Challenges: Stream Restoration and Floodplain Regulations

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Agenda

1. Floodplain Regulation
2. Stream Restoration
3. Example Projects
National Flood Insurance Program (NFIP)

- Founded in 1968 with Congress passing the National Flood Insurance Act
  - Goal to strengthen the program, ensure funding, and increase public awareness
- Program ultimately creates the floodplain maps
- Maps are created using hydraulic calculations and GIS process.
National Flood Insurance Program

Alterations

- Reasons for maps and floodplains
  - Development
  - Alterations to the terrain

- Map and floodplain can be altered via a
  - Conditional Letter of Map Revision (CLOMR)
  - Letter of Map Revision (LOMR)

- Flood Zones
  - Each flood zone has different requirements
  - Zone AE & Floodways more stringent than Zone A

- Options
  - Use hydraulic modeling & GIS mapping to determine impact of project.

LOMR on Regulated Map
Stream Restoration

Regulatory Issues

• How to know if you have an issue?
  • First check your project location using KY Risk Map Portal or the FEMA Map Service Center
    - Risk Map port contain hydraulic data for Zone A Models
    - Zone AE models will need to be obtained through FEMA
  • Depending on project location you may need to compare regulatory floodplain to your stream restoration project. Use hydraulic modeling to compare.
  • Determine impact of proposed design. May require:
    1. No Rise Certificate
    2. CLOMR / LOMR

Stream Restoration

Goals & Benefits

• Flood Control
• Prevent streambank erosion
  • Protect infrastructure and properties
• Restore hydrologic function
• Protect upstream channel
• Restore sediment transport
• Biological
  • Habitat Enhancement - Fish Passage / Riparian
  • Water quality – nutrient and sediment load
  • Removal of Invasive species

Fish Barrier
Stream Restoration
Goals & Benefits

Un-natural Channel / No floodplain Access

Bank Erosion / Undercutting
Stream Restoration

Techniques

- Structures
  - Rock Structures (Cross Vane & J Hook)
  - Natural Structures (Log Vane & Root Wad)
  - Toe Stone
  - Grade control, rock keys

- Raise Grade Approach

- Natural Channel Design
  - Restore floodplain access
  - Mimic un-impaired stream nearby

- Riparian Zone
  - Stream bank plantings
  - Wetlands
  - Reforestation
Stream Restoration
West Creek

• Brooklyn Heights, Ohio
• Urbanized stream, commercial development, and main interstate
• Stream is extremely flashy with peak flow generally occurring 30 minutes after the majority of rainfall has occurred
• Zone A Floodplain
• Stream has many issues
  • Fish Passage
  • Bank Erosion – encroaching on properties, bridge, and infrastructure
  • Un-natural concrete flume
  • Limited floodplain access due to the incision of the channel
• Multiple approaches have been taken in the past to restore the stream. Including:
  • Gabion Blanket
  • Cross Vane
  • Flume
  • Two temporarily bank stabilization projects within the past 2 years
Stream Restoration

West Creek

Exposed Infrastructure

Pipe after a large rainfall event
Stream Restoration Approach

West Creek

- Restoration technique include:
  - Raise Grade
  - Bank Armoring (Toe Rock)
  - Grade Control & Rock Keys

- Increases regulatory water surface elevation by more than 1-ft in multiple locations. Max increase was nearly 7-ft.
Stream Restoration Approach

West Creek

Grade Control Structure

Grade Control Structure - Detail

Bank Armoring
Stream Restoration
West Creek

HEC-RAS Model

100-yr Water Surface Elevation Comparison
Stream Restoration

West Creek

• Through hydraulic modeling and calculations the raised grade approach does not impact
  • The Storm and Sanitary Sewer Network
  • Adjacent Property Owners

• Additionally, the modeling determined the regulatory floodplain is not indicative to the existing conditions present. The existing channel is now much more incised and narrower!
Stream Restoration

West Creek

Comparison of 100-year Existing to Proposed Floodplain
West Creek Bank Stabilization and Stream Restoration
March 26, 2020

Legend
- Existing Floodplain (100-year)
- Proposed Floodplain (100-year)

Proposed 100-year Floodplain
Stream Restoration
West Creek – Conclusion

• Project causes
  • An increase in water surface elevation by 6-ft in certain areas
  • Increased channel and bank stability.
  • Adjacent properties are still protected by 3+ ft.
• Currently, going through CLOMR process.
• Increased permitting and associated fees

Comparison between Existing and Proposed Water Surface Elevation
Stream Restoration
Lake Metro Housing Authority

- Willoughby, OH
- Urbanized stream threatening the adjacent, building patio, sanitary sewer line, power
- Bank stabilization project occurring within the floodway.
- Design approach took extra consideration due to floodway. Multiple designs were trialed in the hydraulic modeling.
- Required a No-Rise Certification.
- Utilized a series of single stone bendway weirs and bank armoring
Stream Restoration
Lake Metro Housing Authority
Stream Restoration
Lake Metro Housing Authority

Bendway Weirs

Cross Section

Bendway Weir Detail

Cross Section
Stream Restoration
Lake Metro Housing Authority

Bendway Weir Construction

Bendway weir post 1-year
Stream Restoration
Lake Metro Housing Authority

Main Channel Flood Stage

Bank during flood stage

Debris Indicator – 5-ft higher than flood stage shown
Stream Restoration
Lake Metro Housing Authority

Stabilization 1-year Post Construction

Bendway Weir 1-year Post Construction
Stream Restoration
Lake Metro Housing Authority

Plant Growth – Dogwood

1-year Plant Growth – willow
Stream Restoration
Lake Metro Housing Authority - Conclusion

• Numerous design iterations to meet No Rise Criteria
  • Client couldn’t afford CLOMR/LOMR fees and review time-line
• No-Rise Certificate was obtained
• Ultimately, series of bendway weirs are conveying high flows off stream banks.
• Vegetation is beginning to establish

HEC-RAS Cross Section
KAMM 2020
Stream Restoration
Blackburn Boat Ramp – Union County, KY

- Boat ramp used for emergency management and recreation.
- Located along the Ohio River – located in floodway
- Floodwaters damage & erode bank, which is now impeding on infrastructure.
- Solution was to mitigate bank to protect boat ramp.
  - Option A: Grade back slope
  - Option B: Install Sheet pile wall
- Both options allowed for a No Rise certificate to be received
Stream Restoration
Blackburn Boat Ramp – Union County, KY

Conceptual Plan: Sheet Pile Wall

Conceptual Plan: Grading
Stream Restoration
Blackburn Boat Ramp – Union County, KY

Sheet Pile Wall Design

Bank Erosion
Stream Restoration
Blackburn Boat Ramp – Union County, KY
Stream Restoration
Uniontown Boat Ramp – Uniontown, KY

- Boat ramp used for emergency management, commercial navigation and recreation.
- Located along the Ohio River – located in floodway
- Floodwaters erode stream & riverbanks along the Ohio River and within the watershed.
- Has caused for a large amount of sediment to be deposited along bank
- Sediment impacts boat traffic
- Solution: Dredge material and store off site
- Still evaluating impacts to the floodplain but initial modeling indicates a No-Rise Certificate will qualify
Stream Restoration
Uniontown Boat Ramp – Uniontown, KY

Boat Ramp w/ sediment buildup

Sediment Buildup

HEC-RAS Predicting velocity vectors
Stream Restoration
Uniontown Boat Ramp – Uniontown, KY
Conclusion

- Nature based solution/Restoration is a powerful tool. It can:
  - Protect against flooding
  - Improve water quality
  - Protect property and assets

- Regulation can hinder the design process
  - Expenses are increased with CLOMR/LOMR
  - No-Rise Certificate is an alternative with more minimal fees
Q&A

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