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# Aquatic Habitat Restoration in the Lower Missouri River

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# Introduction

- History of Missouri River
- Missouri River Mitigation
- 2000 Biological Opinion (2003 amendment)
- Construction Types / what we have tried
- Short-term Observations
- Future Directions



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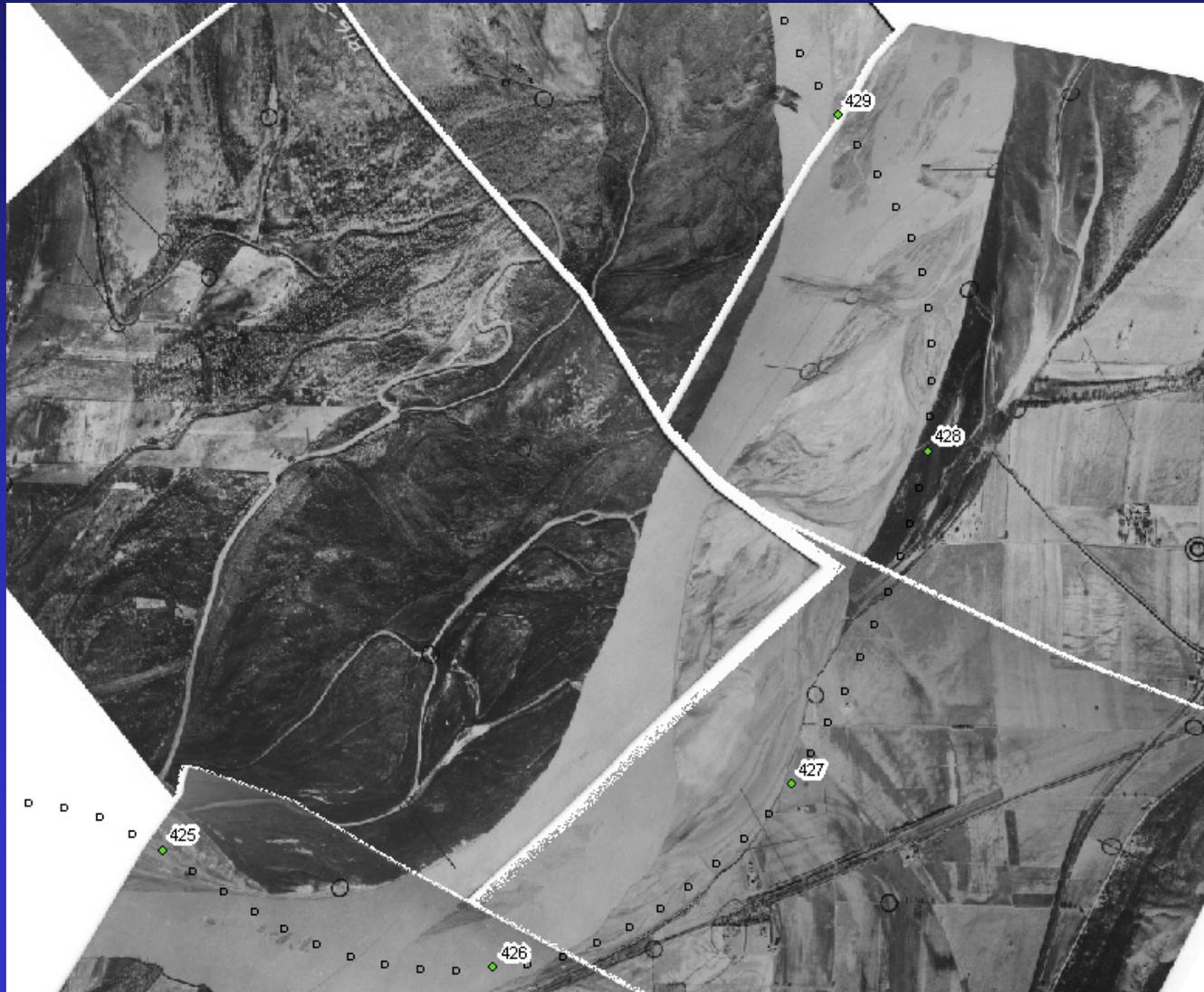


# History and Changes to the Missouri River



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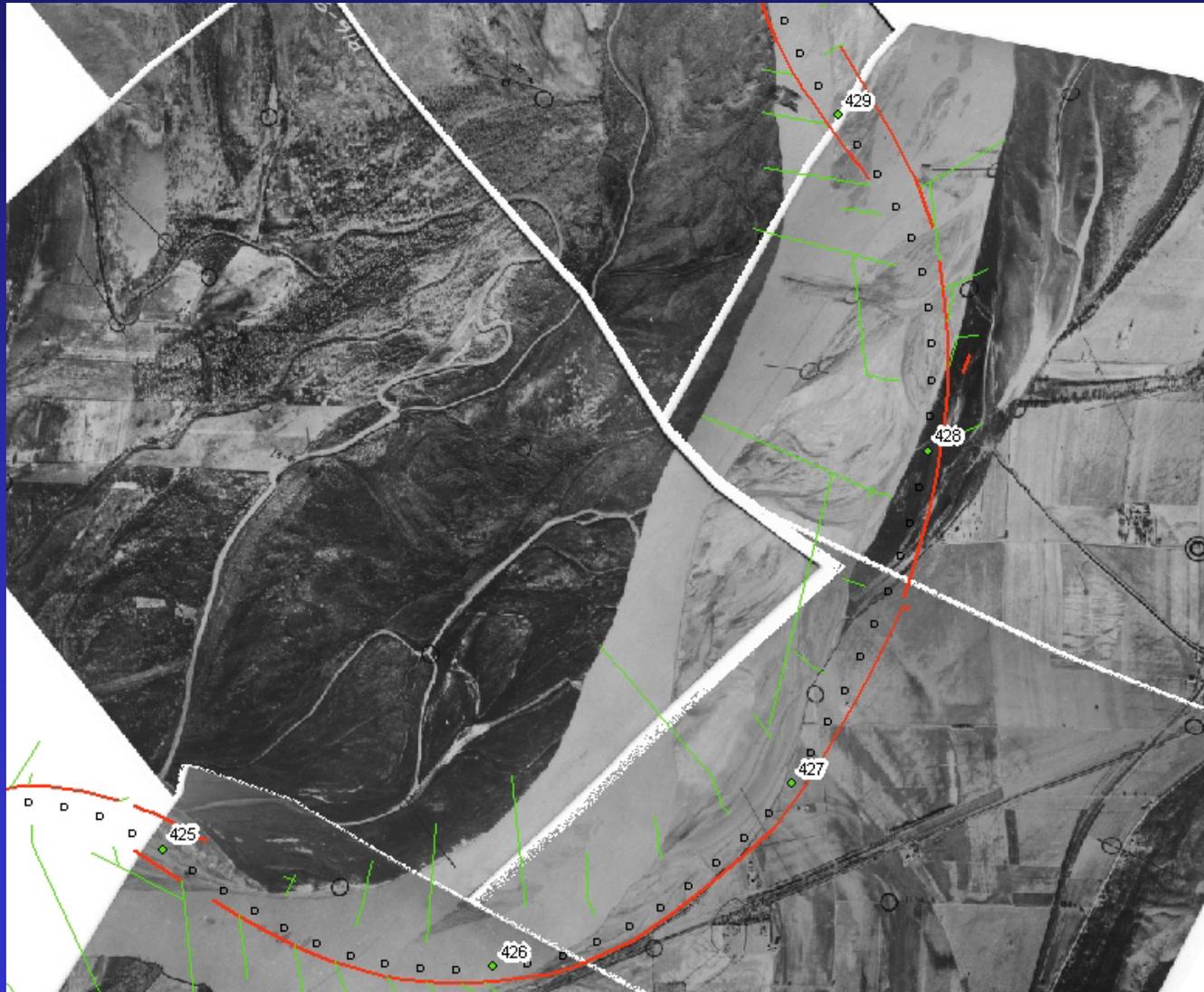
## Benedictine Bottoms, 1928





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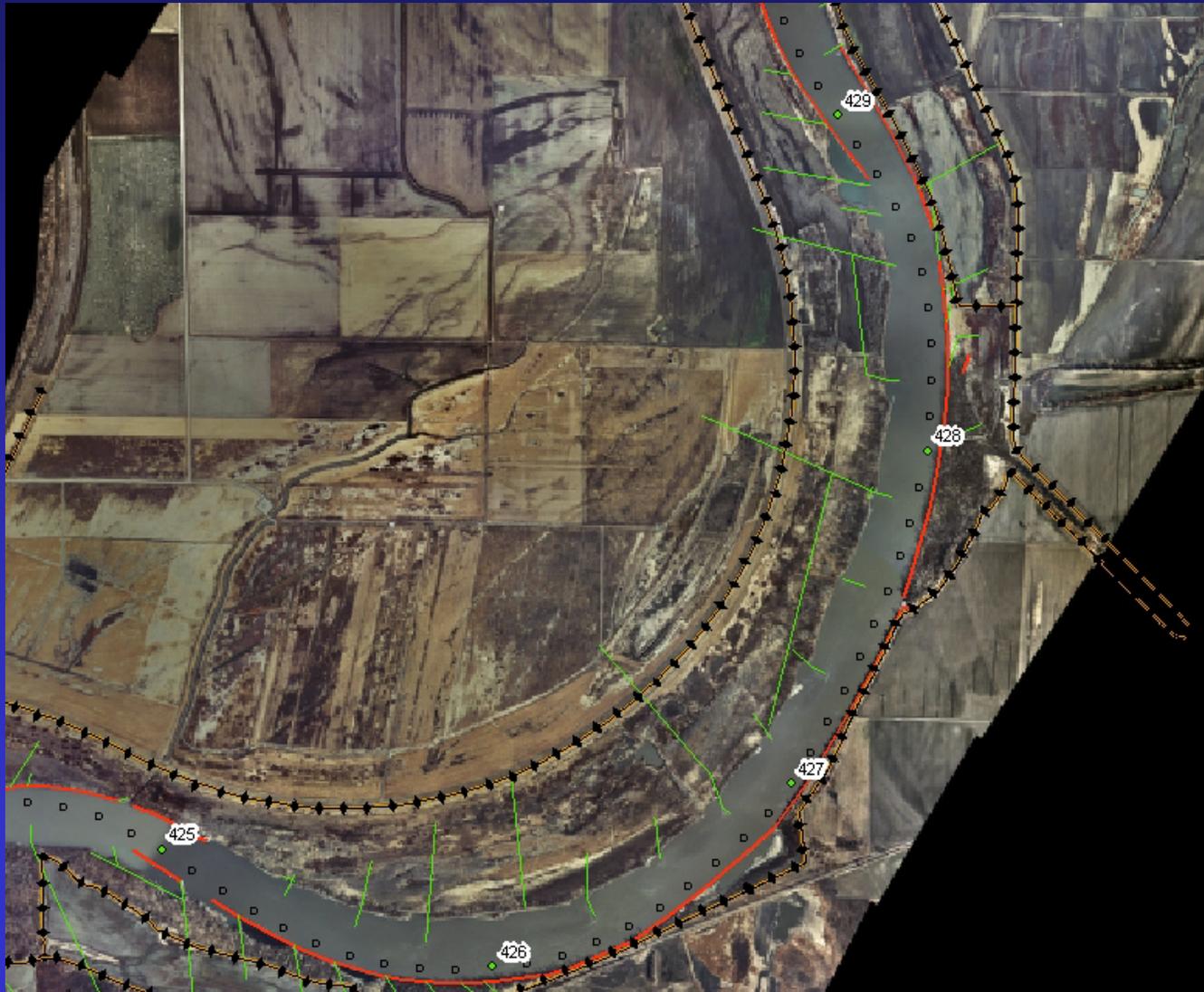
## Benedictine Bottoms, 1928





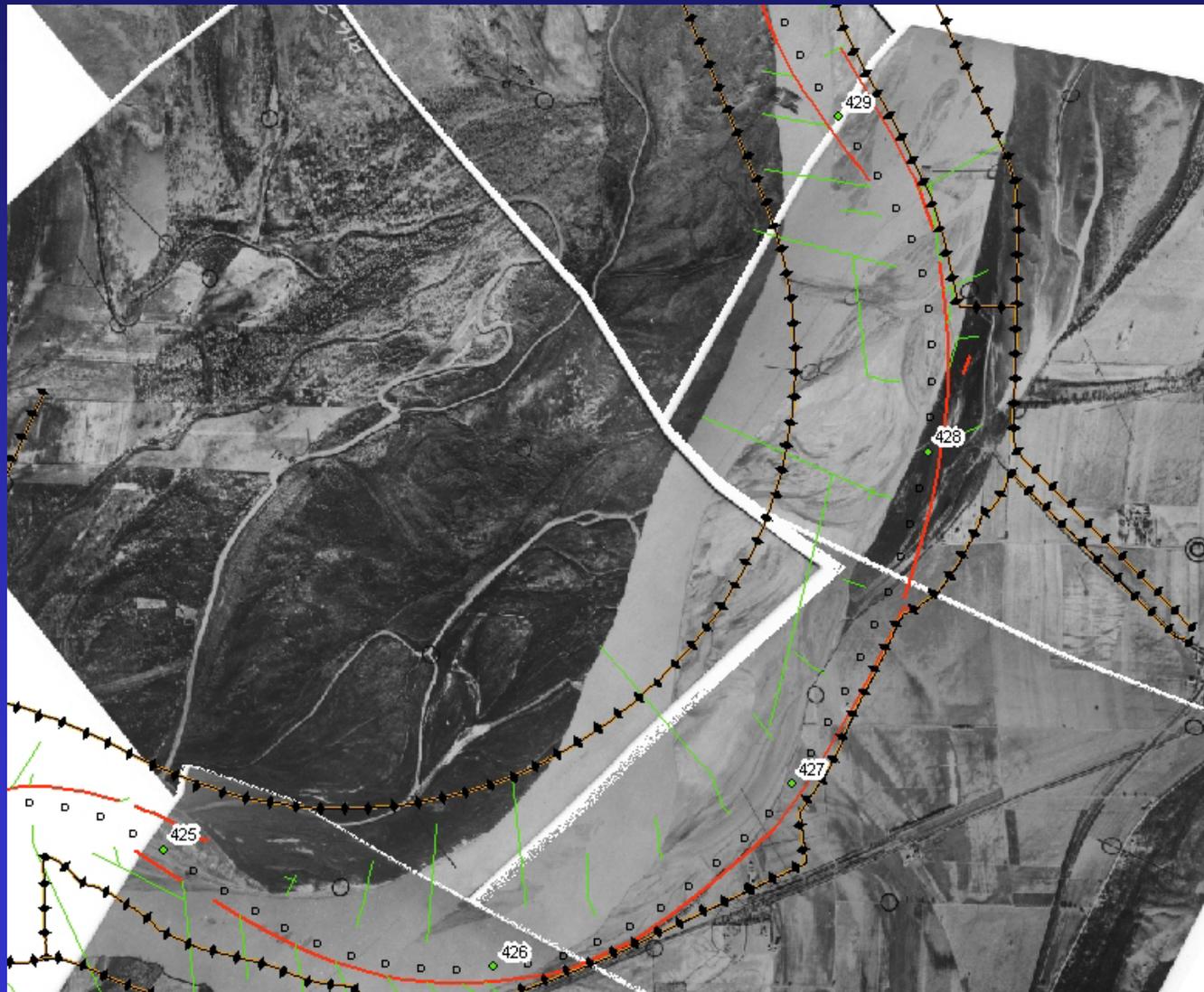
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## Benedictine Bottoms, 2000



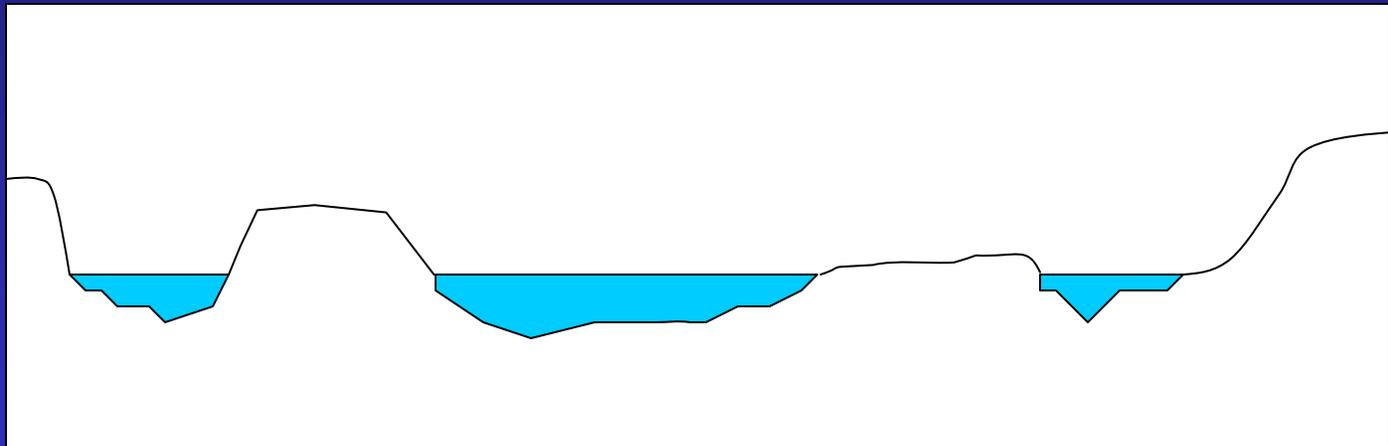


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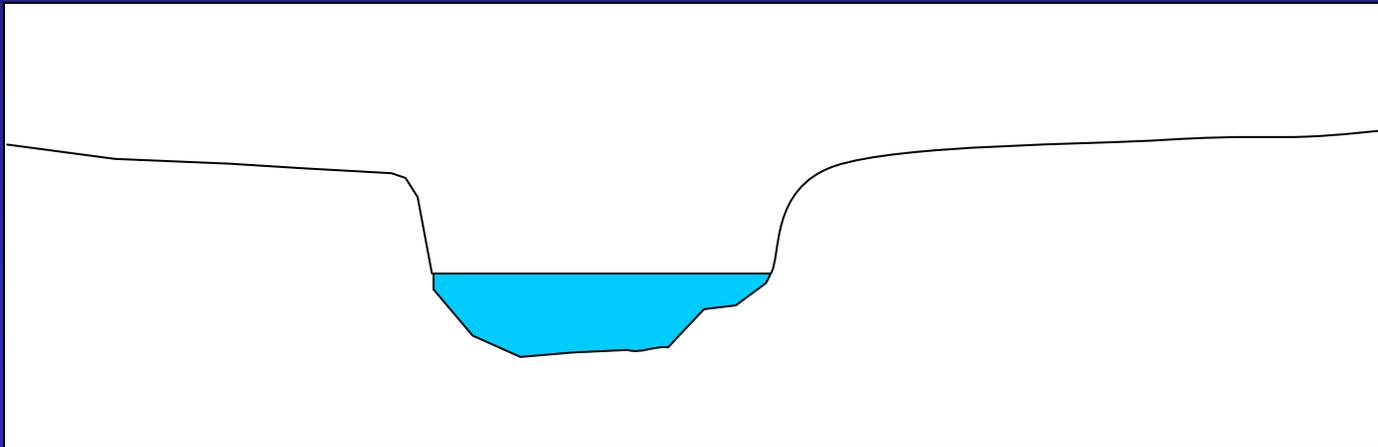


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# Missouri River Mitigation

- Mitigate for Habitats lost due to Construction and O&M of BSNP
- Early Aquatic Work in KCD
  - Grand Pass Chute (1991)
  - Dike and Revetment Notching Program
    - (initiated in the 1970's), approx 2000 notches, various elevations and sizes)
  - Rootless dikes, approx 160 constructed before 1991



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# Flooding

- 1993, 1995, and 1997 floods
- Lisbon Chute
- Jameson
- Plowboy Bend
- Numerous Scour Holes



Jameson Island, Feb 1995



Jameson Island, Feb 2000







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## 2000 Biological Opinion

- Mitigate for impacts to the Pallid Sturgeon and the significant loss of Shallow Water Habitat
  - Velocities less than 2.5-ft/s, depths less than 5-ft.



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# Toolbox

- Modification of Navigation Structures
- Construct New Structures
- Chute Construction (island restoration)
- River Widening
- Placement of Rootballs or other cover
- Flooding



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# Dike Notching



21 Apr 2004  
COE in-house Crew



21 Apr 2004 Series of Notches  
Completed in April 2004.



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# Revetment Notching



21 Apr 2004 Revetment Notch Examples.



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# Bank Notching



10 JUL 2004: Bank Notch Examples.



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# Pilot Channeling



Monkey Mtn Pilot Channel A.  
21 APR 2004, Stage: -1.5-ft CRP



Monkey Mtn Pilot Channel B.  
29 APR 2004, Stage: -1.5-ft CRP



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# Chute Construction



April 2004



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# KCD Summary Since 2000



- 833 Dike Notches
- 183 Revetment Notches
- 85 Bank Notches
- 14 Pilot Channels, 12,100-ft length
- 9 short chute projects, 6,670-ft length
- 3 Major Chutes, 4.6 - miles total length
- In-Construction: 60 notches, 1.7 mile chute



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# Challenges and Limitations



- Other Congressionally Authorized Projects
- Spoil Placement
- Debris
- Public Perception
- Number of Structures in the Missouri River
- Tracking and Documenting Changes
- Drought
- Definition of SWH
- Land acquisition



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# Short-Term Observations



- Bank Notches
- Pilot Channels
- Short Chutes

RM 181: Overton South: 28 April 2005: Stage = +1 CRP



RM 457: Worthwine: 26 JULY 2005: Stage = -1 CRP





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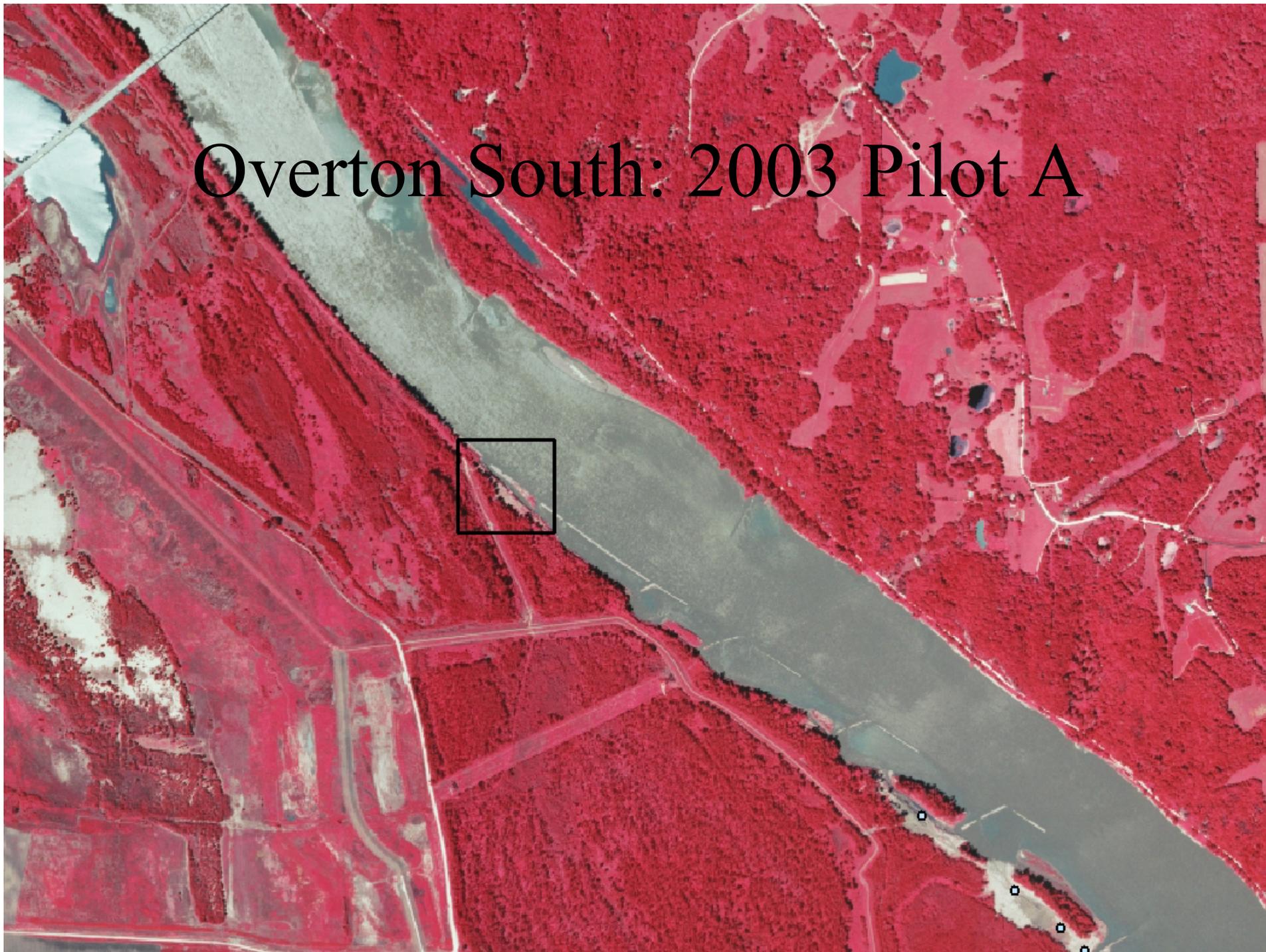
RM 198: Franklin Island: 28 APR 2005: Stage +1 CRP



Baltimore Bend: 26 APR 2005: Stage 0 CRP



# Overton South: 2003 Pilot A



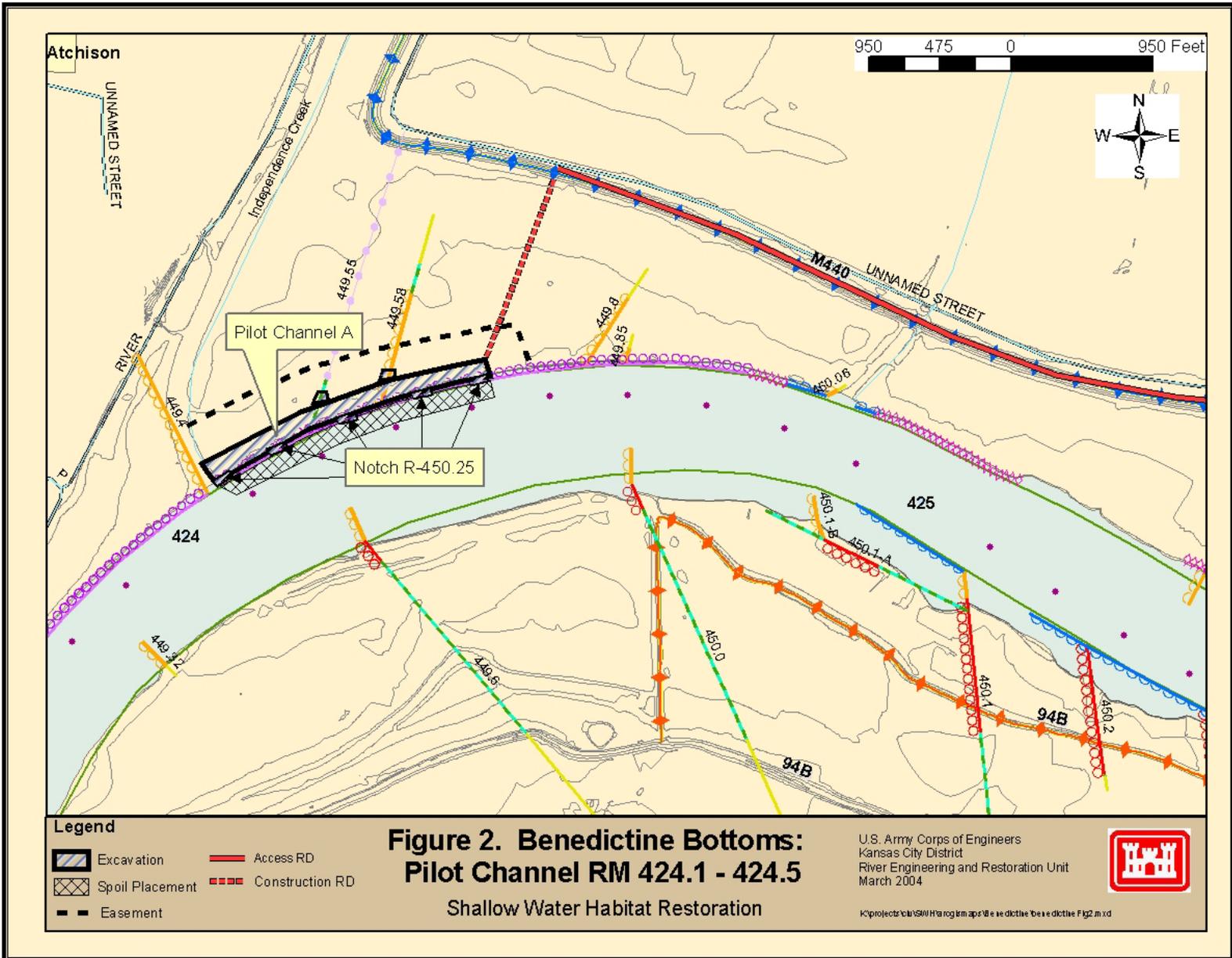
22 Apr 2004, stage at -2 CRP

Overton Bottoms South  
SWH Work



Overton South Pilot A: 02 SEP 2004: Stage +6 CRP





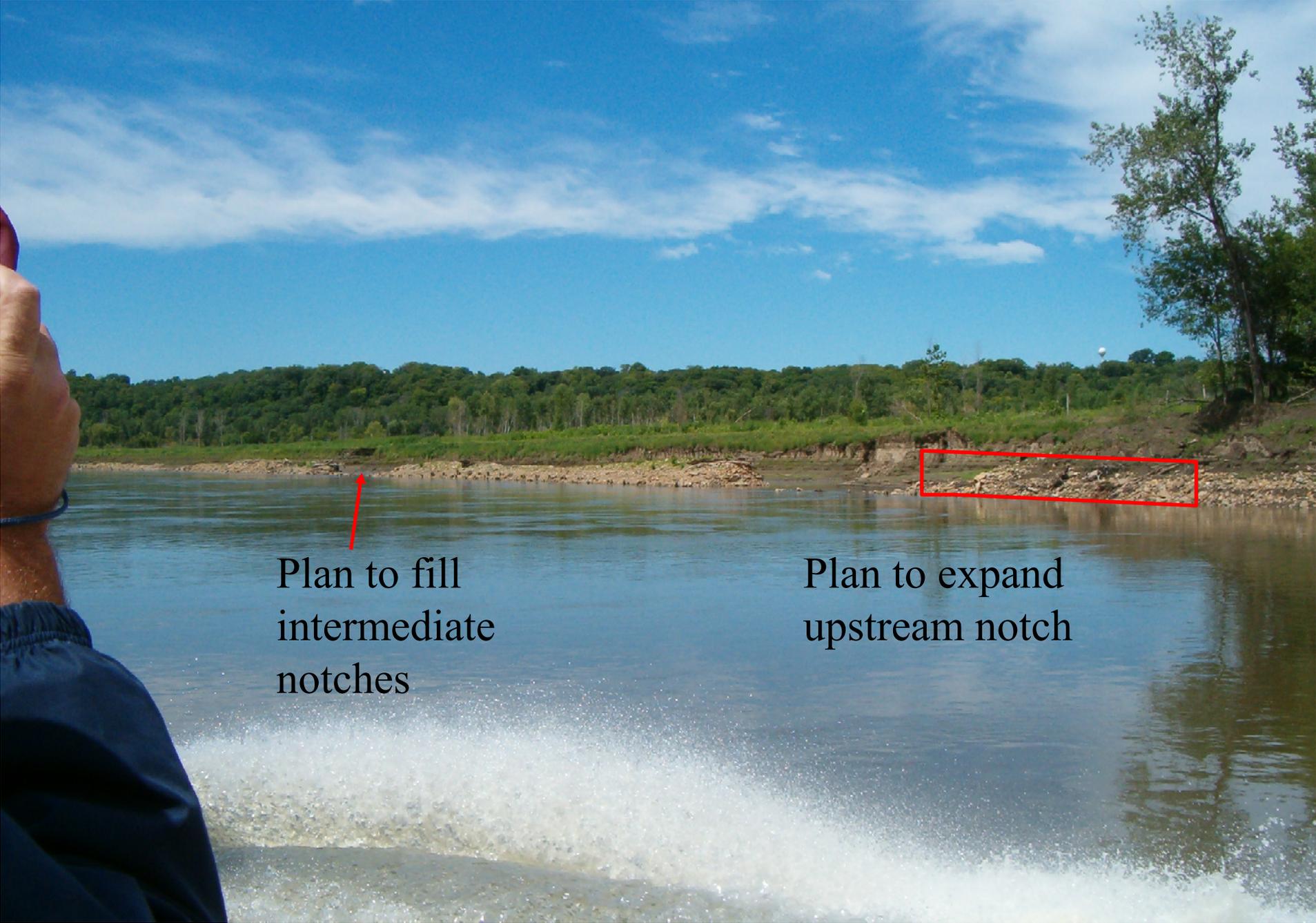
Benedictine Pilot Channel: 17 DEC 2004, Stage ~-6.5-ft CRP  
Looking upstream from exit.



Benedictine Pilot Channel A: 11 MAY 2005, Stage ~ -1-ft CRP  
View of channel looking downstream from entrance



Benedictine Pilot Channel A: 24 AUG 2004, Stage ~-2-ft CRP



Plan to fill  
intermediate  
notches

Plan to expand  
upstream notch

Monkey Mountain Pilot Channel A: 22 SEP 2004, Stage ~ -1-ft CRP



Monkey Mtn: 12 JULY 2005: Stage = -1 CRP



Monkey Mtn: 26 JULY 2005: Stage = 0 CRP



Monkey Mtn: 12 JULY 2005: Stage = -1 CRP



Monkey Mtn: 19 JULY 2005: Stage = -1 CRP



Worthwine Island Pilot Channel: 17 DEC 2004, Stage ~ -6-ft CRP.  
Looking upstream from the downstream end.



Worthwine Island Pilot Channel: 26 JUL 2005, Stage ~ 0-ft CRP.  
Looking downstream from the midpoint.





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0 450 900 1,800 Feet

### Smokey Waters Conservation Area Chute Habitat

U.S. Army Corps of Engineers  
Kansas City District  
River Engineering and Restoration Unit  
June 2004





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Smokey Waters Chute, 21 OCT 2004, Stage ~ -5-ft CRP  
Looking Downstream from the upstream end



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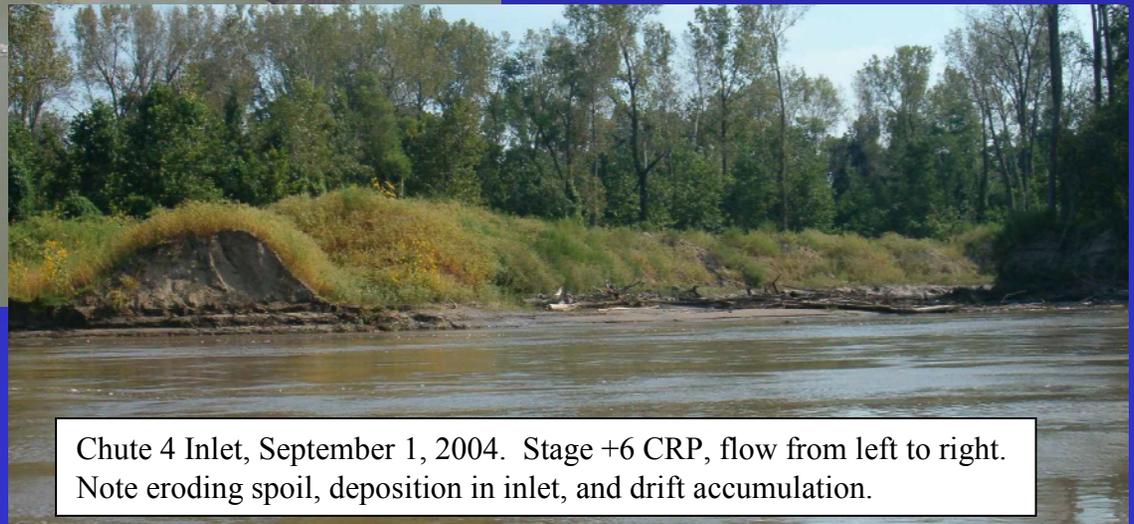
Smokey Waters Chute, 21 OCT 2004, Stage ~ -5-ft CRP  
Looking Upstream at the chute from a created gravel bar



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22 Apr 2004, stage at -2 CRP



Chute 4 Inlet, September 1, 2004. Stage +6 CRP, flow from left to right.  
Note eroding spoil, deposition in inlet, and drift accumulation.

# Overton South Chute

## River Mile 182



Overton Bottoms South,

22 Apr 2004, stage at  $-2$  CRP



Overton South Chute 2: 02 SEP 2006: Stage +6 CRP



Invert EL +0 CRP



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# Comparison

- Cost / Benefit? Must Rely on Biological Monitoring
- Relative Construction Cost
  - Dike/Revetment Notches, Bank Notches, New Structures, Pilot Channels, Chutes



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# Future Directions

- Dike notch program (until we run out of dikes)
- Multiple iterations of bank notch program
- Continue chute construction
- Aggressive pilot channel construction behind revetments
- Other in-stream habitat changes (if found successful by monitoring)
- Creek and Tributary mouth modifications
- Wait for flooding...



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# Thanks to our Partners



- Missouri Department of Conservation
- Missouri Department of Natural Resources
- US Fish and Wildlife Service, Big Muddy Refuge
- Kansas Department of Wildlife and Parks
- Iowa Department of Natural Resources
- Nebraska Game and Parks Commission