
Surface-Water and Groundwater Interactions along Onion Creek, Central Texas

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ABSTRACT

Onion Creek is an important hydrologic link between two major aquifers in Central Texas. Multiple small springs discharging from the Trinity Aquifers sustain base flow in Onion Creek, which in turn recharges the Edwards Aquifer, ultimately discharging at Barton and San Marcos springs. The creek generally contains clear, low nutrient water with high ecological and recreational value. This watershed is rapidly being developed and is experiencing significant population growth and land use changes, thus increasing demand for water supplies and potentially affecting regional hydrology. Several wastewater treatment plants are operating in the watershed with additional treatment plants being planned. Despite the critical importance of Onion Creek to the community, no comprehensive gain-loss studies have been conducted that characterize the surface and groundwater interactions across the Trinity (Upper Glen Rose) and Edwards aquifers. This paper presents the results of a flow study in Onion Creek and its tributaries extending 46 mi from the headwaters in Blanco County to downstream of the Edwards Aquifer recharge zone in Hays County. A total of 69 flow sites were established and acoustic Doppler velocimeters (ADV) were used to make 139 wading flow measurements from January through December 2015. Detailed geologic, hydrogeologic, and geochemical data were incorporated into the evaluation to understand the hydrogeologic significance of the data. Two synoptic flow-measurement events were done during low and high flow conditions in July and November 2015, respectively. This study reveals complex surface and groundwater interactions in the Onion Creek watershed. Flow losses are documented to occur along a creek reach underlain by the Upper Glen Rose. These losses combined with other hydrogeologic and geochemical data suggest Onion Creek provides some recharge to the Middle Trinity Aquifer in those reaches. A better understanding of the surface water and groundwater interactions along the creek is important for groundwater and surface-water management in an area undergoing significant population growth.

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Corpus Christi, Texas
September 18-20, 2016*

Study Purpose & Goal

Purpose:

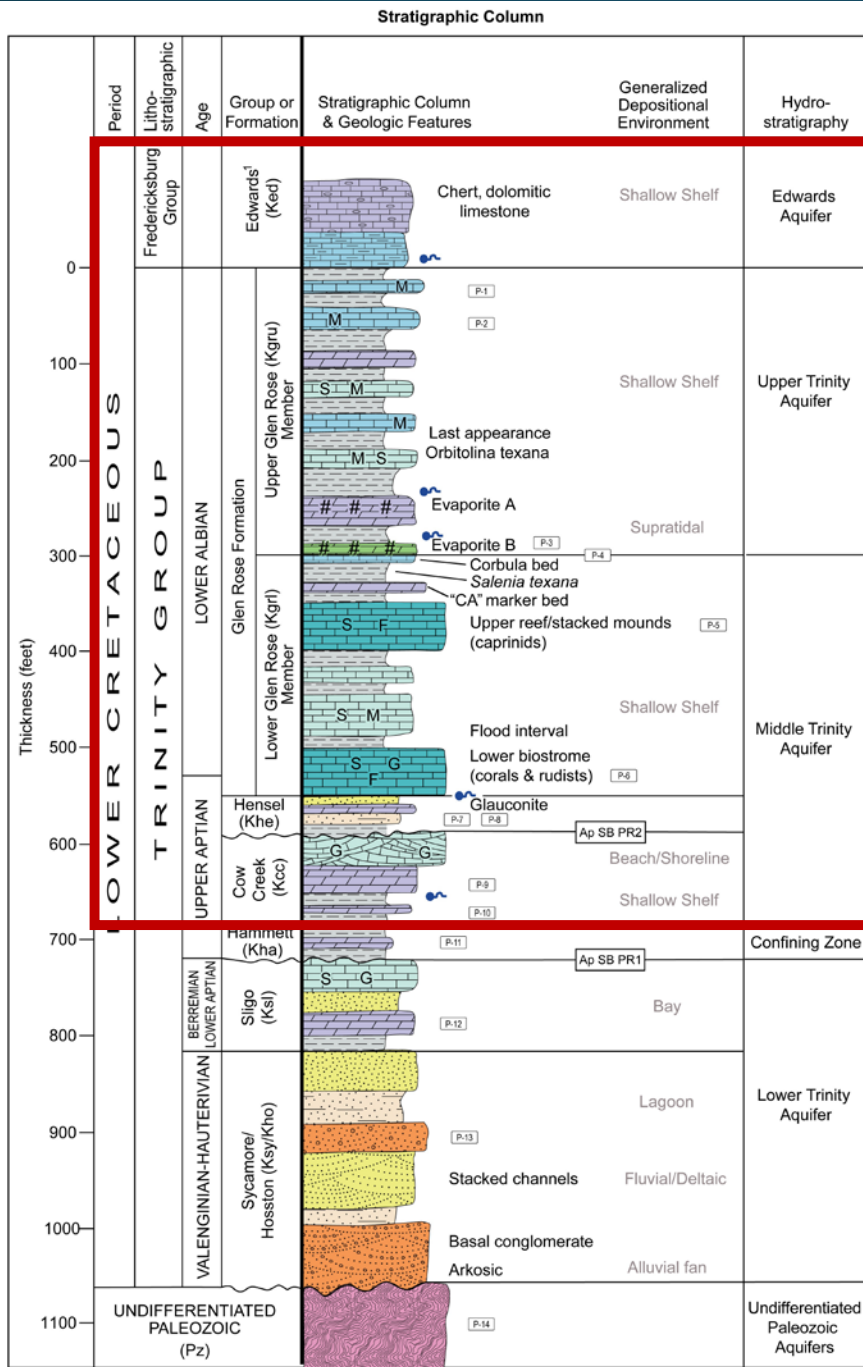
Understand recharge from Onion Creek to the Edwards and Trinity Aquifers to inform our conceptual model.

Goal:

Inform decision-makers on both groundwater quantity and quality issues.



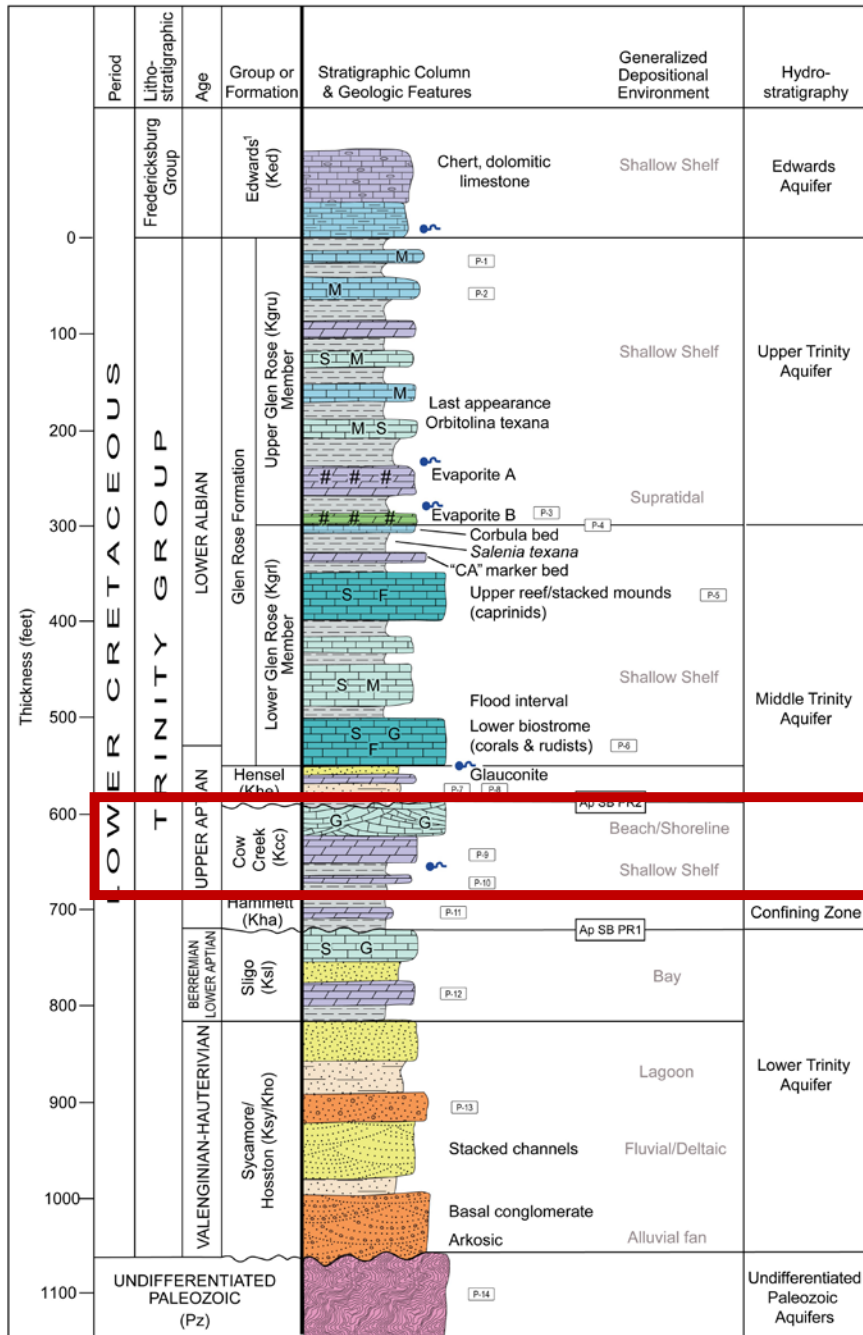
Stratigraphy



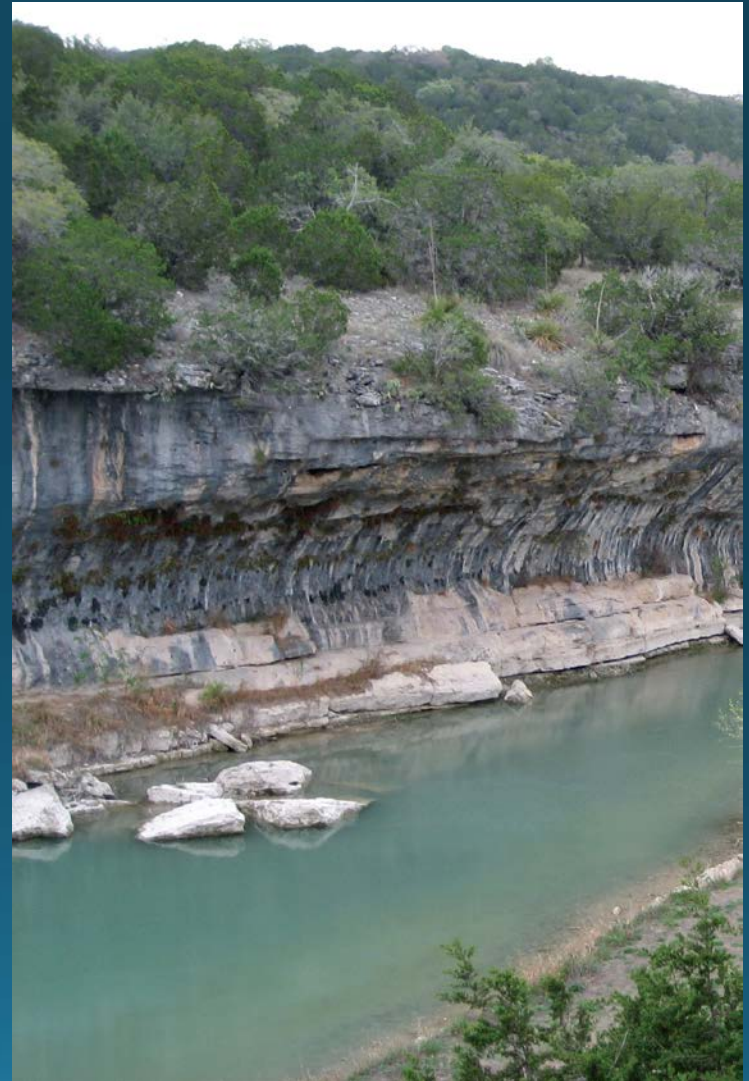
- Lower Cretaceous
- Limestones/dolomites
- Fractured, karstic

From Wierman et al., 2010

Stratigraphic Column

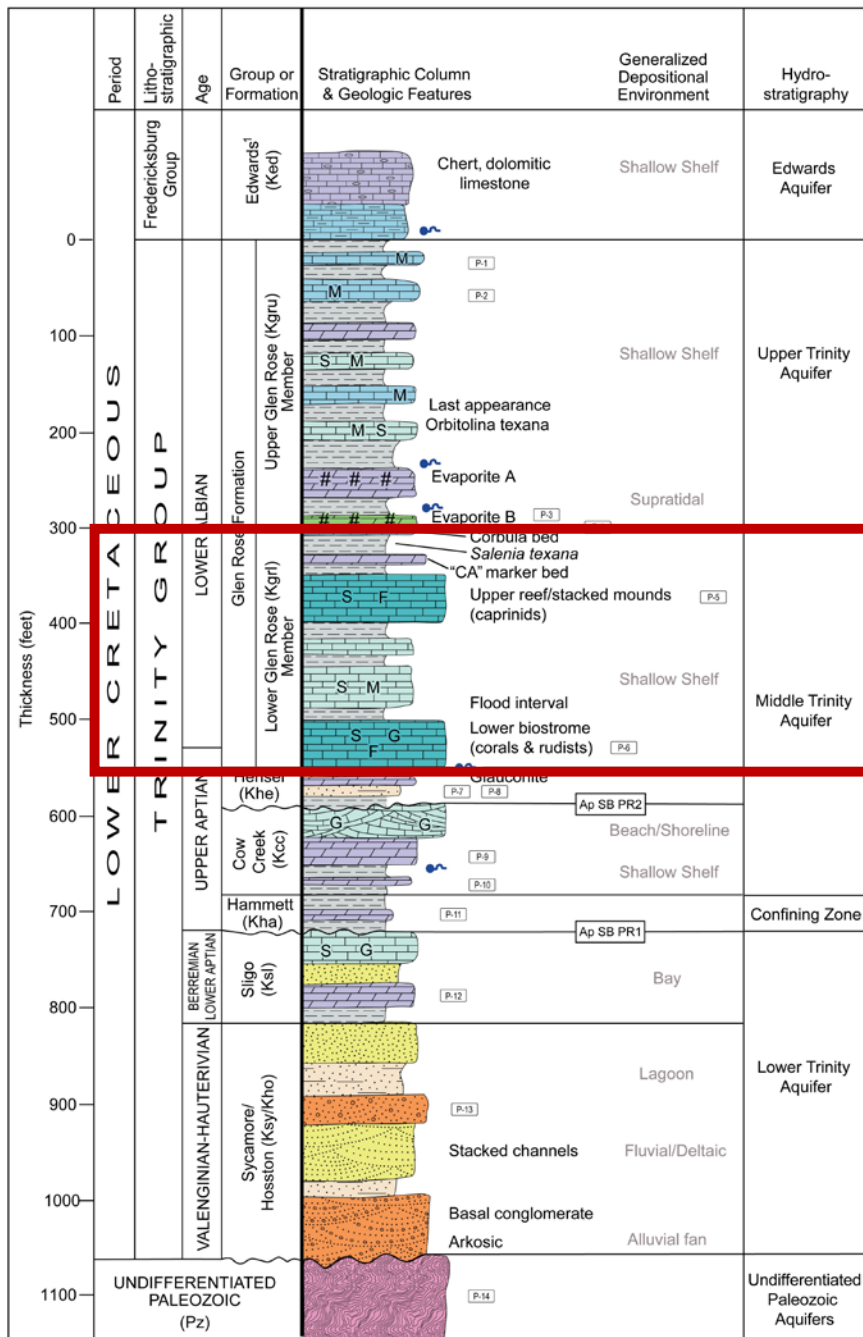


Cow Creek



Flat Creek, Blanco Co.

Stratigraphic Column



Lower Glen Rose



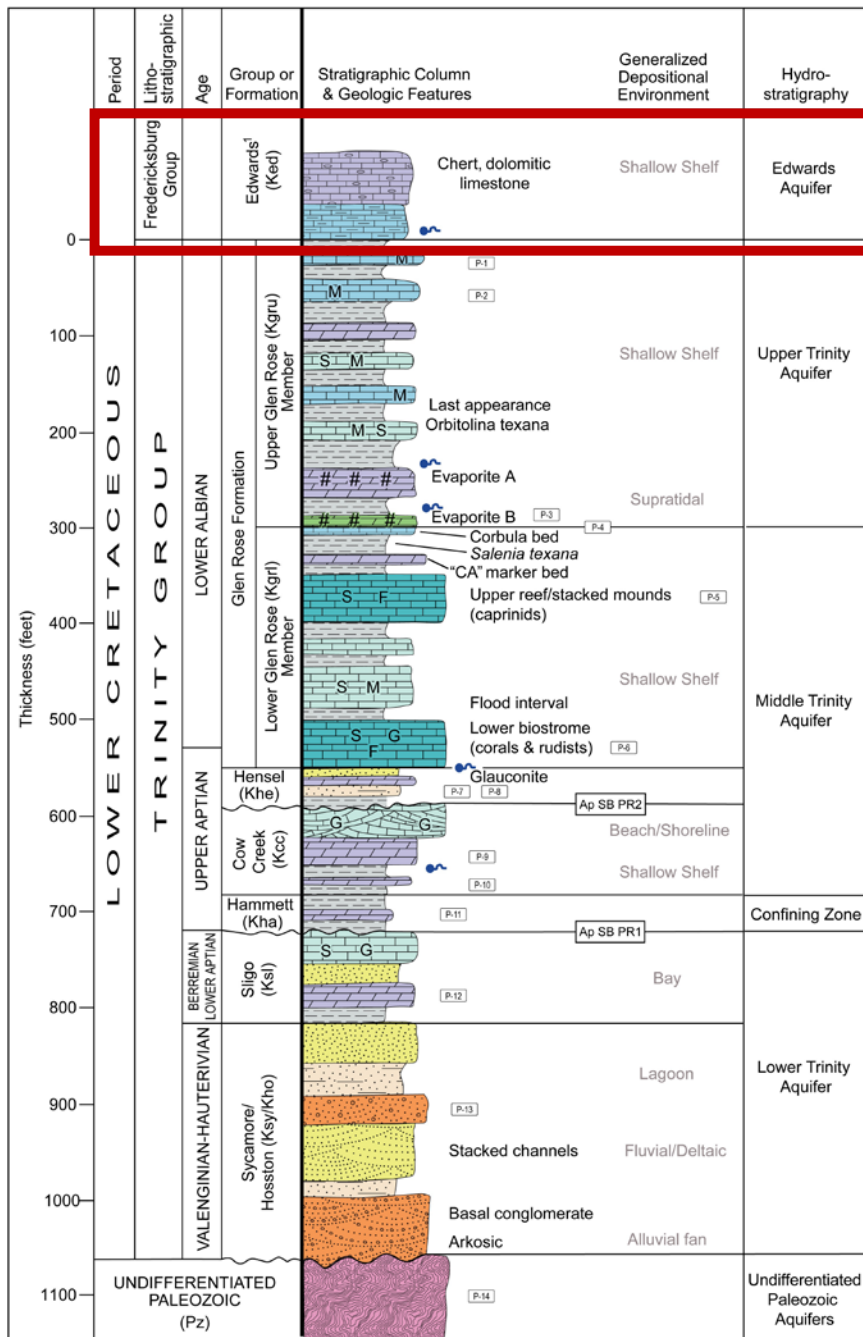
Narrows, Blanco River

Period	Litho-stratigraphic Group	Age	Group or Formation	Stratigraphic Column & Geologic Features	Generalized Depositional Environment	Hydro-stratigraphy
	Fredericksburg Group		Edwards ¹ (Ked)	Chert, dolomitic limestone	Shallow Shelf	Edwards Aquifer
0						
100						
200						
300						
400						
500						
600						
700						
800						
900						
1000						
1100						

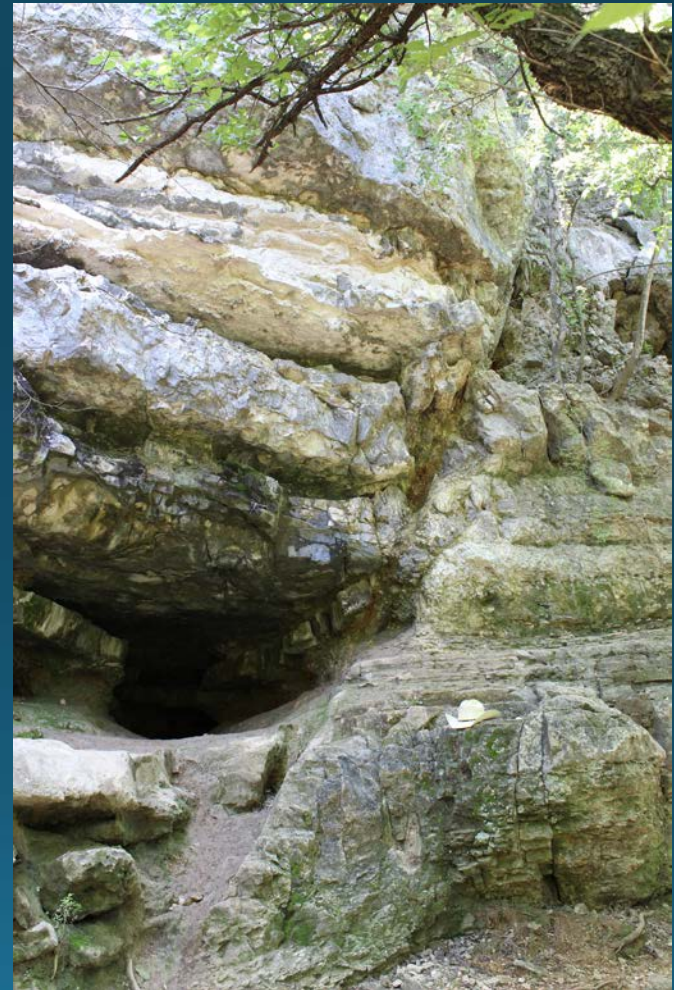
A photograph of a steep, eroded hillside showing distinct horizontal sedimentary rock layers. The top of the hill is covered with sparse vegetation and small trees. Power lines run across the top of the hill. The foreground shows a grassy area with some small evergreen trees.

Hwy 290, Dripping Springs

Stratigraphic Column

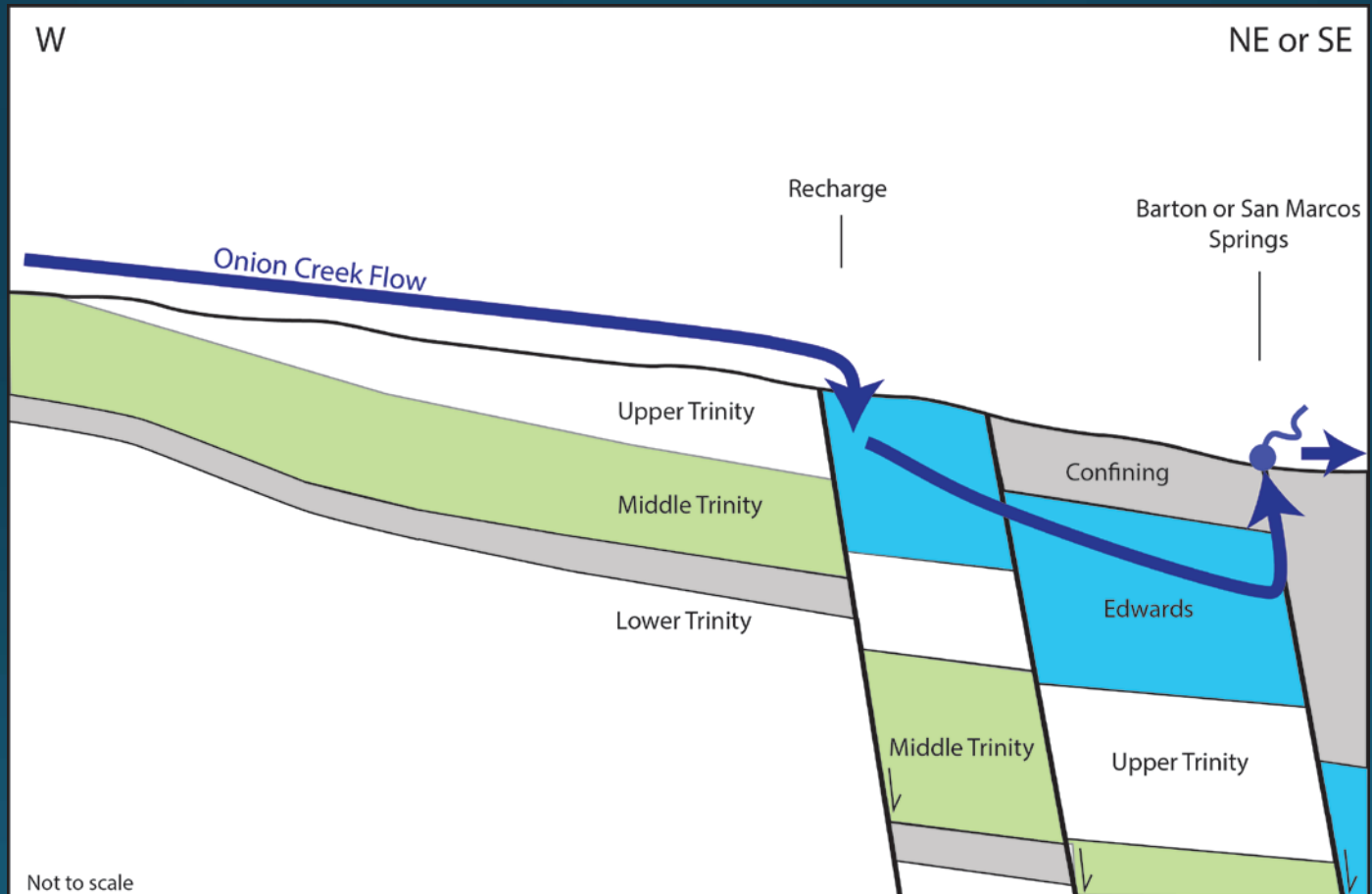


Edwards

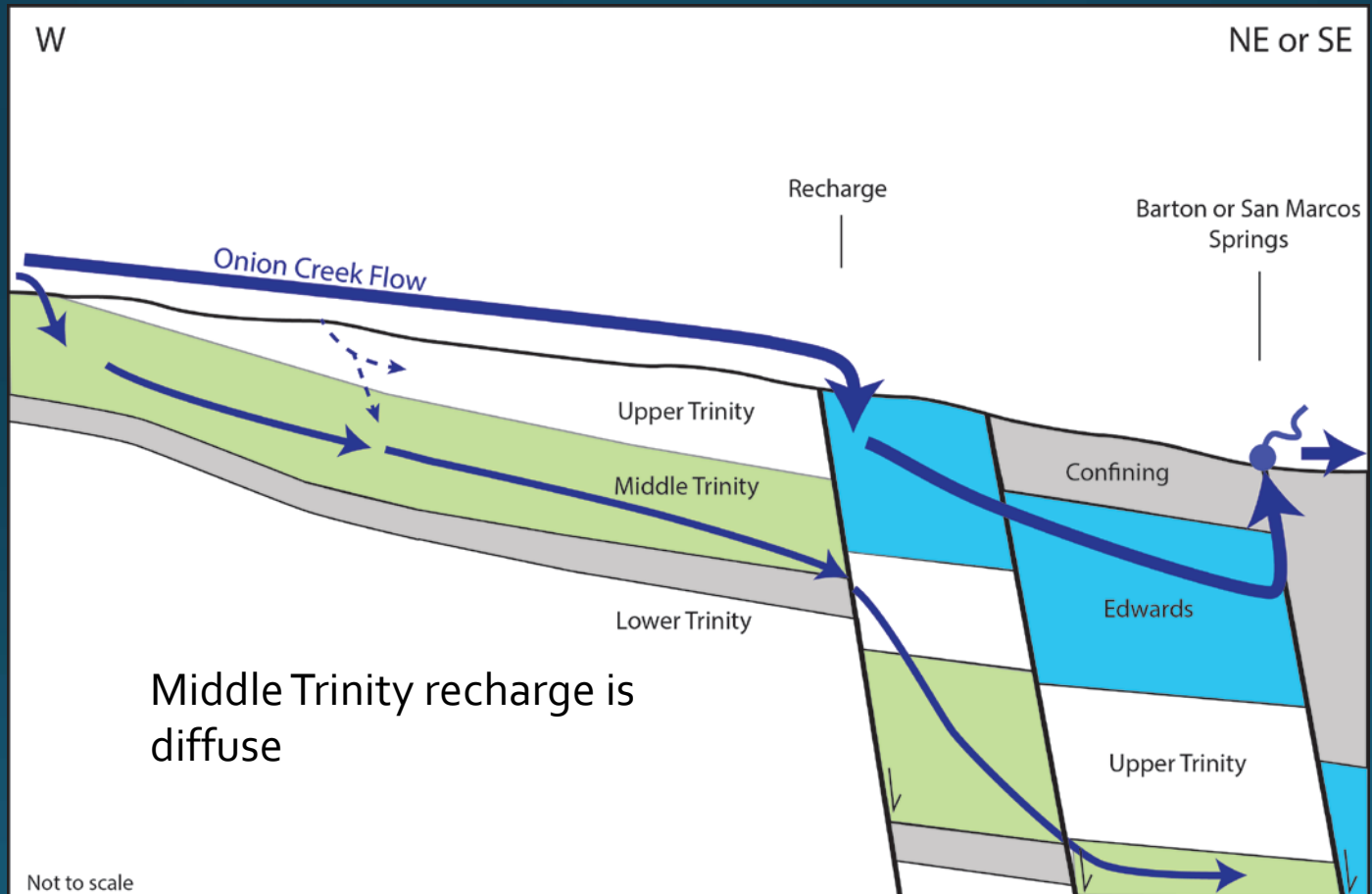


Airman's Cave, Barton Creek

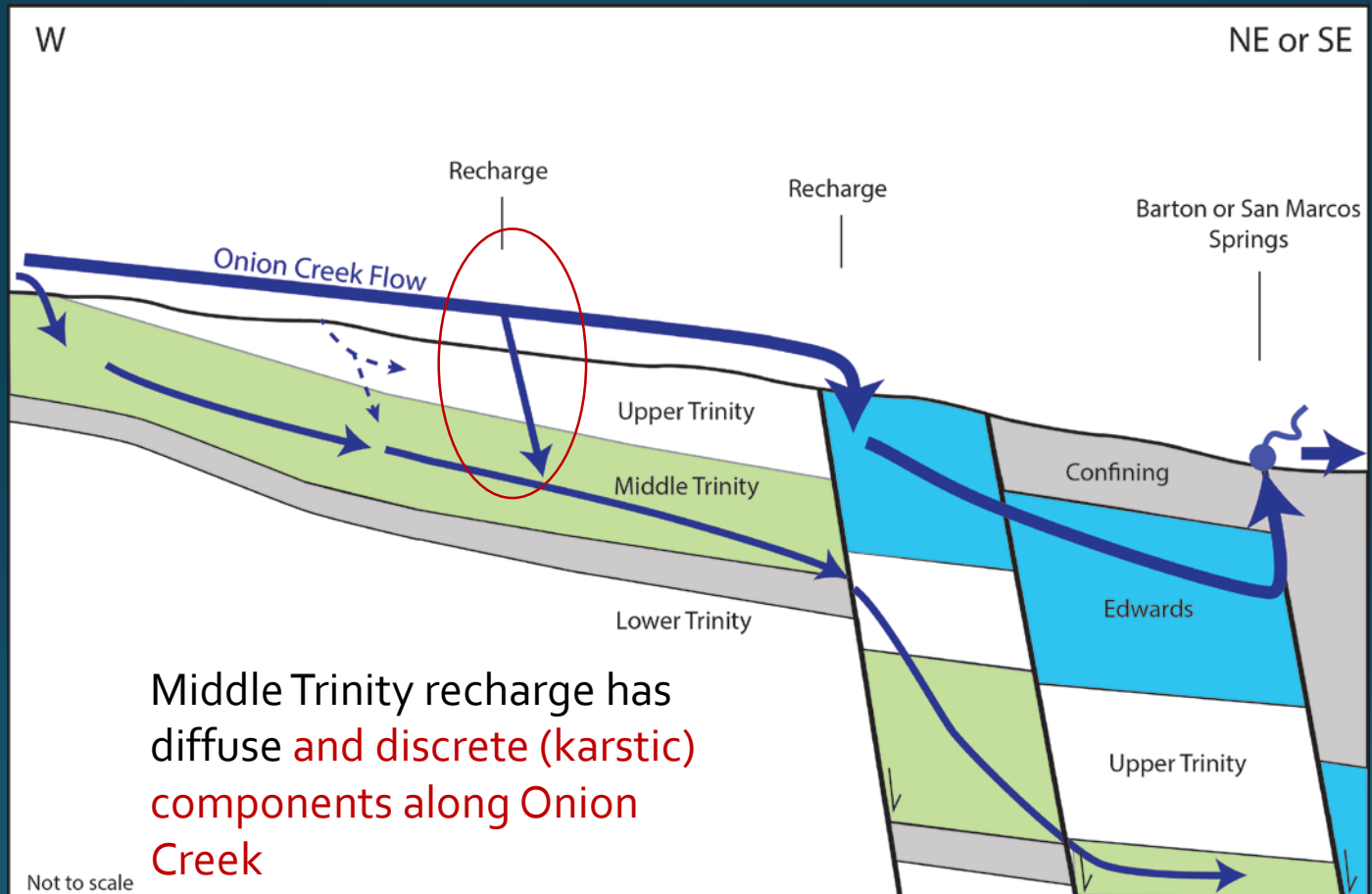
Previous Conceptual Model



Previous Conceptual Model



Revised Conceptual Model



Data and Methods



Flow
Gain/Loss

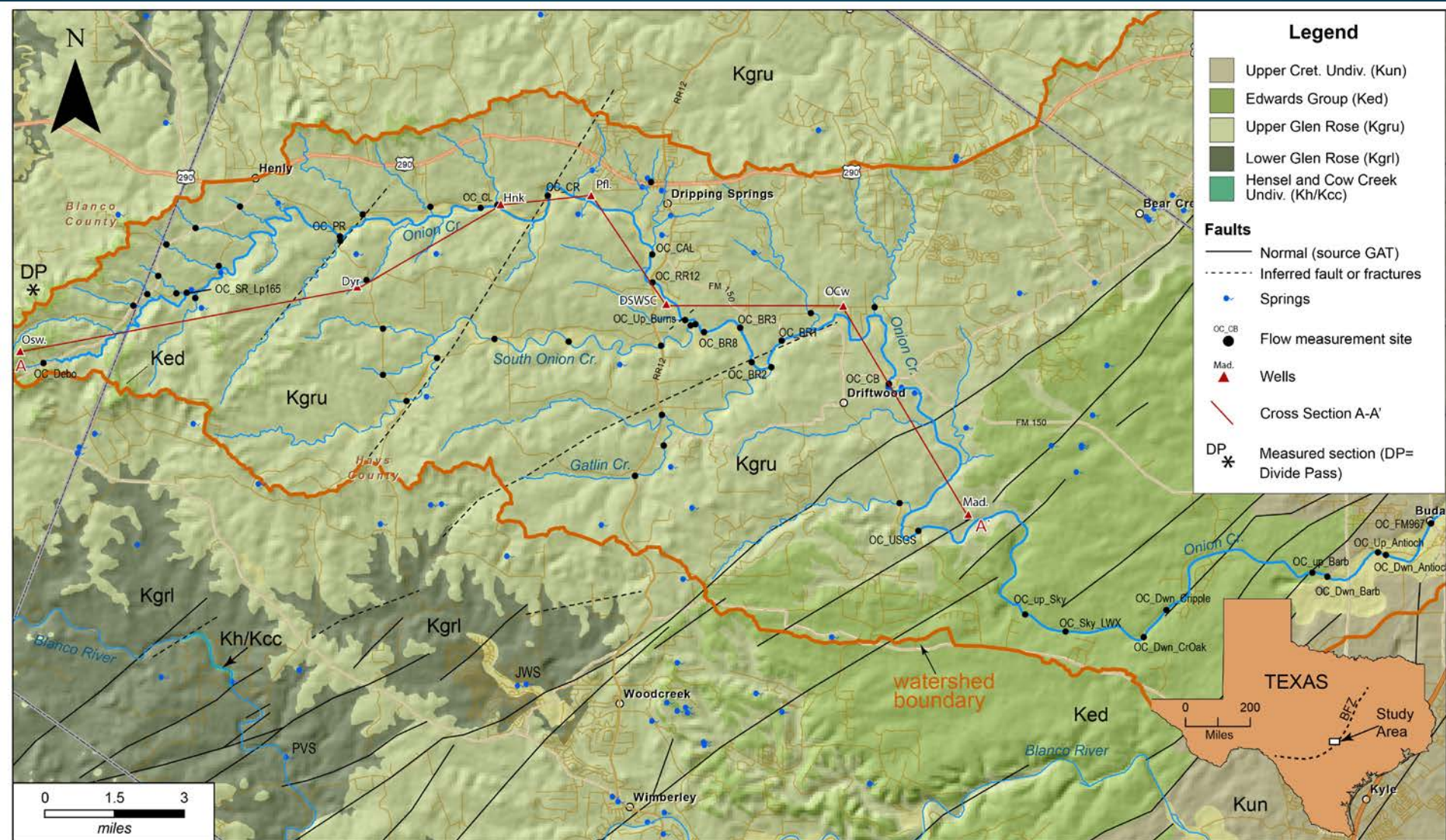


Geologic



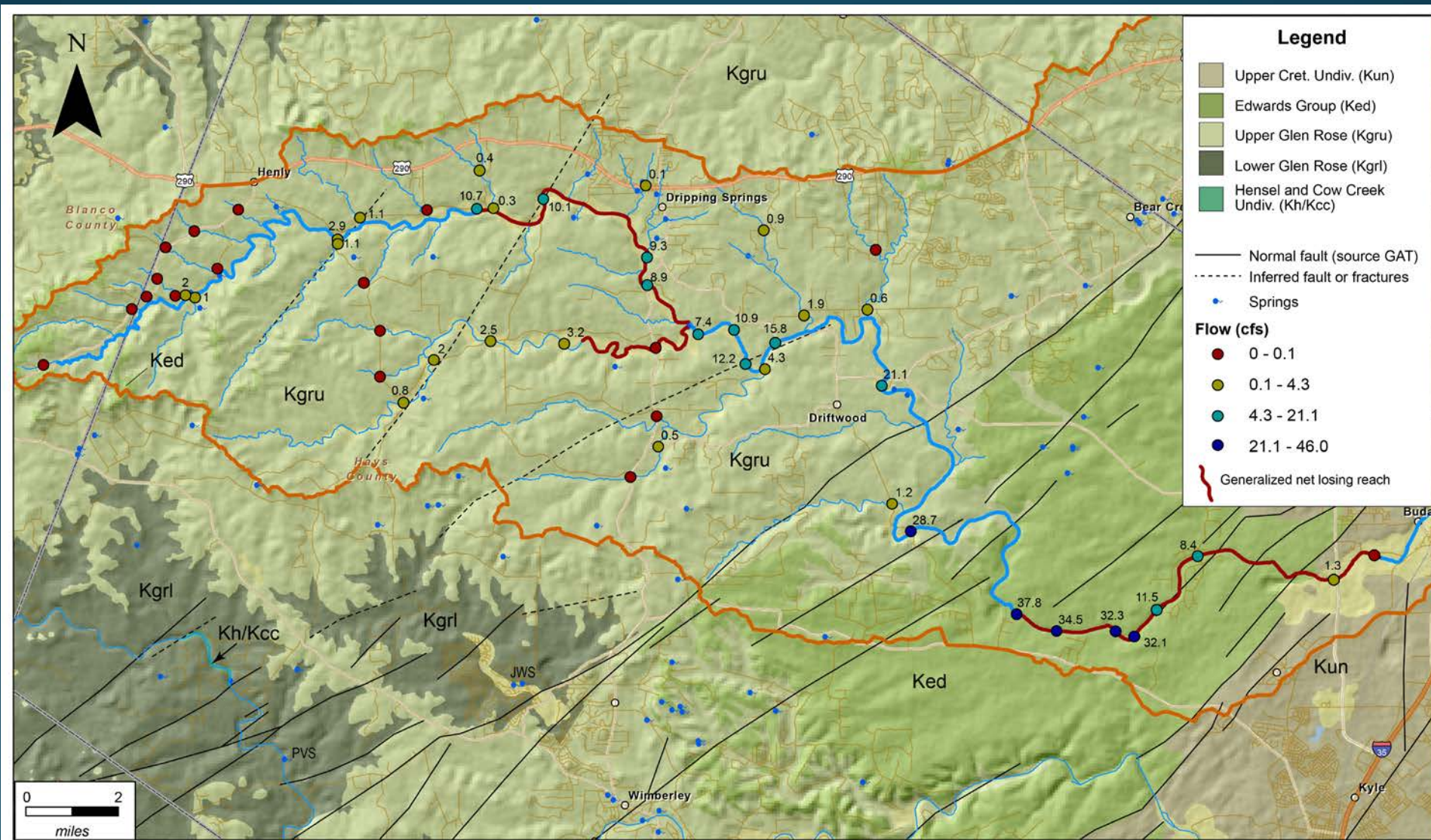
Geochemistry
Water Levels

Study Area



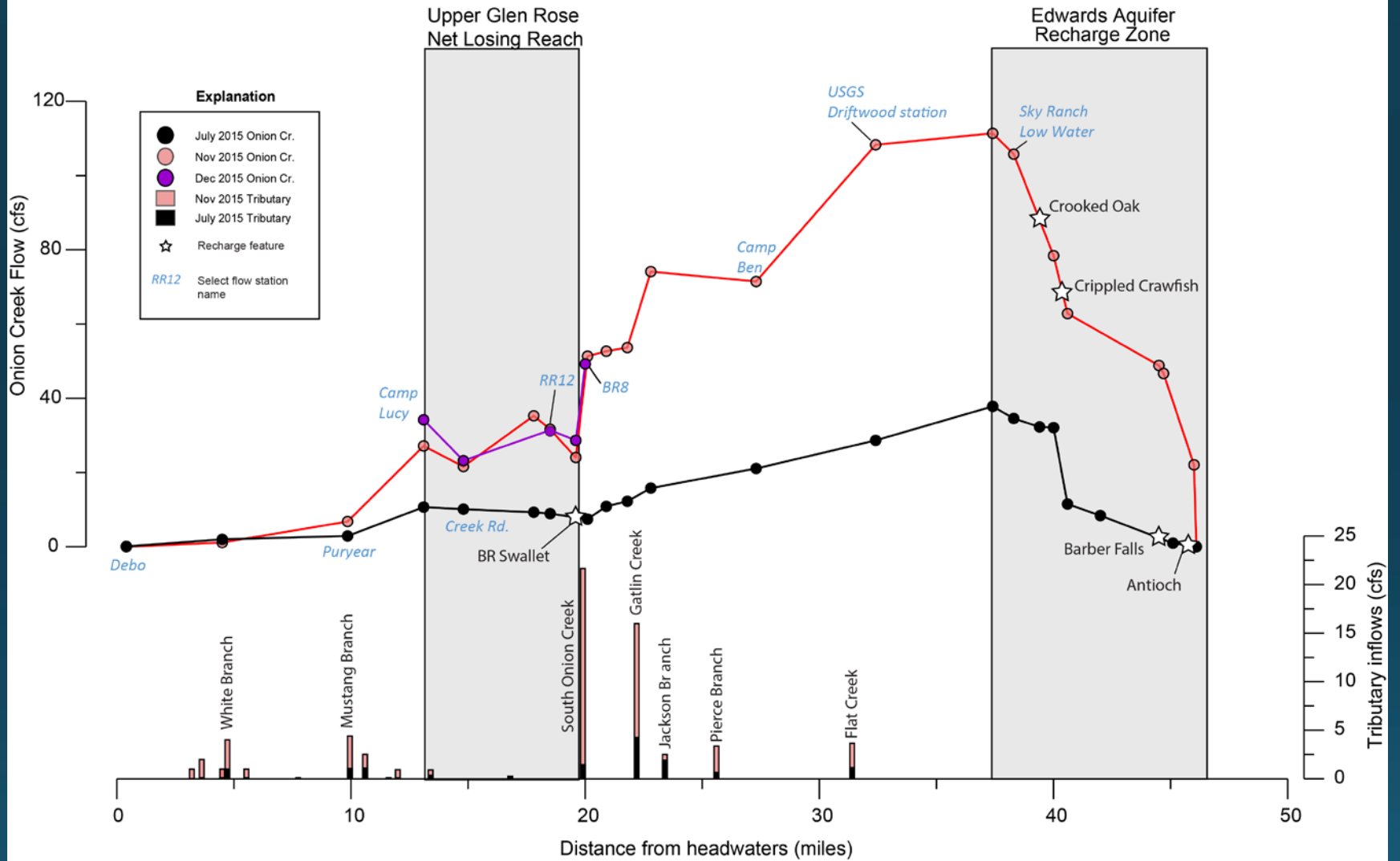
Study surface sites, select wells, and springs are shown.

Flow Measurement Results-July 2015

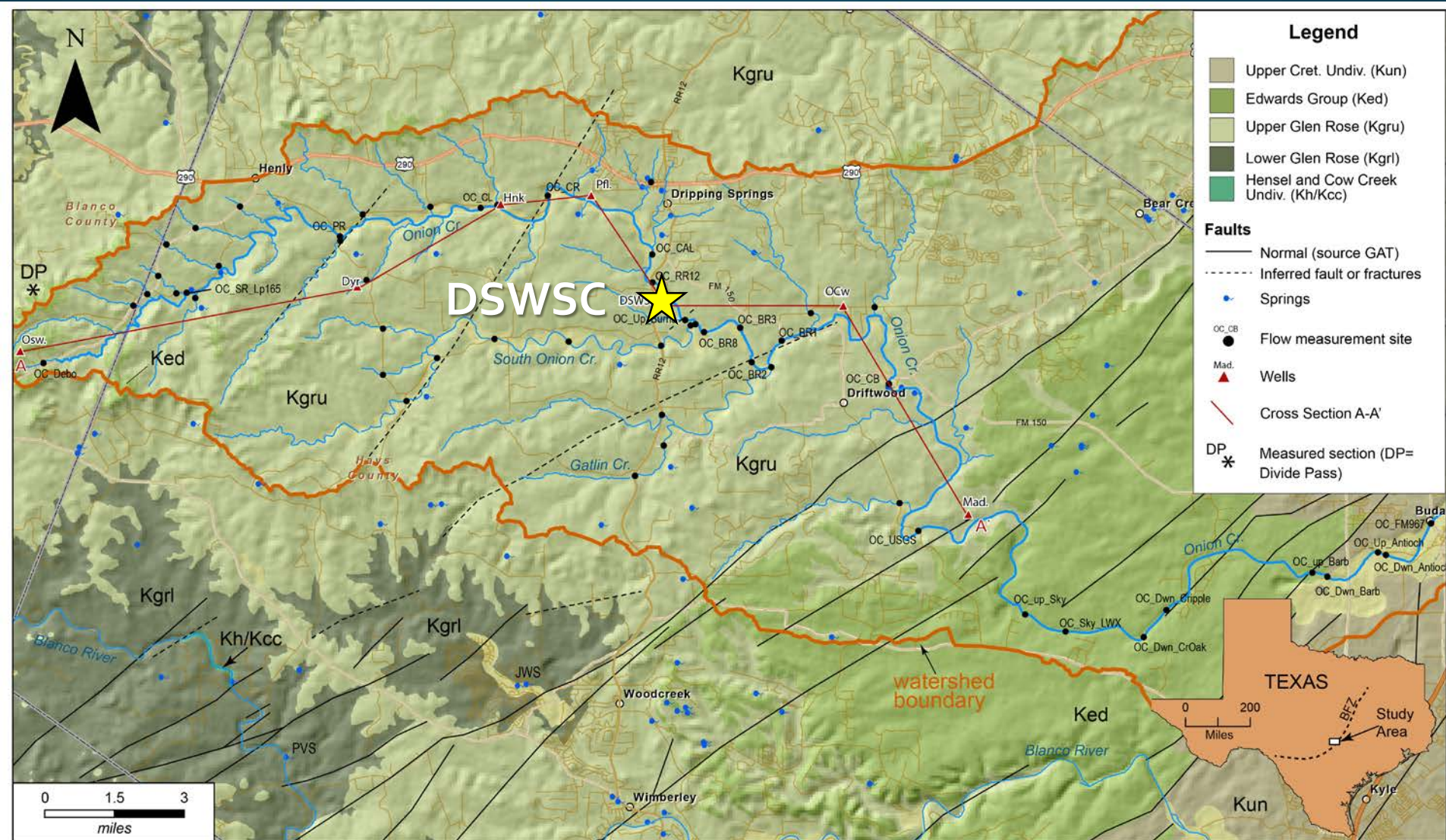


Low-flow conditions

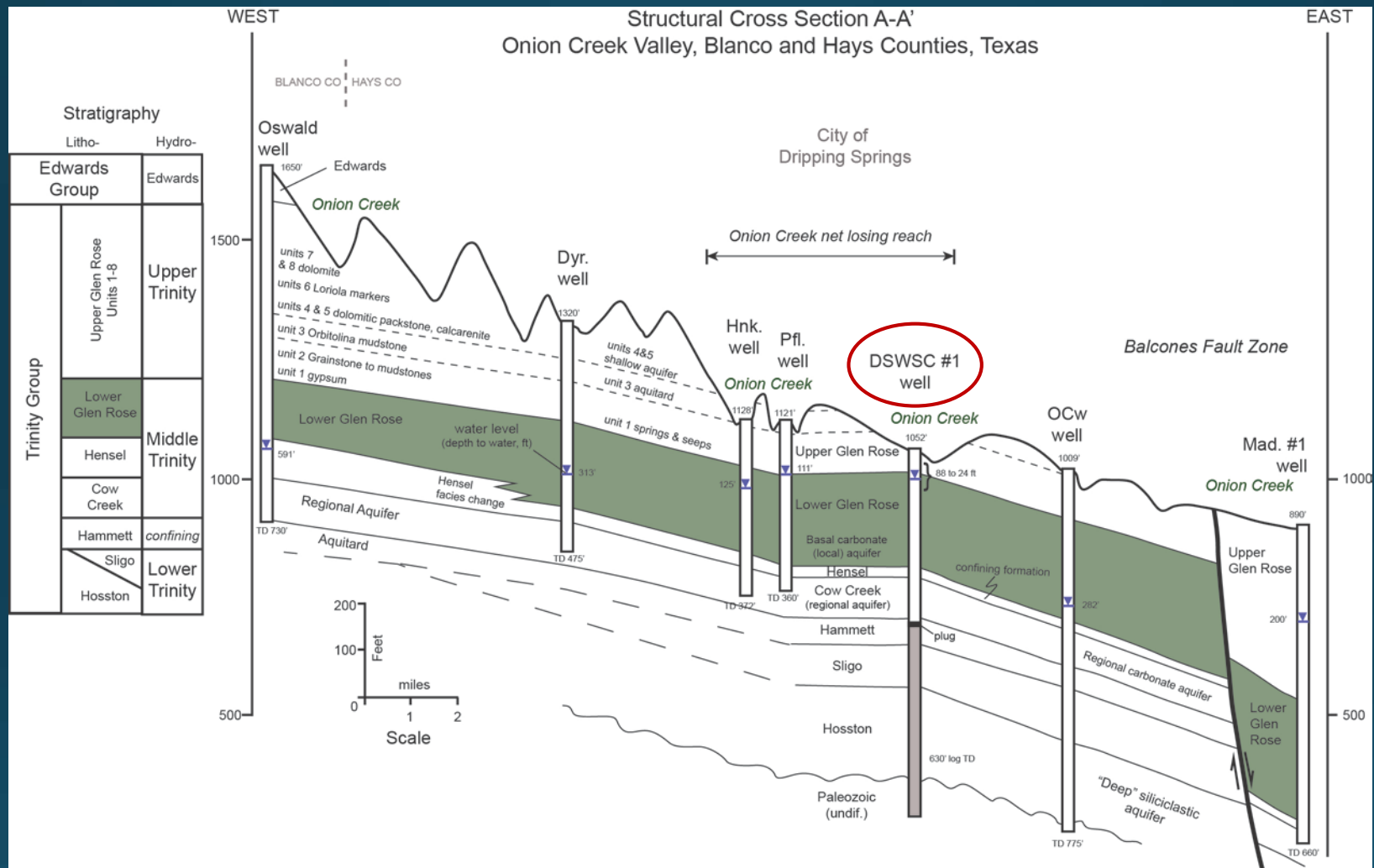
Onion Creek Distance-Flow Hydrograph



Study Area



Study surface sites, select wells, and springs are shown.



A relatively thin (20 ft) and fractured Upper Glen Rose may enhance recharge to the Middle Trinity Aquifer in the losing reach of Onion and South Onion Creeks. This reach of the creek has incised below a potential aquitard (unit 3).



Dripping
Springs
Water Supply
Wells

fractures

Karst feature

Google Earth, 2013

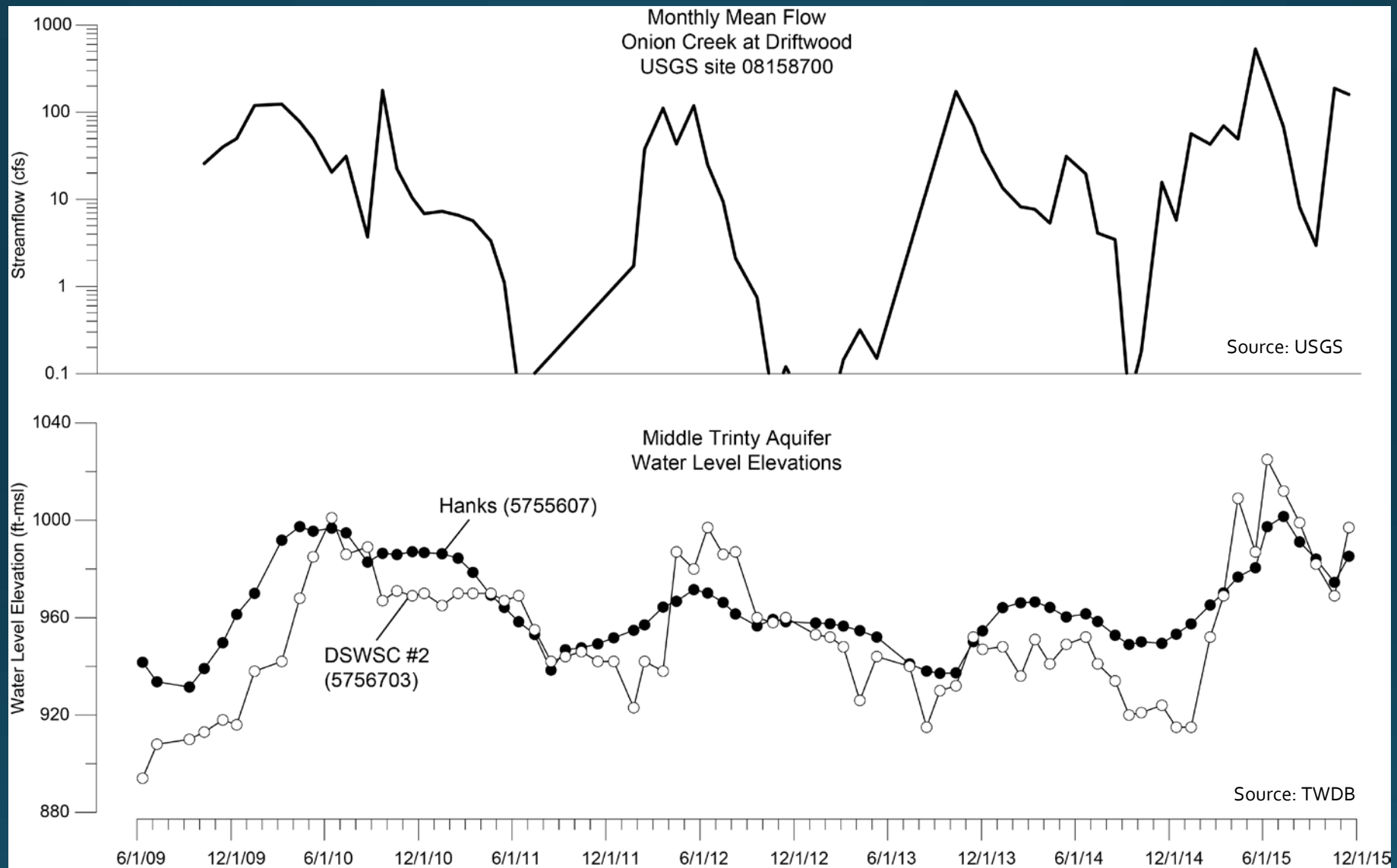
Fractured bedrock



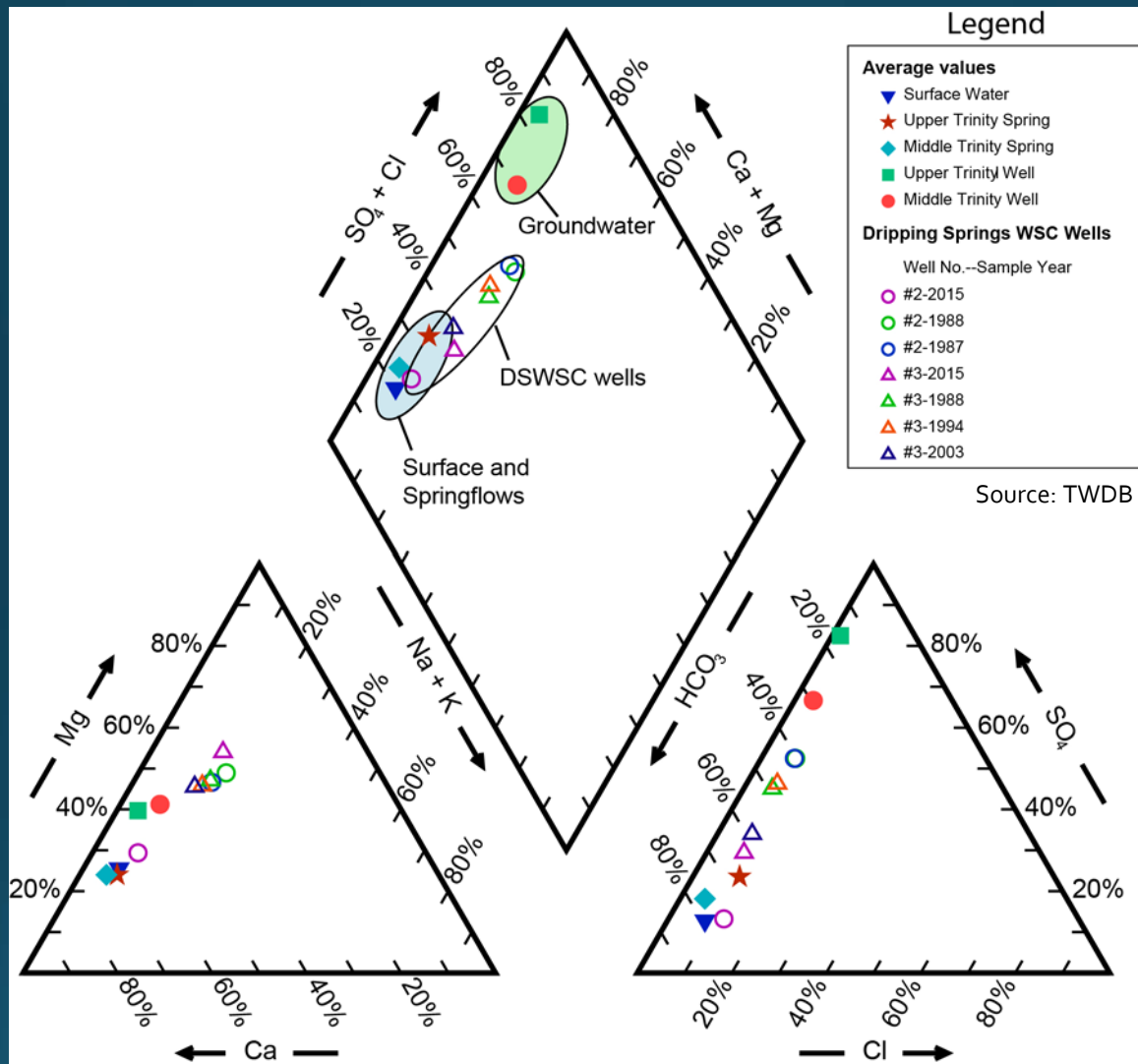


Recharge directly observed!

Karst feature (swallet) actively recharging on Onion Creek. This is one of a number of solution-enlarged fractures in the creek.



High flow in the creek appears to result in increased recharge, and higher heads in the vicinity of the losing reaches of both Onion and South Onion Creeks



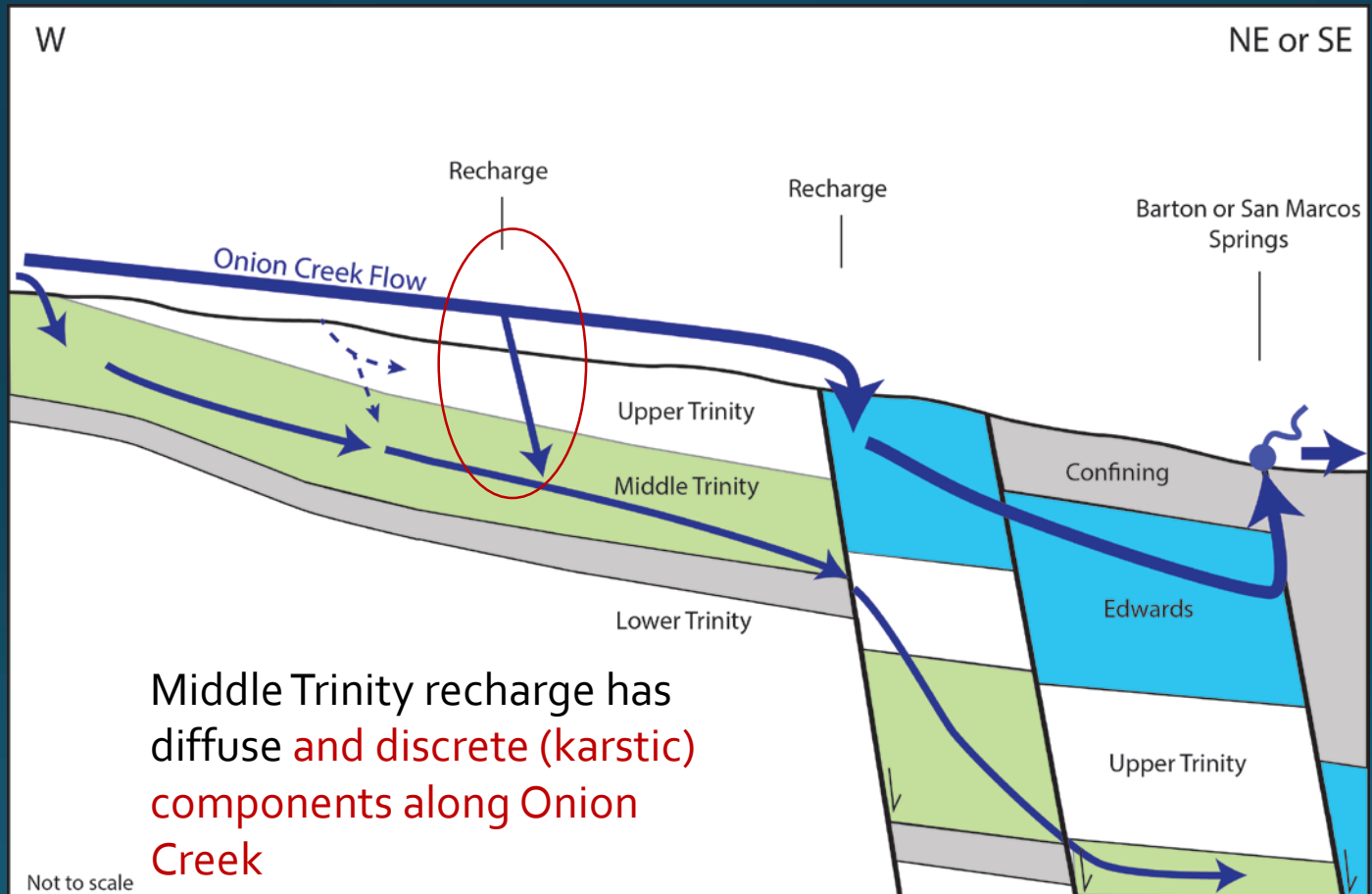
The geochemistry from the DSWSC #2 and #3 plots as calcium/bicarbonate water for some samples, similar to springs and surface water.

Isotopes

^{12}C 12.00000 98.89% Stable	^{13}C 13.00335 1.11% Stable	^{14}C 14.0 $t_{1/2} = 5715\text{yrs}$ Radioactive Cosmogenic/ anthropogenic
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- Isotope geochemistry suggest recharge is occurring from nearby surface water.
- Isotopes of modern carbon from DSWSC wells ranged 73-102 pMC
- Relatively high levels of tritium (1.8 TU) in DSWSC#3 also suggest “young” water.

Conclusions: Revised Conceptual Model



Generalized Surface and Groundwater Interaction Map Blanco River and Onion Creek, Central Texas

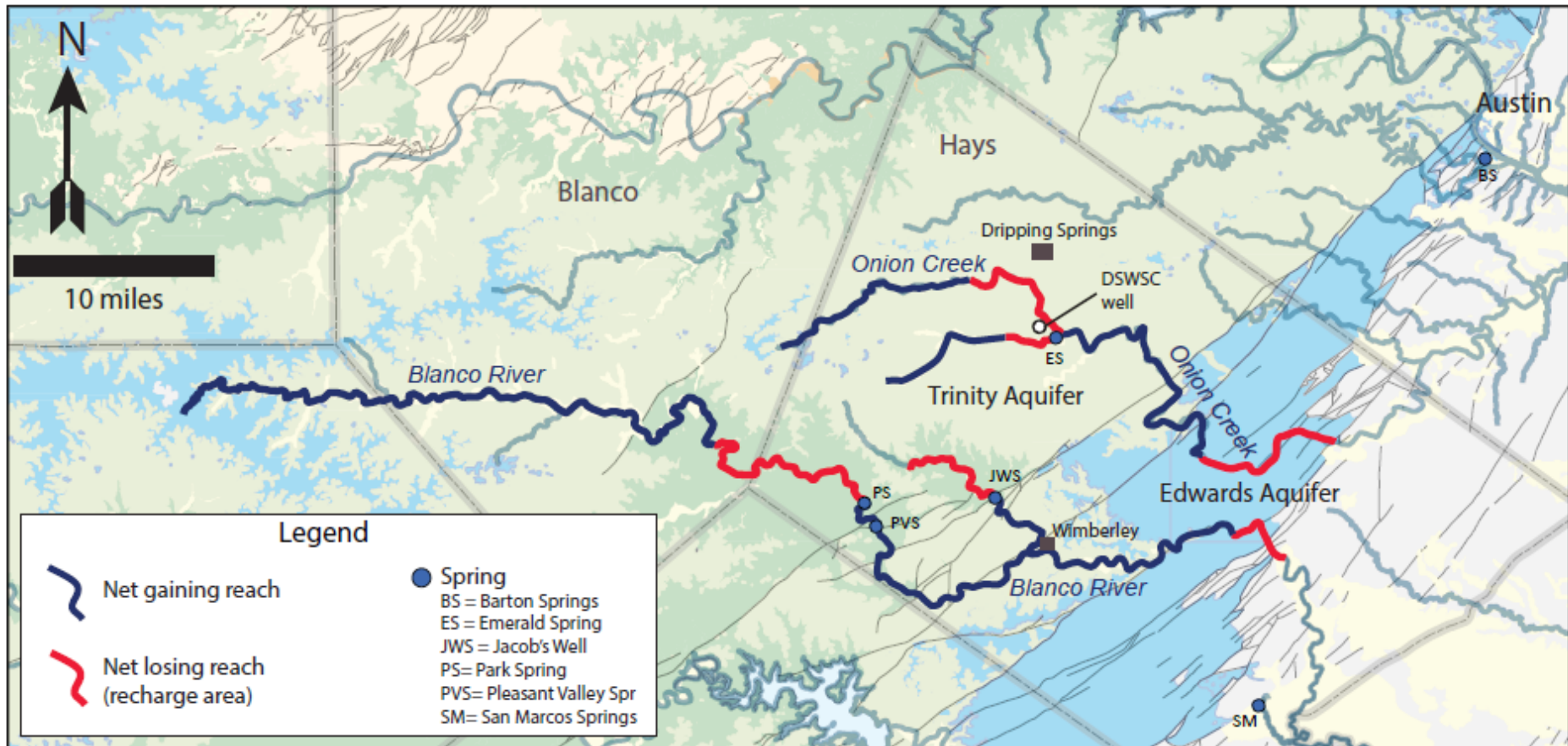


Figure 1. Map showing the generalized geology of Central Texas with the net gaining and losing reaches indicated along the Blanco River and Onion Creek. These are generalized from the studies of Smith et al., (2015) and Hunt et al. (In Press).

Implications

1. **Water Quality**—changes in the surface water quality could affect the Middle Trinity Aquifer, particularly in the areas of identified flow loss.
2. **Water Availability**— increased recharge could buffer the negative impacts of large-scale drawdown from increased pumping.

Groundwater Quality

City of Dripping Springs
proposed effluent discharge
into Onion Creek

- TCEQ draft permit may allow a discharge of effluent into Onion Creek (up to ~1 MGD or 1.5 cfs)
- Location is within the losing reach documented in this study, and upstream of the DSWSC wells.



Austin-American Statesman

Groundwater Availability

Dripping Springs Water
Supply Corporation

Annual Pumping Permit

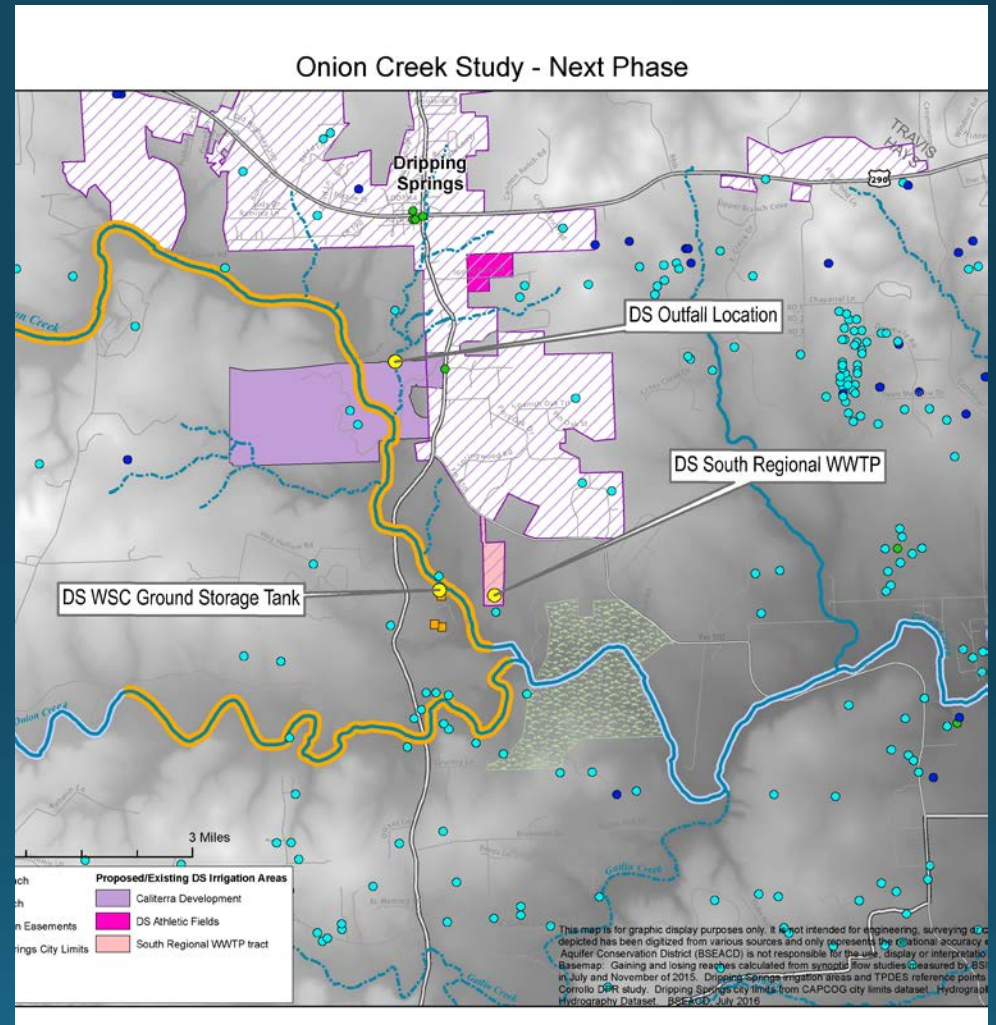
Current		Requested
625 ac-ft	=>	1,450 ac-ft
200 MG	=>	472 MG



DSWSC #3

Future Studies

- Dye Tracing
- Flow studies
- Additional surface and groundwater sampling
- Dedicated monitor wells



Acknowledgments

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We extend our thanks to the cooperation and support of landowners and other entities: Dripping Springs Water Supply Cooperation (DSWSC), Les White, Browning Ranch, Lucy Hibberd, Reed Burns, Camp Lucy, Lyndon Smith Ranch, US Geological Survey, and the Texas Water Development Board.

A photograph of a river with a prominent whirlpool in the center. The water is a deep blue, and the whirlpool creates concentric ripples. In the upper right corner, there are dark, leafy branches hanging over the water. The text "Thank you!" is written in a bold, orange, sans-serif font across the upper middle of the image.

Thank you!

Whirlpool forming above Cripple Crawfish Cave, a major recharge feature of the Edwards Aquifer. Photo by David Johns

Select References

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- **Wierman**, D.A., A. S. Broun, B.B. Hunt, 2010, Hydrogeologic Atlas of the Hill Country Trinity Aquifer, Blanco, Hays, and Travis Counties, Central Texas: Hays-Trinity Groundwater Conservation District, United States. 15 plates.