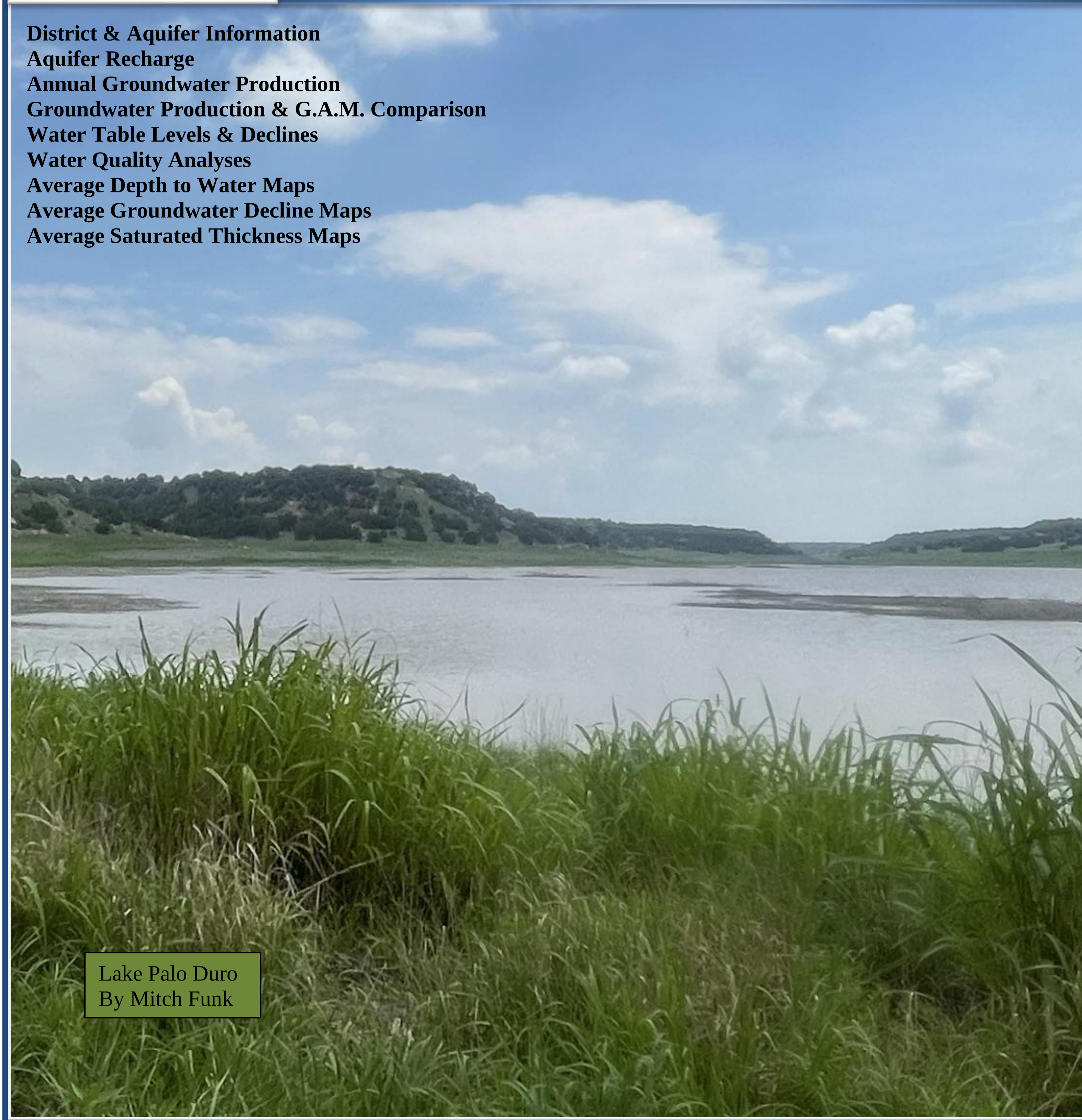
# Hydrology & Groundwater Resources 2022-2023

Sixteenth Edition

**District & Aquifer Information**
**Aquifer Recharge**
**Annual Groundwater Production**
**Groundwater Production & G.A.M. Comparison**
**Water Table Levels & Declines**
**Water Quality Analyses**
**Average Depth to Water Maps**
**Average Groundwater Decline Maps**
**Average Saturated Thickness Maps**



Lake Palo Duro
By Mitch Funk

**North Plains Groundwater Conservation District**
**Mail: P.O. Box 795**
**603 East First Street**
**Dumas Texas 79029**

**Office Ph. 806-935-6401, Fax 806-935-6633**
**Publication Year 2023**

## Table of Contents

I. Introduction ........ - 4 -
II. Definitions ........ - 4 -
III. District Boundaries ........ -5-
IV. General Geology and Hydrology ........ - 6 -
V. Aquifer Thickness or Saturated Material ........ - 6 -
VI. Aquifer Recharge, Inflows and Outflows ........ - 7 -
VII. Annual Groundwater Production and Modeled Available Groundwater ........ - 9 -
VIII. Depth to Water, Average Declines Based on Groundwater Production and Declines Observed in District Monitor Wells ........ - 9 -
IX Active Production Wells within the District ........ - 14 -
X. District Monitor Wells ........ - 14 -
XI. District Monitor Well Locations and On-line Interactive Maps ........ - 15 -
XII. Water Quality ........ - 16 -
XIII. Depth to Water from Land Surface ........ - 18 -
XIV. Declines (in Monitor Wells) by County ........ - 27 -
XV. Estimated (Average) Saturated Thickness of the Ogallala Aquifer by County ........ - 36 -
XVI. Contributors to Hydrology and Groundwater Resources ........ - 45 -

**Disclaimer:** *This document is a general information report about the regional hydrology and groundwater resources within the North Plains Groundwater Conservation District. The groundwater resources or hydrological properties of any property can and do vary significantly from those indicated by, or what may be inferred from this document. This document and the information contained within is provided on an "as is" basis. Neither the District Board of Directors nor District Staff make any claims or warranties as to this document's suitability for any use public or private.*

# I. Introduction

The North Plains Groundwater Conservation District (NPGCD or District) manages groundwater resources in all or part of eight counties in the Northern Texas Panhandle and is governed by an elected seven-member Board of Directors. The Board established the District's mission, "maintaining our way of life through conservation, protection, and preservation of our groundwater resources" and achieves this mission through the development of long-range management plans, creating and enforcing rules, being actively involved in regional and state water planning, undertaking conservation demonstrations projects, and providing public outreach and education programs.

To further advance its management strategies the District promotes new conservation management methods and technologies, cooperates with private, corporate and government entities to promote the conservation, protection, and preservation of the area's critically important groundwater resources. The District manages and operates information collection programs, undertakes scientific investigations, and offers well GPM testing and water quality analysis services as part of its on-going efforts to monitor aquifer conditions.

Information collected by the District and other agencies is broadly summarized in this "Hydrology and Groundwater Resources" report. District's staff prepared maps for this report showing the District boundaries, estimated depth to water, estimated average annual water level declines, estimated aquifer saturated thickness and maps showing District monitor well locations. This report summarizes the number of active and inactive wells, the number of new wells drilled, measured annual groundwater production, and provides a broad overview of general water quality.

# II. Definitions

**Cretaceous-** A geological period corresponding to 65-144 million years ago.

**DFC- (Desired Future Condition)** a goal set by the District Board of Directors specifying the condition that an Aquifer will be in at a specified time in the future.

**GAM-** (Groundwater Availability Model) a predictive numerical computer model of Aquifers that the Texas Water Development Board maintains and operates.

**Heterogeneous-** Consisting of dissimilar elements or parts; not homogeneous.

**Jurassic-** A geological period corresponding to 144-208 million years ago.

**Inter-formational Flow**- A flow of water from one formation into another formation.

**Intra-formational Flow-** A flow of water from one part of a formation into another part of the same formation.

**MAG- (Managed Available Groundwater) a** groundwater volume results of a GAM based on specified DFC's.

**Permian-** A geological period corresponding to 245-286 million years ago.

**Pliocene-** A geological period corresponding to 2.5 to 5.3 million years before the present.

**Recharge-** The process whereby water is added to an aquifer either through natural or artificial means. Recharge normally refers to rainfall infiltrating an aquifer through a recharge zone.

**Red-Bed-** a geological strata consisting primarily of red to orange clays and silts in place below the base of the Ogallala Aquifer.

**Saturated Thickness -** The distance from the top of an aquifer to the base of the aquifer where the pore spaces are filled with water.

**Triassic-** A geological period corresponding to 208-245 million years ago.

**Unconformably (Unconformity) -** the surface between successive strata representing a missing interval in the geologic time record.

## III. District Boundaries

The North Plains Groundwater Conservation District is in the Texas Panhandle, north of the city of Amarillo and North of the Canadian River. The District consists of approximately 7,390 square miles which includes all of Dallam, Hansford, Lipscomb, Ochiltree and Sherman counties, as well as part of Hartley, Hutchinson and Moore counties.

The original (1954/1955) area of the District included part of Hartley, Moore and Hutchinson counties and all of Sherman, Hansford and Ochiltree counties. Other areas have annexed into the District over time.

**Map 1:** District boundaries including areas that annexed into the District over time.

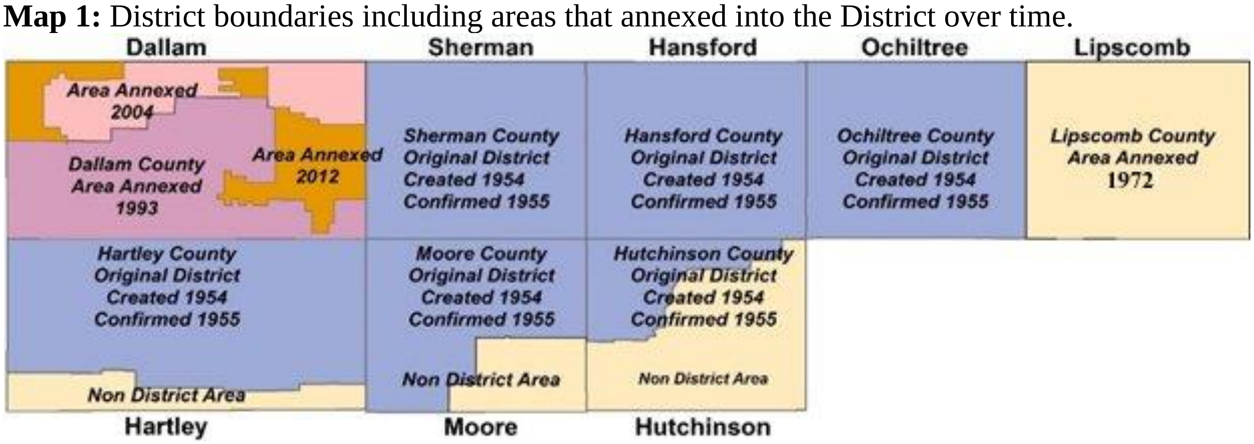



**Table 1:** County area and percent of each county within the NPGCD.

| County | County Area (Sq. Mi.) | Estimated Area in District (Sq. Mi.) | Approximate Number of Acres | Percent of County in the District |
|---|---|---|---|---|
| Dallam | 1505 | 1505 | 963,200 | 100 % |
| Hansford | 907 | 907 | 580,480 | 100 % |
| Hartley | 1463 | 1244 | 796,160 | 83.56 % |
| Hutchinson | 894 | 278 | 177,920 | 30.55 % |
| Lipscomb | 934 | 934 | 597,760 | 100 % |
| Moore | 914 | 699 | 447,360 | 76.51 % |
| Ochiltree | 907 | 907 | 580,480 | 100 % |
| Sherman | 916 | 916 | 586,240 | 100 % |
| **Totals** | **8440 Sq. Mi.** | **7390 Sq. Mi.** | **4,729,600 Acres** | |

## IV. General Geology and Hydrology

**Ogallala Aquifer**

The Ogallala Aquifer extends from the northern United States into the Texas Panhandle and West Texas and is the primary source of water within the District. The aquifer consists of sands, gravel, silts, and clay sediments that were deposited as part of ancient river systems from about three million to about six million years ago during the Neogene geologic period. An ancient land surface separates the Ogallala from much older strata below of the Permian, Triassic, Jurassic, and Cretaceous geologic periods which range in age from 65 million years to 286 million years. This ancient land surface is called an unconformity and represents between six million years and 65 million years of missing geologic strata in the area.

South of the District, the Canadian River has totally or partially eroded through the Ogallala along much of its length and separates the North Plains from the South Plains. Water-bearing units of Cretaceous and Jurassic ages combine to form the Rita Blanca (a minor aquifer) in the western part of Dallam and Hartley counties. Underlying these aquifers and much of the Ogallala are Triassic age (Dockum Aquifer) sediments and Red Bed strata. The Dockum is a minor, confined to semi-confined aquifer located under Dallam, Hartley and far western Sherman and Moore counties. The water bearing strata is generally locally referred to as the Santa Rosa. For this document, the Ogallala Aquifer is considered to consist of the Ogallala formation and any underlying, potable water-bearing geologic units hydraulically connected with it.

**Red Bed (Base of the Aquifer)**

Throughout much of the District, the Ogallala aquifer is underlain by “Red Bed”. The geology consists of mixed deposits of reddish to orange clay, sands and gravel. The reddish color is caused by staining from the oxides of iron containing minerals. In some areas, the red bed may be absent and in other areas may be several hundred feet thick.

## V. Aquifer Thickness or Saturated Material

Saturated thickness maps depict the vertical distance from the water level to the bottom of the aquifer. The saturated thickness of the Ogallala Aquifer ranges from less than 30 feet to over 350 feet and has an estimated average thickness (Table 2) of 163 feet within the District. Saturated thicknesses are calculated every other year and use data from District monitor wells. Other calculation methods will give differing results.

**Table 2:** 2020-2021 Estimated average aquifer thickness by county (District Area only).

| Dallam | Hartley | Sherman | Moore | Hansford | Hutchinson | Ochiltree | Lipscomb |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 158 ft. | 144 ft. | 142 ft. | 139 ft. | 193 ft. | 155 ft. | 172 ft. | 202 ft. |

*Next scheduled update: Summer of 2025.*

## VI. Aquifer Recharge, Inflows and Outflows

Surface water and precipitation provide minimal annual recharge to the Ogallala aquifer especially when compared to aquifer withdrawals. District-wide average recharge estimates vary slightly but tend to be below one third of an inch per year. Other inflows and outflows, from and to streams and lateral inflows and outflows tend to be somewhat equal. Some areas of the District however may experience significant local recharge.

The recharge information below (Tables 3,4 and 5) are from the Texas Water Development Board's (TWDB) Groundwater Availability Model Run 17-008. The GAM run was requested by the District for use in the 2018 District Management Plan.

**Table 3:** Summarized recharge, inflows and out flows to the Ogallala Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

| Management Plan requirement | Aquifer or confining unit | Results |
|---|---|---|
| Estimated annual amount of recharge from precipitation to the district | Ogallala Aquifer | 137,029 |
| Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers | Ogallala Aquifer | 26,368 |
| Estimated annual volume of flow into the district within each aquifer in the district | Ogallala Aquifer | 50,186 |
| Estimated annual volume of flow out of the district within each aquifer in the district | Ogallala Aquifer | 94,559 |
| Estimated net annual volume of flow between each aquifer in the district | From Ogallala Aquifer to Rita Blanca and Dockum Aquifers | 3,807 |

**TABLE 4:** Summarized inflows and outflows to the Dockum Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

| Management Plan requirement | Aquifer or confining unit | Results |
|---|---|---|
| Estimated annual amount of recharge from precipitation to the district | Dockum Aquifer | 49 |
| Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers | Dockum Aquifer | 0 |
| Estimated annual volume of flow into the district within each aquifer in the district | Dockum Aquifer | 4,097 |
| Estimated annual volume of flow out of the district within each aquifer in the district | Dockum Aquifer | 2,293 |
| Estimated net annual volume of flow between each aquifer in the district1 | From Dockum Aquifer to Ogallala and Rita Blanca Aquifers | 1,997 |

**TABLE 5:** Summarized inflows and outflows to the Rita Blanca Aquifer. All values are in acre-feet per year rounded to the nearest acre-foot.

| Management Plan requirement | Aquifer or confining unit | Results |
|---|---|---|
| Estimated annual amount of recharge from precipitation to the district | Rita Blanca Aquifer | 0 |
| Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers | Rita Blanca Aquifer | 0 |
| Estimated annual volume of flow into the district within each aquifer in the district | Rita Blanca Aquifer | 902 |
| Estimated annual volume of flow out of the district within each aquifer in the district | Rita Blanca Aquifer | 229 |
| Estimated net annual volume of flow between each aquifer in the district | From Ogallala Aquifer to Rita Blanca Aquifer | 2,909 |
| | From Dockum Aquifer to Rita Blanca Aquifer | 555 |

## VII. Annual Groundwater Production and Modeled Available Groundwater

Municipal, Commercial, Industrial, and Agriculture water user groups reported 1,943,500 acre-feet groundwater production in the North Plains Groundwater Conservation District in 2022. **Table 6: Production by County in acre-feet**

| County | 2022 Production (Acre-feet) |
|---|---|
| Dallam | 372,900 |
| Hartley | 418,900 |
| Moore | 221,200 |
| Sherman | 369,300 |
| Hansford | 258,700 |
| Hutchinson | 100,600 |
| Lipscomb | 63,200 |
| Ochiltree | 138,700 |
| **GMA -1 West** | **1,382,300** |
| **GMA -1 East** | **561,200** |
| **TOTAL** | **1,943,500** |

District groundwater production exceeded the 5-year historical production average by approximately 251,320 acre-feet. Table 7 below represents annual groundwater production in acre-feet from 2018 to 2022 collectively from all aquifers in the district.

**Table 7:** Annual groundwater production in acre-feet from 2018 to 2022

| County | 2018 | 2019 | 2020 | 2021 | 2022 | Average |
|---|---|---|---|---|---|---|
| Dallam | 349,900 | 303,200 | 342,700 | 339,500 | 372,900 | 341,640 |
| Hartley | 422,600 | 349,200 | 402,200 | 408,500 | 418,900 | 400,280 |
| Moore | 200,600 | 157,700 | 199,400 | 195,300 | 221,200 | 194,840 |
| Sherman | 312,000 | 255,400 | 328,400 | 326,300 | 369,300 | 318,280 |
| Hansford | 190,800 | 162,300 | 195,100 | 194,800 | 258,700 | 200,340 |
| Hutchinson | 75,500 | 68,400 | 79,400 | 79,100 | 100,600 | 80,600 |
| Lipscomb | 44,200 | 43,400 | 54,500 | 55,300 | 63,200 | 52,120 |
| Ochiltree | 95,500 | 81,800 | 105,200 | 99,200 | 138,700 | 104,080 |
| **GMA-West** | **1,285,100** | **1,065,500** | **1,272,700** | **1,269,600** | **1,382,300** | **1,255,040** |
| **GMA-East** | **406,000** | **355,900** | **434,200** | **428,400** | **561,200** | **437,140** |
| **Total** | **1,691,100** | **1,421,400** | **1,706,900** | **1,698,000** | **1,943,500** | **1,692,180** |

The district's 2022 total groundwater production was 43,800 acre-feet lower than what stakeholders reported in 2011. However, West Management Zone production declined 136,800 acre-feet while the East Management Zone showed a collective increase 93,000 acre-feet production in 2022. The dataset for Dallam County is incomplete because the district did not require stakeholders in the annexed portion of the county to report groundwater until 2012. **Table 8:** Comparing 2022 groundwater production to 2011 in acre-feet.

| County | 2022 | 2011 | Compared |
|---|---|---|---|
| Dallam | 372,900 | 369,400 | 3,500 |
| Hartley | 418,900 | 485,400 | -66,500 |
| Moore | 221,200 | 267,500 | -46,300 |
| Sherman | 369,300 | 396,800 | -27,500 |
| Hansford | 258,700 | 233,700 | 25,000 |
| Hutchinson | 100,600 | 73,700 | 26,900 |
| Lipscomb | 63,200 | 51,200 | 12,000 |
| Ochiltree | 138,700 | 109,600 | 29,100 |
| **GMA-West** | **1,382,300** | **1,519,100** | **-136,800** |
| **GMA-East** | **561,200** | **468,200** | **93,000** |
| **Total** | **1,943,500** | **1,987,300** | **-43,800** |

The district annually reviews groundwater production from the previous year and determines if there are conditions that may trigger District Rule 8.4 and District Rule 8.5 evaluation to reduce Allowable Annual Production. The determination in part is based on the Modeled Available Groundwater (MAG) measured in acre-feet to achieve the desired future conditions (DFCs) in the district. The District's board approved Texas Water Development Board GR16-029 MAG Report to compare all subsequent groundwater analyses by the district for implementing Chapter 8 of the District rules. TWDB GR16-029 MAG Report provides the model data for this assessment. The table below is a compilation of MAG for Dockum aquifer, Ogallala aquifer and Rita Blanca aquifer DFCs.

**Table 9:** Compilation of MAG for Dockum aquifer, Ogallala aquifer and Rita Blanca aquifer DFCs.

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2062 |
|---|---|---|---|---|---|---|
| Dallam | 401,663 | 301,393 | 239,759 | 181,074 | 127,048 | 117,442 |
| Hartley | 409,187 | 282,289 | 222,845 | 164,993 | 111,222 | 101,737 |
| Moore | 219,654 | 177,153 | 143,815 | 109,433 | 77,673 | 71,911 |
| Sherman | 398,183 | 349,022 | 281,817 | 212,871 | 148,647 | 136,869 |
| Hansford | 275,016 | 272,656 | 271,226 | 270,281 | 269,589 | 269,479 |
| Hutchinson | 62,803 | 64,522 | 65,652 | 66,075 | 66,027 | 65,956 |
| Lipscomb | 266,809 | 266,710 | 266,640 | 266,591 | 266,559 | 266,557 |
| Ochiltree | 243,778 | 243,932 | 244,002 | 244,051 | 244,082 | 244,085 |
| **GMA West** | **1,428,687** | **1,109,857** | **888,236** | **668,371** | **464,590** | **427,959** |
| **GMA East** | **848,406** | **847,820** | **847,520** | **846,998** | **846,257** | **846,077** |
| **Total** | **2,277,093** | **1,957,677** | **1,735,756** | **1,515,369** | **1,310,847** | **1,274,036** |

On February 28, 2023, the Texas Water Development board completed GAM Run 21-007 MAG Report related to the most recent GMA-1 joint planning cycle. In this run, the 2020 modeled amounts are less than the previous model run.

**Table 10:** GAM Run 21-007 MAG Report.

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2080 |
|---|---|---|---|---|---|---|---|
| Dallam | 335,957 | 285,097 | 243,426 | 208,907 | 179,300 | 157,255 | 140,674 |
| Hartley | 368,048 | 282,022 | 218,805 | 180,224 | 154,319 | 133,600 | 117,183 |
| Moore | 144,904 | 145,144 | 138,146 | 126,680 | 110,916 | 92,639 | 77,341 |
| Sherman | 290,593 | 288,073 | 261,831 | 226,430 | 198,631 | 166,963 | 145,690 |
| Hansford | 297,486 | 295,700 | 281,612 | 264,290 | 247,744 | 229,800 | 211,464 |
| Hutchinson | 77,920 | 80,189 | 77,835 | 74,461 | 70,609 | 67,496 | 64,083 |
| Lipscomb | 251,489 | 270,819 | 263,478 | 249,968 | 235,561 | 218,975 | 201,984 |
| Ochiltree | 259,676 | 259,973 | 247,274 | 231,502 | 215,617 | 199,324 | 181,295 |
| **GMA West** | **1,139,502** | **1,000,336** | **862,208** | **742,241** | **643,166** | **550,457** | **480,888** |
| **GMA East** | **886,571** | **906,681** | **870,199** | **820,221** | **769,531** | **715,595** | **658,826** |
| **Total** | **2,026,073** | **1,907,017** | **1,732,407** | **1,562,462** | **1,412,697** | **1,266,052** | **1,139,714** |

**Table 11:** Comparison of 2022 annual production to the district 2020 MAG (GR16-029 MAG Report).

| County | 2020 MAG | 2022 Production | 2022 Percent Difference between MAG & Production | Average Production 2018-2022 | Average Percent Difference between MAG and Production 2018-2022 |
|---|---|---|---|---|---|
| Dallam | 401,663 | 372,900 | -7.71% | 341,640 | -17.57% |
| Hartley | 409,187 | 418,900 | 2.32% | 400,280 | -2.23% |
| Moore | 219,654 | 221,200 | 0.70% | 194,840 | -12.74% |
| Sherman | 398,183 | 369,300 | -7.82% | 318,280 | -25.10% |
| Hansford | 275,016 | 258,700 | -6.31% | 200,340 | -37.27% |
| Hutchinson | 62,803 | 100,600 | 37.57% | 80,600 | 22.08% |
| Lipscomb | 266,809 | 63,200 | -322.17% | 52,120 | -411.91% |
| Ochiltree | 243,778 | 138,700 | -75.76% | 104,080 | -134.22% |
| **GMA-West** | **1,428,687** | **1,382,300** | **-3.36%** | **1,255,040** | **-13.84%** |
| **GMA-East** | **848,406** | **561,200** | **-51.18%** | **437,140** | **-94.08%** |
| **Total** | **2,277,093** | **1,943,500** | **-17.16%** | **1,692,180** | **-34.57%** |

2022 Annual Production does not exceed the 2020 MAG (GR16-029 MAG Report). Therefore, there are no conditions that trigger District Rule 8.4 and District Rule 8.5 evaluation to reduce Allowable Annual Reduction. In contrast, the 2020 MAG (GR21-007) shows a substantial reduction from GR16-029. The chart below shows the same comparison for GR21-007 as in the table above (GR16-029).

**Table 12**: Comparison for GR21-007 as in the table above (GR16-029).

| County | 2020 MAG (GR21-007) | 2022 Production | 2022 Percent Difference between MAG and Production | Average Production 2018-2022 | Average Percent Difference between MAG and Production 2018-2022 |
|---|---|---|---|---|---|
| Dallam | 335,957 | 372,900 | 9.91% | 341,640 | 1.66% |
| Hartley | 368,048 | 418,900 | 12.14% | 400,280 | 8.05% |
| Moore | 144,904 | 221,200 | 34.49% | 194,840 | 25.63% |
| Sherman | 290,593 | 369,300 | 21.31% | 318,280 | 8.70% |
| Hansford | 297,486 | 258,700 | -14.99% | 200,340 | -48.49% |
| Hutchinson | 77,920 | 100,600 | 22.54% | 80,600 | 3.33% |
| Lipscomb | 251,489 | 63,200 | -297.93% | 52,120 | -382.52% |
| Ochiltree | 259,676 | 138,700 | -87.22% | 104,080 | -149.50% |
| **GMA-West** | **1,139,502** | **1,382,300** | **17.56%** | **1,255,040** | **9.21%** |
| **GMA-East** | **886,571** | **561,200** | **-57.98%** | **437,140** | **-102.81%** |
| **Total** | **2,026,073** | **1,943,500** | **-4.25%** | **1,692,180** | **-19.73%** |

TWDB GAM Run 21-007 MAG Report estimate a straight-line decline over a 60-year period in pumping to achieve the joint planning DFC. TWDB MAG Summaries for GAM Run 21-007 are attached to this report. Whereas TWDB GAM Run 16-029 estimates a curved groundwater decline rate.

## VIII. Depth to Water, Average Declines Based on Groundwater Production and Declines Observed in District Monitor Wells

Changes in the water table, calculated from monitor well measurements vary from rises in the water level to declines that may locally exceed 8-12 feet per year. Each county in the District has areas experiencing little or no decline as well as areas of much greater decline. Declines are caused predominately by agricultural pumping and are influenced primarily by surface recharge of the aquifer and lateral flows into and out of the aquifer.

Recharge is affected by rainfall, surface runoff, evaporation and plant uptake, depth to water, soil porosity and the geologic substrata present. An aquifer characteristic that affects the speed an aquifer refills and consequently how much water a well can produce is intra-formational flow. Intra-formational flow is the flow of water from one part of an aquifer into another part of the same aquifer.

**Table 13:** Average yearly county declines in water levels calculated from groundwater production reports.

| County | Average Annual Feet of Decline |
|---|---|
| Dallam | 2.15 |
| Hansford | 2.48 |
| Hartley | 2.92 |
| Hutchinson | 3.14 |
| Lipscomb | 0.59 |
| Moore | 2.75 |
| Ochiltree | 1.33 |
| Sherman | 3.50 |

Average declines in water level are calculated values (Table 13) created using reported annual groundwater production and an estimated aquifer specific yield of 18 percent.

Average county declines and average declines observed in monitor wells differ because District monitor wells are predominately located near areas of high pumping. This bias in monitor well location tends to cause an over estimation of declines when used to calculate county averages.

***Table 14:** 2022-2023, Average depth to water and comparisons of average declines in **<u>select</u>** District water level monitor wells.

| County | Avg. Depth to Water (Feet) | 2023 Avg. Well Decline (Feet) | 2022 Avg. Well Decline (Feet) | Current 5-Year Avg. Well Decline (Feet) | Previous 5-Year Avg. Well Decline (Feet) | Current 10-Year Avg. Well Decline (Feet) | Previous 10-Year Avg. Well Decline (Feet) |
|---|---|---|---|---|---|---|---|
| Dallam | 292 | 2.65 | 2.63 | 2.58 | 2.75 | 2.66 | 2.77 |
| Hansford | 303 | 1.79 | 1.77 | 1.73 | 1.67 | 1.70 | 1.59 |
| Hartley | 371 | 3.06 | 3.08 | 3.11 | 3.20 | 3.14 | 3.54 |
| Hutchinson | 347 | 1.64 | 1.63 | 1.61 | 1.50 | 1.53 | 1.55 |
| Lipscomb | 161 | 0.95 | 0.95 | 0.95 | 0.94 | 0.95 | 0.91 |
| Moore | 361 | 2.34 | 2.20 | 2.17 | 2.28 | 2.19 | 2.04 |
| Ochiltree | 335 | 1.46 | 1.41 | 1.40 | 1.34 | 1.38 | 1.34 |
| Sherman | 323 | 2.69 | 2.68 | 2.63 | 2.50 | 2.53 | 2.44 |
| | | | | | | | |
| **District-wide** | **311.6** | **2.07** | **2.04** | **2.02** | **2.02** | **2.01** | **2.02** |

**The information in Table 14 is derived from statistical analyses of monitor well hydrographs created from current and historical information. The statistical analyses (indicating both rises and declines) may indicate the quality of information collected from some wells is less than optimal. Such data may be included in the calculations of declines and depth to water as it represents the best or in some cases the only information available.*

## IX Active Production Wells within the District

District records indicate that there are over 18,000 wells have been permitted or registered since the District was created in 1955. Currently there are 11,319 large active wells which include wells varying in production between 18 GPM to over 1,000 GPM. During 2021, the District issued 500 permits of all types from January through June 24th.

**Table 15:** Summary of wells in the District and recent new well permits.

| County | Active Production Wells | Capped Wells | Small Registered Wells | 2022 Production Permits Issued | 2023 Permits Issued Through June 2023 |
|---|---|---|---|---|---|
| Dallam | 2,772 | 240 | 802 | 113 | 51 |
| Hansford | 987 | 379 | 324 | 40 | 13 |
| Hartley | 2,778 | 222 | 461 | 69 | 58 |
| Hutchinson | 431 | 119 | 135 | 12 | 8 |
| Lipscomb | 306 | 56 | 269 | 8 | 1 |
| Moore | 1,399 | 284 | 583 | 20 | 6 |
| Ochiltree | 590 | 215 | 321 | 23 | 6 |
| Sherman | 2,123 | 239 | 331 | 67 | 35 |
| **Total** | **11,386** | **1,754** | **3,226** | **352** | **178** |

*Well count totals may vary over time due to differing database query techniques and as any errors are corrected.

## X. District Monitor Wells

*Typical District Monitor Well*

The District monitors declines in groundwater levels by maintaining a network of water-level monitoring wells. Currently the District measures 436 wells (Table 13). Monitor wells are measured annually beginning in January and measurements are complete March or by mid-March at the latest. The information collected is analyzed, used to create maps and plays a vital role in making reasonable long-term management decisions based on the best available data.

As part of its water level monitoring program, the District may drill or install water level monitoring equipment in wells annually. The drilled wells are non-production wells dedicated solely to data collection which provide information of more accuracy, reliability, and consistency than other types of wells the District monitors. They are also readily available, if needed, for conducting aquifer tests that cannot be easily conducted using other well types.

**Table 16:** 2021 water level monitor wells by county.

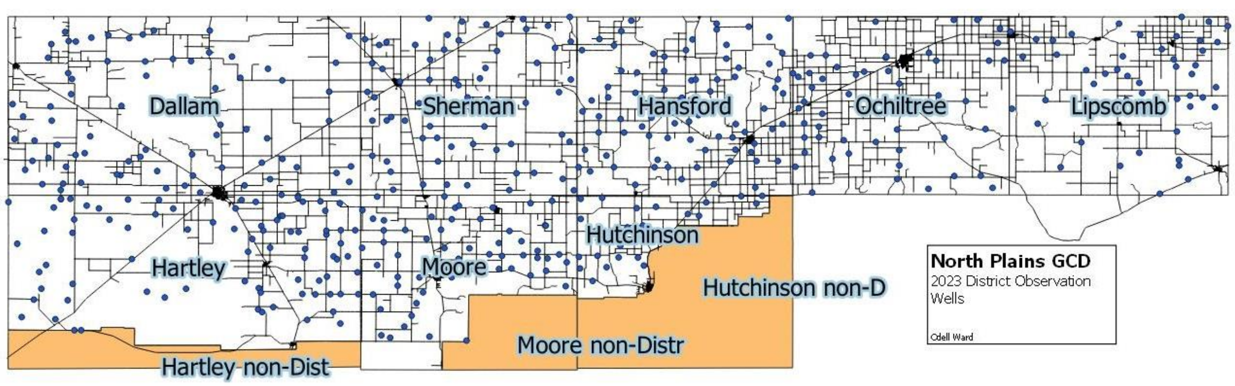
| County | Number of Monitor Wells |
|---|---|
| | |
| Dallam | 72 |
| Hartley | 86 |
| Sherman | 66 |
| Moore | 107 |
| Hansford | 78 |
| Hutchinson | 26 |
| Ochiltree | 52 |
| Lipscomb | 48 |
| **Total** | **484** |

District monitor well under construction

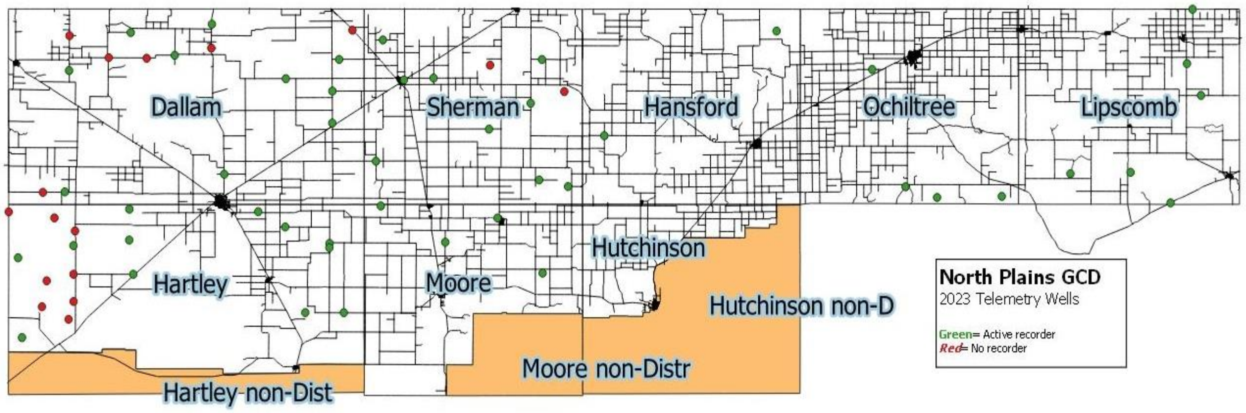
## XI. District Monitor Well Locations and On-line Interactive Maps

The District maintains a website where data from wells, monitor wells and recording equipment may be viewed. The map is always a work in progress and all data may not yet be available. More data and other map layers may become available as work on the on-line map progresses.
**https://map.northplainsgcd.org/mapv2/**

**Map 2:** Map of private well locations from which the District annually measures water levels.



**Map 3:** District-owned water level monitor wells with and without recording equipment. (Red = No Recording Equipment Installed).




## XII. Water Quality

The District's goals for groundwater is that future water supplies are of sufficient quantity and also of excellent quality. The District monitors groundwater chemistry by analyzing samples from select wells within the District and performing water quality analyses upon request from area residents.

*District Natural Resource Specialist performing a water quality analysis.*

The District may analyze water samples for the following parameters as necessary:
Total Hardness,
Chloride,
Conductivity,
Fluoride,
Iron,
Nitrate,
pH,
Sodium,
Sulfate,
Total Dissolved Solids,
The Presence or Absence of Coliform Bacteria.

Groundwater within the District is considered excellent although it is "hard" water and contains considerable calcium and some magnesium carbonate (hardness) (Table 14). The District also performs analyses to indicate the presence or absence of coliform bacteria. In the rare instance an analysis indicates the presence of coliform bacteria, the contamination source is often located within a few yards of the sampled well. Normally a well that tests positive for coliform bacteria can be decontaminated by eliminating the contaminate source, chlorinating the well, pipes and water storage equipment and then purging the well, pipes and water storage equipment.

**Table 17:** Typical mineral analyses in mg/L from wells within the District.

| Parameter | Units | 2020 Number of Analyses | 2020 Average Analysis Result | 2021 Number of Analyses | 2021 Average Analysis Result | 2022 Number of Analyses | 2022 Average Analysis Result |
|---|---|---|---|---|---|---|---|
| Sulfate | mg/l | 21 | 77.85 | 17 | 52.78 | 15 | 27.33 |
| Nitrate | mg/l | 21 | 1.83 | 17 | 3.04 | 15 | 1.186 |
| Total Iron | mg/l | 21 | 0.04 | 17 | 14.84 | 15 | 0.05 |
| Chlorides | mg/l | 21 | 51 | 17 | 19.28 | 15 | 33 |
| Fluoride | mg/l | 21 | 1.32 | 17 | 1.13 | 15 | 5.386 |
| Total Hardness | mg/l | **21** | **256.91** | **17** | **231.74** | **15** | **188.466** |

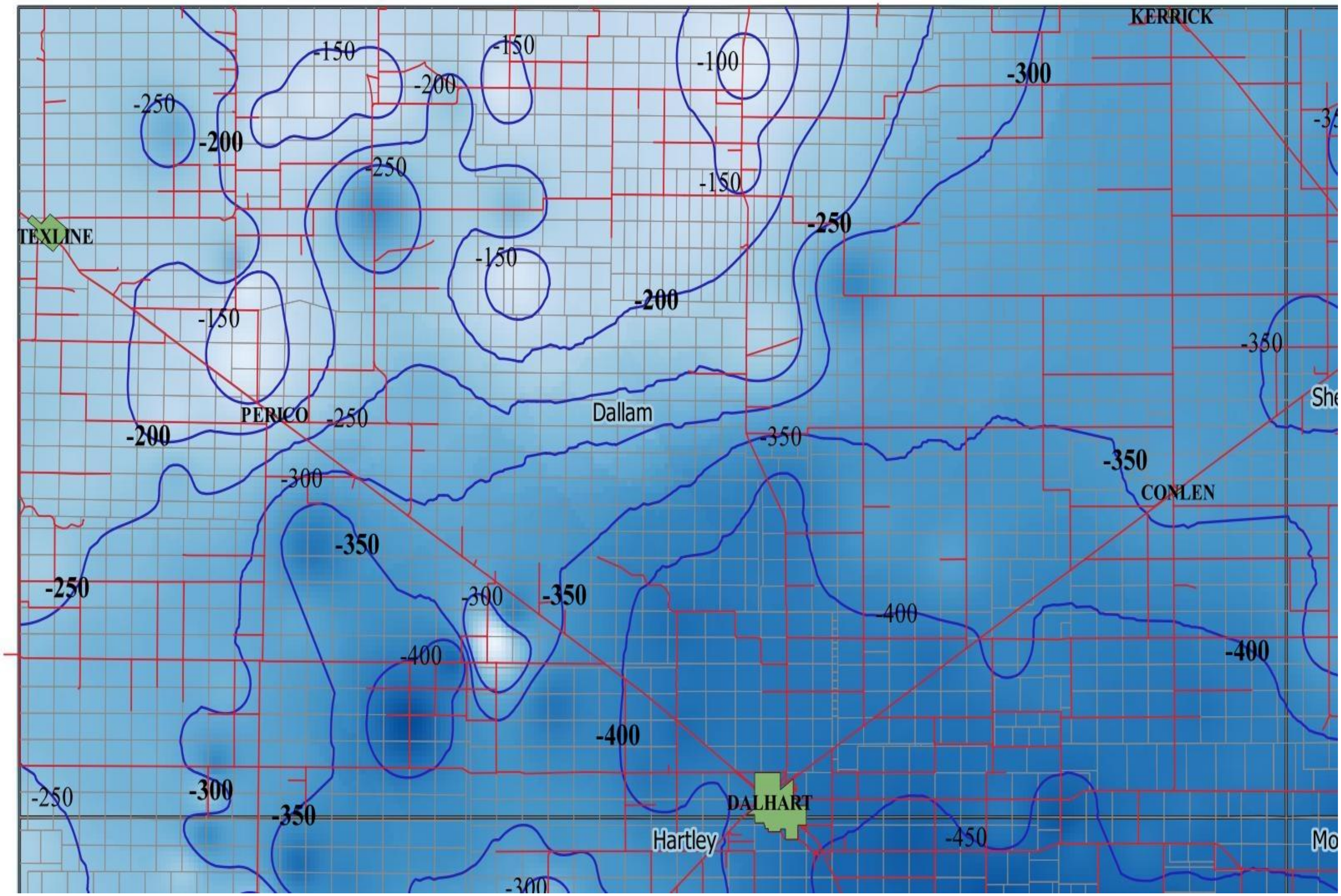
Table 17 shows the average mineral compositions in milligrams per liter as indicated from analyses of well water from within the District. The District samples random wells at the owner's request as well as annually analyzing a subset of wells from the District's monitoring well program. No meaningful conclusions may be drawn from the above table about potential changes in water quality over time as the values are not all from the same set of wells. District residents may request a groundwater analysis by contacting the District. In most instances the analyses are free to District residents.

## III. 2023 Depth to Water from Land Surface

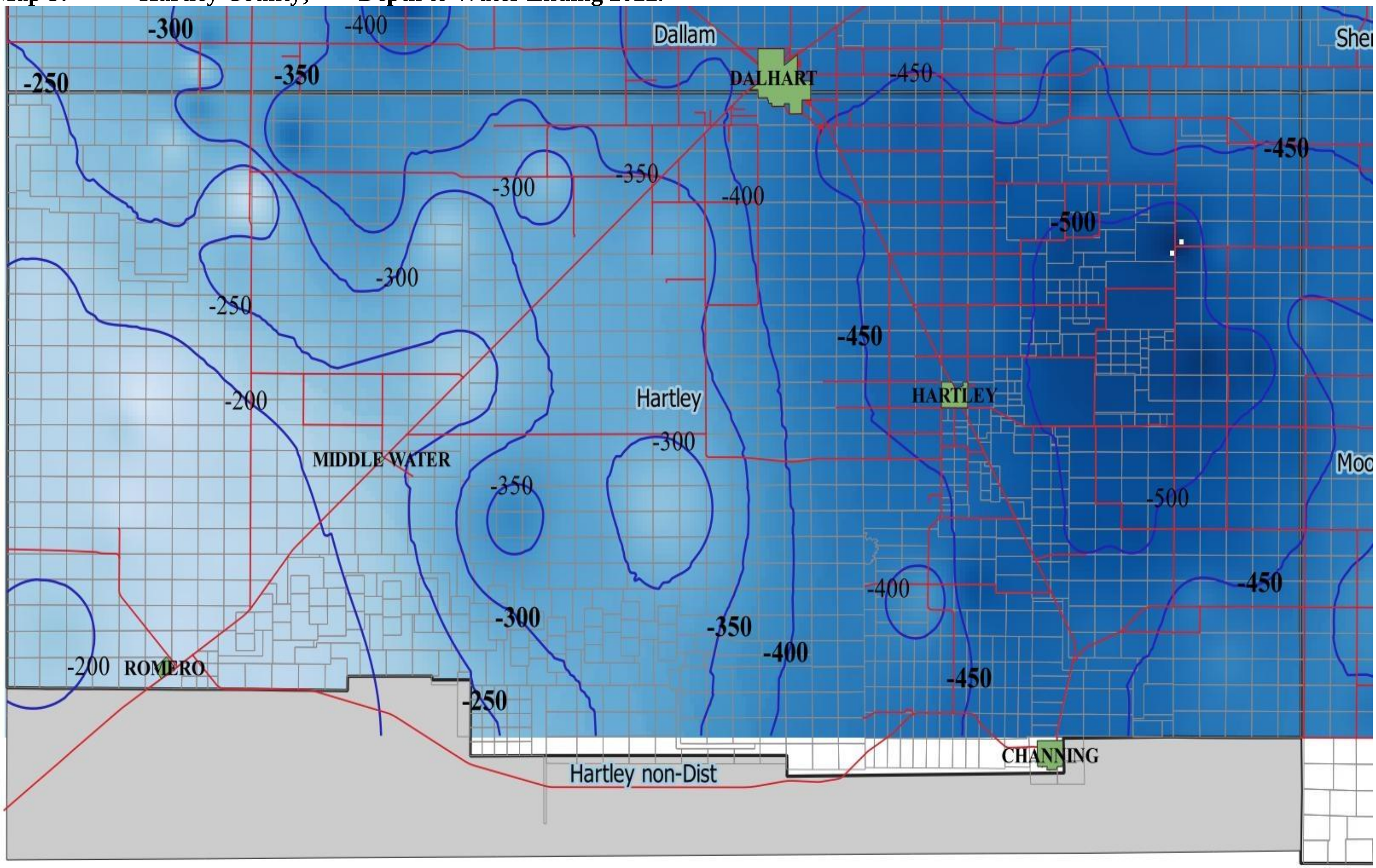
Maps depicting depth to water below land surface are created from statistical analyses of current and historical water level measurements. The most recent water level measurements were measured in January and February of 2023. Those water level measurements represent the depth to water at the end of the 2022 agricultural pumping season and prior to the beginning of the 2023 pumping season. It is valid to title the maps either 2022 or 2023 Depth to Water.

Accuracy: The accuracy of the depth to water is estimated to be equal to the contour interval, +/- 50 feet.

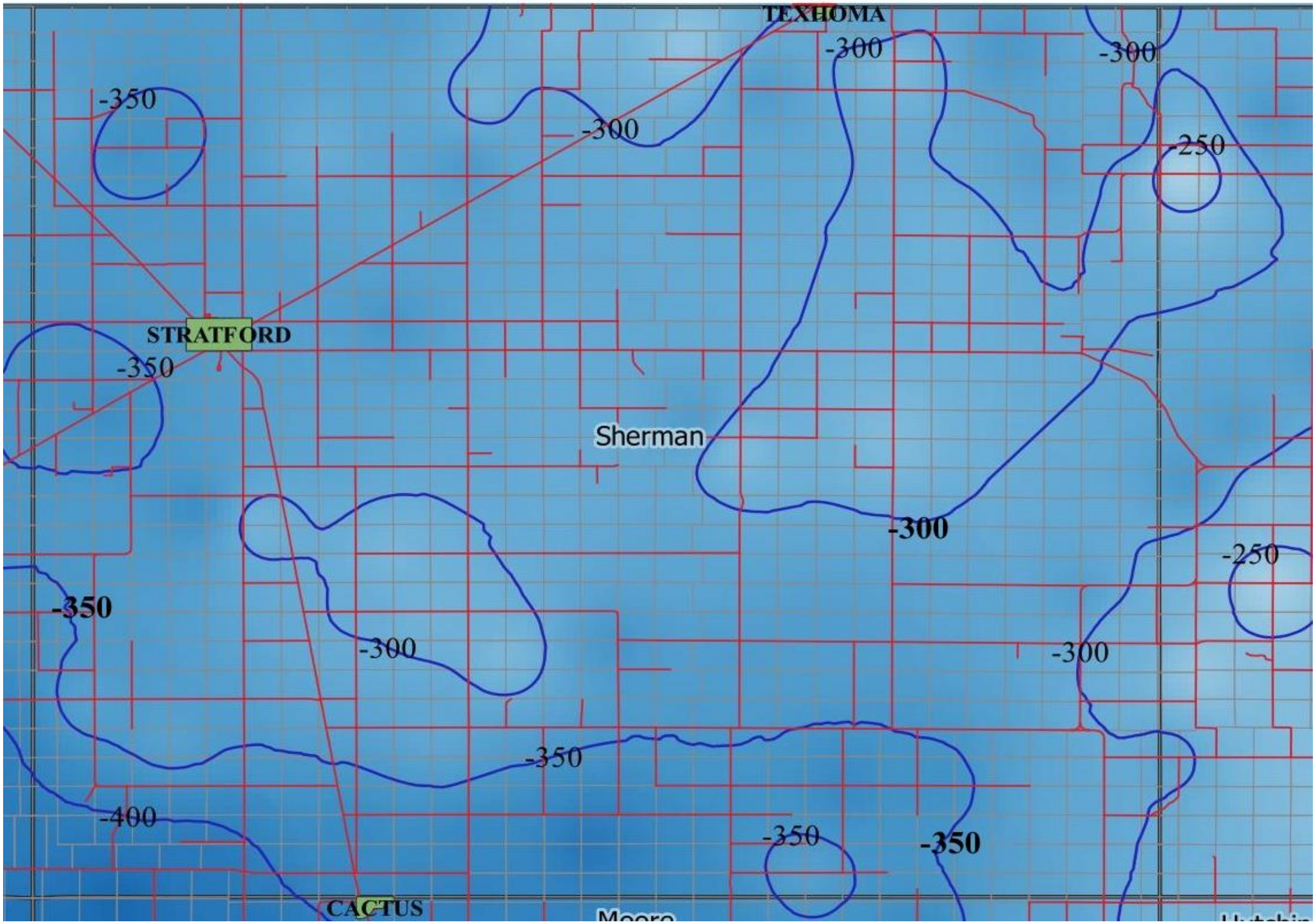
**Map 4:** **Dallam County;** **Depth to Water Ending 2022.**



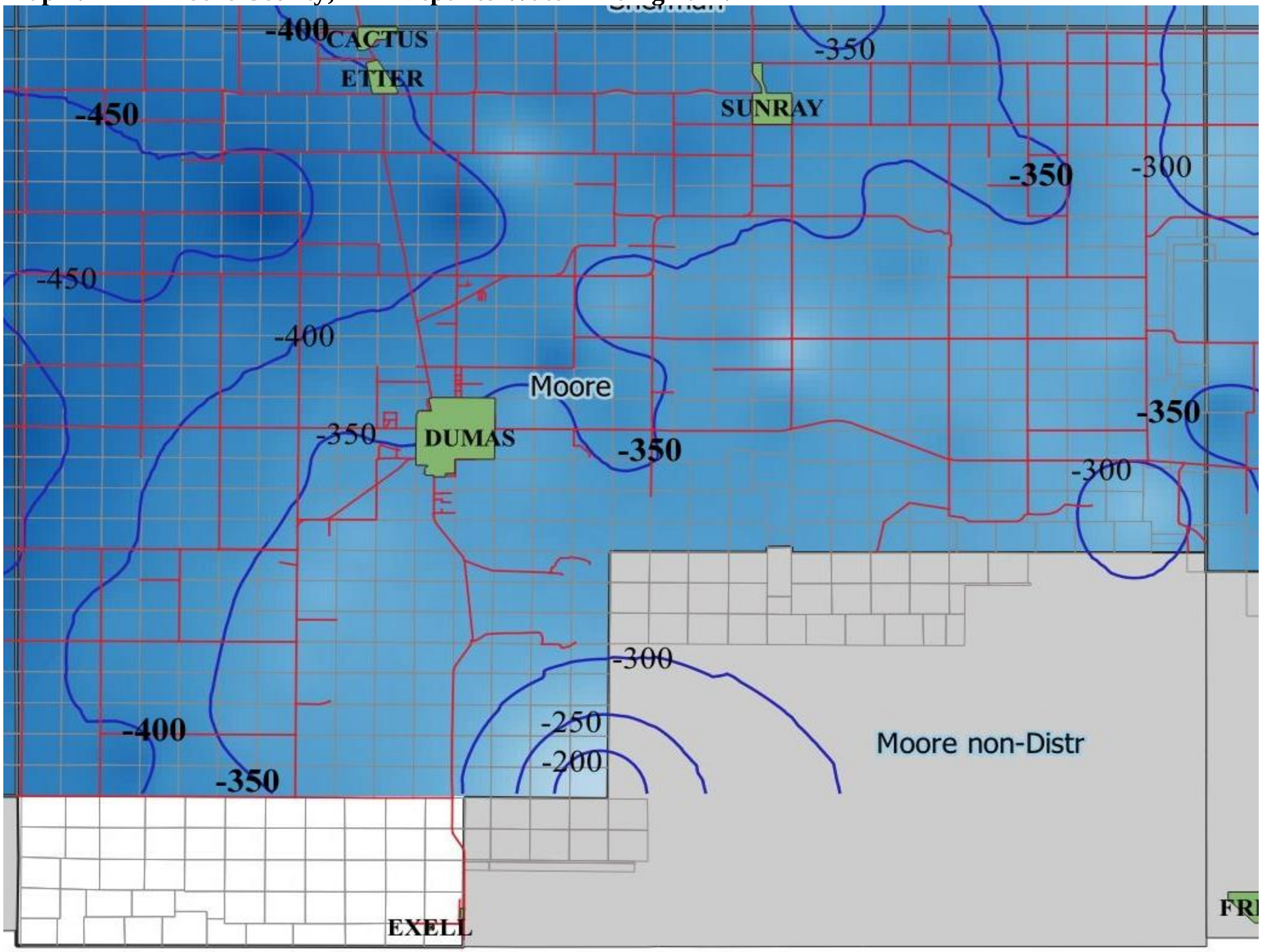
**Map 5: Hartley County; Depth to Water Ending 2022.**



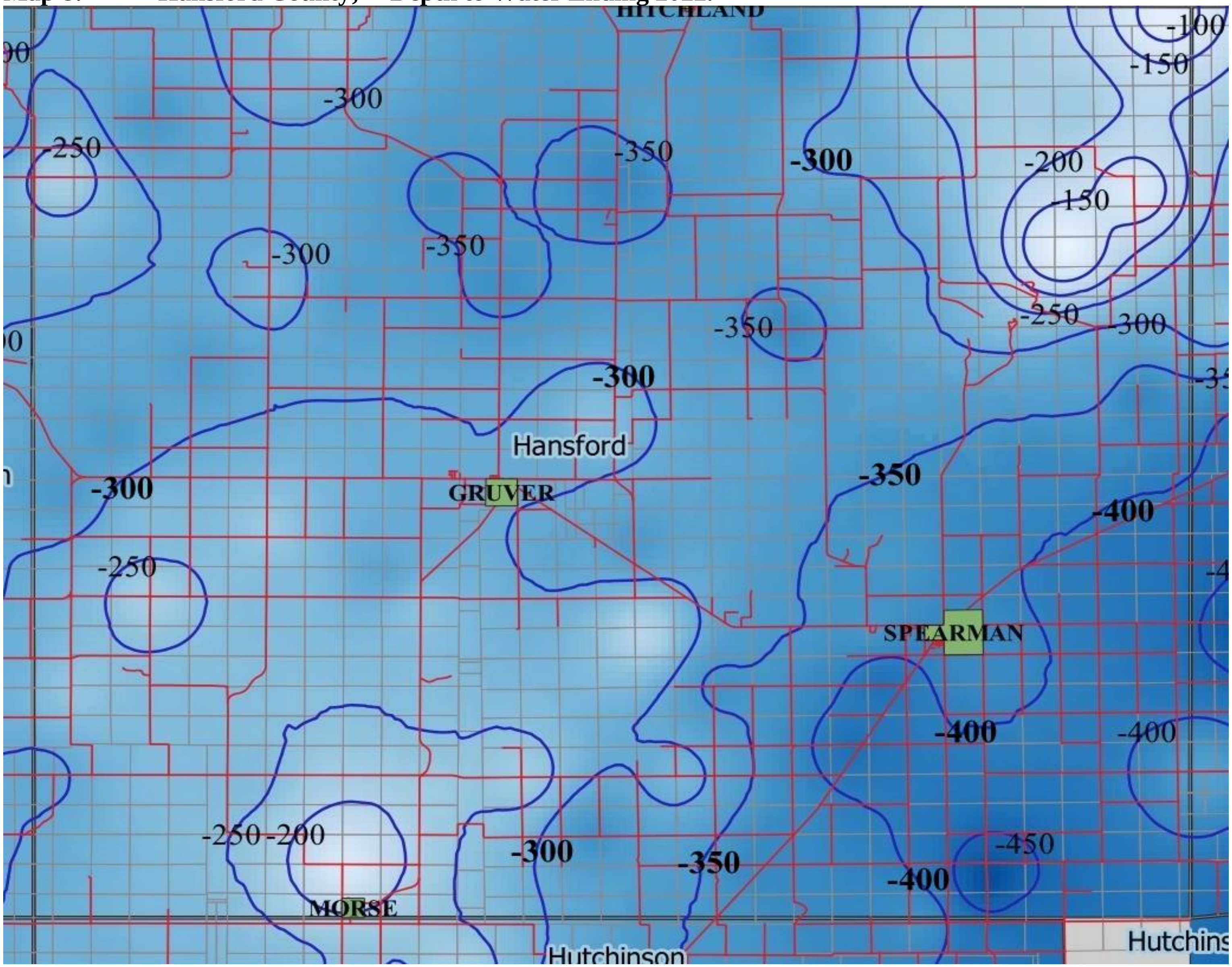
**Map 6:** **Sherman County;** **Depth to Water Ending 2022.**



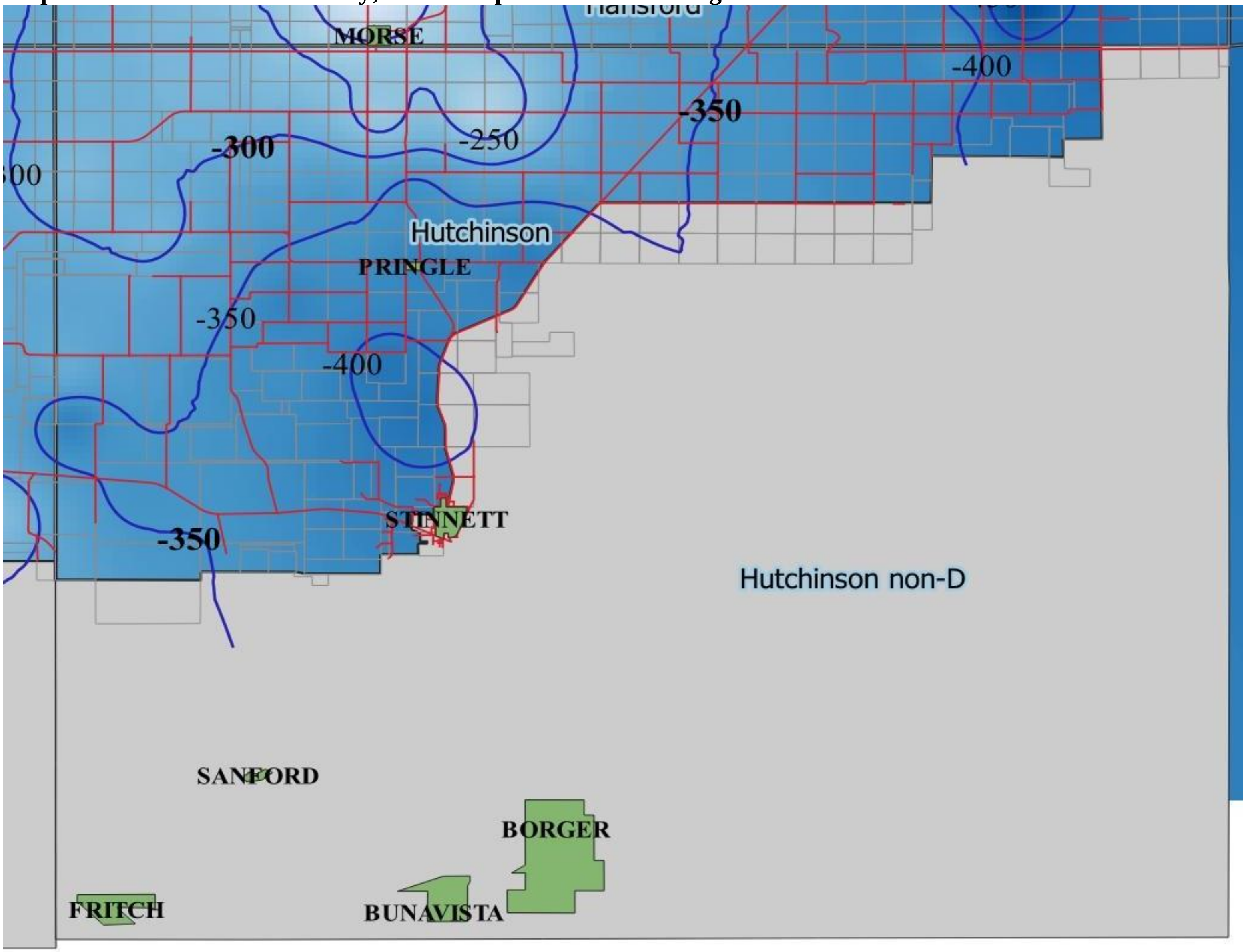
**Map 7: Moore County; Depth to Water Ending 2022.**



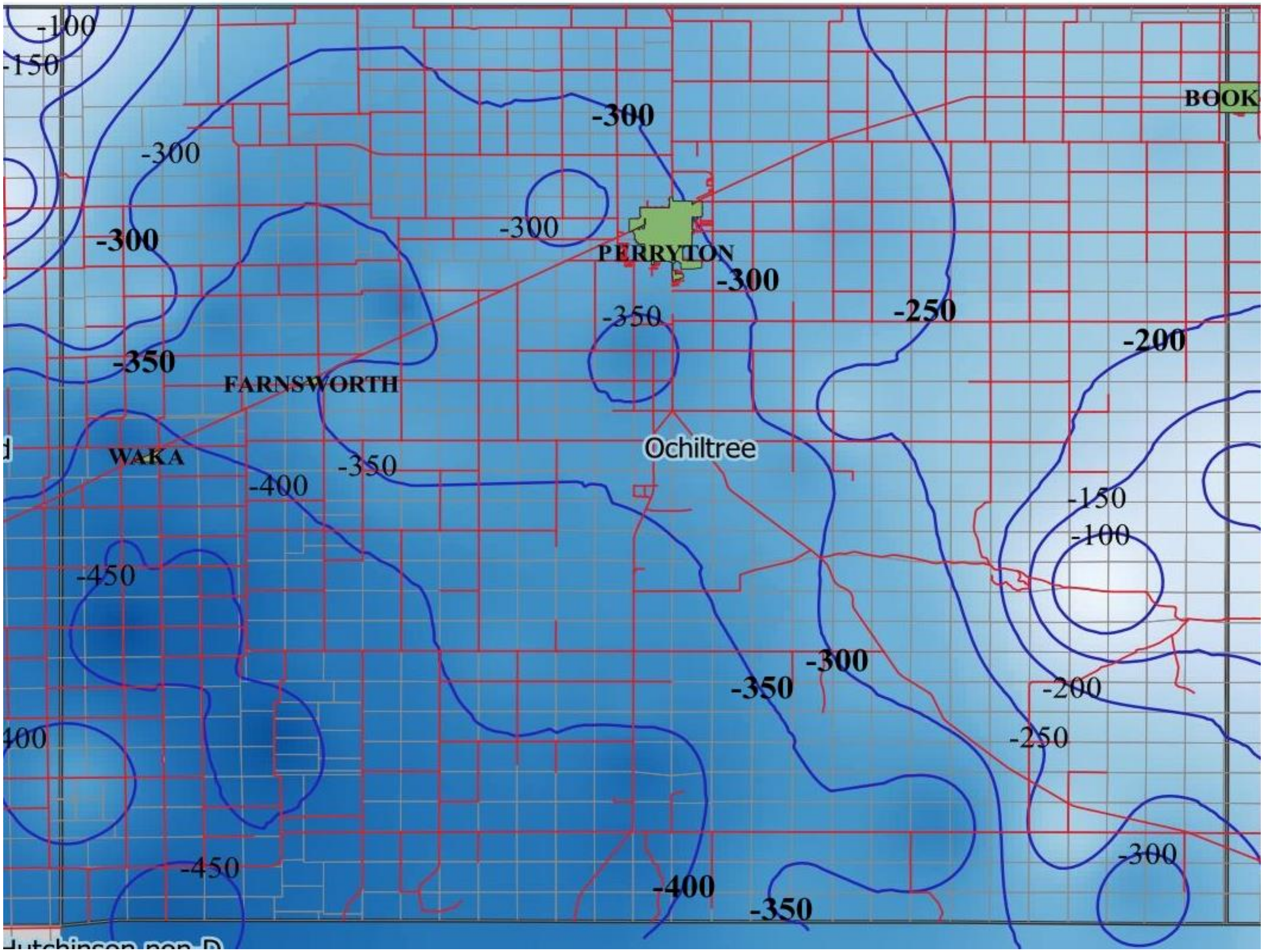
**Map 8:** **Hansford County; Depth to Water Ending 2022.**



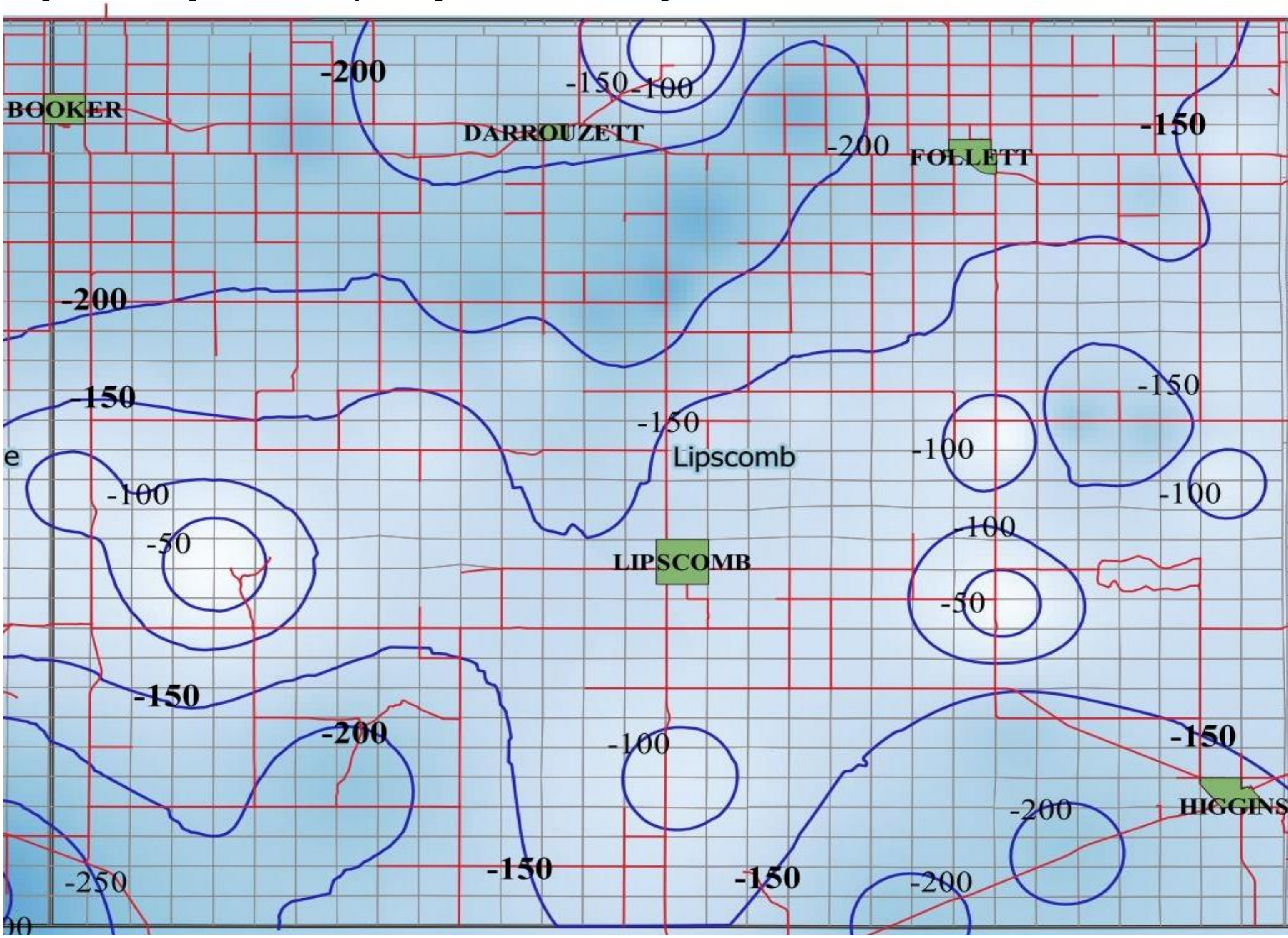
**Map 9: Hutchinson County; Depth to Water Ending 2022.**



**Map 10: Ochiltree County; Depth to Water Ending 2022.**



**Map 11: Lipscomb County; Depth to Water Ending 2022.**



## XIV. Declines (from 2022 Pumping) in Monitor Wells by County

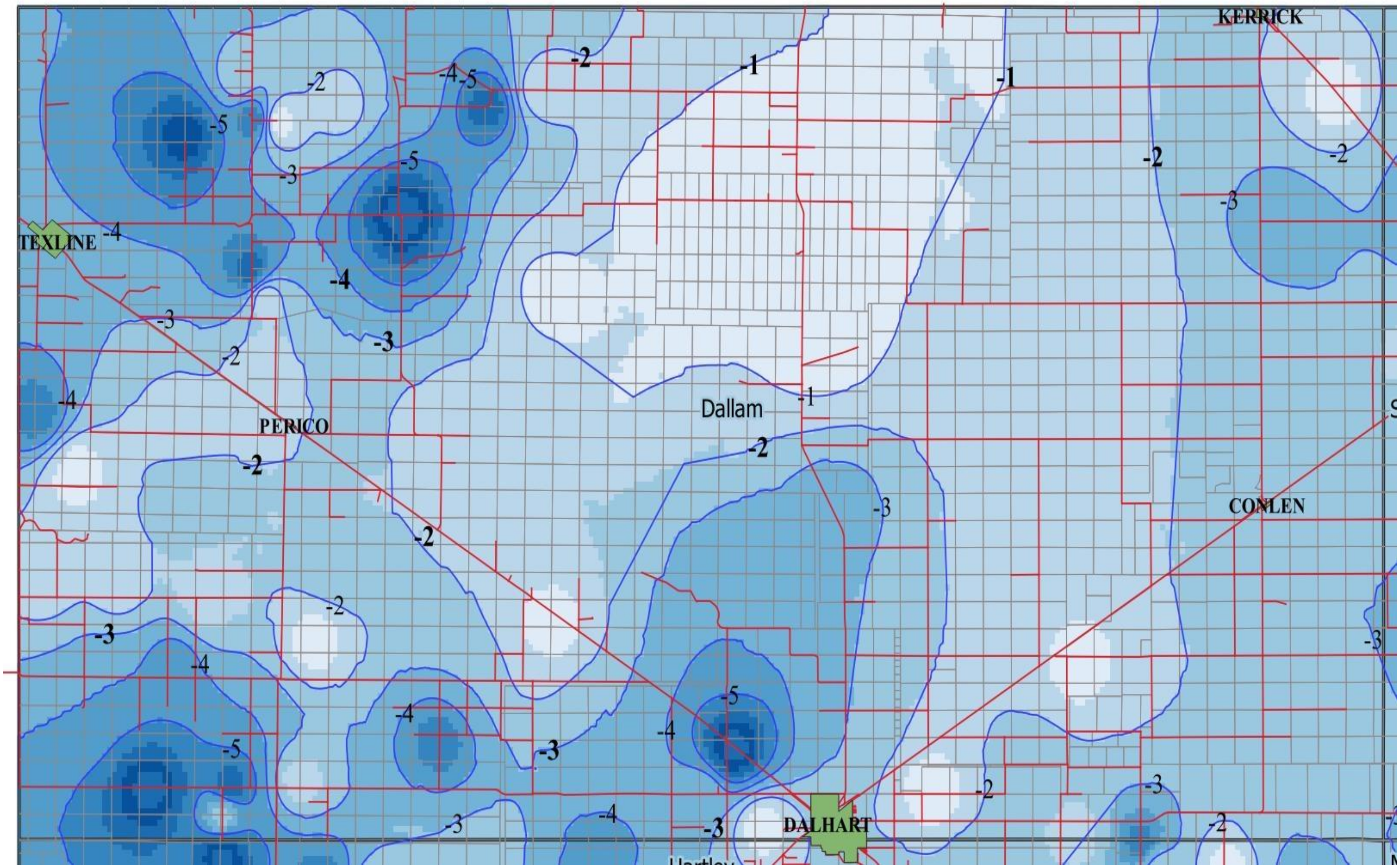
These maps do not include well measurements that indicate rises in water level. Rises may be valid for some specific areas but generally the statistical analyses do not indicate a high level of confidence in that data, therefore it is not used.

Maps depicting declines in monitor wells are created from a statistical analysis of current and historical water level measurements. The most recent water level measurements were taken in January and February of 2023. The declines represent declines resulting predominantly from the 2022 agricultural pumping season.

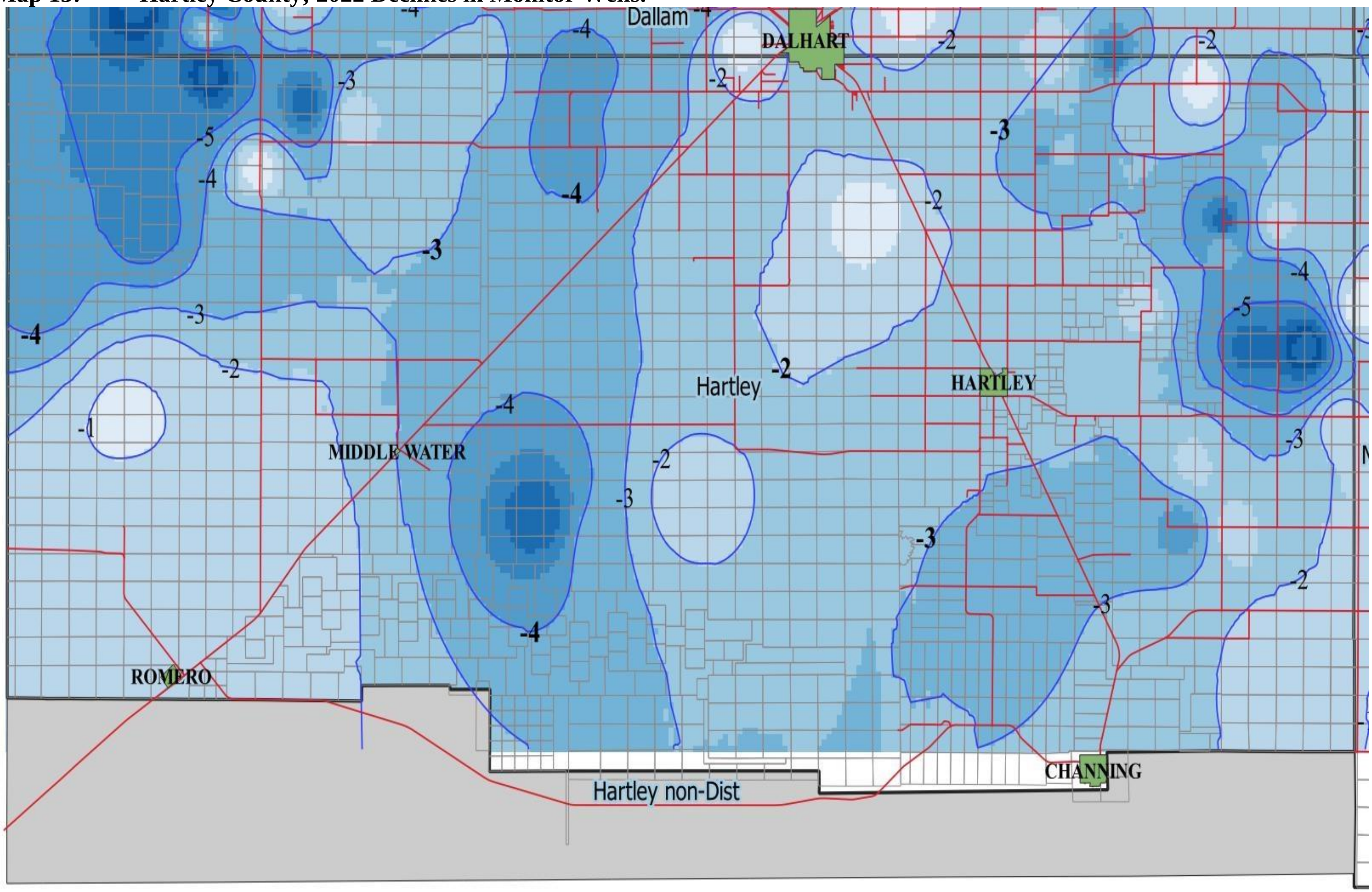
Declines are calculated using water level measurements taken from District monitor wells which are located primarily in high pumping areas. Consequently, these wells tend to show higher declines than what a true county-average-decline would show.

Accuracy: The accuracy of the decline maps is estimated to be +/- 2 feet.

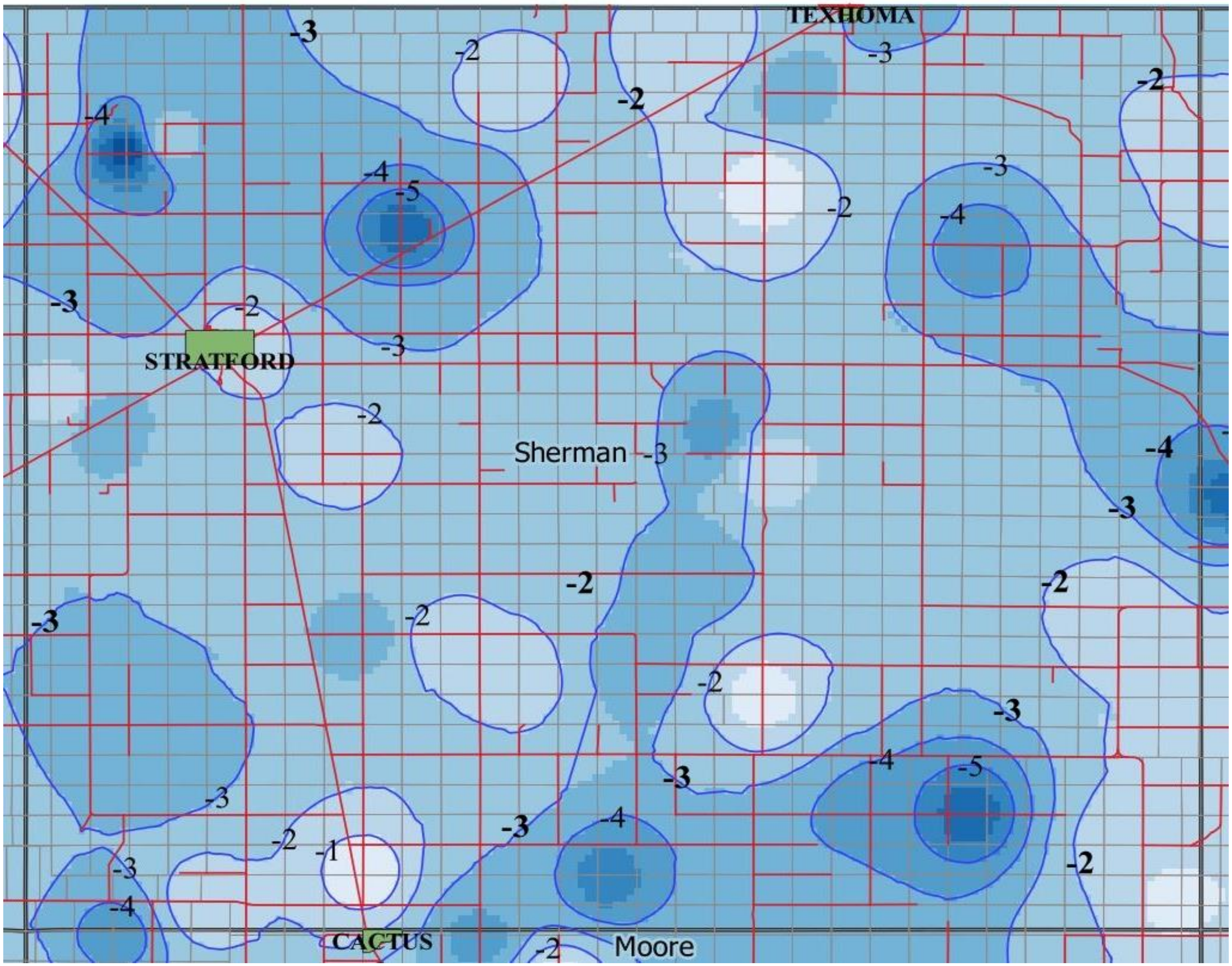
**Map 12:** **Dallam County; 2022 Declines in Monitor Wells.**



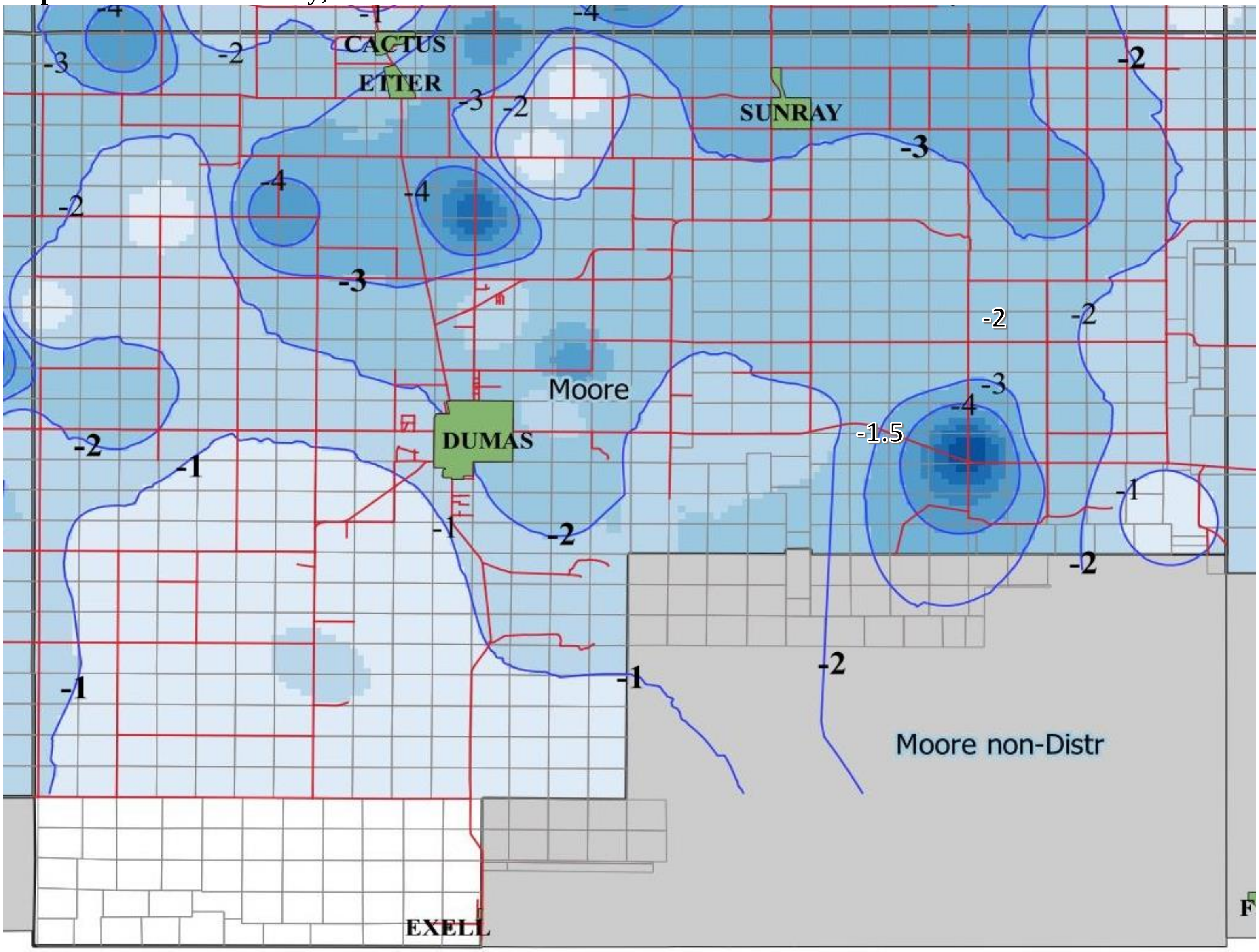
**Map 13:** **Hartley County; 2022 Declines in Monitor Wells.**



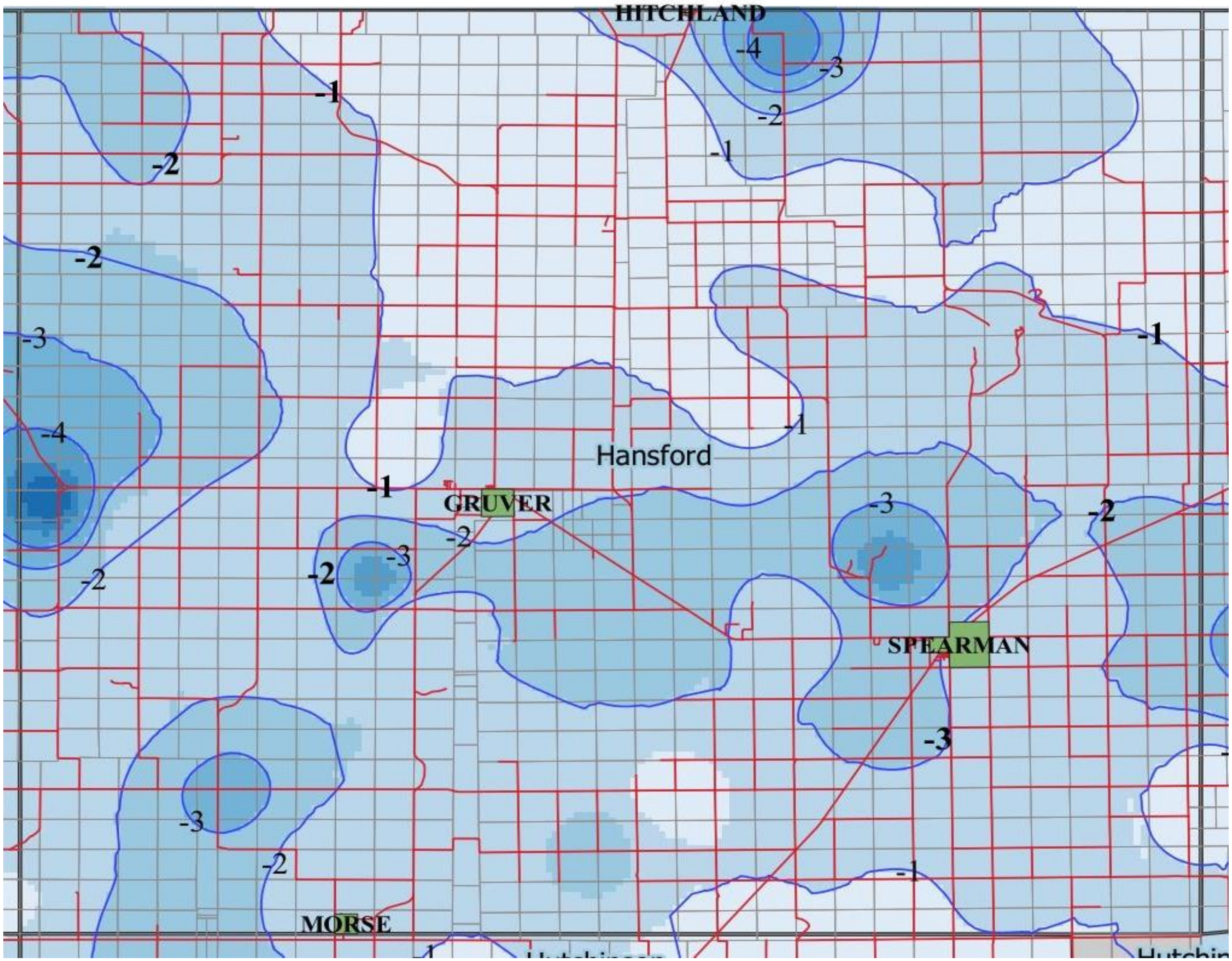
**Map 14:** **Sherman County; 2022 Declines in Monitor Wells.**



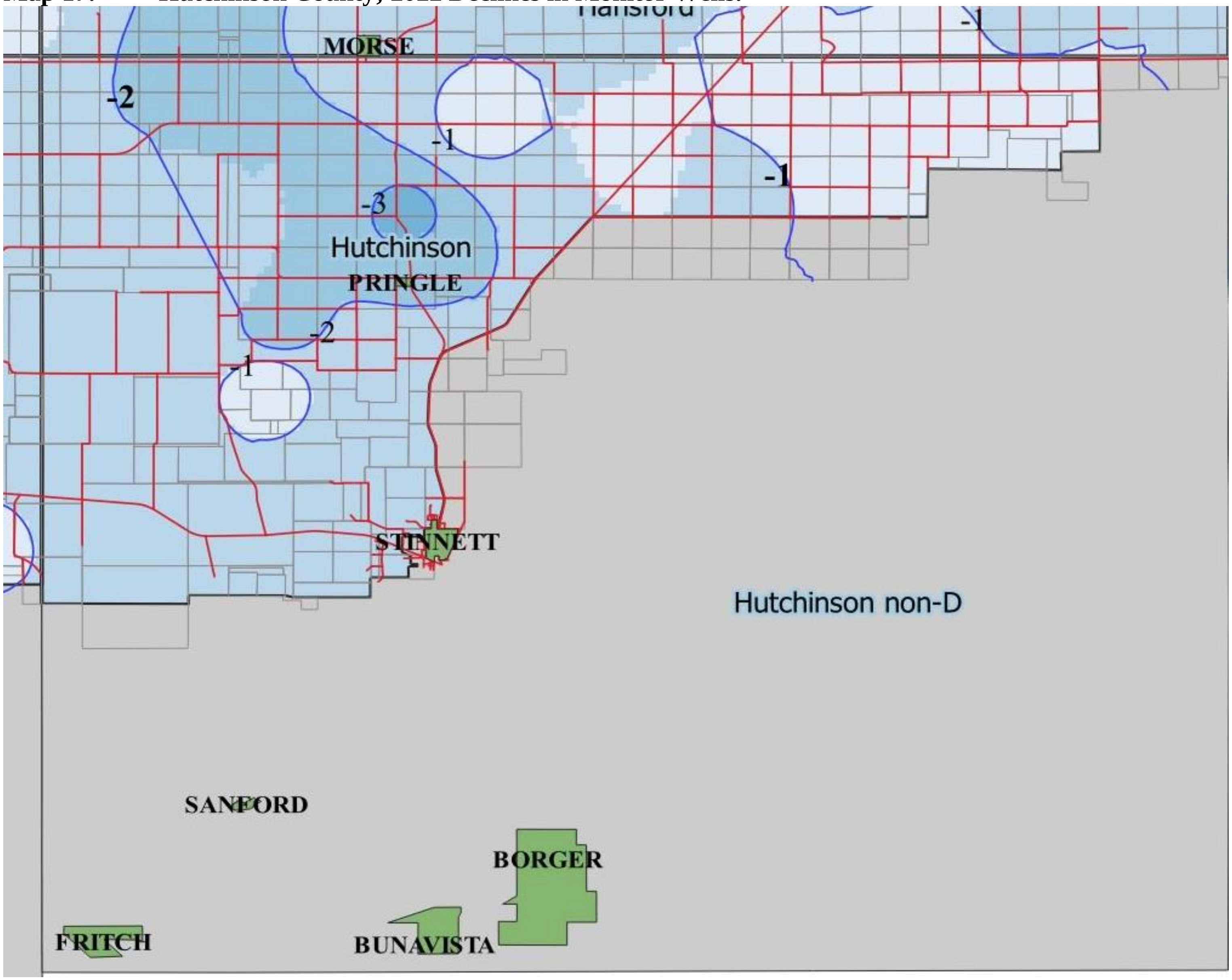
**Map 15: Moore County; 2022 Declines in Monitor Wells.**



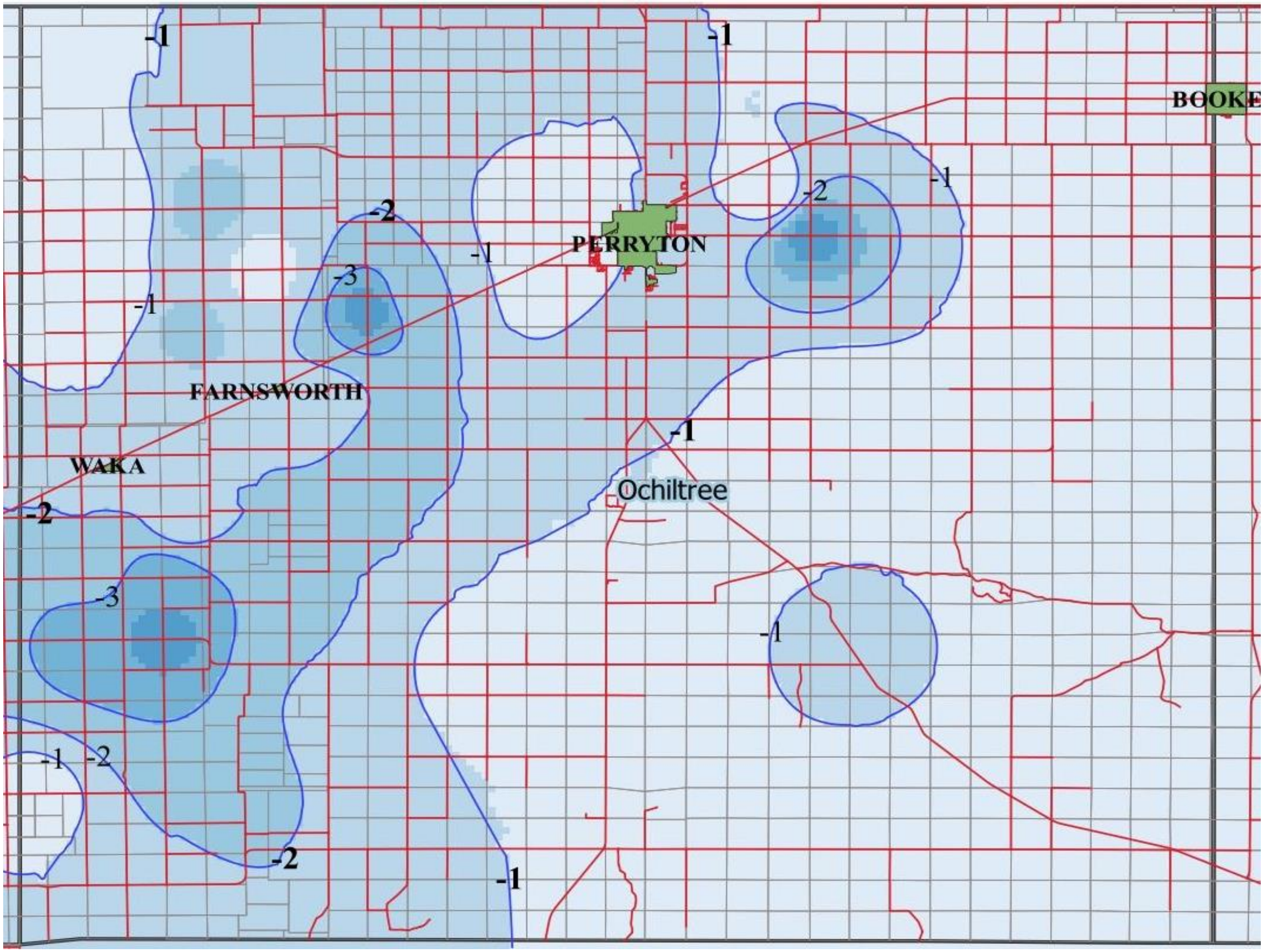
**Map 16:** **Hansford County; 2022 Declines in Monitor Wells.**



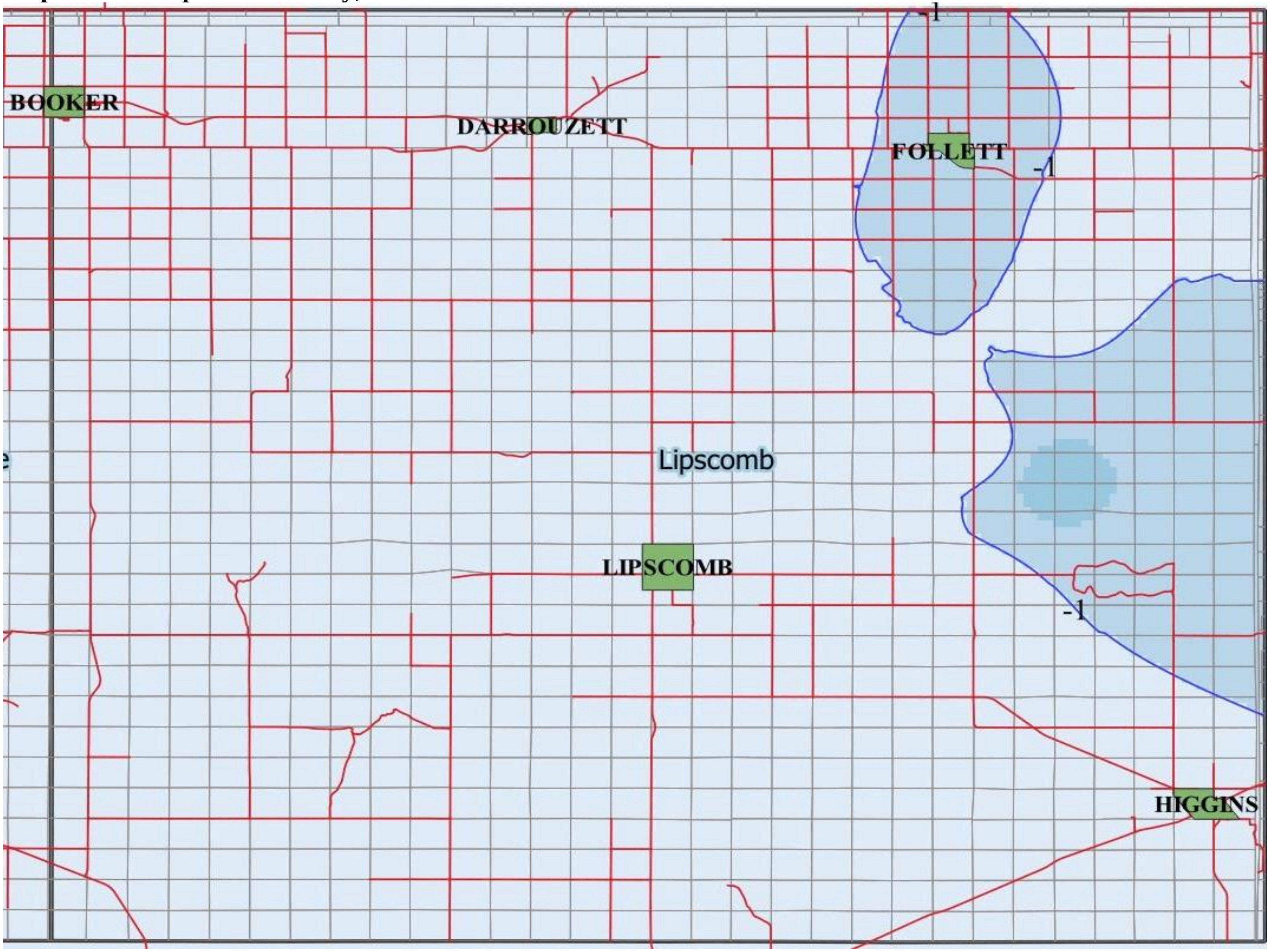
**Map 17: Hutchinson County; 2022 Declines in Monitor Wells.**



**Map 18:** **Ochiltree County; 2022 Declines in Monitor Wells.**



**Map 19:** **Lipscomb County; 2022 Declines in Monitor Wells.**



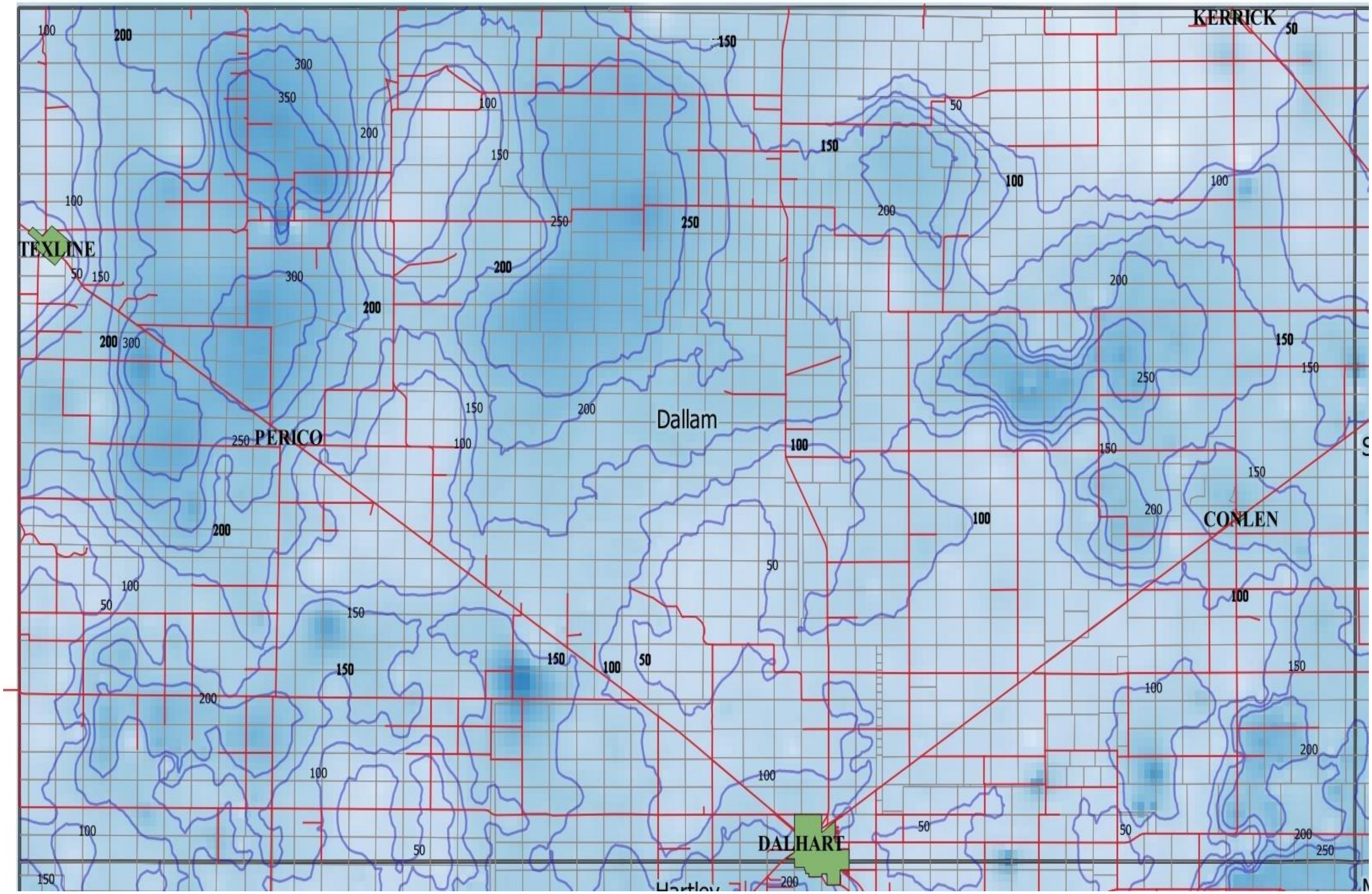
## XV. 2022-2023 Estimated (Average) Saturated Thickness of the Ogallala Aquifer by County

Maps depicting estimated aquifer saturated thickness are created using geographical information mapping software and may be created by various methodologies. The most recent water measurements used in creating saturated thickness maps were taken in January, and February of 2023. The water level elevations calculated represent the water level elevations at the end of the 2022 pumping season and the beginning of the 2023 pumping season. The Saturated Thickness maps represent the saturated thickness at the beginning of 2023 and is considered reasonably accurate for at least a three-year period.

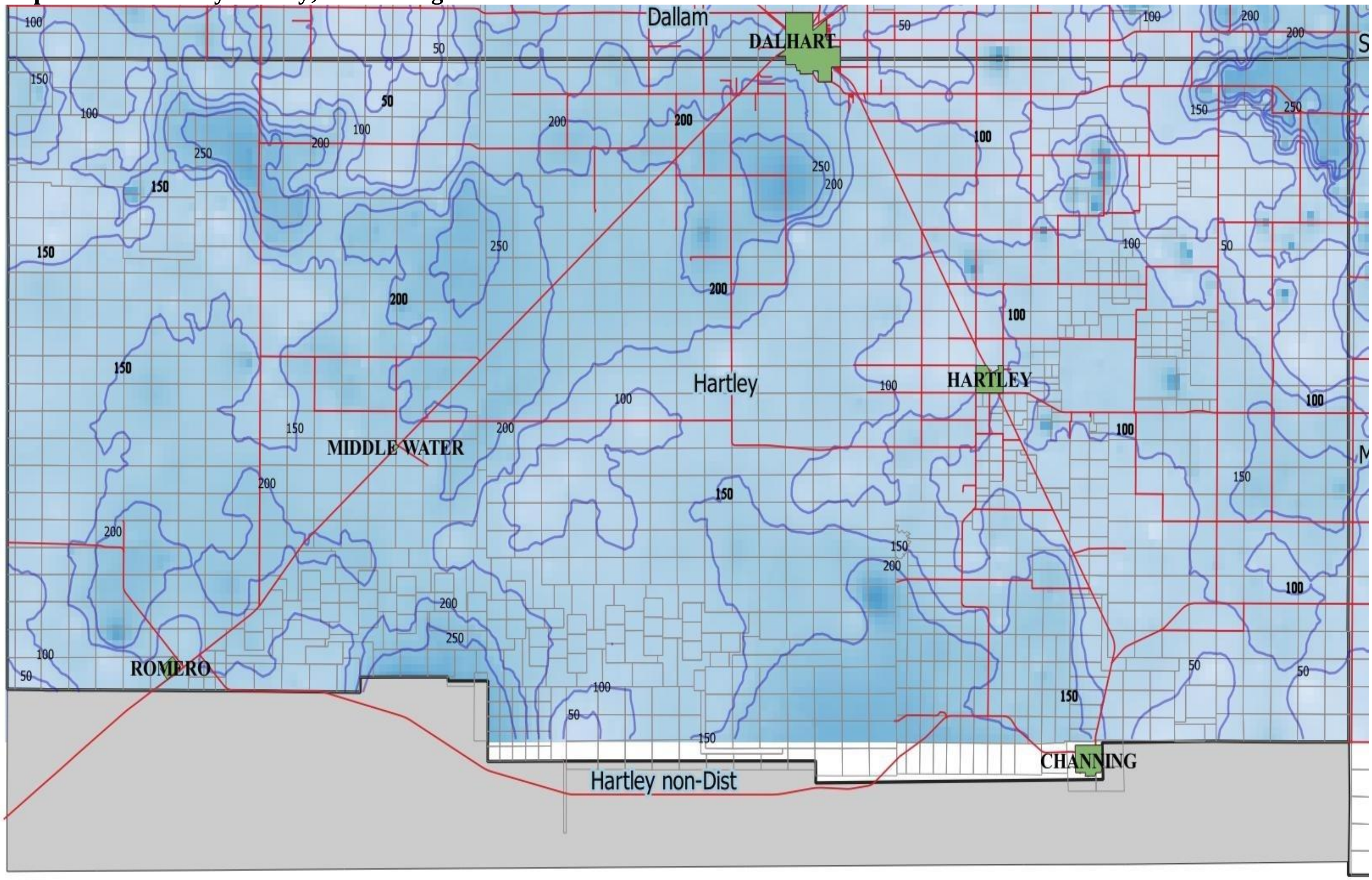
Estimated Saturated Thickness Maps are created every third year. The next set of estimated aquifer thickness maps are scheduled to be created by mid-late Summer of 2026.

Accuracy: Map accuracy is estimated to be equal to +/- 50 feet. In some areas data may have been included from the Rita Blanca or the Dockum Aquifers due to the uncertainty in delineating those boundaries. Inclusion of such data may increase the value of the saturated thickness of the Ogallala above what may be encountered in the field.

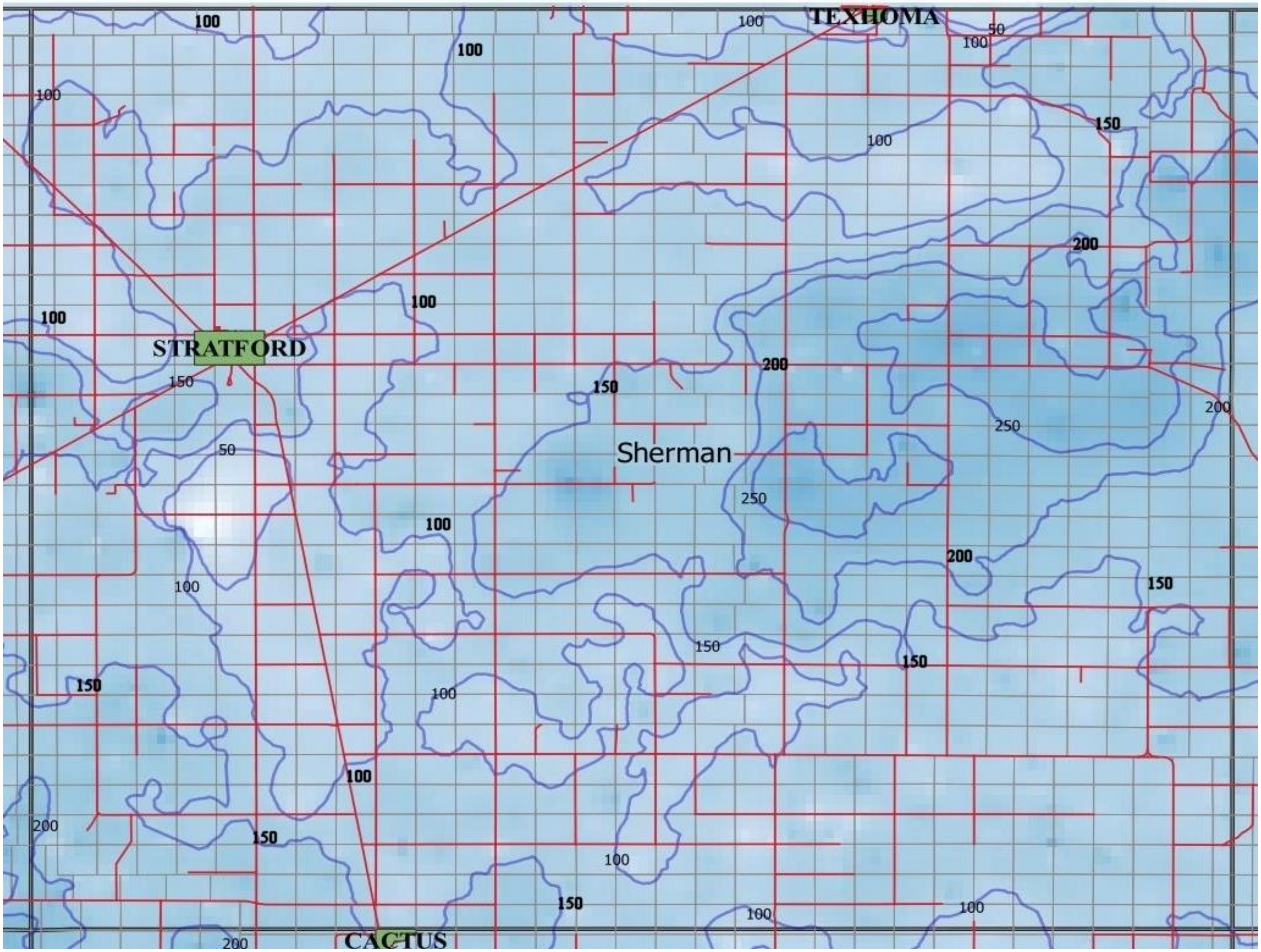
**Map 20: Dallam County; Average Saturated Thickness 2022-2023.**



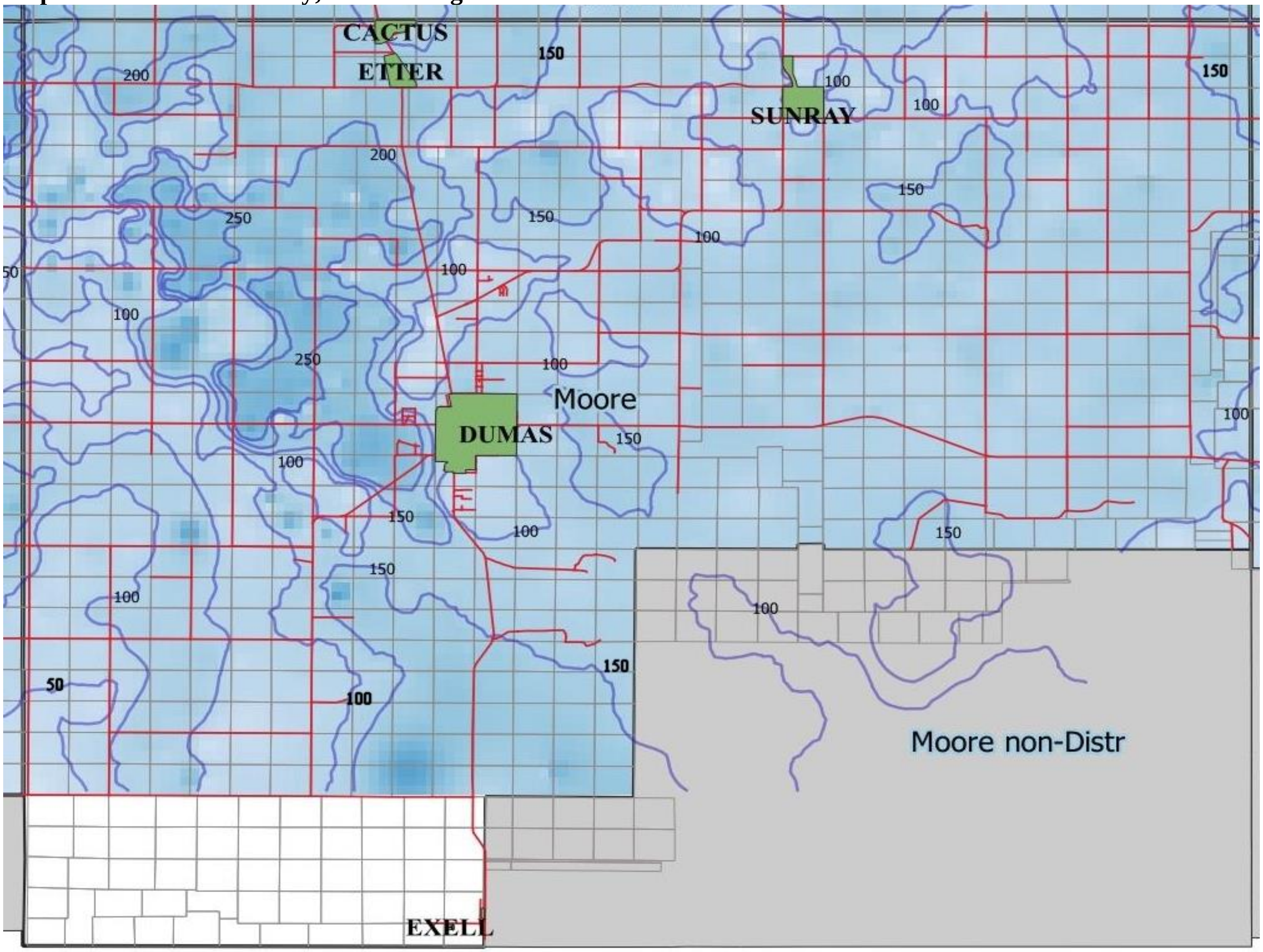
**Map 21: Hartley County; Average Saturated Thickness 2022-2023.**



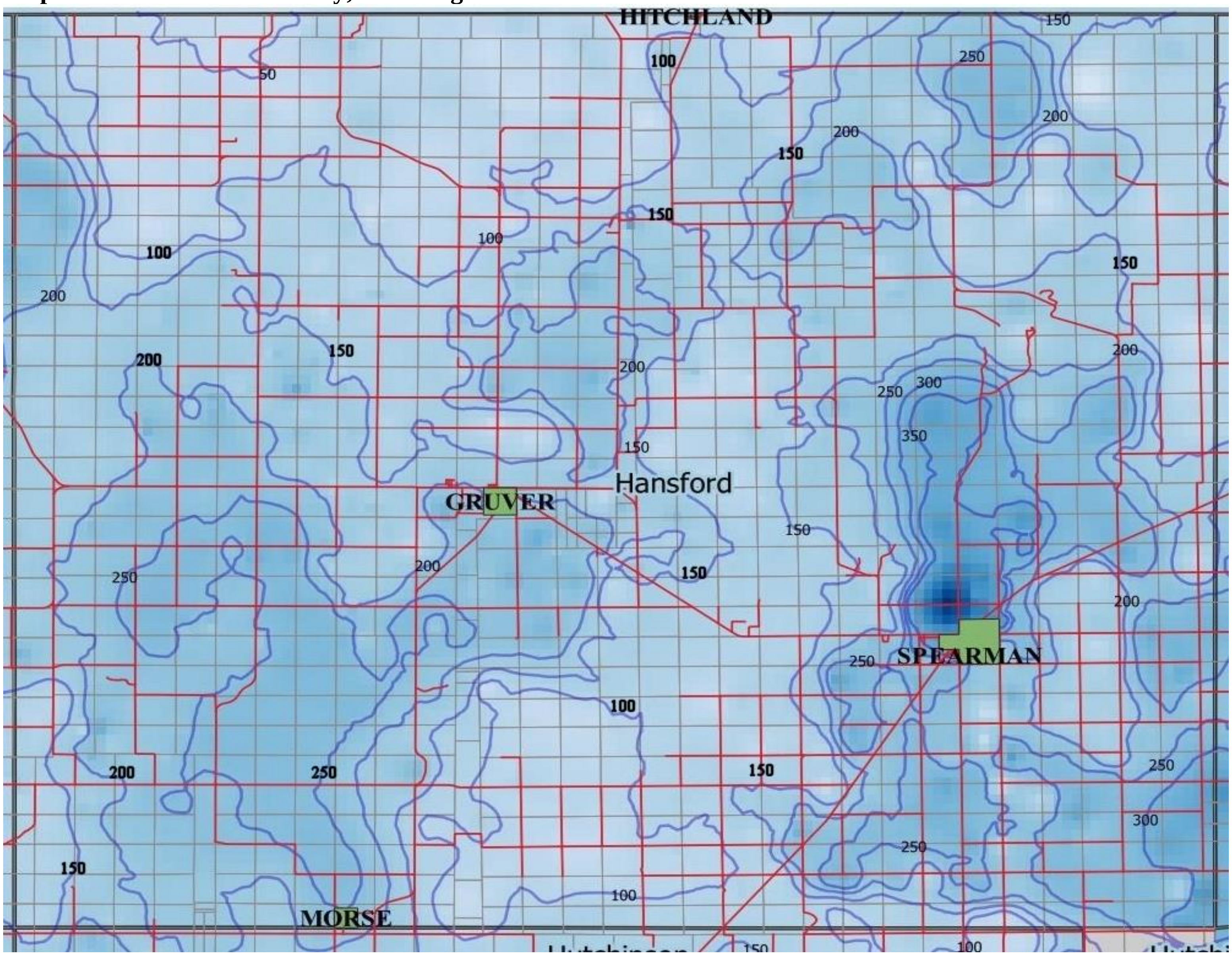
**Map 22: Sherman County; Average Saturated Thickness 2022-2023.**



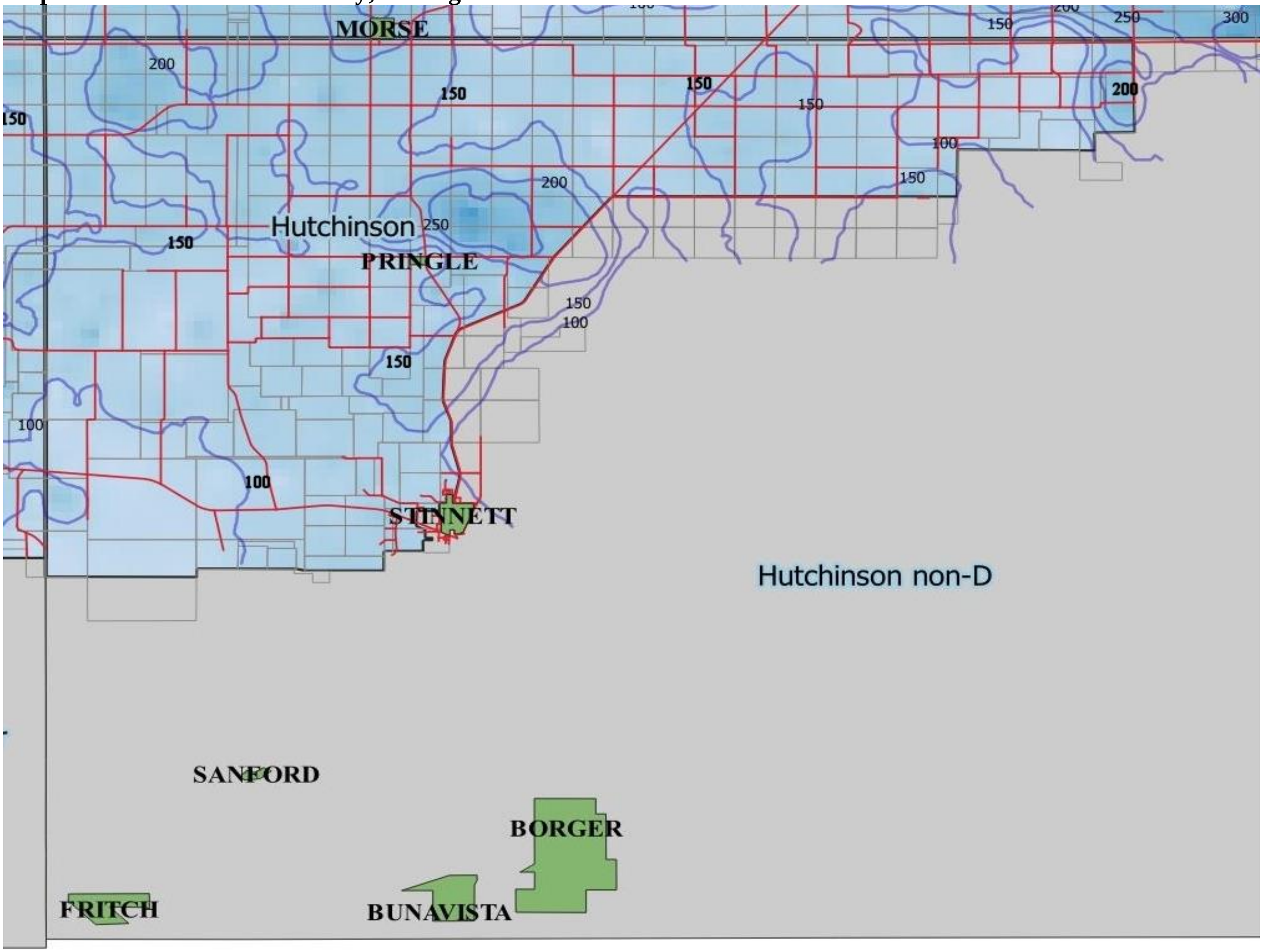
**Map 23: Moore County; Average Saturated Thickness 2022-2023.**



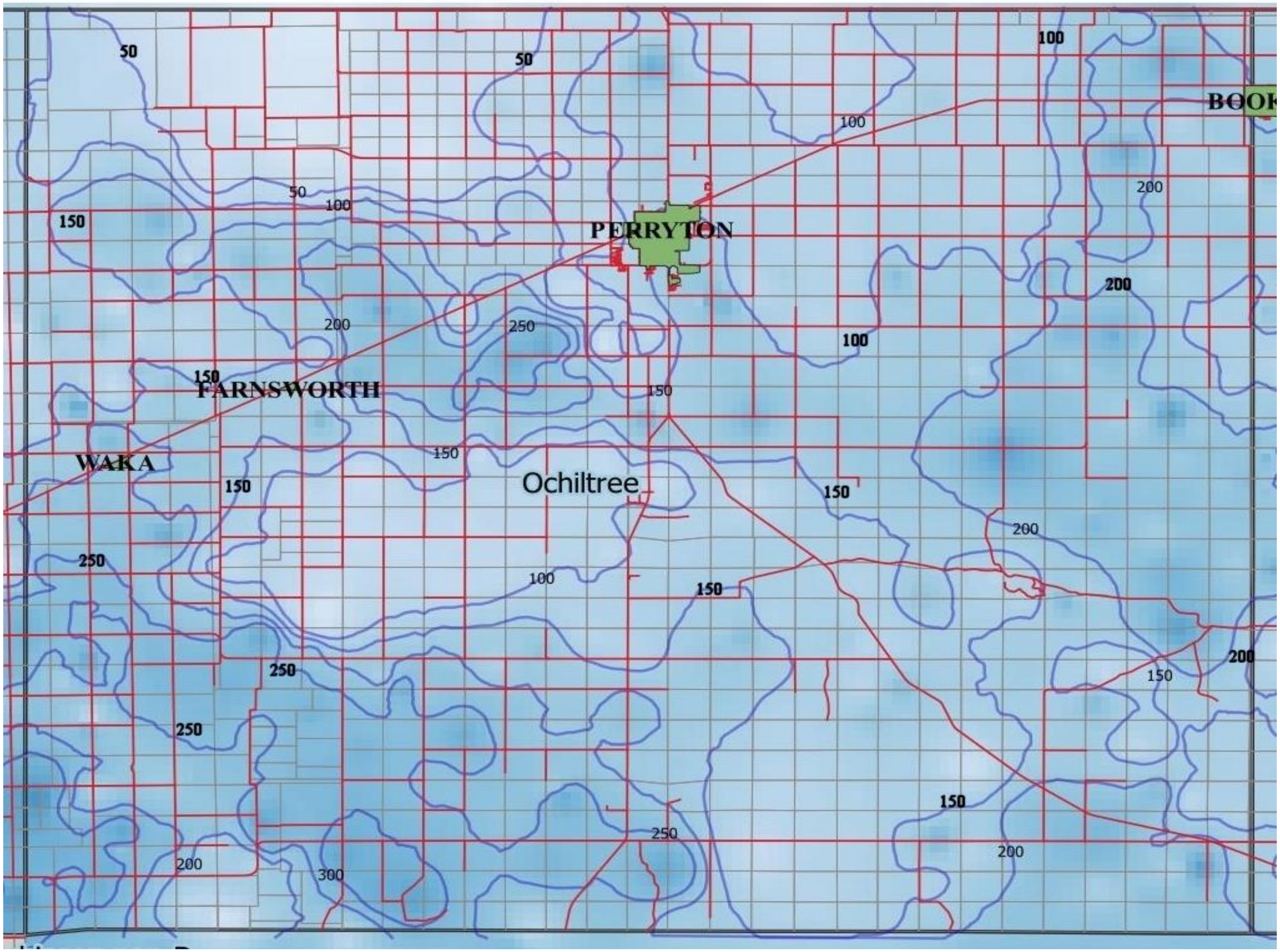
**Map 24: Hansford County; Average Saturated Thickness 2022-2023.**



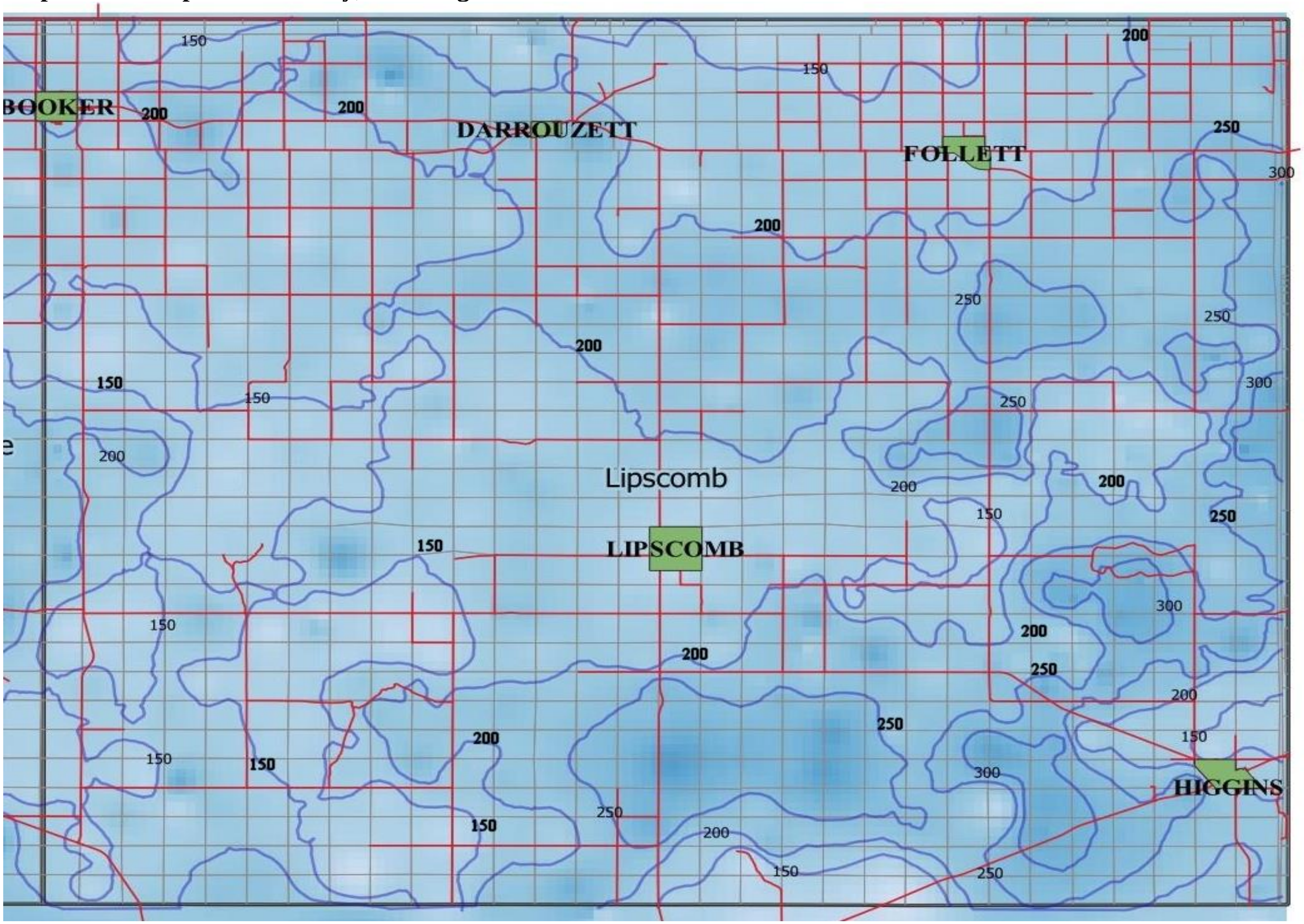
**Map 25: Hutchinson County; Average Saturated Thickness 2022-2023.**



**Map 26: Ochiltree County; Average Saturated Thickness 2022-2023.**



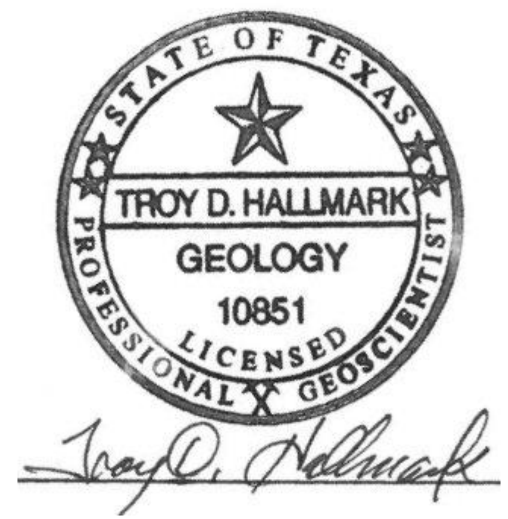
**Map 27: Lipscomb County; Average Saturated Thickness 2022-2023.**



## XVI. Contributors to Hydrology and Groundwater Resources 2022-2023

**2023 North Plains Groundwater District Staff:**

| | |
|---|---|
| Barnes, Baylee | Conservation Outreach Specialist |
| Blackwell, Kristen | Administration Manager |
| Cadenhead, Braden | Natural Resource Specialist |
| Davila, Keila | Natural Resource Specialist |
| Donley, Krystal | Administrative Assistant |
| Funk, Mitch | Natural Resource Specialist |
| Glazner, Paige | Conservation Outreach Assistant |
| Holt, Dusty | Permitting Specialist/Finance Assistant |
| Orthman, Lou | Compliance Coordinator |
| Schwertner, Curtis | Natural Resource Specialist |
| Tice, Casey | Production Coordinator |
| Robinett, Sherry | Admin Assistant |
| Walthour, Steve | General Manager |
| Ward, Odell | Aquifer Science Manager |
| Welch, Kirk | Assistant General Manager |




The Professional Geoscientist Seal's use and the signature was authorized by Troy D. Hallmark, P.G. (# 10851) in June of 2023 and is valid solely while this "Hydrology and Groundwater Resources 2022-2023" document is maintained together in its entirety and has not been altered in any manner from the original document retained at the North Plains Groundwater Conservation District Office in Dumas, Texas.

**Document Compiled by:**
Dale Hallmark, P.G.
Independent Consultant
dalehall@email.com

**North Plains Groundwater Conservation District**
**603 East First Street (Mail: P.O. Box 795)**
**Dumas Texas 79029**
**Office 806-935-6401, Fax 806-935-6633**
**Office Hours 8-12 AM, and 1-5 PM, Mon-Fri**