US Army Corps of Engineers

Geomorphology Study of the Middle Mississippi River

APPLIED RIVER ENGINEERING CENTER

US Army Corps of Engineers
St. Louis District

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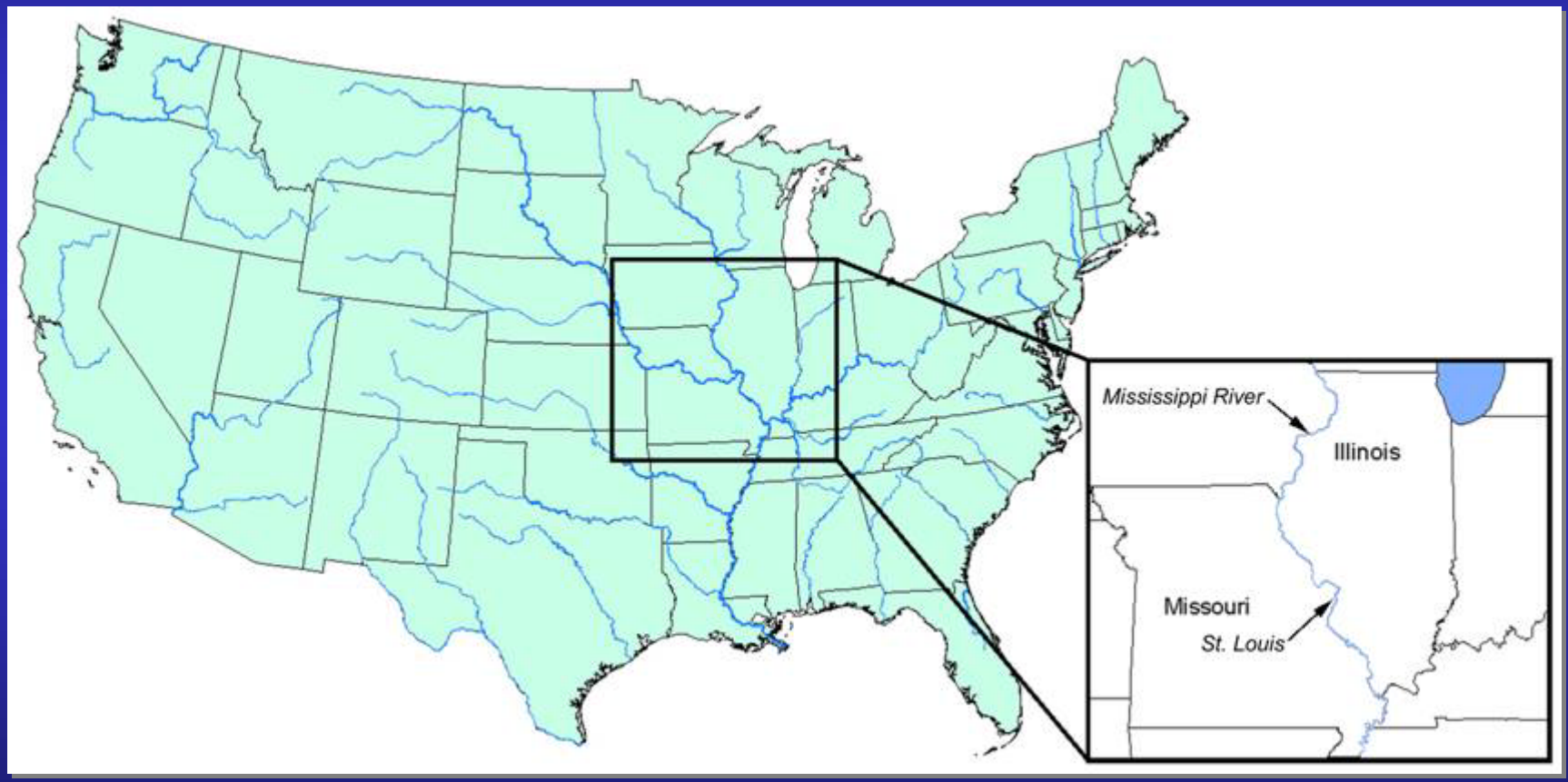
Study Reach



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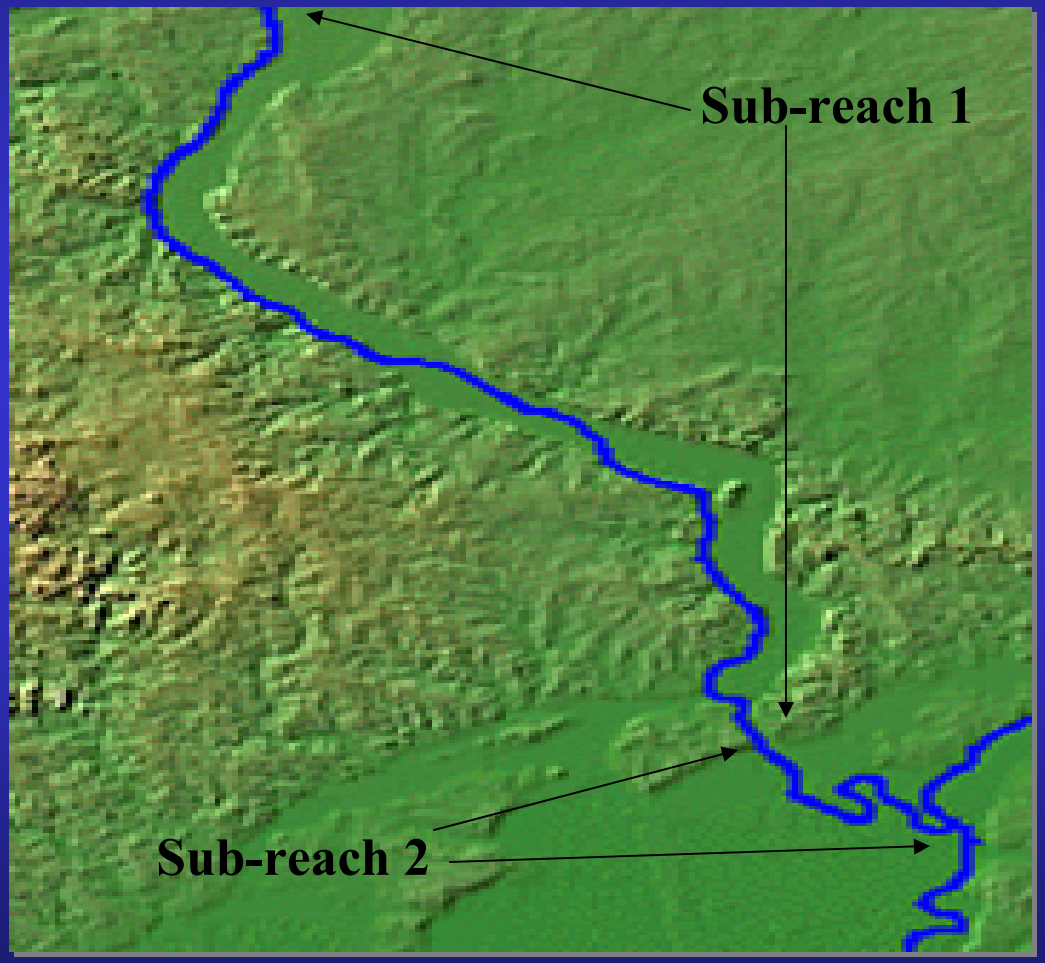
Study Reach



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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

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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

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Early History

Marquette and Jolliet paddled down the Mississippi River 1673

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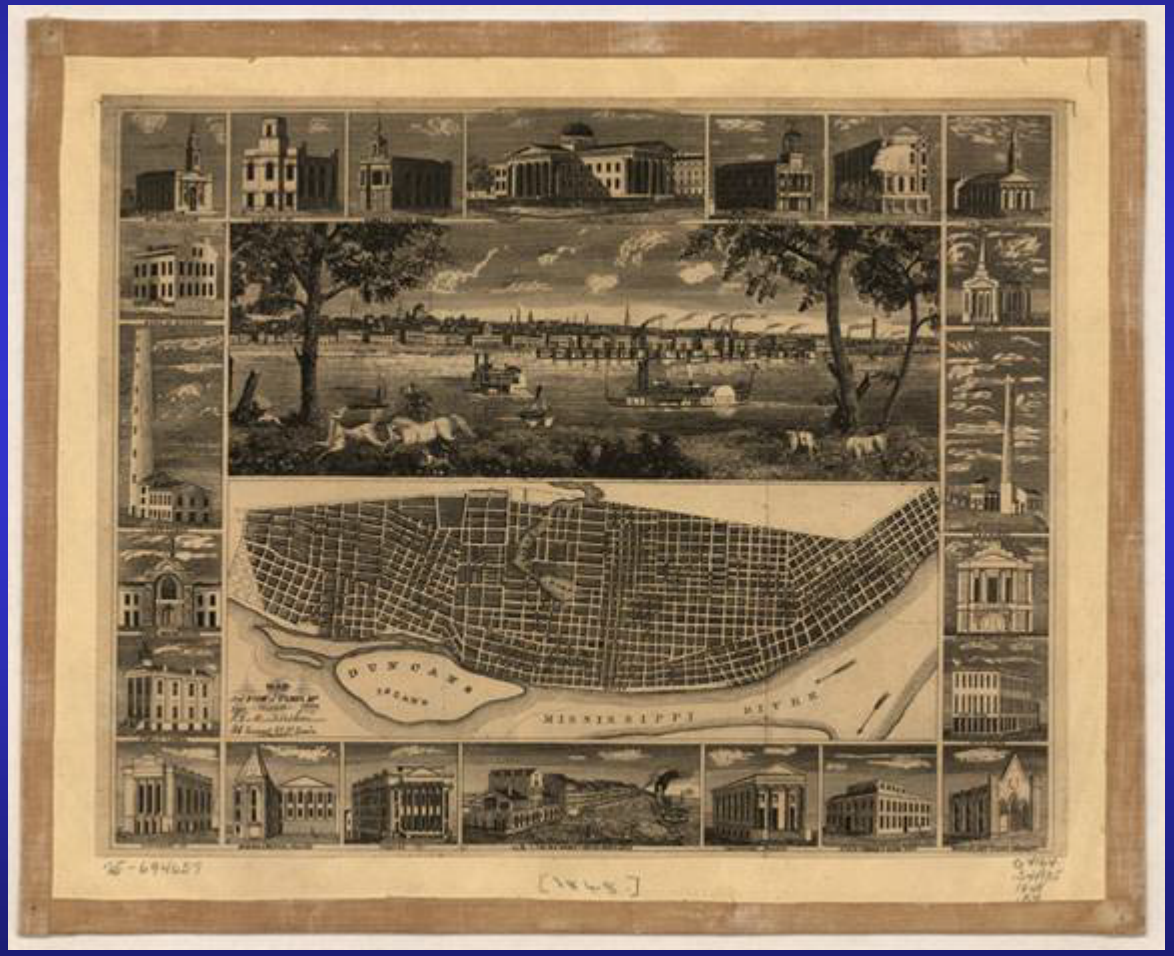
City Of St. Louis



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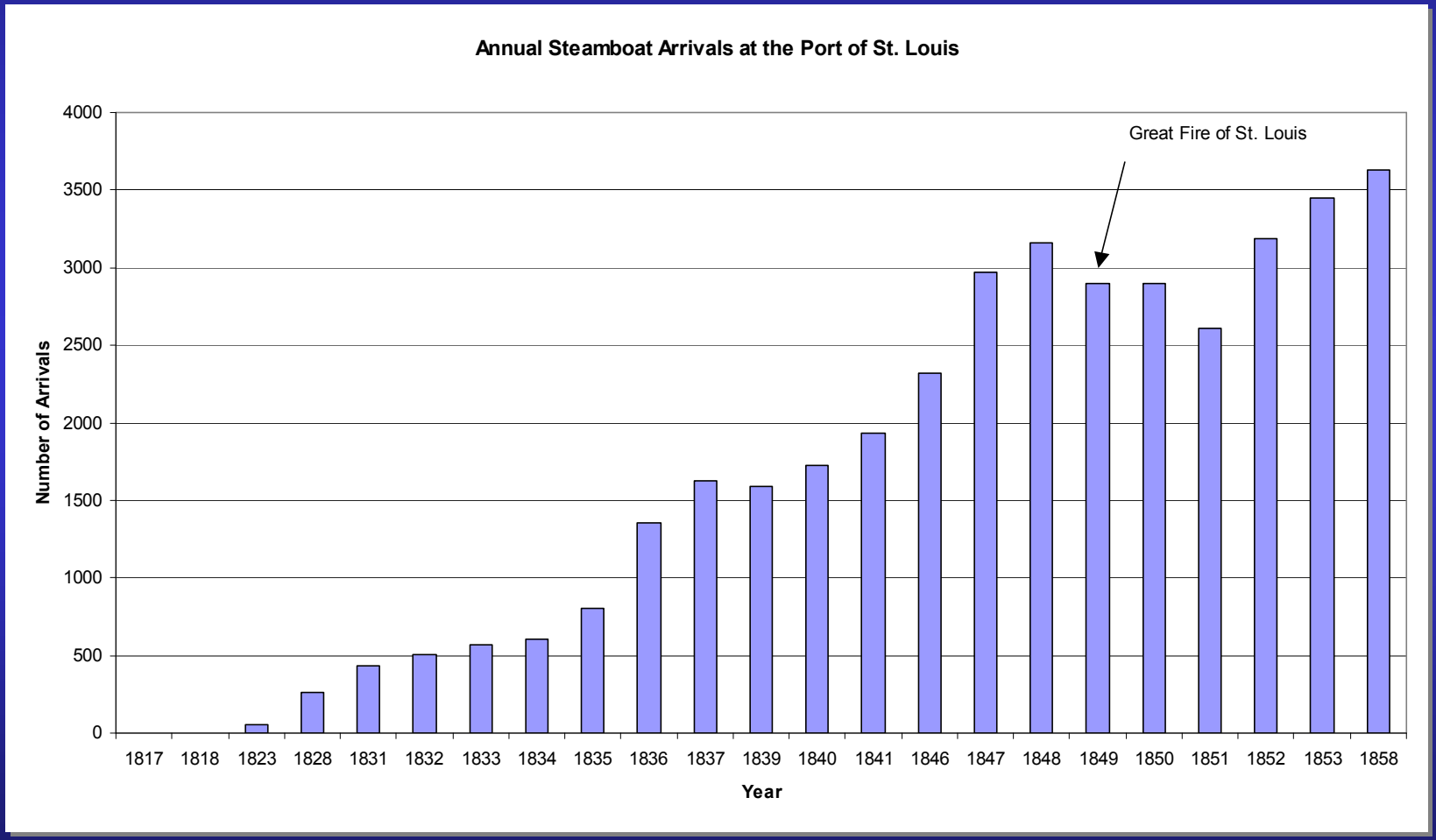
Annual Steamboat Arrivals



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City of St. Louis 1859

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Dangers

"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

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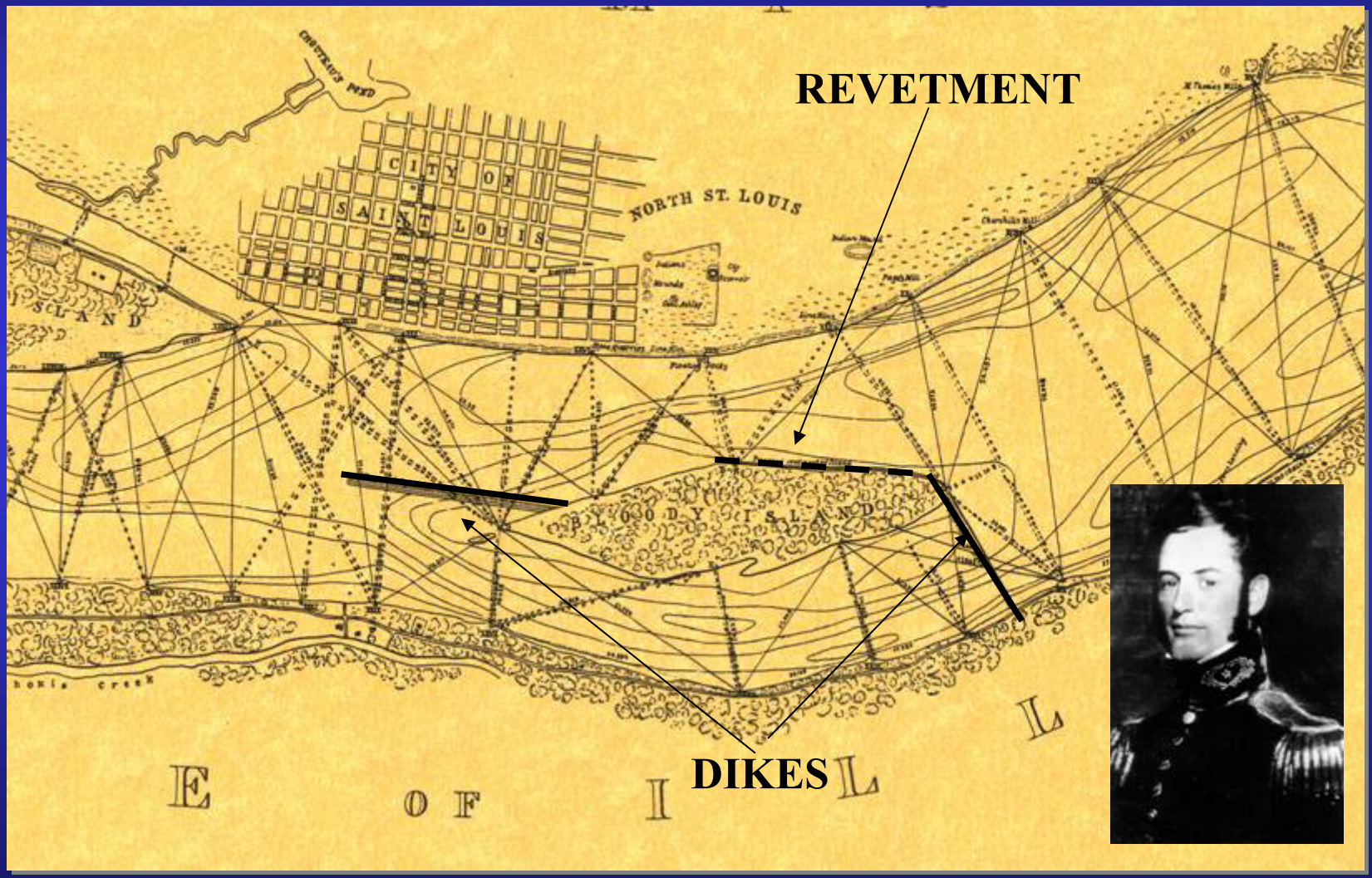
River Training Structures



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Mississippi River Commission

- 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

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MRC Master Plan

- "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"

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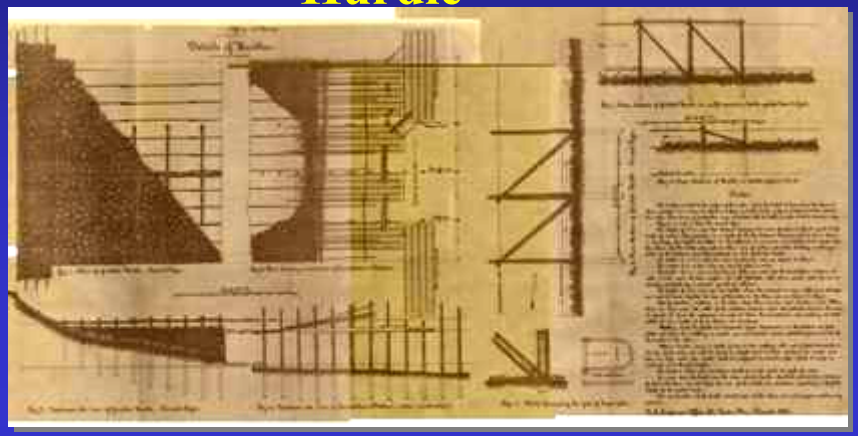
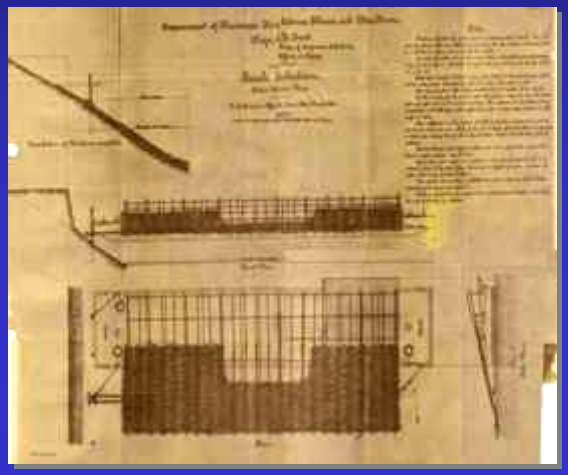
River Training Structures

Hurdle



Willow Weave Mattress



Workers Constructing Pile Dikes

Hand Placing Stone Riprap

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Environmental River Engineering

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Bolters Bar, Pool 26, River Miles 226 – 225

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

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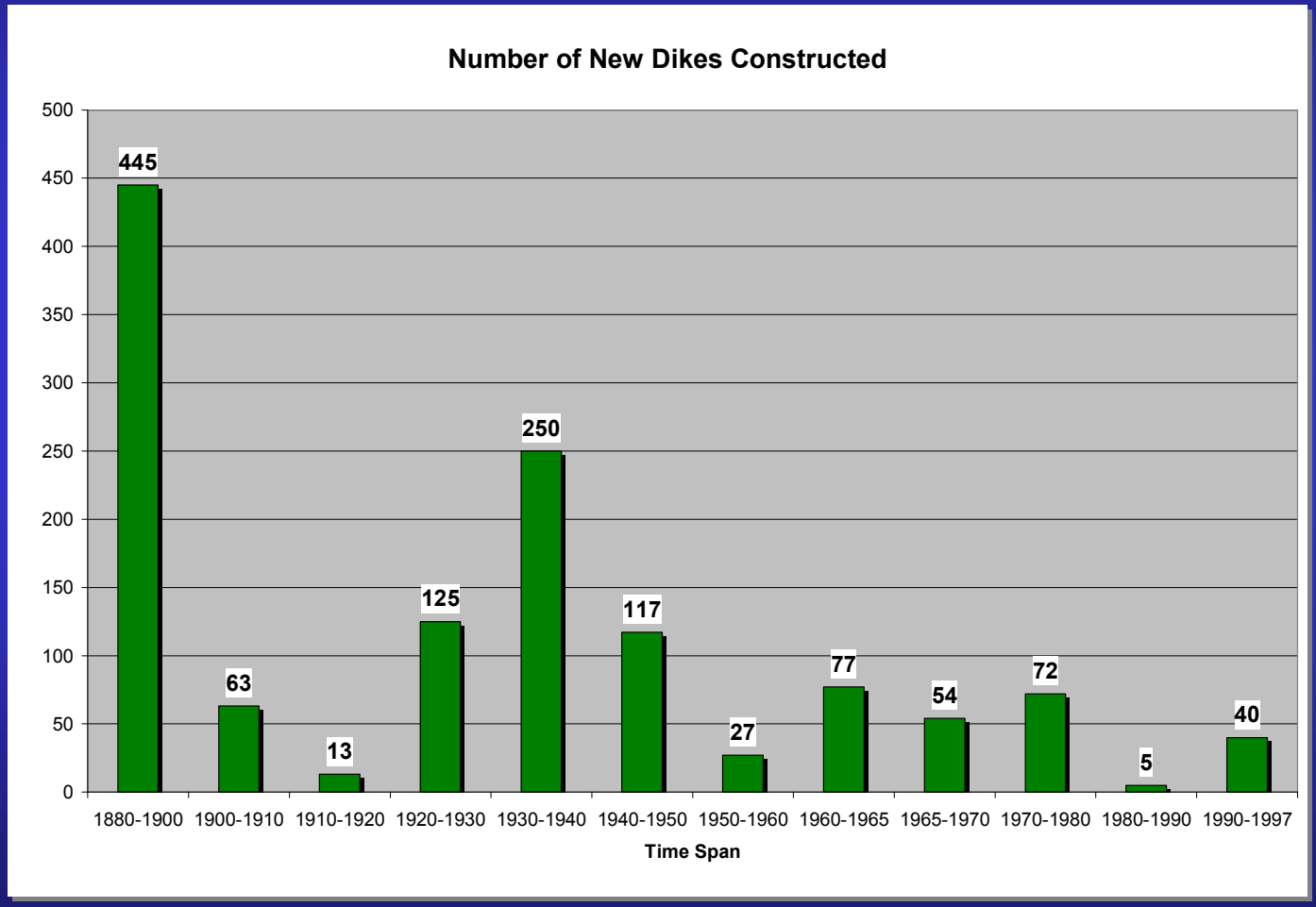
Number of New Dikes Constructed



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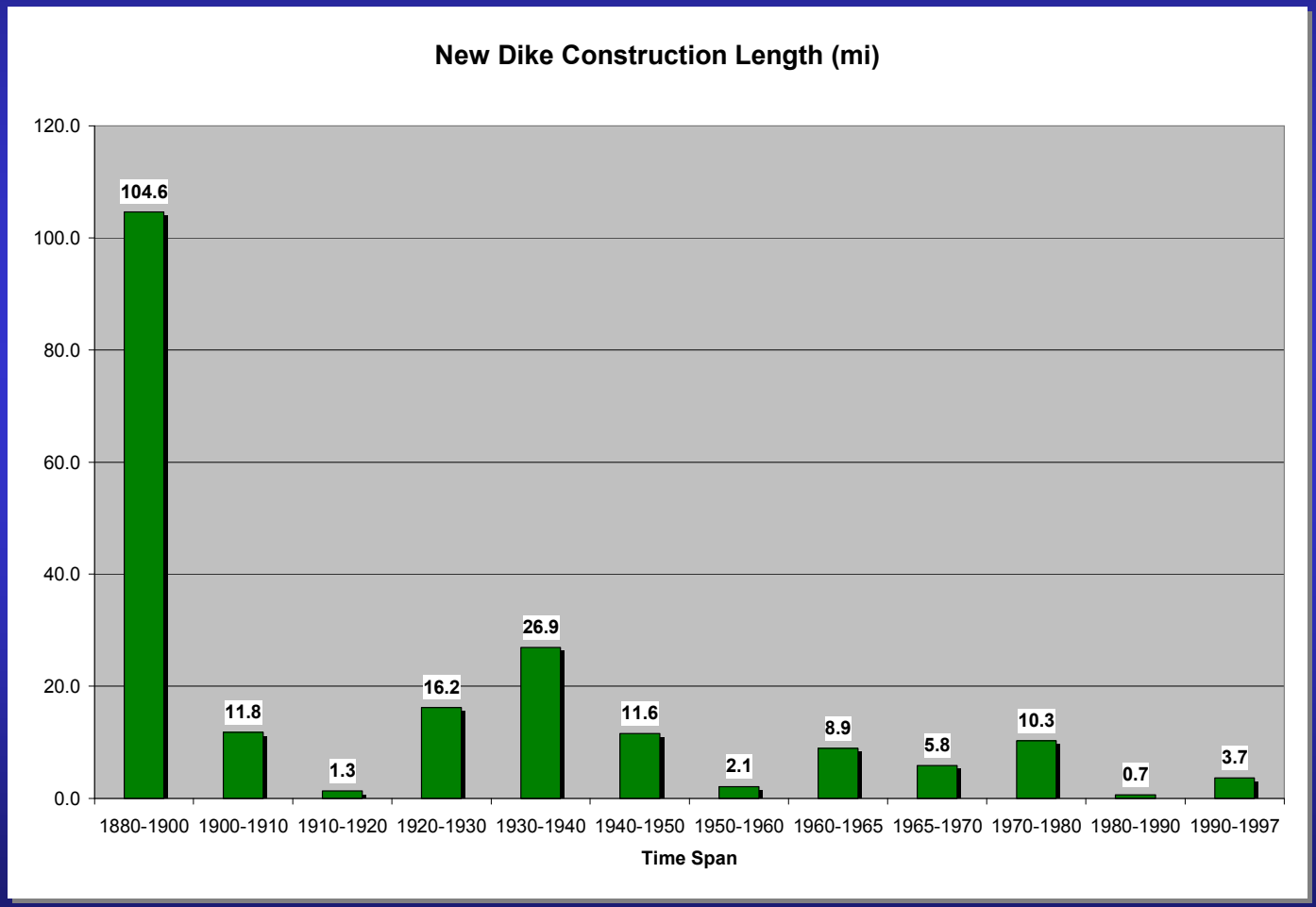
New Dike Construction



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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

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Available Maps & Data

- 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

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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

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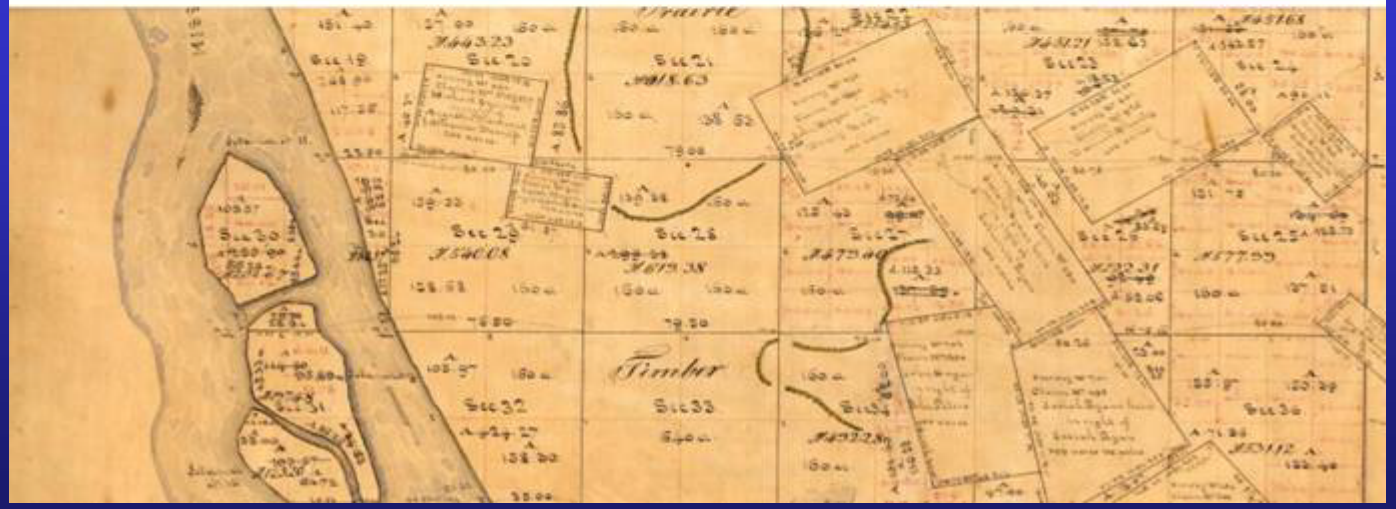
Government Land Office Surveys

Missouri Surveyed in 1817

Illinois Surveyed in1821



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1817 Planform

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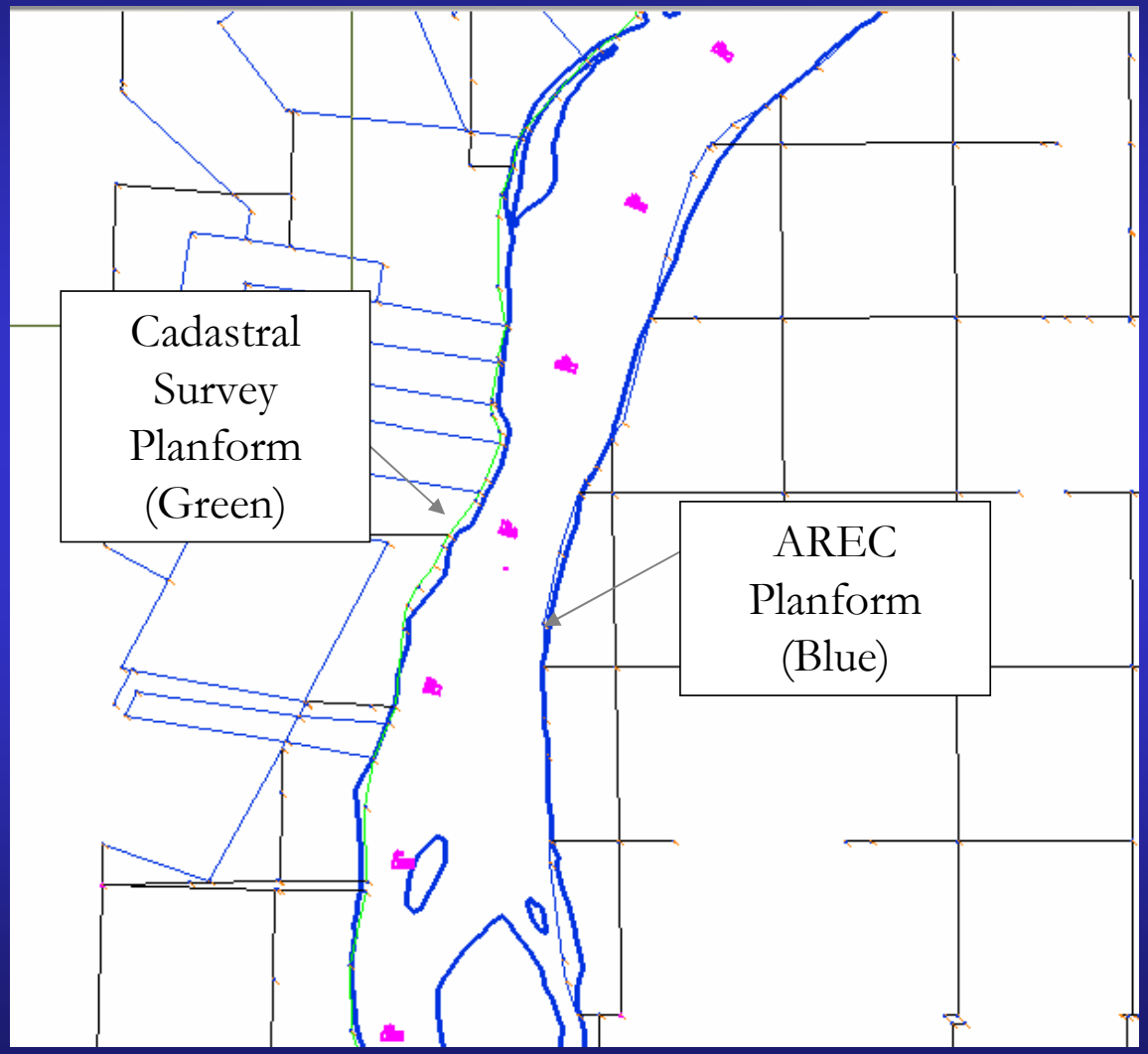
Cadastral Survey



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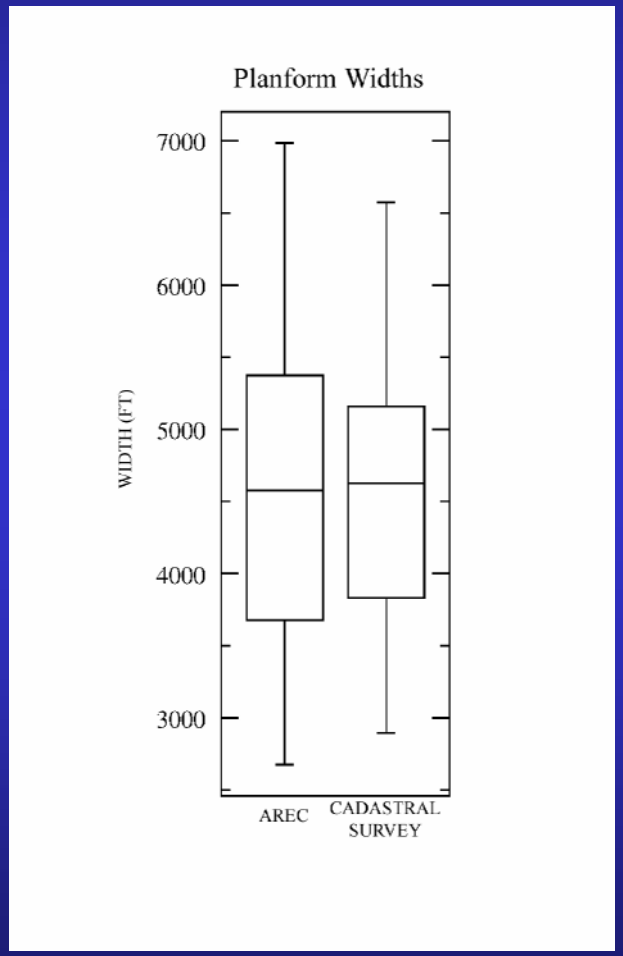
Unpaired t-Test



River Widths Measured at ½ Mile Increments

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P-value=.99

AREC planform in substantial agreement with cadastral survey

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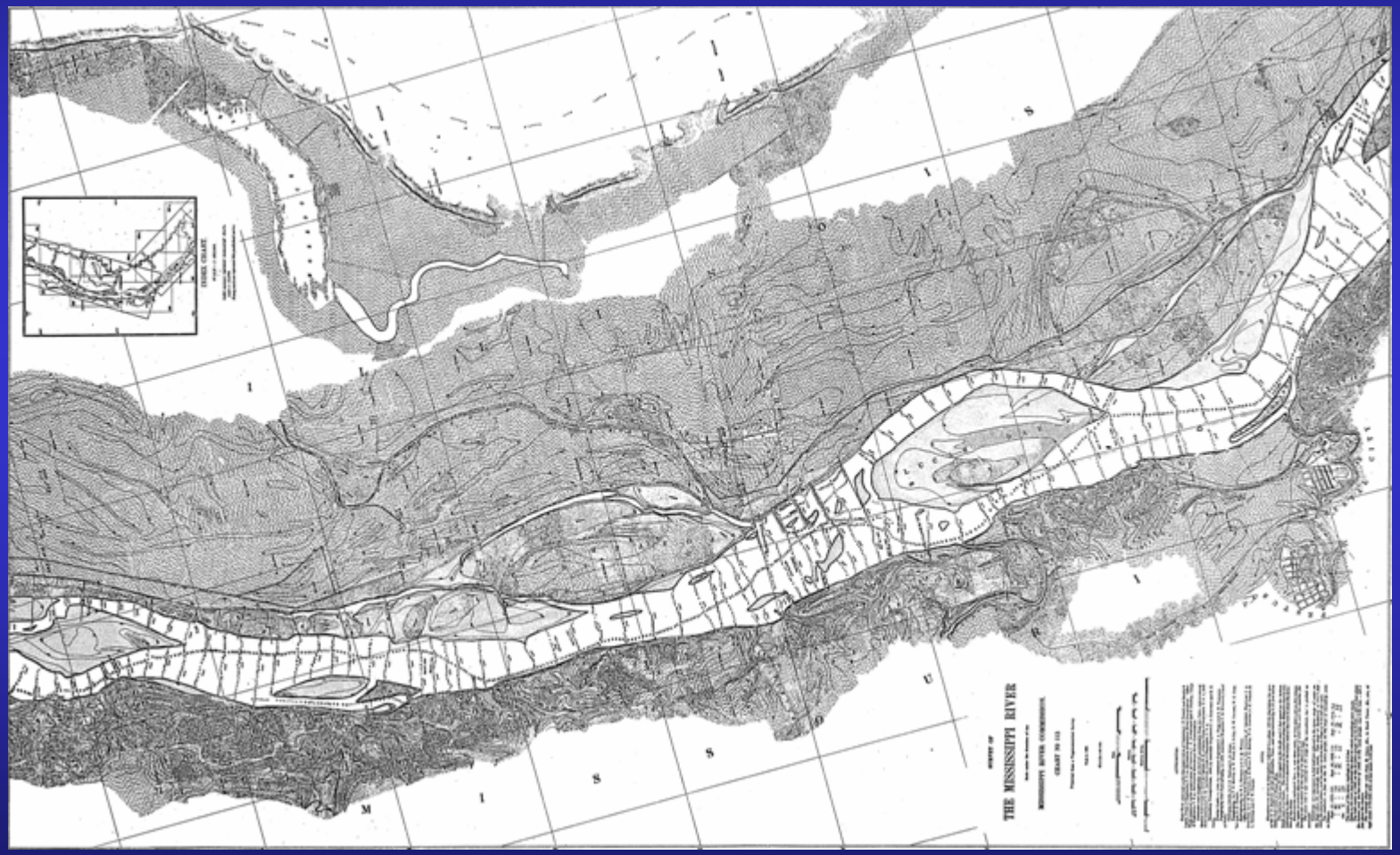
MRC Survey



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Aerial Photographs

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Physical Changes

- 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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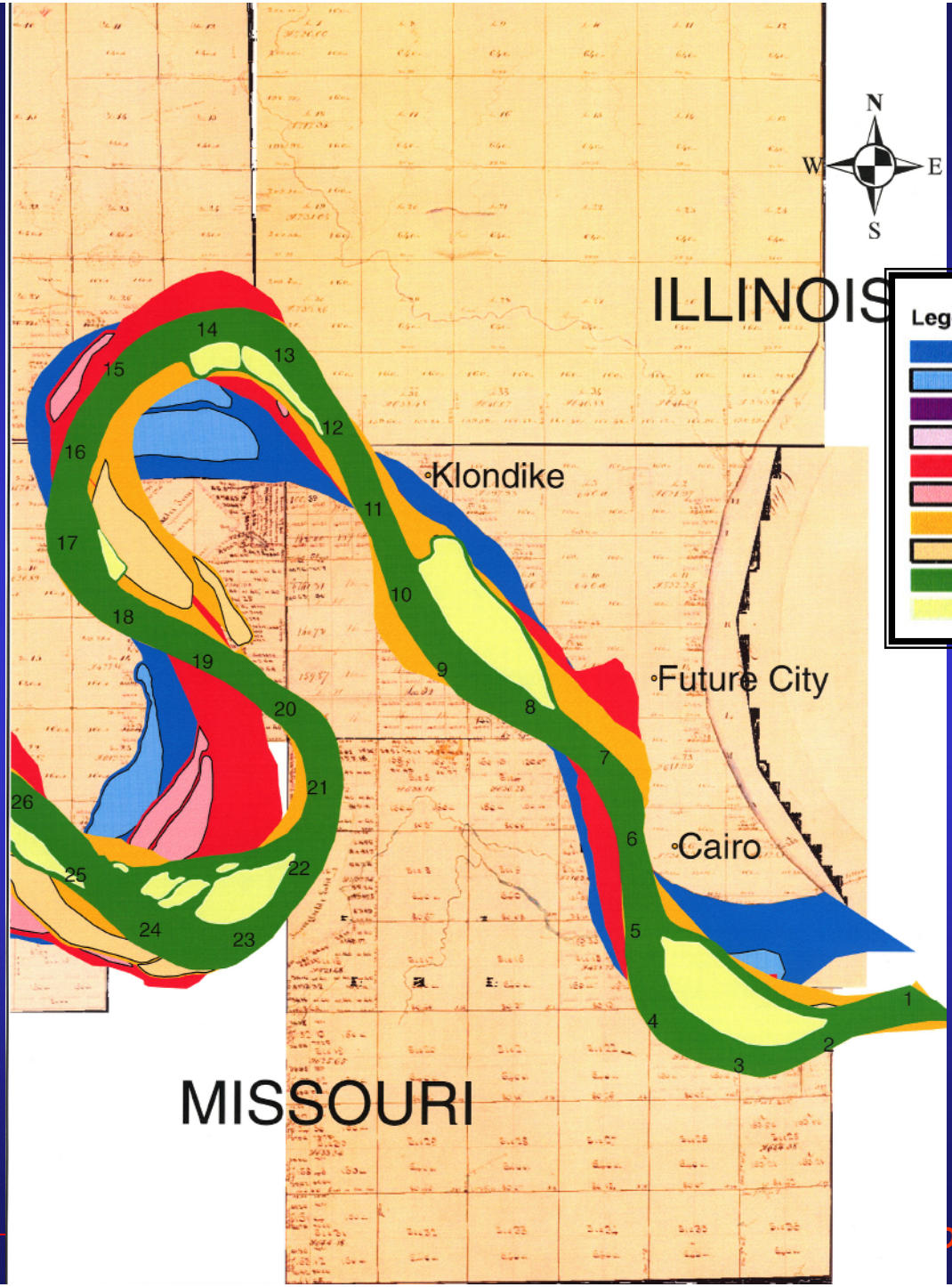

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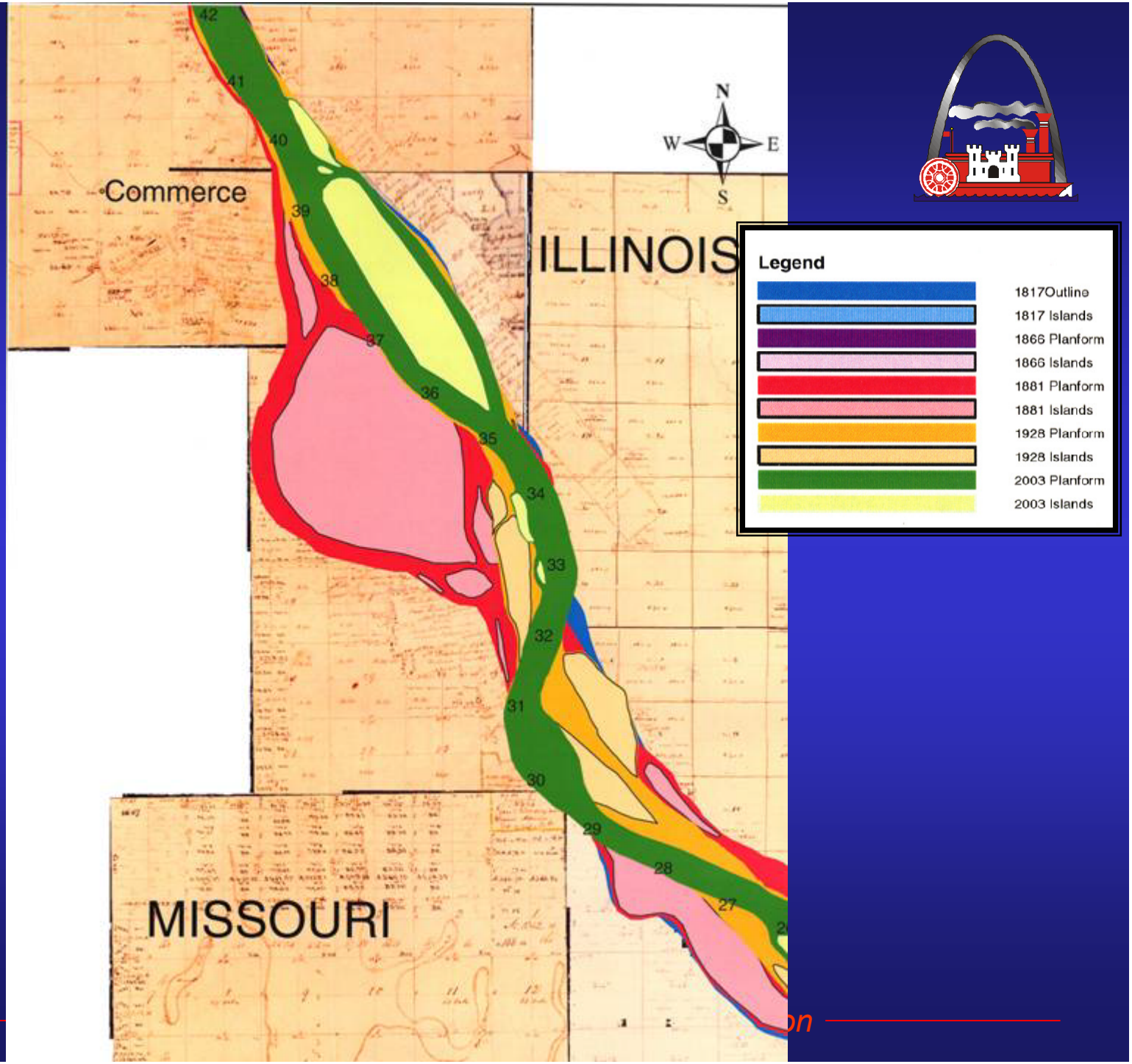

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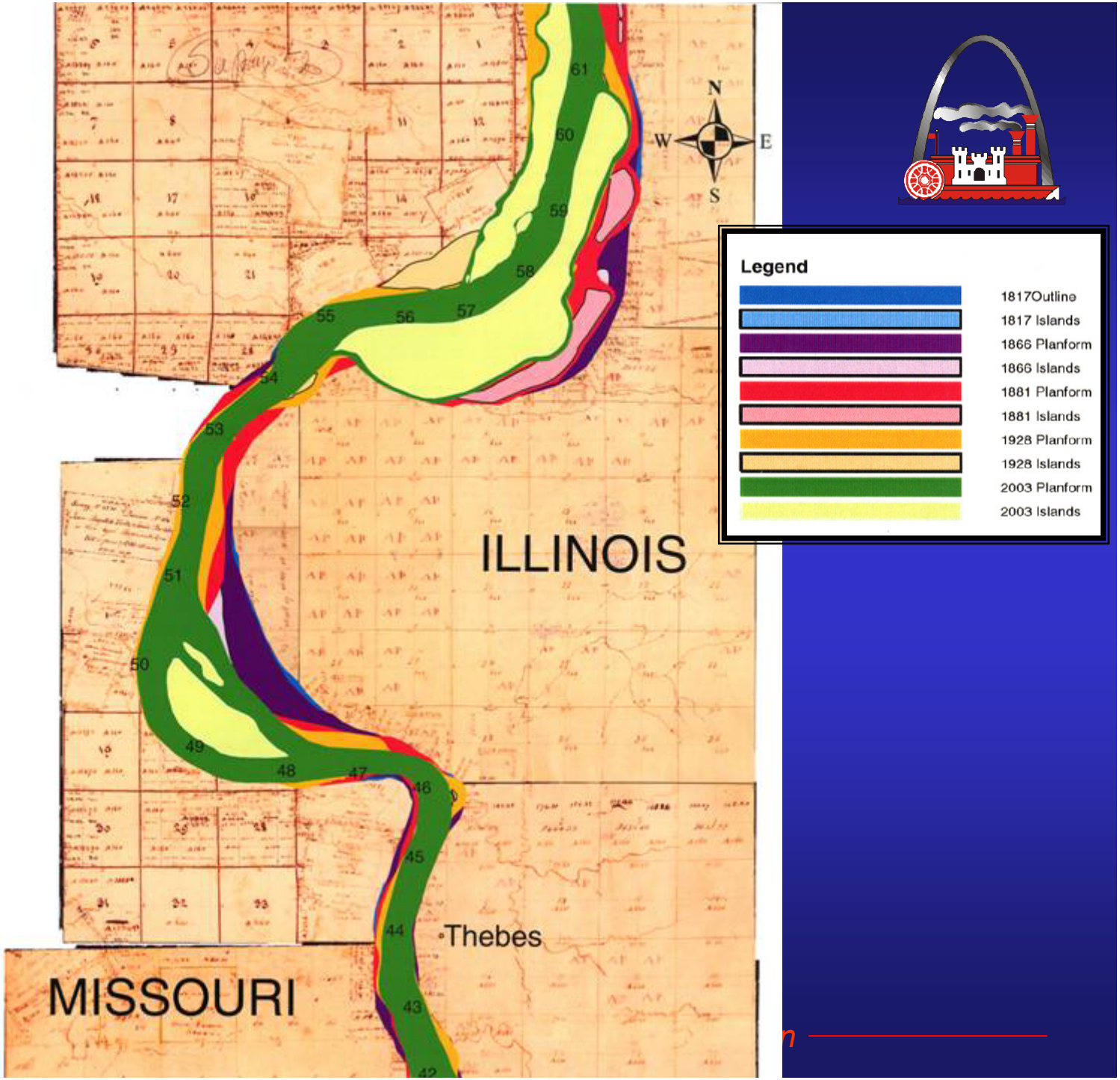

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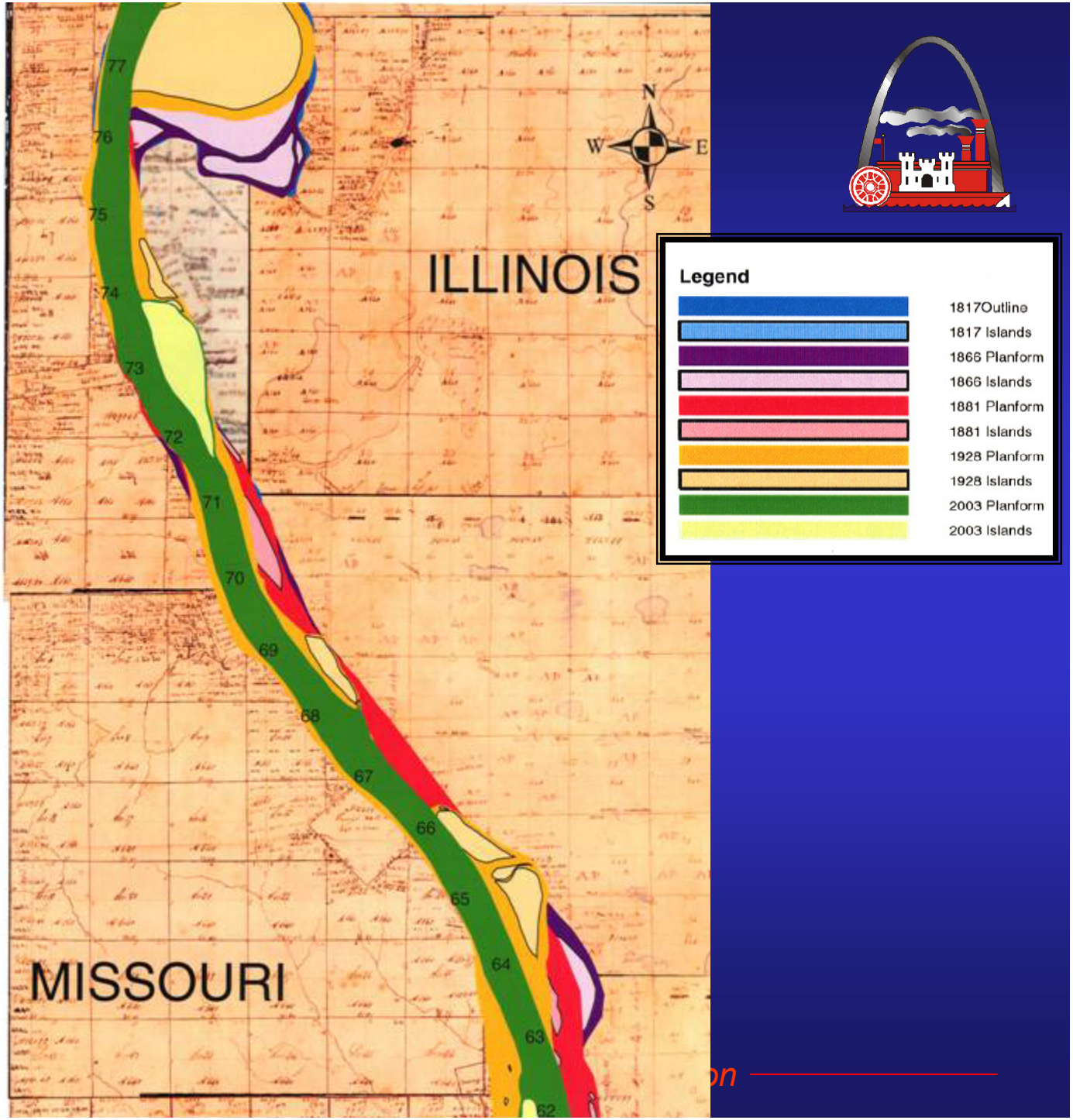

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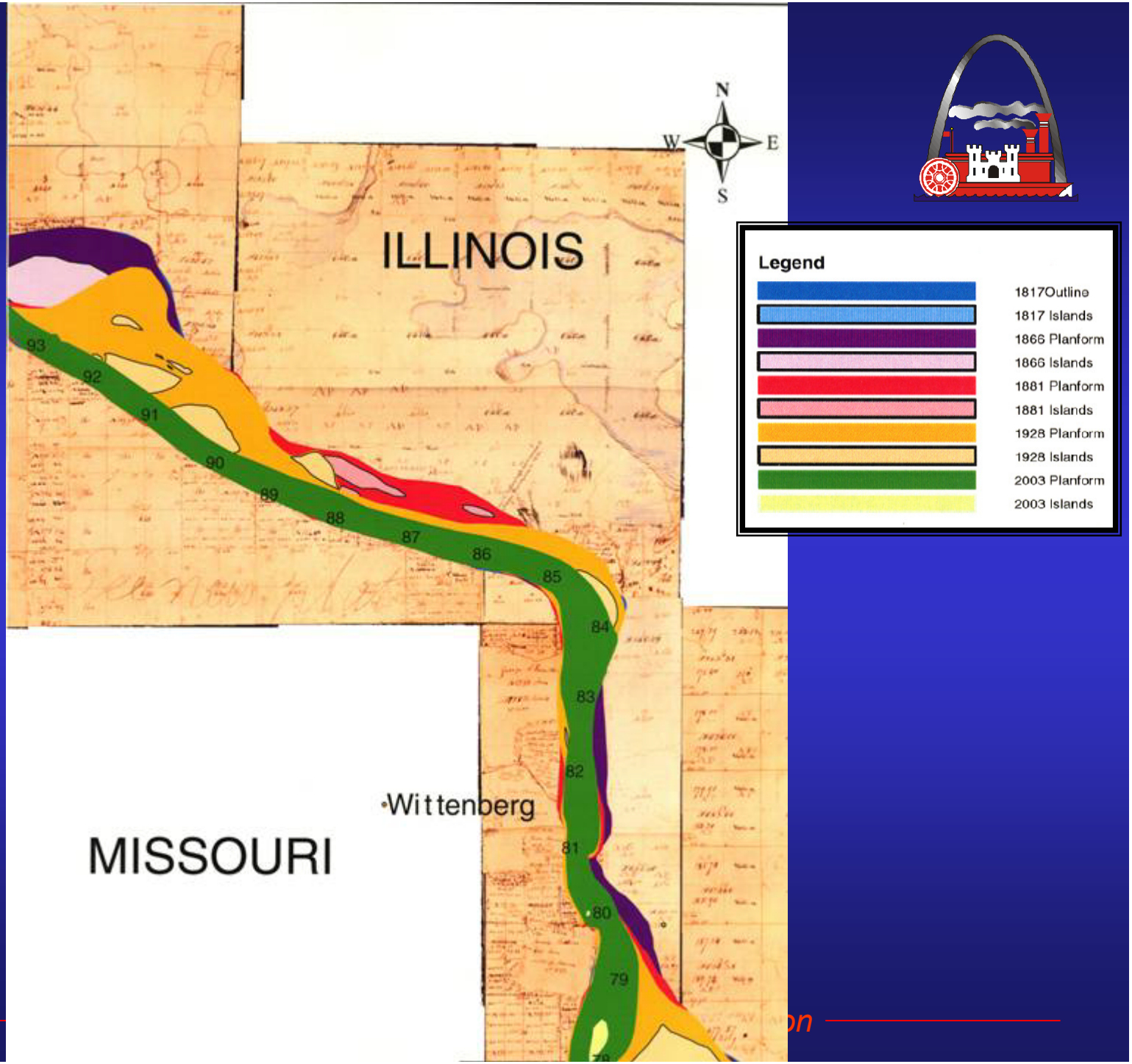

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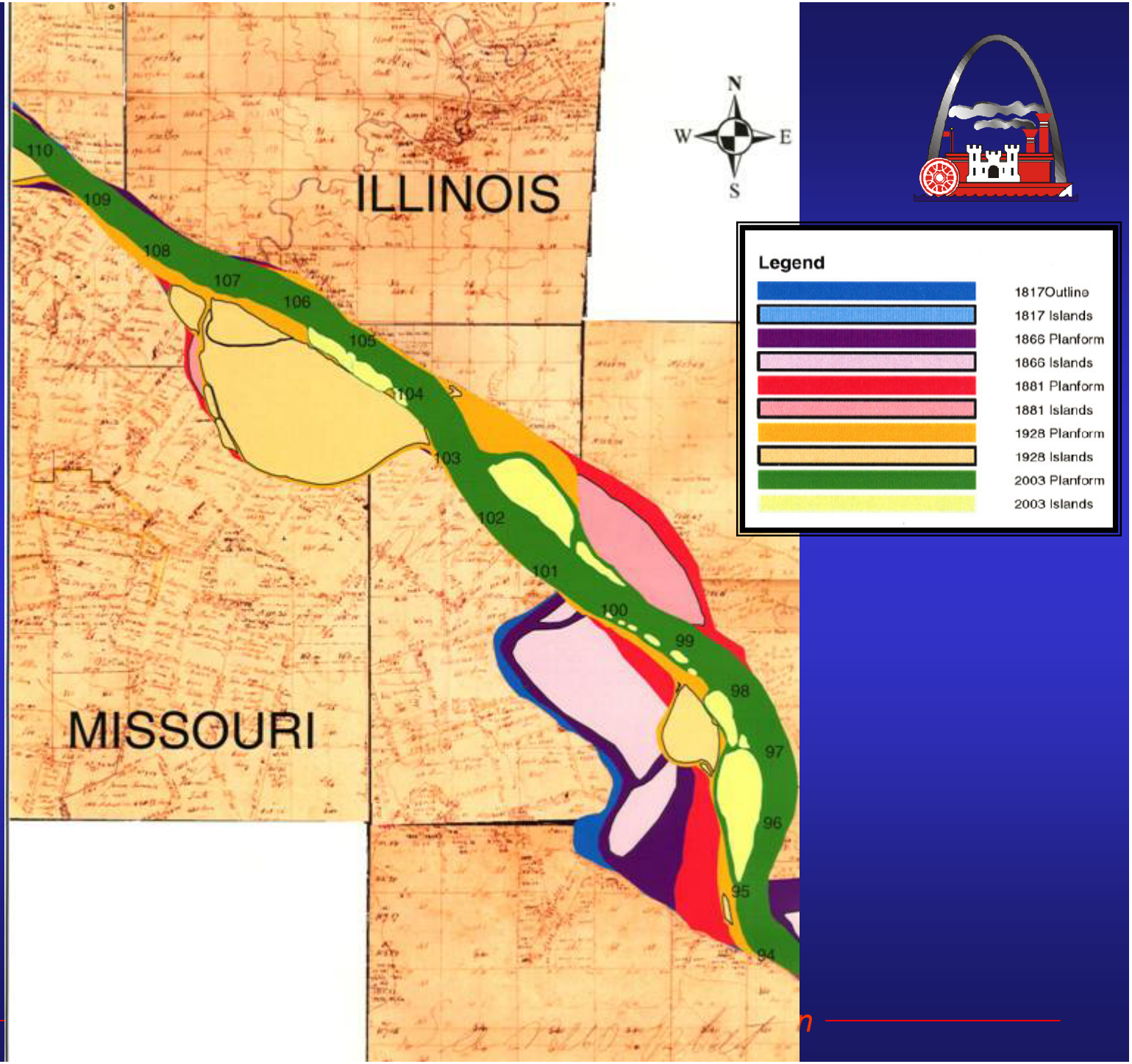

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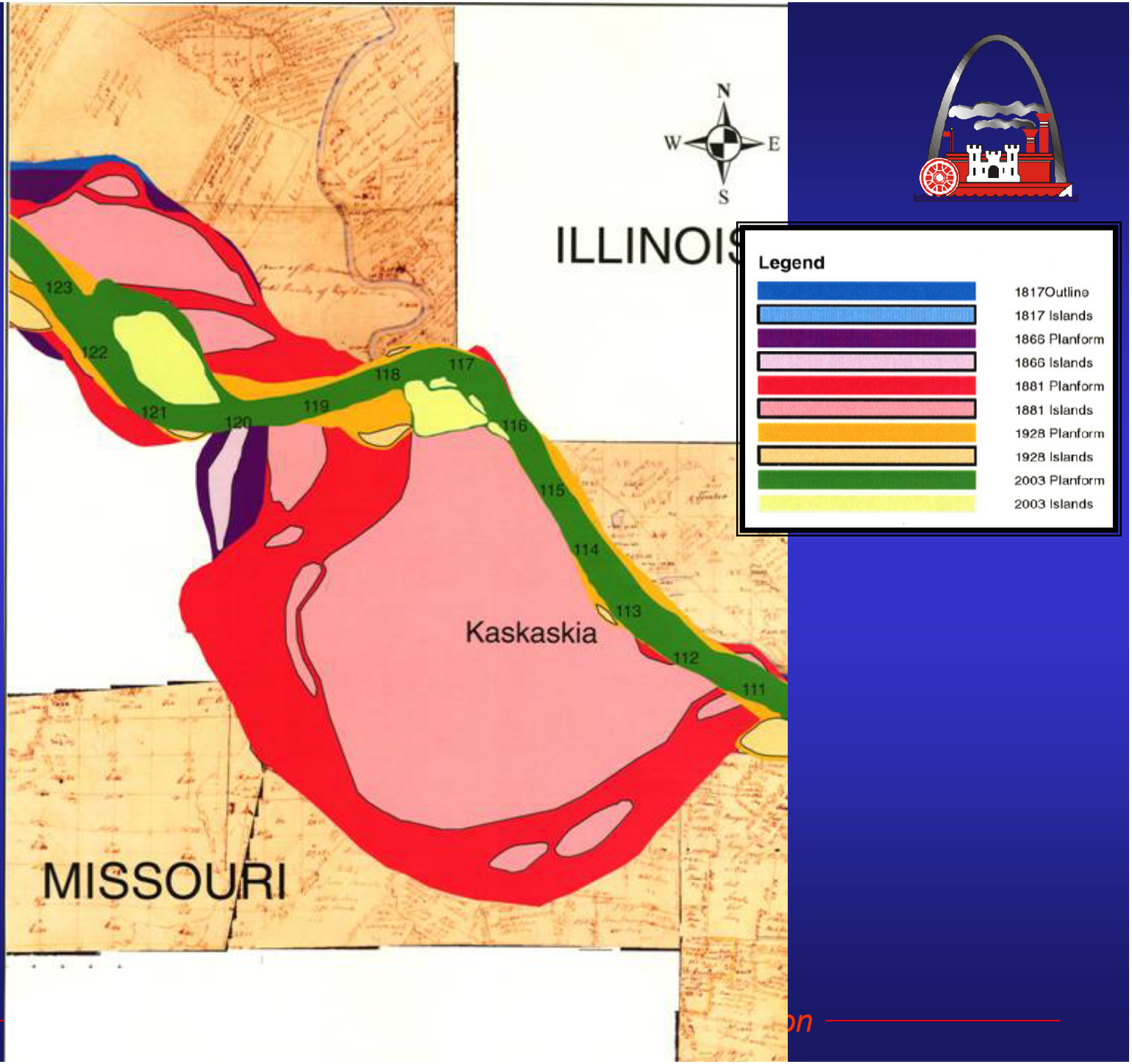

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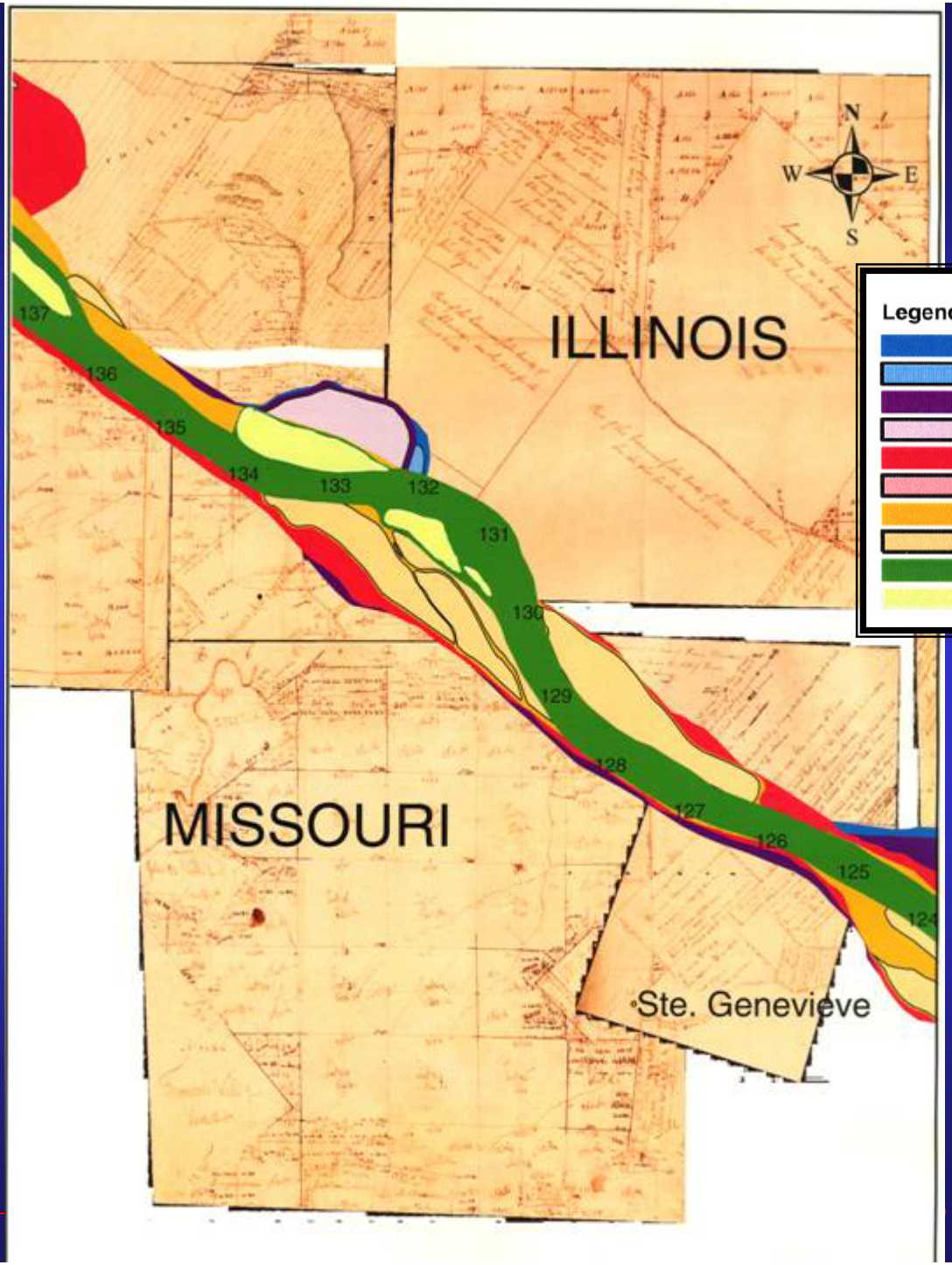

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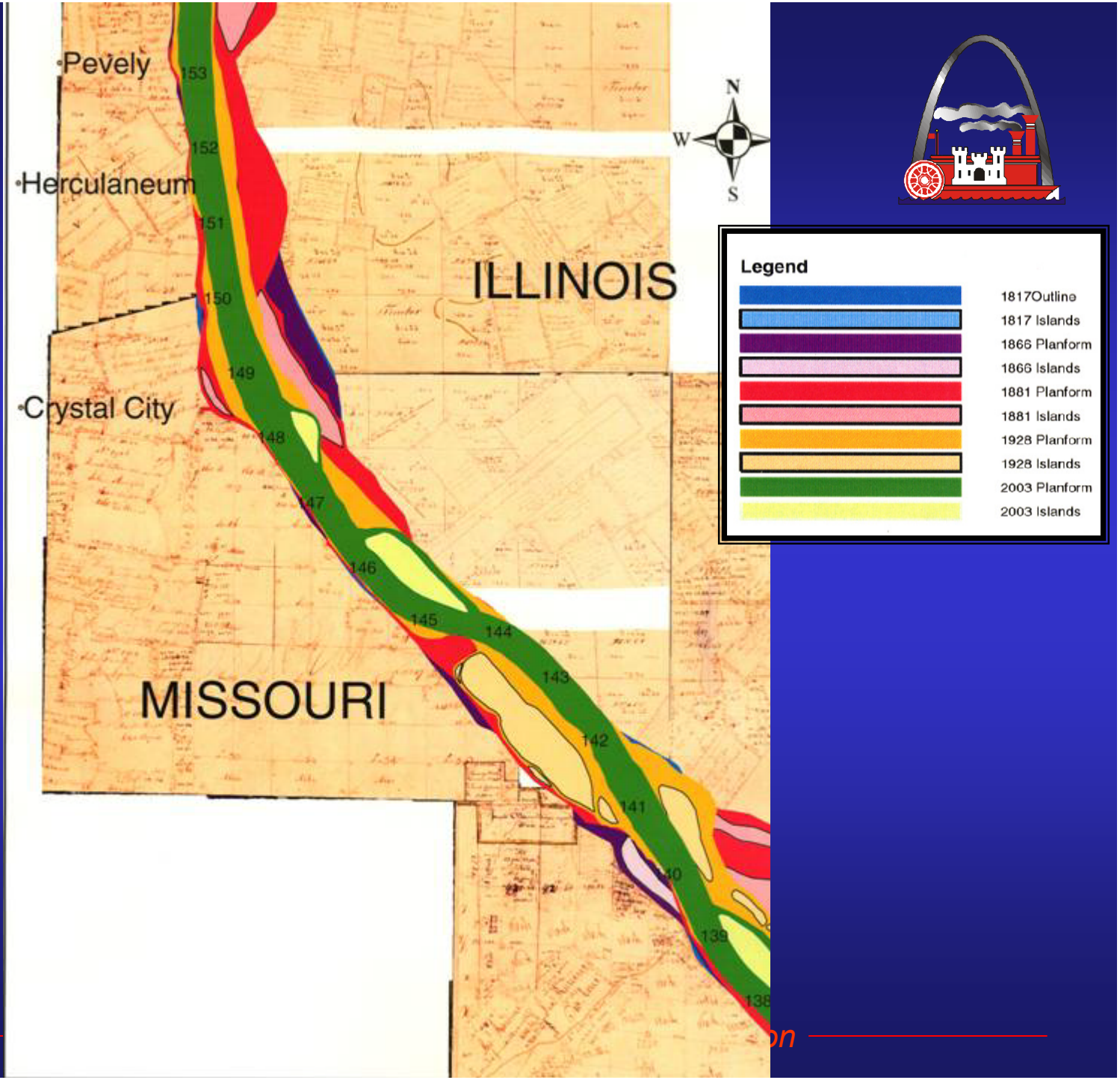

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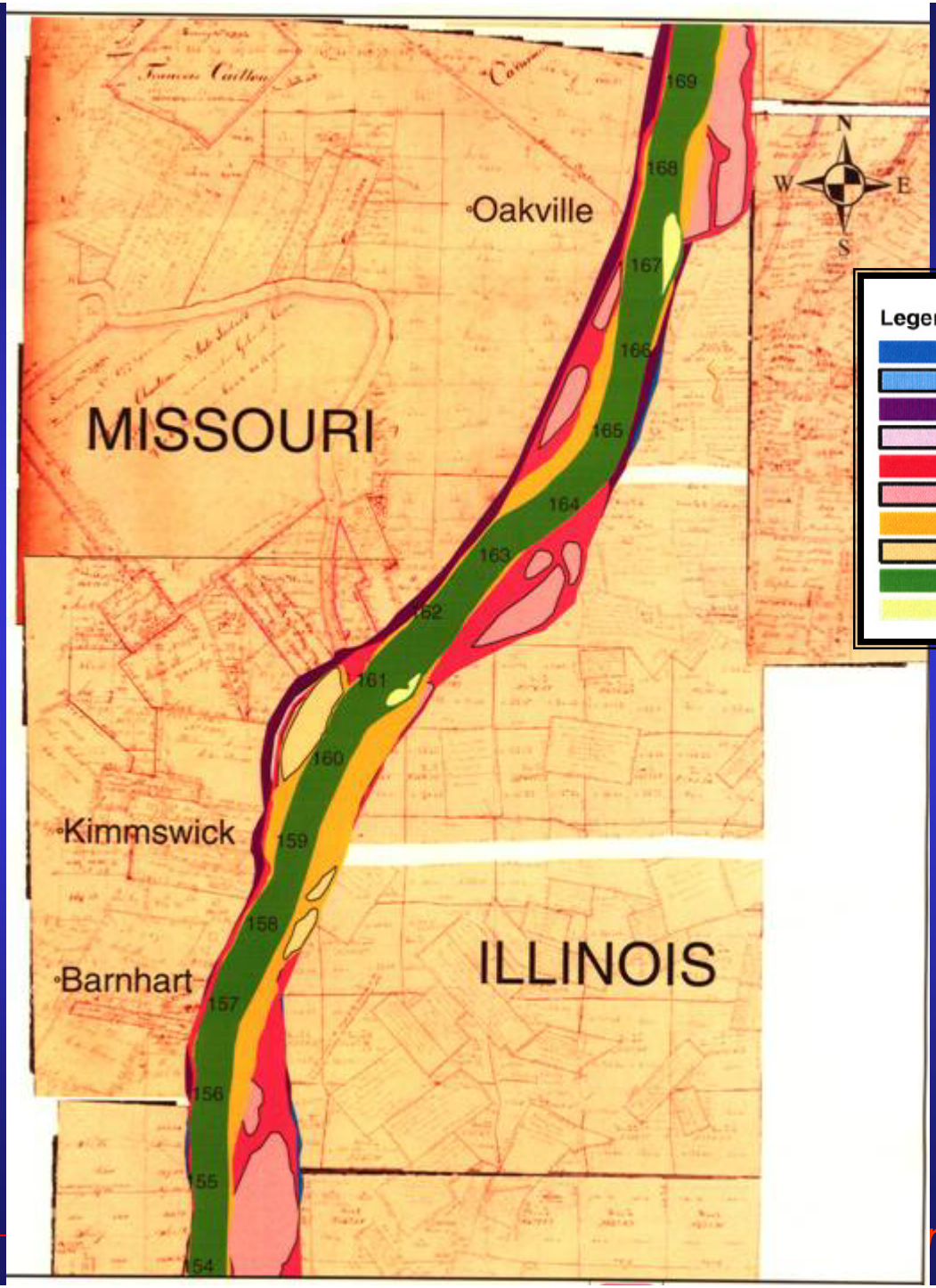

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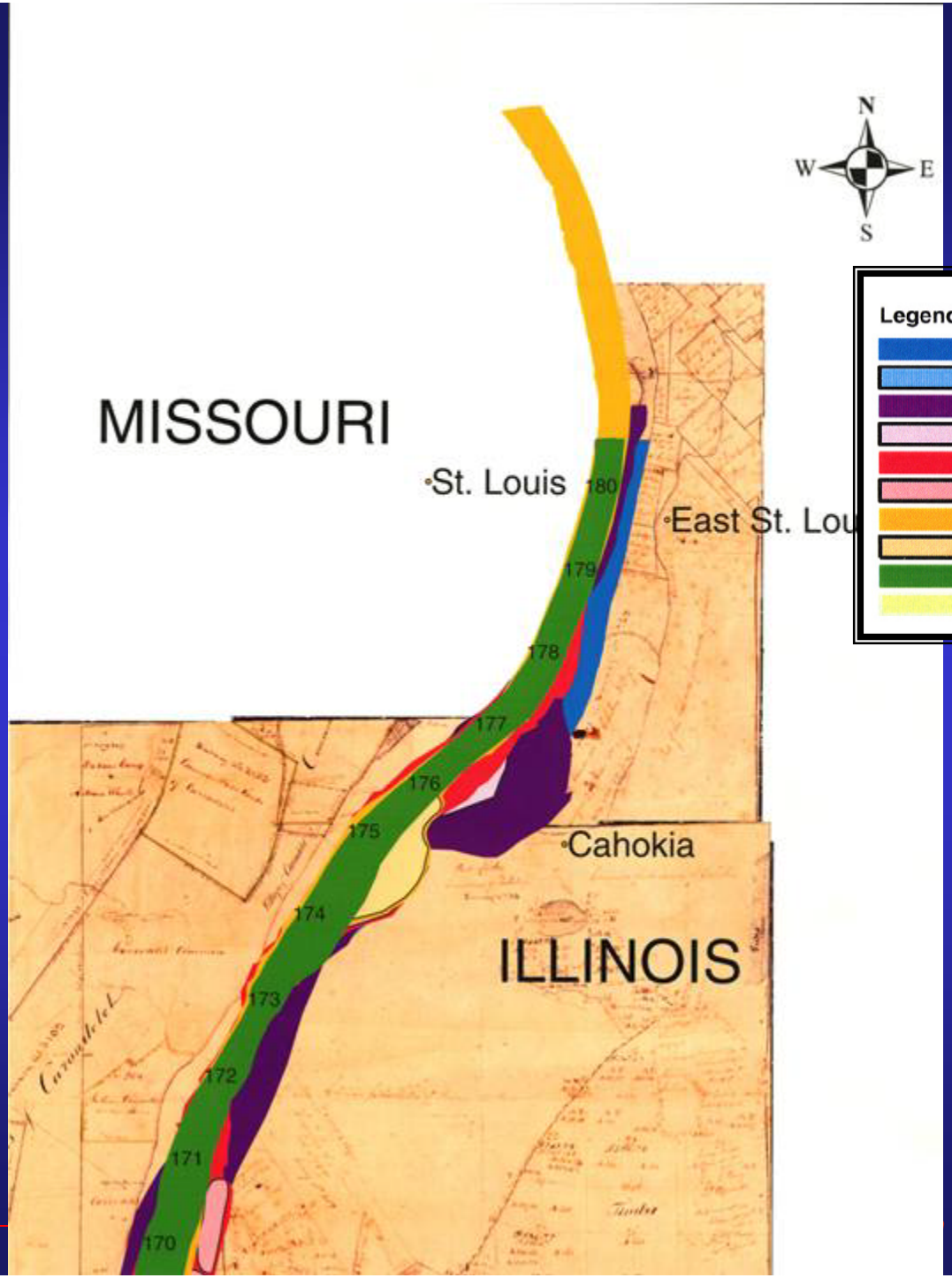

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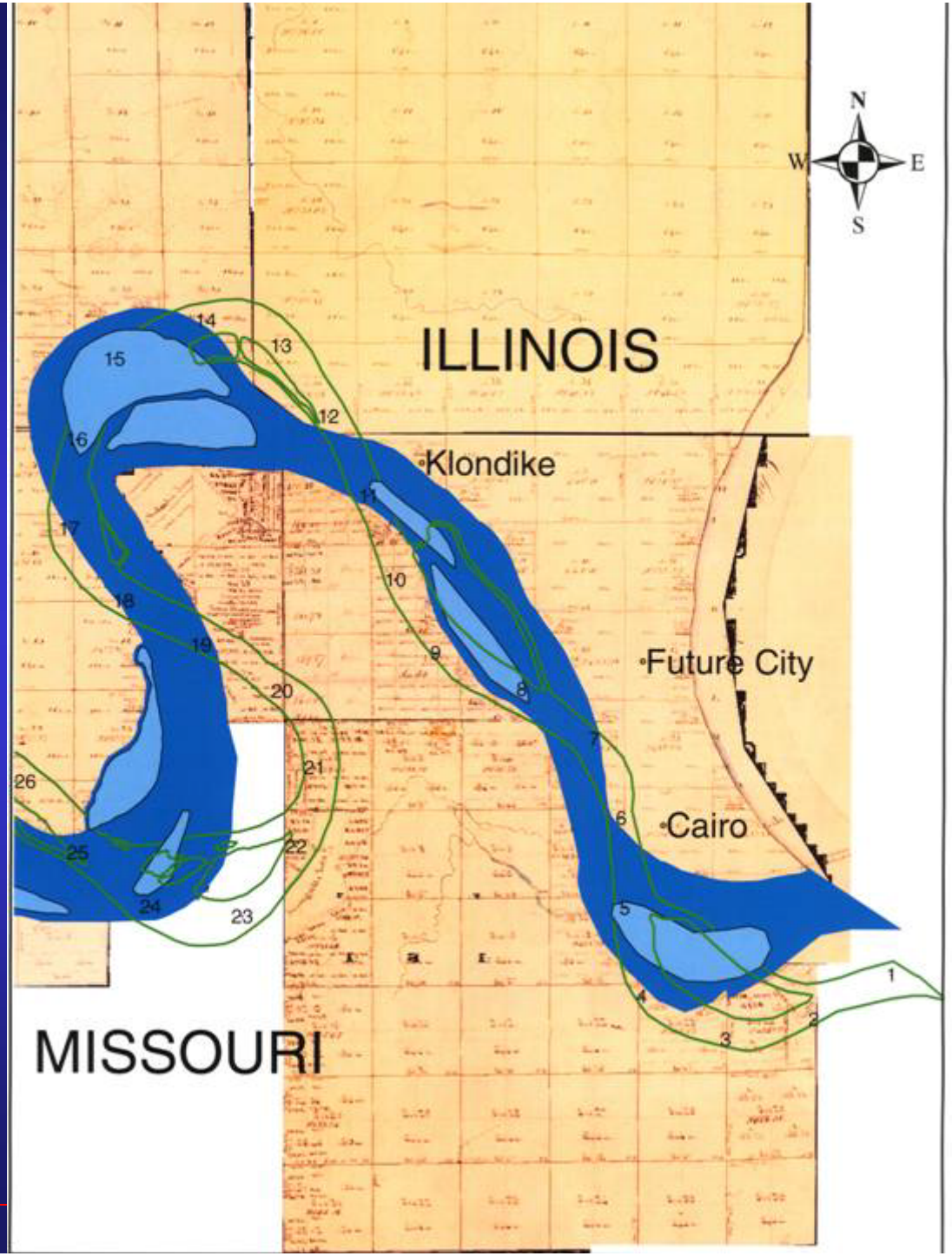

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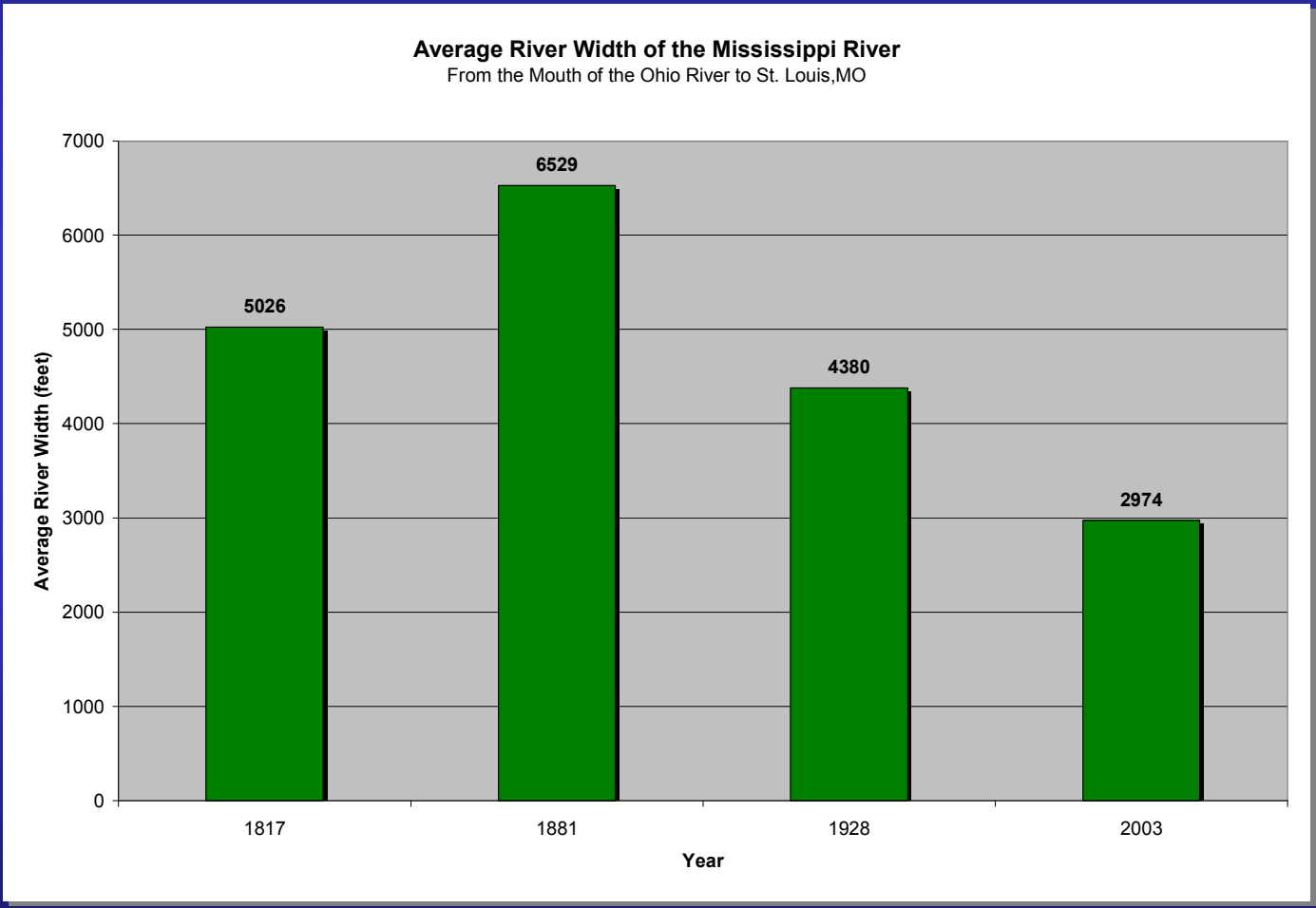
Average Planform Width



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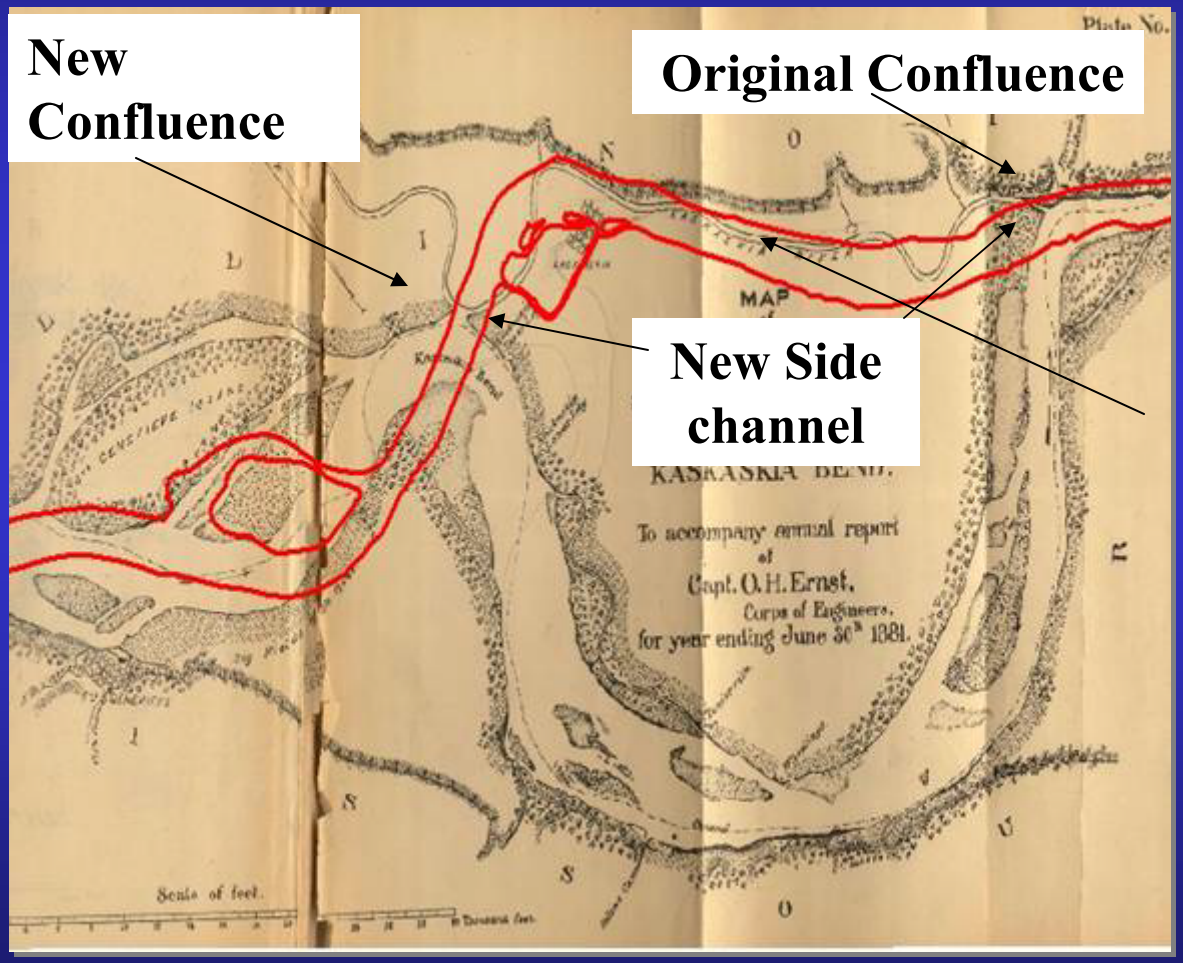
Kaskaskia River Capture



Approximate Location of 2003 Planform

Average River Width Excluding the Kaskaskia Island reach

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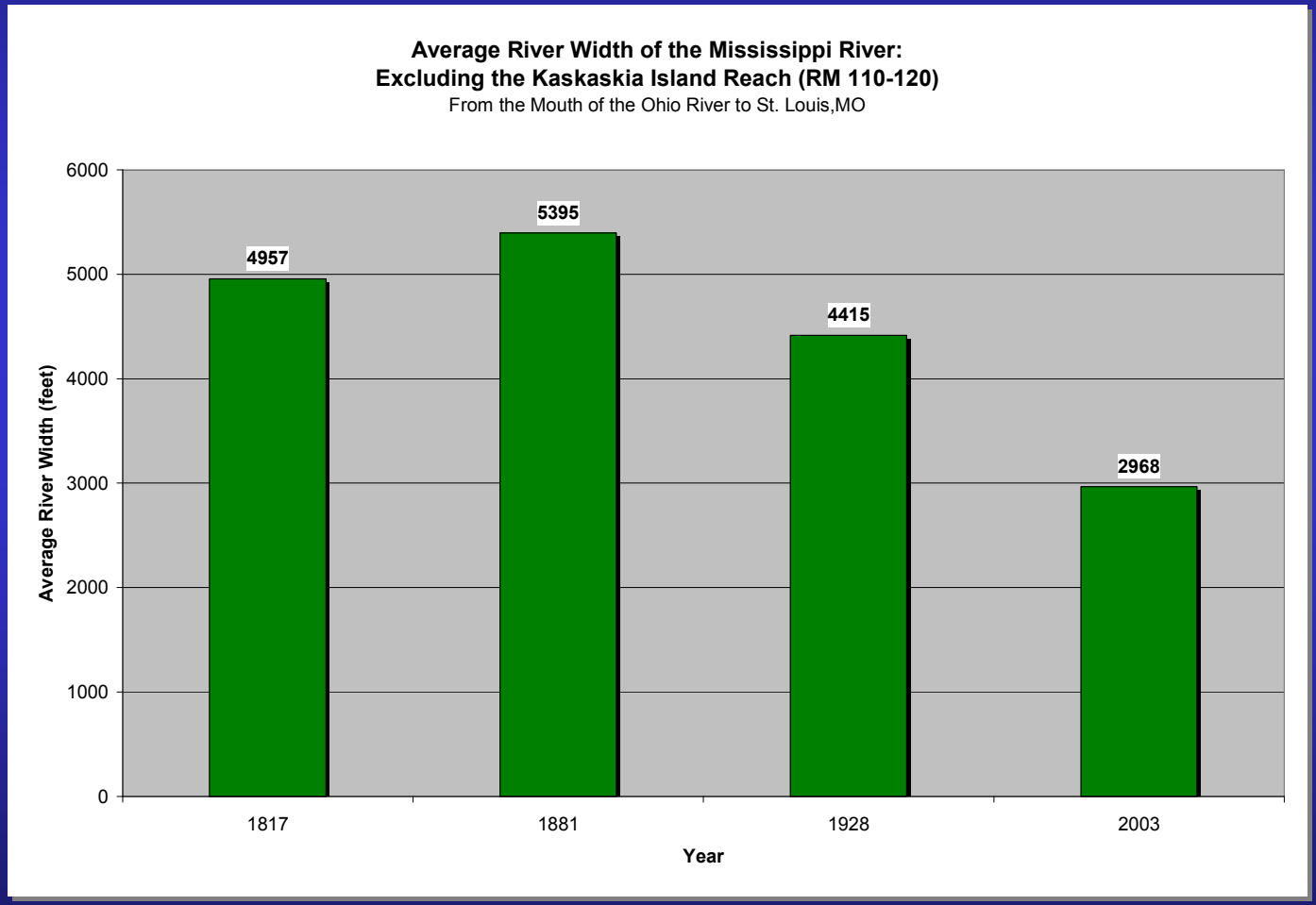

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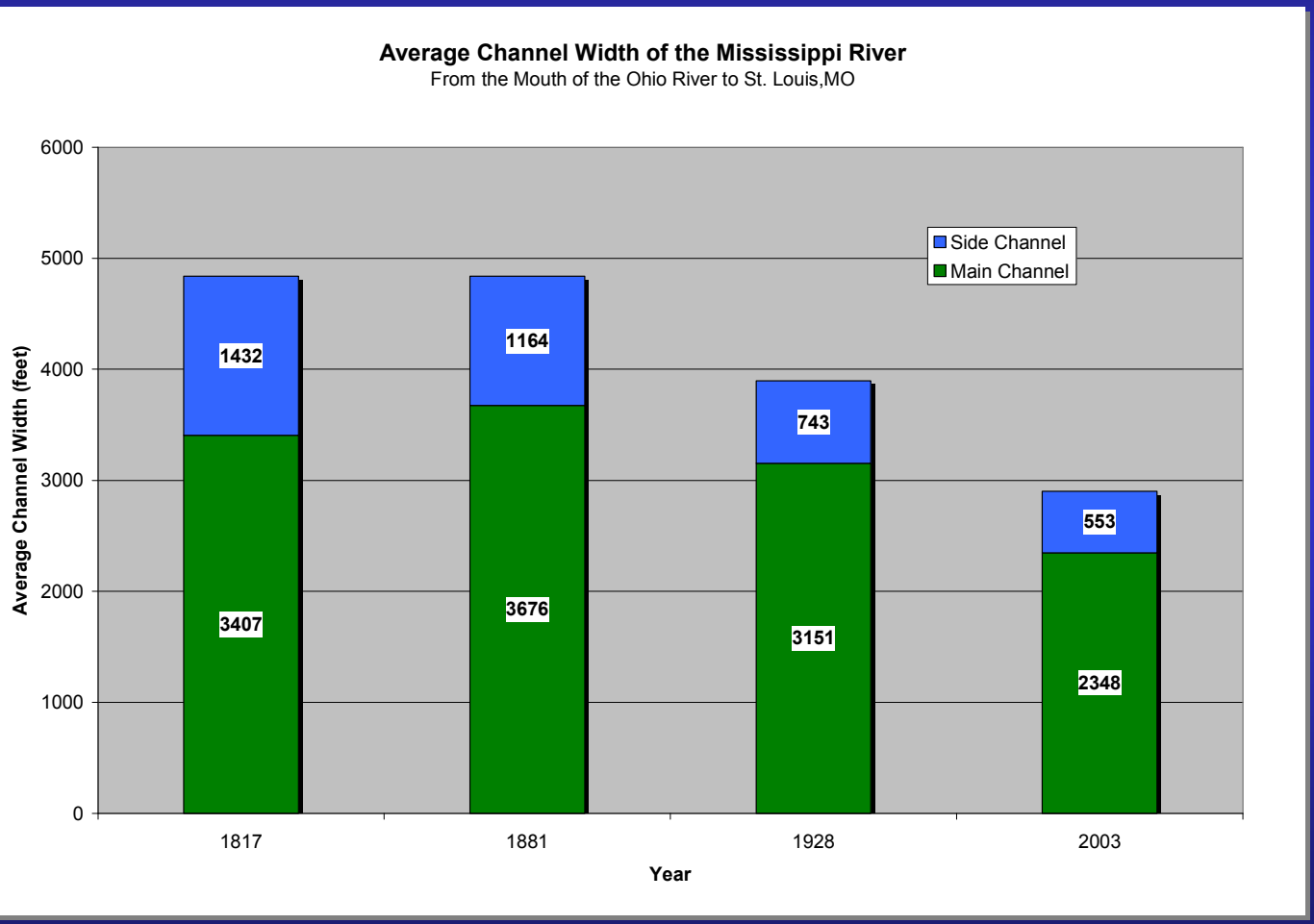
Average Channel Width



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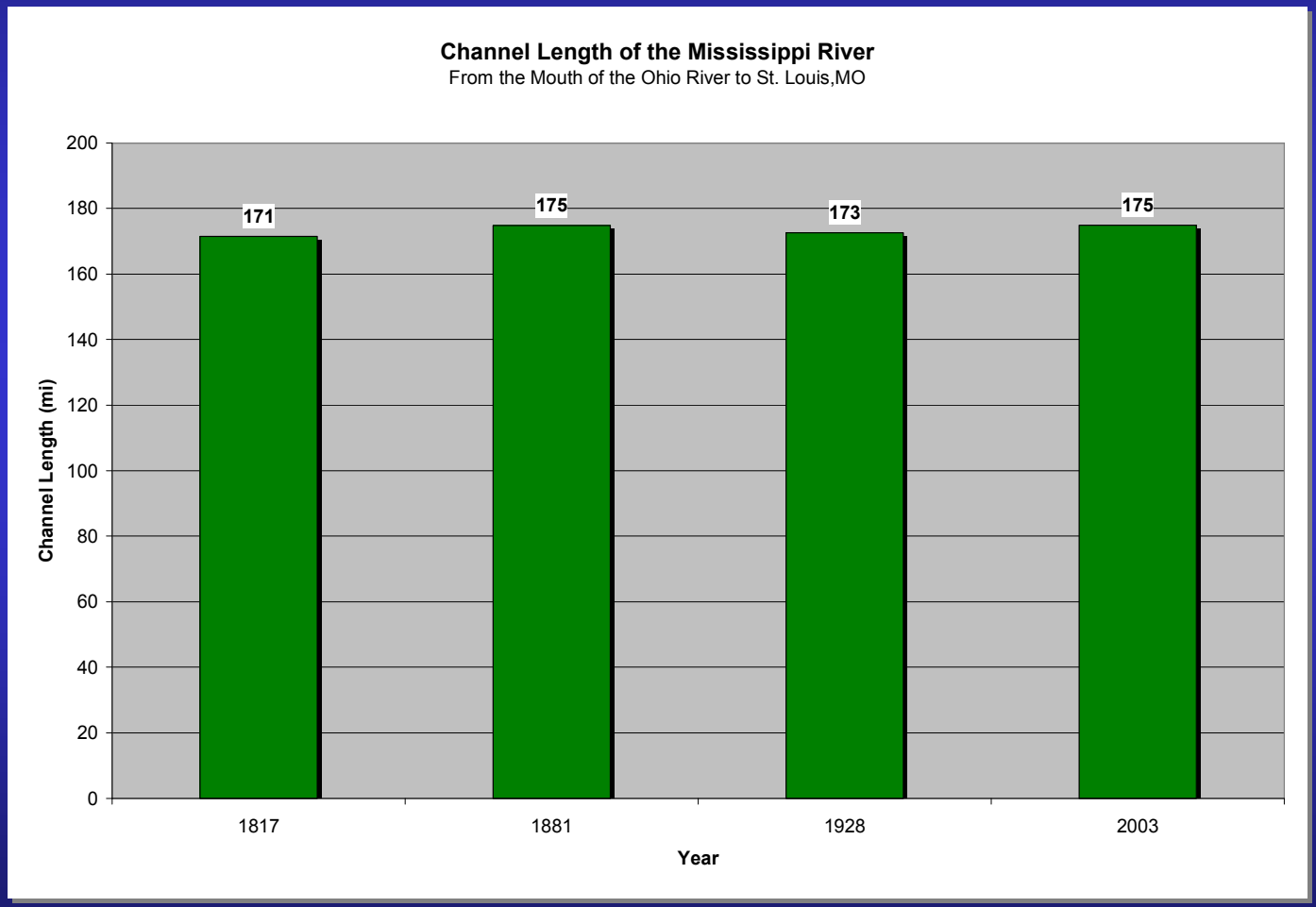
Channel Length



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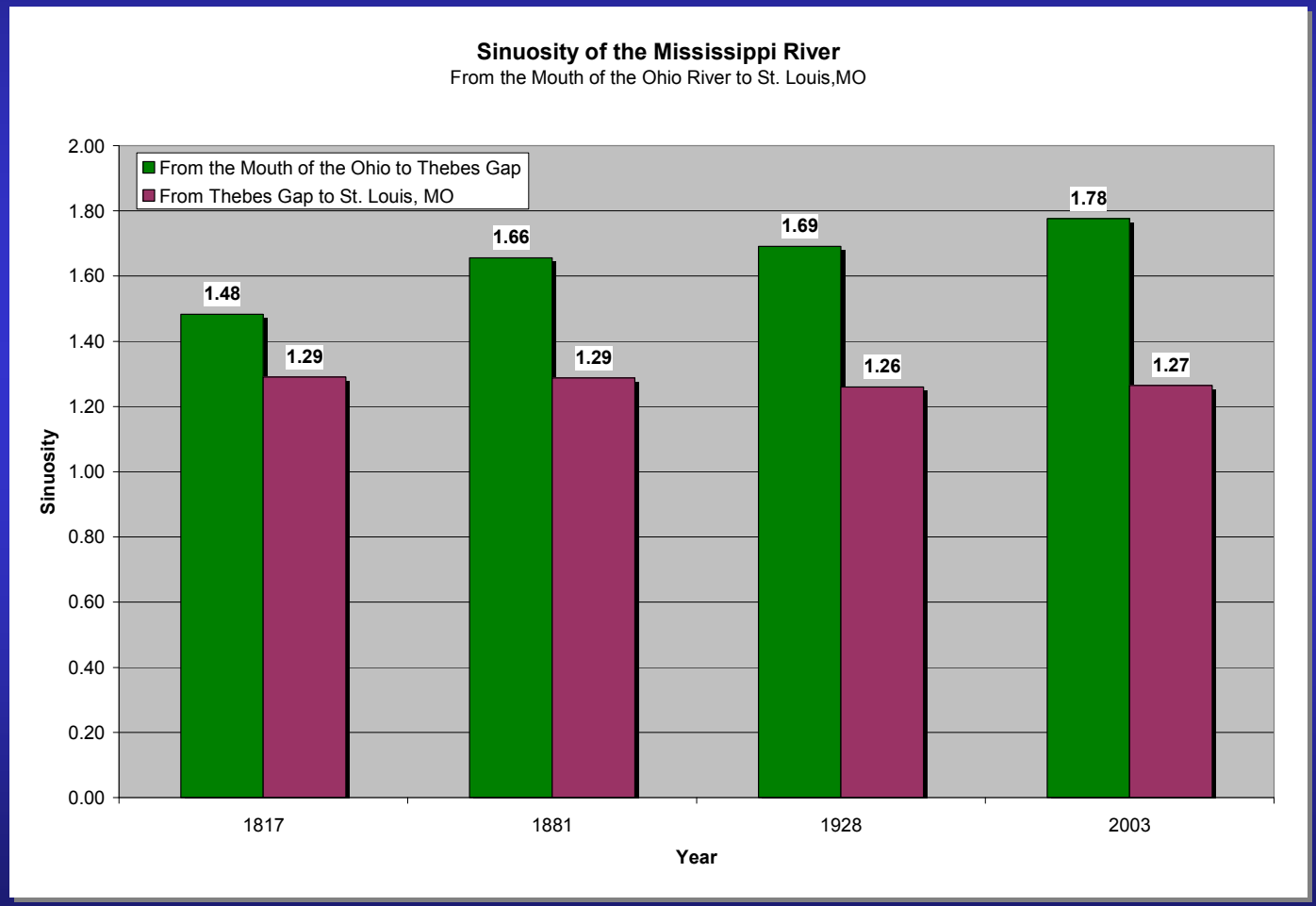

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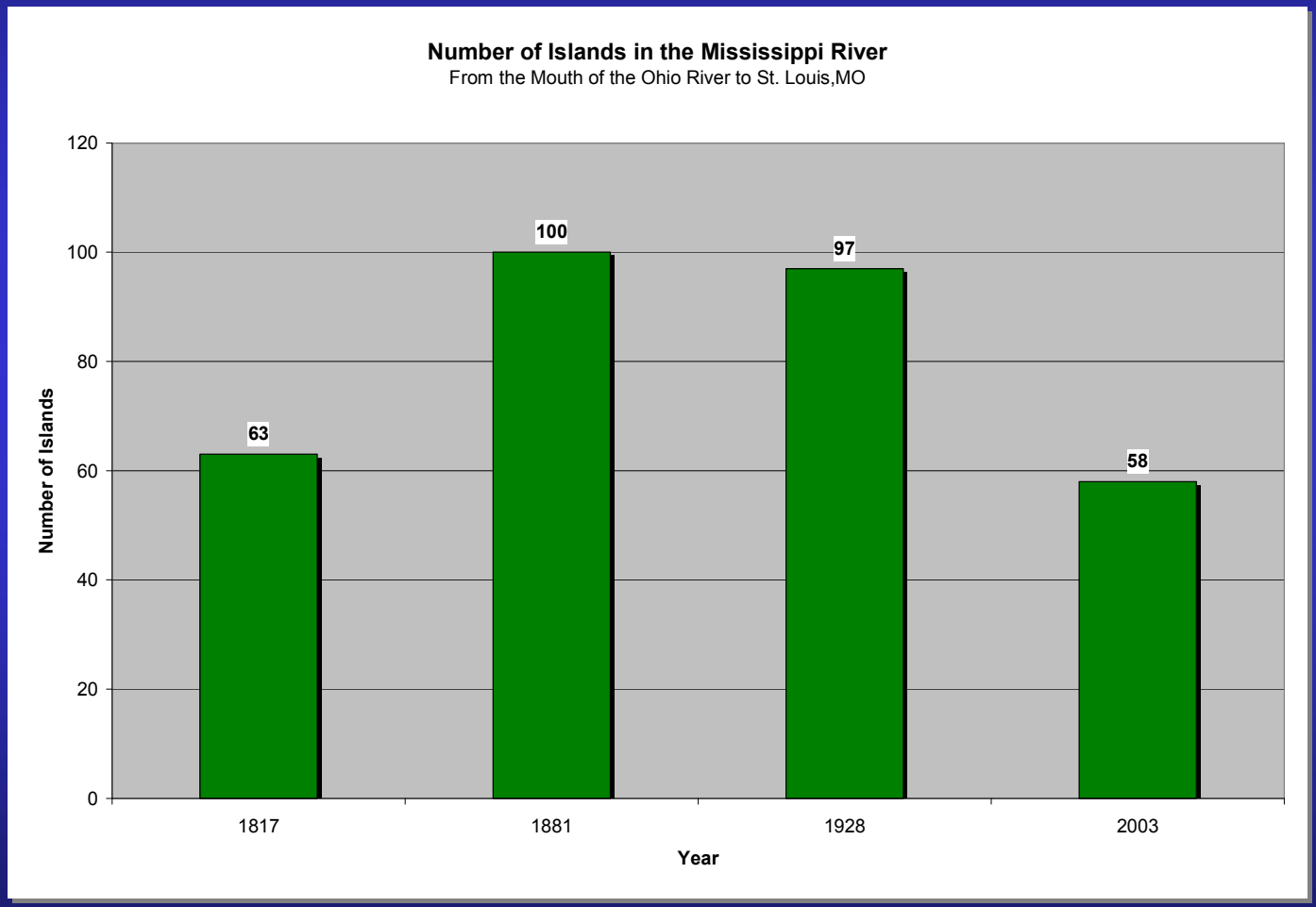
Number of Islands



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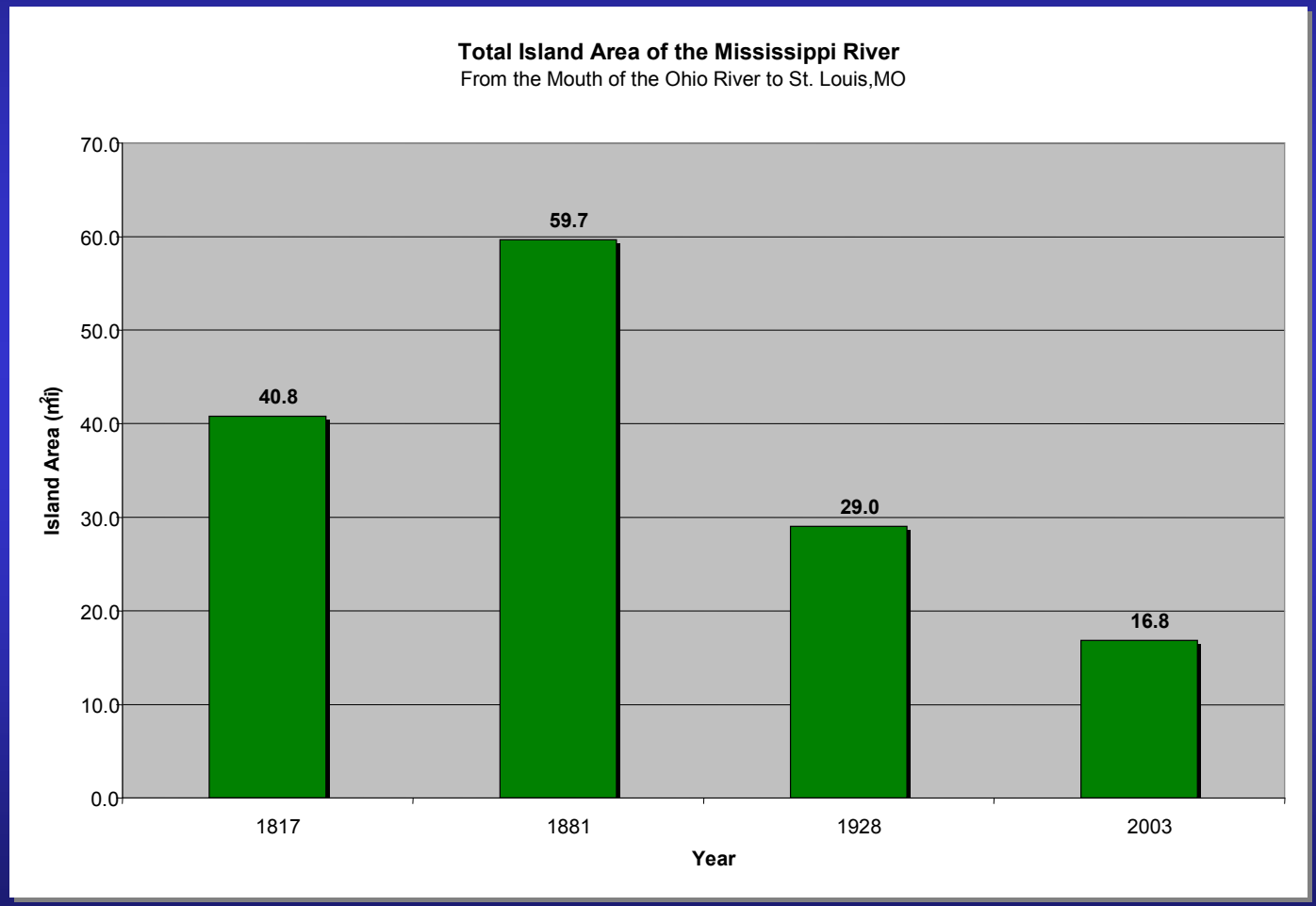
Total Island Area



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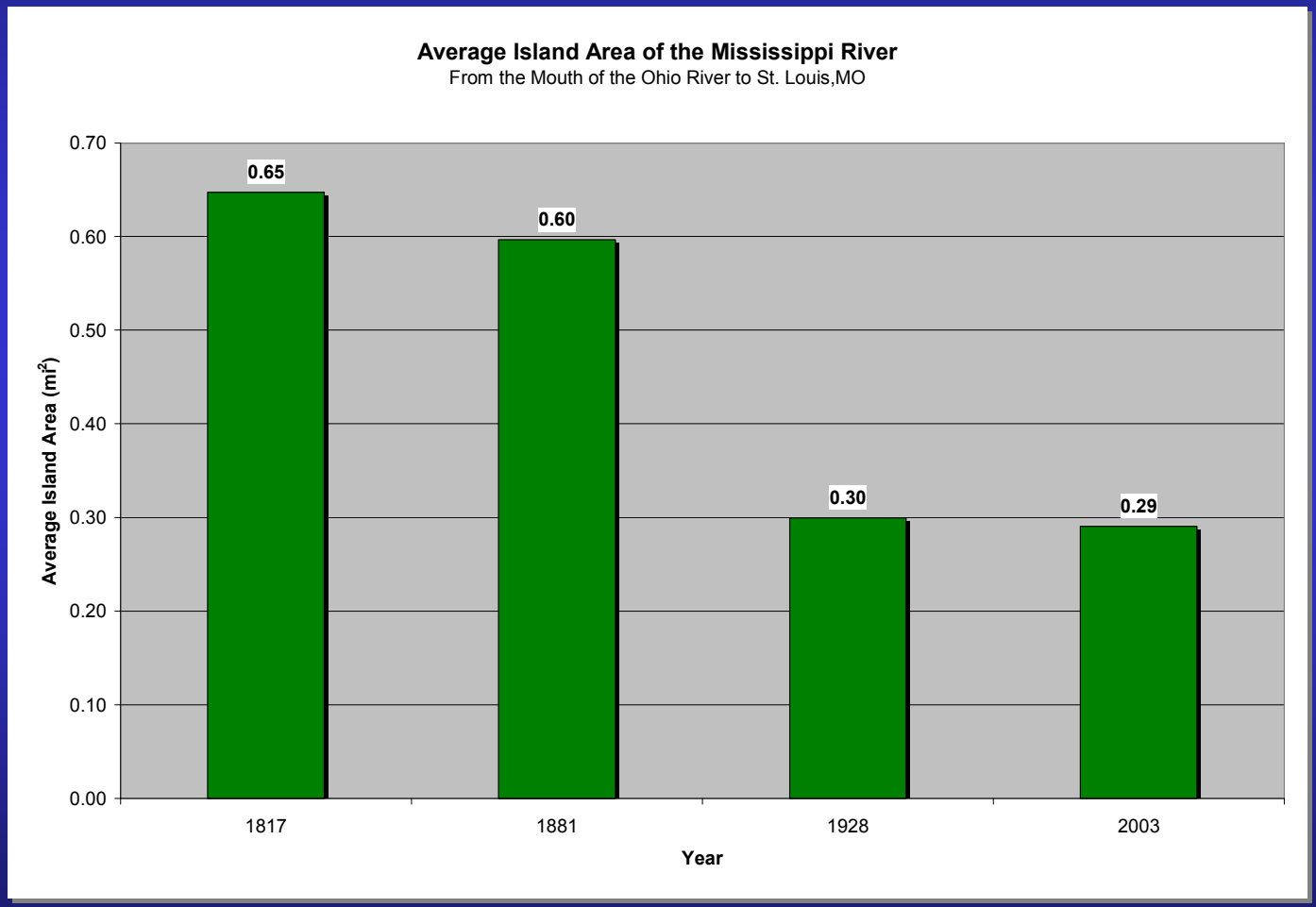
Average Island Area



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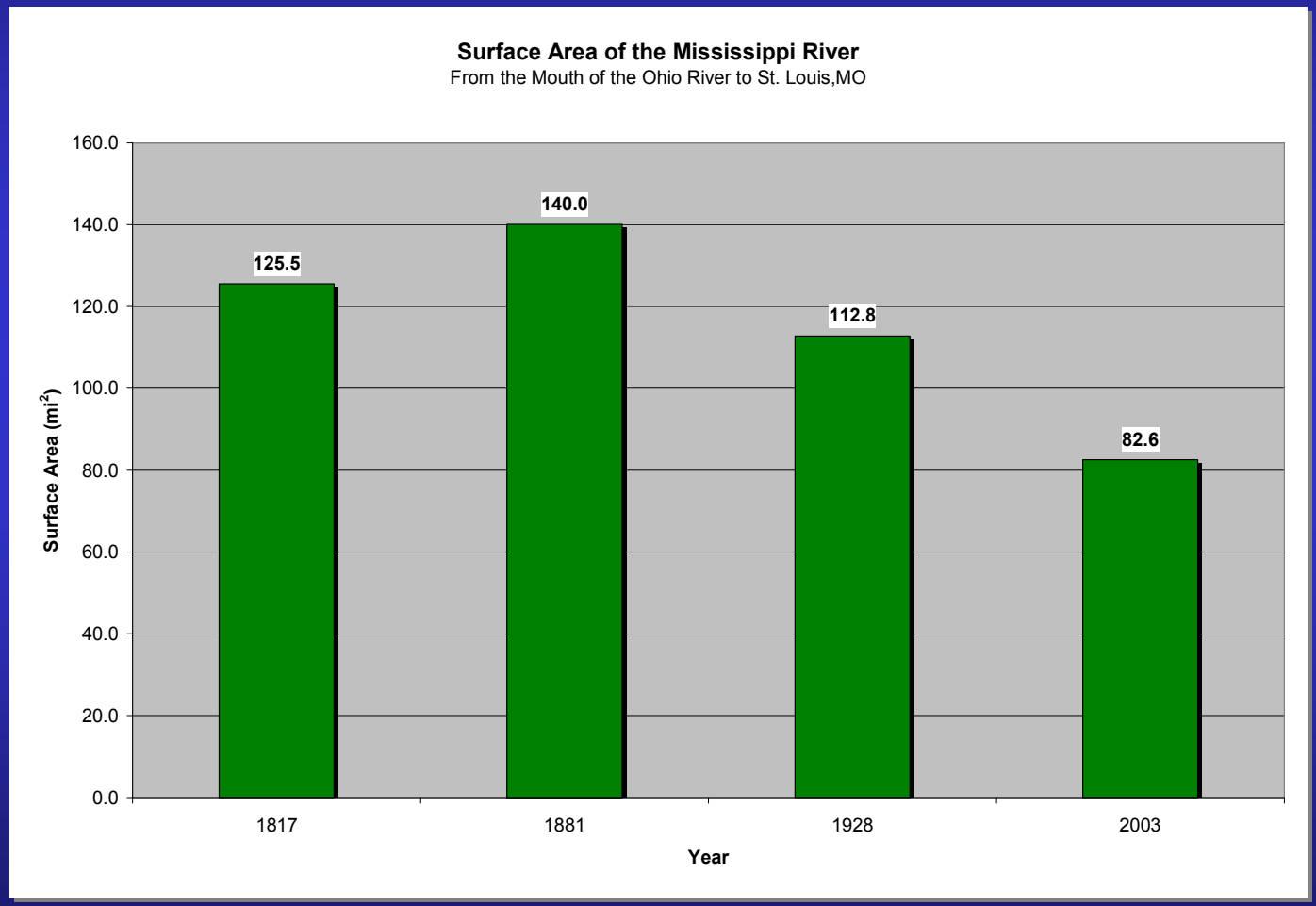
Surface Area



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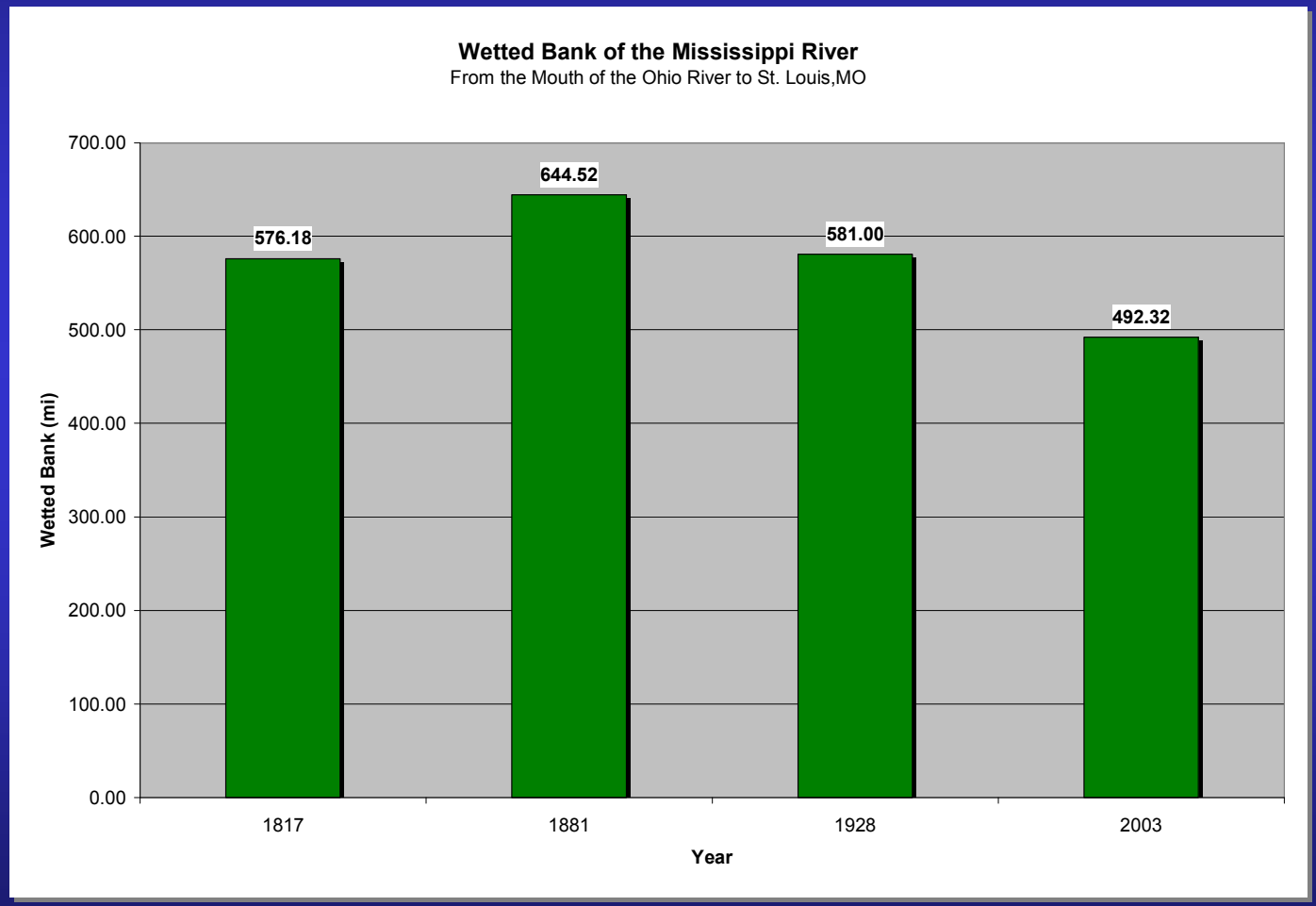
Wetted Bank



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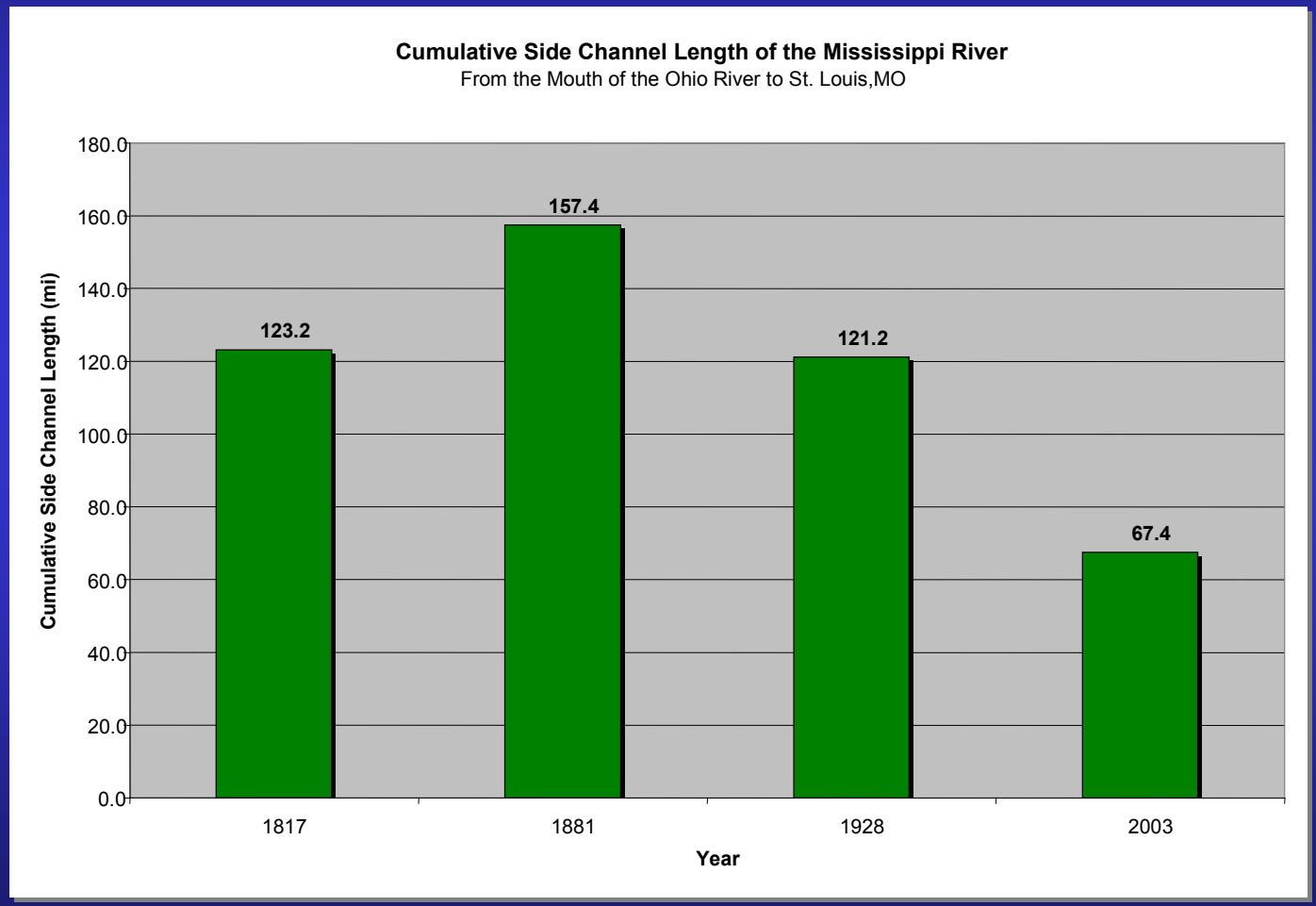
Cumulative Side Channel Length



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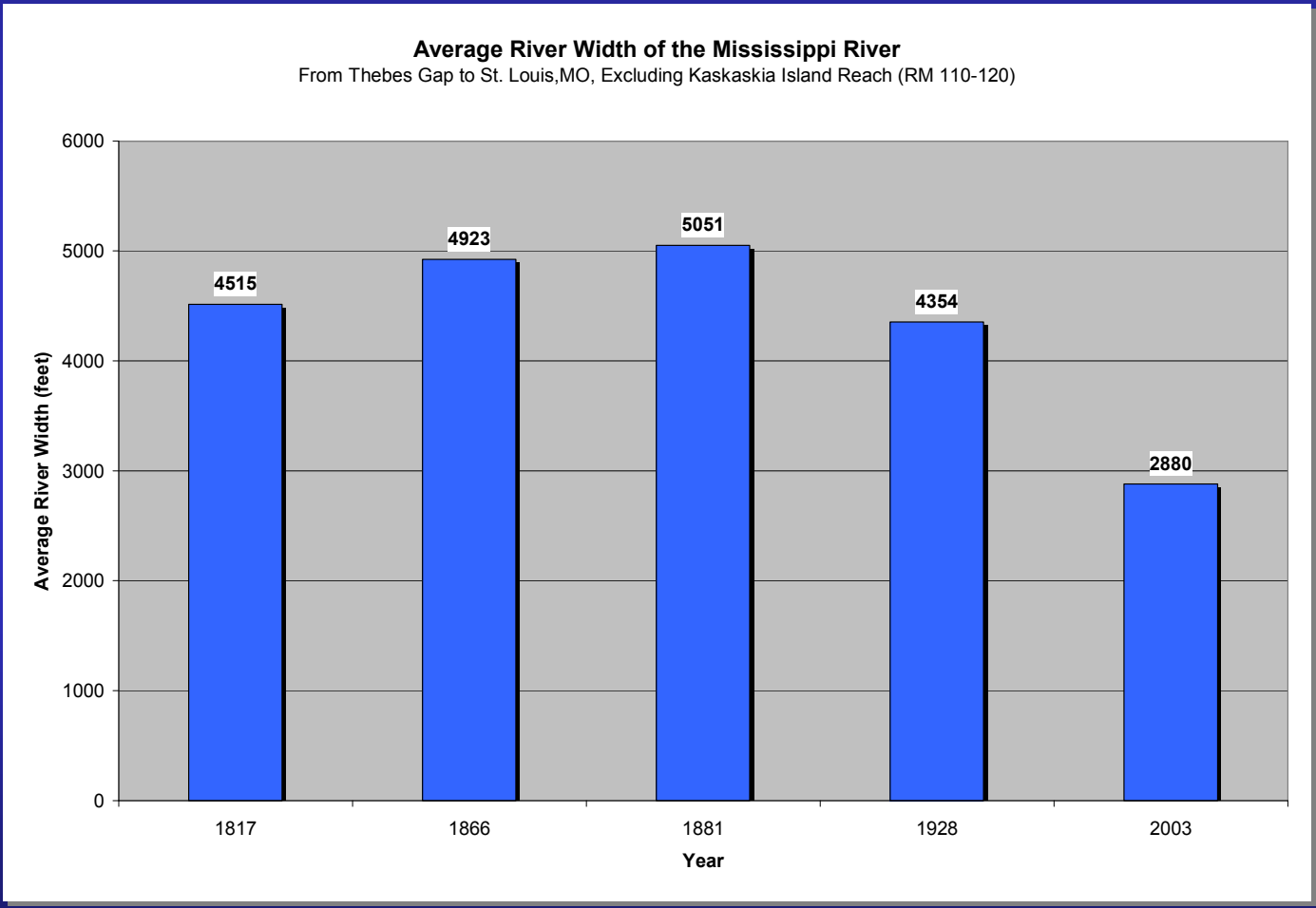
Average River Width



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Blueprint For Restoration

- 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

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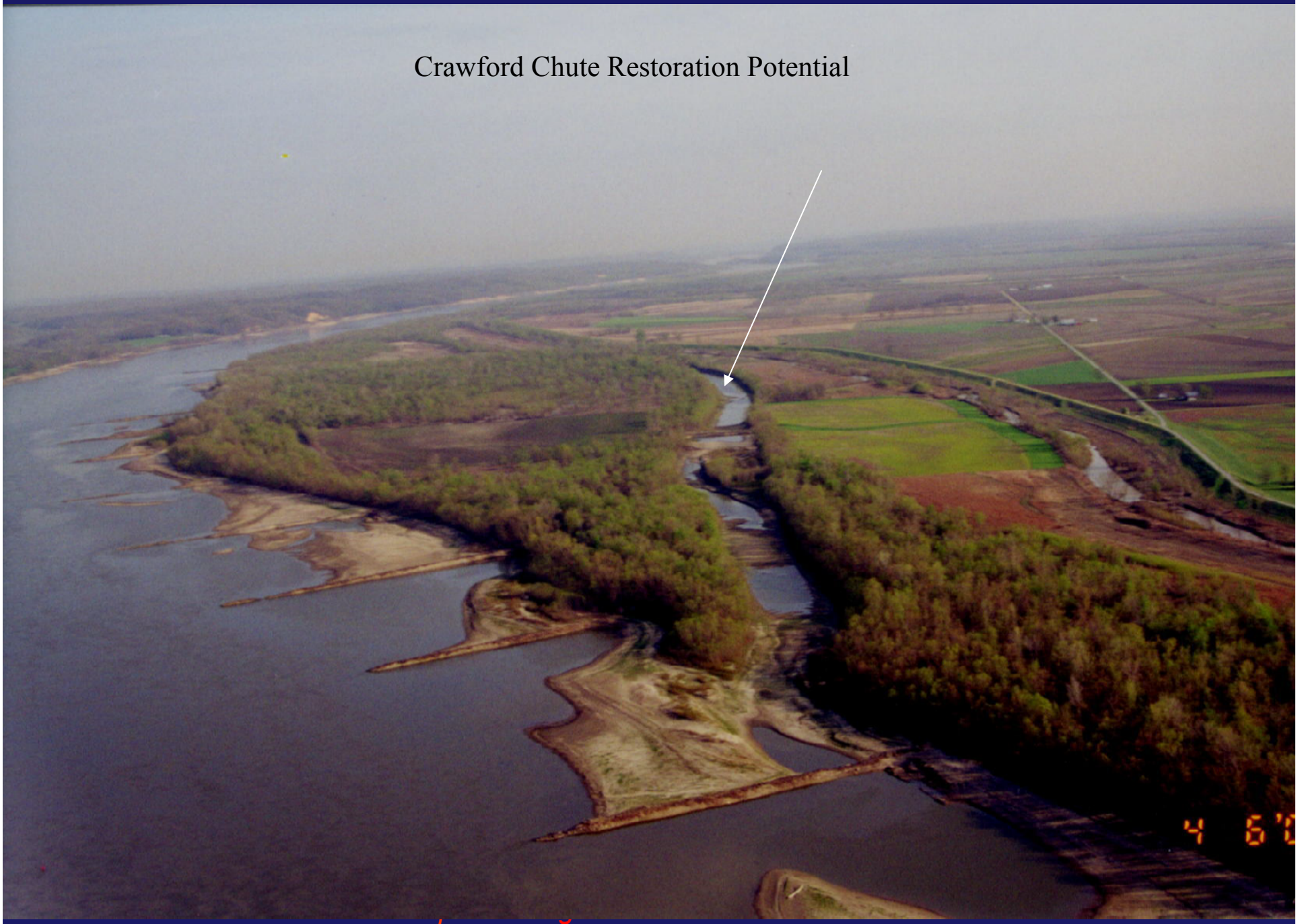
RIPARIAN CORRIDOR

Crawford Chute Restoration Potential Mile 74 to 71

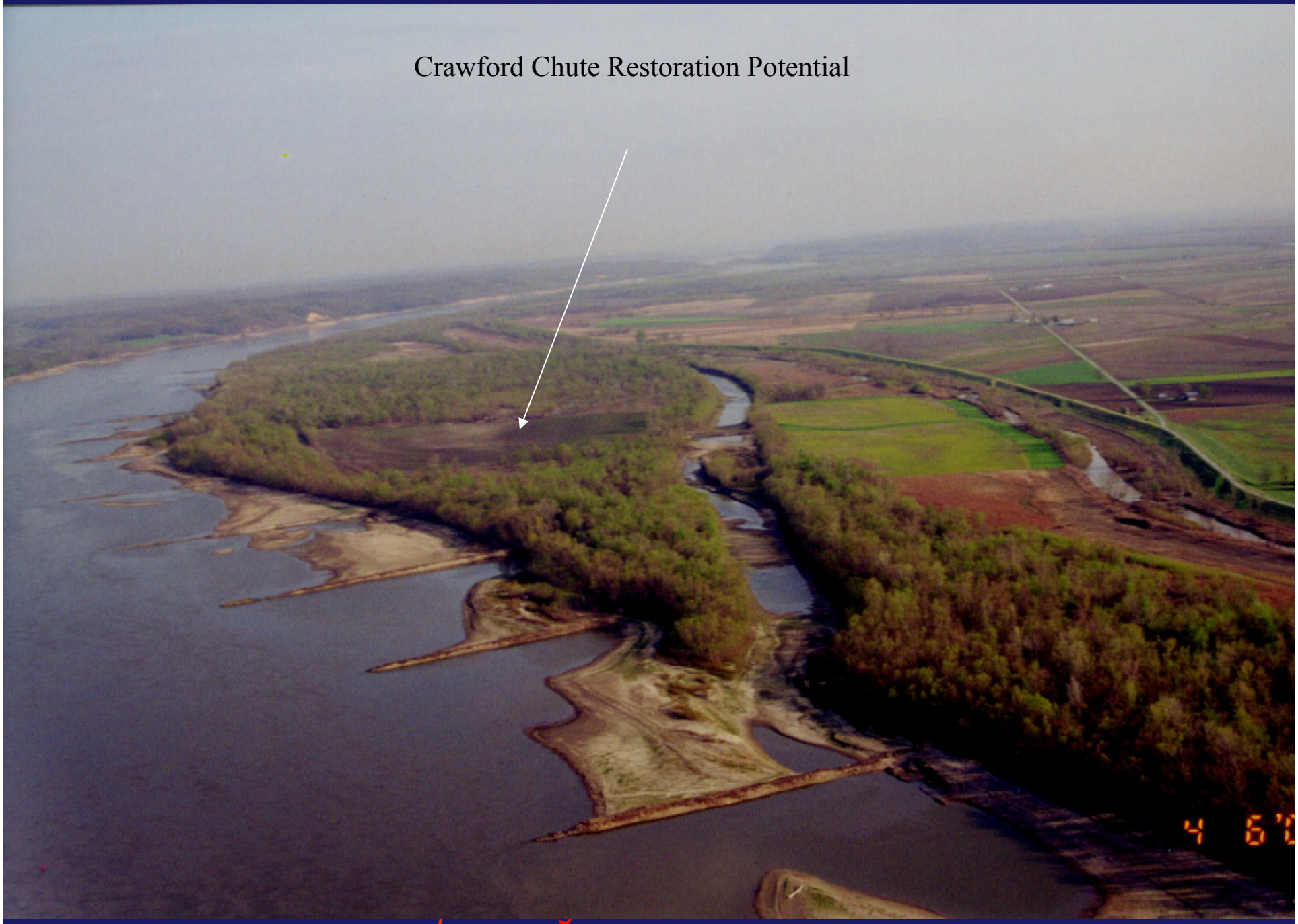
Crawford Chute Restoration Potential

Crawford Chute Restoration Potential

Crawford Chute Restoration Potential



Crawford Chute Restoration Potential




Crawford Chute Restoration Potential
4 6'00

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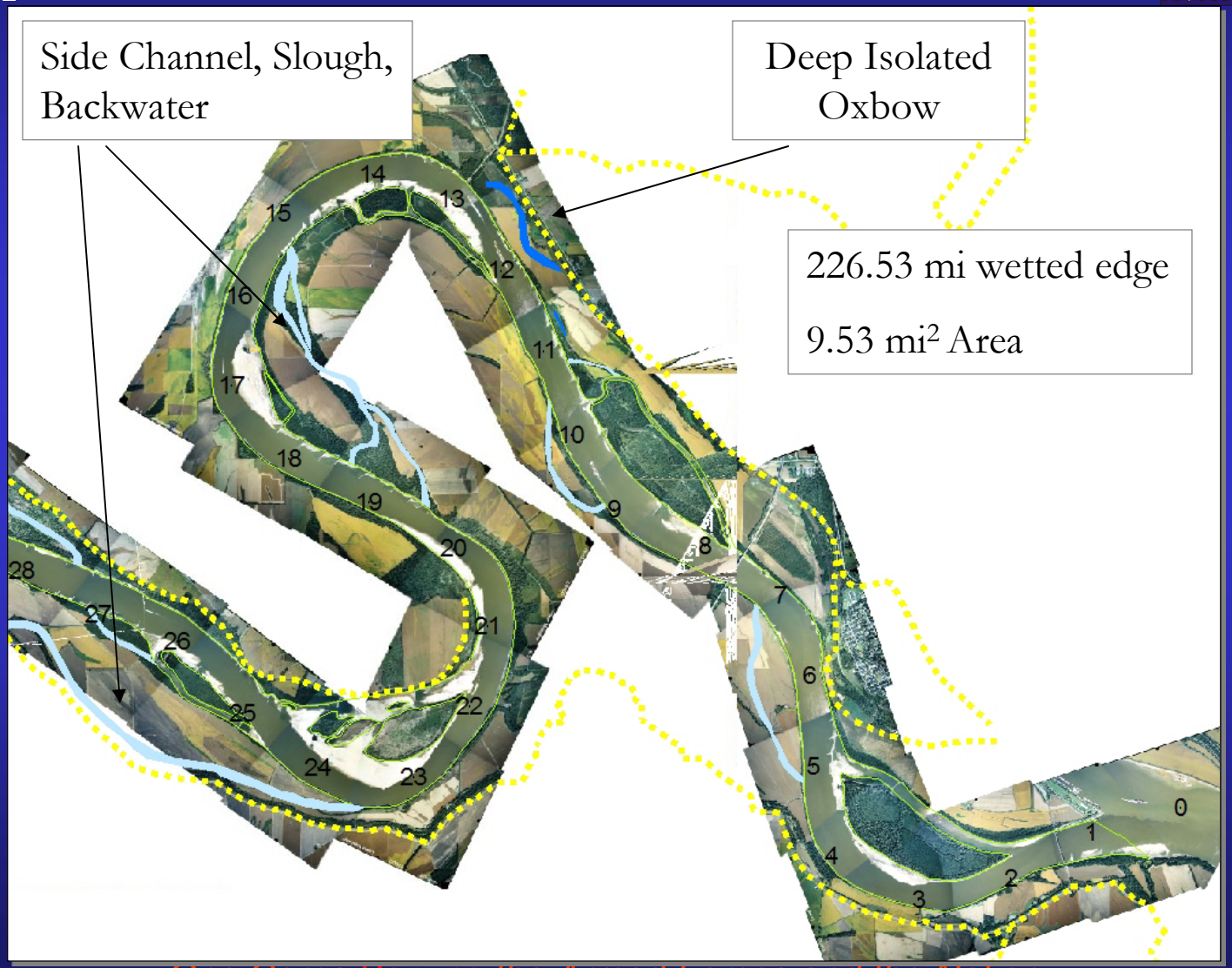
Restoration Potential



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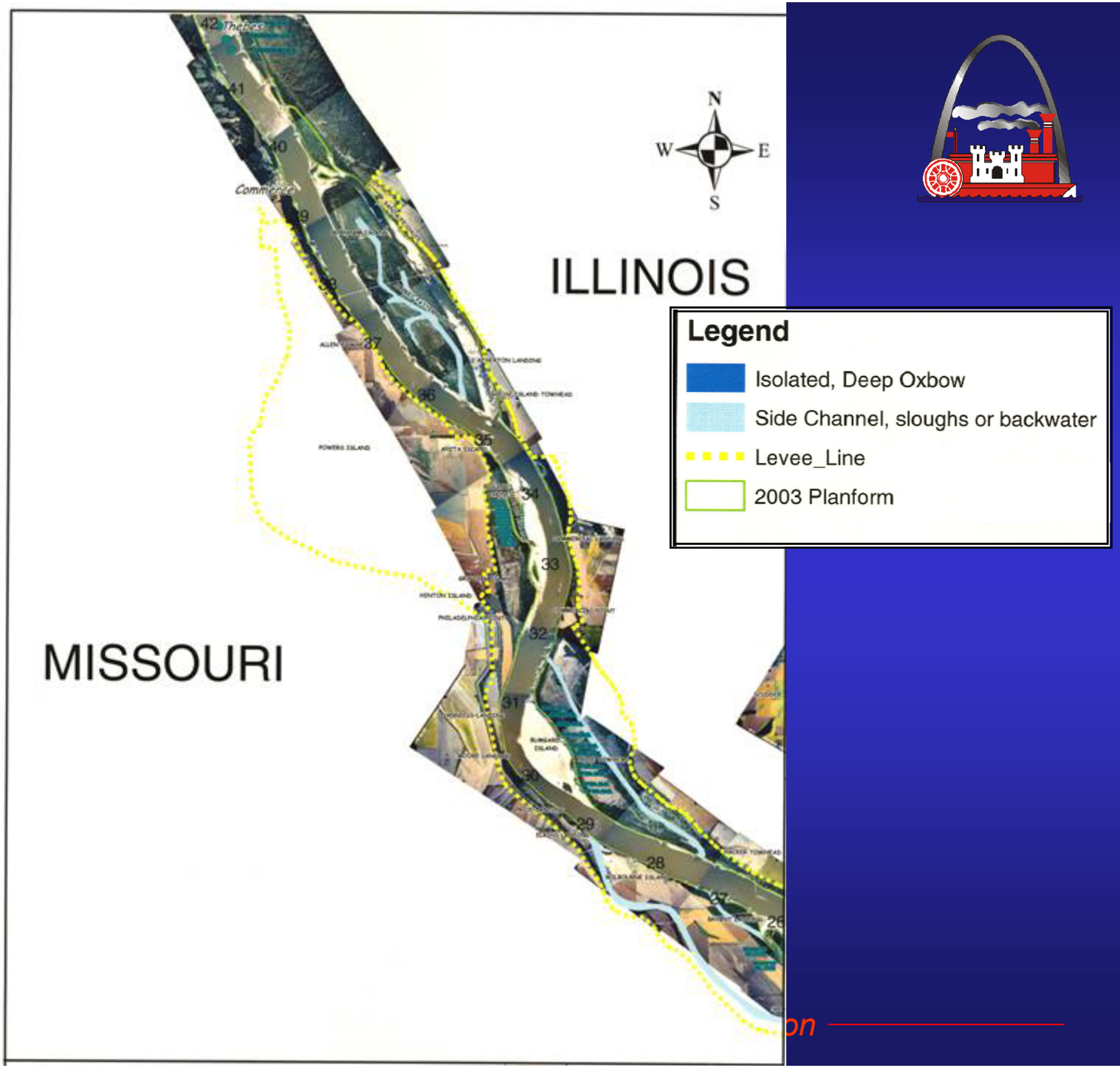

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Blueprint For Restoration

- 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

US Army Corps of Engineers

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U.S. Army Corps of Engineers- St. Louis
314-263-8094

Edward.j.brauer@mvs02.usace.army.mil

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Questions?

"That's good enough water for any one, you couldn't improve it without putting in a little whisky."

-Mark Twain