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Fish Passage Studies III: Sediment Redistribution and Impact Analysis: Springborn Dam - Enfield, Connecticut

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Sediment Redistribution & Impact Analysis

Springbom Dam - Enfield, Connecticut

Josh Wilson, PWS
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Connecticut owns over 150 dams in the State.

Connecticut DEEP wants to:
- Open up rivers to fish passage
- Reduce cost & risk of dam ownership
Project Question

• What is the environmental risk of allowing sediments (clean or polluted) to re-distribute downstream naturally?

• While controversial in some regulatory jurisdictions, the answer to this question has the potential of making some dam removals much more affordable and thus feasible without causing long-term harm to downstream resources and properties.
Long-Term O&M Challenges

• Regular inspections
• Yearly clearing and cleaning of spillways, outlets and embankments
• Managing water levels in the reservoir and stream flows downstream
• Repairs to existing structures or other deficiencies.
Springborn Dam

- There is great interest in removing the Springborn Dam as it is currently deteriorating.
- The removal would restore an additional 2.5 miles of fish habitat and support efforts to restore an additional 27.5 miles (Somersville Mill Pond Dam).
Springborn Dam Drainage Basin
Springborn Dam - Overview

Constructed c. 1840
Modified in 1900’s, 1920’s 1950’s and 1980’s
Springborn Dam - Overview

Run-of-River, Composite Structure

Timber Crib over Block Masonry
Springborn Dam
Technical Challenges to Removal

- Management of accumulated sediments
- Scouring of upstream infrastructure
- Riverbanks and natural resources
- Downstream hydrologic and sediment impacts from flood flows
- Steep embankments limit construction (removal) access
- Land ownership challenges
• The concern with the sediment management alternative is the potential impacts to downstream organisms due to physical and chemical effects of the sediment redistribution process.

• This evaluation was conducted in two-stages:
  • Stage 1 – Preliminary Sediment Characterization
  • Stage 2 – Toxicological Assessment
Stage 1 - Preliminary Sediment Characterization
Stage 1a - Sediment Quantity & Quality

- Quantity: Depths → Volume
- Estimated 90,000 CY of impounded sediment – 41,000 CY “mobile”
Stage 1a - Sediment Quantity & Quality

• Quality: Analytical Chemistry
  – Metals, ETPH, PCBs, PAHs, Pesticide/Herbicides
• Compared Against
  – RSRs (Human Health)
  – Effects-Based Screening Criteria (Ecological Health)
• Results:
  – Elevated concentrations of PAHs, Metals (Cd, Cr, Cu, Pb, Hg, Ag, Zn), Pesticides
  – Assumed for all 41,000 CY of sediment
Stage 1b – “Hydrobiogeomorphic” Assessment

Field analysis

• What potential physical impact sediment released from the impoundment upon dam removal would have on downstream river reaches?

• Existing data reviewed included:
  • Historic and contemporary maps and aerial photos of the stream channel, valley and watershed
  • Geologic and physiographic maps
  • Land use data
  • Regional curves
  • Habitat assessments
  • Biological sampling
  • Scantic River Watershed Association data/reports
Stage 1b - “Hydrobiogeomorphic” Assessment
Stage 1b - “Hydrobiogeomorphic” Assessment

Maps courtesy of KCI Technologies
Stage 1b - Conclusion

- Sediment release from behind the dam would pass through Reach 1 and settle in low gradient reaches downstream (Reaches 2 and 3)

- Evidence of biological degradation (low benthic diversity, marginal fish habitat) in some reaches downstream of the dam

- The similarity of gradation of impoundment sediment and sediment downstream of the dam make natural redistribution a viable option
Stage 2 - Toxicological Assessment

Detailed chemical and toxicological assessment of impounded sediment

- Re-tested for metals, PAHs and pesticides
- Bioavailability Analysis – Metals & PAHS
- Sediment Toxicity Testing
  - Whole Sediment
  - Water Column
  - Re-deposited Whole Sediment
- Surface Water Toxicity
Stage 2 - Toxicological Assessment

- Whole Sediment (Impoundment)
- Consolidate
  - H. azteca
  - C. dilutus

- Agitate

- Suspended Sediment (Water Column)
- Consolidate
  - C. dubia
  - P. promelas

- Whole Sediment (Re-Deposited)
- H. azteca
  - C. dilutus
Stage 2 - Toxicological Assessment

Whole Sediment & Re-deposited Whole Sediment

28-day *Hyella azteca*

20-day *Chironomus dilutus*

Water Column

48-hour *Ceriodaphnia dubia*

96-hour *Pimephales promelas*
Stage 2 - Toxicological Assessment
Conclusions

• Accumulated sediments near the dam show toxicity
• Chemistry shows elevated concentrations of metals, pesticides and PAHs
  • Cd, Cr, Ag, Zn
  • B(a)A and B(b)F
  • Dieldrin
• Water column shows no toxicity
• Re-deposition of sediment shows similar toxicity to sediments in place
Overall Conclusion

- Approximately 14,000 CY of sediment was considered ecologically “unsafe” for redistribution
- Remaining 27,000 CY could be dredged OR left in place
- Reduced overall cost of dredging and disposal to $2.2M (from $6.0M)
Acknowledgements
Questions?