Reginal Sediment Management of Watersheds, Reservoirs, and Rivers

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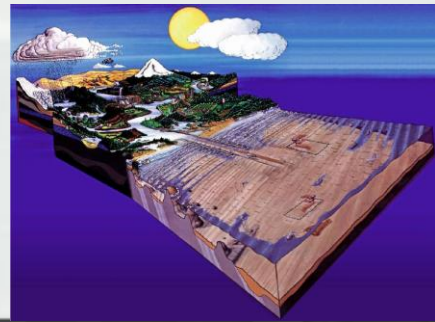
Outline

- Regional Sediment Management Defined
- Example #1- Hickahala Creek
- Example #2- Missouri River Post-Flood Recovery
- Example #3- Tuttle Creek Lake

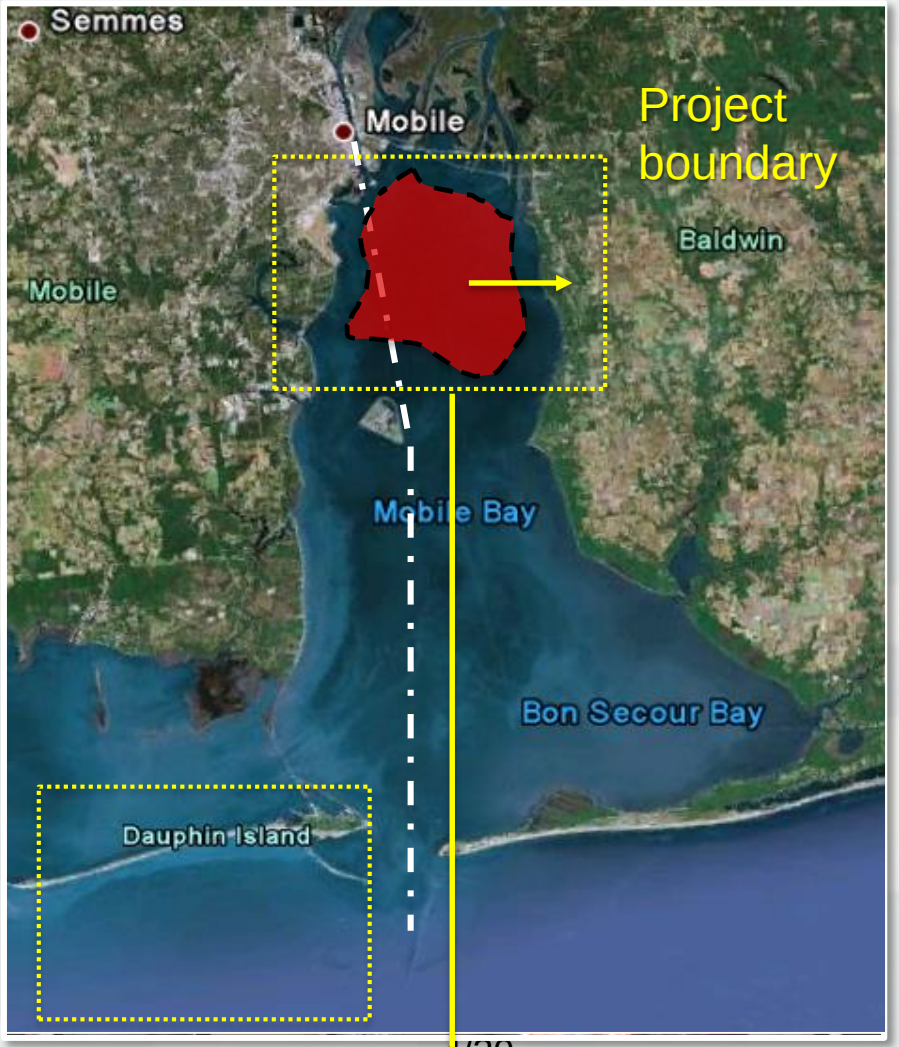
Regional Sediment Management

A systems approach to deliberately manage sediments in a manner that maximizes natural and economic efficiencies…

- Recognizes sediment as a valuable resource
- Regional strategies across multiple projects and business lines to guide investments to achieve long-term economic and environmental value and benefits
- Enhances relationships with stakeholders & partners to better manage sediments across a region (local actions with regional benefits)
- Share data, tools, technology, and lessons learned

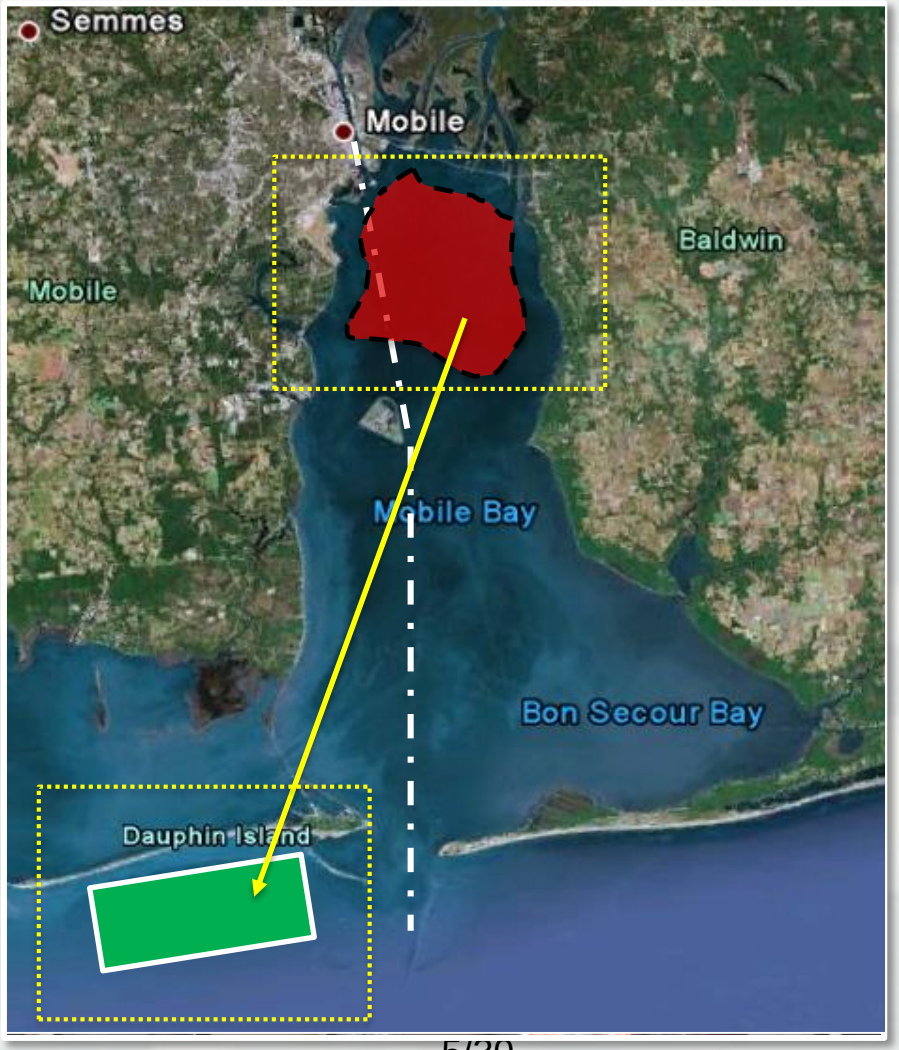


Regional Sediment Management



Project boundary

Regional Sediment Management



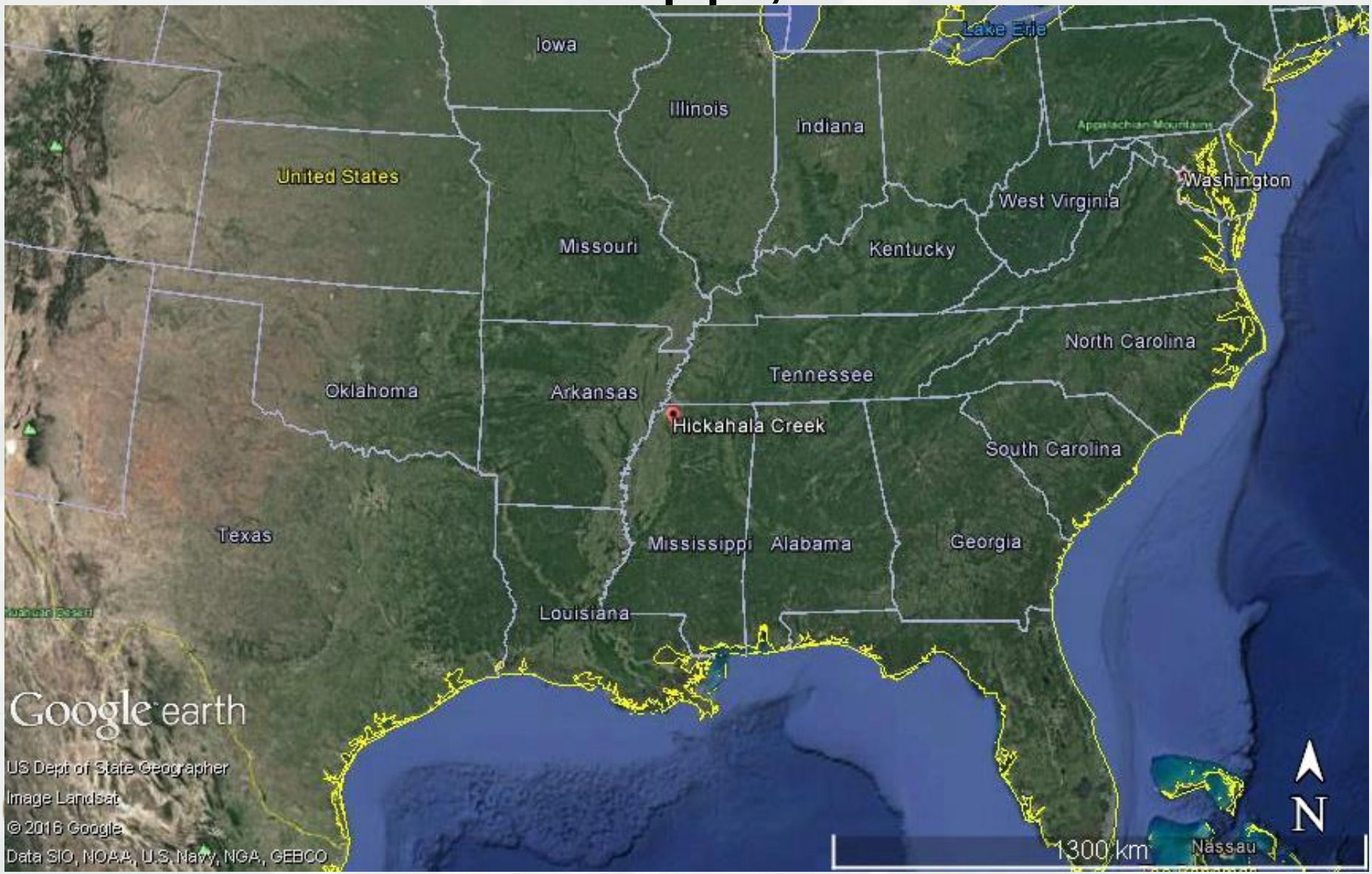
RSM Participation (2000-2016)

28 Districts

- 20 Coastal
- 8 Inland
- 7 Coastal/Inland

ERDC, IWR-HEC

Example #1: Hickahala Creek, Mississippi, USA



This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, GIS Management Section on 31 May 2002.

The TMDL watershed boundary and TMDL Water was produced by the MDEQ. All other map data were obtained by MARIS.
Map Projection: Mississippi Transverse Mercator

The Mississippi Department of Environmental Quality makes no warranties, express or implied, as to the accuracy, completeness, correctness, reliability, or suitability for any particular purpose, of the data contained on this map.

MDEQ

Mississippi

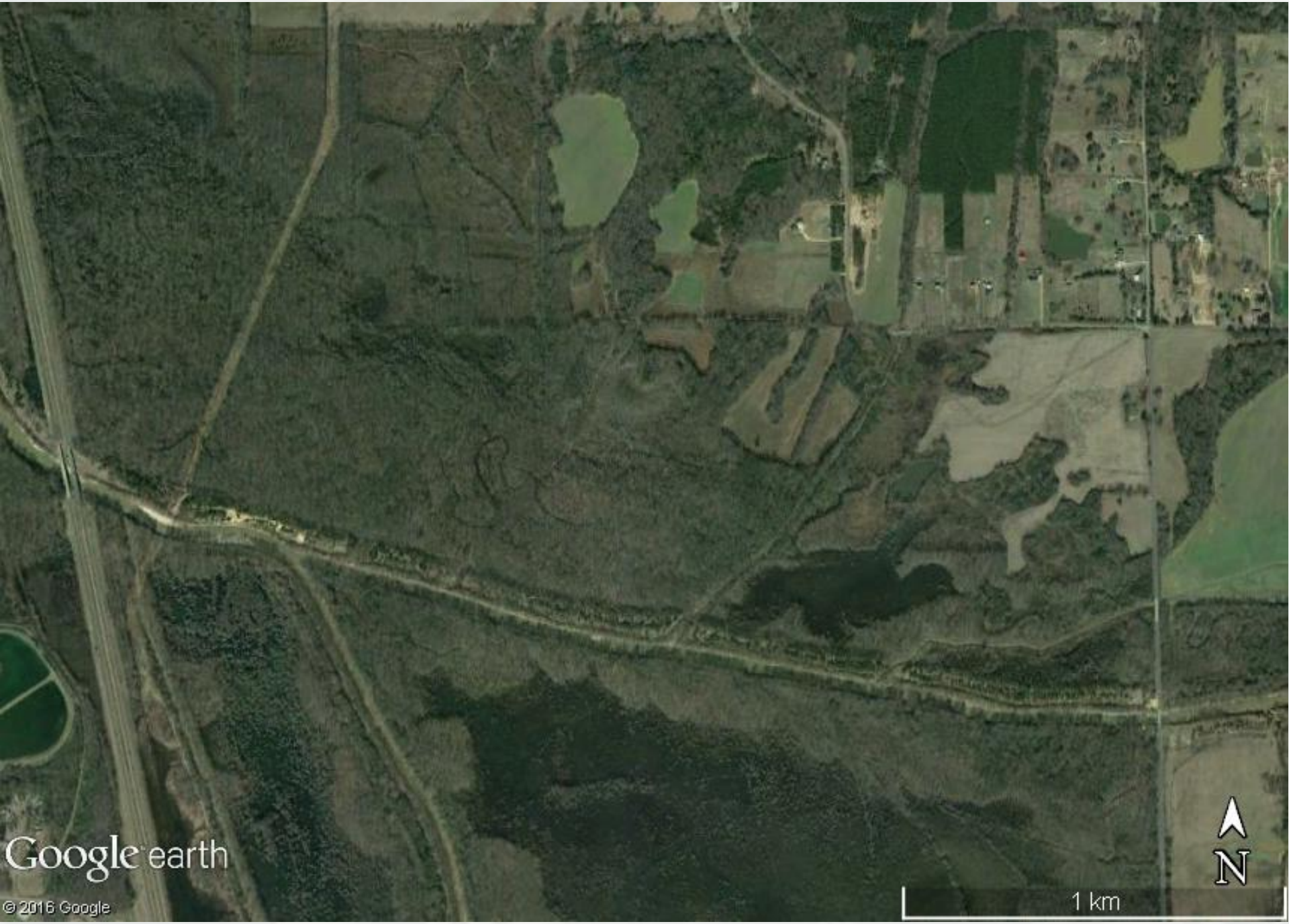
Legend

- Interstate/US Highway
- Lake or Pond
- County Boundary
- Perennial Stream
- Hickahala Watershed

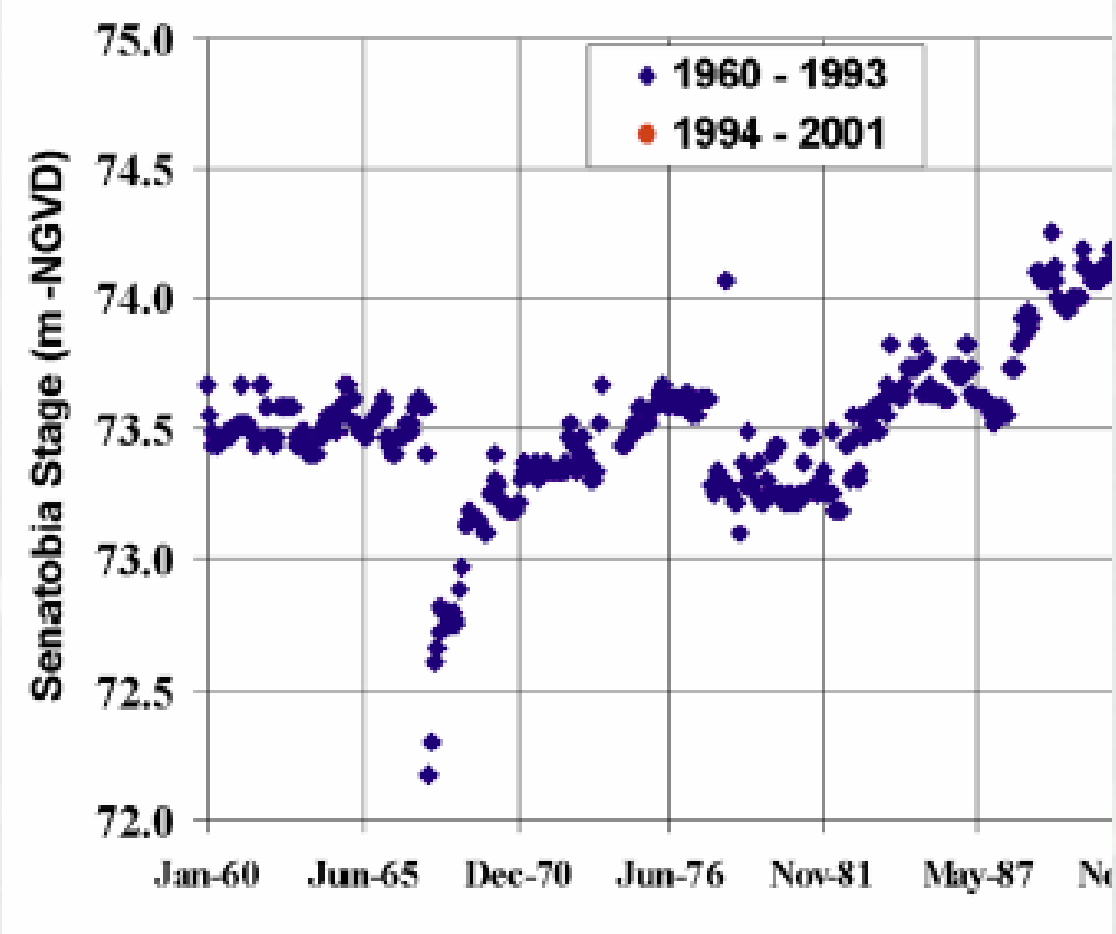
Hickahala Watershed

Scale 1:500,000

0 1 2 3 4 5 Miles

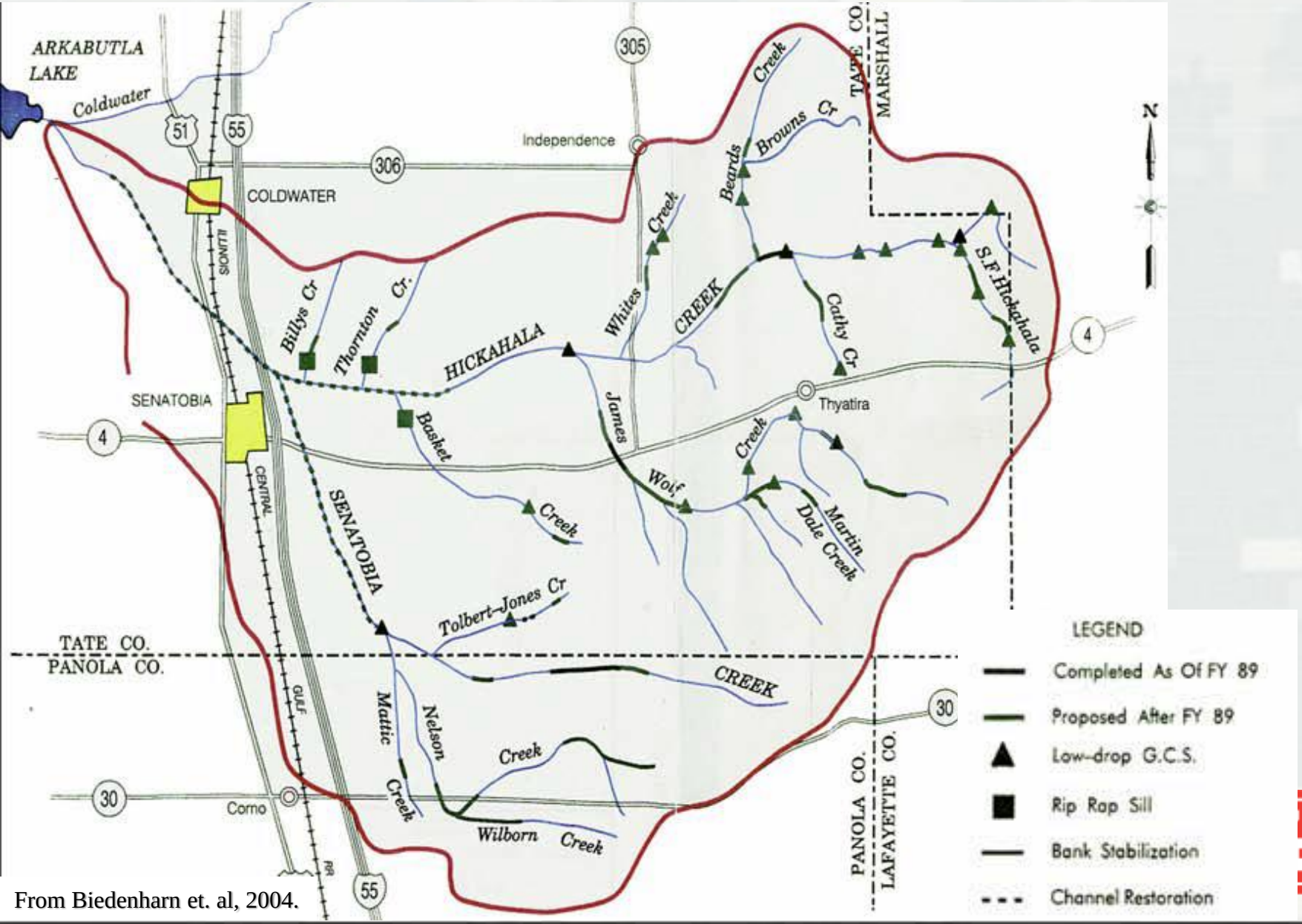

Google earth
© 2016 Google
N
1 km

Dredging of Flood Control Channel without Regional Sediment Management



Minimum Monthly Elevation of Gage Readings on Senatobia Creek, Tributary to Hickahala Creek. From Biedenharn et. al, 2004.

Extensive Watershed Treatments



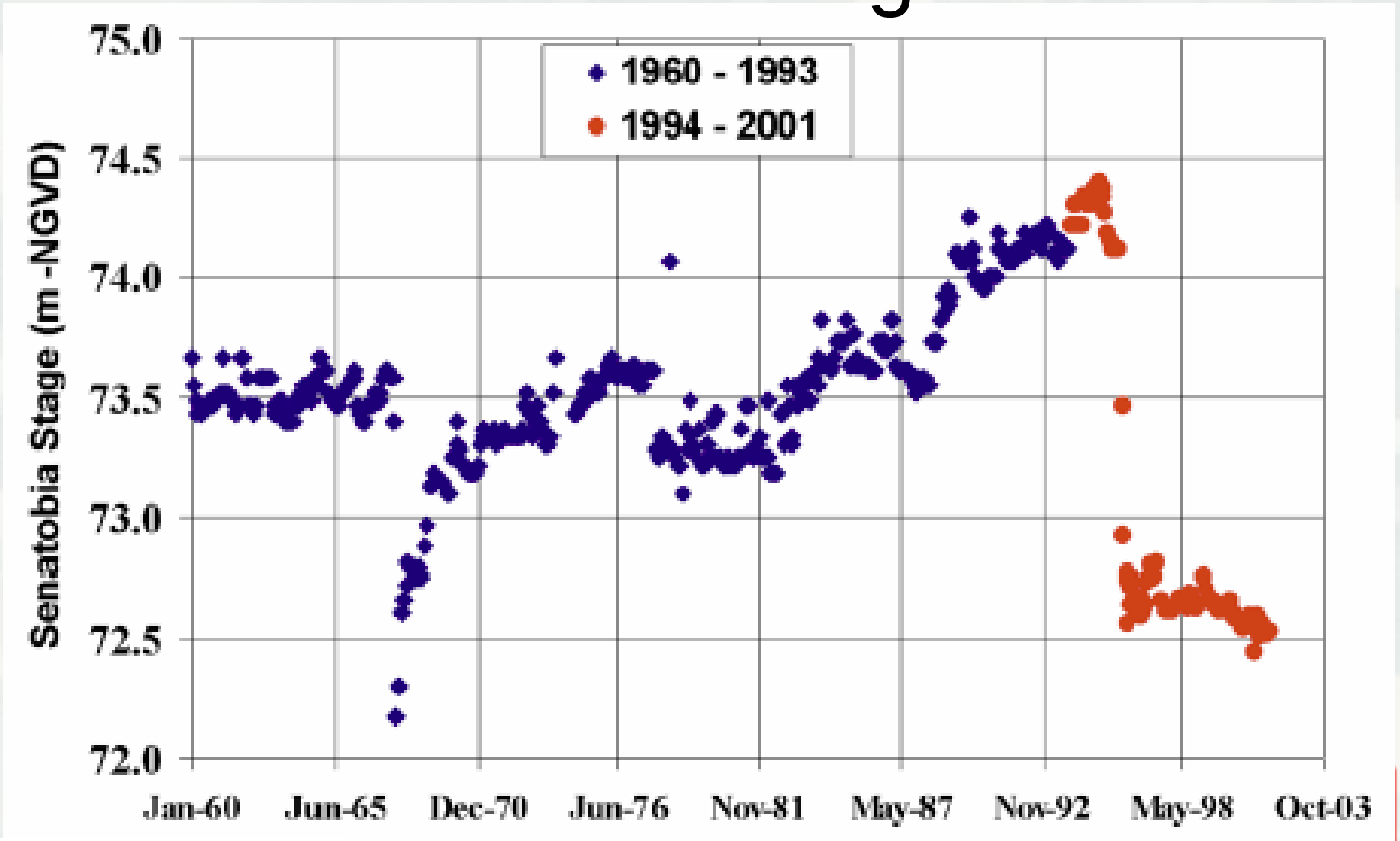
From Biedenharn et. al, 2004.

Grade control sills, immediately after construction

Grade control sills, after 10 years

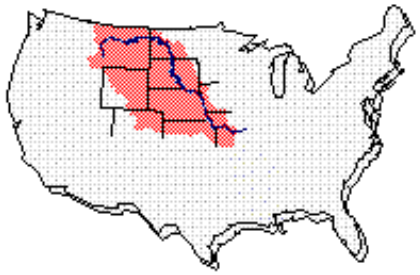
From Biedenharn et. al, 2004.

River elevations with Regional Sediment Management



From Biedenharn et. al, 2004.

Missouri River Basin



Fort Peck
Montana
Canyon Ferry
Yellowstone River
Tongue River
Big Horn River
Powder River
Yellowtail
Wyoming
Garrison
North Dakota
South Dakota
James River
Cheyenne River
Oahe
Big Bend
Fort Randall
Big Sioux River
Gavins Point
Iowa
Nebraska
Platte River
Colorado
Kansas
Kansas River
Grand River
Osage River
Missouri

Navigation Channel U/S Limit

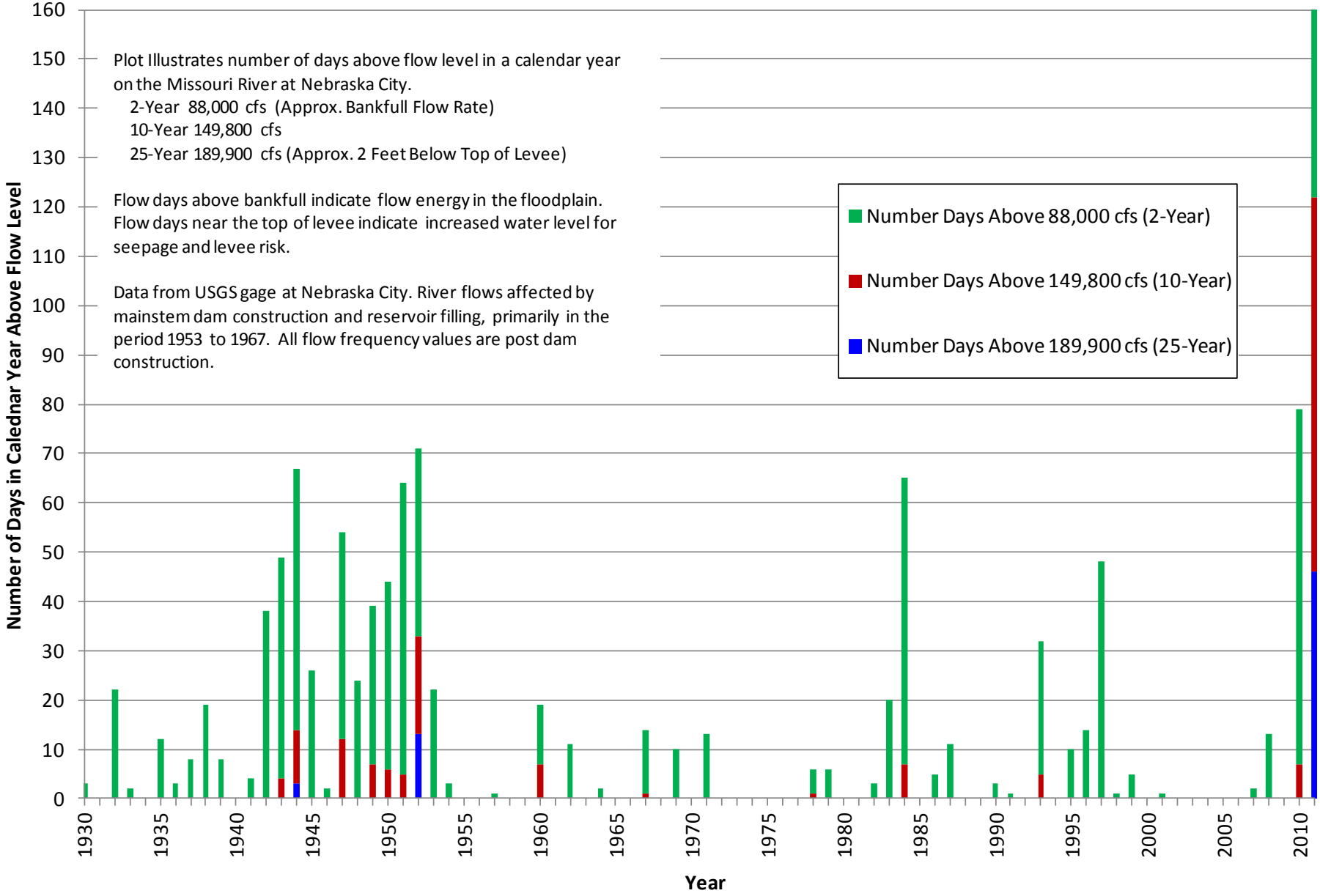
Omaha District Boundary

Missouri River 2011 Flood

Description

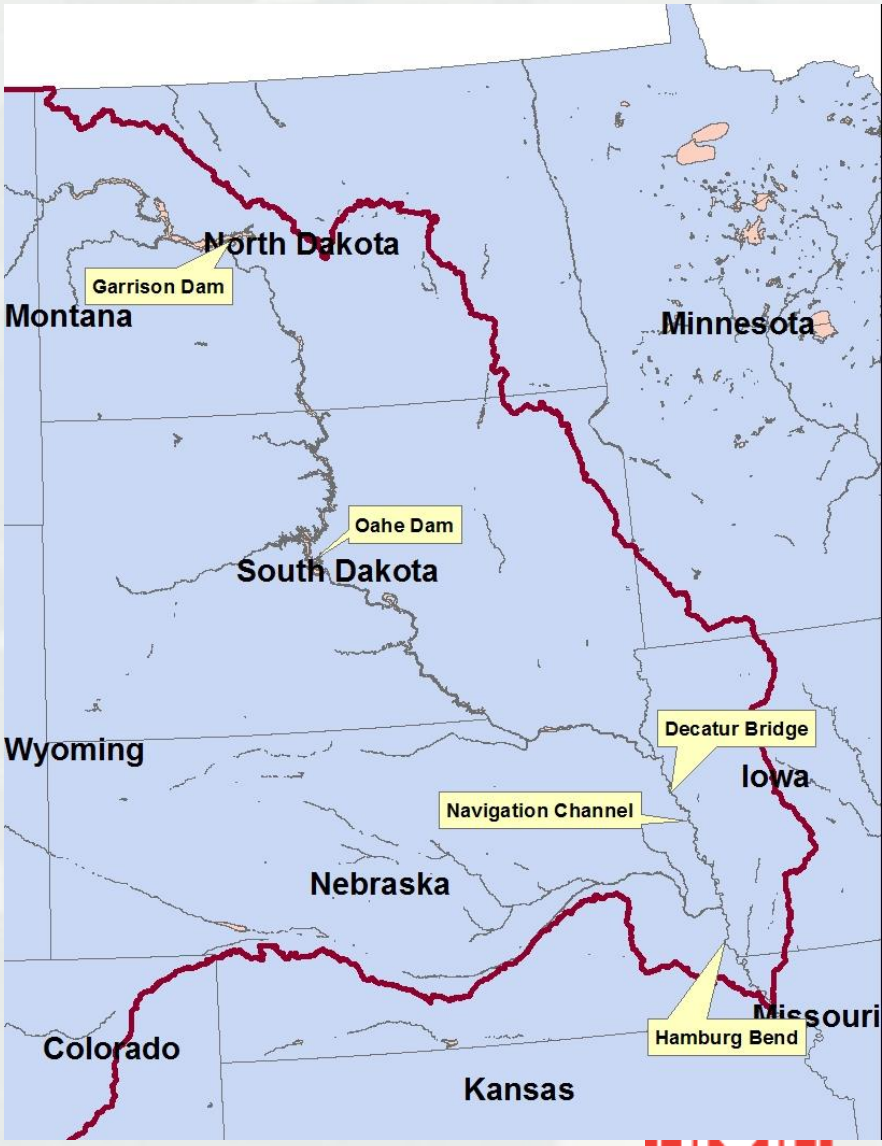
- Overbank flows from Mid-June through Mid-September (3 months!)
- Maximum dam discharge reached 160,000 cfs at 5 of 6 mainstem dams (previous max ≈70k)
- Within Navigation Channel reach, flows inundated federal levees for prolonged period
- Levee breaches of multiple federal levees resulted in extensive flooding
- High discharges redistributed sediment within the system
- Large amounts of sediment were left on farm fields, deposited in the navigation channel

Nebraska City Days Above Flow Value By Year



Challenges

- Rebuilding Flood Protection Infrastructure
  - Hamburg Bend Levee and Decatur Bridge
- Restoring Mainstem Dam System Capacity
  - Garrison and Oahe Dam Spillways
- Opening the Navigation Channel
  - Infrastructure Assessment and Decatur Bend Channel
- Managing the Return of Sediment to the River
  - Developing Emergency Permits for In-Channel Sediment Disposal



Hamburg Bend Chute Levee

Goals/Issues to Address

Missouri River erosion in Upper Hamburg Bend Chute, which encroached on the toe of the Federal levee

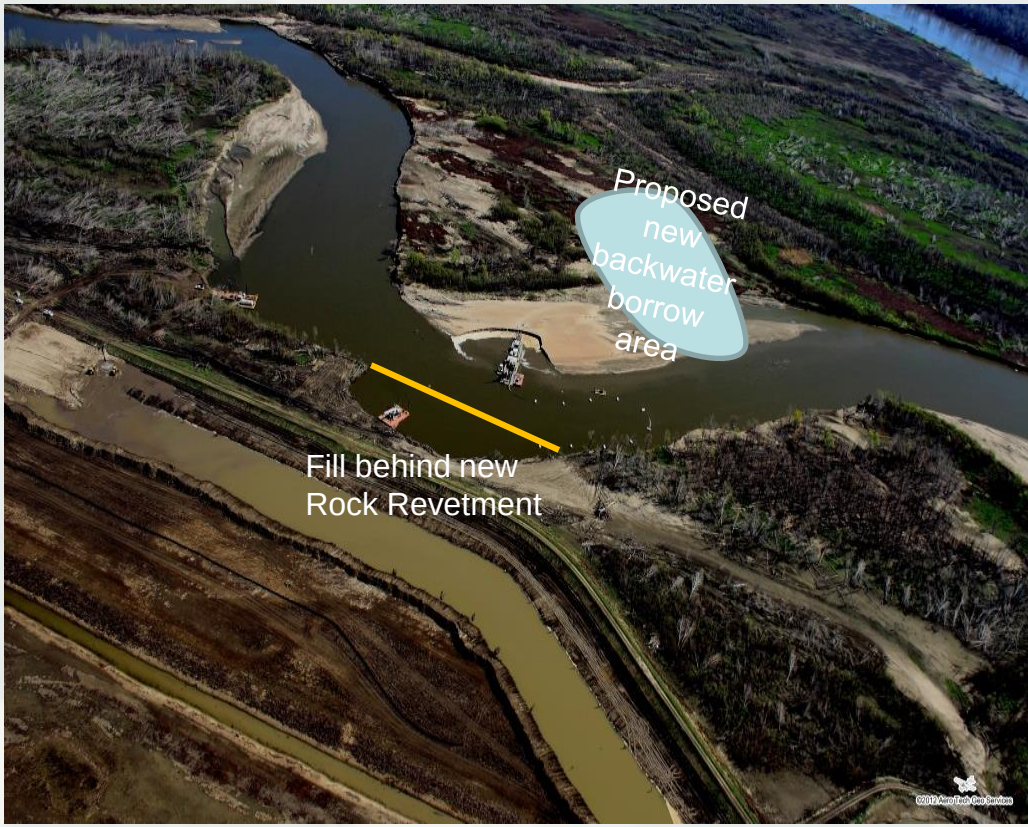
Reconstruction and protection of the levee toe required

RSM Integrated Solution

To prevent further damage to levee, a rock revetment was added at the failure point

40,000 tons of riprap placed to create fill area, dredge backfill. Also dredge to create seepage berm

Initial dredging from point bar, additional dredging done to create backwater for shallow water habitat



Result: Dredging of backwater for shallow water habitat provides fill for repair at less cost as other sources while supporting habitat creation for the MRRP

Decatur Bridge Repair

Goals/Issues to Address

Bridge abutment toe eroded during flood

Repair of bridge abutment required significant fill material

Repair needs to minimize damage in future floods

RSM Integrated Solution

USACE worked with Iowa Dept Natural Resources, IA DOT to develop plan to armor abutment and create habitat ponds

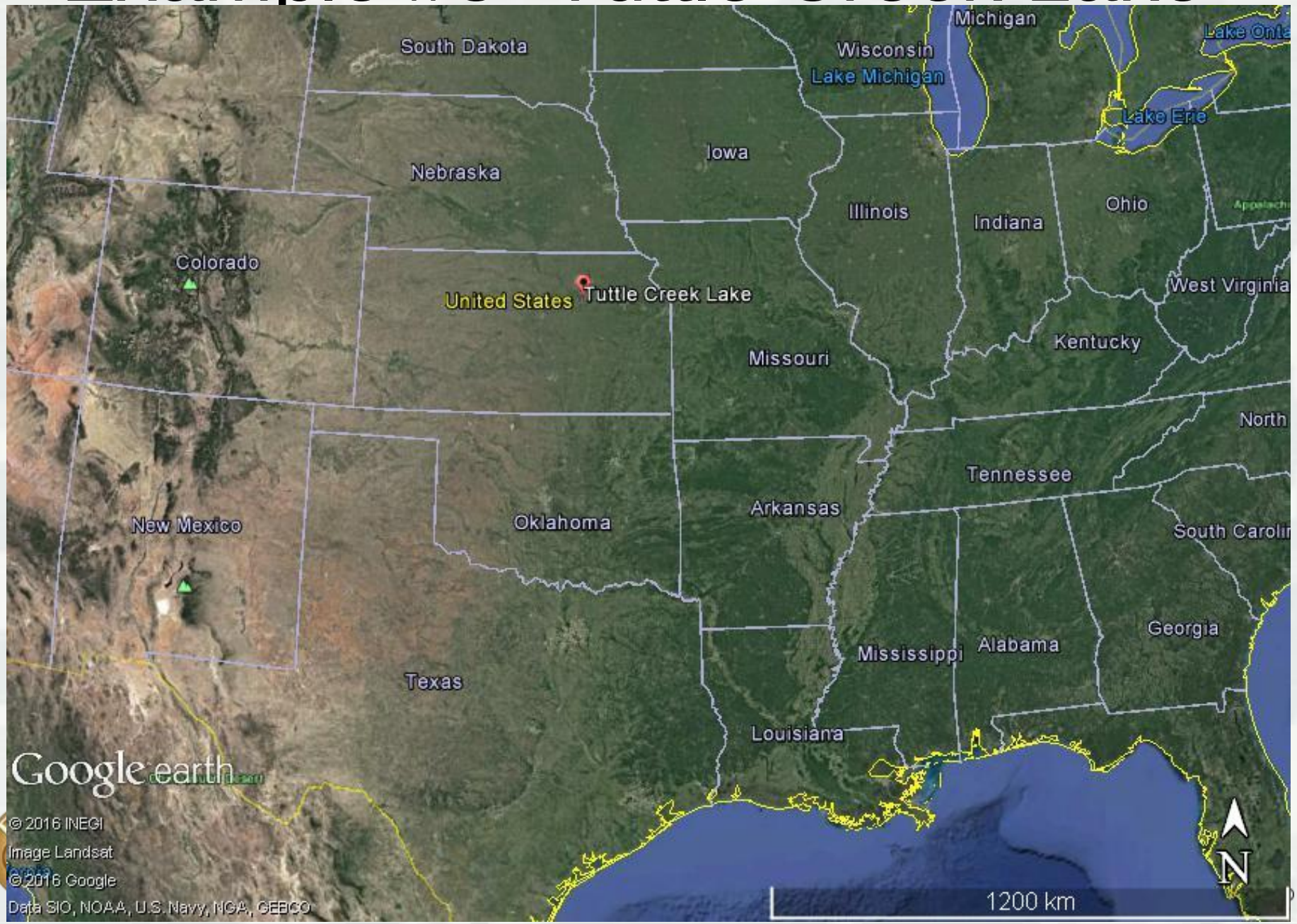
Flood deposition impacted SWH/wetlands nearby in Tieville Bend

Dredged material used to build control structures and bank stabilization near bridge abutment

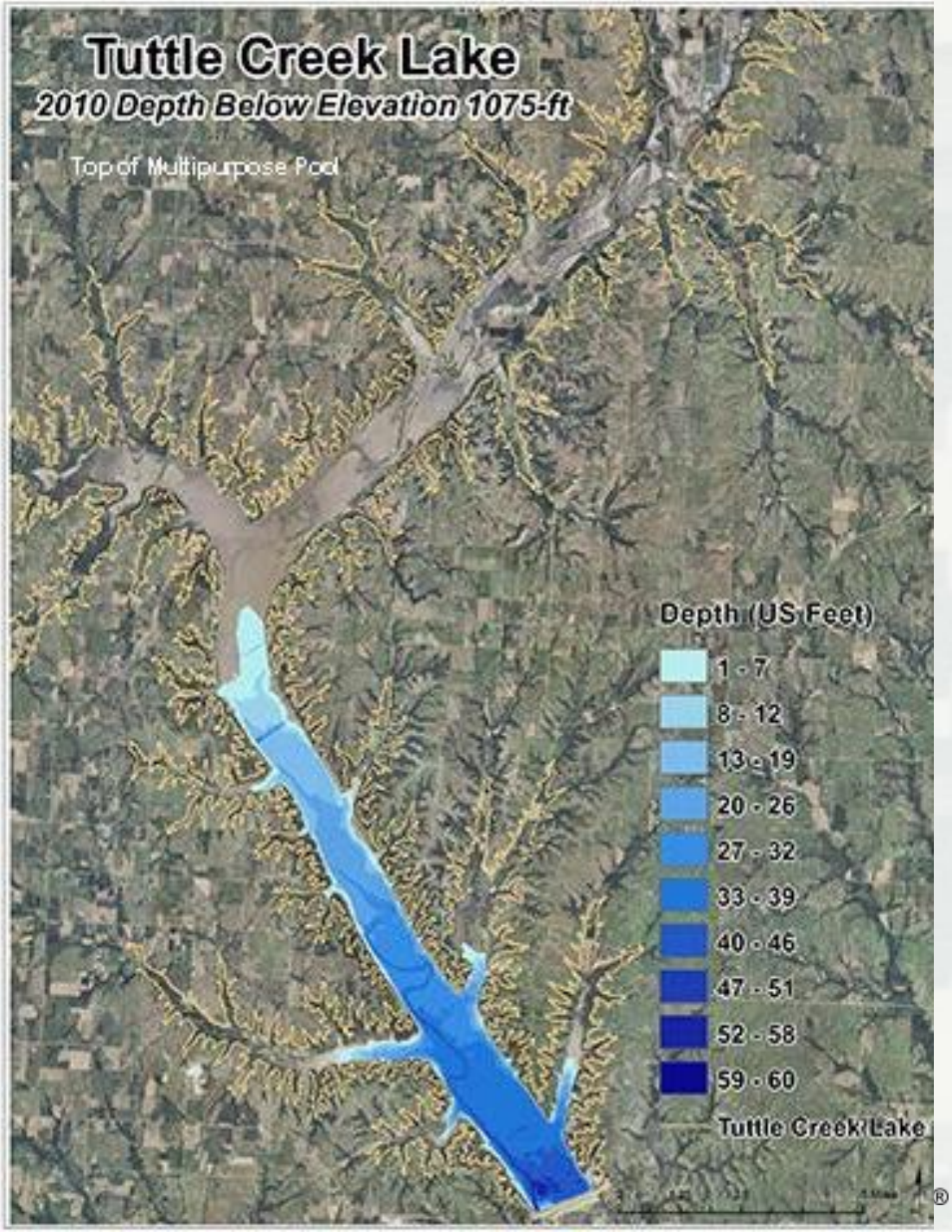
Project restored depth to SWH / wetlands, increasing function at lower cost than other borrow material sources

Result: State of Iowa adds wetland habitat at similar cost to other sediment sources

Example #3- Tuttle Creek Lake

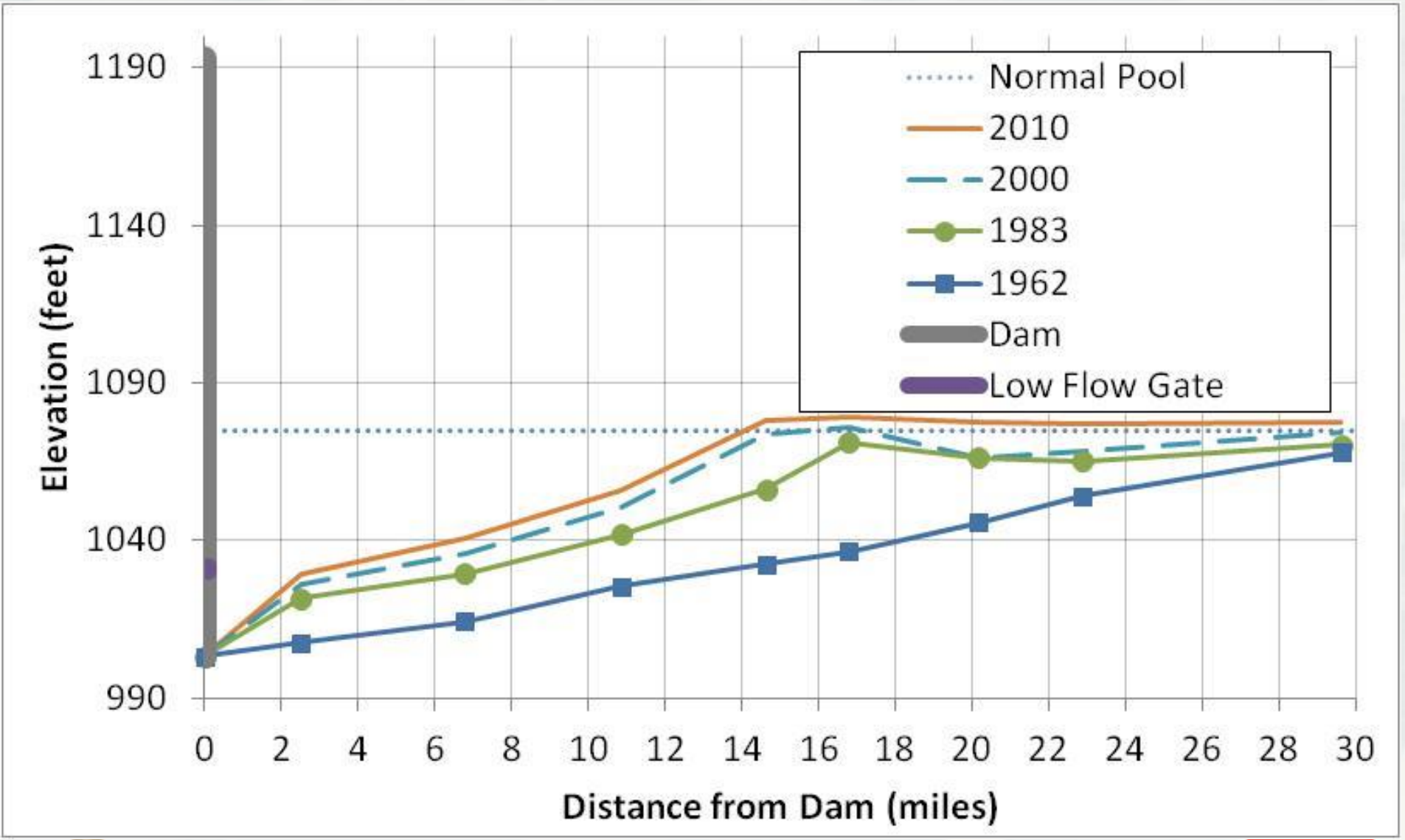



Tuttle Creek Lake
1957 Depth Below Elevation 1075-ft
Top of Multipurpose Pool


Tuttle Creek Lake
2010 Depth Below Elevation 1075-ft
Top of Multipurpose Pool
Depth (US Feet)
1 - 7
8 - 12
13 - 19
20 - 26
27 - 32
33 - 39
40 - 46
47 - 51
52 - 58
59 - 60
Tuttle Creek Lake

COE/HNTB

Tuttle Creek Lake



Multi-purpose pool will be 88% full in 50 years

Reservoir Dredging…?

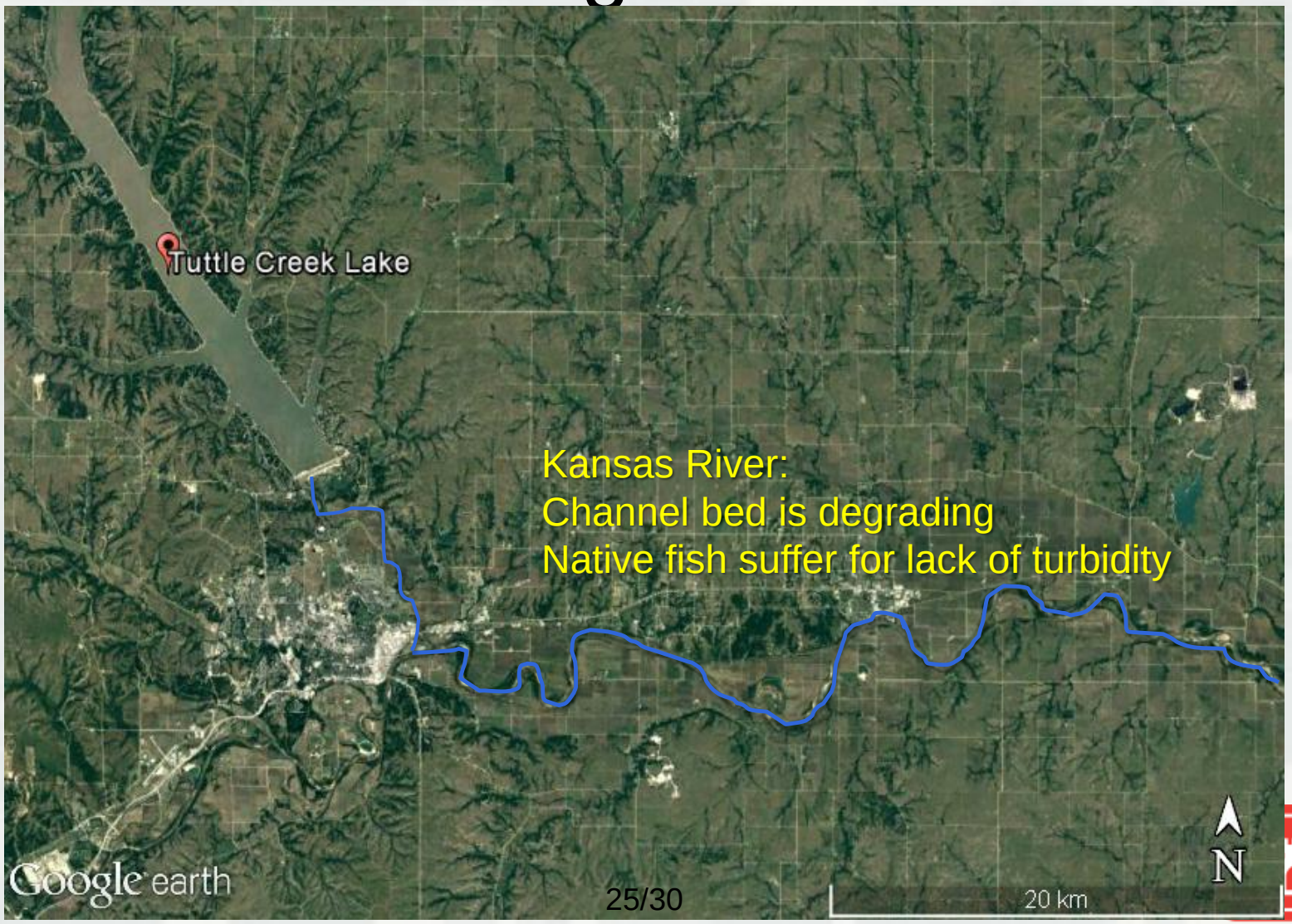
- 4.4 million cubic meters per year
  - ►Just to keep pace with sediment accumulation

- Over $40 million per year

Bank Erosion Hot Spots

- 21 times more cost-effective than reservoir dredging

The Next Step in Regional Sediment Management



Conclusion

- Common sense
- Link projects with excess sediment to those needing sediment
- Three examples:
  - Hickahala Creek
  - Missouri River
  - Tuttle Creek Lake