

APPENDIX E: OTHER SUPPORTING INFORMATION

LIST OF DOCUMENTS INCLUDED

- Summary table of impacts to aquatic resources, includes:
 - Avoidance and minimization measures
 - Compliance with Food Security Act / Swampbuster
 - Analysis for Executive Order 11990
- Summary maps of impacts to aquatic resources
- Geotechnical Investigation Report
- Wetland Delineation Reports
- CERT Reports
- IPaC Reports
- Redacted Cultural Resources Report
- Draft NHPA Section 106 Programmatic Agreement

Osmond															
Aquatic Resource Name	Cowardin Classification or Stream Type	Wetland Subclass	Avoidance and Minimization Measures Taken	Total Impacted Area (AC)	Impacts to USACE Jurisdictional Resources					Impacts to Non-USACE Jurisdictional Resources					
					Impact Area (AC)	Impact Type and Description	Compliance with Clean Water Act Section 404	Anticipated Mitigation Action*	Anticipated Mitigation Area (AC)*	Impact Area (AC)	Impact Type and Description	Compliance with Food Security Act (FSA) Swampbuster	Compliance with Executive Order (EO) 11990	Mitigation Action (if needed)	Mitigation Area (AC)
Wetland A	PEMA/C	Floodplain Depression	Impacts avoided.	0.000	0.000	N/A	Project will be reviewed under CWA Section 404, a Nationwide Permit is anticipated from the USACE.	N/A	0.000	0.000	N/A	These wetlands are currently farmed. Proposed activities will not increase the farmability of these wetlands or result in any conversion under FSA provisions. Potential lateral effects were analyzed using NRCS procedures to ensure there would be no induced draining of wetlands.	There will be no impact to these wetlands, and therefore no mitigation. As there is no change, this is not detrimental under EO 11990 provisions.	N/A	N/A
Unnamed Stream	Ephemeral	N/A	Impacts minimized to the greatest extent possible by limiting grading extents.	0.011	0.011	Fill placement.		Not required, impact is less than allowable 0.03 ac limit.	0.000	0.000	N/A	Wetlands are not present within this stream channel. FSA conversion effects to adjacent wetlands were analyzed separately.	Wetlands are not present within this stream channel. EO 11990 effects to adjacent wetlands were analyzed separately.	N/A	N/A
Pierce															
Aquatic Resource Name	Cowardin Classification or Stream Type	Wetland Subclass	Avoidance and Minimization Measures Taken	Total Impacted Area (AC)	Impacts to USACE Jurisdictional Resources					Impacts to Non-USACE Jurisdictional Resources					
					Impact Area (AC)	Impact Type and Description	Compliance with Clean Water Act Section 404	Anticipated Mitigation Action*	Anticipated Mitigation Area (AC)*	Impact Area (AC)	Impact Type and Description	Compliance with Food Security Act (FSA) Swampbuster	Compliance with Executive Order (EO) 11990	Mitigation Action (if needed)	Mitigation Area (AC)
Wetland A	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland B	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland C	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland D	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.003	0.003	Southwest channel bridge / culvert installation		4:1 wetland creation	0.012	0.000	N/A			N/A	N/A
Wetland E	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland F	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland G	PEMA/C	Lacustrine Fringe	0.000	0.000	N/A	N/A		0.000	0.000	N/A	N/A			N/A	
Wetland H	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.006	0.006	Lateral drainage for southwest channel		N/A	0.024	0.000	N/A			N/A	N/A
Wetland I	PEMA/C	Riverine Channel		0.285	0.285	Excavation & lateral drainage for southwest channel		4:1 wetland creation	1.140	0.000	N/A			N/A	N/A
Wetland J	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland K	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland L	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland M	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland N	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland O	PEMA/C	Riverine Channel		0.098	0.098	Excavation & lateral drainge for northwest channel		4:1 wetland creation	0.392	0.000	N/A			N/A	N/A
Wetland P	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.178	0.178	Excavation for northwest channel		4:1 wetland creation	0.712	0.000	N/A			N/A	N/A
Wetland Q	PEMA/C	Floodplain Depression		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland R	PEMA/C	Riverine Channel		0.114	0.114	Excavation & lateral drainge for northwest channel		4:1 wetland creation	0.454	0.000	N/A			N/A	N/A
Wetland S	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	2.200	2.200	Excavation & lateral drainge for northwest channel		4:1 wetland creation	8.800	0.000	N/A			N/A	N/A
Wetland T	PEMA/C	Riverine Channel		0.011	0.011	Lateral drainage for northwest channel		4:1 wetland creation	0.044	0.000	N/A			N/A	N/A
Wetland U	PEMA/C	Riverine Channel		0.199	0.199	Excavation & lateral drainge for northwest channel		4:1 wetland creation	0.796	0.000	N/A			N/A	N/A
Wetland V	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland W	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland X	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland Y	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland Z	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland AA	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland BB	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland CC	PEMA/C	Riverine Channel		0.000	0.000	N/A		N/A	0.000	0.000	N/A			N/A	N/A
Wetland DD	PEMA/C	Riverine Channel		Impacts minimized to the greatest extent possible by limiting grading extents.	1.194	1.194		Excavation & lateral drainge for northwest channel	4:1 wetland creation	4.776	0.000			N/A	N/A

Wetland EE	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.544	0.544	Excavation / riprap fill / lateral drainage for northwest channel
Wetland FF	PEMA/C	Floodplain Depression	Impacts avoided.	0.000	0.000	N/A
Wetland GG	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.032	0.032	Excavation / riprap fill / lateral drainage for northwest channel
Wetland HH	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A
Wetland II	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland JJ	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.001	0.001	Fill for levee embankment
Wetland KK	PEMA/C	Riverine Channel		0.003	0.003	Fill for levee embankment
Wetland LL	PEMA/C	Floodplain Depression		0.097	0.097	Fill for levee seepage berm
Wetland MM	PEMA/C	N/A		0.039	0.039	Fill for levee seepage berm
Wetland NN	PEMA/C	N/A		0.039	0.039	Fill for levee seepage berm
Wetland OO	PEMA/C	N/A	Impacts avoided.	0.035	0.035	Fill for levee seepage berm
Wetland PP	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland QQ	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland RR	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland SS	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland TT	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland UU	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland VV	PUBA/C	Riverine Channel		0.000	0.000	N/A
Wetland WV	PUBA/C	Riverine Channel		0.000	0.000	N/A
Wetland XX	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland YY	PUBA/C	Riverine Channel		0.000	0.000	N/A
Wetland ZZ	PEMA/C	Lacustrine Fringe		0.000	0.000	N/A
Wetland AAA	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland BBB	PFOA/C	Riverine Channel		0.000	0.000	N/A
Wetland CCC	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland DDD	PEMA/C	Lacustrine Fringe		0.000	0.000	N/A
Wetland EEE	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland FFF	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland GGG	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.038	0.038	Fill for levee seepage berm
Wetland HHH	PEMA/C	Riverine Channel		0.036	0.036	Fill for levee seepage berm
Wetland III	PEMA/C	Riverine Channel		0.001	0.001	Fill for levee seepage berm
Wetland JJJ	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A
Wetland KKK	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland LLL	PEMA/C	Floodplain Depression	Impacts minimized to the greatest extent possible by limiting grading extents.	0.119	0.119	Fill for levee seepage berm
Wetland MMM	PEMA/C	Floodplain Depression		0.124	0.124	Fill for levee seepage berm
Wetland NNN	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A
Wetland OOO	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland PPP	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland QQQ	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland RRR	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland SSS	PEMA/C	Lacustrine Fringe	Impacts minimized to the greatest extent possible by limiting grading extents.	0.196	0.196	Fill for levee embankment
Wetland TTT	PEMA/C	Riverine Channel	Impacts avoided.	0.000	0.000	N/A
Wetland UUU	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland VVV	PEMA/C	Riverine Channel		0.000	0.000	N/A
Wetland WWW	PEMA/C	Riverine Channel	Impacts minimized to the greatest extent possible by limiting grading extents.	0.023	0.023	Fill for levee embankment
Wetland XXX	PEMA/C	Floodplain Depression	Impacts avoided.	0.000	0.000	N/A
North Fork Elkhorn River	Perennial	N/A		0.000	0.000	N/A
Willow Creek	Perennial	N/A		0.000	0.000	N/A
Unnamed Stream 1	Ephemeral	N/A	Impacts minimized to the greatest extent possible by limiting grading extents.	0.002	0.002	Southwest channel bridge / culvert installation
Unnamed Stream 2	Ephemeral	N/A	Impacts avoided.	0.000	0.000	N/A
Unnamed Stream 3	Ephemeral	N/A	Impacts minimized to the greatest extent possible by limiting grading extents.	0.045	0.045	Realignment for southwest channel
Unnamed Stream 4	Ephemeral	N/A	Impacts avoided.	0.000	0.000	N/A
Unnamed Stream 5	Ephemeral	N/A		0.000	0.000	N/A
Unnamed Stream 6	Canal	N/A		0.018	0.018	Riprap placement for northwest channel

Project will be reviewed under CWA Section 404, an Individual Permit is anticipated from the USACE.

4:1 wetland creation	2.176	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.128	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.004	0.000	N/A
4:1 wetland creation	0.012	0.000	N/A
4:1 wetland creation	0.388	0.000	N/A
4:1 wetland creation	0.156	0.000	N/A
4:1 wetland creation	0.156	0.000	N/A
4:1 wetland creation	0.140	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.152	0.000	N/A
4:1 wetland creation	0.144	0.000	N/A
4:1 wetland creation	0.004	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.476	0.000	N/A
4:1 wetland creation	0.496	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.784	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
4:1 wetland creation	0.092	0.000	N/A
N/A	0.000	0.000	N/A
	0.000	0.000	N/A
N/A	0.000	0.000	N/A
Channel improvements	N/A	0.000	N/A
N/A	0.000	0.000	N/A
Channel improvements	N/A	0.000	N/A
N/A	0.000	0.000	N/A
N/A	0.000	0.000	N/A
Channel improvements	N/A	0.000	N/A

These wetlands are not currently farmed. Proposed activities will not increase the farmability of these wetlands or result in any conversion under FSA provisions. Potential lateral effects were analyzed using NRCS procedures to ensure there would be no induced draining of wetlands.

Impacts to these wetlands will be adequately replaced by new wetlands which will be established for the purpose of mitigation. Therefore, this change is not detrimental under EO 11990 provisions.

Wetlands are not present within this stream channel. FSA conversion effects to adjacent wetlands were analyzed separately.

Wetlands are not present within this stream channel. EO 11990 effects to adjacent wetlands were analyzed separately.

Unnamed Stream 7	Ephemeral	N/A	Impacts minimized to the greatest extent possible by limiting grading extents.	0.006	0.006	Fill for levee embankment	Channel improvements	N/A	0.000	N/A			N/A	N/A
Unnamed Stream 8	Intermittent	N/A		0.002	0.002	Fill for levee embankment	Channel improvements	N/A	0.000	N/A			N/A	N/A
Unnamed Stream 9	Ephemeral	N/A		0.021	0.021	Fill for levee seepage berm	Channel improvements	N/A	0.000	N/A			N/A	N/A
Unnamed Stream 10	Ephemeral	N/A	Impacts avoided.	0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A
Unnamed Stream 11	Ephemeral	N/A		0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A
Pierce Lake	Pond	N/A		0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A
Unnamed Pond 1	Pond	N/A		0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A
Unnamed Pond 2	Pond	N/A		0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A
Unnamed Pond 3	Pond	N/A		0.000	0.000	N/A	N/A	0.000	0.000	N/A			N/A	N/A

Total Project Impacts			
Aquatic Resource	Osmond Impacts (AC)	Pierce Impacts (AC)	Total (AC)
Wetlands by Cowardin Classification			
PEMA/C	0.000	5.615	5.615
PUBA/C	0.000	0.000	0.000
PFOA/C	0.000	0.000	0.000
Wetlands by Subclass			
Floodplain Depression	0.000	0.340	0.340
Lacustrine Fringe	0.000	0.196	0.196
Riverine Channel	0.000	4.966	4.966
N/A	0.000	0.113	0.113
Streams and Waterbodies			
Perennial Stream	0.000	0.000	0.000
Intermittent Stream	0.000	0.002	0.002
Ephemeral Stream	0.011	0.074	0.085
Canal	0.000	0.018	0.018
Pond	0.000	0.000	0.000

*Note: Anticipated mitigation ratios are subject to change during final permitting.

Impacts, avoidance and minimization details, and compliance information is included in the accompanying table.

Total Wetland Impact: 0.000 ac
Total Stream Impact: 0.011 ac



Aquatic Habitat Impacts

Osmond, NE

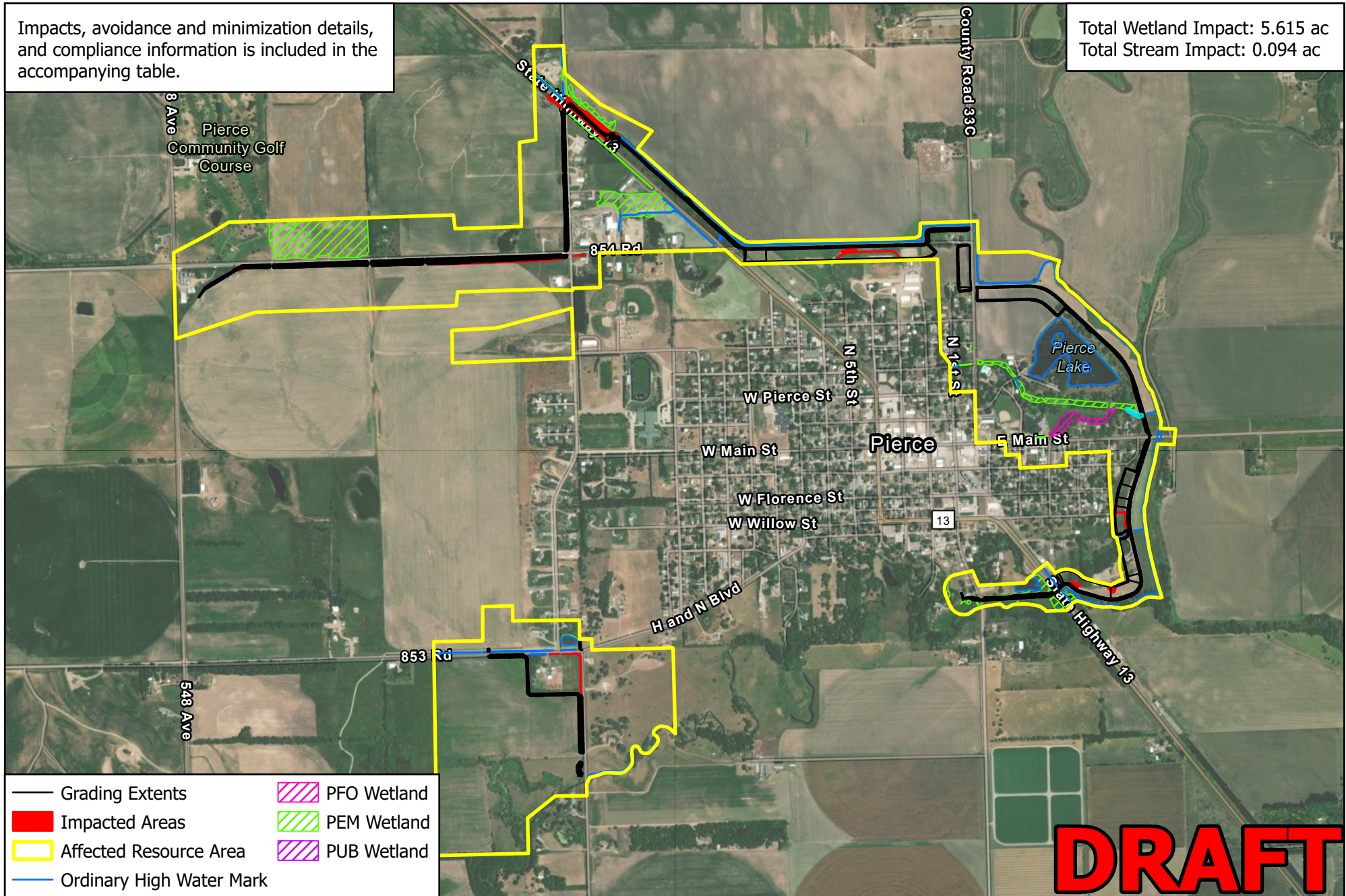
Created By: DJV
Date: 9/9/2024

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Impacts, avoidance and minimization details, and compliance information is included in the accompanying table.

Total Wetland Impact: 5.615 ac
Total Stream Impact: 0.094 ac

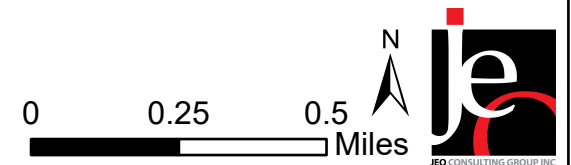


Aquatic Habitat Impacts

Pierce, NE

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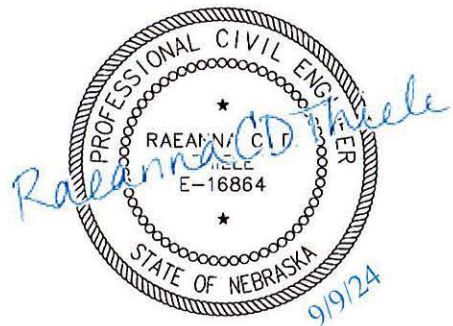
Preliminary Geotechnical Exploration Report

North Fork Elkhorn River Watershed WFPO

Pierce & Osmond, Nebraska

Prepared for:
JEO Consulting Group
1937 North Chestnut Street
Wahoo, NE 68066

September 9, 2024
TG Project No. 24350.01



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Preliminary Geotechnical Exploration Report
North Fork Elkhorn River Watershed WFPO

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INTRODUCTION

Thiele Geotech, Inc. has completed a preliminary geotechnical exploration study for the proposed North Fork Elkhorn River Watershed WFPO project located in Pierce and Osmond, Nebraska. The purpose of this study was to identify the general soil and ground water conditions underlying the site; to present the relevant engineering properties of the existing soils; to provide preliminary earthwork and site preparation recommendations; and discuss general geotechnical considerations for the proposed improvements. Additional borings will be required to develop final recommendations after more design information is available.

This study included soil borings, laboratory testing, and engineering analysis. A series of 14 test borings was spaced across the project sites at strategic locations (12 in Pierce and 2 in Osmond). The field and laboratory data are presented in the Appendix, along with a description of investigative methods.

The drilling and testing performed for this study were conducted solely for preliminary geotechnical analysis. No analytical testing or environmental assessment has been conducted. Any statements or observations in this report regarding odors, discoloration, or suspicious conditions are strictly for the information of our client. If an evaluation of environmental conditions is desired, a separate environmental assessment should be conducted. This study did not include biological assessment (e.g. mold, fungi, bacteria) or evaluation of measures for their control.

It should also be noted that this report was prepared for preliminary design purposes only, and may not be sufficient for a contractor in bid preparation. Prospective contractors should evaluate potential construction problems on the basis of their own knowledge and experience in the local area and on similar projects, taking into account their own intended construction methods and procedures.

This report is an instrument of service prepared for use by our client on this specific project. The report may be duplicated as necessary and distributed to those directly associated with this project, including members of the design team and prospective contractors. However, the technical approach and report format shall be considered proprietary and confidential, and this report may not be distributed in whole or in part to any third party not directly associated with this project. By using and relying on this report, all other parties agree to the same terms, conditions, and limitations to which the client has agreed.

PROJECT DESCRIPTION

Our understanding of the project is based upon information provided by JEO Consulting Group.

The project consists of evaluating soil conditions at several potential project sites within the North Fork Elkhorn River watershed located in Pierce and Osmond, Nebraska. At the time of this report, various alternative options are being considered as part of the Watershed and Flood Prevention Operations (WFPO) program. These options include levee improvements, diversion channels, pump stations, and construction of a detention cell, which are summarized below.

- ***Levee Improvements***

This potential project involves improving the existing levee located north of Pierce and along the east side of Osmond. These improvements include constructing a berm at the north end of the existing levee on the southwest side of Highway 13 in Pierce and increasing the overall height of the levee and roadway between North Hill Street and North Park Street along 4th Street in Osmond, which both may require fill placement of up to 5 feet to establish assumed grades.

- ***Diversion Channels***

This potential project involves improving the network of existing ditches and constructing new channels located northwest and southwest of Pierce that lead to the North Fork Elkhorn River and Willow Creek. We assume improvements will consist of widening and deepening the existing ditches to allow for more water flow and storage capacity. Construction will primarily consist of cuts, with maximum depths estimated at approximately 5 feet.

- ***Pump Stations***

Two pump stations are being considered behind the levee along the east side of Pierce. The pump house footprints which contain the station are anticipated to be small and constructed utilizing brick or metal walls and a metal roof. Maximum column loads of 25 kips and maximum continuous wall loads of 2 kips per lineal foot are assumed for the pump house. Grade changes are assumed to be minor. The depths of the pump stations are unknown at this time.

- ***Detention Cell***

One detention cell will potentially be constructed northeast of Pierce. The cell will be located northeast of Gilman Park. The cell will have an approximate footprint of 39 acres, with overall assumed depths ranging from 4 to 8 feet below existing grades.

SURFACE AND SUBSURFACE CONDITIONS

SITE CONDITIONS

The overall project area covering the four noted projects is primary located north, east, and south of Pierce and along the east side of Osmond in Pierce County, Nebraska. In general, the area has historically been primarily utilized for agricultural production. The North Fork Elkhorn River runs north to south along the east side of both cities. Both areas are relatively flat, with gradual grade changes.

LOCAL GEOLOGY

The project site lies within the geologic floodplain of the North Fork Elkhorn River. Alluvial soils within the floodplain generally consist of silts and clays near the surface. The deeper deposits typically consist of fine to coarse sand with interbedded clay layers. The alluvial deposits are underlain by Pennsylvanian limestone and shale that form the bedrock unit underlying the region. The depth to bedrock varies dramatically due to erosion within the North Fork Elkhorn River valley.

BORING LOCATIONS

The test borings were conducted as shown on the Boring Location Plan included in the Appendix and presented in Table 1. Coordinates of the borings are approximate and based on as-drilled locations following completion of the borings and interpolation from Google Earth.

Table 1 – Boring Locations

Boring Number	Coordinates		Project Location
	Latitude	Longitude	
NF B-1	42° 12' 22.41" N	97° 33' 27.69" W	Diversion channel
NF B-2	42° 12' 22.27" N	97° 32' 53.94" W	Diversion channel
NF B-3	42° 12' 32.65" N	97° 32' 36.54" W	Diversion channel
NF B-4	42° 12' 36.78" N	97° 32' 32.02" W	Diversion channel/Berm
NF B-5	42° 12' 7.76" N	97° 31' 21.27" W	Detention cell
NF B-6	42° 12' 0.21" N	97° 30' 57.58" W	Pump Station
NF B-7	42° 11' 45.13" N	97° 31' 0.26" W	Pump Station
NF B-8	42° 11' 19.20" N	97° 32' 49.51" W	Diversion channel
NF B-9	42° 11' 27.46" N	97° 32' 49.53" W	Diversion channel
NF B-10	42° 11' 31.17" N	97° 32' 41.63" W	Diversion channel

Table 1 – Boring Locations (cont.)

Boring Number	Coordinates		Project Location
	Latitude	Longitude	
NF B-11	42° 11' 27.54" N	97° 32' 36.61" W	Diversion channel
NF B-12	42° 11' 19.04" N	97° 32' 36.89" W	Diversion channel
OS B-1	42° 21' 35.46" N	97° 35' 36.51" W	Levee
OS B-2	42° 21' 35.39" N	97° 35' 33.61" W	Levee

SOIL CONDITIONS

The soils encountered in the test borings generally consisted of man-placed fill and alluvium.

Man-placed fill was encountered at the surface of borings NF B-3 and NF B-12, extending to a depth of 3.5 to 4 feet. It was generally described as dark brown or brown, dry, hard, clayey sand or silt.

Alluvium was encountered at the surface of all remaining borings and beneath the man-placed fill in borings NF B-3 and NF B-12, extending to a termination depth of 20 feet. It was generally described as brown, reddish brown, reddish gray, gray, light brown, dark gray, light gray, olive gray, grayish brown, or dark brown, dry to wet, very soft to hard, very loose to medium dense, fat clay, lean clay, silty sand, poorly graded sand with silt, or poorly graded sand.

Ranges of engineering properties from laboratory tests on selected samples are presented in Table 2.

Table 2 - Laboratory Results

Soil Layer	Moisture Content (%)	Dry Unit Weight (pcf)	Unconfined Compressive Strength (tsf)	Standard Penetration Values (N)*	Classification (<i>LL/PI</i>)
Man-placed fill	5 to 9	110 to 119	1.9	--	SC (visual) ML (19/5)
Alluvium (fine-grained)	6 to 37	82 to 112	0.6 to 2.1	WOH to 9	CH (56/42) CL (35/19, 43/24, P200 88.3%)
Alluvium (coarse-grained)	5 to 42	81 to 116	--	WOH to 27	SM (P200 30.2%, 30.0%) SP-SM (P200 11.6%, 9.5%, 6.6%, 10.0%, 9.4%, 6.9%, 7.9%) SP (visual)
* Standard Penetration Values are actual field recorded values and have not been corrected for hammer energy					

GROUND WATER OBSERVATIONS

Ground water levels were observed in the borings as presented in Table 3. Note that ground water levels may fluctuate due to seasonal variations and other factors. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current ground water conditions.

Table 3 - Water Level Observations

Boring Number	Boring Elevation (ft.)	Water Level (ft. below grade)		Ground Water Elevation (ft.)
		During Drilling	End of Drilling	
NF B-1	1,625	9.0	9.4	1,616
NF B-2	1,619	6.0	NE (cave 11.7)	1,613
NF B-3	1,588	6.0	14.1	1,582
NF B-4	1,586	4.0	NE (cave 8.4)	1,582
NF B-5	1,578	10.0	NE (cave 5.9)	1,568
NF B-6	1,581	5.0	14.1	1,576
NF B-7	1,577	9.0	NE (cave 7.6)	1,568
NF B-8	1,600	6.0	13.8	1,594
NF B-9	1,600	6.0	NE (cave 4.8)	1,594
NF B-10	1,599	6.0	5.4	1,594
NF B-11	1,594	12.0	10.0	1,584
NF B-12	1,598	9.0	NE (cave 9.9)	1,589
OS B-1	1,658	19.0	18.5	1,639
OS B-2	1,657	5.0	NE (cave 7.3)	1,652

Ground water observations were made in the borings both during and after completion of drilling operations. The borings were drilled with hollow stem augers limiting observation during drilling operations. Upon removal of the augers, partial filling of the boring occurred due to the loss of cuttings into the boring. Water level observations taken after completion of the borings were limited to the remaining depth of the open boring. The water level observations include the condition observed (such as cave in) and the depth to which the observations could be made.

ANALYSIS AND RECOMMENDATIONS

GENERAL

This preliminary geotechnical exploration consisted of widely spaced borings to determine the general soil conditions within the proposed project areas. An additional geotechnical exploration(s) consisting of more strategically placed borings should be conducted once more design information is available. The borings performed during this preliminary study may be used to supplement a final geotechnical exploration.

The existing soils encountered across all project sites primarily consisted of alluvial deposits ranging in moisture content, consistency, and plasticity. These soil conditions appear generally suitable for support of the proposed improvements. However, we have provided site preparation considerations that may be necessary depending on the final design of the improvements. There are several potential geotechnical engineering concerns for this project site, including: high moisture contents of excavated materials, consolidation of the alluvial soils that could occur under the induced stresses of structural fill placement, permeability of the soils in the proposed detention cell, relatively shallow ground water, and moderately low strength alluvial deposits. These concerns are discussed in the remaining sections of this report.

SITE PREPARATION

General Earthwork

Topsoil and vegetation should be stripped to a depth of 4 to 6 inches in areas to be disturbed during grading, including borrow and fill areas. Stripping depths will likely vary and should be adjusted to remove all vegetation and root systems. Care should be exercised to separate these materials to avoid incorporation of the organic matter in structural fill sections.

Excavated Site Soils

The fine-grained alluvial soils consisting of either lean or fat clay will generally be suitable for reuse as structural fill for levee improvements; however, moderate to significant moisture conditioning should be anticipated. It may be impractical to dry some of the wetter soils excavated near the ground water table sufficiently, if required. It is anticipated that soils above 30 percent moisture content cannot be reasonably dried. Therefore, it may be necessary to replace some of the excavated natural soil with off-site borrow. It will also likely be necessary to use off-site borrow for raising the levee and constructing a berm. Any off-site borrow should consist of a clay material with a minimum liquid limit of 40 and a plasticity index of 15 or higher. Borrow material should not contain an appreciable amount of roots, rock, or debris, and should not contain any foreign material with a dimension greater than 3 inches.

Fill-Induced Settlement

Fill placement of up to 5 feet is assumed to achieve proposed finished grades at the proposed new berm and existing levee. The existing fine-grained alluvial soils encountered in the test borings are

compressible, and the addition of fill to raise grades will cause these soils to consolidate. The amount of settlement is dependent upon the extent and magnitude of the fill to be placed. The time rate of settlement is largely dependent on the degree of saturation and aerial extent of the fill. The amount of settlement and length of delay prior to construction of any improvements can be determined and provided in a final geotechnical exploration report after a final grading plan has been developed.

Ground Water

Ground water was encountered in all of the test borings conducted on the two sites, with during drilling depths ranging from 4 to 19 feet below existing grades. The presence of shallow ground water is anticipated to impact excavations near or below these depths. It is likely that stabilization of soft subgrades will be necessary for excavations that extend close to or below the ground water. A combination of dewatering and stabilization with layers of geotextile and coarse aggregate would likely be required if excavations extend near or below the ground water table. A dewatering contractor should be consulted if dewatering is deemed necessary.

DETENTION CELL CONSIDERATIONS

One detention cell will potentially be constructed northeast of Pierce. The cell will be located northeast of Gilman Park and have an approximate footprint of 39 acres, with overall assumed depths ranging from 4 to 8 feet below existing grades and sloped to drain to the east. Boring NF B-5 was drilled near the south edge of the cell. In general, a 3.5-foot thick layer of low to high plasticity alluvial clay underlain by coarse alluvial sand layers that were slightly moist to wet with very loose to loose consistencies were encountered in this area. Ground water was encountered at a depth of 10 feet during drilling in the boring.

Based on limited laboratory testing conducted on samples taken from the cell, reviewing final plans will be critical in determining what remedial actions will need to take place for the cell to be constructed. If the cell is intended to hold water for extended periods of time, for example in a flooding event, excavating the coarse-grained alluvial soils below and then reusing and recompacting the existing fine-grained soils that were encountered above as a clay liner would create somewhat of an impervious layer allowing the cell to hold water. However, based on the permeability test conducted on sample U-1 of boring NF B-5, it appears that recompacting these soils will allow water to permeate through the matrix at a rate faster than the recommended permeability rate of 1×10^{-7} cm/sec. Therefore, if a near-impermeable condition is required, some consideration should be given to treating the entire recompacted clay placed at the base of the basin with bentonite to limit water infiltration. The installation of a synthetic liner would need to be considered if impermeable conditions are required.

Regardless of which option is selected, both underseepage and blowout from unbalanced hydrostatic loads should be studied once final plans become available. If the cell is intended to drain, consideration

should be given to setting the bottom of the cell elevation in the poorly graded sand with silt soil layer. This layer will have a higher permeability rate allow the water to drain.

It should be noted that the samples were taken from one boring conducted in a moderately variable alluvial setting. Based on the boring logs and previous experience in the area, we anticipate that high plasticity alluvial clay soils with lower sand content and assumed lower permeabilities are likely present within the basin footprint, which could be mined and compacted as a suitable clay liner. Additional borings would be necessary to identify and delineate such soils.

PUMP STATION CONSIDERATIONS

Structural loading information was not available at the time of this exploration. The existing site conditions appear suitable to support the assumed lightly loaded pump house structures on a shallow foundation system. For structures supported on the natural alluvium, a net allowable bearing pressure in the range of 1,200 to 1,500 pounds per square foot should be anticipated unless an overexcavation is performed to improve the bearing soils. Note that this bearing pressure range is general and should not be used for design.

We do not have any information regarding design of the pump stations, but assume that a below-grade wet well may be required. The allowable bearing pressure for a buried structure would be the gross bearing pressure, which is the net allowable bearing pressure derived from the shear strength of the soil plus the surrounding overburden pressure. During construction, the net allowable bearing pressure controls before the structure is backfilled. Thus, we recommend that both the construction case and long-term case be considered in sizing the mat foundation for the structures.

Based on the soil conditions in boring NF B-6 and NF B-7, the base of the structures would be expected to bear within the soft to firm, fine-grained alluvium or very loose to medium dense, coarse-grained alluvium depending on the proposed depths. The net allowable bearing pressure would likely be in the range of approximately 1,000 to 1,500 pounds per square foot (psf) and is dependent on the depth of the buried structure. The overburden pressure at a certain depth would be a function of the depth of the structure below the ground water table, multiplied by 53 pcf. Thus, the gross allowable bearing pressure for the pump station would be the sum of the net allowable and overburden pressure. Final design recommendations for design of mat foundations for the pump stations should be determined during final geotechnical exploration once designs have been developed.

Depending on the proposed depth of the pump station, we anticipate that dewatering will likely be required to facilitate construction. A dewatering contractor should be consulted if dewatering is deemed necessary.

We anticipate that use of a mud mat or crushed aggregate at the base of the excavation to provide a level working platform and to limit disturbance to the clays or saturated sands will be required.

OTHER RECOMMENDATIONS

During detailed design, additional issues may arise and possible conflicts may occur with our recommendations. Such issues and conflicts should be resolved through dialogue between the geotechnical engineer and designers. It is recommended that the geotechnical engineer perform additional borings to develop final recommendations for construction of any of the proposed improvements for this project.

The analysis and preliminary recommendations in this report are based upon borings at specific locations. The nature and extent of variation between boring locations is impossible to predict. Because of this, geotechnical recommendations are preliminary until they have been confirmed through observation of site excavation and earthwork preparation. If variations appear during subsequent exploration or during construction, we may reevaluate our recommendations and modify them, if appropriate. The geotechnical engineer should be retained during construction to observe compliance with the recommendations of this report and to provide quality control testing of earthwork construction. If these services are provided by others, including the contractor, the entity that provides construction phase observation and testing shares responsibility as the geotechnical engineer of record for implementing or modifying these recommendations.

Respectfully submitted,
Thiele Geotech, Inc.

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Prepared under the supervision of,

Raeanna C.D. Thiele

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APPENDIX

Subsurface Exploration Methods

Legend of Terms

Boring Location Plan

Boring Logs

Soil Test Summary

Permeability Tests

Crumb Tests

SUBSURFACE EXPLORATION METHODS

The fieldwork for this study was conducted on July 24 and 25, 2024. The exploratory program consisted of 14 test borings drilled at the approximate locations shown on the Boring Location Plan. Boring locations were selected to provide the desired site coverage and were adjusted to accommodate access conditions. The boring locations were laid out in the field using a handheld GPS and coordinates obtained from Google Earth. Elevations were interpolated from Google Earth. The boring locations should only be considered accurate to the degree implied by the methods used to define them.

Test borings were advanced using flight augers powered by a truck-mounted drill rig. Soil samples were obtained at selected depths as indicated on the boring logs. A 3-inch nominal diameter thin-walled sampler was hydraulically pushed to obtain undisturbed samples. Disturbed samples were obtained by driving a 2-inch nominal diameter split barrel sampler while conducting standard penetration tests (SPT). The SPT values presented on the boring logs are actual field recorded numbers and have not been corrected for hammer energy or overburden.

The boring logs were prepared based on visual classification of the samples and drill cuttings, and by observation of the drilling characteristics of the subsurface formations. The logs have been supplemented and modified based on the laboratory test results and further examination of the recovered samples. The stratification lines on the boring logs represent the approximate boundary between soil types, but the insitu transition may be gradual.

Water level observations were made at the times stated on the boring logs. The borings were backfilled with drill cuttings at the completion of the fieldwork.

The field boring logs were reviewed to outline the depths, thicknesses, and extent of the soil strata. A laboratory testing program was then developed to further classify the basic soils and to evaluate the engineering properties for use in our analysis.

Laboratory tests to further classify the soils included visual classification, moisture content, dry unit weight, Atterberg limits, and crumb tests. The shear strengths of cohesive samples were evaluated using the unconfined compression test. Hydraulic conductivity was calculated using the flexible wall permeameter.

The boring logs and related information in this report are indicators of subsurface conditions only at the specific locations and times noted. Subsurface conditions, including ground water levels, at other locations of the site may differ significantly from conditions that exist at the sampling locations. Also note that the passage of time may affect conditions at the sampling locations.

Soil Description Terms

<u>Consistency - Fine Grained</u>	<u>Consistency - Coarse Grained</u>	<u>Moisture Conditions</u>
Very Soft, Soft, Firm, Hard, Very Hard	Very Loose, Loose, Medium Dense, Dense, Very Dense	Dry, Slightly Moist, Moist Very Moist, Wet (Saturated)

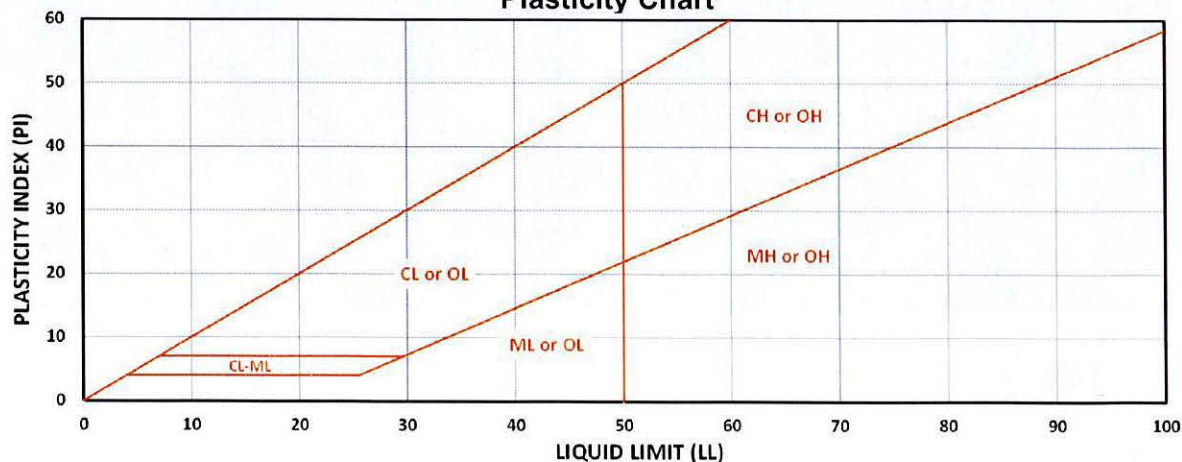
Sample Identification

<u>Sample Type</u>	<u>Sample Data</u>	<u>Laboratory Data</u>
U -- Undisturbed (Shelby Tube)	No. -- Number	MC -- Moisture content
S -- Split barrel (disturbed)	SPT -- Standard penetration test	γ_d -- Dry unit weight
C -- Continuous sample	bpf -- blows per foot	q_u -- Unconfined compression
A -- Auger cuttings (disturbed)	Rec -- Recovery	LL/PI -- Liquid limit & plasticity index

Unified Soil Classification System

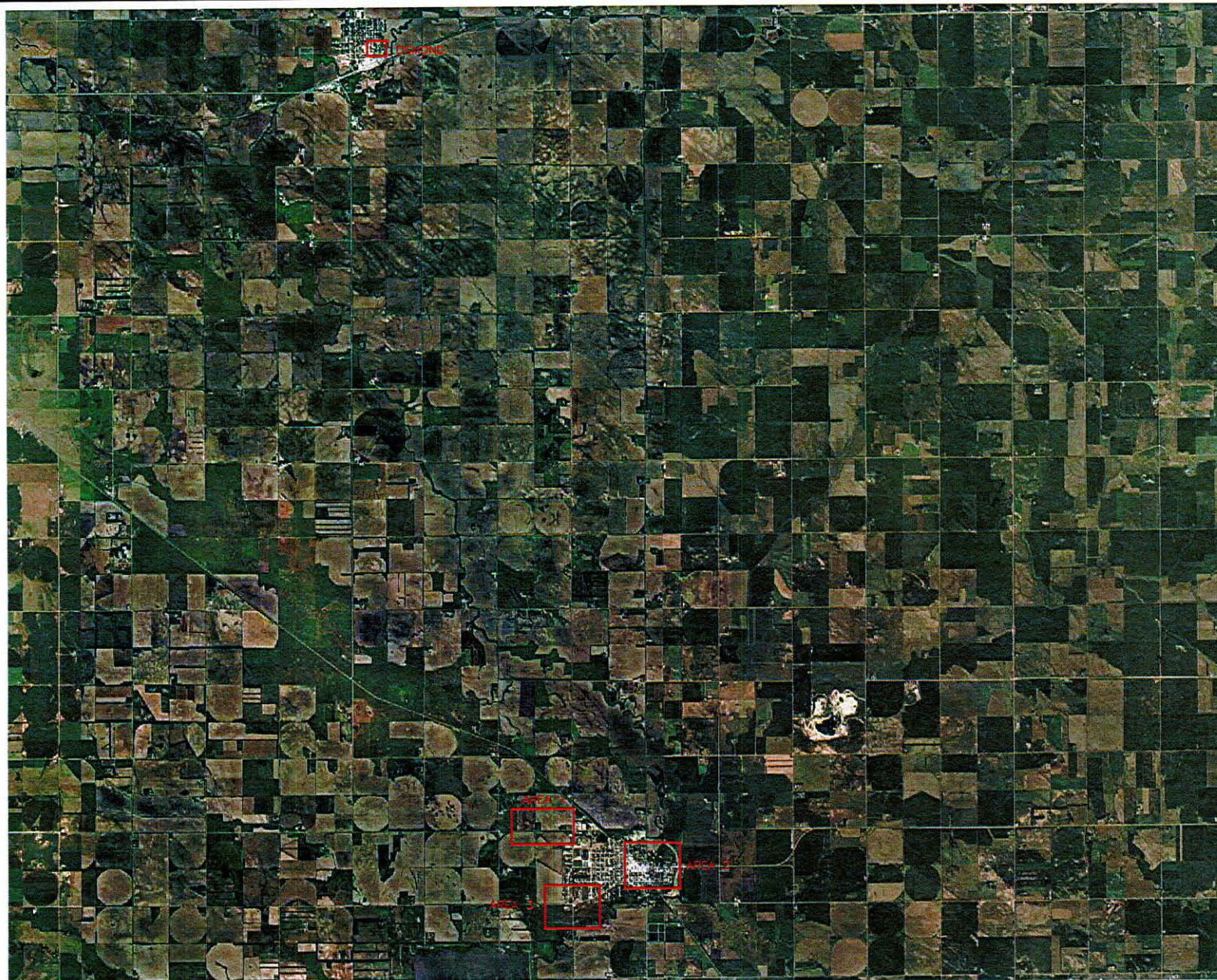
Peat	Pt	Highly organic soils Clay - Liquid Limit > 50 * Silt - Liquid Limit > 50 * Clay - Liquid Limit < 50 * Silt - Liquid Limit < 50 * Silty Clay *	50% or more smaller than No. 200 sieve	
Fat Clay	CH			
Elastic Silt	MH			
Lean Clay	CL			
Silt	ML			
Silty Clay	CL-ML			
Clayey Sand	SC	Sands with 12 to 50 percent smaller than No. 200 sieve *	More than 50% larger than No. 200 sieve and % sand > % Gravel	
Silty Sand	SM			
Poorly-Graded Sand with Clay	SP-SC	Sands with 5 to 12 percent smaller than No. 200 Sieve *		
Poorly-Graded Sand with Silt	SP-SM			
Well-Graded Sand with Clay **	SW-SC			
Well-Graded Sand with Silt **	SW-SM			
Poorly-Graded Sand	SP	Sands with less than 5 percent smaller than No. 200 sieve *		
Well-Graded Sand **	SW			
Clayey Gravel	GC	Gravels with 12 to 50 percent smaller than No. 200 Sieve *		More than 50% larger than No. 200 sieve and % gravel > % sand
Silty Gravel	GM			
Poorly-Graded Gravel with Clay	GP-GC	Gravels with 5 to 12 percent smaller than No. 200 sieve *		
Poorly-Graded Gravel with Silt	GP-GM			
Well-Graded Gravel with Clay **	GW-GC			
Well-Graded Gravel with Silt **	GW-GM			
Poorly-Graded Gravel	GP	Gravels with less than 5 percent smaller than No. 200 sieve *		
Well-Graded Gravel **	GW			
* See Plasticity Chart for definition of silts and clays				
** See Criteria for Sands and Gravels for definition of well-graded				

Plasticity Chart

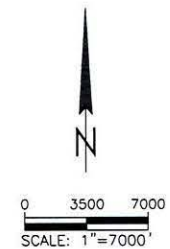


Criteria for Sands and Gravels

Boulders	Cobbles	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	FINES (silt or clay)
Sieve size	12"	3"	¾"	#4	#10	#40	#200
Well-graded sands (SW) $C_u = D_{60}/D_{10} \geq 6$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							
Well-graded gravels (GW) $C_u = D_{60}/D_{10} \geq 4$ and $C_c = (D_{30})^2 / (D_{10} \times D_{60}) \leq 3$ and ≥ 1							



SITE PLAN



LEGEND:

✚ BORING LOCATION

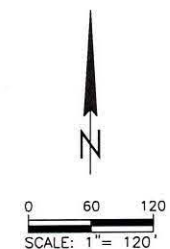


PROJECT

N. FORK ELKHORN RIVER
WATERSHED WFPO
PIERCE & OSMOND, NE

JOB # 24350.01

DATE: 9/5/2024

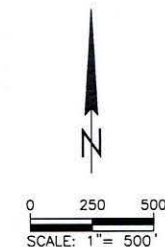


LEGEND:
 + BORING LOCATION



PROJECT
 N. FORK ELKHORN RIVER
 WATERSHED WFPO
 OSMOND, NE
 JOB # 24350.01 DATE: 9/5/2024

BORING LOCATION PLAN

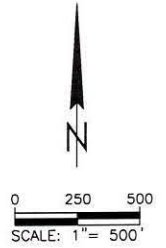


LEGEND:
 + BORING LOCATION



PROJECT
N. FORK ELKHORN RIVER WATERSHED WFPO PIERCE, NE
JOB # 24350.01 DATE: 9/5/2024

BORING LOCATION PLAN—AREA 1



LEGEND:
◆ BORING LOCATION



BORING LOCATION PLAN-AREA 2

PROJECT
N. FORK ELKHORN RIVER
WATERSHED WFPO
PIERCE, NE
JOB # 24350.01 DATE: 9/5/2024



LEGEND:
 ◆ BORING LOCATION



BORING LOCATION PLAN—AREA 3

PROJECT	
N. FORK ELKHORN RIVER WATERSHED WFPO PIERCE, NE	
JOB # 24350.01	DATE: 9/5/2024



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BORING NUMBER NF B-1

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE
DRILLING DATE	7/24/2024	SURFACE	Grass
DRILLING METHOD	Flight	HOLE SIZE	6 inches
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	1625 ft
		BORING DEPTH	20.0 feet
		GROUND WATER LEVELS:	
		▽ DURING DRILLING	9.0 ft / Elev 1616.0 ft
		▼ END OF DRILLING	9.4 ft / Elev 1615.6 ft
		AFTER DRILLING	Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		very moist	brown	loose	silty sand	alluvium	fine grained	X S-1		9		11.9						
5			reddish brown	hard	fat clay			X S-2		9		24.9			56	14	42	
10		wet	reddish gray	firm	lean clay		appreciable sand	X S-3		6		31.7						88.3
15			gray	very soft				X S-4		0		28.8						
20								X S-5		2		25.8						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-2

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/24/2024	SURFACE	Grass	GROUND ELEVATION	1619 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	DURING DRILLING 6.0 ft / Elev 1613.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	END OF DRILLING None encountered, cave at 11.7 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING Not measured			

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		moist	brown	loose	silty sand	alluvium	fine grained, lenses of silt	X S-1		6		8.9						
5		very moist	light brown		poorly graded sand w/ silt			X S-2		8		17.0						11.6
		wet																
10								X S-3		6		18.4						
15					silty sand			X S-4		9		19.3						
20			brown	firm	fat clay		minor sand	X S-5		8		22.6						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-3

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/24/2024	SURFACE	Grass	GROUND ELEVATION	1588 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	▽ DURING DRILLING 6.0 ft / Elev 1582.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	▼ END OF DRILLING 14.1 ft / Elev 1573.9 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING Not measured			

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		dry	dark brown	hard	clayey sand	fill	medium grained, trace gravel crumb test	U-1	11			4.8	118.5					
5		very moist	brown	loose	silty sand	alluvium	fine grained	S-2		7		12.8						
		wet		very loose														
10							lenses of silt	S-3		3		18.5						30.2
15			light brown	medium dense				S-4		16		20.7						
20								S-5		19		16.2						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-4

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CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/24/2024	SURFACE	Grass	GROUND ELEVATION	1586 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	DURING DRILLING 4.0 ft / Elev 1582.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	END OF DRILLING None encountered, cave at 8.4 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING Not measured			

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		very moist	dark gray	loose	silty sand	alluvium	fine grained, roots crumb test	U-1	11			42.3	81.2					
			gray	very loose				S-2		0		17.3						
5		wet						S-3		16		16.6						9.5
10			light gray	medium dense	poorly graded sand w/ silt			S-4		15		19.1						
15			brown		silty sand			S-5		17		17.0						
20																		

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-5

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE
DRILLING DATE	7/25/2024	SURFACE	Grass
DRILLING METHOD	HSA	HOLE SIZE	8 inches
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	1578 ft
		BORING DEPTH	20.0 feet
		GROUND WATER LEVELS:	
		DURING DRILLING	10.0 ft / Elev 1568.0 ft
		END OF DRILLING	None encountered, cave at 5.9 ft
		AFTER DRILLING	Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION					SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		slightly moist	gray	firm	lean clay	alluvium											
							U-1	12			12.6	112.4					
5		very moist	brown	loose	poorly graded sand w/ silt		S-2		7		13.1						6.6
			light brown	very loose	poorly graded sand		S-3		4		16.0						
10		wet															
			dark gray		silty sand		S-4		3		24.7						
15																	
							S-5		4		20.0						
20																	

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-6

PAGE 1 OF 1

CLIENT JEO - Wahoo

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT NUMBER 24350.01

PROJECT LOCATION Various, Pierce & Osmond, NE

DRILLING DATE 7/25/2024

SURFACE Grass

GROUND ELEVATION 1581 ft

BORING DEPTH 20.0 feet

DRILLING METHOD HSA

HOLE SIZE 8 inches

GROUND WATER LEVELS:

DRILLER Jon Livingston

DRILL RIG CME 45B #008

▽ DURING DRILLING 5.0 ft / Elev 1576.0 ft

LOGGED BY Nick Phillips

CHECKED BY Broc Burmeister

▽ END OF DRILLING 14.1 ft / Elev 1566.9 ft

NOTES Boring backfilled with cuttings

AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION					REMARKS	SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		moist	dark gray	firm	lean clay	alluvium	minor sand, roots	U-1	12			21.8	97.7	0.88				
5		very moist					minor wood, crumb test	U-2	12			25.3	96.1		35	16	19	
		wet																
			gray	medium dense	silty sand		fine grained	U-3	10									
			dark gray	loose	poorly graded sand w/ silt		lenses of silt	S-4		6		22.9						
			gray	medium dense				S-5		17		15.3						
20																		

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-7

PAGE 1 OF 1

CLIENT JEO - Wahoo

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT NUMBER 24350.01

PROJECT LOCATION Various, Pierce & Osmond, NE

DRILLING DATE 7/25/2024

SURFACE Grass

GROUND ELEVATION 1577 ft

BORING DEPTH 20.0 feet

DRILLING METHOD HSA

HOLE SIZE 8 inches

GROUND WATER LEVELS:

 DURING DRILLING 9.0 ft / Elev 1568.0 ft

DRILLER Jon Livingston

DRILL RIG CME 45B #008

END OF DRILLING None encountered, cave in at 7.6 ft

LOGGED BY Nick Phillips

CHECKED BY Broc Burmeister

AFTER DRILLING Not measured

NOTES Boring backfilled with cuttings

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0																		
		moist	dark gray	soft	lean clay	alluvium	trace sand, roots	 U-1	12			21.1	89.3	0.63	43	19	24	
5								 U-2	6			23.9	95.0					
		very moist	gray	loose	silty sand		fine grained											
10		wet					crumb test	 U-3	12			20.8	105.9					
15				very loose	poorly graded sand w/ silt			 S-4		0		17.6						
20			dark gray		silty sand			 S-5		3		18.8						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-8

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/25/2024	SURFACE	Grass	GROUND ELEVATION	1600 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	▽ DURING DRILLING 6.0 ft / Elev 1594.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	▼ END OF DRILLING 13.8 ft / Elev 1586.2 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING			Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		moist	brown	very loose	silty sand	alluvium	fine grained	X S-1		3		6.6						
		very moist						X S-2		4		18.2						
5																		
		wet	light brown	loose	poorly graded sand w/ silt			X S-3		8		18.6						
10																		
								X S-4		7		18.0						
15																		
								X S-5		6		17.2						
20																		

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-9

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE
DRILLING DATE	7/25/2024	SURFACE	Grass
DRILLING METHOD	HSA	HOLE SIZE	8 inches
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	1600 ft
		BORING DEPTH	20.0 feet
		GROUND WATER LEVELS:	
		▽ DURING DRILLING 6.0 ft / Elev 1594.0 ft	
		END OF DRILLING None encountered, cave at 4.8 ft	
		AFTER DRILLING Not measured	

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		very moist	brown	very loose	silty sand	alluvium	fine grained	X S-1		2		11.5						
5			light brown					X S-2		4		16.2						30.0
▽		wet		loose														
10								X S-3		6		16.8						
15			olive gray	medium dense			lenses of lean clay	X S-4		27		20.1						
20			light brown		poorly graded sand w/ silt			X S-5		13		16.8						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER NF B-10

PAGE 1 OF 1

CLIENT JEO - Wahoo

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT NUMBER 24350.01

PROJECT LOCATION Various, Pierce & Osmond, NE

DRILLING DATE 7/24/2024

SURFACE Grass

GROUND ELEVATION 1599 ft

BORING DEPTH 20.0 feet

DRILLING METHOD HSA

HOLE SIZE 8 inches

GROUND WATER LEVELS:

DRILLER Jon Livingston

DRILL RIG CME 45B #008

▽ DURING DRILLING 6.0 ft / Elev 1593.0 ft

LOGGED BY Nick Phillips

CHECKED BY Broc Burmeister

▽ END OF DRILLING 5.4 ft / Elev 1593.6 ft

NOTES Boring backfilled with cuttings

AFTER DRILLING Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		moist	brown	loose	silty sand	alluvium	fine grained crumb test	U-1	12			5.1	109.5					
5		very moist	light brown					S-2		7		19.2						
		wet			poorly graded sand w/ silt			S-3		6		16.2						9.4
10								S-4		6		17.8						
15																		
20			gray	firm	lean clay		minor sand	S-5		4		21.0						

Bottom of borehole
at 20.0 feet.



BORING NUMBER NF B-11

PAGE 1 OF 1

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT LOCATION Various, Pierce & Osmond, NE

GROUND ELEVATION 1594 ft

BORING DEPTH 20.0 feet

HOLE SIZE 8 inches

GROUND WATER LEVELS:

 DURING DRILLING 12.0 ft / Elev 1582.0 ft

DRILL RIG CME 45B #008

END OF DRILLING 10.0 ft / Elev 1584.0 ft

NOTES Boring backfilled with cuttings

AFTER DRILLING Not measured

Bottom of borehole
at 20.0 feet.

BTG COLUMNS - GINT STD US LAB.GDT - 9/5/24 13:20 - P:\24350.01\NORTH FORK ELKHORN RIVER WATERSHED.GPJ



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BORING NUMBER NF B-12

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/25/2024	SURFACE	Grass	GROUND ELEVATION	1598 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	DURING DRILLING 9.0 ft / Elev 1589.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	END OF DRILLING None encountered, cave at 9.9 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING Not measured			

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		dry	brown	hard	silt	fill	much sand, minor gravel crumb test	U-1	12			9.3	110.3	1.86	19	14	5	
5		moist	brown	loose	silty sand	alluvium	fine grained	S-2		9		7.4						
10		wet			poorly graded sand w/ silt			S-3		6		18.1						7.9
15			dark gray	firm	lean clay		appreciable sand	S-4		4		30.1						
20			light brown	very loose	silty sand		fine grained	S-5		4		17.2						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER OS B-1

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE
DRILLING DATE	7/26/2024	SURFACE	Grass
DRILLING METHOD	HSA	HOLE SIZE	8 inches
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister
NOTES	Boring backfilled with cuttings		
		GROUND ELEVATION	1658 ft
		BORING DEPTH	20.0 feet
		GROUND WATER LEVELS:	
		▽ DURING DRILLING	19.0 ft / Elev 1639.0 ft
		▽ END OF DRILLING	18.5 ft / Elev 1639.5 ft
		AFTER DRILLING	Not measured

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION					REMARKS	SAMPLE TYPE NUMBER	RECOVERY (in)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		moist	brown	hard	fat clay	alluvium	trace sand, roots	U-1	12			22.0	105.2	2.11				
5								U-2	10			16.6	107.1					
10				medium dense	silty sand		fine grained, lenses of silt crumb test	U-3	12			6.4	115.4					
15		very moist						S-4		11		14.0						
20		wet						S-5		13		19.9						

Bottom of borehole
at 20.0 feet.



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BORING NUMBER OS B-2

PAGE 1 OF 1

CLIENT	JEO - Wahoo	PROJECT NAME	North Fork Elkhorn River Watershed WFPO				
PROJECT NUMBER	24350.01	PROJECT LOCATION	Various, Pierce & Osmond, NE				
DRILLING DATE	7/26/2024	SURFACE	Grass	GROUND ELEVATION	1657 ft	BORING DEPTH	20.0 feet
DRILLING METHOD	HSA	HOLE SIZE	8 inches	GROUND WATER LEVELS:			
DRILLER	Jon Livingston	DRILL RIG	CME 45B #008	DURING DRILLING 5.0 ft / Elev 1652.0 ft			
LOGGED BY	Nick Phillips	CHECKED BY	Broc Burmeister	END OF DRILLING None encountered, cave at 7.3 ft			
NOTES	Boring backfilled with cuttings			AFTER DRILLING Not measured			

DEPTH (ft)	GRAPHIC LOG	VISUAL/MANUAL DESCRIPTION						SAMPLE TYPE NUMBER	RECOVERY (IN)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	q _u (tsf)	ATTERBERG LIMITS			FINES CONTENT (%)
		MOISTURE	COLOR	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		dry	dark brown	hard	lean clay	alluvium	much sand, trace gravel	U-1	12			6.0	106.2					
5		moist		firm			crumb test	U-2	12			19.0	91.3					
		wet																
10			dark gray	soft	fat clay		trace sand	U-3	12			36.5	81.6					
15							minor sand	U-4	12			33.8						
20			gray	firm	lean clay		much sand, trace gravel	U-5	12			23.5						

Bottom of borehole
at 20.0 feet.



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SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 2

CLIENT JEO - Wahoo

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT NUMBER 24350.01

PROJECT LOCATION Various, Pierce & Osmond, NE

Boring Number	Sample Number	Depth	Water Content (%)	Unit Weight		Void Ratio	Sat. (%)	Unconfined Compression		Atterberg Limits		% < #200 Sieve	Class.	Other Tests
				Wet Density (pcf)	Dry Density (pcf)			q _u (tsf)	Strain (%)	LL	PI			
NF B-1	S-1	0.5-2.0'	11.9											
	S-2	3.5-5.0'	24.9							56	42		CH	
	S-3	8.5-10.0'	31.7									88.3	CL	
	S-4	13.5-15.0'	28.8											
	S-5	18.5-20.0'	25.8											
NF B-2	S-1	0.5-2.0'	8.9											
	S-2	3.5-5.0'	17.0									11.6	SP-SM	
	S-3	8.5-10.0'	18.4										NP	
	S-4	13.5-15.0'	19.3											
	S-5	18.5-20.0'	22.6											
NF B-3	U-1	0.5-2.0'	4.8	124.2	118.5	0.421	31						NP	
	S-2	3.5-5.0'	12.8											
	S-3	8.5-10.0'	18.5									30.2	SM	
	S-4	13.5-15.0'	20.7											
	S-5	18.5-20.0'	16.2											
NF B-4	U-1	0.5-2.0'	42.3	115.5	81.2	1.076	100						NP	
	S-2	3.5-5.0'	17.3											
	S-3	8.5-10.0'	16.6									9.5	SP-SM	
	S-4	13.5-15.0'	19.1				345							
	S-5	18.5-20.0'	17.0											
NF B-5	U-1	0.5-2.0'	12.6	126.6	112.4	0.471	71							
	S-2	3.5-5.0'	13.1									6.6	SP-SM	
	S-3	8.5-10.0'	16.0											
	S-4	13.5-15.0'	24.7											
	S-5	18.5-20.0'	20.0											
NF B-6	U-1	0.5-2.0'	21.8	119.0	97.7	0.725	81	0.88	5.8					
	U-2	3.5-5.0'	25.3	120.5	96.1	0.752	91			35	19		CL	
	U-3	8.5-10.0'												
	S-4	13.5-15.0'	22.9											
	S-5	18.5-20.0'	15.3											
NF B-7	U-1	0.5-2.0'	21.1	108.1	89.3	0.887	64	0.63	2.1	43	24		CL	
	U-2	3.5-5.0'	23.9	117.7	95.0	0.741	86							
	U-3	8.5-10.0'	20.8	127.9	105.9	0.591	95						NP	
	S-4	13.5-15.0'	17.6											
	S-5	18.5-20.0'	18.8											
NF B-8	S-1	0.5-2.0'	6.6											
	S-2	3.5-5.0'	18.2										NP	
	S-3	8.5-10.0'	18.6									10.0	SP-SM	
	S-4	13.5-15.0'	18.0											
	S-5	18.5-20.0'	17.2											
NF B-9	S-1	0.5-2.0'	11.5											
	S-2	3.5-5.0'	16.2									30.0	SM	
	S-3	8.5-10.0'	16.8										NP	

TG SOIL TEST SUMMARY - GINT STD US LAB GDT - 8/29/24 07:46 - P:\24350.01\NORTH FORK ELKHORN RIVER WATERSHED.GPJ



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SUMMARY OF LABORATORY RESULTS

PAGE 2 OF 2

CLIENT JEO - Wahoo

PROJECT NAME North Fork Elkhorn River Watershed WFPO

PROJECT NUMBER 24350.01

PROJECT LOCATION Various, Pierce & Osmond, NE

Boring Number	Sample Number	Depth	Water Content (%)	Unit Weight		Void Ratio	Sat. (%)	Unconfined Compression		Atterberg Limits		%<#200 Sieve	Class.	Other Tests
				Wet Density (pcf)	Dry Density (pcf)			q _u (tsf)	Strain (%)	LL	PI			
NF B-9	S-4	13.5-15.0'	20.1											
	S-5	18.5-20.0'	16.8											
NF B-10	U-1	0.5-2.0'	5.1	115.1	109.5	0.539	26						NP	
	S-2	3.5-5.0'	19.2											
	S-3	8.5-10.0'	16.2									9.4	SP-SM	
	S-4	13.5-15.0'	17.8											
	S-5	18.5-20.0'	21.0											
NF B-11	U-1	0.5-2.0'	6.3	122.8	115.5	0.459	37						NP	
	S-2	3.5-5.0'	10.9											
	S-3	8.5-10.0'	15.6									6.9	SP-SM	
	S-4	13.5-15.0'	16.4											
	S-5	18.5-20.0'	24.6											
NF B-12	U-1	0.5-2.0'	9.3	120.6	110.3	0.527	47	1.86	3.4	19	5		ML	
	S-2	3.5-5.0'	7.4											
	S-3	8.5-10.0'	18.1									7.9	SP-SM	
	S-4	13.5-15.0'	30.1											
	S-5	18.5-20.0'	17.2											
OS B-1	U-1	0.5-2.0'	22.0	128.4	105.2	0.601	99	2.11	5.8					
	U-2	3.5-5.0'	16.6	124.8	107.1	0.544	81							
	U-3	8.5-10.0'	6.4	122.8	115.4	0.460	38							
	S-4	13.5-15.0'	14.0											
	S-5	18.5-20.0'	19.9											
OS B-2	U-1	0.5-2.0'	6.0	112.6	106.2	0.586	28							
	U-2	3.5-5.0'	19.0	108.6	91.3	0.845	61							
	U-3	8.5-10.0'	36.5	111.3	81.6	1.028	94							
	U-4	13.5-15.0'	33.8											
	U-5	18.5-20.0'	23.5											

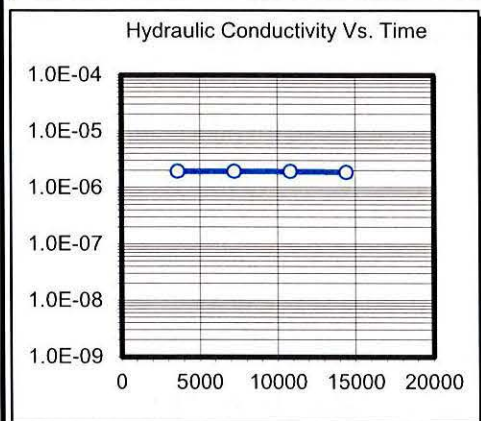


Thiele Geotech Inc

ASTM D 5084-90

HYDRAULIC CONDUCTIVITY (PERMEABILITY)

PROJECT IDENTIFICATION		SAMPLE IDENTIFICATION	
Client	JEO - Wahoo	Sample Descrip	brown, lean clay w/ fine sands
Project:	North Fork Elkhorn River Watershed WFPO	Sample ID	NF B-5, U-1
Phase:	Geotechnical	Depth	0.5-2.0'
Location:	Various	Lab #	
City, State	Pierce & Osmond, NE	Remarks	
Job.:	24350.01	Sample Type	Undisturbed (Shelby)
Report Date: September 9, 2024		Compaction	Not Applicable



SPECIMEN PARAMETERS			
INITIAL	FINAL		
12.29	12.29	Height (cm)	(Min. 2.54 cm)
7.32	7.34	Diameter (cm)	(Min 2.54 cm)
126.6	128.1	Wet Density (pcf)	
12.6	17.7	Moisture Content, %	
112.4	108.9	Dry Density (pcf)	
2.65	2.65	Assumed Specific Gravity	
71.0	90.2	Degree of Saturation, %	

TEST PARAMETERS				
	Interval 1	Interval 2	Interval 3	Interval 4
Lateral (Chamber) Pressure (psi)	20.5	20.5	20.5	20.5
Upper Channel Pressure (psi)	16.0	16.0	16.0	16.0
Lower Channel Pressure (psi)	18.0	18.0	18.0	18.0
Differential Pressure (psi)	2.0	2.0	2.0	2.0
Hydraulic Gradient	11.4	11.4	11.4	11.4
Test Time (sec)	3600	3600	3600	3600
Elapsed Time (sec)	3600	7200	10800	14400
Upper Burette - Inflow - initial	0.00	0.00	0.00	0.00
Upper Burette - Inflow - final	7.40	7.60	7.60	7.50
Lower Burette - Outflow - initial	10.00	10.00	10.00	10.00
Lower Burette - Outflow - final	2.50	2.40	2.40	2.50
Inflow/Outflow Ratio (0.75-1.25)	1.01	1.00	1.00	1.00
Permeability (cm/sec)	2.09E-06	2.12E-06	2.12E-06	2.09E-06
Temperature (C)	23.3	23.7	23.9	24.6
Temperature Correction	0.924	0.914	0.909	0.892
Permeability, K @ 20 C (cm/sec)	1.9E-06	1.9E-06	1.9E-06	1.9E-06
Acceptable Test Limits	PASS LIMITS	PASS LIMITS	PASS LIMITS	PASS LIMITS

Permeability Four Interval Average 1.9E-06 cm/sec
Permeability Requirement < 1.0E-07 cm/sec



PROJECT IDENTIFICATION		SAMPLE IDENTIFICATION	
Client	JEO - Wahoo	Sample Descrip	brown, lean clay
Project:	North Fork Elkhorn River Watershed WFPO	Sample ID	NF B-7 U-2
Phase:	Geotechnical	Depth	3.5-5.0'
Location:	Various	Lab #	
City, State	Pierce & Osmond, NE	Remarks	
Job.:	24350.01	Sample Type	Undisturbed (Shelby)
Report Date: September 9, 2024		Compaction	Not Applicable

Hydraulic Conductivity Vs. Time

The graph shows a horizontal line at 1.0E-07 cm/sec on a logarithmic y-axis (ranging from 1.0E-09 to 1.0E-06) against time on the x-axis (ranging from 0 to 50,000 seconds). The data points are plotted at approximately 10,000, 20,000, 30,000, and 40,000 seconds, all showing a constant value of 1.0E-07 cm/sec.

SPECIMEN PARAMETERS		
INITIAL	FINAL	
12.34	12.37	Height (cm) (Min. 2.54 cm)
7.29	7.32	Diameter (cm) (Min 2.54 cm)
117.7	119.3	Wet Density (pcf)
23.9	27.2	Moisture Content, %
95.0	93.7	Dry Density (pcf)
2.65	2.65	Assumed Specific Gravity
85.6	94.5	Degree of Saturation, %

TEST PARAMETERS				
	Interval 1	Interval 2	Interval 3	Interval 4
Lateral (Chamber) Pressure (psi)	20.3	20.3	20.3	20.3
Upper Channel Pressure (psi)	16.0	16.0	16.0	16.0
Lower Channel Pressure (psi)	18.0	18.0	18.0	18.0
Differential Pressure (psi)	2.0	2.0	2.0	2.0
Hydraulic Gradient	11.4	11.4	11.4	11.4
Test Time (sec)	10800	10800	10800	10800
Elapsed Time (sec)	10800	21600	32400	43200
Upper Burette - Inflow - initial	0.00	0.00	0.00	0.00
Upper Burette - Inflow - final	1.30	1.30	1.30	1.30
Lower Burette - Outflow - initial	10.00	10.00	10.00	10.00
Lower Burette - Outflow - final	8.60	8.60	8.60	8.60
Inflow/Outflow Ratio (0.75-1.25)	1.08	1.08	1.08	1.08
Permeability (cm/sec)	1.29E-07	1.29E-07	1.29E-07	1.29E-07
Temperature (C)	24.6	25	23.6	23.9
Temperature Correction	0.892	0.882	0.916	0.909
Permeability, K @ 20 C (cm/sec)	1.2E-07	1.1E-07	1.2E-07	1.2E-07
Acceptable Test Limits	PASS LIMITS	PASS LIMITS	PASS LIMITS	PASS LIMITS

Permeability Four Interval Average	1.2E-07	cm/sec
Permeability Requirement <	1.0E-07	cm/sec

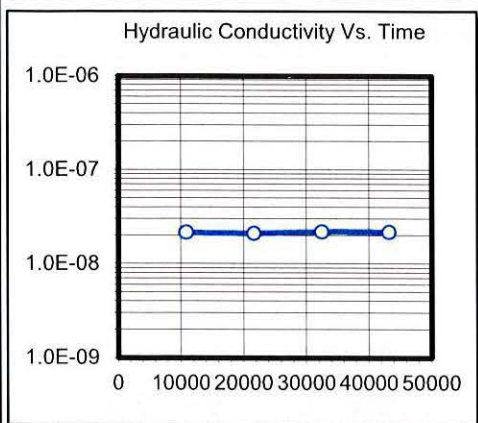


Thiele Geotech Inc

ASTM D 5084-90

HYDRAULIC CONDUCTIVITY (PERMEABILITY)

PROJECT IDENTIFICATION		SAMPLE IDENTIFICATION	
Client	JEO - Wahoo	Sample Descrip	brown, lean clay
Project:	North Fork Elkhorn River Watershed WFPO	Sample ID	OS B-1, U-2
Phase:	Geotechnical	Depth	3.5-5.0'
Location:	Various	Lab #	
City, State	Pierce & Osmond, NE	Remarks	
Job.:	24350.01	Sample Type	Undisturbed (Shelby)
Report Date: September 9, 2024		Compaction	Not Applicable



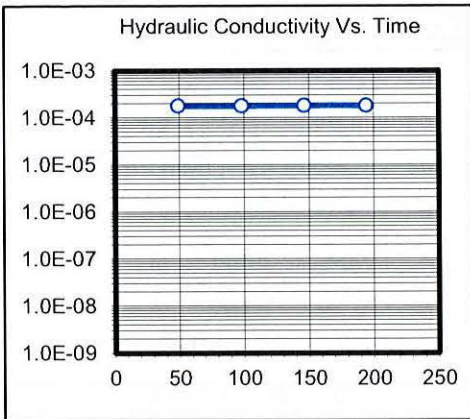
SPECIMEN PARAMETERS		
INITIAL	FINAL	
8.13	8.18	Height (cm) (Min. 2.54 cm)
7.34	7.34	Diameter (cm) (Min 2.54 cm)
124.8	126.6	Wet Density (pcf)
16.6	83.8	Moisture Content, %
107.1	68.9	Dry Density (pcf)
2.65	2.65	Assumed Specific Gravity
80.7	100.0	Degree of Saturation, %

TEST PARAMETERS				
	Interval 1	Interval 2	Interval 3	Interval 4
Lateral (Chamber) Pressure (psi)	30.0	30.0	30.0	30.0
Upper Channel Pressure (psi)	26.0	26.0	26.0	26.0
Lower Channel Pressure (psi)	28.0	28.0	28.0	28.0
Differential Pressure (psi)	2.0	2.0	2.0	2.0
Hydraulic Gradient	17.3	17.3	17.3	17.3
Test Time (sec)	10800	10800	10800	10800
Elapsed Time (sec)	10800	21600	32400	43200
Upper Burette - Inflow - initial	0.00	0.00	0.00	0.00
Upper Burette - Inflow - final	0.40	0.40	0.40	0.40
Lower Burette - Outflow - initial	10.00	10.00	10.00	10.00
Lower Burette - Outflow - final	9.60	9.60	9.60	9.60
Inflow/Outflow Ratio (0.75-1.25)	1.00	1.00	1.00	1.00
Permeability (cm/sec)	2.39E-08	2.39E-08	2.39E-08	2.39E-08
Temperature (C)	24.3	25	23.6	23.9
Temperature Correction	0.899	0.882	0.916	0.909
Permeability, K @ 20 C (cm/sec)	2.1E-08	2.1E-08	2.2E-08	2.2E-08
Acceptable Test Limits	PASS LIMITS	PASS LIMITS	PASS LIMITS	PASS LIMITS

Permeability Four Interval Average 2.2E-08 cm/sec
Permeability Requirement < 1.0E-07 cm/sec



PROJECT IDENTIFICATION		SAMPLE IDENTIFICATION	
Client	JEO - Wahoo	Sample Descrip	dark brown, lean clay
Project:	North Fork Elkhorn River Watershed WFPO	Sample ID	OS B-2, U-3
Phase:	Geotechnical	Depth	8.5-10.0'
Location:	Various	Lab #	
City, State	Pierce & Osmond, NE	Remarks	0
Job.:	24350.01	Sample Type	Undisturbed (Shelby)
Report Date: September 9, 2024		Compaction	Not Applicable



SPECIMEN PARAMETERS		
INITIAL	FINAL	
11.23	11.23	Height (cm) (Min. 2.54 cm)
7.29	7.29	Diameter (cm) (Min 2.54 cm)
111.3	111.8	Wet Density (pcf)
36.5	36.2	Moisture Content, %
81.6	82.1	Dry Density (pcf)
2.65	2.65	Assumed Specific Gravity
94.1	94.5	Degree of Saturation, %

TEST PARAMETERS				
	Interval 1	Interval 2	Interval 3	Interval 4
Lateral (Chamber) Pressure (psi)	20.0	20.0	20.0	20.0
Upper Channel Pressure (psi)	16.0	16.0	16.0	16.0
Lower Channel Pressure (psi)	18.0	18.0	18.0	18.0
Differential Pressure (psi)	2.0	2.0	2.0	2.0
Hydraulic Gradient	12.5	12.5	12.5	12.5
Test Time (sec)	49	49	48	48
Elapsed Time (sec)	49	98	146	194
Upper Burette - Inflow - initial	0.00	0.00	0.00	0.00
Upper Burette - Inflow - final	10.00	10.00	10.00	10.00
Lower Burette - Outflow - initial	10.00	10.00	10.00	10.00
Lower Burette - Outflow - final	0.00	0.00	0.00	0.00
Inflow/Outflow Ratio (0.75-1.25)	1.00	1.00	1.00	1.00
Permeability (cm/sec)	1.90E-04	1.90E-04	1.94E-04	1.94E-04
Temperature (C)	23.6	23.6	23.6	23.6
Temperature Correction	0.916	0.916	0.916	0.916
Permeability, K @ 20 C (cm/sec)	1.7E-04	1.7E-04	1.8E-04	1.8E-04
Acceptable Test Limits	PASS LIMITS	PASS LIMITS	PASS LIMITS	PASS LIMITS

Permeability Four Interval Average 1.8E-04 cm/sec

Permeability Requirement < 1.0E-07 cm/sec



Project North Fork Elkhorn River Watershed WFPO				Location Pierce & Osmond, NE					
Job # 24350.01				Tested by BB/BG			Date 8/15/24		
Boring #	NF B-3			NF B-3			NF B-3		
Sample #	U-1			U-1			U-1		
Depth	0.5 - 2			0.5 - 2			0.5 - 2		
Sample Description	Top half brown CL much sand, bottom half brown ML			Top half brown CL much sand, bottom half brown ML			Top half brown CL much sand, bottom half brown ML		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	8			7			10		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:45	23.2	-	8:45	23.2	-	8:45	23.2	-
2 min ± 15 s	8:47	23.2	2	8:47	23.2	2	8:47	23.2	2
1 hour ± 8 min	9:44	23.4	2	9:44	23.4	2	9:44	23.4	2
6 hours ± 45 min	14:32	23.6	2	14:32	23.6	2	14:32	23.6	2
Dispersive Classification*:	2			2			2		
*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive									
Boring #	NF B-4			NF B-4			NF B-4		
Sample #	U-1			U-1			U-1		
Depth	0.5 - 2			0.5 - 2			0.5 - 2		
Sample Description	Dk gray CL			Dk gray CL			Dk gray CL		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	9			3			6		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:45	23.2	-	8:45	23.2	-	8:45	23.2	-
2 min ± 15 s	8:47	23.2	1	8:47	23.2	1	8:47	23.2	1
1 hour ± 8 min	9:44	23.4	1	9:44	23.4	1	9:44	23.4	1
6 hours ± 45 min	14:32	23.6	1	14:32	23.6	1	14:32	23.6	1
Dispersive Classification*:	1			1			1		
*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive									



Project North Fork Elkhorn River Watershed WFPO				Location Pierce & Osmond, NE					
Job # 24350.01				Tested by BB/BG			Date 8/16/24		

Boring #	NF B-6			NF B-6			NF B-6		
Sample #	U-2			U-2			U-2		
Depth	3.5 - 5			3.5 - 5			3.5 - 5		
Sample Description	Dk gray CL (wood)			Dk gray CL (wood)			Dk gray CL (wood)		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	7			8			9		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	7:45	26.2	-	7:45	26.2	-	7:45	26.2	-
2 min ± 15 s	7:47	26.2	1	7:47	26.2	1	7:47	26.2	1
1 hour ± 8 min	8:46	25.2	1	8:46	25.2	1	8:46	25.2	1
6 hours ± 45 min	13:20	24.8	2	13:20	24.8	1	13:20	24.8	1
Dispersive Classification*:	2			1			1		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive

Boring #	NF B-7			NF B-7			NF B-7		
Sample #	U-3			U-3			U-3		
Depth	8.5 – 10			8.5 – 10			8.5 – 10		
Sample Description	Gray SM			Gray SM			Gray SM		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	10			6			3		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	7:45	26.2	-	7:45	26.2	-	7:45	26.2	-
2 min ± 15 s	7:47	26.2	3	7:47	26.2	2	7:47	26.2	2
1 hour ± 8 min	8:46	25.2	3	8:46	25.2	2	8:46	25.2	2
6 hours ± 45 min	13:20	24.8	3	13:20	24.8	2	13:20	24.8	2
Dispersive Classification*:	3			2			2		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive



Project North Fork Elkhorn River Watershed WFPO				Location Pierce & Osmond, NE					
Job # 24350.01				Tested by BB/BG			Date 8/19/24		

Boring #	NF B-10			NF B-10			NF B-10		
Sample #	U-1			U-1			U-1		
Depth	0.5 - 2			0.5 - 2			0.5 - 2		
Sample Description	Br SM			Br SM			Br SM		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	9			6			7		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:09	23.9	-	8:09	23.9	-	8:09	23.9	-
2 min ± 15 s	8:11	23.9	1	8:11	23.9	1	8:11	23.9	1
1 hour ± 8 min	9:15	24.1	1	9:15	24.1	1	9:15	24.1	1
6 hours ± 45 min	14:15	24.7	1	14:15	24.7	1	14:15	24.7	1
Dispersive Classification*:	1			1			1		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive

Boring #	NF B-11			NF B-11			NF B-11		
Sample #	U-1			U-1			U-1		
Depth	0.5 – 2			0.5 – 2			0.5 – 2		
Sample Description	Br SM			Br SM			Br SM		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	3			8			10		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:09	23.9	-	8:09	23.9	-	8:09	23.9	-
2 min ± 15 s	8:11	23.9	4	8:11	23.9	4	8:11	23.9	3
1 hour ± 8 min	9:15	24.1	4	9:15	24.1	4	9:15	24.1	3
6 hours ± 45 min	14:15	24.7	4	14:15	24.7	4	14:15	24.7	3
Dispersive Classification*:	4			4			3		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive



Project North Fork Elkhorn River Watershed WFPO				Location Pierce & Osmond, NE					
Job # 24350.01				Tested by BB/BG			Date 8/20/24		

Boring #	NF B-12			NF B-12			NF B-12		
Sample #	U-1			U-1			U-1		
Depth	0.5 – 2			0.5 – 2			0.5 – 2		
Sample Description	Fill, Br ML, much sand, minor gravel			Fill, Br ML, much sand, minor gravel			Fill, Br ML, much sand, minor gravel		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	8			3			7		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:09	24.0	-	8:09	24.0	-	8:09	24.0	-
2 min ± 15 s	8:11	24.0	1	8:11	24.0	1	8:11	24.0	1
1 hour ± 8 min	9:08	23.9	1	9:08	23.9	1	9:08	23.9	1
6 hours ± 45 min	14:11	23.7	1	14:11	23.7	1	14:11	23.7	1
Dispersive Classification*:	1			1			1		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive

Boring #	OS B-1			OS B-1			OS B-1		
Sample #	U-3			U-3			U-3		
Depth	8.5 – 10			8.5 – 10			8.5 – 10		
Sample Description	Lt Br SM, layers ML & SP-SM			Lt Br SM, layers ML & SP-SM			Lt Br SM, layers ML & SP-SM		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	10			6			9		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	8:09	24.0	-	8:09	24.0	-	8:09	24.0	-
2 min ± 15 s	8:11	24.0	2	8:11	24.0	2	8:11	24.0	3
1 hour ± 8 min	9:08	23.9	2	9:08	23.9	2	9:08	23.9	3
6 hours ± 45 min	14:11	23.7	2	14:11	23.7	2	14:11	23.7	3
Dispersive Classification*:	2			2			3		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive


Thiele Geotech Inc

CRUMB DISPERSION ASTM D6572

Project North Fork Elkhorn River Watershed WFPO				Location Pierce & Osmond, NE					
Job # 24350.01				Tested by BB/BG			Date 8/21/24		

Boring #	OS B-2			OS B-2			OS B-2		
Sample #	U-2			U-2			U-2		
Depth	3.5 – 5			3.5 – 5			3.5 – 5		
Sample Description	Fill, Dk gray CL, minor sand			Fill, Dk gray CL, minor sand			Fill, Dk gray CL, minor sand		
Method	x	A (Natural)		x	A (Natural)		x	A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type	x	Distilled		x	Distilled		x	Distilled	
		Type IV			Type IV			Type IV	
Container #	6			9			10		
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start	7:57	23.6	-	7:57	23.6	-	7:57	23.6	-
2 min ± 15 s	7:59	23.6	1	7:59	23.6	1	7:59	23.6	1
1 hour ± 8 min	8:57	23.8	1	8:57	23.8	1	8:57	23.8	1
6 hours ± 45 min	14:02	23.6	1	14:02	23.6	1	14:02	23.6	1
Dispersive Classification*:	1			1			1		

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive

Boring #									
Sample #									
Depth									
Sample Description									
Method		A (Natural)			A (Natural)			A (Natural)	
		B (Remolded)			B (Remolded)			B (Remolded)	
Water Type		Distilled			Distilled			Distilled	
		Type IV			Type IV			Type IV	
Container #									
	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)	Time (hh:mm:ss)	Temp. (C)	Grade (1-4)
Start									
2 min ± 15 s									
1 hour ± 8 min									
6 hours ± 45 min									
Dispersive Classification*:									

*Grade 1 – Nondispersive Grade 2 – Intermediate Grade 3 – Dispersive Grade 4 – Highly Dispersive



NE Firm# CA-0080E

WETLAND DELINEATION REPORT



LENRD North Fork Elkhorn River WFPO - Pierce

JEO PROJECT NUMBER: 201302.00

AUGUST 2024



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INTRODUCTION

Location

The study area is split into three locations surrounding Pierce, Pierce County, Nebraska (see Appendix A, Figure 1).

Location 1:

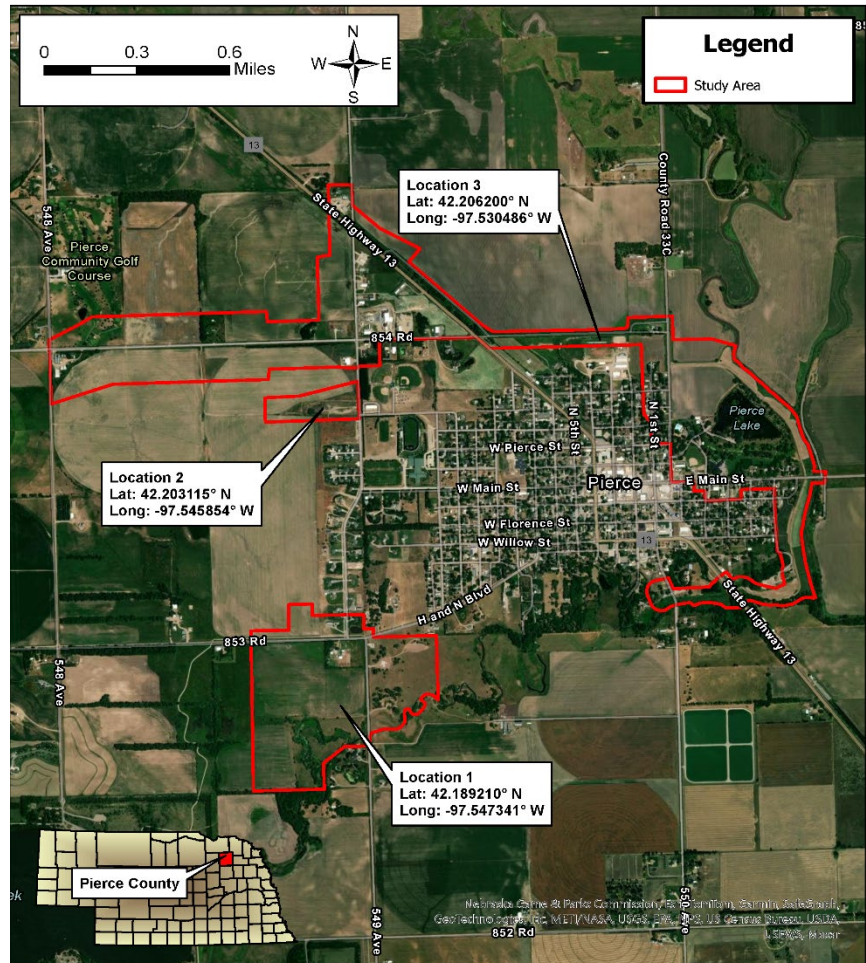
Located in Sections 27, 28, 33, and 34, Township 26 North, Range 2 West and the approximate coordinates are 42.189210° N latitude and -97.547341° W longitude.

Location 2:

Located in Section 28, Township 26 North, Range 2 West and the approximate coordinates are 42.203115° N latitude and -97.545854° W longitude.

Location 3:

Located in Sections 21, 22, 23, 26, 27, and 28, Township 26 North, Range 2 West and the approximate coordinates are 42.206200° N latitude and -97.530486° W longitude.



Background

JEO Consulting Group, Inc. (JEO) was retained by the Lower Elkhorn Natural Resource District (LENRD) to conduct a wetland delineation and prepare a wetland report for North Fork Elkhorn River WFPO in Pierce County, Nebraska (study area). This document summarizes the findings of the wetland delineation completed on July 9, July 10, and July 11, 2024, in accordance with the 1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987 Manual) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0) (Midwest Regional Supplement).

WETLAND DELINEATION

Desktop Review

Prior to the field delineation, a desktop review was conducted using U.S. Geological Survey (USGS) topographic maps, U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), Natural Resources Conservation Service (NRCS) Web Soil Survey, Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (DFIRM), USGS National Hydrography Dataset (NHD), as well as current and historic aerial imagery provided through Google Earth to identify potential Waters of the U.S. (WOTUS), including wetlands, and areas historically prone to wetland development. The following is a summary of the desktop review.

USGS 7.5-MINUTE SERIES TOPOGRAPHIC MAP

Topographic maps obtained from the USGS depict an unnamed pond, Willow Creek, an unnamed intermittent stream, Pierce Lake, and the North Fork Elkhorn River. The general topographic gradient through the study areas is southeast (*see Appendix A, Figure 2*). Elevations in the study area are approximately 1,570 feet to 1,630 feet above mean sea level.

USFWS NWI

The NWI map depictions are as follows (*see Appendix A, Figure 3*).

The study area exhibited:

- 12 – Palustrine, emergent, persistent, temporarily flooded wetland (PEM1A)
- 2 – Palustrine, emergent, persistent, temporarily flooded, excavated wetland (PEM1Ax)
- 7 – Palustrine, emergent, persistent, seasonally flooded wetland (PEM1C)
- 5 – Palustrine, emergent, persistent, seasonally flooded, excavated wetland (PEM1Cx)
- 2 – Palustrine, forested, temporarily flooded wetland (PFOA)
- 1 – Palustrine, unconsolidated bottom, semipermanently flooded wetland (PUBF)
- 2 – Palustrine, unconsolidated bottom, semipermanently flooded, excavated wetland (PUBFx)
- 1 – Riverine, lower perennial, unconsolidated bottom, intermittently exposed, excavated stream (R2UBGx)
- 1 – Riverine, lower perennial, unconsolidated bottom, permanently flooded stream (R2UBH)
- 2 – Riverine, intermittent, streambed, seasonally flooded stream (R4SBC)
- 1 – Riverine, intermittent, streambed, seasonally flooded, excavated stream (R4SBCx)

- 1 – Riverine, unknown perennial, unconsolidated bottom, permanently flooded stream (R5UBH)

No other aquatic resources are mapped within the study area.

NRCS WEB SOIL SURVEY

The Web Soil Survey maps 17 soil units within the study area which include:

- 2354 – Inavale loamy fine sand, 0 to 3 percent slopes, frequently flooded
- 3553 – Hobbs silt loam, 0 to 2 percent slopes, frequently flooded, cool
- 3556 – Muir silt loam, calcareous, rarely flooded
- 4241 – Ord fine sandy loam, occasionally flooded
- 4244 – Ord loam, occasionally flooded
- 4553 – Elsmere loamy fine sand, 0 to 2 percent slopes, rarely flooded
- 4686 – Marlake loam, frequently ponded
- 4796 – Valentine fine sand, rolling, moist
- 6352 – Leshara silt loam, occasionally flooded
- 6369 – Orwet loam, rarely flooded
- 6570 – Thurman loamy fine sand, terrace, 0 to 2 percent slopes
- 6584 – Ortello fine sandy loam, terrace, 0 to 2 percent slopes
- 6646 – Boelus-Loretto complex, 0 to 2 percent slopes
- 6700 – Thurman loamy fine sand, 0 to 2 percent slopes
- 6703 – Thurman loamy fine sand, 2 to 6 percent slopes
- 6715 – Thurman-Valentine complex, undulating
- 8540 – Ovina fine sandy loam, rarely flooded

All mapped soil units are included in the Nebraska Hydric Soils list and are therefore considered to be hydric (*see Appendix A, Figure 4a-4d*).

Additional Mapped Units:

- 9967 – Sanitary landfill
- 9999 - Water

FEMA DFIRM

The FEMA DFIRM shows the study area on Panel 3104660150B, effective date 6/4/1987, Panel 3104660100B, effective date 6/4/1987, and Panel 310174B, effective date 9/4/1985. The areas surrounding the North Fork Elkhorn River and Willow creek are depicted as Zone A (shaded), which are areas within the 100-year floodplain. All other areas are depicted as Zone C (unshaded), which are areas of minimal flooding.

USGS NHD

The online NHD mapping tool shows the study area within hydrologic unit code (HUC) 102200020305, within the Lower Willow Creek watershed; HUC 102200020504, within the City of Pierce-North Fork Elkhorn River watershed; and HUC 102200020604, within the Pleasant View School-North Fork Elkhorn River watershed. The NHD map depicts an unnamed pond, Willow Creek, an unnamed intermittent stream, Pierce Lake, and the North Fork Elkhorn River. No other aquatic resources are within the study area (see Appendix A, Figure 5).

AERIAL IMAGERY

A review of both recent and historic aerial imagery (1993 – 2020) in Google Earth depicts the study areas surrounding Pierce, NE with a mix of residential housing, commercial properties, pastures, and row-crop fields. Continuous development was observed at each of the three locations during the years reviewed.

Farmed Wetland Analysis

In accordance with guidance contained in the Midwest Regional Supplement and NRCS National Engineering Handbook, Part 650, Chapter 19, available data from the NRCS Geospatial Data Gateway for Pierce County, Nebraska were utilized to complete a farmed wetland analysis.

A desktop review of five years of color aerial imagery taken during the growing season obtained from the National Agricultural Imagery Program (NAIP), was completed to determine whether wetland hydrology is present within the agricultural fields in the study area. The selected years of imagery reviewed and analyzed for potential wetlands based on hydrologic indicators includes 2010, 2014, 2016, 2018, and 2022 (see Appendix D, Figures 1-5). Precipitation data from the nearest NRCS WETS stations to the study area were analyzed for the three months prior to the date each aerial image was taken. The precipitation data was then given a weighted value to determine wet, dry, or normal conditions (see Appendix D, Antecedent Precipitation Worksheets).

The hydrology analysis process then requires using at least five years of aerial imagery from normal precipitation years to estimate the boundaries of potential wetlands. In accordance with NRCS National Engineering Handbook, Part 650, Chapter 19, one wet year (2010), one dry year (2022), and three normal years (2014, 2016, 2018) were available to be reviewed and analyzed. The specific wetland signatures analyzed during the farmed wetland analysis included:

- Standing water
- Flooded or drowned-out crops
- Crop stress
- Dry areas
- Inclusions of wet areas as “set-aside”

Areas displaying saturated soil signatures that overlapped in at least three years (>50%) of the selected five years of NAIP imagery were identified as potential wetlands and geospatially referenced using GIS (see Appendix D, Figure 6). A site visit was conducted on July 9, July 10, and July 11, 2024, to determine the presence or absence of hydric soils within the identified potential wetlands. Wetland boundaries were updated based on hydric soils and topography. Final wetland boundaries are available in Appendix A, Figure 6a-6r.

Several areas identified in the farmed wetland analysis had hydric soils and were determined to be a wetland. No other potential wetland areas were identified during the farmed wetland analysis.

Delineation Methods

JEO conducted a wetland delineation on July 9, July 10, and July 11, 2024, in accordance with the methods described in the 1987 Manual and the Midwest Regional Supplement using a routine wetland determination method, including the standard multi-parameter approach (vegetation, soils, and hydrology) for wetland identification. An area is considered to be a wetland if hydrophytic vegetation, hydric soils, and wetland hydrology are all present. Sample locations were determined using NWI maps and visual observations that supported a hydrophytic plant community, where applicable, as well as characteristics of hydric soils and wetland hydrology. Definitions and methods for determining each of these three parameters are summarized below:

HYDROPHYTIC VEGETATION

Definition	The prevalence (>50%) of dominant plant species that are adapted to life in saturated soil conditions.
Method	To determine if vegetation was hydrophytic, the scientific name and indicator status of dominant plant species at each wetland were recorded on USACE data sheets. Dominance refers to the spatial extent of a species that is directly observed in the field. The most abundant plant species that individually or collectively account for more than 50 percent of the total coverage of each vegetation stratum and any other individual species comprising 20 percent or more of the total are considered to be dominant species for that stratum. Where 50 percent or more of all dominant species were hydrophytic, the hydrophytic vegetation parameter was met. Absolute percent cover of dominant species within each stratum is listed on data sheets.

HYDRIC SOILS

Definition	Soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper 12 inches.
Method	Soils from each sample location were characterized using Munsell Soil Color Charts and soil texturing. Soil samples were also compared to the NRCS Web Soil Survey and Nebraska Hydric Soils List. If one or more of the hydric soil indicators on the USACE data sheet were identified, the soil was considered to be hydric.

WETLAND HYDROLOGY

Definition	Fourteen or more consecutive days of flooding, ponding, or water table within 12 inches of the surface during the growing season at a minimum frequency of 5 out of 10 years (50%).
Method	Wetland hydrology was determined by observing the presence of primary and/or secondary indicators listed on the USACE data sheet. If one primary indicator or two secondary indicators were present, the wetland hydrology parameter was met.

Field maps were developed using aerial photography combined with information from the NRCS Web Soil Survey, USFWS NWI, and USGS topographic map. Field-delineated wetland boundaries were determined based on the USACE wetland delineation process by completing paired sample points, where possible, and investigating vegetation, soil, and hydrology parameters. Vegetation was identified to the species level and referenced to the State of Nebraska 2022 Wetland Plant List. Soil and hydrology characteristics were evaluated by using a sharpshooter/tile spade to examine the soil profile. Wetland boundaries were then recorded using Field Maps for ArcGIS in conjunction with a Trimble Catalyst DA2 unit to provide submeter accuracy. Portions of some wetlands may extend beyond the study area; however, only wetland boundaries within the study area were delineated. Site photographs are included in Appendix B and the Midwest Region Wetland Determination Data Forms are included in Appendix C.

WETLAND DELINEATION RESULTS

Data was collected at 97 locations within the study area to document existing conditions. Seventeen WOTUS were present and 76 areas meeting all three criteria for wetland classification were identified during the site visit, as detailed below in Table 1 and Table 2, and overlain on aerial imagery in Appendix A, Figure 6a-6r. Areas highlighted orange on Figures 6a-6r are areas where a wetland delineation was not completed due to lack of property access. No other special aquatic sites (e.g., sanctuaries and refuges, riffle and pool complexes) were identified within the study area.

Table 1: Delineated Wetlands

Sample ID	Wetland ID	Figure	Wetland Classification (Cowardin ¹ Nebraska Subclass)	Area (acres)
1	Wetland A	6a, 6b	PEMA/C Riverine Channel	0.006
2, 4	Wetland B	6a, 6b	PEMA/C Riverine Channel	0.027
-	Wetland C	6a, 6b	PEMA/C Riverine Channel	0.032
5	Wetland D	6a, 6b, 6c	PEMA/C Riverine Channel	0.146
6	Wetland E	6a, 6c	PEMA/C Riverine Channel	0.020
-	Wetland F	6a, 6c	PEMA/C Riverine Channel	0.008
8	Wetland G	6a, 6c	PEMA/C Lacustrine Fringe	0.107
-	Wetland H	6a, 6c	PEMA/C Riverine Channel	0.006
11, 13	Wetland I	6a, 6c, 6d, 6e	PEMA/C Riverine Channel	0.286
16	Wetland J	6a, 6e	PEMA/C Riverine Channel	0.016
18	Wetland K	6a, 6e	PEMA/C Riverine Channel	0.006
19	Wetland L	6a, 6e	PEMA/C Riverine Channel	0.015
21	Wetland M	6a, 6e	PEMA/C Riverine Channel	0.017
22	Wetland N	6a, 6e	PEMA/C Riverine Channel	0.002
25	Wetland O	6a, 6g	PEMA/C Riverine Channel	0.099

-	Wetland P	6a, 6g	PEMA/C Riverine Channel	0.178
27, 28, 30	Wetland Q	6a, 6g	PEMA/C Floodplain Depression	14.848
-	Wetland R	6a, 6g, 6h	PEMA/C Riverine Channel	0.114
31	Wetland S	6a, 6h	PEMA/C Riverine Channel	2.201
32	Wetland T	6a, 6h	PEMA/C Riverine Channel	0.012
33	Wetland U	6a, 6h, 6i	PEMA/C Riverine Channel	0.200
35	Wetland V	6a, 6i, 6j	PEMA/C Riverine Channel	0.272
38	Wetland W	6a, 6i	PEMA/C Riverine Channel	0.074
-	Wetland X	6a, 6i	PEMA/C Riverine Channel	0.150
-	Wetland Y	6a, 6i	PEMA/C Riverine Channel	0.017
-	Wetland Z	6a, 6i	PEMA/C Riverine Channel	0.021
-	Wetland AA	6a, 6i	PEMA/C Riverine Channel	0.047
40	Wetland BB	6a, 6i	PEMA/C Riverine Channel	0.028
-	Wetland CC	6a, 6i	PEMA/C Riverine Channel	0.013
41	Wetland DD	6a, 6i, 6j, 6k, 6l	PEMA/C Riverine Channel	2.193
-	Wetland EE	6a, 6i	PEMA/C Riverine Channel	0.544
42	Wetland FF	6a, 6i	PEMA/C Floodplain Depression	0.982
-	Wetland GG	6a, 6i, 6j, 6k, 6l	PEMA/C Riverine Channel	0.663
45	Wetland HH	6a, 6h, 6j	PEMA/C Riverine Channel	5.005
47, 49	Wetland II	6a, 6j	PEMA/C Riverine Channel	0.404
-	Wetland JJ	6a, 6j	PEMA/C Riverine Channel	0.003
51	Wetland KK	6a, 6j	PEMA/C Riverine Channel	0.027

53	Wetland LL	6a, 6k	PEMA/C Floodplain Depression	0.098
-	Wetland MM	6a, 6k	PEMA/C N/A	0.039
55	Wetland NN	6a, 6k	PEMA/C N/A	0.039
-	Wetland OO	6a, 6k	PEMA/C N/A	0.035
-	Wetland PP	6a, 6l	PEMA/C Riverine Channel	0.022
56	Wetland QQ	6a, 6l	PEMA/C Riverine Channel	0.014
57, 60	Wetland RR	6a, 6l, 6m	PEMA/C Riverine Channel	0.232
-	Wetland SS	6a, 6m	PEMA/C Riverine Channel	0.006
-	Wetland TT	6a, 6m	PEMA/C Riverine Channel	0.064
62	Wetland UU	6a, 6m, 6n	PEMA/C Riverine Channel	0.528
-	Wetland VV	6a, 6m, 6n	PUBA/C Riverine Channel	0.007
-	Wetland WW	6a, 6m, 6n	PUBA/C Riverine Channel	0.017
63	Wetland XX	6a, 6n, 6o	PEMA/C Riverine Channel	1.805
-	Wetland YY	6a, 6n	PUBA/C Riverine Channel	0.104
-	Wetland ZZ	6a, 6m, 6n	PEMA/C Lacustrine Fringe	0.012
-	Wetland AAA	6a, 6n	PEMA/C Riverine Channel	0.050
65	Wetland BBB	6a, 6n, 6o	PFOA/C Riverine Channel	1.862
-	Wetland CCC	6a, 6n, 6o	PEMA/C Riverine Channel	0.533
66	Wetland DDD	6a, 6m, 6n, 6o	PEMA/C Lacustrine Fringe	0.162
69	Wetland EEE	6a, 6o	PEMA/C Riverine Channel	0.012
-	Wetland FFF	6a, 6o	PEMA/C Riverine Channel	0.012
-	Wetland GGG	6a, 6p, 6q	PEMA/C Riverine Channel	0.039

72	Wetland HHH	6a, 6p, 6q	PEMA/C Riverine Channel	0.044
73	Wetland III	6a, 6p, 6q	PEMA/C Riverine Channel	0.006
-	Wetland JJJ	6a, 6p, 6q	PEMA/C Riverine Channel	0.010
76	Wetland KKK	6a, 6p, 6q	PEMA/C Riverine Channel	0.010
81	Wetland LLL	6a, 6q	PEMA/C Floodplain Depression	0.119
83	Wetland MMM	6a, 6q	PEMA/C Floodplain Depression	0.124
-	Wetland NNN	6a, 6q	PEMA/C Riverine Channel	0.029
84	Wetland OOO	6a, 6q	PEMA/C Riverine Channel	0.022
86	Wetland PPP	6a, 6q	PEMA/C Riverine Channel	0.201
-	Wetland QQQ	6a, 6q	PEMA/C Riverine Channel	0.022
87	Wetland RRR	6a, 6q, 6r	PEMA/C Riverine Channel	0.043
89	Wetland SSS	6a, 6q, 6r	PEMA/C Lacustrine Fringe	1.165
91	Wetland TTT	6a, 6q, 6r	PEMA/C Riverine Channel	0.427
92	Wetland UUU	6a, 6r	PEMA/C Riverine Channel	0.064
-	Wetland VVV	6a, 6r	PEMA/C Riverine Channel	0.021
94	Wetland WWW	6a, 6r	PEMA/C Riverine Channel	0.198
96	Wetland XXX	6a, 6r	PEMA/C Floodplain Depression	0.218

TOTAL**PEM = 35.214****PFO = 1.862****PUB = 0.128**

Notes: ¹ PEMA = Palustrine, Emergent, Temporarily Flooded; PEMC = Palustrine, Emergent, Seasonally Flooded

PFOA = Palustrine, Forested, Temporarily Flooded; PFOC = Palustrine, Forested, Seasonally Flooded

PUBA = Palustrine, Unconsolidated Bottom; Temporarily Flooded; PUBC = Palustrine, Unconsolidated Bottom, Seasonally Flooded

Table 2: Other Water Resources

Photo ID	Figure	Name	Type ¹
2-8	6a, 6b, 6c	Unnamed Stream 1	Ephemeral
10, 11	6a, 6c	Unnamed Pond 1	Pond
12	6a, 6c	Unnamed Stream 2	Ephemeral
14, 16-18	6a, 6c, 6d, 6e	Unnamed Stream 3	Ephemeral
19, 21, 23, 24, 26-28, 189-191, 193, 194, 205, 207-209, 211, 213	6a, 6e, 6q, 6r	Willow Creek	Perennial
76, 78, 81	6a, 6i	Unnamed Stream 4	Ephemeral
83	6a, 6i	Unnamed Stream 5	Ephemeral
74, 75, 84, 89, 91, 92, 116, 127, 129, 131-133, 135-139	6a, 6i, 6j, 6k, 6l	Unnamed Stream 6	Canal
100-102, 107, 109-114	6a, 6j	Unnamed Stream 7	Ephemeral
140, 170-172, 175, 176, 184-186, 188	6a, 6l, 6m, 6o, 6p, 6q	North Fork Elkhorn River	Perennial
143, 149, 165, 167, 173	6a, 6m, 6n, 6o	Unnamed Stream 8	Intermittent
150-152, 168, 169	6a, 6m, 6n, 6o	Pierce Lake	Pond
179-183	6a, 6p, 6q	Unnamed Stream 9	Ephemeral
197, 198	6a, 6q, 6r	Unnamed Stream 10	Ephemeral
199-201	6a, 6q, 6r	Unnamed Stream 11	Ephemeral
202, 203	6a, 6q, 6r	Unnamed Pond 2	Pond
206	6a, 6q, 6r	Unnamed Pond 3	Pond

Notes: ¹ Other Water Resources are non-wetland resources such as channels, ponds, and canals.

The following provides a brief narrative for each of the identified aquatic resources:

- **Wetland A** – PEMA/C wetland located north of 853rd Road within the roadside ditch. Dominant vegetation within the wetland consisted of sandbar willow (*Salix interior*) and reed canarygrass (*Phalaris arundinacea*). See Appendix B, Photo 1, and Appendix C, Datasheet 1.
- **Wetland B** – PEMA/C wetland located on the north bank of Unnamed Stream 1 on the north side of 853rd Road. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 2-4, and Appendix C, Datasheets 2 and 4.
- **Wetland C** – PEMA/C wetland located on the south bank of Unnamed Stream 1 on the north side of 853rd Road. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 2 and 4.
- **Wetland D** – PEMA/C wetland located north of 853rd Road along the banks and below the OHWM of Unnamed Stream 1. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 5 and 6, and Appendix C, Datasheet 5.
- **Wetland E** – PEMA/C wetland located north of 853rd Road on the north bank of Unnamed Stream 1. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 7 and 8, and Appendix C, Datasheet 6.
- **Wetland F** – PEMA/C wetland located north of 853rd Road on the south bank of Unnamed Stream 1. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 7 and 8.
- **Wetland G** – PEMA/C wetland located north of 853rd Road along the banks of Unnamed Pond 1. Dominant vegetation within the wetland consisted of reed canarygrass and broad-leaf cattail (*Typha latifolia*). See Appendix B, Photos 10 and 11, and Appendix C, Datasheet 8.
- **Wetland H** – PEMA/C wetland located south of 853rd Road within the roadside ditch. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photo 13.
- **Wetland I** – PEMA/C wetland located along the banks of Unnamed Stream 3 on the south side of 853rd Road and the west side of 549th Avenue. Dominant vegetation within the wetland consisted of reed canarygrass and stinging nettle (*Urtica dioica*). See Appendix B, Photos 14, 16-18, and Appendix C, Datasheets 11 and 13.
- **Wetland J** – PEMA/C wetland located on the northwest bank of Willow Creek. Dominant vegetation within the wetland consisted of prairie cordgrass (*Spartina pectinata*), eastern woodland sedge (*Carex blanda*), and smooth brome (*Bromus inermis*). See Appendix B, Photo 21, and Appendix C, Datasheet 16.
- **Wetland K** – PEMA/C wetland located on the northwest bank of Willow Creek. Dominant vegetation within the wetland consisted of prairie cordgrass and eastern woodland sedge. See Appendix B, Photo 23, and Appendix C, Datasheet 18.
- **Wetland L** – PEMA/C wetland located on the north bank of Willow Creek. Dominant vegetation within the wetland consisted of dark-green bulrush (*Scirpus atrovirens*) and prairie cordgrass. See Appendix B, Photo 24, and Appendix C, Datasheet 19.

- **Wetland M** – PEMA/C wetland located on the west bank of Willow Creek. Dominant vegetation within the wetland consisted of dark-green bulrush. See *Appendix B, Photo 26, and Appendix C, Datasheet 21*.
- **Wetland N** – PEMA/C wetland located on the northwest bank of Willow Creek. Dominant vegetation within the wetland consisted of prairie cordgrass and dark-green bulrush. See *Appendix B, Photo 27, and Appendix C, Datasheet 22*.
- **Wetland O** – PEMA/C wetland located south of 854th Road within the roadside ditch. Dominant vegetation within the wetland consisted of perennial rye grass (*Lolium perenne*), troublesome sedge (*Carex molesta*), and prairie cordgrass. See *Appendix B, Photos 41 and 42, and Appendix C, Datasheet 25*.
- **Wetland P** – PEMA/C wetland located south of 854th Road within the roadside ditch. Dominant vegetation within the wetland consisted of perennial rye grass, troublesome sedge, and prairie cordgrass. See *Appendix B, Photos 43 and 55*.
- **Wetland Q** – PEMA/C wetland located within a row-crop field on the north side of 854th Road. Dominant vegetation within the wetland consisted of soybeans (*Glycine max*). See *Appendix B, Photos 45-53, and Appendix C, Datasheets 27, 28, and 30*.
- **Wetland R** – PEMA/C wetland located south of 854th Road within the roadside ditch. Dominant vegetation within the wetland consisted of perennial rye grass, troublesome sedge, and prairie cordgrass. See *Appendix B, Photos 56 and 57*.
- **Wetland S** – PEMA/C wetland located south of 854th Road within the roadside ditch. Dominant vegetation within the wetland consisted of narrow-leaf cattail (*Typha angustifolia*) and reed canarygrass. See *Appendix B, Photos 58 and 59, and Appendix C, Datasheet 31*.
- **Wetland T** – PEMA/C wetland located south of 854th Road within the roadside ditch. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 62, and Appendix C, Datasheet 32*.
- **Wetland U** – PEMA/C wetland located west of 549th Avenue within the roadside ditch. Dominant vegetation within the wetland consisted of prairie cordgrass and narrow-leaf cattail. See *Appendix B, Photo 69, and Appendix C, Datasheet 33*.
- **Wetland V** – PEMA/C wetland located southwest of Highway 13 within the roadside ditch. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photos 70 and 71, and Appendix C, Datasheet 35*.
- **Wetland W** – PEMA/C wetland located northeast of Highway 13 along the bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photos 74 and 75, and Appendix C, Datasheet 38*.
- **Wetland X** – PEMA/C wetland located northeast of Highway 13 along the bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photos 74 and 75*.
- **Wetland Y** – PEMA/C wetland located west of 549th Avenue on the east bank of Unnamed Stream 4. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 76*.

- **Wetland Z** – PEMA/C wetland located west of 549th Avenue on the west bank of Unnamed Stream 4. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 76*.
- **Wetland AA** – PEMA/C wetland located west of 549th Avenue within the roadside ditch. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 77*.
- **Wetland BB** – PEMA/C wetland located west of 549th Avenue on the west bank of Unnamed Stream 4. Dominant vegetation within the wetland consisted of smooth brome, perennial rye grass, reed canarygrass, and prairie cordgrass. See *Appendix B, Photos 78 and 81, and Appendix C, Datasheet 40*.
- **Wetland CC** – PEMA/C wetland located west of 549th Avenue on the east bank of Unnamed Stream 4. Dominant vegetation within the wetland consisted of smooth brome, perennial rye grass, reed canarygrass, and prairie cordgrass. See *Appendix B, Photos 78 and 81*.
- **Wetland DD** – PEMA/C wetland located on the north bank of Unnamed Stream 6, extending from 549th Avenue to County Road 33C. Dominant vegetation within the wetland consisted of eastern cottonwood (*Populus deltoides*), sandbar willow, reed canarygrass, and pinkweed (*Persicaria pensylvanica*). See *Appendix B, Photos 82-84, 89, 92, 116, 127, and 129, and Appendix C, Datasheet 41*.
- **Wetland EE** – PEMA/C wetland located on the southwest bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of eastern cottonwood, sandbar willow, reed canarygrass, and pinkweed. See *Appendix B, Photos 85 and 91*.
- **Wetland FF** – PEMA/C wetland located east of 549th Avenue within a row-crop field. Dominant vegetation within the wetland consisted of corn (*Zea mays*). See *Appendix B, Photos 86 and 87, and Appendix C, Datasheet 42*.
- **Wetland GG** – PEMA/C wetland located on the south bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of eastern cottonwood, sandbar willow, reed canarygrass, and pinkweed. See *Appendix B, Photos 89, 91, 92, 116, 127, and 129*.
- **Wetland HH** – PEMA/C wetland located southwest of Highway 33 along the bank of Unnamed Stream 7. Dominant vegetation within the wetland consisted of prairie cordgrass and perennial ryegrass. See *Appendix B, Photos 93-95, 98-102, and 107, and Appendix C, Datasheet 45*.
- **Wetland II** – PEMA/C wetland located along the bank of Unnamed Stream 7. Dominant vegetation within the wetland consisted of reed canarygrass, large barnyard grass (*Echinochloa crus-galli*), and tall false rye grass (*Schedonorus arundinaceus*). See *Appendix B, Photos 100-102, and 107, and Appendix C, Datasheets 47 and 49*.
- **Wetland JJ** – PEMA/C wetland located along the bank of Unnamed Stream 7. Dominant vegetation within the wetland consisted of eastern cottonwood, American elm (*Ulmus americana*), reed canarygrass, and smooth brome. See *Appendix B, Photo 110*.
- **Wetland KK** – PEMA/C wetland located along the bank of Unnamed Stream 7. Dominant vegetation within the wetland consisted of eastern cottonwood, American elm, reed

canarygrass, and smooth brome. See Appendix B, Photos 111-114, and Appendix C, Datasheet 51.

- **Wetland LL** – PEMA/C wetland located in a swale east of Highway 13. Dominant vegetation within the wetland consisted of prairie cordgrass, foxtail barley (*Hordeum jubatum*), reed canarygrass, and red clover (*Trifolium pratense*). See Appendix B, Photos 119 and 123, and Appendix C, Datasheet 53.
- **Wetland MM** – PEMA/C wetland located east of Highway 13 within an old sand volleyball pit. Dominant vegetation within the wetland consisted of common spike-rush (*Eleocharis palustris*) and narrow-leaf cattail. See Appendix B, Photo 120.
- **Wetland NN** – PEMA/C wetland located east of Highway 13 within an old sand volleyball pit. Dominant vegetation within the wetland consisted of common spike-rush and narrow-leaf cattail. See Appendix B, Photo 121, and Appendix C, Datasheet 55.
- **Wetland OO** – PEMA/C wetland located east of Highway 13 within an old sand volleyball pit. Dominant vegetation within the wetland consisted of common spike-rush and narrow-leaf cattail. See Appendix B, Photo 122.
- **Wetland PP** – PEMA/C wetland located east of County Road 33C on the east bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of reed canarygrass and smooth brome. See Appendix B, Photos 131 and 132.
- **Wetland QQ** – PEMA/C wetland located east of County Road 33C on the west bank of Unnamed Stream 6. Dominant vegetation within the wetland consisted of reed canarygrass and smooth brome. See Appendix B, Photo 131, and Appendix C, Datasheet 56.
- **Wetland RR** – PEMA/C wetland located along the banks and below the OHWM of Unnamed Stream 6 extending from County Road 33C to the North Fork Elkhorn River. Dominant vegetation within the wetland consisted of reed canarygrass and silver maple (*Acer saccharinum*). See Appendix B, Photo 133, 135-140, and Appendix C, Datasheets 57 and 60.
- **Wetland SS** – PEMA/C wetland located west of N Mill Street within the roadside ditch. See Appendix B, Photo 142.
- **Wetland TT** – PEMA/C wetland located within a drainageway west of N Mill Street. See Appendix B, Photos 143 and 145.
- **Wetland UU** – PEMA/C wetland located within a drainageway east of N Mill Street. Dominant vegetation within the wetland consisted of reed canarygrass and duck-potato (*Sagittaria latifolia*). See Appendix B, Photos 146 and 148, and Appendix C, Datasheet 62.
- **Wetland VV** – PUBA/C wetland located within a drainageway east of N Mill Street. See Appendix B, Photo 146.
- **Wetland WW** – PUBA/C wetland located within a drainageway east of N Mill Street. See Appendix B, Photo 148.
- **Wetland XX** – PEMA/C wetland located within a drainageway east of N Mill Street. Dominant vegetation within the wetland consisted of reed canarygrass and duck-potato. See Appendix B, Photos 149, 153-156, and 163, and Appendix C, Datasheet 63.

- **Wetland YY** – PUBA/C wetland located within a drainageway east of N Mill Street. See *Appendix B, Photo 153*.
- **Wetland ZZ** – PEMA/C wetland located on the southwest bank of Pierce Lake. Dominant vegetation within the wetland consisted of three-square (*Schoenoplectus pungens*), swamp milkweed (*Asclepias incarnata*), and annual ragweed (*Ambrosia artemisiifolia*). See *Appendix B, Photo 151*.
- **Wetland AAA** – PEMA/C wetland located north of E Main Street. See *Appendix B, Photo 158*.
- **Wetland BBB** – PFOA/C wetland located north of E Main Street. Dominant vegetation within the wetland consisted of American elm, silver maple, green ash (*Fraxinus pennsylvanica*), hooded blue violet (*Viola sororia*), groundivy (*Glechoma hederacea*), and stinging nettle. See *Appendix B, Photos 161 and 162, and Appendix C, Datasheet 65*.
- **Wetland CCC** – PEMA/C wetland located in a drainageway north of E Main Street. Dominant vegetation within the wetland consisted of reed canarygrass and duck-potato. See *Appendix B, Photos 164 and 166*.
- **Wetland DDD** – PEMA/C wetland located on the northeast bank of Pierce Lake. Dominant vegetation within the wetland consisted of silver maple, three-square, swamp milkweed, and annual ragweed. See *Appendix B, Photos 150 and 169, and Appendix C, Datasheet 66*.
- **Wetland EEE** – PEMA/C wetland located on the north bank of Unnamed Stream 8. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photos 173 and 174, and Appendix C, Datasheet 69*.
- **Wetland FFF** – PEMA/C wetland located on the south bank of Unnamed Stream 8. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 173*.
- **Wetland GGG** – PEMA/C wetland located on the bank of Unnamed Stream 9. Dominant vegetation within the wetland consisted of reed canarygrass and curly dock (*Rumex crispus*). See *Appendix B, Photos 179-181*.
- **Wetland HHH** – PEMA/C wetland located on the bank of Unnamed Stream 9. Dominant vegetation within the wetland consisted of reed canarygrass and curly dock. See *Appendix B, Photos 179-181, and Appendix C, Datasheet 72*.
- **Wetland III** – PEMA/C wetland located on the bank of Unnamed Stream 9. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 181, and Appendix C, Datasheet 73*.
- **Wetland JJJ** – PEMA/C wetland located on the north bank of Unnamed Stream 9. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 183*.
- **Wetland KKK** – PEMA/C wetland located on the south bank of Unnamed Stream 9. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 183, and Appendix C, Datasheet 76*.

- **Wetland LLL** – PEMA/C wetland located in a depressional feature east of Highway 13. Dominant vegetation within the wetland consisted of eastern cottonwood, large barnyard grass, red-root amaranth (*Amaranthus retroflexus*), reed canarygrass, and kentucky blue grass (*Poa pratensis*). See Appendix B, Photo 192, and Appendix C, Datasheet 81.
- **Wetland MMM** – PEMA/C wetland located in a depressional feature east of Highway 13. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photo 196, and Appendix C, Datasheet 83.
- **Wetland NNN** – PEMA/C wetland located on the northeast bank of Unnamed Stream 10. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 197 and 198.
- **Wetland OOO** – PEMA/C wetland located on the southwest bank of Unnamed Stream 10. Dominant vegetation within the wetland consisted of silver maple, American elm, green ash, and reed canarygrass. See Appendix B, Photos 197 and 198, and Appendix C, Datasheet 84.
- **Wetland PPP** – PEMA/C wetland located on the northeast bank of Unnamed Stream 11. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 199 and 200, and Appendix C, Datasheet 86.
- **Wetland QQQ** – PEMA/C wetland located on the southwest bank of Unnamed Stream 11. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photo 200.
- **Wetland RRR** – PEMA/C wetland located along the banks of and below the OHWM of Unnamed Stream 11. Dominant vegetation within the wetland consisted of green ash, reed canarygrass, duck-potato, and narrow-leaf cattail. See Appendix B, Photo 201, and Appendix C, Datasheet 87.
- **Wetland SSS** – PEMA/C wetland located west of Highway 13 along the banks of Unnamed Pond 2. Dominant vegetation within the wetland consisted of reed canarygrass and prairie cordgrass. See Appendix B, Photos 202-204, 210, and Appendix C, Datasheet 89.
- **Wetland TTT** – PEMA/C wetland located west of Highway 13. Dominant vegetation within the wetland consisted of silver maple, eastern cottonwood, American elm, and reed canarygrass. See Appendix B, Photos 205 and 206, and Appendix C, Datasheet 91.
- **Wetland UUU** – PEMA/C wetland located along the north bank of Willow Creek. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 207 and 208, and Appendix C, Datasheet 92.
- **Wetland VVV** – PEMA/C wetland located along the north bank of Willow Creek. Dominant vegetation within the wetland consisted of reed canarygrass. See Appendix B, Photos 209 and 211.
- **Wetland WWW** – PEMA/C wetland located on the north bank of Willow Creek. Dominant vegetation within the wetland consisted of elderberry (*Sambucus nigra*), reed canarygrass, pinkweed, and stinging nettle. See Appendix B, Photo 212, and Appendix C, Datasheet 94.

- **Wetland XXX** – PEMA/C wetland located west of S 1st Street. Dominant vegetation within the wetland consisted of reed canarygrass. See *Appendix B, Photo 214, and Appendix C, Datasheet 96*.
- **Unnamed Stream 1** – Ephemeral stream flowing generally west to east on the north side of 853rd Road. The channel has an average OHWM ranging in width from 1 foot to 6 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photos 2-8*.
- **Unnamed Pond 1** – Pond located northwest of the intersection of 853rd Road and 549th Avenue. See *Appendix B, Photos 10 and 11*.
- **Unnamed Stream 2** – Ephemeral stream flowing generally west to east on the south side of 853rd Road. The channel has an average OHWM ranging in width from 1 foot to 3 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photo 12*.
- **Unnamed Stream 3** – Ephemeral stream flowing generally north to south on the west side of 549th Avenue. The channel has an average OHWM ranging in width from 2 feet to 3 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photos 14, 16-18*.
- **Willow Creek** – Perennial stream flowing generally southwest to northeast along the south side of the study area. The channel has an average OHWM ranging in width from 15 feet to 30 feet and an average depth from the top of bank to the OHWM ranging from 2 feet to 10 feet. See *Appendix B, Photos 19, 21, 23, 24, 26-28, 189-191, 193, 194, 205, 207-209, 211, 213*.
- **Unnamed Stream 4** – Ephemeral stream flowing generally north to south on the west side of 549th Avenue. The channel has an average OHWM ranging in width from 1 foot to 8 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photos 76, 78, 81*.
- **Unnamed Stream 5** – Ephemeral stream flowing generally west to east on the east side of 549th Avenue. The channel has an average OHWM ranging in width from 1 foot to 2 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photo 83*.
- **Unnamed Stream 6** – Manmade canal flowing generally northwest to southeast from 549th Avenue to the North Fork Elkhorn River. The channel has an average OHWM ranging in width from 2 feet to 6 feet and an average depth from the top of bank to the OHWM ranging from 2 feet to 4 feet. See *Appendix B, Photos 74, 75, 84, 89, 91, 92, 116, 127, 129, 131-133, 135-139*.
- **Unnamed Stream 7** – Ephemeral stream flowing generally west to east on the west and east side of Highway 13. The channel has an average OHWM ranging in width from 1 foot to 14 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 5 feet. See *Appendix B, Photos 100-102, 107, 109-114*.
- **North Fork Elkhorn River** – Perennial stream flowing generally north to south along the east side of the study area. The channel has an average OHWM width of 50 feet and an average depth from the top of bank to the OHWM of 5 feet. See *Appendix B, Photos 140, 170-172, 175, 176, 184-186, 188*.

- **Unnamed Stream 8** – Intermittent stream flowing generally west to east through the city park. The channel has an average OHWM ranging in width from 3 feet to 12 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 5 feet. See *Appendix B, Photos 143, 149, 165, 167, 173.*
- **Pierce Lake** – Pond located within the city park. See *Appendix B, Photos 150-152, 168, 169.*
- **Unnamed Stream 9** – Ephemeral stream flowing generally west to east on the east side of Hall Street. The channel has an average OHWM ranging in width from 1 foot to 4 feet and an average depth from the top of bank to the OHWM ranging from 2 feet to 4 feet. See *Appendix B, Photos 179-183.*
- **Unnamed Stream 10** – Ephemeral stream flowing generally northwest to southeast on the northeast side of Highway 13. The channel has an average OHWM ranging in width from 1 foot to 3 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 4 feet. See *Appendix B, Photos 197 and 198.*
- **Unnamed Stream 11** – Ephemeral stream flowing generally northwest to southeast on the northeast side of Highway 13. The channel has an average OHWM ranging in width from 2 feet to 5 feet and an average depth from the top of bank to the OHWM ranging from 1 foot to 3 feet. See *Appendix B, Photos 199-201.*
- **Unnamed Pond 2** – Pond located on the southwest side of Highway 13. See *Appendix B, Photos 202 and 203.*
- **Unnamed Pond 3** – Pond located on the southwest side of Highway 13. See *Appendix B, Photo 206.*

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Appendix A: Figures

Figure 1: Location Map

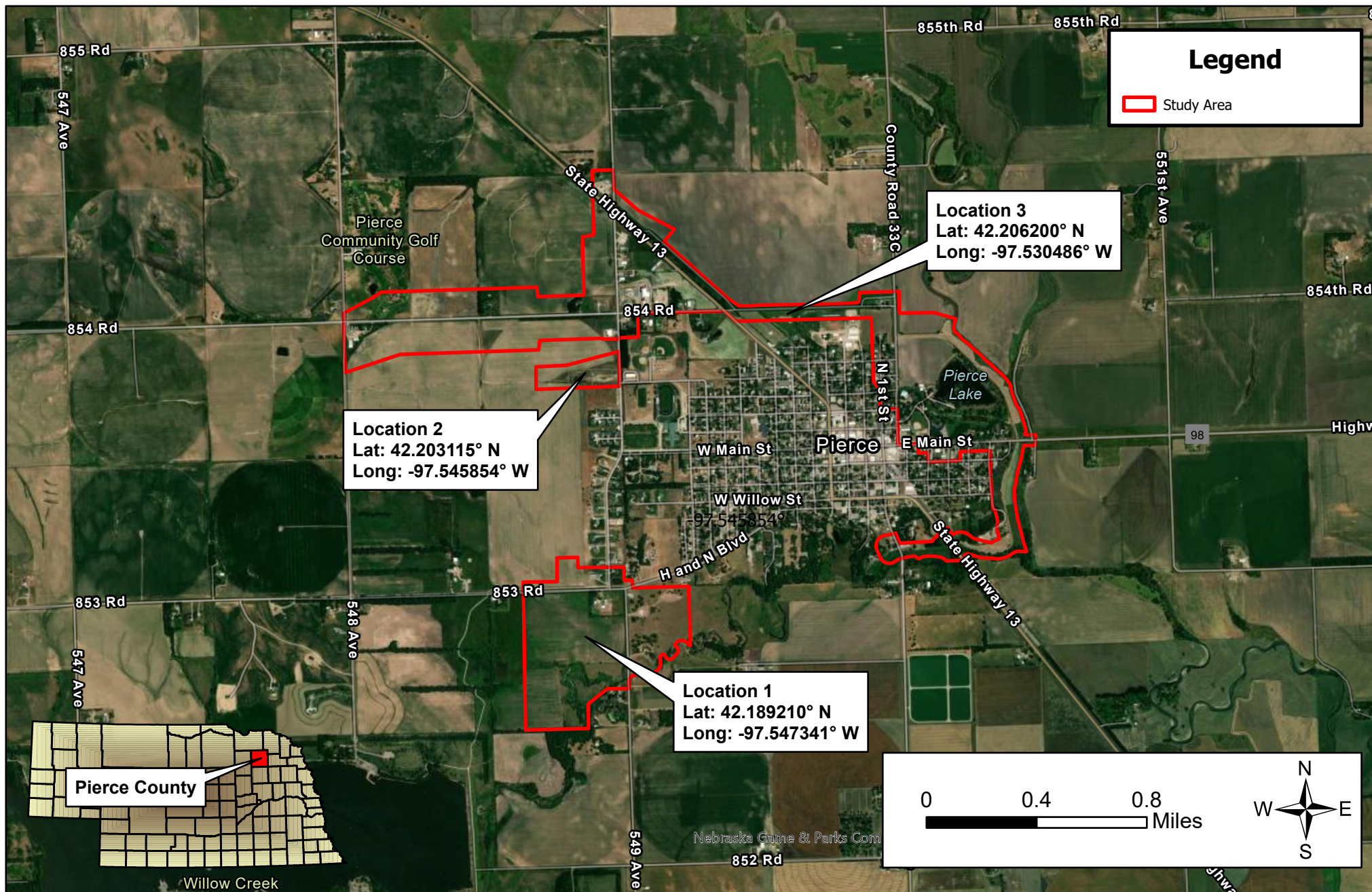
Figure 2: Topographic Map

Figure 3: NWI Map

Figure 4a-4d: Soils Map

Figure 5: NHD Map

Figure 6a-6r: Delineated Wetlands/WOTUS



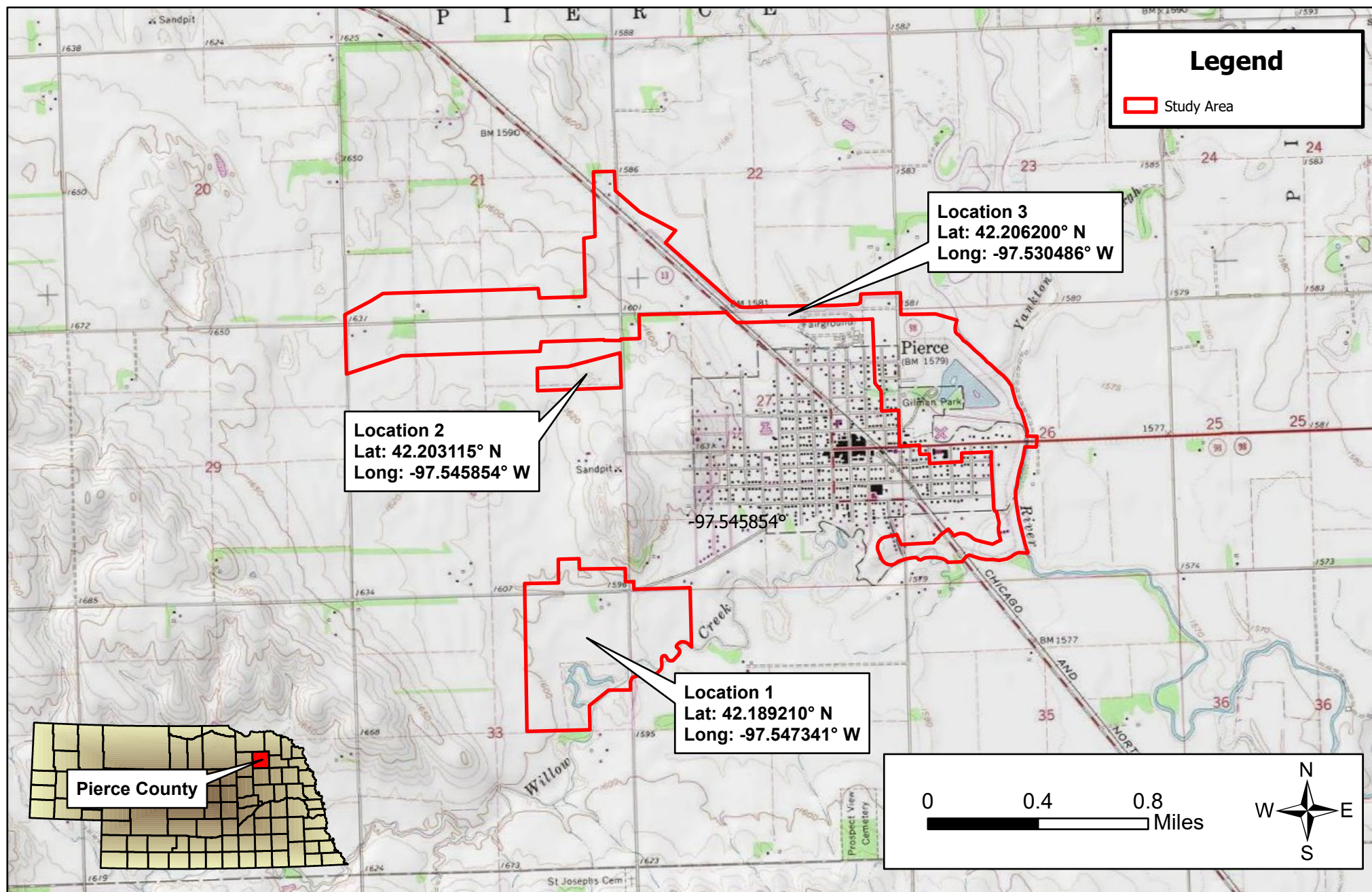
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LENRD North Fork Elkhorn River WFPO Pierce

Figure 1 - Project Location Map
Pierce County, NE



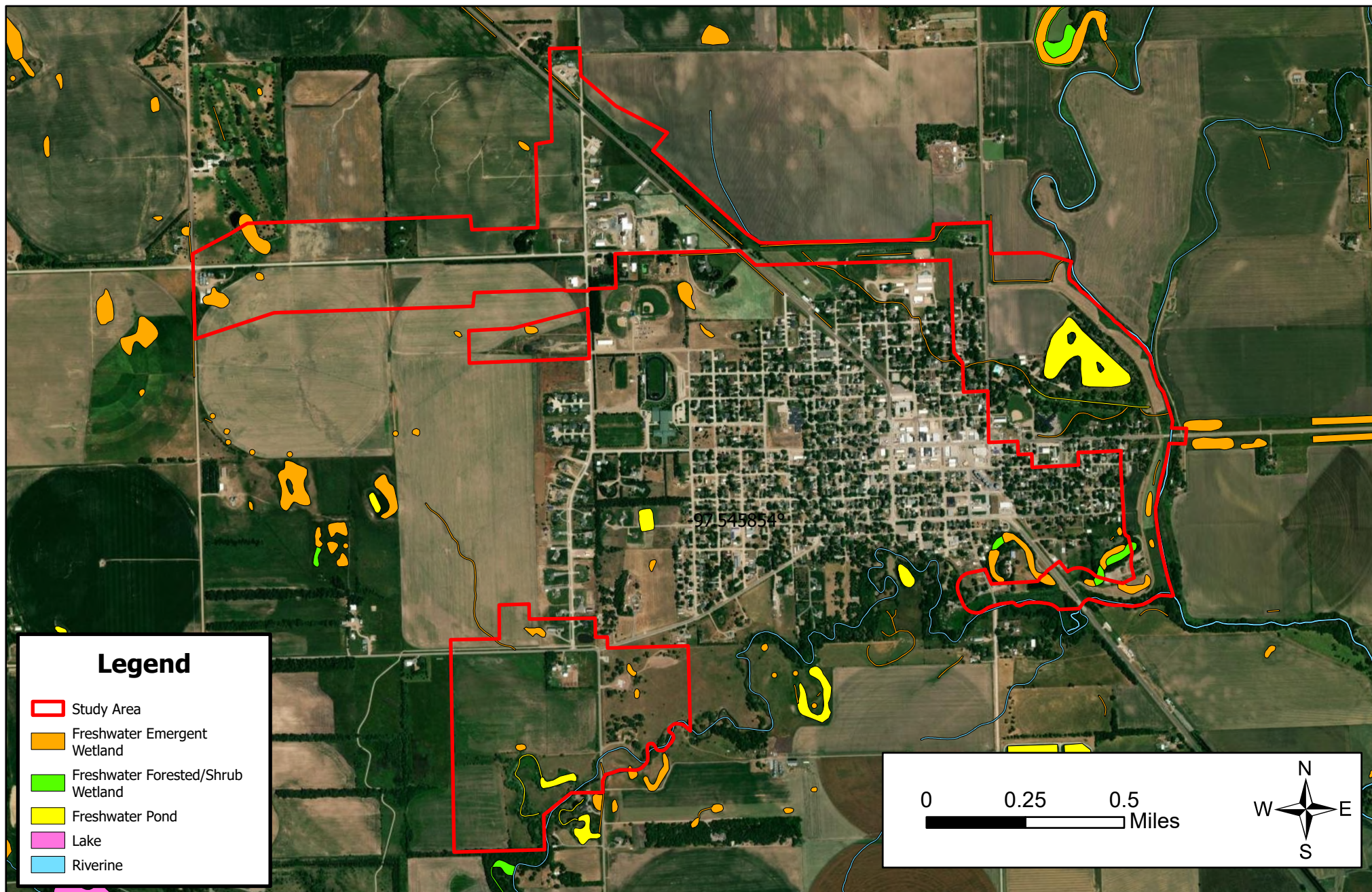


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Figure 2 - Topographic Map
Pierce County, NE

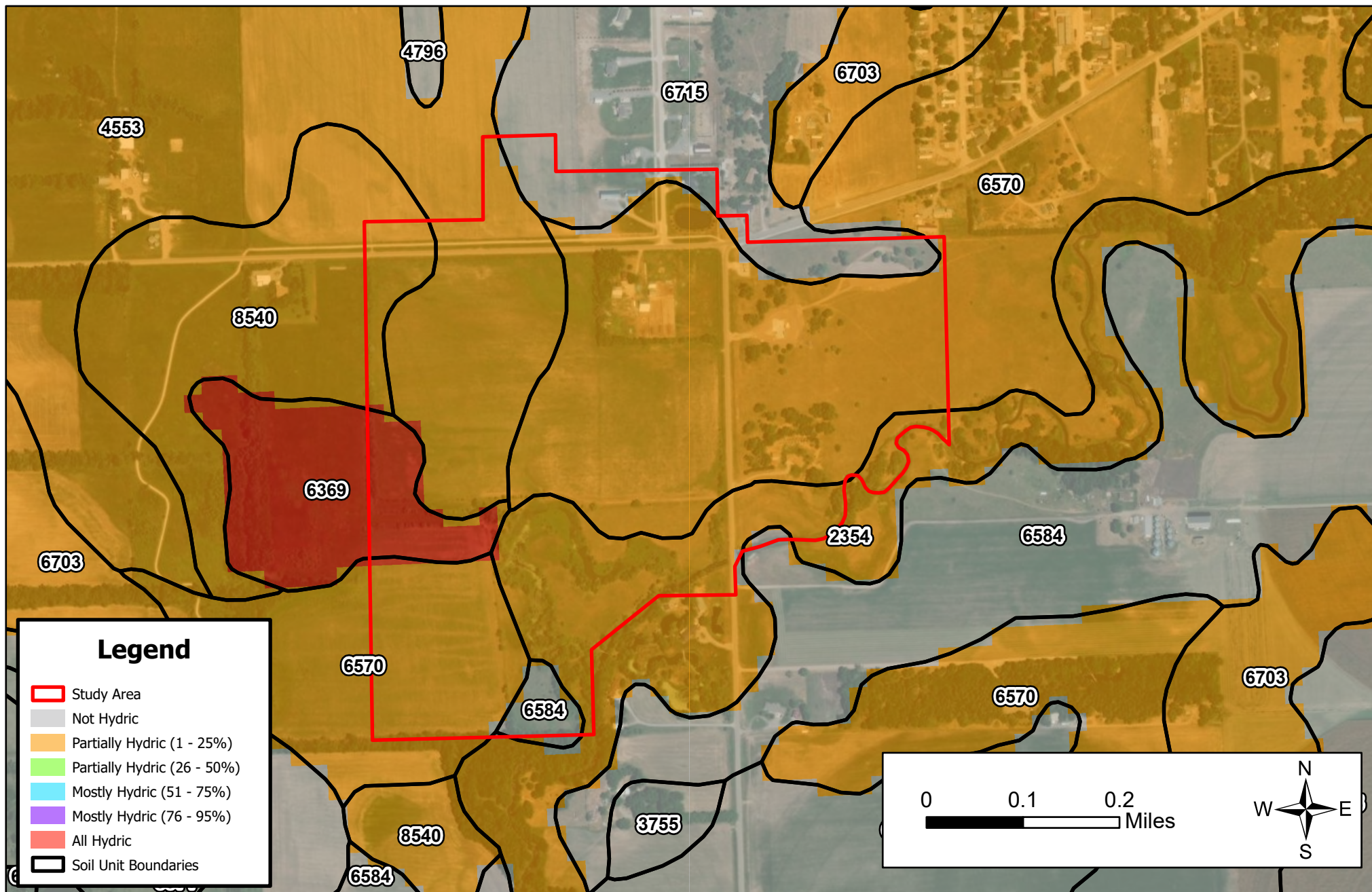


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Figure 3 - NWI Map
 Pierce County, NE

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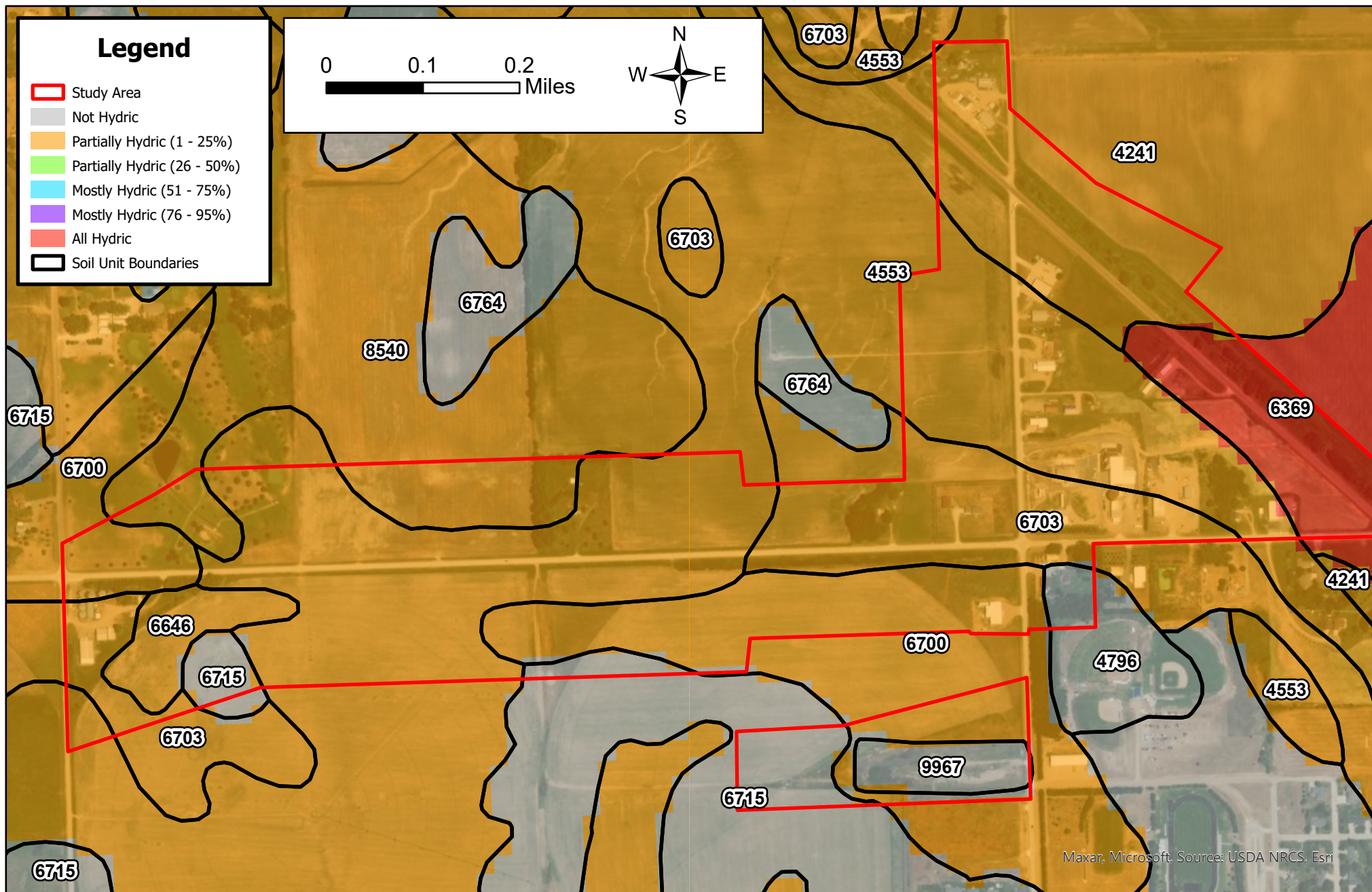


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Figure 4a - Soils Map
Pierce County, NE

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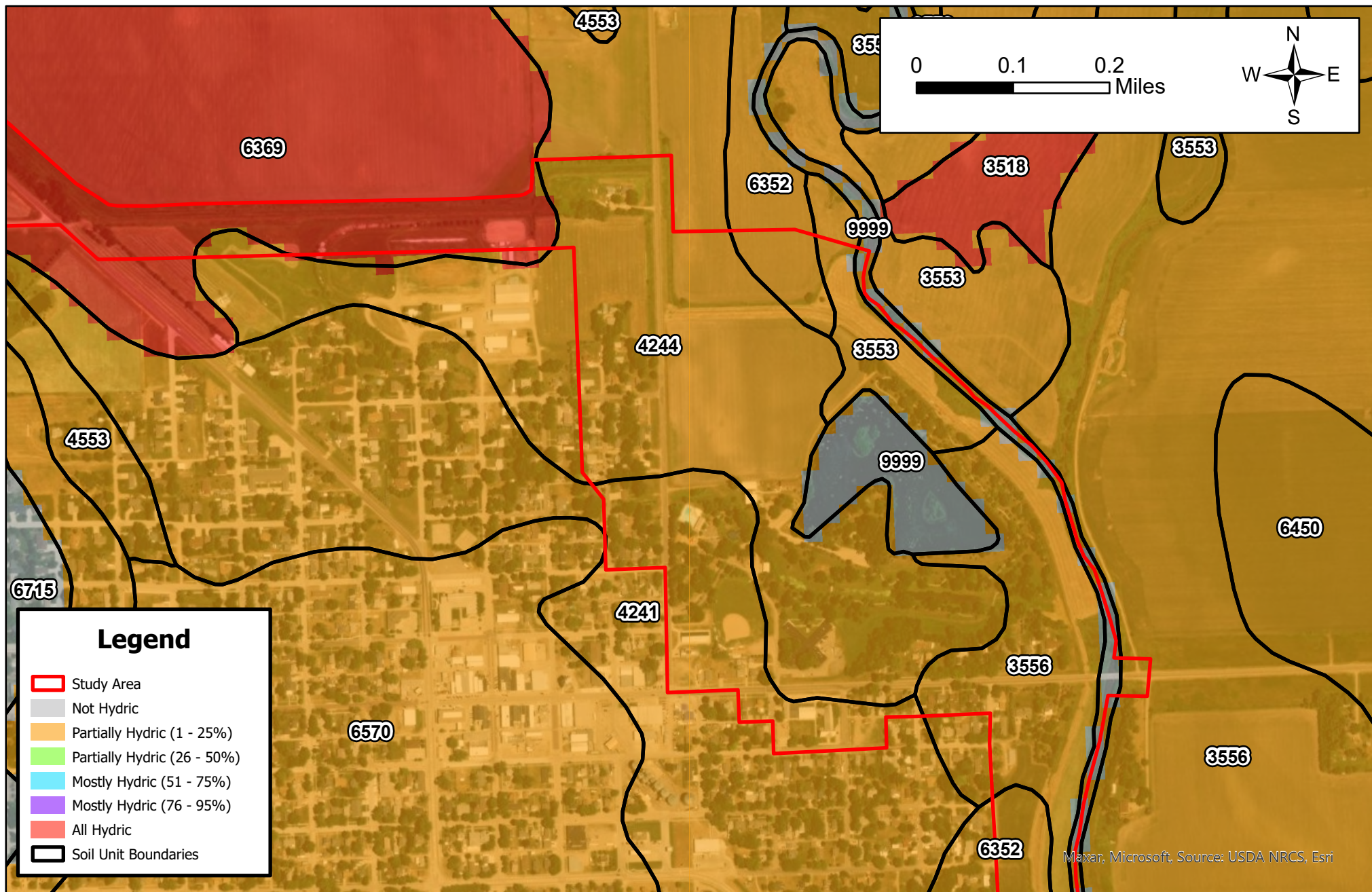


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LENRD North Fork Elkhorn River WFPO Pierce

Figure 4b - Soils Map
Pierce County, NE

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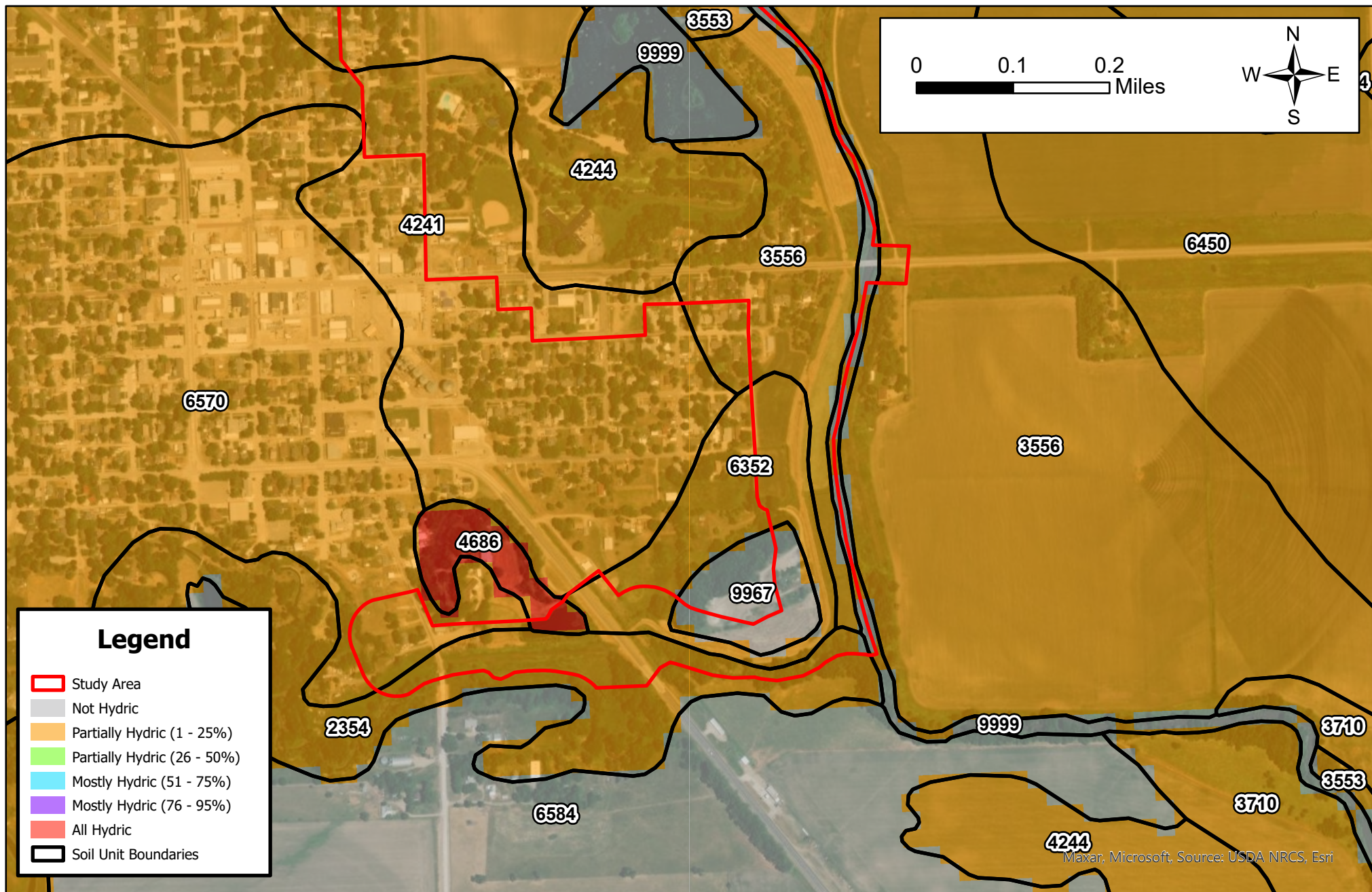


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LENRD North Fork Elkhorn River WFPO Pierce

Figure 4c - Soils Map
Pierce County, NE

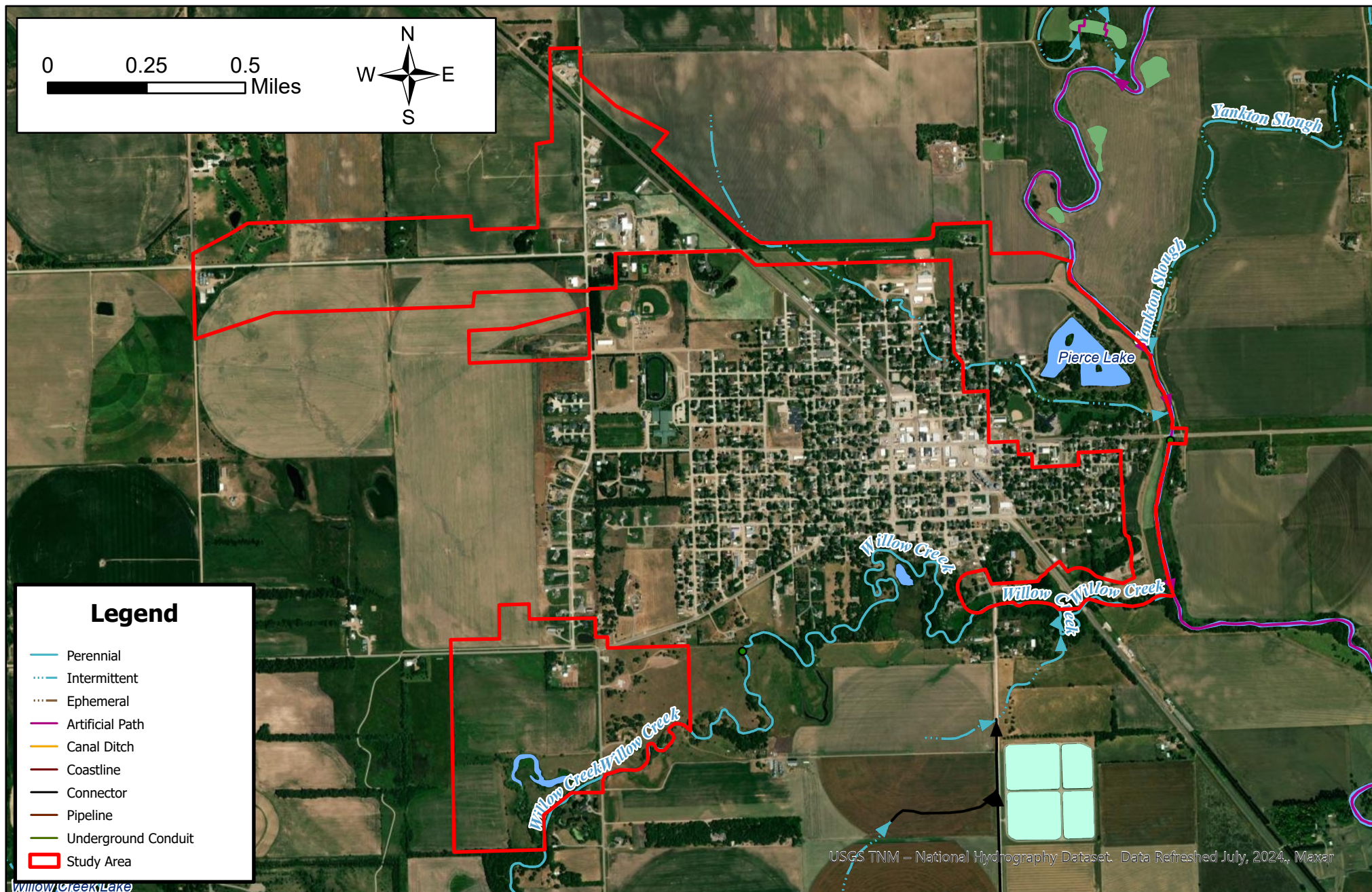


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 Date: 7/29/2024
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 File: North Fork Elkhorn WFPO.aprx

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Figure 4d - Soils Map
 Pierce County, NE

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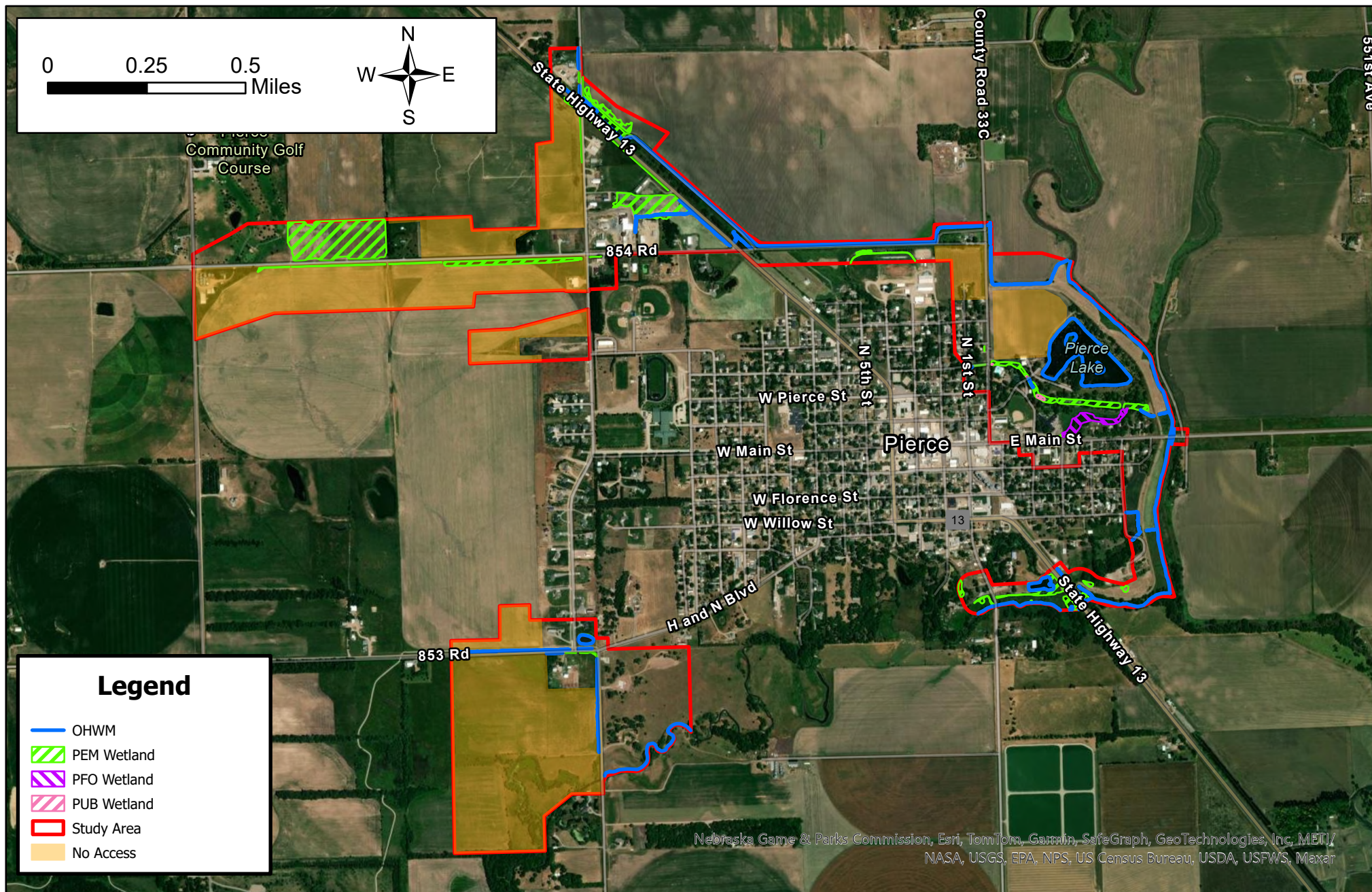


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LENRD North Fork Elkhorn River WFPO Pierce

Figure 5 - NHD Map
 Pierce County, NE

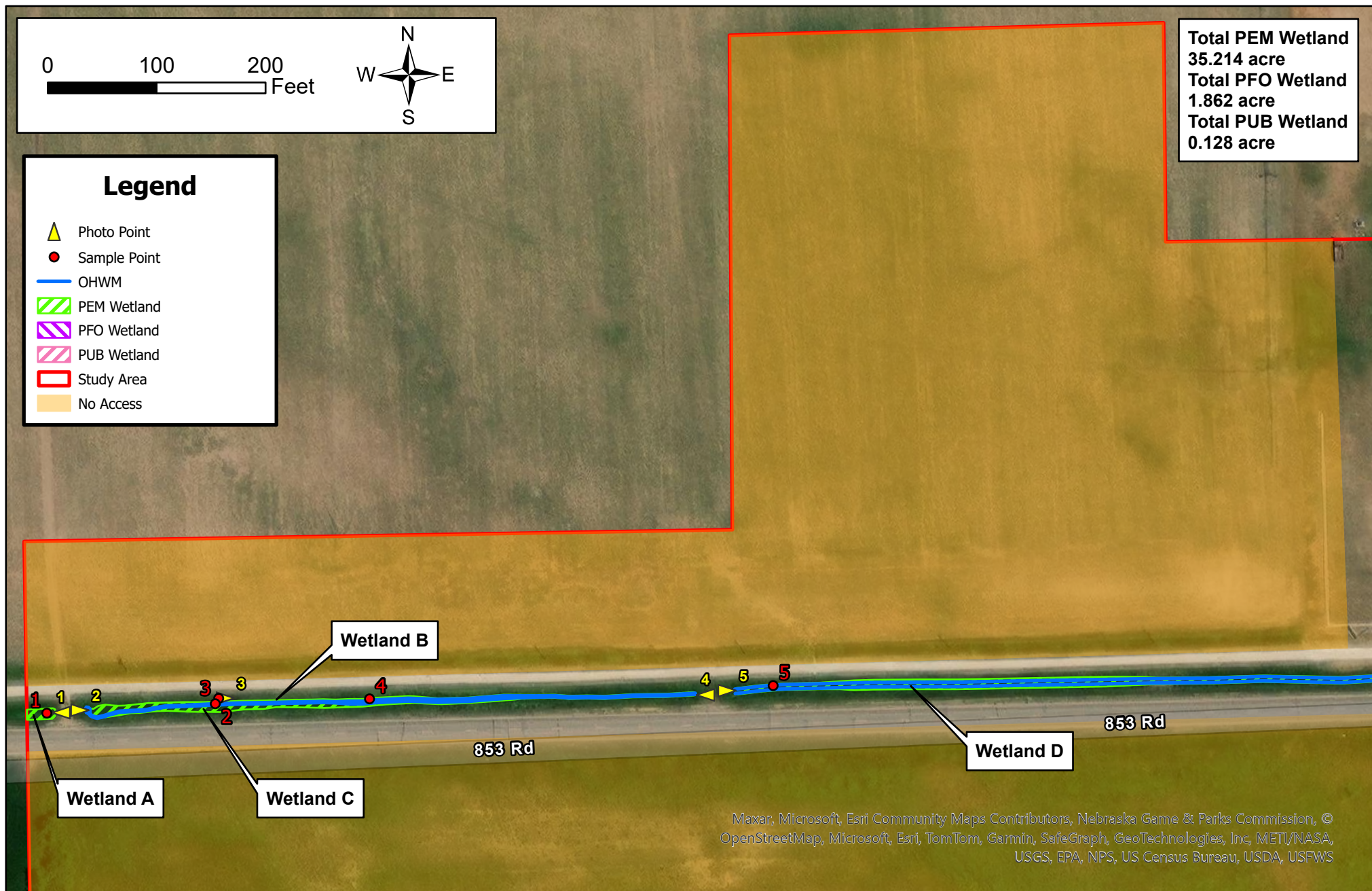


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Figure 6a - Delineated Wetlands / WOTUS
 Pierce County, NE

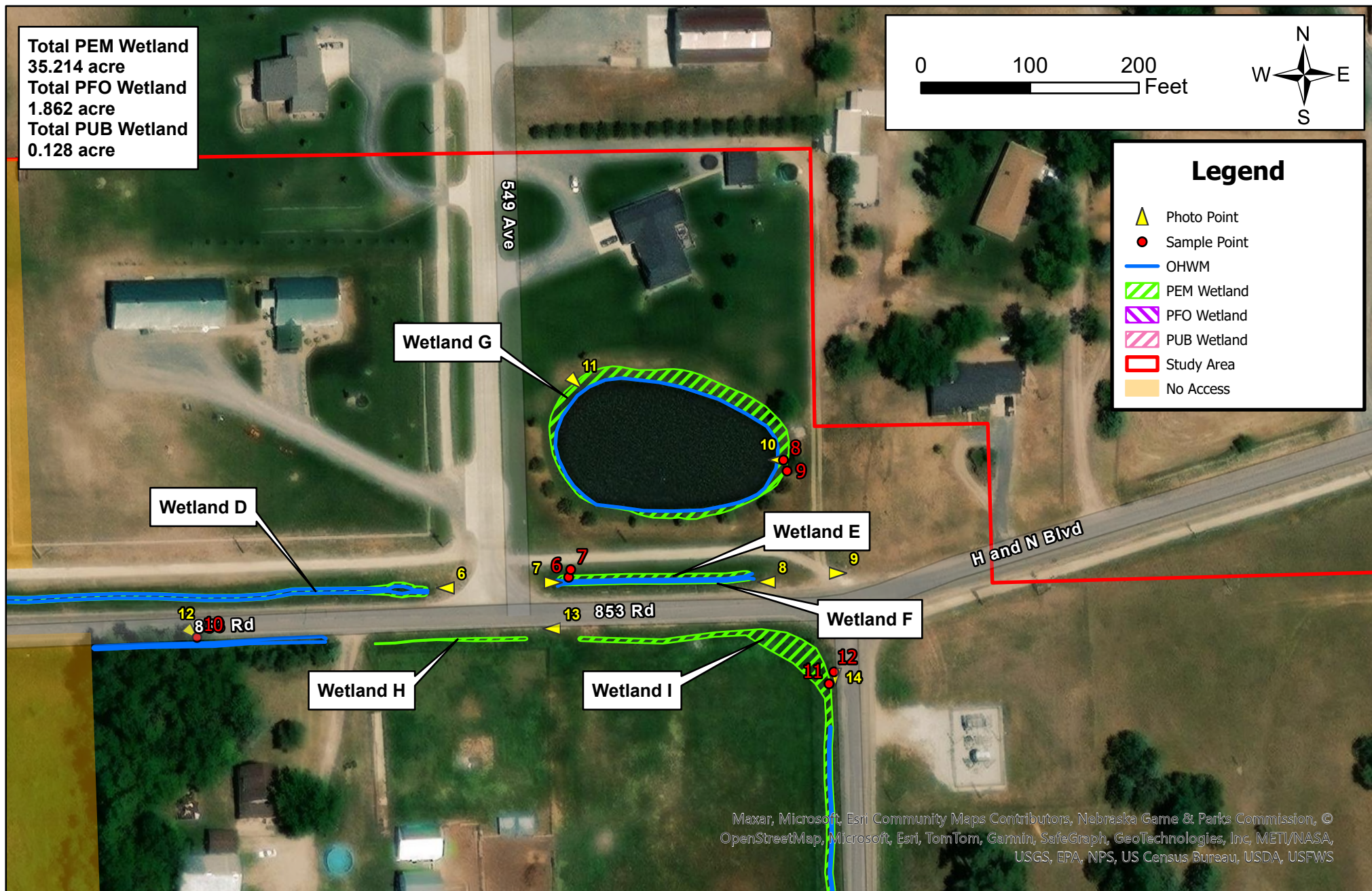


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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6b - Delineated Wetlands / WOTUS
Pierce County, NE



Created By: K. Boden
Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6c - Delineated Wetlands / WOTUS
Pierce County, NE



Total PEM Wetland
35.214 acre
Total PFO Wetland
1.862 acre
Total PUB Wetland
0.128 acre

0 100 200 Feet



Legend

- Photo Point
- Sample Point
- OHWM
- PEM Wetland
- PFO Wetland
- PUB Wetland
- Study Area
- No Access

Wetland I

549 Ave

15

16

14

17

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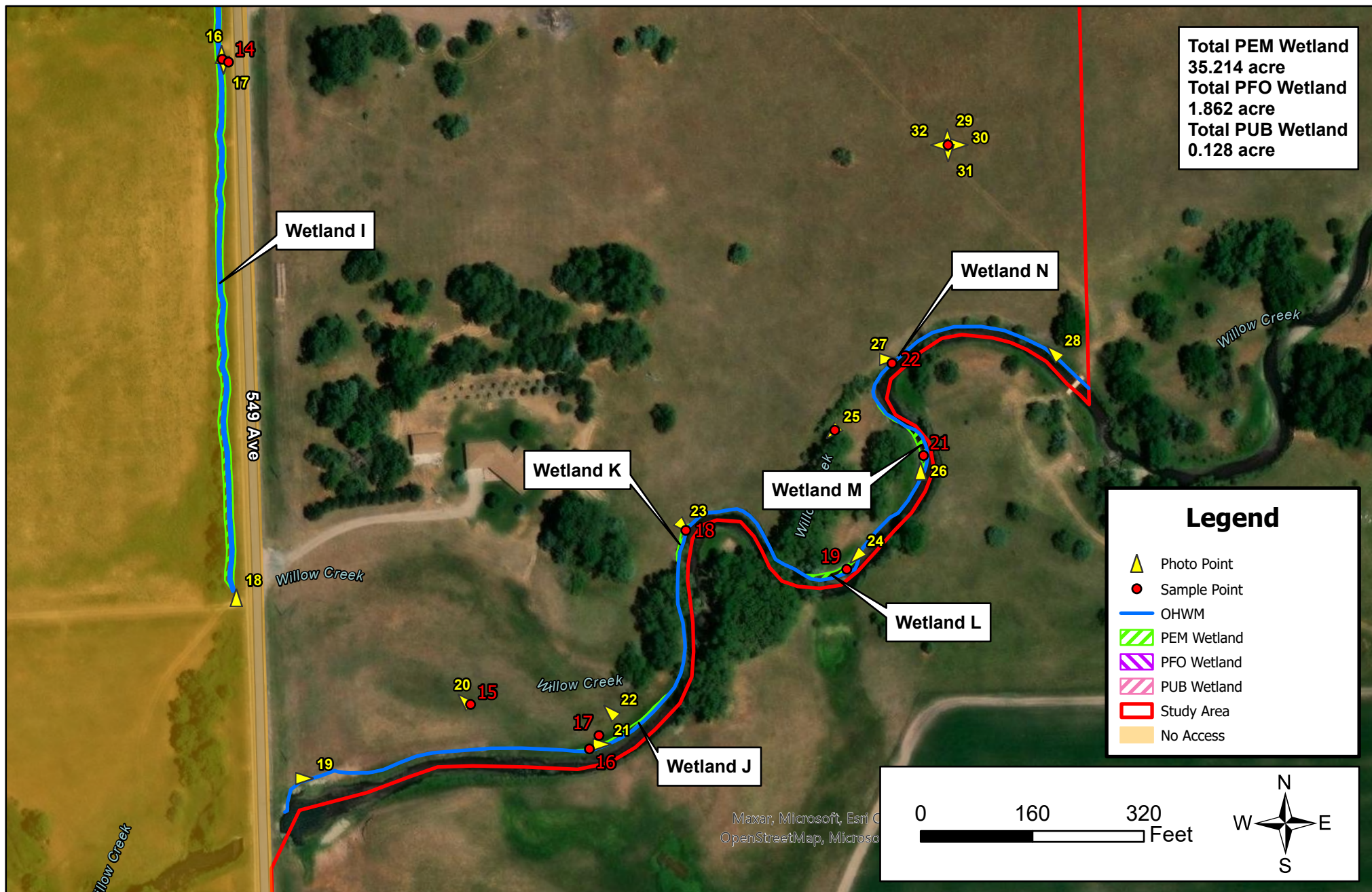
Created By: K. Boden
Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6d - Delineated Wetlands / WOTUS
Pierce County, NE





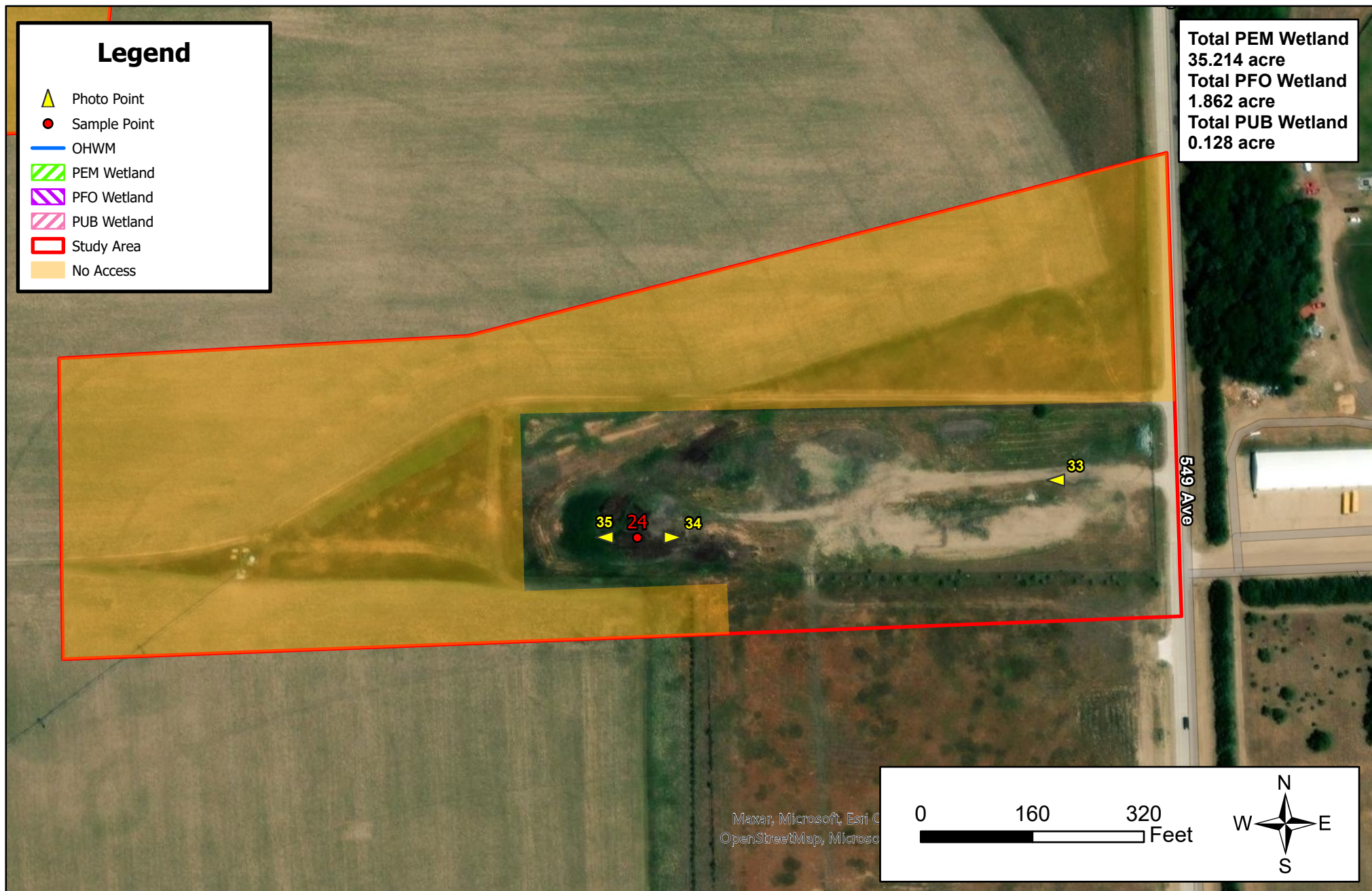
Created By: K. Boden
Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6e - Delineated Wetlands / WOTUS
Pierce County, NE





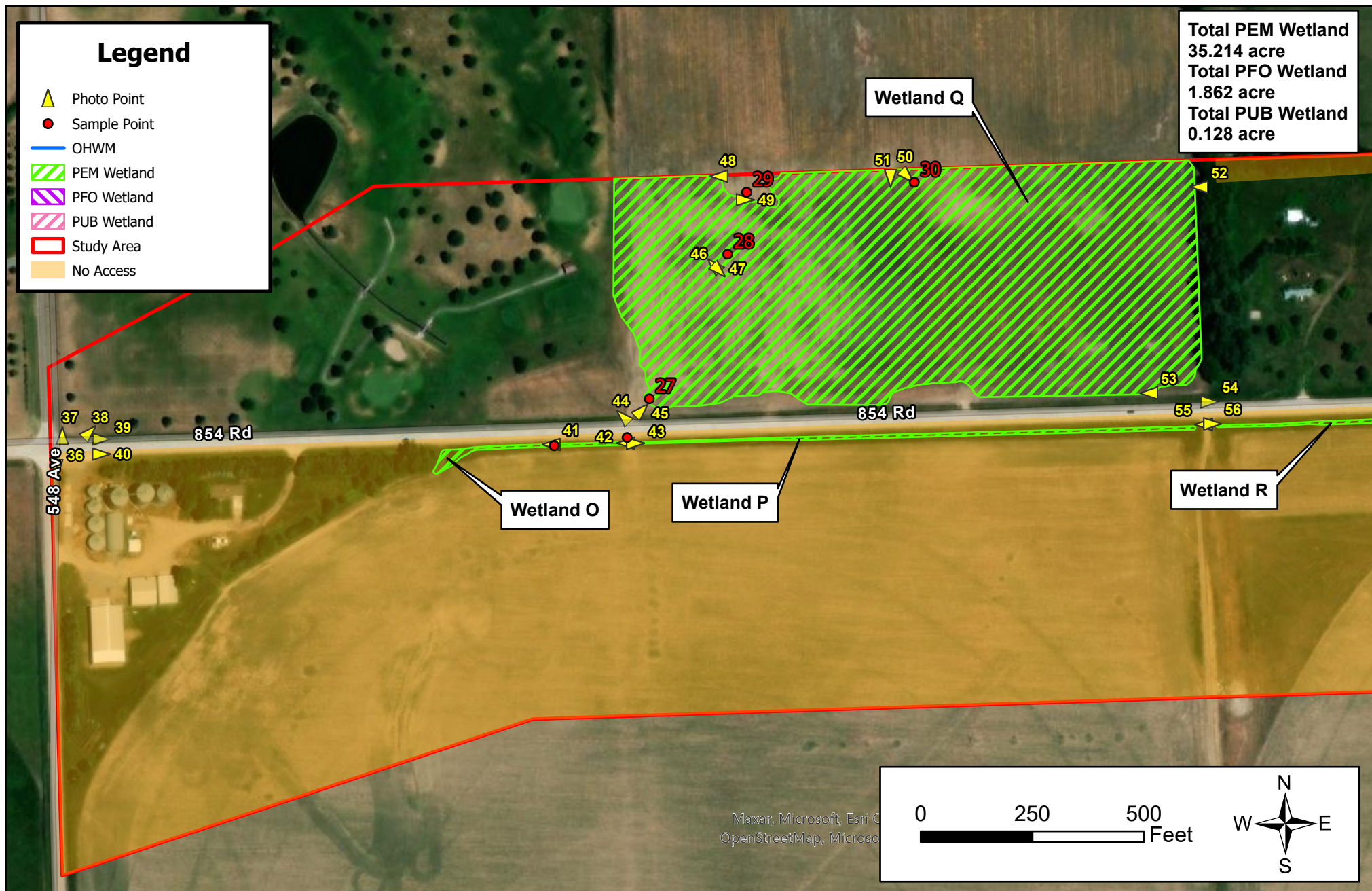
Created By: K. Boden
Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

LENRD North Fork Elkhorn River WFPO Pierce

Figure 6f - Delineated Wetlands / WOTUS
Pierce County, NE

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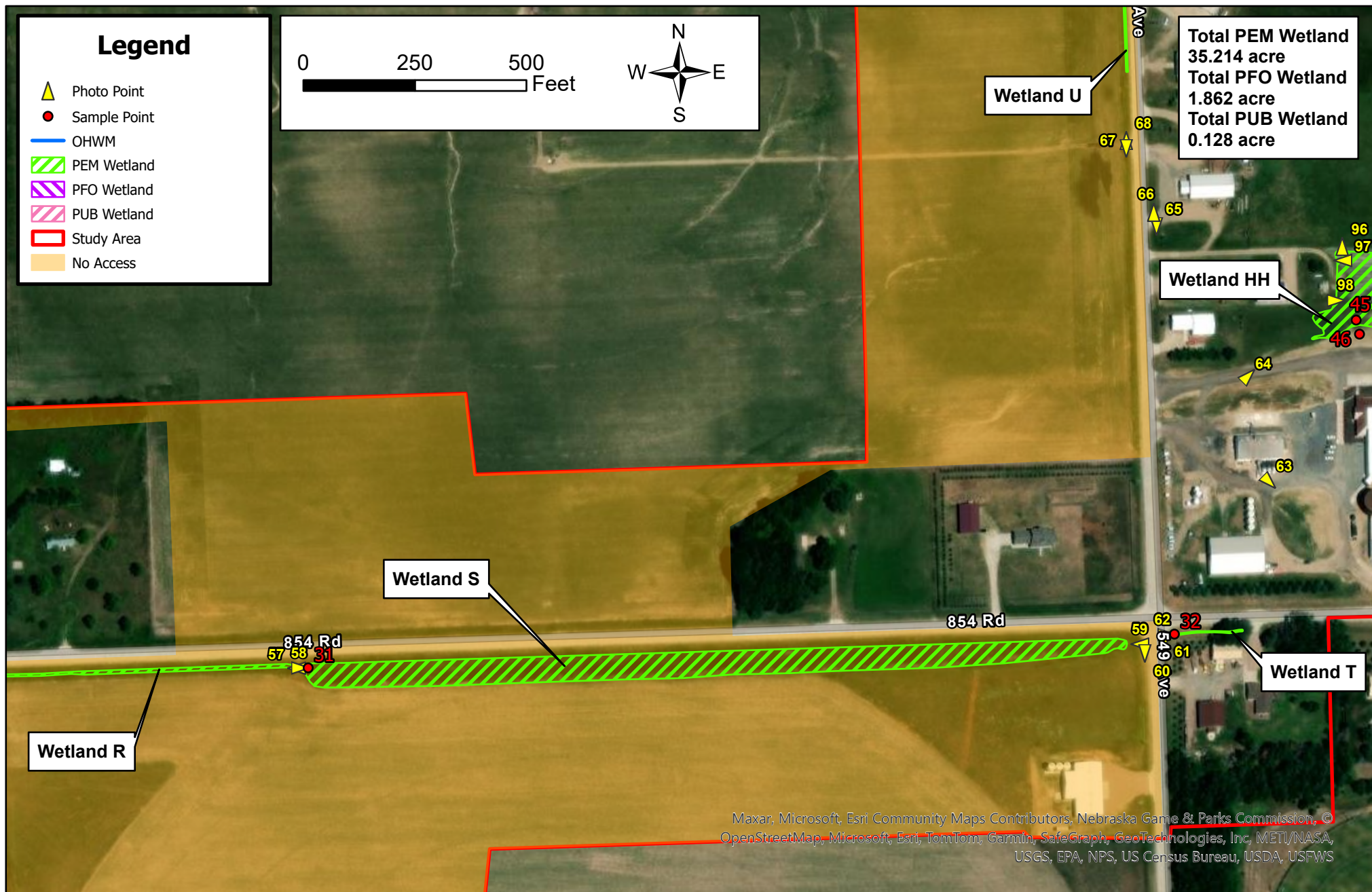
Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6g - Delineated Wetlands / WOTUS
Pierce County, NE





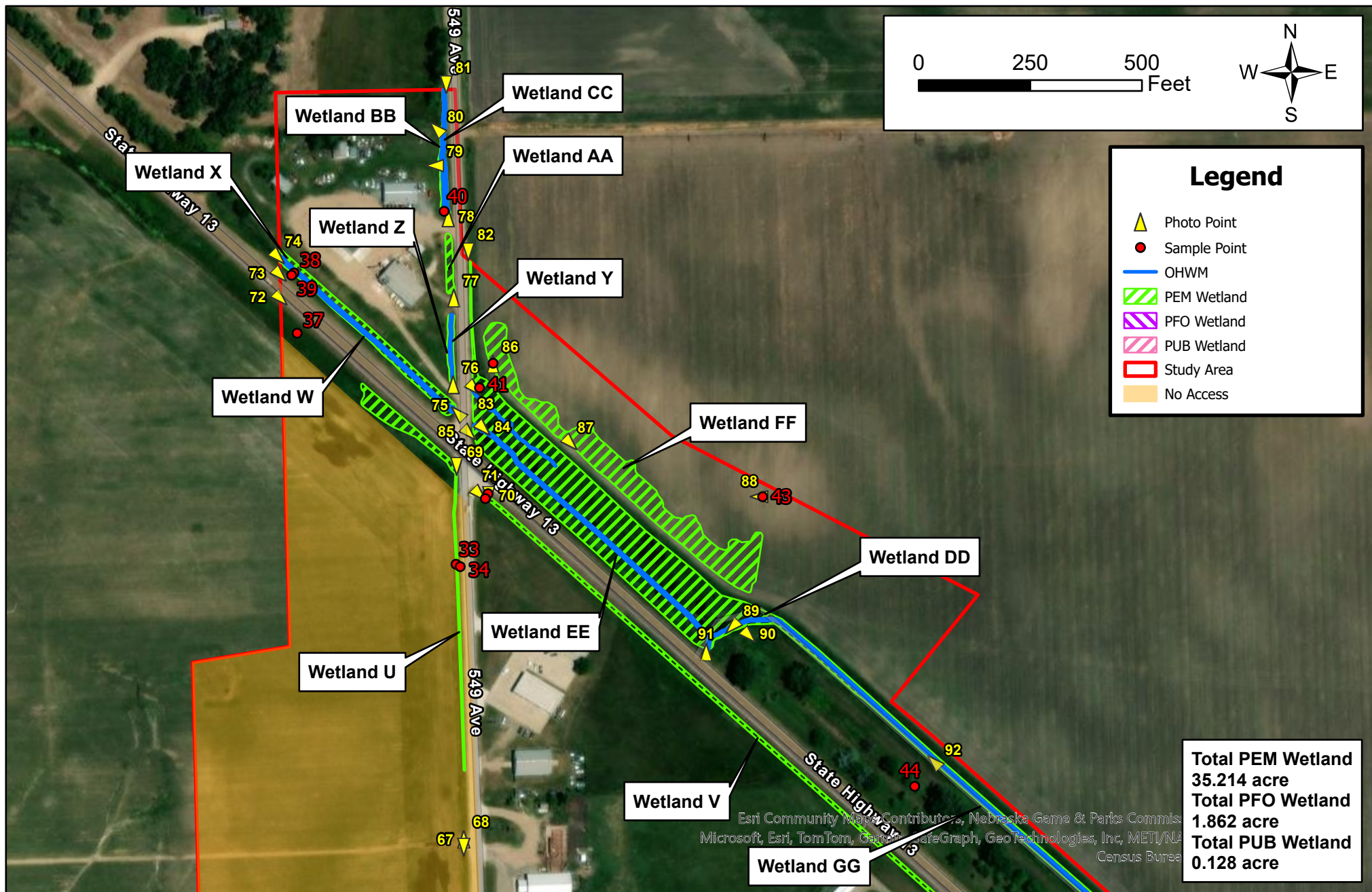
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Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6h - Delineated Wetlands / WOTUS
Pierce County, NE





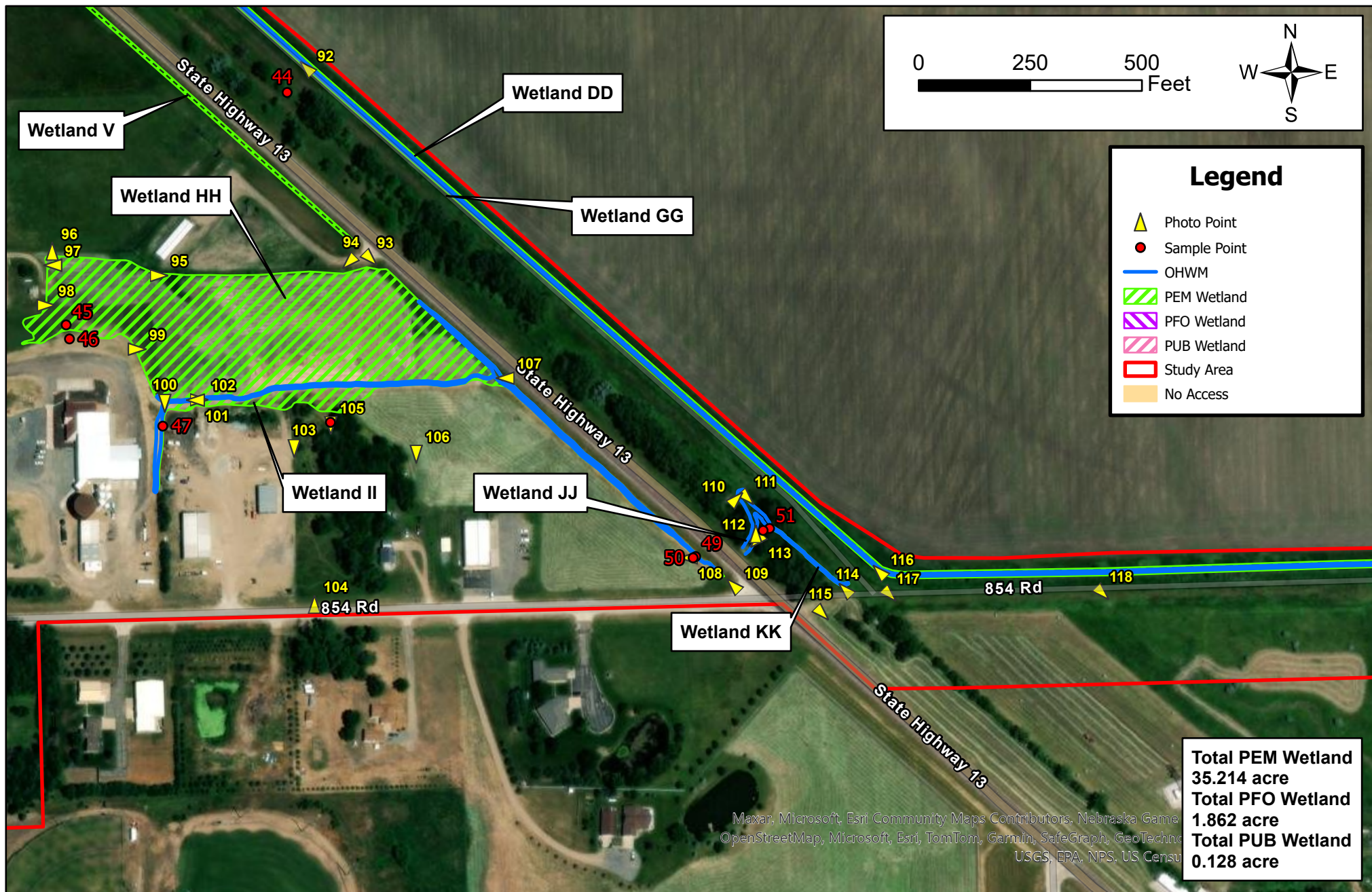
Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6i - Delineated Wetlands / WOTUS
Pierce County, NE



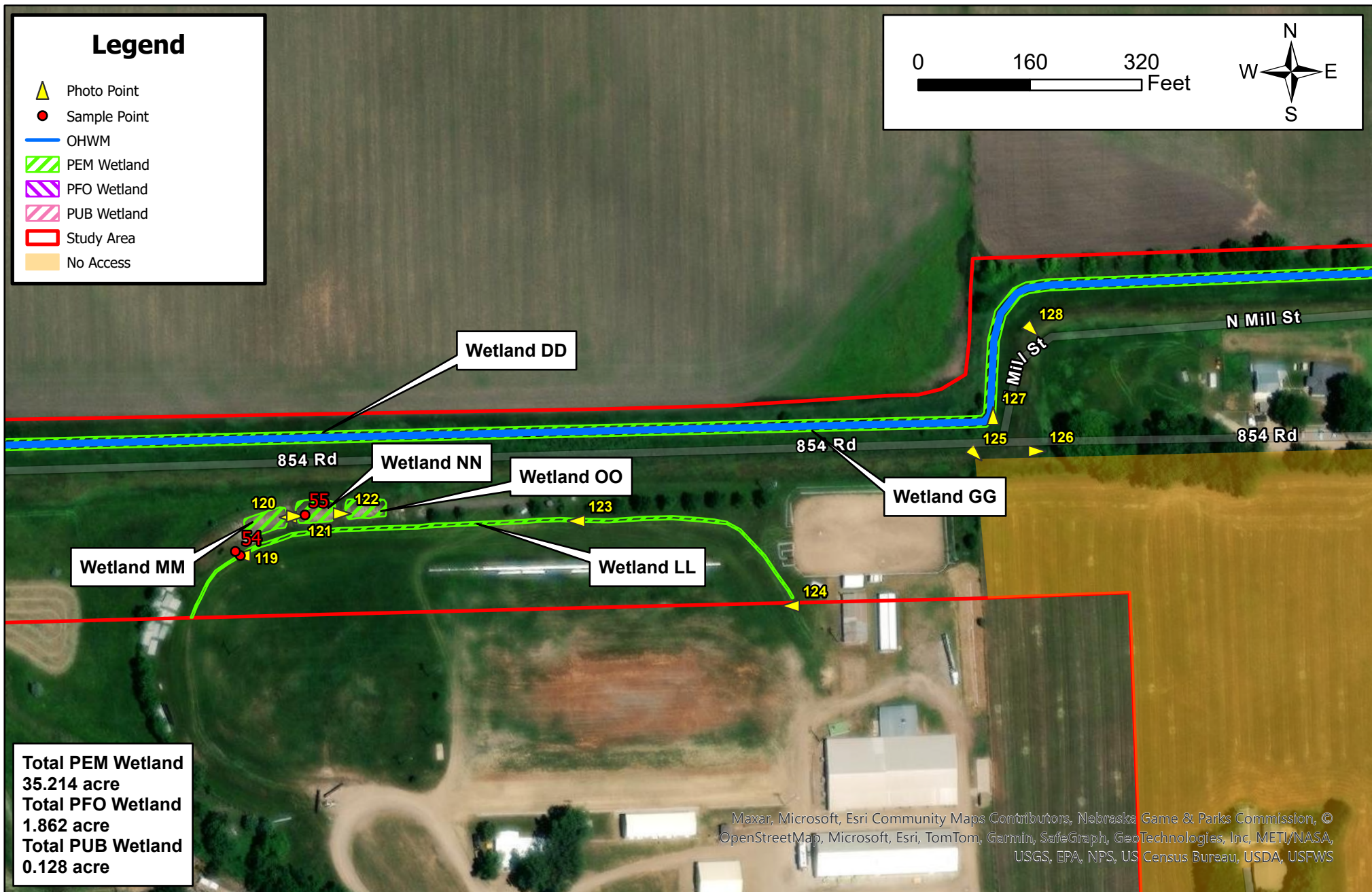


Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6j - Delineated Wetlands / WOTUS
Pierce County, NE



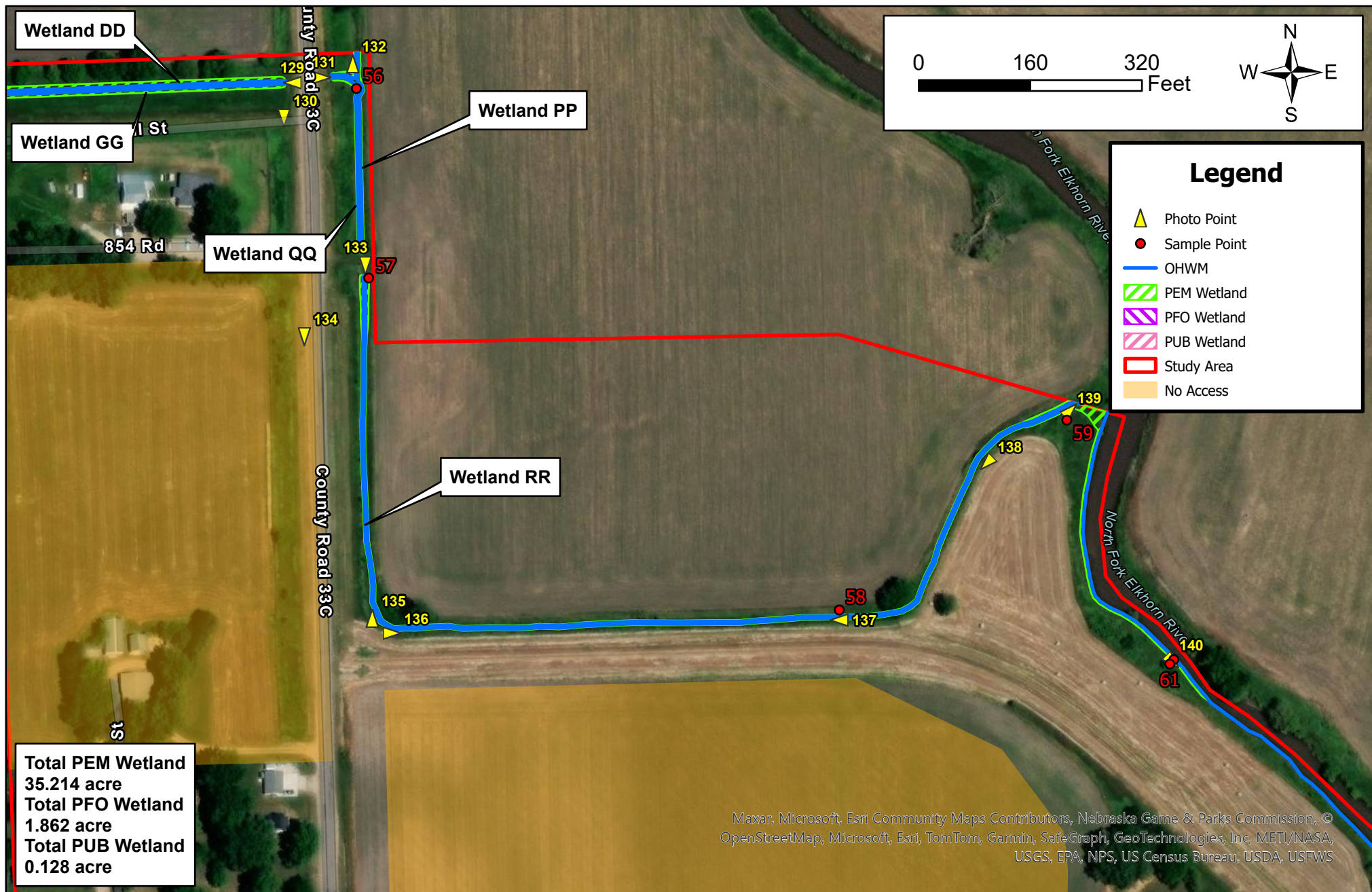
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File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6k - Delineated Wetlands / WOTUS
Pierce County, NE





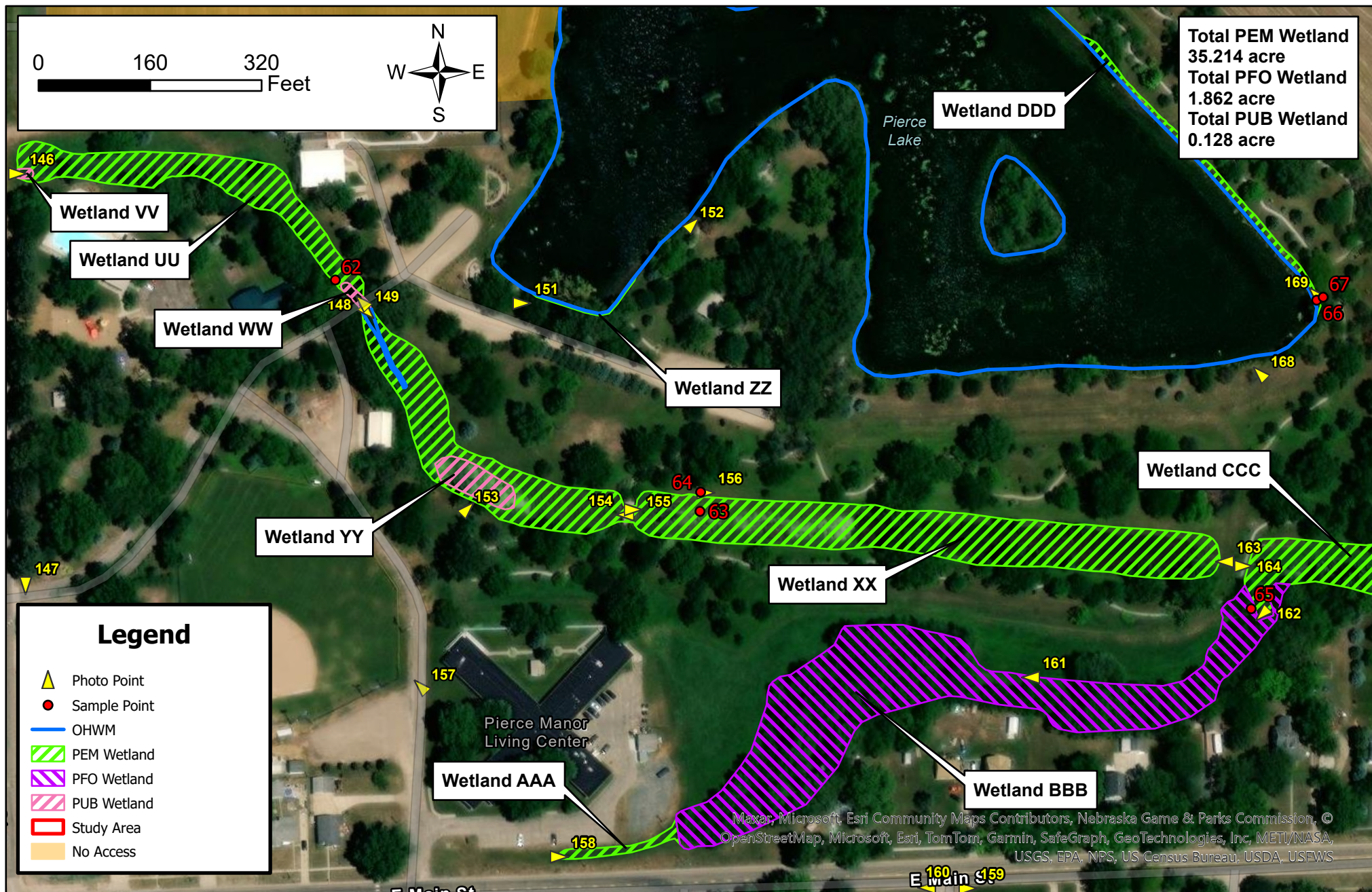
Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 61 - Delineated Wetlands / WOTUS
Pierce County, NE



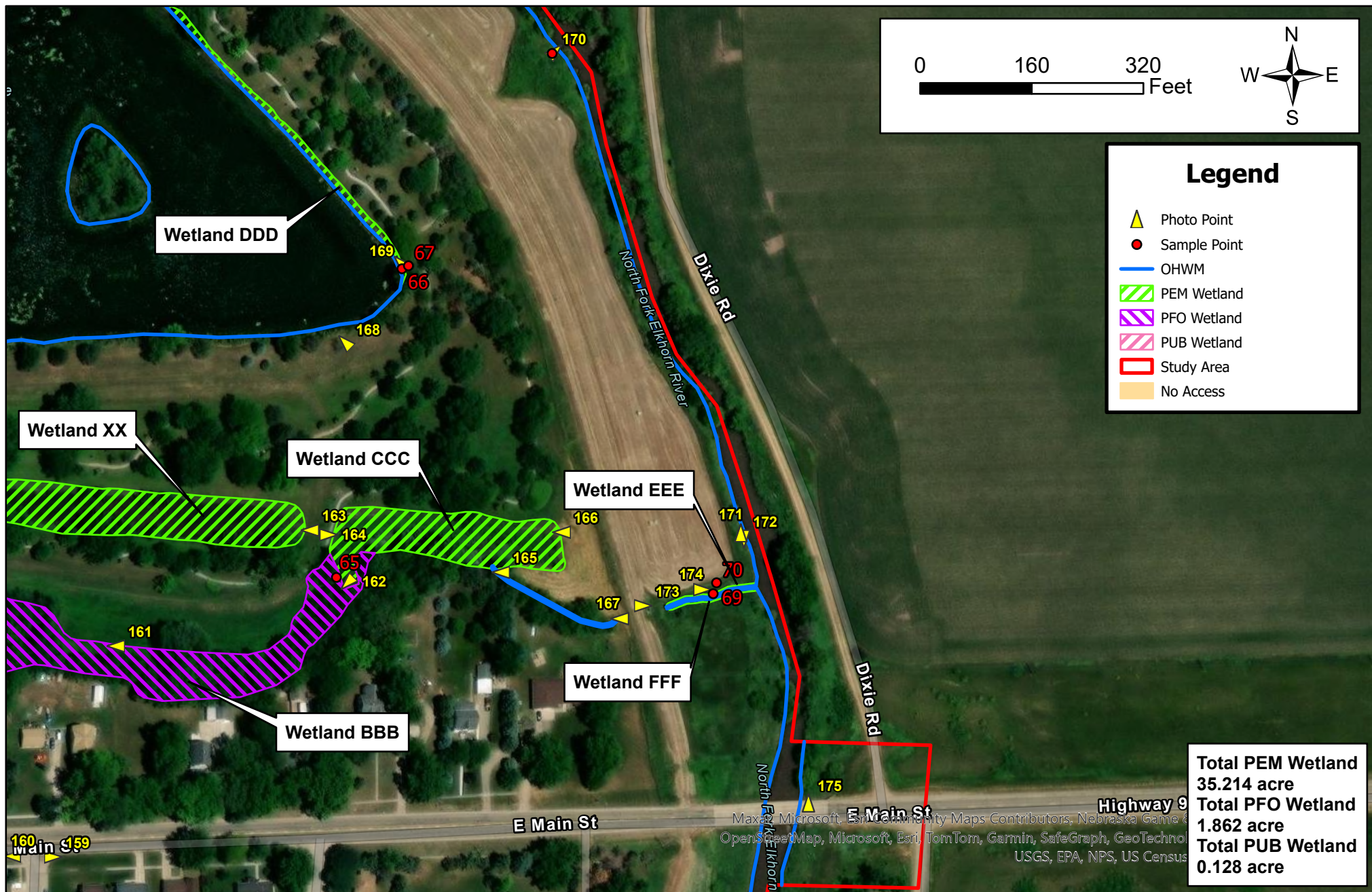


Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6n - Delineated Wetlands / WOTUS
Pierce County, NE



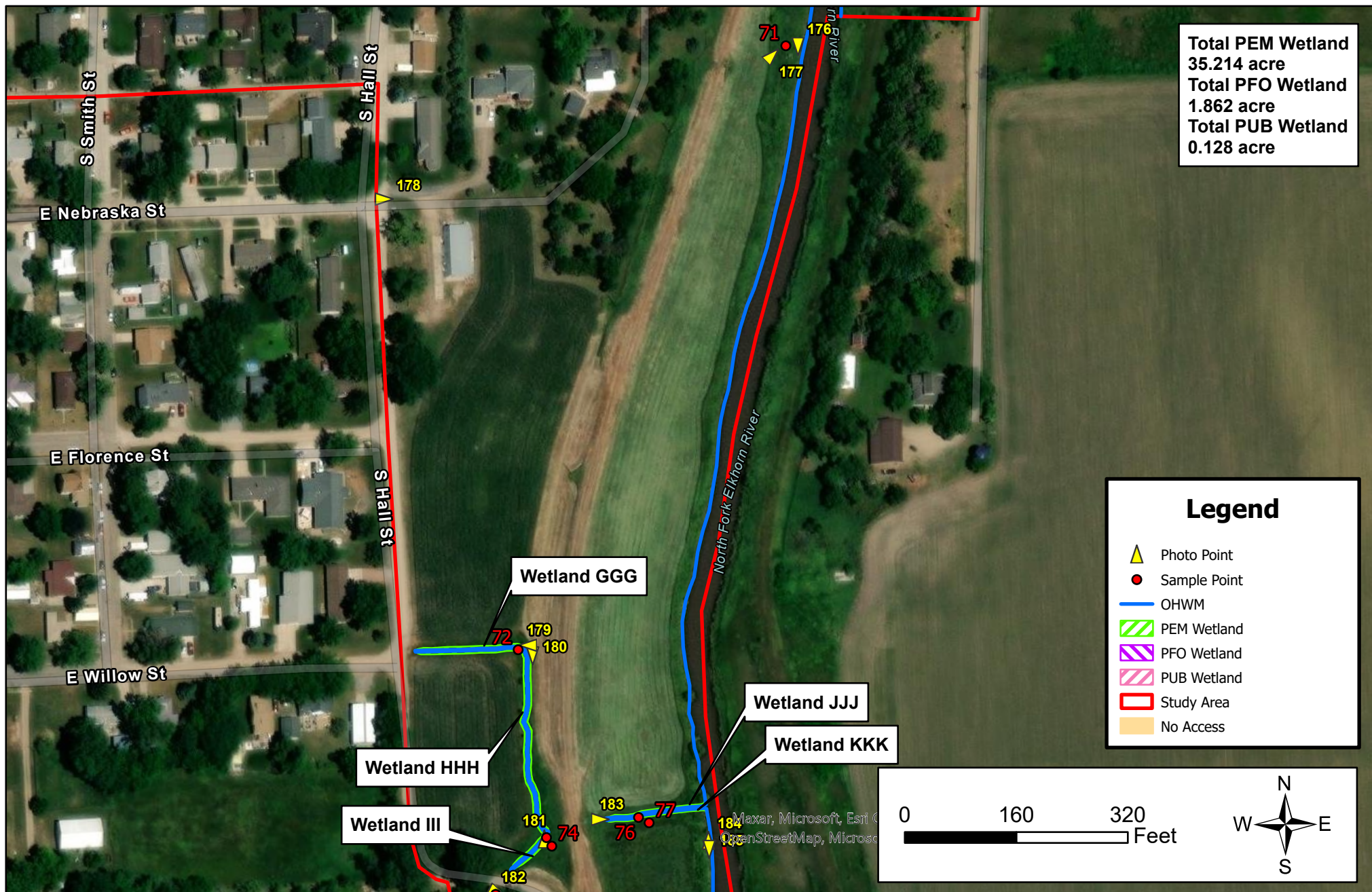
Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFO.aprx

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LENRD North Fork Elkhorn River WFO Pierce

Figure 6o - Delineated Wetlands / WOTUS
 Pierce County, NE





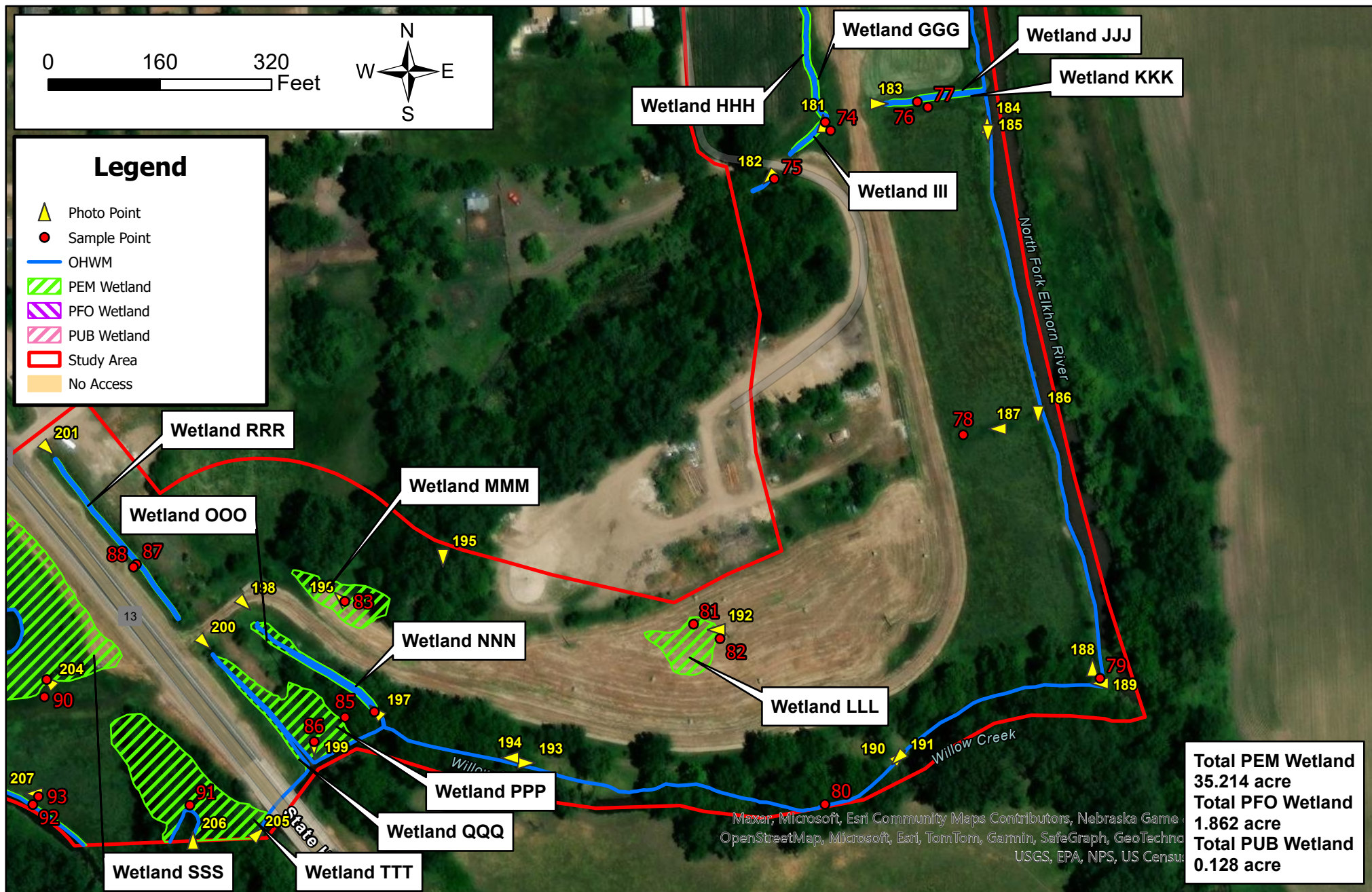
Created By: K. Boden
Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6p - Delineated Wetlands / WOTUS
Pierce County, NE



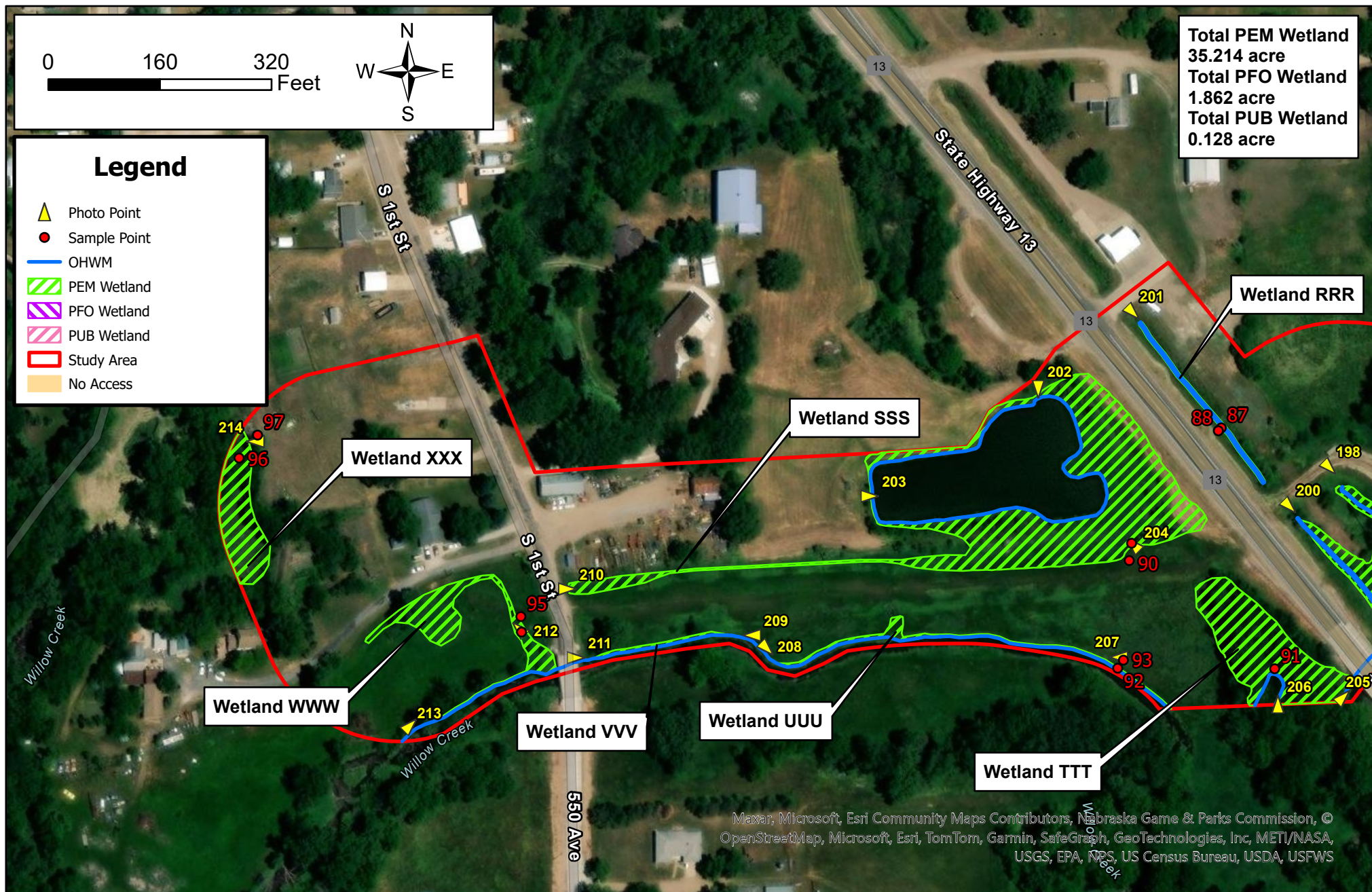


Created By: K. Boden
 Date: 7/29/2024
 Software: ArcGIS Pro 3.3.0
 File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6q - Delineated Wetlands / WOTUS
Pierce County, NE



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Date: 7/29/2024
Software: ArcGIS Pro 3.3.0
File: North Fork Elkhorn WFPO.aprx

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LENRD North Fork Elkhorn River WFPO Pierce

Figure 6r - Delineated Wetlands / WOTUS
Pierce County, NE

Appendix B: Site Photographs



Photo 1 – View looking west toward Sample Point 1. Photo depicts PEM Wetland A within the roadside ditch.



Photo 2 – View looking east along the north side of 853rd Road. Photo depicts Unnamed Stream 1 with PEM Wetlands B and C along the banks.



Photo 3 – View looking east from Sample Point 3. Photo depicts the upland/wetland boundary of PEM Wetland B.



Photo 4 – View looking west along the north side of 853rd Road. Photo depicts Unnamed Stream 1 with PEM Wetlands B and C along the banks.



Photo 5 – View looking east toward Sample Point 5. Photo depicts PEM Wetland D below the OHWM of Unnamed Stream 1.



Photo 6 – View looking west from the intersection of 853rd Road and 549th Avenue. Photo depicts the OHWM of Unnamed Stream 1 with PEM Wetland D along the banks.



Photo 7 – View looking east from the intersection of 853rd Road and 549th Avenue. Photo depicts PEM Wetlands E and F along the banks of Unnamed Stream 1.



Photo 8 – View looking west along the north side of 853rd Road. Photo depicts PEM Wetlands E and F along the banks of Unnamed Stream 1.



Photo 9 – View looking east along the north side of 853rd Road. Photo depicts an upland ditch.



Photo 10 – View looking west from Sample Point 8. Photo depicts Unnamed Pond 1 with PEM Wetland G along the bank.



Photo 11 – View looking southeast from the northwest side of Unnamed Pond 1. Photo depicts PEM Wetland G along the bank.



Photo 12 – View looking southeast toward Sample Point 10. Photo depicts the upland area adjacent to Unnamed Stream 2.



Photo 13 – View looking west along the south side of 853rd Road. Photo depicts PEM Wetland H within the roadside ditch.



Photo 14 – View looking south from Sample Point 12. Photo depicts the upland/wetland boundary of PEM Wetland I.



Photo 15 – View looking east from the east side of 549th Avenue. Photo depicts an upland pasture.



Photo 16 – View looking north from Sample Point 13. Photo depicts PEM Wetland I along the banks of Unnamed Stream 3.



Photo 17 – View looking south from Sample Point 13. Photo depicts PEM Wetland I along the banks of Unnamed Stream 3.



Photo 18 – View looking north along the west side of 549th Avenue. Photo depicts PEM Wetland I along the banks of Unnamed Stream 3.



Photo 19 – View looking east from the east side of 549th Avenue. Photo depicts the northern bank of Willow Creek.



Photo 20 – View looking northwest from Sample Point 15. Photo depicts an upland pasture.



Photo 21 – View looking east from Sample Point 16. Photo depicts PEM Wetland J along the bank of Willow Creek.



Photo 22 – View looking northwest from PEM Wetland J. Photo depicts the upland area adjacent to the wetland.



Photo 23 – View looking southeast toward Sample Point 18. Photo depicts PEM Wetland K along the bank of Willow Creek.



Photo 24 – View looking southwest toward Sample Point 19. Photo depicts PEM Wetland L along the bank of Willow Creek.



Photo 25 – View looking southwest from Sample Point 20. Photo depicts a swale near Willow Creek. No wetlands were present.



Photo 26 – View looking north toward Sample Point 21. Photo depicts PEM Wetland M along the bank of Willow Creek.



Photo 27 – View looking east toward Sample Point 22. Photo depicts PEM Wetland N along the bank of Willow Creek.



Photo 28 – View looking northwest from the eastern boundary of the study area. Photo depicts the OHWM of Willow Creek.



Photo 29 – View looking north from Sample Point 23. Photo depicts an upland pasture.



Photo 30 – View looking east from Sample Point 23. Photo depicts an upland pasture.



Photo 31 – View looking south from Sample Point 23. Photo depicts an upland pasture.



Photo 32 – View looking west from Sample Point 23. Photo depicts an upland pasture.



Photo 33 – View looking west from the west side of 549th Avenue. Photo depicts an upland area.



Photo 34 – View looking east from Sample Point 24. Photo depicts an upland area.



Photo 35 – View looking west from Sample Point 24. Photo depicts an upland area.



Photo 36 – View looking south along the east side of 548th Avenue. Photo depicts an upland roadside ditch.



Photo 37 – View looking north along the east side of 548th Avenue. Photo depicts an upland roadside ditch.



Photo 38 – View looking northeast from the north side of 854th Road. Photo depicts a pasture.



Photo 39 – View looking east along the north side of 854th Road. Photo depicts an upland roadside ditch.



Photo 40 – View looking east along the south side of 854th Road. Photo depicts an upland roadside ditch.



Photo 41 – View looking west from Sample Point 25. Photo depicts PEM Wetland O within the roadside ditch.



Photo 42 – View looking west along the south side of 854th Road. Photo depicts PEM Wetland O within the roadside ditch.



Photo 43 – View looking east along the south side of 854th Road. Photo depicts PEM Wetland P within the roadside ditch.



Photo 44 – View looking northwest on the north side of 854th Road. Photo depicts an upland pasture.



Photo 45 – View looking northeast toward Sample Point 27. Photo depicts PEM Wetland Q within a row-crop field.



Photo 46 – View looking northwest near Sample Point 28. Photo depicts PEM Wetland Q within a row-crop field.



Photo 47 – View looking southeast near Sample Point 28. Photo depicts PEM Wetland Q within a row-crop field.



Photo 48 – View looking west along the northern boundary of the study area. Photo depicts the upland area adjacent to PEM Wetland Q.



Photo 49 – View looking east near Sample Point 29. Photo depicts the upland/wetland boundary of PEM Wetland Q.



Photo 50 – View looking southeast toward Sample Point 30. Photo depicts PEM Wetland Q within a row-crop field.



Photo 51 – View looking south from the northern boundary of the study area. Photo depicts PEM Wetland Q within a row-crop field.



Photo 52 – View looking west from the eastern boundary of PEM Wetland Q. Photo depicts the wetland within a row-crop field.



Photo 53 – View looking west along the north side of 854th Road. Photo depicts the southern boundary of PEM Wetland Q.



Photo 54 – View looking east along the north side of 854th Road. Photo depicts an upland roadside ditch.



Photo 55 – View looking west from the south side of 854th Road. Photo depicts PEM Wetland P within the roadside ditch.



Photo 56 – View looking east from the south side of 854th Road. Photo depicts PEM Wetland R within the roadside ditch.



Photo 57 – View looking west from the south side of 854th Road. Photo depicts PEM Wetland R within the roadside ditch.



Photo 58 – View looking east toward Sample Point 31. Photo depicts PEM Wetland S within a roadside ditch.