

Water Committee Meeting
Thursday, August 28, 2025 9:30 AM
Lower Platte North NRD Office
P.O. Box 126
Wahoo, NE 68066

1. UNFINISHED BUSINESS

2. REGULATORY

2.A. GROUND WATER MANAGEMENT AREA

2.A.1. Variance Request in the Hydrologically Connected Area (Limited Development Area)

The deadline is September 15th for applications.

2.A.2. Variance Requests in the Non-Hydrologically Connected Area (Normal Development Area)

There are four applications submitted for review at the Committee Meeting.

- Kevin Wolfe - SE1/4 14-16-8E, Saunders County, new well variance (West of Leshara)
- Todd Yindrick - E SE 22-15-3E, Butler County, expansion of acres from existing well (East of David City). This tract was approved for an Expansion of Acres Variance with allocation in 2023. Todd's allocation was 14.30, and he used 12.06 in the first 2 years. If approved, the Expansion of Acres Variance with allocation will lapse.
- Bryan Hein - NW1/4 7-15-3E, Butler County (2 miles north of David City)
- Bryan Hein - SE1/4 17-15-3E, Butler County (1 mile east of David City)

Bryan Hein is going through the process of getting the correct permits from David City. Bryan reported that he has all the permits from Planning and Zoning, but City Council needs to approve.

By Groundwater Rules and Regulations, the NRD is allowed to issue up to 75 Acre Feet of Depletion in the Non-Hydrologically Connected Area (Normal Development Area). The total of the four applications was 70.302 Acre Feet.

2.A.3. Variance Requests in the Restricted Development Areas

Both applications were reviewed by Katie Cameron. Two applications have been received, with one application adjacent to the white area (NHCA) and the other next to the blue (HCA). In the past, we reviewed these applications in what area they are adjacent to, so we will only be reviewing one application this month.

- Gregg Fujan - SW SW 29-15-6E, Saunders County (SW of Malmo) Greg has sent his yield history map for this field.

Comments from Katie with her interpretation attached.

The SW SW 29-15N-6E, Saunders County... looks to be on a glacial till edge area

but maybe a 10 to 20 foot-thick sand and gravel are available around 80 feet + or - . This area is hard to map the extent of units because of the apparent past glacial processes, and we don't have many wells (however, each of the nearby wells does show saturated thicknesses of gravel available in the top 100ft). The nearest AEM line is ~800 feet to the west in Section 30 (north-south line L1004700). I couldn't recommend any specific direction and would reiterate that the yellow hatch estimated areas on the Google Earth map are very rough with question marks on the boundary extents. Deeper Dakota we don't know the character, but based on 02-LPN-2015 by Malmo, the variable Dakota units might be interpreted as more sandstone dominant than is actually present (log summary depicted on AEM L504800 profile for reference).

Thanks!
Katie

Section P - Restricted Development Area from the Groundwater Rules and Regulations is attached.

Staff recommends allowing this variance with the stipulation of Section P from Groundwater Rules and Regulations are followed before a well permit is issued.

2.A.4. Variance Extension in Restricted Development Area

Variance LPN-V-024-0644 was approved for Larry Rasmussen in a restricted area on 10/15/2024. The site is located in the NW 1/4 27-16-8 and within 1 mile of the Hydrologically Connected Area. Larry consulted with Katie Cameron on test hole locations and each site did not prove to be able to produce an irrigation well. He contacted Jesse Korus about utilizing tTem, a version of AEM, but is pulled behind a 4-wheeler. Larry would like to extend his variance until February 1, 2026, to allow him to do one more investigation with the tTem. Larry has agreed to provide any information he gathered to the NRD. The Committee would like to see what the data shows and suggested having staff notify Committee members when tTem is at the field.

2.A.5. Well Permit Program

2.A.6. Groundwater Management Plan

A draft of the GWMP has been emailed to the stakeholders along with an email blast to 1303 contacts. Results from the email are shown with the campaign attached.

The second digital newsletter for the Water Resources Department went out on August 12th and overall had a good response. This newsletter covered updates to the draft copy of the Groundwater Management Plan, Wellhead Protection Program public meetings, and announcing producer text message alerts. Daryl reported he had a few calls that week regarding the Groundwater Management Plan. We have had 2 people opt in to the text message alerts.

Contacts	Emails Delivered	Open Rate	Clicks to links in Email	Unsubscribes
1,303	1,209	52.36%	298	9

A draft public review copy of the Groundwater Management is attached. Shown are the comments from a stakeholder.

"I have reviewed the document and want to congratulate all on a very robust and

informative document with great background a clearly defined mission statement with actionable goals and objectives. Minor issues are listed below."

- Page 7, 1.5.1. 'Sampling area greater than 9 sq miles, unless a well-head protection area' . I'm was unclear whether being within a WHP increased or decreased the requirement for sampling. **(Can reword)** The Committee decided to reword to sample 50% of the high capacity well within a Wellhead Boundary.
- Section 1.5.4 - Hurray for you/us? Good call.
- Page 13, Fig 8. May consider replacing brighter with warmer and darker with cooler in describing colors on the map. Also Permeability...it would help my understanding as it relates to surface recharge if a map could show the range of permeability in inches/hour. **(This would be hard to do with this type of map but can visit with LRE)** The Committee decided that permeability is variable and to put in the map might be misleading. They recommend rewording for better understanding.
- Section 2.7water level rises and declines changes affect... Perhaps rephrase as 'water level changes (rise or decline) affect'? Please define "dewatering activities" **(Can reword and clarify)**. Committee decided to re-phase the water level change but decided not to define de-watering because of its different uses.
- Page 30, Paragraph 2 - spelling error ntrual = natural; overtime = over time. **(can correct)** Will correct
- Page 31, Section 2.1.5, 7th bullet. Spring filed = filled. **(can correct)** Will correct
- Page 35, Section 3.2, Paragraph 2. Consider moving the sentence, "This map also provides a general representation of areas that are more likely to naturally recharge groundwater" to the end of the paragraph to avoid confusion switching from artificial recharge. May consider exchanging, "This map" with Figure 26. You may consider taking out the reference to a 1 to 5 scale since it is not on the map and just state from Very Low to Very High as shown in Figure 26. **(Can reword and correct)** Committee agreed on rewording and taking out the 1 to 5 scale.
- Section 3.2 continued. I would like to see this section expanded to include other "treatment" options that reflect the majority of the land use in the LPNRD (i.e. soy/corn production), such as grassy buffer strips, cover crops, reduced tillage, maintaining crop residues, perineal rotation cropping. **(Discussion with Committee)** Committee decide to leave this as is as best management practices could change or new ones are utilized.
- Interesting that Fremont used about 3X as much water per person than Wahoo. Perhaps the difference is due to industrial uses? What programs are available for industries to reduce harmful artificial discharge and who manages those? **(These are the numbers)** The Committee decided to leave as is.
- Section 3.3, Paragraph 2. Table 5 and 6 in the text and Table 6 and 7 shown in the legends. **(Can Correct)** Will correct
- In my opinion, Table 8 would be more informative if the gallons used by each category was provided in addition to the break down of type of wells. For example, Commmunity/Industry is only 1% of wells but may account for a large % of water useage. **(May not have accurate numbers**

available but can investigate) The Committee recommends leaving as it is because it is a snapshot of usage.

- Section 4.1.1, Paragraph 3. Land use categories could use additional clarification. Irrigated farmland is 5 and all other is 1? What about a factory or processing plant or feedlot that discharges into a tributary or over land? **(Can Clarify)** Committee suggested to clarify
- Page 44. HOW do we get neonicotinoids on the list for monitoring? **Discussion** The Committee recommended leaving this off the list.
- Section 4.2, Paragraph 1, Line 8, trave=travel **(can correct)** Will correct
- Section 5. 1.3 Objective 3.4, with thin = within **(thin is correct)** Will try to reword
- Section 5.1.4, Nitrate Risk Too? Please add an explanatory phrase for this title. **(Can correct with more explanation)** Will correct and add a brief explanation.

The plan is to hold the hearing for the GWMP on October 13 at 5 pm in the NRD Board Room in Wahoo. Public notice by State Statue requires 3 consecutive weeks in a row with the last notice 7 days prior to the hearing. Public notices would be published for the weeks of September 15, 22 and 29.

Recommend moving forward with corrections being done by the Board Meeting. Set the hearing date for October 13 at 5 pm.

Staff and LRE have made the corrections to the GWMP since the committee meeting, which is attached as LPN GWMP - Final 11.0.

An invoice is attached from LRE for \$1,552.52.

2.A.7. Cost Share Programs

Tim Svatora Installed an RO Unit through our RO Unit Cost share program. We are offering to pay 75% of the total cost up to \$800.

Tim Svatora one RO Unit cost share of \$800.

2.A.7.a. Irrigation Well Sample Kits

The NRD has received a few kits, but a number of producers have not used their wells. Some producers do not plan on laying out pipes or putting their power unit out by the well. This might be a year to waive the requirement to collect a water sample from the Water Quality Phase Areas. The bottles in the kits are good until September 2026, so producers would just keep the kits if they have ordered and paid for them. If a water sample has been received, the NRD could not charge them for next year's kit.

2.A.8. Voluntary Integrated Water Management Plan - LPNNRD

DWEE staff will be at the September 28 Water Committee Meeting to give the annual update.

2.B. CHEMIGATION

For 2025 we have 660 renewals and 42 new permit applications for a current total of 702. Inspections for 174 renewal permits have been completed.

2.C. GROUND WATER QUALITY SAMPLING

2025 Irrigation Sampling

- 28 out of the 53 Statewide Network Wells have been sampled. All nitrate samples with some pesticide, chloride, sodium, and uranium.
- 10 out of the 53 wells said no to sampling, due to pivots already being winterized, and rain.
- Potential to sample 15 more wells.

Data & Analysis

- Further analysis of sample results will be completed in the fall/winter.
- Analysis will include a district-wide map of nitrate levels, comparisons from historical data, comparisons from a wet to dry year, and other contaminant analysis as needed.

3. GROUND WATER PROGRAMS

3.A. DECOMMISSIONED WELL PROGRAM

3.A.1. Well Estimates

No new wells have been reviewed and approved for decommissioning since the last Committee meeting.

3.A.2. Plugged Wells

No wells have been plugged, reviewed, and ready for cost share payment approval this month.

3.B. LOWER PLATTE NORTH NRD GROUND WATER STUDIES

3.B.1. Phase Area Update

We are still receiving invoices for Flow Meter Cost Share.

Russell Shonka 4 \$	4,000.00
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3.C. SOURCE WATER PROTECTION

3.C.1. NET Grant-Source Water Monitoring Project

The LPNNRD has been in the process of filling out a NET grant application for the Source Water Monitoring Project. This project would succeed in the goal of adding more dedicated monitoring wells into the district. This project originally applied for the Water Sustainability fund, but was not accepted. The cost of the total project is estimated at \$447,702, with the LPNNRD matching 40% of that cost at \$179,081 over a 3-year period, equaling \$59,693.67 per year. The Grant is due by September 2nd.

3.C.2. Mead Source Water Protection Grant

The Village of Mead is applying for the Source Water Protection Grant. The LPNNRD has been assisting in the application process. The total cost of the

project is estimated at \$45,700 with the LPNNRD cash-match of \$5,000 dollars as well as assisting the community in updating the Wellhead Protection Plan, water sampling, and public outreach.

3.C.3. Yutan Source Water Protection Grant

The City of Yutan is pursuing the Source Water Protection Grant and the LPNNRD is currently assisting with the application process. The estimated total of this project is \$48,500 with the NRD putting in a cash-match of \$3,000 dollars. The LPNNRD will also assist in water sampling in the proposed project area and helping with components of updating the Wellhead Protection Plan.

4. SURFACE WATER PROGRAMS

4.A. STATE LAKES, FOR THE WEEK OF

This week's beach Bacteria and Harmful Algal Bloom results are now posted on the DWEE web page ([Current Health Alerts and Sampling Results For This Week](#)).

Cub Creek Lake in Jefferson County and Bluestem Lake in Lancaster County will be on Health Alert this week after testing high for microcystin.

Branched Oak Lake at Liebers Point Beach, Maple Creek Recreation Area Lake, and Summit Lake all tested above 235 colonies/100 mL for *E. coli* bacteria.

There are 2 beaches on Health Alert this week.

Current Lakes on "Health Alert"			
Lake	County	Microcystin (ppb)	Sample Date
Bluestem Lake	Lancaster	>35	8/25/2025
Cub Creek Lake	Jefferson	12.43	8/25/2025

When a lake exceeds 8 ppb of microcystin it will be placed on Health Alert. If a lake is under a Health Alert, signs will be posted recommending people avoid full body contact activities such as swimming, wading, skiing, jet skiing, etc.

There are 3 beaches with *E.coli* testing above 235 colonies/100 mL.

Lakes with High <i>E.coli</i> Bacteria			
Lake	County	<i>E.coli</i> (MPN)	Sample Date
Branched Oak Lake at Liebers Point Beach	Lancaster	488	8/25/2025
Maple Creek Recreation Area Lake	Colfax	2,420	8/25/2025
Summit Lake	Burt	313	8/25/2025

When *E. coli* bacteria levels test above 235 colonies/100 mL a Health Alert is not issued. However, conditions are at a higher risk to human health when swimming. Considering the more rapid changes in bacteria conditions, signs are not posted with these higher levels. Although, we want people to be

aware of beach conditions and use their own judgment as to whether they use a listed water body.
Have a great Labor Day weekend!

Justin Haas
State Lakes Coordinator
Department of Water, Energy and Environment
245 Fallbrook Blvd., Suite 100
Lincoln, NE 68509-8922
Direct: 402-471-4224 | Main Office: 402-471-2186

5. OTHER

5.A. COMMENTS FROM THE PUBLIC

Ecklund

89.53 ac

2024 Corn



Harvest Summary

Avg. Yield (bu/ac)

251.6

↑ 1% compared to farm avg.

Moisture (%)

16.3%

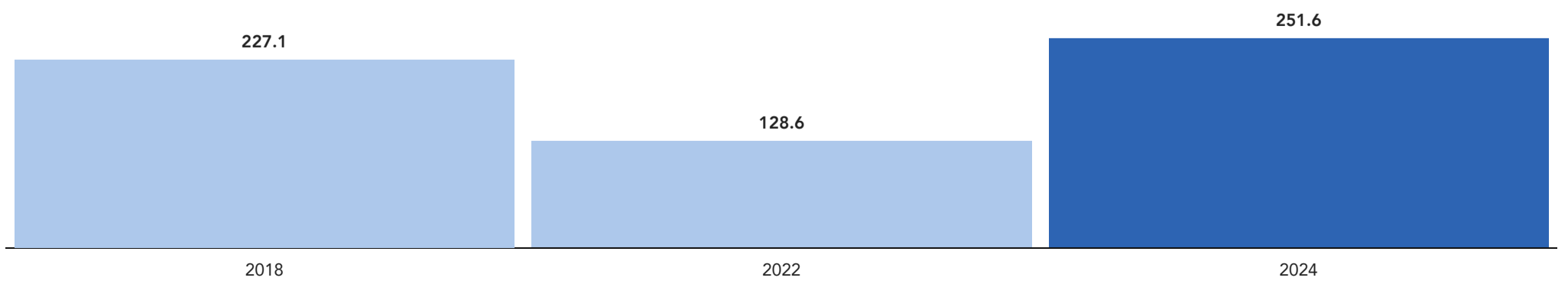
↑ 2% compared to farm avg.

Avg. Yield (bu/ac)

252

P1413AM (AM, LL, RR2)

Historical Trends (bu/ac)



This information is supplied to you by Nebraska's geological survey:

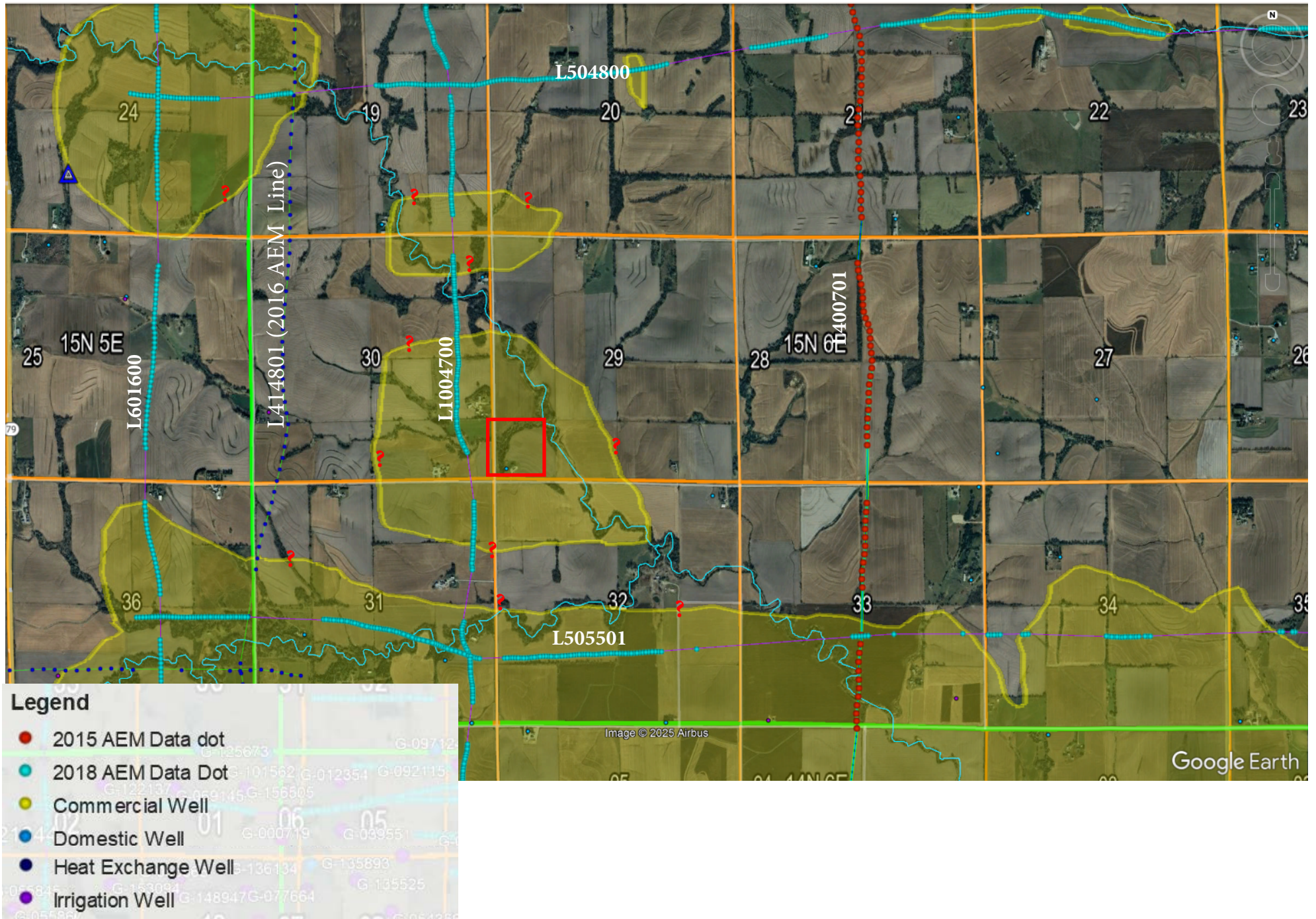
Conservation and Survey Division

School of Natural Resources

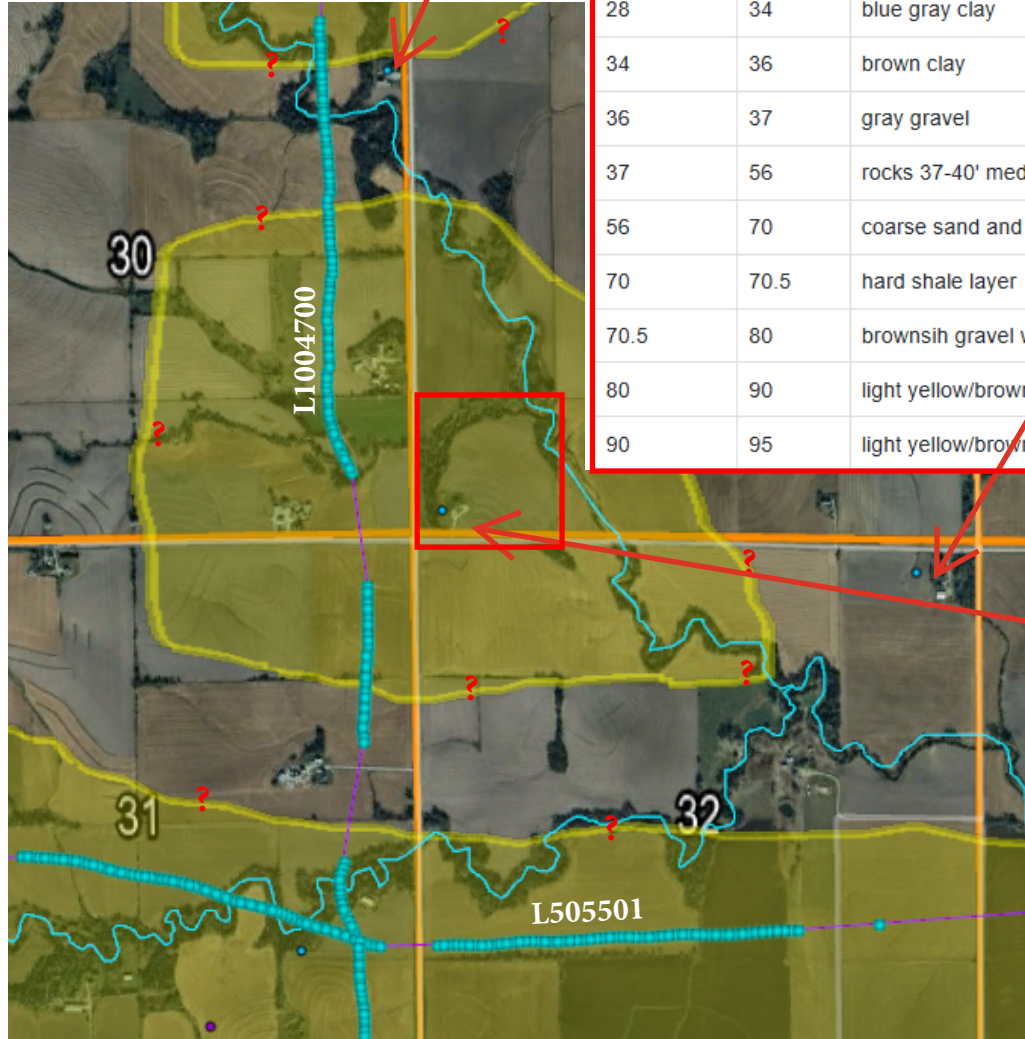


Hardin Hall
3310 Holdrege Street
University of Nebraska–Lincoln
Lincoln, Nebraska 68583
<http://snr.unl.edu/csd/>

Google Earth Map with AEM survey lines, registered wells and roughly estimated aquifer material areas from AEM survey interpretations (yellow)



Map zoom in with nearby registered well logs



Geo Logs [Print Friendly Geo Logs](#)

FromDepth	ToDepth	Description
0	2	top soil
2	17	brown clay
17	19	dark brown clay
19	25	light gray/brown clay med. hardness
25	28	coarse sand - gravel
28	34	blue gray clay
34	36	brown clay
36	37	gray gravel
37	56	rocks 37-40' med. hard med. dark gray clay
56	70	coarse sand and gravel reddish gray, few gray clay layers prese
70	70.5	hard shale layer
70.5	80	brownsih gravel with rocks present 1190-1200'
80	90	light yellow/brown shale
90	95	light yellow/brown with reddish steaks

Geo Logs [Print Friendly Geo Logs](#)

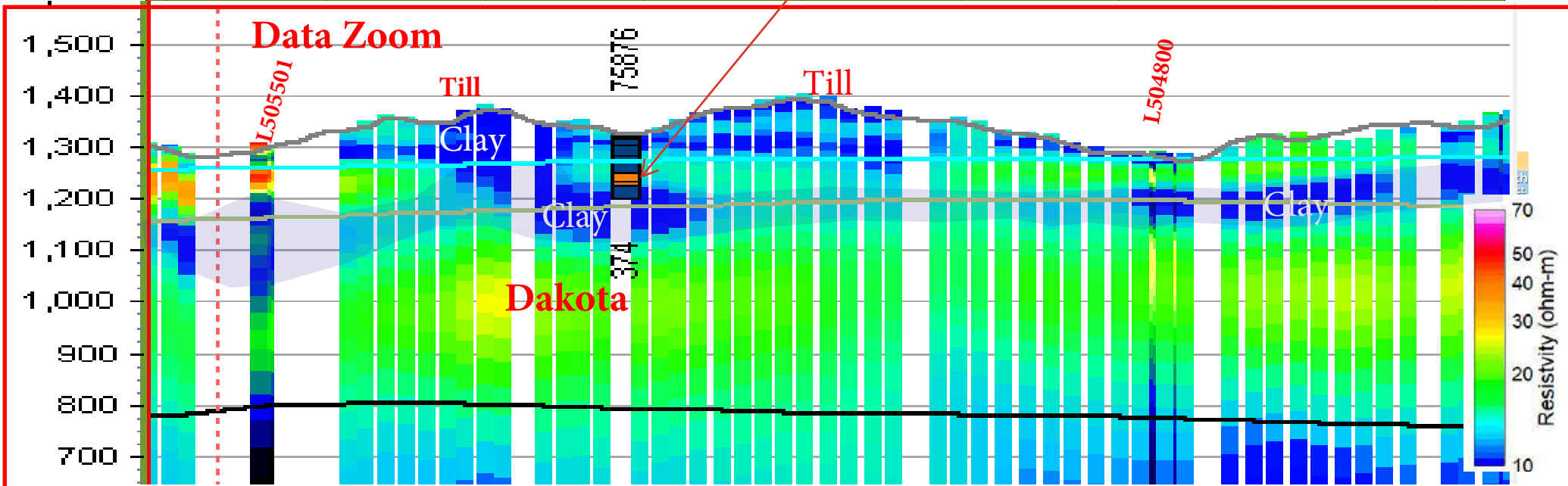
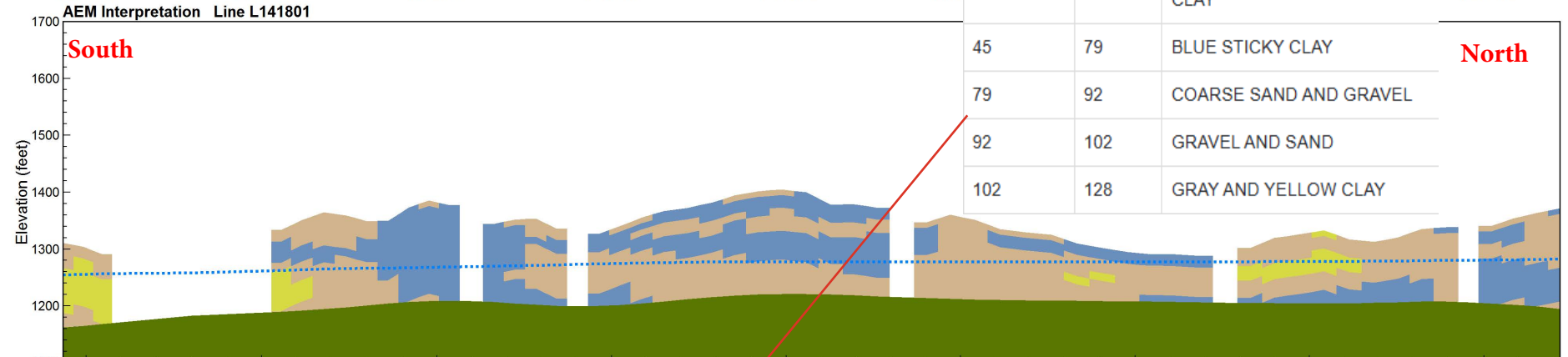
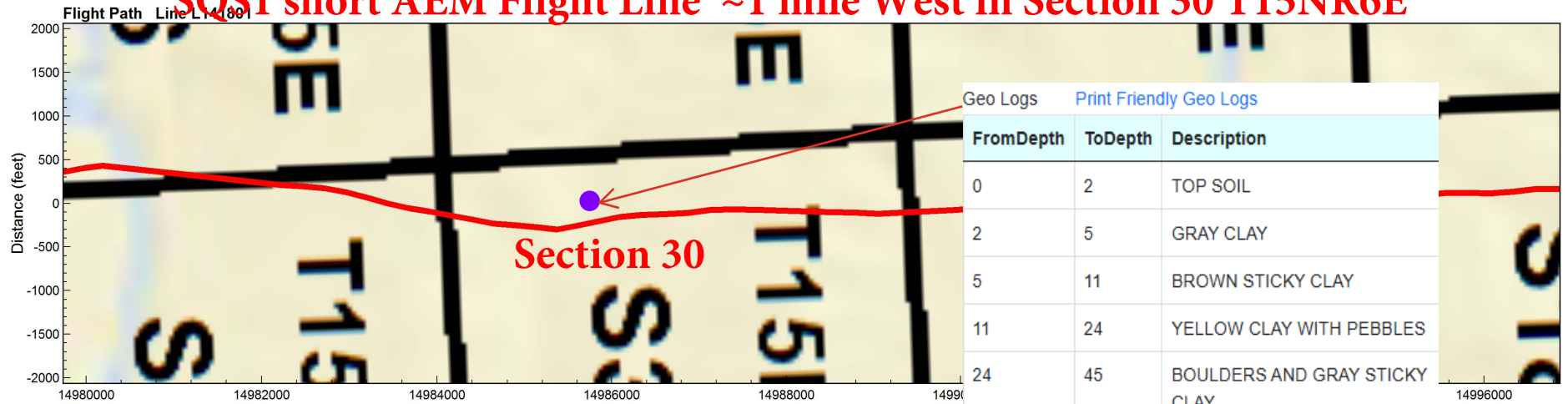
FromDepth	ToDepth	Description
0	22	brown clay
22	36	sand
36	50	brown clay
50	60	gray clay
60	77	sandy clay
77	86	gravel 1184-1193
86	102	gray clay
102	115	fine sand to clay
115	122	gray sandy clay
122	126	sand
126	130	gray clay
130	132	sand
132	137	clay
137	148	gravely clay

Geo Logs [Print Friendly Geo Logs](#)

FromDepth	ToDepth	Description	Color	Density	Composition
0	2		Brown	Dense/Stiff	Top Soil
2	25		Brown	Dense/Stiff	Clay
25	28	rocky	Gray	Loose	Gravel
28	45		Brown	Dense/Stiff	Clay
45	51	gray slightly hard	Brown	Hard	Clay
51	60		Gray	Dense/Stiff	Clay
60	100	rusty with rocks	Red	Loose	Gravel

1190 to 1230 FT Elevation

SQS1 short AEM Flight Line ~1 mile West in Section 30 T15NR6E

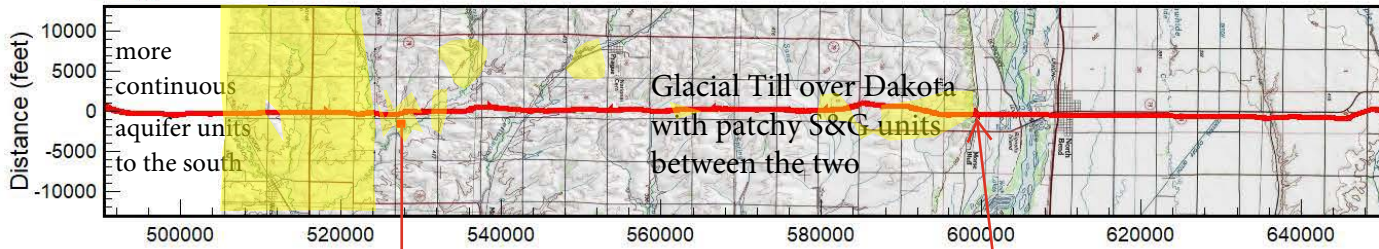


Nearest AEM Flight Line ~800 feet West of Section 29 T15NR6E

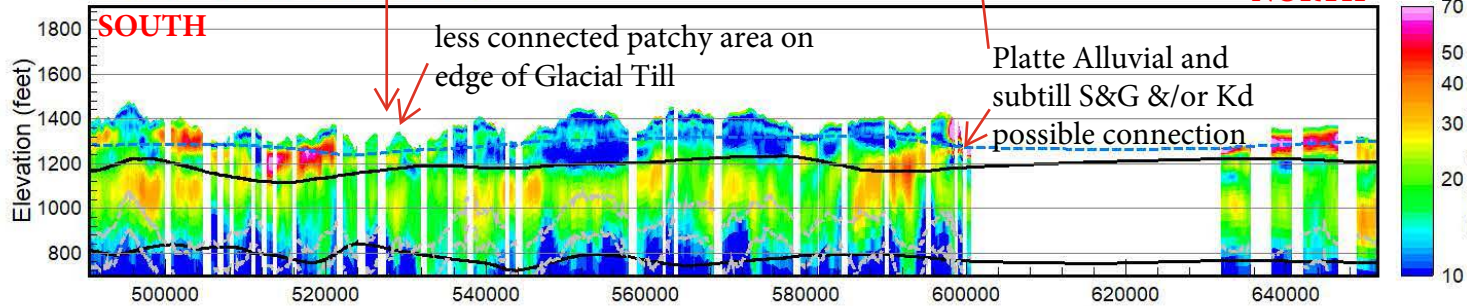
Appendix 1: 2D Profiles – 2018 LPNNRD Inverted AEM Resistivity and Interpretation



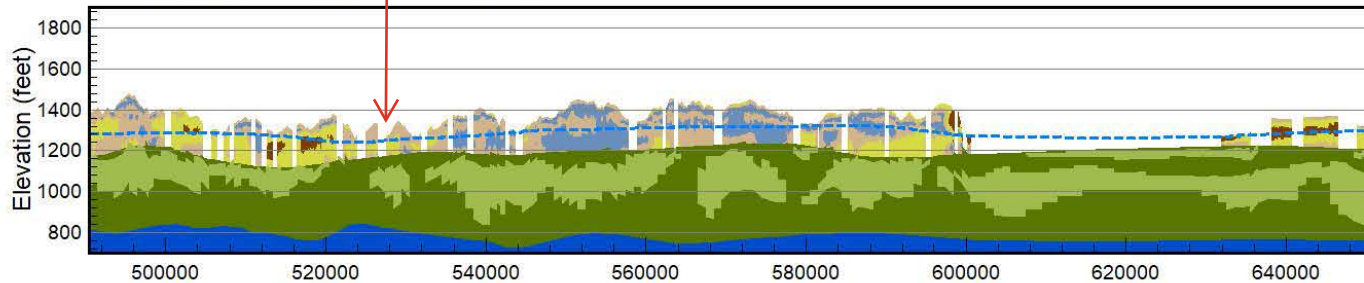
Flight Line Position Line L1004700



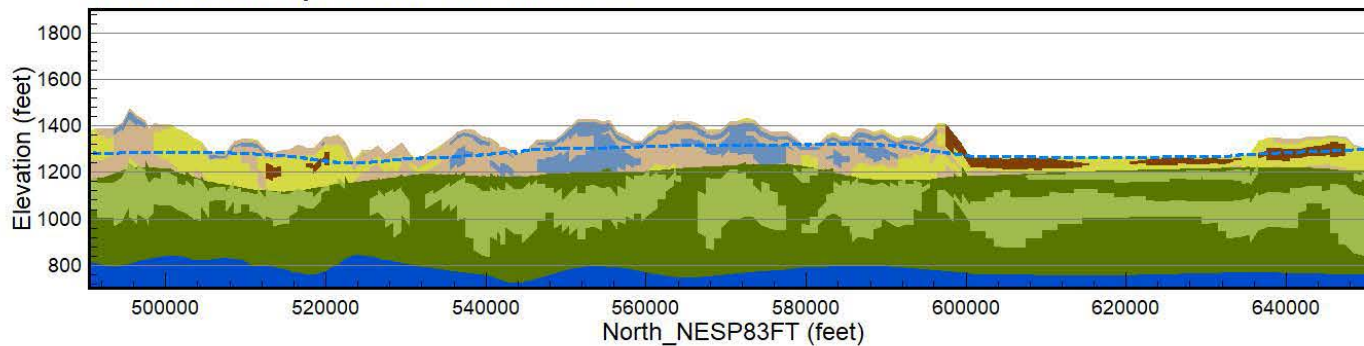
AEM Inversion Line L1004700



AEM Interpretation Line L1004700



AEM Voxel Interpretation Line L1004700



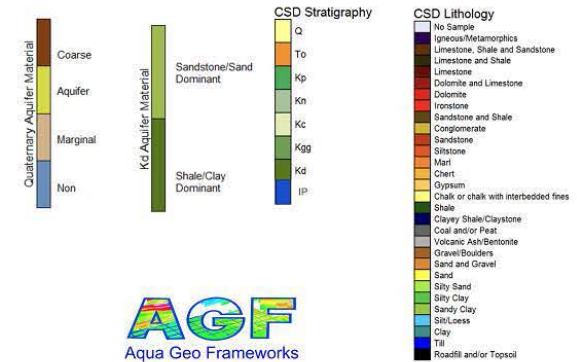
Results of the final inversion of Airborne Electromagnetic (AEM) data collected along flight lines within the Lower Platte North Natural Resources District (LPNNRD) June 22-July 14, 2018. The red line on the Flight Path Map (US Geological Survey 100K Topo) indicates the location of the data collection.

The AEM inversions shown are Spatially-Constrained using the Aarhus Geo Software Workbench version 5.8.3 in the indicated electrical resistivity color scale. Boreholes displayed on the AEM inversion profile indicate the estimated depth of investigation (DOI). White gaps in the AEM inversion profile indicate gaps in data coverage due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-black line. Solid-black lines on the AEM Inversion profile indicate interpreted stratigraphic contacts (Kp=Cretaceous Pierre Shale; Kn=Cretaceous Niobrara Formation; Kc=Cretaceous Carlile Shale; Kgg=Cretaceous Greenhorn Limestone and Graneros Shale; Kd=Cretaceous Dakota Group; and IP=undifferentiated Pennsylvanian formations/groups. The 1995 CSD water table is represented by a dashed blue line.

The AEM interpretation profiles shows Q=Quaternary materials classified into the four groups indicated by the legend. Gaps in the quaternary materials are due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-orange line. Cretaceous units as well as the undifferentiated Pennsylvanian are indicated as continuous formations and are colored as indicated in the legend. The depth extent of the profile is optimized to illustrate the Quaternary materials.

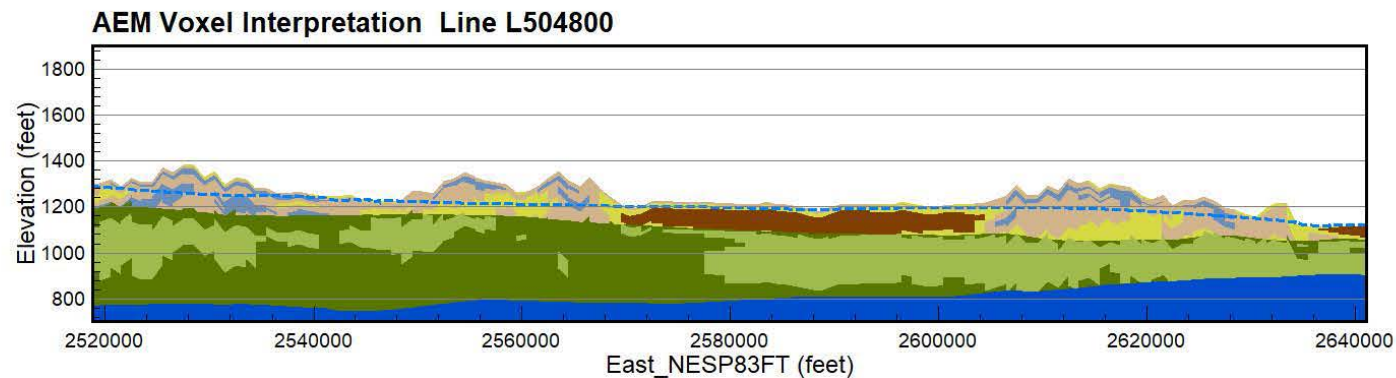
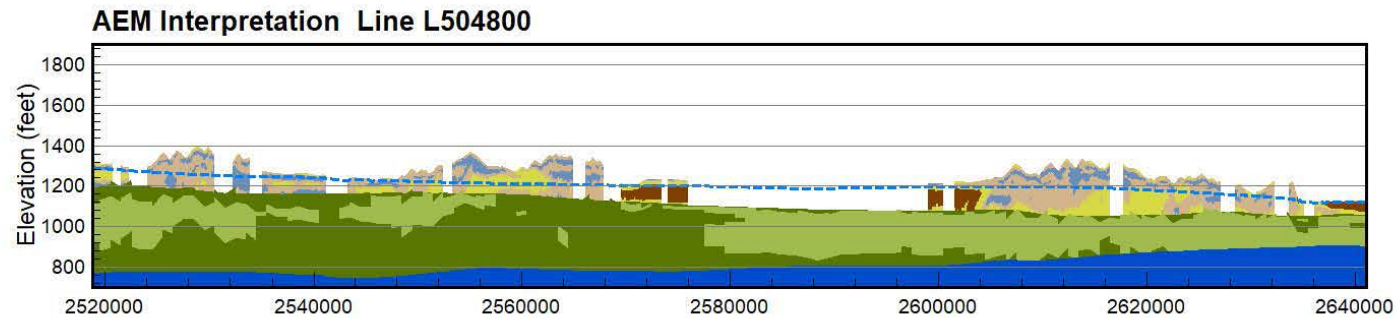
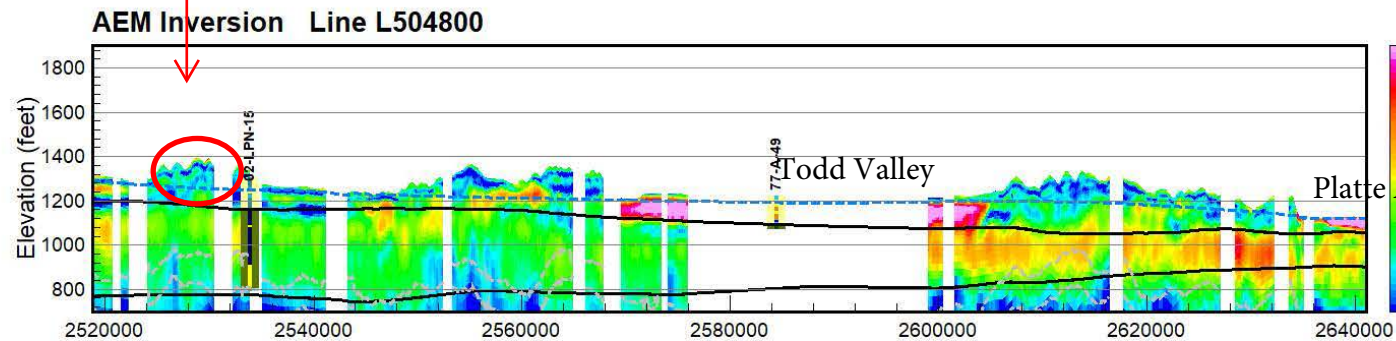
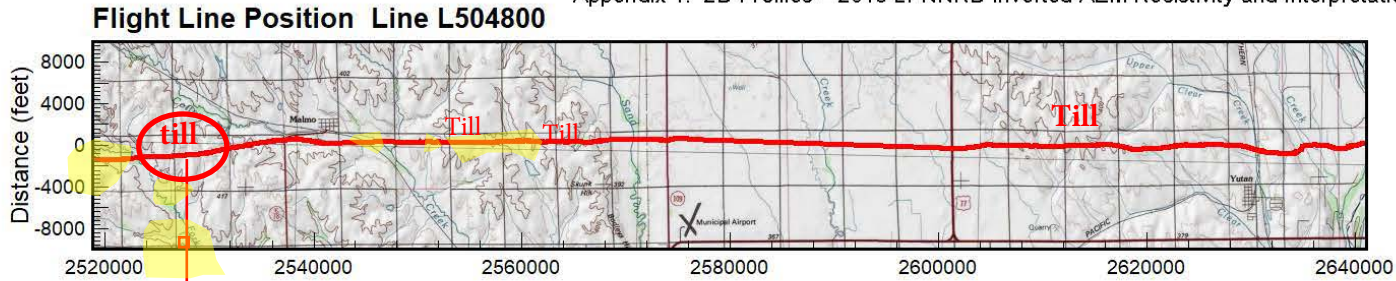
The AEM Voxel Interpolation Profile indicates a 1,000-foot cell size interpolation of the Quaternary materials classified into the four groups indicated by the legend. In addition to the interpreted 1,000-foot cell size interpolation, sand/sandstone-dominant sections of the Cretaceous Dakota Group are indicated in the legend.

Prepared for the LPNNRD and the Eastern Nebraska Water Resources Assessment (ENWRA) by Aqua Geo Frameworks, LLC.



Section 29 is south of this west to east flight line

Appendix 1: 2D Profiles – 2018 LPNNRD Inverted AEM Resistivity and Interpretation



Results of the final inversion of Airborne Electromagnetic (AEM) data collected along flight lines within the Lower Platte North Natural Resources District (LPNNRD) June 22-July 14, 2018. The red line on the Flight Path Map (US Geological Survey 100K Topo) indicates the location of the data collection.

The AEM inversions shown are Spatially-Constrained using the Aarhus Geo Software Workbench version 5.8.3 in the indicated electrical resistivity color scale. Boreholes displayed on the AEM inversion profile are within 1/2 mile of the flight line and are from the Conservation Survey Division (CSD) public website downloaded on September 9, 2018. Lithology and stratigraphy are indicated by the legends. Gray-dashed lines when visible on the AEM inversions profile indicate the estimated depth of investigation (DOI). White gaps in the AEM inversion profile indicate gaps in data coverage due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-black line. Solid-black lines on the AEM Inversion profile indicate interpreted stratigraphic contacts (Kp=Cretaceous Pierre Shale, Kn=Cretaceous Niobrara Formation, Kc=Cretaceous Carlile Shale, Kgg=Cretaceous Greenhorn Limestone and Graneros Shale, Kd=Cretaceous Dakota Group, and IP=undifferentiated Pennsylvanian formations/groups. The 1995 CSD water table is represented by a dashed blue line.

The AEM interpretation profiles shows Quaternary materials classified into the four groups indicated by the legend. Gaps in the quaternary materials are due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-orange line. Cretaceous units as well as the undifferentiated Pennsylvanian are indicated as continuous formations and are colored as indicated in the legend. The depth extent of the profile is optimized to illustrate the Quaternary materials.

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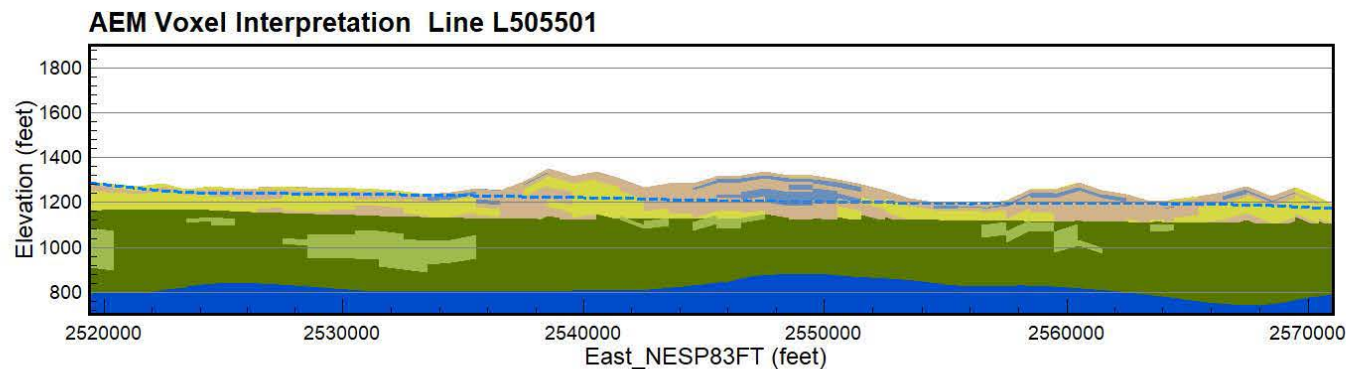
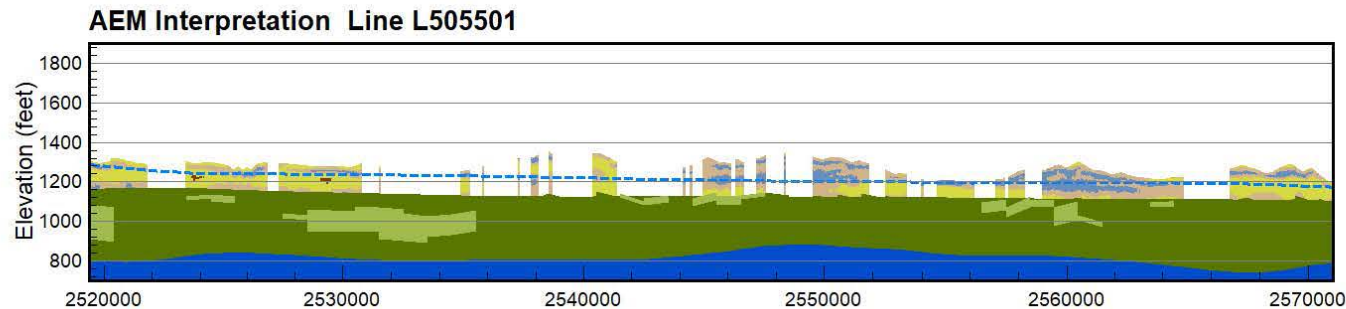
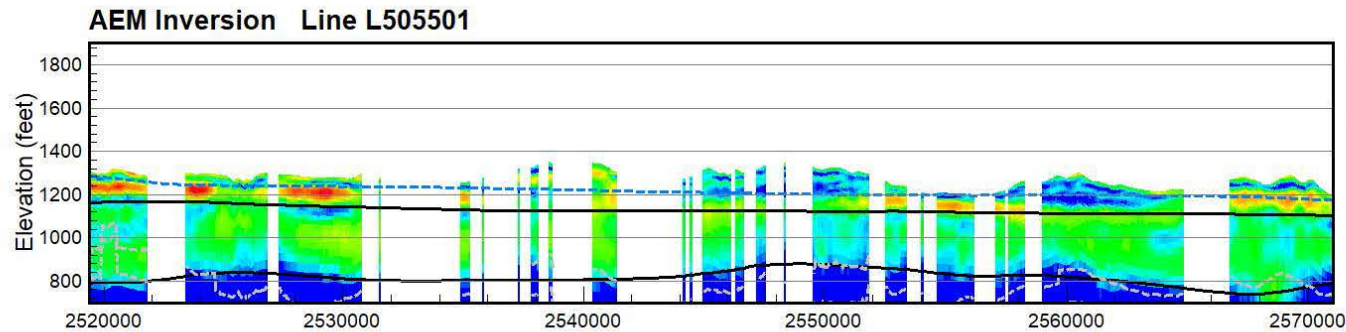
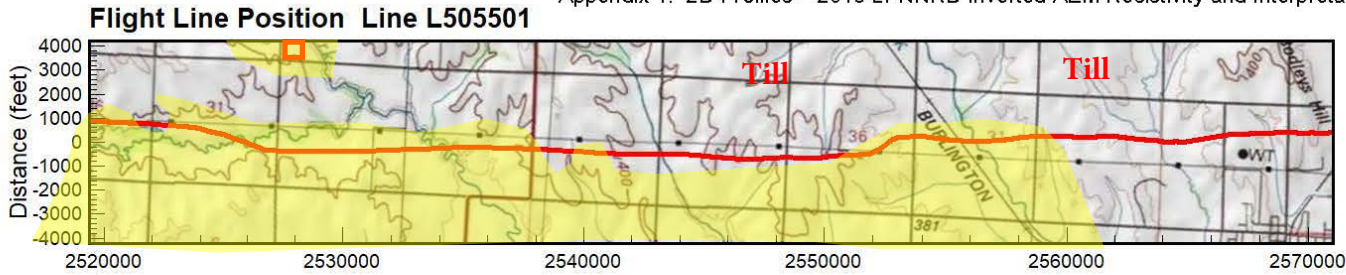
Prepared for the LPNNRD and the Eastern Nebraska Water Resources Assessment (ENWRA) by Aqua Geo Frameworks, LLC.

<p>Quaternary Aquifer Material</p> <ul style="list-style-type: none"> Coarse Aquifer Marginal Non 	<p>Kd Aquifer Material</p> <ul style="list-style-type: none"> Sandstone/Sand Dominant Shale/Clay Dominant 	<p>CSD Stratigraphy</p> <ul style="list-style-type: none"> Q To Kp Kn Kc Kgg Kd IP 	<p>CSD Lithology</p> <ul style="list-style-type: none"> No Sample Igneous/Metamorphics Limestone, Shale and Sandstone Limestone and Shale Limestone Dolomite and Limestone Dolomite Ironstone Sandstone and Shale Conglomerate Sandstone Siltstone Marl Chert Ogypsum Chalk or chalk with interbedded fines Shale Clayey Shale/Claystone Coal and/or Peat Volcanic Ash/Bentonite Gravel/Boulders Sand and Gravel Sand Silty Sand Silty Clay Sandy Clay Silt/Loess Clay Till Roadfill and/or Topsoil
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Section 29 is north of this west to east flight line

Appendix 1: 2D Profiles – 2018 LPNNRD Inverted AEM Resistivity and Interpretation



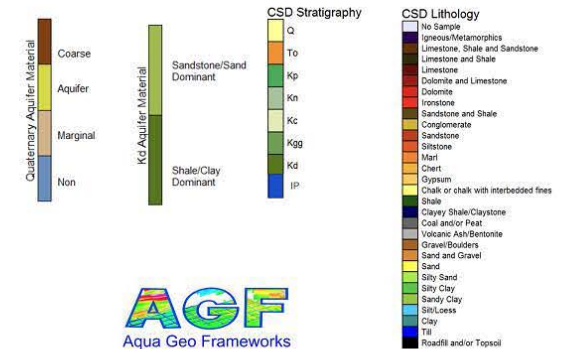
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The AEM inversions shown are Spatially-Constrained using the Aarhus Geo Software Workbench version 5.8.3 in the indicated electrical resistivity color scale. Boreholes displayed on the AEM inversion profile are within 1/2 mile of the flight line and are from the Conservation Survey Division (CSD) public website downloaded on September 9, 2018. Lithology and stratigraphy are indicated by the legends. Gray-dashed lines when visible on the AEM inversions profile indicate the estimated depth of investigation (DOI). White gaps in the AEM inversion profile indicate gaps in data coverage due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-black line. Solid-black lines on the AEM Inversion profile indicate interpreted stratigraphic contacts (Kp=Cretaceous Pierre Shale; Kn=Cretaceous Niobrara Formation; Kc=Cretaceous Carlile Shale; Kgg=Cretaceous Greenhorn Limestone and Graneros Shale; Kd=Cretaceous Dakota Group; and IP=undifferentiated Pennsylvanian formations/groups. The 1995 CSD water table is represented by a dashed blue line.

The AEM interpretation profiles shows Q=Quaternary materials classified into the four groups indicated by the legend. Gaps in the quaternary materials are due to electromagnetic coupling or areas that were not flown due to infrastructure. To=Tertiary Ogallala Group estimated contact is represented by a dashed-orange line. Cretaceous units as well as the undifferentiated Pennsylvanian are indicated as continuous formations and are colored as indicated in the legend. The depth extent of the profile is optimized to illustrate the Quaternary materials.

The AEM Voxel Interpolation Profile indicates a 1,000-foot cell size interpolation of the Quaternary materials classified into the four groups indicated by the legend. In addition to the interpreted 1,000-foot cell size interpolation, sand/sandstone-dominant sections of the Cretaceous Dakota Group are indicated in the legend.

Prepared for the LPNNRD and the Eastern Nebraska Water Resources Assessment (ENWRA) by Aqua Geo Frameworks, LLC.



Section P Irrigation Development in the Restricted Development Areas (RDA)

Rule 1 The District will allow expansion of new acres but does not allow for any more consumptive use in the RDA. Any development of new irrigated acres in the RDA shall be offset with an equal number of irrigated acres retired within the same aquifer subarea and shall be considered a transfer. The RDA areas within Lower Platte North NRD are on file in the District office and shown on Exhibit A.

Rule 2 LPNNRD shall require a water quality test from any well pumping from the Dakota Aquifer, due to its high variability in water quality.

Rule 3 If a transfer is approved, the new irrigation well shall not irrigate more than 160 acres in total.

Rule 4 The district shall send notices to adjacent landowners notifying them about the proposed well and allow them to testify at a Water Committee or Board meeting to present their case for or against the proposed well. This shall be required before the permit for the proposed well can be approved by the NRD. Adjacent landowners are those whose land touches the tract that is requesting the variance. If the adjacent land is part of a city, village or SID then a single notice will be sent to the political subdivision.

Rule 5 The Board may grant a variance to Rule 1 if the relevant parcel of ground is within 1 mile of a Normal Development Area or Limited Development Area. Such variance for new irrigation shall follow all rules as set forth in the applicable development area.

Rule 6 The well owner, landowner and tenant will allow the LPNNRD to measure the groundwater energy levels within the new well and add it to the LPNNRD GWEL network.

Rule 7 The well owner will install small diameter piping, placed in the gravel pack of the high capacity well, so LPNNRD can measure drawdown when the pump is operating and to measure the recovery rate.

Rule 8 Three test holes will be required to show the geology at and near the proposed well site. One test hole will be drilled at the proposed well site with the second and third test hole drilled approximately 300 feet from the proposed well site and spaced from each other. If a registered well with a well log exists within 1,000 feet of the proposed well site then this well log maybe used to replace one of the required test holes.

Rule 9 Any permit issued for development in the restricted development area is a "conditional permit". Conditional permits may be treated differently than other well permits within LPNNRD. With good cause these permits may have pumping restrictions placed on them, or withdrawn by the NRD.

Rule 10 A pump test may be performed for a minimum of 24 hours, or until the flow stabilizes or slows down. This pump test will be conducted during peak irrigation season.

Rule 11 A continuation of Stay Management Area Rules as defined in Section M, Rule 4, 6, 8, 10, and 12, shall apply.

Groundwater Management Plan

Approval Date: 10/13/2025

Prepared for:



Prepared by:



Board of Directors - 2025

Name	Sub-District
Lon Olson	1
Anthony Hanson	1
John Goldsberry	2
Bill Saeger	2
Dave Saalfeld	3
Andrew Tonnies	3
Chris Yosten	4
Matt Bailey	4
Mark Seier	5
David Lawrence	5
Joe Birkel	6
Robert Hilger	6
Ryan Sabatka, Chairman	7
Ryan Engel	7
Jerry Johnson	8
Roger Harder	8
Duane Johnson	9
Robert Meduna Jr	9
Thomas McKnight	At-Large

This third update of the Lower Platte North Natural Resources Groundwater Management Plan (GWMP) has been prepared per Nebraska Revised Statute 46-709. The GWMP was created based upon the best available scientific information.

TABLE OF CONTENTS

List of Tables.....	ii
Table of Figures	ii
List of Abbreviations and Acronyms.....	iii
1 Introduction	1
1.1 LPNNRD Background.....	1
1.2 Legal Authority and Obligations.....	2
1.3 Agency Roles and Functions	3
1.4 Joint-Planning Efforts.....	5
1.5 Current Rules and Regulations.....	6
2 Description of the NRD	11
2.1 Groundwater Regions and Principal Aquifer	11
2.2 Hydrogeologic Datasets	12
2.3 Topography	15
2.4 Soils	15
2.5 Geology and Hydrological Characteristics	17
2.6 Total Saturated Sand.....	18
2.7 Confined vs. Unconfined Aquifers	19
2.8 Transmissivity.....	22
2.9 Climate and Precipitation	22
2.10 Land Cover.....	23
2.11 Population – Economic Base	25
2.12 Surface Water.....	26
2.13 Wells and Test Holes	28
2.14 Partners and Programs.....	29
2.15 Environmental Education and Information.....	31
3 Groundwater Quantity	32
3.1 Groundwater Levels and Existing Wells.....	32
3.2 Groundwater Recharge.....	35
3.3 Water Use and Demand.....	37
3.4 Certified Irrigated Acres.....	39
4 Groundwater Quality.....	41
4.1 Aquifer Vulnerability	41
4.2 Wellhead Protection Areas	46
5 Goals and Objectives	49
5.1 Groundwater Management Goals and Objectives	49
6 Stakeholder Involvement.....	52
6.1 Outreach Methods.....	52
6.2 Stakeholder Group.....	52
6.3 Open House Meetings	52
6.4 Board Retreat.....	52
7 Recommendations.....	53
7.1 Adoption of Groundwater Management Subareas	53
7.2 Expansion of the Observation Network.....	54
7.3 Alteration to the Well Variance Scoring Protocol.....	56

7.4	Quantity Trigger Adjustments.....	57
7.5	Clarification of Terminology.....	58
7.6	Re-evaluation of Special Quantity Subareas.....	58
7.7	Efforts to Enhance Data Transparency and Communication.....	58
7.8	Reassessment of Water Quality Triggers.....	59
8	References	60

LIST OF TABLES

Table 1:	Confined and Unconfined Aquifer Triggers.....	9
Table 2:	Geologic Sequence of Major Formations in LPNNRD	17
Table 3:	LPNNRD Land Cover Change (2009 – 2023).....	24
Table 4:	Population of Incorporated Places (1990 – 2025)	25
Table 5:	LPNNRD Steam Gage Information.....	27
Table 6:	Annual Municipal Water Usage All Communities	37
Table 7:	Annual Municipal Water Usage Without LWS and MUD	38
Table 8:	Active Registered Well Distribution	39
Table 9:	LPNNRD PWS State-Approved WHP Plans	46
Table 10:	Observation Wells and Proposed Sites by Subarea	55

TABLE OF FIGURES

Figure 1:	LPNNRD Location	1
Figure 2:	Board of Director Sub-districts (2025).....	4
Figure 3:	Lower Platte River Basin Coalition NRDs	5
Figure 4:	Quality and Special Quantity Sub-areas.....	8
Figure 5:	Groundwater Limited Development Areas.....	10
Figure 6:	Groundwater Regions of the LPNNRD	12
Figure 7:	AEM Flights within and near the LPNNRD	13
Figure 8:	3D Leapfrog output in cross section	14
Figure 9:	Well and Test Holes with Geologic Logs (LRE Water, 2023).....	14
Figure 10:	Topography of the LPNNRD	15
Figure 11:	Soil Types	16
Figure 12:	Bedrock Formations.....	17
Figure 13:	Total Saturated Sand, Well and Test Holes.....	19
Figure 14:	Confined vs. Unconfined Aquifers	21
Figure 15:	Hydrograph of Transitional Aquifer Type	21
Figure 16:	Aquifer Transmissivity.....	22
Figure 17:	Average Annual Precipitation (1981-2010).....	23
Figure 18:	2023 Land Cover	24
Figure 19:	Major River Systems, Stream Gages and Diversion Points.....	27
Figure 20:	Registered Active Wells in the LPNNRD.....	28
Figure 21:	Test Holes within 5-miles of LPNNRD	29
Figure 22:	Groundwater-Level Changes in LPNNRD, Predevelopment to Spring 2023.....	32
Figure 23:	Observation Well Network	33

Figure 24: Depth to Groundwater 34

Figure 25: Potential Areas for Sub-irrigation 35

Figure 26: Artificial Recharge Potential 36

Figure 27: Percent of NeDNR Active Registered Wells 39

Figure 28: Certified Irrigated Acres in the LPNNRD (2024) 40

Figure 29: Aquifer Vulnerability 42

Figure 30: LPNNRD Nitrate Concentrations 2019-2023 43

Figure 31: LPNNRD Statewide Water Quality Monitoring Network Wells 45

Figure 32: Wellhead Protection Areas 47

Figure 33: Five Steps of the WHP Program 47

Figure 34: Proposed Groundwater Management Subareas 54

Figure 35: Existing Observation Wells and Potential Expansion Sites 56

LIST OF ABBREVIATIONS AND ACRONYMS

ACT	Nebraska Groundwater Management Act
AF	Acre Feet
AEM	Airborne Electromagnetic
Assessment	LPNNRD Hydrogeologic Assessment (2023)
Coalition	Lower Platte River Basin Coalition
CSD	Conservation and Survey Division
District	Lower Platte North NRD
DCP	Drought Contingency Plan
DEM	Digital Elevation Model
DWEE	Nebraska Department of Water, Energy, and Environment
ENWRA	Eastern Nebraska Water Resources Assessment
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information System
GWMA	Groundwater Management Area
GWMP	Groundwater Management Plan
HCA	Hydrologically Connected Areas
IMP	Integrated Management Plan
LENRD	Lower Elkhorn Natural Resources District
LPMT	Lower Platte Missouri Tributary Groundwater Model
LPNNRD	Lower Platte North Natural Resources District
LPSNRD	Lower Platte South Natural Resources District
LPRCA	Lower Platte River Corridor Alliance
LWS	Lincoln Water System
Mg/L	Milligrams per Liter
MUD	Metropolitan Utilities District
NARD	Nebraska Association of Resources Districts
NASS	National Agricultural Statistics Service
NDEE	Nebraska Department of Environment and Energy

NeDNR	Nebraska Department of Natural Resources
NeDWEE	Nebraska Department of Water, Energy, and Environment
NHCAs	Non Hydrologically Connected Areas
NPDES	National Pollutant Discharge Elimination System
NRC	Natural Resources Commission
NRD	Natural Resources District
LWS	Lincoln Water System
PMRNRD	Papio-Missouri River Natural Resources District
PPM	Parts Per Million
PPB	Parts per Billion
RWS	Rural Water System
SQS	Special Quantity Subareas
UNL	University of Nebraska-Lincoln
USGS	United States Geological Survey
WHP	Wellhead Protection

1 INTRODUCTION

1.1 LPNNRD BACKGROUND

The Lower Platte North Natural Resources District (LPNNRD or District) spans 1,587 square miles, or just over 1 million acres, over seven counties in eastern Nebraska and is shown in Figure 1. The total estimated population is nearly 66,000 (NARD, 2024). The primary watersheds used to delineate the LPNNRD includes Shell Creek, starting at the northwest boundary past Newman Grove and to the southeast to the Lower Platte River at Fremont, and the Wahoo Creek watershed to the southeast near Ashland. The LPNNRD economy is predominantly focused on agricultural and industrial activities.

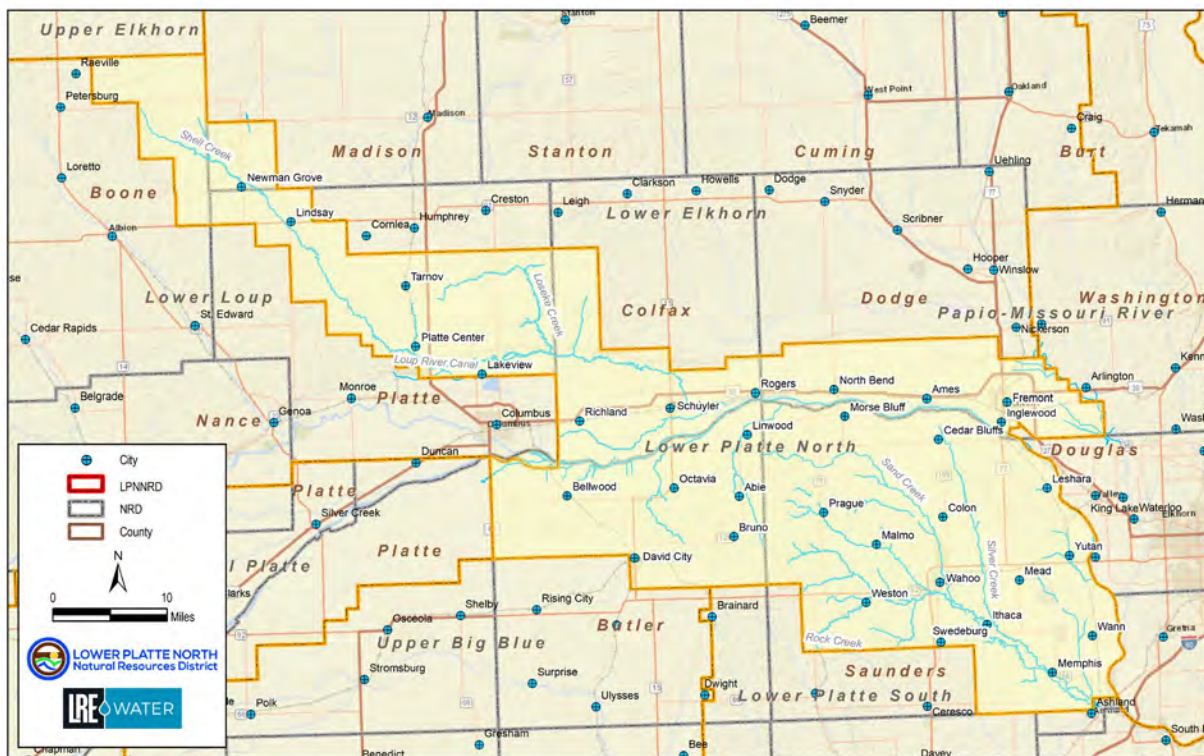


Figure 1: LPNNRD Location

1.2 LEGAL AUTHORITY AND OBLIGATIONS

Groundwater is widely recognized as one of the state's most valuable natural resources, and the management is a key responsibility granted to the Nebraska Natural Resources Districts (NRDs), which were established in 1972. The declaration, intent, and purpose of NRDs groundwater management responsibilities were established by the Nebraska Groundwater Management and Protection Act (Act) as outlined in Nebraska Revised Statute Chapter 46, Article 7, passed in 1975.

In 1984, the Nebraska Legislature mandated that NRDs prepare a Groundwater Management Plan (GWMP) by January 1986. The original LPNNRD GWMP was prepared in 1985 and with the adoption of the 1985 plan, the LPNNRD embarked upon a new era of groundwater resource management marked by an intensive program of data collection designed to characterize the resource and establish the relationship with other water resources. In addition, the District developed education and demonstration programs designed to increase awareness of groundwater supplies, use, and protection.

Legislative Bill 51 (LB51) was passed in 1991 and amended the Act by providing clarification, therefore the GWMP was updated in 1995, as an amendment to the 1985 version and the amendment meets the intent of LB51 and fulfills the District's need for continued understanding of the supply and quality of its groundwater resource, and sets forth a plan of protection for the future. The Board of Directors recognizes, along with the Nebraska legislature, that groundwater is a valuable resource and planned management is essential and in the public interest.

This version of the GWMP is intended to meet requirements of Section 46-709 of the Act (NeDNR, 2021), which states, The plan shall include, but not be limited to, the identification to the extent possible of the following:

- 1) Groundwater supply information within the District including transmissivity, saturated thickness maps, and other groundwater reservoir information, if available;
- 2) Local recharge characteristics and rates from any sources, if available;
- 3) Average annual precipitation and the variations within the District;
- 4) Crop water needs within the District;
- 5) Current groundwater data-collection programs;
- 6) Past, present, and potential groundwater use within the District;
- 7) Groundwater quality concerns within the District;
- 8) Proposed water conservation and supply augmentation programs for the District;
- 9) The availability of supplemental water supplies, including the opportunity for groundwater recharge;
- 10) The opportunity to integrate and coordinate the use of water from different sources of supply;
- 11) Groundwater management objectives, including a proposed groundwater reservoir life goal for the District. For management plans adopted or revised after July 19, 1996, the groundwater management objectives may include any proposed integrated management objectives for hydrologically connected groundwater and surface water supplies but a management plan does not have to be revised prior to the adoption or implementation of an integrated management plan pursuant to section 46-718 or 46-719;
- 12) Existing subirrigation uses within the District;
- 13) The relative economic value of different uses of groundwater proposed or existing within the District; and

- 14) The geographic and stratigraphic boundaries of any proposed management area.

This version was prepared by the staff, the Board of Directors, with technical and planning assistance provided by LRE Water.

1.3 AGENCY ROLES AND FUNCTIONS

The LPNNRD is governed by a locally elected Board consisting of 19 Directors. The LPNNRD is divided into sub-districts (Figure 2), with two Directors per sub-district and one at-large member. Based upon state statute, each NRD shares a common set of responsibilities, listed below, but each also establishes its own additional priorities based upon need.

- Erosion prevention and control
- Soil conservation
- Flood prevention and control
- Prevention of damages from flood water and sediment
- Water supply for any beneficial uses
- Development, management, utilization and conservation of groundwater and surface water
- Pollution control
- Solid waste disposal and sanitary discharge
- Drainage improvement and channel rectification
- Development and management of recreational and park facilities
- Forestry and range management
- Outdoor recreation
- Education

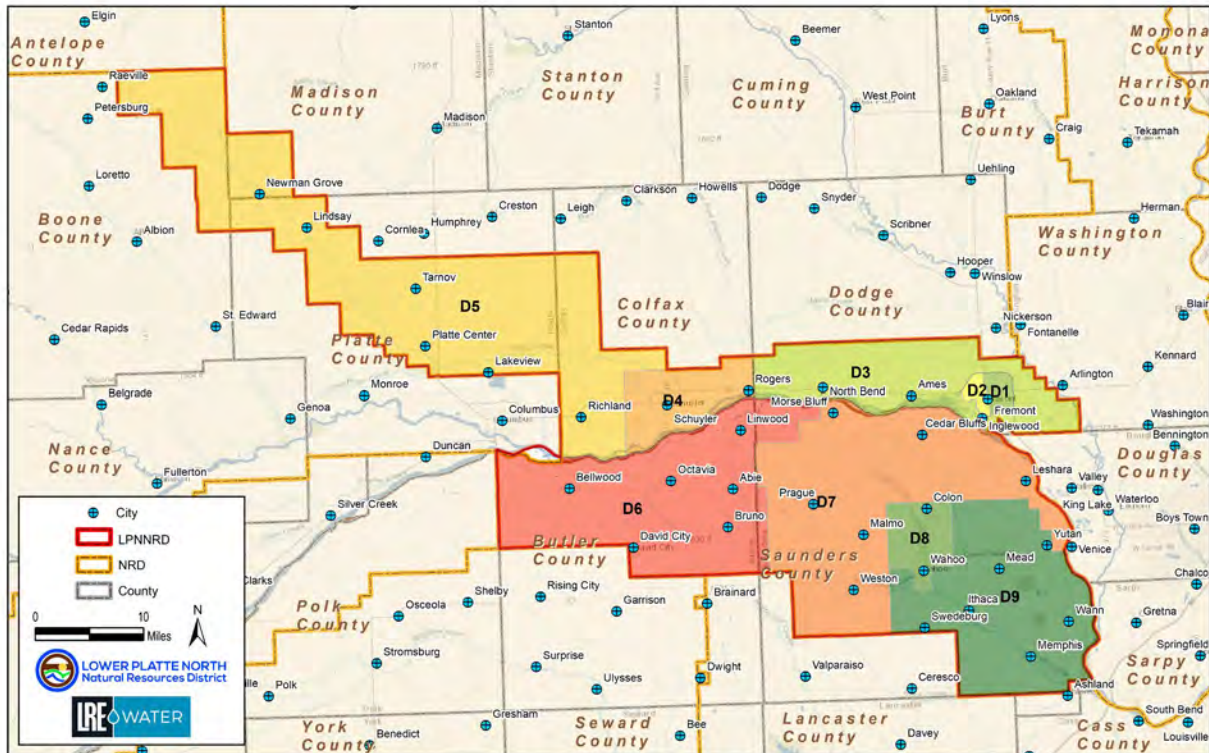


Figure 2: Board of Director Sub-districts (2025)

The LPNNRD is responsible for a variety of programs and projects and has identified five primary services with a focus on the following:

- Water Management
 - Groundwater management phase areas, monitoring programs, chemigation, nitrogen certification, nitrate management, wellhead protection (WHP) program, non-point source pollution management, and well decommissioning.
 - Groundwater restricted and limited control areas, well permits and registration, variances, irrigated acre certification, water use management, and conservation.
- Rural Water Systems (RWS)
 - Management of the Bruno-David City RWS and Colon-Wahoo RWS.
- Forestry and Wildlife
 - Implementing a tree planting program
- Watershed and Flood Damage Reduction
 - Management of seven watershed-wide flood reduction projects that include nearly 60 flood reduction structures, including three high-hazard dams.
- Conservation Programs
 - Cost-share for soil and water conservation, small dams, cost-share for priority watersheds, rock and jetty program, and weed management.
- Education
 - Includes newsletters, environmental education program, events, grants and scholarships, and workshops

1.4 JOINT-PLANNING EFFORTS

Lower Platte River Basin Coalition

In 2017, seven NRDs came together with NeDNR to form the Lower Platte River Basin (Basin) Coalition (Coalition). This Coalition is operating under the guidance of the Basin Water Management Plan, published in October 2017. The Basin is one of Nebraska's most valuable resources, playing a crucial role in the state's agricultural, social, industrial, and municipal development and sustainability (Coalition, 2017).

The Coalition includes the LPNDR, along with the NeDNR and six other NRDS, including Upper Loup, Lower Loup, Lower Platte South, Papio-Missouri River, Lower Elkhorn, and Upper Elkhorn. These NRDs collaborate with the Nebraska Association of Resource Districts (NARD) to maintain a sustainable balance between water supplies and uses in the Basin (Figure 3). Key groundwater elements of the Basin Water Management Plan have been integrated in this GWMP update.

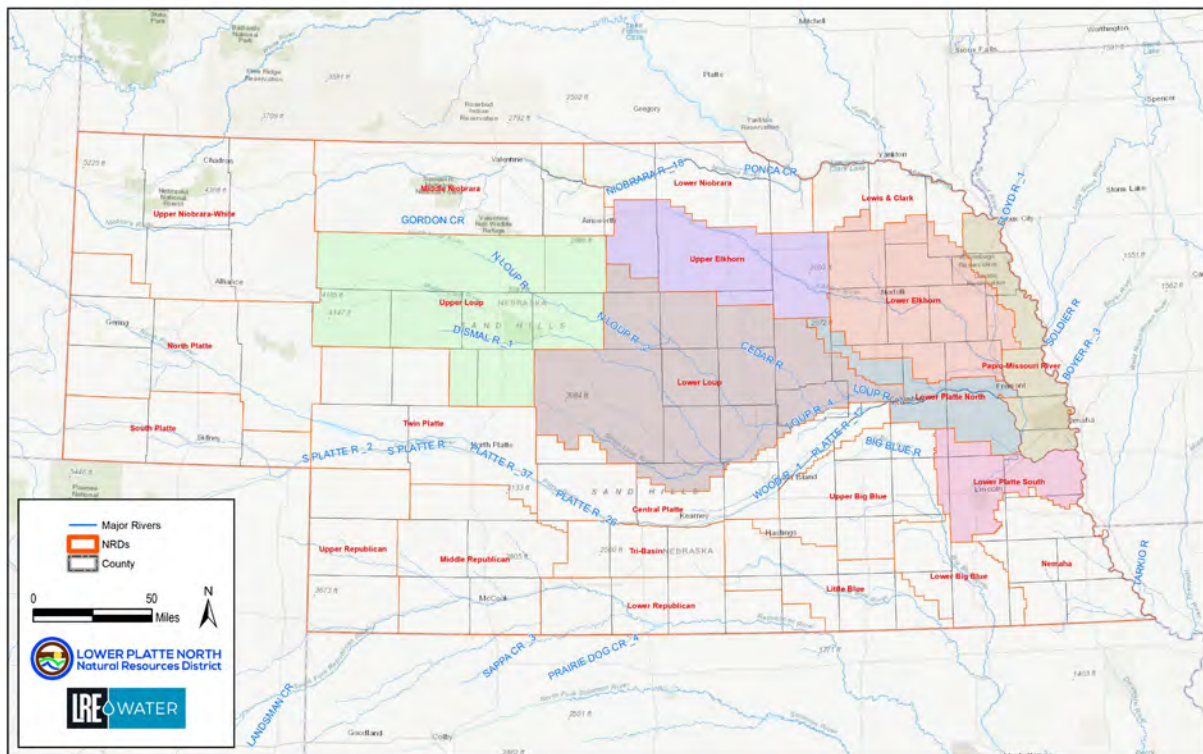


Figure 3: Lower Platte River Basin Coalition NRDs

Lower Platte River Drought Contingency Plan

The Lower Platte River Basin, including its tributaries and aquifers, serves approximately 80 percent of Nebraska's population, thousands of businesses, and industries, includes more than two million irrigated acres, and provides streamflow for threatened and endangered species. The drought-driven risks are diverse and a potential drought in the region would pose serious risk to public health, the economy, and fish/wildlife. Projects and programs designed to increase water supply and decrease water demands would benefit a variety of interests, including irrigation, power, environmental, and recreational

activities (Consortium, 2019). As a result, the LPNNRD, LPSNRD, PMRNRD, Metropolitan Utilities District (MUD), Lincoln Water System (LWS), and NeDNR established the Lower Platte River Drought Contingency Plan in 2019.

Integrated Management Plan

The LPNNRD's first voluntary Integrated Management Plan (IMP) was adopted by the District on June 11, 2018, and by the NeDNR on June 13, 2018, with an effective date of July 15, 2018. The IMP was developed in accordance with the Nebraska Ground Water Management and Protection Act (Act). The Act assigns the NeDNR and the District responsibilities and authority for management of groundwater, surface water, and their hydrologically connected areas in accordance with the Act, N.R.S. Chapter 46, Article 7. The voluntary IMP provides the framework for joint management of groundwater and surface water, recognizing that the two water sources are hydrologically connected. This framework enables the District and the NeDNR to coordinate management actions and monitoring of groundwater and surface water, to better protect water resources for future generations (LPN, 2018a). The IMP recognized five goals:

- 1) Develop and maintain a District-wide water supply inventory
- 2) Develop and maintain a District-wide water demand inventory
- 3) Develop and implement water use policies and practices with the purpose of achieving and sustaining a balance between water uses and supplies
- 4) Communicate to the public that Nebraska has a great supply of water, and a need to continue to manage it well
- 5) Coordinate with the Lower Platte River Basin NRDs, and appropriate groups and agencies, to develop a water management plan for the Coalition that maintains a balance between current and future water supplies and demands

LPNNRD Drought Contingency Plan

The LPNNRD was developing a district-wide Drought Management Plan in 2025. The Drought Management Plan will help to reduce district-wide impacts during drought events and aid the LPNNRD in water resource management. This project will include establishing drought monitoring and forecasting protocol, identifying potential best management practices, creating educational and awareness materials, and identifying future actions to reduce drought impacts. The GWMP will be a key resource integrated into the Drought Plan.

A significant part of the planning process will focus on local communities and their public water systems to evaluate their drought vulnerabilities and understand available community drought ordinances. The plan will include the development of drought mitigation strategies and other recommendations based on the outcomes of the drought risk analysis and meetings with communities. Also included with the plan will be a community engagement materials kit and sample drought ordinances for communities to utilize and update to fit their needs. The outcome will be a more sustainable and stable water supply for all uses across the district.

1.5 CURRENT RULES AND REGULATIONS

The Groundwater Management Area Rules and Regulations were first implemented on January 1, 1997, and last amended on June 15, 2018. Under Neb. Rev. Statutes 46-701 to 46-754 of the Act. The LPNNRD

has designated the entirety of the District as a Phase I Management Area for groundwater quality and quantity.

1.5.1 Groundwater Quality Management Areas

Groundwater quality management areas can have one of four designated phases (i.e., Phase I through Phase IV) based on nitrate contamination concentrations. If concentrations increase in an area enough to meet specified trigger levels, that area is moved to a higher Phase area with increased corresponding management regulations. Areas are triggered by 50 percent of the wells exceeding the trigger for a minimum of two sampling events, a minimum of ten registered wells must be sampled, and the area must be a minimum 9-square miles. The exception is for WHP Areas which can be smaller and may require a larger percentage of wells to be sampled. Based on the June 15, 2018, amended Rules and Regulations, the phases and corresponding groundwater nitrate concentration trigger levels are as follows:

1. **Phase I:** 0 to 8.01 parts per million (ppm)
2. **Phase II:** > 8.01 to 10.01 ppm
3. **Phase III:** > 10.01 to 15 ppm
4. **Phase IV:** > 15 ppm

For all other contaminants, a Phase 2 is triggered at 81% of the MCL, Phase 3 = >100% of the MCL. Currently, the LPNNRD has two Quality Groundwater Management Areas shown in Figure 4 triggered by nitrate concentrations. One is near the Village of Bellwood and is currently in a Phase II level of management. The second is near the cities of Richland/Schuyler area, where Phase III and Phase IV levels of management are in place. Additional nitrogen management, reporting, and educational requirements are required for operators within these areas. In 2024, a Phase IV area was added for exceedance of the Maximum Contaminant Level (MCL) of nitrates and uranium west of Schuyler.

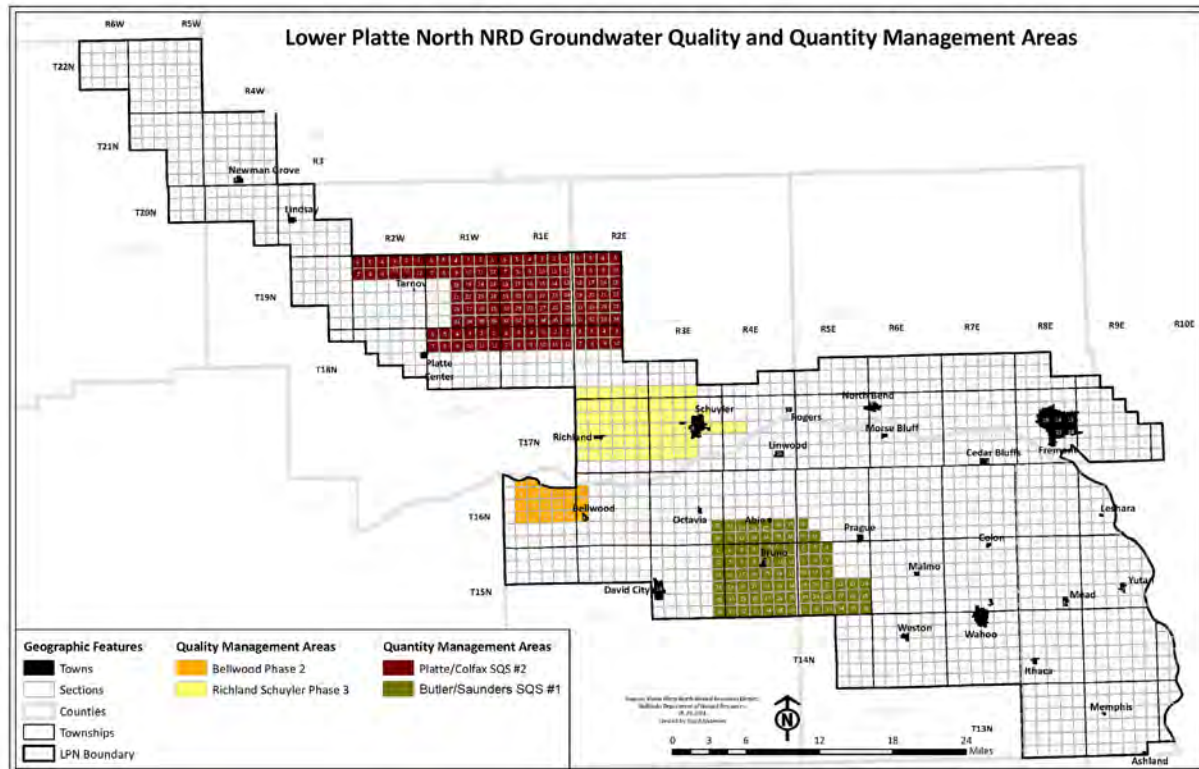


Figure 4: Quality and Special Quantity Sub-areas

1.5.2 Special Quantity Sub-Areas

Starting on January 1, 1997, the LPNNRD established two Special Quantity Sub-Areas (SQS) as a result of excessive seasonal declines in water levels that caused well interference. Due to the declines occurring during the summer, they did not qualify under the criteria for Groundwater Quantity Management Areas described below. These are referred to as Butler/Saunders SQS #1 and Platte/Colfax SQS #2. There are no new wells and expansion of irrigated acres are limited to the original allocation in these areas, and several other restrictions apply. The SQS areas are shown on Figure 4 above along with the Quality Management Areas.

1.5.3 Groundwater Quantity Management Areas

The Rules and Regulations also allow for the development of Groundwater Quantity Management Areas based on the percentage of water level decline for an unconfined aquifer and the percentage of hydraulic head decline for a confined aquifer. Assessment of the percentage drop is calculated using spring readings of the District’s spring/fall static observation wells over a 3-year period. Over 50 percent of the wells must reach or exceed a predetermined water level percent trigger. A general summary of the quantity triggers is shown below. Currently, the LPNNRD does not have a designated Groundwater Quantity Management Area.

Table 1: Confined and Unconfined Aquifer Triggers

AQUIFER TYPE	TRIGGER %	LEVEL CONTROL
Unconfined	10	I
	15	II
Confined	7	IA
	10	IIA

1.5.4 Groundwater Development Areas

In March 2018, the LPNNRD established Groundwater Limited Development Areas (Figure 5), where restrictions are in place on the development of high-capacity wells and the expansion of irrigated acres. These areas were delineated by the results of NeDNR's Lower Platte Missouri Tributaries Groundwater Model (LPMT)'s Hydrologically Connected Areas (HCAs). These areas have been determined to have a physical hydrologic connection between groundwater and surface water, and the goal is to ensure no further impact to surface water flow occurs as a result of excessive groundwater pumping. These areas are shown in Figure 5, along with the Special Quantity Subareas, which are unrelated to the HCAs.

- **Outside Groundwater Control Area (white):** Up to 75 new acre-feet (AF) per year are allowed through a variance process due annually on August 15.
- **Inside Groundwater Control Area (blue):** Up to 200 new AF per year with a variance deadline of September 15.
- **Restricted Development Area (red):** Was established through a separate study, and there are no new irrigated acres or water uses allowed, but consideration is given to areas within 1 mile of the red area.

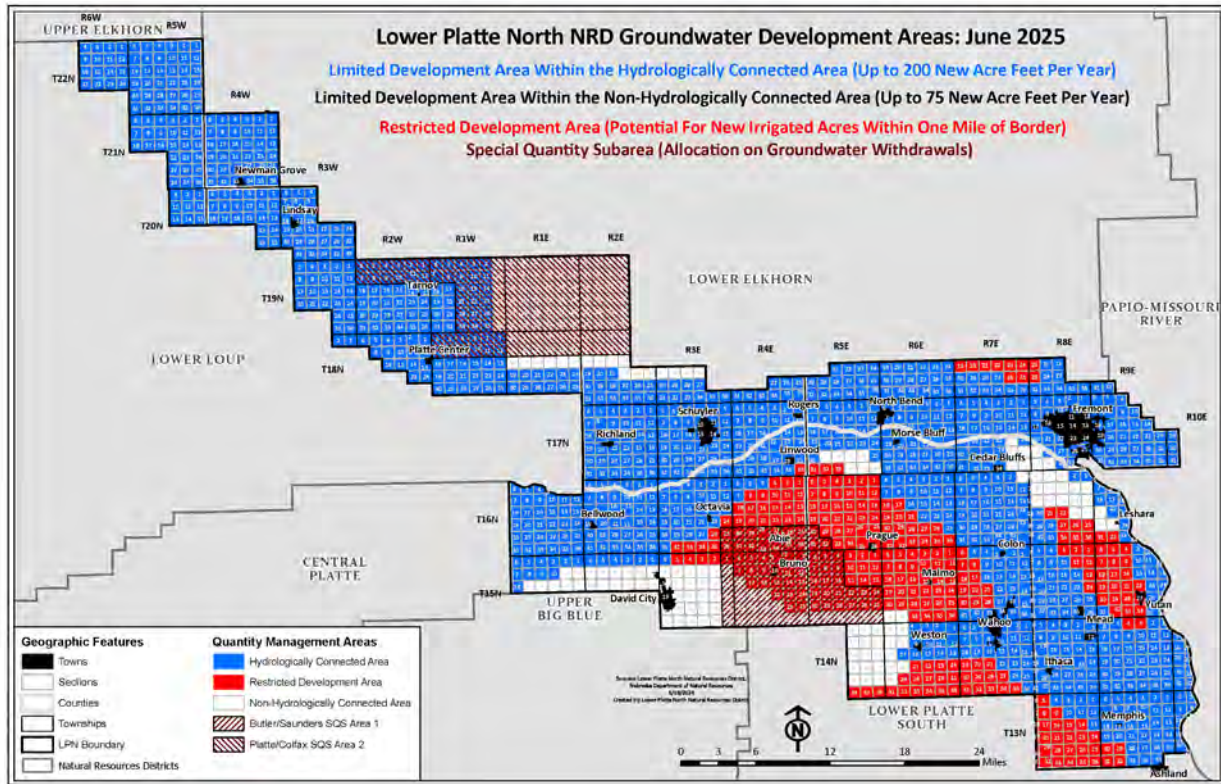


Figure 5: Groundwater Limited Development Areas

2 DESCRIPTION OF THE NRD

2.1 GROUNDWATER REGIONS AND PRINCIPAL AQUIFER

The 1995 GWMP subdivides the District into four distinct regions based on hydrogeologic and physiographic characteristics. The regions are described in the LPNNRD Hydrogeologic Evaluation and Subarea Delineation Study (Olsson, 2009) and are shown in Figure 6.

- **Platte River** This area is characterized by fluvial sand and gravel deposits of varying thickness, which are overlain by alluvial silt and clay, and younger loess deposits. Coarser and thicker sands and gravels appear to be present in paleovalley deposits, which sometimes extend into the Uplands Region described below.
- **Shell Creek:** Located in the northwest portion of the District, this region extends from the Platte River to the Sandhills and dissects glacial terrain similar to that of the Uplands Region. The upper reaches include the Ogallala Group.
- **Todd Valley:** This region was formed by the ancestral Platte River, which carved a fluvial valley. This region consists of fluvial sand and gravel deposits capped by loess and overlies the Cretaceous-age Dakota Group bedrock formations. The fluvial deposits typically grade from fine to a progressively coarser-grained sands and gravels with depth. The Todd Valley aquifer is connected to the Platte River alluvial sand and gravel aquifer.
- **Uplands:** This region is characterized by dissected clay-rich glacial till and younger loess deposits with interbedded, discontinuous sand and gravel outwash deposits. In places, the glacial deposits overlie deeper paleovalleys that contain thicker and coarser sands and gravels or are in contact with the underlying Dakota Group. The sandstone units of the Dakota Formation contain brackish to saline water.

Principal Aquifer is the major groundwater reservoir in the District. It refers to the saturated unconsolidated sand and gravel aquifers, including the Ogallala Group, where present.

The following sections provide more insight into the hydrogeologic data and recent assessments, and background of the LPNNRD.

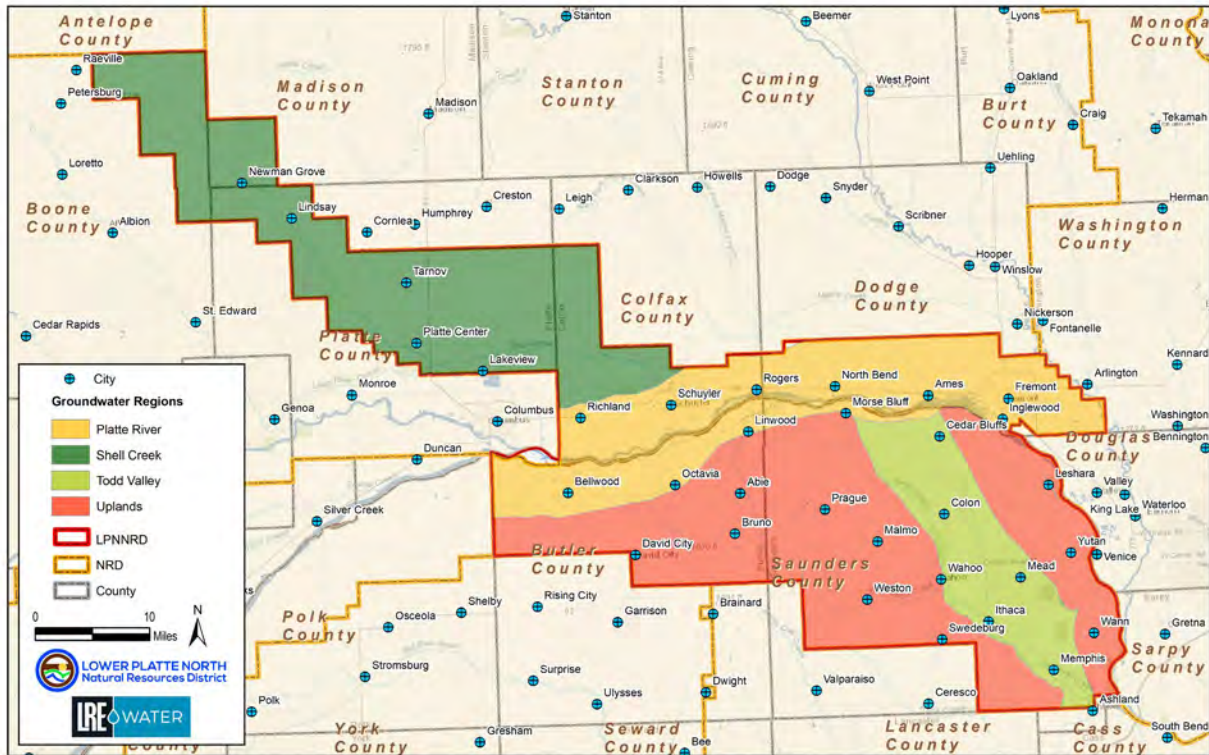


Figure 6: Groundwater Regions of the LPNNRD

2.2 HYDROGEOLOGIC DATASETS

Since 2006, the Eastern Nebraska Water Resources Assessment's (ENWRA) work has resulted in vast geologic datasets and creation of hydrogeologic frameworks for six NRDs in eastern Nebraska, including the LPNNRD. The major datasets include airborne electromagnetic (AEM) data, and geologic logs from the NeDNR and University of Nebraska-Lincoln, Conservation Survey Division (UNL-CSD) well and test holes database. These data sets and detailed desktop hydrogeologic assessments completed recently for the District are available to aid in well siting and similar groundwater management actions.

2.2.1 Airborne Electromagnetic Survey

AEM is an airborne geophysical survey method that can provide characterization of electrical properties of earth materials from 3 to 10 feet to depths over 1,000 feet. These surveys provide geophysical data quickly and efficiently and when analyzed, can help define aquifer and non-aquifer materials. The AEM surveys have been crucial in the LPNNRD's efforts to help address water quality and quantity challenges.

The LPNNRD's AEM survey datasets and reports from 2009, 2012, 2015, 2016 and 2018 are available on EWRA's projects website (<https://enwra.org/projects>). The AEM flight line locations within the District and adjacent NRDs are shown in Figure 7.

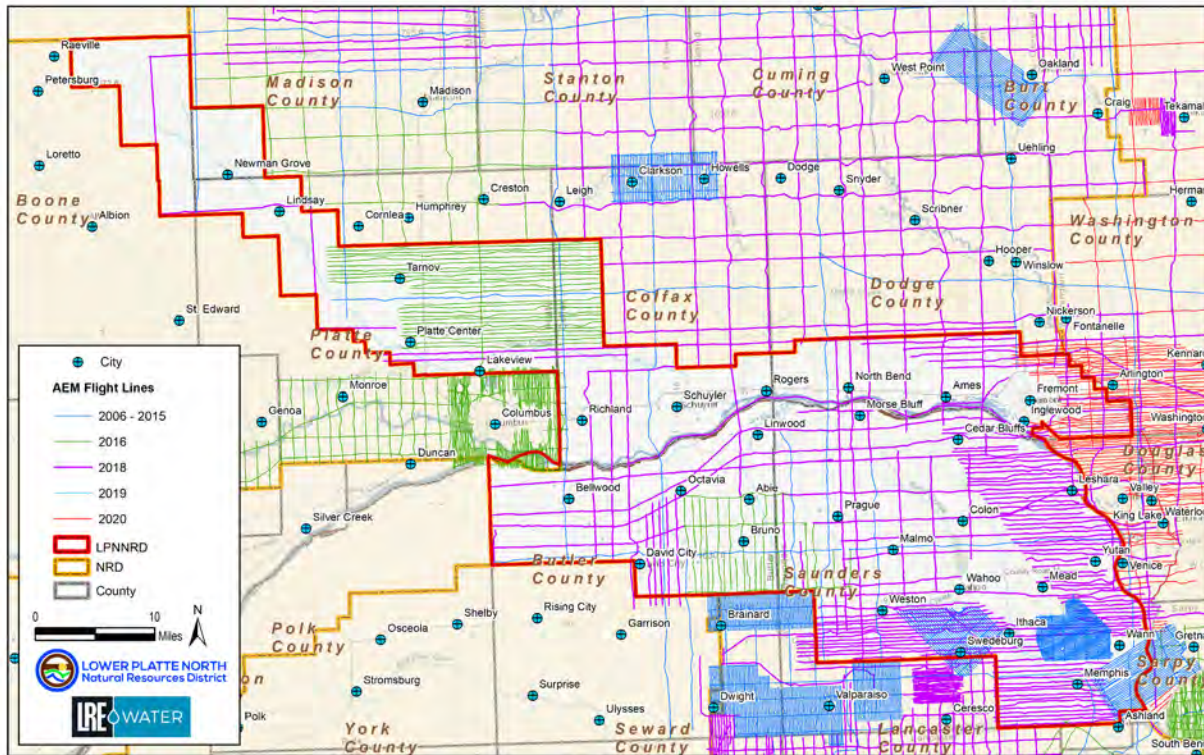


Figure 7: AEM Flights within and near the LPNNRD

2.2.2 3D AEM Framework and Hydrogeologic Assessment

In 2022, the LPNNRD utilized the AEM datasets to create a 3D AEM Framework (LRE Water, 2022), in addition to constructing detailed hydrogeologic cross sections from geologic logs. The framework was created using Leapfrog, a 3D geological modeling software program. The program delineated the hydrostratigraphy and hydraulic conductivity zones from the processed AEM data. The framework offers several benefits:

- Provides hydrogeologic information to assist staff in reviewing well permits.
- Enhances understanding of aquifer characteristics, such as recharge areas and water-bearing layers.
- Facilitates vulnerability assessments and identifies areas needing best management practices.
- Better defines hydrologically connected surface and groundwater.
- Improves collaboration with neighboring NRDs and NeDNR.
- Creates a MODFLOW grid, including layers, cells, and hydraulic conductivity zones for numerical groundwater flow modeling.

An example of a Leapfrog Works model output is shown in Figure 8 where higher resistivities are shown as brighter colors and are representative of sand and gravel. The darker colors represent low resistivity and represent clay, till, and losses. The bedrock surface is shown as a black line.

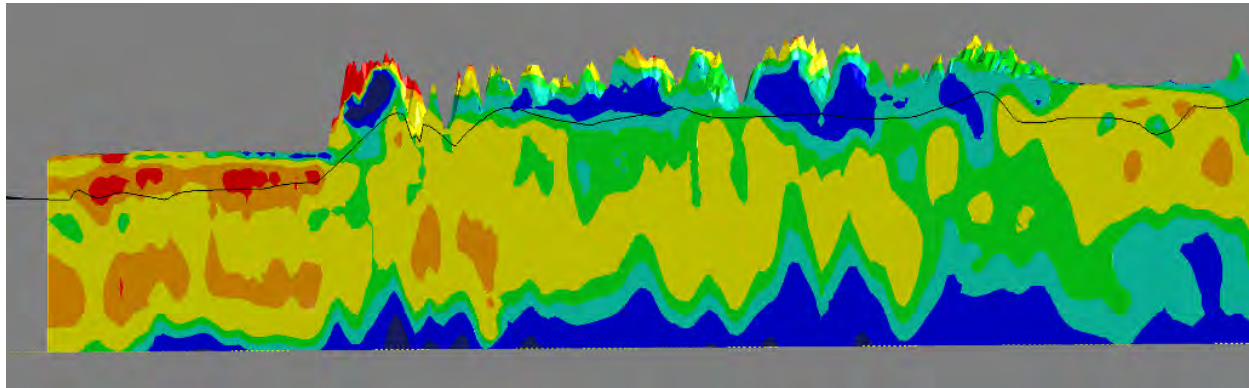


Figure 8: 3D Leapfrog output in cross section

In 2023, a Hydrogeologic Assessment (Assessment) was completed for the LPNNRD utilizing all available NeDNR well logs UNL-CSD test holes (LRE Water, 2023). In total, 22,500 well logs and 290 test holes were incorporated into the Assessment, which included a 5-mile buffer around the LPNNRD boundary. There was a total of 11,893 wells within the LPNNRD with geologic logs as seen in Figure 79. The Assessment also utilized existing geologic information from the 2022 3D AEM Framework.

In addition to a bedrock surface, the geospatial and hydrogeologic analyses completed on the geologic log data were used to develop 28 hydrogeologic cross sections, and to generate the other hydrogeologic raster surfaces, many of which were utilized to create the maps illustrated below within this plan.

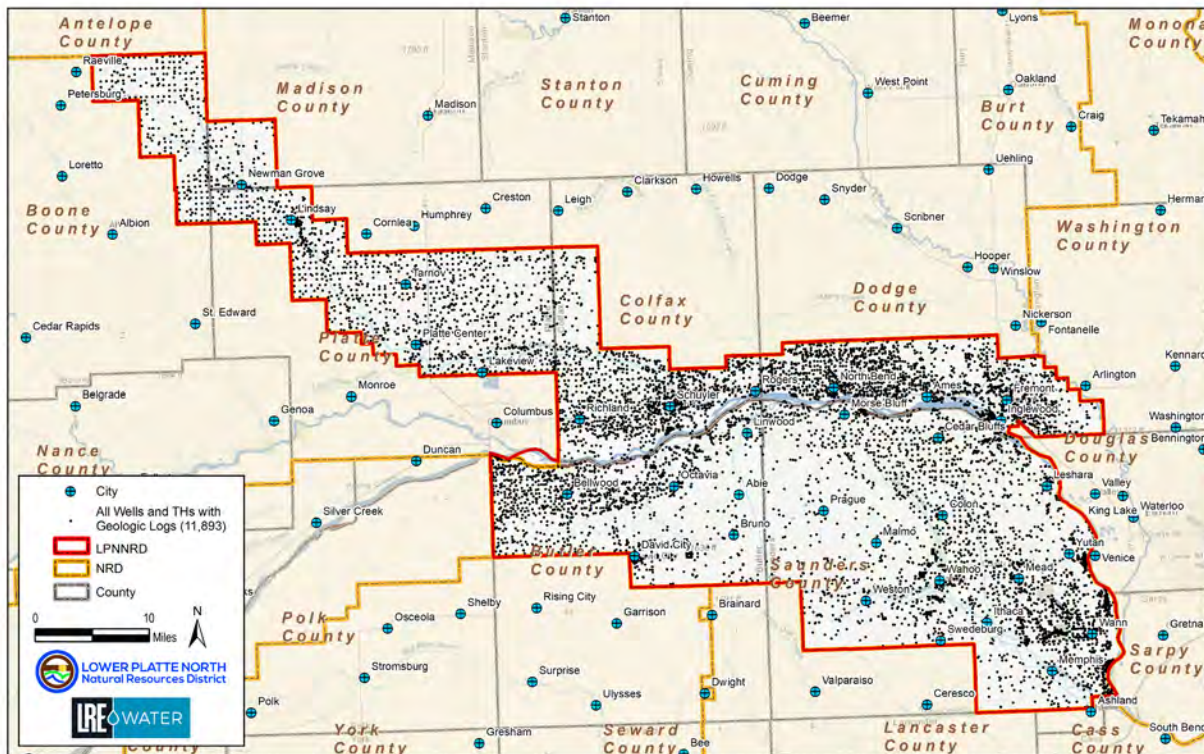


Figure 9: Well and Test Holes with Geologic Logs (LRE Water, 2023)

2.3 TOPOGRAPHY

The northwest arm of the District is dominated by upland dissected plains topography and includes portions of Boone and Madison counties, and about two-thirds of Platte County. To the southeast, the central portion of the LPNND includes approximately 125 miles of the Platte River Valley, extending from the cities of Columbus to the west and Ashland to the east. Through the east-central portion of Saunders County, from the cities of North Bend to Ashland, is a broad fertile area 5 to 8 miles wide, referred to as the Todd Valley. West and southwest Saunders County and eastern Butler County, known locally as the 'hill area', is comprised of bluffs along the north edge and rolling hills, ridges, and steep valley slopes south of the Platte River Valley. A map of the topography, derived from a Digital Elevation Model (LRE Water, 2023), is shown in Figure 10.

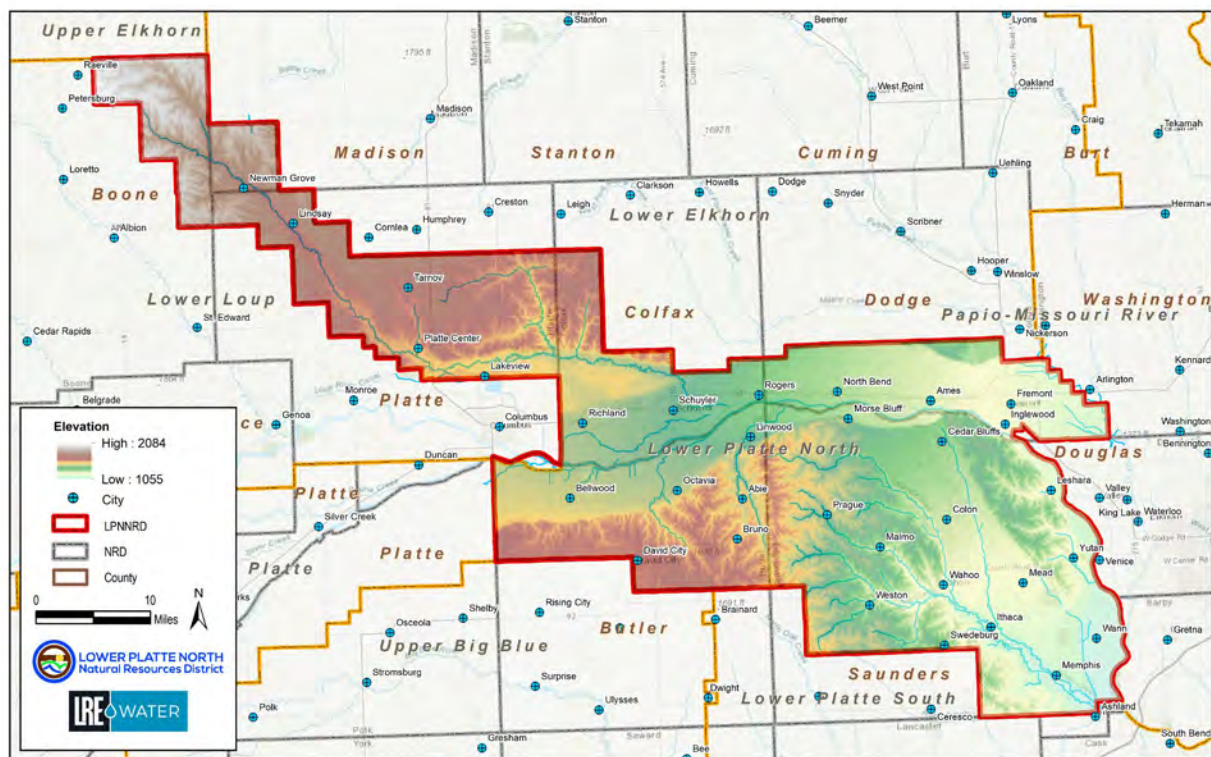


Figure 10: Topography of the LPNND

2.4 SOILS

Soils in the uplands of Butler and Saunders counties consist primarily of clays and silty clays to silty clay loams somewhat similar to the Sharpsburg and Sharpsburg-Pawnee association. Primary soils in the upland areas are eroded to a point where they no longer exist, and landowners are now farming in the "B" horizon. This has implications for surface and groundwater quality. The permeability of these soils is less than 1.0 inch per hour on slopes that range from gentle to 20 percent. Recharge rates are quite low and recharge is principally limited to perched aquifers. These soils are loess type soils with some intermixed glacial till areas. The drainage pattern and flood plain configuration of Wahoo Creek is primarily composed of Kennebec soils of silty clay loam ranging from moderate to poorly drained (HWS, 1995).

The western portion of the Platte River corridor is comprised of Acadia-Platte alluvial fine sands underlain by sands and gravels. The eastern portion of the corridor is practically the same, however, depth to water in the eastern area is greater. This primary water line, where groundwater is most significantly present within the Platte River corridor, is bounded on the north by poorly drained Gibbon-Luton silty and clayey soils. Areas to the south and a few areas along the western end of the Platte River corridor contain silty soils that are well drained and of loess origin (HWS, 1995).

The northwest corner of the District is composed of moderately to well drained silty type soils with permeabilities ranging from 1 to 2 inches per hour above the areas adjacent to Shell Creek. Areas in northeast Platte County have permeability ranges of 1.5 to 5 inches per hour (HWS, 1995).

The general pattern of soil distribution shows that soils of loess origin are found on the uplands with alluvial soils predominant on the bottom lands, as seen in Figure 11. Permeabilities range from practically zero to greater than 10 inches per hour (near Columbus and southeast of Bellwood). The pattern shows that, generally, soils south of the Platte River are less permeable than those of the north side. Soil textures range from fine sands to silty clays.

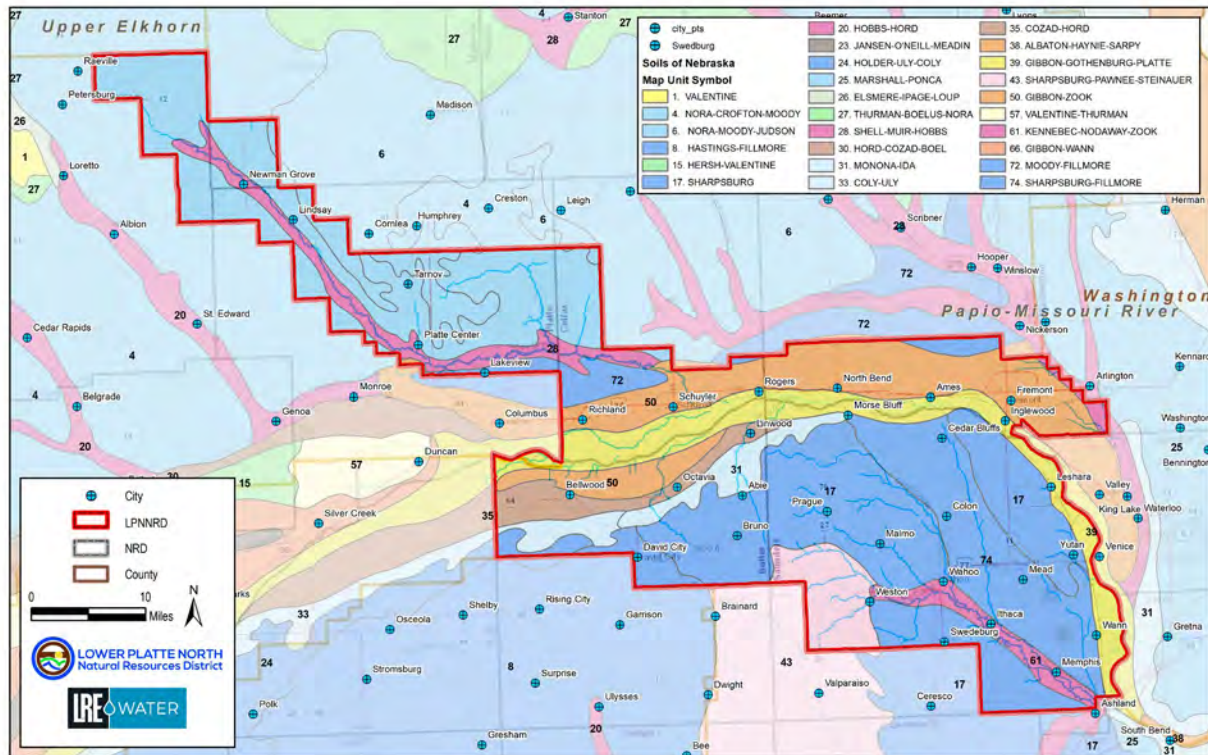


Figure 11: Soil Types

2.5 GEOLOGY AND HYDROLOGICAL CHARACTERISTICS

The geology of the District generally consists of Quaternary-age unconsolidated loess, glacial till and outwash, and older buried fluvial deposits overlying bedrock. The five primary bedrock formations are shown in Figure 12. A description of the major unconsolidated and bedrock formations and their potential to transmit water to wells, as described in the previous plan, are listed in Table 2.

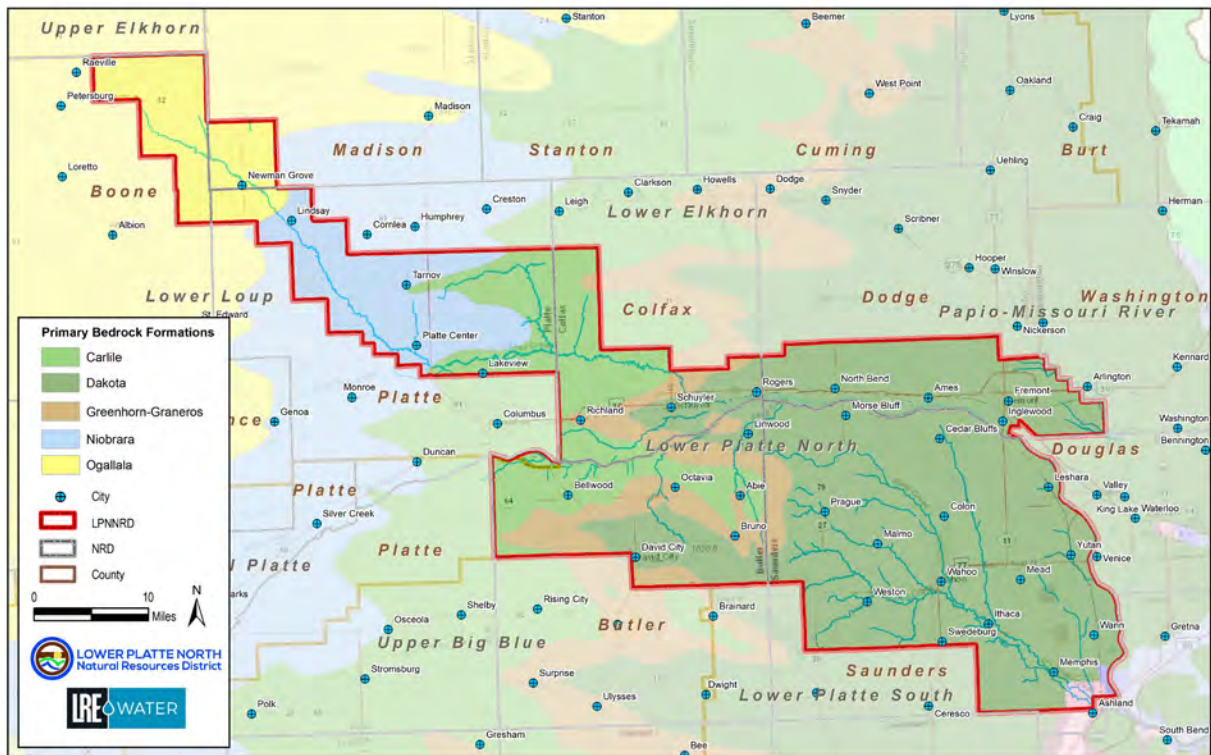


Figure 12: Bedrock Formations

Table 2: Geologic Sequence of Major Formations in LPNDRD

SYSTEM	SERIES	MAJOR STRATIGRAPHIC UNITS	PHYSICAL CHARACTER	WATER SUPPLY
Quaternary	Holocene	Modern Soils	Locally silty, clayey, or sandy.	Transmits locally variable amounts of recharge to the groundwater reservoir.
		Recent valley-fill deposits	Alluvial deposits of gravel, sand, silt, and clay associated with the most recent cycle of erosion	May contribute significant amounts of water to wells.

SYSTEM	SERIES	MAJOR STRATIGRAPHIC UNITS	PHYSICAL CHARACTER	WATER SUPPLY
	Pleistocene	Loess	Wind-blown silt with lesser amounts of very fine sand and clay.	Transmits recharge to the underlying aquifers. May provide small quantities of water to shallow wells.
		Till	Ice-deposited silty, sandy clay with gravel and larger pebbles and boulders.	Relatively impermeable. Transmits water slowly to buried aquifers. Groundwater may be perched above the till. Sand deposits within the till provide water to low-capacity wells.
		Glacial outwash and other ancient valley-fill deposits	Alluvial deposits of gravel, sand, silt, and clay associated with ancient erosional and depositional cycles.	Contributes water to wells in generally large amounts, stream-deposited sand and gravel constitute the major aquifers and yields to high-capacity wells.
Tertiary	Pliocene(?)	Ancient valley-fill deposits	Mostly unconsolidated silt. May blanket Cretaceous bedrock at base and on side slopes of paleo-valleys.	Generally, too fine textured to yield water to wells.
	Miocene	Ogallala	Poorly sorted clay, silt, sand, and gravel generally uncemented to slightly cemented.	The Ogallala constitutes a major aquifer in western portion of LPNRD. Yields to large-capacity wells.
Cretaceous	Upper Cretaceous	Niobrara	Chalk	May supply water to wells where fractures exist or are saturated.
		Carlile	Shale	Not known to supply water to wells
		Greenhorn	Limestone	
		Graneros	Shale	
	Lower Cretaceous	Dakota	Sandstone and shale	Constitutes a significant aquifer in the eastern part, potentially yields and water quality are locally variable.

Source: HWS, 1995

2.6 TOTAL SATURATED SAND

The total thickness of saturated sand is an indicator that can be used to qualitatively evaluate the relative potential yield from an aquifer or aquifers. The total saturated sand in the District, shown in Figure 13 (LRE, 2023), was created using water level and geologic data from NeDNR well logs and UNL-CSD test holes logs. Figure 13 was created by reviewing only the available geologic logs that

encountered bedrock from the NeDNR and UNL CSD datasets. The thicker aquifers are present in the northwest and Todd Valley portions of the District, and generally become thinner in the central portion and beyond Todd Valley.

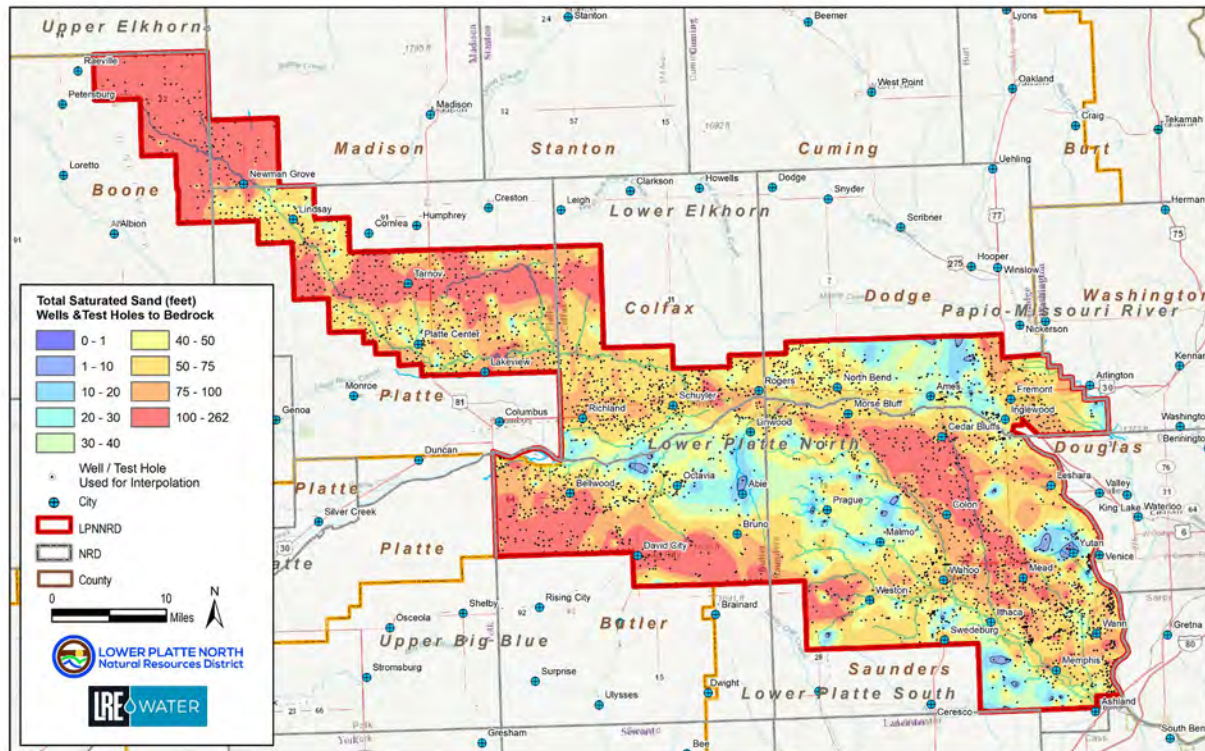


Figure 13: Total Saturated Sand, Well and Test Holes

2.7 CONFINED VS. UNCONFINED AQUIFERS

A confined aquifer is a formation below the land surface that is saturated with water and has impermeable layers above and below it causing it to be under pressure. As a result, when a confined aquifer is penetrated by a well, the water will rise above the top of the aquifer in the well. Artesian wells are a result of confined aquifers. In a confined aquifer, water level declines represent a reduction of artesian head, not saturated thickness.

A management strategy for a confined aquifer is to avoid pumping a confined aquifer to levels where it unnaturally transitions to unconfined conditions. The primary risk of this is decreasing the aquifer's pore pressure, which can potentially reduce well yields and quality due to changes in water pressure and oxidation. Over pumping can also lead to well interference by reducing the available head in the aquifer, declining water levels, and reduced well yields.

Unconfined aquifers, also referred to as water table aquifers, are present where the upper water surface (water table) is equal to atmospheric pressure. In an unconfined aquifer, water level changes (rise and decline) affect the saturated thickness.

Management strategies for an unconfined aquifer are to avoid over pumping if the rate of withdrawal exceeds the rate of recharge. In addition, pumping activities can draw in pollutants, potentially

contaminating the water source, and excessive pumping can lead to reduced saturated thickness and well yields, reduced water levels in nearby surface waters if hydraulically connected, and the potential for well interference with other users.

Differences in static (i.e., non-pumping) groundwater levels measured in adjacent wells could be caused by wells being screened at different depths and/or in different aquifers.

Knowing whether an aquifer is confined or unconfined is important for effective groundwater management in Nebraska for several reasons:

1. **Water Availability:** Unconfined aquifers, also known as water table aquifers, are more influenced by surface conditions and can be more susceptible to droughts. Confined aquifers, under pressure, provide a more stable water supply.
2. **Recharge Rates:** Unconfined aquifers recharge more quickly due to their proximity to the surface and direct receipt of precipitation. Confined aquifers recharge more slowly due to impermeable layers above them.
3. **Water Quality:** Unconfined aquifers are more vulnerable to surface contamination from activities like agriculture and industry, while confined aquifers are generally better protected. Well construction issues will increase the vulnerability.
4. **Management Strategies:** Different practices are required for managing confined and unconfined aquifers. Unconfined aquifer management focuses on protecting recharge areas and controlling surface contamination, while confined aquifer management involves monitoring pressure levels and ensuring sustainable withdrawal rates. Pressure levels can be monitored using a piezometer to measure water level, known as the piezometric head. The pressure is calculated at a specific depth using a formula that includes the density of water, acceleration due to gravity, and height of the water column above the point of measurement.
5. **Hydraulic Properties:** The hydraulic properties, such as transmissivity and storativity, differ between confined and unconfined aquifers, affecting water movement and extraction.

By understanding the differences in aquifer types, the staff and Board can develop more effective strategies to promote sustainable water use and protect water quality by allocating resources based on specific needs. Figure 14 (LRE, 2023) illustrates the distribution of confined and unconfined aquifers. In certain areas, aquifers may transition from unconfined to confined due to fluctuations in water levels, with transitional zones defined as areas experiencing water level changes of approximately ± 10 feet. For the purposes of the GWMP, all transitional zones are classified as unconfined. Figure 15 provides an example of a transitional zone where over pumping has resulted in a shift from confined to unconfined conditions.

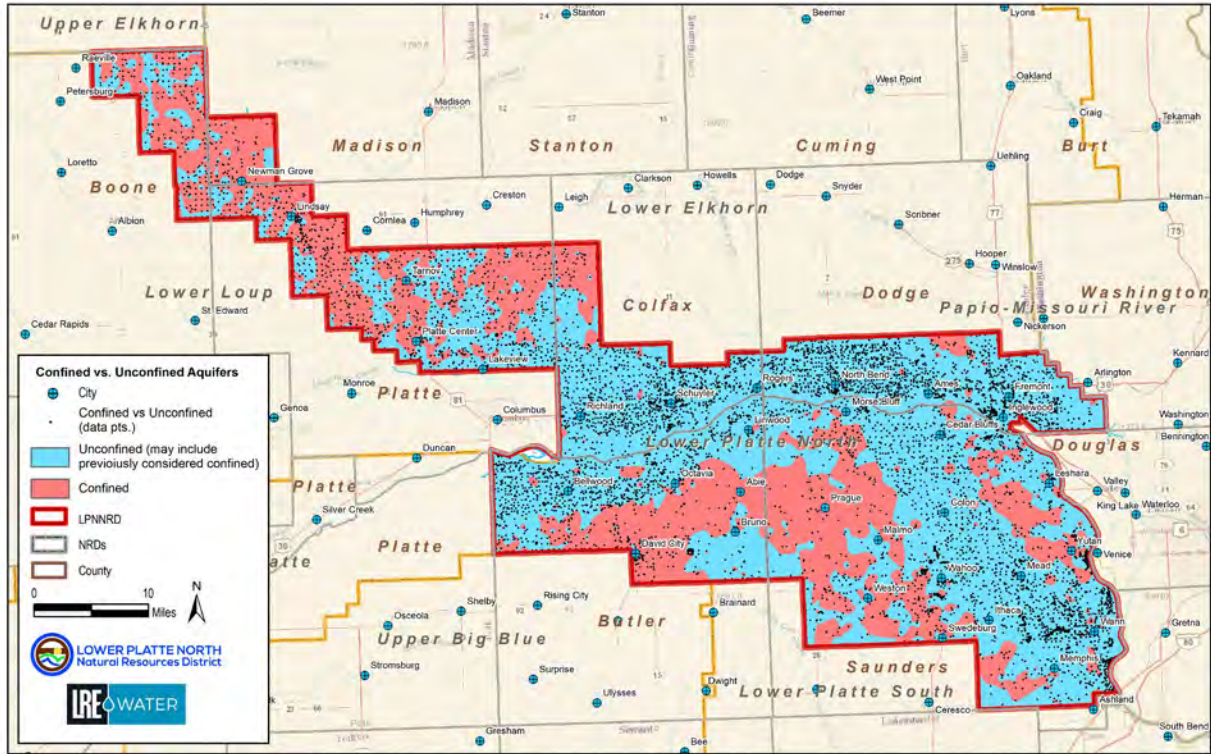


Figure 14: Confined vs. Unconfined Aquifers

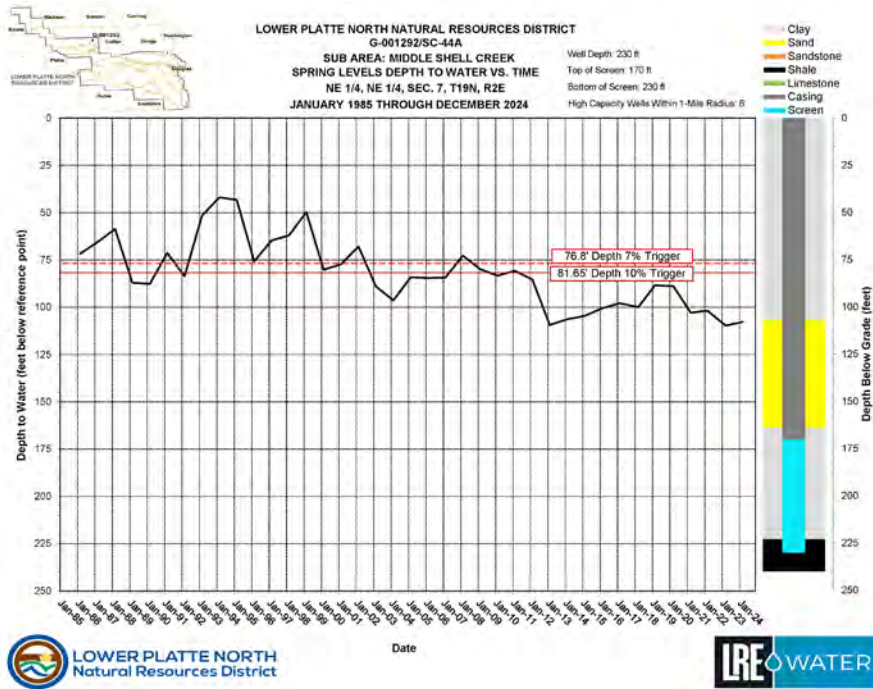


Figure 15: Hydrograph of Transitional Aquifer Type

2.8 TRANSMISSIVITY

Transmissivity is perhaps the one hydrologic parameter which best describes the aquifer and its potential for use and withdrawal. Transmissivity is the rate which quantifies the ability of an aquifer to transmit water and is dependent on saturated thickness and permeability.

Figure 16 shows the transmissivity of the Principal Aquifer for the LPNNRD based upon the Assessment (LRE Water, 2023). Areas with transmissivity less than 10,000 gallons per day per foot are not considered optimal areas for high-capacity wells, which are hatched.

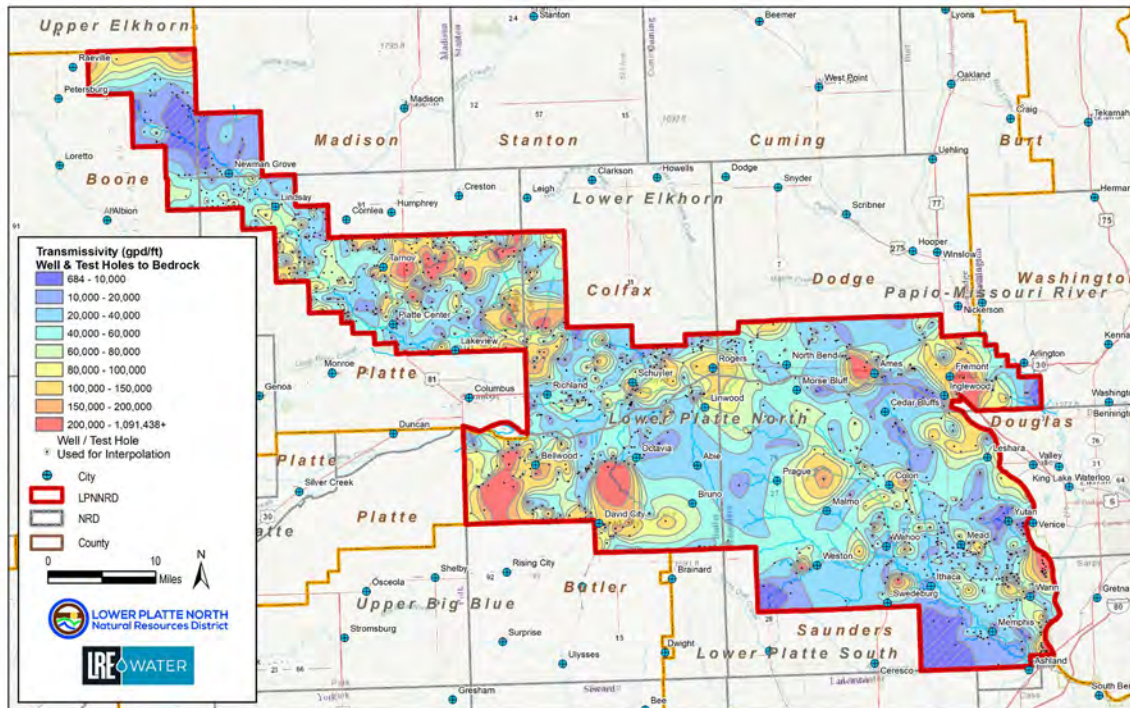


Figure 16: Aquifer Transmissivity

2.9 CLIMATE AND PRECIPITATION

Precipitation in the LPNNRD serves as the principal source of water for recharge, except in the Platte River Valley and areas adjacent to the Platte River, where river water contributes to aquifer recharge. Pumping in these areas can further induce additional recharge from the river. Figure 17 demonstrates the mean annual precipitation for the state and the LPNNRD between 1981 and 2020, provided by the National Oceanic and Atmospheric Administration. The average annual water requirement for maximum yield by crops varies from 25 inches for corn to 22 inches for grain sorghum and soybeans (HWS, 1995). The overall average water use for irrigation to supplement precipitation is 5.56 inches district-wide, with the exception of Butler/Saunders SQS#1 (4.65) and Platte/Colfax SQS#2 (4.59) where allocations restrict pumping (LPN, 2024). Moisture needs are more critical at certain times in the crop growing cycle and if moisture is not available, crop production can and does suffer. Detailed evaluations of precipitation versus soil moisture and crop water needs are necessary components in providing a comprehensive management system.

This area of the state receives maximum precipitation in April, May, and June, at which time the highest rate of leaching of contaminants is occurring. The maximum water use period by crops stretches from April through September (crop dependent), with July, August, and September water requirements exceeding available average precipitation. It is apparent that at certain times there is a need for irrigation water to consistently produce high yields.

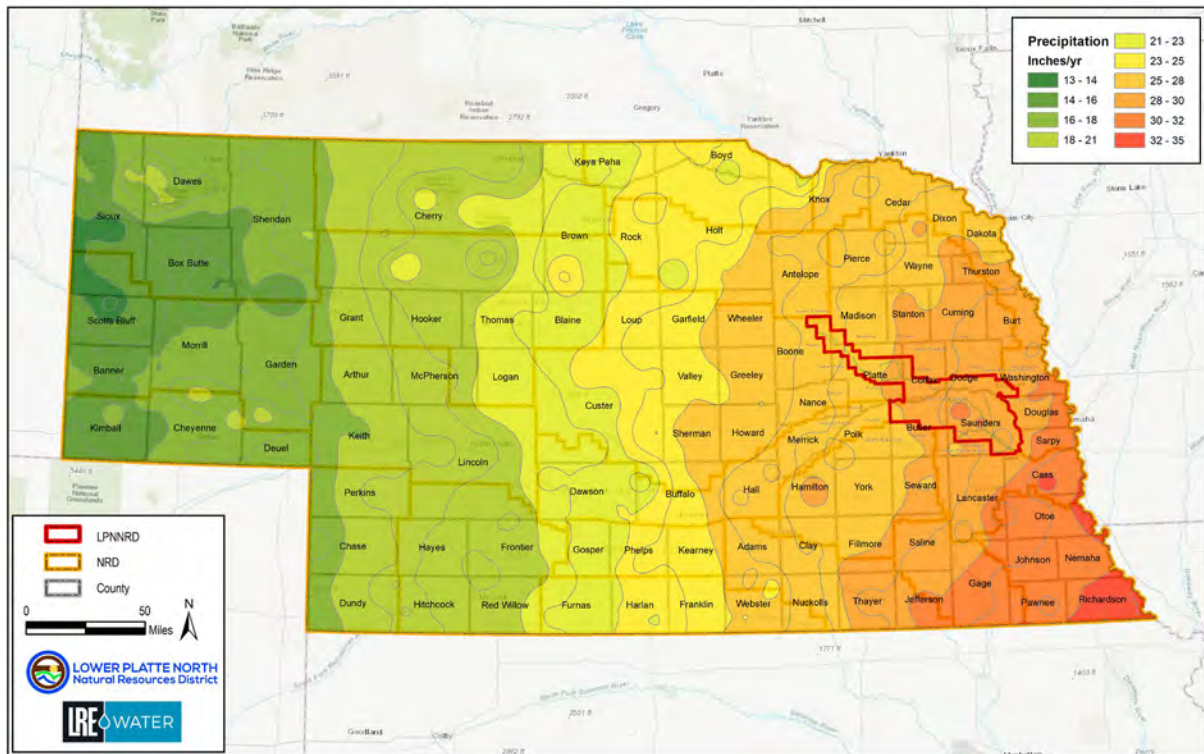


Figure 17: Average Annual Precipitation (1981-2010)

2.10 LAND COVER

The vast majority of the District’s 1,030,468 acres (approximately 75 percent) of LPNDRD is classified as row crop by the CropScape – Cropland Data Layer, derived from the U.S. Department of Agriculture’s National Agricultural Statistics Service (NASS). The NASS dataset was used to look at land cover changes since 2009 and categories were combined into seven sub-categories, out of the 37 that are available. As shown in Table 3, over 84,500 acres of grass or pasture have been converted since 2009. The increase in wetlands was not determined but could be a result of the 2019 flood event or potentially a difference in interpretations of data collected in each respective year. A spatial representation of land cover is shown in Figure 18.

Table 3: LPNNRD Land Cover Change (2009 – 2023)

Land Cover	2009	2023	Ac Change	% Change	2009 Coverage	2023 Coverage
Row Crop	716,285.3	769,604.6	53,319.3	7.4%	69.5%	74.7%
Alfalfa/Hay	19,640.1	34,722.4	15,082.3	76.8%	1.9%	3.4%
Developed	55,475.7	58,863.9	3,388.2	6.1%	5.4%	5.7%
Grass/pasture	179,834.1	95,315.4	-84,518.7	-47.0%	17.5%	9.2%
Forest	33,010.9	35,942.7	2,931.8	8.9%	3.2%	3.5%
Open Water	17,666.4	19,698.6	2,032.2	11.5%	1.7%	1.9%
Wetlands	8,556.2	16,320.7	7,764.5	90.7%	0.8%	1.6%

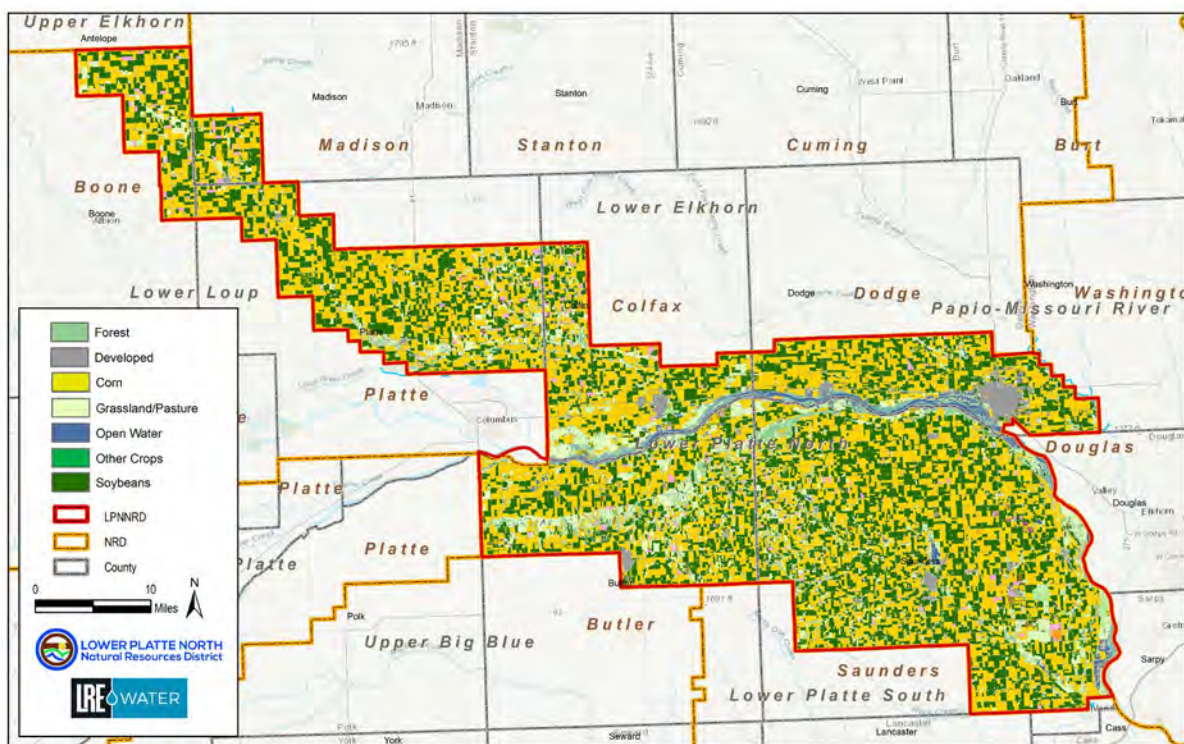


Figure 18: 2023 Land Cover

As the total number of acres harvested increases, the following occurs:

1. The number of acres of permanent cover decrease.
2. The number of acres more susceptible to erosion and runoff increases.
3. The usage of fertilizer, herbicides, pesticides, etc. increases.
4. The potential for ground and surface water degradation increases.
5. The use of high-capacity wells for irrigation increases demand on the aquifers and surface water resources.

2.11 POPULATION – ECONOMIC BASE

The economic base for LPNNRD communities varies, but generally includes agriculture, manufacturing, and services. Many of the communities rely heavily on agriculture, including crop production (corn, soybeans) and livestock farming. The City of Fremont, the largest community, has a diverse industrial base with food processing, metal fabrication, and other manufacturing sectors. Tourism and recreation are also available, with multiple state and locally operated lakes open to the public, along with use of the Platte River for open water recreation.

The total population of the LPNNRD is estimated at 65,447 (NARD, 2024) with approximately 49,860 within incorporated communities, or approximately 76 percent. Most of these residents in the rural areas are relying on private drinking water wells. A breakdown of population for the 28 LPNNRD communities is shown in Table 4.

Table 4: Population of Incorporated Places (1990 – 2025)

Village/City	1990	2000	2010	2020	Projected Population 2025
Yutan	1,100	1,216	1,174	1,308	1,350
Weston	310	310	324	335	340
Wahoo	3,700	3,942	4,508	4,509	4,600
Prague	340	346	303	285	290
Morse Bluff	130	134	135	135	140
Memphis	110	106	114	114	120
Mead	580	564	569	617	630
Malmo	120	109	120	120	125
Leshara	115	112	112	112	115
Ithaca	150	168	148	148	150
Colon	140	138	110	110	115
Cedar Bluffs	630	615	610	610	620
Schuyler	5,200	5,371	6,211	6,547	6,700
Rogers	95	95	95	95	100
Richland	75	73	73	73	75
North Bend	1,180	1,213	1,177	1,241	1,300
Inglewood	390	382	325	325	330
Fremont	24,500	25,174	26,397	27,141	27,500
Octavia	125	127	127	127	130
Linwood	88	88	88	88	90
David City	2,550	2,597	2,906	2,995	3,050
Bruno	110	112	99	99	100
Bellwood	440	446	435	435	440
Abie	110	108	69	69	70
Newman Grove	790	797	721	721	730
Tarnov	65	63	46	46	50

Village/City	1990	2000	2010	2020	Projected Population 2025
Platte Center	340	336	336	336	340
Lindsay	320	321	255	255	260
TOTALS	43,803	45,063	47,587	48,996	49,860

Source: Statistical Atlas of the U.S.

Information on industrial activity demonstrates a variety of industrial types present in the District that includes grain processing, alfalfa products, concrete products, equipment manufacturing, fiberglass manufacturing, irrigation equipment manufacturing, sand and gravel mining, steel fabrication, confined animal feeding operations (swine, beef, and chickens), packing plants, among many others. This industrial array also yields a diversity of water needs and waste treatment problems. These needs and problems may have a degrading effect on both ground and surface water quality and quantity if not properly addressed.

2.12 SURFACE WATER

The LPNNRD is recognized by its northwest boundary consisting of the Shell Creek watershed extending from the cities of Newman Grove to Schuyler, where it meets the Platte River. Other significant streams include Elm Creek, Loseke Creek, Lost Creek, Skull Creek, and Wahoo Creek and its tributaries including Sand Creek, Silver Creek, and Cottonwood Creek (Figure 19).

Outside of the Platte River, most of the other perennial streams do not support floating or active recreational uses. Flow through this region of the Platte River is a combination of the Upper Platte, the Loup, and the Elkhorn Rivers. Flow in the Platte River can range from no flow to overbank flows. The data (for 51 years up to 1995 as listed in the 1995 GWMP), at the City of Ashland shows the contributions of flow are: Elkhorn River (22 percent), Loup River (48 percent), upper Platte River (28 percent) and tributaries and valley groundwater inflow (2 percent). The annual and seasonal percentages of contribution vary extensively and are dependent upon the level of precipitation or runoff from snowmelt within the areas of influence. As precipitation influences streamflow, dry periods likewise influence streamflow and the manner of loss and gain to groundwater areas is often linked with streamflow volume.

Most of the streams receive baseflow from groundwater seepage to help maintain stream levels during dry periods. However, during heavy rain events, streams become 'flashy' and experience rapid increases in flow and water levels due to surface water runoff.

Surface water rights are managed by NeDNR. As of 2025, there are a total of 154 active surface water diversion points across the LPNNRD with a record of 10,163 acres of irrigated crops utilizing surface water (NeDNR, 2025a).

The Platte River's role in recharging groundwater by induced pumping and during periods of overbank flow within portions the LPNNRD is vital. Wellfields along the Platte River are crucial for supplying water to a significant portion of Nebraska's population, including water supplies for the City of Lincoln Water System (296,000 customers) (City of Lincoln, 2024) and Metropolitan Utilities District (600,000 customers) (MUD, 2024). The importance of this water source, managing the balance between groundwater recharge and surface water flow is essential. This involves monitoring water quality,

managing water withdraws, water rights, and ensuring sustainable practices to maintain the health of the aquifer and the river system.

There are a total of seven stream gages, managed USGS, within the LPNDR, including one in progress. The location and station name for each of the gage stations is shown in Table 6 with locations in Figure 19. Historical stream flow hydrographs can be found in Attachment A. Statistics from the USGS gage stations provide an idea of the volume of water, and variation in flow events, within Shell Creek, Wahoo Creek, and Platte River.

Table 5: LPNDR Steam Gage Information

Station Number	Station Name	General Location
06795500	Shell Creek near Columbus	122nd Ave - 4 miles NE of Lake Babcock
06796000	Platte River at North Bend	State HWY 79 - 0.5 miles S of North Bend
06796500	Platte River near Leshara	State HWY 64 west of Valley
06804000	Wahoo Creek at Ithaca	CRG - 1 mile S of Ithaca
06804700	Wahoo Creek at Ashland	State HWY 63 - 0.5 miles N of Ashland
06801000	Platte River near Ashland	At HWY 6
06795050	Shell Creek near Platte Center	In Progress

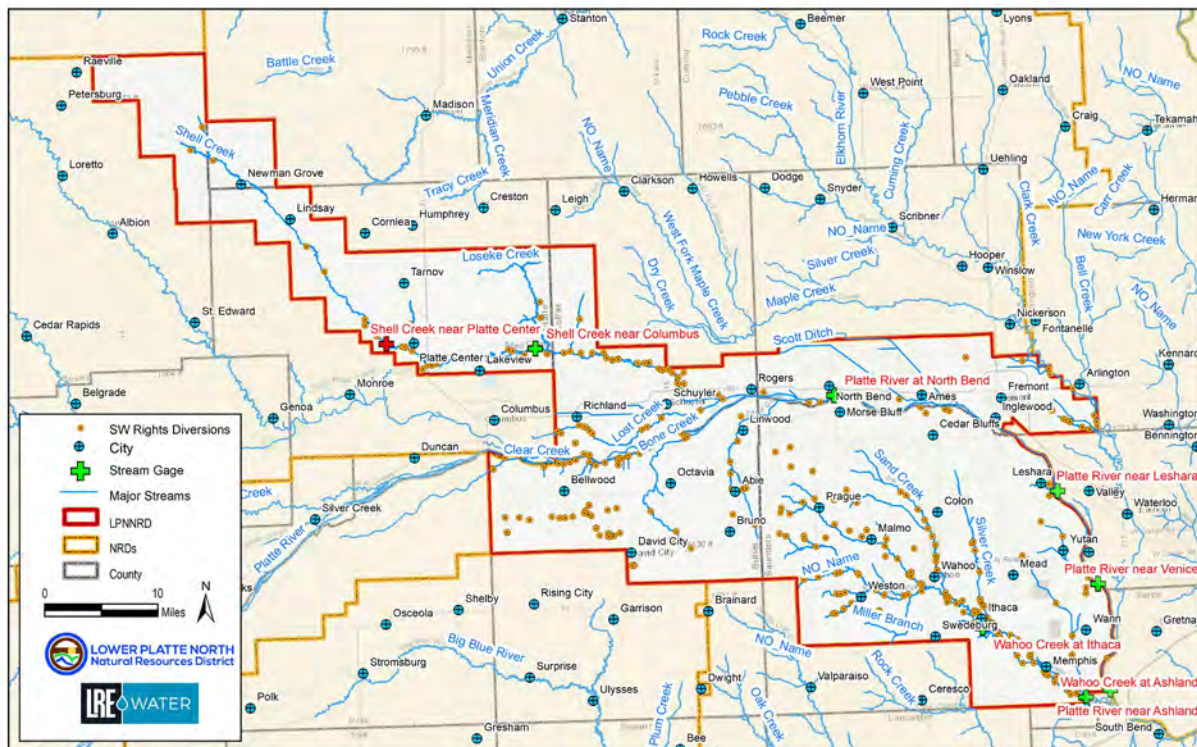


Figure 19: Major River Systems, Stream Gages and Diversion Points

2.13 WELLS AND TEST HOLES

The primary volumetric uses of groundwater in the District are for irrigation and municipal water needs, as shown in Figure 19. Groundwater is the principal source of supply for public drinking water systems, with all public water supplies deriving their supply from these sources. The cities of Lincoln, Omaha, and Fremont have extensive wellfields along the Platte River. Although the City of Lincoln is not located in the LPNNRD, a significant portion of its wellfield for public water supply is situated along the Platte River north of the City of Ashland.

The current use rate for the City of Lincoln's wellfield averages 39.4 million gallons per day (mgd) but can reach up to 64 mgd during the summer months (LWS, 2020). This volume, combined with the demand from irrigation and other public and private users within the District, underscores the importance of both the quantity and quality of groundwater for continued and sustained development. While community water use is reported annually as part of the IMP implementation, the development of irrigation wells serves as an indicator of the majority of the aquifer use, as shown in Figure 20.

The UNL-CSD's drilling program and has drilled 6,000 test holes throughout the state since 1930. Geologic material from these sites is preserved at the CSD Geological Sample Repository. This data is maintained by UNL-CSD and made available to the public for research, well siting, aquifer mapping, and much more. There are 151 UNL-CSD test holes within the LPNNRD, and another 136 within 5 miles of the LPNNRD boundary, as shown in Figure 21.

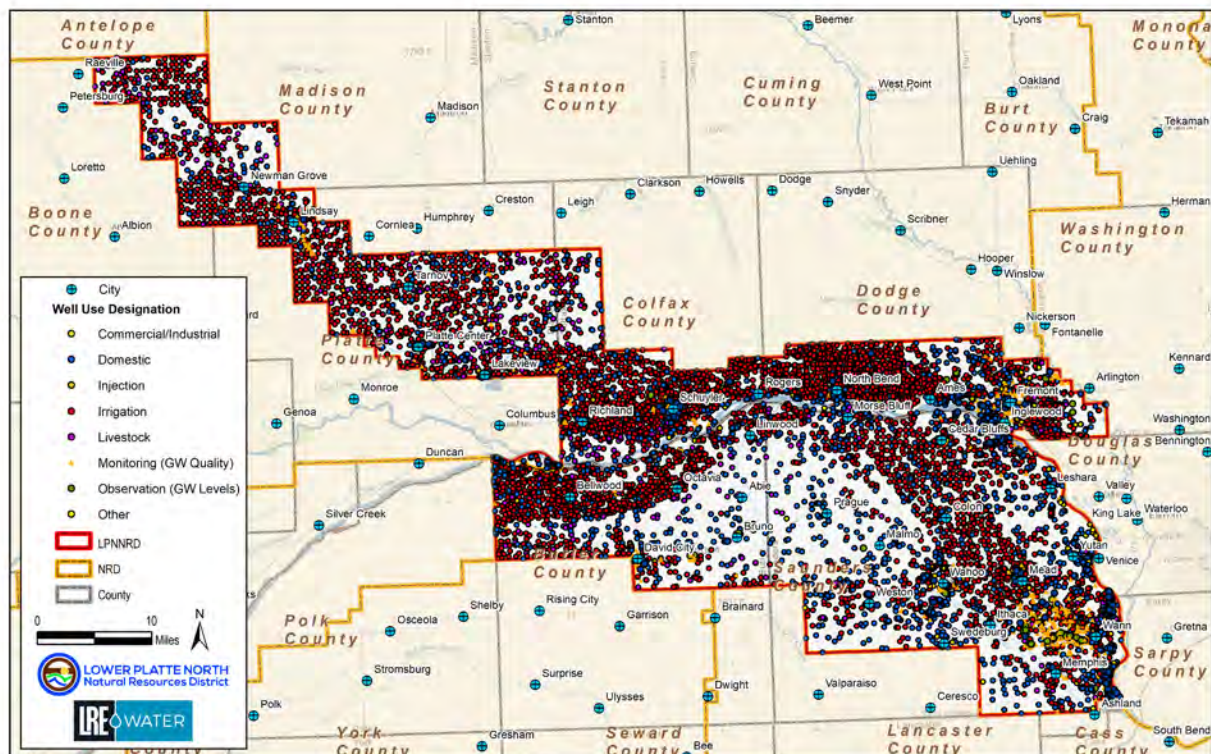


Figure 20: Registered Active Wells in the LPNNRD

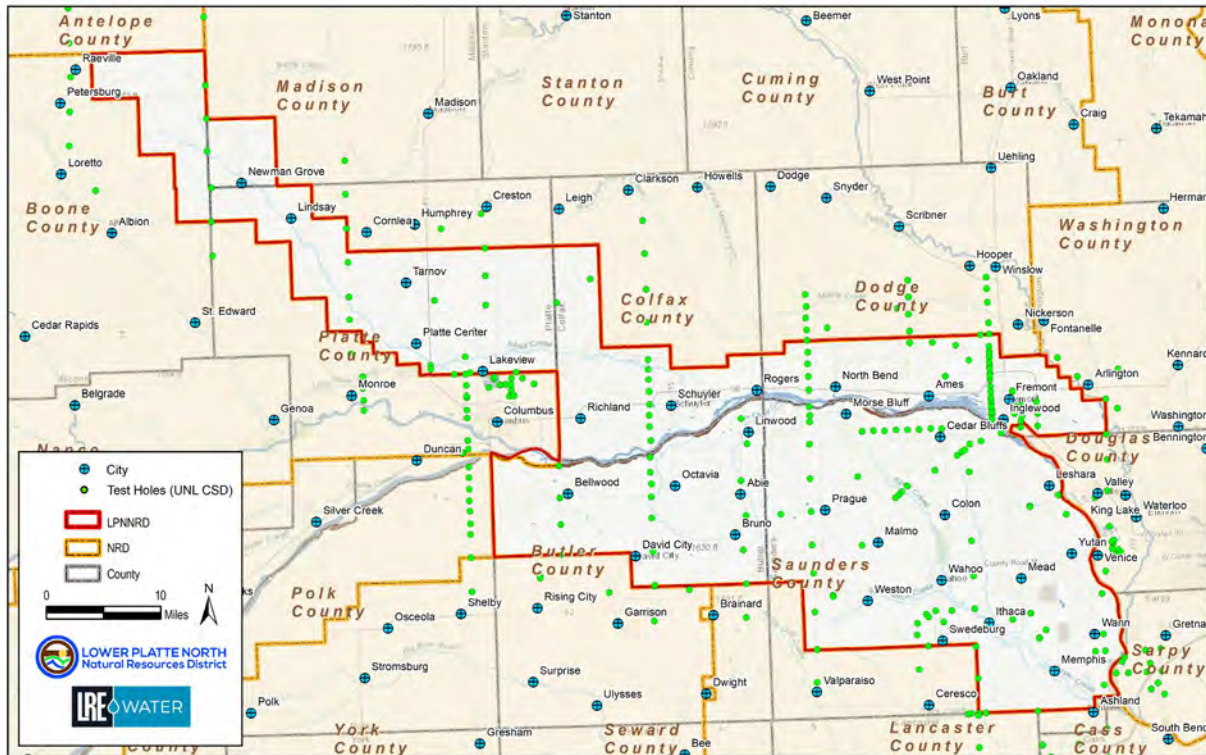


Figure 21: Test Holes within 5-miles of LPNNRD

2.14 PARTNERS AND PROGRAMS

The LPNNRD commonly works with a wide-array of partners in managing water resources. A summary of the major partners are listed below:

U.S. Geologic Survey (USGS)

The Nebraska Water Science Center, a organization of the USGS, commonly partners with NRDs to provide reliable, impartial, and foundational data and scientific analysis to support a wide-variety of groundwater and surface water projects. The USGS is responsible for the maintenance of the five stream gages in the LPNNRD.

Nebraska Department of Environment and Energy (NDEE)¹

The NDEE is responsible for protecting and improving human health, the environment, and energy resources. Primary responsibilities include environmental protection of air quality, water quality, land and waste management, emergency response to spills, petroleum remediation, climate change, assistance to agricultural practices, and energy resources.

The NDEE maintains the Nebraska Groundwater Quality Clearinghouse, a one-stop location for a wide-variety of water quality data that is strongly supported by NRDs. The Source Water Protection Program

¹ As of July 1, 2025, NDEE and NeDNR merged and are referred to as the Nebraska Department of Water, Energy, and Environment (NeDWEE)

provides funding and is utilized to support the protection and sustainability of public water systems and the WHP program. Other programs related to groundwater include Underground Injection Control, Onsite Wastewater Compliance, Agricultural Permitting, and the National Pollution Discharge Elimination System. NDEE also provides Section 319 funding including support of projects addressing nitrate leaching to groundwater.

Nebraska Department of Natural Resources (NeDNR)²

The NeDNR is responsible for surface water, groundwater, floodplain management, dam safety, natural resources planning, water planning and integrated management, storage of natural resources and related data, and administration of State funds (NeDNR, 2025b). The NeDNR is a regular partner with the NRDs and is currently working with the LPNNRD on implementation and updates to the IMP. The NeDNR is responsible for the maintaining the registered well database, registering wells, providing GIS data, and maintaining stream gages. They also administer multiple funding programs.

University of Nebraska – Lincoln Extension

The UNL Extension provides education and outreach, and is spearheading a statewide initiative to enhance collaboration among project partners to tackle health concerns related to contamination of water resources.

University of Nebraska – Conservation and Survey Division (UNL-CSD)

The UNL-CSD serves as the natural resources component of the School of Natural Resources. Over time, UNL-CSD has partnered with the LPNNRD on a variety of projects aimed at installing dedicated monitoring wells and analyzing AEM data.

Eastern Nebraska Water Resources Assessment (ENWRA)

The ENWRA started in 2006 with six NRDs collaborating on the development of a geologic framework and water budget for the previously glaciated portion of eastern Nebraska (ENWRA, 2024). This group has been responsible for the collection of AEM surveys across a large area of Eastern Nebraska, including most of the LPNNRD.

Neighboring NRDs

Through efforts such as the Lower Platte River Basin Coalition, the LPNNRD regularly collaborates with neighboring NRDs on regional and local water management efforts. The LPNNRD is also a partner of the Lower Platte River Drought Contingency Plan and is working with NeDNR, LPSNRD and PMRNRD on development of a subregional groundwater model for the Lower Platte River.

Cities and Villages

The LPNNRD regularly collaborates with Nebraska cities and villages to manage and protect natural resources effectively including flood management, water quality programs, stormwater management, education outreach, recreation projects, and grant and funding assistance. The LPNNRD will assist

² As of July 1, 2025, NDEE and NeDNR merged and are referred to as the Nebraska Department of Water, Energy, and Environment (NeDWEE)

communities with development of WHP plans, source water protection projects, and engage with communities to site new public water supply wells.

Counties

The LPNNRD collaborates with Counties on flood reduction and ice jam management, groundwater management, education programs at county fairs, and engagement of special projects on a county-wide basis (SQS areas).

NARD

The NARD serves as the trade association for Nebraska's 23 NRDs. Some of the basic functions include coordination and support, governmental representation, education and outreach, resource sharing, and policy development.

Other Organizations

Local agronomists, cooperatives, and other partners support groundwater protection through nutrient management guidance, promotion of BMPs, and outreach that encourages sustainable farming practices across the LPNNRD.

2.15 ENVIRONMENTAL EDUCATION AND INFORMATION

The LPNNRD offers a variety of hands-on activities, classroom presentations, field trip opportunities, career exploration and more for young and old to learn more about the environment and our natural resources. There are two full time staff available to implement environmental education programs. All activities are of no cost to the public. Activities offered include:

- Coffee Lakeside and Monthly Educational Program
- Local and Regional Land Judging Contests
- Adult Environmental Education Opportunities
- Field trips to recreation areas and prairies
- Envirothon Field Day at Clint Johannes Education Building at Lake Wanahoo
- Local and regional range judging contest in partnership with area NRDs
- Spring Conservation Sensation – a natural resources field day for local 5th and 6th graders
- Test Your Well events in conjunction with local FFA Chapters
- Scholarships for:
 - Students participating in the Shell Creek Watershed monitoring group
 - Nebraska Association for Conservation and Environmental Education (NACEE) – support for teachers and other educators who are interested in science as it relates to natural resources.
 - Ag in the Classroom – incorporation of program materials into the classroom
 - Natural Resources Grant – to assist local high school students monetarily in a natural resources-based project within their community.

3 GROUNDWATER QUANTITY

3.1 GROUNDWATER LEVELS AND EXISTING WELLS

Most of the LPNNRD has not seen significant declines according to the UNL-CSD's annual 'Groundwater-Level Changes in Nebraska – Predevelopment (mid-1950s) to Spring 2023' dataset, shown in Figure 22. It is important to note that 2022 and 2023 were significantly dry years for the region. The primary area of concern is within Colfax County, where groundwater levels have declined 30 to 40 feet near the Village of Leigh where the District borders the LENRD. Other areas around the Village Bruno in Butler County also have documented declines. On the other hand, the far northwest corner of the District in the Shell Creek region has seen increasing level up to 30 feet near the Village of Petersburg and toward the Sandhills.

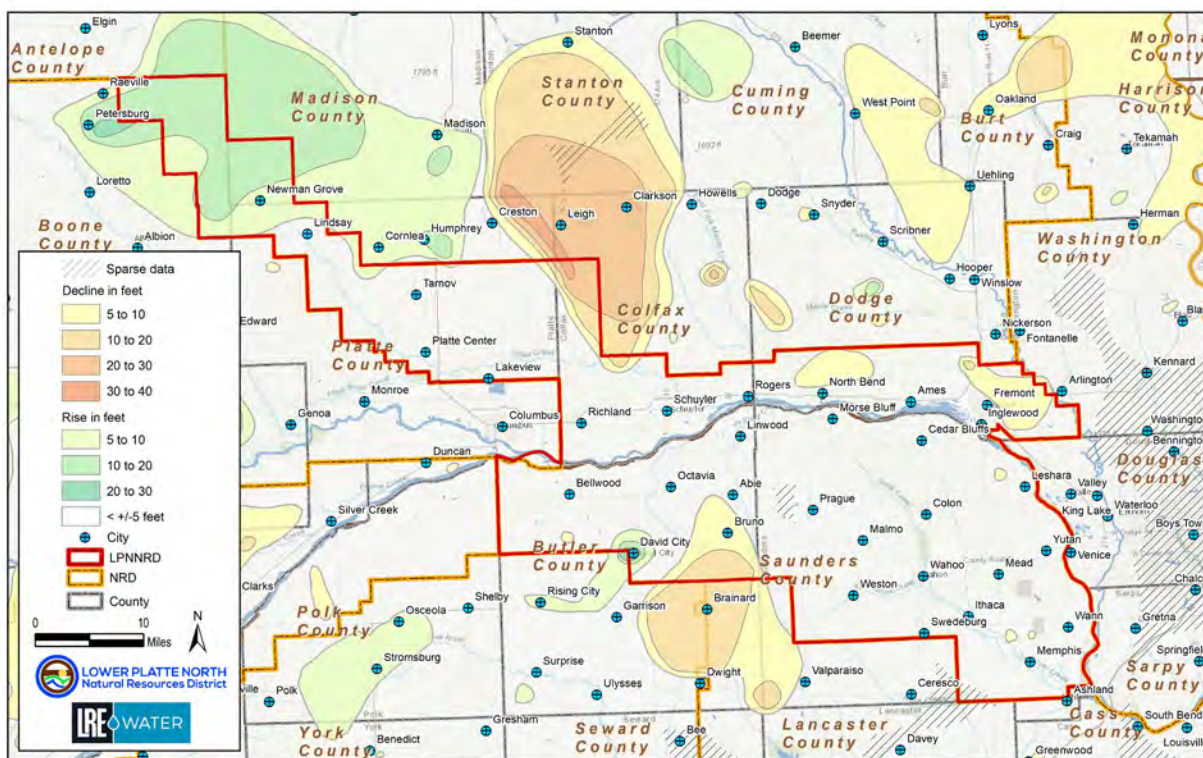


Figure 22: Groundwater-Level Changes in LPNNRD, Predevelopment to Spring 2023

Each spring and fall, LPNNRD staff measure static water levels from approximately 215 wells, most of which are utilized for high-capacity irrigation. The staff also manage a dedicated observation well network with 62 sites, each with a pressure transducer and logger with telemetry, providing real-time data to the staff and public through the District's website. The data from the spring water levels are utilized annually to review changes in water levels and are reviewed against the triggers set for Groundwater Management Phase Areas. Locations of the spring/fall static wells and dedicated network are shown in Figure 23.

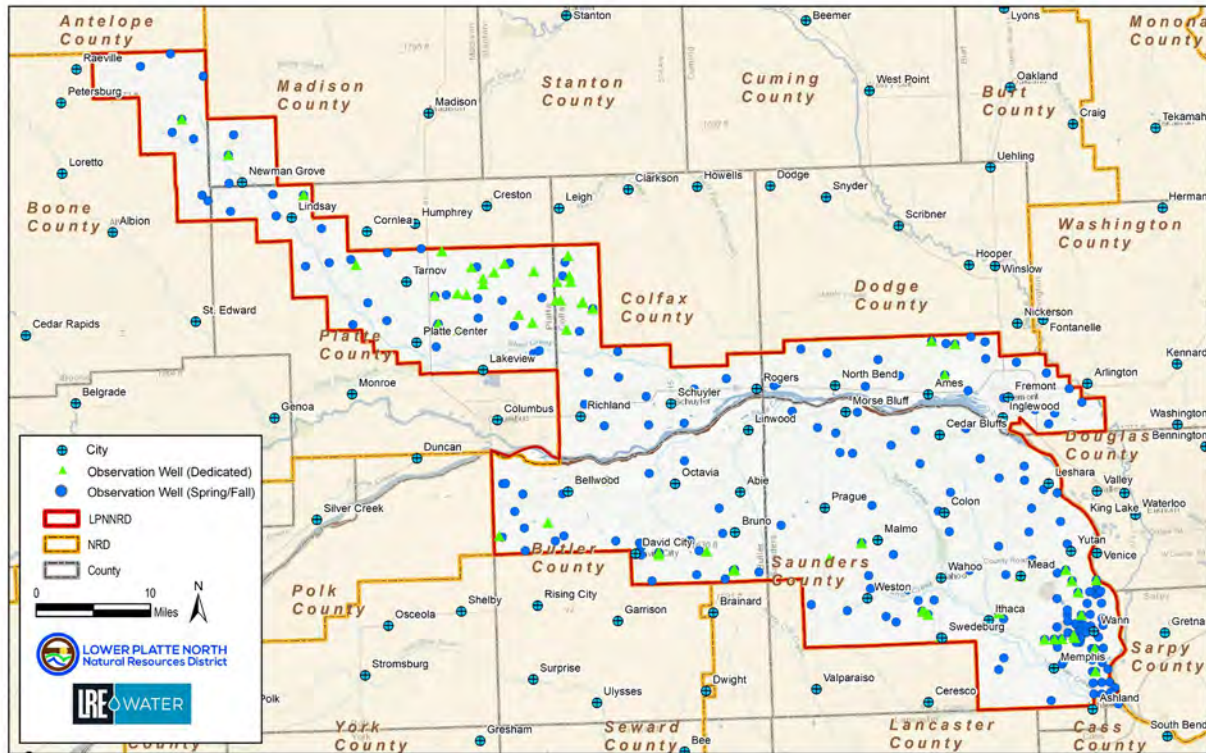


Figure 23: Observation Well Network

The depth to groundwater shown in Figure 24 was produced as part of the Assessment (LRE, 2023) and shows the depth to groundwater, in feet below ground surface. This elevation was determined by subtracting the ground surface elevation shown in Figure 10 from the groundwater surface elevations created during the Assessment. Water elevations were determined by reviewing all available geologic logs and test holes and utilizing static water level data at the time the well was drilled. Depth to water varies from near the surface to 20 feet deep along the Platte River to more than 250 feet below grade in the Shell Creek and Upland regions.

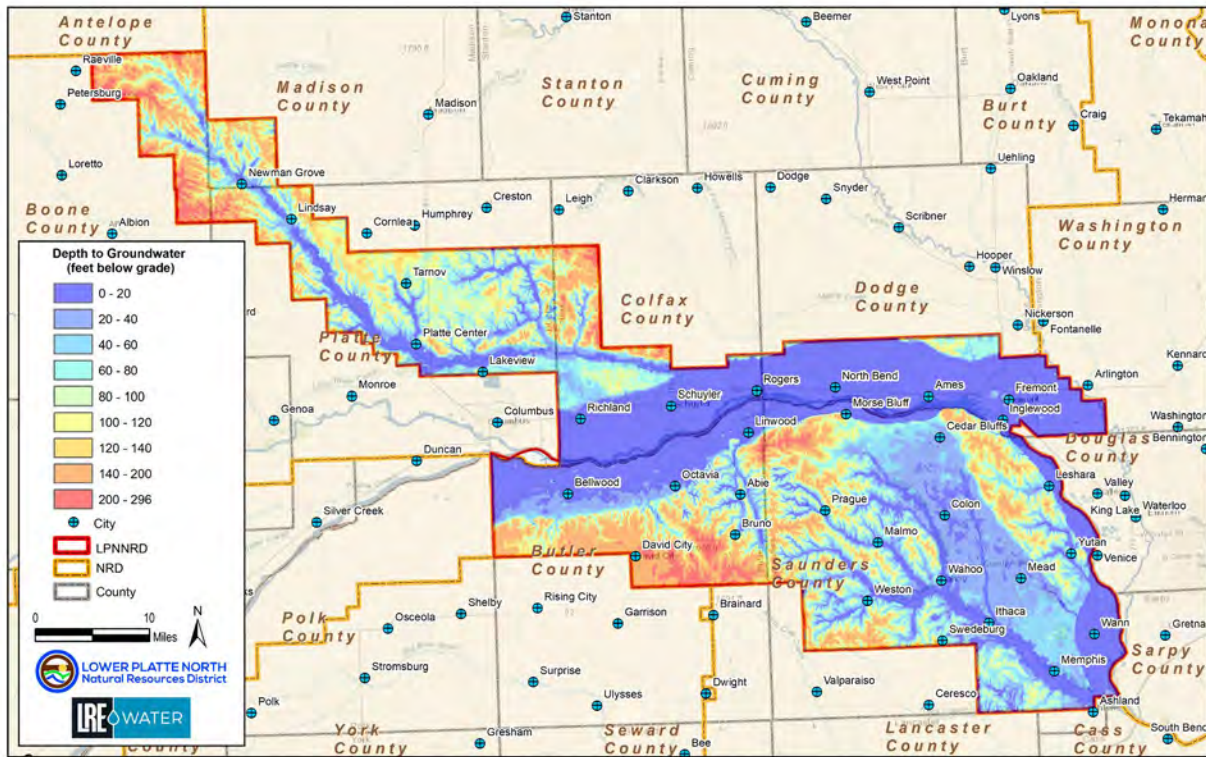


Figure 24: Depth to Groundwater

3.1.1 Sub-irrigation Potential

Sub-irrigation occurs naturally when a high groundwater table provides moisture to plant roots. There is significant potential for sub-irrigation within the LPNNRD, primarily due to the Platte River valley. The LPNNRD Rules and Regulations has defined sub-irrigation as, “the natural occurrence of a groundwater table within the root zone of agricultural vegetation, not exceeding ten feet below the surface of the ground”. Currently, the LPNNRD asks producers who plan to introduce new acres utilizing sub-irrigation to contact staff, but the LPNNRD is not currently requiring annual reports from agricultural producers who benefit from sub-irrigation.

The Hydrogeologic Assessment (LRE, 2023) was used to identify areas within the LPNNRD that include all areas that have groundwater within 10 feet or less, which totals over 228,000 acres, or over 22 percent, mostly due to the presence of the Lower Platte River valley. The depth of groundwater was determined by subtracting the groundwater elevation surface from the Digital Elevation Model, as shown in Figure 25.

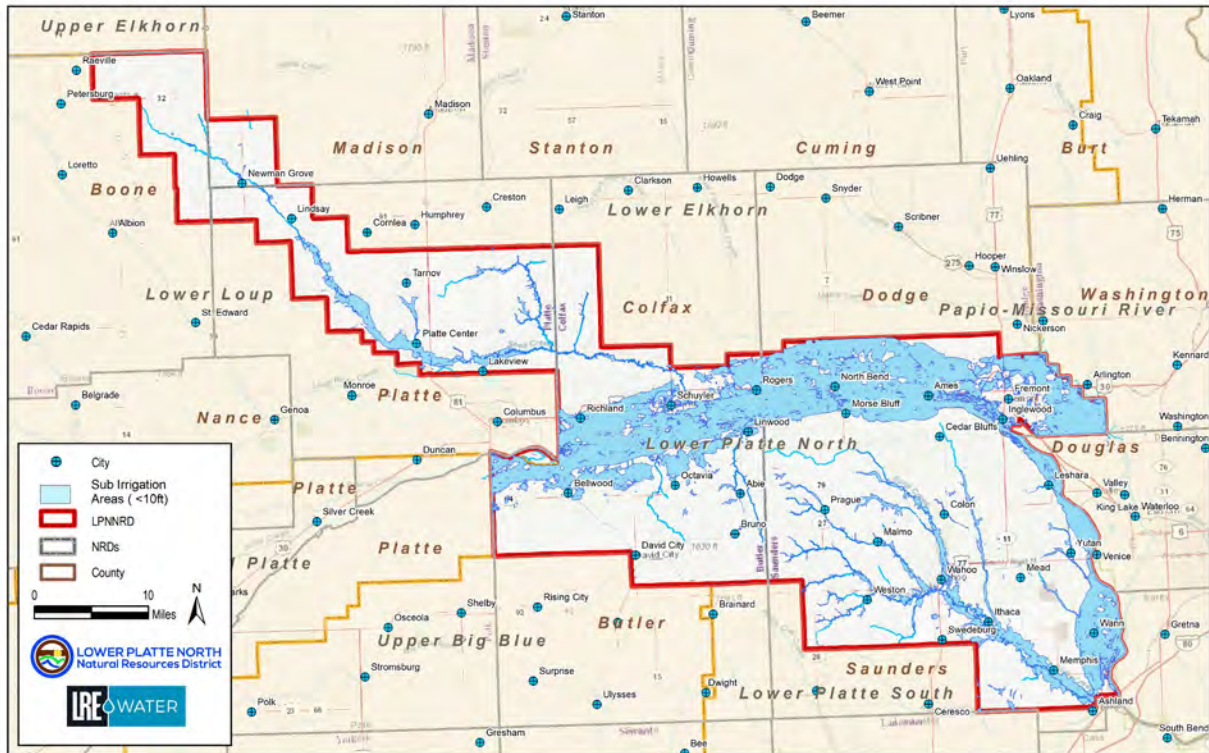


Figure 25: Potential Areas for Sub-irrigation

3.2 GROUNDWATER RECHARGE

Local precipitation serves as a major recharge source for aquifers in the LPNDR, complemented by the Platte River. The river receives significant runoff from Rocky Mountain snowmelt and baseflow contributions from major tributaries originating in the Nebraska Sandhills, facilitating natural infiltration. Its sand and gravel substrate enhances percolation into underlying aquifers, helping to sustain groundwater levels in the LPNDR. Additionally, groundwater from western regions, including the Sandhills, migrates eastward through the High Plains Aquifer system, contributing to baseflow in numerous rivers and streams. These hydrologically connected areas—particularly Shell Creek, Platte Valley, and Todd Valley aquifers—have been documented by the NeDNR.

Artificial groundwater recharge potential refers to the capacity of a specific area to effectively increase the amount of water entering an aquifer through human-controlled methods, which would require importing water or retiming water to make a project practical. This process, known as artificial recharge, involved techniques such as:

- **Surface spreading:** Using canals, infiltration basins, or ponds to direct water across the land surface.
- **Injection wells:** Directly injecting water into the subsurface.
- **Irrigation methods:** Recharge from agricultural practices involving furrow or sprinkler systems to enhance infiltration.

Using the GIS data resources available from the Assessment (LRE, 2023), a representation of artificial recharge was created using two key inputs, the depth to groundwater and unsaturated clay thickness above the Principle Aquifer. Using GIS, a qualitative model was created from lowest potential to very high potential, as shown in Figure 26. As expected, the Platte Valley and Todd Valley regions display a high to very high potential, whereas other areas within the Shell Creek and Upland regions tend to be limited to area along active waterways. This map is not necessarily representative of injection well methods. This map also provides a general representation of areas that are more likely to naturally recharge groundwater.

Artificial recharge potential is also closely linked to groundwater risk, as these areas are also prone to infiltration of contaminants, such as nitrate, into the aquifer, potentially degrading water quality. This is especially critical in areas where the recharge water might carry pollutants from agricultural runoff, industrial processes, or urban runoff. Treatment wetlands could be a consideration to improve water quality and provide groundwater recharge in the highly vulnerable locations.

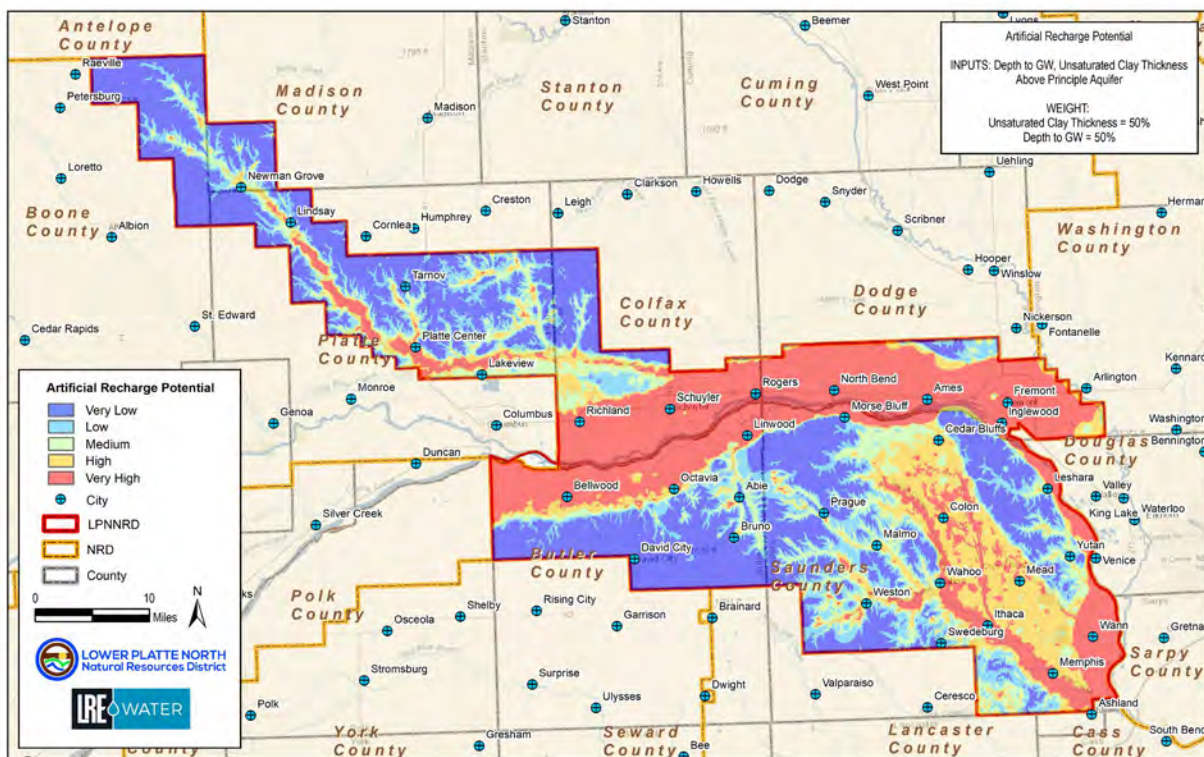


Figure 26: Artificial Recharge Potential

3.3 WATER USE AND DEMAND

The LPNNRD reports annually on water demand as part of the LPRCA Basin Water Management Plan Annual Report. This report is available by contacting the LPNNRD office. Highlights of the reporting on water use include the following:

1. Collection of data from over 1,300 flow meters, of which nearly 1,200 are on irrigation systems.
2. Recording of water use within SQS#1 (Bulter/Saunders) and SQS#2 (Platte/Colfax).
3. Continuous updating and tracking of nearly 392,500 certified irrigated acres (as of 2024).
4. Tracking of municipal and industrial groundwater uses.
5. Data collection and monitoring of new groundwater consumptive uses (agricultural, municipal, industrial).
6. Tracking of acres for groundwater consumptive uses (agricultural, municipal, industrial).
7. Creation of the 3-District Model, an ongoing effort with PMRNRD, LPSNRD, and NeDNR to utilize the 3-D AEM Framework created for the participating NRDs.
8. Working with the Coalition to track new stream depletion accounting (depletions and accretions).

The LPNNRD requires public water suppliers to report annual total water use as part of the LPRCA reporting. Table 6 displays the 2023 reported value, outside of Memphis, Bellwood, and Ithaca, which all have 2022 pumping shown. The Village of Bruno is connected to the City of David City and the Village of Colon receive water from the City of Wahoo. Numbers reported by the Lincoln Water System (LWS) and Metropolitan Utilities District (MUD), which serves Omaha and surrounding communities, including only pumping from wellfields located within the LPNNRD, each in eastern Saunders County. Table displays the same information, but without the LWS and MUD wellfields.

Table 6: Annual Municipal Water Usage All Communities

Municipality	Gallons Pumped	Percent of Total
Newman Grove	32,205,200	0.15%
North Bend	64,260,000	0.30%
Wahoo*	269,693,307	1.27%
Abie	2,576,600	0.01%
Lindsay	65,992,600	0.31%
Malmo	1,980,000	0.01%
Mead	20,280,316	0.10%
Morse Bluff	2,183,000	0.01%
Platte Center	19,348,203	0.09%
Weston	13,948,027	0.07%
Yutan	49,132,000	0.23%
Fremont	3,654,341,000	17.26%
David City*	163,436,066	0.77%
Schuyler	376,856,000	1.78%
LWS (Lincoln)	5,841,820,110	27.59%
Cedar Bluffs	25,147,232	0.12%

Municipality	Gallons Pumped	Percent of Total
MUD (Omaha)	10,334,804,000	48.80%
Ashland	190,022,000	0.90%
Prague	11,420,000	0.05%
Memphis	9,524,000	0.04%
Bellwood	19,807,000	0.09%
Ithaca	4,000,000	0.02%
Rogers	4,006,000	0.02%
TOTAL	21,176,782,661	100.00%

Table 7: Annual Municipal Water Usage Without LWS and MUD

Municipality	Gallons Pumped	Percent of Total
Newman Grove	32,205,200	0.64%
North Bend	64,260,000	1.29%
Wahoo*	269,693,307	5.39%
Abie	2,576,600	0.05%
Lindsay	5,992,600	1.32%
Malmo	1,980,000	0.04%
Mead	20,280,316	0.41%
Morse Bluff	2,183,000	0.04%
Platte Center	19,348,203	0.39%
Weston	13,948,027	0.28%
Yutan	49,132,000	0.98%
Fremont	3,654,341,000	73.08%
David City*	63,436,066	3.27%
Schuyler	76,856,000	7.54%
Cedar Bluffs	25,147,232	0.50%
Ashland	90,022,000	3.80%
Prague	1,420,000	0.23%
Memphis	9,524,000	0.19%
Bellwood	19,807,000	0.40%
Ithaca	4,000,000	0.08%
Rogers	4,006,000	0.08%
	5,000,158,551	100.00%

3.3.1 Registered Wells

One method to generally understand water demand is through an evaluation of registered wells, as shown in Figure 27. In total, there are 13,025 registered wells in the LPNNRD (including PWS wells) in 2024. This total does not account for the likely thousands of unregistered wells constructed before

registration was required for all domestic wells in 1993. Of this total, 9,711 are active, and 47 percent are used for irrigation. Domestic well use is the second most common at 28 percent, as seen in Table 7. The ‘other’ category includes injection, other, and recovery wells. The majority of inactive wells within the database were decommissioned wells.

Table 8: Active Registered Well Distribution

TYPE	ACTIVE	PERCENT
Irrigation	4,611	47%
Domestic	2,716	28%
Livestock	295	3%
Observation	211	2%
Monitoring	1,156	12%
Commercial/Industrial	71	1%
Ground Heat/Heat Pump	170	2%
Public Supply Wells	188	2%
Other	293	3%
TOTAL	9,711	100%

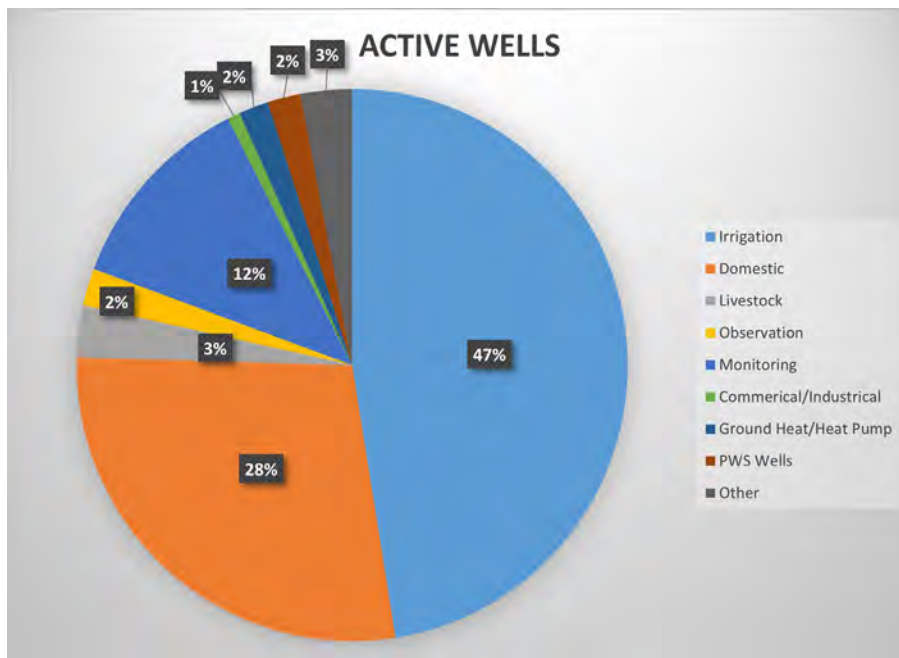


Figure 27: Percent of NeDNR Active Registered Wells

3.4 CERTIFIED IRRIGATED ACRES

The LPNNRD began certifying irrigated acres in the spring of 2010 as governed by the Nebraska Groundwater Management and Protection Act, 46-701. This statute provides the legal framework for managing and protection groundwater resources, including the certification of irrigated acres to ensure sustainable water use. The certification process helps catalog all existing irrigated acres and aligns

records from the LPNNRD, County Assessor, and the Farm Service Agency. This process helps ensure that irrigation practices comply with local and state water management regulations and helps manage and allocate water resources more effectively to prevent overuse and ensure sustainability. The certified irrigated acres as of January 2025 are shown in Figure 28.

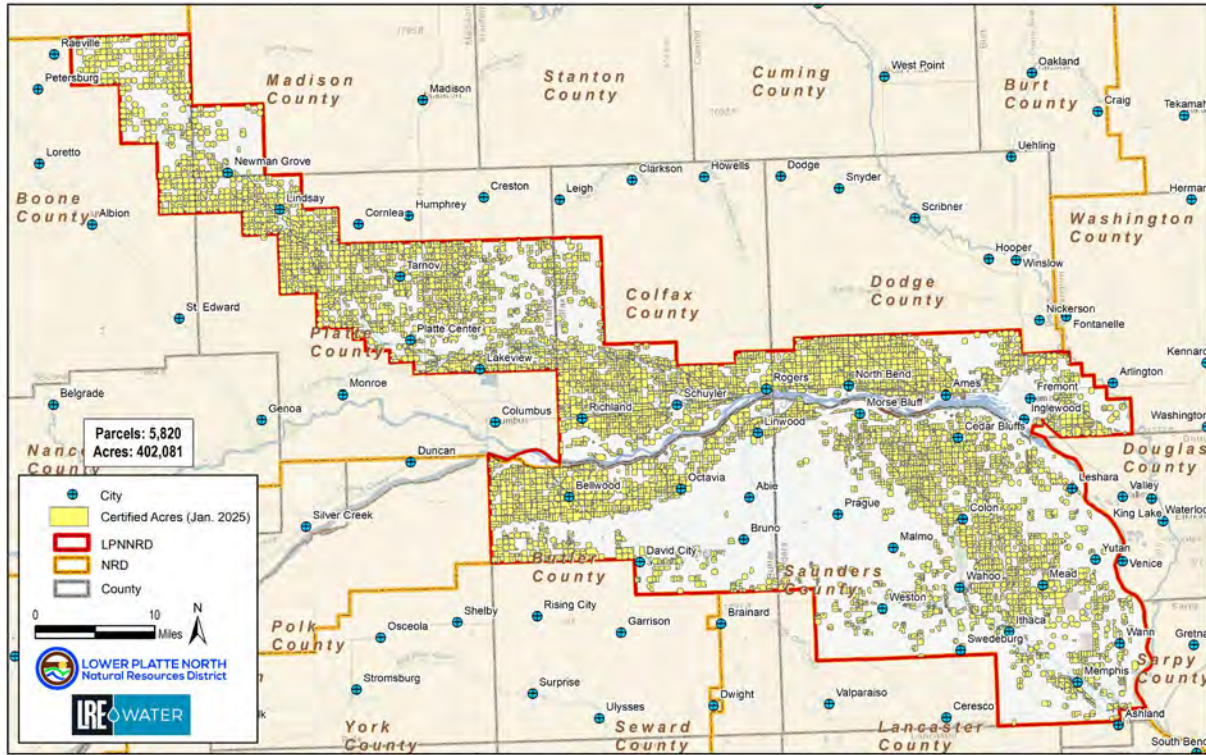


Figure 28: Certified Irrigated Acres in the LPNNRD (2024)

4 GROUNDWATER QUALITY

4.1 AQUIFER VULNERABILITY

4.1.1 Nonpoint Source Pollution

Non-point source pollution is generally defined as pollution arising from diffuse sources where no single point of release can be identified. While non-point source pollution can be related to weathering of minerals or soil erosion, human activities are commonly the originator for non-point source groundwater pollution. The diffuse application of fertilizers, pesticides, and herbicides in agricultural operations as well as urban areas account for large areas of land with soils containing these additives. Heavy application of chemicals, coupled with heavy precipitation or irrigation can result in these chemicals leaching to groundwater. Overland flow resulting from runoff can also provide a means of chemical leaching to a groundwater aquifer. In Nebraska, as well as in the LPNNRD, nitrate is the most common non-point source pollutant.

Aquifer vulnerability within the LPNNRD was mapped as part of the Assessment (LRE, 2023) by quantifying the amount of unsaturated clay above the top of the first encountered aquifer at each well or test hole location. The clay thickness values (75% of the model weight) were reclassified into five categories:

- 0 – 5 ft = 5
- 5 – 10 ft = 4
- 10 – 20 ft = 3
- 20 – 40 ft = 2
- > 40 ft = 1

Irrigated row crop agriculture has a high fertilizer input and irrigation accelerates leaching. Therefore, LRE Water included land use (25% weight) and reclassified into two categories with a value of either 1 or 5. For this particular model, irrigated farmland is considered the most vulnerable (a rating of 5), and the remaining land use categories, such as pasture, grassland, alfalfa, and dryland row crop, are considered least vulnerable (ratings of 1). Other potential pollutant sources, such as feedlots, were not included in this model.

The resulting raster layer contains qualitative values that show where the aquifer has more or less potential vulnerability to the downward migration of potential contaminants from activities on the ground surface. This map shows a qualitatively modeled spatial distribution of groundwater vulnerability, from very low to very high, across the LPNNRD Boundary. A “Very Low” potential vulnerability means the aquifer is not likely to receive contaminants from activities on the ground surface. Conversely, a “Very High” potential vulnerability means the aquifer is potentially very susceptible to surface contaminants. The aquifer vulnerability map is shown in Figure 29.

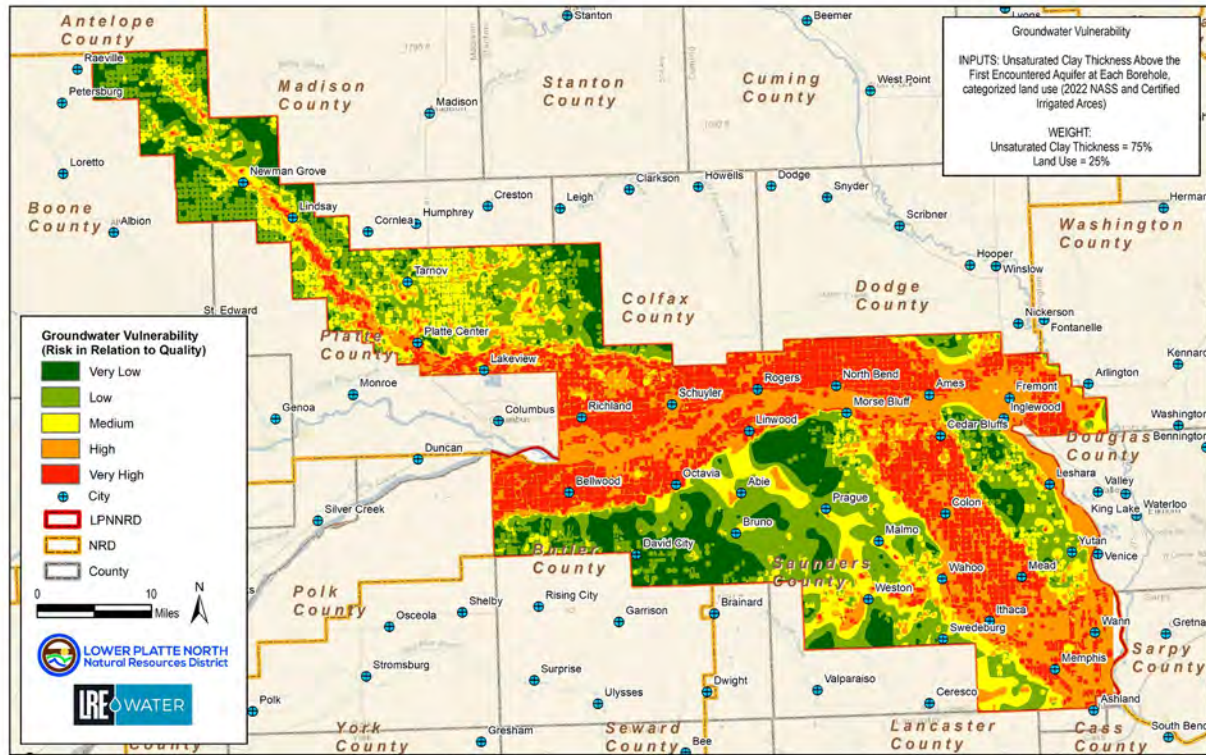


Figure 29: Aquifer Vulnerability

Nitrate can be found in most areas in Nebraska. Sources of nitrate include breakdown of organic material in soils, human or livestock wastes, and chemical fertilizers. When exposed to nitrate levels in excess of the U.S. Environmental Protection Area’s (USEPA) Maximum Contaminant Level (MCL) of 10 mg/L in drinking water, infants younger than about 6 months of age may develop methemoglobinemia or "blue-baby" syndrome. The University of Nebraska Medical Center has also recently begun researching the connection of nitrate in drinking water to various cancers in Nebraska.

To provide an illustration of the most recent nitrate concentrations, data from 2019 through 2023, collected by the LPNDR staff from 537 wells across the District, is shown in Figure 30. Each year, the LPNDR staff collected representative data across the entire District and concentrated sampling in Groundwater Management Areas, as seen within the Richland/Schuyler phase three GWMA. Staff have also been obtaining additional samples throughout the Shell Creek region where concentrations of nitrate have been slowly rising.

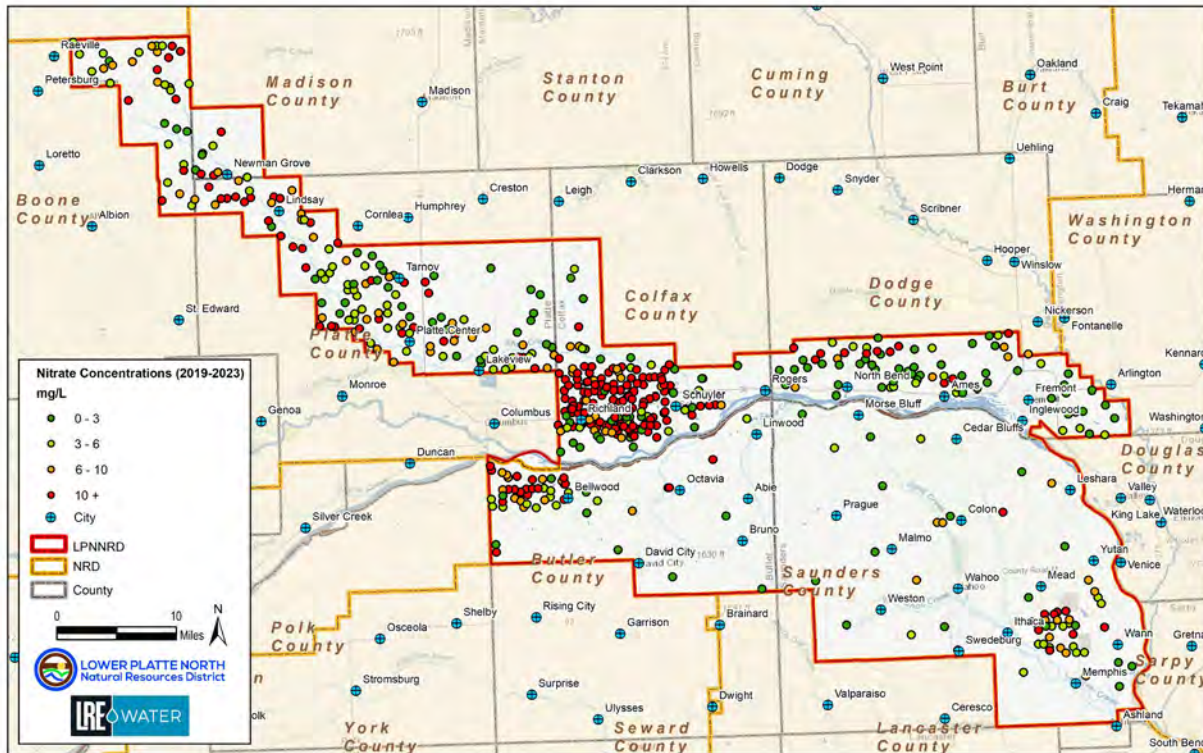


Figure 30: LPNNRD Nitrate Concentrations 2019-2023

4.1.2 Additional Water Quality Monitoring

The LPNNRD conducts a wide variety of additional water quality data, including random sampling of wells for unique circumstances. In the past, sampling included nickel, sodium, selenium, mercury, among others. The LPNNRD can also provide property owners assistance to monitor nitrates and bacteria from private wells.

While nitrate remains the top water quality concern in LPNNRD due to agricultural runoff, other issues like arsenic, iron, uranium, and saltwater intrusion pose growing threats. Arsenic and uranium, both naturally occurring in regional geology, requires focused testing and public outreach—especially in areas like Richland-Schuyler, where uranium levels have exceeded 30 ppb in half of the sampled wells (LPN, 2025). Iron, though often an aesthetic nuisance, can signal redox conditions that mobilize other contaminants. Saltwater intrusion, driven by over-pumping or proximity to saline sources such as the Dakota aquifer, threatens aquifer quality and calls for proactive monitoring and recharge strategies (UNL, 2017). Meanwhile, emerging contaminants like PFAS and pharmaceuticals, though less prevalent, warrant early action through partnerships, education, and hotspot identification. By expanding monitoring, encouraging treatment and management practices, and collaborating with health and research agencies, LPNNRD can address these evolving challenges with foresight and resilience.

Starting in 2001, the Nebraska Legislature passed LB329, which directed the NDEE to report on groundwater quality monitoring in Nebraska (NDEE, 2024). The NRDs are also required (§46-1305) to submit an annual report on water quality to the legislature, which is prepared by NARD annually, and is issued concurrently with NDEE’s annual Nebraska Groundwater Quality Monitoring Report. As a partner, the LPNNRD collects water quality samples from a total of 53 wells district-wide over a four year period,

as shown in Figure 31. This data is part of the Nebraska Groundwater Quality Clearinghouse, which includes an online, interactive database featuring data, maps, well construction details, and statistics (NDEE, 2024). One of the focuses of the statewide network is on pesticides and includes the following:

1. **Metribuzin:** A herbicide used to control broadleaf weeds and grasses.
2. **Methoxychlor:** An insecticide used to control flies, mosquitoes, and other insects.
3. **Hexachlorobenzene:** A fungicide used to treat seeds.
4. **Alachlor:** A herbicide used to control annual grasses and broadleaf weeds.
5. **Butylate:** A herbicide used to control grasses and some broadleaf weeds.
6. **Atrazine:** A herbicide used to prevent pre- and post-emergence broadleaf weeds.
7. **Cyanazine:** A herbicide used to control annual grasses and broadleaf weeds.
8. **Hexachlorocyclopentadiene:** A chemical intermediate used in the production of pesticides.
9. **Propachlor:** A herbicide used to control annual grasses and some broadleaf weeds.
10. **Trifluralin:** A herbicide used to control annual grasses and broadleaf weeds.
11. **Chlorpyrifos:** An insecticide used to control various pests including termites and mosquitoes.
12. **Aldrin:** An insecticide used to control soil pests.
13. **Lindane:** An insecticide used to treat lice and scabies.
14. **Di(2-ethylhexyl)phthalate:** A plasticizer that can be found as a contaminant in the environment.
15. **Dieldrin:** An insecticide used to control soil pests.
16. **Fonofos:** An insecticide used to control soil insects.
17. **Simazine:** A herbicide used to control broadleaf weeds and grasses.
18. **Benzo(a)pyrene:** A polycyclic aromatic hydrocarbon that can be found as a contaminant.
19. **Heptachlor:** An insecticide used to control soil insects.
20. **Heptachlor Epoxide:** A breakdown product of heptachlor.
21. **Total Chlordane:** Refers to the sum of chlordane and its breakdown products.
22. **Endrin:** An insecticide used to control pests on crops.

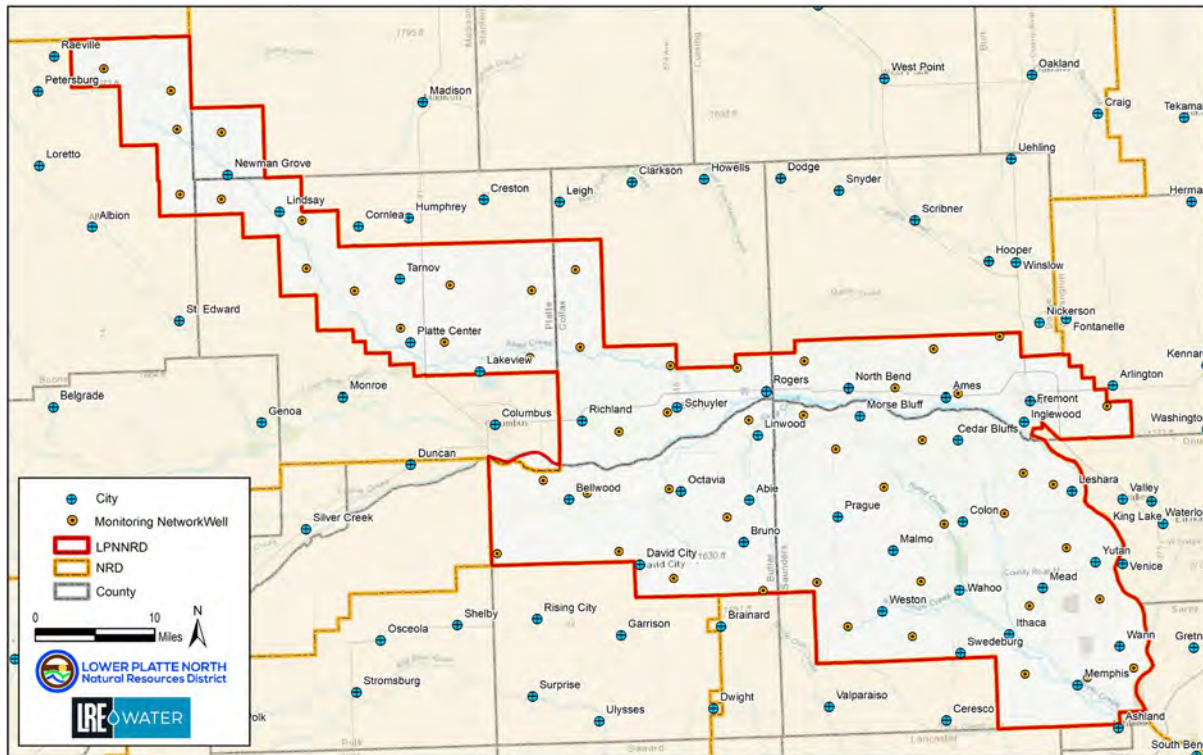


Figure 31: LPNNRD Statewide Water Quality Monitoring Network Wells

4.1.3 Point Source Pollution

Point source pollution generally impacts the quality of the groundwater in localized areas. However, when these sites are located above potential drinking water supplies or are located adjacent to domestic or municipal wells the impact of a spill or leak can affect larger land areas and populations. Even spills that are cleaned up to health-based cleanup goals of a regulatory agency can impact drinking water supplies as human taste thresholds of many chemicals are below the health based "action" levels.

There are numerous manufacturing facilities and petroleum handling facilities, grain bin storage sites, and fertilizer and pesticide storage facilities within the LPNNRD. Although new regulations and generally improved product and waste handling procedures have reduced the chances of a spill or release of contaminants from these type of activities, historically, numerous spills have been documented.

The NDEE holds regulatory authority over substances from point source discharges that can cause or contribute to groundwater contamination. To obtain a permit, they are reviewed by engineering and permitted if they meet minimum design requirements and have no adverse impacts to water quality standards.

The NDEE maintains a permitted facilities database of regulated facilities under their jurisdiction, which are known or suspected to have soil and water contamination. This database includes various categories, such as the National Pollutant Discharge Elimination System (NPDES) program, Integrated Waste Management, Leaking Storage Tanks, Livestock Waste Control, Onsite Wastewater Treatment, Release Assessment, Remedial Action Plan Monitoring, Resource Conservation Recovery, Superfund, SARA Title III, and Underground Injection Control. Some of these facilities could potentially be point

sources of groundwater contamination if they do not maintain full compliance. Additional information on NDEE regulated facilities can be found on an interactive mapping application on their website.

4.2 WELLHEAD PROTECTION AREAS

The NDEE oversees the WHP program, a voluntary initiative that offers financial and technical support to communities with public water suppliers to safeguard water supplies from contamination. Each community water system with a groundwater supply has a designated WHP area, as shown in Figure 32, but few communities have exercised controls to regulate contamination threats within the WHP Area. The WHP area delineates the time-of-travel and the surficial region drawn around a water well or wellfield that supplies a Public Water System (PWS), indicating where contaminants are likely to travel toward and reach the well. Typically, a 20-year time-of-travel is utilized for the WHP Area, while some communities have opted to use the 50-year time-of-travel. The five minimum steps for the WHP Program are shown in Figure 33.

As of 2025, the LPNNRD was supporting WHP plans, well siting assessments, and delineation efforts in the Village of Platte Center and City of Newman Grove, and had recently supported projects for the cities of Ashland, David City, and Wahoo. A summary of WHP plans in the LPNNRD is shown in Table 8.

Table 9: LPNNRD PWS State-Approved WHP Plans

PWS Name	COUNTY	DATA APPROVED
Platte Center	Platte	2025
Newman Grove	Platte/Madison	2025
Wahoo	Saunders	2023 (plan & ordinance)
David City	Butler	2023 (plan & ordinance)
Lindsay	Platte	2015
Fremont	Dodge/Douglas	2010
Woodcliff Water System	Saunders/Dodge	2006
Weston	Saunders	2005
Abie	Butler	2003
North Bend	Dodge	2003
Yutan	Saunders	2003

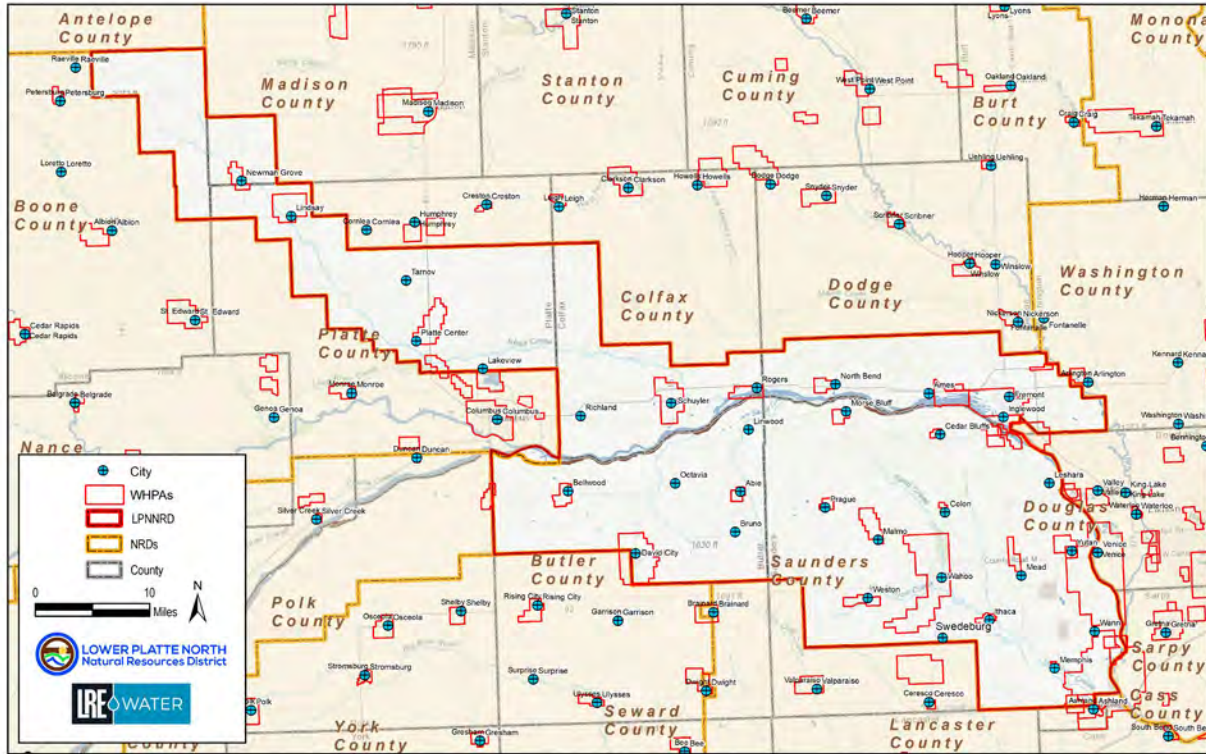


Figure 32: Wellhead Protection Areas



Source: NDEE

Figure 33: Five Steps of the WHP Program

4.2.1 Water Quality Activities

A summary of recent water quantity activities for the LPNNRD for 2023 are as follows:

- Completion of 6 nitrogen/irrigation certification meetings with 200 - 300 in attendance.

- Implementation of a program, funded by WSF, to provide cost-share practices in the Schuyler-Richland GWMA for gravity to pivot/SDI conversions, water flow meters, and cover crops.
- USGS is leading an age-dating project, in conjunction with LLNRD, near the Schuyler-Richland GWMA.
- District-wide soil moisture sensor cost-share
- Well decommissioning cost-share
- Shell Creek Watershed Water Quality Project, including agricultural and urban cost-share for best management practices.

5 GOALS AND OBJECTIVES

5.1 GROUNDWATER MANAGEMENT GOALS AND OBJECTIVES

The primary management target, defined below in the Vision Statement, is to maintain the ‘groundwater reservoir life goal’ – defined within the Rules and Regulations as the period of time which the District establishes as its goal for maintenance of the supply and quality of water in a groundwater reservoir. This goal can also be described as ensuring a safe yield for aquifers, which is the amount of water that can be sustainably withdrawn without causing long-term depletion or adverse effects on the aquifer and hydrologically connected water resources. The goals and objectives are designed to guide the staff and Board of Directors in making decisions about water resource management.

LPNNRD Groundwater Management Vision Statement

Strive for the continuous management of the groundwater reservoir, in perpetuity, to ensure it meets the standards appropriate for its various uses, including domestic, livestock, public water supply, public health, irrigation, agriculture, wildlife, industrial, and other beneficial uses. Minimizing, as much as possible, the adverse impact of these uses on the quantity and quality of groundwater that supports lakes, wetlands, and streams.

By implementing the five goals and objectives shown below, the LPNNRD can ensure groundwater remains a reliable resource while protecting the ecosystems that depend on it. Goal categories include monitoring, pollution prevention, conservation, public education, and sustainable management plans and regulations.

5.1.1 Goal 1 – Groundwater Monitoring

Continuously monitor and assess groundwater levels and quality, ensuring early detection of significant changes for proactive resource management, with clear benchmarks for expansion and data utilization.

- **Objective 1.1** – Expand groundwater monitoring efforts by installing up to four new dedicated observation wells per year over the next 10 years covering more vulnerable areas such as WHP areas.
- **Objective 1.2** – Integrate scientific advances and research into regulatory frameworks, updating policies at least every two years to incorporate the latest hydrogeologic findings.
- **Objective 1.3** – Conduct annual water quality sampling, tracking nonpoint source contamination trends over time and using the data to refine mitigation strategies.
- **Objective 1.4** – Strengthen collaborative efforts by partnering with new organizations or research institution to enhance the water quality monitoring network.
- **Objective 1.5** – Maintain and expand the spring/fall water energy level monitoring network by adding at least five additional wells with construction data annually, ensuring comprehensive coverage.
- **Objective 1.6** – Develop a real-time monitoring initiative by adding telemetry to dedicated observation wells, integrating data into a public-facing online dashboard within two years (2027) to improve transparency.
- **Objective 1.7** – Implement more frequent monitoring programs to track water quantity changes in known problem areas related to groundwater pumping, identifying risks early and adjusting management strategies accordingly.

5.1.2 Goal 2 – Water Quality

Reduce the potential for pollution to ensure a sustainable supply of high-quality, consumable, and safe groundwater for all users in the NRD. Implement and support best management practices that achieve a district-wide reduction in nitrate concentrations by an average of 0.5 ppm per year, tracked through annual water quality monitoring reports.

- **Objective 2.1** – Utilize advanced studies and modeling tools (MODFLOW) to conduct at least two groundwater flow and contamination movement analyses per year, ensuring data-driven management decisions.
- **Objective 2.2** – Obtain and assess new groundwater and contamination data using sources such as the Clearinghouse, integrating findings into sustainable development strategies to track improvement trends.
- **Objective 2.3** – Develop and implement at least one new cost-share initiative annually that supports pollution reduction efforts, focusing on precision nutrient management and contaminant mitigation programs.
- **Objective 2.4** – Provide cost-share funding for at least 15 well decommissioning projects per year, prioritizing locations with high contamination risks.
- **Objective 2.5** – Actively manage Phase Areas with vulnerable aquifers or excessive nitrate concentrations by conducting annual mitigation strategy reviews, ensuring targeted interventions effectively reduce nitrogen loading in public water supply sources.

5.1.3 Goal 3 – Water Quantity

The LPNNRD will continue to encourage highly efficient water conservation management practices, with the objective of recovering and maintaining sustainable water levels to support beneficial uses.

- **Objective 3.1** – Utilize hydrogeologic and modeling data to assess the impacts of new uses and quantify water level responses to drought or reduced precipitation trends, setting baseline measurements and tracking fluctuations annually.
- **Objective 3.2** – Connect 1,000+ property owners annually to conservation programs that enhance water quality and quantity, tracking participation rates and success metrics.
- **Objective 3.3** – Develop a drought response strategy with phased thresholds, defining trigger points for water conservation measures and emergency response actions within the district.
- **Objective 3.4** – Conduct annual groundwater assessments for Special Quantity Sub-areas and Control Areas with thin or limited aquifers, using the data to refine conjunctive management strategies and improve hydrologic sustainability and reverse declining water level trends.

5.1.4 Goal 4 – Outreach and Education

Continue to be a resource for outreach and education for youth and adults, emphasizing the importance of protecting groundwater resources through measurable engagement and awareness strategies.

- **Objective 4.1** – Conduct stakeholder review at least every five years (agriculture, industry, local government, environmental groups, and public health) to gather diverse perspectives and needs.
- **Objective 4.2** – Expand public environmental education programs by hosting four or more outreach events annually focused on nitrate impacts and water conservation, measured by attendance and participant feedback surveys.

- **Objective 4.3** – Utilize hydrogeologic data and studies, to conduct a minimum of 20 one-on-one educational sessions per year, ensuring direct engagement with landowners, producers, or other stakeholders.
- **Objective 4.4** – Participate in at least 10 natural resources workshops, county fairs, camps, or classroom presentations annually, tracking engagement metrics.
- **Objective 4.5** – Demonstrate cutting-edge water and fertilizer management technologies through three or more field demonstrations annually, documenting adoption rates among participants.
- **Objective 4.6** – Provide information and education through a minimum of six published pieces per year across news articles, social media posts, newsletters, brochures, and website updates.
- **Objective 4.7** – Develop and launch a web-based graphic user interface within two years, ensuring public accessibility to hydrogeologic data and maps, with a tracking system for user engagement.
- **Objective 4.8** – Develop and launch a district-wide notification system to be in place by 2026 with at least 500 members to provide timely updates on water quality, conservation programs, and regulatory changes.

5.1.5 Goal 5 – Rules and Regulations

Develop and enforce rules, regulations, and plans that balance water usage with natural replenishment rates while reducing contamination through structured monitoring and compliance efforts.

- **Objective 5.1** – Conduct updates at least every five years to the Groundwater Management Plan and Rules and Regulations to reflect emerging contaminants, policy changes, and evolving water use patterns.
- **Objective 5.2** – Align regulations with 100% compliance to new state and federal policies within six months of adoption, ensuring resources are leveraged for district-wide water management improvements.
- **Objective 5.3** – Implement an adaptive management strategy with annual performance evaluations, adjusting policies and responses based on monitoring data trends.
- **Objective 5.4** – Maintain consistent engagement in Lower Platte River Basin integrated and drought management plans, tracking participation and policy influence through quarterly reports.
- **Objective 5.5** – Increase community participation in NDEE’s Wellhead Protection Program by at least 15% annually, expanding outreach efforts and tracking adoption rates.
- **Objective 5.6** – Utilize hydrogeologic-based subareas for Control Area management, conducting annual data reviews to refine Phase Area designations and mitigation strategies.
- **Objective 5.7** – Conduct biennial reviews of the Integrated Management Plan, ensuring sustainable water use strategies align with conservation goals and include annual instream flow assessments.
- **Objective 5.8** – Support and conduct at least three special studies annually, focusing on research initiatives that enhance groundwater sustainability and contamination mitigation.

6 STAKEHOLDER INVOLVEMENT

6.1 OUTREACH METHODS

The LPNNRD utilized the website (www.lpnrd.org), district-wide publications, press releases to local newspapers, radio, social media, and announcements through Board meetings to spread the word about the GWMP update. The Summer 2024 edition of the Viaduct included an announcement on the update process, need for Stakeholders, and the locations and times of the first two public open houses.

6.2 STAKEHOLDER GROUP

The LPNNRD established two Stakeholder Groups, one meeting in the Village of Platte Center and another meeting in the City of Wahoo. The group included agricultural producers, community representatives, NeDNR, UNL Extension, NRCS, LPNNRD, and LRE Water. The role of the stakeholder group was to work closely with LPNNRD to provide feedback, identify information, discuss concerns, communicate and engage with other stakeholders, and provide feedback on the draft Plan. A summary of the meetings included:

- Platte Center meetings on June 4th, 2024, and January 16, 2025
- Wahoo meetings on June 6, 2024, and January 9th, 2025

6.3 OPEN HOUSE MEETINGS

Two sets of Open House meetings were held to provide an opportunity for the public to learn about the purpose and requirements of the GWMP, discuss water quality and quantity concerns, review the proposed subareas, review the highlights of the draft GWMP, and discuss recommendations. Meetings occurred at:

- Wahoo on August 24, 2024, and January 9, 2025
- Platte Center on August 26, 2024, and January 16, 2025

6.4 BOARD RETREAT

On February 7, 2025, the LPNNRD held a Board of Directors retreat with a major focus on the GWMP and key recommendations by LRE Water. The retreat aimed to provide a general education on key hydrogeologic terminology and principles, obtain consensus on actions to enhance groundwater management effectiveness, and discuss the goals and objectives.

7 RECOMMENDATIONS

This section outlines considerations for modifications, additions, or adjustments to the current procedures used for the management of groundwater. These recommendations were established after a review of existing data, reports, studies, water level data, hydrographs, and input from the LPNNRD staff, Board of Directors, the Stakeholder Group, and the public.

7.1 ADOPTION OF GROUNDWATER MANAGEMENT SUBAREAS

The original subareas were delineated by Olsson in the March 2009 LPNNRD Hydrogeologic Evaluation and Subarea Delineation Study (Olsson, 2008) based on local hydrogeologic conditions and depositional characteristics; however, these were not officially recognized by the LPNNRD. LRE Water and the LPNNRD staff reviewed the existing sub-areas and made slight adjustments using hydrogeologic information from the Assessment (LRE, 2023). This process included the following key steps:

- 1) LPNNRD staff squared off the subareas to the nearest section boundary.
- 2) Subareas were adjusted by LRE Water by reviewing the saturated sand thickness, hydrogeologic cross sections, AEM, and the DEM. Overall, changes were minimal by merging small areas and adding or subtracting a few sections based upon the new saturated sand thickness.
- 3) LRE Water provided the LPNNRD with GIS data and an updated subarea map to allow for review and edits by District staff and the Board of Directors.

There are several advantages to adopting and utilizing subareas named by local communities or other known features. Some of the benefits include:

- 1) **Localized Management:** Subareas allow for more precise and localized management of groundwater resources. This means that specific issues within a smaller area can be addressed more effectively, rather than applying a one-size-fits-all approach across a larger region.
- 2) **Tailored Solutions:** Different subareas may have unique geological and hydrological characteristics. By focusing on subareas, the LPNNRD can focus studies and develop tailored solutions that are more effective for the specific conditions of each subarea.
- 3) **Efficient Resource Allocation:** Managing groundwater at the subarea level helps in the efficient allocation of resources. It ensures that efforts and funds are directed towards areas with the most pressing needs or the highest potential for improvement.
- 4) **Enhanced Monitoring and Data Collection:** Subareas facilitate more detailed monitoring and data collection. This detailed data can lead to better decision-making and more effective management practices.
- 5) **Community Involvement:** Working with subareas often involves local stakeholders and communities, leading to greater public involvement and support for groundwater management initiatives.

While groundwater quality and quantity studies may occur across an entire subarea, it is important to note that Groundwater Quality and Quantity Management Areas, or phase areas, can be smaller or larger than a subarea and could include may also cross multiple subareas or portions of subareas. A breakdown of the proposed subareas is shown in Figure 34. It is also recommended that the areas be referred to by name, rather than only a number.

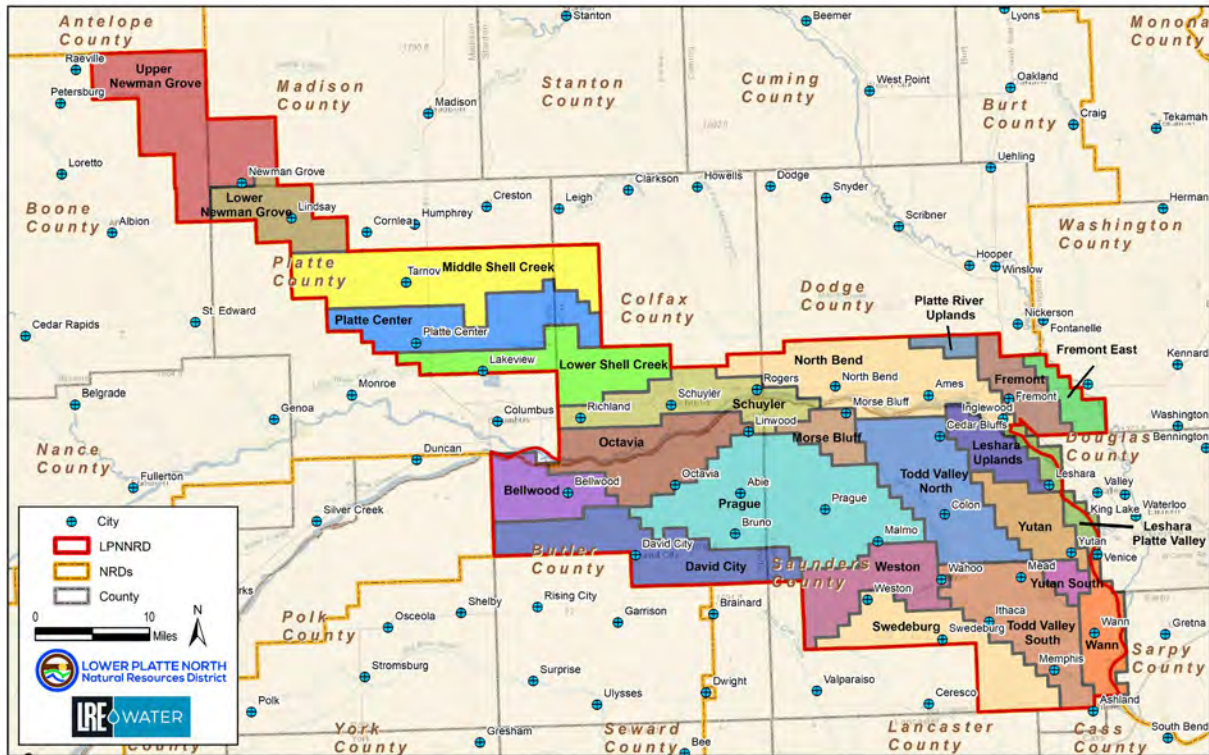


Figure 34: Proposed Groundwater Management Subareas

7.2 EXPANSION OF THE OBSERVATION NETWORK

Water levels alone cannot accurately determine the percentage of decline in saturated thickness for an unconfined aquifer or hydraulic head in a confined aquifer unless the screen interval and depth to water are compared to the geologic layers. Variations in water levels in wells may result from data collected from wells of differing depths and screened at various intervals, penetrating both confined and unconfined aquifers. To ensure that the data collected is representative of the area of study or concern, the following recommendations are proposed:

- Utilize the new standard scale hydrograph format to analyze all future observation wells, ensuring consistency and accuracy in data interpretation.
- Categorize and select new observation wells that are consistent and representative of the subarea, considering factors such as well depth, screened interval, and whether the aquifer is confined or unconfined.
- Ensure adequate spacing of observation wells from pumping wells to avoid interference and obtain more accurate readings.
- Partner with public water supplies to strategically place observation wells within wellhead protection areas and/or upgradient from PWS wells, enhancing the monitoring of water levels and water quality.

To assist with understanding the spatial representation of the current observation well network, an evaluation was completed by subarea. Table 9 displays the current spatial representation of spring/fall monitoring wells and the dedicated observation wells by subarea, which is displayed in Figure 35.

Table 10: Observation Wells and Proposed Sites by Subarea

Subarea Name	Spring Fall Well Count	Dedicated Observation Well Count	Potential Area for New Observation Well Count
Bellwood	6	0	1
David City	22	8	0
Fremont	7	0	0
Fremont East	3	0	0
Leshara Platte Valley	0	0	0
Leshara Uplands	5	0	0
Lower Newman Grove	5	1	0
Lower Shell Creek	6	1	3
Middle Shell Creek	19	16	5
Morse Bluff	4	0	0
North Bend	12	2	1
Octavia	5	1	2
Platte Center	11	9	0
Platte River Uplands	4	2	0
Prague	5	2	6
Schuyler	7	0	0
Swedeburg	10	4	2
Todd Valley North	8	0	0
Todd Valley South	12	9	0
Upper Newman Grove	10	2	6
Wann	10	4	0
Weston	11	0	2
Yutan	7	0	0
Yutan South	4	3	0

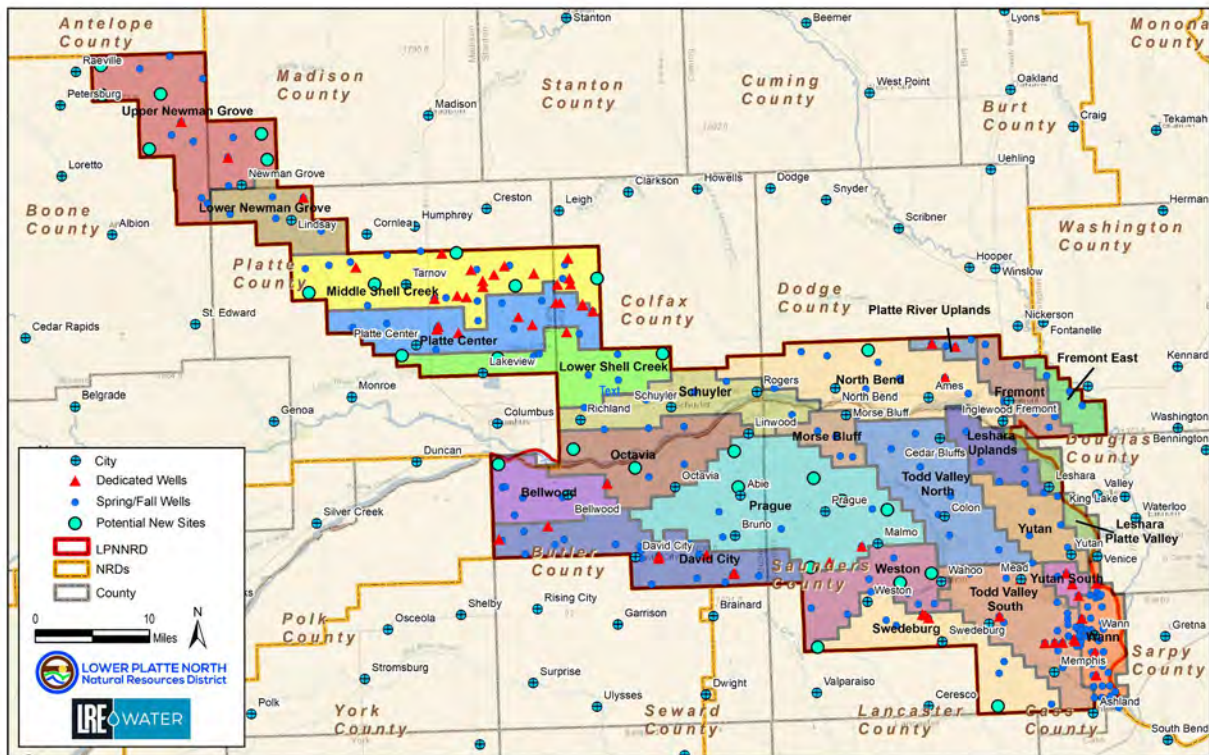


Figure 35: Existing Observation Wells and Potential Expansion Sites

7.3 ALTERATION TO THE WELL VARIANCE SCORING PROTOCOL

Many well permit application reviews raise questions about adequate aquifer thickness, target yield capabilities, pumping influence on surface water, well interference, and aquifer protection. To address these questions and uncertainties, alternations to the well variance scoring sheet would improve the accuracy of the decision-making process. The following recommendations are proposed:

Point Sheet

1. Include points for the location of the well within the Groundwater Resource Development Risk map.
2. Review ranges for the New Groundwater Consumptive Use category.
3. Create separate sheets for unconfined and confined aquifers, considering specific yield and saturated thickness for an unconfined aquifer, but not confined.
4. Use aquifer thickness, storativity, and available head for a confined aquifer.
5. Include irrigation well density, domestic well density, and other well densities (livestock, municipal) to address potential well interference.
6. Review how transmissivity is calculated (e.g., from aquifer thickness multiplied by estimated hydraulic conductivity, or from hydrogeologic assessment maps).
7. Approximate the extent of the aquifer (e.g., any negative aquifer boundaries).
8. Include a theoretical radius of influence based on the above information.
9. Include a score for water level trends in the area of the proposed well.

10. Include point ranges based on existing nitrate concentrations.
11. Review other NRD scoring systems for additional criteria and methods.

Other Review Criteria and Procedures

1. Establish a radius for Class 1 and Class 2 and obtain all well logs within the study area.
2. Review well logs within a radius determined by the scoring sheet or class.
3. Conduct a limited desktop assessment, if necessary, to determine the level of uncertainty qualitatively, based on the class of well and data gaps.
4. Provide the applicant with a summary of the District's review and any additional data required, with technical justification.
5. Complete test hole(s) prior to issuing the permit if a data gap analysis indicates this is necessary.
6. Require an aquifer pumping test or capacity test for Class 2 and Class 3 variances based on points scored and data gaps, if necessary.

7.4 QUANTITY TRIGGER ADJUSTMENTS

Since 1987, quantity management triggers have been in place but have yet to initiate a Groundwater Management Area 'control area' designation. To improve effectiveness, adjustments to the policy may include eliminating triggers for confined aquifers, incorporating qualitative criteria, and refining delineation strategies for quantity control areas. The proposed modifications include:

- Identify and prioritize areas with consistent well interference, incorporating data from annual pumping impact reports to track severity.
- Differentiate management strategies for confined and unconfined aquifers, ensuring policy adjustments align with their distinct hydrologic responses.
- Enhance monitoring practices by utilizing observation wells and hydrograph trends to detect seasonal declines rather than relying solely on spring/fall measurements, allowing for continuous multi-season assessments.
- Incorporate historical drought impact data to evaluate magnitude trends, setting baseline depletion benchmarks for proactive response measures.
- Strengthen unconfined aquifer management through policies aligned with Integrated Management Plan goals, including stream depletion factors and annual recharge trend analyses.
- Refine decline impact assessments, distinguishing significant drops (e.g., a 10% decline in aquifers exceeding 100 feet vs. those under 50 feet) to prioritize intervention efforts accordingly.
- Establish quantified thresholds for confined aquifers, such as triggering management action at 50% of remaining head above the aquifer top, ensuring proactive conservation.
- Implement subarea-based resource allocation, directing management efforts and funding to high-risk zones where depletion issues are most pronounced.
- Utilize numerical groundwater flow models to identify areas of concern, assessing long-term trends and aquifer response to pumping impacts from a variety of scenarios to refine management strategies and improve predictive capabilities.

7.5 CLARIFICATION OF TERMINOLOGY

When updating the Rules and Regulations, provide clarity and consistency to key terminology utilized in the GWMP.

- Revise the GWMP and Rules and Regulations to ensure clear and consistent terminology and definitions throughout. This may include, but is not limited to, the clarifying the following terms: “Trigger Level,” “Level Controls,” “Level Criteria,” “Control Areas,” “Quantity Areas,” “Subareas,” “Groundwater Management Areas,” “Limited Development Area,” “Restricted Development Areas,” and “Special Quantity Sub Areas.”
- Recognize the following hierarchy for groundwater management within the Rules and Regulations, GWMP, and other district publications:
 - Groundwater Regions: Platte, Shell Creek, Uplands, and Todd Valley
 - Within the regions, establish Groundwater Subareas
 - Groundwater Management Areas:
 - Quality: Phase I, II, III, IV
 - Quantity: Phase I, II, III
 - Groundwater Control Areas
 - Limited and restricted development areas
- Where relevant, ensure the GWMP and Rules and Regulations refer to “aquifer thickness,” “available head” or “hydraulic head,” and “potentiometric surface” for confined aquifers, and “water table surface” and “saturated thickness” for unconfined aquifers.

7.6 RE-EVALUATION OF SPECIAL QUANTITY SUBAREAS

In 2016, the Special Quantity Subareas were established to address significant pressure drops in the aquifer during peak irrigation periods, which can cause shallower wells to run short on water. Overtime, it is valuable to reevaluate these Groundwater Management Areas to monitor improvement or worsening conditions.

- Complete a hydrogeologic study to reassess the sufficiency of the current boundaries of the Butler/Saunders SQS #1 and Platte/Colfax SQS #2. Utilize existing studies and research, including AEM surveys and hydrogeologic assessment data.
- Engage with local farmers and stakeholders to gather input and address concerns regarding the accuracy of the current boundaries.
- Incorporate recent data and technological advancements to ensure the boundaries reflect the most accurate and up-to-date information.
- Provide a detailed report with recommendations for any necessary modifications to improve groundwater management and address stakeholder concerns.

7.7 EFFORTS TO ENHANCE DATA TRANSPARENCY AND COMMUNICATION

Nebraska’s NRDs have been making significant efforts to improve transparency and accessibility of data through real-time data collection and online visualization tools. The following recommendations are provided for consideration to enhance communication with constituents:

- Create an online, data visualization tool to allow users to obtain data on recent nitrate concentrations, water level trends, and similar water use information.
- Provide maps and information from the Hydrogeologic Assessment, the GWMP, features of the Rules and Regulations such as locations of Groundwater Management Areas, subareas, and groundwater regions; Wellhead Protection Areas, and similar features.
- Establish a system to communicate with the public by allowing sign-up using a feature on the website to receive push notifications through text messaging and/or email about upcoming events, meetings, and planned changes to policies.

7.8 REASSESSMENT OF WATER QUALITY TRIGGERS

The UNMC has conducted extensive research recently on the public health effects of nitrates in groundwater, highlighting several critical concerns (Water for Food, 2024):

- **Health Risks:** High concentrations of nitrates in drinking water have been linked to various adverse health outcomes, including methemoglobinemia (especially in infants), colorectal cancer, thyroid disease, and neural tube defects. Other potential health issues include increased heart rate, nausea, headaches, and abdominal cramps.
- **Cancer and Birth Defects:** Studies have shown a significant association between high nitrate levels and certain cancers, such as pediatric brain cancer, kidney cancer, bladder cancer, and non-Hodgkin lymphoma. Additionally, there is evidence linking nitrate exposure to an increase in birth defects.
- **Economic Impact:** The economic costs associated with health effects from nitrate-contaminated drinking water are substantial. These costs include medical expenses and lost productivity due to illness. Treating drinking water for nitrate has a significant economic impact, especially for small communities, and drilling new wells can be expensive.

Given these findings, the LPNNRD should consider a reassessment of the water quality triggers. By doing so, the LPNNRD can proactively reduce nitrate levels in groundwater, thereby protecting public health and mitigating economic burdens associated with nitrate contamination.

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ATTACHMENT A – STREAM FLOW HYDROGRAPHS



**HEALTHY WATER,
HEALTHY FUTURE.**



LOWER PLATTE NORTH
Natural Resources District

This newsletter is intended to keep you, our area's producers, knowledgeable about the latest developments, trends, and initiatives concerning water quality and quantity within the district. As the Lower Platte North Natural Resources District remains steadfast in its commitment to protecting Nebraska's groundwater for future generations, this newsletter will provide you with straightforward, informative updates, relevant data, and valuable insights into the vital work being done to manage this critical resource.

Groundwater Management Plan Available for Review

How does the Lower Platte North Natural Resources District ensure sustainable groundwater for generations to come? The answer lies in a carefully crafted document called the Groundwater Management Plan (GWMP). Over the last year, the LPNNRD has been updating the Groundwater Management Plan with current and previous information. This plan will serve as a guideline for how the district will manage groundwater for future generations.

This is where we need your help!

LPNNRD is asking for public review and comments of the most recent draft copy of the plan by August 25. A final public hearing will be held after all comments are addressed. If you would prefer a print copy of the draft, please contact the LPNNRD office at 402-443-4675. All comments about the plan can be sent to Daryl Andersen, LPNNRD Water Resources Manager, by email at dandersen@lpnnrd.org

[Read the GWMP](#)

Wellhead Protection Program Meetings

With approximately 85% of Nebraskans relying on groundwater as their source of drinking water, it is essential to protect this natural resource from contamination. By participating in the Wellhead Protection Program, communities can help safeguard their drinking water supplies now and for the future. LPNNRD has partnered with local officials to discuss the Wellhead Protection Plan in Newman Grove and Platte Center.

August 12 at 7:00 pm in Newman Grove

September 15 at 7:00 p.m. in Platte Center

Residents are highly encouraged to attend their area public hearing to discuss the Wellhead Protection Plan. This is a great opportunity to understand this voluntary initiative aimed at safeguarding public drinking water from contamination.

**Producers are Invited to take Advantage of Text
Message Alerts**

What is it? The Lower Platte North Natural Resources District is launching a new means of communication for producers – SMS texting. After signing up, producers will receive important LPNNRD functions such as public information meetings, public hearings, upcoming events, water use report information, chemigation information, well sampling information and other information relevant to important LPNNRD activities. You will not receive spam materials from the Lower Platte North Natural Resources District as part of this program.

How often? The frequency of these messages will vary depending on the area of the producer, specifically relating to groundwater quality and groundwater quantity areas. By opting in, you acknowledge that you may receive multiple messages per month, depending on your interactions with us. *Message and data rates may apply. Please contact your carrier with any questions regarding this.*

How can I sign up? Text LPNWATER to (844) 614-3120 to opt-in. A follow up message will be sent to confirm your subscription. Or visit lpnnrd.org/downloads, under the Other Water-Related Forms section you will find an opt-in form near the bottom titled "Producer/Landowner Text Message Opt-In." Additionally, the [Privacy Policy and Terms and Conditions](#) can be found in this location.

How did I get this? The Lower Platte North NRD Water Resources Department is working to ensure landowners and producers across our district are able to receive current news and updates as much as possible! We are testing a new email marketing system to assist in our communications. Stay subscribed for more updates coming soon!



Lower Platte North Natural Resources District

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Groundwater Management Plan

Public Review Version 10.0

Approval Date: XX/XX/XXX

Prepared for:



LOWER PLATTE NORTH
Natural Resources District

Prepared by:



Board of Directors - 2024

Name	Sub-District
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Bill Saeger	2
Dave Saalfeld	3
Andrew Tonnies	3
Chris Yosten	4
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Jerry Johnson	8
Roger Harder	8
Duane Johnson	9
Robert Meduna Jr	9
Thomas McKnight	At-Large

This third update of the Lower Platte North Natural Resources Groundwater Management Plan (GWMP) has been prepared per Nebraska Revised Statute 46-709. The GWMP was created based upon the best available scientific information.

TABLE OF CONTENTS

List of Tables	ii
Table of Figures	ii
List of Abbreviations and Acronyms	iii
1 Introduction	1
1.1 LPNNRD Background	1
1.2 Legal Authority and Obligations.....	2
1.3 Agency Roles and Functions	3
1.4 Joint-Planning Efforts	5
1.5 Current Rules and Regulations.....	6
2 Description of the NRD	11
2.1 Groundwater Regions and Principal Aquifer	11
2.2 Hydrogeologic Datasets	12
2.3 Topography	15
2.4 Soils	15
2.5 Geology and Hydrological Characteristics	17
2.6 Total Saturated Sand.....	18
2.7 Confined vs. Unconfined Aquifers	19
2.8 Transmissivity.....	22
2.9 Climate and Precipitation	22
2.10 Land Cover.....	23
2.11 Population – Economic Base	25
2.12 Surface Water.....	26
2.13 Wells and Test Holes	28
2.14 Partners and Programs.....	29
2.15 Environmental Education and Information.....	31
3 Groundwater Quantity	32
3.1 Groundwater Levels and Existing Wells.....	32
3.2 Groundwater Recharge.....	35
3.3 Water Use and Demand.....	37
3.4 Certified Irrigated Acres.....	39
4 Groundwater Quality	41
4.1 Aquifer Vulnerability	41
4.2 Wellhead Protection Areas	46
5 Goals and Objectives	49
5.1 Groundwater Management Goals and Objectives	49
6 Stakeholder Involvement	52
6.1 Outreach Methods.....	52
6.2 Stakeholder Group.....	52
6.3 Open House Meetings	52
6.4 Board Retreat.....	52
7 Recommendations	53
7.1 Adoption of Groundwater Management Subareas	53
7.2 Expansion of the Observation Network.....	54
7.3 Alteration to the Well Variance Scoring Protocol.....	56

7.4	Quantity Trigger Adjustments.....	57
7.5	Clarification of Terminology.....	58
7.6	Re-evaluation of Special Quantity Subareas.....	58
7.7	Efforts to Enhance Data Transparency and Communication.....	58
7.8	Reassessment of Water Quality Triggers.....	59
8	References	60

LIST OF TABLES

Table 1:	Confined and Unconfined Aquifer Triggers.....	9
Table 2:	Geologic Sequence of Major Formations in LPNNRD	17
Table 3:	LPNNRD Land Cover Change (2009 – 2023).....	24
Table 4:	Population of Incorporated Places (1990 – 2025)	25
Table 5:	LPNNRD Steam Gage Information.....	27
Table 6:	Annual Municipal Water Usage All Communities	37
Table 7:	Annual Municipal Water Usage Without LWS and MUD	38
Table 8:	Active Registered Well Distribution	39
Table 9:	LPNNRD PWS State-Approved WHP Plans	46
Table 10:	Observation Wells and Proposed Sites by Subarea	55

TABLE OF FIGURES

Figure 1:	LPNNRD Location	1
Figure 2:	Board of Director Sub-districts (2025).....	4
Figure 3:	Lower Platte River Basin Coalition NRDs	5
Figure 4:	Quality and Special Quantity Sub-areas.....	8
Figure 5:	Groundwater Limited Development Areas.....	10
Figure 6:	Groundwater Regions of the LPNNRD	12
Figure 7:	AEM Flights within and near the LPNNRD	13
Figure 8:	3D Leapfrog output in cross section	14
Figure 9:	Well and Test Holes with Geologic Logs (LRE Water, 2023).....	14
Figure 10:	Topography of the LPNNRD	15
Figure 11:	Soil Types	16
Figure 12:	Bedrock Formations.....	17
Figure 13:	Total Saturated Sand, Well and Test Holes.....	19
Figure 14:	Confined vs. Unconfined Aquifers	21
Figure 15:	Hydrograph of Transitional Aquifer Type	21
Figure 16:	Aquifer Transmissivity.....	22
Figure 17:	Average Annual Precipitation (1981-2010).....	23
Figure 18:	2023 Land Cover	24
Figure 19:	Major River Systems, Stream Gages and Diversion Points.....	27
Figure 20:	Registered Active Wells in the LPNNRD.....	28
Figure 21:	Test Holes within 5-miles of LPNNRD	29
Figure 22:	Groundwater-Level Changes in LPNNRD, Predevelopment to Spring 2023.....	32
Figure 23:	Observation Well Network	33

Figure 24: Depth to Groundwater 34

Figure 25: Potential Areas for Sub-irrigation 35

Figure 26: Artificial Recharge Potential 36

Figure 27: Percent of NeDNR Active Registered Wells 39

Figure 28: Certified Irrigated Acres in the LPNNRD (2024) 40

Figure 29: Aquifer Vulnerability 42

Figure 30: LPNNRD Nitrate Concentrations 2019-2023 43

Figure 31: LPNNRD Statewide Water Quality Monitoring Network Wells 45

Figure 32: Wellhead Protection Areas 47

Figure 33: Five Steps of the WHP Program 47

Figure 34: Proposed Groundwater Management Subareas 54

Figure 35: Existing Observation Wells and Potential Expansion Sites 56

LIST OF ABBREVIATIONS AND ACRONYMS

ACT	Nebraska Groundwater Management Act
AF	Acre Feet
AEM	Airborne Electromagnetic
Assessment	LPNNRD Hydrogeologic Assessment (2023)
Coalition	Lower Platte River Basin Coalition
CSD	Conservation and Survey Division
District	Lower Platte North NRD
DCP	Drought Contingency Plan
DEM	Digital Elevation Model
DWEE	Nebraska Department of Water, Energy, and Environment
ENWRA	Eastern Nebraska Water Resources Assessment
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information System
GWMA	Groundwater Management Area
GWMP	Groundwater Management Plan
HCA	Hydrologically Connected Areas
IMP	Integrated Management Plan
LENRD	Lower Elkhorn Natural Resources District
LPMT	Lower Platte Missouri Tributary Groundwater Model
LPNNRD	Lower Platte North Natural Resources District
LPSNRD	Lower Platte South Natural Resources District
LPRCA	Lower Platte River Corridor Alliance
LWS	Lincoln Water System
Mg/L	Milligrams per Liter
MUD	Metropolitan Utilities District
NARD	Nebraska Association of Resources Districts
NASS	National Agricultural Statistics Service
NDEE	Nebraska Department of Environment and Energy

NeDNR	Nebraska Department of Natural Resources
NeDWEE	Nebraska Department of Water, Energy, and Environment
NHCAs	Non Hydrologically Connected Areas
NPDES	National Pollutant Discharge Elimination System
NRC	Natural Resources Commission
NRD	Natural Resources District
LWS	Lincoln Water System
PMRNRD	Papio-Missouri River Natural Resources District
PPM	Parts Per Million
PPB	Parts per Billion
RWS	Rural Water System
SQS	Special Quantity Subareas
UNL	University of Nebraska-Lincoln
USGS	United States Geological Survey
WHP	Wellhead Protection

1 INTRODUCTION

1.1 LPNNRD BACKGROUND

The Lower Platte North Natural Resources District (LPNNRD or District) spans 1,587 square miles, or just over 1 million acres, over seven counties in eastern Nebraska and is shown in Figure 1. The total estimated population is nearly 66,000 (NARD, 2024). The primary watersheds used to delineate the LPNNRD includes Shell Creek, starting at the northwest boundary past Newman Grove and to the southeast to the Lower Platte River at Fremont, and the Wahoo Creek watershed to the southeast near Ashland. The LPNNRD economy is predominantly focused on agricultural and industrial activities.

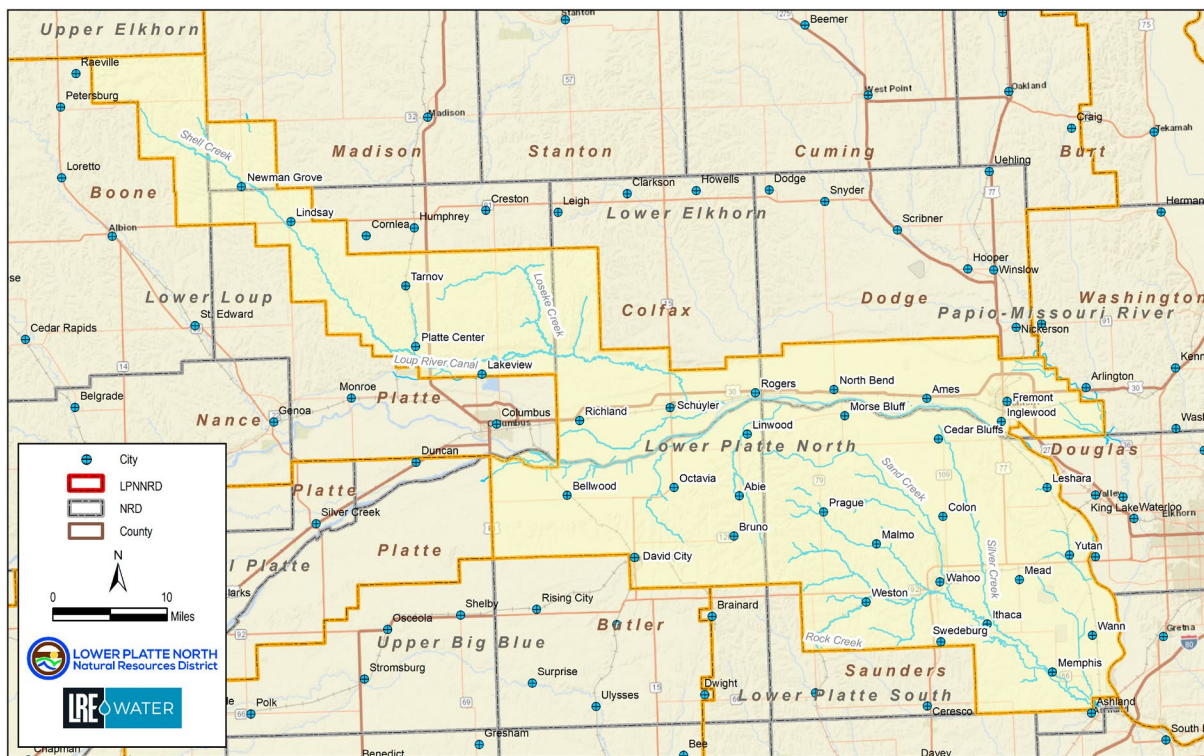


Figure 1: LPNNRD Location

1.2 LEGAL AUTHORITY AND OBLIGATIONS

Groundwater is widely recognized as one of the state's most valuable natural resources, and the management is a key responsibility granted to the Nebraska Natural Resources Districts (NRDs), which were established in 1972. The declaration, intent, and purpose of NRDs groundwater management responsibilities were established by the Nebraska Groundwater Management and Protection Act (Act) as outlined in Nebraska Revised Statute Chapter 46, Article 7, passed in 1975.

In 1984, the Nebraska Legislature mandated that NRDs prepare a Groundwater Management Plan (GWMP) by January 1986. The original LPNNRD GWMP was prepared in 1985 and with the adoption of the 1985 plan, the LPNNRD embarked upon a new era of groundwater resource management marked by an intensive program of data collection designed to characterize the resource and establish the relationship with other water resources. In addition, the District developed education and demonstration programs designed to increase awareness of groundwater supplies, use, and protection.

Legislative Bill 51 (LB51) was passed in 1991 and amended the Act by providing clarification, therefore the GWMP was updated in 1995, as an amendment to the 1985 version and the amendment meets the intent of LB51 and fulfills the District's need for continued understanding of the supply and quality of its groundwater resource, and sets forth a plan of protection for the future. The Board of Directors recognizes, along with the Nebraska legislature, that groundwater is a valuable resource and planned management is essential and in the public interest.

This version of the GWMP is intended to meet requirements of Section 46-709 of the Act (NeDNR, 2021), which states, The plan shall include, but not be limited to, the identification to the extent possible of the following:

- 1) Groundwater supply information within the District including transmissivity, saturated thickness maps, and other groundwater reservoir information, if available;
- 2) Local recharge characteristics and rates from any sources, if available;
- 3) Average annual precipitation and the variations within the District;
- 4) Crop water needs within the District;
- 5) Current groundwater data-collection programs;
- 6) Past, present, and potential groundwater use within the District;
- 7) Groundwater quality concerns within the District;
- 8) Proposed water conservation and supply augmentation programs for the District;
- 9) The availability of supplemental water supplies, including the opportunity for groundwater recharge;
- 10) The opportunity to integrate and coordinate the use of water from different sources of supply;
- 11) Groundwater management objectives, including a proposed groundwater reservoir life goal for the District. For management plans adopted or revised after July 19, 1996, the groundwater management objectives may include any proposed integrated management objectives for hydrologically connected groundwater and surface water supplies but a management plan does not have to be revised prior to the adoption or implementation of an integrated management plan pursuant to section 46-718 or 46-719;
- 12) Existing subirrigation uses within the District;
- 13) The relative economic value of different uses of groundwater proposed or existing within the District; and

- 14) The geographic and stratigraphic boundaries of any proposed management area.

This version was prepared by the staff, the Board of Directors, with technical and planning assistance provided by LRE Water.

1.3 AGENCY ROLES AND FUNCTIONS

The LPNNRD is governed by a locally elected Board consisting of 19 Directors. The LPNNRD is divided into sub-districts (Figure 2), with two Directors per sub-district and one at-large member. Based upon state statute, each NRD shares a common set of responsibilities, listed below, but each also establishes its own additional priorities based upon need.

- Erosion prevention and control
- Soil conservation
- Flood prevention and control
- Prevention of damages from flood water and sediment
- Water supply for any beneficial uses
- Development, management, utilization and conservation of groundwater and surface water
- Pollution control
- Solid waste disposal and sanitary discharge
- Drainage improvement and channel rectification
- Development and management of recreational and park facilities
- Forestry and range management
- Outdoor recreation
- Education

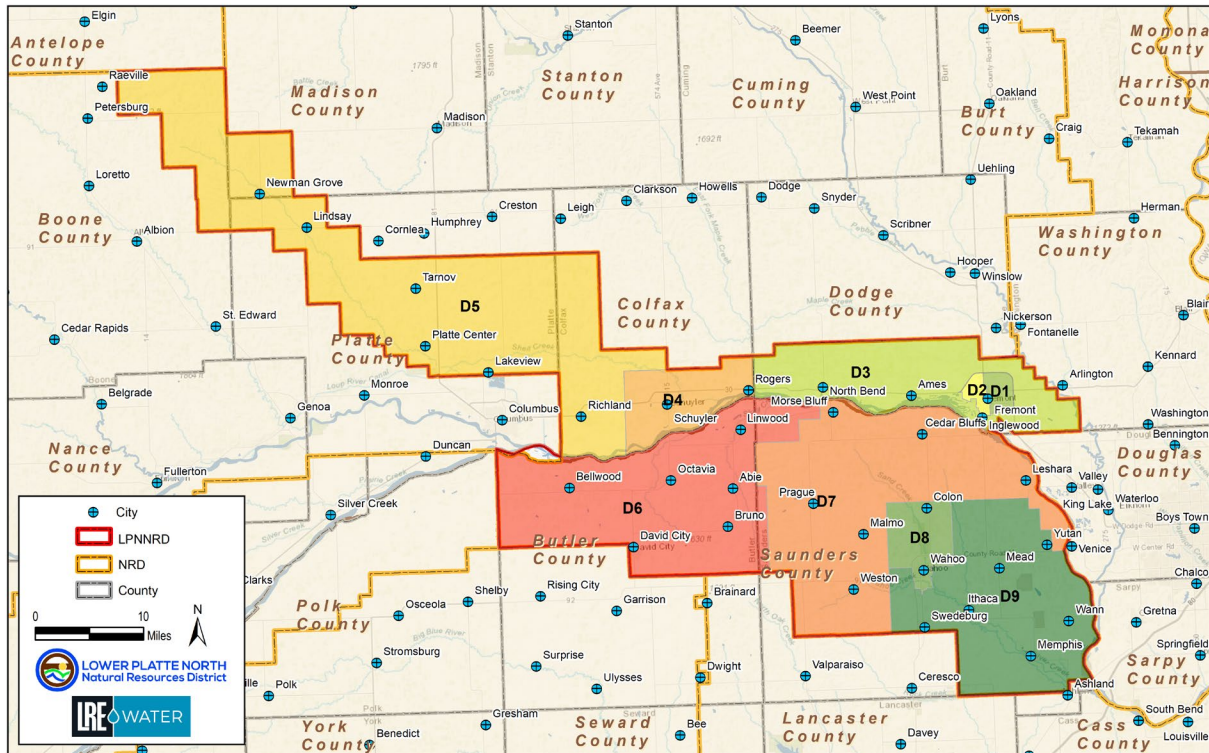


Figure 2: Board of Director Sub-districts (2025)

The LPNNRD is responsible for a variety of programs and projects and has identified five primary services with a focus on the following:

- Water Management
 - Groundwater management phase areas, monitoring programs, chemigation, nitrogen certification, nitrate management, wellhead protection (WHP) program, non-point source pollution management, and well decommissioning.
 - Groundwater restricted and limited control areas, well permits and registration, variances, irrigated acre certification, water use management, and conservation.
- Rural Water Systems (RWS)
 - Management of the Bruno-David City RWS and Colon-Wahoo RWS.
- Forestry and Wildlife
 - Implementing a tree planting program
- Watershed and Flood Damage Reduction
 - Management of seven watershed-wide flood reduction projects that include nearly 60 flood reduction structures, including three high-hazard dams.
- Conservation Programs
 - Cost-share for soil and water conservation, small dams, cost-share for priority watersheds, rock and jetty program, and weed management.
- Education
 - Includes newsletters, environmental education program, events, grants and scholarships, and workshops

1.4 JOINT-PLANNING EFFORTS

Lower Platte River Basin Coalition

In 2017, seven NRDs came together with NeDNR to form the Lower Platte River Basin (Basin) Coalition (Coalition). This Coalition is operating under the guidance of the Basin Water Management Plan, published in October 2017. The Basin is one of Nebraska's most valuable resources, playing a crucial role in the state's agricultural, social, industrial, and municipal development and sustainability (Coalition, 2017).

The Coalition includes the LPNDR, along with the NeDNR and six other NRDS, including Upper Loup, Lower Loup, Lower Platte South, Papio-Missouri River, Lower Elkhorn, and Upper Elkhorn. These NRDs collaborate with the Nebraska Association of Resource Districts (NARD) to maintain a sustainable balance between water supplies and uses in the Basin (Figure 3). Key groundwater elements of the Basin Water Management Plan have been integrated in this GWMP update.

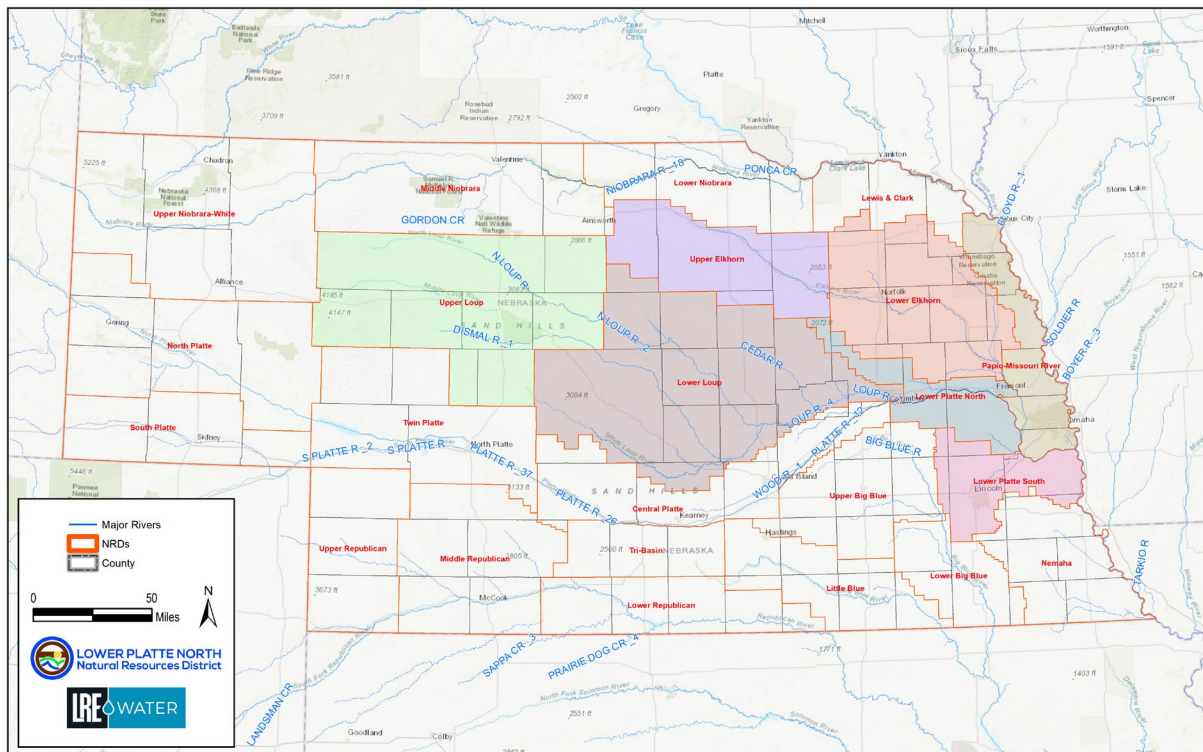


Figure 3: Lower Platte River Basin Coalition NRDs

Lower Platte River Drought Contingency Plan

The Lower Platte River Basin, including its tributaries and aquifers, serves approximately 80 percent of Nebraska's population, thousands of businesses, and industries, includes more than two million irrigated acres, and provides streamflow for threatened and endangered species. The drought-driven risks are diverse and a potential drought in the region would pose serious risk to public health, the economy, and fish/wildlife. Projects and programs designed to increase water supply and decrease water demands would benefit a variety of interests, including irrigation, power, environmental, and recreational

activities (Consortium, 2019). As a result, the LPNNRD, LPSNRD, PMRNRD, Metropolitan Utilities District (MUD), Lincoln Water System (LWS), and NeDNR established the Lower Platte River Drought Contingency Plan in 2019.

Integrated Management Plan

The LPNNRD's first voluntary Integrated Management Plan (IMP) was adopted by the District on June 11, 2018, and by the NeDNR on June 13, 2018, with an effective date of July 15, 2018. The IMP was developed in accordance with the Nebraska Ground Water Management and Protection Act (Act). The Act assigns the NeDNR and the District responsibilities and authority for management of groundwater, surface water, and their hydrologically connected areas in accordance with the Act, N.R.S. Chapter 46, Article 7. The voluntary IMP provides the framework for joint management of groundwater and surface water, recognizing that the two water sources are hydrologically connected. This framework enables the District and the NeDNR to coordinate management actions and monitoring of groundwater and surface water, to better protect water resources for future generations (LPN, 2018a). The IMP recognized five goals:

- 1) Develop and maintain a District-wide water supply inventory
- 2) Develop and maintain a District-wide water demand inventory
- 3) Develop and implement water use policies and practices with the purpose of achieving and sustaining a balance between water uses and supplies
- 4) Communicate to the public that Nebraska has a great supply of water, and a need to continue to manage it well
- 5) Coordinate with the Lower Platte River Basin NRDs, and appropriate groups and agencies, to develop a water management plan for the Coalition that maintains a balance between current and future water supplies and demands

LPNNRD Drought Contingency Plan

The LPNNRD was developing a district-wide Drought Management Plan in 2025. The Drought Management Plan will help to reduce district-wide impacts during drought events and aid the LPNNRD in water resource management. This project will include establishing drought monitoring and forecasting protocol, identifying potential best management practices, creating educational and awareness materials, and identifying future actions to reduce drought impacts. The GWMP will be a key resource integrated into the Drought Plan.

A significant part of the planning process will focus on local communities and their public water systems to evaluate their drought vulnerabilities and understand available community drought ordinances. The plan will include the development of drought mitigation strategies and other recommendations based on the outcomes of the drought risk analysis and meetings with communities. Also included with the plan will be a community engagement materials kit and sample drought ordinances for communities to utilize and update to fit their needs. The outcome will be a more sustainable and stable water supply for all uses across the district.

1.5 CURRENT RULES AND REGULATIONS

The Groundwater Management Area Rules and Regulations were first implemented on January 1, 1997, and last amended on June 15, 2018. Under Neb. Rev. Statutes 46-701 to 46-754 of the Act. The LPNNRD

has designated the entirety of the District as a Phase I Management Area for groundwater quality and quantity.

1.5.1 Groundwater Quality Management Areas

Groundwater quality management areas can have one of four designated phases (i.e., Phase I through Phase IV) based on nitrate contamination concentrations. If concentrations increase in an area enough to meet specified trigger levels, that area is moved to a higher Phase area with increased corresponding management regulations. Areas are triggered by 50 percent of the wells sampled being over the trigger for a minimum of two sampling events, a minimum of ten registered wells must be sampled, and the area must be a minimum 9-square miles unless the area is a Wellhead Protection Area. Based on the June 15, 2018, amended Rules and Regulations, the phases and corresponding groundwater nitrate concentration trigger levels are as follows:

1. **Phase I:** 0 to 8.01 parts per million (ppm)
2. **Phase II:** > 8.01 to 10.01 ppm
3. **Phase III:** > 10.01 to 15 ppm
4. **Phase IV:** > 15 ppm

For all other contaminants, a Phase 2 is triggered at 81% of the MCL, Phase 3 = >100% of the MCL. Currently, the LPNNRD has two Quality Groundwater Management Areas shown in Figure 4 triggered by nitrate concentrations. One is near the Village of Bellwood and is currently in a Phase II level of management. The second is near the cities of Richland/Schuyler area, where Phase III and Phase IV levels of management are in place. Additional nitrogen management, reporting, and educational requirements are required for operators within these areas. In 2024, a Phase IV area was added for exceedance of the Maximum Contaminant Level (MCL) of nitrates and uranium west of Schuyler.

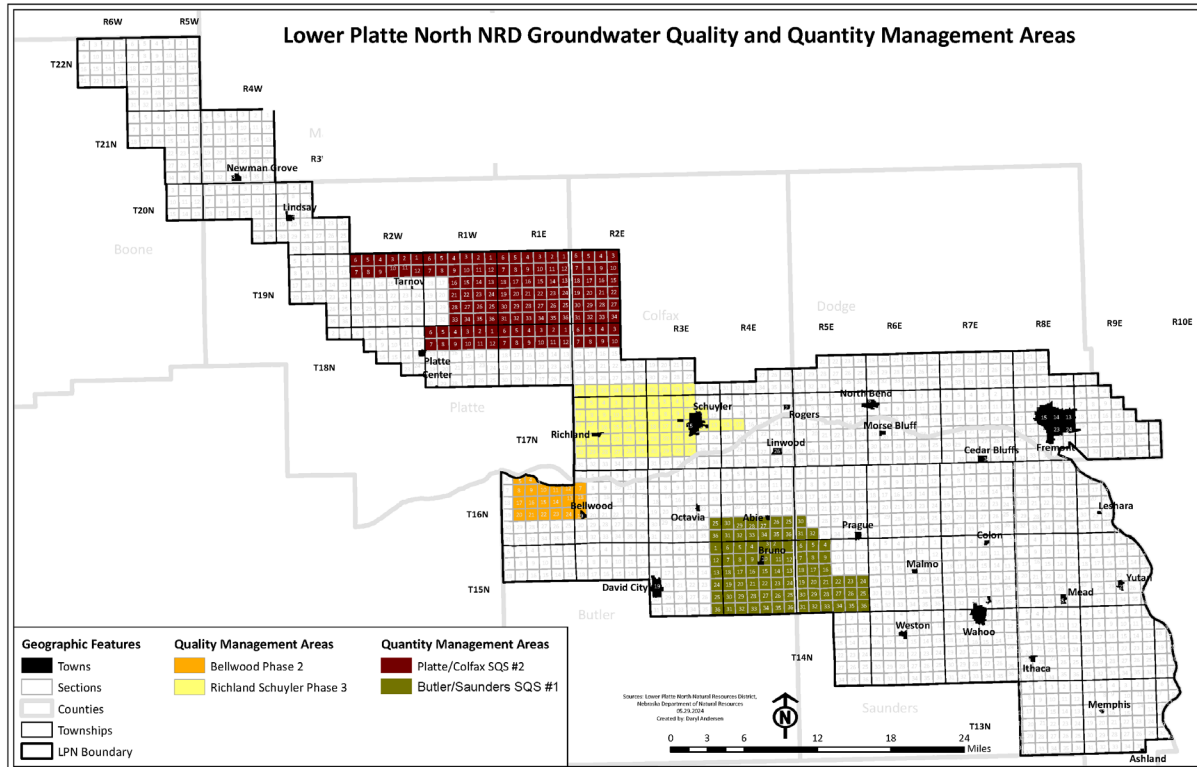


Figure 4: Quality and Special Quantity Sub-areas

1.5.2 Special Quantity Sub-Areas

Starting on January 1, 1997, the LPNNRD established two Special Quantity Sub-Areas (SQS) as a result of excessive seasonal declines in water levels that caused well interference. Due to the declines occurring during the summer, they did not qualify under the criteria for Groundwater Quantity Management Areas described below. These are referred to as Butler/Saunders SQS #1 and Platte/Colfax SQS #2. There are no new wells and expansion of irrigated acres are limited to the original allocation in these areas, and several other restrictions apply. The SQS areas are shown on Figure 4 above along with the Quality Management Areas.

1.5.3 Groundwater Quantity Management Areas

The Rules and Regulations also allow for the development of Groundwater Quantity Management Areas based on the percentage of water level decline for an unconfined aquifer and the percentage of hydraulic head decline for a confined aquifer. Assessment of the percentage drop is calculated using spring readings of the District’s spring/fall static observation wells over a 3-year period. Over 50 percent of the wells must reach or exceed a predetermined water level percent trigger. A general summary of the quantity triggers is shown below. Currently, the LPNNRD does not have a designated Groundwater Quantity Management Area.

Table 1: Confined and Unconfined Aquifer Triggers

AQUIFER TYPE	TRIGGER %	LEVEL CONTROL
Unconfined	10	I
	15	II
Confined	7	IA
	10	IIA

1.5.4 Groundwater Development Areas

In March 2018, the LPNNRD established Groundwater Limited Development Areas (Figure 5), where restrictions are in place on the development of high-capacity wells and the expansion of irrigated acres. These areas were delineated by the results of NeDNR's Lower Platte Missouri Tributaries Groundwater Model (LPMT)'s Hydrologically Connected Areas (HCAs). These areas have been determined to have a physical hydrologic connection between groundwater and surface water, and the goal is to ensure no further impact to surface water flow occurs as a result of excessive groundwater pumping. These areas are shown in Figure 5, along with the Special Quantity Subareas, which are unrelated to the HCAs.

- **Outside Groundwater Control Area (white):** Up to 75 new acre-feet (AF) per year are allowed through a variance process due annually on August 15.
- **Inside Groundwater Control Area (blue):** Up to 200 new AF per year with a variance deadline of September 15.
- **Restricted Development Area (red):** Was established through a separate study, and there are no new irrigated acres or water uses allowed, but consideration is given to areas within 1 mile of the red area.

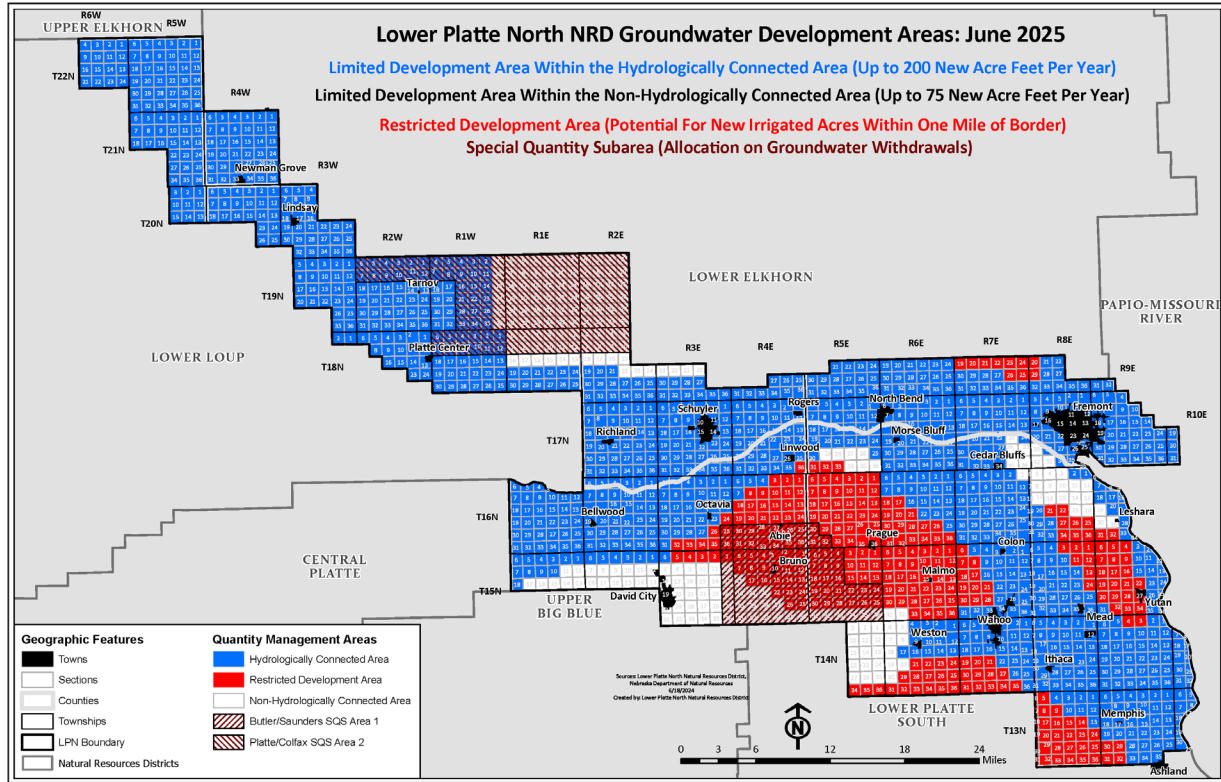


Figure 5: Groundwater Limited Development Areas

2 DESCRIPTION OF THE NRD

2.1 GROUNDWATER REGIONS AND PRINCIPAL AQUIFER

The 1995 GWMP subdivides the District into four distinct regions based on hydrogeologic and physiographic characteristics. The regions are described in the LPNNRD Hydrogeologic Evaluation and Subarea Delineation Study (Olsson, 2009) and are shown in Figure 6.

- **Platte River** This area is characterized by fluvial sand and gravel deposits of varying thickness, which are overlain by alluvial silt and clay, and younger loess deposits. Coarser and thicker sands and gravels appear to be present in paleovalley deposits, which sometimes extend into the Uplands Region described below.
- **Shell Creek:** Located in the northwest portion of the District, this region extends from the Platte River to the Sandhills and dissects glacial terrain similar to that of the Uplands Region. The upper reaches include the Ogallala Group.
- **Todd Valley:** This region was formed by the ancestral Platte River, which carved a fluvial valley. This region consists of fluvial sand and gravel deposits capped by loess and overlies the Cretaceous-age Dakota Group bedrock formations. The fluvial deposits typically grade from fine to a progressively coarser-grained sands and gravels with depth. The Todd Valley aquifer is connected to the Platte River alluvial sand and gravel aquifer.
- **Uplands:** This region is characterized by dissected clay-rich glacial till and younger loess deposits with interbedded, discontinuous sand and gravel outwash deposits. In places, the glacial deposits overlie deeper paleovalleys that contain thicker and coarser sands and gravels or are in contact with the underlying Dakota Group. The sandstone units of the Dakota Formation contain brackish to saline water.

Principal Aquifer is the major groundwater reservoir in the District. It refers to the saturated unconsolidated sand and gravel aquifers, including the Ogallala Group, where present.

The following sections provide more insight into the hydrogeologic data and recent assessments, and background of the LPNNRD.

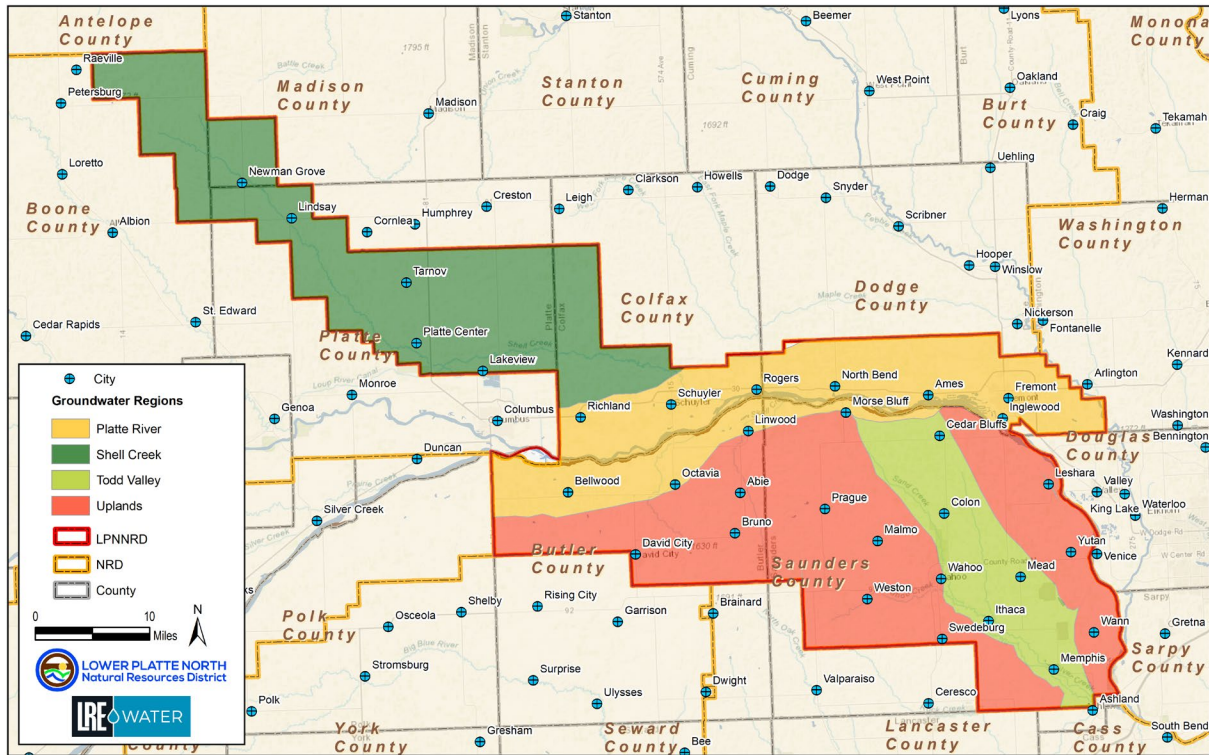


Figure 6: Groundwater Regions of the LPNNRD

2.2 HYDROGEOLOGIC DATASETS

Since 2006, the Eastern Nebraska Water Resources Assessment's (ENWRA) work has resulted in vast geologic datasets and creation of hydrogeologic frameworks for six NRDs in eastern Nebraska, including the LPNNRD. The major datasets include airborne electromagnetic (AEM) data, and geologic logs from the NeDNR and University of Nebraska-Lincoln, Conservation Survey Division (UNL-CSD) well and test holes database. These data sets and detailed desktop hydrogeologic assessments completed recently for the District are available to aid in well siting and similar groundwater management actions.

2.2.1 Airborne Electromagnetic Survey

AEM is an airborne geophysical survey method that can provide characterization of electrical properties of earth materials from 3 to 10 feet to depths over 1,000 feet. These surveys provide geophysical data quickly and efficiently and when analyzed, can help define aquifer and non-aquifer materials. The AEM surveys have been crucial in the LPNNRD's efforts to help address water quality and quantity challenges.

The LPNNRD's AEM survey datasets and reports from 2009, 2012, 2015, 2016 and 2018 are available on EWRA's projects website (<https://enwra.org/projects>). The AEM flight line locations within the District and adjacent NRDs are shown in Figure 7.

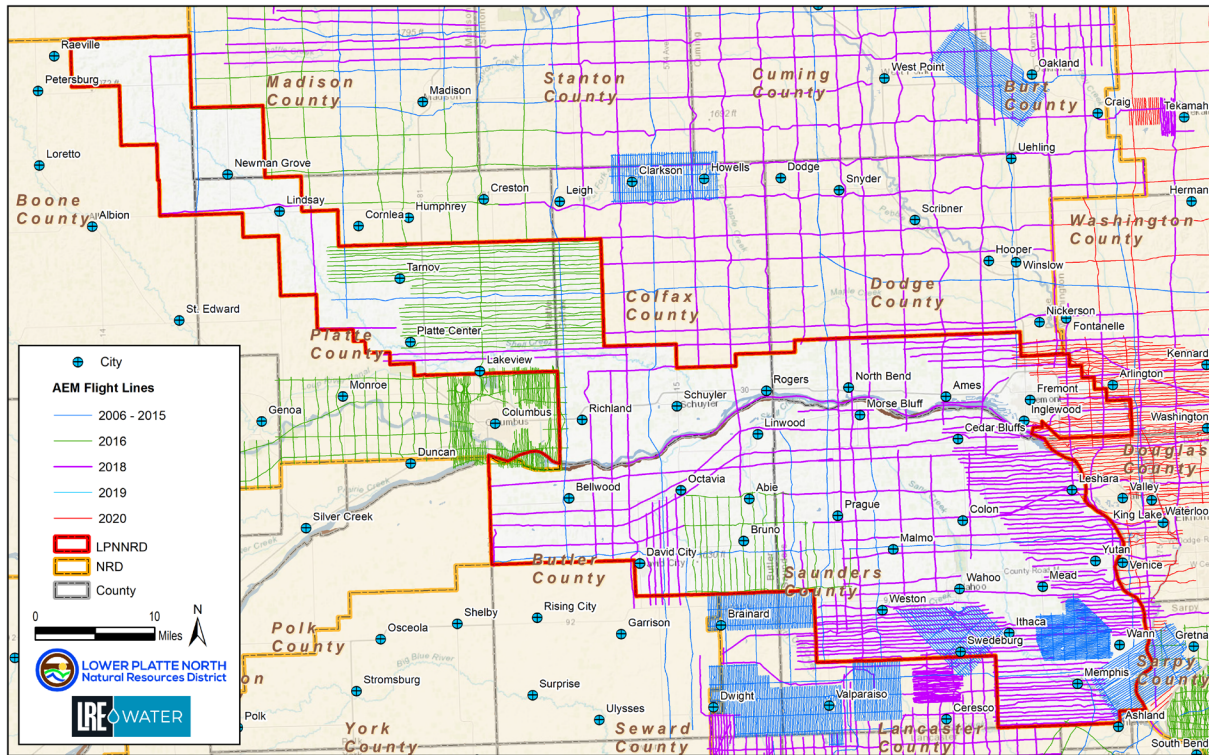


Figure 7: AEM Flights within and near the LPNNRD

2.2.2 3D AEM Framework and Hydrogeologic Assessment

In 2022, the LPNNRD utilized the AEM datasets to create a 3D AEM Framework (LRE Water, 2022), in addition to constructing detailed hydrogeologic cross sections from geologic logs. The framework was created using Leapfrog, a 3D geological modeling software program. The program delineated the hydrostratigraphy and hydraulic conductivity zones from the processed AEM data. The framework offers several benefits:

- Provides hydrogeologic information to assist staff in reviewing well permits.
- Enhances understanding of aquifer characteristics, such as recharge areas and water-bearing layers.
- Facilitates vulnerability assessments and identifies areas needing best management practices.
- Better defines hydrologically connected surface and groundwater.
- Improves collaboration with neighboring NRDs and NeDNR.
- Creates a MODFLOW grid, including layers, cells, and hydraulic conductivity zones for numerical groundwater flow modeling.

An example of a Leapfrog Works model output is shown in Figure 8 where higher resistivities are shown as brighter colors and are representative of sand and gravel. The darker colors represent low resistivity and represent clay, till, and losses. The bedrock surface is shown as a black line.

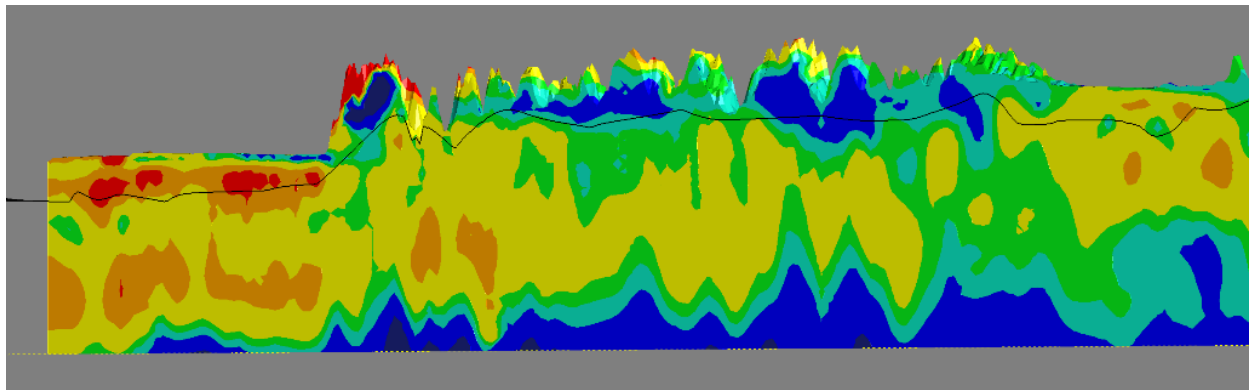


Figure 8: 3D Leapfrog output in cross section

In 2023, a Hydrogeologic Assessment (Assessment) was completed for the LPNNRD utilizing all available NeDNR well logs UNL-CSD test holes (LRE Water, 2023). In total, 22,500 well logs and 290 test holes were incorporated into the Assessment, which included a 5-mile buffer around the LPNNRD boundary. There were a total of 11,893 wells within the LPNNRD with geologic logs as seen in Figure 79. The Assessment also utilized existing geologic information from the 2022 3D AEM Framework.

In addition to a bedrock surface, the geospatial and hydrogeologic analyses completed on the geologic log data were used to develop 28 hydrogeologic cross sections, and to generate the other hydrogeologic raster surfaces, many of which were utilized to create the maps illustrated below within this plan.

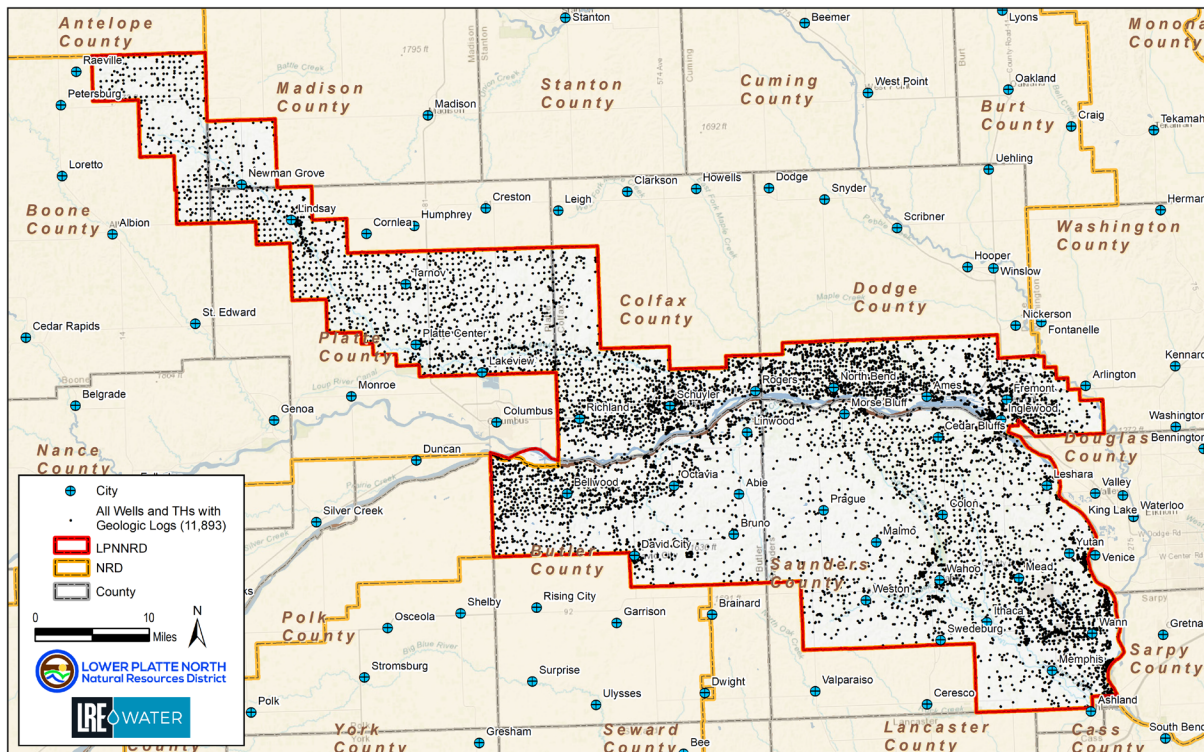


Figure 9: Well and Test Holes with Geologic Logs (LRE Water, 2023)

2.3 TOPOGRAPHY

The northwest arm of the District is dominated by upland dissected plains topography and includes portions of Boone and Madison counties, and about two-thirds of Platte County. To the southeast, the central portion of the LPNND includes approximately 125 miles of the Platte River Valley, extending from the cities of Columbus to the west and Ashland to the east. Through the east-central portion of Saunders County, from the cities of North Bend to Ashland, is a broad fertile area 5 to 8 miles wide, referred to as the Todd Valley. West and southwest Saunders County and eastern Butler County, known locally as the 'hill area', is comprised of bluffs along the north edge and rolling hills, ridges, and steep valley slopes south of the Platte River Valley. A map of the topography, derived from a Digital Elevation Model (LRE Water, 2023), is shown in Figure 10.

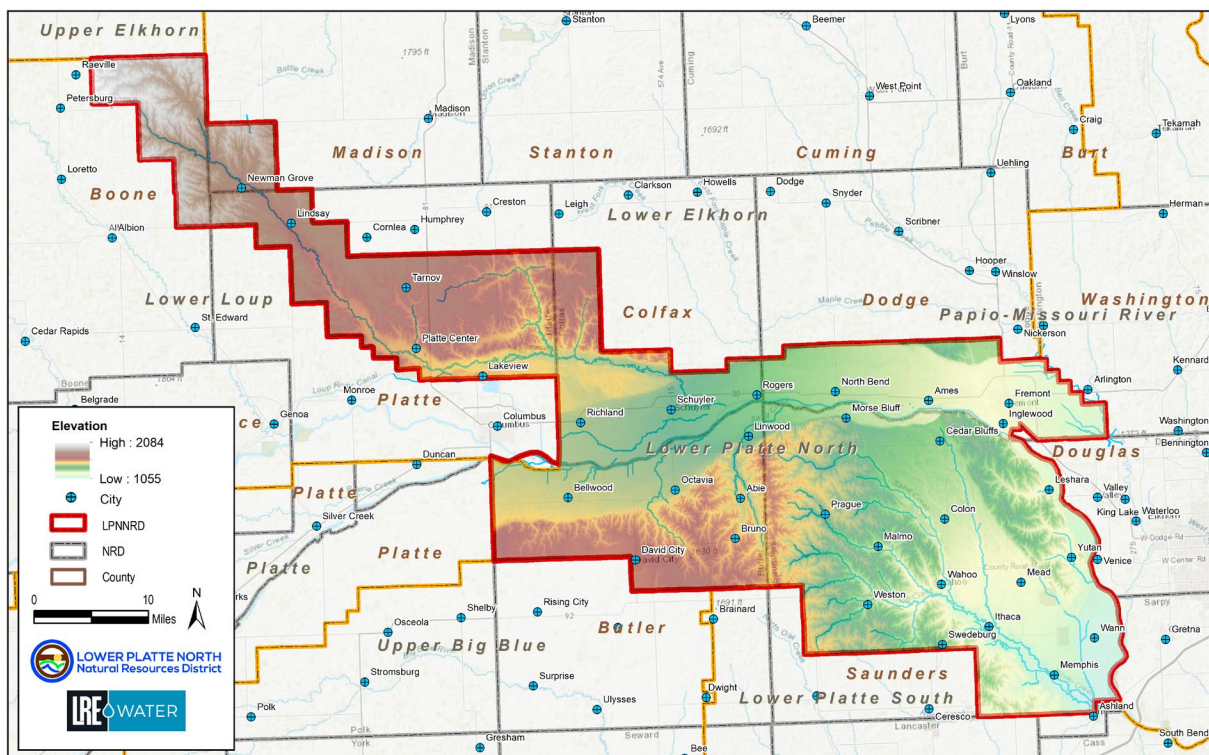


Figure 10: Topography of the LPNND

2.4 SOILS

Soils in the uplands of Butler and Saunders counties consist primarily of clays and silty clays to silty clay loams somewhat similar to the Sharpsburg and Sharpsburg-Pawnee association. Primary soils in the upland areas are eroded to a point where they no longer exist, and landowners are now farming in the "B" horizon. This has implications for surface and groundwater quality. The permeability of these soils is less than 1.0 inch per hour on slopes that range from gentle to 20 percent. Recharge rates are quite low and recharge is principally limited to perched aquifers. These soils are loess type soils with some intermixed glacial till areas. The drainage pattern and flood plain configuration of Wahoo Creek is primarily composed of Kennebec soils of silty clay loam ranging from moderate to poorly drained (HWS, 1995).

The western portion of the Platte River corridor is comprised of Acadia-Platte alluvial fine sands underlain by sands and gravels. The eastern portion of the corridor is practically the same, however, depth to water in the eastern area is greater. This primary water line, where groundwater is most significantly present within the Platte River corridor, is bounded on the north by poorly drained Gibbon-Luton silty and clayey soils. Areas to the south and a few areas along the western end of the Platte River corridor contain silty soils that are well drained and of loess origin (HWS, 1995).

The northwest corner of the District is composed of moderately to well drained silty type soils with permeabilities ranging from 1 to 2 inches per hour above the areas adjacent to Shell Creek. Areas in northeast Platte County have permeability ranges of 1.5 to 5 inches per hour (HWS, 1995).

The general pattern of soil distribution shows that soils of loess origin are found on the uplands with alluvial soils predominant on the bottom lands, as seen in Figure 11. Permeabilities range from practically zero to greater than 10 inches per hour (near Columbus and southeast of Bellwood). The pattern shows that, generally, soils south of the Platte River are less permeable than those of the north side. Soil textures range from fine sands to silty clays.

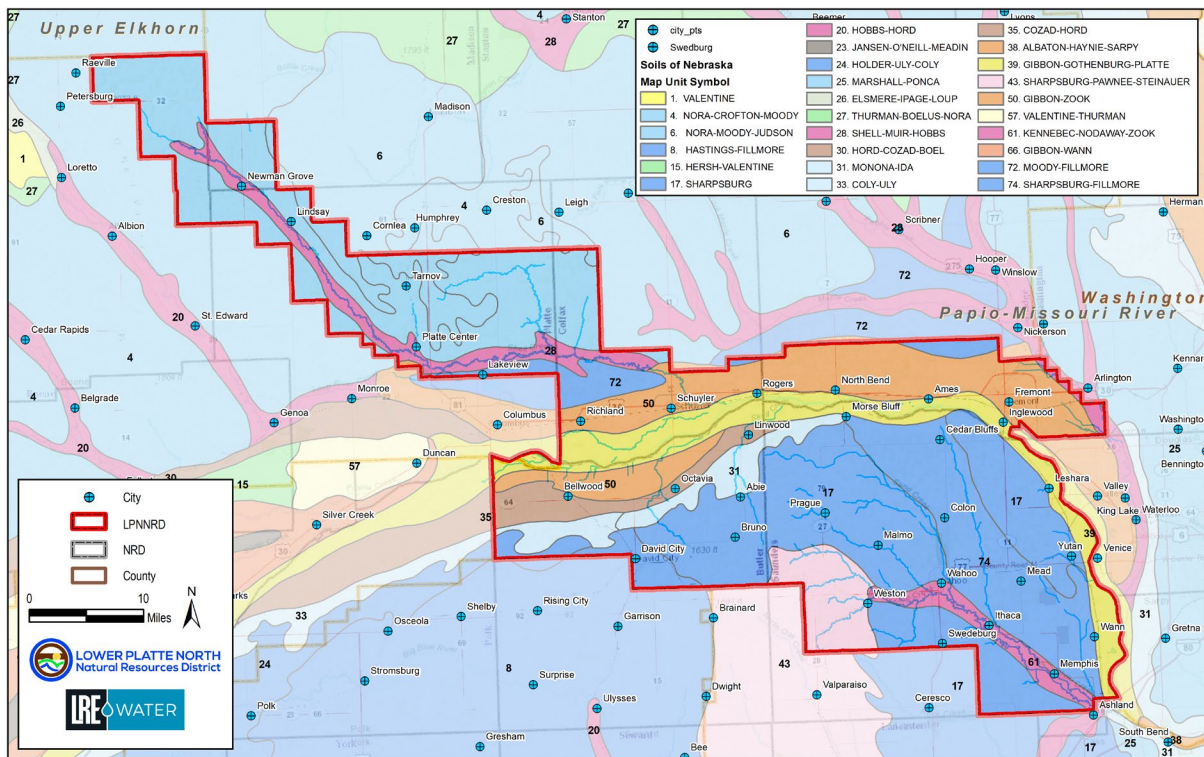


Figure 11: Soil Types

2.5 GEOLOGY AND HYDROLOGICAL CHARACTERISTICS

The geology of the District generally consists of Quaternary-age unconsolidated loess, glacial till and outwash, and older buried fluvial deposits overlying bedrock. The five primary bedrock formations are shown in Figure 12. A description of the major unconsolidated and bedrock formations and their potential to transmit water to wells, as described in the previous plan, are listed in Table 2.

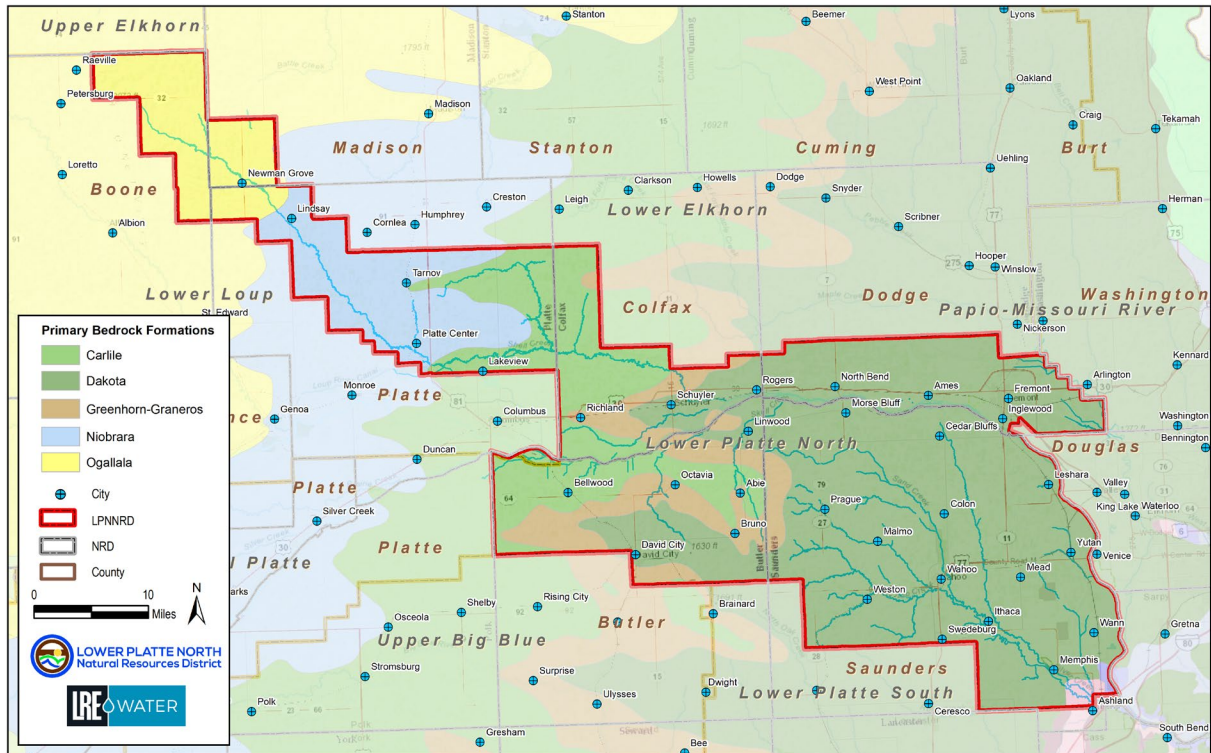


Figure 12: Bedrock Formations

Table 2: Geologic Sequence of Major Formations in LPNNRD

SYSTEM	SERIES	MAJOR STRATIGRAPHIC UNITS	PHYSICAL CHARACTER	WATER SUPPLY
Quaternary	Holocene	Modern Soils	Locally silty, clayey, or sandy.	Transmits locally variable amounts of recharge to the groundwater reservoir.
		Recent valley-fill deposits	Alluvial deposits of gravel, sand, silt, and clay associated with the most recent cycle of erosion	May contribute significant amounts of water to wells.

SYSTEM	SERIES	MAJOR STRATIGRAPHIC UNITS	PHYSICAL CHARACTER	WATER SUPPLY
	Pleistocene	Loess	Wind-blown silt with lesser amounts of very fine sand and clay.	Transmits recharge to the underlying aquifers. May provide small quantities of water to shallow wells.
		Till	Ice-deposited silty, sandy clay with gravel and larger pebbles and boulders.	Relatively impermeable. Transmits water slowly to buried aquifers. Groundwater may be perched above the till. Sand deposits within the till provide water to low-capacity wells.
		Glacial outwash and other ancient valley-fill deposits	Alluvial deposits of gravel, sand, silt, and clay associated with ancient erosional and depositional cycles.	Contributes water to wells in generally large amounts, stream-deposited sand and gravel constitute the major aquifers and yields to high-capacity wells.
Tertiary	Pliocene(?)	Ancient valley-fill deposits	Mostly unconsolidated silt. May blanket Cretaceous bedrock at base and on side slopes of paleo-valleys.	Generally, too fine textured to yield water to wells.
	Miocene	Ogallala	Poorly sorted clay, silt, sand, and gravel generally uncemented to slightly cemented.	The Ogallala constitutes a major aquifer in western portion of LPNRD. Yields to large-capacity wells.
Cretaceous	Upper Cretaceous	Niobrara	Chalk	May supply water to wells where fractures exist or are saturated.
		Carlile	Shale	Not known to supply water to wells
		Greenhorn	Limestone	
		Graneros	Shale	
	Lower Cretaceous	Dakota	Sandstone and shale	Constitutes a significant aquifer in the eastern part, potentially yields and water quality are locally variable.

Source: HWS, 1995

2.6 TOTAL SATURATED SAND

The total thickness of saturated sand is an indicator that can be used to qualitatively evaluate the relative potential yield from an aquifer or aquifers. The total saturated sand in the District, shown in Figure 13 (LRE, 2023), was created using water level and geologic data from NeDNR well logs and UNL-CSD test holes logs. Figure 13 was created by reviewing only the available geologic logs that

encountered bedrock from the NeDNR and UNL CSD datasets. The thicker aquifers are present in the northwest and Todd Valley portions of the District, and generally become thinner in the central portion and beyond Todd Valley.

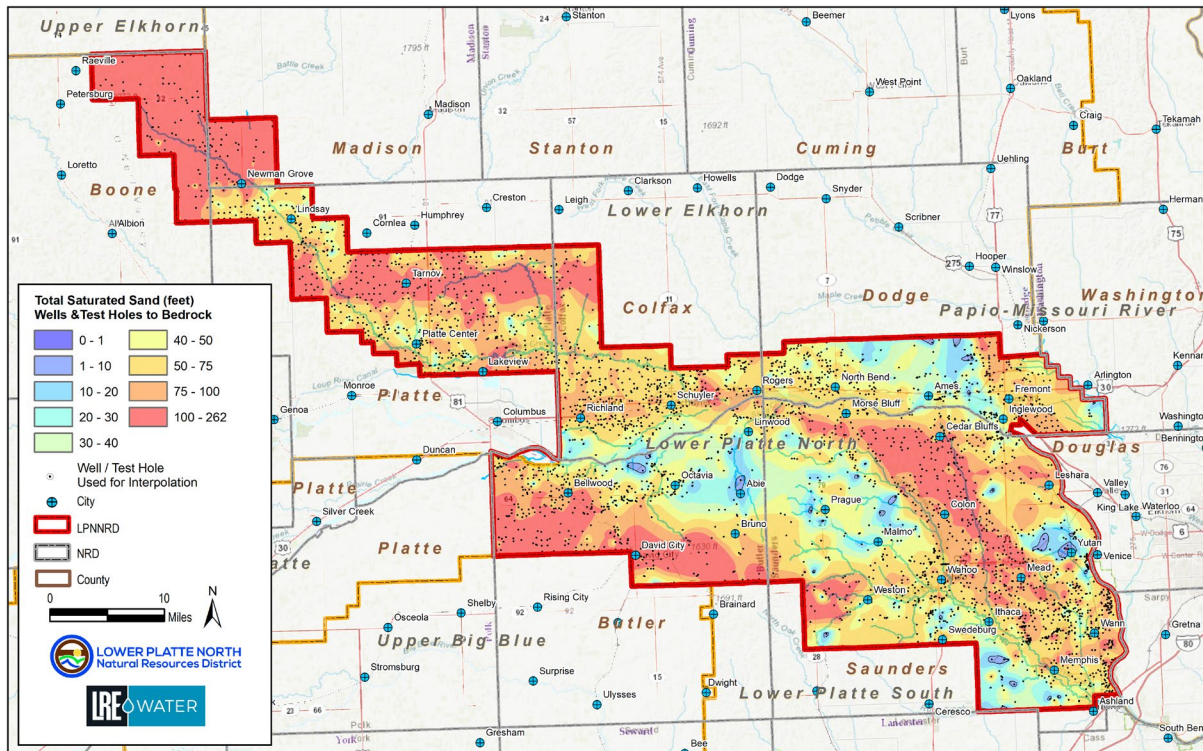


Figure 13: Total Saturated Sand, Well and Test Holes

2.7 CONFINED VS. UNCONFINED AQUIFERS

A confined aquifer is a formation below the land surface that is saturated with water and has impermeable layers above and below it causing it to be under pressure. As a result, when a confined aquifer is penetrated by a well, the water will rise above the top of the aquifer in the well. Artesian wells are a result of confined aquifers. In a confined aquifer, water level declines represent a reduction of artesian head, not saturated thickness.

A management strategy for a confined aquifer is to avoid pumping a confined aquifer to levels where it unnaturally transitions to unconfined conditions. The primary risk of this is decreasing the aquifer's pore pressure, which can potentially reduce well yields and quality due to changes in water pressure and oxidation. Over pumping can also lead to well interference by reducing the available head in the aquifer, declining water levels, and reduced well yields.

Unconfined aquifers, also referred to as water table aquifers, are present where the upper water surface (water table) is equal to atmospheric pressure. In an unconfined aquifer, water level rises and declines changes affect the saturated thickness.

Management strategies for an unconfined aquifer are to avoid over pumping if the rate of withdrawal exceeds the rate of recharge. In addition, dewatering activities can draw in pollutants, potentially

contaminating the water source, and excessive pumping can lead to reduced saturated thickness and well yields, reduced water levels in nearby surface waters if hydraulically connected, and the potential for well interference with other users.

Differences in static (i.e., non-pumping) groundwater levels measured in adjacent wells could be caused by wells being screened at different depths and/or in different aquifers.

Knowing whether an aquifer is confined or unconfined is important for effective groundwater management in Nebraska for several reasons:

1. **Water Availability:** Unconfined aquifers, also known as water table aquifers, are more influenced by surface conditions and can be more susceptible to droughts. Confined aquifers, under pressure, provide a more stable water supply.
2. **Recharge Rates:** Unconfined aquifers recharge more quickly due to their proximity to the surface and direct receipt of precipitation. Confined aquifers recharge more slowly due to impermeable layers above them.
3. **Water Quality:** Unconfined aquifers are more vulnerable to surface contamination from activities like agriculture and industry, while confined aquifers are generally better protected. Well construction issues will increase the vulnerability.
4. **Management Strategies:** Different practices are required for managing confined and unconfined aquifers. Unconfined aquifer management focuses on protecting recharge areas and controlling surface contamination, while confined aquifer management involves monitoring pressure levels and ensuring sustainable withdrawal rates. Pressure levels can be monitored using a piezometer to measure water level, known as the piezometric head. The pressure is calculated at a specific depth using a formula that includes the density of water, acceleration due to gravity, and height of the water column above the point of measurement.
5. **Hydraulic Properties:** The hydraulic properties, such as transmissivity and storativity, differ between confined and unconfined aquifers, affecting water movement and extraction.

By understanding the differences in aquifer types, the staff and Board can develop more effective strategies to promote sustainable water use and protect water quality by allocating resources based on specific needs. Figure 14 (LRE, 2023) illustrates the distribution of confined and unconfined aquifers. In certain areas, aquifers may transition from unconfined to confined due to fluctuations in water levels, with transitional zones defined as areas experiencing water level changes of approximately ± 10 feet. For the purposes of the GWMP, all transitional zones are classified as unconfined. Figure 15 provides an example of a transitional zone where over pumping has resulted in a shift from confined to unconfined conditions.

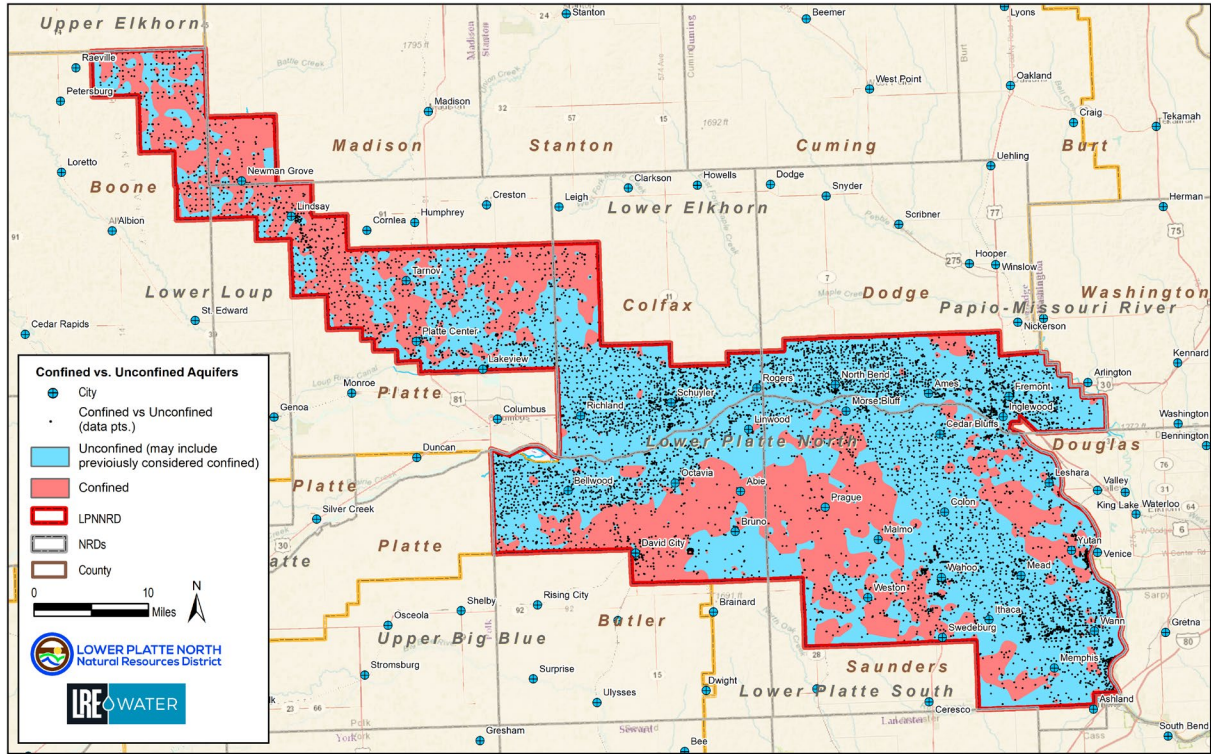


Figure 14: Confined vs. Unconfined Aquifers

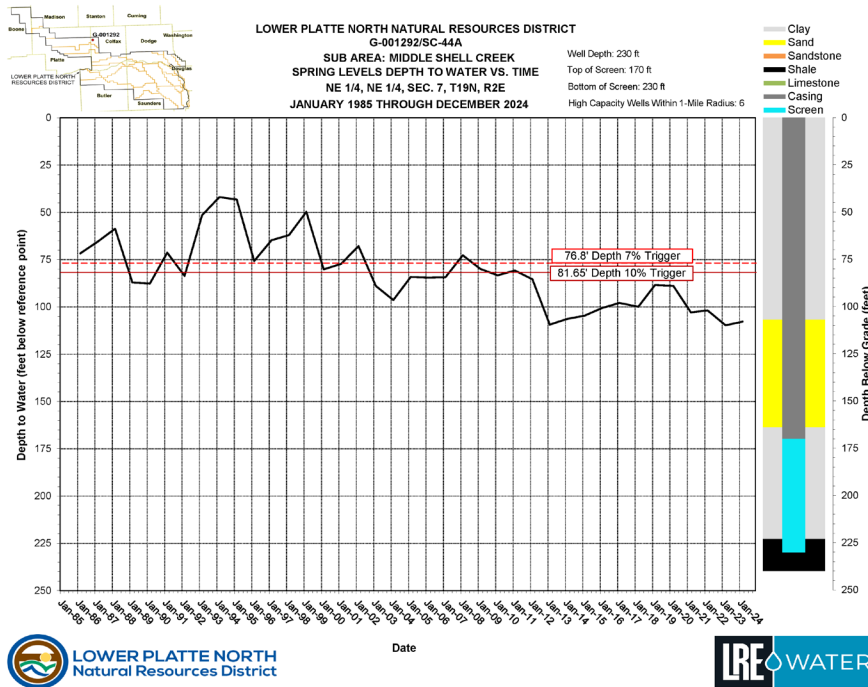


Figure 15: Hydrograph of Transitional Aquifer Type

2.8 TRANSMISSIVITY

Transmissivity is perhaps the one hydrologic parameter which best describes the aquifer and its potential for use and withdrawal. Transmissivity is the rate which quantifies the ability of an aquifer to transmit water and is dependent on saturated thickness and permeability.

Figure 16 shows the transmissivity of the Principal Aquifer for the LPNNRD based upon the Assessment (LRE Water, 2023). Areas with transmissivity less than 10,000 gallons per day per foot are not considered optimal areas for high-capacity wells, which are hatched.

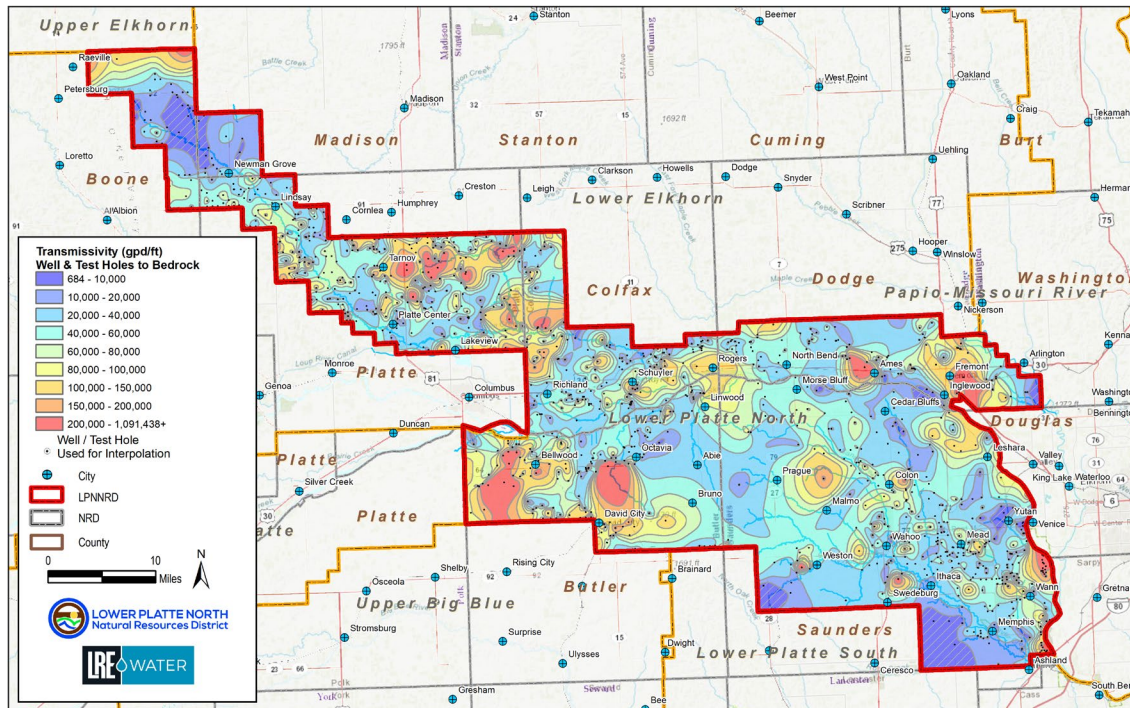


Figure 16: Aquifer Transmissivity

2.9 CLIMATE AND PRECIPITATION

Precipitation in the LPNNRD serves as the principal source of water for recharge, except in the Platte River Valley and areas adjacent to the Platte River, where river water contributes to aquifer recharge. Pumping in these areas can further induce additional recharge from the river. Figure 17 demonstrates the mean annual precipitation for the state and the LPNNRD between 1981 and 2020, provided by the National Oceanic and Atmospheric Administration. The average annual water requirement for maximum yield by crops varies from 25 inches for corn to 22 inches for grain sorghum and soybeans (HWS, 1995). The overall average water use for irrigation to supplement precipitation is 5.56 inches district-wide, with the exception of Butler/Saunders SQS#1 (4.65) and Platte/Colfax SQS#2 (4.59) where allocations restrict pumping (LPN, 2024). Moisture needs are more critical at certain times in the crop growing cycle and if moisture is not available, crop production can and does suffer. Detailed evaluations of precipitation versus soil moisture and crop water needs are necessary components in providing a comprehensive management system.

This area of the state receives maximum precipitation in April, May, and June, at which time the highest rate of leaching of contaminants is occurring. The maximum water use period by crops stretches from April through September (crop dependent), with July, August, and September water requirements exceeding available average precipitation. It is apparent that at certain times there is a need for irrigation water to consistently produce high yields.

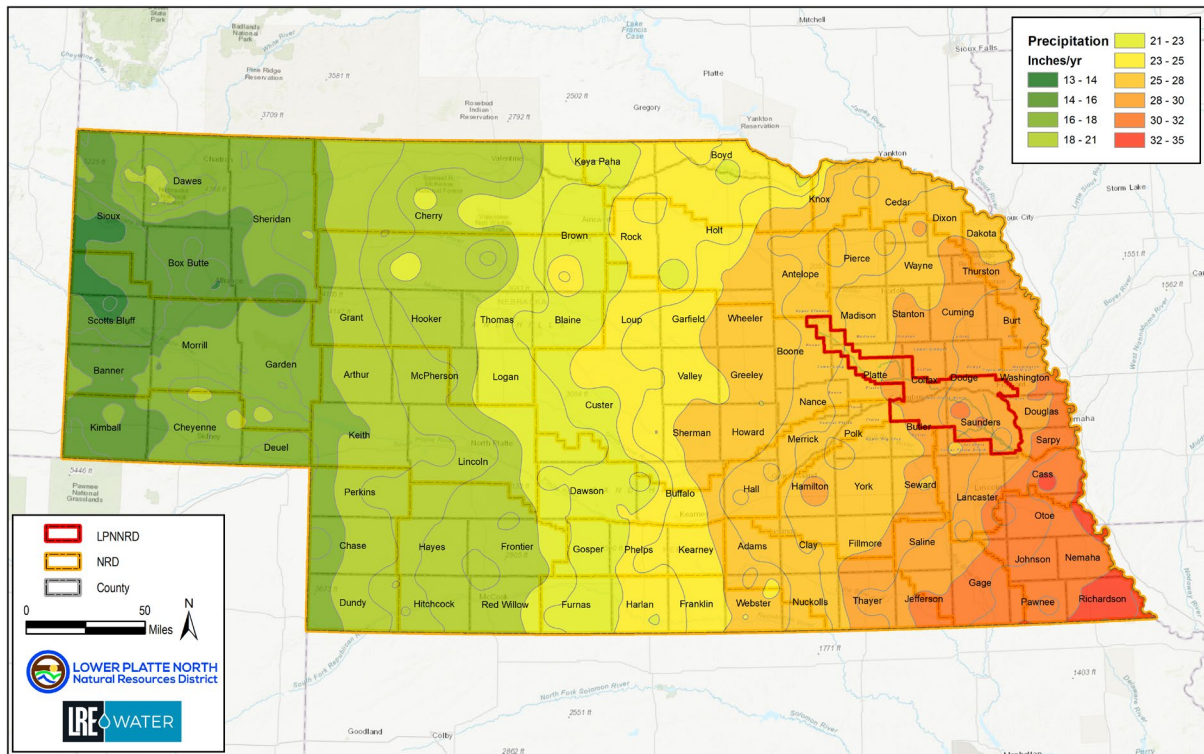


Figure 17: Average Annual Precipitation (1981-2010)

2.10 LAND COVER

The vast majority of the District’s 1,030,468 acres (approximately 75 percent) of LPNNRD is classified as row crop by the CropScape – Cropland Data Layer, derived from the U.S. Department of Agriculture’s National Agricultural Statistics Service (NASS). The NASS dataset was used to look at land cover changes since 2009 and categories were combined into seven sub-categories, out of the 37 that are available. As shown in Table 3, over 84,500 acres of grass or pasture has been converted since 2009. The increase in wetlands was not determined but could be a result of the 2019 flood event or potentially a difference in interpretations of data collected in each respective year. A spatial representation of land cover is shown in Figure 18.

Table 3: LPNNRD Land Cover Change (2009 – 2023)

Land Cover	2009	2023	Ac Change	% Change	2009 Coverage	2023 Coverage
Row Crop	716,285.3	769,604.6	53,319.3	7.4%	69.5%	74.7%
Alfalfa/Hay	19,640.1	34,722.4	15,082.3	76.8%	1.9%	3.4%
Developed	55,475.7	58,863.9	3,388.2	6.1%	5.4%	5.7%
Grass/pasture	179,834.1	95,315.4	-84,518.7	-47.0%	17.5%	9.2%
Forest	33,010.9	35,942.7	2,931.8	8.9%	3.2%	3.5%
Open Water	17,666.4	19,698.6	2,032.2	11.5%	1.7%	1.9%
Wetlands	8,556.2	16,320.7	7,764.5	90.7%	0.8%	1.6%

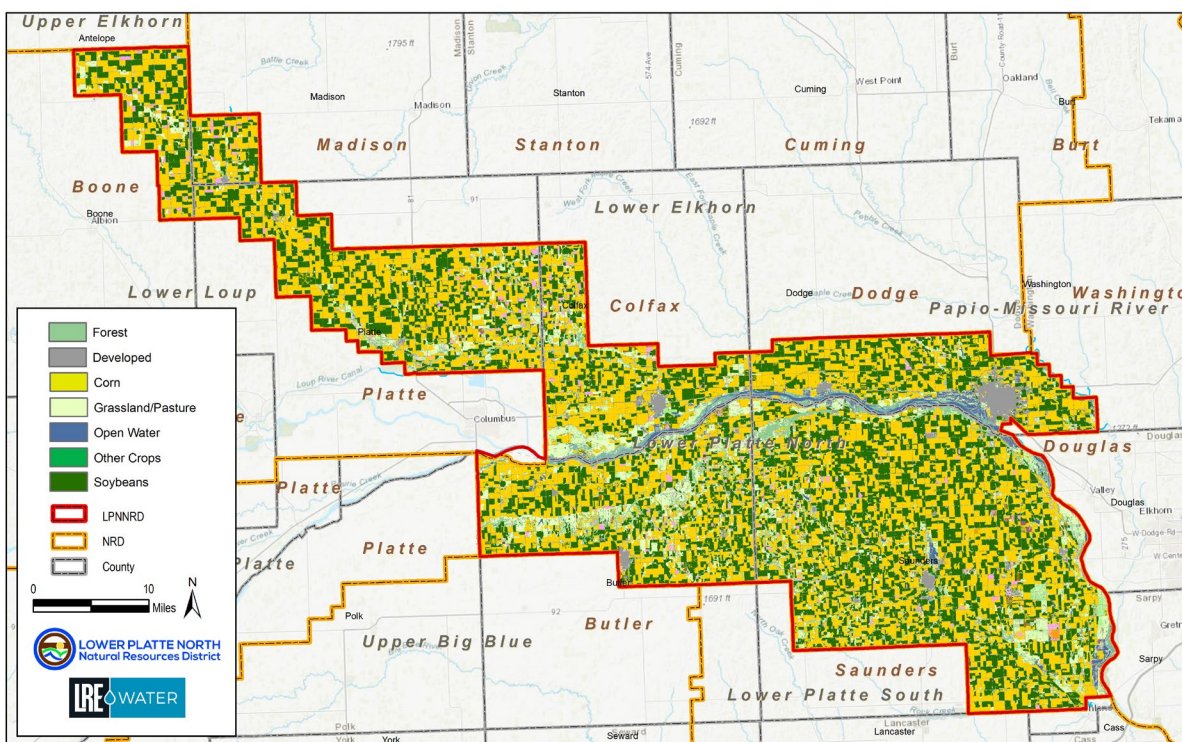


Figure 18: 2023 Land Cover

As the total number of acres harvested increases, the following occurs:

1. The number of acres of permanent cover decrease.
2. The number of acres more susceptible to erosion and runoff increases.
3. The usage of fertilizer, herbicides, pesticides, etc. increases.
4. The potential for ground and surface water degradation increases.
5. The use of high-capacity wells for irrigation increases demand on the aquifers and surface water resources.

2.11 POPULATION – ECONOMIC BASE

The economic base for LPNDR communities varies, but generally includes agriculture, manufacturing, and services. Many of the communities rely heavily on agriculture, including crop production (corn, soybeans) and livestock farming. The City of Fremont, the largest community, has a diverse industrial base with food processing, metal fabrication, and other manufacturing sectors. Tourism and recreation are also available, with multiple state and locally operated lakes open to the public, along with use of the Platte River for open water recreation.

The total population of the LPNDR is estimated at 65,447 (NARD, 2024) with approximately 49,860 within incorporated communities, or approximately 76 percent. Most of these residents in the rural areas are relying on private drinking water wells. A breakdown of population for the 28 LPNDR communities is shown in Table 4.

Table 4: Population of Incorporated Places (1990 – 2025)

Village/City	1990	2000	2010	2020	Projected Population 2025
Yutan	1,100	1,216	1,174	1,308	1,350
Weston	310	310	324	335	340
Wahoo	3,700	3,942	4,508	4,509	4,600
Prague	340	346	303	285	290
Morse Bluff	130	134	135	135	140
Memphis	110	106	114	114	120
Mead	580	564	569	617	630
Malmo	120	109	120	120	125
Leshara	115	112	112	112	115
Ithaca	150	168	148	148	150
Colon	140	138	110	110	115
Cedar Bluffs	630	615	610	610	620
Schuyler	5,200	5,371	6,211	6,547	6,700
Rogers	95	95	95	95	100
Richland	75	73	73	73	75
North Bend	1,180	1,213	1,177	1,241	1,300
Inglewood	390	382	325	325	330
Fremont	24,500	25,174	26,397	27,141	27,500
Octavia	125	127	127	127	130
Linwood	88	88	88	88	90
David City	2,550	2,597	2,906	2,995	3,050
Bruno	110	112	99	99	100
Bellwood	440	446	435	435	440
Abie	110	108	69	69	70
Newman Grove	790	797	721	721	730
Tarnov	65	63	46	46	50

Village/City	1990	2000	2010	2020	Projected Population 2025
Platte Center	340	336	336	336	340
Lindsay	320	321	255	255	260
TOTALS	43,803	45,063	47,587	48,996	49,860

Source: Statistical Atlas of the U.S.

Information on industrial activity demonstrates a variety of industrial types present in the District that includes grain processing, alfalfa products, concrete products, equipment manufacturing, fiberglass manufacturing, irrigation equipment manufacturing, sand and gravel mining, steel fabrication, confined animal feeding operations (swine, beef, and chickens), packing plants, among many others. This industrial array also yields a diversity of water needs and waste treatment problems. These needs and problems may have a degrading effect on both ground and surface water quality and quantity if not properly addressed.

2.12 SURFACE WATER

The LPNNRD is recognized by its northwest boundary consisting of the Shell Creek watershed extending from the cities of Newman Grove to Schuyler, where it meets the Platte River. Other significant streams include Elm Creek, Loseke Creek, Lost Creek, Skull Creek, and Wahoo Creek and its tributaries including Sand Creek, Silver Creek, and Cottonwood Creek (Figure 19).

Outside of the Platte River, most of the other perennial streams do not support floating or active recreational uses. Flow through this region of the Platte River is a combination of the Upper Platte, the Loup, and the Elkhorn Rivers. Flow in the Platte River can range from no flow to overbank flows. The data (for 51 years up to 1995 as listed in the 1995 GWMP), at the City of Ashland shows the contributions of flow are: Elkhorn River (22 percent), Loup River (48 percent), upper Platte River (28 percent) and tributaries and valley groundwater inflow (2 percent). The annual and seasonal percentages of contribution vary extensively and are dependent upon the level of precipitation or runoff from snowmelt within the areas of influence. As precipitation influences streamflow, dry periods likewise influence streamflow and the manner of loss and gain to groundwater areas is often linked with streamflow volume.

Most of the streams receive baseflow from groundwater seepage to help maintain stream levels during dry periods. However, during heavy rain events, streams become 'flashy' and experience rapid increases in flow and water levels due to surface water runoff.

Surface water rights are managed by NeDNR. As of 2025, there are a total of 154 active surface water diversion points across the LPNNRD with a record of 10,163 acres of irrigated crops utilizing surface water (NeDNR, 2025a).

The Platte River's role in recharging groundwater by induced pumping and during periods of overbank flow within portions the LPNNRD is vital. Wellfields along the Platte River are crucial for supplying water to a significant portion of Nebraska's population, including water supplies for the City of Lincoln Water System (296,000 customers) (City of Lincoln, 2024) and Metropolitan Utilities District (600,000 customers) (MUD, 2024). The importance of this water source, managing the balance between groundwater recharge and surface water flow is essential. This involves monitoring water quality,

managing water withdraws, water rights, and ensuring sustainable practices to maintain the health of the aquifer and the river system.

There are a total of seven stream gages, managed USGS, within the LPNDR, including one in progress. The location and station name for each of the gage stations is shown in Table 6 with locations in Figure 19. Historical stream flow hydrographs can be found in Attachment A. Statistics from the USGS gage stations provide an idea of the volume of water, and variation in flow events, within Shell Creek, Wahoo Creek, and Platte River.

Table 5: LPNDR Steam Gage Information

Station Number	Station Name	General Location
06795500	Shell Creek near Columbus	122nd Ave - 4 miles NE of Lake Babcock
06796000	Platte River at North Bend	State HWY 79 - 0.5 miles S of North Bend
06796500	Platte River near Leshara	State HWY 64 west of Valley
06804000	Wahoo Creek at Ithaca	CRG - 1 mile S of Ithaca
06804700	Wahoo Creek at Ashland	State HWY 63 - 0.5 miles N of Ashland
06801000	Platte River near Ashland	At HWY 6
06795050	Shell Creek near Platte Center	In Progress

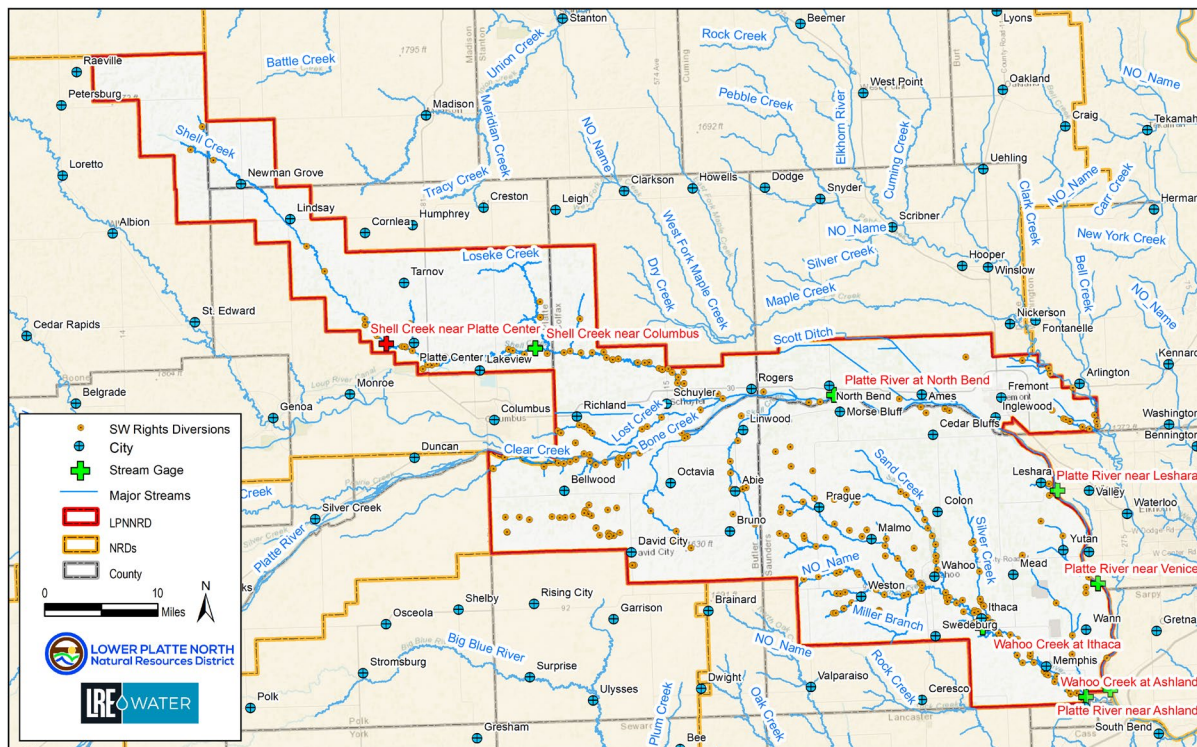


Figure 19: Major River Systems, Stream Gages and Diversion Points

2.13 WELLS AND TEST HOLES

The primary volumetric uses of groundwater in the District are for irrigation and municipal water needs, as shown in Figure 19. Groundwater is the principal source of supply for public drinking water systems, with all public water supplies deriving their supply from these sources. The cities of Lincoln, Omaha, and Fremont have extensive wellfields along the Platte River. Although the City of Lincoln is not located in the LPNNRD, a significant portion of its wellfield for public water supply is situated along the Platte River north of the City of Ashland.

The current use rate for the City of Lincoln’s wellfield averages 39.4 million gallons per day (mgd) but can reach up to 64 mgd during the summer months (LWS, 2020). This volume, combined with the demand from irrigation and other public and private users within the District, underscores the importance of both the quantity and quality of groundwater for continued and sustained development. While community water use is reported annually as part of the IMP implementation, the development of irrigation wells serves as an indicator of the majority of the aquifer use, as shown in Figure 20.

The UNL-CSD’s drilling program and has drilled 6,000 test holes throughout the state since 1930. Geologic material from these sites is preserved at the CSD Geological Sample Repository. This data is maintained by UNL-CSD and made available to the public for research, well siting, aquifer mapping, and much more. There are 151 UNL-CSD test holes within the LPNNRD, and another 136 within 5 miles of the LPNNRD boundary, as shown in Figure 21.

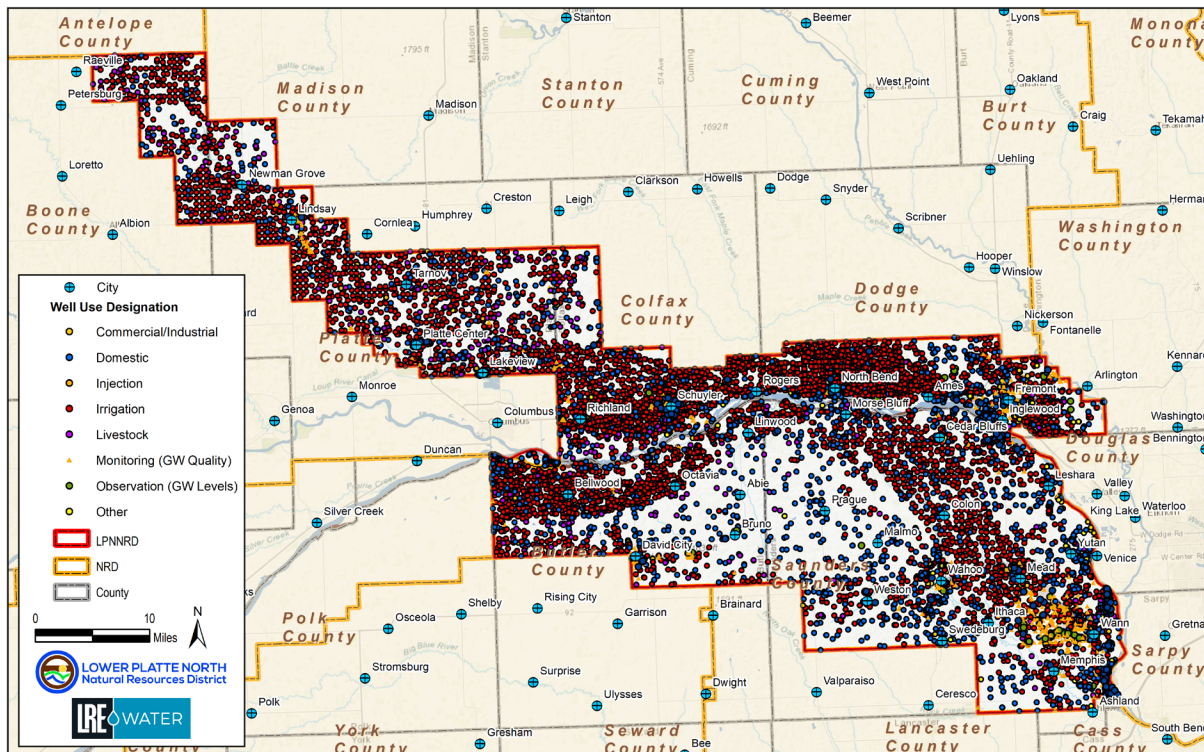


Figure 20: Registered Active Wells in the LPNNRD

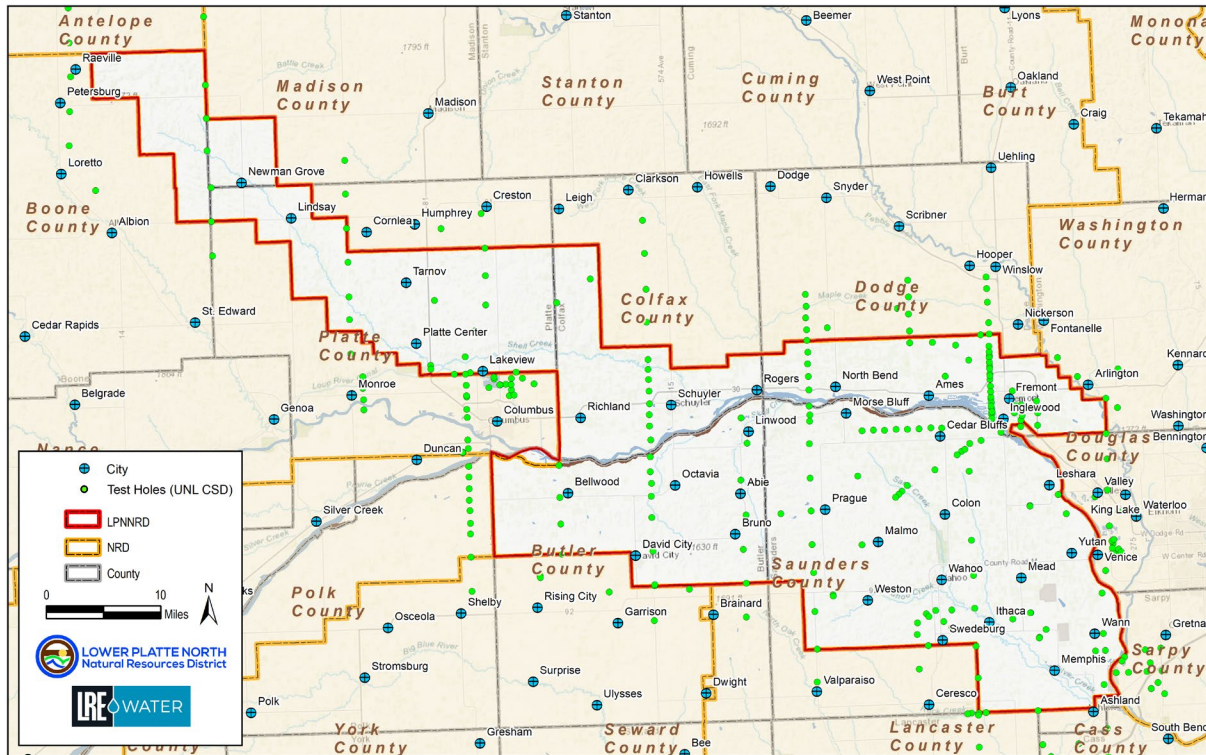


Figure 21: Test Holes within 5-miles of LPNNRD

2.14 PARTNERS AND PROGRAMS

The LPNNRD commonly works with a wide-array of partners in managing water resources. A summary of the major partners are listed below:

U.S. Geologic Survey (USGS)

The Nebraska Water Science Center, a organization of the USGS, commonly partners with NRDs to provide reliable, impartial, and foundational data and scientific analysis to support a wide-variety of groundwater and surface water projects. The USGS is responsible for the maintenance of the five stream gages in the LPNNRD.

Nebraska Department of Environment and Energy (NDEE)¹

The NDEE is responsible for protecting and improving human health, the environment, and energy resources. Primary responsibilities include environmental protection of air quality, water quality, land and waste management, emergency response to spills, petroleum remediation, climate change, assistance to agricultural practices, and energy resources.

The NDEE maintains the Nebraska Groundwater Quality Clearinghouse, a one-stop location for a wide-variety of water quality data that is strongly supported by NRDs. The Source Water Protection Program

¹ As of July 1, 2025, NDEE and NeDNR merged and are referred to as the Nebraska Department of Water, Energy, and Environment (NeDWEE)

provides funding and is utilized to support the protection and sustainability of public water systems and the WHP program. Other programs related to groundwater include Underground Injection Control, Onsite Wastewater Compliance, Agricultural Permitting, and the National Pollution Discharge Elimination System. NDEE also provides Section 319 funding including support of projects addressing nitrate leaching to groundwater.

Nebraska Department of Natural Resources (NeDNR)²

The NeDNR is responsible for surface water, groundwater, floodplain management, dam safety, natural resources planning, water planning and integrated management, storage of natural resources and related data, and administration of State funds (NeDNR, 2025b). The NeDNR is a regular partner with the NRDs and is currently working with the LPNNRD on implementation and updates to the IMP. The NeDNR is responsible for the maintaining the registered well database, registering wells, providing GIS data, and maintaining stream gages. They also administer multiple funding programs.

University of Nebraska – Lincoln Extension

The UNL Extension provides education and outreach, and is spearheading a statewide initiative to enhance collaboration among project partners to tackle health concerns related to contamination of water resources.

University of Nebraska – Conservation and Survey Division (UNL-CSD)

The UNL-CSD serves as the natural resources component of the School of Natural Resources. Overtime, UNL-CSD has partnered with the LPNNRD on a variety of projects aimed at installing dedicated monitoring wells and analyzing AEM data.

Eastern Nebraska Water Resources Assessment (ENWRA)

The ENWRA started in 2006 with six NRDs collaborating on the development of a geologic framework and water budget for the previously glaciated portion of eastern Nebraska (ENWRA, 2024). This group has been responsible for the collection of AEM surveys across a large area of Eastern Nebraska, including most of the LPNNRD.

Neighboring NRDs

Through efforts such as the Lower Platte River Basin Coalition, the LPNNRD regularly collaborates with neighboring NRDs on regional and local water management efforts. The LPNNRD is also a partner of the Lower Platte River Drought Contingency Plan and is working with NeDNR, LPSNRD and PMRNRD on development of a subregional groundwater model for the Lower Platte River.

Cities and Villages

The LPNNRD regularly collaborates with Nebraska cities and villages to manage and protect natural resources effectively including flood management, water quality programs, stormwater management, education outreach, recreation projects, and grant and funding assistance. The LPNNRD will assist

² As of July 1, 2025, NDEE and NeDNR merged and are referred to as the Nebraska Department of Water, Energy, and Environment (NeDWEE)

communities with development of WHP plans, source water protection projects, and engage with communities to site new public water supply wells.

Counties

The LPNNRD collaborates with Counties on flood reduction and ice jam management, groundwater management, education programs at county fairs, and engagement of special projects on a county-wide basis (SQS areas).

NARD

The NARD serves as the trade association for Nebraska's 23 NRDs. Some of the basic functions include coordination and support, governmental representation, education and outreach, resource sharing, and policy development.

Other Organizations

Local agronomists, cooperatives, and other partners support groundwater protection through nutrient management guidance, promotion of BMPs, and outreach that encourages sustainable farming practices across the LPNNRD.

2.15 ENVIRONMENTAL EDUCATION AND INFORMATION

The LPNNRD offers a variety of hands-on activities, classroom presentations, field trip opportunities, career exploration and more for young and old to learn more about the environment and our natural resources. There are two full time staff available to implement environmental education programs. All activities are of no cost to the public. Activities offered include:

- Coffee Lakeside and Monthly Educational Program
- Local and Regional Land Judging Contests
- Adult Environmental Education Opportunities
- Field trips to recreation areas and prairies
- Envirothon Field Day at Clint Johannes Education Building at Lake Wanahoo
- Local and regional range judging contest in partnership with area NRDs
- Spring Conservation Sensation – a natural resources field day for local 5th and 6th graders
- Test Your Well events in conjunction with local FFA Chapters
- Scholarships for:
 - Students participating in the Shell Creek Watershed monitoring group
 - Nebraska Association for Conservation and Environmental Education (NACEE) – support for teachers and other educators who are interested in science as it relates to natural resources.
 - Ag in the Classroom – incorporation of program materials into the classroom
 - Natural Resources Grant – to assist local high school students monetarily in a natural resources-based project within their community.

3 GROUNDWATER QUANTITY

3.1 GROUNDWATER LEVELS AND EXISTING WELLS

Most of the LPNNRD has not seen significant declines according to the UNL-CSD's annual 'Groundwater-Level Changes in Nebraska – Predevelopment (mid-1950s) to Spring 2023' dataset, shown in Figure 22. It is important to note that 2022 and 2023 were significantly dry years for the region. The primary area of concern is within Colfax County, where groundwater levels have declined 30 to 40 feet near the Village of Leigh where the District borders the LENRD. Other areas around the Village Bruno in Butler County also have documented declines. On the other hand, the far northwest corner of the District in the Shell Creek region has seen increasing level up to 30 feet near the Village of Petersburg and toward the Sandhills.

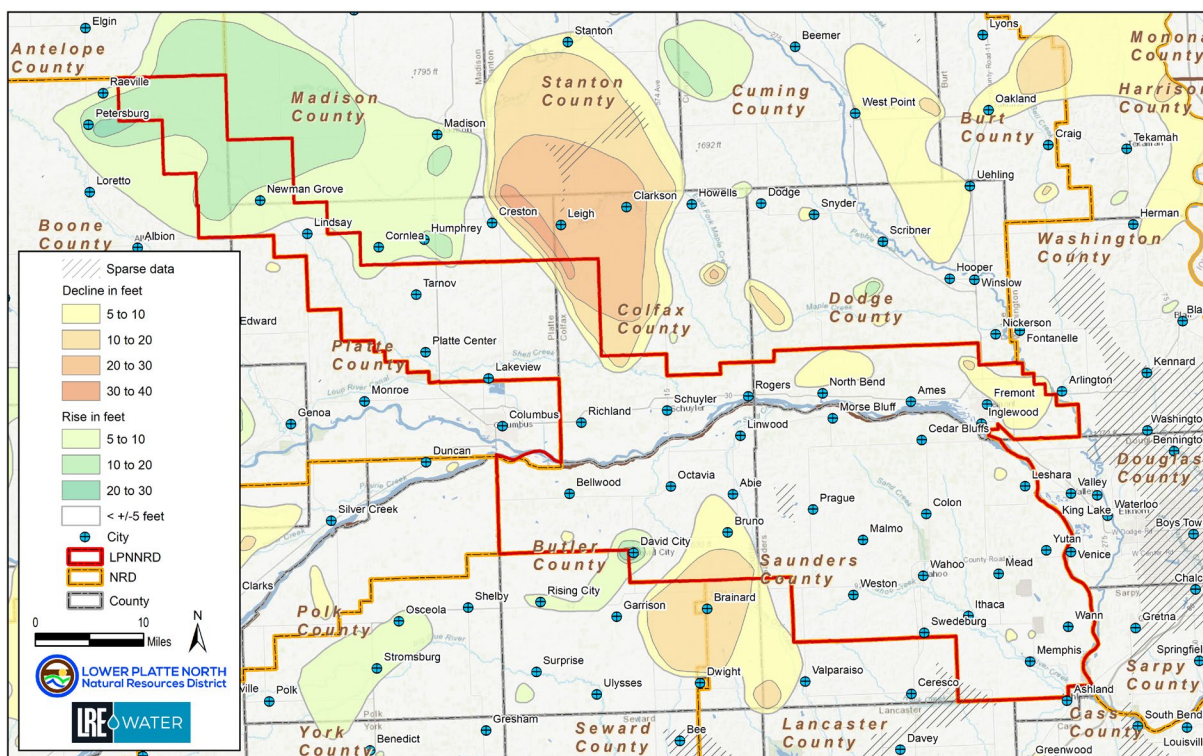


Figure 22: Groundwater-Level Changes in LPNNRD, Predevelopment to Spring 2023

Each spring and fall, LPNNRD staff measure static water levels from approximately 215 wells, most of which are utilized for high-capacity irrigation. The staff also manage a dedicated observation well network with 62 sites, each with a pressure transducer and logger with telemetry, providing real-time data to the staff and public through the District's website. The data from the spring water levels are utilized annually to review changes in water levels and are reviewed against the triggers set for Groundwater Management Phase Areas. Locations of the spring/fall static wells and dedicated network is shown in Figure 23.

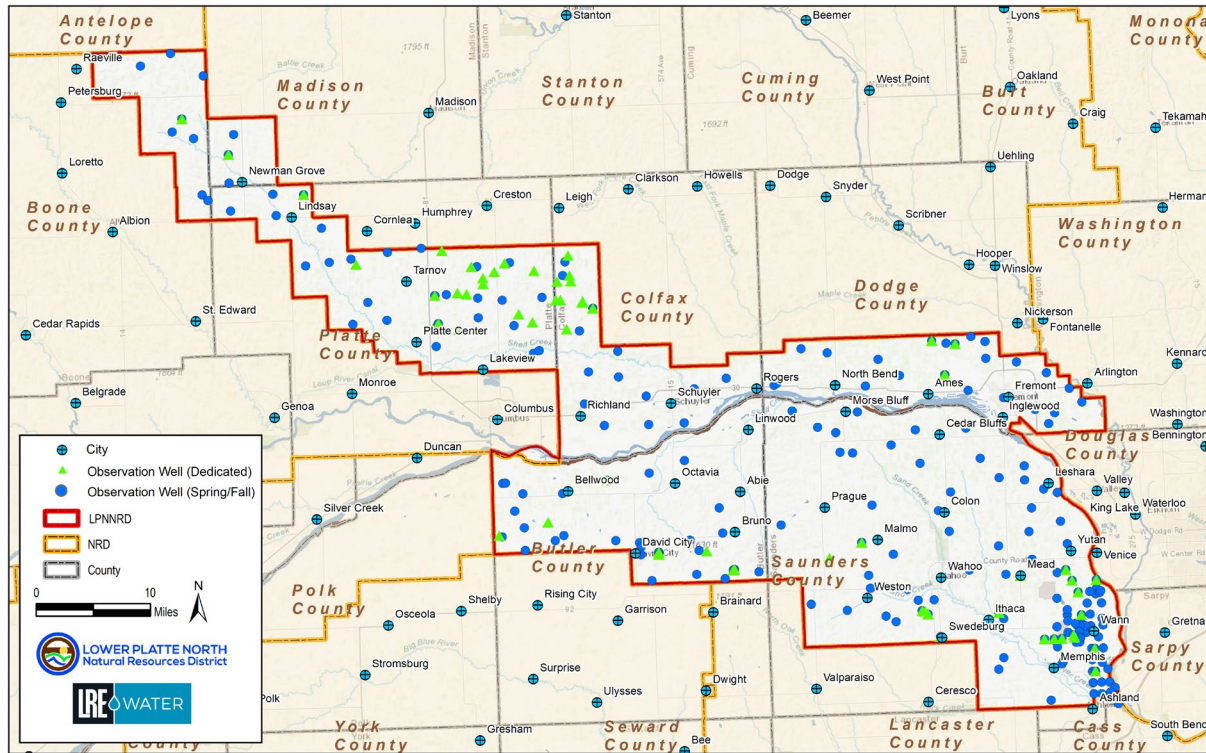


Figure 23: Observation Well Network

The depth to groundwater shown in Figure 24 was produced as part of the Assessment (LRE, 2023) and shows the depth to groundwater, in feet below ground surface. This elevation was determined by subtracting the ground surface elevation shown in Figure 10 from the groundwater surface elevations created during the Assessment. Water elevations were determined by reviewing all available geologic logs and test holes and utilizing static water level data at the time the well was drilled. Depth to water varies from near the surface to 20 feet deep along the Platte River to more than 250 feet below grade in the Shell Creek and Upland regions.

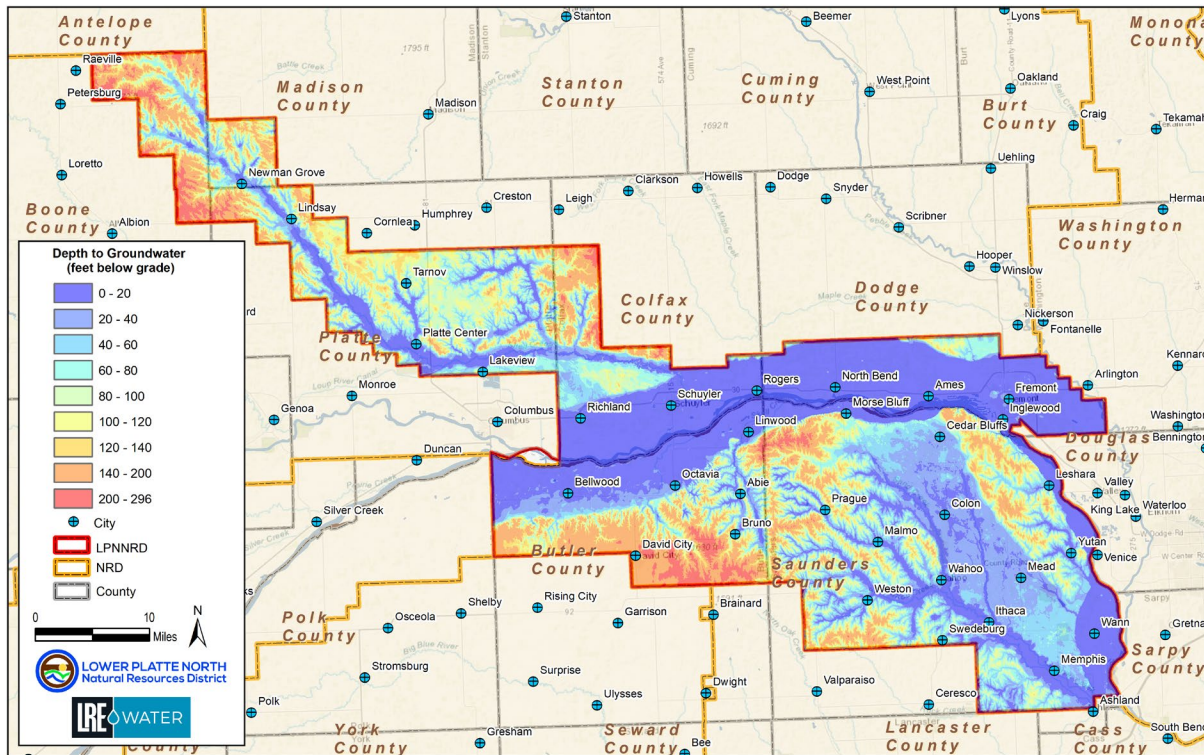


Figure 24: Depth to Groundwater

3.1.1 Sub-irrigation Potential

Sub-irrigation occurs naturally when a high groundwater table provides moisture to plant roots. There is significant potential for sub-irrigation within the LPNNRD, primarily due to the Platte River valley. The LPNNRD Rules and Regulations has defined sub-irrigation as, “the natural occurrence of a groundwater table within the root zone of agricultural vegetation, not exceeding ten feet below the surface of the ground”. Currently, the LPNNRD asks producers who plan to introduce new acres utilizing sub-irrigation to contact staff, but the LPNNRD is not currently requiring annual reports from agricultural producers who benefit from sub-irrigation.

The Hydrogeologic Assessment (LRE, 2023) was used to identify areas within the LPNNRD that include all areas that have groundwater within 10 feet or less, which totals over 228,000 acres, or over 22 percent, mostly due to the presence of the Lower Platte River valley. The depth of groundwater was determined by subtracting the groundwater elevation surface from the Digital Elevation Model, as shown in Figure 25.

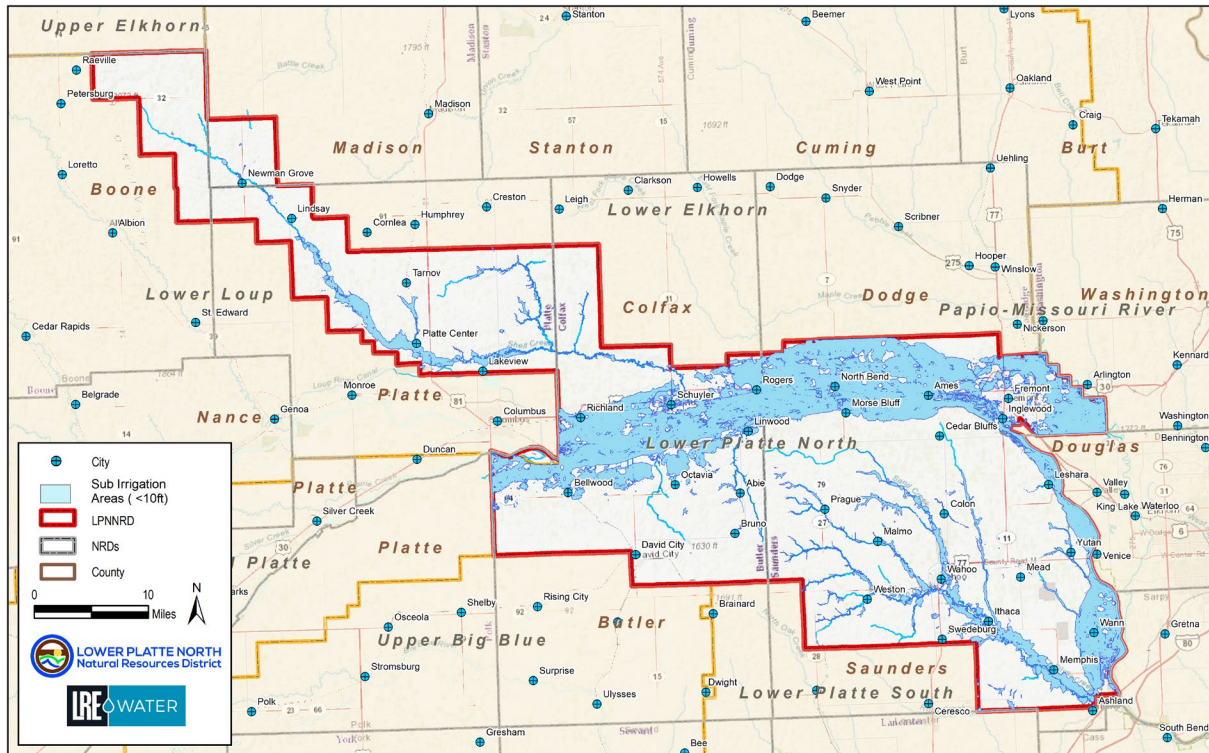


Figure 25: Potential Areas for Sub-irrigation

3.2 GROUNDWATER RECHARGE

Local precipitation serves as a major recharge source for aquifers in the LPNDR, complemented by the Platte River. The river receives significant runoff from Rocky Mountain snowmelt and baseflow contributions from major tributaries originating in the Nebraska Sandhills, facilitating natural infiltration. Its sand and gravel substrate enhances percolation into underlying aquifers, helping to sustain groundwater levels in the LPNDR. Additionally, groundwater from western regions, including the Sandhills, migrates eastward through the High Plains Aquifer system, contributing to baseflow in numerous rivers and streams. These hydrologically connected areas—particularly Shell Creek, Platte Valley, and Todd Valley aquifers—have been documented by the NeDNR.

Artificial groundwater recharge potential refers to the capacity of a specific area to effectively increase the amount of water entering an aquifer through human-controlled methods, which would require importing water or retiming water to make a project practical. This map also provides a general representation of areas that are more likely to naturally recharge groundwater. This process, known as artificial recharge, involved techniques such as:

- **Surface spreading:** Using canals, infiltration basins, or ponds to direct water across the land surface.
- **Injection wells:** Directly injecting water into the subsurface.
- **Irrigation methods:** Recharge from agricultural practices involving furrow or sprinkler systems to enhance infiltration.

Using the GIS data resources available from the Assessment (LRE, 2023), a representation of artificial recharge was created using two key inputs, the depth to groundwater and unsaturated clay thickness above the Principle Aquifer. Using GIS, a qualitative model was created on a scale from 1 (Lowest Potential) to 5 (Very High Potential), as shown in Figure 26. As expected, the Platte Valley and Todd Valley regions display a high to very high potential, whereas other areas within the Shell Creek and Upland regions tend to be limited to area along active waterways. This map is not necessarily representative of injection well methods.

Artificial recharge potential is also closely linked to groundwater risk, as these areas are also prone to infiltration of contaminants, such as nitrate, into the aquifer, potentially degrading water quality. This is especially critical in areas where the recharge water might carry pollutants from agricultural runoff, industrial processes, or urban runoff. Treatment wetlands could be a consideration to improve water quality and provide groundwater recharge in the highly vulnerable locations.

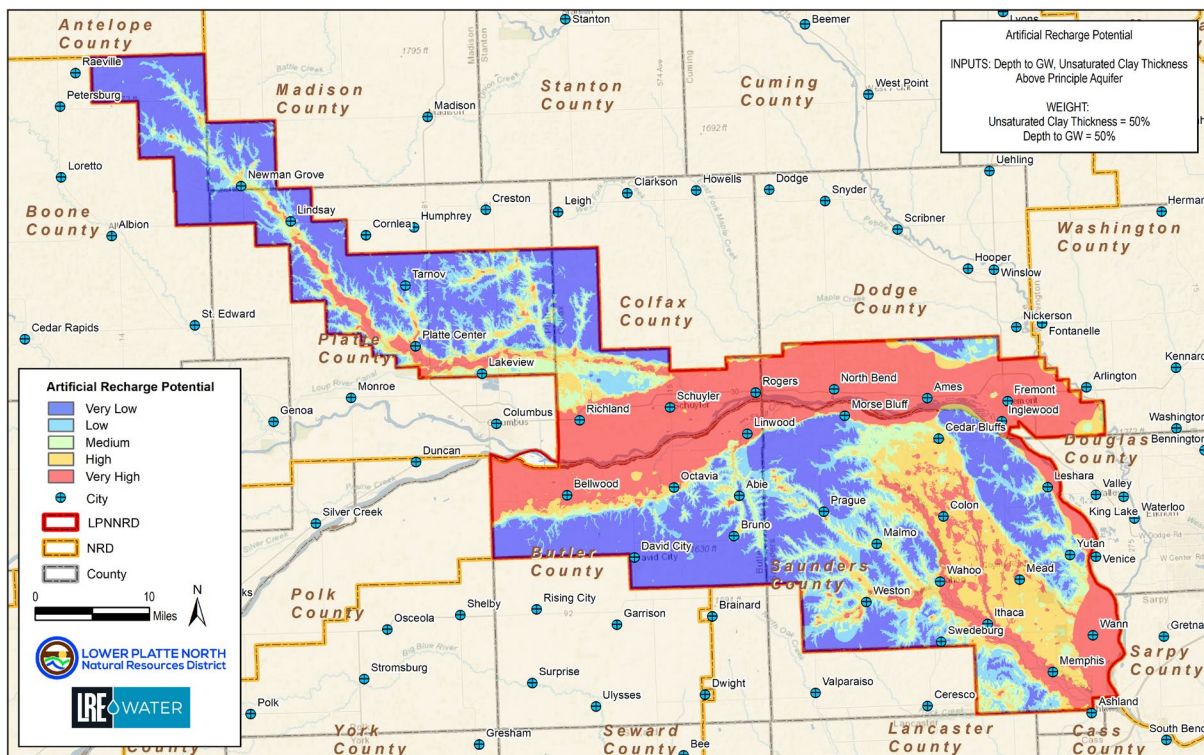


Figure 26: Artificial Recharge Potential

3.3 WATER USE AND DEMAND

The LPNNRD reports annually on water demand as part of the LPRCA Basin Water Management Plan Annual Report. This report is available by contacting the LPNNRD office. Highlights of the reporting on water use include the following:

1. Collection of data from over 1,300 flow meters, of which nearly 1,200 are on irrigation systems.
2. Recording of water use within SQS#1 (Bulter/Saunders) and SQS#2 (Platte/Colfax).
3. Continuous updating and tracking of nearly 392,500 certified irrigated acres (as of 2024).
4. Tracking of municipal and industrial groundwater uses.
5. Data collection and monitoring of new groundwater consumptive uses (agricultural, municipal, industrial).
6. Tracking of acres for groundwater consumptive uses (agricultural, municipal, industrial).
7. Creation of the 3-District Model, an ongoing effort with PMRNRD, LPSNRD, and NeDNR to utilize the 3-D AEM Framework created for the participating NRDs.
8. Working with the Coalition to track new stream depletion accounting (depletions and accretions).

The LPNNRD requires public water suppliers to report annual total water use as part of the LPRCA reporting. Table 5 displays the 2023 reported value, outside of Memphis, Bellwood, and Ithaca, which all have 2022 pumping shown. The Village of Bruno is connected to the City of David City and the Village of Colon receive water from the City of Wahoo. Numbers reported by the Lincoln Water System (LWS) and Metropolitan Utilities District (MUD), which serves Omaha and surrounding communities, including only pumping from wellfields located within the LPNNRD, each in eastern Saunders County. Table 6 displays the same information, but without the LWS and MUD wellfields.

Table 6: Annual Municipal Water Usage All Communities

Municipality	Gallons Pumped	Percent of Total
Newman Grove	32,205,200	0.15%
North Bend	64,260,000	0.30%
Wahoo*	269,693,307	1.27%
Abie	2,576,600	0.01%
Lindsay	65,992,600	0.31%
Malmo	1,980,000	0.01%
Mead	20,280,316	0.10%
Morse Bluff	2,183,000	0.01%
Platte Center	19,348,203	0.09%
Weston	13,948,027	0.07%
Yutan	49,132,000	0.23%
Fremont	3,654,341,000	17.26%
David City*	163,436,066	0.77%
Schuyler	376,856,000	1.78%
LWS (Lincoln)	5,841,820,110	27.59%
Cedar Bluffs	25,147,232	0.12%

Municipality	Gallons Pumped	Percent of Total
MUD (Omaha)	10,334,804,000	48.80%
Ashland	190,022,000	0.90%
Prague	11,420,000	0.05%
Memphis	9,524,000	0.04%
Bellwood	19,807,000	0.09%
Ithaca	4,000,000	0.02%
Rogers	4,006,000	0.02%
TOTAL	21,176,782,661	100.00%

Table 7: Annual Municipal Water Usage Without LWS and MUD

Municipality	Gallons Pumped	Percent of Total
Newman Grove	32,205,200	0.64%
North Bend	64,260,000	1.29%
Wahoo*	269,693,307	5.39%
Abie	2,576,600	0.05%
Lindsay	5,992,600	1.32%
Malmo	1,980,000	0.04%
Mead	20,280,316	0.41%
Morse Bluff	2,183,000	0.04%
Platte Center	19,348,203	0.39%
Weston	13,948,027	0.28%
Yutan	49,132,000	0.98%
Fremont	3,654,341,000	73.08%
David City*	63,436,066	3.27%
Schuyler	76,856,000	7.54%
Cedar Bluffs	25,147,232	0.50%
Ashland	90,022,000	3.80%
Prague	1,420,000	0.23%
Memphis	9,524,000	0.19%
Bellwood	19,807,000	0.40%
Ithaca	4,000,000	0.08%
Rogers	4,006,000	0.08%
	5,000,158,551	100.00%

3.3.1 Registered Wells

One method to generally understand water demand is through an evaluation of registered wells, as shown in Figure 27. In total, there are 13,025 registered wells in the LPNNRD (including PWS wells) in 2024. This total does not account for the likely thousands of unregistered wells constructed before

registration was required for all domestic wells in 1993. Of this total, 9,711 are active, and 47 percent are used for irrigation. Domestic well use is the second most common at 28 percent, as seen in Table 7. The ‘other’ category includes injection, other, and recovery wells. The majority of inactive wells within the database were decommissioned wells.

Table 8: Active Registered Well Distribution

TYPE	ACTIVE	PERCENT
Irrigation	4,611	47%
Domestic	2,716	28%
Livestock	295	3%
Observation	211	2%
Monitoring	1,156	12%
Commercial/Industrial	71	1%
Ground Heat/Heat Pump	170	2%
Public Supply Wells	188	2%
Other	293	3%
TOTAL	9,711	100%

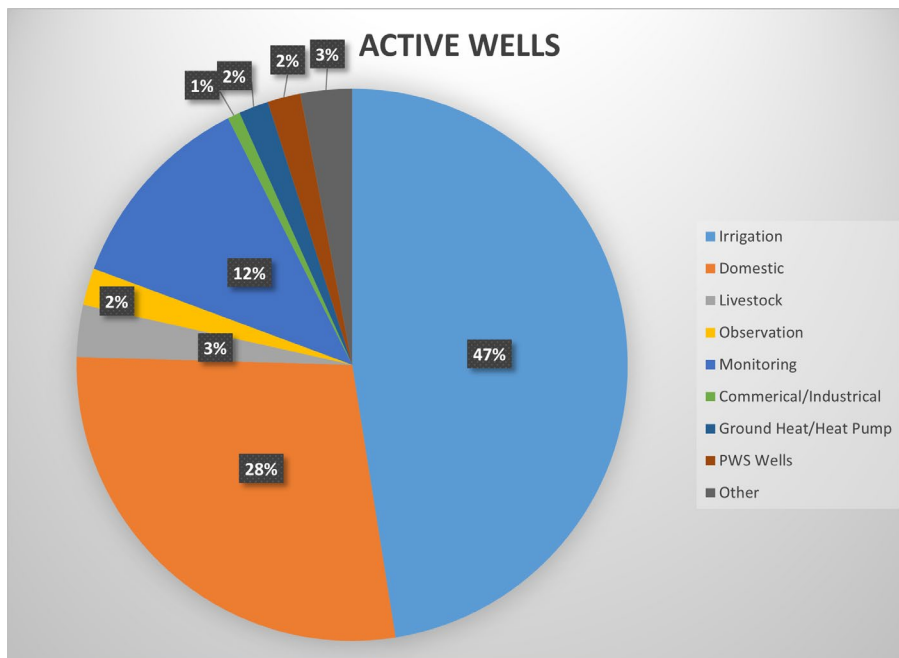


Figure 27: Percent of NeDNR Active Registered Wells

3.4 CERTIFIED IRRIGATED ACRES

The LPNNRD began certifying irrigated acres in the spring of 2010 as governed by the Nebraska Groundwater Management and Protection Act, 46-701. This statute provides the legal framework for managing and protection groundwater resources, including the certification of irrigated acres to ensure sustainable water use. The certification process helps catalog all existing irrigated acres and aligns

records from the LPNNRD, County Assessor, and the Farm Service Agency. This process helps ensure that irrigation practices comply with local and state water management regulations and helps manage and allocate water resources more effectively to prevent overuse and ensure sustainability. The certified irrigated acres as of January 2025 are shown in Figure 28.

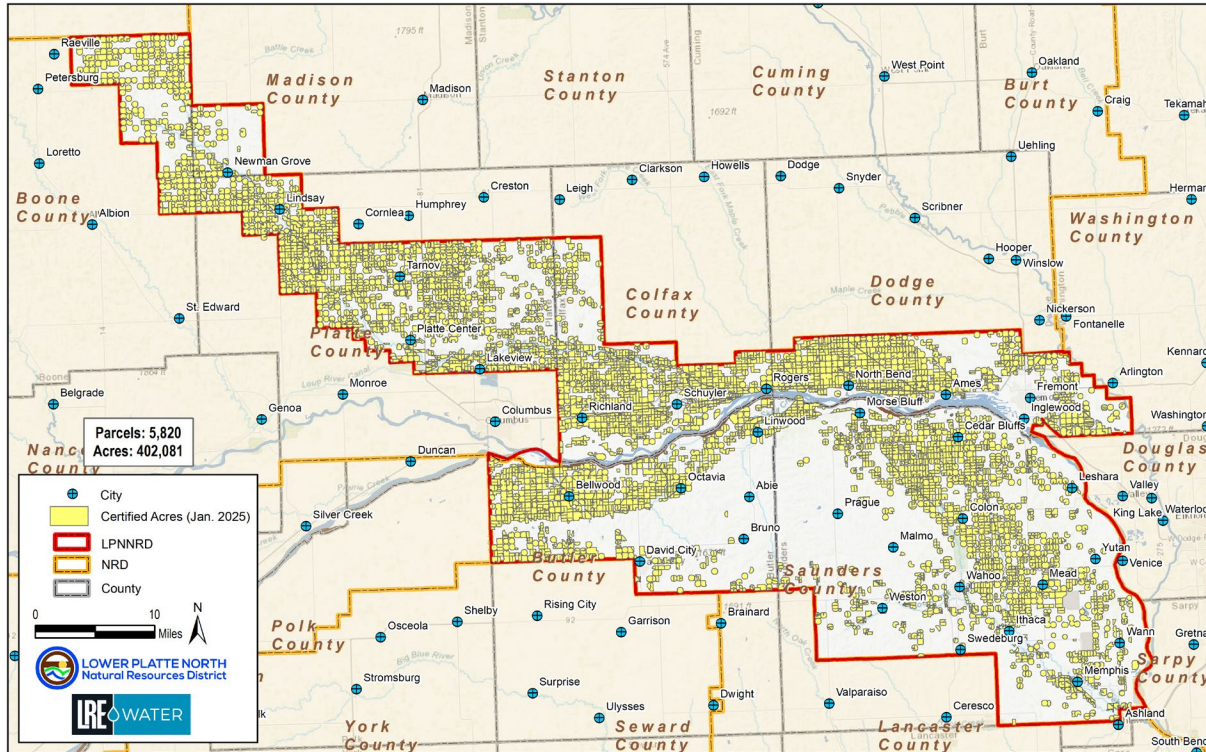


Figure 28: Certified Irrigated Acres in the LPNNRD (2024)

4 GROUNDWATER QUALITY

4.1 AQUIFER VULNERABILITY

4.1.1 Nonpoint Source Pollution

Non-point source pollution is generally defined as pollution arising from diffuse sources where no single point of release can be identified. While non-point source pollution can be related to weathering of minerals or soil erosion, human activities are commonly the originator for non-point source groundwater pollution. The diffuse application of fertilizers, pesticides, and herbicides in agricultural operations as well as urban areas account for large areas of land with soils containing these additives. Heavy application of chemicals, coupled with heavy precipitation or irrigation can result in these chemicals leaching to groundwater. Overland flow resulting from runoff can also provide a means of chemical leaching to a groundwater aquifer. In Nebraska, as well as in the LPNNRD, nitrate is the most common non-point source pollutant.

Aquifer vulnerability within the LPNNRD was mapped as part of the Assessment (LRE, 2023) by quantifying the amount of unsaturated clay above the top of the first encountered aquifer at each well or test hole location. The clay thickness values (75% of the model weight) were reclassified into five categories:

- 0 – 5 ft = 5
- 5 – 10 ft = 4
- 10 – 20 ft = 3
- 20 – 40 ft = 2
- > 40 ft = 1

Land use was also considered (25% weight) and reclassified into two categories with a value of either 1 or 5. Irrigated farmland is considered the most vulnerable (a rating of 5), and the remaining land use categories are considered least vulnerable (ratings of 1).

The resulting raster layer contains qualitative values that show where the aquifer has more or less potential vulnerability to the downward migration of potential contaminants from activities on the ground surface. This map shows a qualitatively modeled spatial distribution of groundwater vulnerability, from very low to very high, across the LPNNRD Boundary. A “Very Low” potential vulnerability means the aquifer is not likely to receive contaminants from activities on the ground surface. Conversely, a “Very High” potential vulnerability means the aquifer is potentially very susceptible to surface contaminants. The aquifer vulnerability map is shown in Figure 29.

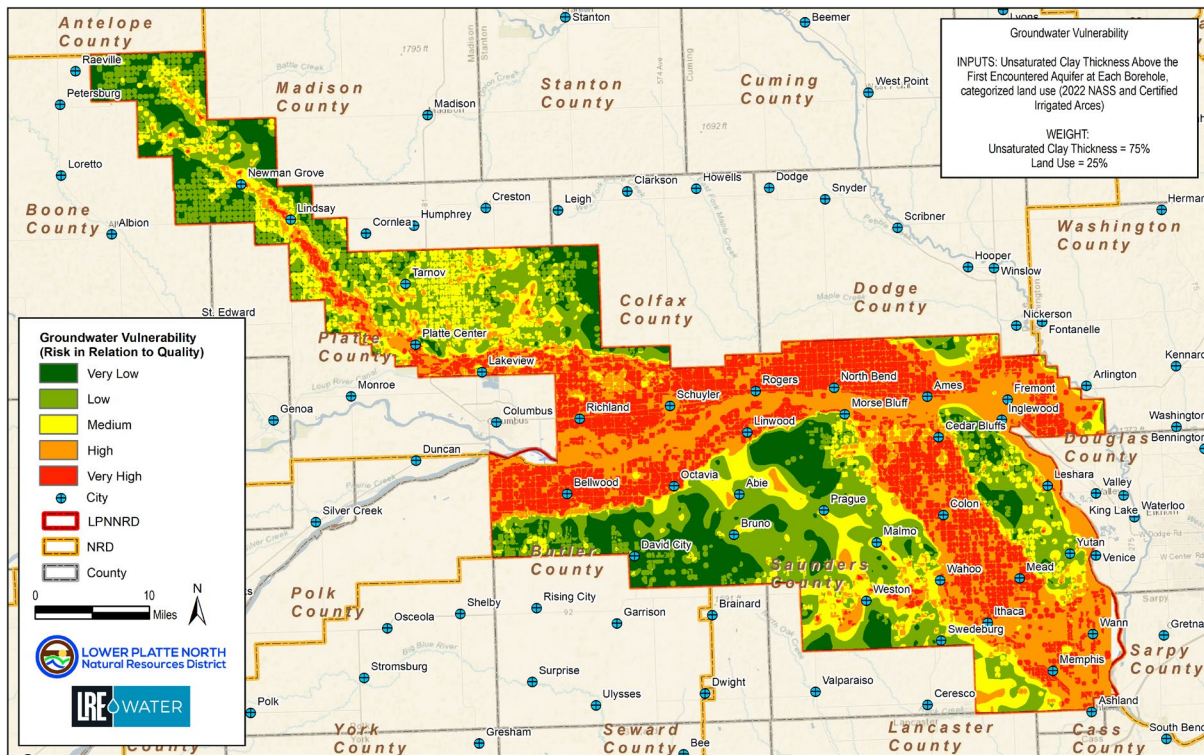


Figure 29: Aquifer Vulnerability

Nitrate can be found in most areas in Nebraska. Sources of nitrate include breakdown of organic material in soils, human or livestock wastes, and chemical fertilizers. When exposed to nitrate levels in excess of the U.S. Environmental Protection Area’s (USEPA) Maximum Contaminant Level (MCL) of 10 mg/L in drinking water, infants younger than about 6 months of age may develop methemoglobinemia or "blue-baby" syndrome. The University of Nebraska Medical Center has also recently begun researching the connection of nitrate in drinking water to various cancers in Nebraska.

To provide an illustration of the most recent nitrate concentrations, data from 2019 through 2023, collected by the LPNDR staff from 537 wells across the District, is shown in Figure 30. Each year, the LPNDR staff collected representative data across the entire District and concentrated sampling in Groundwater Management Areas, as seen within the Richland/Schuyler phase three GWMA. Staff have also been obtaining additional samples throughout the Shell Creek region where concentrations of nitrate have been slowly rising.

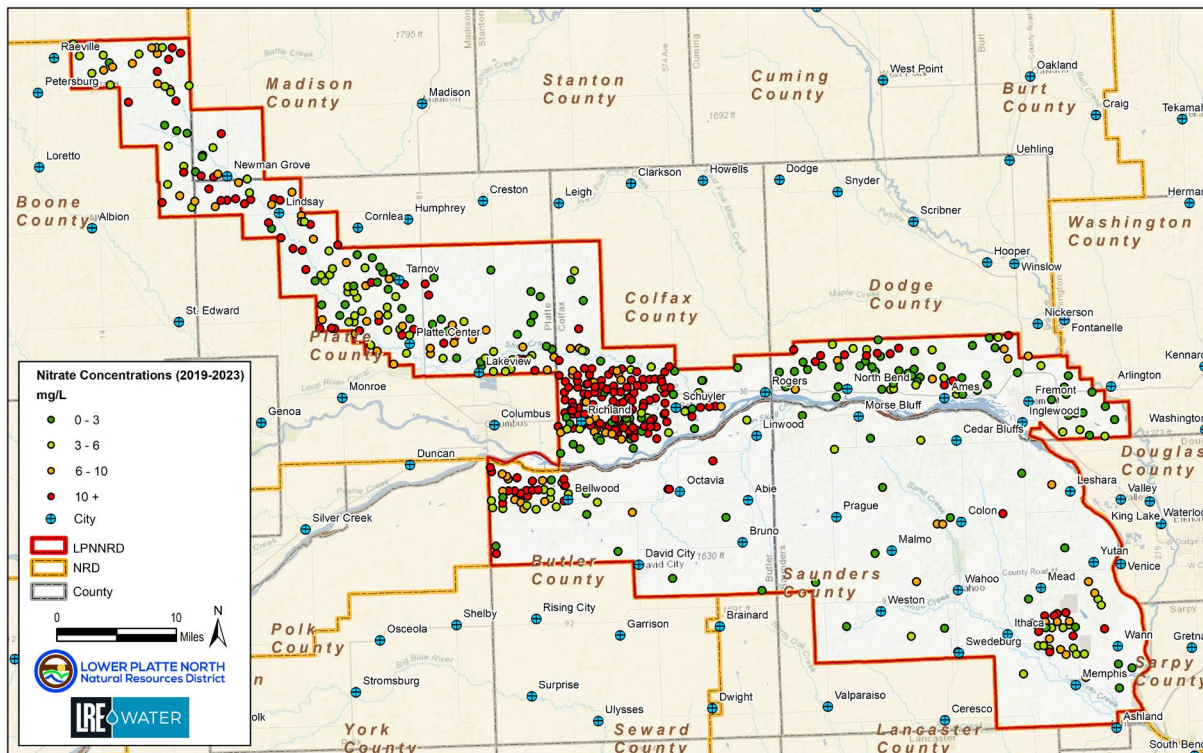


Figure 30: LPNNRD Nitrate Concentrations 2019-2023

4.1.2 Additional Water Quality Monitoring

The LPNNRD conducts a wide variety of additional water quality data, including random sampling of wells for unique circumstances. In the past, sampling included nickel, sodium, selenium, mercury, among others. The LPNNRD can also provide property owners assistance to monitor nitrates and bacteria from private wells.

While nitrate remains the top water quality concern in LPNNRD due to agricultural runoff, other issues like arsenic, iron, uranium, and saltwater intrusion pose growing threats. Arsenic and uranium, both naturally occurring in regional geology, requires focused testing and public outreach—especially in areas like Richland-Schuyler, where uranium levels have exceeded 30 ppb in half of the sampled wells (LPN, 2025). Iron, though often an aesthetic nuisance, can signal redox conditions that mobilize other contaminants. Saltwater intrusion, driven by over-pumping or proximity to saline sources such as the Dakota aquifer, threatens aquifer quality and calls for proactive monitoring and recharge strategies (UNL, 2017). Meanwhile, emerging contaminants like PFAS and pharmaceuticals, though less prevalent, warrant early action through partnerships, education, and hotspot identification. By expanding monitoring, encouraging treatment and management practices, and collaborating with health and research agencies, LPNNRD can address these evolving challenges with foresight and resilience.

Starting in 2001, the Nebraska Legislature passed LB329, which directed the NDEE to report on groundwater quality monitoring in Nebraska (NDEE, 2024). The NRDs are also required (§46-1305) to submit an annual report on water quality to the legislature, which is prepared by NARD annually, and is issued concurrently with NDEE’s annual Nebraska Groundwater Quality Monitoring Report. As a partner, the LPNNRD collects water quality samples from a total of 53 wells district-wide over a four year period,

as shown in Figure 31. This data is part of the Nebraska Groundwater Quality Clearinghouse, which includes an online, interactive database featuring data, maps, well construction details, and statistics (NDEE, 2024). One of the focuses of the statewide network is on pesticides and includes the following:

1. **Metribuzin:** A herbicide used to control broadleaf weeds and grasses.
2. **Methoxychlor:** An insecticide used to control flies, mosquitoes, and other insects.
3. **Hexachlorobenzene:** A fungicide used to treat seeds.
4. **Alachlor:** A herbicide used to control annual grasses and broadleaf weeds.
5. **Butylate:** A herbicide used to control grasses and some broadleaf weeds.
6. **Atrazine:** A herbicide used to prevent pre- and post-emergence broadleaf weeds.
7. **Cyanazine:** A herbicide used to control annual grasses and broadleaf weeds.
8. **Hexachlorocyclopentadiene:** A chemical intermediate used in the production of pesticides.
9. **Propachlor:** A herbicide used to control annual grasses and some broadleaf weeds.
10. **Trifluralin:** A herbicide used to control annual grasses and broadleaf weeds.
11. **Chlorpyrifos:** An insecticide used to control various pests including termites and mosquitoes.
12. **Aldrin:** An insecticide used to control soil pests.
13. **Lindane:** An insecticide used to treat lice and scabies.
14. **Di(2-ethylhexyl)phthalate:** A plasticizer that can be found as a contaminant in the environment.
15. **Dieldrin:** An insecticide used to control soil pests.
16. **Fonofos:** An insecticide used to control soil insects.
17. **Simazine:** A herbicide used to control broadleaf weeds and grasses.
18. **Benzo(a)pyrene:** A polycyclic aromatic hydrocarbon that can be found as a contaminant.
19. **Heptachlor:** An insecticide used to control soil insects.
20. **Heptachlor Epoxide:** A breakdown product of heptachlor.
21. **Total Chlordane:** Refers to the sum of chlordane and its breakdown products.
22. **Endrin:** An insecticide used to control pests on crops.

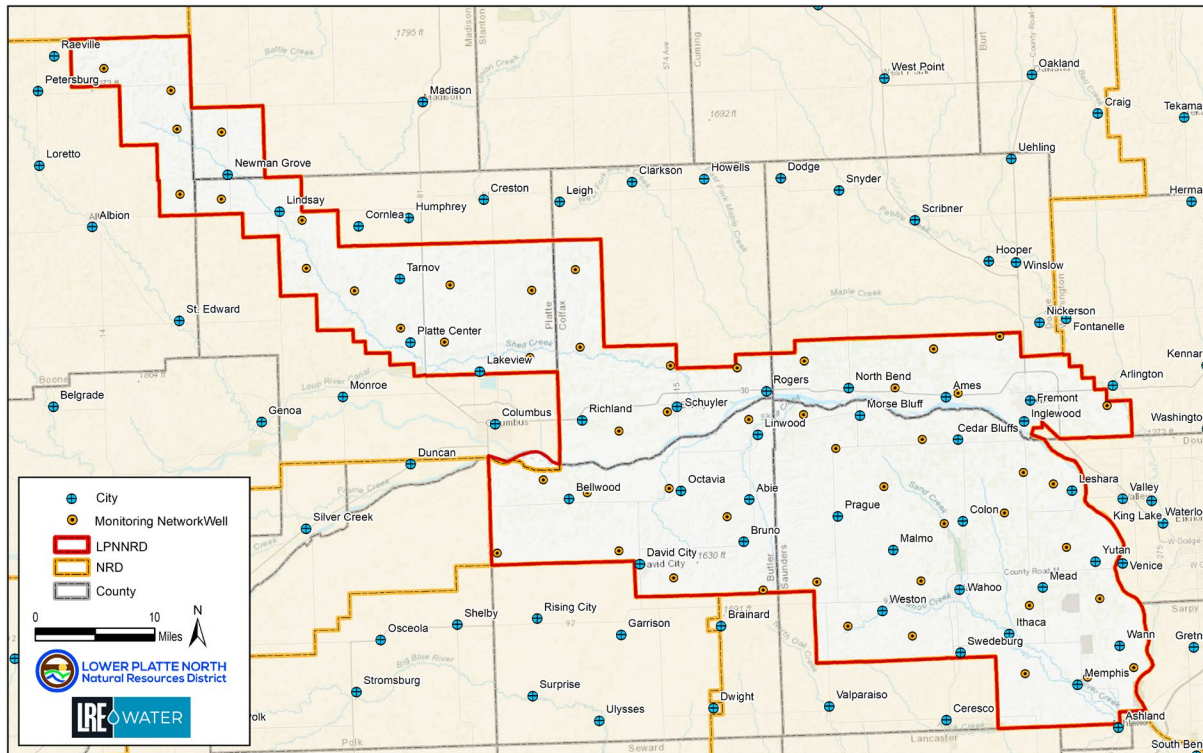


Figure 31: LPNNRD Statewide Water Quality Monitoring Network Wells

4.1.3 Point Source Pollution

Point source pollution generally impacts the quality of the groundwater in localized areas. However, when these sites are located above potential drinking water supplies or are located adjacent to domestic or municipal wells the impact of a spill or leak can affect larger land areas and populations. Even spills that are cleaned up to health-based cleanup goals of a regulatory agency can impact drinking water supplies as human taste thresholds of many chemicals are below the health based "action" levels.

There are numerous manufacturing facilities and petroleum handling facilities, grain bin storage sites, and fertilizer and pesticide storage facilities within the LPNNRD. Although new regulations and generally improved product and waste handling procedures have reduced the chances of a spill or release of contaminants from these type of activities, historically, numerous spills have been documented.

The NDEE holds regulatory authority over substances from point source discharges that can cause or contribute to groundwater contamination. To obtain a permit, they are reviewed by engineering and permitted if they meet minimum design requirements and have no adverse impacts to water quality standards.

The NDEE maintains a permitted facilities database of regulated facilities under their jurisdiction, which are known or suspected to have soil and water contamination. This database includes various categories, such as the National Pollutant Discharge Elimination System (NPDES) program, Integrated Waste Management, Leaking Storage Tanks, Livestock Waste Control, Onsite Wastewater Treatment, Release Assessment, Remedial Action Plan Monitoring, Resource Conservation Recovery, Superfund, SARA Title III, and Underground Injection Control. Some of these facilities could potentially be point

sources of groundwater contamination if they do not maintain full compliance. Additional information on NDEE regulated facilities can be found an interactive mapping application on their website.

4.2 WELLHEAD PROTECTION AREAS

The NDEE oversees the WHP program, a voluntary initiative that offers financial and technical support to communities with public water suppliers to safeguard water supplies from contamination. Each community water system with a groundwater supply has a designated WHP area, as shown in Figure 32, but few communities have exercised controls to regulate contamination threats within the WHP Area. The WHP area delineates the time-of-travel and the surficial region drawn around a water well or wellfield that supplies a Public Water System (PWS), indicating where contaminants are likely to travel toward and reach the well. Typically, a 20-year time-of-travel is utilized for the WHP Area, while some communities have opted to use the 50-year time-of-travel. The five minimum steps for the WHP Program are shown in Figure 33.

As of 2025, the LPNNRD was supporting WHP plans, well siting assessments, and delineation efforts in the Village of Platte Center and City of Newman Grove, and had recently supported projects for the cities of Ashland, David City, and Wahoo. A summary of WHP plans in the LPNNRD is shown in Table 8.

Table 9: LPNNRD PWS State-Approved WHP Plans

PWS Name	COUNTY	DATA APPROVED
Platte Center	Platte	2025
Newman Grove	Platte/Madison	2025
Wahoo	Saunders	2023 (plan & ordinance)
David City	Butler	2023 (plan & ordinance)
Lindsay	Platte	2015
Fremont	Dodge/Douglas	2010
Woodcliff Water System	Saunders/Dodge	2006
Weston	Saunders	2005
Abie	Butler	2003
North Bend	Dodge	2003
Yutan	Saunders	2003

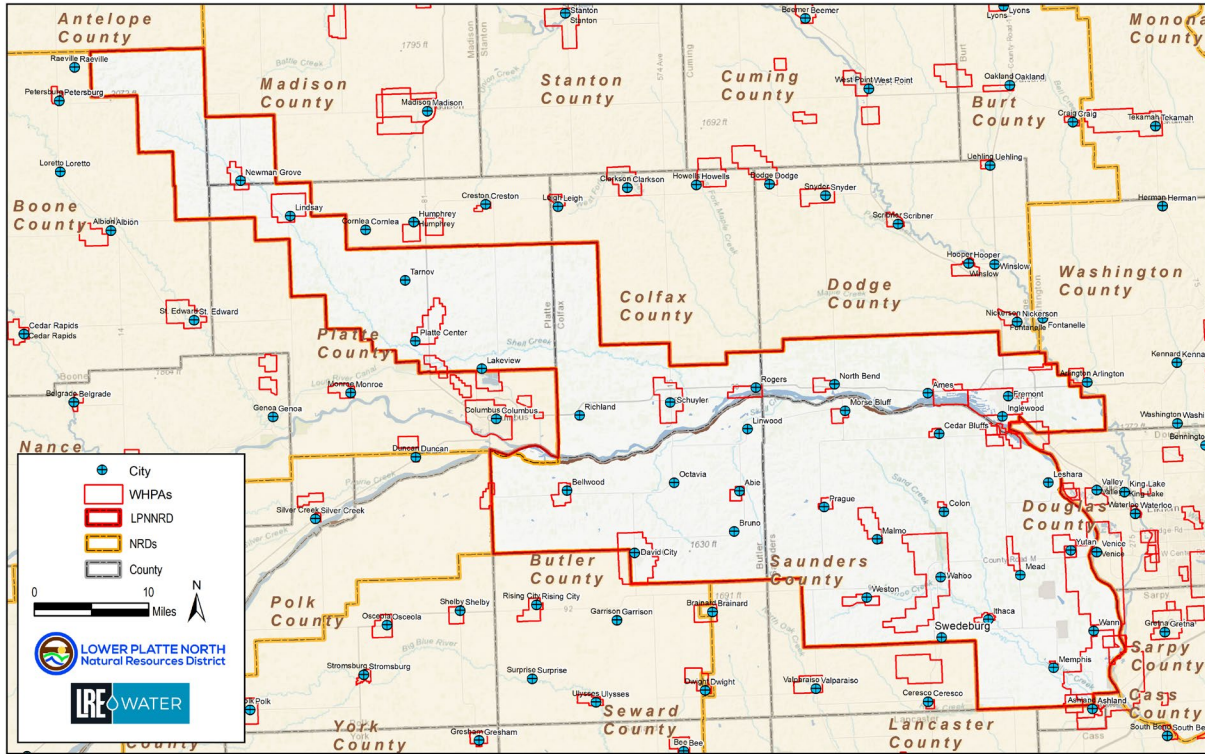


Figure 32: Wellhead Protection Areas



Source: NDEE

Figure 33: Five Steps of the WHP Program

4.2.1 Water Quality Activities

A summary of recent water quantity activities for the LPNNRD for 2023 are as follows:

- Completion of 6 nitrogen/irrigation certification meetings with 200 - 300 in attendance.

- Implementation of a program, funded by WSF, to provide cost-share practices in the Schuyler-Richland GWMA for gravity to pivot/SDI conversions, water flow meters, and cover crops.
- USGS is leading an age-dating project, in conjunction with LLNRD, near the Schuyler-Richland GWMA.
- District-wide soil moisture sensor cost-share
- Well decommissioning cost-share
- Shell Creek Watershed Water Quality Project, including agricultural and urban cost-share for best management practices.

5 GOALS AND OBJECTIVES

5.1 GROUNDWATER MANAGEMENT GOALS AND OBJECTIVES

The primary management target, defined below in the Vision Statement, is to maintain the ‘groundwater reservoir life goal’ – defined within the Rules and Regulations as the period of time which the District establishes as its goal for maintenance of the supply and quality of water in a groundwater reservoir. This goal can also be described as ensuring a safe yield for aquifers, which is the amount of water that can be sustainably withdrawn without causing long-term depletion or adverse effects on the aquifer and hydrologically connected water resources. The goals and objectives are designed to guide the staff and Board of Directors in making decisions about water resource management.

LPNNRD Groundwater Management Vision Statement

Strive for the continuous management of the groundwater reservoir, in perpetuity, to ensure it meets the standards appropriate for its various uses, including domestic, livestock, public water supply, public health, irrigation, agriculture, wildlife, industrial, and other beneficial uses. Minimizing, as much as possible, the adverse impact of these uses on the quantity and quality of groundwater that supports lakes, wetlands, and streams.

By implementing the five goals and objectives shown below, the LPNNRD can ensure groundwater remains a reliable resource while protecting the ecosystems that depend on it. Goal categories include monitoring, pollution prevention, conservation, public education, and sustainable management plans and regulations.

5.1.1 Goal 1 – Groundwater Monitoring

Continuously monitor and assess groundwater levels and quality, ensuring early detection of significant changes for proactive resource management, with clear benchmarks for expansion and data utilization.

- **Objective 1.1** – Expand groundwater monitoring efforts by installing up to four new dedicated observation wells per year over the next 10 years covering more vulnerable areas such as WHP areas.
- **Objective 1.2** – Integrate scientific advances and research into regulatory frameworks, updating policies at least every two years to incorporate the latest hydrogeologic findings.
- **Objective 1.3** – Conduct annual water quality sampling, tracking nonpoint source contamination trends over time and using the data to refine mitigation strategies.
- **Objective 1.4** – Strengthen collaborative efforts by partnering with new organizations or research institution to enhance the water quality monitoring network.
- **Objective 1.5** – Maintain and expand the spring/fall water energy level monitoring network by adding at least five additional wells with construction data annually, ensuring comprehensive coverage.
- **Objective 1.6** – Develop a real-time monitoring initiative by adding telemetry to dedicated observation wells, integrating data into a public-facing online dashboard within two years (2027) to improve transparency.
- **Objective 1.7** – Implement more frequent monitoring programs to track water quantity changes in known problem areas related to groundwater pumping, identifying risks early and adjusting management strategies accordingly.

5.1.2 Goal 2 – Water Quality

Reduce the potential for pollution to ensure a sustainable supply of high-quality, consumable, and safe groundwater for all users in the NRD. Implement and support best management practices that achieve a district-wide reduction in nitrate concentrations by an average of 0.5 ppm per year, tracked through annual water quality monitoring reports.

- **Objective 2.1** – Utilize advanced studies and modeling tools (MODFLOW) to conduct at least two groundwater flow and contamination movement analyses per year, ensuring data-driven management decisions.
- **Objective 2.2** – Obtain and assess new groundwater and contamination data using sources such as the Clearinghouse, integrating findings into sustainable development strategies to track improvement trends.
- **Objective 2.3** – Develop and implement at least one new cost-share initiative annually that supports pollution reduction efforts, focusing on precision nutrient management and contaminant mitigation programs.
- **Objective 2.4** – Provide cost-share funding for at least 15 well decommissioning projects per year, prioritizing locations with high contamination risks.
- **Objective 2.5** – Actively manage Phase Areas with vulnerable aquifers or excessive nitrate concentrations by conducting annual mitigation strategy reviews, ensuring targeted interventions effectively reduce nitrogen loading in public water supply sources.

5.1.3 Goal 3 – Water Quantity

The LPNNRD will continue to encourage highly efficient water conservation management practices, with the objective of recovering and maintaining sustainable water levels to support beneficial uses.

- **Objective 3.1** – Utilize hydrogeologic and modeling data to assess the impacts of new uses and quantify water level responses to drought or reduced precipitation trends, setting baseline measurements and tracking fluctuations annually.
- **Objective 3.2** – Connect 1,000+ property owners annually to conservation programs that enhance water quality and quantity, tracking participation rates and success metrics.
- **Objective 3.3** – Develop a drought response strategy with phased thresholds, defining trigger points for water conservation measures and emergency response actions within the district.
- **Objective 3.4** – Conduct annual groundwater assessments for Special Quantity Sub-areas and Control Areas with thin or limited aquifers, using the data to refine conjunctive management strategies and improve hydrologic sustainability and reverse declining water level trends.

5.1.4 Goal 4 – Outreach and Education

Continue to be a resource for outreach and education for youth and adults, emphasizing the importance of protecting groundwater resources through measurable engagement and awareness strategies.

- **Objective 4.1** – Conduct stakeholder review at least every five years (agriculture, industry, local government, environmental groups, and public health) to gather diverse perspectives and needs.
- **Objective 4.2** – Expand public environmental education programs by hosting four or more outreach events annually focused on nitrate impacts and water conservation, measured by attendance and participant feedback surveys.

- **Objective 4.3** – Utilize hydrogeologic data and studies, including the Nitrate Risk Too, to conduct a minimum of 20 one-on-one educational sessions per year, ensuring direct engagement with landowners, producers, or other stakeholders.
- **Objective 4.4** – Participate in at least 10 natural resources workshops, county fairs, camps, or classroom presentations annually, tracking engagement metrics.
- **Objective 4.5** – Demonstrate cutting-edge water and fertilizer management technologies through three or more field demonstrations annually, documenting adoption rates among participants.
- **Objective 4.6** – Provide information and education through a minimum of six published pieces per year across news articles, social media posts, newsletters, brochures, and website updates.
- **Objective 4.7** – Develop and launch a web-based graphic user interface within two years, ensuring public accessibility to hydrogeologic data and maps, with a tracking system for user engagement.
- **Objective 4.8** – Develop and launch a district-wide notification system to be in place by 2026 with at least 500 members to provide timely updates on water quality, conservation programs, and regulatory changes.

5.1.5 Goal 5 – Rules and Regulations

Develop and enforce rules, regulations, and plans that balance water usage with natural replenishment rates while reducing contamination through structured monitoring and compliance efforts.

- **Objective 5.1** – Conduct updates at least every five years to the Groundwater Management Plan and Rules and Regulations to reflect emerging contaminants, policy changes, and evolving water use patterns.
- **Objective 5.2** – Align regulations with 100% compliance to new state and federal policies within six months of adoption, ensuring resources are leveraged for district-wide water management improvements.
- **Objective 5.3** – Implement an adaptive management strategy with annual performance evaluations, adjusting policies and responses based on monitoring data trends.
- **Objective 5.4** – Maintain consistent engagement in Lower Platte River Basin integrated and drought management plans, tracking participation and policy influence through quarterly reports.
- **Objective 5.5** – Increase community participation in NDEE’s Wellhead Protection Program by at least 15% annually, expanding outreach efforts and tracking adoption rates.
- **Objective 5.6** – Utilize hydrogeologic-based subareas for Control Area management, conducting annual data reviews to refine Phase Area designations and mitigation strategies.
- **Objective 5.7** – Conduct biennial reviews of the Integrated Management Plan, ensuring sustainable water use strategies align with conservation goals and include annual instream flow assessments.
- **Objective 5.8** – Support and conduct at least three special studies annually, focusing on research initiatives that enhance groundwater sustainability and contamination mitigation.

6 STAKEHOLDER INVOLVEMENT

6.1 OUTREACH METHODS

The LPNNRD utilized the website (www.lpnnrd.org), district-wide publications, press releases to local newspapers, radio, social media, and announcements through Board meetings to spread the word about the GWMP update. The Summer 2024 edition of the Viaduct included an announcement on the update process, need for Stakeholders, and the locations and times of the first two public open houses.

6.2 STAKEHOLDER GROUP

The LPNNRD established two Stakeholder Groups, one meeting in the Village of Platte Center and another meeting in the City of Wahoo. The group included agricultural producers, community representatives, NeDNR, UNL Extension, NRCS, LPNNRD, and LRE Water. The role of the stakeholder group was to work closely with LPNNRD to provide feedback, identify information, discuss concerns, communicate and engage with other stakeholders, and provide feedback on the draft Plan. A summary of the meetings included:

- Platte Center meetings on June 4th, 2024, and January 16, 2025
- Wahoo meetings on June 6, 2024, and January 9th, 2025

6.3 OPEN HOUSE MEETINGS

Two sets of Open House meetings were held to provide an opportunity for the public to learn about the purpose and requirements of the GWMP, discuss water quality and quantity concerns, review the proposed subareas, review the highlights of the draft GWMP, and discuss recommendations. Meetings occurred at:

- Wahoo on August 24, 2024, and January 9, 2025
- Platte Center on August 26, 2024, and January 16, 2025

6.4 BOARD RETREAT

On February 7, 2025, the LPNNRD held a Board of Directors retreat with a major focus on the GWMP and key recommendations by LRE Water. The retreat aimed to provide a general education on key hydrogeologic terminology and principles, obtain consensus on actions to enhance groundwater management effectiveness, and discuss the goals and objectives.

7 RECOMMENDATIONS

This section outlines considerations for modifications, additions, or adjustments to the current procedures used for the management of groundwater. These recommendations were established after a review of existing data, reports, studies, water level data, hydrographs, and input from the LPNNRD staff, Board of Directors, the Stakeholder Group, and the public.

7.1 ADOPTION OF GROUNDWATER MANAGEMENT SUBAREAS

The original subareas were delineated by Olsson in the March 2009 LPNNRD Hydrogeologic Evaluation and Subarea Delineation Study (Olsson, 2008) based on local hydrogeologic conditions and depositional characteristics; however, these were not officially recognized by the LPNNRD. LRE Water and the LPNNRD staff reviewed the existing sub-areas and made slight adjustments using hydrogeologic information from the Assessment (LRE, 2023). This process included the following key steps:

- 1) LPNNRD staff squared off the subareas to the nearest section boundary.
- 2) Subareas were adjusted by LRE Water by reviewing the saturated sand thickness, hydrogeologic cross sections, AEM, and the DEM. Overall, changes were minimal by merging small areas and adding or subtracting a few sections based upon the new saturated sand thickness.
- 3) LRE Water provided the LPNNRD with GIS data and an updated subarea map to allow for review and edits by District staff and the Board of Directors.

There are several advantages to adopting and utilizing subareas named by local communities or other known features. Some of the benefits include:

- 1) **Localized Management:** Subareas allow for more precise and localized management of groundwater resources. This means that specific issues within a smaller area can be addressed more effectively, rather than applying a one-size-fits-all approach across a larger region.
- 2) **Tailored Solutions:** Different subareas may have unique geological and hydrological characteristics. By focusing on subareas, the LPNNRD can focus studies and develop tailored solutions that are more effective for the specific conditions of each subarea.
- 3) **Efficient Resource Allocation:** Managing groundwater at the subarea level helps in the efficient allocation of resources. It ensures that efforts and funds are directed towards areas with the most pressing needs or the highest potential for improvement.
- 4) **Enhanced Monitoring and Data Collection:** Subareas facilitate more detailed monitoring and data collection. This detailed data can lead to better decision-making and more effective management practices.
- 5) **Community Involvement:** Working with subareas often involves local stakeholders and communities, leading to greater public involvement and support for groundwater management initiatives.

While groundwater quality and quantity studies may occur across an entire subarea, it is important to note that Groundwater Quality and Quantity Management Areas, or phase areas, can be smaller or larger than a subarea and could include may also cross multiple subareas or portions of subareas. A breakdown of the proposed subareas is shown in Figure 34. It is also recommended that the areas be referred to by name, rather than only a number.

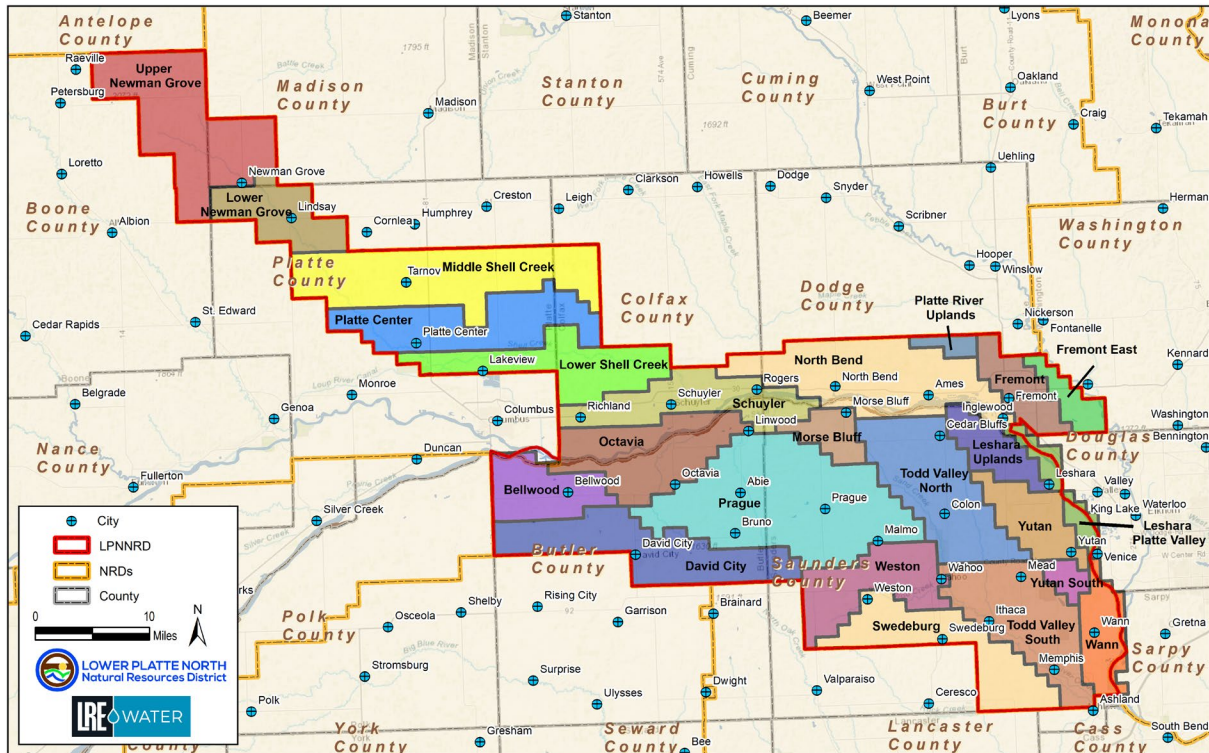


Figure 34: Proposed Groundwater Management Subareas

7.2 EXPANSION OF THE OBSERVATION NETWORK

Water levels alone cannot accurately determine the percentage of decline in saturated thickness for an unconfined aquifer or hydraulic head in a confined aquifer unless the screen interval and depth to water are compared to the geologic layers. Variations in water levels in wells may result from data collected from wells of differing depths and screened at various intervals, penetrating both confined and unconfined aquifers. To ensure that the data collected is representative of the area of study or concern, the following recommendations are proposed:

- Utilize the new standard scale hydrograph format to analyze all future observation wells, ensuring consistency and accuracy in data interpretation.
- Categorize and select new observation wells that are consistent and representative of the subarea, considering factors such as well depth, screened interval, and whether the aquifer is confined or unconfined.
- Ensure adequate spacing of observation wells from pumping wells to avoid interference and obtain more accurate readings.
- Partner with public water supplies to strategically place observation wells within wellhead protection areas and/or upgradient from PWS wells, enhancing the monitoring of water levels and water quality.

To assist with understanding the spatial representation of the current observation well network, an evaluation was completed by subarea. Table 9 displays the current spatial representation of spring/fall monitoring wells and the dedicated observation wells by subarea, which is displayed in Figure 35.

Table 10: Observation Wells and Proposed Sites by Subarea

Subarea Name	Spring Fall Well Count	Dedicated Observation Well Count	Potential Area for New Observation Well Count
Bellwood	6	0	1
David City	22	8	0
Fremont	7	0	0
Fremont East	3	0	0
Leshara Platte Valley	0	0	0
Leshara Uplands	5	0	0
Lower Newman Grove	5	1	0
Lower Shell Creek	6	1	3
Middle Shell Creek	19	16	5
Morse Bluff	4	0	0
North Bend	12	2	1
Octavia	5	1	2
Platte Center	11	9	0
Platte River Uplands	4	2	0
Prague	5	2	6
Schuyler	7	0	0
Swedeburg	10	4	2
Todd Valley North	8	0	0
Todd Valley South	12	9	0
Upper Newman Grove	10	2	6
Wann	10	4	0
Weston	11	0	2
Yutan	7	0	0
Yutan South	4	3	0

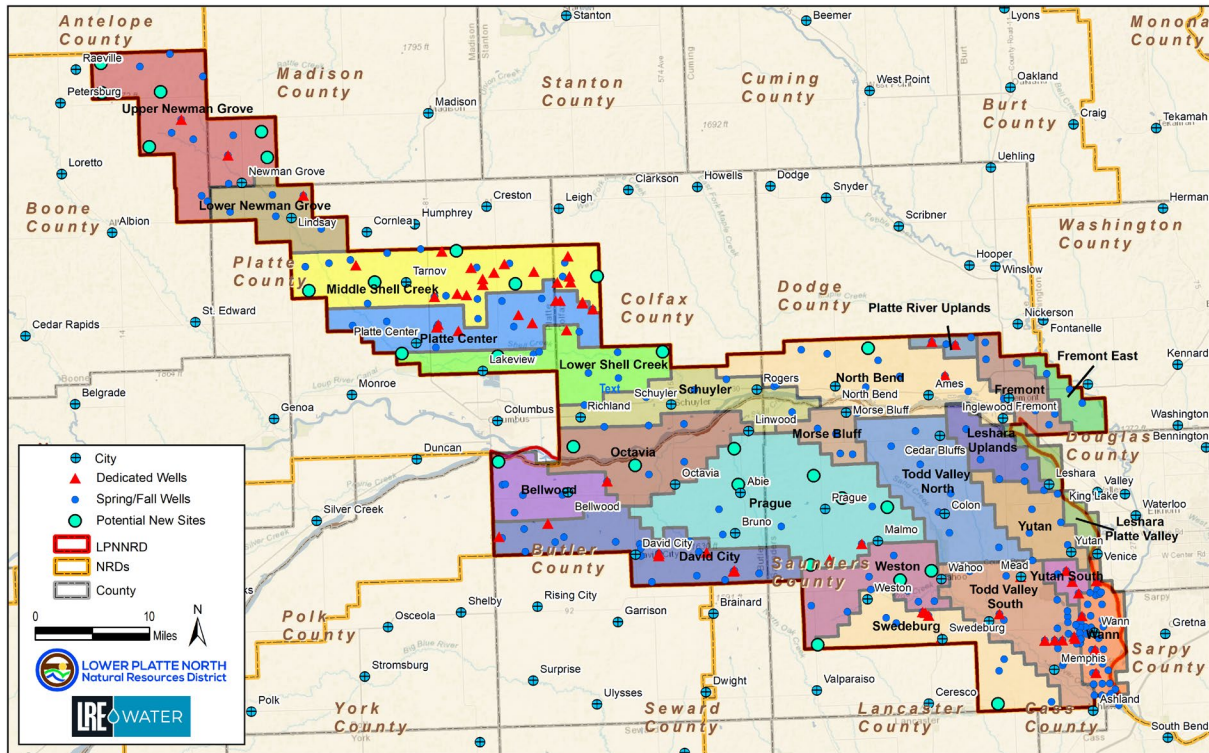


Figure 35: Existing Observation Wells and Potential Expansion Sites

7.3 ALTERATION TO THE WELL VARIANCE SCORING PROTOCOL

Many well permit application reviews raise questions about adequate aquifer thickness, target yield capabilities, pumping influence on surface water, well interference, and aquifer protection. To address these questions and uncertainties, alternations to the well variance scoring sheet would improve the accuracy of the decision-making process. The following recommendations are proposed:

Point Sheet

1. Include points for the location of the well within the Groundwater Resource Development Risk map.
2. Review ranges for the New Groundwater Consumptive Use category.
3. Create separate sheets for unconfined and confined aquifers, considering specific yield and saturated thickness for an unconfined aquifer, but not confined.
4. Use aquifer thickness, storativity, and available head for a confined aquifer.
5. Include irrigation well density, domestic well density, and other well densities (livestock, municipal) to address potential well interference.
6. Review how transmissivity is calculated (e.g., from aquifer thickness multiplied by estimated hydraulic conductivity, or from hydrogeologic assessment maps).
7. Approximate the extent of the aquifer (e.g., any negative aquifer boundaries).
8. Include a theoretical radius of influence based on the above information.
9. Include a score for water level trends in the area of the proposed well.

10. Include point ranges based on existing nitrate concentrations.
11. Review other NRD scoring systems for additional criteria and methods.

Other Review Criteria and Procedures

1. Establish a radius for Class 1 and Class 2 and obtain all well logs within the study area.
2. Review well logs within a radius determined by the scoring sheet or class.
3. Conduct a limited desktop assessment, if necessary, to determine the level of uncertainty qualitatively, based on the class of well and data gaps.
4. Provide the applicant with a summary of the District's review and any additional data required, with technical justification.
5. Complete test hole(s) prior to issuing the permit if a data gap analysis indicates this is necessary.
6. Require an aquifer pumping test or capacity test for Class 2 and Class 3 variances based on points scored and data gaps, if necessary.

7.4 QUANTITY TRIGGER ADJUSTMENTS

Since 1987, quantity management triggers have been in place but have yet to initiate a Groundwater Management Area 'control area' designation. To improve effectiveness, adjustments to the policy may include eliminating triggers for confined aquifers, incorporating qualitative criteria, and refining delineation strategies for quantity control areas. The proposed modifications include:

- Identify and prioritize areas with consistent well interference, incorporating data from annual pumping impact reports to track severity.
- Differentiate management strategies for confined and unconfined aquifers, ensuring policy adjustments align with their distinct hydrologic responses.
- Enhance monitoring practices by utilizing observation wells and hydrograph trends to detect seasonal declines rather than relying solely on spring/fall measurements, allowing for continuous multi-season assessments.
- Incorporate historical drought impact data to evaluate magnitude trends, setting baseline depletion benchmarks for proactive response measures.
- Strengthen unconfined aquifer management through policies aligned with Integrated Management Plan goals, including stream depletion factors and annual recharge trend analyses.
- Refine decline impact assessments, distinguishing significant drops (e.g., a 10% decline in aquifers exceeding 100 feet vs. those under 50 feet) to prioritize intervention efforts accordingly.
- Establish quantified thresholds for confined aquifers, such as triggering management action at 50% of remaining head above the aquifer top, ensuring proactive conservation.
- Implement subarea-based resource allocation, directing management efforts and funding to high-risk zones where depletion issues are most pronounced.
- Utilize numerical groundwater flow models to identify areas of concern, assessing long-term trends and aquifer response to pumping impacts from a variety of scenarios to refine management strategies and improve predictive capabilities.

7.5 CLARIFICATION OF TERMINOLOGY

When updating the Rules and Regulations, provide clarity and consistency to key terminology utilized in the GWMP.

- Revise the GWMP and Rules and Regulations to ensure clear and consistent terminology and definitions throughout. This may include, but is not limited to, the clarifying the following terms: “Trigger Level,” “Level Controls,” “Level Criteria,” “Control Areas,” “Quantity Areas,” “Subareas,” “Groundwater Management Areas,” “Limited Development Area,” “Restricted Development Areas,” and “Special Quantity Sub Areas.”
- Recognize the following hierarchy for groundwater management within the Rules and Regulations, GWMP, and other district publications:
 - Groundwater Regions: Platte, Shell Creek, Uplands, and Todd Valley
 - Within the regions, establish Groundwater Subareas
 - Groundwater Management Areas:
 - Quality: Phase I, II, III, IV
 - Quantity: Phase I, II, III
 - Groundwater Control Areas
 - Limited and restricted development areas
- Where relevant, ensure the GWMP and Rules and Regulations refer to “aquifer thickness,” “available head” or “hydraulic head,” and “potentiometric surface” for confined aquifers, and “water table surface” and “saturated thickness” for unconfined aquifers.

7.6 RE-EVALUATION OF SPECIAL QUANTITY SUBAREAS

In 2016, the Special Quantity Subareas were established to address significant pressure drops in the aquifer during peak irrigation periods, which can cause shallower wells to run short on water. Overtime, it is valuable to reevaluate these Groundwater Management Areas to monitor improvement or worsening conditions.

- Complete a hydrogeologic study to reassess the sufficiency of the current boundaries of the Butler/Saunders SQS #1 and Platte/Colfax SQS #2. Utilize existing studies and research, including AEM surveys and hydrogeologic assessment data.
- Engage with local farmers and stakeholders to gather input and address concerns regarding the accuracy of the current boundaries.
- Incorporate recent data and technological advancements to ensure the boundaries reflect the most accurate and up-to-date information.
- Provide a detailed report with recommendations for any necessary modifications to improve groundwater management and address stakeholder concerns.

7.7 EFFORTS TO ENHANCE DATA TRANSPARENCY AND COMMUNICATION

Nebraska’s NRDs have been making significant efforts to improve transparency and accessibility of data through real-time data collection and online visualization tools. The following recommendations are provided for consideration to enhance communication with constituents:

- Create an online, data visualization tool to allow users to obtain data on recent nitrate concentrations, water level trends, and similar water use information.
- Provide maps and information from the Hydrogeologic Assessment, the GWMP, features of the Rules and Regulations such as locations of Groundwater Management Areas, subareas, and groundwater regions; Wellhead Protection Areas, and similar features.
- Establish a system to communicate with the public by allowing sign-up using a feature on the website to receive push notifications through text messaging and/or email about upcoming events, meetings, and planned changes to policies.

7.8 REASSESSMENT OF WATER QUALITY TRIGGERS

The UNMC has conducted extensive research recently on the public health effects of nitrates in groundwater, highlighting several critical concerns (Water for Food, 2024):

- **Health Risks:** High concentrations of nitrates in drinking water have been linked to various adverse health outcomes, including methemoglobinemia (especially in infants), colorectal cancer, thyroid disease, and neural tube defects. Other potential health issues include increased heart rate, nausea, headaches, and abdominal cramps.
- **Cancer and Birth Defects:** Studies have shown a significant association between high nitrate levels and certain cancers, such as pediatric brain cancer, kidney cancer, bladder cancer, and non-Hodgkin lymphoma. Additionally, there is evidence linking nitrate exposure to an increase in birth defects.
- **Economic Impact:** The economic costs associated with health effects from nitrate-contaminated drinking water are substantial. These costs include medical expenses and lost productivity due to illness. Treating drinking water for nitrate has a significant economic impact, especially for small communities, and drilling new wells can be expensive.

Given these findings, the LPNNRD should consider a reassessment of the water quality triggers. By doing so, the LPNNRD can proactively reduce nitrate levels in groundwater, thereby protecting public health and mitigating economic burdens associated with nitrate contamination.

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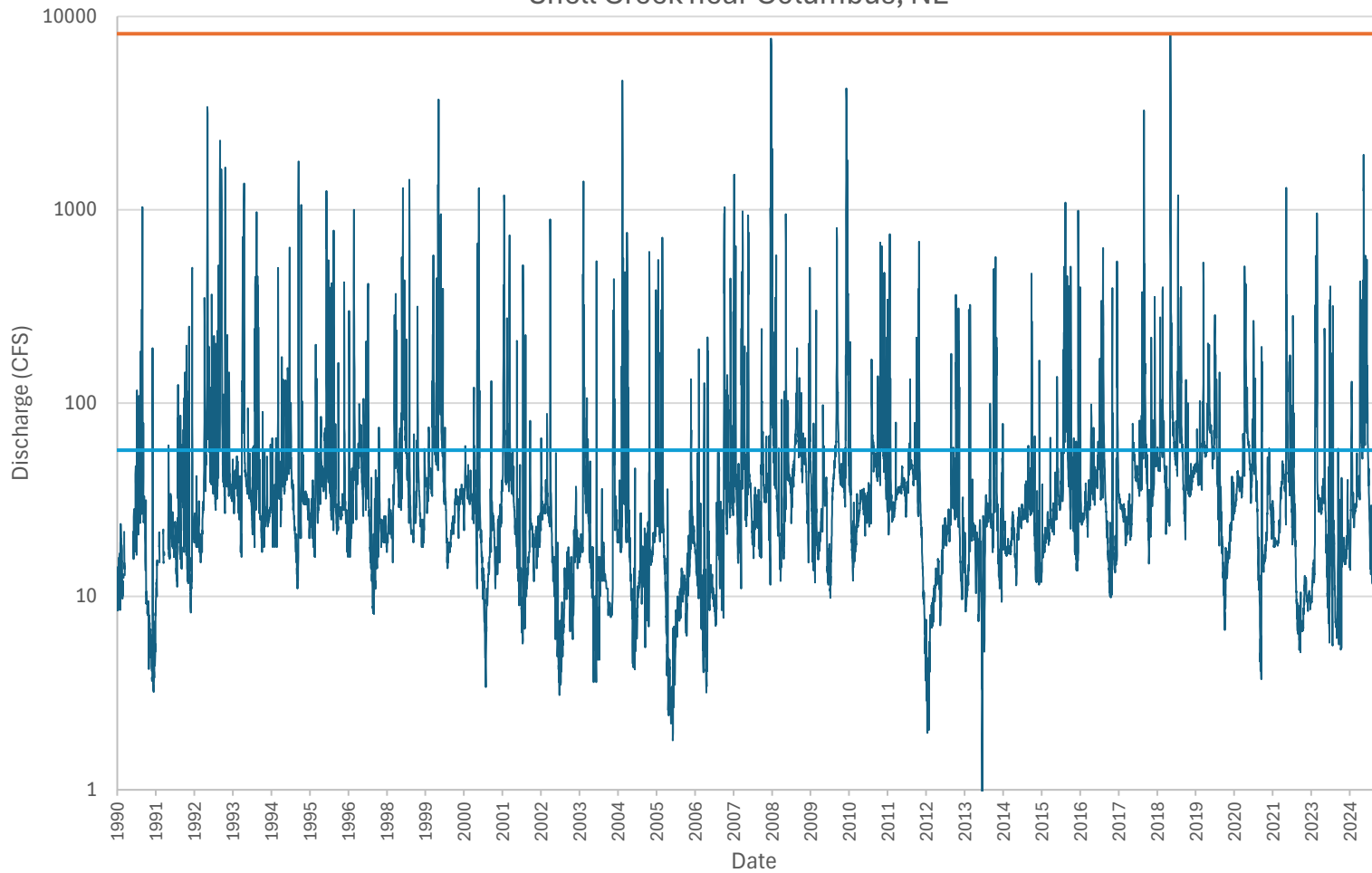
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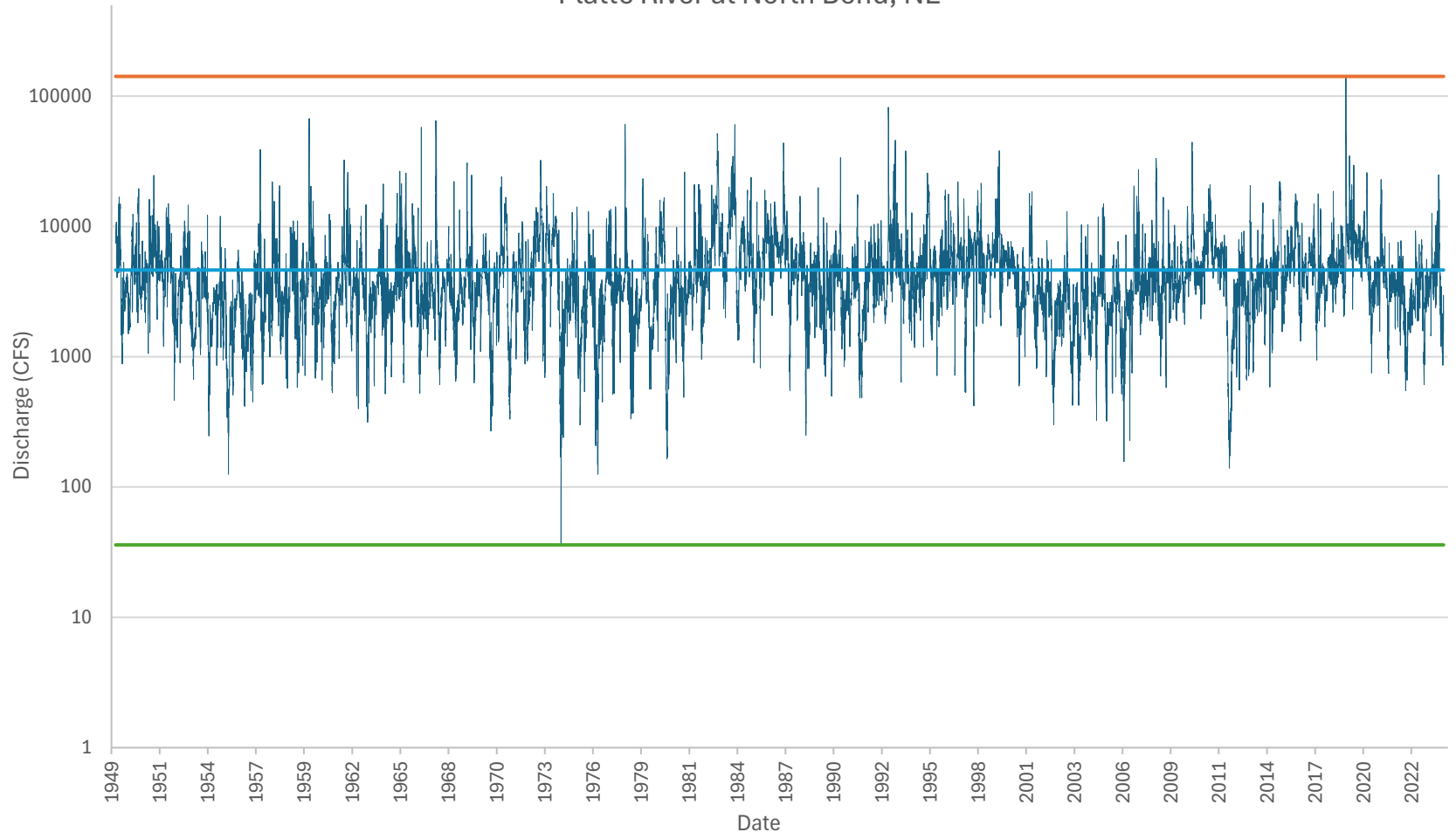
ATTACHMENT A – STREAM FLOW HYDROGRAPHS

USGS Station No. 06795500
Shell Creek near Columbus, NE



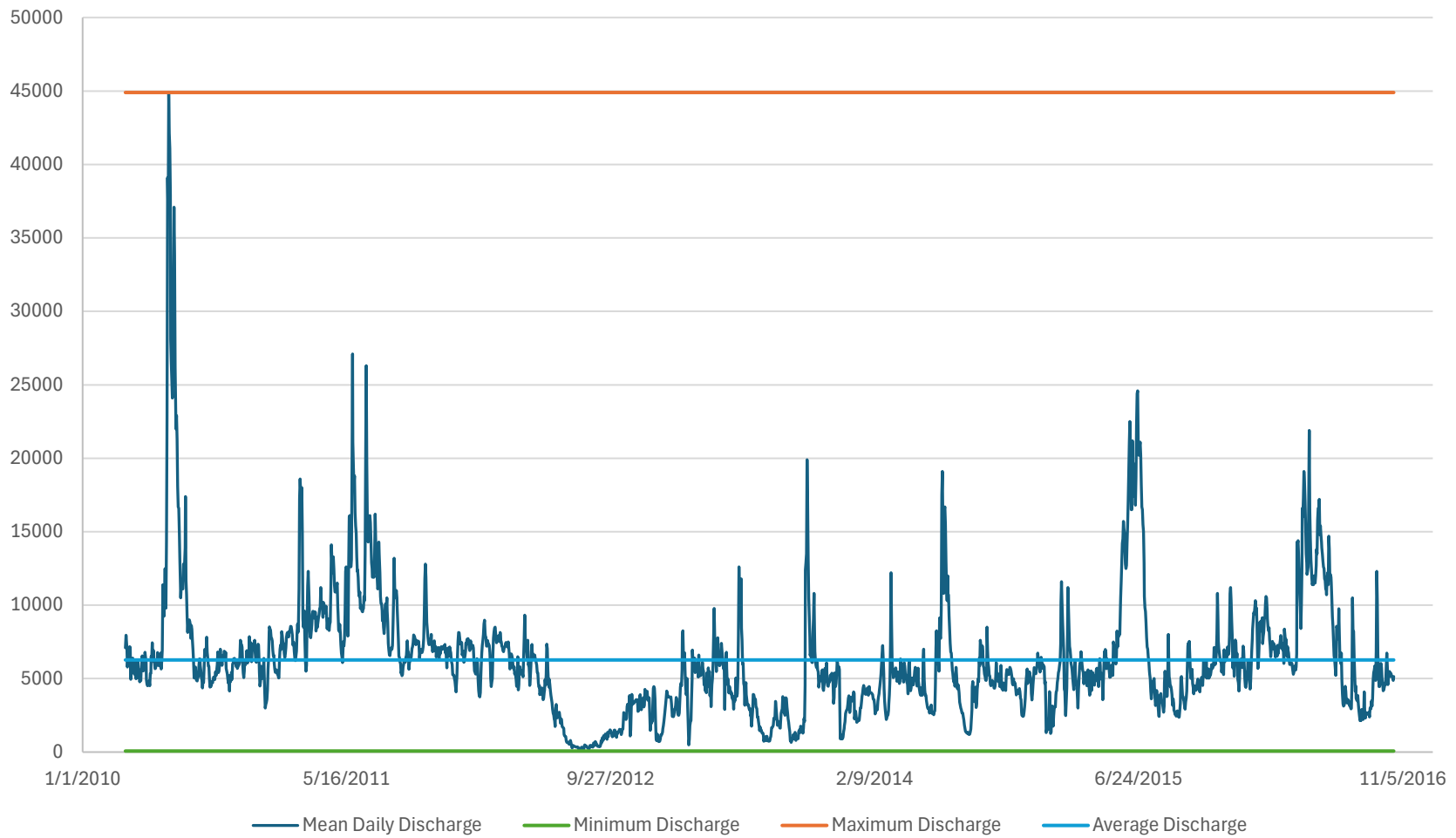
— Mean Daily Discharge — Minimum Discharge — Maximum Discharge — Average Discharge

USGS Station No. 06796000
Platte River at North Bend, NE

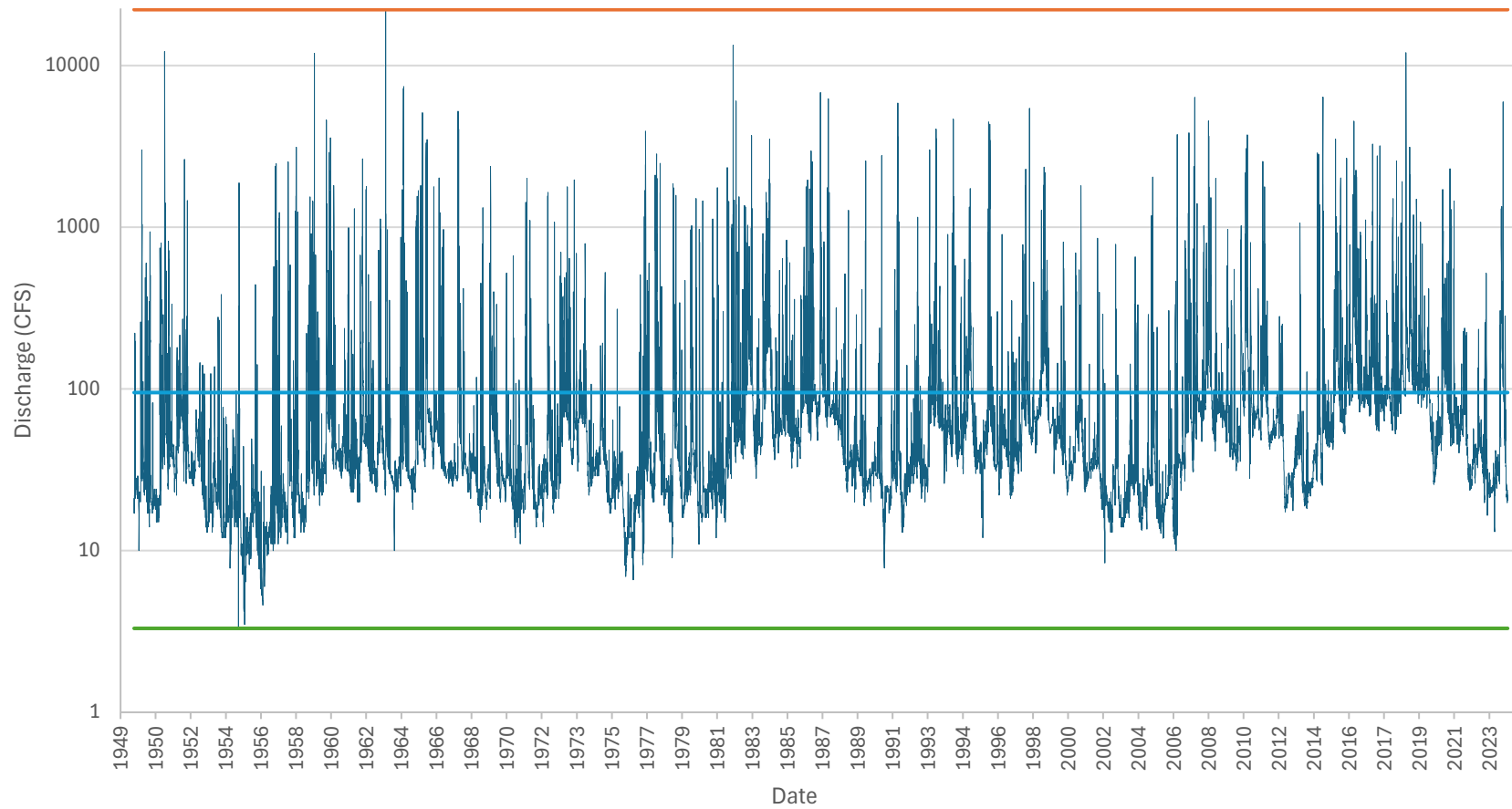


— Mean Daily Discharge — Minimum Discharge — Maximum Discharge — Average Discharge

USGS Station No. 06796550
Platte River near Leshara, NE

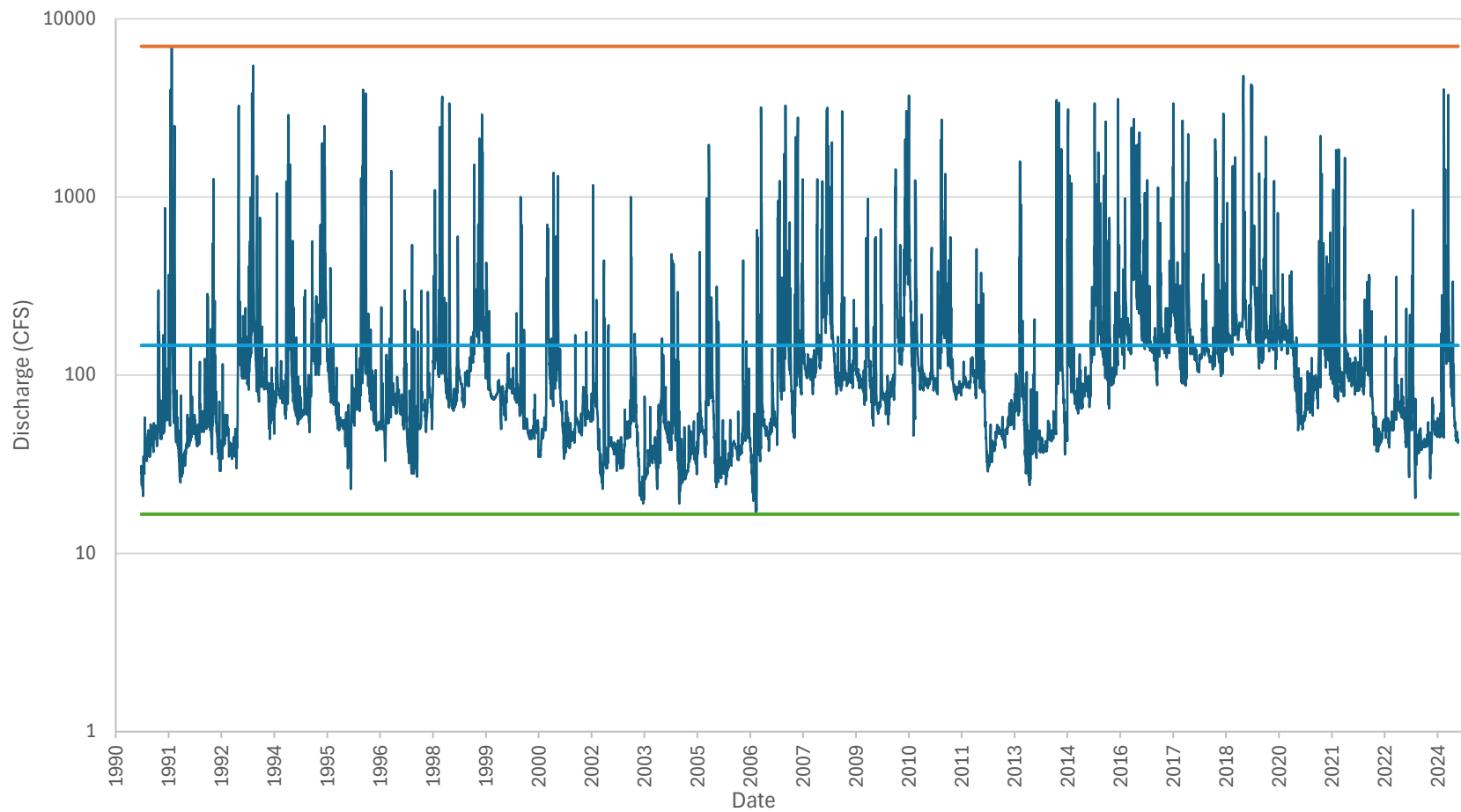


USGS Station No. 06804000
Wahoo Creek at Ithica, NE



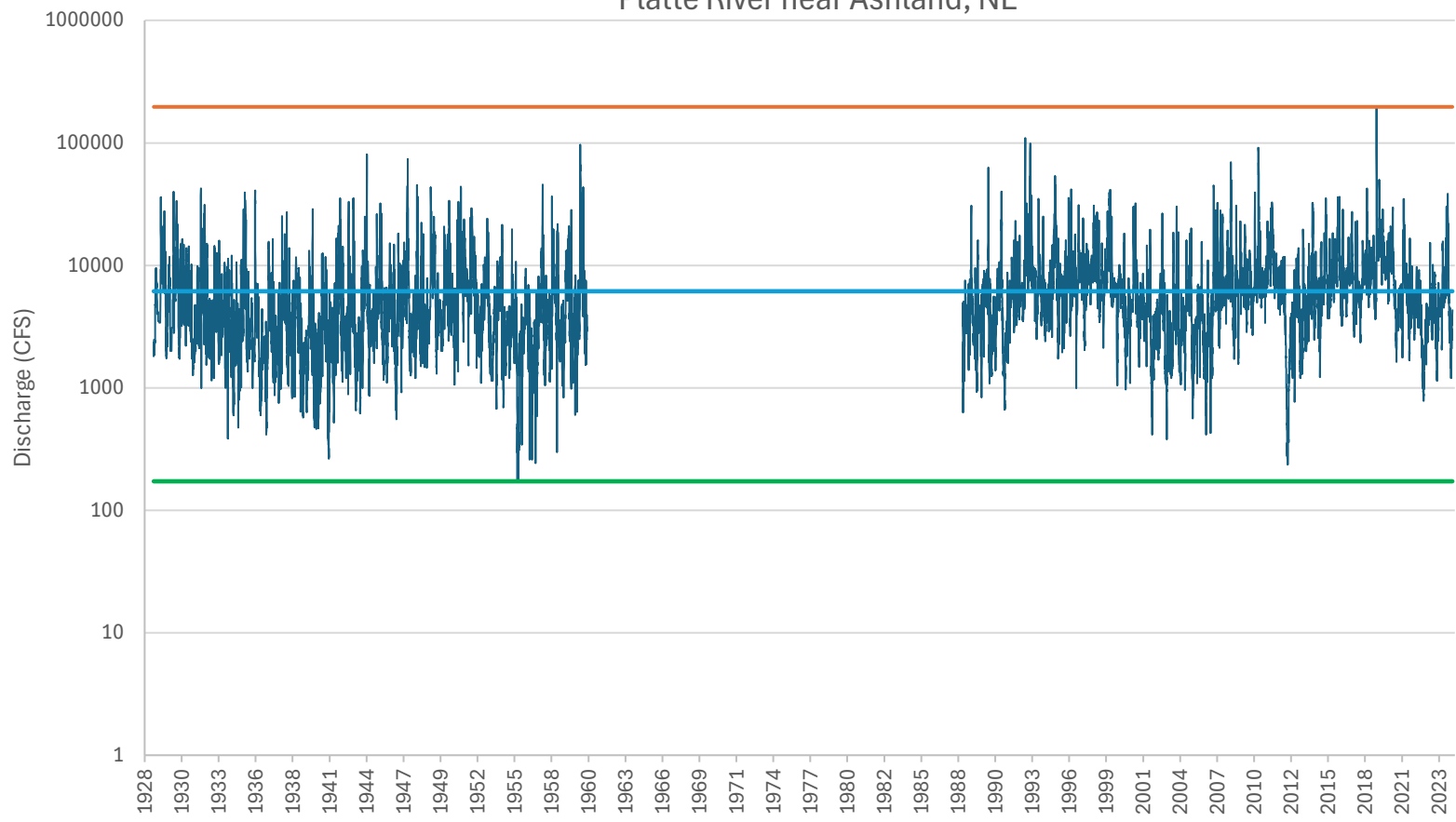
— Mean Daily Average — Minimum Discharge — Maximum Discharge — Average Discharge

USGS Station No. 06804700
Wahoo Creek at Ashland, NE



— Mean Daily Discharge — Minimum Discharge — Maximum Discharge — Average Discharge

USGS Station No. 06801000
Platte River near Ashland, NE



— Mean Daily Discharge — Minimum Discharge — Maximum Discharge — Average Discharge



August 5, 2025

Invoice No: 30981

Invoice Total: \$1,552.50

Daryl Andersen
Lower Platte North NRD
511 Commercial Park Road
Wahoo, NE 68066-0126

Please Remit To:
LRE Water
1221 Auraria Pkwy
Denver, CO 80204
(303) 455-9589
billing@LREwater.com

Invoice Email: dandersen@lpnrd.org
Project No.: 5036LPN03
Project Name: LPNNRD GW Management Plan

Professional Services through July 26, 2025

Task 04 Plan Review & Presentation

Professional Personnel

	Hours	Rate	Amount
Mohr, Jonathan	7.50	207.00	1,552.50
Totals	7.50		1,552.50
Total Labor			\$1,552.50
		Total this Task	\$1,552.50
		Total this Invoice	\$1,552.50

CHEMIGATION - August 2025

TOTAL CHEMIGATION APPLICATIONS IN 2024 (714)

NEW CHEMIGATION APPLICATIONS - 42

(10) Boone (6) Butler (6) Colfax (5) Dodge (2) Madison (9) Platte (4) Saunders

RENEWALS: 660

BOONE COUNTY - 49
BUTLER COUNTY - 78
COLFAX COUNTY - 79
DODGE COUNTY - 111
MADISON COUNTY - 7
PLATTE COUNTY - 108
SAUNDERS COUNTY - 228

RENEWAL INSPECTIONS: 174

(11) Boone (21) Butler (26) Colfax (21) Dodge (0) Madison (35) Platte (60) Saunders

NEW INSPECTIONS: 42

(13) Boone (5) Butler (5) Colfax (4) Dodge (2) Madison (9) Platte (4) Saunders

NEW CANCELLATIONS: 4

(0) Boone (3) Butler (0) Colfax (1) Dodge (0) Madison (0) Platte (0) Saunders

EMERGENCY: 0

MEAD SOURCE WATER BUDGET AUGUST 2025

ACTIVITY	ESTIMATE D COST	NeDWEE	VILLAGE	NRD
PERSONNEL				
Labor (In-kind)	\$ -	\$ -	\$ -	\$ -
IMPLEMENTATION				
Water sampling (lab fees)	\$ 700.00	\$ 700.00	\$ -	\$ -
CONSULTANT*				
GW Model	\$ 15,000.00	\$ 6,000.00	\$ 9,000.00	\$ -
Wellhead Ordinance	\$ 2,500.00	\$ 1,000.00	\$ 1,500.00	\$ -
Hydrogeo Report / Education / Open House	\$ 17,500.00	\$ 7,000.00	\$ 10,500.00	\$ -
Wellhead Protection Plan**	\$ 10,000.00	\$ -	\$ 5,000.00	\$ 5,000.00
TOTALS	\$ 45,000.00	\$ 14,000.00	\$ 26,000.00	\$ 5,000.00
TOTAL PROJECT	\$ 45,700.00	\$ 14,700.00	\$ 26,000.00	\$ 5,000.00
PERCENT OF TOTAL		32.2%	56.9%	10.9%

*NeDWEE consultant fee cap of \$91.50/hr, assumes 40% of consultant as eligible

**WHP Plans not eligible for SWP funds

ACTIVITY	ESTIMATED COST	NeDWEE	CITY	NRD
PERSONNEL				
Labor (In-kind)	\$ -	\$ -	\$ -	
IMPLEMENTATION				
Water sampling (lab fees)	\$ 500.00	\$ 500.00	\$ -	\$ -
Well No. 1 Decomm.	\$ 15,000.00	\$ 15,000.00	\$ -	\$ -
TOTALS	\$ 15,500.00	\$ 15,500.00	\$ -	\$ -
TECHNICAL ASSISTANCE				
Well Siting Assessment	\$ 15,000.00	\$ 6,000.00	\$ 9,000.00	
Groundwater Model	\$ 12,000.00	\$ 4,800.00	\$ 7,200.00	
WHP Plan Assistance	\$ 6,000.00	\$ -	\$ 3,000.00	\$ 3,000.00
TOTALS	\$ 33,000.00	\$ 10,800.00	\$ 19,200.00	\$ 3,000.00
TOTAL PROJECT	\$ 48,500.00	\$ 26,300.00	\$ 19,200.00	\$ 3,000.00
PERCENT OF TOTAL		54.2%	39.6%	6.2%