

Upper Fox River Streambank Erosion and Pollutant Load Characterization

March 22, 2019
7th Annual Fox River Summit
Burlington, Wisconsin



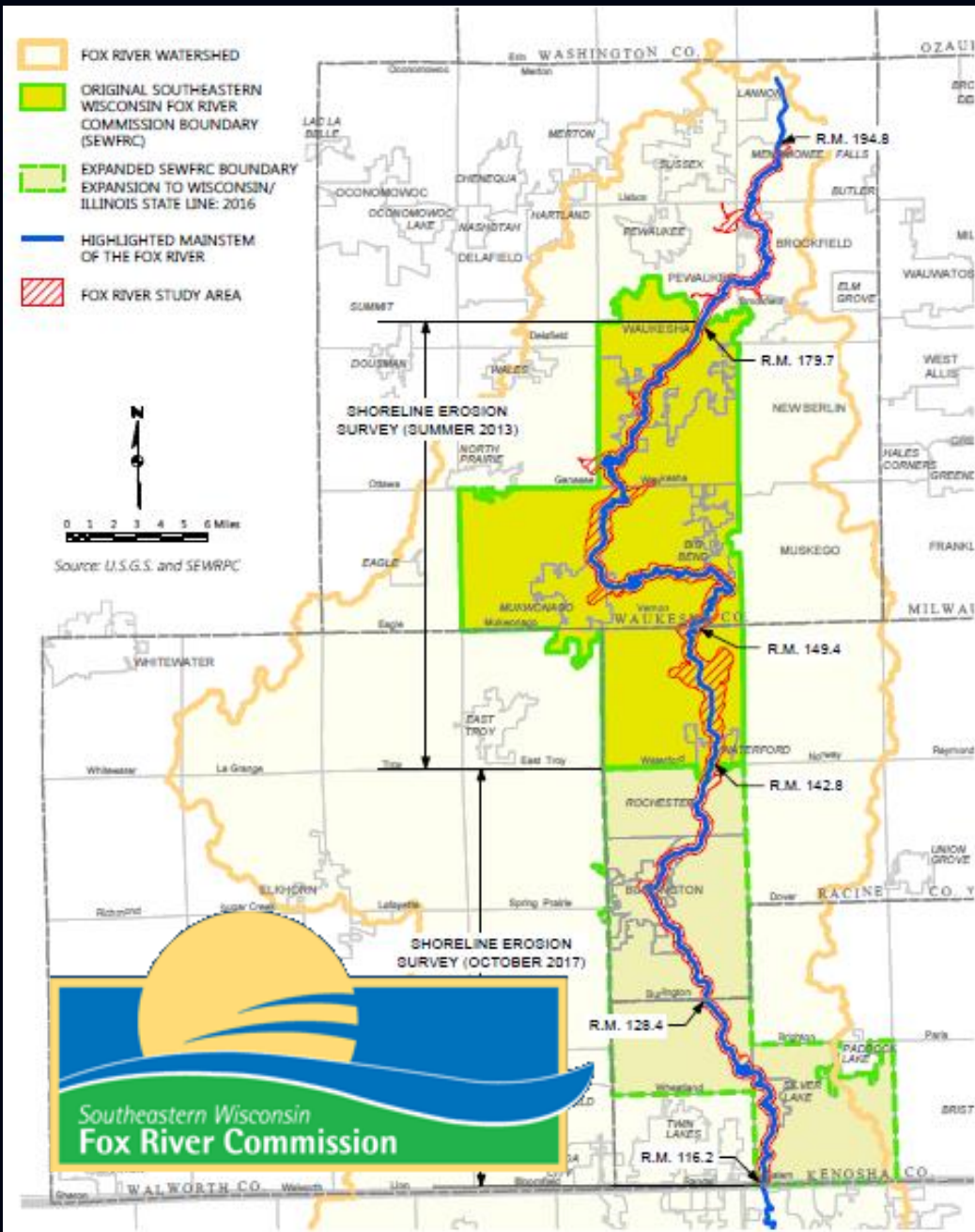
SEWRPC

Serving the counties of
Kenosha, Milwaukee,
Ozaukee, Racine, Walworth,
Washington, and Waukesha

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Project Boundary & Objectives



- Map eroding/unstable banks.
- Rank and prioritize sites.
- Provide recommendations to enhance water quality & fisheries.

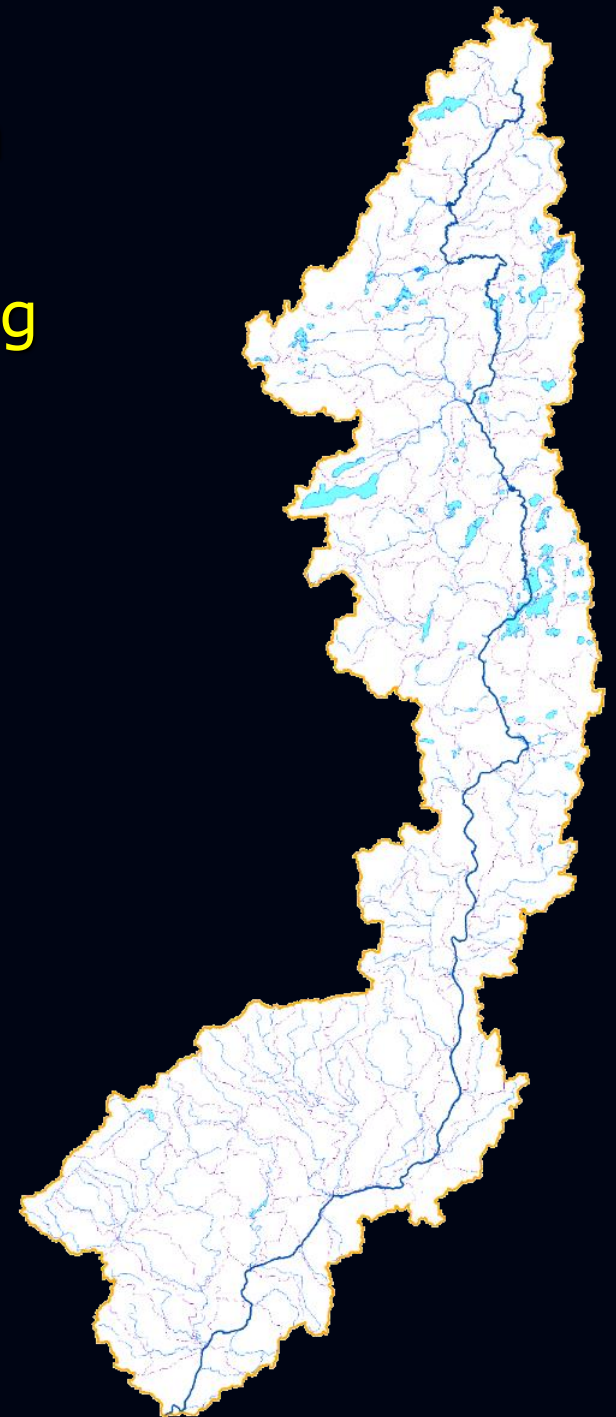
Post-Settlement Channel Evolution

Massive change has occurred during the past two centuries.

Examples:

- Land use
- Hydrology
- Streambank vegetation
- Population/human manipulation

How has post-settlement change affected channel morphology and bank condition?



Post-Settlement Channel Evolution



Barron Land



Blackwood Photographic Club



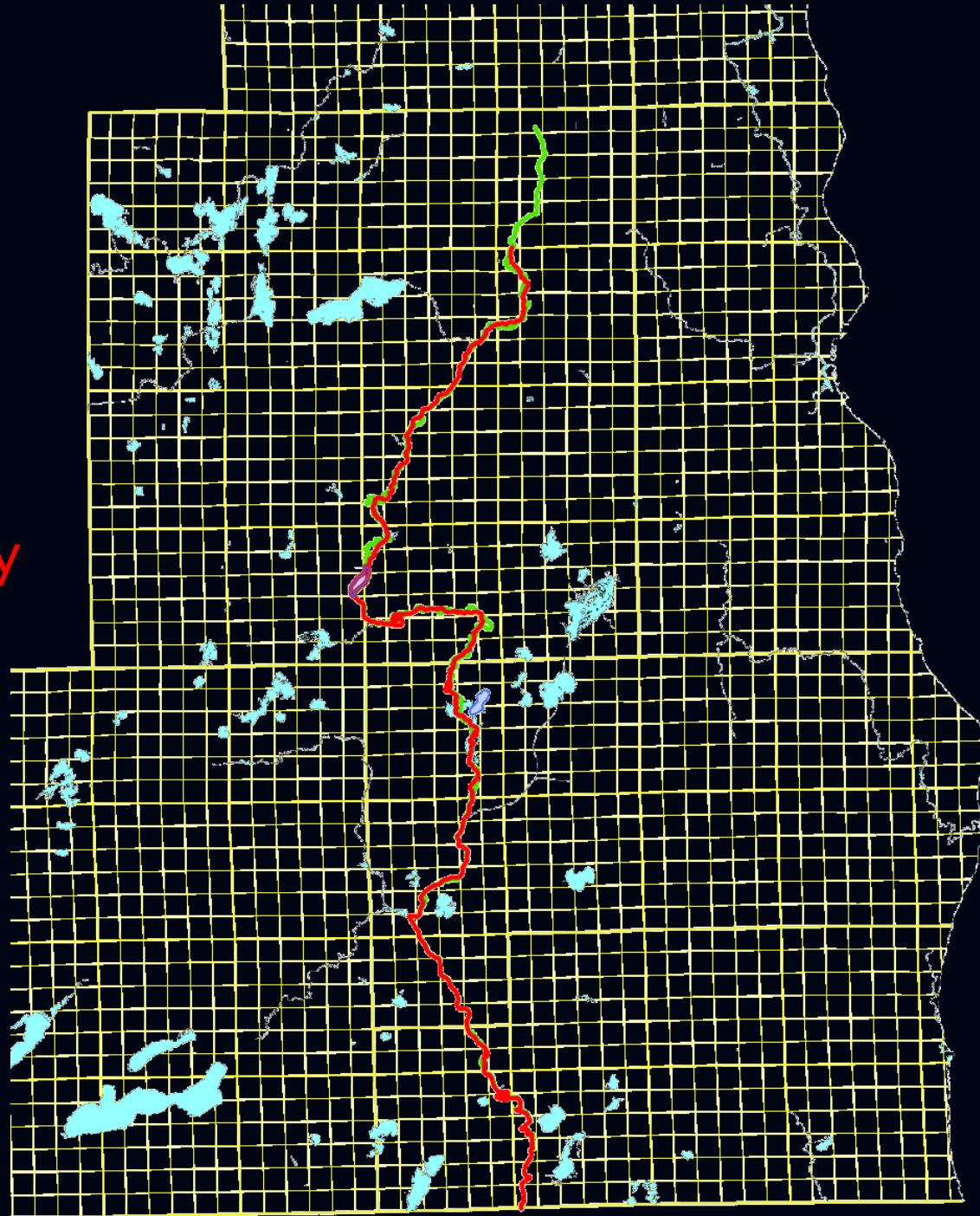
*Vermessung
Meixner*

If streambanks are actively eroding, shouldn't erosion be visible over time?

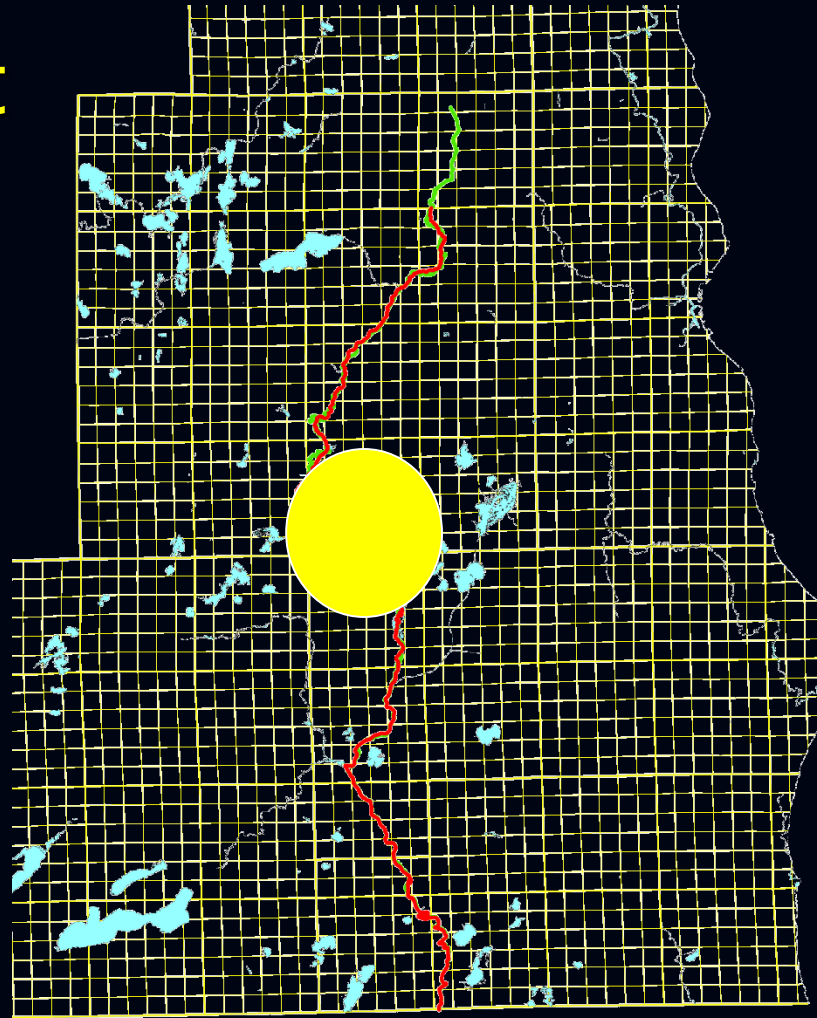
Post-Settlement Channel Evolution

1836 River Channel
On-the-ground survey

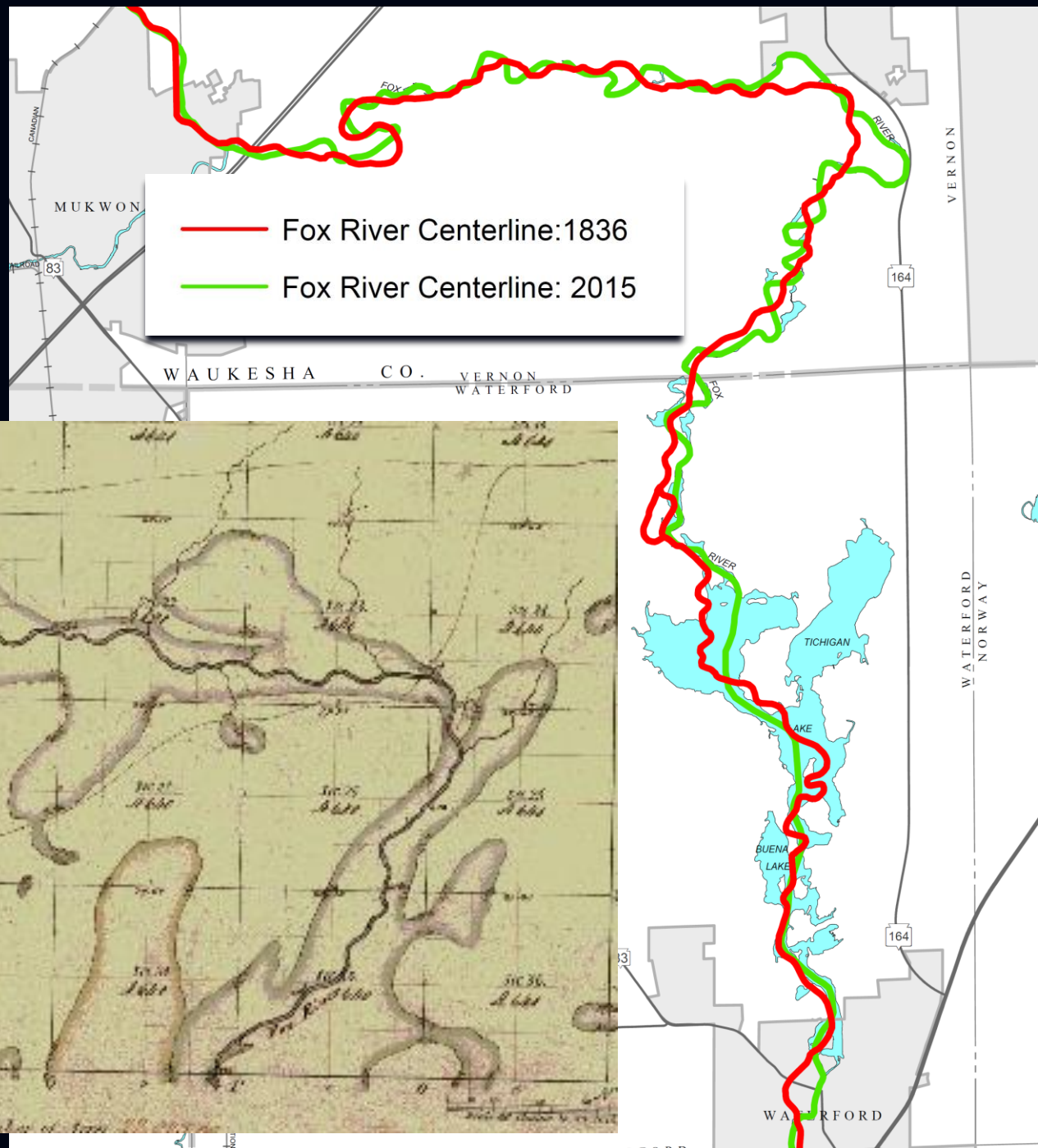
2015 River Channel
Orthophotography



Post- Settlement Channel Evolution



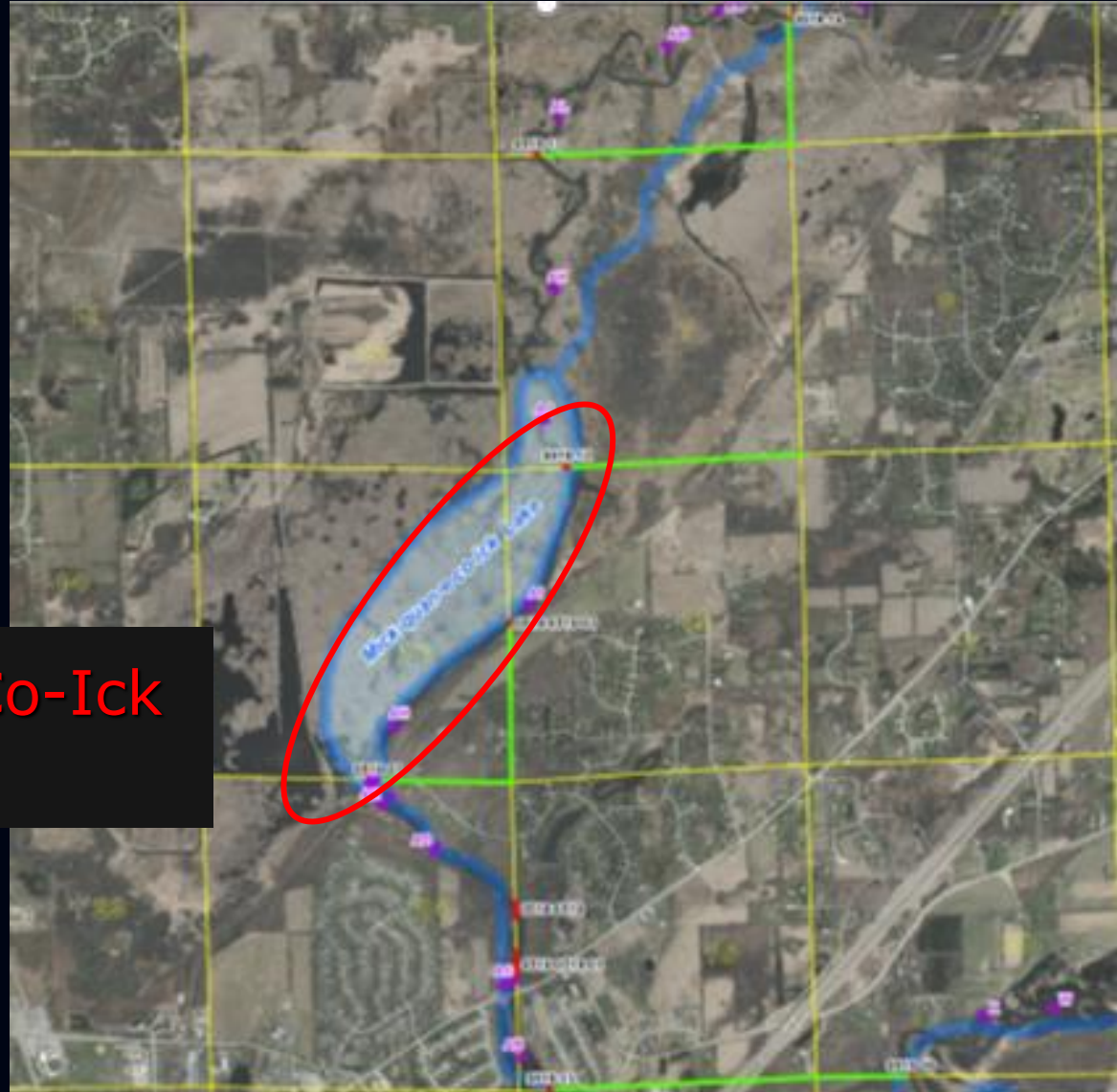
Historical River Channel Changes



Post-Settlement Channel Evolution

1836

Mick-Quan-E-Co-Ick
Lake



Post-Settlement Channel Evolution

1892



Post-Settlement Channel Evolution

1906



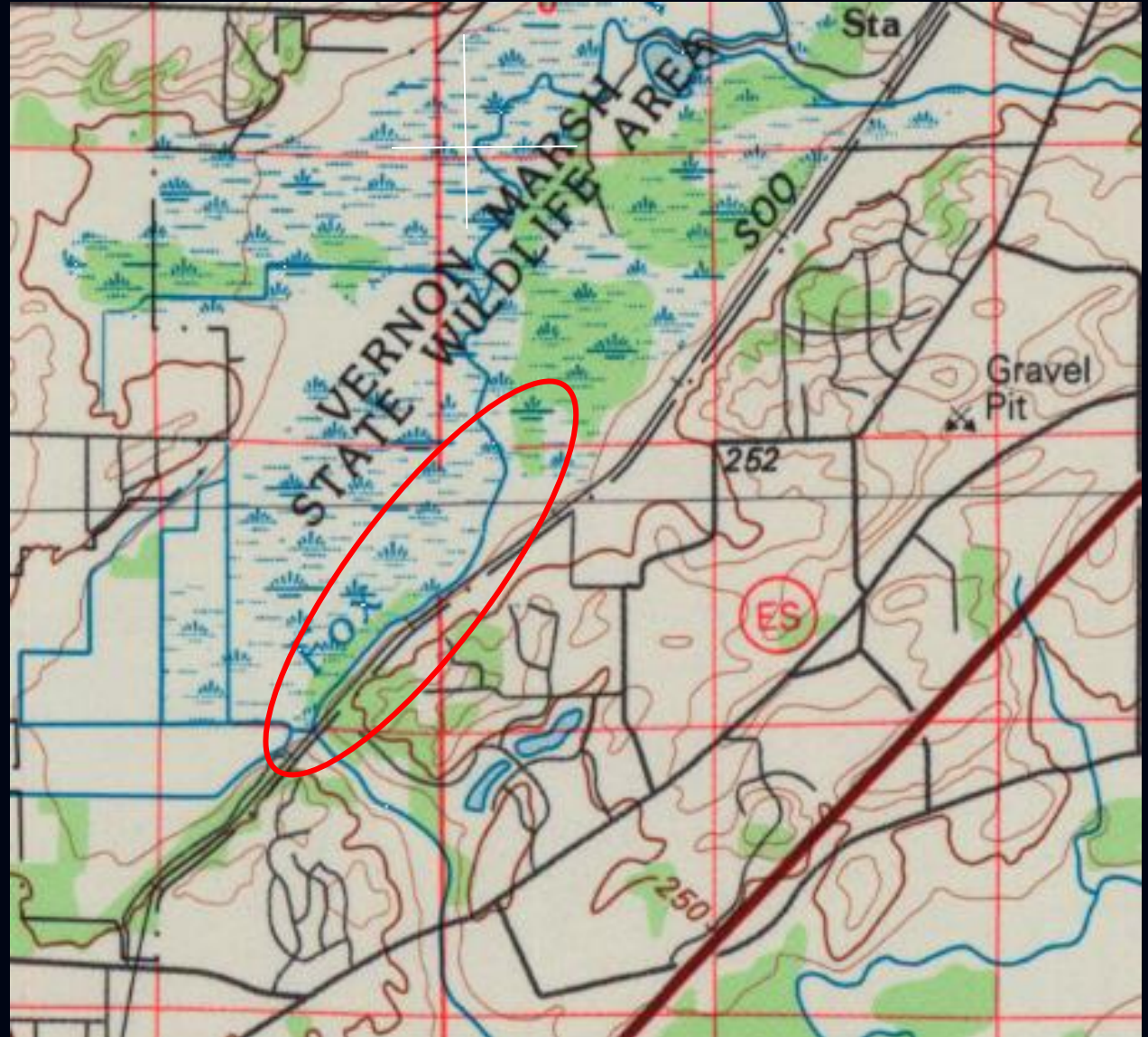
Post-Settlement Channel Evolution

1964



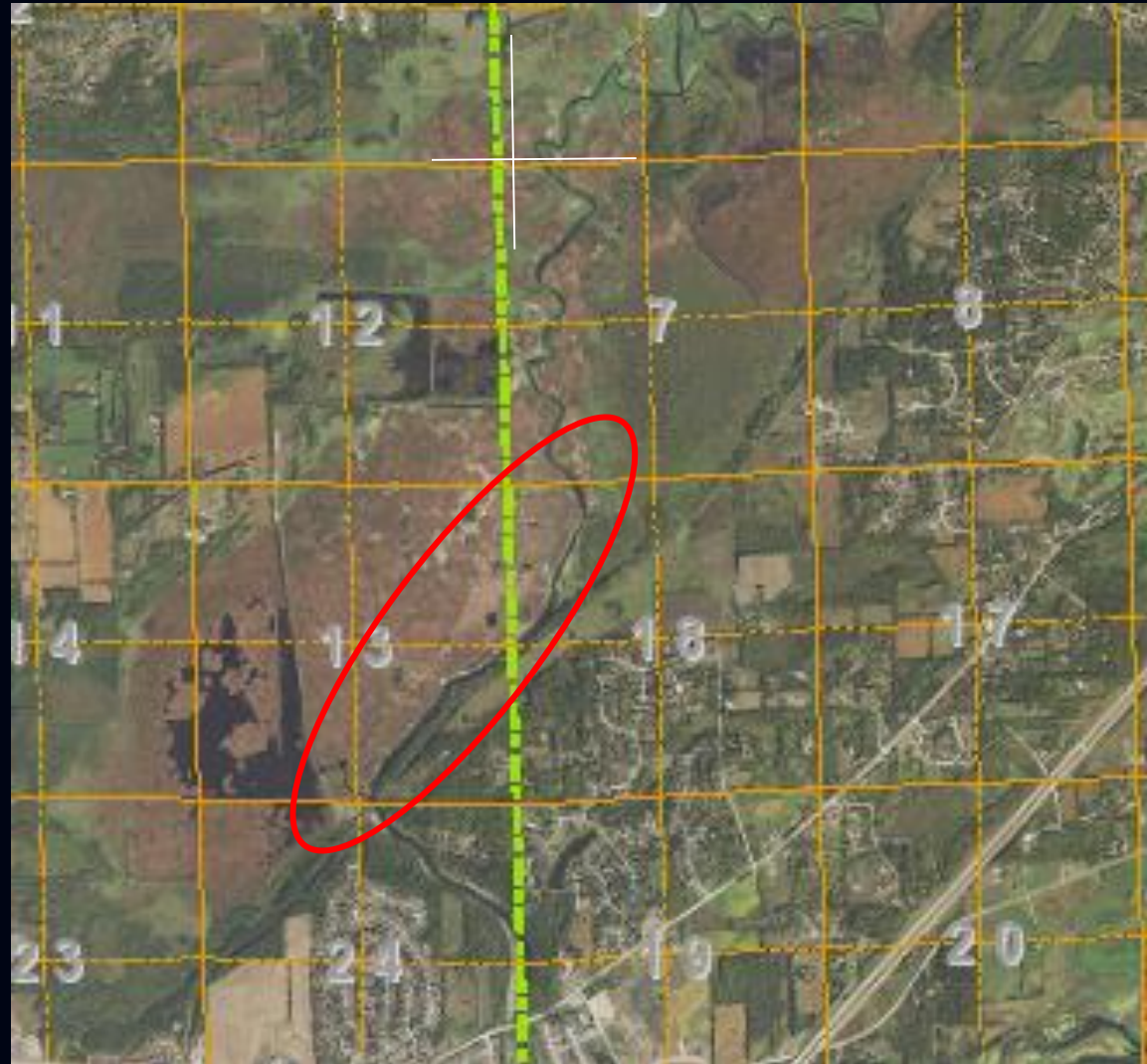
Post-Settlement Channel Evolution

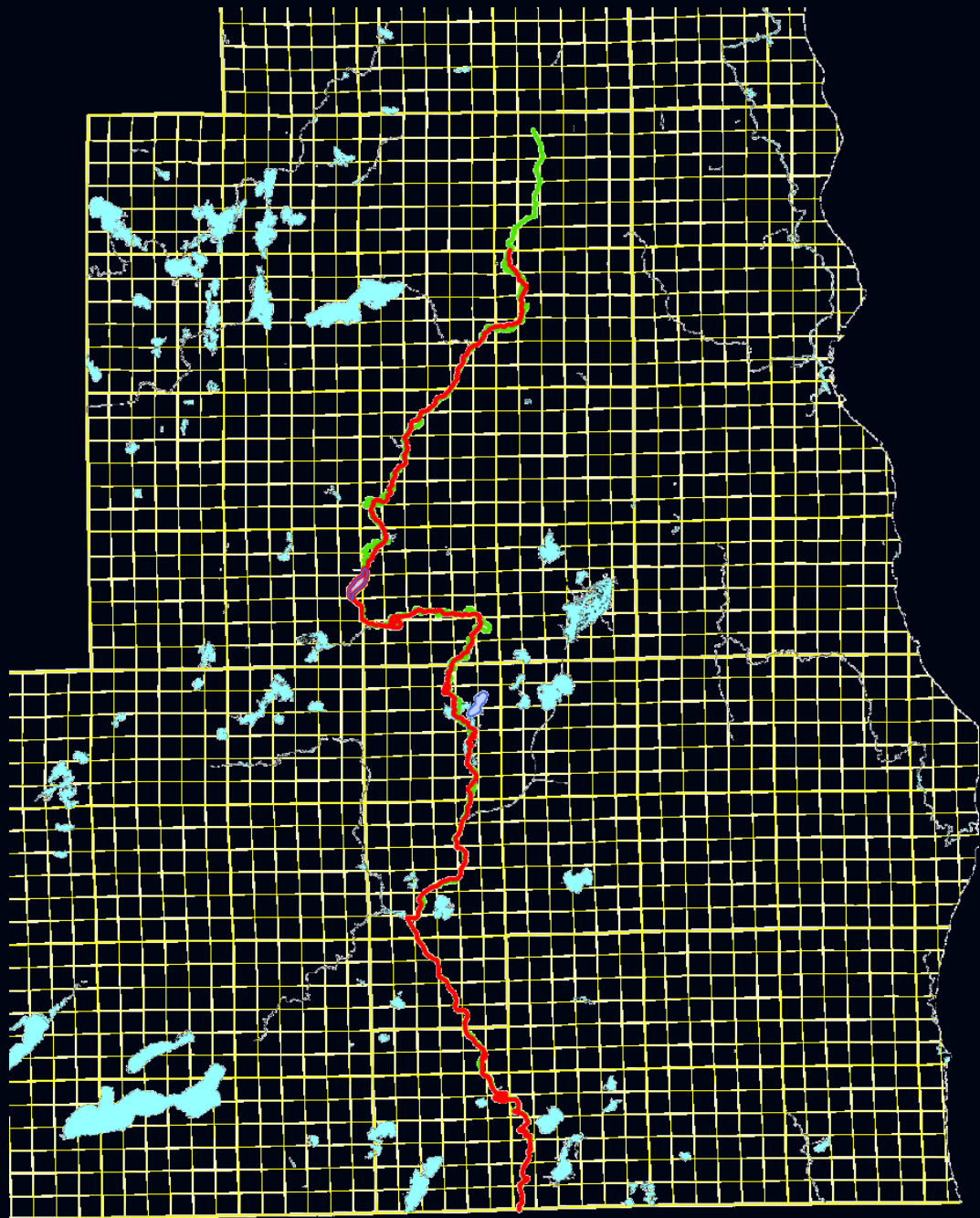
1980



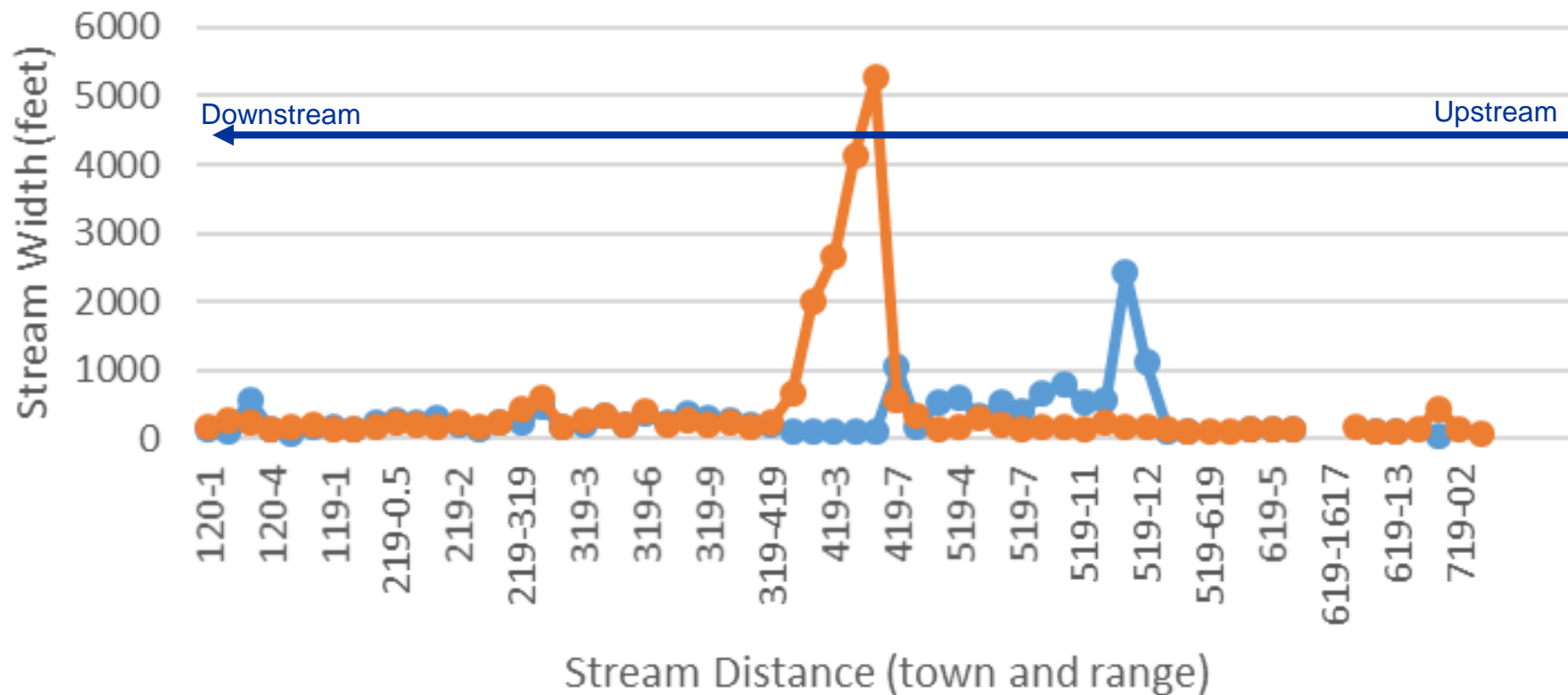
Post-Settlement Channel Evolution

2017





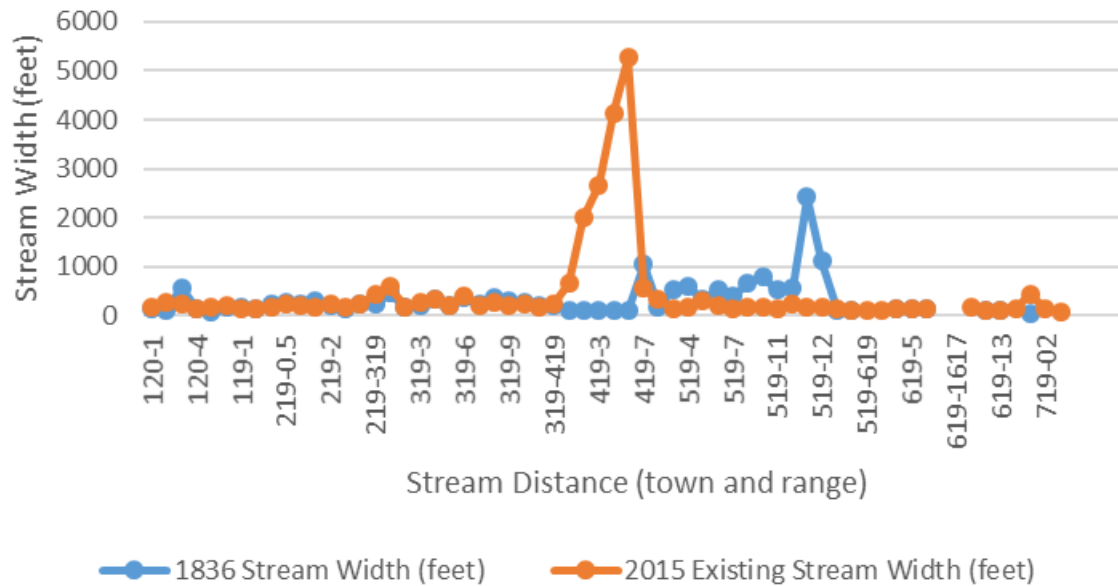
Fox River Width Comparison



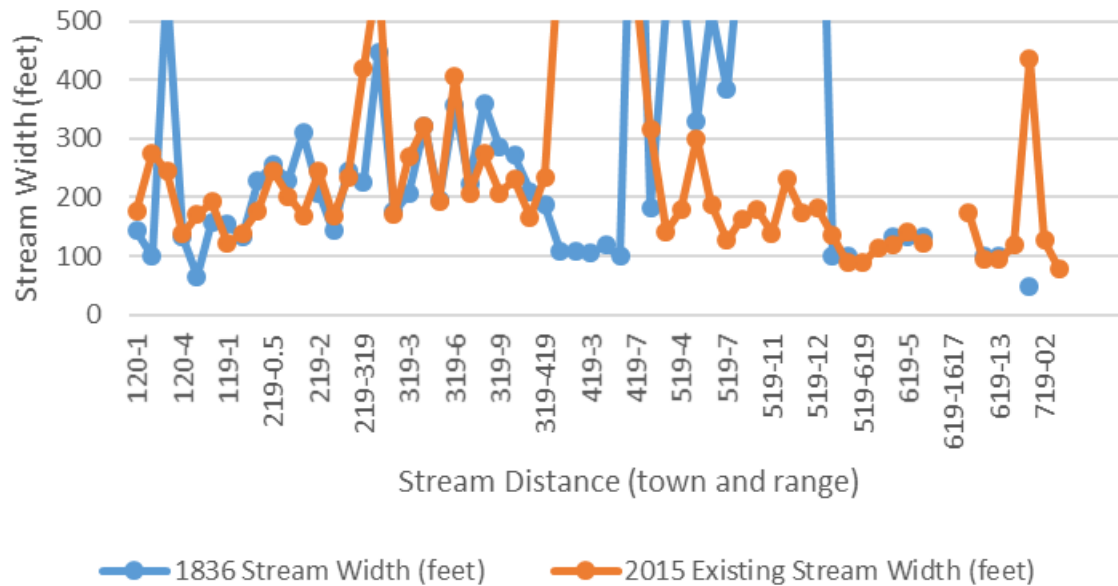
● 1836 Stream Width (feet)

● 2015 Existing Stream Width (feet)

Fox River Width Comparison

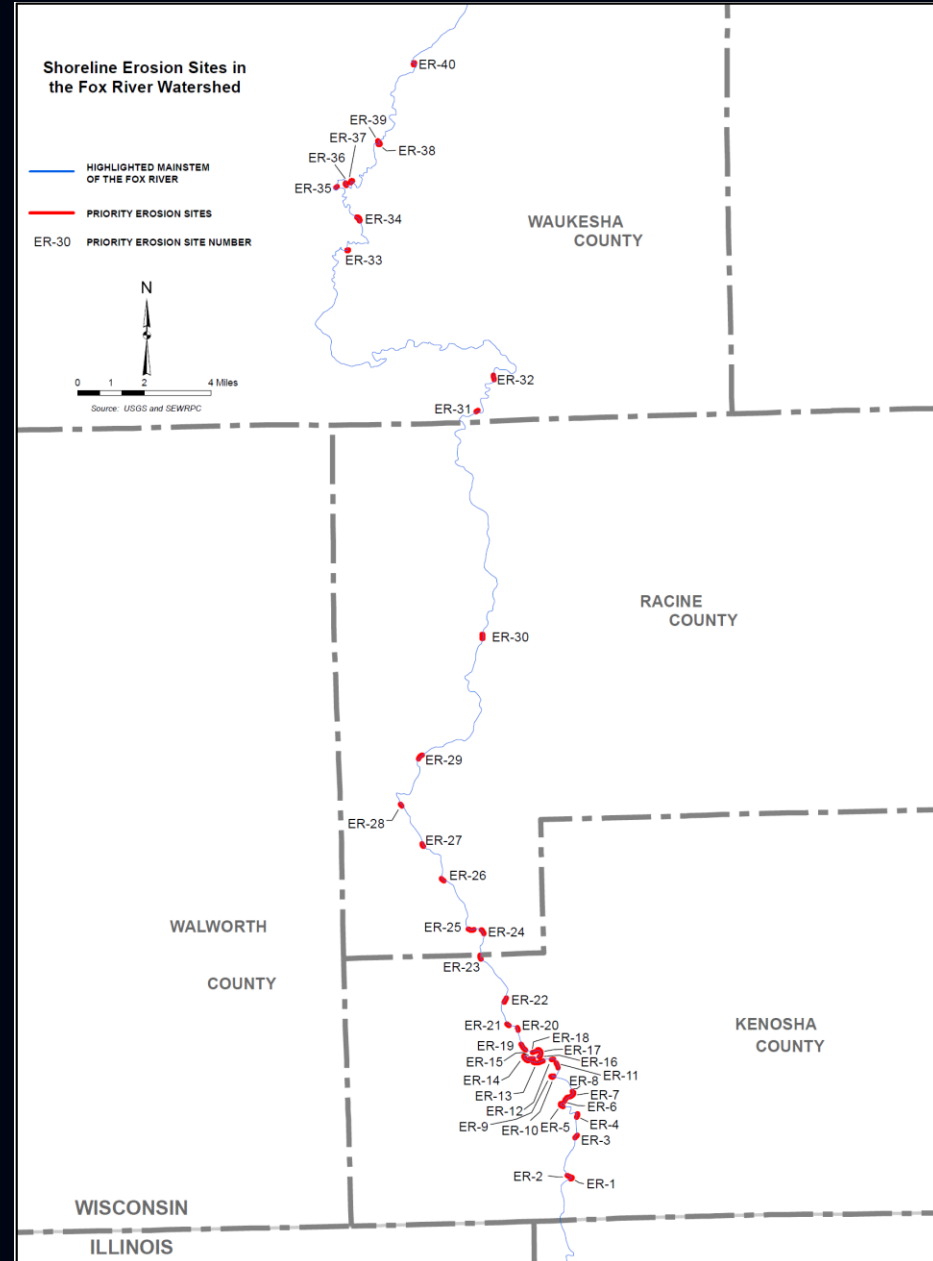


Fox River Width Comparison



Streambank Erosion Sites Noted During On-the-Water Visual Survey

| County | Total Reach Length (mi) | Number of Visually Eroding Sites | Percent eroding per reach |
|----------|-------------------------|----------------------------------|---------------------------|
| Waukesha | 30.3 | 10 | 2.7 |
| Racine | 21.0 | 7 | 4.3 |
| Kenosha | 12.2 | 23 | 24.8 |



Initial prioritization criteria for streambank protection and water quality improvement:

- **Infrastructure protection**
 - proximity to roads, bridges, utilities
 - age of bridges
 - scheduled roadway reconstruction
- **Channel position/vulnerability/condition-**
 - (e.g., outside versus inside bends)
- **Erosion Severity**-loading rates (i.e. erosion rate, bank height, bank length, slope, soil composition)
- **Vegetation type & integrity**
- **Riparian buffer ranking-**
 - Position*-lands within floodway boundary or 1,000 feet of the edge of stream, whichever is greater
 - Erodibility*-Soil types and slopes
- **Ease of implementation**-public versus private lands, accessibility, cost, landowner willingness

Eroding Streambanks A Real Problem, Attention Grabbing, Or Just Plain Ugly?



GP030520

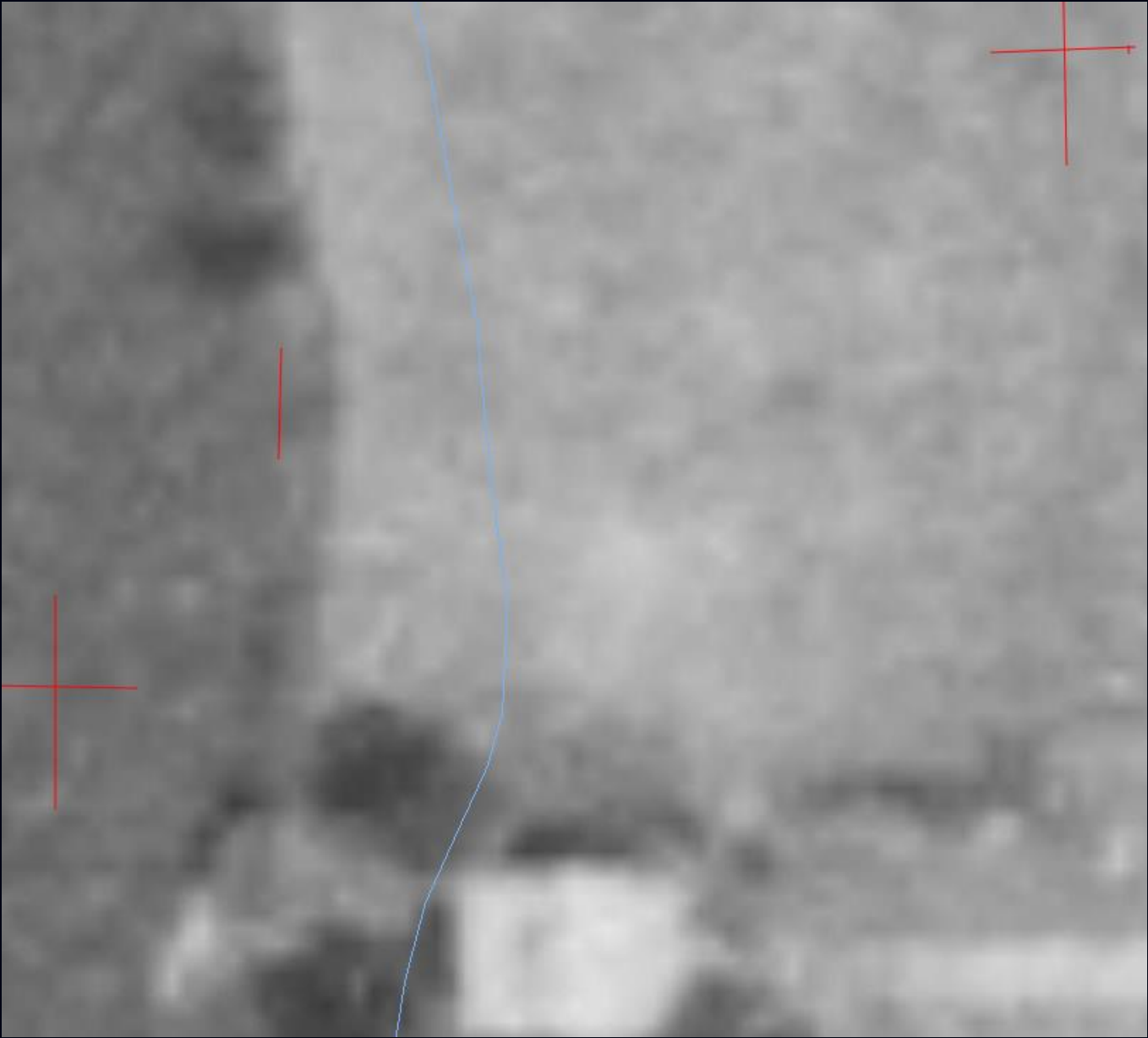
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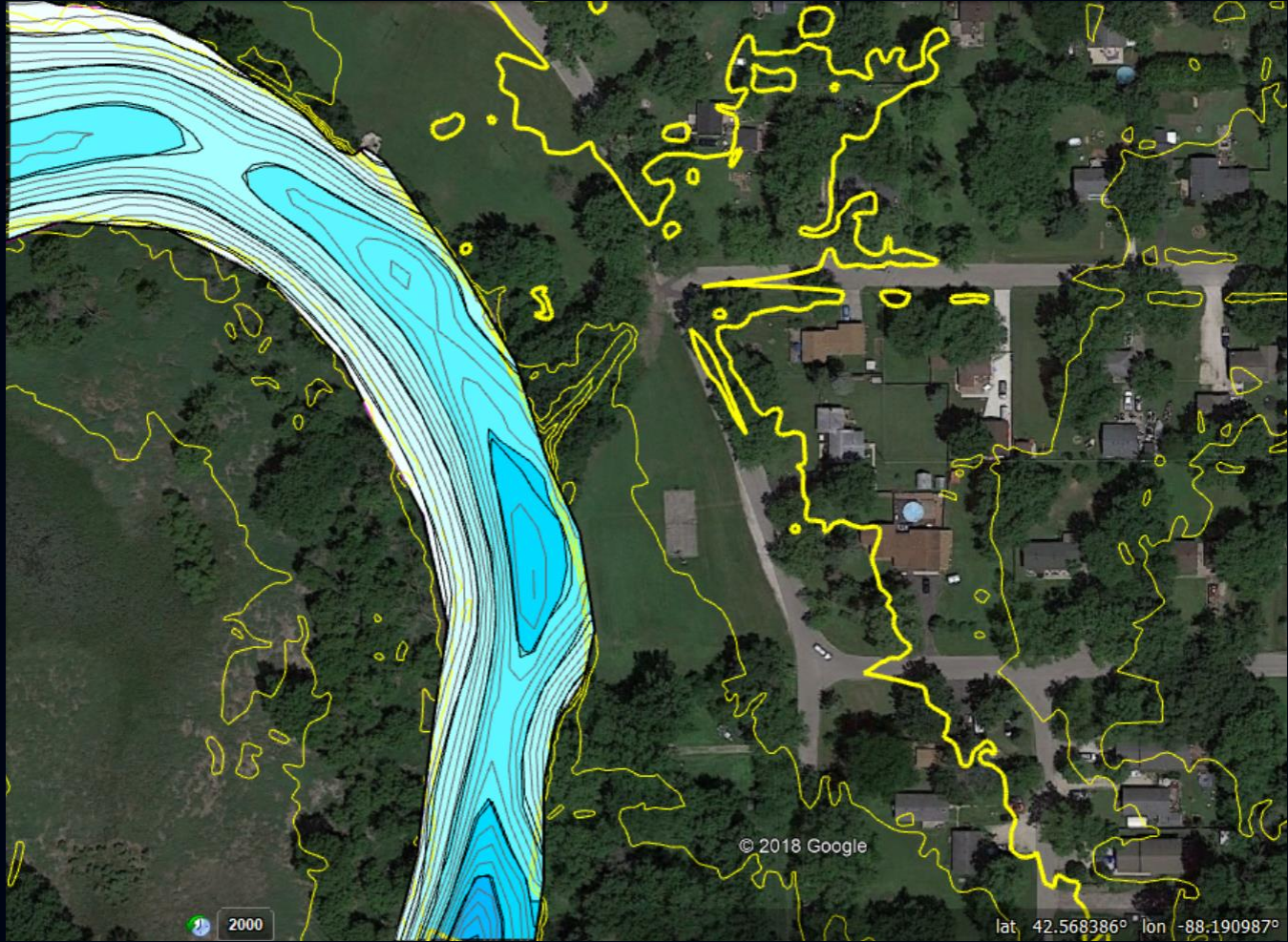


SHOREWOOD TERRACE PARK STREAMBANK STABILIZATION PROJECT 95-4-119-014-1215, Kenosha County

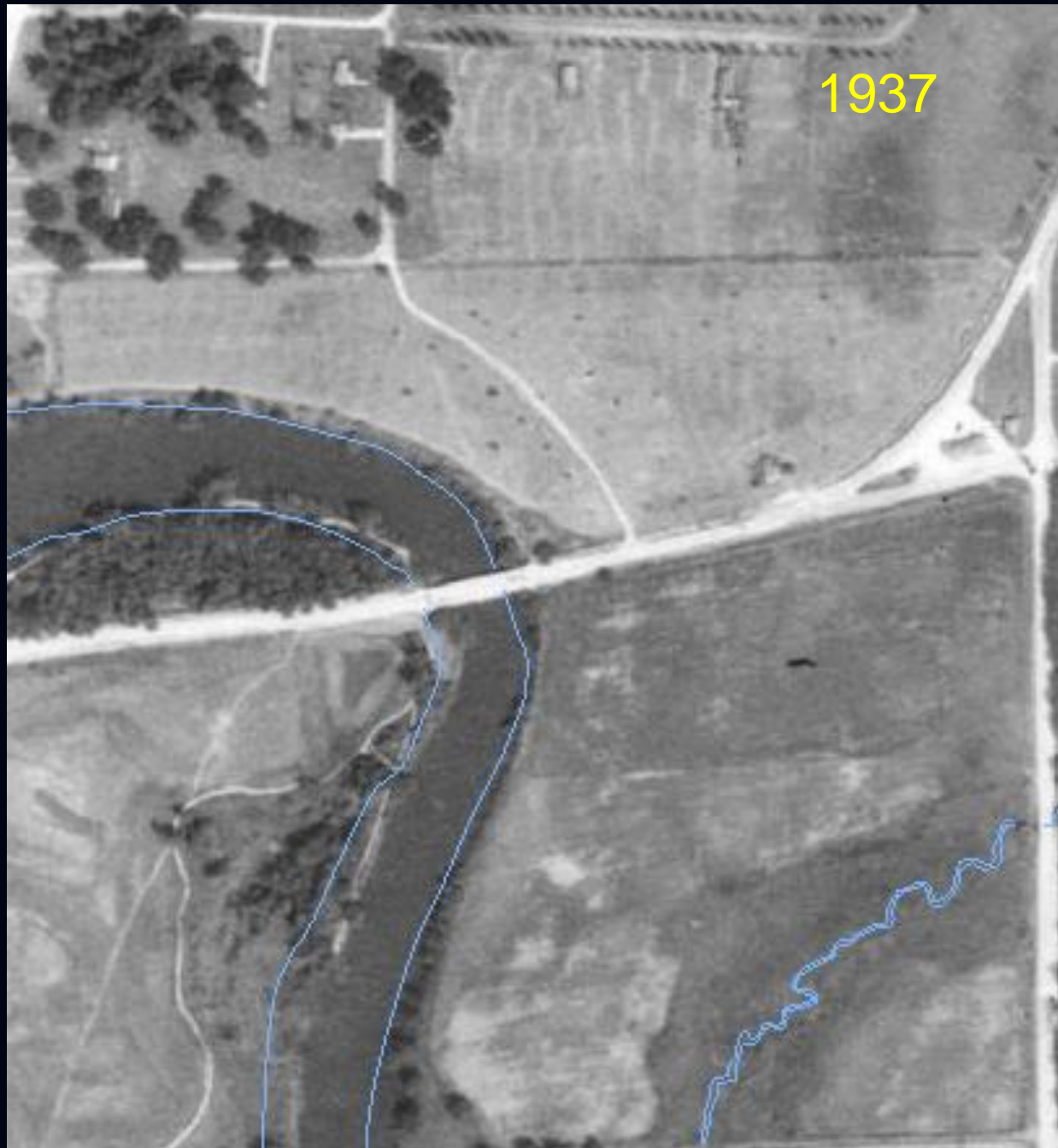






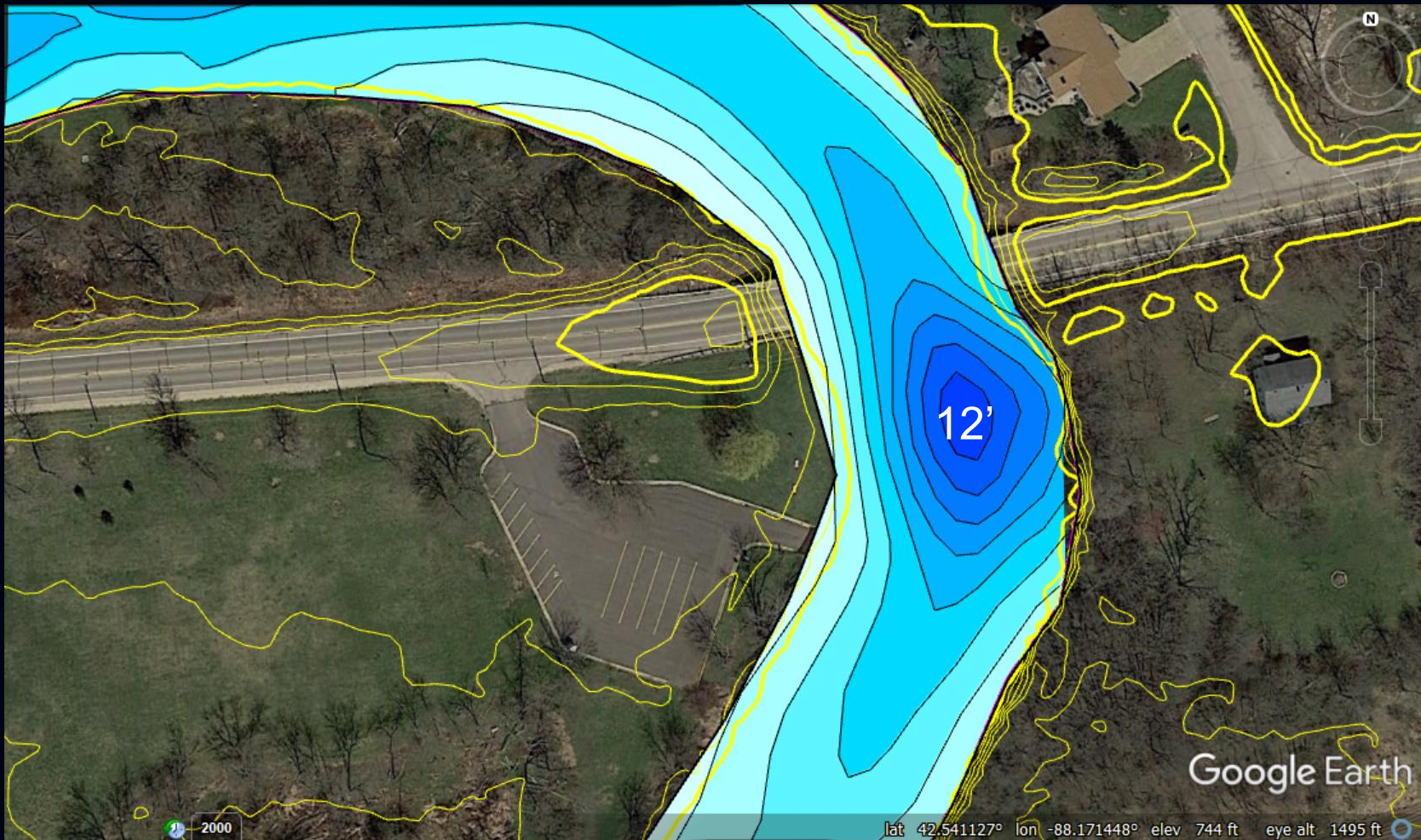


1937





2015

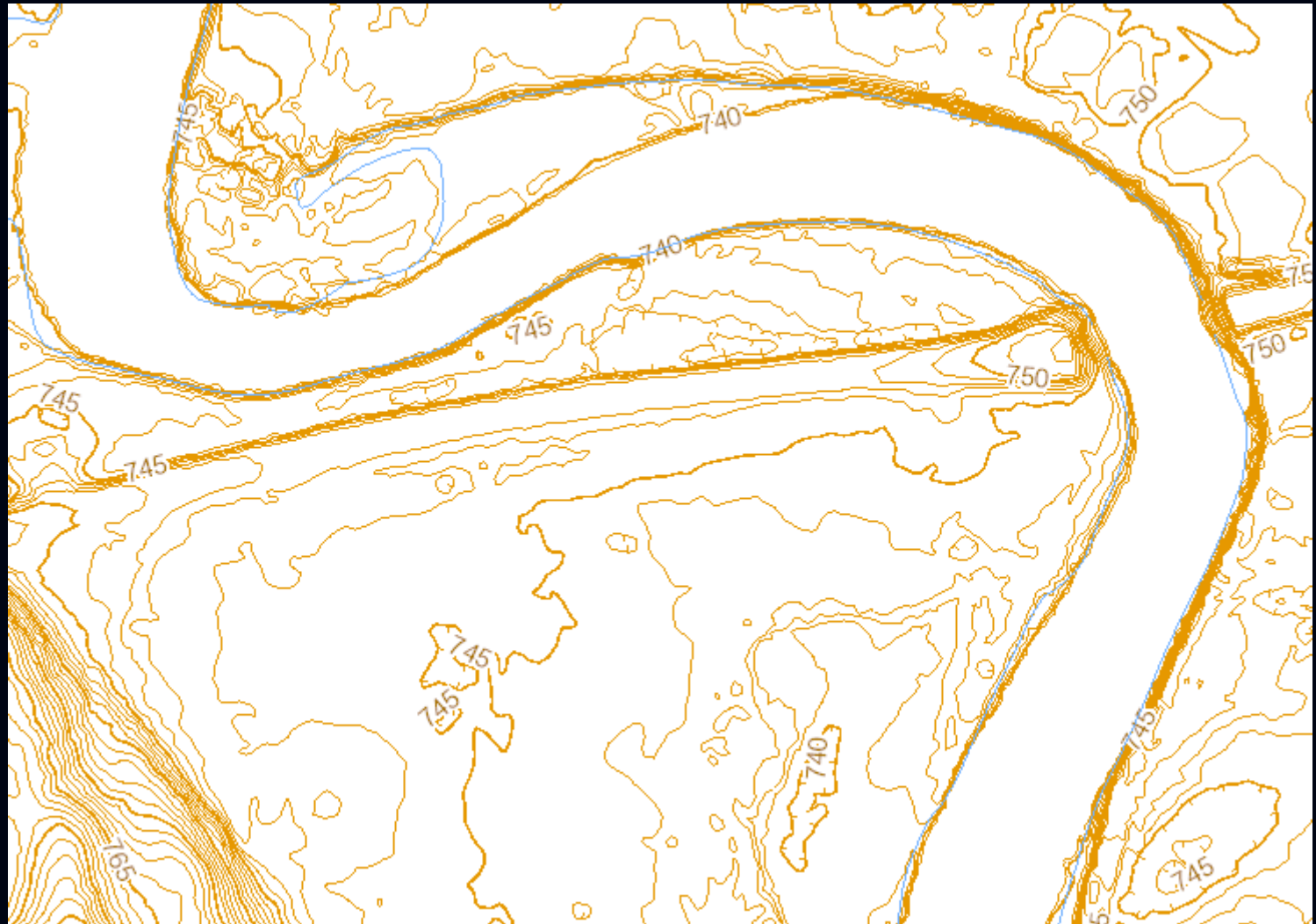


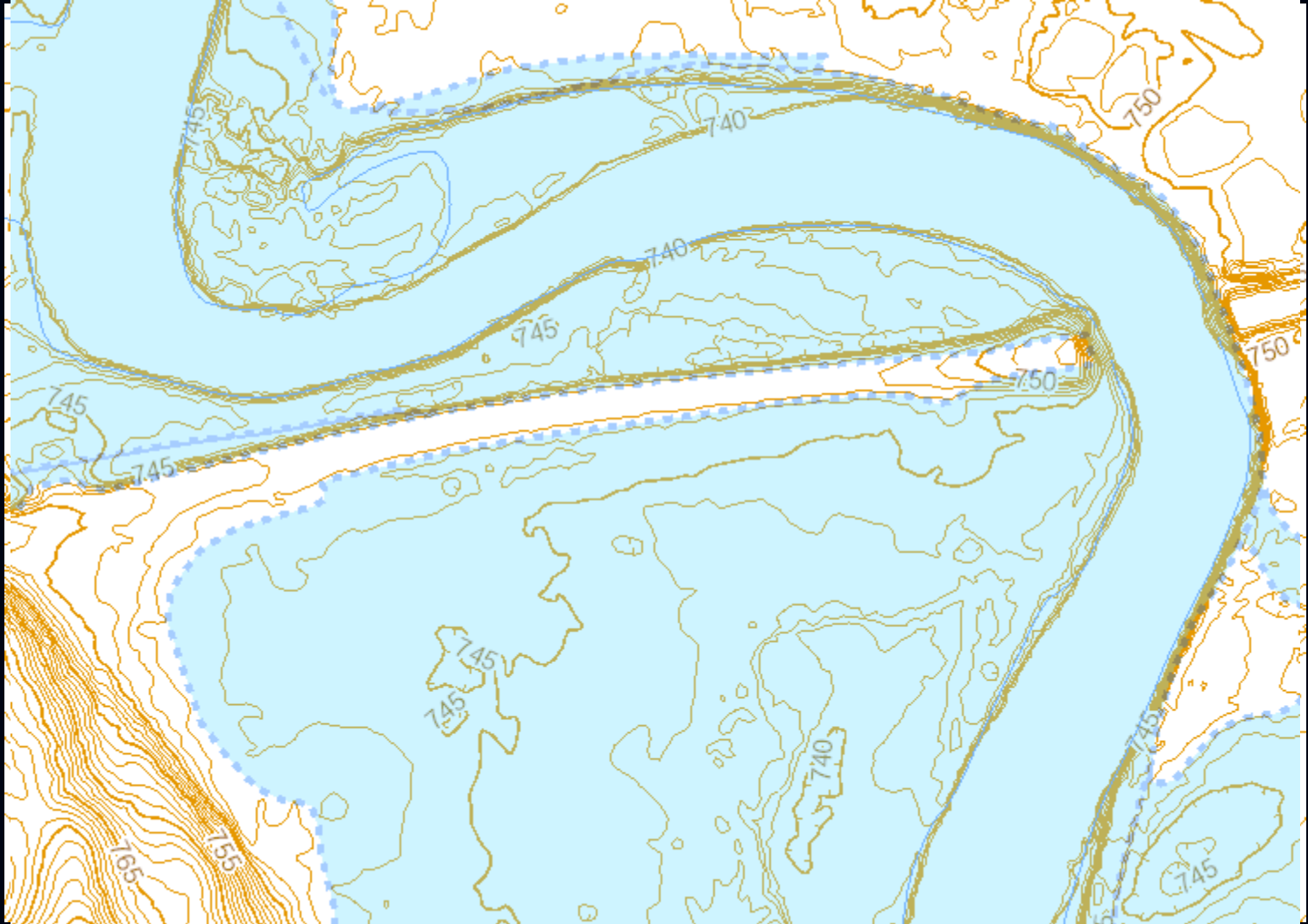
12'

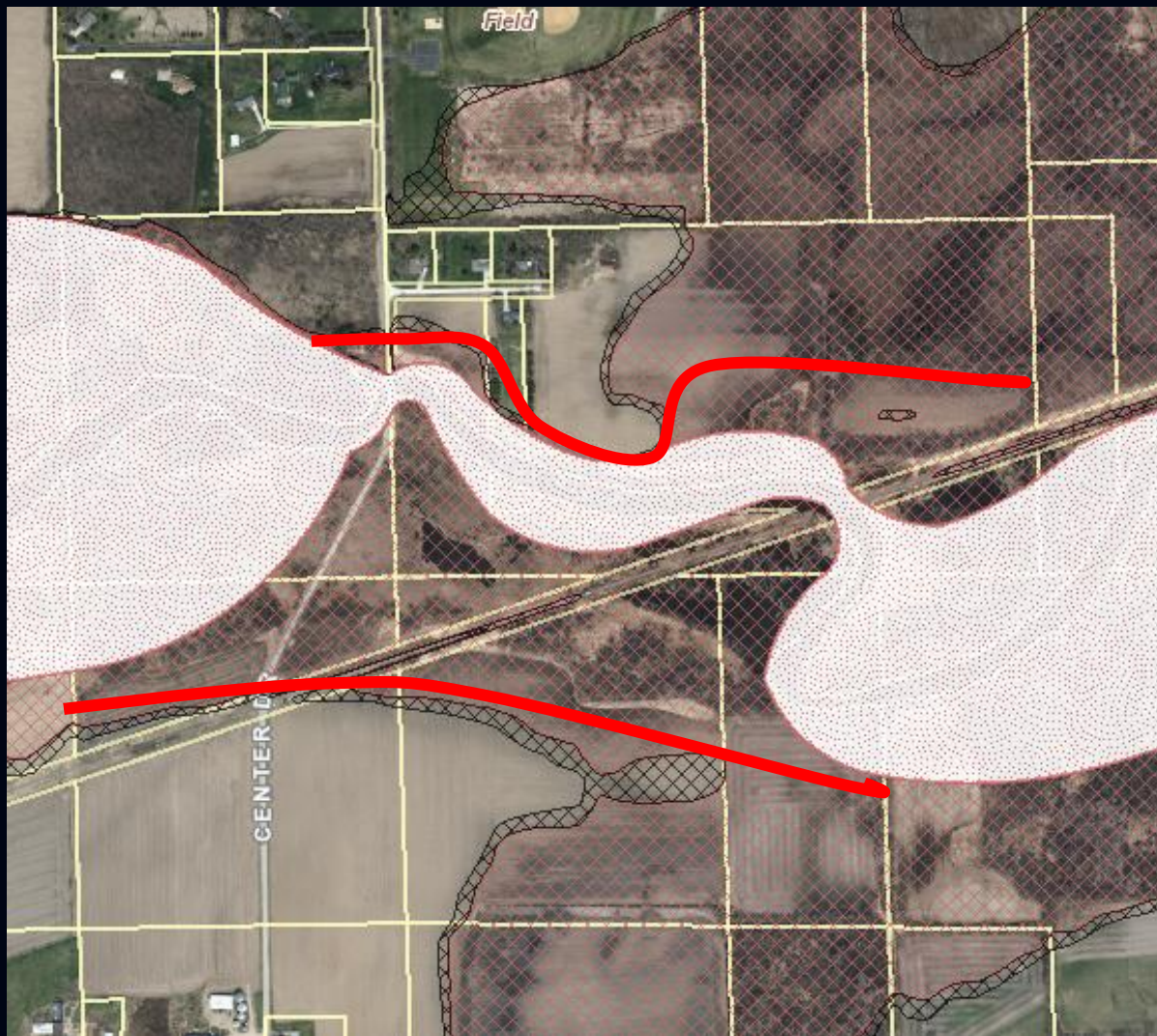
Google Earth

lat 42.541127° lon -88.171448° elev 744 ft eye alt 1495 ft

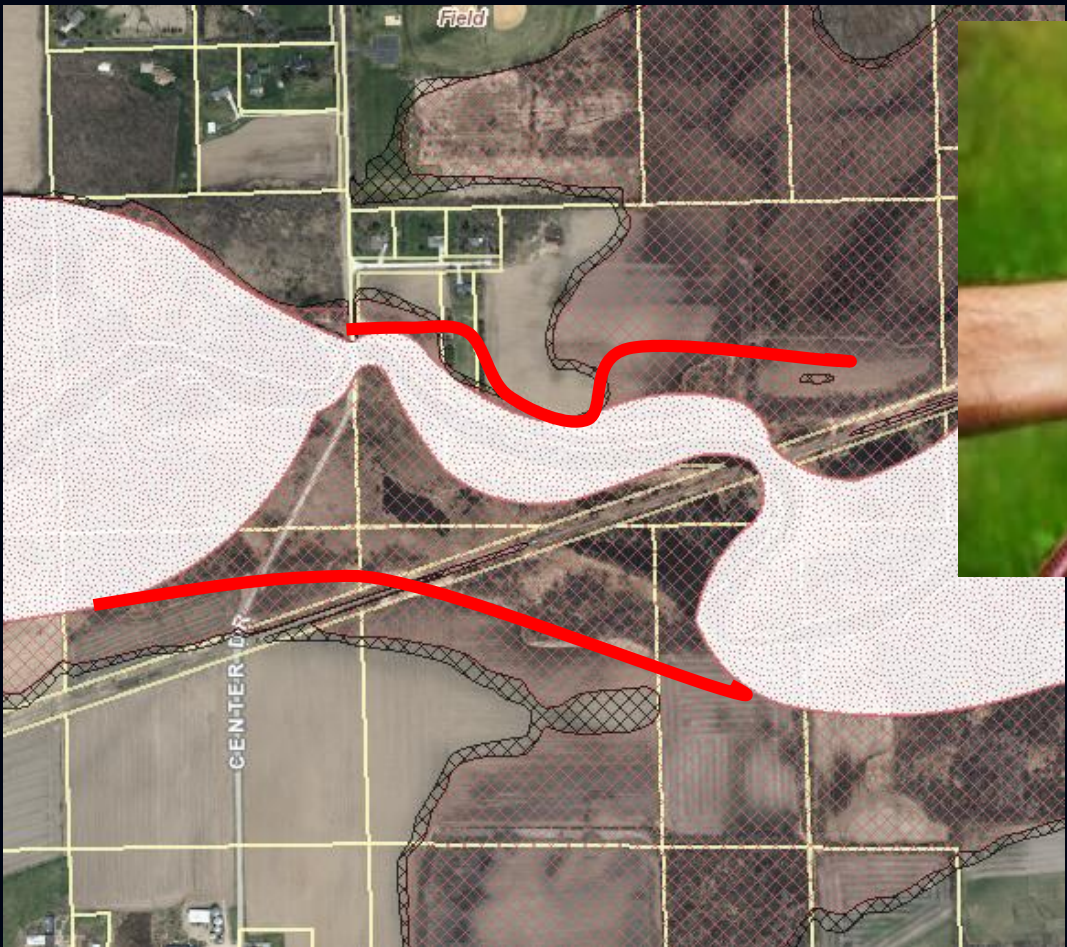
2000



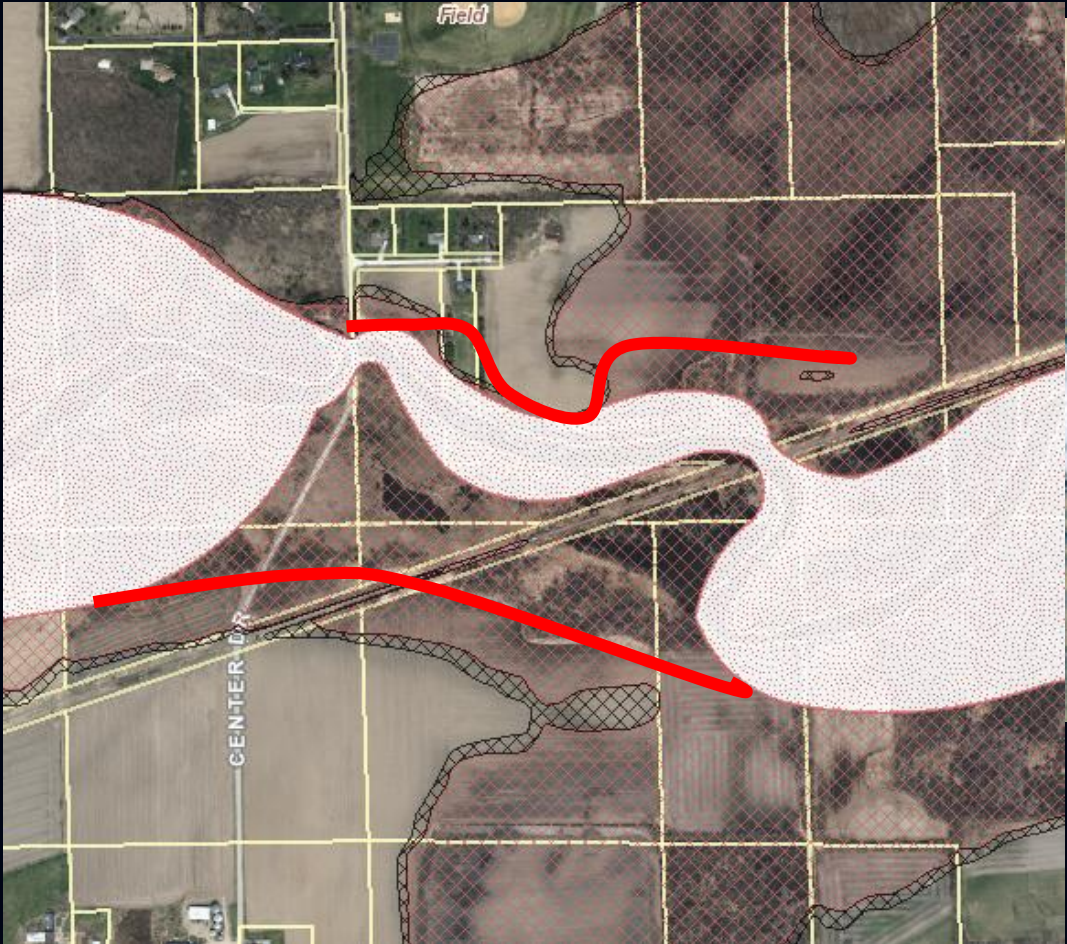




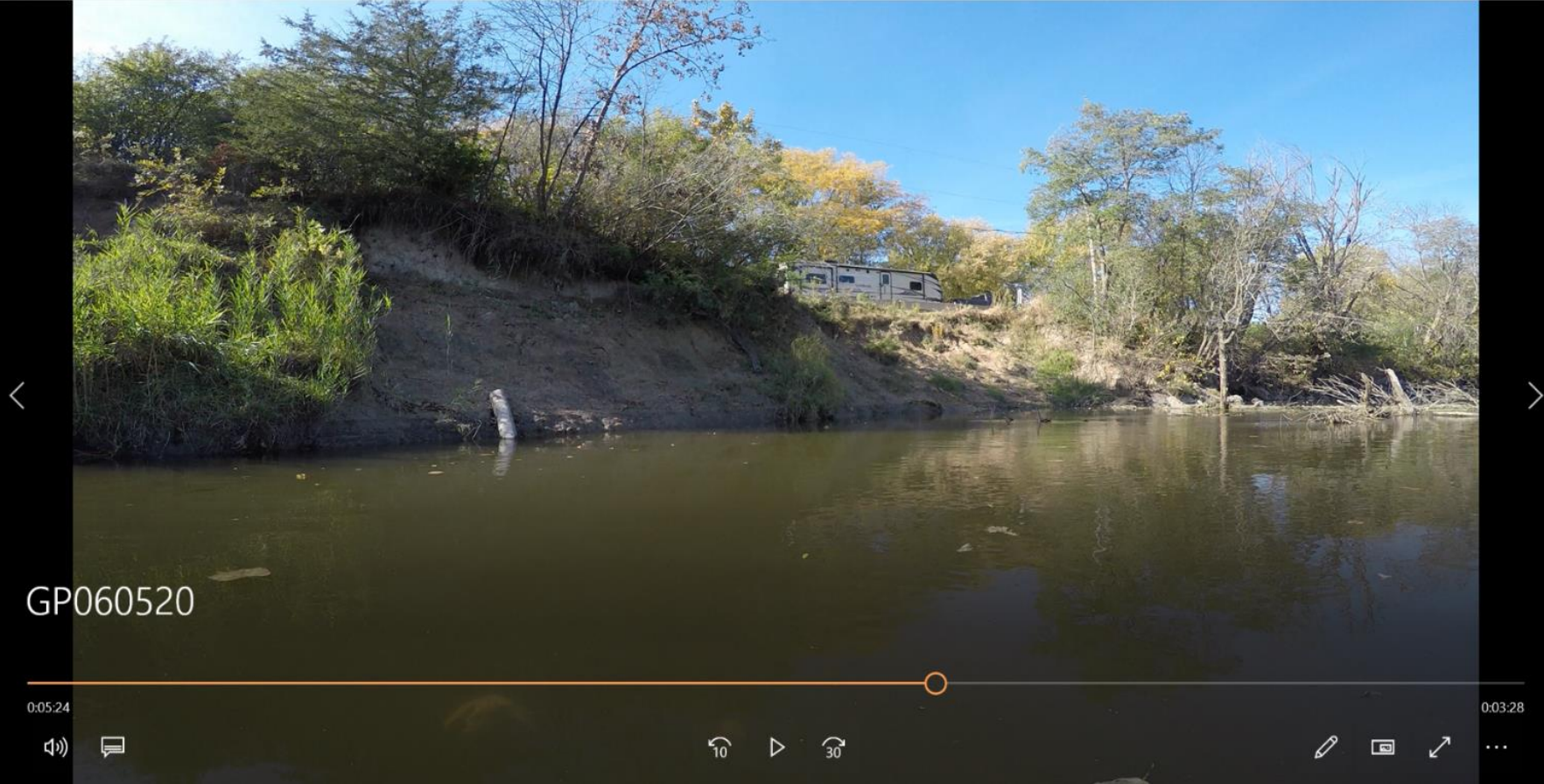
Confining stream channel increases stream power and promotes bed/bank erosion.



Confining stream channel increases stream power and promotes bed/bank erosion.



Confining stream channel increases stream power and promotes bed/bank erosion.



- Infrastructure protection
- Channel position, bank vulnerability, bank condition



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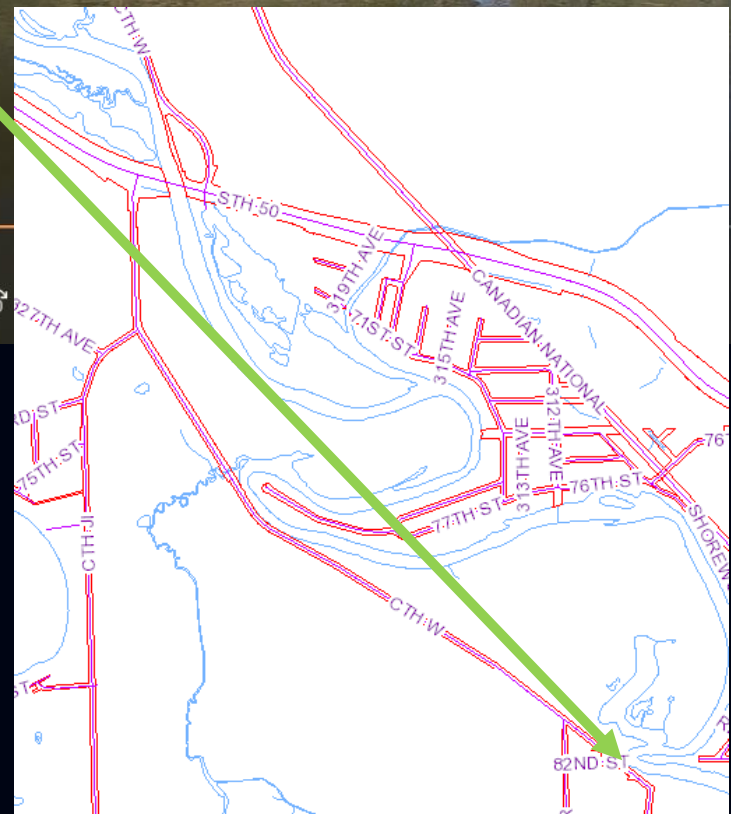
0:05:24



0:03:28



- Infrastructure protection
- Channel position, bank vulnerability, bank condition





GP060520

0:05:24



0:03:28

- Infrastructure protection
- Channel position, bank vulnerability, bank condition





Photo #: 56

Direction of View:

North

Comment:

Location ID: 111

Significant bank erosion.



Photo #: 57

Direction of View:

North-northeast

Comment:

Location ID: 111 Bank erosion.

Streambank Erosion Site

Looks Bad?

SITE PHOTOGRAPHS

Fox River Shoreline Erosion Photos
Waukesha and Racine Counties, Wisconsin

Photos Taken by GRAEF

Streambank Erosion Site-2015



Streambank Erosion Site- 1941



Streambank Erosion Site- 1941



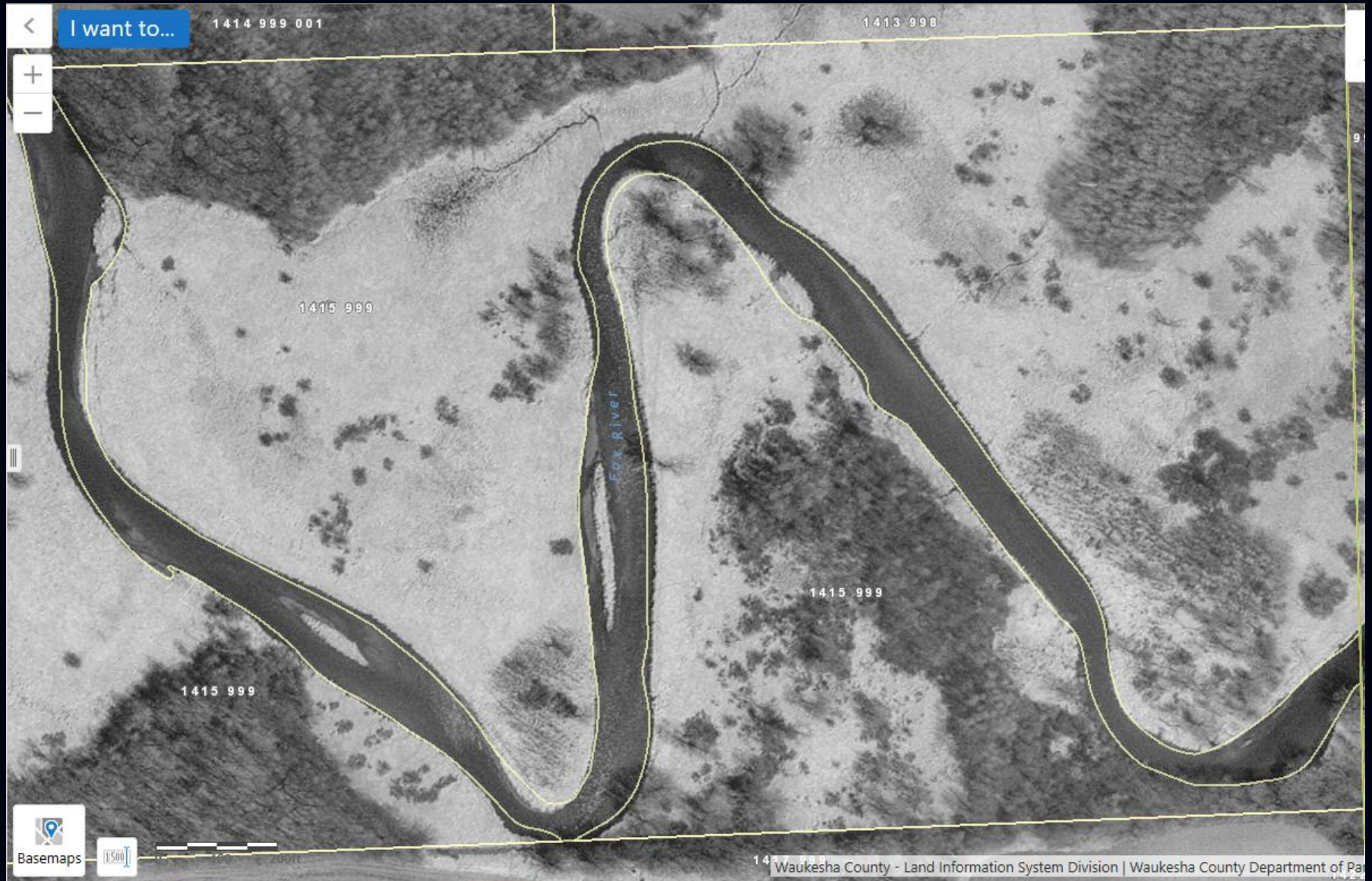
Analysis:

- Looks aren't everything!
- No measurable erosion in nearly 75 years?

Erosion & Deposition Channel Evolution- 2017



Erosion & Deposition Channel Evolution - 2000

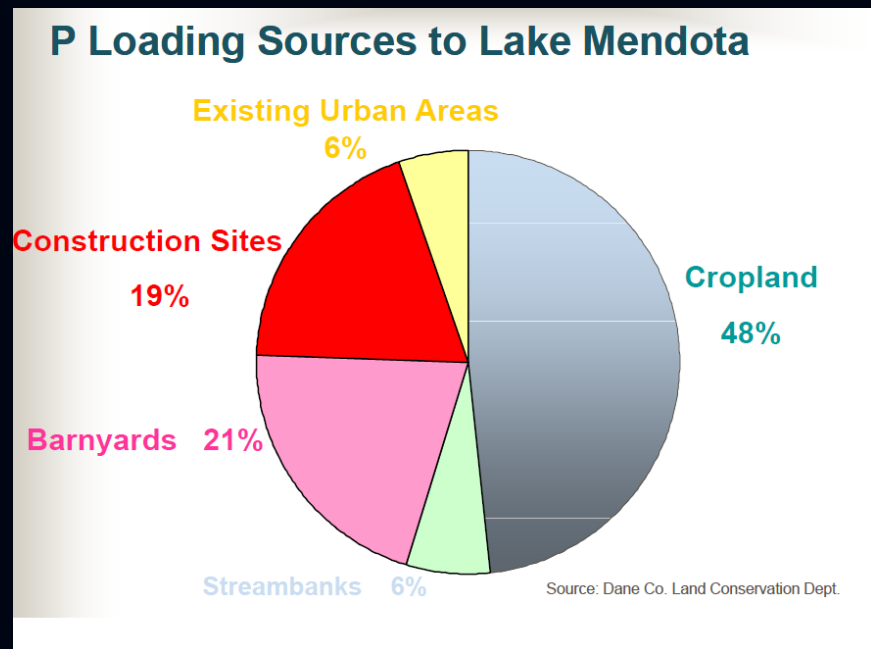


Erosion & Deposition Channel Evolution - 1941



Sediment and Phosphorus: Is It All About Eroding Streambanks?

- 1984 Iowa study estimated 45% of suspended sediment sourced from bank erosion.
- Milwaukee River northern Ozaukee County: 2% of sediment load from eroding streambanks.
- Lake Mendota: 6% of phosphorus load from eroding streambanks.
- Fox River - less than 1% of phosphorus load from eroding streambanks.



Sediment and Phosphorus: Is It All About Eroding River Banks?

- According to NRCS, average cropland soil loss in Wisconsin is 3.1 tons per acre per year.
- 3.1 tons/acre/year =
 - Roughly 0.02 inch/year
 - Five days growth of a typical fingernail
 - Thickness of 20 strands of typical human hair
- So what?



Sediment and Phosphorus: Is It All About Eroding River Banks?

Consider a 40-acre field: 3.1 tons/acre/year translates to between 7 and 9 dump trucks of soil excavated from the field and deposited elsewhere each year!



Earthhaulers, Inc.

Sediment and Phosphorus: Is It All About Eroding River Banks?



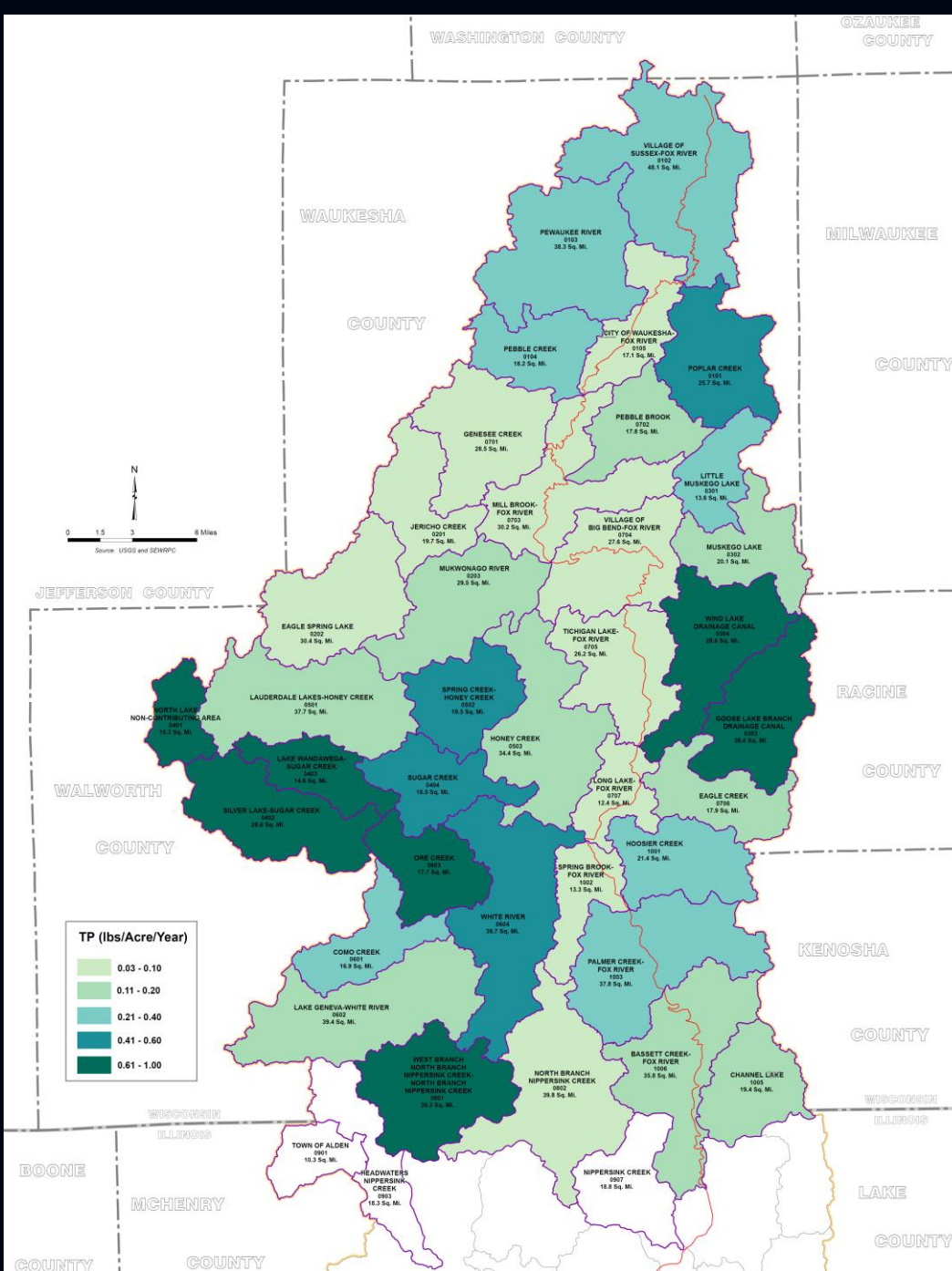
- Echo Lake Dam: 250 square mile watershed
- If 10 percent of soil lost from agricultural portions of the watershed was transported to streams, how much soil enters watershed streams each year?



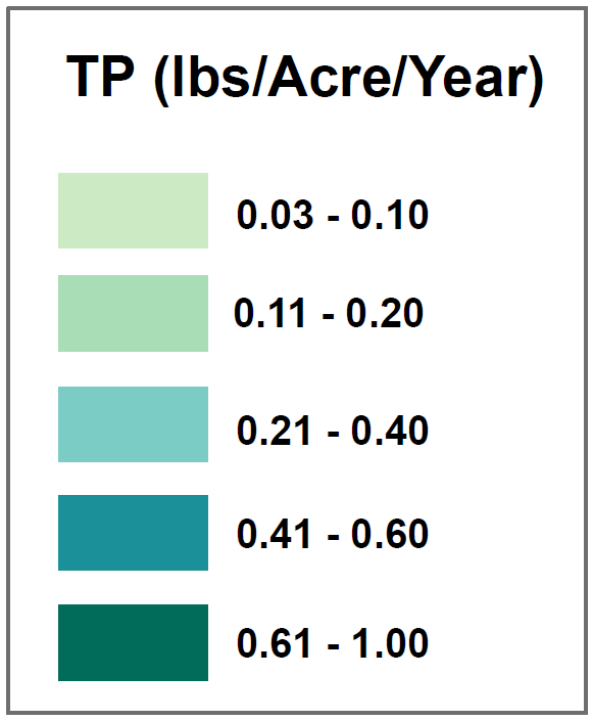
Sediment and Phosphorus: Is It All About Eroding River Banks?

- Echo Lake Dam: 250 square mile watershed, 50 percent agriculture.
- If 10 percent of soil lost from agricultural portions of the watershed was transported to streams, how much soil enters watershed streams each year?
- **Would fill this ballroom over twice each year.**
- **Large amount of sediment is also contributed by the other land uses in the watershed.**





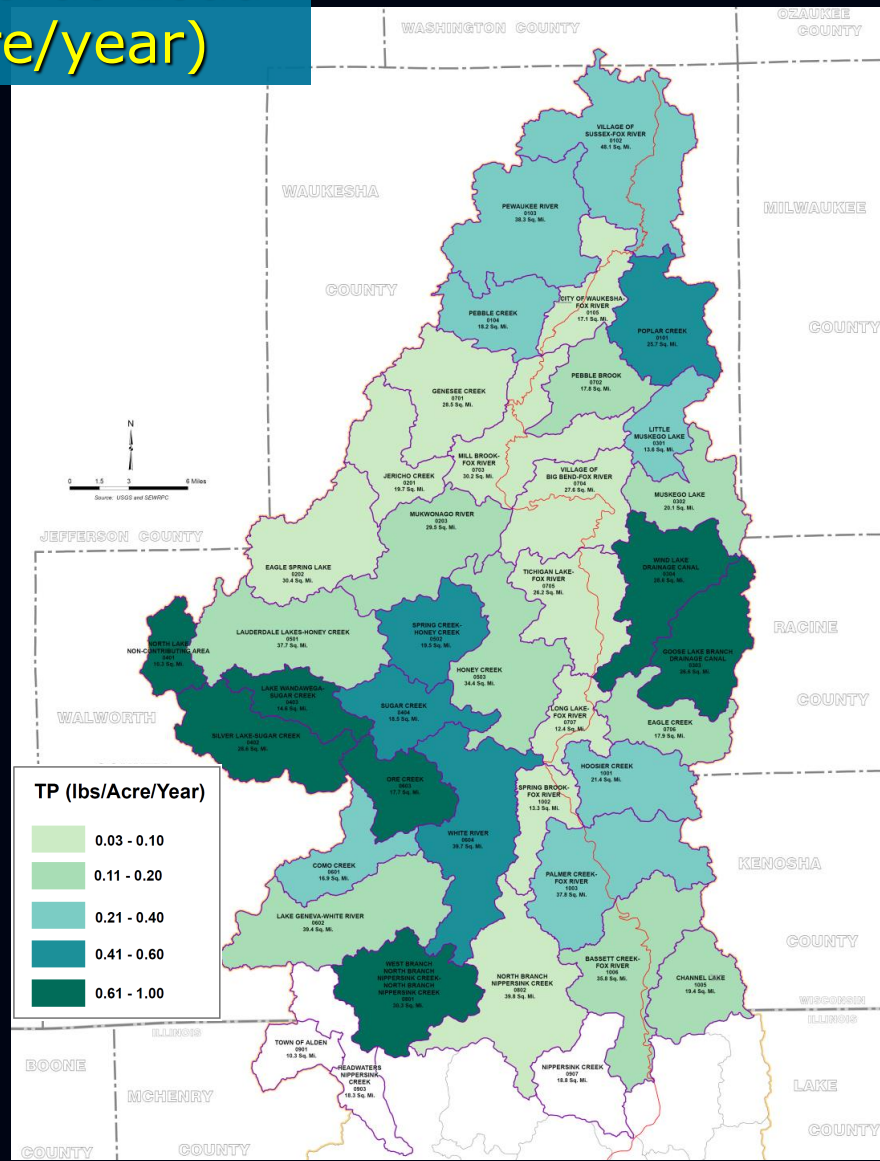
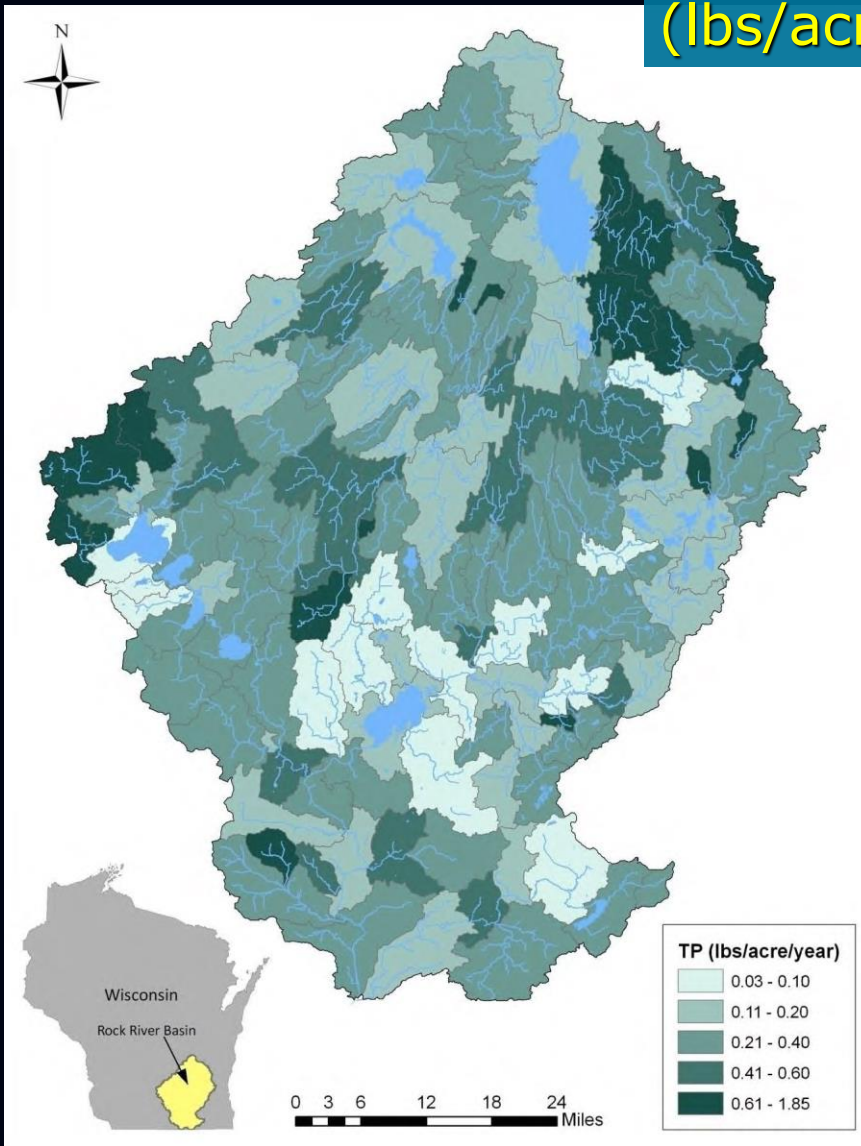
Phosphorus Load (lbs/acre/year)



Rock River

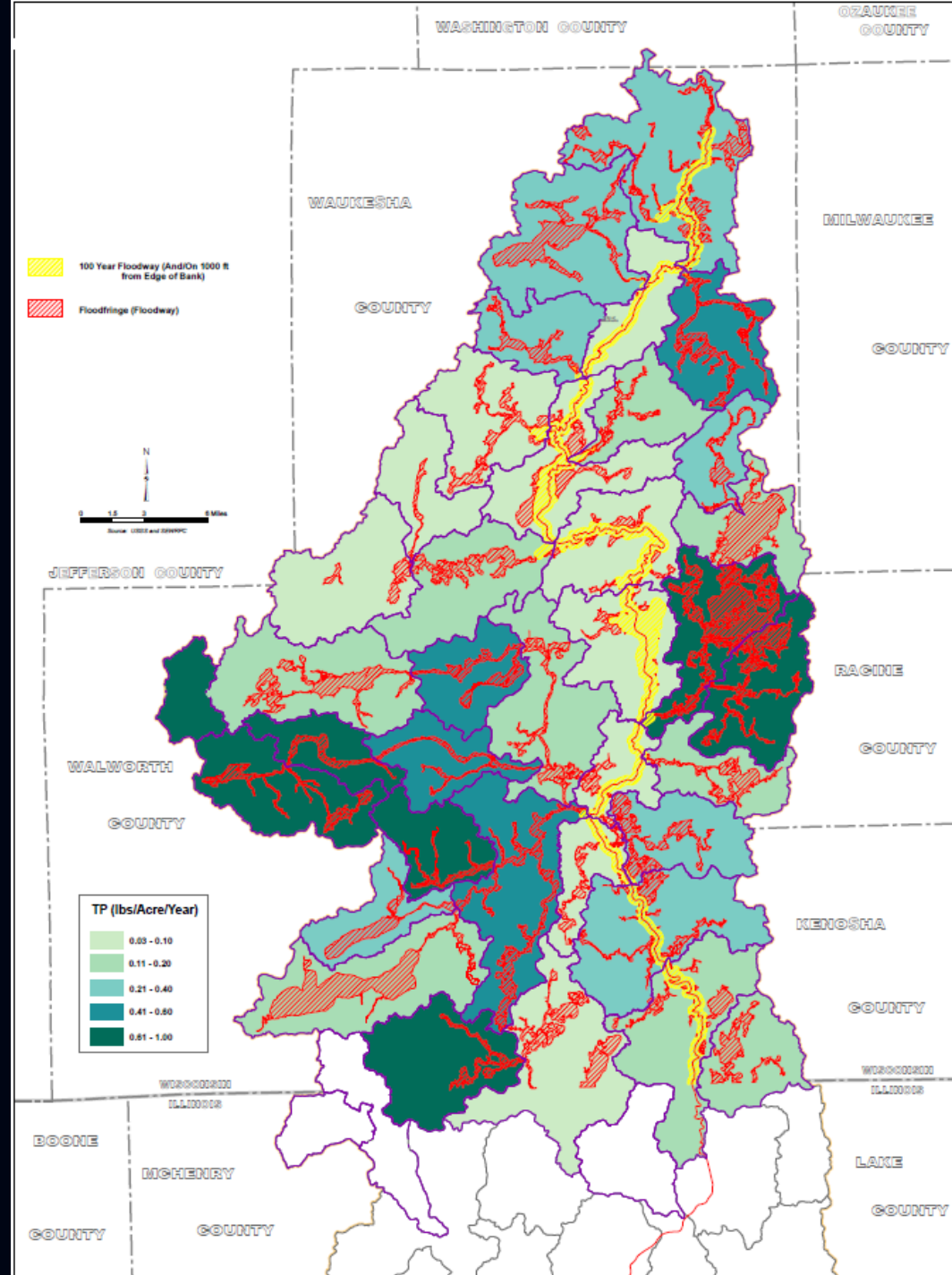
Phosphorus Load (lbs/acre/year)

Fox River



Phosphorus Sources

- Total nonpoint source phosphorus load approximately 187,000 pounds/year.
- Streambank erosion on Fox River main stem contributes about 1,000 pounds of phosphorus each year.
- 186,000 pounds/year from other sources.

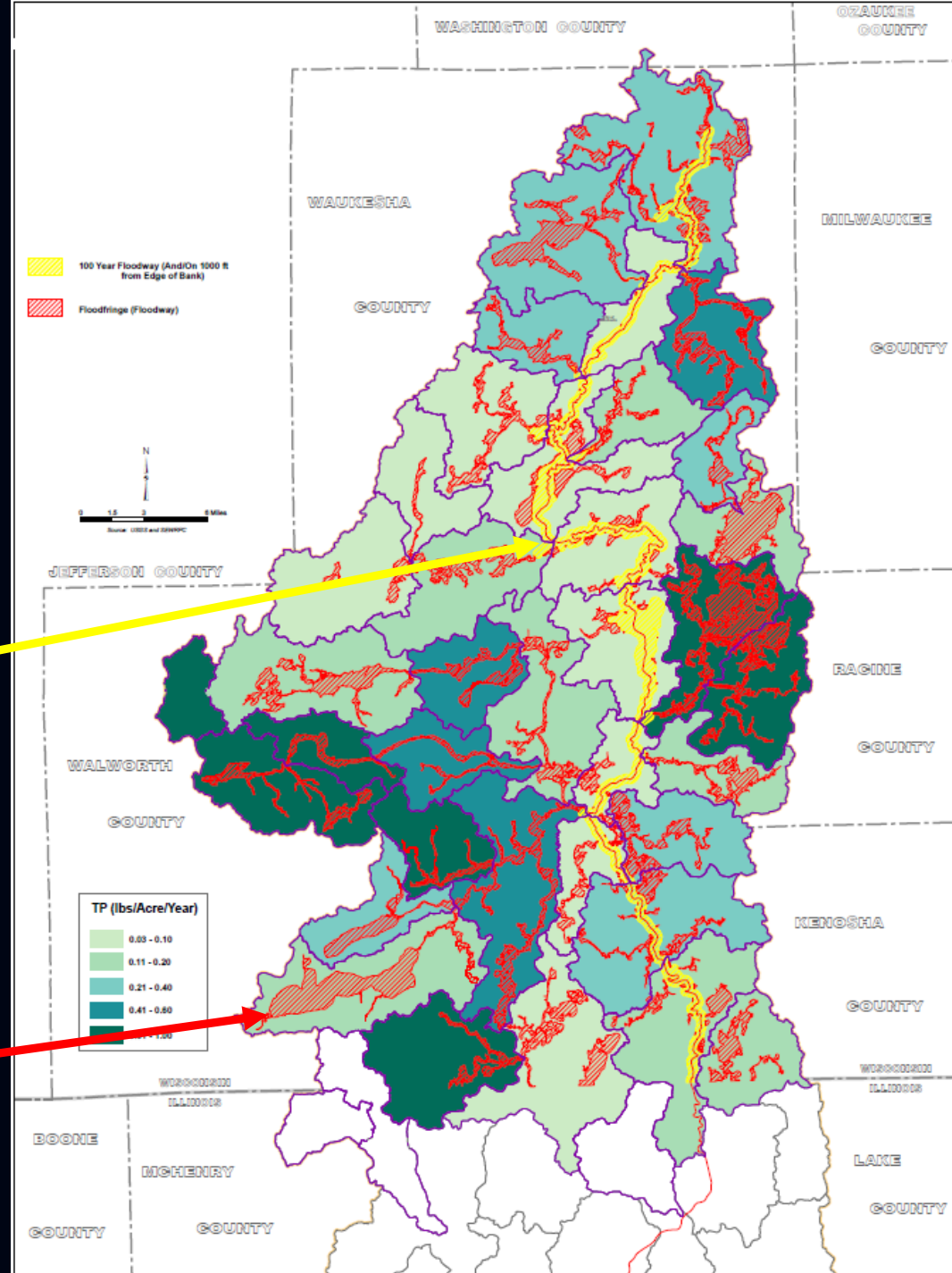


Priority Load Reduction Areas

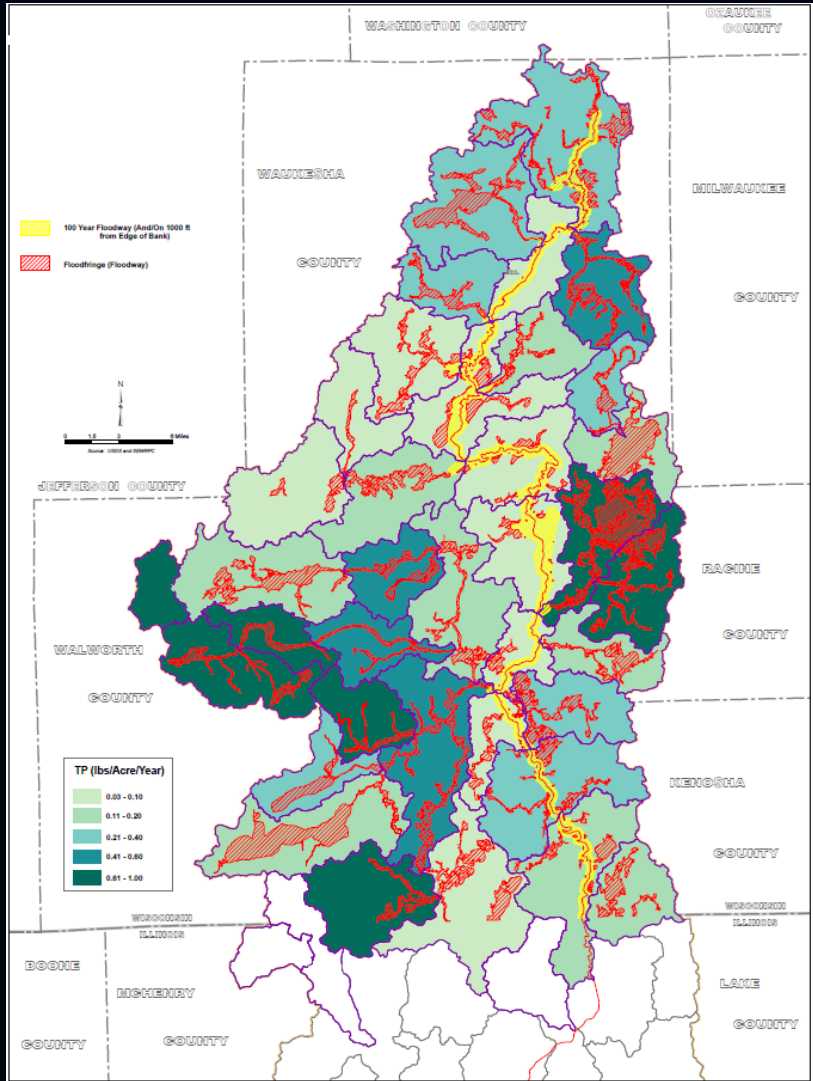
Erosion near water or seasonally flooded areas = sediment in river.

Fox River main stem ~2,500 acres within floodway, floodplain, or within 1,000 feet of channel.

Fox River tributaries ~10,000 acres within floodway/floodplain.



Priority Load Reduction Areas Hypothetical Example



Best management practices overall reduce average phosphorus load by nearly half.

Adopt BMPs. Target average soil loss reduced from 3.1 to 1.6 tons/acre/year.

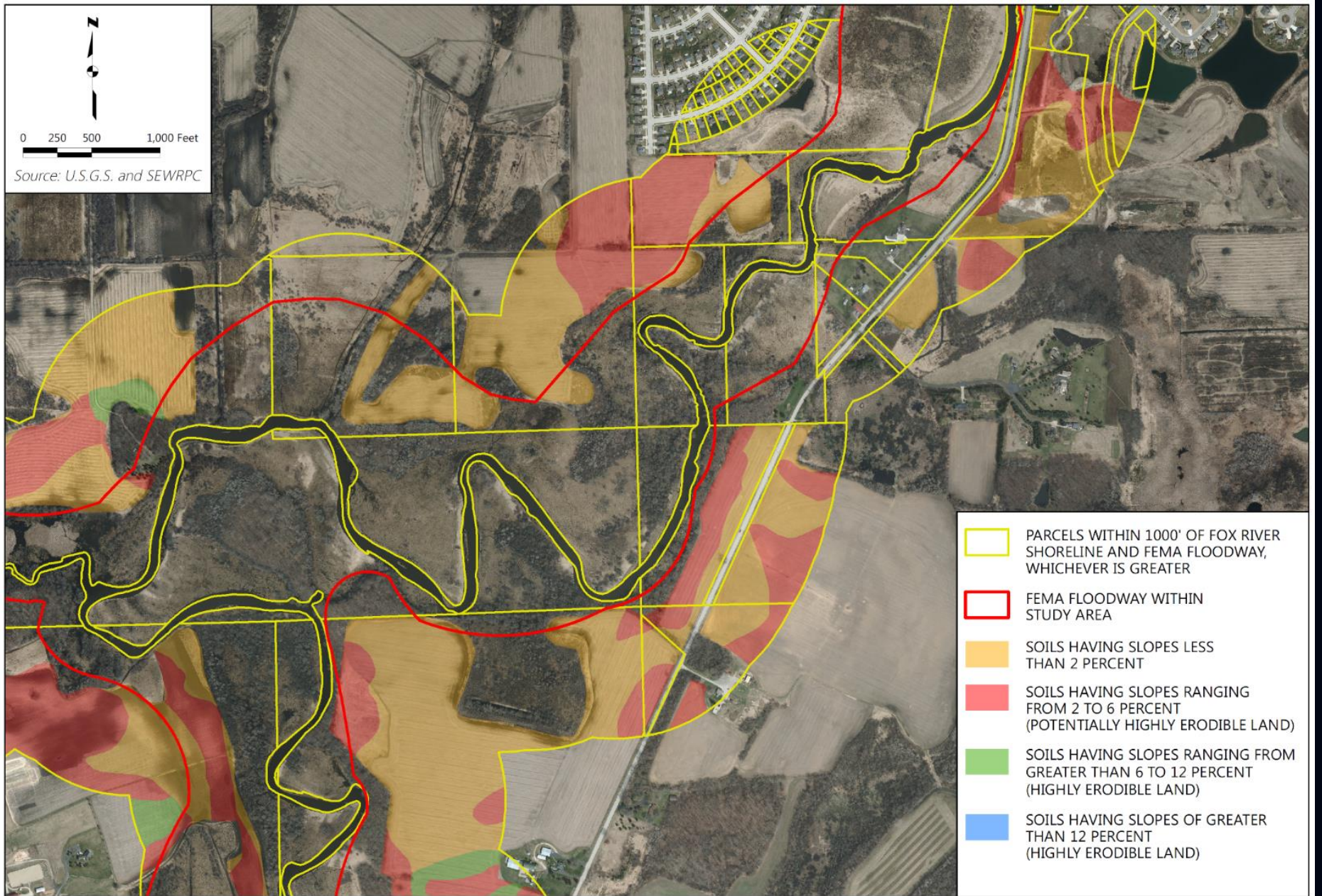
Focus on highly erodible and potentially highly erodible parcels.

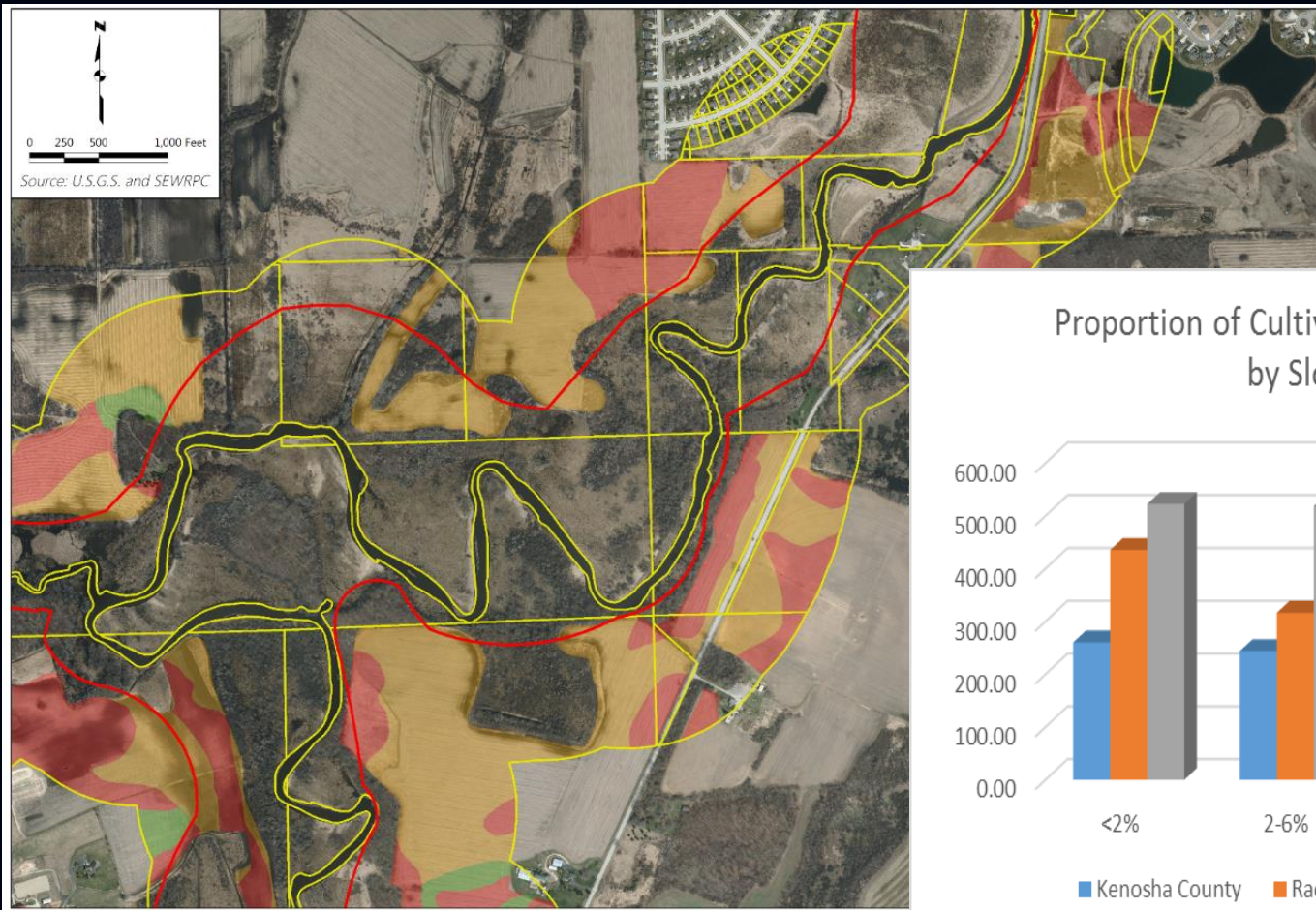
Fox River main stem ~2,500 acres. Soil loss reduced by 3,750 tons/year.

Equivalent to filling this ballroom each year.

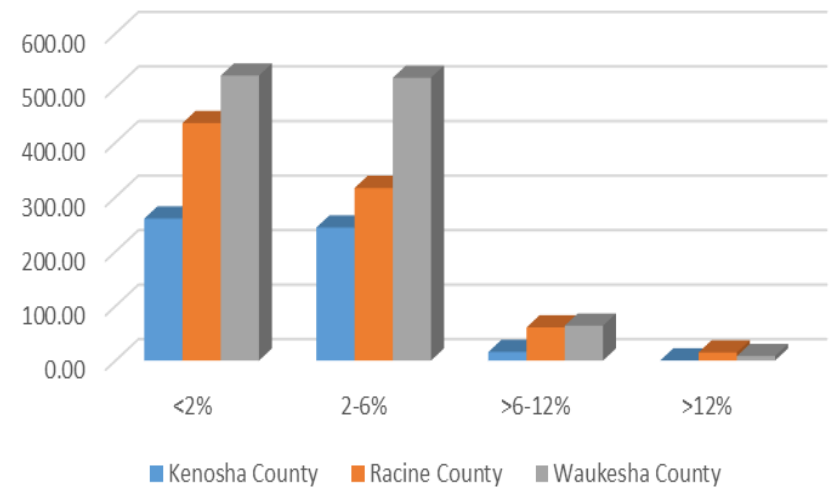
Also equal to 750 feet of 10 foot high bank receding 10 feet every year.

Riparian Buffer-Position & Erodibility



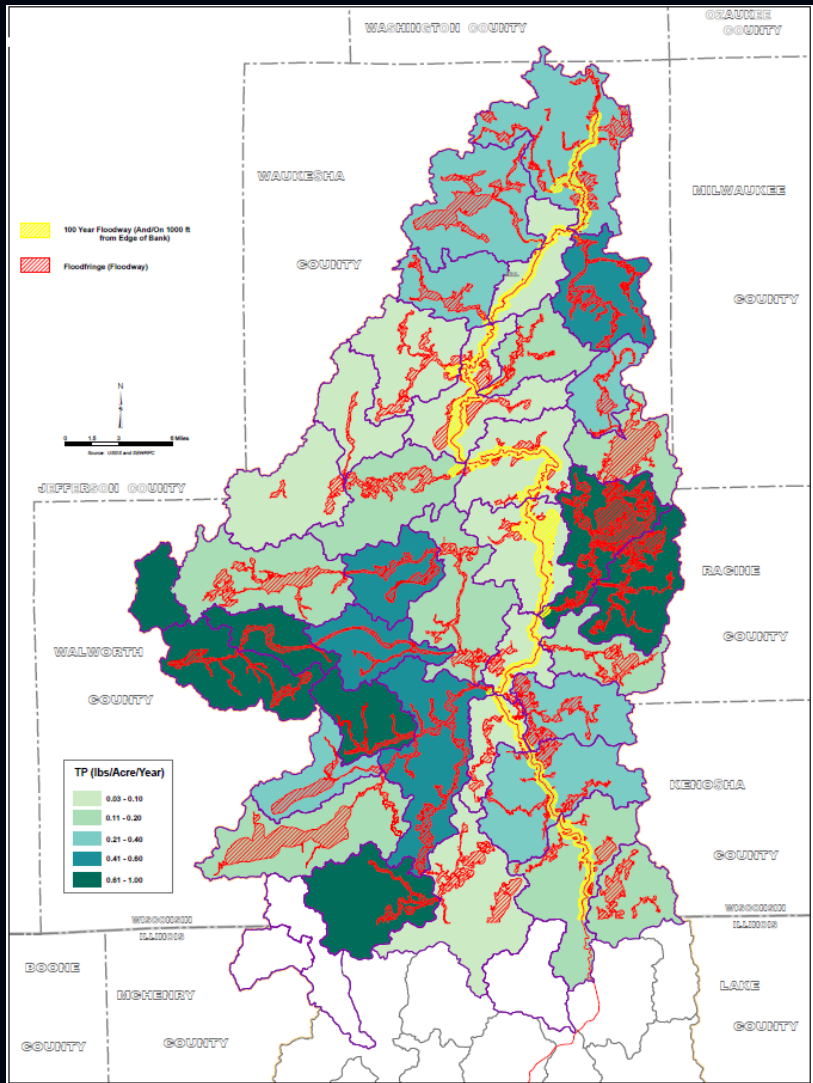


Proportion of Cultivated Lands Among Counties by Slope Categories



| Land Slope Category | Kenosha County | | Racine County | | Waukesha County | |
|---|----------------|--------|---------------|--------|-----------------|---------|
| | No. Parcels | Acres | No. Parcels | Acres | No. Parcels | Acres |
| <2% | 62 | 260.48 | 81 | 435.63 | 122 | 522.56 |
| 2-6% (Potentially Highly Erodible Land) | 75 | 243.83 | 86 | 316.32 | 161 | 518.54 |
| >6-12% (Highly Erodible Land) | 19 | 15.71 | 42 | 60.82 | 40 | 64.04 |
| >12% (Highly Erodible Land) | 3 | 0.42 | 18 | 14.83 | 14 | 8.10 |
| Total | 159 | 520.44 | 227 | 827.60 | 337 | 1113.23 |

Priority Load Reduction Areas Hypothetical Example



Best management practices overall reduce average phosphorus load by nearly half.

Adopt BMPs. Target average soil loss reduced from 3.1 to 1.6 tons/acre/year.

Focus on highly erodible and potentially highly erodible parcels.

Fox River tributaries ~10,000 acres. Soil loss reduced by 15,000 tons/year.

Equivalent to filling the ballroom 4 times each year.

Also equal to over a half mile of 10 foot high bank receding 10 feet every year.

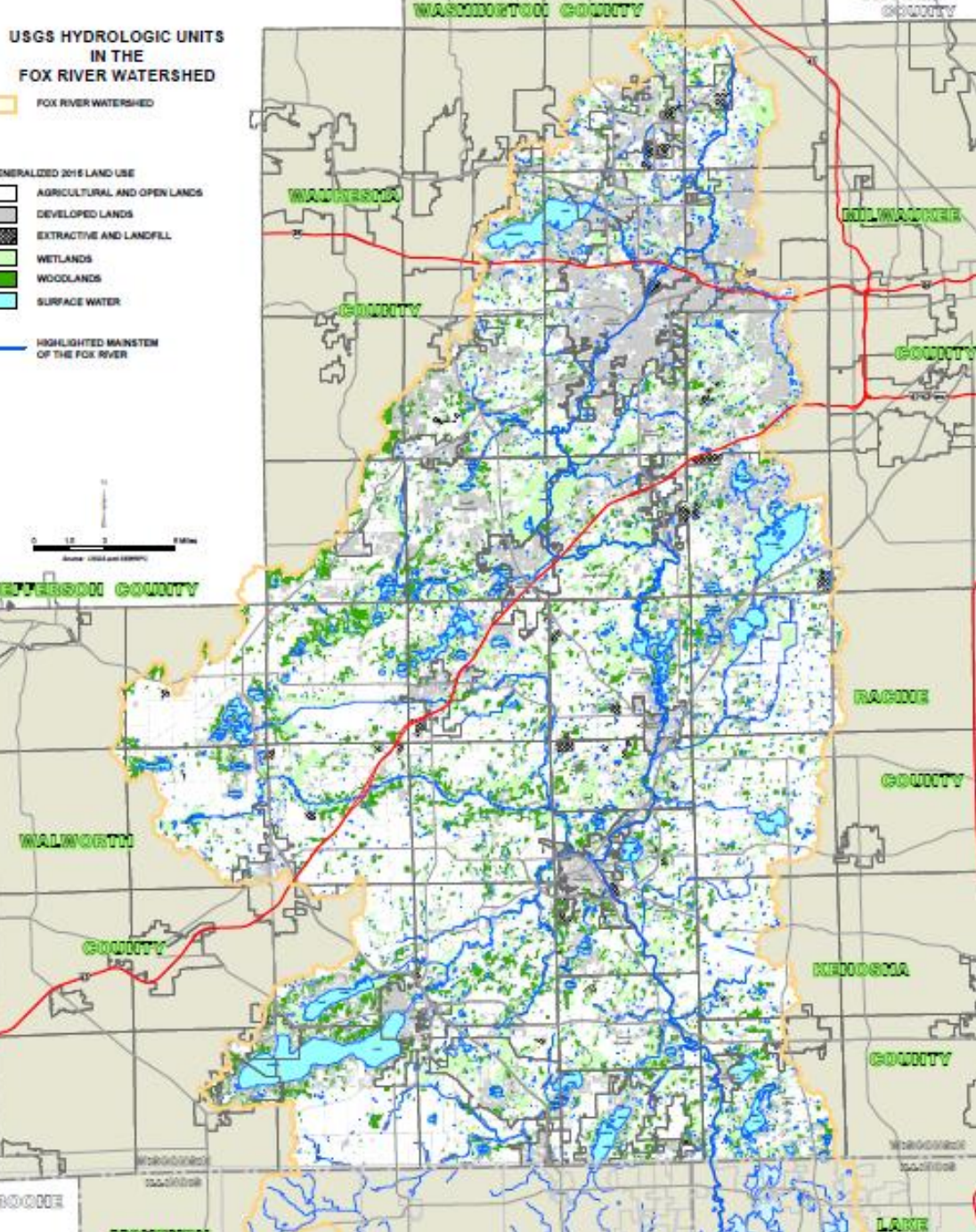
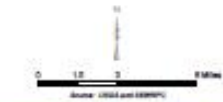
USGS HYDROLOGIC UNITS
IN THE
FOX RIVER WATERSHED

FOX RIVER WATERSHED

GENERALIZED 2016 LAND USE

- AGRICULTURAL AND OPEN LANDS
- DEVELOPED LANDS
- EXTRACTIVE AND LANDFILL
- WETLANDS
- WOODLANDS
- SURFACE WATER

HIGHLIGHTED MAINSTEM
OF THE FOX RIVER



Almost 1,000 square mile watershed with mixed land use.

Substantially less than half is agriculture.

Other opportunities?

Questions?

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