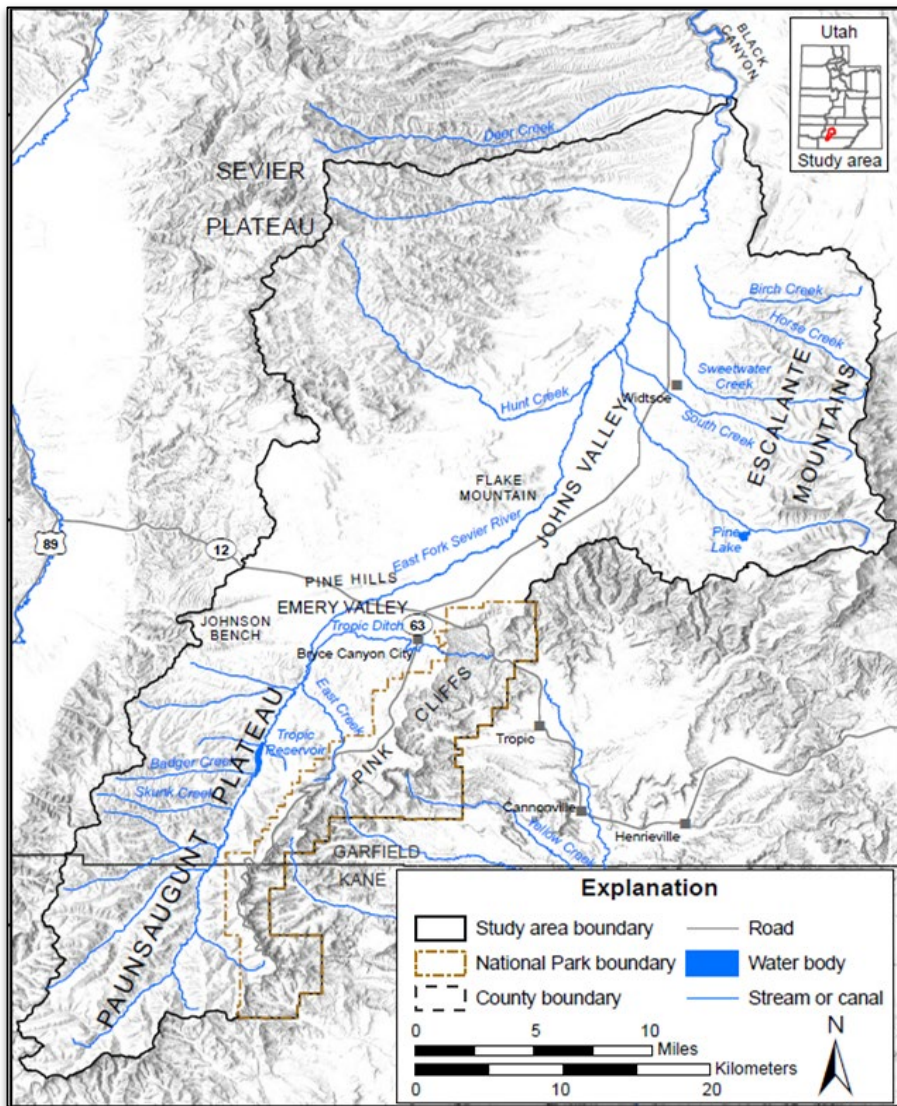


JOHNS AND EMERY VALLEYS HYDROGEOLOGY STUDY



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Bryce NP and Emery-Johns Valleys Hydrogeology and Water Budget

Janae Wallace, Trevor Schlossnagle, Nathan Payne, Kathryn Ladig, Christian Hardwick, Paul Inkenbrandt

- [Open File Report 733](#) - 2021
- GW Quality Classification Map & Petition - 2021
- [Survey Notes Article](#) - May 2021 and Jan 2024
- [Special Study 172](#) - Feb 2024



Background – Context

- Development driven by tourism to Bryce Canyon National Park (2.7 million visitors in 2018)
- Increased demand on water resources, especially in Emery Valley
- East Fork Sevier River – dominantly diverted for irrigation to Tropic Ditch- April to October-(drainage to Paria River)



Background - Study Goals & Products









- Characterize hydrogeology
 - Groundwater level measurements
 - Discharge and seepage of streams and springs
 - Groundwater/surface water connection
 - Valley-Fill aquifer water budget
- Assess groundwater quality
- Determine groundwater ages & sources

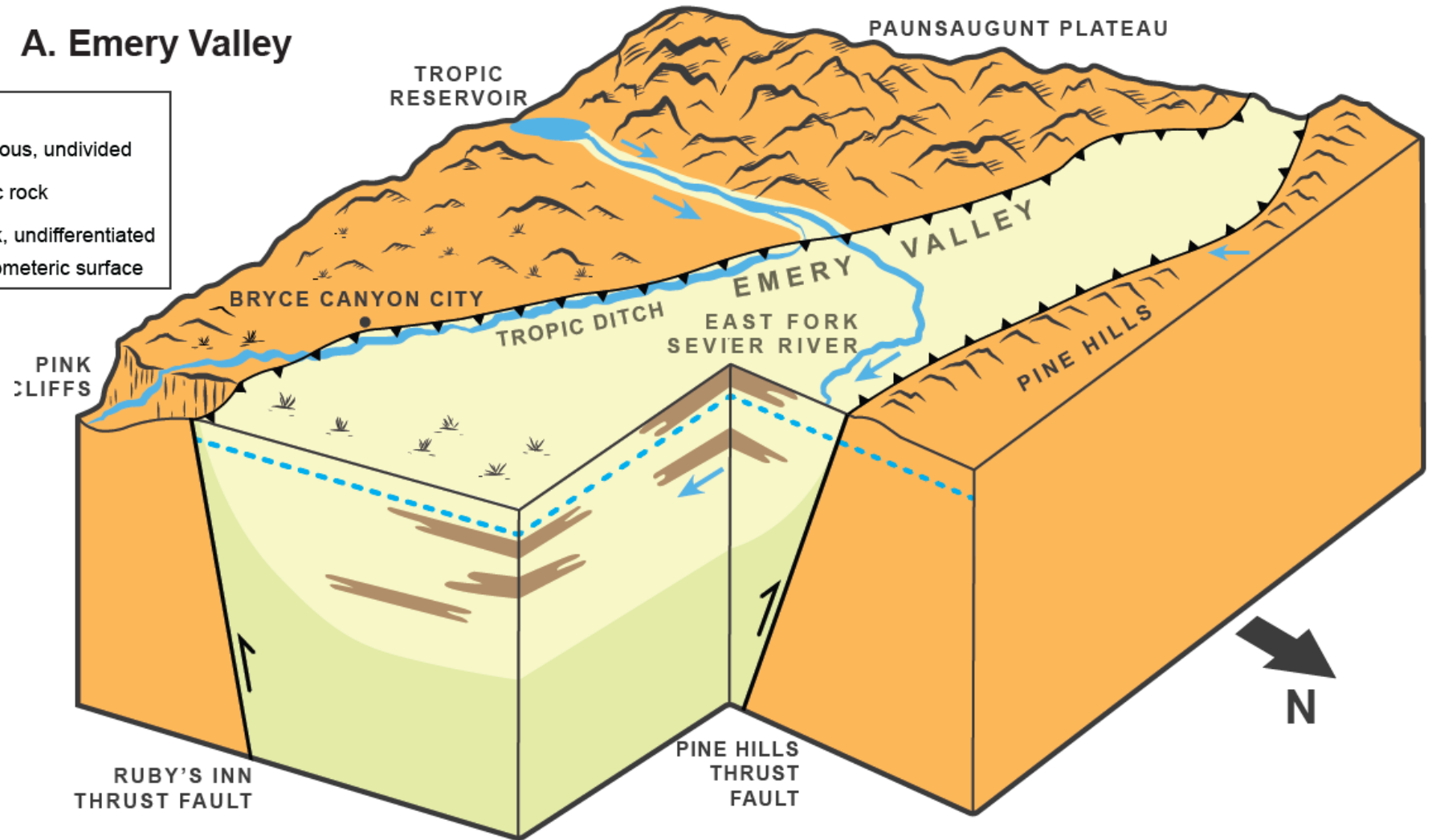


Hydrogeology & Conceptual Model

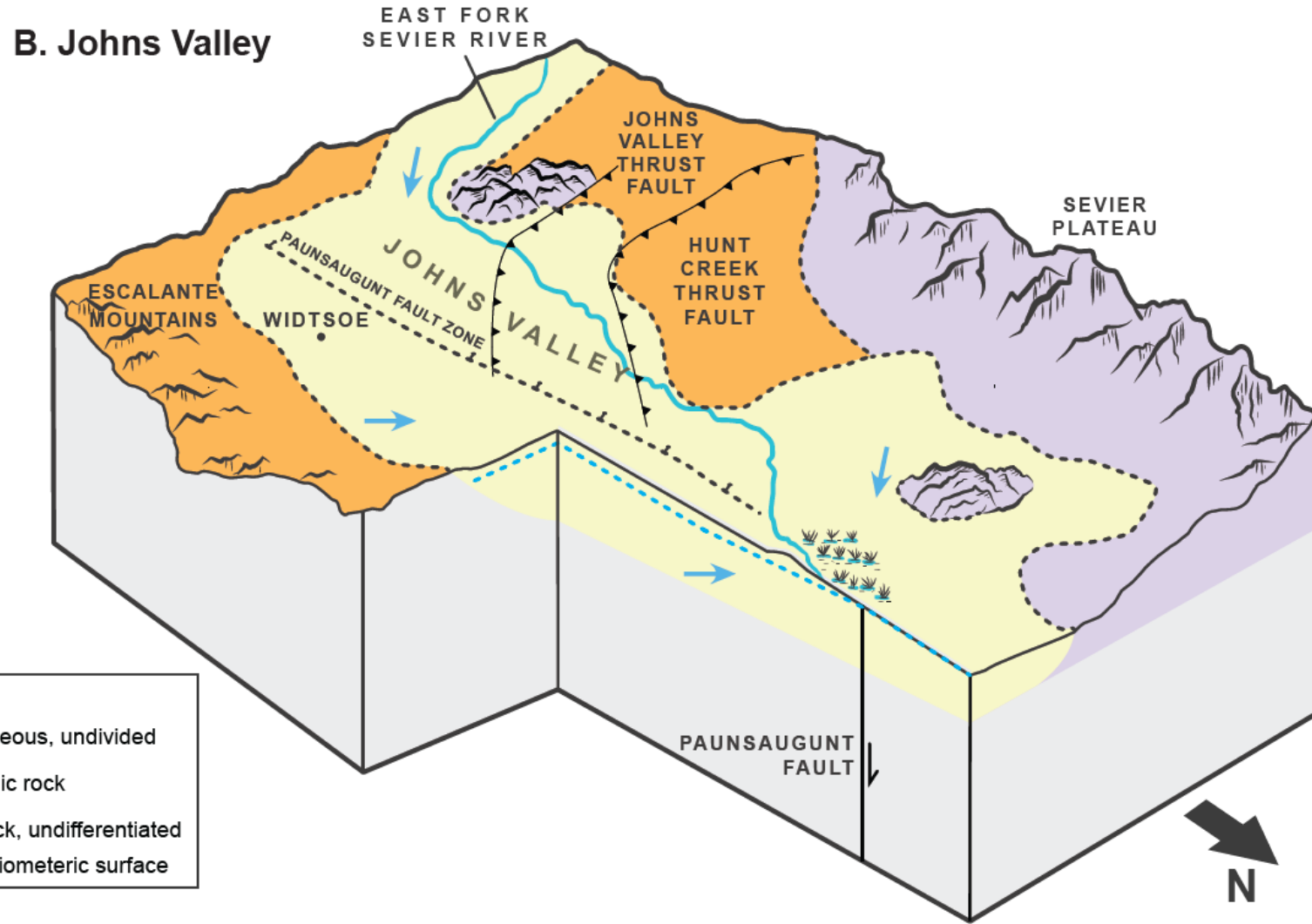
A. Emery Valley

Explanation









 Fine-grained unconsolidated	 Cretaceous, undivided
 Coarse-grained unconsolidated	 Volcanic rock
 Claron Formation	 Bedrock, undifferentiated
 Groundwater flow	 Potentiometric surface



Hydrogeology & Conceptual Model

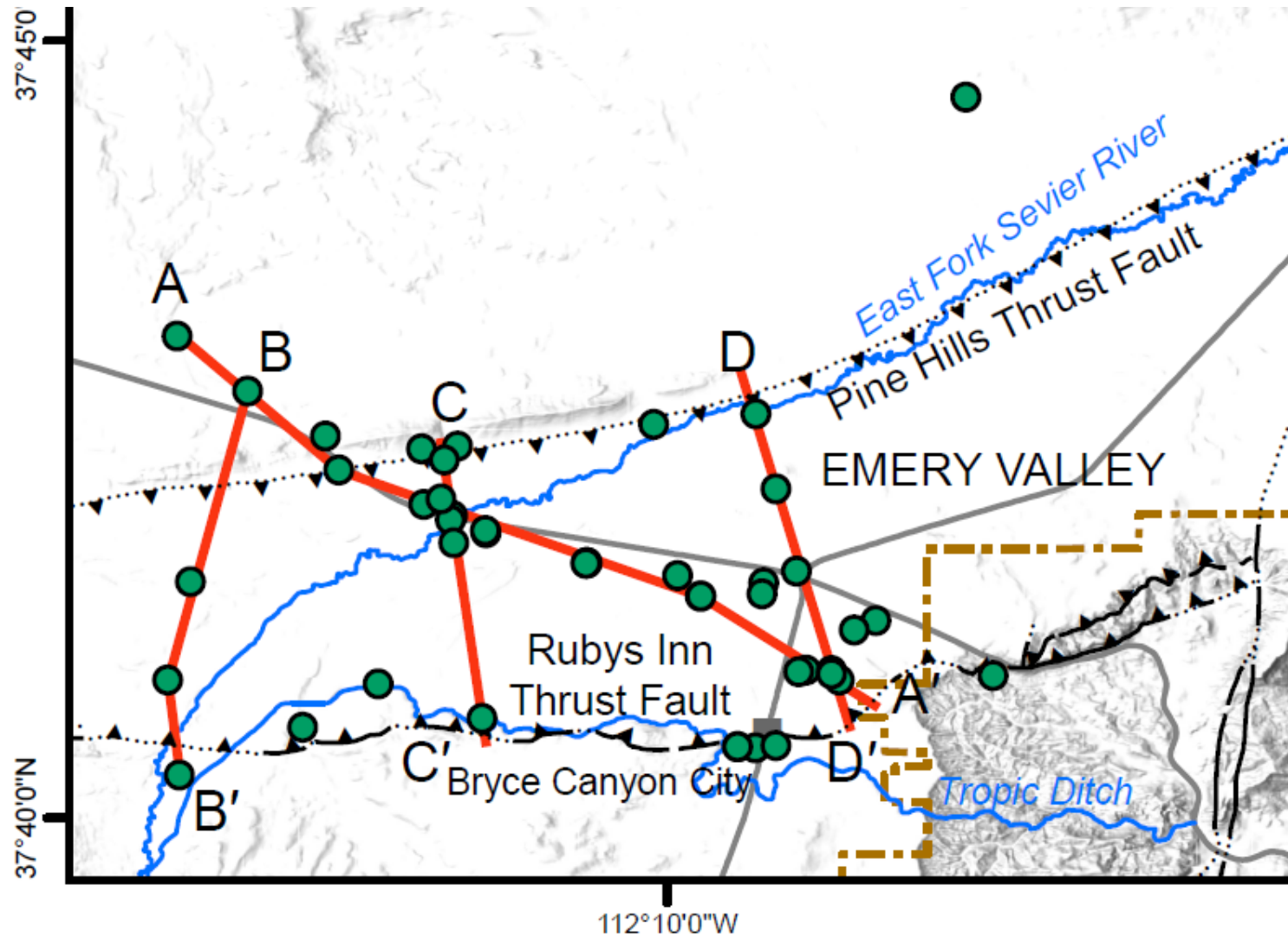


Explanation

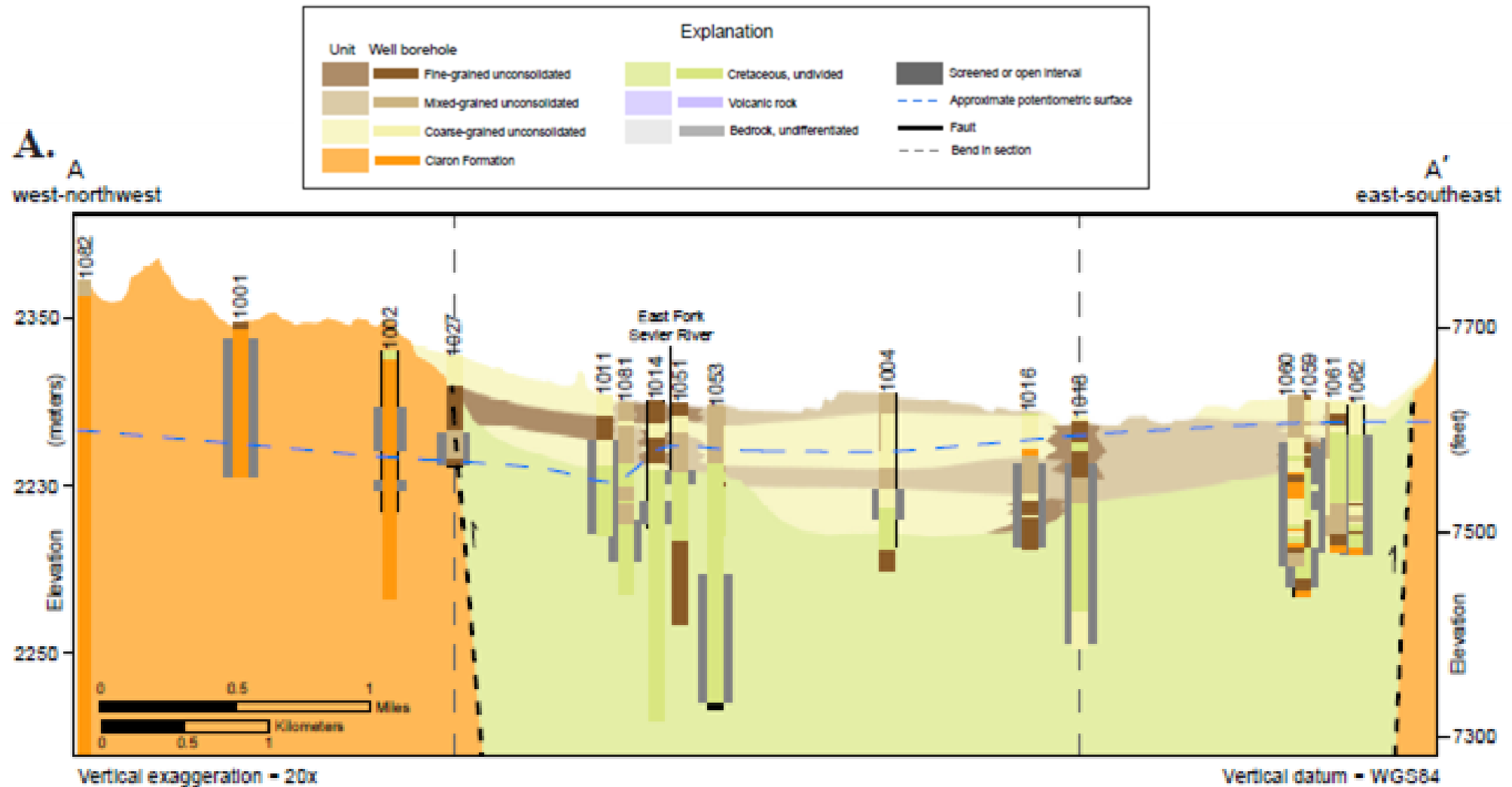
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Basin Fill Cross Sections



Basin Fill Cross Sections

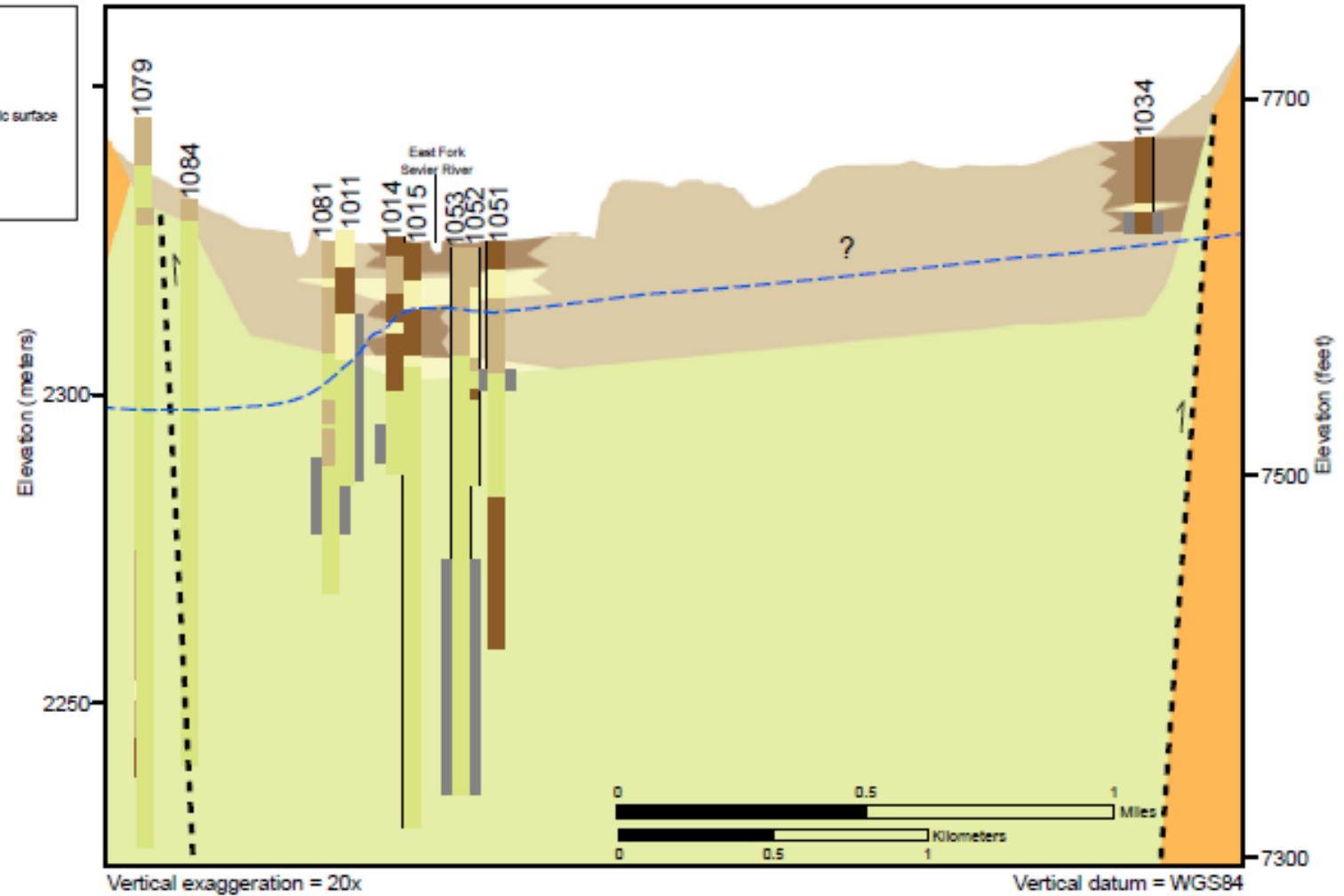
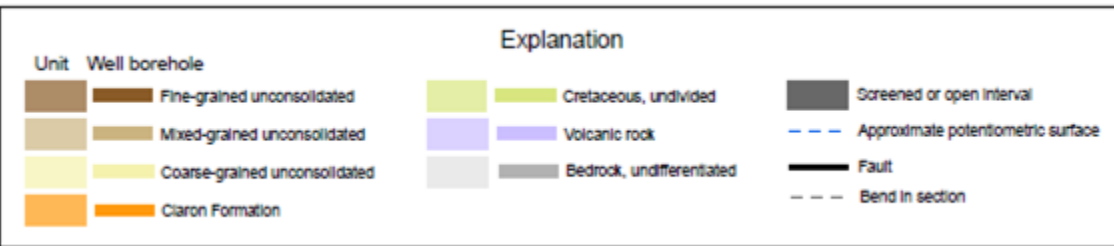


Basin Fill Cross Sections

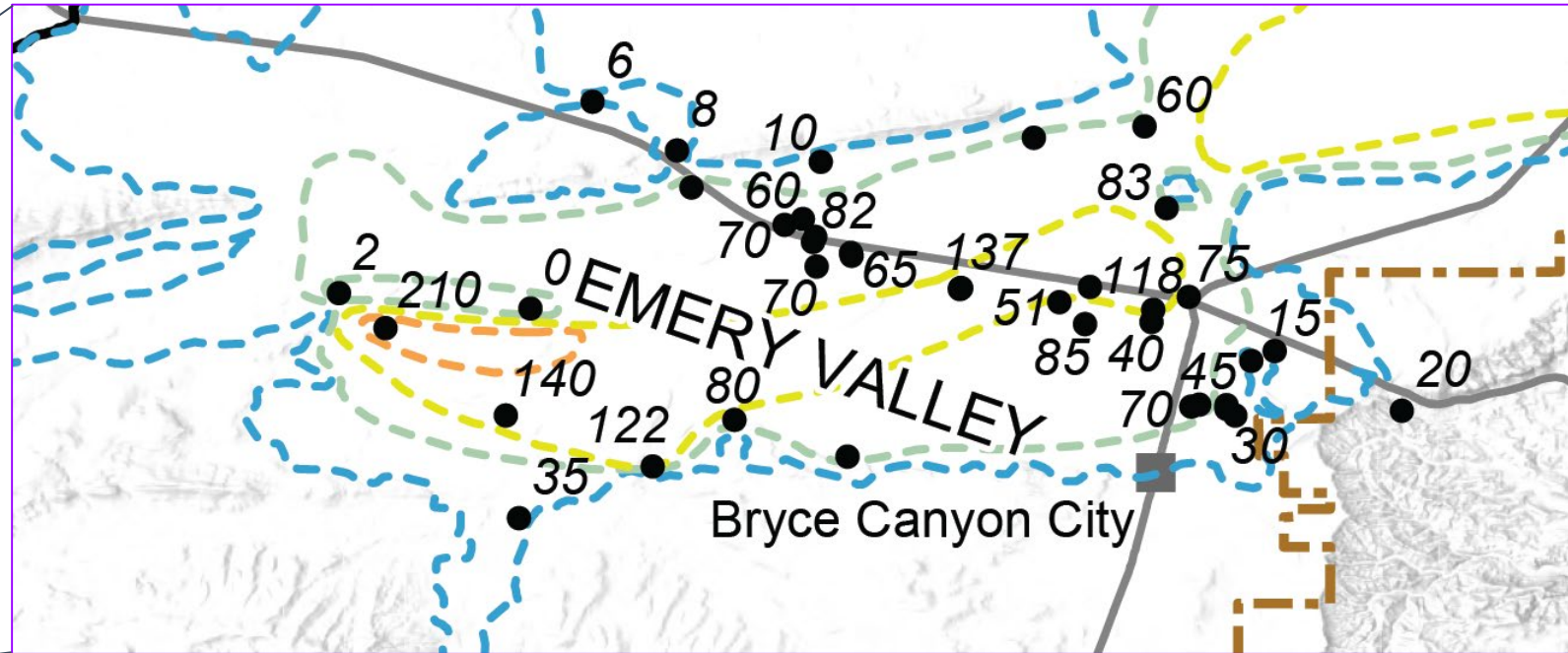
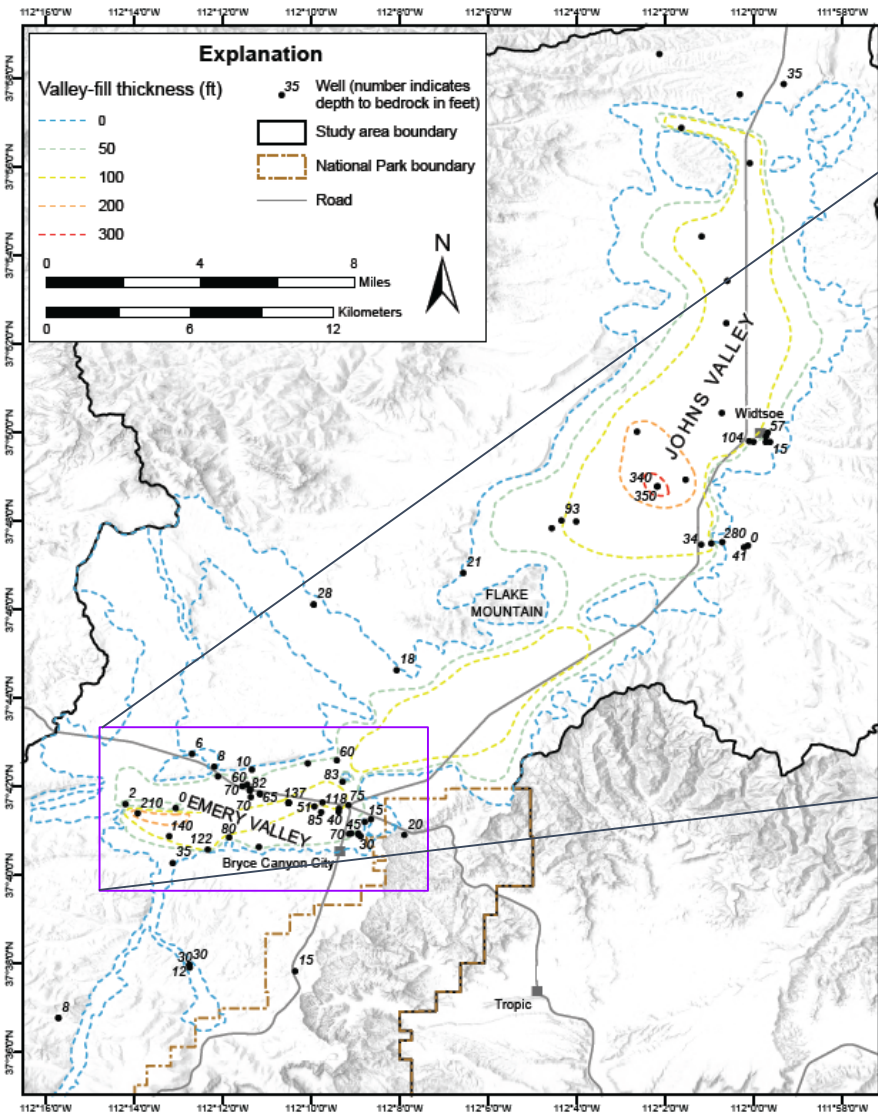
C.

C
north

C'
south



Valley-fill Thickness



Isopach map



Aquifer Transmissivity

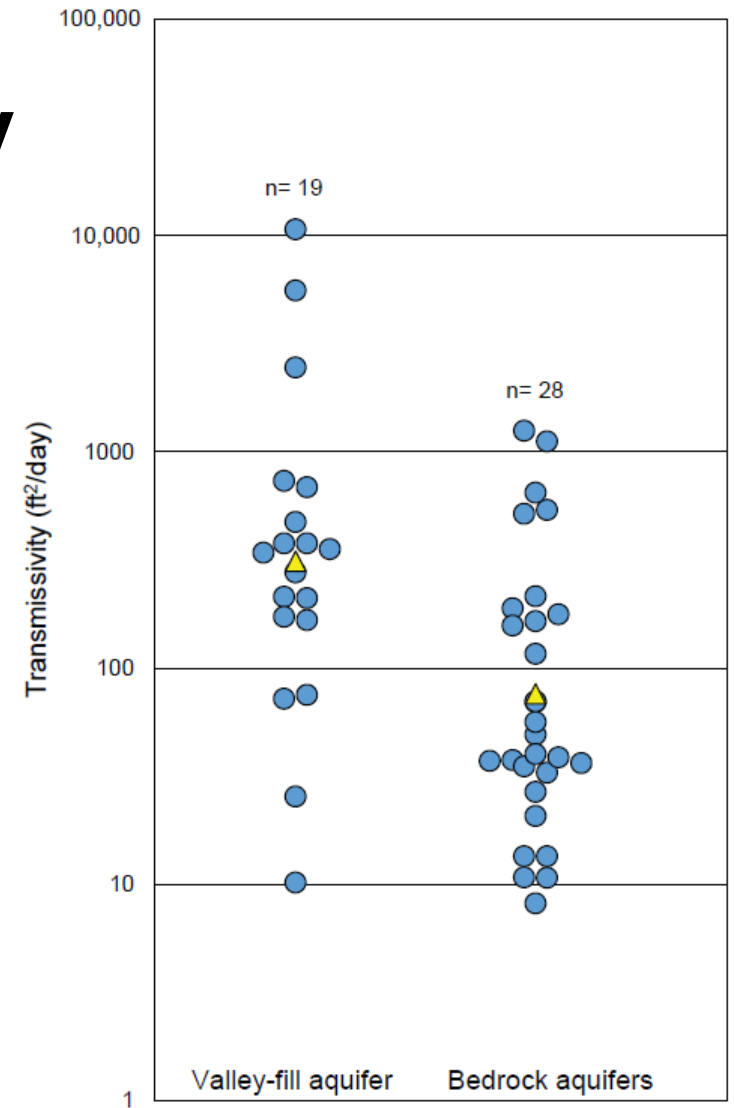
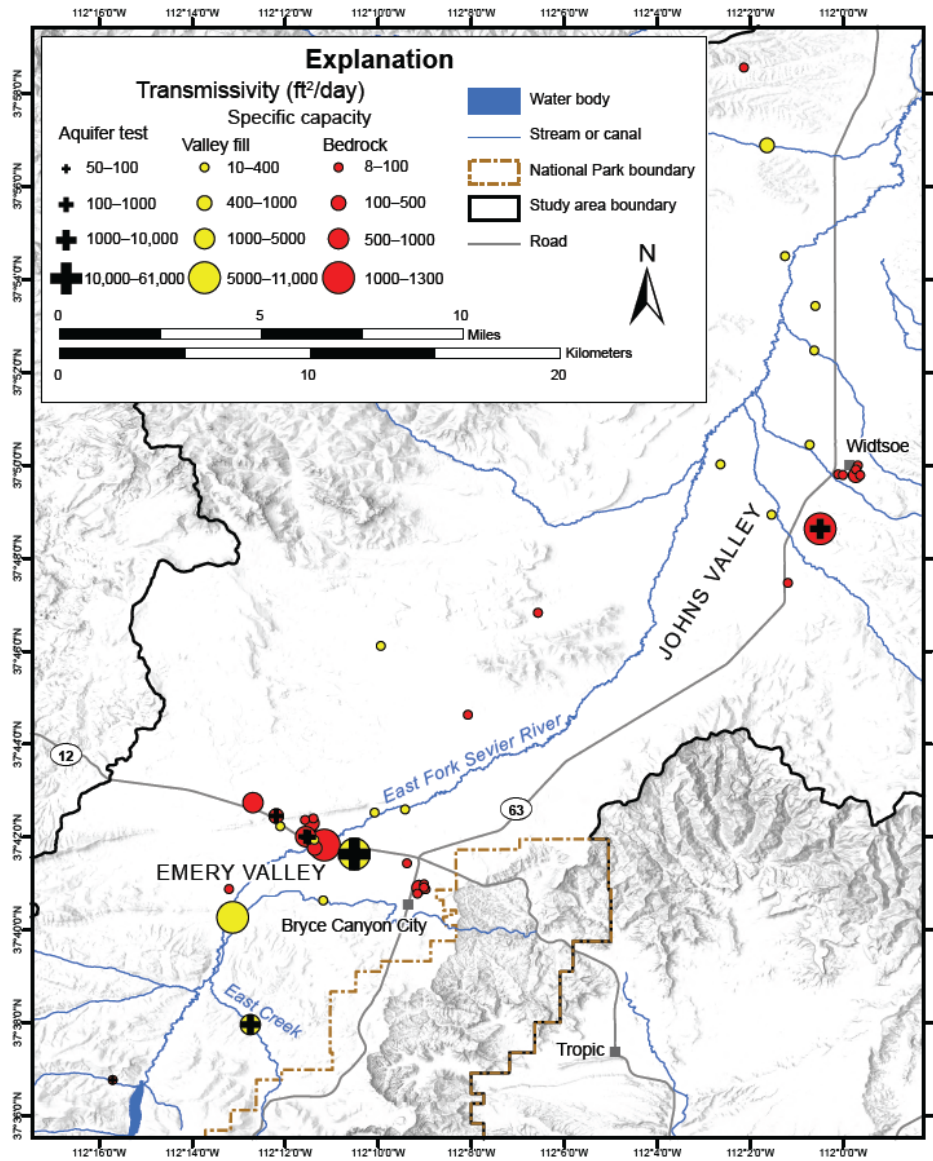
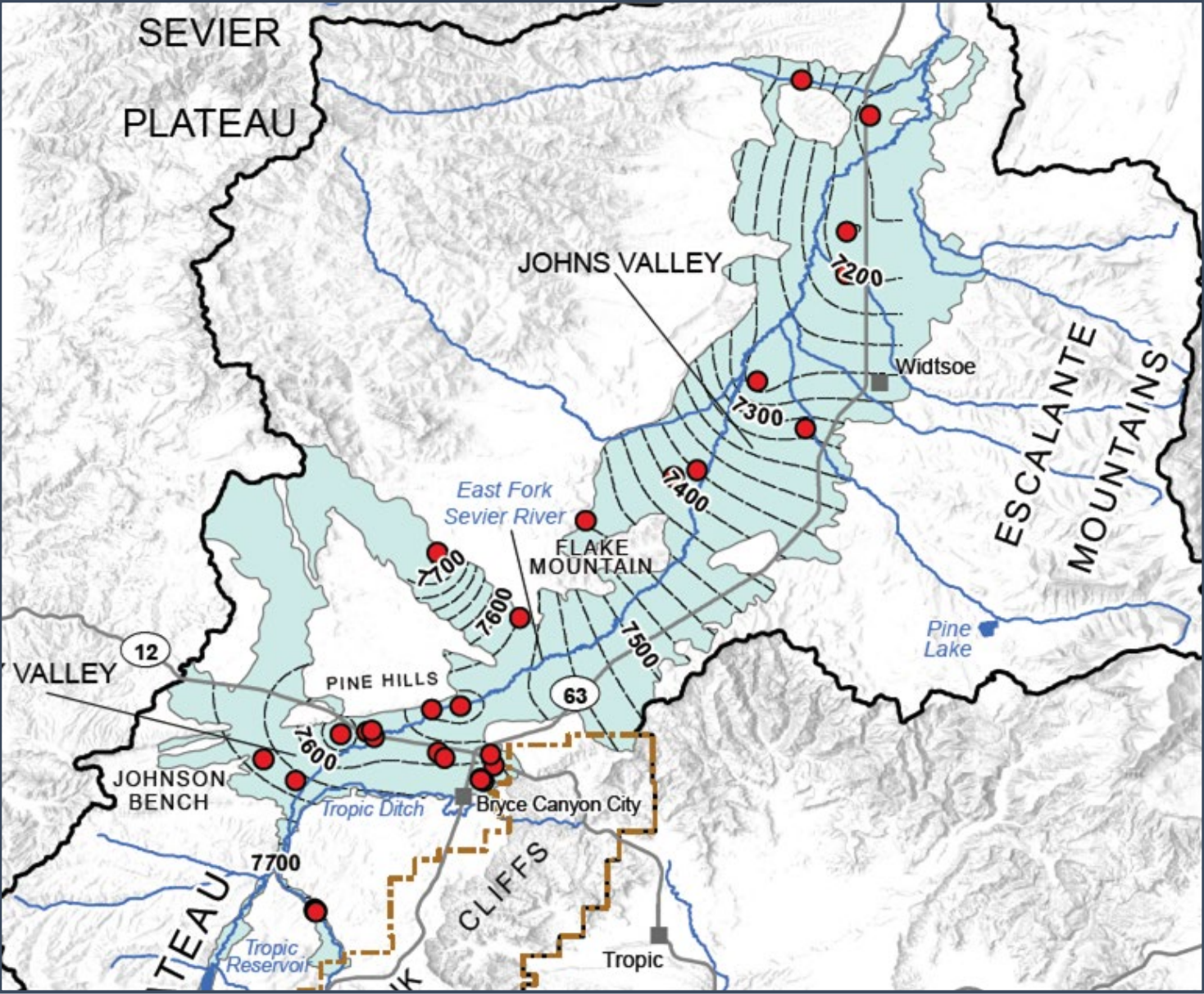


Figure 10. Transmissivity values for study area aquifers. Geometric mean shown as yellow triangle.



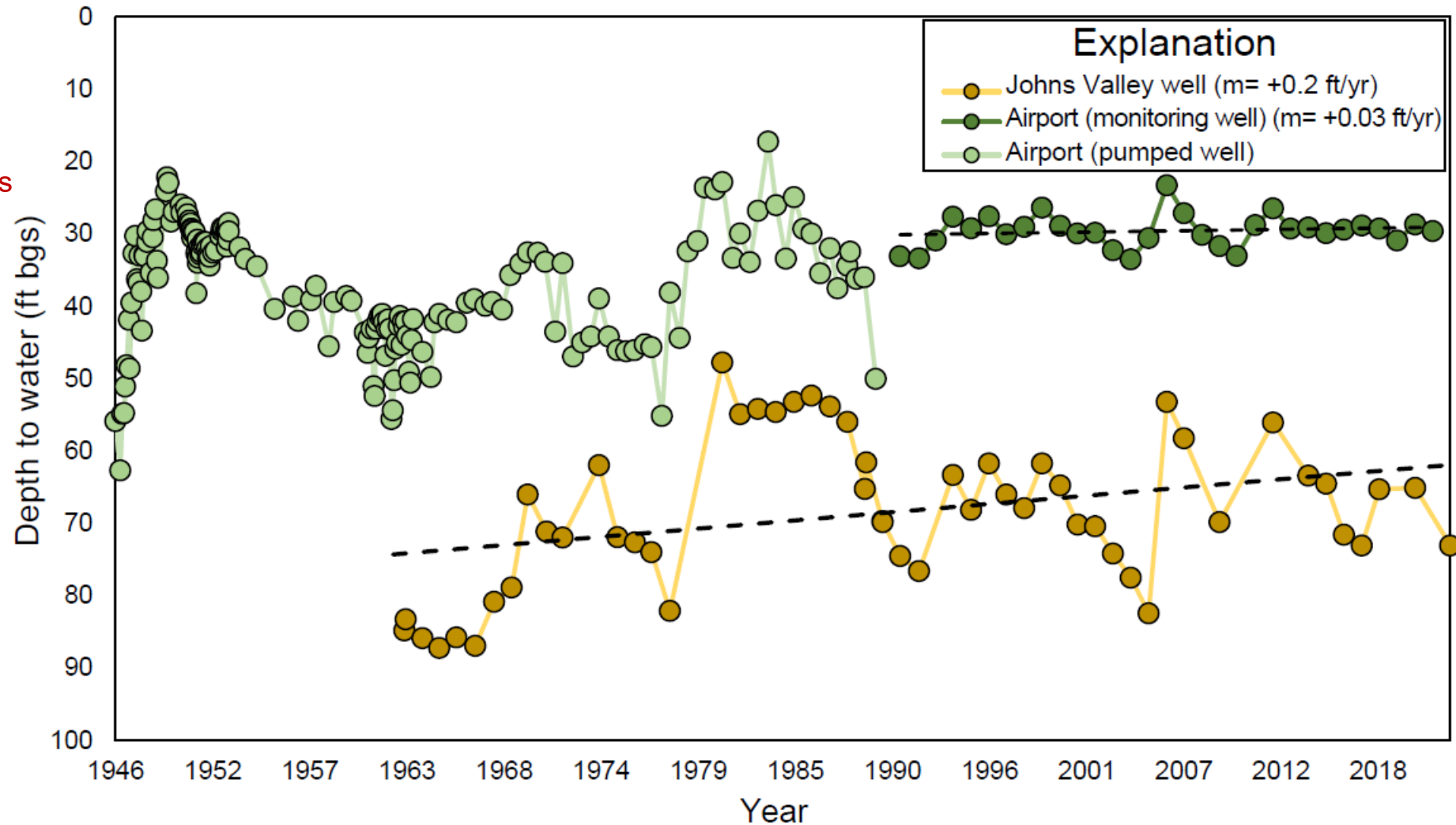
Groundwater Levels

Water level
campaigns
from 2018-2022
spring & autumn



Long-Term Water-Level Monitoring (USGS Data)

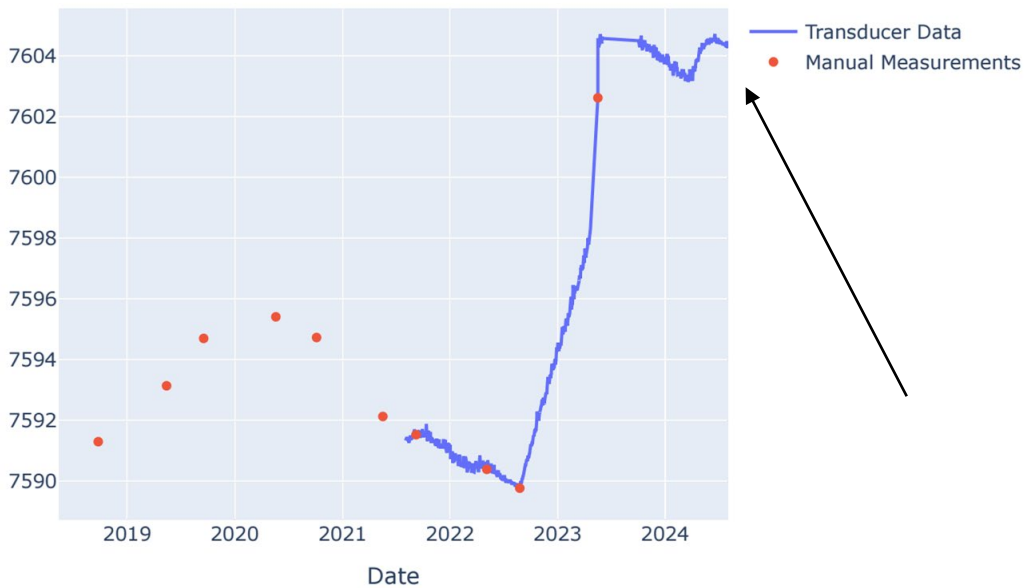
Slight Increase in
water level over 30
years-
Long-term change is
negligible



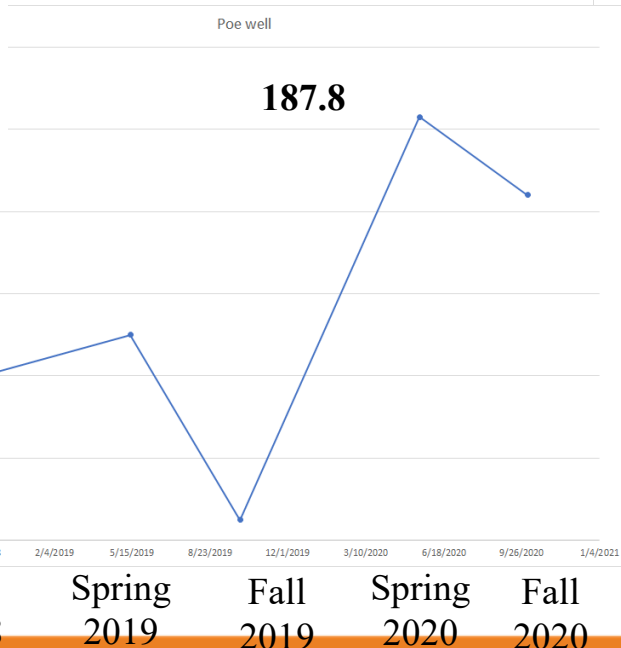
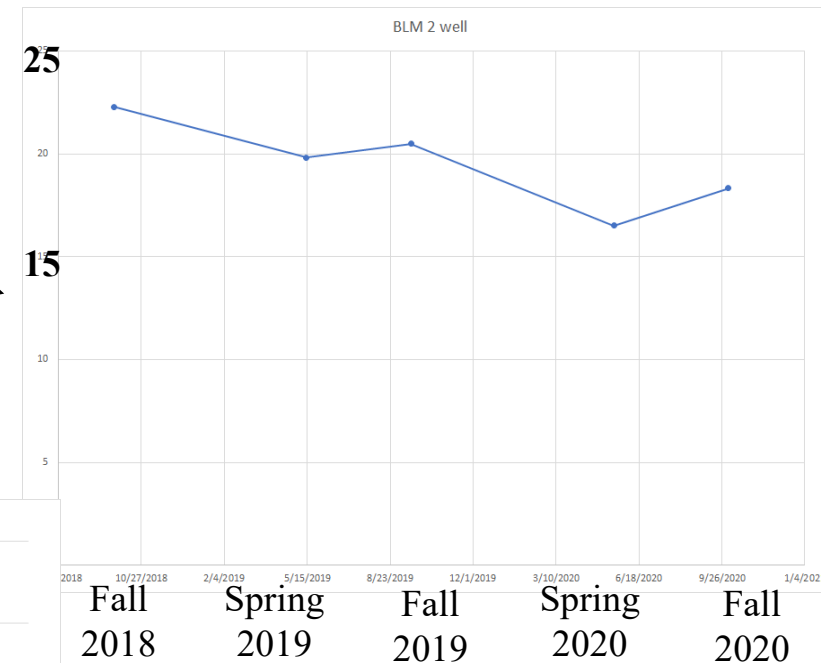
Water Level Fluctuations

BC 23

BC 24



ALLUVIAL
shallow wells
~4 ft change
(during the
study up to 17
ft post study)



BEDROCK
deep well
~1 ft change

BC 13

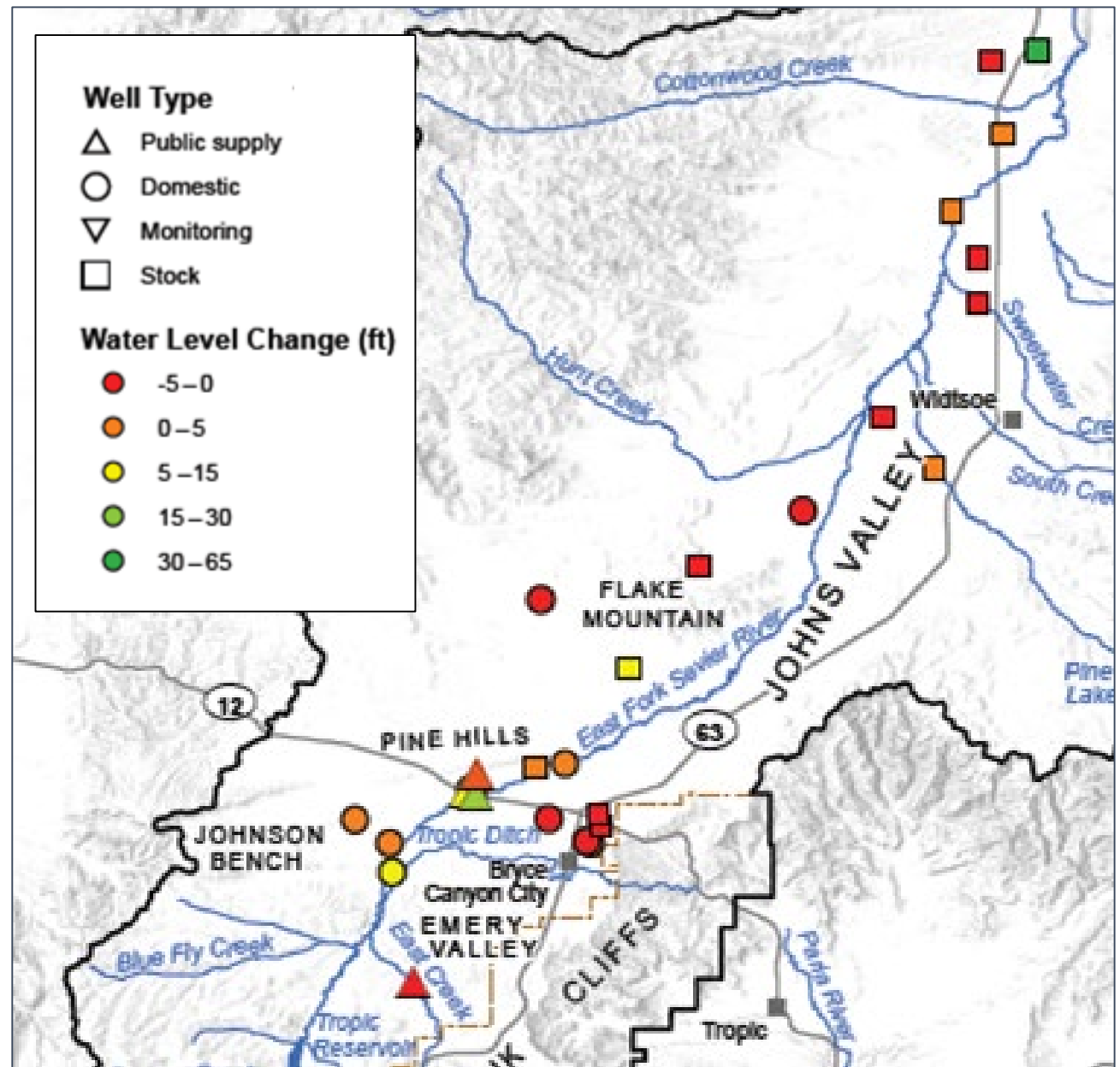
186.8

Fall 2018 Spring 2019 Fall 2019 Spring 2020 Fall 2020



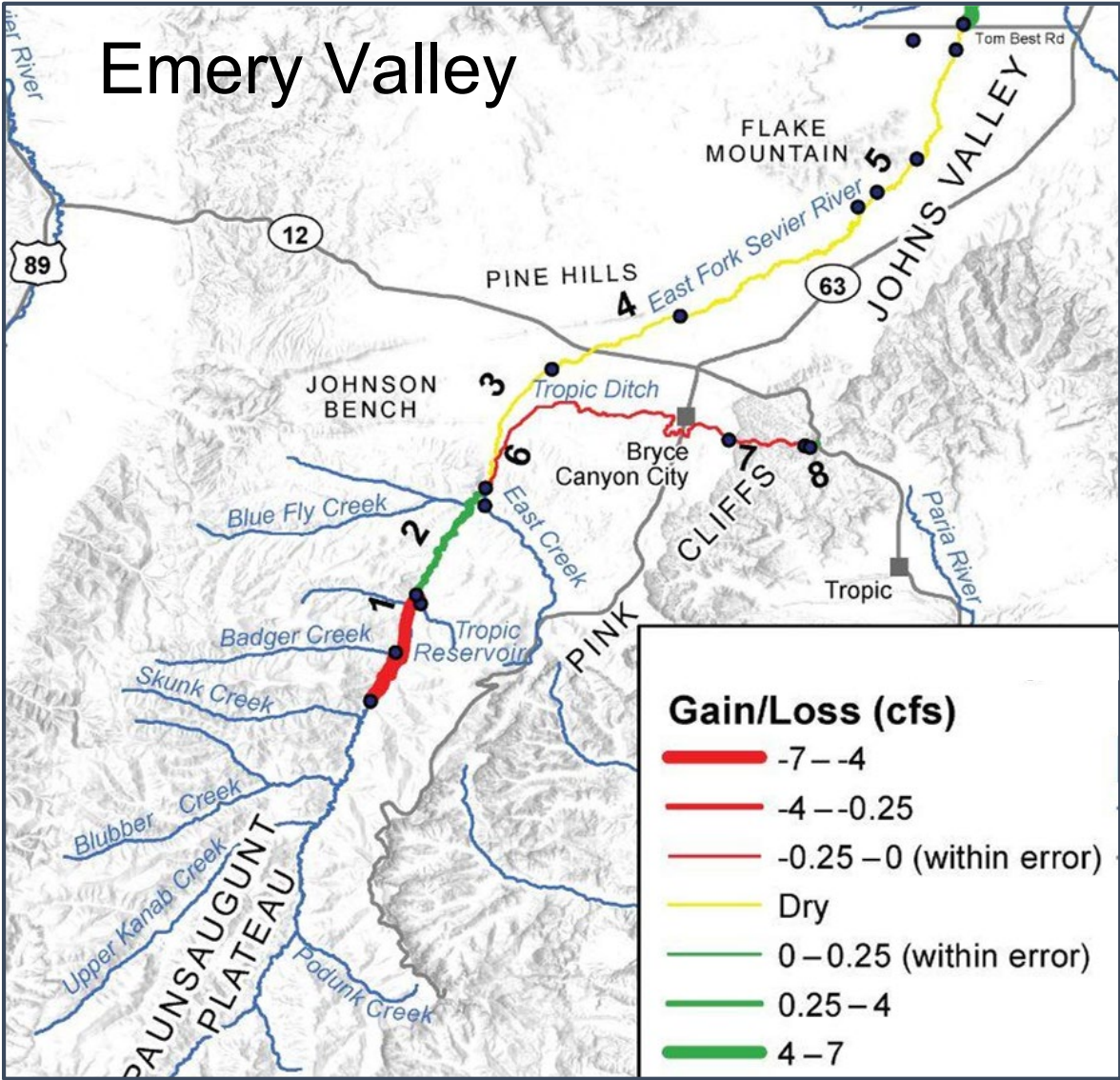
Short-Term Groundwater Level Change

Autumn 2021 to Spring 2022
(during prolonged, record drought)



Stream Loss/Gain

- East Fork loses through Emery Valley and southern Johns Valley if flowing
- Switches to gaining in northern Johns Valley



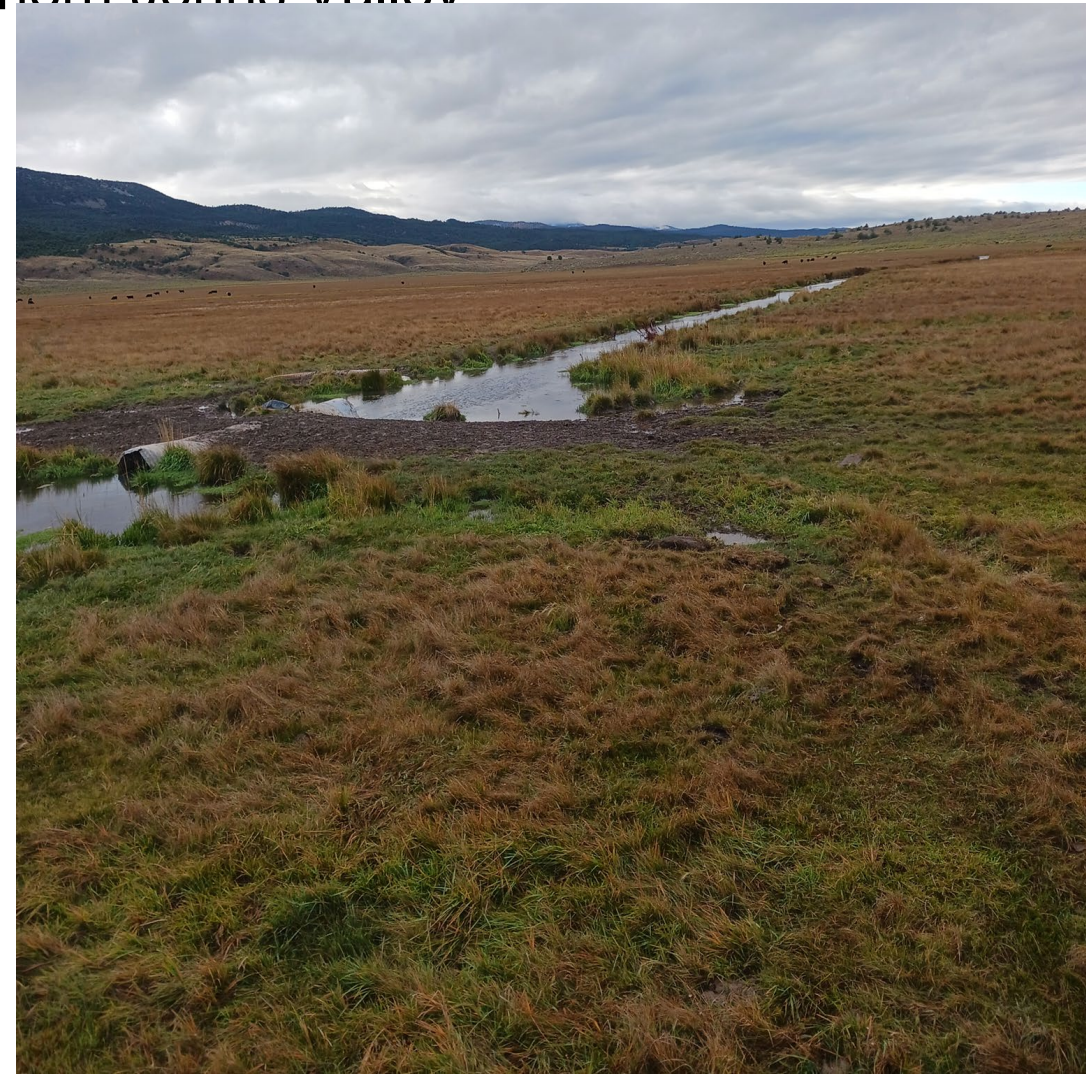
Johns Valley



~100 acre wetland adjacent to the East Fork
northern Johns Valley

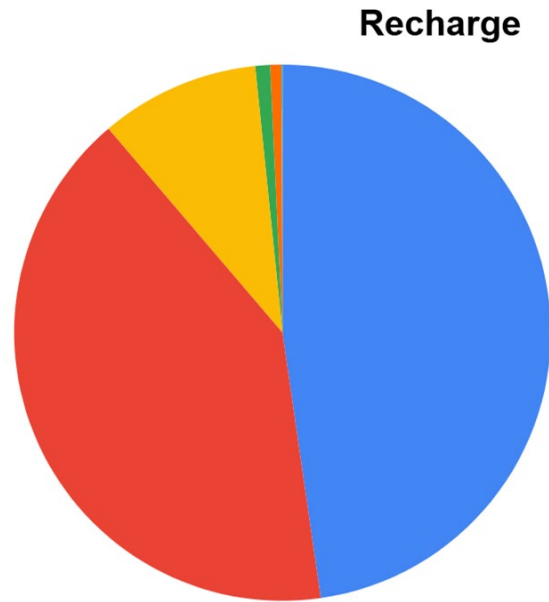


Spring
south
of this
ditch
(avg
2 cfs)

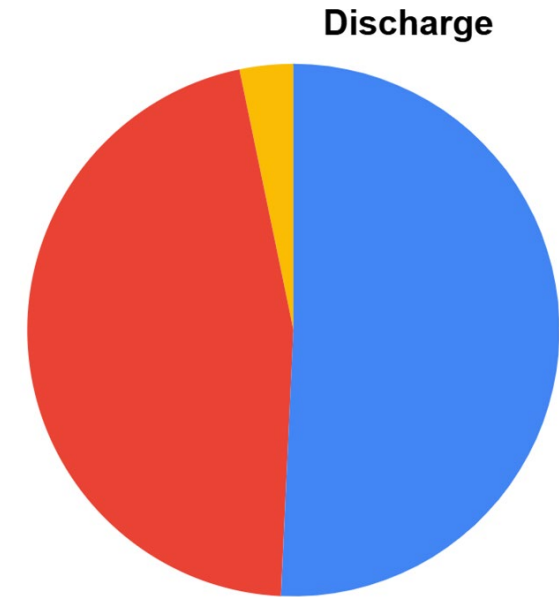


Valley-Fill Aquifer Water Budget

Recharge	Average (ac-ft)
Adjacent Mtn Bedrock	4391
Runoff Infiltration	3776
Precip Infiltration	884
East Fork seepage	82
Septic Tanks	62
Interflow	6
TOTAL	9190



Discharge	Avg. (ac-ft)
East Fork gain	5578
Phreatophyte ET	5055
Pumping	358
TOTAL	10,992



	2017	2018	2019	2020	2021	Averages
Total Recharge	8138	1074	22,523	6761	7068	9190
Total Discharge	10,895	4553	18,005	7981	12,440	10,992
Net Groundwater Change	-2757	-3479	4518	-1220	-5372	-1801

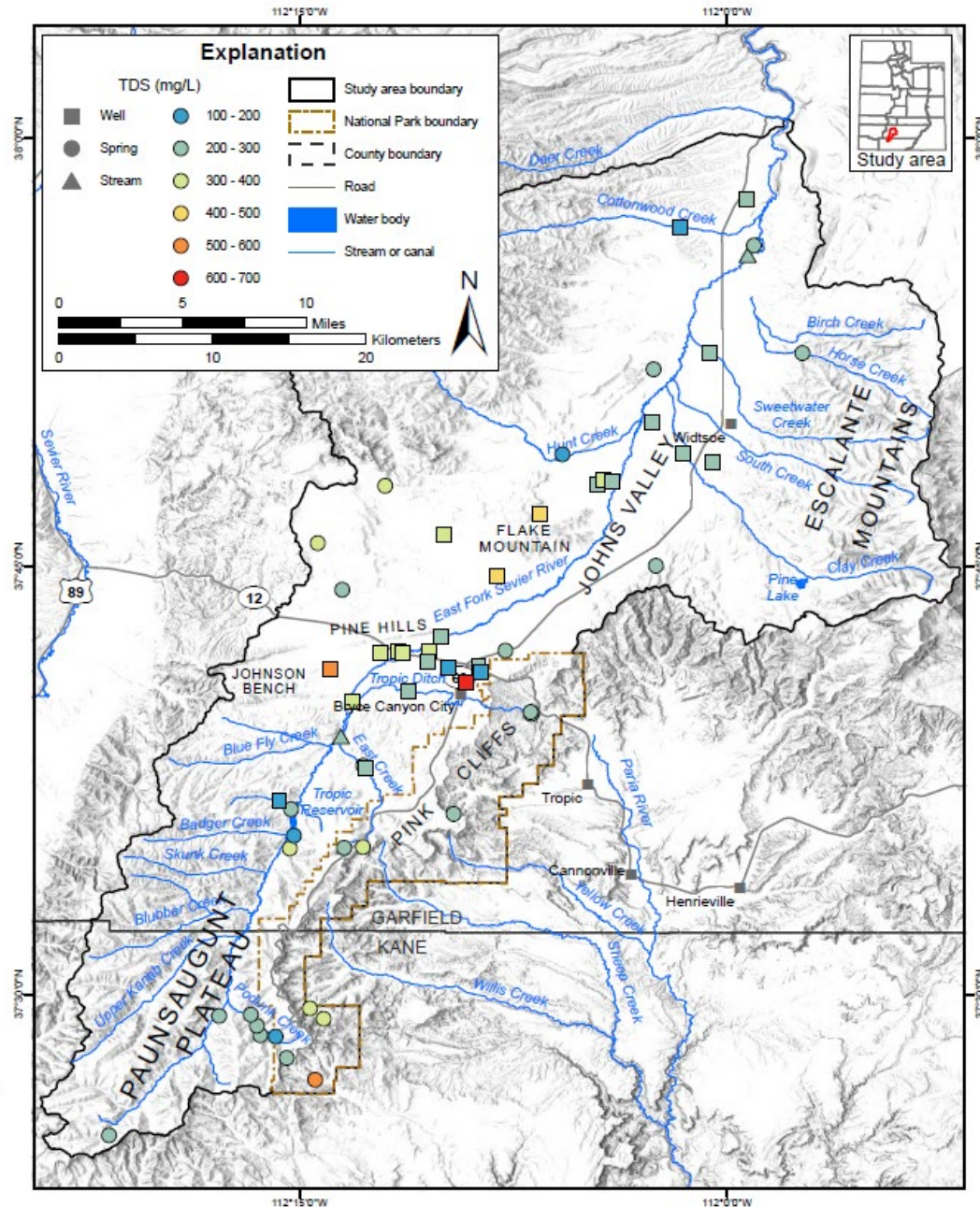
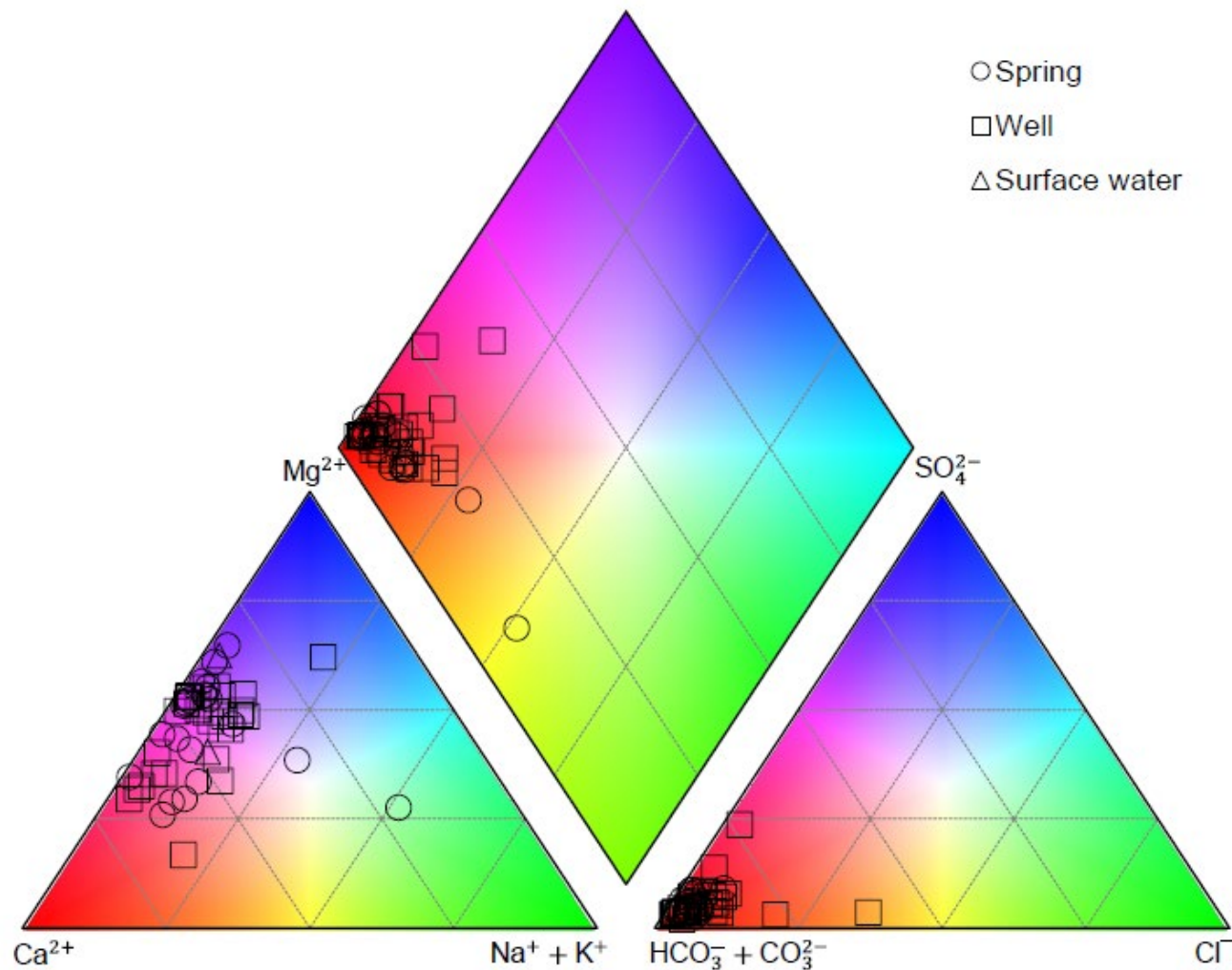


Water Quality

- TDS range: 192-716 mg/L; average of 303 mg/L. Excellent Quality
- Major ion composition dominantly Ca-Mg HCO₃
- Mostly young water – mixture of modern and old
- Claron Formation: modern – recharged after 1950
- Cretaceous sandstones –mixed & older (1000s years); Carbon-14 recharge ages of ~5000 – 8000 years



Major Ion Composition & TDS



Groundwater Quality Classification

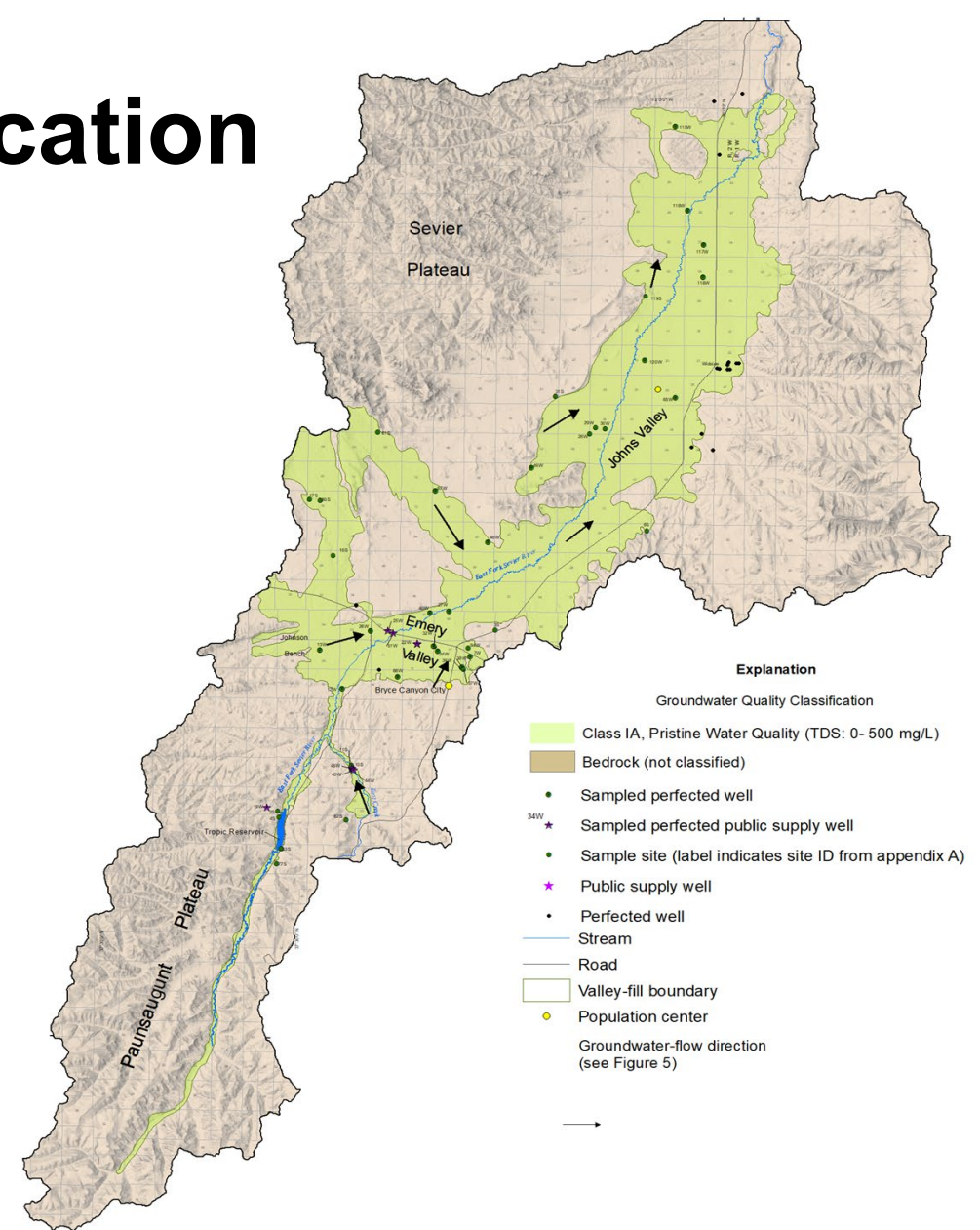
GW Classification is:

- Used to establish protection levels
- A management tool
- A means of summarized geohydrology
- Acknowledgment of resource's value

GW Classification is NOT:

An Obligation to:

- Impose zoning restrictions
- Do technical assessments
- Monitor
- Make financial investments
- A restriction of existing or future land use not already allowed or prohibited by law



Groundwater Management Takeaways

- Most groundwater utilized by stakeholders is modern recharge
- Valley-fill aquifer responds quickly to large fluctuations between water years; deeper Cretaceous aquifer has a slower and/or muted response
- Low storativity/high transmissivity in the alluvial aquifer
- Close connection between valley-fill aquifer and surface water
- Pristine water quality in valley-fill aquifer – i.e., water quality worth preserving
- Recommend nested piezometer in VFA & Bedrock well; measurement of Tropic Ditch diversion (out of basin diversion)



EMERY VALLEY-hwy 12



East Fork Sevier
Northern JOHNS
VALLEY

East Fork Sevier Spring 2023



Utah Geological Survey

geology.utah.gov

Questions?

