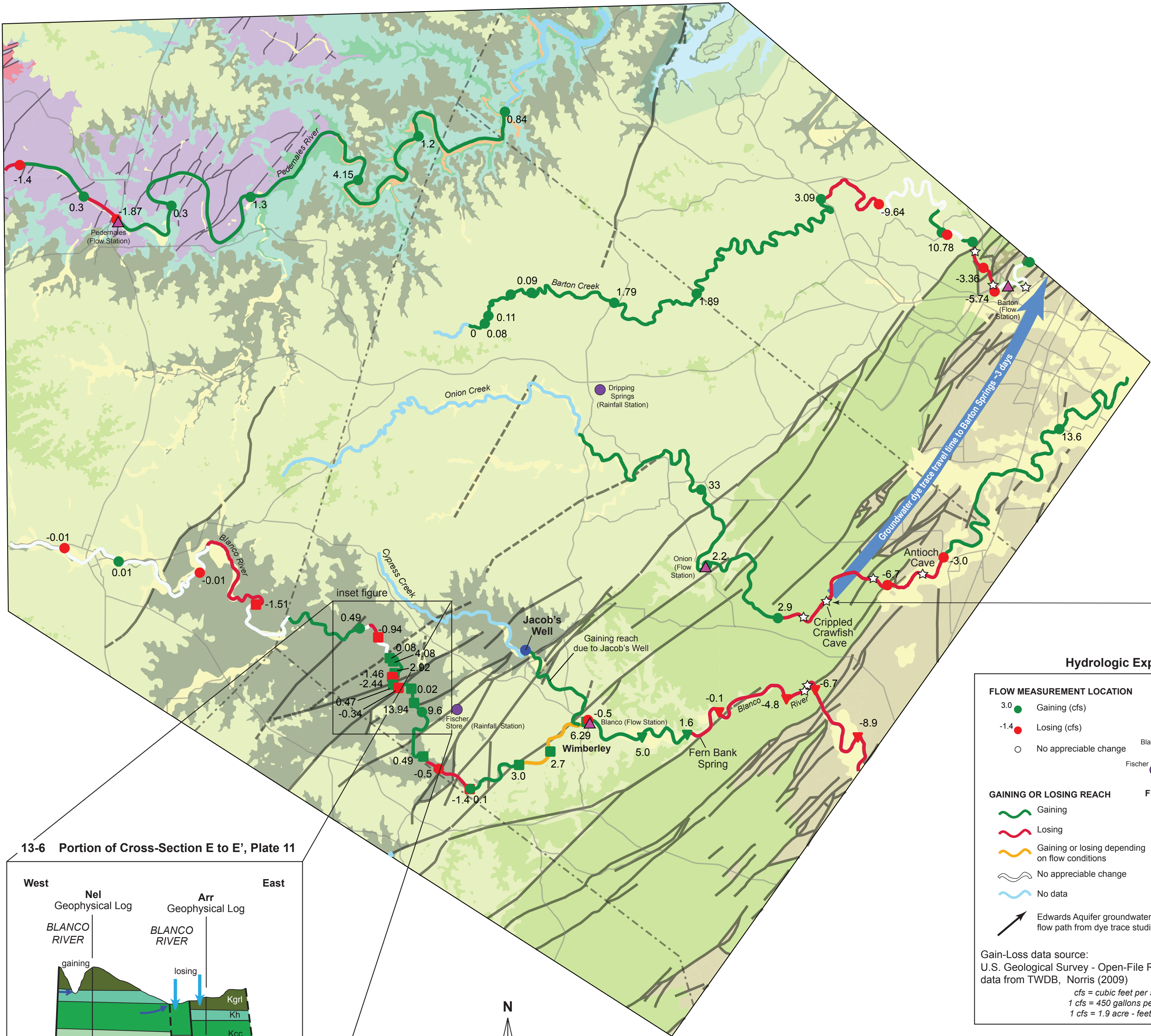
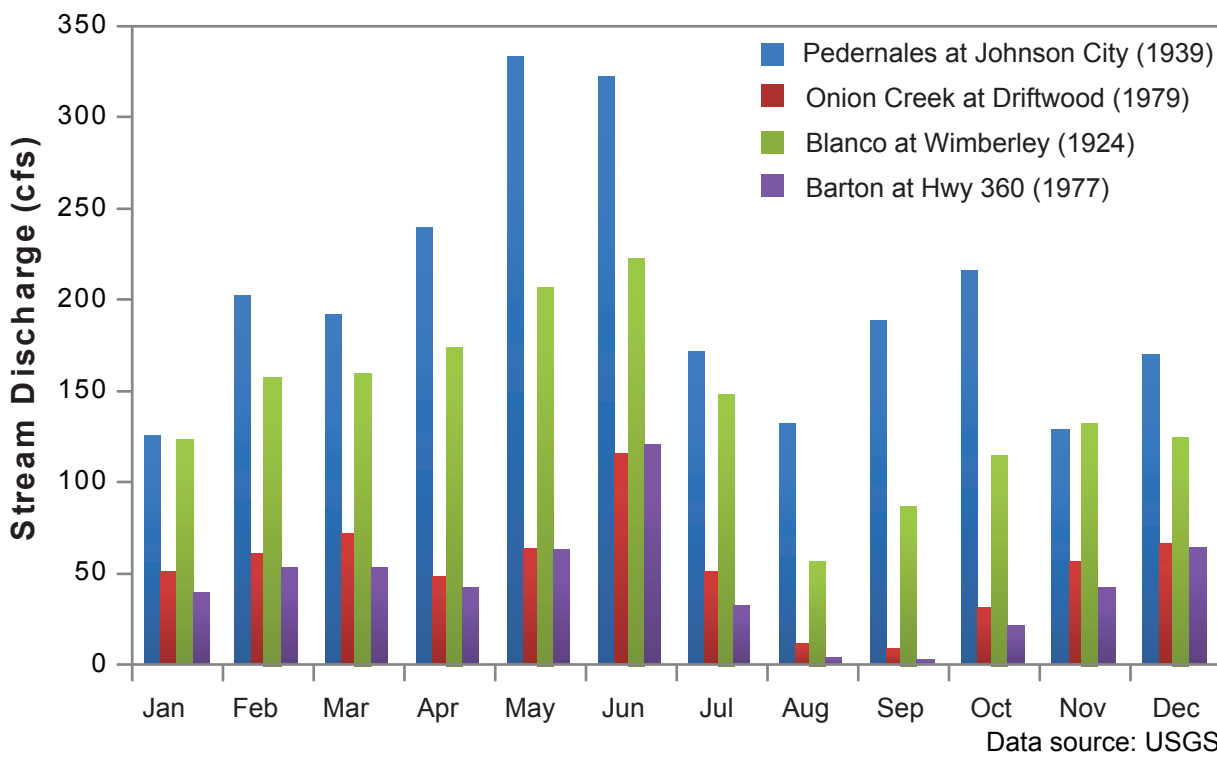


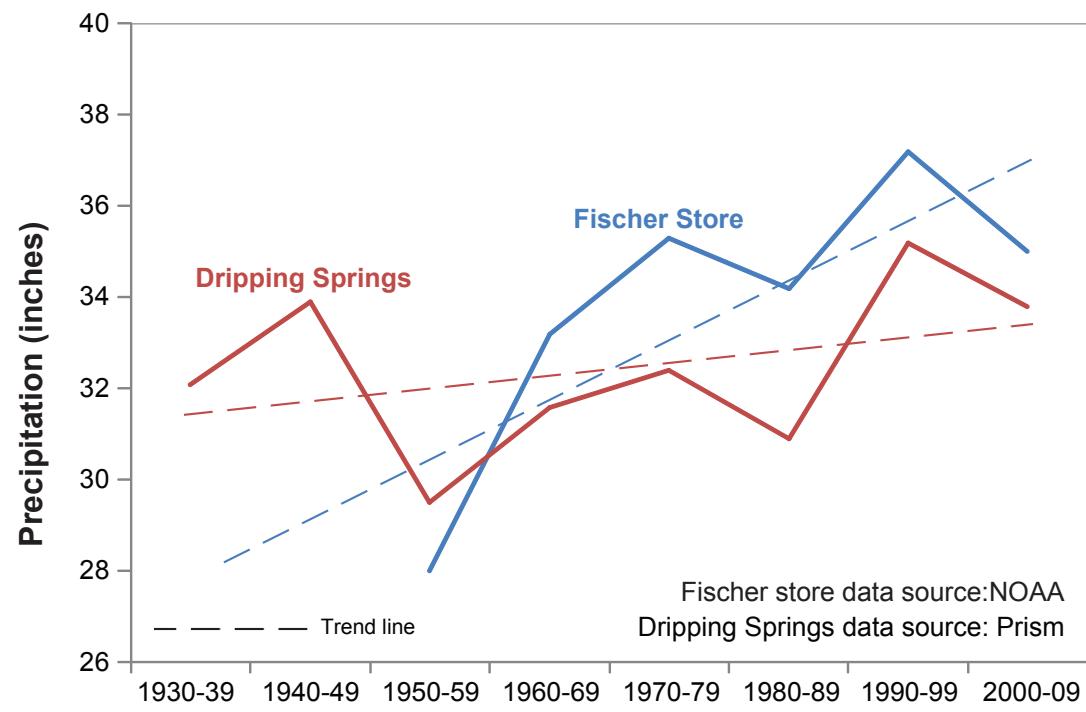
13-1 Map of River or Stream Reach Gain and Loss



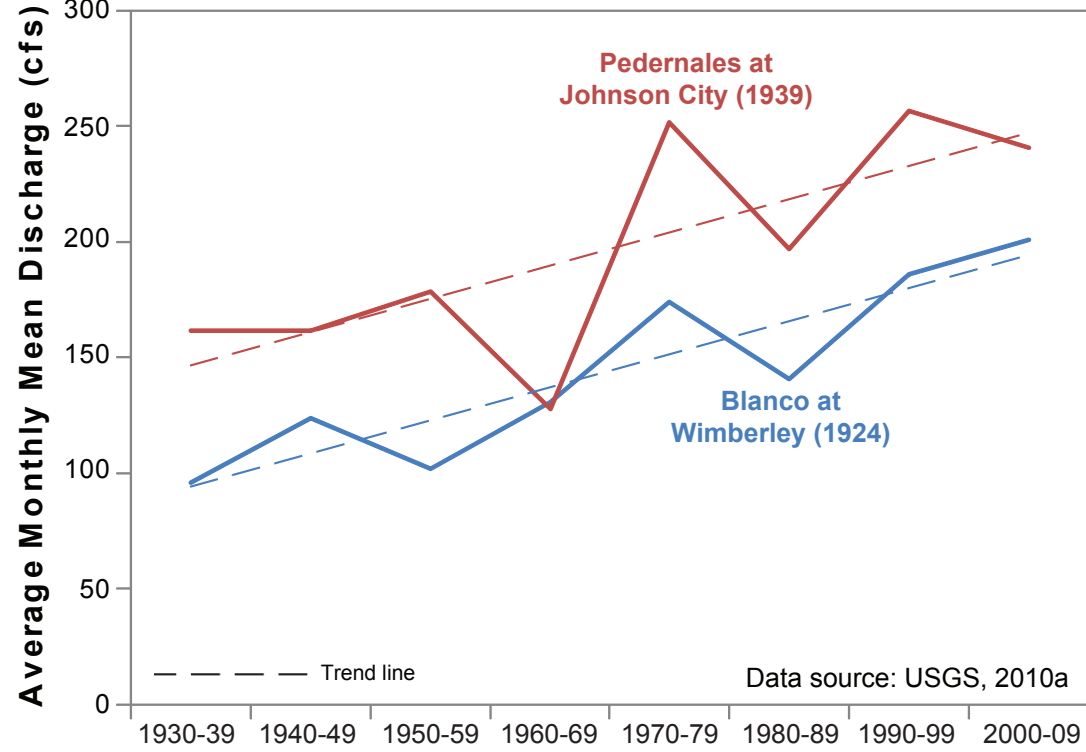
13-2 Mean of Monthly Stream Discharges for Period of Record



13-3 10-year Average Precipitation

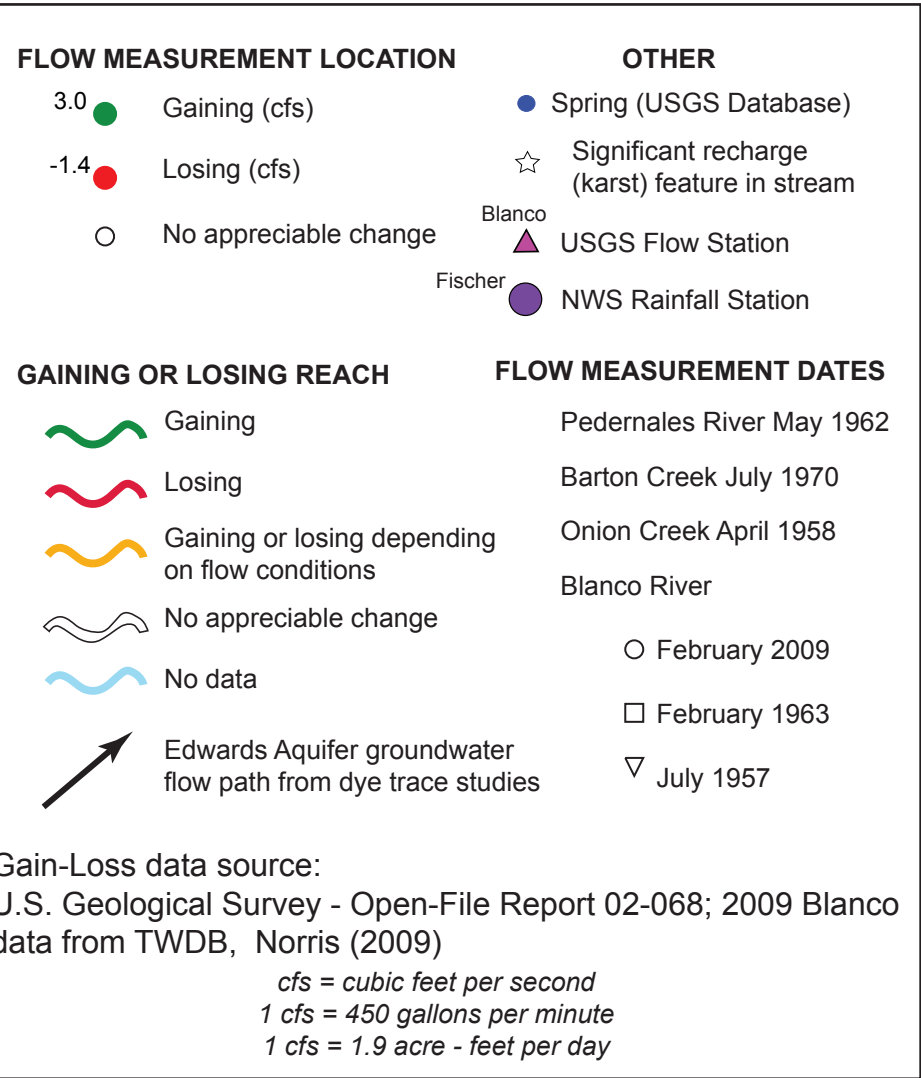


13-5 10-Year Average Stream Discharge

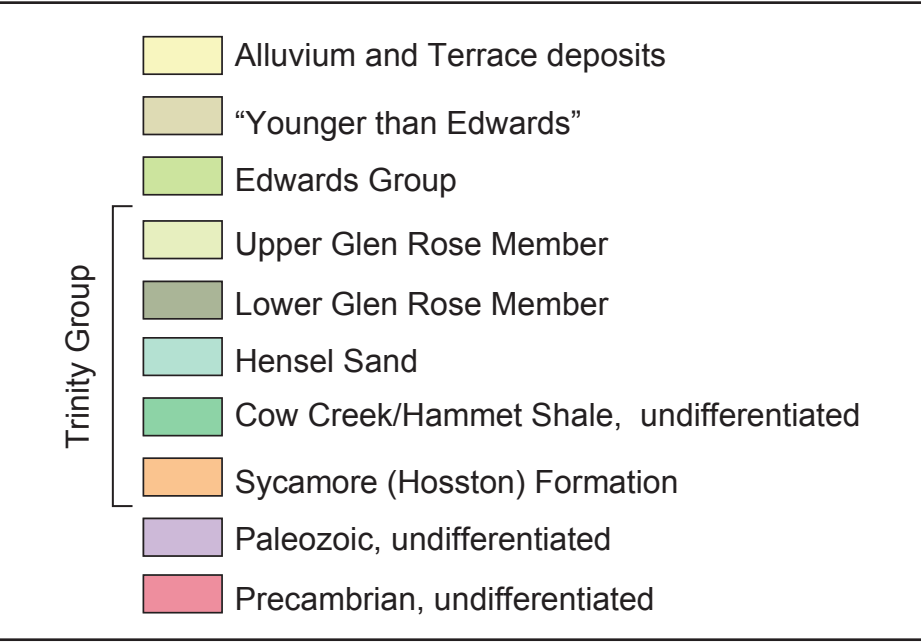


13-4 Whirlpool over Crippled Crawfish Cave during a recharge event on Onion Creek. Photo by David Johns.

Hydrologic Explanation



Geologic Explanation



Surface Water and Groundwater Interaction

The interconnectivity of surface water and groundwater can be quantified through gain-loss studies. In the Trinity Aquifer, where streams flow across areas of exposed rock (outcrops), streamflow gains and losses are indicative of aquifer discharge and recharge. Stream gains reflect aquifer discharge, and stream losses reflect aquifer recharge. Gain-loss studies are conducted by measuring streamflow at the two points, one upstream and one downstream, and comparing the difference. If the downstream point has a higher flow, then the stream is gaining (aquifer discharging). Conversely, if the downstream flow is lower, then the stream is losing (aquifer recharging). Gain-loss studies are typically performed during baseflow conditions to minimize any effect on flow from short-term stormwater runoff.

Figure 13-1 illustrates the results of gain-loss studies performed on the major streams and rivers in the study area. Most of the studies were performed by the USGS (Slade et al., 2002), with the exception of the area upstream of Wimberley on the Blanco River which was performed by TPWD (Norris, 2009). A comparison of average monthly flow in each of the major streams is shown on Figure 13-2.

Flow in the Blanco River in Blanco County originates from the Edwards (Plateau) and Upper Glen Rose. The river is intermittently fed by shallow springs and seeps. As the river flows southeasterly it cuts down through the Upper Glen Rose and eventually flows over a relatively short reach of up-faulted Hensel and Cow Creek (Middle Trinity Aquifer) as shown on Figures 13-1 and 13-6. The major gaining reach occurs just downstream of this area where a fault zone crosses the river several miles west of Wimberley. Baseflow in Cypress Creek, which converges with the Blanco River in Wimberley, originates from artesian flow from the Cow Creek in Jacob's Well (see Plate 14).

Most of the base flow in Barton Creek, Onion Creek and the Pedernales River originates from shallow springs and seeps. The Upper Glen Rose (Upper Trinity Aquifer) is the source for Barton and Onion Creeks. Both Cretaceous (Glen Rose, Hensel, and

Cow Creek) and Paleozoic formations (primarily Ellenburger) are contributors to the Pedernales River prior to its confluence with the Colorado River.

Balcones Fault Zone

Surface water flows generally west to east towards the Balcones Fault Zone (BFZ). As the streams encounter individual faults within the BFZ, SW-NE trending bends in stream beds following the faults are common. Significant losses occur as the streams flow across faults and karst features of the Edwards Aquifer Recharge Zone. Dye tracing studies (Hunt et al., 2006) of karst features within the Onion Creek watershed upon the Edwards Aquifer (Figure 13-1) have shown recharge and rapid groundwater flow to Barton Springs (up to 6 miles per day), indicating a well-developed karst flow system.

Temporal Trends

Both streamflow and precipitation generally have increased over the last 80 years as shown on Figures 13-3 and 13-5. Using linear regression analysis on 10-year average annual precipitation to compare the data, precipitation has increased several inches over the last 80 years (Figure 13-3). Similarly, 10-year average discharge in the Blanco River at Wimberley and in the Pedernales River at Johnson City have significantly increased since the 1930s over the same 80 year period (Figure 13-5).

Historic streamflow gain-loss data collected on Onion Creek document that Onion Creek's base flow was sustained by gains in flow in the stream channel from the Trinity Aquifer (Slade et al., 2002). However, despite the apparent increase in rainfall and streamflow noted above, Slade (2007) notes that the streamflow of Onion Creek have diminished in recent years. Slade (2007) attributes this decrease in Onion Creek flow to recent substantial increases in groundwater withdrawals in northern Hays County (in the Onion Creek basin). "Because of the increased groundwater withdrawals in the area, it is expected that Onion Creek will experience no flow conditions for all but storm runoff periods in the future" (Slade, 2007).

13-6 Portion of Cross-Section E to E', Plate 11

