BURNS McDONNELL

2017 Annual Wetland Monitoring Report

METROPOLITAN UTILITIES DISTRICT

Metropolitan Utilities District

Platte West Water Production Facility Project
Project No. 101060

1/12/2018

2017 Annual Wetland Monitoring Report

prepared for

Metropolitan Utilities District
Platte West Water Production Facility Project
Omaha, NE

Project No. 101060

1/12/2018

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

EXECUTIVE SUMMARY

The Metropolitan Utilities District (District), Omaha, Nebraska, was issued a Section 404 Individual Permit (Permit) on May 16, 2003, from the U.S. Army Corps of Engineers, Omaha District (Corps), for the Platte West Water Production Facilities Project (Project) (U.S. Army Corps of Engineers 2003). As part of the terms and conditions included in the Corps Section 404 Permit, the wetlands located in the well fields and projected cones of depression must be monitored to determine the extent of any impacts to wetlands that may take place as a result of Project operation. To comply with this condition, a Wetland Monitoring Plan was prepared and approved in 2005 and has been implemented annually (Burns & McDonnell 2005a).

As part of the Wetland Monitoring Plan, on-site vegetation monitoring of the wetlands in the well fields is conducted to characterize major wetland and upland plant communities and the variation between them. In 2017, only W-100 was monitored in June and September. The other primary wetlands whose vegetation has been monitored on-site did not require monitoring in 2017 due to the approved reduction in monitoring intensity. The 2017 sampling effort represents the ninth full year of monitoring during operation of the water treatment plant and thirteenth year of overall monitoring (including baseline monitoring). Vegetation sampling took place in sample plots along permanent transects and gradsects established in the wetland ecosystem. Data obtained during 2017 have been analyzed and compared to the baseline data and the results are discussed in this annual report and included in Appendix I.

As a result of the conditions observed during 2017 monitoring, it is recommended that wetland monitoring at W-100 decrease to Level 2 Reduced Annual Monitoring with monitoring efforts scheduled for spring 2018. W-100 differs from the other monitored wetlands in that it is underlain by sandy soils rather than a thick clay layer. Additionally, W-100 is located much farther from the Platte River and, therefore, is not as directly tied to the water elevation of the river. If the mean weighted average (WA_M) value and other vegetative indices at W-100 continue to show statistically significant changes from baseline condition, the level of monitoring intensity at W-100 may continue to be increased or an impact may be occurring, which will be discussed with the District and the Corps.

Although not monitored in 2017, W-68 in Douglas County and W-25 in Saunders County are currently at Level 3 Decreased Annual Wetland Monitoring. The protocol for Level 3 dictates monitoring will once again take place at W-68 and W-25 in the spring of 2018. This will be the only monitoring effort at these wetlands in 2018.

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1.0 INTRODUCTION

The Metropolitan Utilities District (District), Omaha, Nebraska, was issued a Section 404 Individual Permit (Permit) on May 16, 2003, from the U.S. Army Corps of Engineers, Omaha District (Corps), for the Platte West Water Production Facilities Project (Project) (U.S. Army Corps of Engineers 2003). As part of the terms and conditions included in the Corps Section 404 Permit, the wetlands located in the well fields and projected cones of depression must be monitored to determine the extent of any impacts to wetlands that may take place as a result of Project operation. To comply with this condition, a Wetland Monitoring Plan was prepared and approved in 2005 and has been implemented annually (Burns & McDonnell 2005a).

As stated in Permit Condition 37: "The purpose of the monitoring is to identify any changes in the existing or future wetlands or aquatic sites impacted as a result of project development and operation." Both temporary and permanent impacts to wetlands are expected to result from the construction and operation of the Project, which is located in Douglas and Saunders Counties, Nebraska. The 2005 Wetland Monitoring Plan presents a systematic, multi-tiered approach to monitor wetlands within the Douglas County and Saunders County well fields and their associated cones of depression to evaluate any impact due to the operation of the Project.

Wetlands selected for monitoring were chosen from those identified during the delineations conducted in the well fields (Burns & McDonnell 2004) and in the cones of depression (Burns & McDonnell 2005b). Monitoring of wetlands in accordance with the Wetland Monitoring Plan was initiated in June 2005. Annual monitoring reports, characterizing each year's monitoring effort (2005 through 2007) and culminating in the *Baseline Wetland Monitoring Report*, were submitted for each year of baseline monitoring (Burns & McDonnell 2006a, 2007a, 2008, 2009). Monitoring through spring of 2008 was conducted to characterize the baseline conditions of the wetlands prior to initiation of Project operation. The Project began producing water for municipal use during the summer of 2008; therefore, the monitoring efforts from fall 2008 through the present are considered operational. The 2017 monitoring represents the ninth full year of monitoring during operation of the water treatment plant and thirteenth year of overall monitoring (including baseline monitoring).

This report summarizes the 2017 monitoring and provides some comparisons to the baseline and operational conditions.

* * * * *

2.0 SAMPLING METHODOLOGY

The goal of monitoring wetlands within the Douglas County and Saunders County well fields and associated cones of depression is to evaluate the impact that operation of the Project may have on the existing wetlands. To accomplish this goal, a wetland monitoring approach consisting of a systematic, multi-tiered vegetation sampling procedure has been developed, approved, and implemented. In developing this vegetation sampling procedure, numerous literature sources and references were reviewed. Several discussions with personnel from the Corps and the District occurred during the preparation of this plan and the synthesis of the approach. Key references and sources used included:

- 1987 Corps and 1989 Federal wetland delineation manuals (Environmental Laboratory 1987 and Federal Interagency Committee for Wetland Delineation 1989)
- performance standards for wetland creation and restoration (Streever 1999 and Environmental Law Institute 2004)
- vegetation sampling and analysis methodologies (U.S. Environmental Protection Agency 2002 and Tiner 1999)
- wetland mitigation guidelines (Taylor and Krueger 1997)

Wetland monitoring, as stated above and described in the following paragraphs, began during Project construction in 2005, prior to initiation of Project operation. Monitoring will continue until the Corps agrees that any impacts to wetlands as a result of Project operation either have been completely mitigated or are not likely to occur. If the results of the monitoring program indicate that no wetland impacts are occurring, long-term monitoring can either be decreased or stopped, in accordance with the thresholds analysis discussed in Section 4.0 Thresholds. If the results of the monitoring indicate effects are occurring to wetlands that have not been previously mitigated, discussions with the Corps will be initiated to determine what additional mitigation may be required.

2.1 WETLAND MONITORING IN THE WELL FIELDS

The types of data that were collected, the methods used, and the analyses completed during the wetland monitoring process in the well fields are described in the paragraphs that follow.

2.1.1 Vegetation Sampling

Vegetation was sampled in selected wetlands in the two well fields to characterize the major wetland and adjacent upland plant communities and the variation between them. Wetlands where vegetative change was most likely to be detected first were selected for vegetation sampling; these wetlands are referred to

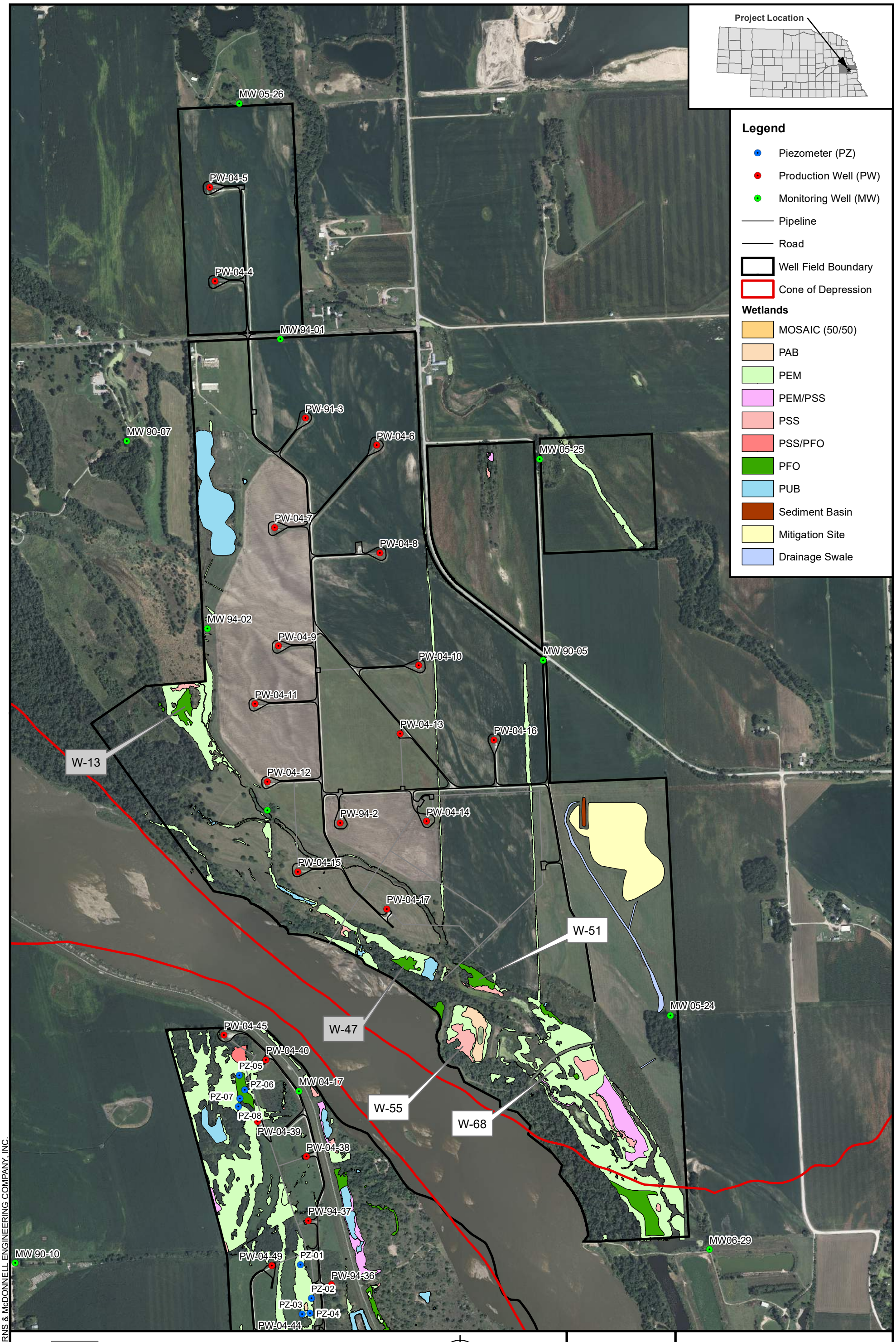
as “primary” wetlands. During the initial years of Level 1 Standard Monitoring, vegetation sampling in these primary wetlands occurred twice each year, in mid-June and in late September. In 2011, the monitoring intensity decreased from Level 1 (monitoring of palustrine emergent (PEM) wetlands twice yearly) to Level 2 (monitoring of PEM wetlands once yearly) based on the data collected during monitoring. Following the 2012 drought, W-25 and W-100 were increased to Level 1 Decreased Monitoring after discussions with the Corps and the District in 2013. Due to the increase in monitoring intensity, monitoring occurred twice in 2013 for W-25 and W-100. In 2014, W-25 was returned to Level 2 as it had recovered sufficiently from drought damage and W-100 remained at Level 1. In 2015, W-25 and W-68 were lowered to Level 3 Decreased Monitoring, requiring monitoring every other year, and have remined at that level. W-100 has remained at Level 1 with two monitoring efforts taking place each year.

If Project operation-induced impacts to wetland vegetation are observed and documented in any of the primary wetlands, the monitoring of nearby secondary wetlands will be initiated. The monitoring of the secondary wetlands, in addition to the primary wetlands, will help determine if the observed impact is localized and confined to the primary wetland, or is spreading to the adjacent or surrounding wetlands. The primary and secondary wetlands that are being or will be monitored in the Douglas County and Saunders County well fields are shown in Figures 2-1 and 2-2. The wetlands in the Saunders County well field are monitored more extensively than wetlands in the Douglas County well field due to the presence of the 95-acre Wet Meadow in Saunders County. However, the proposed monitoring plan is flexible and can be adjusted to meet specific, identified needs for monitoring, if they develop.

Vegetation sampling methods used vary depending on the type of wetland vegetation being sampled. These differences in methodologies are described in the following sections.

2.1.1.1 Palustrine Emergent Wetlands

The vegetation in a PEM wetland is normally comprised of herbaceous plant species. However, seedlings of woody plants less than one meter tall may also be included in the PEM wetland vegetation. Herbaceous plant species were sampled using gradient-oriented transects, or “gradsects”. A gradsect is defined as a transect that is placed perpendicular to the baseline transect along the ecotone gradient. The ecotone is the distinct area where one plant community changes or intergrades into another separate, distinct plant community. Sampling units are located in the center of each vegetation community and at each ecotone. The sampling unit consists of five, three-foot-diameter circular sample plots placed along the gradsect. Three baseline transects with between two and seven gradsects have been placed in each PEM wetland.



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Source: Wilson & Company 2017 Aerial Photography

Issued: 1/12/2018

Project Location

Legend

- Piezometer (PZ)
- Production Well (PW)
- Monitoring Well (MW)
- Pipeline
- Road
- Cone of Depression
- Well Field Boundary

Wetlands

- MOSAIC (50/50)
- PAB
- PEM
- PEM/PSS
- PSS
- PSS/PFO
- PFO
- PUB
- Mitigation Site

PW-04-45
PW-04-40
W-5
PZ-05
MW 04-17
PZ-06
PZ-07
PZ-08
PW-04-39
W-50
PW-04-38
W-17
PW-94-37
MW 90-10
PW-04-49
PZ-01
PW-94-36
W-25
PZ-02
W-54
PZ-03
PZ-04
PW-04-44
PZ-13
PW-94-35
PZ-14
W-31
PW-04-43
PZ-15
PZ-17
PW-94-34
PZ-16
PZ-18
PW-04-42
PW-94-33
PW-94-32
PW-04-46
PW-04-41
PW-94-31
MW 94-04
PW-04-54
PW-04-55
PW-91-30
PW-04-52
PW-04-53
PW-04-51
PW-04-50
PW-04-48
PW-04-47
PZ-12
W-100
PZ-11
MW 05-23
MW 05-22
PZ-10
PZ-09

W-55 Primary Wetland

W-47 Secondary Wetland

NORTH

1,000 500 0 1,000

Scale in Feet

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Figure 2-2
Monitoring Locations
Saunders County Well Field
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/12/2018

Vegetation and wetland monitoring in the PEM wetlands began in 2005. During the first sampling period in June 2005, each permanent transect, gradsect, and sample plot was located and recorded using a global positioning system (GPS; Trimble® Pro XRS sub-meter GPS unit). The beginning and end of each transect and gradsect were permanently marked in each wetland using two-foot sections of 3/8-inch or 1/2 inch rebar, painted orange and flagged. These permanent markers also serve as photograph stations. A photographic record is being maintained for each sampling period at each gradsect and transect. This photographic record will provide a repetitive visual record of the wetland vegetation monitoring during seasons and over years.

Vegetation and plant species data that were collected during the PEM wetland vegetation monitoring effort include the identification, to species when possible, of each plant located within the three-foot diameter sample plot. The percent cover for each plant species occurring in a sample plot was estimated using a modified Daubenmire cover-class method. In this methodology, percent canopy cover is visually estimated for each plant species either rooted within or extending into each three-foot diameter plot. The plant species is placed into one of a series of cover classes using the estimated percent canopy cover. These classes are based on the mid-point of canopy coverage per the modified Daubenmire canopy cover method shown in Table 2-1 (Daubenmire 1959; Bailey and Poulton 1968).

Table 2-1: Modified Daubenmire Cover Class Scale

Cover Class	1	2	3	4	5	6	7
Range (%)	0-1	1-5	5-25	25-50	50-75	75-95	95-100
Midpoint (%)	0.5	3.0	15.0	37.5	62.5	85.0	97.5

A cover class was also estimated for the non-vegetated area in the three-foot diameter plot because sample plots are often not completely vegetated. Non-vegetated areas can include bare soil, rocky surface, open water, or litter. Quantifying the bare area provides an indication of the potential for additional vegetation in the sample plot. Even with bare area in a plot, the total cover of vegetation may be greater than 100 percent, because plants often overlap in a plot.

If standing water is present within the sample plot, the water depth (in inches) at the center of each plot will be recorded. The percentage of the plot that is inundated will also be estimated and assigned a cover class value that is recorded on the data entry forms.

2.1.2 False-color Infrared (CIR) Aerial Photography

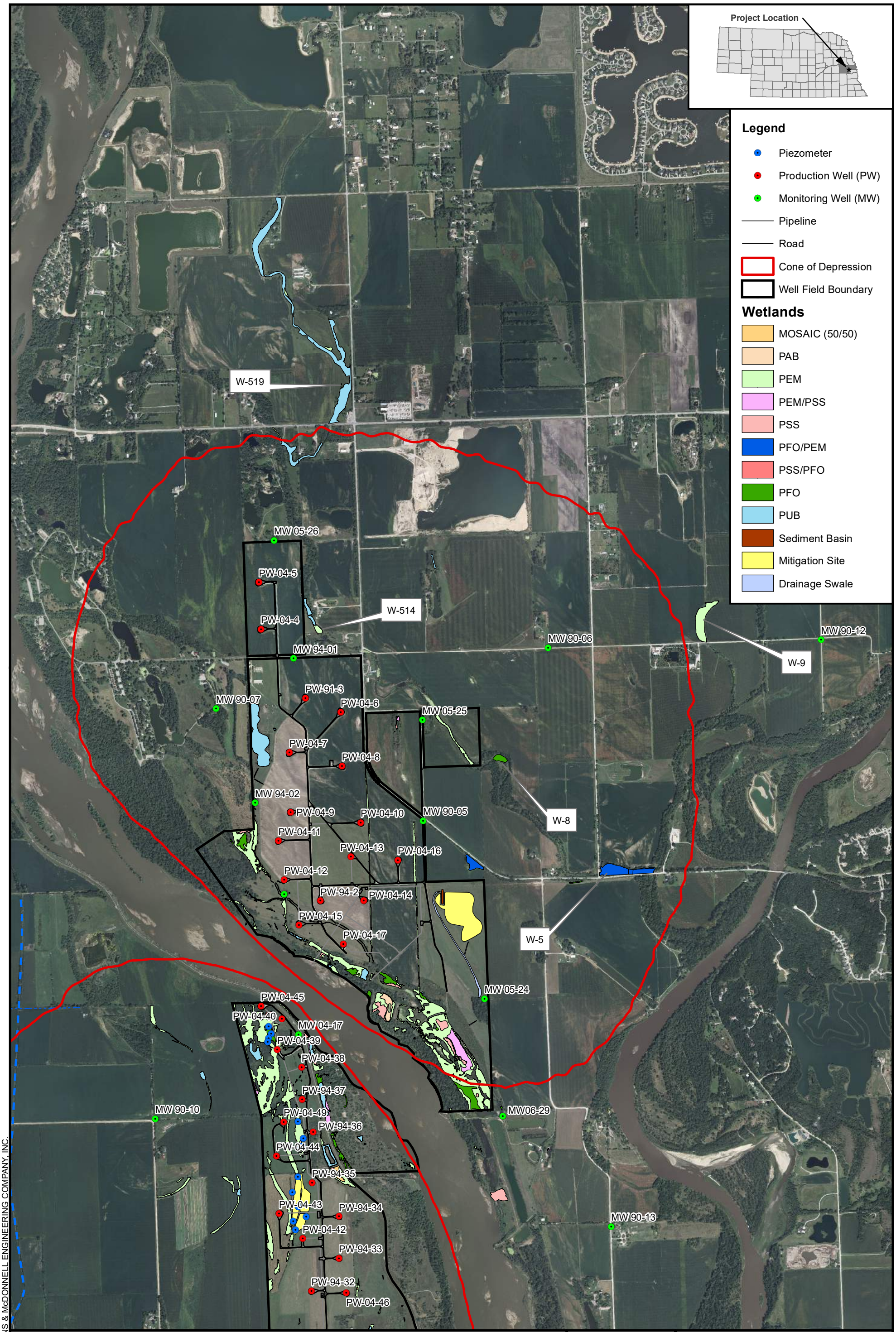
False-color infrared (CIR) aerial photography was initially taken in 2005 and was obtained annually through 2009. In accordance with the reduced monitoring intensity level, as described in Section 4.0 Thresholds, CIR aerial photography has subsequently been collected every other year. CIR photography was obtained in 2017. In accordance with the current schedule, CIR photography will again be obtained in 2019. The CIR photographic coverage includes both well fields and the associated cones of depression in Douglas and Saunders Counties. The CIR aerial photography is used to monitor the overall size, shape and condition of the wetlands and different types of vegetation occurring in the well fields over time.

2.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

The Douglas County and Saunders County well fields are owned in fee title by the District. As a result, access to the well fields for vegetation and groundwater monitoring is available at all times. The land surrounding or adjacent to the well fields is projected to potentially experience some groundwater drawdown during Project operation. Groundwater modeling is conducted annually to incorporate data collected from the monitoring and production wells (Burns & McDonnell 2017). The groundwater model is able to predict the area of land surrounding the well fields that is expected to experience a one-foot drawdown of local groundwater during project operation. These areas are designated as “cones of depression” and are larger than the well fields. The originally modeled cones of depression are included in Figure 2-3 and Figure 2-4.

The land outside the well fields but within the cones of depression is not owned by the District. As such, seasonal and annual access to that portion of the cones of depression for consistent wetland monitoring cannot be assured. Therefore, the monitoring methodology for the wetlands within the cones of depression, but outside of the District-owned well fields, is based on the interpretation and comparison of the CIR aerial photography. The CIR aerial photography for the cones of depression will be obtained per the methods described in Section 2.1.2 above for the wetland monitoring in the well fields.

A total of eight wetlands in the cones of depression have been selected for secondary monitoring from those that were identified during the wetland delineation of accessible property within the cones of depression (Burns & McDonnell 2005b; Figures 2-3 and 2-4). Six of these eight wetlands are emergent wetlands (W-9, W-514, and W-519 in Douglas County and W-306, W-321, and W-700 in Saunders County), one is a PFO/PEM wetland complex (W-5 in Douglas County), and one is a PFO wetland (W-8 in Douglas County). More emergent wetlands are being monitored than other types of wetlands due to the presence of more emergent wetlands in the cones of depression than any other type of wetland.



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Source: Wilson & Company 2017 Aerial Photography

Issued: 1/12/2018

PW-94-2
PW-04-14
PW-04-15
PW-04-17
MW 05-24
PW-04-45
PW-04-40
MW 04-17
PW-04-39
PW-04-38
PW-94-37
MW06-29
MW 94-05
MW 90-10
PW-04-49
PW-94-36
PW-04-44
PW-94-35
PW-04-43
PW-94-34
PW-04-42
PW-94-33
PW-94-32
PW-04-46
PW-04-41
PW-94-31
MW06-28
MW 94-04
PW-04-54
PW-91-30
PW-04-55
W-700
W-306
PW-04-52
PW-04-53
PW-04-51
MW 06-27
PW-04-50
PW-04-48
PW-04-47
MW 05-23
MW 05-22
MW 06-18
MW 94-06
MW 94-03
MW-39A
W-321
MW 94-07

Legend

- Piezometer
- Production Well (PW)
- Monitoring Well (MW)
- Pipeline
- Road
- Cone of Depression
- Well Field Boundary

Wetlands

- MOSAIC (50/50)
- PAB
- PEM
- PEM/PSS
- PSS
- PSS/PFO
- PFO
- PUB
- Mitigation Site
- Drainage Swale

Project Location

W-55 Monitored Wetland

NORTH

0 2,000 4,000

Scale in Feet

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Figure 2-4
Monitoring Locations
Saunders County Cone
of Depression
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

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2.3 HYDROLOGICAL MONITORING

Several different types of hydrological data are being collected and analyzed. This hydrological data is being used to document the effect the existing water table has on wetlands in the two well fields and the potential effect Project operation may have on the water table.

2.3.1 Groundwater Monitoring Wells

Permanent monitoring wells designed to measure local groundwater levels have been installed by the District at specific locations in and around the Douglas County and Saunders County well fields and cones of depression (Figures 2-1 through 2-4). The locations of these groundwater monitoring wells were recorded using GPS. Data loggers have been installed at the monitoring wells so that groundwater levels can be measured and recorded on a daily basis. Groundwater data from the monitoring wells is correlated with the other hydrological data that is being collected to evaluate if any Project-induced groundwater system changes are occurring.

2.3.2 Production Wells

The Project production wells that are pumped to provide raw water to the water treatment facility during Project operation are located in the Douglas County and Saunders County well fields (Figures 2-1 and 2-2). These water production wells have also been fitted with data loggers that measure and record the depth to the water table at each wellhead whether or not the well is actively being pumped. In addition, the rate at which each well is being pumped is measured in millions of gallons per day (MGD). The locations of these water production wells were recorded using GPS. Data from the water production wells (production rate, drawdown, cone of depression, etc.) during Project operation is correlated with the other hydrological data that is being collected to evaluate if Project-induced changes to wetlands are occurring.

2.3.3 Piezometers

A total of 18 piezometers were installed in five wetlands in the Saunders County well field (Figure 2-2). Twelve of these were installed in three existing wetlands (four piezometers per wetland) already being monitored as part of the Wetland Monitoring Plan (Burns & McDonnell 2005a). Four piezometers were installed in the Phase I Mitigation Site located adjacent to the Wet Meadow and described in the Phase I Wetland Mitigation Plan (Burns & McDonnell 2005d). The remaining two piezometers were installed in the Phase II Wet Meadow Mitigation Site (Burns & McDonnell 2007c). In July 2010, eight of the existing piezometers were replaced by installing a new piezometer adjacent to the old ones. The replacement of some piezometers was necessary as a result of the undermining of existing piezometers due to frost heave, erosion, or animal activity. A modified installation approach was implemented during the replacement of the eight piezometers. Additional rebar was driven into the ground at divergent angles before the concrete

base was poured. This additional rebar should help stabilize the piezometers against frost heave. The locations and elevations of the installed piezometers have been recorded using GPS.

In each of the five wetlands being monitored with piezometers, one of the piezometers was located near the center or low point. Since subsurface groundwater flow is generally from north to south, one piezometer was installed at the northern edge of each wetland; the remaining two piezometers were installed along the southern edge of each wetland.

The piezometers installed in two existing wetlands in the Wet Meadow (W-5 and W-25) and the created Phase I and Phase II Wet Meadow Mitigation Sites adjacent to the Wet Meadow are designed to monitor the shallow, perched water table between the soil surface and the clay layer before and after Project operation begins. Piezometers were also installed in a PEM wetland (W-100) in the southern portion of the Saunders County well field that is outside of the Wet Meadow boundary (and also outside of the perched water table located above the shallow clay layer) to monitor the shallow groundwater prior to and during Project operation. All piezometers are being monitored on an approximate monthly basis during the growing season to assess the seasonal and annual fluctuation in the shallow water table and the variation between years. For additional information on the installation and monitoring of the piezometers, please refer to Burns & McDonnell's Wetland Monitoring Plan (2005a).

2.3.4 Bathymetric Monitoring of Ponds

Bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was initiated in 2004 (Burns & McDonnell 2005c). Using GPS and a boat-mounted sonar recorder, bathymetric maps were developed for each of the ponds being monitored. These maps established baseline conditions by depicting each pond's water surface area and water depth contours. Prior to initiation of Project operations, water surface elevations at each pond were monitored four times (March, August, September, and October) each year. The pond surface water elevation data collected provides a basis for comparing the seasonal pre-Project changes with the changes that may occur with operation of the Project.

Permanent benchmarks and elevations were established near each pond above the high water mark during the early summer of 2005. The location and elevation of each permanent benchmark was established using a survey-grade GPS. Water surface elevations were measured from the established permanent benchmark using a surveyor's level. The 2005 bathymetric monitoring also included the contour mapping of one pond that was overlooked during the 2004 mapping effort (Burns & McDonnell 2006b). During the 2006 bathymetric monitoring effort, an additional pond was surveyed at the request of the landowner

(Burns & McDonnell 2007b). In 2008, two ponds were added and two ponds were removed. In 2009, an additional pond, DG-11, was added by request of the landowner and is being monitored by photographic documentation only at this time. In 2010, pond DG-02A was added to the monitored ponds at the request of the landowner. Currently, a total of 44 ponds are being monitored.

The seasonal variation in surface water elevation of the 43 ponds being monitored quantitatively (DG-11 is being monitored by photographic documentation only) are compared between baseline and operational conditions and evaluated in concert with the other hydrologic data that are being collected. The bathymetric data collected from the ponds will be used to indicate if Project operation is resulting in water level fluctuations for a specific pond or ponds and if these fluctuations are different than would normally occur under baseline conditions.

2.3.5 Other Hydrological Data

Additional hydrological data is also collected during the annual monitoring effort each year. This additional data includes monthly total precipitation, monthly average ambient air temperature, and stream gauge data for the Platte and Elkhorn Rivers.

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3.0 DATA ANALYSIS

The following sections provide a brief discussion of the data analysis of the 2017 annual wetland monitoring efforts in the well fields and cones of depression.

3.1 WETLAND MONITORING IN THE WELL FIELDS

The spring and fall 2017 monitoring efforts in the well fields consisted of the systematic sampling and analysis of wetland and nearby upland vegetation and the collection and comparison of various types of hydrological data.

3.1.1 Vegetation Data

Vegetation monitoring of the wetlands in the well fields occurred in June and September 2017 for only W-100 to characterize major wetland and upland plant communities. This sampling effort represents the ninth full year of monitoring during operation of the water treatment plant. Vegetation sampling took place in sample plots along permanent transects and gradsects established in the wetland ecosystem as described previously. Data obtained during 2017 has been analyzed and compared to baseline data and the results are discussed below and included in Appendix I. Additionally, some comparisons of vegetation data collected during each sampling period during Project operation have also been included.

All of the wetland vegetation data obtained during monitoring was input into a Microsoft Access database that has been designed specifically to accommodate seasons and years of data. The database was also designed for the rapid comparative assessment of selected vegetative characteristics within and among wetlands and wetland types in general. In 2012 and 2016 the Corps issued an update to the National Wetland Plant List (NWPL; Lichvar and Kartesz 2009), which resulted in changes to some of the wetland indicator statuses and nomenclature. However, for consistency with previous analyses, nomenclature and plant characteristics were obtained from the USDA PLANTS Database (USDA NRCS 2016). A complete list of plant species that have been identified in each of the monitored wetlands has been compiled and is included in Appendix II. The vegetative characteristics that were analyzed are described below.

During data collection in the field, the percent cover for each plant species observed in each sample plot was estimated. As explained in the following paragraphs, these collected vegetative data were used to calculate a weighted average for each sampling unit in addition to calculating the species richness; species diversity; percent native species; percent invasive species; the percentage of perennial, biennial, and annual species; the mean coefficient of conservatism (c-value); and the Floristic Quality Index (FQI).

3.1.1.1 Change in Wetness

Species abundance and the wetland indicator status for each species can be used to measure the wetness of an area. This measure of wetness is referred to as the weighted average (Tiner 1999) or the Prevalence Index [Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0, 2010)]. For the current year's data, the average or mean weighted average (WA_M) was calculated for each wetland as a whole and for each gradsect located in the emergent wetlands. The WA_M is calculated using the following formula:

$$\text{Mean Weighted Average}\,(WA_M) = \frac{\sum I\,E}{\sum I}$$

where $I = \text{importance value for the species (e.g., percent cover)}$

$E = \text{ecological index for the species}$

The importance value used for this evaluation is the percent cover for the species in the sample plot. The ecological index is a value between 1 and 5 that corresponds to the wetland indicator status for the given species. An ecological index value of 1 corresponds to an obligate wetland plant and a value of 5 corresponds to an upland plant. The calculated WA_M should be equal to or less than 3.0 in order for a specific site to be considered a wetland if hydric soils and sufficient hydrology are present. In transitional areas, a WA_M should approach 3.5, depending on landscape position, hydrology, and other related features.

3.1.1.2 Change in Species Composition

Change in species composition over time will be analyzed by comparing the various vegetative indices that are being calculated each year. These indices were calculated from the collected data to assist in interpreting any changes observed in the vegetation communities. These additional calculations are explained in the following paragraphs and include:

- Species richness
- Species diversity
- Percent of native vegetation
- Percent of invasive species
- Percent of perennial/annual/biennial vegetation
- Floristic Quality Index (FQI)
- Mean c-value

Species richness is the count of the number of different species identified in a plant community. This parameter is used to help characterize the plant community being examined and is often used in concert with species diversity indices (Greig-Smith 1983). In most cases, a higher species richness value is obtained from a better quality or more diverse plant community.

Species diversity is an index that combines species richness and equitability (the evenness of the contribution of different species to the community) in order to investigate the heterogeneity of a plant community that is more a measure of the functional or apparent number of species rather than the absolute number of species as in species richness (Greig-Smith 1983). Species diversity in this study is the number of different species in an area weighted by some measure of abundance. Here, the measure of abundance used is the number of occurrences of each species in each wetland out of the total number of plots. The formula for species diversity follows Simpson (1949) and is included below:

$$\text{Species Diversity}(D) = \frac{N(N-1)}{\sum n(n-1)}$$

where N = total number of occurences for all species in all plots

n = number of occurences for each individual species

Simpson's Reciprocal Index (1/D) is calculated and included in the data analysis. In general, diversity increases with increasing heterogeneity: the higher the diversity value, the more diverse the plant community.

Assessing the abundance of native and invasive species provides an indication of the quality of the plant community and, when used long-term, provides an indication of whether there is a shift in quality over time. For this study, the percent of native vegetation is the percent of plant species out of the total species occurring in the wetland that are considered to be native to the United States. The percent of invasive vegetation is the percent of plant species out of the total species occurring in the wetland that are considered to be invasive in the United States or have the potential to dominate a community to the exclusion of more desirable species. Invasive species can be both native and non-native plants.

Additionally, the percentages of the total plant species that are annual, biennial, and perennial are indicated. This parameter shows the contribution of the different types of plants, and provides, in part, an indication of the diversity of the plant community in question.

A Floristic Quality Analysis (FQA) will also be conducted on the vegetation data. The FQA is typically conducted on vegetation data collected during a pedestrian survey of the whole site. However, because

the sampling of these wetlands is so extensive, the FQA calculations will be based on data collected from the sample plots rather than a separate survey. The mean c-value and FQI are calculated using c-values that were assigned for the Nebraska region by Rolfsmeier and Steinauer (2003). The c-value is a number between 0 and 10 that is assigned to each plant species in a region. The c-value assigned is an indication of whether the plant is native to the area and how tolerant to disturbances the species is. For example, a native plant that is found only in intact natural communities would be assigned a value of 10, while an invasive or non-native species commonly found on roadsides, for example, would be assigned a value of 0. The mean c-value is the average of the c-values from the plant species identified in the site.

While the mean c-value provides a measure of the botanical quality of a site that can be compared from year to year, it does not take into account the size of the site or the quality of the surrounding area. Therefore, the FQI is calculated to combine the mean c-value with the total number of species identified in the site. The FQI is calculated using the following formula:

$$\text{Floristic Quality Index (FQI)} = \bar{c}\sqrt{n}$$

where $\bar{c}$ = mean coefficient of conservatism
n = number of native species

With this calculation, higher FQI values correspond to intact, more natural sites that have a higher diversity. Lower FQI values indicate a more disturbed or lower quality site.

3.1.1.3 Statistical Analysis

Statistical analysis of the vegetation data was first included in the 2010 Annual Wetland Monitoring Report once a sufficient number of sampling efforts had taken place since the beginning of operation to allow for an evaluation of the vegetative characteristics. To determine whether any observed changes in the vegetative indices that are calculated each year are significant, a statistical analysis is conducted to compare the baseline data, which captured some of the natural variation in the wetlands, to the operational data to determine if Project operation is having any significant effect on the wetlands. Statistical analysis is again included in the 2017 Annual Wetland Monitoring Report.

Through discussions between the District, Corps, and Burns & McDonnell, the Repeated Measures Analysis of Variance (ANOVA) was selected as the statistical test appropriate for this analysis. The statistical add-on package to Microsoft Excel that was utilized for this analysis is the EZAnalyze program (www.ezanalyze.com). The Repeated Measures ANOVA is able to compare multiple sampling seasons of data against the baseline average for a given vegetative index. A post-hoc analysis is also included when a significant difference is detected to determine which sampling efforts were significantly different. A

Bonferroni correction is then applied to the p-values to decrease the error that may occur when comparing multiple data sets. The final p-Bonferroni values are reviewed to determine if any of the sampling efforts are significantly different from the baseline average value. This indication of significance is the analysis used when triggering thresholds for monitoring intensity or identifying possible impacts to the wetland due to Project operation.

The Repeated Measures ANOVA test is conducted on each of the vegetative indices that are calculated for each sampling effort: WA_M, FQI, c-value, Species Richness, and Species Diversity.

3.1.2 False-color Infrared (CIR) Aerial Photography

In accordance with the reduced monitoring intensity level, as described in Section 4.0 Thresholds, CIR aerial photography was obtained in 2017. Figures of the photography are included in Appendix I, Section A.

3.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

As stated above, CIR aerial photography was obtained in 2017. Wetland monitoring of the wetlands in the cones of depression based on CIR photography is included in Appendix II. Future monitoring of these wetlands will continue according to the monitoring requirements as described in Section 4.0.

3.3 HYDROLOGICAL MONITORING

Several different types of hydrological data were collected during the 2017 monitoring efforts. The collected data, their sources, and any analyses performed are discussed below and included in Appendix III.

3.3.1 Groundwater Monitoring Wells

Permanent wells designed to measure groundwater levels before and during Project operation have been monitored by the District using the installed data loggers. A total of 20 monitoring wells were monitored during 2017. Water level readings were measured and recorded on a regular basis using an electronic data logger. The collected data in 2017 have been graphed over time and are presented for each monitoring well in Section A of Appendix III.

3.3.2 Production Wells

The Project production wells that are pumped to provide raw water to the new water treatment plant during Project operation were monitored in 2017 using installed data loggers. The total production well pumping rates by month, the total volume pumped per month, and the average monthly pumping rates for each production well have been included in Tables 1 and 2 in Section B of Appendix IV. This data will be

evaluated and analyzed to provide corroborating information should any changes be detected in the other monitoring data.

3.3.3 Piezometers

Sixteen piezometers were installed in four wetlands in the Saunders County well field in 2005. Twelve of the piezometers were installed in May and four piezometers (located in the Phase I Wet Meadow Mitigation Site, WM-1, adjacent to the Wet Meadow) were installed in late October. In May of 2009, two additional piezometers were installed in the Phase I Wet Meadow Expansion Mitigation Site, WM-2, for a total of 18 piezometers. As described in Section 2.3.3, eight of the piezometers were reinstalled adjacent to their original position in July of 2010. The collected data from the 2017 monitoring efforts have been graphed over time and are presented in Section C, Appendix III.

The piezometers installed in PEM W-25 (PZ-01 through PZ-04), PFO W-5 (PZ-05 through PZ-08), PEM WM-1 (PZ-13 through PZ-16), and PEM WM-2 (PZ-17 and PZ-18) are all located above the shallow clay layer associated with the Wet Meadow (Figures 1, 3, and 4; Section C, Appendix III). Piezometers installed in PEM W-100 (PZ-09 through PZ-12) are outside of both the Wet Meadow boundary and the perched water table located above the shallow clay layer (Figure 2, Section C, Appendix III). These readings are used to provide corroborating hydrological evidence should any changes be detected in the wetland vegetation data.

3.3.4 Bathymetric Monitoring of Ponds

The post-operation bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was completed during 2017 as planned. The data collected from these monitoring efforts is presented in a separate report entitled the *2017 Annual Bathymetric Monitoring Report for the Ponds within the Well Fields and Cones of Depression* (Burns & McDonnell 2018). Pond monitoring is conducted to document the variation in each monitored pond's seasonal water surface elevation. The data presented in the bathymetric monitoring report will provide corroborating hydrological evidence should any changes be detected in the wetland vegetation data.

3.3.5 Other Hydrological Data

Additional hydrological data collected during the 2017 monitoring efforts included monthly total precipitation, monthly average ambient air temperature, and stream gauge data. The monthly total precipitation and monthly average ambient air temperature were both obtained from the weather station at Fremont Municipal Airport in Fremont, Nebraska. The 2017 precipitation and temperature data and the

historical average monthly precipitation and temperature have been graphed over time; the graphs are included as Figures 1 and 2 (Section D, Appendix IV).

Stream gauge data was obtained from the USGS stream gauge stations on the Platte and Elkhorn Rivers. Platte River data was obtained from the stream gauge near Venice, Nebraska (USGS Stream Gauge No. 06796550). The installation of this stream gauge took place at the request of and funded by the District. Data collected from this stream gauge is represented in Figure 3 (Section D, Appendix IV). The Elkhorn River data was obtained from the stream gauge near Waterloo, Nebraska (USGS Stream Gauge No. 06800500). Data collected from this stream gauge is represented in Figure 4 (Section D, Appendix IV).

* * * * *

4.0 THRESHOLDS

According to the Section 404 Permit conditions, the monitoring of wetlands in the well fields and cones of depression will take place during Project operation. To determine whether an impact is taking place at a given wetland, thresholds have been established in accordance with the baseline data that was collected. As monitoring data are evaluated after each sampling effort, thresholds are either met or not met, and the intensity of monitoring may be increased or decreased as a result. The wetland monitoring intensity levels and the process for determining whether a wetland has met the thresholds used to identify potential changes in the wetlands is described below.

4.1 LEVELS OF WETLAND MONITORING INTENSITY

A Wetland Monitoring Plan was developed and implemented in 2005 (Burns & McDonnell 2005a). This Monitoring Plan describes in detail the standard annual monitoring approach. During the years of baseline monitoring and the first several seasons of operational monitoring, the standard approach was considered an appropriate protocol. However, as monitoring continued, it became apparent that it may be beneficial to adjust the amount of data being collected based on whether changes were being observed or not. If changes have been documented ("yellow flags"), the intensity of monitoring increases. If no changes have been documented ("green flags"), then the intensity of monitoring decreases. The five levels of monitoring intensity are listed below and described in detail in Figure 4-1.

- High-Intensity Annual Wetland Monitoring
- Standard Annual Wetland Monitoring
- Level 1 Decreased Annual Wetland Monitoring
- Level 2 Decreased Annual Wetland Monitoring
- Level 3 Decreased Annual Wetland Monitoring

4.2 METHOD FOR DETERMINING WETLAND IMPACTS

A series of evaluations and comparisons to the baseline data is being conducted after each sampling effort during Project operation to determine whether wetland impacts are occurring. The process for these evaluations is outlined in a flowchart included in Figure 4-2. A "green flag" on the chart indicates that no thresholds have been triggered and no significant impacts to wetlands due to Project operation have been observed. A "yellow flag" on the chart indicates that a change or an anomaly has been detected in either a vegetative index, the aerial photography, or in the hydrological monitoring. This anomaly may be attributable to Project operation or it may be due to one of many naturally-occurring environmental or climatic factors. A "red flag" indicates that a threshold has been triggered and an impact to wetlands due to Project operation may have occurred.

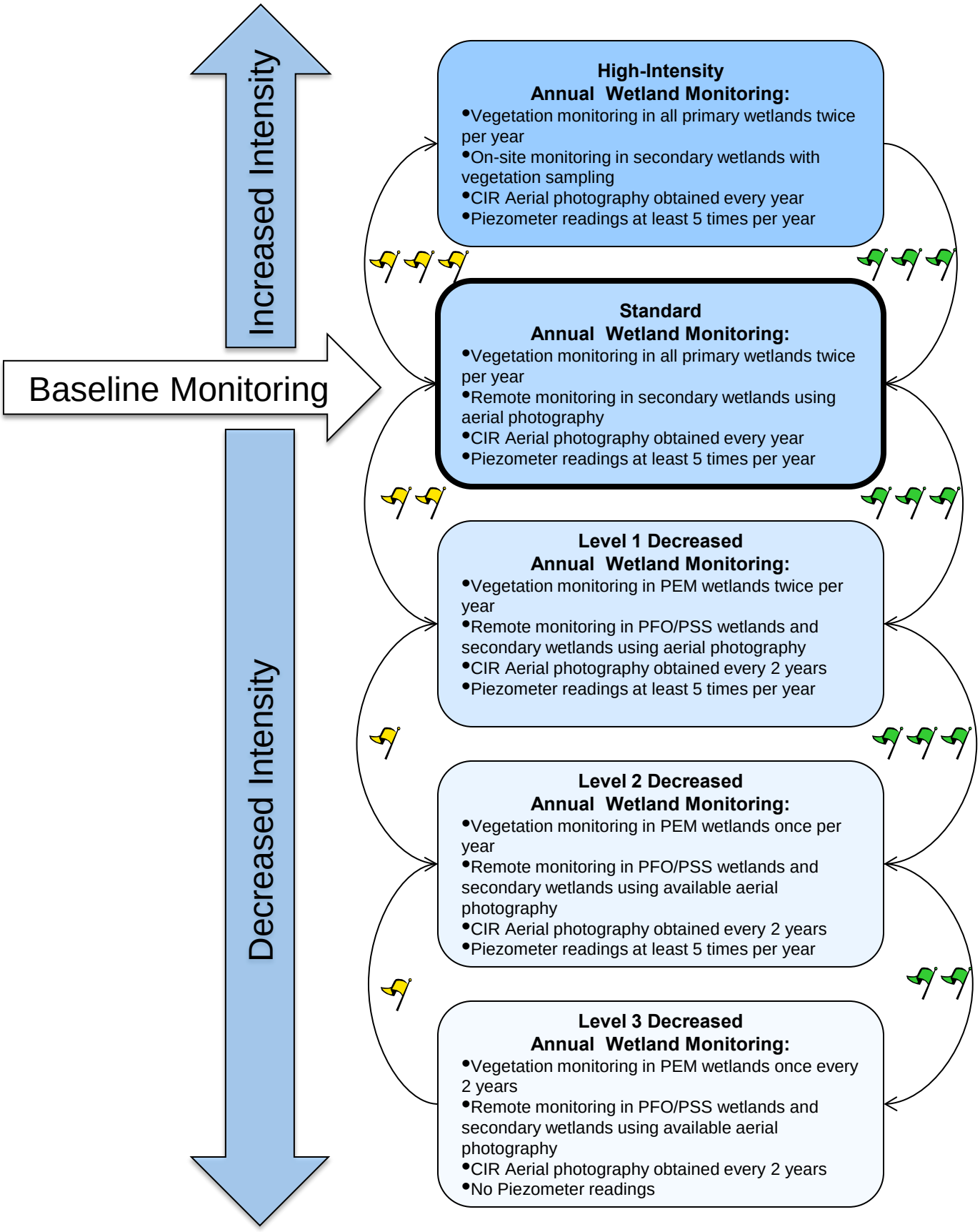

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Figure 4-1

Levels of Wetland Monitoring Intensity

V:\OMAHAMUD\56799_2010_Monitoring\Monitoring-Wetlands\Threshold.Flowchart.pptx

Sampling Effort #1
Conduct **Standard Intensity** Wetland Monitoring and Analyze Data

Does the data analysis for this sampling effort meet one or more of the following criteria?:
- Increase in mean weighted average by more than 0.5 from baseline maximum
- A *significant difference* in three or more of the following indices: FQI, mean c-value, species diversity, or species richness
- Evident change from baseline variation visible on either CIR or natural color aerial photography

Yes

Sampling Effort #2
Increase Monitoring Intensity by One Level or Remain at Standard Intensity
Conduct Wetland Monitoring and Analyze Data

Does the data analysis for this sampling effort meet one or more of the following criteria?:
- Increase in mean weighted average by more than 0.5 from baseline maximum
- A *significant difference* in three or more of the following indices: FQI, mean c-value, species diversity, or species richness
- Evident change from baseline variation visible on either CIR or natural color aerial photography

Yes

****Potential Impact****
- Alert Corps and District of potential change
- Increase monitoring intensity to Standard Monitoring (if it had been decreased)
- Conduct detailed comparison to hydrology/climate data to identify potential cause for observed change

Sampling Effort #3
Increase to *Standard Monitoring Intensity*
Conduct Wetland Monitoring and Analyze Data

Does the data analysis for this sampling effort meet one or more of the following criteria?:
- Increase in mean weighted average by more than 0.5 from baseline maximum
- A *significant difference* in three or more of the following indices: FQI, mean c-value, species diversity, or species richness
- Evident change from baseline variation visible on either CIR or natural color aerial photography

Yes

****Wetland Impact****
Discussions between Corps and District to determine whether to:
- Take closer look at surrounding wetlands to determine if impact is isolated
- Increase monitoring to *High-Intensity Annual Monitoring*
- Consider providing additional wetland mitigation

No

No impact occurring, restart same level monitoring

No

Sampling Effort #2
Conduct Wetland Monitoring and Analyze Data

Does the data analysis for this sampling effort meet one or more of the following criteria?:
- Increase in mean weighted average by more than 0.5 from baseline maximum
- A *significant difference* in three or more of the following indices: FQI, mean c-value, species diversity, or species richness
- Evident change from baseline variation visible on either CIR or natural color aerial photography

No

Sampling Effort #3
Conduct Wetland Monitoring and Analyze Data

Does the data analysis for this sampling effort meet one or more of the following criteria?:
- Increase in mean weighted average by more than 0.5 from baseline maximum
- A *significant difference* in three or more of the following indices: FQI, mean c-value, species diversity, or species richness
- Evident change from baseline variation visible on either CIR or natural color aerial photography

Yes

No

No Impact Occurring
Reduce Intensity of Monitoring by One Level
(*Levels of Wetland Monitoring Intensity Chart*)
- 3 consecutive green flags = reduce from Standard to Level 1, or from Level 1 to Level 2 Reduced Monitoring
- 2 consecutive green flags = reduce from Level 2 to Level 3 Reduced Monitoring

Yes

Legend

= No impact occurring. Continue standard monitoring protocol.

= Impacts possible at this wetland. Continue monitoring until three consecutive sampling efforts show change.

= Impacts likely. District will initiate discussion with Corps.

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Figure 4-2
Flowchart for Determining Wetland Impacts

5.0 RESULTS

The following sections provide the results of the data analysis for the wetlands that were monitored during the 2017 effort. The complete set of data (figures, summary tables, ground photographs, and raw data sheets) for the wetland in the well fields is available in Appendix I. In addition, a comprehensive species list of vegetation observed at the monitored wetlands between 2005 and 2017 is included in Appendix III. Finally, Appendix IV contains all hydrological data collected and analyzed in graphic form.

The various vegetative indices, aerial photography, and other supporting hydrological data that are collected annually have been analyzed to compare 2017 data to baseline averages. To determine whether any differences from baseline averages are significant, a Repeated Measures ANOVA statistical analysis is conducted to identify if an observed change to a wetland has taken place, and if it would be indicative of a Project-induced impact. A discussion of the threshold that was conducted for each wetland is included below.

5.1 WETLAND MONITORING IN THE WELL FIELDS

Data collected during monitoring of the wetlands in the well fields included quantitative vegetation data. In addition, hydrological data was collected for the area. The results of the data collection are presented in the following sections.

5.1.1 Vegetation Sampling

As was recommended in the 2016 Annual Wetland Monitoring Report, W-68 in Douglas County and W-25 in Saunders County were at Level 3 Decreased Monitoring and were not monitored in 2017. The next monitoring effort for these wetlands will be in the spring of 2018. W-100 was increased to Level 1 Decreased Monitoring, with monitoring occurring in both the fall and spring of 2017. Detailed results for W-100 are included in the sections that follow.

5.1.1.1 PEM Wetland 100 – Saunders County

Wetland 100 is a PEM wetland located in Saunders County, Nebraska (Figure 1, Section C-1, Appendix I). The vegetation in this wetland was sampled using 3 transects, 11 gradsects, and 55 sample plots. Dominant species identified during the 2017 monitoring efforts included Kentucky bluegrass (*Poa pratensis*) and fox sedge (*Carex vulpinoidea*). Wetland 100 (excluding upland transects) had a WA_M of 2.96 in the spring and 3.26 in the fall of 2017 (Table 5-1). The 2017 WA_M values indicate an apparent recovery toward pre-2012 wetland conditions. The WA_M value for the Fall of 2017 exceeded the baseline threshold as illustrated in Table 5-2 and Figure 2 in Section C-1 of Appendix I. However, the spring 2017 value fell right at the baseline high. This wetland contained an average of 83 percent native species and

54 percent invasive species in 2017 compared to 81 percent native and 54 percent invasive in 2016. The average FQI for this wetland in 2017 was 9.61, implying a moderately low ecological value. Tables 1 and 2 in Section C-2 of Appendix I contain a summary of the monitoring data and the complete species list from both of the 2017 monitoring efforts.

Table 5-1: Wetland 100 Comparison of 2017 Vegetation Data to Baseline Averages

	Spring 2017	Fall 2017	Baseline Mean	Baseline Low	Baseline High
WA_M	2.96	3.26	2.40	1.71	2.96
Species Richness	37	32	28.71	23.00	33.00
Species Diversity	14.92	10.42	14.13	11.34	17.09
Mean c-value	1.88	1.72	3.41	3.00	3.72
FQI	10.44	8.78	16.42	14.70	18.33

The WA_M for the fall 2017 monitoring effort was above the baseline maximum, although it did not exceed the baseline maximum value by more than 0.5 (Table 5-1; Figure 2, Section C-1, Appendix I). The WA_M for the spring 2017 monitoring effort was at the baseline maximum. The values for species richness in the spring was above the baseline high. The value for species diversity in the spring and fall were below the baseline high, but higher than the baseline low value. Both the spring and fall values for mean-C and FQI were below their respective baseline low values. The statistical analysis, using the Repeated Measures ANOVA, indicated statistically significant changes in two of the four indices (FQI and mean c-value) when compared to the baseline averages (Table 5-1). The data gathered during the operational monitoring effort in 2017 resulted in a “green flag” for both the spring and fall seasons, as outlined in Figure 4-2 and illustrated in Table 5-2. Following the 2018 monitoring efforts, it is recommended that monitoring at Wetland 100 proceed with Level 2 decreased annual monitoring, in accordance with the Levels of Wetland Monitoring Intensity flowchart (Figure 4-1), with the next monitoring effort taking place in June 2018. A discussion between the Corps, the District, and Burns & McDonnell about the monitoring protocol at W-100 will follow the 2018 monitoring effort.

Table 5-2: Record of Thresholds Evaluation by Sampling Season for Wetland 100

Sampling Season	Increase in WA_M by more than 0.5?	A *significant difference* in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No*	No	No	No	No	No		No
June 2009	No*	No	No	No	No	No		No
Sept. 2009	No	No	No	No	No	No		Yes - Decrease to Level 1
June 2010	No	No	No	No	No	No		No - Remain at Level 1
Sept. 2010	No	Yes	Yes	No	No	NA		No - Remain at Level 1
June 2011	No	Yes	Yes	No	Yes	No		Yes - Decrease to Level 2
Sept. 2012	Yes	Yes	Yes	Yes	Yes	NA		No – Remain at Level 2
June 2013	No	Yes	Yes	No	No	No		Yes – Increase to Level 1
Sept. 2013	Yes	Yes	Yes	Yes	Yes	No		No – Remain at Level 1
June 2014	Yes	Yes	Yes	No	No	NA		No – Remain at Level 1
Sept. 2014	No	Yes	No	No	No	NA		No – Remain at Level 1[1]
June 2015	Yes	Yes	Yes	No	No	No		No – Remain at Level 1
Sept. 2015	Yes	Yes	Yes	No	No	No		No – Remain at Level 1
June 2016	No	Yes	Yes	No	No	NA		No – Remain at Level 1
Sept. 2016	No	No	No	No	No	NA		No – Remain at Level 1
June 2017	No	Yes	Yes	No	No	No		No – Remain at Level 1[1]
Sept. 2017	No	Yes	Yes	No	No	No		Yes – Decrease to Level 2

* = A significant decrease in WAM occurred, indicating that the wetland was wetter than baseline average.
[1] = Recommend remaining at Level 1 monitoring due to adverse impacts resulting from extreme drought.

5.1.2 False-color Infrared (CIR) Aerial Photography

As described above, CIR aerial photography was obtained in 2017. CIR and natural color aerial photography were flown by Wilson and Company on August 23, 2017 and are included in Appendix I, Section A. Analysis of the 2017 natural color and CIR photography indicated a general lack of wetland signatures in W-100, which is consistent with the 2015 CIR photography analysis. One very faint signature is present near gradsects 3-1 and 3-2, however, the remainder of W-100 appears to lack signatures. Aerial photography will be obtained again in 2019.

5.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

As stated above, natural color and CIR aerial photography were obtained in 2017, after being obtained in 2015 per the Level 3 Decreased Monitoring protocol. Figures depicting the monitoring of these wetlands in the cones of depression based on natural color and CIR aerial photography are included in Appendix II. A detailed analysis of the secondary wetlands has not been conducted at this time, however some deviations from past aerial photography were noted in 2017, particularly with regard to changes in land

use at a few of the wetlands. As Project operation continues and potential impacts are noted, a more detailed analysis of the wetlands may be warranted.

5.3 HYDROLOGICAL MONITORING

Several different types of hydrological data were collected during the 2017 monitoring efforts. The collected data have been analyzed and the results are discussed below and included in Appendix III.

5.3.1 Groundwater Monitoring Wells

The groundwater monitoring well data collected for 2017 have been graphed and are presented for each monitoring well in Figures 1 through 20 in Section A of Appendix III. Readings from these monitoring wells provide additional hydrological data for comparison, should any changes be detected in the wetland vegetation data. The 2017 readings showed highest water level elevation readings in May and June for most wells. The lowest readings were typically observed in August.

5.3.2 Production Wells

The 2017 pumping rate for each production well in the Douglas and Saunders County well fields is presented in Tables 1 and 2 in Section B of Appendix IV.

The Project production wells operated throughout 2017, completing the ninth full year of operation. As in past years, pumping on an annual basis was well below regulated capacity. Above normal precipitation for the Omaha area along with minor mechanical issues in the Plant resulted in full-year annual production levels being the second lowest in the history of the wellfield. Annual production for 2017 increased from 10,599 MG in 2016 to 12,493 MG in 2017. The 2017 production was still below the record high full-year of 13,379 MG in 2011 and the regulated annual capacity of 19,000 MG (52 MGD).

5.3.3 Piezometers

Eighteen piezometers have been installed and are being monitored in the Saunders County well field. The collected data from the 2017 monitoring efforts were graphed over time and are presented in Section C of Appendix III. Many of the 2017 piezometer readings were again within inches of the bottom of the piezometers, and held steady over multiple readings. The bottom elevation of each piezometer is included in the legend of each figure in Section C of Appendix IV. Based on the consistent readings over months, as indicated by many of the piezometers, it is likely that the readings are the result of residual moisture and sediment retained in the tips of the piezometers rather than an accurate measurement of the local water table elevation. In these cases, the actual water table elevation is assumed to be lower than the reported level.

5.3.4 Bathymetric Monitoring of Ponds

The post-operation bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was completed during 2017 as planned. In 2017, most of the pond water levels were highest in March and October. One pond (SN-24) showed a statistically significant difference in water elevations between the 2017 operational data and the baseline data. This pond exhibited significantly higher surface water elevations in 2017 than the recorded 2006 baseline surface water elevations. Comparatively, in 2016, one pond (DG-20G) showed a higher water elevation that was statistically different in water elevations than baseline data. Detailed analysis of these monitoring efforts is included in a separate report, *2017 Annual Bathymetric Monitoring Report for the Ponds within the Well Fields and Cones of Depression* (Burns & McDonnell 2018).

5.3.5 Other Hydrological Data

Additional hydrological data collected during the 2017 monitoring efforts included monthly total precipitation, monthly average ambient air temperature, and stream gauge data.

The monthly precipitation from January through November 2017 has little correlation with the monthly historical averages (Figure 1, Section D, Appendix IV). Overall, the January through December 2017 recorded precipitation total was 28.33 inches, while the annual historical average during the same period was 28.36 inches, slightly drier year than normal (Weather Underground 2017). Historically, the amount of precipitation increases from January to a peak in June, declines to a plateau in late summer, and continues to decline through the end of the year. In 2017, however, the precipitation spiked in August after a very dry June.

Average ambient air temperature in 2017 fell within the expected monthly high and low temperature range based on historical averages (Figure 2, Section D, Appendix IV). Average monthly temperatures ranged between 26°F and 78 °F from January 1 through December 31, 2017.

Historically, stream elevations for the Platte River are highest in the spring and lowest in late summer and early fall (Section D, Figure 3, Appendix IV). The stream elevations in 2017 followed this trend, but were generally lower than the historic averages (Figure 3, Section D, Appendix IV). Abnormally low elevations were recorded during the month of July, this is likely related to extremely low precipitation in June and early July. Data from January and February of this year appear as zero due to ice which impaired the ability of the monitoring gauges to measure water elevation.

Mean stream elevations in the Elkhorn River are historically highest in the spring and early summer and lowest in the late summer and early fall (Figure 4, Section D, Appendix IV). The stream elevations in 2017 followed this trend, although the elevations in the late fall were above the historical means. The

values throughout the year where otherwise comparable to the historical averages (Figure 4, Section D, Appendix IV). Abnormally low elevations were recorded during the month of August. Data from January and February of this year appear as zero due to ice which impaired the ability of the monitoring gauges to measure water elevation.

* * * * *

6.0 DISCUSSION AND RECOMMENDATIONS

The goal of monitoring wetlands within the Douglas County and Saunders County well fields and associated cones of depression is to evaluate the impact that operation of the Project may have on the existing wetlands. To accomplish this goal, a monitoring approach consisting of a systematic, multi-tiered vegetation sampling procedure has been developed and implemented. Monitoring efforts conducted from the inception of the monitoring program in 2005 through this year's monitoring effort (2017) are discussed in the sections below. A review of the thresholds analysis and the current and proposed level of monitoring efforts proposed for next year are also included below.

6.1 DISCUSSION

The following sections discuss the 2017 wetland monitoring efforts for wetlands in the well fields and cones of depression.

6.1.1 Wetland Monitoring in the Well Fields

Data obtained during the 2017 sampling season have been analyzed and the results are included in Appendix I. In 2017, the Level 1 Decreased Annual Wetland Monitoring protocol was followed for W-100; this required sampling of the wetland occurred in June and September 2017. No field surveys took place at other wetlands within the well fields according to Level 3 reduced monitoring as described in last year's annual report. Natural color and CIR aerial imagery obtained for the Project included these wetlands, and are provided in Appendix I, Sections B and C.

The WA_M calculated for W-100 and each sampling season since monitoring began have been graphed and are included as Figure 3 in Appendix I. This vegetative parameter has been accepted as the most likely indicator of change in the monitored wetlands and these graphs provide a useful visual reference of the WA_M over time. A trend line was calculated for this wetland. Prior to 2012, the trend line of W-100 in Saunders County had negative or nearly level slopes. However, the extreme drought conditions in the summer of 2012 resulted in higher WA_M values for W-100, causing a positive trend line that signified the wetland was heading toward slightly drier conditions. Following 2012, WA_M values have decreased on average but are still above the baseline threshold value (Table 6-1). The upward trend line pattern continued in 2017 at this wetland, although the calculated WA_M values did decrease on average compared to previous values and may be indicative of a trend toward conditions that were occurring during baseline monitoring.

Other vegetative indices for W-100, including FQI, are also outside of the baseline range. After the drought in 2012, the FQI was at an all-time low, 2.00 (Table 6-1). Since the drought, the FQI has

rebounded and is increasing to pre-drought levels, though the values are still below the baseline range. A lower FQI value is indicative of a disturbed site with lower quality vegetation. The calculated WA_M values did decrease on average for W-100 compared to values since the drought in 2012 and may be indicative of a trend toward conditions more similar to those observed during baseline monitoring.

Table 6-1: Wetland 100 Data Comparison from 2011 to 2017

	WA_M	FQI
Baseline Threshold	**2.96**	**18.33**
Spring 2009	1.83	16.37
Fall 2009	1.99	14.77
Spring 2010	2.07	17.82
Fall 2010	2.81	11.82
Spring 2011	2.67	13.36
Fall 2012	3.98	2.00
Spring 2013	3.41	9.73
Fall 2013	3.63	3.74
Spring 2014	3.47	8.21
Fall 2014	3.31	12.77
Spring 2015	3.21	10.58
Fall 2015	3.36	7.90
Spring 2016	3.09	13.49
Fall 2016	2.86	8.57
Spring 2017	2.96	10.44
Fall 2017	3.26	8.87

Average WA_M values for 2017 are within an acceptable range of the baseline threshold (<0.5 greater) indicating that the area is recovering from the drought damage and is increasingly dominated by hydrophytic vegetation. A decrease in FQI values in W-100 indicates a lower floristic quality composition when compared to the baseline values.

6.1.2 Wetland Monitoring in the Cones of Depression

Project-specific aerial photography was obtained in 2017, consistent with the protocol developed for the Level 1 Decreased Monitoring. There were changes in land use at some of the wetlands, though the changes were minimal. Project-specific aerial photography will be obtained again in 2019, per the monitoring protocols. Over time, photographs will continue to provide documentation of the normal fluctuations in size, shape, or condition of the various wetlands and will be compared to baseline conditions.

6.1.3 Hydrological Monitoring

In addition to the wetland monitoring efforts, several different types of hydrological data have been gathered and analyzed as part of the ongoing monitoring efforts. These hydrological data include groundwater monitoring wells, piezometers, monthly average precipitation, monthly average ambient air temperature, and stream gauge data for the Platte and Elkhorn Rivers. Each of these pieces of data remains appropriate and relevant to the monitoring effort and no change to the collection or analysis of this data is recommended at this time.

6.2 RECOMMENDATIONS

This report summarizes the 2017 wetland monitoring efforts. The results of the 2017 monitoring efforts indicated a "green flag" for W-100 and the monitoring intensity should be decreased to Level 2 Decreased Annual Wetland Monitoring for 2018 in accordance with the Levels of Monitoring Intensity flowchart (Figure 4-2). This will involve one vegetation monitoring event per year, to be conducted in June 2018, and continued remote monitoring for PFO/PSS wetlands. Piezometer data will still be collected five times per year, and CIR aerial photography will be obtained next in 2020. Although the FQI and mean c-value indicate that vegetation quality at W-100 is significantly lower than baseline data, the overall trend in 2017 indicates that conditions are wetter than in previous years. Additionally, species richness continues to increase each year while percent invasive continues to decrease. These values indicate an overall improvement in the vegetation community. Average to slightly drier conditions in 2017 could have contributed to the slightly higher WA_M recorded during the fall monitoring event. Wetter conditions in 2018 could contribute to a return to baseline values. If the results of the 2018 monitoring efforts yield another "green flag", monitoring intensity may be changed to Level 3 Decreased Annual Monitoring.

Although not monitored in 2017, Level 3 Decreased Annual Wetland Monitoring protocol indicates vegetation monitoring will once again take place at W-68 in Douglas County and W-25 in Saunders County in the spring of 2018. This will be the only monitoring effort at these wetlands in 2018.

In 2018, CIR aerial photography will not be obtained, which is consistent with the protocol for Level 2 Decreased Annual Wetland Monitoring, as recommended for W-100. Additionally, all hydrological data will again be collected and analyzed in 2018. Data collected in 2018 will continue to be compared to the baseline data in an attempt to determine the effects, if any, of Project operation.

* * * * *

7.0 REFERENCES

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APPENDIX I

WETLAND MONITORING DATA FOR THE DOUGLAS COUNTY AND SAUNDERS COUNTY WELL FIELDS (FIGURES, TABLES, PHOTOGRAPHS, DATA SHEETS)

APPENDIX I - SECTION A

PEM WETLAND 100, SAUNDERS COUNTY WELL FIELD WETLAND MONITORING DATA

TABLE OF CONTENTS

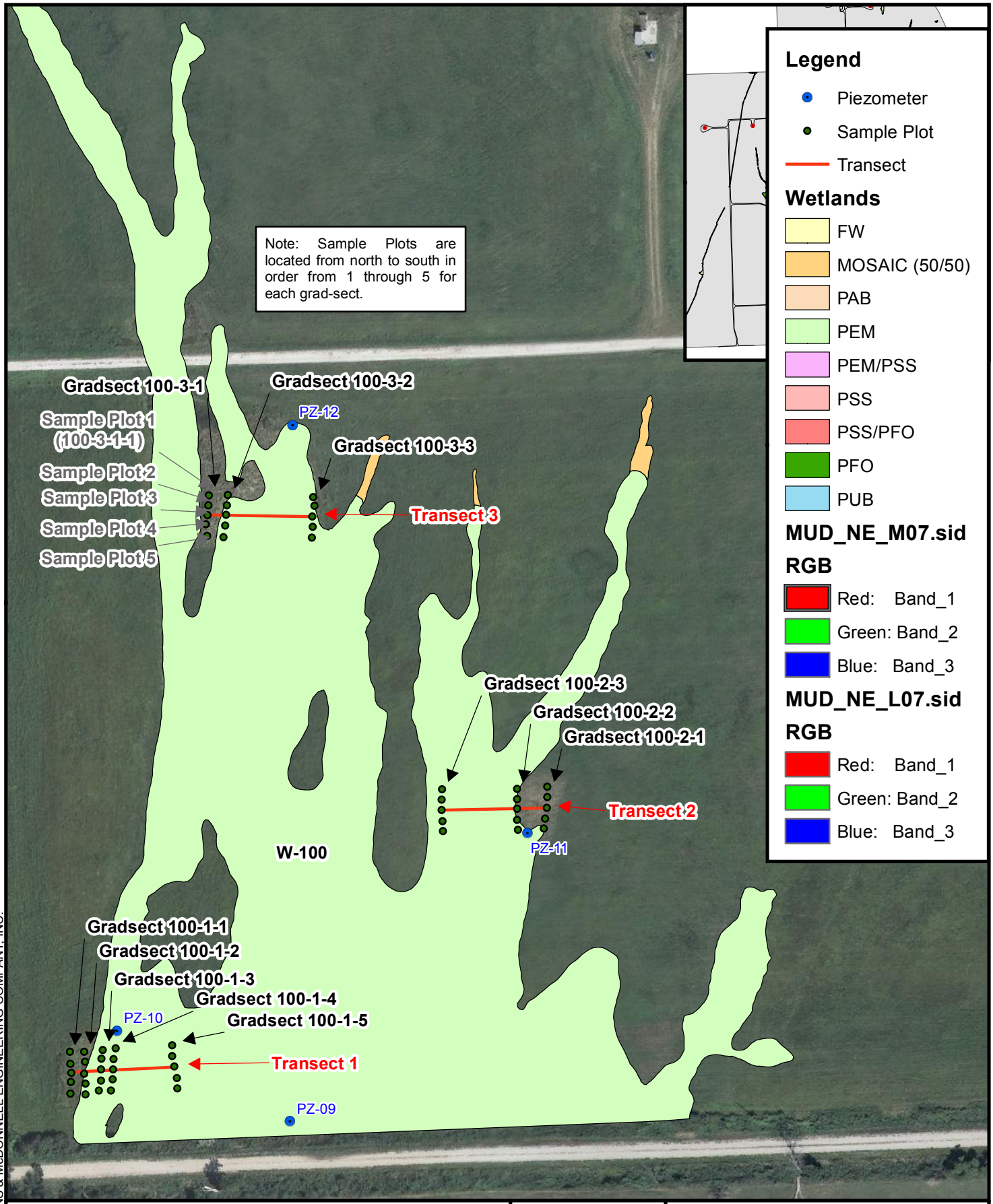


Figure 1
Location Map for
PEM Wetland 100
Saunders County Wellfield
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/12/2018

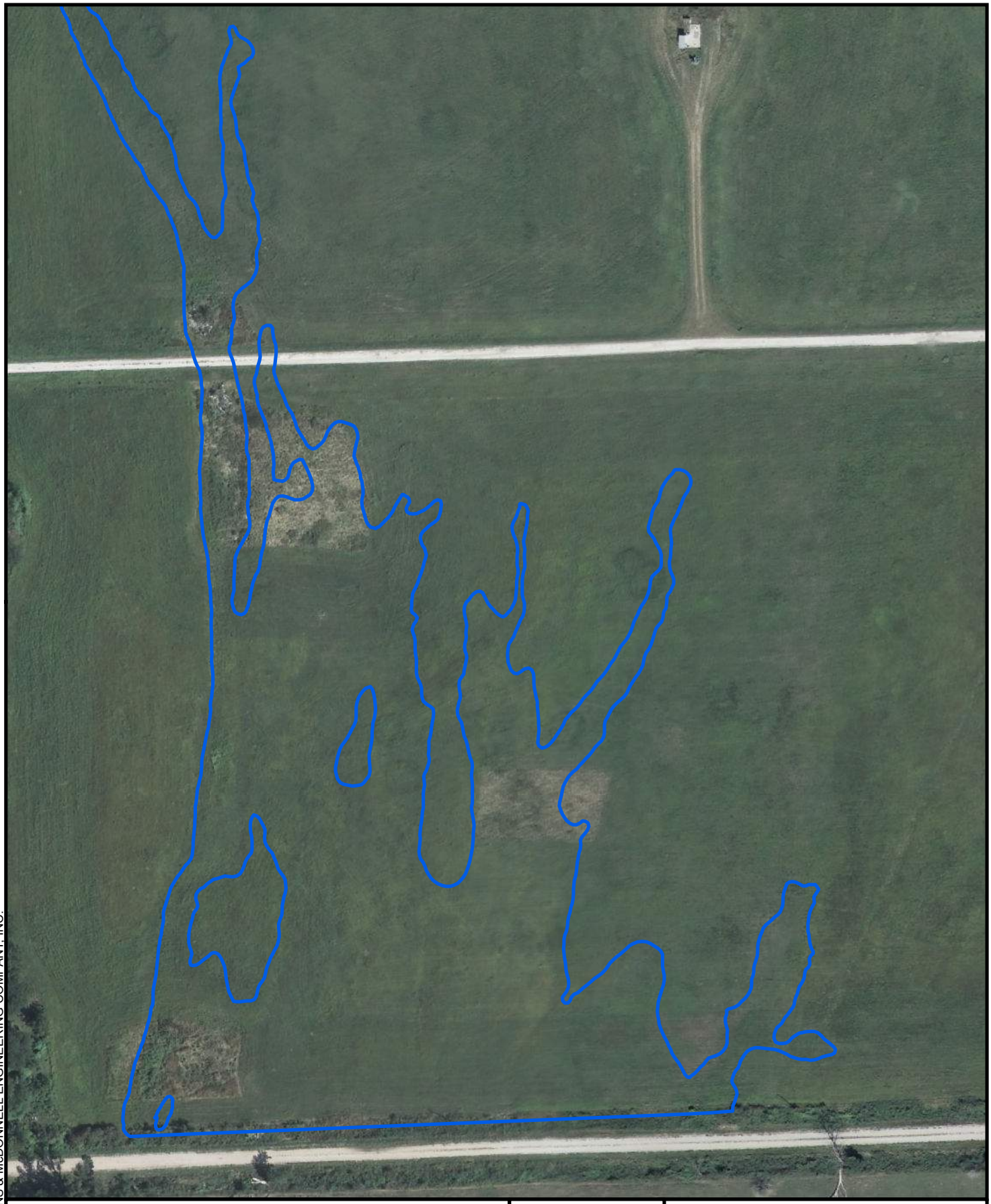


Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 100
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/12/2018

Approximate Wetland Boundary

NORTH

125 62.5 0 125

Scale in Feet

BURNS McDONNELL

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 100
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/12/2018

SECTION A-1

FIGURES

Figure 4 Mean Weighted Average of Wetland Gradsects Compared to the Baseline Threshold in Wetland-100

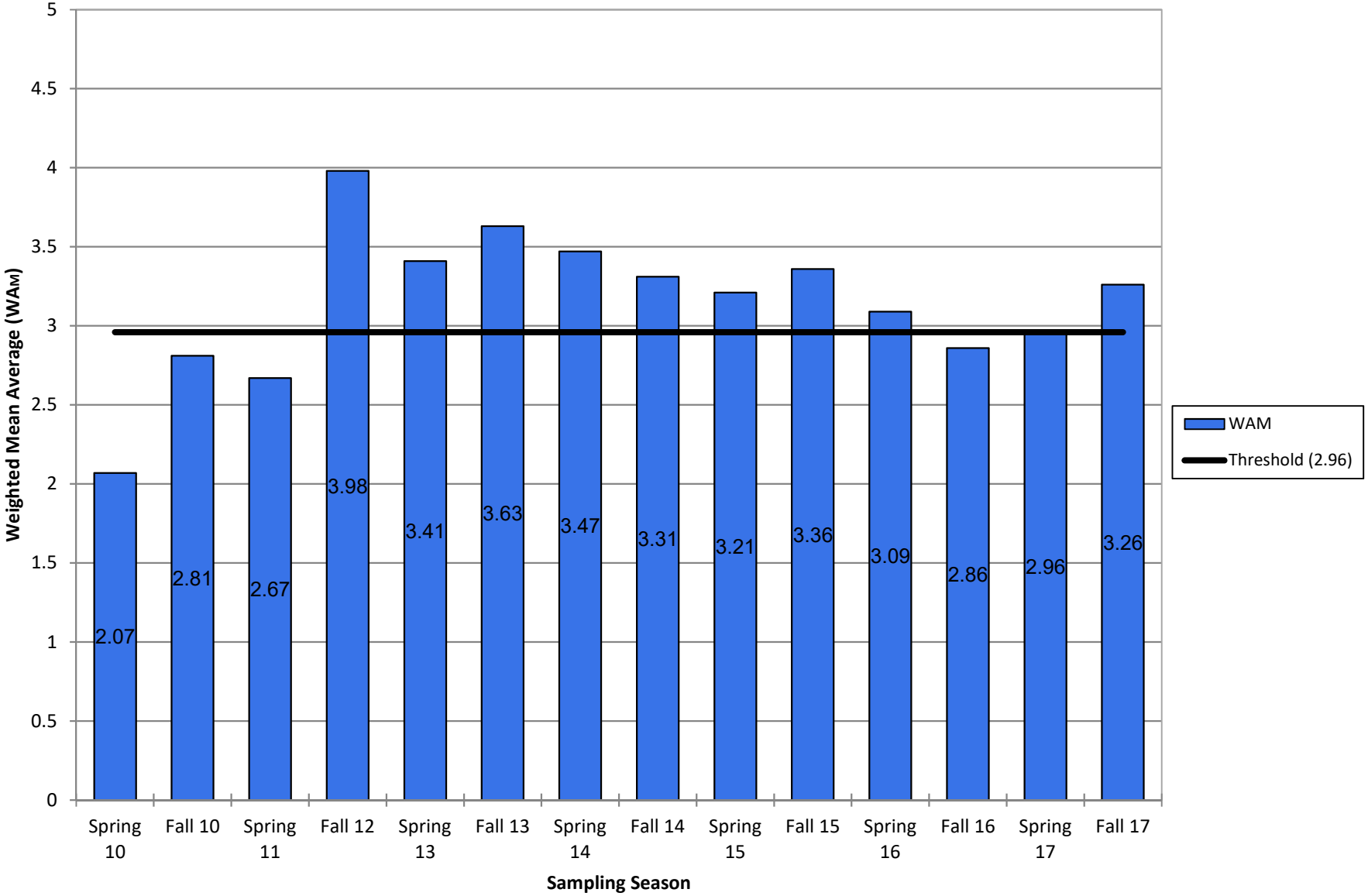
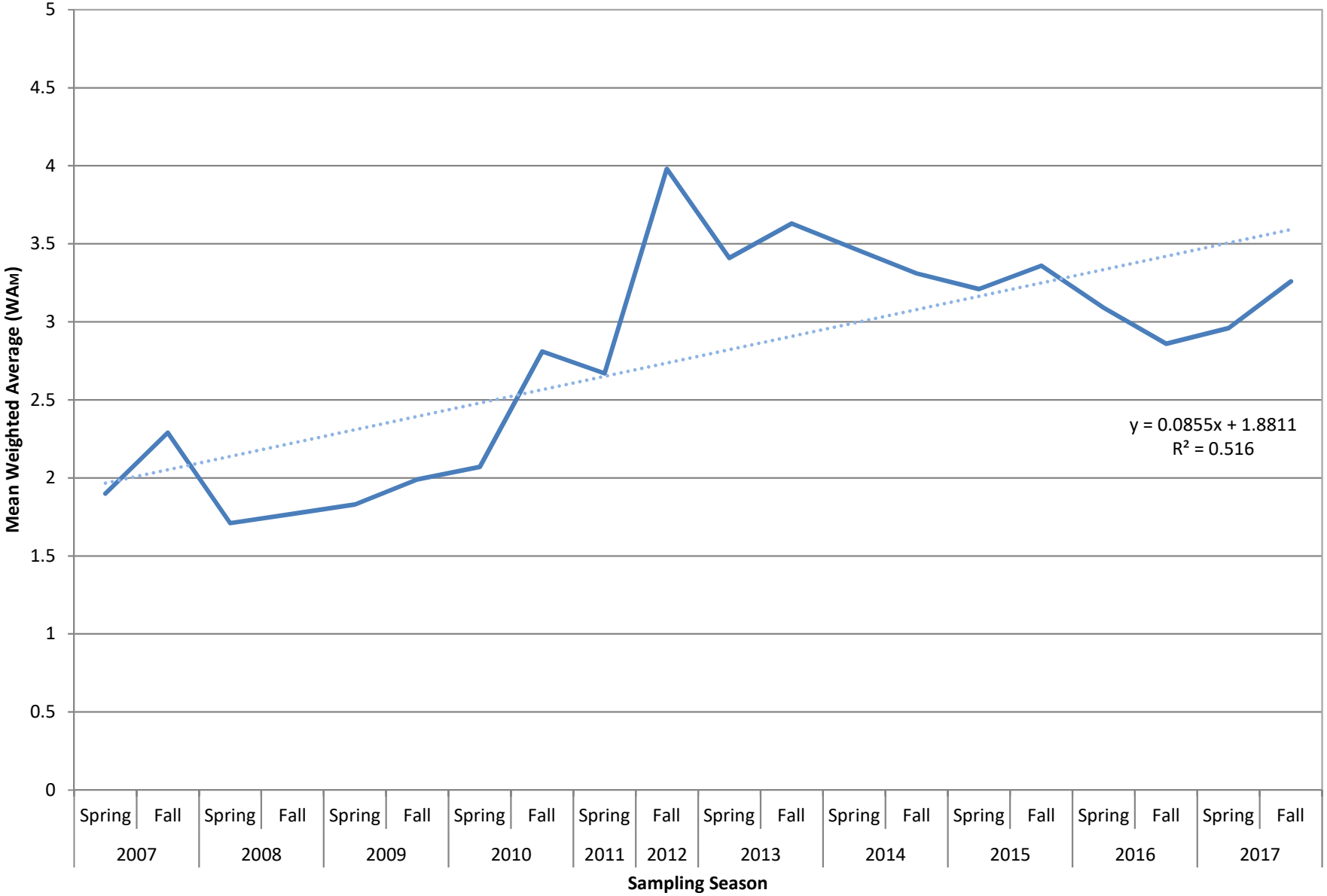


Figure 5 Mean Weighted Average of Wetland 100 Over Time



SECTION A-2

TABLES

Table 1 Summary of Wetland Monitoring Data for Wetland 100

Wetland Name: **W-100**
Wetland Type: **PEM**
County: **Saunders**

Number of Transects/Macroplots: **3**
Number of Gradsects: **11**
Number of Sample Plots: **55**
Number of Wetland Sample Plots: **40**

Sampling Effort: **2017 Fall**

Weighted Average: **3.26**
Species Richness: **32**
Species Diversity: **10.42**
FQI: **8.78**

Percent Native Species: **81**
Percent Invasive Species: **56**
Percent Perennial/Biennial/Annual Species **78 / 6 / 34**
Mean C-Value: **1.72**

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
Ambrosia trifida	Great ragweed	FACW	13.7
Carex vulpinoidea	Fox sedge	OBL	6.56
Poa pratensis	Kentucky bluegrass	FACU	56.62
Spartina pectinata	Prairie cordgrass	FACW	7.69

Sampling Effort: **2017 Spring**

Weighted Average: **2.96**
Species Richness: **37**
Species Diversity: **14.92**
FQI: **10.44**

Percent Native Species: **84**
Percent Invasive Species: **51**
Percent Perennial/Biennial/Annual Species **70 / 11 / 35**
Mean C-Value: **1.88**

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
Avena sativa	Common oat	NL	24.25
Carex stricta	Upright sedge	OBL	10.94
Carex vulpinoidea	Fox sedge	OBL	13.81
Poa pratensis	Kentucky bluegrass	FACU	59.12

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Wednesday, October 04, 2017

Sampling Effort: **2017 Fall**

Scientific Name	Common Name	Wetland Indicator Status[1]	Ecological Index[2]	C-Value	Native Status	Invasive?	Frequency[3]	Average Percent Cover[4]
Ambrosia artemisiifolia	Annual ragweed	FACU	4	0	Native	☑	2	1.31
Ambrosia psilostachya	Cuman ragweed	FAC	3	1	Native	☑	10	1.88
Ambrosia trifida	Great ragweed	FACW	2	0	Native	☑	16	13.70
Bromus inermis	Smooth brome	NL	3		Native & Introduced	☑	1	2.12
Calystegia sepium	Hedge false bindweed	FAC	3	1	Native & Introduced	☑	1	0.38
Cannabis sativa	Marijuana	FACU-	4		Introduced	☑	5	1.45
Carex sp. 1	Sedge	--	3		Native	☐	2	3.12
Carex vulpinoidea	Fox sedge	OBL	1	4	Native	☐	10	6.56
Chenopodium album	Lambsquarters	FAC	3		Native & Introduced	☑	1	0.38
Conyza canadensis	Canadian horseweed	FACU-	4	0	Native	☑	3	0.50
Cornus drummondii	Roughleaf dogwood	FAC	3	3	Native	☐	1	0.94
Festuca arundinacea	Tall fescue	FACU	4		Introduced	☑	7	5.50
Galium obtusum	Bluntleaf bedstraw	FACW	2	6	Native	☐	4	0.56
Gleditsia triacanthos	Honeylocust	FAC	3	1	Native	☑	1	0.38
Iva annua	Annual marsh elder	FAC	3	1	Native	☐	1	0.06
Medicago lupulina	Black medick	FAC	3		Introduced	☑	1	0.06
Melilotus officinalis	Yellow sweetclover	FACU	4		Introduced	☑	4	0.88
Morus alba	White mulberry	FAC	3		Introduced	☐	3	0.19

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calcuated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Wednesday, October 04, 2017

Pascopyrum smithii	Western wheatgrass	NL	3		Native	☐	1	0.38
Phalaris arundinacea	Reed canarygrass	FACW+	2	0	Native	☑	5	3.56
Physalis longifolia	Longleaf groundcherry	NL	3	0	Native	☐	8	2.62
Poa pratensis	Kentucky bluegrass	FACU	4		Native & Introduced	☑	38	56.62
Polygonum hydropiperoides	Swamp smartweed	OBL	1		Native	☐	1	0.06
Polygonum scandens	Climbing false buckwheat	FACU	4		Native & Introduced	☐	2	0.12
Rumex altissimus	Pale Dock	FAC	3	0	Native	☐	1	0.06
Setaria faberi	Japanese bristlegrass	UPL	5		Introduced	☑	1	0.94
Solidago canadensis	Canada goldenrod	FACU	4	2	Native	☐	2	0.44
Spartina pectinata	Prairie cordgrass	FACW	2	5	Native	☐	9	7.69
Symphyotrichum lanceolatum	White panicle aster	NI	3	2	Native	☐	2	0.75
Taraxacum officinale	Common dandelion	FACU	4		Native & Introduced	☑	1	0.06
Verbena stricta	Hoary verbena	NL	3	2	Native	☑	3	1.69
Vernonia baldwinii	Baldwin's ironweed	FACW-	2	3	Native	☑	1	0.38

Sampling Effort: **2017 Spring**

Scientific Name	Common Name	Wetland Indicator Status[1]	Ecological Index[2]	C-Value	Native Status	Invasive?	Frequency[3]	Average Percent Cover[4]
Ambrosia artemisiifolia	Annual ragweed	FACU	4	0	Native	☑	5	1.25
Ambrosia trifida	Great ragweed	FACW	2	0	Native	☑	13	6.25
Anemone canadensis	Canadian anemone	FACW	2	4	Native	☐	1	0.06

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calcuated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Wednesday, October 04, 2017

Asclepias syriaca	Common milkweed	NL	3	1	Native	☑	1	0.38
Avena sativa	Common oat	NL	3		Introduced	☐	19	24.25
Brassica sp.	Mustard	--	3		--	☐	3	1.94
Bromus inermis	Smooth brome	NL	3		Native & Introduced	☑	1	2.12
Cannabis sativa	Marijuana	FACU-	4		Introduced	☑	7	2.56
Carex stricta	Upright sedge	OBL	1		Native	☐	9	10.94
Carex vulpinoidea	Fox sedge	OBL	1	4	Native	☐	12	13.81
Chenopodium album	Lambsquarters	FAC	3		Native & Introduced	☑	1	0.38
Cirsium altissimum	Tall thistle	NL	3	1	Native	☑	2	0.44
Conyza canadensis	Canadian horseweed	FACU-	4	0	Native	☑	1	0.06
Cornus drummondii	Roughleaf dogwood	FAC	3	3	Native	☐	1	0.06
Erechtites hieraciifolia	American burnweed	FAC	3	1	Native	☐	4	0.56
Festuca arundinacea	Tall fescue	FACU	4		Introduced	☑	4	5.56
Galium aparine	Stickywilly	FACU	4	0	Native	☑	6	0.69
Galium obtusum	Bluntleaf bedstraw	FACW	2	6	Native	☐	4	0.88
Gleditsia triacanthos	Honeylocust	FAC	3	1	Native	☑	1	0.06
Hordeum jubatum	Foxtail barley	FACW	2	1	Native	☑	4	1.50
Iva annua	Annual marsh elder	FAC	3	1	Native	☐	2	0.75
Melilotus officinalis	Yellow sweetclover	FACU	4		Introduced	☑	2	0.12
Mentha arvensis	Wild mint	FACW	2	4	Native	☑	1	0.06
Phalaris arundinacea	Reed canarygrass	FACW+	2	0	Native	☑	8	6.25

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calcuated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Wednesday, October 04, 2017

Physalis longifolia	Longleaf groundcherry	NL	3	0	Native	☐	6	1.88
Poa pratensis	Kentucky bluegrass	FACU	4		Native & Introduced	☑	33	59.12
Polygonum hydropiperoides	Swamp smartweed	OBL	1		Native	☐	1	0.38
Polygonum punctatum	Dotted smartweed	OBL	1		Native	☐	1	0.38
Rumex altissimus	Pale Dock	FAC	3	0	Native	☐	1	0.06
Rumex crispus	Curly dock	FACW	2		Introduced	☑	1	0.06
Solidago canadensis	Canada goldenrod	FACU	4	2	Native	☐	1	0.38
Spartina pectinata	Prairie cordgrass	FACW	2	5	Native	☐	10	8.62
Symphyotrichum lanceolatum	White panicle aster	NI	3	2	Native	☐	2	1.31
Verbena hastata	Swamp verbena	FACW	2	4	Native	☐	4	0.88
Verbena stricta	Hoary verbena	NL	3	2	Native	☑	1	2.12
Vernonia baldwinii	Baldwin's ironweed	FACW-	2	3	Native	☑	1	0.38
Viola sp.	Violet	--	3		Native	☐	4	1.19

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calcuated from the coverages estimated during this monitoring effort.

SECTION A-3

WETLAND 100 GROUND PHOTOGRAPHS

Photograph A-1: View east of Transect 1 in W-100 (June 2017).

Photograph A-2: View north of Gradsect 1 on Transect 1 in W-100 (June 2017).

Photograph A-3: View north of Gradsect 2 on Transect 1 in W-100 (June 2017).

Photograph A-4: View north of Gradsect 3 on Transect 1 in W-100 (June 2017).

Photograph A-5: View north of Gradsect 4 on Transect 1 in W-100 (June 2017).

Photograph A-6: View north of Gradsect 5 on Transect 1 in W-100 (June 2017).

Photograph A-7: View west of Transect 2 in W-100 (June 2017).

Photograph A-8: View north of Gradsect 1 on Transect 2 in W-100 (June 2017).

Photograph A-9: View north of Gradsect 2 on Transect 2 in W-100 (June 2017).

Photograph A-10: View north of Gradsect 3 on Transect 2 in W-100 (June 2017).

Photograph A-11: View east of Transect 3 in W-100 (June 2017).

Photograph A-12: View north of Gradsect 1 on Transect 3 in W-100 (June 2017).

Photograph A-13: View north of Gradsect 2 on Transect 3 in W-100 (June 2017).

Photograph A-14: View north of Gradsect 3 on Transect 3 in W-100 (June 2017).

Photograph A-15: View east of Transect 1 in W-100 (September 2017).

Photograph A-16: View north of Gradsect 1 on Transect 1 in W-100 (September 2017).

Photograph A-17: View north of Gradsect 2 on Transect 1 in W-100 (September 2017).

Photograph A-18: View north of Gradsect 3 on Transect 1 in W-100 (September 2017).

Photograph A-19: View north of Gradsect 4 on Transect 1 in W-100 (September 2017).

Photograph A-20: View north of Gradsect 5 on Transect 1 in W-100 (September 2017).

Photograph A-21: View west of Transect 2 in W-100 (September 2017).

Photograph A-22: View north of Gradsect 1 on Transect 2 in W-100 (September 2017).

Photograph A-23: View north of Gradsect 2 on Transect 2 in W-100 (September 2017).

Photograph A-24: View north of Gradsect 3 on Transect 2 in W-100 (September 2017).

Photograph A-25: View east of Transect 3 in W-100 (September 2017).

Photograph A-26: View north of Gradsect 1 on Transect 3 in W-100 (September 2017).

Photograph A-27: View north of Gradsect 2 on Transect 3 in W-100 (September 2017).

Photograph A-28: View north of Gradsect 3 on Transect 3 in W-100 (September 2017).

SECTION A-4

RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER DEPTH AT WETLAND 100

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-1

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	5	6
Asclepias syriaca					1
Festuca arundinacea	6	7	7	7	5
Galium aparine					3
Iva annua					2
Poa pratensis	4	5	4	4	
Solidago canadensis	3	4			
Spartina pectinata				4	6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-2

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	5	6	6	7
Ambrosia trifida		3		5	4
Avena sativa		4	3	4	4
Cannabis sativa				3	
Cornus drummondii					2
Erechtites hieraciifolia				2	2
Festuca arundinacea	6	6		4	
Galium aparine				2	2
Hordeum jubatum					3
Iva annua				3	
Melilotus officinalis				2	
Mentha arvensis				2	
Phalaris arundinacea			7		
Poa pratensis	6	4			4
Polygonum hydropiperoides				3	
Spartina pectinata		4		4	6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-3

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	5
Ambrosia trifida		3	4	3	3
Avena sativa	4	7	6	4	3
Brassica sp.				4	
Cannabis sativa	2		4	3	3
Carex stricta	4				5
Carex vulpinoidea				4	4
Chenopodium album				3	
Festuca arundinacea	3				
Galium aparine				2	
Iva annua				3	
Phalaris arundinacea	3	3			
Poa pratensis	4		4	3	3
Polygonum punctatum				3	
Verbena hastata	2				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-4

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	6
Ambrosia trifida	2	3	2		3
Anemone canadensis		2			
Avena sativa	7	4	6	6	2
Cannabis sativa		2			3
Carex stricta		4			
Carex vulpinoidea	5	5	5	4	6
Conyza canadensis				2	
Hordeum jubatum				3	
Phalaris arundinacea			3		
Poa pratensis		3			
Rumex altissimus	2				
Spartina pectinata				4	5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-5

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	5	5	5
Ambrosia trifida		2	3		
Avena sativa		5		4	
Brassica sp.		4		2	
Carex stricta	5	5	4	4	4
Cirsium altissimum		3			
Erechtites hieraciifolia				3	2
Hordeum jubatum					3
Phalaris arundinacea				3	3
Physalis longifolia	3		2		
Poa pratensis	6	5	6	5	7
Spartina pectinata	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-1

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	6
Ambrosia artemisiifolia				3	
Carex vulpinoidea		3			
Cornus drummondii					3
Desmanthus illinoensis		2			2
Galium obtusum					2
Hordeum jubatum	3				
Poa pratensis	7	6	7	7	6
Spartina pectinata					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-2

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	6
Ambrosia artemisiifolia				2	
Carex vulpinoidea	3				
Galium aparine				2	
Galium obtusum				2	
Hordeum jubatum					3
Melilotus officinalis				2	
Physalis longifolia	2		2		
Poa pratensis	6	6	7	6	6
Solidago canadensis					3
Spartina pectinata		4			2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-3

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	7	6	6
Ambrosia artemisiifolia					3
Avena sativa			4	5	5
Carex stricta					5
Carex vulpinoidea	5		3	4	4
Cirsium altissimum			2		
Physalis longifolia				4	3
Poa pratensis	6	7	6	6	4
Spartina pectinata	3				
Verbena hastata	3	2	3		
Vernonia baldwinii				3	
Viola sp.					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-1

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	6
Ambrosia artemisiifolia		3	3	2	2
Cannabis sativa	3	4	3		4
Cirsium altissimum					3
Desmanthus illinoensis					2
Festuca arundinacea	6	6	5	6	6
Galium aparine	3	3		2	
Galium obtusum		2		2	
Iva annua			2		
Melilotus officinalis			3	2	
Parietaria pensylvanica				2	
Physalis heterophylla	4				
Poa pratensis		4	5		
Spartina pectinata	3				
Viola sp.	3	4			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-2

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	5	5	6
Ambrosia artemisiifolia				2	
Asclepias syriaca	3				
Galium aparine	2			3	
Galium obtusum	3				
Gleditsia triacanthos	2				
Phalaris arundinacea	5	3			
Poa pratensis	6	7	7	6	6
Rumex crispus					2
Spartina pectinata		3			
Viola sp.	2	3			3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-3

Sampling Date: 6/20/2017 **Last Rain Date:** 6/17/2017 **Last Rain Amount (in):** 0.01

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	6
Ambrosia artemisiifolia			3	3	
Bromus inermis	6				
Galium obtusum		3		2	
Poa pratensis	5	6	6	7	6
Symphyotrichum lanceolatum			3		4
Verbena stricta					6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-1

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	5	5	5	5
Asclepias syriaca					2
Festuca arundinacea	7	7	7	7	4
Iva annua					2
Poa pratensis	3	3	4	4	5
Solidago canadensis	4	3			
Spartina pectinata				4	6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-2

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	5	6	6	6
Ambrosia trifida		3		4	4
Cannabis sativa		1			
Carex sp. 1				5	
Cornus drummondii		4			
Festuca arundinacea	6	4			
Phalaris arundinacea			6		
Poa pratensis	4	4		4	5
Setaria faberi					4
Solidago canadensis			2		
Spartina pectinata				5	5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-3

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	7	6	6	6
Ambrosia artemisiifolia	3				
Ambrosia trifida	3	5	6	6	4
Cannabis sativa	3			2	4
Carex sp. 1					5
Carex vulpinoidea	2		3	4	
Chenopodium album				3	
Festuca arundinacea	5	3			
Medicago lupulina	2				
Phalaris arundinacea		2			
Poa pratensis	3	2	3	3	4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-4

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	6	6	5
Ambrosia trifida	3	4	4	4	3
Calystegia sepium	3				
Cannabis sativa				2	
Carex vulpinoidea	4	3	3	4	5
Conyza canadensis		3			
Morus alba	2				2
Phalaris arundinacea			2		
Poa pratensis	2	2	3		3
Polygonum hydropiperoides				2	
Polygonum scandens	2	2			
Rumex altissimus	2				
Spartina pectinata				4	4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-1-5

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	5	5	6	5
Ambrosia trifida		3	3	1	
Conyza canadensis		2			
Morus alba	2				
Phalaris arundinacea				4	3
Physalis longifolia	2		2		
Poa pratensis	7	6	6	5	7
Spartina pectinata	4				3
Taraxacum officinale			2		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-1

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	6	6	6	5
Ambrosia psilostachya	2			5	
Carex sp. 1		3			
Cornus drummondii					3
Desmanthus illinoensis		3			
Poa pratensis	6	5	5	5	6
Spartina pectinata					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-2

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	6	5	5	6
Ambrosia psilostachya	2			3	
Melilotus officinalis				3	
Physalis longifolia	3		3		
Poa pratensis	5	5	6	6	6
Solidago canadensis					3
Spartina pectinata		4			3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-2-3

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	6	5	6	6
Ambrosia psilostachya	2	3	2	2	3
Carex vulpinoidea				2	4
Conyza canadensis					2
Galium obtusum			3		
Iva annua					2
Melilotus officinalis			2		
Physalis longifolia				4	3
Poa pratensis	6	5	6	5	5
Spartina pectinata	2				
Verbena stricta		2	2		
Vernonia baldwinii				3	

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-1

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	6	6	6	6
Ambrosia artemisiifolia	3	3	2	2	3
Cannabis sativa	2	4	2		3
Desmanthus illinoensis					3
Erechtites hieraciifolia					3
Festuca arundinacea	6	5	5	6	5
Melilotus officinalis			3		
Poa pratensis	3	4	5	3	4
Rumex crispus					2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-2

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	5	5	6	6	5
Ambrosia psilostachya			3	2	2
Festuca arundinacea	2	3	2		
Galium obtusum				2	
Gleditsia triacanthos	3				
Melilotus officinalis				2	
Pascopyrum smithii	3				
Physalis longifolia	3				
Poa pratensis	6	6	6	6	6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: **W-100**

Wetland Transect/Gradsect #: 100-3-3

Sampling Date: 9/13/2017 **Last Rain Date:** 8/25/2017 **Last Rain Amount (in):** 0.64

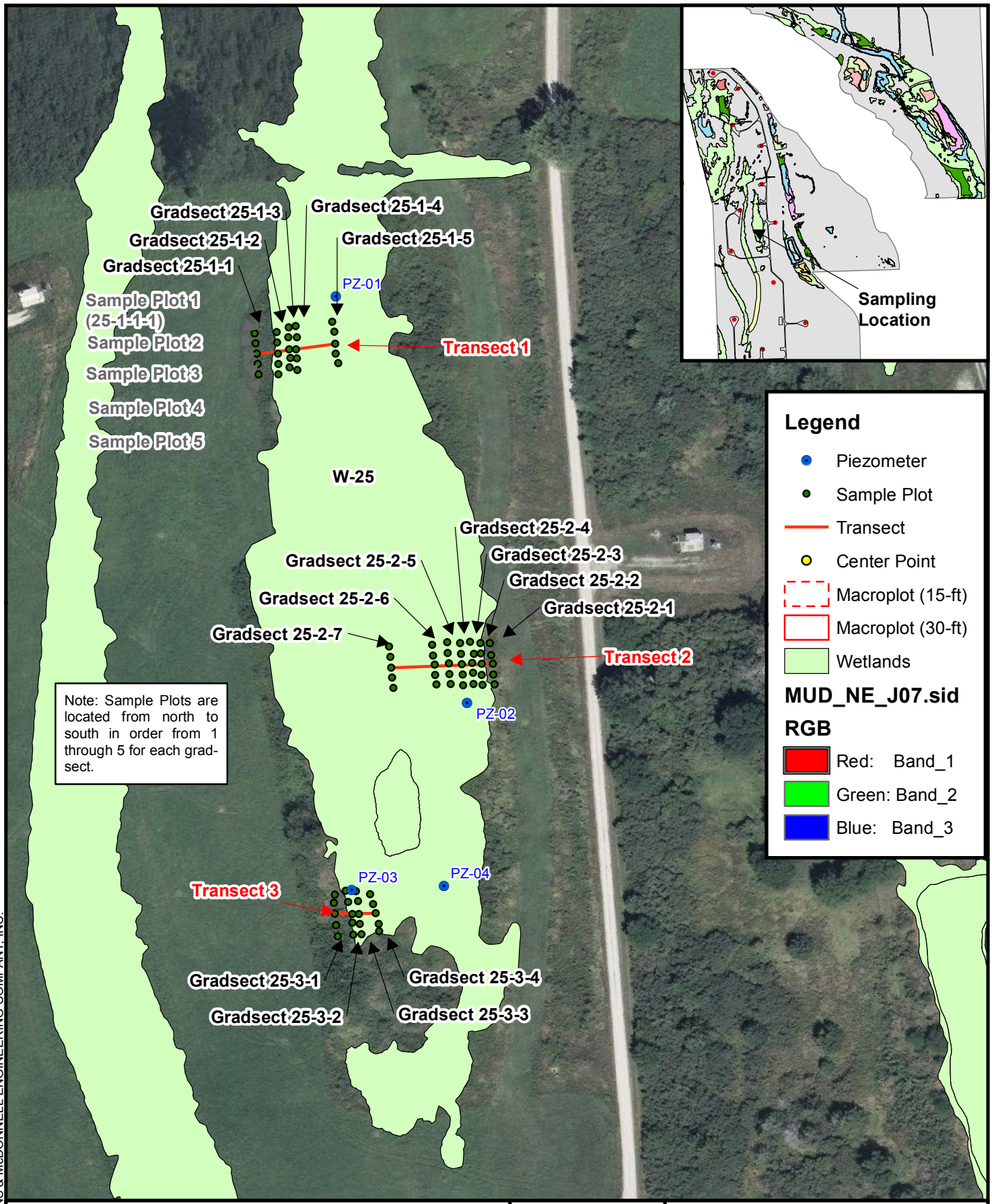
Canopy Coverage Analysis	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**
Depth of Standing Water (in):					
Open Water (in):					
Bare Soil (in):	6	5	5	5	6
Ambrosia artemisiifolia			4		
Bromus inermis	6				
Galium obtusum		2	2		
Melilotus officinalis				3	
Physalis longifolia				2	
Poa pratensis	4	7	6	7	5
Symphyotrichum lanceolatum			3		3
Verbena stricta					5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

APPENDIX I - SECTION B

PEM WETLAND 25, SAUNDERS COUNTY WELL FIELD WETLAND MONITORING DATA

TABLE OF CONTENTS



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BURNS McDONNELL

Figure 1
Location Map for
PEM Wetland 25
Saunders County Wellfield
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 25
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Approximate Wetland Boundary

NORTH

125 62.5 0 125

Scale in Feet

BURNS McDONNELL

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 25
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

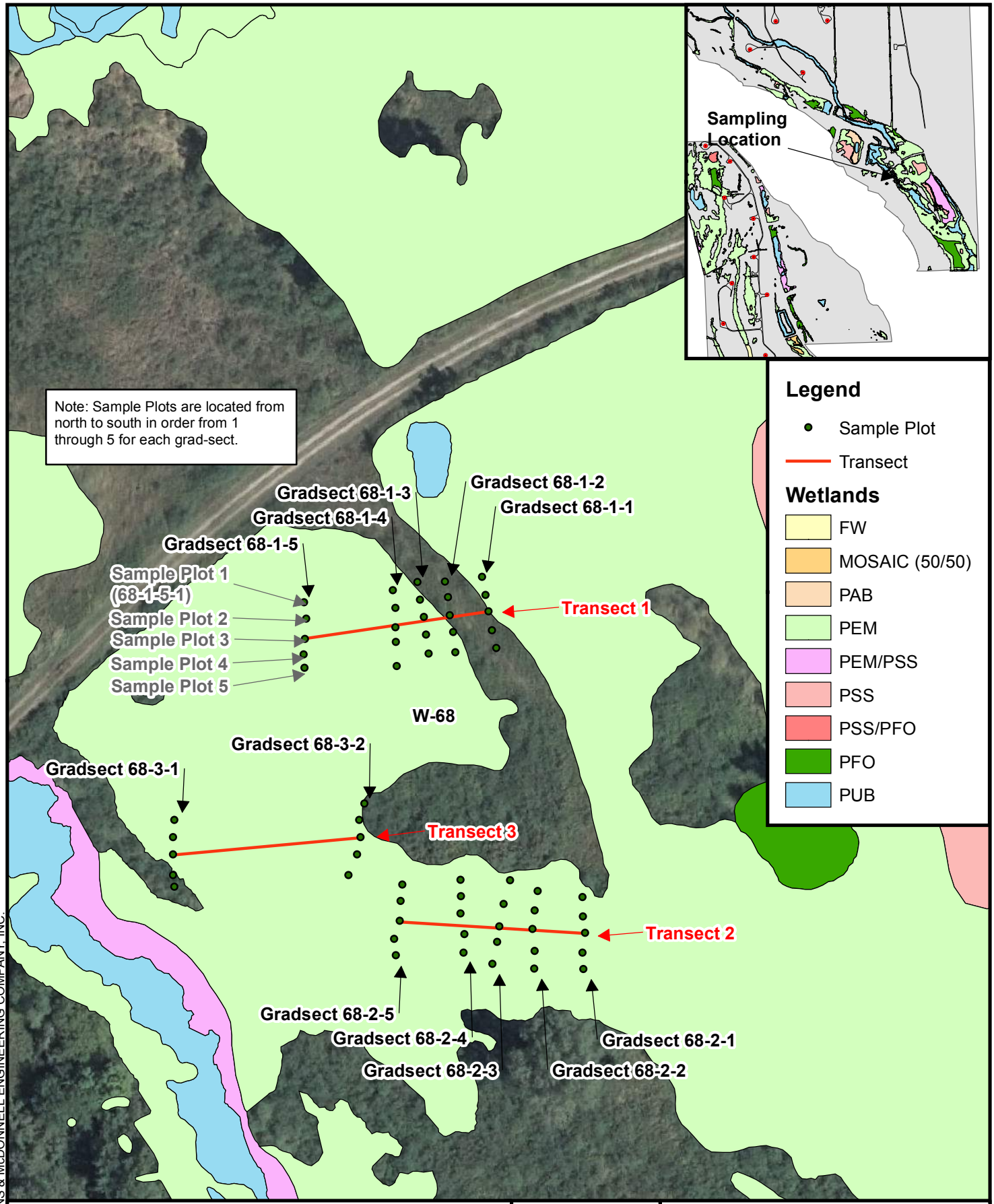
Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX I - SECTION C

PEM WETLAND 68, DOUGLAS COUNTY WELL FIELD WETLAND MONITORING DATA

TABLE OF CONTENTS



BURNS McDONNELL

Figure 1
Location Map for
PEM Wetland 68
Douglas County Wellfield
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 2
2017 Natural Color Aerial Photograph
of PEM Wetland 68
Douglas County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 68
Douglas County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II

WETLAND MONITORING DATA FOR THE DOUGLAS COUNTY AND SAUNDERS COUNTY CONES OF DEPRESSION (FIGURES)

APPENDIX II – SECTION A

PEM WETLAND 9, DOUGLAS COUNTY CONE OF DEPRESSION

TABLE OF CONTENTS

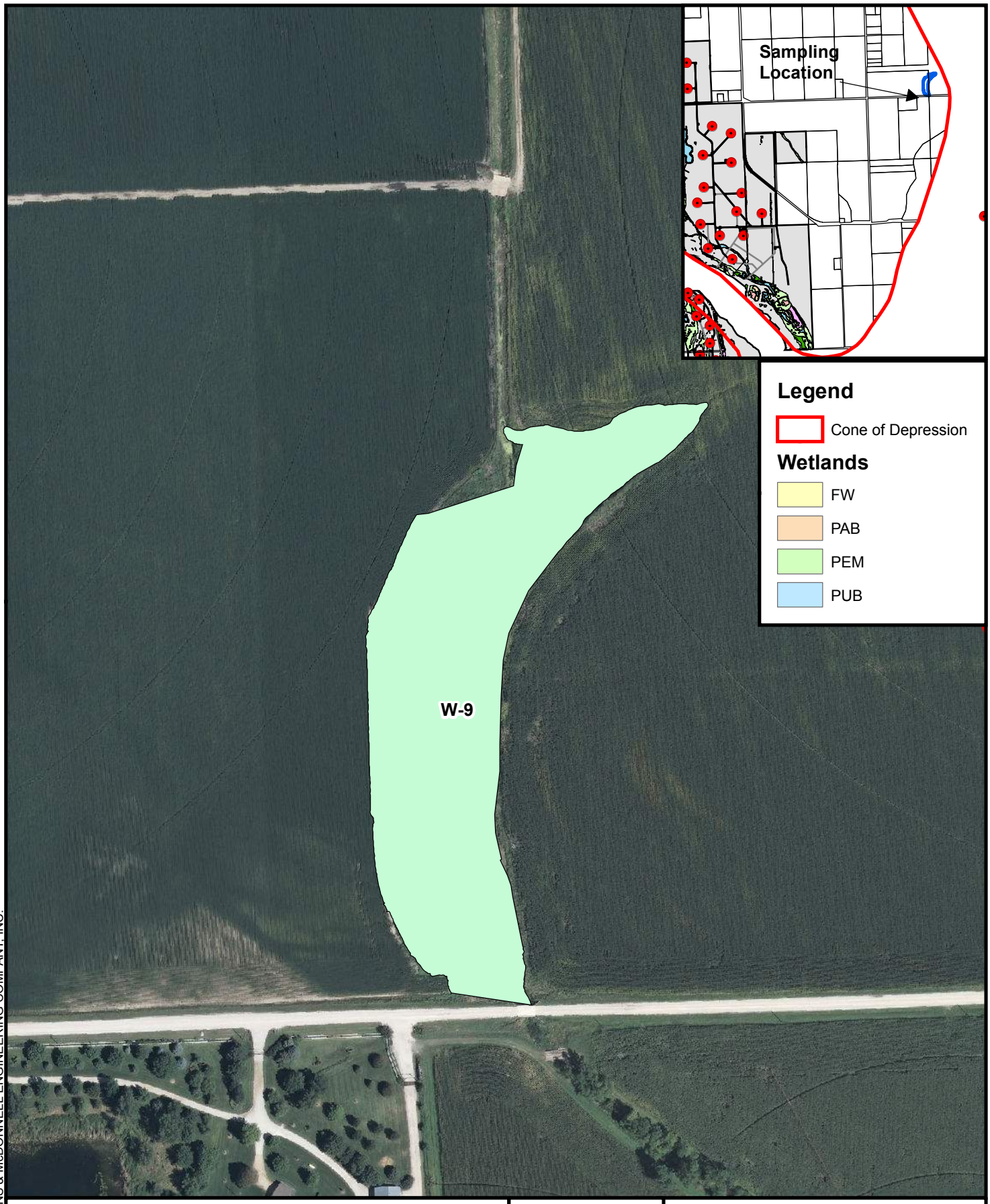


Figure 1
Location of PEM Wetland 9
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

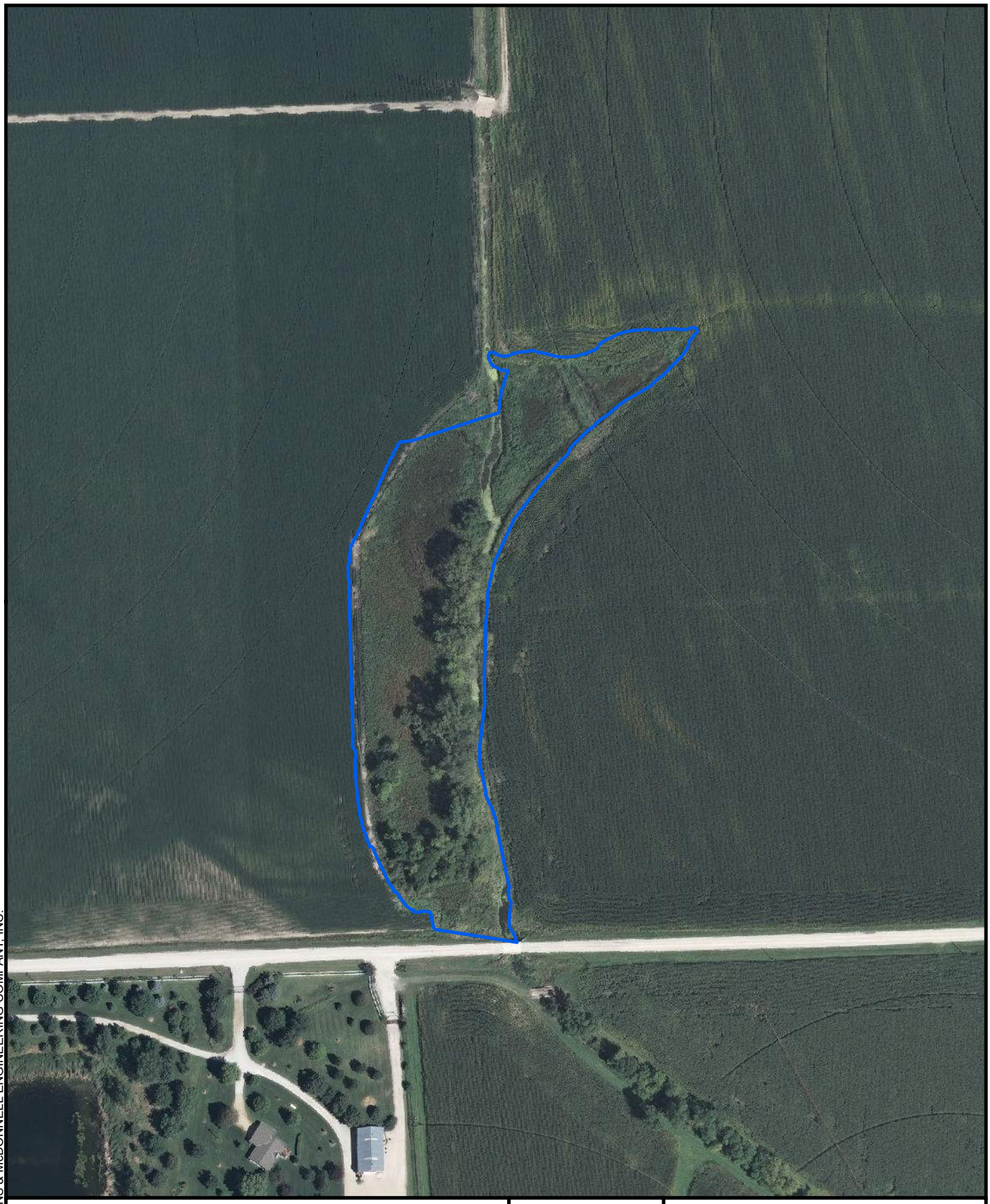


Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 9
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

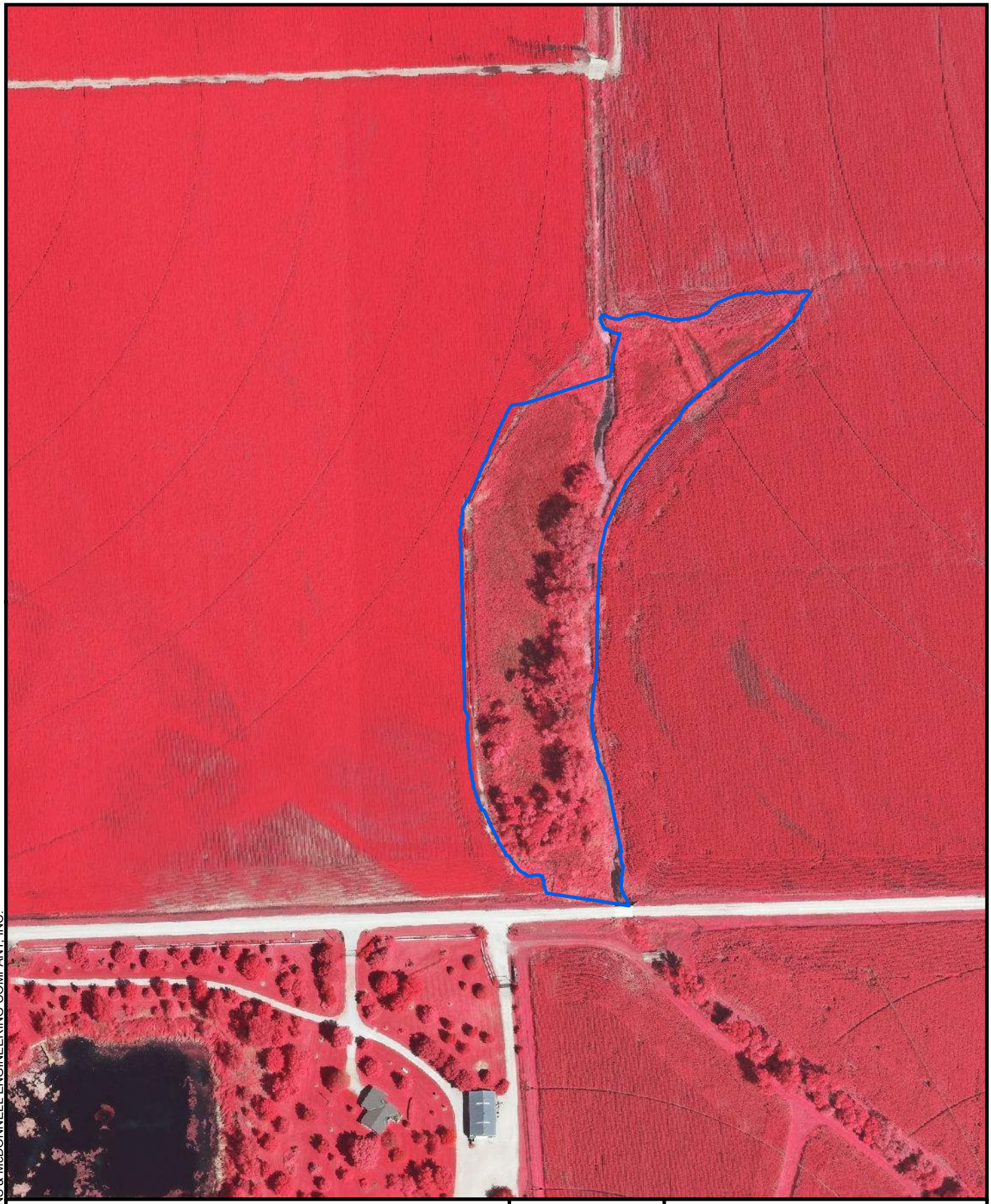


Figure 3
2017 CIR Aerial Photography
of PEM Wetland 9
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Path: Z:\Clients\ENS\OMUD\101060_PlatteWest2017\Studies\Geospatial\DataFiles\ArcDocs\WetlandMonitoringReport2017\CIR_cod_W-9_2017.mxd slgutman 1/11/2018

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION B

PEM WETLAND 514, DOUGLAS COUNTY CONE OF DEPRESSION

TABLE OF CONTENTS

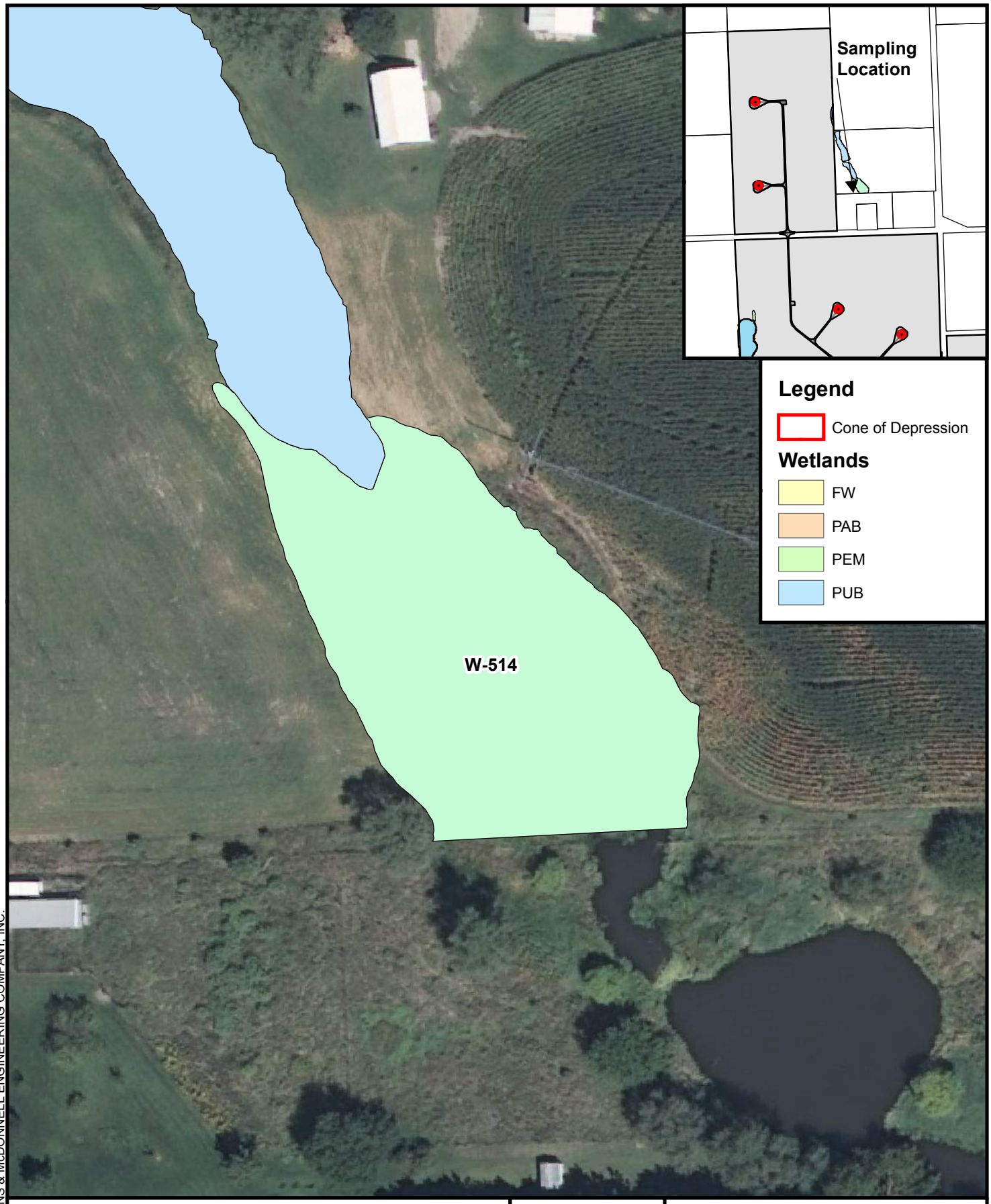


Figure 1
Location of PFO Wetland 514
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 514
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

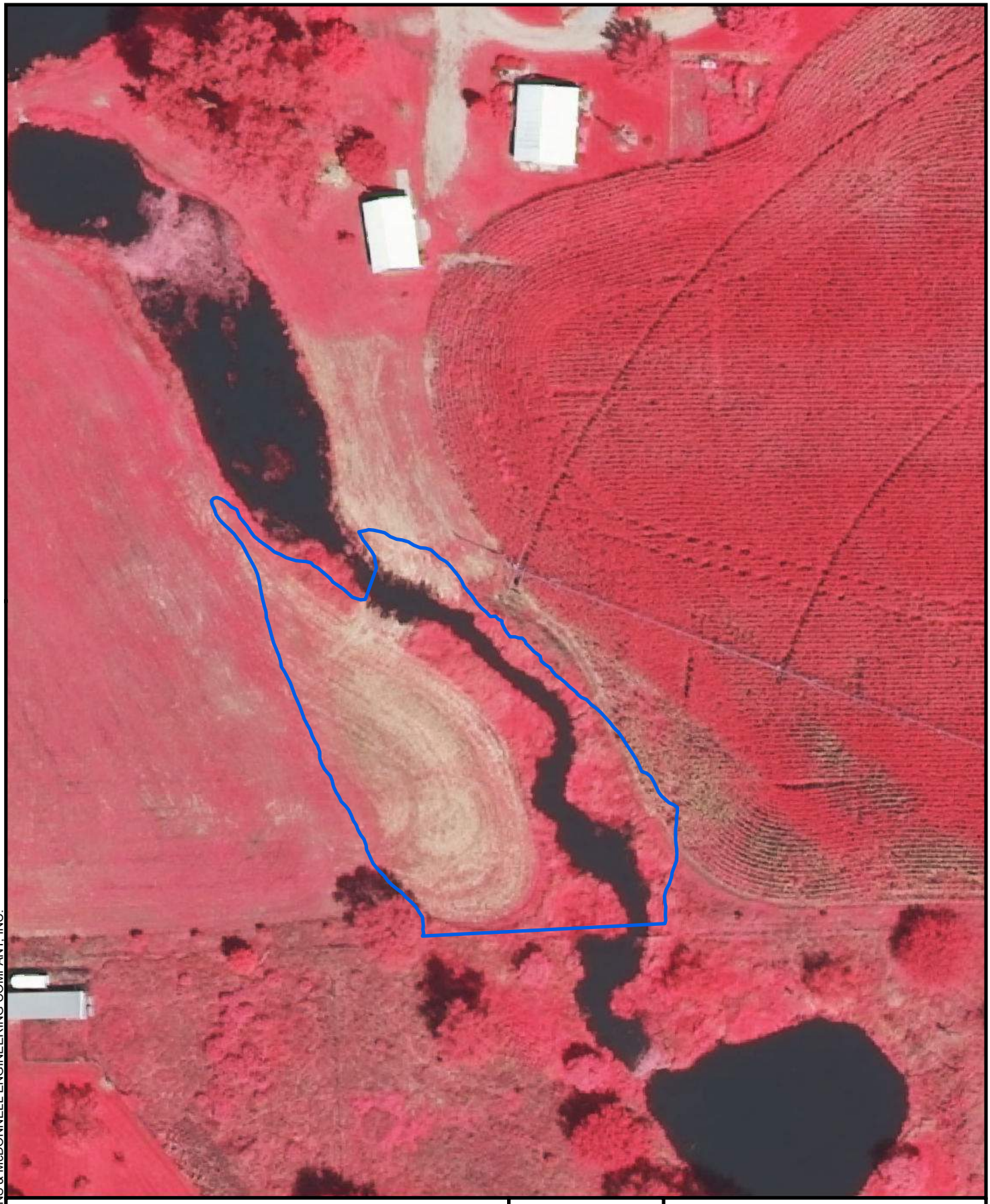


Figure 3
2017 CIR Aerial Photography
of PEM Wetland 514
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION C

PEM WETLAND 519, DOUGLAS COUNTY CONE OF DEPRESSION

TABLE OF CONTENTS

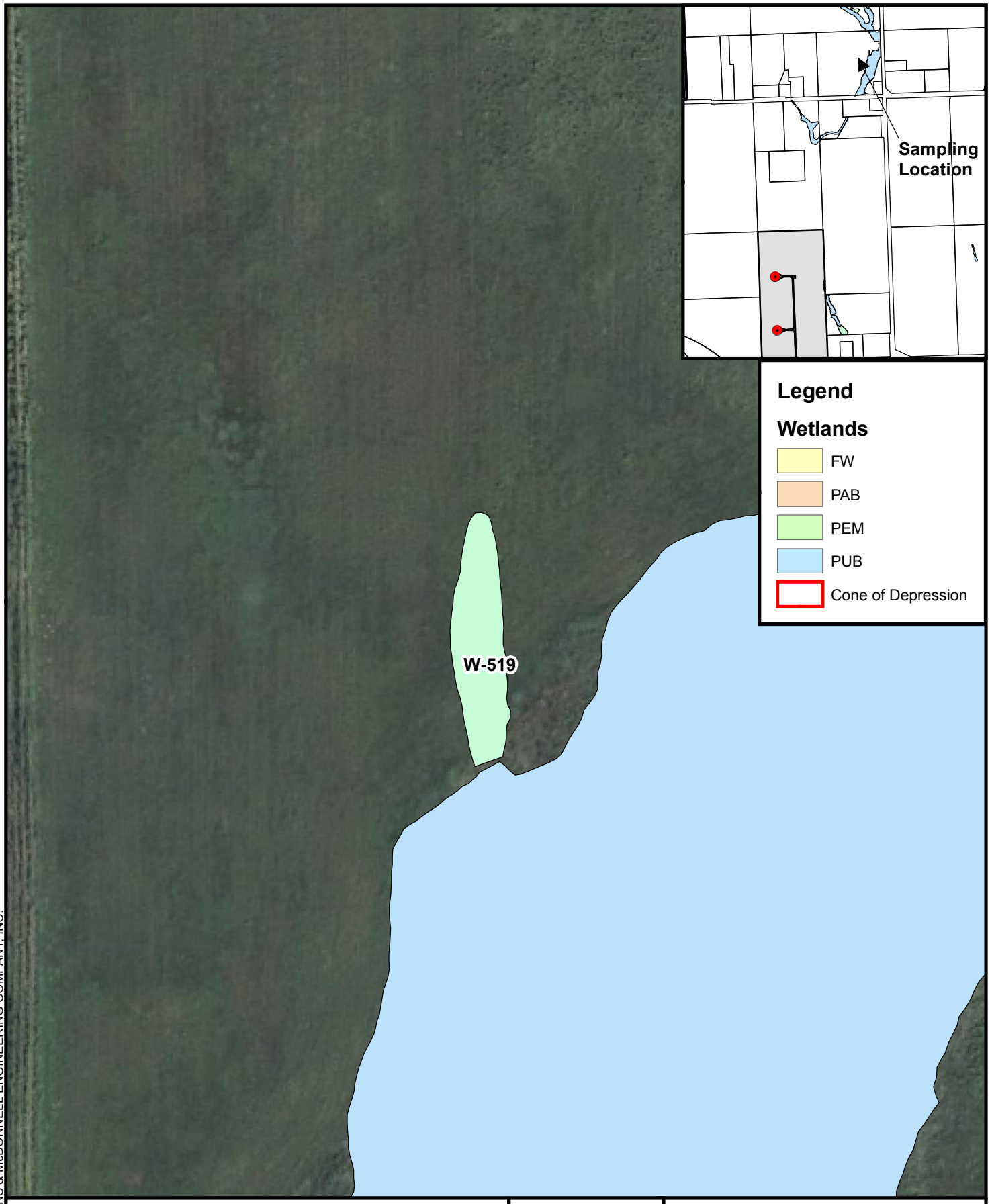


Figure 1
Location of PEM Wetland 519
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Approximate Wetland Boundary

NORTH

50 25 0 50

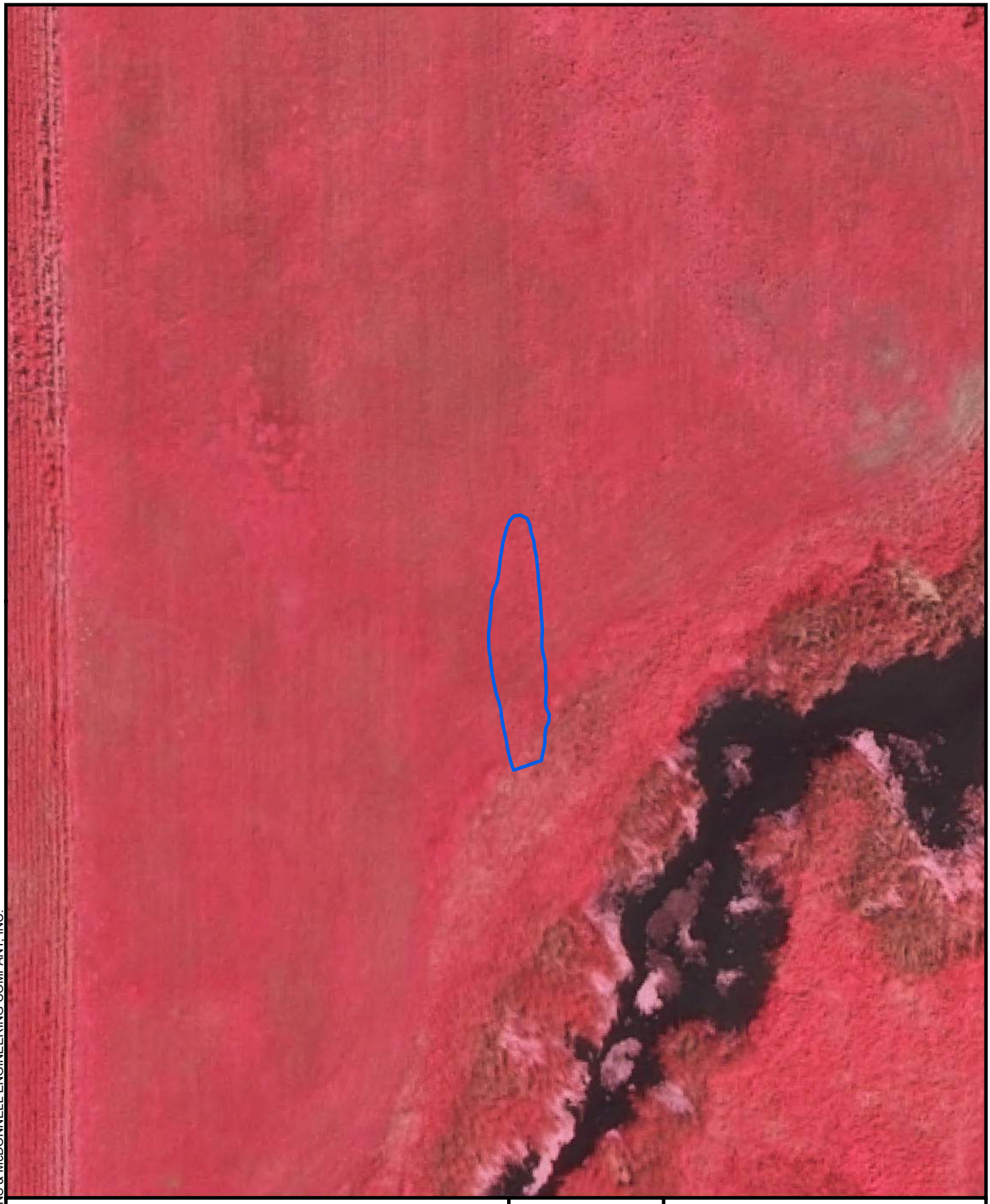
Scale in Feet

BURNS McDONNELL

Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 519
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018



Approximate Wetland Boundary

NORTH

50 25 0 50

Scale in Feet

BURNS McDONNELL

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 519
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION D

PEM WETLAND 306, SAUNDERS COUNTY CONE OF DEPRESSION

TABLE OF CONTENTS

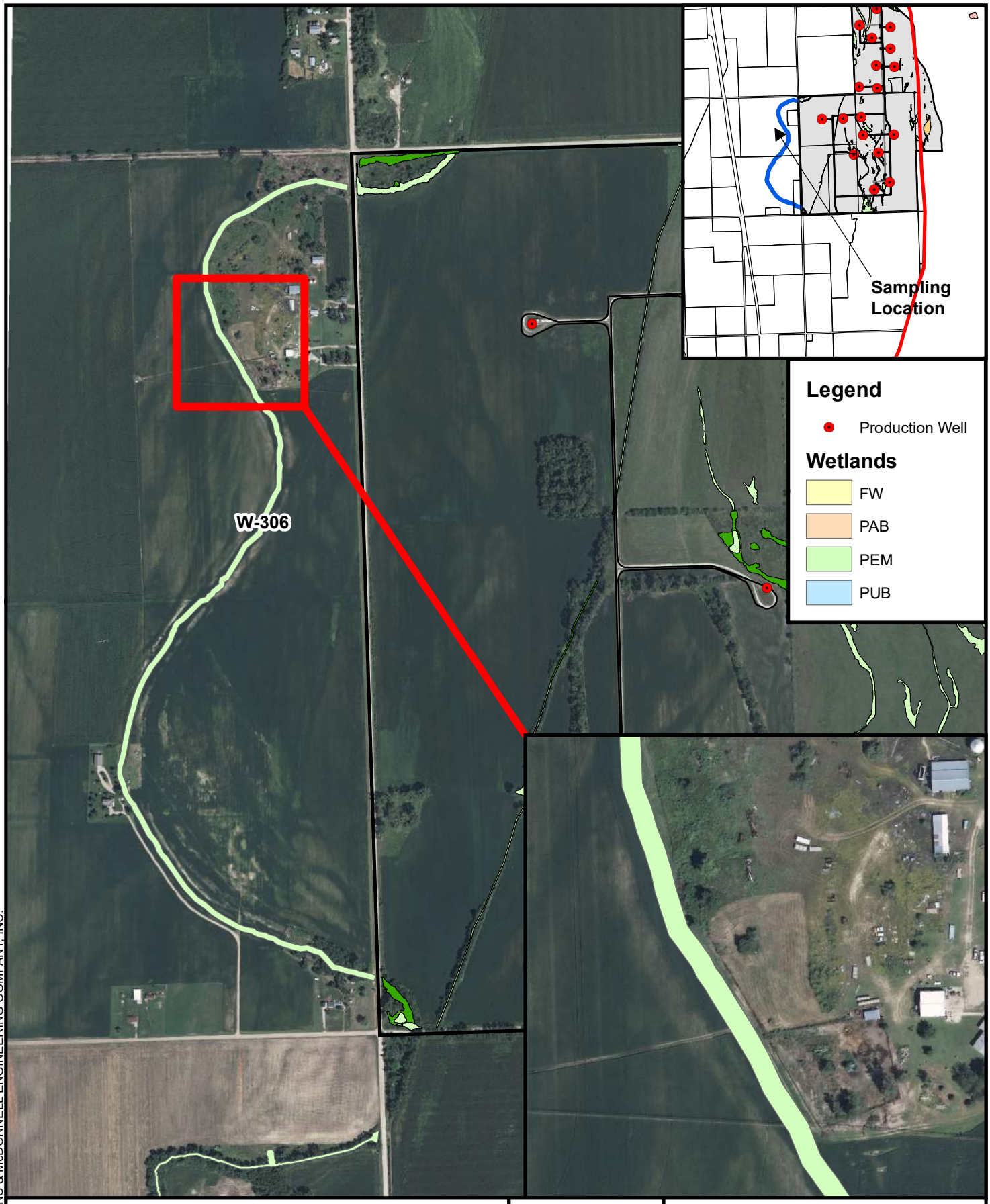


Figure 1
Location of PEM Wetland 306
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

BURNS McDONNELL

Source: Wilson & Company 2017 Aerial Photography

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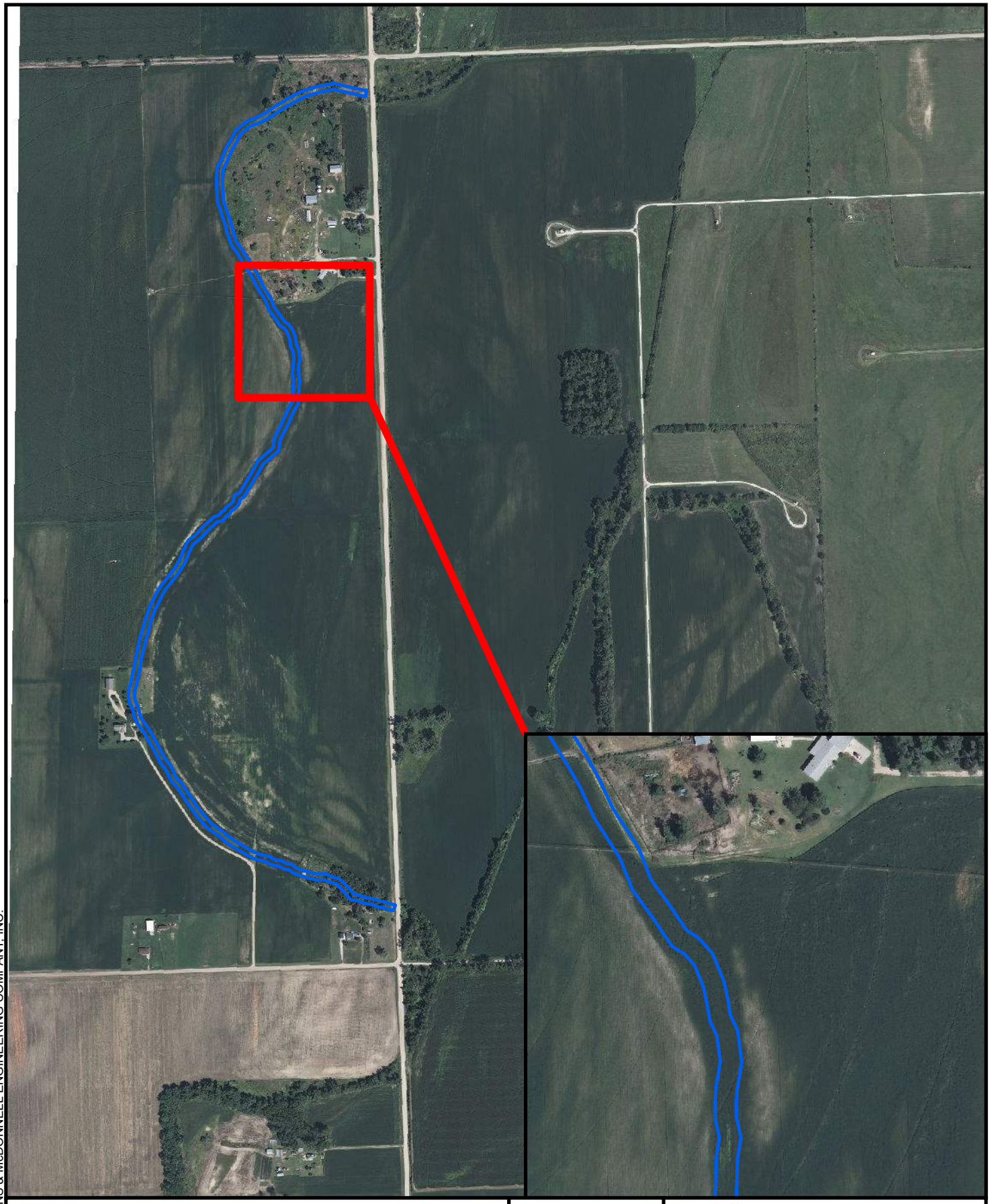

Approximate Wetland Boundary

NORTH

750 375 0 750

Scale in Feet

BURNS McDONNELL

Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 306
Saunders County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

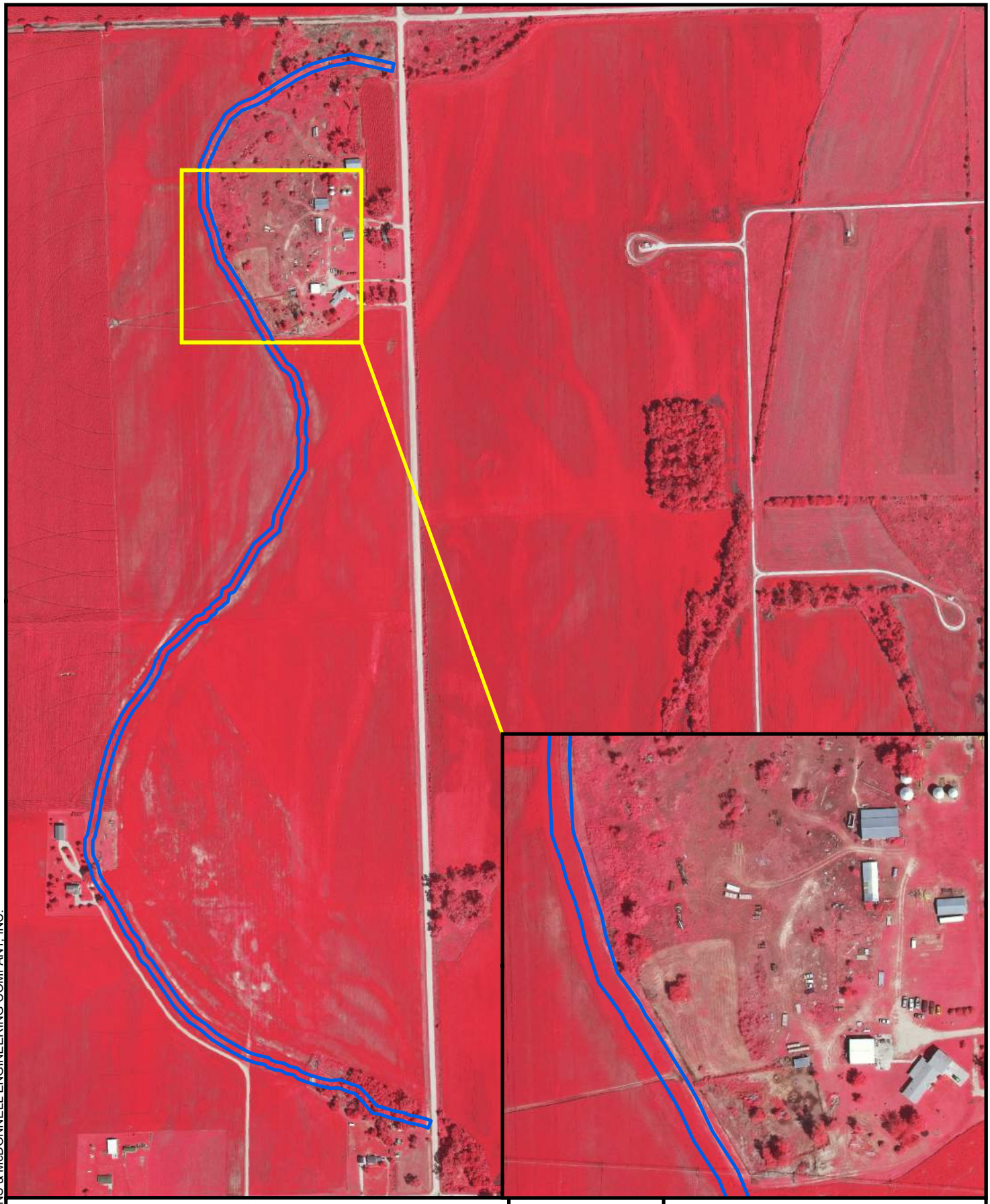

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 306
Saunders County Cone of Depression
Wellfield Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION E

PEM WETLAND 321, SAUNDERS COUNTY CONE OF DEPRESSION

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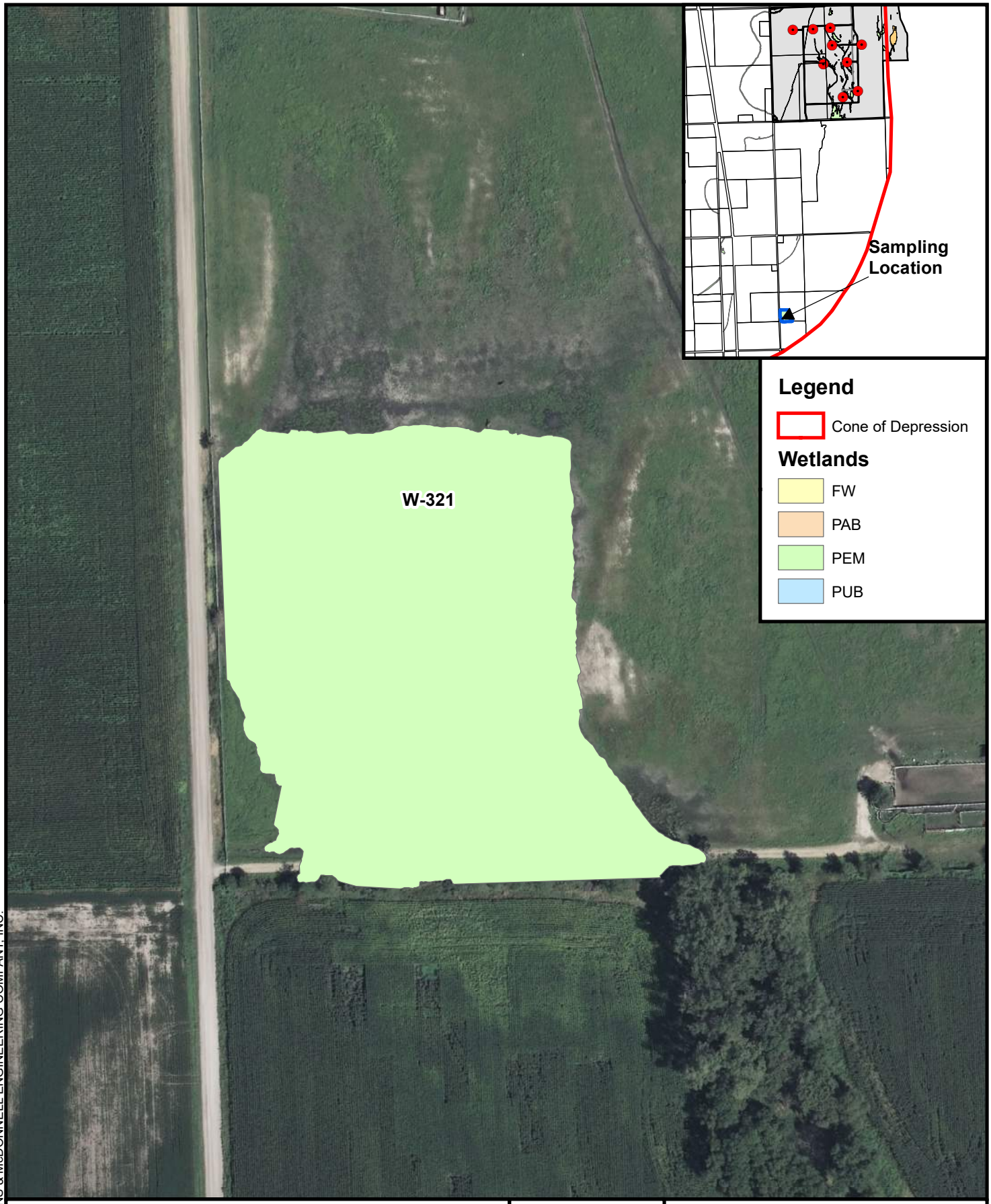

Figure 1
Location of PEM Wetland 321
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

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Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 321
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

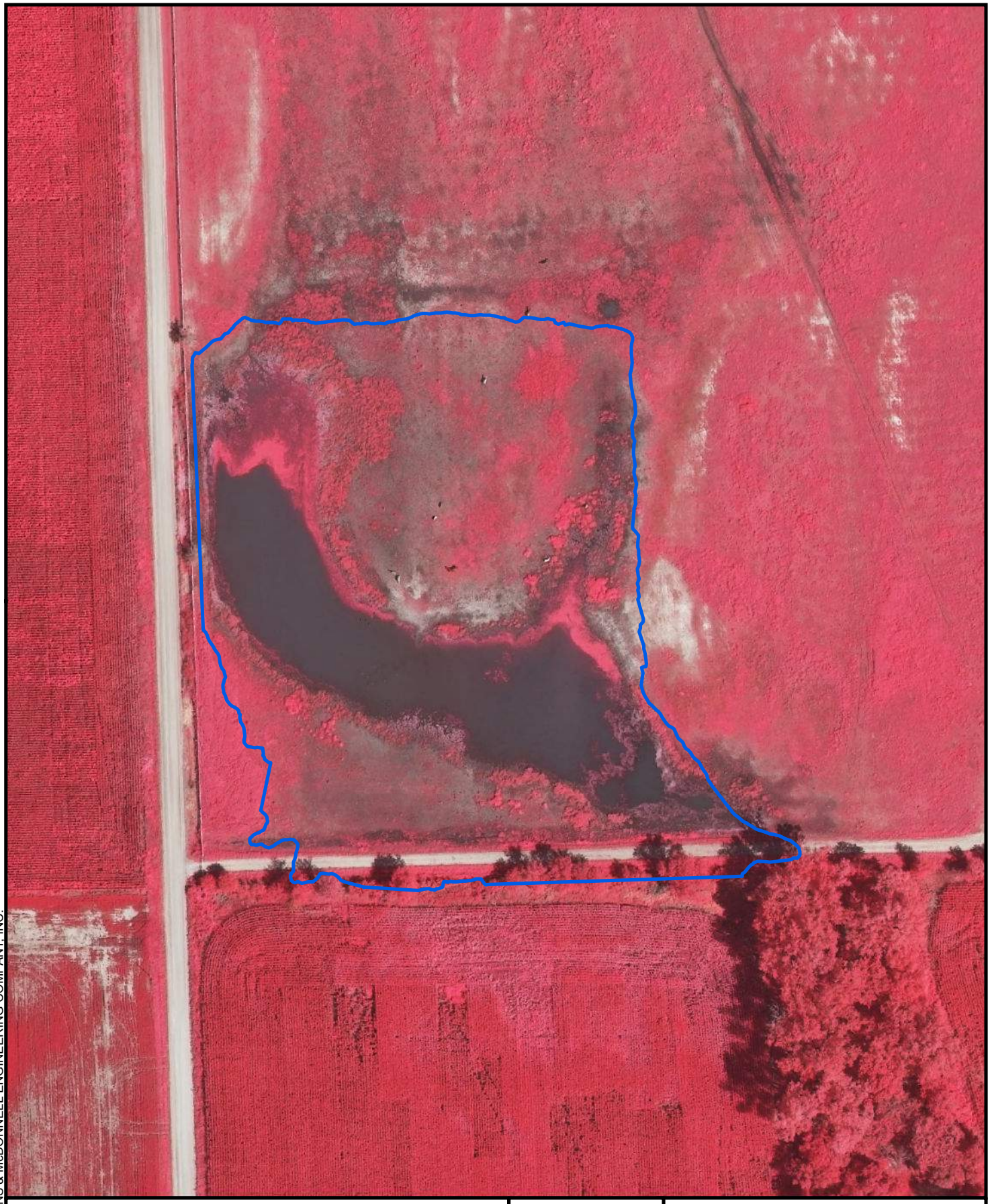

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 321
Douglas County Cone of Depression
Wellfield Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION F

PEM WETLAND 700, SAUNDERS COUNTY CONE OF DEPRESSION

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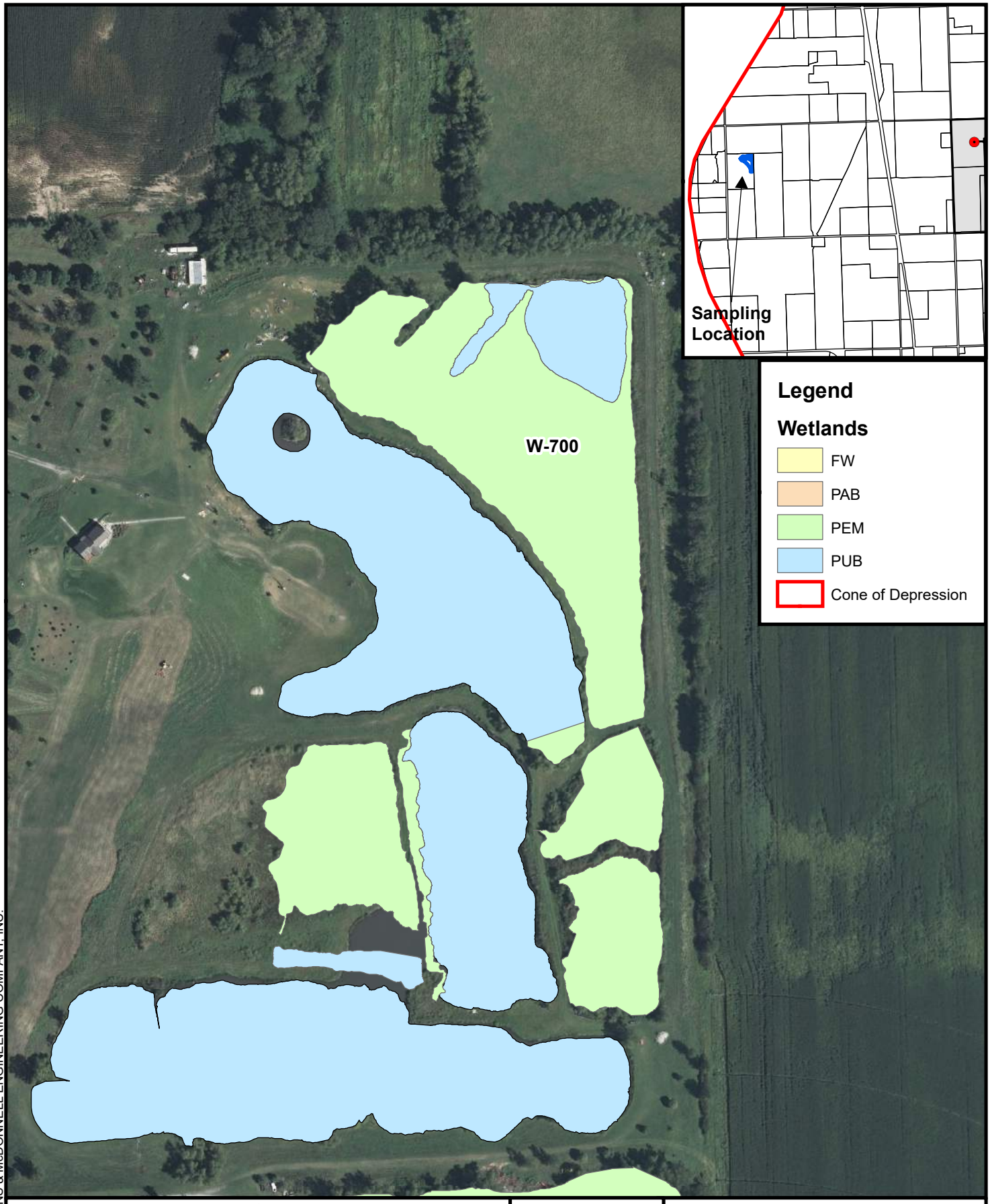

Figure 1
Location of PEM Wetland 700
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 2
2017 Natural Color Aerial Photography
of PEM Wetland 700
Saunders County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 3
2017 CIR Aerial Photography
of PEM Wetland 700
Saunders County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION G

PFO/PEM WETLAND 5, DOUGLAS COUNTY CONE OF DEPRESSION

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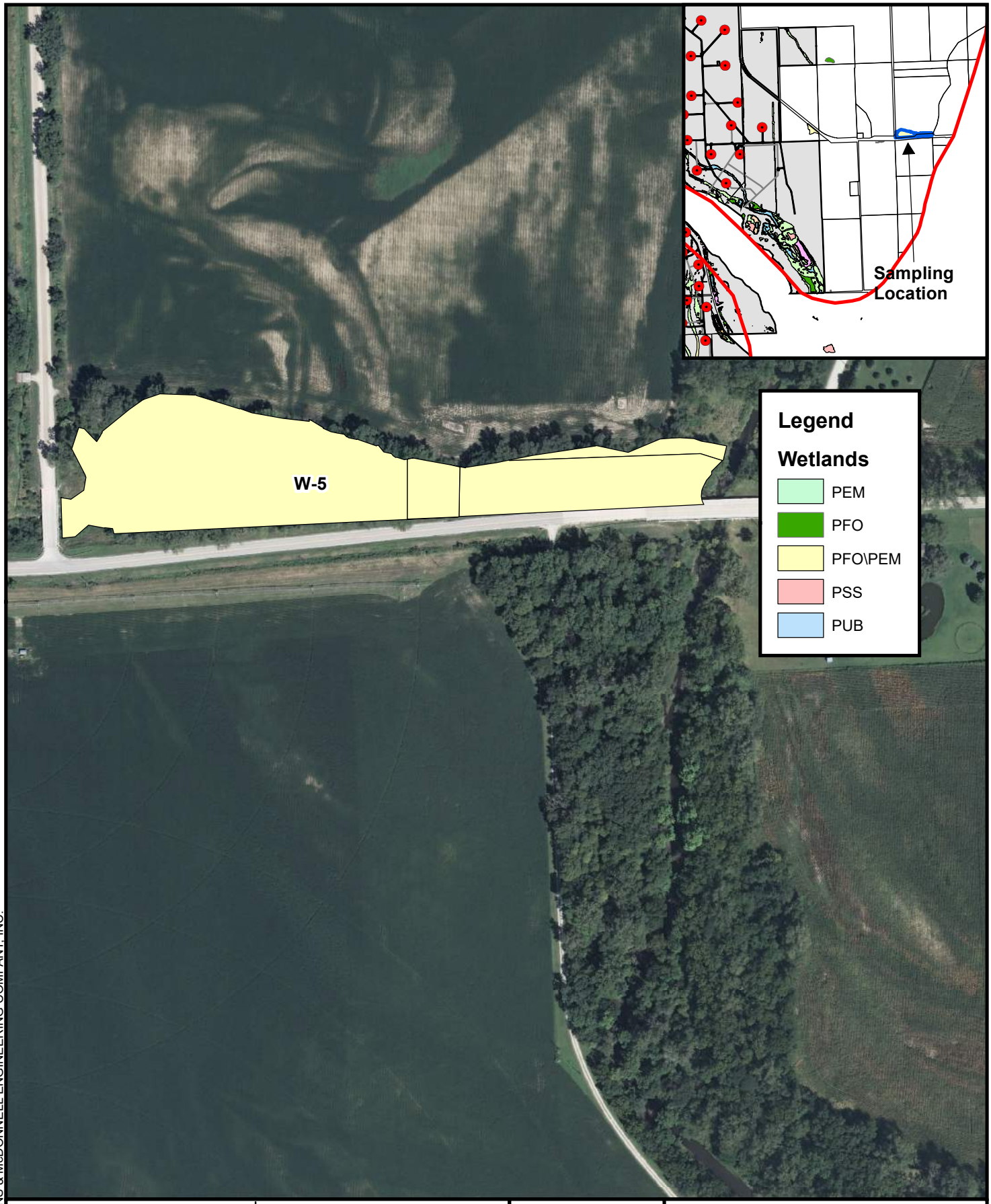

NORTH

300 150 0 300

Scale in Feet

BURNS McDONNELL

Figure 1
Location of PFO\PEM Wetland 5
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

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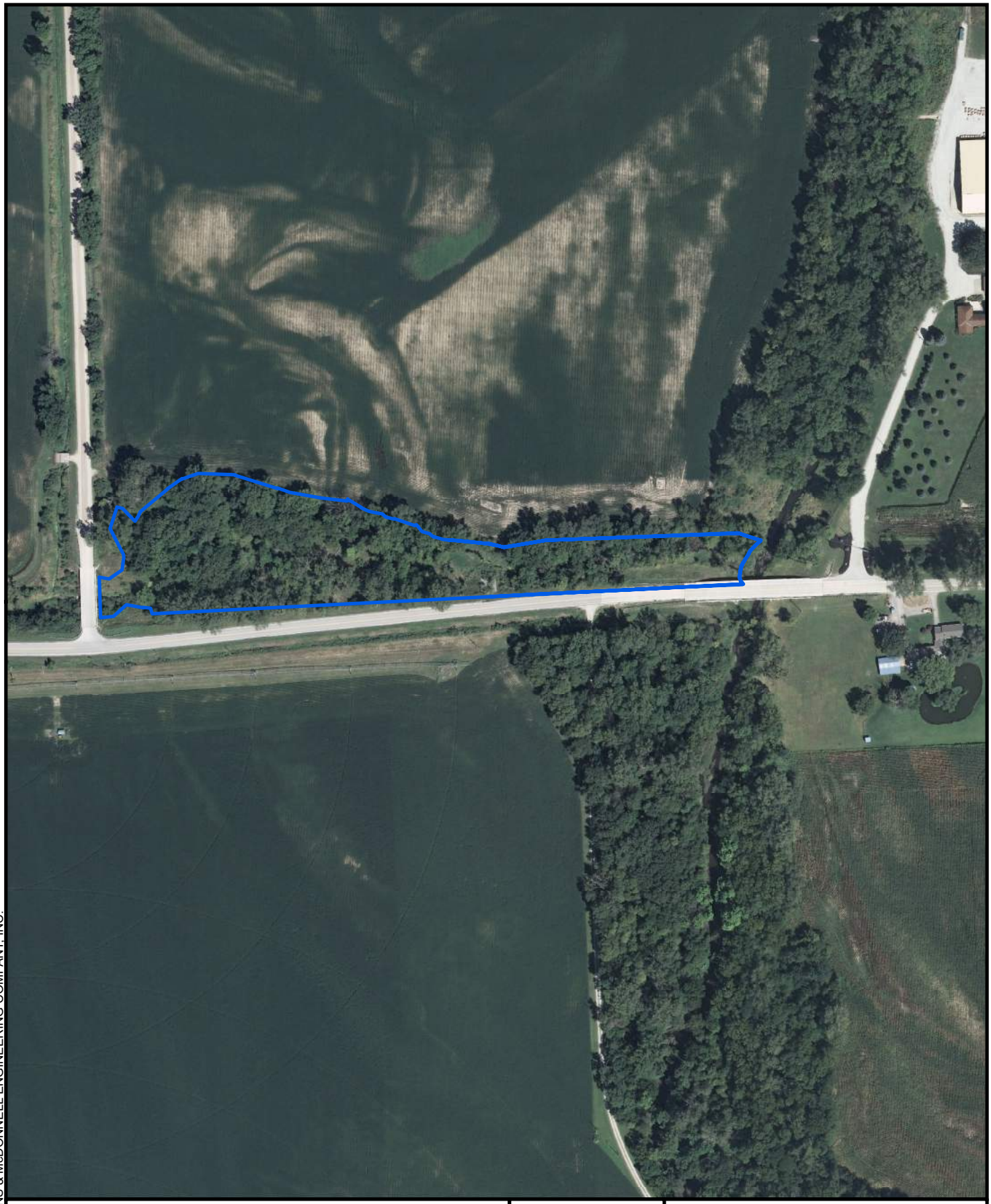

Figure 2
2017 Natural Color Aerial Photography
of PFO\PEM Wetland 5
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Approximate Wetland Boundary

NORTH

250 125 0 250

Scale in Feet

BURNS McDONNELL

Figure 3
2017 CIR Aerial Photography
of PFO/PEM Wetland 5
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX II – SECTION H

PFO WETLAND 8, DOUGLAS COUNTY CONE OF DEPRESSION

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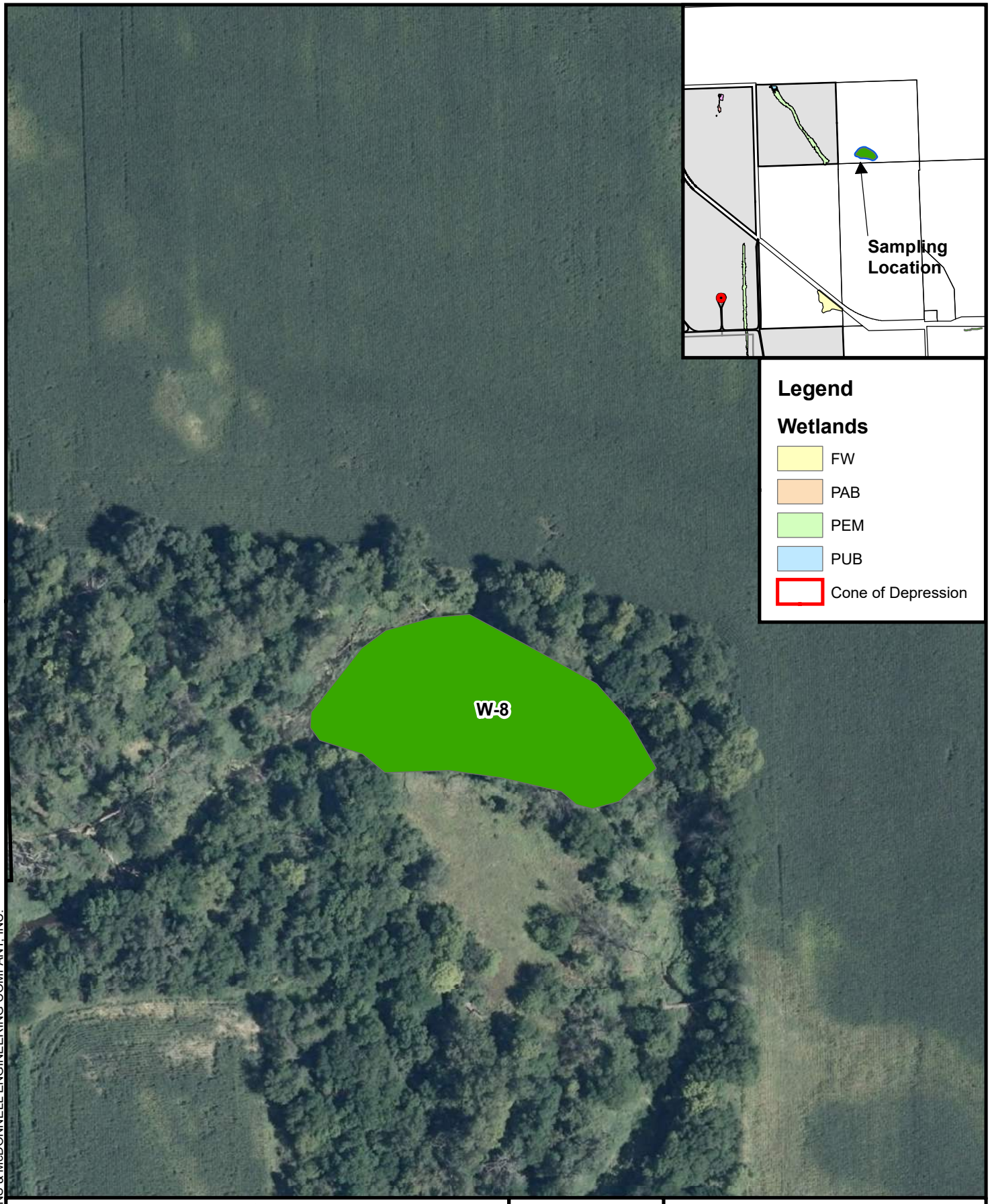

NORTH

125 62.5 0 125

Scale in Feet

BURNS McDONNELL

Figure 1
Location of PFO Wetland 8
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Path: Z:\Clients\ENS\OMUD\92445_PlatteWest2016\Studies\Geospatial\DataFiles\ArcDocs\Wetlands Report 2016\DG_PFO_W-8_2015.mxd cfwisniewski 1/11/2018

Approximate Wetland Boundary

NORTH

125 62.5 0 125

Scale in Feet

BURNS McDONNELL

Figure 2
2017 Natural Color Aerial Photography
of PFO Wetland 8
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Aerial Photography

Issued: 1/11/2018

Figure 3
2017 CIR Aerial Photography
of PFO Wetland 8
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2017 Color Infrared Aerial Photography

Issued: 1/11/2018

APPENDIX III

COMPREHENSIVE VEGETATION SPECIES LIST BY WETLAND, 2005-2017

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Wetland Indicator Status	C Value	PEM			PFO			PSS
					W-68	W-100	W-25	W-5	W-51	W-54	W-55
Acalypha rhomboidea	Common threeseed mercury	Native	FACU-	0		X			X	X	X
Acer negundo	Boxelder	Native	FAC	1	X						
Acer rubrum	Red maple	Native	--		X						
Acer saccharinum	Silver maple	Native	FACW	4						X	
Achillea millefolium	Common yarrow	Native & Introduced	FACU	2		X					
Ageratina altissima	White snakeroot	Native	NI	4					X		
Agrimonia gryposepala	Tall hairy agrimony	Native	FAC	5					X		
Agrostis gigantea	Redtop	Introduced	NI	0	X	X	X	X	X		
Agrostis sp.	Bentgrass	--	--					X			
Agrostis stolonifera	Creeping bentgrass	Introduced	FAC+		X	X	X	X	X		
Amaranthus retroflexus	Redroot amaranth	Native	FACU			X	X				
Amaranthus tuberculatus	Roughfruit amaranth	Native	OBL	0		X	X				
Ambrosia artemisiifolia	Annual ragweed	Native	FACU	0	X	X	X	X	X		X
Ambrosia psilostachya	Cuman ragweed	Native	FAC	1		X					
Ambrosia trifida	Great ragweed	Native	FACW	0	X	X			X		
Amorpha fruticosa	Desert false indigo	Native	OBL	5	X		X		X		
Amphicarpaea bracteata	American hogpeanut	Native	FACW	4					X		
Andropogon gerardii	Big bluestem	Native	FAC-	5	X	X	X				
Anemone canadensis	Canadian anemone	Native	FACW	4	X	X			X		
Anemone caroliniana	Carolina anemone	Native	NL	7	X						
Anemone virginiana	tall thimbleweed	Native	NI	4			X				
Apios americana	Groundnut	Native	FACW	6	X				X		X
Apocynum cannabinum	Indianhemp	Native	FAC	2	X	X	X				
Arnoglossum plantagineum	Groovestem Indian plantain	Native	FACW	7		X					
Asarum canadense	Canadian wildginger	Native	NL	0				X			
Asclepias incarnata	Swamp milkweed	Native	OBL	4	X	X	X				
Asclepias sp.	Milkweed	Native	--		X	X	X				
Asclepias syriaca	Common milkweed	Native	NL	1	X	X	X				
Astragalus lotiflorus	Lotus milkvetch	Native	NL	4	X						
Avena sativa	Common oat	Introduced	NL		X	X	X				
Bidens cernua	Nodding beggartick	Native	OBL	3			X				
Bidens sp.	Beggartick	Native	FACW				X				
Boehmeria cylindrica	Smallspike false nettle	Native	OBL	6	X	X	X		X	X	X

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Brassica sp.	Mustard	--	--		X	X					
Bromus arvensis	Field brome	Introduced	NL		X	X					
Bromus inermis	Smooth brome	Native & Introduced	NL		X	X	X				
Calamagrostis canadensis	Bluejoint	Native	OBL	6	X	X	X		X		
Calamagrostis stricta	Slimstem reedgrass	Native	NL	6	X		X	X	X		
Calystegia sepium	Hedge false bindweed	Native & Introduced	FAC	1	X	X	X				
Camassia scilloides	Atlantic camas	Native	FAC			X					
Cannabis sativa	Marijuana	Introduced	FACU-			X	X				
Capsella bursa-pastoris	Shepherd's purse	Introduced	FACU			X					
Carduus nutans	Nodding plumless thistle	Introduced	NL		X	X					
Carex aquatilis	Water sedge	Native	OBL	9		X					
Carex bicknellii	Bicknell's sedge	Native	FACU	6	X		X				X
Carex blanda	Eastern woodland sedge	Native	FAC	2	X				X		
Carex brevior	Shortbeak sedge	Native	FAC	4	X	X		X	X	X	X
Carex cristatella	Crested sedge	Native	FACW	5	X						
Carex emoryi	Emory's sedge	Native	OBL	5		X					
Carex grayi	Gray's sedge	Native	FACW	0			X				
Carex hyalinolepis	Shoreline Sedge	Native	OBL	5			X				
Carex molesta	Troublesome sedge	Native	FAC	3	X	X					
Carex pellita	Wooly sedge	Native	OBL	4	X	X	X	X			
Carex praegracilis	Clustered field sedge	Native	FACW	4	X	X	X	X			
Carex sartwellii	Sartwell's sedge	Native	OBL	6				X			
Carex scoparia	Broom sedge	Native	FACW	5	X						
Carex sp. 1	Sedge	Native	--		X	X	X	X	X	X	X
Carex sp. 2	Sedge	Native	--		X	X	X	X	X		
Carex sp. 3	Sedge	Native	--				X				
Carex stricta	Upright sedge	Native	OBL		X	X	X				
Carex vulpinoidea	Fox sedge	Native	OBL	4	X	X	X	X	X	X	X
Celtis occidentalis	Commom hackberry	Native	FACU	4					X	X	X
Cenchchrus longispinus	Mat sandbur	Native	NL	0		X					
Chamaecrista fasciculata	Partridge pea	Native	NL	1	X		X				
Chenopodium album	Lambsquarters	Native & Introduced	FAC			X	X				
Cicuta maculata	Spotted waterhemlock	Native	OBL	5	X						
Cinna arundinacea	Sweet woodreed	Native	FACW	5					X		

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Cirsium altissimum	Tall thistle	Native	NL	1	X	X	X	X	X		
Cirsium arvense	Canada thistle	Introduced	FACU		X	X	X				
Cirsium canescens	Prairie thistle	Native	NL	4			X				
Cirsium sp.	Thistle	--	--			X					
Commelina communis	Asiatic dayflower	Introduced	FAC		X						
Commelina erecta	Whitemouth dayflower	Native	NL	5					X		
Convolvulus arvensis	Field bindweed	Introduced	NL		X	X			X		
Conyza canadensis	Canadian horseweed	Native	FACU-	0	X	X	X				
Cornus drummondii	Roughleaf dogwood	Native	FAC	3	X	X	X	X	X	X	X
Cryptotaenia canadensis	Canada honewort	Native	FACU	4				X	X		
Cynodon dactylon	Bermudagrass	Introduced	FACU		X	X	X				
Cyperus acuminatus	Tapertip flatsedge	Native	OBL	3	X						
Cyperus esculentus	Yellow nutsedge	Native & Introduced	FACW	0	X	X	X				
Cyperus strigosus	Strawcolored flatsedge	Native	FACW	4	X		X				
Descurainia sophia	Herb sophia	Introduced	NI	0		X					
Desmanthus illinoensis	Illinois bundleflower	Native	FACU	5	X	X	X	X			
Dichanthelium acuminatum	Tapered rosette grass	Native	FAC	6	X	X	X				
Dichanthelium oligosanthes	Heller's rosette grass	Native	FACU	4	X	X	X				
Digitaria ischaemum	Smooth crabgrass	Introduced	UPL		X						
Distichlis spicata	Saltgrass	Native	FACW	3	X				X		
Doellingeria umbellata	parasol whitetop	Native	FACW	2		X					
Echinochloa crus-galli	Barnyardgrass	Introduced	FACW			X	X				
Echinochloa sp.	Barnyardgrass	--	--				X				
Eleocharis compressa	Flatstem spikerush	Native	FACW	6			X				
Eleocharis erythropoda	Bald spikerush	Native	OBL	5	X	X	X	X			
Eleocharis lanceolata	Daggerleaf spikerush	Native	FACW+		X		X				
Eleocharis obtusa	Blunt spikerush	Native	OBL	3	X						
Eleocharis palustris	Common spikerush	Native	OBL	4		X					
Eleocharis sp.	Spikerush	--	--		X	X	X	X			
Elymus canadensis	Canada wildrye	Native	FACU	5	X	X	X				
Elymus hystrix	Eastern bottlebrush grass	Native	NL	6	X	X		X			
Elymus submuticus	Virginia wildrye	Native	NL		X				X		X
Elymus virginicus	Virginia wildrye	Native	FAC	4	X	X	X		X	X	X
Equisetum arvense	Field horsetail	Native	FAC	4	X		X	X	X		X

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Equisetum hyemale	Scouringrush horsetail	Native	FACW	4		X	X				
Erechtites hieraciifolia	American burnweed	Native	FAC	1	X	X	X		X	X	
Erigeron annuus	Eastern daisy fleabane	Native	FACU	1		X					
Erigeron strigosus	Prairie fleabane	Native	FAC	2	X	X	X				
Eupatoriadelphus maculatus	Spotted trumpetweed	Native	OBL			X					
Eupatorium perfoliatum	Common boneset	Native	OBL	5	X				X		
Eupatorium purpureum	Sweet scented joe pye weed	Native	NL		X		X		X		
Eupatorium serotinum	Lateflowering thoroughwort	Native	FAC	3				X			
Eupatorium sp.	Thoroughwort	Native	--		X						
Euphorbia maculata	Spotted sandmat	Native	FACU	4		X					
Euthamia gymnospermoides	Texas goldentop	Native	FACW	4	X						
Festuca arundinacea	Tall fescue	Introduced	FACU			X	X				
Fragaria virginiana	Virginia strawberry	Native	FACU	5			X		X		
Fraxinus pennsylvanica	Green ash	Native	FACW	2				X	X	X	X
Galium aparine	Stickywilly	Native	FACU	0	X	X	X	X	X	X	X
Galium obtusum	Bluntleaf bedstraw	Native	FACW	6	X	X	X	X	X		X
Galium pilosum	Hairy bedstraw	Native	NL						X		
Galium trifidum	Threepetal bedstraw	Native	OBL	8	X				X		
Galium triflorum	Fragrant bedstraw	Native	FACU	4	X				X		
Gaura longiflora	Longflower beeblossom	Native	NL	3	X		X				
Geum canadense	White avens	Native	FACU	3	X	X	X	X	X	X	X
Gleditsia triacanthos	Honeylocust	Native	FAC	1	X	X			X		
Helenium autumnale	Common sneezeweed	Native	FACW	6	X		X				
Helianthus annuus	Common sunflower	Native	FACU	0	X	X	X				
Helianthus grosseserratus	Sawtooth sunflower	Native	FACW	4	X	X	X	X	X		
Heliantus hirsutus	Hairy sunflower	Native	NL	6	X						
Helianthus maximiliani	Maxilian sunflower	Native	UPL	4	X		X		X		
Helianthus pauciflorus	Stiff sunflower	Native	NL	5	X			X	X		
Helianthus sp.	Sunflower	Native	--		X		X		X		
Helianthus tuberosus	Jerusalem Artichoke	Native	FACU	4	X		X				
Hieracium longipilum	Hairy hawkweed	Native	NL	6			X				
Hordeum jubatum	Foxtail barley	Native	FACW	1	X	X	X	X			
Hypericum ascyron	Great St. Johnswort	Native	FAC	3	X						
Hypericum sp.	St. Johnswort	--	--		X						

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Impatiens capensis	Jewelweed	Native	FACW	4	X						
Impatiens sp.	Touch-me-not	--	--		X						
Ipomoea hederacea	Ivyleaf morning-glory	Introduced	FACU		X						
Ipomoea purpurea	Tall morning-glory	Introduced	FACU		X	X	X				
Iris versicolor	Harlequin Blueflag	Native	OBL	1	X						
Iris virginica	Virginia iris	Native	OBL	8							X
Iva annua	Annual marsh elder	Native	FAC	1		X	X	X			
Juglans nigra	Black walnut	Native	FACU	5					X		
Juncus arcticus ssp. Littoralis	Mountain rush	Native	OBL	6	X	X	X				
Juncus dudleyi	Dudley's rush	Native	NL	5	X		X				
Juncus effusus	Common rush	Native	OBL	6	X		X				
Juncus interior	Inland rush	Native	FAC	4	X						
Juncus sp.	Rush	Native	--		X	X					
Juncus tenuis	Poverty rush	Native	FAC	3	X		X	X	X		
Juncus torreyi	Torrey's rush	Native	FACW	4	X		X				
Lactuca ludoviciana	Biannual lettuce	Native	FAC	3			X				
Lactuca serriola	Prickly lettuce	Introduced	FAC		X	X	X				
Lactuca sp.	Lettuce	--	--			X		X			
Laportea canadensis	Canadian woodnettle	Native	FACW	4	X				X		X
Leersia oryzoides	Rice cutgrass	Native	OBL	4	X	X	X		X		X
Leersia virginica	White grass	Native	FACW	4	X	X		X	X		
Lemna minor	Common duckweed	Native	OBL	0	X						
Lepidium virginicum	Virginia pepperweed	Native	FACU	0		X					
Leptochloa fusca	Bearded sprangletop	Native	OBL	1		X					
Liatris punctata	Dotted blazing star	Native	NL	5		X	X				
Lonicera japonica	Japanese honeysuckle	Introduced	FACU						X		
Lycopus americanus	American water horehound	Native	OBL	4	X	X	X	X			
Lycopus asper	Rough bugleweed	Native	OBL	5	X		X				
Lycopus uniflorus	Northern bugleweed	Native	OBL	6		X	X		X		X
Lycopus virginicus	Virginia water horehound	Native	OBL	5	X	X	X			X	X
Lysimachia nummularia	Creeping jenny	Introduced	OBL								X
Lysimachia thyrsiflora	Tufted loosestrife	Native	OBL	7	X				X		
Lythrum alatum	Winged lythrum	Native	OBL	6	X	X					
Lythrum salicaria	Purple loostrife	Introduced	OBL	0	X						

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Medicago lupulina	Black medick	Introduced	FAC		X	X	X				
Medicago sp.	Medick	Introduced	--				X				
Melilotus officinalis	Yellow sweetclover	Introduced	FACU		X	X	X				
Melilotus sp.	Clover	--	--		X	X					
Mentha arvensis	Wild mint	Native	FACW	4	X	X	X	X	X		
Morus alba	White mulberry	Introduced	FAC			X				X	
Morus sp.	Mulberry	--	--					X		X	
Muhlenbergia asperifolia	Scratchgrass	Native	FACW	5	X	X	X	X	X		
Muhlenbergia cuspidata	Plains muhly	Native	NL	5	X						
Muhlenbergia mexicana	Mexican muhly	Native	FACW	4	X						
Muhlenbergia racemosa	Marsh muhly	Native	FACW	4	X				X		
Muhlenbergia schreberi	Nimblewill	Native	FACU	0	X				X		
Muhlenbergia sp.	Muhly	Native	--		X				X		
Nepeta cataria	Catnip	Introduced	FACU	0			X				
Oxalis stricta	Common yellow oxalis	Native	FACU	0	X	X					
Panicum capillare	Witchgrass	Native	FAC	0		X	X				
Panicum virgatum	Switchgrass	Native	FAC	4	X	X	X				
Parietaria pensylvanica	Pennsylvania pellitory	Native	FAC	0	X	X	X	X			
Parthenocissus quinquefolia	Virginia creeper	Native	FAC	5	X				X	X	X
Pascopyrum smithii	Western wheatgrass	Native	NL		X	X	X				X
Paspalum dilatatum	Dallisgrass	Introduced	NI						X		
Phalaris arundinacea	Reed canarygrass	Native	FACW+	0	X	X	X	X	X	X	X
Phragmites australis	Common reed	Native	FACW		X						
Phyla lanceolata	Lanceleaf fogfruit	Native	OBL	3	X	X	X	X		X	X
Physalis heterophylla	Clammy groundcherry	Native	NL	4	X	X	X				
Physalis longifolia	Longleaf groundcherry	Native	NL	0	X	X	X				
Physalis virginiana	Virginia groundcherry	Native	NL	6				X			
Physostegia virginiana	Obedient plant	Native	OBL	7	X	X		X			
Pilea pumila	Canadian clearweed	Native	FAC	4	X		X				
Plantago patagonica	Woolly plantain	Native	UPL	1	X						
Poa pratensis	Kentucky bluegrass	Native & Introduced	FACU		X	X	X	X	X		
Podophyllum peltatum	Mayapple	Native	FACU-	7	X				X		
Polygonatum biflorum	Smooth Solomon's seal	Native	UPL	4			X		X		
Polygonum amphibium	Water knotweed	Native	OBL				X				X

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Polygonum aviculare	Prostrate knotweed	Introduced	FACW		X						
Polygonum caespitosum	Oriental lady's thumb	Introduced	NI		X	X	X		X		
Polygonum hydropiper	Marshpepper knotweed	Introduced	OBL				X				
Polygonum hydropiperoides	Swamp smartweed	Native	OBL		X	X	X		X		X
Polygonum pensylvanicum	Pennsylvania smartweed	Native	FACW+		X	X	X				X
Polygonum persicaria	Spotted lady's thumb	Introduced	OBL				X				
Polygonum punctatum	Dotted smartweed	Native	OBL		X	X	X				
Polygonum scandens	Climbing false buckwheat	Native & Introduced	FACU		X	X	X				
Polygonum sp.	Polygonum	--	--		X	X	X	X	X	X	
Populus deltoides	Eastern cottonwood	Native	FAC	3			X		X	X	
Portulaca oleracea	Little-Hogweed	Introduced	UPL	3		X					
Potamogeton amplifolius	Largeleaf pondweed	Native	OBL	10	X		X				
Pseudognaphalium obtusifolium	rabbit-tobacco	Native	NI	3			X				
Potentilla arguta	Tall cinquefoil	Native	FACU						X		
Prunella vulgaris	Common selfheal	Native	FAC	4					X		
Prunus sp.	Plum	Native	--					X			
Pycnanthemum tenuifolium	Narrowleaf mountainmint	Native	FACW	7			X				
Pycnanthemum virginianum	Virginia mountainmint	Native	FAC	6			X	X			
Ranunculus sceleratus	Cursed buttercup	Native	OBL		X						
Rudbeckia hirta	Blackeyed susan	Native	FACU	4	X	X	X				
Rudbeckia laciniata	Cutleaf coneflower	Native	FAC	4					X		
Rumex altissimus	Pale Dock	Native	FAC	0		X					
Rumex crispus	Curly dock	Introduced	FACW			X	X				X
Rumex orbiculatus	Greater water dock	Native	OBL		X						
Rumex sp.	Dock	--	--		X	X					
Sagittaria latifolia	Broadleaf arrowhead	Native	OBL	5	X	X					
Salix amygdaloides	Peachleaf willow	Native	FACW	4	X				X	X	
Salix exigua	Narrowleaf willow	Native	OBL	3	X						X
Salix interior	Sandbar willow	Native	NL	3	X						X
Salix lutea	Yellow willow	Native	OBL	6	X						
Salix nigra	Black willow	Native	OBL	3	X				X	X	X
Sambucus canadensis	Common elderberry	Native	FAC	2						X	
Sanicula canadensis	Canadian blacksnakeroot	Native	NI	3					X	X	
Sanicula odorata	Clustered blacksnakeroot	Native	FAC	4				X	X	X	X

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Saxifraga sp.	Saxifrage	Native	--					X			
Schedonorus phoenix	Tall fescue	Introduced	FACU		X	X	X	X	X		
Schizachyrium scoparium	Little bluestem	Native	FACU	4			X				
Schoenoplectus acutus var. acutus	Hardstem bulrush	Native	OBL	5		X	X				
Schoenoplectus fluviatilis	River bulrush	Native	OBL		X		X	X			X
Schoenoplectus pungens	Common threesquare	Native	OBL	4	X	X	X	X			X
Schoenoplectus tabernaemontani	Softstem bulrush	Native	OBL	5	X		X				
Scirpus pendulus	Rufous pendulus	Native	OBL	8	X						
Scirpus sp.	Bulrush	Native	OBL		X						X
Setaria faberi	Japanese bristlegrass	Introduced	UPL		X	X	X				
Setaria pumila ssp. pumila	Yellow foxtail	Introduced	FAC			X	X				
Setaria verticillata	Hooked bristlegrass	Introduced	FAC			X	X				
Setaria viridis	Green bristlegrass	Introduced	NL				X				
Sium suave	Hemlock waterparsnip	Native	OBL	7	X						
Smilax bona-nox	Saw greenbrier	Native	FAC		X		X				
Smilax sp.	Greenbrier	Native	--						X		
Smilax tamnoides	Bristly greenbrier	Native	FAC								X
Solanum carolinense	Carolina horsenettle	Native	UPL	2	X	X	X		X		
Solanum rostratum	Buffalobur nightshade	Native	NL	0			X				
Solidago canadensis	Canada goldenrod	Native	FACU	2	X	X	X	X			
Solidago gigantea	Giant goldenrod	Native	FACW	3	X	X	X	X	X	X	X
Solidago sp.	Goldenrod	--	--		X						
Sonchus oleraceus	Common sowthistle	Introduced	FACU	0		X	X				
Spartina pectinata	Prairie cordgrass	Native	FACW	5	X	X	X	X	X		X
Sphenopholus obtusata	Prairie wedgescale	Native	FACW	5		X	X	X			X
Sporobolus compositus	Composite dropseed	Native	FACU	3			X				
Stachys palustris	Marsh hedgenettle	Native	OBL	5							X
Symphoricarpos orbiculatus	Coralberry	Native	FACU-	2	X		X		X		
Symphyotrichum ericoides	White heath aster	Native	FACU	3			X				
Symphyotrichum lanceolatum	White panicle aster	Native	NI	2	X	X	X	X			
Symphyotrichum lateriflorum	Calico aster	Native	FACW	5	X			X	X		
Symphyotrichum novae-angliae	New England aster	Native	FACW	4	X						
Symphyotrichum ontarionis	Bottomland aster	Native	FAC	5	X		X	X	X		X
Symphyotrichum pilosum	Hairy white oldfield aster	Native	FACU	0	X		X	X	X		

Appendix III - Comprehensive Vegetation Species List by Wetland, 2005-2017

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Symphyotrichum praealtum	Willowleaf aster	Native	FACW	5	X	X	X	X	X		
Symphyotrichum puniceum	Purplestem aster	Native	OBL			X	X	X			
Symphyotrichum sp.	Aster	Native	--			X	X	X	X		
Taraxacum officinale	Common dandelion	Native & Introduced	FACU			X	X		X		
Teucrium canadense	Canada germander	Native	FACW	4	X	X	X		X		
Thlaspi arvense	Field pennycress	Introduced	FACU	0	X	X					
Toxicodendron radicans	Eastern poison ivy	Native	FACU	2	X		X	X	X	X	X
Trifolium repens	White clover	Introduced	FACU		X	X					
Typha angustifolia	Narrowleaf cattail	Introduced	OBL				X				
Typha latifolia	Broadleaf cattail	Native	OBL	1	X		X				X
Ulmus americana	American elm	Native	FAC	3	X	X			X		
Ulmus pumila	Siberian elm	Introduced	NL						X		
Ulmus rubra	Slippery elm	Native	FAC	5	X						X
Ulmus sp.	Elm	--	--						X	X	
Unknown 1	Unknown seedling	--	--		X	X	X	X	X	X	X
Unknown 2	Unknown seedling	--	--		X	X	X		X		
Unknown Poaceae 1	Unknown grass	--	--		X	X	X		X		
Unknown Poaceae 2	Unknown grass	--	--				X				
Urtica dioica	Stinging nettle	Native & Introduced	FACW	1			X		X		X
Verbascum thapsus	Common mullein	Introduced	NL				X				
Verbena hastata	Swamp verbena	Native	FACW	4	X	X	X				
Verbena simplex	Narrowleaf vervain	Native	NL	4		X					
Verbena stricta	Hoary verbena	Native	NL	2	X	X					
Verbena urticifolia	White vervain	Native	UPL			X					
Verbesina alternifolia	Wingstem	Native	FAC	4	X						
Vernonia baldwinii	Baldwin's ironweed	Native	FACW-	3		X	X				
Vernonia fasciculata	Prairie ironweed	Native	FAC	4	X	X	X				
Veronicastrum virginicum	Culver's root	Native	FAC	9			X				
Viola nephrophylla	Northern bog violet	Native	FACW	8			X				
Viola sp.	Violet	Native	--		X	X	X	X	X		X
Vitis riparia	Riverbank grape	Native	FAC	3	X	X	X		X	X	X
Vitis sp.	Grape	Native	--					X			
Xanthium strumarium	Rough cocklebur	Native	FAC	1		X					
Zizia aurea	Golden zizia	Native	FAC	6			X				

APPENDIX IV

HYDROLOGICAL DATA

APPENDIX IV – SECTION A

GROUNDWATER MONITORING WELLS

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Figure 1 Monitoring Well Readings for MW 90-05 in Douglas County

(Jan 1, 2017 thru October 17, 2017)

Figure 2 Monitoring Well Readings for MW 90-06 in Douglas County

(January 1, 2017 thru October 17, 2017)

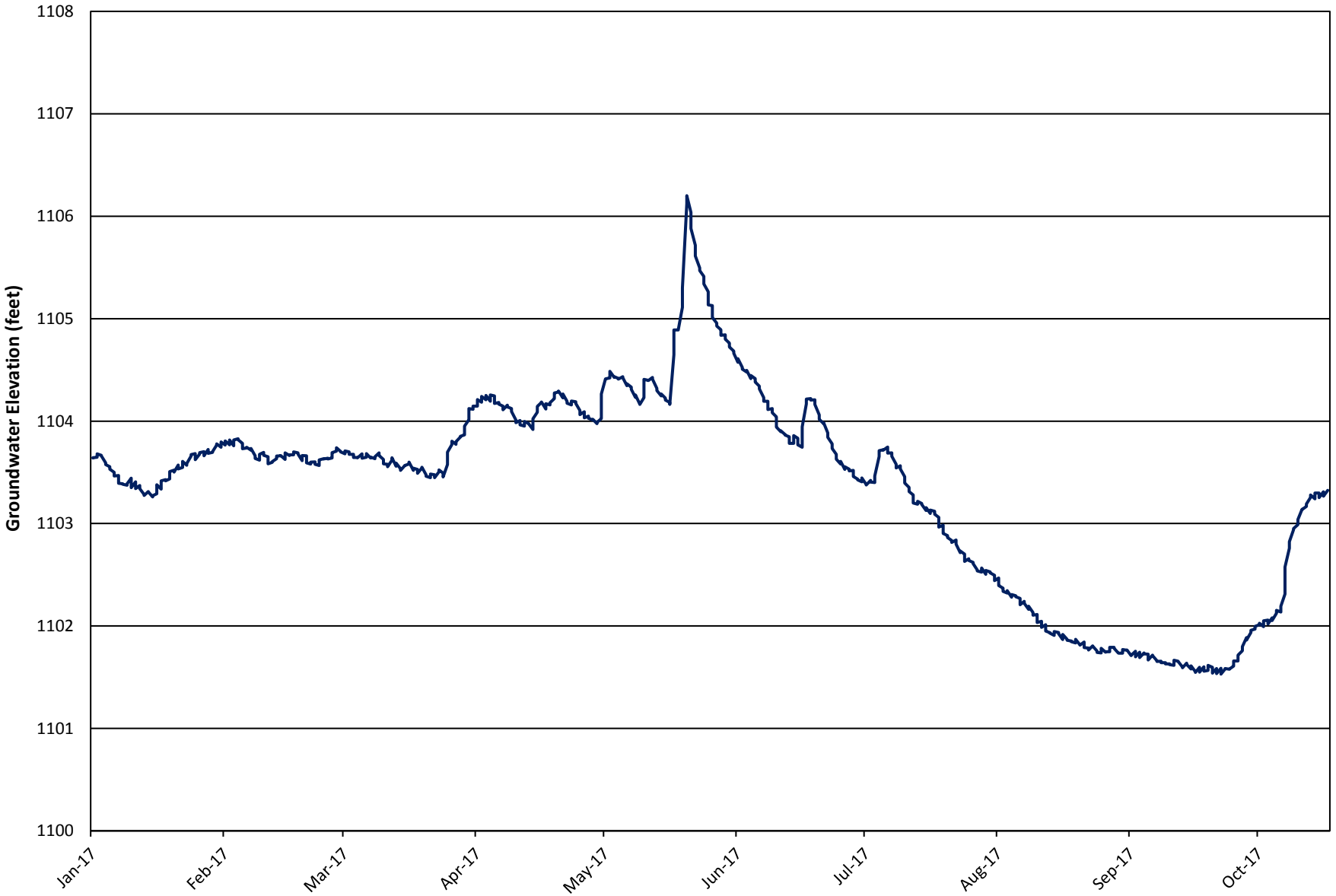


Figure 3 Monitoring Well Readings for MW 90-07 in Douglas County

(January 1, 2017 thru October 17, 2017)

Figure 4 Monitoring Well Readings for MW 90-10 in Saunders County

(January 1, 2017 thru October 18, 2017)

Figure 5 Monitoring Well Readings for MW 90-12 in Douglas County

(January 1, 2017 thru May 11, 2017)

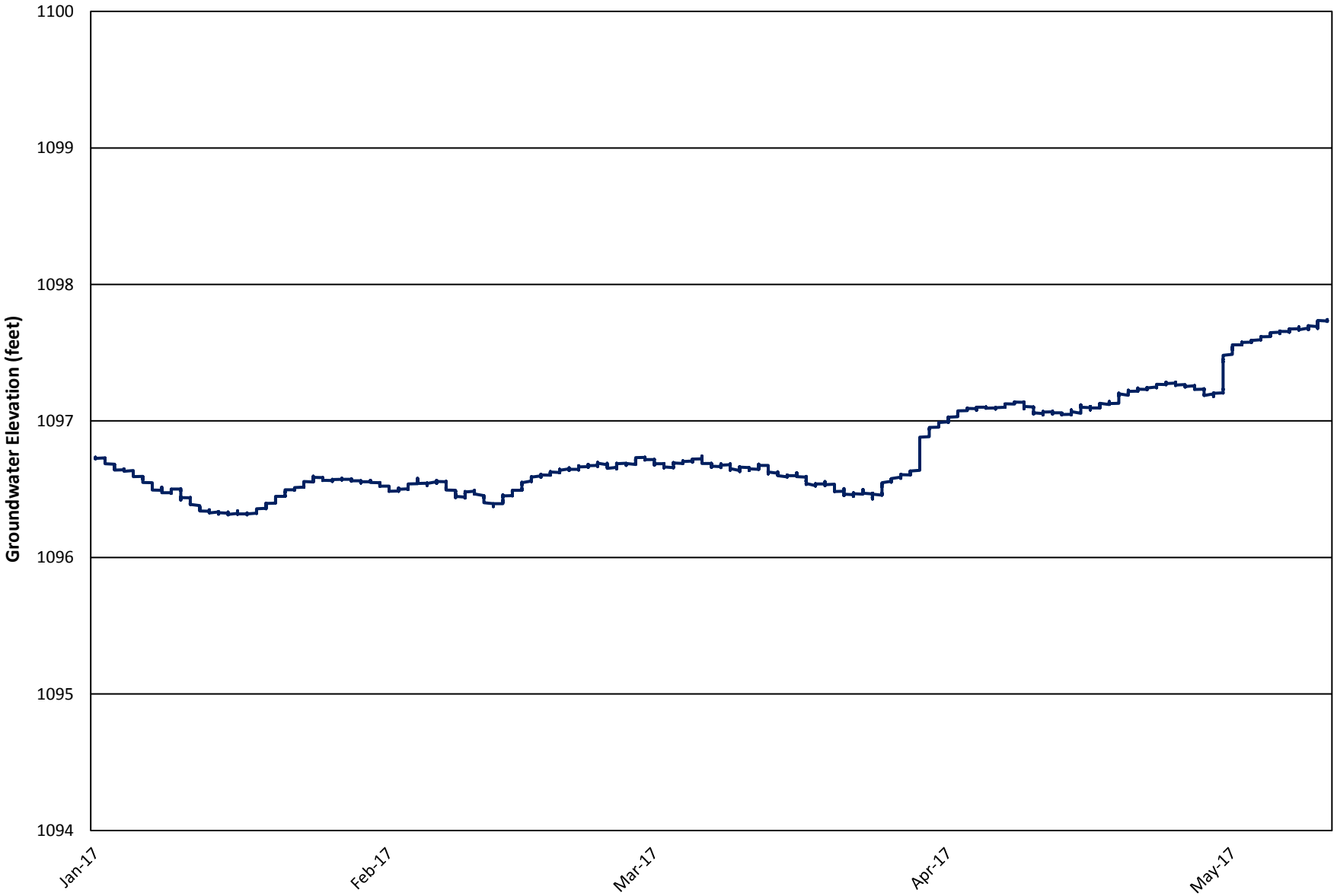


Figure 6 Monitoring Well Readings for MW 90-13 in Douglas County

(January 1, 2017 thru October 17, 2017)

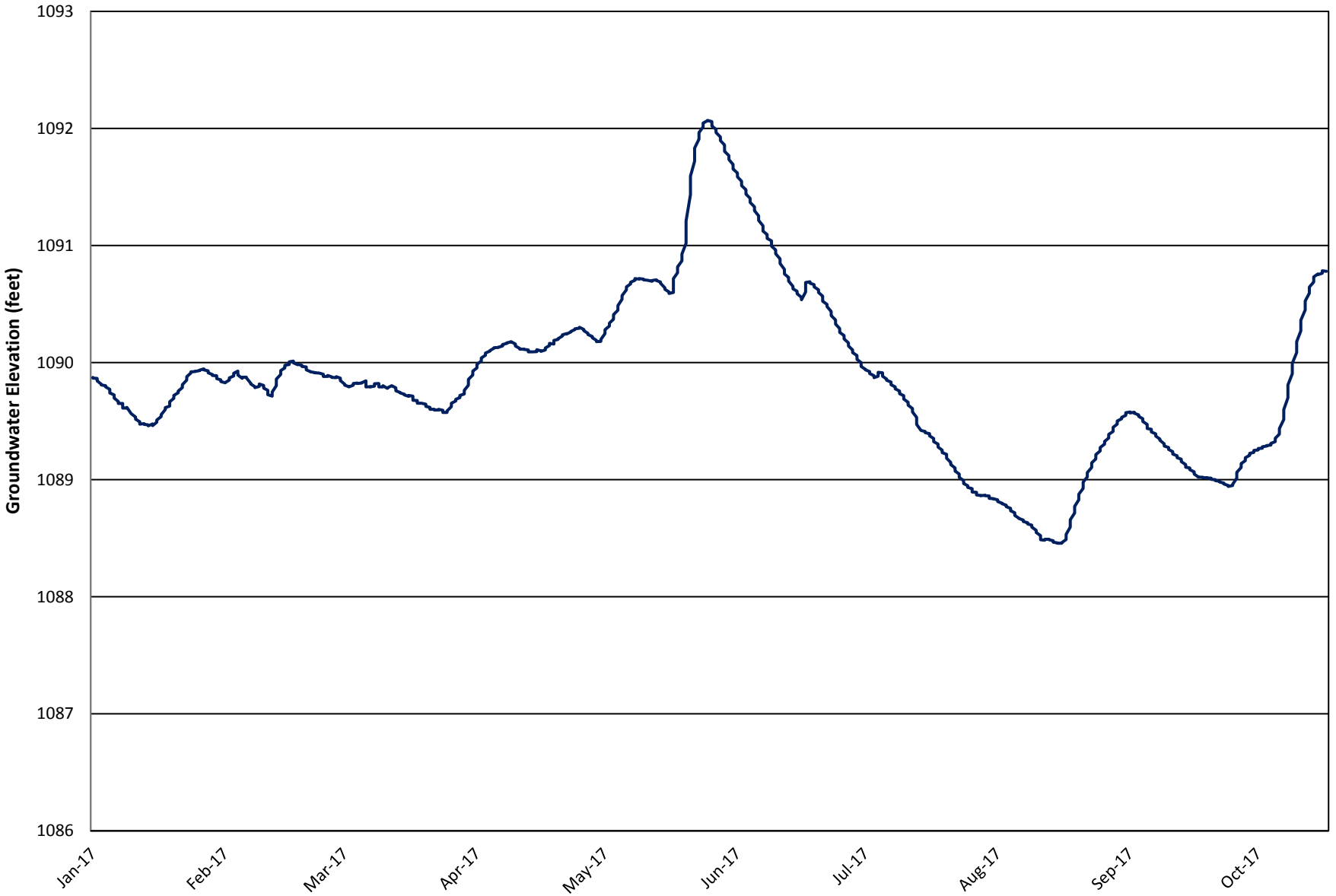


Figure 7 Monitoring Well Readings for MW 94-01 in Douglas County

(January 1, 2017 thru November 13, 2017)

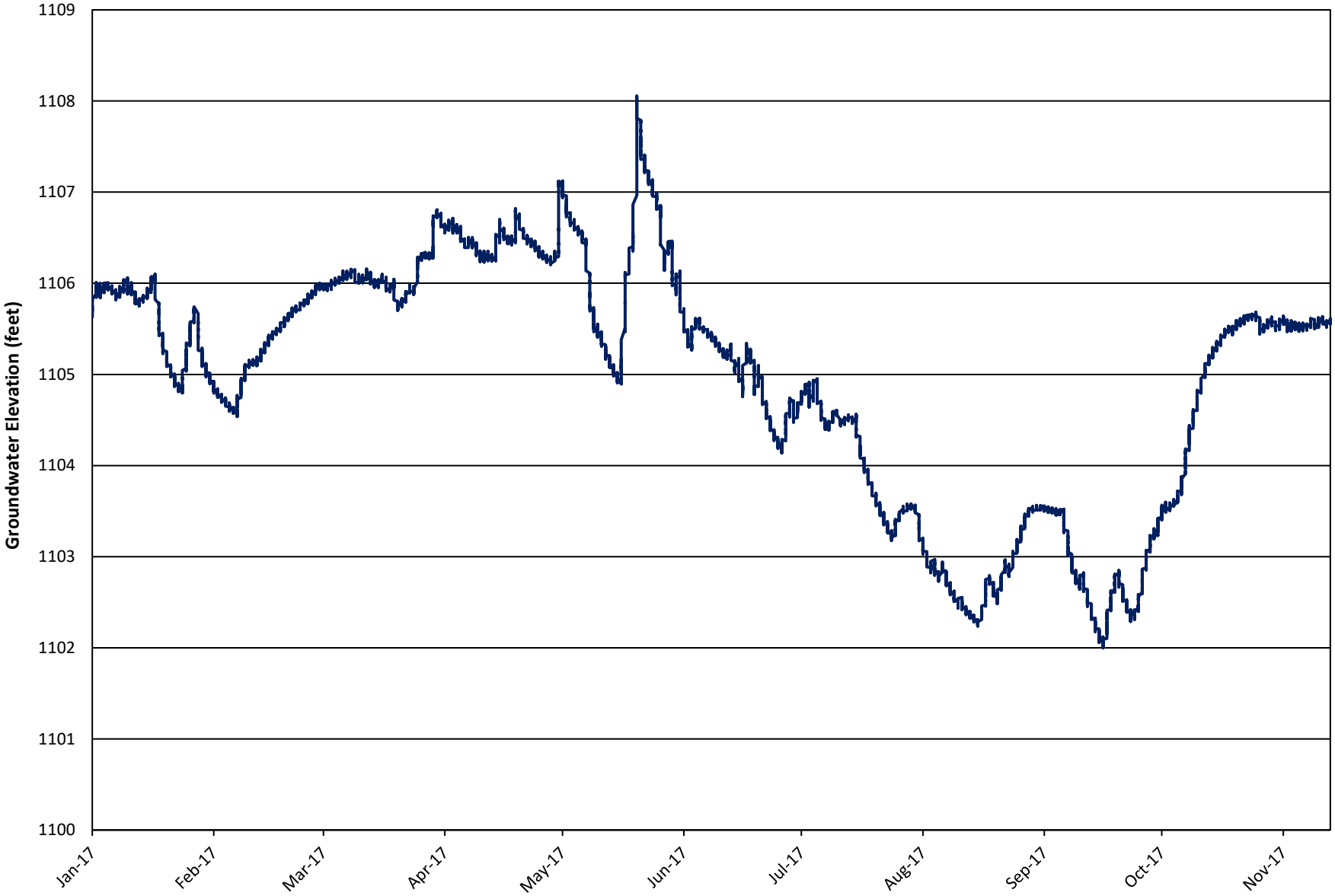


Figure 8 Monitoring Well Readings for MW 94-02 in Douglas County

(January 1, 2017 thru October 17, 2017)

Figure 9 Monitoring Well Readings for MW 94-03 in Saunders County

(Jan 1, 2017 thru October 18, 2017)

Figure 10 Monitoring Well Readings for MW 94-04 in Saunders County

(January 1, 2017 thru October 19, 2017)

Figure 11 Monitoring Well Readings for MW 94-05 in Saunders County

(January 1, 2017 thru October 19, 2017)

Figure 12 Monitoring Well Readings for MW 94-06 in Saunders County

(Jan 1, 2017 thru October 19, 2017)

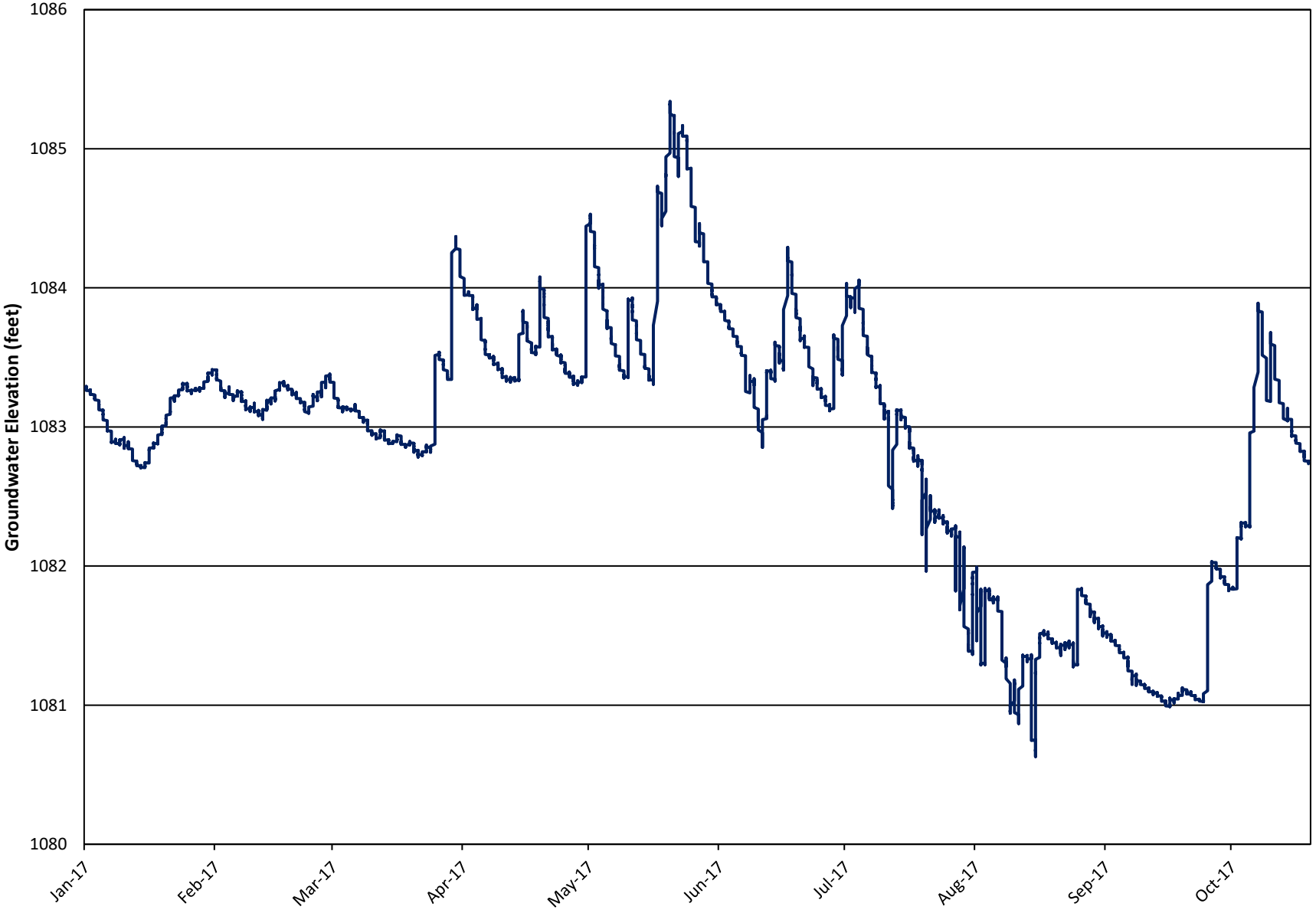


Figure 13 Monitoring Well Readings for MW 94-07 in Saunders County

(Jan 1, 2017 thru October 19, 2017)

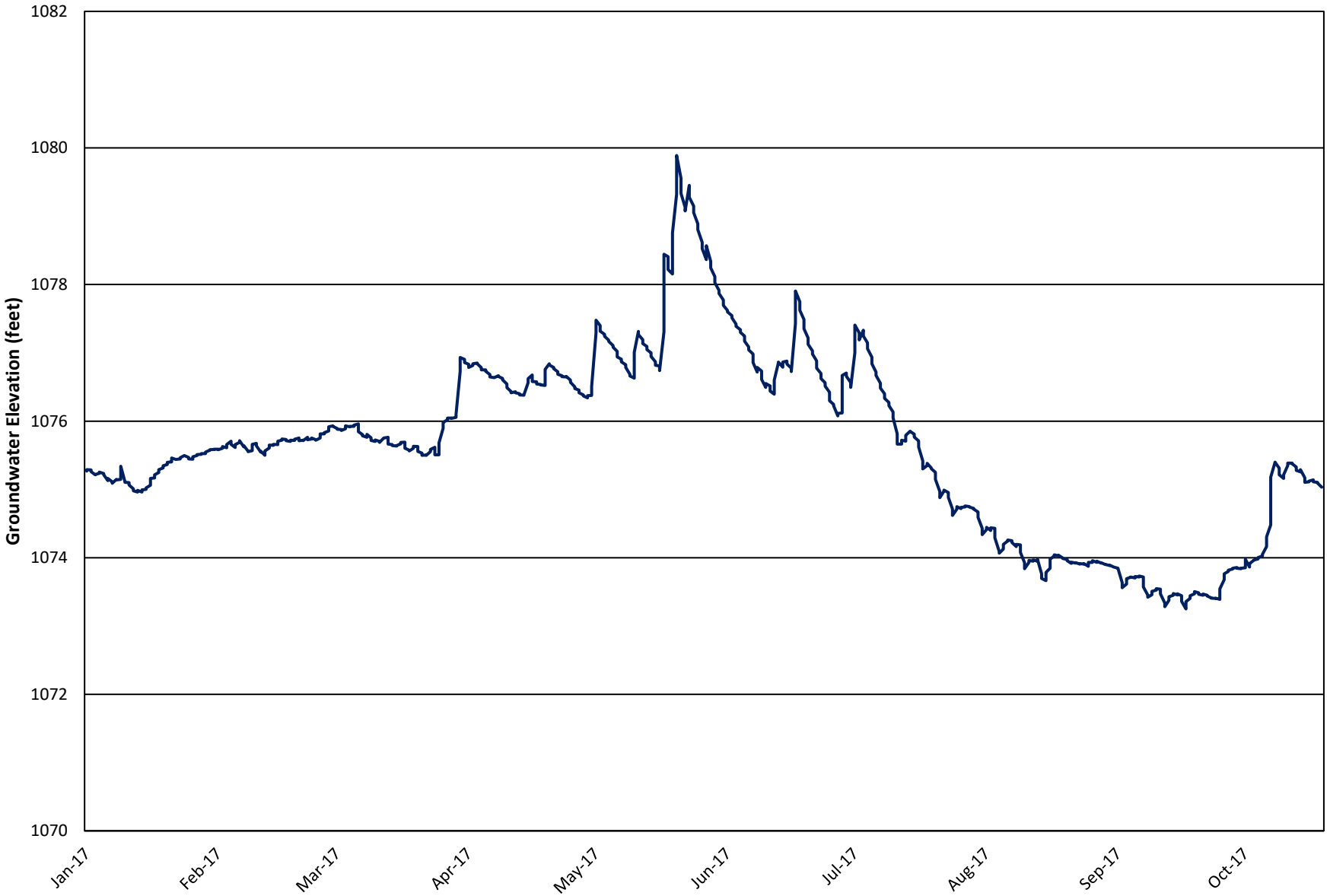


Figure 14 Monitoring Well Readings for MW 05-22 in Saunders County

(January 1, 2017 thru October 18, 2017)

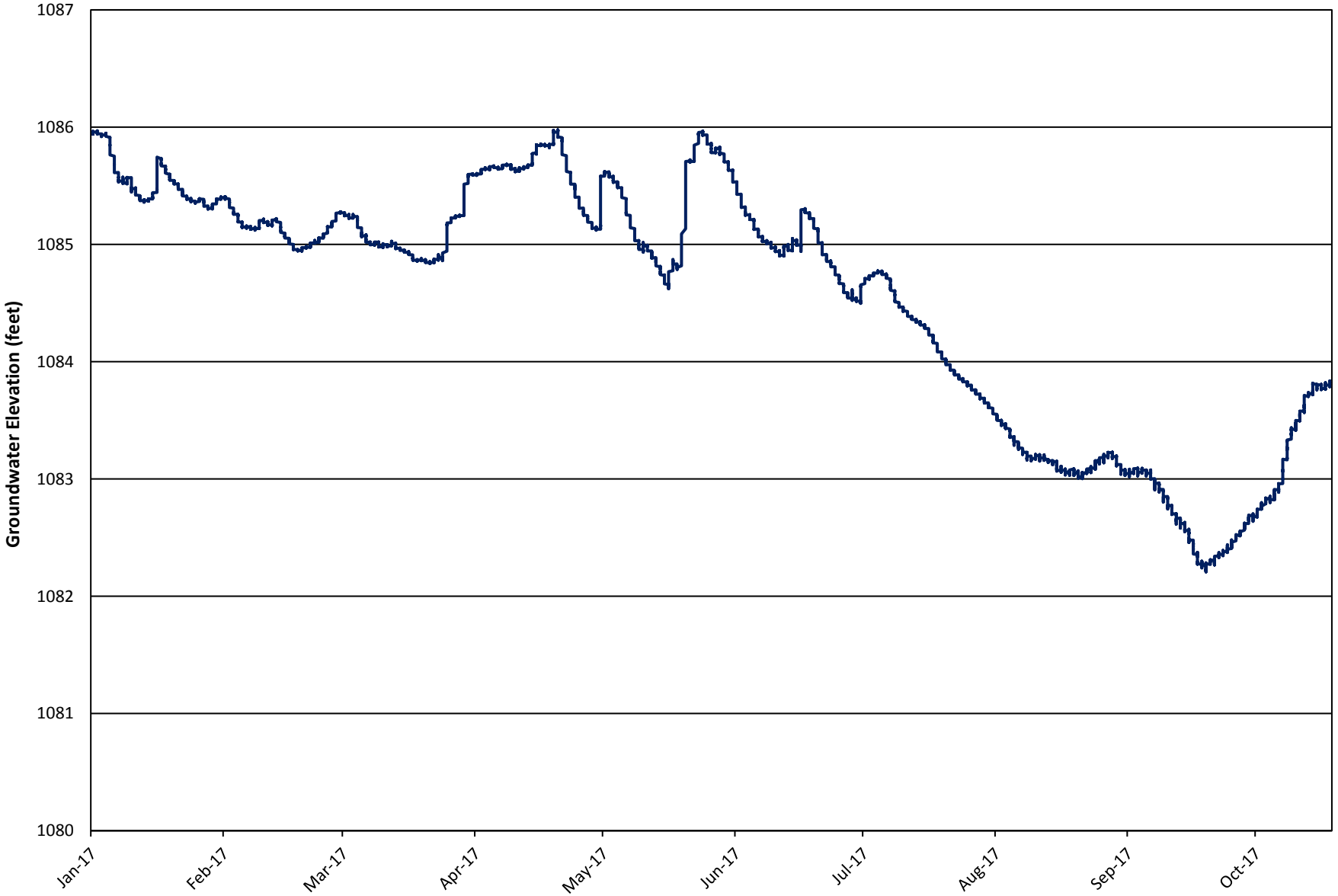


Figure 15 Monitoring Well Readings for MW 05-23 in Saunders County

(Jan 1, 2017 thru November 13, 2017)

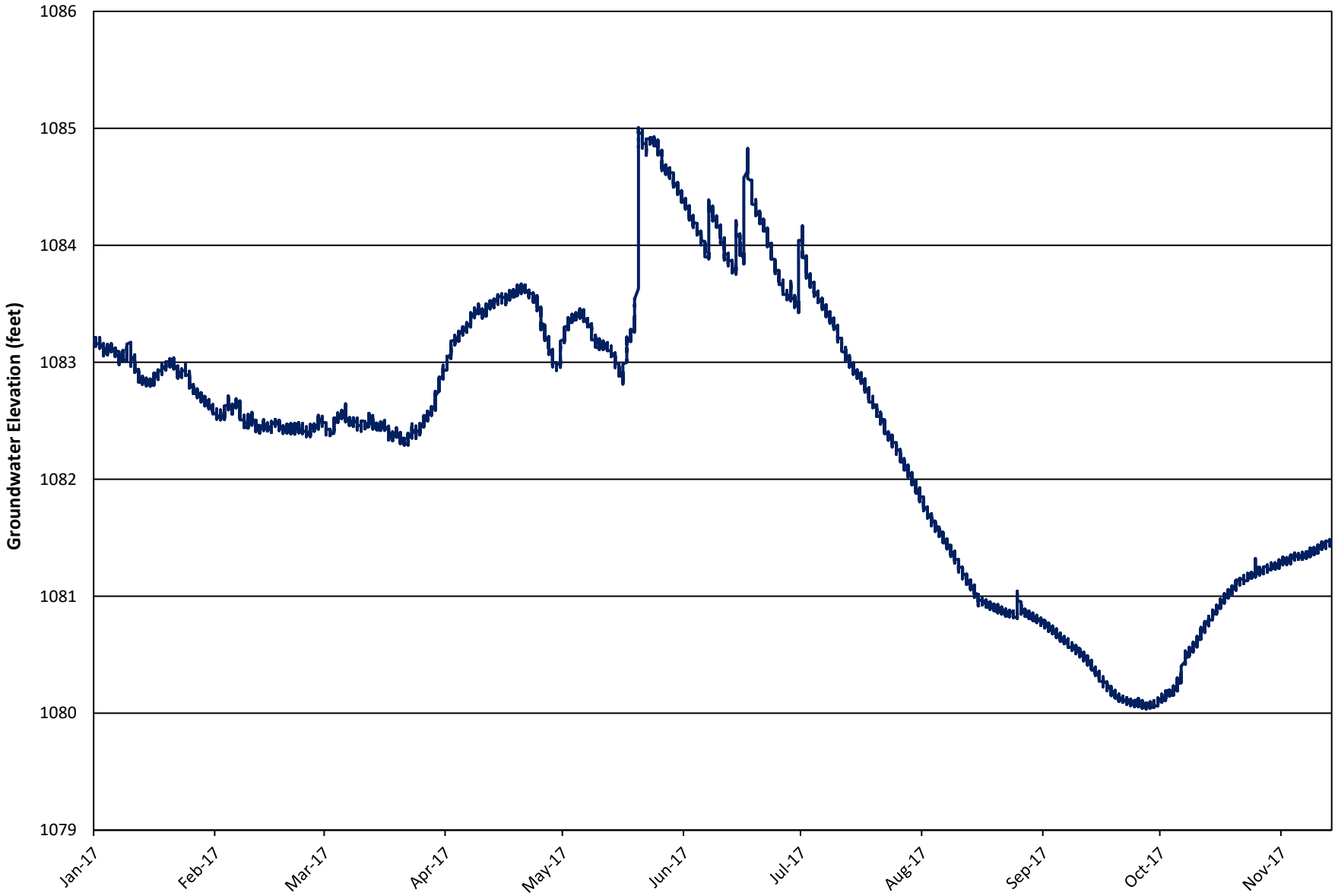


Figure 16 Monitoring Well Readings for MW 05-24 in Douglas County

(Jan 1, 2017 thru November 13, 2017)

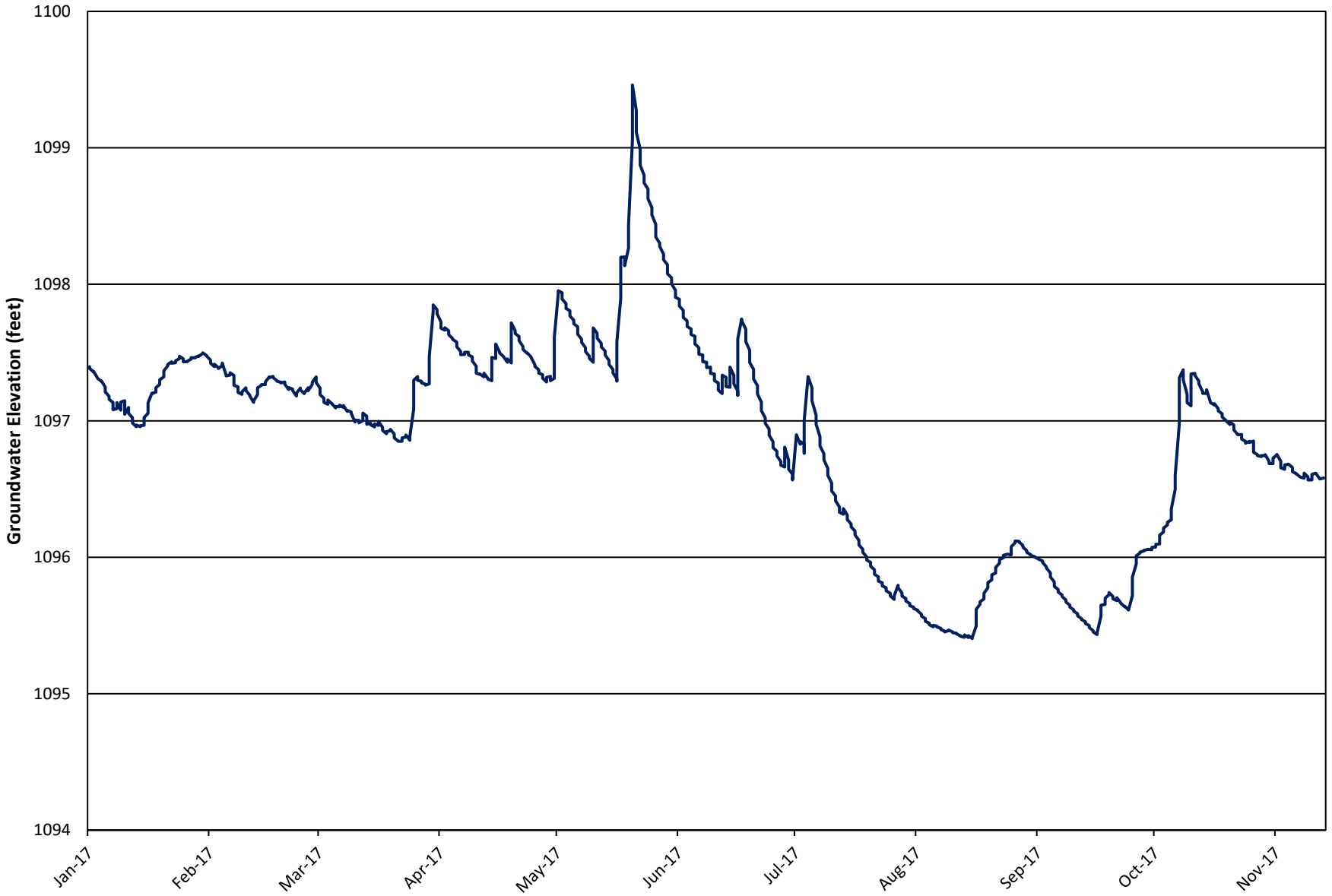


Figure 17 Monitoring Well Readings for MW 05-25 in Douglas County

(January 1, 2017 thru October 17, 2017)

Figure 18 Monitoring Well Readings for MW 05-26 in Douglas County

(Jan 1, 2017 thru November 13, 2017)

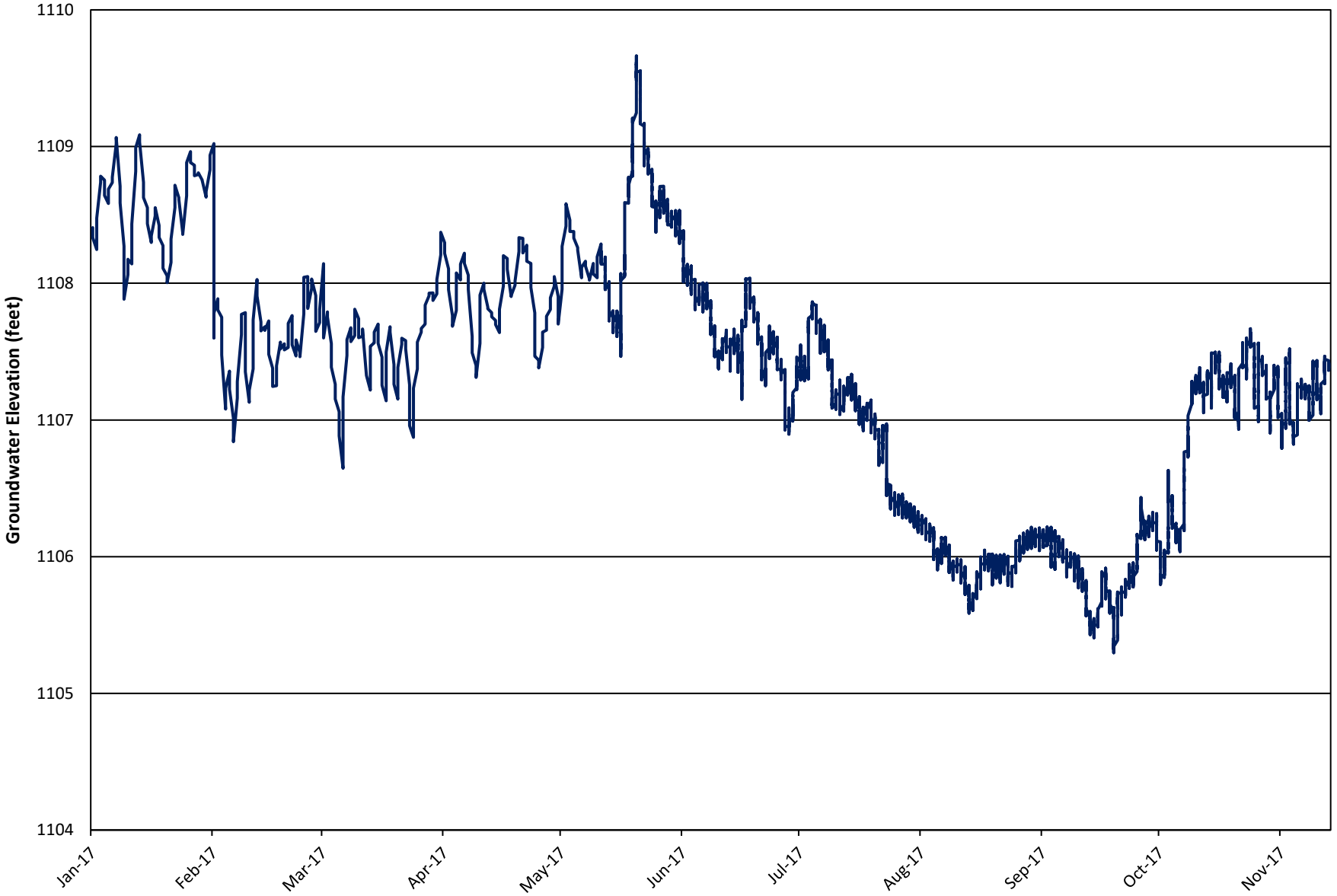


Figure 19 Monitoring Well Readings for MW 06-28 in Douglas County

(Jan 1, 2017 thru November 15, 2017)

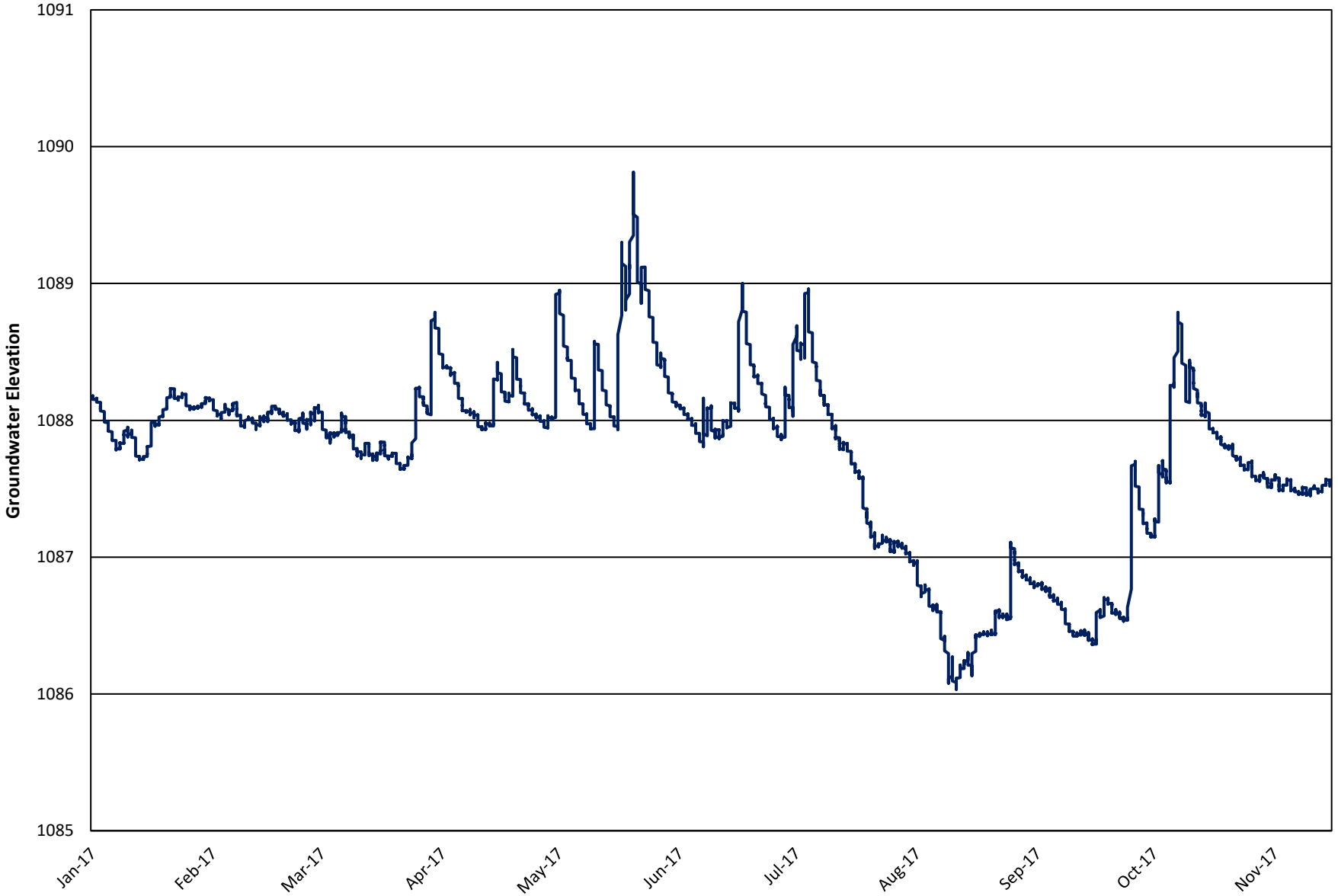
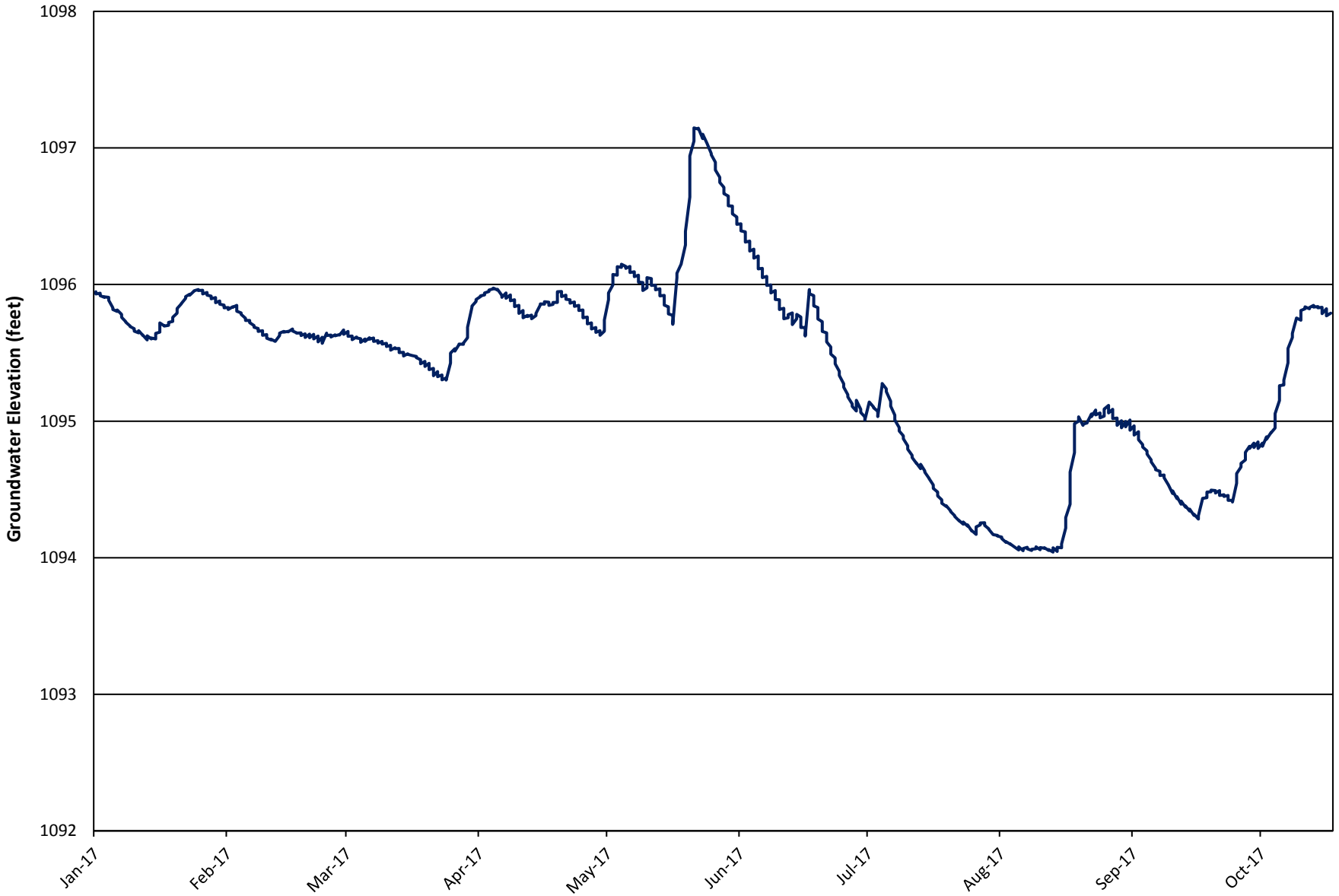


Figure 20 Monitoring Well Readings for MW 06-29 in Douglas County

(January 1, 2017 thru October 17, 2017)



APPENDIX IV - SECTION B

PRODUCTION WELL DATA

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Table 1 2017 Production Well Pumping Rates, Toral Million Gallons Per Day (MGD) - Douglas County

WELL #	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEARLY WELL DATA
94-2	7.94	32.18	57.36	58.46	61.38	79.77	89.88	50.91	25.64	0.00	11.53	0.00	475.05
91-3	48.66	28.09	0.00	0.00	48.89	52.25	65.07	74.11	59.96	1.23	0.00	0.00	378.26
04-4	0.00	0.00	1.47	0.00	0.00	1.64	0.00	0.00	0.00	0.00	1.43	0.00	4.54
04-5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04-6	1.85	18.71	0.00	0.00	2.00	36.40	33.92	19.30	36.38	12.98	0.87	0.00	162.41
04-7	0.00	10.81	0.00	0.00	0.00	3.16	0.74	0.00	3.63	0.00	0.00	0.00	18.34
04-8	1.46	0.00	0.00	0.00	1.31	5.67	0.02	0.00	0.00	0.00	0.00	0.00	8.46
04-9	0.00	0.00	0.00	0.00	0.00	0.36	6.04	0.00	0.00	0.00	0.00	0.00	6.40
04-10	0.00	31.70	0.00	0.00	37.62	45.17	30.61	21.11	18.54	0.00	0.01	0.00	184.76
04-11	42.71	36.64	7.68	0.00	0.01	27.93	65.40	27.02	0.00	0.00	0.00	0.00	207.39
04-12	83.33	61.70	37.50	51.09	78.50	49.19	71.62	73.43	73.62	96.52	61.08	0.00	737.58
04-13	0.00	4.41	0.00	0.00	0.01	11.41	4.40	2.05	0.00	0.00	0.00	0.00	22.28
04-14	0.00	0.00	0.00	0.00	0.55	24.87	15.33	0.00	2.04	0.00	0.00	0.00	42.79
04-15	26.19	6.77	49.23	0.00	19.86	45.58	0.00	0.00	0.00	0.00	0.00	0.00	147.63
04-16	60.39	16.85	85.45	98.55	62.86	61.67	83.90	93.18	92.35	106.54	103.03	0.00	864.77
04-17	61.11	74.77	42.09	3.50	15.07	35.11	65.88	84.45	73.43	75.72	41.74	0.00	572.87
Monthly Totals, MG	333.64	322.63	280.78	211.60	328.06	480.18	532.81	445.56	385.59	292.99	219.69	0.00	
Daily Ave., MGD	10.76	11.13	9.06	7.05	10.58	16.01	17.19	14.37	12.85	9.45	7.32	0.00	

Table 2 2017 Production Well Pumping Rates, Toral Million Gallons Per Day (MGD) - Saunders County

WELL #	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEARLY WELL DATA
91-30	54.50	78.63	6.66	12.19	19.74	23.52	59.21	32.17	27.87	34.90	0.00	0.00	349.39
94-31	28.70	46.73	0.00	20.92	45.07	52.38	39.01	64.67	25.66	67.43	1.88	0.00	392.45
94-32	0.00	54.59	15.80	26.33	28.76	56.11	64.73	62.99	42.96	0.00	0.00	0.00	352.27
94-33	0.00	68.22	74.91	45.85	0.22	54.41	35.60	18.43	36.09	7.79	15.84	0.00	357.36
94-34	0.00	24.50	7.67	2.82	56.49	66.53	85.85	81.18	62.21	31.20	71.06	0.00	489.51
94-35	109.69	98.34	94.75	40.29	3.40	32.86	56.71	71.79	89.22	36.08	32.34	0.00	665.47
94-36	45.41	38.84	29.94	0.00	19.10	49.88	53.83	25.01	35.59	43.18	45.59	0.00	386.37
94-37	74.28	5.93	22.76	51.75	5.69	68.36	106.56	22.31	38.95	8.59	22.64	0.00	427.82
04-38	0.12	59.98	10.11	0.00	27.26	91.15	13.42	43.49	64.90	74.26	0.03	0.00	384.72
04-39	84.33	5.87	87.84	13.17	21.35	14.76	57.69	96.90	77.57	30.54	70.98	0.00	561.00
04-40	80.62	32.60	0.00	0.00	0.00	13.38	83.59	45.41	44.01	3.81	31.27	0.00	334.69
04-41	0.00	0.00	7.03	24.04	32.63	21.28	26.05	1.80	0.00	0.00	16.44	0.00	129.27
04-42	12.51	0.00	88.06	103.63	53.66	22.03	0.00	0.00	39.46	2.25	24.88	0.00	346.48
04-43	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	3.22	0.00	0.00	0.00	3.25
04-44	66.48	0.00	0.00	0.00	46.60	30.37	94.30	51.64	81.66	44.14	69.21	0.00	484.40
04-45	8.61	62.22	86.39	66.04	48.00	68.00	70.43	96.07	87.38	93.07	58.30	0.00	744.51
04-46	96.27	2.41	7.61	0.00	54.79	42.91	74.98	17.91	15.01	59.44	14.00	0.00	385.33
04-47	0.00	0.00	6.12	14.49	6.40	9.25	38.77	19.28	19.73	3.19	1.37	0.00	118.60
04-48	39.50	28.21	5.76	16.69	39.65	30.93	21.38	29.55	29.52	1.67	2.59	0.00	245.45
04-49	0.00	0.00	0.00	0.00	0.01	47.68	41.90	77.63	80.53	70.82	7.65	0.00	326.22
04-50	22.81	13.29	0.84	22.56	18.70	4.35	5.67	29.27	24.67	0.00	2.27	0.00	144.43
04-51	22.95	0.00	33.66	1.31	27.22	42.21	50.20	4.97	31.07	9.93	41.11	0.00	264.63
04-52	14.65	15.37	18.44	40.18	0.00	22.60	16.80	23.73	70.45	39.21	0.23	0.00	261.66
04-53	0.00	0.00	11.27	0.00	76.35	11.04	8.25	67.50	1.48	5.01	1.04	0.00	181.94
04-54	5.18	14.27	4.19	0.00	35.92	11.47	52.24	3.38	0.00	12.16	2.31	0.00	141.12
04-55	0.00	11.12	0.07	2.76	3.29	37.24	0.16	15.01	12.85	9.18	0.54	0.00	92.22
Monthly Totals, MG	766.61	661.12	619.88	505.02	670.30	924.73	1157.33	1002.09	1042.1	687.85	533.57	0.00	
Daily Ave., MGD	24.73	22.80	20.00	16.83	21.62	30.82	37.33	32.33	34.74	22.19	17.79	0.00	

APPENDIX IV - SECTION C

PIEZOMETERS

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Figure 1 2017 Piezometer Readings for PEM Wetland 25

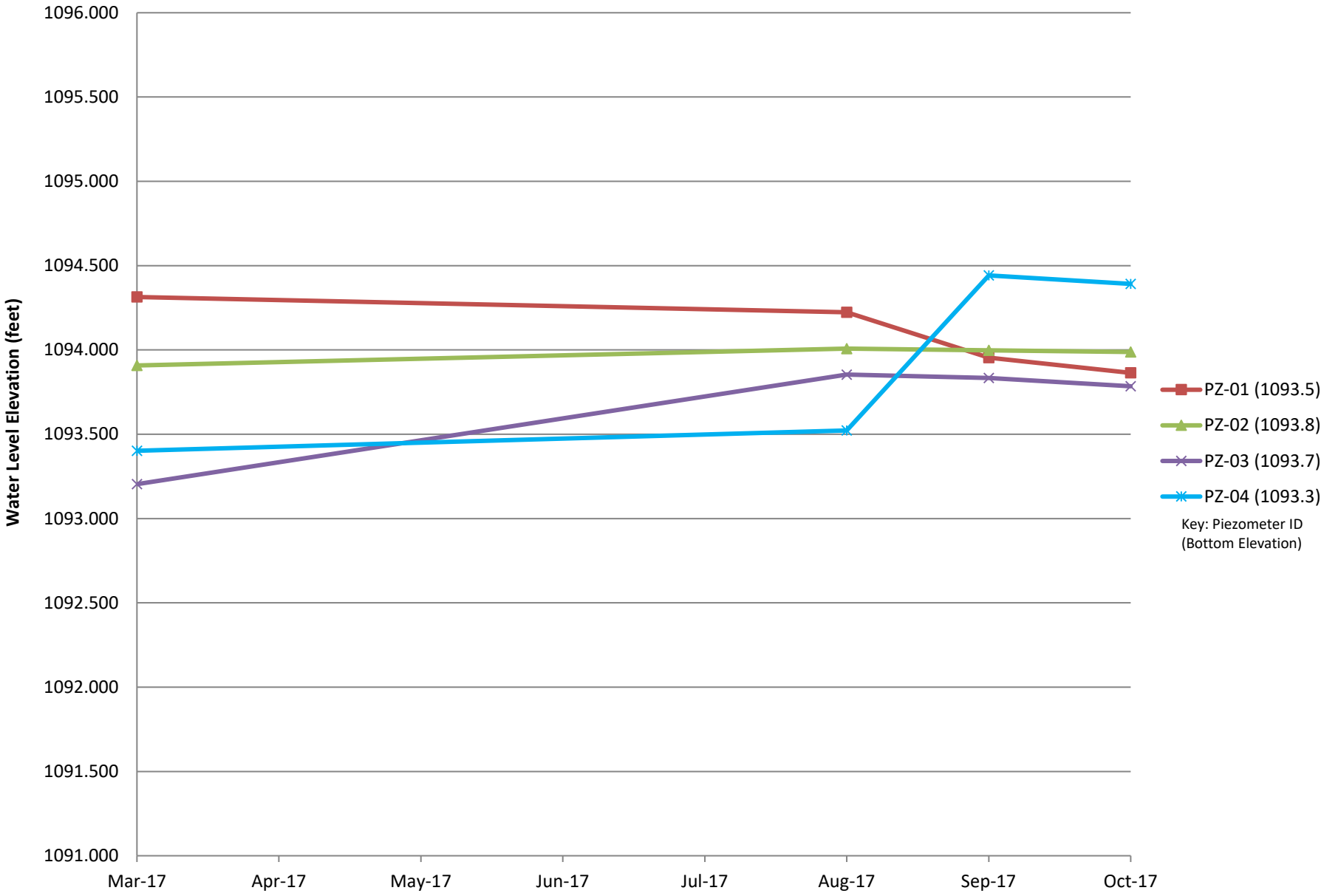


Figure 2 2017 Piezometer Readings for PEM Wetland 100

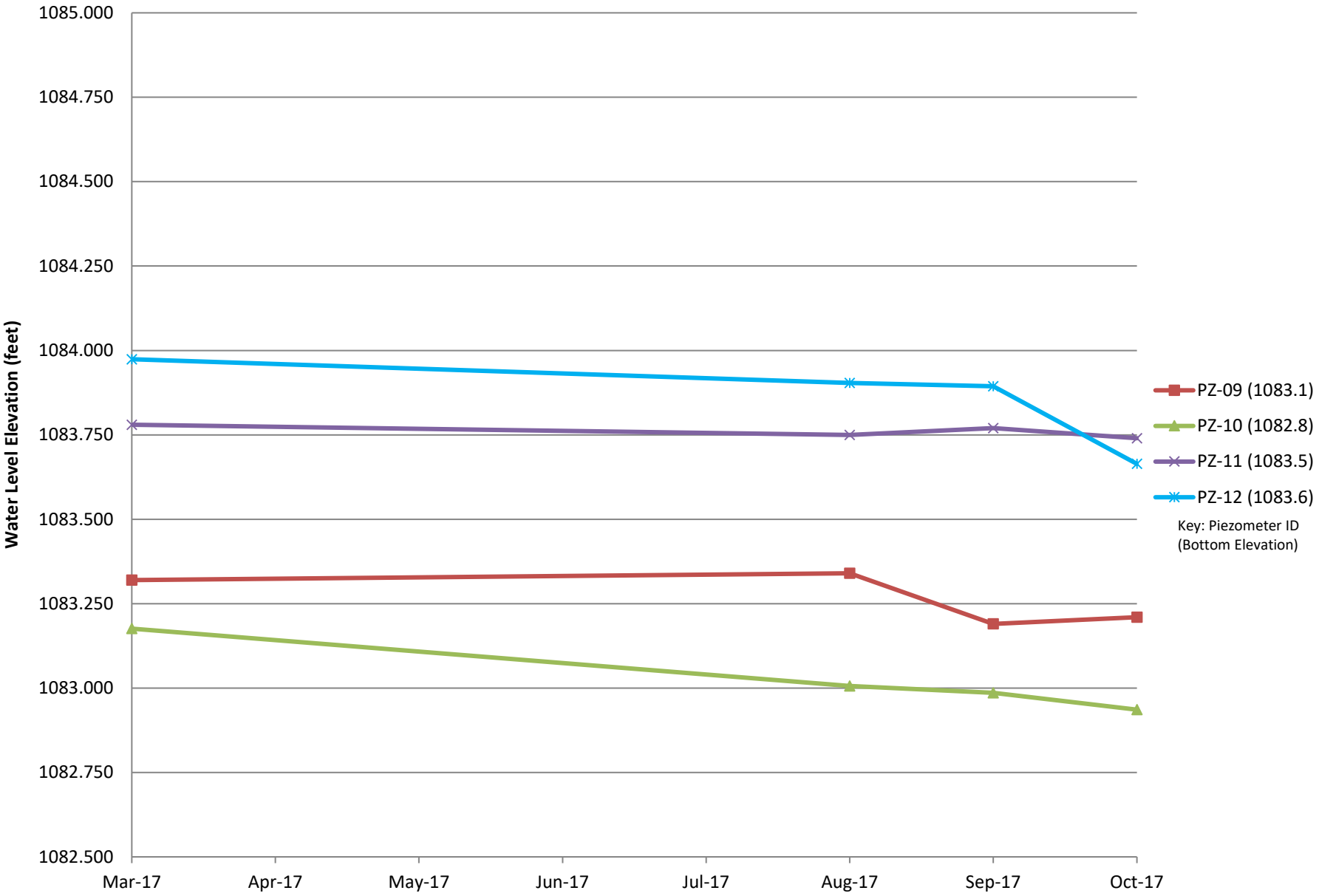


Figure 3 2017 Piezometer Readings for PFO Wetland 5

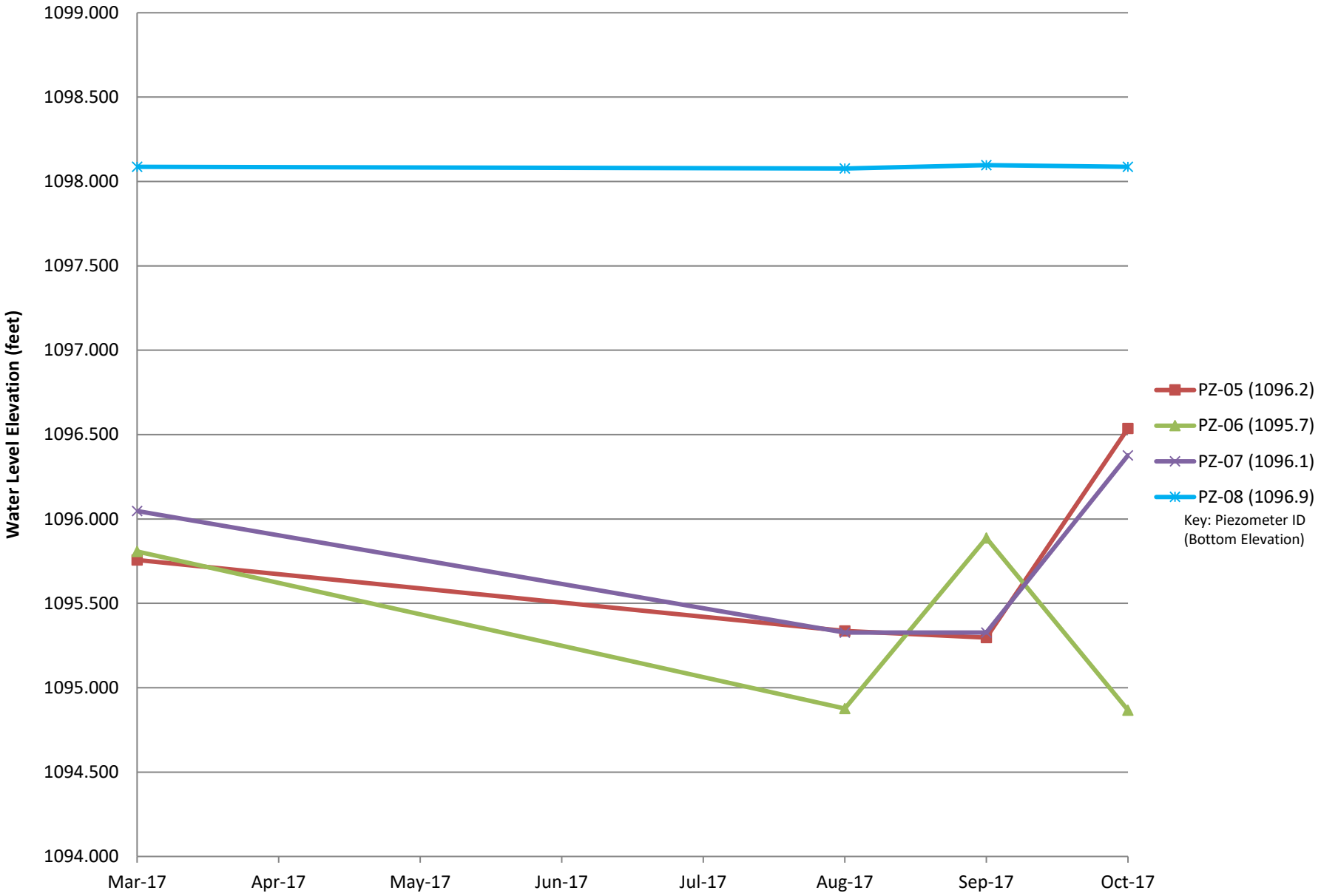
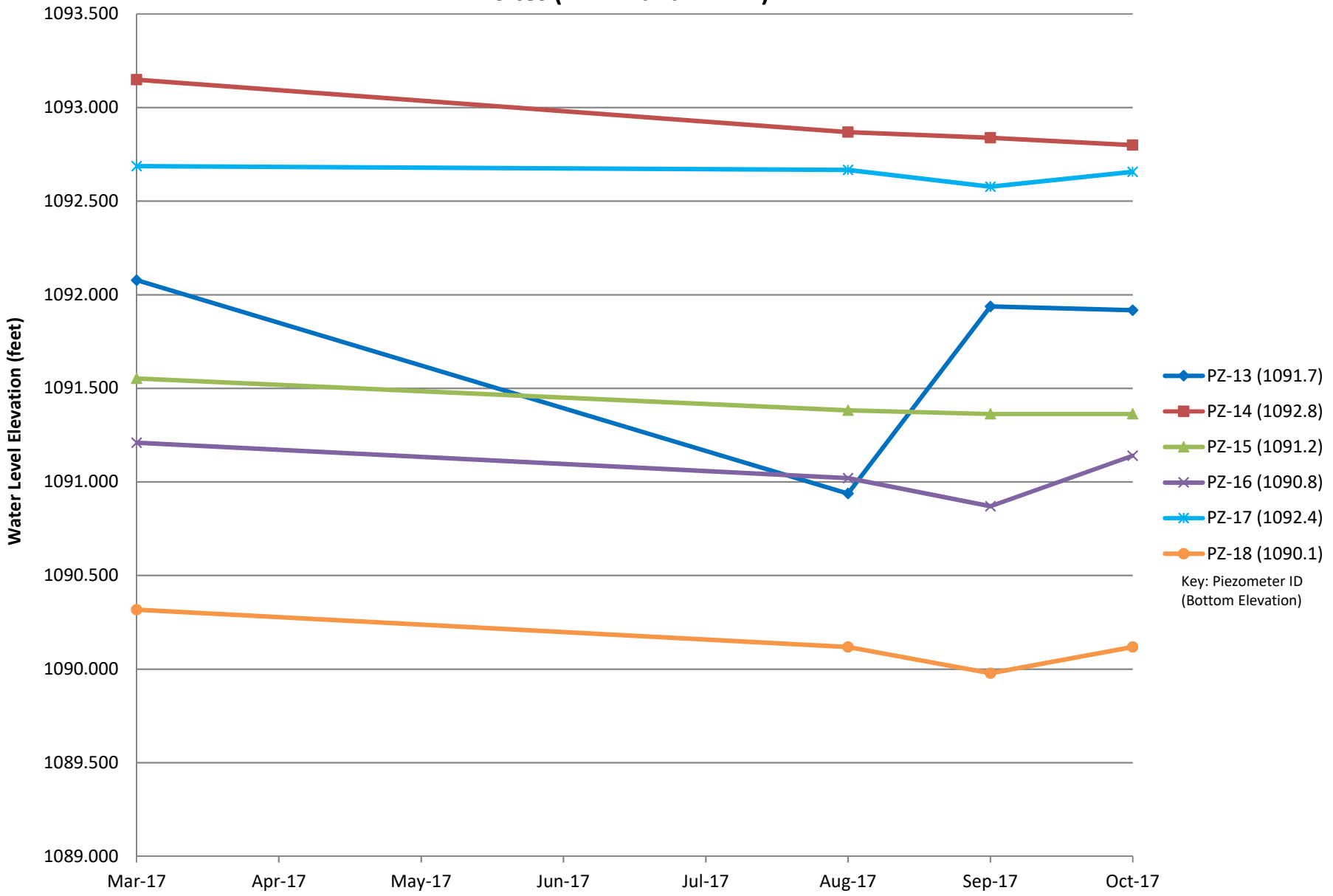


Figure 4 2017 Piezometer Readings at the Phase I and Phase II Wet Meadow Mitigation Sites (WM-1 and WM-2)



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OTHER HYDROLOGICAL DATA

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Figure 1 2017 Total Monthly Precipitation
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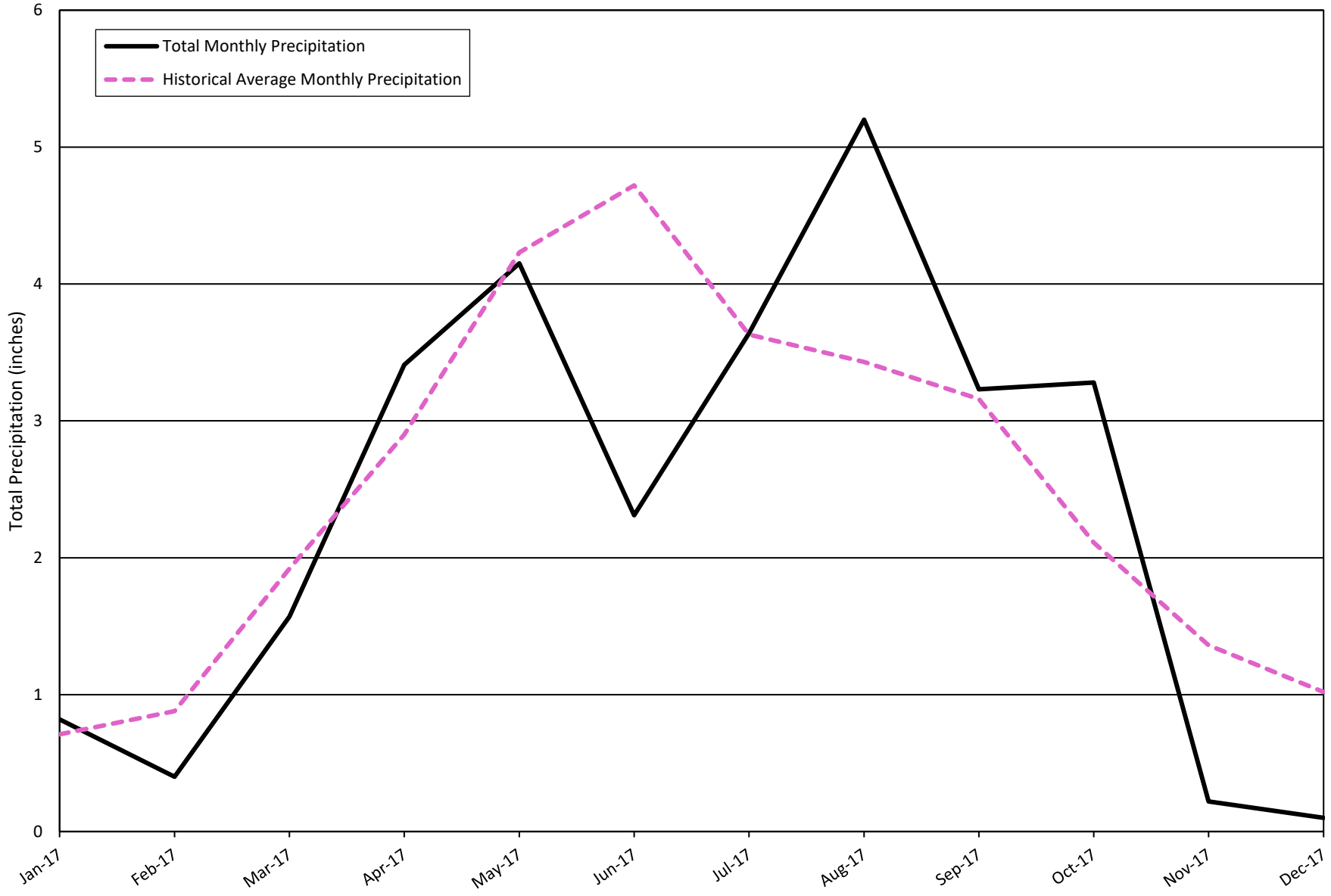


Figure 2 2017 Monthly Average Ambient Air Temperature
Fremont, NE

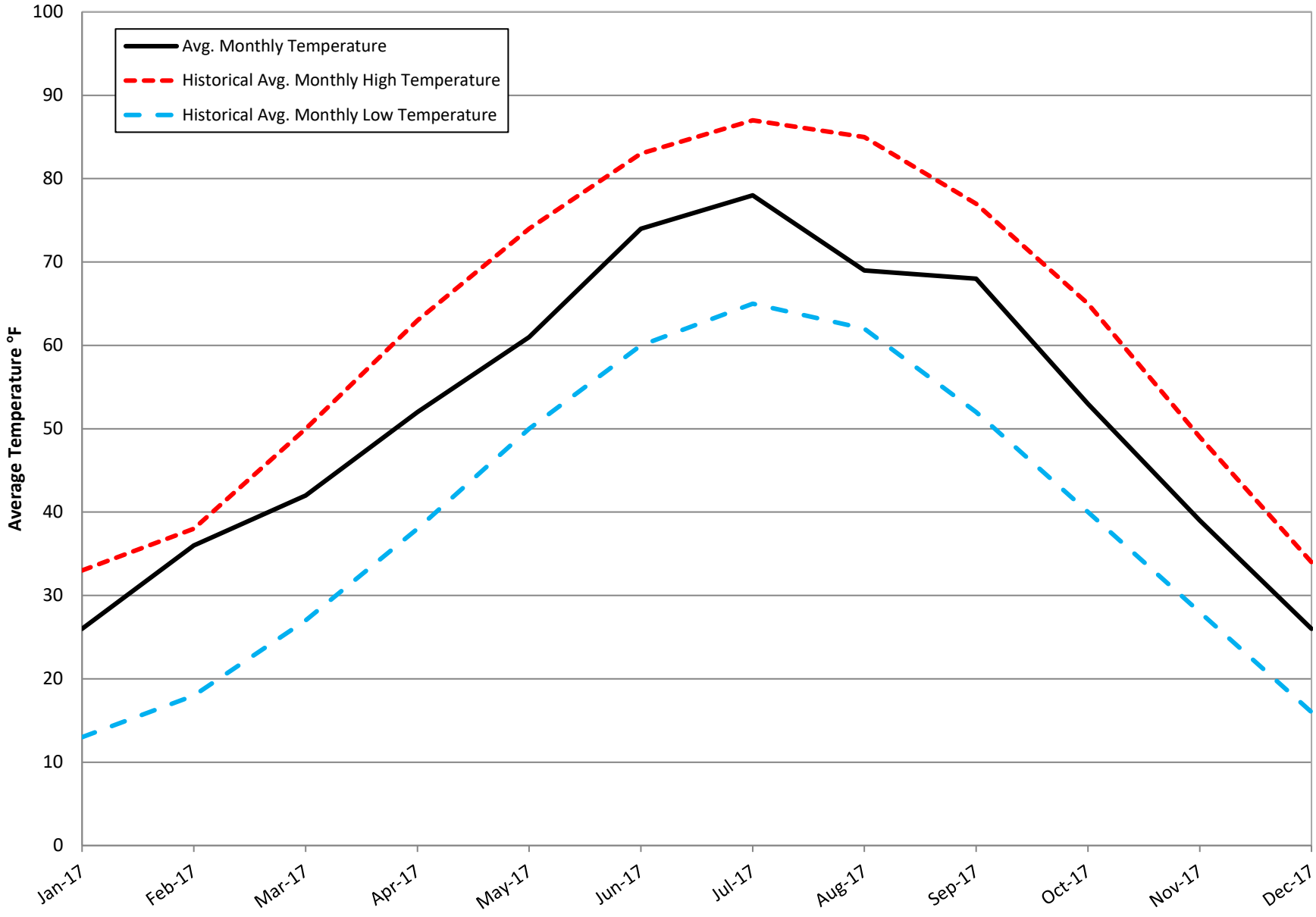
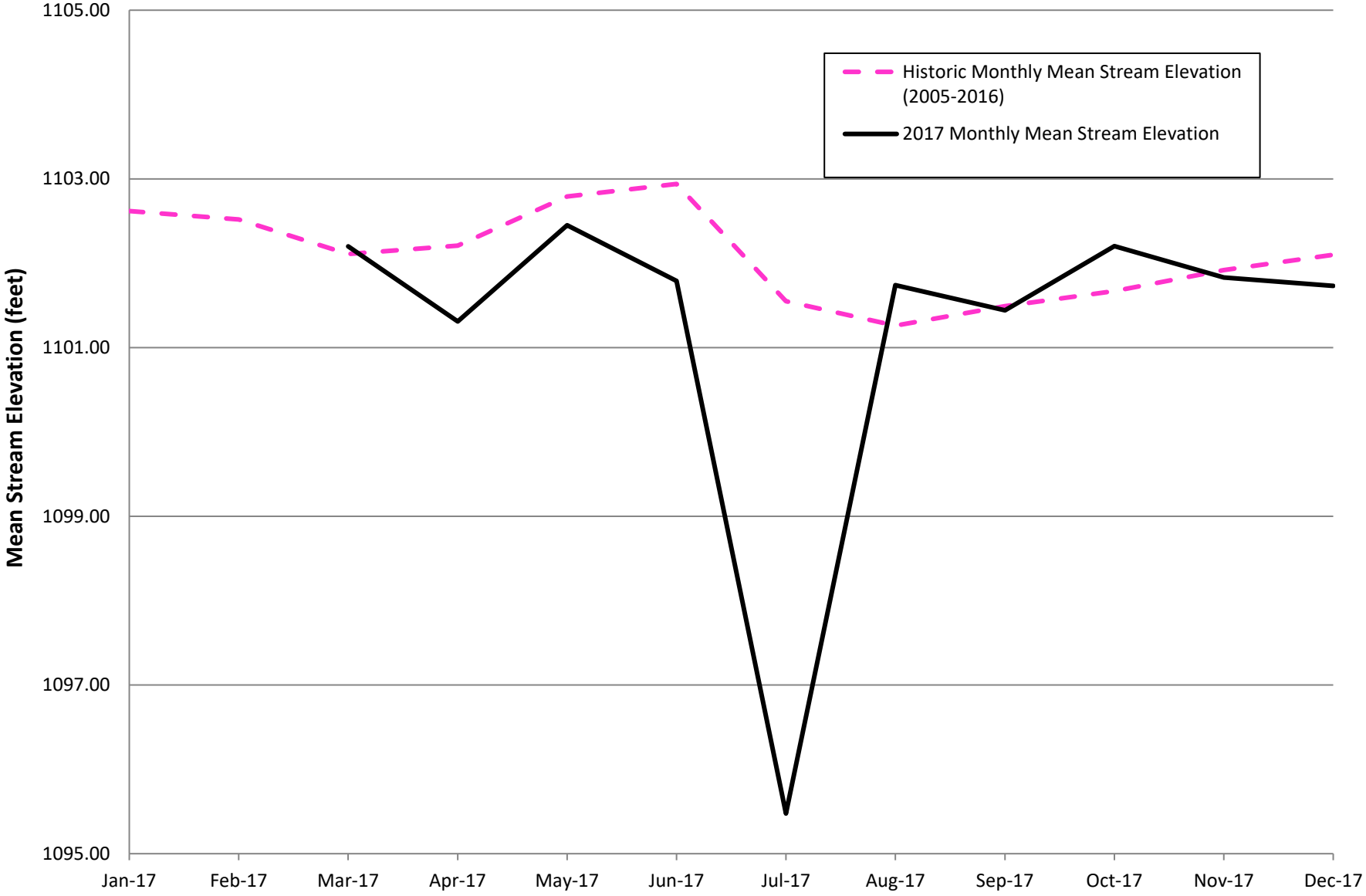
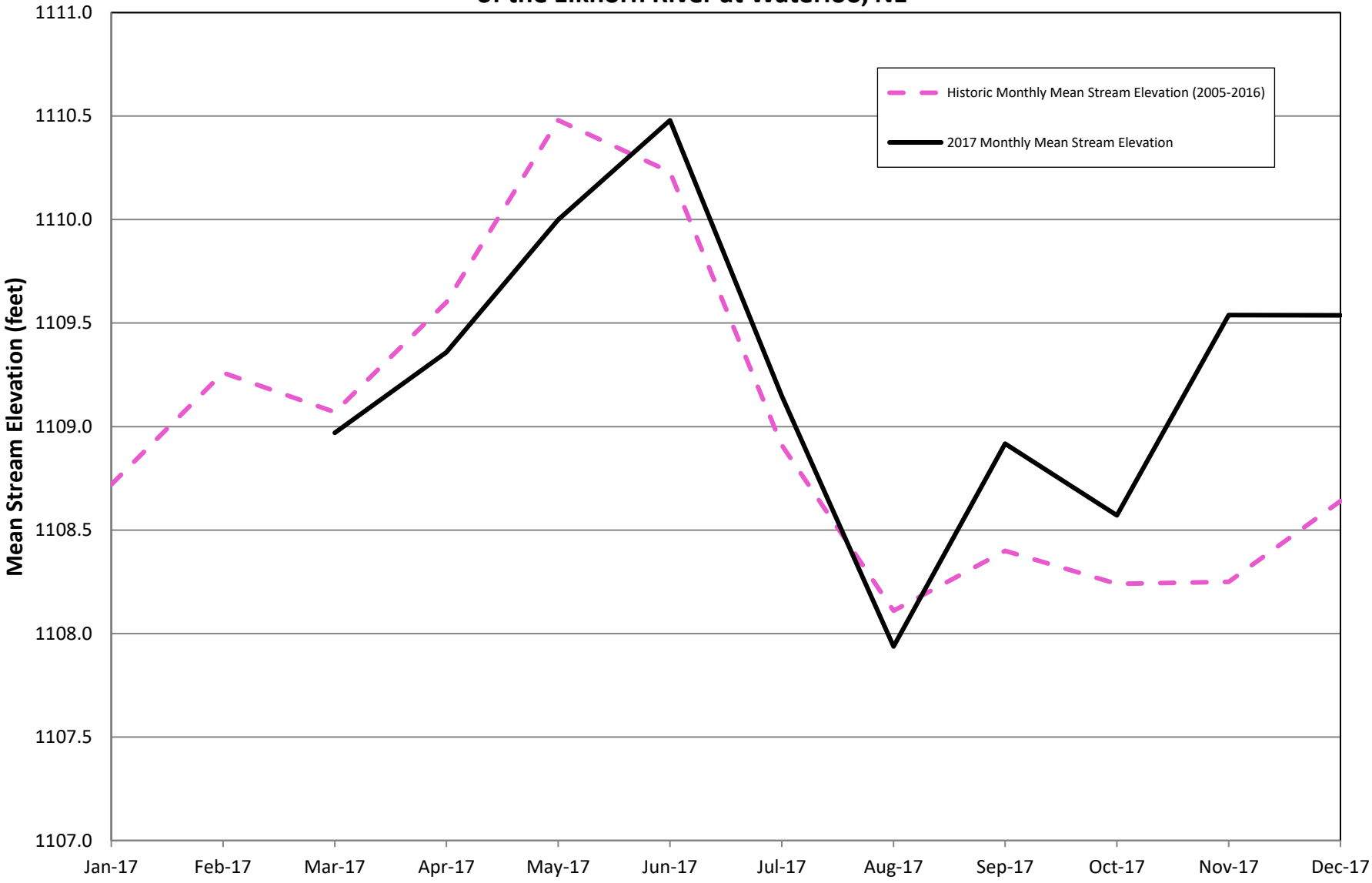


Figure 3 2017 Monthly Mean Stream Elevation of the Platte River near Venice, NE



Source: USGS. 2017b. National Water Information System: Platte River near Venice, Nebraska 06796550

Figure 4 2017 Monthly Mean Stream Elevation of the Elkhorn River at Waterloo, NE



Source: USGS. 2017a. National Water Information System: Elkhorn River at Waterloo, Nebraska 06800500

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