

River Falls Hydroelectric Project (FERC P-10489)

Updated Study Report Meeting

February 9, 2021



Agenda

9:00 AM

Meeting Overview

- Introductions – Kevin Westhuis, RFMU & Lesley Brotkowski, TRC
- Meeting Purpose and FERC Process Update – RFMU, TRC, & FERC

9:30 AM

Studies Conducted in 2020

- Hydraulic and Hydrologic Analysis – Pat Dowd, USACE
- Water Quality – Ellen Faulkner, Ayres
- Mussel Survey – Dan Kelner, USACE

11:00 AM

Break

11:15 AM

Studies Conducted in 2020, Continued

- Lake George Shoreline Habitat Assessment – Josh McEnany, GSRC

Agenda

11:15 AM

Studies Conducted in 2020, Continued

- Aquatic Invasive Species Survey- Marty Melchior & Sean Morrison, Inter-Fluve
- Riverine Habitat Evaluation Below Powell Falls – Marty Melchior & Sean Morrison, Inter-Fluve

12:30 PM

Lunch Break

1:00 PM

Studies conducted in 2020, Continued

- Recreation Use Assessment – Ross Hackbarth, GSRC
- Archaeology Survey – Rachel Klabacka-Williams, TRC
- Sediment Study – Pete Haug, Ayres & Ben Lenz, TRC

2:30 PM

Break

2:45 PM

Powell Falls Decommissioning Plan – Pete Haug, Ayres

3:30 PM

Next Steps and Meeting Conclusion

Introductions

- Welcome
- Virtual meeting housekeeping
 - Meeting will be recorded
 - Raise hand or use meeting chat functions to make a comment or ask questions
 - Sign-in: unknown meeting participants will be asked to identify themselves periodically

Meeting Purpose

- Review the contents of the Updated Study Report
- Provide an opportunity to discuss the 2020 study results prior to the submittal of the Draft License Application
- Each study update will include an opportunity for questions and comments

Project Boundary



FERC Process Update

Responsible Party	Pre-Filing Milestone	Date*
Licensee	Second Study Season	2020
Licensee	Updated Study Report due	1/30/2021
All stakeholders	Updated Study Report Meeting	2/9/2021
Licensee	Updated Study Report Meeting Summary	2/24/2021
Licensee	Draft License Application Due	4/3/2021
Stakeholders	Draft Comments Due	7/2/2021
Licensee	License Application filed	8/31/2021
Licensee	Public Notice of License Application filing	9/14/2021

*Dates based on FERC Revised Process Plan and Schedule issued on 7/10/2019

FERC Process Update

- **USACE Planning Assistance to States (PAS) Program**
 - USACE cost-share program assists with preparation of comprehensive plans for water and related land resources
 - 50/50 cost share, with \$210,000 provided by USACE
 - PAS Program used to support 2020 studies

FERC Process Update - 2020 Flood

- June 28-29, 2020: 7-8” of rainfall in parts of the Kinnickinnic Watershed
- Damage to the Powell Falls dam
- July 16, 2020: RFMU filed a flood damage report with FERC Division of Dam Safety and Inspection (D2SI)
- September 10, 2020: FERC D2SI requested a plan and schedule to address dam safety inspection and replacement of gages

2020 Flood

Junction Falls



- Headworks at Powell Falls were underwater on June 29, 2020
- At the height of the flood, water was 7 feet above the crest of the dam



Powell Falls

Powell Falls Before and After

Before



- Damage to right wing wall



After

Lake Louise Drawdown

- September 25, 2021: RFMU filed Plan and Schedule for Lake Louise drawdown to conduct dam safety inspection
- October 1, 2020: FERC Division of Hydropower Administration and Compliance (DHAC) Order approved drawdown and temporary variance from run-of-river operation, required refill plan by April 2021 and return to normal by June 2021
- October 2, 2020:
 - FERC D2SI concurred with inspection plan, asked for future action options
 - Drawdown initiated
- December 22, 2020: RFMU filed Post-Flood Dam Safety Inspection and Repair Options letter for Powell Falls

Powell Falls Action Options

- **Option 1:** Repair the dam and refill Lake Louise
- **Option 2:** Keep Lake Louise drawn down as is
- **Option 3:** Keep Lake Louise drawn down, fix the gate and pull the turbine to enhance flow capacity
- **Option 4:** Keep Lake Louise drawn down and add flow capacity by opening a new passage route
- **Option 5:** Proceed with full dam removal (accelerated by two years from original schedule)

Powell Falls Action Options

- **Option 1:** Repair the dam and refill Lake Louise
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- **Option 4:** Keep Lake Louise drawn down and add flow capacity by opening a new passage route
- **Option 5:** Proceed with full dam removal (accelerated by two years from original schedule)

Next Steps

FERC Amendment Application - FERC DHAC

- Remove Powell Falls from FERC license
- Lake Louise will not be refilled, power generation will not resume
- Fix gate and remove turbine
- Decommission powerhouse and appurtenant facilities (excluding dam removal)

Conduct dam removal under state jurisdiction

- Apply to Wisconsin DNR Municipal Dam Removal Grant Program

Next Steps

FERC License Application – FERC Licensing

- Draft & Final License Applications will include Junction Falls only
- Study results will still be used to inform the licensing process, but results specific to Powell Falls and dam removal will not be included

Updated Study Report (USR)

- All 2020 studies conducted in accordance with the FERC Study Plan Determination have been included in the USR filed with FERC and will be discussed today

Studies Conducted 2019 & 2020

Study	2019	2020
Hydrologic & Hydraulic Evaluation		✓
Water Quality	✓	✓
Lake George Shoreline Habitat Assessment		✓
Aquatic Invasive Species Survey		✓
Mussel Survey		✓
Wetland, Riparian, and Terrestrial Resources Survey	✓	
Riverine Habitat Evaluation below Powell Falls		✓
Recreation		
- Recreation Facility Inventory	✓	
- Recreation Use Assessment		✓
Cultural Resources		
- Architectural Resources Survey	✓	
- Archaeology Resources Survey		✓
Sediment Study		✓
Decommissioning Plan	✓	✓

Hydraulic & Hydrologic Analysis

Pat Dowd, USACE

Water Quality Study

Ellen Faulkner, Ayres

Mussel Survey

Dan Kelner, USACE

Lake George Shoreline Habitat Assessment

Josh McEnany, GSRC

Aquatic Invasive Species Survey

Marty Melchior & Sean Morrison, Inter-Fluve

Riverine Habitat Evaluation Below Powell Falls

Marty Melchior & Sean Morrison, Inter-Fluve

Recreation Use Assessment

Ross Hackbarth, GSRC

Archaeology Survey

Rachel Klabacka-Williams, TRC

Sediment Study

Pete Haug, Ayres & Ben Lenz, TRC

Powell Falls Decommissioning Plan

Pete Haug, Ayres

Next Steps

Responsible Party	Pre-Filing Milestone	Date*
All stakeholders	Updated Study Report Meeting	2/9/2021
Licensee	Updated Study Report Meeting Summary	2/24/2021
Licensee	Amendment Application for Powell Falls Surrender	3/15/2021
Licensee	Draft License Application Due	4/3/2021
Stakeholders	Draft License Comments Due	7/2/2021
Licensee	License Application Filed	8/31/2021
Licensee	Public Notice of License Application	9/14/2021

*Dates based on FERC Revised Process Plan and Schedule issued on 7/10/2019

Final Thoughts & Questions

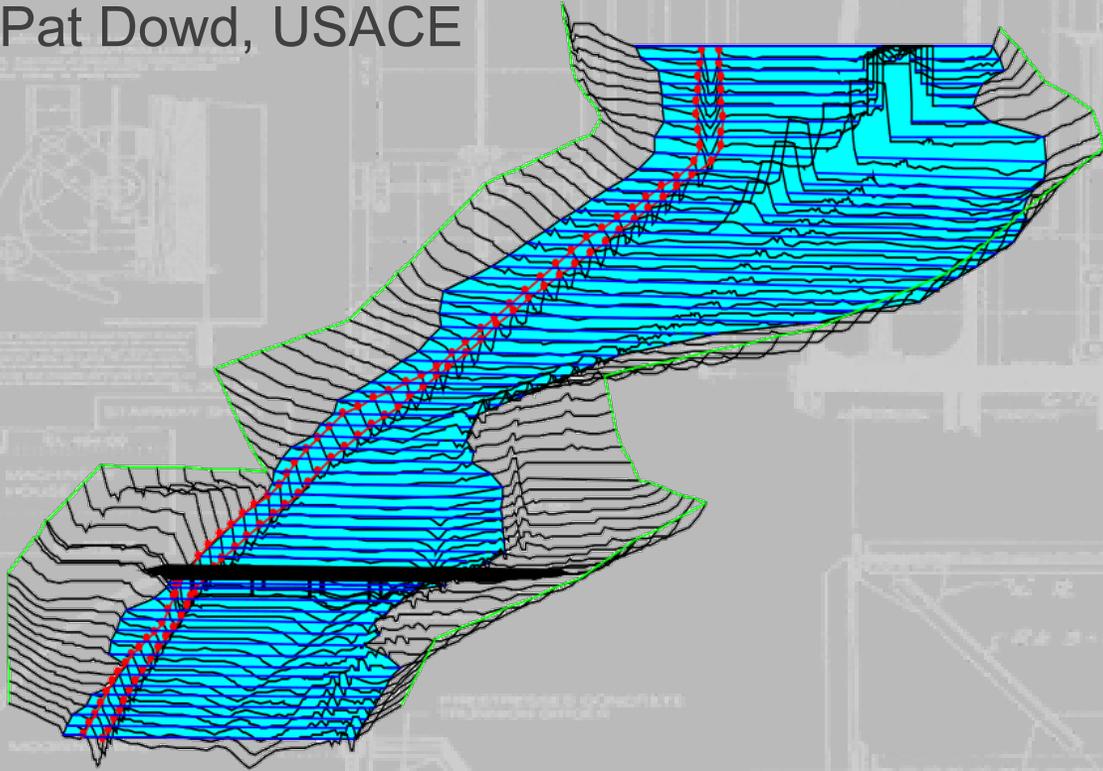
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HYDRAULIC & HYDROLOGIC ANALYSIS

Pat Dowd, USACE



University Archives & Area Research Center
University of Wisconsin-River Falls



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PRESENTATION OUTLINE



- Study Objectives and Scope of Work
- Previous Studies
- Hydrologic Analysis
- Hydraulic Analysis
- Results and Discussion



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STUDY OBJECTIVES



- Estimate streamflow rates for several flood events (hydrologic)
- Estimate river levels during those events with and without Powell Falls Dam (hydraulic)





SCOPE OF HYDROLOGIC ANALYSIS



- The Revised Study Plan:
 - Use USGS gage data and *Bulletin 17C*
 - Use FEMA's hydrologic model (HEC-HMS) and NOAA's *Atlas 14*
 - Use the USGS's flood frequency regression equations for Wisconsin



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SCOPE OF HYDROLOGIC ANALYSIS



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SCOPE OF HYDRAULIC ANALYSIS



- Revised Study Plan:
 - Update SEH's hydraulic model (HEC-RAS)
 - Review the hydraulic model's geometry for opportunities for improvement
 - Conduct a topographic and bathymetric survey and add data to model





SCOPE OF HYDRAULIC ANALYSIS



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SCOPE OF HYDRAULIC ANALYSIS



- Swanson's (professor at UWRF) Kinnickinnic Watershed Study (1976)
- FEMA's Flood Insurance Study (FIS) 2002 (published in 2011)
- Inter-Fluve's Sediment Assessment (2016)
- SEH's Hydraulic & Hydrologic Analysis (2017)



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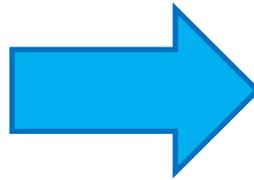
Hydrologic Analysis



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USGS REGRESSION EQUATIONS



USGS
science for a changing world

Prepared in cooperation with the Wisconsin Department of Transportation

Flood-Frequency Characteristics of Wisconsin Streams

Scientific Investigations Report 2016–5140
Version 2.2, April 2020

U.S. Department of the Interior
U.S. Geological Survey



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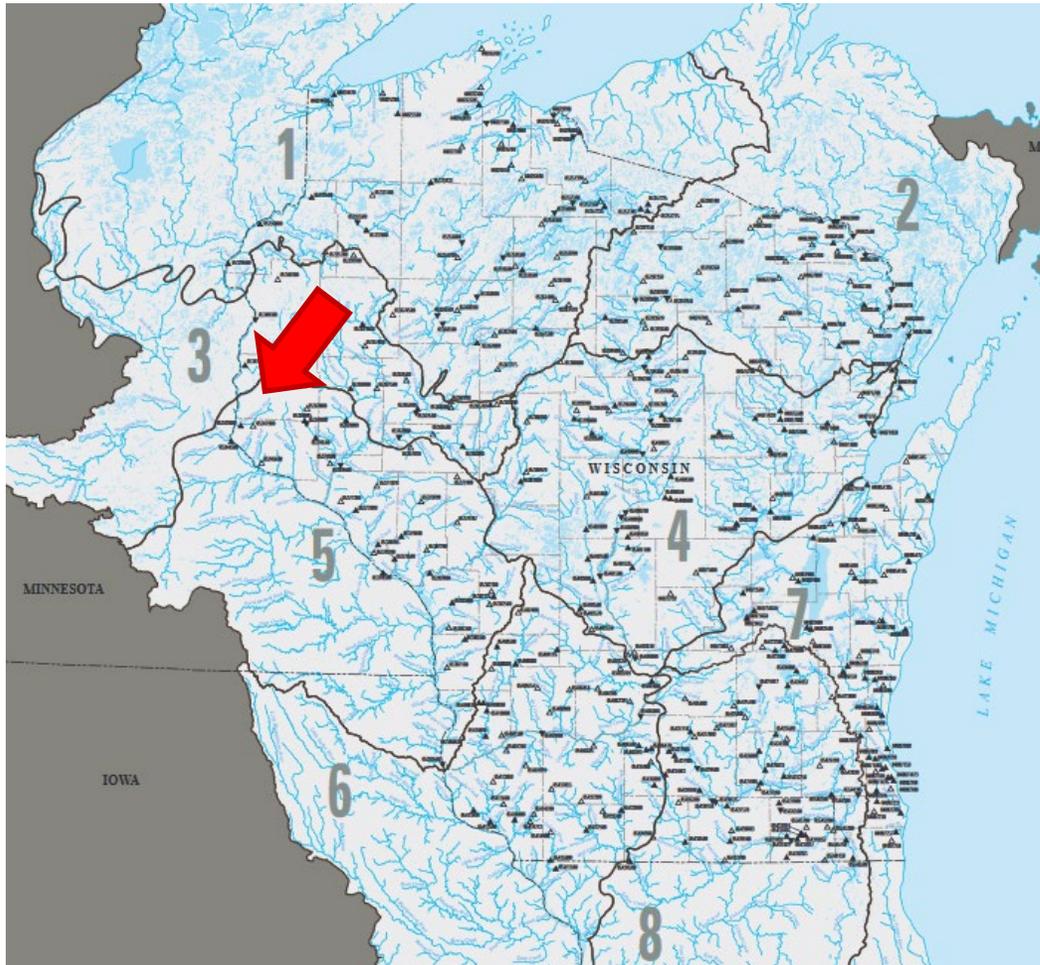
USGS REGRESSION EQUATIONS



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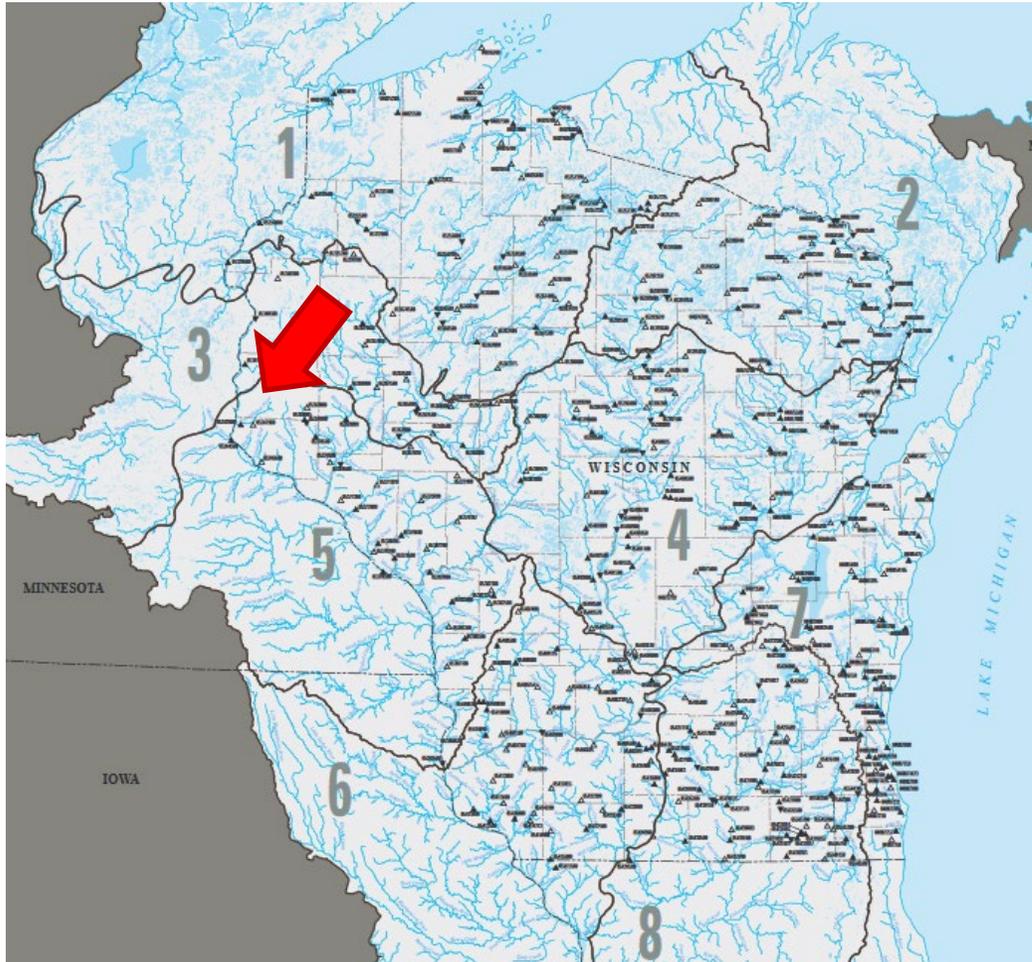
USGS REGRESSION EQUATIONS



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USGS REGRESSION EQUATIONS



Streamflow Dependent on 3 Variables:

- Watershed Area
- Soil Infiltration Rate
- Percent Forest Cover



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USGS REGRESSION EQUATIONS



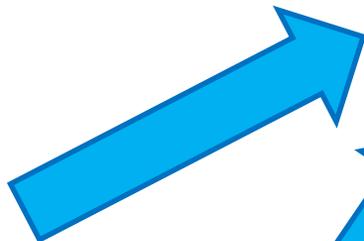
Watershed Area



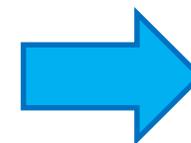
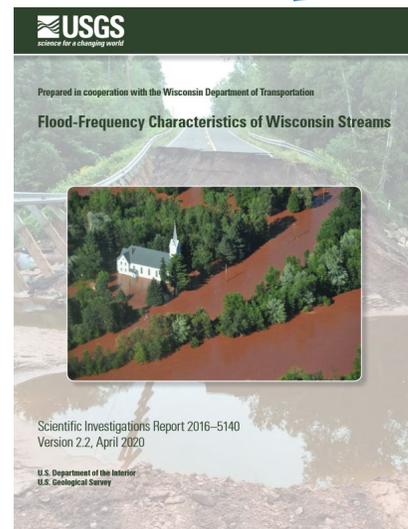
Geospatial Analysis



Land Use (Forest Cover) Data



Soil Infiltration Rate Data



Estimated Flow Values

USGS Regression Equations



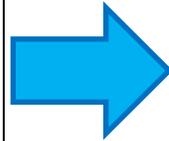
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USGS REGRESSION EQUATIONS



Best-fit equation						SEP, in percent
Area 5, 26 streamflow-gaging stations						
Q_{50p}	=	183	A ^{0.701}	$K_{sat}^{-0.540}$	F ^{-0.422}	47.5
Q_{20p}	=	521	A ^{0.707}	$K_{sat}^{-0.701}$	F ^{-0.403}	45.4
Q_{10p}	=	951	A ^{0.709}	$K_{sat}^{-0.796}$	F ^{-0.383}	45.1
Q_{4p}	=	1,870	A ^{0.709}	$K_{sat}^{-0.906}$	F ^{-0.358}	46.0
Q_{2p}	=	2,950	A ^{0.710}	$K_{sat}^{-0.982}$	F ^{-0.340}	47.7
Q_{1p}	=	4,530	A ^{0.709}	$K_{sat}^{-1.05}$	F ^{-0.316}	48.5
$Q_{0.5p}$	=	6,750	A ^{0.709}	$K_{sat}^{-1.12}$	F ^{-0.302}	50.1
$Q_{0.2p}$	=	11,100	A ^{0.708}	$K_{sat}^{-1.21}$	F ^{-0.277}	51.1

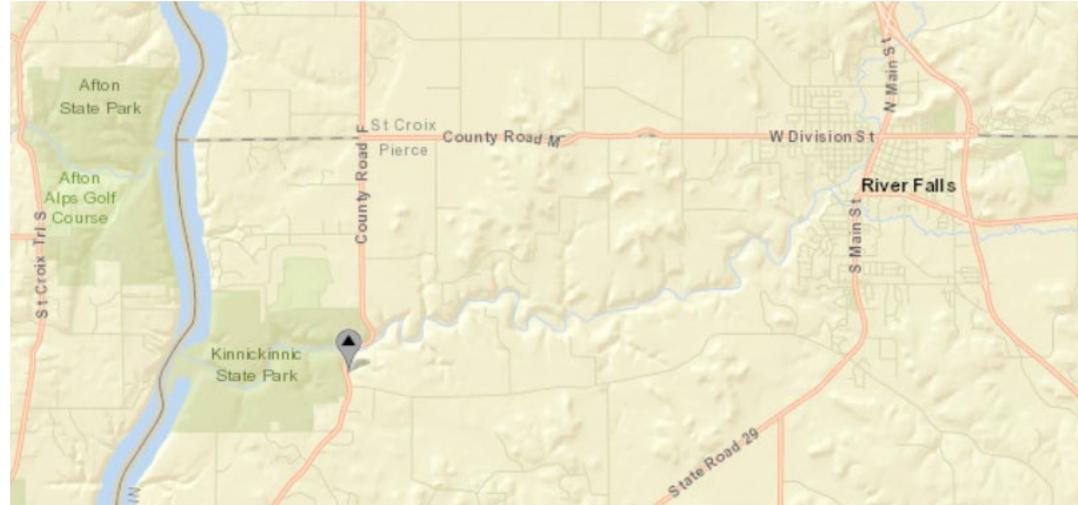


HEC-RAS Model Cross-Section/Location	50% AEP Discharge (cfs)	10% AEP Discharge (cfs)	1% AEP Discharge (cfs)
RS-71222	2,700	6,600	13,800
RS-66059	2,800	7,000	14,600
RS-53219	2,800	7,000	14,500
USGS Gage 05342000	3,000	7,500	15,600



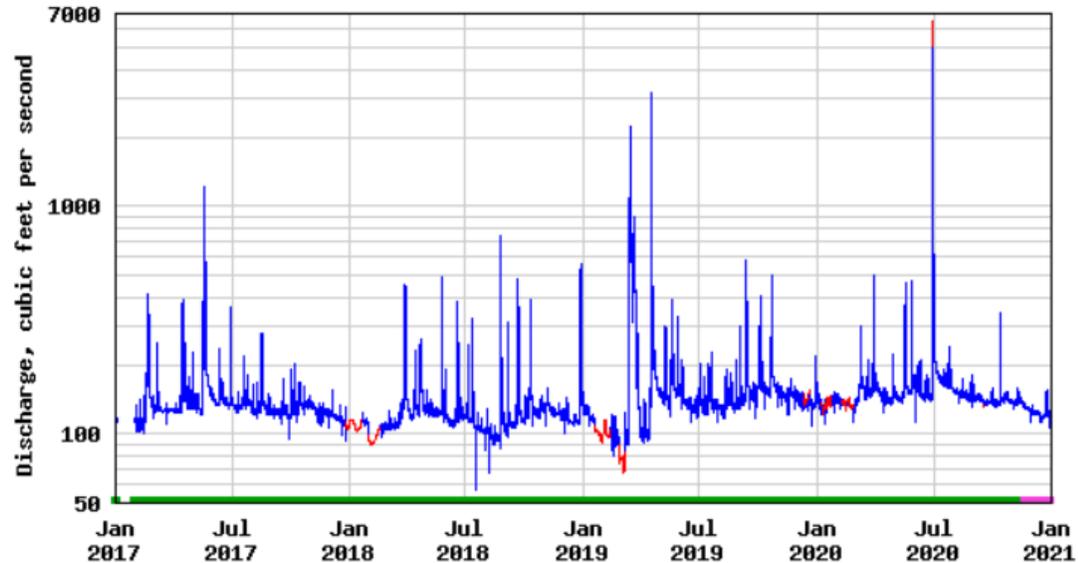


USGS GAGE DATA



1917-1921 and
2002 - Present

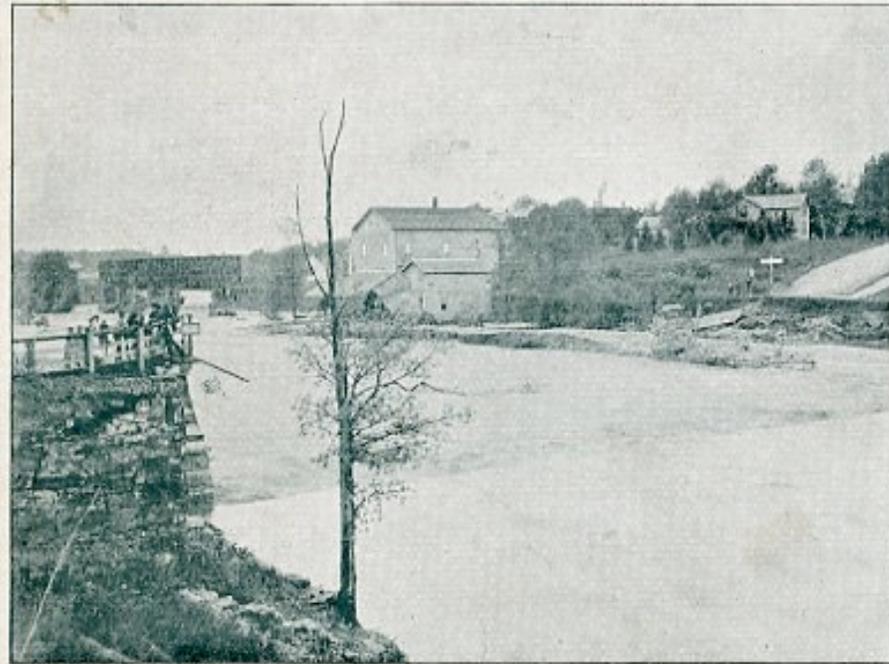
USGS 05342000 KINNICKINNIC RIVER NEAR RIVER FALLS, WI



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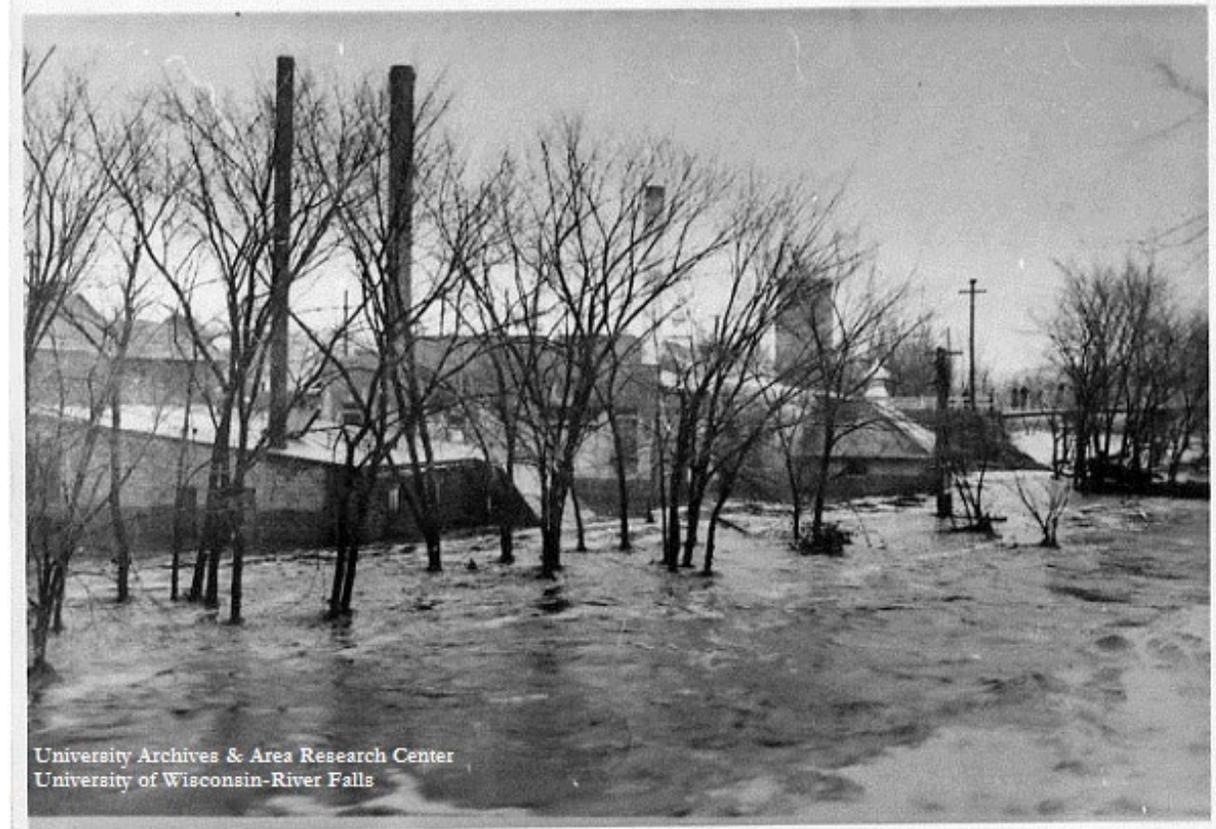


HISTORICAL FLOODS



The Flood of 1894,
Site of Maple St. Bridge
River Falls, Wis.

CANT SAY
the town
has gone
DRY
now.



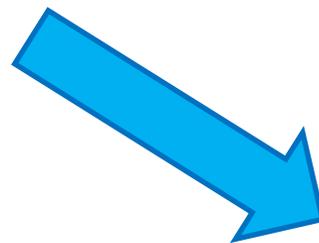
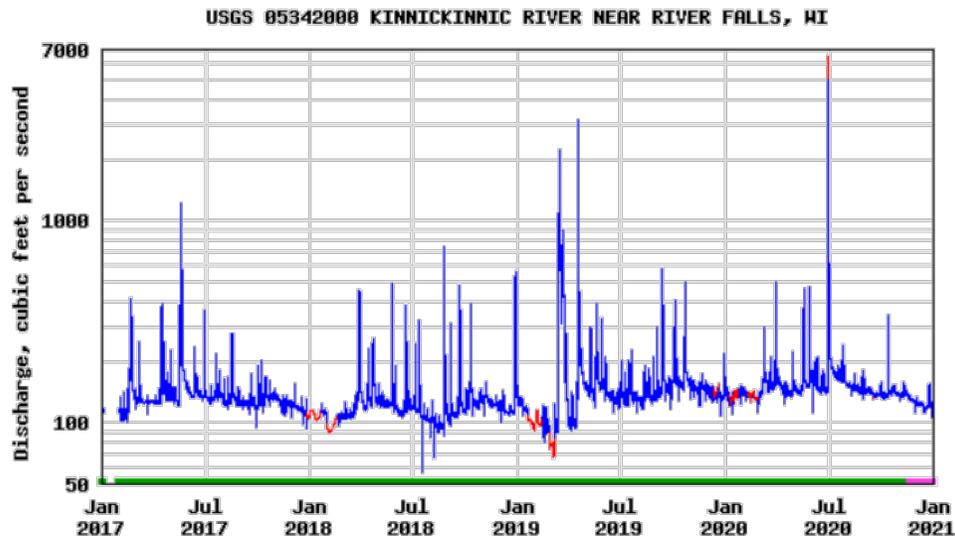
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University of Wisconsin-River Falls



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BULLETIN 17C ANALYSIS



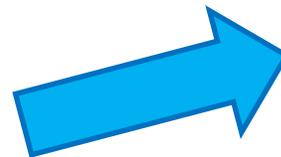
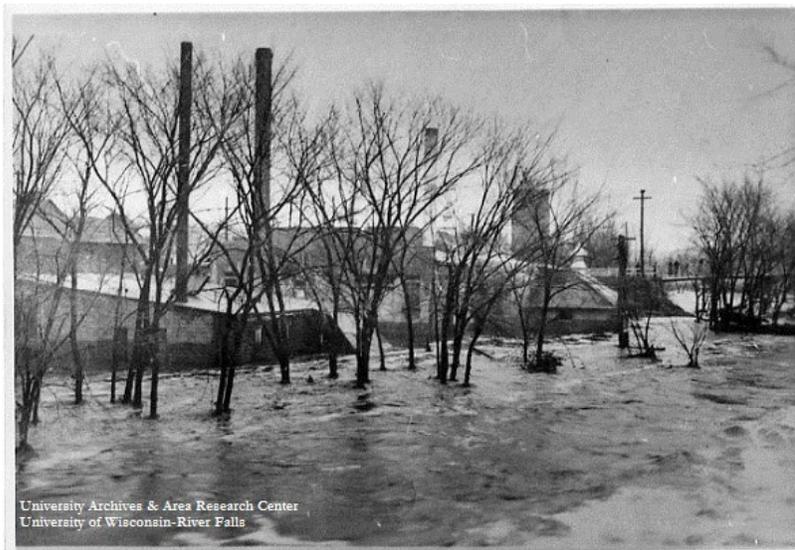
Guidelines for Determining Flood Flow Frequency Bulletin 17C

Chapter 5 of
Section B, Surface Water
Book 4, Hydrologic Analysis and Interpretation



Techniques and Methods 4-B5
Version 1.1, May 2019

U.S. Department of the Interior
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BULLETIN 17C ANALYSIS



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U.S. GEOLOGICAL SURVEY

US Army Corps of Engineers

ACWI Advisory Committee on Water Information

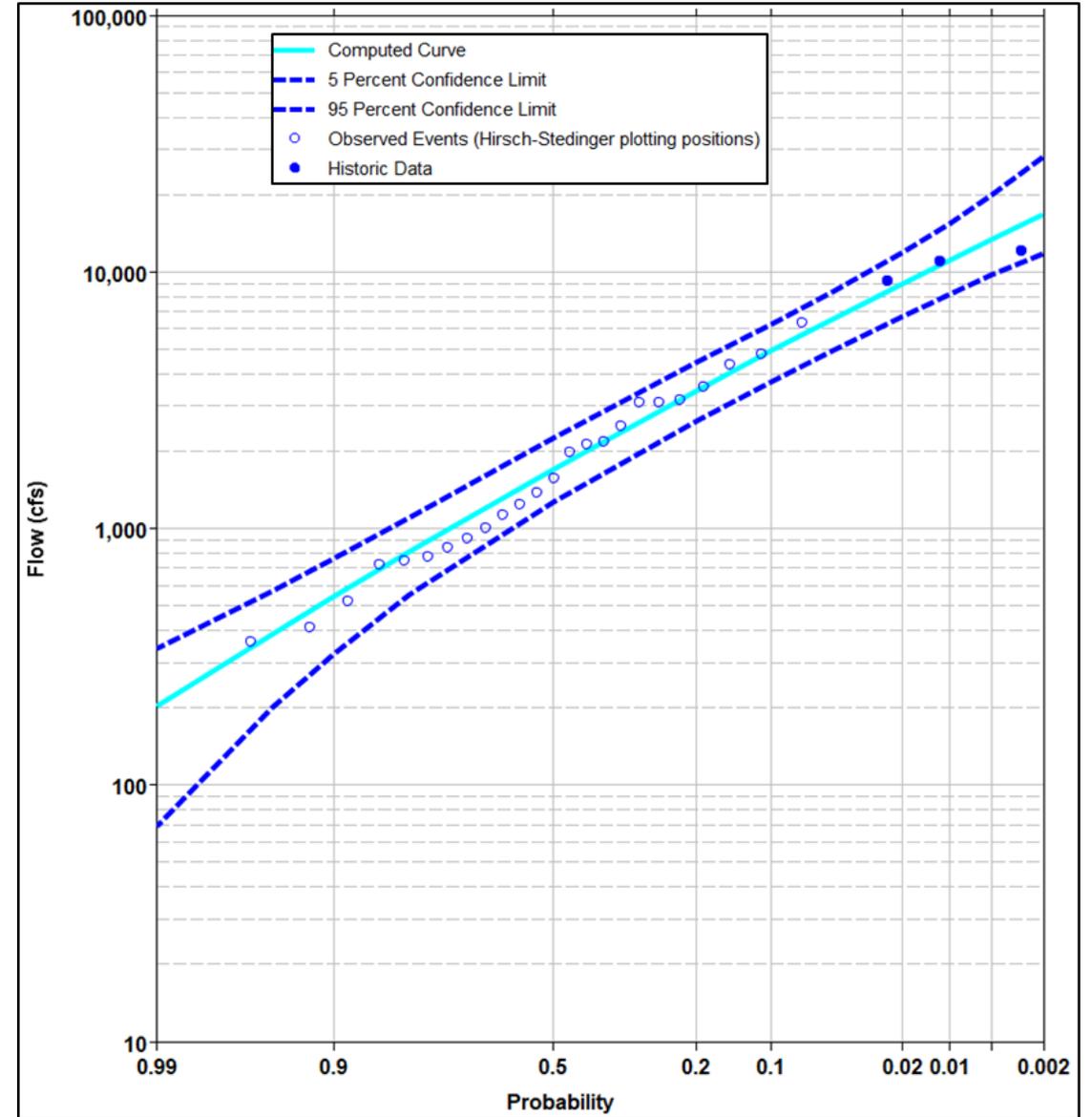
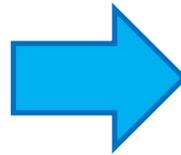
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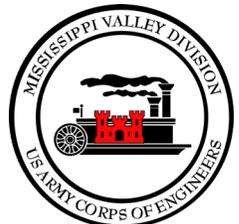
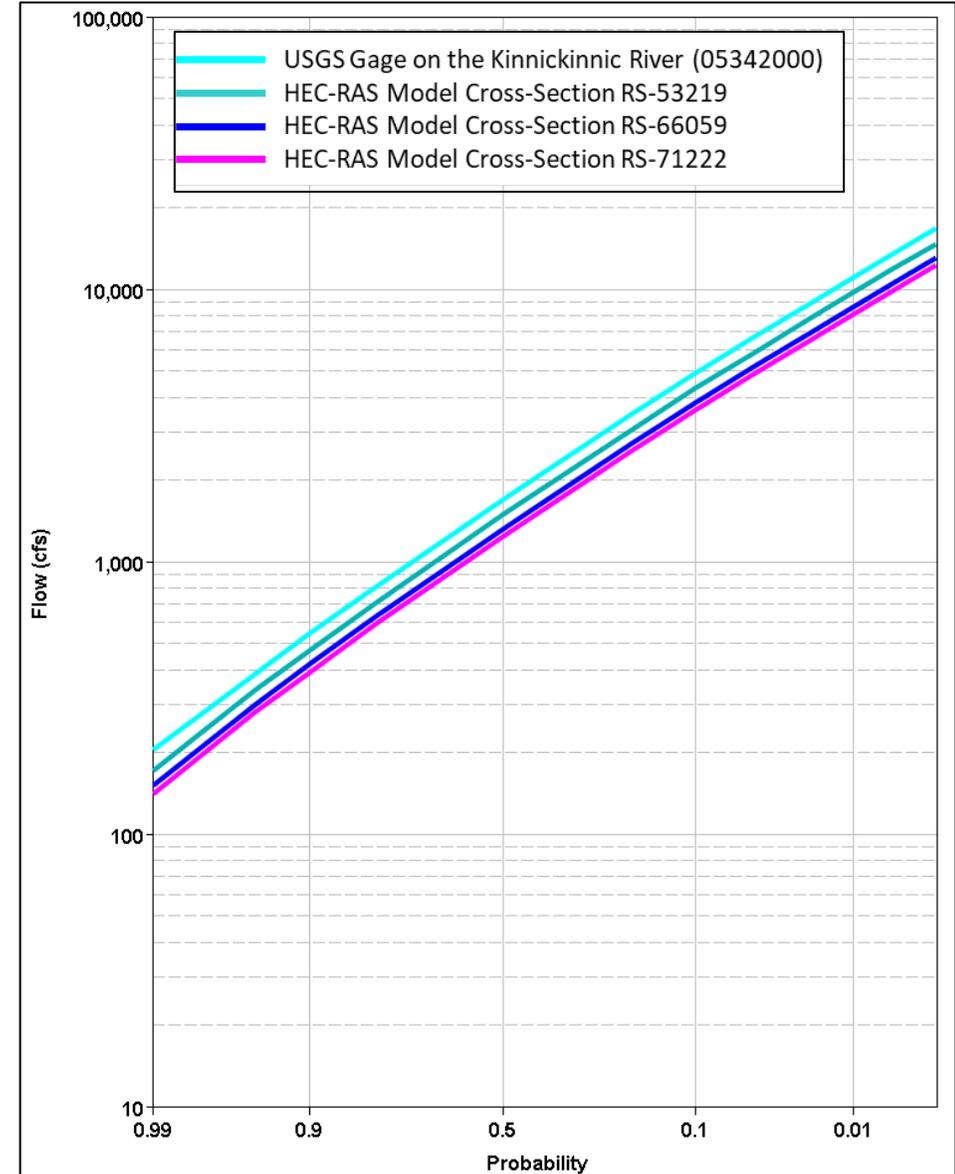
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BULLETIN 17C ANALYSIS



Exceedance Probability	Discharge Estimates (cfs)			
	Cross-Section RS-71222	Cross-Section RS-66059	Cross-Section RS-53219	USGS Gage 05342000
0.002 (0.2%)	12,200	13,000	14,600	16,690
0.01 (1%)	8,110	8,630	9,740	11,070
0.02 (2%)	6,590	7,020	7,920	9,000
0.1 (10%)	3,590	3,830	4,320	4,910



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COMPARISON TO PAST HYDROLOGIC ANALYSES



	Discharge Estimates for Cross-Section RS-66059 (Upstream of Junction Falls) (cfs)		
Exceedance Probability (%)	1976 Study	2011 FIS Study	This Study
0.2	9,900	13,000	13,000
1	8,600	8,700	8,630
2	7,200	7,050	7,020
10	4,200	3,350	3,830



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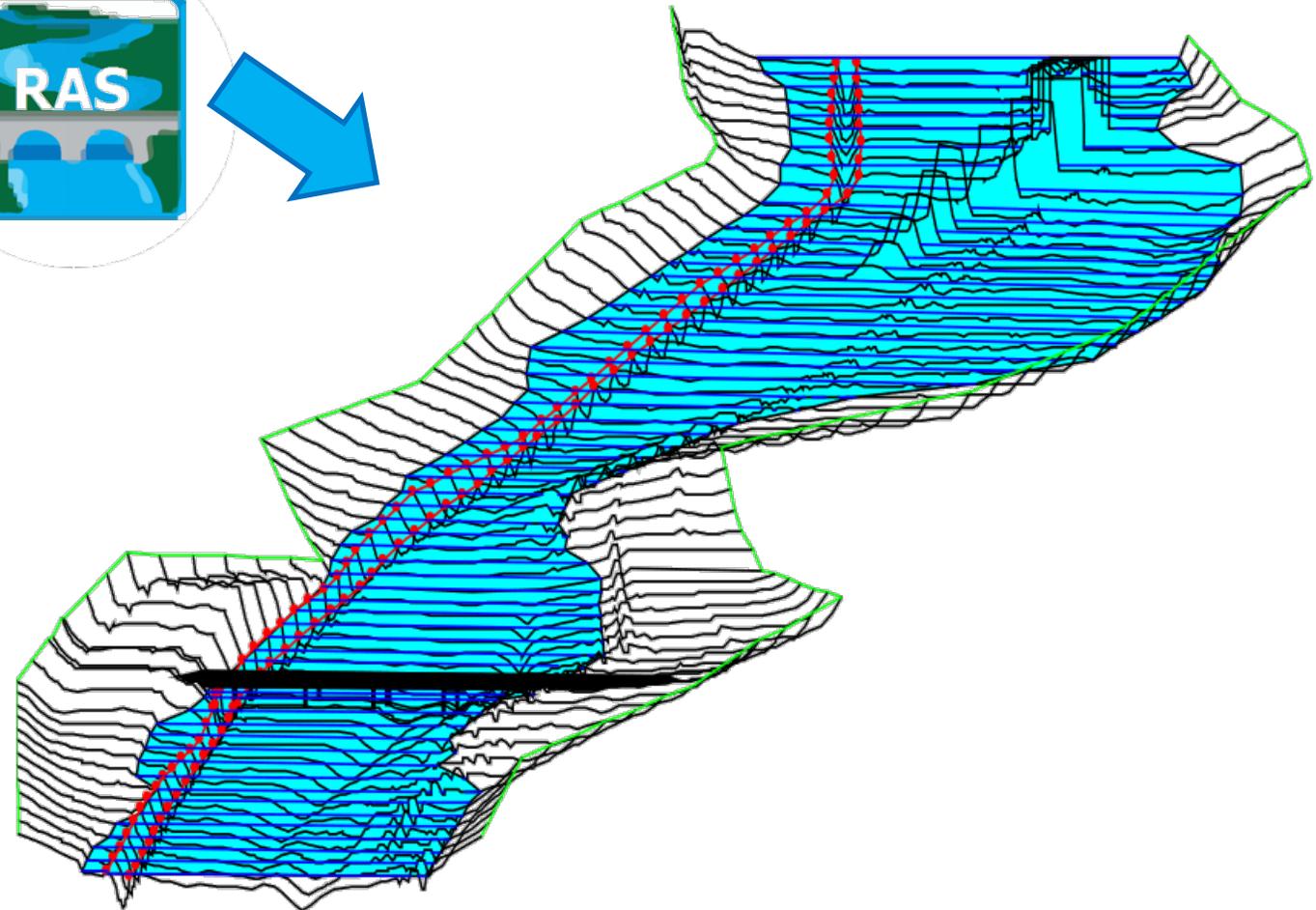
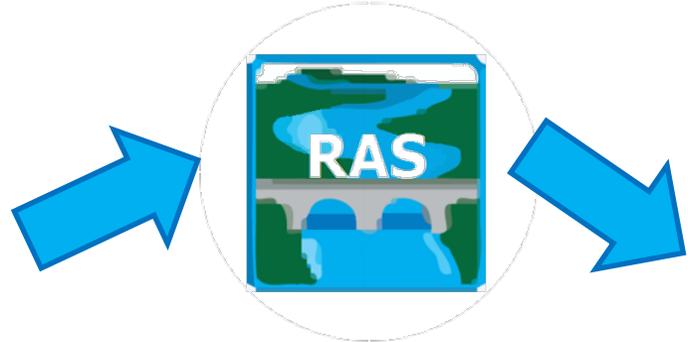
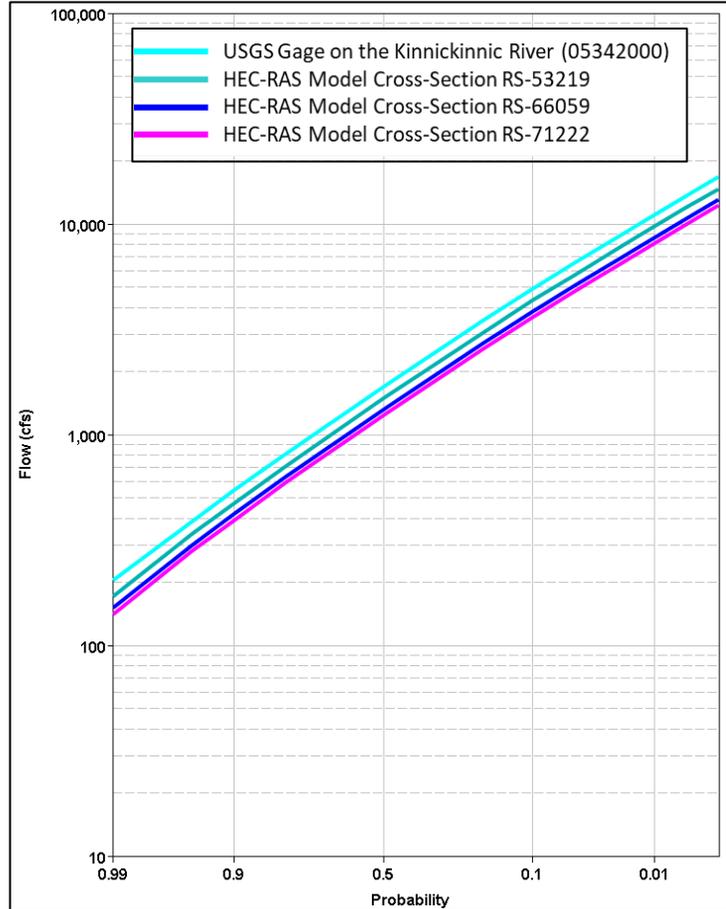
Hydraulic Analysis



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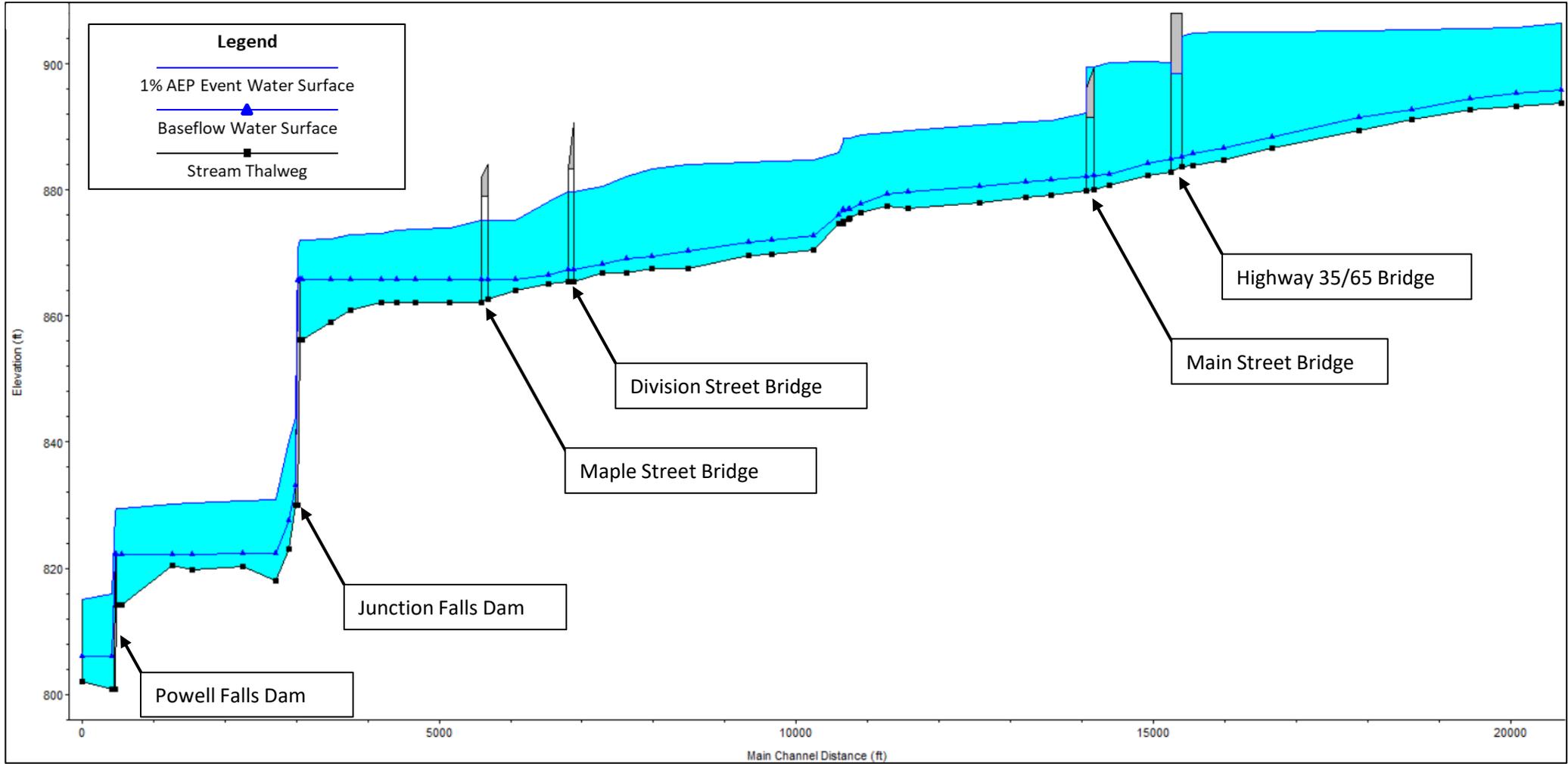
HYDRAULIC ANALYSIS



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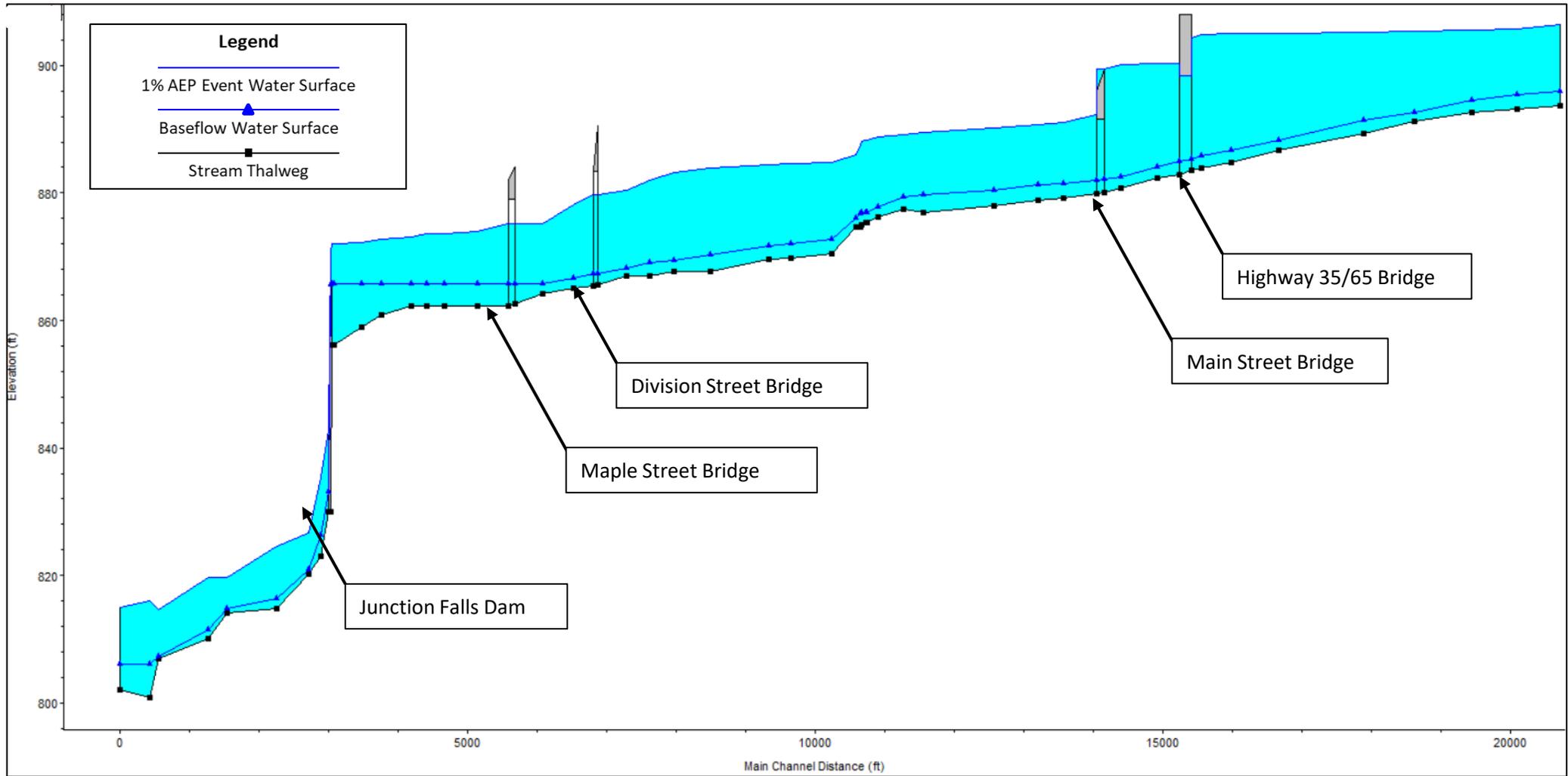
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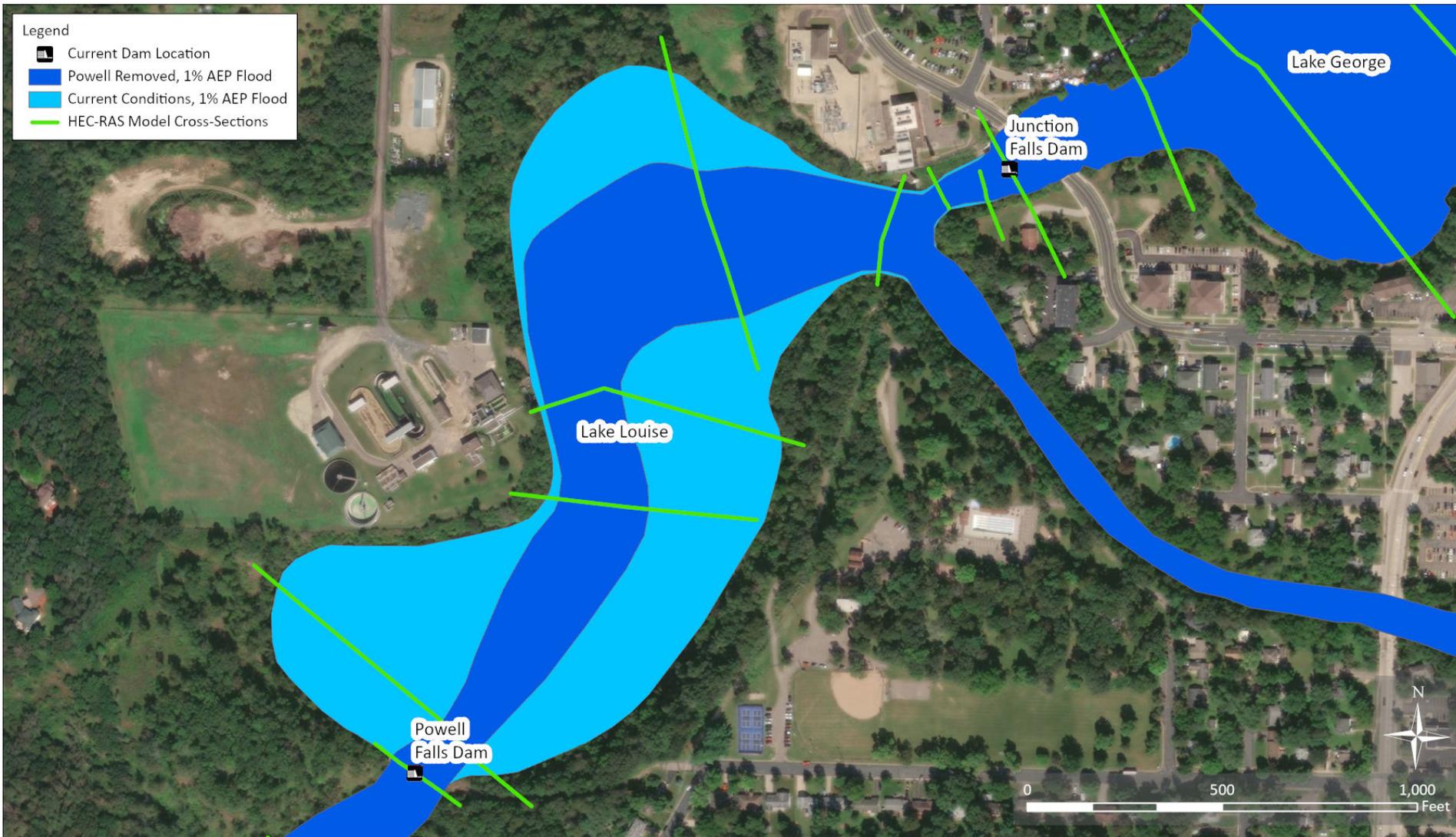
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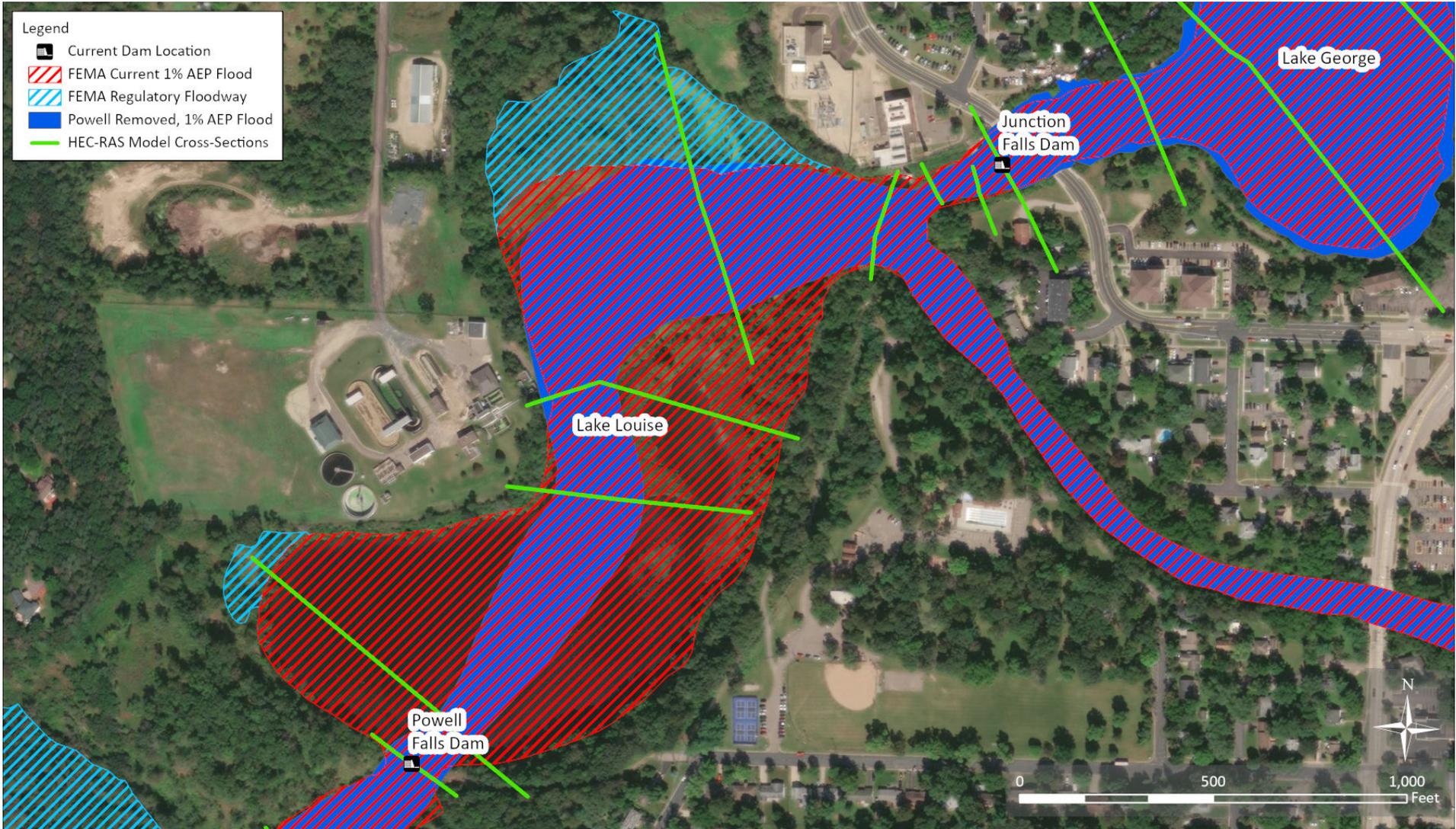
RESULTS



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RESULTS



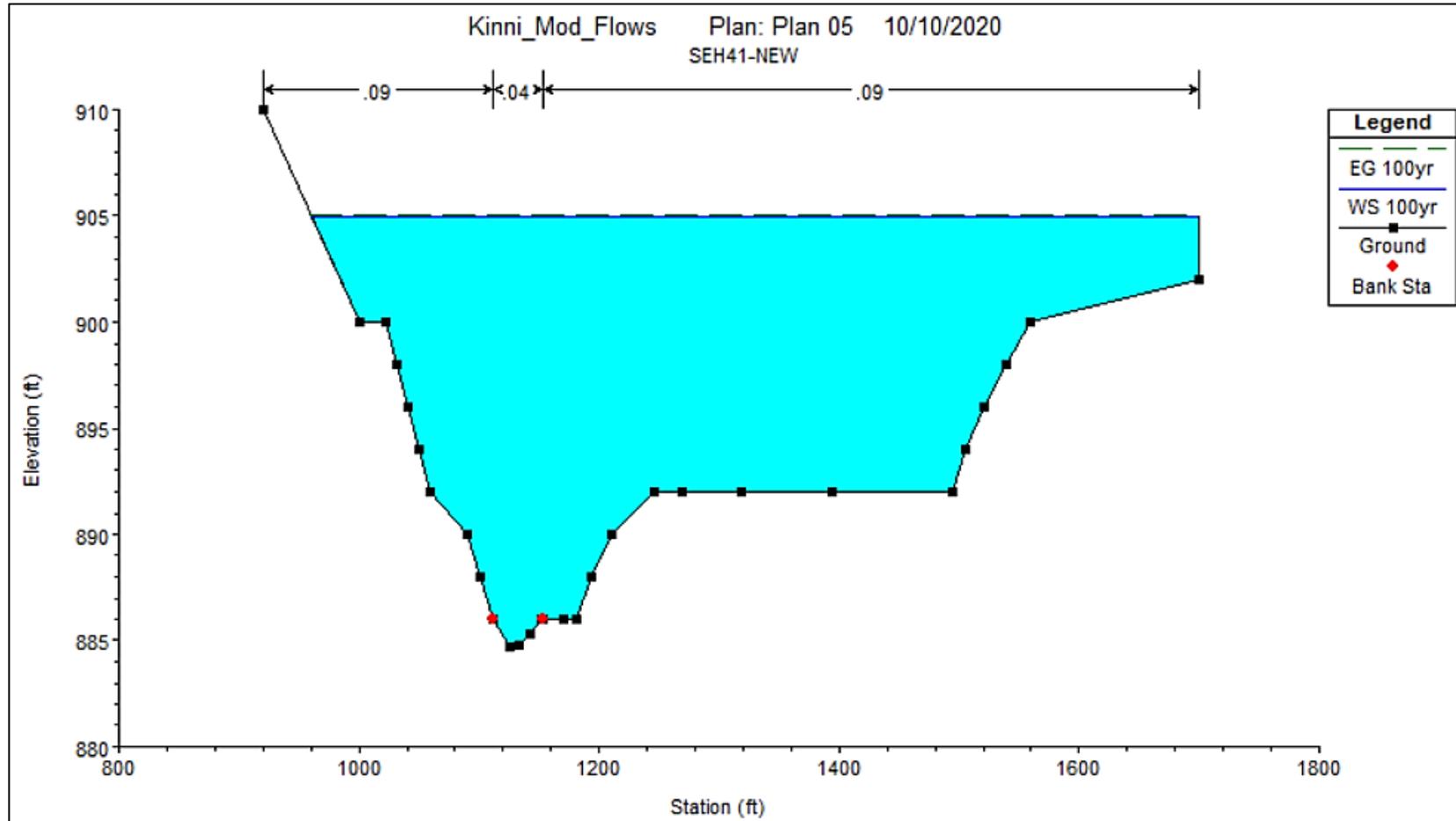
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OPPORTUNITIES FOR RAS MODEL IMPROVEMENT



- Expanding Model Cross-Sections



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OPPORTUNITIES FOR RAS MODEL IMPROVEMENT



- Updating Model Geometry (Bathymetry and Topography)
 - Bathymetric Surveys (What Channel Looks Like Under Water)
 - Topographic Surveys and LiDAR (What Channel Looks Like Above Water)
 - Sediment Surveys/Geomorphological Analysis (What Channel Will Look Like After Dam Removal)
- Georeferencing Model (Map Cross-Section to Path of River)
- Updating Model to Run as Unsteady Flow





QUESTIONS



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Water Quality Study

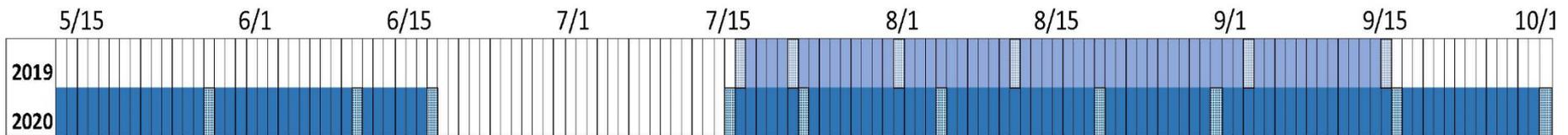
Ellen Faulkner, Ayres



- Dissolved oxygen and water temperature in the project area recorded at 15-minute intervals, summer 2019 and 2020
- Supporting observations including independent DO meter “grab samples,” air temperature, algae cover, streamflow

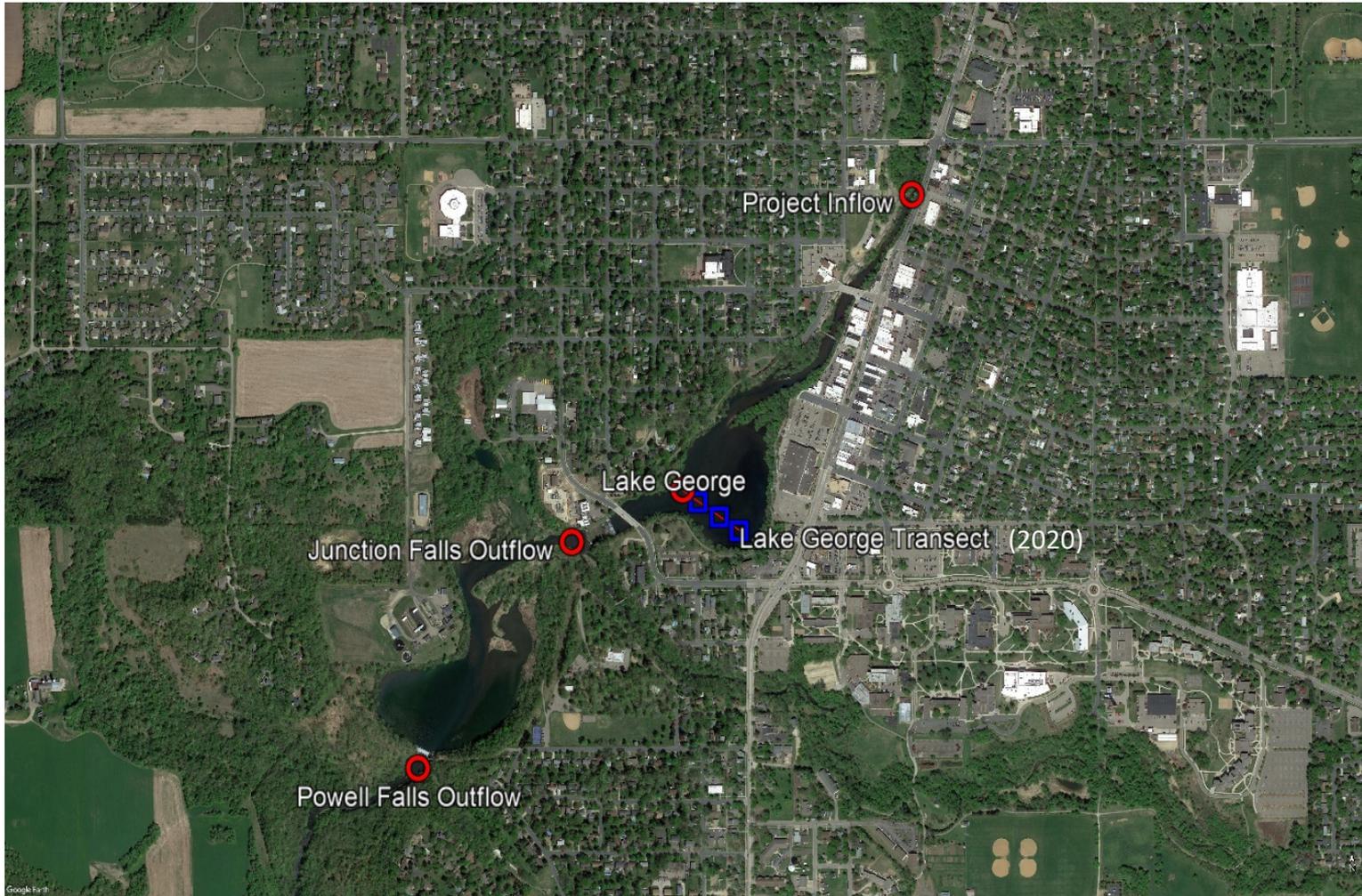
Water Quality Study

- 15-minute readings at 4 locations
 - July 18-September 17, 2019
 - May 15-June 19, 2020
 - *Flood June 29, 2020, lost all instruments*
 - July 17-Oct. 2, 2020
- Handheld meter readings/data downloads at 1-2 week intervals



Water Quality Study

DO Meter Locations



Water Quality Study

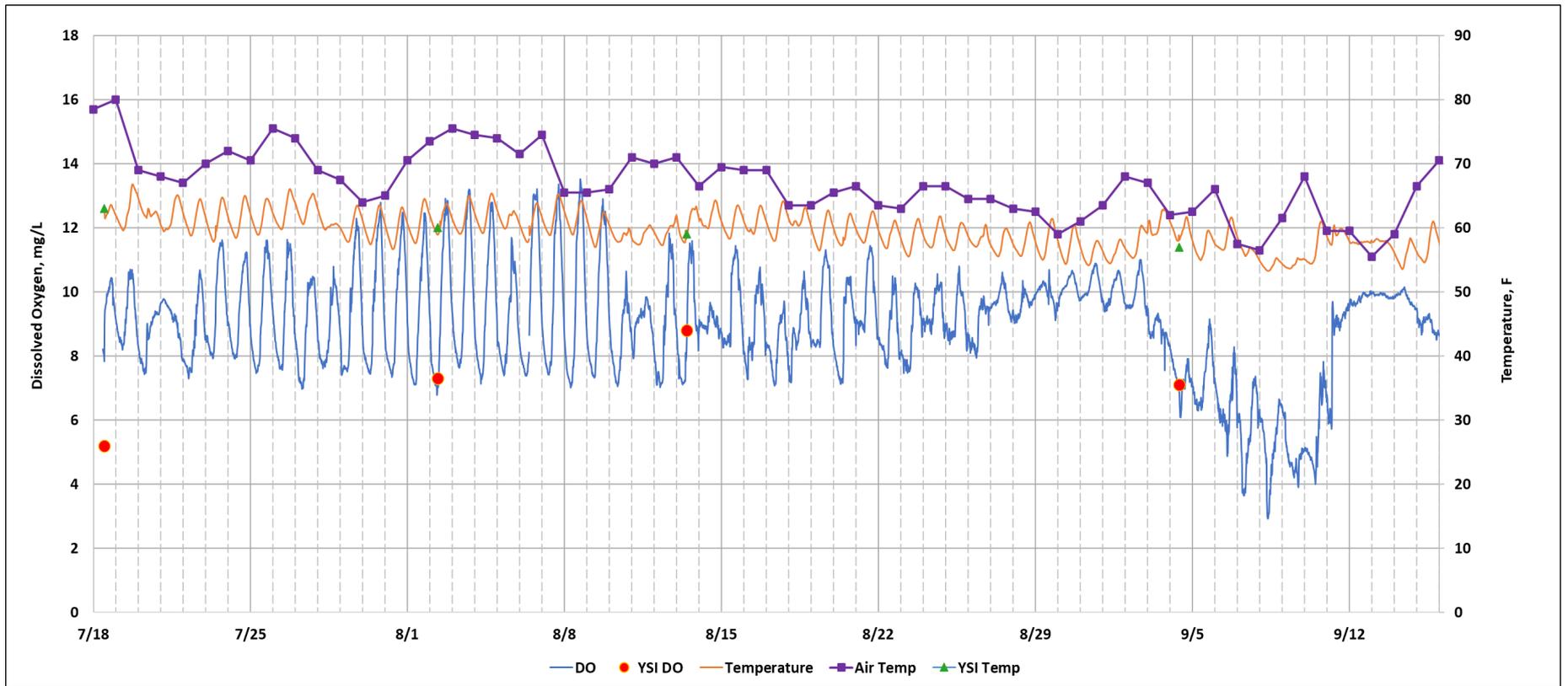
Continuous Instrumentation



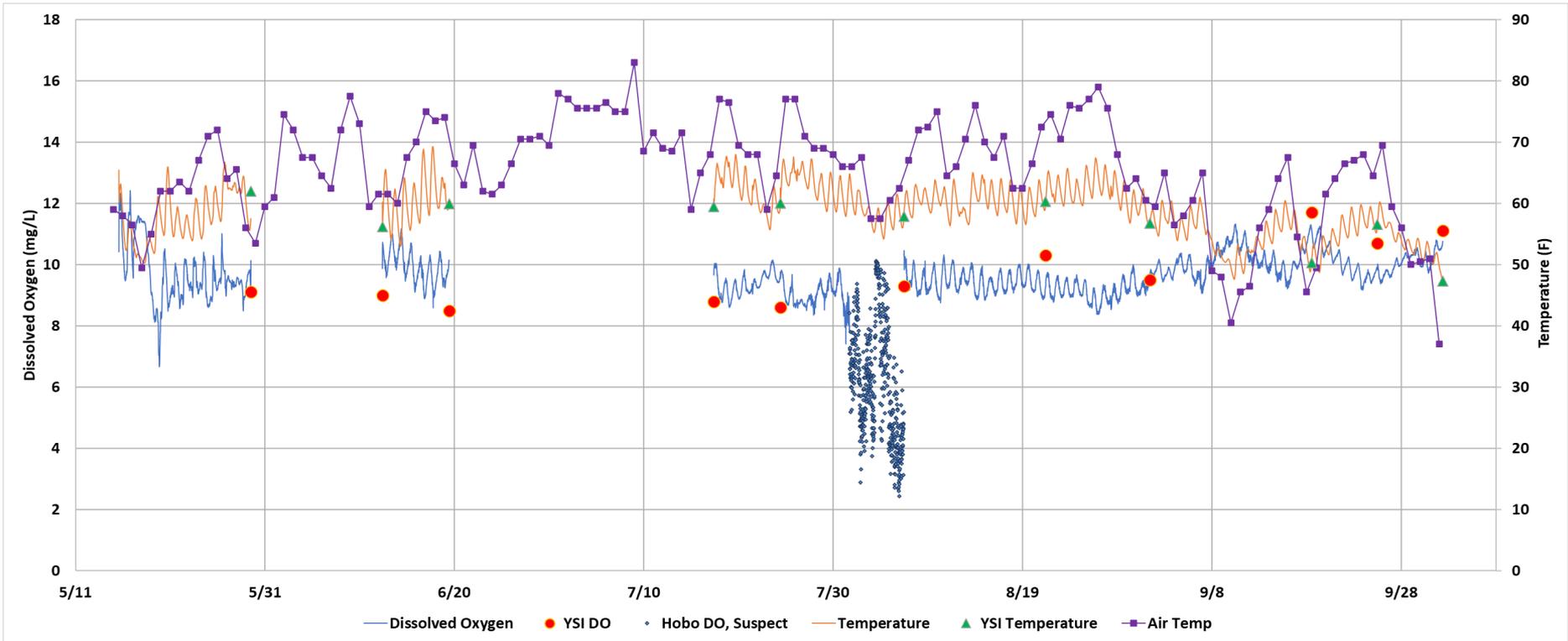
Junction Falls outflow site, 2019

- 4 HOBO U26-001 DO and temperature data loggers
- Sensors positioned mid-water column
- Meter check, sensor cleaning, data download at 1-2 week intervals
- Public interference issues early in 2019 season, throughout 2020

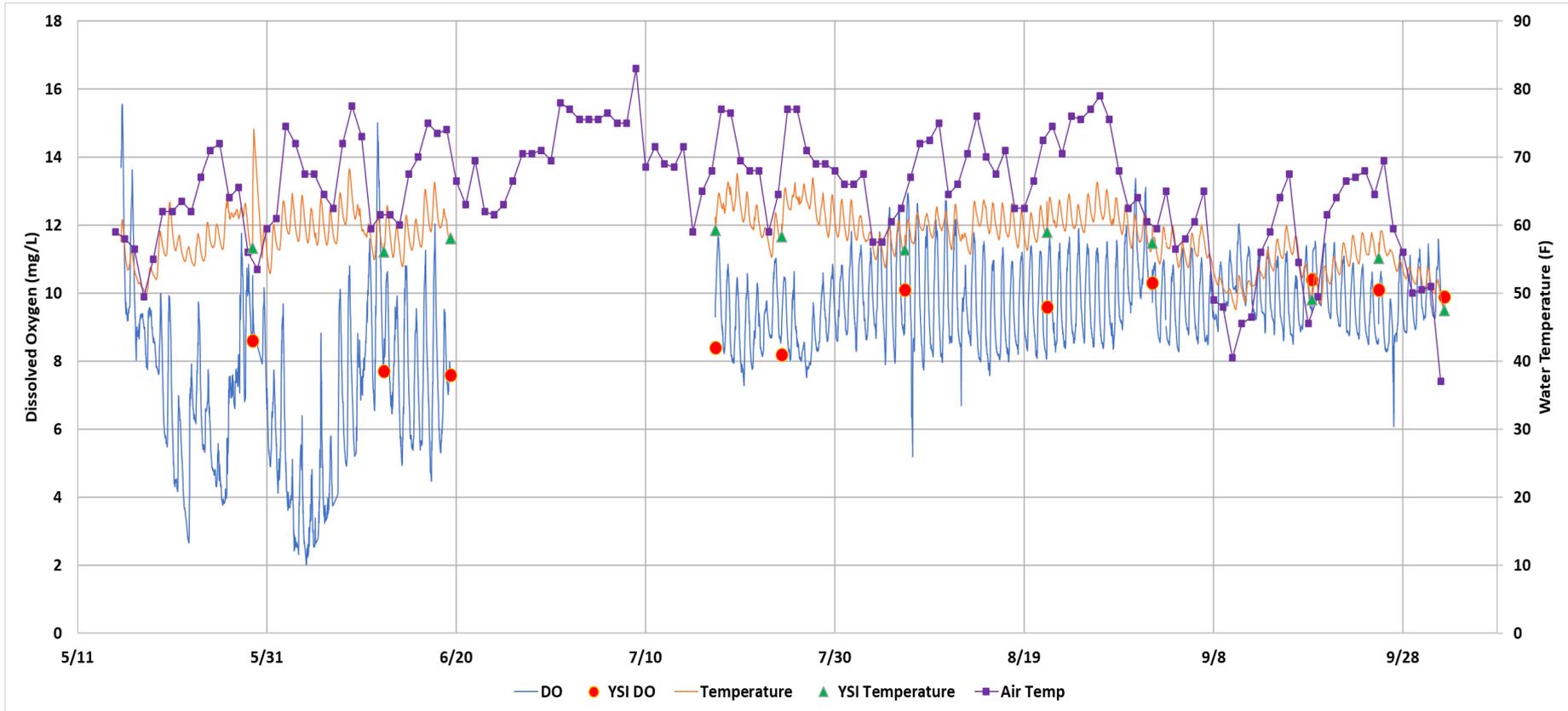
Water Quality Time Series – Junction Falls Outflow, 2019



Water Quality Time Series – Junction Falls Outflow, 2020



Water Quality Time Series – Lake George, 2020



Water Quality Study

Summary of Recorded Dissolved Oxygen Concentrations

Location	Year	Measured Dissolved Oxygen Range (mg/L) for Season	Percent of readings < 6.0 mg/L (trout stream standard)	Percent of readings < 5.0 mg/L (other water body standard)
Inflow	2019	7.0 – 13.0	0 %	0 %
	2020	1.4*(6.3) - 14.5	1.6	1.5
Lake George	2019	0.0 – 13.0	37 %	28 %
	2020	2.0 – 15.5	12%	8%
Junction Falls Outflow	2019	2.9 – 13.5	4 %	3 %
	2020	2.4*(6.7) – 12.4	3%*	2%*
Powell Falls Outflow	2019	0.7 – 12.2	29 %	18 %
	2020	0.0*(2.2) – 15.0	15%*	13%*

* Instrument data suspect due to disturbance; lowest non-suspect value shown in ()

Water Quality Study

Summary of Recorded Maximum 15-Minute Water Temperatures

Month	Acute Water Temperature Criteria for Cold Water Stream/Lake, °F		Maximum 15-minute Temperature, °F			
	Stream	Lake	Project Inflow	Lake George	Junction Falls Outflow	Powell Falls Outflow
July 2019	73	86	64	78	78	80
Aug. 2019	73	86	63	65	65	82
Sept. 2019	72	84	63	62	63	66
May 2020	72	81	65	65	67	73
June 2020	72	85	65	68	69	72
July 2020	73	86	66	68	68	69
Aug. 2020	73	86	65	66	68	70
Sept. 2020	72	84	59	60	61	62

Water Quality Study

Summary of Average Monthly Water Temperatures

Month	Ambient Water Temperature Criteria for Cold Water Stream/Lake, °F		Monthly Average Water Temperature, °F			
	Stream	Lake	Project Inflow	Lake George	Junction Falls Outflow	Powell Falls Outflow
July 2019	64	72	60	61	62	63
Aug. 2019	63	71	60	59	60	61
Sept. 2019	57	63	56	57	57	58
May 2020	56	55	57	57	58	59
June 2020	62	67	59	60	61	62
July 2020	64	72	61	62	63	63
Aug. 2020	63	71	59	60	61	62
Sept. 2020	57	63	54	54	55	55

Water Quality Study – Key Points

- Project inflows met state criteria for cold water fisheries. Exceptions were generally explainable by instrument disturbance.
- From upstream to downstream in the study area, water temperature typically increased by 2° F to 4° F on a given day.
- Recorded DO concentrations generally decreased from upstream to downstream. The rate of decrease was variable.
- In Lake George, the DO concentration dropped below 5 mg/L on several occasions in 2019 and in the first (pre-flood) half of the 2020 season.
- After the June 2020 flood, Lake George showed higher overall DO concentrations with less variability than prior to the flood.
- Points on the transect southeast of the primary flow path in Lake George showed increased temperatures and higher-amplitude DO cycles but little vertical stratification. Field personnel reported detectable current at all Lake George transect points.

Water Quality Study – Key Points, cont'd

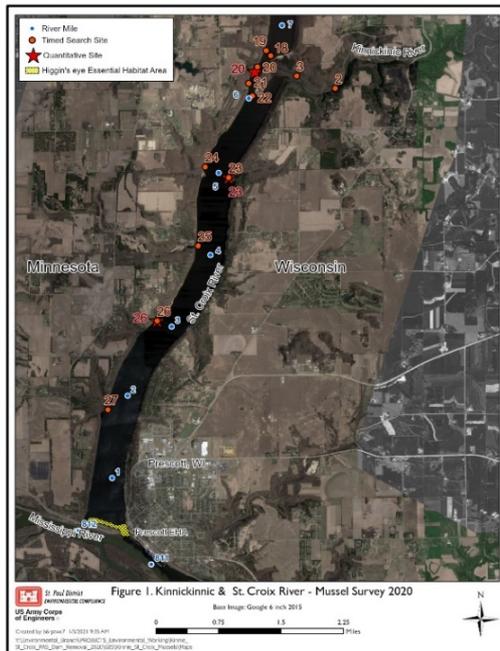
- **DO concentrations in or downstream of the dams' impoundments dropped below 5 mg/L during some periods in both years, more frequently in 2019 than 2020. The 2020 record below Junction Falls lacked data corresponding to a low-DO period (May 31-June 12) in Lake George.**
- **Temperatures and DO concentrations not meeting state standards occurred more frequently below Powell Falls than below Junction Falls.**
- **Neither sampling season included exceptionally high temperatures or low streamflows.**
- **The June, 2020 flood noticeably affected impoundment sediments, vegetation, and bed morphology.**
- **Visually estimated algae cover in Lake George ranged from 0% to 50% and was highest in mid-summer 2019.**

Mussel Survey

Lower Kinnickinnic and St. Croix Rivers

River Falls Hydroelectric Project (FERC No. 10489)

Updated Study Report
Meeting
9 February 2021



Dan Kelner
U.S. Army Corps of Engineers – St. Paul District



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**US Army Corps
of Engineers®**



Native Freshwater Mussels of the lower St. Croix River



Higgins eye pearlymussel



Snuffbox

Male

Female



Spectaclecase



Sheepnose



Winged mapleleaf



39 Species

~1/2 State Listed T & E

5 Federally Listed T & E

Threatened

Special Concern

Unclassified

Black
Ligumina ligumina

Elk
Alasmidonta marginata

Spectaclecase
Cymbella ummoodonta

Purple weedyback
Cyclonitta tuberculata

Butterfly
Elliptio borealis

Woodworth
Strophomena

Round pigtoe
Ligumia compressa

Monkeyface
Strophomena

Flatfoot
Ligumia

Petalslip
Trigloia renovata

Elgie
Venzaticosta elliptica

Spine
Elliptio dilatata

Creek heelsplitter
Ligumia compressa

Fluted shell
Ligumia costata

Black spindle
Ligumia recta

Hickorynut
Obovaria obvara

Purpleback
Quereuxia

Plain postback
Ligumia catenata

Fatmucket
Ligumia saxatilis

Eastern elliptio
Elliptio complanatus

Cylindrical papershell
Anodonta imbecilis

Giant Duster
Pygostola grandis

Flat Rooster
Anodonta subrotundata

Threelobe
Anodonta planata

Pandora
Ligumia subretrata

Threelobe weedyback
Obovaria reflexa

Pink heelsplitter
Potomaris stans

Pink papershell
Potomaris chinensis

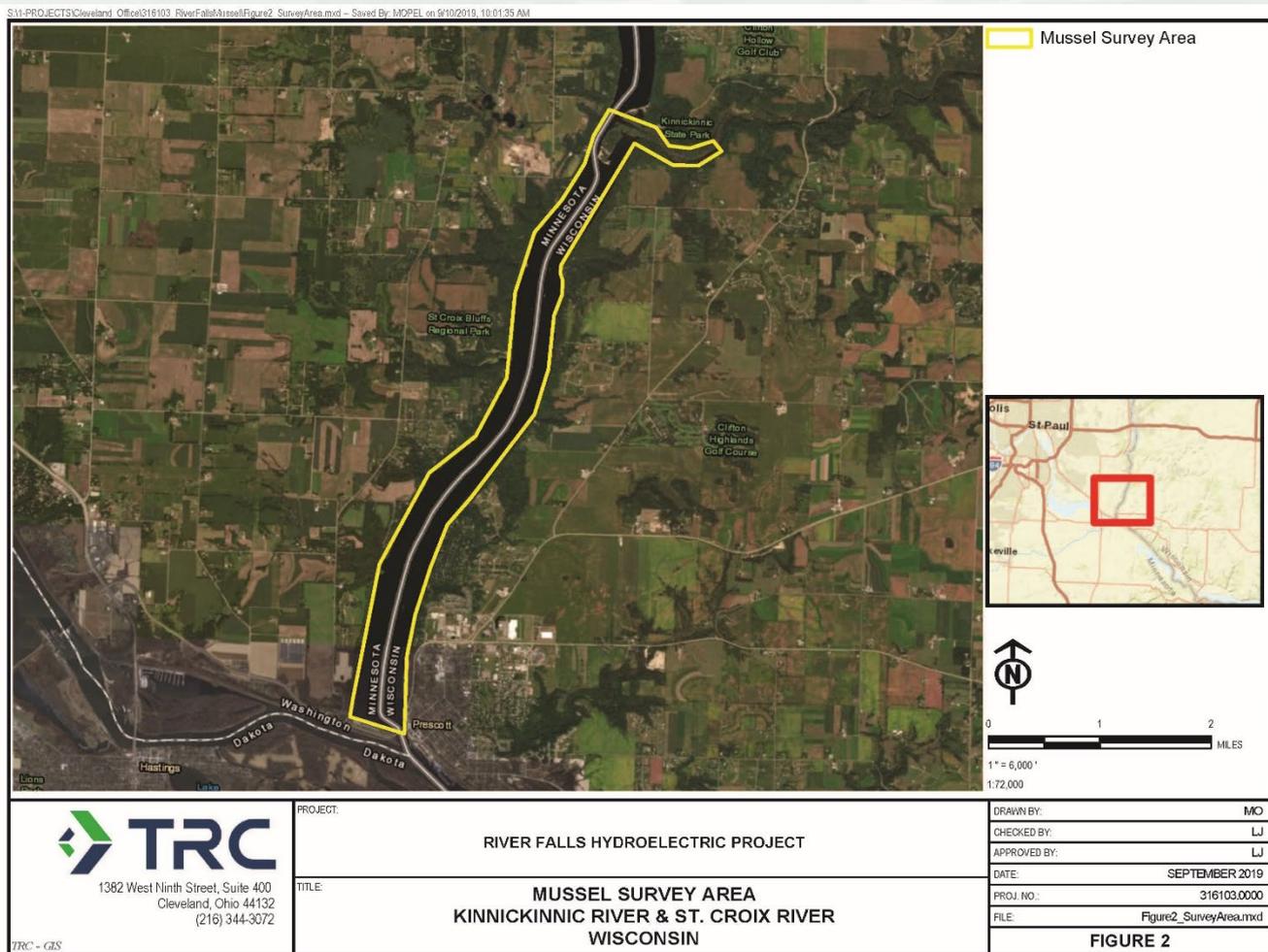
Welsh pigtoe
Faxonella farrar

White heelsplitter
Ligumia complanata

Objective

Baseline Information on Native Mussel Community

Presence, density, distribution, relative abundance including T&E species
 Document mussel habitat (location, depth, substrate)



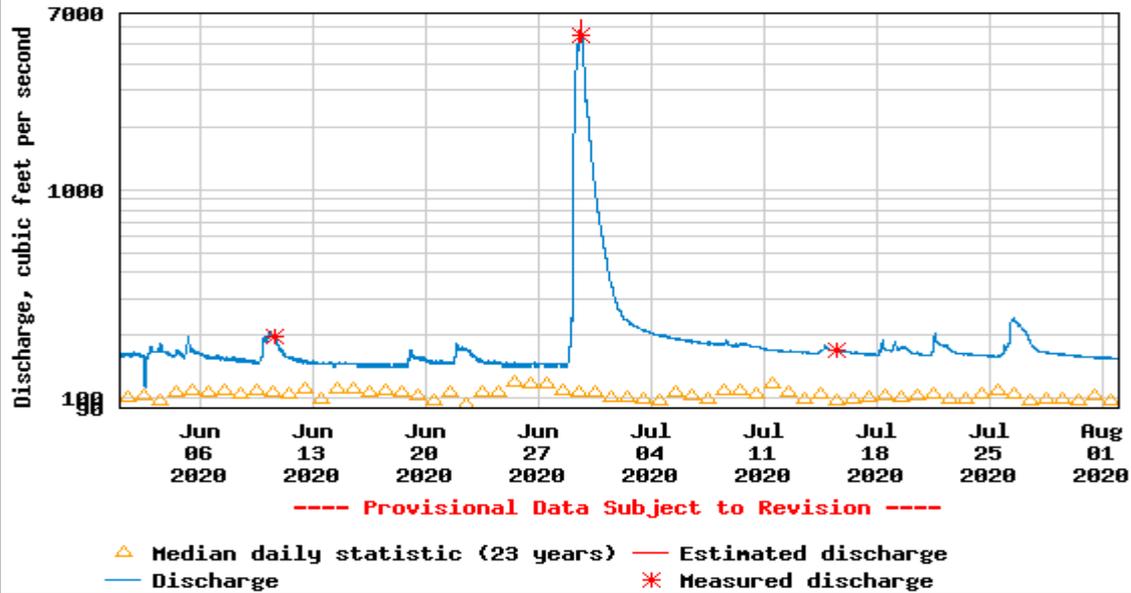
Methodology

Reconnaissance, Timed Searches (qualitative), Quantitative

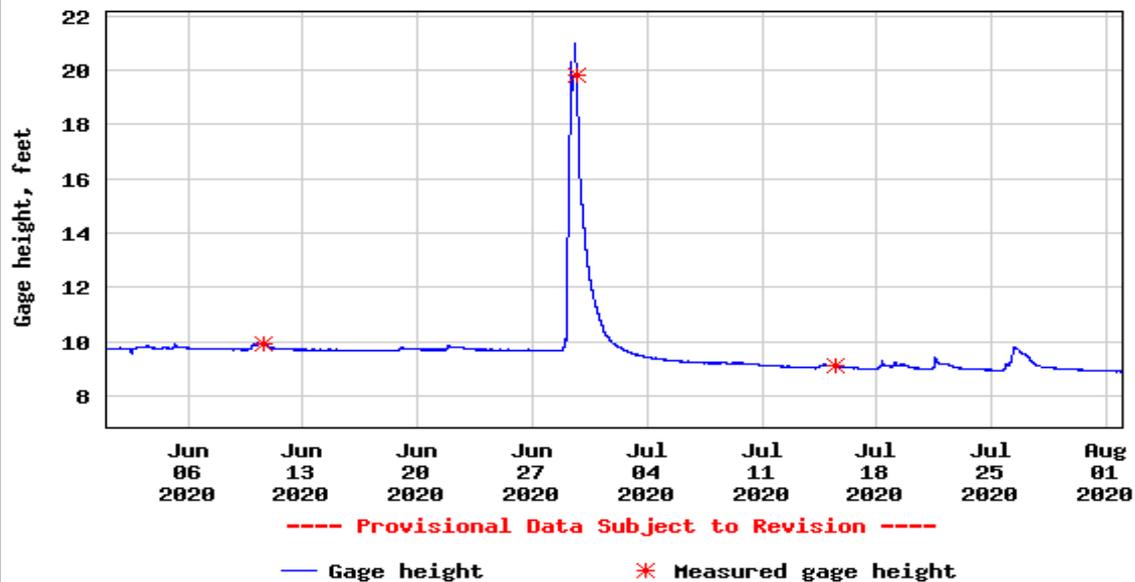
- WiDNR Guidelines for Sampling Mussels in Wadable Streams (2015)
- MnDNR Statewide Mussel Survey – Lower St. Croix River (2001)
- USACE Large River Mussel Monitoring Protocols (Kelner pers. Comm)



USGS 05342000 KINNICKINNIC RIVER NEAR RIVER FALLS, WI

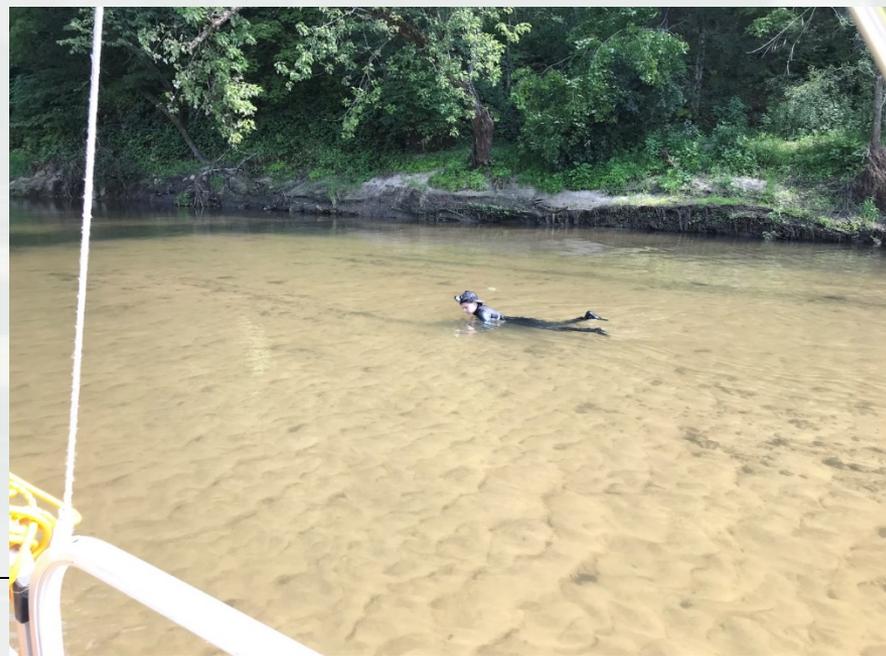


USGS 05342000 KINNICKINNIC RIVER NEAR RIVER FALLS, WI









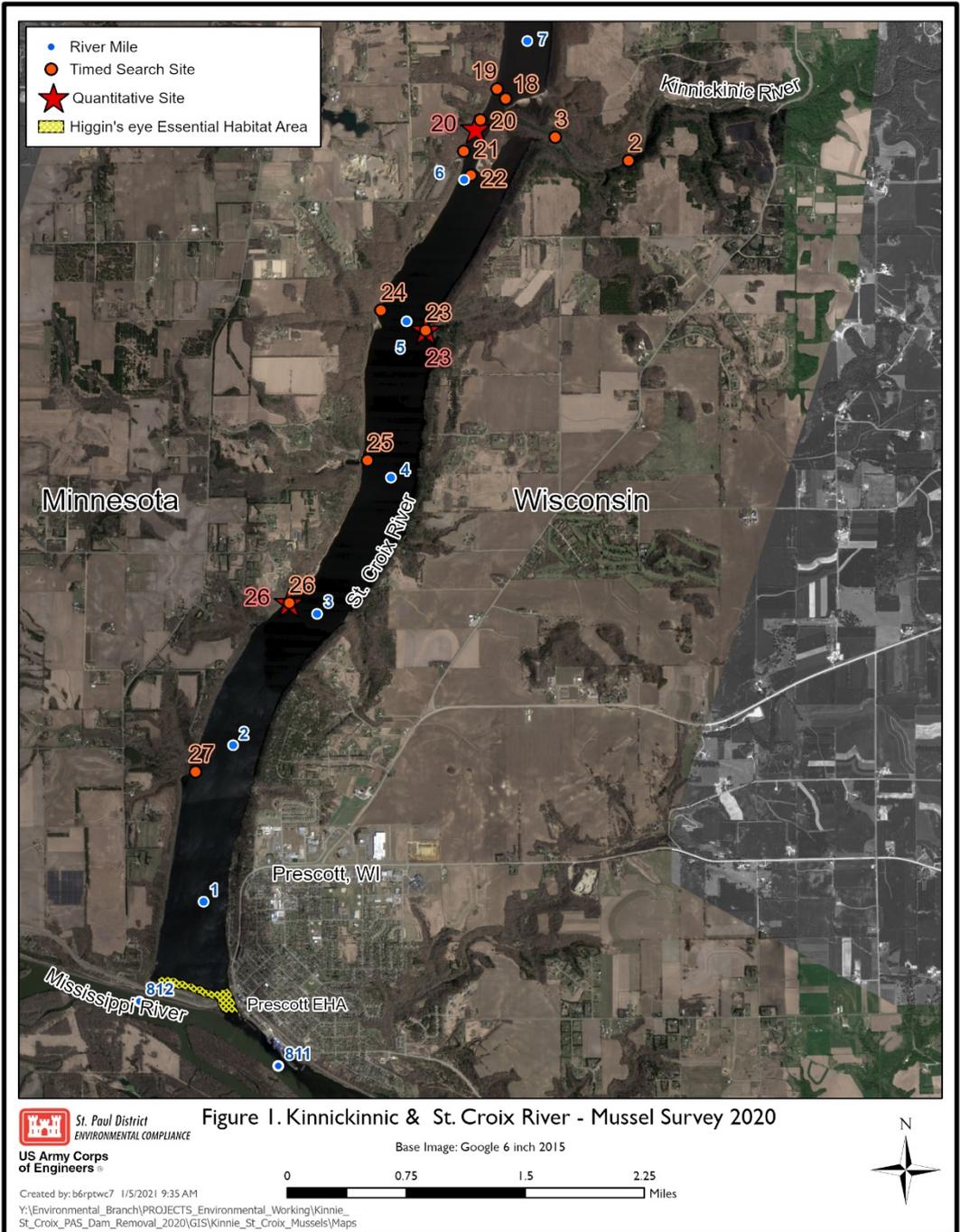


Figure 1. Kinnickinnic & St. Croix River - Mussel Survey 2020

St. Paul District
ENVIRONMENTAL COMPLIANCE
US Army Corps
of Engineers

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Mussel species from timed search qualitative and quantitative sampling in the lower St. Croix River, August 2020.

Species	Common Name	Status	Qualitative		Quantitative		Total	
			No. live	%	No. live	%	No. live	%
Amblemini								
<i>Amblema plicata</i>	threeridge		923	55.0	105	55.0	1,028	55.0
Anodontini								
<i>Lasmigona complanata</i>	white heelsplitter		3	0.2			3	0.2
<i>Pyganodon grandis</i>	giant floater		1	0.1	1	0.5	11	0.6
Lampsilini								
<i>Actinonaias ligamentina</i>	mucket	MnT	6	0.4	2	1.0	8	0.4
<i>Lampsilis cardium</i>	plain pocketbook		35	2.1	4	2.1	39	2.1
<i>Lampsilis higginsi</i>	Higgins eye	FE,MnE,WiE	2	0.1			2	0.1
<i>Lampsilis siliquoidea</i>	fatmucket		31	1.8	1	0.5	32	1.7
<i>Leptodea fragilis</i>	fragile papershell		7	0.4	1	0.5	8	0.4
<i>Ligumia recta</i>	black sandshell		2	0.1			2	0.1
<i>Obliquaria reflexa</i>	threehorn wartyback		255	15.2	28	14.7	283	15.1
<i>Obovaria olivaria</i>	hickorynut		1	0.1		0.0	1	0.1
<i>Potamilus alatus</i>	pink heelsplitter		14	0.8	5	2.6	19	1.0
<i>Truncilla truncata</i>	deertoe		3	0.2	D		3	0.2
<i>Toxolasma parvum</i>	lilliput		1	0.1	D		1	0.1
Pleurobemini								
<i>Fusconaia flava</i>	Wabash pigtoe		273	16.3	19	9.9	292	15.6
<i>Pleurobema sintoxia</i>	round pigtoe		38	2.3	4	2.1	42	2.2
<i>Eurynia dilatata</i>	spike	MnT	6	0.4	9	4.7	15	0.8
Quadrulini								
<i>Quadrula quadrula</i>	mapleleaf		6	0.4			6	0.3
<i>Cyclonaias pustulosa</i>	pimpleback		61	3.6	12	6.3	73	3.9
Total live			1,677		191		1,868	
Live species			19		12		19	
Total species			19		14		19	
No. sites			12		3		12	
N (No. 0.25 m2 per site)					40			
Effort (min/site)			60					

Species / site

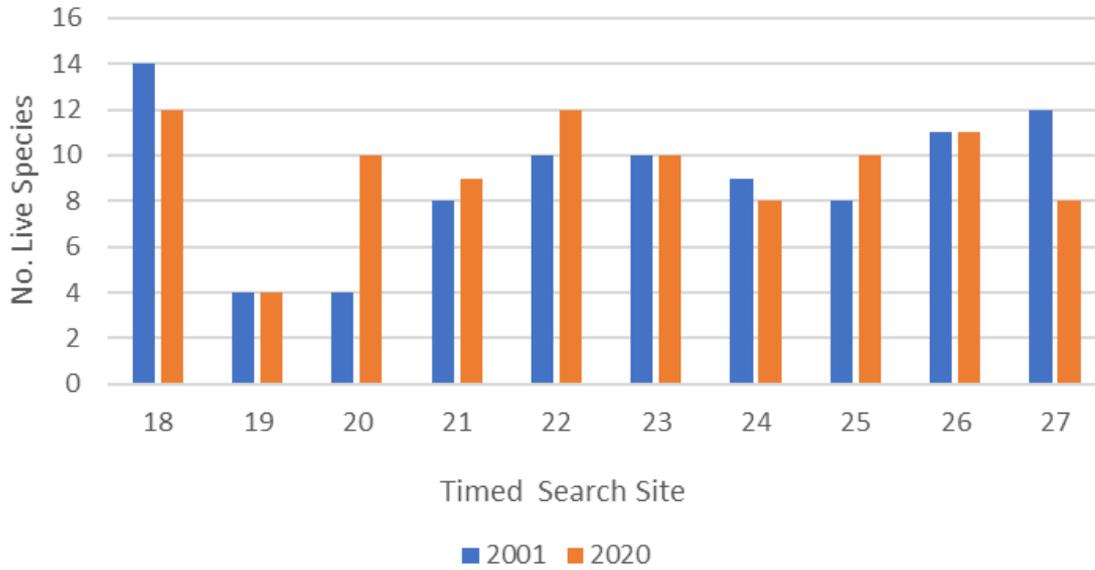


Higgins eye

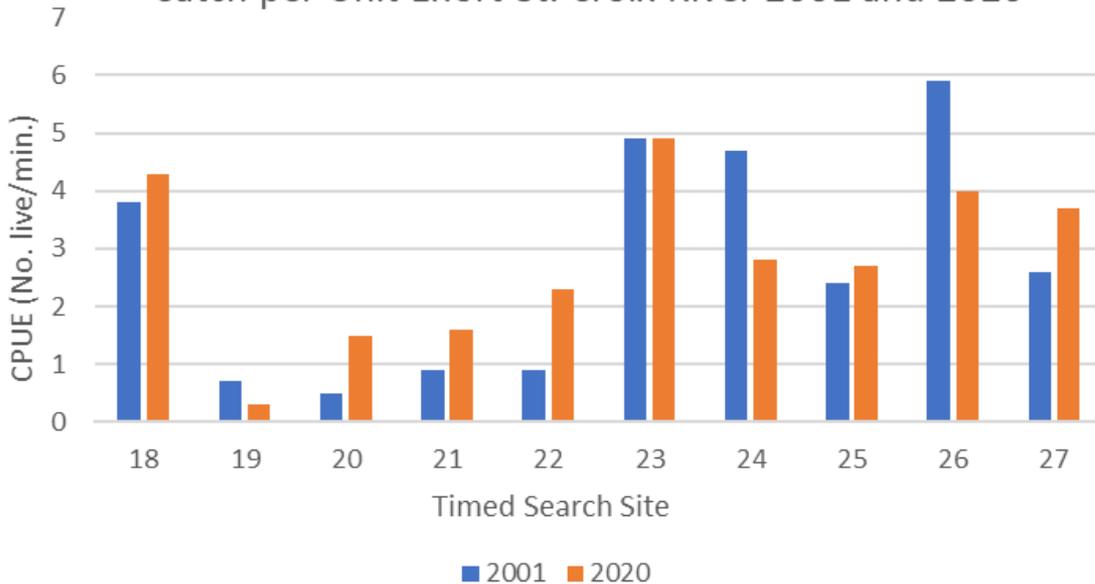


Timed Searches St. Croix River

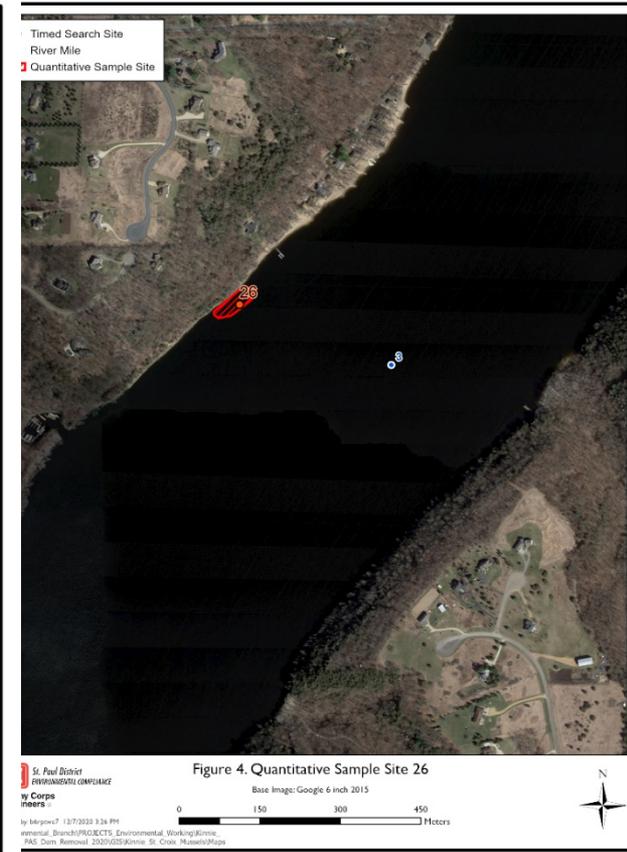
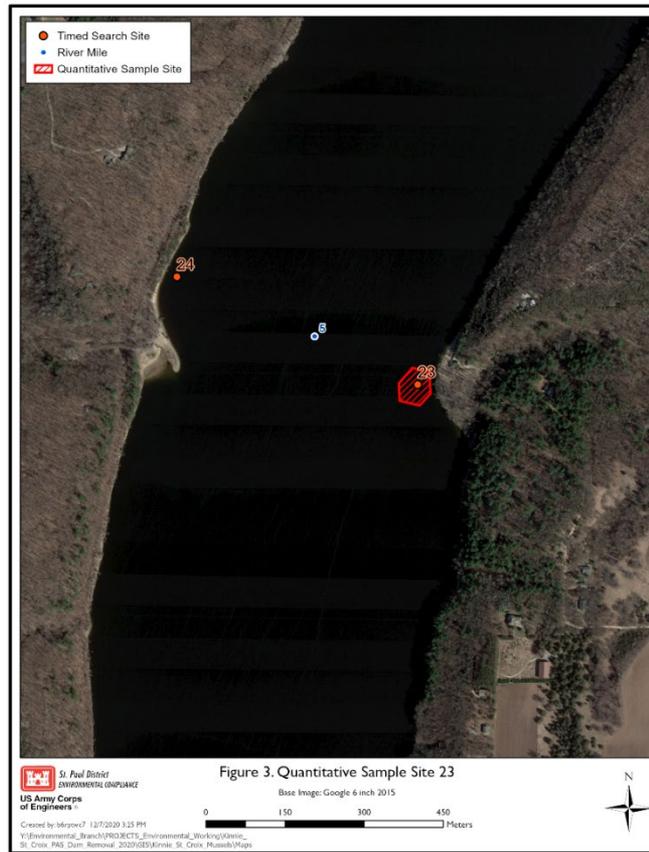
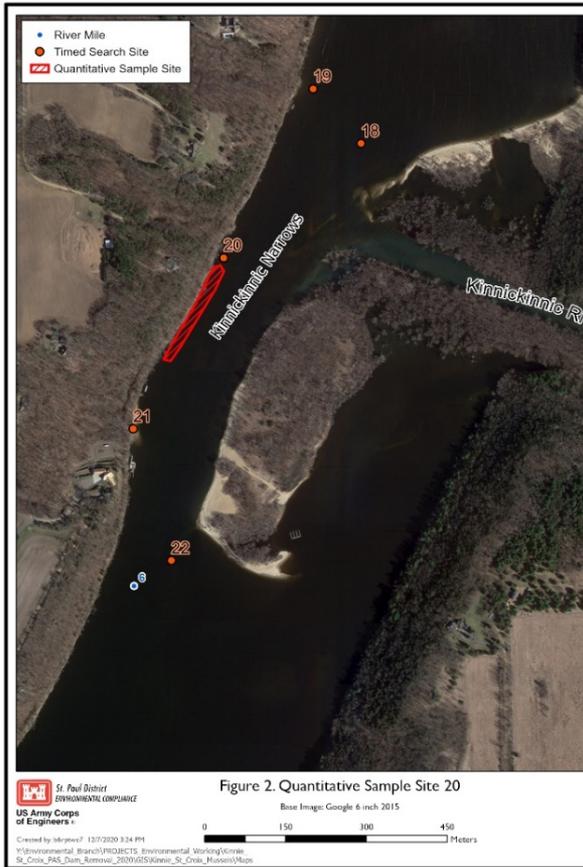
Species Richness - St Croix River 2001 and 2020



Catch per Unit Effort St. Croix River 2001 and 2020



Quantitative Sampling – Sites 20, 23, 26

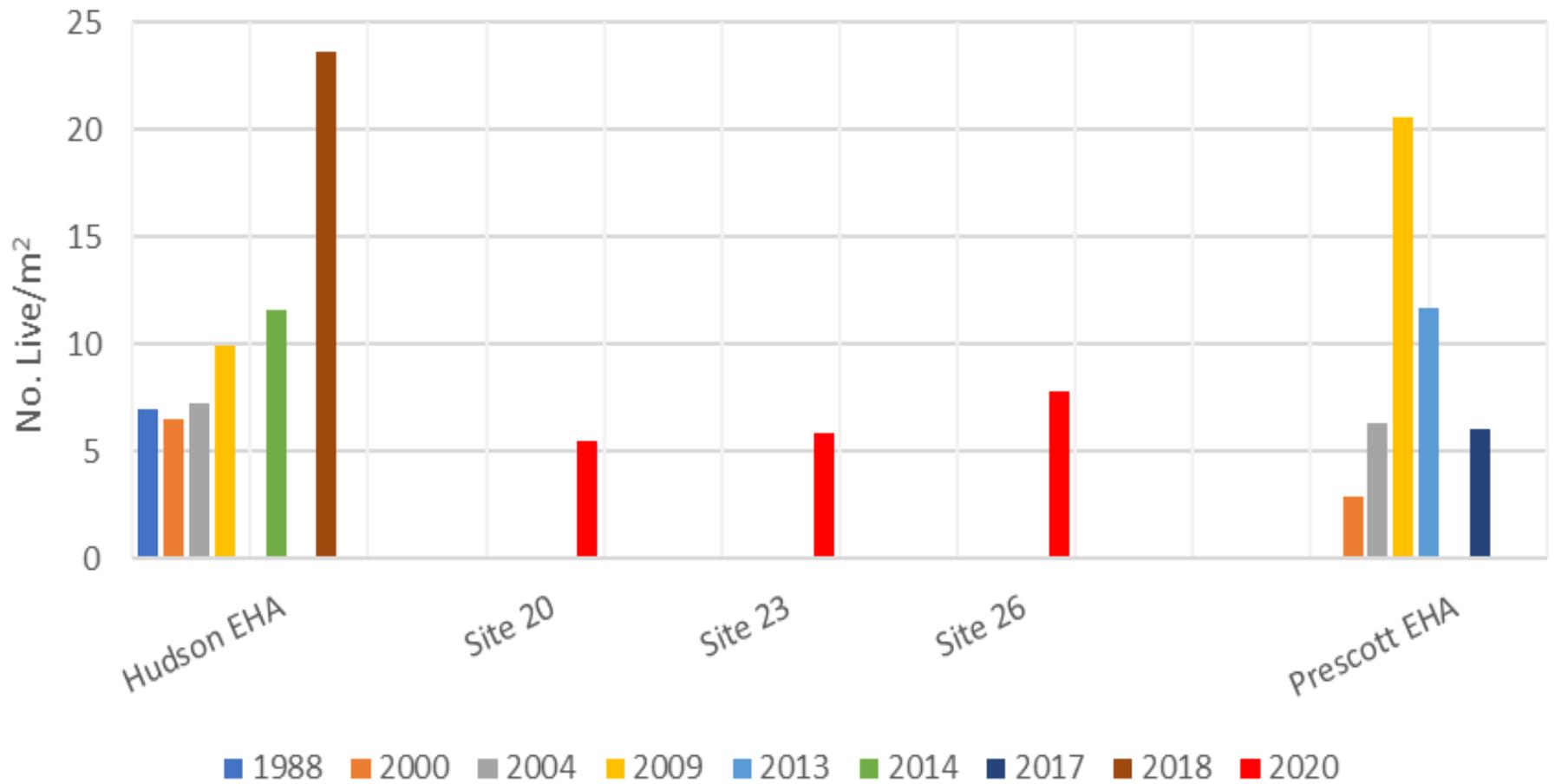


11 Live Species
5.5 mussels / m²
No ZM infestation
Area = 3,692m² (0.9 acre)
3-12 ft depth
Consolidated Sand/gravel/cobble

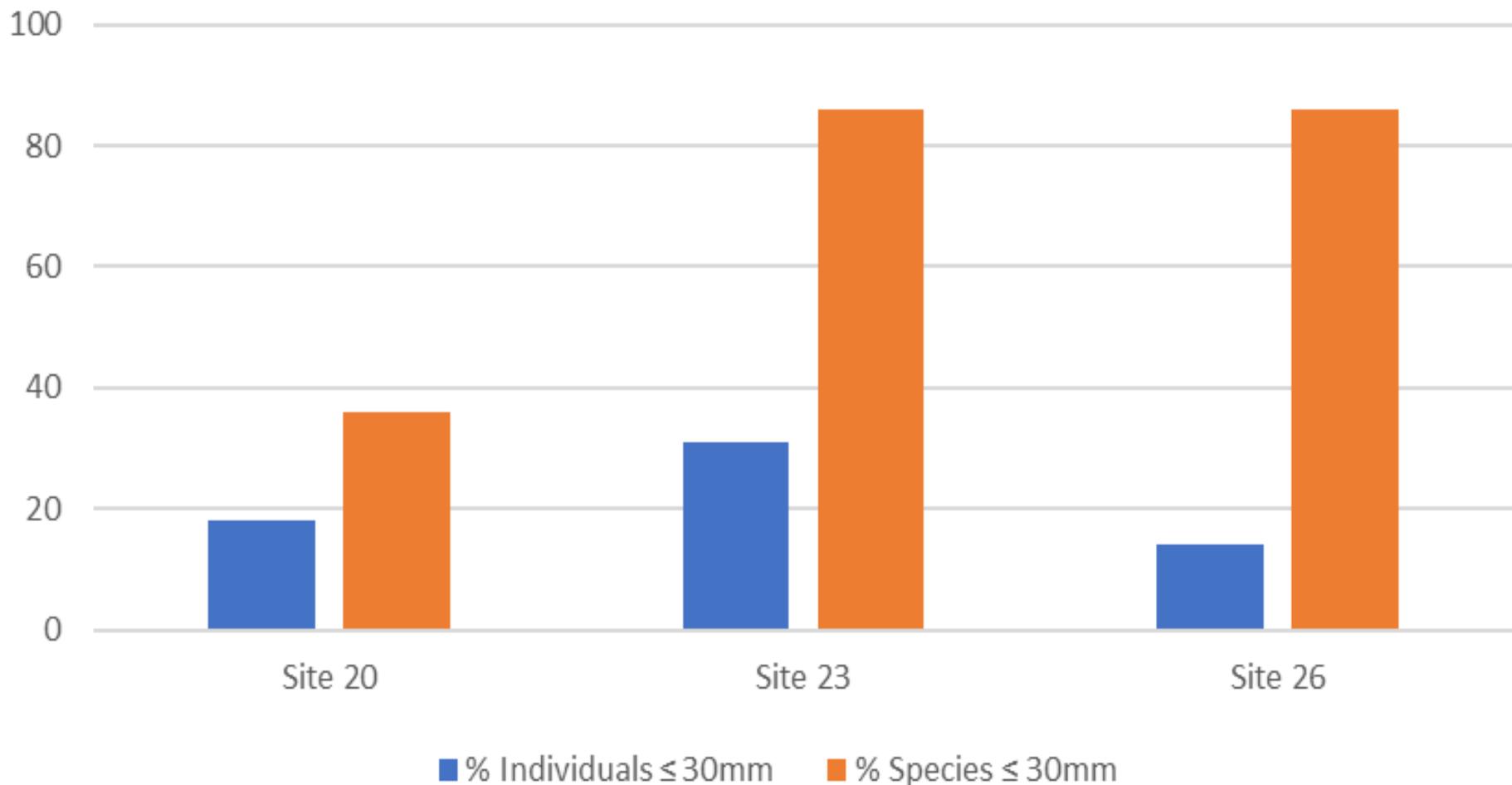
7 Live Species
5.8 mussels / m²
59% natives w ZM, 1.6 ZM/native
Area = 3,306m² (0.8 acre)
3-15 ft depth
Consolidated sand/gravel

7 Live Species
7.8 mussels / m²
64% natives w ZM, 3.1 ZM/native
Area = 2,061m² (0.5 acre)
2-12 ft depth
Sand/empty ZM shells/flocc.

Native Mussel Density - St. Croix EHAs and This Study



Site 20, 23, 26 - Percent Individuals and Species \leq 30mm



Conclusion

Baseline data obtained pre dam removal

Lower Kinnickinnic

- Mussels absent - likely pre-flood as well.

Lower St. Croix

- 19 live species including Higgins eye (this study)
- Pockets of moderately densely populated areas (this study)
- Stable compared to 2001
 - Species richness and abundance
 - Minimally impacted by zebra mussels

Dam removal effects to mussels

- 2020 Flood observations
- Likely minimal impacts to native mussels including T&E
 - Repeat survey one time 10-20 years post dam removal?





Questions?

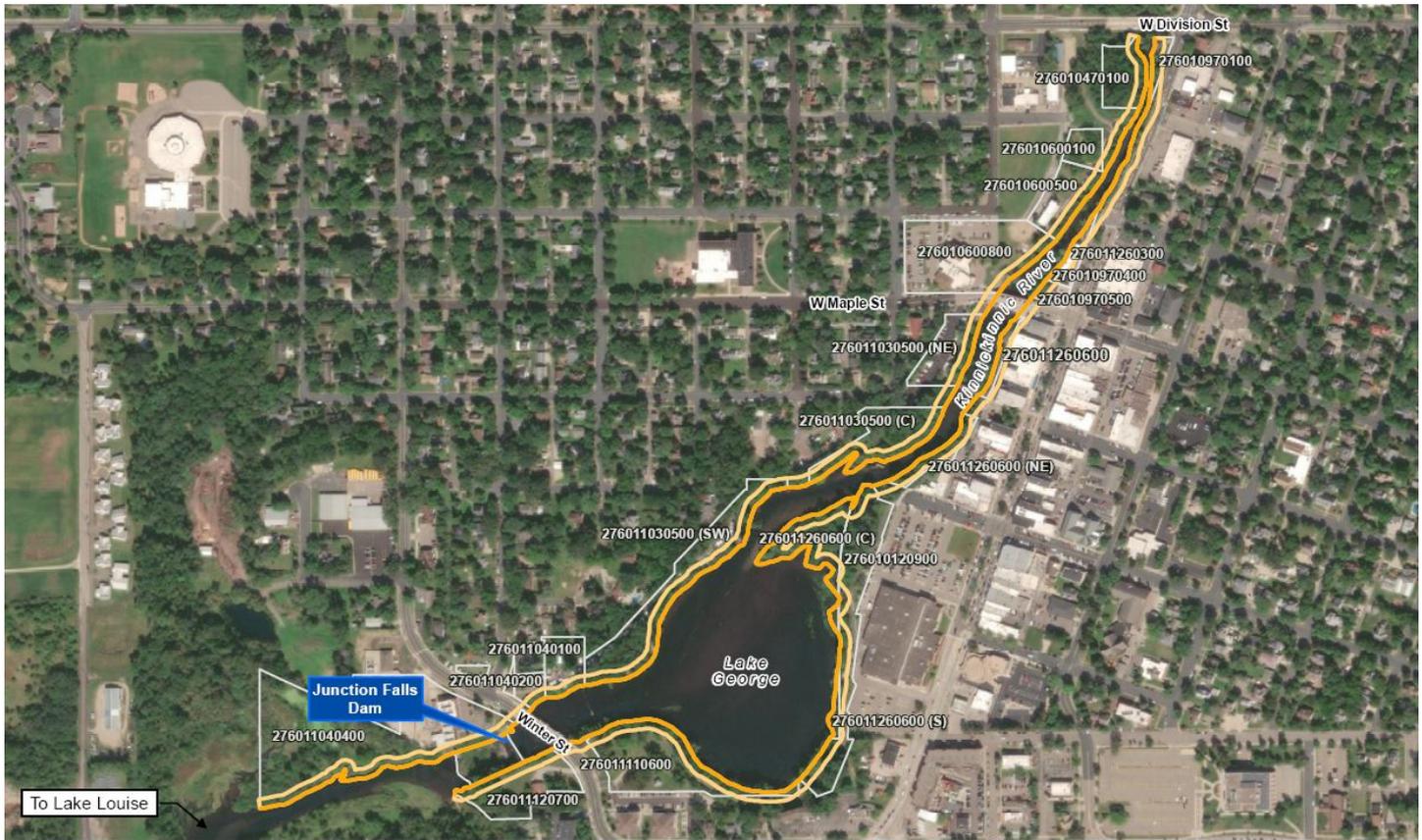


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LAKE GEORGE SHORELINE HABITAT ASSESSMENT JOSH MCENANY, GSRC

Gulf South Research Corporation (GSRC) was contracted by the U.S. Army Corps of Engineers, St. Paul District, on behalf of the City of River Falls, Wisconsin to conduct a Shoreline Habitat Assessment (SHA) on a portion of the Kinnickinnic River south of Junction Falls Dam, the Lake George impoundment, and another portion of the river directly upstream from the impoundment.

The SHA was conducted on July 28 and 29, 2020. The SHA was implemented in accordance with the *Lake Shoreland & Shallows Habitat Monitoring Field Protocol* provided by the Wisconsin Department of Natural Resources.



Legend

-  Lake Shoreline Within the Study Area
-  35-Foot Riparian Buffer
-  Parcel Boundary



December 2020

MATERIALS AND METHODOLOGY

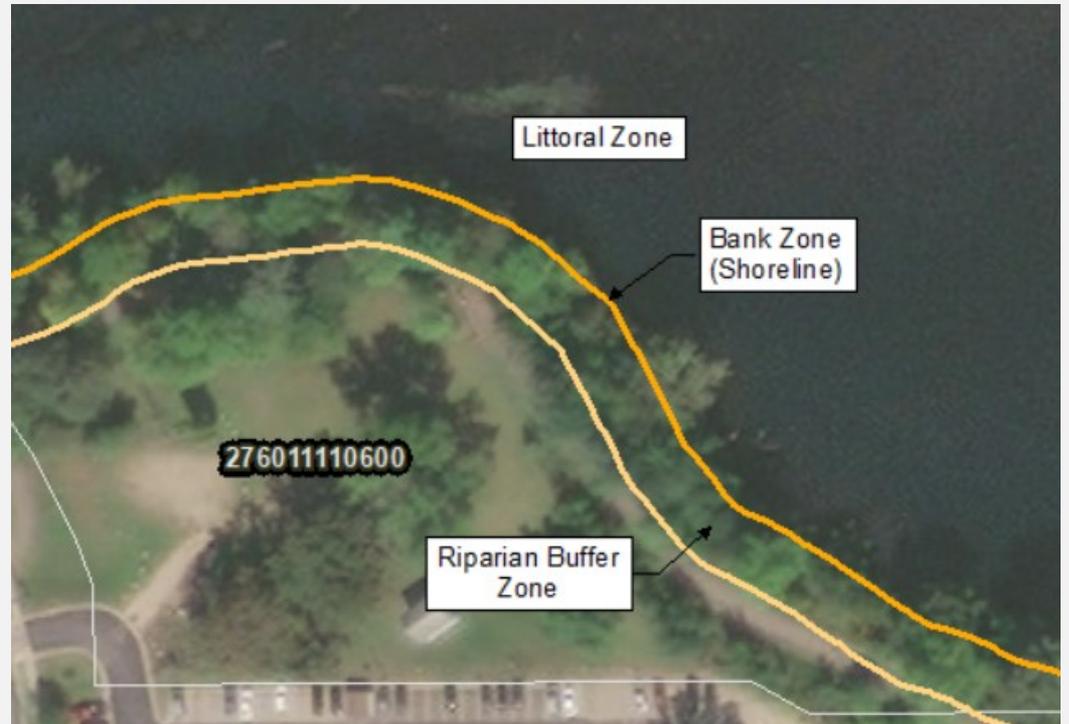
Initial background research and aerial imagery review

- Preliminary mapping
 - Parcel mapping
 - 20 parcels with 7 landowners (City of River Falls, 14/20 parcels)

The protocol dictated the assessment of the lake use three habitat zones and recording that information on a datasheet as provided by the protocol.

- Littoral Zone: defined as the in-water area of the lake starting at the present water line and extending approximately 50 feet into the lake
- Bank Zone: the area between the top of the bank lip and the bank toe, which includes the ordinary high-water mark (OHWM)
- Riparian Buffer Zone: begins at the top edge of the bank zone and extends inland 35 feet.

Assessment Zones for Lake George SHA



DATASHEET FOR SHORELINE HABITAT ASSESSMENT

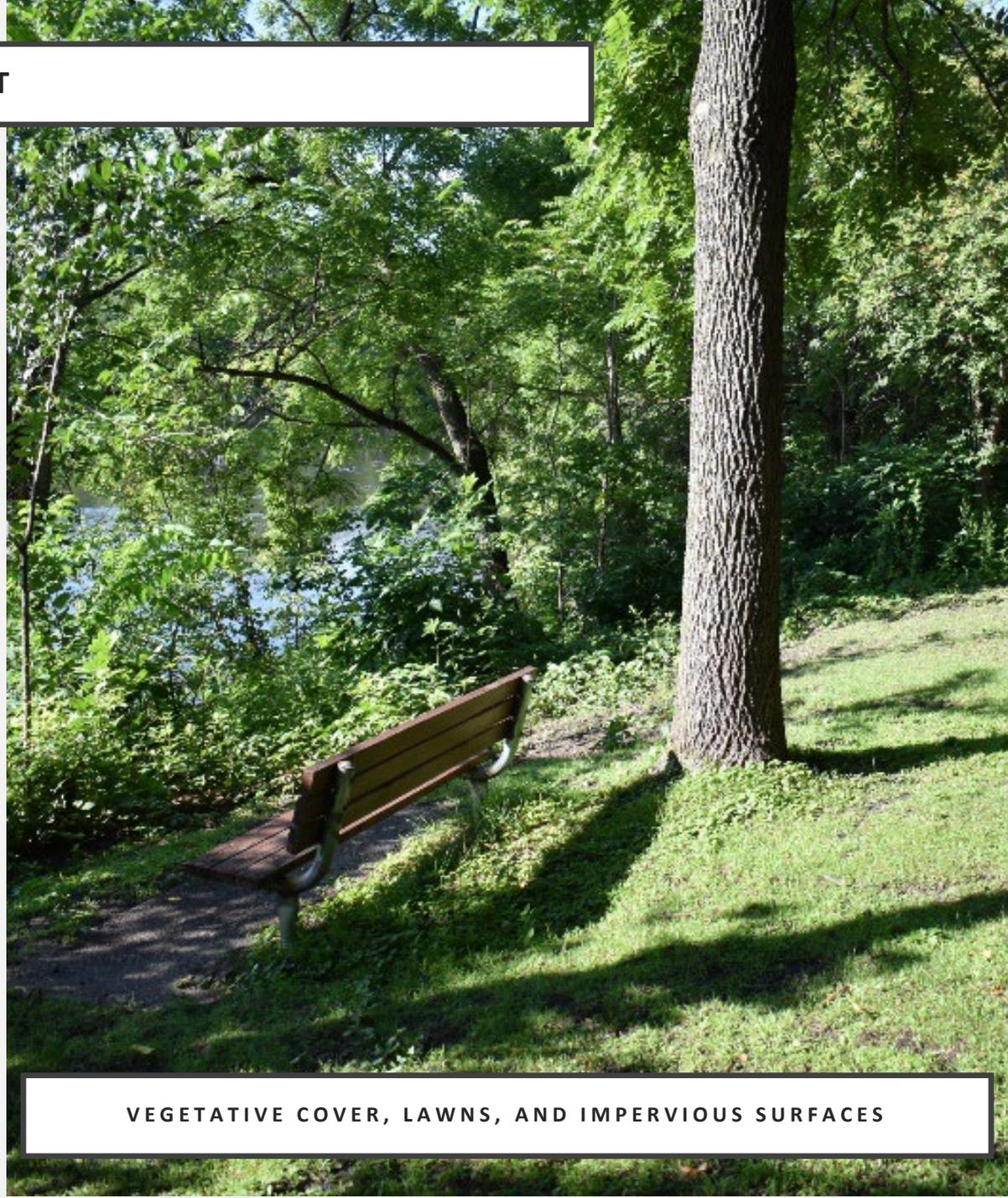
Date		Lake Name		WBIC				
Parcel ID			Observers					
RIPARIAN ZONE			BANK ZONE					
Percent Cover in Riparian			Percent	Length (ft)				
Canopy			(0-100)	Vertical Sea Wall				
Shrub	Herbaceous			Rip Rap				
Shrub/Herbaceous				Other Erosion Control Structures				
Impervious Surface				Artificial Beach				
Manicured Lawn				Bank Erosion >1 ft face				
Agriculture				Bank Erosion <1 ft face				
Other (e.g., duff, soil, mulch)								
Description:								
Human Structures in Riparian			Number	LITTORAL ZONE				
Buildings				Human Structures				
Boats on Shore				Piers	Number			
Fire Pits				Boat Lifts				
Other				Boat Shelters				
Description:								
Runoff Concerns in Riparian or Entire Parcel			Present in Riparian	Present out of Riparian				
Point Source								
Channelized Water Flow/Gully								
Stair/Trail/Road to Lake								
Lawn/Soil Sloping to Lake								
Bare Soil								
Sand/Silt Deposits								
Other								
Description:								
Notes:			Aquatic Plants			Present		
			Emergents					
			Floating					
			Plant Removal					
			If Applicable (Low Water Level):					
			EXPOSED LAKE BED ZONE					
			Plants			Present		
			Canopy					
			Shrubs					
			Herbaceous					
Disturbed								
Plants (Mowed or Removed)								
Sediment (Tilled or Dug)								

LOOP 1: HABITAT ASSESSMENT

Biologists walked a literal loop (Loop 1) around the entire lake and river corridor within the Riparian Buffer Zone and upland areas. The Bank and Littoral Zones were assessed by making another loop with kayaks around entire lake and river corridor

Riparian Buffer Zone Assessment Percent Cover

- Canopy
- Shrub
- Herbaceous
- Impervious Surfaces
- Lawn
- Agriculture
- Other (exposed sand/soil)



VEGETATIVE COVER, LAWNS, AND IMPERVIOUS SURFACES

PARCEL LENGTH AND PERCENT COVER IN RIPARIAN ZONE

Parcel No.	Canopy	Shrub	Herb.	Impervious	Lawn	Agriculture	Other	Description (Other)	Total Disturbed	Length (ft)
276010120900	60	75	10	10	5	0	0		15	498.46
276010470100	100	40	60	0	0	0	0		0	279.05
276010600100	25	20	40	25	10	0	5	exposed sand/soil	40	272.75
276010600500	20	10	40	35	15	0	0		50	313.10
276010600800	20	15	30	25	20	0	10	exposed soil	55	280.88
276010970100	100	40	20	40	0	0	0		40	266.41
276010970400	20	20	20	60	0	0	0		60	44.63
276010970500	30	25	25	50	0	0	0		50	94.43
276011030500-NE	35	25	25	40	10	0	0		50	323.32
276011030500-C	60	30	20	5	10	0	35	exposed sand/soil	50	871.92
276011030500-SW	45	50	35	5	10	0	0		15	1,229.51
276011040100	30	25	15	5	55	0	0		60	156.56
276011040200	20	50	10	0	40	0	0		40	75.81
276011040400	15	85	10	5	0	0	0		5	1,145.23
276011110600	85	40	40	15	5	0	0		20	976.11
276011120700	80	45	45	0	10	0	0		10	413.33
276011260300	20	20	20	60	0	0	0		60	304.50
276011260600-NE	85	50	30	20	0	0	0		20	897.23
276011260600-C	100	70	20	0	0	0	10	exposed sand	10	1,184.71
276011260600-S	80	60	30	5	5	0	0		10	309.38
none ¹	0	0	0	100	0	0	0		100	54.91
none ¹	0	0	0	100	0	0	0		100	67.48
none ²	80	40	40	20	0	0	0		20	406.64
none ¹	0	0	0	100	0	0	0		100	80.85
none ¹	0	0	0	100	0	0	0		100	68.83
AVERAGE	46.96	36.96	22.68	30.89	7.32	0.00	2.14	-	40.36	10,616.03 (2.01 miles)
WEIGHTED AVERAGE	58.72	47.32	26.86	15.59	5.84	0.00	4.38	-	25.81	-

¹ Road crossing (i.e., bridge).

² Section of land south of Parcel No. 276010970100 and north of Parcel No. 276011260300 in the northeast corner of the Project Area.

HUMAN STRUCTURES IN RIPARIAN BUFFER ZONE

Parcel No.	Buildings	Boats on Shore	Fire Pits	Other	Description (Other)
276010120900	0	0	0	0	
276010470100	0	0	0	0	
276010600100	0	0	0	2	bench, light pole
276010600500	0	0	0	2	light poles
276010600800	0	0	0	1	bridge abutment
276010970100	1	0	0	1	adjacent road
276010970400	1	0	0	0	
276010970500	1	0	0	0	
276011030500-C	0	0	0	1	paved trail
276011030500-NE	0	0	0	3	bike rack, benches, trash cans
276011030500-SW	0	0	0	2	fishing pier, boat ramp
276011040100	0	0	0	2	benches
276011040200	0	0	0	0	
276011040400	1	0	0	1	dam-related infrastructure
276011110600	0	0	0	0	
276011120700	0	0	0	0	
276011260300	1	0	0	0	
276011260600-C	0	0	0	0	
276011260600-NE	0	0	0	0	
276011260600-S	0	0	0	1	paved trail
Totals (20 parcels)	5	0	0	16	-



BOAT RAMP ON WEST SIDE OF LAKE GEORGE

RUNOFF CONCERNS IN THE RIPARIAN BUFFER ZONE

Parcel No.	Point Source		Channelized Water/Gully ¹	Stair, Trail, Road		Lawn, Soil Sloping		Bare Soil ¹	Sand/Silt ¹	Other Runoff ¹
	Riparian	Upland		Riparian	Upland	Riparian	Upland			
276010120900	0	1	1	0	0	1	0	0	0	0
276010470100	0	0	1	1	0	0	0	1	1	0
276010600100	1	0	1	1	1	1	1	1	1	0
276010600500	0	0	0	0	0	1	0	0	1	0
276010600800	1	0	0	1	0	1	0	0	0	0
276010970100	1	0	0	0	0	1	0	0	0	0
276010970400	0	0	0	0	0	1	0	0	0	0
276010970500	0	0	0	0	0	1	0	0	0	0
276011030500-SW	0	0	0	1	0	1	0	1	0	0
276011030500-C	0	0	0	1	0	1	0	1	1	0
276011030500-NE	1	0	0	1	0	1	0	1	0	0
276011040100	0	0	0	1	0	1	0	0	0	0
276011040200	1	0	0	0	0	1	0	0	0	0
276011040400	0	0	0	0	0	0	0	1	1	0
276011110600	1	0	0	1	0	1	0	1	0	0
276011120700	0	0	0	1	0	1	0	0	0	0
276011260300	0	0	0	0	0	1	0	0	0	0
276011260600-NE	1	0	0	0	0	1	0	0	0	0
276011260600-C	0	0	0	0	0	1	0	0	0	0
276011260600-S	1	0	0	0	0	1	0	0	0	0
Totals (20 parcels)	8	1	3	9	1	18	1	7	5	0



TYPICAL POINT SOURCE

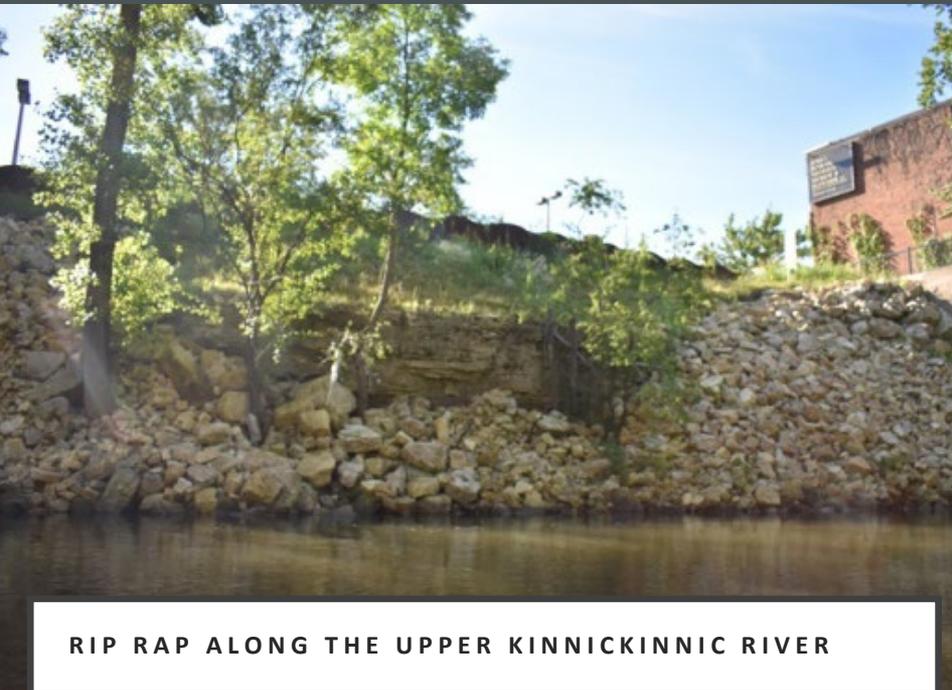
BANK ZONE

The portion of shoreline between the upper bank lip and lower bank toe that typically contains the OHWM.

Vertical Retaining Wall: 355 feet

Rip Rap: 615 feet

Bank Erosion (>1 ft): 90 feet



RIP RAP ALONG THE UPPER KINNICKINNIC RIVER



RETAINING WALL ALONG UPPER KINNICKINNIC RIVER

LITTORAL ZONE

Human Structures in Littoral Zone:

- A total of nine human structures
- 2 old bridge abutments
- 1 pedestrian bridge
- 1 fishing pier
- 1 boat ramp (kayak or canoe take out area)
- Junction Falls Dam
- West Maple Street Bridge
- Winter Street Bridge



AQUATIC PLANTS / EXPOSED LAKEBED

- Emergent and floating aquatic plants were observed in approximately 25 percent of the parcels assessed. It should be noted that submerged aquatic plants were not recorded as part of this study.
- Typically found along the edges of Lake George or the slower, wider section of the Kinnickinnic River upstream from Lake George
- No areas of exposed lakebed were observed during the assessment

LOOP 2: MAPPING COARSE WOODY DEBRIS

Woody debris was mapped and recorded by using a kayak from within the water.

Woody debris consisted of logs/tree limbs greater than 4 inches in diameter and at least 5 feet in length.

Two variables were recorded during the mapping of woody debris:

- Connectivity to shore (present/not present)
- Branching (no branches, some branches, and full canopy)



LOOP 3: PHOTO-DOCUMENTATION OF SHORELINE

GSRC made a third loop, photo-documenting the entire shoreline within the project area.

- Approximately 50 feet from the shoreline looking back at the shoreline.
- GPS coordinates were taken at the location of each photograph for future reference.





Three distinct portions of the Project Area:

- South of Junction Falls Dam
- Lake George
- Upper Kinnickinnic River

South of Junction Falls Dam

Shoreline changes rapidly from exposed bedrock waterfalls that have been modified by the installation of the dam, adjoining retaining wall, and powerhouse to a short “river reach” that leads to Lake Louise to the south



**VIEW OF NORTHWEST PORTION OF
LAKE GEORGE SHORELINE**



**VIEW OF SOUTHEAST PORTION OF
LAKE GEORGE SHORELINE**

Lake George

Lake George is the second distinct portion of the Project Area and the focal point of the SHA study. The original channel of the Kinnickinnic River flowed near the existing northwest shoreline.

Modifications within the current bank zone of Lake George are minimal. Rip rap has been placed as stabilization in some areas. Due to the shallow nature of most areas of Lake George, the littoral zone (i.e., nearshore zone) is similar in character to much of the open water zone. Floating and/or emergent vegetation are found in small stretches around the shoreline.

In accordance with RFMU's 2019 Revised Study Plan for the River Falls Hydroelectric Project (FERC P-10489), the feasibility of a short-term drawdown of water within the impoundment in order to consolidate sediment and stimulate plant growth was considered during the shoreline assessment. Data collected during this survey did not contribute substantially to the conclusion that a short-term drawdown was necessary within the next re-licensing period to remove sediment.

It would be most efficient to perform a drawdown and sediment removal concurrently with dam removal, if dam removal is being considered after the next license term. To warrant a drawdown prior to future dam removal, Lake George would have to be at risk of completely filling with sediment. In order to determine whether the lake is at risk of complete sedimentation, necessary considerations include the current sediment level and the rate of sedimentation. This information could then be used to project when the lake would completely fill with sediment. A planned drawdown and associated sediment removal would be recommended prior to the estimated date calculated for when complete sedimentation of the lake would occur.

Aquatic Invasive Species Survey



Goals

- Survey aquatic invasive species (AIS) in Lake Louise and Lake George

Aquatic Invasive Species Survey



Survey

- July 6-7, 2020 survey
- Visually, vegetation along impoundment margins where vegetation is most dense was not affected by June flood.
- Followed Hauxwell et al. (2010)

Aquatic Invasive Species Survey



Rake Fullness 1, typically



Rake Fullness 2, typically



Rake Fullness 3, typically

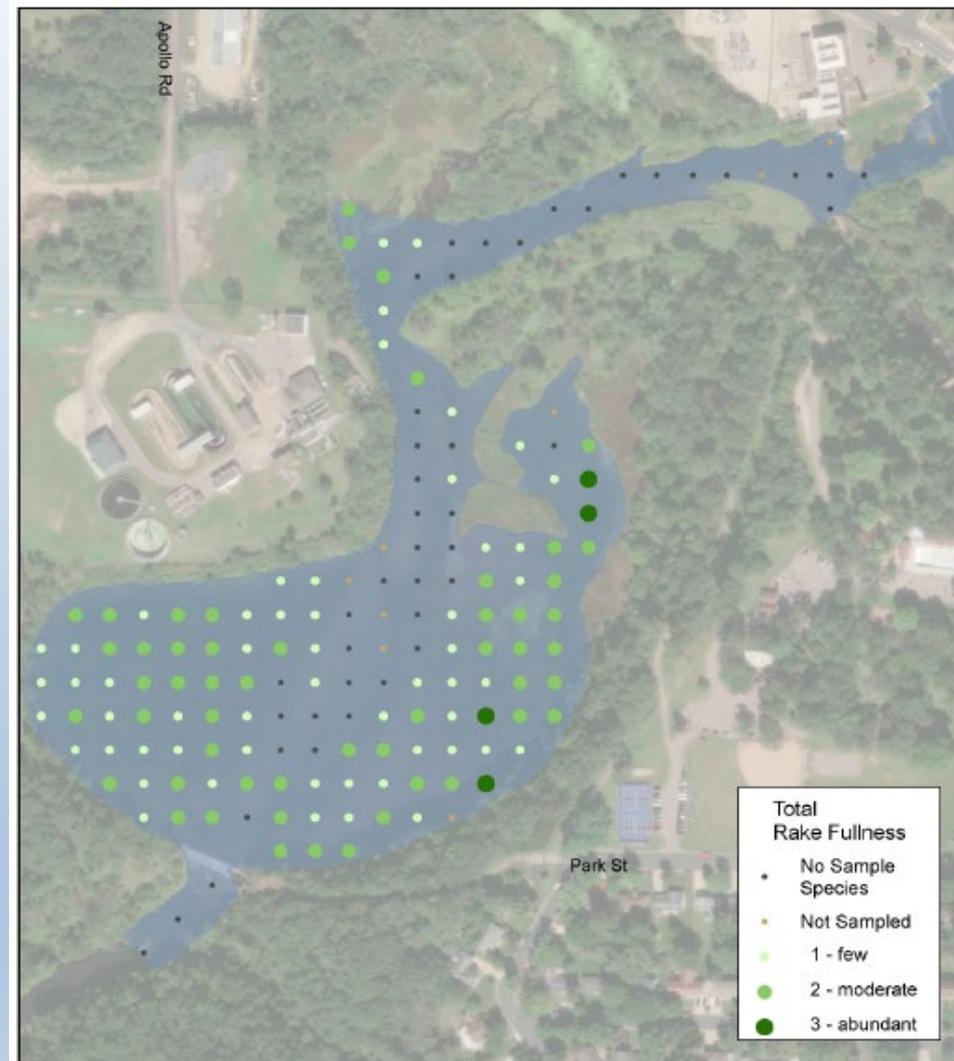
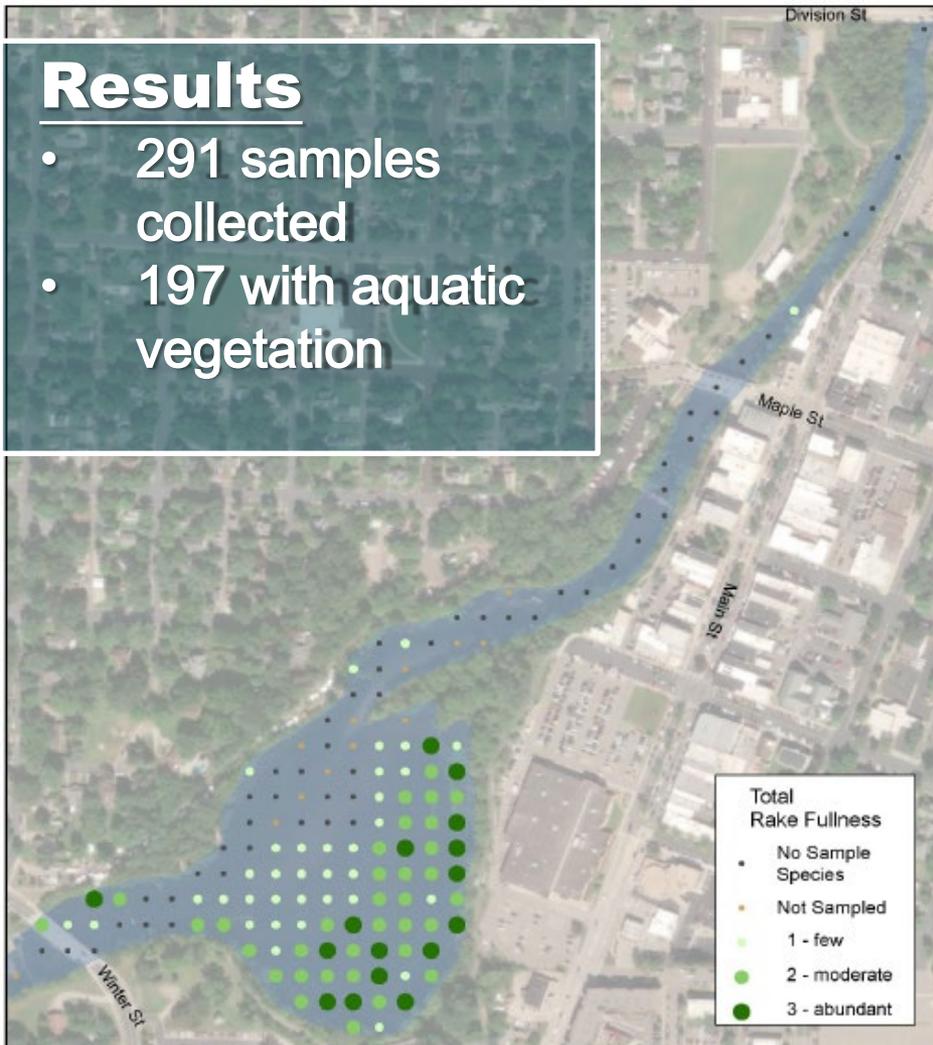
Methods

- Rake cast into lake and retrieved
- Plant species identified
- “Rake fullness” quantified

Aquatic Invasive Species Survey

Results

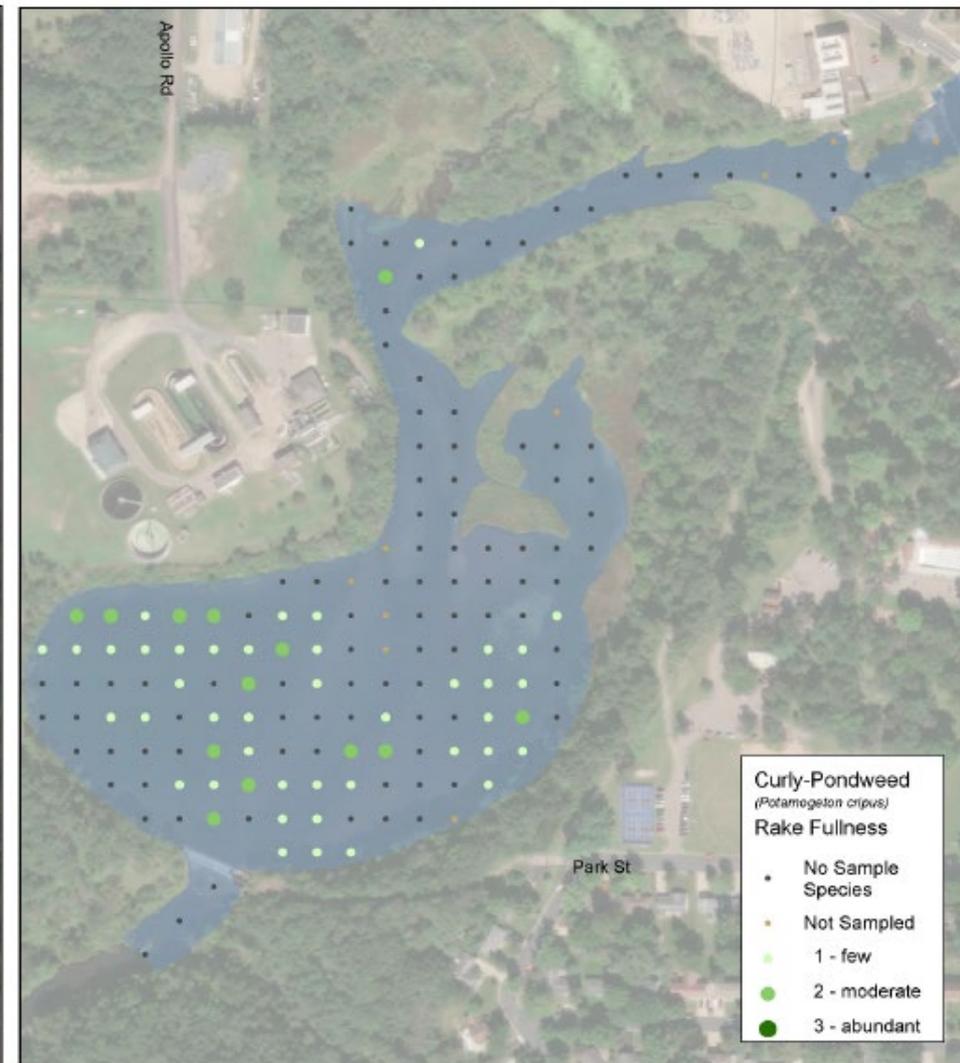
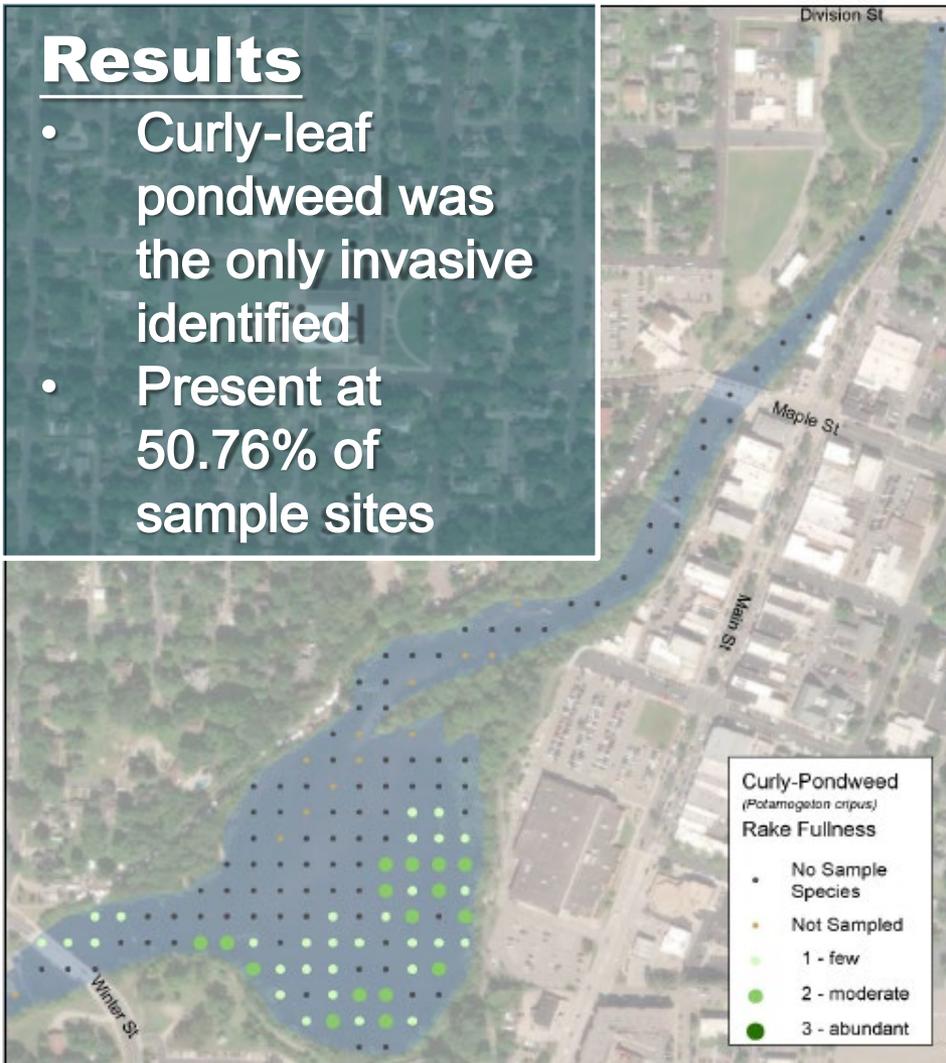
- 291 samples collected
- 197 with aquatic vegetation



Aquatic Invasive Species Survey

Results

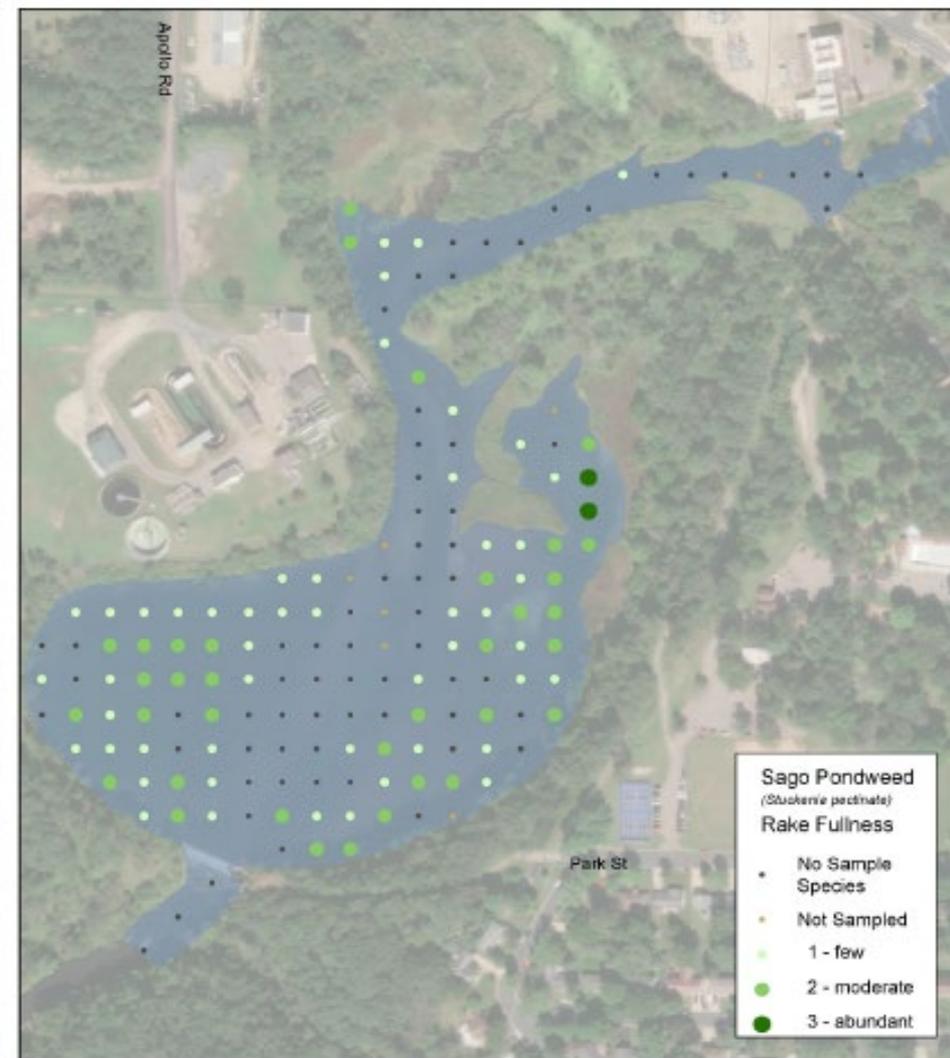
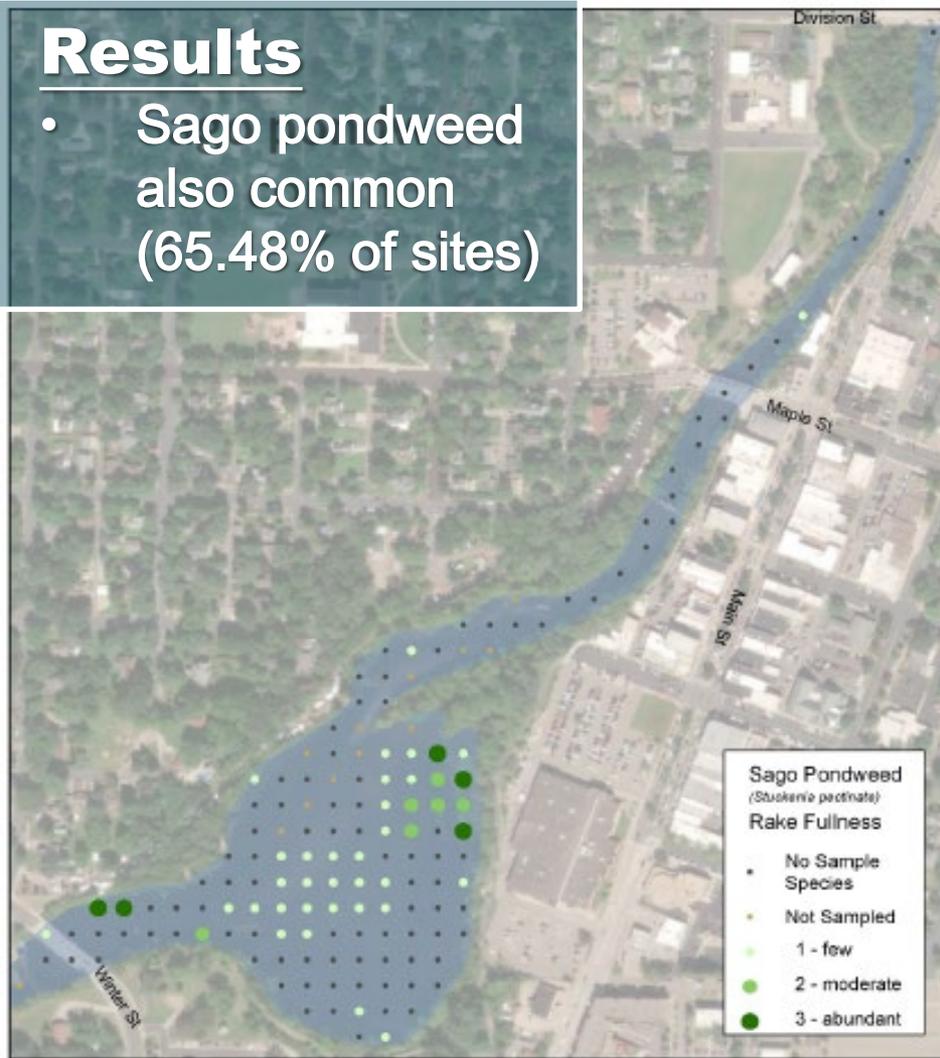
- Curly-leaf pondweed was the only invasive identified
- Present at 50.76% of sample sites



Aquatic Invasive Species Survey

Results

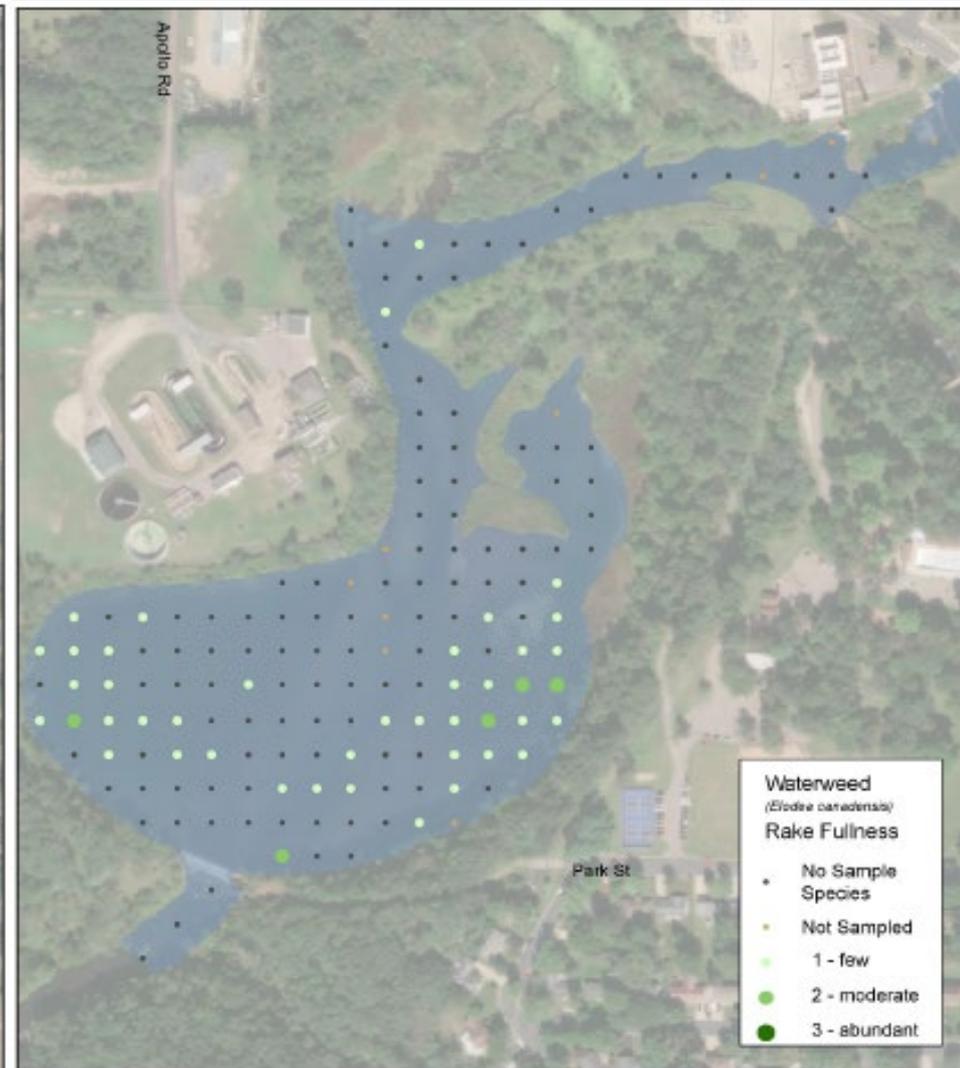
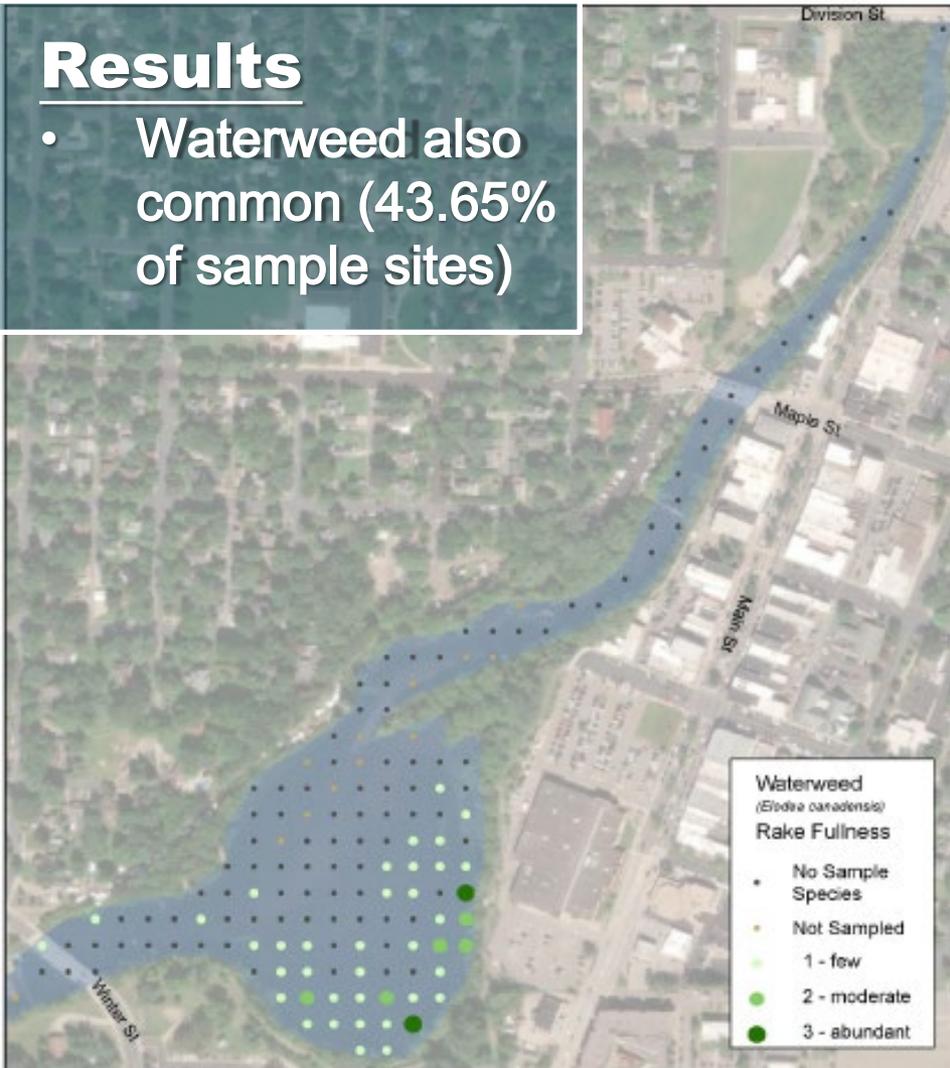
- Sago pondweed also common (65.48% of sites)



Aquatic Invasive Species Survey

Results

- Waterweed also common (43.65% of sample sites)



Aquatic Invasive Species Survey

Results

- Coontail – 24.87% of sites
- Duckweed – 3.55% of sites
- Floating pondweed – 0.51% of sites
- Fine-leaf pondweed – 6.09% of sites

Aquatic Invasive Species Survey

Conclusion

- Curly-leaf pondweed was the only aquatic invasive species identified
- Present in both lakes
- Absent from riverine sections of impoundment



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Riverine Habitat Evaluation Below Powell Falls

Goals

- Evaluate habitat conditions downstream of Powell Falls
- Assess mesohabitat features
 - Pools, riffles, runs
 - Large wood
 - Sediment characteristics, floodplain deposits
 - Channel geometry



Riverine Habitat Evaluation Below Powell Falls

Background

- Riparian ecosystem
- *Resident animals*
- *Travel corridors*
- *Pollinator habitat*

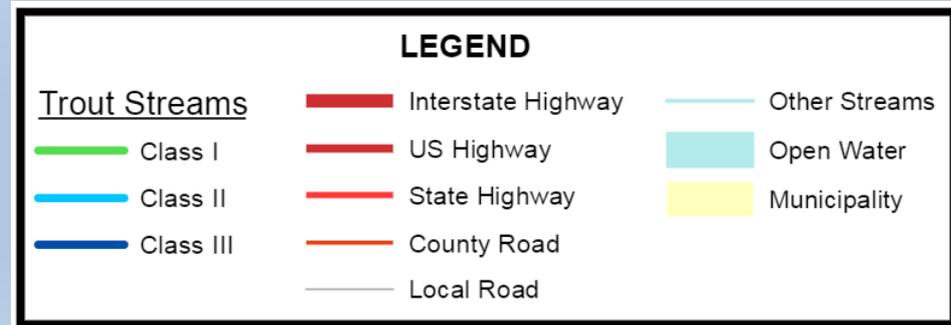
- **GREATER BIODIVERSITY
STEMS FROM GREATER
HABITAT DIVERSITY**

Riverine Habitat Evaluation Below Powell Falls



Background

- Class I trout stream
- Trout habitat needs
 - Food (benthic invertebrates, small fish)
 - Instream diversity (deep pools, boulders, large wood)
 - Gravel substrate



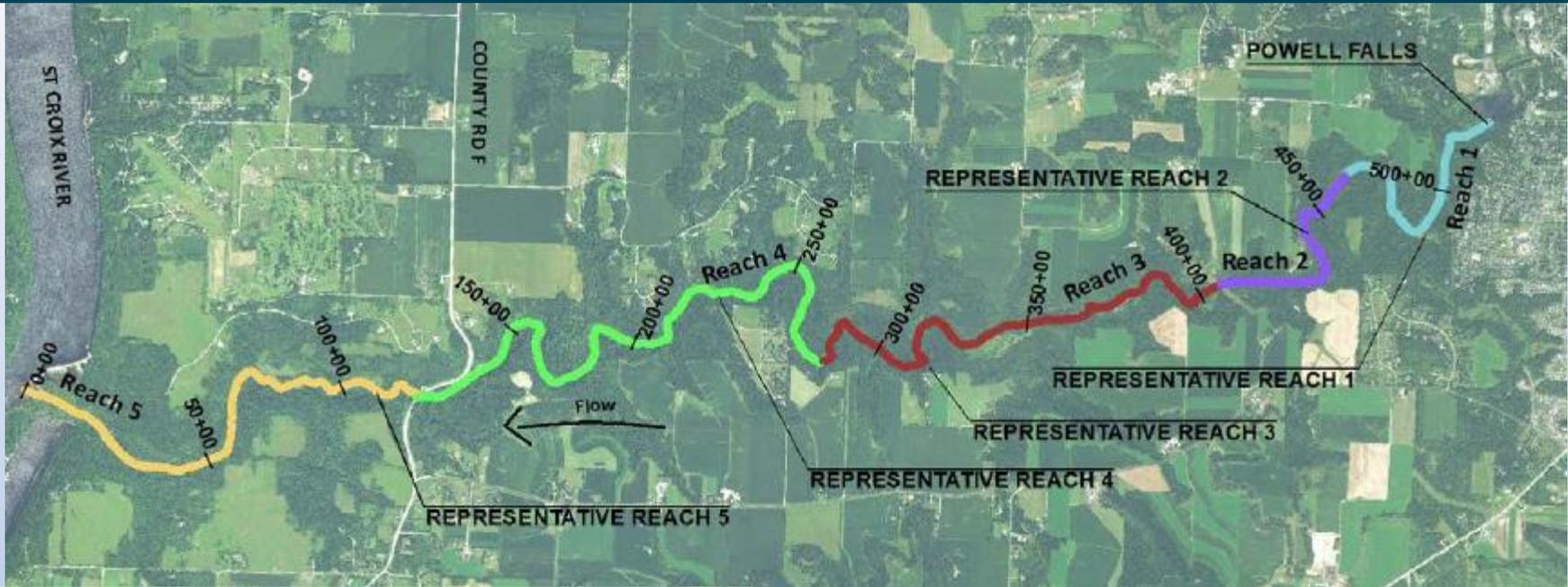
Riverine Habitat Evaluation Below Powell Falls



Methods

- Survey conducted Sept. 21-24, 2020
- Large flood June 28-29, 2020
- Apple iPad with Bad Elf GPS receiver to map location of features
- Visual estimates throughout
- Surveyed channel geometry and pebble counts in select subreaches

Riverine Habitat Evaluation Below Powell Falls



Methods

- Over 10 miles of stream surveyed
- 5 representative subreaches surveyed

Riverine Habitat Evaluation Below Powell Falls



Reach 1

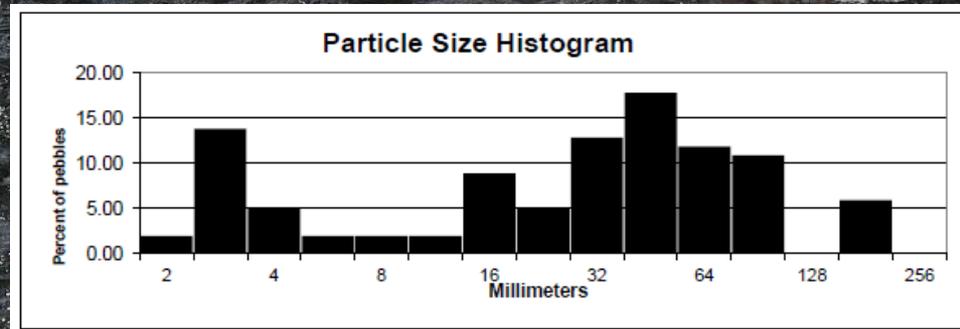
- Pool-riffle with naturally confined floodplain
- Bedrock controlled riffle at 512+00 (pictured)
- Overbank deposition common
- Low habitat diversity

Riverine Habitat Evaluation Below Powell Falls



Subreach 1

- Vegetated island on right
- ~120 feet of eroding bank
- Width 66 +/- 4.5 feet
- Depth 4 +/- 0.5 feet
- Poorly sorted sand and gravel riffles



Riverine Habitat Evaluation Below Powell Falls

Reach 2

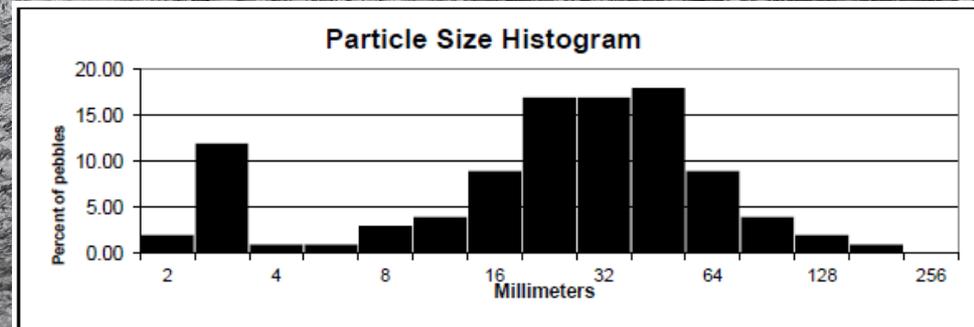
- Pool-riffle with naturally confined floodplain
- Private access a station 432+00
- Overbank deposition common
- Low habitat diversity

Riverine Habitat Evaluation Below Powell Falls



Subreach 2

- Gravel to cobble bar (pictured)
- Width 67 +/- 6.2 feet
- Depth 4 +/- 1.3 feet
- Poorly sorted sand and gravel riffles
- Main habitat coarse riffle substrate



Riverine Habitat Evaluation Below Powell Falls

Reach 3

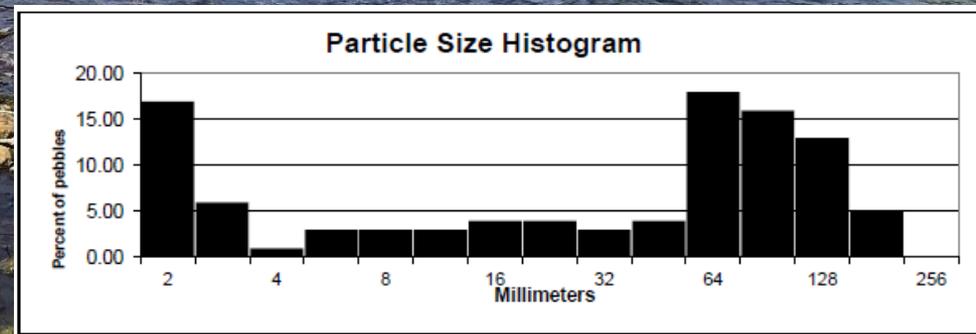
- Pool-riffle with naturally confined floodplain
- Some riffles transitional with runs
- Private access a station 350+00
- Overbank deposition common
- Low habitat diversity

Riverine Habitat Evaluation Below Powell Falls



Subreach 3

- Gravel to cobble bar (pictured)
- Width 61 +/- 10.1 feet
- Depth 4 +/- 1.5 feet
- Poorly sorted sand and gravel riffles
- Main habitat coarse riffle substrate



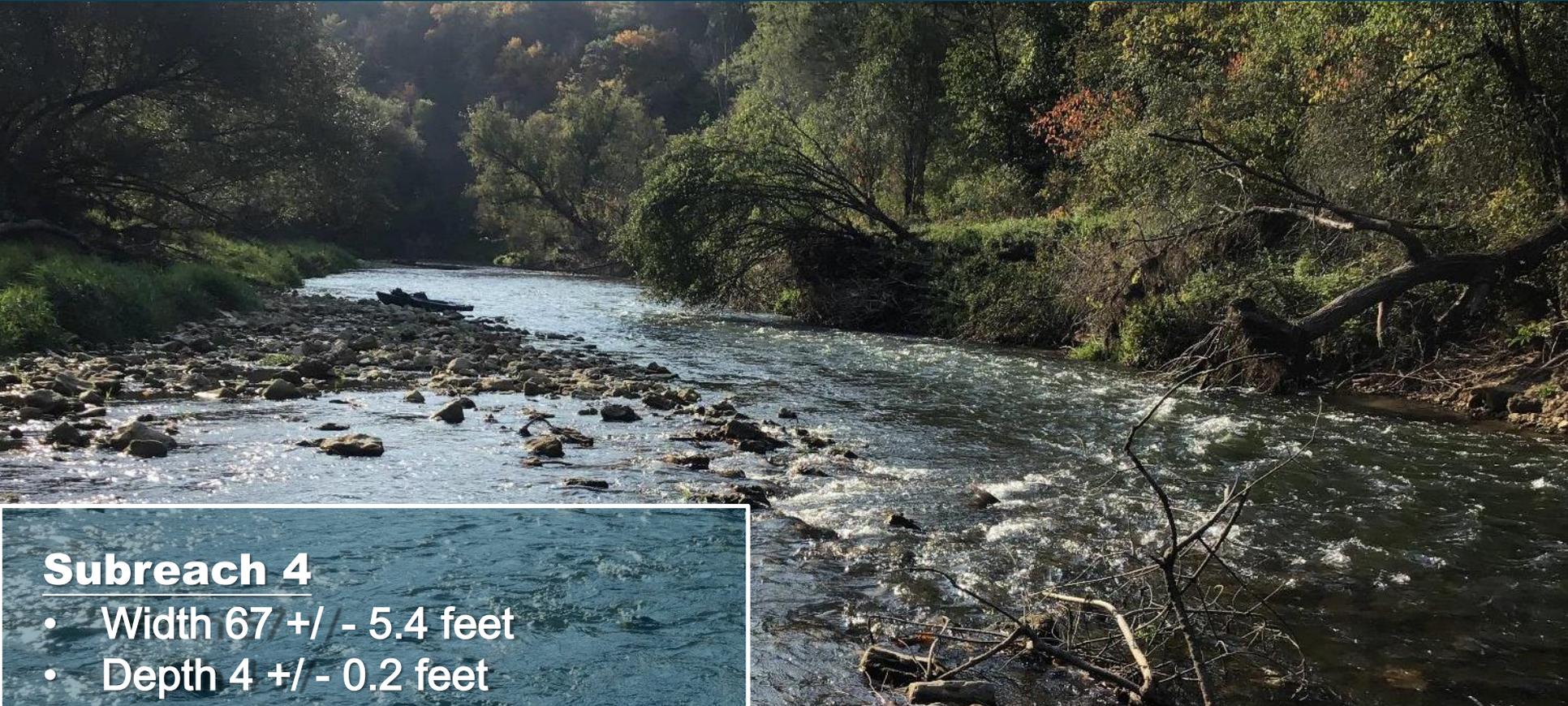
Riverine Habitat Evaluation Below Powell Falls



Reach 4

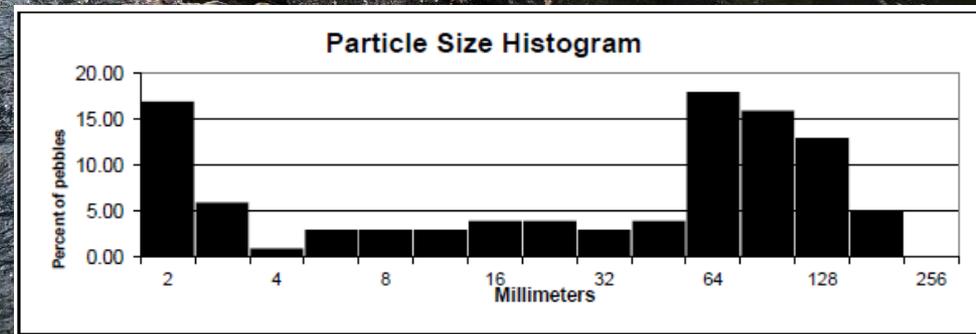
- Pool-riffle with naturally confined floodplain
- Bedrock commonly exposed at outside of meander bends
- Overbank deposition common
- Low habitat diversity

Riverine Habitat Evaluation Below Powell Falls



Subreach 4

- Width 67 +/- 5.4 feet
- Depth 4 +/- 0.2 feet
- Poorly sorted sand to cobble riffles
- Main habitat coarse riffle substrate



Riverine Habitat Evaluation Below Powell Falls



Reach 5

- Upstream – pool riffle with naturally confined floodplain
- Abundant large wood
- Recent avulsion of channel

Riverine Habitat Evaluation Below Powell Falls



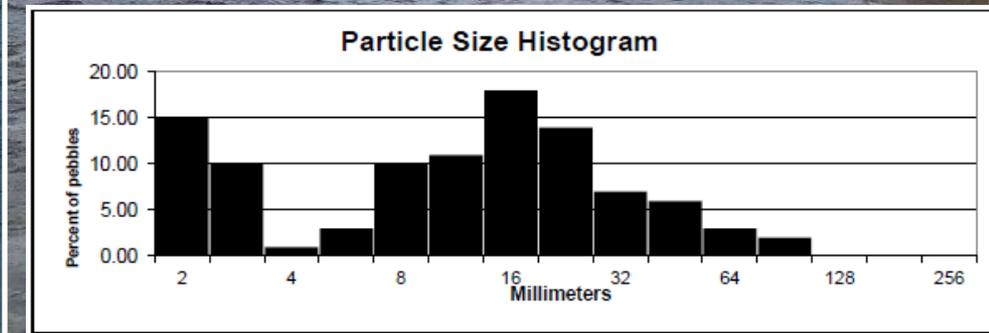
Reach 5

- Downstream – riffle run with naturally confined to unconfined floodplain
- Sand dominated

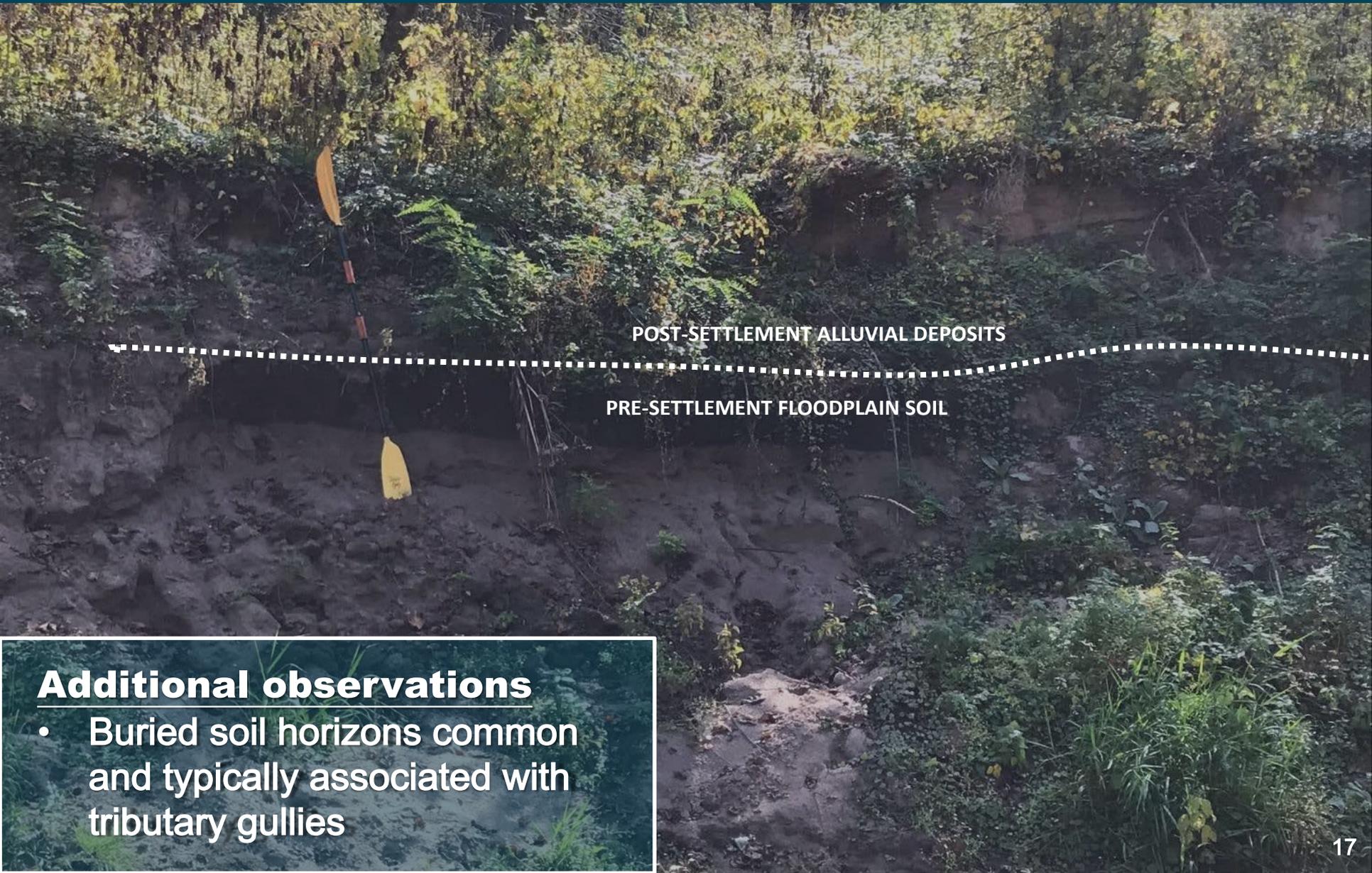
Riverine Habitat Evaluation Below Powell Falls

Subreach 5

- Width 100 +/- 58.3 feet
- Depth 5 +/- 0.8 feet
- Poorly sorted sand to gravel riffles
- Main habitat coarse riffle substrate



Riverine Habitat Evaluation Below Powell Falls



POST-SETTLEMENT ALLUVIAL DEPOSITS

PRE-SETTLEMENT FLOODPLAIN SOIL

Additional observations

- Buried soil horizons common and typically associated with tributary gullies

Riverine Habitat Evaluation Below Powell Falls



SAND DEPOSITED
FOLLOWING RECENT
FLOODING

Additional observations

- Massive overbank sedimentation following June floods

Riverine Habitat Evaluation Below Powell Falls



REED CANARY GRASS
BEGINNING COLONIZATION
OF MID-CHANNEL BAR

Additional observations

- Reed canary grass common in riparian areas

Riverine Habitat Evaluation Below Powell Falls

Discussion

- Channel is relatively stable, but lacks habitat complexity
- Pool depth was typically limited which was also observed in Inter-fluve 2017 assessment
- In-channel large wood was rare in most of study area
- Overbank sedimentation was widespread as result of recent flood
- Main aquatic habitat feature was coarse substrate



Riverine Habitat Evaluation Below Powell Falls

Conclusions

- Aquatic habitat diversity is low throughout study area
- Abundance of trout from water quality, stream size, food abundance, and coarse substrate
- Unregulated release of sediment is a concern since it may lead to the burial of coarse substrate
- Terrestrial habitat limited by reed canary grass monocultures





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Recreation Use Assessment

Ross Hackbarth, GSRC



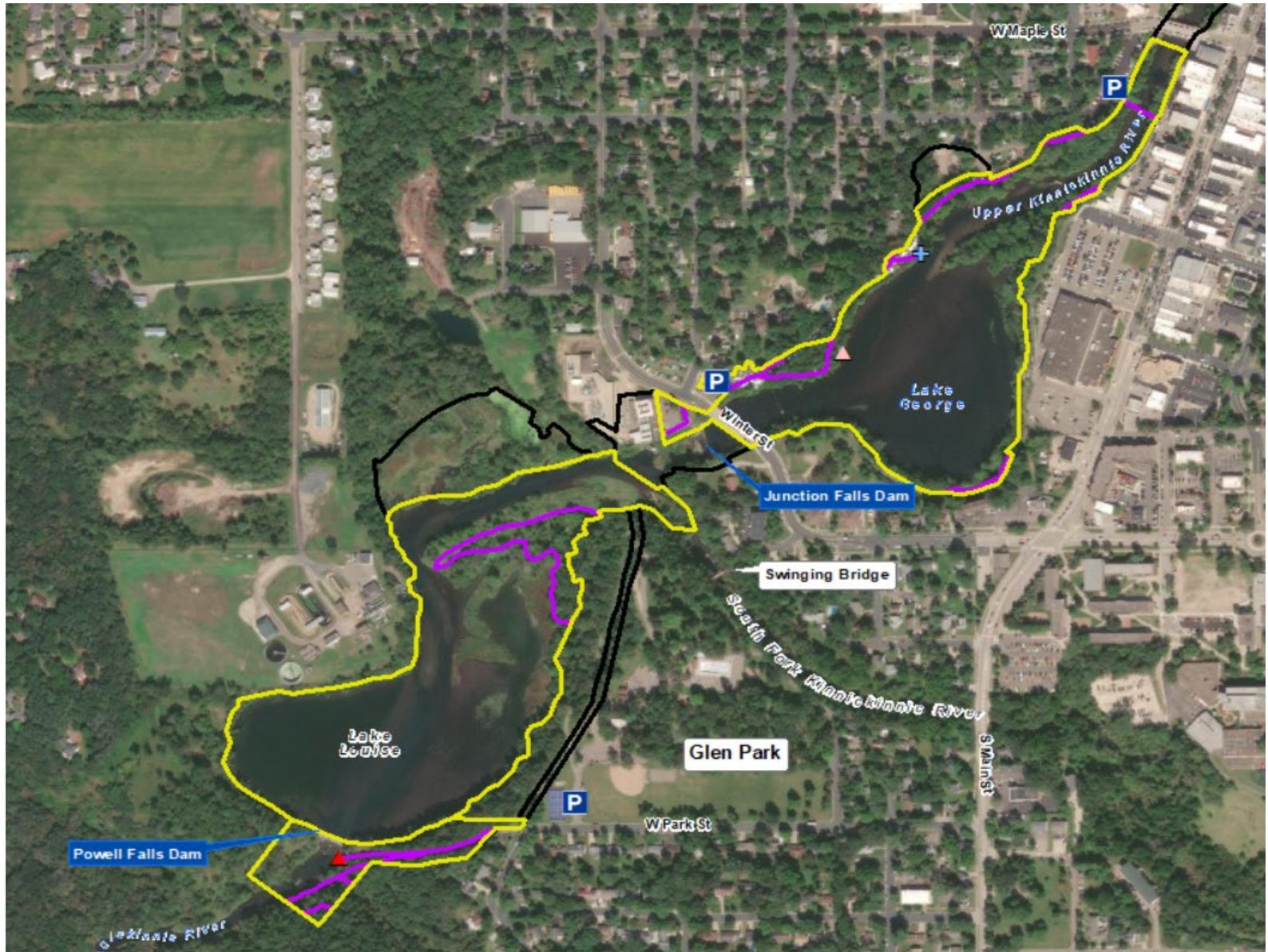
PROJECT OBJECTIVES

Recreation Use Assessment

Objectives:

- 1. Document scope of recreation opportunities/amenities and the condition of these amenities.**
- 2. Assess recreation use rates for various recreation activities.**
- 3. Gauge the public opinion on recreation opportunities in the Project Area.**
- 4. Predict future recreation use rates and provide management recommendations if applicable.**

STUDY AREAS





METHODOLOGY

- 1. Documentation of Survey Area amenities and conditions.**
- 2. Recreation use one-hour spot counts at each Survey Area.**
- 3. Recreation user opinion surveys.**

WHITE KINNICKINNIC PATHWAY
Recreation Amenities



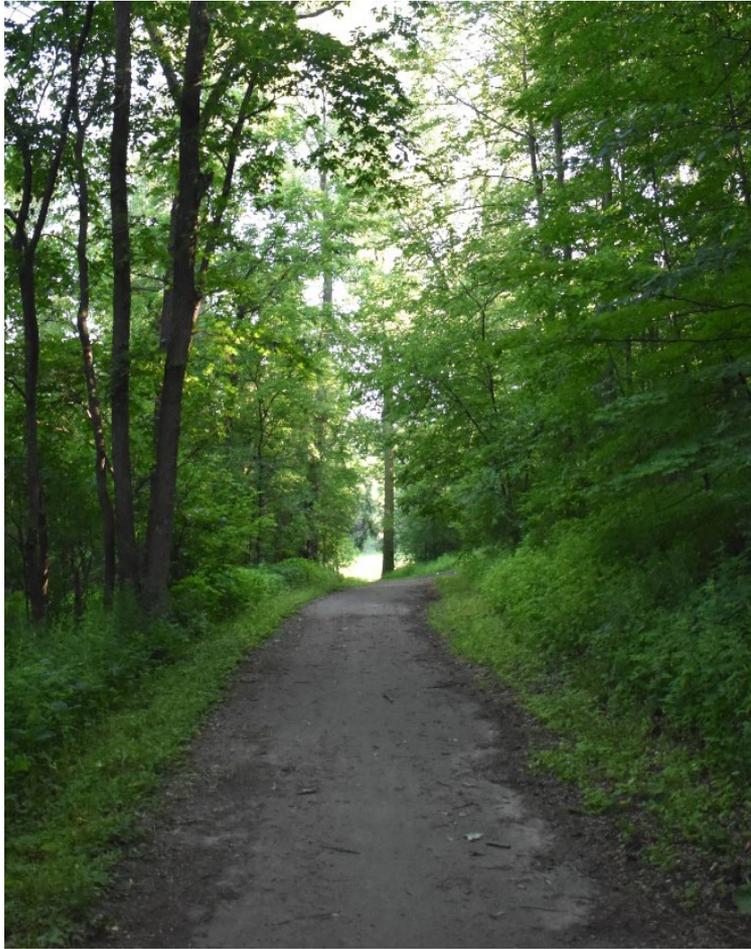
WHITE KINNICKINNIC PATHWAY

Recreation Amenities



GLEN PARK TRAILS

Recreation Amenities



GLEN PARK TRAILS

Recreation Amenities



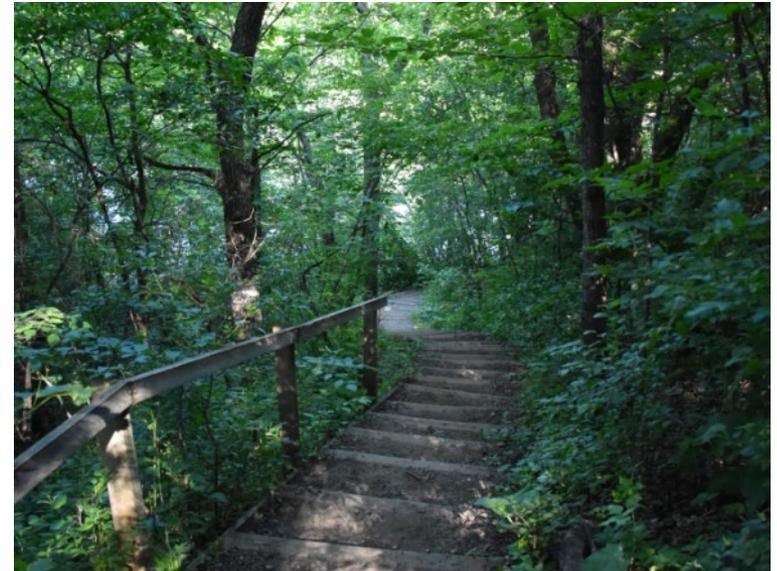
POWELL FALLS KAYAK LAUNCH

Recreation Amenities



POWELL FALLS KAYAK LAUNCH

Recreation Amenities



WHITE KINNICKINNIC PATHWAY

Focal Point: Lake George (16 acres)

Amenities

- Walking path
- Maintained lawn, street lamps, benches
- Kayak/boat take-out
- Fishing pier
- Parking lot (7 spaces)



Conditions

- Weedy/areas of dense algae
- Overall well-maintained pathway and associated amenities
- No bathrooms/toilets



WHITE KINNICKINNIC PATHWAY

Rank	Recreation Activity	Users Observed	Users Per Hour
1	Walking/Running	288	9.60
2	Biking	132	4.40
3	Looking at Dam/Flooding	92	3.07
4	Dog Walking	80	2.67
5	Canoeing/Kayaking	25	0.83
6	Skateboarding/Rollerblading	9	0.30
7	Birding/Nature Observing	8	0.27
8	Fishing from Shore	5	0.17
9	Picnicking	4	0.13
10	Berry-picking	3	0.10
11	Sightseeing	1	0.03
12	Photography	1	0.03
-	All Activities (Total)	648	21.6

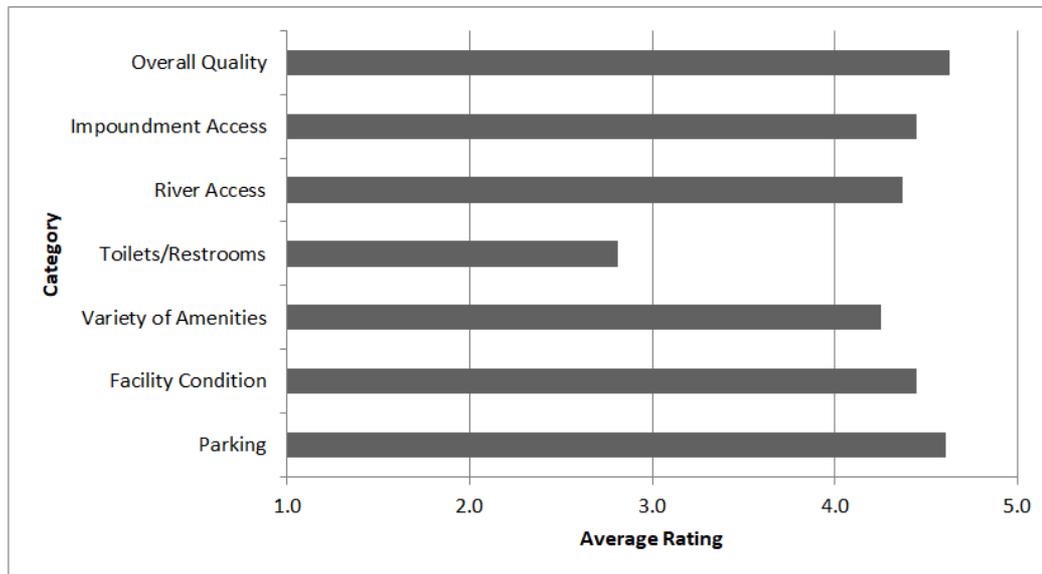
Notes

- Most common activities used pathway
- Close to River Falls downtown and surrounding neighborhoods
- Parking: 4.27 vehicles/hour on weekdays, 2.33 vehicles/hour on weekends

Type of Day	Total Recreation Users	Recreation Users per Hour
Weekday	342	26.3
Weekend	242	18.6
Holiday	64	16.0

WHITE KINNICKINNIC PATHWAY

Participated in recreation survey before?		Gender		How many in group?	
Yes	13.9%	Male	27.8%	1-2	69.4%
No	86.1%	Female	72.2%	3+	30.6%
Vehicle(s)?		Resident of River Falls?		Ever visited Project Area before?	
Yes	27.8%	Yes	77.8%	Yes	97.2%
No	72.2%	No	22.2%	No	2.8%



Notes

- Most common activities: walking, dog walking, and bicycle riding
- Over-crowding never observed
- Complaints: weeds in lake, goose poop, lack of bathrooms

GLEN PARK TRAILS

Focal Point: Junction Falls Dam and Lake Louise

Amenities

- Walking path
- Hiking trails
- Water access
- Parking lot (Glen Park)

Conditions

- Paved trail in good condition
- Pre- and post-flood conditions drastically different at base of Junction Falls Dam



GLEN PARK TRAILS

Notes

Rank	Recreation Activity	Users Observed	Users Per Hour
1	Walking/Running	224	7.23
2	Dog Walking	28	0.90
3	Swimming	16	0.52
4	Fishing from Shore	12	0.39
5	Fly Fishing	6	0.19
6	Biking	5	0.16
6	Photography	5	0.16
8	Picnicking	3	0.10
9	Canoeing/Kayaking	2	0.06
10	Flying a Drone	2	0.06
-	All Activities (Total)	303	9.77

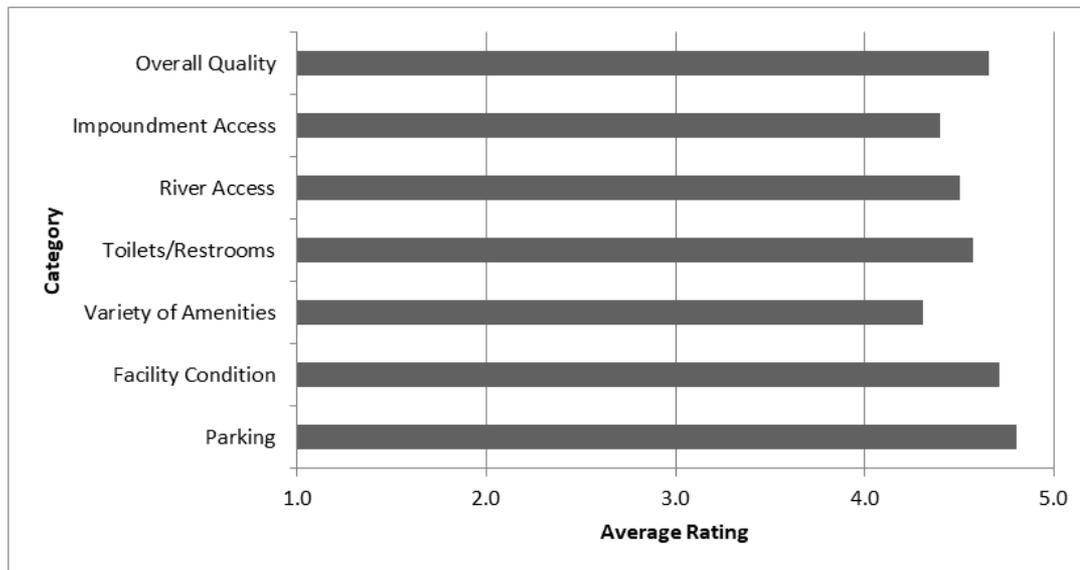
- Most common activities were walking and dog walking
- No one observed on bank of Lake Louise
- Parking (Glen Park): 26.6 vehicles/hour on weekdays, 38.1 vehicles/hour on weekends

Type of Day	Total Recreation Users	Recreation Users per Hour
Weekday	136	9.1
Weekend	144	12.0
Holiday	23	5.8



GLEN PARK TRAILS

Participated in recreation survey before?		Gender		How many in group?	
Yes	6.3%	Male	40.6%	1-2	84.4%
No	93.7%	Female	59.4%	3+	15.6%
Vehicle(s)?		Resident of River Falls?		Ever visited Project Area before?	
Yes	65.6%	Yes	68.8%	Yes	93.7%
No	34.4%	No	31.2%	No	6.3%



Notes

- Most common activities: walking, dog walking
- Over-crowding never observed
- Complaints: weeds in lake, Lake Louise isn't accessible

POWELL FALLS KAYAK LAUNCH

Focal Point: Powell Falls Dam and Kinnickinnic River

Amenities

- Kayak launch
- Hiking trails
- Kayak staging area with picnic tables



Conditions

- Trails steep and uneven in areas
- Pre- and post-flood conditions drastically different at base of Junction Falls Dam
- No bathrooms/toilets

POWELL FALLS KAYAK LAUNCH

Rank	Recreation Activity	Users Observed	Users Per Hour
1	Canoeing/Kayaking	458	15.80
2	Walking/Running	116	4.00
3	Fly Fishing	38	1.31
4	Dog Walking	33	1.14
5	Fishing from Shore	22	0.76
6	Biking	17	0.59
7	Swimming	9	0.31
8	Sightseeing	5	0.17
9	Scout River for Fishing	3	0.10
10	Photography	2	0.07
-	All Activities (Total)	703	24.2

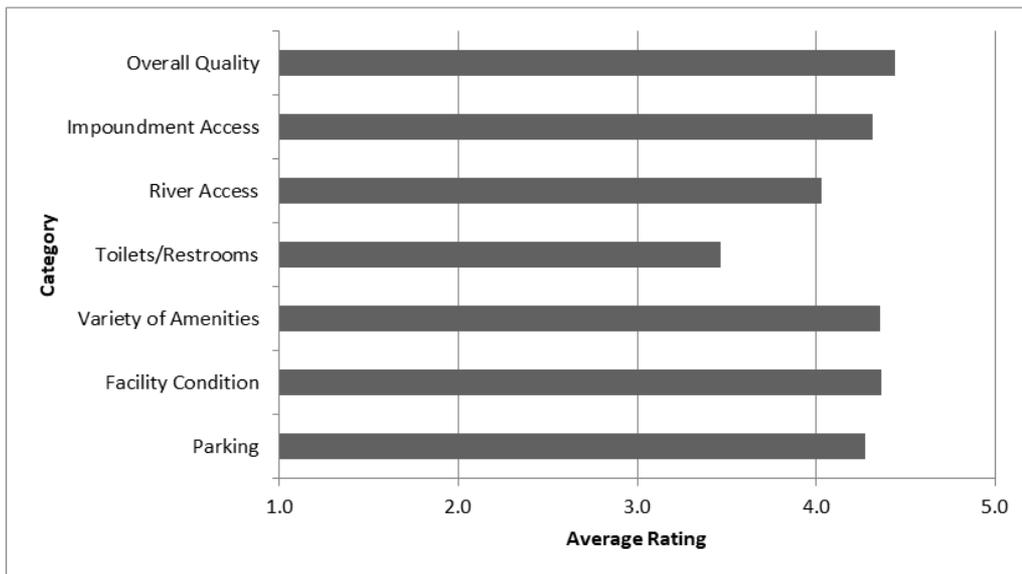
Notes

- Most common activity was kayaking and canoeing
- Much busier on weekends and holidays
- Parking (street): 12.0 vehicles/hour on weekdays, 1.86 vehicles/hour on weekends

Type of Day	Total Recreation Users	Recreation Users per Hour
Weekday	217	15.5
Weekend	367	33.4
Holiday	119	29.8

POWELL FALLS KAYAK LAUNCH

Participated in recreation survey before?		Gender		How many in group?	
Yes	16%	Male	58%	1-2	62%
No	84%	Female	42%	3+	38%
Vehicle(s)?		Resident of River Falls?		Ever visited Project Area before?	
Yes	90%	Yes	48%	Yes	88%
No	10%	No	52%	No	12%



Notes

- Most common activities: kayaking and canoeing
- Kayaking loading zone observed full multiple times
- Complaints: over-crowding, lack of accessibility

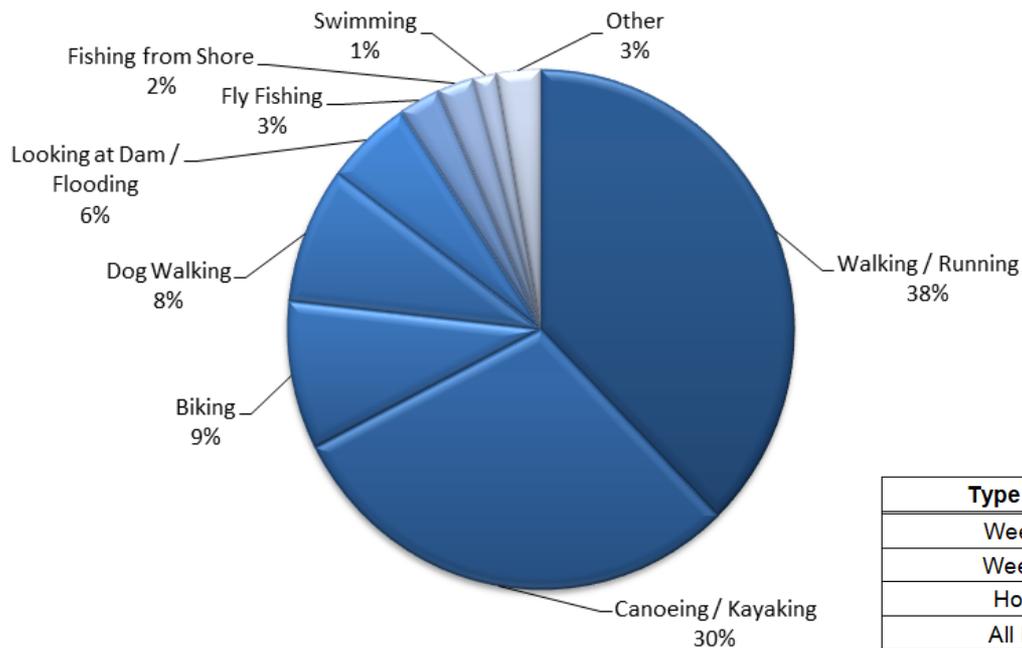


PROJECT AREA SUMMARY

White Kinnickinnic Pathway (Lake George): Popular for paved pathway activities, most accessible

Glen Park Trails (Junction Falls Dam/Lake Louise): Popular as an area of exploration

Powell Falls Kayak Launch (Lower Kinnickinnic River): Kayaking and canoeing



Notes

- Average respondent visited 76.1 times per year
- Most out of town visitors came for kayaking at Powell Falls
- Overall aesthetic rating was 4.05 out of 5

Type of Day	Total Recreation Users	Recreation Users per Hour
Weekday	686	16.7
Weekend	762	20.6
Holiday	206	17.2
All Days	1654	18.4

FUTURE RECREATION USE

Population Growth Estimates for River Falls, Wisconsin (Zip Code: 54022)

Year	2010	2020	2030	2040	2050 ¹
Population	41,019	43,575	46,125	46,825	47,527
Estimated Growth	n/a	6.2%	5.9%	1.5%	1.5%
Population Growth Coefficient	n/a	1.062	1.059	1.015	1.015

Source: WI DOA 2020

¹ A projection was not provided for 2050; the growth projection for 2040 was repeated as an estimation.

Projected Total Recreation Days for Project Area

Recreation Activity	2020 Recreation Assessment		Projected Summer Recreation Days		
	Users Observed	Summer Recreation Days	2030	2040	2050
Walking / Running	628	10,293.6	11,151.6	11,749.0	12,593.1
Canoeing / Kayaking	485	5,645.3	5,464.2	4,969.4	4,494.1
Biking	154	2,512.7	2,663.6	2,741.4	2,888.2
Dog Walking	141	2,188.9	2,318.1	2,352.8	2,388.1
Looking at Dam / Flooding	92	2,158.6	2,286.0	2,320.3	2,355.1
Fly Fishing	44	490.1	492.0	462.9	427.6
Fishing from Shore	39	613.4	615.8	579.4	535.1
Swimming	25	385.4	413.5	429.8	453.7
Skateboarding / <u>Rollerskating</u>	9	173.5	183.7	186.4	189.2
Birding/Nature Observing	8	124.8	132.5	134.9	137.7
Photography	8	134.2	142.4	145.0	148.0
Picnicking	7	65.1	69.1	70.4	72.1
Sightseeing	6	65.4	69.2	70.2	71.3
Berry-picking	3	70.4	74.7	76.0	77.6
Scout River for Fishing	3	70.4	74.5	75.7	76.8
Flying a Drone	2	21.8	23.1	23.4	23.8
Total	1,654	25,014	26,174	26,387	26,932
Percent Increase	n/a	n/a	4.6%	0.8%	2.1%



Ross Hackbarth, Natural Resources Specialist

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Gulf South Research Corporation



Archaeology Survey

Rachel Klabacka-Williams, TRC

KEY STAFF

Rachel Klabacka-Williams

Has worked in Archaeology since 1999 and has been conducting Hydroelectric Project surveys since 2011

Amanda McMahon

Has worked in Archaeology and has been conducting Hydroelectric Project Surveys since 2015

Allen Van Dyke

Has worked in Archaeology since 1973 and has been conducting Hydroelectric Project surveys since 1992



National Historic Preservation Act and Section 106

- **National Historic Preservation Act (NHPA) (36 CFR Part 800)**
 - Was enacted in 1966 to require the acting agency to take into account the effects on cultural resources and to establish a program for the Preservation of Historic Properties throughout the Nation.
- **Section 106**
 - Outlines the process and required steps for implementing the NHPA and requires licensees or license applicants to identify all cultural resources and assess the effects on these resources.

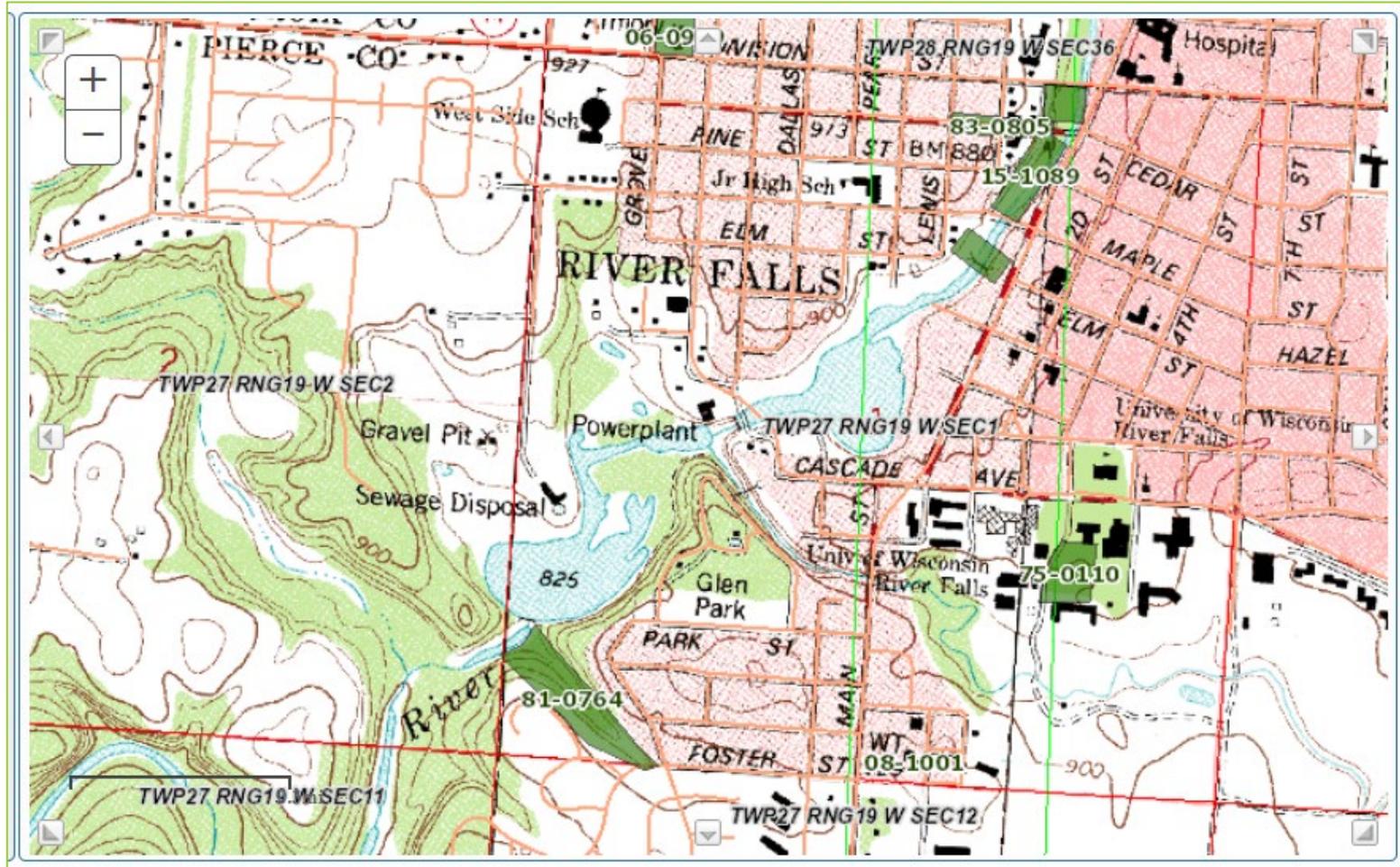
Phase I Archaeological Survey

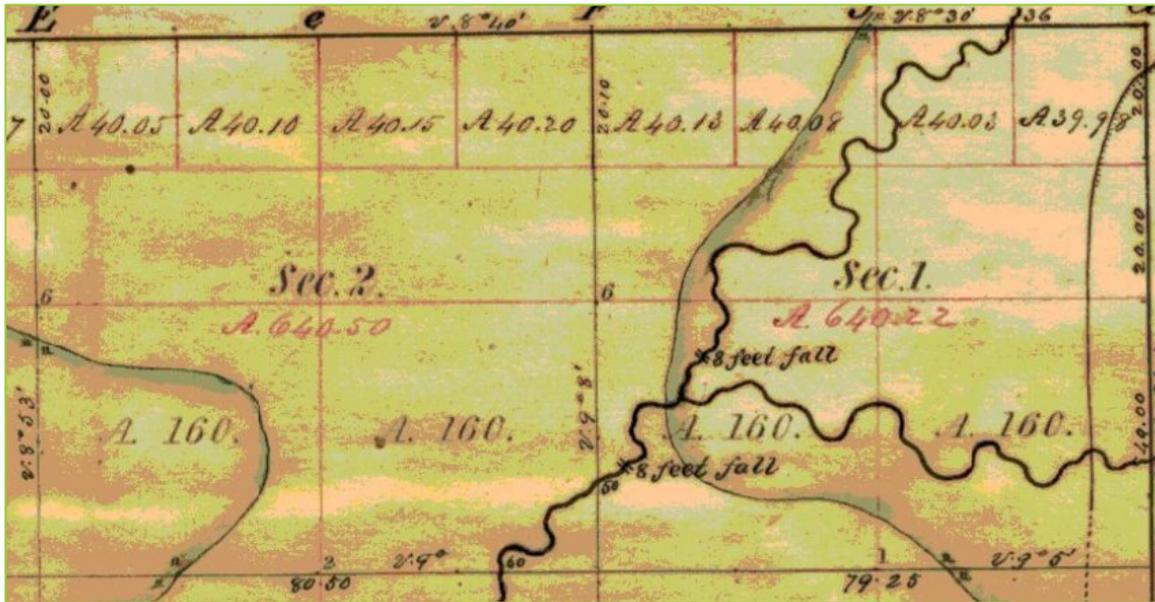


- **Literature and Archives Research**
 - SHPO files - Archaeological Site and Previous Surveys;
 - National Register of Historic Places Inventory;
 - Historic Maps and Aerial Photography;
 - County Histories;
 - Etc...
- **Fieldwork**
 - Shoreline Review;
 - Shovel Testing and Surface Collection.

Literature and Archives Research Results

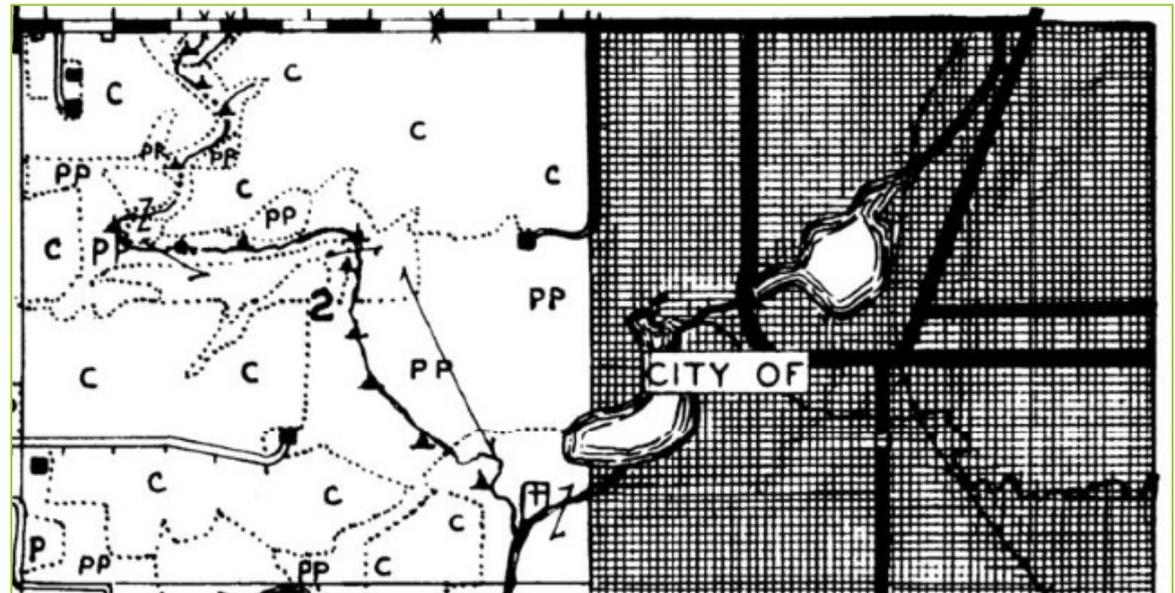
SHPO Files – Accessed through the Wisconsin Historic Preservation Database





1848 General Land Office (GLO) Survey Plat Map

1947 Wisconsin Land Economic Inventory (WLEI) Plat Map





1939 Aerial Photograph of River Falls, WI

Archaeological Fieldwork Results

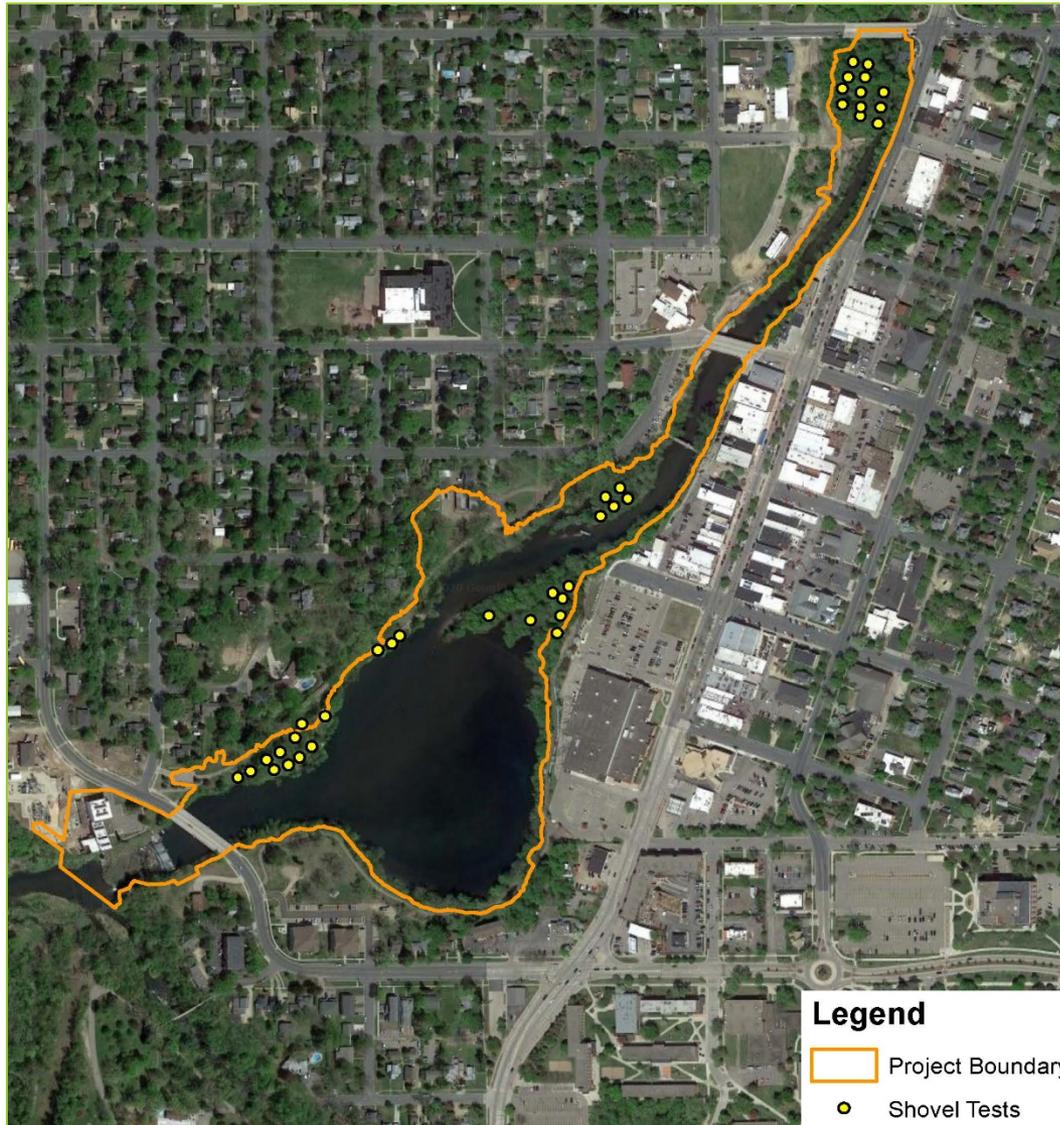
Junction Falls and Powell Falls Hyro Shovel Test app

FIELDS LAYOUT (FIELDS: 64)

Basic	GENERAL INFORMATION
<input type="text"/> Text	Excavator
<input type="text"/> Numeric	<input type="text"/> Excavator's Initials
<input checked="" type="checkbox"/> Yes / No	<input type="text"/> Additional Excavators
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<input type="text"/> Time	<input type="text"/> Excavation Number
Choice	<input type="text"/> Transect Interval (m)
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<input type="text"/> Multiple Choice	<input type="text"/> Shovel Test ID
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Design	<input type="text"/> Y
<input type="text"/> Section	<input type="text"/> Projection Display
<input type="text"/> Repeatable	<input type="text"/> proj4js
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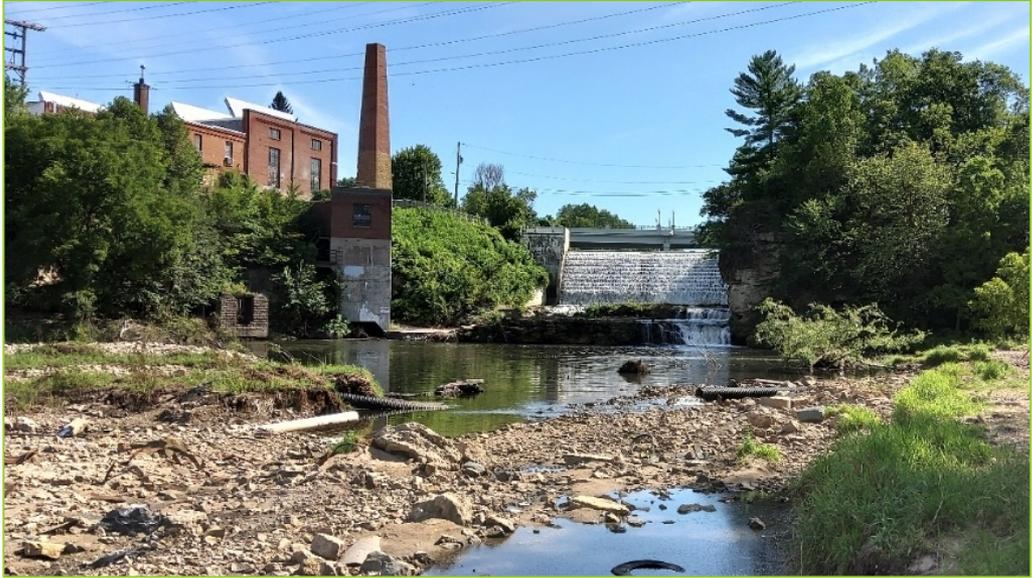
Junction Falls



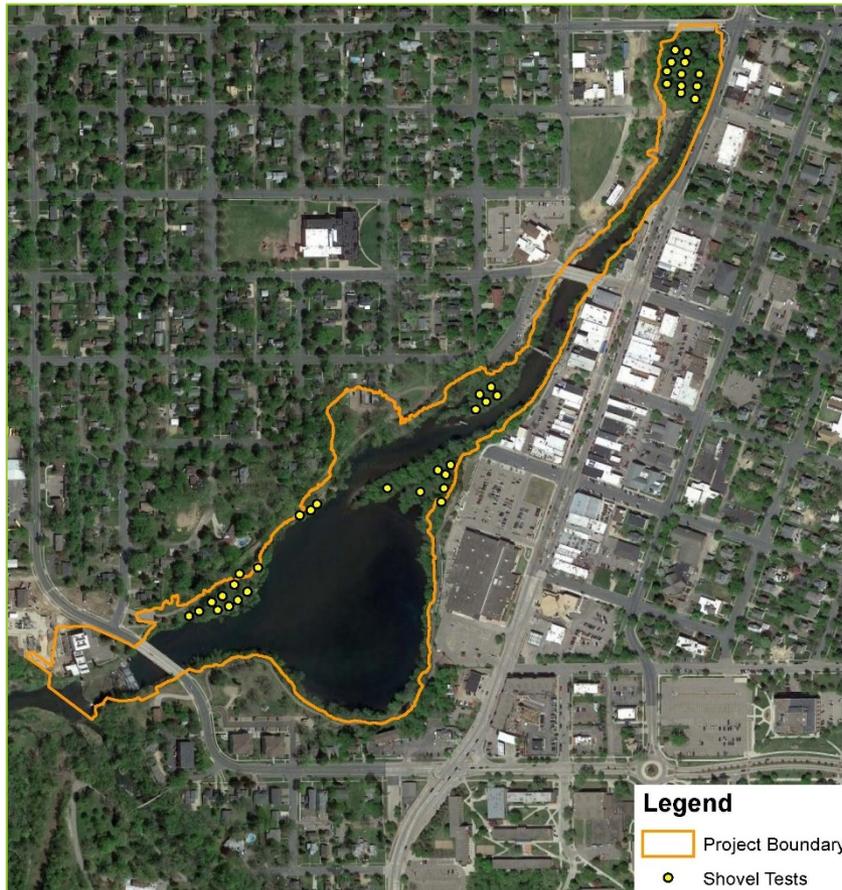
Junction Falls
2020 Survey Map

Shoreline Review





Shovel Test Survey





Powell Falls



Powell Falls
2020 Survey Map

Shoreline Review







Shovel Test Survey







Conclusions and Recommendations

- **Junction Falls**

- Visual inspection of the shoreline did not encounter any areas of erosion, the shoreline appears to be well vegetated and stable;
- Shovel testing did not encounter any subsurface archaeological artifacts or deposits;
- **Nothing was found and no additional archaeological work is recommended until that stipulated by the Historic Resources Management Plan (HRMP).**

- **Powell Falls**

- Visual inspection of the shoreline did not encounter any areas of erosion, the shoreline appears to be well vegetated and stable;
- Shovel testing did not encounter any subsurface archaeological artifacts or deposits;
- **Nothing was found and no additional archaeological work is recommended for this Project.**

**Thank You
and
Questions?**

Sediment Study

Pete Haug, Ayres & Ben Lenz, TRC

POWELL FALLS DAM REMOVAL SEDIMENT STUDY ECOLOGICAL RISK EVALUATION

Objective 1 – Compare the amount of sediment that could be released downstream of Powell Falls Dam to average releases and determine the level of ecological risk to the downstream geomorphology and aquatic resources.

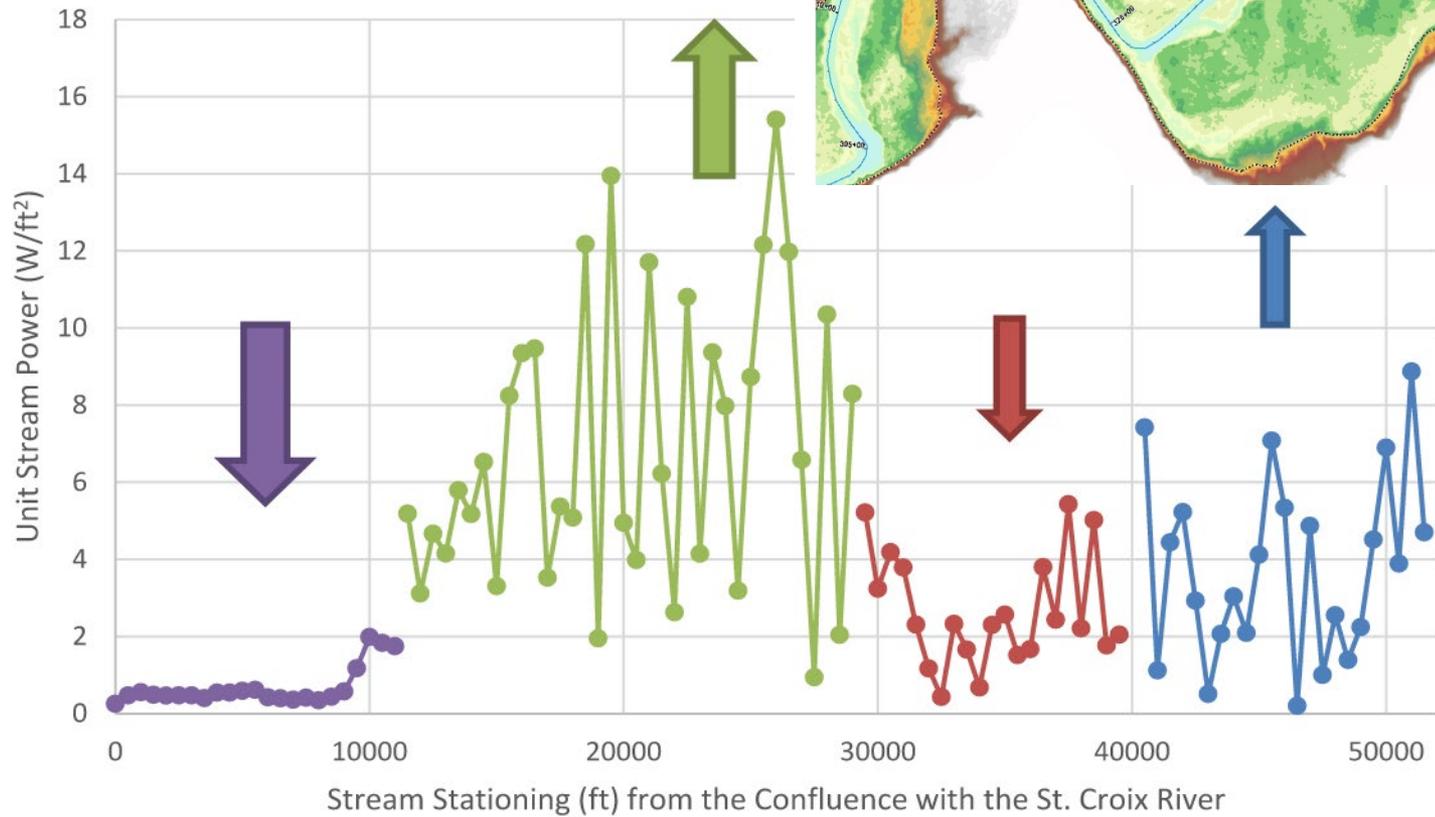
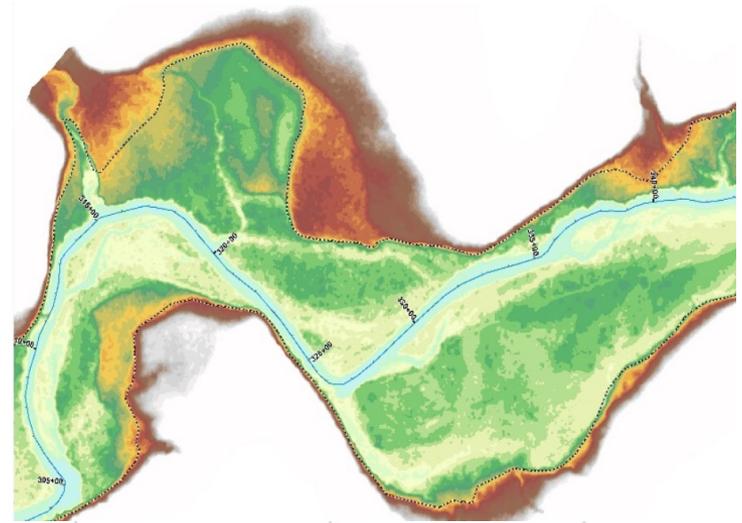
Objective 1 geomorphological risk evaluation

- 1) Determine existing channel morphology
 - a) geomorphologically distinct reaches
 - b) description of each reach's sediment capacity
 - c) estimate sensitivity to new sediment influx

- 2) Estimate dam removal impacts
 - a) expected average and maximum sediment influx
 - b) opinion of Kinnickinnic reach responses
 - c) opinion of St. Croix response

Note that this study was planned as a desktop study, but staff did do some field reconnaissance to see conditions following the 2020 flood and better inform how future sediment releases might similarly impact the lower Kinnickinnic.

Existing channel morphology



—●— Reach 1 —●— Reach 2 —●— Reach 3 —●— Reach 4

Existing channel morphology

- ❑ Four geomorphologically similar reaches were found
- ❑ Stationing numbered per hydraulic engineering convention from mouth of river and heading upstream
- ❑ Same reaches as in other studies except the upstream Reach 4 in this study was split into two reaches in the habitat study.



	Channel Slope (ft/ft)	Valley Slope (ft/ft)	Avg Unit Stream Power (Watts/ft ²)	Bankfull Width (ft)	Valley Width (ft)	Alluvial Channel Type
Reach 1	0.0007	0.0008	0.68	73	469	Dune - Ripple / Pool - Riffle
Reach 2	0.0031	0.0035	6.86	57	242	Pool - Riffle
Reach 3	0.0027	0.0032	2.53	48	464	Pool - Riffle
Reach 4	0.0031	0.0035	3.86	52	359	Pool - Riffle

Dam Removal Impacts: Sediment Supply

❑ Case 1 Studied:

- ❑ Pre-removal = 10,000 tons or more per year
- ❑ +10,000 tons (5000 CY) in Yr 1 after removal
- ❑ Tapering down to +2,000 tons (1000 CY) in Yr 6 after removal

❑ Case 1 represents the release of 33,000 tons (16,500 CY) during annual flood events.

❑ Case 2 Studied:

- ❑ Pre-removal = 10,000 tons or more per year
- ❑ +90,000 tons (45,000 CY) in Yr 1
- ❑ Case 2 assumes that a 10- year or larger flood comes through the partially removed dam, eroding the full trapezoid of sediment where the future channel is expected within the former Lake Louise.

The USBR dam removal guidance predicts about 1700 tons in the average Kinni sandbar or about 40,000 tons in the non-backwater reaches. In addition, there is no less than 100,000 tons in just the main channel dunes of the lower Kinni near the St. Croix confluence and approximately a million tons in the overbank “delta bar” (discussed later).

Dam Removal Impacts: Sediment Transport

❑ Case 1 (normal flows):

- ❑ Much of sediment released will transport in channel through same mechanism that is transporting sand after the 2020 flood.
- ❑ Temporary impacts include pool filling, point bar formation, increased sand thickness on inside of meander bends, and some sand deposited on the floodplain during annual flow events.
- ❑ Silt would likely wash through the Kinnickinnic within a couple months; sand may take a few years to travel from dam to St. Croix.

❑ Case 2 (major flood):

- ❑ As this would happen during a 10-year or larger flood event, much of the sediment would be deposited in the floodplain, inundating current floodplain deposits with several feet of new sand and silt.
- ❑ Because the Kinnickinnic is entrenched with narrow valley margins, there is very little risk of avulsion (major river alignment changes). However, there are areas documented in the report that could experience lateral channel migration during the Case 2 scenario.

Summary of Sediment Capacity: Reach 1

- ❑ This reach is downstream near mouth of Kinnickinnic River
- ❑ Dune-ripple planforms (sand bed, uniformity in channel, and generally less ecological function and habitat heterogeneity than other reaches)
- ❑ Significant amounts of stored sand in channel and in overbank near delta
- ❑ Expected impacts after dam removal: **temporary deposition on top of dune bed and permanent deposition on overbanks.**



Summary of Sediment Capacity: Reach 2

- ❑ This reach is upstream of CTH F
- ❑ Reduced valley width and increased confinement
- ❑ Highest stream power between dam and St. Croix is in this reach
- ❑ Sand deposits from 2020 flood found in eddies and on point bars.
- ❑ Pool-riffle channel throughout
- ❑ Expected impacts after dam removal: **temporary pool filling but steep reach should flush pools faster than other reaches.**



Summary of Sediment Capacity: Reach 3

- This reach is upstream of 1130th Street and continues upstream about 2 miles
- Confinement is less than for Reach 2, so the channel slope and stream power are also reduced.
- Wider valley margins and the confluence of two larger tributary channels dominate this reach.
- Expected impacts after dam removal: **permanent deposition on overbank during floods and temporary filling of pools during low flow periods.**



Summary of Sediment Capacity: Reach 4

- ❑ This reach is from the Powell Falls Dam to about 2.2 miles downstream.
- ❑ Riverbed has very little sand from 0 to 600 feet below Powell Falls, mainly exposed bedrock and cobble with some gravel. Some sand is stored on the overbanks, likely from the 2020 flood.
- ❑ Expected impacts after dam removal: **most changes of any reach, especially within 1000 feet of dam, including temporary filling of pools and possibly permanent changes from a bedrock thalweg below the dam to gravel thalweg and more sand bars between banks.**



Dam Removal Impacts: St. Croix Effects

- ❑ Current Sediment Capacity:
 - ❑ 25,000 tons per year at St. Croix Falls (6240 sq. mile watershed)
 - ❑ More than 30,000 tons per year at Prescott (8570 sq. mile watershed)
 - ❑ Volume of sand stored in the “delta bar” and bank at the mouth of the Kinnickinnic greatly exceeds the total volume of Lake Louise sediment (by 10x or more).
 - ❑ The 2020 flood and dam removal sediment releases will likely have similar impacts to the St. Croix.
Permanent impacts are expected to include expansion of the delta bar and thicker channel dunes.



Questions



POWELL FALLS DAM REMOVAL SEDIMENT STUDY ECOLOGICAL RISK EVALUATION

Objective 2 - Assess the potential effects on geomorphology and aquatic resources based on the predicted level of ecological risk.

FERC Requirement

Use “*Dam Removal Analysis Guidelines for Sediment*” (Randle and Bounty 2017) and “*Guidelines for Dam Decommissioning Projects*” (USSD 2015)

Objective 2 ecological risk evaluation elements

- 1) Water quality
- 2) Downstream aquatic habitat for species of concern
- 3) Downstream aquatic species or life stages
 - a) fish eggs
 - b) mussels
 - c) invertebrates
- 4) Riparian vegetation
- 5) Aquatic species migration
- 6) Restoration of riverine habitat in reservoir area
- 7) Restoration of riverine habitat dynamic processes
 - a) physical habitat features
- 8) Ice jams considerations
- 9) Recreational use

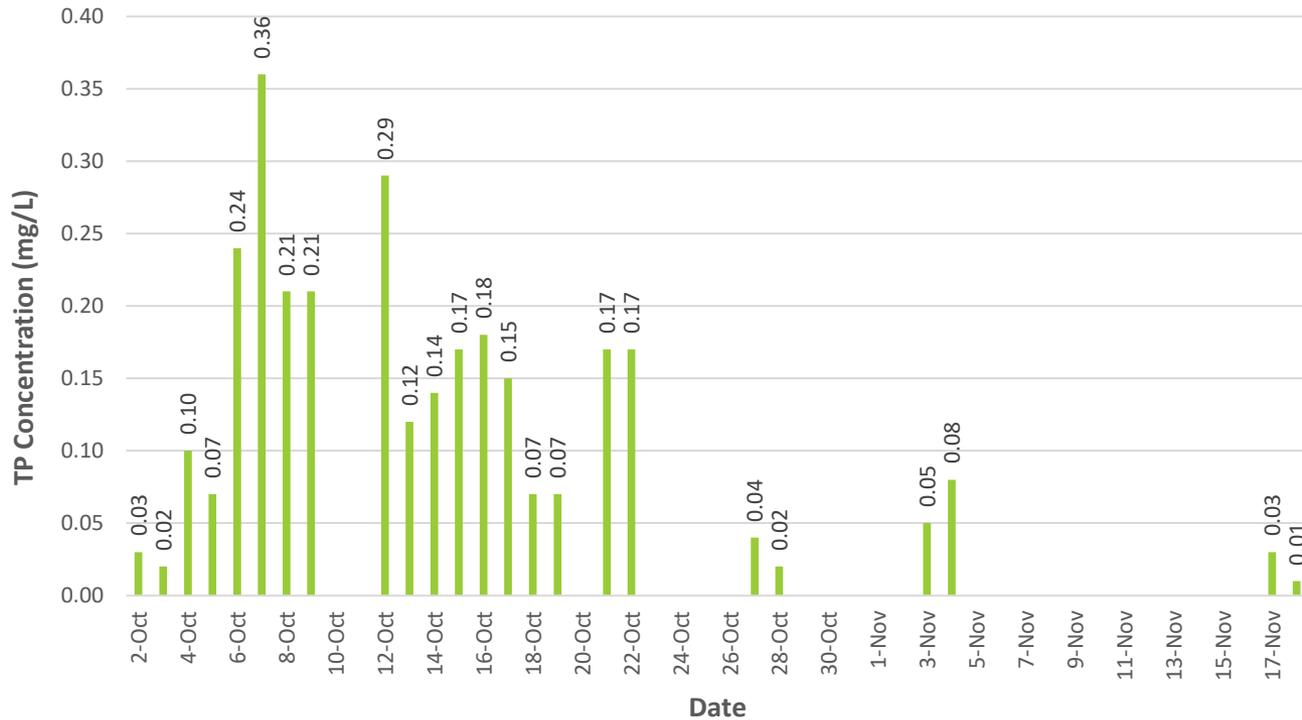
Methods

- Utilize recently collected water data related to the drawdown event.
- Integrate the Objective 1 analysis and relicensing studies results.
- Compare the Powell Falls Dam setting with relicensing studies results and literature-based research.
- Comprehensive qualitative risk and benefit analysis

Objective 2 Results

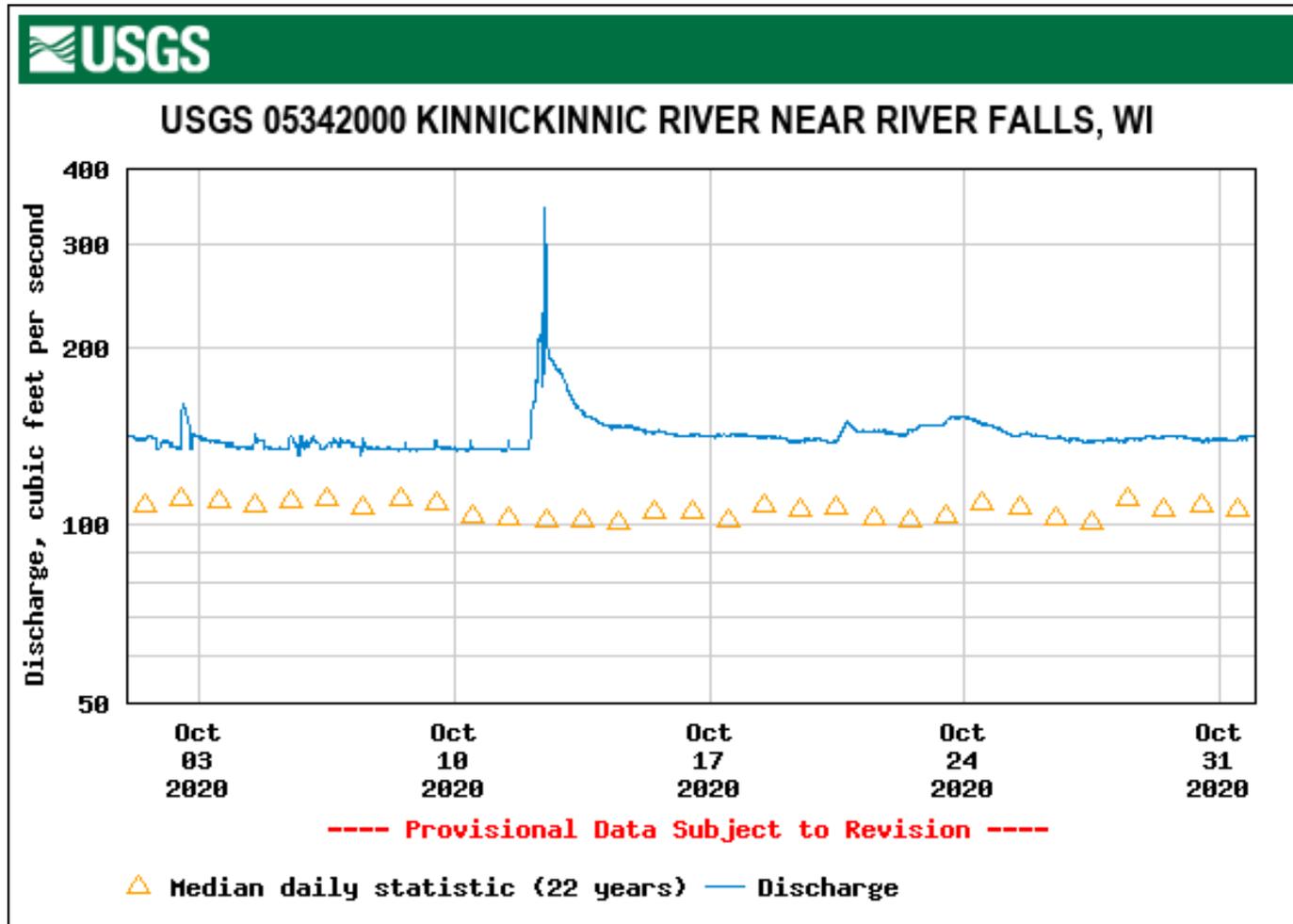
1) Water quality impacts - Phosphorus

- Increase during drawdown
- Primary productivity absent due to end of growing season



Objective 2 Results

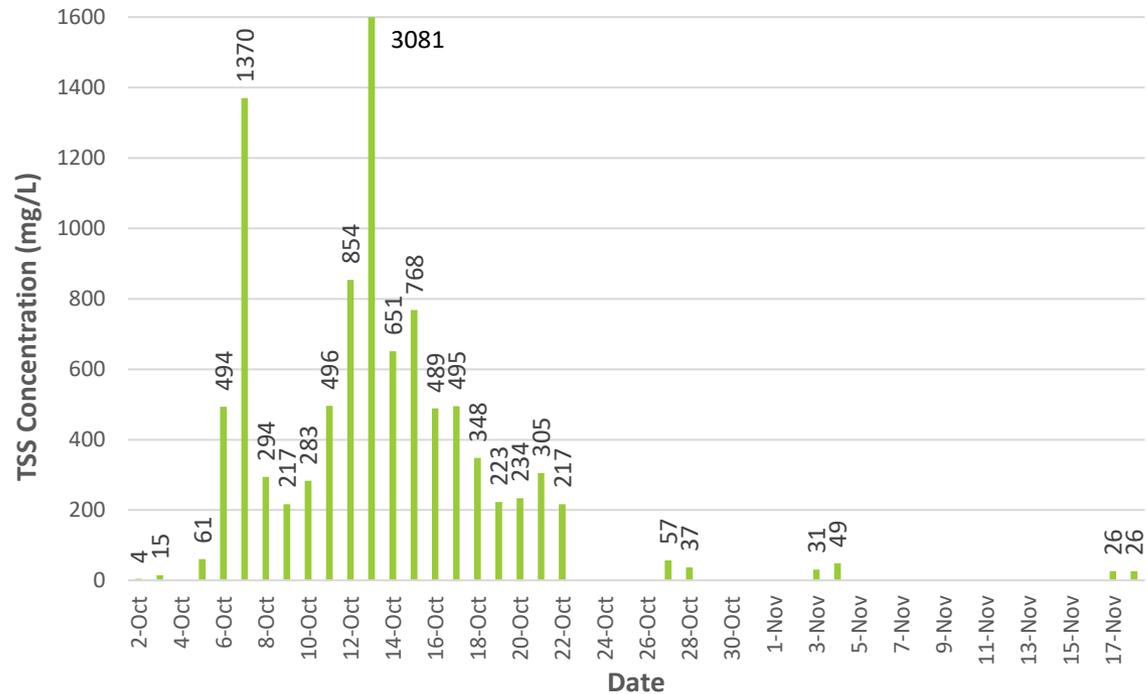
1) Water quality impacts -



Objective 2 Results

1) Water quality impacts - Suspended solids

- Increase during drawdown
- Predicted element



Objective 2 Results

2) Downstream aquatic habitat for species of concern

- Pool depth decrease by fine sediment deposition immediately downstream of Powell Falls
- Riffle features maintained



Objective 2 Results

3) Downstream aquatic species or life stages

- a) fish eggs - downstream of Powell Falls, flexibility during early part of spawn season
- b) mussels - Absent
- c) invertebrates - downstream of Powell Falls, productivity occurred earlier in season, habitat diversity benefits

Objective 2 Results

4) Riparian vegetation - *Palustrine Floodplain Forest*

- Adapted to dynamic nature of disturbance
 - Seasonally saturated organic soils
 - Mosaic of small patches of vegetation with different species composition and successional stages
 - Intolerance to lack of sediment deposition
- ▶ **Deposition of fine sediment out of channel benefits riparian vegetation**

Objective 2 Results

5) Aquatic species migration

- No blockages reported by drawdown sediment release or during June flood

Objective 2 Results

- 6) Restoration of riverine habitat in reservoir area
 - Primary benefit of dam removal



A screenshot of drone footage shows the Lake Louise riverbed on Jan. 1, 2021. Photo by Kinni Corridor Collaborative

Objective 2 Results

7) Restoration of riverine habitat dynamic processes a) physical habitat features

- bars, islands, large wood features, and side channel activation



Source: GoogleEarth, imagery collection date prior to October 2, 2020



Source: Source: Kinnickinnic Corridor Collaborative,
<https://www.youtube.com/channel/UCB-jCo-8r4iQVowafzC1UhQ>

Objective 2 Results

8) Ice jams considerations

- Groundwater influence decreases likelihood
- No prior evidence
- Dam removal is a neutral factor

Objective 2 Results

9) Recreational use impacts

- Boat launch downstream of Powell Falls reduced depth



Source: GoogleEarth, imagery collection date prior to October 2, 2020



Source: Source: Kinnickinnic Corridor Collaborative,
<https://www.youtube.com/channel/UCB-jCo-8r4iQVowaFzC1UhQ>

Ecological Risk-Benefit Comprehensive Summary

Impact	Risk		Benefit	
	Short-term	Long-term	Short-term	Long-term
Water quality	M	L	L	H
Sedimentation				
Trout habitat	H	L	L	H
Freshwater mussels	L	L	L	L
Floodplain vegetation	M	L	L	H
Fish movement	L	L	L	H
Impoundment				
Riverine conditions	L	L	M	H
Instream Habitat				
Substrate complexity	H	L	M	M
Invertebrate taxa	M	L	M	M
Ice Jams	L	L	L	M
Recreation	H	L	L	H

POWELL FALLS DAM DECOMMISSIONING PLAN

Objective – Provide a general overview of decommissioning and schedule.

Specific methods proposed in the Revised Study Plan:

- Discuss dam removal case studies from WI/MN
- Survey site for access and disposal options
- Identify environmental, health, and safety mitigation measures
- Investigate long-term maintenance and monitoring considerations
- Describe sediment management and cofferdam sequencing
- Prepare drawings, schedule, and milestones

Decommissioning Plan: Case Studies

Woodley Dam (40mi from PF)

2009 end of project



Grimh Dam (93mi from PF)

2012 end of project



Decommissioning Plan: Case Studies

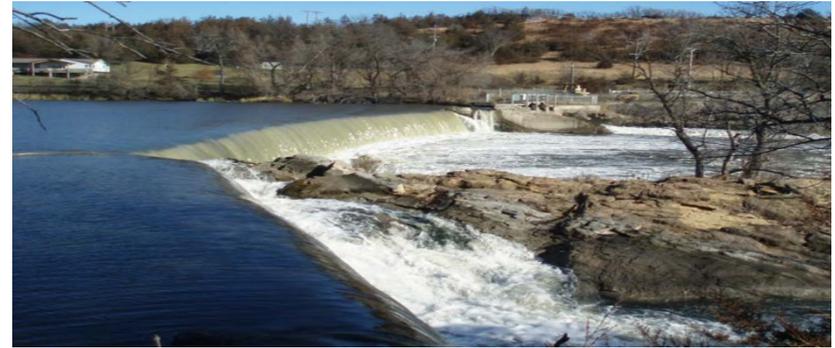
Gordon Dam (104mi from PF)

2015 end of project



Minnesota Falls Dam (141mi away)

2013 end of project



Decommissioning Plan: Case Studies

Lessons learned from Case Studies

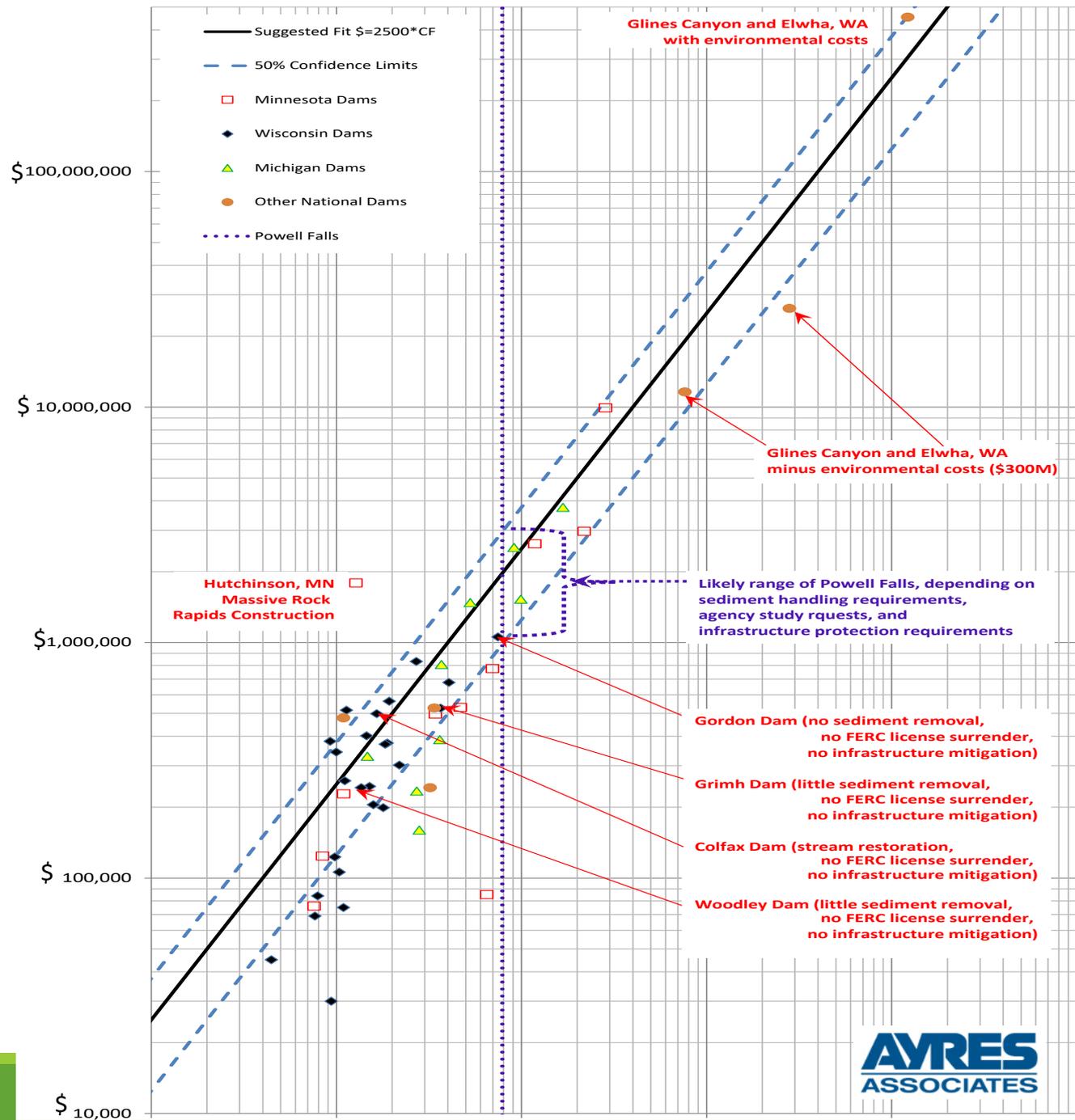
- ❑ Powell Falls is in the middle of the case studies for costs, sediment in the impoundment, impacts to infrastructure, and construction costs

- ❑ Largest contributors to project risk are:
 - ❑ Sediment release during construction -> vegetate lakebed early
 - ❑ Floods impacting dam removal safety -> post-tensioned sections need to come out completely in stages
 - ❑ Excessive dewatering costs -> draw down impoundment and keep it down

□ Powell Falls expected costs are a function of project complexity.

□ Powell Falls is within the range of previous dam removal complexities.

□ Early draw down and early lakebed vegetation will likely result in costs on the low end of this expected uncertainty band.



Decommissioning Plan: Approach

EXPECTED PERMIT CONDITIONS

- Worksite safety signage/fencing
- Controlled rate of drawdown
- Construction equipment cleaning
- Sediment barriers in-stream and on land throughout construction
- Reservoir restoration is two part – quick rooting cover crops and long-term establishment of natives
- 5-year monitoring period for bank erosion

AYRES' RECOMMENDATIONS

- 2+ growing seasons of drawdown prior to removing dam
- Mitigate sediment as reasonably practicable but understand that some sediment release can be accommodated by downstream river
- Sediment removal is cheapest in traps created by turbidity barriers or against the upstream face of dam
- Expect a large flood to occur during construction

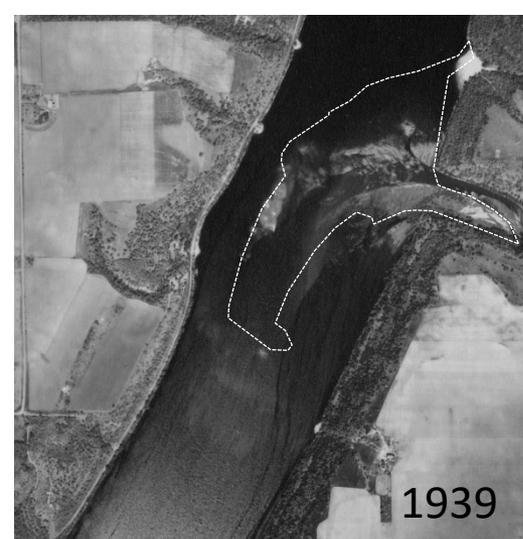
Decommissioning Plan: Sediment Management

SUSPENDED LOAD

- ❑ Highly variable suspended load at CTH F bridge
- ❑ 733 tons per day on April 2, 1998
- ❑ 1 ton per day on multiple dates
- ❑ Regressed average = 6400 tons per year
- ❑ 7500 tons predicted during the 72 hours of the 2020 flood

BED LOAD

- ❑ Ayres found no published values for bed load in the Kinnickinnic
- ❑ However, bedload is usually the same magnitude as suspended load for Wisconsin streams – likely 5000 to 10000 tons per year at CTH F bridge.
- ❑ To put all this in perspective, the 66 acre “delta bar” contains more than a million tons of sediment.



□ The 66 acre “delta bar” likely contains between 600,000 and 1,500,000 cubic yards, which is well over 1,000,000 tons of sediment.

□ The maximum expected release from removal of Powell Falls Dam is 33,000 to 90,000 tons.



Decommissioning Plan: Sediment Management

SUMMARY OF SEDIMENT TODAY

- Annual average sediment release at the dam is estimated to be 10,000 tons per year (suspended + bedload)
- 40,000 tons of bedload is estimated to be stored in the Kinnickinnic's free flowing sections and another 100,000 tons is estimated in the backwater area near the St. Croix.

AYRES' EXPECTATIONS OF SEDIMENT MANAGEMENT

- Suspended + bedload sediment release during construction is expected to be 33,000 to 90,000 tons over the first six years following dam removal.
- Use DNR standard practices for sediment containment and management.
- Drawings show details used on other projects with good success.

Decommissioning Plan: 2021 Activities Expected

- ❑ Manually seed lakebed and then aerially seed lakebed
- ❑ Permit applications for sediment management and license amendment request
- ❑ Construct access route to tailrace
- ❑ Sediment management in tailrace
- ❑ Naturally dewater lakebed sediments (up to a year process)



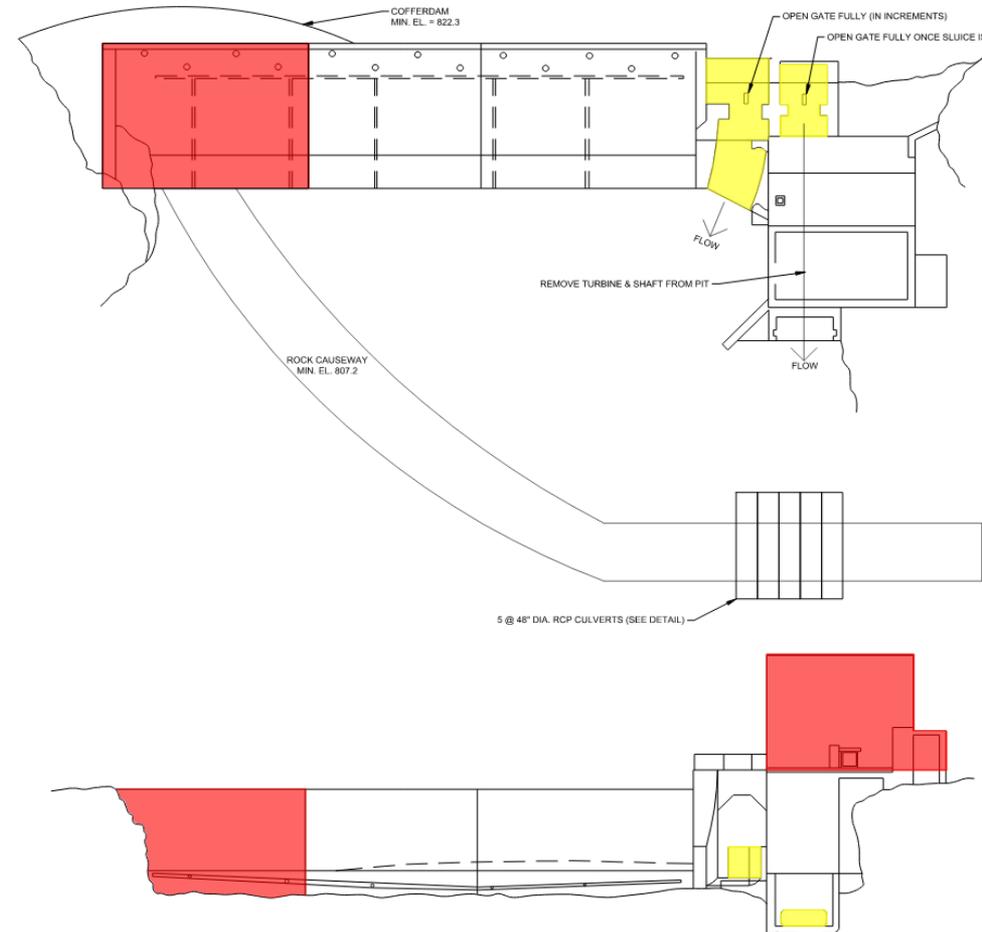
Decommissioning Plan: 2022 Activities Expected

- ❑ Monitor lakebed vegetation growth and invasive species
- ❑ Monitor and armor sanitary sewer infrastructure as necessary
- ❑ Sediment management in tailrace
- ❑ Naturally dewater lakebed sediments (up to a year process)
- ❑ Finalize dam removal drawings for anticipated WDNR submission
- ❑ Finalize lakebed restoration plan



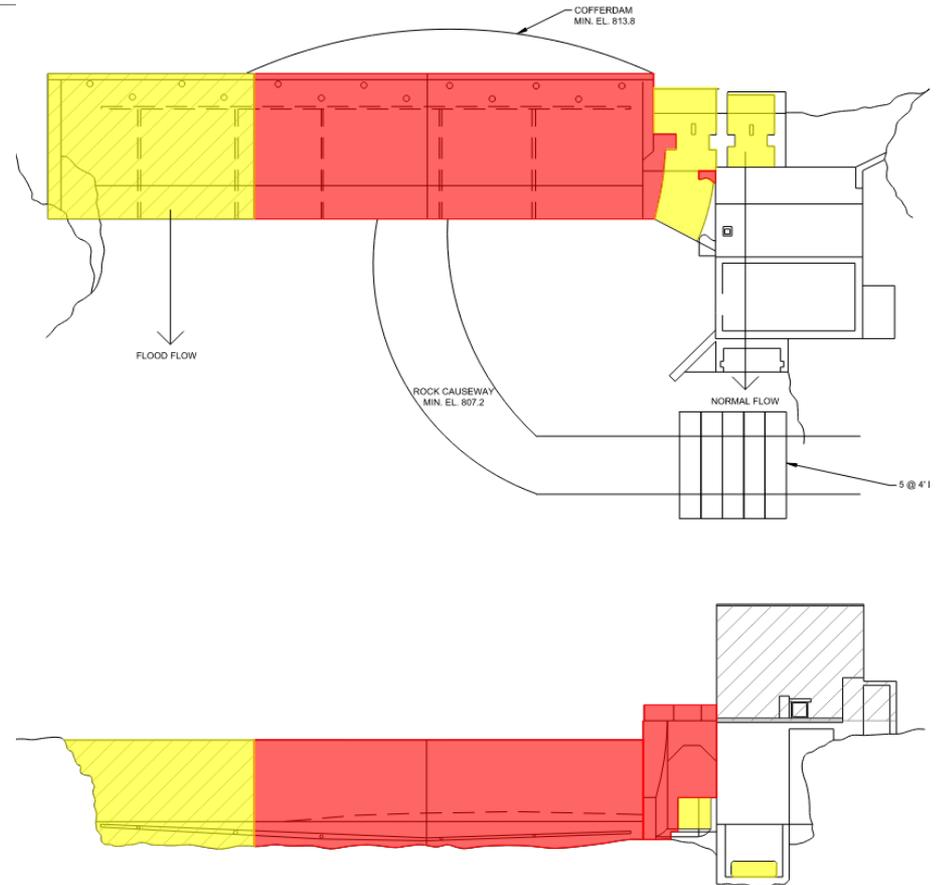
Decommissioning Plan: 2023-4 Activities Expected

- Apply for grants, finalize funding arrangements
- Bid construction project after all permits are in hand
- Build causeway from disposal site to dam
- Remove west end of spillway to allow causeway to come through dam
- Sediment management in tailrace
- Remove top of powerhouse



Decommissioning Plan: 2024-6 Activities Expected

- Implement lakebed restoration plan
- Remove rest of spillway
- Remove sluice gate structure
- Stabilize powerhouse foundation for future reuse
- Remove causeways and access roads
- Remove sediment management system
- Monitor bank erosion and invasive species



Decommissioning Plan: 2026-30 Activities Expected

- Monitor bank erosion and invasive species



Decommissioning Plan: Schedule

- ❑ Amendment to remove Powell Falls from the FERC license submitted in 2021
- ❑ Sediment containment and management construction starts in 2021
- ❑ Dam removal construction permit applications submitted no later than 2022
- ❑ Dam removal construction ends no later than 2026

Milestone	Deliverable(s)	Estimated Time of Completion
Initial Study Report Submittal	Draft Decommissioning Plan	January 31, 2020
Initial Drawdown for Inspection	Inspection Report and Refill Options	December 18, 2020
RFMU Workshop on Options for Plan Forward	Decision on Preferred Plan and Schedule for Decommissioning	January 19, 2021
Updated Study Report Submittal	Final Decommissioning Plan	January 30, 2021
Updated Study Report Meeting	Virtual Meeting	February 9, 2021
License Amendment Application Submitted to FERC	Request to remove Powell Falls from existing FERC license	March 2021
Lakebed Seeding (1)	Hand seeding of lakebed	March 2021
Applications Submitted	Permits for sediment management and access road improvements	March 2021
Permits Issued by WDNR and USACE		Late April 2021
FERC Authorization Received to Improve Flow Management and Temporary Abutment Protection	Turbine removed, sluice gate operation improved, right abutment sandbagged	June 2021
Lakebed Seeding (2)	Drone seeding of lakebed	June 2021
Monitoring of Infrastructure	Wastewater line crossings monitored, adaptive management for repair needs	2021-2026 with riprap placed prior to the start of river diversion (large opening)
Sediment Management	Removal of tailrace sediments and installation of sediment trap	Summer 2021
FERC Amendment Decision	FERC decision received	April 2022
Sediment Management Annual Evaluation	Evaluate need to remove tailrace sediments	Annually until dam removal is complete
Final Design of Dam Removal	Plans and Specifications	Fall 2022
Final Restoration Plan	Plans and Specifications	December 2022 ⁷
Permit Applications Submitted	Removal permit applications	December 2022 ⁸
Contractor Mobilization	Notice to Proceed	June 1, 2023
Dam Removal Completed	Dam removal phase completed	December 31, 2026
Restoration Monitoring, Management, and Implementation	Recreational, Habitat, and Corridor Use Improvements; Invasive Species Monitoring	June 1, 2023 to December 31, 2028