Technical Report M23.1

STONE DIKE ALTERATIONS PROJECT REPORT
MIDDLE MISSISSIPPI RIVER, MILES 201 – 0
(UMRS – EMP) ENVIRONMENTAL MANAGEMENT PROGRAM

REPORT UPDATE

10/4/12

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INTRODUCTION

For the purposes of this project, the Middle Mississippi River is defined as the reach from approximately Alton to Cairo, Illinois between Miles 201 and 0. The 201-mile reach of river is relatively short compared to the more notable Upper and Lower Mississippi Rivers. The reach begins immediately upstream of Mel Price Lock and Dam and ends at the confluence with the Ohio River. Over 750 dikes and chevrons currently exist on the Middle Mississippi River for the purpose of maintaining adequate depths for navigation.

The Stone Dike Alterations Project was initiated under the Environmental Management Program by a fact sheet dated September 30, 1991. The project investigated the possibility of altering existing dikes to permit flow near channel borders at higher river stages which would result in more diverse scour and depositional patterns. The project outlined recommendations for areas where it was determined that the biological need for habitat alteration was the greatest and where the notching of existing dikes offered the greatest opportunity for success. As part of the project, a report was generated in 2002 focusing on an inventory of Middle Mississippi River parameters and the potential for structure alteration based on need for habitat enhancement and the possibility for enhancement. This report is intended to update the 2002 report, outlining changes in channel geometry, updating dike construction and notching locations, and providing new recommendations for channel enhancement. This report will also serve as a guide for possible pallid sturgeon habitat restoration activities in the Middle Mississippi River related to the District's Biological Opinion Program.

OBJECTIVES

The objectives of this Stone Dike Alterations Project Report update follow:

1. Document the channel geometry and construction changes in each reach from 2002 to 2011.

2. Identify the repetitive maintenance dredging locations in each reach from 2002 to 2011.

3. Re-prioritize the reaches for modifications based on their initial ranking, changes within the reach, and other new additional information since the previous report.

4. Provide an updated description of the types and effects of structures currently designed and constructed within the district.

5. Coordinate with partnering agencies – US Fish and Wildlife Service, Illinois Department of Natural Resources, and Missouri Department of Conservation – to update where benefit is both possible and necessary.

6. Produce a finalized update detailing the changes in Middle Mississippi River parameters and needs for use in guiding future design decisions.

MIDDLE MISSISSIPPI RIVER REACHES

The predecessor to this report identified the basic features of the Middle Mississippi River, which are largely unchanged. For convenience in comparison, the 22 individual sections (here on identified as reaches) were held constant from the 2002 report to this report. Physical descriptions and the parameters of each reach follow. The descriptions for each reach include: river miles, characteristics and configuration, water surface slope, average bank and navigation channel widths, total number of main channel structures, main channel structures per river mile, percent of main channel structures notched, bendway weir fields, side channels, side channel miles per river mile, dredging areas, priority ranking, and alteration possibilities. Tables and graphs that summarize this data for all the reaches are shown in Appendix A. Maps of each reach are located in Appendix B, Figures 1 to 22. These maps include: the navigation line, the channel contraction borders, river borders, dikes, chevrons, weirs, revetments, the 2010 bathymetry, dredge cuts and disposal sites between 2002 and 2011, 2011 aerial photography, and local reference annotation. The dikes whose identifier symbols have crosses are older structures that were not visible in low water aerial photographs from 2006. The green rectangles represent dredge cut sites and the red rectangles represent dredge disposal sites. Degraded structure indicated on the maps includes both natural and designed (i.e. constructed notches) degradation. Notches totaled below and in tables and charts in Appendix A are strictly designed notches.

The same system used for the prioritization of the reaches in the last report was used in this update. The reaches were prioritized to reflect the areas the team members felt were most critical and in need of environmental modifications. To prioritize the reaches, a rating system of one through five stars was used, with five stars being the highest priority. The rating for each reach was developed based on a combination of the need for additional habitat and biological enhancement and the probability of each reach achieving the goals set forth (i.e. a small number of dikes limits enhancement possibilities, industry opposition limits construction options, etc.). A secondary rating system was established to rate the specific fields along the same criteria of need and opportunity; the rankings used were high, medium, or low.

GUIDANCE:

Bankline width includes width to the outer bank of chutes if present
Trail dikes and rootless dike extensions were counted as part of the main stem dike
Only main channel structures were included in dikes/mile calculation
Chute mile per channel mile length was calculated using estimated chute centerline
For the purpose of the dikes per mile calculation, chevrons were considered dikes; hardpoints were not

REACH 1: MEL PRICE TAILWATER, 5 MILES (201 – 196)

Map: Appendix B, Figure 1

Characteristics: Straight from the Lock (Mile 201) to Mile 199, then a gradual 70-degree bend to the right to Mile 197, then straight to Mile 196. No bedrock controls or bluff lines.

Slope: Water Surface: 0.59 feet/mile

Avg Width: Bankline: 2080 ft
Nav. Channel: 1500 ft

Dikes: 2002:
3 Total Dikes on RDB (198.7 – 197.5)
0.6 dikes/mile – 0% Notched
These dikes consist of a hand-placed stone exterior with a sand filled interior. Therefore, modifications to these structures are not possible without adversely affecting the structural integrity of the entire dike

2011:
5 Main Channel Structures
5 Dikes on the RDB (199.4 - 197.7)
1.0 dikes/mile – 0% Notched
Some of these dikes (198.7 – 197.5) are known to consist of a hand-placed stone exterior with a sand filled interior. Therefore, modifications to these structures are not possible without adversely affecting the structural integrity of the entire dike.

Structure changes:
Two dikes discounted in the 2002 report were present in the low water aerial photography.

Weirs: None

Chutes: 2002:
0.60 miles/mile
Maple Island RDB (200.5 – 197.5) 3 closures (probably hand-placed stone and segments of the dikes on the located channel side)

2006:
0.60 miles/mile
Maple Island RDB (200.5 – 197.5) 4 closures (3 probably hand-placed stone and segments of the dikes on the located channel side)

Dredging: 10 cuts, along the LDB (auxiliary lock chamber at Mel Price L&D) for a total of 794,238 cubic yards (CY)

Priority: 2002:
1 Star.

2011:
1 Star.

Conclusions: 2002:
Structural modifications are not possible due to the existing dikes being sand-filled. Notches cut into these dikes may cause failure of the entire structure.

2011:
No change.

REACH 2: MOSENTHEIN, 12 MILES (196 TO 184)

Map: Appendix B, Figure 2

Characteristics: Gradual bend to the right between Miles 196 to 194, then straight to Mile 192, then a gradual bend to the left to Mile 190.5, then a gradual bend to the right to Mile 188.5, then a long, gradual bend to the left to Mile 185, and then straight to Mile 184.
The confluence with the Missouri River along the RDB is located at Mile 195R
Bedrock control at the Chain of Rocks and Low Water Dam No. 27, Mile 190.5
The navigation channel ends at Mile 194 and resumes at Mile 184 due to Chain of Rocks bypass canal in Illinois.

Slope: Water Surface: 0.47 feet/mile

Avg Width Bankline: 4558 ft
Nav. Channel: 1058 ft

Dikes: 2002:
9 Total Dikes on LDB (189.5 to 185.2) at Mosenthein Island/Chute
0.8 dikes/mile – 0% Notched

2011:
12 Main Channel Structures
1 Dike on RDB (191.5 to 190.3)
11 Dikes on LDB (189.6 – 184)
1.0 dikes/mile – 0% Notched

Structure Changes:
Three dikes (190.3 R, 184.4 L, 184.2 L) discounted in the 2002 report were present in the low water aerial photography.

Weirs: 2002:
Mosenthein LDB (195 to 194) 8 Weirs

2011:
No change

Chutes: 2002:
0.45 miles/mile
Duck Island RDB (195.2 – 193.8) 0 Closures, recently constructed hard points
Mosenthein LDB (189 – 185) 1 Closure & 4 L-Dikes within chute

2006:

0.48 miles/mile
Duck Island RDB (195.3 – 193.8) 0 Closures
Mosenthein LDB (189 – 184.8) 1 Closure & 6 Dikes within chute

Dredging: 17 cuts for a total of 1,594,767 CY:
5 cuts along the LDB at ~RM 196 for a total of 586,538 CY
7 cuts along the LDB at ~RM 194 at the entrance to the canal for a total of 691,518 CY
5 cuts along the LDB at ~RM 184 at the entrance to the canal for a total of 316,711 CY

Priority: 2002:
3 Stars.

2011:
3 Stars.

Conclusions: 2002:
The area is a transition point between the Middle Mississippi River and the Lower Missouri River. Therefore, the area may be an important staging area for sturgeon and other species. There are limited opportunities to improve habitat conditions in the St. Louis Harbor, located just downstream of this reach. Experimental structures or modifications may be tested in most of this reach due to the absence of a navigation channel. None of the existing dikes in this reach have been modified for environmental enhancement.

2011:
Changes in this area have been limited to weir restoration and the extension of the 184.2 L dike. Opportunities exist throughout the reach if there is interest although the habitat is already generally perceived as good. RM 196 continues to be a repetitive maintenance issue that may allow for a habitat-conducive remedy such as a chevron. No notching has been done on the LDB structures in the vicinity of Mosenthien Island. However, deposition in the old channel may limit ability for construction changes from RM 184 to 192.

REACH 3: ST. LOUIS HARBOR, 16 MILES (184 TO 168)

Map: Appendix B, Figure 3

Characteristics: Long bend to the right between Miles 184 to 176, then a slight bend to the left to Mile 174, and then straight to Mile 168.
Minimal dikes located throughout reach due to the number of facilities along both banks.
The bluff line is located along RDB throughout most of the reach.
6 Existing Bridges and 1 Planned Bridge crossing are between Miles 183.2 and 179.

Slope: Water Surface: 0.56 feet/mile

Avg Width Bankline: 2175 ft
Channel: 1406 ft

Dikes:

2002:
7 Total Dikes along LDB
0.4 dikes/mile – 86% Notched
Dike Field 1: 2 New (2001) Dikes on LDB (175.0 and 174.5) (lower dike is notched)
Dike Field 2: 5 Dikes on LDB (171 to 168.5)

2011:
17 Main Channel Structures
3 Chevrons along the RDB (182.9 – 182.45)
14 Dikes along the LDB (182.9 – 168.5)
1.1 dikes/mile – 47% Notched

Structure Changes:
Three dikes (181.7 L, 177.8 L, 168.8 L) discounted in the 2002 report were present in the low water aerial photography. Two dikes (175.3 R, 174.5 R) not identified in the 2002 report were in the low water aerial photography. The three chevrons constructed since 2002 all show evidence of scour hole development behind the structures. Two dikes (182.05 R, 181.85 R) were built in 2011 and show evidence of downstream scour hole formation in more recent surveys. One dike (181.7 L) has been extended. Two dikes (181.7 L, 174.5 L) were notched.

Weirs:

2002:
Bellerive RDB (174.5 to 174) 5 Weirs
Davis Street RDB (172.8 to 172.3) 4 Weirs

2011:
Lacledes Landing LDB (179.9 – 179.6) 3 Weirs
Bellerive RDB (174.5 to 174) 5 Weirs
Davis Street RDB (172.8 to 172.3) 4 Weirs

Chutes:

2002:
None – 0.0 miles/mile

2006:
No change.

Dredging:

73 cuts for a total of 5,861,449 CY:
11 cuts in the center of the channel at RM 184.2 – RM 182.7 for a total of 694,759 CY
14 cuts along the RDB at ~RM 181.5 for a total of 1,467,282 CY
3 cuts in the center of the channel at ~RM 178.1 for a total of 74,899 CY
1 cut in the center of the channel at ~RM 177.6 for a total of 40,871 CY
10 cuts along the RDB at RM 177.1 – RM 175.5 for a total of 324,173 CY
1 cut in the center of the channel at RM 175.6 for a total of 55,313 CY
16 cuts in the center of the channel at ~RM 173.25 for a total of 1,431,090 CY
13 cuts along the RDB at RM 171.9 – RM 170.6 for a total of 1,352,728 CY
4 cuts along the RDBl at RM 169.8 – RM 168.7 for a total of 439,824 CY

Priority:

2002:
1 Star.

2011:

2 Stars. – Need being model with an HSR Model

Conclusions: 2002:
Additional structures absolutely must not affect navigation through this busy stretch of river, especially within the reach with 7 bridge crossings. The 5 existing structures in Dike Field 2 already have additional environmental modifications designed to create an island and side channel complex – see the Jefferson Barracks Micro Model Study Report M17. A portion of this design has already been constructed. No other opportunities exist due to the lack of navigation structures located in the reach.

2011:
Navigation concerns heavily dominate this reach, and thus limit bathymetric and environmental concerns. There have been efforts to include notching and chevrons into construction plans since the last report. A model study is currently ongoing (2012) of this reach and may present an opportunity for testing additional designs as part of navigation improvement work.

REACH 4: CLIFF CAVE, 4.5 MILES (168 TO 163.5)

Map: Appendix B, Figure 4

Characteristics: Straight to Mile 165 and then a gradual 30-degree bend to Mile 163.5
The bluff line is located along the RDB

Slope: Water Surface: 0.55 feet/mile

Width
Bankline: 2000 ft
Channel: 1350 ft

Dikes: 2002:
21 Total Dikes (12 RDB & 9 LDB)
4.7 dikes/mile – 5% notched
Dike Field 1: LDB continuous (168 – 166) 6 Dikes around JB Chute
Dike Field 2: RDB continuous (166.5 – 163.5) 12 dikes, many D/S angled
Dike Field 3: LDB (165 – 164.5) 3 dikes, mainly stub or hard points

2011:
22 Main Channel Structures
12 Dikes along the RDB (166.4 – 163.7)
10 Dikes along the LDB (167.7 – 163.6)
4.9 dikes/mile – 14% Notched

Structure Changes:
One dike (163.6 L) discounted in the 2002 report was present in the low water aerial photography. Two dikes (167.7 L, 167.4 L) were extended.

Weirs: 2002:
Carl Baer LDB (164 – 163.5) 6 Weirs

2011:

No change

Chutes: 2002:
0.27 miles/mile
Jefferson Barracks LDB (167.7 – 166.5) 1 closure

2006:
No change

Dredging: 9 cuts in the center of the channel at ~RM 168 – RM 166.5 for a total of 1,349,713 CY

Priority: 2002:
4 Stars.

2011:
3 Stars. – Additional notching has occurred and constructability is an issue.

Conclusions: 2002:
This is a relatively short reach with only one small side channel. Possible modifications exist in dike fields 1 & 2. Modifications in field 1 and the upper part of field 2 may also have a secondary benefit of reducing maintenance dredging. Field 3 consists mainly of stub dikes.

2011:
Field 1 – High. Opportunities exist around Jefferson Barracks Chute and surrounding dikes. This field was a larger dredging issue in the past that is still active. Fleeting will be an issue.
Field 2 – Medium. There is limited opportunity for dike modification, but the potential for dike construction exists around the sand bar along the lower end of the field.
Field 3 – Low. This is a short field with only three short dikes with fleeting in the vicinity.

REACH 5: KIMMSWICK, 7 MILES (163.5 – 156.5)

Map: Appendix B, Figure 5

Characteristics: Relatively straight throughout the reach.
The bluff line is located along the RDB
The confluence with the Meramec River along the RDB is located at Mile 160.7R

Slope: Water Surface: 0.52 feet/mile

Width Bankline: 2371
Channel: 1271

Dikes: 2002:
26 Total Dikes (4 RDB & 22 LDB)
3.7 dikes/mile – 4% notched
Dike Field 1: LDB Continuous (163 – 156.5) 22 dikes
Dike Field 2: RDB Continuous (160 – 159) 4 dikes

2011:
34 Main Channel Structures
4 Dikes along RDB (159.8 –158.9)
23 Dikes along the LDB (163 – 156.7)
7 Chevrons along the LDB (162.8 – 159.9)
4.9 dikes/mile – 3% Notched

Structure Changes:
Four new dikes (162.1 L, 158.1 R, 157.7 R, 157.3 R) were constructed; the survey revealed a scour hole off the tip of three of the four dikes (157.7 R the lone exception). Seven chevrons were constructed. Four (162.5 L, 160.3 L, 160.0 L, 159.9 L) of the seven chevrons that were constructed demonstrated scour hole development downstream. The three remaining chevrons were not constructed before the survey. One dike (161.9 L) was extended from the root.

Weirs: None

Chutes: 2002:
0.10 miles/mile
Atwood LDB (161.5 – 160.8) 1 closure

2006:
No change

Dredging: 19 cuts for a total of 1,945,141 CY:
4 cuts in the center of the channel at ~RM 162.5 for a total of 277,571 CY
9 cuts along the RDB at RM 161.4 – RM 160.2 for a total of 952,776 CY
6 cuts in the center of the channel at RM 158.3 – RM 156.9 for a total of 714,794 CY

Priority: 2002:
4 Stars.

2011:
3 Stars. – Recent work needs to be evaluated.

Conclusions: 2002:
This is a relatively straight reach with only one small side channel. Possible modifications exist in both dike fields. More possibilities exist in dikes along LDB. A secondary benefit of reducing maintenance dredging may be incurred with modifications to the dikes adjacent to the mouth of the Meramec River. This confluence may contain important spawning habitat for sturgeon.

2011:
Field 1 – Low. Chevron construction and dike modification was recently completed in this field. The results of this work will be evaluated and the field reassessed in future years. Half of the chevrons built in this section exhibit the downstream scour that has been beneficial to habitat diversity.
Field 2 – Medium. Opportunities for modification in this field are limited, but the opportunity exists for island creation downstream of the field. There is a sensitivity issue with the locals in this area.

REACH 6: HERCULANEUM, 7 MILES (156.5 – 149.5)

Map: Appendix B, Figure 6

Characteristics: Very straight reach with the bluff line along the RDB.

Slope: Water Surface: 0.46 feet/mile

Width
Bankline: 1943
Channel: 1271

Dikes:
2002:
29 Total Dikes (12 RDB & 17 LDB)
4.1 dikes/mile – 0% notched
Dike Field 1: LDB continuous (156.5 – 150) 17 dikes
Dike Field 2: RDB continuous (154 – 153) 4 dikes
Dike Field 3: RDB (151.8 – 151.3) 3 dikes
Dike Field 4: RDB continuous (150.6 – 149.5) 5 dikes

2011:
30 Main Channel Structures
18 Dikes along LDB (156.5 – 150)
12 Dikes along RDB (154 – 149.5)
4.3 dikes/mile – 3% notched

Structure Changes:
One dike (150.3 L) discounted in the 2002 report was present in the low water aerial photography. One dike (146.3 L) was notched.

Weirs: None

Chutes:
2002:
None – 0.0 miles/mile

2006:
No change.

Dredging: 4 cuts along the LDB of the channel at ~RM 153 for a total of 142,380 CY

Priority:
2002
5 Stars.

2011:
5 stars.

Conclusions:
2002:
There are no side channels, the reach is straight, and none of the dikes have been modified for environmental enhancement. Because of the reduced contraction line, there are no dredging problems. Therefore, many possible modifications exist.

2011:

Field 1 – High. Herculaneum has a project plan developed and priced under NESP for chevrons and dike modifications as the Prototype Reach. It is awaiting funding. The situation remains the same.
Field 2 – High. Herculaneum has a project plan developed and priced under NESP for chevrons and dike modifications. It is waiting for funding. The situation remains the same.
Field 3 – Low. This is a short field with only three short dikes.
Field 4 – Low. This is a short field with only five short dikes.

REACH 7: CALICO/OSBORNE, 6.5 MILES (149.5 – 143)

Map: Appendix B, Figure 7

Characteristics: Straight to Mile 146 and then a gradual bend to the left then to the right to Mile 143. The bluff line is located along the RDB.

Slope: Water Surface: 0.49 feet/mile

Width:
Bankline: 2043
Channel: 1257

Dikes:

2002:
33 Total Dikes (15 RDB & 18 LDB)
5.1 dikes/mile – 3% notched
Dike Field 1: LDB continuous (149.5 – 143) 18 dikes
Dike Field 2: RDB sporadic (149.5 – 146.3) 5 dikes
Dike Field 3: RDB continuous (145.5 – 143) 10 dikes

2011:
32 Main Channel Structures
16 Dikes along RDB (149.3 – 143)
16 Dikes along the LDB (149.2 – 143.4)
4.9 dikes/mile – 6% Notched

Structure Changes:
Two dikes (149.0 L, 146.25 L) identified in the 2002 report were not visible on the 2006 aerial photography. One dike (146.25 R) discounted in the 2002 report was present in the low water aerial photography. One dike (146.3 L) was notched.

Weirs: None

Chutes:

2011:
0.46 miles/mile
Calico LDB (148.3 – 147.3) 1 closure
Osborne LDB (146.3 – 144.3) 6 closures

2006:
0.46 miles/mile

Calico LDB (148.3 – 147.3) 2 closure (an additional closure was visible in the 2006 aerial photography)
Osborne LDB (146.3 – 144.3) 6 closures

Dredging: 2 cuts in the center of the channel at ~RM 145.5 for a total of 96,056 CY

Priority: 2002:
2 Stars.

2011:
3 Stars. – Island creation poses modification opportunity.

Conclusions: 2002:
Two side channels currently exist in this reach. Because of the reduced contraction line, there are no dredging problems. Therefore, many possible modifications exist. Note: There may be issues with possible lead contamination in this reach.

2011:
Field 1 – High. Numerous opportunities exist for dike modification, and great opportunities exist for habitat complex creation around the chutes.
Field 2 – Low. This is a short field with only five short dikes.
Field 3 – High. Opportunities exist with the adjacent Harlow Island site. This area has been identified as a high priority site for island creation. Any modifications would likely be coupled with an EMP project at Harlow Island.

REACH 8: SALT LAKE, 8.5 MILES (143 – 134.5)

Map: Appendix B, Figure 8

Characteristics: Relatively straight throughout the reach except for a slight bend between Miles 140 and 138. The bluff line is located along the RDB in the downstream portion of the reach.

Slope: Water Surface: 0.53 feet/mile

Width Bankline: 2688
Channel: 1388

Dikes: 2002:
37 Total Dikes (10 RDB & 27 LDB)
4.4 dikes/mile – 8% notched
Dike Field 1: LDB continuous (142.2 – 134.5) 27 dikes
Dike Field 2: RDB sporadic (142.5 – 139.5) 10 dikes, mainly stub

2011:
38 Main Channel Structures
11 Dikes along RDB (142.5 – 134.7)
27 Dikes along the LDB (142.2 – 134.8)
4.5 dikes/mile – 8% notched

Structure Changes:
One dike (134.7 R) discounted in the 2002 report was present in the low water aerial photography.

Weirs: None

Chutes: 2002:
0.35 miles/mile
Salt Lake LDB (139.5 – 136.5) 6 closures

2006:
No change.

Dredging: 1 cut in the center of the channel at ~RM 138.7 for a total of 34,551 CY

Priority: 2002:
3 Stars.

2011:
3 Stars.

Conclusions: 2002:
Although one large side channel currently exists in the reach, there is a general lack of diversity due to the relatively few number of dikes that have been notched. There are no dredging problems therefore many possible modifications exist. More possibilities exist in dike field 1 due to the number and length of these dikes. Dike modifications for the enhancement of Salt Lake Chute have been designed – see the Salt Lake Chute Micro Model Study Report M16.

2011:
Field 1- High. Opportunities exist in conjunction with work for habitat complex creation at Salt Lake Chute. This site has been proposed for studying with a model soon.
Field 2 – Low. The dikes in this field are typically very short, and as such, any improvements would be on a dike-specific basis.

REACH 9: FORT CHARTRES, 6.5 MILES (134.5 – 128)

Map: Appendix B, Figure 9

Characteristics: The reach consists of three consecutive bends. First there is a bend to the left, then to the right, then back to the left.

Slope: Water Surface: 0.55 feet/mile

Width Bankline: 2257
Channel: 1086

Dikes: 2002:
19 Total Dikes (6 RDB & 13 LDB)
2.9 dikes/mile – 0% notched

Dike Field 1: LDB continuous along Ft Chartres Island (134.5 – 132.5) 6 dikes
Dike Field 2: RDB along Establishment Island (132.5 – 130) 6 dikes
Dike Field 3: LDB continuous (130.5 – 128.5) 7 dikes, many stub

2011:
22 Main Channel Structures
6 Dikes along RDB (132.6 –130.2)
2 Chevrons along the RDB (130 – 129.9)
14 Dikes along the LDB (134.3 – 128.6)
3.4 dikes/mile – 14% notched

Structure Changes:
Two dikes discounted in the 2002 report were present in the low water aerial photography. Two dikes (132.9 R, 132.8 R) were removed. The dike at RM 132.5 R was extended both, of the root and rootless. Two chevrons (130.0 R, 129.9 R) were constructed. One new dike constructed at RM 132.6 R in 2006; the survey suggested a scour hole had developed off the tip of the dike. Neither of the chevrons constructed along the RDB show evidence of scour hole development behind the structure.

Weirs: Establishment RDB (133) 4 Weirs
Fort Chartres LDB (131 – 130) 9 Weirs

Chutes: 2002:
0.69 miles/mile
Fort Chartres LDB (134.5 – 132.3) 1 closure
Establishment RDB (132.5 – 130.2) 5 closures

2006:
0.66 miles/mile
Fort Chartres LDB (134.3 – 132.3) 1 closure
Establishment RDB (132.5 – 130.2) 5 closures

Dredging: 11 cuts in the center of the channel at ~RM 130 – RM 129 for a total of 1,767,341 CY

Priority: 2002:
2 Stars.

2011:
1 Star. – Recent GP for side channel enhancement at Establishment.

Conclusions: 2002:
Two side channels currently exist in the reach. Some possibilities exist in dike field 1. Many possibilities exist in dike field 2, especially within the bar in front of Establishment and Schmidts Islands. Modifications in dike field 3 may have the secondary benefit of reducing maintenance dredging in the crossing.

2011:
Field 1 – Medium. There are six dikes in this field, but they are shorter. This field encompasses Fort Chartres Chute.

Field 2 – Low. This field was the site of a recently completed HSR model study (2012) with a GP moving forward with construction. The recommended alternative would lead to the creation of a Side Channel Enhancement Dike (SCED) with the intended purpose of sending additional flow down the side channel, decreasing sedimentation in the channel promoting scour off downstream structures.
Field 3 – Medium. There are limited opportunities among the existing dikes; any dike work in this field would likely involve new construction. The opportunity for island creation exists among the existing dikes.

REACH 10: STE. GENEVIEVE, 8.5 MILES (128 – 119.5)

Map: Appendix B, Figure 10

Characteristics: A gradual bend to the left then right between Miles 128 and 123, then straight to Mile 122, then a sharp bend to the left to Mile 120.

Slope: Water Surface: 0.54 feet/mile

Width
Bankline: 2038
Channel: 1063

Dikes:
2002:
34 Total Dikes (14 RDB & 20 LDB)
4.0 dikes/mile – 9% notched
Dike Field 1: LDB continuous (125.5 – 119.5) 20 dikes
Dike Field 2: RDB continuous (125 – 122.5) 12 dikes
Dike Field 3: RDB (121.4 – 121.2) 2 trail dikes

2011:
36 Main Channel Structures
15 Dikes along RDB (124.9 – 121.2)
21 Dikes along the LDB (126.6 – 120.2)
4.2 dikes/mile – 17% Notched

Structure Changes:
Two dikes (125.3 L, 121.45 R) discounted in the 2002 report were present in the low water aerial photography. Three dikes (130.2 R, 130.05 R, 129.9 R) were notched.

Weirs: Ste. Genevieve RDB (120.8 – 119.8) 10 Weirs

Chutes:
2002:
0.32 miles/mile
Moro LDB (122.7 – 120) 2 closures

2006:
No change.

Dredging: 14 cuts for a total of 1,505,305 CY:
10 cuts along the LDB and channel center at ~RM 126.5 – RM 125 for a total of 1,221,144 CY

4 cuts along the LDB and channel center at ~RM 122 – RM 121 for a total of 284,191 CY

Priority: 2002:
1 Star.

2011:
2 Stars. Opportunity for additional work with HSR model.

Conclusions: 2002:
The reach currently has one large side channel complex. The dike at the exit to Moro Chute is scheduled for notching. Areas between Miles 126 and 122 have been identified as habitat for the endangered Pallid Sturgeon. Therefore, modifications are not recommended until additional monitoring is completed. The greatest possibilities exist in dike fields 1 & 2, which secondarily may reduce the repetitive dredging in the crossing.

2011:
Field 1 – Medium. Opportunities exist with dikes at the lower end of the field. Additional work is possible with Moro Chute. This site has been proposed for studying with a model soon.
Field 2 – Medium. Opportunities exist in this field, but the dikes are shorter and the presence of pallid sturgeon is a concern that could lower the ability to work in the field.
Field 3 – Low. This is a small field with no real opportunities.

REACH 11: KASKASKIA, 10 MILES (119.5 – 109.5)

Map: Appendix B, Figure 11

Characteristics: Straight to Mile 117.5, then a severe 70-degree bend to the right to Mile 116.5, then straight to Mile 114, then a slight bend to the left to Mile 112, then straight to Mile 109.5. The confluence with the Kaskaskia River is located along the LDB at Mile 117.5L. The bluff line is located along the LDB.

Slope: Water Surface: 0.54 feet/mile

Width Bankline: 2210
Channel: 1220

Dikes: 2002:
53 Total Dikes (35 RDB & 18 LDB)
5.3 dikes/mile – 6% notched
Dike Field 1: RDB continuous (119.5 – 116) 16 dikes
Dike Field 2: LDB continuous (116 – 111) 18 dikes
Dike Field 3: RDB continuous (114.5 – 112.5) 10 dikes
Dike Field 4: RDB continuous (111.5 – 110) 9 dikes

2011:
Three dikes (113.9 R, 113.5 R, 113.2 R) were extended.

Weirs: Kaskaskia LDB (117 – 116) 11 Weirs

Since 2002 – Kaskaskia LDB (117.2) 1 Weirs

Chutes: 2002:
0.20 miles/mile
Kaskaskia RDB (118 – 116) 1 closure

2006:
0.21 miles/mile
Beaver Island Complex (two channels) RDB (117.8 – 115.7) 5 closures

Dredging: 9 cuts for a total of 2,210,101 CY:
2 cuts in the center of the channel at ~RM 117.5 for a total of 197,150 CY
2 cuts in the center of the channel at ~RM 115.5 for a total of 347,307 CY
5 cuts along the RDB at RM 113.4 – RM 112.4 for a total of 1,665,644 CY

Priority: 2002:
2 Stars.
2011:
3 Stars. - Many dikes in the reach with little modification.

Conclusions: 2002:
Environmental modifications have already been designed for the dikes at the lower end of Beaver Island. It is recommended that this work be completed and monitored before additional enhancements are designed. Other possibilities exist in all dike fields, especially with those dikes in front of Beaver Island, which may also provide a secondary benefit of reducing dredging between Miles 113 and 112. There are many dikes in this reach and only a few have been modified for environmental enhancement. The area also seems to provide important habitat for sturgeon.

2011:
Field 1 – High. Little opportunity exists at the upper end of the field, but there are opportunities associated with Kaskaskia Chute and Beaver Island.
Field 2 – Medium. Work was completed in this field within the last five years that needs further evaluation. Opportunities exist in the downstream section of the field, but pallid sturgeon presence is a concern.
Field 3 – Low. There are a number of dikes in this reach, but they are shorter and have accreted.
Field 4 – Medium. The channel is aligned with the beginning of the field, promoting beneficial development with structure modification.

REACH 12: MILE 100 ISLANDS, 14.5 MILES (109.5 – 95)

Map: Appendix B, Figure 12

Characteristics: Straight to Mile 108, then a slight bend to the left then to the right between Miles 108 and 106, then straight to Mile 104, then another slight bend to the right then to the left between Miles 104 and 102, then straight to Mile 98.5, then a moderate 80 degree bend to the right to Mile 95. The LDB at the upstream end of the reach is located along the bluff line.

Slope: Water Surface: 0.55 feet/mile

Width
Bankline: 3307
Channel: 1086

Dikes:
2002:
54 Total Dikes (43 RDB & 11 LDB)
3.7 dikes/mile – 28% notched
Dike Field 1: RDB continuous (108.7 – 102.5) 28 dikes
Dike Field 2: LDB (106.6 – 105.6) 4 dikes
Dike Field 3: LDB continuous (104 – 102) 7 dikes
Dike Field 4: RDB continuous (101 – 96) 15 dikes

2011:
72 Main Channel Structures
48 Dikes along RDB (108.7 – 96.2)
4 Chevrons along the RDB (104.4 – 103.4)
17 Total Dikes along the LDB (106.5 – 95.2)
3 Chevrons along the LDB (100.1 – 99.9)
5.0 dikes/mile – 25% Notched

Structure Changes
Seven chevrons have been constructed. Eleven dikes discounted in the 2002 report were present in the low water aerial photography. All of the chevrons constructed show evidence of scour hole development behind the structure. Two dikes (106.2 L, 105.9 L) have had sections disconnected from the dike root. Two rootless dike extensions (96.8 R, 96.6 R) were constructed. Three notches were constructed.

Weirs:
2002:
None

2011:
Weir 103.2 L

Chutes:
2002:
0.58 miles/mile
Crains RDB (105 – 104) 0 closures
Liberty LDB (103 – 100) 3 closures
Strauser RDB (100 – 98.8) island complex 5 closures
Jones RDB (98.2 – 95) 3 closures

2006:
0.61 miles/mile
Crains RDB (105.7 – 104) 6 closures
Liberty LDB (102.7 – 100) 3 closures
Strauser RDB (100 – 98.8) dike and island complex
Jones RDB (98.2 – 95) 2 closures

Dredging:
30 cuts for a total of 7,220,966 CY:
14 cuts in the center of the channel at RM 104.1 – RM 101.8 for a total of 4,922,249 CY
6 cuts in the center of the channel at RM 100.3 – RM 99 for a total of 601,448 CY

2 cuts in the center of the channel at ~RM 97.6 for a total of 273,570 CY
8 cut in the center of the channel at RM 96.8 – 95.8 for 1,423,699 CY

Priority: 2002:
1 Star.

2011:
1 Star.

Conclusions: 2002:
Most of the reach is very diverse with multiple islands and side channels. Approximately 28% of the existing dikes in this reach have already been notched. Three dikes on the LDB just downstream of the mouth of Mary's River (106.5 L) are scheduled for notching. Other possibilities exist in dike field 1 where diversity is the lowest of the 4 fields. A secondary benefit of these alterations may be a reduction of dredging in the crossings between Miles 103 & 102 and 100 & 99.5. Modifications may also be beneficial in the dike field 4, in front of Liberty Bar and Jones Towhead, which may also secondarily reduce dredging between Miles 97 & 96.

2011:
Field 1 – Medium. This field was the site of the Waters Landing HSR model study and GP. There has been significant accretion in this dike field. Opportunities for dike alteration exist associated with the Crains Island complex. It is recommended that the site be re-evaluated after the Waters Landing structures have their full effect.
Field 2 – Medium. This is a short field that already contains notches in the field. However, the area is ripe for large island creation and improving Mary's Island river connectivity. Any additional dike work would likely be due to extension of the field upstream.
Field 3 - Medium. Limited opportunities exist in the field, but better separation of the sandbar at the downstream end of the field could be better separated from Rockwood Island. Dredging remains an issue in this field.
Field 4 – Medium. Work has been done in this field both with ARRA funding and as part of the Red Rock contract. The lower end of this field still presents an opportunity for enhancements. This field should be re-evaluated when all the effects of all recent work reaches equilibrium

This has been an incredibly active repetitive maintenance dredging location. Only one additional dike was notched in the period between reports, but chevrons and rootless dikes have been constructed between the side channel sections.

REACH 13: RED ROCK TO TOWER ROCK, 15 MILES (95 – 80)

Map: Appendix B, Figure 13

Characteristics: Severe 60-degree bend to the left between Miles 95 and 93.5 where the river intersects the Missouri bluff line (Red Rock at Mile 94.5R) at the same angle, then relatively straight for 9 miles before a severe 80-degree bend to the right between Miles 85.5 and 83 where the river intersects the Illinois bluff line (Fountain Bluff at Mile 83.7L), then straight to the Devil's Bake Oven rock outcrop (Mile 81L), then a bend to the left to the Tower Rock (Mile 80R) outcrop.

Several bedrock controls are located this reach where 4 rock bluff lines severely intersect the river bankline and bottom. The river does not migrate away from a rock bluff line in this reach.

Slope: Water Surface: 0.54 feet/mile

Width
Bankline: 2163
Channel: 1225

Dikes:
2002:
35 Total Dikes (14 RDB & 21 LDB)
2.3 dikes/mile – 0% notched
Dike Field 1: LDB Continuous (93 – 91.5) 6 dikes
Dike Field 2: RDB Continuous (91.5 – 90.5) 6 dikes
Dike Field 3: LDB Continuous (89.5 – 85) 15 dikes
Dike Field 4: RDB Continuous (86.5 – 85) 8 dikes

2011:
48 Main Channel Structures
18 Total Dikes along RDB (94.6 – 85.05)
1 Chevron along the RDB (90.4)
26 Total Dikes along the LDB (106.5 – 95.2)
3 Chevrons along the LDB (89.55 – 82)
3.2 dikes/mile – 8% Notched

Structure Changes:
Five dikes discounted in the 2002 report were present in the low water aerial photography. Four new dikes (93.3L, 93.1L, 81.85, 81.65) were constructed in the reach. All dikes show evidence of scour occurring of the tips of the dikes. Four new chevrons (90.4 R, 89.55 L, 89.15 L, 82.0 L) were constructed in the reach. All four chevrons exhibited scour. Four notches were constructed. Rootless extensions were constructed off of three dikes (93.0 L, 89.3 L, 89.0 L). Two dikes (89.3 L, 89.0 L) were extended.

Weirs:
Red Rock RDB (95 – 93.7) 9 Weirs
Fountain Bluff LDB (84 – 83) 10 Weirs
Since 2002 – Fountain Bluff RDB (82.5 - 82.4) 2 Weirs

Chutes:
2002:
0.15 miles/mile
Owl Creek Bar RDB (84.8 – 82.5) 17 Hard Points along bankline

2006:
No change.

Dredging:
21 cuts for a total of 1,870,202 CY:
3 cuts in the center of the channel at RM 99.8 – RM 94.3 for a total of 242,236 CY
4 cuts in the center of the channel at RM 93.4 – RM 92 for a total of 480,748 CY
4 cuts in the center of the channel at RM 82.6 – 81.2 for a total of 273,570 CY
10 cuts in the center of the channel at ~RM 80.3for 908,377 CY

Priority: 2002:
5 Stars.

2011:
4 Stars. Dike construction, chevron construction, and notching have occurred and construction warrants further monitoring.

Conclusions: 2002:
This is a very unique reach with numerous bedrock bluffs and controls but without a significant backwater or side channel. The two weir fields and the hard points at Owl Creek Bar provide the only diversity. This reach has been repeatedly identified as a reach that requires biological enhancement. Good possibilities exist between miles 93 and 85 where many dikes exist but only very minimal dredging occurs and the RDB is firmly against the rock bluff line. New environmental structures could be placed between miles 82 and 81 where the banks widen. These structures may have a secondary benefit of reducing the repetitive dredging in this area.

2011:
Field 1 – Low. A number of these dikes were extended and notched in 2010 and 2011. Some opportunity still remains. It is recommended that the recent work be monitored and revisited at a future time.
Field 2 - Medium. Work was completed in this field under the Biological Opinion program. Evaluation of this work is ongoing.
Field 3 - Medium. Work was completed in this field under the Biological Opinion program. Evaluation of this work is ongoing.
Field 4 – Medium. Little opportunity in this field among the existing dikes, but extension of the field to isolate the Owl Creek sandbar from the mainland would have significant benefit.

This remains a reach with potential. This reach continues to require repetitive maintenance dredging, but the LDB between RM 90 – 85 remains a possibility for alteration. The Owl Creek side channel remains mostly closed, and may be an opportunity for further rehabilitation.

REACH 14: BIG MUDDY, 9 MILES (80 – 71)

Map: Appendix B, Figure 14

Characteristics: A slight bend to the right between Miles 80 and 78, then a gradual bend to the left to Mile 76.5,then straight to Mile 73.5, then a another slight bend to the left to Mile 72.5, then straight to Mile 71. The bluff line is located along the RDB.
The confluence with the Big Muddy River is located along the LDB at Mile 75.6L

Slope: Water Surface: 0.61 feet/mile

Width Bankline: 2525
Channel: 1050

Dikes: 2002:
35 Total Dikes (8 RDB & 27 LDB)

3.9 dikes/mile – 11% notched
Dike Field 1: LDB (79.3 – 79) 2 small dikes
Dike Field 2: LDB continuous (78.2 – 71) 25 dikes
Dike Field 3: RDB sporadic (79.5 – 71) 8 dikes, scattered throughout reach

2011:
38 Main Channel Structures
7 Total Dikes along RDB (75.5 – 71)
31 Total Dikes along the LDB (79.5 - 71)
4.2 dikes/mile – 16% Notched

Structure Changes:
Four dikes (79.5 L, 75.3 L, 74.1 L, 71.3 R) discounted in the 2002 report were present in the low water aerial photography. One dike (71.0 R) that was counted in the 2002 report was considered to be in the next reach. Two dikes (75.5 L, 75.2 L) were notched. Three rootless extensions (72.4 L, 72.1 L, 71.9 L) were constructed.

Weirs: None

Chutes: 2002:
0.48 miles/mile
Cottonwood RDB (79.5 – 77.5) 0 closures
Crawford LDB (73.8 – 71.5) 0 closures

2006:
0.47 miles/mile
Cottonwood RDB (79.3 – 77.5) 0 closures
Crawford LDB (73.8 – 71.4) 0 closures

Dredging: 25 cuts for a total of 2,241,165 CY:
17 cuts in the center of the channel at RM 79.7 – RM 74.7 for a total of 1,483,978 CY
8 cuts in the center of the channel at RM 73.4 – RM 71.7 for a total of 757,187 CY

Priority: 2002:
2 Stars.

2011:
1 Star. – Additional notching has been done.

Conclusions: 2002:
Two side channels currently exist in the reach. The Cottonwood Chute may be the deepest and most functional side channel on the Middle Mississippi River. Two dikes on the LDB just downstream of the mouth of the Big Muddy River have recently been notched. The greatest possibilities for alterations exist mainly within dike field 2.

2011:
Field 1 – Low. This is a short field with only three short dikes.
Field 2 – High. Recent work has been done, with additional work planned around Crawford Towhead in FY13. Further work and opportunities for habitat enhancement exist below Big Muddy Island and near Crawford Towhead.

Field 3 – Low. While this is a long field, it contains only a few dikes with limited opportunities.

REACH 15: TRAIL OF TEARS, 8.5 MILES (71 – 62.5)

Map: Appendix B, Figure 15

Characteristics: A slight bend to the left to Mile 69, then straight to Mile 66, then a slight bend to the right to Mile 64, then straight to Mile 62.5. The bluff line is located along the RDB.

Slope: Water Surface: 0.59 feet/mile

Width
Bankline: 2300
Channel: 1411

Dikes:
2002:
53 Total Dikes (22 RDB & 31 LDB)
6.2 dikes/mile – 25% notched
Dike Field 1: LDB continuous (71 – 62.5) 31 dikes, stubby near D/S end
Dike Field 2: RDB continuous (71 – 69) 5 dikes
Dike Field 3: RDB continuous (67.5 – 62.5) 17 dikes

2011:
55 Main Channel Structures
23 Dikes along RDB (70.7 – 62.5)
32 Dikes along the LDB (70.6 – 62.5)
6.5 dikes/mile – 24% Notched

Structure Changes:
One dike (69.8 L) discounted in the 2002 report were present in the low water aerial photography. One dike (71.0 R) was included in this reach that had been included in another reach in the 2002 report.

Weirs: Hanging Dog LDB (70.5 – 70) 5 Weirs

Chutes:
2002:
None – 0.0 miles/mile

2006:
0.04 miles/mile
Vancill Towhead LDB (67.7 – 67.4)

Dredging:
20 cuts for a total of 2,929,416 CY:
6 cuts in the center of the channel at RM 71.2 – RM 69.0 for a total of 655,279 CY
10 cuts in the center of the channel at RM 68.0 – RM 67.1 for a total of 1,896,350 CY
3 cuts in the center of the channel at RM 66.2 – 65.2 for a total of 305,559 CY
1 cuts in the center of the channel at ~RM 64.0 for 72,228 CY

Priority:
2002:
5 Stars.

2011:
5 Stars.

Conclusions: 2002:
This is a relatively straight reach without a side channel. Possibilities exist within all dike fields. Modifications between miles 68 and 67 may be able to establish a side channel where the banklines widen near the bar at Vancill Towhead. This may also have a secondary benefit of improving depths in the navigation channel thereby reducing dredging. This area provides an excellent opportunity that should not be overlooked, but is at the current time the Biological Monitoring area for the NESP project at Herculaneum (RM 68.5 – 64.5).

2011:
Field 1 – High. This field is being modeled as part of the Vancill Towhead HSR model. The possibility for island creation exists in this field.
Field 2 – Medium. This field is being modeled as part of the Vancill Towhead HSR model.
Field 3 – High. There are opportunities for island creation through dike modification and placement, though no construction is planned at this time.

This remains an active dredging area with no construction efforts outside of weir restoration. A currently ongoing (2012) HSR model study is examining alternatives to alleviate maintenance dredging and presents an opportunity for habitat-beneficial construction.

REACH 16: SCHENIMANN/PICAYUNE, 8.5 MILES (62.5 – 54)

Map: Appendix B, Figure 16

Characteristics: Straight to Mile 61.5, then a slight bend to the right to Mile 60.5, then straight to Mile 59, then a 70 degree bend to the right to Mile 57, then straight to Mile 55.5, then a 40 degree bend to the left caused by the Cape Rock outcrop (Mile 54R). The only bluff line is located at the end of the reach at Cape Rock.

Slope: Water Surface: 0.57 feet/mile

Width
Bankline: 5700
Channel: 1050

Dikes: 46 Total Dikes (23 RDB & 23 LDB)
5.4 dikes/mile – 9% notched
Dike Field 1: LDB continuous (62.5 – 60.5) 11 dikes
Dike Field 2: RDB continuous (62.5 – 57) 19 dikes, bordering Schenimann Chute
Dike Field 3: LDB sporadic (59 – 54.5) 12 dikes, mostly stub
Dike Field 4: RDB continuous (56.5 – 55.8) 4 dikes

2011:
49 Main Channel Structures
25 Total Dikes along RDB (62.2 – 55.8)

24 Total Dikes along the LDB (62.2 – 54.8)
5.8 dikes/mile – 12% Notched

Structure Changes:
Three dikes (60.6 R, 60.2R, 56.3 L) discounted in the 2002 report were present in the low water aerial photography. Three (62.2 R, 55.2 L, 54.8 L) notches were constructed.

Weirs: Picayune LDB (58 – 56) 14 Weirs
Upper Cape Rock RDB (55 – 54.5) 4 Weirs

Chutes: 2002:
1.38 miles/mile
Schenimann RDB (62.5 – 57) 5 closures
Picayune LDB (61 – 54.8) 2 closures

2006:
1.33 miles/mile
Schenimann RDB (62.4 – 57) 9 closures
Picayune LDB (60.7 – 54.8) 3 closures

Dredging: 7 cuts for a total of 2,558,436 CY:
4 cuts in the center of the channel at RM 59.2 – RM 57.7 for a total of 505,523 CY
3 cuts in the center of the channel at ~RM 55.0 for a total of 363,903 CY

Priority: 2002:
2 Stars.

2011:
2 Stars.

Conclusions: 2002:
Two lengthy side channels currently exist in this reach. Environmental enhancements are scheduled to be constructed in Schenimann Chute – see the Schenimann Chute Micro Model Study Report M15. Possibilities mostly exist in dike field 1, 2, and 4. Dike field 3 consists of mainly stub dikes. Modifications should be made to the structures located at the lower end of Schenimann Island to maintain the small backwater chutes that exist here. These modifications could also have a secondary benefit of reducing the repetitive dredging that occurs in the channel crossing adjacent to the backwater areas.

2011:
Field 1 – Medium. Localized opportunities exist for dike-specific modifications. The bar adjacent to the mouth of Picayune Chute, however, has great opportunity for better separation and access to the chute.
Field 2 – High. Further work is on hold as effects of recent ARRA work are still being realized with monitoring planned. Long-term, this site presents a great opportunity for dike habitat enhancement associated with Schenimann Chute habitat complex development.
Field 3 – Low. This field contains a number of shorter dikes.
Field 4 – Low. This is a short field with only four short dikes.

Additional notching has been done in this reach since 2002. Dredging has occurred in the past, but not in 2010 or 2011, not to the extent of other reaches, and mainly in channel bends.

REACH 17: CAPE GIRARDEAU, 8 MILES (54 – 46)

Map: Appendix B, Figure 17

Characteristics: Straight to Mile 53, then a 40-degree bend to the left to Mile 52, then straight along the RDB bluff line and the City of Cape to Mile 50, then a 100-degree bend to the left to Mile 48.5, then straight with another bluff line along the RDB to Mile 46.5, then the beginning of a tortuous bend at Grays Point. The bluff line is adjacent to the RDB from the upper end of the reach at Cape Rock through the City of Cape Girardeau. Another bluff line resumes on the RDB after the 100-degree bend.

Slope: Water Surface: 0.58 feet/mile

Width
Bankline: 3244
Channel: 1056

Dikes:
2002:
17 Total Dikes (3 RDB & 14 LDB)
2.1 dikes/mile – 0% notched
Dike Field 1: LDB continuous (53 – 50) 11 dikes
Dike Field 2: RDB (48 – 47) 3 dikes
Dike Field 3: LDB (47.5 – 47) 3 dikes

2011:
19 Main Channel Structures
3 Dikes along RDB (47.9 – 47.2)
16 Dikes along the LDB (53 – 47)
2.4 dikes/mile – 11% Notched

Structure Changes:
Two dikes (49.7 L, 48.6 L) discounted in the 2002 report were present in the low water aerial photography. Two notches (51.0L, 50.6 L) were constructed.

Weirs: Lower Cape Rock RDB (54) 4 Weirs at the Cape Rock protrusion
Cape Bend RDB (49.5 – 48.2) 13 Weirs

Chutes:
2002:
0.31 miles/mile
Marquette LDB (51 – 48.5) 4 closures

2006:
0.41 miles/mile
Marquette LDB (51 – 47.7) 4 closures

Dredging: 18 cuts for a total of 1,152,438 CY:
4 cuts in the center of the channel at RM 53.8 – RM 53.1 for a total of 232,661 CY

2 cuts in the center of the channel at RM 50.2 – RM 49.3 for a total of 268,877 CY
9 cuts in the RDB at RM 48.5 – 47.9 for a total of 436,159 CY
3 cuts in the center of the channel at ~ RM 47.1 for 214,741 CY

Priority: 2002:
3 Stars.

2011:
2 Stars. – Notching has taken place.

Conclusions: 2002:
One large side channel currently exists in the reach and the area may provide important habitat for sturgeon. Although few dikes are available, there are none that are notched. However, modifications to the four dikes near the upstream of Marquette Chute have recently been constructed. These dikes were raised and lengthened to reduce dredging. Two of these dikes will be further modified with environmental notches funded under O&M. Possibilities exist in all dike fields but especially in field 1 where more structures are located. Many alternatives have already been evaluated for Marquette Chute – see Marquette Chute Micro Model Study Report M3.

2011:
Field 1 – High. Opportunities exist in the lower end of the field associated with Marquette Chute. The site has been identified by the Corps's environmental partners as an area of interest.
Field 2 – Low. This is a short field with only three short dikes and fleeting in the vicinity.
Field 3 – Medium. Opportunities exist associated with the exit of Marquette Chute.

The only construction activity in this reach has been dike notching. Dredging is scattered in this reach with the largest portion being at SEMO Port.

REACH 18: THEBES, 11MILES (46 – 35)

Map: Appendix B, Figure 18

Characteristics: Extremely tortuous 110-degree bend to the right at Gray's Point (Mile 46R) at the beginning of Thebes Gap or the Grand Chain, then straight to Mile 44.5, then a 40 degree bend to the left to Mile 43, then relatively straight to Mile 37, then a slight bend to the left to Mile 36, then straight to Mile 35. The Thebes Gap is a 6-mile long bedrock controlled geologic feature with bluff lines located along both riverbanks from Gray's Point to the head of Burnham Island and Sante Fe Chute at Mile 40. Water surface slopes are almost double the average of 0.5 foot/mile in this reach. Downstream of this structure is an alluvial valley without rock outcroppings.

Slope: Water Surface: 0.57 feet/mile

Width Bankline: 3780
Channel: 1160

Dikes: 45 Total Dikes (23 RDB & 22 LDB)
4.1 dikes/mile – 2% notched

Dike Field 1: RDB continuous (44.5 – 43.5) 4 dikes
Dike Field 2: LDB continuous (43 – 39.5) 9 dikes
Dike Field 3: RDB continuous (42 – 37.5) 19 dikes
Dike Field 4: LDB continuous along Burnham Island (38.5 – 35) 13 dikes

2011:
54 Main Channel Structures
27 Total Dikes along RDB (44.9 – 35)
23 Total Dikes along the LDB (45.9 – 35)
4 Chevrons along the LDB (36.7 – 35.9)
49.9 dikes/mile – 4% Notched

Structure Changes
Three dikes (40.6 R, 37.7 L, 35.7 L) discounted in the 2002 report were present in the low water aerial photography. Three new dikes (44.9 R, 44.7 R, 35.1 R) and four new chevrons (36.7 L, 36.5 L, 36.2 L, 35.9 L) were constructed. Three of the four chevrons exhibit scour behind the structure in the 2010; the area behind the fourth structure was not surveyed due to the presence of rootless trail dikes. One dike (35.0L) that was included in this reach in the 2002 report was included in another reach. One dike (39.6 L) was notched.

Weirs: Since 2002 – LDB (39.6) 1 Weir

Chutes: 2002:
0.64 miles/mile
Thebes Chute LDB (42 – 39.5)
Sante Fe LDB (39.5 – 35) 1 closure & 7 hard points

2006:
0.63 miles/mile
Rock Island LDB (45.8 – 45.5)
Thebes Chute LDB (41.7 – 39.5)
Santa Fe LDB (39.5 – 35.1)

Dredging: 27 cuts for a total of 3,076,552 CY:
9 cuts in the center of the channel at RM 46.2 – RM 43.9 for a total of 645,850 CY
14 cuts in the center of the channel at RM 42.2 – RM 38.1 for a total of 1,863,680 CY
4 cuts in the center of the channel at RM 36.6 – RM 35.1 for a total of 567,022 CY

Priority: 2002:
4 Stars.

2011:
4 Stars.

Conclusions: 2002:
Several dikes in this reach are scheduled for modifications to reduce dredging. The small and relatively unnoticed Thebes Chute could be enhanced with further modifications. Seven hard points were constructed in Sante Fe Chute in 1997. – See Sante Fe Micro Model Study Report M1. Possibilities may exist in all dike fields although intended

results may not be met in the areas of rock outcrops. The rock outcrops may control most of the modifications to the reach.

2011:
Field 1 – Low. This is a short field with dike-specific opportunities.
Field 2 – High. Offset dikes are currently planned for construction in this field. Potential for habitat enhance,ent remains associated with Santa Fe chute.
Field 3 – Low. The construction of offset dikes is planned for the dikes from RM 39.4 to RM 38.6 in FY12. The majority of the remaining dikes in the field are short and limit the opportunity for enhancement.
Field 4 – Low. Recent work was completed in this field, including the construction of three chevrons and the introduction of the runway chevron.

Numerous structures in this reach have undergone restoration but little notching (possibly due to the rock mentioned previously. Dredging remains an issue, especially near the entrance to Santa Fe Chute.

REACH 19: PRICES, 6 MILES (35 – 29)

Map: Appendix B, Figure 19

Characteristics: A long bend to the right of 50 degrees to Mile 32.5, then straight to Mile 31, then a sharp 80-degree bend to the left to Mile 30, then straight to Mile 29.

Slope: Water Surface: 0.55 feet/mile

Width
Bankline: 2671
Channel: 1029

Dikes:
2002:
15 Total Dikes (7 RDB & 8 LDB)
2.5 dikes/mile – 0% notched
Dike Field 1: RDB sporadic (35 – 32) 7 dikes
Dike Field 2: LDB continuous (32 – 31) 8 dikes, mainly D/S angled

2011:
19 Main Channel Structures
6 Dikes along RDB (34.8 – 32)
3 Chevrons along RDB (32.8 – 32.4)
10 Dikes along the LDB (34.2 – 31.1)
3.2 dikes/mile – 0% Notched

Structure Changes:
Two dikes (34.1 L, 32.2 L) discounted in the 2002 report were present in the low water aerial photography. One dike (35.1 R) was counted in this reach in 2002 despite being outside the reach. Three chevrons (32.8 R, 32.6 R, 32.4R) were constructed. All three chevrons show evidence of downstream scour hole formation.

Weirs: Prices RDB (30.5 – 29.5) 9 Weirs

Chutes: 2002:
0.45 miles/mile
Billings RDB (34 – 33.3) 0 closures
Bumgard Bar LDB (31 – 29) 5 hard points

2006:
0.42 miles/mile
Billings RDB (34 – 33.3) 0 closures
Bumgard Bar LDB (31.1 – 29.3) 5 hard points

Dredging: 16 cuts for a total of 1,741,942 CY:
3 cuts in the center of the channel at RM 34.5 – RM 33.4 for a total of 544,689 CY
7 cuts in the center of the channel at RM 32.9 – RM 31.7 for a total of 706,161 CY
6 cuts in the center of the channel at RM 31.7 – RM 30.6 for a total of 491,092 CY

Priority: 2002:
2 Stars.

2011:
2 Stars.

Conclusions: 2002:
Two side channels currently exist in the reach. Although currently there are not any notched dikes, there are only a small number of dikes that are available for modifications. Possibilities exist in both dike fields. However, the alterations could have a secondary benefit of reducing repetitive dredging in the crossing between Miles 31.5 and 30.5.

2011:

Field 1 – Medium. Three chevrons were constructed in the lower end of this field, but opportunities remain in the upper end of this field through construction and enhancement.
Field 2 – Medium. This area is currently being studied with the Bumgard Island HSR model.

No notches have been constructed, but three chevrons have been built that show evidence of downstream scour. Dredging remains an issue between RM 33 – 30.5.

REACH 20: DOGTOOTH, 9 MILES (29 – 20)

Map: Appendix B, Figure 20

Characteristics: Straight to Mile 26.5, then a slight bend to the right to Mile 25.5, then straight to Mile 24.5, then a severe 180-degree bend to the left to Mile 20.

Slope: Water Surface: 0.61 feet/mile

Width Bankline: 3350
Channel: 938

Dikes:

2002:
27 Total Dikes (10 RDB & 17 LDB)
3.0 dikes/mile – 4% notched
Dike Field 1: LDB (28 – 27) 4 dikes
Dike Field 2: RDB continuous (27.6 – 25) 10 dikes
Dike Field 3: LDB continuous (25.5 – 24) 10 dikes, all D/S angled
Dike Field 4: LDB (21.6 – 20.5) 3 dikes

2011:
32 Total Structures
12 Total Dikes along RDB (27.6 – 24.6)
19 Total Dikes along the LDB (28 – 20.5)
1 Chevron along the LDB (21.8)
3.6 dikes/mile – 3% Notched

Structure Changes:
One dike (24.6 R) discounted in the 2002 report was present in the low water aerial photography. One dike (23.3 R) not identified in the 2002 report was in the low water aerial photography. Two new dikes (22.1 L, 21.4 L) were constructed. One chevron (21.8) was constructed. The three new structures were constructed in 2011 and have yet to be re-surveyed.

Weirs:

Dogtooth RDB (24 – 22.5) 13 Weirs

Chutes:

2002:
0.49 miles/mile
Buffalo RDB (26.2 – 24.8) 1 closure
Browns LDB (24.5 – 21.5) 2 closures

2006:
0.48 miles/mile
Buffalo RDB (26.1 – 24.7) 1 closure
Browns LDB (24.8 – 21.9) 2 closures

Dredging:

18 cuts for a total of 4,683,743 CY:
6 cuts in the center of the channel at RM 11.7 – RM 10.9 for a total of 1,706,545 CY
5 cuts along the RDB at RM 25.0 – RM 23.9 for a total of 1,366,953 CY
6 cuts in the center of the channel at RM 22.5 – RM 21.3 for a total of 1,483,292 CY
1 cut in the center of the channel at ~RM 20.5 for 126,593 CY

Priority:

2002:
2 Stars.

2011:
2 Stars.

Conclusions:

2002:
Few dikes currently contain notches; however, many possibilities exist for environmental enhancement in all dike fields. The alterations could have a secondary benefit of reducing repetitive dredging in the crossing between Miles 25 and 24.

2011:
Field 1 – Medium. This is a short field with four short dikes. This field is just downstream of a proposed flexible pipe location, and the field could be extended to support the use of the flexible pipe.
Field 2 – High. Opportunities exist for habitat complex development associated with Buffalo Chute and Browns Bar. Work in this field could affect the Buffalo Chute project.
Field 3 – Low. There are opportunities in this field associated with Browns Bar, but the area is considered sensitive and any work in the field would need to be modeled.
Field 4 – Low. Recent work was completed in this field.

The situation remains largely the same. This reach remains a considerable dredging reach that has resisted solutions despite a model study being done.

REACH 21: THOMPSON, 8 MILES (20 – 12)

Map: Appendix B, Figure 21

Characteristics: Straight to Mile 18, then a severe 180-degree bend to Mile 12.

Slope: Water Surface: 0.32 feet/mile

Width
Bankline: 2422
Channel: 1078

Dikes:
2002:
25 Total Dikes (20 RDB & 5 LDB)
3.1 dikes/mile – 20% notched
Dike Field 1: RDB continuous (19.7 – 16.7) 12 dikes, many D/S angled
Dike Field 2: RDB continuous (15.5 – 13.5) 8 dikes
Dike Field 3: LDB continuous (13.7 – 13) 5 dikes, most with trails

2011:
30 Main Channel Structures
23 Dikes along the RDB (19.7 – 13.4)
7 Dikes along LDB (16.9 – 13.1)
3.8 dikes/mile – 17% Notched

Structure Changes:
Two dikes (16.0 R, 14.3 R) discounted in the 2002 report were present in the low water aerial photography. Three dikes (16.9 L, 16.8 L, 13.4 R) not identified in the 2002 report were present in the low water aerial photography. Two of the dikes appeared to be partially removed for the installation of a weir field but are still evident; the third previously unidentified structure was a pile dike present in 1950s hydro books.

Weirs: Scudders LDB (17.3 – 16.7) 10 Weirs

Chutes: 2002:
0.71 miles/mile
Thompson RDB (19 – 15.8) 0 closures (disconnected from U/S end)
Sister RDB (14.5 – 12) 2 closures

2006:
0.68 miles/mile
Thompson RDB (18.7 – 15.8) 0 closures (disconnected from U/S end)
Sister RDB (14.4 – 11.9) 3 closures

Dredging: 9 cuts for a total of 1,855,230 CY:
7 cuts along the LDB at RM 16.2 – RM 14.7 for a total of 1,496,092 CY
2 cuts in the center of the channel at RM 14.1 – RM 13.3 for a total of 359,138 CY

Priority: 2002:
1 Star.

2011:
1 Star.

Conclusions: 2002:
Two side channels currently exist in this reach and 20% of the dikes are already notched. Opportunities for environmental enhancements exist in all dike fields. A secondary benefit of environmental alterations may be a reduction of repetitive dredging along the LDB throughout much of the reach, especially between Miles 16 and 15.

2011:
Field 1 – Medium. This field was recently modeled as part of the Grand Lake Towhead HSR model study. Options were explored in this field with the goal of downstream potential effects, but model results were inconclusive.
Field 2 – Medium. Opportunities exist in this field in conjunction with Sister Chute and Island #28, but the Grand Lake Towhead HSR model study was unable to find a solution to the ongoing dredging issues.
Field 3 – Low. This is a short field with only dike-specific modifications possible.

REACH 22: CAIRO, 12 MILES (12 – 0)

Map: Appendix B, Figure 22

Characteristics: Straight to Mile 10, then a slight bend to the left to Mile 8, then a bend to the right to Mile 6, then straight to Mile 5, then a sharp 110 degree bend to the left to Mile 2, then straight to Mile 0 and the Ohio River confluence.

Slope: Water Surface: 0.29 feet/mile

Width Bankline: 3636
Channel: 1045

Dikes: 2002:
33 Total Dikes (10 RDB & 23 LDB)

2.8 dikes/mile – 3% notched
Dike Field 1: LDB continuous (12 – 9.8) 11 dikes
Dike Field 2: RDB continuous (10.2 – 9.5) 7 hard points (stubs)
Dike Field 3: LDB continuous (8.7 – 6.5) 7 dikes
Dike Field 4: LDB continuous (5.5 – 4) 5 dikes
Dike Field 5: RDB continuous (1.5 – 0.8) 3 dikes

2011:
42 Main Channel Structures
13 Dikes along RDB (10.1 – 0.1)
29 Dikes along the LDB (11.9 – 4)
3.5 dikes/mile – 12% Notched

Structure changes:
Two dikes (7.5 L, 6.1L) discounted in the 2002 report were present in the low water aerial photography. Four dikes (6.7 R, 0.6 R, 0.3 R, 0.1 R) not identified in the 2002 report were present in the low water aerial photography. One dike (9.5 R) present in the 2002 report was not visible in the 2006 aerial photography. Four dikes have been constructed since the last survey (9.4 R, 9.2 R, 8.3 L, and the W-Dike at 4.0 L). Four notches have been constructed.

Weirs:
Eliza Point LDB (6.7 – 5.7) 10 Weirs
Greenfield RDB (4.2 – 3) 9 Weirs
Bird's Point RDB (2) 3 Weirs

Chutes:
2002:
0.52 miles/mile
Boston LDB (10.2 – 7.5) 2 closures
Angelo LDB (5 – 1.5) 2 closures

2006:
0.49 miles/mile
Boston LDB (10.2 – 7.7) 2 closures
Angelo LDB (5 – 1.6) 2 closures

Dredging:
34 cuts for a total of 3,657,364 CY:
2 cuts in the center of the channel at RM 11.7 – RM 10.9 for a total of 397,639 CY
4 cuts in the center of the channel at RM 9.7 – RM 8.4 for a total of 627,546 CY
4 cuts in the center of the channel at RM 7.3 – RM 6.4 for a total of 273,652 CY
1 cut in the center of the channel at ~RM 4.5 for 137,902 CY
5 cuts in the center of the channel at RM 2.9 – RM 2.2 for a total of 506,285 CY
18 cuts in the center of the channel at RM 1.3 – RM 0 for a total of 1,714,340 CY

Priority:
2002:
3 Stars.

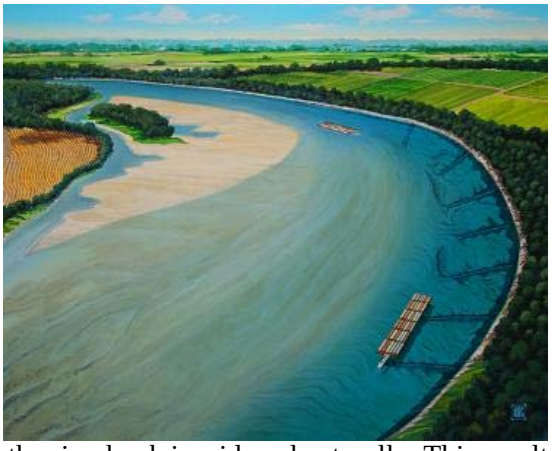
2011:
2 Stars. – Additional notching has taken place.

Conclusions: 2002:
Possibilities for environmental enhancement exist in all dike fields. These alterations may have the secondary benefit of reducing repetitive dredging along the RDB between Miles 9 & 8 and 5 & 4 as well as to those areas between Miles 3 & 0.

2011:
Field 1 – Medium. Dike modifications were included as part of the approved Bi-Op model outcome for Boston Chute.
Field 2 – Low. This is a short field containing six short dikes.
Field 3 – Low. This field contains a number of shorter dikes and weirs. Modifications have already been undertaken in the upstream portion of the field.
Field 4 – Low. ARRA funding in this field supported the construction of a W-dike, multiple roundpoint structures, and dike notching. The area continues to be monitored.
Field 5 – Low. This is a sensitive area for the navigation industry given the proximity of the bridge and difficult currents in the area.

STRUCTURE DESCRIPTIONS

The following descriptions outline the structures currently employed by St. Louis District staff to attempt to meet the navigational and environmental components of the Corps's mission on the Mississippi.



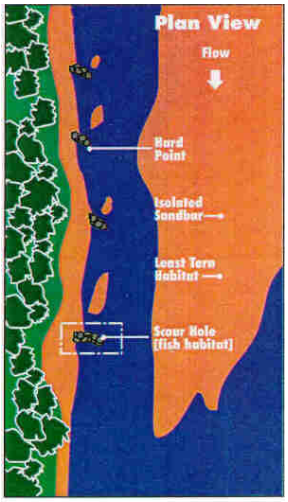
Bendway Weirs - The Bendway Weir is a low level, totally submerged rock structure that is positioned from the outside bankline of the riverbend and angled upstream toward the flow. These underwater structures extend directly into the navigation channel underneath passing tows. Their unique position and alignment alter the river's spiraling, secondary currents in a manner which shifts the currents away from the outside bankline. This controls excessive channel deepening and reduces adjacent riverbank erosion on the outside bendway. Because excessive river depths are controlled, the opposite side of the riverbank is widened naturally. This results in a wider and safer navigation channel through the bend without the need for periodic maintenance dredging. The Bendway Weir also eliminates the need for dikes to be constructed on the inside of the bendway, protecting bend interior sandbar habitat. There had been concern that bendway weir construction was leading to increased bend-interior slopes; analysis of pre- to post-construction data found that slope changes were largely within the expected natural deviation[1].

Bullnoses – Bullnoses redirect flows around islands protecting the islands from erosion. Without the rounded upstream rock structures, island heads can be exposed to high-velocity flows that hit head-on and mobilize sediment, eroding an island away. The bullnose locks

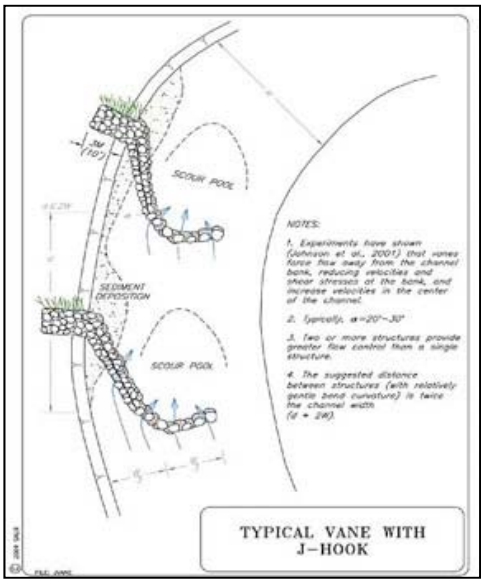
[1] Lauth et. al., "Analysis of the Effects of Bendway Weir Construction on Channel Cross-Sectional Geometry", 2011

in the island's upstream geometry, rendering the island, and the aquatic and terrestrial habitat it forms, largely permanent.

Chevrons – Chevrons are "U"- or "V"-shaped rock structures with their apexes oriented upstream that divide flow smoothly so that a portion of the flow can be redirected without a significant undesired scour area forming. Dividing the flow in this manner can increase energy and decrease sedimentation in both side channels and the main channel. Besides redirecting flow along the front of the chevron, chevrons are designed with intent of periodic overtopping of the apex occurring. This overtopping results in the formation of a plunge pool within the chevron. The lower-velocity flow exiting the plunge pool can no longer maintain its sediment load and deposits sediment downstream of the chevron. This deposition can lead to the development of ephemeral or permanent islands downstream of chevrons. The bathymetric diversity presented by a plunge pool and downstream depositional area have been found to be favorable habitat for a variety of fish species. In the case of two or more chevrons, deposition behind the chevrons and side channel depth both increased with the number of chevrons. Use of multiple chevrons in a field can be used to either maintain a split flow situation or direct a split flow to a particular location (such as an area prone to a lower energy level). The disadvantage to the construction of chevrons is that they obstruct far less flow than a typical dike of equivalent length. Chevrons can be constructed with rootless trails extending the effective length of the chevron legs with regards to splitting flow while allowing for some flow behind the chevron. They can also be constructed with notches, with the intent of decreasing the depth of the plunge pool; these effects are still being studied. A third option for chevron construction is the shortening of one leg and the extension of the other. This J-shape can be used to further maintain a split flow.

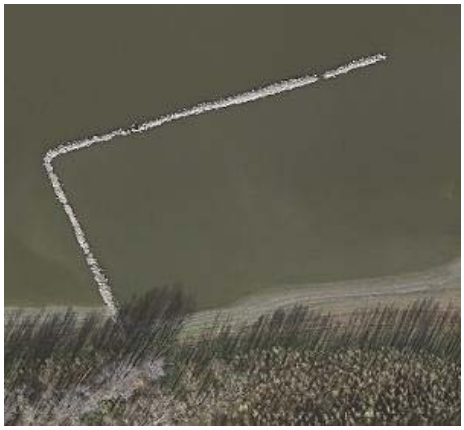


Hard Points - Hard points are very short rock dikes that are used to stabilize side channel river banks. The structures extend from the bank into the side channel and do not cause a significant buildup of sediment. Their contribution to habitat improvement is the creation of scour holes behind the hard points. These plunge holes attract fish that flourish in this environment. Effective hardpoint placement requires a relatively active side channel with little ongoing sedimentation.

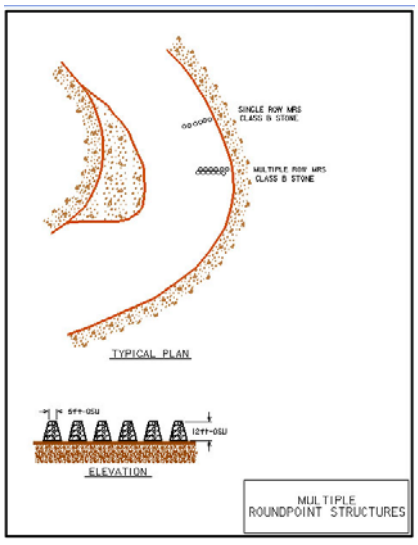


J-Hooks – J-Hook Rock Vanes are structures designed to re-direct velocity distribution and high velocity gradient in the near-bank region, stabilize stream-banks, dissipate energy in deep, wide, and long pools created below the structure, and create holding cover for fish and spawning habitat in the tail-out

of the structure. The basic function of the structure utilizes the principle that water will flow over immoveable objects at right angles (90° angles). The device is constructed of large stone that is tied into the streambank. The stone is trenched into two rows at an upstream angle of 20° to 30° at a distance of 1/3 stream width. The stone is then formed into a hook shape to cover a distance of 1/3 stream width. The downstream row of rock is trenched into the stream bottom so that the top of the rock is approximately level with the stream bottom. The second row of rock is then placed just upstream of that row of rock slightly overlapping it so that as the water flows over the top of the upstream line of rock it will flow onto the downstream line of rock. This creates a stable surface on which the energy of the stream can be dissipated without completely scouring the stream bottom. As the stream dissipates its energy, it will scour the stream bottom slightly, creating a small scour pool immediately downstream of the device that serves as a source of aquatic habitat.



L-Dike – L-Dikes consist of a normal dike that has a trail dike constructed parallel to the flow from the tip. The constructed trail dike continues the constriction of the channel further along the main channel to increase main channel energy and decrease deposition. The area behind the L-Dike becomes a slack water area with beneficial habitat characteristics. This area can be prone to deposition due to the low energy level within the dikes, but such deposition can be reduced by notching the trail dike so that periodic sediment flushing occurs. Some disadvantages of L-Dikes are that they isolate the bankline from the river channel and that they don't promote new bathymetric diversity.

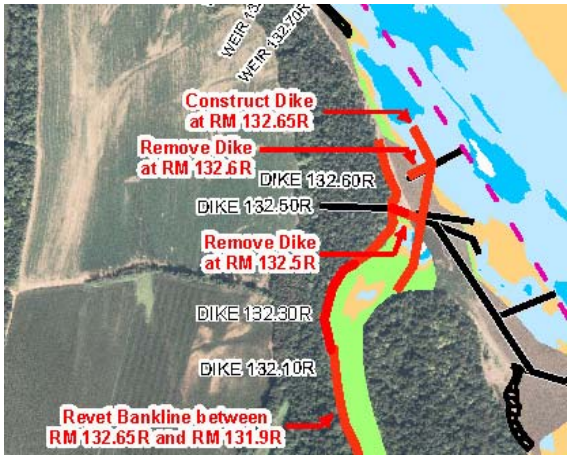


Multiple Roundpoint Structures (MRS) – Multiple Roundpoint Structures induce scouring off the tips of the structures and create depositional areas with the increased roughness generated by the structures. The MRS can also act as a primitive bank stabilization technique by creating depositional zones near the banks of the structures. The structures are generally built to 2/3 bankfull and the grade of stone needed is channel dependent. The spacing of the MRS is dependent of the height of the structure and natural angle of repose of the rock used. A rule of thumb with the spacing between the structures is to space them no less than 2/3 of the height. MRSs can be designed as a single row or in multiple rows. Preliminary data shows that incorporating more rows generates increased bathymetric changes. MRSs are not recommended as a bank stabilization technique but can be incorporated with other forms of bank stabilization such as revetment. The data collected suggest that MRS are providing useful and valuable habitat for a variety of riverine fishes. Collection of blue suckers may indicate these structures are providing a unique habitat type, once more common in the river.

Notched Dikes – Many rock dikes with notches in them can continue to have the same effect on navigation dimensions as un-notched dikes while also promoting increased bathymetric variation. Notches in the center or bank side of dikes achieve this variation by promoting scour downstream of the notch leading to a diversity of habitat. Varying notch depth is one factor that can be used to alter the depth of scour and thus the diversity. Low energy areas behind the un-notched portions of dikes can lead to deposition, supporting the creation of islands or side channels when used in a series. Notching is not always recommended; notching does remove a portion of the dike that may be necessary for the dike to have its intended effect, and a notch may have little effect without the proper flow depth and frequency through the notch.

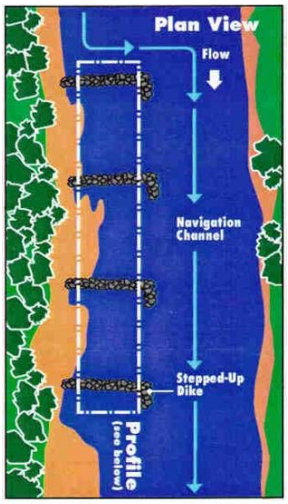
Off-Bankline Revetment – Off-Bankline Revetment reduces erosion on the shallow side of a river. By constructing a stone structure parallel to the bankline, a small side channel area is formed that is largely cut off from the energy of the main channel, producing a slow water habitat area. There is little critical bathymetric effect as the revetment is placed in shallow areas. However, the use of off-bankline revetment does not guarantee the same level of protection as normal revetment and leaves the bankline exposed at higher flow events.

Rootless Dikes – Rootless dikes function much like notched dikes; they can have the intended effect of redirecting flow in beneficial directions while promoting bathymetric and habitat diversity in the space between the dike and the bank. Rootless dikes are also like notched dikes in that they need to obstruct enough of the flow to have their desired effect, they need to cause a constriction of the flow, and they need the gap between the dike and the bankline to experience the proper flow depth and frequency to have an effect.

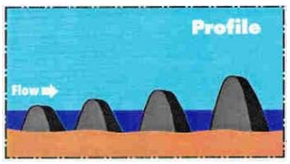


Side Channel Enhancement Dike – Side Channel Enhancement Dikes (SCEDs) are a special class of L-Dikes with the trail oriented upstream from a spur dike constructed on the island side of a side channel entrance. With the upstream-oriented trail, the SCED captures flow from the main channel and redirects it down a side channel, increasing the energy in the side channel, scouring out deposited sediment, and preventing further sedimentation in the side channel. Under the right conditions, the installation of a SCED can reopen closed

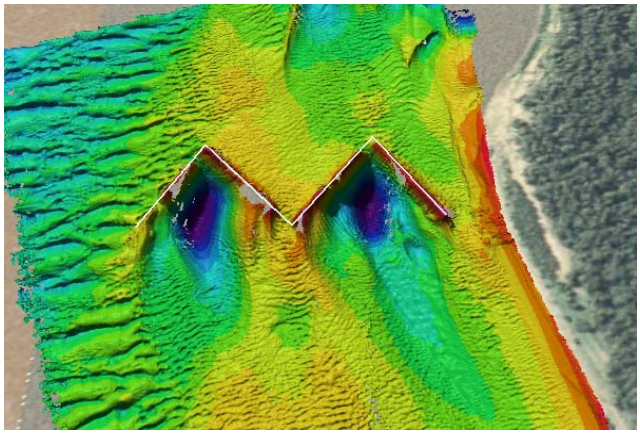
side channels, once again providing aquatic habitat in areas it had previously existed. The construction of a SCED does require certain conditions to be met for a higher likelihood of success: 1) a SCED works best when it can be constructed on the channel-dominant bank, and 2) SCED design requires a careful balance of flow capture between the side channel and main channel to avoid sedimentation in either channel.

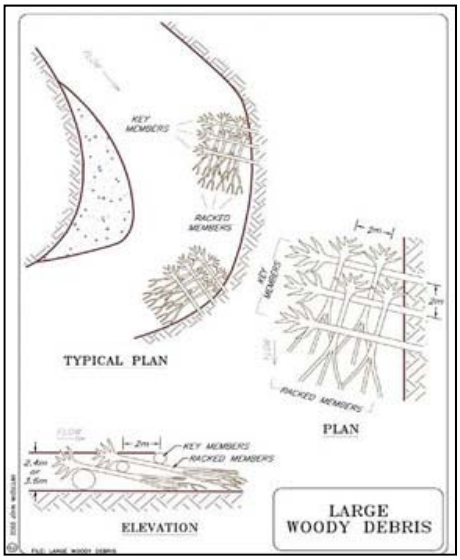


Stepped-Up Dikes - Stepped-Up dike fields of various elevations were developed to provide an additional element of diversity. They counteract sediment deposition, thereby preventing the conversion of aquatic environment into terrestrial. In the stepped-up dike configuration, each dike in sequence rises two feet higher than the previous one. This approach utilizes the river's energy to change the sediment deposits as the water level rises and falls. When the river's current hits the first dike it is propelled toward the main channel. As the river level rises, it moves over the first dike and hits the second dike, once again moving back into the main channel. This process repeats itself as the river rises and falls. The river's current, moving over each submerged dike, allows the sediment buildup to be redistributed back into the main channel and carried downstream.



W-Dikes – W-Dikes function in a manner very similar to chevrons, but are constructed to act over a larger width of the channel. By using a W-Dike instead of a chevron, two plunge pools are created between the inside and outside legs of the W, with deposition typically occurring downstream of the center of the W. Disadvantages of W-Dike construction include the cost of construction (as they require 2-3 times the stone), the difficulty in construction, and the channel width and depth needed.





Woody Debris - Naturally occurring large woody debris (LWD) (i.e., >10 cm diameter and 2 m in length) is an important component of many lotic systems. It provides roughness, reducing velocities and providing overhead cover for fishes, substrate for aquatic invertebrates, and can be an important source of particulate organic matter adding to primary productivity of a river. Large woody debris dissipates flow energy, resulting in channel stability and improved fish migration. It also provides basking and perching sites for reptiles and birds. Placing LWD into streams is an increasingly popular technique to improve fish and wildlife habitat. Large woody debris projects can be divided into two categories: improving the habitat by increasing the amount of LWD in the

stream, and using LWD to alter flow in some way to improve aquatic habitat. Some specific objectives that can be accomplished by using LWD are the following: create pool habitat, generate scour, increase depths through shallow reaches, divert flows away from the bank to reduce erosion, armor stream banks to reduce erosion, promote bar formation through induced sediment deposition, and increase instream cover and refugia. Large woody debris commonly placed into the streams can be categorized as three types: whole trees, logs, and root wads. The use of woody bundles is more common in side channel rehabilitation and streambank stabilization, but can be implemented in dike structures in river environments. A primary concern with the installation of woody debris is that it can have a short life in the field.

Wood Pile Structures - Prior to the 1960's almost all of the structures placed in the Middle Mississippi River were of the woody pile type. Logs were driven into the river bed to create roughness and formed into a river training structure. Due to the higher maintenance of these woody structures, river training structures began to be constructed from stone during the 1960s. There is currently a push to start bringing back the woody pile structures because of their benefit to the micro- and macro-invertebrate species. While wood pile structures promote bathymetric diversity, they are not as effective as stone dike structures for maintaining the navigation channel.

APPENDICES

Appendix A

Appendix B

Appendix A-1: 22 Reaches Diagram

Reach #	RM	MO Field #	MO Chute	Dredging 2002 - 2011 (cy)	IL Chute	IL Field #	Reach Rank
1 - Mel Price Tailwater	201			794,238			
Field 1 - LDB - Low	200		Maple Isl			1	
	199					1	
	198					1	
	197					1	
	196						
2 - Mosenthien	195			1,594,767			
Field 1 - LDB - Medium	194		Duck Isl				
	193						
	192						
	191					1	
	190					1	
	189					1	
	188				Mosenth.	1	
	187					1	
	186					1	
	185					1	
	184						
3 - St. Louis Harbor	183			5,861,449			
Field 1 - LDB - Low	182					1	
Field 2 - LDB - Low	181					1	
Field 3 - LDB - Medium	180						
	179						
	178						
	177					2	
	176					2	
	175					2	
	174					2	
	173						
	172						
	171						
	170					3	
	169					3	
	168					3	
4 - Cliff Cave	167			1,349,713	JB Chute	1	
Field 1 - LDB - High	166	2				1	
Field 2 - RDB - Medium	165	2					
Field 3 - LDB - Low	164	2				3	
	163						
5 - Kimmswick	162			1,945,141		1	
Field 1 - LDB - Low	161				Atwood	1	
Field 2 - RDB - Medium	160					1	
	159	2				1	
	158					1	
	157					1	
	156						
6 - Herculaneum	155			142,380		1	
Field 1 - LDB - High	154					1	
Field 2 - RDB - High	153	2				1	
Field 3 - RDB - Low	152					1	
Field 4 - RDB - Low	151	3				1	
	150	4				1	
	149						
7 - Calico / Osborne	148	2		96,056		1	
Field 1 - LDB - High	147	2			Calico	1	
Field 2 - RDB - Low	146	2				1	
Field 3 - RDB - High	145				Osborne	1	
	144	3				1	
	143	3				1	
8 - Salt Lake	142	2		34,551			
Field 1 - LDB - High	141	2				1	
Field 2 - RDB - Low	140	2				1	
	139	2			Salt Lake	1	
	138					1	
	137					1	
	136					1	
	135					1	
	134					1	
9 - Fort Chartres	133			1,767,341	Ft Chartrs	1	
Field 1 - LDB - Medium	132	2	Establish			1	
Field 2 - RDB - Low	131	2					
Field 3 - LDB - Medium	130	2				3	
	129					3	
	128					3	
10 - St. Genevieve	127			1,505,305			
Field 1 - LDB - Medium	126						
Field 2 - RDB - Medium	125					1	
Field 3 - RDB - Low	124	2				1	
	123	2				1	
	122	2			Moro	1	
	121	3				1	
	120					1	
	119	1				1	

- 1-5 Dredge boxes e within RM
- 5+ Dredge boxes e within RM
- Medium need / oppc
- Medium need / oppc
- Low need / opportur

Prototype Reach

11 - Kaskaskia	118	1		2,210,101			★★★	
Field 1 - RDB - High	117	1	Kasky					
Field 2 - LDB - Medium	116	1						
Field 3 - RDB - Low	115					2		
Field 4 - RDB - Medium	114	3				2		
	113	3				2		
	112					2		
	111	4				2		
	110	4						
	109							
12 - Mile 100 Islands	108	1		7,220,966			★★	
Field 1 - RDB - Medium	107	1						
Field 2 - LDB - Medium	106	1				2		
Field 3 - LDB - Medium	105	1				2		
Field 4 - RDB - Medium	104	1	Crains					
	103	1				3		
	102	1			Liberty	3		
	101							
	100	4						
	99	4	Mile 100					
	98	4						
	97	4	Jones					
	96	4						
	95							
13 - Red Rock to Tower Rock	94			1,870,202			★★★	
Field 1 - LDB - Low	93					1		
Field 2 - RDB - Medium	92					1		
Field 3 - LDB - Medium	91	2				1		
Field 4 - RDB - Medium	90	2						
	89					3		
	88					3		
	87					3		
	86	4				3		
	85	4				3		
	84	4				3		
	83		Owl Creek					
	82							
	81							
	80							
14 - Big Muddy	79	3		2,241,165		1	★★	
Field 1 - LDB - Low	78	3	Cottonwd			2		
Field 2 - LDB - High	77	3				2		
Field 3 - RDB - Low	76	3				2		
	75	3				2		
	74	3				2		
	73	3			Crawford	2		
	72	3				2		
	71	3				2		
15 - Trail of Tears	70	2		2,929,416		1	★★★	
Field 1 - LDB - High	69	2				1		
Field 2 - RDB - Medium	68	2				1	★★	
Field 3 - RDB - High	67	3			Vancil	1		
	66	3				1		
	65	3				1		
	64	3				1		
	63	3				1		
16 - Schenimann / Picayune	62	2		2,558,436		1	★★★	
Field 1 - LDB - Medium	61	2	Schenimn			1		
Field 2 - RDB - High	60	2			Picayune	1		
Field 3 - LDB - Low	59	2						
Field 4 - RDB - Low	58	2				3		
	57	2				3		
	56	4				3		
	55	4				3		
	54					3		
17 - Cape Girardeau	53	1		1,152,438			★★	
Field 1 - RDB - High	52	1						
Field 2 - RDB - Low	51	1						
Field 3 - LDB - Medium	50	1			Marquette			
	49							
	48							
	47	2				3		
	46							
18 - Thebes	45	1		3,076,552			★★★	
Field 1 - RDB - Low	44	1						
Field 2 - LDB - High	43							
Field 3 - RDB - Low	42	3				2		
Field 4 - LDB - Low	41	3			Thebes	2		
	40	3				2		
	39	3			Sante Fe	2		
	38	3				4		
	37	3				4		
	36					4		
	35					4		

19 - Prices	34	1		1,741,942			★★	
Field 1 - RDB - Medium	33	1	Billings					
Field 2 - LDB - Medium	32	1				2		
	31					2		
	30				Bumgard			
	29							
20 - Dogtooth	28			4,683,743		1	★★★	
Field 1 - LDB - Medium	27	2				1		
Field 2 - RDB - High	26	2				1		
Field 3 - LDB - Low	25	2	Buffalo			3		
Field 4 - LDB - Low	24	2			Browns	3		
	23					3		
	22							
	21					4		
	20					4		
21 - Thompson	19	1		1,855,230			★	
Field 1 - RDB - Medium	18	1	Thompson					
Field 2 - RDB - Medium	17	1						
Field 3 - LDB - Low	16	1						
	15	2						
	14	2						
	13	2	Sister			3		
	12							
22 - Cairo	11			3,657,364		1	★★	
Field 1 - LDB - Medium	10				Boston	1		
Field 2 - RDB - Low	9	2						
Field 3 - LDB - Low	8					3		
Field 4 - LDB - Low	7					3		
Field 5 - RDB - Low	6					3		
	5					4		
	4				Angelo	4		
	3							
	2							
	1	5						
	0	5						

extend

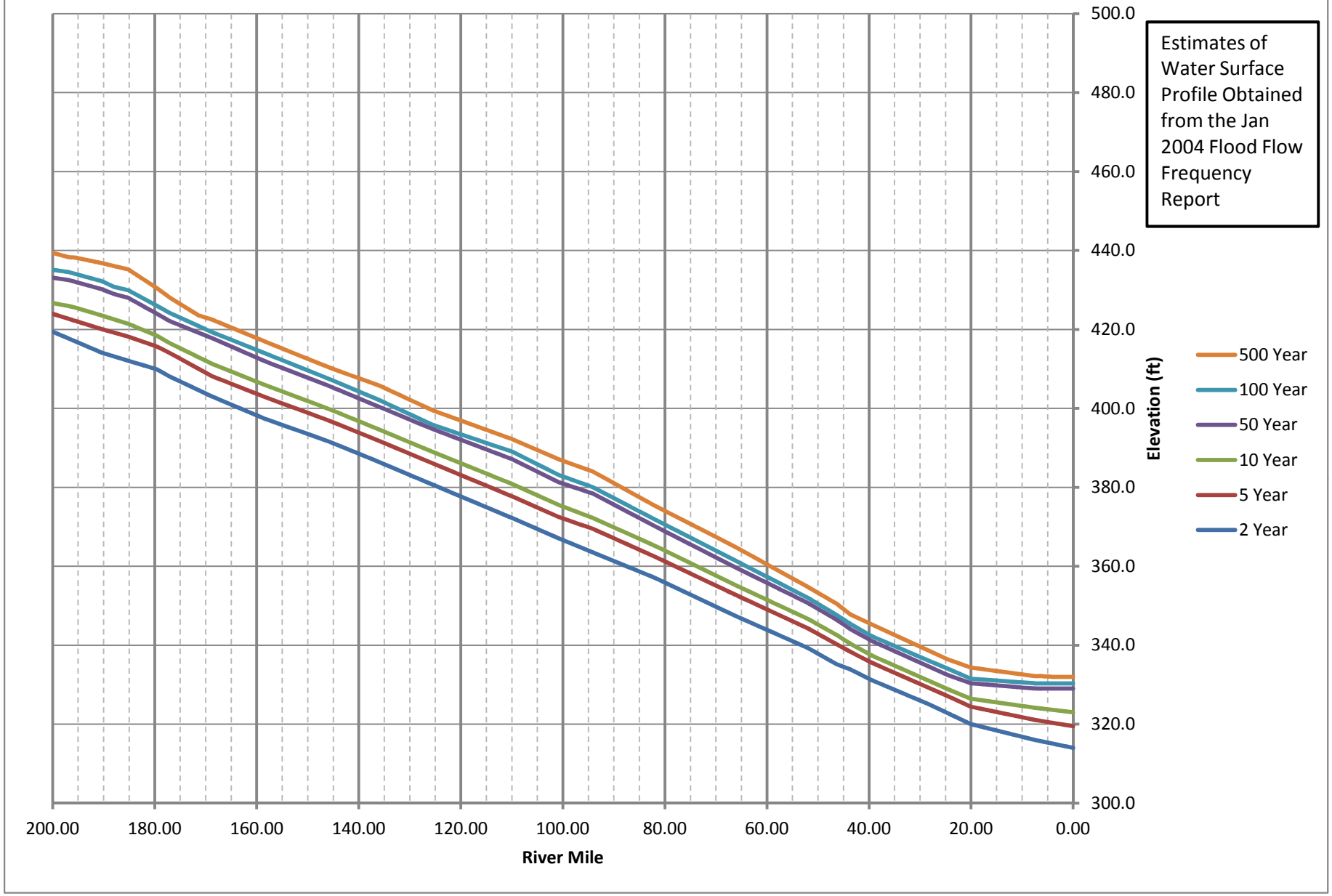
xtend

ortunity for work

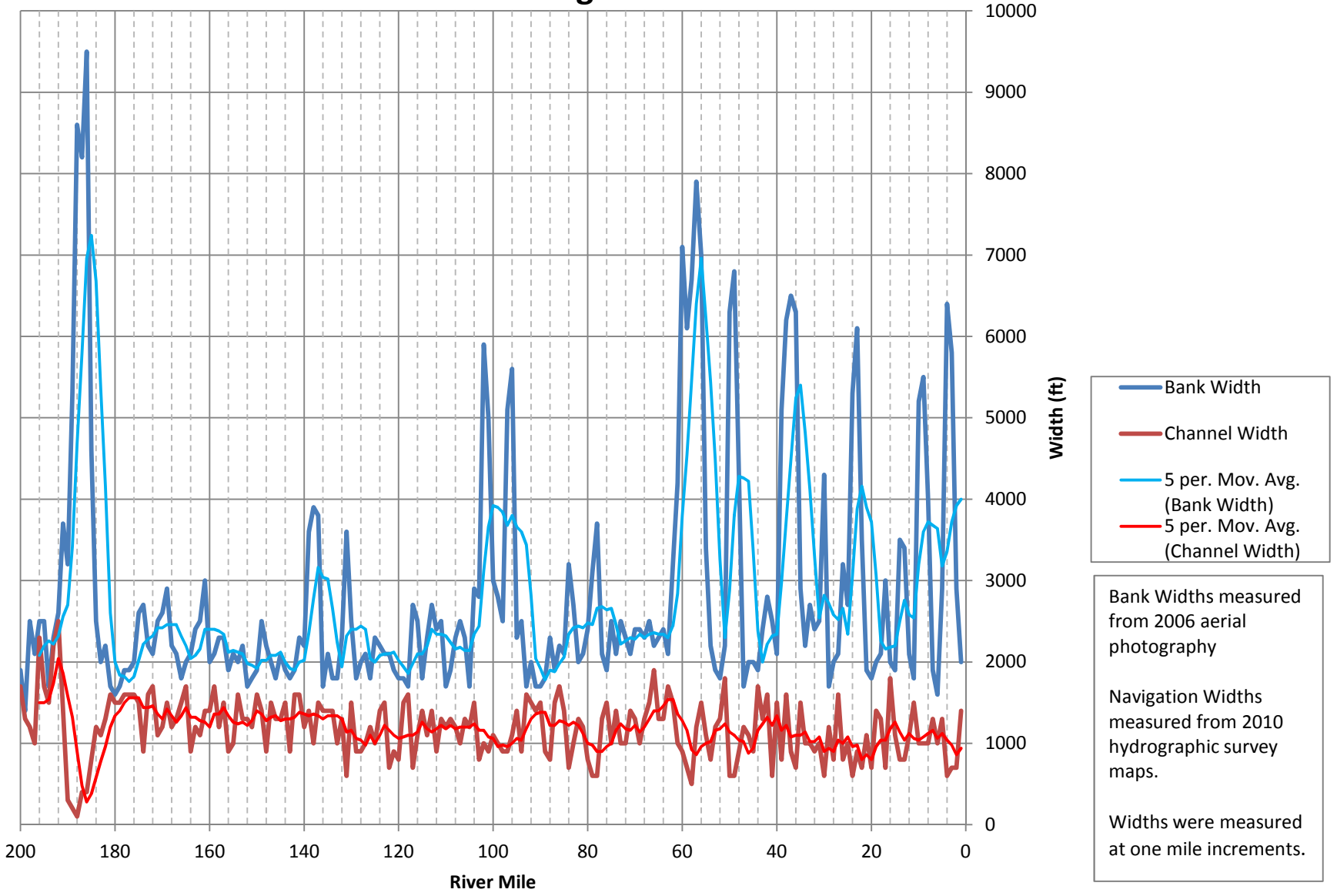
ortunity for work

nity for work

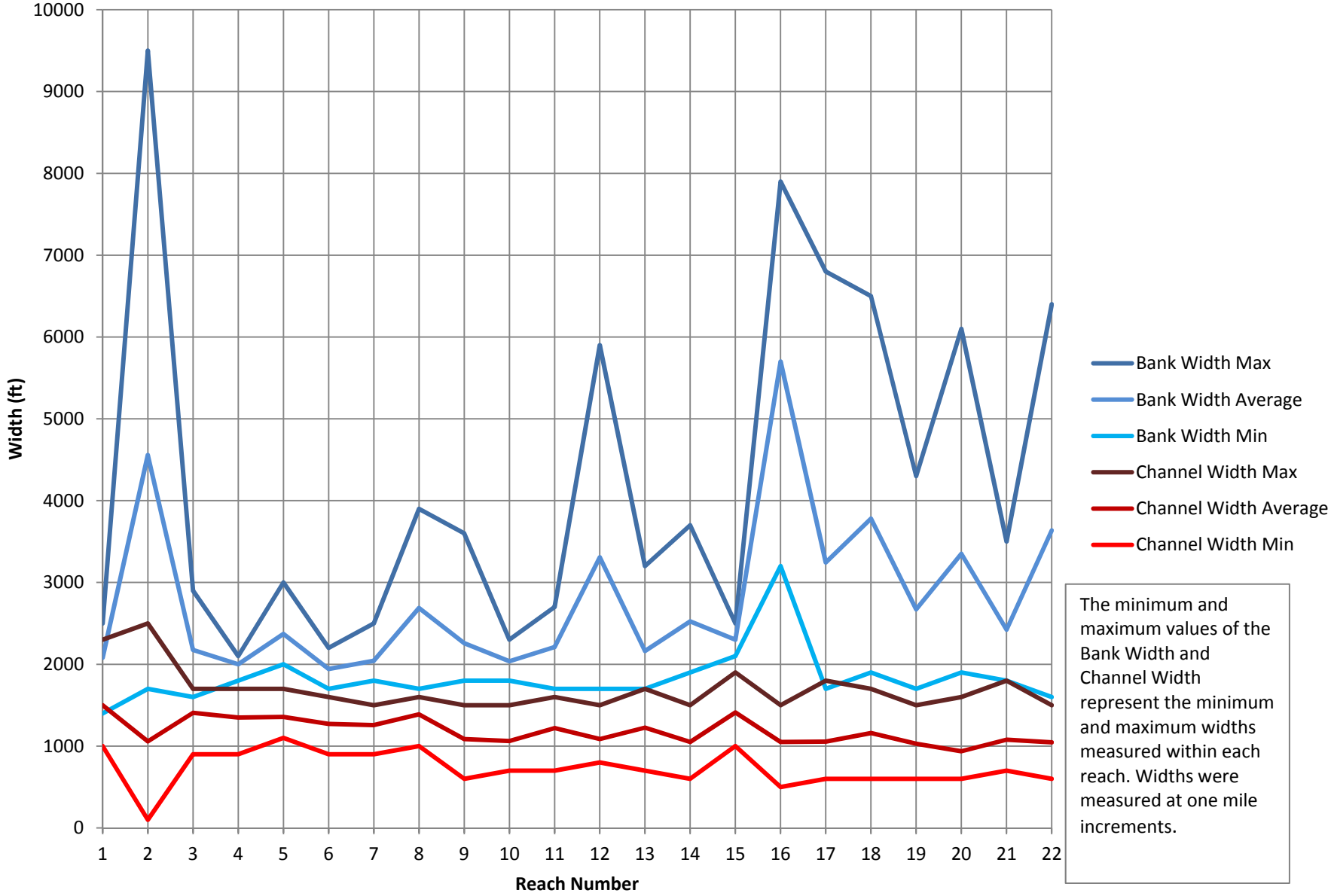
Appendix A-2: Middle Mississippi Water Surface Profiles



Appendix A-3: Middle Mississippi Bankline and Navigation Channel Widths



Appendix A-4: Bankline and Navigation Channel Widths in Each Reach



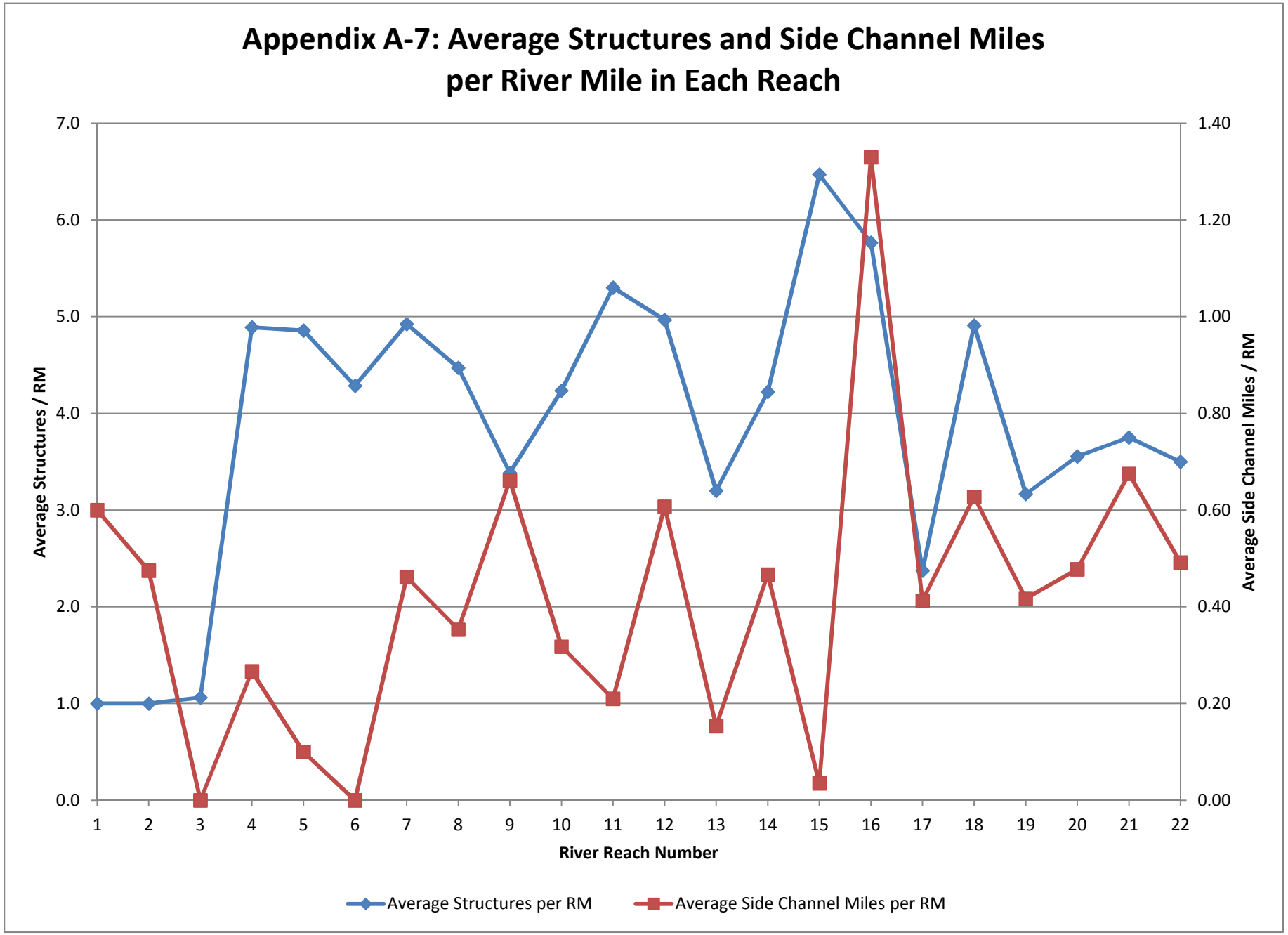
Appendix A-5: Table of Average Structures per River Mile in Each Reach

Reach	Reach Name	RM Start	RM End	Total Miles	RDB Dikes	Avg. RDB Dikes/RM	LDB Dikes	Avg. LDB Dikes/RM	Chevrons	Avg. Chevrons / RM	TOTAL Struc.	Average Structures / RM
1	Mel Price Tailwater	201	196	5	5	1.0	0	0.0		0.0	5	1.0
2	Mosenthien	196	184	12	1	0.1	11	0.9		0.0	12	1.0
3	St. Louis Harbor	184	168	16		0.0	14	0.9	3	0.2	17	1.1
4	Cliff Cave	168	163.5	4.5	12	2.7	10	2.2		0.0	22	4.9
5	Kimmswick	163.5	156.5	7	4	0.6	23	3.3	7	1.0	34	4.9
6	Herculaneum	156.5	149.5	7	12	1.7	18	2.6		0.0	30	4.3
7	Calico / Osborne	149.5	143	6.5	16	2.5	16	2.5		0.0	32	4.9
8	Salt Lake	143	134.5	8.5	11	1.3	27	3.2		0.0	38	4.5
9	Fort Chartres	134.5	128	6.5	6	0.9	14	2.2	2	0.3	22	3.4
10	St. Genevieve	128	119.5	8.5	15	1.8	21	2.5		0.0	36	4.2
11	Kaskaskia	119.5	109.5	10	35	3.5	18	1.8		0.0	53	5.3
12	Mile 100 Islands	109.5	95	14.5	48	3.3	17	1.2	7	0.5	72	5.0
13	Red Rock to Tower Rock	95	80	15	18	1.2	26	1.7	4	0.3	48	3.2
14	Big Muddy	80	71	9	7	0.8	31	3.4		0.0	38	4.2
15	Trail of Tears	71	62.5	8.5	23	2.7	32	3.8		0.0	55	6.5
16	Schenimann / Picayune	62.5	54	8.5	25	2.9	24	2.8		0.0	49	5.8
17	Cape	54	46	8	3	0.4	16	2.0		0.0	19	2.4
18	Thebes	46	35	11	27	2.5	23	2.1	4	0.4	54	4.9
19	Prices	35	29	6	6	1.0	10	1.7	3	0.5	19	3.2
20	Dogtooth	29	20	9	12	1.3	19	2.1	1	0.1	32	3.6
21	Thompson	20	12	8	7	0.9	23	2.9		0.0	30	3.8
22	Cairo	12	0	12	13	1.1	29	2.4		0.0	42	3.5
				201	306	1.5	422	2.1	31	0.2	759	3.8

Appendix A-6: Table of Average Side Channel Miles per River Mile in Each Reach

Reach	Reach Name	River Miles (RM) Start	River Miles (RM) End	Total Miles	Side Channels	RDB Miles	RDB Avg. Mile/RM	LDB Miles	LDB Avg. Mile / RM	Total Side Channel Miles	Average Miles/RM
1	Mel Price Tailwater	201	196	5	Maple Island Chute	3	0.60	0	0.00	3	0.60
2	Mosenthien	196	184	12	Mosenthien & Duck Island Chutes	1.5	0.13	4.2	0.35	5.7	0.48
3	St. Louis Harbor	184	168	16			0.00		0.00	0	0.00
4	Cliff Cave	168	163.5	4.5	JB Chute		0.00	1.2	0.27	1.2	0.27
5	Kimmswick	163.5	156.5	7	Atwood		0.00	0.7	0.10	0.7	0.10
6	Herculaneum	156.5	149.5	7			0.00		0.00	0	0.00
7	Calico / Osborne	149.5	143	6.5	Calico & Osborne Chutes		0.00	3	0.46	3	0.46
8	Salt Lake	143	134.5	8.5	Salt Lake Chute		0.00	3	0.35	3	0.35
9	Fort Chartres	134.5	128	6.5	Fort Chartres & Establishment Chutes	2.3	0.35	2	0.31	4.3	0.66
10	St. Genevieve	128	119.5	8.5	Moro Chute		0.00	2.7	0.32	2.7	0.32
11	Kaskaskia	119.5	109.5	10	Kaskaskia Chute	2.1	0.21		0.00	2.1	0.21
12	Mile 100 Islands	109.5	95	14.5	Mile 100, Crains, Liberty & Jones Chutes	2.9	0.20	5.9	0.41	8.8	0.61
13	Red Rock to Tower Rock	95	80	15	Owl Creek Bar	2.3	0.15		0.00	2.3	0.15
14	Big Muddy	80	71	9	Cottonwood & Crawford Chutes	1.8	0.20	2.4	0.27	4.2	0.47
15	Trail of Tears	71	62.5	8.5	Vancill Towhead		0.00	0.3	0.04	0.3	0.04
16	Schenimann / Picayune	62.5	54	8.5	Schenimann & Picayune Chutes	5.4	0.64	5.9	0.69	11.3	1.33
17	Cape	54	46	8	Marquette Chute		0.00	3.3	0.41	3.3	0.41
18	Thebes	46	35	11	Rock Island, Santa Fe, & Thebes Chutes	6.9	0.63		0.00	6.9	0.63
19	Prices	35	29	6	Billings & Bumgard Chutes	0.7	0.12	1.8	0.30	2.5	0.42
20	Dogtooth	29	20	9	Buffalo & Browns Chutes	1.4	0.16	2.9	0.32	4.3	0.48
21	Thompson	20	12	8	Thompson & Sister Chutes	5.4	0.68		0.00	5.4	0.68
22	Cairo	12	0	12	Boston & Angelo Chutes	5.9	0.49		0.00	5.9	0.49

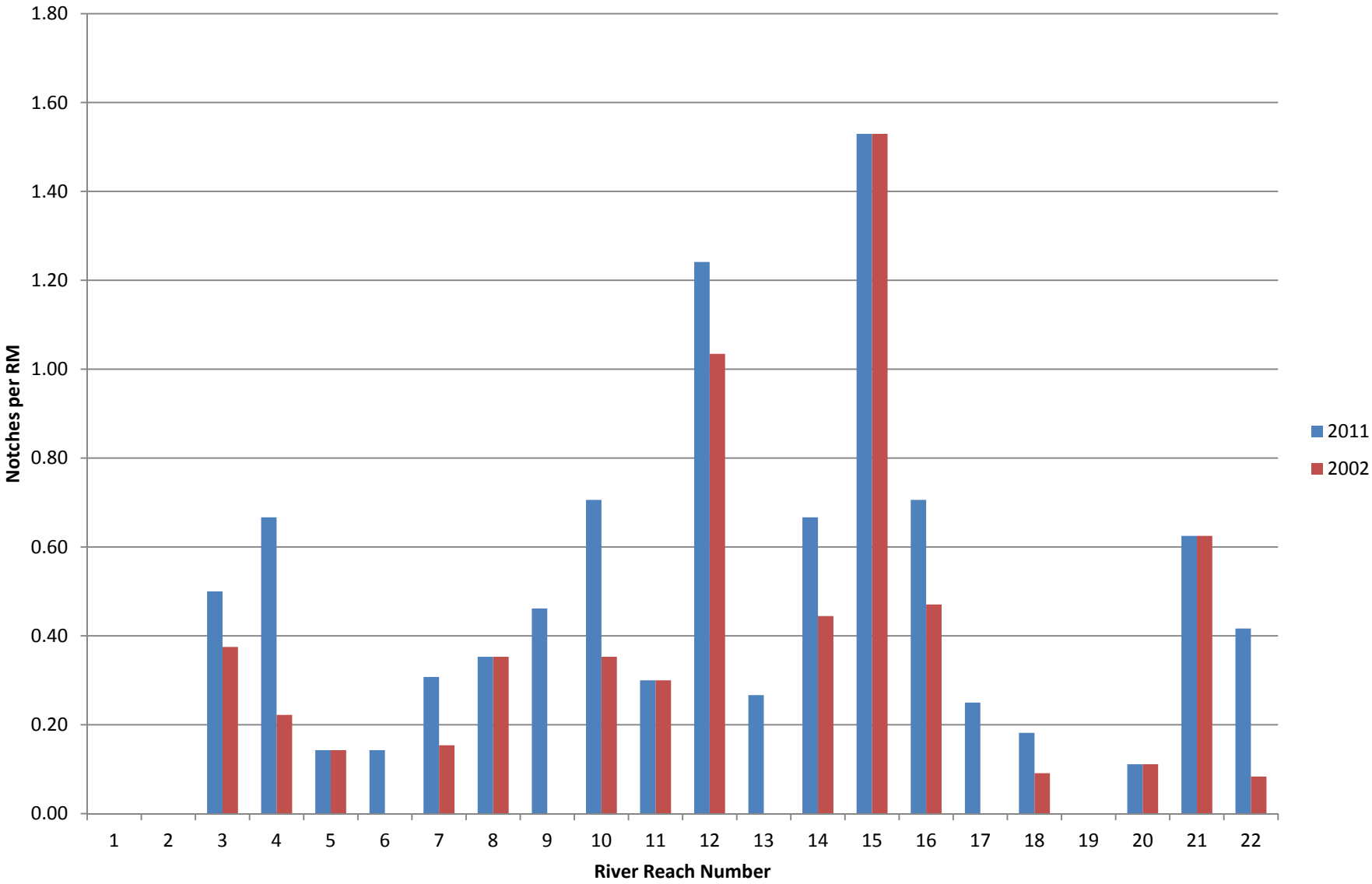
Appendix A-7: Average Structures and Side Channel Miles per River Mile in Each Reach



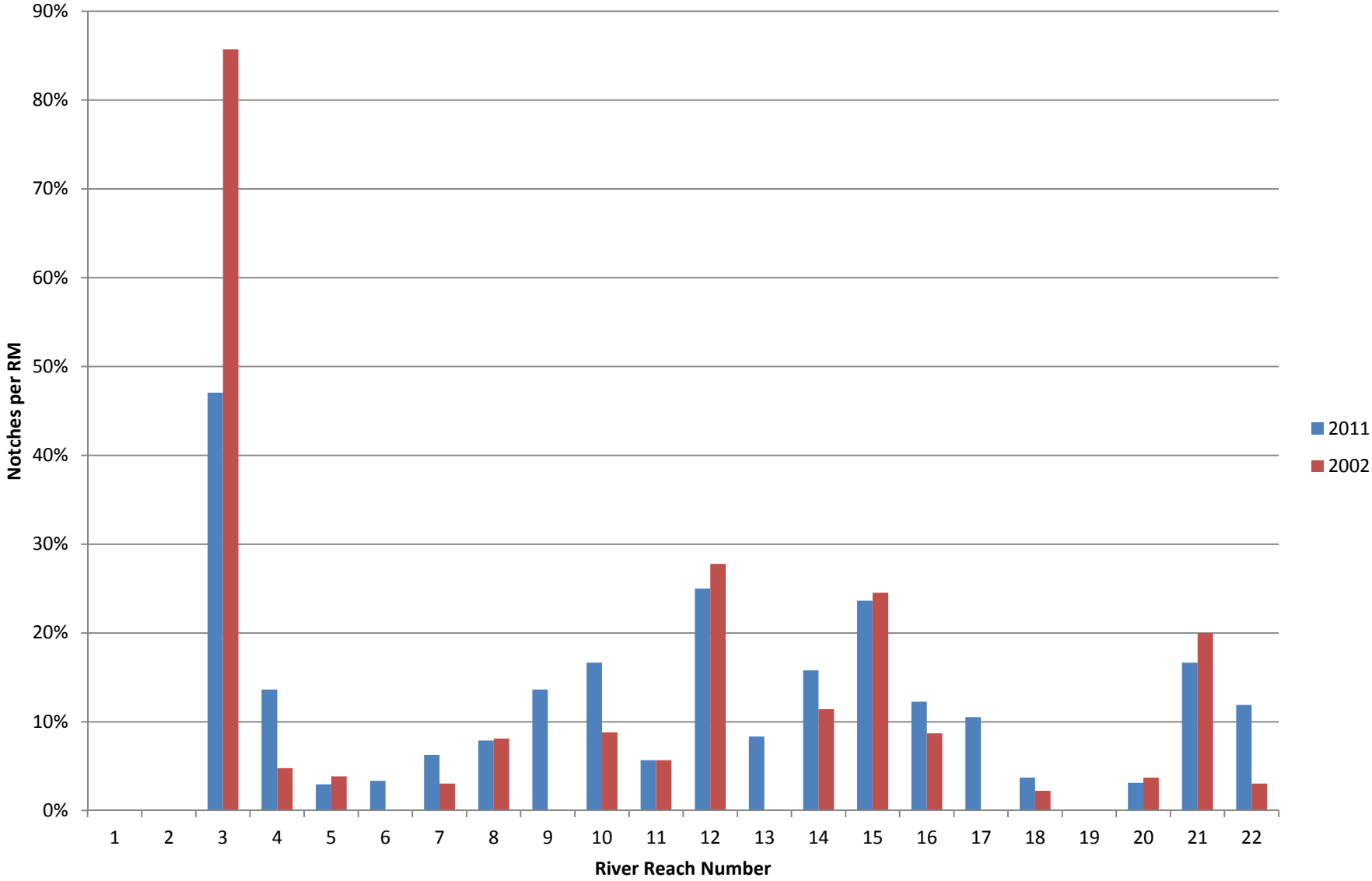
Appendix A-8: Tables of Average Notches per River Mile and per Structure Total in Each Reach

Reach	Reach Name	River Miles (RM) Start	River Miles (RM) End	Total Miles	Notched Dikes	Average Notched Dikes / RM	Main Channel Structures	Averge Notched Dikes / Main Chnl. Structures	2002 Notched Dikes	Average Notched Dikes / RM	2002 Main Channel Structures	Avg Notched Dikes / Main Chnl. Structures
1	Mel Price Tailwater	201	196	5	0	0.00	5	0%	0	0.00	3	0%
2	Mosenthien	196	184	12	0	0.00	12	0%	0	0.00	9	0%
3	St. Louis Harbor	184	168	16	8	0.50	17	47%	6	0.38	7	86%
4	Cliff Cave	168	163.5	4.5	3	0.67	22	14%	1	0.22	21	5%
5	Kimmswick	163.5	156.5	7	1	0.14	34	3%	1	0.14	26	4%
6	Herculaneum	156.5	149.5	7	1	0.14	30	3%	0	0.00	29	0%
7	Calico / Osborne	149.5	143	6.5	2	0.31	32	6%	1	0.15	33	3%
8	Salt Lake	143	134.5	8.5	3	0.35	38	8%	3	0.35	37	8%
9	Fort Chartres	134.5	128	6.5	3	0.46	22	14%	0	0.00	19	0%
10	St. Genevieve	128	119.5	8.5	6	0.71	36	17%	3	0.35	34	9%
11	Kaskaskia	119.5	109.5	10	3	0.30	53	6%	3	0.30	53	6%
12	Mile 100 Islands	109.5	95	14.5	18	1.24	72	25%	15	1.03	54	28%
13	Red Rock to Tower Rock	95	80	15	4	0.27	48	8%	0	0.00	35	0%
14	Big Muddy	80	71	9	6	0.67	38	16%	4	0.44	35	11%
15	Trail of Tears	71	62.5	8.5	13	1.53	55	24%	13	1.53	53	25%
16	Schenimann / Picayune	62.5	54	8.5	6	0.71	49	12%	4	0.47	46	9%
17	Cape	54	46	8	2	0.25	19	11%	0	0.00	17	0%
18	Thebes	46	35	11	2	0.18	54	4%	1	0.09	45	2%
19	Prices	35	29	6	0	0.00	19	0%	0	0.00	15	0%
20	Dogtooth	29	20	9	1	0.11	32	3%	1	0.11	27	4%
21	Thompson	20	12	8	5	0.63	30	17%	5	0.63	25	20%
22	Cairo	12	0	12	5	0.42	42	12%	1	0.08	33	3%
				201	92	0.46	759			0.00		

Appendix A-9 : Average Number of Notched Structures per River Mile in Each Reach



Appendix A-10: Average Number of Notched Structures per Structure Total in Each Reach



600,000 605,000 610,000 615,000

1,110,000 1,105,000 1,100,000 1,095,000 1,090,000 1,085,000

SKINNY ISLAND

MEL PRICE

WOOD RIVER

200.00L

200.30R

200.00R

ICE LOCK & DAM

MAPLE ISLAND

199.70R

199.40R

199.10R

MAPLE CHUTE

198.70R

198.20R

197.70R

CHIPPEWA LANDING

MOBILE ISLAND

GILHAM LANDING

MISSOURI RIVER

DUCK

201 200 199 198 197 196 195 0 1 2 3

1

Legend

- Structure degradation
- Dikes since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 1

0 400 800 1,600 2,400 3,200 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 1
MEL PRICE TAILWATER

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

580,000 585,000 590,000 595,000 600,000 605,000 610,000 615,000

1,085,000 1,080,000 1,075,000 1,070,000 1,065,000 1,060,000 1,055,000 1,050,000 1,045,000 1,040,000 1,035,000

DUCK ISLAND CHUTE

DUCK ISLAND

CAHOKIA

0

195

194.50L

194.30L

194

193.20R

193.00R

192.70R

192.40R

193

WILSON ISLAND

192

CHOUTEAU ISLAND

190.3R (Homer Dike)

191

191.20L

I-270 BRIDGE

OLD CHAIN OF ROCKS BRIDGE

LOW WATER DAM

DAM27

190

189

189.60L

CHAIN OF ROCKS CANAL

189.30L

188

188.50L

1

187.60L

MOSENTHEIN ISLAND

GABARET ISLAND

187

187.00L

AWYER BEND

MOSENTHEIN CHUTE

186.30L

MOSENTHEIN CHUTE

185.80L

186

185.30L

LOCK 27

185

184.40L

184.20L

KERR ISLAND

BISSEL POINT

184

Merchants Railroad Bridge

182.90

183

182.90L

Legend

- Structure degradation
- Dikes since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER

2

0 750 1,500 3,000 4,500 6,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 2
MOSENTHIEN

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

555,000 560,000 565,000 570,000 575,000 580,000 585,000 590,000 595,000 600,000

1,035,000 1,030,000 1,025,000 1,020,000 1,015,000 1,010,000 1,005,000 1,000,000 995,000 990,000 985,000 980,000 975,000 970,000 965,000

184
183
182.90
182.90L
182.75
182.45
182.05L
182
181.85L
181.70L
181
LACLEDES LANDING
180
179
178
177.80L
177
176
175.90L
175
175.30L
ARSENAL ISLAND
174.50L
174
CAHOKIA CHUTE
173
172
171
170.90L
170.40L
170.20L
170
170.00L
169.45L
169
168.80L
168.50L
CARROLL ISLAND
168

1
2
3

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 3

0 1,000 2,000 4,000 6,000 8,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 3
ST. LOUIS HARBOR

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

555,000 560,000 565,000

960,000 955,000 950,000 945,000 940,000

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

168 167 166 165 164 163

167.70L
167.50L
167.40L
167.10L
166.850L
166.60L
166.40L
166.20L
165.90L

166.40R
166.20R
166.10R
165.90R
165.70R
165.50R
165.30R
165.10R
164.90R
164.70R
164.00R
163.70R

164.90L
164.85L
164.80L
164.75L
164.70L
164.50L
164.25L
164.10L
163.90L
163.60L
163.50L
163.30L

JEFFERSON BARRACKS CHUTE

CLIFF CAVE LANDING

PULLTIGHT LANDING

BEARD ISLAND

1 2 3

555,000 560,000 565,000

PLATE NUMBER 4

0 350 700 1,400 2,100 2,800 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 4
CLIFF CAVE

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

535,000 540,000 545,000 550,000 555,000

940,000 935,000 930,000 925,000 920,000 915,000 910,000

BEARD ISLAND

ATWOOD CHUTE

CHELSEY ISLAND

WATERS POINT

1

2

163.90L 163.60L 163.50L 163.30L 163.00L 162.8L 162.60L 162.6L 162.5L 162.4L 162.30L 162.10L 161.90L 161.50L 161.10L 160.90L 160.60L 160.30L 160.0L 160.00L 159.90L 159.9L 159.70L 159.50L 159.20L 158.90L 158.60L 158.30L 158.10L 158.00L 157.80L 157.50L 157.40L 157.10L 156.70L 156.30L

161.10R 160.60R 159.80R 159.70R 159.30R 159.10R 158.90R 158.10R 157.70R 157.30R

163 162 161 160 159 158 157 156

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 5

0 500 1,000 2,000 3,000 4,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 5
KIMMSWICK

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

525,000 530,000 535,000 540,000 545,000 550,000

905,000 900,000 895,000 890,000 885,000 880,000 875,000

156.30L
156.00L
155.60L
155.30L
154.90L
154.60L
154.40L
154.10L
154.00R
153.90L
153.70R
153.70L
153.60L
153.50R
153.30L
153.25R
153.10L
153.10R
153.00L
152.80L
152.50L
152.20L
152.10L
151.80R
151.80L
151.50R
151.50L
151.30R
151.30L
151.10L
151.00L
150.70L
150.60R
150.50R
150.40R
150.30L
150.20R
150.00L
150.00R
149.70R

156 155 154 153 152 151 150

LWRP 366
LWRP 365.5
LWRP 364.5
LWRP 363

FOSTER ISLAND
HARRISONVILLE LANDING
HUG LANDING

Model Study

1 2 3 4

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 6

0 500 1,000 2,000 3,000 4,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 6
HERCULANEUM

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MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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US Army Corps of Engineers ®
St. Louis District

535,000 540,000 545,000 550,000 555,000 560,000

880,000 875,000 870,000 865,000 860,000 855,000 850,000 845,000 840,000

151
150.70L
150.60R
150.50R
150.40R
150.30L
150.20R
150.00L
150
150.00R
HUG LANDING
149.70R
149.20L
149.30R
149.00L
149
148.50L
148.85R
148.10L
CALICO CHUTE
148.30R
CALICO ISLAND
147.70L
148
147.30L
147.10L
147.00L
147.00L
146.80L
146.70L
147
146.40L
146.60R
(PILE)
146.10L
OSBORNE CHUTE
146.30R
146
145.40L
145.00L
144.60L
144.30L
144.10L
144.00L
143.80L
143.60L
143.40L
145.40R
145.20R
145
MICHAELS TOWHEAD
145.10R
145.00R
144.90R
144.50R
144.20R
144.15R
144.10R
144.00R
143.70R
144
LOWRY LANDING
HARLOW ISLAND
143.40R
143.00R
143
142

1

2

3

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 7

0 625 1,250 2,500 3,750 5,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 7
CALICO / OSBORNE

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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
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St. Louis District

560,000 565,000 570,000 575,000 580,000 585,000 590,000

855,000 850,000 845,000 840,000 835,000 830,000 825,000 820,000 815,000 810,000

143.40L
LOWRY LANDING
143
143.00R
KEMPER LANDING
142.20L
142.10L
142.00L
142.50R
142.30R
DURFEE LANDING
142
141.80L
141.70R
141.40L
141.10L
141.40R
140.80L
141
141.10R
RUSH ISLAND
140.60L
140.90R
140.60R
140.50L
DANBY LANDING
140.30L
140.10L
140.50R
140.00L
139.80L
140.30R
BEAGLES ISLAND
139.50L
140
139.30L
139.00L
DURFEE BAR
139.40R
138.80L
138.40L
139
SALT LAKE CHUTE
LEE ISLAND
138.10L
137.60L
138
SALT LAKE TOWHEAD
137.00L
AMES TOWHEAD
136.80L
136.50L
PENITENTIARY POINT
137
136.00L
135.70L
135.60L
135.30L
136
135.20L
134.90L
134.80L
134.60L
SYCAMORE LANDING
135
SALT POINT
134.70R
134

2

1

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 8

0 625 1,250 2,500 3,750 5,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 8
SALT LAKE

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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St. Louis District

590,000 595,000 600,000 605,000 610,000 615,000

825,000 820,000 815,000 810,000 805,000 800,000 795,000 790,000

1

2

3

SYCAMORE LANDING

FORT CHARTRES CHUTE

FORT CHARTRES ISLAND

POINT

FORT CHARTRES LANDING

ESTABLISHMENT ISLAND

COLUMBIA QUARRY LANDING

ESTABLISHMENT CHUTE

SCHMIDTS ISLAND

Model Study

LWRP 355 LWRP 354.5 LWRP 354 LWRP 353.5 LWRP 353 LWRP 352 LWRP 351.5 LWRP 351

134.30L 134.00L 133.70L 133.30L 133.00L 132.70R 132.60L 132.60R 132.50R 131.90R 131.30R 130.75L 130.60R 130.50L 130.40L 130.35L 130.30L 130.25L 130.20L 130.20R 130.00L 130.0R 129.90L 129.90R 129.60L 129.20L 128.80L 128.70L 128.60L

134 133 132 131 130 129 128

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

590,000 595,000 600,000 605,000 610,000 615,000

PLATE NUMBER 9

0 500 1,000 2,000 3,000 4,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 9
FT. CHARTRES

U.S. ARMY ENGINEER DIVISION
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MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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St. Louis District

615,000 620,000 625,000 630,000 635,000 640,000 645,000 650,000

810,000 805,000 800,000 795,000 790,000 785,000 780,000 775,000 770,000 765,000 760,000

NDING

TURKEY ISLAND

128.60L

128

126.60L 126.40L 126.30L

127

MUD LANDING

125.3L 125.30L 124.90L 124.70L 124.50L 124.20L 124.00L 123.90L 123.60L 123.40L 123.20L 123.00L 122.60L

LWRP 350.5

LWRP 350

126

LWRP 349.5

125

LITTLE ROCK LANDING

Model Study

LWRP 349

124.90R 124.70R 124.50R 124.20R 123.90R 123.70R 123.50R 123.40R 123.20R 122.90R 122.80R 122.60R

124

LWRP 348.5

LWRP

123

STE. GENEVIEVE ISLAND

1

2

3

122.10L 121.90L 121.70L 121.50L 121.20L 121.00L 120.70L 120.20L 119.50L

MORO CHUTE

Study

122

MORO ISLAND

LWRP 347

121.45R 121.35R 121.20R

121

120

LWRP 346.5

New Bourbon Regional Port
(Under Construction)

LWRP 346

STE. GENEVIEVE BEND

119.50R 119.30R

8

7

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER

10

0 750 1,500 3,000 4,500 6,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 10
STE. GENEVIEVE

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MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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St. Louis District

655,000 660,000 665,000 670,000 675,000 680,000 685,000 690,000

795,000 790,000 785,000 780,000 775,000 770,000 765,000 760,000 755,000 750,000 745,000 740,000 735,000

KASKASKIA RIVER

KASKASKIA LOCK & DAM

ELLIS GROVE LANDING

SWINGS LANDING

BEAVER ISLAND

FARMERS LANDING

KASKASKIA ISLAND

CHEROKEE LANDING

HORSESHOE LANDING

KLONDIKE LANDING

HORSE ISLAND

Chester Bridge

1 2 3 4

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 11

0 750 1,500 3,000 4,500 6,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 11
KASKASKIA

U.S. ARMY ENGINEER DIVISION
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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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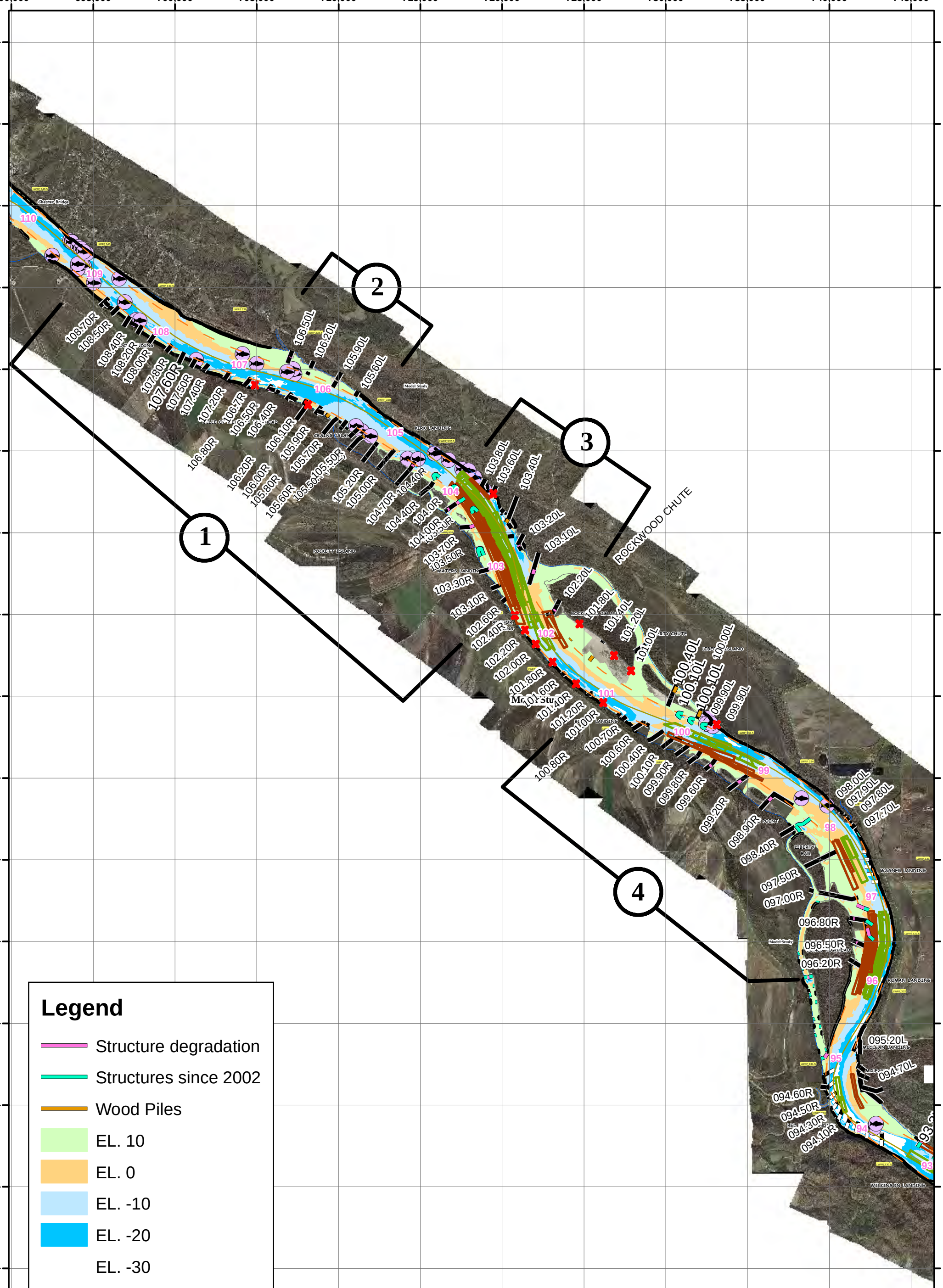
690,000 695,000 700,000 705,000 710,000 715,000 720,000 725,000 730,000 735,000 740,000 745,000

765,000 760,000 755,000 750,000 745,000 740,000 735,000 730,000 725,000 720,000 715,000 710,000 705,000 700,000 695,000 690,000



Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 12

0 1,000 2,000 4,000 6,000 8,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 12
MILE 100 ISLANDS

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

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St. Louis District

740,000 745,000 750,000 755,000 760,000 765,000 770,000 775,000 780,000 785,000 790,000

715,000 710,000 705,000 700,000 695,000 690,000 685,000 680,000 675,000 670,000 665,000 660,000 655,000 650,000 645,000

LIBERTY BAR
WAGNER LANDING
ROMAN LANDING
MCCLEAN LANDING
WILKINSON LANDING
WILKINSON ISLAND
HOLSCHEN LANDING
STAR LANDING
LACOSS ISLAND
PAUL LANDING
BRUNKHORST LANDING
TUCKERS POINT
Model Study
Texas-Illinois Natural Gas Pipeline Brid

98 97 96 95 94 93 92 91 90 89 88 87 86 85 84 83 82 81 80 79 78 77

096.15R 096.10RC 095.90R 095.80RR 095.70LC 095.55RC 095.45LC 096.50RR 096.20R

094.80L 094.60L 094.40L 094.60R 094.60L 094.50R 094.50L 094.30R 094.10R 093.3L 093.1L 093.0L 092.6L 092.30L 092.05L 091.80L 091.60L

091.60R 091.40R 091.10R 090.90R 090.70R 090.50R 090.40R CHEVRON 089.55L 089.30L 089.15L 089.00L 088.50L 088.20L 087.80L 087.50L 087.30L 087.00L 086.70L 086.50L 086.20L 086.00L 085.70L 085.50L 085.20L 084.90L

086.40R 086.15R 085.90R 085.70R 085.50R 085.20R 085.10R 085.05R

082.00L 081.85L 081.65L

079.50L 079.30R 079.30L 079.20

078.15L 078.10L 077.90L 077.60L 077.40L 077.20L 077.00L

1 2 3 4

Legend

- Structure degradation
- Wood Piles
- Structures since 2002
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 13

0 1,125 2,250 4,500 6,750 9,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 13
RED ROCK TO TOWER ROCK

U.S. ARMY ENGINEER DIVISION
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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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US Army Corps of Engineers ®
St. Louis District

775,000 780,000 785,000 790,000 795,000 800,000 805,000

655,000 650,000 645,000 640,000 635,000 630,000 625,000 620,000 615,000 610,000

LWRP 324.5 LWRP 324 LWRP 323.5 LWRP 323 LWRP 322.5 LWRP 322 LWRP 321.5 LWRP 321 LWRP 320.5 LWRP 320

80 79 78 77 76 75 74 73 72 71

079.50L
079.30L
079.20L
079.30R
078.15L
077.90L
077.60L
077.40L
077.20L
077.00L
076.60L
076.10L
075.80L
075.50R
075.50L
075.30L
075.30R
075.20L
074.80L
074.60L
074.40L
074.20L
074.10L
073.90L
073.65L
073.40L
072.90L
073.10R
072.70L
072.45L
072.40L
072.40R
072.10L
071.90L
071.70L
071.40L
071.30L
071.00L
071.30R
071.20R
071.00R
070.60L
070.70R
070.45L

1 2 3

R ISLAND
BIG MUDDY ISLAND
WILSON LANDING
HALF MOON ISLAND
HINES LANDING
CRAWFORD LANDING
CRAWFORD CK
CRAWFORD

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 14

0 750 1,500 3,000 4,500 6,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 14
BIG MUDDY

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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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St. Louis District

785,000 790,000 795,000 800,000 805,000 810,000 815,000

615,000 610,000 605,000 600,000 595,000 590,000 585,000 580,000 575,000 570,000

072.40R 072.10L 071.90L 071.70L 071.40L 071.30L 071.30R 071.20R 071.00R 071.00L 070.70R 070.60L 070.30L 070.30R NEELY LANDING 070.10L 069.80L 069.90R 069.50L 069.50R 069.10L 068.80L 068.50L 069.10R 068.30L 067.80L 067.50R 067.40R 067.20R 067.00R 066.90R 066.70R 066.60R 067.30L 067.10L 066.80L 066.50L 066.30L 066.00L 065.90L 065.80L 066.00R 065.80R 065.60L 065.30L 065.10L 065.30R 064.70L 064.50L 064.80R 064.30L 064.40R 064.0L 063.90L 064.10R 063.60L 063.70R 063.50L 063.40L 063.40R 063.20L 063.00L 062.90L 063.10R 062.70L 062.80R 062.50L 062.50R 062.20L

72 71 70 69 68 67 66 65 64 63 62

LWRP 320.5 LWRP 320 LWRP 319 LWRP 318.5 LWRP 318 LWRP 315.5

1 2 3

TRAIL OF TEARS
BIOLOGICAL MONITORING AREA
RIVER MILES 64.5 - 68.5

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 15

0 750 1,500 3,000 4,500 6,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 15
TRAIL OF TEARS

U.S. ARMY ENGINEER DIVISION
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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

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St. Louis District

795,000 800,000 805,000 810,000 815,000 820,000

575,000 570,000 565,000 560,000 555,000 550,000 545,000 540,000

063.00L 16
063.10R
062.90L
63
062.80R
062.70L
HAMBURG LANDING
062.50L
062.50R
062.20L
062.20R
LWRP 315.5
062
061.90L
061.90R
SCHENIMAN CHUTE
061.80L
061.70L
061.50R
061.50L
061.30R
061.30L
LWRP 315
061.10L
061.00L
061
060.90R
060.60R
060.45R
060.70L
060.50L
060.20R
DUCKY BAR
060.00R
60
LWRP 314.5
059.80R
059.60R
059.50R
059.30R
SWIFT SURE TOWHEAD
LWRP 314
058.70R
059.00R
59
058.20R
058.80L
058.70L
058.30R
058.50L
057.90R
LWRP 313.5
058
058.20L
057.10R
KINNEY POINT
056.00R
056.20R
056.40R
055.80R
LWRP 311.5
56
57
057.40L
057.20L
057.00L
54.60R
55
055.40L
056.30L
056.40L
056.60L
056.70L
056.90L
055.80L
DEVILS ISLAND
055.20L
054.80L
MINTON POINT
54
LWRP 313
057.00L
PICAYUNE CHUTE
LWRP 312.5
LWRP 312

1
2
Model Study
3
4

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

795,000 800,000 805,000 810,000 815,000 820,000

PLATE NUMBER 16

0 500 1,000 2,000 3,000 4,000 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 16
SCHENIMANN / PICAYUNE

U.S. ARMY ENGINEER DIVISION
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ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
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St. Louis District

785,000 790,000 795,000 800,000

545,000 540,000 535,000 530,000 525,000 520,000 515,000

054.00R
053.80R
MINTON 80L
54
LWRP 312
LWRP 310.5
53
053.00L
052.30L
052.20L
Model Study
052.10L
LWRP 310
52
051.80L
Bill Emerson Memorial Bridge
051.40L
LWRP 309.5
051.00L
051.00L
51
1
GIBONEY ISLAND
050.70L
050.60L
LWRP 309
CAPE050.20L
CHUTE
050.50L
049.60L
050.10L
50
LWRP 308.5
049.70L
048.60L
048.60L (PILE)
047.60L
3
MARQUETTE ISLAND
049.40R
049.30R
049.10R
049.00R
048.90R
048.80R
048.70R
048.60R
048.40R
048.30R
49
48
LWRP 308
047.20L
047.00L
47
047.90R
047.20R
047.10R
LWRP 306.5
LWRP 307
GRAYS POINT
046
045.80
SOUTHEAST MISSOURI
PORT AUTH
LWRP 307.5
2
Model Study
LWRP 306

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 17

0 450 900 1,800 2,700 3,600 Feet

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

REACH 17
CAPE

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
2010 River Survey
2011 Side Channel Survey
2011 Aerial Photography

N

US Army Corps of Engineers ®
St. Louis District

795,000 800,000 805,000 810,000 815,000 820,000 825,000 830,000

515,000 510,000 505,000 500,000 495,000 490,000 485,000 480,000 475,000 470,000 465,000

48 47 46 45 44 43 42 41 40 39 38 37 36 35 34

SOUTHEAST MISSOURI PORT AUTH
LWRP 307.5
047.90R
047.60R
047.20R
LWRP 306.5
GRAYS POINT
045.90L
ROCK ISLAND
045.80
045.60
045.50
045.30
Model Study
044.90R
044.70R
044.50R
DORRITY LANDING
044.20R
1
LWRP 305
043.90R
Thebes Railroad Bridge
043.60R
LWRP 304.5
042.80L
042.50L
042.30L
UNCLE JOE LANDING
LWRP 304
042.10R
041.90R
041.70L
041.70R
041.60R
041.40L
041.40R
040.60L
041.00R
040.80R
040.40L
040.60R
040.00L
040.20R
040.00R
039.60L
039.70R
039.40R
LWRP 302
039.10R
038.90R
LWRP 301.5
BURNHAM ISLAND
038.30L
038.60R
038.00L
038.40R
037.70L
038.20R
037.50L
037.40L
038.00R
037.20L
037.80R
037.60R
037.10L
JACKET PATTERN CHUTE
36.70L
36.70L
036.50L
36.50L
ALLEN TOWHEAD
LWRP 300
36.20L
036.20L
35.90L
035.90L
035.70L
ATHERTON LANDING
LWRP 299.5
035.50L
035.20L
GOOSE ISLAND TOWHEAD
035.00L
LWRP 299
LWRP 298
034.60L
LWRP 298.5
POWERS ISLAND
ANITA ISLAND
034.20L
035.10R
034.80R
034.10L
LWRP 297.5
2
3
4
SANTA FE CHUTE
Model Study

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER
18

0 750 1,500 3,000 4,500 6,000 Feet

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REACH 18
THEBES

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815,000 820,000 825,000 830,000 835,000

465,000 460,000 455,000 450,000 445,000 440,000

LWRP 299
LWRP 298.5
LWRP 298
LWRP 297.5
LWRP 297
LWRP 296.5
LWRP 295.5
LWRP 295
LWRP 294.5
LWRP 294

035.10R
035.0R
034.80R
034.60L
034.20L
034.10L
034.10R
033.30R
32.8R
32.6R
032.60R
32.40R
032.20R
032.00R
032.20L
032.00L
031.90L
031.80L
031.60L
031.40L
031.20L
031.10L
030.30R
030.10R
030.00R
029.80R
029.60R

35
34
33
32
31
30
29

ANITA ISLAND
BILLINGS CHUTE
BILLINGS ISLAND
COMMERCIAL LANDING
GRIFFITH ISLAND
HINTON ISLAND
COMMERCIAL POINT
PHILADELPHIA POINT
DANNIELS LANDING
BUMGARD ISLAND
PRICE TOWHEAD
MOORE LANDING
PRICE LANDING
ELKINS LANDING

1
2

Legend

- Structure degradation
- Dikes since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 19

0 450 900 1,800 2,700 3,600 Feet

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REACH 19
PRICES

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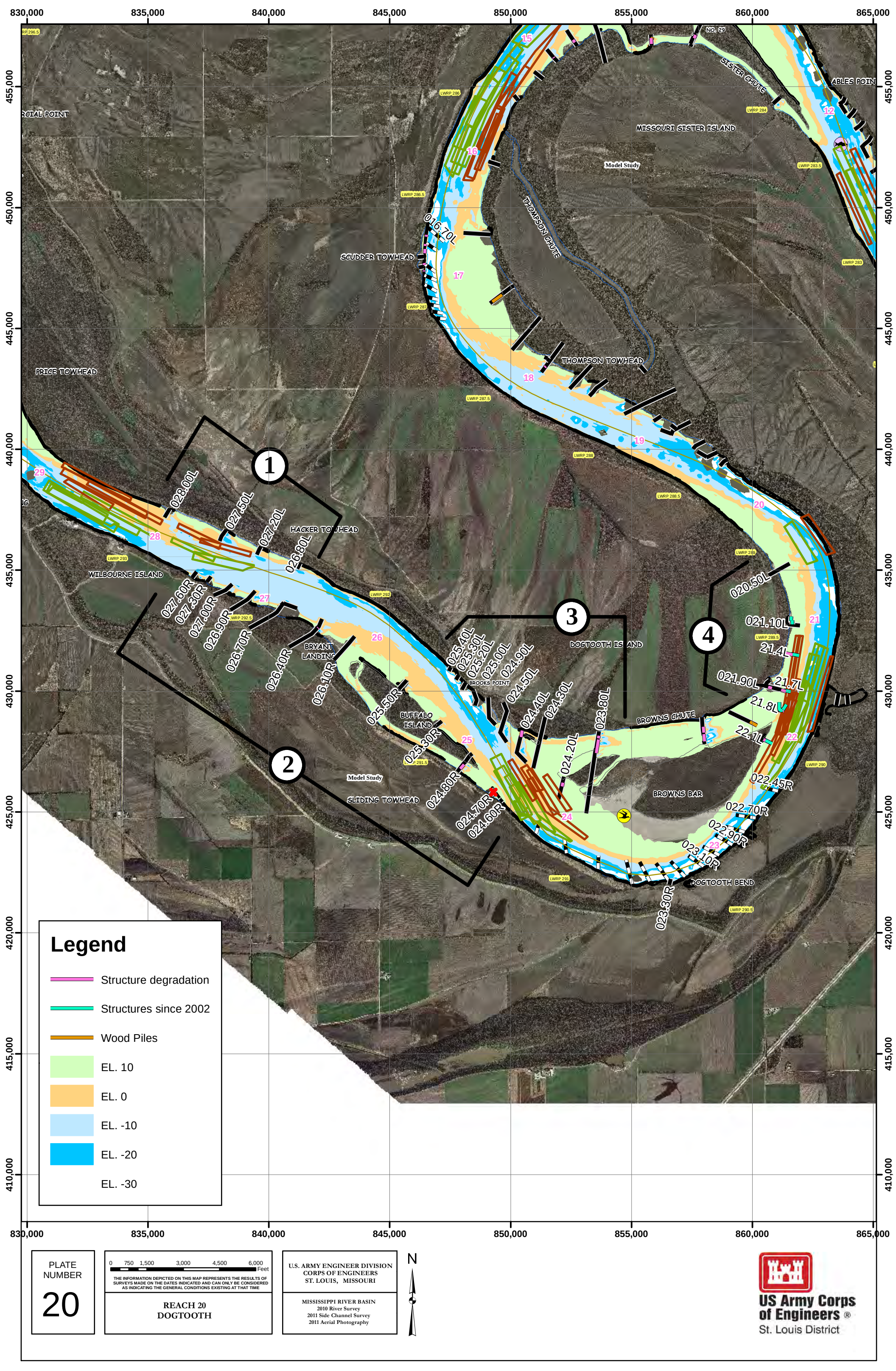

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER 20

0 750 1,500 3,000 4,500 6,000 Feet

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REACH 20
DOGTOOTH

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845,000 850,000 855,000 860,000 865,000

460,000 455,000 450,000 445,000 440,000 435,000

3

2

1

Model Study

GREENLEAF BEND

013.70L
013.60L
013.40L
013.20L
013.10L

LWRP 285
LWRP 284.5

GRAND LAKE TOWHEAD

LWRP 285.5

ISLAND NO. 28
ISLAND NO. 29

014.00R
014.20R
013.70R
014.50R
014.30R
013.40R
014.70R
014.90R
015.10R
015.50R

SISTER CHUTE

ABLES POINT

LWRP 286
LWRP 284
LWRP 283.5
LWRP 283

MISSOURI SISTER ISLAND

016.00R

LWRP 286.5

THOMPSON CHUTE

016.70L
016.80L
016.80L TOWHEAD
016.90L
016.90L
017.10L
016.70R
017.40R
017.80R
018.10R
018.40R
018.50R
019.00R
019.10R
019.30R
019.50R
019.60R
019.70R

THOMPSON TOWHEAD

LWRP 287
LWRP 287.5
LWRP 288
LWRP 288.5
LWRP 289

020.50L

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

845,000 850,000 855,000 860,000 865,000

PLATE NUMBER 21

0 375 750 1,500 2,250 3,000 Feet

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REACH 21
THOMPSON

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865,000 870,000 875,000 880,000 885,000 890,000 895,000 900,000

465,000 460,000 455,000 450,000 445,000 440,000 435,000 430,000 425,000 420,000 415,000 410,000

ABLES POINT
011.90L
011.80L
011.70L
011.60L
011.40L
011.20L
010.80L
010.60L
010.30L
009.80L
010.10R
010.00R
009.90R
009.70R
009.60R
009.40R
09.4R
09.20R
BOSTON BAR
BOSTON CHUTE
008.70L
8.3L
008.00L
007.50L
007.40L
I-57 Bridge
007.00L
006.80L
006.60L
006.40L
006.30L
006.70R
006.10L
005.40L
005.20L
005.10L
004.90L
004.70L
004.40L
004.00L
004.00L
ANGELO TOWHEAD
OHIO RIVER
Cairo Highway Bridge
001.40R
001.30R
000.80R
000.60R
000.30R
000.10R
GREENFIELD BEND
021.70R
021.70R
1
2
3
4
5

Legend

- Structure degradation
- Structures since 2002
- Wood Piles
- EL. 10
- EL. 0
- EL. -10
- EL. -20
- EL. -30

PLATE NUMBER
22

0 750 1,500 3,000 4,500 6,000 Feet

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REACH 22
CAIRO

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