

# DAM REMOVAL PLANNING FOR THE NEXT DECADE

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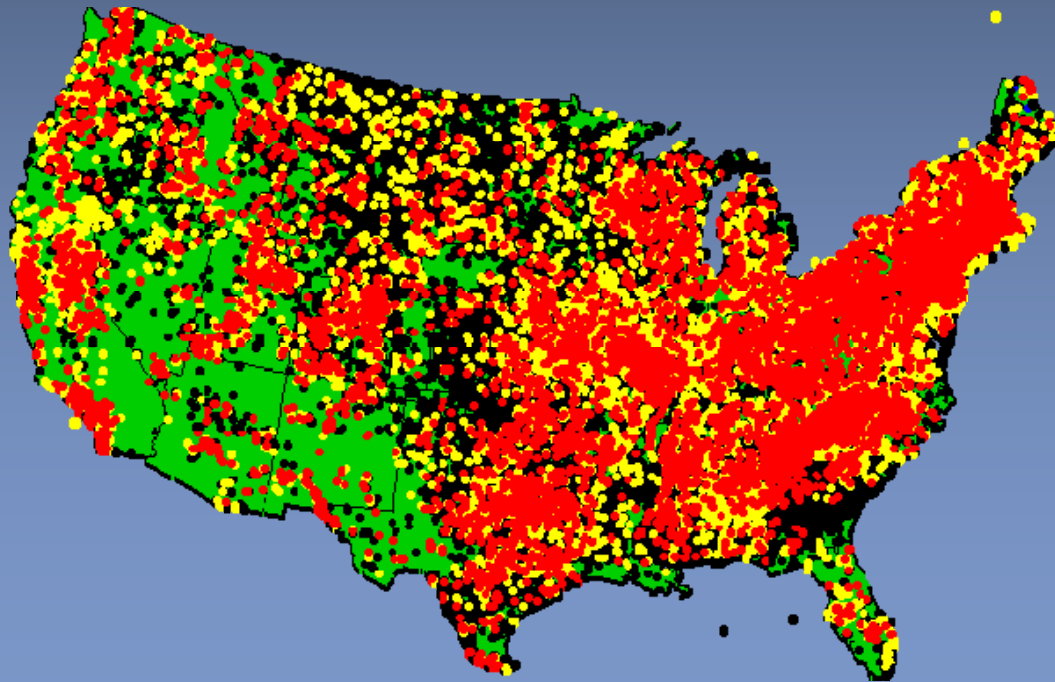
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# Outline

- Review of dam removal history/economics
- Factors affecting cost
  - Regional differences
  - Sediment management
  - Post-removal activities
  - Permitting
  - Social issues
- Recommendations for moving forward

# Small Dams in the US

- 2.5 million dams have been built in the US
- Aging dams are failing regularly
- Wisconsin alone has over 3,000 small dams
- >700 dams have been removed in the US



# The Economics of Removal

Dam (removal date)	Approximate cost
Upper Cooks Canyon Dam (2006)	\$45,000
Rat Lake Dam, WA (1989)	52,000
Grist Mill Dam, ME (1998)	56,000
Lake Christopher Dam, CA (1994)	100,000
Sandstone Dam, MN (1995)	208,000
Waterworks Dam, WI (1998)	213,770
Billington St. Dam (2002)	275,000
Sawmill Dam (2010)	280,000
Ballou Dam (2006)	350,000
Mounds Dam, WI (1998)	500,000
Newport No.11 Dam, VT (1996)	550,000
Cedar Creek Dam	1,200,000

# Average Removal Costs

- From Northeast dam removals over the past 10 years

<u>Phase</u>	<u>Range</u>	<u>Mean</u>	<u>n</u>
Feasibility	\$9,000 – 236,000	\$106,000	30
Design /Permit	\$9,000 - 188,000	\$88,000	11
Construction†	\$6,500 - 720,000	\$114,000	20

Mean total cost = \$296,000

Cost per foot/rise = \$37,033

*Source – NOAA Fisheries*

# Average Removal Costs

- From Pennsylvania dam removals over the past 9 years

Dam height (ft)	Cost range	Median Cost
1-3	\$1,500 – 95,000	\$17,200
4-6	5,000 – 300,000	38,500
7-9	3,200 – 187,000	45,651
10-15	50,000 – 195,000	70,000
16-25	30,000 – 440,000	117,000

*Source: American Rivers*

# Factors Influencing Cost

- Regional differences
- Sediment management
- Post-removal activities
- Permitting
- Social issues

# West

- Larger dams (hydro/irr.)
- Steeper rivers
- Large sediment volumes
- Gravel and sand
- Younger (<75 yrs)
- Salmon/ESA driven
- Water rights

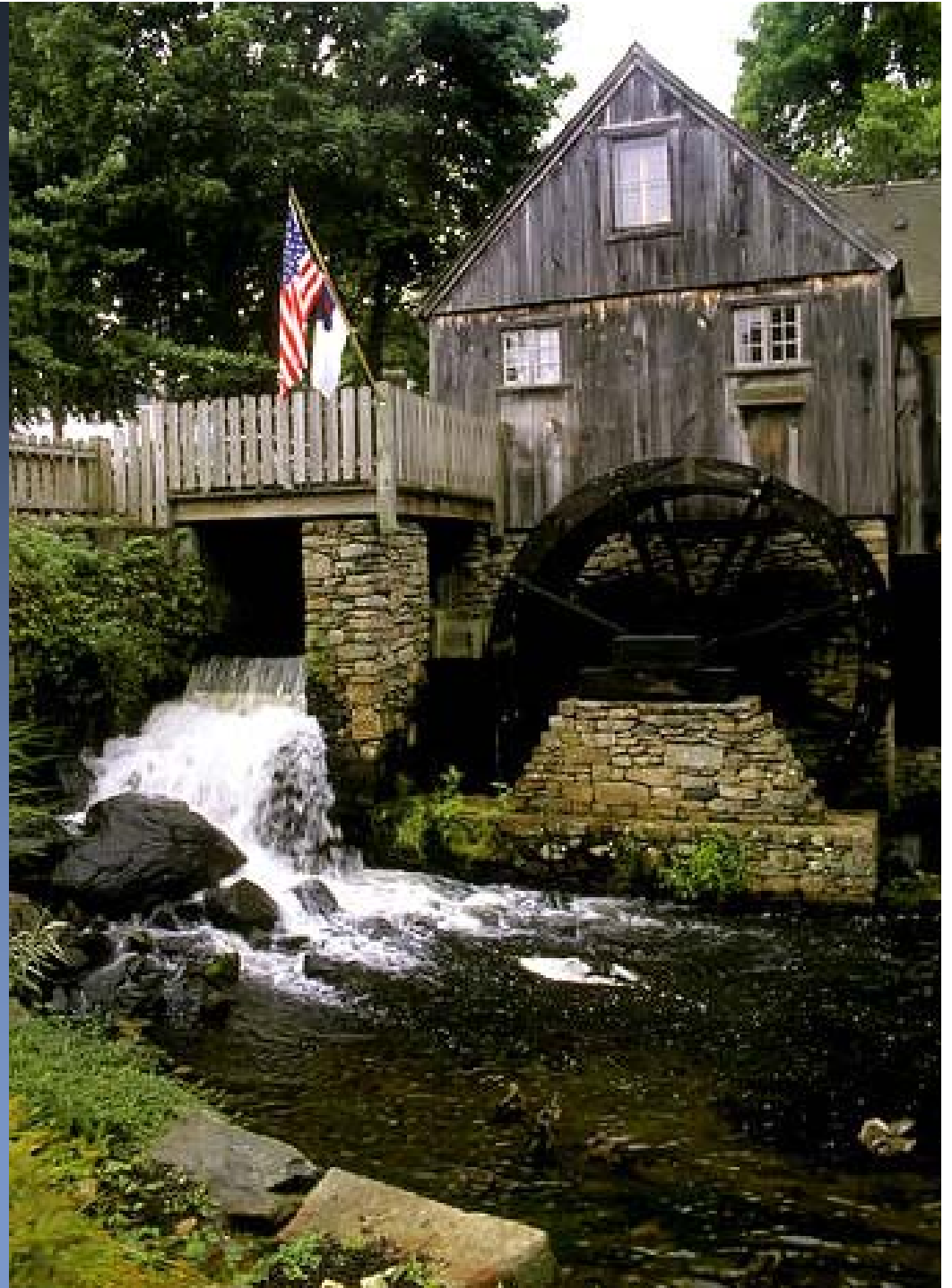
*San Clemente Dam*





# East

- More *of* them
- Most are small (<15 ft)
- Older (>150 yrs)
- Variable sediment
- Contaminated
- Established urban areas
- Infrastructure (bridges, pipes, buildings)



# Midwestern Dams

- Typically small (<15 ft)
- Moderate sediment volumes
- Fine sediment
- Urban (small towns), suburban or rural



# Factors Influencing Cost

- Regional differences in sediment character
- Sediment management
- Post-removal activities
- Permitting
- Social issues





## Rapid or Staged drawdown

- Traditional method
- Applicability must consider:
  - Potential impacts
  - Contaminants/nutrients



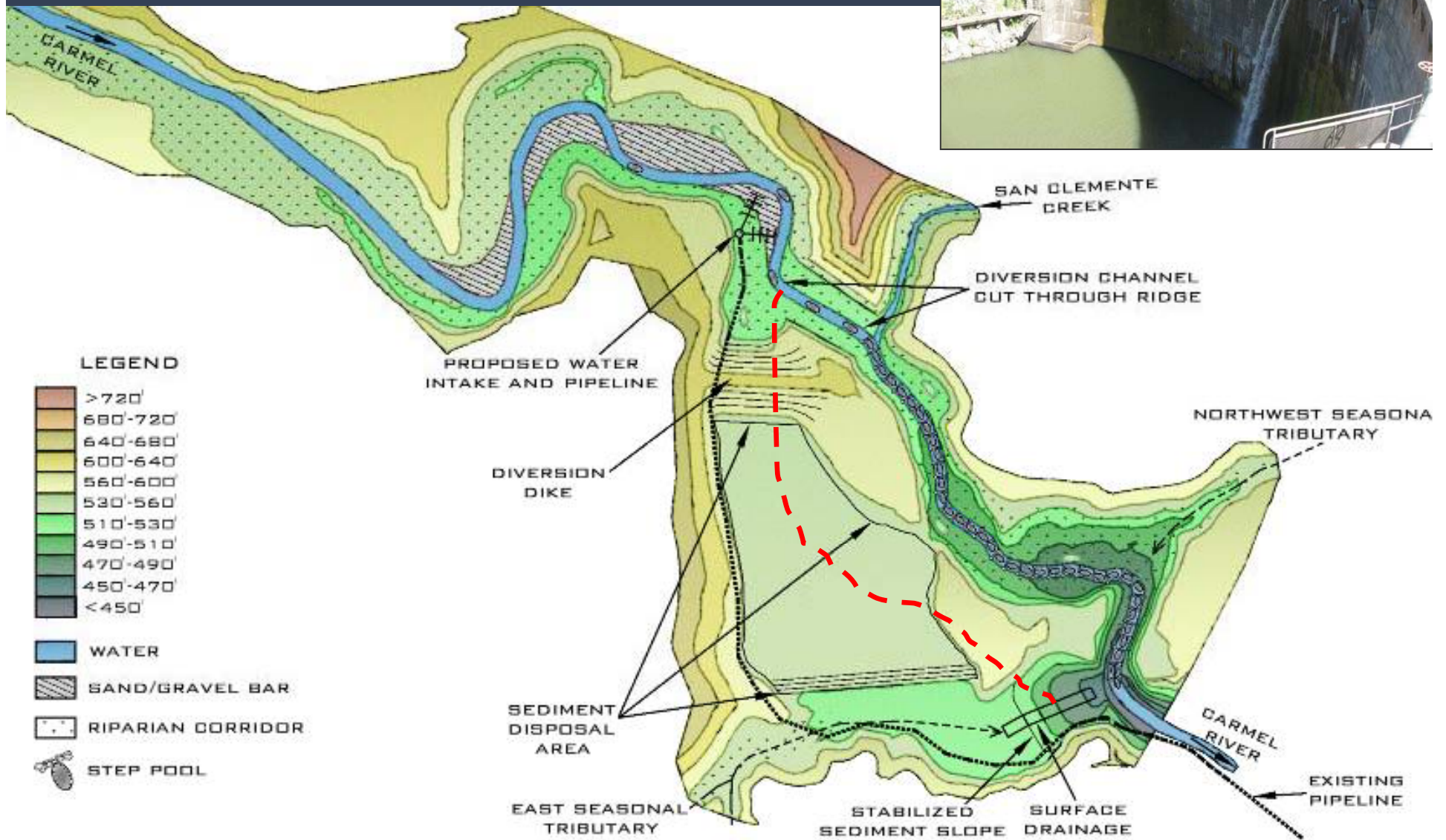
# Active sediment management



- Cost = \$1 – \$25/CY for clean sediment
- \$50 - \$500 per CY if contaminated



# Alternative sediment management



# Post – removal restoration

- Minimal/None



*Source: PA Fish and Boat Commission  
(Heilman Dam Removal)*

# Post – removal restoration

- Intensive (Hemlock Dam)





# Post-removal restoration



- Cedar Creek – 20,000 CY of excavation



# Post – removal restoration

- Intensive





# Permitting

- Triggers many permits
  - Clean Water Act
  - E & S Control
  - EA/EIS
  - T&E species
  - Cultural resources
  - Dredge / disposal
  - Solid waste
- New concept to some



# Social concerns

- Contaminants – Downstream landowners and impoundment residents concerned about transport or exposure
- Water levels – Flooding concerns
  - *Building consensus*
    - Post removal aesthetics
    - Boating
    - Fishing
  - *Performing due diligence*



# Example

- Small dam (Milwaukee area)



# Recommendations for making the money go further

- Funding
  - *Secure non-coastal funding for fish passage*
- Permitting
  - *Create dedicated dam or river restoration permit staff (PA model)*
  - *Include workshops for permit staff*
  - *Streamline Section 106 process*

# Recommendations

- Legal
  - *Statutes to protect dam owners and practitioners from litigation*
  - *State/federal ownership of dams*
  - *Define due engineering due diligence and develop standards of practice*
- Remove more dams
  - *Collect more data*
  - *Build a set of defensible standards*

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