

ECOSYSTEM RESTORATION VIA PASSAGE OF LAKE STURGEON AT FIVE HYDROELECTRIC DAMS ON THE MENOMINEE RIVER



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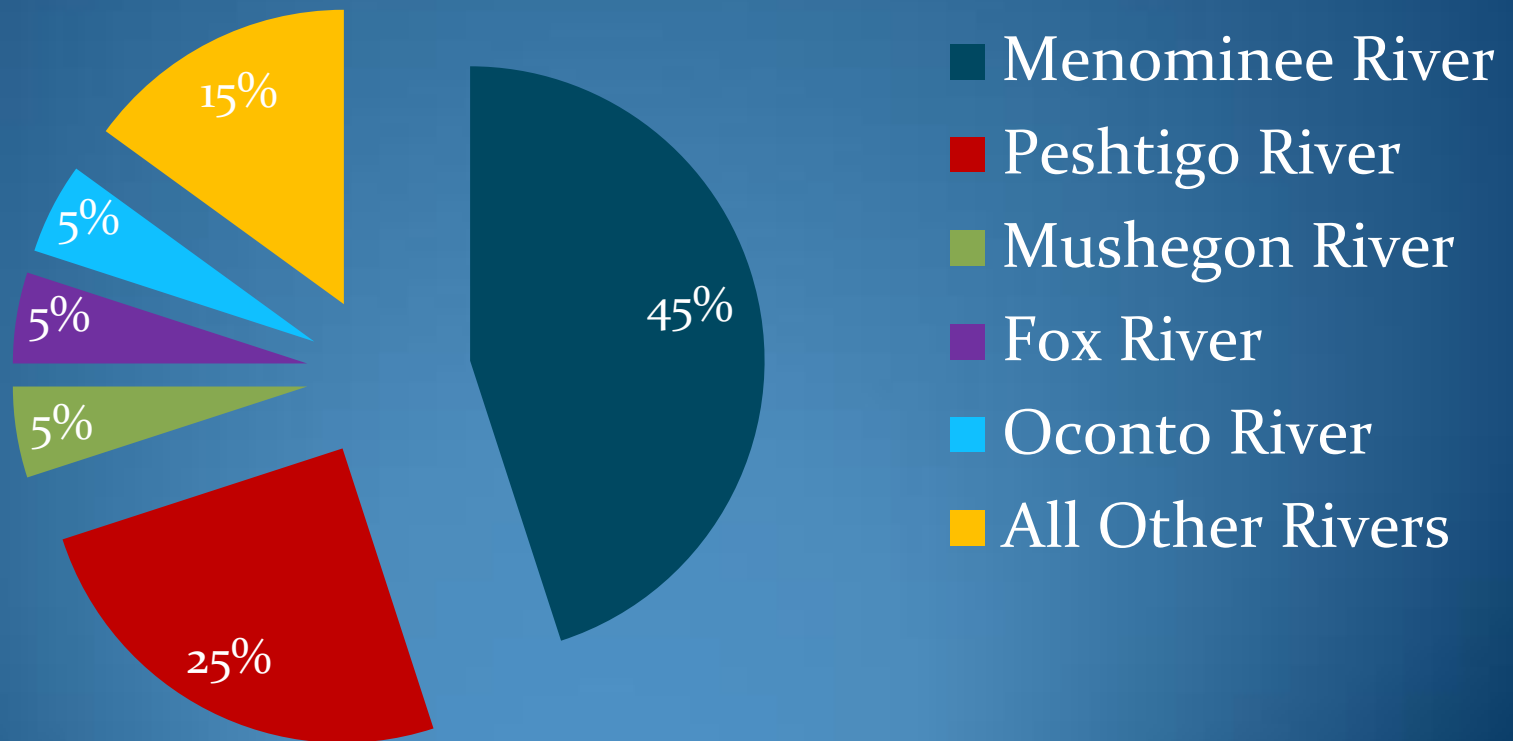
US Army Corps
of Engineers®

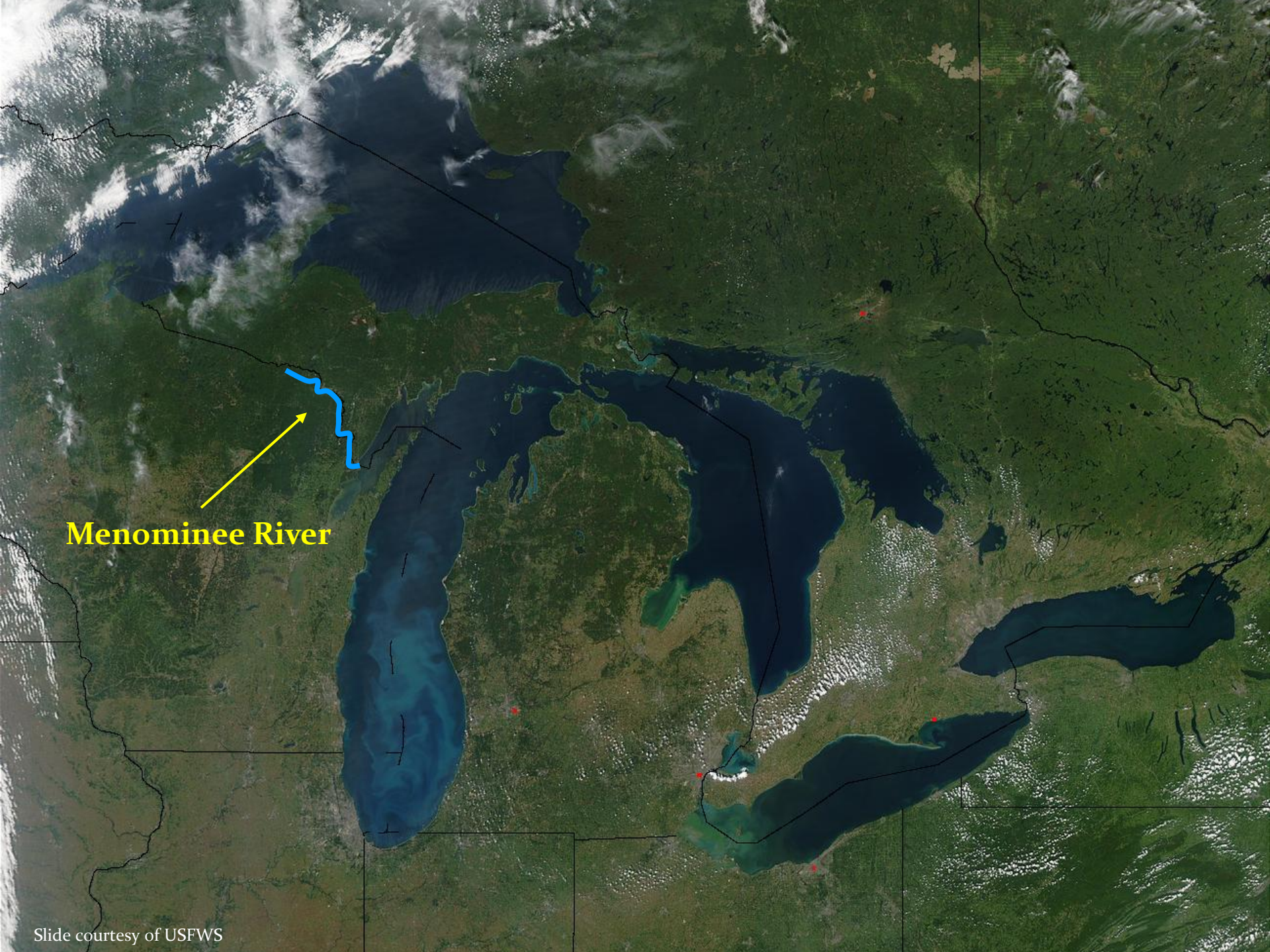
URS | Baird
a Joint Venture

Kleinschmidt

PROJECT BACKGROUND

Lake Michigan Tributary Rivers with Known Sturgeon Spawning





Menominee River

BENEFITS OF STURGEON PASSAGE ON THE MENOMINEE RIVER



- Currently Available Habitat
 - 2.75 miles of river
 - Currently produces few fish
- Passage at Menominee and Park Mill
 - Would open 21 miles of river
- Passage at Grand Rapids
 - Would open 30 miles of river
- Passage at White Rapids and Chalk Hill
 - Would open 32 miles of river

FISH PASSAGE FEASIBILITY STUDY

Project Team

- Engineers
- Fishery Biologists
- Regulatory Specialists
- Economists
- Ecologists
- Archaeologists

Scope of Work

- Identify Fish Passage Alternatives
- Review Engineering Feasibility
- Review Hydrology and Hydraulics
- Review Costs and Economics
- Review Habitat Benefits
- Review Historical and Cultural Impacts
- Review Real Estate Constraints

FISH PASSAGE FEASIBILITY STUDY

Alternatives Considered for Sturgeon Passage

- Upstream Passage
 - Fish Elevators
 - Nature-like Fishways
 - Vertical Slot Fishways
 - Dam Removal
 - Trap and Transport
- Downstream Passage
 - Close Spaced Trash Racks
 - Angled Bar Racks
 - Exclusion Nets
 - Louver Structures
 - Induced Flow Devices
 - Surface Bypass
 - Submerged Orifice Bypass
 - Transport Pipes
 - Transport Flumes

FISH PASSAGE FEASIBILITY STUDY

The Three Rules of Fish Passage Planning

- LOCATION, LOCATION, LOCATION
 - Fish Behavior
 - Guided By Flow
 - Guided By Natural Bathymetry or Man Made Structure
 - Site Layout Considerations
 - Bathymetry and Topography
 - Existing Structures
 - Existing Operations
 - Real Estate Considerations

FISH PASSAGE FEASIBILITY STUDY

Screening of Alternatives

- Effectiveness
 - Fish Passage Effectiveness
 - Effect on Hydro Project Operations
- Efficiency
 - Construction Cost
 - Operations and Maintenance Cost
- Acceptability
 - Flood Impacts
 - Environmental Constraints
 - Historical and Cultural Constraints

FISH PASSAGE FEASIBILITY STUDY

Selected Alternatives

- Fishway 1 – Menominee & Park Mill
 - Downstream Passage – Close Spaced Inclined Bar Racks and Surface Bypass
- Fishway 2 – Grand Rapids
 - Upstream Passage – Fish Lift in Tailrace
 - Downstream Passage – Existing Bar Racks and Surface Bypass
- Fishway 3 – White Rapids & Chalk Hill
 - Upstream Passage – Fish Lift in Tailrace
 - Downstream Passage – Close Spaced Bar Racks and Submerged Bypass

MENOMINEE & PARK MILL DAMS (FISHWAY 1)

Lake Michigan

Menominee, MI

Marinette, WI

Menominee Dam

Wisconsin

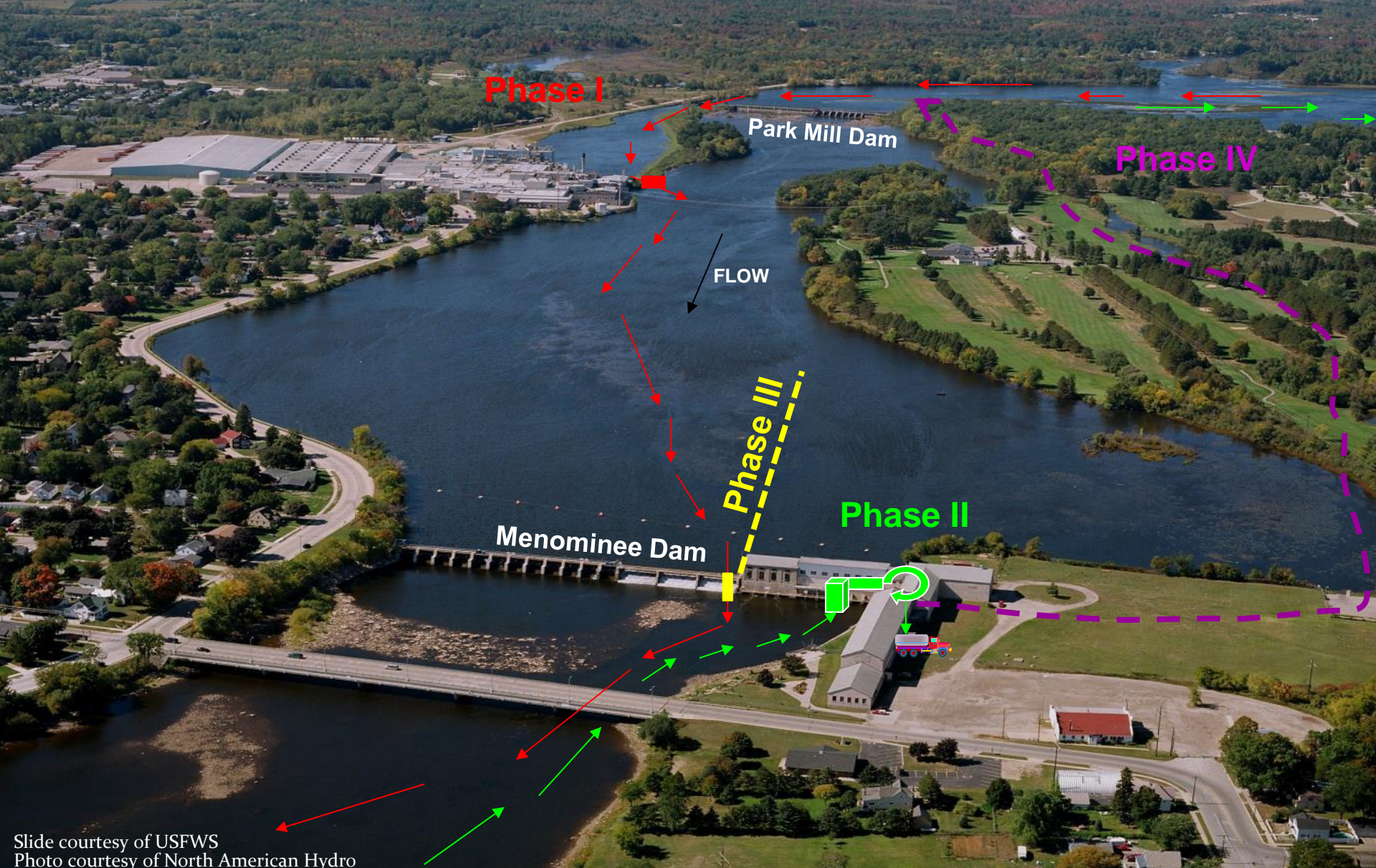
Michigan

Flow

Park Mill Dam



FOUR PHASE FISH PASSAGE AND PROTECTION PLAN



Slide courtesy of USFWS
Photo courtesy of North American Hydro

GRAND RAPIDS DAM (FISHWAY 2)









NOTICE
AUTHORIZED
PERSONNEL ONLY



WATER LEVELS
CHANGE RAPIDLY DUE
TO WINDY PLANT
OPERATIONS

08/10/2011 04:42

WHITE RAPIDS & CHALK HILL DAMS (FISHWAY 3)



WHITE RAPIDS DAM



CHALK HILL DAM



CHALK HILL DAM



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WHITE RAPIDS DAM



Fishway 1

Menominee – Park Mills

Downstream Alternative: Incline rack with surface bypass



Available Habitat:

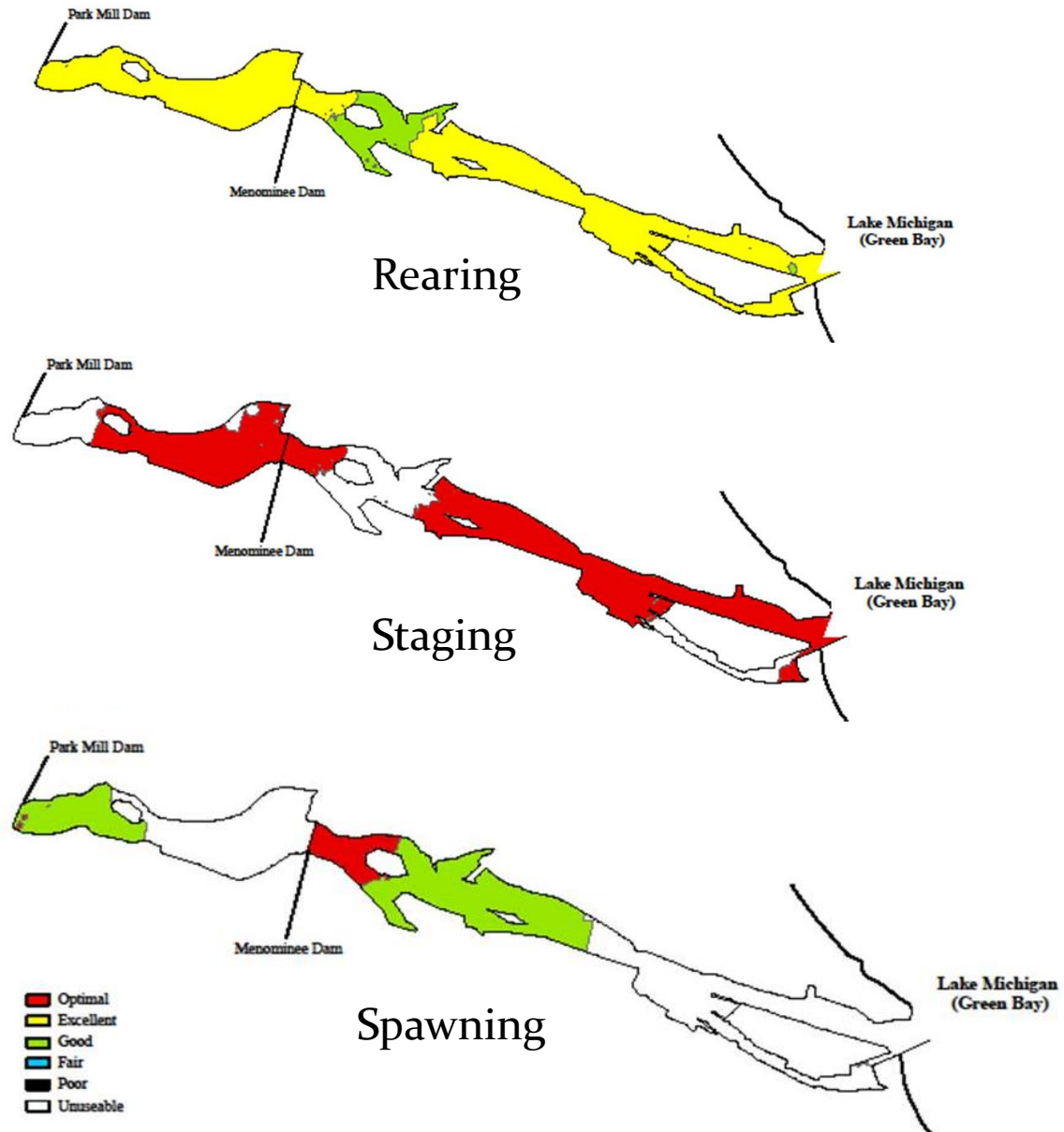
<i>Excellent</i>	spawning habitat: 59 acres,	juvenile habitat: 1,742 acres
<i>Good</i>	spawning habitat: 706 acres,	juvenile habitat: 0 acres
<i>Fair</i>	spawning habitat: 0 acres,	juvenile habitat: 0 acres

Number of lake sturgeon above Park Mills:

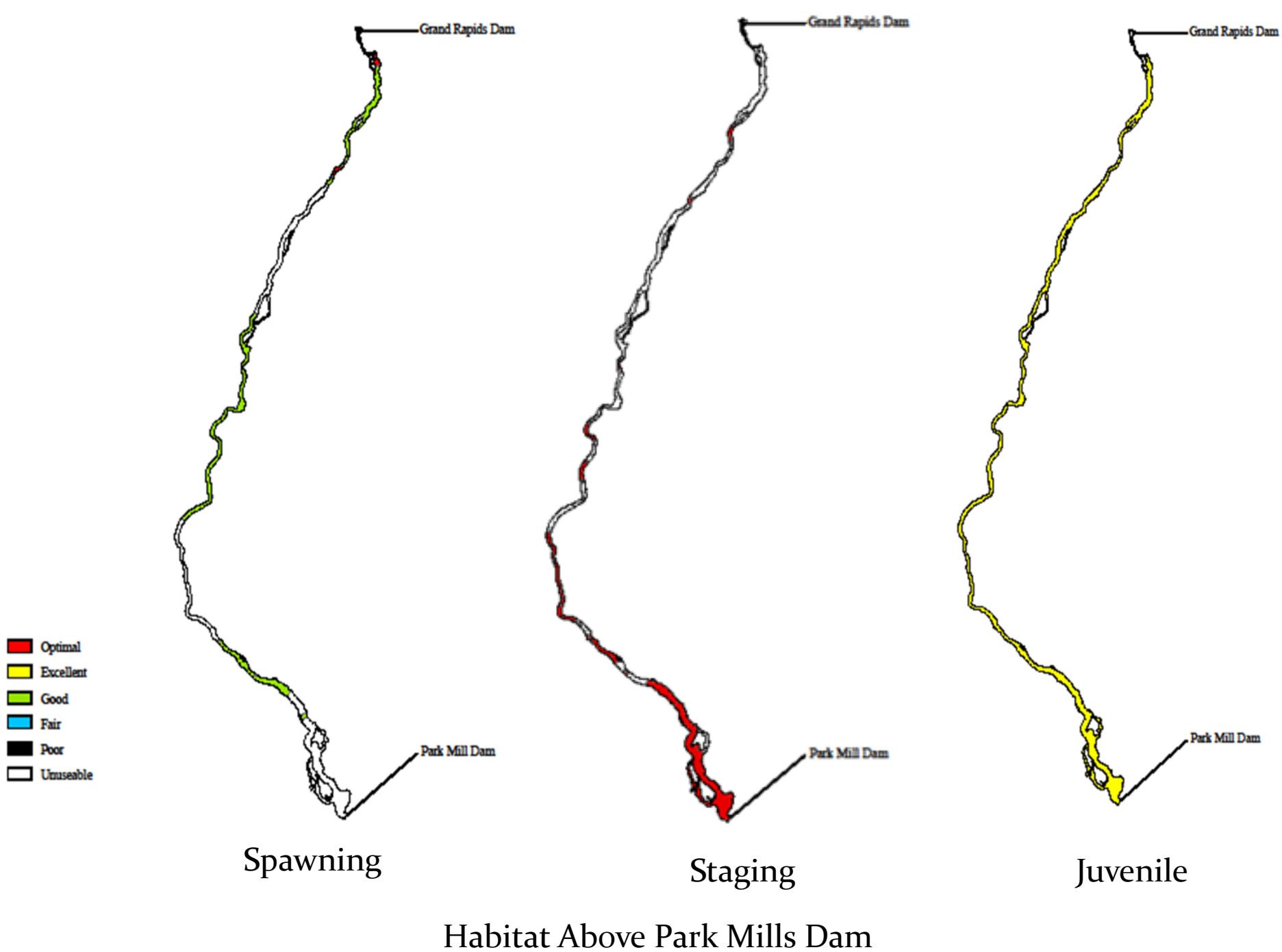
Total length (cm)	<u>2011</u>	
<91	1,362	(1,152-1,572)
>91	713	(603-822)
>107	483	(396-571)
>127	166	(129-203)

Number of lake sturgeon below Menominee:

Total length (cm)	<u>2009</u>	
>91	2,455	(2,214-2,738)
>107	2,286	(2,060-2,553)
>127	1,181	(1,051-1,338)



Habitat Above and Below Menominee Dam



Habitat Above Park Mills Dam

Fishway 2 Grand Rapids

Upstream Alternative:
Fish Lift

Downstream Alternative:
Existing Trash Racks and Surface Bypass

Available Habitat:

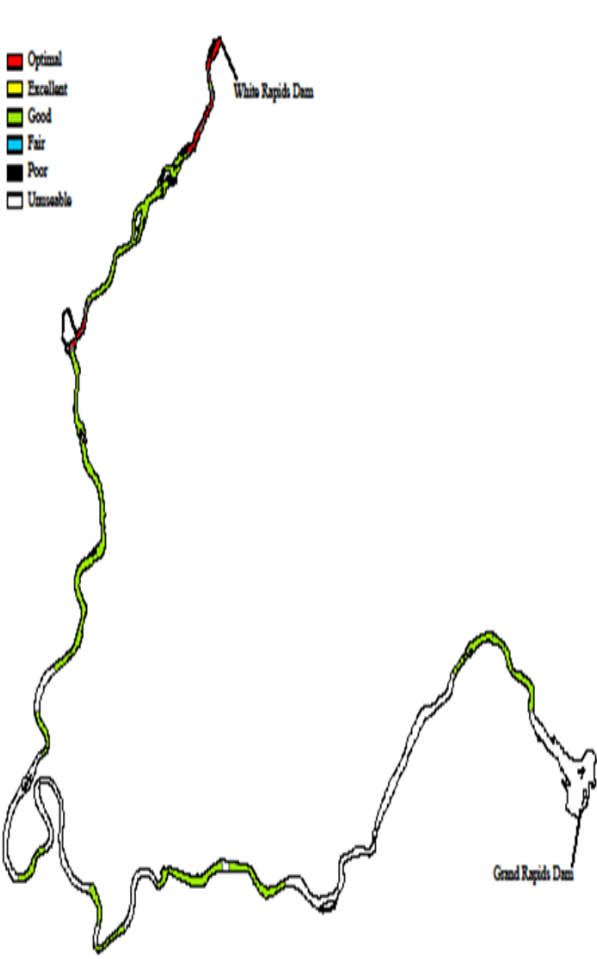
<i>Excellent</i>	spawning habitat: 100 acres,	juvenile habitat: 1,593 acres
<i>Good</i>	spawning habitat: 784 acres,	juvenile habitat: 166 acres
<i>Fair</i>	spawning habitat: 0 acres,	juvenile habitat: 0 acres

Number of lake sturgeon above Grand Rapids:

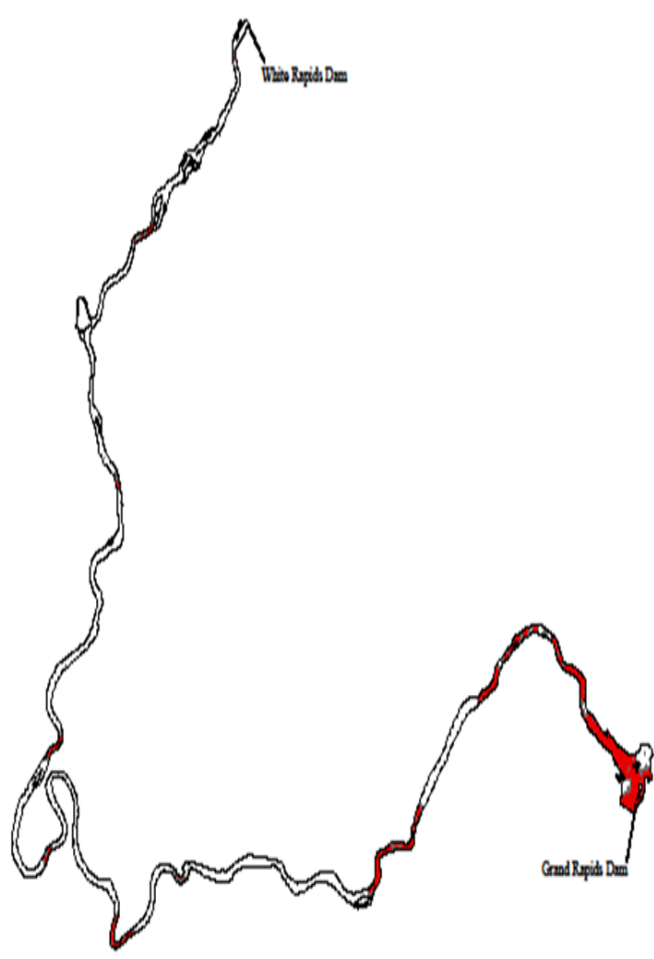
Total length (cm)	<u>2009</u>	
>91	2,627	(2,376-2,925)
>107	1,782	(1,602-2,001)
>127	572	(470-717)



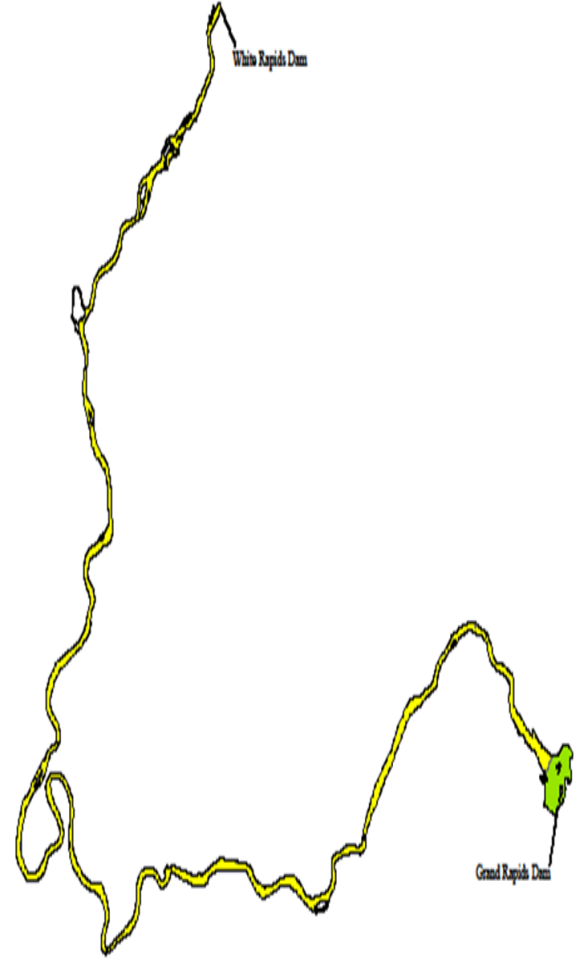
- Optimal
- Excellent
- Good
- Fair
- Poor
- Unusable



Spawning



Staging



Rearing

Habitat Above Grand Rapids Dam

Fishway 3

White Rapids – Chalk Hill

Upstream Alternative:

Fish Lift

Downstream Alternatives:

New Close Spaced Trash Racks and Submerged Orifice Bypass

Available Habitat:

<i>Excellent</i>	spawning habitat: 78 acres,	juvenile habitat: 1,592 acres
<i>Good</i>	spawning habitat: 664 acres,	juvenile habitat: 842 acres
<i>Fair</i>	spawning habitat: 98 acres,	juvenile habitat: 0 acres

Number of lake sturgeon above White Rapids:

Total length (cm)	<u>1970</u>	<u>1978</u>	<u>1990</u>
<107	2,680	2,543	2,423
>107	185	206	733
>127	115	105	320
>140	57	45	121
>152	20	9	53
>165	2	0	9





Spawning

Staging

Juvenile

Habitat Above White Rapids Dam



Spawning



Staging



Juvenile



Habitat Above Chalk Hill Dam

QUESTIONS



Menominee River Fish
Passage Partnership Video

[http://www.youtube.com/
watch?v=FvNrJG4G8O4](http://www.youtube.com/watch?v=FvNrJG4G8O4)