Upper Mississippi River Restoration:

Managing a Dual Purpose River for Fish and Wildlife Habitat

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Outline:

General overview:
- Human alterations to the River ecosystem
- Events that set groundwork for authorization of UMRR

Examples of HREP Design and Features:
- Island Restoration
- Dredging
  - Mechanical
  - Hydraulic

Planning and Design “Lessons Learned”
Locks And Dams on the Upper Mississippi River System

1934-1940

“Stairsteps” of Water
Habitat Loss in Lower Pool 8

- Permanently Elevated Water Levels
- Island Loss and Erosion
- Increased Connectivity
- Sedimentation
RESOURCE PROBLEMS

Loss of Depth Diversity (Lower Pool 8)

- < 0.3 m
- 0.3 to 1.8 m
- > 1.8 m

Used with permission from:
Jim Rogala, USGS UMESC
RESOURCES

PROBLEMS

WIND FETCH

Pre Lock and Dam

1937

Lowest fetch

Highest fetch

Lower Pool 8

1989

Used with permission from:
Jim Rogala, USGS UMESC
State of Wisconsin Sued Corps for Indiscriminate Placement of Dredged Material
"To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system." -- Section 1103, WRDA 1986
Upper Mississippi River Restoration
Geographical Extent and Program Partners

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- States of:
  - Minnesota
  - Wisconsin
  - Iowa
  - Illinois
  - Missouri
- Public
- U.S. Geological Survey
Upper Mississippi River Restoration
Program Elements

Long Term Resource Monitoring

Habitat Rehabilitation and Enhancement Projects
Upper Mississippi River Restoration
HREP Accomplishments Since 1986

- 38 projects in planning
- 57 projects completed
- >100,000 acres of habitat restored
- In 5 different states
- On > 1,200 miles of the Mississippi and Illinois Rivers
Dredging and disposal for HREPs is permitted through an MOU between the State of Wisconsin and Corps of Engineers. State statutes regarding MOU were passed following GREAT (early 1980’s).
All Projects Must Meet the Following:

- 50 year project life
- Minimize operation and maintenance
- No recreation benefits can be used to justify projects
- Almost all water based construction and support
A Combination of Tools and Approaches

Backwater Dredging

Island Construction

Bank Stabilization

Culverts to Oxygenate Backwaters

Seed Islands

Moist Soil Units

Modifications of Wing Dams and Closing Dams

Partial Closing Dams

Revegetation of Disposal Sites

Habitat Channels
Common HREP Goals/Objectives

- Increase emergent, submersed and floating leaved aquatic vegetation
- Create backwater fish overwintering habitat
- Enhance backwater fish spawning and summer habitat
- Enhance channel habitat for riverine fish and mussels
- Increase and maintain quality dabbling duck habitat
- Increase and maintain quality diving duck habitat
- Create habitat for neotropical migrants and shorebirds
- Create turtle nesting habitat
In the Beginning...

Lake Onalaska Islands and Dredge Cuts, Pool 7

Shadow zone of islands

Aquatic vegetation in shadow zone of islands

Construct 1988 - 1990
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project

Spring 1989

Phase I

Spring 1993

Pool 8 Islands, Phase I (1992-1993)
BUILDING AN ISLAND

Constructing sand base with dredged material

Shaping fine material (topsoil)

Sand base and work limit stake
Design features to stabilize constructed islands.

- Willow Plantings
- Vegetative Cover (Grasses, trees, legumes)
- Rock Groin
- Sacrificial Berm
Subtle changes in island elevation to make islands stable during floods.

During flood of 1993

After flood of 1993
Lessons Learned!

Focus on wind direction during growing season!

Pool 8 Islands, Phase I
(1992-1993)

Pool 9 Islands (1995)
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project

Phase I

Spring 1989

Spring 1993

Phase II

Spring 1999

Spring 1989

Fall 1992

Fall 1998
POOL 8 ISLANDS PHASE II, POOL 8 (Stoddard Bay)

Constructed between Oct. 1997 and Summer 1999

October 1961  August 1994  August 2000
Observed Increase in Aquatic Vegetation was Significant

Graph and Figure from: Langrehr, Gray and Janvrin. Evaluation of Aquatic Macrophyte Community Response to Island Construction in the Upper Mississippi River, 2007
Criteria to Achieve Aquatic Vegetation Objectives

General criteria were initially developed by resource managers. These criteria have been confirmed and refined over time based on project monitoring and LTRMP data.

Emergent Vegetation

**Water Depth:** <0.6 meters

**Water Velocities:** 0.0 m/sec preferred, <0.1 m/sec acceptable over portions of the area

**Substrate:** Wide range, but not highly organic/floculent or pure sand

**Wind Fetch/Island Placement:** Determine based on equation provided under Engineering Consideration 4: Wind-driven Wave Action for the water depth <2 feet that makes up the majority of area in shadow zone of island (for example, if 75% of the water depth in the shadow zone of the island is 1 foot, then spacing should be based on minimizing sediment resuspension in 1 foot of water).

Rooted Floating Leaf Vegetation

**Water Depth:** <0.8 meters

**Water Velocities:** 0.0 m/sec preferred, <0.1 m/sec acceptable over portions of the area

**Substrate:** Wide range, but not highly organic/floculent or pure sand

**Wind Fetch/Island Placement:** Determine based on equation provided under Engineering Consideration 4: Wind-driven Wave Action for the water depth 3 feet that makes up the majority of area in shadow zone of island (for example, if the majority (i.e. 75%) of the water depth in the shadow zone of the island is 1.5 foot, then spacing should be based on minimizing sediment resuspension in 1.5 foot of water).

Submersed Vegetation

**Water Depth:** June-September water depth 1-4 feet range, best around 2-3 feet

**Water Velocities:** June-September velocity 10 cm/s or less (higher upper limit is suggested to give Vallisneria an edge to compete with coontail and elodea).

**Substrate:** Silt/clay is the best substrate for most species except Vallisneria americana and Heteranthera dubia which prosper on ‘sand with silt’ substrate best.

**Wind Fetch/Island Placement:** Wind fetch 1,000 m or less
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project
Spring 1989

Phase I
Spring 1993

Phase II
Spring 1999

Phase III
Spring 2012
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project
- Spring 1989
- 26 Acres of Isl.
- 1,000 Acres impacted
- 200,000 yd³ sand
- 75,000 yd³ fines
- 8,000 yd³ rock
- $1.64 million

Phase I
- Spring 1993
- 26 Acres of Isl.
- 600 Acres impacted
- 211,600 yd³ sand
- 66,235 yd³ fines
- 38,623 yd³ rock
- $2.65 million

Phase II
- Spring 1999
- 150 Acres of Isl.
- 3,000 Acres Impacted
- 800,000 yd³ sand
- 200,000 yd³ fines
- 100,000 yd³ rock
- $18.00 million

Phase III
- Spring 2012
- 150 Acres of Isl.
- 3,000 Acres Impacted
- 800,000 yd³ sand
- 200,000 yd³ fines
- 100,000 yd³ rock
- $18.00 million
Phase III Change to Weighted Wind Fetch

Pre Project

Weighted Wind Fetch (m)

Post Project (2012)

April – July, 1998 – 2007 climatological data, La Crosse, WI Municipal Airport. Model run provided by Jason Rohweder, USGS, UMESC
CUMULATIVE AFFECTS
Velocity Diversity And Sediment Transport

Hydraulic Model Results for 80,000 cfs
In the Pool 8 Islands Phase III Area

2001 Conditions

Predicted Change
Breakwaters

2006

Rock Mound with Spawning Substrate

Rock Log

Rock Mound with Fines

Pool 8 Islands, Phase III
Cumulative Benefits from HREPs in Lower Pool 8

1930

1938

2090
Bluegill Overwintering Habitat Criteria

- Water Depths > 4 Feet
- Water Velocities < 0.01 feet per second
- Warm water temperatures (> 32 degrees Fahrenheit)
- Dissolved Oxygen > 5 ppm
Hydraulic Modeling used to Predict Velocities

Lessons Learned!

Factor in seasonal physical conditions that may affect velocity and discharge.

Without Ice

With Ice
POOL 8 ISLANDS PHASE II, POOL 8 (Stoddard Bay)
Fisheries Response Monitoring
Functioning fall 1998, 640 acres

Average Pre-project Age 1+ CPUE = 0

Stoddard Bluegill

Average Pre-project Age 1+ CPUE = 6

Stoddard Largemouth Bass

Lessons Learned!
Project performance monitoring has to take into consideration the life history of target biota.

Fall Fishing at Stoddard Bay
DREDGING

Hydraulic

Mechanical
DREDGE CUT DESIGN

Difference in sediment types require dredge cut designs to be based on local site conditions. The slope of the cut must include consideration of the geotechnical properties of the sediment.

Lessons Learned!
Incorporation of Isolated Wetlands into Island Design

- Bertom McCartney, Pool 11
- Perched Isolated Wetland
- Polander Lake, Stage 2, Pool 5A
- Bussey Lake, Pool 10
- Willow Island
Spring Lake Islands HREP, Pool 5
Mud Flats increase habitat diversity and increase capacity for fines
Basic Elements to Planning Successful Projects

Pool 8 Islands, Phase I and III
Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

Goals describing the desired habitat and processes
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Measurable objectives that include physical and chemical parameters and consider life cycle of target species (CRITERIA)

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Include Design Considerations

For example: Use of rock should be minimized to allow for more aesthetic and natural looking conditions.

Spring Lake Islands, Pool 5
Mud Flats

Incorporate existing islands into design
Capoli Slough, Pool 9

Minimize use of rock
Pool 8 Phase I, Boomerang Island
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Pre and post project monitoring should be practical:

- Physical criteria (DO, Temp., Depth, etc.)
- Biotic should be long enough for populations to respond.
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