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

Raymond, 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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Vice President

Date

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CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

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)
H_2SO_4	sulfuric acid
lb/ac-ft	pounds per acre-foot (pounds per one acre of surface area to a depth of one foot)
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
SS	shallow sample
USDA	United States Department of Agriculture
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. (EA) to document the results of the nitrate-N verification study for the Raymond, Nebraska Community Water System Protection Area (CWSPA), which is supplied by groundwater from three public water supply wells. The purpose of this study was to identify the source and extent of the reported nitrate-N within the Raymond 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.

Field Activities and Results

Field activities included installation of three monitoring wells; collection of 149 shallow soil samples at 6 sites; and collection of 101 deep soil samples at 12 sites. Sampling activities were completed from 16 November 2020 through 13 December 2020 and monitoring well installation was completed from 26 October 2021 through 1 December 2021.

The deep soil sampling and groundwater results suggest that 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. The soil sampling results indicate that dryland corn and soybean sites had nitrate-N values that typically exceeded background nitrate-N concentrations and appear to be a non-point source of nitrate loading. The vadose zone soil nitrate-N levels were found to be generally close to background levels through most of the profile for sites where the land use was range, pasture, or grass. No evidence of point sources such as industrial processes, leakage from an industrial or municipal wastewater site, or large spills were identified within the Raymond CWSPA. One area that is inconclusive is the area surrounding Site 010. 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 east of the Village of Raymond directly southwest of the municipal wells. A point source cannot be ruled out for the high levels of nitrate-N in groundwater at one site southeast of the intersection of NW 40th St and Raymond Road. Additional investigation would be needed to determine of 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. This data gap was identified after field activities were complete. 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.

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 Raymond community water system located within the Lower Platte South Natural Resources District (LPSNRD). EA has prepared this report as authorized through a contract with the LPSNRD.

The community of Raymond, Nebraska is located in northwestern Lancaster County, approximately 14 miles northwest of Lincoln, Nebraska (Figure 1). The Raymond community water system was selected by the LPSNRD for a nitrate-N study based off the guidelines within the 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 Raymond 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 RAYMOND STUDY AREA

The study area includes the entire Raymond CWSPA, which encompasses approximately 700 acres and includes the village of Raymond, and areas north, east, and south of Raymond (Figure 1). The CWSPA boundary extends north of Raymond ½ a mile, to the east of Raymond about ½ a mile, and to the northeast approximately 1¼ miles. The boundary extends ¼ mile south of Raymond. A Union Pacific railroad runs from the northwest to the southeast located to the west of the CWSPA.

1.3 PURPOSE OF STUDY

Currently the Raymond CWSPA is within a Phase I area. Previous sampling results from the three Raymond public water supply wells located to the east of Raymond have indicated that nitrate-N levels in two of the three wells have exceeded the 50% of the MCL, with all three wells reporting around 4-5 mg/L nitrate-N since the initial sampling in 2003, and the third well indicating an upward trend. Throughout this report, these wells are labelled as PWS-1, PWS-2, and PWS-3 rather than their well registration numbers. Based on the records through 2018, the highest nitrate-N concentration reported was 6.4 mg/L in PWS-2 (G-084064) in 2008. Data for the public wells is further described in section 3.6.1.

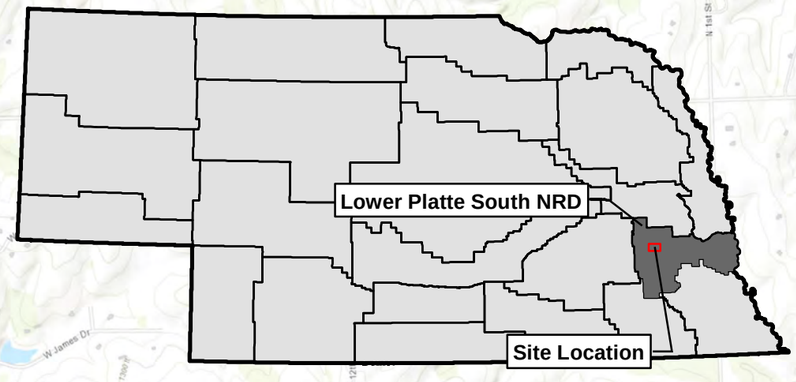
These wells exhibit consistently higher nitrate concentrations suggesting that the Phase II trigger requirements may be met. In accordance with the Ground Water Management Plan, these sampling results trigger the need for a verification study to determine the source of nitrate-N and whether it is warranted to change the entire 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 Raymond 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 Raymond CWSPA should be designated as a Phase II area.

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



0 1 2 Miles

N

Site Location Map

Figure 1

LPSNRD Nitrate Verification Study for Raymond 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

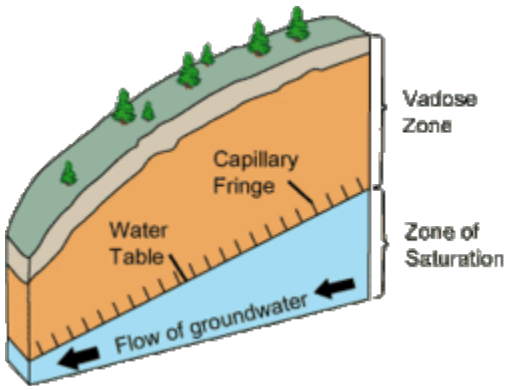
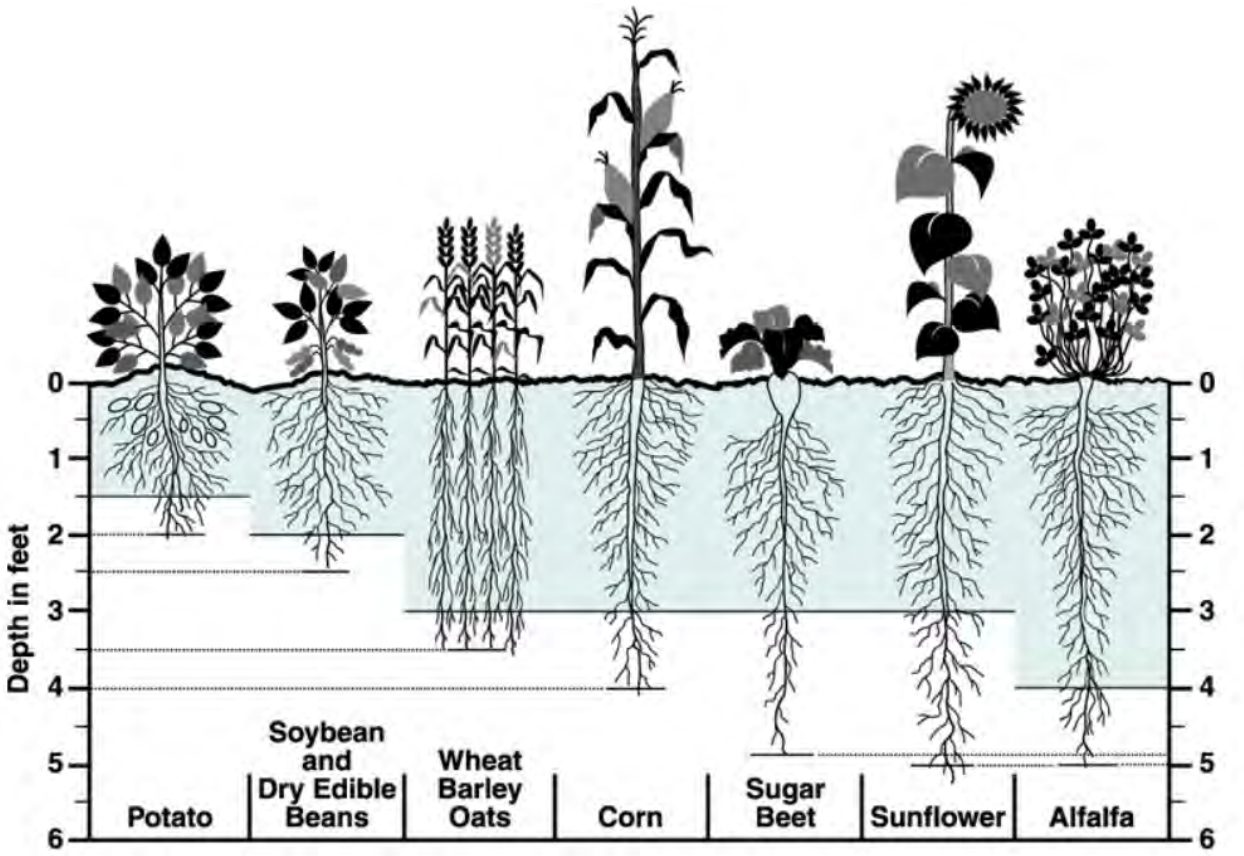


Figure 3. Root Zone Illustration



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.

2.3 TIER 1 INVESTIGATIVE REPORT IN RAYMOND

A Tier 1 Investigative Report was prepared in 2009 near the Raymond Patrol Station (5th & Pacific Street) in response to a petroleum spill in 1988 (Array, 2009). The 650-gallon underground fuel tank was removed and at the time it was estimated that the tank had not been used since 1970. In 2002, construction occurred on the property and during demolition, a 12 inch well was discovered with the presence of free product. The well was 62 ft deep and free product was detected at 38 ft below surface.

Seven monitoring wells were installed near the subject site in 2009 to determine groundwater flow, the amount, and concentration of free product, benzene, toluene, ethylbenzene, total xylenes, MTBE, n-hexane, and total extractable hydrocarbons as diesel fuel. Groundwater flow direction was determined to be due west. One monitoring well (G-153639B) was installed where the former underground storage tank was located. Six other wells were installed surrounding the spill location. In monitoring well G-153639B, 15.15 ft of free product was measured. In the remaining monitoring wells, no free product was detected. It should be noted that the subject site is upgradient of the three public water supply wells and therefore should not be anticipated to impact the municipal water supply.

In 2018, a groundwater sampling report was submitted to NDEE. All wells were sampled for present free product. At the time of measurement, monitoring well G-153639Bmeasured 24.62 ft of free product and was not sampled (Array, 2018). The 6 remaining sampled monitoring wells were non-detect. Based on the groundwater sampling report, the free product appears to be

contained in one general location. The report updated the groundwater gradient calculation, which slightly changed the groundwater flow direction; however, flow direction was still generally to the west.

The most recent work conducted at the site included groundwater extraction in 2019. A total of 1,608 gallons of groundwater and free product were recovered over the period from March 2019 to September 2019. Product thickness in March initially measured at 26.33 ft and by December 2019, product thickness was measured at 2.16 ft.

Proposed future study investigations include 12 soil borings each at a depth of 70 ft and a free product delineation to characterize the plume localized. This investigation is likely ongoing at the time of this report.

3. PHYSICAL SETTING

3.1 LAND USE

The Raymond CWSPA encompasses approximately 700 acres. A breakdown of land use within the CWSPA is provided in Table 1. The most predominant land use type is Range, Pasture, and Grass which accounts for 73% of land use. Remaining land use within the CWSPA is urban land, riparian forest and woodlands, dryland soybeans, dryland corn, and wetlands.

Table 1. Raymond Study Area Land Use Categories

Land Use	CSD 2005		Field Adjusted	
	Acres	%	Acres	%
Range, Pasture, Grass	510.7	73.0	235.9	33.7
Urban Land	65.8	9.4	139.2	19.9
Riparian Forest and Woodlands	64.2	9.2	64.2	9.2
Wetlands	7.4	1.1	7.4	1.1
Dryland Corn	19.5	2.8	92.4	13.2
Dryland Soybeans	32.1	4.6	160.6	23.0
Total	**700**	**100**	**700**	**100**

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

Land use within and surrounding Raymond is illustrated in Figure 4. During field verification, it was found that two cropland areas and one urban land area (low density) were outdated and these areas were significant. The revisions based on field verification are shown on Figure 4 and the revised acres are shown in separate columns in Table 1.

All the cultivated crops within the Raymond CWSPA currently use dryland farming techniques. An irrigation well exists south of the CWSPA, but evidence of recent irrigation was not found during review of aerial images and during visual reconnaissance.

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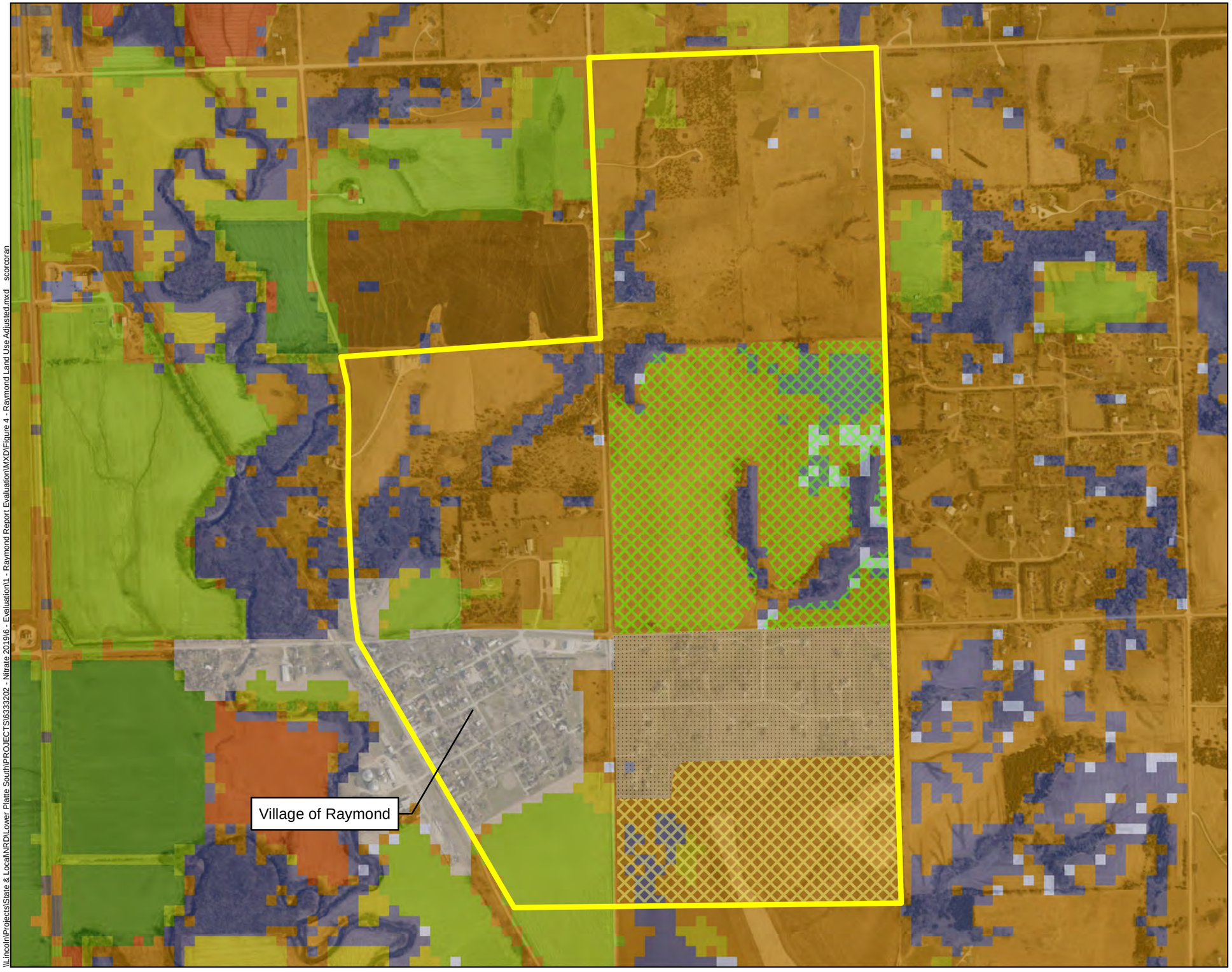

VICINITY MAP

Legend

- CWSPA Boundary

Adjusted Land Use in 2020

- Dryland Corn
- Dryland Soybeans
- Urban Low Density

2005 CSD

- Irrigated Corn
- Irrigated Soybeans
- Range, Pasture, Grass
- Urban Land
- Riparian Forest and Woodslands
- Wetlands
- Roads
- Dryland Corn
- Dryland Soybeans

0 470 940
Feet

N

Map Date: 3/18/2022
Source: NeDNR, NDEE, USGS, USDA
Projection: NAD 1983 (2011) NE StatePlane

LOWER PLATTE SOUTH natural resources district

Figure 4
Raymond Land Uses
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 4 - Raymond Land Use Adjusted.mxd scorcoran

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3.2 REGIONAL HYDROGEOLOGY

Lancaster County is primarily dependent on groundwater resources for domestic and irrigation uses. The main aquifers of the county lie within the Quaternary System with older bedrock consisting of the Cretaceous bedrock, as well as within Quaternary sediments composed of sands and gravel (Divine, 2014). These Quaternary sediments provide the main source of water usage for the county, yielding mostly high-quality water, with some smaller areas producing more highly mineralized groundwater (Druliner & Mason, 1994).

3.3 SITE HYDROGEOLOGY

The localized areas of Raymond, Nebraska surficial features are described as dissected rolling hills, formed by erosion of loess exposing the more resistant glacial sediments below. This is combined with the flatter landscape of the Oak Creek Valley. Approximate surface elevations range between 1,200 feet to 1,350 above mean sea level (AMSL). Depth to water in the local area ranges from approximately 0 to 100 ft below ground surface. Aquifers in the area occur in alluvial sediments, as well as glacial sediments of the Quaternary. Fresh groundwater quality has been of concern in the area due to iron and manganese concentrations, as well as saltwater intrusion issues (Young et al, 2016). Water supply for the municipal wells is screened in the Dakota Group Shale and Sandstone. The water bearing formations (alluvial sediments and the Dakota Group Shale and Sandstone) are generally connected hydraulically.

3.4 SURFACE DRAINAGE

Due to past glaciation, this area of Lancaster County is primarily defined as dissected rolling hills surrounding the flatter Oak Creek Valley. North Oak Creek, a tributary of Salt Creek, lies less than half a mile outside the western portion of the CWSPA. The typical ground surface elevation decreases across the CWSPA boundary from north to south and ranges between 1,345 AMSL in the north to 1,215 ft AMSL in the south.

3.5 POINT SOURCE INVESTIGATION

An investigation was conducted by EA to identify any recorded contaminant spills in the Raymond CWSPA area using readily available resources in Lancaster County. The investigation did not identify any point source locations of reported nitrate-N spills within the Raymond CWSPA. A Tier I investigation was conducted in the study area as described in Section 2.3; however, the spill site would not be a significant contributor to nitrate-N.

The records indicate a single nitrate-N sampling event from one privately owned, inactive domestic well located east of the CWSPA boundary on the edge of a dryland row crop area. The records show the single sampling event from 2014 with nitrate-N reporting at 4.09 mg/L.

3.6 REGISTERED WELLS

Registered wells from the Nebraska Department of Natural Resources (NDNR) database were identified inside Raymond CWSPA and within a ½ mile surrounding the Raymond CWSPA as shown in Figure 5 and listed in Table 2. A total of 27 registered wells are currently active within the CWSPA; including three public water supply wells, six domestic wells, two ground heat exchange wells, 15 monitoring wells and one well registered as 'other' with the intended use for lawn watering.

Two separate single use project well nests exist within the Raymond CWSPA. The United States Department of Agriculture (USDA) installed 9 monitoring wells in and surrounding the CWSPA boundary in part to monitor carbon tetrachloride. The second well nest is completely located within the Raymond CWSPA and includes 7 wells monitored by Lancaster County and overseen by NDEE. These wells were installed to monitor a petroleum spill in 2009. Additional information regarding the Lancaster County petroleum spill is found in Section 2.3.

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 Raymond CWSPA

Wells Within Raymond CWSPA Boundary					
Location	**Use**	**Year Completed**	**Status**	**Well Depth (ft)**	**Pump rate (gallons per minute)**
G-084063	Municipal	1995	A	80	80
G-084064	Municipal	1995	A	85	80
G-111121	Municipal	2001	A	100	60
G-090663	Domestic	1996	A	130	10
G-092590	Domestic	1997	A	177	12
G-109946	Domestic	2001	A	140	10
G-180270	Domestic	2016	A	141	30
G-182738	Domestic	2017	A	80	20
G-185647	Domestic	2018	A	80	20
G-153928	Ground Heat Exchange	2009	A	180	0
G-158960	Ground Heat Exchange	2011	A	200	0
G-083124	Other	1994	A	67	0
G-092699C	Monitoring	1997	A	70	0
G-092699E	Monitoring	1997	A	165	0
G-092699F	Monitoring	1997	A	90	0
G-092699G	Monitoring	1997	A	35	0

Wells Within Raymond CWSPA Boundary					
Location	**Use**	**Year Completed**	**Status**	**Well Depth (ft)**	**Pump rate (gallons per minute)**
G-092699H	Monitoring	1997	A	18	0
G-092699I	Monitoring	1997	A	117	0
G-092699J	Monitoring	1997	A	25	0
G-097199	Monitoring	1998	A	50	0
G-153639A	Monitoring	2009	A	38	0
G-153639B	Monitoring	2009	A	57	0
G-153639C	Monitoring	2009	A	42	0
G-153639D	Monitoring	2009	A	28	0
G-153639E	Monitoring	2009	A	28	0
G-154146A	Monitoring	2009	A	55	0
G-154146B	Monitoring	2009	A	26	0
Wells Surrounding CWSPA Boundary Within 0.5 Miles					
G-177714	Commercial/Industrial	2015	A	80	65
G-075908	Domestic	1982	A	58	30
G-083918	Domestic	1994	A	132	12
G-085961	Domestic	1995	A	193	10
G-090024	Domestic	1996	A	163	0
G-097638	Domestic	1998	A	110	9
G-098936	Domestic	1998	A	40	10
G-100180	Domestic	1997	A	77	7
G-102760	Domestic	1999	A	155	20
G-142304	Domestic	2006	A	133	10
G-146510	Domestic	2007	A	140	5
G-149731	Domestic	2008	A	180	10
G-151005	Domestic	2008	A	112	10
G-162665	Domestic	2012	A	150	10
G-169360	Domestic	2013	A	101	18
G-177738	Domestic	2015	A	80	20
G-180073	Domestic	2016	A	177	15
G-187216	Domestic	2019	A	140	15
G-187358	Domestic	2019	A	141	10
G-147340	Domestic	2019	A	54	10
G-099145	Ground Heat Exchange	1998	A	170	0

Wells Within Raymond CWSPA Boundary					
Location	**Use**	**Year Completed**	**Status**	**Well Depth (ft)**	**Pump rate (gallons per minute)**
G-181086	Ground Heat Exchange	2016	A	40	0
G-002661	Irrigation	1956	A	78	800
G-114990	Observation	2002	A	77.5	0
G-092699D	Monitoring	1997	A	56	0

G-102760
G-146510
G-075908
G-187358
G-090024
G-100180
G-085961
G-187216
G-142304
G-097638
G-180073
G-083918
G-151005
G-158960
G-185647
G-109946
G-182738
G-099145
G-177714
G-177738
G-180270
G-181086
G-149731
G-098936
G-092699E
G-162665
G-092699G
G-090663
PWS-1
G-092699F
PWS-2
G-092699J
G-114990
G-153639D
G-153639E
G-092699H
G-092699I
G-153639A
PWS-3
G-154146A
G-153639B
G-092699C
G-092590
G-153639C
G-154146B
G-153928
G-083124
G-097199
G-092699D
G-002661
G-169360
G-147340
Little Salt Creek
North Oak Creek
Oak Creek
Oak Creek

VICINITY MAP

Legend

- CWSPA Boundary
- Surface Water
- Public Water Supply (PWS)

Active Registered Wells

- Commercial/Industrial
- Domestic
- Ground Heat Exch-Clo Loop
- Irrigation
- Observation
- Other
- Monitoring

WhAEM Model - April 2005

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

0 700 1,400
Feet

N

Map Date: 3/4/2022
Source: NeDNR, NDEE, USGS, USDA
Projection: NAD 1983 (2011) NE StatePlane

Figure 5
Registered Well Locations
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

I:\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 5 - Registered Well Locations .mxd scorcoran

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3.6.1 Public Water Supply Wells

The Village of Raymond obtains drinking water from three wells: PWS-1 (G-111121) originally drilled in 2001 to a depth of 100 ft. PWS-2 (G-084064) originally drilled in 1995 to a depth of 85 ft. PWS-3 (G-084063) originally drilled in 1995 to a depth of 80 ft. PWS-1 has a screened interval at 85 ft to 97 ft. PWS-2 has a screened interval of 70 ft to 85 ft. PWS-3 has a screened interval at 60 ft to 80 ft.

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 Raymond municipal wells for dates ranging from 2003 to 2018 available through NDHHS are presented in Table 3 (NDHHS 2018). None of the municipal wells have exceeded the MCL of 10 mg/L nitrate-N. However, two wells have reached the 50% MCL of 5.0 mg/L nitrate-N. PWS-2 (G-084064) has reached a maximum nitrate-N of 6.4 mg/L in 2008. Data from the collected samples over time indicate that nitrate-N is fluctuating, but generally staying between 3 and 6 mg/L.

Table 3. Municipal Well Groundwater Nitrate-N Sample

Nitrate-N Concentrations (mg/L) – Public Water Supply Wells			
Sample Date	**Raymond #1 North (G-111121)**	**Raymond #2 Middle (G-084064)**	**Raymond #3 Southeast (G-084063)**
08/27/2003	3.9	5.9	5.0
09/13/2004	3.3	5.5	4.5
08/18/2005	3.7	6.0	4.8
08/23/2006	4.3	4.4	-
07/11/2008	3.5	6.4	5.3
06/11/2009	4.0	4.9	4.1
07/07/2010	3.8	4.8	4.4
08/10/2011	3.8	4.4	4.6
08/08/2012	4.1	4.3	4.1
06/04/2013	3.5	4.6	4.1
09/17/2014	2.9	3.9	3.8
09/29/2016	3.4	4.4	4.2
06/13/2017	3.1	4.1	4.7
06/26/2018	4.2	5.3	5.3

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 for public water supplies. The WhAEM for the Raymond municipal wells was originally run by the Nebraska Department of Environmental Quality (NDEQ; currently titled Nebraska Department of Environment and Energy, NDEE) in 2005 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 that the base of aquifer elevation in Raymond is 1,170 feet, which was a reasonable estimate based on the information available at the time. Aquifer thickness was reported to be 112 ft and was based on the average aquifer thickness from the three production well logs. Thus, the model aquifer thickness is likely greater than the actual aquifer thickness. The hydraulic conductivity was reported at 8 feet/day for the which appears to be a higher estimate of hydraulic conductivity, but not unreasonably high. A low porosity was used for the model at 0.07. This suggested value may be low, but appropriate.

The conclusion from the review of the WhAEM Model suggested that the model assumptions appeared to be reasonable. A full report for the WhAEM Review Report and associated information can be found in Appendix A. The WhAEM Model capture zones are for 1, 2, 10, and 20 years and can be viewed in Figure 5.

4. METHODS OF INVESTIGATION

The Raymond 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 (EA 2020). The methods and procedures of the investigation are summarized in the following sections. See the Work Plan for additional details.

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 6 sites, with 5 borings per site, resulting in 30 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 149 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. Each deep soil sample was collected during the same winter season.

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 10 sites, with 1 to 2 locations per site, resulting in 12 sample locations. Samples were collected from 5 to 13 depth intervals at each location (increments of 5 ft, to a range of 25 to 64 ft). This yielded a total of 101 deep samples collected.

4.2.2 Groundwater Sampling

A groundwater sample was collected from the unconfined aquifer at 8 of the 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 was 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 was gathered during drilling from the drill cuttings. Three permanent monitoring wells were installed. 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 or to a depth providing a productive screened interval, 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 wells, (RMW-1, RMW-2, and RMW-3) were installed on private properties. Monitoring wells were 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).

Wells were 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.

Each 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 groundwater samples from the Raymond monitoring wells installed as part of this study. The results of the LPSNRD groundwater sampling were 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 RDS008 was a Raymond (R) deep sample by direct push (DS) at location 008.

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 RDS010-15 was identified as sample DSDUP-17 (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. Likely, the 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 wells 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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RMW-2
RMW-1
PWS-1
PWS-2
PWS-3
RMW-3
North Oak Creek
Oak Creek
79

VICINITY MAP

Legend

- Public Water Supply (PWS)
- Monitoring Well
- Deep Soil and Groundwater Sample
- Deep Soil Only
- Shallow Soil
- CWSPA Boundary
- Surface Water

WhAEM Model - April 2005

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

0 450 900
Feet

N

Map Date: 3/4/2022
Source: NeDNR, NDEE, USGS, USDA
Projection: NAD 1983 (2011) NE StatePlane

Figure 6
Sampling Locations
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 6 - Sampling Locations.mxd scorcoran

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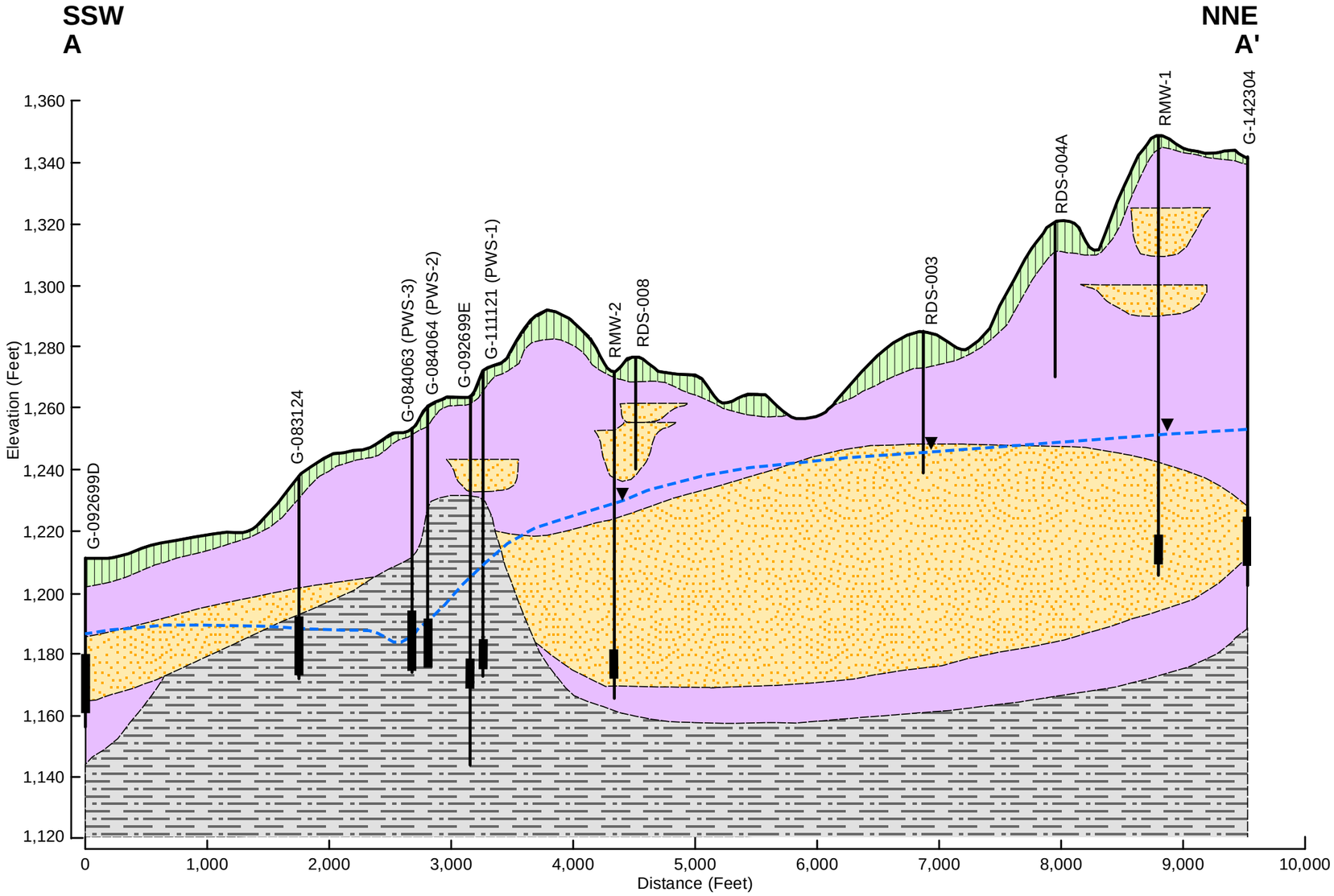
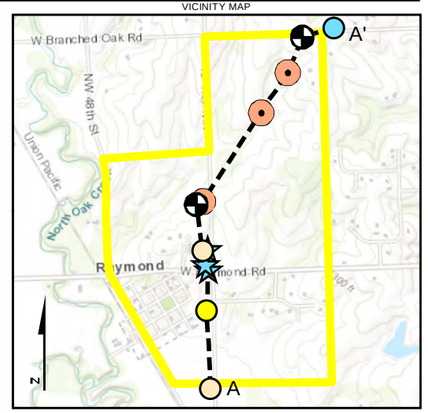
SSW
A

NNE
A'



VICINITY MAP



Legend

- Raymond CWSPA
- Monitoring Well (MW)
- Domestic Well
- Monitoring Well
- Other
- Deep Soil Locations
- Public Water Supply
- Loess (Silt and Clay)
- Glacial Till (Primarily Clay)
- Glacial Sand and Clayey Sand
- Bedrock (Dakota Group Shale and Sandstone)
- 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" = 1000'
Vertical Scale: 1" = 40'

LOWER PLATTE SOUTH
natural resources district

Figure 7
Geologic Profile
Raymond Nitrate Verification Study
Raymond, Lancaster County, Nebraska

F:\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\7 - Reports\Raymond\Figures\Cross Section\Figure 7- Raymond Geologic Profile.mxd nbutts

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5.2 GROUNDWATER LEVELS

5.2.1 Groundwater Levels During Field Investigation

Groundwater levels at the direct push locations were estimated as shown in Table 4 by measurement with an electronic water level tape and referenced to the ground surface elevation.

Results from direct push technology for deep samples indicate that generally, the water surface elevations fall into a range of 1,196 – 1,253 feet AMSL. Geologic materials in all twelve deep soil boring locations indicate a variety of sands, fine to medium grained sands, silty clays, and a few locations of clay and sandy clay. Based on monitoring well bore logs, the bottom of boreholes was comprised of fine sands, fine gravels and clays, or shale, siltstone, and sandstone.

Table 4. Raymond Study Area - Groundwater Level Measurements

Location	Ground Elevation (ft AMSL)	Depth to Water (ft bgs)	Water Elevation (ft AMSL)	Date
RDS001	1281	31	1250	12/10/2020
RDS002	1235	39	1196	12/12/2020
RDS003	1288	37	1251	12/11/2020
RDS005	1277	24	1253	12/12/2020
RDS006	1299	48	1251	12/11/2020
RDS007	1222	36	1186	12/11/2020
RDS008	1283	34	1249	12/12/2020
RDS009B	1263	20	1243	12/10/2020

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

Additionally, three permanent monitoring wells were installed in November 2021. Groundwater levels were measured in the three monitoring wells with an electronic water level tape as noted on the boring logs and referenced to measuring point elevation (top of casing) as shown in Table 5. Depth to water varied from approximately 34 ft to 99 ft. The monitoring wells are screened in a relatively shallow glacial sand deposits of the that are assumed to be hydraulically connected to deeper Dakota Group shale and sandstone deposits.

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RMW-1
10/26/2021
1,251.87 ft

RDS003
1,251 ft

RDS006
1,251 ft

RDS008
1,249 ft

RMW-2
11/17/2021
1,233.44 ft

RDS001
1,250 ft

RDS009B
1,243 ft

RDS005
1,253 ft

G-111121

G-084064

G-084063

RMW-3
11/18/2021
1,252.28 ft

RDS002
1,196 ft

RDS007
1,186 ft

79

North Oak Creek

Oak Creek

VICINITY MAP

Legend

- CWSPA Boundary
- Surface Water
- Public Supply Wells
- Monitoring Well

Groundwater Elevation in ft asml Sampled During Field Investigation 12/2021

- Deep Soil Locations

WhAEM Model - April 2005

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

0 450 900
Feet

N

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

Figure 8
Groundwater Elevations
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 8 - Groundwater Elevations.mxd scorcoran

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5.2.2 Groundwater Flow Direction

The direction and gradient of groundwater flow was determined using triangulation from water level measurements from the three monitoring wells collected by the LPSNRD during the 8 December 2021 sampling event. The water level measurements are shown in Table 5. The gradient was found to be 0.0071 ft/ft and flow direction is to the west as shown in Figure 9.

Table 5. Groundwater Flow Direction Measurements

Well Name	Measuring Point Elevation	Depth to Water from TOC	Water Level Elevation
RMW-1	1,351.42	99.55	1,251.87
RMW-2	1,276.92	43.48	1,233.44
RMW-3	1,286.51	34.23	1,252.28

It should be noted that the groundwater levels south of the Raymond public wells are much lower than north of the public wells. The three monitoring wells are intended to describe the flow direction north and east of the Raymond well field. The lower groundwater levels south of public wells are illustrated in geologic profile (Figure 7) and the deep borings (RDS002 and RDS007) shown in Figure 8.

Based on these results, the groundwater flow direction was found to be slightly different than the original estimated groundwater flow direction used in the WhAEM modeling. The two groundwater flow arrows are presented in Figure 9. The WhAEM GW Flow arrow represents the original groundwater flow included in the WhAEM model. The General GW Flow arrow represents the groundwater flow direction based on the monitoring wells. The general flow direction determined in this study, is oriented more towards west while the previous estimate was towards southwest (Figure 9).

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RMW-2
10/26/2021
1,251.87 ft

WhAEM GW Flow

General GW Flow

RMW-1
11/17/2021
1,233.44 ft

1240'

1248'

1250'

RMW-3
11/18/2021
1,252.28 ft

VICINITY MAP

Legend

- Public Supply Wells
- Monitoring Well
- Estimated Contours
- CWSPA Boundary
- Surface Water

WhAEM Model - April 2005

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

0 440 880
Feet

N

Map Date: 3/15/2022
Source: NeDNR, NDEE, USGS, USDA
Projection: NAD 1983 (2011) NE StatePlane

Figure 9
Groundwater Flow Direction
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 9 - Groundwater Flow Direction.mxd scorcoran

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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 and Figure 10, organized by site. Each site included five shallow soil borings. Figure 10 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
RSS001	Dryland Soybeans	15	18.04	7.79	117
RSS003	Range Pasture Grass	15	7.22	3.90	58
RSS004	Range Pasture Grass	15	3.61	3.61	54
RSS005	Range Pasture Grass	15	7.22	3.75	56
RSS008	Woodland	15	3.61	3.61	54
RSS009	Dryland Soybeans	15	25.26	9.32	134

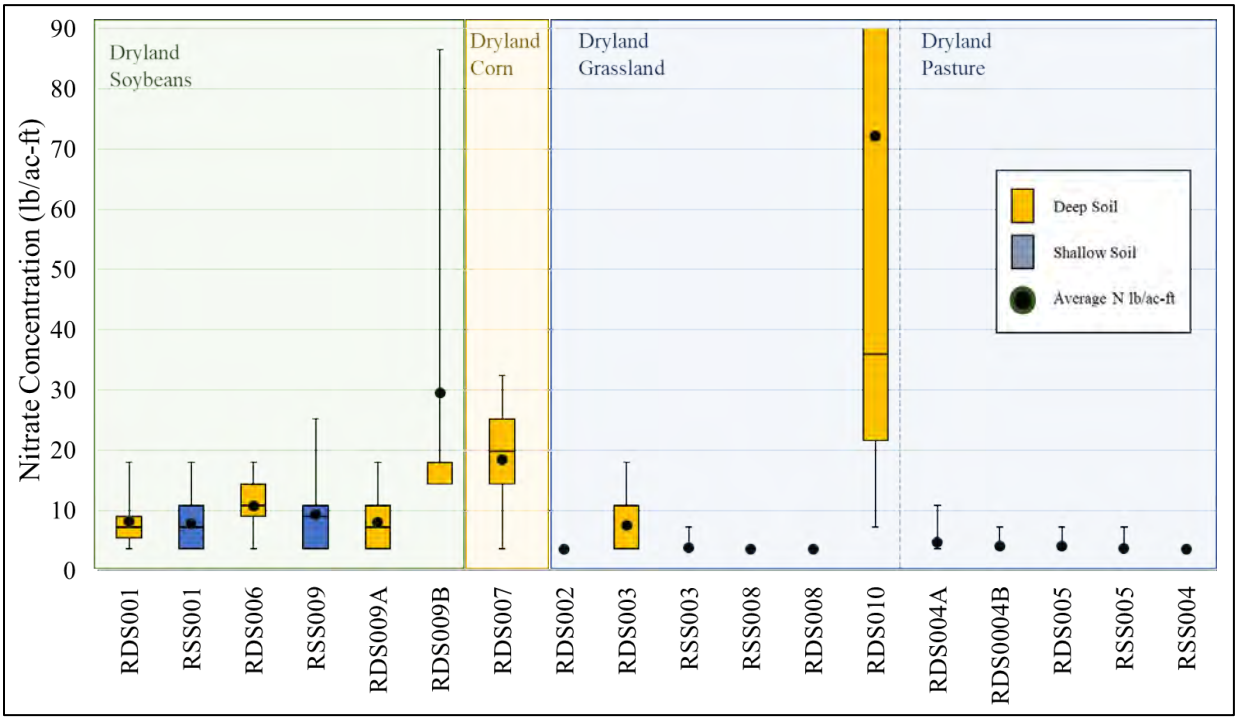
5.3.2 Deep Soil Samples

For deep soil borings, the average nitrate (lb/ac-ft) and total nitrate (lb/ac) results are represented in Table 7 and Figure 10, 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. 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	Boring Depth	Maximum Nitrate-N, lb/ac-ft	Average Nitrate-N lb/ac-ft	Total Nitrate-N lb/ac
RDS001	Dryland Soybeans	35	18	8	289
RDS002	Range, Pasture, Grass	40	4	4	144
RDS003	Range, Pasture, Grass	45	18	8	343
RDS004A	Range, Pasture, Grass	48	11	5	225
RDS004B	Range, Pasture, Grass	35	7	4	144
RDS005	Range, Pasture, Grass	35	7	4	144
RDS006	Dryland Soybeans	55	18	11	595
RDS007	Dryland Corn	40	32	18	740
RDS008	Woodland	35	4	4	126
RDS009A	Dryland Soybeans	45	18	8	361
RDS009B	Dryland Soybeans	25	87	30	740
RDS010	Range, Pasture, Grass	64	213	72	4618

Figure 10. Soil Sampling Results



Note: RDS010 box plot has the third quartile value of 152 lb/ac-ft and maximum value of 213 lb/ac-ft. Y-axis is capped at 90 lb/ac-ft for optimum visibility of other data.

5.3.3 Direct Push Groundwater Samples

Groundwater samples were collected at eight of the twelve direct push boring locations. Direct push groundwater results varied from a non-detect at less than 0.2 mg/L at location RGW005 to 25.6 mg/L at RGW003 as shown in Table 8. Figure 11 illustrates the distribution of the direct push groundwater sample results. Appendix C contains the laboratory results for the direct push groundwater samples. The nitrate-N results in groundwater were variable. Two of the eight groundwater samples collected exceeded the recommended groundwater nitrate-N limit of 10 mg/L MCL, and three locations were below 1 mg/L. The highest groundwater nitrate-N concentration was sampled within a grassland, which is an unexpected result.

Table 8. Raymond CWSPA - Direct Push Groundwater Sample Results

Sample Location	Type	Sample Interval	Nitrate (mg/L)	Land Use at Time of Sampling
RGW001	Direct Push	35	4.58	Dryland Soybeans
RGW002	Direct Push	40	0.99	Range, Pasture, Grass
RGW003	Direct Push	45	25.6	Range, Pasture, Grass
RGW005	Direct Push	35	<0.2	Range, Pasture, Grass
RGW006	Direct Push	55	1.19	Dryland Soybeans
RGW007	Direct Push	40	0.29	Dryland Corn
RGW008	Direct Push	35	2.97	Woodland
RGW009B	Direct Push	25	12.3	Dryland Soybeans

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RMW-2
12/8/2021
0.41 mg/L

RDS003
12/22/2020
25.6 mg/L

RDS006
12/22/2020
1.19 mg/L

RDS008
12/22/2020
2.97 mg/L

RMW-1
12/8/2021
5.3 mg/L

RDS001
12/22/2020
4.58 mg/L

RDS005
12/22/2020
<0.2 mg/L

G-111121

RDS009B
12/22/2020
12.3 mg/L

RMW-3
12/8/2021
4.13 mg/L

G-084064

G-084063

RDS002
12/22/2020
0.99 mg/L

RDS007
12/22/2020
0.29 mg/L

79

North Oak Creek

Oak Creek

VICINITY MAP

Legend

- CWSPA Boundary
- Public Supply Wells
- Monitoring Well

Groundwater Results for Nitrate

- Groundwater Sample at Bottom of Deep Boring

WhAEM Model - April 2005

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

0 450 900
Feet

N

Map Date: 3/15/2022
Source: NeDNR, NDEE, USGS, USDA
Projection: NAD 1983 (2011) NE StatePlane

Figure 11
Groundwater Nitrate Results
Raymond Nitrate Study for LPSNRD
Raymond, Lancaster County, Nebraska

\\Lincoln\Projects\State & Local\NRD\Lower Platte South\PROJECTS\6333202 - Nitrate 2019\6 - Evaluation\1 - Raymond Report Evaluation\MXD\Figure 12 - Groundwater Results.mxd scorcoran

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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 Raymond CWSPA.

Overall nitrate-N trends:

- Of the 12 deep soil sampling locations, six deep samples were collected in range, pasture, grass land use sites. One sample was collected in a woodland land use site. The remaining five were categorized as cultivated cropland (corn and soybeans) land use sites. There were no irrigated sites.

- Several sites had low variability in results within the vertical soil profile, such as for Sites 002 (RSS002), 003 (RSS003) 004 (RSS004, RDS004A, and RDS004B), 005 (RSS005 and RDS005) and 008 (RSS008 and RDS008). All of these sites are grassland, pasture, or woodland.

- Other sites had high variability in results within the vertical soil profile, such as for 001 (RDS001 and RSS001), 003 (RDS003), Site 006 (RDS006), 007 (RDS007), 009 (RDS009A and RDS009B), and 010 (RDS010). All these sites include cultivated cropland (corn and soybeans), except for site location 003 and 010 which are both grasslands. The sites listed with high variability are discussed individually in the key site-specific observations below.

Key site-specific evaluations:

- The results for dryland soybeans at Sites 001 and 006, deep borings, reported nitrate-N at and slightly above background levels, respectively. The average nitrate-N for Site 001 is 8 lb/ac-ft and Site 006 is 11 lb/ac-ft, and the maximum nitrate-N for both sites is 18 lb/ac-ft at 0-5’ bgs and 15-20’ bgs respectively. Shallow sampling for Site 001 indicated the same average and maximum nitrate-N as the deep boring. Shallow sampling was not performed on Site 006.

- Site 003 was a grassland site. Three consecutive intervals at this location were elevated from (30-45’) for the deep boring. These depth intervals indicated above background nitrate-N levels ranging from 11 lb/ac-ft to 18 lb/ac-ft. In comparison, all nitrate-N samples collected from shallow soil samples were below background levels and ranged from 4 lb/ac-ft to 7 lb/ac-ft. The groundwater sample result from RDS003 measured at 25.6 mg/L. Boring logs from this location indicate the presence of moisture starting at 25 ft bgs. Moisture was found throughout the coring from 25 ft until groundwater was encountered at 45 ft bgs. This data suggests that the nitrate-N levels in the soil ranging

from 30 ft to 45 ft bgs were saturated enough with the aquifer and might have been influenced by the nitrate-N levels in the groundwater at this location.

- The results for grassland at Site 010, a deep boring, indicated highly elevated nitrate-N results throughout the soil profile. The average nitrate-N was 72 lb/ac-ft and the maximum nitrate-N was 213 lb/ac-ft at 25-30' bgs. Samples at four depths ranging from 20' to 40' bgs were particularly high. Shallow sampling was not performed on this site, therefore spatial variability of nitrates in the field is unknown. 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.

- The results for dryland corn at Site 007, a deep boring, reported nitrate-N above background levels and was noticeably higher than several dryland soybeans sites. The average nitrate-N was 18 lb/ac-ft and the maximum nitrate-N was 32 lb/ac-ft at 10-15' bgs. However, the results highly varied throughout the boring. Shallow sampling was not performed on this site, therefore spatial variability of nitrates in the field is unknown. Land use on this site likely changes year to year.

- The results for dryland soybeans at Site 009AB, deep borings, reported nitrate-N above background levels. The average nitrate-N for Site 009A is 8 lb/ac-ft and for Site 009B is 30 lb/ac-ft. The maximum nitrate-N for Site 009A is 18 lb/ac-ft at 10-15' bgs and for Site 009B is 87 lb/ac-ft at 0-5' bgs. The groundwater sample at 009B measured 12.3 mg/L. Groundwater sample was not collected at 009A. Several shallow soil samples reported above background nitrate-N levels, with the location RSS009-04 reporting highest concentrations of 22 and 25 lb/ac-ft in 9-12' and 12-15' intervals, respectively.

5.4 QA/QC SAMPLES

Quality assurance and quality control samples were collected throughout the Raymond CWSPA for deep and shallow soil samples. QA/QC samples were collected at a 5% ratio of all planned soil samples. The greatest percent difference was found at five separate intervals with a 67% difference between samples. As reference, QA/QC data is considered agreeable up to 50% difference. The five sample pairs had the same relationship, each parent sample was 1 ppm and the duplicate was 2 ppm. A review of the data suggests that the five intervals sampled at 67% difference is not considered to be unacceptable though exceeds the range. The values reported are below background levels. 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 8 shows the summary of the QA/QC relationships for shallow and deep soil samples.

Table 9. QA/QC Sample Percent Differences

Matrix	Sample Parent ID	Parent Results, ppm	Duplicate ID	Duplicate Results, ppm	Percent Difference
Soil	RSS001-01-06	1	DUP-2	1	0
Soil	RSS001-04-09	1	DUP-3	1	0
Soil	RSS003-05-06	1	DUP-5	1	0
Soil	RSS003-05-06	1	DUP 7	1	0
Soil	RSS004-05-15	1	DUP-4	1	0
Soil	RSS008-01-03	1	DUP 6	1	0
Soil	RSS008-01-03	1	DUP-8	1	0
Soil	RSS009-03-03	3	DUP-1	3	0
Soil	RDS001-25	2	DSDUP-9	3	40
Soil	RDS003-15	1	DSDUP-13	2	67
Soil	RDS003-40	4	DSDUP-14	6	40
Soil	RDS004A-25	3	DSDUP-10	3	0
Soil	RDS004B-35	1	DSDUP-11	2	67
Soil	RDS005-20	1	DSDUP-15	2	67
Soil	RDS006-10	3	DSDUP-12	3	0
Soil	RDS008-30	1	DSDUP-16	2	67
Soil	RDS009A-45	1	DSDUP-8	2	67
Soil	RDS010-15	2	DSDUP-17	2	0

5.5 GROUNDWATER MONITORING WELL RESULTS

This section presents the nitrate-N results for groundwater samples collected in the installed monitoring wells as part of the Raymond nitrate-N verification study. Figure 11 shows the monitoring well sampling locations and concentrations of nitrate-N.

5.5.1 Monitoring Well Groundwater Samples

Groundwater samples were collected by the LPSNRD on December 8, 2021. Monitoring Well 1 (RMW-1) is located near north of the public supply wells on Northwest 40th Street. RMW-2 is located near the northern CWSPA boundary on West Branched Oak Road. RMW-3 is located east of the Village on West Raymond Road. Nitrate results from each well can be found in Table 10 and are shown in Figure 11.

Table 10. Monitoring Well Groundwater Results

Well ID	Well Name	Sample Date	Nitrate mg/L
268113	RMW-1	12/8/2021	5.3
268119	RMW-2	12/8/2021	0.41
268123	RMW-3	12/8/2021	4.13

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 lb/ac-ft	Deep Soil Average Nitrate-N lb/ac-ft	# of Shallow Sites	Shallow Soil Maximum Nitrate lb/ac-ft	Shallow Soil Average Nitrate-N lb/ac-ft
Dryland Corn	1	32	18	-	-	-
Dryland Soybeans	4	87	12	2	25	9
Range, Pasture, Grass	5	18	5	3	7	4
Woodland	1	4	4	1	4	4

* The Range Pasture Grass group does not include results for site 010 as it was believed to be an outlier in this dataset. Discussion in included in section 5.3.4.

5.6.1 Dryland Corn/Soybeans

All cropland sites where soil samples were collected used dryland farming techniques. Many of the average nitrate-N levels are elevated and surpass the 8 lb/ac-ft background nitrate average concentration for soils. 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 time of sampling.

For the shallow soil sampling, the dryland soybeans had above background maximum and average nitrate-N levels. No shallow samples were collected in dryland corn land use.

In deep soil borings, dryland soybeans had a higher maximum nitrate-N level than dryland corn. The maximum nitrate-N in dryland soybeans was 87 lb/ac-ft sampled at the first 5 ft interval. Dryland corn had an overall higher average nitrate-N level than dryland soybeans. This is expected within the root zone due to seasonal impacts of the different crops but was also exhibited to a lesser extent below the root zone. One of the direct push groundwater samples was 12.3 mg/L, exceeding the 10 mg/L MCL.

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

Six samples were collected from range pasture and grassland sites. Four grassland sites were comprised of both maintained and unmaintained native grasses. One horse pasture was sampled in two locations. One sample location (Site 010) had unusually high results, was considered an outlier, and was considered separately later in this section.

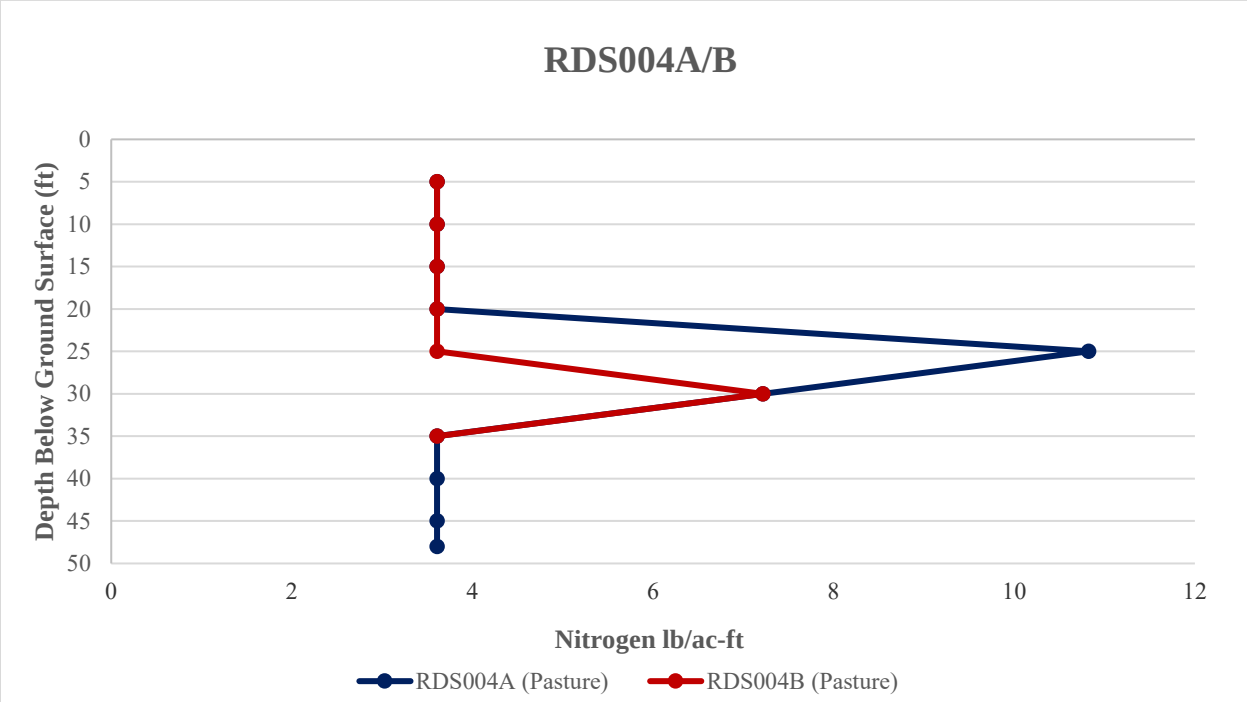
The average nitrate concentrations reported in remaining deep and shallow soil samples are 5 lb/ac-ft and 4 lb/ac-ft respectively. The maximum nitrate-N concentrations in deep and shallow soils are 18 lb/ac-ft and 7 lb/ac-ft respectively. The maximum concentration was reported at RDS003 in the last deep soil interval of 40-45 ft. The highest groundwater sample nitrate-N within the range pasture grass land uses was 25.6 mg/L and it was collected at the deepest interval of RDS003. The deep soil nitrate-N at this location was likely impacted by the high levels of nitrate-N in groundwater at this site. This trend suggests that nitrate-N has impacted the groundwater under this area and may not be the result of vertical leaching through the vadose zone. It is likely that the nitrate-N in groundwater comes from an upgradient source.

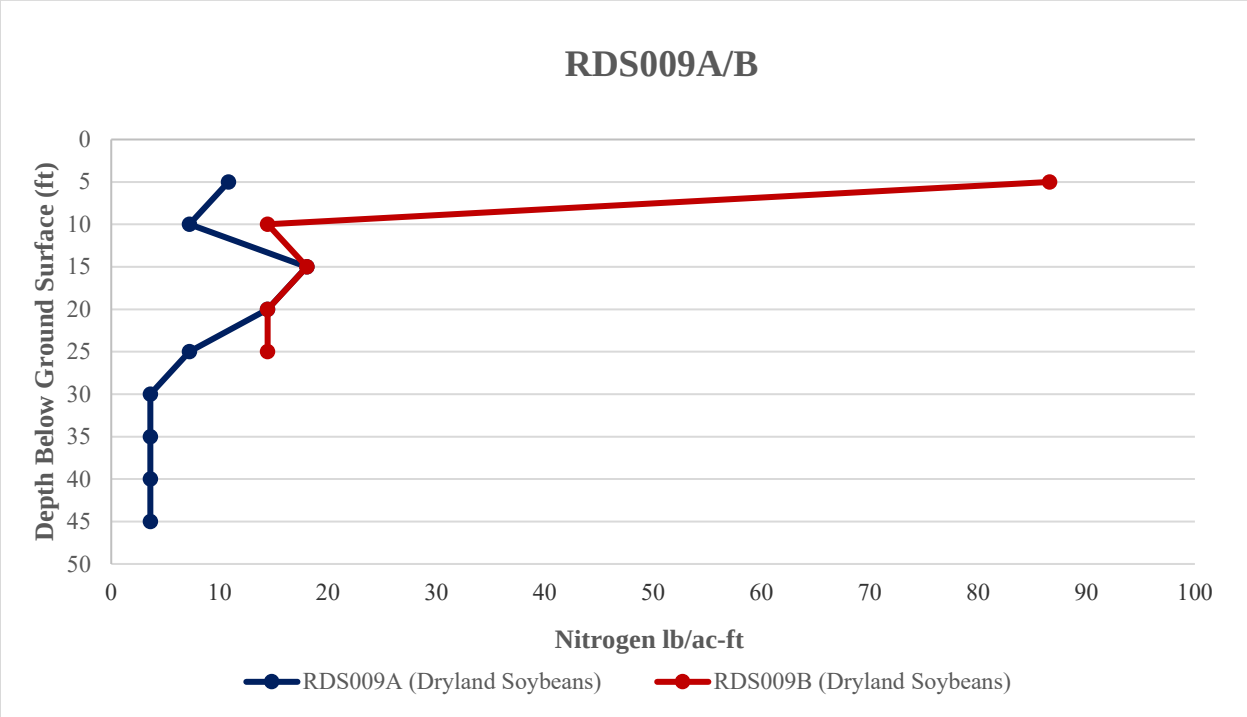
As noted in Section 5.3.4, Site 010 had unusually high concentrations and is therefore discussed separately. The maximum nitrate-N concentrations at this site in deep soils were reported to be 213 lb/ac-ft and an average of 72 lb/ac-ft.

5.6.3 Nitrate Variability Within the Same Field

It is important to note that the results can vary when comparing deep soil nitrate profiles from within the same field. Shallow soil samples are collected to account for the nitrate-N variability across the site. In some cases, two deep soil samples are collected within the same field. Within the Raymond CWSPA, two sampling sites included two deep borings per site. The land use was the same for each pair. The soil profiles for each pair of samples can be seen in Figure 12.

Figure 12. Variability of Nitrate in Deep Profiles for Same Field





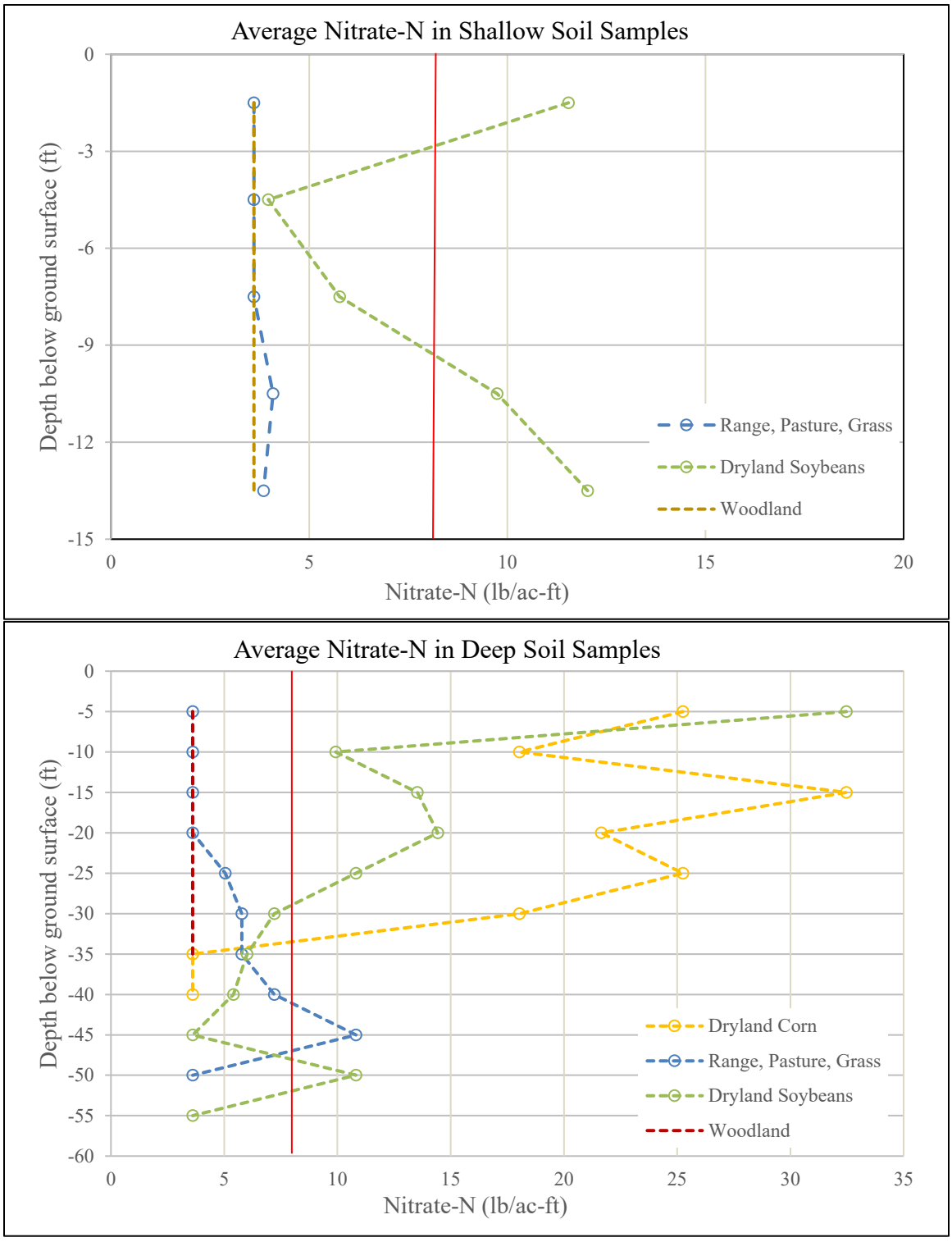
5.6.4 Average Nitrate by Land Use

The shallow soil sampling results were generally higher for dryland soybean land use compared to range, pasture, grass and woodland land uses. The average shallow soil sampling results for each depth by land use is illustrated in Figure 13.

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 13. Site 010 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 13. 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, 149 shallow soil samples were collected to a depth of 15 ft at 3 ft intervals and analyzed for nitrate-N from 6 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 11 of the 150 samples (7%) 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 some non-point source leaching of nitrate-N from agricultural sources is occurring within the study area. Across the locations with dryland crops, a total of 19 of the 49 samples (39%) were identified as having nitrate-N above background levels of 8 lb/ac-ft. Across remaining land uses-range, pasture, grass, and a woodland, there were no elevated nitrate-N above 8 lb/ac-ft.

6.1.2 Deep Soil Samples

For this investigation, 101 deep soil samples were collected at 5 ft intervals from twelve direct push sampling sites. Deep soil samples were collected from pasture, range, and grass areas and in dryland corn and soybean fields. Samples were collected in depths ranging up to 64 ft bgs.

Deep soil sample results clearly show that non-point source leaching of nitrate-N from agricultural sources is occuring. The average concentrations below from cropland was found to be higher than typical range pasture and grass land uses. A total of 24 of the 40 (60%) samples collected from dryland corn and soybean areas had elevated nitrate-N levels above background levels.

One site location, RDS010 reported unexpectedly high levels of nitrate-N throughout the entire boring, except at interval 10 ft bgs. The average nitrate-N throughout the 64 ft boring was 72 lb/ac-ft. The maximum nitrate-N reported was significantly elevated at 213 lb/ac-ft collected at 30 ft bgs. It is unknown if elevated nitrate-N exists throughout the remainder of the field at this site. RDS010 was located to the east of the Village of Raymond. Shallow soil samples and a groundwater sample was not collected at this location. 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. Groundwater monitoring well sampling results were provided by the LPSNRD. Historical nitrate-N data for the Village of Raymond municipal wells was available from the NDHHS for the years 2003 to 2018.

Direct Push Sampling
Direct push groundwater samples were collected from eight of the twelve locations. Groundwater samples were collected from the maximum depth of the boring, typically 20-55 ft bgs. Nitrate-N was reported in each of the direct push groundwater samples at concentration ranging from a non-detect less than 0.2 mg/L to 25.6 mg/L. The direct push results were highly variable but indicate the presence of elevated nitrate-N in groundwater within the Raymond CWSPA.

Municipal Well Sampling
As described in previous sections, two wells have reached the 50% MCL of 5.0 mg/L nitrate-N most recently during 2018 sampling. Data from the collected samples over time indicate that nitrate-N is fluctuating, but generally staying between 3 and 6 mg/L.

Monitoring Well Sampling
The three new monitoring wells were sampled for the first time in December 2021. Initially, the monitoring wells will be sampled on a quarterly basis by the LPSNRD. The groundwater samples collected from the monitoring wells reported nitrate-N at 5.3 mg/L, 0.41 mg/L, and 4.13 mg/L, from wells RMW-1, RMW-2, and RMW-3, respectively. The results for RMW-1 and RMW-3 are in a similar range as the historical sampling results from the municipal wells.

Results from future sampling events from the monitoring wells should be reviewed for trends. If the monitoring wells results are similar, additional investigation may be needed to better define groundwater flow direction, particularly from north and west of the municipal wells.

6.3 NITRATE LOADING BY LAND USE

The shallow and 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 and woodland land uses, as shown in Figure 13.

Sites where the land use was range, pasture or grass, the vadose zone soil nitrate-N levels were found to be below background or generally near background levels through the entire profile with the exception of site RDS010 and RDS003. Elevated nitrate-N was found throughout the entire boring of RDS010, and within the last three intervals before groundwater in RDS003. In general, range, pasture, and grass does not appear to be a significant contributor to nitrate-N concentrations within the CWSPA. RDS010 is an exception and discussed separately in Section 6.5.

6.4 SOURCES OF NITRATE-N

The results generally indicate that the source of nitrate-N in groundwater samples collected is likely due to application of commercial fertilizer or manure on cropland. No evidence from the point source investigation was found to indicate the source of elevated nitrate-N was sourced from events such as industrial processes, leakage from an industrial or municipal wastewater site, or large spills within the Raymond CWSPA.

6.5 DATA GAP

A data gap was identified regarding the area east of the Village of Raymond directly southwest of the municipal wells. Unexpected results were found in one deep soil boring collected at RDS010 in grassland land use. Results averaged 72 lb/ac-ft throughout the boring, and the maximum nitrate-N reported was 212.9 lb/ac-ft. No shallow soil samples were taken at this location and refusal was reached before groundwater; therefore, a groundwater sample was not collected at this location. There are no point sources that were identified at the time of the study, and it is unknown if non-point sources influenced the high nitrate-N at this site. The sparsity of data in this location renders the results inconclusive. Additional investigation would be needed to determine if the source of nitrate-N at RDS010 is from a point source or from non-point source.

6.6 FUTURE LEACHING POTENTIAL

There is leachable nitrate-N in the soil and subsoil within the Raymond 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 has 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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EA Engineering, Science, and Technology, Inc., PBC

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www.eaest.com

24 January 2020

MEMORANDUM

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

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

SUBJECT: LPSNRD – Nitrate Study for Raymond, 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 Raymond 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 Raymond.

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 – The aquifer thickness for Raymond was calculated using a custom spreadsheet called the 'K Wizard'. A copy of the K Wizard spreadsheet was provided by NDEE. The spreadsheet calculated the average aquifer thickness of three wells in the Raymond area. The aquifer thickness for each well was the total drilling depth. This does not appear to be a reasonable approximation of the aquifer thickness.

Hydraulic Conductivity (K) – Values for K for Raymond were estimated using a custom spreadsheet called the 'K Wizard'. Information from bore logs is entered into the spreadsheet to determine K based on bore log descriptions, and formation thickness based on bore log intervals. A composite transmissivity was calculated using all of the formations below static water level. The aquifer thickness was an 'average' K assigned by dividing the transmissivity by the aquifer thickness.

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.

RAYMOND RESULTS

The model was last updated in April 2005 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 3 production wells.

- Well G-084063 (Well 1)
  - Registered capacity = 80 gallons per minute (gpm)
  - Model rate = 4.2 gpm

- Well G-084064 (Well 2)
  - Registered capacity = 80 gpm
  - Model rate = 4.2 gpm

- Well G-111121 (Well 3)
  - Registered capacity = 60 gpm
  - Model rate = 4.2 gpm

Base of Aquifer Elevation – The model used a base of aquifer elevation of 1170 feet. This value appears to be reasonable.

Aquifer Thickness – The model used an aquifer thickness of 112 feet and appears to be based on the average aquifer thickness from the three production well logs. The aquifer thickness of each well is the total drilling depth, thus the model aquifer thickness is likely greater than the actual aquifer thickness.

Hydraulic Conductivity (K) – The model used a K of 8 feet/day for the aquifer and the K value appears to be based on the K-Wizard. The well logs specified that the aquifer is silty clay mixed with fine sand. According to Table 3.2.1 of Groundwater Hydrology (Todd, 1980), representative K values are 0.00065 feet/day for clay, 0.26 feet/day for silt, and 8.2 feet/day for fine sand. Therefore, the K value of 8 feet/day appears to be a higher estimate of hydraulic conductivity, but not unreasonably high.

Porosity – The model used a porosity of 0.07 for the aquifer. This is the minimum porosity for silty gravels/silty sandy gravels and clayey sands. According to Swiss Standard SN 670 010b and Advanced Soil Mechanics (Das 2008), porosity in silty clay ranges from 0.29 to 0.41, and porosity in fine sand ranges from 0.29 to 0.46, 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:

- 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 model likely has an overestimated aquifer thickness. This is unlikely to greatly affect the results of the model.

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

DS/dm

Wellhead Protection Area Boundary

Time of Travel Thresholds
computed by WhAEM

20 yr
10 yr
2 yr
1 yr
1000 ft

Well 2001-1
G-111121

Well 91-1
G-084064

Well 75-1
G-084063

North Oak Creek

Union Pacific

NW 40th St

NW 48th St

W Branched Oak Rd

R6E

NW 27th St

NW 32nd St

Hottovy Rd

Wassung Dr

NW 30th St

Trudy Ann Dr

NW 31st St

W Raymond Rd

T 12 N

T 11 N

31

32

33

5

6

Pacific St

5th St

4th St

2nd St

Clark St

3rd St

Nickols St

Maple St

1st St

Raymond

N

W

E

S

0.5 0 0.5 1 Miles

RAYMOND

Lancaster County

Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, April 2005

LJB

Appendix B

Monitoring Well Construction Forms and Boring Logs

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS001
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,281.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536853.67	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687699.76	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	31 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR3/4	ML	Silt, dark yellowish brown, med to high stiffness, dry to moist, root traces	DPT	60	100		
5	1276.0					DPT	60	100		
			10YR4/6	CL	Silty clay, dark yellowish brown, med to high stiffness, moist to wet, trace very fine sand					
10	1271.0				Same as previous	DPT	60	100		
15	1266.0				Same as previous	DPT	60	100		
			10YR6/3	CL	Sandy clay, pale brown, low to med stiffness, moist to wet, very fine to fine sand grains					
20	1261.0				Same as previous	DPT	60	100		
			10YR6/3	SP	Clayey sand, pale brown, med to high density, moist to wet, very fine to fine sand grains					
25	1256.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS001
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,281.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536853.67	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687699.76	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	31 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
						DPT	60	100		
			10YR5/3	SP	Sand, brown, med to high density, wet to saturated, very fine sand grains, trace of clay					
30	1251.0				Same as previous	DPT	60	100		
35	1246.0				Bottom of Hole @ 35 feet			0		
40	1241.0							0		
45	1236.0							0		
50	1231.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	40 ft	**BORING NO.:**	RDS002
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,235.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536332.00	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687125.47	**TYPE OF SURFACE:**	Maintained grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	39 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, dark brown, med to high stiff, dry to moist, root traces	DPT	48	80		
5	1230.0		10YR4/6	ML	Clayey silt, dark yellowish brown, med to high stiff, dry to moist, trace of fine gravel / till	DPT	60	100		
10	1225.0		10YR5/6	CL	Silty clay, yellowish brown, low to med stiff, moist to wet	DPT	60	100		
15	1220.0		10YR4/4	CL	Sandy silty clay, dark yellowish brown, low to med stiff, moist to wet, sand grains fine to coarse	DPT	60	100		
20	1215.0				Same as previous	DPT	60	100		
25	1210.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	40 ft	**BORING NO.:**	RDS002
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,235.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536332.00	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687125.47	**TYPE OF SURFACE:**	Maintained grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	39 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	1205.0				Same as previous	DPT	60	100		
35	1200.0				Same as previous	DPT	60	100		
40	1195.0		10YR4/4	SW	Sand, dark yellowish brown, dense, wet to saturated, fine to coarse grains					
					Bottom of Hole @ 40 feet			0		
45	1190.0							0		
50	1185.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	RDS003
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,288.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537645.54	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687434.16	**TYPE OF SURFACE:**	Maintained brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	37 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, brown, med to high stiff, dry to moist, root traces	DPT	48	80		
5	1283.0				Same as previous	DPT	48	80		
10	1278.0					DPT	60	100		
			10YR6/3	CL	Silty clay, pale brown, med to high stiff, dry to moist, decreasing silt content with depth					
15	1273.0				Same as previous, low to med stiff	DPT	48	80		
20	1268.0				Same as previous	DPT	36	60		
25	1263.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	RDS003
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,288.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537645.54	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687434.16	**TYPE OF SURFACE:**	Maintained brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	37 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, moist to wet	DPT	60	100		
30	1258.0					DPT	60	100		
			10YR5/2	CL	Sandy silty clay, grayish brown, low to med stiff, moist to wet					
35	1253.0		10YR6/2	SP	Clayey sand, light brownish gray, low to med dense, wet to saturated, very fine sand grains	DPT	60	100		
40	1248.0				Same as previous, saturated	DPT	60	100		
45	1243.0				Bottom of Hole @ 45 feet			0		
50	1238.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	48 ft	**BORING NO.:**	RDS004A
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,327.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537917.73	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687617.60	**TYPE OF SURFACE:**	Native forbes / grasses
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		(horse pasture)

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR5/1	ML	Silt, gray, med to high stiffness, dry to slightly moist, root traces	DPT	36	60		
5	1322.0					DPT	48	80		
			10YR5/1	ML	Clayey silt, gray, med to high stiffness, dry to moist					
10	1317.0					DPT	60	100		
			10YR3/4	CL	Silty clay, dark yellowish brown, med to high stiffness, moist, iron staining, trace gravel / till					
15	1312.0					DPT	60	100		
			10YR4/6	CL	Clay (till), dark yellowish brown, high stiffness / hard, moist, traces of fine sands / gravels					
20	1307.0				Same as previous	DPT	60	100		
25	1302.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	48 ft	**BORING NO.:**	RDS004A
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,327.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537917.73	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687617.60	**TYPE OF SURFACE:**	Native forbes / grasses
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		(horse pasture)

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	1297.0				Same as previous	DPT	60	100		
35	1292.0				Same as previous	DPT	60	100		
40	1287.0				Same as previous	DPT	60	100		
45	1282.0				Same as previous, very high stiffness, hard, till	DPT	36	60		
					Bottom of Hole @ 48 feet (Refusal)					
50	1277.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS004B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,315.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537456.46	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687638.73	**TYPE OF SURFACE:**	Natural forbes and grasses
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		(horse pasture)

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, root traces	DPT	36	60		
5	1310.0		10YR5/4	ML	Clayey silt, yellowish brown, low to med stiffness, dry to moist	DPT	60	100		
10	1305.0					DPT	60	100		
			10YR5/6	CL	Sandy clay, yellowish brown, med to high stiffness, moist, very fine sand grains, traces of pebbles / till					
15	1300.0					DPT	60	100		
			10YR5/8	SP	Clayey sand, yellowish brown, med to high density, moist to wet, very fine sand grains					
20	1295.0					DPT	60	100		
			10YR4/4	CL	Clay, dark yellowish brown, med to high stiffness, traces of sand / gravel inclusions					
25	1290.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS004B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,315.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537456.46	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687638.73	**TYPE OF SURFACE:**	Natural forbes and grasses
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		(horse pasture)

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	1285.0									
					Same as previous, high stiffness / hard	DPT	60	100		
35	1280.0									
					Bottom of Hole @ 35 feet (Refusal)			0		
40	1275.0									
								0		
45	1270.0									
								0		
50	1265.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS005
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,277.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536688.55	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	686848.00	**TYPE OF SURFACE:**	Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	24 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 stiff, dry to moist, root traces	DPT	60	100		
5	1272.0				Same as previous	DPT	60	100		
			10YR4/2	CL	Silty clay, dark grayish brown, med to high stiff, dry to moist, root traces					
10	1267.0				Same as previous	DPT	60	100		
15	1262.0		10YR4/4	CL	Clay, dark yellowish brown, med to high stiff, moist to wet, trace of till	DPT	60	100		
			10YR4/6	SW	Clayey sand, dark yellowish brown, med to high density, moist to wet, fine to coarse sand grains					
20	1257.0					DPT	60	100		
25	1252.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS005
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,277.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536688.55	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	686848.00	**TYPE OF SURFACE:**	Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	24 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		
			10YR5/2	CL	Clay, grayish brown, med to high stiff, moist to wet, trace till / very fine sand					
30	1247.0									
					Same as previous	DPT	60	100		
			10YR6/2	CL	Sandy clay, light brownish gray, med to high stiff, wet to saturated, very fine sand grains					
35	1242.0									
					Bottom of Hole @ 35 feet			0		
40	1237.0							0		
45	1232.0							0		
50	1227.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	55 ft	**BORING NO.:**	RDS006
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,299.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537311.17	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687491.53	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	48 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, brown, med to high stiff, dry to moist, root traces	DPT	60	100		
5	1294.0									
			10YR3/4	ML	Clayey silt, dark yellowish brown, med to high stiff, moist	DPT	60	100		
10	1289.0									
			10YR5/2	CL	Clay, grayish brown, low to med stiff, moist	DPT	60	100		
15	1284.0				Same as previous, low stiff, moist to wet	DPT	60	100		
20	1279.0				Same as previous	DPT	60	100		
25	1274.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	55 ft	**BORING NO.:**	RDS006
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,299.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537311.17	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687491.53	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	48 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
						DPT	60	100		
			10YR5/4	CL	Clay, yellowish brown, high stiff, moist to wet, pebbles / sand (till) present					
30	1269.0		10YR6/4	SP	Clayey sand, light yellowish brown, med to high density, moist to wet, very fine sand grains	DPT	60	100		
35	1264.0				Same as previous, wet	DPT	60	100		
40	1259.0				Same as previous, slightly higher clay content 41-44 ft	DPT	60	100		
45	1254.0				Same as previous, very fine sand grains, trace of clay	DPT	60	100		
50	1249.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	55 ft	**BORING NO.:**	RDS006
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,299.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537311.17	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687491.53	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	48 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		
			10YR5/3	SP	Sand, brown, med to high density, wet to saturated, very fine sand grains					
55	1244.0				Bottom of Hole @ 55 feet			0		
60	1239.0							0		
65	1234.0							0		
70	1229.0							0		
75	1224.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	40 ft	**BORING NO.:**	RDS007
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,222.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536002.77	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687218.92	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	36 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 stiff, dry to moist	DPT	48	80		
5	1217.0					DPT	60	100		
			10YR3/3	CL	Silty clay, dark brown, low to med stiff, moist to wet					
10	1212.0				Same as previous	DPT	60	100		
15	1207.0				Same as previous	DPT	60	100		
20	1202.0				Same as previous, soft, wet	DPT	60	100		
25	1197.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	40 ft	**BORING NO.:**	RDS007
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,222.00	**DATE DRILLED:**	12/11/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536002.77	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687218.92	**TYPE OF SURFACE:**	Corn Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	36 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	1192.0		10YR5/1	CL	Clay, gray, low to med stiff, moist to wet, trace very fine sand	DPT	60	100		
35	1187.0					DPT	60	100		
			10YR5/1	SP	Clayey sand, gray, low to med density, saturated, very fine sand grains					
40	1182.0				Bottom of Hole @ 40 feet			0		
45	1177.0							0		
50	1172.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS008
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,283.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537047.11	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687029.63	**TYPE OF SURFACE:**	Brome grass / cedars
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	34 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 stiff, dry to moist, root traces	DPT	48	80		
			10YR4/4	CL	Silty clay, dark yellowish brown, med to high stiff, dry to moist, root traces					
5	1278.0									
			10YR4/3	CL	Clay, brown, med to high stiff, moist, trace of gravel / till	DPT	60	100		
10	1273.0									
					Same as previous, slightly more coarse sand and gravel / till	DPT	60	100		
15	1268.0									
					Same as previous	DPT	60	100		
			10YR6/2	SP	Clayey sand, light brownish gray, med to high density, moist to wet, very fine sand grains					
20	1263.0					DPT	60	100		
25	1258.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	35 ft	**BORING NO.:**	RDS008
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,283.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4537047.11	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687029.63	**TYPE OF SURFACE:**	Brome grass / cedars
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	34 ft		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR6/2	SP	Sand, light brownish gray, med to high density, moist to wet, very fine sand grains	DPT	60	100		
30	1253.0				Same as previous	DPT	60	100		
35	1248.0				Bottom of Hole @ 35 feet			0		
40	1243.0							0		
45	1238.0							0		
50	1233.0									

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BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	RDS009A
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,311.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536938.48	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687253.03	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/4	ML	Clayey silt loam, dark yellowish brown, med to high stiffness, moist, root traces	DPT	60	100		
5	1306.0				Same as previous	DPT	60	100		
10	1301.0				Same as previous, low to med stiffness, moist to wet	DPT	60	100		
15	1296.0					DPT	60	100		
			10YR3/6	CL	Silty clay, dark yellowish brown, med to high stiffness, moist, traces of sand / gravel till					
20	1291.0					DPT	60	100		
			10YR5/6	CL	Sandy clay, yellowish brown, med to high stiffness, moist to wet, sand is fine grained, trace gravel / till					
25	1286.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	45 ft	**BORING NO.:**	RDS009A
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,311.00	**DATE DRILLED:**	12/9/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536938.48	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687253.03	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (Refusal)		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/3	CL	Clay, brown, high stiffness, gravel / till	DPT	60	100		
30	1281.0				Same as previous	DPT	60	100		
35	1276.0				Same as previous	DPT	60	100		
40	1271.0				Same as previous	DPT	60	100		
			10YR2/1	CL	Clay / shale, black, hard, high stiffness, moist, trace sand / gravel till					
45	1266.0				Bottom of Hole @ 45 feet (Refusal)			0		
50	1261.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	25 ft	**BORING NO.:**	RDS009B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,263.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536720.31	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687462.81	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	20 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	1258.0					DPT	60	100		
			10YR5/6	CL	Silty clay loam, yellowish brown, med to high stiffness, moist					
10	1253.0				Same as previous, low to med stiffness, moist to wet	DPT	60	100		
15	1248.0				Same as previous	DPT	60	100		
			10YR6/4	CL	Sandy silty clay, light yellowish brown, low to med stiffness, wet					
20	1243.0					DPT	60	100		
			10YR5/3	SP	Clayey sand, brown, low density, sand is fine grained, saturated					
			10YR5/3	SP	Sand, brown, med to high density, very fine to fine sand grains, saturated					
25	1238.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	25 ft	**BORING NO.:**	RDS009B
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,263.00	**DATE DRILLED:**	12/10/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536720.31	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	687462.81	**TYPE OF SURFACE:**	Soybean Field
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	20 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	1233.0							0		
35	1228.0							0		
40	1223.0							0		
45	1218.0							0		
50	1213.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	64 ft	**BORING NO.:**	RDS010
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,262.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536353.91	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	686986.54	**TYPE OF SURFACE:**	Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (refusal)		

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 stiff, dry to moist, root traces	DPT	48	80		
5	1257.0		10YR5/3	CL	Silty clay, brown, low to med stiff, moist to wet	DPT	60	100		
10	1252.0				Same as previous, med to high stiff	DPT	60	100		
15	1247.0				Same as previous	DPT	60	100		
			10YR5/6	CL	Sandy clay, yellowish brown, med to high stiff, dry to moist, very fine sand grains					
20	1242.0					DPT	60	100		
25	1237.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	64 ft	**BORING NO.:**	RDS010
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,262.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536353.91	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	686986.54	**TYPE OF SURFACE:**	Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (refusal)		

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	1232.0				Same as previous	DPT	60	100		
35	1227.0				Same as previous, low to med stiff	DPT	60	100		
40	1222.0				Same as previous	DPT	60	100		
45	1217.0				Same as previous	DPT	60	100		
50	1212.0									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	64 ft	**BORING NO.:**	RDS010
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,262.00	**DATE DRILLED:**	12/12/2020
DRILLING CO.:	Plains Environmental	**NORTHING:**	4536353.91	**BORING METHOD:**	DPT
DRILLER:	Jason A.	**EASTING:**	686986.54	**TYPE OF SURFACE:**	Brome grass
GEOLOGIST:	Travis H.	**DEPTH TO WATER:**	N/A (refusal)		

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		
			10YR5/1	CL	Clay, gray, med to high stiff, moist, trace very fine sand					
55	1207.0					DPT	60	100		
60	1202.0				Same as previous, very high stiff to hard	DPT	48	80		
65	1197.0				Bottom of Hole @ 64 feet			0		
70	1192.0							0		
75	1187.0									

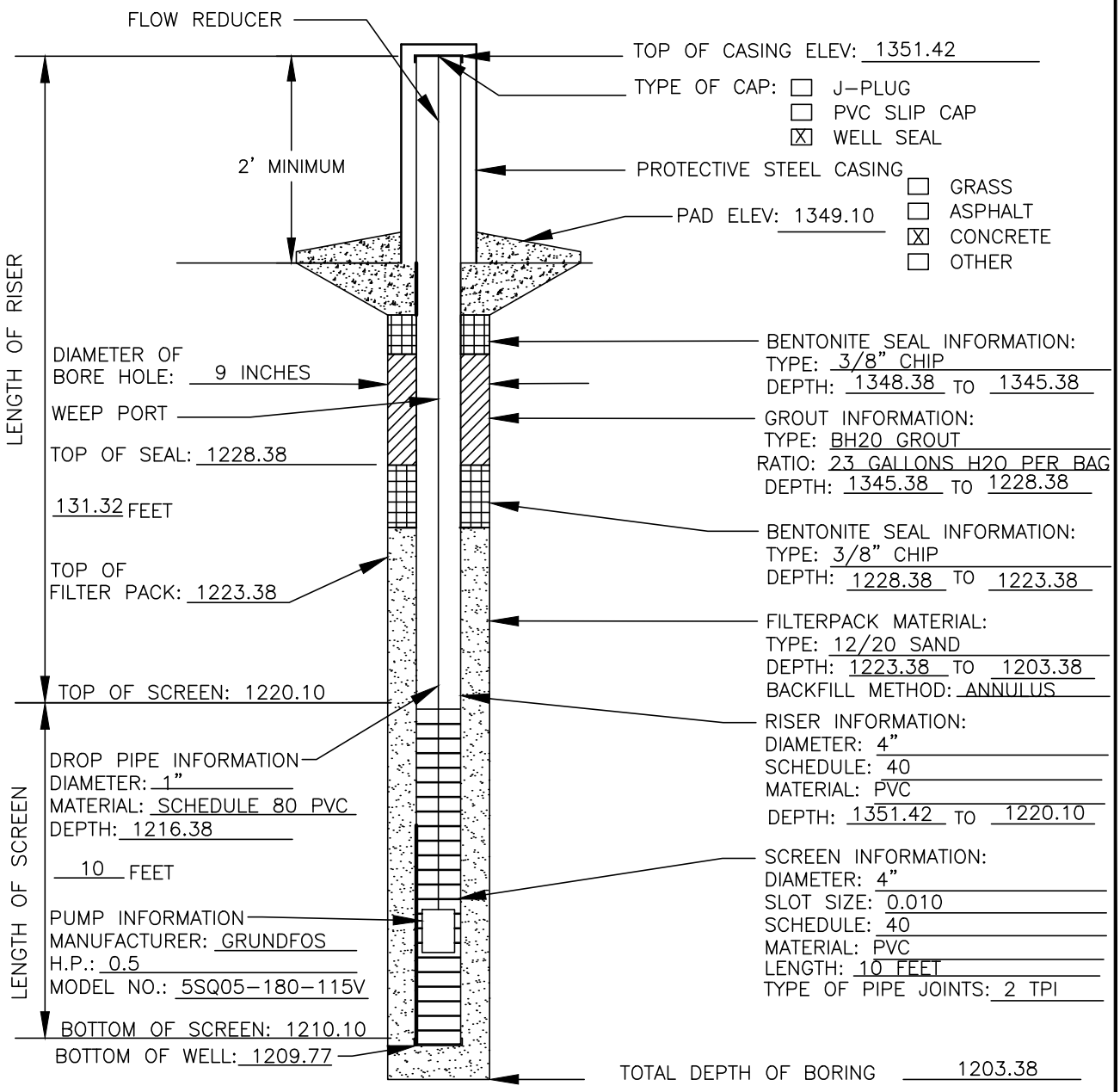
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
GROUND-WATER MONITORING WELL
STICK-UP COMPLETION

Project Name/ Project Number:	Start Date:	Completion Date:
LPSNRD 2 NITRATE/6333202	10/26/2021	12/1/2021
Well ID:	**Drilling Method:**	**Depth of Water (FT. TOC):**
RMW-1	MUD ROTARY	99.55

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:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR3/1	OL	Organic layer, very dark gray, moist to wet, low to med plasticity, organics and root traces	Grab		0		
5	1344.1		10YR5/3	CL	Silty clay, brown, moist to wet, med to high plasticity	Grab		0		
10	1339.1		10YR5/3	CL	Silty clay, brown, moist to wet, low to med plasticity, root traces.	Grab		0		
15	1334.1		10YR5/3	CL	Same as previous, trace of fine black grains	Grab		0		
20	1329.1		10YR5/3	CL	Same as previous, trace of fine black grains, trace of gravel (till)	Grab		0		
			10YR5/6	SW	Sand, vf to coarse grains, yellowish brown, angular, nonplastic	Grab				
25	1324.1									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR5/6	SW	Same as previous, trace clay	Grab		0		
30	1319.1		10YR5/4	SW	Clayey sand, vf to coarse, yellowish brown, non plastic to low plasticity	Grab		0		
35	1314.1		10YR5/4	SW	Same as previous with traces of coarse sand / gravel, increased clay content	Grab		0		
			10YR5/3	CL	Sandy/gravelly clay, coarse sand and medium gravel, low to med plasticity (till)	Grab				
40	1309.1				Increasing sand content, no gravel, low plasticity	Grab		0		
45	1304.1		10YR5/3	CL	Sandy/gravelly clay, 20-30% sand/gravel, brown, med to high plasticity, some iron staining (till)	Grab		0		
			10YR5/4	SW	Sand, vf to coarse, yellowish brown, trace of clay	Grab				
50	1299.1									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR5/4	SW	Same as previous	Grab		0		
55	1294.1									
			10YR5/4	SW	Same as previous, trace gravel, slightly higher clay content	Grab		0		
			10YR5/3	CL	Sandy/gravelly clay, coarse sand to med gravel, brown, med to high plasticity (till)	Grab				
60	1289.1									
			10YR4/1	CL	Sandy clay, vf sand to fine gravel, dark gray, med to high plasticity (till)	Grab		0		
65	1284.1									
			10YR4/1	CL	Same as previous, lower sand/gravel content (till)	Grab		0		
70	1279.1									
			10YR4/1	CL	Same as previous, gray clay, high density, med to high plasticity, trace coarse sand/fine gravel (till)	Grab		0		
75	1274.1									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/1	CL	Same as previous (till)	Grab				
80	1269.1									
			10YR4/1	CL	Same as previous (till)	Grab				
85	1264.1									
			10YR4/1	CL	Same as previous (till)	Grab				
90	1259.1									
			10YR4/1	CL	Same as previous, slightly lower clay density (till)	Grab				
95	1254.1									
			10YR4/1	CL	Same as previous (till)	Grab				
100	1249.1									

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

BORING LOG

PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR4/1	CL	Sandy/gravelly clay, 30-40% vf sand to fine gravels, gray, low to med plasticity	Grab				
105	1244.1		10YR4/1	CL	Same as previous	Grab				
			10YR4/1	SW	Clayey sand/gravel, 20-30% fines, vf sand to fine gravels, dark gray, nonplastic, angular grains	Grab				
110	1239.1		10YR4/1	SW	Same as previous	Grab				
			10YR5/1	SP	Sand, vf to med grains, gray, nonplastic, trace of clay	Grab				
115	1234.1		10YR5/1	SP	Same as previous	Grab				
			10YR5/1	SP	Sand, vf sand, trace fine gravel, trace clay	Grab				
120	1229.1		10YR5/1	SP	Sand, vf to med grains, gray, nonplastic	Grab				
125	1224.1									

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

BORING LOG

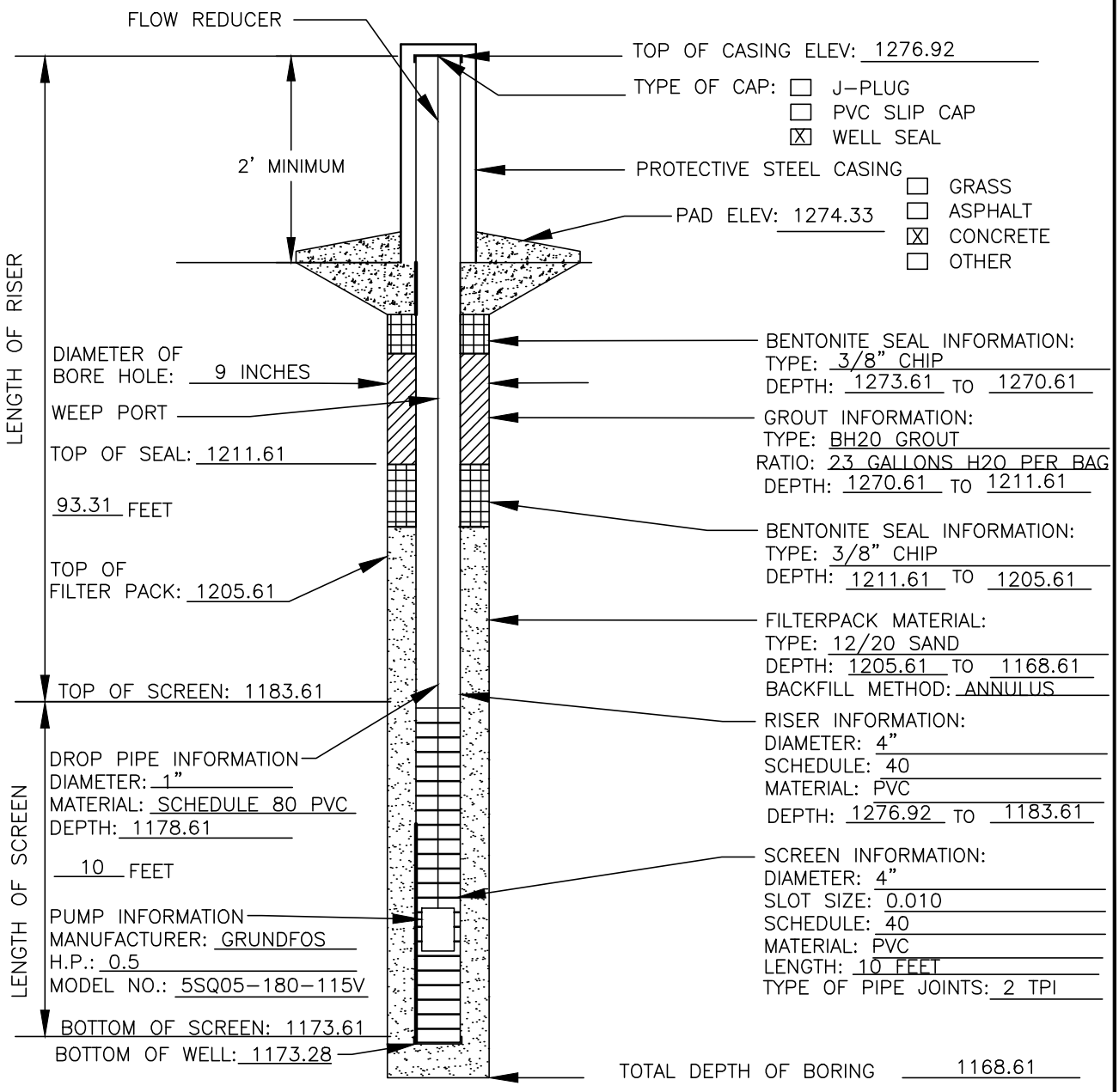
PROJECT:	LPSNRD - 2 Communities	**BORING DEPTH:**	145 ft	**BORING NO.:**	Raymond #1 (Sorensen)
EA PROJECT #:	6333202-0003	**SURFACE ELEV:**	1,349.10	**DATE DRILLED:**	10/26/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532184.66	**BORING METHOD:**	Mud Rotary
DRILLER:	Sam Wulf	**EASTING:**	431836.3963	**TYPE OF SURFACE:**	maintained grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	99.55 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10YR5/1	SP	Same as previous	Grab				
130	1219.1		10YR5/1	SP	Same as previous	Grab				
135	1214.1		10YR5/1	SP	Same as previous	Grab				
			10YR5/1	SW	Sand, vf sand to med gravel	Grab				
140	1209.1				BOH @ 140 feet bgs					
					Screened Interval: 129' - 139' bgs					
					Surface Elevation collected from concrete well pad					
					▼ Indicates groundwater elevation from surface					
145	1204.1									

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

Project Name/ Project Number: LPSNRD 2 NITRATE/6333202	Start Date: 11/17/2021	Completion Date: 12/1/2021
Well ID: RMW–2	Drilling Method: MUD ROTARY	Depth of Water (FT. TOC): 43.48
Driller Name, Company and Registration #: SAM WULF, PETERSON DRILLING, INC., #39440		
Geologist Name: TRAVIS HERMAN		

NOTES: 1. ALL FEATURES NOT TO SCALE



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BORING LOG

PROJECT:	LPSNRD Two Communities	**BORING DEPTH:**	105 ft	**BORING NO.:**	Raymond #2 (Thompson)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,274.3	**DATE DRILLED:**	11/17/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2529799.93	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	428007.4391	**TYPE OF SURFACE:**	native grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	43.48 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 3/1	OL/ML	Silty organic top layer, very dark gray, dry to moist, root traces	Grab		0		
5	1269.3		10YR 5/3	CL	Silty clay, brown, 40-50% silt, low to medium plasticity	Grab		0		
10	1264.3		10YR 5/3	CL	Same as previous	Grab		0		
15	1259.3		10YR 5/3	CL	Same as previous, trace of fine to medium black angular grains	Grab		0		
20	1254.3		10YR 5/3	CL	Sandy clay, 30-40% fine to medium sand, low to medium plasticity	Grab		0		
			10YR 5/3	SW/CL	Clayey sand, brown, well graded sands, fine to coarse, non to low plasticity, sub-angular to angular	Grab				
25	1249.3									

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

BORING LOG

PROJECT:	LPSNRD Two Communities	**BORING DEPTH:**	105 ft	**BORING NO.:**	Raymond #2 (Thompson)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,274.3	**DATE DRILLED:**	11/17/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2529799.93	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	428007.4391	**TYPE OF SURFACE:**	native grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	43.48 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
								0		
30	1244.3		10YR 4/3	SP/CL	Clayey sand, brown, poorly graded, very fine sand, 10-20% fines, nonplastic	Grab		0		
35	1239.3		10YR 4/3	SW/CL	Clayey sand, brown, fine to coarse sand, 20-30% fines, low to medium plasticity, trace of medium black grains	Grab		0		
40	1234.3		10YR 4/3	SP/CL	Clayey sand, brown, very fine to medium sand, 20-30% fines, low to medium plasticity	Grab		0		
					Increasing clay content, 30-40% fines	Grab				
45	1229.3		10YR 4/3	CL/SW	Sandy clay, brown, 20-30% fine to coarse sand, low to medium plasticity	Grab		0		
50	1224.3		10YR 4/3	SP/CL	Clayey sand, light brown, very fine grains, 10-20% fines, non to low plasticity	Grab				

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

BORING LOG

PROJECT:	LPSNRD Two Communities	**BORING DEPTH:**	105 ft	**BORING NO.:**	Raymond #2 (Thompson)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,274.3	**DATE DRILLED:**	11/17/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2529799.93	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	428007.4391	**TYPE OF SURFACE:**	native grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	43.48 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
								0		
55	1219.3		10YR 4/3	SW/CL	Clayey sand, light brown, well graded fine to coarse sand, 20-30% fines, low to medium plasticity	Grab		0		
			10YR 4/3	CL/SP	Sandy clay, brown, 10-20% fine sand, medium to high plasticity	Grab				
60	1214.3							0		
			10YR 5/1	CL	Clay, gray, 0-10% fine sand, medium to high plasticity	Grab				
65	1209.3		10YR 5/1	CL	Same as previous, no sand, light gray	Grab		0		
			10YR 5/1	CL	Same as previous with 10-20% coarse sand (till)	Grab				
70	1204.3		10YR 5/1	CL	Same as previous, 20-30% coarse sand	Grab		0		
75	1199.3									

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

BORING LOG

PROJECT:	LPSNRD Two Communities	**BORING DEPTH:**	105 ft	**BORING NO.:**	Raymond #2 (Thompson)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,274.3	**DATE DRILLED:**	11/17/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2529799.93	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	428007.4391	**TYPE OF SURFACE:**	native grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	43.48 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 5/1	CL	Same as previous (till)	Grab				
			10YR 5/2	CL	Increasing sand content to 30-40%, medium to coarse grains, grayish brown	Grab				
80	1194.3									
85	1189.3		10YR 5/2	CL	Same as previous, grayish brown, 10-20% sand, dark red streaks in clay, (till)	Grab				
90	1184.3		10YR 5/2	CL	Same as previous	Grab				
95	1179.3		10YR 5/2	CL	Same as previous	Grab				
100	1174.3									

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

BORING LOG

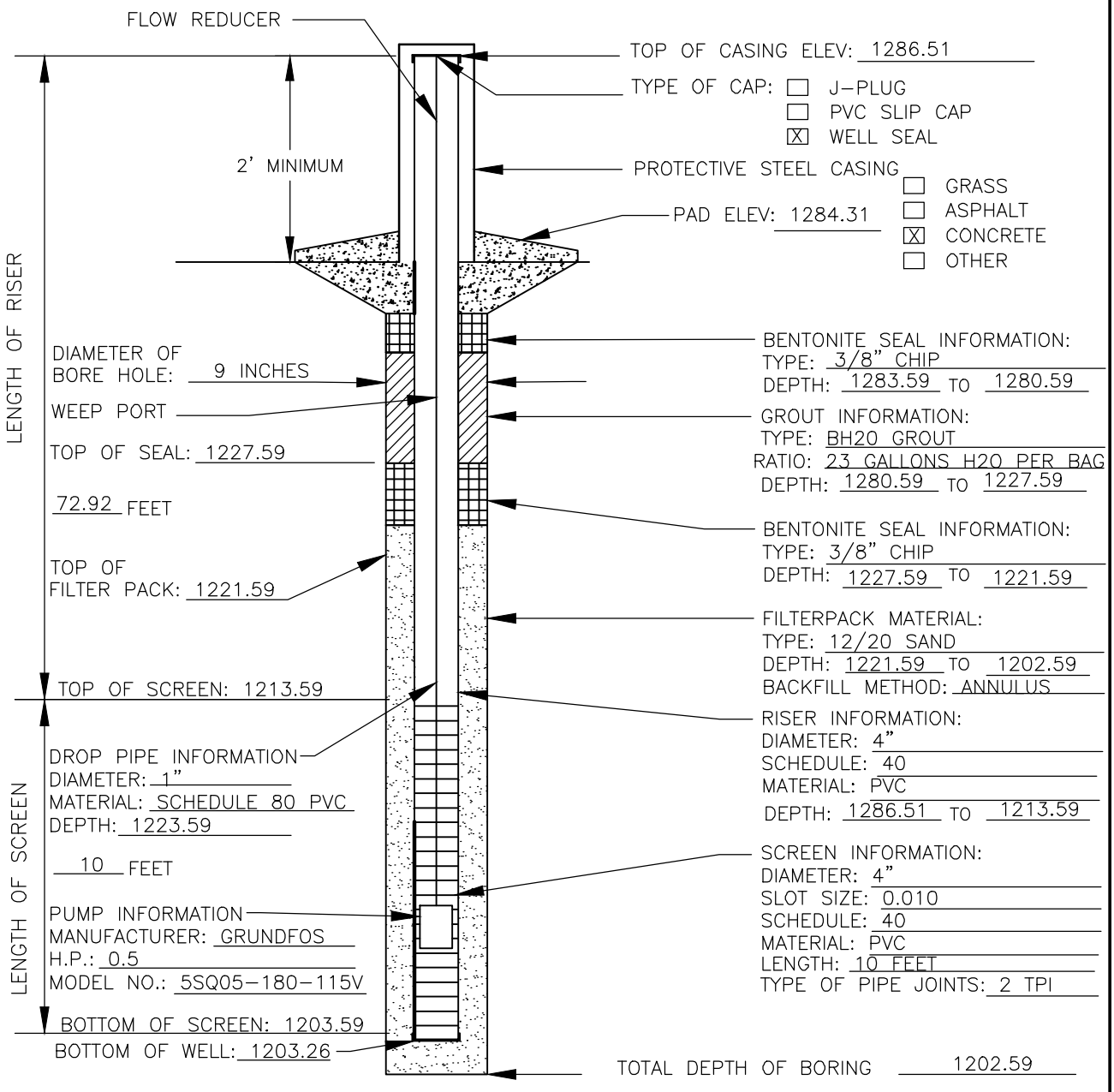
PROJECT:	LPSNRD Two Communities	**BORING DEPTH:**	105 ft	**BORING NO.:**	Raymond #2 (Thompson)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,274.3	**DATE DRILLED:**	11/17/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2529799.93	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	428007.4391	**TYPE OF SURFACE:**	native grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	43.48 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
105	1169.3		10YR 6/1	CL	Same as previous, gray	Grab				
					BOH @ 105'					
					Screened Interval 90' - 100' bgs					
					Surface Elevation collected from concrete well pad					
					▼ Indicates groundwater elevation from surface					
110	1164.3									
115	1159.3									
120	1154.3									
125	1149.3									

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

Project Name/ Project Number: LPSNRD 2 NITRATE/6333202	Start Date: 11/18/2021	Completion Date: 12/1/2021
Well ID: RMW-3	Drilling Method: MUD ROTARY	Depth of Water (FT. TOC): 34.23
Driller Name, Company and Registration #: SAM WULF, PETERSON DRILLING, INC., #39440		
Geologist Name: TRAVIS HERMAN		

NOTES: 1. ALL FEATURES NOT TO SCALE



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BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	81 feet	**BORING NO.:**	Raymond #3 (Settje)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,284.3	**DATE DRILLED:**	11/18/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532571.807	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	426675.4257	**TYPE OF SURFACE:**	grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	34.23 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 2/1	OL	Organic top layer, silt, black, low to medium plasticity, roots	Grab		0		
5	1279.3		10YR 2/2	CL	Silty clay, very dark brown, medium to high plasticity.	Grab		0		
10	1274.3		10YR 2/2	CL	Same as previous	Grab		0		
15	1269.3		10YR 4/4	CL	Silty clay, dark yellowish brown, 10-20% fine to medium sand, low to medium plasticity.	Grab		0		
			10YR 4/4	CL	Lower silt content, red and yellow streaks in clay, medium to high plasticity	Grab				
20	1264.3		10YR 4/4	CL	Sandy clay, dark yellowish brown, 20-30% fine to medium sand, low to medium plasticity	Grab		0		
25	1259.3									

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

BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	81 feet	**BORING NO.:**	Raymond #3 (Settje)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,284.3	**DATE DRILLED:**	11/18/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532571.807	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	426675.4257	**TYPE OF SURFACE:**	grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	34.23 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 4/4	CL	Same as previous	Grab		0		
			10YR 4/3	SP/CL	Clayey sand, brown, very fine grained, sub-angular to rounded, 10-20% fines, nonplastic	Grab				
30	1254.3							0		
35	1249.3							0		
			10YR 5/3	CL/SP	Sandy clay, brown, 10-20% vf sand, medium to high plasticity	Grab				
40	1244.3									
			10YR5/1	CL/SP	Same as previous, gray	Grab		0		
					Increasing sand content, 20-30% vf to coarse grains (till)	Grab				
45	1239.3									
			10YR 5/1	CL/SW	Sandy clay, gray, 30-40% vf to coarse sand, trace gravel, medium to high plasticity	Grab		0		
50	1234.3									

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

BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	81 feet	**BORING NO.:**	Raymond #3 (Settje)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,284.3	**DATE DRILLED:**	11/18/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532571.807	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	426675.4257	**TYPE OF SURFACE:**	grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	34.23 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 5/1	CL/SW	Same as previous	Grab		0		
55	1229.3		10YR 4/1	CL/SW	Same as previous, dark gray, 30-40% sands and gravels (till)	Grab		0		
60	1224.3		10YR 4/1	CL/SW	Same as previous	Grab		0		
65	1219.3		10YR 4/1	CL/SW	Same as previous, 20-30% sands and gravels	Grab		0		
70	1214.3		10YR 4/1	CL/SW	Same as previous	Grab		0		
75	1209.3									

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BORING LOG

PROJECT:	LPSNRD 2 Communities	**BORING DEPTH:**	81 feet	**BORING NO.:**	Raymond #3 (Settje)
EA PROJECT #:	6333202	**SURFACE ELEV:**	1,284.3	**DATE DRILLED:**	11/18/2021
DRILLING CO.:	Peterson Drilling	**NORTHING:**	2532571.807	**BORING METHOD:**	mud rotary
DRILLER:	Sam Wulf	**EASTING:**	426675.4257	**TYPE OF SURFACE:**	grass
GEOLOGIST:	Travis Herman	**DEPTH TO WATER:**	34.23 ft from TOC		

DEP. (FT)	ELEV (FT)	WELL CONST.	COLOR	USCS CODE	GEOLOGIC DESCRIPTION	SAMPLE METHOD	LENGTH (IN.)	% RE-COVERY	Blow Count	LAB DATA
			10 YR 4/1	CL/SW	Same as previous	Grab				
80	1204.3		10YR 4/1	CL/SW	Same as previous	Grab				
					BOH @ 81' bgs					
					Screened Interval 70' - 80'					
					Surface Elevation collected from concrete well pad					
					▼ Indicates groundwater elevation from surface					
85	1199.3									
90	1194.3									
95	1189.3									
100	1184.3									

Appendix C

Laboratory Results

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20-351-0564
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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RDSOO1

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
73653	RDS001-05																								
73654	RDS001-10																								
73655	RDS001-15																								
73656	RDS001-20																								
73657	RDS001-25																								
73658	RDS001-30																								
73659	RDS001-35																								

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
73653	5	8	0-5							8															
73654	2	3	5-10							3															
73655	2	3	10-15							3															
73656	3	4	15-20							4															
73657	2	3	20-25							3															
73658	1	2	25-30							2															
73659	1	2	30-35							2															

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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
73660	RDS002-05																								
73661	RDS002-10																								
73662	RDS002-15																								
73663	RDS002-20																								
73664	RDS002-25																								
73665	RDS002-30																								
73666	RDS002-35																								
73667	RDS002-40																								

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	
73660	1	2	0-5							2																
73661	1	2	5-10							2																
73662	1	2	10-15							2																
73663	1	2	15-20							2																
73664	1	2	20-25							2																
73665	1	2	25-30							2																
73666	1	2	30-35							2																
73667	1	2	35-40							2																

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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): HLS Date/Time: 12/16/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RDS002-05	12-12-2020	1455	Soil	X				
RDS002-10	12-12-2020	1500	Soil	X				
RDS002-15	12-12-2020	1507	Soil	X				
RDS002-20	12-12-2020	1510	Soil	X				
RDS002-25	12-12-2020	1514	Soil	X				
RDS002-30	12-12-2020	1517	Soil	X				
RDS002-35	12-12-2020	1522	Soil	X				
RDS002-40	12-12-2020	1532	Soil	X				
~~RDS002-45~~			~~Soil~~	X				
~~RDS002-50~~			~~Soil~~	X				
~~RDS002-55~~			~~Soil~~	X				
~~RDS002-60~~			~~Soil~~	X				
~~RDS002-65~~			~~Soil~~	X				
~~RDS002-70~~			~~Soil~~	X				
~~RDS002-75~~			~~Soil~~	X				

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RDS003

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
73668	RDS003-05																								
73669	RDS003-10																								
73670	RDS003-15																								
73672	RDS003-20																								
73673	RDS003-25																								
73674	RDS003-30																								
73675	RDS003-35																								
73676	RDS003-40																								
73677	RDS003-45																								

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	
73668	1	2	0-5							2																
73669	1	2	5-10							2																
73670	1	2	10-15							2																
73672	1	2	15-20							2																
73673	1	2	20-25							2																
73674	2	3	25-30							3																
73675	3	4	30-35							4																
73676	4	6	35-40							6																
73677	5	8	40-45							8																

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RDS004

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
73678	RDS004A-05																								
73679	RDS004A-10																								
73680	RDS004A-15																								
73681	RDS004A-20																								
73682	RDS004A-25																								
73683	RDS004A-30																								
73684	RDS004A-35																								
73685	RDS004A-40																								
73686	RDS004A-45																								
73687	RDS004A-48																								

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	
73678	1	2	0-5							2																
73679	1	2	5-10							2																
73680	1	2	10-15							2																
73681	1	2	15-20							2																
73682	3	4	20-25							4																
73683	2	3	25-30							3																
73684	1	2	30-35							2																
73685	1	2	35-40							2																
73686	1	2	40-45							2																
73687	1	1	45-48							1																

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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
73688	RDS004B-05																								
73689	RDS004B-10																								
73690	RDS004B-15																								
73691	RDS004B-20																								
73692	RDS004B-25																								
73693	RDS004B-30																								
73694	RDS004B-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	
73688	1	2	0-5							2																
73689	1	2	5-10							2																
73690	1	2	10-15							2																
73691	1	2	15-20							2																
73692	1	2	20-25							2																
73693	2	3	25-30							3																
73694	1	2	30-35							2																

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RDS005

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
73695	RDS005-05																								
73696	RDS005-10																								
73697	RDS005-15																								
73698	RDS005-20																								
73699	RDS005-25																								
73700	RDS005-30																								
73701	RDS005-35																								

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	
73695	1	2	0-5							2																
73696	1	2	5-10							2																
73697	1	2	10-15							2																
73698	1	2	15-20							2																
73699	1	2	20-25							2																
73700	1	2	25-30							2																
73701	2	3	30-35							3																

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RDS006

SOIL ANALYSIS REPORT

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	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
73702	RDS006-05																								
73703	RDS006-10																								
73704	RDS006-15																								
73705	RDS006-20																								
73706	RDS006-25																								
73707	RDS006-30																								
73708	RDS006-35																								
73709	RDS006-40																								
73711	RDS006-45																								
73712	RDS006-50																								

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
73702	4	6	0-5							6															
73703	3	4	5-10							4															
73704	3	4	10-15							4															
73705	5	8	15-20							8															
73706	4	6	20-25							6															
73707	4	6	25-30							6															
73708	3	4	30-35							4															
73709	2	3	35-40							3															
73711	1	2	40-45							2															
73712	3	4	45-50							4															

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RDS006

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
73713	RDS006-55																								

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	
73713	1	2	50-55							2																

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RDS007

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
73714	RDS007-05																								
73715	RDS007-10																								
73716	RDS007-15																								
73717	RDS007-20																								
73718	RDS007-25																								
73719	RDS007-30																								
73720	RDS007-35																								
73721	RDS007-40																								

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
73714	7	10	0-5							10															
73715	5	8	5-10							8															
73716	9	14	10-15							14															
73717	6	9	15-20							9															
73718	7	10	20-25							10															
73719	5	8	25-30							8															
73720	1	2	30-35							2															
73721	1	2	35-40							2															

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RDS008

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
73722	RDS008-05																								
73723	RDS008-10																								
73724	RDS008-15																								
73725	RDS008-20																								
73726	RDS008-25																								
73727	RDS008-30																								
73728	RDS008-35																								

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	
73722	1	2	0-5							2																
73723	1	2	5-10							2																
73724	1	2	10-15							2																
73725	1	2	15-20							2																
73726	1	2	20-25							2																
73727	1	2	25-30							2																
73728	1	2	30-35							2																

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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
73729	RDS009A-05																								
73730	RDS009A-10																								
73731	RDS009A-15																								
73732	RDS009A-20																								
73733	RDS009A-25																								
73734	RDS009A-30																								
73735	RDS009A-35																								
73736	RDS009A-40																								
73737	RDS009A-45																								
73738	RDS009B-05																								

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	
73729	3	4	0-5							4																
73730	2	3	5-10							3																
73731	5	8	10-15							8																
73732	4	6	15-20							6																
73733	2	3	20-25							3																
73734	1	2	25-30							2																
73735	1	2	30-35							2																
73736	1	2	35-40							2																
73737	1	2	40-45							2																
73738	24	36	0-5							36																

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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
73739	RDS009B-10																								
73740	RDS009B-15																								
73741	RDS009B-20																								
73742	RDS009B-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	
73739	4	6	5-10							6																
73740	5	8	10-15							8																
73741	4	6	15-20							6																
73742	4	6	20-25							6																

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SOIL ANALYSIS REPORT

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	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
73743	RDS010-05																								
73744	RDS010-10																								
73745	RDS010-15																								
73746	RDS010-20																								
73747	RDS010-25																								
73748	RDS010-30																								
73750	RDS010-35																								
73751	RDS010-40																								
73752	RDS010-45																								
73753	RDS010-50																								

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
73743	10	15	0-5							15															
73744	4	6	5-10							6															
73745	2	3	10-15							3															
73746	5	8	15-20							8															
73747	46	69	20-25							69															
73748	59	88	25-30							88															
73750	42	63	30-35							63															
73751	42	63	35-40							63															
73752	19	28	40-45							28															
73753	7	10	45-50							10															

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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
73754	RDS010-55																								
73755	RDS010-60																								
73756	RDS010-64																								

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	
73754	6	9	50-55							9																
73755	11	16	55-60							16																
73756	7	8	60-64							8																

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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
72393	RSS001-01-03																								
72394	RSS001-01-06																								
72395	RSS001-01-09																								
72396	RSS001-01-12																								
72397	RSS001-01-15																								
72398	RSS001-02-03																								
72399	RSS001-02-06																								
72400	RSS001-02-09																								
72401	RSS001-02-12																								
72402	RSS001-02-15																								

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	
72393	3	3	0-3							3																
72394	1	1	3-6							1																
72395	1	1	6-9							1																
72396	3	3	9-12							3																
72397	4	4	12-15							4																
72398	4	4	0-3							4																
72399	1	1	3-6							1																
72400	1	1	6-9							1																
72401	1	1	9-12							1																
72402	2	2	12-15							2																

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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
72403	RSS001-03-03																								
72404	RSS001-03-06																								
72405	RSS001-03-09																								
72406	RSS001-03-12																								
72407	RSS001-03-15																								
72408	RSS001-04-03																								
72409	RSS001-04-06																								
72410	RSS001-04-09																								
72411	RSS001-04-12																								
72412	RSS001-04-15																								

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	
72403	4	4	0-3							4																
72404	1	1	3-6							1																
72405	2	2	6-9							2																
72406	2	2	9-12							2																
72407	3	3	12-15							3																
72408	2	2	0-3							2																
72409	1	1	3-6							1																
72410	1	1	6-9							1																
72411	2	2	9-12							2																
72412	2	2	12-15							2																

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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
72413	RSS001-05-03																								
72414	RSS001-05-06																								
72415	RSS001-05-09																								
72416	RSS001-05-12																								
72417	RSS001-05-15																								

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	
72413	5	4	0-3							4																
72414	2	2	3-6							2																
72415	2	2	6-9							2																
72416	2	2	9-12							2																
72417	2	2	12-15							2																

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: 11-23-2020 / 1436
Received By (Signature): _____ Date/Time: 11-23-2002 / 1436

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

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

25 1

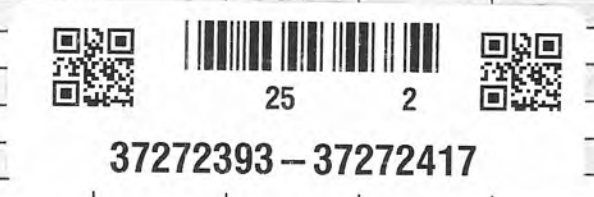
37272393 – 37272417

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS001-01-03	11-17-2020	1146	Soil	X				
RSS001-01-06	11-17-2020	1147	Soil	X				
RSS001-01-09	11-17-2020	1149	Soil	X				
RSS001-01-12	11-17-2020	1150	Soil	X				
RSS001-01-15	11-17-2020	1151	Soil	X				
RSS001-02-03	11-17-2020	1209	Soil	X				
RSS001-02-06	11-17-2020	1210	Soil	X				
RSS001-02-09	11-17-2020	1211	Soil	X				
RSS001-02-12	11-17-2020	1213	Soil	X				
RSS001-02-15	11-17-2020	1214	Soil	X				
RSS001-03-03	11-17-2020	1230	Soil	X				
RSS001-03-06	11-17-2020	1231	Soil	X				
RSS001-03-09	11-17-2020	1232	Soil	X				
RSS001-03-12	11-17-2020	1233	Soil	X				
RSS001-03-15	11-17-2020	1235	Soil	X				

25 MT

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS001-04-03	11-17-2020	1252	Soil	X				
RSS001-04-06	11-17-2020	1253	Soil	X				
RSS001-04-09	11-17-2020	1255	Soil	X				
RSS001-04-12	11-17-2020	1257	Soil	X				
RSS001-04-15	11-17-2020	1258	Soil	X				
RSS001-05-03	11-17-2020	1317	Soil	X				
RSS001-05-06	11-17-2020	1318	Soil	X				
RSS001-05-09	11-17-2020	1319	Soil	X				
RSS001-05-12	11-17-2020	1320	Soil	X				
RSS001-05-15	11-17-2020	1321	Soil	X				



REPORT NUMBER
20-330-0075
COMPLETED DATE
Nov 28, 2020
ACCOUNT
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LOWER PLATTE SOUTH NRD
CHRIS WITTHUHN
PO BOX 83581
LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS003

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
72418	RSS003-01-03																								
72419	RSS003-01-06																								
72420	RSS003-01-09																								
72421	RSS003-01-12																								
72422	RSS003-01-15																								
72424	RSS003-02-03																								
72425	RSS003-02-06																								
72426	RSS003-02-09																								
72427	RSS003-02-12																								
72428	RSS003-02-15																								

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	
72418	1	1	0-3							1																
72419	1	1	3-6							1																
72420	1	1	6-9							1																
72421	1	1	9-12							1																
72422	1	1	12-15							1																
72424	1	1	0-3							1																
72425	1	1	3-6							1																
72426	1	1	6-9							1																
72427	1	1	9-12							1																
72428	1	1	12-15							1																

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RSS003

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
72429	RSS003-03-03																								
72430	RSS003-03-06																								
72431	RSS003-03-09																								
72432	RSS003-03-12																								
72433	RSS003-03-13																								
72434	RSS003-04-03																								
72435	RSS003-04-06																								
72436	RSS003-04-09																								
72437	RSS003-04-12																								
72438	RSS003-04-15																								

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	
72429	1	1	0-3							1																
72430	1	1	3-6							1																
72431	1	1	6-9							1																
72432	1	1	9-12							1																
72433	2	1	12-13							1																
72434	1	1	0-3							1																
72435	1	1	3-6							1																
72436	1	1	6-9							1																
72437	2	2	9-12							2																
72438	1	1	12-15							1																

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS003

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
72439	RSS003-05-03																								
72440	RSS003-05-06																								
72441	RSS003-05-09																								
72442	RSS003-05-12																								
72443	RSS003-05-15																								

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	
72439	1	1	0-3							1																
72440	1	1	3-6							1																
72441	1	1	6-9							1																
72442	1	1	9-12							1																
72443	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

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Lower Platte South NRD
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Lincoln, NE 68501-3581
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Relinquished By (Signature): _____ Date/Time: _____
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Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MJS Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS003-01-03	11-18-2020	1224	Soil	X				
RSS003-01-06	11-18-2020	1225	Soil	X				
RSS003-01-09	11-18-2020	1226	Soil	X				
RSS003-01-12	11-18-2020	1227	Soil	X				
RSS003-01-15	11-18-2020	1228	Soil	X				
RSS003-02-03	11-18-2020	1243	Soil	X				
RSS003-02-06	11-18-2020	1244	Soil	X				
RSS003-02-09	11-18-2020	1245	Soil	X				
RSS003-02-12	11-18-2020	1246	Soil	X				
RSS003-02-15	11-18-2020	1247	Soil	X				
RSS003-03-03	11-18-2020	1310	Soil	X				
RSS003-03-06	11-18-2020	1311	Soil	X				
RSS003-03-09	11-18-2020	1312	Soil	X				
RSS003-03-12	11-18-2020	1313	Soil	X				
RSS003-03-13	11-18-2020	1314	Soil	X				

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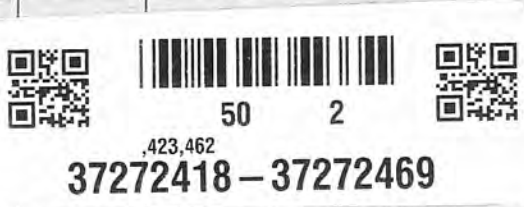
37272418 – 37272469

56 TAT

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS003-04-03	11-18-2020	1333	Soil	X				
RSS003-04-06	11-18-2020	1334	Soil	X				
RSS003-04-09	11-18-2020	1335	Soil	X				
RSS003-04-12	11-18-2020	1336	Soil	X				
RSS003-04-15	11-18-2020	1337	Soil	X				
RSS003-05-03	11-18-2020	1356	Soil	X				
RSS003-05-06	11-18-2020	1357	Soil	X				
RSS003-05-09	11-18-2020	1358	Soil	X				
RSS003-05-12	11-18-2020	1359	Soil	X				
RSS003-05-15	11-18-2020	1400	Soil	X				
RSS004-01-03	11-17-2020	1455	Soil	X				
RSS004-01-06	11-17-2020	1456	Soil	X				
RSS004-01-09	11-17-2020	1456	Soil	X				
RSS004-01-12	11-17-2020	1457	Soil	X				
RSS004-01-15	11-17-2020	1458	Soil	X				
RSS004-02-03	11-18-2020	1016	Soil	X				
RSS004-02-06	11-18-2020	1017	Soil	X				
RSS004-02-09	11-18-2020	1018	Soil	X				
RSS004-02-12	11-18-2020	1019	Soil	X				
RSS004-02-15	11-18-2020	1020	Soil	X				
RSS004-03-03	11-18-2020	1049	Soil	X				
RSS004-03-06	11-18-2020	1050	Soil	X				
RSS004-03-09	11-18-2020	1051	Soil	X				
RSS004-03-12	11-18-2020	1052	Soil	X				
RSS004-03-15	11-18-2020	1053	Soil	X				
RSS004-04-03	11-18-2020	1114	Soil	X				
RSS004-04-06	11-18-2020	1115	Soil	X				
RSS004-04-09	11-18-2020	1116	Soil	X				
RSS004-04-12	11-18-2020	1117	Soil	X				
RSS004-04-15	11-18-2020	1118	Soil	X				



LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS004-05-03	11-18-2020	1141	Soil	X				
RSS004-05-06	11-18-2020	1142	Soil	X				
RSS004-05-09	11-18-2020	1143	Soil	X				
RSS004-05-12	11-18-2020	1144	Soil	X				
RSS004-05-15	11-18-2020	1145	Soil	X				

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,423,462
37272418 – 37272469

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LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS004

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
72444	RSS004-01-03																								
72445	RSS004-01-06																								
72446	RSS004-01-09																								
72447	RSS004-01-12																								
72448	RSS004-01-15																								
72449	RSS004-02-03																								
72450	RSS004-02-06																								
72451	RSS004-02-09																								
72452	RSS004-02-12																								
72453	RSS004-02-15																								

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	
72444	1	1	0-3							1																
72445	1	1	3-6							1																
72446	1	1	6-9							1																
72447	1	1	9-12							1																
72448	1	1	12-15							1																
72449	1	1	0-3							1																
72450	1	1	3-6							1																
72451	1	1	6-9							1																
72452	1	1	9-12							1																
72453	1	1	12-15							1																

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS004

SOIL ANALYSIS REPORT

NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)

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72454	RSS004-03-03																								
72455	RSS004-03-06																								
72456	RSS004-03-09																								
72457	RSS004-03-12																								
72458	RSS004-03-15																								
72459	RSS004-04-03																								
72460	RSS004-04-06																								
72461	RSS004-04-09																								
72463	RSS004-04-12																								
72464	RSS004-04-15																								

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	
72454	1	1	0-3							1																
72455	1	1	3-6							1																
72456	1	1	6-9							1																
72457	1	1	9-12							1																
72458	1	1	12-15							1																
72459	1	1	0-3							1																
72460	1	1	3-6							1																
72461	1	1	6-9							1																
72463	1	1	9-12							1																
72464	1	1	12-15							1																

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS004

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
72465	RSS004-05-03																								
72466	RSS004-05-06																								
72467	RSS004-05-09																								
72468	RSS004-05-12																								
72469	RSS004-05-15																								

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	
72465	1	1	0-3							1																
72466	1	1	3-6							1																
72467	1	1	6-9							1																
72468	1	1	9-12							1																
72469	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.

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): MJS Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS003-01-03	11-18-2020	1224	Soil	X				
RSS003-01-06	11-18-2020	1225	Soil	X				
RSS003-01-09	11-18-2020	1226	Soil	X				
RSS003-01-12	11-18-2020	1227	Soil	X				
RSS003-01-15	11-18-2020	1228	Soil	X				
RSS003-02-03	11-18-2020	1243	Soil	X				
RSS003-02-06	11-18-2020	1244	Soil	X				
RSS003-02-09	11-18-2020	1245	Soil	X				
RSS003-02-12	11-18-2020	1246	Soil	X				
RSS003-02-15	11-18-2020	1247	Soil	X				
RSS003-03-03	11-18-2020	1310	Soil	X				
RSS003-03-06	11-18-2020	1311	Soil	X				
RSS003-03-09	11-18-2020	1312	Soil	X				
RSS003-03-12	11-18-2020	1313	Soil	X				
RSS003-03-13	11-18-2020	1314	Soil	X				

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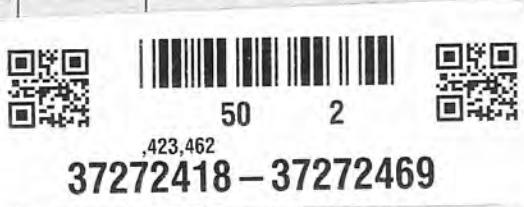
37272418 – 37272469

56 TAT

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS003-04-03	11-18-2020	1333	Soil	X				
RSS003-04-06	11-18-2020	1334	Soil	X				
RSS003-04-09	11-18-2020	1335	Soil	X				
RSS003-04-12	11-18-2020	1336	Soil	X				
RSS003-04-15	11-18-2020	1337	Soil	X				
RSS003-05-03	11-18-2020	1356	Soil	X				
RSS003-05-06	11-18-2020	1357	Soil	X				
RSS003-05-09	11-18-2020	1358	Soil	X				
RSS003-05-12	11-18-2020	1359	Soil	X				
RSS003-05-15	11-18-2020	1400	Soil	X				
RSS004-01-03	11-17-2020	1455	Soil	X				
RSS004-01-06	11-17-2020	1456	Soil	X				
RSS004-01-09	11-17-2020	1456	Soil	X				
RSS004-01-12	11-17-2020	1457	Soil	X				
RSS004-01-15	11-17-2020	1458	Soil	X				
RSS004-02-03	11-18-2020	1016	Soil	X				
RSS004-02-06	11-18-2020	1017	Soil	X				
RSS004-02-09	11-18-2020	1018	Soil	X				
RSS004-02-12	11-18-2020	1019	Soil	X				
RSS004-02-15	11-18-2020	1020	Soil	X				
RSS004-03-03	11-18-2020	1049	Soil	X				
RSS004-03-06	11-18-2020	1050	Soil	X				
RSS004-03-09	11-18-2020	1051	Soil	X				
RSS004-03-12	11-18-2020	1052	Soil	X				
RSS004-03-15	11-18-2020	1053	Soil	X				
RSS004-04-03	11-18-2020	1114	Soil	X				
RSS004-04-06	11-18-2020	1115	Soil	X				
RSS004-04-09	11-18-2020	1116	Soil	X				
RSS004-04-12	11-18-2020	1117	Soil	X				
RSS004-04-15	11-18-2020	1118	Soil	X				



LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS004-05-03	11-18-2020	1141	Soil	X				
RSS004-05-06	11-18-2020	1142	Soil	X				
RSS004-05-09	11-18-2020	1143	Soil	X				
RSS004-05-12	11-18-2020	1144	Soil	X				
RSS004-05-15	11-18-2020	1145	Soil	X				

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37272418 – 37272469

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PO BOX 83581
LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS005

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
72485	RSS005-01-03																								
72486	RSS005-01-06																								
72487	RSS005-01-09																								
72488	RSS005-01-12																								
72489	RSS005-01-15																								
72490	RSS005-02-03																								
72491	RSS005-02-06																								
72492	RSS005-02-09																								
72493	RSS005-02-12																								
72494	RSS005-02-15																								

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	
72485	1	1	0-3							1																
72486	1	1	3-6							1																
72487	1	1	6-9							1																
72488	2	2	9-12							2																
72489	1	1	12-15							1																
72490	1	1	0-3							1																
72491	1	1	3-6							1																
72492	1	1	6-9							1																
72493	1	1	9-12							1																
72494	1	1	12-15							1																

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VADOSE ZONE SAMPLING PROGRAM
RSS005

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
72495	RSS005-03-03																								
72496	RSS005-03-06																								
72497	RSS005-03-09																								
72498	RSS005-03-12																								
72499	RSS005-03-15																								
72500	RSS005-04-03																								
72502	RSS005-04-06																								
72503	RSS005-04-09																								
72504	RSS005-04-12																								
72505	RSS005-04-15																								

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	
72495	1	1	0-3							1																
72496	1	1	3-6							1																
72497	1	1	6-9							1																
72498	1	1	9-12							1																
72499	1	1	12-15							1																
72500	1	1	0-3							1																
72502	1	1	3-6							1																
72503	1	1	6-9							1																
72504	1	1	9-12							1																
72505	1	1	12-15							1																

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LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS005

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
72506	RSS005-05-03																								
72507	RSS005-05-06																								
72508	RSS005-05-09																								
72509	RSS005-05-12																								
72510	RSS005-05-15																								

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	
72506	1	1	0-3							1																
72507	1	1	3-6							1																
72508	1	1	6-9							1																
72509	1	1	9-12							1																
72510	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: _____
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Relinquished By (Signature): _____ Date/Time: _____
Received By (Signature): MJS Date/Time: 11/24/20

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS005-01-03	11-17-2020	1544	Soil	X				
RSS005-01-06	11-17-2020	1545	Soil	X				
RSS005-01-09	11-17-2020	1546	Soil	X				
RSS005-01-12	11-17-2020	1547	Soil	X				
RSS005-01-15	11-17-2020	1548	Soil	X				
RSS005-02-03	11-17-2020	1603	Soil	X				
RSS005-02-06	11-17-2020	1604	Soil	X				
RSS005-02-09	11-17-2020	1605	Soil	X				
RSS005-02-12	11-17-2020	1606	Soil	X				
RSS005-02-15	11-17-2020	16060	Soil	X				
RSS005-03-03	11-17-2020	1622	Soil	X				
RSS005-03-06	11-17-2020	1623	Soil	X				
RSS005-03-09	11-17-2020	1624	Soil	X				
RSS005-03-12	11-17-2020	1625	Soil	X				
RSS005-03-15	11-17-2020	1626	Soil	X				

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37272485 – 37272560

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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				
RSS005-04-03	11-17-2020	1644	Soil	X				
RSS005-04-06	11-17-2020	1645	Soil	X				
RSS005-04-09	11-17-2020	1646	Soil	X				
RSS005-04-12	11-17-2020	1647	Soil	X				
RSS005-04-15	11-17-2020	1648	Soil	X				
RSS005-05-03	11-17-2020	1707	Soil	X				
RSS005-05-06	11-17-2020	1708	Soil	X				
RSS005-05-09	11-17-2020	1709	Soil	X				
RSS005-05-12	11-17-2020	1710	Soil	X				
RSS005-05-15	11-17-2020	1711	Soil	X				
RSS008-01-03	11-18-2020	1514	Soil	X				
RSS008-01-06	11-18-2020	1515	Soil	X				
RSS008-01-09	11-18-2020	1516	Soil	X				
RSS008-01-12	11-18-2020	1517	Soil	X				
RSS008-01-15	11-18-2020	1518	Soil	X				
RSS008-02-03	11-18-2020	~~1332~~ TH 1532	Soil	X				
RSS008-02-06	11-18-2020	1533	Soil	X				
RSS008-02-09	11-18-2020	1534	Soil	X				
RSS008-02-12	11-18-2020	1535	Soil	X				
RSS008-02-15	11-18-2020	1536	Soil	X				
RSS008-03-03	11-18-2020	1554	Soil	X				
RSS008-03-06	11-18-2020	1555	Soil	X				
RSS008-03-09	11-18-2020	1556	Soil	X				
RSS008-03-12	11-18-2020	1557	Soil	X				
RSS008-03-15	11-18-2020	1558	Soil	X				
RSS008-04-03	11-18-2020	1620	Soil	X				
RSS008-04-06	11-18-2020	1621	Soil	X				
RSS008-04-09	11-18-2020	1622	Soil	X				
RSS008-04-12	11-18-2020	1623	Soil	X				
RSS008-04-15	11-18-2020	1624	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS008-05-03	11-18-2020	1648	Soil	X				
RSS008-05-06	11-18-2020	1649	Soil	X				
RSS008-05-09	11-18-2020	1650	Soil	X				
RSS008-05-12	11-18-2020	1651	Soil	X				
RSS008-05-15	11-18-2020	1652	Soil	X				
RSS009-01-03	11-17-2020	0940	Soil	X				
RSS009-01-06	11-17-2020	0942	Soil	X				
RSS009-01-09	11-17-2020	0943	Soil	X				
RSS009-01-12	11-17-2020	0944	Soil	X				
RSS009-01-~~15~~ 13 TH	11-17-2020	0946	Soil	X				
RSS009-02-03	11-17-2020	1004	Soil	X				
RSS009-02-06	11-17-2020	1005	Soil	X				
RSS009-02-09	11-17-2020	1005	Soil	X				
RSS009-02-12	11-17-2020	1006	Soil	X				
RSS009-02-15	11-17-2020	1007	Soil	X				
RSS009-03-03	11-17-2020	1032	Soil	X				
RSS009-03-06	11-17-2020	1033	Soil	X				
RSS009-03-09	11-17-2020	1034	Soil	X				
RSS009-03-12	11-17-2020	1035	Soil	X				
RSS009-03-~~15~~ 14 TH	11-17-2020	1036	Soil	X				
RSS009-04-03	11-17-2020	1054	Soil	X				
RSS009-04-06	11-17-2020	1055	Soil	X				
RSS009-04-09	11-17-2020	1056	Soil	X				
RSS009-04-12	11-17-2020	1057	Soil	X				
RSS009-04-15	11-17-2020	1058	Soil	X				
RSS009-05-03	11-17-2020	1117	Soil	X				
RSS009-05-06	11-17-2020	1119	Soil	X				
RSS009-05-09	11-17-2020	1120	Soil	X				
RSS009-05-12	11-17-2020	1120	Soil	X				
~~RSS009-05-15~~ TH	Not collected	N/A	Soil	X				

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS008

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
72511	RSS008-01-03																								
72512	RSS008-01-06																								
72513	RSS008-01-09																								
72514	RSS008-01-12																								
72515	RSS008-01-15																								
72516	RSS008-02-03																								
72517	RSS008-02-06																								
72518	RSS008-02-09																								
72519	RSS008-02-12																								
72520	RSS008-02-15																								

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
72511	1	1	0-3							1															
72512	1	1	3-6							1															
72513	1	1	6-9							1															
72514	1	1	9-12							1															
72515	1	1	12-15							1															
72516	1	1	0-3							1															
72517	1	1	3-6							1															
72518	1	1	6-9							1															
72519	1	1	9-12							1															
72520	1	1	12-15							1															

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LINCOLN NE 68501-3581

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS008

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
72521	RSS008-03-03																								
72522	RSS008-03-06																								
72523	RSS008-03-09																								
72524	RSS008-03-12																								
72525	RSS008-03-15																								
72526	RSS008-04-03																								
72527	RSS008-04-06																								
72528	RSS008-04-09																								
72529	RSS008-04-12																								
72530	RSS008-04-15																								

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	
72521	1	1	0-3							1																
72522	1	1	3-6							1																
72523	1	1	6-9							1																
72524	1	1	9-12							1																
72525	1	1	12-15							1																
72526	1	1	0-3							1																
72527	1	1	3-6							1																
72528	1	1	6-9							1																
72529	1	1	9-12							1																
72530	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
20-330-0081
COMPLETED DATE
Nov 28, 2020
ACCOUNT
8722
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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
RSS008

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
72531	RSS008-05-03																								
72532	RSS008-05-06																								
72533	RSS008-05-09																								
72534	RSS008-05-12																								
72535	RSS008-05-15																								

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	
72531	1	1	0-3							1																
72532	1	1	3-6							1																
72533	1	1	6-9							1																
72534	1	1	9-12							1																
72535	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.

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

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS005-01-03	11-17-2020	1544	Soil	X				
RSS005-01-06	11-17-2020	1545	Soil	X				
RSS005-01-09	11-17-2020	1546	Soil	X				
RSS005-01-12	11-17-2020	1547	Soil	X				
RSS005-01-15	11-17-2020	1548	Soil	X				
RSS005-02-03	11-17-2020	1603	Soil	X				
RSS005-02-06	11-17-2020	1604	Soil	X				
RSS005-02-09	11-17-2020	1605	Soil	X				
RSS005-02-12	11-17-2020	1606	Soil	X				
RSS005-02-15	11-17-2020	16060	Soil	X				
RSS005-03-03	11-17-2020	1622	Soil	X				
RSS005-03-06	11-17-2020	1623	Soil	X				
RSS005-03-09	11-17-2020	1624	Soil	X				
RSS005-03-12	11-17-2020	1625	Soil	X				
RSS005-03-15	11-17-2020	1626	Soil	X				

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37272485 – 37272560

74 TNT

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS005-04-03	11-17-2020	1644	Soil	X				
RSS005-04-06	11-17-2020	1645	Soil	X				
RSS005-04-09	11-17-2020	1646	Soil	X				
RSS005-04-12	11-17-2020	1647	Soil	X				
RSS005-04-15	11-17-2020	1648	Soil	X				
RSS005-05-03	11-17-2020	1707	Soil	X				
RSS005-05-06	11-17-2020	1708	Soil	X				
RSS005-05-09	11-17-2020	1709	Soil	X				
RSS005-05-12	11-17-2020	1710	Soil	X				
RSS005-05-15	11-17-2020	1711	Soil	X				
RSS008-01-03	11-18-2020	1514	Soil	X				
RSS008-01-06	11-18-2020	1515	Soil	X				
RSS008-01-09	11-18-2020	1516	Soil	X				
RSS008-01-12	11-18-2020	1517	Soil	X				
RSS008-01-15	11-18-2020	1518	Soil	X				
RSS008-02-03	11-18-2020	~~1332~~ TH 1532	Soil	X				
RSS008-02-06	11-18-2020	1533	Soil	X				
RSS008-02-09	11-18-2020	1534	Soil	X				
RSS008-02-12	11-18-2020	1535	Soil	X				
RSS008-02-15	11-18-2020	1536	Soil	X				
RSS008-03-03	11-18-2020	1554	Soil	X				
RSS008-03-06	11-18-2020	1555	Soil	X				
RSS008-03-09	11-18-2020	1556	Soil	X				
RSS008-03-12	11-18-2020	1557	Soil	X				
RSS008-03-15	11-18-2020	1558	Soil	X				
RSS008-04-03	11-18-2020	1620	Soil	X				
RSS008-04-06	11-18-2020	1621	Soil	X				
RSS008-04-09	11-18-2020	1622	Soil	X				
RSS008-04-12	11-18-2020	1623	Soil	X				
RSS008-04-15	11-18-2020	1624	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS008-05-03	11-18-2020	1648	Soil	X				
RSS008-05-06	11-18-2020	1649	Soil	X				
RSS008-05-09	11-18-2020	1650	Soil	X				
RSS008-05-12	11-18-2020	1651	Soil	X				
RSS008-05-15	11-18-2020	1652	Soil	X				
RSS009-01-03	11-17-2020	0940	Soil	X				
RSS009-01-06	11-17-2020	0942	Soil	X				
RSS009-01-09	11-17-2020	0943	Soil	X				
RSS009-01-12	11-17-2020	0944	Soil	X				
RSS009-01-~~15~~ 13 TH	11-17-2020	0946	Soil	X				
RSS009-02-03	11-17-2020	1004	Soil	X				
RSS009-02-06	11-17-2020	1005	Soil	X				
RSS009-02-09	11-17-2020	1005	Soil	X				
RSS009-02-12	11-17-2020	1006	Soil	X				
RSS009-02-15	11-17-2020	1007	Soil	X				
RSS009-03-03	11-17-2020	1032	Soil	X				
RSS009-03-06	11-17-2020	1033	Soil	X				
RSS009-03-09	11-17-2020	1034	Soil	X				
RSS009-03-12	11-17-2020	1035	Soil	X				
RSS009-03-~~15~~ 14 TH	11-17-2020	1036	Soil	X				
RSS009-04-03	11-17-2020	1054	Soil	X				
RSS009-04-06	11-17-2020	1055	Soil	X				
RSS009-04-09	11-17-2020	1056	Soil	X				
RSS009-04-12	11-17-2020	1057	Soil	X				
RSS009-04-15	11-17-2020	1058	Soil	X				
RSS009-05-03	11-17-2020	1117	Soil	X				
RSS009-05-06	11-17-2020	1119	Soil	X				
RSS009-05-09	11-17-2020	1120	Soil	X				
RSS009-05-12	11-17-2020	1120	Soil	X				
~~RSS009-05-15~~ TH	Not collected	N/A	Soil	X				

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

IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS009

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
72536	RSS009-01-03																								
72537	RSS009-01-06																								
72538	RSS009-01-09																								
72539	RSS009-01-12																								
72541	RSS009-01-13																								
72542	RSS009-02-03																								
72543	RSS009-02-06																								
72544	RSS009-02-09																								
72545	RSS009-02-12																								
72546	RSS009-02-15																								

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
72536	3	3	0-3							3															
72537	1	1	3-6							1															
72538	2	2	6-9							2															
72539	4	4	9-12							4															
72541	4	1	12-13							1															
72542	2	2	0-3							2															
72543	1	1	3-6							1															
72544	1	1	6-9							1															
72545	2	2	9-12							2															
72546	3	3	12-15							3															

REV.10/17

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PO BOX 83581
LINCOLN NE 68501-3581

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VADOSE ZONE SAMPLING PROGRAM
RSS009

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
72547	RSS009-03-03																								
72548	RSS009-03-06																								
72549	RSS009-03-09																								
72550	RSS009-03-12																								
72551	RSS009-03-14																								
72552	RSS009-04-03																								
72553	RSS009-04-06																								
72554	RSS009-04-09																								
72555	RSS009-04-12																								
72556	RSS009-04-15																								

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	
72547	3	3	0-3							3																
72548	1	1	3-6							1																
72549	3	3	6-9							3																
72550	3	3	9-12							3																
72551	3	2	12-14							2																
72552	3	3	0-3							3																
72553	1	1	3-6							1																
72554	2	2	6-9							2																
72555	6	5	9-12							5																
72556	7	6	12-15							6																

REV.10/17

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IDENTIFICATION
VADOSE ZONE SAMPLING PROGRAM
RSS009

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
72557	RSS009-05-03																								
72558	RSS009-05-06																								
72559	RSS009-05-09																								
72560	RSS009-05-12																								

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	
72557	3	3	0-3							3																
72558	1	1	3-6							1																
72559	1	1	6-9							1																
72560	2	2	9-12							2																

REV.10/17

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

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

Sample #	Date	Time	Matrix	Tests Requested: Nitrate-N		Lab #/Order # (Internal Use)		Notes
RSS005-01-03	11-17-2020	1544	Soil	X				
RSS005-01-06	11-17-2020	1545	Soil	X				
RSS005-01-09	11-17-2020	1546	Soil	X				
RSS005-01-12	11-17-2020	1547	Soil	X				
RSS005-01-15	11-17-2020	1548	Soil	X				
RSS005-02-03	11-17-2020	1603	Soil	X				
RSS005-02-06	11-17-2020	1604	Soil	X				
RSS005-02-09	11-17-2020	1605	Soil	X				
RSS005-02-12	11-17-2020	1606	Soil	X				
RSS005-02-15	11-17-2020	16060	Soil	X				
RSS005-03-03	11-17-2020	1622	Soil	X				
RSS005-03-06	11-17-2020	1623	Soil	X				
RSS005-03-09	11-17-2020	1624	Soil	X				
RSS005-03-12	11-17-2020	1625	Soil	X				
RSS005-03-15	11-17-2020	1626	Soil	X				

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37272485 – 37272560

74 TNT

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS005-04-03	11-17-2020	1644	Soil	X				
RSS005-04-06	11-17-2020	1645	Soil	X				
RSS005-04-09	11-17-2020	1646	Soil	X				
RSS005-04-12	11-17-2020	1647	Soil	X				
RSS005-04-15	11-17-2020	1648	Soil	X				
RSS005-05-03	11-17-2020	1707	Soil	X				
RSS005-05-06	11-17-2020	1708	Soil	X				
RSS005-05-09	11-17-2020	1709	Soil	X				
RSS005-05-12	11-17-2020	1710	Soil	X				
RSS005-05-15	11-17-2020	1711	Soil	X				
RSS008-01-03	11-18-2020	1514	Soil	X				
RSS008-01-06	11-18-2020	1515	Soil	X				
RSS008-01-09	11-18-2020	1516	Soil	X				
RSS008-01-12	11-18-2020	1517	Soil	X				
RSS008-01-15	11-18-2020	1518	Soil	X				
RSS008-02-03	11-18-2020	~~1332~~ TH 1532	Soil	X				
RSS008-02-06	11-18-2020	1533	Soil	X				
RSS008-02-09	11-18-2020	1534	Soil	X				
RSS008-02-12	11-18-2020	1535	Soil	X				
RSS008-02-15	11-18-2020	1536	Soil	X				
RSS008-03-03	11-18-2020	1554	Soil	X				
RSS008-03-06	11-18-2020	1555	Soil	X				
RSS008-03-09	11-18-2020	1556	Soil	X				
RSS008-03-12	11-18-2020	1557	Soil	X				
RSS008-03-15	11-18-2020	1558	Soil	X				
RSS008-04-03	11-18-2020	1620	Soil	X				
RSS008-04-06	11-18-2020	1621	Soil	X				
RSS008-04-09	11-18-2020	1622	Soil	X				
RSS008-04-12	11-18-2020	1623	Soil	X				
RSS008-04-15	11-18-2020	1624	Soil	X				

LPSNRD Vadose Zone Sampling Program Chain-of Custody

Sample #	Date	Time	Matrix	Tests Requested		Lab #/Order # (Internal Use)		Notes
				Nitrate-N				
RSS008-05-03	11-18-2020	1648	Soil	X				
RSS008-05-06	11-18-2020	1649	Soil	X				
RSS008-05-09	11-18-2020	1650	Soil	X				
RSS008-05-12	11-18-2020	1651	Soil	X				
RSS008-05-15	11-18-2020	1652	Soil	X				
RSS009-01-03	11-17-2020	0940	Soil	X				
RSS009-01-06	11-17-2020	0942	Soil	X				
RSS009-01-09	11-17-2020	0943	Soil	X				
RSS009-01-12	11-17-2020	0944	Soil	X				
RSS009-01-~~15~~ 13 TH	11-17-2020	0946	Soil	X				
RSS009-02-03	11-17-2020	1004	Soil	X				
RSS009-02-06	11-17-2020	1005	Soil	X				
RSS009-02-09	11-17-2020	1005	Soil	X				
RSS009-02-12	11-17-2020	1006	Soil	X				
RSS009-02-15	11-17-2020	1007	Soil	X				
RSS009-03-03	11-17-2020	1032	Soil	X				
RSS009-03-06	11-17-2020	1033	Soil	X				
RSS009-03-09	11-17-2020	1034	Soil	X				
RSS009-03-12	11-17-2020	1035	Soil	X				
RSS009-03-~~15~~ 14 TH	11-17-2020	1036	Soil	X				
RSS009-04-03	11-17-2020	1054	Soil	X				
RSS009-04-06	11-17-2020	1055	Soil	X				
RSS009-04-09	11-17-2020	1056	Soil	X				
RSS009-04-12	11-17-2020	1057	Soil	X				
RSS009-04-15	11-17-2020	1058	Soil	X				
RSS009-05-03	11-17-2020	1117	Soil	X				
RSS009-05-06	11-17-2020	1119	Soil	X				
RSS009-05-09	11-17-2020	1120	Soil	X				
RSS009-05-12	11-17-2020	1120	Soil	X				
~~RSS009-05-15~~ TH	Not collected	N/A	Soil	X				

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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

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

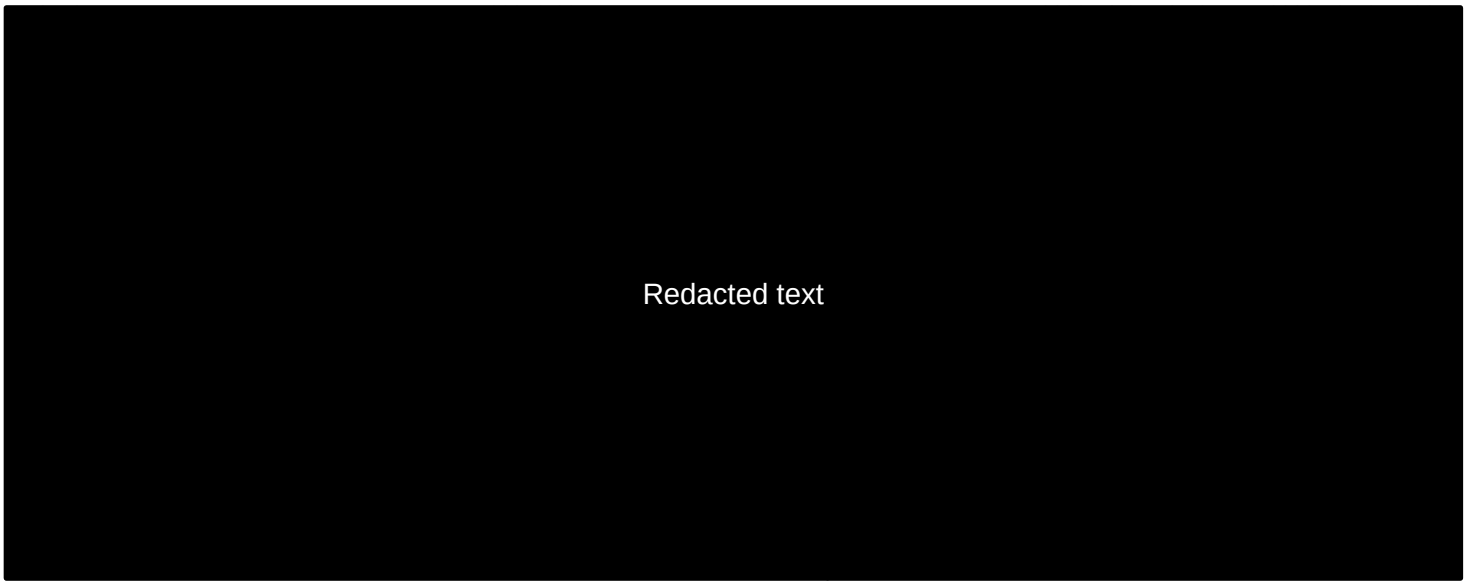
Project: Nitrate Only/Irrigation Wells

Project Manager: CHRIS WITTHUHN

Reported
2020-12-23 16: 1

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RGW001	1566879-01	Aqueous	2020-12-10 12:15	2020-12-16 11:00
RGW002	1566879-02	Aqueous	2020-12-12 15:38	2020-12-16 11:00
RGW003	1566879-03	Aqueous	2020-12-11 1 :	2020-12-16 11:00
RGW005	1566879-0	Aqueous	2020-12-12 09: 7	2020-12-16 11:00
RGW006	1566879-05	Aqueous	2020-12-11 11:13	2020-12-16 11:00
RGW007	1566879-06	Aqueous	2020-12-11 16:11	2020-12-16 11:00
RGW008	1566879-07	Aqueous	2020-12-12 11:5	2020-12-16 11:00
RGW009B	1566879-08	Aqueous	2020-12-10 08:59	2020-12-16 11:00



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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 16:41

Sample ID: RGW001
Laboratory ID: 1566879-01
Sampled Date/Time: 2020-12-10 12:15

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	4.58	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: RGW002
Laboratory ID: 1566879-02
Sampled Date/Time: 2020-12-12 15:38

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.99	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: RGW003
Laboratory ID: 1566879-03
Sampled Date/Time: 2020-12-11 14:44

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	25.6	0.40	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: RGW005
Laboratory ID: 1566879-04
Sampled Date/Time: 2020-12-12 09:47

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	<	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: RGW006
Laboratory ID: 1566879-05
Sampled Date/Time: 2020-12-11 11:13

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	1.19	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: RGW007
Laboratory ID: 1566879-06
Sampled Date/Time: 2020-12-11 16:11

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	0.29	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: RGW008
Laboratory ID: 1566879-07
Sampled Date/Time: 2020-12-12 11:54

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	2.97	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: RGW009B
Laboratory ID: 1566879-08
Sampled Date/Time: 2020-12-10 08:59

Analyte	Result	Reporting Limit	Units	Method	Prepared	Analyzed	Analyst	(Container) / Notes
Environmental Chemistry								
Nitrate/Nitrite Nitrogen	12.3	0.20	mg/L	EPA 353.2	2020-12-22	2020-12-22	JAJ4	(A)

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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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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

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Site RSS001							
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-ft
0-3 ft	11	14	14	7	18	13	39
3-6 ft	4	4	4	4	7	4	13
6-9 ft	4	4	7	4	7	5	15
9-12 ft	11	4	7	7	7	7	22
12-15 ft	14	7	11	7	7	9	28
Root Zone Avg. (0-3, 3-6 ft)	7	9	9	5	13	9	156
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	10	5	8	6	7	7	195
Avg. N for all depths	9	6	9	6	9	8	-
Avg. N lb/ac	130	97	130	87	141	-	117

Site RSS003							
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-ft
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	4	4	11
9-12 ft	4	4	4	7	4	4	13
12-15 ft	4	4	7	4	4	4	13
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	5	5	4	4	110
Avg. N for all depths	4	4	4	4	4	4	-
Avg. N lb/ac	54	54	65	65	54	-	58

Site RSS004							
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-ft
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	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	4	4	65
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	54	-	54

Site RSS005							
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-ft
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	4	4	11
9-12 ft	7	4	4	4	4	4	13
12-15 ft	4	4	4	4	4	4	11
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)	5	4	4	4	4	4	104
Avg. N for all depths	4	4	4	4	4	4	-
Avg. N lb/ac	65	54	54	54	54	-	56

Site RSS008							
Sample Location #	1	2	3	4	5	Avg. N	Avg. N
Land use	Woodland	Woodland	Woodland	Woodland	Woodland		
Units	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft	lb/ac-ft
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	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	4	4	65
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	54	-	54

Site RSS009							
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-ft
0-3 ft	11	7	11	11	11	10	30
3-6 ft	4	4	4	4	4	4	11
6-9 ft	7	4	11	7	4	6	19
9-12 ft	14	7	11	22	7	12	37
12-15 ft	14	11	11	25		15	46
Root Zone Avg. (0-3, 3-6 ft)	7	5	7	7	7	7	123
Below Root Zone Avg. (6-9, 9-12, 12-15 ft)	12	7	11	18	5	11	307
Avg. N for all depths	10	6	9	14	6	9	-
Avg. N lb/ac	152	97	141	206	76	-	134

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Appendix E

Deep Soil Sampling Results Tables

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	RDS001	RDS002	RDS003	RDS004A	RDS0004B	RDS005	RDS006	RDS007	RDS008	RDS009A	RDS009B	RDS010
Interval (ft)	Soybeans	Grassland	Grassland	Pasture	Pasture	Grassland	Soybeans	Corn	Woodland	Soybeans	Soybeans	Grassland
0-5	18	4	4	4	4	4	14	25	4	11	87	36
5-10	7	4	4	4	4	4	11	18	4	7	14	14
10-15	7	4	4	4	4	4	11	32	4	18	18	7
15-20	11	4	4	4	4	4	18	22	4	14	14	18
20-25	7	4	4	11	4	4	14	25	4	7	14	166
25-30	4	4	7	7	7	4	14	18	4	4	-	213
30-35	4	4	11	4	4	7	11	4	4	4	-	152
35-40	-	4	14	4	-	-	7	4	-	4	-	152
40-45	-	-	18	4	-	-	4	-	-	4	-	69
45-50	-	-	-	4	-	-	11	-	-	-	-	25
50-55	-	-	-	-	-	-	4	-	-	-	-	22
55-60	-	-	-	-	-	-	-	-	-	-	-	40
60-65	-	-	-	-	-	-	-	-	-	-	-	25
Average	8	4	8	5	4	4	11	18	4	8	30	72
Minimum	4	4	4	4	4	4	4	4	4	4	14	7
Maximum	18	4	18	11	7	7	18	32	4	18	87	213
Total Lb/Ac	289	144	343	225	144	144	595	740	126	361	740	4618
Quartile 2	5	4	4	4	4	4	9	14	4	4	14	21
Quartile 3	9	4	11	4	4	4	14	25	4	11	18	152

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