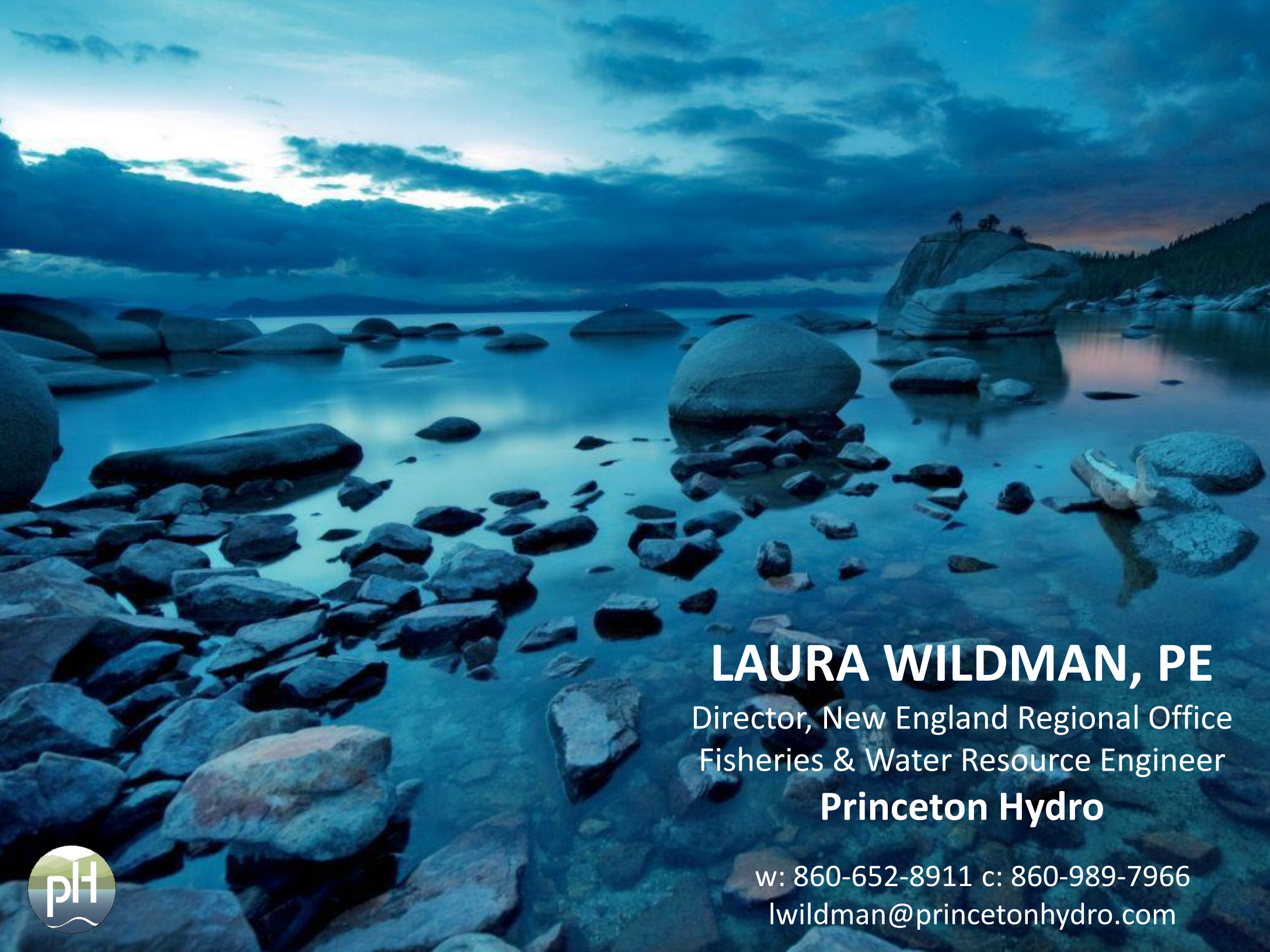
Dam Removal: When Less is More

By: Laura Wildman

Dam removals come in all shapes and sizes, with a myriad of different issues that impact the final design, sediment management, and channel restoration approaches selected. Some projects require a more “engineered” design when critical infrastructure is at risk; however, many dam removal projects can be designed with a “less is more” approach, letting the river do the work, and setting the river back on a trajectory to restore itself. We will discuss multiple successful dam removal projects that we purposefully designed to avoid “heavy handed” approaches. For these projects, an upfront understanding of the channel’s equilibrium slope, history of sediment deposition, and understanding of potential risks and impacts were critical to the final design choices made. Habitat building blocks were added as needed, however grade controls, hard armoring, extensive plantings, and active channel reestablishment were avoided. The upstream channels were allowed to remain dynamic and re-establish themselves. Examples of completed projects such as the Tannery Dam removal in New Hampshire and the Pleasant Grove mitigation site in New Jersey will be described, and other dams throughout the greater northeastern US. While a “less is more” approach is not always attainable, we will discuss the benefits of this approach, such as ease of constructability, and how to look for the right opportunities to apply this approach.



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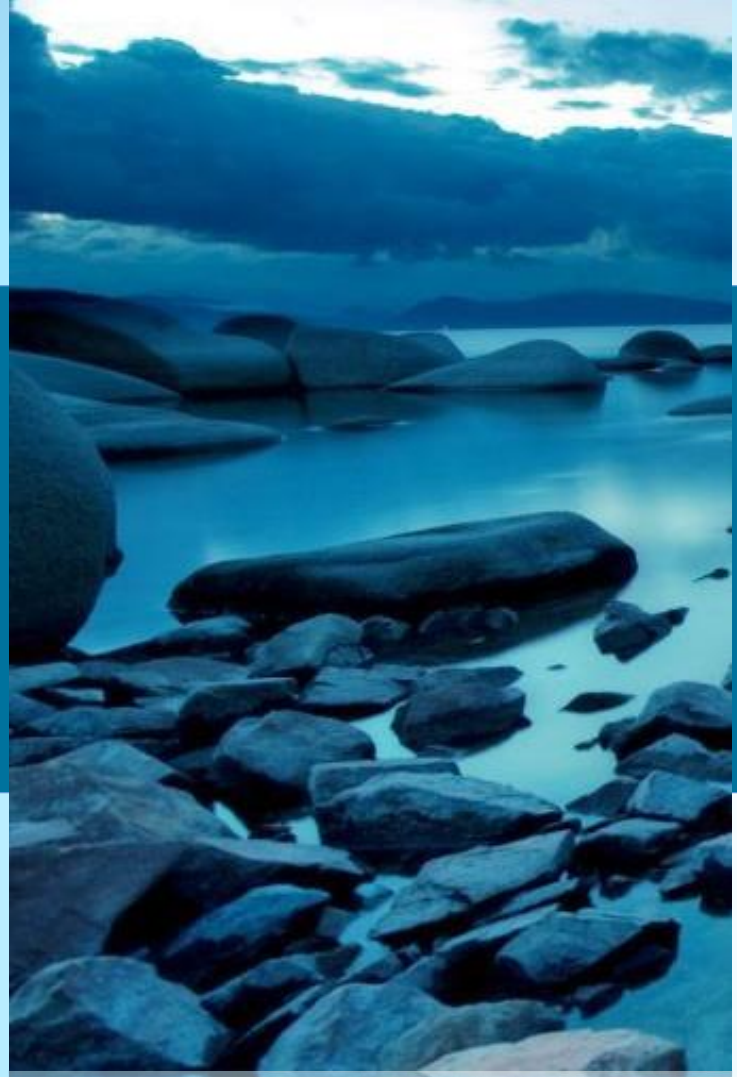
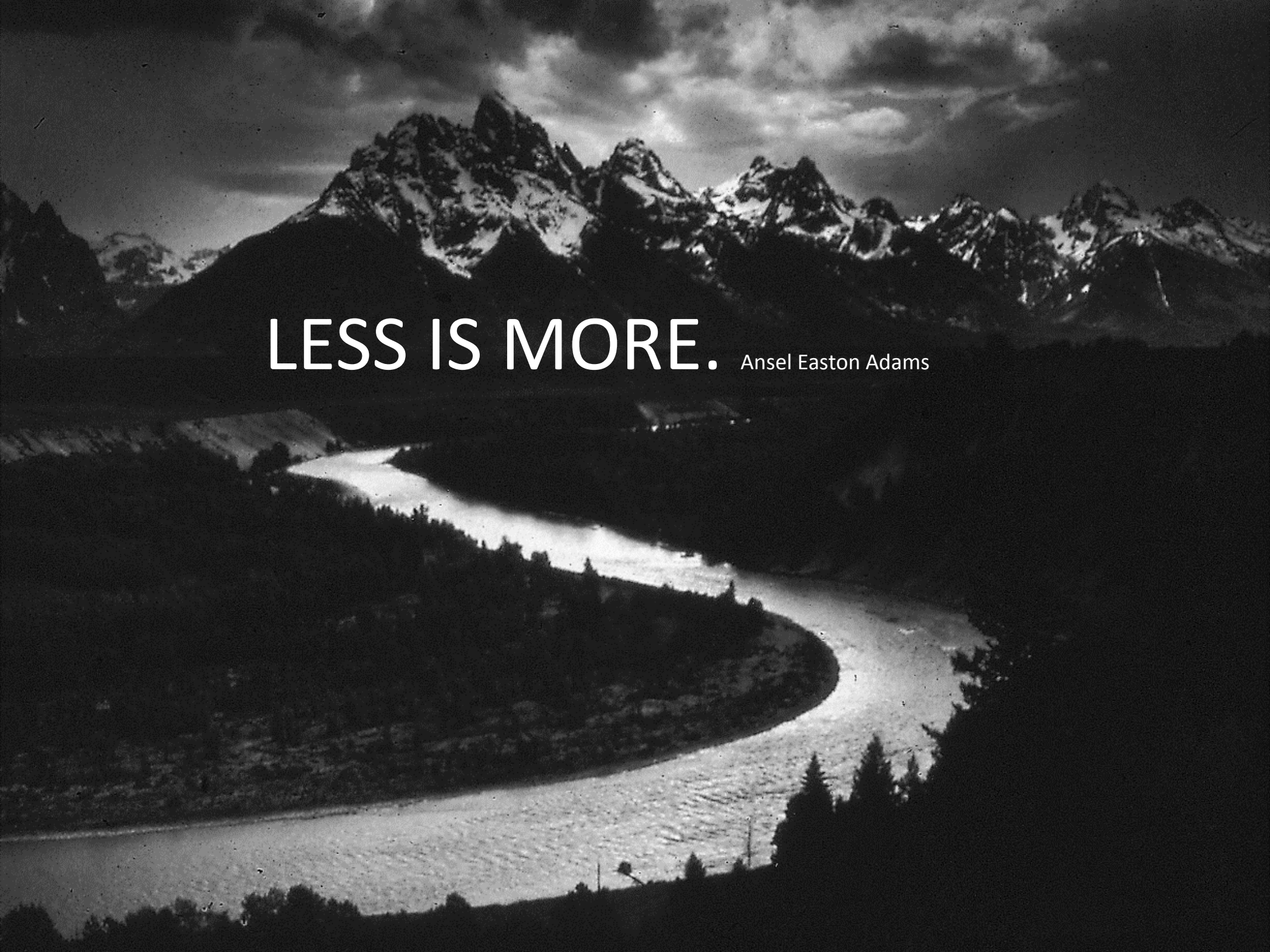


DAM REMOVAL
WHEN LESS IS MORE

Guiding a river on a course to restore itself


LESS IS MORE. Ludwig Mies van der Rohe
Unidas clothing / Respect the Architect Series


LESS IS MORE. Ansel Easton Adams

Weave by Nancy L Carlsen

Depicting the numerous paths of the Missouri River Channel between 1860-2004

"LESS IS MORE" vs "ENGINEERED"

Passive vs Active

- **Guide** the river to restore itself
- Let the river do the work
- Encourage restoration of dynamic function
- Avoid adding structure(s)
- Do not lock the channel in place
- Add habitat building blocks as needed (don't lock them in)
- Looking to promote complexity
- Not always allowed by regulators
- No maintenance needed
- Less costly

- **Prescribe** for the river
- Engineered design approach
- Typically locks the channel and any habitat features in place
- Heavy emphasis on stabilization
- Creates restoration infrastructure
- Often needed when protecting existing infrastructure
- Often required by regulators
- May require maintenance
- More Costly

“LESS IS MORE” vs “ENGINEERED”

Passive vs Active

Tannery Dam Removal, NH

Design: Princeton Hydro

San Clemente Dam Removal, CA

Design by Others

PASSIVE OR "LESS IS MORE" RESTORATION

Tannery Dam Removal, NH in 2015

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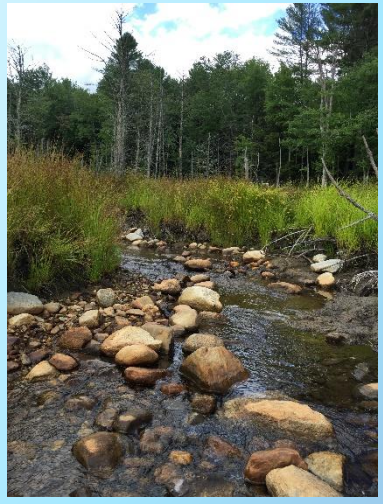


ACTIVE or "ENGINEERED" RESTORATION

San Clemente Dam Removal, CA

ACTIVE or "ENGINEERED" RESTORATION

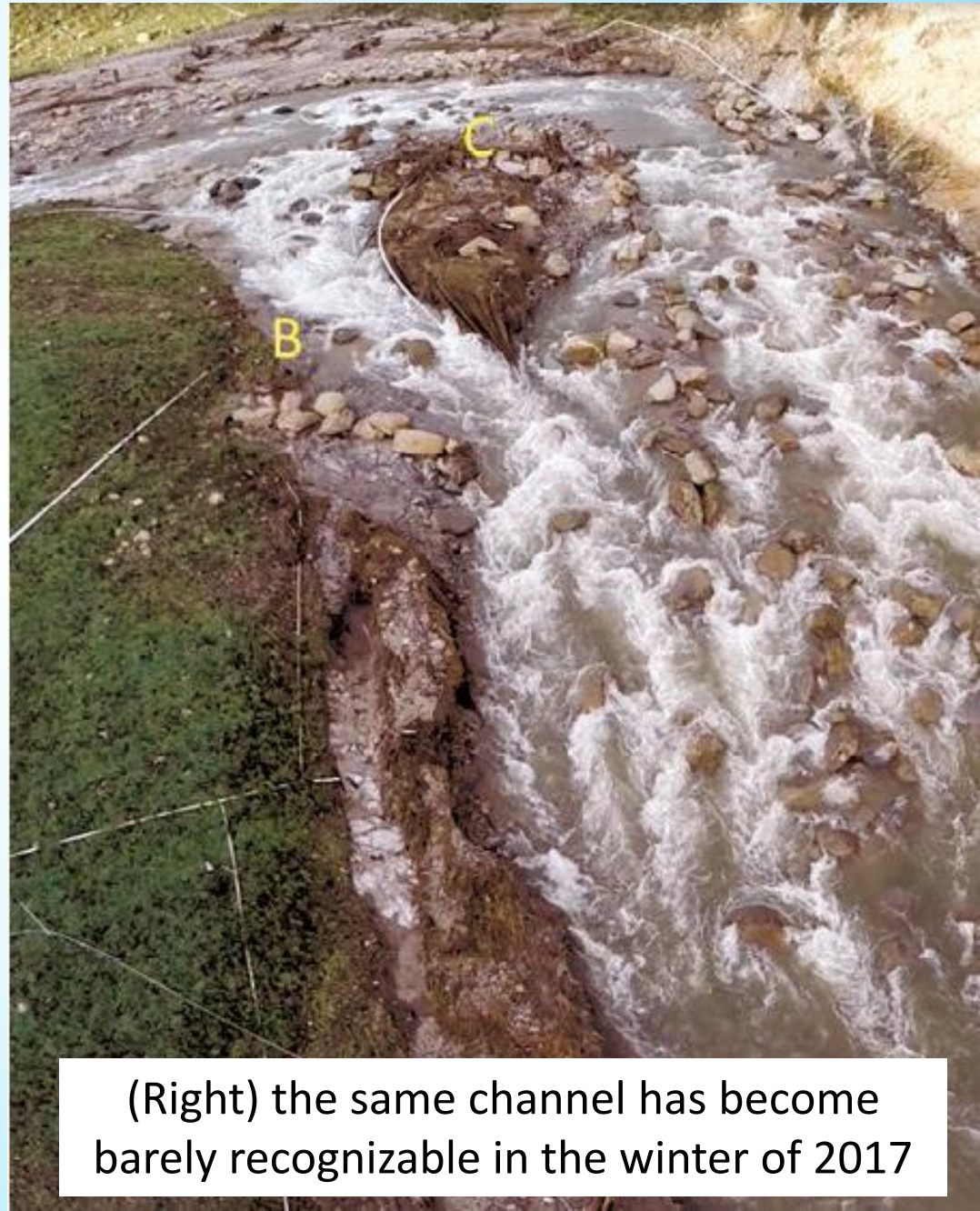
San Clemente Dam Removal, CA

ACTIVE or "ENGINEERED" RESTORATION

San Clemente Dam Removal, CA

Source Doug Smith

(Left) step pools were engineered in 2015 to last for decades



(Right) the same channel has become barely recognizable in the winter of 2017

ACTIVE or "ENGINEERED" RESTORATION

San Clemente Dam Removal, CA

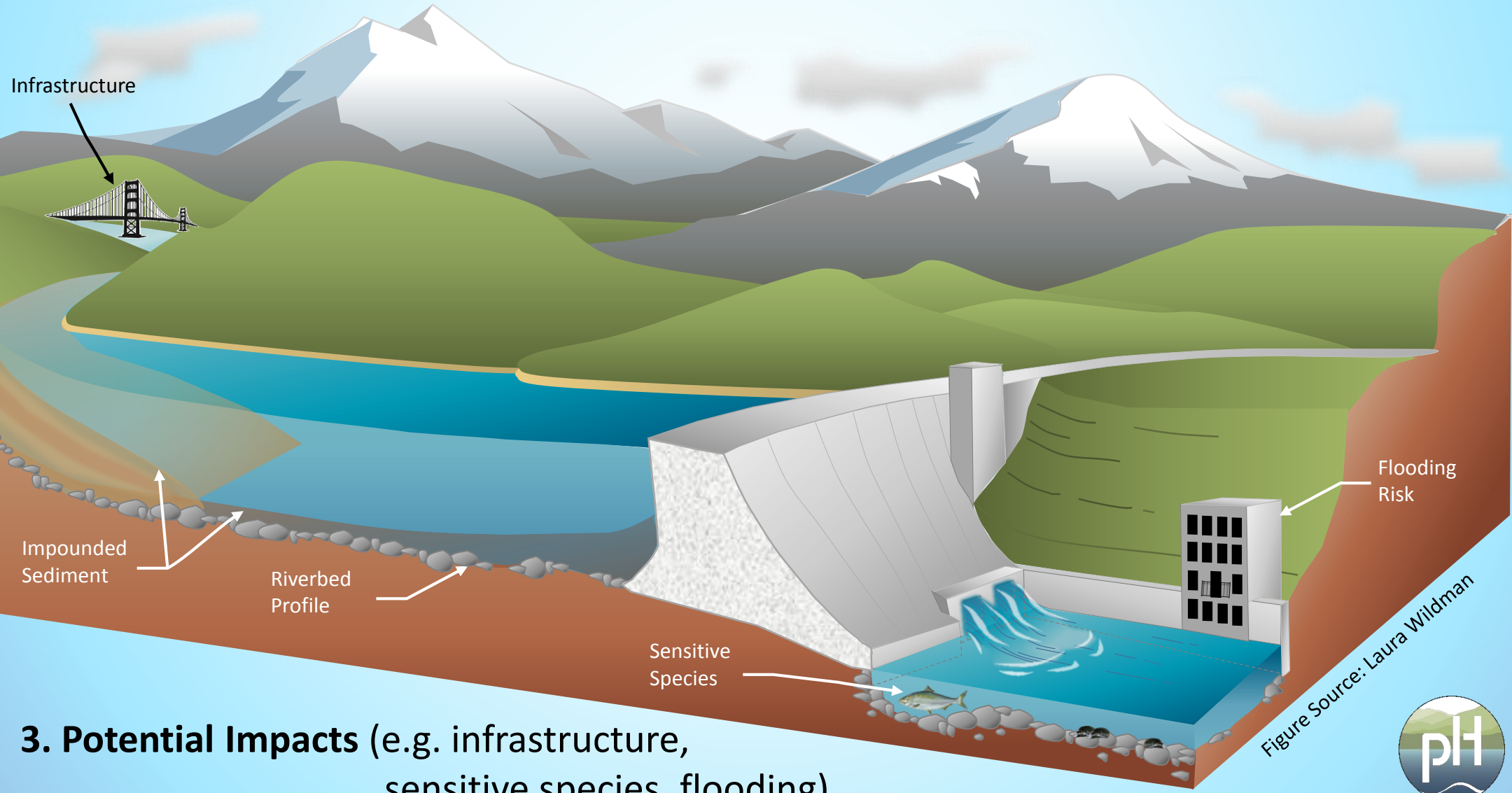
Post - Dam as Designed

Post – Dam as Decided by River

CRITICAL ISSUES

THAT CONTROL HOW YOU RESTORE A SITE POST DAM REMOVAL

1. **Riverbed Profile** (quasi-equilibrium slope)
2. **Impounded Sediment Characteristics** (quality & quantity)



3. **Potential Impacts** (e.g. infrastructure, sensitive species, flooding)

SELECTING THE APPROPRIATE APPROACH

	LESS IS MORE	ENGINEERED
1. Riverbed Profile	• Legacy thalweg • Easily identified channel thalweg • Pre-dam streambed substrate	• Previously dredged below pre-dam riverbed • Pre-dam profile was unstable (i.e. post channel avulsion) • D/S channel bed degradation
2. Impounded Sediment Characteristics (quality & quantity)	• Little to no impounded sediment • Quantity of sediment lends itself to passive sediment transport • D/S channel has ability to transport sediment • Sediment clean or similar to background levels	• Quantity of sediment requires active management • D/S channel can not transport sediment without issue • Sediment is contaminated in excess of background levels
3. Potential Impacts (e.g. infrastructure, sensitive species, flooding)	• No potential for infrastructure impacts • No sensitive species • No potential for increased flooding (or can be managed passively)	• Potential of Infrastructure impacts • Sensitive species need protection • Potential for increased flooding

RIVERBED PROFILE

SIMPLE EXAMPLE

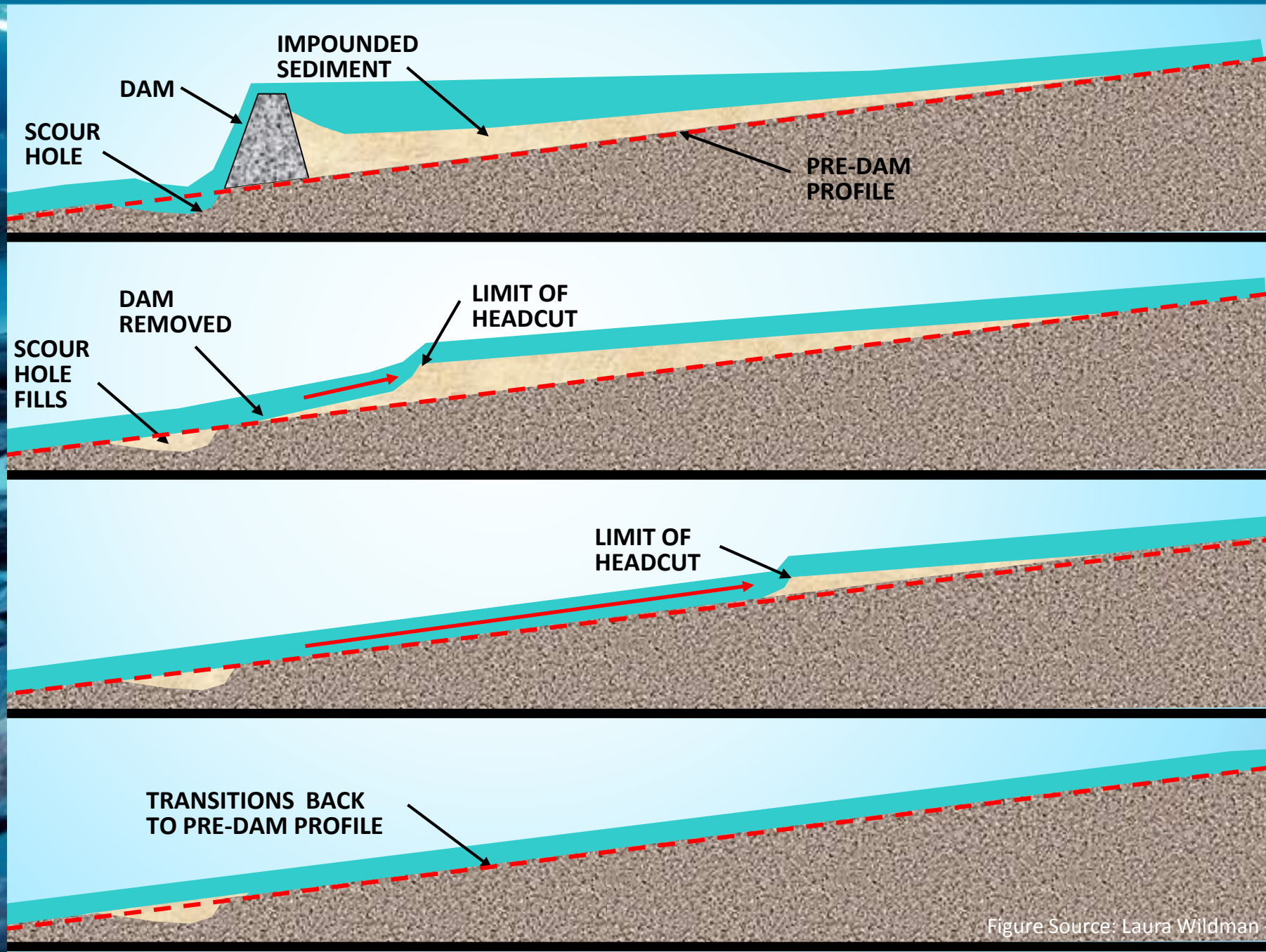
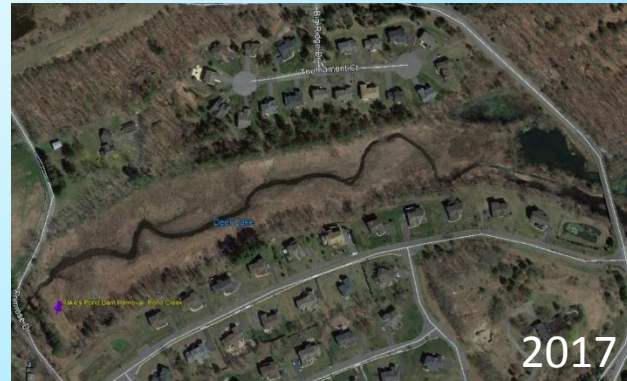


Figure Source: Laura Wildman

LEGACY THALWEG

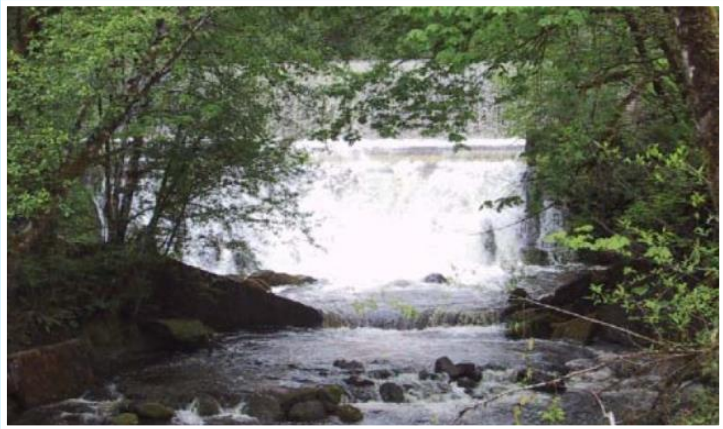
LESS IS MORE (RAKES POND DAM, PA)

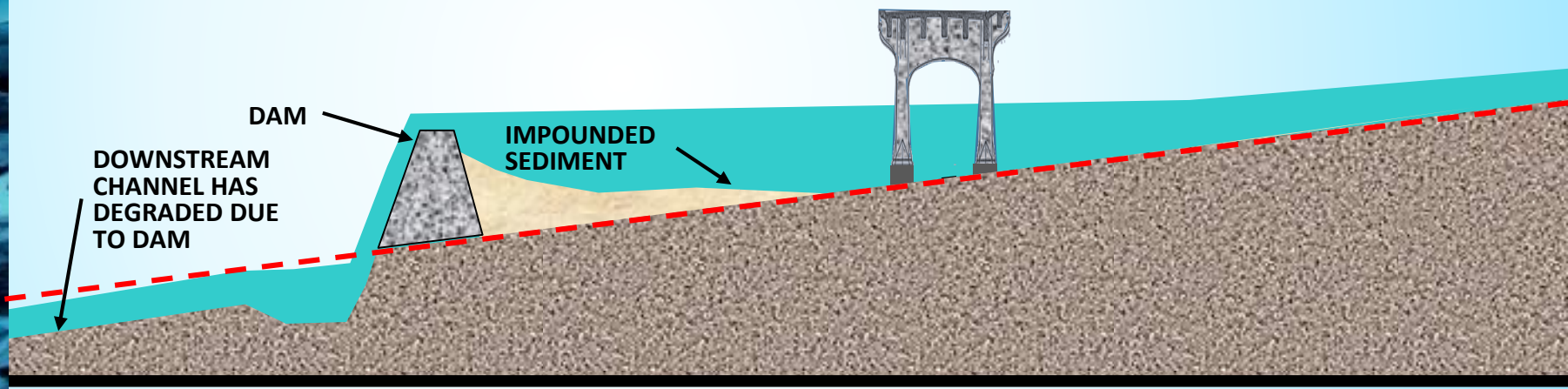


Design: Princeton Hydro

RIVERBED PROFILE

D/S DEGRADATION EXAMPLE (Goldsborough Dam)





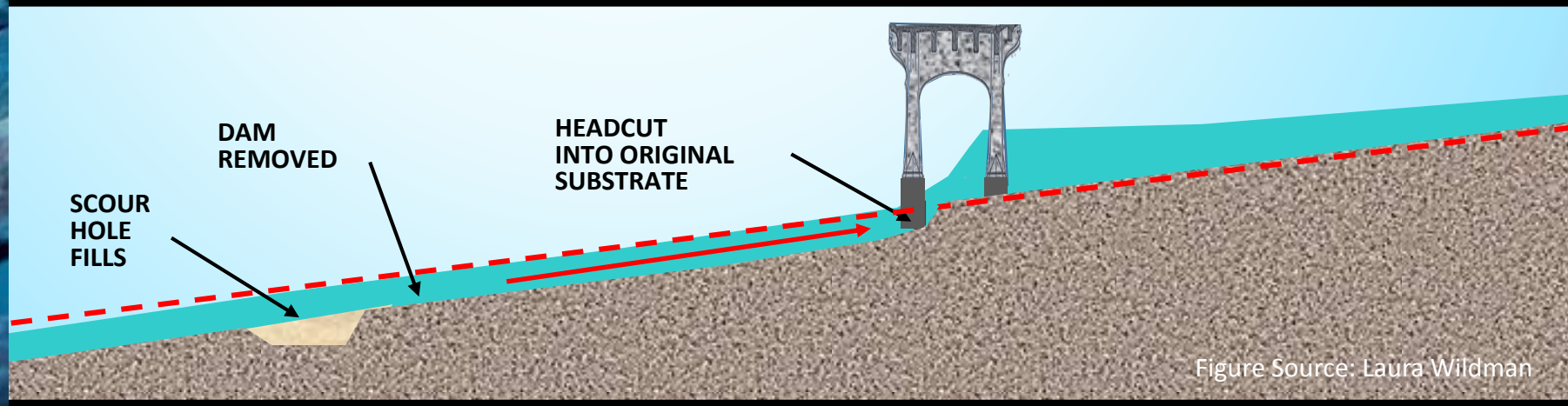


Figure Source: Laura Wildman

EXTREME OVER "ENGINEERED" APPROACH

Goldsborough Dam Removal, WA

Comes with price tag for the next generation

Design by others

RIVERBED PROFILE

EXCAVATED POND EXAMPLE (Heminway Dam, CT)

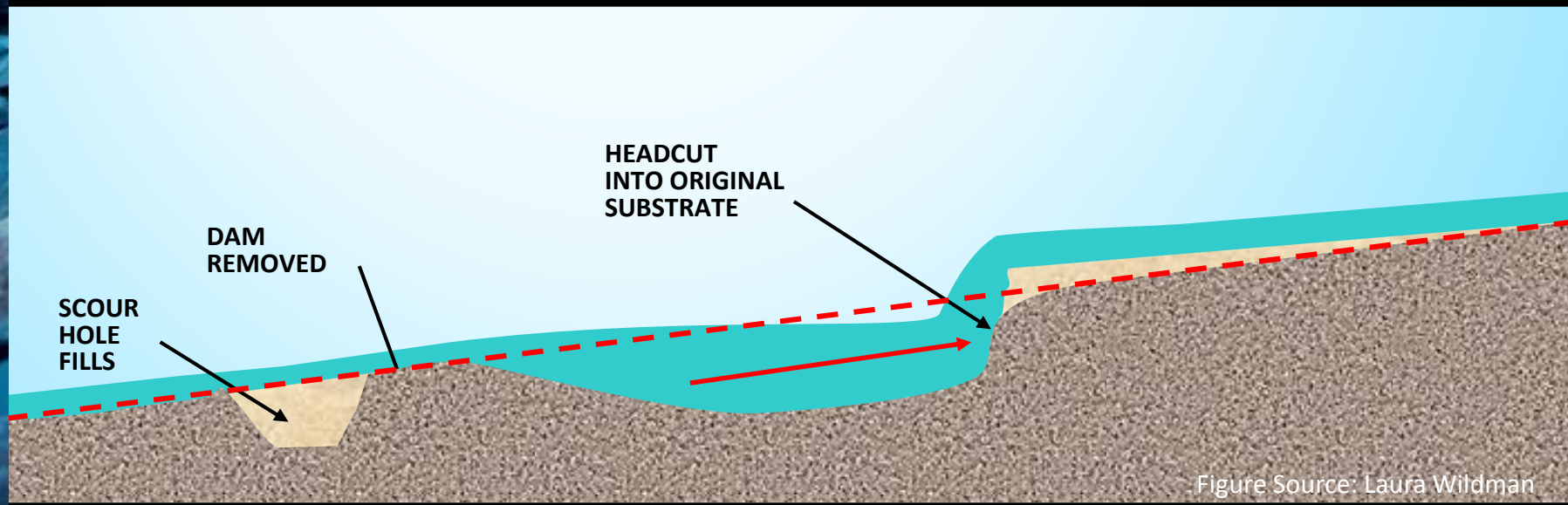


Figure Source: Laura Wildman

RIVERBED PROFILE

EXCAVATED POND EXAMPLE (Heminway Dam, CT)

1970 2011

Steele Brook Rd

Steele Brook Rd

Knowlton St

Porter St

100 feet

25

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Design by Princeton Hydro

RIVERBED PROFILE

EXCAVATED POND EXAMPLE (Heminway Dam, CT)

Design by Princeton Hydro

RIVERBED PROFILE

BEDROCK PROFILE (SPOONVILLE DAM, CT)

Design: Princeton Hydro

IMPOUNDED SEDIMENT CHARACTERISTICS

CONTAMINATED SEDIMENT - REQUIRED ENGINEERED APPROACH

Town Brook Dam, MA

Design: MMI

Milltown Dam, MT

Final Design: River Design Group and Envirocon

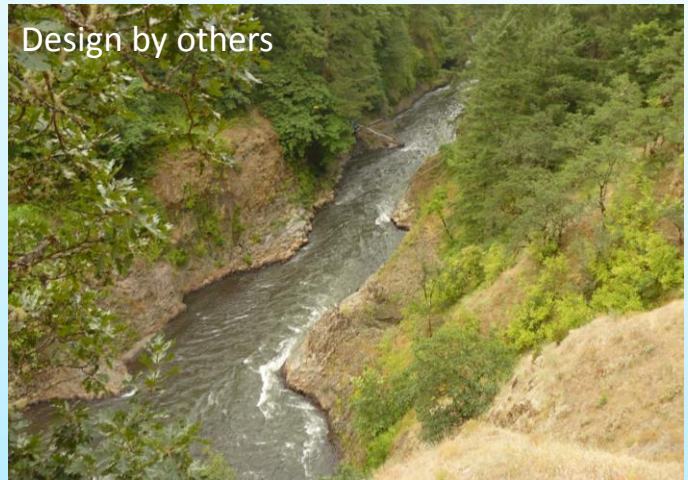
IMPOUNDED SEDIMENT CHARACTERISTICS

REGULATORY CONCERNS RE: QUANTITY LED TO PILOT CHANNEL APPROACH

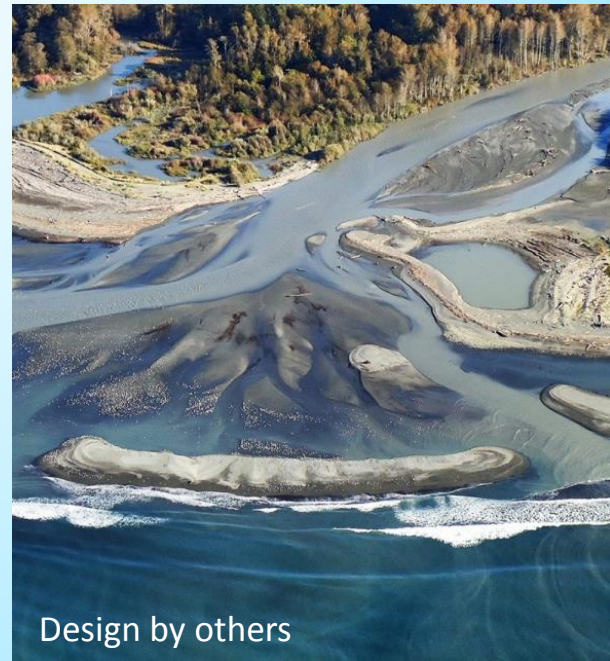
IMPOUNDED SEDIMENT CHARACTERISTICS

LARGE QUANTITY with PASSIVE SEDIMENT TRANSPORT

CONDIT DAM, WA



GLINES CANYON DAM, WA



POTENTIAL IMPACTS

INFRASTRUCTURE IMPACTS (Tel-Electric Dam, MA)

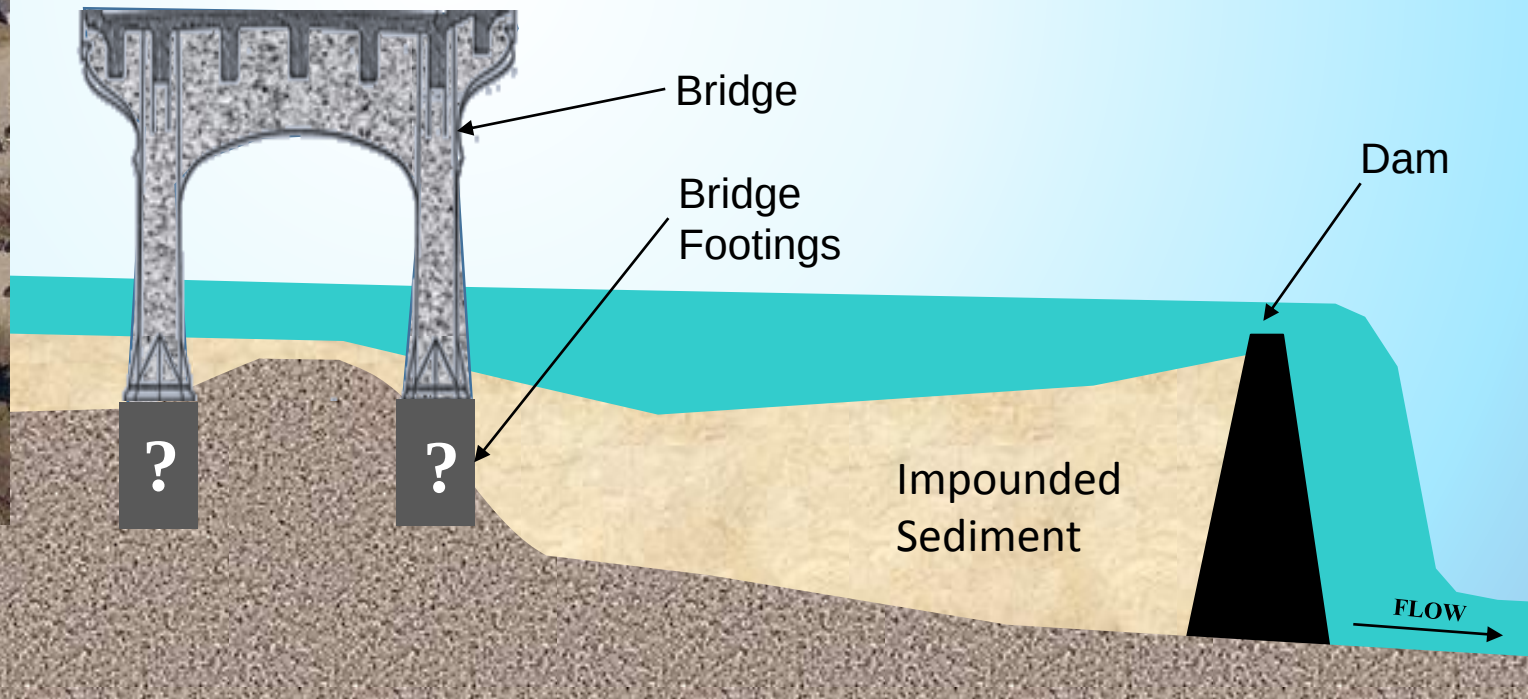
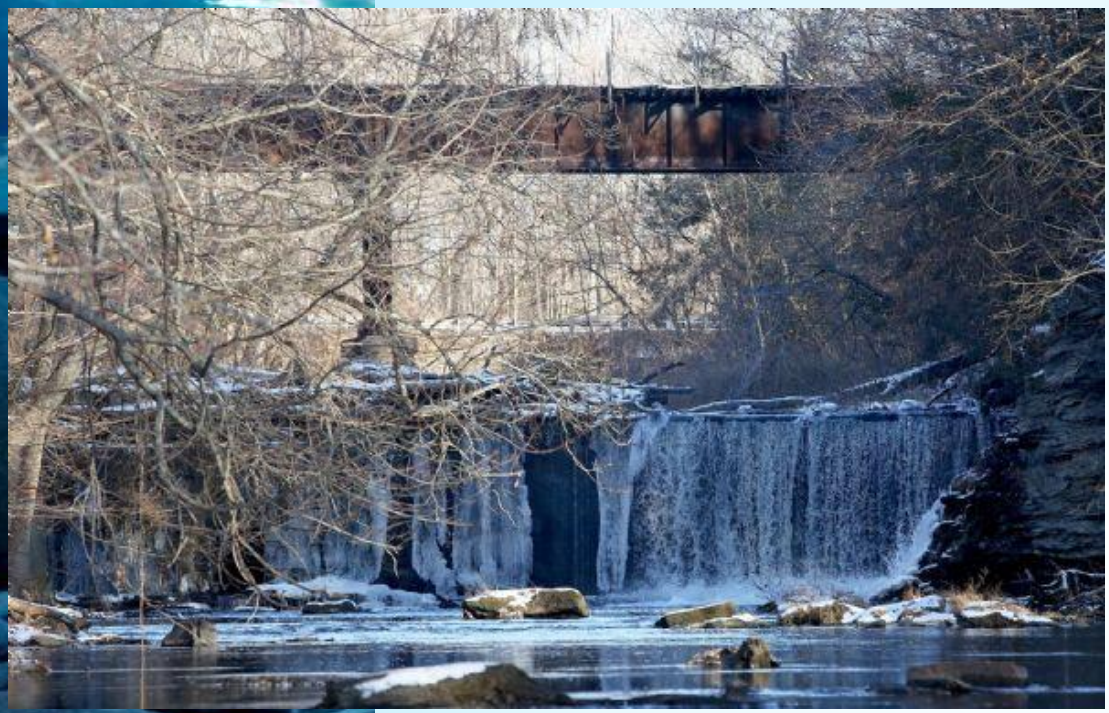


Figure Source: Laura Wildman

POTENTIAL IMPACTS

INFRASTRUCTURE IMPACTS (Springborn Dam, CT)



Design: Fuss & O'Neil

POTENTIAL IMPACTS

INFRASTRUCTURE IMPACTS (Brave Station Dam, PA)

Cooling Pipes for Gas Pumping Station Under impoundment

POTENTIAL IMPACTS

SENSITIVE SPECIES D/S (Cuddebackville Dam, NY)

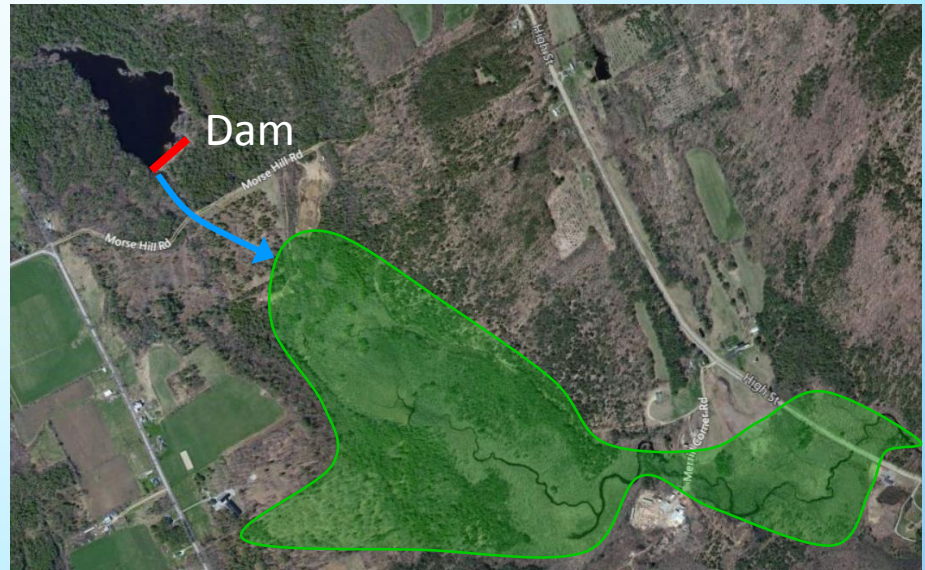
Dwarf Wedge Mussels
locate & relocate

POTENTIAL IMPACTS

DOWNSTREAM FLOODING

Engineered - Heminway Pond Dam, CT

Less is More - Tannery Dam, NH



"ENGINEERED" for What Reason?

Puddin'Head Branch Dam Removal, FL

Design by others

Source: Steve Herrington/TNC

"ENGINEERED" for What Reason?

Puddin'Head Branch Dam Removal, FL

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Design by others

ADDING BUILDING BLOCKS

PLEASANT GROVE DAM REMOVAL, NJ

Design: Princeton Hydro

Design: Princeton Hydro

ADDING BUILDING BLOCKS

PLEASANT GROVE DAM REMOVAL, NJ

Design: Princeton Hydro

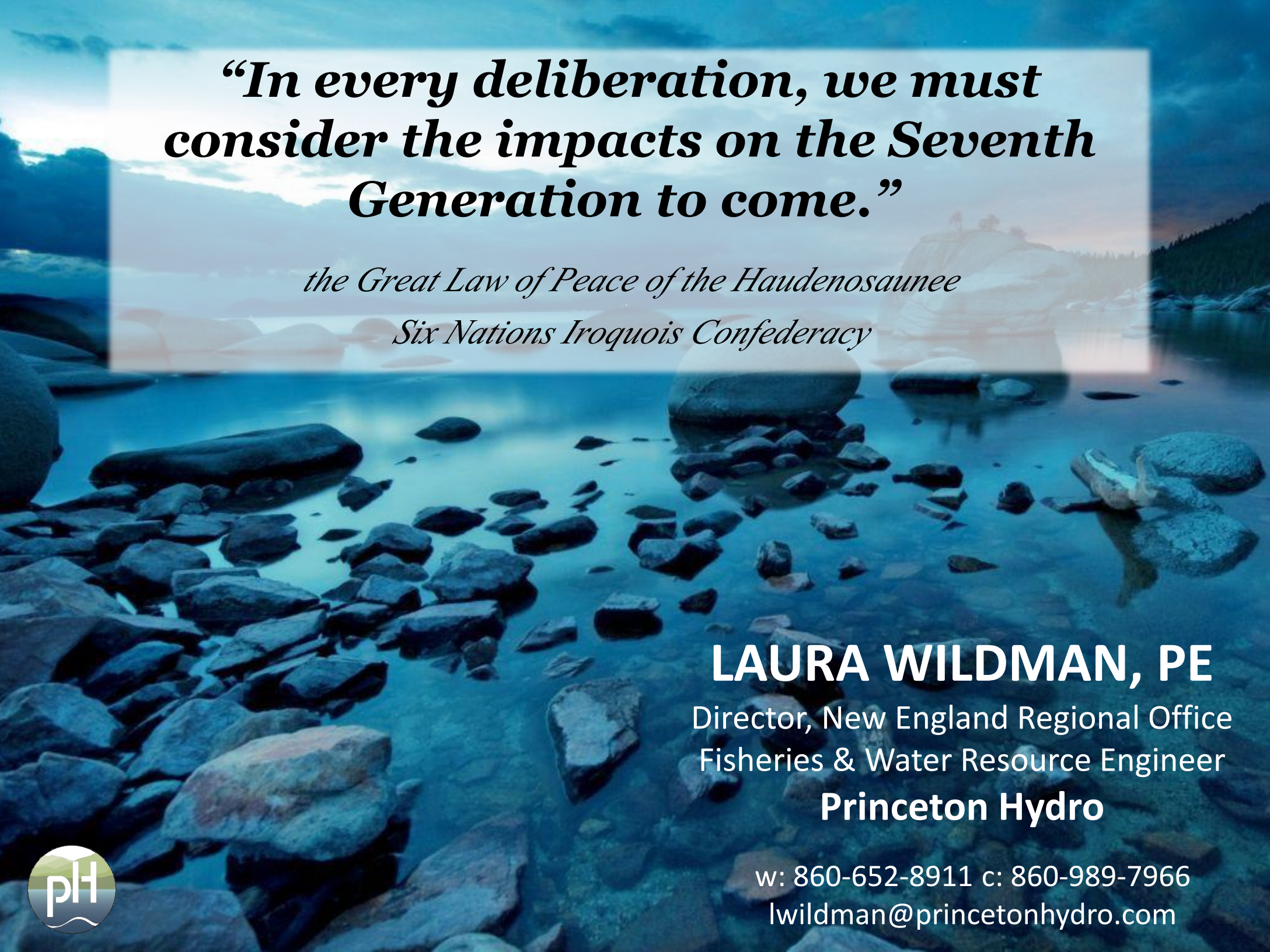
DAM REMOVAL

ALWAYS LOOK FOR A "LESS IS MORE" APPROACH FIRST

But make sure you first assess:

1. **Riverbed Profile**
2. **Impounded Sediment Characteristics** (quality & quantity)
3. **Potential Impacts** (infrastructure, sensitive species, flooding)

Design: Princeton Hydro



"In every deliberation, we must consider the impacts on the Seventh Generation to come."

the Great Law of Peace of the Haudenosaunee

Six Nations Iroquois Confederacy

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