Water Committee Meeting
Thursday, July 3, 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. Well Permit Program

2.A.2. Special Quantity Subareas

At last month's Committee meeting, it was decided to budget money to re-evaluate the SQS areas. LRE provided a scope of service of $29,000 with a contract extension attached for review. If the Committee wants this to be completed by December 15, this firm would need to start in July. They would look at how the area was determined in 2015-16 along with utilizing the data collected in the last 10 years.

2.A.3. Cost Share Programs

2.A.3.a. Irrigation Well Sample Kits

Sample kits are being requested and sent out.

2.A.3.b. Demonstrations Sites

This year the NRD is working with two producers, Joe Birkel and Bruce Williams, for in-season nitrogen applications. Joe's field was done 2 years ago and research is being done on how a field will react by doing it a second time. Bruce will be doing 133 acres, which in the past the field was a fall application of nitrogen fertilizer. An invoice is attached for $2,376 for the services from SentinelAg to allow the NRD to conduct these demonstrations.

2.B. CHEMIGATION

For 2025, we have 658 renewals and 33 new permit applications for a current total of 691. Inspections for 59 renewal permits have been completed along with 16 new permit inspections.
Report attached.

2.C. GROUND WATER QUALITY SAMPLING

The YSI meters should be serviced every 3–5 years. In May 2021, the NRD purchased 3 YSI probes for $8,634.55. The NRD sent in one of the meters in for evaluation as some of the probes were not working correctly. The quote attached for replacing probes is $1,198.80. It has not been serviced since it was bought in 2021. The NRD has another YSI probe that needs to be sent in to be evaluated but doing 1 at a time.

2.D. Groundwater Management Plan

The Groundwater Management Plan Public Review is attached for Committee review. Goals and Objectives are shown on pages 50-52, which have been updated. If the plan moves forward, a hearing date will need to be established.

Staff and Committee review the plan with the following list of suggestions for LRE

- Be consistent with your map legends.
  - Make each map cities the same color and maybe change the symbol (They recommend blue or hot pink).
  - Add Swedeburg to the maps.
- Take out 3.1.1 page 34 along with Figure 25 out of the plan.
- Figure 29: They do like the color of the certified acres and make more contrast between city and acres.
- Figure 35 Middle Shell Creek, Platte Center and Lower Shell Creek all look similar in color. Make Platte Center a different color other than green.
- Figure 35 North Bend and Todd Valley are both blue. I would like a different color.
- Figure 35 Weston and Swedeburg to close of similar color.
- Figure 35 is it possible to a black boundary around each subarea?
- Objective 1.4 take out "with at least one" and "each year". Page 50
- Objective 1.6 take out "to as least five" and "per year". Page 50
- Objective 4.1 Reword to "Conduct stakeholder review field at least every 5 years", Page 51
- Consistency with NDEE and NeDNR throughout the plan.

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

One well has been plugged, reviewed, and ready for cost share payment approval this month.

Well Owner	Type of Well	Cost Share Estimate	Shell Creek Cost Share	County

Timothy Mueller	Irrigation	$1,178.54	$392.85	Platte

3.B. LOWER PLATTE NORTH NRD GROUND WATER STUDIES

3.B.1. Phase Area Update

We have received invoices from the following:

Name	Number of meters	Total Amount
Merlyn Bell and Marty Eaton	1	$1,000.00
Gene Novak	1	$1,000.00
Russ novak	1	$1,000.00
Anette Pycha	1	$1,000.00
Dean Novak	2	$2,000.00
Keith Kallweit	1	$1,000.00
Brian Kluck	1	$1,000.00
Marcy Kallweit	3	$3,000.00
Larry Svoboda	1	$1,000.00
Pathfinder Co.	1	$1,000.00

3.C. MONITORING WELLS and EQUIPMENT

We have some Hydrovu and data logger monitoring equipment that was having problems connecting to the logger from normal maintenance and mice chewing. Attached below is an invoice for $3,748.68 for the maintenance costs, mice repairs and cable repairs and replacements.

3.D. Database Transfer

A couple of months ago, the Board voted to move data from the Phoenix Database to Longitude 103. An invoice is attached for $7,500 to start the migration. NeDNR is paying the other $10,000 for the migration.

3.E. SOURCE WATER PROTECTION

The transducer was installed into the Abie municipal well. However, there was an issue with the transducer. In-Situ is replacing the transducer with one that can withstand more pressure. The transducer will be arriving in early August.

The public hearing for the Platte Center Wellhead Protection Plan is scheduled for August 12th from 7:00 PM-7:30 PM.

The public hearing for the Newman Grove Wellhead Protection Plan is scheduled for August 14th from 7:00 PM-7:30 PM.

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).

I wanted everyone to know that the Nebraska Department of Environment and Energy (NDEE) and the Nebraska Department of Natural Resources (NeDNR) merged on July 1st and are now the Department of Water, Energy, and Environment (DWEE). Our new agency web page can be found here: https://dwee.nebraska.gov/.

Glenn Cunningham Lake is on Health Alert this week.

Also, with multiple thunderstorms contributing to runoff across Nebraska, we are seeing lakes test high for *E. coli*. Bluestem, Cottonmill, Harlan County - Northeast Beach, Hugh Butler, Lake North, Louisville No. 2, Maple Creek, Summit, and Windmill No. 5 Lakes all tested above 235 colonies/100 mL. Remember that bacteria is everywhere in our environment and rain water will pick it up as it runs off the landscape and finds its way into our lakes. The good news is that sunlight is a great disinfectant on *E.coli*. So, when the sun shines those bacteria numbers will drop quickly.

There is **1** beach on Health Alert this week.

Current Lakes on Health Alert			
Lake	**County**	**Microcystin (ppb)**	**Sample Date**
Glenn Cunningham Lake	**Douglas**	**>35 (>RL)**	**6/30/2025**

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 **9** beaches with *E.coli* testing above 235 colonies/100 mL.

Lakes with High *E.coli* Bacteria			
Lake	**County**	***E.coli* (MPN)**	**Sample Date**
Bluestem Lake	**Lancaster**	**250**	**6/30/2025**
Cottonmill Park Swim Lake	**Buffalo**	**1,986**	**6/30/2025**
Harlan County Reservoir - Northeast Beach	**Harlan**	**285**	**6/30/2025**
Hugh Butler Lake (Red Willow Reservoir)	**Frontier**	**344**	**6/30/2025**
Lake North	**Platte**	**326**	**6/30/2025**
Louisville Lake No. 2 (SRA)	**Cass**	**980**	**6/30/2025**
Maple Creek Recreation Area Lake	**Colfax**	**613**	**6/30/2025**
Summit Lake	**Burt**	**248**	**6/30/2025**

Windmill Lake No. 5 (SRA)	**Buffalo**	**687**	**6/30/2025**

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 Fourth of July 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

CONTRACT AMENDMENT No. 2
LPNNRD GWMP Update

This is an amendment to the contract between LRE Water and the Lower Platte North Natural Resources District (LPNNRD) to add expense and labor to complete the Special Quantity Subarea Reevaluation Study (Project). A detailed scope of services and cost breakdown can be found in Attachment A.

TERMS OF THE AGREEMENT: There are no changes. This Project will be referred to as LRE Water Project No. 5036LPN05 and the Project will be listed as Task 1.

This Project represents the second formal modification to the original agreement executed between the LPNNRD and LRE Water, dated January 18, 2024, for the purpose of updating the LPNNRD's Groundwater Management Plan (GWMP). This modification builds upon the scope, objectives, and deliverables outlined in the original agreement and its first amendment, incorporating additional tasks and refinements necessary to address evolving groundwater quality and quantity concerns within the LPNNRD. All work associated with this modification shall be conducted in accordance with the terms, conditions, and scope of services defined in the existing agreement, unless otherwise specified.

PROJECT FUNDS AWARDED (MOD2): The first project modification (MOD1) was submitted to the LPNNRD for an increase in cost of $35,000 bringing the total to $89,000. The amount of funds awarded to LRE Water for MOD2 shall be increased by $29,000 and therefore amended from $89,000 to $118,000. The parties hereto have executed this amendment as of the later date signed below.

CONTRACT	COST
Original	$54,000
MOD 1 – Subareas Delineation, Spring/Fall Well Review, Quantity Trigger Evaluation, and Safe-Yield Thresholds	$35,000
MOD2 – SQS Study	$29,000
TOTAL	$118,000

LRE Water
Roscoe Sopiwnik, PG
By (Signature):

Title: Midwest Regional Director
Date:

LPNNRD

By (Signature):

Title:
Date:

ATTACHMENT A – SCOPE OF SERVICES

LRE WATER
CONNECTING WATER TO LIFE
A SPHEROS ENVIRONMENTAL COMPANY

Special Quantity Subarea Reevaluation Study – Scope of Services

June 30, 2025

The Special Quantity Subareas (SQS) established in 2016 aim to address aquifer level declines during peak irrigation periods that risk water shortages in shallower wells. Periodic boundary reevaluations are essential for monitoring and effective management. The SQS Subarea Reevaluation Study (Project) proposes a hydrogeologic assessment of current conditions of Butler/Saunders SQS #1 and Platte/Colfax SQS #2, leveraging existing data, Airborne Electromagnetic (AEM) surveys, existing studies, and hydrogeologic insights based upon the Lower Platte North Naturals Resources District's Hydrogeologic Assessment completed previously by LRE Water. The Study Area is defined as two miles around each of the existing SQS areas.

The proposed Project includes:

- Researching the justification for the original SQS boundaries.
- Conducting a desktop review of water levels within and around the SQS areas, incorporating data from neighboring NRDs.
- Integrating Hydrogeologic Assessment and 3D AEM Framework information to characterize project-area hydrogeology.
- Obtain and review historic metered well pumping volumes.
- Review the 2022 study of the SQS areas completed by the University of Nebraska – Conservation and Survey Division (UNL-CSD).
- Developing a Geographic Information System (GIS) model to visualize historic groundwater changes, including an animated representation.
- Producing a detailed report with findings, data gaps, and recommendations for potential boundary modifications.

1. SCOPE OF SERVICES

Task 1.1: Data Collection and Project Management

- Complete typical project management activities including invoicing, progress reports, coordination, and one kickoff meeting.
- Complete a second meeting with LPNNRD staff and revisit the reasoning and justification for establishing the original SQS boundaries.
- Work with LPNNRD to identify, obtain, and review existing hydrogeologic data, reports, and studies relevant to the Project. This includes the Hydrogeologic

Assessment and 3D AEM Framework projects completed in 2022 and 2023, and other sources such as the University of Nebraska Lincoln-Conservation Survey Division, Nebraska Department of Water, Energy, and Environment, and U.S. Geological Survey.

- Obtain updated hydrographs from spring/fall observation wells and dedicated wells within the Study Area.
- Compile and inventory available datasets, provide a brief summary of the information from each source, and assess the quality and relevance of the data used in the Study.

Task 1.2: Desktop Review

- Utilize the LPNNRD Hydrogeologic Assessment data to develop detailed localized maps of the Study Area detailing AEM flight locations, aquifer thickness, transmissivity, groundwater elevation and flow direction, depth to groundwater, saturated sand thickness, and similar datasets.
- Create up to three additional hydrogeologic cross sections per SQS area illustrating the land surface, clay, sand/gravel aquifers, and wells. The new cross sections will include the location of spring/fall and dedicated observation wells, if adequate construction data is available.
- Using GIS, LRE Water will create an illustrative rendering of groundwater changes overtime using existing water level data. The animation will be used to identify areas of concern and also be used as a visual when sharing information with the public.
- Identify data gaps and provide a GIS layer of specific wells, or new locations for observation wells, to be added to the water level monitoring network for future monitoring by LPNNRD staff.
- Create a map illustrating areas by section that have experienced steady water level declines since the SQS was initiated in 2016.

Task 1.3: Reporting and Presentation

- Provide a report that summarizes the findings of the Study including the purpose, background information including all data sources, summary of hydrograph trends by section, Study Area hydrogeology, and recommendations for the location of future observation wells.
- Complete one presentation of all the findings to the LPNNRD Water Committee that may include a mix of in-person and virtual attendance by LRE Water. Then complete one in-person presentation to the Board of Directors.

2. TIME REQUIRED

LRE Water is assuming the Project will be authorized by the LPNNRD in July 2025 allowing for Project kickoff to occur in August 2025. The Project is expected to take up to four months with a presentation to the Board of Directors at the November 2025 Board Meeting. A detailed schedule will be established and shared with the LPNNRD at the kick-off meeting.

3. PAYMENT

The estimated time and materials fee to complete the Project outlined below will not exceed $29,000. The estimated distribution of compensation is outlined in the table below. The costs include LRE Water's labor and expenses, which includes mileage, lodging, and meals.

PROJECT TASKS		COST
1	Data Collection and Project Management	$5,000
2	Desktop Assessment	$11,500
3	Report and Presentation	$12,500
TOTAL (3 TASKS)		$29,000

Special Quantity Subarea Reevaluation – DRAFT Scope

The Special Quantity Subareas (SQS) established in 2016 aim to address aquifer level declines during peak irrigation periods that risk water shortages in shallower wells. Periodic boundary reevaluations are essential for monitoring and effective management. This study proposes a hydrogeologic reassessment of Butler/Saunders SQS #1 and Platte/Colfax SQS #2, leveraging existing data, Airborne Electromagnetic (AEM) surveys, and hydrogeologic insights. The proposed tasks include:

- Conducting a desktop review of water levels within and around the SQS areas, incorporating data from neighboring NRDs.
- Integrating Hydrogeologic Assessment the 3D AEM Framework data to characterize project-area hydrogeology.
- Obtain and review historic metered well pumping volumes.
- Developing a Geographic Information System (GIS) model to visualize historic groundwater changes, including an animated representation.
- Producing a detailed report with findings, data gaps, and recommendations for potential boundary modifications.

The Study Area is defined as two miles around each SQS area.

1. SCOPE OF SERVICES

Task 1: Data Collection and Project Management

- Complete typical project management activities including invoicing, progress reports, coordination, and one virtual kickoff meeting.
- Complete a kickoff meeting with LPNNRD staff and revisit the reasoning and justification for establishing the SQS boundaries.
- Work with LPNNRD to identify, obtain, and review existing hydrogeologic data, reports, and studies relevant to the Project. This includes LRE Water's Hydrogeologic Assessment Report and 3D AEM Framework projects in 2019, and other sources such as the University of Nebraska Lincoln-Conservation Survey Division, NeDNR, and US Geological Survey.
- Obtain updated hydrographs from spring/fall observation wells and dedicated wells within the Study Area.
- Compile and inventory available datasets, provide a brief summary of the information from each source, and assess the quality and relevance of the data used in the Study.

Task 2: Desktop Review

- Utilize the LPNNRD Assessment data to develop maps detailing AEM flight locations, aquifer thickness, transmissivity, groundwater elevation and flow direction, depth to groundwater, saturated sand thickness, and similar datasets within the Study Area.
- Create up to two additional hydrogeologic cross sections per SQS area illustrating the land surface, clay, sand/gravel aquifers, and wells. The new cross sections will include the location of spring/fall and dedicated observation wells, if adequate construction data is available.
- Using Geographic Information Systems (GIS), LRE Water will create an illustrative rendering of groundwater changes overtime using existing water level data. The animation will be used to identify areas of decline and also be used to share information with the public.
- Identify data gaps by providing a GIS layer of specific wells to be added to the water level monitoring network for future monitoring by LPNNRD staff.
- Create a map illustrating areas by section that have experienced steady water level declines since the SQS was initiated in 2016.

Task 3: Reporting and Presentation

- Provide a report that summarizes the findings of the Study including the purpose, background information including all data sources, summary of hydrograph trends by section, Study Area hydrogeology, and recommendations for the location of future observation wells.
- Provide one formal presentation of all the findings to the LPNNRD Water Committee and Board of Directors.

2. TIME REQUIRED

LRE Water is assuming the Project will be authorized by the LPNRD in June 2025. The complete Project is expected to take up to four months with a presentation to the Board of Directors at the November 2025 Board Meeting. A detailed schedule will be established and shared with the LPNNRD at the kick-off meeting.

3. PAYMENT

The estimated time and materials fee to complete the Project outlined below will not exceed $29,000. The estimated distribution of compensation is outlined in the table below. The costs include LRE Water's labor and expenses, which includes mileage, lodging, and meals. LRE Water will begin invoicing after NNRD's July 1, 2025, fiscal year.

PROJECT TASKS		**COST**
1	Data Collection and Project Management	$5,000
2	Desktop Assessment	$11,500
3	Report and Presentation	$12,500
TOTAL (3 TASKS)		$29,000

INVOICE

Sentinel Ag
1071 County Road G
Ithaca, NE 68033-2243

sales@sentinelfertigation.com
+1 (531) 324-0634
www.sentinelag.tech

SENTINELAG

Bill to
Daryl Andersen
Lower Platte North Natural Resource District
511 Commercial Park Rd
PO Box 126
Wahoo, NE 68066 US

Ship to
Daryl Andersen
Lower Platte North Natural Resource District
511 Commercial Park Rd
PO Box 126
Wahoo, NE 68066 US

Invoice details
Invoice no.: 1334
Terms: Net 30
Invoice date: 06/27/2025
Due date: 07/27/2025

Account Manager: James Herrick

#	Date	Product or service	Description	Qty	Rate	Amount
1.	06/25/2025	**N-Time Advanced**	N-Time Advanced Insights enrollment for 12 months - Mick's North - Joe Birkel.	65	$12.00	$780.00
2.	06/25/2025	**N-Time Advanced**	N-Time Advanced Insights enrollment for 12 months - Gaughens - Bruce Williams	133	$12.00	$1,596.00

Total **$2,376.00**

Ways to pay

VISA | Mastercard | DISCOVER | AMEX | BANK | PayPal | venmo

View and pay

CHEMIGATION - July 2025

TOTAL CHEMIGATION APPLICATIONS IN 2024 (714)

NEW CHEMIGATION APPLICATIONS - 33

(7) Boone (6) Butler (3) Colfax (5) Dodge (2) Madison (6) Platte (4) Saunders

RENEWALS: 658

BOONE COUNTY - 49
BUTLER COUNTY - 78
COLFAX COUNTY - 78
DODGE COUNTY - 111
MADISON COUNTY - 7
PLATTE COUNTY - 107
SAUNDERS COUNTY - 228

RENEWAL INSPECTIONS: 59

(0) Boone (16) Butler (0) Colfax (10) Dodge (0) Madison (8) Platte (25) Saunders

NEW INSPECTIONS: 16

(0) Boone (3) Butler (1) Colfax (4) Dodge (0) Madison (4) Platte (4) Saunders

NEW CANCELLATIONS: 4

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

EMERGENCY: 0

Jake Pittman
Lower Platte North NRD
511 Commercial Park Road
Wahoo, Nebraska 68066
Tel. 402-443-4675

Quote: #155569-1
Contact: Justin Walters
Email: justin.walters@fondriest.com
Date: 06/16/25
Expires: 09/14/25

Notes: *ProQuatro (21D104293)*

Part #	Manufacturer	Description	Price	Qty	Total
Evaluation	Fondriest Repair	Instrument evaluation	$0.00	1	$0.00
605203	YSI	2003 polarographic DO sensor with yellow 1.25 mil PE membrane kit, Pro Series	$224.20	1	$224.20
005560	YSI	5560 temperature/conductivity sensor, 556 & Quatro	$550.05	1	$550.05
605101	YSI	1001 pH (ISE) sensor, Pro Series	$209.00	1	$209.00
Tune-Up Pro	Fondriest Repair	Tune-up YSI Pro Series water quality meter, includes all repair labor	$149.00	1	$149.00
YSI-Tariff	YSI	Tariff surcharge	$34.41	1	$34.41

Send Purchase Order To:
Fondriest Environmental, Inc.
2091 Exchange Court
Fairborn, OH 45324
Phone: (888) 426-2151
Fax: (937) 426-1125
Email: customercare@fondriest.com

Subtotal:	$1,166.66
Tax:	$0.00
Shipping:	$32.14
Total:	**$1,198.80**

PLACE ORDER ONLINE

Delivery:	
FOB Point:	Origin
Freight:	UPS - UPS Ground
Terms:	Net 30 w/ approved credit Visa, MC, AMEX, Discover
Late Payments:	1.5% interest per month. 3% surcharge for late payments made with credit card

Jake Pittman

Lower Platte North NRD

Evaluation Report

06/09/2025

Your equipment has been evaluated and this report summarizes our findings.

Equipment	Serial #
ProQuatro	21D104293

As Received (Tap Water)

Parameter	Result	Min	Max	Comments
Temperature	21.67	21.43	22.03	Pass
SpCond	.675			Pass
pH	9.59			Fail
DO%	N/A			Fail

Tests

Test	Result	Min	Max	Comments
Temperature	21.67	21.43	22.03	Pass
SpCond Air	0.003	-1	0.005	Pass
SpCond 1.413	1.413			Pass
pH 7 mV	-87.2	35	-35	Fail
Tested with FEI pH probe				N/A
pH 7 mV	-18.5	35	-35	Pass
pH 10 mV	-181.9	-140	-220	Pass
pH 4 mV	145.2	140	220	Pass
Slope (pH 7-4 mV)	163.7	165	185	Pass
Slope (pH 7-10 mV)	163.4	165	185	Pass
DO %	N/A			Fail
Tested with FEI DO probe				N/A
DO %	N/A			Fail

Tested with FEI cable				N/A
DO %	198.7			Fail

Parts/Labor

Part #	Description	Qty
119054-1	Quatro cable assembly, 1m	1
605101	1001 pH (ISE) sensor, Pro Series	1
005560	5560 temperature/conductivity sensor, 556 & Quatro	1
605203	2003 polarographic DO sensor with yellow 1.25 mil PE membrane kit, Pro Series	1
Tune up	Tune up	1

Repair Tech Comments

Cable flex affects readings
Reconditioned DO probe
pH probe due for replacement
Temp/Cond Probe is damaged, needs replaced
Cable assembly causes DO to read out of spec
DO probe reads high; needs replaced

Groundwater Management Plan

Public Review Version 9.0

Approval Date: XX/XX/XXX

Prepared for:

LOWER PLATTE NORTH
Natural Resources District

Prepared by:

LRE WATER
CONNECTING WATER TO LIFE

Board of Directors - 2024

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 Statue 46-709. The GWMP was created based upon the best available scientific information.

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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
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.

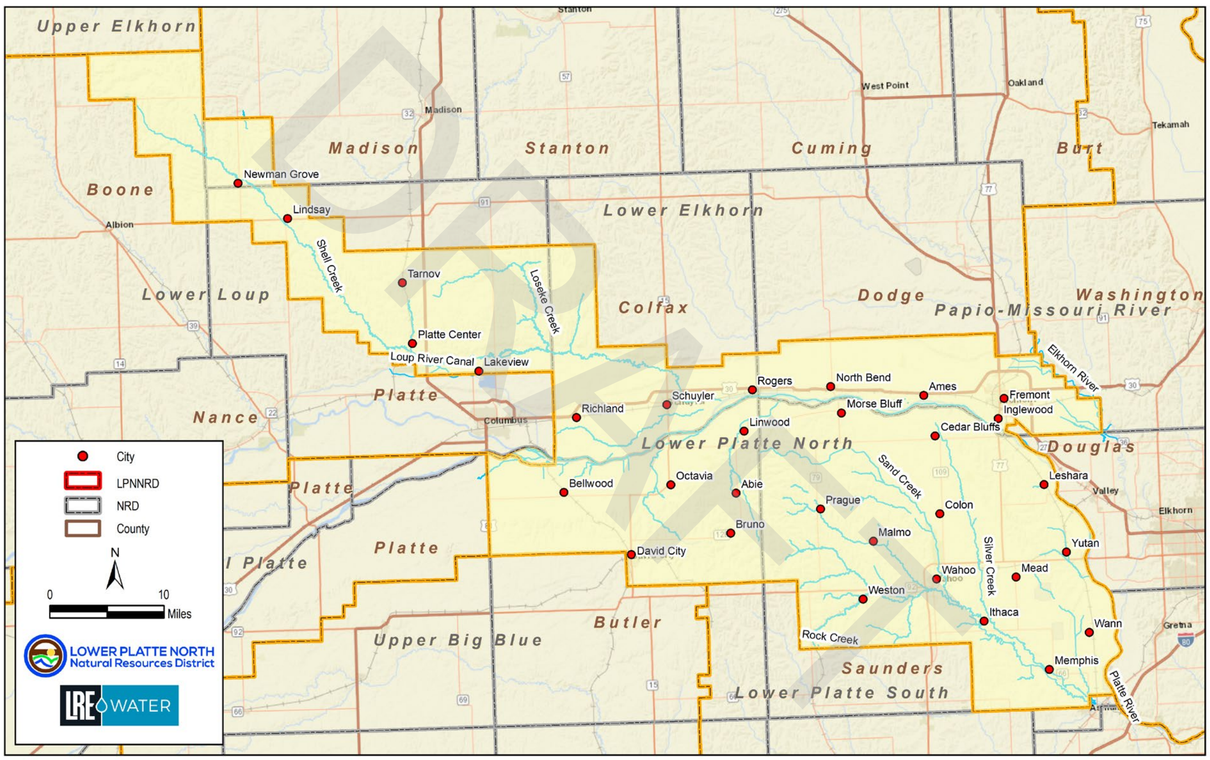

Figure 1: LPNNRD Location

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 Statue 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

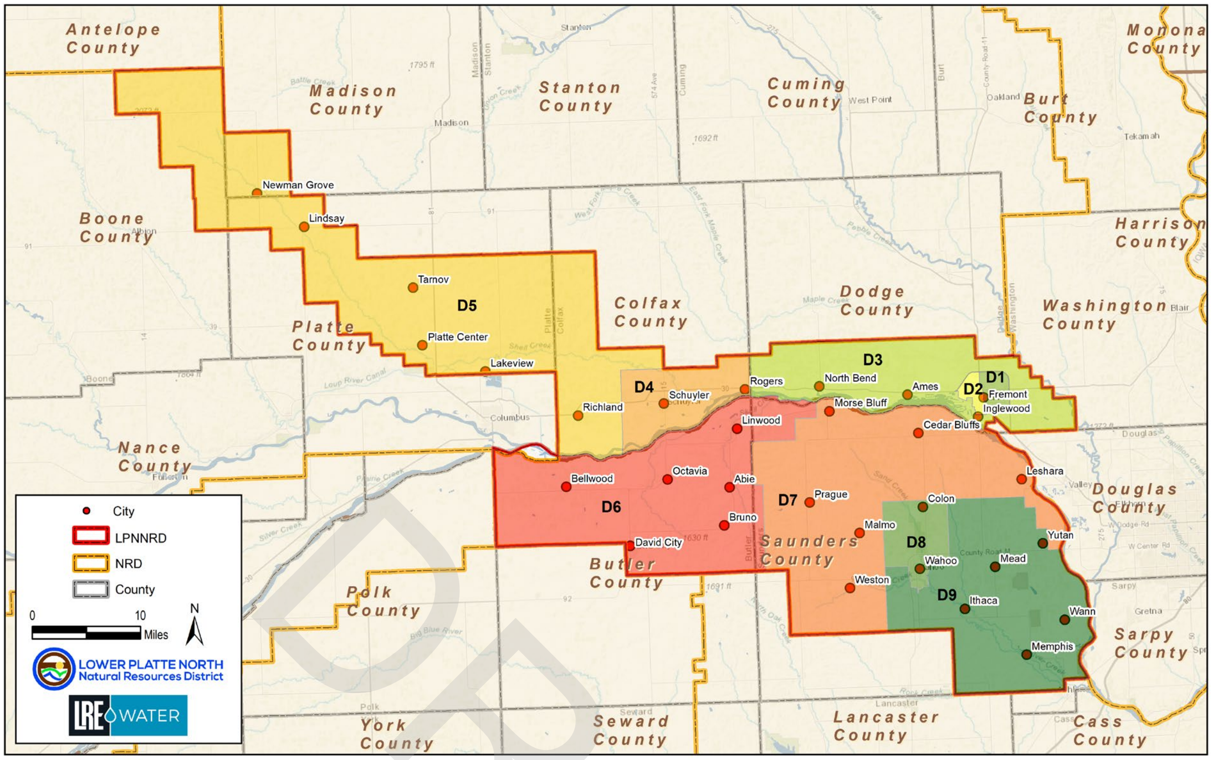

Figure 2: Board of Director Sub-districts (2025)

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 Coalitions 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 LPNNRD, 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.

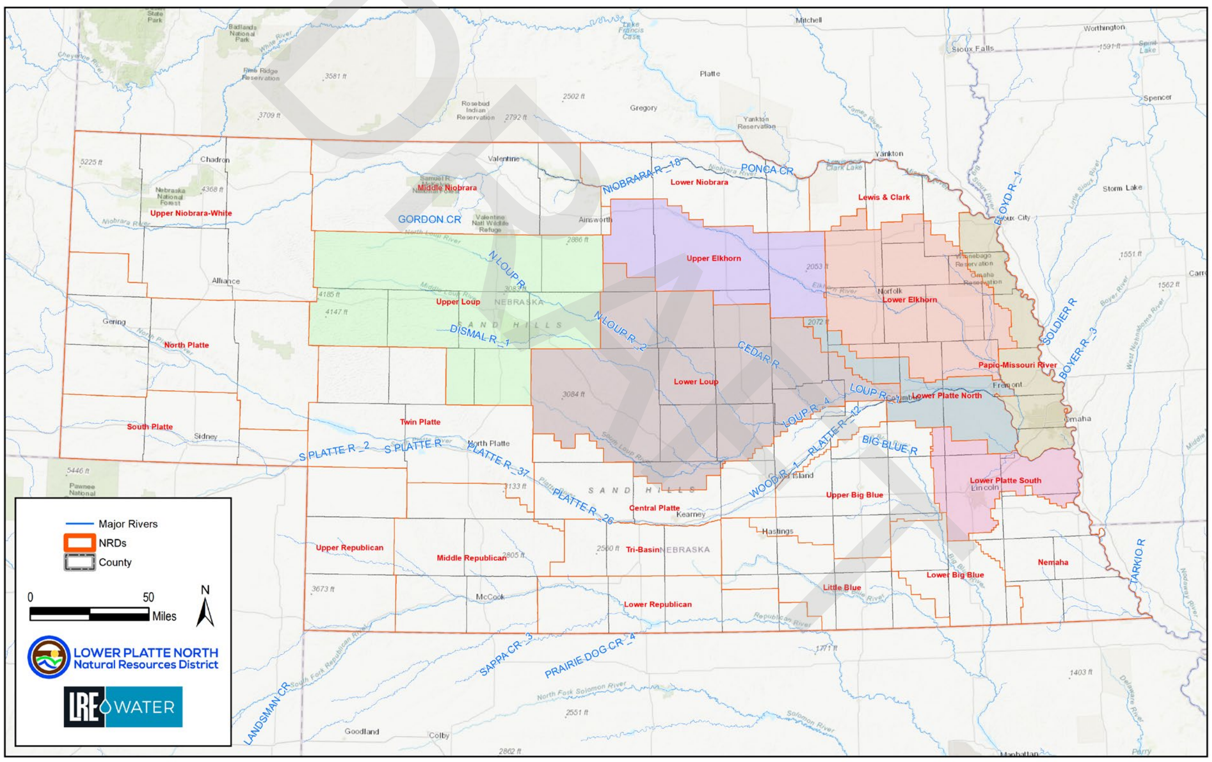

Figure 3: Lower Platte River Basin Coalition NRDs

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.

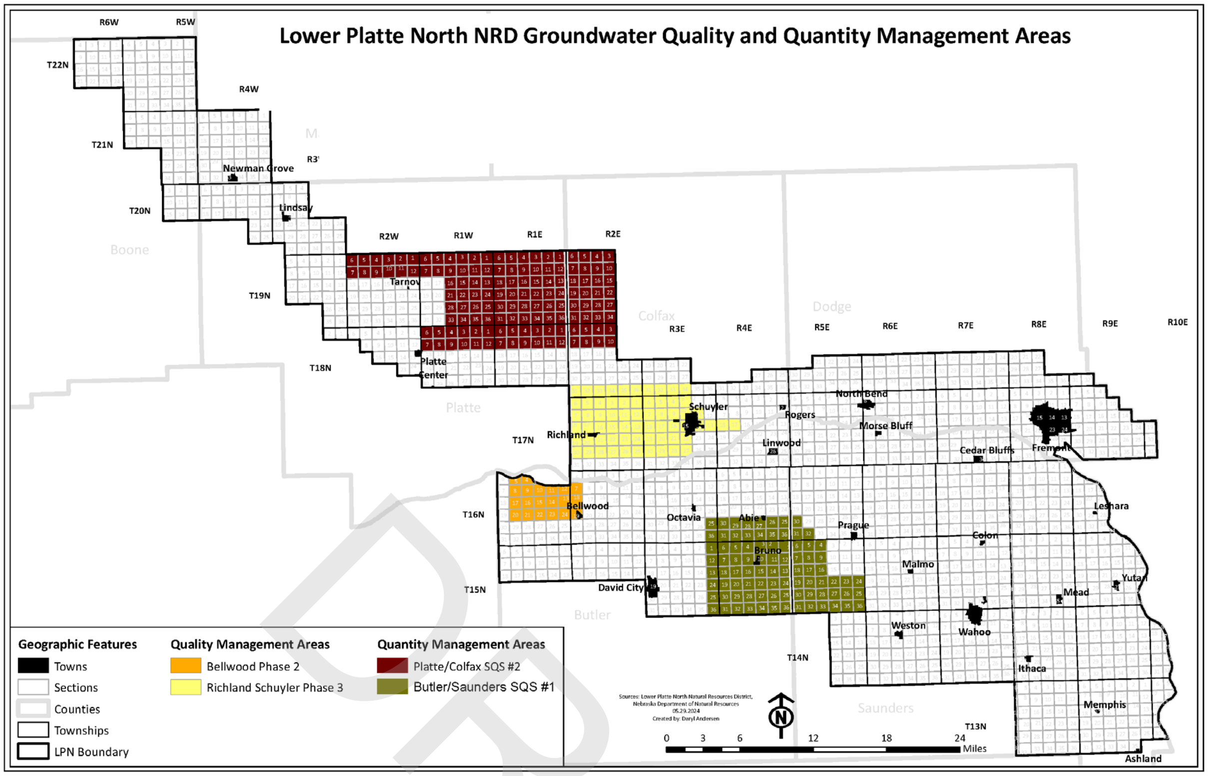

Figure 4: Quality and Special Quantity Sub-areas

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.

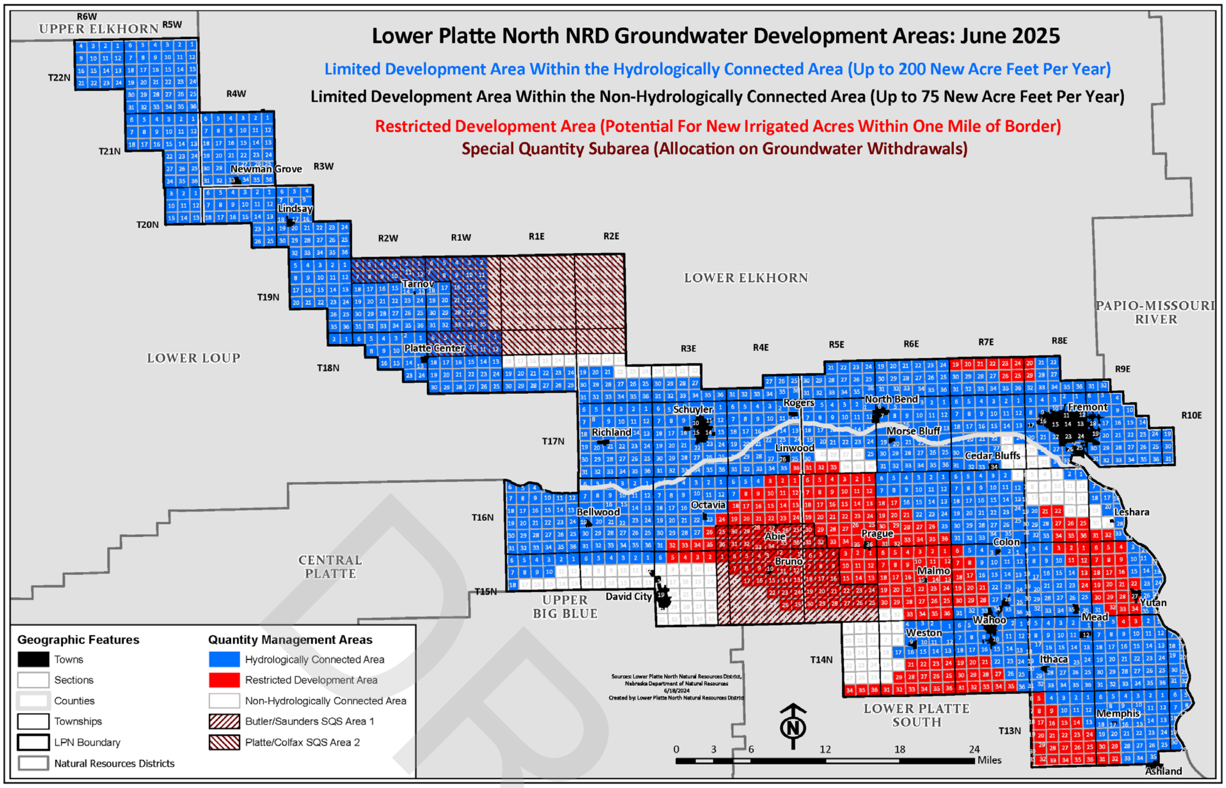

Figure 5: Groundwater Limited Development Areas

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 overlie 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.

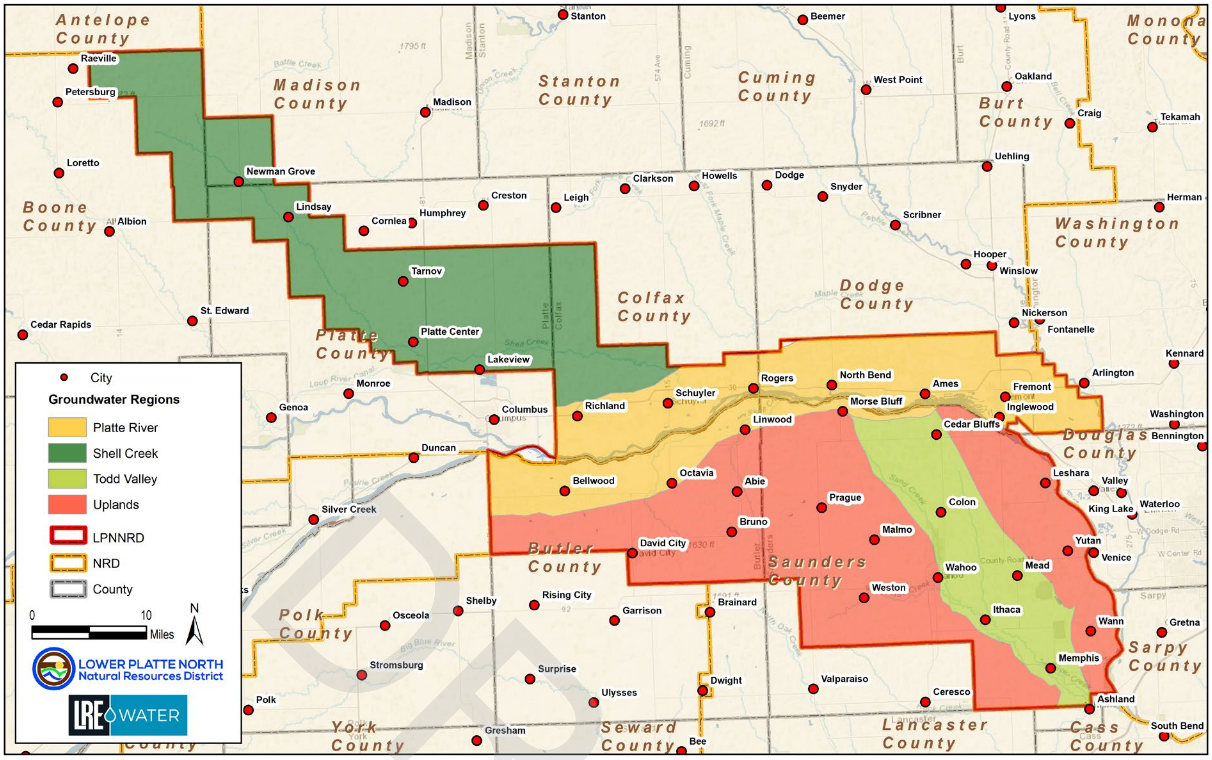

Figure 6: Groundwater Regions of the LPNNRD

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.

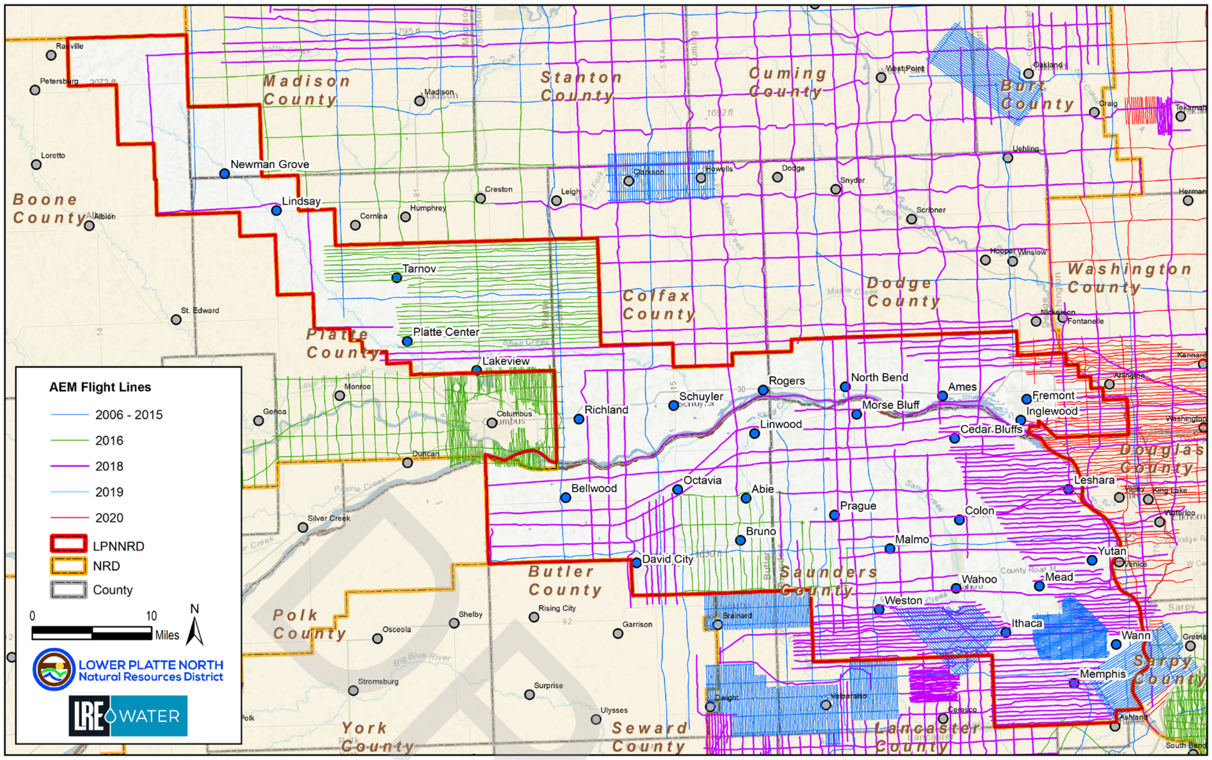

Figure 7: AEM Flights within and near the LPNNRD

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.

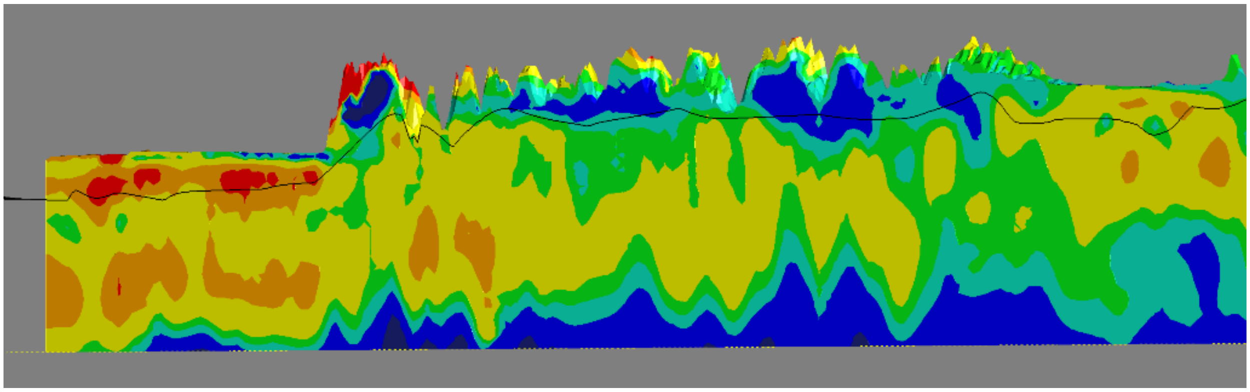

Figure 8: 3D Leapfrog output in cross section

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.

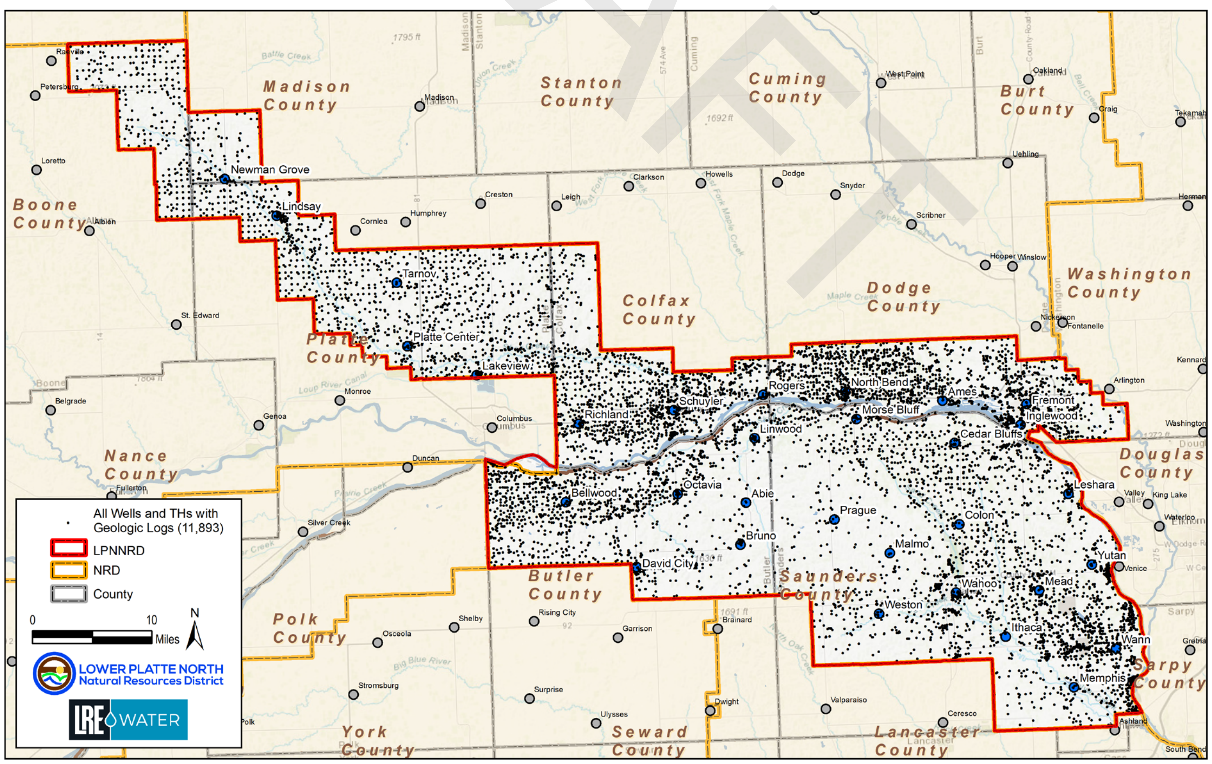

Figure 9: Well and Test Holes with Geologic Logs (LRE Water, 2023)

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 LPNNRD 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.

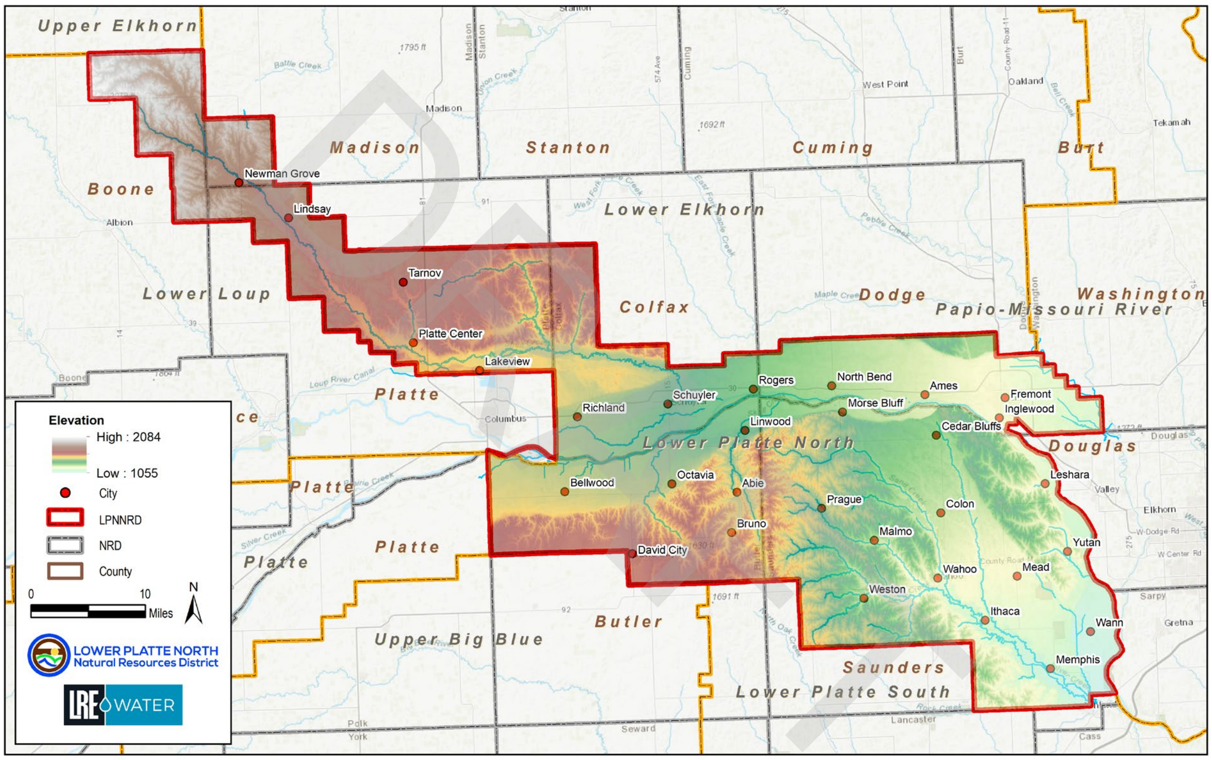

Figure 10: Topography of the LPNNRD

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.

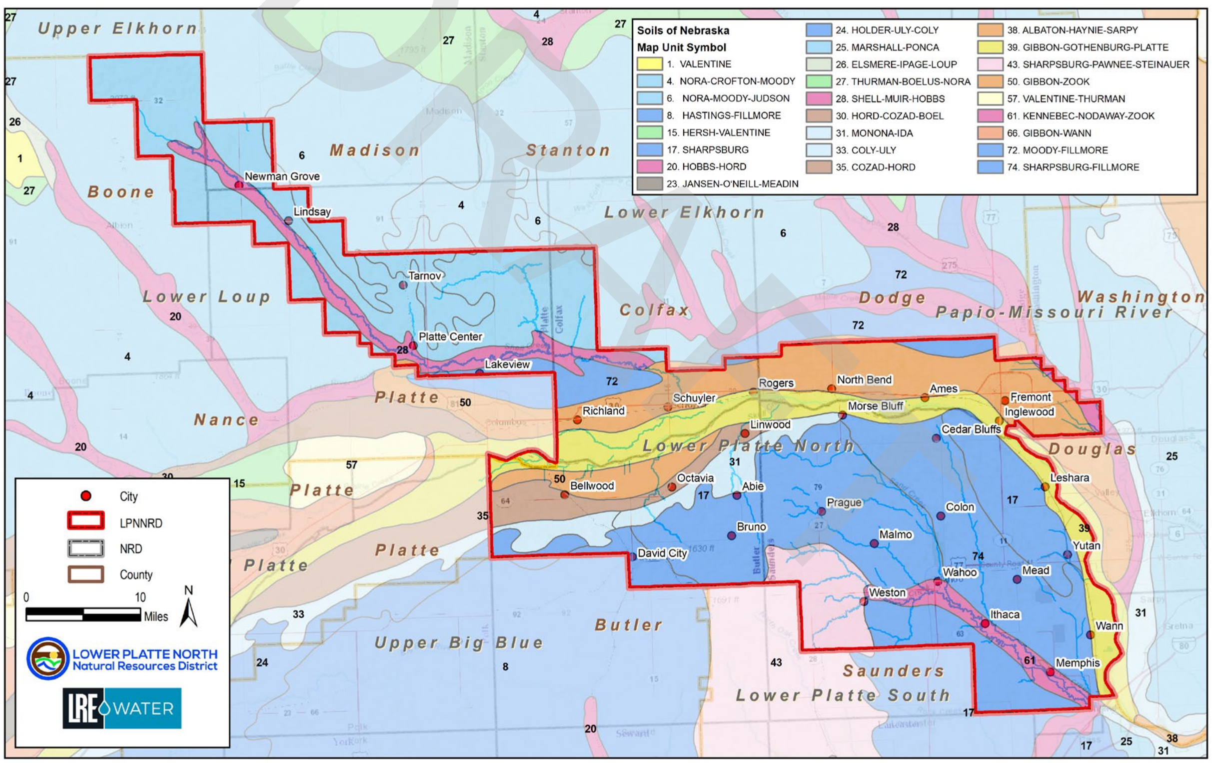

Figure 11: Soil Types

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.

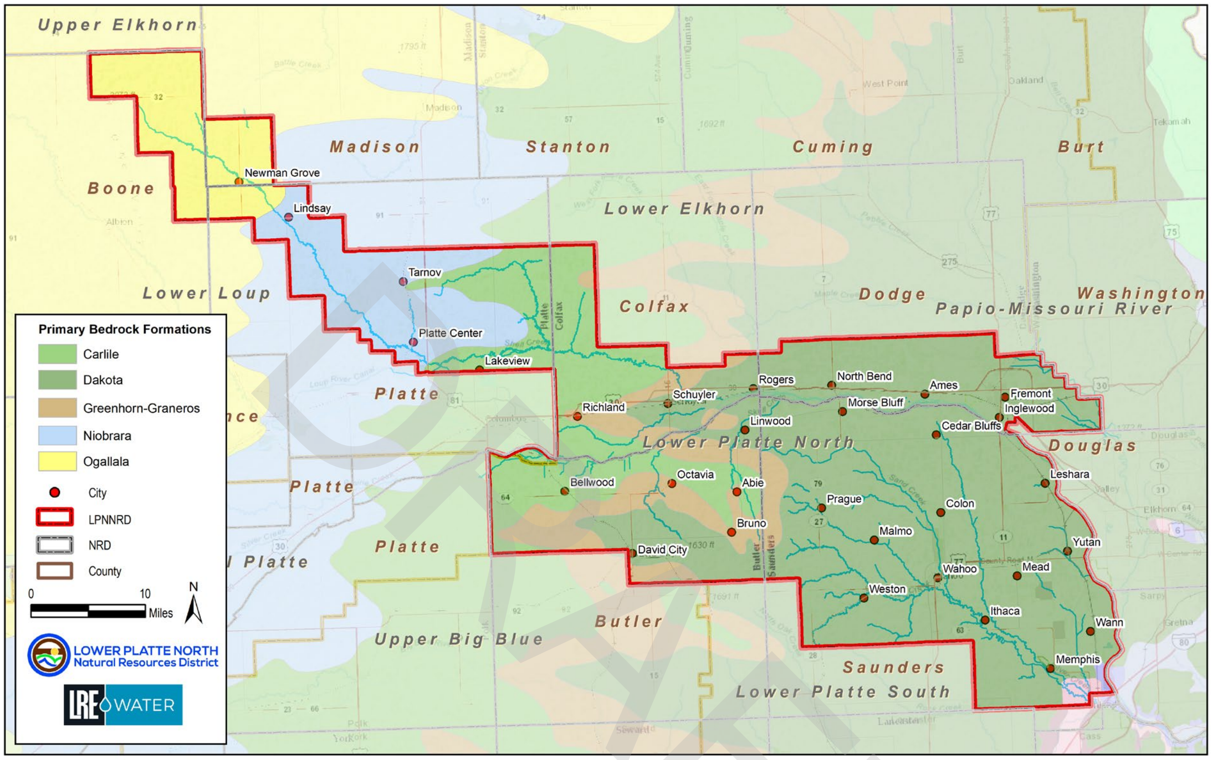

Figure 12: Bedrock Formations

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.

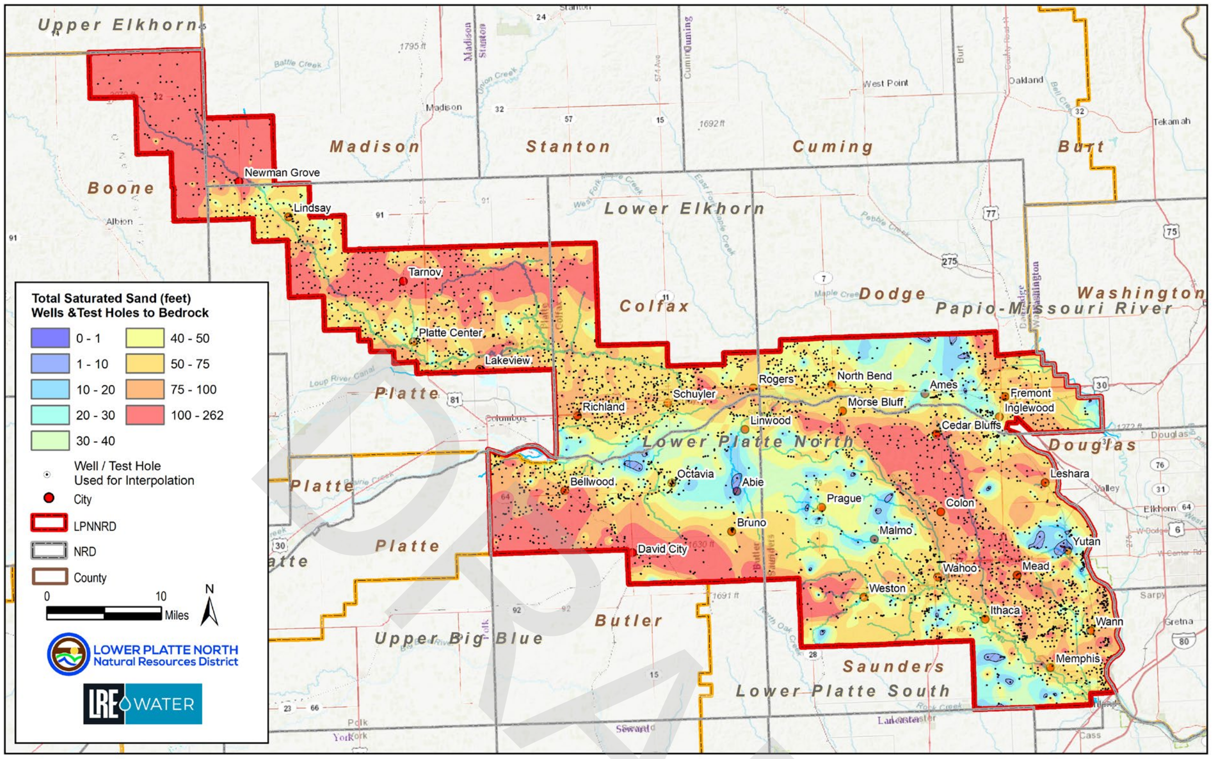

Figure 13*: Total Saturated Sand, Well and Test Holes*

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 is 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.

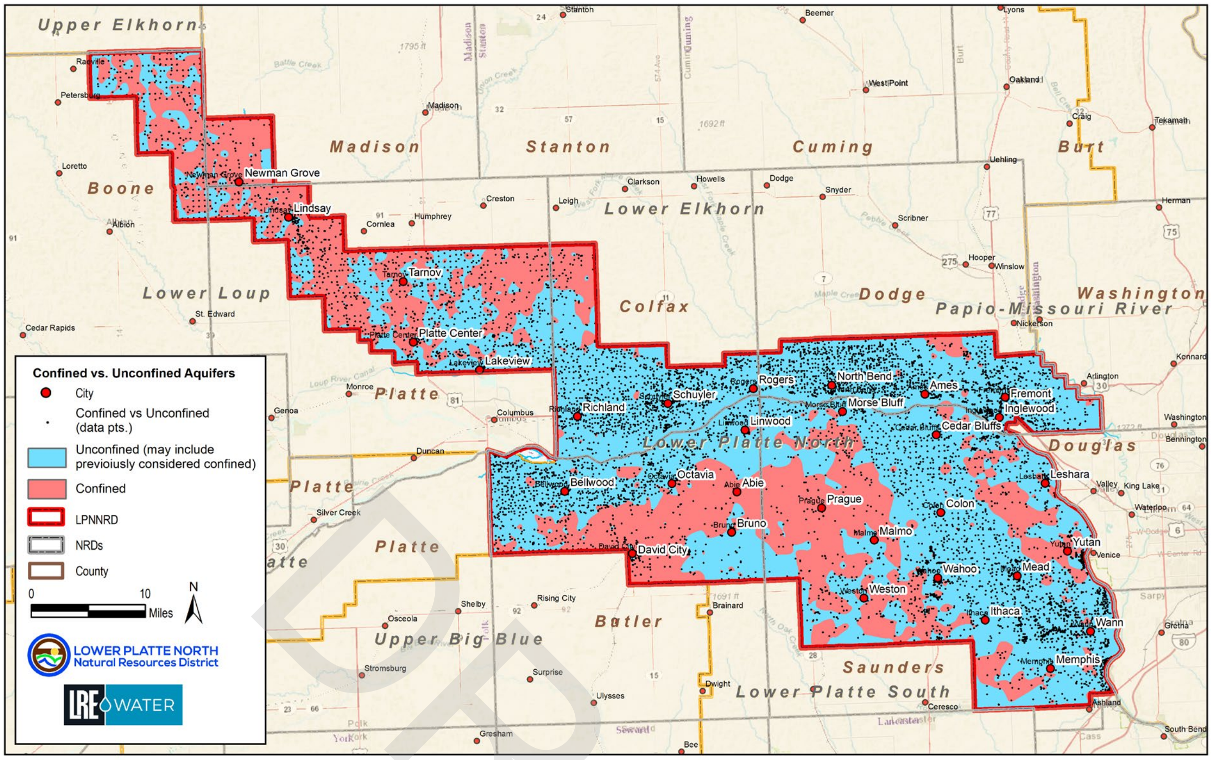

Figure 14: Confined vs. Unconfined Aquifers

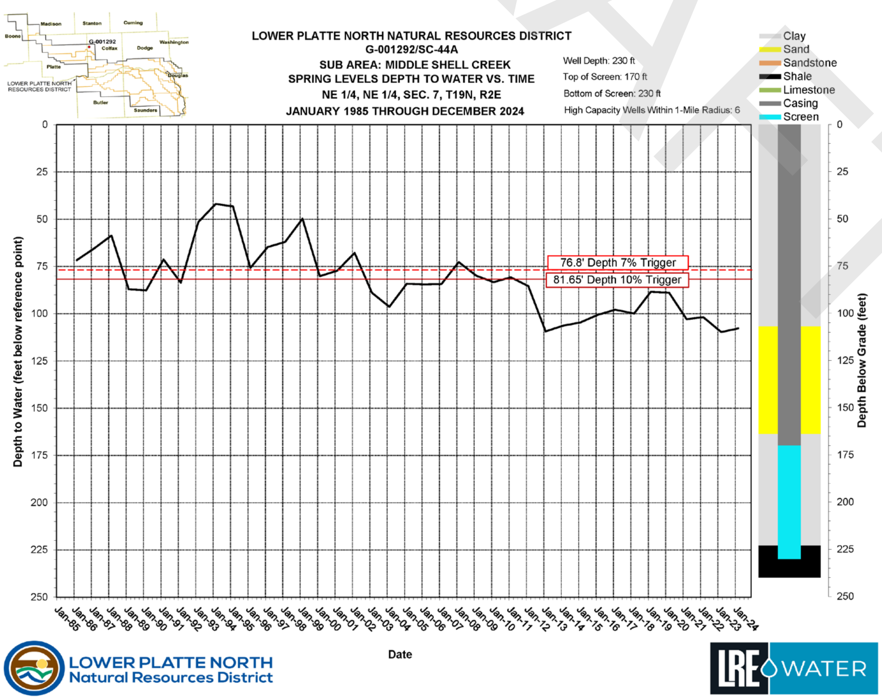

Figure 15: Hydrograph of Transitional Aquifer Type

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.

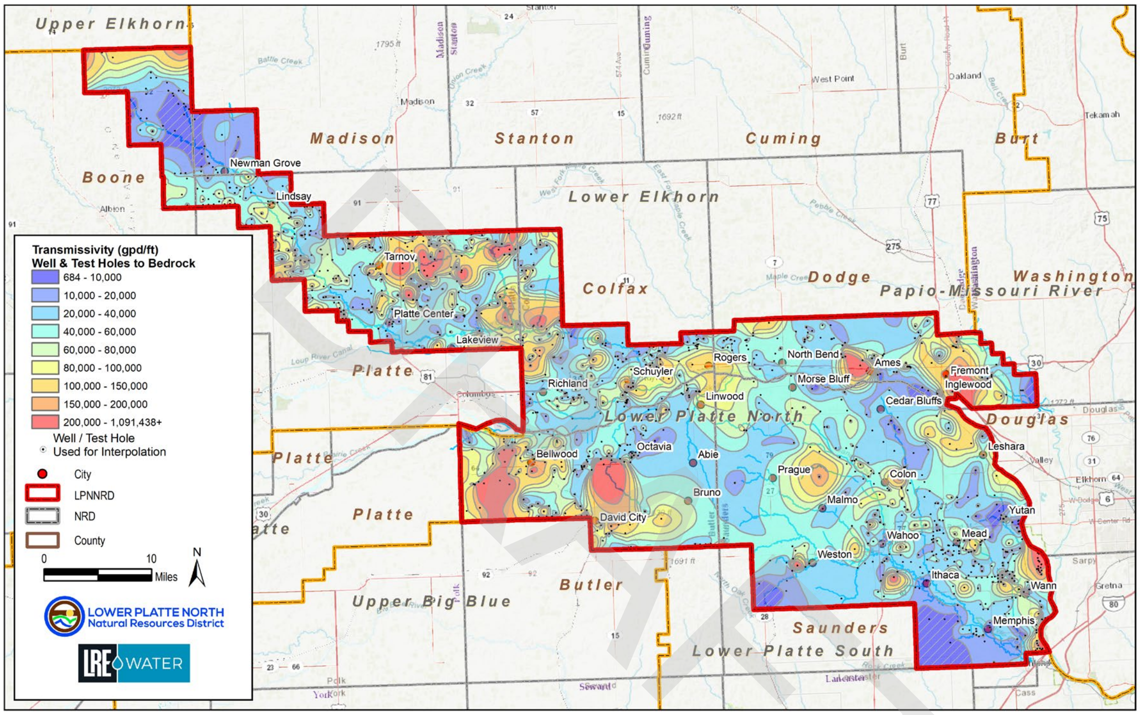

Figure 16: Aquifer Transmissivity

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.

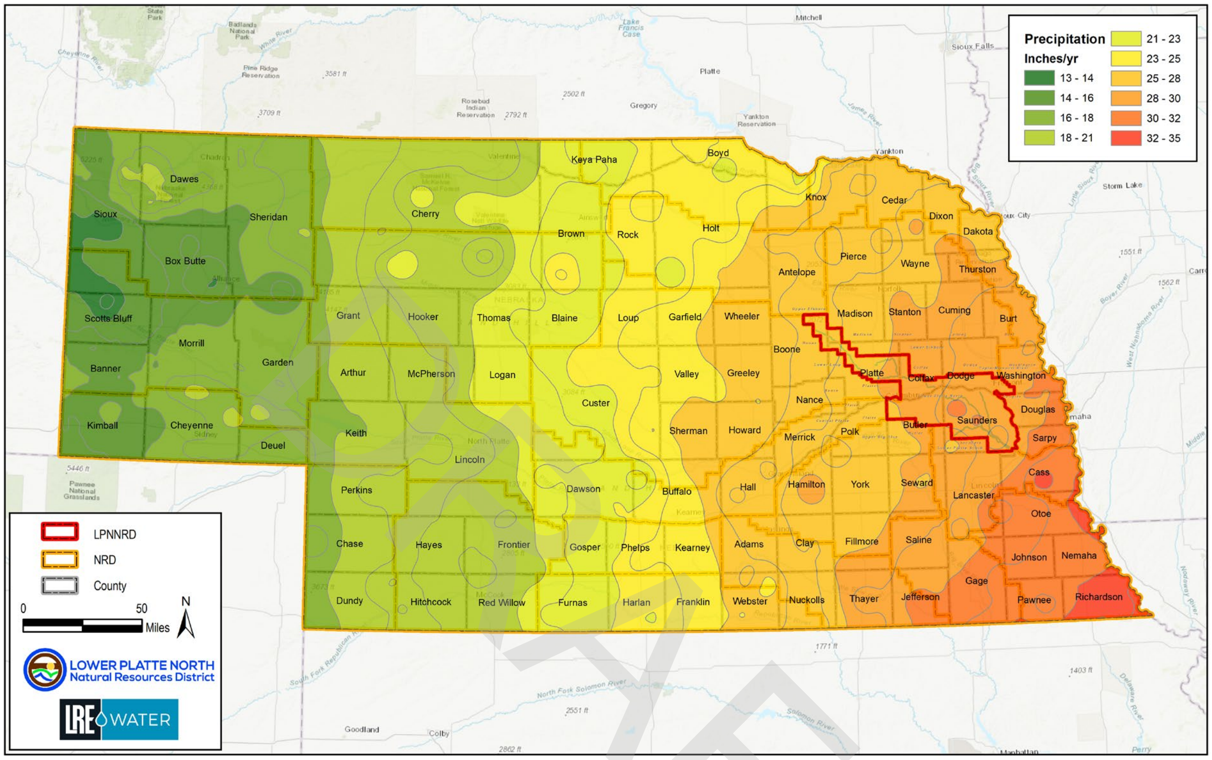

Figure 17: Average Annual Precipitation (1981-2010)

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%

Land Cover	2009	2023	Ac Change	% Change	2009 Coverage	2023 Coverage
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%

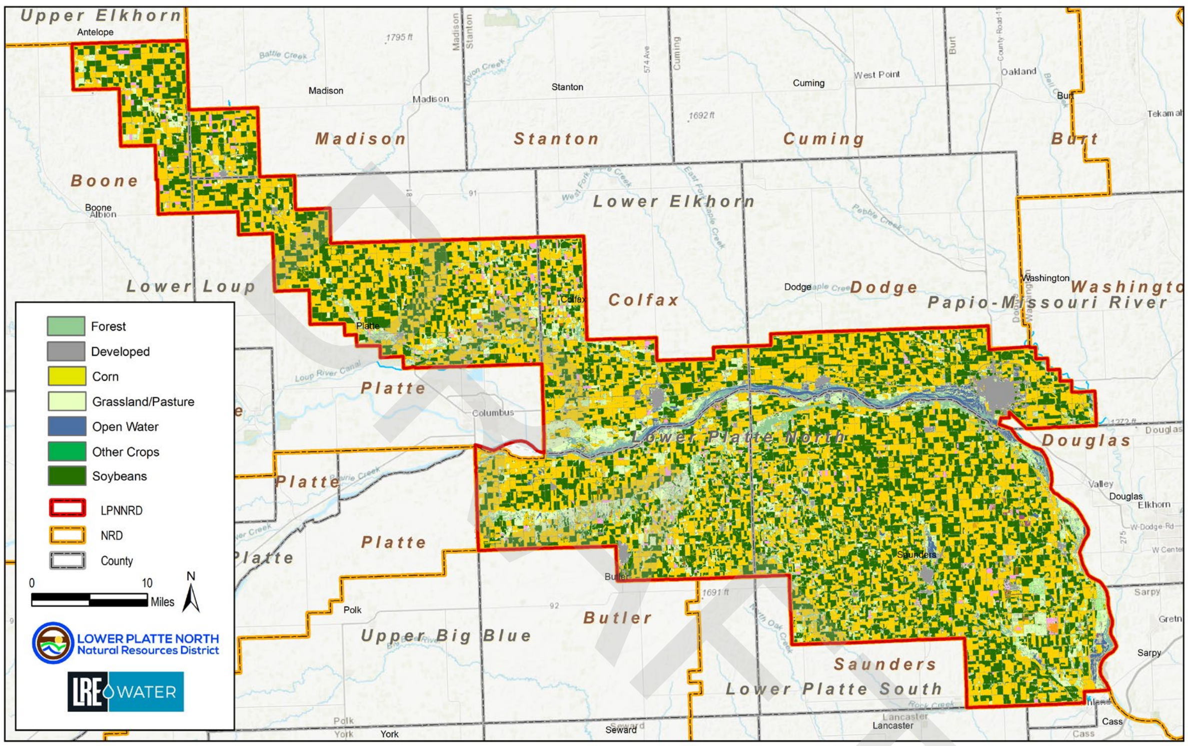

Figure 18: 2023 Land Cover

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 ares are relying on private drinking water wells. A breakdown of population for the 28 LPNNRD communities in 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
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 LPNNRD, 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: LPNNRD 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

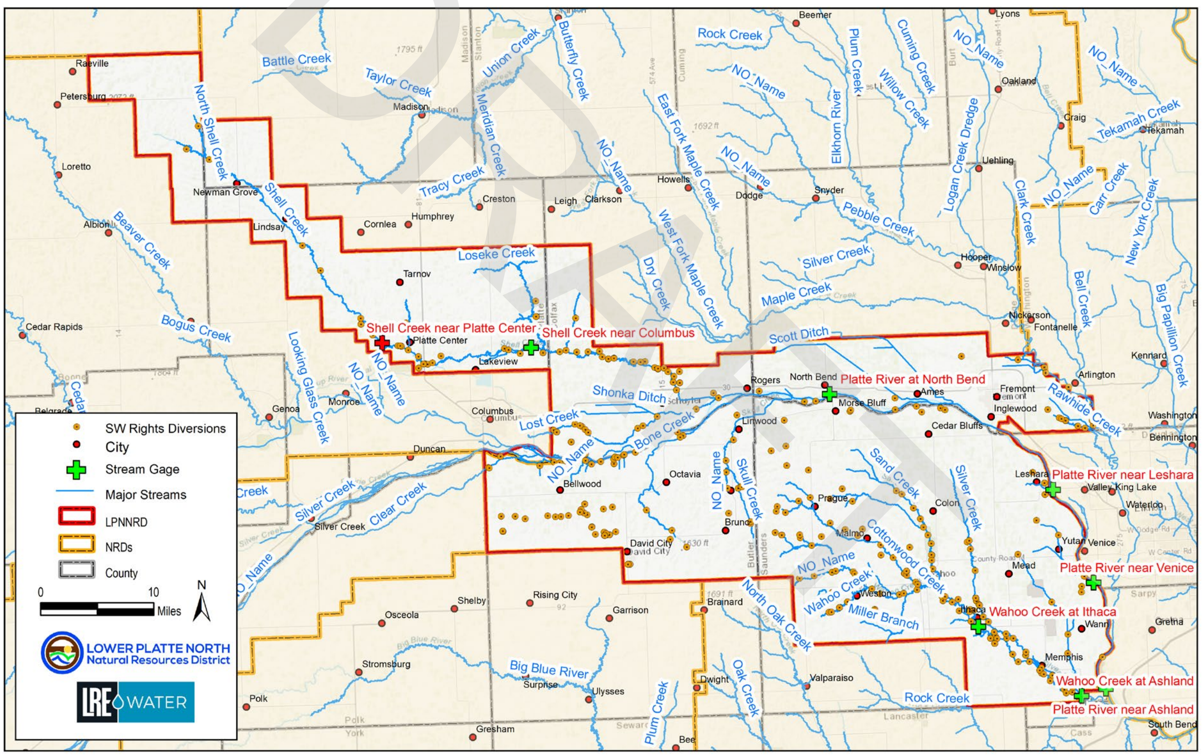

Figure 19: Major River Systems, Stream Gages and Diversion Points

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 reportly 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.

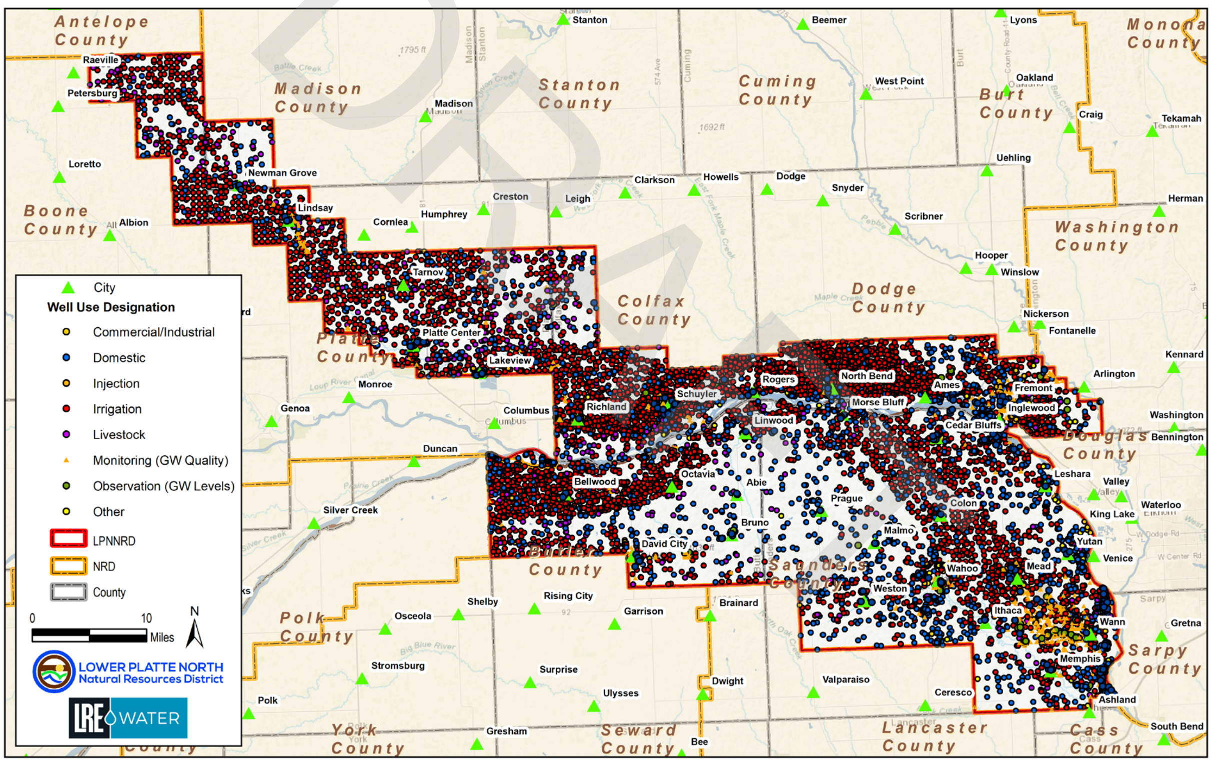

Figure 20: Registered Active Wells in the LPNNRD

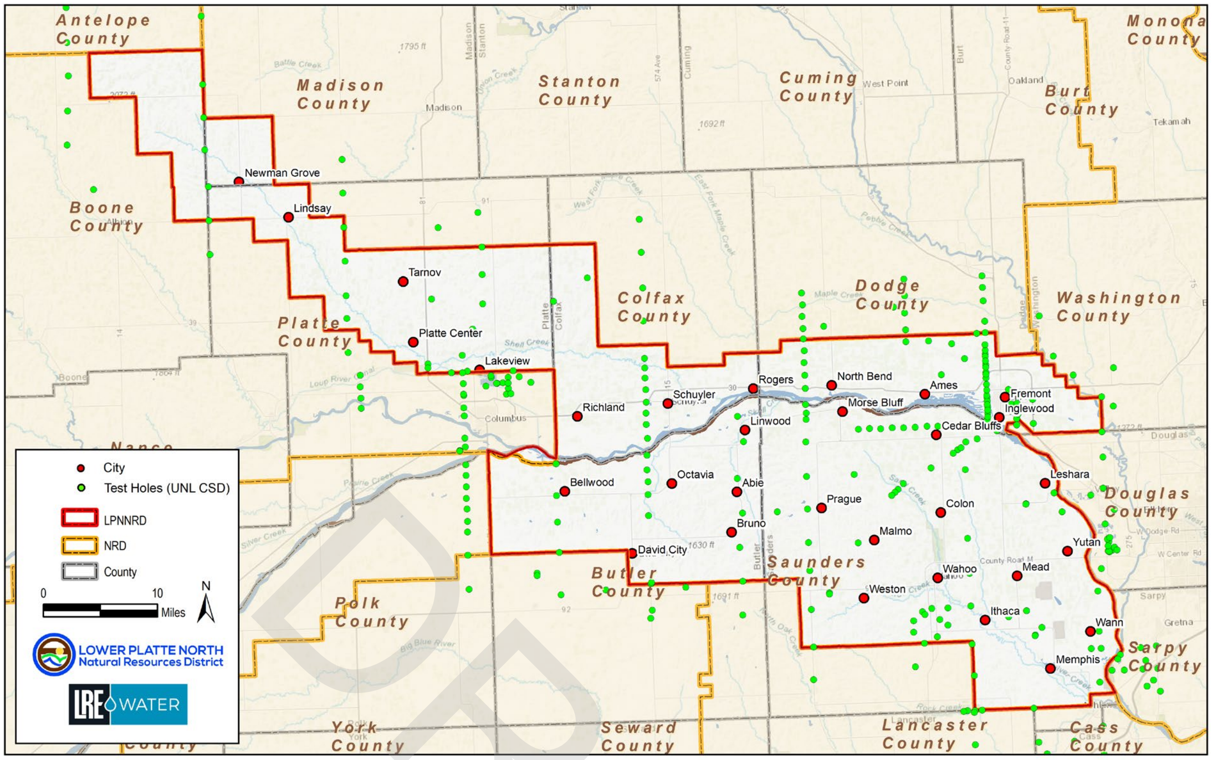

Figure 21: Test Holes within 5-miles of LPNNRD

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>U.S. Geologic Survey (USGS)</u>

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.

<u>Nebraska Department of Environment and Energy (NDEE)</u>[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 Discharage Elimination System. NDEE also provides Section 319 funding including support of projects addressing nitrate leaching to groundwatewr.

Nebraska Department of Natural Resources (NeDNR)[2]

The NeDNR is responsible for surface water, groundwater, floodplain mananagement, dam safety, ntural 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.

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 filed 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.

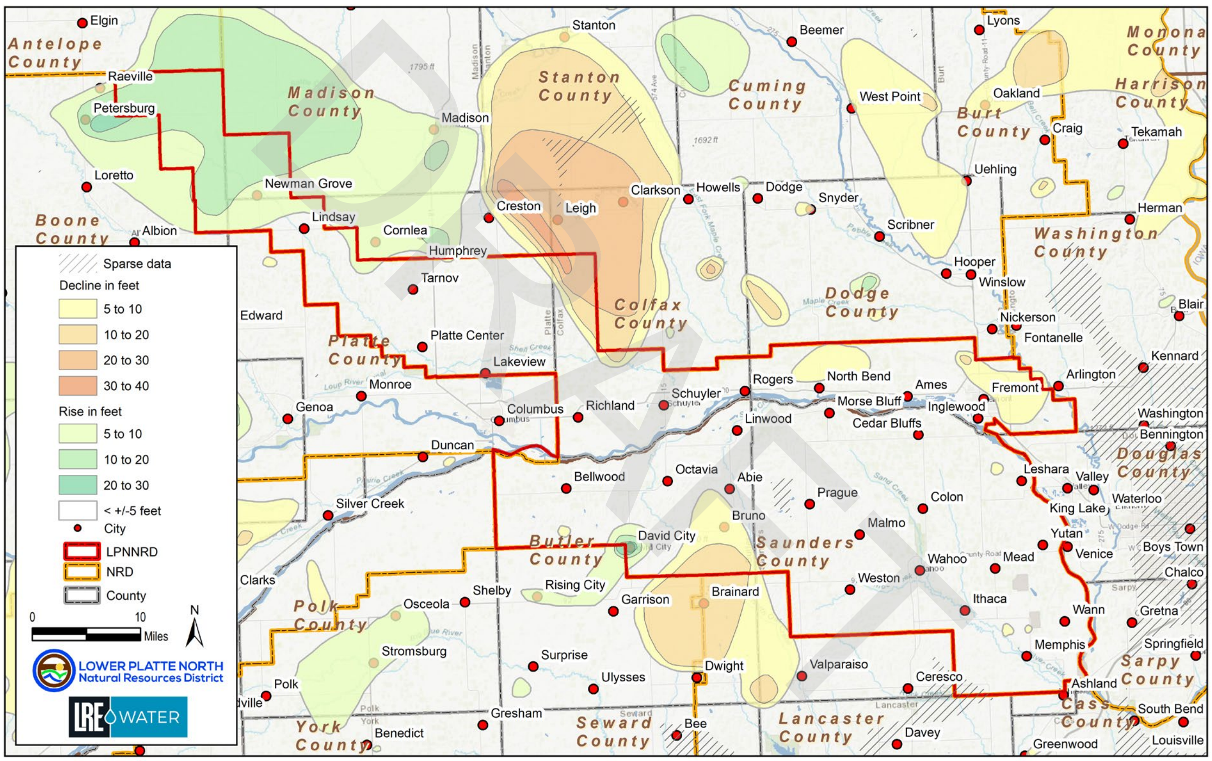

Figure 22: Groundwater-Level Changes in LPNNRD, Predevelopment to Spring 2023

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.

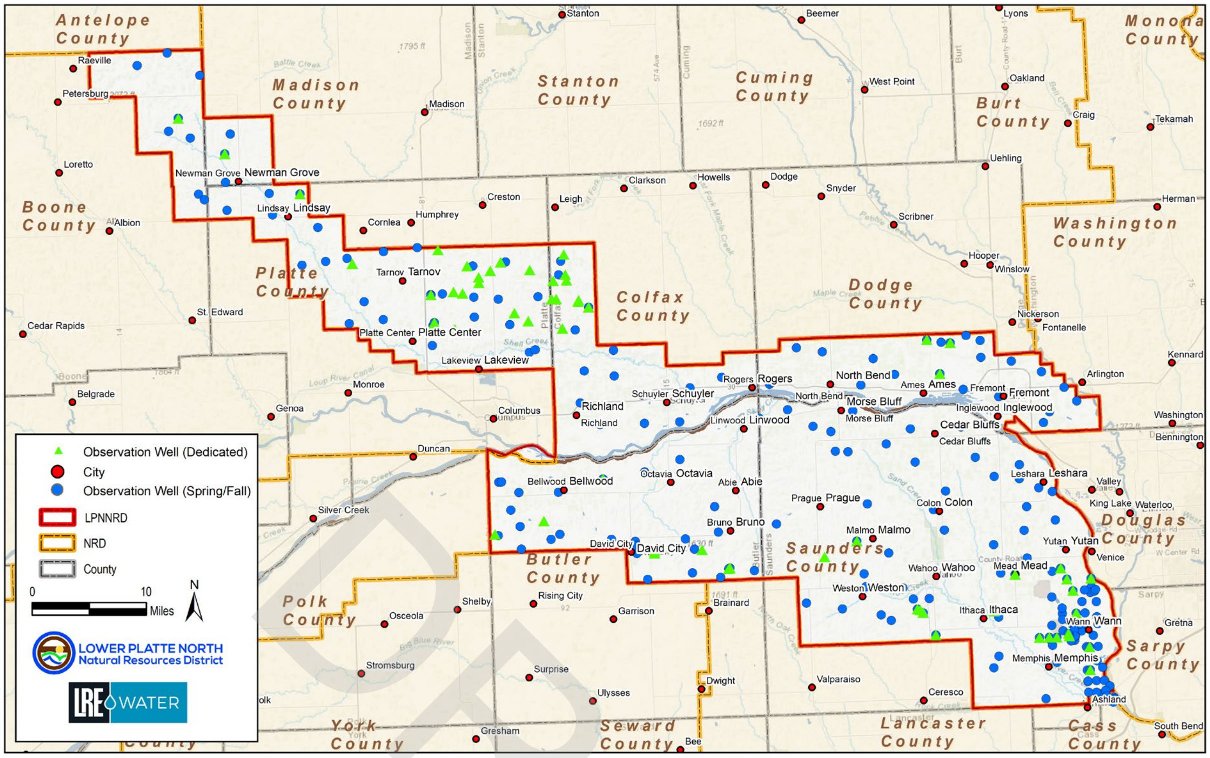

Figure 23: Observation Well Network

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.

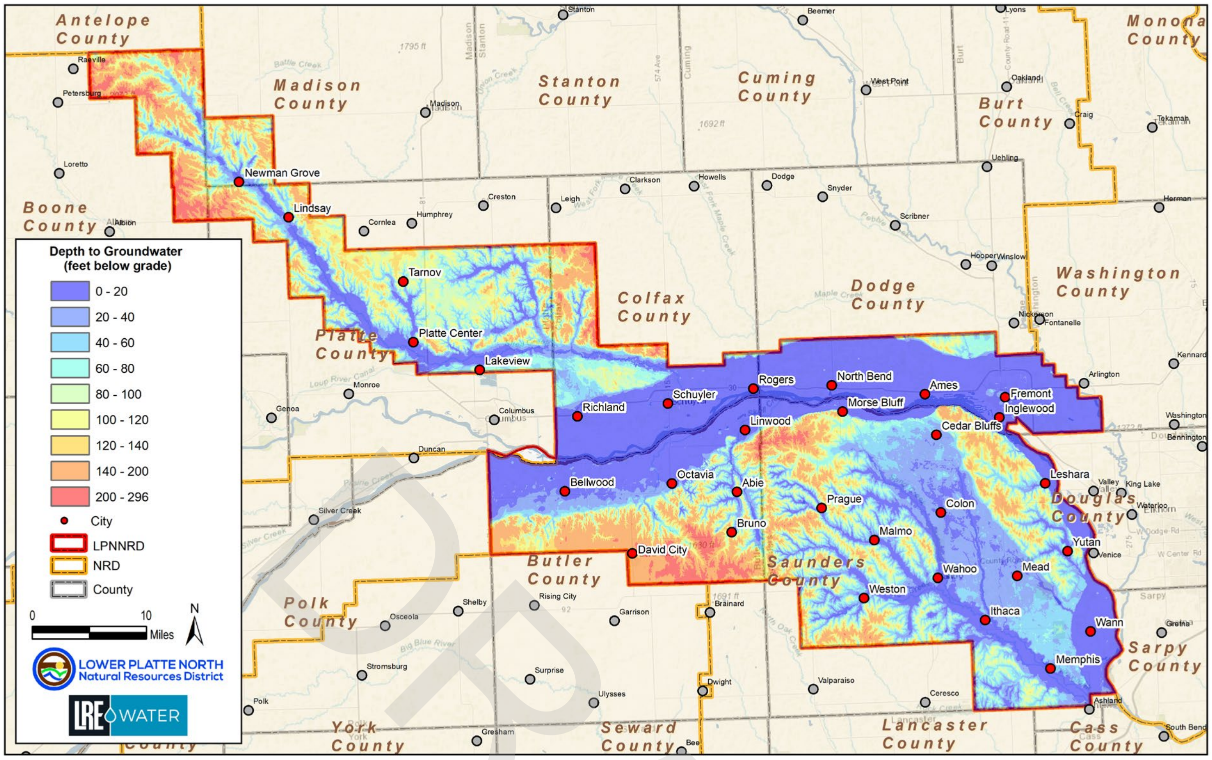

Figure 24: Depth to Groundwater

3.1.1 High-capacity Well Development Risk

To better understand the risk of future high-capacity well development, the Hydrogeologic Assessment (LRE, 2023) was utilized to establish Groundwater Development Risk based upon geologic information (Figure 25). This five level system was built to look at risk in relation to quantity available and can be used as a guide. Local data should be collected to ultimately make a decision on the risk of a new well. A combination of transmissivity and total saturated sand thickness were incorporated into a GIS model, each weighing 50/50. The analysis does not consider well density and pumping rate.

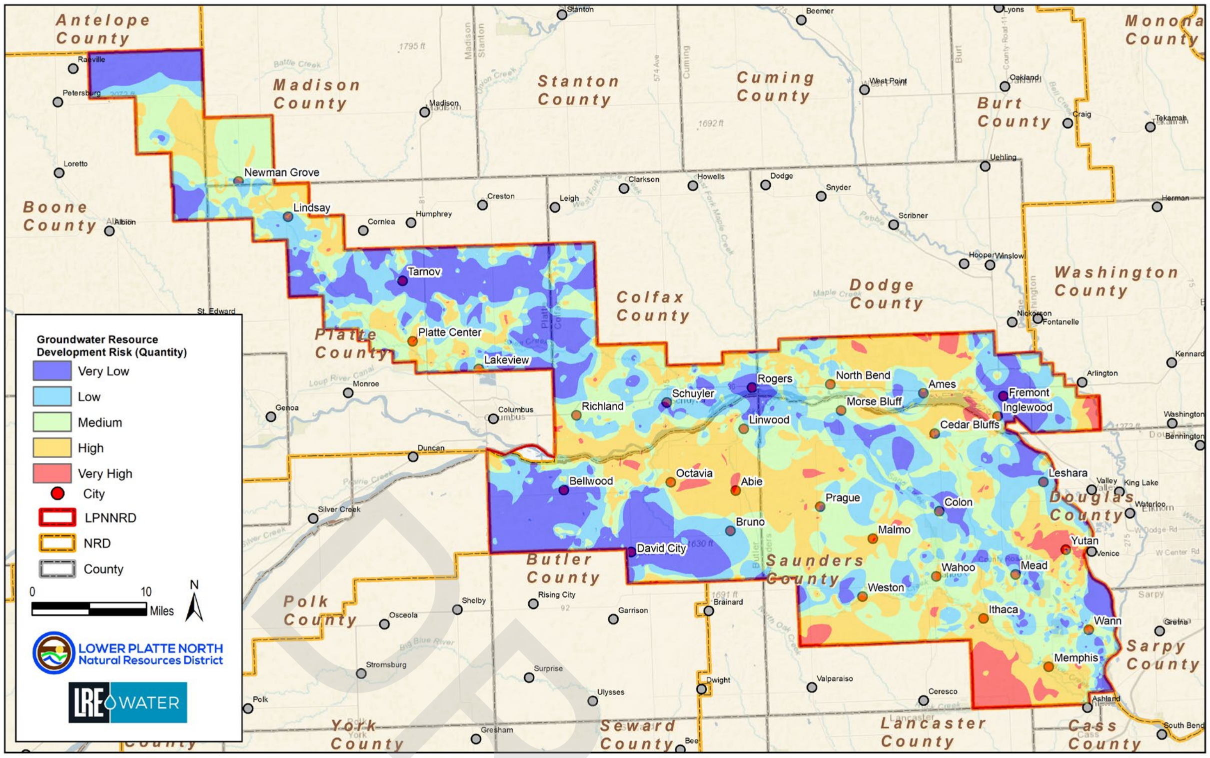

Figure 25: Groundwater Resource Development Risk

3.1.2 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 26.

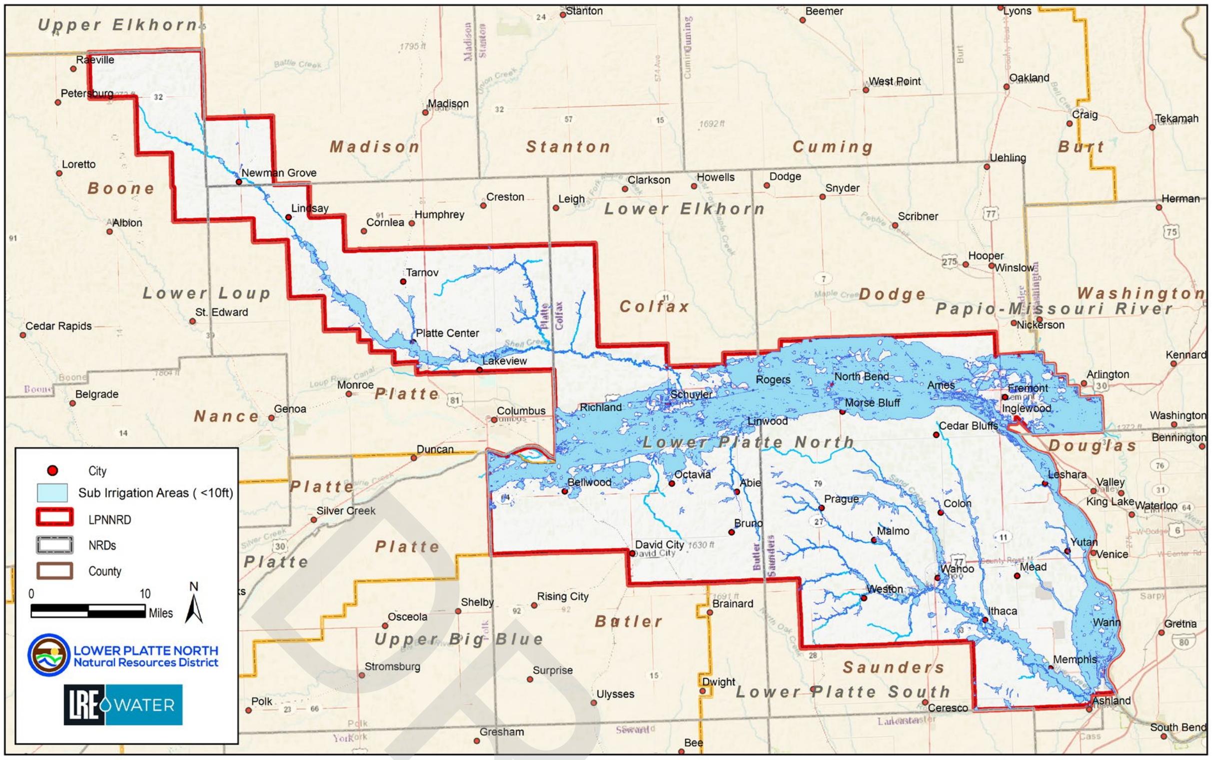

Figure 26: Potential Areas for Sub-irrigation

3.2 Groundwater Recharge

Local precipitation serves as a major recharge source for aquifers in the LPNNRD, 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 LPNNRD. 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 27. 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.

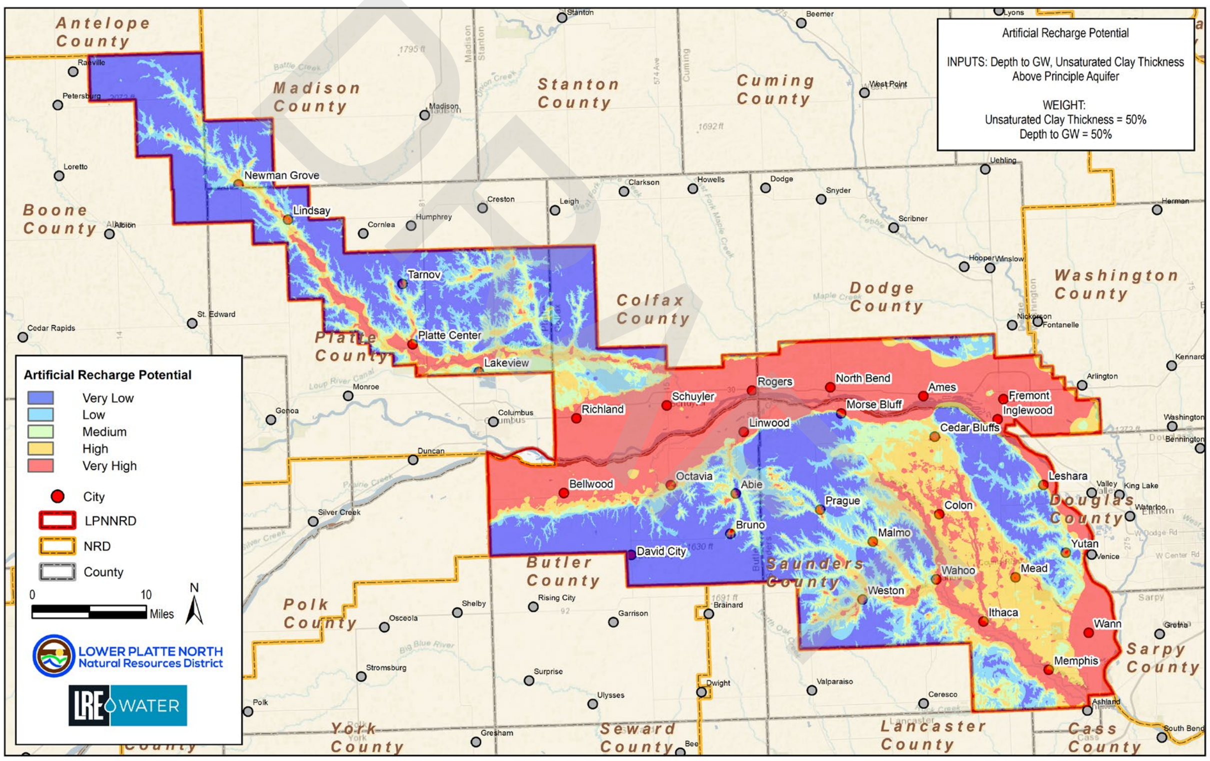

Figure 27: Artificial Recharge Potential

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 28. 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%

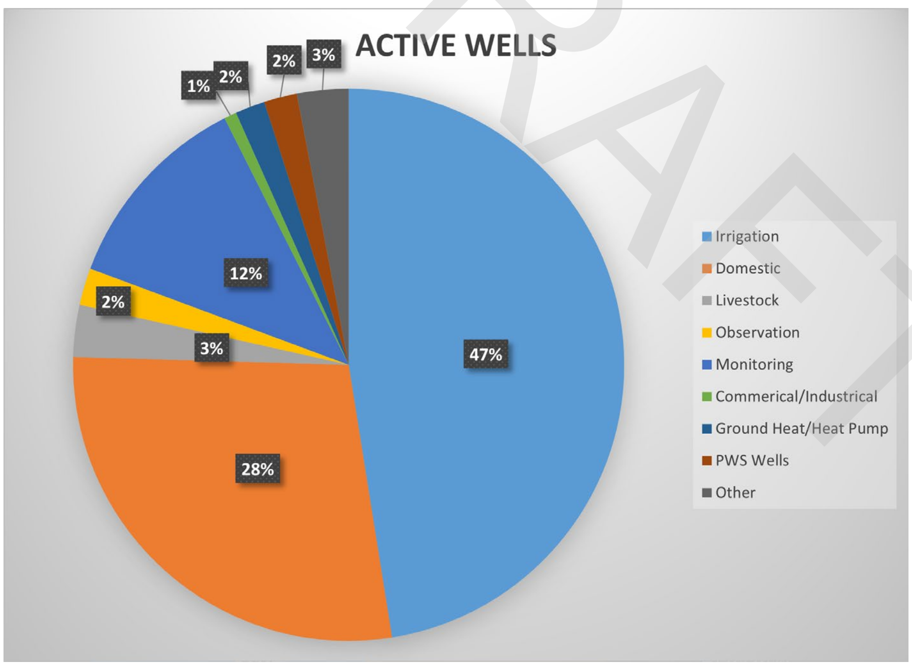

Figure 28: Percent of NeDNR Active Registered Wells

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 statue 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 29.

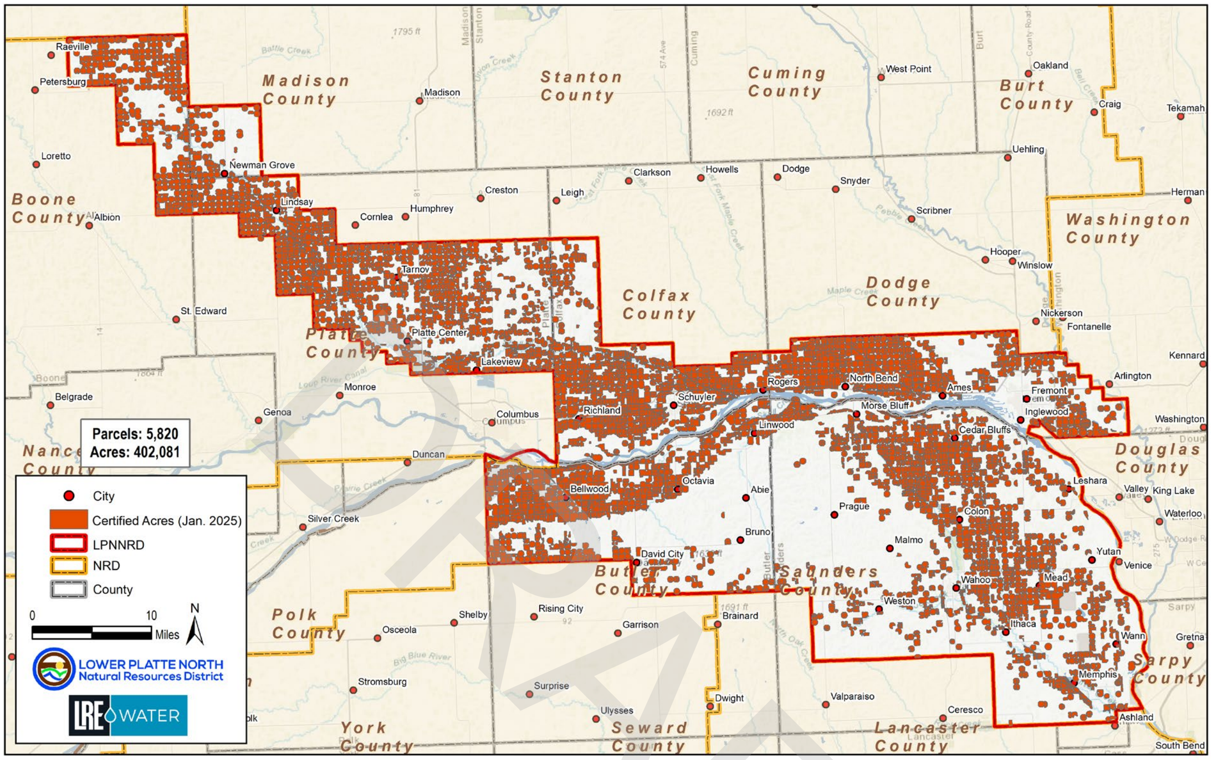

Figure 29: Certified Irrigated Acres in the LPNNRD (2024)

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 30.

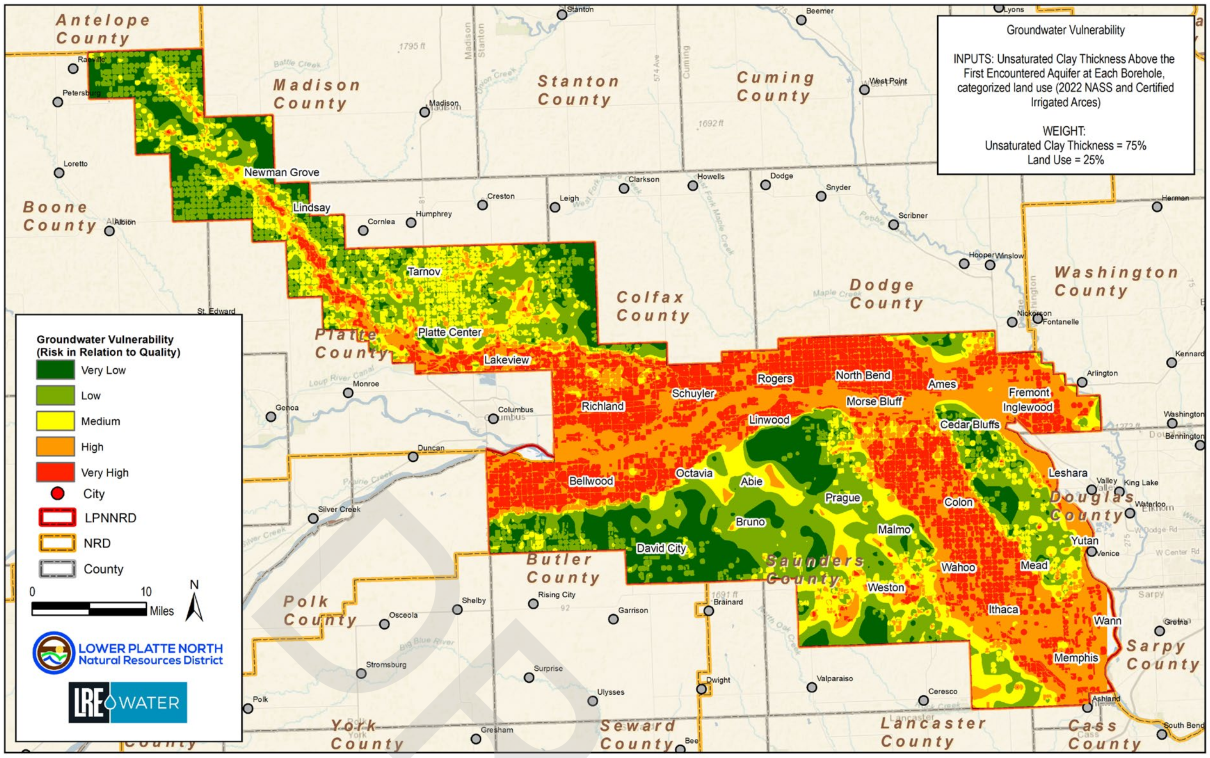

Figure 30: Aquifer Vulnerability

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 LPNNRD staff from 537 wells across the District, is shown in Figure 31. Each year, the LPNNRD 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.

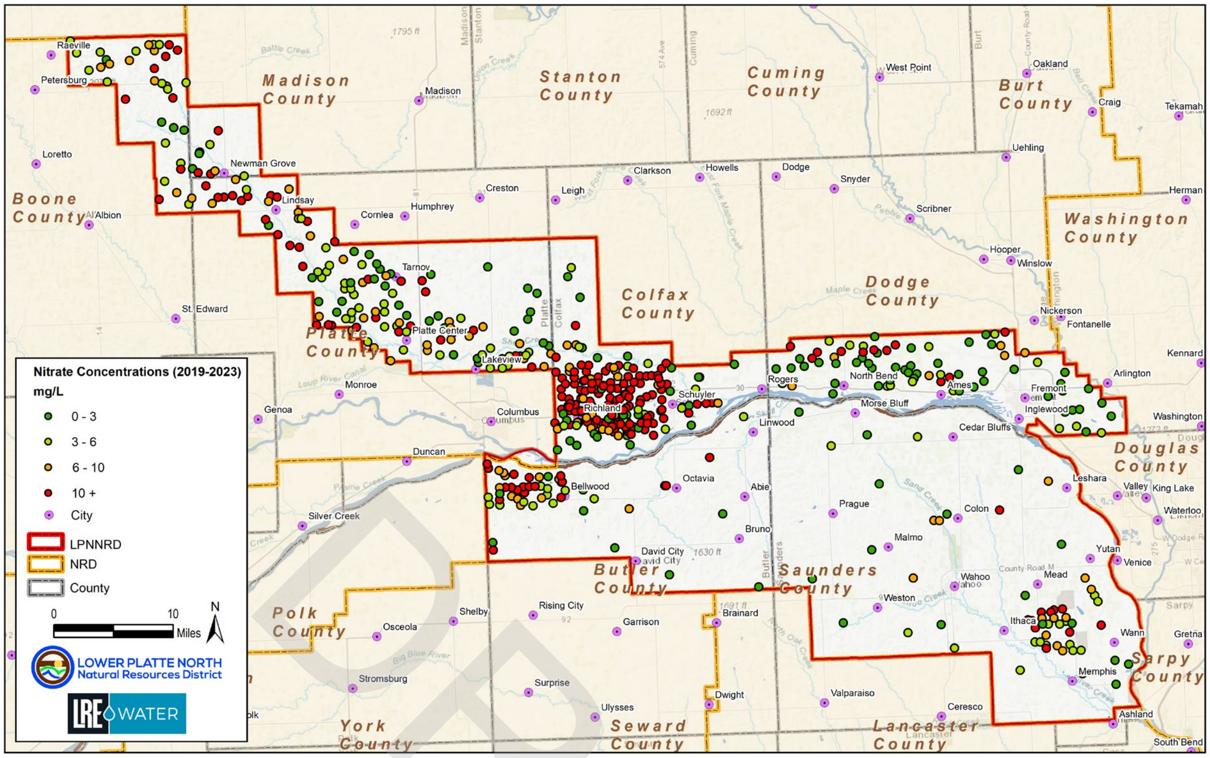

Figure 31: LPNNRD Nitrate Concentrations 2019-2023

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 32. 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.

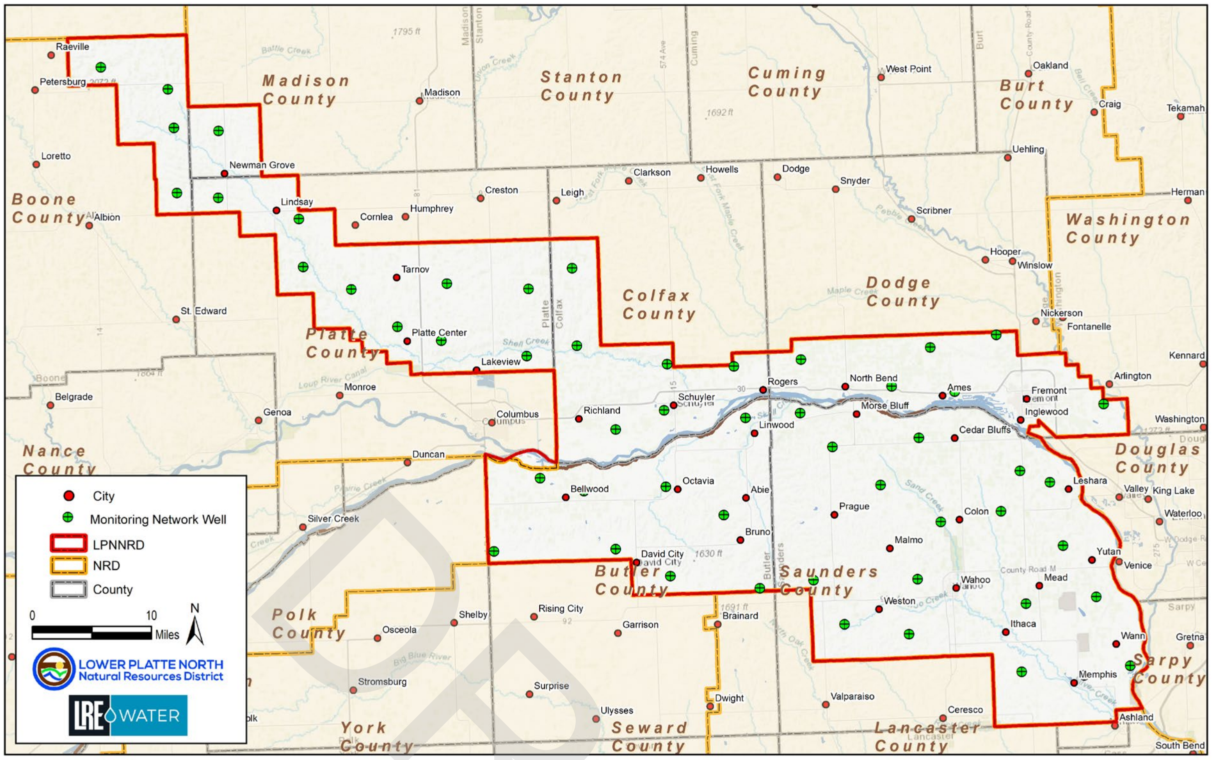

Figure 32: LPNNRD Statewide Water Quality Monitoring Network Wells

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 33, 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-trave. The five minimum steps for the WHP Program are shown in Figure 34.

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

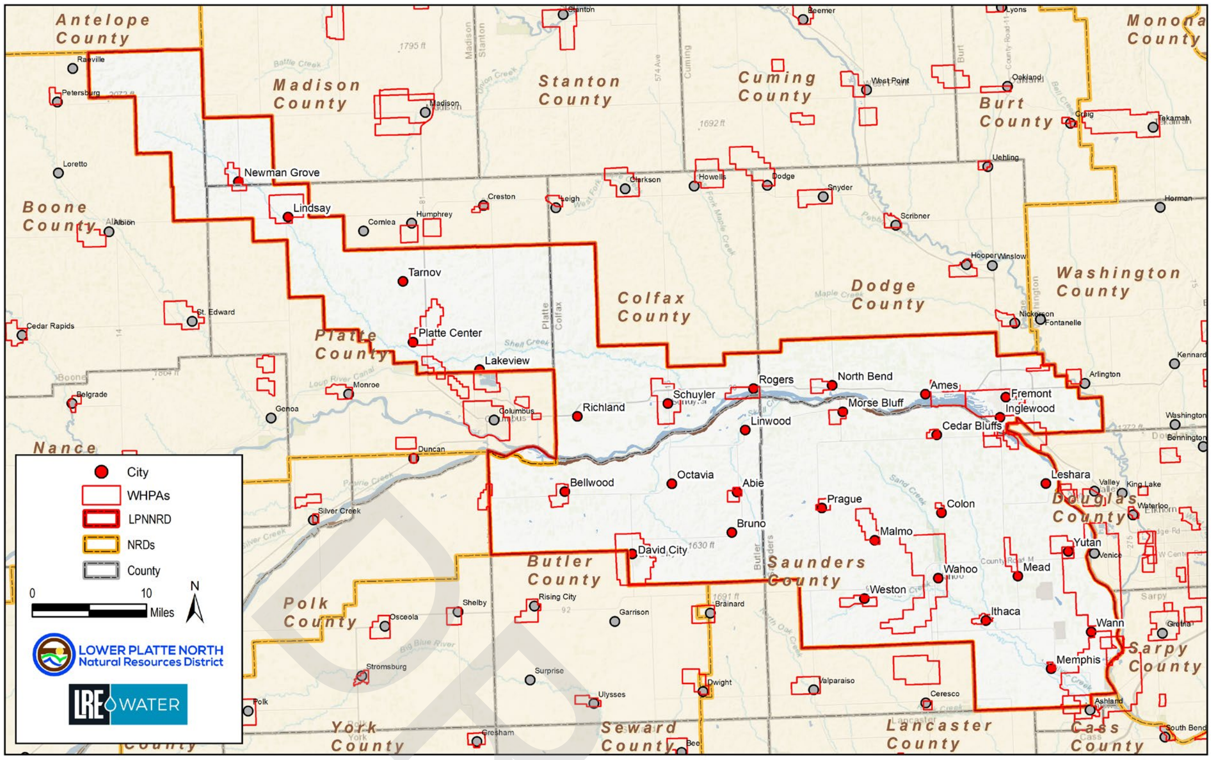

Figure 33: Wellhead Protection Areas

Source: NDEE

Figure 34: 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 at least one new organizations or research institution each year 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 as least five dedicated observation wells per year, 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 annual stakeholder review feedback with representation from at least five key sectors (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 35. It is also recommended that the areas be referred to by name, rather than only a number.

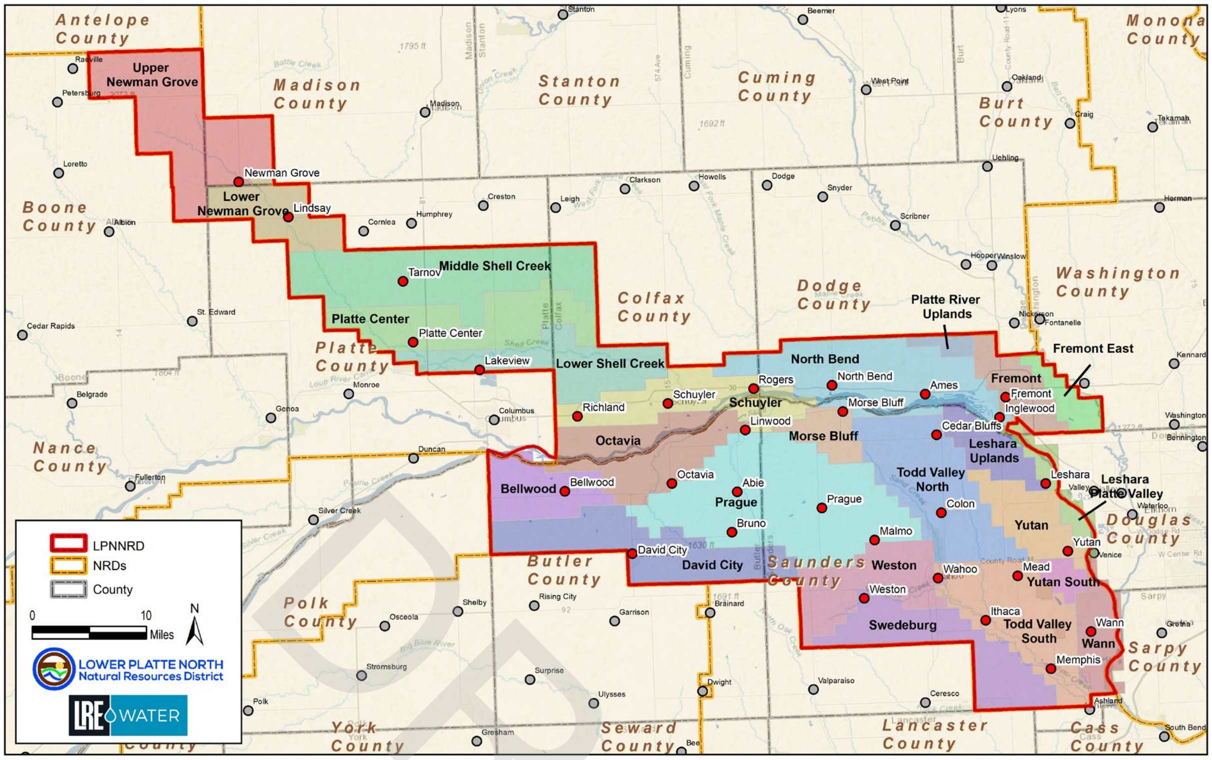

Figure 35: Proposed Groundwater Management Subareas

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 36.

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

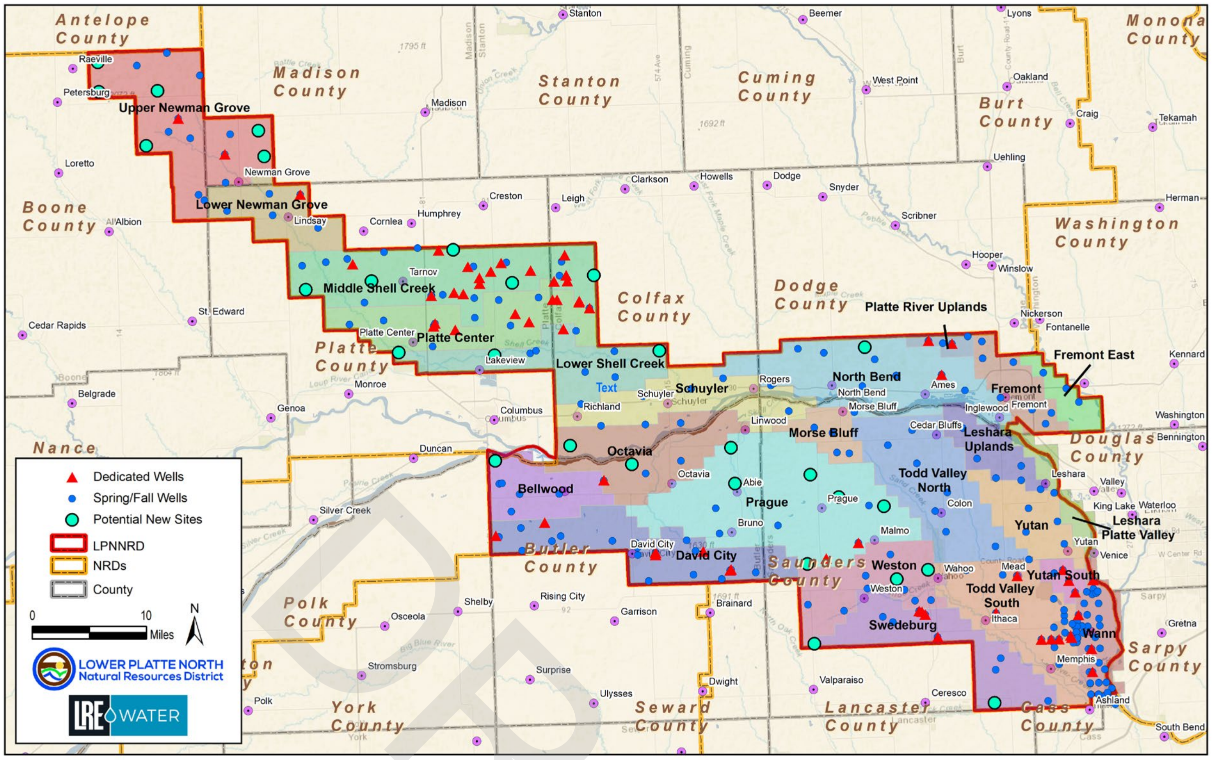

Figure 36: Existing Observation Wells and Potential Expansion Sites

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 (Figure 25).
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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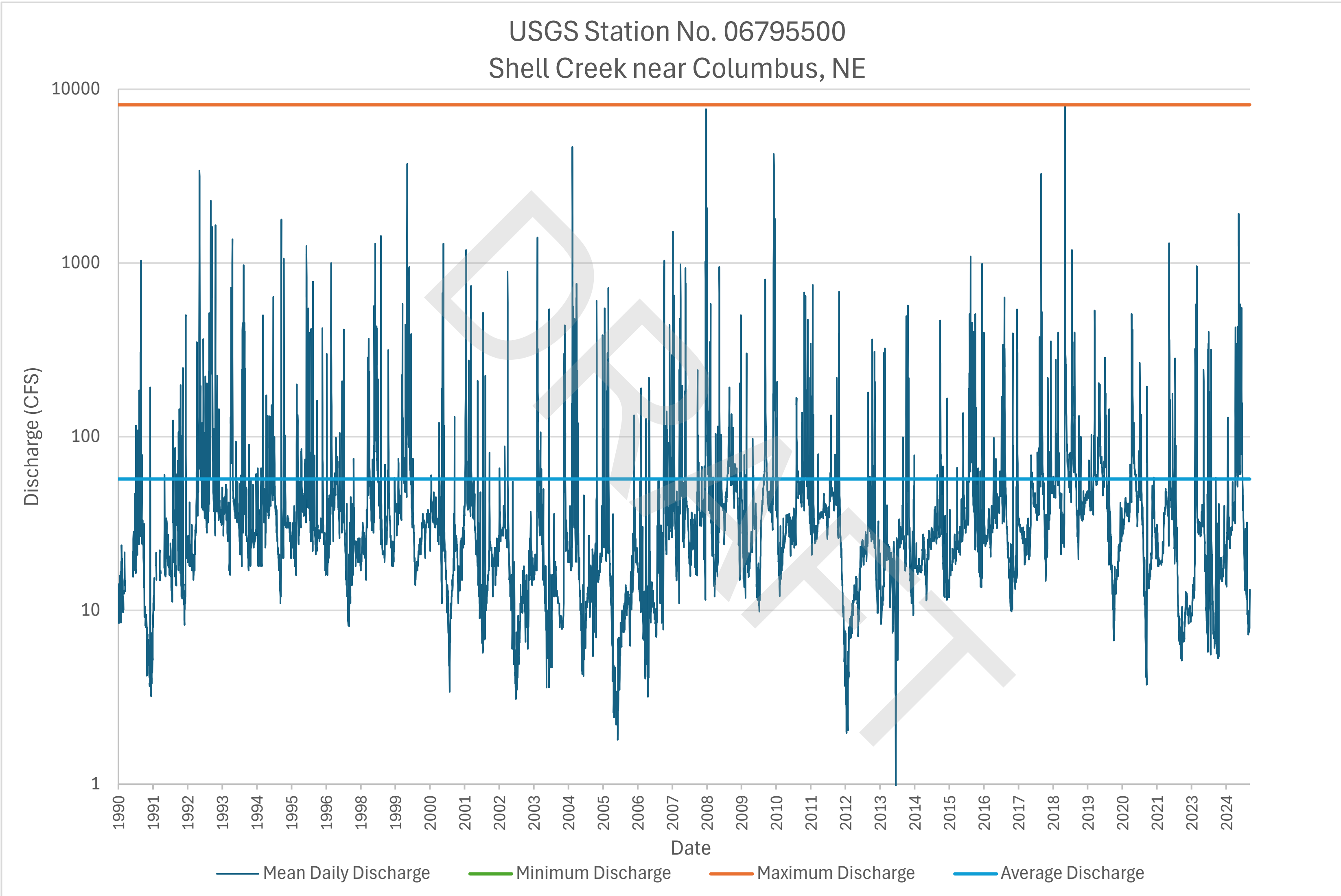
ATTACHMENT A – STREAM FLOW HYDROGRAPHS



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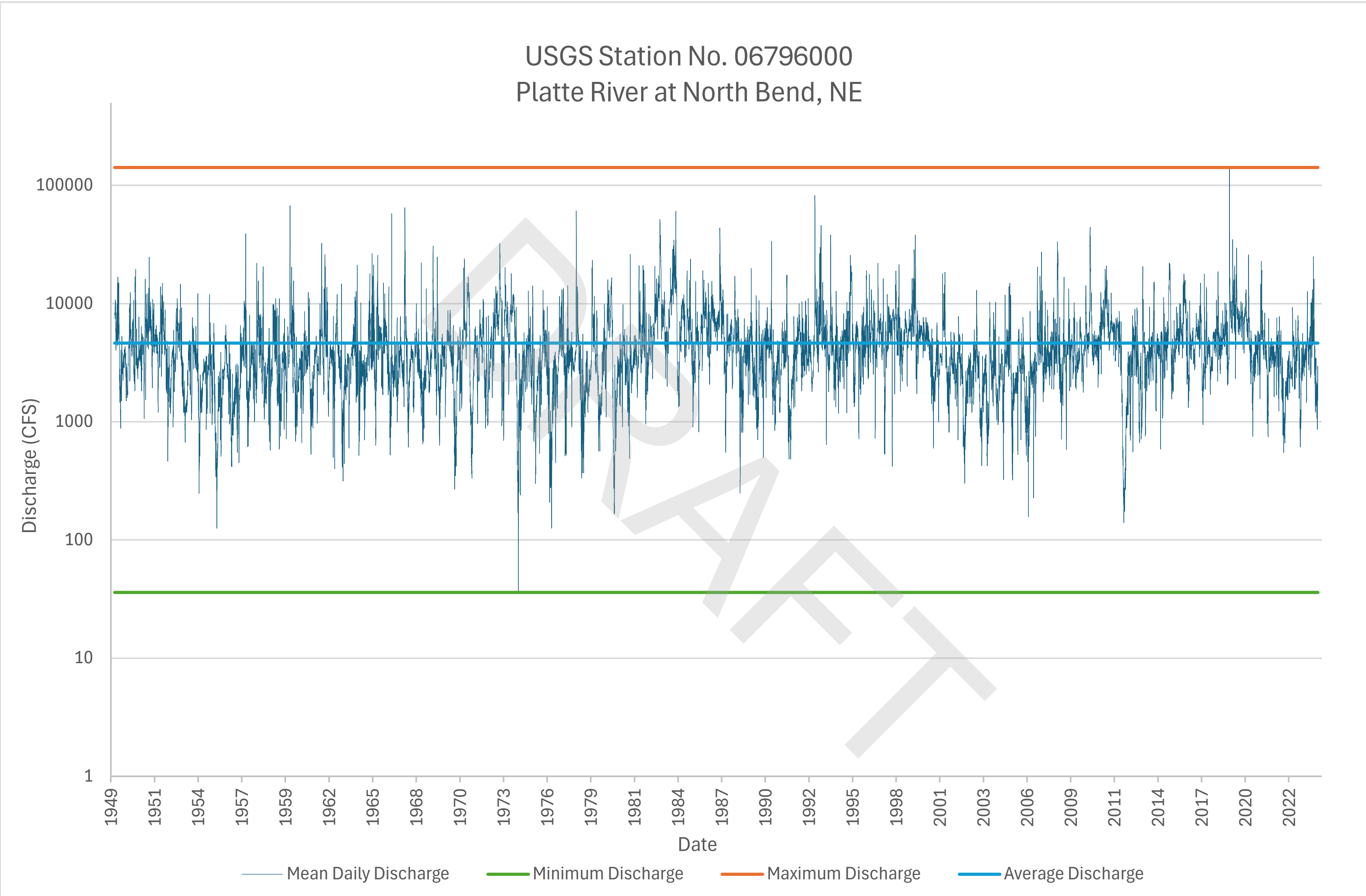
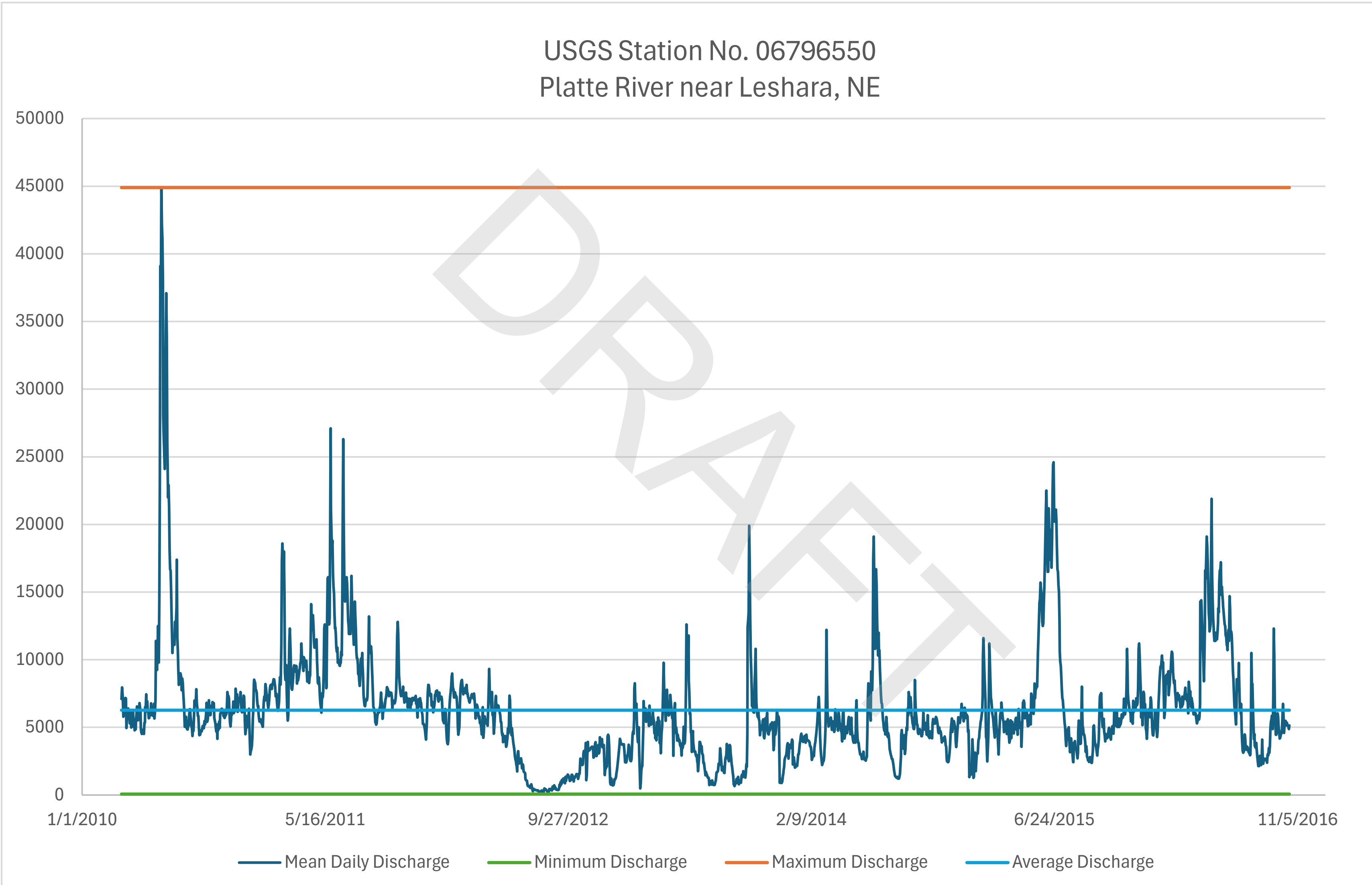
Shell Creek near Columbus, NE
Discharge (CFS)
10000
1000
100
10
1
1990
1991
1992
1993
1994
1995
1996
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2023
2024
Date
Mean Daily Discharge
Minimum Discharge
Maximum Discharge
Average Discharge
DRAFT



USGS Station No. 06796000
Platte River at North Bend, NE
Discharge (CFS)
100000
10000
1000
100
10
1
1949
1951
1954
1957
1959
1962
1965
1968
1970
1973
1976
1979
1981
1984
1987
1990
1992
1995
1998
2001
2003
2006
2009
2011
2014
2017
2020
2022
Date
Mean Daily Discharge
Minimum Discharge
Maximum Discharge
Average Discharge
DRAFT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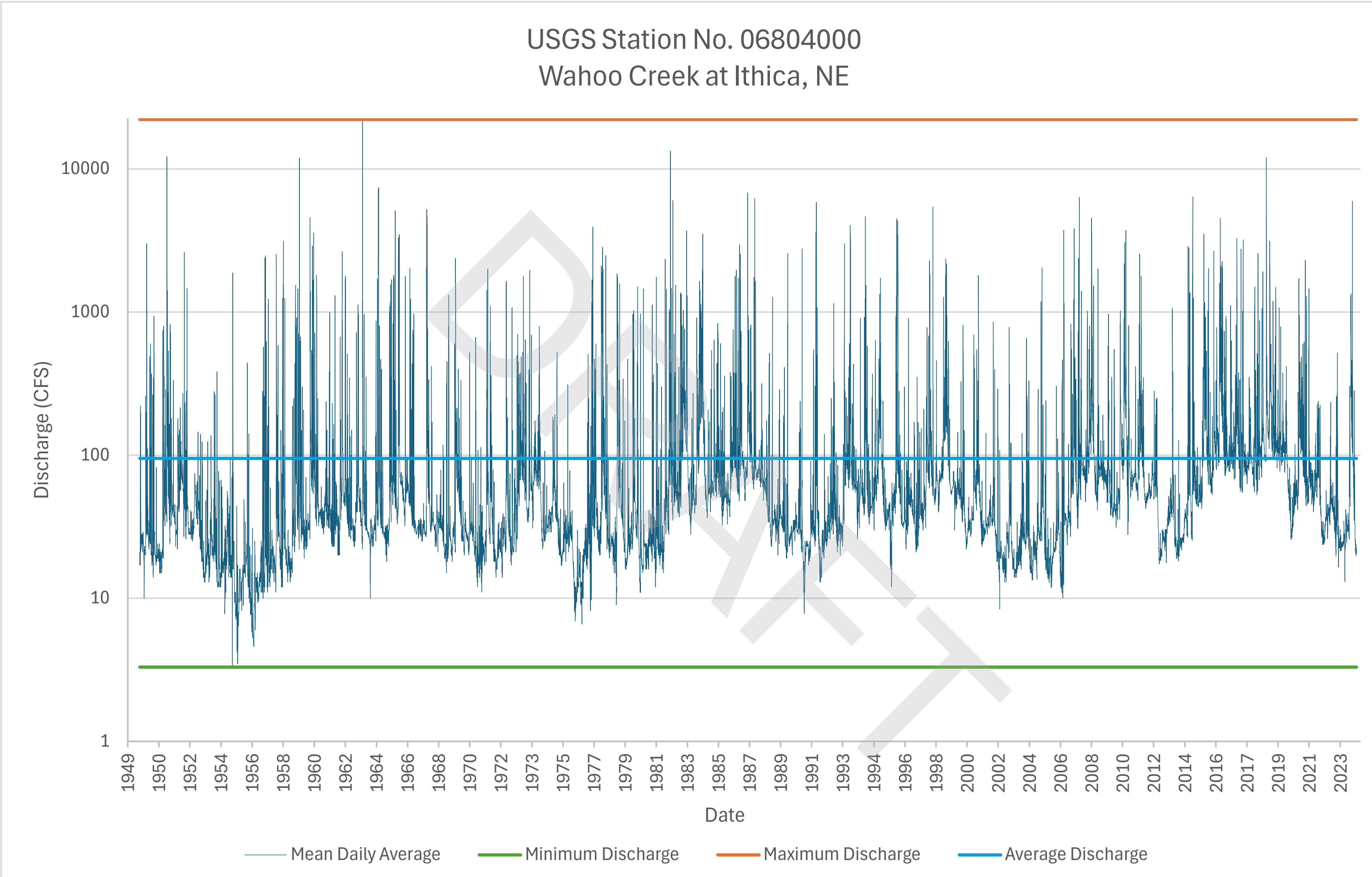
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1/1/2010
5/16/2011
9/27/2012
2/9/2014
6/24/2015
11/5/2016
Mean Daily Discharge
Minimum Discharge
Maximum Discharge
Average Discharge
DRAFT



USGS Station No. 06804000
Wahoo Creek at Ithica, NE
DRAFT
Discharge (CFS)
10000
1000
100
10
1
1949
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1970
1972
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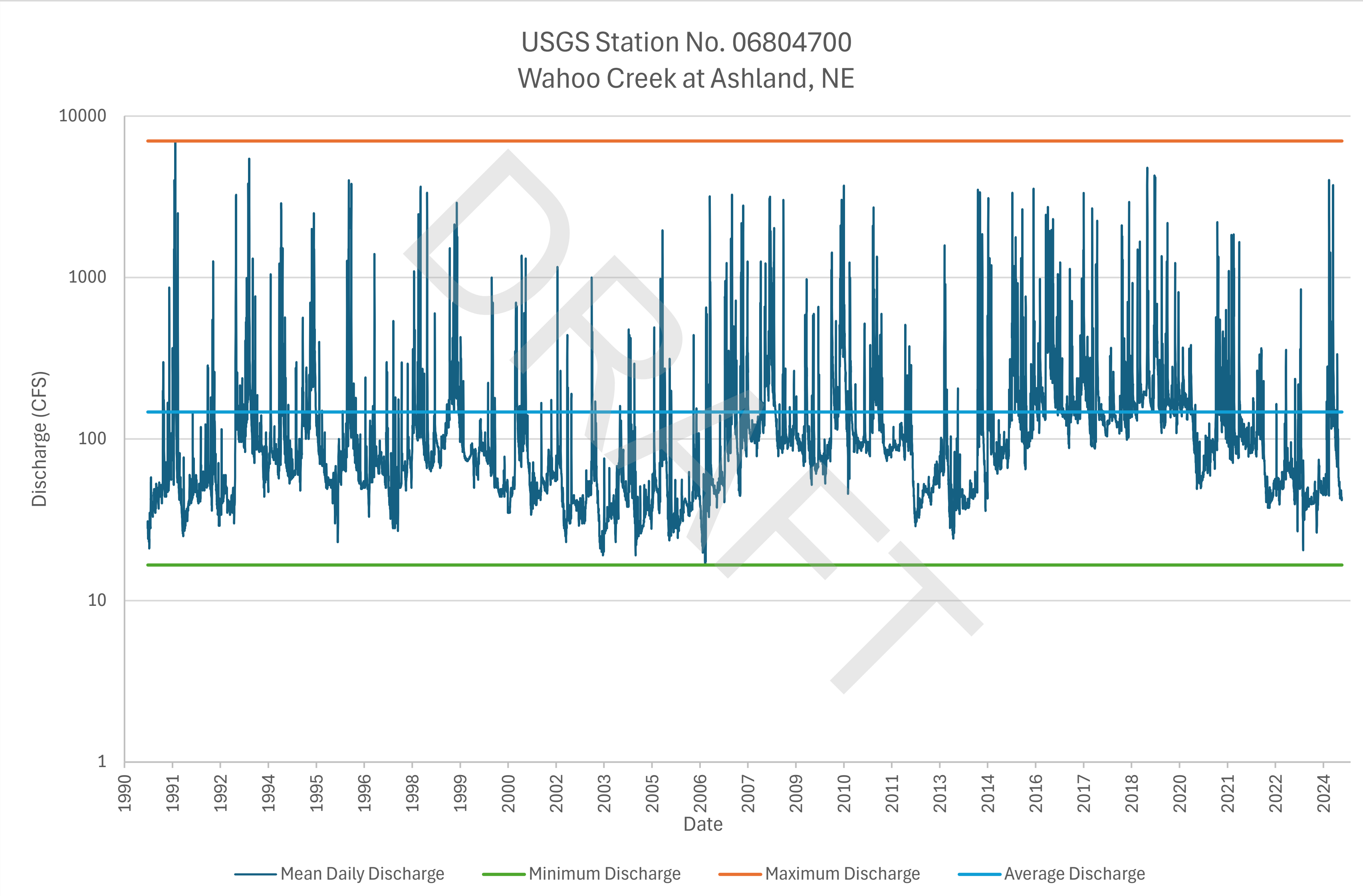
2016
2017
2019
2021
2023
Date
Mean Daily Average
Minimum Discharge
Maximum Discharge
Average Discharge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Wahoo Creek at Ashland, NE
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1000
100
10
1
Discharge (CFS)
1990
1991
1992
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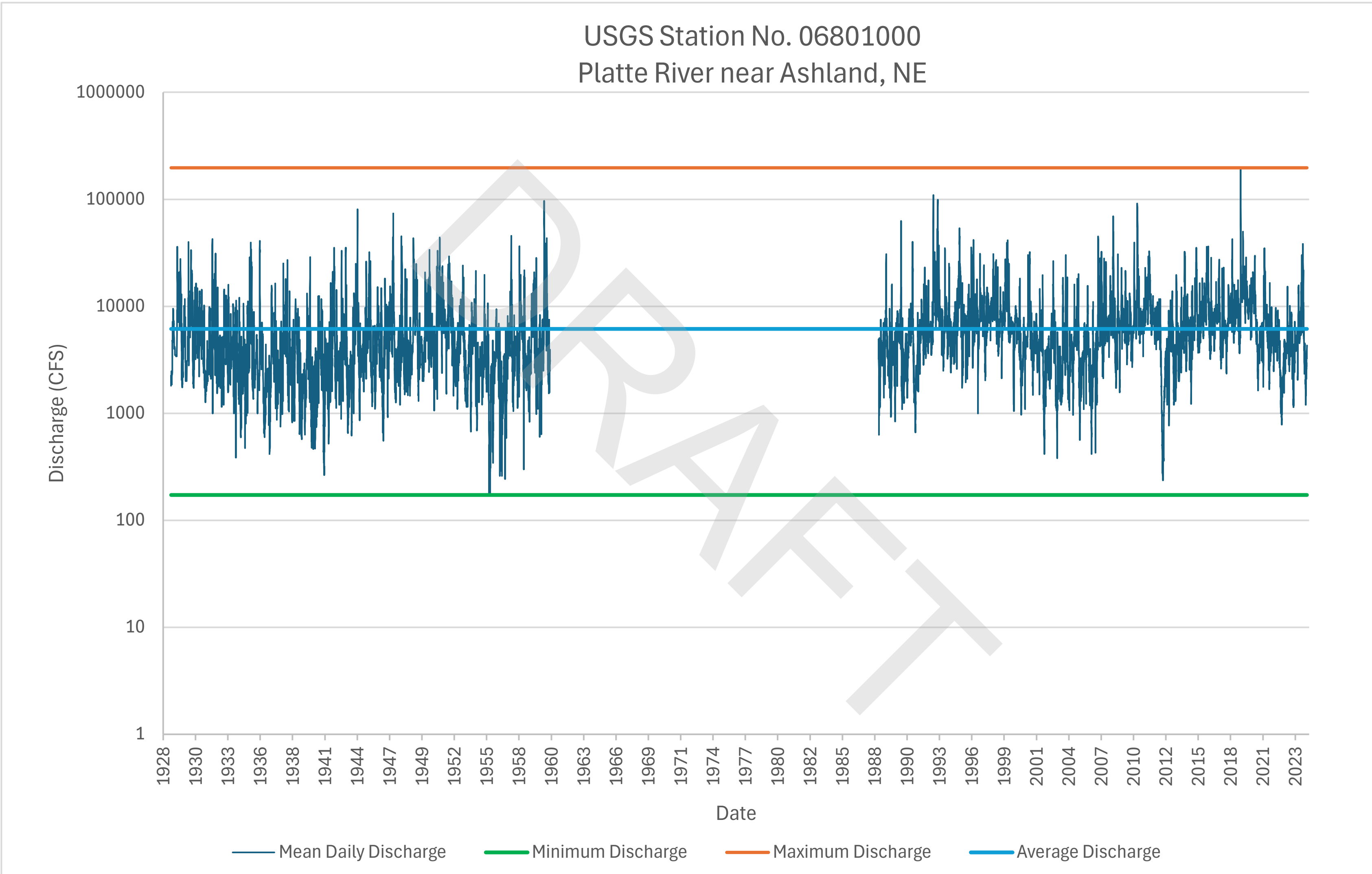
1995
1996
1998
1999
2000
2002
2003
2005
2006
2007
2009
2010
2011
2013
2014
2016
2017
2018
2020
2021
2022
2024
Date
Mean Daily Discharge
Minimum Discharge
Maximum Discharge
Average Discharge
DRAFT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Platte River near Ashland, NE
Discharge (CFS)
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100000
10000
1000
100
10
1
1928
1930
1933
1936
1938
1941
1944
1947
1949
1952
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1958
1960
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1999
2001
2004
2007
2010
2012
2015
2018
2021
2023
Date
Mean Daily Discharge
Minimum Discharge
Maximum Discharge
Average Discharge
DRAFT

Service Quote

SV0000261

Billing Address
LOWER PLATTE NORTH NRD
Kaitlyn Bargen
511 COMMERCIAL PARK ROAD
P.O. BOX 126
WAHOO, NE 68066
United States

Ship-to Address
LOWER PLATTE NORTH NRD
Daryl Anderson
511 COMMERCIAL PARK ROAD
WAHOO, NE 68066
United States

In-Situ, Inc.
221 E Lincoln Ave
Fort Collins, CO 80524-2533
United States

Contact Name Kaitlyn Bargen
Phone No. 402-443-4675
Email kbargen@lpnnrd.org

Order Date	Customer Account	Inco Terms
06/13/25	C004961	FOB Origin

P.O. No.	Payment Terms	Shipping Agent
	Net 30 days	FEDEX GROUND

Service Item Lines

Description	Contract No.	Item No.	Serial No.
VuLink CI (Global Cellular, does not include antenna)		0094840	1054689
VuLink CI (Global Cellular, does not include antenna)		0094840	1045598
Rugged Twist-Lock Cable (Premium all-Titanium connectors - 2 year warranty)		0052000	681064
VuLink CI (Global Cellular, does not include antenna)		0094840	1055262
Rugged Twist-Lock Cable (Premium all-Titanium connectors - 2 year warranty)		0052000	595177
VuLink CI (Global Cellular, does not include antenna)		0094840	1055049
Level TROLL 500, Level Sensor Range - 21m, 69 ft (30 PSIG)		0089020	755220
Level TROLL 400, Level Sensor Range - 60m, 197 ft (100 PSIA)		0099250	1077061
Rugged Twist-Lock Cable (Premium all-Titanium connectors - 2 year warranty)		0052000	212660

Service Lines

No.	Description	Quantity	Unit Price Excl. Tax	Disc %	Amount
S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S102001	VuLink top cap replacement (circuit board, SMA connecto	1.00	205.00	0	205.00
S102002	VuLink label replacement (removal and replacement origi	1.00	46.00	0	46.00

Terms and Conditions: https://in-situ.com/us/terms-conditions
Warranty: https://in-situ.com/us/warranty

Service Quote

SV0000261

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United States

Contact Name Kaitlyn Bargen
Phone No. 402-443-4675
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Order Date	Customer Account	Inco Terms
06/13/25	C004961	FOB Origin

P.O. No.	Payment Terms	Shipping Agent
	Net 30 days	FEDEX GROUND

S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S102001	VuLink top cap replacement (circuit board, SMA connecto	1.00	205.00	0	205.00
S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S100307	Factory pressure multi-temperature calibration	1.00	160.00	0	160.00
S100100	Instrument evaluation (maintenance, functional & analytic	1.00	96.00	0	96.00
S100307	Factory pressure multi-temperature calibration	1.00	160.00	0	160.00
S100120	Cable evaluation (visual inspections of cable termination	1.00	81.00	0	81.00
S103011	Twist-Lock connector replacement (removal, replacement	1.00	215.00	0	215.00
2206-0030		1.00	0.00	0	0.00
S103011	Twist-Lock connector replacement (removal, replacement	2.00	215.00	0	430.00
S100120	Cable evaluation (visual inspections of cable termination	1.00	81.00	0	81.00
S100120	Cable evaluation (visual inspections of cable termination	1.00	81.00	0	81.00
0052000	Rugged Twist-Lock Cable (Premium all-Titanium connect	1.00	1,644.10	8.237	1,508.68

Service Quote

SV0000261

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Ship-to Address
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221 E Lincoln Ave
Fort Collins, CO 80524-2533
United States

Contact Name	Kaitlyn Bargen
Phone No.	402-443-4675
Email	kbargen@lpnnrd.org

Order Date	Customer Account	Inco Terms
06/13/25	C004961	FOB Origin

P.O. No.	Payment Terms	Shipping Agent
	Net 30 days	FEDEX GROUND

Subtotal	3,748.68
Estimated Tax	0.00
Total USD	3,748.68

Longitude 103, Inc.
120 E 16th St Suite 207
Scottsbluff, NE 69361

LONGITUDE 103

Invoice

BILL TO
Lower Platte North NRD
511 Commercial Park Rd
Wahoo, Nebraska 68066

INVOICE # 04634
DATE 06/25/2025
DUE DATE 07/25/2025
TERMS Net 30

DATE	DESCRIPTION	AMOUNT
06/25/2025	Data migration into HydroData fee, 1 @ $7,500.00	7,500.00

BALANCE DUE **$7,500.00**