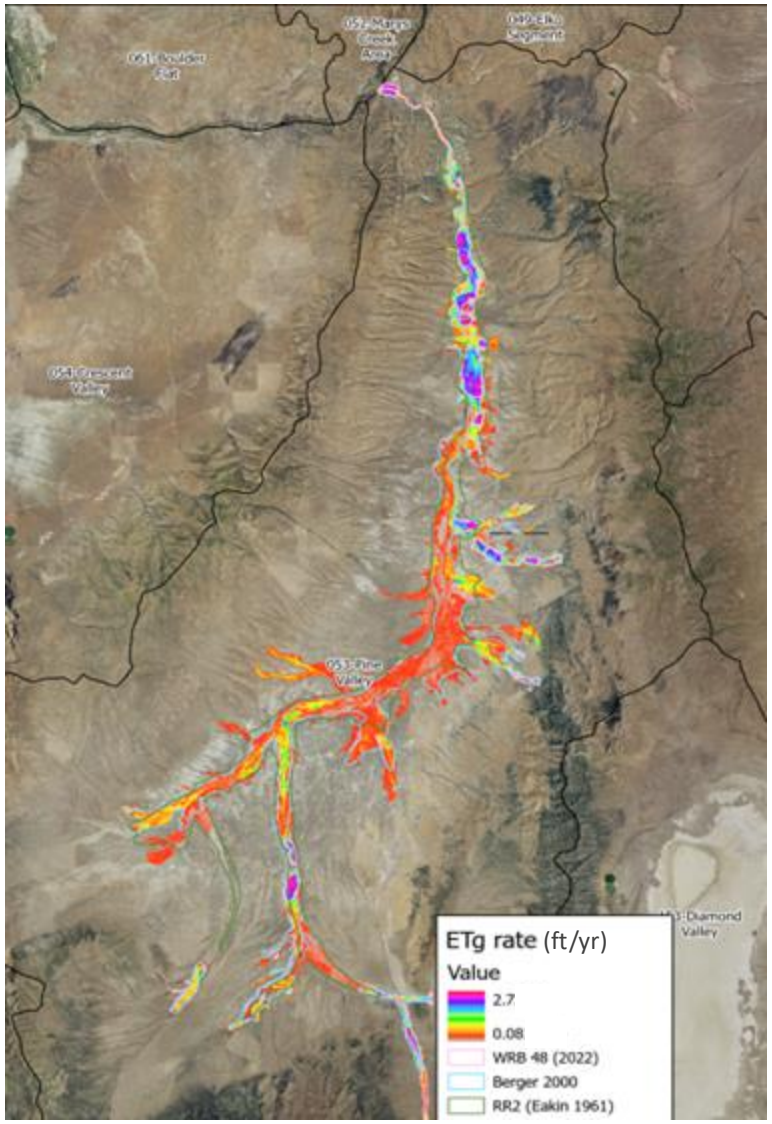
* PRELIMINARY RESULTS* GROUNDWATER DISCHARGE

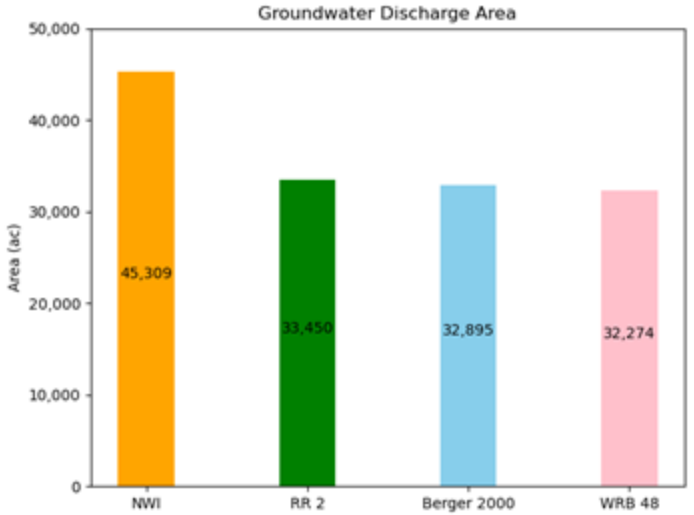
- Update Groundwater Discharge and Water Budgets
  - Preliminary updates compared to previous work

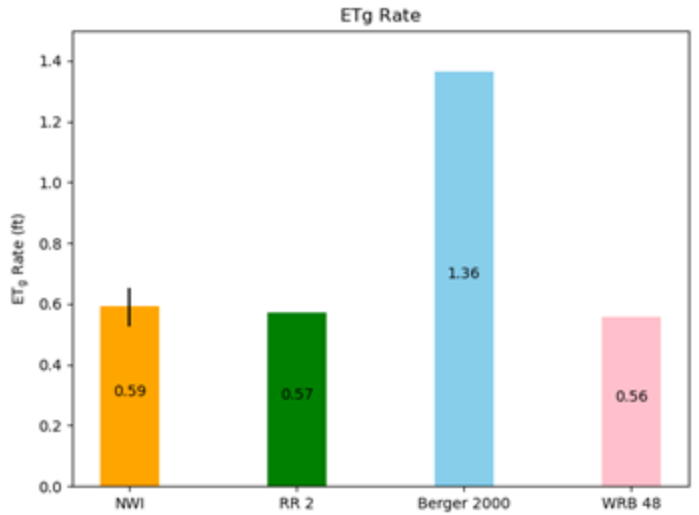


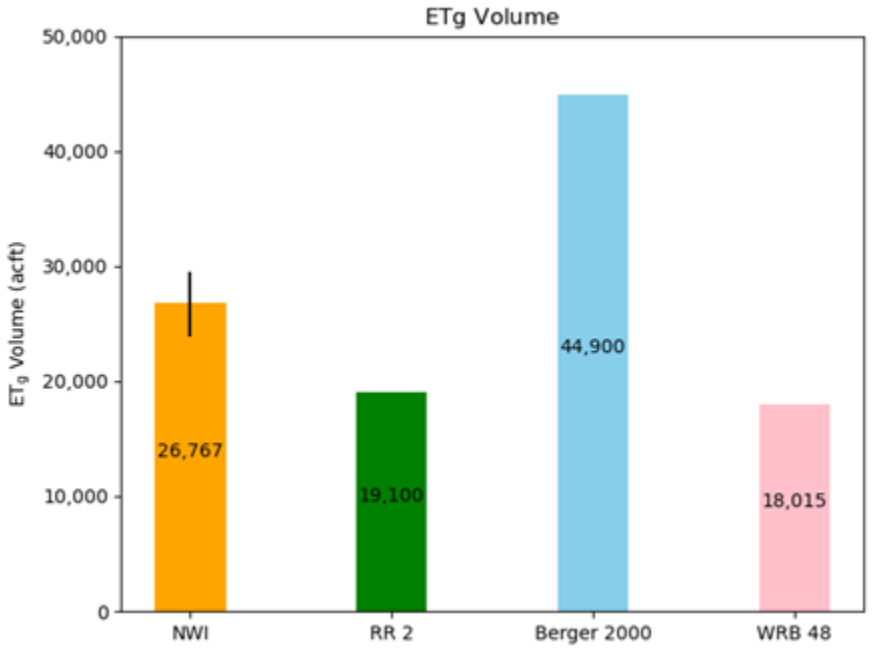
* PRELIMINARY RESULTS* GROUNDWATER DISCHARGE

- Update Groundwater Discharge and Water Budgets
  - Preliminary updates compared to previous work









NEXT STEPS

- Investigate and finalize preliminary groundwater discharge and agricultural water use estimates
- Compile basin pumping inventories and data where available, and refine splits between SW/GW
- Continue to measure ET at weather stations
- Compare satellite-based estimates of ET to weather station data and basin pumping data and inventories
- Summarize future climate and hydrology projection information for each basin
- Summarize flow system water budgets in coordination with USGS
- Continue development and application of hydrology models for demo basins in coordination with USGS
- Draft reports for internal review Q4 2025 - Q1 2026

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Nevada Water Initiative
USGS
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