Geomorphology Study of the Middle Mississippi River
Sub-Reach 1 (Mi 40-180)

- **Floodplain Width** Between 10,000’-40,000’
  - Average = 31,000

- **Channel Width** Between 1400’-3800’

- **Floodplain Width to Channel Width Ratio** Between 7-10

- **Mildly sinuous canaliform**
  - Narrow crescent-shaped point bars
  - Notably uniform width
  - Lack of braiding
  - Low to moderate sinousity

- **Alluvium:** Fine Sands, Silts, Clays
Sub-Reach 2 (Mi 0-40)

- **Floodplain Width Between 10,300’- over 500,000’**
  - Average= 333,000’
- **Channel Width Between 1,000’-7,000’**
- **Floodplain Width to Channel Width Ratio Between 5-200**
- **Highly Sinuous Point Bar Canaliform**
  - Prominent point bars
  - Lower bank erosion resistance compared to sub-reach 1
- **Average Slope in Both Sub-Reaches is Approximately 0.5’/mile**
Early History

Marquette and Jolliet paddled down the Mississippi River 1673
City Of St. Louis

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Annual Steamboat Arrivals at the Port of St. Louis

Great Fire of St. Louis
City of St. Louis 1859

One Corps Serving the Armed Forces and the Nation
“the Mississippi changes its channel so constantly that the pilots used to always find it necessary to run down to Cairo to take a fresh look, when their boats were to line in port for a week; that is, when the water was at a low state”

- Mark Twain
Formed in 1879

To “improve and give safety and ease to navigation” and “prevent destructive floods” on Mississippi River

All Members were appointed by the President of the United States and confirmed by the Senate

All work done through the U.S. Army Corps of Engineers
“To make the improvement continuous, working downstream from St. Louis, by reclaiming land and building up new banks, thus reducing the width of the river to the uniform width of about 2500 feet”

Construction was intended to “simply restore what once existed, and to do it in such a way that the restoration shall be permanent”
River Training Structures

Hurdle

Willow Weave Mattress

Workers Constructing Pile Dikes

Hand Placing Stone Riprap

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The Bolters Bar Project has:
- Eliminated 2 years of dredging thus far
- Improved alignment for navigation
- Created unique aquatic habitat
- Maintained access to the side channels for recreational boaters
Number of New Dikes Constructed

<table>
<thead>
<tr>
<th>Time Span</th>
<th>Number of Dikes Constructed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880-1900</td>
<td>445</td>
</tr>
<tr>
<td>1900-1910</td>
<td>63</td>
</tr>
<tr>
<td>1910-1920</td>
<td>13</td>
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<tr>
<td>1920-1930</td>
<td>125</td>
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<tr>
<td>1930-1940</td>
<td>250</td>
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<tr>
<td>1940-1950</td>
<td>117</td>
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<td>1950-1960</td>
<td>27</td>
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<td>1960-1965</td>
<td>77</td>
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<td>1965-1970</td>
<td>54</td>
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<td>1970-1980</td>
<td>72</td>
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<tr>
<td>1980-1990</td>
<td>5</td>
</tr>
<tr>
<td>1990-1997</td>
<td>40</td>
</tr>
</tbody>
</table>
New Dike Construction

New Dike Construction Length (mi)

<table>
<thead>
<tr>
<th>Time Span</th>
<th>Length (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880-1900</td>
<td>104.6</td>
</tr>
<tr>
<td>1900-1910</td>
<td>11.8</td>
</tr>
<tr>
<td>1910-1920</td>
<td>1.3</td>
</tr>
<tr>
<td>1920-1930</td>
<td>16.2</td>
</tr>
<tr>
<td>1930-1940</td>
<td>26.9</td>
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<tr>
<td>1940-1950</td>
<td>11.6</td>
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<td>1950-1960</td>
<td>2.1</td>
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<tr>
<td>1960-1965</td>
<td>8.9</td>
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<tr>
<td>1965-1970</td>
<td>5.8</td>
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<tr>
<td>1970-1980</td>
<td>10.3</td>
</tr>
<tr>
<td>1980-1990</td>
<td>0.7</td>
</tr>
<tr>
<td>1990-1997</td>
<td>3.7</td>
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</table>

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Geomorphology Study

**Primary Goals:**

- Define and Develop a Detailed Historical Baseline of the Mississippi River Prior to the Steamboat Era to Qualitatively and Quantitatively Compare the “undisturbed” River to the Modern Day River

- Develop Conclusions to be Used to Formulate Ideas that May Influence Future Environmental Initiatives
Task was accomplished by Researching all Available Records and Maps in Order to Find the Most Complete and Accurate Historical Data of the Mississippi River.

Requirements of Accuracy and Completeness made Task Difficult.

- Many Early Maps Were Either Rough Maps (sketches) or Maps of a Particular Reach.
Creating the Planforms

- Raw Data was Digitized Using a Flatbed Scanner
- Images were Georeferenced
  - Georeferencing is the process of putting digitized images into their correct place in space by matching known points
- Georeferenced Images Were Used to Accurately Digitize Bank Locations, River Widths, Dike Locations, Weir Locations and Island Locations
Government Land Office Surveys

Missouri Surveyed in 1817
Illinois Surveyed in 1821
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1817 Planform
Cadastral Survey

Cadastral Survey Planform (Green)

AREC Planform (Blue)
River Widths Measured at ½ Mile Increments

\[ t\text{-value} = 0.011907 \]

\[ P\text{-value} = 0.99 \]

AREC planform in substantial agreement with cadastral survey
Aerial Photographs

1928

2003

One Corps Serving the Armed Forces and the Nation
Planforms were analyzed using ArcMap

River Width was defined as the distance between the vegetated banks observed on all maps taken normal to the general direction of flow in the river

Widths were measured at approximately one-half mile increments along the centerline of the planform
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US Army Corps of Engineers
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Legend
- 1817 Outline
- 1817 Islands
- 1866 Planform
- 1866 Islands
- 1881 Planform
- 1881 Islands
- 1928 Planform
- 1928 Islands
- 2003 Planform
- 2003 Islands

MISSOURI

Oakville

Kimmswick

Barnhart

ILLINOIS
Average Planform Width

Average River Width of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

Year | Average River Width (feet)
--- | ---
1817 | 5026
1881 | 6529
1928 | 4380
2003 | 2974
Kaskaskia River Capture

Approximate Location of 2003 Planform

New Confluence

Original Confluence

New Side channel
Average River Width Excluding the Kaskaskia Island reach

Average River Width of the Mississippi River:
Excluding the Kaskaskia Island Reach (RM 110-120)
From the Mouth of the Ohio River to St. Louis, MO

- 1817: 4957 feet
- 1881: 5395 feet
- 1928: 4415 feet
- 2003: 2968 feet
Channel Length of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

<table>
<thead>
<tr>
<th>Year</th>
<th>Channel Length (mi)</th>
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</thead>
<tbody>
<tr>
<td>1817</td>
<td>171</td>
</tr>
<tr>
<td>1881</td>
<td>175</td>
</tr>
<tr>
<td>1928</td>
<td>173</td>
</tr>
<tr>
<td>2003</td>
<td>175</td>
</tr>
</tbody>
</table>
Sinuosity of the Mississippi River

From the Mouth of the Ohio River to St. Louis, MO

Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Sinuosity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1817</td>
<td>1.48</td>
</tr>
<tr>
<td>1881</td>
<td>1.29</td>
</tr>
<tr>
<td>1928</td>
<td>1.29</td>
</tr>
<tr>
<td>2003</td>
<td>1.27</td>
</tr>
</tbody>
</table>
Total Island Area

Total Island Area of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

<table>
<thead>
<tr>
<th>Year</th>
<th>Island Area (mi²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1817</td>
<td>40.8</td>
</tr>
<tr>
<td>1881</td>
<td>59.7</td>
</tr>
<tr>
<td>1928</td>
<td>29.0</td>
</tr>
<tr>
<td>2003</td>
<td>16.8</td>
</tr>
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Average Island Area of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Island Area (mi²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1817</td>
<td>0.65</td>
</tr>
<tr>
<td>1881</td>
<td>0.60</td>
</tr>
<tr>
<td>1928</td>
<td>0.30</td>
</tr>
<tr>
<td>2003</td>
<td>0.29</td>
</tr>
</tbody>
</table>
Surface Area of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

Surface Area (mi²)

Year
1817: 125.5
1881: 140.0
1928: 112.8
2003: 82.6
Wetted Bank of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

Year
1817 1881 1928 2003

Wetted Bank (mi)
576.18 644.52 581.00 492.32
Cumulative Side Channel Length of the Mississippi River
From the Mouth of the Ohio River to St. Louis, MO

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative Side Channel Length (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1817</td>
<td>123.2</td>
</tr>
<tr>
<td>1881</td>
<td>157.4</td>
</tr>
<tr>
<td>1928</td>
<td>121.2</td>
</tr>
<tr>
<td>2003</td>
<td>67.4</td>
</tr>
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</table>
Average River Width of the Mississippi River
From Thebes Gap to St. Louis, MO, Excluding Kaskaskia Island Reach (RM 110-120)

Year | Average River Width (feet)
-----|---------------------------
1817 | 4515
1866 | 4923
1881 | 5051
1928 | 4354
2003 | 2880
This Purpose of this Study is to Serve as a Reference for Future Restoration Initiatives

It is Physically Impossible to Return to the 1817 Planform
- Unless navigation ceases and landowners evacuate the floodplain

It is Possible to Develop a River that Achieves all of the Goals of a Healthy Ecosystem
- Using modern river engineering methods combined with the latest fisheries and waterfowl management strategies
RIPARIAN CORRIDOR

From St. Louis, MO to Cairo, IL
85.0 Square Miles of Riparian Corridor
Crawford Chute Restoration Potential
Mile 74 to 71
Crawford Chute Restoration Potential
Crawford Chute Restoration Potential
Restoration Potential

- Side Channel, Slough, Backwater
- Deep Isolated Oxbow

226.53 mi wetted edge
9.53 mi² Area
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Legend
- Isolated, Deep Oxbow
- Side Channel, sloughs or backwater
- Levee Line
- 2003 Planform

US Army Corps of Engineers
One Corps Serving the Armed Forces and the Nation
The Proposed Restoration Shown in the Blueprint reclaims:

- 965 Feet of Average Planform Width
  - 50% of difference between 1817 and 2003
- 226 Miles of Wetted Bank
  - 25% more than 1817
- 9.53 Square Miles of Area
Eddie Brauer

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U.S. Army Corps of Engineers - St. Louis
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"That's good enough water for any one, you couldn't improve it without putting in a little whisky."

-Mark Twain