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
RSM Participation (2000-2016)

28 Districts
- 20 Coastal
- 8 Inland
- 7 Coastal/Inland

ERDC, IWR-HEC
Example #1: Hickahala Creek, Mississippi, USA
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

Grade control sills, immediately after construction

Grade control sills, after 10 years

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

Plot Illustrates number of days above flow level in a calendar year on the Missouri River at Nebraska City.

- 2-Year 88,000 cfs (Approx. Bankfull Flow Rate)
- 10-Year 149,800 cfs
- 25-Year 189,900 cfs (Approx. 2 Feet Below Top of Levee)

Flow days above bankfull indicate flow energy in the floodplain. Flow days near the top of levee indicate increased water level for seepage and levee risk.

Data from USGS gage at Nebraska City. River flows affected by mainstem dam construction and reservoir filling, primarily in the period 1953 to 1967. All flow frequency values are post dam construction.
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
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
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
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

Kansas River:
Channel bed is degrading
Native fish suffer for lack of turbidity
Conclusion

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