U.S. Army Corps of Engineers
St. Louis District

Grand Tower Phase 5
Public Meeting
March 9, 2016

US Army Corps of Engineers
BUILDING STRONG®

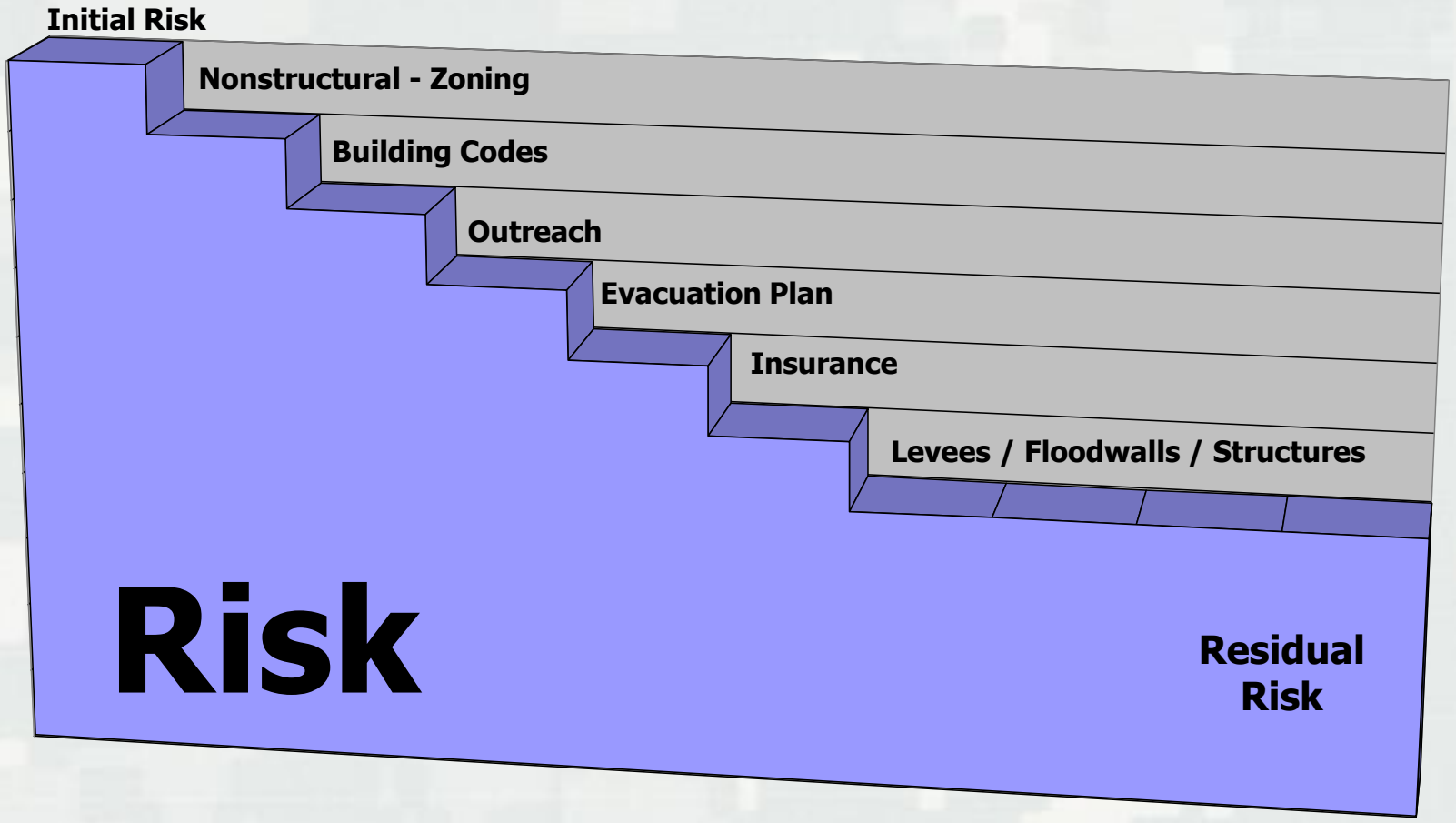
St. Louis District
Value to the Nation

Provide engineering and water resource solutions that:

- Improve safety and reduce risk
- Energize the economy
- Sustain the environment
- Enhance the quality of life
- Through expertise, innovation, and partnerships

- 10 rivers
- 5 lock & dam sites
- 5 Corps lakes
- 750 miles of levees
- 92 flood control systems
- 416 miles of navigable channel
- 70 pumping plants
- 162 recreation areas
- 1 hydropower plant

Risk –
A Shared Responsibility



Grand Tower Phase 5

Regulating Works Project
Middle Mississippi River

Grand Tower Public Meeting
9 March, 2016

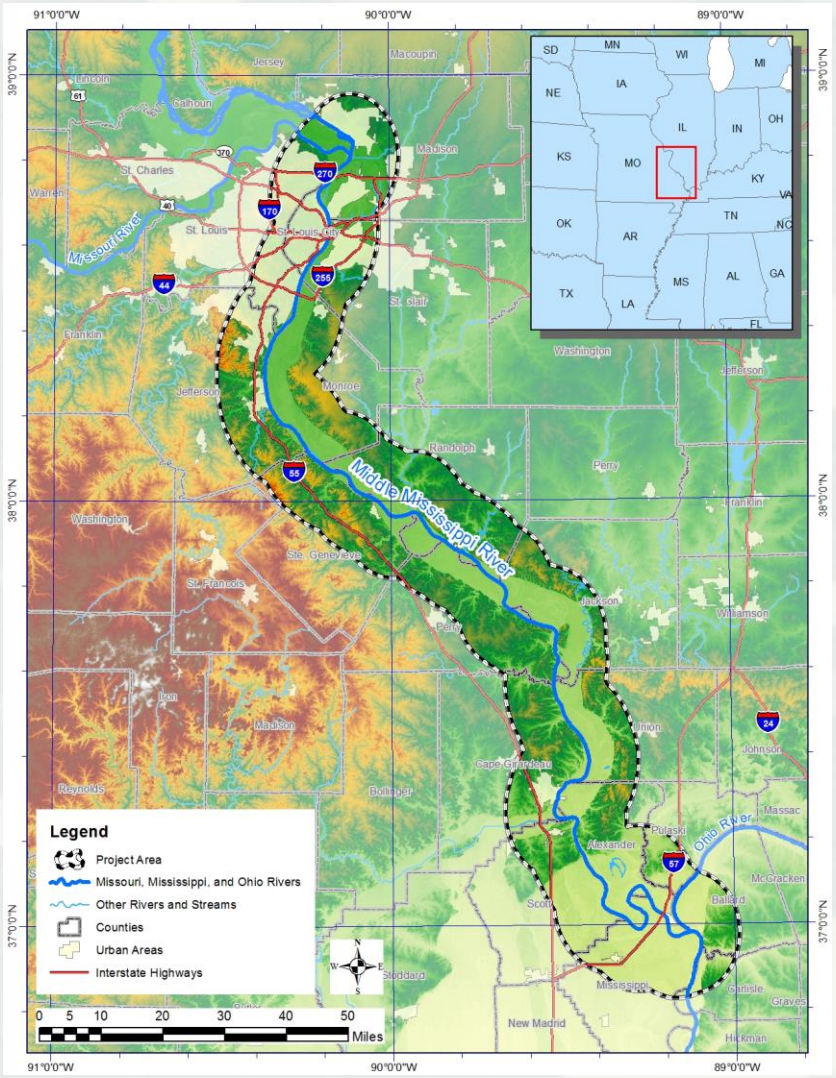
Objectives of Brief

1. Provide a status update on the Grand Tower Phase 5 Regulating Works Project

2. Address questions and concerns on the path forward

Grand Tower Phase 5 Regulating Works Project

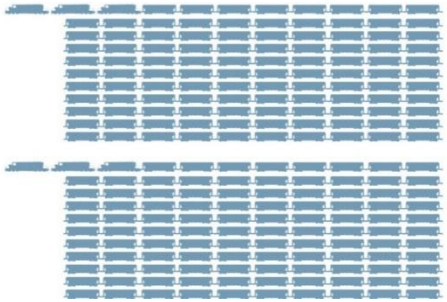
- Authorized to provide a 9’ deep, 300’ wide navigation channel and to reduce dredging to a minimum by constructing river training structures (1927 Chief’s Report)
- Middle Miss. River (MMR) defined as the 195-mile reach between confluence of the Missouri and Ohio Rivers
- St. Louis is the 3rd busiest port on inland waterway system, handling approximately 110 million tons annually. Our efforts reduces transportation cost by over $3B in costs annually



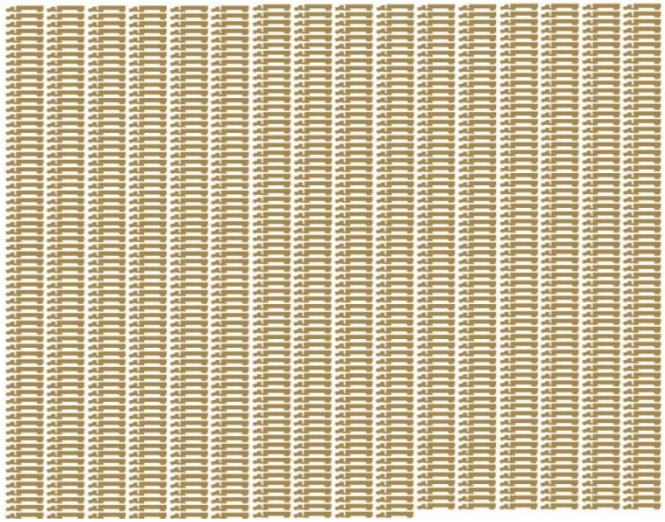
One 15-Barge Tow Equals 216 Rail Cars or 1,050 Trucks

One 15-Barge Tow

216 Rail Cars + 6 Locomotives



1,050 Large Semi Tractor-Trailers



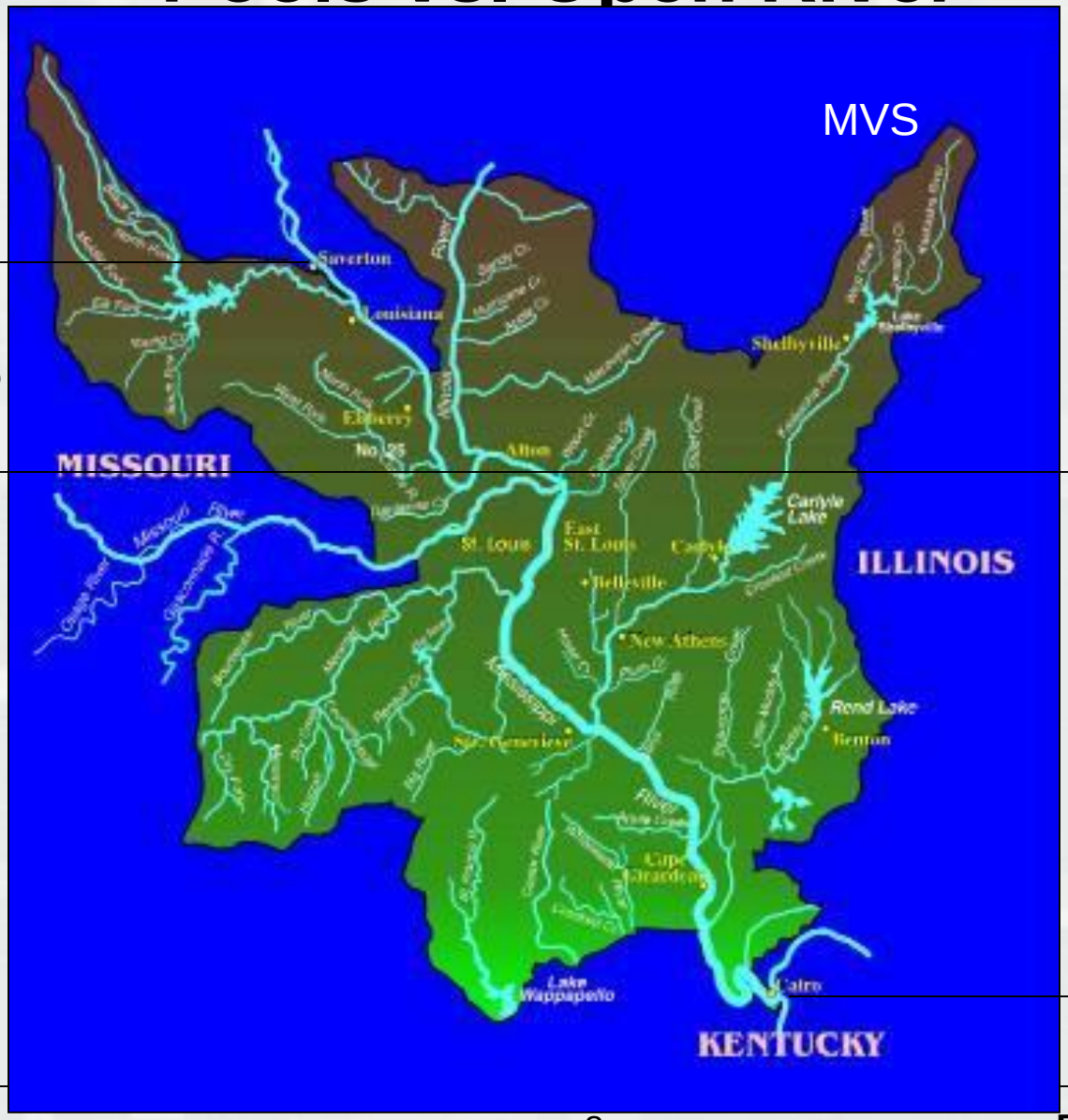
To move identical amounts of cargo by rail generates 30% more CO_2 and by truck generates 1,000% more CO_2

* Typical barge configuration within MMR is 25 barge per tow

NATIONAL WATERWAYS FOUNDATION

U.S.ARMY

MVS Channel Improvement Pools vs. Open River

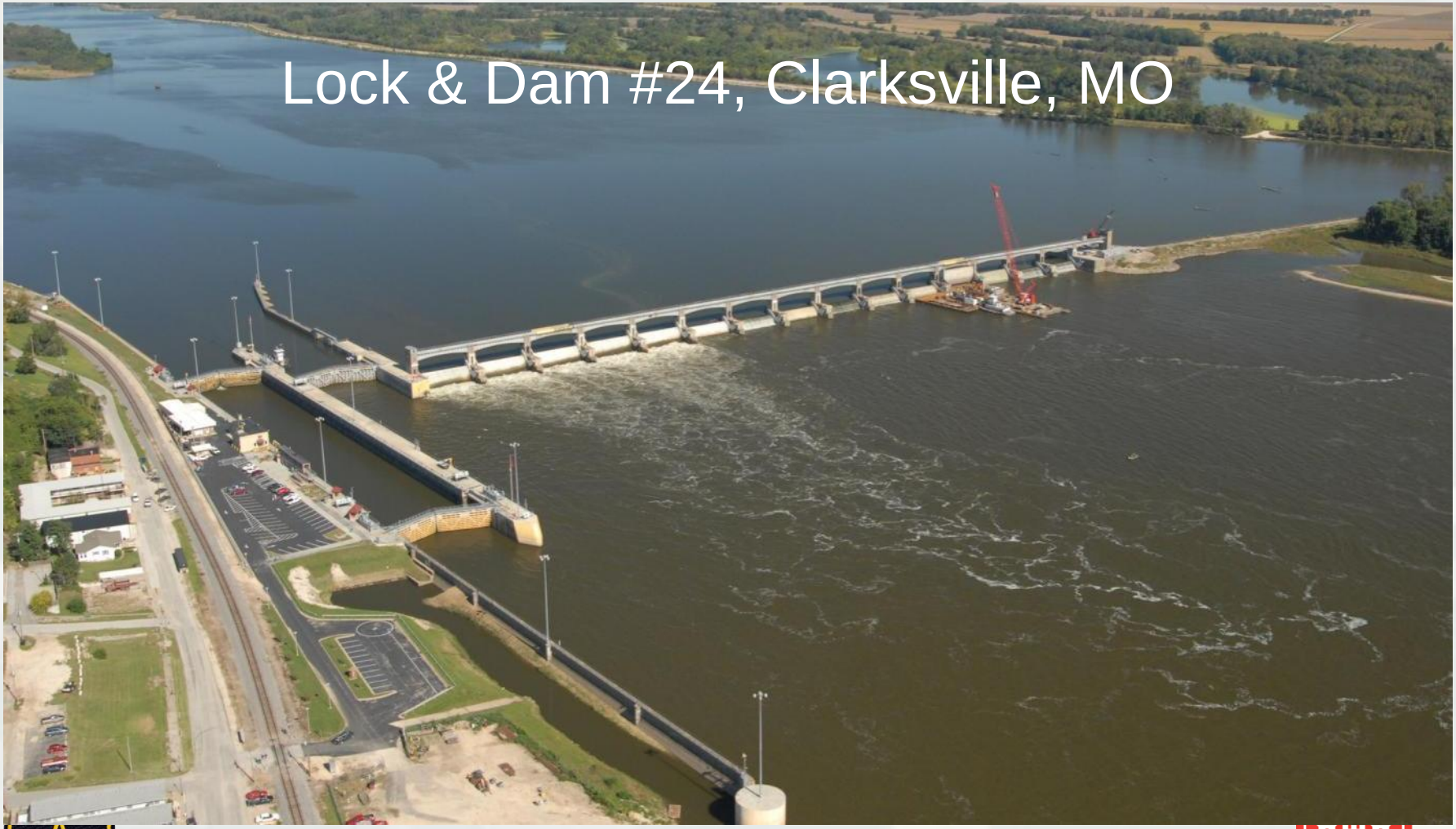


Pools 300-195

Open River 195-0

BUILDING STRONG®

Pools: Impounded Mississippi River Upper River (RM 300-195) O&M



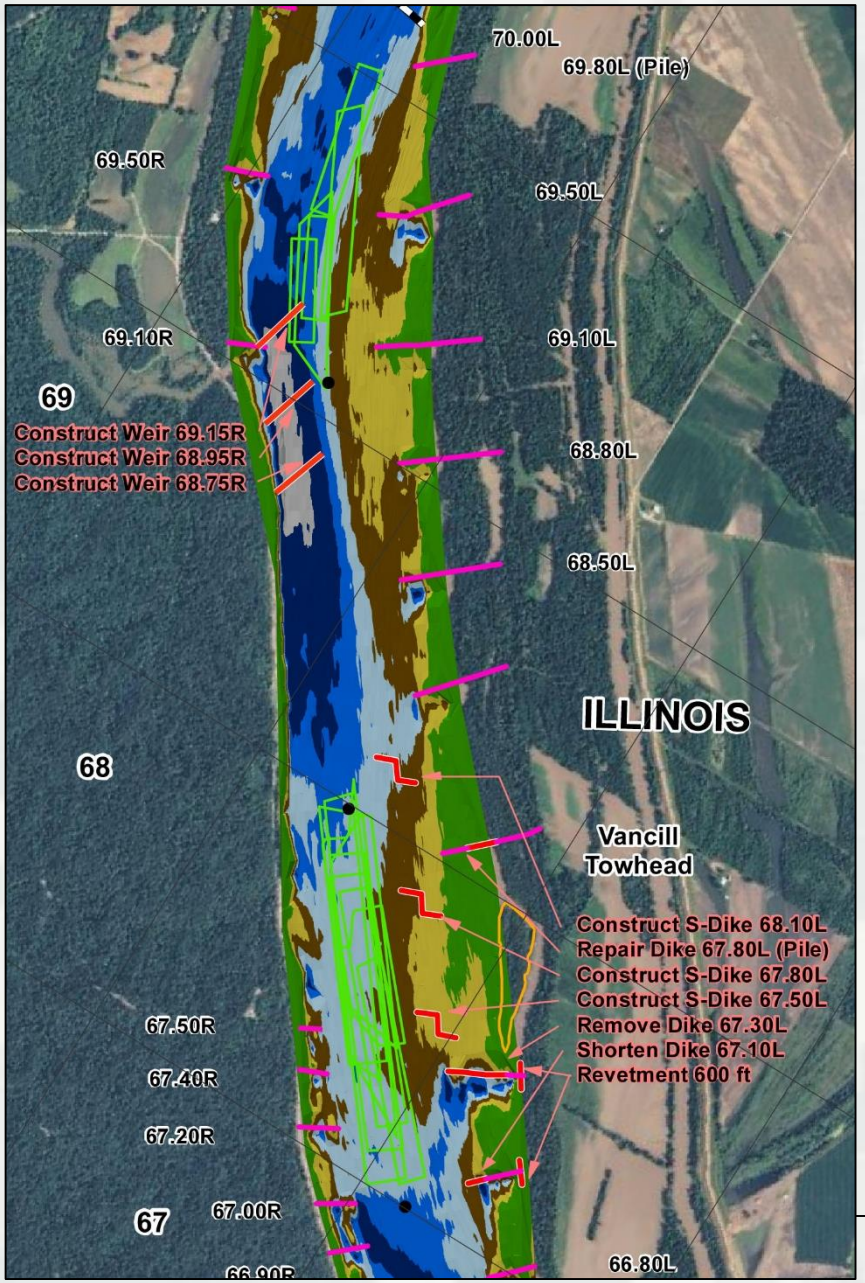
Channel Improvement Tools

Dredging

Bendway Weirs

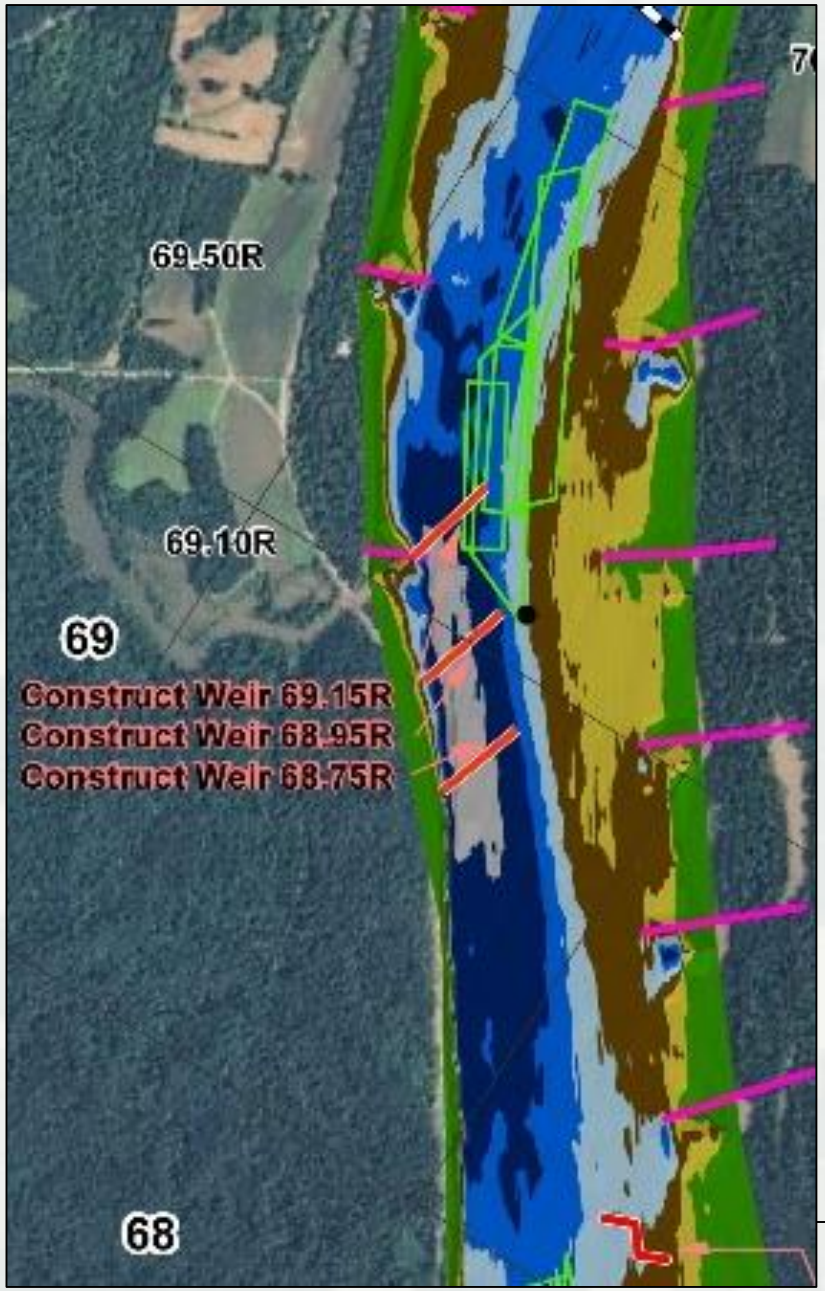
Dikes

Grand Tower Phase 5



- Repetitive Dredge Issue
  - 2000 to 2015 4.8M cy - $11M
  - 2010 to 2015 1.7M cy - $4.2M
  - 2015 278,000 cy - $700k
- Hydraulic Sediment Response (HSR) model was completed in 2012 with a total of 37 alternatives evaluated.
- Alternative 33 was selected because it reduced/eliminated repetitive dredging and maintained ecological diversity within the study reach
- 2014 a public hearing was held (19-Feb-14) and we received many comments about the impacts of river training structures to flood heights and the construction of new “diverter” dikes.
- Based on public comments we moved forward with a numerical model (AdH 2-D) to evaluate the hydrodynamic portion of this project. The modeling was completed in November 2015 and the report finalized February 2016.

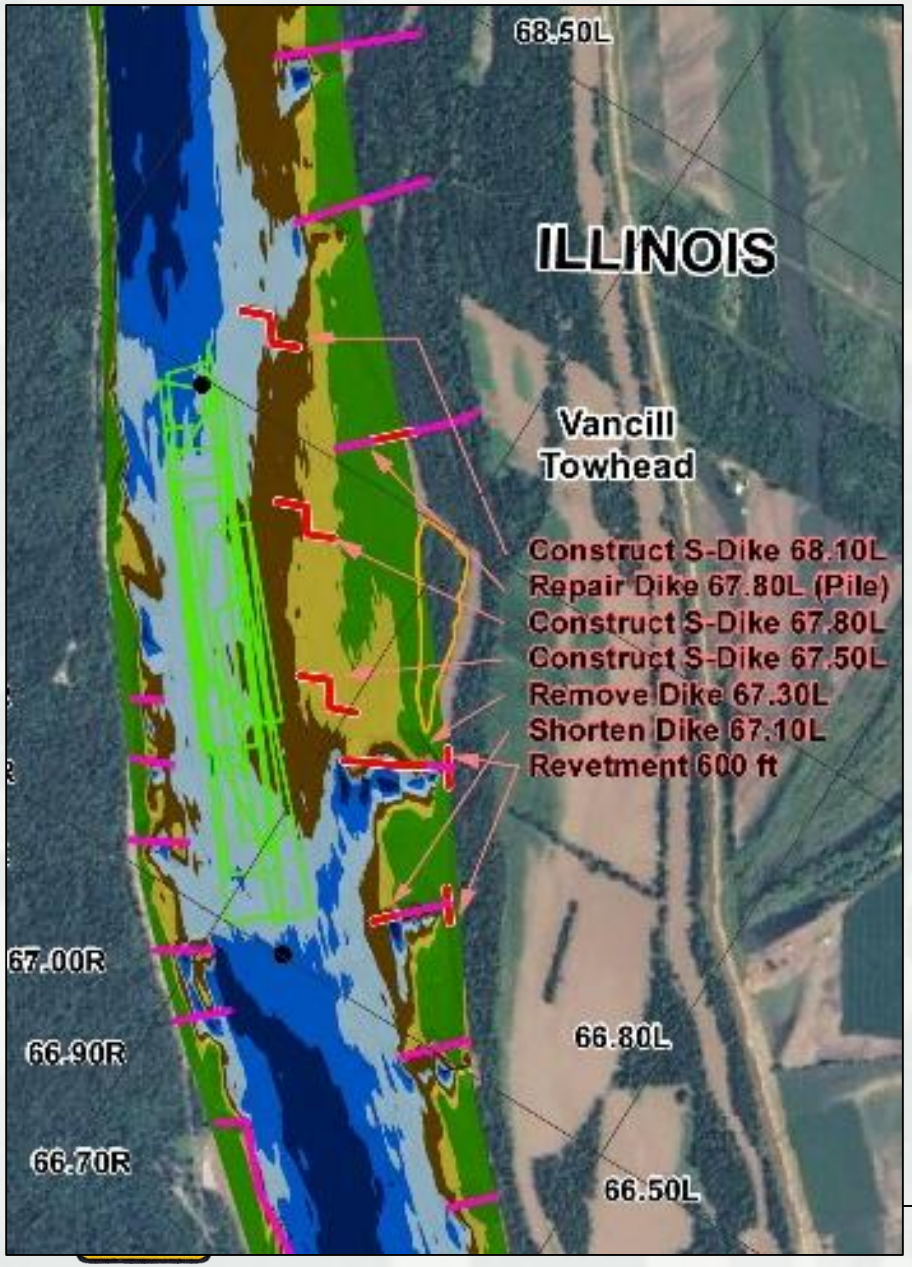
Grand Tower Phase 5



Upstream Effort

- Construct three (3) weirs; 69.15R, 68.95R, and 68.75R to redirect the flow on the right descending bank to the center of the channel
- Weirs are angled upstream so flow is concentrated to the center of the channel.
- Weirs are permanently below water surface, 15 feet below our low water reference plane
- Construction will be river based and stone will be a well graded limestone with 5,000 lb max size

Grand Tower Phase 5



Downstream Effort

- Construct three (3) Diverter “S” Dikes; 68.10L, 67.80L, and 67.50L to deepen the river channel bed to authorized navigation channel requirements.
- Multiple river training structures were tested at this location to deepen the river, “S” Dikes were selected based upon stakeholder input/request
- Remove Dike 67.30L and shorten Dike 67.10L to enhance flow on the land side of the “S” Dikes to maintain ecological diversity.
- The “S” Dikes will be constructed 18 feet above our low water reference plane, approximately 2/3rd bankfull stage
- Construction will be river based and stone will be a well graded limestone with 5,000 lb max size

Schedule

- Contract Award – Aug 2016
- Construction – likely start Sept 2016 (stage dependent)
- Phased Construction

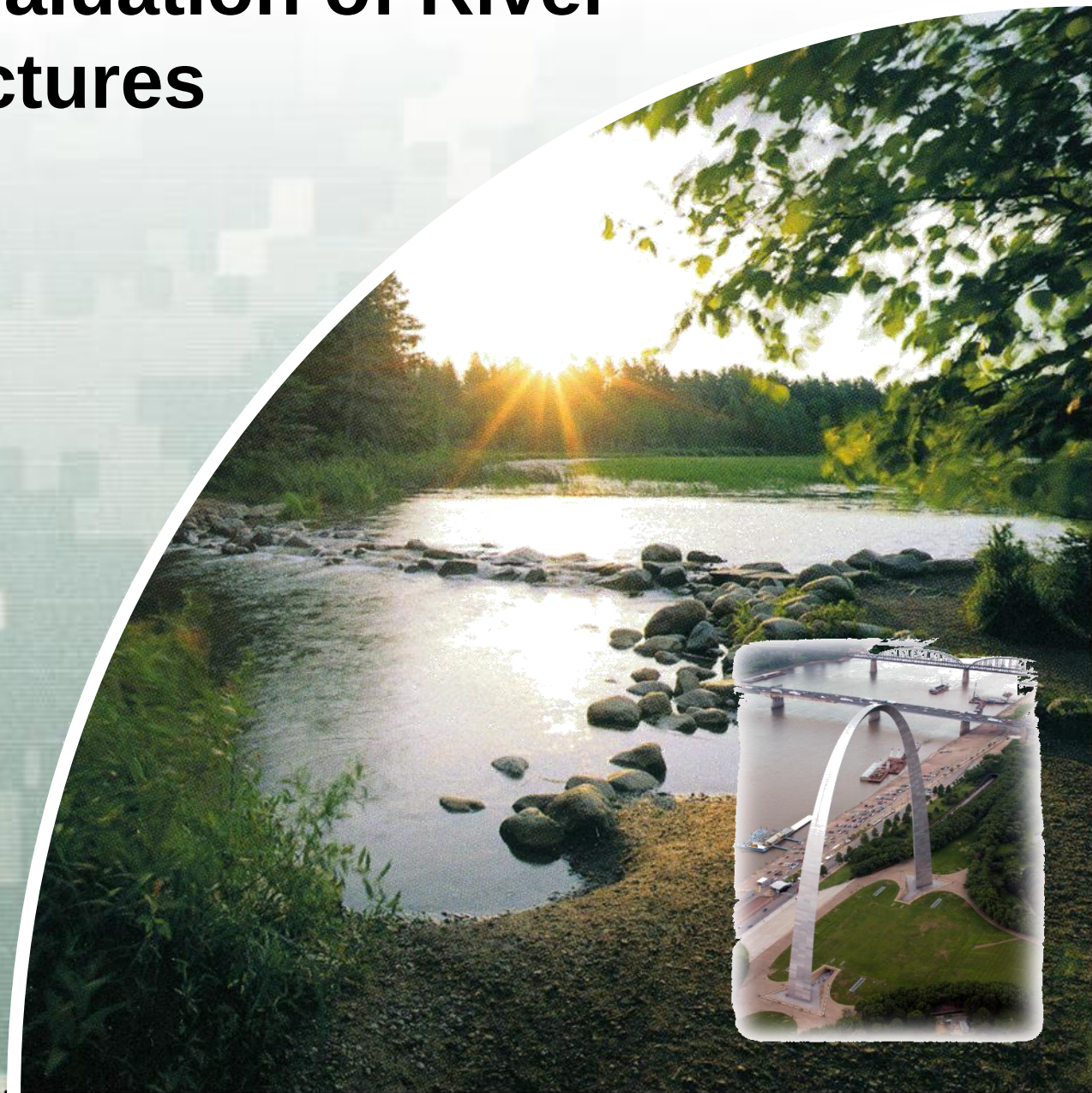
Flood Risk Evaluation of River Training Structures

Edward Brauer, P.E.

Hydraulic Engineer

St. Louis District

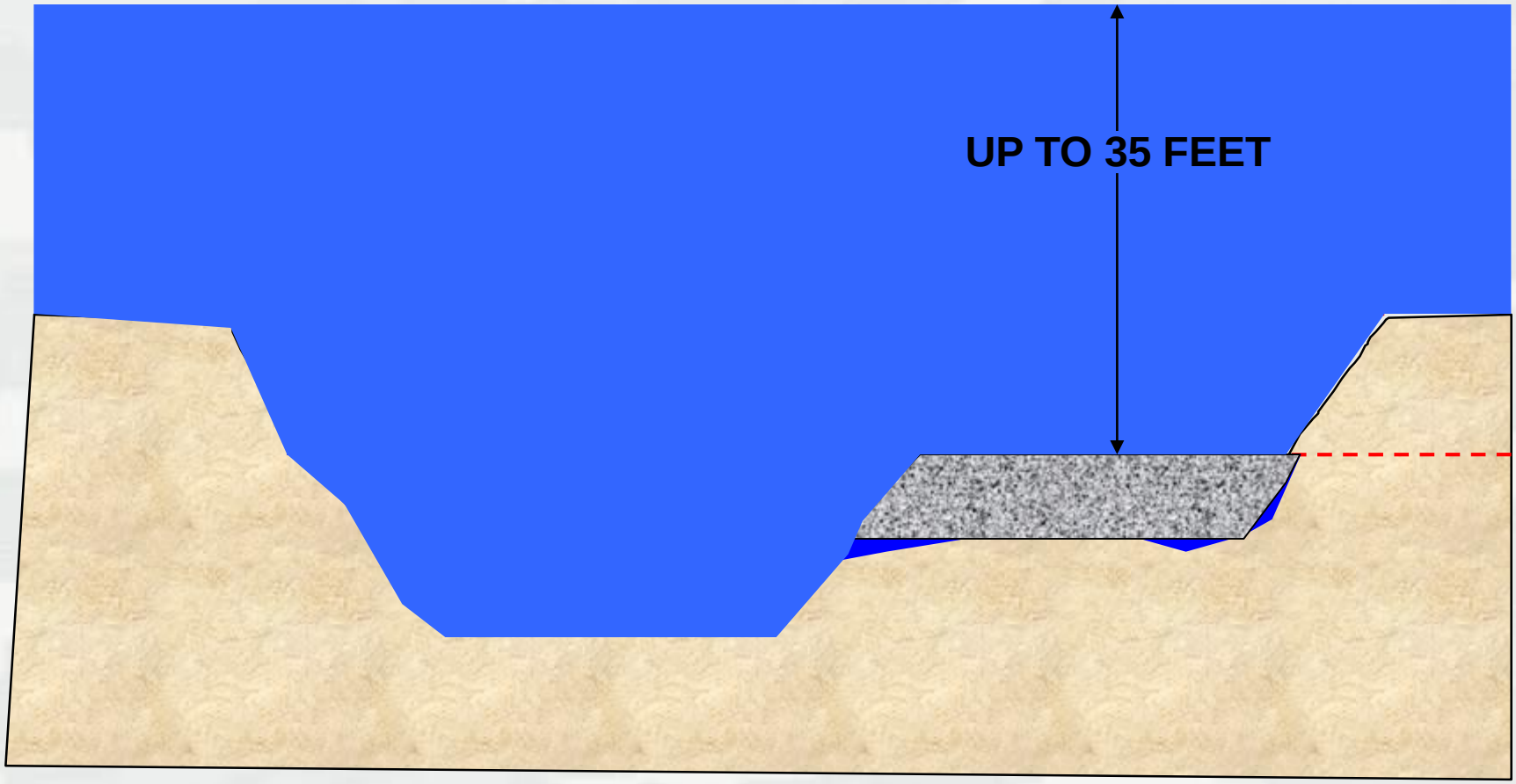
February 19, 2015

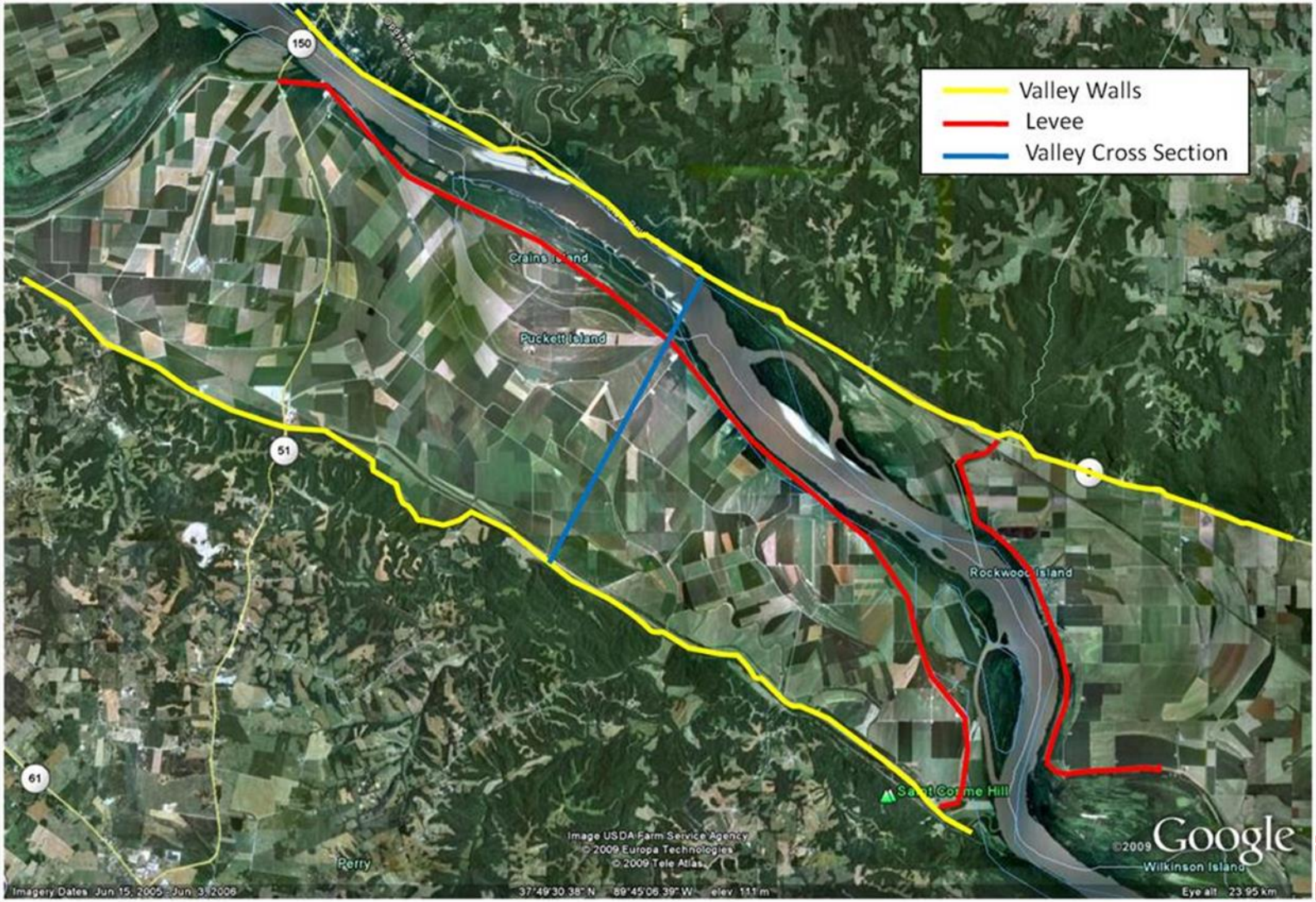


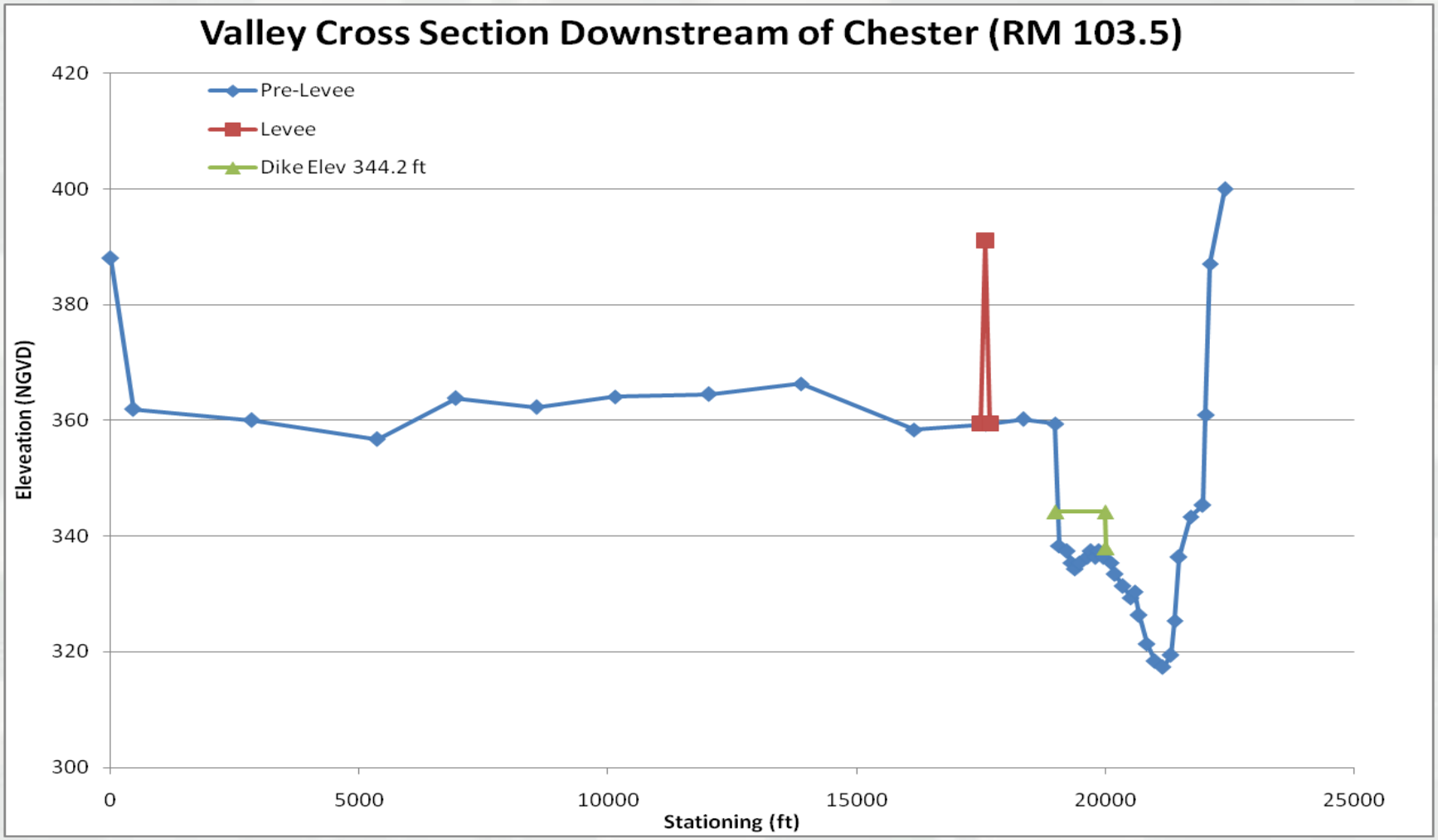
US Army Corps of Engineers

BUILDING STRONG®

Cross Section




Valley Walls
Levee
Valley Cross Section
150
51
61
Crains Island
Puckett Island
Rockwood Island
Wilkinson Island
Perry
Image USDA Farm Service Agency
© 2009 Europa Technologies
© 2009 Tele Atlas
©2009 Google
Imagery Dates: Jun 15, 2005 - Jun 3, 2006
37°49'30.38" N 89°45'06.39" W elev 111 m
Eye alt 23.95 km


Valley Cross Section Downstream of Chester (RM 103.5)
Pre-Levee
Levee
Dike Elev 344.2 ft
Eleveation (NGVD)
420
400
380
360
340
320
300
0
5000
10000
15000
20000
25000
Stationing (ft)

Timeline of Floodway Capacity Studies

1866: First Discharge measurement at St. Louis taken by City of St. Louis Engineer

1945: Floodway Capacity Study

1985: Physical Model Tests using Mississippi Basin Model (MBM)

1979: SLD Potamology Study (S-3): Comparison between different common discharge instruments

March 1933: USGS takes over responsibility of streamgaging

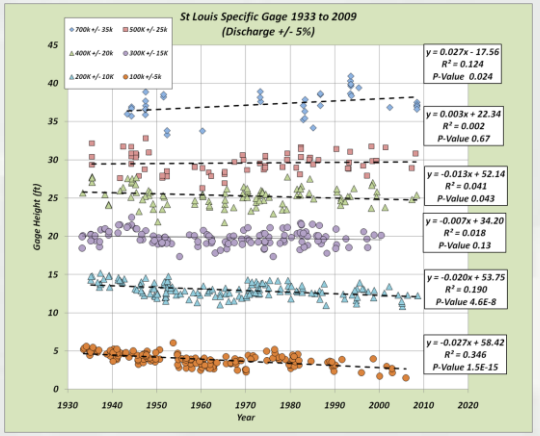
1935: First Comparison Study between USGS and USACE Methods

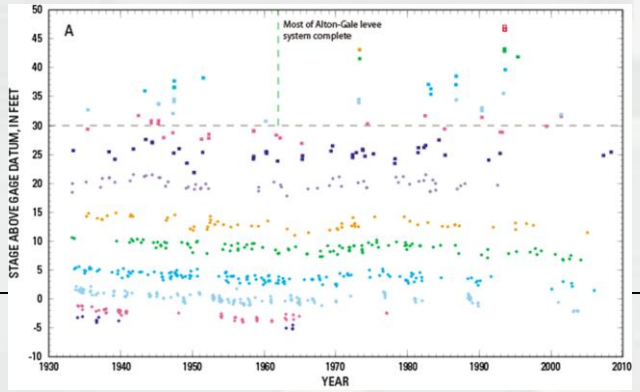
1949: Comparison study in Alton

1952: Comparative Discharge Study (USGS v USACE)

Independent External Reviews

- Biedenharn Group – Specific Gage Analysis
- USGS – Analysis of Gage Data
- Missouri S&T (Dr. V. Samaranayake) – Statistics
- Iowa Institute of Hydraulic Research (IIHR) – Numerical Simulations
- University of Illinois – Physical Model





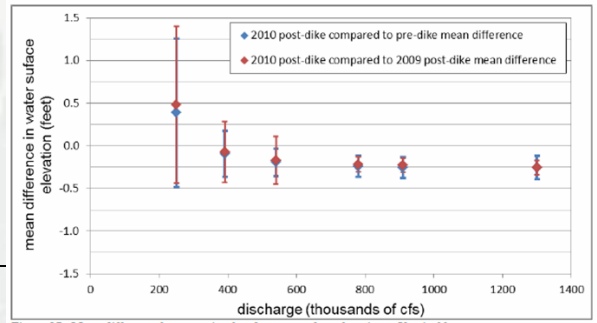


Figure 17. Mean difference between simulated water surface elevations. Vertical bars represent one standard deviation. The 2010-to-pre-construction difference in mean is similar to the 2010-to-2009 difference in mean, indicating the combined impact of the river training structures and the Mississippi River's naturally variable river bed is comparable to that of the river bed alone.

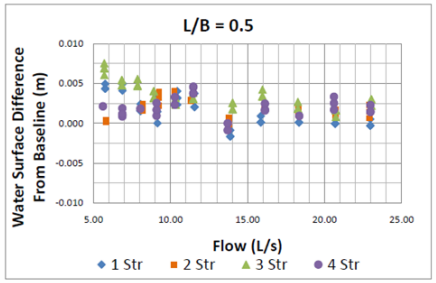


Figure 3.7: Water Surface Difference from Baseline, L/B = 0.5

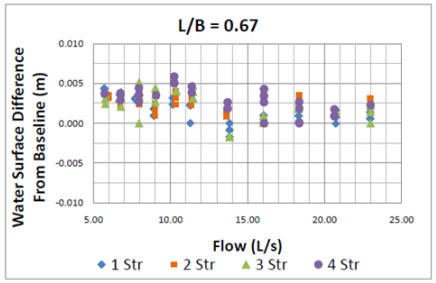


Figure 3.8: Water Surface Difference from Baseline, L/B = 0.67

Conclusion

- The results of analyses over the past 80+ years have lead to the conclusion that the construction of river training structures on the MMR do not raise flood levels.
- The results of external reviews all support the conclusion that the construction of river training structures on the MMR do not raise flood levels.

Conclusion -Future Analysis

- The Corps continues to monitor the physical effects of river training structures using updated field data (gage, ADCP, hydrographic survey)
- The Corps will continue to study the physical effects of river training structures as new data and technology becomes available.

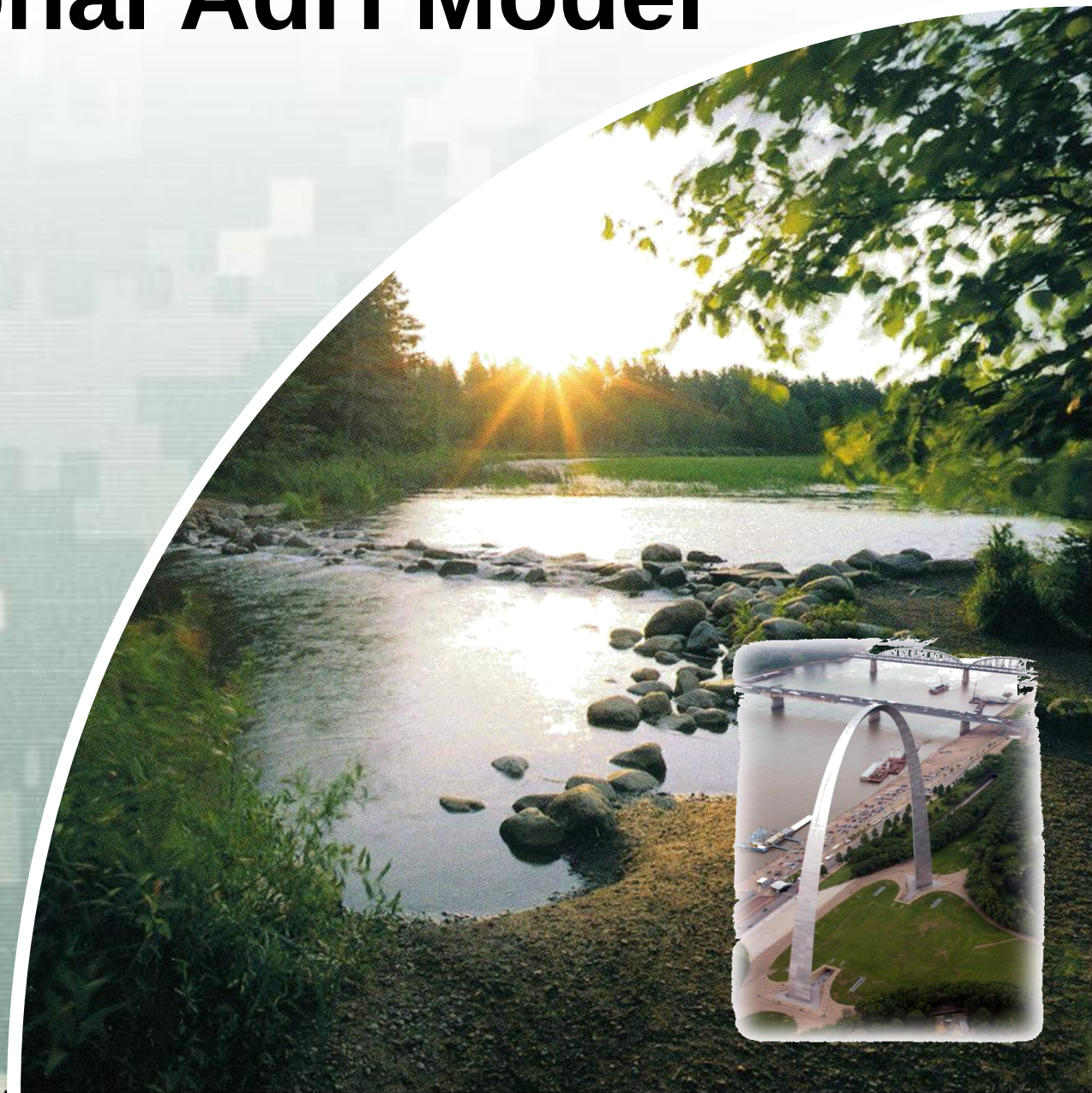
2-Dimensional AdH Model

Zachary Ryals, P.E.

Hydraulic Engineer

St. Louis District

March 9, 2016

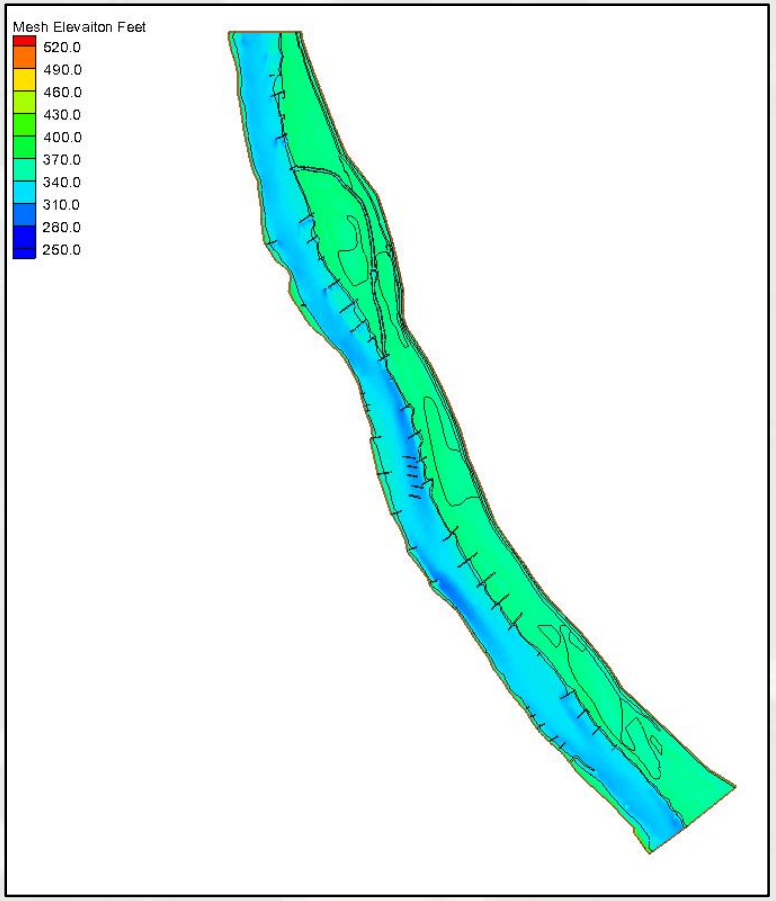


US Army Corps of Engineers

BUILDING STRONG®

Adaptive Hydraulics Modeling System (AdH)

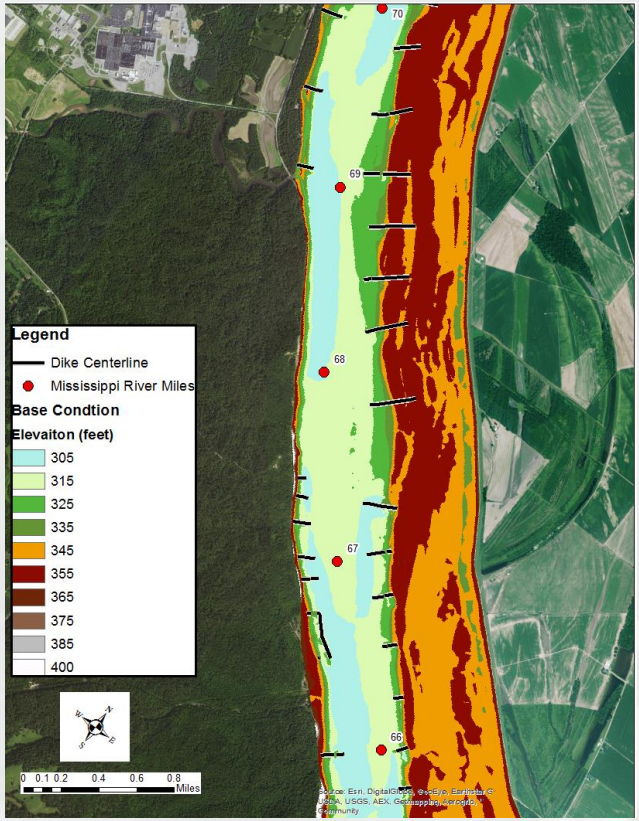
- Developed by the Coastal and Hydraulics Laboratory (CHL) at the Engineer Research and Development Center (ERDC)
- 2-Dimensional modeling system



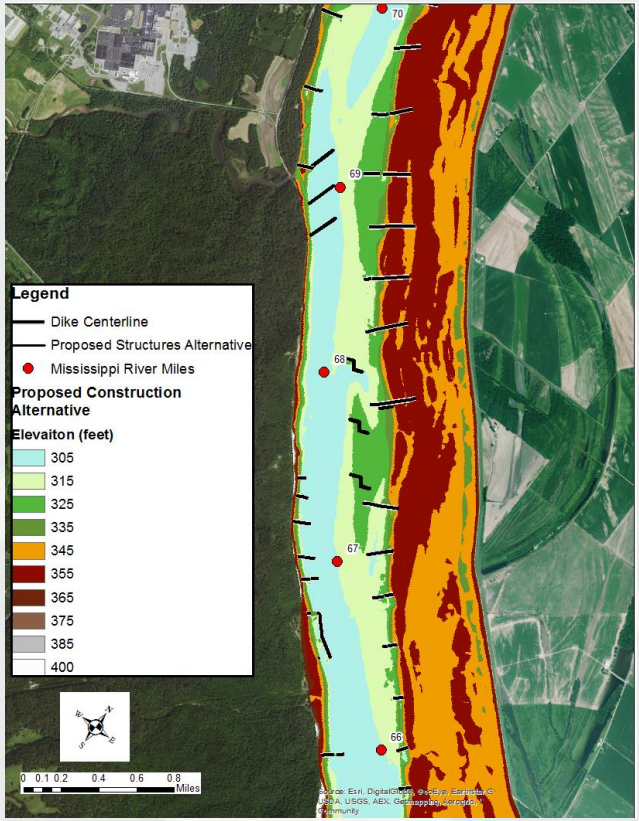
Engineer Research and Development Center

- ERDC is the premier engineering and scientific research organization of the U.S. Army Corps of Engineers.
- Conducts research and development in support of the military, civil works projects, other federal/state/local authorities, and U.S. industry.
- Integrated teams of engineers and scientists
- Coastal and Hydraulics Laboratory

Base and Proposed Construction Alternative

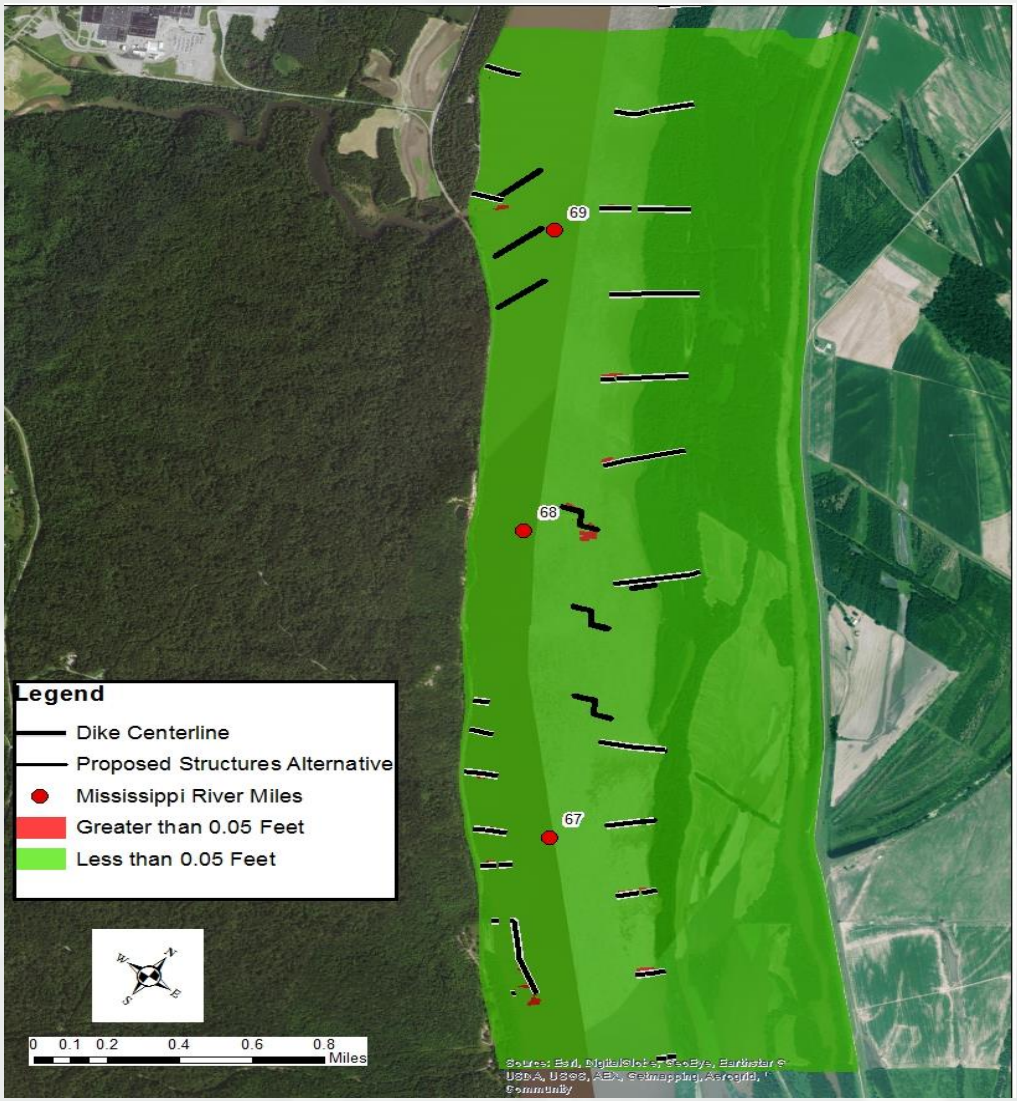


Base



Proposed

AdH Model Results



For Information and Questions

- St. Louis District Website
  http://www.mvs.usace.army.mil
- Amended Environmental Assessment:
  http://bit.ly/MVS_plans_reports
- Study: http://bit.ly/hydrostudy
- Questions to TeamSTL-PAO@usace.army.mil
  - Subject: Grand Tower