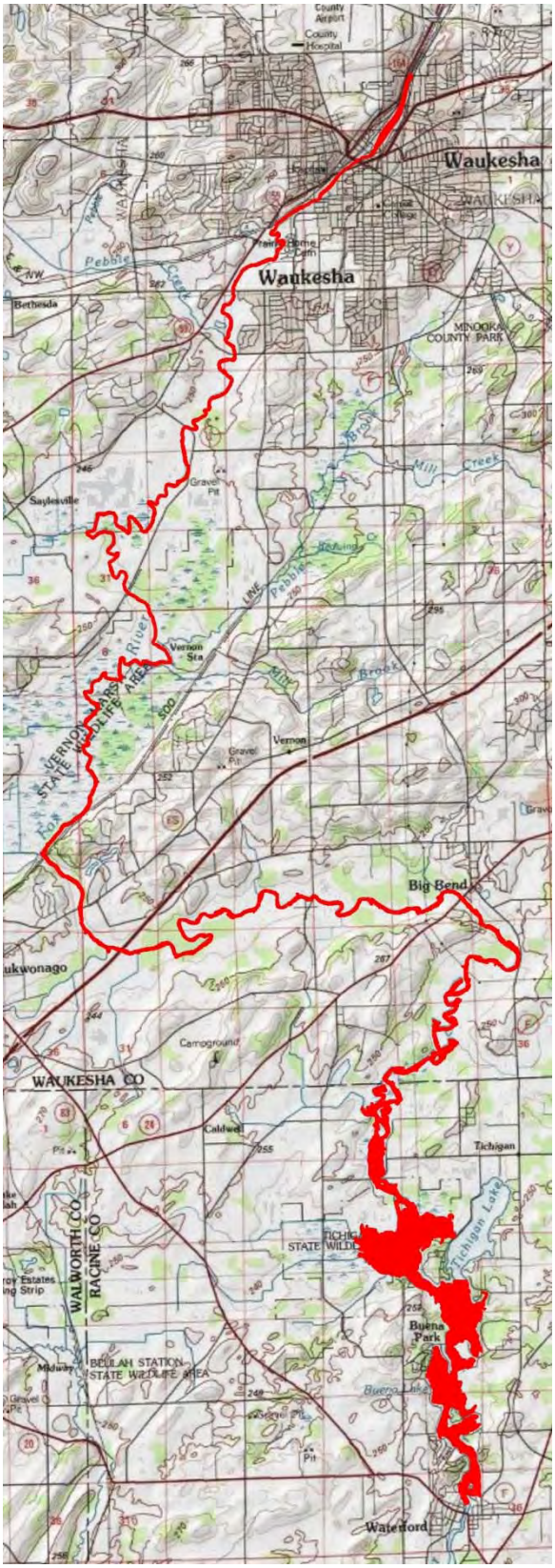


Fox River Shoreline Erosion and Invasive Species Mapping

Waukesha and Racine Counties

January 2014

Prepared for

Southeastern Wisconsin Fox River Commission

Waterford, Wisconsin

Prepared by

GRAEF

125 South 84th Street, Suite 4001
Milwaukee, Wisconsin 53214-1470
414-259-1500
414-259-0037

Project Manager: Geoffrey Parish, M.S., P.G., P.H.
geoffrey.parish@graef-usa.com
Project scientist: Ron Londre, M.S., C.E.
ron.londre@graef-usa.com

Project No.: 2013-0430.00

TABLE OF CONTENTS

APPENDICES

I. INTRODUCTION

GRAEF conducted a shoreline erosion study and targeted invasive species investigation for the Southeastern Wisconsin Fox River Commission (SEWFRC) along the main stem of the Fox River within the SEWFRC boundaries extending from approximately 1,800 river feet north of the West Moreland Boulevard Road Bridge in Waukesha, Wisconsin at the northern SEWFRC boundary to Waterford Damn in Waterford, Wisconsin. The total length of shoreline evaluated includes 93 linear miles or 491,050 linear feet (Figure 1, Appendix A).

The goal of this project was to map and evaluate areas of shoreline erosion and map areas of targeted invasive species along the main stem of the Fox River to identify for the SEWFRC potential projects to improve the quality of the Fox River. Areas of significant erosion were identified for potential SEWFRC projects and targeted invasive species were selected for investigation as a part of an early detection and rapid response process.

Our study is presented here in terms of methodology, results, discussion and conclusions.

II. METHODS

Background Review and Field Study Preparation

The initial effort included a review of background studies on the Fox River performed by Southeastern Wisconsin Regional Planning Commission (SEWRPC), Waukesha County, and SEWFRC. A shape file of previously mapped areas of erosion and invasive species was obtained from Waukesha County and was added to the project GIS. SEWRPC orthographic aerial photographs were obtained for the years 2000 and 2010. These photographs were used as the base for the in-field mapping efforts.

A river coordinate system, based on distance upstream from the confluence with the Illinois River in Illinois, was established to reference areas identified in the field study and is shown on the maps included with this report.

There are two counties in the study area, Waukesha and Racine Counties. The approximate boundary between these two counties occurs approximately at river mile 148.5 as mapped on fifth map in each of the five map series, specifically on Figures 2-5, 3-5, 4-5 and 5-5.

Soil Mapping

Soils data, sourced from NRCS soils maps, in a 1000 foot wide corridor along both sides of the river were added to the project GIS. The soils were grouped into three categories based on the nature of the parent materials, the materials in which the soils formed – cohesive, granular, and organic soils within the project GIS environment. Cohesive soils are soils with significant clay content. Granular soils are soils with significant sand and silt content without significant levels of clay. Organic soils are mucks and peats. The presence of mapped erosion was compared to

the nature of the soils to determine if the nature of the shoreline soils had an apparent effect on erosion, and if parent soil material should be considered in the assessment of project priority.

Changes in Shoreline Position between 2000 and 2010

The changes in shoreline locations between 2000 and 2010 were compared to identify areas of potential erosion and deposition. To accomplish this, the apparent location of banks on SEWRPC 2000 and 2010 aerial photographs were mapped using ESRI Arc GIS. Once apparent areas of changes in bank locations were identified, these areas were inspected during the field investigation. The natures of the shorelines on both sides of the river were noted in these identified areas in attempt to qualitatively account for differences in relative elevation of the shorelines. One limitation we accounted for was when the height of a bank was near or at the same elevation as the water Ievel. In such cases, it was anticipated that elevated river water levels would create the appearance of shifts in shoreline on that side of the river. Accordingly, the approximate heights of the shorelines and types of vegetation were noted at the identified areas of potential erosion.

Shoreline Erosion Field Study

GRAEF scientists Geof Parish and Ron Londré conducted a field survey of shoreline erosion by traversing the main stem of the river by canoe from 1,800 river feet north of the West Moreland Boulevard Bridge in Waukesha at the northern SEWFRC boundary to Waterford Damn in Waterford at the southern SEWFRC boundary. Shoreline erosion was mapped based on three categories; 1) stable, 2) minor erosion, and 3) moderate erosion. Stable shorelines were generally defined as a shoreline that was well vegetated and appeared stable with no outward signs of any type of erosion. Shorelines with minor erosion were generally defined as a shoreline with vegetation that generally appeared stable but exhibited signs of undercuts and/or bank erosion that either appeared to be a result of natural riverine processes or apparently resulted in the release of a relatively small amount of soil material. Shorelines with moderate erosion were generally defined as an exposed shoreline with little to no vegetation where an apparently significant amount of soils had been released into the river potentially contributing to water quality degradation and which may pose a continued threat to future stability of the shoreline. Additional observational data was collected which included; dominant type of shoreline vegetation, bank slope or vertical height, and general observations.

Targeted Invasive Species Field Study

GRAEF scientists Geof Parish and Ron Londré conducted a field survey of targeted invasive species along shoreline by traversing the main stem of the river by canoe from 1,800 river feet north of the West Moreland Boulevard Bridge in Waukesha at the northern SEWFRC boundary

to Waterford Damn in Waterford at the southern SEWFRC boundary. The targeted invasive species included; common reed grass (*Phragmites australis*), Japanese knot weed (*Fallopia japonica*), and tall manna grass (*Glyceria maxima*). These species were selected due to their known aggressive nature and because they are relatively new invaders. Through early detection and mapping, it may be possible to reduce and or eliminate the spread of these species along the Fox River.

Populations of these species were mapped and observational data on the approximate number of stems observed from the vantage point of the canoe was collected. Observational data on the dominant shoreline vegetation were collected and include invasive species other than the targeted species.

Environmental Corridor Evaluation

GRAEF scientists and GIS specialists conducted a cursory evaluation of environmental corridors and potential expansion. This was accomplished by projecting mapped SEWRPC primary environmental corridors onto an aerial image and adding a measured 1000 foot buffer from the river shoreline. The buffer width is based on an article from *R.D. Semlitsch and J.R. Bodie, 2003, Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibian and Reptiles, Conservation Biology, 17(5): 1219-1228;* is an approximate optimum core habitat for the protection of wildlife including frogs, salamanders, snakes, turtles, birds, mammals, and fish and aquatic insects. :

III. RESULTS AND DISCUSSION

Soil Mapping

It was anticipated that areas of granular soils would be subject to higher levels of erosion than either cohesive soils or organic soils. However, areas of mapped moderate shoreline erosion were equally as likely to occur in the cohesive soils, with 5 mapped areas, as in the granular soils, also with 5 mapped areas. Based on the number of areas mapped in the field as having minor shoreline erosion, there were approximately 25 percent more areas of minor erosion in cohesive soils, with 50 areas mapped, as compared with granular soils, where there were 36 mapped areas, and three times as many areas of minor erosion in cohesive soils as compared to organic soils, where there were 13 mapped areas. There were approximately two and a half times as many areas of minor erosion in granular soils as in organic soils. The differences in these numbers may relate to the relative distribution of the soils within the corridor rather than the structure of the soils.

There were different results for the areas of shifted shorelines based on the aerial photography. For each area of mapped shoreline shift, a qualitative indexing value was assigned based on whether the soils were eroding (assigned value of 2), possibly eroding (assigned value of 1) or not eroding (assigned value of 0). The set of values assigned for each soil type were then averaged. The granular soils had an average of 1.1, the cohesive soils had an average of 0.7

and the organic soils had an average of 0.7. The granular soils appear to have a higher probability of being found to be eroding, based on the aerial photography interpretations.

Shoreline Erosion Field Study

Based on the field study, which evaluated 93 linear of shoreline, GRAEF scientists mapped 69.55 miles (74.8%) as stable shoreline, 14.65 miles (15.8%) as having minor erosion, and 1.23 miles (1.3%) as having moderate erosion. A total of ten (10) areas were identified as having moderate erosion and ninety-nine (99) areas as having minor erosion.

Figures 3-1 through 3-17, Appendix A show the shoreline areas mapped as stable, as having minor erosion, and as having moderate erosion. Table 1, Appendix B provides a summary of each mapped areas along the shoreline and includes data on the dominant type of shoreline vegetation, type of erosion observed, photograph ID numbers, and general comments. Photographs of areas with moderate erosion are included in Appendix E; all other photographs are included on a CD accompanying this report.

It is our professional opinion that these ten areas exhibiting moderate erosion be considered a priority. These areas have apparently resulted in a significant discharge of soils into the rivers potentially contributing to downstream sedimentation and are a future threat to the stability of the shoreline.

It is possible that some of the areas mapped as having minor erosion may collectively contribute to downstream sedimentation. Decadal changes in shoreline position in these areas were evaluated as a portion of this project and are discussed in more detail in another section of this report.

Targeted Invasive Species Field Study

Based on the field study, which evaluated 93 linear miles (491,050 linear feet) of shoreline, GRAEF scientists identified forty-eight areas with populations of common reed grass (*Phragmities australis)* which constituted 7.56 miles (8.13%) of the mapped shoreline. GRAEF scientists did not identify the presence of Japanese knot weed (*Fallopia japonica)* or tall manna grass (*Glyceria maxima*) along the shoreline.

Figures 3-1 through 3-17, Appendix A show the location of common reed grass populations and Table 1, Appendix B provides information of the approximate number of stems observed from the vantage point of a canoe.

The majority of common reed grass populations were observed between river mile 161.5 and 166.5 as shown of Figures 3-10 through 3-12, Appendix A. Although total population size beyond the shoreline was not determined, it is recommended that priority be given to those apparently large populations that are located in areas surrounded by shallow marsh and wet meadow. Generally, when prioritizing the control of common reed grass we recommend that larger populations be given priority over smaller populations and populations surrounded by large areas of shallow marsh and wet meadow be given priority over areas surrounded by

developed or managed lands. If entire populations are not able to be controlled, we recommend starting at the upstream end of populations and working downstream. It is also advantageous to start with satellite populations to reduce the rate of spread and work towards larger central populations.

We highly recommend that the management of common reed grass be prioritized while population sizes are manageable from the ground. If left unmanaged, there is the potential for the invasive species to out compete reed canary grass and cattails and form a large monoculture resulting in further degradation of riparian wetlands.

Changes in Shoreline Position between 2000 and 2010

As described in the methods section, apparent locations of shorelines on 2000 aerial photographs were compared to the locations on 2010 aerial photographs. At 179 locations shoreline erosion was considered a possibility. At 31 locations deposition was considered a possibility. These areas are shown on Figure 4. Based on these results, locations where the shoreline appeared to have moved were inspected in the field. The average shoreline erosion rate was calculated for all areas where a shoreline shift was noted in the aerial photographs and erosion was noted in the field, and these areas averaged 0.8 feet per year. If the areas where erosion was not confirmed in the field the average increases to 0.9 feet per year. The areas of possible deposition had an annual growth rate of 2.0 feet per year. Table 2 has a listing of the investigated areas of possible erosion and Table 3 has a listing of the areas of possible deposition.

The averages for the three general soil parent materials were also calculated. The cohesive and organic soils averaged 0.8 feet per year and the granular soils averaged 0.7 feet per year. If the areas of possible soil erosion are included in the averages the numbers are 1 foot per year for cohesive soils, 0.9 feet per year for organic soils and 0.7 feet per year for granular soils.

Environmental Corridors

The Southeastern Wisconsin Regional Planning Commission areas of Primary Environmental Corridors (PEC), Secondary Environmental Corridors (SEC) and Isolated Natural Resource Areas (INRA) were mapped on Figure 5. Based on the cursory evaluation of environmental corridor, GRAEF scientists did not identify high potential for expansion of environmental corridor from the northern limits of the SEWFRC boundary to approximately river mile 171 largely due to highly develop lands within the 1000 foot zone of optimal core habitat. From river mile 171 through 146 (Figures 5-4 through 5-14, Appendix A) there are a significant amount of lands that are either agricultural or undeveloped that have high potential for expansion of environmental corridor to increase was is currently mapped as SEWRPC Primary Environmental Corridor to include those agricultural and undeveloped lands within the 1000 foot zone of optimal core habitat.

This cursory evaluation supports the need for further study to identify specific parcels, evaluate the current land use, and prioritize the lands for potential acquisition and restoration.

IV. PRIORITY AREAS

Nineteen projects were evaluated in terms of priority for possible projects to reduce the sediment load to the river. The areas that were included in the evaluation included all ten areas considered to have moderate erosion based on field observations, the four areas having the highest erosion rate based on the aerial photographic interpretations, the four areas documented as having minor erosion adjacent to farm fields without significant buffers and the one farm fields without significant buffers adjacent to the shoreline not documented in the field as having an eroding shoreline, totaling 19 areas. In order to arrive at a numerical ranking of these nineteen areas numerical values were assigned to the observed features. Specifically, a value of one was given to areas without observed erosion, a value of 2 was given to areas with minor erosion and a value of three was given to areas with moderate erosion. The average slope height was used as another value. In areas of sloping shorelines a value of three was used. The estimated erosion rate was assigned a value of one in areas where no value was measured and where the rate was estimated, the estimate was added to one. These four factors were multiplied to arrive at a total weight that was then ranked from one to, one being the highest priority and nineteen the lowest priority. This methods weights larger sources of sediment heavier than smaller sources and weights areas that appear to be eroding more severely heavier than areas of lesser erosion. The area that did not have either erosion documented during the field survey or the aerial photographic interpretation was included as a control measure. This area scored as the nineteenth, or the lowest priority. The results are presented in Table 4. The five top priority areas were all areas mapped in the field as having moderate erosion.

The targeted invasive species, common reed grass, was found to be most abundant between river mile 161.5 and 166.5 which is also an areas with a large surrounding wetlands. Common reed grass was also found to be present in Conservancy Bay where there are large areas of surrounding wetlands. We would recommend these two areas be given the highest priority to begin the management of common reed grass.

V. CONCLUSIONS

The shoreline of the Fox River was inspected within the Southeastern Wisconsin Fox river Commission jurisdictional boundaries from approximately river mile 141.75 to 178.75, a distance of 37 river miles. A total of 93 miles of shoreline was mapped along the river within that area. During the field investigation 10 areas of moderate shoreline erosion were mapped, ninety -nine areas of minor shoreline erosion were mapped, and 48 areas of phragmites invasion were mapped. In terms of percentages, 83 percent of the mapped shoreline appeared to be stable, 16 percent had minor erosion and one percent had moderate erosion. Of the mapped shoreline 8 percent was mapped as having phragmites.

The aerial photographic interpretations resulted in 210 areas where the shoreline appeared to shift. Of those areas 85 were considered as likely stable, 64 as possibly eroding and 48 as likely eroding. A total of 31 areas were identified as depositional.

A numerical means was established to prioritize the areas of eroding shoreline based on length and height of the shoreline (size of the sediment source) and the severity of the erosion. Nineteen areas were evaluated and the top five priority areas were from those identified in the field as having moderate erosion. The five highest priority areas were identified at river mile 172.1, 168.3, 149.1, 154.6 and 175.75.

VI. LIMITATIONS

Bank heights were estimated from the investigators canoe at the time of the field survey and reflect the elevation of the river at the time of the survey. Erosion rates were estimated from aerial photographic interpretations not actual field measurements. Field observations were made from the vantage point of the investigators canoe and the extent of invasive species shoreward from the river edge is not certain.

APPENDICES

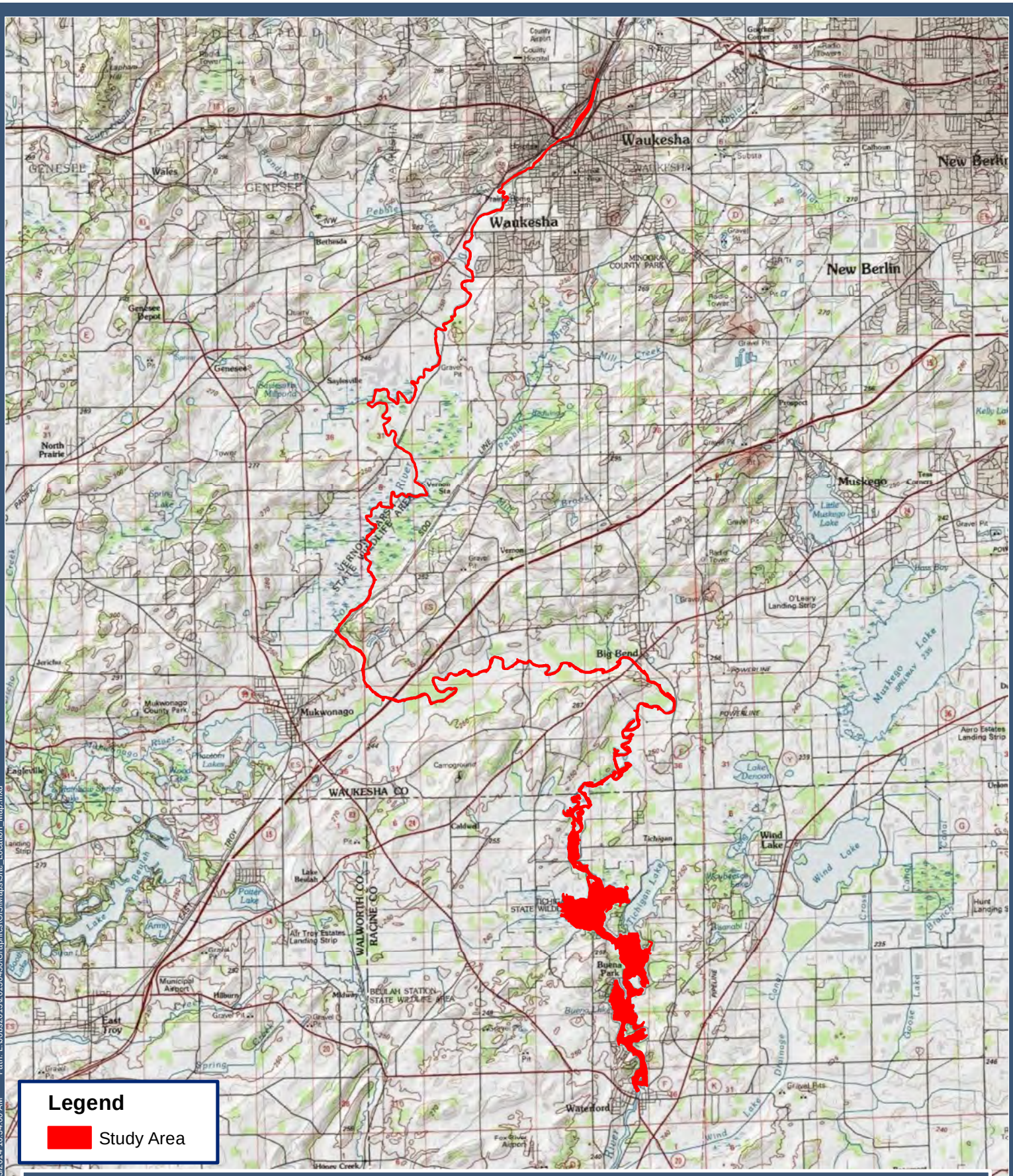
Appendix A Figures

Appendix B Tables

Appendix C Site Photographs

APPENDIX A

Figures



SITE LOCATION MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE COUNTY, WISCONSIN

FIGURE # 1

GRAEF

Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Site_Location_Map.mxd
Date Saved: 3/3/2014 10:34:00 AM
User: 1774

Proj. Number: 2013-0430 Source: Wisconsin DNR USGS DRG

FIGURE #2-1

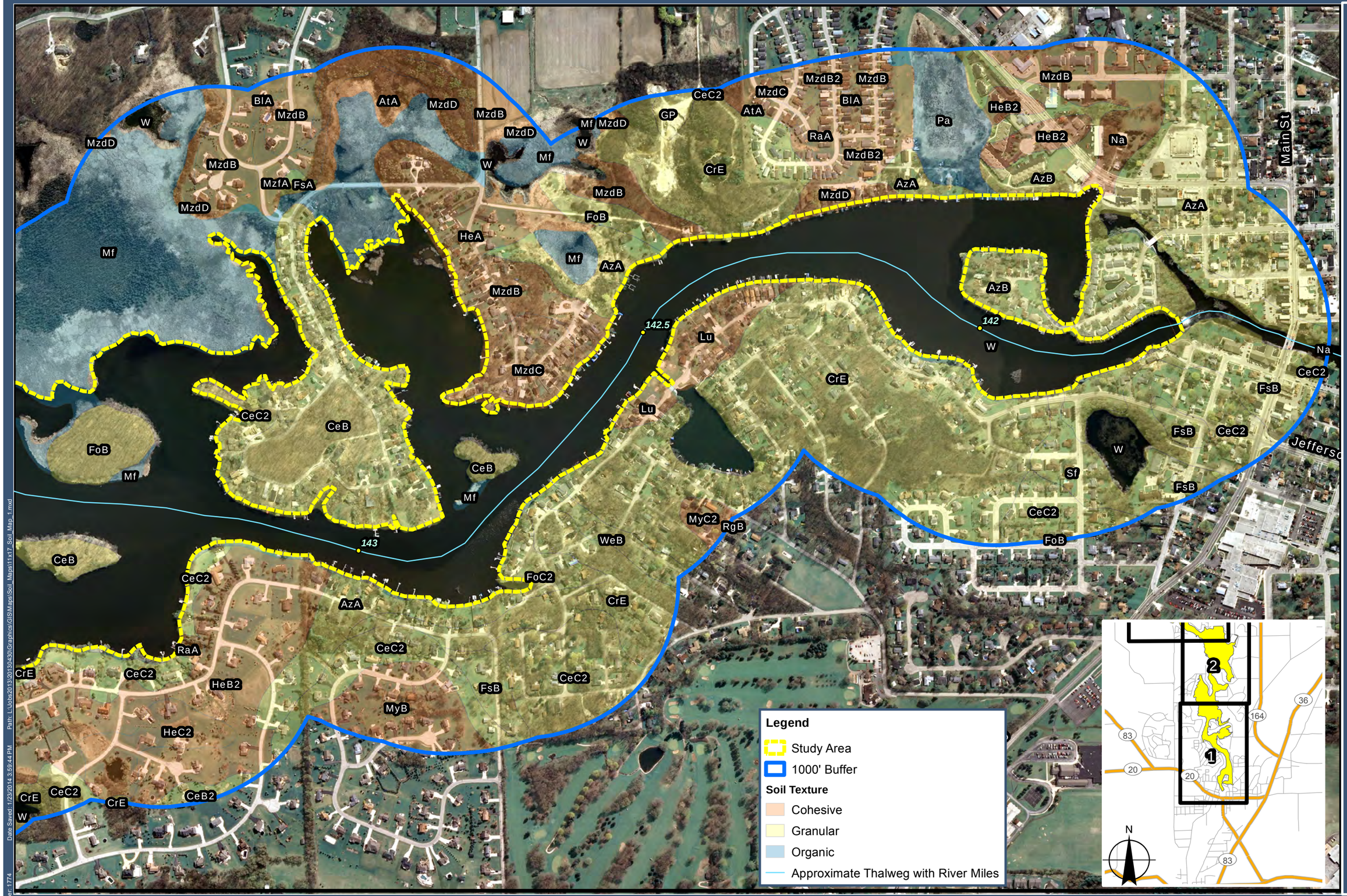
GRĀEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN



Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17 Soil_Map_1.mxd

Date Saved: 1/23/2014 3:59:44 PM

User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-2

GRĀEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_2.mxd
Date Saved: 1/23/2014 3:59:51 PM
User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-3

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600 Feet

1 in = 600 ft

User: 1774 Date Saved: 1/23/2014 3:59:58 PM Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_3.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

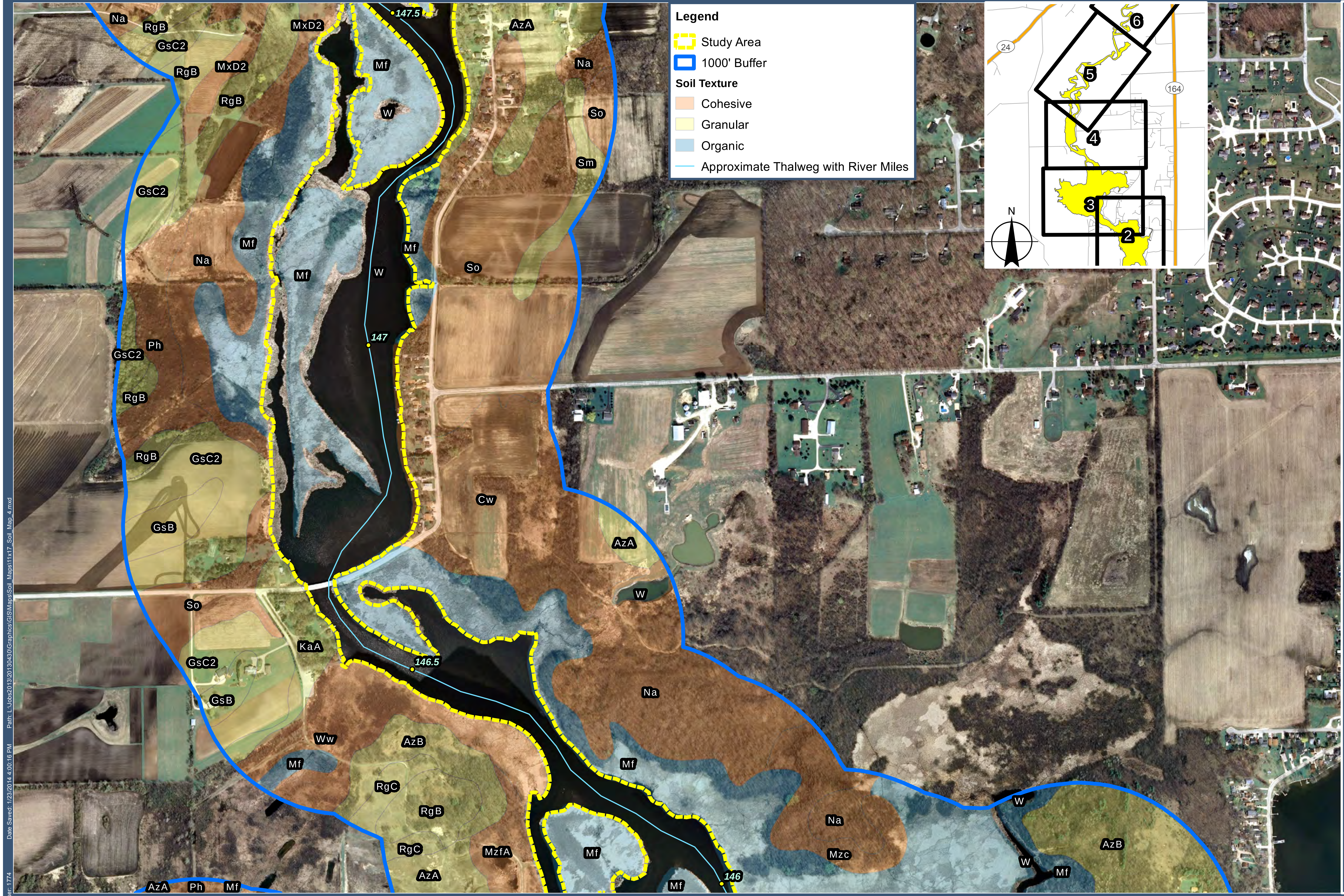


FIGURE #2-4

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_4.mxd

Date Saved: 1/23/2014 4:00:16 PM

User: 1774

Proj. Number: 2013-0430.00   2010 WROC 18" DOQQ

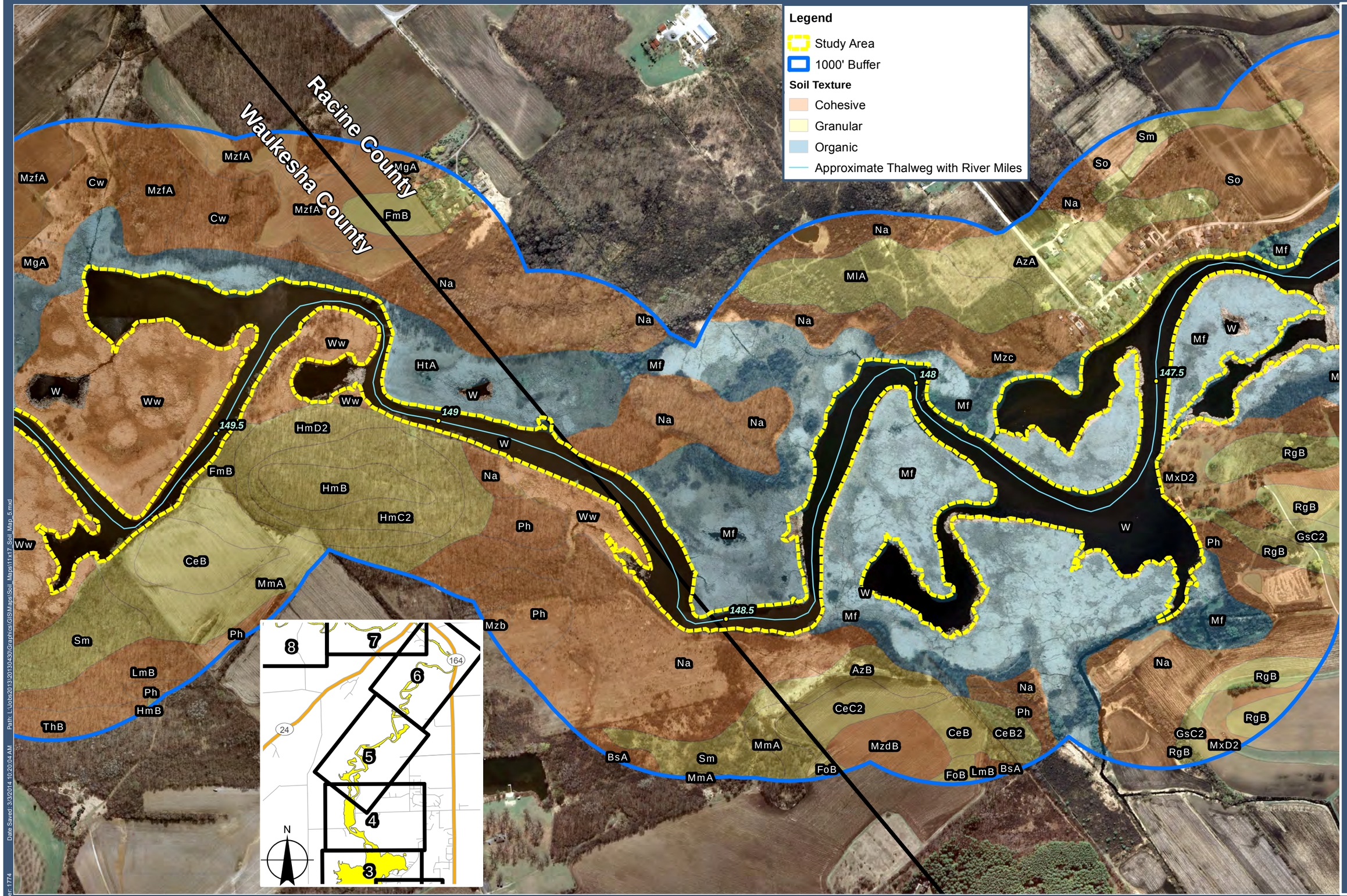


FIGURE #2-5

GRĀEF

SOILS MAP
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Date Saved: 3/3/2014 10:20:04 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_5.mxd User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-6

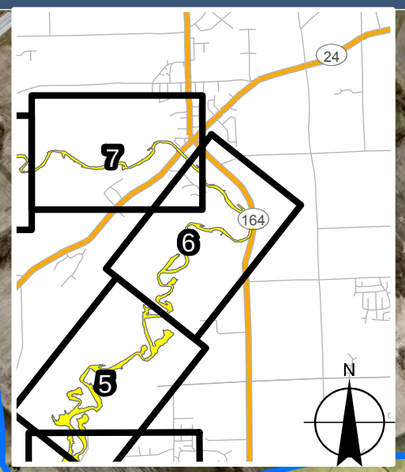
GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN



HeA HeB Mzb BlA BlA STH 164 MzfA FnB MzdC2 FmA MzdB 152 BnB MzdD2 Ac HtB Ww Oc FoB Sm FmA MmA W 151.5 Lu FmB Sm FmC2 MmA 152.5 FoB Pa HtA MmA Sm CfC3 MmA HmC2 Ripple Brook Ct CeB HtA HmB HmC2 MmA HtA HmD2 Ph Sm CeC2 HtA Sg HtA BmC2 W Na MmA HtA BnB

MzfA FmC2 FmB MgA Na HeB HtA HeB AzA MhA 150 MzfA Cw MzfA Ph 151 HtA 150.5 Ww W Ww W HtA W Ph AzB Sm MmA HmC2 HmB LmB BsA HtB HmC2

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles

0 150 300 600 Feet

1 in = 600 ft

User: 1774 Date Saved: 3/3/2014 10:20:46 AM Path: L:\Jobs\2013\2013-0430\Graphics\GISMaps\Soil_Maps\11x17_Soil_Map_6.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-7

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

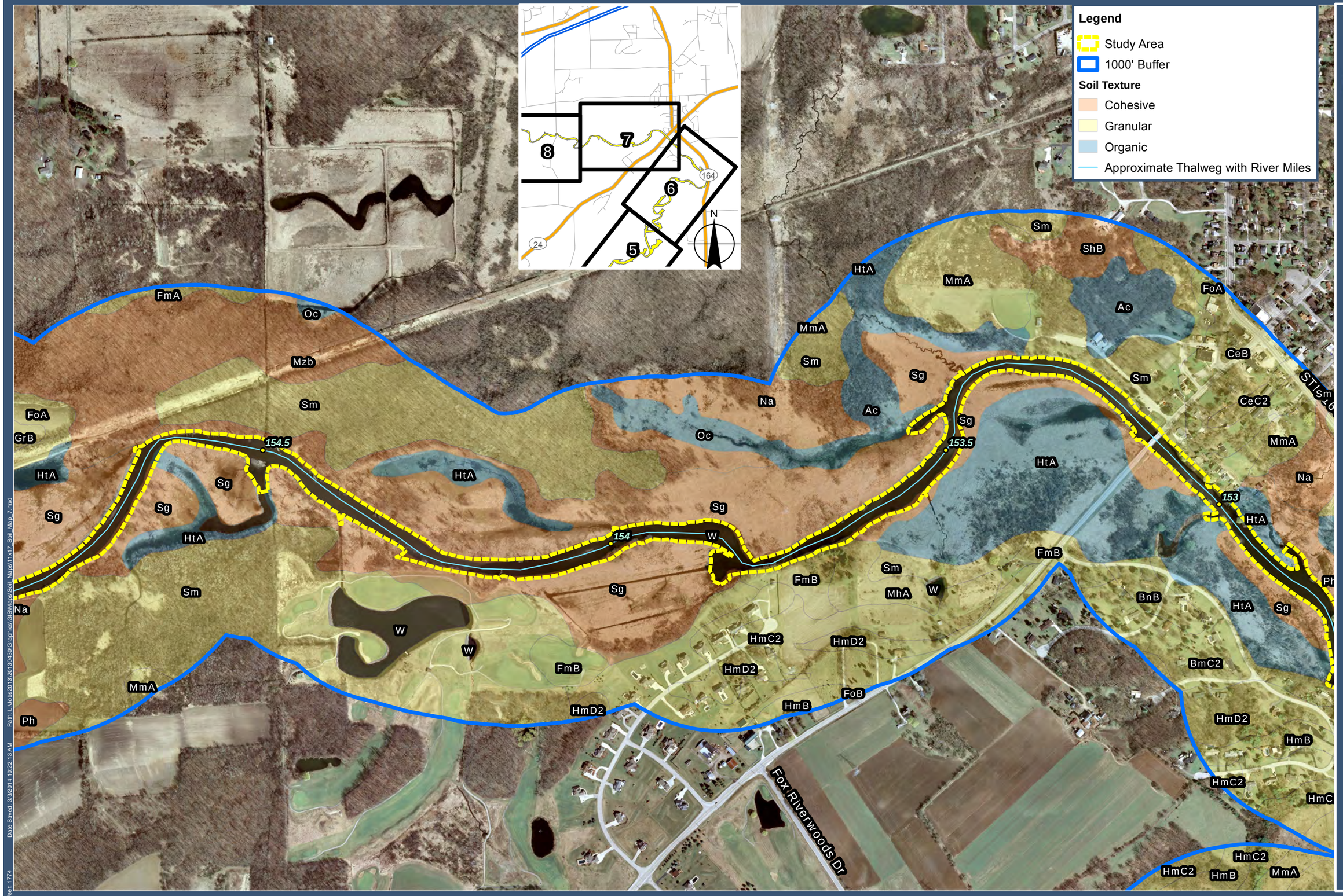
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles



N

0 150 300 600 Feet

1 in = 600 ft

Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_7.mxd

Date Saved: 3/3/2014 10:22:13 AM

User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-8

GRĀEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

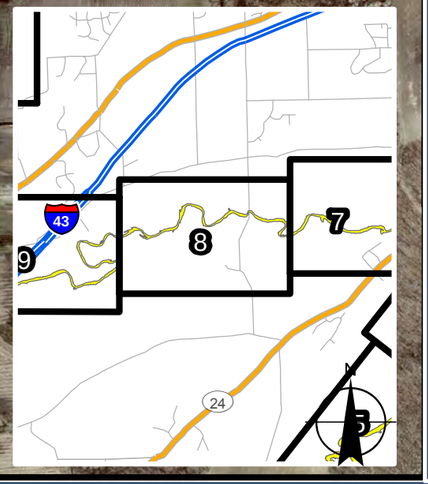
HtA
CeD2
FoC2
HmC2
MxC2
MmA
LmB
Mzb
GrB
Sm
Ph
MgA
GrB
HmB
FoB
CeB
Sg
HtA
BsA
Sm
MgA
CeB
156.5
MgA
HtA
155.5
HmC2
Sg
GrB
MmA
Ph
HtA
Sg
Sg
W
156
W
MmA
Ww
Sg
Sg
Sg
157
MhA
FmB
HeA
AzA
Na
155
Sg
Ac
FmA
Sm
AzB
FmB
HeB
AzB
MmA
HmB
Sm
Ph
Ac
FoB
FoB
MhA
Center Dr
MhA
Mound Ave
FmB
Sm
Pa

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles



N

0 150 300 600
Feet

1 in = 600 ft

Date Saved: 3/3/2014 10:22:55 AM Path: L:\Jobs\2013\2013-0430\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_8.mxd User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

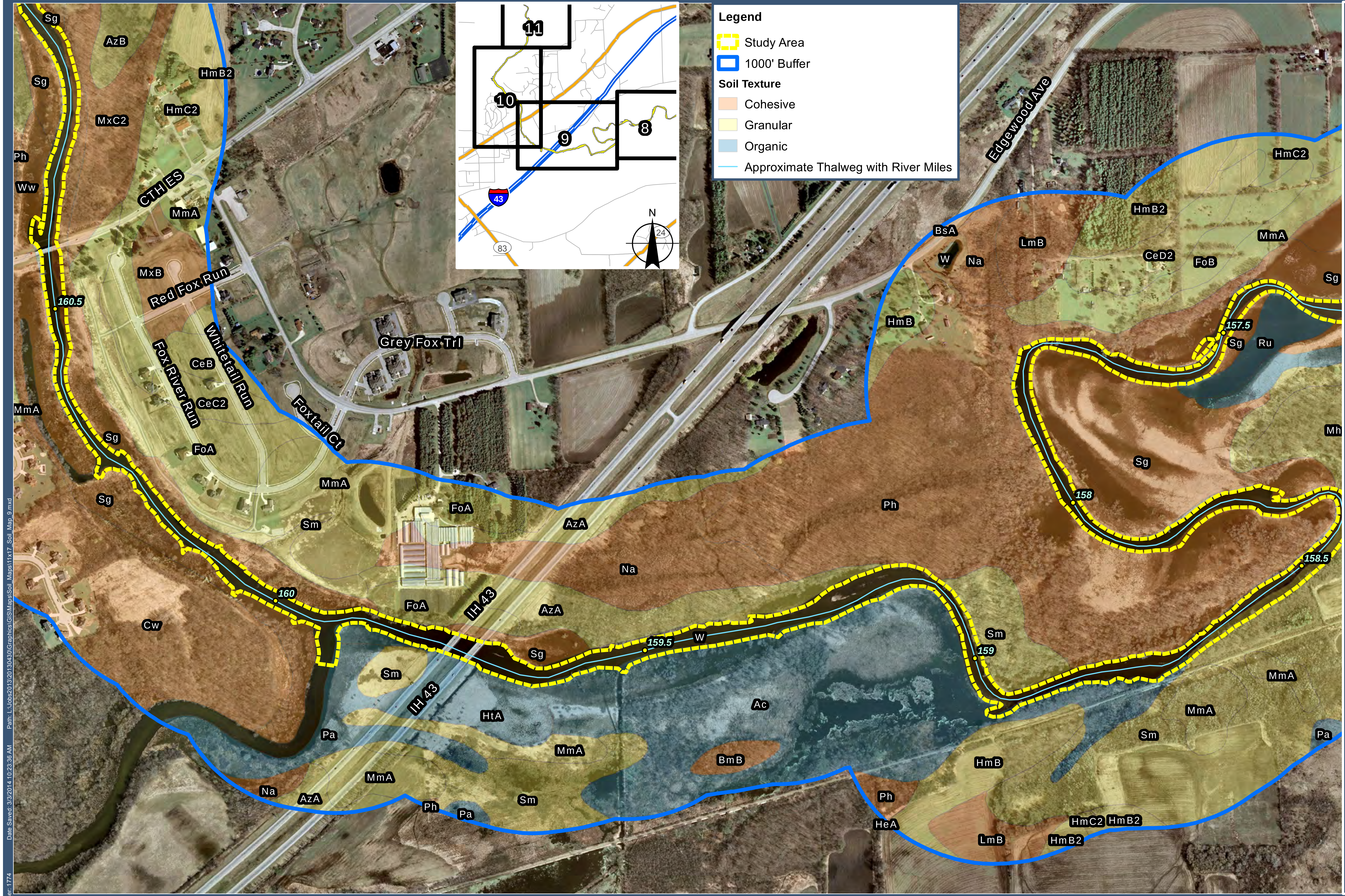


FIGURE #2-9

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-10

GRĀEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Edgewood Ave

Red Fox Run

Whitetail Run

Fox River Run

HmC2 CrD GP FmA W AzB CeB HmB2 MmA MxB CeC2 FoA MxC2 Sg CeD2 Ww Ph Sm FoB HmE2 HmB2 WeB CcD2 CrE CeC2 CrF HmD2 HtA HtB HmB Ac

160.5 161 161.5 162

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic

Approximate Thalweg with River Miles

N

0 150 300 600 Feet

1 in = 600 ft

Path: L:\Jobs\2013\2013043\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_10.mxd

Date Saved: 3/3/2014 10:24:19 AM

User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-11

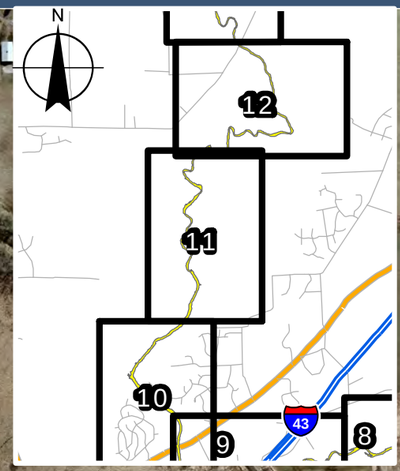
GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN



Ac
W
FoA
HtA
W
Ac
164.5
W
164
163.5
163
162.5
HtA
W
HtA
HtA
Ww
WhA
BnB
HoC3
HtA
FmA
Sg
HtA
W

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles

N

0 150 300 600

1 in = 600 ft

Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_11.mxd

Date Saved: 3/3/2014 10:25:23 AM

User: 1774

Proj. Number: 2013-0430.00

2010 WROC 18" DOQQ

Legend

- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles

Na, Oc, Dt, Dt, W, AzA, 167, FmB, HmC2, FmA, CeC2, FoB, Sm, FmB, AzA, CeB, AzA, Pa, 166.5, Sm, Mzk, Oc, Sm, Sm, Oc, W, HtA, 166, W, 165.5, HtA, 165, HtA, W, Sm, MmA, HtA, 164.5, Ac, FoA, Mzk, Ac, W

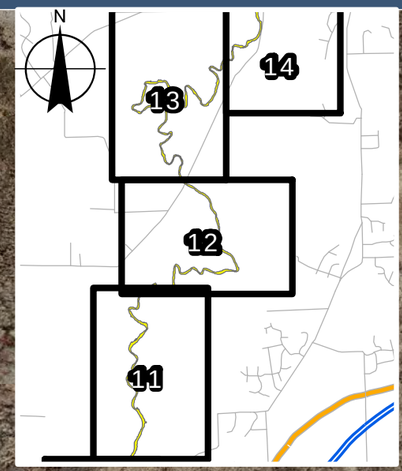


FIGURE #2-12

GRAEF

SOILS MAP
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

N
0 150 300 600
Feet
1 in = 600 ft

User: 1774 Date Saved: 3/3/2014 10:25:57 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17 Soil_Map_12.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-13

GRÄEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

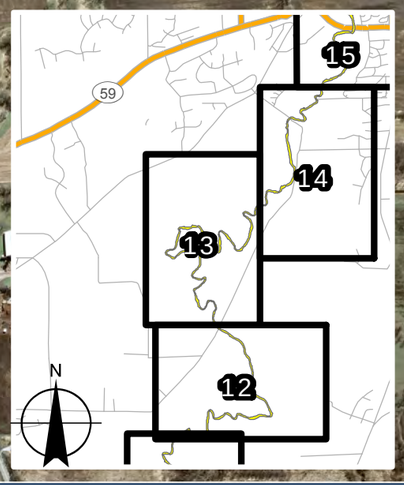
- Study Area
- 1000' Buffer

Soil Texture

- Cohesive
- Granular
- Organic
- Approximate Thalweg with River Miles

WhA, Na, WeA, HeA, FoA, OmB, Ww, MmA, FmA, HmB2, Ph, FmB, WeB, MtA, HtA, OnB, HmB, HmC2, FoB, Dt, Pa, FmC2, Cw, PrA, MhA, Oc

170.5, 170, 169.5, 169, 168.5, 168, 167.5



N

0 150 300 600 Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 1774 Date Saved: 1/23/2014 4:06:26 PM Path: L:\Jobs\2013\2013043\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_13.mxd

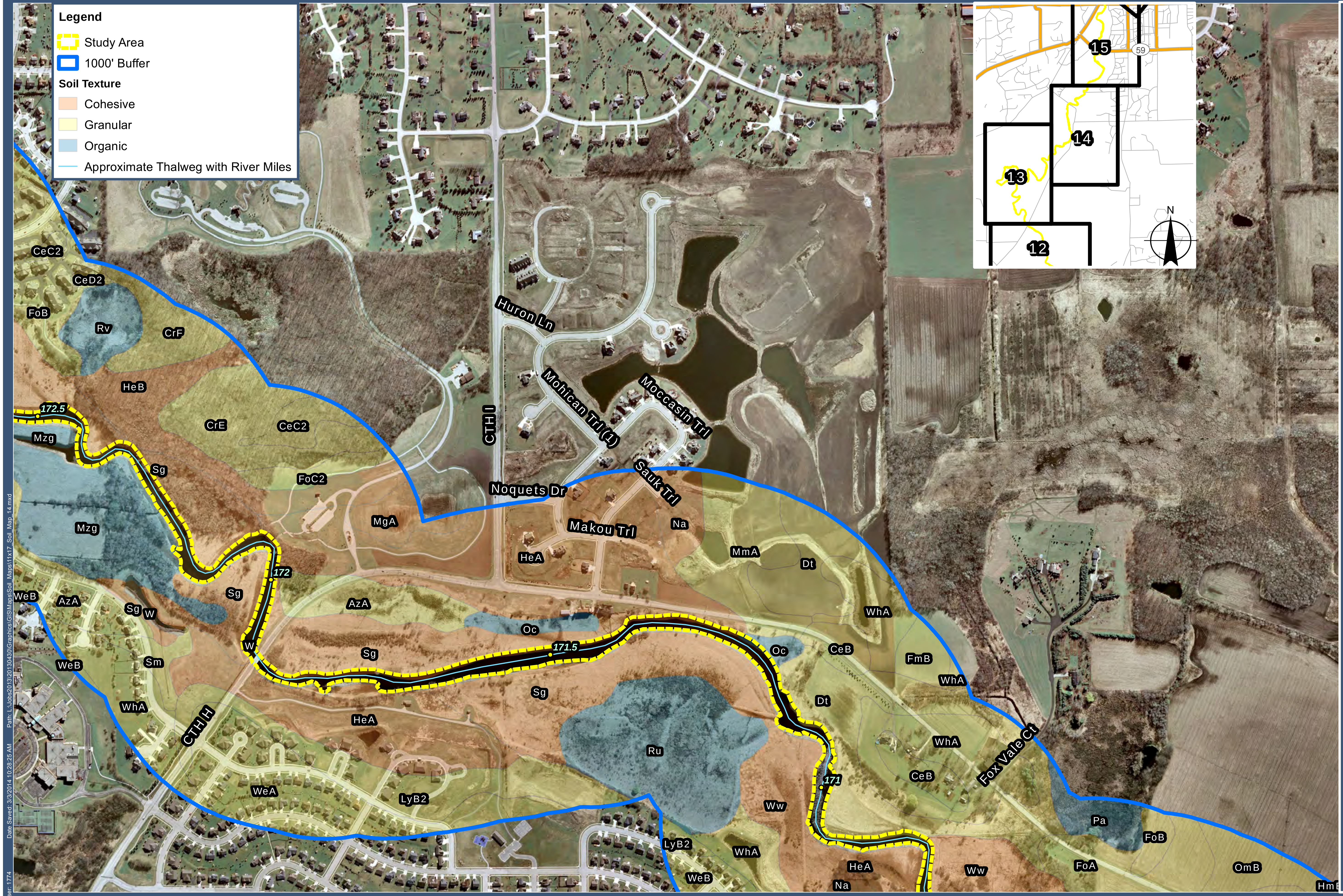

Legend
Study Area
1000' Buffer
Soil Texture
Cohesive
Granular
Organic
Approximate Thalweg with River Miles
15
59
14
13
12
N
Huron Ln
Mohican Trl (1)
Moccasin Trl
Sauk Trl
Noquets Dr
Makou Trl
CTH I
CTH H
Fox Vale Ct
172.5
172
171.5
171
CeC2
CeD2
FoB
Rv
CrF
HeB
Mzg
CrE
CeC2
Sg
FoC2
MgA
Na
MmA
Dt
HeA
WeB
AzA
Sg
W
AzA
Oc
WhA
Sm
Sg
Oc
CeB
FmB
WhA
Sg
Dt
WhA
HeA
Ru
WhA
CeB
WeA
LyB2
Ww
Pa
FoB
LyB2
WhA
HeA
Ww
FoA
OmB
WeB
Na
HmB

FIGURE #2-14

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_14.mxd

Date Saved: 3/3/2014 10:28:25 AM

User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

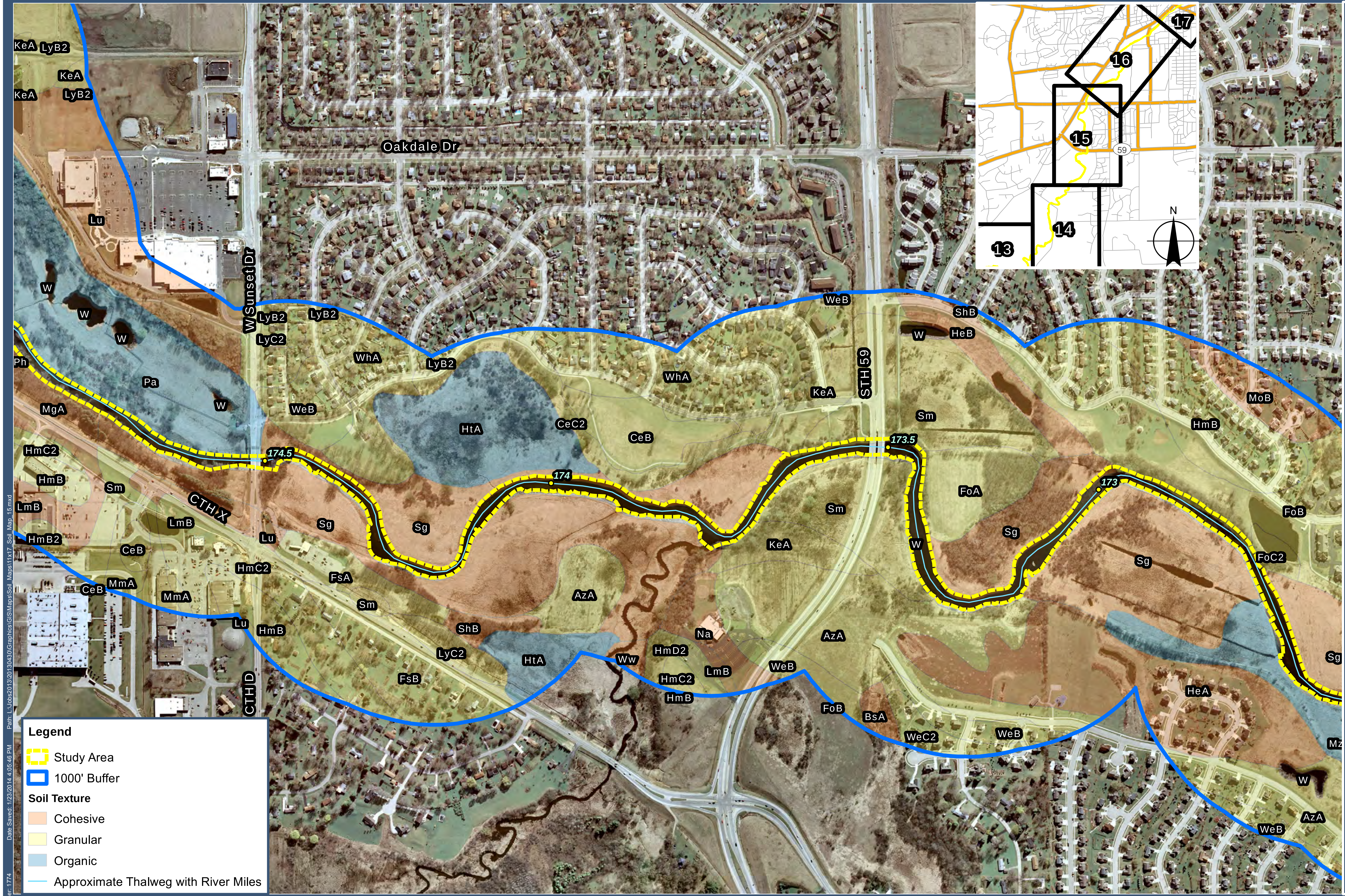


FIGURE #2-15

SOILS MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #2-16

GRAEF

SOILS MAP
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

0 150 300 600
Feet

1 in = 600 ft

User: 1774 Date Saved: 3/3/2014 10:31:32 AM Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_16.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

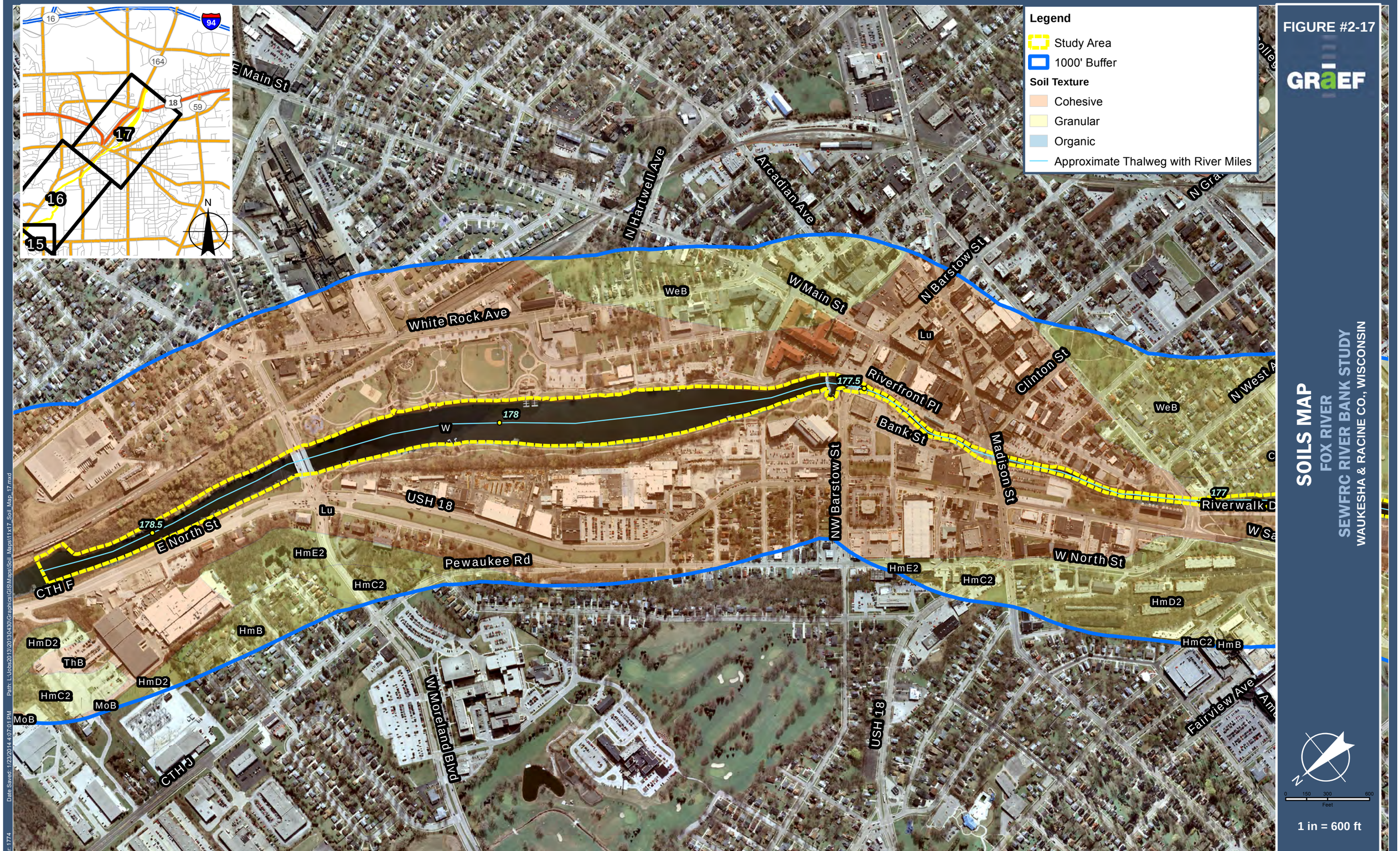


FIGURE #2-17

GRAEF

SOILS MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

User: 1774

Date Saved: 1/23/2014 4:07:01 PM

Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Soil_Maps\11x17_Soil_Map_17.mxd

Proj. Number: 2013-0430.00

2010 WROC 18" DOQQ

FIGURE #3-1

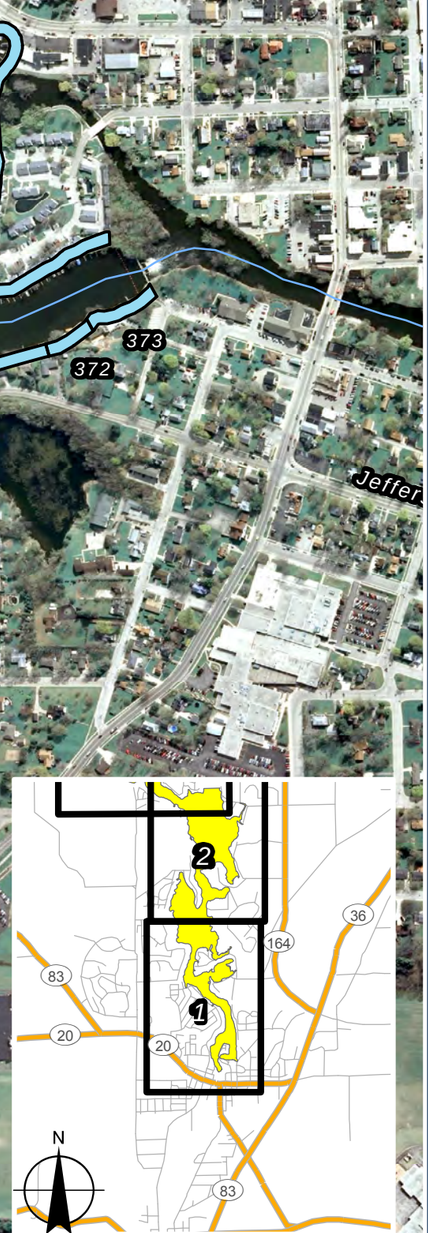
GRÄEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:07:24 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_1.mxd

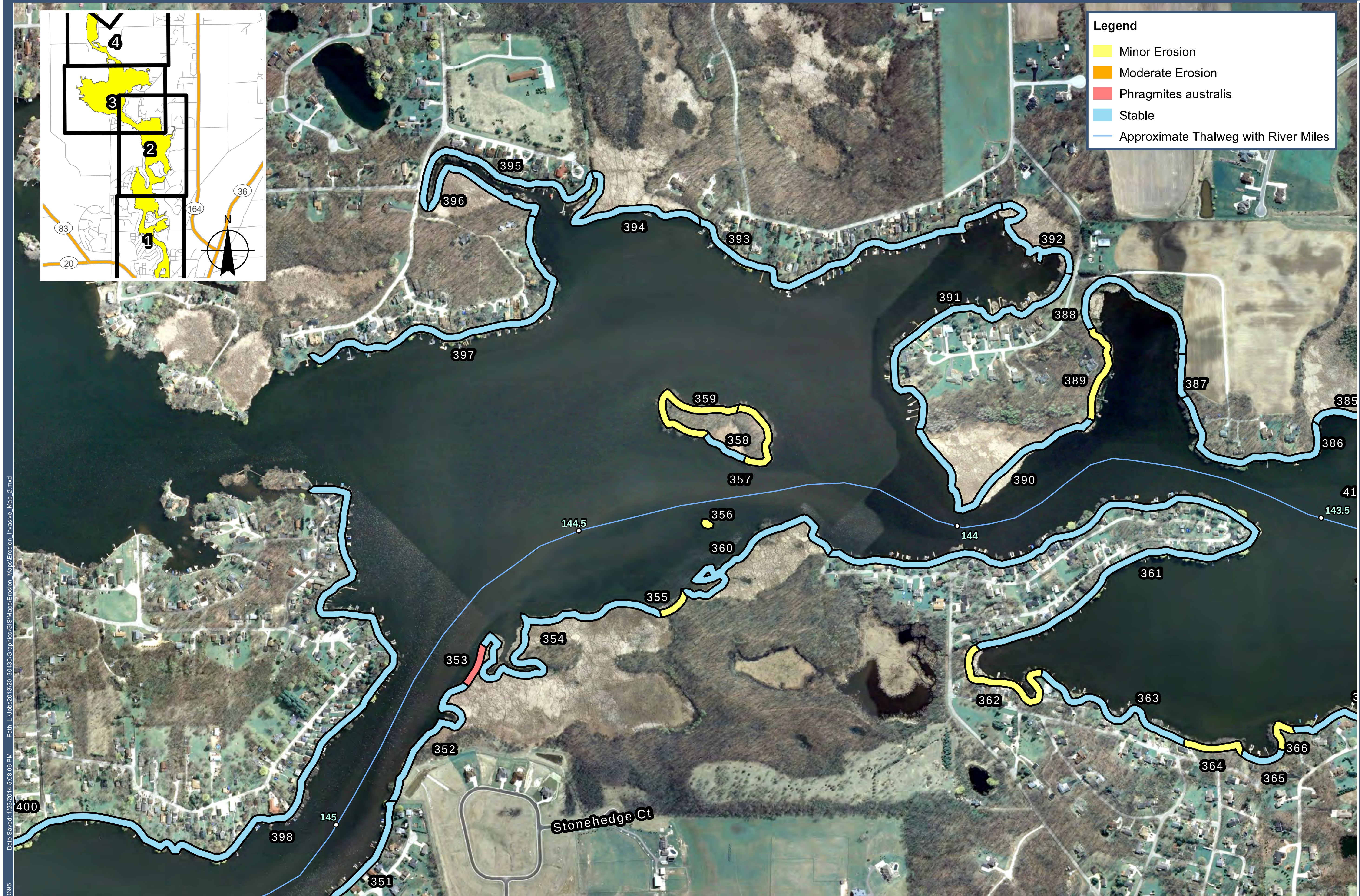


FIGURE #3-2

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 5:08:06 PM Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_2.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

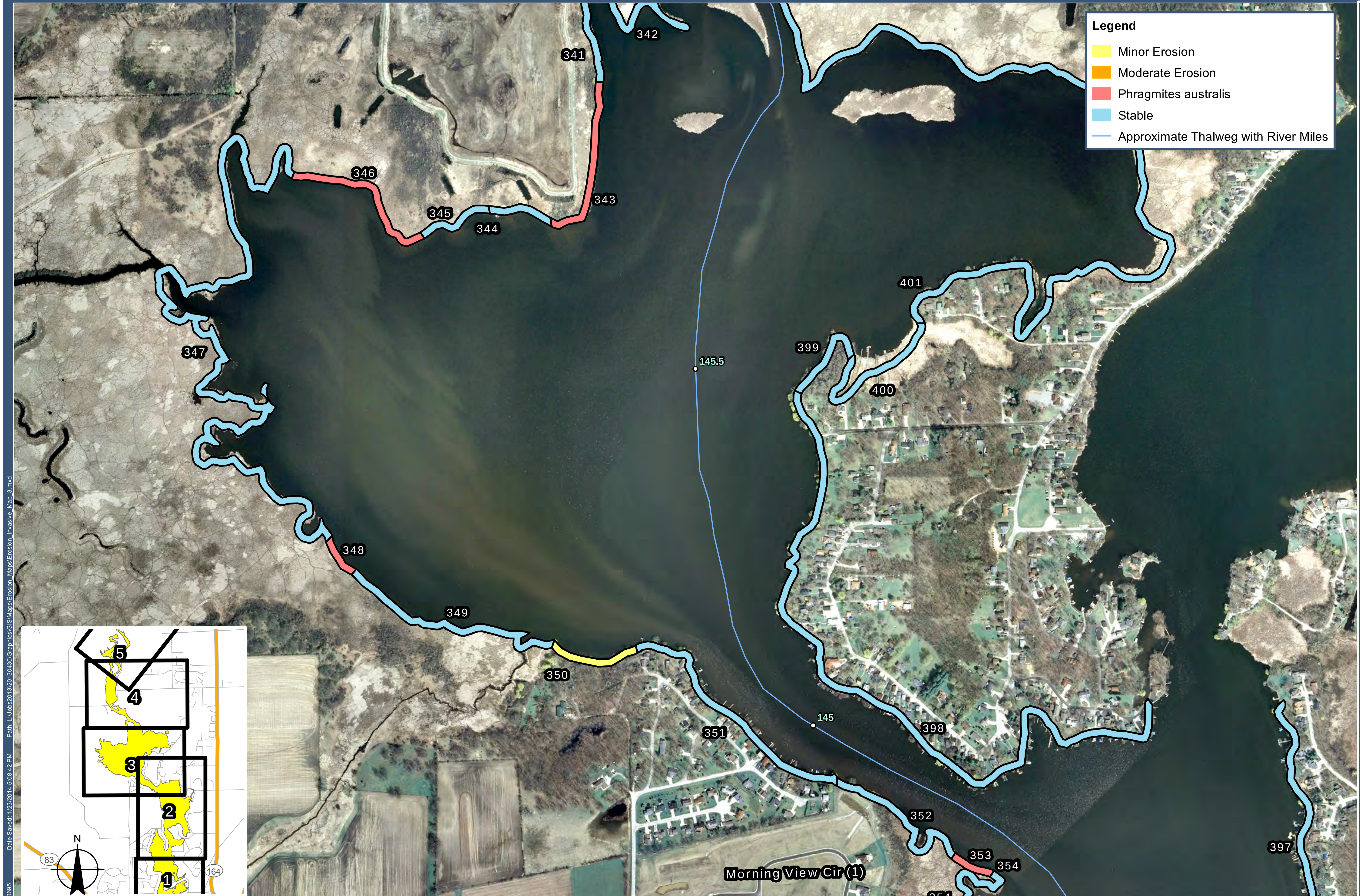


FIGURE #3-3

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600

Feet

1 in = 600 ft

Path: L:\Jobs2013\20130430\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_3.mxd

Date Saved: 1/23/2014 5:08:42 PM

User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

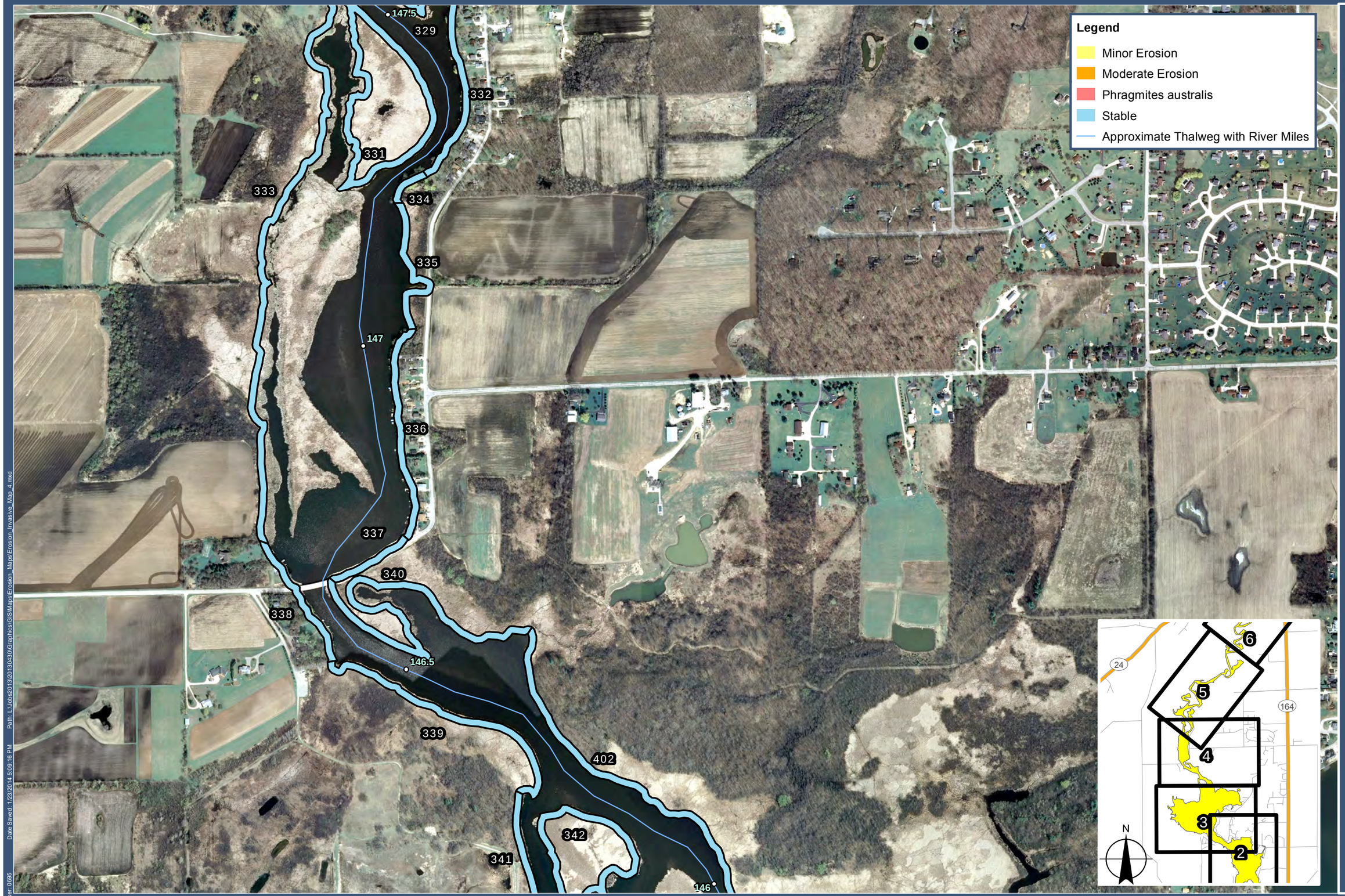


FIGURE #3-4

GRÄEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0685 Date Saved: 1/23/2014 5:09:16 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_4.mxd

Racine County

Waukesha County

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334

149.5 149 148.5 148 147.5

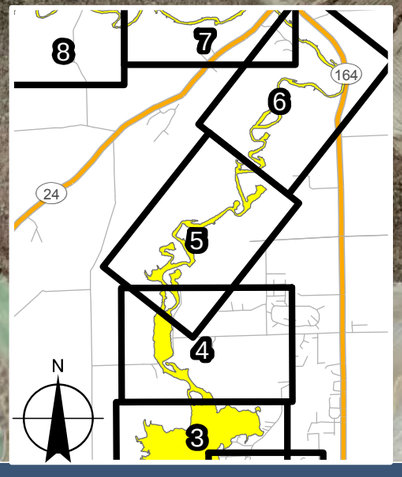


FIGURE #3-5

GRĀEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600

Feet

1 in = 600 ft

User: 0685 Date Saved: 1/24/2014 10:26:21 AM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_5.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #3-6

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

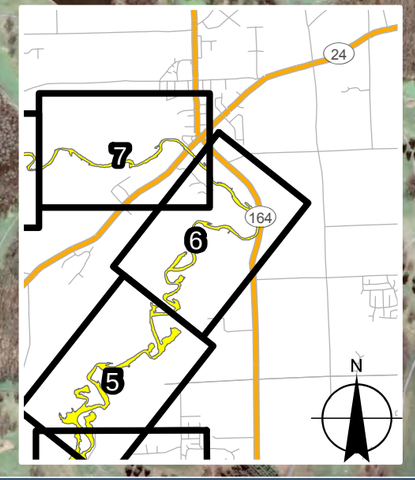
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

STH 164

Ripple Brook Ct

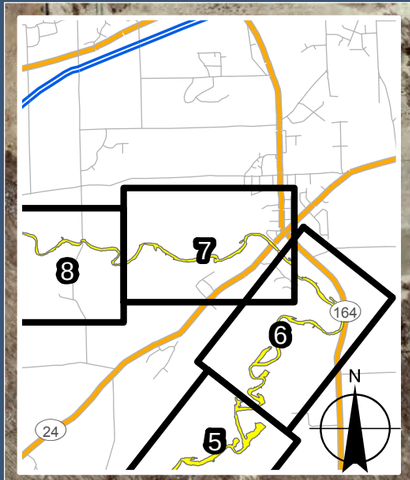


0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 5:10:21 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion_Maps\Erosion Invasive_Map_6.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ



Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

FIGURE #3-7

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 5:11:43 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_7.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #3-8

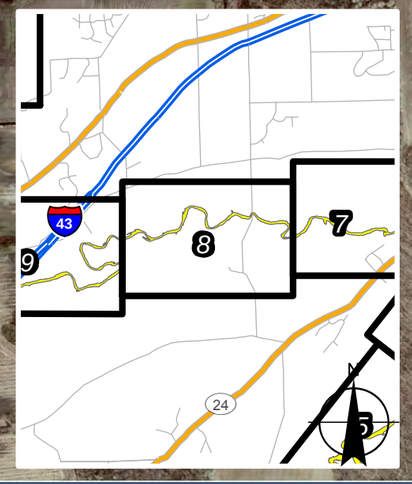
GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:09:48 PM Path: L:\Jobs\2013\2013-0430\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_8.mxd

FIGURE #3-9

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

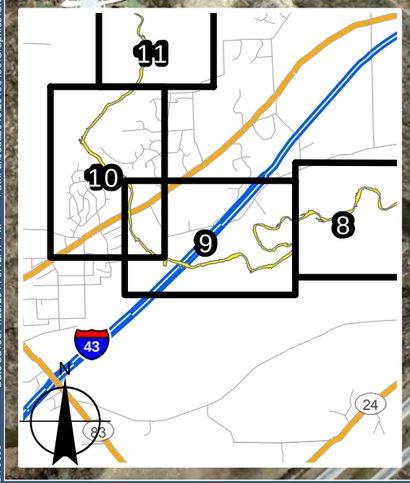
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

CTH ES
Red Fox Run
Fox River Run
Whitetail Run
Foxtail Ct
Grey Fox Trl
Edgewood Ave

189 81 192 191 193 194 195 160.5 197 196 198 199 201 200 160 202 203 204 205 206 159.5 207 208 209 210 211 212 159 213 214 215 216 217 218 158.5 158 220 221 222 223 224 225 157.5 227



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:12:47 PM Path: L:\Jobs\2013\20130430\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_9.mxd

FIGURE #3-10

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

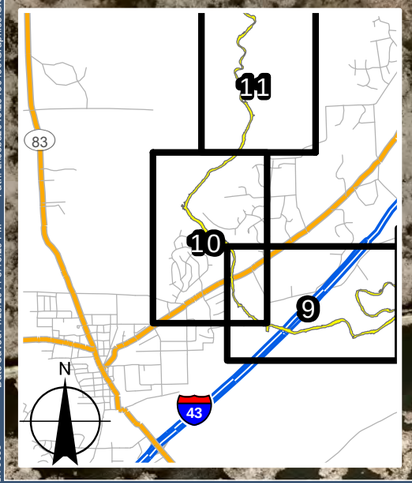
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

Edgewood Ave
Red Fox Run
Whitetail Run
Fox River Run
CTH NN
CTH ES

181 180 182 183 162 184 185 186 187 161.5 188 161 189 81 192 190 191 82A 194 193 195 160.5 197 196 198 199 200 201 202



N
0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:13:29 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion_Maps\Erosion Invasive_Map_10.mxd

FIGURE #3-11

GRAEF

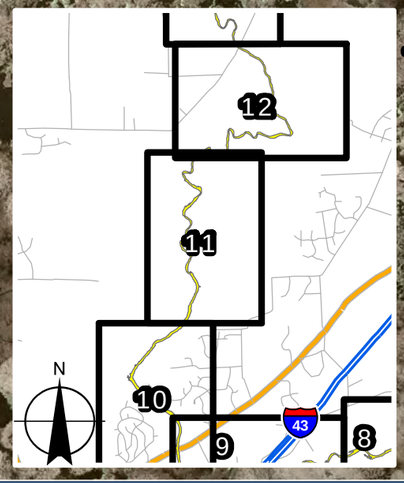
EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

147 149 150 151 152 152 164.5 153 154 155 156 157 158 159 164 161 160 164 163.5 166 162 163 165 167 168 170 169 172 171 174 163 173 176 175 177 178 162.5 179 180



N
0 150 300 600
1 in = 600 ft

Date Saved: 1/23/2014 5:15:00 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_11.mxd User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #3-12

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 5:15:33 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_12.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #3-13

GRĀEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

N

0 150 300 600

Feet

1 in = 600 ft

CTH X

User: 0695 Date Saved: 1/23/2014 5:16:40 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion_Maps\Erosion Invasive_Map_13.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #3-14

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

Huron Ln

Mohican Trl (1)

Moccasin Trl

Sauk Trl

Noquets Dr

Makou Trl

CTH I

CTH H

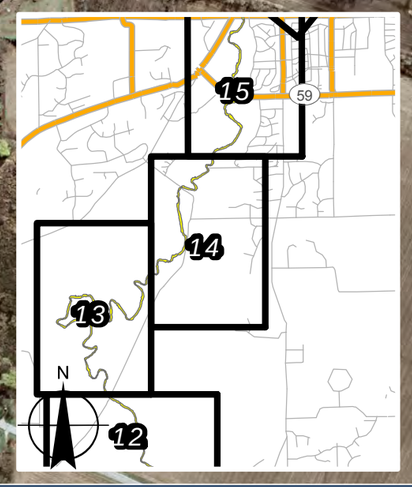
Fox Vale Ct

172.5

172

171.5

171



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00

2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:17:10 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_14.mxd

FIGURE #3-15

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

Oakdale Dr

W Sunset Dr

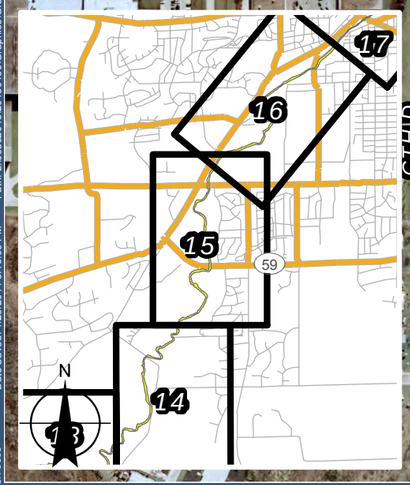
STH 59

CTH X

CTH D

37 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

174.5 174 173.5 173



N

0 150 300 600

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:16:06 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_15.mxd

FIGURE #3-16

GRAEF

EROSION AND TARGETED INVASIVE SPECIES MAP

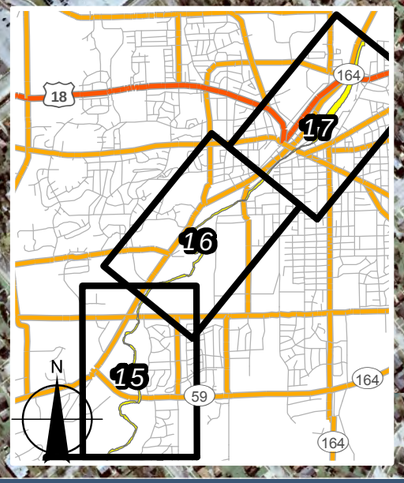
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles

N West Ave
W College Ave
W Saint Paul Ave
CTH X
Oxford Pl
Oakda

12 15 11 13 14 17 176.5 16 18 19 20 21 176 22 24 23 26 25 28 27 29 175.5 6A 30 31 32 34 33 35 36 37 175 38 39 40 41



0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 5:17:45 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Erosion Maps\Erosion Invasive Map_16.mxd

FIGURE #3-17

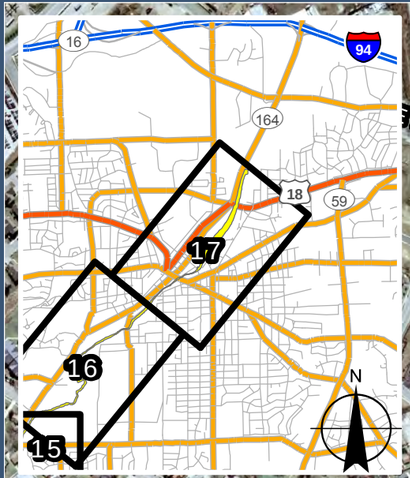
GRÄEF

EROSION AND TARGETED INVASIVE SPECIES MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Minor Erosion
- Moderate Erosion
- Phragmites australis
- Stable
- Approximate Thalweg with River Miles



E Main St
N Hartwell Ave
Arcadian Ave
N Grand Ave
N Barstow St
W Main St
White Rock Ave
Clinton St
N West A
177.5
178
4
3
2
178:5
1
5
6
7
8
9
10
177
12
11
W Sa
USH 18
NW Barstow St
Pewaukee Rd
W North St
W Moreland Blvd
USH 18
CTH J
Fairview Ave
Ame

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 5:14:29 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Erosion_Maps\Erosion_Invasive_Map_17.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-1

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

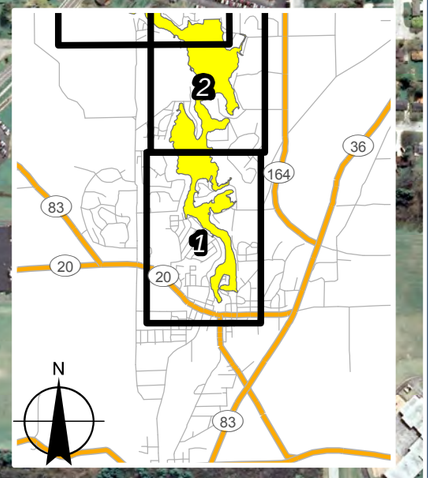
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

GRAEF

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

AE
AF
153
152
154
143
142.5
142
155
Main S
Jeffer
STH 20



N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 8:49:02 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_1.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

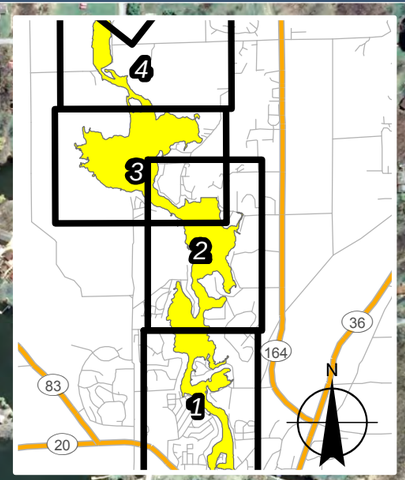


FIGURE #4-2

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

N
0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 8:50:35 AM Path: L:\Jobs\2013\2013430\Graphics\GIS\Maps\Shorelines\Shoreline_Map_2.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-3

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

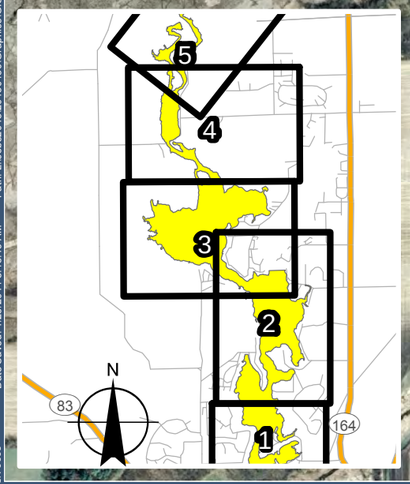
- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

145.5

145

146

Morning View Cir (1)



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 8:48:19 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shoreline\Shoreline_Map_3.mxd

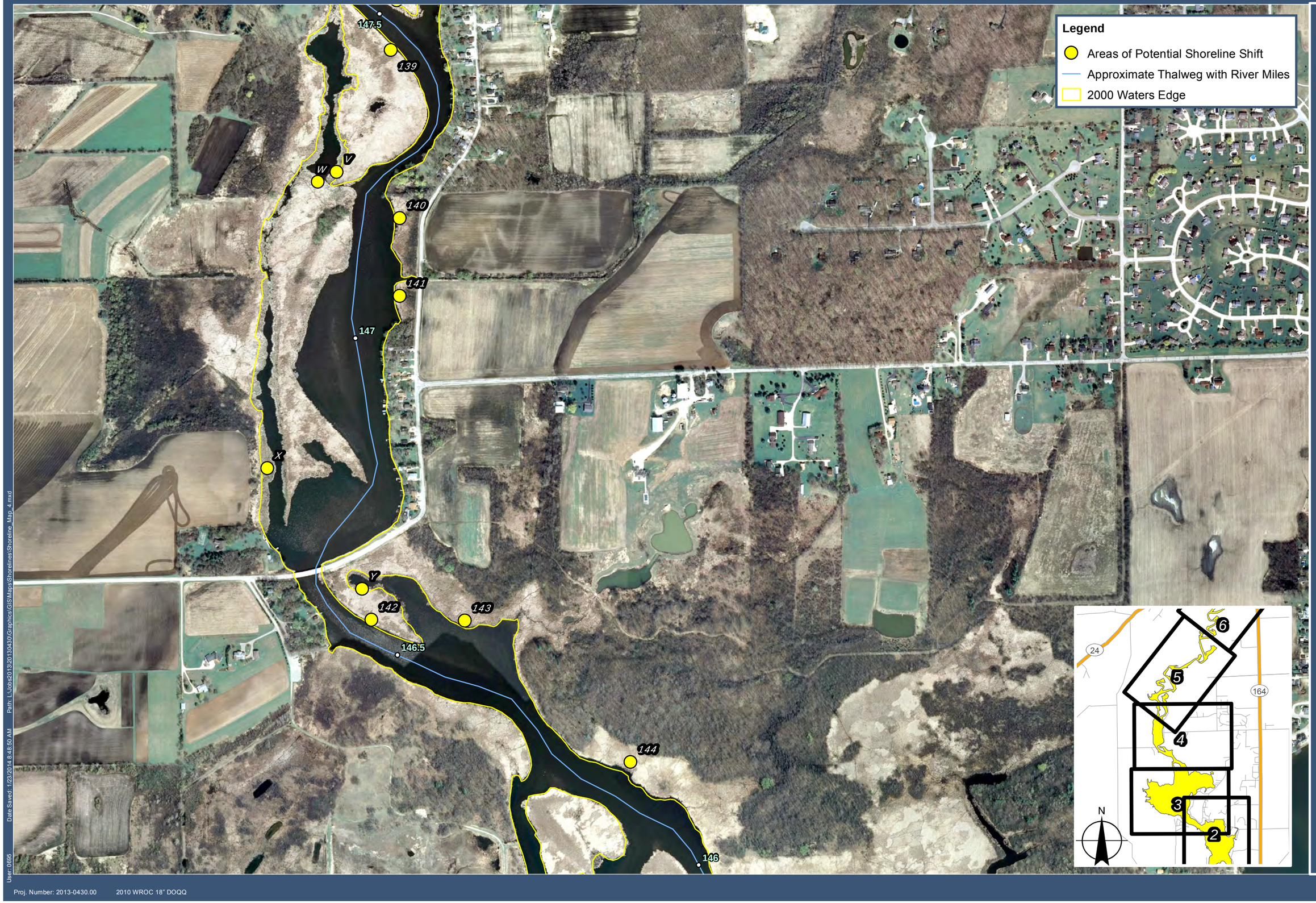


FIGURE #4-4

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

User: 0695 Date Saved: 1/23/2014 8:48:50 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_4.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

Racine County

Waukesha County

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

124 Q 125 149.5 126 127 127A 127B R 128 149 129 130 131 S 148.5 132 133 134 135 136 148 137 T 138 139 147.5 U V 140

FIGURE #4-5

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWERC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600

Feet

1 in = 600 ft

Date Saved: 1/24/2014 10:29:36 AM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Shorelines\Shoreline_Map_5.mxd User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-6

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

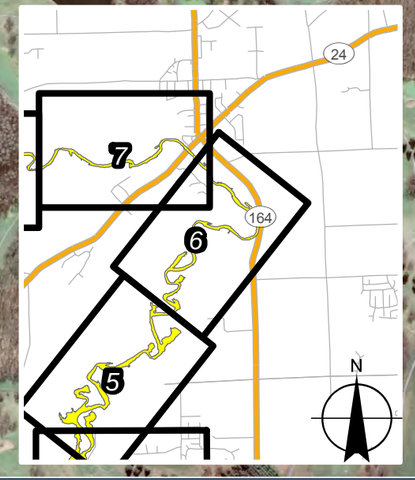
Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

STH 164

115C, 152, 115B, 115A, G, 115, H, 151.5, 116, 120, 119, 151, 117, 117A, I, 118, 114, 152.5, 122, M, L, N, P, 123, O, 150, K, 150.5, 121, 121A, J

Ripple Brook Ct



0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 8:51:06 AM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Shorelines\Shoreline_Map_6.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-7

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

106A
154.5
106
107
108
110
111
154
109
113
F
112
153.5
153
STH 1
Fox Riverwoods Dr

N

0 150 300 600

Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 8:51:46 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_7.mxd

FIGURE #4-8

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

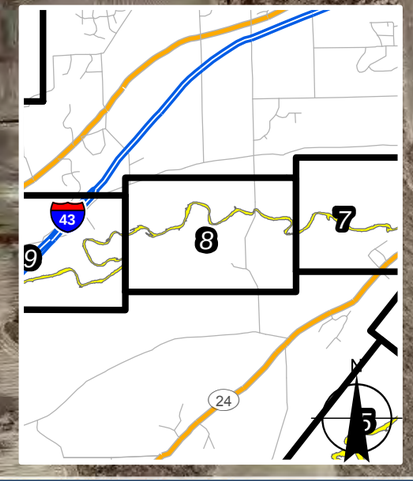
Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

95 96 97 98 99 100 101 102 103 104 105

156.5 156 155.5 155

157



N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 2/3/2014 4:39:33 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Shorelines\Shoreline_Map_8.mxd

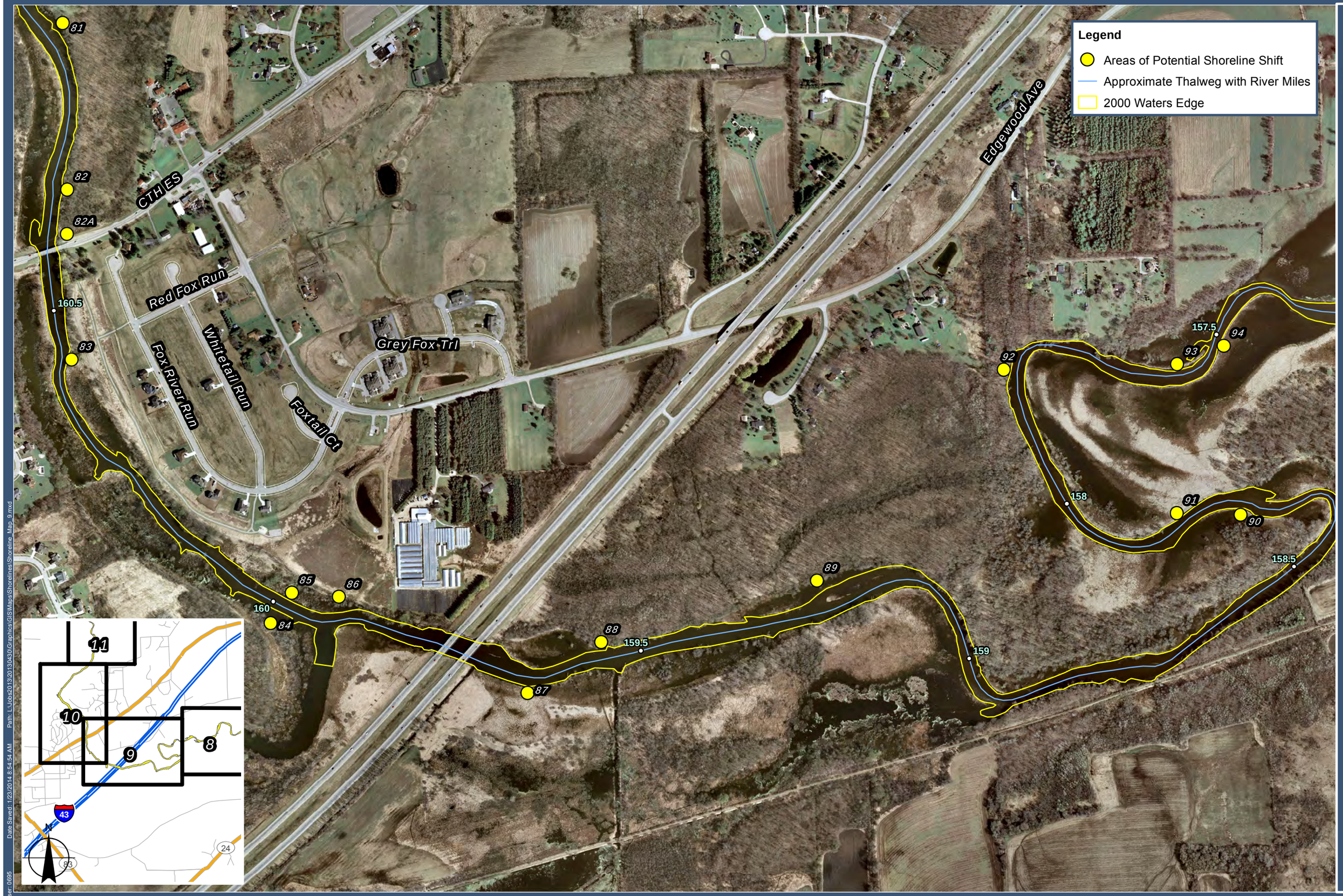


FIGURE #4-9

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 8:54:54 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_9.mxd

FIGURE #4-10

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Potential Erosion Locations
- Approximate Thalweg with River Miles
- 2000 Waters Edge

Edgewood Ave

Red Fox Run

Whitetail Run

Fox River Run

77

81

82

82A

83

160.5

161

162

80

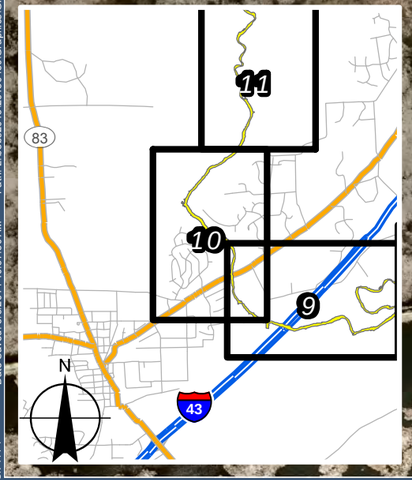
78

79

161.5

CTH ES

CTH NN



N

0 150 300 600

1 in = 600 ft

Date Saved: 3/3/2014 10:37:30 AM Path: L:\Jobs\2013\2013-0430\Graphics\GIS\Maps\Shorelines\Shoreline_Map_10.mxd User: 1774

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-11

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

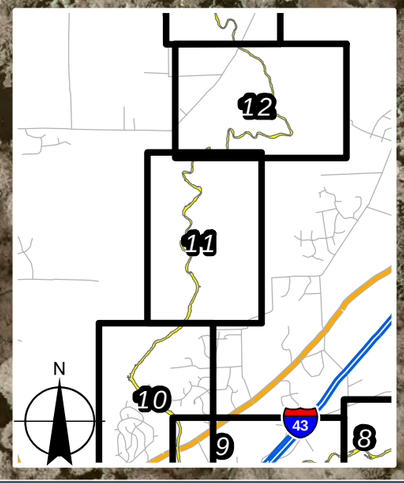
SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

58 59 60 164.5 61 62 63 64 164 65 66 67 163.5 68 67A 69 70 71 72 163 73 74 75 162.5



N

0 150 300 600

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 3:19:59 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_11.mxd

FIGURE #4-12

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0685 Date Saved: 1/23/2014 12:56:24 PM Path: L:\Jobs\2013\2013430\Graphics\GIS\Maps\Shorelines\Shoreline_Map_12.mxd

FIGURE #4-13

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

29A
30
31
29B
170.5
170
32
33
33A
B
34
169.5
35
36
36A
37
169
168.5
38
39
40
41
168
42
43
44
45
167.5
46
47
48
CTH X

N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 3:20:53 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_13.mxd

FIGURE #4-14

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 12:55:47 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_14.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #4-15

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

Oakdale Dr

W Sunset Dr

CTH XX

STH 59

CTH X

CTH ID

9 9B 9A 10 11 12 13 14 15 16 17 18 19 20

174.5 174 173.5 173

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 1774 Date Saved: 3/3/2014, 10:36:09 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_15.mxd

FIGURE #4-16

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

N West Ave

W College Ave

Oakda

Riverwalk Dr

S Prairie Ave

W Saint Paul Ave

CTH X

Oxford Pl

2

176.5

3

176

4

175.5

6A

6B

6

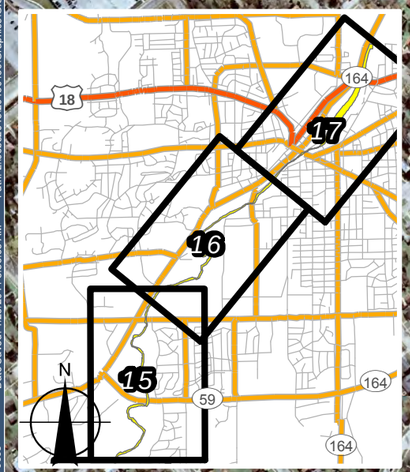
5

7

8

175

9

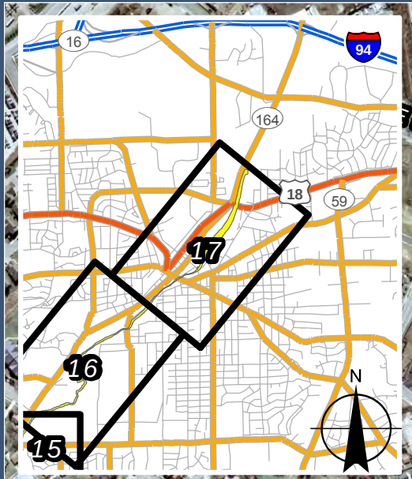


0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 8:53:35 AM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\Shorelines\Shoreline_Map_16.mxd



Legend

- Areas of Potential Shoreline Shift
- Approximate Thalweg with River Miles
- 2000 Waters Edge

E Main St
N Hartwell Ave
Arcadian Ave
N Grand Ave
N Barstow St
W Main St
White Rock Ave
Friedman Dr
Clinton St
N West A
Madison St
Riverwa
W Sa
W North St
NW Barstow St
USH 18
Pewaukee Rd
E North St
CTH F
W Moreland Blvd
CTH J
Fairview Ave
Ame
177.5
178
178.5
177
1

FIGURE #4-17

GRAEF

MAPPING OF 2000 SHORELINE LOCATION ON 2010 AERIAL IMAGERY

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 8:52:23 AM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\Shorelines\Shoreline_Map_17.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-1

GRĀEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

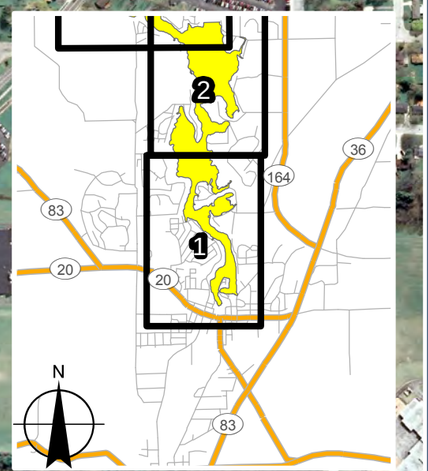
Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

142.5

142

143



N

0 150 300 600

Feet

1 in = 600 ft

Path: L:\Jobs\2013\2013-0430\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_1.mxd

Date Saved: 1/23/2014 4:20:22 PM

User: 0695

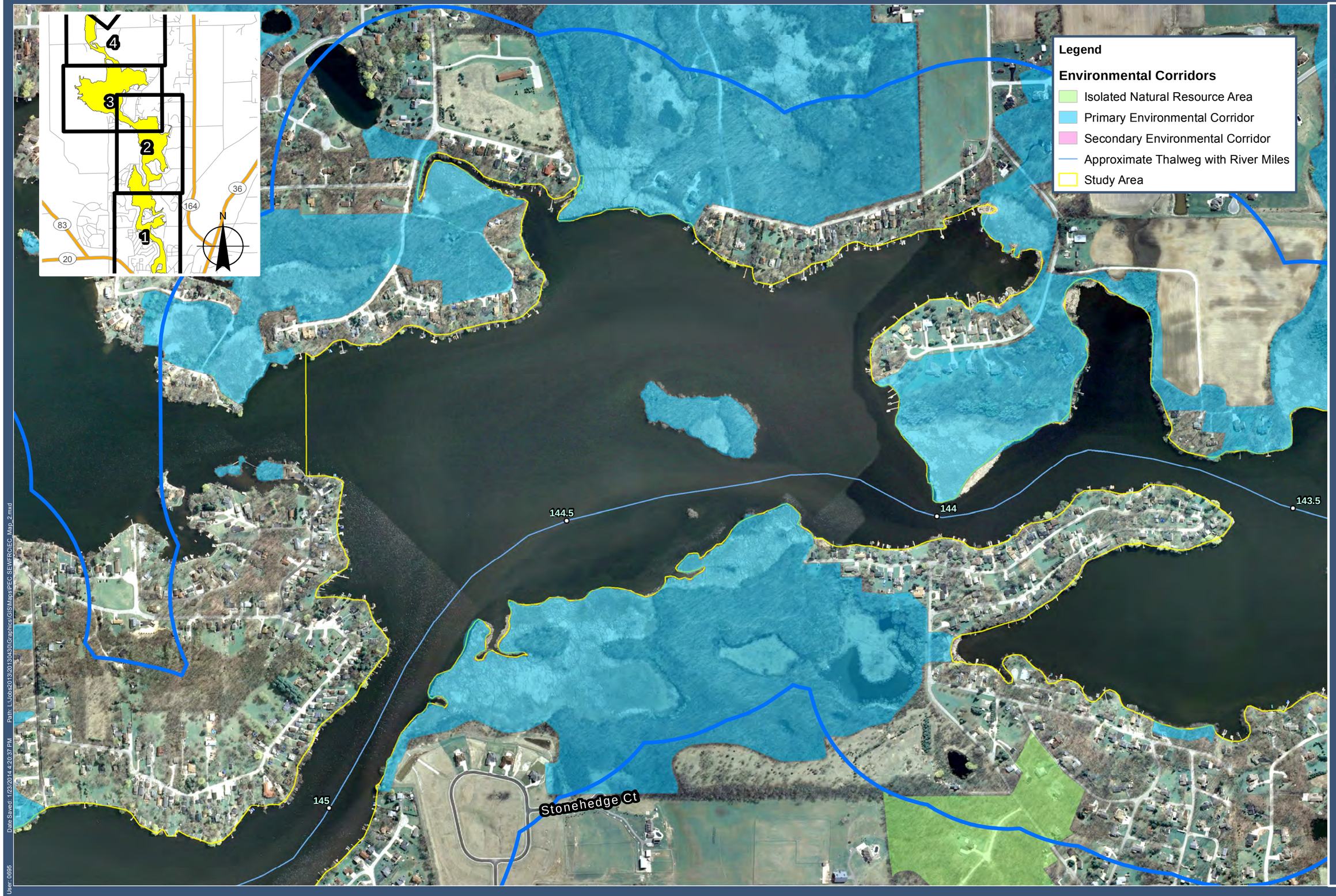
Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-2

GRĀEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN



N

0 150 300 600

1 in = 600 ft

Date Saved: 1/23/2014 4:20:37 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_2.mxd User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-3

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

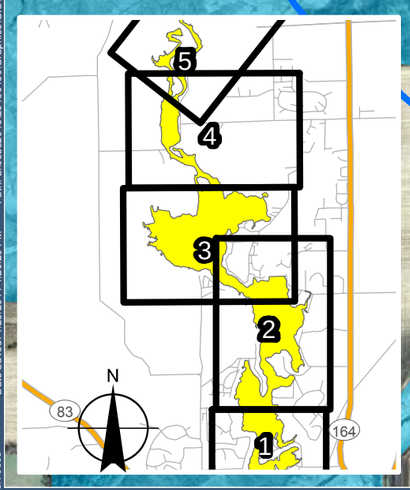
Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

145.5

145

Morning View Cir (1)



N

0 150 300 600

Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 4:20:29 PM Path: L:\Jobs\2013\20130430\Graphics\GIS\Maps\PEC SEWFRCIEC_Map_3.mxd

FIGURE #5-4

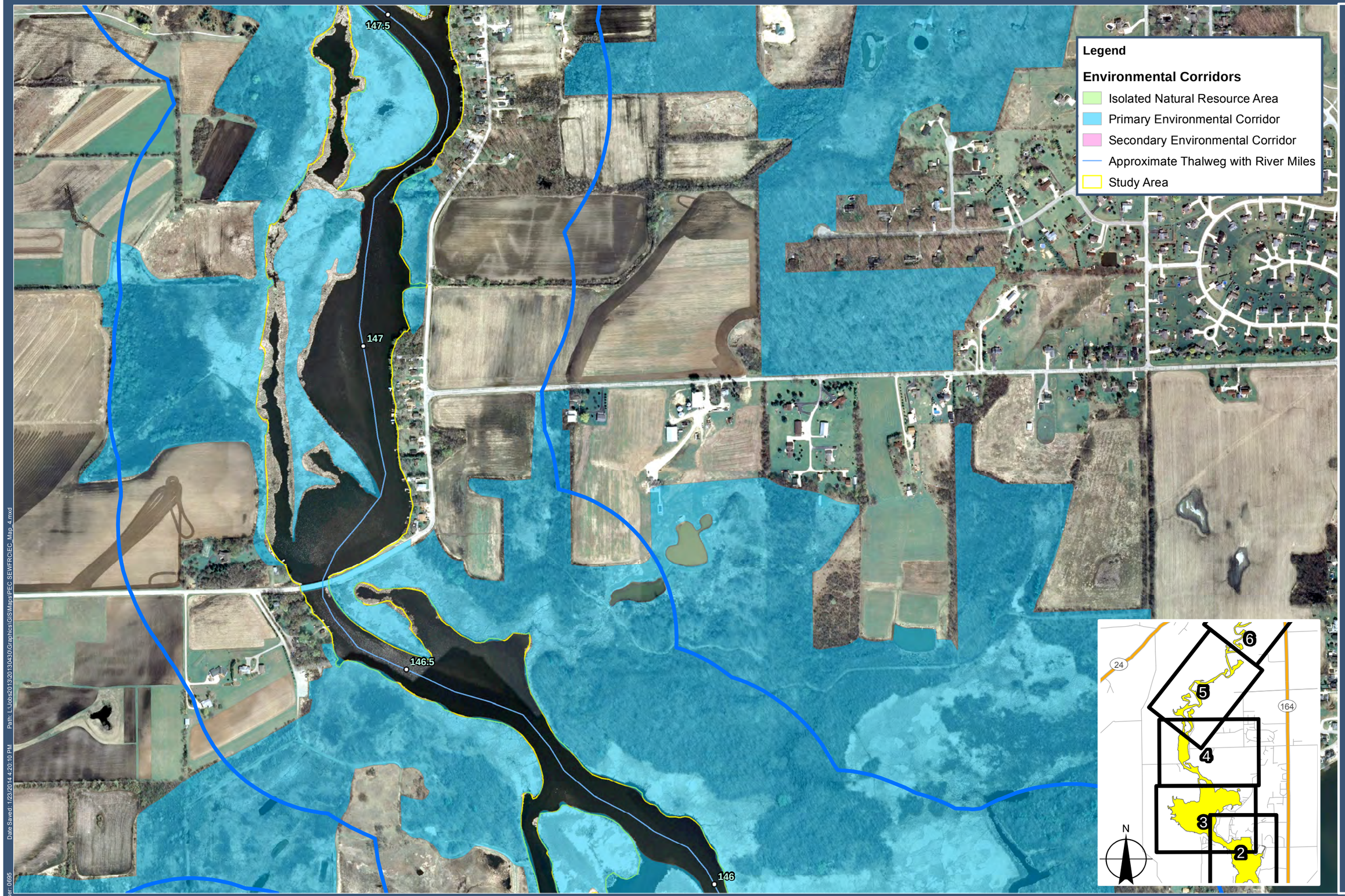
GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN



Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0685 Date Saved: 1/23/2014 4:20:10 PM Path: L:\Jobs2013\2013043O\Graphics\GISMaps\PEC SEWFRCIEC_Map_4.mxd

FIGURE #5-5

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Racine County

Waukesha County

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Arera

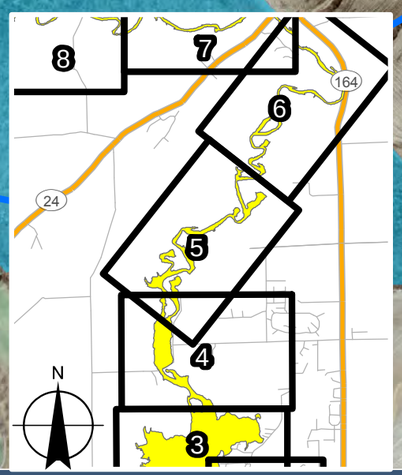
149.5

149

148

147.5

148.5



0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/24/2014 10:28:39 AM Path: L:\Jobs\2013\20130430\Graphics\GIS\Maps\PEC SEWFRCIEC_Map_5.mxd

FIGURE #5-6

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

STH 164

152

151.5

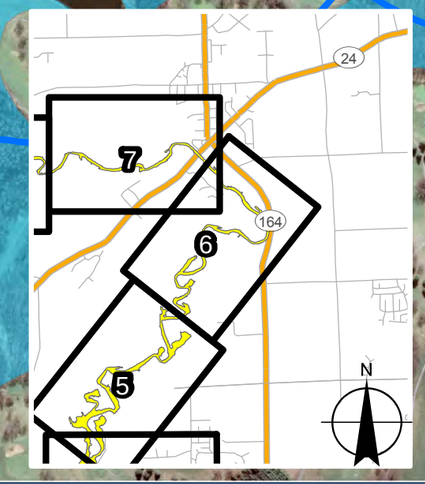
151

150.5

150

152.5

Ripple Brook Ct



0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 4:22:07 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRCEC_Map_6.mxd

FIGURE #5-7

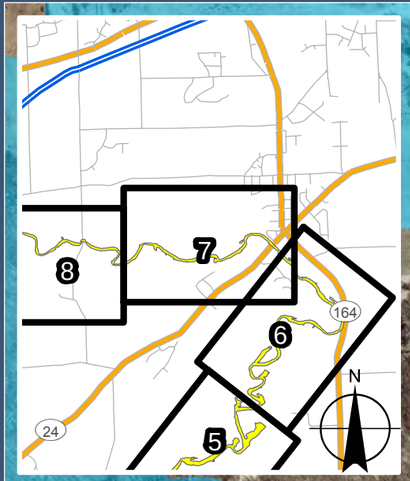
GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN



Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

154.5

154

153.5

153

STH 1

Fox Riverwoods Dr

N

0 150 300 600

Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

Date Saved: 1/23/2014 4:23:05 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_7.mxd User: 0695

FIGURE #5-8

GRĀEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

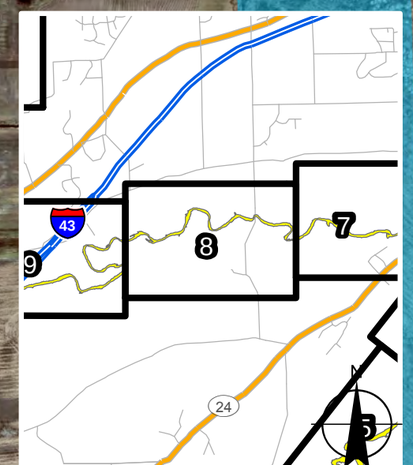
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

156.5
156
155.5
157
155



N

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 4:23:36 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_8.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-9

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

CTH ES

Red Fox Run

Fox River Run

Whitetail Run

Foxtail Ct

Grey Fox Trl

Edgewood Ave

160.5

160

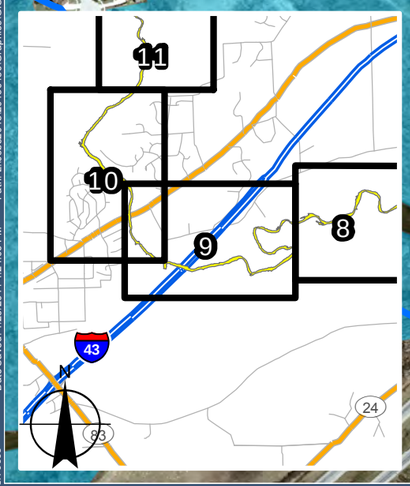
159.5

159

158.5

158

157.5



N

0 150 300 600

Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 4:24:06 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRCIEC_Map_9.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-10

GRĀEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

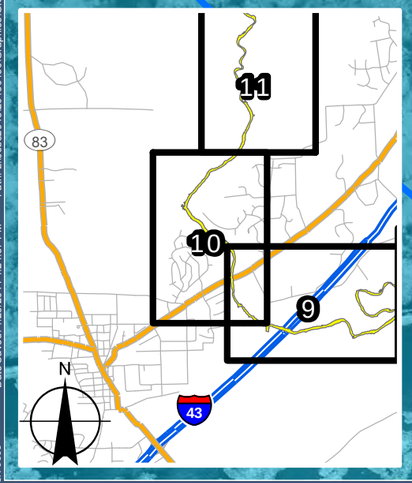
FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

Edgewood Ave
Red Fox Run
Whitetail Run
Fox River Run
160
160.5
161
161.5
162
CTH NN
CTH ES



N
0 150 300 600
Feet

1 in = 600 ft

Date Saved: 1/29/2014 4:24:57 PM Path: L:\Jobs\2013\2013043O\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_10.mxd User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-11

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

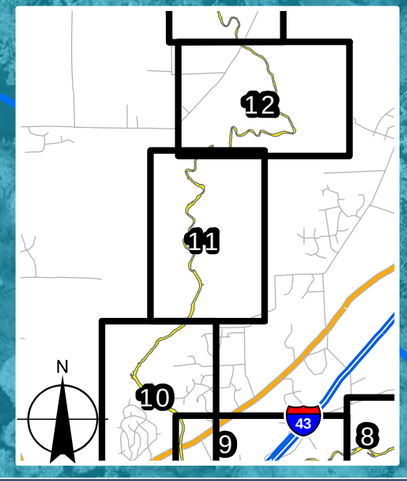
164.5

164

163.5

163

162.5



N

0 150 300 600

1 in = 600 ft

Path: L:\Jobs\2013\20130430\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_11.mxd

Date Saved: 1/23/2014 4:25:55 PM

User: 0695

Proj. Number: 2013-0430.00

2010 WROC 18" DOQQ

FIGURE #5-12

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

167

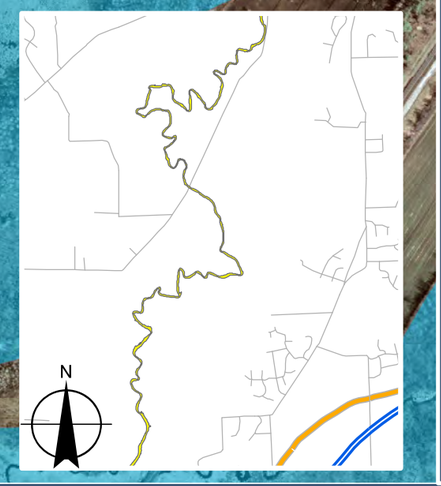
166.5

166

165.5

165

164.5



N

0 150 300 600

Feet

1 in = 600 ft

User: 0605

Date Saved: 1/23/2014 4:27:29 PM

Path: L:\Jobs\2013\2013430\Graphics\GIS\Maps\PEC SEWFRC\EC Map_12.mxd

Proj. Number: 2013-0430.00

2010 WROC 18" DOQQ

FIGURE #5-13

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

170.5
170
169.5
169
168.5
168
167.5

CTH X

N

0 150 300 600
Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 4:28:50 PM Path: L:\Jobs\2013\20130430\Graphics\GISMaps\PEC_SEWFRCEC_Map_13.mxd

FIGURE #5-14

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

Huron Ln

Mohican Trl (1)

Moccasin Trl

Sauk Trl

Noquets Dr

Makou Trl

CTH I

CTH H

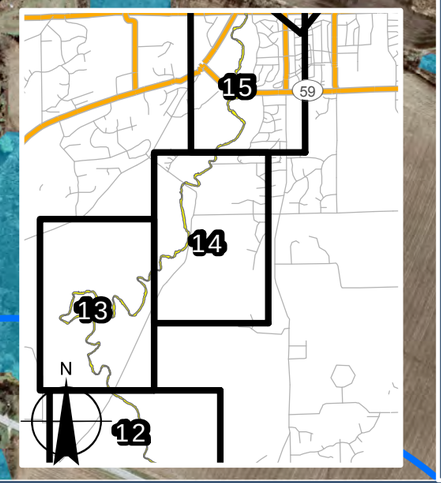
Fox Vale Ct

172.5

172

171.5

171



N

0 150 300 600

Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 4:28:02 PM Path: L:\Jobs\2013\2013-0430\Graphics\GIS\Maps\PEC SEWFRC\EC Map 14.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-15

GRĀEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

Oakdale Dr

W Sunset Dr

STH 59

CTH X

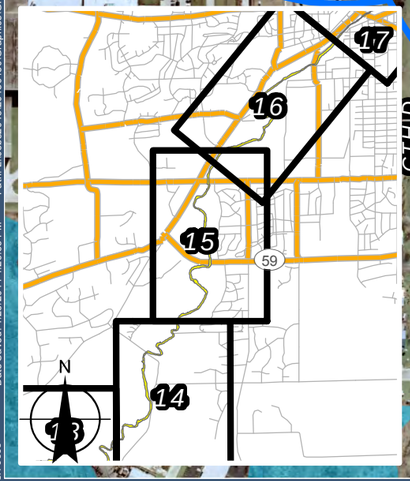
CTH D

174.5

174

173.5

173



N

0 150 300 600

Feet

1 in = 600 ft

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

User: 0695 Date Saved: 1/23/2014 4:29:35 PM Path: L:\Jobs\2013\2013430\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_15.mxd

FIGURE #5-16

GRAEF

SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER

SEWFRC RIVER BANK STUDY

WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area

N West Ave

W College Ave

Riverwalk Dr

S Prairie Ave

W Saint Paul Ave

Oxford Pl

CTH X

176.5

175.5

175

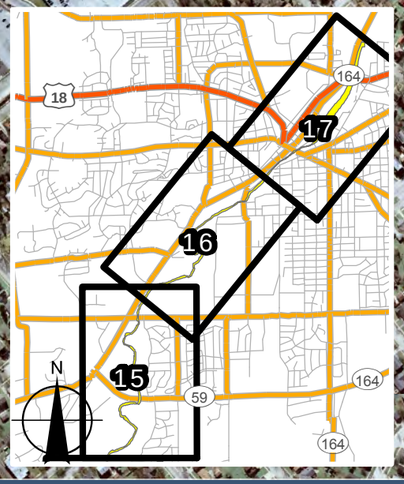
176

N

0 150 300 600

Feet

1 in = 600 ft



Date Saved: 1/23/2014 4:30:07 PM Path: L:\Jobs\2013\2013043\0\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_16.mxd User: 0695

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

FIGURE #5-17

GRAEF

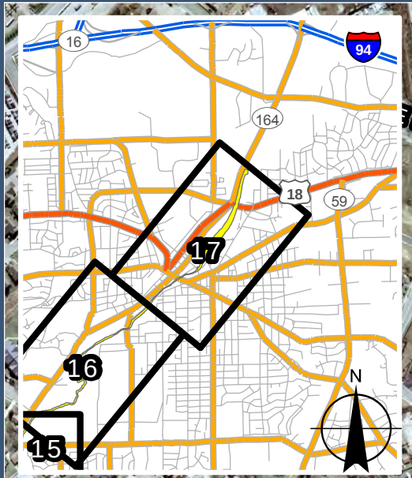
SEWRPC ENVIRONMENTAL CORRIDOR MAP

FOX RIVER
SEWFRC RIVER BANK STUDY
WAUKESHA & RACINE CO., WISCONSIN

Legend

Environmental Corridors

- Isolated Natural Resource Area
- Primary Environmental Corridor
- Secondary Environmental Corridor
- Approximate Thalweg with River Miles
- Study Area



E Main St
N Hartwell Ave
Arcadian Ave
N Barstow St
W Main St
White Rock Ave
177.5
178
Friedman Dr
Clinton St
N West A
Madison St
177
Riverwa
W Sa
NW Barstow St
USH 18
178.5
E North St
Pewaukee Rd
W North St
CTH F
W Moreland Blvd
USH 18
Fairview Ave
Ame
CTH J

0 150 300 600
Feet

1 in = 600 ft

User: 0695 Date Saved: 1/23/2014 4:30:40 PM Path: L:\Jobs\2013\20130430\Graphics\GIS\Maps\PEC SEWFRC\EC_Map_17.mxd

Proj. Number: 2013-0430.00 2010 WROC 18" DOQQ

APPENDIX B

Tables

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
1	2:1 / 3:1	wooded, scrubby	none			1	historic rip rap
2	1-2'	wooded	none			2	
3	1-2'	herbaceous veg, reed canary grass	none			3	rip rap lined, turf behind bank
4	1-3'	herbaceous veg, reed canary grass	none			4	rip rap lined, turf behind bank
5	3:1	none	none			5	boulder & cobble lined
6	3:1	none	none			6	boulder & cobble lined
7	vertical wall	none	none			7, 8, 9, 10	mixed block / concrete wall, 8' section of wall collapsed
8	3:1	wooded	none				rip rap lined
9	3:1	wooded	none			11	rip rap lined
10	vertical wall	none	none			12	concrete retaining wall
11	2'	reed canary grass	none				potentially erodible bank
12	3'	reed canary grass	erodible				potentially erodible bank, some minor undercutting
13	2'	shrubby	undercuts			13	30' of erosion
14	2'	wooded w/ shrubs	minor undercuts, minor bank erosion			14	
15	3:1	wooded	none				
16	3-4'	wooded	minor			15	exposed bank, thin tree line
17	3:1	wooded	none				
18	3:1, 1'	wooded	none				
19	2-3'	shrubby, some trees	minor undercuts			16	
20	3:1	wooded	none			17	
21	3:1	wooded	none			18	
22	4'	reed canary grass	none			19, 20	
23	terraced	reed canary grass	none			21	
24	3:1	wooded	eroding			22	exposed bank
25	3-4'	reed canary grass	none				
26	2'	wooded	none				
27	2'	wooded	minor				rip rap lined
28	3-5'	reed canary grass	significant bank erosion				
29	3-5'	reed canary grass	minor undercuts			23	
30	3-5'	reed canary grass	none				
31	3:1	reed canary grass, few trees	none				
32	3:1 / 2-3'	reed canary grass, few trees	minor bank erosion				
33	2-4'	wooded and reed canary grass	none				
34	2-3'	reed canary grass	none				
35	2-4'	wooded and reed canary grass	none				
36	1-2'	reed canary grass, few trees	none				
37	2'	reed canary grass	none			24	
38	0-2'	reed canary grass	none				
39	1-2'	reed canary grass	none				
40	3:1	wooded	none			25	
41	3-5'	wooded	minor undercuts				
42	1-2'	reed canary grass	none				
43	1-2'	wooded	none				
44	1-2'	reed canary grass	none				
45	1-2'	reed canary grass, cattails	none				
46	1-2'	wooded	minor undercuts				
47	1-3'	wooded, reed canary grass	minor undercuts				
48	1-2'	reed canary grass	none				
49	2-5'	reed canary grass	none			26	
50	0-2'	reed canary grass	none			27	
51	2-4'	wooded, scrubby, reed canary grass	minor bank erosion				
52	1-3'	scrubby, reed canary grass	minor bank erosion			28	
53	1-3'	reed canary grass	none			29	
54	1-5'	wooded	eroded vertical bank			30	
55	1-3'	wooded, reed canary grass	none				

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
56	2-3'	reed canary grass	minor undercuts				
57	1-3'	reed canary grass, few trees	none				
58	1-3'	reed canary grass, few trees and shrubs	none				
59	3:1/4:1	wooded	none				
60	2-3'	reed canary grass	minor undercuts			31	
61	0.50-2'	reed canary grass	none				
62	1-2'	wooded	undercuts				
63	1-2'	reed canary grass	none				
64	1-2'	reed canary grass	none				
65	1-3'	wooded	undercuts and bank erosions			32	some sand bags present
66	1-3'	wooded, reed canary grass	minor bank erosion				
67	1-3'	wooded, reed canary grass	undercuts				
68	0.50-2'	reed canary grass	none				
69	2-4'	reed canary grass	undercuts				
70	2-3'	reed canary grass	none			33	
71	4-5'	wooded	significant bank erosion			34	
72	2-3'	reed canary grass	none				
73	1-3'	reed canary grass	none			35	
74	4-7'	reed canary grass	significant bank erosion			36	
75	1-3'	reed canary grass	minor undercuts			37	
76	1-2'	reed canary grass	none			38	
77	1-2'	reed canary grass	minor undercuts				
78	3:1	wooded, reed canary grass	none				
79	2-3'	reed canary grass	minor undercuts				
80	2-3'	reed canary grass	none				
81	2-3'	reed canary grass	none				
82	2-3'	reed canary grass	minor undercuts, minor bank erosion				
83	2-4'	reed canary grass	minor bank erosion				
84	2-3'	reed canary grass	minor undercuts				
85	2-3'	reed canary grass	undercuts and bank erosion			39	
86	1-3'	reed canary grass	none			40	
87	2-3'	reed canary grass, wooded, scrubby	minor undercuts, minor bank erosion				
88	2-3'	reed canary grass, few silver maples	minor bank erosion				
89	1-3'	wooded	spots of bank erosion				
90	1-2'	wooded, reed canary grass	minor undercuts			41, 42	
91	1-2'	wooded, reed canary grass	minor undercuts, minor bank erosion				
92	1-3'	wooded	eroded bank			43	
93	1-3'	reed canary grass	minor bank erosion			44	
94	2-3'	reed canary grass	minor bank erosion				
95	1-3'	reed canary grass	none				
96	1-2'	wooded, reed canary grass	none				
97	1-3'	reed canary grass	none			45, 46	mud flat present
98	2-4'	reed canary grass	minor bank erosion			47	
99	3:1	wooded	minor undercuts, minor bank erosion			48	
100	0.50'/ 8:1	wooded	none			49	
101	1-3'	reed canary grass, scrubby	minor undercuts			50	
102	2-3'	reed canary grass	undercuts, bank erosion			51	
103	2-4'	reed canary grass	bank erosion			52	
104	1-3'	reed canary grass	none				
105	0.50-1'	reed canary grass	none				
106	1-2' / 3:1	wooded	bank erosion				
107	1-3'	reed canary grass	minor bank erosion				
108	1-3'	reed canary grass, scrubby	minor bank erosion			53	potential location for buffer between bank and ag field
109	0.50-1'	wooded, reed canary grass	none				
110	1-3'	wooded, reed canary grass	minor bank erosion			54	

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
111	4-6' / 2-3'	wooded	significant bank erosion, exposed bank in portion of section			55, 56, 57, 58	potential priority project
112	1-3'	wooded, reed canary grass	none			59	
113	1-3'	reed canary grass	minor bank erosion			60	
114	2-4'	wooded, reed canary grass	minor undercuts				
115	1-3'	reed canary grass	minor undercuts			61	
116	1:1	wooded	exposed bank, some significant erosion			62	
117	2-4'	reed canary grass	bank erosion				
118	0.50-2'	reed canary grass	none				some mud flats
119	2-3'	reed canary grass	minor undercuts				
120	2-4'	reed canary grass	minor bank erosion				
121	2-3'	reed canary grass	minor bank erosion				
122	4-6'	wooded	bank erosion			63	
123	2-3'	reed canary grass, few trees	bank erosion				
124	2-3'	reed canary grass	none			64	
125	2-3'	reed canary grass	minor bank erosion			65	
126	4-6'	reed canary grass	bank erosion			66, 70	
127	2-4'	reed canary grass	minor bank erosion				
128	1-3'	reed canary grass	spotty minor bank erosion			71, 72	
129	1-3'	wooded, scrubby	spots of significant bank erosion				
130	2-3'	wooded, reed canary grass	spotty minor bank erosion			73	
131	2-4'	reed canary grass, few trees	none	Phragmities	50-200 stems		
132	2-4'	reed canary grass	none	Phragmities	25-50 stems		
133	2-4'	reed canary grass, few trees	minor bank erosion				
134	2-4'	reed canary grass, few trees	none				
135	2-4'	reed canary grass	none	Phragmities	500 - 100 stems	74, 75	abundant Phragmities beyond bank
136	2-4'	reed canary grass	none				some rip rap
137	3:1	reed canary grass	none			76	rip rap armored shore
138	2-4'	reed canary grass	none	Phragmities	50-200 stems		sporadic rip rap
139	2-4'	reed canary grass	none	Phragmities	500+ stems		distant from shoreline is cattails
140	0	cattails	none				
141	0	none	none				sandy deposition, mud flat
142	1-3'	reed canary grass, river bulrush	none				
143	2-4'	reed canary grass	none				
144	0	none	none				mud flat
145	2-4'	reed canary grass	none	Phragmities	500+ stems		
146	2-3'	reed canary grass	spots of minor bank erosion			77	
147	1-3'	reed canary grass	none	Phragmities	50-200 stems		
148	1-3'	reed canary grass	none	Phragmities	50-100 stems		
149	6-8'	none	significant bank erosion			78	potential priority project
150	2-3'	reed canary grass	none	Phragmities	50-200 stems	79	
151	2-6'	wooded, scrubby	minor bank erosion				some tree falls
152	2-3'	reed canary grass	none	Phragmities	500+ stems		patchy stands of Phragmities
153	2-3'	reed canary grass	none	Phragmities	500+ stems		patchy stands of Phragmities
154	2-3'	reed canary grass	none	Phragmities	50-200 stems		
155	1-3'	reed canary grass	none	Phragmities	50-200 stems		
156	1-3'	reed canary grass, cattails	none			80	
157	1-3'	reed canary grass	none			81	
158	1-2'	reed canary grass	none				
159	0-2'	reed canary grass, cattails	none				
160	0-1'	reed canary grass, cattails	none	Phragmities	50-200 stems		
161	0-1'	reed canary grass, cattails	none	Phragmities	200-500 stems		
162	0-1'	cattails	none	Phragmities	1000+ stems		
163	1-2'	reed canary grass	none	Phragmities	50-200 stems		
164	0-1'	cattails, sparse reed canary grass	none				
165	0-1'	cattails, river bulrush	none			82	

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
166	1-2'	reed canary grass	none	Phragmities	50-200 stems	83	
167	0'	cattails	none				
168	1-2'	reed canary grass	none	Phragmities	500+ stems		
169	1-2'	reed canary grass	none	Phragmities	500+ stems		
170	0'	river bulrush	none	Phragmities	500 + stems		
171	1-2'	reed canary grass	none	Phragmities	500+ stems		
172	0'	cattails	none				
173	0-1'	cattails, some reed canary grass	none				
174	0-1'	cattails, some reed canary grass	none	Phragmities	50-200 stems		
175	0-1'	reed canary grass, cattails	none	Phragmities	50-200 stems		
176	0-1'	reed canary grass, cattails	none	Phragmities	50-200 stems		
177	0'	cattails	none				
178	1-2'	reed canary grass	none	Phragmities	50-200 stems		
179	1-2'	reed canary grass	none	Phragmities	50-200 stems		
180	0-1'	cattails, sparse reed canary grass	none				
181	1-3'	wooded, reed canary grass	none				
182	1-2'	reed canary grass	none	Phragmities	500+ stems		
183	0-2'	cattails, reed canary grass, few trees	none				
184	1-2'	wooded, reed canary grass	none	Phragmities	50-100 stems	84	
185	0-2'	reed canary grass, cattails, few trees	none	Phragmities	50-100 stems		
186	1-2'	wooded, reed canary grass	none				3:1 slope inland at forested land
187	0'	cattails, reed canary grass, few trees	none				beaver lodge
188	0-2'	reed canary grass, cattails, few trees and shrubs	none				
189	1-2'	reed canary grass, few trees and shrubs	none			85	
190	1-2'	reed canary grass	none	Phragmities	50-200 stems	86	
191	1-2'	reed canary grass	none			87	
192	1-2' / 3:1	reed canary grass, wooded away from bank	none				
193	3:1	none	potentially erodible			88	exposed soil access road, potential erosion
194	1-2'	willows, reed canary grass	none				
195	vertical wall	none	retaining wall falling into water			89	
196	1-2'	reed canary grass, few willows	none				
197	1-2'	reed canary grass, few trees and willows	none				
198	1-2'	reed canary grass	none	Phragmities	50-100 stems		
199	1-2'	wooded, reed canary grass	none				
200	1-2'	reed canary grass, cattails, few trees and willows	none			90	
201	1-2'	reed canary grass, willows	none			91	
202	1-2'	reed canary grass, willows, few trees	none				
203	1-2'	reed canary grass, cattails	none				
204	0-2'	reed canary grass, few cattail and rushes	none				
205	1-2'	reed canary grass, few trees	none			92	
206	1-2'	reed canary grass, wooded away from bank	none				
207	0-2'	reed canary grass, few trees and willows	none				
208	1-2'	reed canary grass, few trees	none				>200 ' from shoreline is wooded
209	1-2'	reed canary grass	none	Phragmities	50-100 stems	93	
210	1-3'	wooded	none				
211	3-4'	wooded	bank erosion			94	
212	1-3'	wooded, reed canary grass	none				
213	0-1'	reed canary grass	none				
214	0-1'	reed canary grass, few trees	none				
215	0-1' / 4:1	wooded	none				
216	0-1'	wooded, reed canary grass	none				
217	0-1'	reed canary grass, wooded	none				
218	1-2'	reed canary grass, few trees	none				
219	2-4'	turf grasses, few trees	bank erosion			95	park area
220	0-2'	wooded, reed canary grass	none				

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
221	0-2'	wooded, reed canary grass	none				
222	2-6'	wooded, reed canary grass	bank erosion, undercuts			96, 97	
223	3:1	wooded, reed canary grass	none				
224	0-1'	reed canary grass, cattails, rushes	none				
225	1-2'	wooded, reed canary grass	none			98	
226	0-1'	reed canary grass, cattails, rushes	none			99	
227	0-1'	reed canary grass, cattails, rushes	none				
228	1-2'	reed canary grass	none			100	
229	3:1	wooded, scrubby	minor bank erosion				potential corridor expansion beyond shoreline
230	NA	reed canary grass	none	Phragmities	50-200 stems	101	
231	4:1	wooded, reed canary grass	none				
232	1-2'	reed canary grass, few willows	none				upslope farmed
233	2-3'	wooded, reed canary grass	bank erosion			102	
234	1-2'	reed canary grass	none				
235	1-2'	reed canary grass	none	Phragmities	50-100 stems		
236	1-3'	turf grasses, reed canary grass	bank erosion				rip rap, 20' buffer strip from exposed soils, land used as animal farm
237	0-1'	reed canary grass, cattails	none			103, 104	
238	1-4'	wooded, scrubby	bank erosion			105	
239	0-1'	reed canary grass, cattails	none			106	
240	6:1	wooded, scrubby, reed canary grass	none				potentially restorable corridor/wetland (farmed wetland)
241	0-1'	reed canary grass	none				
242	3:1	none	gully erosion				rudimentary boat launch
243	1-2'	reed canary grass, scrubby	none				
244	0-2'	reed canary grass, few trees and shrubs	none				
245	1-2'	reed canary grass	none	Phragmities	50-100 stems		
246	0-2'	reed canary grass, few cattails	none				
247	2-3'	wooded	bank erosion				
248	2-4'	wooded	minor bank erosion				
249	0-2'	reed canary grass, few trees	none			107	
250	2-4'	wooded, reed canary grass	significant bank erosion			108	
251	1-3'	wooded, reed canary grass	minor spotty bank erosion				
252	1-2'	reed canary grass, few trees	none				
253	1-2'	reed canary grass	none				
254	1-2'	wooded, reed canary grass	none			109	
255	1-2'	reed canary grass, few trees	none				
256	0-2'	reed canary grass, few trees and willows	none				
257	3:1	reed canary grass, few trees and willows	none			110	
258	3:1	50' reed canary grass buffer prior to turf	potentially erodible				
259	1-2'	wooded, mowed turf	none			111	
260	2-3'	reed canary grass	none				
261	1-3'	scrubby, reed canary grass	none				
262	1-2'	reed canary grass	none				
263	1-2'	reed canary grass, few trees and willows	none			112	
264	1-2'	reed canary grass	none	Phragmities	500 - 1000 stems	113	
265	0-2'	cattails, reed canary grass	none				
266	2'	wooded, turf grass	minor bank erosion			114, 115	
267	2-3'	turf grass behind rip rap	none				rip rap lined shore
268	1-2'	reed canary grass, few trees and shrubs	none				
269	1-3'	turf grass behind rip rap	none				rip rap lined shore
270	0-3'	reed canary grass, few trees and shrubs	none				
271	3:1	wooded	none			116	some rip rap lined
272	1-3'	wooded, scrubby, reed canary grass	none				
273	3:1	wooded	none			117	
274	1-2'	partially wooded	none				
275	1-3'	wooded	minor bank erosion			118	

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
276	1-2'	reed canary grass, cattails	none				
277	1-4'	wooded, scrubby	none				
278	3:1 / 4:1	wooded, reed canary grass	none				
279	1:1 / 2:1	wooded	exposed bank, undercuts			119, 120, 121	susceptible to erosion along road
280	1-2'	wooded, turf grass	none			122	
281	3-Jan	none	none				rip rap lined shore
282	1-3'	reed canary grass, few trees and shrubs	none				
283	0-3'	reed canary grass, cattails	none				
284	1-3'	reed canary grass	none				>20' from shore is wooded
285	1-3'	wooded, reed canary grass	none			123	
286	1-3'	reed canary grass	minor bank erosion				
287	4:1	wooded	none				
288	0'	cattails	none			124	
289	2-3'	scrubby	none			125	potential candidate for buffer
290	1-3'	reed canary grass, few shrubs	minor bank erosion			126	
291	0-2'	reed canary grass, cattails, rushes	none			127, 128	
292	1-3'	reed canary grass, few shrubs	minor bank erosion			129	
293	1-3'	reed canary grass	none	Phragmities	500 - 1000 stems		
294	1-2'	reed canary grass, few trees	none				
295	1-3'	reed canary grass	none			130	
296	0-2'	reed canary grass, cattails	none	Phragmities	1000+ stems	131	
297	2-3'	turf grass	none				rip rap lined shore
298	1-2'	reed canary grass	none			132	
299	0-1'	cattails, sparse reed canary grass	none			133	
300	0-1'	reed canary grass, cattails	none	Phragmities	1000+ stems		
301	0'	cattails	none				
302	1-2'	reed canary grass, cattails	none				
303	0'	cattails	none				
304	0'	cattails	none				
305	1-2'	reed canary grass, cattails	none			134	
306	5-7'	wooded	bank erosion, undercuts			135	
307	4:1 / 2-3'	wooded, scrubby	none				
308	0'	cattails	none				
309	1-3'	wooded, scrubby, reed canary grass	none				
310	1-2'	wooded, scrubby	minor undercuts			136	
311	0-1'	cattails, reed canary grass	none			137	
312	1-2'	reed canary grass	none				
313	8'	wooded	significant bank erosion			138	
314	1-3'	reed canary grass	none	Phragmities	500 - 1000 stems		
315	0'	cattails	none			139	
316	2-4'	wooded	undercuts				
317	1-3'	wooded, scrubby	none				
318	0-3'	cattails	none				
319	0'	cattails	none				
320	2-4'	scrubby	none			140	
321	0-3'	cattails, shrubs	none				
322	1-3'	cattails, reed canary grass, few shrubs	none	Phragmities	200-500 stems	141	
323	0-1'	cattails, reed canary grass	none				
324	1-3'	cattails, reed canary grass	none	Phragmities	200-500 stems	142	
325	0'	cattails	none			143	
326	0-1'	cattails, few trees	none				
327	0'	cattails	none				
328	0-1'	shrubs, cattails, reed canary grass	none				
329	0'	cattails	none				
330	1-3'	turf grass buffer	none				rip rap lined shore

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
331	0'	cattails	none				
332	1-3'	NA	none				developed shoreline, mixed armoring
333	0'	cattails	none				
334	2-3'	partially wooded	none				developed shoreline, mixed armoring
335	0'	cattails	none				
336	1-2'	turf grass behind rip rap	none				developed shoreline, mixed armoring
337	1-2'	turf grass behind rip rap	none				developed shoreline, mixed armoring
338	1-2'	turf grass behind rip rap	none				developed shoreline, mixed armoring
339	0'	cattails	none				
340	0'	cattails	none				
341	0-2'	cattails, wooded	none				
342	0'	cattail	none				
343	1-3'	scrubby, reed canary grass	none	Phragmities	500-1000 stems	144, 145	
344	0-2'	cattails, reed canary grass, few shrubs	none				
345	0'	cattails	none				
346	0'	cattails, purple loosestrife	none	Phragmities	200-500 stems		
347	0'	cattails, purple loosestrife	none				
348	0'	cattails, purple loosestrife	none	Phragmities	50-100 stems		
349	0'	cattails, purple loosestrife	none				
350	1-3'	wooded	minor bank erosion				
351	1-3'	developed	none				mixed armoring
352	0'	cattails, purple loosestrife	none				
353	0'	cattails, purple loosestrife	none	Phragmities	50-100 stems		
354	0'	cattails	none				
355	2-3'	wooded	bank erosion, undercuts				
356	1-3'	wooded	minor erosion				
357	4-7'	wooded, scrubby	bank erosion				
358	0'	cattail, purple loosestrife	none				
359	3:1	wooded	minor bank erosion				
360	0'	cattails	none				
361	2-3'	developed	none				mixed armoring
362	2-4'	wooded	minor bank erosion				
363	2-3'	developed, some woody vegetation	none				mostly rip rap lined
364	3:1, 2-3'	wooded	bank erosion				
365	1-3'	developed	none				mostly rip rap lined
366	3-5'	developed	bank erosion				not armored
367	1-4'	developed	none				mostly rip rap lined
368	1-2'	wooded	none				natural shoreline
369	1-4'	developed	none				mostly rip rap lined
370	1-4'	developed	none			146	mostly rip rap lined
371	2-3'	scrubby	none				some rip rap
372	2-3'	developed	none				deteriorated rip rap
373	1-3'	developed	none				rip rap, retaining wall armoring
374	1-3'	developed	none				mixed armoring
375	1-3'	developed	none				mixed armoring
376	1-2'	wooded, scrubby	minor bank erosion			147	
377	1-3'	developed	none				mixed armoring
378	0'	cattails, purple loosestrife	none				
379	1-3'	developed	none				mixed armoring
380	0-1'	partially developed, Phragmities	none	Phragmities	50-200 stems		
381	1-2'	developed	none				mixed armoring
382	1-3'	wooded, scrubby	none				
383	2-4'	wooded, scrubby	eroded bank, undercuts				
384	1-2'	developed	none				mixed armoring
385	0'	cattails, purple loosestrife	none			148	

Table 1
Fox River Shoreline Erosion and Targeted Invasive Species Summary
Southeastern Wisconsin Fox River Commission

Location (Figure 3)	Bank Height† / Slope	Dominant Shoreline Vegetation	Erosion	Targeted Invasive Species	Invasive Species Abundance	Photo #	Comments
386	1-2'	developed	none				rip rap lined
387	2-3'	scrubby	none				some rip rap, farmed - candidate for a buffer
388	0'	cattails	none				
389	3-5'	wooded, scrubby	minor bank erosion, undercuts				
390	0'	cattails, purple loosestrife	none				
391	1-2'	developed	none				mixed armoring
392	0'	cattails	none				
393	3:1, 1-3'	developed	none				mixed armoring
394	0'	cattails	none				
395	1-2'	developed	none				mixed armoring
396	0'	cattails	none				
397	1-3'	developed	none				mixed armoring
398	1-2'	developed	none				developed shoreline, mixed armoring
399	1-2'	wooded	none				rip rap shoreline
400	0'	cattails	none				
401	1-3'	wooded / developed	none				rip rap shoreline
402	0'	cattails	none				
403	2-4'	wooded, scrubby	minor undercuts	Phragmities	25-50 stems		
404	2-4'	wooded, scrubby	minor undercuts				
405	1-3'	developed	none				some rip rap
406	2-4'	partially developed, scrubby	eroded bank, undercuts			149	
407	0-2'	herbaceous veg	none				
408	1-3'	1-3'	minor bank erosion, undercuts				
409	1-2'	scrubby	none			150	
410	0'	cattails, purple loosestrife	none				
411	3-5'	wooded, scrubby	minor bank erosion, undercuts				

sed on the water level at the time of field observation.

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
82A	NA	NA	Gulley	Sg	NA	NA	NA		Y
84	50	5	Outside of curve	Sg	RCG	1-2	1-2		N
86	50	5	Oppposite stream outlet	Sg	Trees	1-2	Mukwonago River		P
78	35	3.5	Inside of curve	Sg	C	<1	<1		N
79	30	3	Outside of curve	Sg	RCG	<1	<1		N
81	30	3	Outside of curve	Sg	Trees	Sloping wooded	1		N
74	25	2.5	Outside of curve	Sg	RCG	<1	<1		N
53	20	2	Outside of curve	HtA	Bolders	sloping	1-2	Eroded and armored	N
73	20	2	Inside of curve	HtA	RCG	<1	<1		N
75	20	2	Straight Section	HtA	RCG	<1	<1		N
76	20	2	Inside of curve	Sg	RCG	<1	<1		N
88	20	2	Inside of curve	AzA	RCG	1	1		N
95	20	2	Inside of curve	Sg	RCG	<1	1-2		N
150	20	2	Straight Section	Mf	C	<1	NA		N
69	18	1.8	Outside of curve	HtA	RCG	<1	<1		N
21	17	1.7	Outside of curve	Sg	RCG	1-2	1		P
20A	15	1.5	Outside of curve	Mzg	RCG	1-2	1-2		P
33	15	1.5	Outside of curve	Ww	RCG	1-2	1-2	Undercut	Y
35	15	1.5	Outside of curve	Ww	RCG	1-2	Mud flat		Y
38	15	1.5	Outside of curve	HtA	RCG	1-2	Mud flat	Undercut	Y
54	15	1.5	Outside of curve	Oc	RCG	1-2	1-2		P
56	15	1.5	Outside of curve	Oc	RCG	1-2	1		P
60	15	1.5	Outside of curve	Ac	RCG	1	1		P
67A	15	1.5	Inside of curve	HtA	RCG	1	<1		P
71	15	1.5	Outside of curve	HtA	RCG	<1	<1		N
93	15	1.5	Inside of curve	Sg	RCG	1	1		N
96	15	1.5	Outside of curve	Sg	RCG	<1	<1		N
97	15	1.5	Inside of curve	Sg	RCG	<1	<1		N
102	15	1.5	Inside of curve	Sg	RCG	1	<1		N
103	15	1.5	Outside of curve	Sg	RCG	1	1-2		N
111	15	1.5	Outside of curve	Sg	RCG	1	1		P
121	15	1.5	Outside of curve	Ww	RCG	1	<1		P
122	15	1.5	Inside of curve	Ww	RCG	<1	1		N

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
126	15	1.5	Outside of curve	Ww	C	<1	1-2		N
131	15	1.5	Inside of curve	Ww	C	<1	<1		N
134	15	1.5	Outside of curve	Mf	C	<1	1-2		N
144	15	1.5	Outside of curve	Mf	C	<1	NA		N
145	15	1.5	Southwest end of bay	Mf	C	<1	NA		N
146	15	1.5	Straight Section	Mf	RCG / C	<1	NA		N
148	15	1.5	Straight Section	Mf	C	<1	NA		P
149	15	1.5	Upstream end of peninsula	Mf	C	<1	NA		P
153	15	1.5	Upstream side of island	FoB	C	<1	NA		P
22A	12	1.2	Outside of curve	Sg	RCG	>2	1-2		Y
41	12	1.2	Straight Section	Ww	RCG	1-2	>2		N
55	12	1.2	Outside of curve	HtA	RCG	<1	Mud flat		P
58	12	1.2	Outside of curve	HtA	RCG	1-2	>3		Y
63	12	1.2	Outside of curve	AC	RCG	1	1		P
64	12	1.2	Outside of curve	HtA	RCG	1	1		P
65	12	1.2	Outside of curve	HtA	RCG	1-2	<1		P
67	12	1.2	Outside of curve	HtA	RCG	1	<1		P
70	12	1.2	Outside of curve	HtA	C	<1	<1		N
77	12	1.2	Outside of curve	MmA	RCG	<1	<1		N
80	12	1.2	Inside of curve	Sg	RCG	<1	Sloping wooded		N
85	12	1.2	Inside of curve	Sg	RCG	1	1-2		N
90	12	1.2	Outside of curve	Ph	RCG	<1	1-2		N
92	12	1.2	Outside of curve	Ph	Trees	1-2	1-2		Y
108	12	1.2	Inside of curve	Sg	RCG	1	1		N
110	12	1.2	Outside of curve	Sg	RCG	1-2	1		P
112	12	1.2	Outside of curve	Sg	RCG	1-2	1		Y
115B	12	1.2	Outside of curve	Sm	Trees	>4	1-2		Y
115C	12	1.2	Outside of curve	FmA	Trees	>4	1-2		Y
124	12	1.2	Outside of curve	Ww	C	<1	<1		N
127	12	1.2	Inside of curve	Ww	C	<1	1-2		N
127B	12	1.2	Inside of curve	Ww	C	<1	<1		P
130	12	1.2	Straight Section	Ww	RCG	<1	1-2		N
133	12	1.2	Inside of curve	Mf	C	<1	<1		Y

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
137	12	1.2	Inside of curve	Mf	C	<1	<1		N
141	12	1.2	Straight Section	Mf	C	<1	<1		N
27	10	1	Outside of curve	Ww	RCG	>2	1		Y
29	10	1	Outside of curve	Ww	RCG	>2	>2		P
32	10	1	Outside of curve	Ww	RCG	2	2		Y
34	10	1	Outside of curve	Ww	RCG	1-2	Mud flat		P
37	10	1	Straight Section	Ww	RCG	1-2	1-2	Undercut	Y
40	10	1	Straight Section	Ww	RCG	1-2	>5		N
45	10	1	Outside of curve	Oc	RCG	2	1-2		Y
47	10	1	Straight Section	Ww	RCG	1-2	>2		Y
61	10	1	Outside of curve	HtA	RCG	1-2	1-2		N
62	10	1	Straight Section	Ac	RCG	1-2	1-2		N
72	10	1	Outside of curve	HtA	RCG	<1	<1		N
82	10	1	Straight Section	Sg	Trees	1	1-2		N
87	10	1	Outside of curve	HtA	RCG	1	1		N
91	10	1	Outside of curve	Sg	RCG	1-2	<1		P
98	10	1	Outside of curve	Sg	RCG	<1			N
100	10	1	Outside of curve	Sg	RCG	1	<1		N
101	10	1	Straight Section	Sg	RCG	1	<1		N
104	10	1	Straight Section	Sg	RCG	1-2	1-2		N
106A	10	1	side of curve, high eroding b	Sg	Trees	4	1-2		Y
107	10	1	Inside of curve	Sg	RCG	1-2	1		P
109	10	1	Outside of curve	Sg	RCG	1	1		P
115	10	1	Straight Section		RCG	<1	1		N
117	10	1	Outside of curve	Ph	RCG	1-2	1		Y
119	10	1	Outside of curve	Sm	RCG	1-2	<1		Y
121A	10	1	Outside of curve	Ww	RCG	1	<1		P
123	10	1	Inside of curve	Ww	RCG	1	<1		N
127A	10	1	Straight Section	Ww	RDG	<1	1		N
135	10	1	Outside of curve	Mf	C	<1	<1		N
136	10	1	Outside of curve	Mf	C	<1	<1		N
138	10	1	Outside of curve	Mf	C	<1	<1		N
139	10	1	Straight Section	Mf	C	<1	1-2		N

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
140	10	1	Straight Section	Mf	C	<1	<1		N
142	10	1	Straight Section	Mf	C	<1	<1		N
143	10	1	Backwater	Mf	C	<1	<1		N
147	10	1	Straight Section	Mf	C	<1	NA		N
151	10	1	Upstream side of island	FoB	C	<1	NA		Y
155	10	1	Downstream side of island	no data	Shrubs	1	NA		N
19	9	0.9	Outside of curve	Sg	RCG	1-2	1		P
12	8	0.8	Outside of curve	Sg	RCG	1-2	1-2		P
20	8	0.8	Straight Section	Sg	RCG	>2	1-2	Eroding bank	Y
42	8	0.8	Straight Section	Ww	RCG	2	2		Y
51	8	0.8	Inside of curve	Oc	RCG	1-2	1		Y
52	8	0.8	Outside of curve	Oc	RCG	1	1-2		N
57	8	0.8	Straight Section	HtA	RCG	Mud flat	1-2		N
66	8	0.8	Straight Section	HtA	C	<1	1		N
68	8	0.8	Outside of curve	HtA	C	<1	1		N
94	8	0.8	Outside of curve	Sg	RCG	1	1		N
113	8	0.8	Outside of curve	Sg	RCG	1	1-2		Y
114	8	0.8	Outside of curve	MmA	RCG	1	Mud flat		P
120	8	0.8	Inside of curve	Ph	RCG	1-2	1		Y
125	8	0.8	Straight Section	Ww	C	<1	>2		N
129	8	0.8	Straight Section	HtA	C	<1	1-2		N
132	8	0.8	Outside of curve	Mf	RCG	1-2	<1		Y
10	7	0.7	Outside of curve	Sg	RCG	1-2	1-2		Y
11	7	0.7	Outside of curve	Sg	RCG	1-2	1-2		P
14	7	0.7	Straight Section	Sg	Shrubs	1	<1	Eroding bank	P
24AA	7	0.7	Outside of curve	Sg	RCG	2	2		Y
28	7	0.7	Straight Section	Dt	RCG	1	1-2		N
29A	7	0.7	Outside of curve	Ww	RCG	>2	>2		Y
152	7	0.7	Upstream side of island	CeB	Trees	1-2	NA		Y
154	7	0.7	Upstream side of island	Mf	C	<1	NA		P
4	6	0.6	Outside of curve	Ww	Grasses	<1	1		N
5	6	0.6	Outside of curve	Ww	RGC	>3	2		P

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
8	6	0.6	Straight Section	Pa	RCG	1-2	1		P
22	6	0.6	Outside of curve	Sg	RCG	1-2	>2		Y
29B	6	0.6	Outside of curve	Ww	RCG	>2	>2		Y
48	6	0.6	Outside of curve	Dt	RCG	>2	1-2		Y
50	6	0.6	Outside of curve	Oc	RCG	2	2-3		Y
83	6	0.6	Outside of curve	Sg	RCG	1-2	1-2		N
9	5	0.5	Straight Section	Pa	RCG	1	sloping		N
13	5	0.5	Straight Section	Sg	RCG	1-2	1-2		P
24A	5	0.5	Outside of curve	Sg	RCG	1-2	1-2		P
36A	5	0.5	Outside of curve	Pa	RCG	1-2	2		Y
50A	5	0.5	Inside of curve	AzA	RCG	2-3	2	Undercut	Y
59	5	0.5	Straight Section	Ac	RCG	1-2	1-2		N
99	5	0.5	Outside of curve	Sm	Turf Grass	2	1-2		Y
105	5	0.5	Outside of curve	FoA	RCG	1	1-2		P
105A	5	0.5	Outside of curve	Sg	RCG	1	1		P
106	5	0.5	Inside of curve	Sg	RCG	1	1-2		N
115A	5	0.5	Outside of curve	Sm	Rip Rap	>4	1-2		P
116	5	0.5	Outside of curve	Oc	RCG	1	1-2		P
117A	5	0.5	Outside of curve	Sm	Trees	2	1-2		P
118	5	0.5	Outside of curve	Sm	RCG	1-2	<1		Y
128	5	0.5	Outside of curve	HtA	RCG	1-2	<1		Y
7	4	0.4	Outside of curve	Lu	RGC	2	2		P
15	4	0.4	Outside of curve	Sm	Trees	1-2	1		Y
36	4	0.4	Straight Section	Ww	RCG	2	1-2		Y
43	4	0.4	Straight Section	Ww	RCG	1-2	1		Y
49	4	0.4	Straight Section	Oc	RCG	2	1		Y
2	3	0.3	Outside of curve	KeA	RCG	2	2		Y
23	3	0.3	Straight Section	Sg	RCG	>2	>2		N
24	3	0.3	Straight Section	Sg	RCG	2	2	Undercut	Y
25	3	0.3	Outside of curve	Og	RCG	1-2	1-2		P
30	3	0.3	Straight Section	Ww	RCG	>2	>2		Y
31	3	0.3	Straight Section	HtA	RCG	1-2	1-2		Y
33A	3	0.3	Straight Section	Ww	RCG	1-2	1-2		P

Table 2
Locations of Shoreline Shift from 2000 to 2010 - Erosion
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Eroding
26	2	0.2	Straight Section	Dt	RCG	1	1-2		N
1	0	0	View obscured by trees	Lu	Bolders	sloping	sloping		N
3	0	0	Straight Section	Ww	Trees	>2	sloping		P
6	0	0	Outside of curve	Ww	RGC	2	2	Eroding bank	Y
6A	0	0	Straight Section	Ww	RGC	2-3	2	Eroding both banks	P
6B	0	0	Outside of curve	Ph	Trees	2	2		N
9A	0	0	Outside of curve	Sg	RCG	1	1		N
9B	0	0	Trees	Pa	RCG	1	1		N
16	0	0	Inside of Curve	Sg	RCG	>2	1		N
17	0	0	Outside of curve	AzA	RCG	1-2	1-2		N
18	0	0	Outside of curve	Sg	RCG	>2	1-2		N
39	0	0	Straight Section	Ww	RCG	<1	Wooded		P
44	0	0	Mud Flat	Ww	Mud Flat	<1	1-2		N
46	0	0	Outside of curve	MhA	RCG	<1	1-2		N
89	0	0	Straight Section	AzA	RCG	<1	1-2		N

Table 3
Locations of River Bank Shift from 2000 to 2010 - Deposition
Southeastern Wisconsin Fox River Commission

GRāEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Depositing
B	10	1	Inside of Curve	Ww	RGC	Mud flat	1-2		Y
C	10	1	Inside of Curve	Oc	RCG	1	<1		N
D		0	Inside of Curve	Ww	RCG	1	1		Y
E	10	1	Inside of Curve	Sg	RCG	1	1-2		Y
F	20	2	Mud flat in river	Island	Mud flat	NA	NA		P
G	30	3	Inside of Curve, Mud flat in river	Ph	RCG	1-2	1-2		Y
H	12	1.2	Inside of Curve, Mud flat in river	Ph	C	<1	1-2		Y
I	12	1.2	At entrance to backwater	Ph	Mud flat	NA	NA		Y
J	25	2.5	Inside of Curve, Mud flat in river	HtA	C	<1	1		Y
K	12	1.2	Inside of Curve	HtA	C	<1	<1		Y
L	10	1	At entrance to backwater	Ph	C	<1	<1		Y
M	20	2	Inside of Curve	Ww	C	<1	1		Y
N	20	2	At entrance to backwater	HtA	C	<1	<1		Y
O	50	5	Outside of curve	HtA	C	<1	1		Y
P	15	1.5	Inside of Curve	Ww	C	<1	<1		Y
Q	15	1.5	At entrance to backwater	Ww	C	<1	<1		Y
R	20	2	Outside of curve	Mf	C	<1	1-2		Y
S	25	2.5	Backwater	Mf	C	<1	<1		Y
T	25	2.5	Straight Section	Mf	C	<1	<1		Y
U	25	2.5	and abandoned chan	Mf	C	<1	<1		Y
V	35	3.5	Island abandoned channel	Mf	C	<1	<1		Y
W	40	4	Backwater	So	C	<1	<1		Y

Table 3
Locations of River Bank Shift from 2000 to 2010 - Deposition
Southeastern Wisconsin Fox River Commission

GRAEF

Location (Figure 4)	Distance (ft)	Apparent Rate (ft/yr)	Comment	Soil Type	Vegetation	Bank Height (FT)	Opposite Bank (FT)	Comments	Depositing
X	40	4	Backwater	Mf	C	<1	<1		Y
Y	20	2	Backwater	Mf	C	<1	NA		Y
Z	20	2	Straight Section	Mf	C	<1	1-2		Y
AA	20	2	Straight Section	Mf	C	<1	1-2		Y
AB	40	4	Peninsula	Mf	C	<1	NA		Y
AC	80	8	Bay	Mf	C	<1	NA		Y
AD	40	4	Bay	FoB	C	<1	NA		Y
AE	15	1.5	Backwater	Mf	C	<1	NA		Y
AF	20	2	Island backwater	FoB	C	<1	<1		Y

Table 4
Erosion Area Prioritization
Southeastern Wisconsin Fox River Commission

River Mile	Field Description	Length (feet)	Shoreline Height (ft)	Shoreline Area	Erosion Area	Erosion Rate (ft/year)	Geomorphic Position	Adjacent Area	Map Reference	Erosion Weight A	Length Weight B	Bank Height Weight C	Erosion Weight Rate D	Total Weight =(AxBxCxD)^.5	Priority Ranking
172.1	Moderate Erosion	900	4-5	71	22	1.5	Outside of Curve	Wooded Upland	3-13, 4-14	3	30	5	2.5	33.5	1
168.3	Moderate Erosion	960	4-6	111	NA	No Data	Outside of Curve	Farm Field with Minor Buffer	3-13	3	31	6	1	23.6	2
154.6	Moderate Erosion	390	2-4	250	106A	1	Outside of Curve	Wooded Upland and Abandoned Railway	3-7, 4-7	3	20	4	2	21.8	3
149.1	Moderate Erosion	360	8	313	NA	No Data	Outside of Curve	Wooded Upland	3-5	3	19	8	1	21.3	4
175.75	Moderate Erosion	300	3-5	28	6	0.7	Outside of Curve	River Terrace	3-16, 4-16	3	17	5	1.7	21.0	5
171.8	Moderate Erosion	390	4-7	74	NA	No Data	Outside of Curve	Openlands	3-14	3	20	7	1	20.4	6
149.6	Minor Erosion	810	5-7	306	NA	No Data	Outside of Curve	Farm Field without Buffer	3-5	2	28	7	1	20.0	7
164.8	Moderate Erosion	210	6-8	149	NA	No Data	Outside of Curve	Openlands	3-12	3	14	8	1	18.6	8
169.3	Minor Erosion	860	1-2	98	35	1.5	Outside of Curve	River Terrace	3-13, 4-13	2	29	2	2.5	17.1	9
166.8	Moderate Erosion	750	1-3	129	NA	No Data	Outside of Curve	Wooded Upland	3-12	3	27	3	1	15.7	10
172.1	Minor Erosion	320	>2	69	22A	1.2	Outside of Curve	River Terrace	3-14, 4-14	2	18	3	2.2	15.4	11
151.1	Minor Erosion	540	1-3	290	118	0.5	Straight Section	Farm Field without Buffer	3-6, 4-6	2	23	3	1.5	14.5	12
169.7	Minor Erosion	320	1-2	93	33	1.5	Outside of Curve	River Terrace	3-13, 4-13	2	18	2	2.5	13.4	13
168.7	Minor Erosion	300	1-2	103	38	1.5	Outside of Curve	River Terrace	3-13, 4-13	2	17	2	2.5	13.2	14
167.9	Moderate Erosion	320	Sloping	116	NA	No Data	Outside of Curve	Wooded Upland	3-13	3	18	3	1	12.7	15
156.9	Minor Erosion	690	Sloping	229	NA	No Data	Outside of Curve	Farm Field without Buffer	3-8	2	26	3	1	12.6	16
165.1	Minor Erosion	210	1-2	151	58	1.2	Outside of Curve	River Terrace	3-12, 4-12	2	14	2	2.2	11.3	17
160.5	Moderate Erosion	130	Sloping	195	NA	No Data	Straight Section	Residential Yards	3-10	3	11	3	1	10.1	18
161.1	Stable	390	Sloping	188	NA	No Data	Straight Section	Farm Field without Buffer	3-10	1	20	3	1	7.7	19

A - Erosion weight was based on a numerical value of 4 being assigned to areas of major erosion,3 to areas of moderate erosion, 2 to areas of minor erosion and 1 to stable areas.
B - Length weight was based on the square root of the length of eroding bank.
C - Height weight was based on the height of the eroding bank. Areas of bank that were sloped were assigned a height of 3 feet.
D - Erosion rate weight was based on the erosion rate estimated from shift in bank location added to 1. Areas without estimated rates were assigned a value of 1.

APPENDIX C

Site Photographs

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 30

Direction of View:

East

Comment:

Eroded vertical bank at bend in river.

Photo #: 34

Direction of View:

East-southeast

Comment:

Significant bank erosion at bend in river.

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 36

Direction of View:

South

Comment:

Height ranges from 4-7’ of vertical eroded bank.

Photo #: 55

Direction of View:

North

Comment:

Bank Erosion

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 56

Direction of View:

North

Comment:

Location ID: 111

Significant bank erosion.

Photo #: 57

Direction of View:

North-northeast

Comment:

Location ID: 111Bank erosion.

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 58

Direction of View:

Northwest

Comment:

Location ID:111

Moderate bank erosion.

Photo #: 62

Direction of View:

North-northwest

Comment:

Location ID: 116

Significant bank erosion.

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 78

Direction of View:

Northeast

Comment:

Location ID: 149

Moderate bank erosion.

Photo #: 89

Direction of View:

North

Comment:

Location ID: 195

Metal retaining wall falling into water.

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Photo #: 108

Direction of View:

East-northeast

Comment:

Location ID: 250

Moderate bank erosion.

Photo #: 138

Direction of View:

South

Comment:

Location ID: 313

Significant bank erosion.