Phase II Nitrate Verification Study
For
Ashland Community Water System Protection Area

Ashland, Nebraska

Prepared for

Lower Platte South Natural Resources District
PO Box 83581
3125 Portia Street
Lincoln, Nebraska 68521

Prepared by

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March 2022
Version: DRAFT
EA Project No. 6333202

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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
bgs	below ground surface
CWSPA	Community Water System Protection Area
DS	deep Sample
EA	EA Engineering, Science, and Technology, Inc., PBC
EPA	United States Environmental Protection Agency
ft	foot (feet)
in	inch (inches)
lb/ac-ft	Pounds per acre-foot (pounds per one acre of surface area to a depth of one foot)
LPNNRD	Lower Platte North Natural Resources District
LPSNRD	Lower Platte South Natural Resources District
MCL	Maximum Contaminant Level
mL	milliliter
MW	monitoring well
N	Nitrogen
NAD83	1983 North American Datum
NAVD88	1988 North American Vertical Datum
NDEE	Nebraska Department of Environment and Energy (formerly NDEQ)
NDEQ	Nebraska Department of Environmental Quality
NDNR	Nebraska Department of Natural Resources
NDHHS	Nebraska Department of Health and Human Services
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RTK GPS	real-time kinematic global positioning system
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SS	shallow sample
SWAP	Source Water Assessment Planning
WhAEM	Wellhead Analytic Element Model
WHPP	Wellhead Protection Programs

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EXECUTIVE SUMMARY

Background and Purpose

This report has been prepared by EA Engineering, Science, and Technology, Inc., PBC (EA) to document the results of the nitrate-N verification study for the Ashland, Nebraska Community Water System Protection Area (CWSPA), which is supplied by groundwater from four public water supply wells. The purpose of this study was to identify the source and extent of the reported nitrate-N within the Ashland CWSPA. The Lower Platte South Natural Resources District (LPSNRD) requires that the source of nitrate-N be verified as non-point sources before a Phase II nitrogen management area is declared. The LPSNRD is leading the investigation, with support from Lower Platte North Natural Resources District (LPNNRD).

Field Activities and Results

Field activities were completed from 16 November 2020 through 13 December 2020. Field activities included installation of a monitoring well; collection of 199 shallow soil samples at 8 sites; and collection of 76 deep soil samples at 12 sites.

The deep soil sampling and groundwater results suggest that widespread elevated nitrate-N levels exist in the soil profiles and in the groundwater.

Sources of Nitrate

The results generally indicate that the source of nitrate-N in groundwater across the CWSPA is likely due to application of commercial fertilizer or manure on cropland. No evidence of point sources such as industrial processes, leakage from an industrial or municipal wastewater site, or large spills were identified within the Ashland CWSPA. One area that is inconclusive is the area surrounding Site 021. Additional investigation would be needed to determine if the source of nitrate-N is from a point source or from non-point source.

Future leaching of nitrate-N through the vadose zone is anticipated. Changes to management practices have potential to reduce the addition of future nitrate loading to the vadose zone. It is recommended that the future sampling results from the monitoring wells be evaluated for trends.

Data Gaps

A data gap was identified regarding the area northwest of the Ashland CWSPA. A point source cannot be ruled out for the high levels of nitrate-N in groundwater at one site south of the intersection of County Road A and County Road 6. Additional investigation would be needed to determine if the source of nitrate-N is from a point source or from non-point source.
The sparsity of data in this area renders the results inconclusive. It was decided to document the findings of the current field activities and allow the LPSNRD to review the data and decide if additional investigation was desired.

The study included the installation of one monitoring well. Typically, three monitoring wells would be installed to better characterize groundwater elevations, nitrate concentrations in the aquifer, and provide long term nitrate data. Two future monitoring well locations have been identified; but the LPSNRD decided to postpone the installation due to site constraints. The remaining two monitoring wells are projected to be installed in 2023.

1. INTRODUCTION

This report has been prepared by EA Engineering, Science & Technology, Inc., PBC (EA) for work related to a nitrate-Nitrogen (N) study regarding the Ashland community water system located within the Lower Platte South Natural Resources District (LPSNRD) and the Lower Platte North Natural Resources District (LPNNRD). EA has prepared this report as authorized through a contract with the LPSNRD.

The community of Ashland, Nebraska is located in southwestern Saunders County, approximately 28 miles east of Lincoln, Nebraska (Figure 1). The Ashland community water system protection area was selected for investigation by the LPSNRD based off the guidelines within the LPSNRD Groundwater Management Plan (LPSNRD, 2020). The LPSNRD initiated the nitrate-N verification study to assist in determining the source and extent of the reported nitrate-N within this area.

1.1 LPSNRD GROUNDWATER MANAGEMENT

The LPSNRD's philosophy regarding groundwater problems is that prevention is less costly than correction. Therefore, the LPSNRD has adopted programs that emphasize proactive protection of groundwater, rather than a reactive, corrective approach.

In 1994, the Nebraska Legislature directed the Natural Resources Districts to: 1) identify possible levels and sources of groundwater contamination within the area, 2) develop groundwater quality goals, 3) create long-term solutions necessary to prevent the levels of groundwater contaminants from becoming too high, 4) reduce high levels of contaminants sufficiently to eliminate health hazards, and 5) implement practices to stabilize, reduce, and prevent the occurrence, increase, or spread of groundwater contamination. The LPSNRD prepared its Ground Water Management Plan in 1995 to address these issues and has performed annual review of the Ground Water Management Plan since then. Along with the review, the groundwater rules and regulations have been updated several times, with the most recent update on 15 January 2020 (LPSNRD, 2020). These documents set out a proactive plan that establishes three separate phases, or levels, for managing groundwater quality. By default, the entire LPSNRD is currently in a Phase I area. The LPSNRD has already identified areas that are Phase II and Phase III based on previous Nitrate Verification Studies. Each successive phase progresses from the previous actions and implements stepped-up measures for dealing with changes in groundwater quality. In Phase II areas, additional education and water quality cost-share programs are implemented. In Phase III areas, additional monitoring and fertilizer/pesticide application requirements are implemented.

The Ground Water Management Plan defines multiple designated areas of management within the LPSNRD based on groundwater availability and uses. Community Water System Protection Areas (CWSPAs) is one of the designations for these areas of management. The LPSNRD has 31 CWSPAs corresponding to the 31 Wellhead Protection Areas (which are designated by the Nebraska Department of Environment and Energy [NDEE]) within its boundaries. A map of the CWSPA for Ashland is shown in Figure 1. Each CWSPA has its own network of groundwater

wells that are sampled by the LPSNRD and is managed separately based on the levels of contaminants found in those wells. For a CWSPA to enter a higher phase, two criteria must be met. First, the monitoring results must exceed a phase 'trigger'. The triggers are based on whether a certain percentage of the wells are at or exceed a certain percentage of the Maximum Contaminant Level (MCL) of the contaminant. The groundwater nitrate-N MCL is determined by the US Environmental Protection Agency (EPA), and it is designated at 10 mg/L for adverse health effects in vulnerable populations. For a Phase II, 50% of the wells in the monitoring network must be at/or above 50% of the MCL. For a Phase III, 80% of the wells in the monitoring network must be at/or above 80% of the MCL. Second, the contamination must be verified as non-point source pollution through a verification study. If both conditions are met, the Board of Directors of the LPSNRD can designate the area as Phase II or III for the contaminant.

1.2 ASHLAND STUDY AREA

The study area includes the entire Ashland CWSPA, which encompasses approximately 3,302 acres and includes the City of Ashland and lands to the north, west, and south of the city (Figure 1). The CWSPA boundary extends north of Ashland about 1 mile, to the west of Ashland about 1½ mile, and to the south of Ashland about ½ mile.

This area is divided by the boundary between the LPSNRD and the LPNNRD, of which about 1,630 acres is within the LPNNRD jurisdiction. LPSNRD is serving as the lead agency, and the report was prepared from the perspective of the LPSNRD.

The Platte River is located 2 miles east of the CWSPA. Salt Creek and Wahoo Creek border the CWSPA to the south and northeast. Highway 6 and railroad tracks pass through the southeast corner of the CWSPA.

1.3 PURPOSE OF STUDY

Currently, the Ashland CWSPA is within a Phase I area; however, a portion of the Ashland CWSPA is within the larger Lower Salt Creek Groundwater Management Area, which has been designated as Phase II. The Ashland CWSPA is an area that the LPSNRD is considering more rigorous monitoring with a Phase II designation. Previous sampling results from the four Ashland public water supply wells have indicated that nitrate-N concentrations have reached the 10 mg/L MCL, with each well approaching or surpassing the 50% of the MCL, suggesting that the Phase II trigger requirements may be met. Throughout this report, these wells are labelled as PWS-1, PWS-2, PWS-3, and PWS-4 rather than their well registration numbers. Based on records through 2019, the highest nitrate-N concentration reported is 10.0 mg/L in PWS-4 (G-070339) in 2004. Data is further described in Section 3.6.1.

In accordance with the Ground Water Management Plan, these sampling results trigger the need for a verification study to determine the source of nitrate-N and whether it is warranted to change the entire Ashland CWSPA from a Phase I to a Phase II Ground Water Management Area.

The purpose of this study is to identify the source and extent of the reported nitrate-N within the Ashland CWSPA. The report presents the findings of the study and documents the procedures used in the field effort. Results and conclusions are anticipated to provide information to allow the LPSNRD Board of Directors to determine if the Ashland CWSPA should be designated as a Phase II area.

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F:\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 1 - Site Location Map Raymond.mxd scorcoran

Legend

- CWSPA Boundary
- NRD Boundaries

Papio-Missouri River

Lower Platte North

Lower Platte South

Memphis
Silver Creek
Camp Ashland
Ashland
Ashland Cemetery
Iron Horse Golf Club
Eugene T. Mahoney State Park
Quarry Oaks Golf Club
The Clusters On The Platte
Ashland Country Club
Callahan Creek
Western Sarpy Ditch
Fishberry Rd
Platteview Rd
Ruff Rd
Emery Rd
Ashland Rd
Little Salt Rd
Agnew Rd
Country Club Rd
E Rock Creek Rd
Kimberly Dr
Ranch Rd
W Park Hwy
Cedar Hills Dr
Long Ln
Willow Point Dr
River Dr
Outer Dr
Ridge Rd
Engineer Rd
Industrial Rd
Euclid St
Dawes St
Clay St
Boyd St
Adams St
Silver St
Ash St
Lakeview Way
Reservoir Dr
SAUNDERS
SARPY
CASS
Burlington Northern
Highway 6
County Road B
County Road C
County Road A
County Road 3
County Road 4
County Road 5
County Road 6
County Road 7
County Road 8
Nelle Rd
N 176th St
N 190th St
S 232nd St
S 234th St
S 250th St
S 228th St
226th St
238th St
250th St
262nd St
220th St
1214 ft
1242 ft
1191 ft
1202 ft
1200 ft
1100 ft
1300 ft

Lower Platte South NRD

Site Location

0 1.75 3.5 Miles

N

Site Location Map

Figure 1

LPSNRD Nitrate Verification Study for Ashland CWSPA

Data Source: NeDNR, USGS, NDEE

Date: 12/11/2020

LOWER PLATTE SOUTH natural resources district

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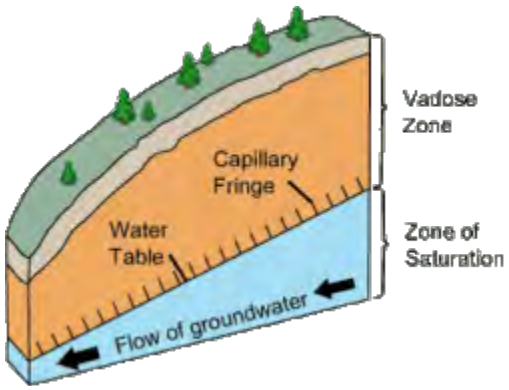
2. BACKGROUND INFORMATION

2.1 KEY TERMS

Vadose Zone – The vadose zone is the area between the land surface and the top of the regional water table, as illustrated in Figure 2 (courtesy of USGS). For this study, the portion of the vadose zone within 15 feet (ft) of the ground surface is called the shallow vadose zone. The portion of the vadose zone below 15 ft to the water table is called the deep vadose zone. Samples for this study were collected from both the shallow and deep vadose zones.

Figure 2. Vadose Zone Illustration



Root Zone – The root zone is the zone in a soil profile penetrated by plant roots, as illustrated in Figure 3 (Scherer and Steele, 2019) for various crops. Throughout this study the root zone was defined to include the top 6 ft immediately below the ground surface and may be within with shallow vadose zone or zone of saturation.

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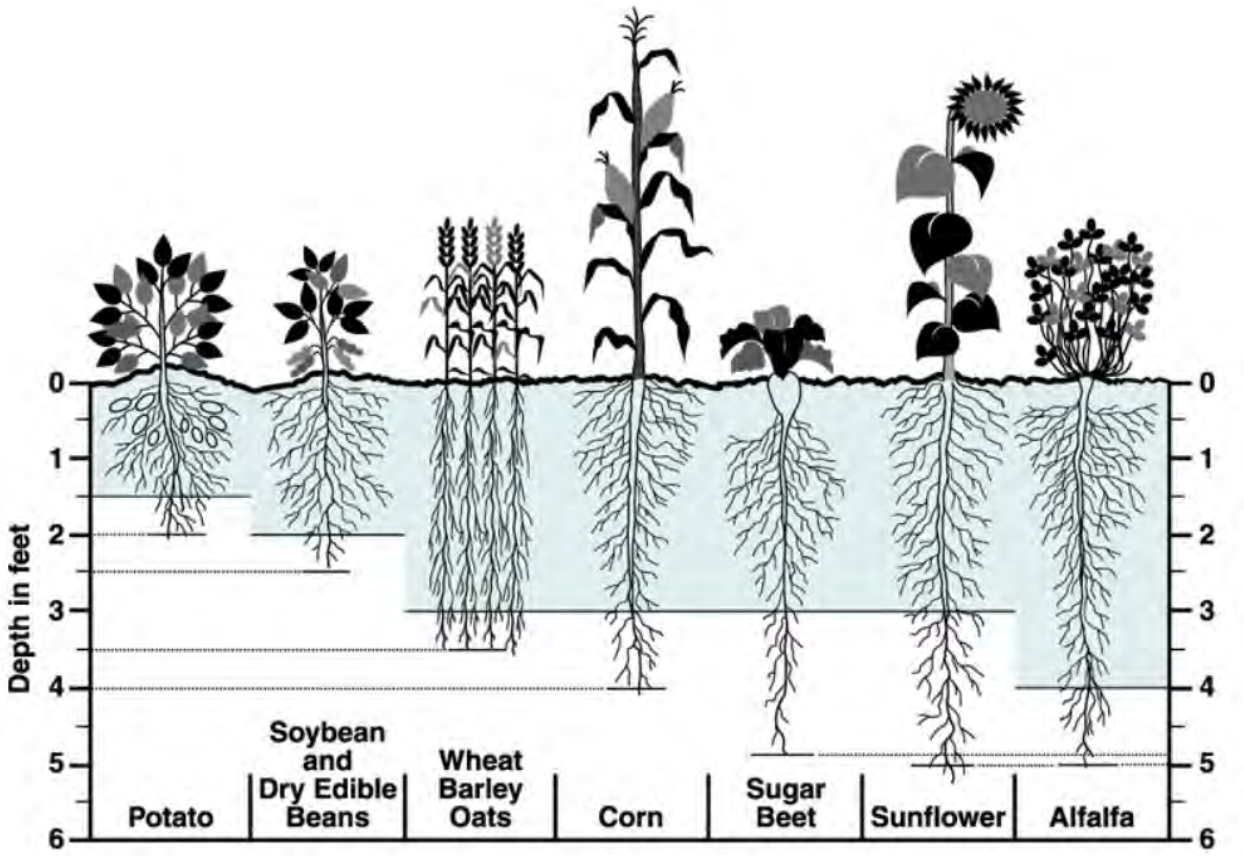
Figure 3. Root Zone Illustration



2.2 NITRATE-NITROGEN (NO_3-N)

Nitrogen (N) is an essential plant nutrient and is naturally produced by plants and animals. Additional sources of nitrogen in the environment include livestock operations, septic and waste systems, application of fertilizer for lawn and garden care, and for crop production. There are several forms of nitrogen, including nitrate (NO_3^-), nitrite (NO_2^-), and ammonia (NH_3). Nitrate is the form of nitrogen most easily taken up by plants and is the most common form found in the environment. Laboratory results, as used in this study, report the pounds per acre-foot (lb/ac-ft) of nitrogen in the form of nitrate-N (NO_3-N).

2.2.1 Background Levels and Leaching

Nitrate is present in every natural system at different levels. These naturally occurring nitrogen levels are commonly referred to as background levels. In natural ecosystems, nitrate-N is cycled between the atmosphere and shallow soils, and only small amounts of nitrate are leached below the root zone of plants. Soil below the root zone typically has background nitrate-N levels below 2 parts per million (ppm), which is equivalent to approximately 8 lb/ac-ft of nitrogen in the soil (Exner et.al., 2014). Therefore, individual sample results above 8 lb/ac-ft were considered elevated for this investigation. When more nitrogen is added than an ecosystem can uptake,

leaching of nitrate-N below the root zone can occur. In many places across Nebraska, groundwater quality has been impacted by increasing nitrate-N concentrations (Spalding & Exner, 1993).

When nitrate-N leaching occurs within the capture zone of a well field, the nitrate-N is transported with groundwater flow through the subsurface to the wells resulting in contamination to drinking water supplies. Since nitrate-N in drinking water can cause adverse health effects, State and Federal regulations established an MCL of 10 ppm for nitrate-N in drinking water.

In addition to the above State and Federal regulations, the LPSNRD has established 'trigger' levels for the management of non-point source nitrate-N. The Phase II and Phase III triggers are described in Section 1.1.

2.2.2 Point and Non-Point Sources

Nitrate-N in groundwater can originate from both point source and non-point sources. Point sources include those releases of nitrate-N that can be traced back to a particular point or spot such as contamination through a pipe or drain, industrial processes, sewage disposal systems, leakage from an industrial or municipal wastewater site, or a spill from a trailer of chemicals. Non-point sources of nitrate-N include chemical and manure fertilizer runoff during rainfall events and leaching beneath cropland, parks, lawns, and gardens.

3. PHYSICAL SETTING

3.1 LAND USE

The Ashland CWSPA encompasses approximately 3,302 acres. A breakdown of land use within the CWSPA is provided in Table 1. The most predominant land use type is Urban Land, Dryland Soybeans, and Dryland Corn, which accounts for a majority of the land use at 25%, 24%, and 20% respectively. Remaining land use within the CWSPA is a mixture of range, pasture, grass, irrigated corn, irrigated soybeans, dryland alfalfa and small grains, and natural areas (riparian forest and woodlands, wetlands), open water, and barren areas.

Table 1. Ashland Study Area Land Use Categories

Land Use	Acres	%
Urban Land	838.9	25.4
Dryland Soybeans	796.0	24.1
Dryland Corn	674.7	20.4
Range, Pasture, Grass	320.1	9.7
Irrigated Corn	312.5	9.5
Irrigated Soybeans	160.8	4.9
Riparian Forest and Woodlands	119.9	3.6
Dryland Alfalfa	49.5	1.5
Barren	17.9	0.5
Wetlands	7.6	0.2
Open Water	3.8	0.1
Dryland Small Grains	0.2	0.0
Total	3,302	100.0

Source: University of Nebraska-Lincoln, Conservation Survey Division, 2005. *https://snr.unl.edu/data/geographygis/land.aspx*

Land use within and surrounding the CWSPA is illustrated in Figure 4. Dryland and irrigated practices take place in the area. Four irrigation wells exist within the CWSPA, and evidence of recent irrigation was found during review of aerial images and during visual reconnaissance on two properties. Irrigation practices can impact the aquifer storage dependent on accumulated water use throughout the growing seasons.

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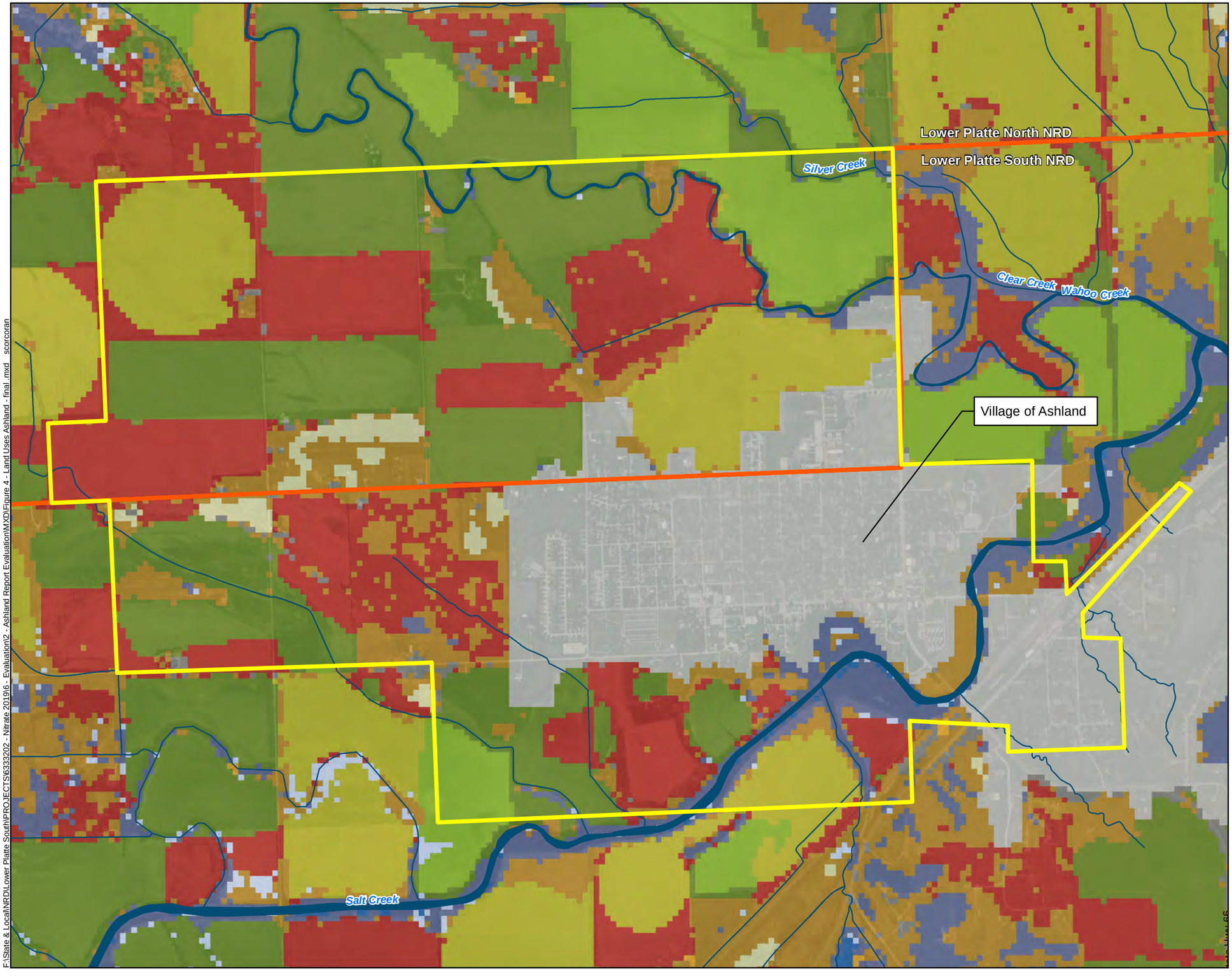

VICINITY MAP

Legend

- CWSPA Boundary
- NRD Boundaries
- Surface Water and Streams
- Irrigated Corn
- Irrigated Soybeans
- Range, Pasture, Grass
- Urban Land
- Open Water
- Riparian Forest and Woodlands
- Wetlands
- Dryland Corn
- Dryland Soybeans
- Dryland Alfalfa
- Dryland Small Grains
- Barren

0 800 1,600
Feet

N

Map Date: 5/7/2021
Source: UNL CSD, USDA, NDEE, NeDNR
Projection: NAD 1983 (2011) NE StatePlane

LOWER PLATTE SOUTH
natural resources district

EA

Figure 4
Ashland Land Uses
Ashland Nitrate Study for LPSNRD
Ashland, Saunders County, Nebraska

F:\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 201916 - Evaluation\2 - Ashland Report Evaluation\MXD\Figure 4 - Land Uses Ashland - final .mxd scorcoran

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3.2 REGIONAL HYDROGEOLOGY

Saunders County includes two main aquifers consisting of unconsolidated alluvial sediments. The two main deposits are identified as the Platte River valley and the Todd Valley aquifers. The greatest saturated thicknesses occur towards the western portion of the county, where paleovalleys are present, with saturated thicknesses between 100 and 230 feet. Within the Platte River valley, these alluvial sediments range from 40 to 100 feet in thickness. Below the unconsolidated sediments of southeast Saunders County lies consolidated Pennsylvanian bedrock consisting of shale, limestone, and mudstone (Divine, 2015). Well fields currently exist in the eastern portion of Saunders County, providing municipal water supplies to the cities of Lincoln and Omaha.

3.3 SITE HYDROGEOLOGY

The City of Ashland lies within the Platte River valley of southeast Saunders County. The local aquifer consists mainly of unconsolidated deposits of the Quaternary (Divine, 2015). Localized surface elevations range from approximately 1,045 feet to 1,200 feet above mean sea level (AMSL). Depth to water in the area ranges from approximately 0 to 100 feet below ground surface (bgs). Aquifers in the area are hydrologically connected and believed to be also connected to surface water. Overall, water quality is good in the local aquifers, although nitrate contamination is considered to be the most widespread (Divine, 2015).

3.4 SURFACE DRAINAGE

The Ashland CWSPA is located within a floodplain valley with several creeks crossing through the CWSPA. Wahoo Creek and Clear Creek are both located in the northeast corner where both creeks drain into Salt Creek one mile west of Ashland CWSPA. Salt Creek cuts through the CWSPA in the south and drains into the Platte River located 2.5 miles west of Ashland CWSPA. Approximately 106 acres located in the southwestern corner of the CWSPA are designated as wetland mitigation lands owned by the State of Nebraska - Department of Roads. Typical ground surface elevation does not vary significantly across the CWSPA boundary. The elevation varies slightly, generally from west to east from about 1,107 ft AMSL in the west to 1,064 ft AMSL in the east.

3.5 POINT SOURCE INVESTIGATION

An investigation was conducted by EA to identify any recorded contaminant spills in the Ashland CWSPA area using readily available resources in Saunders County. The investigation did not identify any point source locations of reported nitrate-N spills in or near the Ashland CWSPA. The records indicate that two wells within the CWSPA have been sampled for nitrate-N. The two wells have reported nitrate-N samples above the MCL. Three samples were taken from an irrigation well located west of the City of Ashland and reported nitrate-N concentrations ranging from 10 to 11.4 mg/L between 1994 and 2006. A domestic well was sampled four times since 1979 with nitrate-N ranging from 7.7 mg/L to 12 mg/L. Based on the groundwater

modeling by NDEE for the CWSPA, these two wells are expected to be generally upgradient to the public wells.

3.6 REGISTERED WELLS

Registered wells from the Nebraska Department of Natural Resources (NDNR) database were identified inside Ashland CWSPA and within a ½ mile surrounding the Ashland CWSPA as shown in Figure 5 and listed in Table 2.

A total of 21 registered wells are currently active within the CWSPA; including four public water supply wells, five domestic wells, five ground heat exchange wells, four irrigation wells one livestock well and two wells categorized as other.

Additional wells surrounding the CWSPA are shown in Table 2 to illustrate types of wells, typical well depths, and pumping rates for wells in the vicinity.

Table 2. Registered Wells Within and Surrounding the Ashland CWSPA

Wells Within Ashland CWSPA Boundary				
Location	**Use**	**Year Completed**	**Well Depth (ft)**	**Pump Rate (gallons per minute)**
G-140851	Municipal	2006	127	300
G-185065	Municipal	2016	135	400
A-10589C	Municipal	1981	122	750
G-070339	Municipal	1981	120	650
G-094852	Domestic	1997	97	10
G-127389	Domestic	2003	117	10
G-142066	Domestic	2006	75	15
G-143305	Domestic	2006	72	10
G-175129	Domestic	2014	70	30
G-151731	Ground Heat Exchange	2007	120	0
G-156815	Ground Heat Exchange	2010	200	0
G-174447	Ground Heat Exchange	2014	205	0
G-176113	Ground Heat Exchange	2014	300	0
G-179913	Ground Heat Exchange	2016	200	0
G-053628	Irrigation	1976	80	900
G-053629	Irrigation	1976	96	700
G-059549	Irrigation	1977	103	0
G-127545	Irrigation	2004	130	500
G-162992	Observation	2012	120	0
G-174816	Other	2014	102	0
G-176038	Other	2015	115	0
Wells Within 0.5 Miles of Ashland CWSPA Boundary				
G-090219	Domestic	1996	150	0
G-105953	Domestic	1998	75	15
G-143303	Domestic	2006	152	20
G-149003	Domestic	2007	100	10
G-166427	Domestic	2013	150	20
G-177573	Domestic	2015	106	15
G-184601	Domestic	2018	118	30
G-166958	Ground Heat Exchange	2013	100	0
G-171888	Ground Heat Exchange	2014	205	0
A-006892	Irrigation	1954	0	0
G-059550	Irrigation	1977	117	400
G-071062	Irrigation	1988	80	850
G-072920	Irrigation	1990	90	400
G-096371	Irrigation	1998	170	700
G-155475	Irrigation	1930	80	500
G-155476	Irrigation	1930	80	500
G-185627	Other	2017	64	200
G-105906	Monitoring	1990	40	0
G-090820	Livestock	1997	38	20

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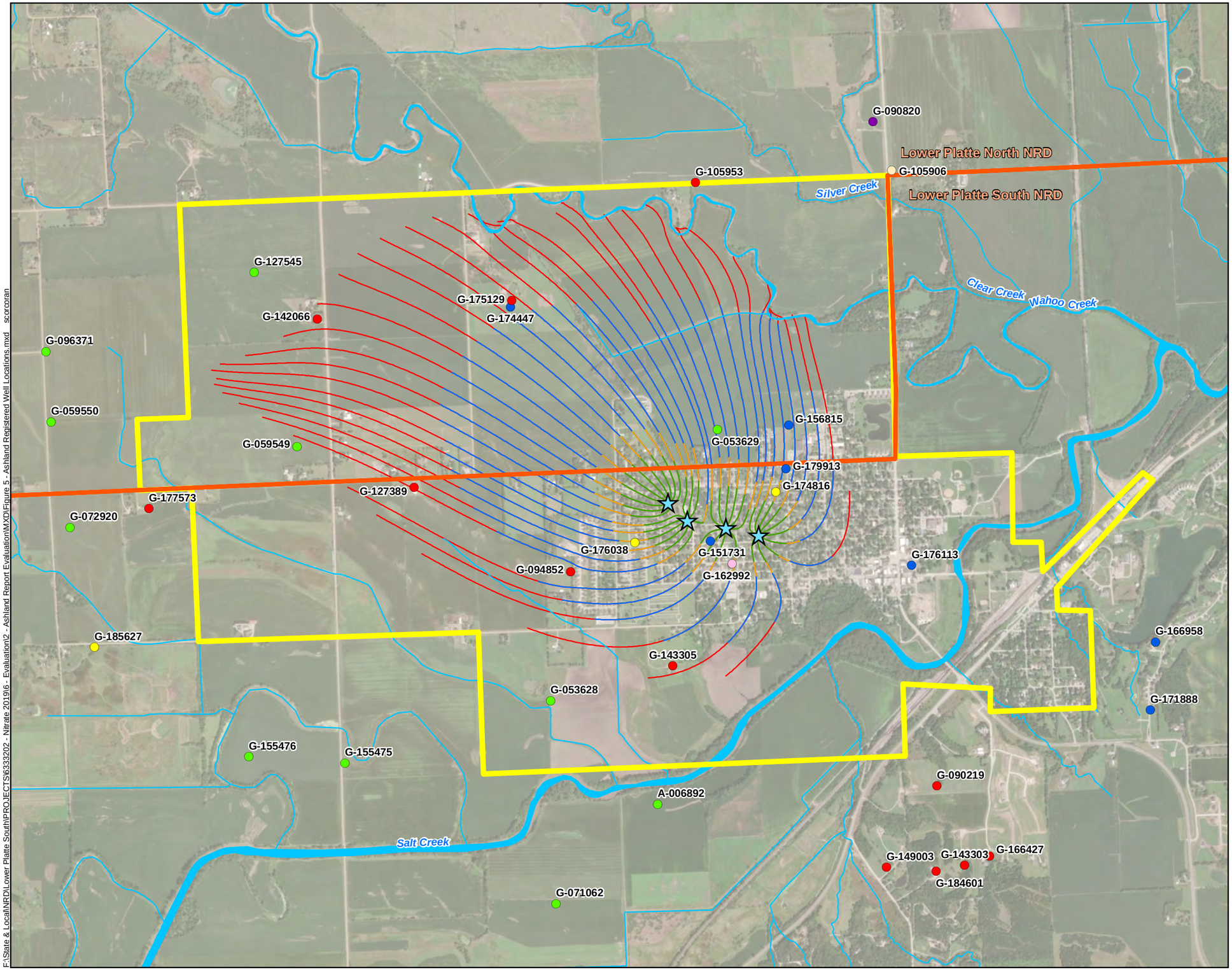
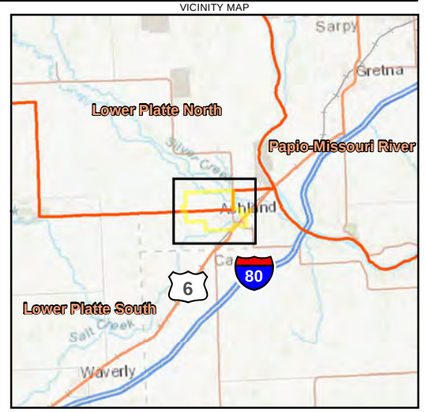


VICINITY MAP



Legend

- NRD Boundaries
- CWSPA Boundary
- Surface Water and Wetlands
- Public Supply Wells

Active Registered Wells

- Domestic
- Ground Heat Exch-Clo Hoop
- Irrigation
- Observation
- Other
- Monitoring
- Stock

WhAEM Model - October 2018

- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 900 1,800
Feet

N

Map Date: 12/11/2020
Source: NDEE, USGS, USDA, NeDNR
Projection: NAD 1983 (2011) NE StatePlane

LOWER PLATTE SOUTH natural resources district

Figure 5
Ashland Registered Well Locations
Ashland Nitrate Study for LPSNRD
Ashland, Saunders County, Nebraska

F:\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\2 - Ashland Report Evaluation\MXD\Figure 5 - Ashland Registered Well Locations.mxd scorcoran

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3.6.1 Public Water Supply Wells

The Village of Ashland obtains drinking water from four wells: PWS- 1 (G-140851) originally drilled in 2006 to a depth of 127 ft, PWS-2 (G-185065) originally drilled in 2016 to a depth of 135 ft, PWS-3 (A-010589C) originally drilled in 1981 to a depth of 122 ft, and PWS-4 (G-070339) originally installed in 1974 to a depth of 120 ft. PWS-1 has a screened interval at 94 ft to 127 ft. PWS-2 has a screened interval at 111 to 131 ft. The screened interval for PWS-3 and PWS-4 is unknown.

The Safe Drinking Water Act (SDWA) sets national limits on contaminant levels in drinking water to ensure that the water is safe for human consumption. The EPA regulates how often public water systems must monitor their water for contaminants. Generally, the larger the population served by a water system, the more frequent the monitoring and reporting requirements. Groundwater samples are collected by local communities to meet these regulatory requirements. The Nebraska Department of Health and Human Services (NDHHS) regulates the sample collection, analyzes the samples, oversees quality assurance (QA) and quality control (QC) procedures, and reports the results to the community and EPA.

Historical nitrate-N results for the Ashland municipal wells for dates ranging from 2003 to 2021 available through NDHHS are presented in Table 3. Each well is capable of being sampled separately and the wells are not connected to a treatment system. Each well is used to store water in the water tower. There is no specific mixing ratio. Nitrate-N samples are sampled from each well. PWS-4 (G-070339) is the only well to have reached the MCL for nitrate-N of 10.0 mg/L nitrate-N since installation. PWS-2 (G-185065) reached a maximum nitrate-N of 7.6 ppm in 2018. Groundwater nitrate-N in PWS-1 is slightly increasing and nitrate-N in PWS-3 fluctuates and the trend is generally consistent around 5 mg/L. Groundwater nitrate-N in PWS-2 and PWS-4 is generally decreasing. In recent years, all four wells consistently record nitrate-N at about 50% of the MCL.

Table 3. Municipal Well Groundwater Nitrate-N Sample

Nitrate-N Concentrations (mg/L) – Public Water Supply Wells				
Sample Date	**PWS-1**	**PWS-2**	**PWS-3**	**PWS-4**
	(G-140851)	**(G-185065)**	**(A-010589C)**	**(G-070339)**
8/20/2003	-	7.6	5.3	5.4
8/24/2004	-	6.3	4.7	10.0
8/16/2005	-	6.4	4.5	5.8
8/17/2006	-	-	4.6	5.8
8/18/2006	-	6.7	-	-
6/26/2007	-	6.5	4.5	7.8
6/18/2008	3.0	5.9	4.6	7.1
6/3/2009	2.8	5.2	4.7	5.3
7/2/2010	3.0	5.2	-	4.5
10/6/2010	-	-	4.0	-
5/4/2011	3.3	4.8	5.2	4.1
6/5/2012	3.7	4.3	5.5	3.6
6/19/2013	3.2	4.8	5.1	5.6
6/25/2014	3.4	-	4.7	6.2
5/24/2016	3.1	-	4.7	5.3
10/3/2017	4.8	-	4.4	4.4
7/25/2018	4.1	-	5.9	-
9/10/2019	4.1	4.83	4.6	5.8
9/17/2020	4.49	5.05	5.04	5.93
9/30/2021	3.76	4.68	3.72	5.24

3.7 WELLHEAD ANALYTICAL ELEMENT MODEL REVIEW

Wellhead Analytic Element Model (WhAEM) is a public domain, groundwater flow model designed to facilitate capture zone delineation and protection area mapping intended to support the State's Wellhead Protection Programs (WHPP) and Source Water Assessment Planning (SWAP) for public water supplies. The WhAEM for the Ashland municipal wells was originally run by the Nebraska Department of Environmental Quality (NDEQ; currently titled Nebraska Department of Environment and Energy, NDEE) in 2018 using readily available information. In order to review the previous results, the newest version of the model (WhAEM2000) was downloaded from the EPA's website (EPA, 2007). Hard copies of the original model results and available supporting documentation were obtained from the NDEE.

The WhAEM Model Review Report concluded the base of aquifer elevation in Ashland is 991 feet, which was a reasonable estimate based on the information available at the time. Aquifer thickness was reported to include 55 to 99 feet of sand and gravel deposits with the model using a value of 31 feet of saturated thickness. These estimates generally match the results from the boring logs for the one monitoring well. The hydraulic conductivity was reported at 109.7 feet per day, which appeared reasonable. A low porosity was reported at 0.20; however, this suggested value may be low, but appropriate as a conservative estimate.

The conclusion from the review of the WhAEM Model suggested that while some of the parameter assumptions seemed low, the assumptions appeared to be reasonable. A full report for the WhAEM Review Report and associated information can be found in Appendix A.

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4. METHODS OF INVESTIGATION

The Ashland nitrate-N verification study involved an inventory and assessment of available information, the collection and analyses of shallow soil samples, subsurface soil samples, and groundwater samples, and the installation of groundwater monitoring wells.

The field work for sample collection was conducted in November and December 2020, and the field work for monitoring well installation was conducted in November 2021. The field work was completed in general conformance with the Work Plan, Nitrate Studies for Two Communities Water Systems Raymond and Ashland, Nebraska, Nebraska (EA, 2020). The methods and procedures of the investigation are summarized in the following sections, and more details are discussed in the Work Plan.

4.1 SHALLOW SAMPLING

The objective of the shallow soil sampling was to obtain nitrate-N levels both within and below the root zone. Shallow soil sample locations were chosen to be representative of different soil types, topography, drainage, and land use.

A small truck-mounted Giddings rig was used to collect shallow soil samples from the surface to 15 ft below grade. Shallow soil samples were collected by pushing a 1 ½ inch interior diameter by 60-inch-long sample tube. Soil samples were collected from 3 ft intervals and were homogenized by thoroughly mixing retrieved soil from each sampling interval in a large, rubberized container. Each sample sent to the laboratory was comprised of several sub-samples randomly collected from throughout the rubberized container. The homogenized samples were analyzed for nitrate-N.

Shallow soil samples were collected from 8 sites, with 5 borings per site, resulting in 40 sample locations. Samples were collected from 5 depth intervals at each location (increments of 3 ft, to a maximum depth of 15 ft). This yielded a total of 199 shallow samples collected.

4.2 DIRECT PUSH SAMPLING

Direct push technology was used to collect both subsurface soil samples and groundwater samples. The objective of the direct push sampling was to obtain deeper nitrate-N soil profiles, to provide additional geologic information, and to collect representative groundwater samples.

The direct push sampling locations were selected within the CWSPA based upon geographical availability.

Soil borings were properly abandoned as required by Nebraska Title 178 NAC 12 (NDHHS, 2005) by filling the boreholes with bentonite to within 3 ft of the surface. The remaining 3 ft was backfilled with native earth material with mounding for settling.

4.2.1 Deep Sampling

Direct push methods were used to collect deep soil samples at 5 ft intervals beginning at the surface and ending at the water table of the unconfined aquifer (defined as 5 ft of continuous saturated soil) or refusal. When the water table was encountered in clay, the boring was continued until sand was encountered to allow for groundwater sample collection. The soil sampling was conducted using a truck-mounted hydraulic direct-push drill rig. A direct-push soil sampling probe was advanced under hydraulic pressure to the selected sample depth where a representative sample from each interval was retrieved.

A lithological description of each recovered sample interval was recorded on a standard boring log form. Information recorded included the boring location, drilling and sampling methods, sampling interval, sample descriptions, and soil descriptions. Soil descriptions were recorded in accordance with the Unified Soil Classification System. Boring Logs are included in Appendix B.

A soil sample from each interval was obtained by thoroughly mixing retrieved soil in a large, rubberized container. The sample was comprised of one sample the length of the retrieved 5 ft sample probe and randomly collected from throughout the rubberized container.

Deep soil samples were collected from 11 sites, with 2 boring locations at one site, resulting in 12 sample locations. Samples were collected from 3 to 10 depth intervals at each location (increments of 5 ft, to a final depth range of 15 to 50 ft). This yielded a total of 76 deep samples collected and sent to the laboratory for analysis.

4.2.2 Groundwater Sampling

A groundwater sample was collected from the unconfined aquifer at all 12 of the direct push boring locations. Groundwater samples were collected utilizing a water sampling probe which was advanced under hydraulic pressure to the selected sample depth. The sample probe was then extruded exposing a 1-inch to 1 ¼-inch outside diameter, stainless steel slotted screen that was connected to a series of threaded steel probe rods and an expendable point.

Groundwater samples were extracted from inside the probe using dedicated polyethylene sample tubing and attached mini-check valve. Groundwater samples were collected in a 500 milliliter (mL) plastic laboratory sample container, preserved with sulfuric acid (H_2SO_4), placed in a cooler filled with ice, and delivered to the LPSNRD for laboratory analyses of nitrate-N.

4.3 MONITORING WELLS

The primary purpose of the groundwater monitoring wells is to provide semi-permanent locations for collection of groundwater samples to monitor nitrate-N levels and other constituents and provide reliable information related to groundwater levels. Additional geologic information is gathered during drilling from the drill cuttings. One permanent monitoring well was installed in the Ashland CWSPA. Two additional well locations have been identified to be considered in

the future but were not installed at this time due to land access. One future well location is on the Nebraska Department of Transportation lands west of Ashland. This location has maintenance activities planned that prevented installation of the monitoring well during the study. The second future location is on lands owned by the Ashland Public Schools. The school was undergoing expansion construction and could not commit to a monitoring well location until construction activities were completed. For both wells, installation opportunities may become available in 2023.

The following subsections describe the methods of installation and sampling procedures.

4.3.1 Monitoring Well Drilling

Subsurface drilling was completed using a truck-mounted mud rotary drilling rig. A six-inch diameter drilling bit was attached to the drilling stem and advanced until bedrock was encountered, or to a depth where a productive screened interval within the targeted aquifer was reached. Soil cuttings were collected from the drill wash. Cuttings were collected approximately every 5 ft, or when a lithological change was encountered.

A lithological description was recorded on a standard boring log form. Information recorded included the boring location, drilling and sampling methods, sampling interval, sample descriptions, and soil descriptions. Soil descriptions were recorded in accordance with the Unified Soil Classification System. Boring Logs are included in Appendix B.

Since mud rotary drilling was used to install the monitoring wells, no soil samples were collected for laboratory analysis.

Upon terminating the boring at bedrock, the drill bit and stem were removed from the bore hole. A 9-inch diameter drill bit was then attached to the drill stem and advanced to a depth approximately halfway between the regional water table and bedrock for well screen installation.

4.3.2 Monitoring Well Construction and Development

Monitoring well AMW-1 was installed on private property. This monitoring well was constructed and installed by a Nebraska licensed well drilling professional in accordance with Nebraska Water Well Standards, Title 178 NAC12, Regulations Governing Water Well Construction, Pump Installation and Water Well Decommissioning Standards (NDHHS, 2005).

The well was constructed with 4-inch diameter, threaded, schedule 40 polyvinyl chloride (PVC) casing. The well screen is comprised of 10 ft of 0.010-slot factory slotted screen. Sand filter pack was placed to a minimum of 2 ft above the well screen. A minimum 5 ft bentonite seal and a high solids bentonite grout to the surface were placed on top of the sand filter pack. Well construction diagrams are included in Appendix B.

The well was developed after construction by placing a pump near the bottom of the well and purging until clear water was obtained or a maximum of two hours had elapsed.

After development, a Grundfos submersible pump connected to 1-inch schedule 80 PVC drop pipe was installed in each well, with a sampling port and electrical plug at the top of the well casing. Each well was completed with a stick-up protective casing, concrete pad, and bollards.

4.3.3 Monitoring Well Groundwater Sampling

The LPSNRD periodically samples and conducts water level measurements from monitoring wells and several other well types (irrigation, municipal, etc.) throughout the LPSNRD to help determine trends in both water quality and quantity. In some cases, wells are drilled strictly for monitoring purposes, and other times existing municipal or irrigation wells are added to the network through agreements with landowners.

In December 2021, the LPSNRD collected a groundwater sample from the Ashland monitoring well installed as part of this study. The result of the LPSNRD groundwater sampling was reviewed and incorporated into this report.

4.4 SAMPLE IDENTIFICATION

The following information was recorded in the field for each sample collected.

- Date/time of sampling
- Land use description at time of sampling
- Sampling depth information
- Direct push/boring identification number
- Laboratory method(s)

Unique sample identification numbers were assigned to each sample collected. Samples collected during the field effort (November-December 2020 and November-December 2021) were given the acronym “DS” for deep sample by direct push soil sample locations, “SS” for shallow soil sample locations, and “MW” for monitoring well sample locations.

For example, sample number ADS020 was an Ashland (A) deep sample by direct push (DS) at location 020.

4.5 QA/QC PROCEDURES

Quality assurance samples (duplicates) were collected to provide a blind sample to the laboratory that could be compared to the original environmental sample results.

The QA/QC samples were given a different identification number from the original environmental sample. For example, the QA/QC sample collected from location ADS021-25 was identified as sample DSDUP-1 (QA sample). An internal duplicate tracking sheet was used to keep a record of duplicate and parent sample relationships.

4.6 UTILITY CLEARANCES

Utility clearances were conducted prior to any drilling or subsurface work. Utility locations were confirmed by locating manholes, poles, vaults, and other related structures. Two to ten business days prior to beginning drilling and sampling activities, the One-Call System and appropriate utility companies were contacted to locate buried utilities. Information collected during the utility surveys was documented in a field logbook.

4.7 SURVEY

4.7.1 Monitoring Well

Horizontal locations were established using a real-time kinematic (RTK) global positioning system (GPS) survey system to within 0.1 ft and referenced to the Nebraska Plane Coordinates, 1983 North American Datum (NAD83). Elevation (grade) for the monitoring well was established to the nearest 0.01 ft and referenced to the 1988 North American Vertical Datum (NAVD88). Elevation was established for both ground elevation at the well and measuring point (top of casing).

4.7.2 Deep Vadose Zone Sampling and Shallow Vadose Zone Sampling Locations

The horizontal location of the deep and shallow sampling locations was established to the nearest +/-2 ft using a hand-held GPS and referenced to the Nebraska State Plane Coordinates, 1983 NAD83. Soil sample elevations were determined from LiDAR based on GPS location.

4.7.3 Irrigation and Domestic Wells

No survey was completed for existing irrigation and domestic wells. State records available from the NDNR and aerial photography were used to determine the potential location of irrigation and domestic wells. A visual site reconnaissance was completed to verify well locations. Elevation (grade) of existing well locations was estimated using Digital Elevation Model topography obtained from LiDAR data. This information was only collected for wells included in the geologic profile.

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5. RESULTS

This section presents the information obtained from the methods of investigation described in Section 4, including the review of the physical setting and regional site hydrogeology, and the results of the drilling, sampling, and laboratory analyses.

The deep soil samples and the shallow soils samples are categorized in this study by land use description at the time of sampling in November and December 2020 when field investigations took place. It is highly likely that land use changes from year to year using crop rotation methods; therefore, there are limitations in which conclusions can be made between corn and soybeans. Throughout the remainder of this report, land use descriptive terms are used to generalize deep and shallow soil categories to represent land use at the time of sampling.

Locations for the monitoring well and soil sampling are shown in Figure 6.

5.1 GEOLOGIC PROFILE

Detailed geologic logs were prepared from the deep soil direct push soil samples and from the drill cuttings obtained during installation of the monitoring wells. A geologic profile was created based on the geologic logs collected for this study and well logs available for select registered wells. The geologic profile is shown in Figure 7.

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Lower Platte North NRD

Lower Platte South NRD

Silver Creek

Clear Creek Wahoo Creek

Salt Creek

PWS-1

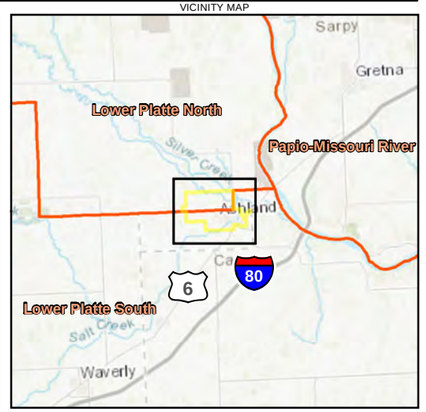
PWS-2

PWS-3

PWS-4

MW-1

VICINITY MAP



Legend

- NRD Boundaries
- CWSPA Boundary
- Public Water Supply (PWS)
- Monitoring Well (MW)
- Deep Soil
- Shallow Soil
- Streams

WhAEM Model - October 2018

- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 900 1,800

Feet

N

Map Date: 12/6/2021
Source: NDEE, USGS, USDA, NeDNR

Projection: NAD 1983 (2011) NE StatePlane

Figure 6
Sampling Locations
Ashland Nitrate Study for LPSNRD
Ashland, Saunders County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\2 - Ashland Report Evaluation\MXD\Figure 6 - Sampling Locations.mxd scorcoran

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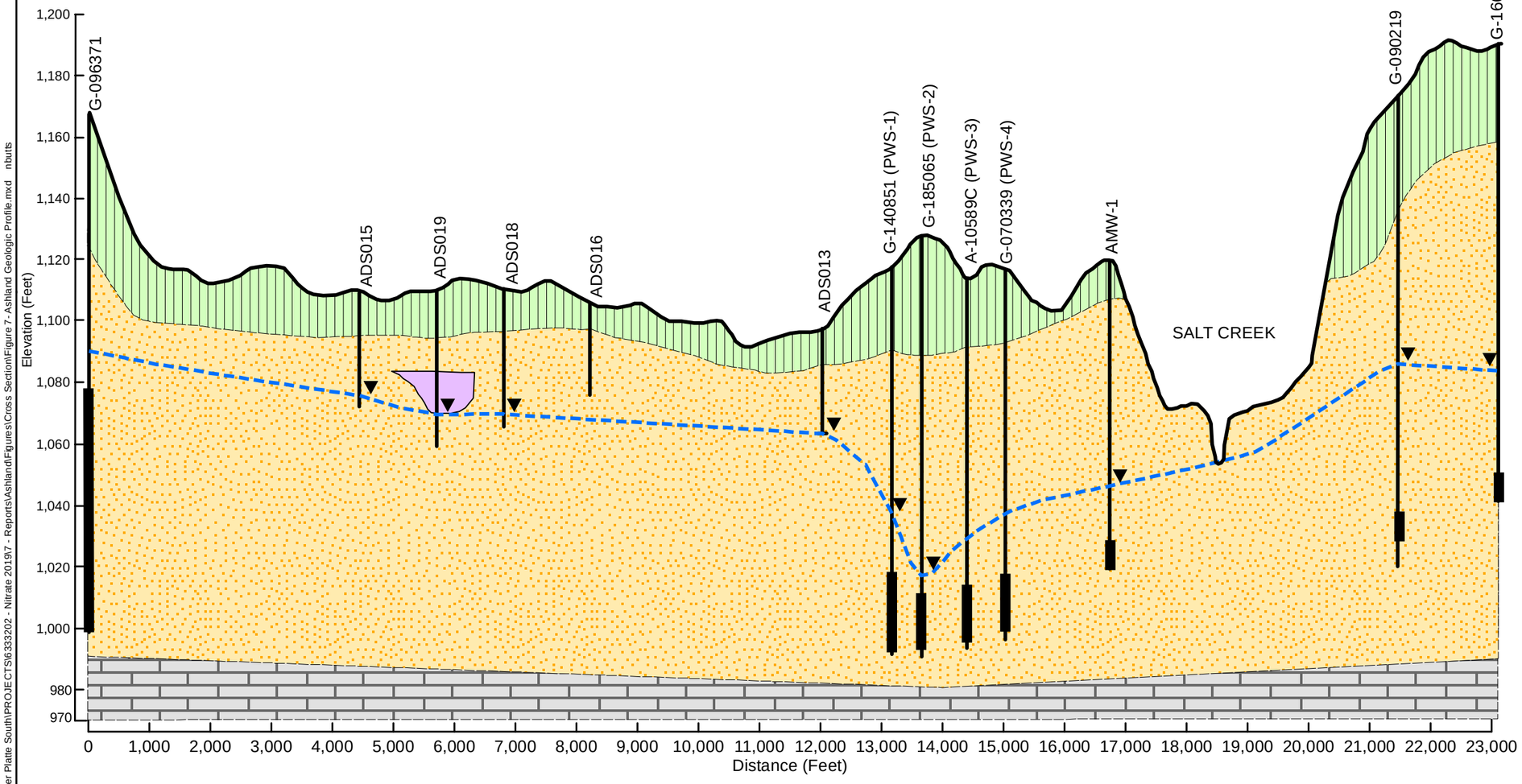
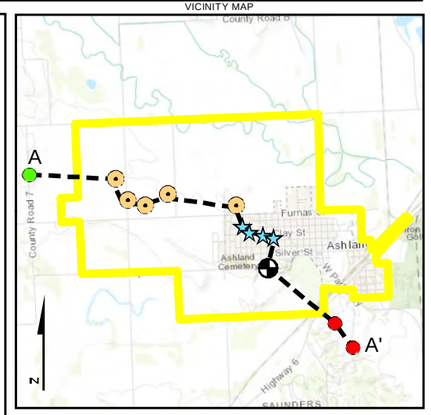
ESE
A'



VICINITY MAP



Legend

- Ashland CWSPA
- Monitoring Well
- Domestic Well
- Irrigation Well
- Deep Soil Locations
- Public Water Supply
- Loess Deposits (Silt and Clay)
- Clay Channel Fill
- Alluvial Sand
- Bedrock (Douglas Group Shale and Limestone)
- Cross-Section Transect
- Approximate Potentiometric Surface
- Well Screen

Note: Potentiometric surface inferred based on depth of groundwater saturation observed during installation of soil borings and monitoring wells. Pumping water level data from NeDNR well database used for public water supply wells where indicated.

Map Date: 3/17/2022
Source: NeDNR, USGS, NDEE, USDA
Projection: NE State Plane

Horizontal Scale: 1" = 2000'
Vertical Scale: 1" = 40'

LOWER PLATTE SOUTH
natural resources district

Figure 7
Geologic Profile
Ashland Nitrate Verification Study
Ashland, Saunders County, Nebraska

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5.2 GROUNDWATER LEVELS

5.2.1 Groundwater Levels During Field Investigation

Groundwater levels were measured in the deep soil borings with an electronic water level tape as noted on the boring logs and referenced to ground surface elevation. The measurements from the deep soil borings are summarized in Table 4. Depth to water varied from approximately 11 ft to 68 ft.

Table 4. Ashland Study Area - Groundwater Level Measurements

Location	Ground Elevation (ft)	Depth to Water from Ground (ft)	Water Elevation (ft)	Date
ADS011	1088	27	1061	12/7/2020
ADS012	1095	26	1069	12/13/2020
ADS013	1093	28	1065	12/9/2020
ADS014	1072	11	1061	12/7/2020
ADS015	1107	33	1074	12/9/2020
ADS016	1100	28	1072	12/8/2020
ADS017A	1070	11	1059	12/7/2020
ADS017B	1082	22	1060	12/8/2020
ADS018	1115	42	1073	12/8/2020
ADS019	1110	38	1072	12/8/2020
ADS020	1084	24	1060	12/8/2020
ADS021	1112	34	1078	12/7/2020

The groundwater elevations from the field investigation are illustrated in Figure 8.

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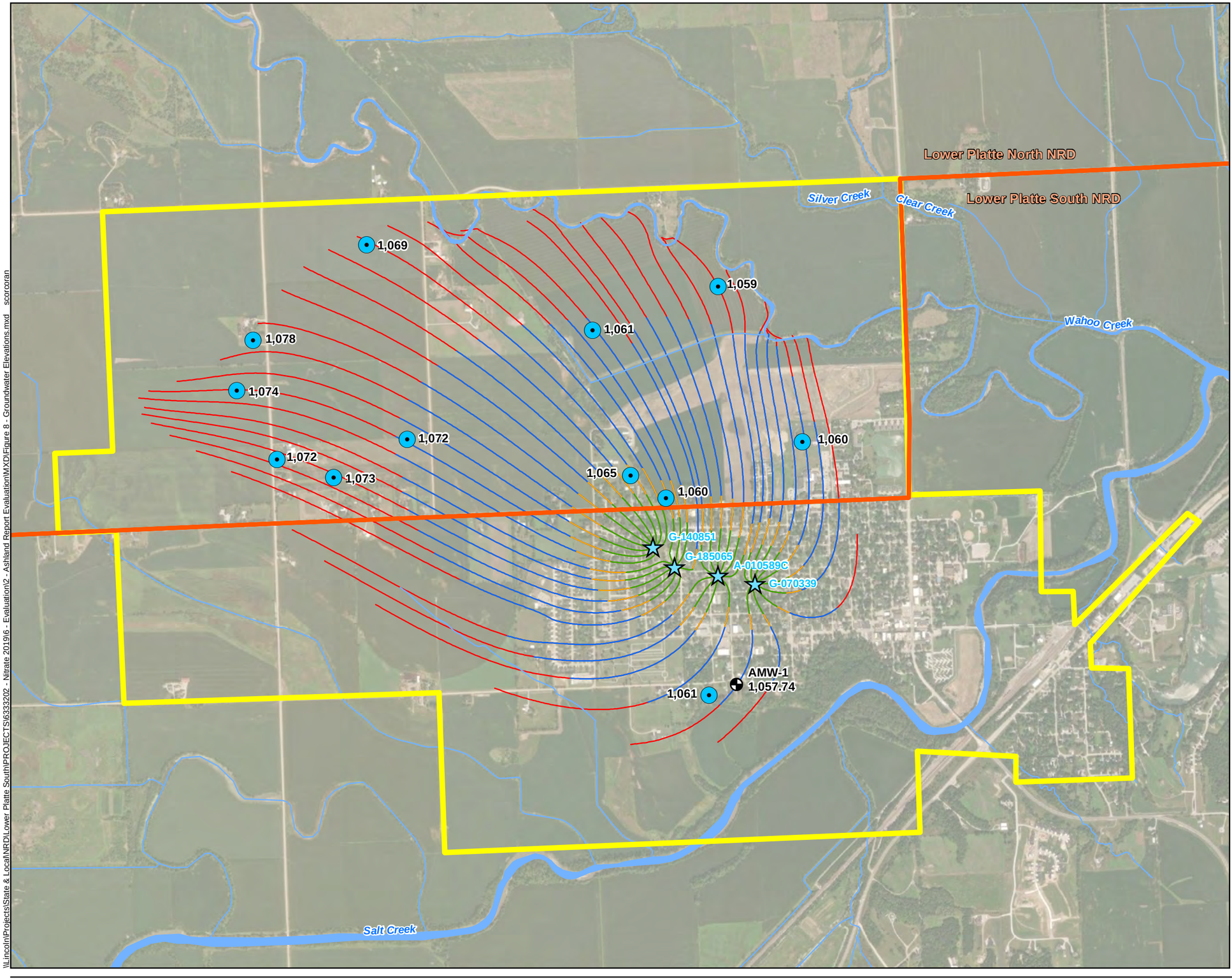
Figure 8. Groundwater Elevations



VICINITY MAP

Legend

- Public Supply Wells
- Monitoring Well 11/2021
- NRD Boundary
- CWSPA Boundary
- Surface Water and Wetlands

Water Level Measurements Sampled During Field Investigation 12/2020

- Deep Soil Locations

WhAEM Model - October 2018

- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 800 1,600
Feet

N

Map Date: 3/11/2022
Source: NDEE, USGS, USDA, NeDNR
Projection: NAD 1983 (2011) NE StatePlane

Figure 8
Groundwater Elevations
Ashland Nitrate Study for LPSNRD
Ashland, Saunders County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 20196 - Evaluation\2 - Ashland Report Evaluation\MXD\Figure 8 - Groundwater Elevations.mxd scorcoran

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5.2.2 Groundwater Flow Direction

One monitoring well installation was completed during the project. The water level measurement from AMW-1 is shown in Table 5. Depth to water was measured from top of casing.

Table 5. Groundwater Level Measurements in Monitoring Well

Well Name	Measuring Point Elevation (ft AMSL)	Depth to Water (ft from TOC)	Water Level Elevation (ft AMSL)
AMW-1	1127.69	69.95	1057.74

Two additional monitoring wells will be considered in the future, depending on land access as previously described. Once all three wells are installed, the direction and gradient of groundwater flow can be determined using triangulation from water level measurements from three wells. However, the general groundwater flow direction can be approximated from the water measurement taken from the soil borings and shown in Figure 8. From these measurements, it can be seen that the groundwater elevation is generally lower to the east and higher to the west, resulting in a groundwater flow direction that is generally towards the east.

5.3 NITRATE LOADING

Deep and shallow soil borings were conducted to determine the amount of nitrate present within the subsurface. Nitrate results are presented in several different ways. Individual soil sample results were reported from the laboratory in units of ppm, and these results were converted to nitrate pound(s) per acre-foot (N lb/ac-ft). Total nitrate for entire boring depth is the cumulative nitrate pound(s) per acre (N lb/ac) through the depth of the boring.

5.3.1 Shallow Soil Samples

The results from the shallow soil borings are summarized in Table 6 organized by site. Each site included five shallow soil borings. One exception is site ASS017 which was a field split between dryland soybeans with two shallow soil borings and irrigated corn with three soil borings. Figure 9 is a combination of all five shallow soil borings for each site. Appendix C contains the laboratory results. A detailed table of the shallow soil sampling results, including totals above and below the root zone, is included in Appendix D. Note that the land use listed is based on the observations during the field effort. It is recognized that crop rotation is a common practice in the area.

Table 6. Summary of Nitrate Results for Shallow Borings

Site ID	Land Use	Boring Depth, ft	Maximum Nitrate-N, lb/ac-ft	Average Nitrate-N lb/ac-ft	Total Nitrate-N lb/ac
ASS011	Range, Pasture, Grass	15	43	7	104
ASS012	Dryland Corn	15	18	8	126
ASS014	Dryland Soybeans	15	7	4	56
ASS015	Dryland Corn	15	14	6	87
ASS016	Range, Pasture, Grass	15	11	5	76
ASS017A	Dryland Soybeans	15	4	4	65
ASS017B	Irrigated Corn	15	11	5	69
ASS019	Dryland Soybeans	15	7	4	65
ASS020	Range, Pasture, Grass	15	11	6	93

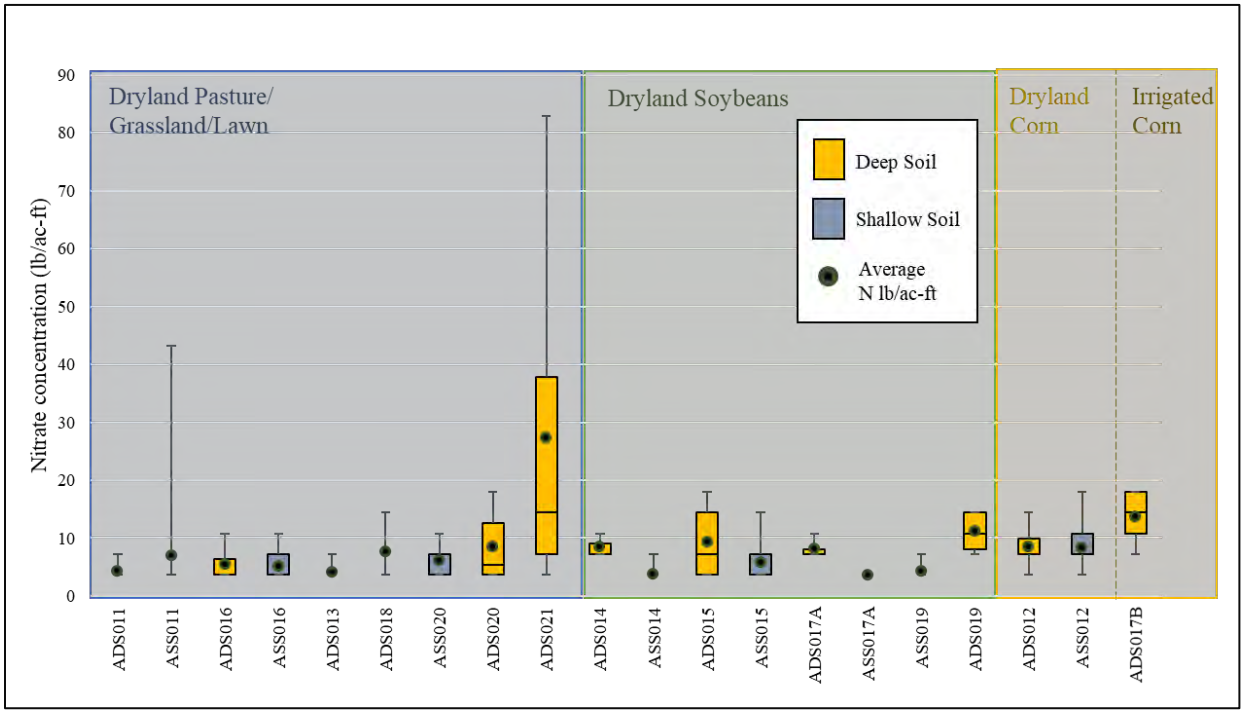
5.3.2 Deep Soil Samples

For deep soil borings, the average nitrate (lb/ac-ft) and total nitrate (lb/ac) results are represented in Table 7 organized by site. Total nitrate is useful because it provides a convenient summation of the results from one boring deeper into the ground; however, it should be remembered that the depth of the boring influences the total nitrate (lb/ac) calculation and land use is categorized based on what land use was present at time of sampling. Figure 9 illustrates the variability of nitrate-N across all soil samples collected. Appendix C contains the laboratory results. A detailed table of the deep sampling results is included in Appendix E.

Table 7. Summary of Nitrate Results for Deep Soil Borings with Land Use Categories

Site ID	Land Use at Time of Sampling	Boring Depth (ft)	Maximum Nitrate-N lb/ac-ft	Average Nitrate-N lb/ac-ft	Total Nitrate-N lb/ac
ADS011	Range, Pasture, Grass	30	7	4	126
ADS012	Dryland Corn	30	14	8	253
ADS013	Range, Pasture, Grass	35	7	4	144
ADS014	Dryland Soybeans	15	11	8	126
ADS015	Dryland Corn	35	18	9	325
ADS016	Range, Pasture, Grass	30	11	5	162
ADS017A	Dryland Soybeans	20	11	8	162
ADS017B	Irrigated Corn	25	18	14	343
ADS018	Range, Pasture, Grass	45	14	8	343
ADS019	Dryland Soybeans	50	14	11	559
ADS020	Range, Pasture, Grass	30	18	8	253
ADS021	Range, Pasture, Grass	35	83	27	956

Figure 9. Soil Sampling Results



5.3.3 Direct Push Groundwater Samples

Groundwater samples were collected at the bottom of all twelve of the direct push boring locations. Direct push groundwater results varied from 0.24 mg/L at location AGW014 to 41.3 mg/L at location AGW021 as shown in Table 8. Figure 10 illustrates the groundwater nitrate-N concentration of samples collected from the direct push deep boring locations. Appendix C contains the laboratory results for the direct push groundwater samples. Six of the 12 groundwater samples collected exceeded the recommended groundwater nitrate-N limit of 10 mg/L MCL. This broad distribution of elevated nitrates suggests that the source of nitrate-N within the groundwater is likely from non-point source nitrogen leaching.

Table 8. Ashland CWSPA - Direct Push Groundwater Sample Results

Sample Location	Land Use at Time of Sampling	Sample Depth (ft bgs)	Nitrate (mg/L)
AGW011	Range, Pasture, Grass	30	2.27
AGW012	Dryland Corn	30	12.4
AGW013	Range, Pasture, Grass	35	0.53
AGW014	Dryland Soybeans	15	0.24
AGW015	Dryland Corn	35	8.96
AGW016	Range, Pasture, Grass	30	8.76
AGW017A	Dryland Soybeans	20	0.31
AGW017B	Irrigated Corn	25	18.8
AGW018	Range, Pasture, Grass	45	14.1
AGW019	Dryland Soybeans	50	11.9
AGW020	Range, Pasture, Grass	30	18.1
AGW021	Range, Pasture, Grass	35	41.3

5.3.4 Evaluation

In this section, shallow and deep soil sampling results were analyzed to assess nitrate-N loading found within the Ashland CWSPA. Shallow soil samples account for spatial variability within the site and deep soil samples account for vertical stratification of nitrate-N below the root zone. The following is a discussion of key findings regarding the shallow and deep soil nitrate-N loading found within the Ashland CWSPA.

Overall nitrate-N trends:

- Of the 12 deep soil sampling locations, six of the deep samples were collected in range, pasture, grass land use sites. The remaining six were categorized as cultivated cropland (corn and soybeans) land use sites, with five dryland sites and one irrigated (corn) site.

- Most of the sites had low variability in results within the vertical soil profile, such as for Sites 011 (ADS011), 012 (ASS012, ADS012), 013 (ADS013), 014 (ASS014 and ADS014), 015 (ASS015 and ADS015), 016 (ASS016 and ADS016), 017A (ADS017A and ASS017), 019 (ASS019, and ADS019), and 020 (ASS020 and ADS020). All these sites are range, pasture, grass, or dryland row crop land use sites.

- Other sites had more variability in results within the soil profile, such as for Sites 011 (ASS011), 017B (ADS017B), Site 018 (ADS018), and 021 (ADS021). All land uses are range, pasture, grass except for Site 17A/B which is split between dryland soybeans and irrigated corn. The sites listed with high variability are discussed individually in the key site-specific observations below.

Key site-specific observations:

- Site 011 (ASS011) is located in range, pasture, grass. Two consecutive intervals (from 6'-12') at shallow soil location, ASS011-01, were elevated. These depth intervals showed elevated nitrate-N levels at 43 lb/ac-ft and 40 lb/ac-ft. In comparison, all nitrate-N samples collected from the remaining soil samples were below background levels and ranged from 4 lb/ac-ft to 7 lb/ac-ft, with overall site average being 7 lb/ac-ft. A site-specific background inventory assessment was conducted for this area to rule out potential point sources for nitrate-N loading. No evidence was found to indicate point source loading.

- Site 017 is the only instance where two deep samples (ADS017A, ADS017B) were collected in addition to 5 shallow samples (ASS017-01 through ASS017-05) collected within the same field which was split between dryland soybeans and irrigated corn landuse at the time of sampling. Deep sample ADS017A and shallow samples ASS017-01 and ASS017-02 were collected on dryland soybeans, while deep sample ADS017B and shallow samples ASS017-03, ASS017-04, and ASS017-05 were collected irrigated corn.

    - Groundwater sampled at both land uses show differing nitrate-N concentrations, where nitrate-N loading on the irrigated corn site is distinctively higher than the dryland soybeans site. Site 017A, dryland soybeans, reached groundwater at 20 ft bgs and a groundwater sample was collected. Groundwater at this location measured 0.31 mg/L nitrate-N. Site 017B, irrigated corn, reached groundwater at 25 ft bgs and a groundwater sample was collected and measured 18.8 mg/L nitrate-N.

    - The deep soil borings at these locations show different vertical nitrate-N profiles. The average nitrate-N for Site 017A, dryland soybeans, is 8 lb/ac-ft and for Site 017B, irrigated corn, is 14 lb/ac-ft. The maximum nitrate-N for Site 017A is 11 lb/ac-ft and for Site 017B is 18 lb/ac-ft both at 0-5' bgs. Nitrate-N was reported higher throughout the boring at 017B than at 017A.

    - Shallow soil borings collected across both land uses indicated below background levels of nitrate-N across the site at 4 lb/ac-ft with the exception of one shallow soil boring. Maximum nitrate-N was recorded in ASS017-05 at both 9-12' and 12-15' bgs at 11 lb/ac-ft. This boring is located within irrigated corn land use which is the same as ADS017B and also reported the highest nitrate-N values for this site.

- Site 018 (ADS018), a deep boring, reported nitrate-N generally at or below background levels except for the first and last interval, 0-5' bgs and 40-45' bgs, which were recorded at 11 lb/ac-ft and 14 lb/ac-ft, respectively. Groundwater sampled at this location was 14.1 mg/L at 45 ft bgs. Moisture was found throughout the boring beyond 20 ft until

groundwater was encountered. This data suggests that the last interval at 45 ft bgs could have been influenced by the nitrate-N in groundwater at this boring. Additionally, a similar trend was observed at Site 020 (ADS020) where the last interval at 30 ft bgs was recorded at 18 lb/ac-ft and the groundwater sample was recorded at 18.1 mg/L while other intervals showed below background concentrations except for the first interval, 0-5' bgs recorded at 14 lb/ac-ft. The land use recorded at both sites was range, pasture, grass.

  - The soil results at these intervals are likely impacted by the nitrate-N present in groundwater rather than downward transport of nitrate-N through the profile. This suggests that the nitrate-N concentration in the last soil boring interval at these locations is not the result of vertical leaching of nitrate-N, but horizontal nitrate-N transport through the aquifer. The location of ADS018 and ADS020 are upgradient of the public water supply wells and are within the 10-year zone and 20-year zone of groundwater travel.

- Site 021 (ADS021), a deep boring, reported highly elevated nitrate-N through the soil profile. The average nitrate-N was 27 lb/ac-ft and the maximum nitrate-N was 83 lb/ac-ft at 15-20' bgs. Shallow soil sampling was not performed on this site, therefore spatial variability of nitrate-N in the field is unknown. Land use at this location is range pasture and grass. Groundwater was reached at 35 ft bgs, and a groundwater sample was collected measuring 41.3 mg/L nitrate-N.

  - The highly elevated sample results for Site 021 were unexpected. A review was conducted to assess potential causes for elevated nitrate-N in the soil profile. Site 021 is located on a residential property with proximity to cattle grazing to the north. Historically, the property has been surrounded by pivot irrigated cropland agriculture. Using the NDEE WhAEM Model, Site 021 is located within the 10-20 year groundwater transit zone with groundwater flow directed southeast towards the public supply wells. Additional sampling would be needed to assess the spatial variability of nitrate-N at this site. For the rest of this report, this site is considered as an outlier for this dataset, to avoid skewing the combined results and conclusions.

5.4 QA/QC SAMPLES

Quality assurance and quality control samples were collected throughout the Ashland CWSPA for soil and groundwater samples. QA/QC samples were collected at a 5% ratio of all planned soil samples. Five of the 18 duplicate samples collected reported a difference in nitrate-N concentrations. The greatest percent difference between duplicate and parent sample was 67%. Four sample pairs have this difference. As reference, QA/QC data is considered agreeable up to 50% difference. The percent difference is outside the typical range; however, it is noted that these four sample pairs have very low concentrations and were different by 1 ppm. For the remaining samples, the low percent differences for the paired samples indicate that the soil cores, (deep and shallow) were adequately composited in the field to obtain representative soil samples

of the sampled interval. For the intent and purpose of this study, this data is considered agreeable. Table 9 shows the summary of the QA/QC relationships recorded for soil and groundwater samples.

Table 9. QA/QC Sample Percent Differences

Matrix	Sample Parent ID	Parent Results, ppm	Duplicate ID	Duplicate Results, ppm	Percent Difference
Soil	ASS014-02-06	1	DUP-9	1	0
Soil	ASS017-01-03	1	DUP-10	1	0
Soil	ASS017-05-06	1	DUP-11	1	0
Soil	ASS015-02-09	2	DUP-12	2	0
Soil	ASS019-02-12	1	DUP-13	1	0
Soil	ASS016-05-06	1	DUP-14	1	0
Soil	ASS011-03-03	1	DUP-15	1	0
Soil	ASS020-02-09	1	DUP-16	1	0
Soil	ASS012-01-09	2	DUP-17	1	67
Soil	ASS012-04-09	2	DUP-18	1	67
Soil	ADS021-25	5	DSDUP-1	5	0
Soil	ADS017A-10	2	DSDUP-2	2	0
Soil	ADS019-40	4	DSDUP-3	4	0
Soil	ADS018-10	1	DSDUP-4	2	67
Soil	ADS017B-05	5	DSDUP-5	4	22
Soil	ADS015-10	5	DSDUP-6	5	0
Soil	ADS013-05	2	DSDUP-7	2	0
Soil	ADS012-20	1	DSDUP-18	2	67
Groundwater	AGW015	8.96	GWDUP-1	8.63	4
Groundwater	AGW013	0.53	GWDUP-2	0.52	2

5.5 GROUNDWATER MONITORING WELL RESULTS

This section presents the nitrate-N results for groundwater samples collected in the installed monitoring well as part of the Ashland nitrate-N verification study. Figure 10 shows the monitoring well sampling location and concentrations of nitrate-N.

5.5.1 Monitoring Well Groundwater Samples

One groundwater sample was collected by the LPSNRD on December 8, 2021. Monitoring Well 1 (AMW-1) is located south of the public water supply wells on private property. Future monitoring well (AMW-2) is planned to be located west of the public supply wells on Nebraska Department of Transportation land on County Road 6. Future monitoring well (AMW-3) is planned to be located north of the public water supply wells on the Ashland-Greenwood Public School property north of Furnas Street.

The nitrate-N result from AMW-1 well can be found in Table 10 and is shown in Figure 10.

Table 10. Monitoring Well Groundwater Result

Well ID	Well Name	Sample Date	Nitrate-N mg/L
268120	AMW-1	12/11/2021	8.9

A clearer understanding of nitrate-N in the aquifer will be possible when the two future monitoring wells will be installed, and samples will be collected over a longer period to monitor trends.

AMW-1 was installed on the property adjacent to the deep boring location ADS011. The groundwater sample collected from the bottom of boring at ADS011 was reported at 2.97 mg/L nitrate-N and the soil sampling results were below the background level.

Lower Platte North NRD

Lower Platte South NRD

ADS012
12/22/2020
12.4 mg/L

ADS017A
12/22/2020
0.31 mg/L

ADS014
12/22/2020
0.24 mg/L

12/23/2020
41.3 mg/L

ADS015
12/22/2020
8.96 mg/L

ADS016
12/22/2020
8.76 mg/L

ADS013
12/22/2020
0.53 mg/L

ADS020
12/23/2020
18.1 mg/L

ADS019
12/23/2020
11.9 mg/L

ADS018
12/22/2020
14.1 mg/L

ADS017B
12/23/2020
18.8 mg/L

G-140851
9/30/2021
3.76 mg/L

A-010589C
9/30/2021
3.72 mg/L

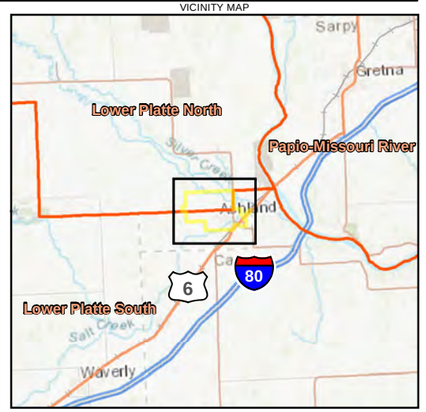
G-185065
9/30/2021
4.68 mg/L

G-070339
9/30/2021
5.24 mg/L

MW-1
12/17/2021
8.9 mg/L

ADS011
12/22/2020
2.27 mg/L

VICINITY MAP



Legend

- NRD Boundary
- CWSPA Boundary
- Monitoring Well (MW)
- Public Supply Wells

Groundwater Results for Nitrate in mg/L

- GW Sample at Bottom of Deep Boring

WhAEM Model - October 2018

- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 900 1,800
Feet

N

Map Date: 3/8/2022
Source: NDEE, USGS, USDA, NeDNR
Projection: NAD 1983 (2011) NE StatePlane

Figure 10
Groundwater Sampling Results
Ashland Nitrate Study for LPSNRD
Ashland, Saunders County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\2 - Ashland Report Evaluation\MXD\Figure 12 - Groundwater Sampling Results.mxd scorcoran

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5.6 NITRATE-N AND LAND USE

The current (2020) land use was recorded for each sample location at each site. Nitrate-N loading by land use is presented in Table 11. The table summarizes the number of sites and samples collected for each land use category and the maximum and average nitrate-N results.

Table 11. Nitrate-N Loading in Soils by Land Use

Land Use	# of Deep Sites	Deep Soil Maximum Nitrate-N lb/ac-ft	Deep Soil Average Nitrate-N lb/ac-ft	# of Shallow Sites	Shallow Soil Maximum Nitrate-N lb/ac-ft	Shallow Soil Average Nitrate-N lb/ac-ft
Irrigated Corn	1	18	14	1	11	5
Dryland Corn	2	18	9	2	18	7
Dryland Soybeans	3	14	10	3	7	4
Range Pasture Grass*	5	18	6	3	43	6

* The Range Pasture Grass group does not include results for site 21 it was believed to be an outlier in this dataset. Discussion in included in section 5.3.4.

5.6.1 Dryland Corn/Soybeans and Irrigated Corn

Many of the soil average nitrate-N levels are elevated and surpass the 8 lb/ac-ft background nitrate average concentration for soils within cultivated cropland sites. It is generally expected that agriculture management includes crop rotation and planted crops most likely change from year to year. The land use listed in Table 11 is the land use observed during the 2020 field investigation and is a snapshot of land use at the time of sampling.

For the shallow soil sampling, the dryland corn and irrigated corn had higher maximum and average nitrate-N levels than dryland soybeans. This is expected within the root zone due to seasonal impacts of the individual crops but was also exhibited to a lesser extent below the root zone.

One deep sample was collected in an irrigated parcel of land at Site 017, which was split between two management practices with dryland soybeans and irrigated corn. All sampled intervals for irrigated corn up to the depth of 25 ft bgs were elevated except the 15-20’ bgs interval which was below background levels. The average nitrate-N in soil samples was 14 lb/ac-ft. The nitrate-N in groundwater at sample Site 017B was 18.8 mg/L.

With elevated levels of nitrate-N present below the root zone in the shallow and deep samples, it is evident that the cropland is contributing as a non-point source to the elevated nitrate-N levels in groundwater within the CWSPA.

5.6.2 Range, Pasture, and Grass

Samples were collected at six locations representing a variety of different grassland managements including range, pasture, or lawn land uses. The land use designation is a broader category to organize maintained and unmaintained lawn, pasture use, and ranges throughout the Ashland CWSPA. The results for Site 021 were considered an outlier and was considered separately. The average nitrate-N concentration for five remaining deep and shallow soil samples are both 6 lb/ac-ft. The maximum nitrate-N concentration in deep soils is 18 lb/ac-ft and in shallow samples is 43 lb/ac-ft. The groundwater samples were collected at the bottom of each deep soil boring. The maximum nitrate-N in groundwater was 18.1 mg/L. Most of the sites reported relatively low nitrate-N results in the deep and shallow borings with very few results above background levels. Sites ADS018 and ADS020 have slightly higher results but the average within deep nitrate-N concentrations were still at background levels (8 lb/ac-ft). This also includes the deepest soils samples results which may have been influenced by groundwater nitrate-N concentrations.

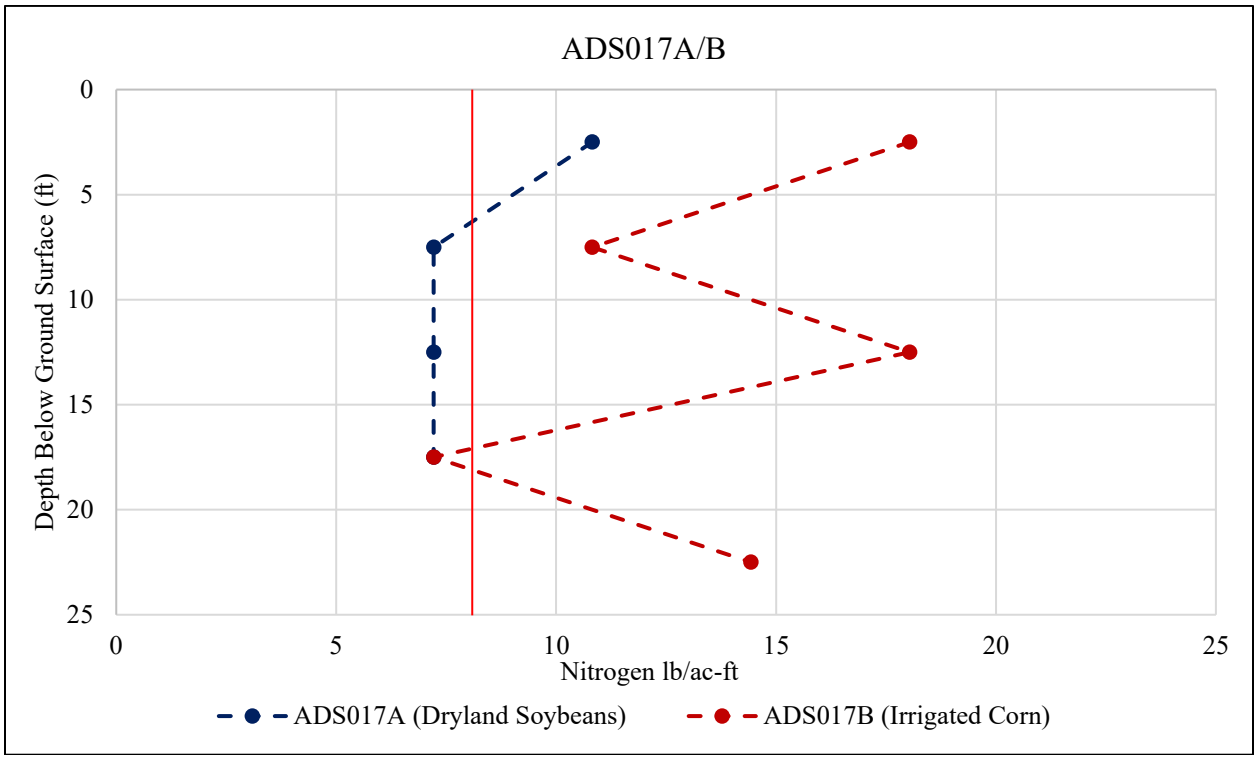
As noted in Section 5.3.4, Site 021 may have had some past uses affecting the site and had unusually high concentrations and is therefore discussed separately. The maximum and average nitrate-N concentrations in deep soils were reported to be 83 lb/ac-ft and 27 lb/ac-ft, respectively. One groundwater sample was collected at the bottom of the deep soil boring, and the nitrate-N in groundwater was 41.3 mg/L.

5.6.3 Nitrate Variability

It is important to note that the results can vary when comparing deep soil nitrate profiles. To evaluate this variability, field data was collected in both shallow and deep borings. The shallow borings collected from a same field often illustrate this variability. For example, the results from site ASS011 (Appendix D) had soil nitrate concentrations below background levels within 4 of the 5 shallow sample locations. However, one of the sample locations had two depths that had highly elevated concentrations of 43 and 40 lb/ac-ft. For the same site, the deep sampling site ADS011 has soil nitrate concentrations below background levels in all depths up to 30 ft.

Another comparison is between two deep borings that were collected in one field with two different land use types, dryland soybeans (ADS017A) and irrigated corn (ADS017B). The nitrate variability within the soil profiles in the pair of samples is presented in Figure 11. As expected, the irrigated corn had higher concentrations; however, concentrations varied throughout the profile.

Figure 11. Variability of Nitrate-N in Deep Profiles in the Same Field



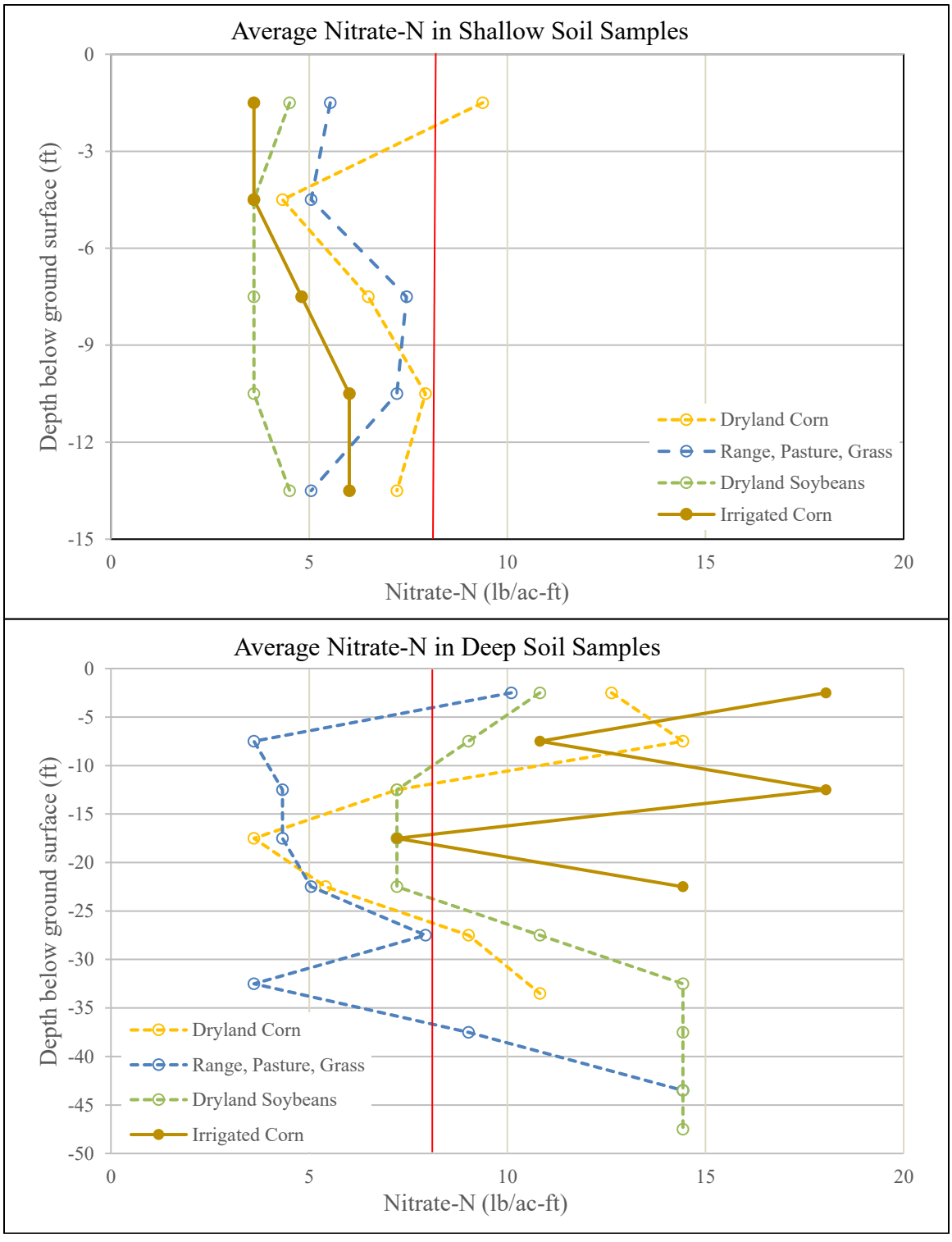
5.6.4 Average Nitrate by Land Use

The shallow soil sampling results were generally low and did not indicate that there was a noticeable difference between land use. The average shallow soil sampling results for each depth by land use is illustrated in Figure 12.

The deep soil sampling results indicated that there are higher average nitrate-N concentrations under sites with crop land uses than sites with range, pasture, and grass land uses, as shown in Figure 12. Site 021 was considered an outlier and not included in averages.

The results indicate that dryland row crops, corn, or soybean sites, had nitrate-N values that were at or exceeded background nitrate-N concentrations and appear to be a non-point source of nitrate loading. At the time of sampling, higher levels of nitrate-N were found in samples collected from dryland corn than from dryland soybeans, but this can be variable from year to year.

Figure 12. Average Nitrate-N in Soil Samples



6. CONCLUSIONS

6.1 LEACHABLE NITRATE-N IN SOIL

Data gathered from soil samples collected during this investigation provided the following conclusions regarding leachable nitrate-N in shallow and deep soils.

6.1.1 Shallow Soil Samples

For this investigation, 199 shallow soil samples were collected to a depth of 15 ft at 3 ft intervals and analyzed for nitrate-N from 8 sampling sites.

The number of soil samples found to have elevated nitrate-N concentrations was relatively low compared to similar investigations. Across all land use types, a total of 13 of the 119 samples (11%) collected from below the root zone had levels of nitrate-N above background levels. Even though this is comparatively low, the shallow soil sample results still indicate that non-point source leaching of nitrate-N is occurring at locations within the study area.

6.1.2 Deep Soil Samples

For this investigation, 76 deep soil samples were collected at 5 ft intervals from twelve direct push sampling sites. Deep soil samples were collected from dryland row crops, corn and soybeans, irrigated corn, and range, pasture and grass fields. Samples were collected in depths ranging up to 50 ft bgs.

Deep soil sample results clearly show that non-point source leaching of nitrate-N is occurring. The average concentrations below cropland were found to be higher than typical range pasture and grass land uses. A total of 14 of the 30 (47%) samples collected from dryland crops and irrigated corn areas had elevated nitrate-N levels above background levels.

One deep sample location (Site 021) had unexpectedly high results for nitrate-N in the soils and in the groundwater. Additional investigation would be needed to clearly determine if this is due to a point source or non-point source.

6.2 NITRATE-N IN GROUNDWATER

Groundwater samples were collected from direct push borings. Historical nitrate-N data for the City of Ashland municipal wells was available from the NDHHS for the years 2003 to 2021. Groundwater monitoring well sampling results were provided by the LPSNRD.

Direct Push Sampling
Direct push groundwater samples were collected from all twelve locations. Groundwater samples were collected from the maximum depth of the boring, typically ranging from 15ft to 50 ft. Nitrate-N was reported in each of the direct push groundwater samples at concentration ranging from 0.24 mg/L to 41.3 mg/L. The direct push results indicate widespread nitrate-N in shallow groundwater within the Ashland CWSPA.

Municipal Well Sampling
As described in previous sections, the nitrate-N concentrations in one of the municipal wells is slightly increasing, and in recent years, all four wells consistently record nitrate-N at about 50% of the MCL. Only one well reached the MCL of 10 mg/L during 2004 sampling.

Monitoring Well Sampling
One new monitoring well was sampled for the first time in December 2021. Initially, the monitoring well will be sampled on a quarterly basis by the LPSNRD. Two additional monitoring wells are planned for the future. The first groundwater sample collected from the monitoring well reported nitrate-N at 8.9 mg/L. Results from future sampling events from the monitoring wells should be reviewed for trends.

6.3 NITRATE LOADING BY LAND USE

The shallow soil sampling results were generally low and did not indicate that there was a noticeable difference between land use. The deep soil sampling results indicated that there are higher average nitrate-N concentrations under sites with crop land uses than sites with range, pasture, and grass land uses, as shown in Figure 12.

The groundwater results indicated that elevated nitrate-N concentrations are widespread across the CWSPA, regardless of land use. However, several of the range, pasture, grass sites (such as Sites 016, 018 and 020) had nitrate levels below background at nearly all levels throughout the soil profile but had high groundwater nitrate-N results. The same sites often have the highest soil concentration from the deepest soil sampling interval, which is likely impacted by the nitrate-N concentrations in the groundwater. This suggests that these sites are contributing minimal amounts of nitrate-N through vertical leaching, but high nitrate groundwater is moving horizontally below the site.

6.4 SOURCES OF NITRATE-N

These results generally indicate that the source of nitrate-N in groundwater across the CWSPA is likely due to application of commercial fertilizer or manure on cropland. No evidence of point sources such as industrial processes, leakage from an industrial or municipal wastewater site, or large spills were identified within the Ashland CWSPA.

One area that is inconclusive is the area surrounding Site 021. Additional investigation would be needed to determine if the source of nitrate-N is from a point source or from non-point source.

6.5 FUTURE LEACHING POTENTIAL

There is leachable nitrate-N in the soil and subsoil within the Ashland CWSPA and a potential for nitrate-N to be leached every year from the subsoil into the groundwater. Little can be done to prevent the existing nitrate-N from continuing to be transported downward by water draining from the root zone and eventually entering the groundwater system. Changes to management practices have potential to reduce the addition of future nitrate loading to the vadose zone. The

LPSNRD (and LPNNRD) have rules and regulations in place that help mitigate nitrate-N using a stepwise approach (Levels or Phases), with different requirements depending on the Level/Phase designation. Nitrate management practices required by the NRDs are generally focused on the education and training of the producer, fertilizer application requirements, and reporting. Due to the time it takes for nitrogen to migrate through the soil, it often takes years for management practices to substantially affect nitrogen concentrations. Effective nitrogen strategies and monitoring consider the delayed responses between management actions and measurable differences. Future monitoring should consider these delays, with a time series of measurements to determine the effects of chosen management on soil and groundwater levels.

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Appendix A

WhAEM Model Review and Data Sheets

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24 January 2020

MEMORANDUM

TO: Dick Ehrman **LOCATION:** LPSNRD–Lincoln

FROM: Dale Schlautman **LOCATION:** EA–Lincoln

SUBJECT: LPSNRD – Nitrate Study for Ashland, Nebraska
Review of Existing WhAEM Results
EA Project No. 63332.02

PURPOSE

The purpose of this memorandum is to document EA Engineering, Science and Technology PBC's (EA's) review of the existing groundwater models developed by the Nebraska Department of Environment and Energy (NDEE) to estimate the 20-year capture zones for the community well fields. This review is a desktop review limited to the information (model files and supporting information) provided by NDEE .

GENERAL

Model Description

The groundwater models were developed by the NDEE based on readily available information. The model used is the U.S. Environmental Protection Agency's (EPA's) Wellhead Analytic Element Model (WhAEM).

WhAEM is a public domain, ground-water flow model designed to facilitate capture zone delineation and protection area mapping intended to support the State's Wellhead Protection Programs (WHPP) and Source Water Assessment Planning (SWAP) for public water supplies in the United States. WhAEM provides an interactive computer environment for design of protection areas based on radius methods, well in uniform flow solutions, and geohydrologic modeling methods. Geohydrologic modeling for steady pumping wells, including the influence of hydrological boundaries, such as rivers, recharge, and no-flow contacts, is accomplished using the analytic element method.

The newest version of the model (Version 3.3.2) was downloaded from the EPA's website. Copies of the modeling results and limited supporting documentation were obtained from the NDEE for Ashland along with electronic model files. Additional supporting information was also requested from NDEE. EA loaded the electronic files into WhAEM to evaluate the assumptions used to determine the 20-year capture zones.

Model Development

The following are some general observations regarding the development of the model for Ashland.

Boundary/Gradient Conditions – The model allows the use of wells, line sinks, barriers and uniform flow to establish boundary conditions and groundwater gradient. The conditions used for each community were site specific.

Aquifer Thickness – It is unknown how aquifer thickness was determined for this site.

Hydraulic Conductivity (K) – It is unknown how K was determined for this site. NDEE typically uses a custom spreadsheet called a 'K Wizard'. It is assumed that this approach was used by NDEE; however, a K Wizard spreadsheet was not provided by NDEE.

Porosity – It is unknown how porosity was determined for this site.

Calibration – It does not appear that any model calibration procedures were conducted, likely due to the limited information available.

ASHLAND RESULTS

The model was last updated in October 2018 by NDEE.

Key Site-Specific Assumptions

Boundary/Gradient Conditions – Static water levels were established using a constant gradient and static water levels from wells. Flow is controlled mostly by the static water levels from the wells. Water levels in the model generally seemed reasonable when compared to the regional water level map.

Wells – The model was developed based on 4 production wells.

- Well G-14085 (Well 1)
  - Registered capacity = Not provided
  - Model rate = 102.8 gallons per minute (gpm)

- Well G-185065 (Well 2)
  - Registered capacity = Not provided
  - Model rate = 76.1 gpm

- Well A-010589C (Well 3)
  - Registered capacity = 750 gpm
  - Model rate = 82.2 gpm

- Well G-070339 (Well 4)
  - Registered capacity = 650 gpm
  - Model rate = 66.6 gpm

Base of Aquifer Elevation – The model used a base of aquifer elevation of 991 feet. This value appears to be reasonable.

Aquifer Thickness – The model used an aquifer thickness of 31 feet and it is not known how the aquifer thickness was determined. Review of the geologic logs from the well registrations yields sand and gravel deposits of 55 to 99 feet thick. Based on the included information, it is unknown how much of the sand and gravel is saturated, which would be the aquifer thickness. Both estimates of sand and gravel deposit thickness include clay lenses interspersed throughout the sand and gravel layers. Of the well logs provided, many of the wells are screened in 20-35 feet of sand and gravel below a clay lens, which may be the basis of the aquifer thickness used. An expanded aquifer thickness could affect the particle flow tracking direction and width.

Hydraulic Conductivity (K) – The model used a K of 109.7 feet/day for the aquifer and it is not known how the K value was determined. According to Table 3.1 of Groundwater Hydrology (Todd, 1980), representative K values are 9 feet/day for fine sand to 148 feet/day for coarse sand. Therefore, the K value of 109.7 feet/day appears to be reasonable.

Porosity – The model used a porosity of 0.20 for the aquifer. This is considered a low value for porosity. According to Advanced Soil Mechanics (Das 2008), porosity in coarse sand ranges from 0.26 to 0.43, but utilizing a lower porosity value generates a more conservative estimate of the wellhead protection area by lengthening the capture zone.

Conclusions

Based on this review the following conclusions are presented:

- Most of the assumptions used to determine the 20-year capture zone appear to be reasonable. While porosity seems to be low, it yields a more conservative capture zone analysis.
- The aquifer thickness may be relatively low. It is unlikely that updating this parameter would yield a significantly different result, however, NDEE may choose to modify this parameter with updated information.

If you have any questions or require additional information, please do not hesitate to contact me at 402-476-3766.

DS/dm

NE3115506

R 9E R 10E

N

W E

S

Wellhead Protection Area Boundary

27 26 25

32 33 34 35 36 31

T 13N
T 12N

T 13N
T 12N

63

6

Salt Creek

Ashland

05 04 03 02 01

08 10 11

G-140851
Well 2006-1
Well #1
Well ID 177281

G-185065
Well 2016-1
Well #2
Well ID 242825

A-010589C
Well 63-1
Well #3
Well ID 3099

G-070339
Well 78-1
Well #4
Well ID 78501

Time-of-Travel lines are created using the U.S. EPA's Wellhead Analytic Element Model, WhAEM2000, 3.2.1 which assumes steady-state flow and average groundwater travel times. This model is a representation of reality based on the best known geologic, water level, and pumping information available. NDEQ will continue to update and revise wellhead protection areas as new information becomes available.

The wellhead protection boundary was deliberately drawn slightly larger than time-of-travel lines shown on the map to allow for seasonal changes and some natural variability in the aquifer. The wellhead protection boundary is also drawn to conform to property boundaries, section lines, and water bodies to allow for easier land management and identification.

Miles
0 0.375 0.75 1.5

Time of Travel

- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

ASHLAND

SAUNDERS

Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, October 2018

DI

NE3115506

Wellhead Protection Area Boundary

R 9E R 10E

Co Rd A

Co Rd 7

Co Rd 4

Industrial Rd

Emery Rd

Ashland Rd

Cooper Rd

Co Rd 5

N 30th St

Furnas St

Euclid St

Dawes St

Clay St

Boyd St

Adams St

Silver St

Birch St

Dale St

S 6th St

Burlington Northern RR

Salt Creek

Ashland

63

6

T 13N
T 12N

27 26 25 33 34 35 36 31 32 05 04 03 02 01 10 11 08

G-140851
Well 2006-1
Well #1
Well ID 177281

G-185065
Well 2016-1
Well #2
Well ID 242825

A-010589C
Well 63-1
Well #3
Well ID 3099

G-070339
Well 78-1
Well #4
Well ID 78501

Time-of-Travel lines are created using the U.S. EPA's Wellhead Analytic Element Model, WhAEM2000, 3.2.1 which assumes steady-state flow and average groundwater travel times. This model is a representation of reality based on the best known geologic, water level, and pumping information available. NDEQ will continue to update and revise wellhead protection areas as new information becomes available.

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Miles
0 0.375 0.75 1.5

Time of Travel
- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

ASHLAND

SAUNDERS

Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, October 2018

DI

HydroGeology of the Ashland Region

NE3115506

R 8E R 9E

R 9E R 10E

T 13N
T 12N

T 13N
T 12N

R 8E R 9E

R 9E R 10E

Burlington Northern RR

Burlington Northern Santa Fe Rlwy

Burlington Northern RR

Burlington Northern RR

63

6

6

6

6

66

66

80

80

G-140851
Well 2006-1
Well #1
Well ID 177281

G-185065
Well 2016-1
Well #2
Well ID 242825

A-010589C
Well 63-1
Well #3
Well ID 3099

G-070339
Well 78-1
Well #4
Well ID 78501

N
W
E
S

Legend

- PumpingWells
- Revised_WHPA
- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 0.75 1.5 3 Miles

Geology

- Principle Aquifer Absent

Glacial Till

- Glacial till < 50 ft.
- Glacial till > 150 ft.

Bedrock

- Dakota
- Douglas
- Kansas City
- Lansing
- Shawnee

HydroGeology of the Ashland Region

NE3115506

R 8E R 9E

R 9E R 10E

T 13N
T 12N

T 13N
T 12N

R 8E R 9E

R 9E R 10E

Burlington Northern RR

Burlington Northern Santa Fe Rlwy

Burlington Northern RR

Burlington Northern RR

G-140851
Well 2006-1
Well #1
Well ID 177281

G-185065
Well 2016-1
Well #2
Well ID 242825

A-010589C
Well 63-1
Well #3
Well ID 3099

G-070339
Well 78-1
Well #4
Well ID 78501

Legend

- Municipal Wells
- WHP Boundary
- 0-1 Year
- 1-2 Year
- 2-10 Year
- 10-20 Year

0 0.75 1.5 3 Miles

Geology

- Base of Aquifer
- 1995 Water Table
- 1979 Water Table

Bedrock

- Dakota
- Douglas
- Kansas City
- Lansing
- Shawnee

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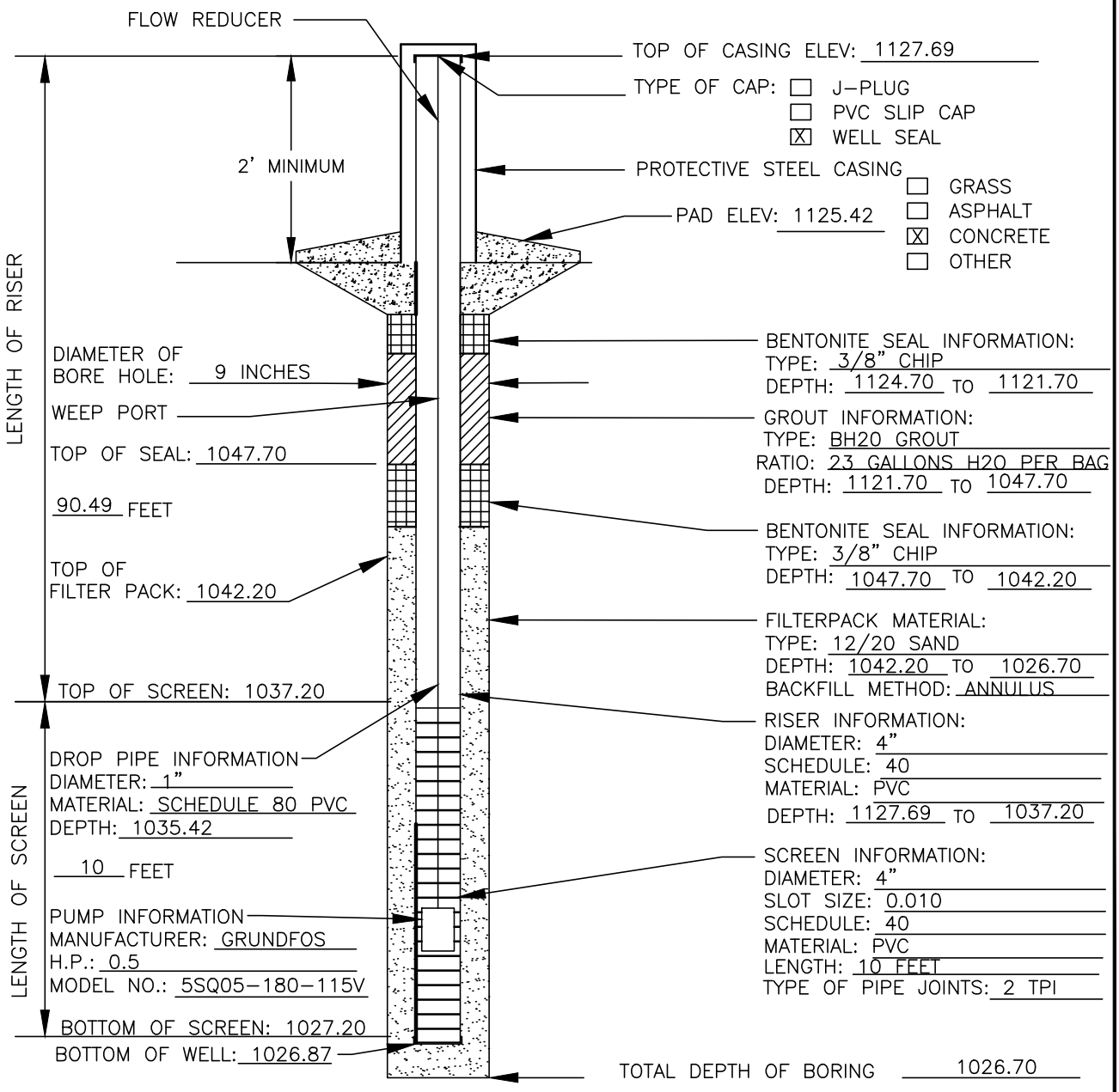
Appendix B

Monitoring Well Construction Forms and Boring Logs

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
GROUND-WATER MONITORING WELL
STICK-UP COMPLETION

Project Name/ Project Number: LPSNRD 2 NITRATE/6333202	Start Date: 11/23/2021	Completion Date: 12/1/2021
Well ID: AMW-1	Drilling Method: MUD ROTARY	Depth of Water (FT. TOC): 69.95
Driller Name, Company and Registration #: SAM WULF, PETERSON DRILLING, INC., #39440		
Geologist Name: TRAVIS HERMAN		

NOTES: 1. ALL FEATURES NOT TO SCALE



EA Engineering, Science and, Technology, Inc., PBC

BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	98 ft	**BORING NO.:**	AMW-1
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,125.42	**DATE DRILLED:**	11/23/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2638753.346	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	459332.6256	**TYPE OF SURFACE:**	Grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	69.95 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR 3/4	OL	Organic top layer, grass, sandy silt, dark yellowish brown, 10-20% vf sand, low to medium plasticity, roots	Grab		0		
5	1120.4		10YR 5/4	SP	Sand, yellowish brown, vf to medium, rounded/sub-angular, nonplastic, trace of black medium grains	Grab		0		
10	1115.4		10YR 5/4	SP	Same as previous	Grab		0		
15	1110.4		10YR 5/4	SP	Same as previous	Grab		0		
20	1105.4		10YR 5/4	SP	Same as previous	Grab		0		
25	1100.4									

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BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	98 ft	**BORING NO.:**	AMW-1
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,125.42	**DATE DRILLED:**	11/23/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2638753.346	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	459332.6256	**TYPE OF SURFACE:**	Grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	69.95 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR 5/4	SP	Same as previous	Grab		0		
30	1095.4									
			10YR 5/4	SP	Same as previous	Grab		0		
35	1090.4									
			10YR 5/4	SP	Same as previous	Grab		0		
40	1085.4									
			10YR 5/4	SP	Same as previous, mostly rounded very fine grains	Grab		0		
45	1080.4									
			10YR 5/4	SW	Sand, vf to coarse, yellowish brown, some multi-colored fine gravel, rounded to sub-angular, nonplastic	Grab		0		
50	1075.4									

EA Engineering, Science and, Technology, Inc., PBC

BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	98 ft	**BORING NO.:**	AMW-1
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,125.42	**DATE DRILLED:**	11/23/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2638753.346	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	459332.6256	**TYPE OF SURFACE:**	Grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	69.95 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR 5/4	SW	Same as previous	Grab		0		
55	1070.4		10YR 5/4	SW	Same as previous	Grab		0		
60	1065.4		10YR 5/4	SW	Same as previous	Grab		0		
65	1060.4		10YR 5/4	SW	Same as previous	Grab		0		
▼										
70	1055.4		10YR 6/4	SP	Sand, very fine grain, light yellowish brown, rounded, trace coarse sand, trace black medium sub-angular grains	Grab		0		
75	1050.4									

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BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	98 ft	**BORING NO.:**	AMW-1
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,125.42	**DATE DRILLED:**	11/23/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2638753.346	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	459332.6256	**TYPE OF SURFACE:**	Grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	69.95 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR 6/4	SP	Same as previous	Grab				
80	1045.4		10YR 6/4	SP	Same as previous, mostly medium grain, rounded to sub-angular	Grab				
85	1040.4		10YR 6/4	SP	Same as previous	Grab				
90	1035.4		10YR 6/4	SP	Same as previous, trace of coarse angular black grains	Grab				
95	1030.4		10YR 6/4	SP	Same as previous 96'-98' coarse sands/fine gravels, calcareous fragments (reacts with HCL), trace black clay	Grab				
100	1025.4				BOH @ 98' bgs Screened Interval: 87.5' - 97.5' Surface Elevation collected from concrete well pad Indicates groundwater elevation from surface					

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS011
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,088.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4546114.00	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720172.10	**TYPE OF SURFACE:**	Grass / Cattle Pasture
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	27 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR3/1	ML	Silt, very dark gray, dry, root traces, trace very fine sand	DPT	60	100		
5	1083.0					DPT	60	100		
			10YR3/3	ML	Sandy silt, dark brown, dry, root traces, very fine sand grains					
			10YR7/3	SP	Sand, very pale brown, dry to moist, very fine sand grains					
10	1078.0					DPT	60	100		
15	1073.0				Same as previous	DPT	60	100		
20	1068.0				Same as previous	DPT	60	100		
25	1063.0									

EA Engineering, Science and, Technology, Inc., PBC

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS011
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,088.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4546114.00	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720172.10	**TYPE OF SURFACE:**	Grass / Cattle Pasture
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	27 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous, saturated	DPT	60	100		
30	1058.0									
					Bottom of Hole @ 30 feet			0		
35	1053.0							0		
40	1048.0							0		
45	1043.0							0		
50	1038.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS012
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,095.00	**DATE DRILLED:**	12/13/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4548411.47	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718469.72	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	26 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/4	ML	Silt, dark yellowish brown, med to high stiffness, dry to moist	DPT	36	60		
5	1090.0									
			10YR4/4	ML	Clayey silt, dark yellowish brown, low to med stiffness, moist to wet	DPT	48	80		
10	1085.0									
					Same as previous	DPT	60	100		
			10YR7/2	SP	Sand, light gray, low to med density, moist to wet, fine to med sand grains					
15	1080.0									
						DPT	60	100		
20	1075.0									
					Same as previous, very fine to fine sand grains	DPT	60	100		
25	1070.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS012
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,095.00	**DATE DRILLED:**	12/13/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4548411.47	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718469.72	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	26 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous, wet to saturated	DPT	60	100		
30	1065.0				Bottom of Hole @ 30 feet			0		
35	1060.0							0		
40	1055.0							0		
45	1050.0							0		
50	1045.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS013
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,093.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	719766.48	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	4547229.64	**TYPE OF SURFACE:**	Pasture / Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	28 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR3/3	ML	Silt loam, dark brown, med to high stiffness, moist, root traces	DPT	60	100		
5	1088.0					DPT	60	100		
			10YR4/4	CL	Silty clay, dark yellowish brown, low to med stiffness, moist					
10	1083.0				Same as previous	DPT	60	100		
15	1078.0		10YR6/2	SP	Sand, light brownish gray, med to high density, moist to wet, very fine to fine sand grains	DPT	60	100		
20	1073.0				Same as previous, very fine to medium sand grains	DPT	60	100		
25	1068.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS013
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,093.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	719766.48	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	4547229.64	**TYPE OF SURFACE:**	Pasture / Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	28 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR6/3		Same as previous, pale brown, wet to saturated at depth	DPT	60	100		
30	1063.0									
					Same as previous, saturated	DPT	60	100		
35	1058.0									
					Bottom of Hole @ 35 feet			0		
40	1053.0							0		
45	1048.0							0		
50	1043.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	15 ft	**BORING NO.:**	ADS014
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,072.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4548023.59	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	719520.08	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	11 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR2/1	ML	Silt loam, black, low to med stiffness, moist, root traces	DPT	60	100		
			10YR5/3	ML	Sandy silt, brown, low to med stiffness, moist, very fine sand grains					
			10YR2/1	ML	Silt loam, black, medium stiffness, moist, trace very fine sand grains					
5	1067.0					DPT	60	100		
			10YR5/1	ML	Silt loam, gray, low to med stiffness, moist					
10	1062.0					DPT	60	100		
			10YR2/2	CL	Silty clay, very dark brown, med to high stiffness, saturated					
15	1057.0									
					Bottom of Hole @ 15 feet			0		
20	1052.0							0		
25	1047.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS015
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,107.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547674.76	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717720.95	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	33 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/3	ML	Silt loam, brown, med to high stiffness, moist, root traces	DPT	60	100		
5	1102.0				Same as previous, low to med stiffness	DPT	60	100		
10	1097.0					DPT	60	100		
			10YR7/3	SP	Sand, very pale brown, med to high density, moist, very fine to fine sand grains					
15	1092.0				Same as previous, fine to med sand grains at depth	DPT	60	100		
20	1087.0				Same as previous	DPT	60	100		
25	1082.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS015
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,107.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547674.76	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717720.95	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	33 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous	DPT	60	100		
30	1077.0									
					Same as previous, wet to saturated at depth	DPT	60	100		
35	1072.0									
					Bottom of Hole @ 35 feet			0		
40	1067.0									
								0		
45	1062.0									
								0		
50	1057.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS016
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,100.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547356.95	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718613.39	**TYPE OF SURFACE:**	Horse Pasture
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	28 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR5/4	ML	Silt, yellowish brown, med to high stiffness, dry to moist, root traces	DPT	60	100		
5	1095.0				Same as previous, low to med stiffness	DPT	60	100		
			10YR7/3	SP	Sand, very pale brown, low to med density, dry to moist, very fine sand grains					
10	1090.0					DPT	60	100		
15	1085.0				Same as previous	DPT	60	100		
20	1080.0				Same as previous, med to high density	DPT	60	100		
25	1075.0									

EA Engineering, Science and, Technology, Inc., PBC

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS016
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,100.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547356.95	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718613.39	**TYPE OF SURFACE:**	Horse Pasture
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	28 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous, wet to saturated, fine to med sand grains	DPT	60	100		
30	1070.0				Bottom of Hole @ 30 feet			0		
35	1065.0							0		
40	1060.0							0		
45	1055.0							0		
50	1050.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	20 ft	**BORING NO.:**	ADS017A
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,070.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4548256.04	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720096.81	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	11 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR2/2	ML	Clayey silt, very dark brown, med to high stiffness, moist, root traces	DPT	60	100		
5	1065.0		10YR4/1	ML	Sandy silt, dark gray, low to med stiffness, moist, very fine sand grains	DPT	60	100		
			10YR2/2	ML	Clayey silt, very dark brown, low to med stiffness, moist, trace very fine sand					
10	1060.0				Same as previous	DPT	60	100		
15	1055.0				Same as previous, med to high stiffness, saturated	DPT	60	100		
20	1050.0				Bottom of Hole @ 20 feet			0		
25	1045.0									

EA Engineering, Science and, Technology, Inc., PBC

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	25 ft	**BORING NO.:**	ADS017B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,082.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547378.83	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720138.56	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	22 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR2/1	ML	Silt, black, med to high stiffness, dry to moist	DPT	60	100		
			10YR2/2	ML	Clayey silt loam, very dark brown, med to high stiffness, moist					
5	1077.0		10YR4/4	CL	Silty clay, dark yellowish brown, med to high stiffness, moist, trace of very fine sand	DPT	60	100		
10	1072.0				Same as previous, low to med stiffness, moist to wet	DPT	60	100		
15	1067.0		10YR4/3	SP	Sand, brown, low to med density, wet, very fine to fine sand grains	DPT	60	100		
20	1062.0		10YR7/2		Same as previous, light gray, med to high density	DPT	60	100		
25	1057.0				Same as previous, fine to med sand grains, saturated					

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	25 ft	**BORING NO.:**	ADS017B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,082.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547378.83	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720138.56	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	22 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Bottom of Hole @ 25 feet			0		
30	1052.0							0		
35	1047.0							0		
40	1042.0							0		
45	1037.0							0		
50	1032.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	ADS018
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,115.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547238.46	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718202.17	**TYPE OF SURFACE:**	Maintained brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	42 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR6/4	ML	Silt, light yellowish brown, med to high stiffness, dry/friable, root traces	DPT	60	100		
5	1110.0				Same as previous	DPT	60	100		
10	1105.0				Same as previous	DPT	60	100		
			10YR6/2	SP	Sand, light brownish gray, low to med density, dry to moist, very fine sand grains					
15	1100.0				Same as previous, moist, very fine to fine sand grains	DPT	60	100		
20	1095.0				Same as previous, moist to wet	DPT	60	100		
25	1090.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	ADS018
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,115.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547238.46	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	718202.17	**TYPE OF SURFACE:**	Maintained brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	42 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous	DPT	60	100		
30	1085.0				Same as previous, med to high densty, very fine sand grains	DPT	60	100		
35	1080.0				Same as previous, some medium sand grains	DPT	60	100		
40	1075.0				Same as previous, wet to saturated	DPT	60	100		
45	1070.0				Bottom of Hole @ 45 feet			0		
50	1065.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	50 ft	**BORING NO.:**	ADS019
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,110.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547316.96	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717886.38	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	38 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR3/2	ML	Silt, very dark grayish brown, med to high stiffness, dry to moist, root traces	DPT	60	100		
5	1105.0					DPT	60	100		
			10YR4/3	ML	Clayey silt, brown, low to med stiffness, moist to wet					
10	1100.0				Same as previous	DPT	60	100		
15	1095.0				Same as previous	DPT	60	100		
			10YR7/3	SP	Sand, very pale brown, low to med density, moist to wet, very fine sand grains					
20	1090.0					DPT	60	100		
			10YR6/2	SP	Sand, light brownish gray, med to high density, moist, very fine to fine sand grains					
25	1085.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	50 ft	**BORING NO.:**	ADS019
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,110.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547316.96	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717886.38	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	38 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous	DPT	60	100		
			10YR4/2	CL	Clay, dark grayish brown, low to med stiffness, moist to wet					
30	1080.0				Same as previous, low to med stiffness, wet	DPT	60	100		
35	1075.0				Same as previous	DPT	60	100		
40	1070.0				Same as previous	DPT	60	100		
					Increases to med to high stiffness, moist					
45	1065.0		10YR5/4	SP	Clayey sand, yellowish brown, med to high density, wet to saturated	DPT	60	100		
			10YR6/3	SP	Sand, pale brown, med to high density, saturated, very fine to fine sand grains, iron staining					
50	1060.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	50 ft	**BORING NO.:**	ADS019
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,110.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547316.96	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717886.38	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	38 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Bottom of Hole @ 50 feet			0		
55	1055.0							0		
60	1050.0							0		
65	1045.0							0		
70	1040.0							0		
75	1035.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS020
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,084.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547295.71	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720659.47	**TYPE OF SURFACE:**	Maintained Grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	24 ft		(Ashland School lawn)

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/3	ML	Silt, brown, med to high stiffness, dry to moist, root traces	DPT	60	100		
5	1079.0					DPT	60	100		
			10YR4/3	CL	Silty clay, brown, low to med stiffness, moist to wet					
10	1074.0				Same as previous	DPT	60	100		
15	1069.0		10YR7/2	SP	Sand, light gray, low to med density, moist to wet, very fine to fine sand grains	DPT	60	100		
20	1064.0				Same as previous	DPT	60	100		
25	1059.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	30 ft	**BORING NO.:**	ADS020
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,084.00	**DATE DRILLED:**	12/8/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547295.71	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	720659.47	**TYPE OF SURFACE:**	Maintained Grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	24 ft		(Ashland School lawn)

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR6/3	SP	Sand, pale brown, med to high density, saturated, fine to coarse sand grains	DPT	60	100		
30	1054.0									
					Bottom of Hole @ 30 feet			0		
35	1049.0							0		
40	1044.0							0		
45	1039.0							0		
50	1034.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS021
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,112.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547935.05	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717909.13	**TYPE OF SURFACE:**	Maintained grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	34 ft		(residence front yard)

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/2	ML	Silt, dark grayish brown, dry, root traces, trace of very fine sand	DPT	36	60		
5	1107.0					DPT	60	100		
			10YR4/4	ML	Silt loam, dark yellowish brown, moist, medium stiffness					
10	1102.0					DPT	48	80		
			10YR7/3	SP	Sand, very pale brown, moist, very fine sand grains					
15	1097.0				Same as previous	DPT	60	100		
20	1092.0				Same as previous	DPT	60	100		
25	1087.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	ADS021
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,112.00	**DATE DRILLED:**	12/7/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4547935.05	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	717909.13	**TYPE OF SURFACE:**	Maintained grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	34 ft		(residence front yard)

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
					Same as previous	DPT	60	100		
30	1082.0					DPT	60	100		
			10YR5/4	SW	Sand, yellowish brown, med to high density, saturated, fine to coarse sand grains					
35	1077.0				Bottom of Hole @ 35 feet			0		
40	1072.0							0		
45	1067.0							0		
50	1062.0									

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Appendix C

Laboratory Results

REPORT NUMBER
20-351-0574 v2
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS011

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73757	ADS011-05																								
73758	ADS011-10																								
73759	ADS011-15																								
73760	ADS011-20																								
73761	ADS011-25																								
73762	ADS011-30																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73757	2	3	0-5							3																
73758	1	2	5-10							2																
73759	1	2	10-15							2																
73760	1	2	15-20							2																
73761	1	2	20-25							2																
73762	1	2	25-30							2																

REV.10/17

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

REPORT NUMBER
20-351-0575
COMPLETED DATE
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ADS012

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73763	ADS012-05																								
73764	ADS012-10																								
73765	ADS012-15																								
73766	ADS012-20																								
73767	ADS012-25																								
73768	ADS012-30																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73763	2	3	0-5							3																
73764	3	4	5-10							4																
73765	2	3	10-15							3																
73766	1	2	15-20							2																
73767	2	3	20-25							3																
73768	4	6	25-30							6																

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REPORT NUMBER
20-351-0576
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
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ADS013

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73769	ADS013-05																								
73770	ADS013-10																								
73771	ADS013-15																								
73772	ADS013-20																								
73773	ADS013-25																								
73774	ADS013-30																								
73775	ADS013-35																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
73769	2	3	0-5							3															
73770	1	2	5-10							2															
73771	1	2	10-15							2															
73772	1	2	15-20							2															
73773	1	2	20-25							2															
73774	1	2	25-30							2															
73775	1	2	30-35							2															

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The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

REPORT NUMBER
20-351-0577
COMPLETED DATE
Dec 18, 2020
ACCOUNT
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ADS014

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73776	ADS014-05																								
73777	ADS014-10																								
73778	ADS014-15																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
73776	3	4	0-5							4															
73777	1	2	5-10							2															
73778	1	2	10-15							2															

REV.10/17

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REPORT NUMBER
20-351-0578
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ADS015

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73779	ADS015-05																								
73780	ADS015-10																								
73781	ADS015-15																								
73782	ADS015-20																								
73783	ADS015-25																								
73784	ADS015-30																								
73785	ADS015-35																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73779	5	8	0-5							8																
73780	5	8	5-10							8																
73781	2	3	10-15							3																
73782	1	2	15-20							2																
73783	1	2	20-25							2																
73784	1	2	25-30							2																
73785	3	4	30-35							4																

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REPORT NUMBER
20-351-0579
COMPLETED DATE
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ADS016

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73786	ADS016-05																								
73787	ADS016-10																								
73789	ADS016-15																								
73790	ADS016-20																								
73791	ADS016-25																								
73792	ADS016-30																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73786	3	4	0-5							4																
73787	1	2	5-10							2																
73789	1	2	10-15							2																
73790	1	2	15-20							2																
73791	1	2	20-25							2																
73792	2	3	25-30							3																

REV.10/17

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REPORT NUMBER
20-351-0581
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
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Dec 18, 2020

LOWER PLATTE SOUTH NRD
CHRIS WITTHUHN
PO BOX 83581
LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS017A

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73802	ADS017A-05																								
73803	ADS017A-10																								
73804	ADS017A-15																								
73805	ADS017A-20																								
73806	ADS017B-05																								
73807	ADS017B-10																								
73808	ADS017B-15																								
73809	ADS017B-20																								
73810	ADS017B-25																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
73802	3	4	0-5							4															
73803	2	3	5-10							3															
73804	2	3	10-15							3															
73805	2	3	15-20							3															
73806	5	8	0-5							8															
73807	3	4	5-10							4															
73808	5	8	10-15							8															
73809	2	3	15-20							3															
73810	4	6	20-25							6															

REV.10/17

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REPORT NUMBER
20-351-0580
COMPLETED DATE
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ACCOUNT
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RECEIVED DATE
Dec 16, 2020

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS018

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73793	ADS018-05																								
73794	ADS018-10																								
73795	ADS018-15																								
73796	ADS018-20																								
73797	ADS018-25																								
73798	ADS018-30																								
73799	ADS018-35																								
73800	ADS018-40																								
73801	ADS018-45																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73793	3	4	0-5							4																
73794	1	2	5-10							2																
73795	2	3	10-15							3																
73796	2	3	15-20							3																
73797	2	3	20-25							3																
73798	2	3	25-30							3																
73799	1	2	30-35							2																
73800	2	3	35-40							3																
73801	4	6	40-45							6																

REV.10/17

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REPORT NUMBER
20-351-0582
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS019

SOIL ANALYSIS REPORT

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73811	ADS019-05																								
73812	ADS019-10																								
73813	ADS019-15																								
73814	ADS019-20																								
73815	ADS019-25																								
73816	ADS019-30																								
73817	ADS019-35																								
73818	ADS019-40																								
73819	ADS019-45																								
73820	ADS019-50																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73811	3	4	0-5							4																
73812	3	4	5-10							4																
73813	2	3	10-15							3																
73814	2	3	15-20							3																
73815	2	3	20-25							3																
73816	3	4	25-30							4																
73817	4	6	30-35							6																
73818	4	6	35-40							6																
73819	4	6	40-45							6																
73820	4	6	45-50							6																

REV.10/17

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REPORT NUMBER
20-351-0583
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS020

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73821	ADS020-05																								
73822	ADS020-10																								
73823	ADS020-15																								
73824	ADS020-20																								
73825	ADS020-25																								
73826	ADS020-30																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73821	4	6	0-5							6																
73822	1	2	5-10							2																
73823	1	2	10-15							2																
73824	1	2	15-20							2																
73825	2	3	20-25							3																
73826	5	8	25-30							8																

REV.10/17

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REPORT NUMBER
20-351-0584
COMPLETED DATE
Dec 18, 2020
ACCOUNT
8722
RECEIVED DATE
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ADS021

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *374*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
73828	ADS021-05																								
73829	ADS021-10																								
73830	ADS021-15																								
73831	ADS021-20																								
73832	ADS021-25																								
73833	ADS021-30																								
73834	ADS021-35																								

LAB NUMBER *374*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
73828	2	3	0-5							3																
73829	1	2	5-10							2																
73830	23	34	10-15							34																
73831	16	24	15-20							24																
73832	5	8	20-25							8																
73833	2	3	25-30							3																
73834	4	6	30-35							6																

REV.10/17

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REPORT NUMBER
20-330-0097
COMPLETED DATE
Nov 28, 2020
ACCOUNT
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Nov 24, 2020

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS011

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72836	ASS011-01-03																								
72837	ASS011-01-06																								
72838	ASS011-01-09																								
72839	ASS011-01-12																								
72840	ASS011-01-15																								
72841	ASS011-02-03																								
72842	ASS011-02-06																								
72843	ASS011-02-09																								
72844	ASS011-02-12																								
72845	ASS011-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72836	1	1	0-3							1															
72837	1	1	3-6							1															
72838	12	11	6-9							11															
72839	11	10	9-12							10															
72840	2	2	12-15							2															
72841	1	1	0-3							1															
72842	1	1	3-6							1															
72843	1	1	6-9							1															
72844	1	1	9-12							1															
72845	1	1	12-15							1															

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS011

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72846	ASS011-03-03																								
72847	ASS011-03-06																								
72848	ASS011-03-09																								
72849	ASS011-03-12																								
72850	ASS011-03-15																								
72851	ASS011-04-03																								
72853	ASS011-04-06																								
72854	ASS011-04-09																								
72855	ASS011-04-12																								
72856	ASS011-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72846	1	1	0-3							1																
72847	1	1	3-6							1																
72848	1	1	6-9							1																
72849	1	1	9-12							1																
72850	1	1	12-15							1																
72851	1	1	0-3							1																
72853	1	1	3-6							1																
72854	1	1	6-9							1																
72855	1	1	9-12							1																
72856	1	1	12-15							1																

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IDENTIFICATION
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ASS011

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72857	ASS011-05-03																								
72858	ASS011-05-06																								
72859	ASS011-05-09																								
72860	ASS011-05-12																								
72861	ASS011-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72857	2	2	0-3							2																
72858	1	1	3-6							1																
72859	1	1	6-9							1																
72860	1	1	9-12							1																
72861	1	1	12-15							1																

REV.10/17

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Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MJJ Date/Time: 11/24/20

50

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS011-01-03	11-20-2020	1200	Soil	X				
ASS011-01-06	11-20-2020	1201	Soil	X				
ASS011-01-09	11-20-2020	1202	Soil	X				
ASS011-01-12	11-20-2020	1203	Soil	X				
ASS011-01-15	11-20-2020	1204	Soil	X				
ASS011-02-03	11-20-2020	1219	Soil	X				
ASS011-02-06	11-20-2020	1220	Soil	X				
ASS011-02-09	11-20-2020	1221	Soil	X				
ASS011-02-12	11-20-2020	1222	Soil	X				
ASS011-02-15	11-20-2020	1223	Soil	X				
ASS011-03-03	11-20-2020	1234	Soil	X				
ASS011-03-06	11-20-2020	1235	Soil	X				
ASS011-03-09	11-20-2020	1236	Soil	X				
ASS011-03-12	11-20-2020	1237	Soil	X				
ASS011-03-15	11-20-2020	1238	Soil	X				

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37272836 – 37272886

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS011-04-03	11-20-2020	1254	Soil	X				
ASS011-04-06	11-20-2020	1255	Soil	X				
ASS011-04-09	11-20-2020	1256	Soil	X				
ASS011-04-12	11-20-2020	1257	Soil	X				
ASS011-04-15	11-20-2020	1258	Soil	X				
ASS011-05-03	11-20-2020	1339	Soil	X				
ASS011-05-06	11-20-2020	1340	Soil	X				
ASS011-05-09	11-20-2020	1341	Soil	X				
ASS011-05-12	11-20-2020	1342	Soil	X				
ASS011-05-15	11-20-2020	1343	Soil	X				
ASS012-01-03	11-20-2020	1728	Soil	X				
ASS012-01-06	11-20-2020	1729	Soil	X				
ASS012-01-09	11-20-2020	1730	Soil	X				
ASS012-01-12	11-20-2020	1731	Soil	X				
ASS012-01-15 13 TH	11-20-2020	1732	Soil	X				
ASS012-02-03	11-20-2020	1745	Soil	X				
ASS012-02-06	11-20-2020	1746	Soil	X				
ASS012-02-09	11-20-2020	1747	Soil	X				
ASS012-02-12	11-20-2020	1748	Soil	X				
ASS012-02-15	11-20-2020	1749	Soil	X				
ASS012-03-03	11-20-2020	1804	Soil	X				
ASS012-03-06	11-20-2020	1805	Soil	X				
ASS012-03-09	11-20-2020	1806	Soil	X				
ASS012-03-12	11-20-2020	1807	Soil	X				
ASS012-03-15	11-20-2020	1808	Soil	X				
ASS012-04-03	11-20-2020	1824	Soil	X				
ASS012-04-06	11-20-2020	1825	Soil	X				
ASS012-04-09	11-20-2020	1826	Soil	X				
ASS012-04-12	11-20-2020	1827	Soil	X				
ASS012-04-15 13 TH	11-20-2020	1828	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS012-05-03	11-20-2020	1842	Soil	X				
ASS012-05-06	11-20-2020	1843	Soil	X				
ASS012-05-09	11-20-2020	1844	Soil	X				
ASS012-05-12	11-20-2020	1845	Soil	X				
ASS012-05-~~15~~ 14 TH	11-20-2020	1846	Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				

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PO BOX 83581
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS012

SOIL ANALYSIS REPORT

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72862	ASS012-01-03																								
72863	ASS012-01-06																								
72864	ASS012-01-09																								
72865	ASS012-01-12																								
72866	ASS012-01-13																								
72867	ASS012-02-03																								
72868	ASS012-02-06																								
72869	ASS012-02-09																								
72870	ASS012-02-12																								
72871	ASS012-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72862	2	2	0-3							2																
72863	1	1	3-6							1																
72864	2	2	6-9							2																
72865	2	2	9-12							2																
72866	2	1	12-13							1																
72867	2	2	0-3							2																
72868	1	1	3-6							1																
72869	2	2	6-9							2																
72870	2	2	9-12							2																
72871	3	3	12-15							3																

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SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72872	ASS012-03-03																								
72873	ASS012-03-06																								
72874	ASS012-03-09																								
72875	ASS012-03-12																								
72876	ASS012-03-15																								
72877	ASS012-04-03																								
72878	ASS012-04-06																								
72879	ASS012-04-09																								
72880	ASS012-04-12																								
72881	ASS012-04-13																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72872	5	4	0-3							4															
72873	3	3	3-6							3															
72874	3	3	6-9							3															
72875	4	4	9-12							4															
72876	4	4	12-15							4															
72877	2	2	0-3							2															
72878	1	1	3-6							1															
72879	2	2	6-9							2															
72880	4	4	9-12							4															
72881	2	1	12-13							1															

REV.10/17

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS012

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72882	ASS012-05-03																								
72883	ASS012-05-06																								
72884	ASS012-05-09																								
72885	ASS012-05-12																								
72886	ASS012-05-14																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72882	2	2	0-3							2																
72883	1	1	3-6							1																
72884	3	3	6-9							3																
72885	2	2	9-12							2																
72886	1	1	12-14							1																

REV.10/17

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Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

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Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS011-01-03	11-20-2020	1200	Soil	X				
ASS011-01-06	11-20-2020	1201	Soil	X				
ASS011-01-09	11-20-2020	1202	Soil	X				
ASS011-01-12	11-20-2020	1203	Soil	X				
ASS011-01-15	11-20-2020	1204	Soil	X				
ASS011-02-03	11-20-2020	1219	Soil	X				
ASS011-02-06	11-20-2020	1220	Soil	X				
ASS011-02-09	11-20-2020	1221	Soil	X				
ASS011-02-12	11-20-2020	1222	Soil	X				
ASS011-02-15	11-20-2020	1223	Soil	X				
ASS011-03-03	11-20-2020	1234	Soil	X				
ASS011-03-06	11-20-2020	1235	Soil	X				
ASS011-03-09	11-20-2020	1236	Soil	X				
ASS011-03-12	11-20-2020	1237	Soil	X				
ASS011-03-15	11-20-2020	1238	Soil	X				

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LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS011-04-03	11-20-2020	1254	Soil	X				
ASS011-04-06	11-20-2020	1255	Soil	X				
ASS011-04-09	11-20-2020	1256	Soil	X				
ASS011-04-12	11-20-2020	1257	Soil	X				
ASS011-04-15	11-20-2020	1258	Soil	X				
ASS011-05-03	11-20-2020	1339	Soil	X				
ASS011-05-06	11-20-2020	1340	Soil	X				
ASS011-05-09	11-20-2020	1341	Soil	X				
ASS011-05-12	11-20-2020	1342	Soil	X				
ASS011-05-15	11-20-2020	1343	Soil	X				
ASS012-01-03	11-20-2020	1728	Soil	X				
ASS012-01-06	11-20-2020	1729	Soil	X				
ASS012-01-09	11-20-2020	1730	Soil	X				
ASS012-01-12	11-20-2020	1731	Soil	X				
ASS012-01-15 13 TH	11-20-2020	1732	Soil	X				
ASS012-02-03	11-20-2020	1745	Soil	X				
ASS012-02-06	11-20-2020	1746	Soil	X				
ASS012-02-09	11-20-2020	1747	Soil	X				
ASS012-02-12	11-20-2020	1748	Soil	X				
ASS012-02-15	11-20-2020	1749	Soil	X				
ASS012-03-03	11-20-2020	1804	Soil	X				
ASS012-03-06	11-20-2020	1805	Soil	X				
ASS012-03-09	11-20-2020	1806	Soil	X				
ASS012-03-12	11-20-2020	1807	Soil	X				
ASS012-03-15	11-20-2020	1808	Soil	X				
ASS012-04-03	11-20-2020	1824	Soil	X				
ASS012-04-06	11-20-2020	1825	Soil	X				
ASS012-04-09	11-20-2020	1826	Soil	X				
ASS012-04-12	11-20-2020	1827	Soil	X				
ASS012-04-15 13 TH	11-20-2020	1828	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS012-05-03	11-20-2020	1842	Soil	X				
ASS012-05-06	11-20-2020	1843	Soil	X				
ASS012-05-09	11-20-2020	1844	Soil	X				
ASS012-05-12	11-20-2020	1845	Soil	X				
ASS012-05-~~15~~ 14 TH	11-20-2020	1846	Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				

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CHRIS WITTHUHN
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LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS014

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72580	ASS014-01-03																								
72581	ASS014-01-06																								
72582	ASS014-01-09																								
72583	ASS014-01-12																								
72584	ASS014-01-15																								
72585	ASS014-02-03																								
72586	ASS014-02-06																								
72587	ASS014-02-09																								
72588	ASS014-02-12																								
72589	ASS014-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72580	1	1	0-3							1																
72581	1	1	3-6							1																
72582	1	1	6-9							1																
72583	1	1	9-12							1																
72584	1	1	12-15							1																
72585	1	1	0-3							1																
72586	1	1	3-6							1																
72587	1	1	6-9							1																
72588	1	1	9-12							1																
72589	1	1	12-15							1																

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ASS014

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72590	ASS014-03-03																								
72591	ASS014-03-06																								
72592	ASS014-03-09																								
72593	ASS014-03-12																								
72594	ASS014-03-15																								
72595	ASS014-04-03																								
72596	ASS014-04-06																								
72597	ASS014-04-09																								
72598	ASS014-04-12																								
72599	ASS014-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72590	1	1	0-3							1																
72591	1	1	3-6							1																
72592	1	1	6-9							1																
72593	1	1	9-12							1																
72594	1	1	12-15							1																
72595	1	1	0-3							1																
72596	1	1	3-6							1																
72597	1	1	6-9							1																
72598	1	1	9-12							1																
72599	1	1	12-15							1																

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ASS014

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72600	ASS014-05-03																								
72601	ASS014-05-06																								
72602	ASS014-05-09																								
72603	ASS014-05-12																								
72604	ASS014-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72600	2	2	0-3							2																
72601	1	1	3-6							1																
72602	1	1	6-9							1																
72603	1	1	9-12							1																
72604	1	1	12-15							1																

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Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

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Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): M.Bs Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS014-01-03	11-19-2020	0901	Soil	X				
ASS014-01-06	11-19-2020	0902	Soil	X				
ASS014-01-09	11-19-2020	0903	Soil	X				
ASS014-01-12	11-19-2020	0904	Soil	X				
ASS014-01-15	11-19-2020	0905	Soil	X				
ASS014-02-03	11-19-2020	0924	Soil	X				
ASS014-02-06	11-19-2020	0925	Soil	X				
ASS014-02-09	11-19-2020	0926	Soil	X				
ASS014-02-12	11-19-2020	0927	Soil	X				
ASS014-02-15	11-19-2020	0928	Soil	X				
ASS014-03-03	11-19-2020	0942	Soil	X				
ASS014-03-06	11-19-2020	0943	Soil	X				
ASS014-03-09	11-19-2020	0944	Soil	X				
ASS014-03-12	11-19-2020	0945	Soil	X				
ASS014-03-15	11-19-2020	0946	Soil	X				

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37272580 – 37272630

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Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS014-04-03	11-19-2020	1003	Soil	X				
ASS014-04-06	11-19-2020	1004	Soil	X				
ASS014-04-09	11-19-2020	1005	Soil	X				
ASS014-04-12	11-19-2020	1006	Soil	X				
ASS014-04-15	11-19-2020	1007	Soil	X				
ASS014-05-03	11-19-2020	1025	Soil	X				
ASS014-05-06	11-19-2020	1026	Soil	X				
ASS014-05-09	11-19-2020	1027	Soil	X				
ASS014-05-12	11-19-2020	1028	Soil	X				
ASS014-05-15	11-19-2020	1029	Soil	X				
ASS015-01-03	11-19-2020	1339	Soil	X				
ASS015-01-06	11-19-2020	1340	Soil	X				
ASS015-01-09	11-19-2020	1341	Soil	X				
ASS015-01-12	11-19-2020	1342	Soil	X				
ASS015-01-15	11-19-2020	1343	Soil	X				
ASS015-02-03	11-19-2020	1401	Soil	X				
ASS015-02-06	11-19-2020	1402	Soil	X				
ASS015-02-09	11-19-2020	1403	Soil	X				
ASS015-02-12	11-19-2020	1404	Soil	X				
ASS015-02-~~15~~ 14 TH	11-19-2020	1405	Soil	X				
ASS015-03-03	11-19-2020	1421	Soil	X				
ASS015-03-06	11-19-2020	1422	Soil	X				
ASS015-03-09	11-19-2020	1423	Soil	X				
ASS015-03-12	11-19-2020	1424	Soil	X				
ASS015-03-15	11-19-2020	1425	Soil	X				
ASS015-04-03	11-19-2020	1443	Soil	X				
ASS015-04-06	11-19-2020	1444	Soil	X				
ASS015-04-09	11-19-2020	1445	Soil	X				
ASS015-04-12	11-19-2020	1446	Soil	X				
ASS015-04-15	11-19-2020	1447	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N	Tests Requested	Lab #/Order # (Internal Use)		Notes
ASS015-05-03	11-19-2020	1506	Soil	X				
ASS015-05-06	11-19-2020	1507	Soil	X				
ASS015-05-09	11-19-2020	1508	Soil	X				
ASS015-05-12	11-19-2020	1509	Soil	X				
ASS015-05-15	11-19-2020	1510	Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				

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PO BOX 83581
LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS015

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72605	ASS015-01-03																								
72606	ASS015-01-06																								
72607	ASS015-01-09																								
72608	ASS015-01-12																								
72609	ASS015-01-15																								
72610	ASS015-02-03																								
72611	ASS015-02-06																								
72612	ASS015-02-09																								
72613	ASS015-02-12																								
72614	ASS015-02-14																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72605	3	3	0-3							3																
72606	1	1	3-6							1																
72607	1	1	6-9							1																
72608	2	2	9-12							2																
72609	2	2	12-15							2																
72610	1	1	0-3							1																
72611	1	1	3-6							1																
72612	2	2	6-9							2																
72613	1	1	9-12							1																
72614	1	1	12-14							1																

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SOIL ANALYSIS REPORT

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72615	ASS015-03-03																								
72616	ASS015-03-06																								
72617	ASS015-03-09																								
72619	ASS015-03-12																								
72620	ASS015-03-15																								
72621	ASS015-04-03																								
72622	ASS015-04-06																								
72623	ASS015-04-09																								
72624	ASS015-04-12																								
72625	ASS015-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72615	2	2	0-3							2																
72616	1	1	3-6							1																
72617	1	1	6-9							1																
72619	2	2	9-12							2																
72620	2	2	12-15							2																
72621	3	3	0-3							3																
72622	1	1	3-6							1																
72623	1	1	6-9							1																
72624	2	2	9-12							2																
72625	2	2	12-15							2																

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS015

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72626	ASS015-05-03																								
72627	ASS015-05-06																								
72628	ASS015-05-09																								
72629	ASS015-05-12																								
72630	ASS015-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72626	4	4	0-3							4																
72627	1	1	3-6							1																
72628	1	1	6-9							1																
72629	1	1	9-12							1																
72630	1	1	12-15							1																

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The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

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Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): M.Bs Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS014-01-03	11-19-2020	0901	Soil	X				
ASS014-01-06	11-19-2020	0902	Soil	X				
ASS014-01-09	11-19-2020	0903	Soil	X				
ASS014-01-12	11-19-2020	0904	Soil	X				
ASS014-01-15	11-19-2020	0905	Soil	X				
ASS014-02-03	11-19-2020	0924	Soil	X				
ASS014-02-06	11-19-2020	0925	Soil	X				
ASS014-02-09	11-19-2020	0926	Soil	X				
ASS014-02-12	11-19-2020	0927	Soil	X				
ASS014-02-15	11-19-2020	0928	Soil	X				
ASS014-03-03	11-19-2020	0942	Soil	X				
ASS014-03-06	11-19-2020	0943	Soil	X				
ASS014-03-09	11-19-2020	0944	Soil	X				
ASS014-03-12	11-19-2020	0945	Soil	X				
ASS014-03-15	11-19-2020	0946	Soil	X				

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Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS014-04-03	11-19-2020	1003	Soil	X				
ASS014-04-06	11-19-2020	1004	Soil	X				
ASS014-04-09	11-19-2020	1005	Soil	X				
ASS014-04-12	11-19-2020	1006	Soil	X				
ASS014-04-15	11-19-2020	1007	Soil	X				
ASS014-05-03	11-19-2020	1025	Soil	X				
ASS014-05-06	11-19-2020	1026	Soil	X				
ASS014-05-09	11-19-2020	1027	Soil	X				
ASS014-05-12	11-19-2020	1028	Soil	X				
ASS014-05-15	11-19-2020	1029	Soil	X				
ASS015-01-03	11-19-2020	1339	Soil	X				
ASS015-01-06	11-19-2020	1340	Soil	X				
ASS015-01-09	11-19-2020	1341	Soil	X				
ASS015-01-12	11-19-2020	1342	Soil	X				
ASS015-01-15	11-19-2020	1343	Soil	X				
ASS015-02-03	11-19-2020	1401	Soil	X				
ASS015-02-06	11-19-2020	1402	Soil	X				
ASS015-02-09	11-19-2020	1403	Soil	X				
ASS015-02-12	11-19-2020	1404	Soil	X				
ASS015-02-~~15~~ 14 TH	11-19-2020	1405	Soil	X				
ASS015-03-03	11-19-2020	1421	Soil	X				
ASS015-03-06	11-19-2020	1422	Soil	X				
ASS015-03-09	11-19-2020	1423	Soil	X				
ASS015-03-12	11-19-2020	1424	Soil	X				
ASS015-03-15	11-19-2020	1425	Soil	X				
ASS015-04-03	11-19-2020	1443	Soil	X				
ASS015-04-06	11-19-2020	1444	Soil	X				
ASS015-04-09	11-19-2020	1445	Soil	X				
ASS015-04-12	11-19-2020	1446	Soil	X				
ASS015-04-15	11-19-2020	1447	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N	Tests Requested	Lab #/Order # (Internal Use)		Notes
ASS015-05-03	11-19-2020	1506	Soil	X				
ASS015-05-06	11-19-2020	1507	Soil	X				
ASS015-05-09	11-19-2020	1508	Soil	X				
ASS015-05-12	11-19-2020	1509	Soil	X				
ASS015-05-15	11-19-2020	1510	Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				
			Soil	X				

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CHRIS WITTHUHN
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LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS016

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72887	ASS016-01-03																								
72888	ASS016-01-06																								
72889	ASS016-01-09																								
72890	ASS016-01-12																								
72892	ASS016-01-15																								
72893	ASS016-02-03																								
72894	ASS016-02-06																								
72895	ASS016-02-09																								
72896	ASS016-02-12																								
72897	ASS016-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72887	1	1	0-3							1															
72888	1	1	3-6							1															
72889	1	1	6-9							1															
72890	1	1	9-12							1															
72892	1	1	12-15							1															
72893	2	2	0-3							2															
72894	2	2	3-6							2															
72895	1	1	6-9							1															
72896	2	2	9-12							2															
72897	1	1	12-15							1															

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SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72898	ASS016-03-03																								
72899	ASS016-03-06																								
72900	ASS016-03-09																								
72901	ASS016-03-12																								
72902	ASS016-03-15																								
72903	ASS016-04-03																								
72904	ASS016-04-06																								
72905	ASS016-04-09																								
72906	ASS016-04-12																								
72907	ASS016-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72898	2	2	0-3							2																
72899	1	1	3-6							1																
72900	1	1	6-9							1																
72901	1	1	9-12							1																
72902	2	2	12-15							2																
72903	2	2	0-3							2																
72904	2	2	3-6							2																
72905	2	2	6-9							2																
72906	1	1	9-12							1																
72907	1	1	12-15							1																

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SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72908	ASS016-05-03																								
72909	ASS016-05-06																								
72910	ASS016-05-09																								
72911	ASS016-05-12																								
72912	ASS016-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72908	3	3	0-3							3															
72909	1	1	3-6							1															
72910	1	1	6-9							1															
72911	1	1	9-12							1															
72912	1	1	12-15							1															

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Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

(49) EBW

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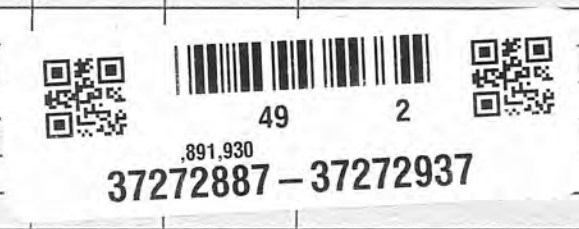
Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MBB Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS016-01-03	11-20-2020	0945	Soil	X				
ASS016-01-06	11-20-2020	0946	Soil	X				
ASS016-01-09	11-20-2020	0947	Soil	X				
ASS016-01-12	11-20-2020	0948	Soil	X				
ASS016-01-15	11-20-2020	0949	Soil	X				
ASS016-02-03	11-20-2020	1009	Soil	X				
ASS016-02-06	11-20-2020	1010	Soil	X				
ASS016-02-09	11-20-2020	1011	Soil	X				
ASS016-02-12	11-20-2020	1012	Soil	X				
ASS016-02-15	11-20-2020	1013	Soil	X				
ASS016-03-03	11-20-2020	1031	Soil	X				
ASS016-03-06	11-20-2020	1032	Soil	X				
ASS016-03-09	11-20-2020	1033	Soil	X				
ASS016-03-12	11-20-2020	1034	Soil	X				
ASS016-03-15	11-20-2020	1035	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS016-04-03	11-20-2020	1052	Soil	X				
ASS016-04-06	11-20-2020	1053	Soil	X				
ASS016-04-09	11-20-2020	1054	Soil	X				
ASS016-04-12	11-20-2020	1055	Soil	X				
ASS016-04-15	11-20-2020	1056	Soil	X				
ASS016-05-03	11-20-2020	1117	Soil	X				
ASS016-05-06	11-20-2020	1118	Soil	X				
ASS016-05-09	11-20-2020	1119	Soil	X				
ASS016-05-12	11-20-2020	1120	Soil	X				
ASS016-05-15	11-20-2020	1121	Soil	X				
ASS017-01-03	11-19-2020	1052	Soil	X				
ASS017-01-06	11-19-2020	1053	Soil	X				
ASS017-01-09	11-19-2020	1054	Soil	X				
ASS017-01-12	11-19-2020	1055	Soil	X				
ASS017-01-15	11-19-2020	1056	Soil	X				
ASS017-02-03	11-19-2020	1116	Soil	X				
ASS017-02-06	11-19-2020	1117	Soil	X				
ASS017-02-09	11-19-2020	1118	Soil	X				
ASS017-02-12	11-19-2020	1119	Soil	X				
ASS017-02-15	11-19-2020	1120	Soil	X				
ASS017-03-03	11-19-2020	1143	Soil	X				
ASS017-03-06	11-19-2020	1144	Soil	X				
ASS017-03-09	11-19-2020	1145	Soil	X				
ASS017-03-12	11-19-2020	1146	Soil	X				
ASS017-03-~~15~~ 14 TH	11-19-2020	1147	Soil	X				
ASS017-04-03	11-19-2020	1204	Soil	X				
ASS017-04-06	11-19-2020	1205	Soil	X				
ASS017-04-09	11-19-2020	1206	Soil	X				
ASS017-04-12	11-19-2020	1207	Soil	X				
~~ASS017-04-15~~ TH			Soil	X				



LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS017-05-03	11-19-2020	1228	Soil	X				
ASS017-05-06	11-19-2020	1229	Soil	X				
ASS017-05-09	11-19-2020	1230	Soil	X				
ASS017-05-12	11-19-2020	1231	Soil	X				
ASS017-05-15	11-19-2020	1232	Soil	X				

49 3

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37272887 – 37272937

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS017

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72913	ASS017-01-03																								
72914	ASS017-01-06																								
72915	ASS017-01-09																								
72916	ASS017-01-12																								
72917	ASS017-01-15																								
72918	ASS017-02-03																								
72919	ASS017-02-06																								
72920	ASS017-02-09																								
72921	ASS017-02-12																								
72922	ASS017-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72913	1	1	0-3							1																
72914	1	1	3-6							1																
72915	1	1	6-9							1																
72916	1	1	9-12							1																
72917	1	1	12-15							1																
72918	1	1	0-3							1																
72919	1	1	3-6							1																
72920	1	1	6-9							1																
72921	1	1	9-12							1																
72922	1	1	12-15							1																

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NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72923	ASS017-03-03																								
72924	ASS017-03-06																								
72925	ASS017-03-09																								
72926	ASS017-03-12																								
72927	ASS017-03-14																								
72928	ASS017-04-03																								
72929	ASS017-04-06																								
72931	ASS017-04-09																								
72932	ASS017-04-12																								
72933	ASS017-05-03																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72923	1	1	0-3							1																
72924	1	1	3-6							1																
72925	1	1	6-9							1																
72926	1	1	9-12							1																
72927	1	1	12-14							1																
72928	1	1	0-3							1																
72929	1	1	3-6							1																
72931	1	1	6-9							1																
72932	1	1	9-12							1																
72933	1	1	0-3							1																

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NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72934	ASS017-05-06																								
72935	ASS017-05-09																								
72936	ASS017-05-12																								
72937	ASS017-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72934	1	1	3-6							1																
72935	2	2	6-9							2																
72936	3	3	9-12							3																
72937	3	3	12-15							3																

REV.10/17

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Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

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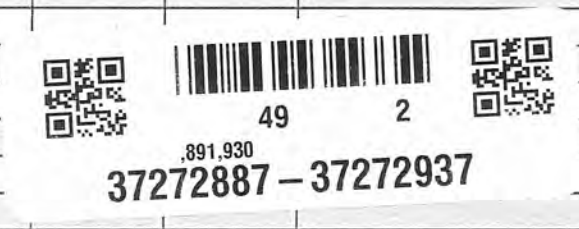
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MBB Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS016-01-03	11-20-2020	0945	Soil	X				
ASS016-01-06	11-20-2020	0946	Soil	X				
ASS016-01-09	11-20-2020	0947	Soil	X				
ASS016-01-12	11-20-2020	0948	Soil	X				
ASS016-01-15	11-20-2020	0949	Soil	X				
ASS016-02-03	11-20-2020	1009	Soil	X				
ASS016-02-06	11-20-2020	1010	Soil	X				
ASS016-02-09	11-20-2020	1011	Soil	X				
ASS016-02-12	11-20-2020	1012	Soil	X				
ASS016-02-15	11-20-2020	1013	Soil	X				
ASS016-03-03	11-20-2020	1031	Soil	X				
ASS016-03-06	11-20-2020	1032	Soil	X				
ASS016-03-09	11-20-2020	1033	Soil	X				
ASS016-03-12	11-20-2020	1034	Soil	X				
ASS016-03-15	11-20-2020	1035	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS016-04-03	11-20-2020	1052	Soil	X				
ASS016-04-06	11-20-2020	1053	Soil	X				
ASS016-04-09	11-20-2020	1054	Soil	X				
ASS016-04-12	11-20-2020	1055	Soil	X				
ASS016-04-15	11-20-2020	1056	Soil	X				
ASS016-05-03	11-20-2020	1117	Soil	X				
ASS016-05-06	11-20-2020	1118	Soil	X				
ASS016-05-09	11-20-2020	1119	Soil	X				
ASS016-05-12	11-20-2020	1120	Soil	X				
ASS016-05-15	11-20-2020	1121	Soil	X				
ASS017-01-03	11-19-2020	1052	Soil	X				
ASS017-01-06	11-19-2020	1053	Soil	X				
ASS017-01-09	11-19-2020	1054	Soil	X				
ASS017-01-12	11-19-2020	1055	Soil	X				
ASS017-01-15	11-19-2020	1056	Soil	X				
ASS017-02-03	11-19-2020	1116	Soil	X				
ASS017-02-06	11-19-2020	1117	Soil	X				
ASS017-02-09	11-19-2020	1118	Soil	X				
ASS017-02-12	11-19-2020	1119	Soil	X				
ASS017-02-15	11-19-2020	1120	Soil	X				
ASS017-03-03	11-19-2020	1143	Soil	X				
ASS017-03-06	11-19-2020	1144	Soil	X				
ASS017-03-09	11-19-2020	1145	Soil	X				
ASS017-03-12	11-19-2020	1146	Soil	X				
ASS017-03-~~15~~ 14 TH	11-19-2020	1147	Soil	X				
ASS017-04-03	11-19-2020	1204	Soil	X				
ASS017-04-06	11-19-2020	1205	Soil	X				
ASS017-04-09	11-19-2020	1206	Soil	X				
ASS017-04-12	11-19-2020	1207	Soil	X				
~~ASS017-04-15~~ TH			Soil	X				



LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS017-05-03	11-19-2020	1228	Soil	X				
ASS017-05-06	11-19-2020	1229	Soil	X				
ASS017-05-09	11-19-2020	1230	Soil	X				
ASS017-05-12	11-19-2020	1231	Soil	X				
ASS017-05-15	11-19-2020	1232	Soil	X				

49 3

,891,930

37272887 – 37272937

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS019

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72785	ASS019-01-03																								
72786	ASS019-01-06																								
72787	ASS019-01-09																								
72788	ASS019-01-12																								
72789	ASS019-01-15																								
72790	ASS019-02-03																								
72791	ASS019-02-06																								
72792	ASS019-02-09																								
72793	ASS019-02-12																								
72794	ASS019-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72785	1	1	0-3							1															
72786	1	1	3-6							1															
72787	1	1	6-9							1															
72788	1	1	9-12							1															
72789	2	2	12-15							2															
72790	1	1	0-3							1															
72791	1	1	3-6							1															
72792	1	1	6-9							1															
72793	1	1	9-12							1															
72794	1	1	12-15							1															

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72795	ASS019-03-03																								
72796	ASS019-03-06																								
72797	ASS019-03-09																								
72798	ASS019-03-12																								
72799	ASS019-03-15																								
72800	ASS019-04-03																								
72801	ASS019-04-06																								
72802	ASS019-04-09																								
72803	ASS019-04-12																								
72804	ASS019-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72795	1	1	0-3							1															
72796	1	1	3-6							1															
72797	1	1	6-9							1															
72798	1	1	9-12							1															
72799	2	2	12-15							2															
72800	2	2	0-3							2															
72801	1	1	3-6							1															
72802	1	1	6-9							1															
72803	1	1	9-12							1															
72804	2	2	12-15							2															

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72805	ASS019-05-03																								
72806	ASS019-05-06																								
72807	ASS019-05-09																								
72808	ASS019-05-12																								
72809	ASS019-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
72805	2	2	0-3							2															
72806	1	1	3-6							1															
72807	1	1	6-9							1															
72808	1	1	9-12							1															
72809	1	1	12-15							1															

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Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

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Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MJS Date/Time: 11/24/20

50 EBW

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS019-01-03	11-19-2020	1527	Soil	X				
ASS019-01-06	11-19-2020	1528	Soil	X				
ASS019-01-09	11-19-2020	1529	Soil	X				
ASS019-01-12	11-19-2020	1530	Soil	X				
ASS019-01-15	11-19-2020	1531	Soil	X				
ASS019-02-03	11-19-2020	1548	Soil	X				
ASS019-02-06	11-19-2020	1549	Soil	X				
ASS019-02-09	11-19-2020	1550	Soil	X				
ASS019-02-12	11-19-2020	1551	Soil	X				
ASS019-02-15	11-19-2020	1552	Soil	X				
ASS019-03-03	11-19-2020	1606	Soil	X				
ASS019-03-06	11-19-2020	1607	Soil	X				
ASS019-03-09	11-19-2020	1608	Soil	X				
ASS019-03-12	11-19-2020	1609	Soil	X				
ASS019-03-15	11-19-2020	1610	Soil	X				

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37272785 – 37272835

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS019-04-03	11-19-2020	1624	Soil	X				
ASS019-04-06	11-19-2020	1625	Soil	X				
ASS019-04-09	11-19-2020	1626	Soil	X				
ASS019-04-12	11-19-2020	1627	Soil	X				
ASS019-04-15	11-19-2020	1628	Soil	X				
ASS019-05-03	11-19-2020	1645	Soil	X				
ASS019-05-06	11-19-2020	1646	Soil	X				
ASS019-05-09	11-19-2020	1647	Soil	X				
ASS019-05-12	11-19-2020	1648	Soil	X				
ASS019-05-15	11-19-2020	1649	Soil	X				
ASS020-01-03	11-20-2020	1604	Soil	X				
ASS020-01-06	11-20-2020	1605	Soil	X				
ASS020-01-09	11-20-2020	1606	Soil	X				
ASS020-01-12	11-20-2020	1607	Soil	X				
ASS020-01-15	11-20-2020	1608	Soil	X				
ASS020-02-03	11-20-2020	1621	Soil	X				
ASS020-02-06	11-20-2020	1622	Soil	X				
ASS020-02-09	11-20-2020	1623	Soil	X				
ASS020-02-12	11-20-2020	1624	Soil	X				
ASS020-02-15	11-20-2020	1625	Soil	X				
ASS020-03-03	11-20-2020	1636	Soil	X				
ASS020-03-06	11-20-2020	1637	Soil	X				
ASS020-03-09	11-20-2020	1638	Soil	X				
ASS020-03-12	11-20-2020	1639	Soil	X				
ASS020-03-15	11-20-2020	1640	Soil	X				
ASS020-04-03	11-20-2020	1649	Soil	X				
ASS020-04-06	11-20-2020	1650	Soil	X				
ASS020-04-09	11-20-2020	1651	Soil	X				
ASS020-04-12	11-20-2020	1652	Soil	X				
ASS020-04-15	11-20-2020	1653	Soil	X				

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS020-05-03	11-20-2020	1704	Soil	X				
ASS020-05-06	11-20-2020	1705	Soil	X				
ASS020-05-09	11-20-2020	1706	Soil	X				
ASS020-05-12	11-20-2020	1707	Soil	X				
ASS020-05-15	11-20-2020	1708	Soil	X				

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37272785 – 37272835

REPORT NUMBER
20-330-0096
COMPLETED DATE
Nov 28, 2020
ACCOUNT
8722
RECEIVED DATE
Nov 24, 2020

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TODAY'S DATE
Nov 28, 2020

LOWER PLATTE SOUTH NRD
CHRIS WITTHUHN
PO BOX 83581
LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
ASS020

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

LAB NUMBER *372*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P_1 (WEAK BRAY) 1:7 ppm	RATE	PHOSPHORUS P_2 (STRONG BRAY) 1:7 ppm	RATE	OLSEN BICARBONATE P ppm	RATE	POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
72810	ASS020-01-03																								
72811	ASS020-01-06																								
72812	ASS020-01-09																								
72814	ASS020-01-12																								
72815	ASS020-01-15																								
72816	ASS020-02-03																								
72817	ASS020-02-06																								
72818	ASS020-02-09																								
72819	ASS020-02-12																								
72820	ASS020-02-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72810	1	1	0-3							1																
72811	1	1	3-6							1																
72812	1	1	6-9							1																
72814	1	1	9-12							1																
72815	1	1	12-15							1																
72816	1	1	0-3							1																
72817	1	1	3-6							1																
72818	1	1	6-9							1																
72819	1	1	9-12							1																
72820	1	1	12-15							1																

REV.10/17

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

REPORT NUMBER
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SOIL ANALYSIS REPORT

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72821	ASS020-03-03																								
72822	ASS020-03-06																								
72823	ASS020-03-09																								
72824	ASS020-03-12																								
72825	ASS020-03-15																								
72826	ASS020-04-03																								
72827	ASS020-04-06																								
72828	ASS020-04-09																								
72829	ASS020-04-12																								
72830	ASS020-04-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72821	2	2	0-3							2																
72822	3	3	3-6							3																
72823	3	3	6-9							3																
72824	3	3	9-12							3																
72825	3	3	12-15							3																
72826	2	2	0-3							2																
72827	3	3	3-6							3																
72828	2	2	6-9							2																
72829	2	2	9-12							2																
72830	2	2	12-15							2																

REV.10/17

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

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72831	ASS020-05-03																								
72832	ASS020-05-06																								
72833	ASS020-05-09																								
72834	ASS020-05-12																								
72835	ASS020-05-15																								

LAB NUMBER *372*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B SORB. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE	
72831	1	1	0-3							1																
72832	1	1	3-6							1																
72833	2	2	6-9							2																
72834	2	2	9-12							2																
72835	2	2	12-15							2																

REV.10/17

Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

Account #: 8722

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): _____ Date/Time: _____

Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MJS Date/Time: 11/24/20

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Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
ASS019-01-03	11-19-2020	1527	Soil	X				
ASS019-01-06	11-19-2020	1528	Soil	X				
ASS019-01-09	11-19-2020	1529	Soil	X				
ASS019-01-12	11-19-2020	1530	Soil	X				
ASS019-01-15	11-19-2020	1531	Soil	X				
ASS019-02-03	11-19-2020	1548	Soil	X				
ASS019-02-06	11-19-2020	1549	Soil	X				
ASS019-02-09	11-19-2020	1550	Soil	X				
ASS019-02-12	11-19-2020	1551	Soil	X				
ASS019-02-15	11-19-2020	1552	Soil	X				
ASS019-03-03	11-19-2020	1606	Soil	X				
ASS019-03-06	11-19-2020	1607	Soil	X				
ASS019-03-09	11-19-2020	1608	Soil	X				
ASS019-03-12	11-19-2020	1609	Soil	X				
ASS019-03-15	11-19-2020	1610	Soil	X				

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37272785 – 37272835

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS019-04-03	11-19-2020	1624	Soil	X				
ASS019-04-06	11-19-2020	1625	Soil	X				
ASS019-04-09	11-19-2020	1626	Soil	X				
ASS019-04-12	11-19-2020	1627	Soil	X				
ASS019-04-15	11-19-2020	1628	Soil	X				
ASS019-05-03	11-19-2020	1645	Soil	X				
ASS019-05-06	11-19-2020	1646	Soil	X				
ASS019-05-09	11-19-2020	1647	Soil	X				
ASS019-05-12	11-19-2020	1648	Soil	X				
ASS019-05-15	11-19-2020	1649	Soil	X				
ASS020-01-03	11-20-2020	1604	Soil	X				
ASS020-01-06	11-20-2020	1605	Soil	X				
ASS020-01-09	11-20-2020	1606	Soil	X				
ASS020-01-12	11-20-2020	1607	Soil	X				
ASS020-01-15	11-20-2020	1608	Soil	X				
ASS020-02-03	11-20-2020	1621	Soil	X				
ASS020-02-06	11-20-2020	1622	Soil	X				
ASS020-02-09	11-20-2020	1623	Soil	X				
ASS020-02-12	11-20-2020	1624	Soil	X				
ASS020-02-15	11-20-2020	1625	Soil	X				
ASS020-03-03	11-20-2020	1636	Soil	X				
ASS020-03-06	11-20-2020	1637	Soil	X				
ASS020-03-09	11-20-2020	1638	Soil	X				
ASS020-03-12	11-20-2020	1639	Soil	X				
ASS020-03-15	11-20-2020	1640	Soil	X				
ASS020-04-03	11-20-2020	1649	Soil	X				
ASS020-04-06	11-20-2020	1650	Soil	X				
ASS020-04-09	11-20-2020	1651	Soil	X				
ASS020-04-12	11-20-2020	1652	Soil	X				
ASS020-04-15	11-20-2020	1653	Soil	X				

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
ASS020-05-03	11-20-2020	1704	Soil	X				
ASS020-05-06	11-20-2020	1705	Soil	X				
ASS020-05-09	11-20-2020	1706	Soil	X				
ASS020-05-12	11-20-2020	1707	Soil	X				
ASS020-05-15	11-20-2020	1708	Soil	X				

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813
37272785 – 37272835

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23 December 2020

Work Order: 1566879

CHRIS WITTHUHN
LOWER PLATTE SOUTH NRD - 8722
PO BOX 83581
LINCOLN, NE 68501-3581

RE: Nitrate Only/Irrigation Wells

Enclosed are the results of analyses for samples received by the laboratory on 2020-12-16 11:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Heather Ramig
Project Manager
hramig@midwestlabs.com

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PO BOX 83581
LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported
2020-12-23 16: 1

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
[redacted]				
AGW011	1566879-09	Aqueous	2020-12-07 10:56	2020-12-16 11:00
AGW012	1566879-10	Aqueous	2020-12-13 09: 2	2020-12-16 11:00
AGW013	1566879-11	Aqueous	2020-12-09 11:31	2020-12-16 11:00
AGW01	1566879-12	Aqueous	2020-12-07 15:06	2020-12-16 11:00
AGW015	1566879-13	Aqueous	2020-12-09 10:03	2020-12-16 11:00
AGW016	1566879-1	Aqueous	2020-12-08 11:39	2020-12-16 11:00
AGW017A	1566879-15	Aqueous	2020-12-07 16:1	2020-12-16 11:00
AGW018	1566879-16	Aqueous	2020-12-08 13:56	2020-12-16 11:00
AGW019	1566879-17	Aqueous	2020-12-08 10:06	2020-12-16 11:00
AGW020	1566879-18	Aqueous	2020-12-08 17:02	2020-12-16 11:00
AGW021	1566879-19	Aqueous	2020-12-07 13:39	2020-12-16 11:00
AGW017B	1566879-20	Aqueous	2020-12-08 16:06	2020-12-16 11:00
GWDUP-1	1566879-21	Aqueous	2020-12-09 09:02	2020-12-16 11:00
GWDUP-2	1566879-22	Aqueous	2020-12-09 1 : 9	2020-12-16 11:00

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LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells
Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Containers used for the following analyses:

	1566879-01 A:	EPA 353.2
	1566879-02 A:	EPA 353.2
	1566879-03 A:	EPA 353.2
	1566879-04 A:	EPA 353.2
	1566879-05 A:	EPA 353.2
	1566879-06 A:	EPA 353.2
#	1566879-07 A:	EPA 353.2
	1566879-08 A:	EPA 353.2
	1566879-09 A:	EPA 353.2
	1566879-10 A:	EPA 353.2
	1566879-11 A:	EPA 353.2
	1566879-12 A:	EPA 353.2
	1566879-13 A:	EPA 353.2
	1566879-14 A:	EPA 353.2
	1566879-15 A:	EPA 353.2
	1566879-16 A:	EPA 353.2
	1566879-17 A:	EPA 353.2
	1566879-18 A:	EPA 353.2
	1566879-19 A:	EPA 353.2
	1566879-20 A:	EPA 353.2
	1566879-21 A:	EPA 353.2
	1566879-22 A:	EPA 353.2

Note: Indicates container was received outside the acceptable pH range and was preserved at the laboratory.

Analysis Results Reviewed by:

EPA 353.2 reviewed by jdb5.

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported
2020-12-23 16: 1

Redacted text

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Project Manager: CHRIS WITTHUHN

Reported
2020-12-23 16: 1

[redacted]
Redacted text

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2020-12-23 16: 1

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Reported
2020-12-23 16: 1

Redacted text

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LOWER PLATTE SOUTH NRD - 8722
PO BOX 83581
LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW011
Laboratory ID: 1566879-09
Sampled Date/Time: 2020-12-07 10:56

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	2.27	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

Work Order: 1566879

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW012
Laboratory ID: 1566879-10
Sampled Date/Time: 2020-12-13 09:42

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	12.4	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

Work Order: 1566879

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW013
Laboratory ID: 1566879-11
Sampled Date/Time: 2020-12-09 11:31

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.53	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

Work Order: 1566879

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LOWER PLATTE SOUTH NRD - 8722
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LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW014
Laboratory ID: 1566879-12
Sampled Date/Time: 2020-12-07 15:06

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.24	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW015
Laboratory ID: 1566879-13
Sampled Date/Time: 2020-12-09 10:03

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	8.96	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

Work Order: 1566879

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW016
Laboratory ID: 1566879-14
Sampled Date/Time: 2020-12-08 11:39

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	8.76	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW017A
Laboratory ID: 1566879-15
Sampled Date/Time: 2020-12-07 16:14

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.31	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

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LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW018
Laboratory ID: 1566879-16
Sampled Date/Time: 2020-12-08 13:56

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	14.1	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

Work Order: 1566879

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW019
Laboratory ID: 1566879-17
Sampled Date/Time: 2020-12-08 10:06

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	11.9	0.20	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

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LINCOLN, NE 68501-3581

Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW020
Laboratory ID: 1566879-18
Sampled Date/Time: 2020-12-08 17:02

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	18.1	0.20	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW021
Laboratory ID: 1566879-19
Sampled Date/Time: 2020-12-07 13:39

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	41.3	0.80	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

Work Order: 1566879

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: AGW017B
Laboratory ID: 1566879-20
Sampled Date/Time: 2020-12-08 16:06

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	18.8	0.20	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: GWDUP-1
Laboratory ID: 1566879-21
Sampled Date/Time: 2020-12-09 09:02

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	8.63	0.20	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Sample ID: GWDUP-2
Laboratory ID: 1566879-22
Sampled Date/Time: 2020-12-09 14:49

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.52	0.20	mg/L	EPA 353.2	2020-12-23	2020-12-23	jaj4	(A)

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Environmental Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B008658										
Blank (B008658-BLK1)				Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	<	0.20	mg/L							
LCS (B008658-BS1)				Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	5.35	0.20	mg/L	5.00		107	90-110			
Matrix Spike (B008658-MS1)		**Source: 1566879-06**		Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	4.57	0.20	mg/L	4.00	0.29	107	90-110			
Matrix Spike (B008658-MS2)		**Source: 1566879-12**		Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	4.60	0.20	mg/L	4.00	0.24	109	90-110			
Matrix Spike Dup (B008658-MSD1)		**Source: 1566879-06**		Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	4.58	0.20	mg/L	4.00	0.29	107	90-110	0.175	10	
Matrix Spike Dup (B008658-MSD2)		**Source: 1566879-12**		Prepared & Analyzed: 2020-12-22						
Nitrate/Nitrite Nitrogen	4.53	0.20	mg/L	4.00	0.24	107	90-110	1.58	10	
Batch B008683										
Blank (B008683-BLK1)				Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	<	0.20	mg/L							
LCS (B008683-BS1)				Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	5.14	0.20	mg/L	5.00		103	90-110			
Matrix Spike (B008683-MS1)		**Source: 1566879-21**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	12.33	0.20	mg/L	4.00	8.63	92.5	90-110			

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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Environmental Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B008683										
Matrix Spike (B008683-MS2)		**Source: 1566879-22**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	4.61	0.20	mg/L	4.00	0.52	102	90-110			
Matrix Spike (B008683-MS3)		**Source: 1564954-01**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	6.82	0.20	mg/L	4.00	2.89	98.1	90-110			
Matrix Spike Dup (B008683-MSD1)		**Source: 1566879-21**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	12.28	0.20	mg/L	4.00	8.63	91.1	90-110	0.463	10	
Matrix Spike Dup (B008683-MSD2)		**Source: 1566879-22**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	4.61	0.20	mg/L	4.00	0.52	102	90-110	0.130	10	
Matrix Spike Dup (B008683-MSD3)		**Source: 1564954-01**		Prepared & Analyzed: 2020-12-23						
Nitrate/Nitrite Nitrogen	6.89	0.20	mg/L	4.00	2.89	100	90-110	1.07	10	

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Project: Nitrate Only/Irrigation Wells
Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Certified Analyses included in this Report

Method	Analyte	Certifications
EPA 353.2 in Aqueous	Nitrate/Nitrite Nitrogen	TX,FL,UT,OK,IA

Code	Description	Number	Expires
FL	Florida Department of Health	E87918	06/30/2021
IA	Iowa Department of Natural Resources	064	05/01/2021
KS	Kansas Department of Health and Environment	E-10402	04/30/2021
NE	State of Nebraska Dept of Health & Human Services	NE-04-05	06/30/2021
OK	Oklahoma Department of Environmental Quality	2019-094	08/31/2021
TX	Texas Commission on Environmental Quality	T104704416-20-14	07/31/2021
UT	State of Utah Department of Health	NE000012020-10	07/31/2021
WA	State of Washington Department of Ecology	C912	06/07/2020

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PO BOX 83581
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Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported:
2020-12-23 16:41

Notes and Definitions

<	Less than reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

EPA 524.2, EPA 624, EPA 8260, OA-1, TCLP VOC, GRO, and all microbiological analyses are conducted in the facility located at 13606 B Street, Omaha, NE 68144. All other analyses are conducted in the main facility located at 13611 B Street, Omaha, NE 68144.

WO# 1566879 pg. of 2

Lower Platte South Natural Resources District
Vadose Zone Sampling Program Chain-of-Custody Form

Report & Bill To: Dick Ehrman
Lower Platte South NRD
P.O. Box 83581
Lincoln, NE 68501-3581
Phone: (402) 476-2729

WORKORDER: **1566879**
COC
Sticker #: 1

Account #: **8722**

Relinquished By (Signature): _____ Date/Time: 12/15/2020 10:10AM
Received By (Signature): Sydney S. Corcoran Date/Time: 12/15/2020 10:10AM

Relinquished By (Signature): Sydney S. Corcoran Date/Time: 12/15/20 1030AM
Received By (Signature): _____ Date/Time: 12/15/20 1030 Am

Relinquished By (Signature) _____ Date/Time: 12/16/20 10:50 am
Received By (Signature): _____ Date/Time: _____

Sample #	Date	Time	Matrix	Tests Requested Nitrate-N		Lab #/Order # (Internal Use)		Notes
RGW001	12-10-2020	1215	Groundwater	X				
RGW002	12-12-2020	1538	Groundwater	X				
RGW003	12-11-2020	1444	Groundwater	X				
~~RGW004~~			~~Groundwater~~	~~X~~				
RGW005	12-12-2020	0947	Groundwater	X				
RGW006	12-11-2020	1113	Groundwater	X				
RGW007	12-11-2020	1611	Groundwater	X				
RGW008	12-12-2020	1154	Groundwater	X				
RGW009B	12-10-2020	0859	Groundwater	X				
~~RGW010~~			~~Groundwater~~	~~X~~				
AGW011	12-7-2020	1056	Groundwater	X				
AGW012	12-13-2020	0942	Groundwater	X				
AGW013	12-9-2020	1131	Groundwater	X				
AGW014	12-7-2020	1506	Groundwater	X				
AGW015	12-9-2020	1003	Groundwater	X				

2.0 ~~At~~ 12/16/20 1100

LPSNRD Vadose Zone Sampling Program Chain-of Custody

AGW016	12-8-2020	1139	Groundwater	X					
AGW017 A	12-7-2020	1614	Groundwater	X					
AGW018	12-8-2020	1356	Groundwater	X					
AGW019	12-8-2020	1006	Groundwater	X					
AGW020	12-8-2020	1702	Groundwater	X					
AGW021	12-7-2020	1339	Groundwater	X					
AGW017 B	12-8-2020	1606	Groundwater	X					
GWDUP-1	12-9-2020	0902	Groundwater	X					
GW DUP-2	12-9-2020	1449	Groundwater	X					

WORKORDER: 1566879
COC
Sticker #: 2

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Appendix D

Shallow Soil Sampling Results Tables

Site ASS011							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	4	4	4	7	4	13
3-6 ft	4	4	4	4	4	4	11
6-9 ft	43	4	4	4	4	12	35
9-12 ft	40	4	4	4	4	11	32
12-15 ft	7	4	4	4	4	4	13
Root Zone Avg. (0-3, 3-6 ft)	4	4	4	4	5	4	71
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	30	4	4	4	4	9	240
Avg. N for all depths	19	4	4	4	4	7	-
Avg. N lb/ac	292	54	54	54	65	-	104

Site ASS012							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Dryland Corn	Dryland Corn	Dryland Corn	Dryland Corn	Dryland Corn		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	7	7	18	7	7	9	28
3-6 ft	4	4	11	4	4	5	15
6-9 ft	7	7	11	7	11	9	26
9-12 ft	7	7	14	14	7	10	30
12-15 ft	7	11	14	7	4	9	26
Root Zone Avg. (0-3, 3-6 ft)	5	5	14	5	5	7	130
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	7	8	13	10	7	9	247
Avg. N for all depths	6	7	14	8	6	8	-
Avg. N lb/ac	97	108	206	119	97	-	126

Site ASS014							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	4	4	4	7	4	13
3-6 ft	4	4	4	4	4	4	11
6-9 ft	4	4	4	4	4	4	11
9-12 ft	4	4	4	4	4	4	11
12-15 ft	4	4	4	4	4	4	11
Root Zone Avg. (0-3, 3-6 ft)	4	4	4	4	5	4	71
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	4	4	4	4	4	4	97
Avg. N for all depths	4	4	4	4	4	4	-
Avg. N lb/ac	54	54	54	54	65	-	56

Site ASS015							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Dryland Corn	Dryland Corn	Dryland Corn	Dryland Corn	Dryland Corn		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	11	4	7	11	14	9	28
3-6 ft	4	4	4	4	4	4	11
6-9 ft	4	7	4	4	4	4	13
9-12 ft	7	4	7	7	4	6	17
12-15 ft	7	4	7	7	4	6	17
Root Zone Avg. (0-3, 3-6 ft)	7	4	5	7	9	6	117
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	6	5	6	6	4	5	143
Avg. N for all depths	6	4	6	6	6	6	-
Avg. N lb/ac	97	65	87	97	87	-	87

Site ASS016							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	7	7	7	11	7	22
3-6 ft	4	7	4	7	4	5	15
6-9 ft	4	4	4	7	4	4	13
9-12 ft	4	7	4	4	4	4	13
12-15 ft	4	4	7	4	4	4	13
Root Zone Avg. (0-3, 3-6 ft)	4	7	5	7	7	6	110
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	4	5	5	5	4	4	117
Avg. N for all depths	4	6	5	6	5	5	-
Avg. N lb/ac	54	87	76	87	76	-	76

Site ASS017							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Dryland Soybeans	Dryland Soybeans	Irrigated Corn	Irrigated Corn	Irrigated Corn		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	4	4	4	4	4	11
3-6 ft	4	4	4	4	4	4	11
6-9 ft	4	4	4	4	7	4	13
9-12 ft	4	4	4	4	11	5	15
12-15 ft	4	4	4	-	11	6	17
Root Zone Avg. (0-3, 3-6 ft)	4	4	4	4	4	4	65
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	4	4	4	4	10	5	134
Avg. N for all depths	4	4	4	4	7	4	-
Avg. N lb/ac	54	54	55	43	108	-	63

Site ASS019							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans	Dryland Soybeans		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	4	4	7	7	5	15
3-6 ft	4	4	4	4	4	4	11
6-9 ft	4	4	4	4	4	4	11
9-12 ft	4	4	4	4	4	4	11
12-15 ft	7	4	7	7	4	6	17
Root Zone Avg. (0-3, 3-6 ft)	4	4	4	5	5	4	78
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	5	4	5	5	4	4	117
Avg. N for all depths	4	4	4	5	4	4	-
Avg. N lb/ac	65	54	65	76	65	-	65

Site ASS020							
Sample Location #	1	2	3	4	5	Avg. N	Avg N.
Land use	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass	Range, Pasture, Grass		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac
0-3 ft	4	4	7	7	4	5	15
3-6 ft	4	4	11	11	4	6	19
6-9 ft	4	4	11	7	7	6	19
9-12 ft	4	4	11	7	7	6	19
12-15 ft	4	4	11	7	7	6	19
Root Zone Avg. (0-3, 3-6 ft)	4	4	9	9	4	6	104
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	4	4	11	7	7	6	175
Avg. N for all depths	4	4	10	8	6	6	-
Avg. N lb/ac	54	54	152	119	87	-	93

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Appendix E

Deep Soil Sampling Results Tables

	ADS011	ADS012	ADS013	ADS014	ADS015	ADS016	ADS017A
	Range Pasture Grass	Corn	Range Pasture Grass	Soybeans	Corn	Range Pasture Grass	Soybeans
Interval (ft)	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft
0-5	7	7	7	11	18	11	11
5-10	4	11	4	7	18	4	7
10-15	4	7	4	7	7	4	7
15-20	4	4	4	-	4	4	7
20-25	4	7	4	-	4	4	-
25-30	4	14	4	-	4	7	-
30-35	-	-	4	-	11	-	-
35-40	-	-	-	-	-	-	-
40-45	-	-	-	-	-	-	-
45-50	-	-	-	-	-	-	-
Average	4	8	4	8	9	5	8
Minimum	4	4	4	7	4	4	7
Maximum	7	14	7	11	18	11	11
Total Lb/Ac	126	253	144	126	325	162	162
Quartile 2	3.61	7.22	3.61	7.22	3.61	3.61	7.22
Quartile 3	3.61	9.92	3.61	9.02	14.43	6.31	8.12

	ADS017B	ADS018	ADS019	ADS020	ADS021
	Irrigated Corn	Range Pasture Grass	Soybeans	Range Pasture Grass	Range Pasture Grass
Interval (ft)	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft
0-5	18	11	11	14	7
5-10	11	4	11	4	4
10-15	18	7	7	4	83
15-20	7	7	7	4	58
20-25	14	7	7	7	18
25-30	-	7	11	18	7
30-35	-	4	14	-	14
35-40	-	7	14	-	-
40-45	-	14	14	-	-
45-50	-	-	14	-	-
Average	14	8	11	8	27
Minimum	7	4	7	4	4
Maximum	18	14	14	18	83
Total Lb/Ac	343	343	559	253	956
Quartile 2	10.82	7.22	8.12	3.61	7.22
Quartile 3	18.04	7.22	14.43	12.63	37.88

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