Waters Point HSR Model Study Read-Ahead

Brad Krischel

Purpose

The U.S. Army Corps of Engineers, St. Louis District, is conducting a study of the flow and sediment transport response near the Waters Point reach of the Mississippi River between River Miles (RM) 165.00 and RM 154.00 near Kimmswick, MO. This study is funded by the U.S. Army Corps of Engineers, St. Louis District's Biological Opinion program. The objective of the model study is to produce a report that outlines the results of an analysis of various river engineering measures intended to enhance environmental diversity within the Waters Point reach.

Goals

The goals of this study were to:

i. Investigate and provide analysis on the existing flow mechanics causing a lack of environmental diversity.
ii. Evaluate a variety of remedial measures utilizing an HSR model with the objective of identifying the most effective and economical plan to create a more diverse habitat within the Waters Point reach. In order to determine the best alternative, 2 criteria will be used to evaluate each alternative:

    a. The alternative should enhance the environmental diversity within the Waters Point reach.
    b. The alternative should maintain the navigation channel requirements of at least 9 foot of depth and 300 foot of width.

iii. Communicate to other engineers, river industry personnel, and environmental agency personnel the results of the HSR model tests and the plans for improvements.

Replication vs. Prototype

Bathymetric trends were recorded from the model using a 3-D Laser Scanner. Replication was achieved after numerous favorable bathymetric comparisons of the prototype surveys were made to several surveys of the model. Results of the HSR model replication test bathymetry and a comparison of the 2007 through 2013 prototype surveys indicated that the thalweg was located in the correct location throughout the model extents with similar channel depths. These prominent features within the model did not always precisely replicate the elevations of the prototype surveys, but the general trends were very comparable. Once the general trends were met, model replication was considered successful.

A calibration meeting for the Water's Point HSR model was held at the Applied River Engineering Center on August 28, 2014. The meeting was used to discuss the model replication and to gather input from navigation and environmental stakeholders. The meeting minutes and attendance can be found on the following pages. At the time of writing, there have been 5 alternatives tested in the model with plans of testing 10 to 15 more before the end of the model study, which will be near the end of October.

The attached plates show the hydrographic surveys used to determine the general trends of the prototype reach as well as the Waters Point HSR model replication survey. The plates are as follows:

1. 2007 Hydrographic Survey
2. 2010 Hydrographic Survey
3. 2013 Hydrographic Survey
4. HSR Model Replication Survey

Water's Point HSR Model Study Calibration Meeting
8/28/14 at 10am

-Brad presented Powerpoint presentation, then the group then gathered around the model and started discussing potential alternatives and areas of interest.

- Location with highest potential to work in: Rootless dikes near RM 158
    - Shannon Hughes expressed how great the channel has been since the construction of the three rootless dikes near Water's Point
        -He also expressed concern with altering them and possibly affecting the navigation channel
        - Mike reinforced that we would not pick an alternative that would negatively affect the navigation channel
    - Everybody agreed that this would be a good area to work on to attempt to get more flow on the Missouri bankline behind the rootless structures. More flow along the bankline would likely result in a positive change in the environmental diversity.
    - All parties present were ok with testing short downstream angled weirs around Water's Point to try and redirect some flow towards the bankline/rootless dikes.

- Next area of interest was the chevrons near RM 160
    - Wanted to look at removing/modifying chevrons and structures near the chevrons to see if it has a positive effect on the area near Water's Point.
    - Danny Brown said at a stage of 9.5 ft, the area around the chevrons looks great (lots of diversity). However, at lower stages you can't get back behind the chevrons because it's so shallow.
    - The dikes near the existing chevrons have not been completely notched/degraded yet. MVS staff noted they wanted to make sure the dikes got degraded to the correct elevation to create more separation between the chevrons and the existing/shortened dikes. The flow patterns and environmental diversity could change in that area once river stages allow for the completion of degrading the dikes. We can still test alternatives in this area, but Brad should be mindful of this incomplete construction.
    - Matt M. was curious about the angle of the chevrons and how they seem to be forcing all the sediment to go to the Illinois bankline – he wanted to possibly modify the chevrons and replace with offset dikes.
    - Final conclusion – look at this area to understand how the chevrons influence flow, both in the immediate vicinity of Water's Point as well as downstream. However, don't do a lot of work/changes around the chevrons since we are waiting for the contractor to get back out there and further degrade the dikes.

- Least area of interest was the sandbar in the LDB dike field downstream of RM 157
    - The only suggestion for this area was to possibly notch a dike or two (or introduce 1 small offset dike) on the LDB near RM 157 to develop a split flow near the ends of the LDB dikes
    - Stakeholders really like the gradually sloping sandbar and the dike field in general. Danny Brown (MDC) said that they always sample a lot of fish in that dike field.

Path Forward: We told them to continue to provide Brad with ideas if they think of any after the meeting. Brad will immediately begin testing alternatives to enhance the environmental features of the reach, while maintaining the existing navigation channel.

Attendance for HSR Model Meeting (08/28/14) – Upper Browns Bar & Waters Point

NAME	Organization	Email
JASEN BROWN	USACE	
MATT MANGAN	USFWS	
KEN COOK	USACE	
Leonard Hopkins	USACE	
Dave Knuth		
Shannon Hughe	RIAC	
Bernie Hereoff	RIAC	
Mike Roo leers	USACE	
David Gordon	USACE	
Lance Engle	USACE	
DAWN LAMM	USACE	
EDDIE BRAUER	USACE	
Dawn Lamm	USACE	
Danny Brown	MDC	
Sarah Peper	MDC	
Corarey Cox	MDC	
ASHLEY COX	USACE	
BRAD KRISCHEL	USACE	
IVAN NGUYEN	USACE	

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

935,000 930,000 925,000 920,000 915,000 910,000 905,000

Meramec River

Dike 163

Dike 162.60L

RM 162

Dike 162.30L

Dike 162.10L

Dike 161.90L

Dike 161.10R

RM 161

Dike 161.50L

Dike 161.10L

Dike 160.60R

Dike 160.90L

Chelsey Island

Dike 160.60L

RM 160

Dike 160.30L

Dike 159.80R

Dike 160.00L

Illinois

Dike 159.70R

Dike 159.90L

Missouri

Dike 159.70L

Dike 159.30R

Dike 159.50L

Dike 159.10R

Dike 158.90R

Dike 159.20L

Kimmswick

RM 159

Dike 158.90L

Dike 158.60L

Waters Point

Dike 158.30L

Dike 158.10L

RM 158

Dike 158.00L

Dike 157.80L

Dike 157.50L

Dike 157.40L

Dike 157.10L

RM 157

Dike 156.70L

Dike 156.30L

Dike 156.00L

RM 156

Dike 155.60L

Dike 155.30L

RM 155

Dike 154.90L

Legend

- RM
- Dike
- Weir
- Representative Dredging

Feet Referenced to LWRP

- > 10
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- < -50

PLATE NUMBER 1

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

2007 Hydrographic Survey
STL Gage: +7.0 ft LWRP

2012 Aerial Photograph

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

Mississippi River Basin
St. Louis District
Waters Point
HSR Model

DESIGNED BY: B Krischel		SURVEY DATE: December 18, 2007	
DRAWN BY: B Krischel	REVIEWED BY: A Cox	CHECKED BY: Tim Lauth, P.E.	
SUBMITTED: B Krischel		APPROVED: Rob Davinroy, P.E.	
FILE NAME: L:\Waters Point		PLOT DATE: 06/17/14	

N W E S

Applied River Engineering Center

US Army Corps of Engineers
St. Louis District

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935,000 930,000 925,000 920,000 915,000 910,000 905,000

Meramec River

Illinois

Missouri

Chelsey Island

Kimmswick

Waters Point

RM 162
RM 161
RM 160
RM 159
RM 158
RM 157
RM 156
RM 155

Dike 163
Chevron 162.60L
Dike 162.60L
Chevron 162.50L
Chevron 162.40L
Dike 162.30L
Dike 162.10L
Dike 161.90L
Dike 161.10R
Dike 161.50L
Dike 161.10L
Dike 160.60R
Dike 160.90L
Dike 160.60L
Dike 160.30L
Chevron 160.30L
Dike 159.80R
Dike 160.00L
Chevron 160.00L
Dike 159.70R
Dike 159.90L
Chevron 159.90L
Dike 159.70L
Dike 159.30R
Dike 159.50L
Dike 159.10R
Dike 158.90R
Dike 159.20L
Dike 158.90L
Dike 158.60L
Dike 158.10R
Dike 158.30L
Dike 157.70R
Dike 158.10L
Dike 158.00L
Dike 157.30R
Dike 157.80L
Dike 157.50L
Dike 157.40L
Dike 157.10L
Dike 156.70L
Dike 156.30L
Dike 156.00L
Dike 155.60L
Dike 155.30L
Dike 154.90L

Legend

- RM
- Dike
- Weir
- Representative Dredging

Feet Referenced to LWRP

- > 10
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- < -50

PLATE NUMBER 2

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

2010 Hydrographic Survey
STL Gage: +21.0 ft LWRP

2012 Aerial Photograph

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI	DESIGNED BY: B Krischel	SURVEY DATE: September 20-21, 2010	
	DRAWN BY: B Krischel	REVIEWED BY: A Cox	CHECKED BY: Tim Lauth, P.E.
Mississippi River Basin St. Louis District Waters Point HSR Model	SUBMITTED: B Krischel	APPROVED: Rob Davinroy, P.E.	
	FILE NAME: L:\Waters Point	PLOT DATE: 06/17/14	

N W E S

Applied River Engineering Center

US Army Corps of Engineers St. Louis District

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

935,000 930,000 925,000 920,000 915,000 910,000 905,000

Meramec River

Illinois

Missouri

Chelsey Island

Kimmswick

Waters Point

RM 162
RM 161
RM 160
RM 159
RM 158
RM 157
RM 156
RM 155

Dike 163
Chevron 162.80
Dike 162.60L
Chevron 162.60L
Chevron 162.50L
Chevron 162.40L
Dike 162.30L
Dike 162.10L
Dike 161.90L
Dike 161.10R
Dike 161.50L
Dike 161.10L
Dike 160.60R
Dike 160.90L
Dike 160.60L
Dike 160.30L
Chevron 160.30L
Dike 159.80R
Dike 160.00L
Chevron 160.00L
Dike 159.70R
Dike 159.90L
Chevron 159.90L
Dike 159.70L
Dike 159.30R
Dike 159.50L
Dike 159.10R
Dike 159.20L
Dike 158.90R
Dike 158.90L
Dike 158.60L
Dike 158.10R
Dike 158.30L
Dike 157.70R
Dike 158.10L
Dike 158.00L
Dike 157.30R
Dike 157.80L
Dike 157.50L
Dike 157.40L
Dike 157.10L
Dike 156.70L
Dike 156.30L
Dike 156.00L
Dike 155.60L
Dike 155.30L
Dike 154.90L

Legend

- RM
- Dike
- Weir
- Representative Dredging

Feet Referenced to LWRP

- > 10
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- < -50

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

PLATE NUMBER 3

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

2013 Hydrographic Survey
STL Gage: +28.5 ft LWRP

2012 Aerial Photograph

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI	DESIGNED BY: B Krischel	SURVEY DATE: May 13-14, 2013	
	DRAWN BY: B Krischel	REVIEWED BY: A Cox	CHECKED BY: Tim Lauth, P.E.
Mississippi River Basin St. Louis District Waters Point HSR Model	SUBMITTED: B Krischel	APPROVED: Rob Davinroy, P.E.	
	FILE NAME: L:\Waters Point	PLOT DATE: 06/17/14	

N W E S

Applied River Engineering Center

US Army Corps of Engineers St. Louis District

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

935,000 930,000 925,000 920,000 915,000 910,000 905,000

Meramec River

RM 162

RM 161

RM 160

RM 159

RM 158

RM 157

RM 156

RM 155

Chelsey Island

Missouri

Illinois

Kimmswick

Waters Point

Dike 163

Chevron 162.80

Dike 162.60L

Chevron 162.60L

Chevron 162.50L

Chevron 162.40L

Dike 162.30L

Dike 162.10L

Dike 161.90L

Dike 161.10R

Dike 161.50L

Dike 161.10L

Dike 160.60R

Dike 160.90L

Dike 160.60L

Dike 160.30L

Chevron 160.30L

Dike 159.80R

Dike 160.00L

Chevron 160.00L

Dike 159.70R

Dike 159.90L

Chevron 159.90L

Dike 159.70L

Dike 159.30R

Dike 159.50L

Dike 159.10R

Dike 159.20L

Dike 158.90R

Dike 158.90L

Dike 158.60L

Dike 158.10R

Dike 158.30L

Dike 157.70R

Dike 158.10L

Dike 158.00L

Dike 157.30R

Dike 157.80L

Dike 157.50L

Dike 157.40L

Dike 157.10L

Dike 156.70L

Dike 156.30L

Dike 156.00L

Dike 155.60L

Dike 155.30L

Dike 154.90L

Legend

- RM
- Dike
- Weir
- Representative Dredging

Feet Referenced to LWRP

- > 10
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- < -50

PLATE NUMBER 4

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

Waters Point HSR Model Replication

2012 Aerial Photograph

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI	DESIGNED BY: B Krischel	SURVEY DATE: June 17, 2014	
	DRAWN BY: B Krischel	REVIEWED BY: A Cox	CHECKED BY: Tim Lauth, P.E.
Mississippi River Basin St. Louis District Waters Point HSR Model	SUBMITTED: B Krischel	APPROVED: Rob Davinroy, P.E.	
	FILE NAME: L:\Waters Point	PLOT DATE: 06/17/14	

N W E S

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US Army Corps of Engineers St. Louis District