Overview of Groundwater – Surface Water Interaction

Lost Pines GCD Board Meeting
January 17, 2023

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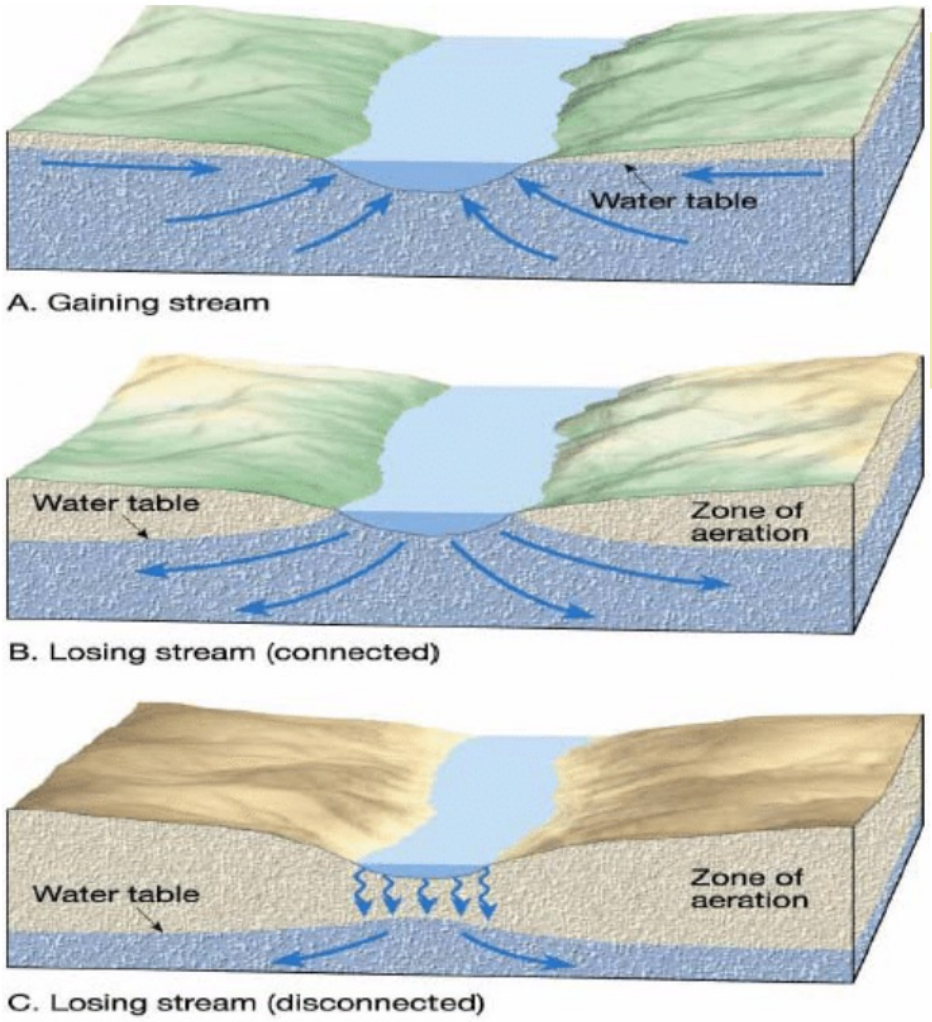


Groundwater – Surface Water Interaction

Does groundwater management effect surface water flow?

Does surface water management effect aquifer water levels?

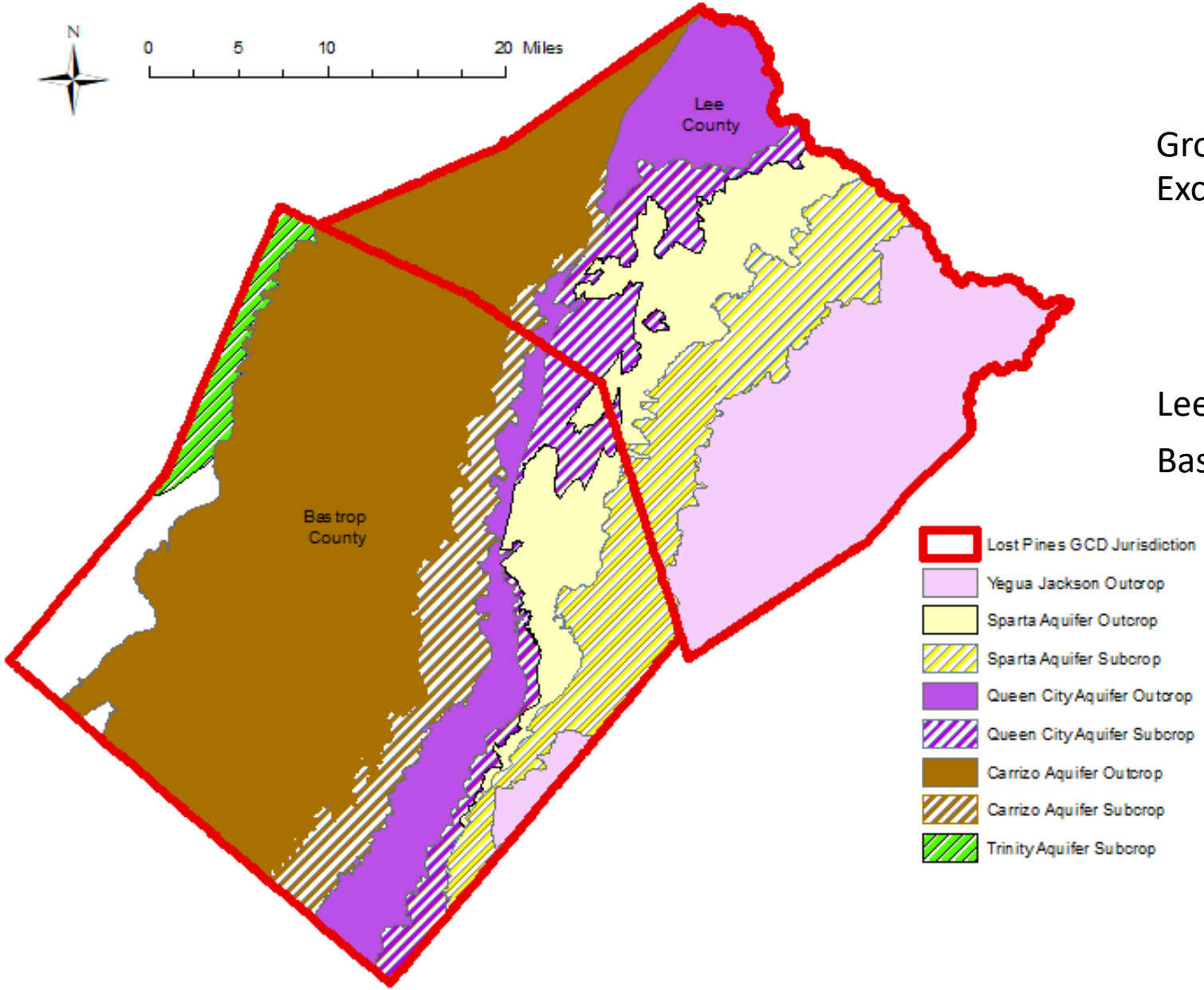
What is the exchange between groundwater and surface water sources?

Where and when does this exchange occur?

Can we quantify this exchange?

Will more or less groundwater pumping effect surface water flows?

Major & Minor Aquifers within Lost Pines GCD



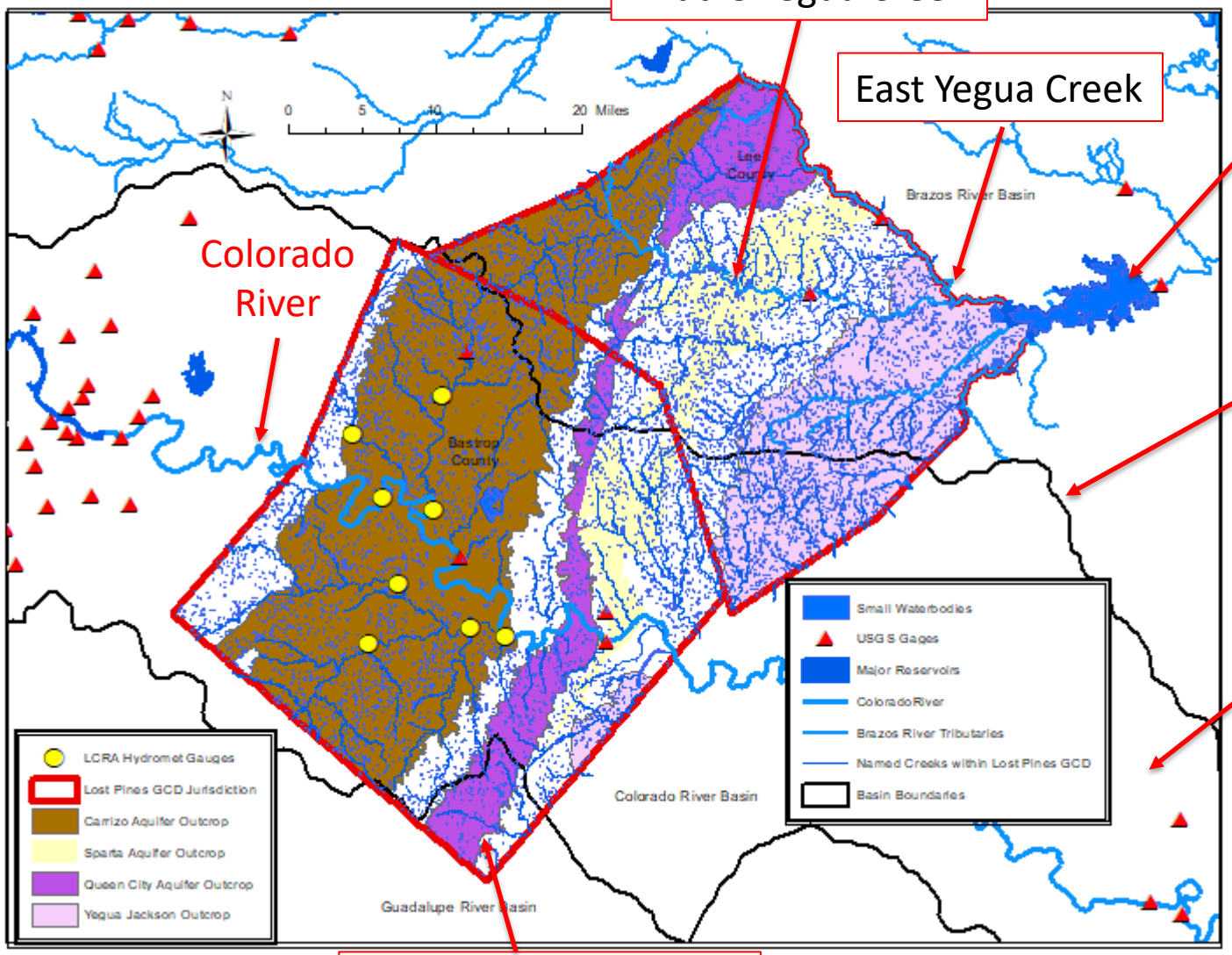
Groundwater – Surface Water
Exchange may occur over outctops

	Total Area	Outcrop
Lee County	= 411,438 Acres	= 75.5%
Bastrop County	= 580,492 Acres	= 68.2%

Is surface water available to
Mingle with groundwater?

Where? How much?
Will SW → GW or GW → SW

Surface water features within Lost Pines GCD



Middle Yegua Creek

East Yegua Creek

Lake Somerville

Colorado River

Brazos River Basin

LCRA Gauges – 8 in Bastrop County
USGS Gauges – 4 in Bastrop County
– 2 in Lee County

Colorado River Basin

1,256 Miles of named streams
2,924 Miles of un-named streams

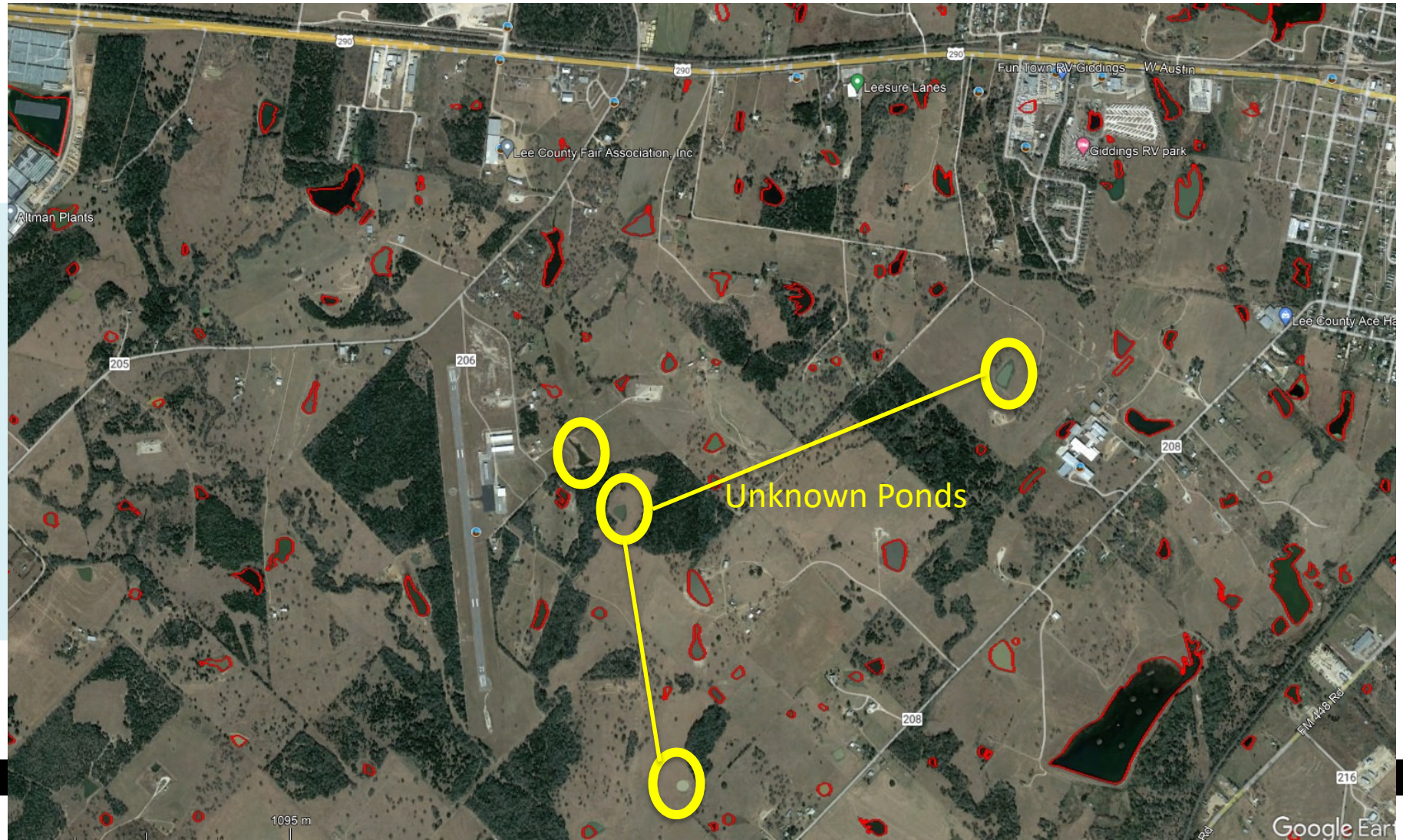
18,599 “Small” Waterbodies – 24,070 acres

Guadalupe River Basin

Small Waterbodies within Lost Pines GCD

18,599 “Small” Waterbodies – 24,070 acres

> 2x Surface Area of Lake Somerville



Giddings Airport Area

Ponds reduce streamflow As the collect storm runoff

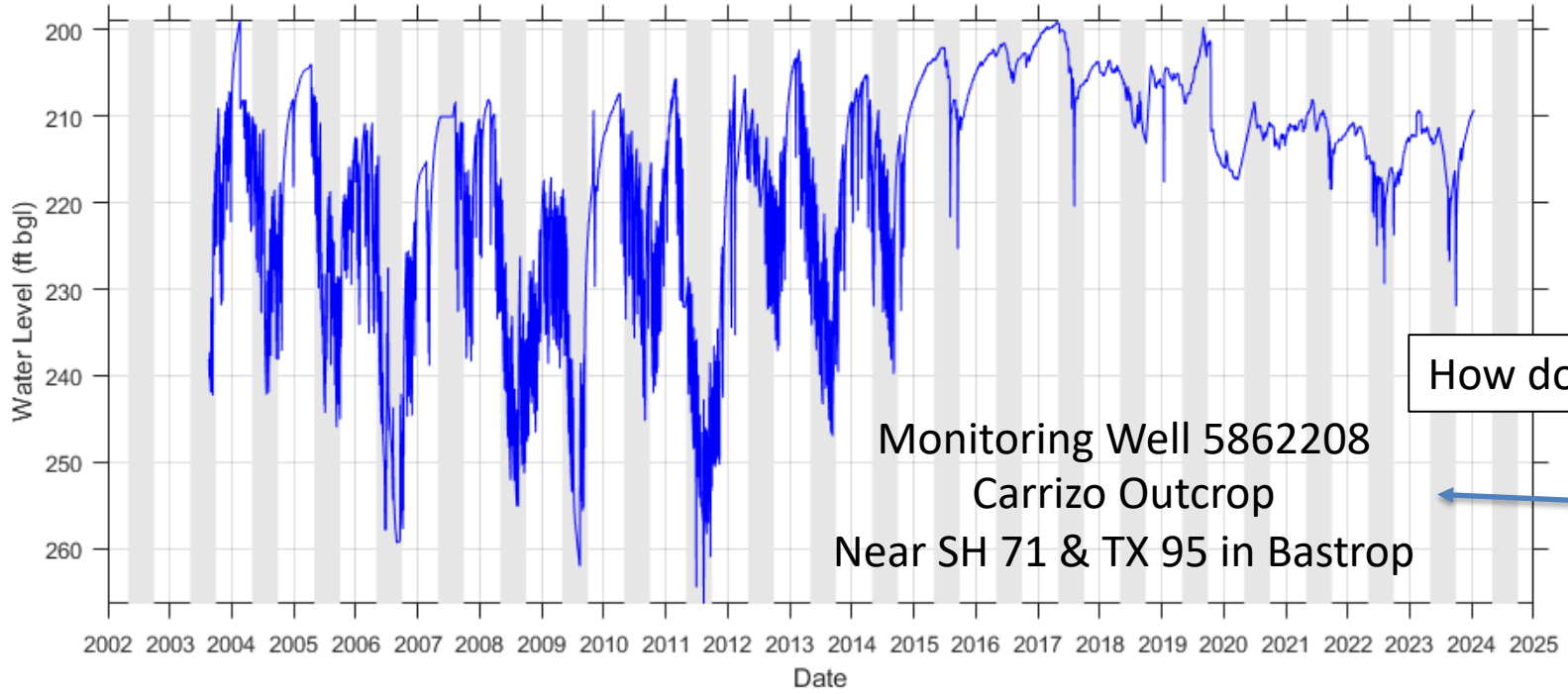
Ponds may also recharge aquifer – depending upon Construction/lining

Ponds my refill from local Groundwater - quarries

Wasteful uses of GW?

Studies in Brazos & Upper Colorado Basin
Recent KXAN investigations

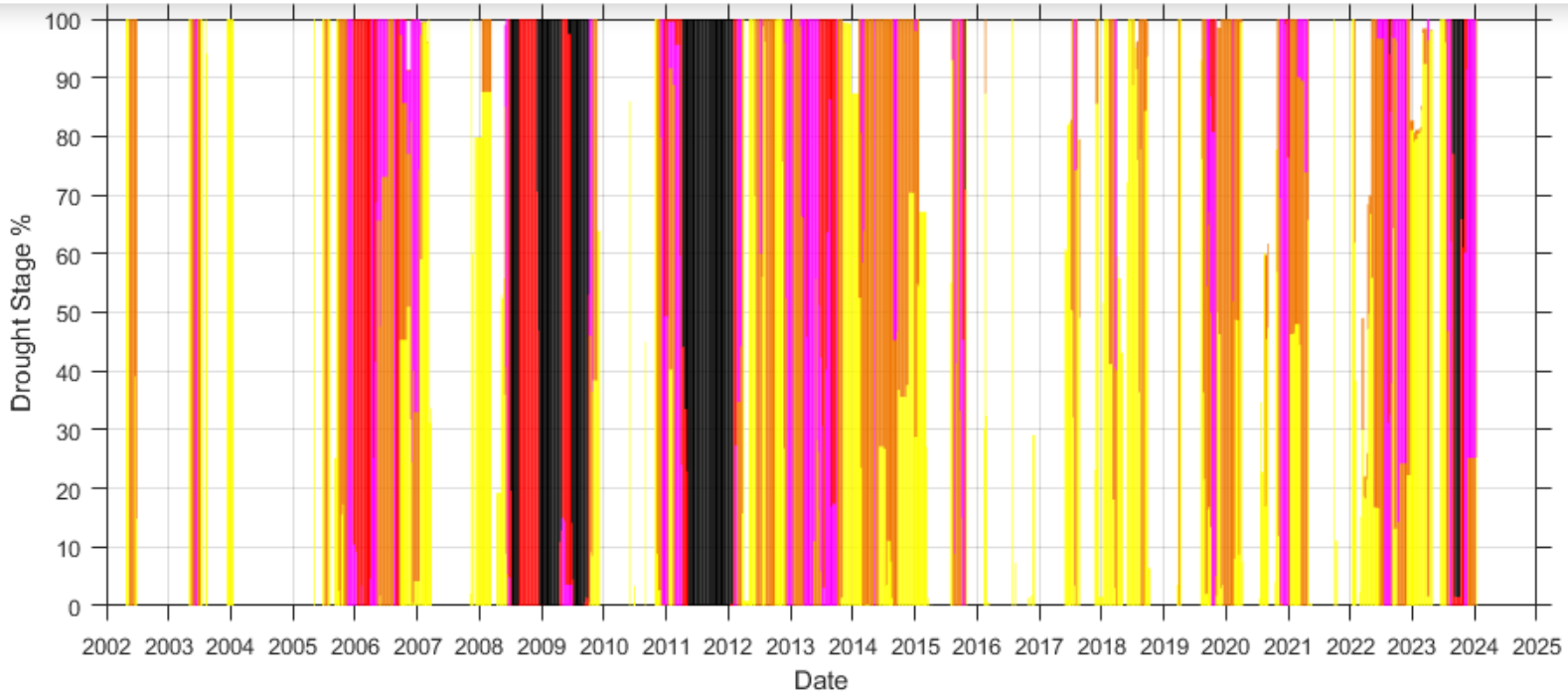
Talk at March 2024 TWCA Meeting @ Hyatt Lost Pines



Monitoring Well 5862208
Carrizo Outcrop
Near SH 71 & TX 95 in Bastrop

How does drought effect Lost Pines Aquifers?

Grey = Summer Months

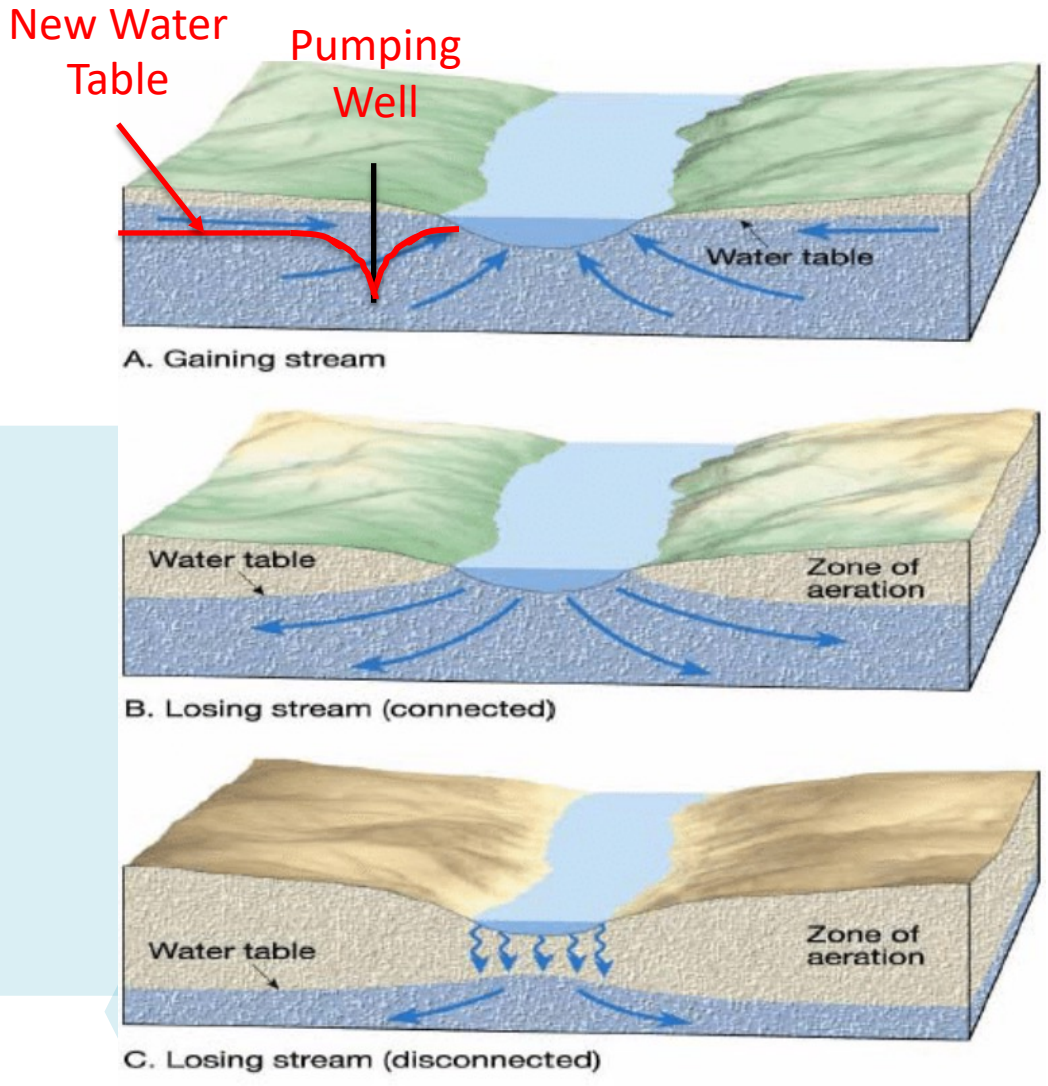


Conclusion: Well Owners Pump More During Drought/Hot Summers

US Drought Monitor Data
for Bastrop County

Black = D4 – Exceptional
Red = D3 – Extreme
Magenta = D2 – Severe
Orange = D1 – Moderate
Yellow = D0 – Abnormally Dry

Groundwater – Surface Water Interaction Theory



Colorado River – Normal Conditions
Perennial LPGCD Streams

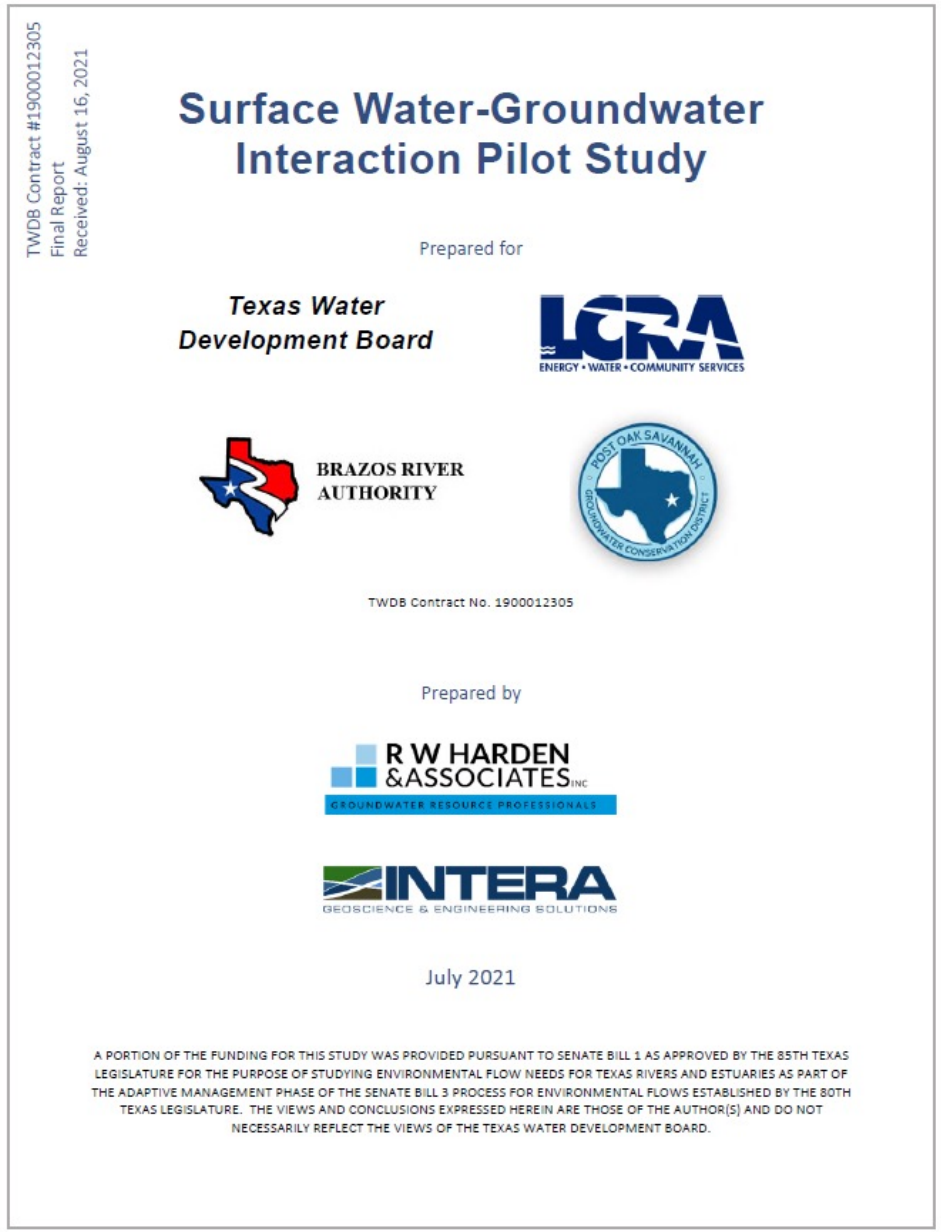
Could excessive pumping Turn gaining stream into Losing stream?

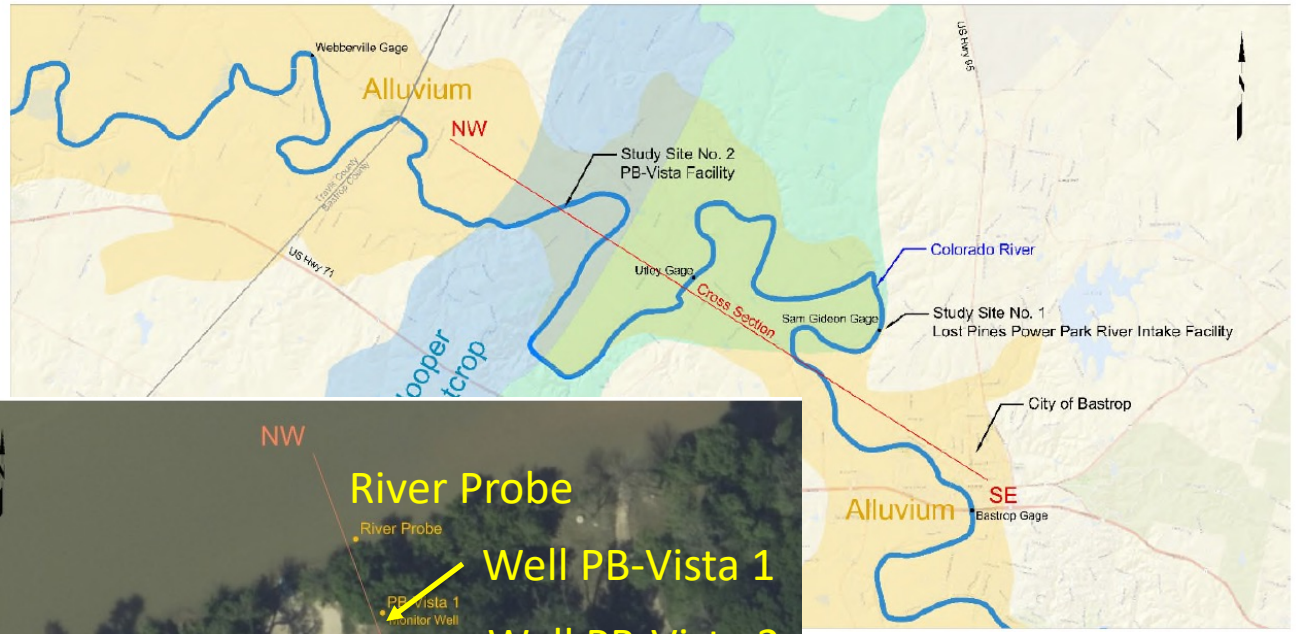
Colorado River – High Flow Conditions
**Pulse Releases for Hydropower

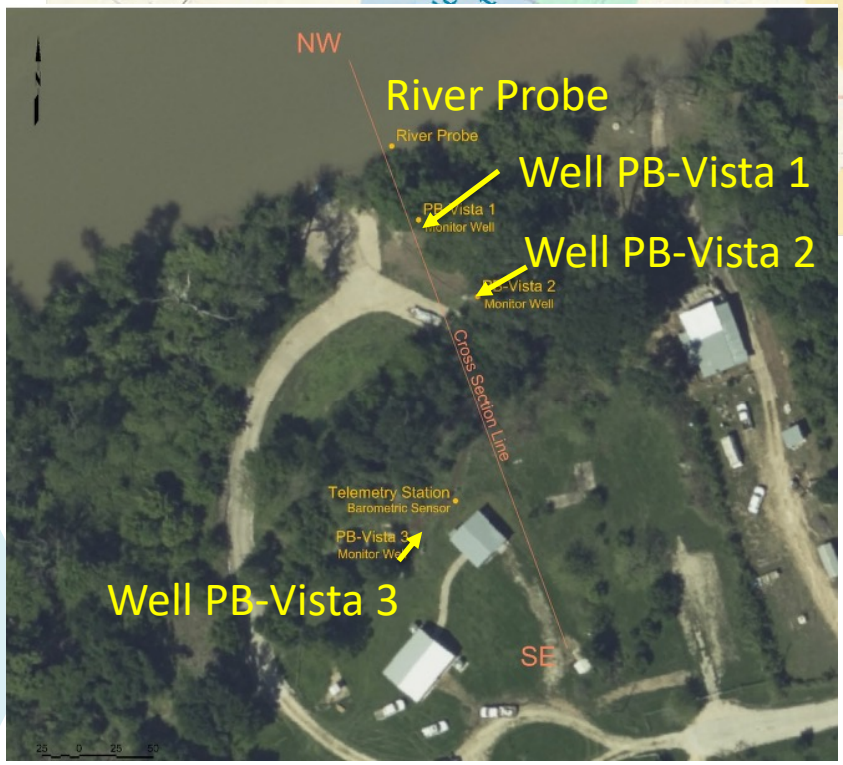
Other LPGCD Streams - Ephemeral

Condition to be avoided!
Stream due only to stormwater runoff
Constant unconfined aquifer recharge

Groundwater – Surface Water Interaction Study

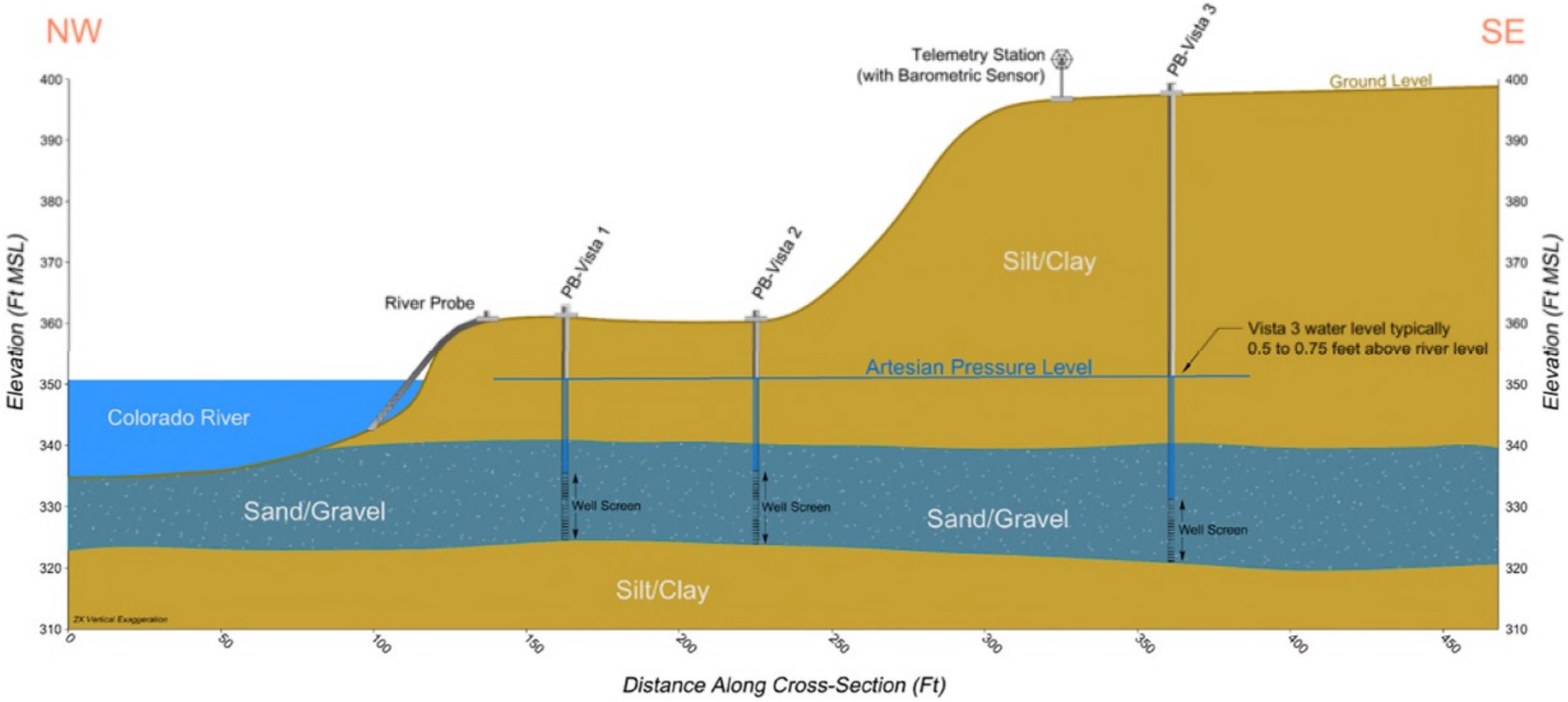






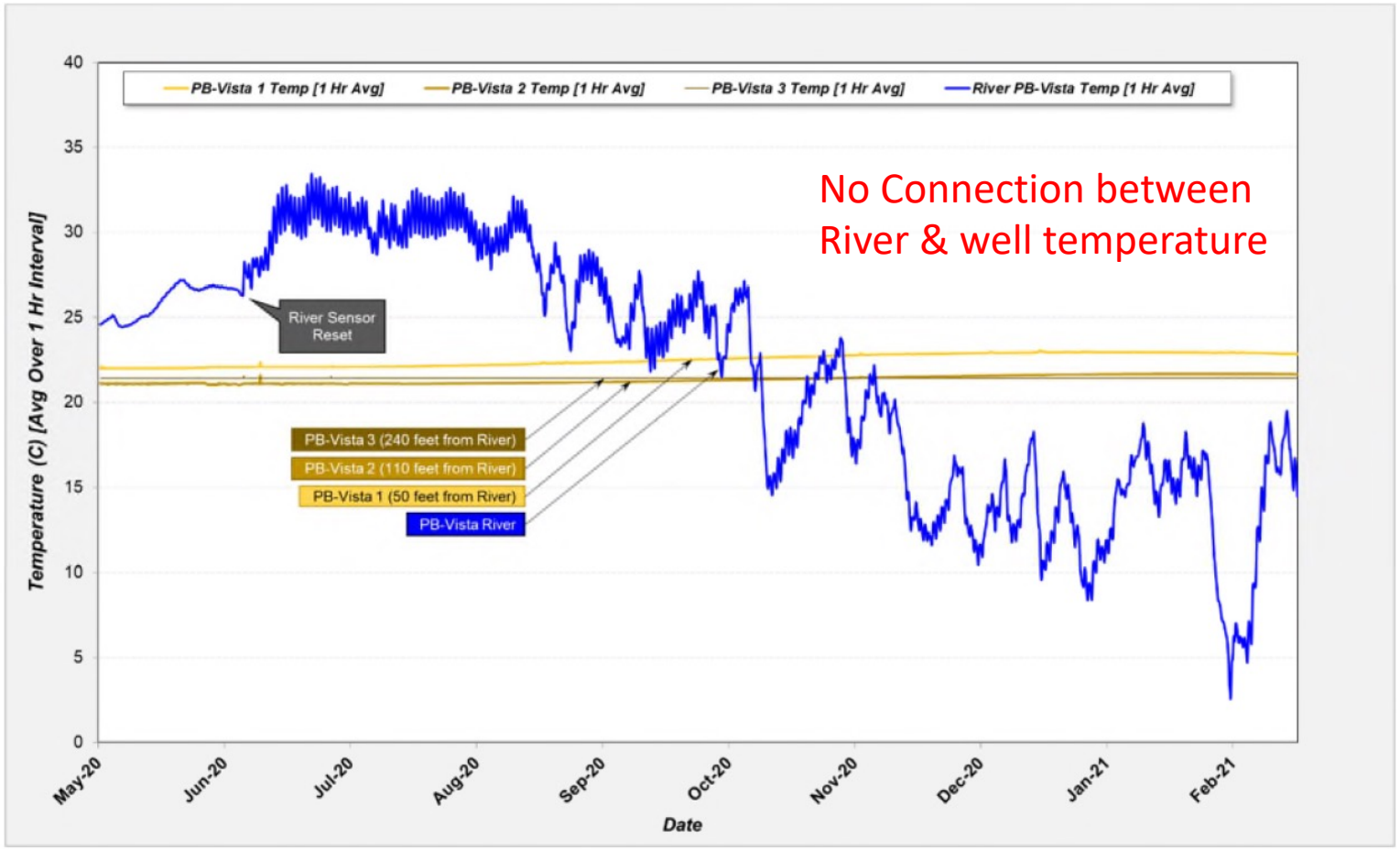
Groundwater – Surface Water Interaction Study

Figure 4. Schematic Cross-Section of Vista Site



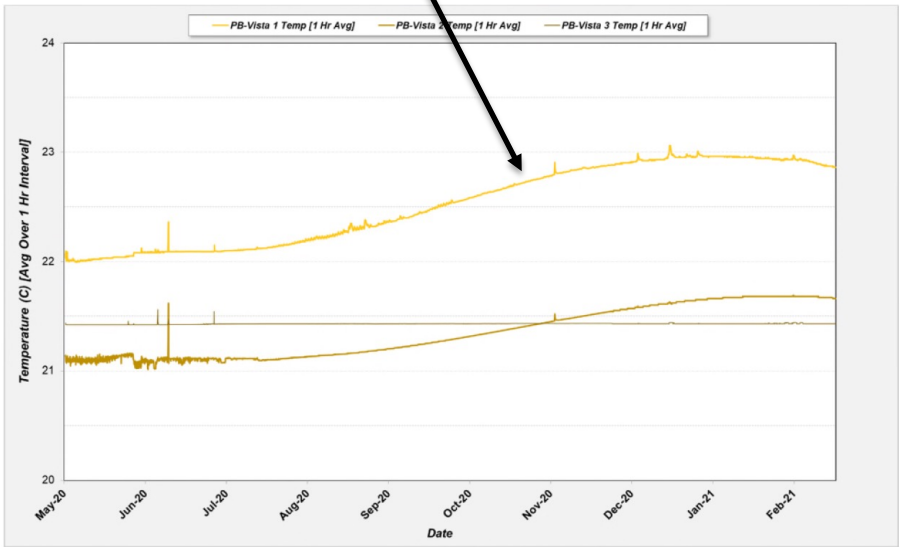
Groundwater – Surface Water Interaction Study

Figure 8. River and Groundwater Temperature



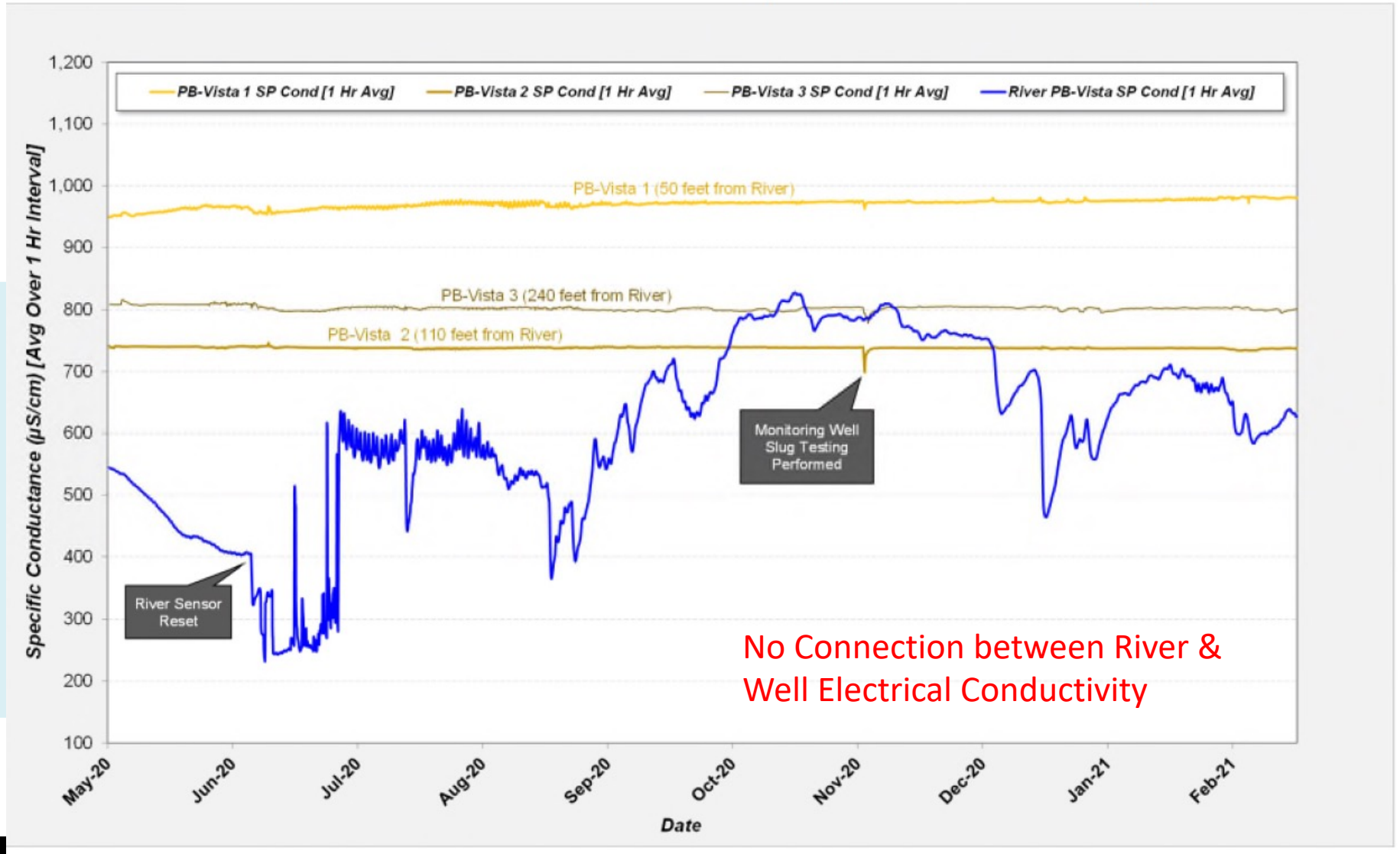
What is the heat source?

1 degree C change – Close to River



Groundwater – Surface Water Interaction Study

Figure 10. Electrical Conductivity (as Specific Conductance)



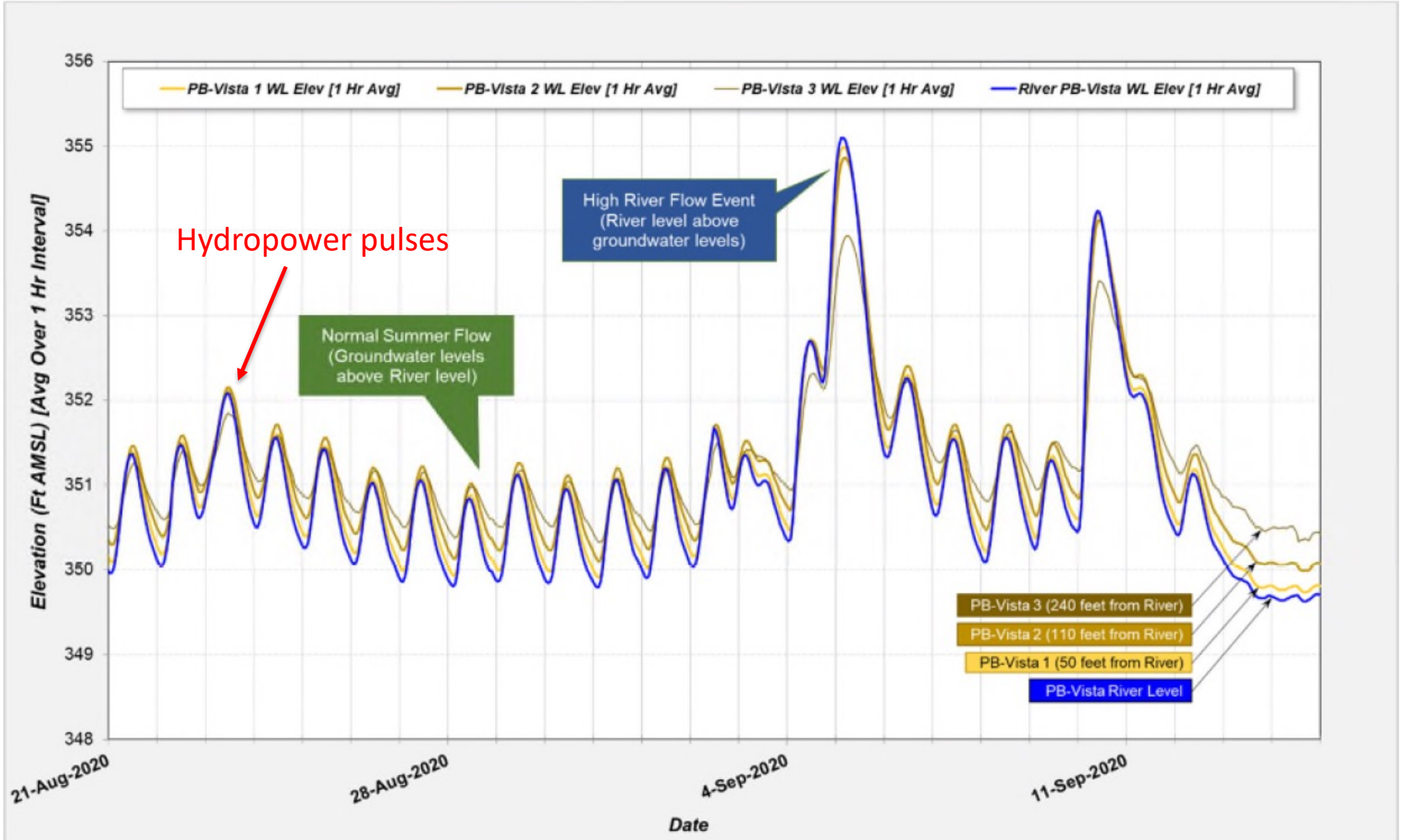
Why is Site 2 least conductive?

No apparent gradient between Aquifer and river

Possible septic discharge On property?

Groundwater – Surface Water Interaction Study

Figure 12. PB-Vista Water Level Elevation – Summer

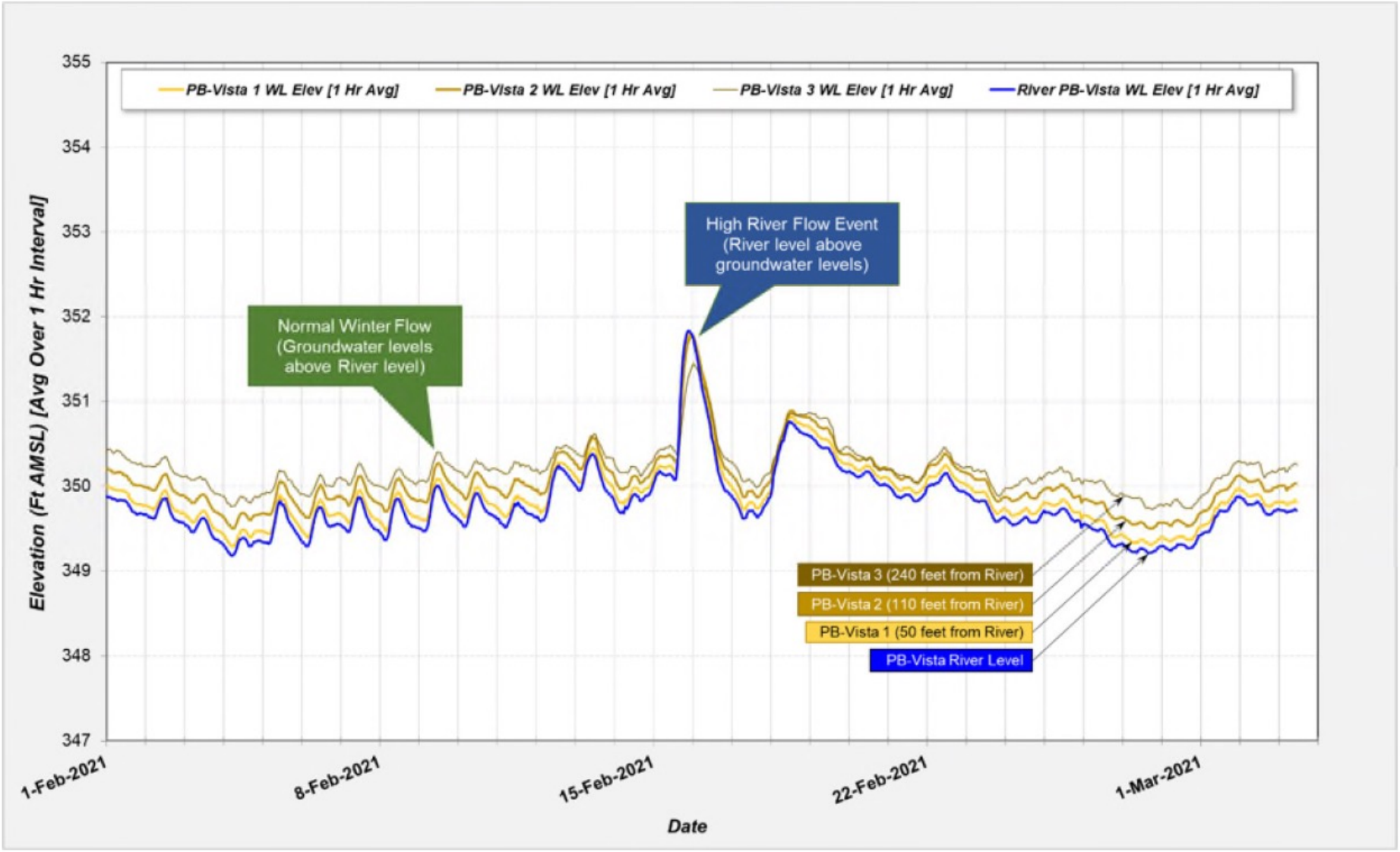


During high pulse events
River does feed aquifer

Conditions quickly reverse
To aquifer feeding river

Groundwater – Surface Water Interaction Study

Figure 13. PB-Vista Water Level Elevation – Winter



During high pulse events
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To aquifer feeding river

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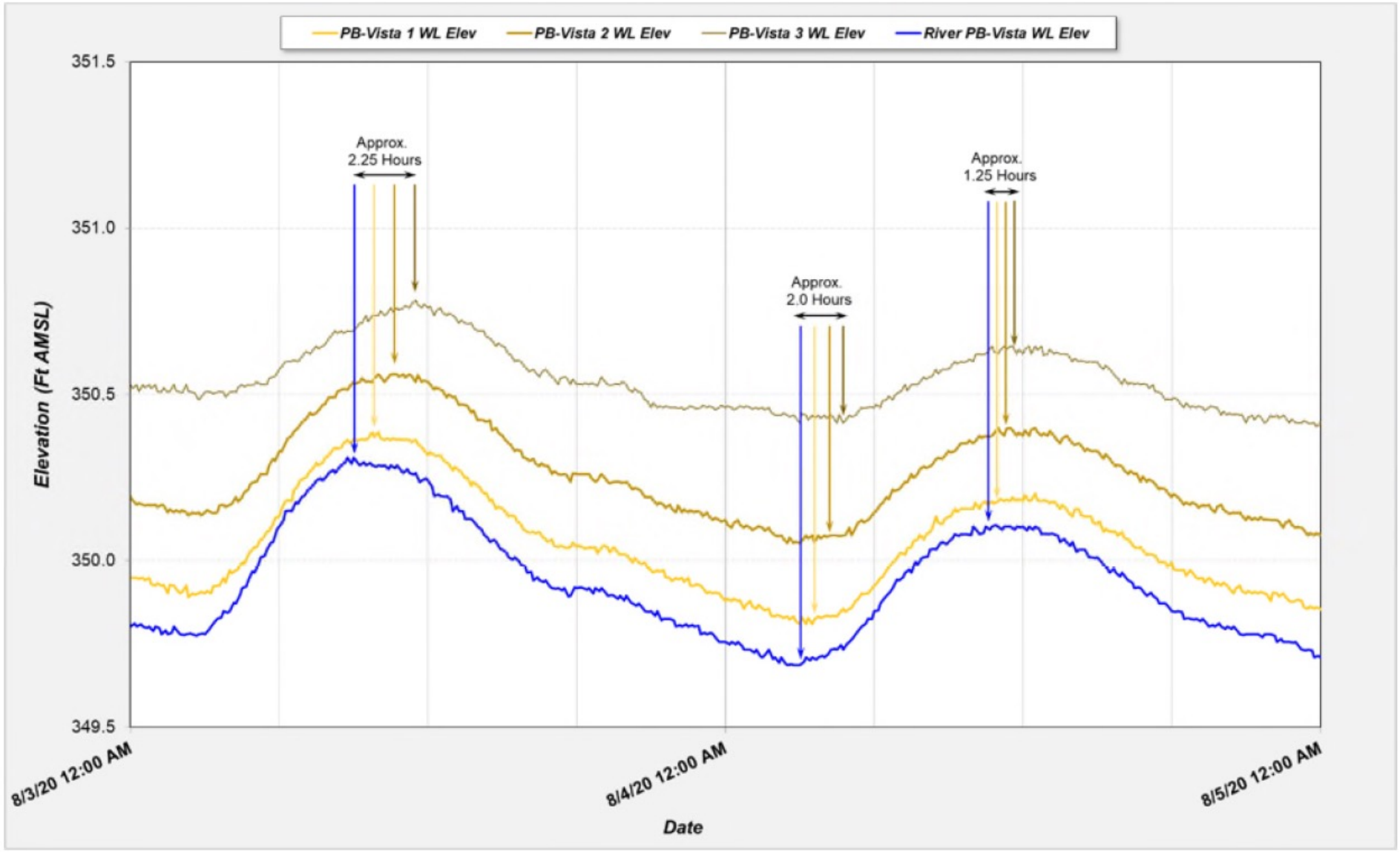
Figure 14. Water Level Elevation Response Delay



River “Presses” on aquifer
Raises/lowers water levels
With slight time lag

Any flux of river water to
Aquifer is short lived,
Quickly reversed

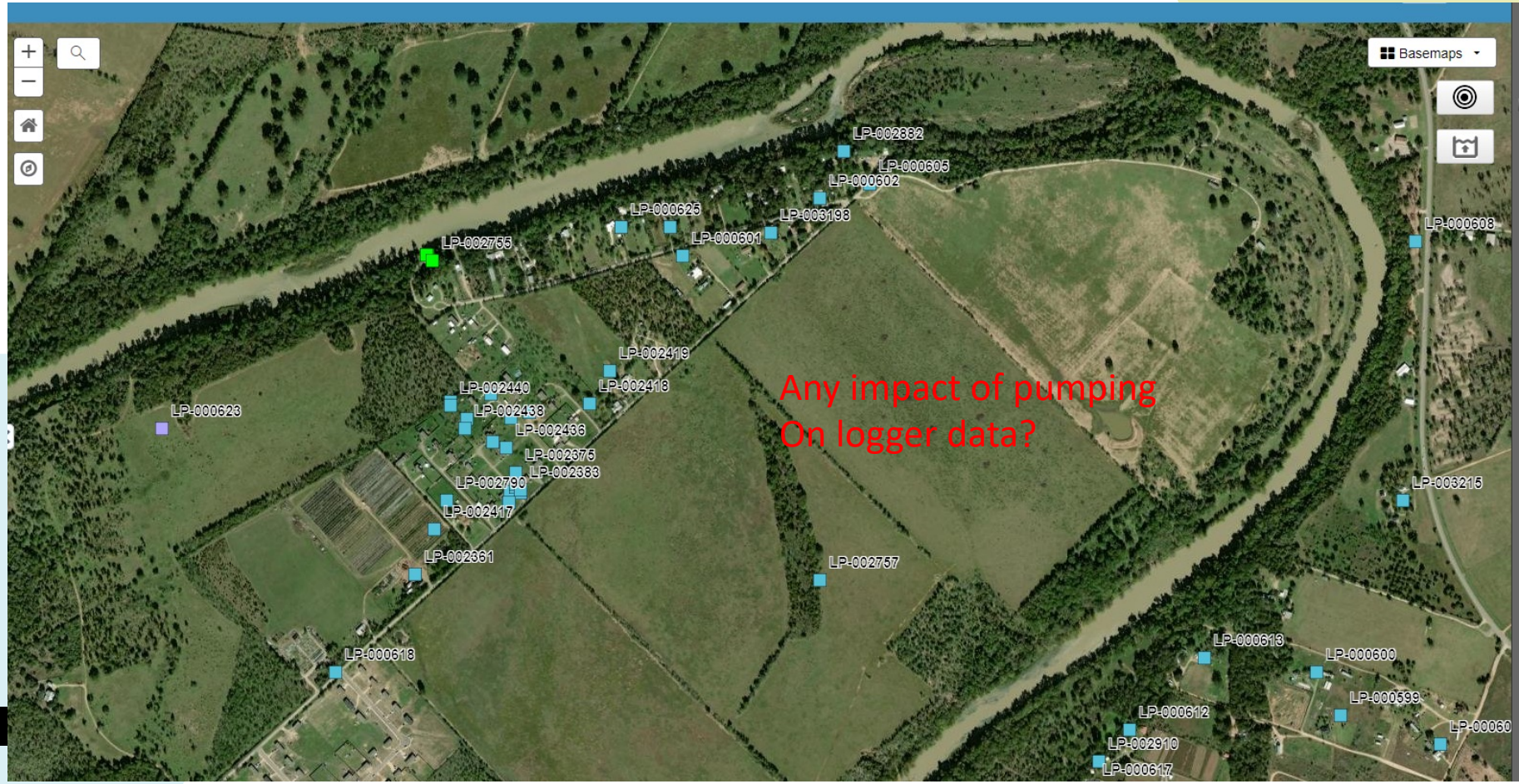
Groundwater – Surface Water Interaction Study

Study Conclusions:

- Alluvial aquifer hydraulic conductivity = 4.9 ft/day
- Pope Bend = 23,500 ft long, contributes 186 ft^3/hr to Colorado River = 0.05 cfs vs. river flow of 315 cfs today!

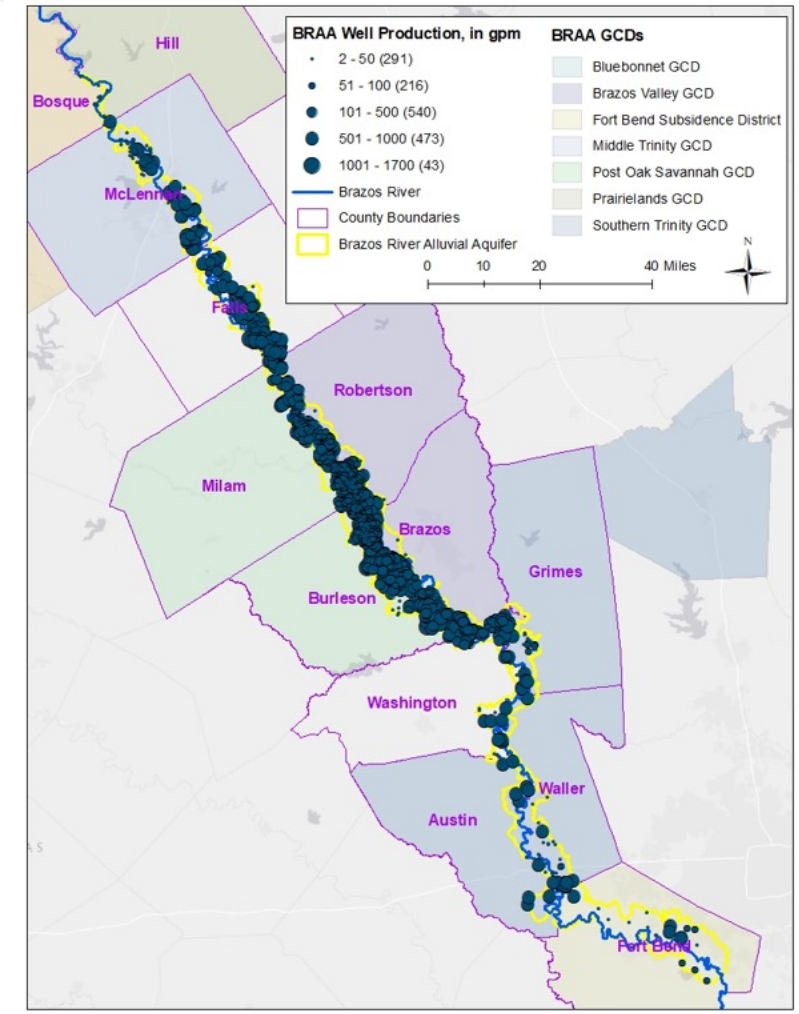
Past studies suggest higher hydraulic conductivity, Greater discharge to stream.

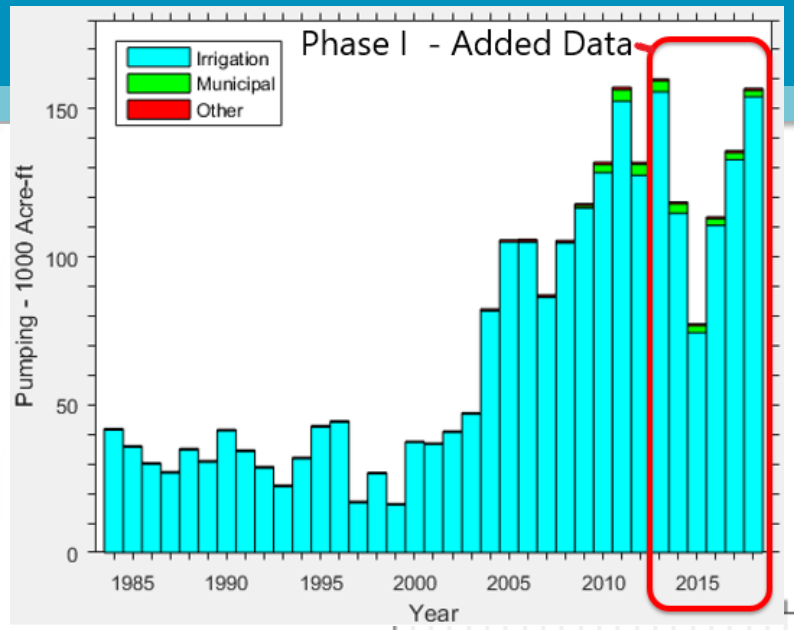
Loggers are supposed to be installed and recording through 2025



BRAZOS RIVER ALLUVIAL STUDY

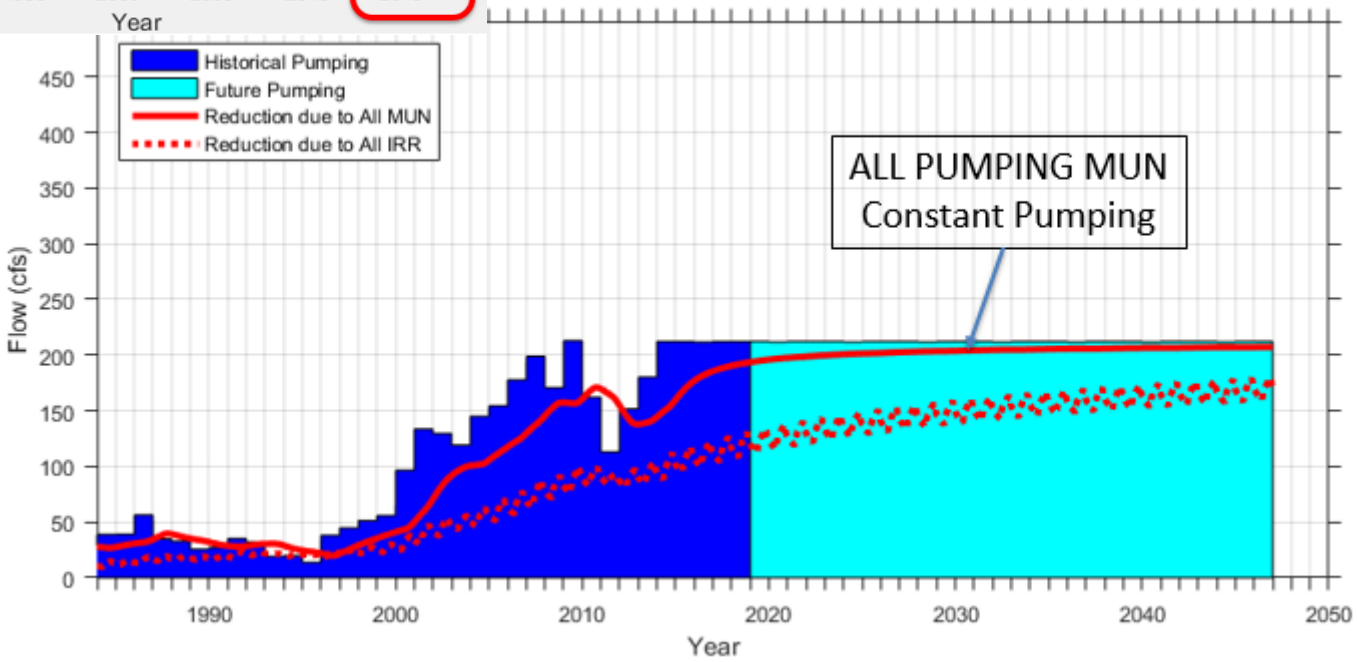
**By LRE Water for GCWA





Conclusion – streamflow is
Reduced by alluvial pumping
Due to reduction in aquifer flux
To river.

Glover-Balmer Analytical Equation



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Questions?