Missouri River Degradation (Lower 498 River Miles)

for

Mid-America Regional Council and U.S. Army Corps of Engineers Stakeholder Meeting

March 5, 2009

Reconnaissance Study Update

- Presentation of results
- Feasibility Study Needs
- Discussion of Civil Works Process
- Project Schedule
- Sponsorship

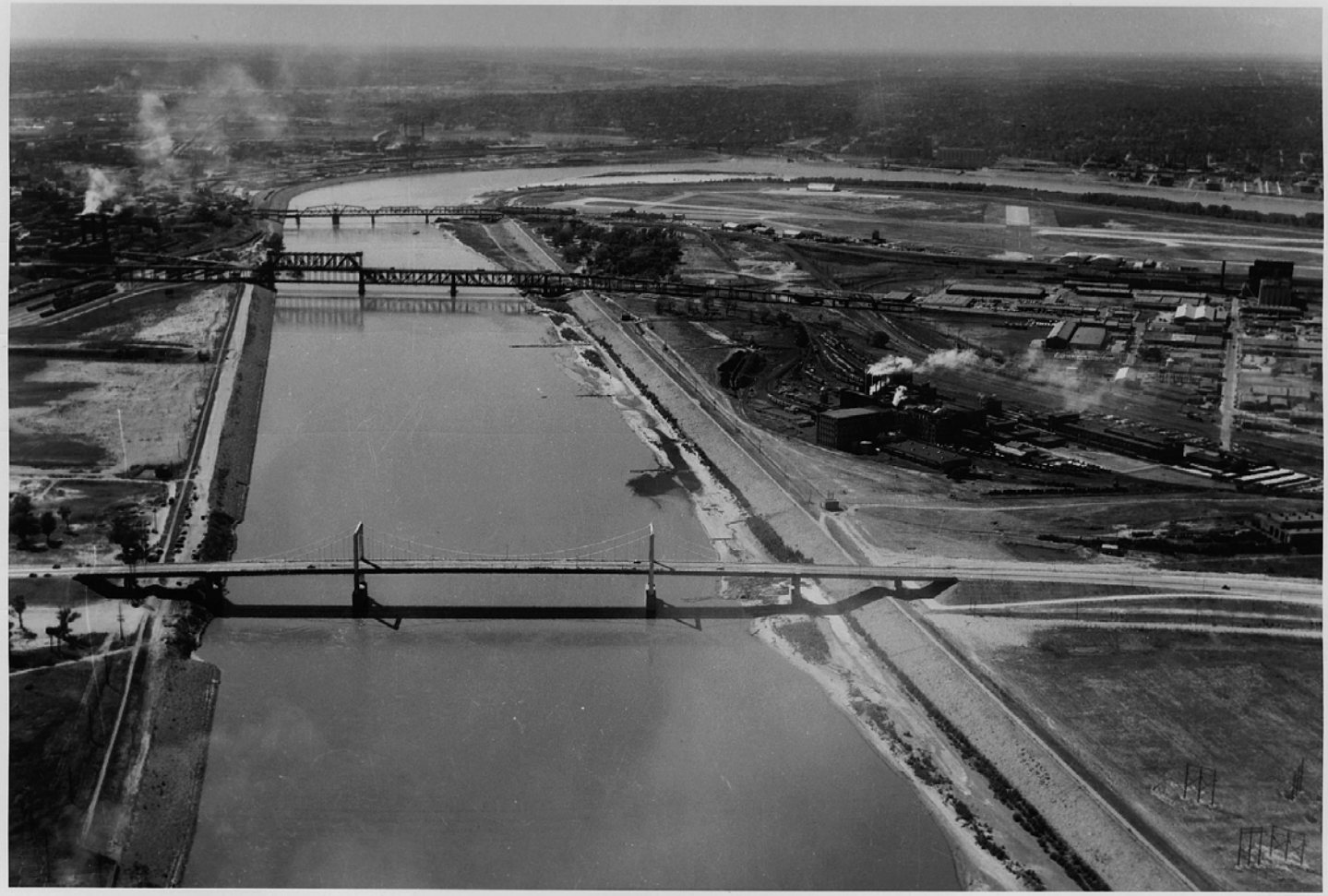
Examples of Degradation Impacts

- Power Plant Intakes Required Modification
- Public Water Supply Intakes Required Modification
- Tributary Erosion
- River Bank Instability
- Pipeline Crossings Exposed
- Drainage Outfall Structure Instability

Existing Information

- Aerial Photography
- Historical Hydrographic Surveys
- Low Water Profiles
- USGS Gathered Data from Discharge Measurements

September 23, 1954



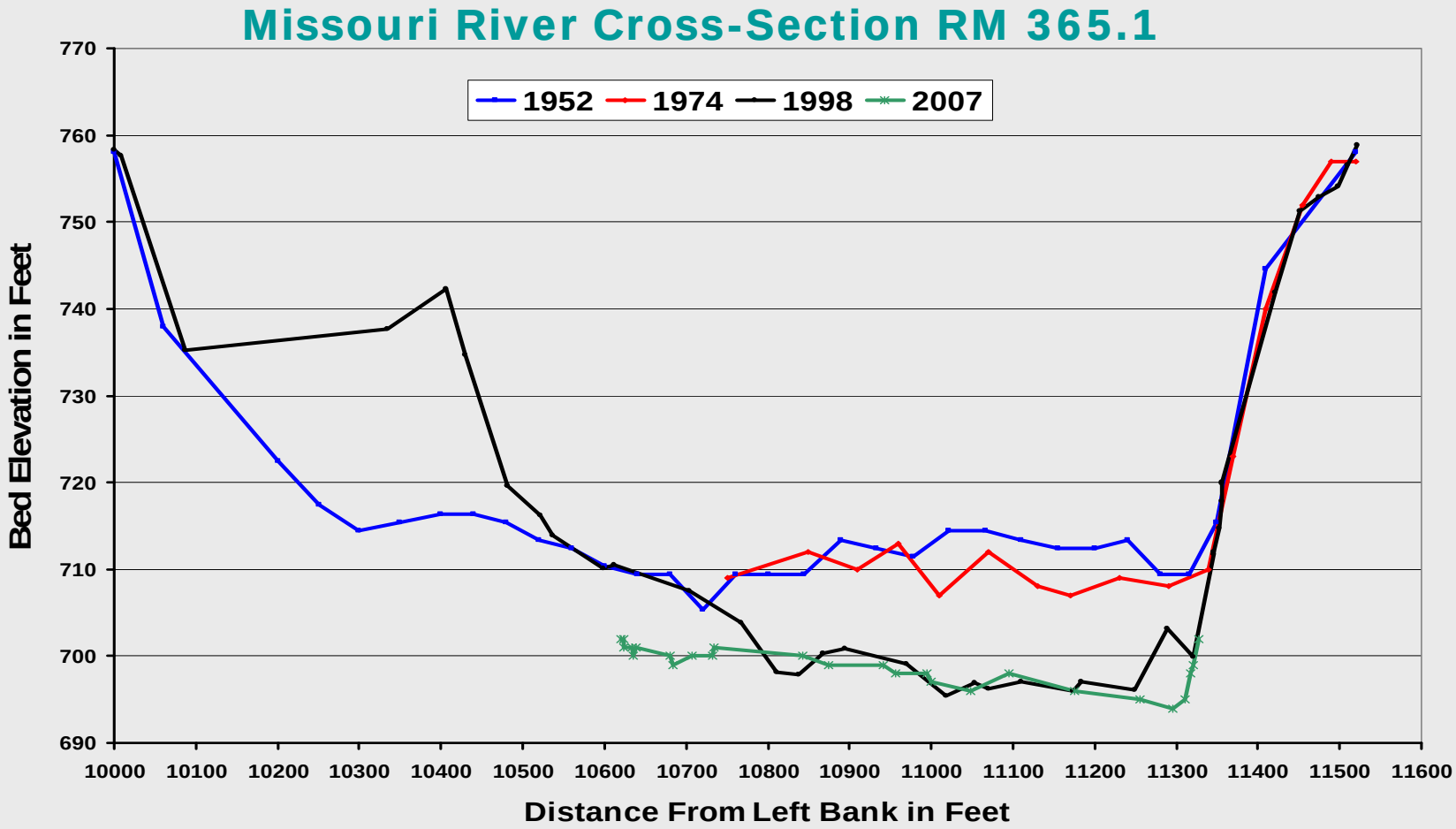
MISSOURI RIVER IMPROVEMENT

KANSAS CITY DISTRICT CHANNEL STABILIZATION AND NAVIGATION PROJECT KANSAS CITY, MISSOURI

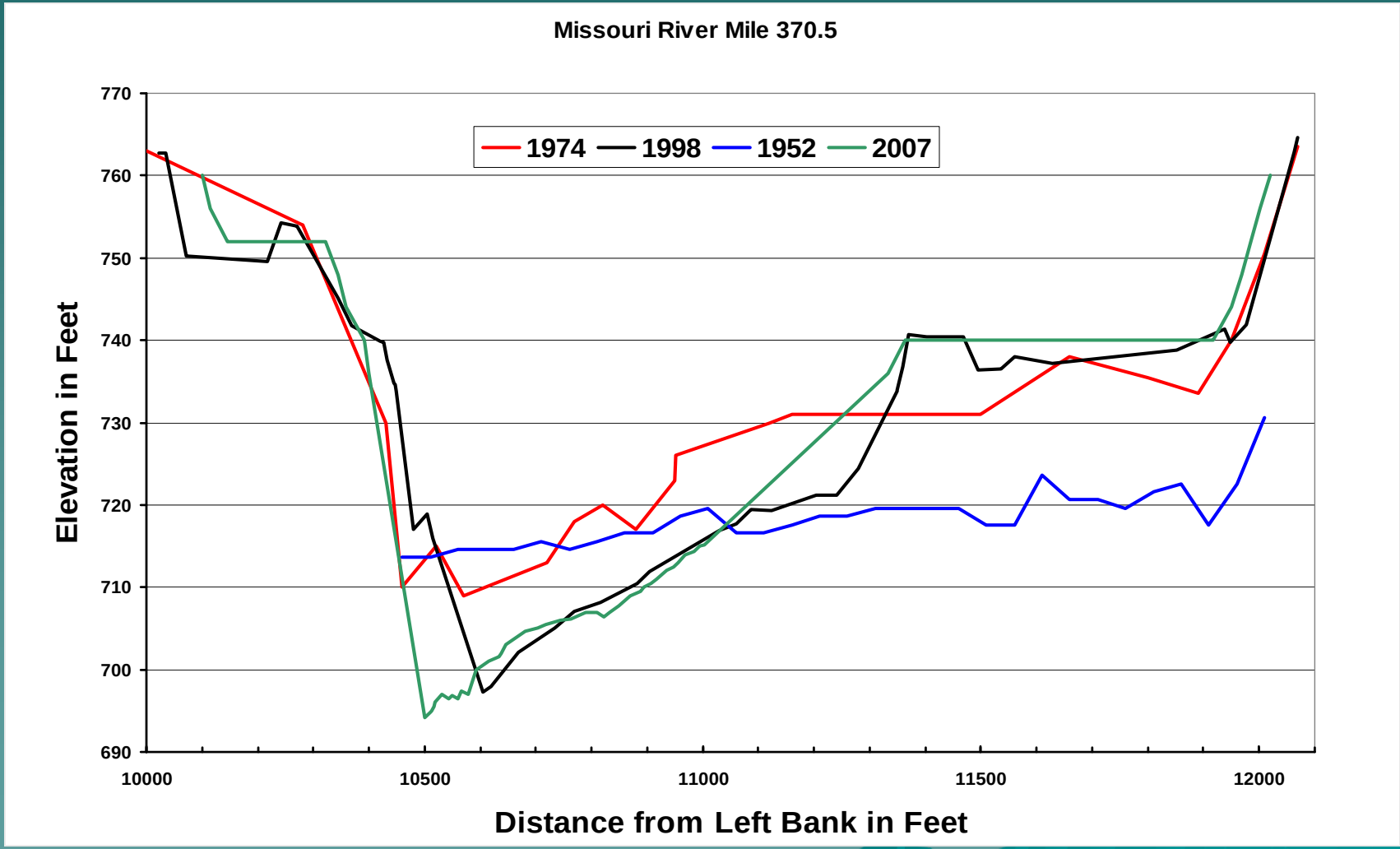
AERIAL VIEW WEST (UPSTREAM) FROM APPROXIMATE RIVER MILE 376, SHOWING PORTION OF RIVER FROM KANSAS CITY REACH TO KANSAS RIVER BEND. LEVEE AND BANK PROTECTION ALONG LEFT BANK IN NORTH KANSAS CITY UNIT, LEVEE AND BANK PROTECTION ON RIGHT BANK IN EAST BOTTOMS UNIT. BRIDGES FROM BOTTOM UP ARE: NEW PASEO BRIDGE; (A.S.B.) HIGHWAY & RAILWAY BRIDGE AND C.B. & Q. R.R. (HANNIBAL) RAILWAY AND HIGHWAY BRIDGE. CONFLUENCE OF KANSAS AND MISSOURI RIVERS IN CENTER BACKGROUND.

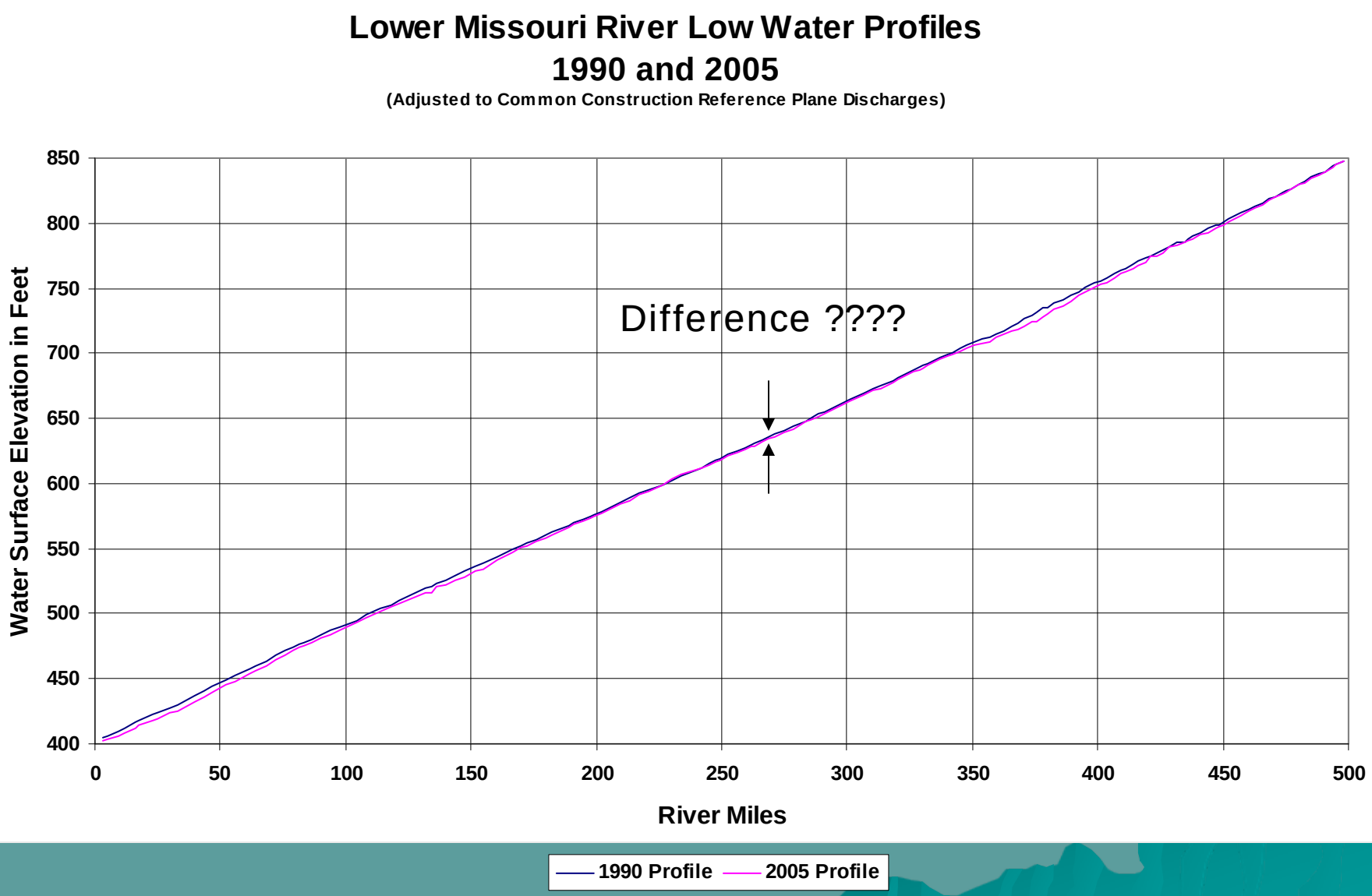
23 SEPTEMBER 1954 NEG. NO. 61775

Current Google Earth Image

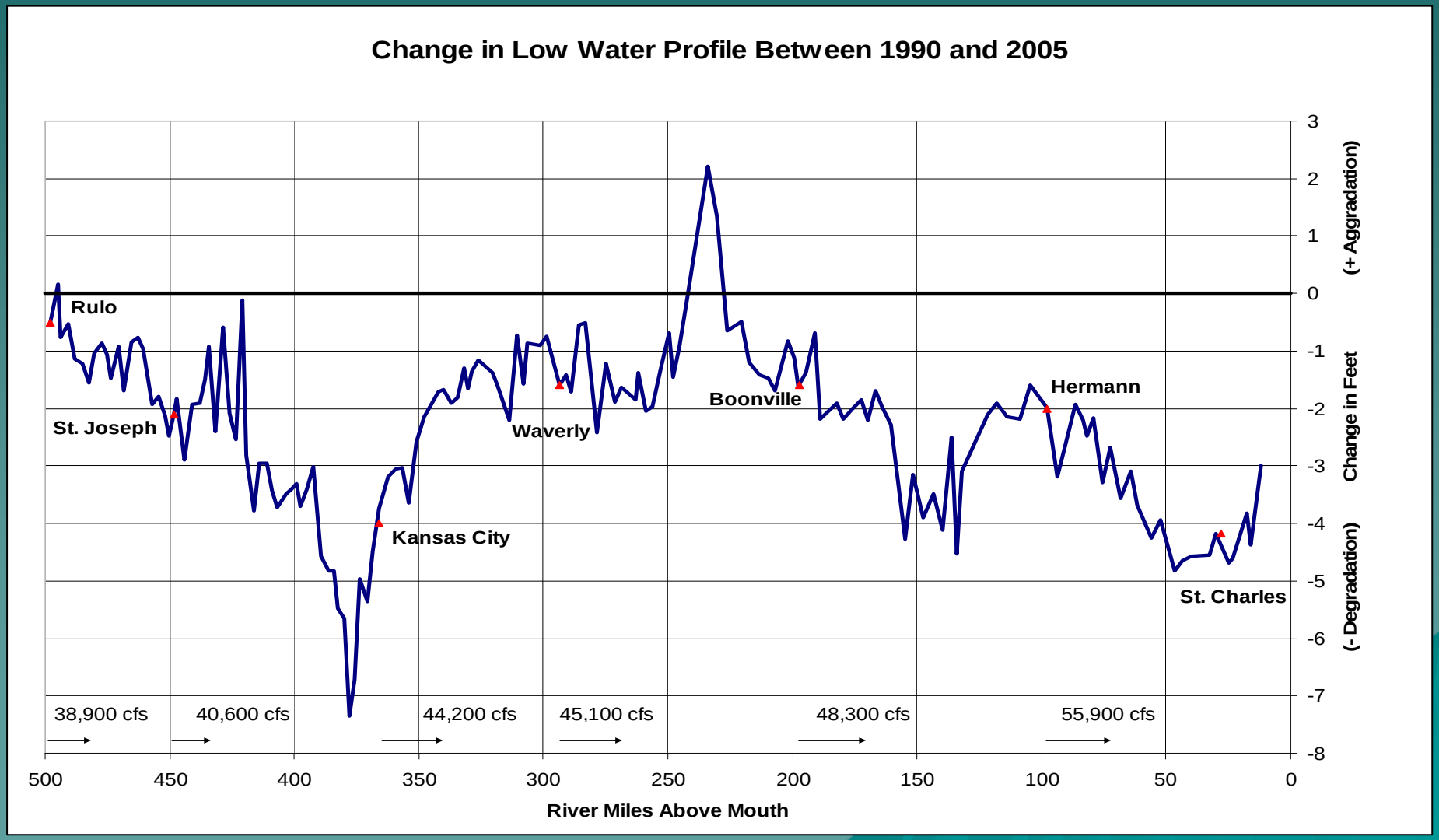

Missouri River Cross-Section RM 365.1
1952
1974
1998
2007
Bed Elevation in Feet
770
760
750
740
730
720
710
700
690
10000
10100
10200
10300
10400
10500
10600
10700
10800
10900
11000
11100
11200
11300
11400
11500
11600
Distance From Left Bank in Feet

Missouri River Cross-Section RM 370.5




Lower Missouri River Low Water Profiles
1990 and 2005
(Adjusted to Common Construction Reference Plane Discharges)
Water Surface Elevation in Feet
850
800
750
700
650
600
550
500
450
400
0
50
100
150
200
250
300
350
400
450
500
River Miles
Difference ????
1990 Profile
2005 Profile

Change in Low Water Profile 1990 to 2005



USGS Discharge Measurements

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

Long-Form Discharge Measurement Summary

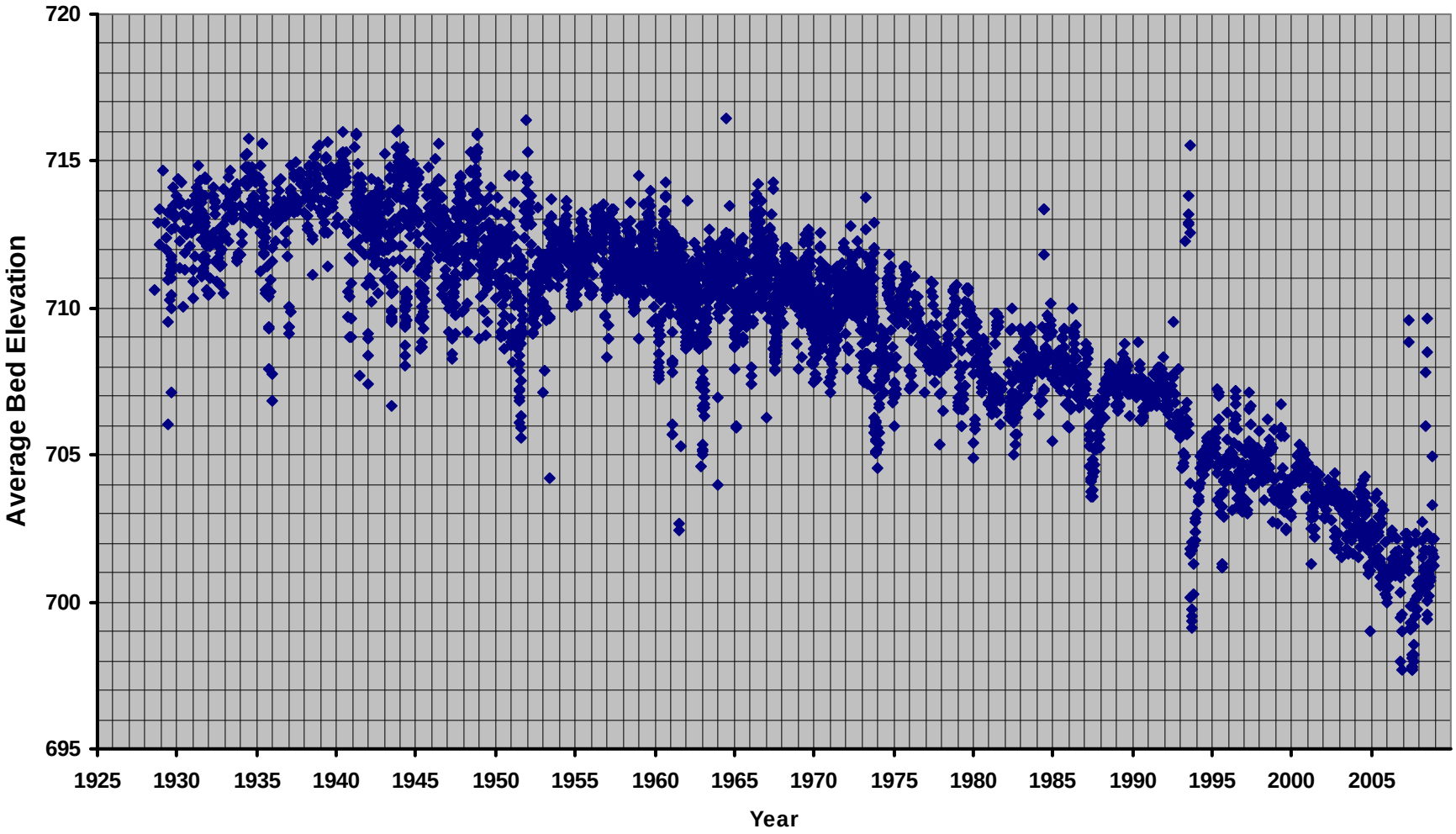
STATION NUMBER 06893000 Missouri River at Kansas City, MO SOURCE AGENCY USGS STATE 29 COUNTY 095

LATITUDE 390642.2 LONGITUDE 0943517.3 NAD83 DRAINAGE AREA 484100 CONTRIBUTING DRAINAGE AREA DATUM 706.40 NGVD29

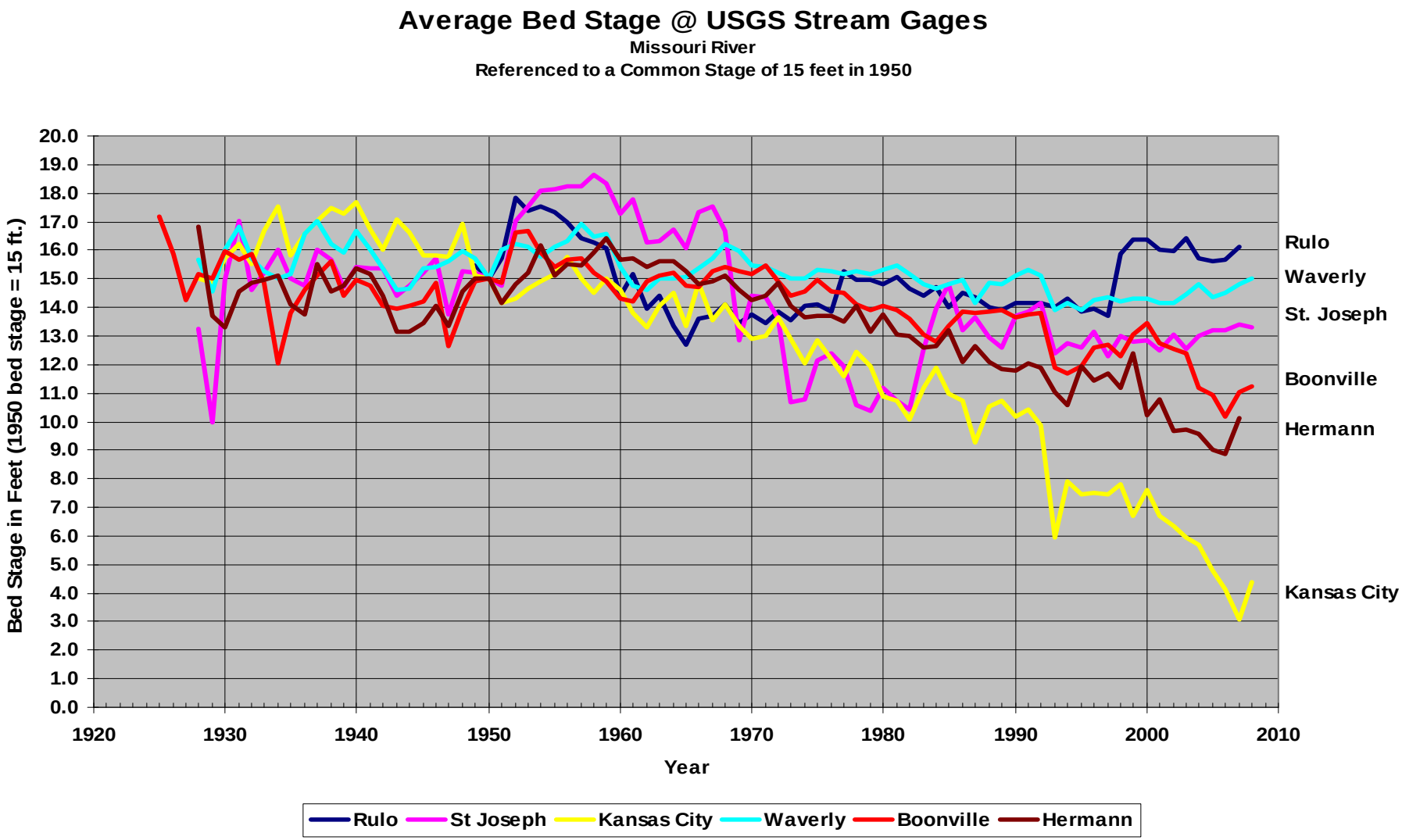
Date Processed:2008-12-05 10:08 By jloewel

Meas+ACM-: 4940 STAGE: 7.12 RATED: F IND. SHIFT: RAT ANLY Q: STATUS: L
DATE: 2008/01/16 DISCH: 34700 GHCH: 0.0 APP. SHIFT: 1.03 AUX. GH:
TIME: 1352 CST QCODE: MEAS TIME: 0.2 BASE +ACU-DIFF: STD. SEC. AREA:
PARTY: JBW/TEH RATING: BAFLOW: UNSP SHFT +ACU-DIFF: 0.0 STD. SEC VEL: MEAN INDEX VEL:
CONTROL LOCATION:
CONTROL CONDITION: Clear
CONTROL REMARKS:
MEASUREMENT REMARKS:
CHANNEL 1 :
NAME: Unspecified
LOC: UNSP Q METH: QADCP HORIZ DIST: UNSP TYPE: UNSP
DISCH: 34700 VEL. METH: VADCP VEL DESC: UNSP
WIDTH: 752 AREA: 9720 MEAN VEL: 3.57 +ACU-MEAS:
NAV METH: UNSP WATER MODE: UNSP COEFF VAR: CELL SIZE:
CHANNEL CONDITION: Unspecified

Average Bed Elevation Based on Hydraulic Depth
from USGS Measurements @ Kansas City, MO



Stream Bed @ USGS Gages



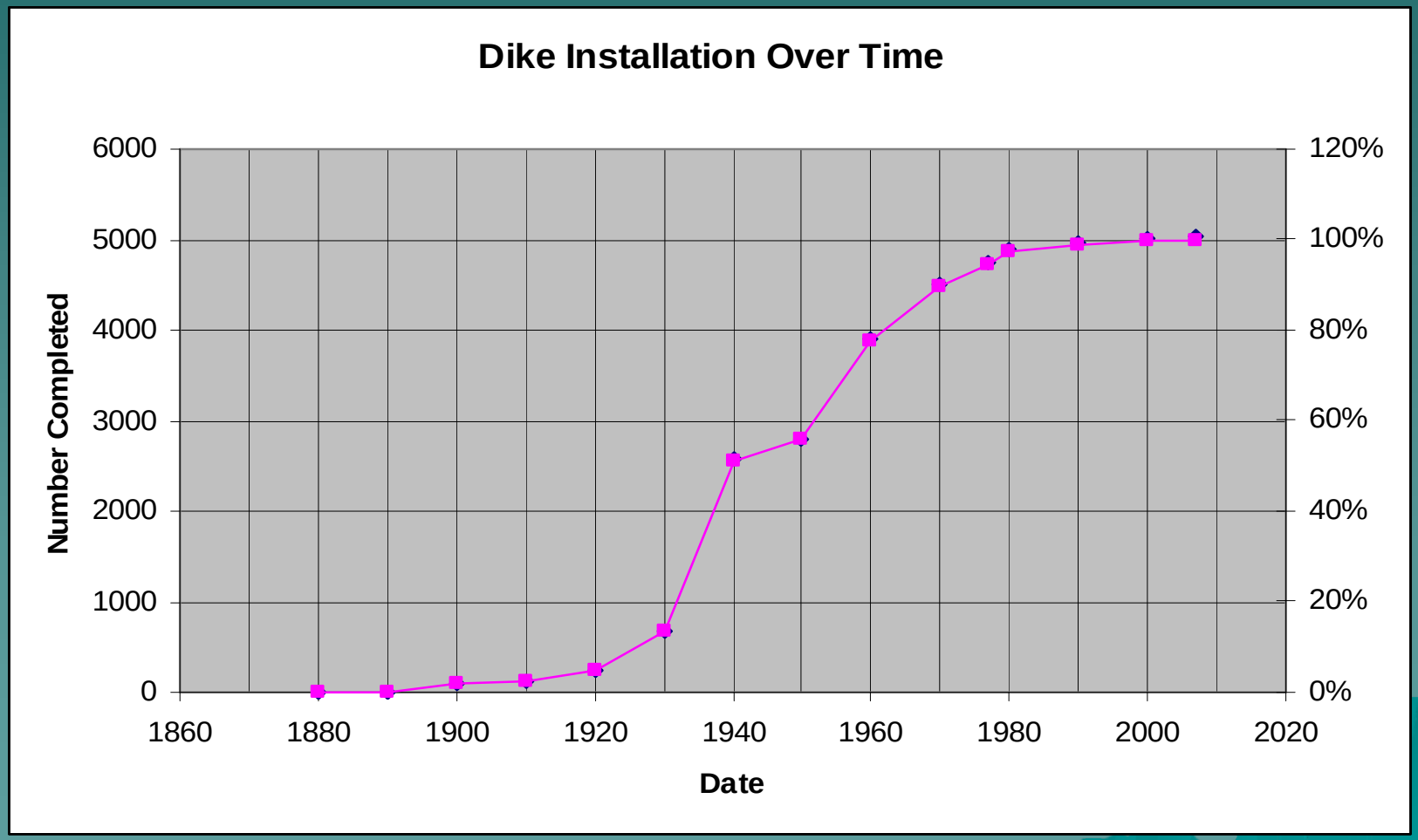
Potential Causes of Degradation

(listed in general historical sequence)

- Land Use Changes
- Dikes and Revetment Construction (Navigation)
- River Cut-Offs
- Major Flood Events
- Missouri River and Tributaries Dam Construction
- Flow Modification by Reservoir Regulation
- Commercial Sand/Aggregate Dredging

Dike Installation History

(Dikes are rocks structures generally perpendicular to river flow.)



Dikes and Revetments Summary

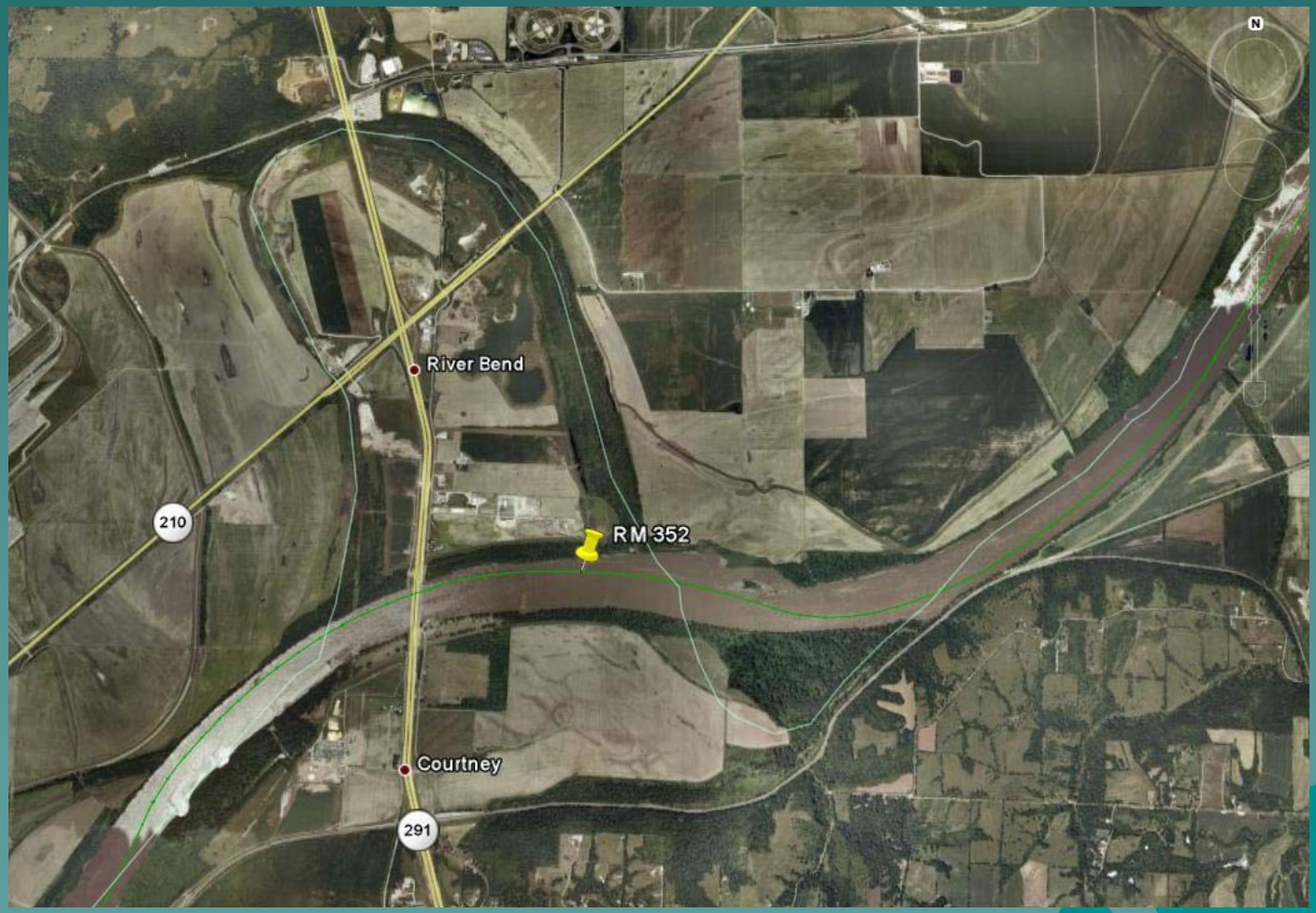
(Bank Stabilization and Navigation Project Impacts)

- Drastically changed the Missouri River channel
- Degraded low flow channel
- Inhibits deposition in degraded reaches
- Essentially complete in 1980s

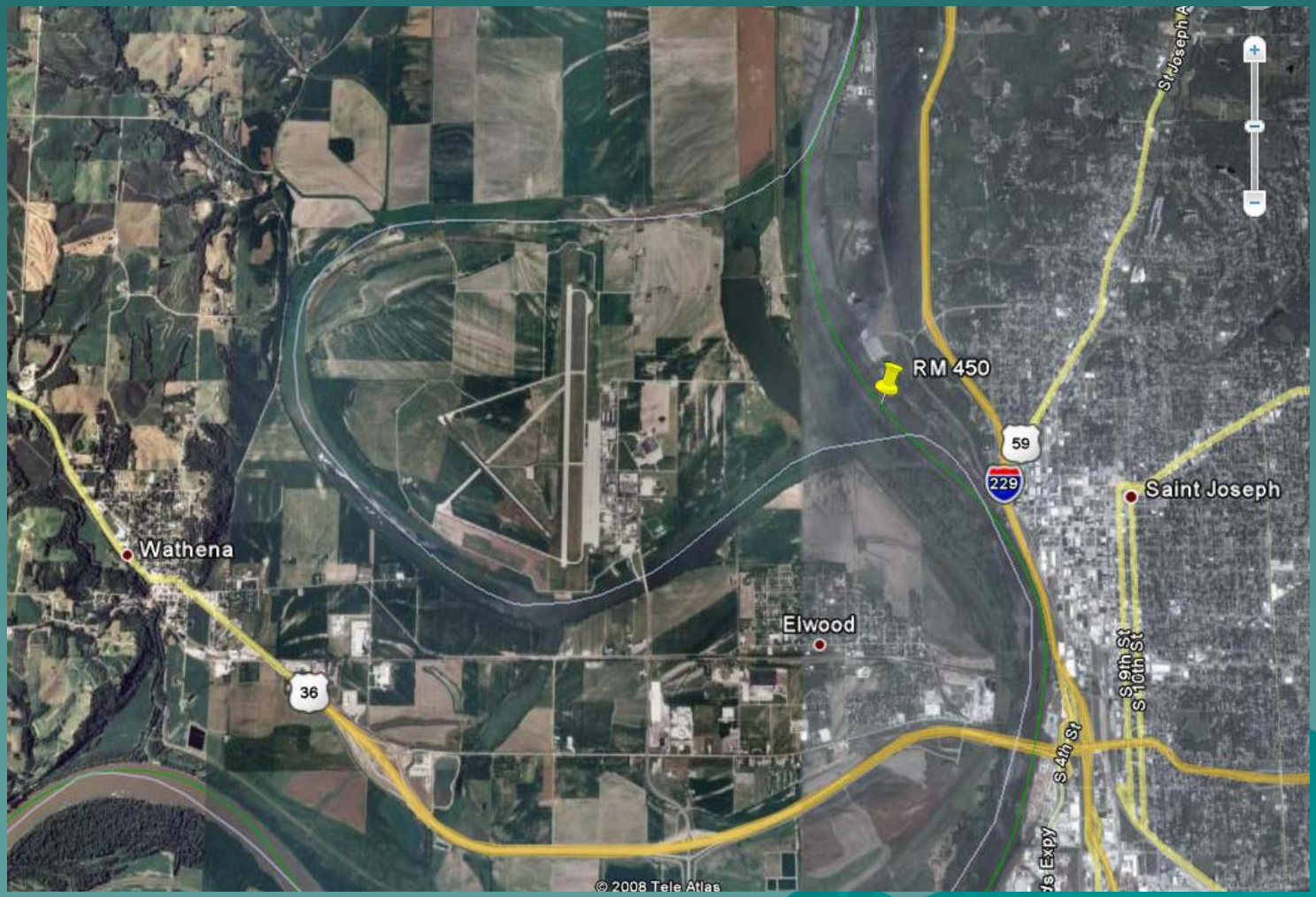
Cut-off Locations and Extents

Name	Pre Cut-Off Slope ft/mi	~ River Mile	Miles Cut-Off	Date of Cut-Off
Napoleon Bend	-	324	~8.2	1915
Big Blue Bend	-	358	~0.5	1940
Liberty Bend	.77	352	~3.6	1950
Jackass Bend	-	337	~4.6	1957
St. Joseph	.75	450	~6.2	1956
Total Miles			~23.1	

Liberty Bend Cut Off (RM 352)



St. Joseph Cut Off (RM 450)



Summary (Cut-Offs)

- Cut-offs have contributed to degradation in certain reaches of the river.
- These reaches have also been altered in character by the construction of dikes and revetments.
- This constraining of the river placed additional stresses on the stream bed.
- Detailed data not available/analyzed to fully quantify.

Major Flood Events Summary

- Short Term Degradation (~ 2 yrs.)
- Long Term Degradation
- Evident at Waverly, Kansas City and St. Joseph Gaging Stations
- Not Clearly Evident at Other Gaging Stations
- Major Flood Events Contribute to Long Term Degradation in Some River Reaches

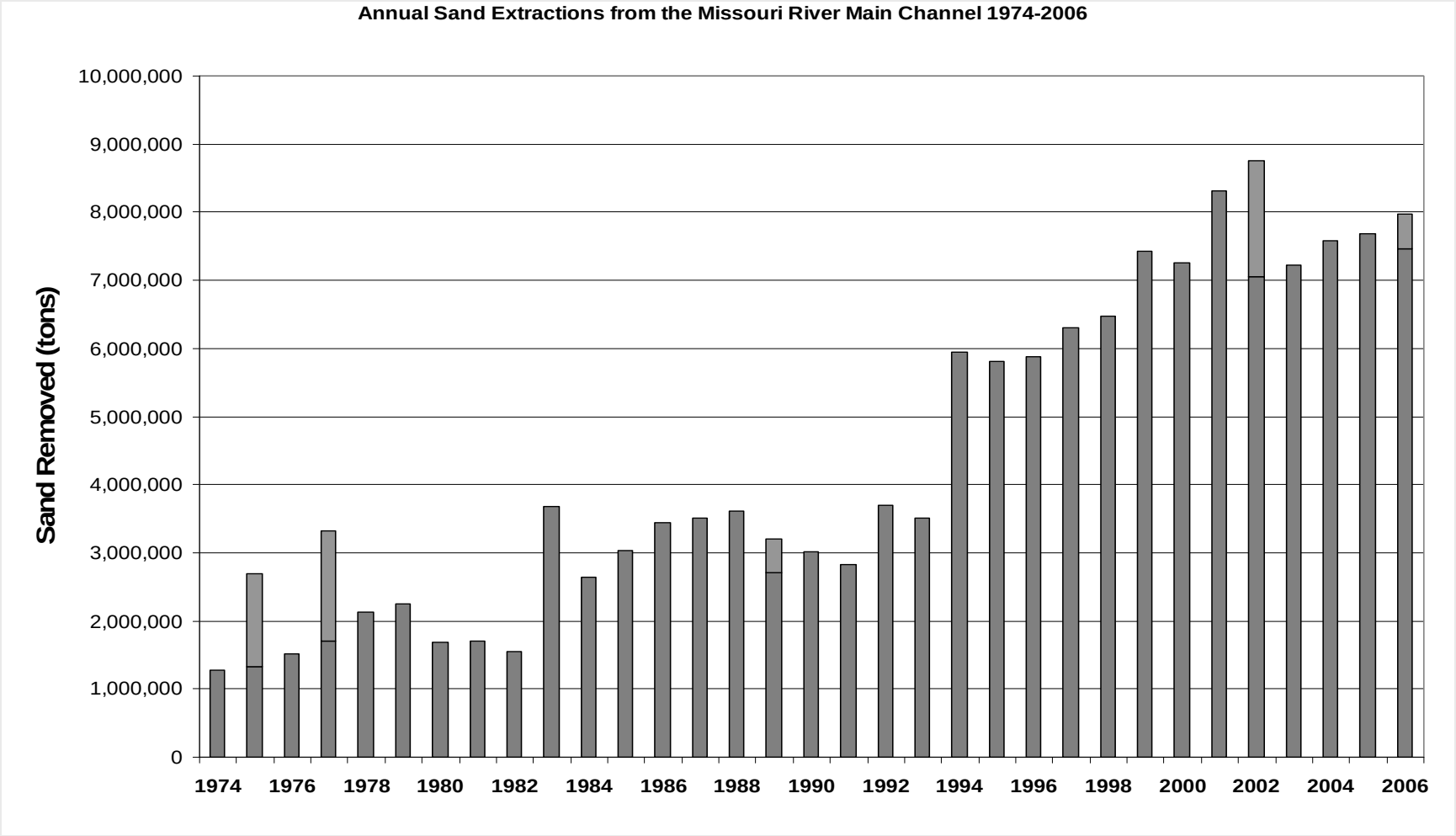
Flow Modification by Regulation

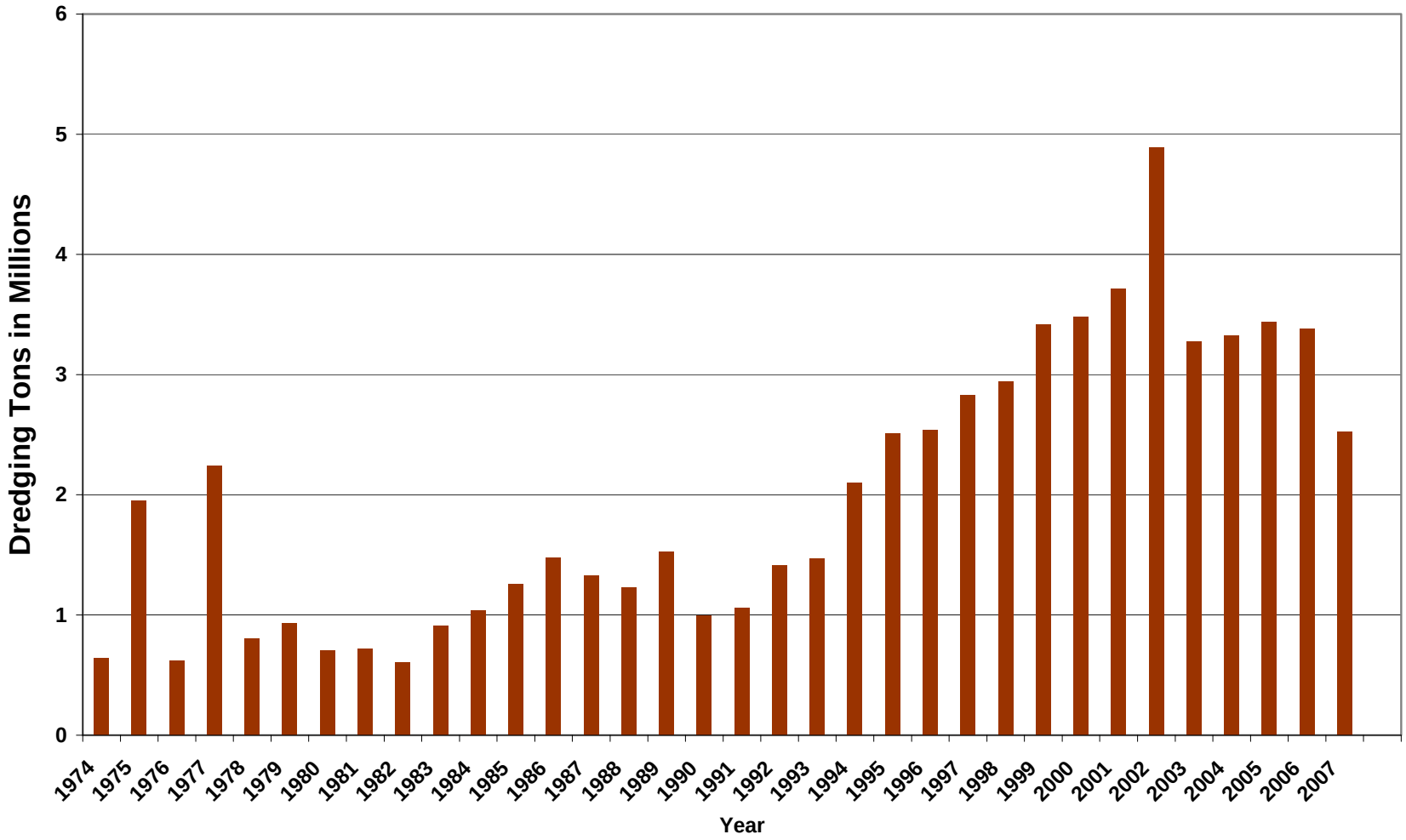
- Summary: Flow regulation has at least a twofold impact:
  - Changes the reference flows and elevations used for structure design and maintenance
  - Potentially lessens the severity of degradation caused by flood events.
  - The combined effects of these have not been quantified to date in this study

Summary of Sediment Trap Impacts

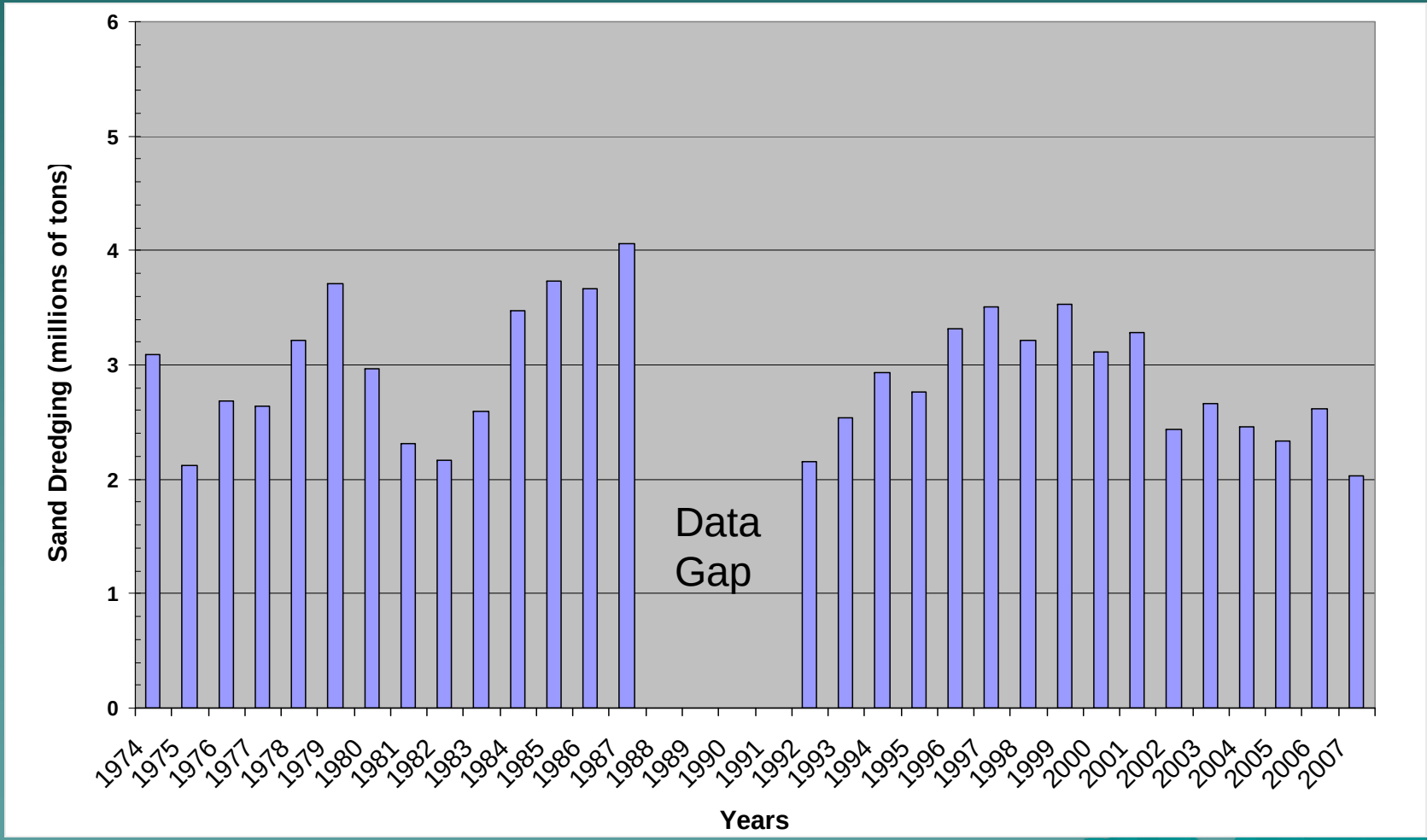
- Mainstem dam impacts are not evident below Rulo, NE.
- Impacts on the Missouri River resulting from trapped sediment above Kansas Basin dams are consider minimal based on:
  - earlier work (Simons, Li and Associates, 1984),
  - mean daily flow records
  - the dams are on tributaries considerably removed from the mouth of the river.
  - none of the dams are the main stem of the Kansas River
- The impact of the structures on the Osage River have not been evaluated.
- The remaining structures on tributaries to the Missouri River represent small drainage areas some distance from the Missouri River and are considered to have little or no impact.
- Open to further evaluation.

Annual Sand Extraction from Missouri River




Commercial Dredging In the Kansas City Reach of the Missouri River by Year
Dredging Tons in Millions
0
1
2
3
4
5
6
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Year

Kansas River Commercial Sand and Gravel Dredging



Summary of Dredging

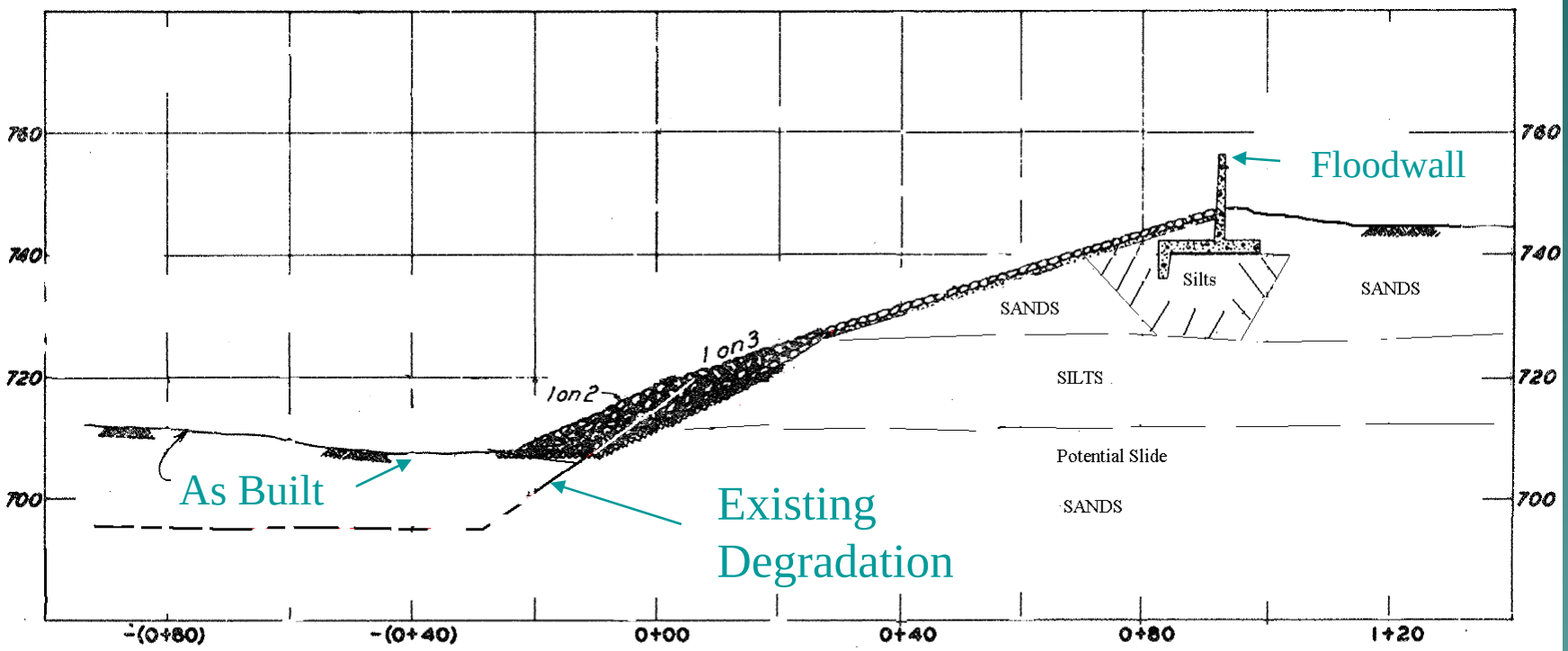
- Data evaluated shows a link between bed degradation and dredging.
- This link is exhibited to some extent at a variety of locations along the lower 498 miles of the Missouri River.
- The link between Kansas River dredging and Missouri River degradation should be evaluated.

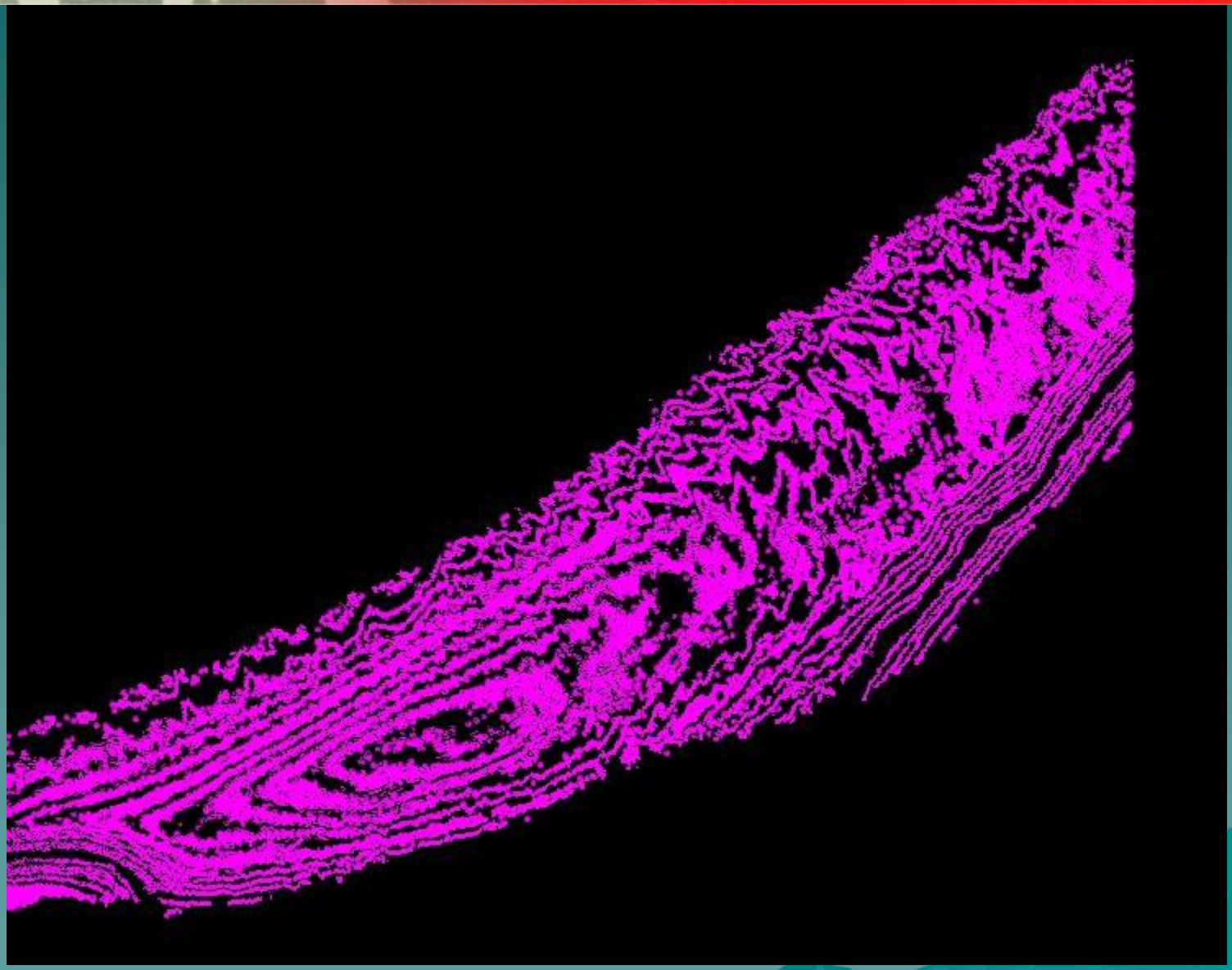
Summary of Degradation Causes

- Primary
  - Bank Stabilization and Navigation Project and Cut-offs
  - Major Flood Events
  - Dredging (extraction)
- Secondary
  - Kansas River Basin Sedimentation

Concerns for the Future

- Bank Failures
- Continued Tributary Head Cutting
- Power Plant Water Intakes Problems
- Levees and Floodwalls Placed in Jeopardy
- Water Supply Intakes Continue to Require Modifications
- Pipeline Crossings Impacted
- Additional Tributary Bridge Crossings at Risk
- Navigation Obstructions Exposed
- Loss Missouri River Recovery Shallow Water Habitat
- Loss of Wetlands


760
740
720
700
Floodwall
Silts
SANDS
SANDS
1 on 3
1 on 2
SILTS
Potential Slide
SANDS
As Built
Existing
Degradation
-(0+80)
-(0+40)
0+00
0+40
0+80
1+20



Feasibility Study Needs

- Further evaluation of dikes impact in the Kansas City and other reaches of the river.
- Cut-off impacts analyses.
- Analysis of hydrographic surveyed cross section and detailed surveys if the revetment toe adjacent to levees and flood walls.
- Sediment Data Update.
- Mass Balance for river reach by reach.
- Identify or develop suitable a sediment transport model for the Missouri River – R.M. 0-498
- Incorporate the Dredging Permit EIS evaluations of dredging and dredging techniques as they impact degradation.
- Further evaluation of levee impacts on degradation.
- Kansas River basin reservoir impacts on Missouri River degradation.
- Evaluate Kansas River dredging impacts on Missouri River degradation.
- Evaluate impacts of sediment contributed by upstream unregulated tributaries such as the Platte River in Nebraska.
- Land Use Evaluation.
- Investigate alternative limitations and applicability.
- Additional analyses of USGS gage data.

Civil Works Process

Moving Forward

Civil Works Project Development Process

Planning

Reconnaissance Phase

Determine Federal Interest

Funding 100% Federal

905(b) Analysis`

Project Management Plan

Feasibility Scope

Feasibility Phase

Plan Formulation, Evaluation, Comparisons, and Recommendations

Funding 50% Federal, 50% Non-Federal

Feasibility Cost Sharing Agreement (FCSA)

Chief of Engineers Report

Feasibility Report, NEPA Documentation

Design

Design Phase

Design Documentation, Permits, Plans and Specifications

Funding 75% Federal, 25% Non-Federal

Design Agreement

Plans, Specifications, Design Documentation (as needed)

Permits: 404, 401, 106, etc.

Building

Construction Phase

Duration Varies With Project, Often Done In Stages

Funding 65% Fed, 35% Local

Project Cooperation Agreement (PCA)

Construction
Real Estate

Acquisition; Lands, Easements, Rights-of-way, Relocations, Disposal areas (LERRDs)

Engineering & Design (as needed)

Plans & Specs (as needed

Engineering Design Report

Life of Project

Operation & Maintenance (O&M) Phase

As Long As Project Remains Authorized

O&M Funding Normally 100% Non-Federal

O&M

Repair,

Replacement,

Rehabilitation

O&M Manual

NEXT STEPS

Complete the Draft 905 b Analysis – March 2009

- Complete qualitative economic evaluation
- Develop an initial FS schedule/budget
- Sponsor Letter of Intent

Project Management Plan - August 2009

- Develop Feasibility Scope of Work

- Feasibility Cost Share Agreement – August 2009

Letter of Intent

- Requirement for submission of 905 (b) Analysis
- Contains –
  - Expression of interest in participating in negotiation of a project management plan and feasibility scope
  - Statement of understanding of the 50/50 cost share requirement for the Feasibility Study
  - Statement of understanding of cost share for construction
  - Is not a financial or contractual obligation

Feasibility Cost Share Agreement

- Standard Agreement – single sponsor – does not take HQ review/approval
- Must be able to self certify financial capability
- Non-Standard Agreement – USACE HQ approval would be required

Future Discussions

- 905 (b) Analysis – focused on the Federal interest while identifying other interests/issues.
- Feasibility Scope planning broadens the focus to include aspects with sponsor interest.

Questions and Comments?