

TECHNICAL MEMORANDUM

TO: Mr. Dirk Aaron, General Manager, CUWCD

FROM: Michael R. Keester, P.G.

SUBJECT: Drawdown Analysis of the Local Middle and Lower Trinity Aquifers

DATE: October 5, 2018

As noted in previous analyses of water level changes, District constituents have expressed concerns regarding declining water levels in the Trinity Aquifer. In addition, in response to proposed mining operations in northern Williamson County, landowners reached out to the District to better understand Trinity Aquifer conditions and how the pumping by the mine operators may affect their wells. To assess the current conditions of the aquifer, we built upon previous analyses of the changes in water levels in the Middle Trinity Aquifer in southern Bell and northern Williamson counties. As part of our analysis, we expanded our evaluation to include an assessment of the water level conditions for the Lower Trinity Aquifer.

Methodology

We began by assembling the most recent water level data collected in 2018. Within Bell County, we relied primarily on the water level measurements collected by District staff or from continuous monitoring wells maintained by the Texas Water Development Board. These water levels and locations were the most reliable as the water levels are collected regularly and the aquifer designation for the well has been reviewed by District staff and multiple hydrogeologists.

To supplement the water level data available from the District's database, we also collected records from the Submitted Driller's Report database. This database provides a record of well completions as reported by licensed water well drillers. Data associated with the report includes the location of the well, the depth and completion interval of the well, and the water level in the well at the time of completion. For each well reportedly completed in 2018, we used the location, depth, and completion interval to determine the aquifer from which the well was producing. These water levels and locations are the most uncertain as they represent various times of the year, the location has not been verified, and the aquifer zone has not been confirmed.

We plotted the water levels at the well locations for each aquifer and prepared contour maps of the water level elevation. For the Middle Trinity Aquifer, we prepared contours of the 2018 water level elevations for comparison with 2006 water levels. For the Lower Trinity Aquifer, we prepared contours of the 2006, 2010, and 2018 water level elevations. For areas with high water level measurement uncertainty, such as northern Williamson County, we contoured the water level surface based on the limited available measurements, the structure of the formation, and trends in water levels from nearby areas.

Using grids generated from the water level contours, we calculated the water level decline (that is, drawdown) in each of the aquifers. We also used the grids to calculate the “available drawdown” remaining in each of the aquifers. For this evaluation, we considered available drawdown as the water level above the top of the aquifer (that is, the artesian head). For the top of the aquifer, we used the surfaces as defined by the District’s three-dimensional geologic model.

Middle Trinity Aquifer

For the Middle Trinity Aquifer, the pattern of the water levels has not changed significantly from previous investigations. To the north of the study area, water levels are lower indicating a cone of depression extending toward McLennan County (see map titled: “Middle Trinity Aquifer Water Level Elevation – 2018”). This pattern is expected due to the historical groundwater production from the Trinity Aquifer north of Bell County.

Review of the drawdown map for the Middle Trinity Aquifer illustrates that though there is a cone of depression north of the study area, the largest recent water level declines are located in the central and southern portions of the study area (see map titled: “Middle Trinity Aquifer Water Level Decline – 2006-2018”). Since 2006, water levels in the Middle Trinity have declined by 200 feet or more toward the Sun City area in Williamson County. Near the city of Florence, the water level declines are greater than 100 feet and are more than 140 feet in much of the area. Within Bell County, the Hidden Springs area to the west of Salado has experienced similar water level declines as those observed in northern Williamson County. The declines in these area since 2006 indicate average Middle Trinity Aquifer water level declines in much of the area exceed 10 feet per year.

The final Middle Trinity Aquifer map indicates that in much of the study area the water levels are near the top of the aquifer (see map titled: “Middle Trinity Aquifer Available Drawdown – 2018”). For example, near Florence water levels are less the 100 feet above the top of the aquifer and less than 50 feet above the top toward Sun City. Similar conditions are evident near the Stillman Valley area in Bell County. These low available drawdown levels mean that well owners will have increased difficulty accessing necessary quantities of groundwater.

Lower Trinity Aquifer

Like the Middle Trinity Aquifer, to the north of the study area, water levels are lower indicating a cone of depression extending toward McLennan County (see map titled: “Lower Trinity Aquifer Water Level Elevation – 2018”). However, for the Lower Trinity, the cone of depression is broader and better defined. This pattern is expected due to the historically high production from the Trinity Aquifer north of Bell County.

Review of the drawdown maps for the Lower Trinity Aquifer illustrates the largest recent water level declines are located in the northern and southern portions of the study area (see map titled: “Lower Trinity Aquifer Water Level Decline – 2006-2018”). Since 2006, water levels in the Lower Trinity have declined by 100 feet or more in northern Williamson County and in the northern

portion of the study area in Bell County. The declines in Bell County are likely influenced primarily by the groundwater production in McLennan County. The declines in Williamson County are more likely caused by local groundwater production as the smaller declines in southern Bell County suggest that Williamson County is somewhat isolated from the regional water level declines occurring north of the study area.

Looking back at the declines since 2010, we see that near the Sun City area the declines are greater since 2010 than they were from 2006 (see map titled: “Lower Trinity Aquifer Water Level Decline – 2010-2018”). The greater declines over the shorter period of time indicates that water levels were recovering (that is, rising higher) from 2006 to 2010, but groundwater production since 2010 has likely increased causing a rapid decline in water levels. In most other areas, the water level declines appear to have remained fairly consistent or slowed to some extent.

In contrast to the Middle Trinity Aquifer, the available drawdown map for the Lower Trinity Aquifer map indicates water levels are typically well above the top of the aquifer (see map titled: “Lower Trinity Aquifer Available Drawdown – 2018”). The only area where water levels appear to be nearing the top of the aquifer is in the far western portion of the District. However, with the apparent rapid water level declines in Williamson County, the available drawdown values would correspondingly decline which is becoming evident around Florence.

Discussion

Continued monitoring of water levels is critical for understanding the changing aquifer conditions. Understanding the aquifer conditions will allow the District to continue to proactively inform and assist constituents who rely on the local aquifers for their water needs. In several areas the water levels are nearing the top of the Middle Trinity aquifer and groundwater users will face continued difficulties accessing the resource. Within the Hidden Springs area, the water levels remain several hundred feet above the top of the aquifer, but with average declines of more than 10 feet per year pumps will likely have to be lowered in wells frequently and water levels may reach the top of the aquifer in about 30 years.

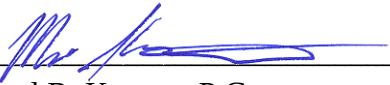
In northern Williamson County, the Middle Trinity water levels are near the top of the aquifer in most of the area. Landowners in this area have reported difficulties accessing groundwater from the Middle Trinity and these issues will continue if not worsen. It is likely that many well owners will soon, if they do not already, have pumps set near the bottom of their wells and will have to adjust to limited groundwater availability or find alternative water supplies.

Conditions in the Lower Trinity are better than in the Middle Trinity. However, available data suggest that water level declines are increasing rapidly within Williamson County. It is likely that the increased declines are associated with increased groundwater production from the aquifer as users move to the deeper aquifer rather than completing wells in the Middle Trinity.

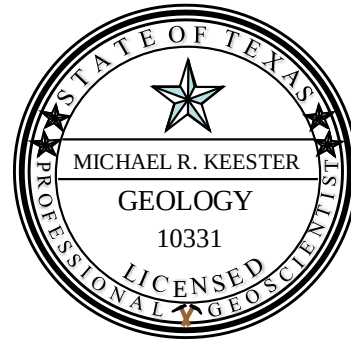
We appreciate being able to provide you with this brief assessment. If you have any questions, please contact me at (512) 962-7660.

Geoscientist Seal

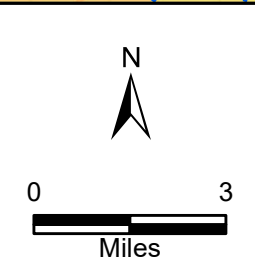
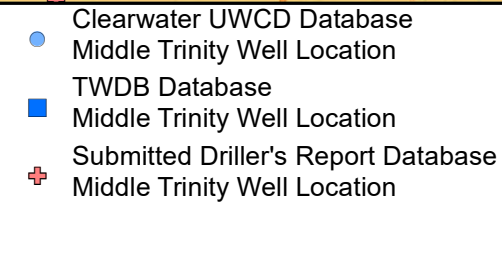
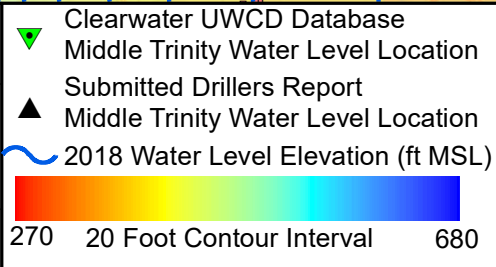
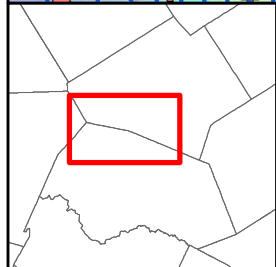
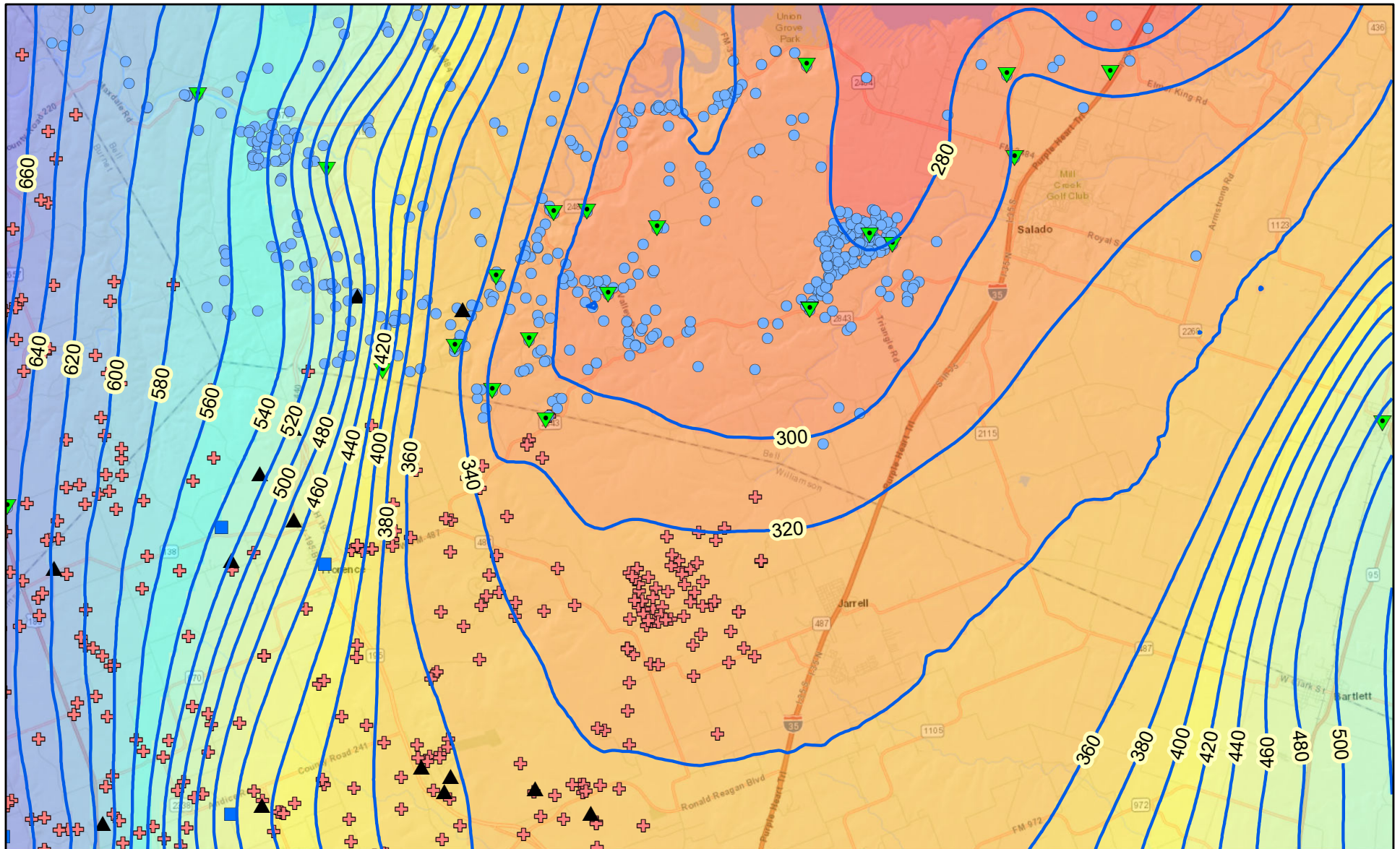
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Michael R. Keester, P.G.
Project Manager / Hydrogeologist



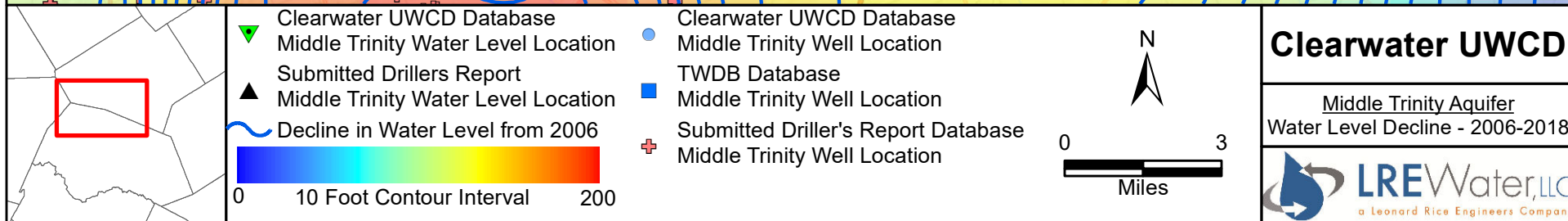
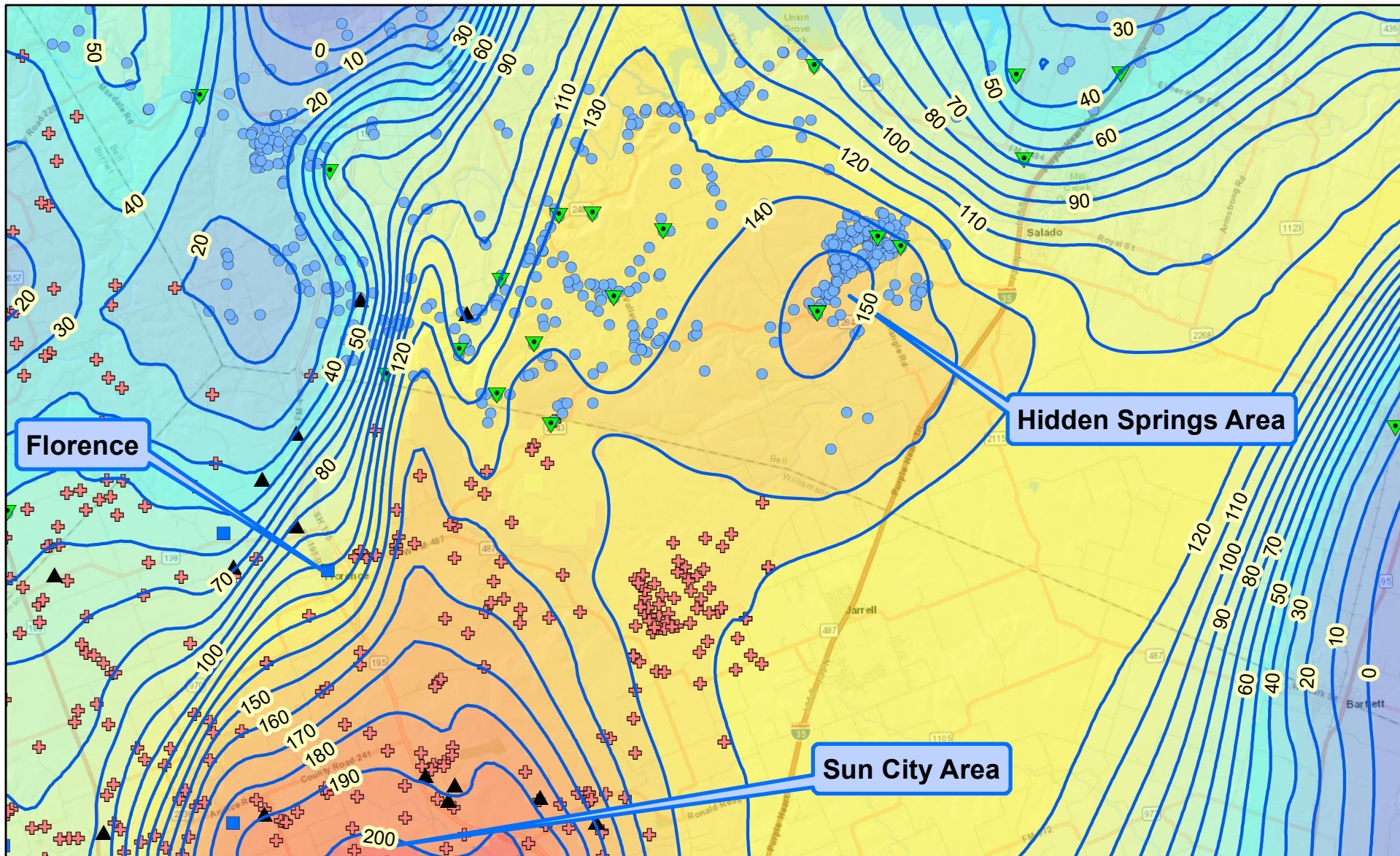
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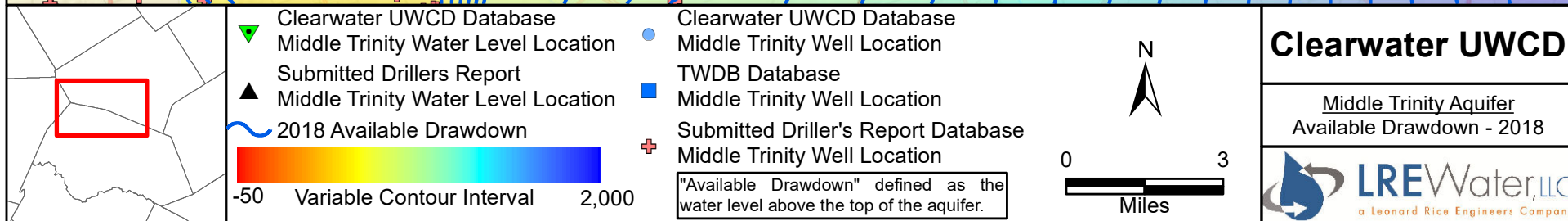
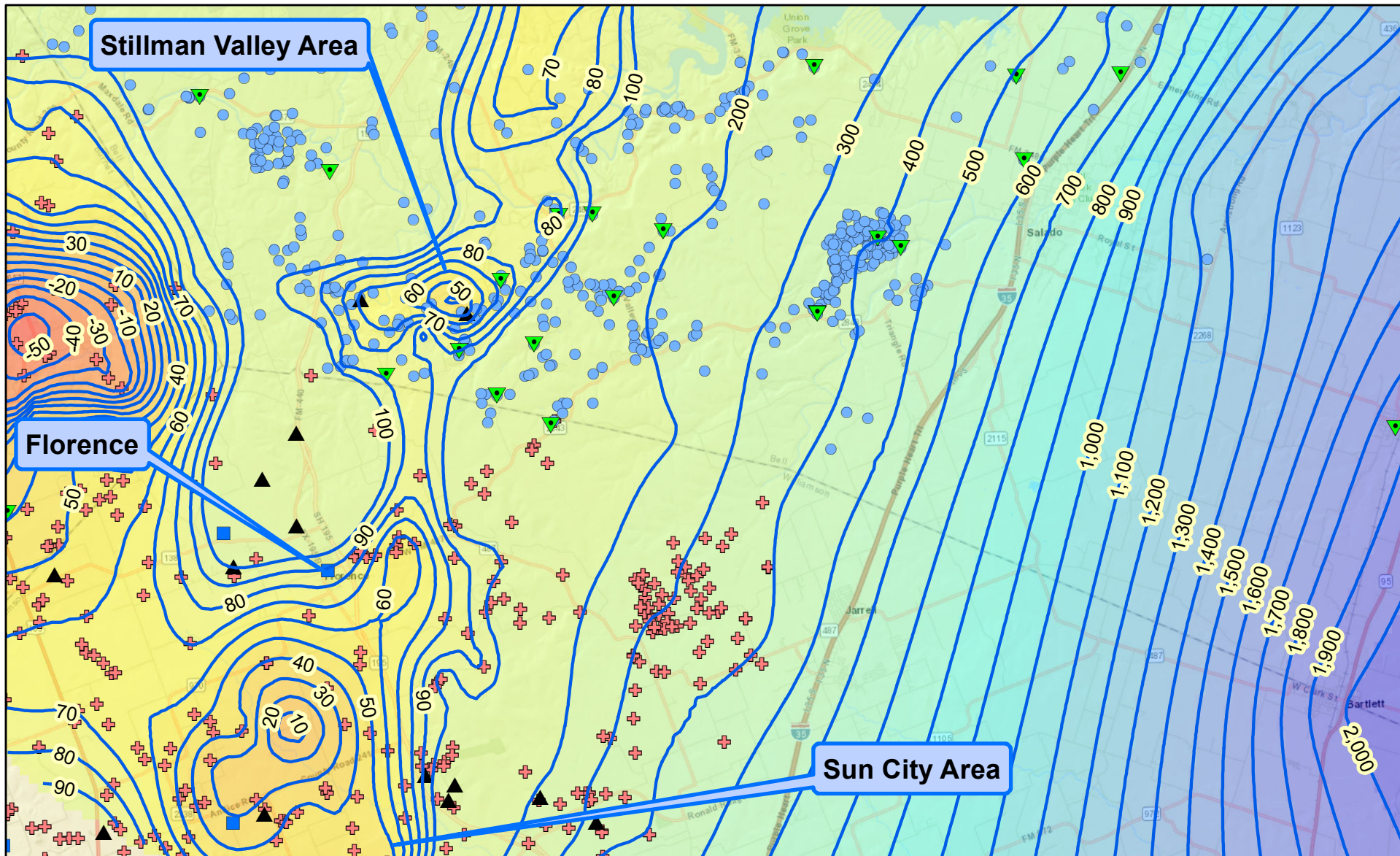


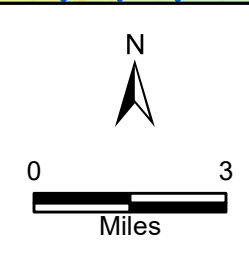
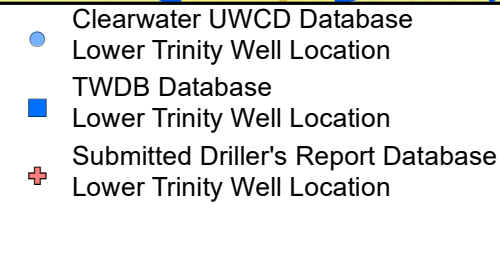
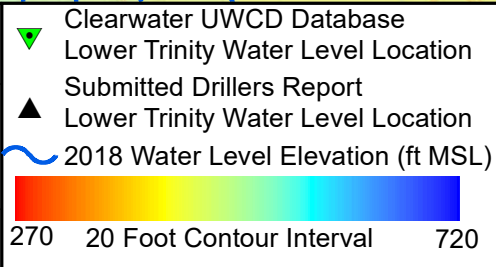
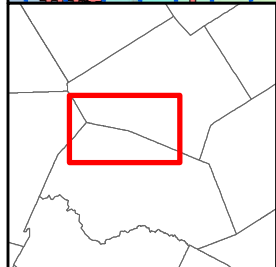
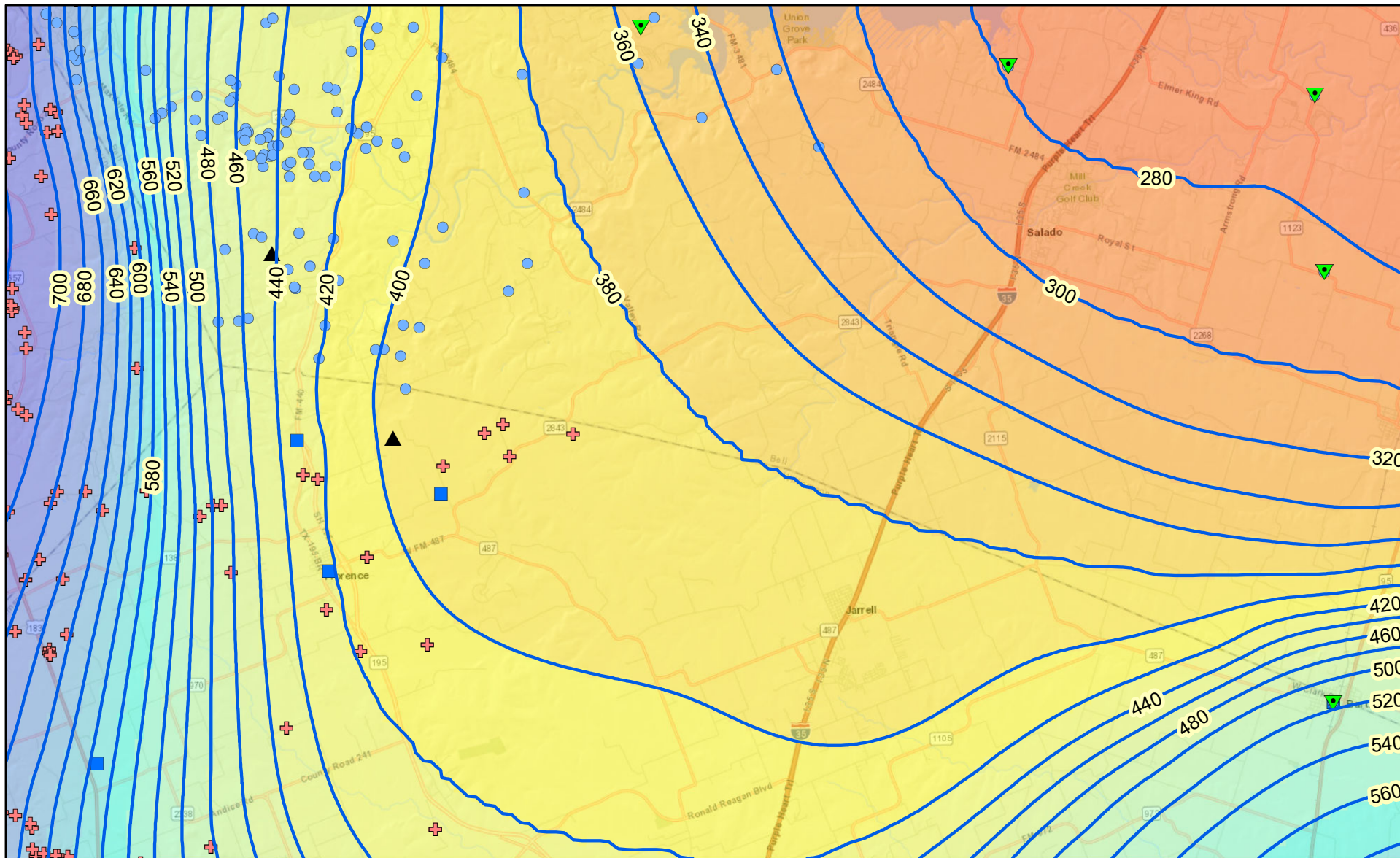
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Middle Trinity Aquifer
Water Level Elevation - 2018

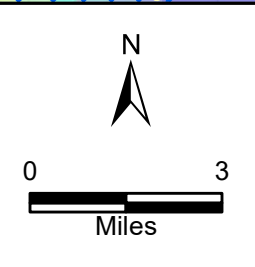
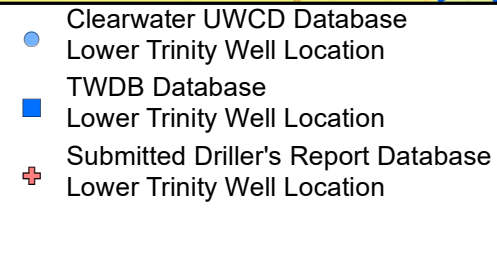
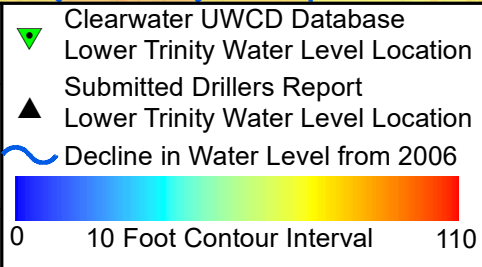
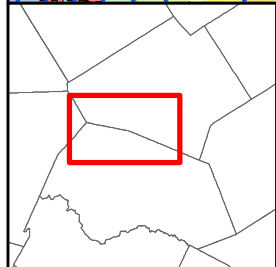
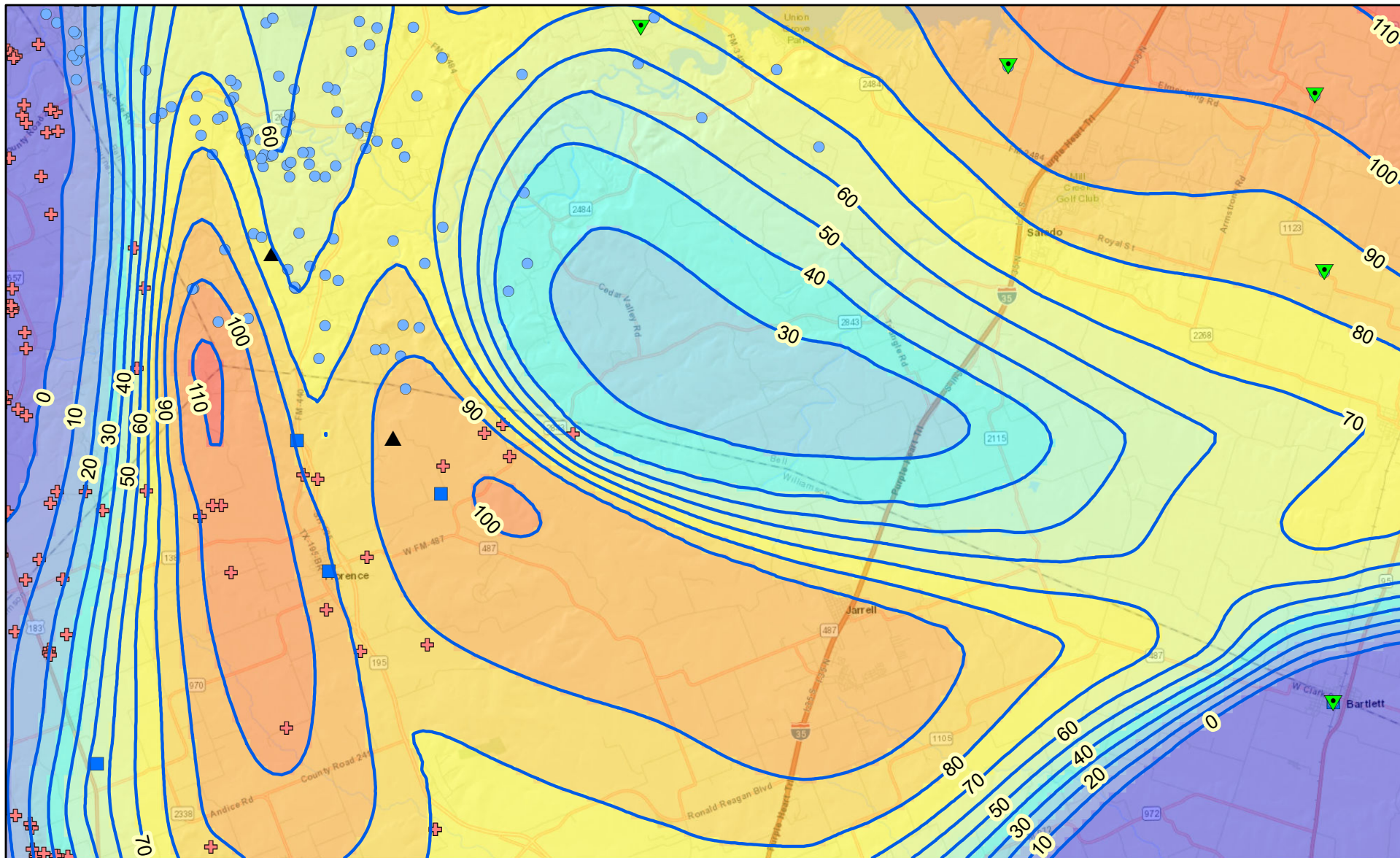
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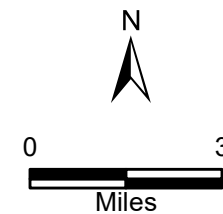
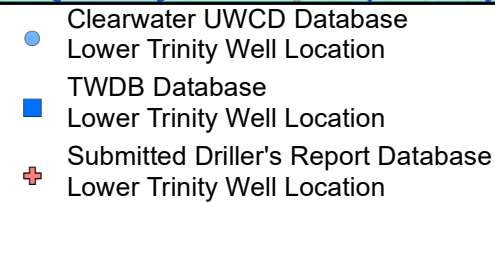
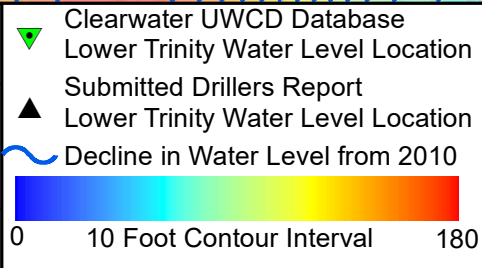
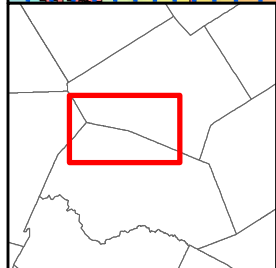
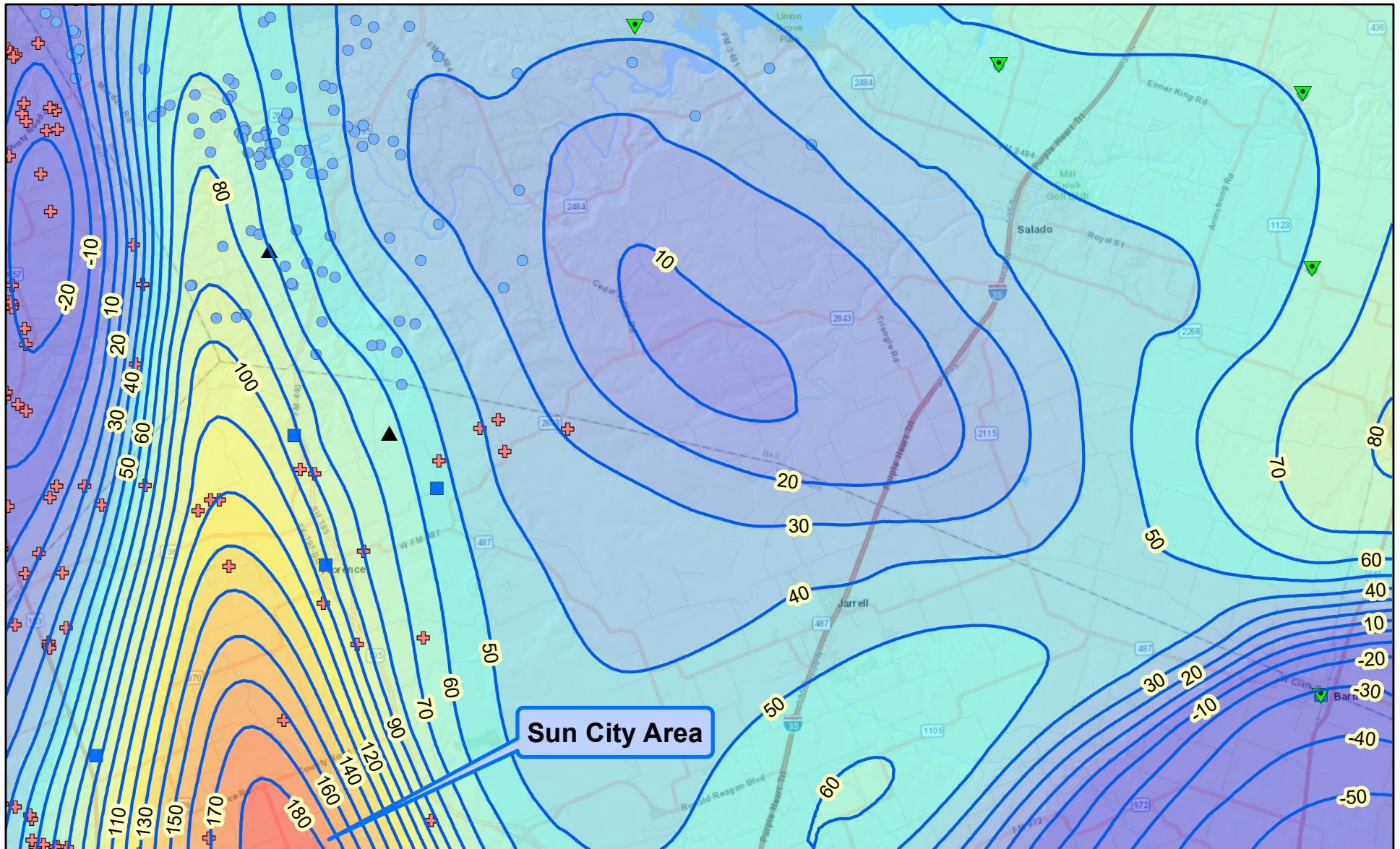
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 Lower Trinity Aquifer
 Water Level Elevation - 2018
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Lower Trinity Aquifer
Water Level Decline - 2006-2018

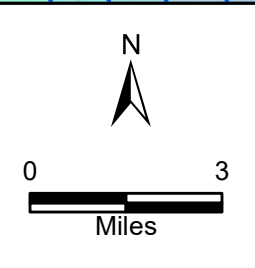
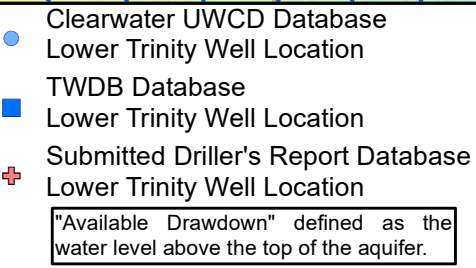
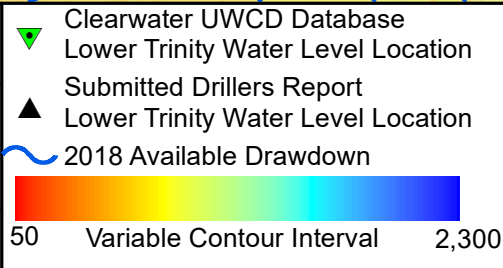
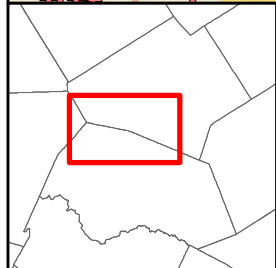
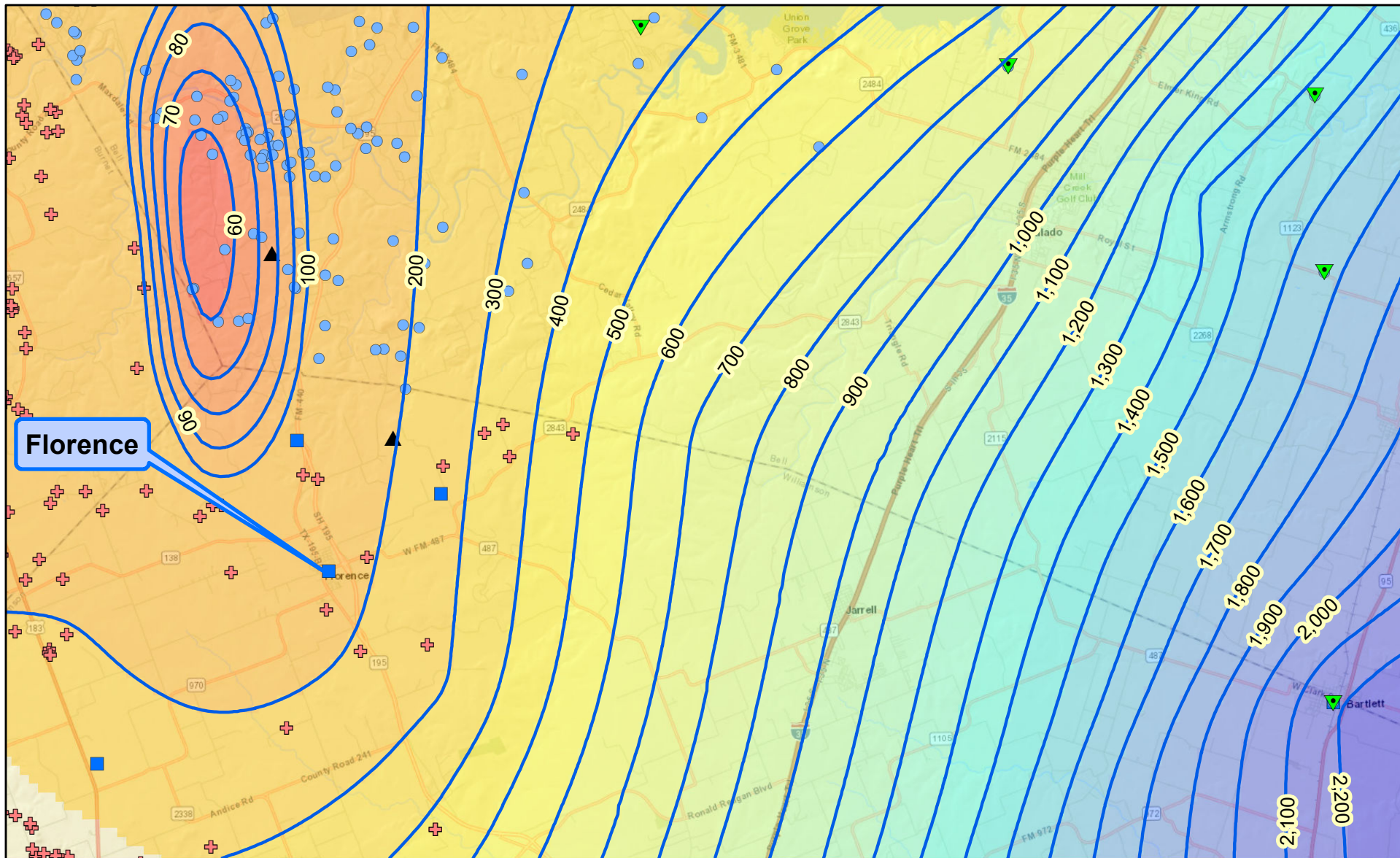
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Lower Trinity Aquifer
 Water Level Decline - 2010-2018





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 Lower Trinity Aquifer
 Available Drawdown - 2018
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