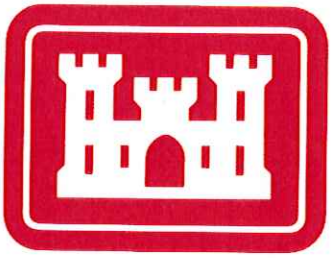
Fargo-Moorhead Metropolitan Area Flood Risk Reduction Project Wetland Determination Report Fargo, North Dakota/Moorhead, Minnesota

Wetland Determination Report For:
U.S. Army Corps of Engineers
Civil Works



US Army Corps of Engineers

St. Paul District

Wetland Determination Performed by:
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July 13, 2011

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Introduction

During the 2010 growing season, the St. Paul District Army Corps of Engineers (ACOE) Regulatory Branch performed a wetland determination on behalf of St. Paul District ACOE Civil Works for the proposed corridor alternatives for the flood diversion of the Red River of the North around the Fargo-Moorhead metropolitan area (Note: hereinafter "Diversion" will be used and refers to all alternatives). Project location and alignment corridors for both the North Dakota and Minnesota alternatives are shown on Figure 1. Documentation of the wetland and other aquatic resources potentially impacted by the proposed Diversion was provided for Final Environmental Impact Statement (FEIS) required by the National Environmental Policy Act (NEPA). Additional project information can be found in detail in the FEIS.

Note: Forested wetland resources were not identified for this report. All forested resources, including forested wetlands, were identified and assessed under a separate section of the FEIS, therefore they were not included in this effort. In addition, areas of wetland outside of the diversion right-of-way footprint were not identified.

Methods

ACOE utilized the procedures outlined in the *1987 US Army Corps of Engineers Wetlands Delineation Manual* (Manual) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)* (Supplement) to perform the wetland determination. The Corps Training Team utilized the routine (Level 3) method (Manual Part IV, Section D, Subsection 3) outlined in the Manual with substantial effort spent with off-site review and field data collection made at representative locations. Therefore, the results of this effort comprise a determination of wetland locations, rather than a wetland delineation.

Definitions of key terms as used in this report relevant to wetland determinations:

Normal circumstances – The soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed. (Manual)

Managed plant communities – Many natural plant communities throughout the Great Plains have been altered and are managed to meet human goals. Examples related to the Red River Valley include periodic disking or plowing, planting of non-native species such as agricultural cultivars and the use of herbicides. (Supplement)

Wetland hydrology – An area has wetland hydrology if it is periodically inundated or has soils saturated to the surface at some time during the growing season. (Manual)

Growing season – The growing season has begun on a site in a given year when either (1) two or more species of non-evergreen vascular plants exhibit biological activity (growth such as bud break or emergence from the ground), or (2) the soil temperature measured at the 12-in. depth is 41°F (5°C) or higher. For this region of North Dakota/Minnesota in the Red River Valley, the

start of the growing season averages during early- to mid-April and is typically two to three weeks earlier than safe planting dates for agricultural crops. (Supplement)

Off-Site Review

The following information was included in the off-site review:

- "Wetland Delineation Precipitation Data Retrieval from a Gridded Database" website, Minnesota Climatology Working Group
- Aerial photography obtained by the Corps:
  - USDA Farm Services Agency (FSA) Aerials 2003 -2006 and 2009-2010
- LiDAR data (2010)
- USDA digital Soil Survey Mapping/Web Soil Survey

Note: While the National Wetlands Inventory (NWI) mapping is an excellent tool that is used on a regular basis for initial identification of potential wetland areas, there are limitations with this mapping in agricultural regions. Through an interagency agreement developed in the 1970s between the U.S. Fish and Wildlife Service and the U.S.D.A. Natural Resources Conservation Service, "NWI maps, by design, do not show many farmed wetlands in most of the country [leading] to a significant underestimate of the amount of wetland in agricultural regions" (National Wetlands Newsletter, Vol. 19, No. 2, 1997). Therefore, NWI was not relied upon for identifying wetland resources along the project corridors.

Off-site procedures followed the concepts outlined in the Wetland Mapping Conventions for the State of Minnesota in the 1994 Interagency Cooperative Agreement and the Joint Mapping Conventions for North Dakota and South Dakota. However, due to the time constraints for reviewing the extremely large project area and because the State Mapping Conventions were developed prior to the advent of LiDAR and did not take into account the accuracy afforded with this data, professional judgment was ultimately employed in applying the Mapping Conventions on a qualitative rather than quantitative level. Not all land could be reviewed with every aerial available to measure the percentage of normal years with wet signatures that a particular wetland area exhibited. Rather, as noted below, LiDAR elevation data was correlated to areas with repeated signatures of wetness. (Note: October 2010 update to the North/South Dakota State Mapping Conventions and proposed update to Minnesota State Mapping Conventions both include the use of LiDAR data.)

The NRCS *Hydrology Tools* for *Wetland Delineation Procedure* (August, 1997) and Corps of Engineers guidance *Assessing and Using Meteorological Data to Evaluate Wetland Hydrology* (April, 2000) both recommend evaluation of precipitation for the 3 months prior to the date of the imagery and field site visits to assist in making determinations of normal circumstances. In general, for this northern portion of the country, aerial photography flights to create FSA slides are conducted during the last week of June or first week of July. Unless a specific date was provided for any aerials reviewed, July 1 was used as the date for determining antecedent precipitation, with April, May and June used as the 3-months prior. Using the "Wetland Delineation Precipitation Data Retrieval" website developed by the Minnesota Climatology Working Group (http://climate.umn.edu/wetland/), antecedent precipitation was obtained for the 3-months prior to every aerial photograph reviewed and site visit and then analyzed relative to the range of normal for that period (dry, normal or wet).

The presence of signatures due to wetness was identified in each of the aerials reviewed. As indicated in the State Mapping Conventions, a photo identified as taken following 'wet' antecedent precipitation, in this case 2005, was used to identify all possible locations of wetland areas. Remaining available aerials were then reviewed for recurring signatures of wetness. It appears that crops were planted later than usual in 2010, leaving the 2010 aerial with more ground surface visible than if the crops were in a later stage of growth and obscuring the ground surface. The July 2010 aerial best shows the lower lying areas in the landscape with regular signatures of wetness throughout the review. Finally, using ArcMap 10 with the detailed topographic mapping available from the LiDAR data and the 2009/2010 FSA aerial photographs (normal years), wetland lines were digitized around the lowest spots on the landscape corresponding to regular signatures of drown outs, crop stress, altered or late planting, brighter green areas in dry years and/or low albedo (areas of darker soil). (Albedo is the fraction of the total light striking a surface that is reflected back from that surface. An object that has a high albedo (near 1) is very bright; an object that has a low albedo (near 0) is dark.)

A note about soil saturation in aerial photography: While some might argue that X-ray vision is required to 'see' soils saturated within 12" on aerial photography, areas of low albedo in some years of aerial review exhibit a strong correlation to both the lower elevations identified in LiDAR and other signatures of wetness such as crop stress and drown outs. Furthermore, soils in the project area are predominantly mapped as fine-textured clays or silty clays, a high percentage of which are hydric soils from which some of the surface water is drained. Therefore, soils lower in the landscape would remain wet longer, resulting in areas with lower albedo due to wetness.

Figures LPP 1-4 of 4 and FCP 1-3 of 3 in Appendix A were developed to display the wetland polygons located within the project corridors, overlaid on 2009 FSA Aerial photography. Antecedent precipitation prior to the 2009 aerial flight was a normal.

On-Site Field Review

Antecedent precipitation was analyzed prior to each field review, as well as in relation to dates of aerial photography. On July 1-2, 2010, the team reviewed all Diversion Corridor alignments to ground-truth the images and signatures previously identified on aerial photography as wetland areas. Antecedent precipitation for this field review was normal. Following this ground-truthing field review, the team completed the off-site mapping of all the wetlands within the study area through July 2010. During July 27-30, 2010 the team returned to the study area to complete representative transects/data collection and functional assessments, using the Manual, the Supplement and Minnesota Routine Assessment Methodology for Evaluating Wetland Functions (MnRAM), Version 3.3, refining the extent of wetlands within all off-site mapped areas. Antecedent precipitation prior to the final field review at the end of July 2010 was wet, with nearly two inches of rain falling on July 27-28, 2010 in the project area. This precipitation provided the team with first-hand observations of the geomorphic positions in the landscape to which water flows.

Due to time constraints and similarity of the vast majority of wetlands within the study area, Corps staff chose not to delineate or assess functionality on every area determined to be

wetland. Instead, at least one randomly-chosen area representative of each type of wetland found within the Diversion alignments was verified through data collection along a transect and assessed for typical functionality. Sample points were taken to document the vegetation, soils, and hydrology indicators within representative upland and wetland locations. As part of the field verification process, soil pits were dug to at least 16 inches to describe the soil colors, using Munsell soil color charts, and to observe any hydrology indicators. Vegetation was documented using the standard plot sizes of a 30-foot radius for trees and woody vines, a 15-foot radius for saplings/shrubs, and a 5-foot radius for herbaceous species and woody seedlings. Percent areal cover was recorded for each plant species and dominants were determined using the "50/20 Rule." Ditch depths throughout the project corridors were estimated for use in lateral effect calculations.

Wetland plant communities were classified using the USACOE - St. Paul District, Eggers and Reed "Wetland Plants and Plant Communities of MN and WI" (1997). The wetland indicator status of plants was determined using the National List of Plant Species That Occur in Wetlands – Region 3 (1988). In accordance with the Great Plains Regional Supplement, the + and – have NOT been removed from the vegetation indicator status.

The determined wetland boundaries are depicted in Appendix A as Figures LPP 1-4 of 4 and FCP 1-3 of 3, overlaid on the 2009 Farm Services Agency (FSA) aerial imagery.

Assessment of impacts to aquatic resources as a result of the proposed Red River Diversion channels included completion of MnRAM V. 3.3 analyses on representative sites within the Diversion Corridors. As stated above, time constraints and similarity of wetlands within the study area allowed Corps staff to assess representative wetlands of each type found within the Diversion alignments. (Note: Although forested wetlands were not identified for this document, a short statement about the functionality of forested wetlands in the project area is included.)

Results

Off-Site Results and Discussion

Soil series in the project area are provided in Tables 1a and 1b. Table 1a lists soils found within the Minnesota Diversion, where at least 63% of the area is hydric soil. Table 1b lists soils found within the North Dakota Diversion, where over 90% of the area is hydric soil. Soils of the study area are dominantly associated with lake plains and floodplains and formed in calcareous clayey lacustrine sediments. They are very deep, poorly and very poorly drained and slowly permeable. Slope gradients are commonly less than 1 percent but range from 0 to 6 percent, with steeper slopes associated with side slopes of streams. Runoff is negligible except where accommodated by slope. Saturated hydraulic conductivity is slow. A system of surface drains associated with road ditches, section lines and agricultural fields remove surface (ponded) water from most soils[1]. A seasonal high water table is at the surface to about 3.0 feet below the surface at some time during the period of March through July; in lower lying depressional areas the water table is 1.0 foot above the surface to 2.0 feet below the surface at some time during the

[1] Land leveling is commonly practiced by agricultural producers in this region and aids in removing ponded water.

period of February through August. (Source: Official Soil Series Descriptions. USDA, NRCS. 2010).

Table 1a – Soils in Minnesota Diversion Corridor

Soil Series	Taxonomic Class	Map Units Present	Hydric	Approx. % of Corridor
Augsburg	Coarse-silty over clayey, mixed over smectitic, superactive, frigid Typic Calciaquolls	**a)** Augsburg silt loam	Yes	1
Bearden	Fine-silty, mixed, superactive, frigid Aeric Calciaquolls	**a)** Bearden silty clay loam; **b)** Bearden silt loam, 0-2% slopes	No	26
Colvin	Fine-silty, mixed, superactive, frigid Typic Calciaquolls	**a)** Colvin silty clay loam	Yes	11
Fargo	Fine, smectitic, frigid Typic Epiaquerts	**a)** Fargo silty clay, 0-2% slopes; **b)** Fargo silty clay, Swales; **c)** Fargo silty clay loam	Yes	48
Hegne w/Fargo inclusion	Fine, smectitic, frigid Typic Calciaquerts	**a)** Hegne-Fargo silty clays	Yes	1
Overly	Fine-silty, mixed, superactive, frigid Pachic Hapludolls	**a)** Overly silty clay loam	Partial	3
Wahpeton	Fine, smectitic, frigid Typic Hapluderts	**a)** Wahpeton silty clay. 0-2% slopes	No	2
Wheatville	Coarse-silty over clayey, mixed over smectitic, superactive, frigid Aeric Calciaquolls	**a)** Wheatville silt loam, 0-2% slopes	No	8

Table 1b – Soils in North Dakota Diversion Corridor

Soil Series	Taxonomic Class	Map Units Present	Hydric	Approx. % of Corridor
Bearden	Fine-silty, mixed, superactive, frigid Aeric Calciaquolls	**a)** Bearden silty clay loam	Partial	2
Cashel	Fine, smectitic, calcareous, frigid Aquertic Udifluvents	**a)** Cashel silt clay	Partial	2

Dovray	Fine, smectitic, frigid Cumulic Vertic Epiaquolls	**a)** Dovray silty clay	Yes	5
Fairdale	Fine-loamy, mixed, superactive, calcareous, frigid Mollic Udifluvents	**a)** Fairdale silt loam	Partial	1
Fargo	Fine, smectitic, frigid Typic Epiaquerts	**a)** Fargo silty clay; **b)** Fargo silty clay loam; **c)** Fargo silty clay, 1-3% slopes;	Yes	67
Hegne w/Fargo inclusion	Fine, smectitic, frigid Typic Calciaquerts	**a)** Hegne-Fargo silty clays	Yes	18
Overly	Fine-silty, mixed, superactive, frigid Pachic Hapludolls	**a)** Overly silty clay loam	Partial	3
Wahpeton	Fine, smectitic, frigid Typic Hapluderts	**a)** Wahpeton silty clay. 0-2% slopes	No	2

As mentioned, surface drains, typically two feet or less deep with flat side slopes, are constructed[2]. Except for lower lying depressions, the drains, in concert with land leveling, remove ponded water from most soils. Given the slow permeability of the area soil, their shallow and random pattern[3], the drains have a lesser effect on lowering the water table over larger areas of the landscape. Nonetheless, the lateral drainage effect of surface drains on the water table was estimated (Table 2) using the van Schilfgaarde equation (Hydrology Tools for Wetland Determination. Engineering Field Handbook, Chapter 19. USDA, NRCS. August, 1997 and Hydrology Tools for Wetland Determination, Minnesota Supplement 19-57 to the Engineering Field Handbook. USDA, NRCS. April, 2005). To calculate lateral effect, variables such as ditch depth were estimated by field visit (July 27-29, 2010) and soil parameters were estimated from the Web Soil Survey. The ditch depths analyzed in Table 2, below, represent the range of ditch depths observed during the field review. The "T" factor, or the duration of time for the drain to lower the water table one foot below the soil surface, was set at 14 days. Fourteen days is the required duration for determining wetland hydrology on hydrologically altered sites (Supplement).

[2] Subsurface drainage, such as tiling, is not a common practice in the study area.

[3] As used here, random means ditches that follow landscape drainage patterns, as opposed to a systematic arrangement of parallel drains.

Table 2 – Lateral drainage effect of surface drains of Red River Valley

Ditch depth (feet)	Lateral effect on each side of ditch
2	80
3	105
4	120
5	135
6	145
7	150

The surface drainage was initiated during European settlement of this area in order to make production of agricultural crops possible, and much of the land within the proposed diversion alignments is currently used for agricultural purposes. Although the surface drainage systems (ditches and land leveling) make agricultural production possible in many areas in most years, the ditches and land leveling have not eliminated wetland hydrology from entire fields during the growing season in most years. Many wetlands are farmed in most years, and crops are often lost or suffer wetness-related stress.

The NRCS *Hydrology Tools* for *Wetland Delineation Procedure* (August, 1997) and Corps of Engineers guidance *Assessing and Using Meteorological Data to Evaluate Wetland Hydrology* (April, 2000) both recommend evaluation of precipitation for the 3 months prior to the date of an aerial photograph to assist in making determinations of normal circumstances. Unless a specific date was identified for an aerial, July 1 was the date used to calculate antecedent precipitation for the three months prior to the photo. Antecedent precipitation was analyzed using the Wetland Delineation Data Retrieval website: http://climate.umn.edu/wetland/. Detailed data were obtained using the Moorhead Station (#215584). Table 3 below provides the antecedent precipitation analysis for the aerials reviewed.

Table 3 – Antecedent Precipitation (April, May, June) for July FSA Aerial Photos

Date of Imagery	Antecedent Precipitation
July 1, 2003	Wet
July 1, 2004	Normal
July 1, 2005	Wet
July 1, 2006	Dry
July 1, 2009	Normal
July 1, 2010	Normal

FSA aerial photography is generally flown during late June or early July. The intent of this photography is related to compliance with USDA Farm Programs; the main purpose is not for assessing hydrology and aiding the determination of wetland areas. However, they remain the most readily available aerials to view the landscape on an annual basis. These mid-summer flights generally miss nearly three months of the growing season, during which areas inundated or saturated within 12" of the surface meet the definition of wetland hydrology. Decisions made about whether an area is wetland based solely upon the FSA aerials would, therefore, result in a very conservative estimate of wetland. Again, use of LiDAR, correlated with repeated signatures

of wetness later in the growing season as shown on the FSA aerials, provides the best available data to make a determination of the full extent of wetlands on the landscape. The question for determining the extent of wetlands is not wetland hydrology based on mid-summer imagery. Rather, the question is the extent of wetland hydrology during the growing season in most years, which, as previously stated, begins in the Fargo-Moorhead area during early- to mid-April. Aerial photographs, LiDAR, the extent and location of hydric soils, and extent and estimated effect of drainage infrastructure when taken together offer an estimate of wetlands based on multiple parameters.

Upon review of available aerial imagery, Web Soil Survey and detailed topographic (LiDAR) data resources, extensive areas of hydric soils exhibiting regular wetland signatures were noted throughout the proposed Diversion corridors, as shown on Figures LPP 1-4 of 4 and FCP 1-3 of 3 in Appendix A. Using LiDAR data correlated to regular signatures of wetness such as saturated soil, crop stress and drown-outs, wetlands were identified in the lower lying areas and digitized as polygons in ArcMap 10. Table 4 below provides a summary of the total area of wetlands, by type, identified within the Diversion corridors.

Table 4 - Summary of the extent of wetlands (acres), by type, within the proposed Diversion corridors.

Wetland Type	**North Dakota/LPP Corridor (Total area: 8054 ac)**	**North Dakota/ND35K Corridor (Total area: 6560 ac)**	**Minnesota/FCP Corridor (Total area: 6415 ac)**
Approximate total acres hydric soil	7250	5900	4040
Farmed, seasonally flooded basin	790	720	800
Wet meadow	140	120	50
Shallow marsh	50	40	50
Shallow open water	10	10	10
Total Wetland Acreage	990	890	910
% Wetland	12%	14%	14%

On-Site Field Results and Discussion

Normal Circumstances

The corridors, especially in North Dakota, are dominantly hydric soil, with insufficient drainage infrastructure to eliminate wetland hydrology during the growing season in most years; as discussed, crops can be planted but are often lost in the lower lying areas in many years. It is the professional opinion of the wetland scientists involved with this review that the soils and hydrology normally present in the areas identified as wetlands in both off-site and on-site review will support a dominance of hydrophytes if normal farming operations were to cease.

Farmed, Seasonally Flooded Basins

The vast majority of wetland resources found within the project area are "managed plant communities" classified as farmed, seasonally flooded basins. These seasonally flooded basins are lower lying areas within actively planted agricultural fields from which shallow surface drains and land leveling have not eliminated wetland hydrology during the growing season in most years. Many of these lower lying areas are themselves shaped into shallow field ditches channeling water from the remainder of the fields. Prior to European settlement of the study area, this lake plain (see soils discussion) was dominated by wetland communities; these seasonally flooded basins are generally the remnants of the historic wetland areas.

Wetland boundaries were identified during off-site review using the LiDAR elevation data correlated to repeated signatures of wetness, and verified with the on-site ground-truth review. The hydric soil field indicators observed include A12 – Thick Dark Surface and F6 – Redox Dark Surface, while the hydrology indicators observed include D2 - Geomorphic Position, B8 – Sparsely Vegetated Concave Surface and, during the off-site review, C9 – Saturation Visible on Aerial Imagery.

Wet Meadows and Shallow Marshes

Wet meadows may have surface water only early in the growing season and are typically saturated into the latter part of the summer. Wet meadows in the study area are dominated by reed canarygrass (*Phalaris arundinacea*), sedges, other grasses and forbs. Shallow marshes typically have at least 6 inches of surface water throughout the growing season, and in the study area are dominated by cattail species (*Typha sp.*). Many field-side and roadside ditches traverse the area (see discussion of lateral effect), and, where these areas also exhibit the characteristics of wetlands, they were classified as wet meadows or shallow marshes, depending upon the predominant vegetation and depth of water present.

Wetland boundaries were identified during off-site review using the LiDAR elevation data correlated to repeated signatures of wetness, and verified with the on-site ground-truth review. The hydric soil field indicators observed include A12 – Thick Dark Surface and F6 – Redox Dark Surface, while the hydrology indicators observed include D2 - Geomorphic Position, A3 – Saturation, and, during the off-site review, B7 – Inundation Visible on Aerial Imagery and C9 – Saturation Visible on Aerial Imagery.

Shallow Open Water

In the North Dakota Diversion study area, there are a few shallow open water basins, where standing water from 3 to 6 feet is normally present throughout the growing season. Most of these areas appear to be excavated ponds, some of which are used as stormwater retention basins, except for one small pond adjacent to the Wild Rice River. There is one shallow open water area in the Minnesota Diversion study area just south of Interstate 94, which is a MnDOT mitigation area/stormwater basin. No sample points were taken at these locations; they are distinct features on the landscape with easily discernible topographic breaks.

Functional Assessment Discussion

Wetlands in this area have been significantly impacted by agricultural practices, including drainage, tillage and loss of the natural vegetation. The wet meadow, shallow marsh and floodplain forest areas, although usually left untouched by direct tillage, have been affected by the agricultural runoff containing sediment.

Wetlands found within those active agricultural lands provide limited levels of functionality within this environment due to the extensive drainage and overall alteration that has taken place in the region. The majority of wetlands within the review area are depressional field ditches and depressional isolated wetlands of the farmed, seasonally flooded basin type (see photos on Figures LPP 1-4 of 4 in Appendix A). Due to the extensive drainage systems, these seasonally flooded wetlands generally provide low function for Maintenance of Hydrologic Regime and Maintenance of Wetland Water Quality. Because the wetlands are found within agricultural fields, they also function at a low level in Maintenance of Character of Wildlife Habitat, and Aesthetics/Recreation/Education/Cultural benefit. Without natural vegetation, there is no opportunity to provide wildlife habitat and the wetlands don't provide any aesthetic or recreational 'value' to the human landscape.

The depressional wetland areas within agricultural fields do, however, generally provide moderate to high functionality for Flood/Storm-water Attenuation and also for Downstream Water Quality. Those wetlands that have been shaped into shallow field ditches provide a moderate level of flood/stormwater attenuation because they are able to hold some of the water on the landscape for at least a short period of time. Shallow isolated depressional wetlands provide a high level of functionality for flood/stormwater attenuation, as they are able to hold the water on the landscape until it can evaporate or infiltrate, rather than run off to nearby over-stressed water courses. All field wetlands provide a moderate level of functionality for protection of downstream water quality because they are able to filter at least some of the nutrients from the agricultural runoff before the water enters nearby waterways. The depressional wetlands generally do not provide any level of function for amphibian or fish habitat or shoreline protection, therefore functional analysis was not applicable in these areas.

Note: As previously stated, locations of forested wetland resources were not identified for this report. All forested resources, including forested wetlands, were identified and assessed under a separate section of the FEIS, therefore they were not included in this effort. However, a brief statement of floodplain forest functionality is included for reference. Floodplain forest wetlands provide a moderate level of functionality for maintenance of the hydrologic regime, as they are able to gradually feed the river system with water stored in the soils following flood events. The forested floodplains also provide a moderate level of shoreline protection and floodwater resistance by increasing the surface roughness resulting in an increased detention of high flows and reduced erosion, and ultimately reducing peak flows downstream. In addition, the forest canopy provides the wetland with the opportunity to provide a moderate level of function for wildlife habitat.

Conclusion

Based upon a preponderance of the evidence collected during both off-site and on-site review, extensive wetland areas exist throughout the Diversion corridors, as shown on Figures LPP 1-4 of 4 and FCP 1-3 of 3 in Appendix A and summarized in Table 4.

Data Sources:

Web Soil Survey. U.S.D.A. SSURGO Data obtained from:
http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Wetland Delineation Precipitation Data Retrieval, website developed by the Minnesota Climatology Working Group (http://climate.umn.edu/wetland/)

Literature Referenced/Technical Documents:

Environmental Laboratory. 1987. *1987 U.S. Army Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

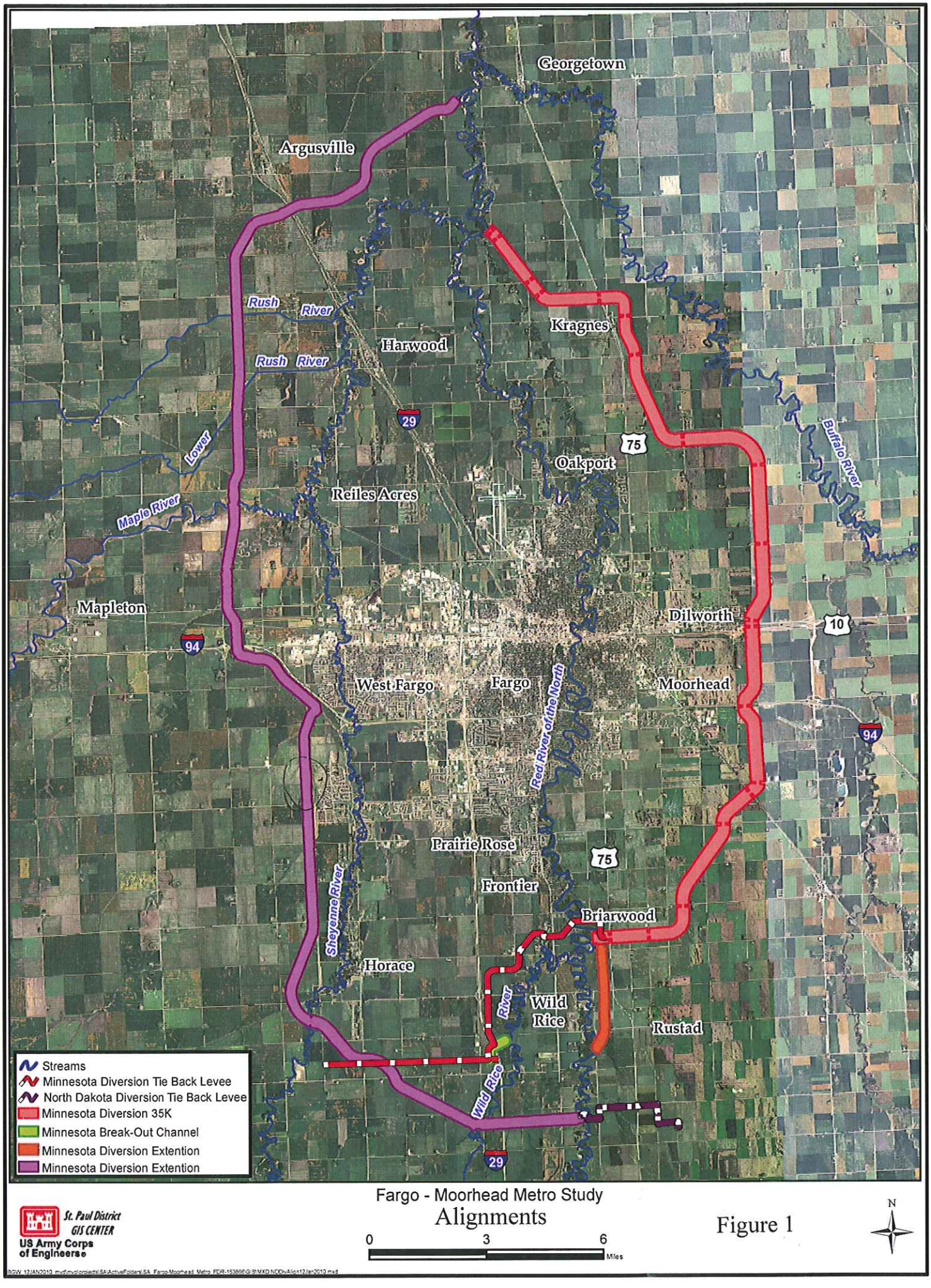
U.S. Army Engineer Research and Development Center. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region*. US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Eggers, Steve D. and Donald M. Reed. 1997. *Wetland Plants and Plant Communities of Minnesota and Wisconsin*. US Army Corps of Engineers, St. Paul District. 263pp, unclassified.

Appendix A

Figures

Figure 1: Fargo-Moorhead Metro Study - Alignments
Figures LPP 1 through 4 of 4: North Dakota Wetland Areas, including on-site photos
Figures FCP 1 through 3 of 3: Minnesota Wetland Areas



Fargo - Moorhead Metro Study

Alignments

Figure 1

St. Paul District GIS CENTER
US Army Corps of Engineers

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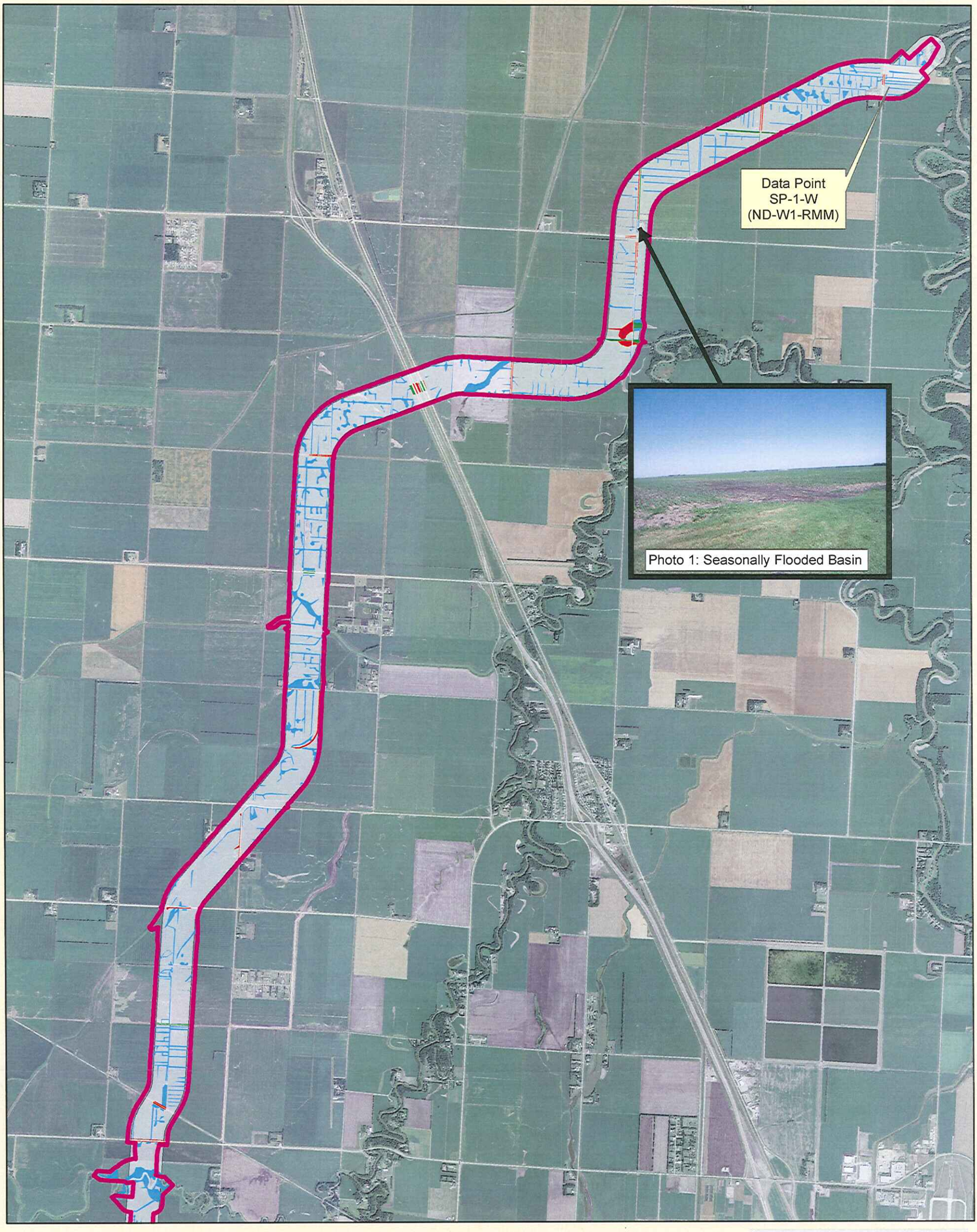
Fargo Moorhead Flood Risk Reduction Project
LPP 1 of 4



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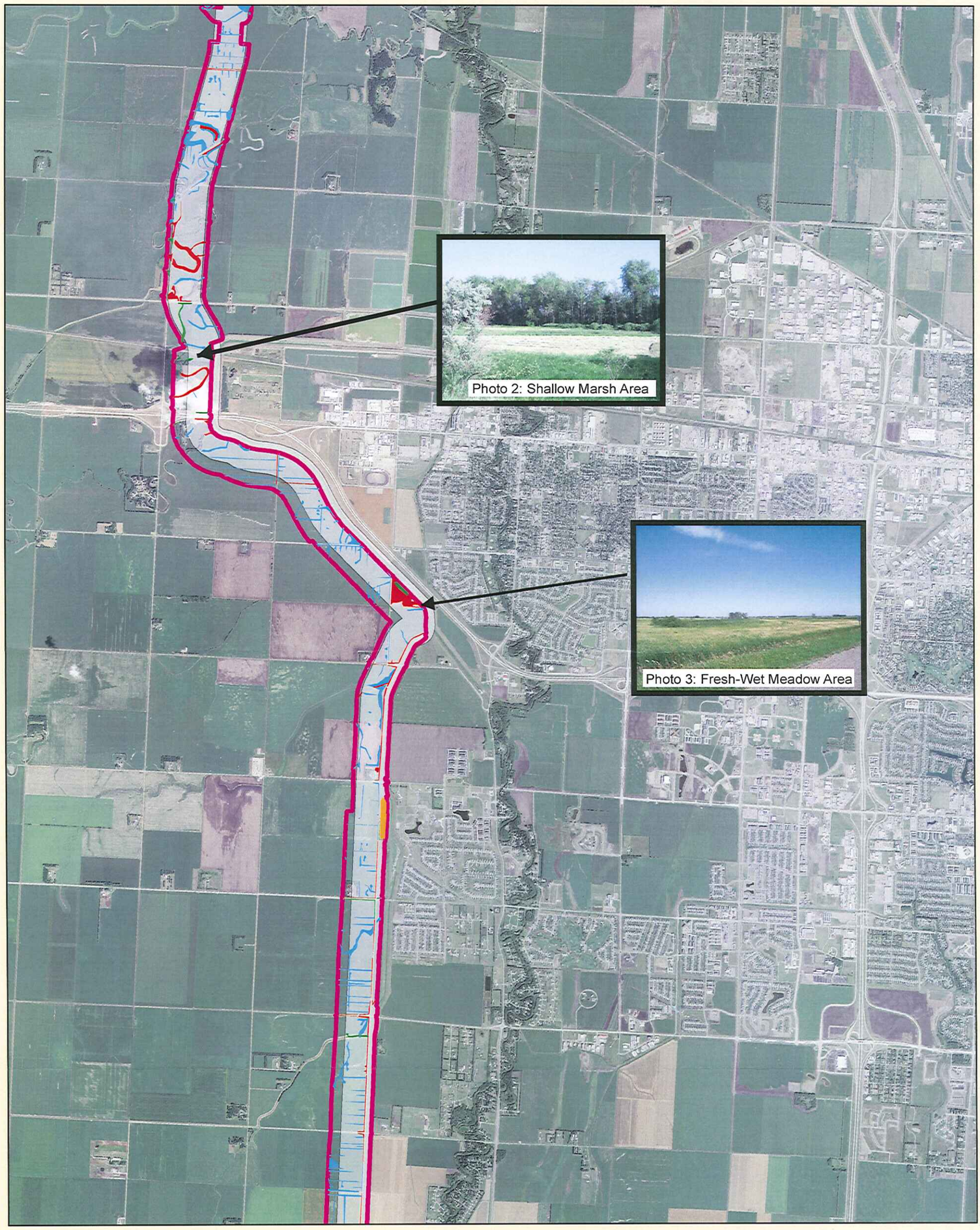
St. Paul District
US Army Corps of Engineers®

Permanent Easement Area
Diversion footprint 1450ft Buffer

Wetland Type

Seasonally Flooded Basin
Shallow Marsh
Shallow Open Water
Wet Meadow

Fargo Moorhead Flood Risk Reduction Project
(North Dakota Diversion Page 2 of 4)



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Miles

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Permanent Easement Area
Diversion footprint 1450ft Buffer

Wetland Type

Seasonally Flooded Basin
Shallow Marsh
Shallow Open Water
Wet Meadow

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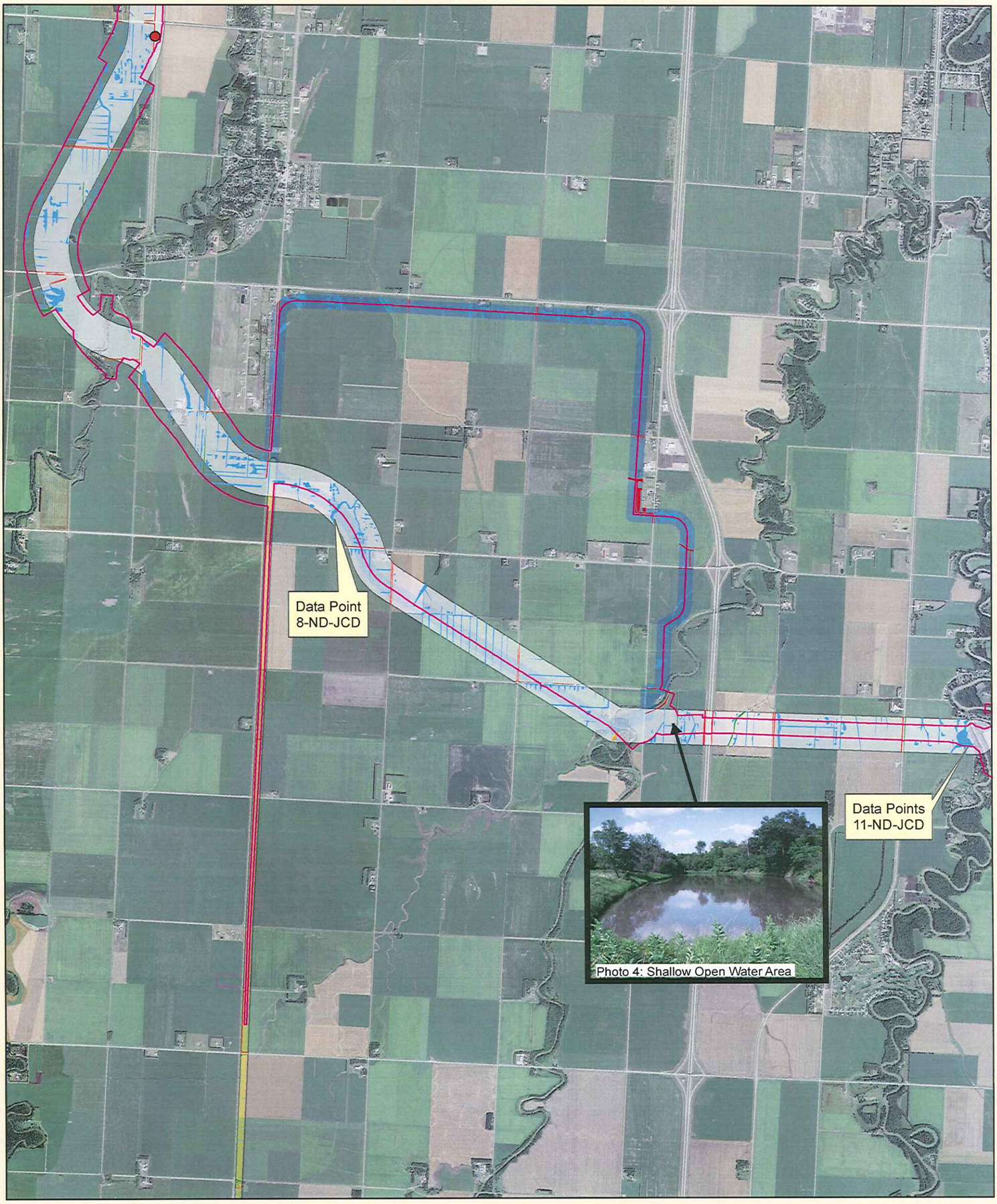
3/30/2011

Fargo Moorhead Flood Risk Reduction Project
(LPP Page 3 of 4)



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St. Paul District
US Army Corps of Engineers®

Created by Nathan Campbell
9/2/2010

Permanent Easement Area
Diversion footprint 1450ft Buffer
StorageArea 300ft Buffer
Cass17TiebackLevee300ft Buffer

Wetland Type

Seasonally Flooded Basin
Shallow Marsh
Shallow Open Water
Wet Meadow

Fargo Moorhead Flood Risk Reduction Project
(LPP Page 4 of 4)

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Miles

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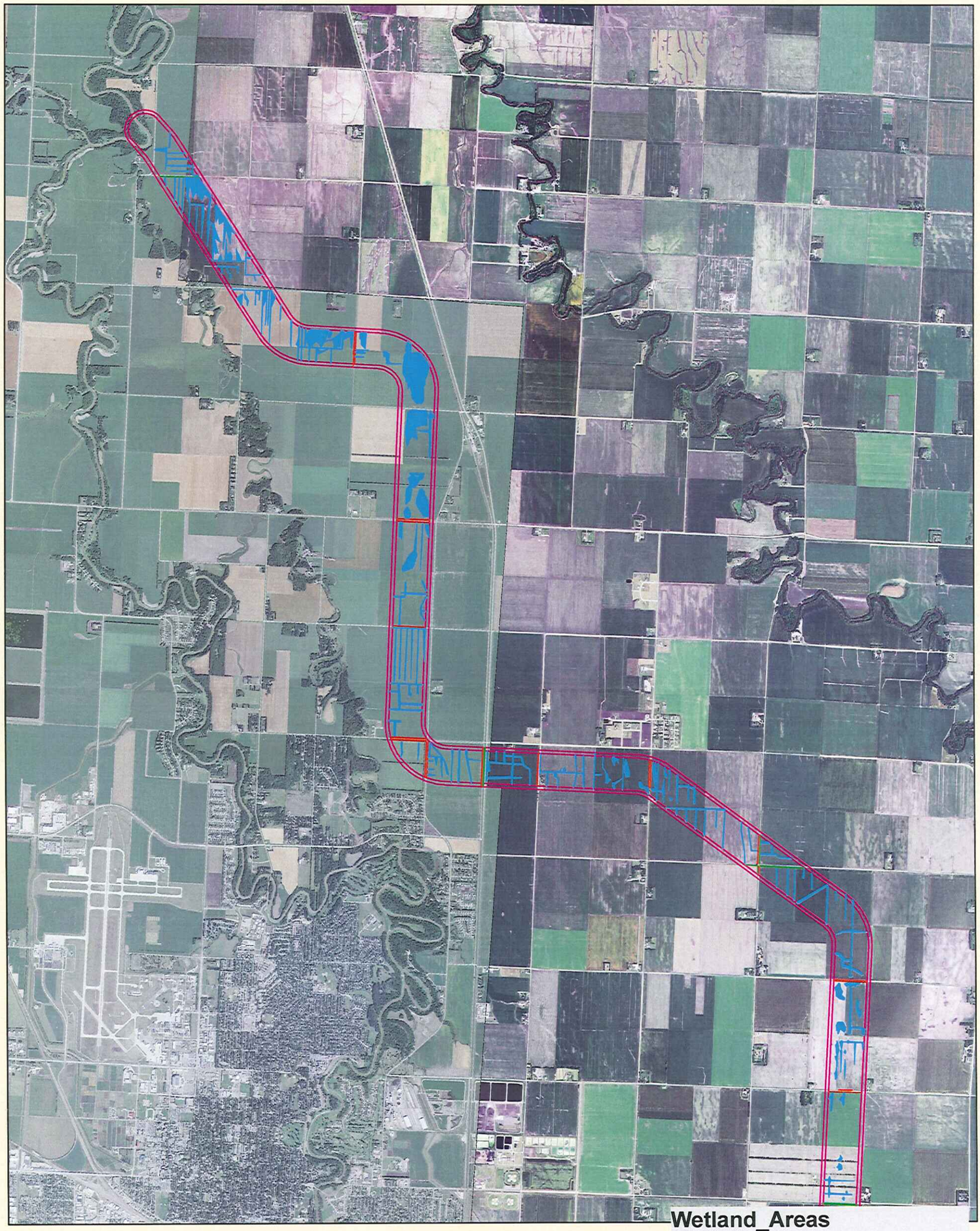
Permanent Easement Area
NDTieback_Levee_200ft_Buffer

Wetland Type

Seasonally Flooded Basin
Shallow Marsh
Shallow Open Water
Wet Meadow

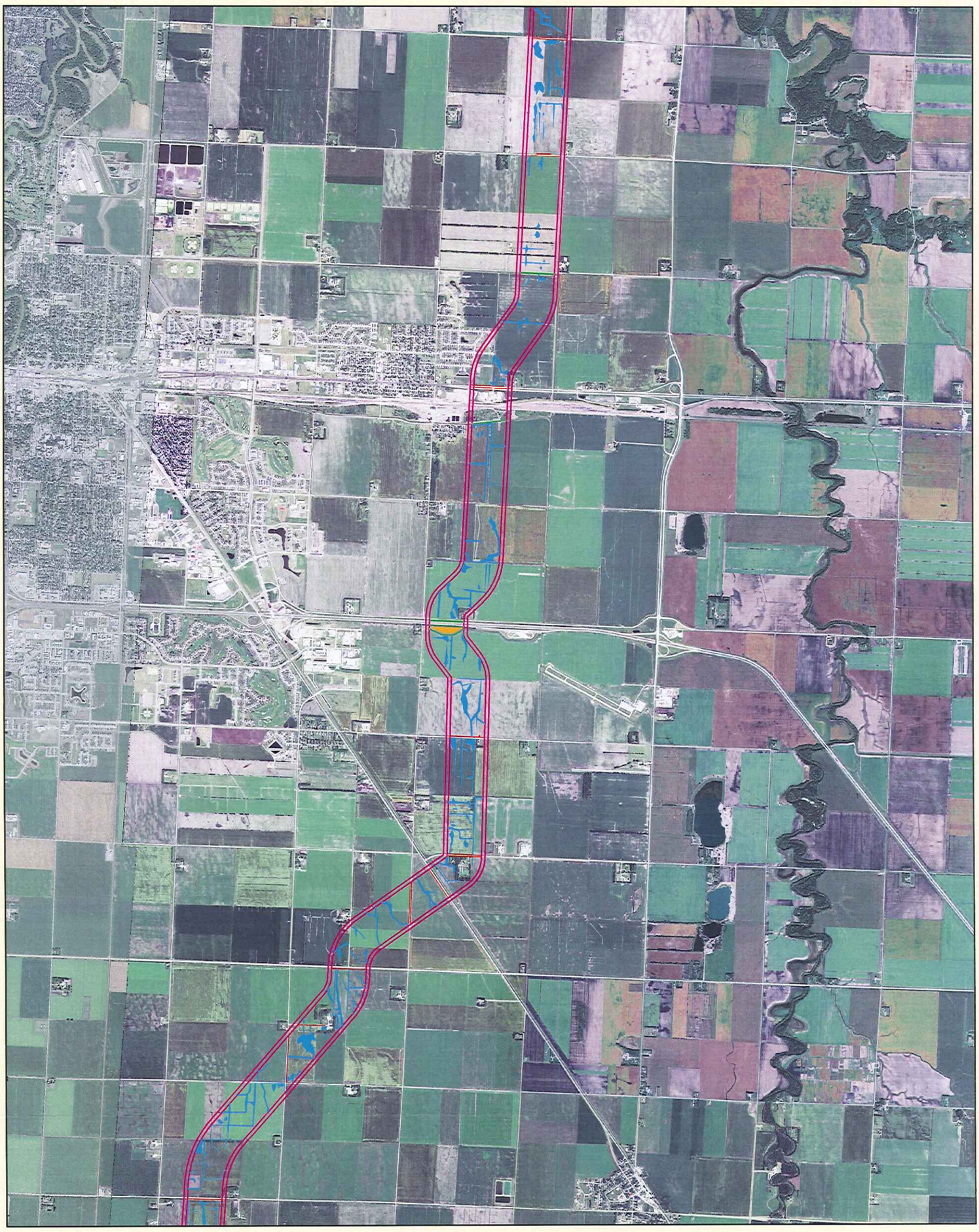
Created by Nathan Campbell
9/2/2010

Fargo Moorhead Flood Risk Reduction Project
FCP 1 of 3



St. Paul District
US Army Corps of Engineers®

Fargo Moorhead Flood Risk Reduction Project
FCP 2 of 3



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Miles

N

W E

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MN_West_Diversion_Footprint

Wetland Type

- Seasonally Flooded Basin
- Shallow Marsh
- Shallow Open Water
- Wet Meadow

St. Paul District

US Army Corps of Engineers®

Fargo Moorhead Flood Risk Reduction Project
FCP 3 of 3

St. Paul District
US Army Corps of Engineers®

0 0.5 1 2
Miles

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MN_Tieback_Levee_300ft_Buffer
MN_West_Diversion_Footprint

Wetland Type
- Seasonally Flooded Basin
- Shallow Marsh
- Shallow Open Water
- Wet Meadow

Appendix B

USDA Official Series Descriptions (OSDs) for Predominant (>10% area) Project Area Soils:

Bearden

Colvin

Fargo

Hegne

LOCATION BEARDEN ND+MN SD

Established Series
KWT-CJH
11/2002

BEARDEN SERIES

The Bearden series consists of very deep, somewhat poorly drained, moderately to slowly permeable soils that formed in calcareous silt loam and silty clay loam lacustrine sediments. These soils are on glacial lake plains and have slopes of 0 to 3 percent. Mean annual air temperature is 39 degrees F, and mean annual precipitation is 18 inches.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, frigid Aeric Calciaquolls

TYPICAL PEDON: Bearden silty clay loam on a plane slope of less than 1 percent under cropland. When described the soil was moist throughout. (Colors are for moist soil unless otherwise stated)

Ap--0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure parting to moderate fine granular; very hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; few threads of carbonates; strong effervescence (8 percent calcium carbonate); slightly alkaline; abrupt smooth boundary. (Combined A horizons 6 to 14 inches thick)

ABk--7 to 18 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) and dark gray (10YR 4/1) dry, gray (10YR 6/1) dry in the lower part; weak coarse and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine roots; many fine pores; few fine masses of carbonates; disseminated carbonates throughout with the amount increasing with depth; violent effervescence (15 to 20 percent calcium carbonate); moderately alkaline; clear irregular boundary. (0 to 14 inches thick)

Bk1--18 to 28 inches; light olive brown (2.5Y 5/4) silty clay loam, light yellowish brown (2.5Y 6/4) dry; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many fine pores; violent effervescence (25 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Bk2--28 to 36 inches; olive brown (2.5Y 4/4) silty clay loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent gray (5Y 5/1) and few fine and medium prominent very dark brown (10YR 2/2) redoximorphic depletions; weak coarse subangular blocky structure parting to moderate fine and very fine subangular blocky; hard, friable, sticky and plastic; few fine pores; few masses of carbonates; violent effervescence (15 percent calcium carbonate); moderately alkaline; clear wavy boundary. (Combined Bk horizons 0 to 54 inches thick)

C1--36 to 46 inches; light olive brown (2.5Y 5/4) laminated silty clay loam, light yellowish brown (2.5Y 6/4) dry; common medium and fine prominent gray (5Y 5/1) redoximorphic depletions and common medium faint dark yellowish brown (10YR 4/4) redoximorphic concentrations; few black non-manganese spots; massive; very hard, friable, sticky and plastic; masses of gypsum crystals; few masses of carbonates; strong effervescence (15 percent calcium carbonate); moderately alkaline; gradual wavy

boundary.

C2--46 to 60 inches; light olive brown (2.5Y 5/4) laminated silty clay loam; light yellowish brown (2.5Y 6/4) dry; common prominent gray (5Y 5/1) redoximorphic depletions and many fine and medium distinct dark yellowish brown (10YR 4/4) and prominent strong brown (7.5YR 5/6) redoximorphic concentrations; massive; very hard, firm, sticky and plastic; few masses of carbonates; strong effervescence (15 percent calcium carbonate); slightly alkaline.

TYPE LOCATION: Pembina County, North Dakota, about 2 miles north and 3 miles east of St. Thomas; 640 feet east and 160 feet south of the northwest corner, sec. 29, T. 160 N., R. 52 W.

RANGE IN CHARACTERISTICS: The mollic epipedon ranges from 7 to 20 inches thick. The soil is slightly alkaline or moderately alkaline. Saline phases are recognized.

The Ap or A horizon has hue of 10YR, 2.5Y, 5Y, or is neutral, value of 2 or 3 and 3 to 5 dry, and chroma of 1 or less. It typically is silty clay loam but some is loam, silt loam, clay loam or silty clay. The A horizon contains 1 to 10 percent carbonates. Some pedons have tongues of A horizon extending into Bk horizon.

The ABk horizon has hue of 10YR, 2.5Y or is neutral, value of 2 to 5 and 3 to 6 dry, and chroma of 2 or less. It is silt loam or silty clay loam. It is slightly alkaline or moderately alkaline.

The Bk horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 7 and 5 to 7 dry, and chroma of 1 to 4. It is silt loam or silty clay loam. It contains 15 to more than 30 percent carbonates. Most of this is disseminated. Some pedons contain few or common, faint to prominent redoximorphic features in this horizon. Some pedons have Bky or BCk horizons.

The C horizon has hue of 2.5Y or 5Y, value of 4 to 7 and 5 to 8 dry, and chroma of 2 to 4. In some pedons below 30 inches the hue is neutral and the chroma is 1 or less. The texture of the C horizon typically is silty clay loam or laminated silt loam and silty clay loam. In some pedons below a depth of 40 inches the textures range from gravelly coarse sand to clay. Some pedons do not have a C horizon within a depth of 60 inches.

COMPETING SERIES: These are the Cubden, Gunclub, McIntosh and Saunders series (it is assumed the Cubden series is competing pending on update in the classification). Cubden and McIntosh soils formed in a silt mantle over glacial till and have 2C horizons containing 15 percent fine sand and coarser. Gunclub soils have clay till within depths of 40 to 60 inches. Saunders soils are poorly drained and have silty clay and clay textures within a depth of 40 inches.

GEOGRAPHIC SETTING: Bearden soils are on level and nearly level glacial lake plains. Slopes are 0 to 3 percent. The soils formed in calcareous silt loam and silty clay loam lacustrine sediments. The climate is cool, subhumid. The mean annual air temperature ranges from 36 to 45 degrees F, and the mean annual precipitation from 15 to 24 inches. Frost-free period ranges from 90 to 145 days. Elevation ranges from 650 to 2000 feet above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Antler, Beotia, Colvin, Gardena, Glyndon, Hegne, Overly and Perella soils. Antler soils are on adjacent interbeach areas where lake sediments are moderately deep over till. They are fine-loamy. Beotia, Colvin, Overly and Perella soils are in a drainage sequence with Bearden soils. Beotia and Overly soils are at higher elevations in the lake plain. They do not have calcic horizons within depths of 16 inches and have Bw horizons. Colvin

and Perella soils are in swales and lower lying flats and basins. Colvin soils are poorly drained. Perella soils do not have calcic horizons within a depth of 16 inches. Glyndon soils are on adjacent areas. They are coarse-silty. Gardena soils are on nearby lake plains at higher elevations. They do not have calcic horizons within depths of 16 inches and are coarse-silty. Hegne soils are on adjacent lake plains. They are fine.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained. Runoff is negligible to high. Permeability is slow to moderate. A seasonal high water table is at depths of 1.5 to 3.5 feet at some time during the period of April through June.

USE AND VEGETATION: Soils are nearly all cropped to small grains and row crops such as sugar beets. Native vegetation was big bluestem, switchgrass, western wheatgrass, and a variety of forbs.

DISTRIBUTION AND EXTENT: The Red River Valley in eastern North Dakota and northwestern Minnesota, and in glacial lake plains in northeastern South Dakota and central North Dakota. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bismarck, North Dakota

SERIES ESTABLISHED: Ransom County, North Dakota, 1906.

REMARKS: Diagnostic horizons and features recognized in this pedon are: mollic epipedon - the zone from the surface of the soil to the depth of 7 inches (Ap horizon); calcic horizon the zone from 7 to 36 inches (ABk, Bk1, and Bk2 horizons); characteristics associated with wetness - calcic horizon (ABk, Bk1, and Bk2 horizons).

Were the soil has previously correlated as moderately well drained it should be recorrelated to the Rondell series (Aquic Calciudolls).

ADDITIONAL DATA: Type location laboratory data S54NDak-34-1; additional data ND51-P-6, S53ND-9-5, S53ND-9-6, S57ND-18-1, and S54ND-34-2.

National Cooperative Soil Survey
U.S.A.

LOCATION COLVIN ND+MN MT SD

Established Series
CJH
06/2001

COLVIN SERIES

The Colvin series consists of very deep, poorly and very poorly drained, moderately to slowly permeable soils formed in silt loam and silty clay loam sediments. These soils are in concave shallow swales and depressions on glacial lake plains, in outwash channels, on stream terraces and in drainageways on till plains. Slope ranges from 0 to 2 percent. Mean annual air temperature is 41 degrees F and mean annual precipitation is 18 inches.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, frigid Typic Calciaquolls

TYPICAL PEDON: Colvin silty clay loam on a level concave slope less than 1 percent under native grass. When described the soil was moist throughout. (Colors are for moist soil unless otherwise stated)

A--0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak coarse prismatic structure parting to moderate medium granular; hard, friable, sticky and plastic; many roots; many fine pores; strong effervescence; slightly alkaline; clear wavy boundary. (6 to 16 inches thick)

Bkg1--10 to 20 inches; gray (5Y 6/1) and olive gray (5Y 5/2) silty clay loam, gray (N 6/0) and white (N 8/0) dry; very weak medium subangular blocky structure parting to weak fine granular; hard, friable, slightly sticky and plastic; common roots; common fine pores; few masses of carbonates; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg2--20 to 30 inches; light olive gray (5Y 6/2) and olive gray (5Y 5/2) silty clay loam, light gray (5Y 7/1) and gray (5Y 6/1) dry; common medium prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; very weak fine subangular blocky structure; hard, friable, slightly sticky and plastic; few roots; common pores; strong effervescence; moderately alkaline; gradual wavy boundary. (Combined Bkg horizons 8 to 54 inches thick)

Cg--30 to 60 inches; olive gray (5Y 5/2) silty clay loam, light gray (5Y 7/2) dry; many coarse prominent yellowish brown (10YR 5/8) and few medium prominent yellowish red (5YR 5/6) redoximorphic concentrations; massive; hard, friable, sticky and plastic; strong effervescence in upper part, gradually decreases to slight effervescence at 50 inches; moderately alkaline.

TYPE LOCATION: LaMoure County, North Dakota; about 1 mile south and 2 miles east of Marion; about 75 feet north and 65 feet east of the southwest corner, sec. 18, T. 136 N., R. 60 W.

RANGE IN CHARACTERISTICS: The mollic epipedon ranges from 7 to 24 inches in thickness. The top of the calcic horizon is at depths of less than 16 inches. In some pedons the lower part of the mollic epipedon is part of the calcic horizon. The 10- to 40-inch particle-size control section typically has 20 to 30 percent noncarbonate clay and ranges from 18 to 35 percent. It contains less than 15 percent fine sand and coarser. Saline phases are recognized.

The A horizon has hue of 10YR, 2.5Y, 5Y or is neutral, value of 2 or 3 and 3 or 4 dry, and chroma of 1 or less. It typically is silt loam or silty clay loam, but the range includes clay loam and silty clay. It is neutral to moderately alkaline. Some pedons have an Ak or ABk horizon. Where present they have hue similar to the A horizon, and value of 3 or 4 and 4 to 6 dry, and chroma of 1 or 2.

The Bkg or Bk horizon has hue of 10YR, 2.5Y, 5Y or is neutral, value of 3 to 7 and 5 to 8 dry, and chroma of 2 or less. Chroma of 3 is allowed below a depth of 30 inches. It is silt loam or silty clay loam, but clay loam is allowed below a depth of 25 inches. It is slightly alkaline to strongly alkaline. It typically has a calcium carbonate equivalent of 20 to 50 percent. Some pedons have Bky, Bkz or BC horizons.

The Cg horizon has hue of 2.5Y or 5Y, value of 3 to 6 and 5 to 7 dry, and chroma of 1 to 4. It is silt loam or silty clay loam, but clay loam is allowed below a depth of 25 inches. The Cg horizon below depths of 40 inches typically has similar textures. However, in some pedons the texture ranges from sand to clay below a depth of 40 inches. The Cg horizon is massive, laminated or has weak grades of blocky structure. It typically contains few to many redoximorphic features with chroma of 3 to 8. It is slightly alkaline or moderately alkaline. Crystals of gypsum and other soluble salts are in some pedons. Some pedons do not have a C horizon within a depth of 60 inches.

COMPETING SERIES: These are the Bear Lake, Colake, Ojata, Regan and Winger series. Bear Lake soils have sola more than 60 inches thick and have lime nodules in the Bkg horizon. Colake soils do not have redoximorphic features within a depth of 40 inches. Ojata soils are strongly saline with conductivity exceeding 16 mmhos/cm. Regan soils contain more than 15 percent fine sand or coarser in the lower half of the control section. Winger soils have loamy glacial till in the lower part of the control section.

GEOGRAPHIC SETTING: Colvin soils are in level concave shallow swales and depressions on glacial lake plains, in outwash channels, on stream terraces and in drainageways on till plains. Slopes are 0 to 2 percent. The soils formed in silt loam and silty clay loam sediments. The mean annual air temperature ranges from 36 to 48 degrees F, and mean annual precipitation from 15 to 25 inches. Frost-free period ranges from 90 to 145 days. Elevation ranges from 650 to 2000 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Ojata soils and Antler, Bearden, Borup, Gardena, Hegne, Lamoure, Overly, Perella and Rauville soils. Ojata soils are on nearby saline swales and depressions. Antler soils are on nearby interbeach areas. They are fine-loamy and have 2C horizons within depths of 20 to 40 inches of firm glacial till. Bearden, Overly and Perella soils are in a drainage sequence with Colvin soils. Bearden and Overly soils are on higher elevations. Overly soils have Bw horizons and do not have carbonates or calcic horizons within depths of 16 inches. Borup soils are on nearby lake plains where sediments contain less clay and more very fine sand. Hegne soils are on nearby lake plains where sediments are clays. Lamoure and Rauville soils are on nearby bottom lands and flood plains of outwash valleys and streams. Perella soils are on similar landscapes as Colvin soils. Perella soils do not have calcic horizons within depths of 16 inches.

DRAINAGE AND PERMEABILITY: Poorly and very poorly drained. Runoff ranges from negligible to medium depending on slope and surface texture. Water runs onto these soils and ponds for a time during wet seasons. The soils commonly are too wet to cultivate unless drained. Soils on stream terraces occasionally flood from stream overflow. Permeability is moderate to slow. An apparent seasonal high water table is at a depth of 0.0 to 1.5 feet at some time during the period of March through July in the poorly drained phase. It is at a depth of 1 foot above the surface to 1 foot below the surface at some time during the period of November through July in the very poorly drained phase.

USE AND VEGETATION: Soils are cropped to small grains. Undrained areas are used for pasture and hay. Native vegetation is slim sedge, wooly sedge, prairie cordgrass, and a variety of forbs and other sedges.

DISTRIBUTION AND EXTENT: Central and eastern North Dakota, western Minnesota and northeastern South Dakota. The soil is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bismarck, North Dakota

SERIES ESTABLISHED: Sargent County, North Dakota, 1961.

REMARKS: Diagnostic horizons and features recognized in this pedon are: mollic epipedon - the zone from the surface of the soil to a depth of 10 inches (A horizon); calcic horizon - the zone from 10 to 30 inches (Bkg1 and Bkg2 horizon); characteristics associated with wetness - calcic horizon (Bkg1 and Bkg2 horizons).

ADDITIONAL DATA: S66NDak-14-2; S66NDak-14-7; S66NDak-14-8; S67NDak-50- 3; S67NDak-50-4.

National Cooperative Soil Survey
U.S.A.

LOCATION FARGO ND+MN MT

Established Series
NDP-CJH
03/2005

FARGO SERIES

The Fargo series consists of very deep, poorly drained and very poorly drained, slowly permeable soils that formed in calcareous, clayey lacustrine sediments. These soils are on glacial lake plains, floodplains, and gently sloping side slopes of streams within glacial lake plains. Slopes range from 0 to 6 percent. Mean annual air temperature is 42 degrees F, and mean annual precipitation is 19 inches.

TAXONOMIC CLASS: Fine, smectitic, frigid Typic Epiaquerts

TYPICAL PEDON: Fargo silty clay on a level plane slope of less than 1/10 percent under cropland. When described the soil was dry from 0 to 8 inches and moist from 8 to 60 inches. (Colors are for moist soil unless otherwise stated)

Ap--0 to 8 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to strong fine granular; very hard, blocks friable, granules firm, very sticky and very plastic; many fine roots; many fine pores; neutral (pH 7.2); abrupt smooth boundary. (Combined A horizons 5 to 15 inches thick)

Bw--8 to 13 inches; black (10YR 2/1) and very dark gray (10YR 3/1) crushed and rubbed silty clay, very dark gray (10YR 3/1) and dark gray (10YR 4/1) crushed and rubbed, dry; moderate medium subangular blocky structure parting to strong very fine angular blocky; extremely hard, firm, very sticky and very plastic; many fine roots; many fine pores; faces of peds have shiny waxy sheen when moist; cracks filled with A material throughout; neutral (pH 7.0); abrupt wavy boundary.

Bss--13 to 21 inches; very dark gray (2.5Y 3/1) and very dark grayish brown (2.5Y 3/2) silty clay, gray (2.5Y 5/1) and dark grayish brown (2.5Y 4/2) dry; dark grayish brown (2.5Y 4/2) crushed and rubbed, grayish brown (2.5Y 5/2) dry; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderate coarse prismatic structure parting to strong fine and very fine angular blocky; extremely hard, firm, very sticky and very plastic; common fine roots; common pores; slickensides on vertical faces of peds; faces of blocks have waxy sheen when moist; slight effervescence in lower part, noneffervescent on tongues; cracks filled with A material throughout; slightly alkaline (pH 7.6); abrupt irregular boundary. (Combined Bw and Bss horizons 8 to 27 inches thick)

Bkg--21 to 32 inches; olive gray (5Y 5/2) silty clay, light gray (5Y 7/2) dry; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; weak medium subangular blocky structure parting to moderate fine angular blocky and granular; hard, friable, sticky and plastic; few roots; common fine pores; cracks filled with A material extend into this horizon; common fine masses of carbonates; strong effervescence; moderately alkaline (pH 8.0); clear wavy boundary. (0 to 26 inches thick)

Cg1--32 to 48 inches; grayish brown (2.5Y 5/2) silty clay, light gray (2.5Y 7/2) dry; common medium distinct brown (10YR 4/3) redoximorphic concentrations and gray (5Y 5/1) redoximorphic depletions;

weak medium subangular blocky structure parting to moderate very fine angular blocky and granular; very hard, firm, very sticky and very plastic; few fine roots; common pores; strong effervescence; moderately alkaline (pH 8.0); gradual wavy boundary.

Cg2--48 to 68 inches; olive (5Y 4/3) and pale olive (5Y 6/3) silty clay, pale olive (5Y 6/3) and pale yellow (5Y 8/3) dry; many medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; laminated, fractures to moderate very fine blocky structure; very hard, firm, very sticky and very plastic; few medium masses of carbonates; slight effervescence; moderately alkaline (pH 8.0); gradual wavy boundary.

Cg3--68 to 80 inches; pale olive (5Y 6/3) silty clay; pale yellow (5Y 8/3) dry; common medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; laminated, fractures to moderate very fine subangular blocky structure; very hard, firm, very sticky and very plastic; common medium masses of carbonates; few fine masses of iron-manganese; slight effervescence; moderately alkaline.

TYPE LOCATION: Traill County, North Dakota; about 9 miles south and 6 miles east of Hillsboro; 1170 feet south and 410 feet east of the northwest corner, sec. 29, T. 144 N., R. 49 W. Latitude 47 degrees, 15 minutes, 42.7 seconds N, Longitude 96 degrees, 55 minutes, 13.5 seconds W. Halstad SW, ND USGS 7.5 minute quadrangle.

RANGE IN CHARACTERISTICS: The 10- to 40-inch particle size control section averages between 40 and 60 percent clay and less than 15 percent fine sand and coarser. It is free of rock fragments. The mollic epipedon ranges from 8 to 40 inches in thickness. The depth to carbonates ranges from 11 to 42 inches. Saline phases are recognized.

The A horizon has hue of 10YR, 2.5Y, 5Y or is neutral, value of 2 and 3 or 4 dry, and chroma of 1 or less. It is clay, silty clay or silty clay loam. It is neutral or slightly alkaline.

The Bw and Bss horizons have hue of 10YR, 2.5Y or 5Y, value of 2 to 4 and 3 to 5 dry, and chroma of 1 or 2. They are clay, silty clay or silty clay loam. It is neutral to moderately alkaline. They typically have weak or moderate prismatic structure which parts to strong fine and very fine blocky structure. Some pedons do not have the prismatic structure. Slickensides and shiny, waxy surfaces of peds are common. Cracks filled with A material commonly extend through the Bw and Bss horizons and range from l/2 inch to 5 inches in width. Some pedons have a Bg horizon.

The Bkg horizon has hue of 10YR, 2.5Y or 5Y, value of 3 to 6 and 5 to 8 dry, and chroma of 1 or 2. It is clay, silty clay or silty clay loam. It is moderately alkaline. It contains 10 to 25 percent calcium carbonate equivalent diffused or in masses. Where it has more than 15 percent calcium carbonate equivalent, it does not have more than 5 percent as masses or decrease by more than 5 percent in a lower horizon.

The Cg horizon has hue of 2.5Y or 5Y, value of 3 to 6 and 5 to 8 dry, and chroma of 1 to 3. It is clay, silty clay or silty clay loam. It is moderately alkaline. It typically contains common to many distinct or prominent low to high chroma redoximorphic features. Some pedons contain gypsum crystals in the Cg horizons. Sediments are laminated in the lower part of the Cg horizon at depths of 36 to 60 inches in most pedons. Some pedons have a 2Cg horizon that is silt loam or sandy below a depth of 40 inches.

COMPETING SERIES: This is the Clearwater series. The Clearwater series has 2 to 8 percent rock fragments throughout and formed in till.

GEOGRAPHIC SETTING: Fargo soils are on level and nearly level glacial lake plains and flood plains and gently sloping side slopes of streams within glacial lake plains. Slope gradients commonly are less than 1 percent but range from 0 to 6 percent. The soils formed in calcareous, clayey lacustrine sediments. The climate is cool subhumid. Mean annual air temperature ranges from 36 to 45 degrees F, and mean annual precipitation from 15 to 23 inches. Most of the moisture falls in the spring and summer. Frost-free period ranges from 90 to 140 days. Elevation above sea level ranges from 650 to 1800 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bearden, Cashel, Dovray, Grano, Hegne, Ludden, Overly, Ryan and Wahpeton soils. Bearden and Overly soils are on nearby lake plains and are fine-silty. Cashel soils are on floodplains of larger streams and have fine stratification below the Ap horizon. Dovray and Grano soils are in concave swales and depressions on lake plains. Ludden soils are on floodplains of larger streams. Dovray do not have cracks filled with A material that extend through the Bw horizon. Grano and Ludden soils have carbonates at depths of less than 10 inches. Hegne soils are on slight rises and have calcic horizons within depths of 16 inches. They usually are in complex with Fargo soils. Ryan soils are on nearby areas where the lake sediments contain more salts and have natric horizons. Wahpeton soils are on levees and low terraces of large streams, commonly at slightly higher elevations than the lake plain and are moderately well drained.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained and very poorly drained. Runoff is negligible to high depending on slope. Saturated hydraulic conductivity is slow. A system of legal drains, section lines, road ditches, and field drains remove surface water from most Fargo soils. A seasonal high water table is at the surface to 3.0 feet below the surface at some time during the period of March through July. It is 1.0 foot above the surface to 2.0 feet below the surface at some time during the period of February through August in the ponded, depressional or very poorly drained phases.

USE AND VEGETATION: The soils are nearly all cropped to small grains, soybeans and sugar beets. Native vegetation is western wheatgrass, Kentucky bluegrass and a variety of forbs.

DISTRIBUTION AND EXTENT: Mainly in the Red River Valley of the North in North Dakota and Minnesota; smaller areas in glaciolacustrine areas and in west-central Montana. The soil is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bismarck, North Dakota

SERIES ESTABLISHED: Grand Forks Area, North Dakota, 1902.

REMARKS: Diagnostic horizons and features recognized in this pedon are: mollic epipedon - the zone from the surface of the soil to a depth of 21 inches (Ap, Bw and Bss horizons); Vertisol criteria - cracks filled with A material extend through the Bw and Bss horizons and range from 1/2 to 5 inches in width, slickensides in the 13 to 21 inch layer (Bss horizon); the site will be redescribed in the future to better document the Vertisol criteria.

ADDITIONAL DATA: S51NDak-5-3; S51NDak-5-4; S51NDak-5-8; S51NDak-5-9; S53NDak-9-3; S53NDak-9-4; S54NDak-50-1; S54NDak-50-2; Soil Survey Investigation No. 2, pages 72 to 87. Also S64NDak-9-1; S64NDak-9-4; S64NDak-50-3; S64NDak-50-4; S65NDak-39-1; S65NDak-39-2; S65NDak-39-3; and S65NDak-39-4; and S65NDak-49-1 (Type Location 15 feet to the west of this lab sample) by Soils Department, North Dakota Agriculture Experiment Station.

LOCATION HEGNE MN+MT ND SD

Established Series
HRF-RBH-CJH
03/2005

HEGNE SERIES

The Hegne series consists of very deep, poorly drained soils that formed in clayey calcareous lacustrine sediments on glacial lake plains. These soils have slow or very slow permeability. They have slopes of 0 to 2 percent. Mean annual precipitation is about 20 inches. Mean annual air temperature is about 42 degrees F.

TAXONOMIC CLASS: Fine, smectitic, frigid Typic Calciaquerts

TYPICAL PEDON: Hegne silty clay, from a Hegne-Fargo complex, on a slightly convex slope of about 0.5 percent on a glacial lake plain in a cultivated field. (Colors are for moist soil unless otherwise stated)

Ap-- 0 to 10 inches; black (5Y 2.5/1) silty clay, very dark gray (5Y 3/1) dry; strong fine and medium subangular blocky structure; firm; common fine distinct olive gray (5Y 4/2) redoximorphic depletions; firm; few fine and medium roots; many fine rounded light gray (10YR 7/2) masses of carbonate; slightly effervescent; slightly alkaline (pH 7.6); clear wavy boundary. (7 to 16 inches thick)

Bkssg1-- 10 to 18 inches; about 60 percent olive gray (5Y 4/2), and 40 percent dark gray (5Y 4/1) silty clay; gray (5Y 6/1) and gray (5Y 5/1) dry; moderate medium subangular blocky structure; firm; few fine roots; few distinct intersecting slickensides tilted less than 45 degrees from horizontal; cracks filled with A material 1/4 to 3 inches wide and 2 to 4 feet apart; many fine masses of carbonate; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary.

Bkssg2-- 18 to 34 inches; olive gray (5Y 5/2) silty clay; light olive gray (5Y 6/2) dry; moderate fine and medium subangular blocky structure; firm; common fine faint dark gray (5Y 4/1) redoximorphic depletions; few very fine roots; few distinct intersecting slickensides tilted less than 60 degrees from horizontal; cracks filled with A material 1/4 to 2 inches wide and 2 to 4 feet apart; many fine masses of carbonate; violently effervescent; moderately alkaline (pH 8.3); clear wavy boundary. (Combined Bkg horizons 10 to 30 inches thick)

Bg-- 34 to 50 inches; olive gray (5Y 4/2) silty clay; weak fine and medium subangular blocky structure; friable; common medium distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; few fine masses of carbonate; violently effervescent; moderately alkaline (pH 8.2); clear wavy boundary. (0 to 20 inches thick)

Cg1--50 to 68 inches; olive gray (5Y 5/2) silty clay; weak fine and medium subangular blocky soil fragments parting to weak fine platy; firm; common medium distinct gray (5Y 5/1) redoximorphic depletions and medium prominent strong brown (7.5YR 4/6) and common fine reddish yellow (7.5YR 6/6) redoximorphic concentrations; few medium carbonate coats on faces of peds; strongly effervescent; moderately alkaline (pH 8.2); clear wavy boundary.

Cg2-- 68 to 80 inches; olive (5Y 5/3) laminated silty clay; laminates part to weak fine platy fragments which part to weak fine subangular blocky fragments; firm; common medium distinct gray (5Y 5/1) redoximorphic depletions and common medium prominent strong brown (7.5YR 5/6) and strong brown (7.5YR 5/8) redoximorphic concentrations; few medium irregular light gray (2.5Y 7/2) carbonate coats on faces of peds; strongly effervescent; moderately alkaline (pH 8.2).

TYPE LOCATION: Marshall County, Minnesota; about 5 miles west and 2 miles north of Stephen; 600 feet south and 2100 feet east of the northwest corner of Sec. 22, T. 157 N., R. 49 W.; USGS STEPHEN quadrangle; Latitude 48 degrees 24 minutes 25 seconds N. and Longitude 96 degrees 59 minutes 22 seconds W.

RANGE IN CHARACTERISTICS: The thickness of the mollic epipedon ranges from 7 to 16 inches. These soils have free carbonates in all parts with calcium carbonate equivalent of 10 to 30 percent throughout. The higher values are in the calcic horizon. The depth to the calcic horizon is less than 16 inches. Typically most pedons do not have rock fragments. The particle-size control section ranges from 40 to 60 percent noncarbonate clay, with an average of 50 percent and less than 5 percent sand. The average linear extensibility is estimated to be about 10.7 centimeters in the upper 40 inches.

The A horizon has hue of 10YR, 2.5Y, 5Y or is neutral, value of 2 or 3, and chroma of 0 or 1. Texture is silty clay, clay or silty clay loam. Effervescence is slight to violent. Reaction is slightly alkaline or moderately alkaline. Tongues of A horizon extend to depths as much as 36 inches in some pedons.

The Bkssg horizon has hue of 2.5Y, 5Y or 10YR, value of 3 to 6, and chroma of 1 or 2. Chroma of 2 is allowed if there are distinct or prominent redoximorphic concentrations. Texture is clay or silty clay. Effervescence is strong or violent. Reaction is slightly alkaline or moderately alkaline.

The Bg horizon has hue of 2.5Y or 5Y, value of 3 to 6, and chroma of 1 or 2. Chroma of 2 is allowed if there are distinct or prominent redoximorphic concentrations. Texture is clay or silty clay. Effervescence is slight to violent. Reaction is slightly or moderately alkaline.

The C horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 3. Distinct or prominent high chroma redoximorphic concentrations are present in most pedons. Texture is clay or silty clay. Silty clay loam textures with more than 35 percent noncarbonate clay are allowed. Effervescence is slight to strong. Reaction is slightly alkaline or moderately alkaline. Masses of gypsum crystals are in the B and C horizon in some pedons. Some pedons have sandy 2C horizons below a depth of 40 inches.

COMPETING SERIES: These are in the Reis series. Reis soils have more than 5 percent sand in the particle-size control section and formed in clayey glacial till.

GEOGRAPHIC SETTING: The Hegne soils have slightly convex to slightly concave slopes of less than 2 percent on glacial lake plains and in a few places these soils are on flood plains. These soils commonly are on the higher lying positions of microrelief topography. They formed in clayey lacustrine sediments of Late Wisconsin age. Mean annual air temperature ranges from 38 to 45 degrees F. Mean annual precipitation ranges from 15 to 27 inches. Frost-free days range from 90 to 140. Elevation above sea level ranges from 650 to 1800 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the poorly drained Fargo soils which formed in similar sediments on glacial lake plains soils. The Hegne soils are found in a complex with these associated soils on slightly higher positions. Fargo soils do not contain a calcic horizon within 16 inches of the surface.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. Runoff is low or medium. Saturated hydraulic conductivity is slow or very slow. Depth to an apparent seasonal high water table when undrained is as high as 0.5 to 1.5 feet at some time from April to June in most years.

USE AND VEGETATION: Nearly all of these soils are cultivated. Principal crops are small grains and sugar beets. Native vegetation is tall grass prairie.

DISTRIBUTION AND EXTENT: Principally in the Red River Valley of northwestern Minnesota and eastern North Dakota, also in smaller glacial lake basins in western Minnesota and north-central North Dakota. These soils are extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bismarck, North Dakota

SERIES ESTABLISHED: Sargent County, North Dakota, 1961.

REMARKS: The classification of these soils is in question as to whether they should be in the Typic or Aeric subgroup of Calciaquerts. This needs further investigation. This series was previously classified in the Typic Calciaquolls subgroup.

Diagnostic horizons and features recognized in this pedon are: mollic epipedon - the zone from the surface to 18 inches (Ap and A portion of A/Bkg horizons); calcic horizon - the zone from 10 to 34 inches (B portion of A/Bkg and Bkg horizons); vertic criteria - slickensides and cracks filled with A material in the zone from 10 to 34 inches (Bkssg1 and Bkssg2 horizons); aquic moisture regime.

ADDITIONAL DATA: Soil Interpretation Record number is MN0053.

National Cooperative Soil Survey
U.S.A.

Appendix C

Wetland Delineation
Data Sheets

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Red River Div. / ND Corridor City/County: / Cass Sampling Date: 07/29/2010
Applicant/Owner: ACE State: ND Sampling Point: (SP_1_W)
Investigator(s): Greg Larson, Ryan M., M.S. Section, Township, Range: GPS point recorded ND-WI-RMM
Landform (hillslope, terrace, etc.): lake plain Local relief (concave, convex, none): Concave Slope (%): 0-2
Subregion (LRR): F Lat: Long: Datum:
Soil Map Unit Name: Fargo silty clay NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation X, Soil ____, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X
Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	Is the Sampled Area within a Wetland? Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	

Remarks: Moderately to high alkaline soils. – Above-normal, wet, antecedent precipitation

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: 5 ft)			
1. Wheat cultivar			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
X Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: Ag. field – planted to wheat

SOIL

Sampling Point: SP-1-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-17	2.5Y 2.5/1						lc	
17-27	2.5Y 3/1						lc	
27-37	2.5Y 5/2		10YR 4/6	3	C	PL	lc	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- X Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: 8-ND-JCD City/County: Cass Sampling Date: 7/29/10
Applicant/Owner: ACOE State: ND Sampling Point: 8-ND-JCD
Investigator(s): JCD, BW, MB Section, Township, Range: GPS point recorded
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): F Lat: Long: Datum:
Soil Map Unit Name: Fargo silty clay NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ~~No~~ No X (If no, explain in Remarks.)
Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X
Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	Is the Sampled Area within a Wetland? Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	

Remarks:
Intensive ag field currently in wheat. ~~Ditch~~ Wetter than normal antecedent precip.
Water course improved as ditch through field

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: N/A)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: N/A)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. Wheat *	60		
2. Polygonum lapathifolium	5		FACW
3. Hibiscus trionum	2		UPL
4. -last years soybeans-weak	2		NI
5. ~~Tom~~ Amaranthus albus	2		FACU
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: N/A)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 30

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): ____ (A)
Total Number of Dominant Species Across All Strata: N/A (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = N/A

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
X Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
Wheat in W/L clearly stressed – shorter, more sparse than in "upper" level of field. Opportunistic weeds.

25 plot - 100% wheat - no WT/water/sat'n in landscape

SOIL

Sampling Point: 8-ND-JCD

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

See profile photo collected 7/28/20 along waterway at 14-MN-JCD

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? ~~Yes~~ X No ___ Depth (inches): ~~6~~ 13+ ?? or WT surface soaking in??

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Recent rains - however - adjacent to waterway thru field visible in most aerials - lateral extent of w/l fringe

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: 11 - ND - JCD - City/County: Cass Sampling Date: 7/28/10

Applicant/Owner: ACE State: ND Sampling Point: ND - 11 - JCD - wet

Investigator(s): JCD, MB, BW Section, Township, Range: GPS point recorded

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR): F Lat: Long: Datum:

Soil Map Unit Name: Cashel silty clay NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ✓	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____	
Wetland Hydrology Present?	Yes ✓ No ____	

Remarks:
Wetter than normal antecedent precip.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. boxelder & red Acer negundo	20	Y	FACW
2. elm, ~~Hackberry~~ Ulmus americana	10	Y	FACW
3.			
4.			
	30	= Total Cover	
Sapling/Shrub Stratum (Plot size: N/A)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: 5')			
1. Soybeans - stressed	50%		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
		= Total Cover	
Woody Vine Stratum (Plot size: N/A)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 50%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ✓ Dominance Test is >50%
- ____ Prevalence Index is ≤3.0[1]
- ____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ✓ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
Soybean field - crop stress

SOIL

Sampling Point: 11-ND-JCD-wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-24	10YR 2/1		7.5YR 4/6	2	C	M	SiC	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ✓	No ___	Depth (inches): ___
Water Table Present?	Yes ✓	No ___	Depth (inches): Ce
Saturation Present? (includes capillary fringe)	Yes ✓	No ___	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: 11-ND-JCD City/County: Cass / ND. Sampling Date: 7/28/10

Applicant/Owner: ACE State: ND Sampling Point: ND-11-JCD-UP

Investigator(s): JCD, BW, MB Section, Township, Range: GPS point recorded

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): CONVEX Slope (%): 2

Subregion (LRR): F Lat: Long: Datum:

Soil Map Unit Name: Cashel silty clay NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes X No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks: Wetter than normal precip in 3 mos prior.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. boxelder Acer negundo	20	Y	FACW
2. elm, Rapaceae (Ulmus americana)	10	Y	FACW
3.			
4.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		

Herb Stratum (Plot size: ____)			
1. Soybeans	100%		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): ____ (A)

Total Number of Dominant Species Across All Strata: N/A (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: Healthy soybean crop – Trees at edge of plot, not indicative of wetland in this location.

29 inch hole

SOIL

Sampling Point: 11-ND-JCD-UP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 3/1		7.5YR 4/6	2%	C	M	SiC	
18-29+	10YR 3/1		7.5YR 4/6	1%	C	M	SiC	calcium carbonates @ 22 inches
			10YR 5/2	1%	D	M		unconfirmed

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✓ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): _____

Water Table Present? Yes ___ No ___ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): _____

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Soil was notably drier than wetland plot just a few feet away. Soybean crop here showing no stress.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: 14-MN-JCD City/County: Co Clay Sampling Date: 7-28-10
Applicant/Owner: ACE State: Sampling Point: 14-MN-JCD
Investigator(s): JD, BM, MB Section, Township, Range: GPS point recorded
Landform (hillslope, terrace, etc.): floodplain terrace Local relief (concave, convex, none): none Slope (%): 0-2
Subregion (LRR): F Lat: Long: Datum:
Soil Map Unit Name: Fluvaquents - Haplaborolls complex NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ~~X~~ No X (If no, explain in Remarks.)
Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X
Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____
Is the Sampled Area within a Wetland? Yes X No ____

Remarks: Seasonally flooded 'basin' – edge of ~~of~~ stream – amidst intensive ag cropping. "Wet" antecedent precip.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: N/A)			
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: N/A)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. Pigweed Amaranthus albus	20%	Y	FACU
2. Crab Grass Digitaria Sp.	2%	N	NA
3. giant Ragweed Ambrosia trifida	3%	N	FAC
4. Lambs quarters Chenopodium album	1%	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	26 = Total Cover		50:13 20:
Woody Vine Stratum (Plot size: N/A)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: N/A (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = N/A

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
X Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: Sparsely vegetated concave surface amid wheat field, opportunistic weeds present in sparse abundance

SOIL

Sampling Point: 14-MN-JCD

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-11e	10YR 2/1		7.5YR 4/6	5	C	M	SiCl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- X Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- X Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix D

MnRAM
Results

Wetland Functional Assessment Summary
Fargo Moorhead Diversion

Wetland Name	*WS*	*SA*	*Location*	*Hydrogeomorphology*	*Maint. of Hydrologic Regime*	*Flood/ Stormwater/ Attenuation*	*Downstream Water Quality*	*Maint. of Wetland Water Quality*	*Shoreline Protection*
MN_W1_MTS	57	4	14-000-00-00-001	Depressional/Isolated (no discernable inlets or outlets)	Low	High	Moderate	Low	Not Applicable
ND_W1_RMM	57	4	00-000-00-00-001	Depressional/Isolated (no discernable inlets or outlets)	Low	High	Moderate	Low	Not Applicable

Wetland Functional Assessment Summary
Fargo Moorhead Diversion

								Additional Information		
Wetland Name	*Location*	*Maint. of Char. of Wildlife Habitat*	*Maint.of Char. Fish Habitat*	*Maint. of Char. Amphibian Habitat*	*Aesthetics/ Recreation/ Education/ Cultural*	*Commercial Uses*	*Ground-Water Interaction*	*Wetland Restoration Potential*	*Additional Stormwater Treatment Needs*	*Wetland Sensitivity to Stormwater and Urban Develop.*
MN_W1_MTS	14-000-00-00-001	Low	Not Applicable	Not Applicab	Low	Not Applicable	Combination Discharge, Recharge	Not Applicable	Low	Exceptional
ND_W1_RMM	00-000-00-00-001	Low	Not Applicable	Not Applicab	Low	Not Applicable	Combination Discharge, Recharge	Not Applicable	Low	Exceptional

Wetland Functional Assessment Summary

Wetland Name	Hydrogeomorphology	Maintenance of Hydrologic Regime	Flood/ Stormwater/ Attenuation	Downstream Water Quality	Maintenance of Wetland Water Quality	Shoreline Protection
ND-33 - Wheat Field Drown-o	Depressional/Isolated (no discernable inlets or outlets)	0.20	0.50	0.45	0.17	0.00
		Low	Moderate	Moderate	Low	Not Applicable

							Additional Information		
Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commercial Uses	Ground-Water Interaction	Wetland Restoration Potential	Wetland Sensitivity to Stormwater and Urban Development	Additional Stormwater Treatment Needs
ND-33 - Wheat Field Dr	0.28	0.00	0.00	0.10	0.00	Recharge	0.00	0.10	0.17
	Low	Not Applicable	Not Applicable	Low	Not Applicable		Not Applicable	Exceptional	Low

Wetland Community Summary

		Vegetative Diversity/Integrity								
		Community								
Wetland Name	Location	Cowardin Classification	Circular 39	Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating
ND-33 - Wheat Field Drown-o				Seasonally Flooded Basin	0	0.1	0.10	0.10	0.00
							Low	Low	Not Applicable
							0.10	0.10	0.00 ☐

☑ *Denotes incomplete calculation data.*

Wetland Functional Assessment Summary
Fargo-Moorhead Red River Diversion

Wetland Name	*WS*	*SA*	*Location*	*Hydrogeomorphology*	*Maint. of Hydrologic Regime*	*Flood/ Stormwater/ Attenuation*	*Downstream Water Quality*	*Maint. of Wetland Water Quality*	*Shoreline Protection*
8-ND-JCD	0	NA	00-138-49-32-001	Depressional/Tributary (outlet but no perennial inlet or drainage entering from upstream subwatershed)	Low	Moderate	Moderate	Low	Not Applicable
7-ND-JCD	57	4	00-137-49-04-001	Depressional/Isolated (no discernable inlets or outlets)	Low	High	Moderate	Low	Not Applicable
11-ND-JCD	0	NA	00-137-48-07-001	Floodplain (outside waterbody banks)	Low	Moderate	Moderate	Low	Not Applicable
0-MN-JCD	57	4	14-137-48-07-001	Floodplain (outside waterbody banks)	Moderate	Moderate	Moderate	Moderate	Moderate
14-MN-JCD	57	4	14-137-48-08-001	Depressional/Flow-through (apparent inlet and outlet), Depressional/Flow-through (apparent inlet and outlet)	Low	Moderate	Low	Low	Not Applicable
134-ND-JCD	57	4	00-138-49-35-001	Depressional/Flow-through (apparent inlet and outlet), Depressional/Flow-through (apparent inlet and outlet)	Low	Moderate	Moderate	Moderate	Not Applicable

Wetland Functional Assessment Summary
Fargo-Moorhead Red River Diversion

								Additional Information		
Wetland Name	*Location*	*Maint. of Char. of Wildlife Habitat*	*Maint.of Char. Fish Habitat*	*Maint. of Char. Amphibian Habitat*	*Aesthetics/ Recreation/ Education/ Cultural*	*Commercial Uses*	*Ground-Water Interaction*	*Wetland Restoration Potential*	*Additional Stormwater Treatment Needs*	*Wetland Sensitivity to Stormwater and Urban Develop.*
8-ND-JCD	00-138-49-32-001	Low	Not Applicable	Not Applicab	Low	Not Applicable	Recharge	Not Applicable	Low	Exceptional
7-ND-JCD	00-137-49-04-001	Moderate	Not Applicable	Not Applicab	Low	Not Applicable	Recharge	Not Applicable	Low	Exceptional
11-ND-JCD	00-137-48-07-001	Low	Not Applicable	Not Applicab	Low	Low	Recharge	Not Applicable	Low	Exceptional
0-MN-JCD	14-137-48-07-001	Moderate	Not Applicable	Not Applicab	Low	Not Applicable	Recharge	Not Applicable	Moderate	Moderate
14-MN-JCD	14-137-48-08-001	Low	Not Applicable	Not Applicab	Low	Low	Recharge	Not Applicable	Low	Exceptional
134-ND-JCD	00-138-49-35-001	Moderate	Not Applicable	Not Applicab	Low	Low	Recharge	Not Applicable	Moderate	Moderate

Wetland Functional Assessment Summary

Wetland Name	Hydrogeomorphology	Maintenance of Hydrologic Regime	Flood/ Stormwater/ Attenuation	Downstream Water Quality	Maintenance of Wetland Water Quality	Shoreline Protection
ND-19 - Shallow Open Water	Depressional/Isolated (no discernable inlets or outlets)	0.33	0.74	0.66	0.39	0.00
		Low	High	High	Moderate	Not Applicable

	Additional Information								
Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commercial Uses	Ground-Water Interaction	Wetland Restoration Potential	Wetland Sensitivity to Stormwater and Urban Development	Additional Stormwater Treatment Needs
ND-19 - Shallow Open	0.35	0.00	0.10	0.42	0.00	Recharge	0.00	0.00	0.39
	Moderate	Not Applicable	Low	Moderate	Not Applicable		Not Applicable		Moderate

Wetland Community Summary

		Vegetative Diversity/Integrity								
		Community								
Wetland Name	Location	Cowardin Classification	Circular 39	Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating	
ND-19 - Shallow Open Water							0.00	0.00	0.00	
							Not Applicable	Not Applicable	Not Applicable	
							0.00	0.00	0.00	☑

☑ *Denotes incomplete calculation data.*

Wetland Functional Assessment Summary

Wetland Name	Hydrogeomorphology	Maintenance of Hydrologic Regime	Flood/ Stormwater/ Attenuation	Downstream Water Quality	Maintenance of Wetland Water Quality	Shoreline Protection
Proposed Diversion Cond.	Depressional/Flow-through (apparent inlet and outlet), Depressional/Flow-through (apparent inlet and outlet), Riverine (within the river/stream banks), Floodplain (outside waterbody banks)	0.52	0.62	0.58	0.47	0.72
		Moderate	Moderate	Moderate	Moderate	High

	Additional Information								
Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commercial Uses	Ground-Water Interaction	Wetland Restoration Potential	Wetland Sensitivity to Stormwater and Urban Development	Additional Stormwater Treatment Needs
Proposed Diversion Co	0.73	0.78	0.05	0.54	0.00	Combination Discharge, Recharge	0.00	0.50	0.47
	High	High	Low	Moderate	Not Applicable		Not Applicable	Moderate	Moderate

Wetland Community Summary

		Vegetative Diversity/Integrity								
		Community								
Wetland Name	Location	Cowardin Classification	Circular 39	Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating	
Proposed Diversion Cond.	00-000-00-00-001	PEMCx	Type 3	Shallow Marsh	15	0.5	0.50	0.50	0.50	
							Moderate	Moderate	Moderate	
		PEMB	Type 2	Fresh (Wet) Meadow	85	0.5	0.50	0.50	0.50	
							Moderate	Moderate	Moderate	
					100		0.50	0.50	0.50	☐

☑ *Denotes incomplete calculation data.*