

# May 23 Fry Stocking in Kingsbury Stream















# Mayo Mill Dam and Appurtenant Facilities Feasibility & Alternatives Study

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for the Town of Dover-Foxcroft





# Presentation Overview:

May 25, 2023

- Why is fish passage a factor?
- What is fish passage?
- What are the types of fish passage options?



Funding for this work is provided by NOAA Fisheries through the Infrastructure and Investment Jobs Act.



**Why is fish passage an important factor to consider at Mayo Mill Dam?**









4 of the 124  
Atlantic salmon  
that have  
migrated past  
Milford to date.









**Above both Guilford and Dover-Foxcroft is 280 river miles of climate resilient Atlantic salmon habitat.**



# Brook Trout (*Salvelinus fontinalis*)

Family Salmonidae, Trouts



PC: USFWS

## Brook Trout Life Cycle

Brook trout, members of the Char Family, live in small, clean, coldwater streams within Pennsylvania and many other eastern states. Their presence indicates a healthy stream.

**FALL:** Adult females (2 to 5 years of age) select a spot for a nest called a redd. A gravel stream bottom with a steady flow from underneath is an ideal location. Using her tail, the female clears a pit to lay the eggs. Female trout ranging between 5 to 10 inches in length will lay between 20 and 400 eggs. The male brook trout fertilizes the eggs as they sink to the stream bottom. After being fertilized, the eggs are then covered with gravel by the female. About 1 to 2 percent of the eggs will survive to adulthood.

**WINTER:** Fertilized eggs develop. Within about two weeks, the egg develops eyes (eyed egg stage). The egg gets oxygen from the water flow around it. Nutrition for the trout comes from the egg yolk. Water temperatures must stay within the 35 to 55 degree range for brook trout. At this stage, the trout are very sensitive to changes in water temperature and quality.

**SPRING:** Developing eggs, still in the redd, hatch from February to March. Hatch date depends on stream temperature and quality. Fry, still living in the gravel, live off the yolk sac (sac fry or alevin). When the sac is used up, the fry emerge from the gravel to begin eating. This usually happens between March and April. Fry will eat plankton or other microscopic animals in the stream.

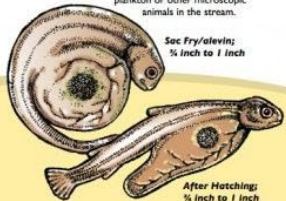
**SUMMER:** To hide from predators, young trout spend time in shallow water hiding under and around rocks. They eat small insects and plankton. Young trout grow quickly and reach 2 to 3 inches long by the end of the summer. As the fry continue to develop, vertical lines called parr marks begin appearing along their body. These bars help camouflage the young trout and protect them from predators. When the trout have parr marks, they are called fingerlings or parr.



Female Trout Excavating a Redd

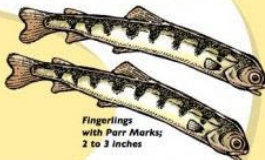


Fertilized Eggs (Eyed Egg Stage): 1/8 inch or less in diameter

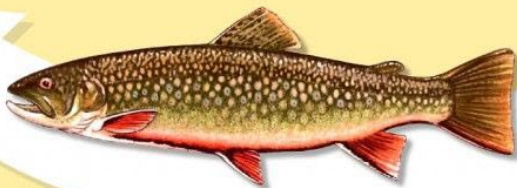


Sac Fry/Alevin; 1/2 inch to 1 inch

After Hatching; 1/2 inch to 1 inch



Fingerlings with Parr Marks; 2 to 3 inches



### BROOK TROUT ADULT:

They are Pennsylvania's state fish and only native trout. A brook trout's body is dark green with light "wormy" lines across the top. Their fins are orange with white edges. Red spots with bluish halos dot the body and their belly appears orange in color. The tail is nearly square.

Adults: 5 to 10 inches



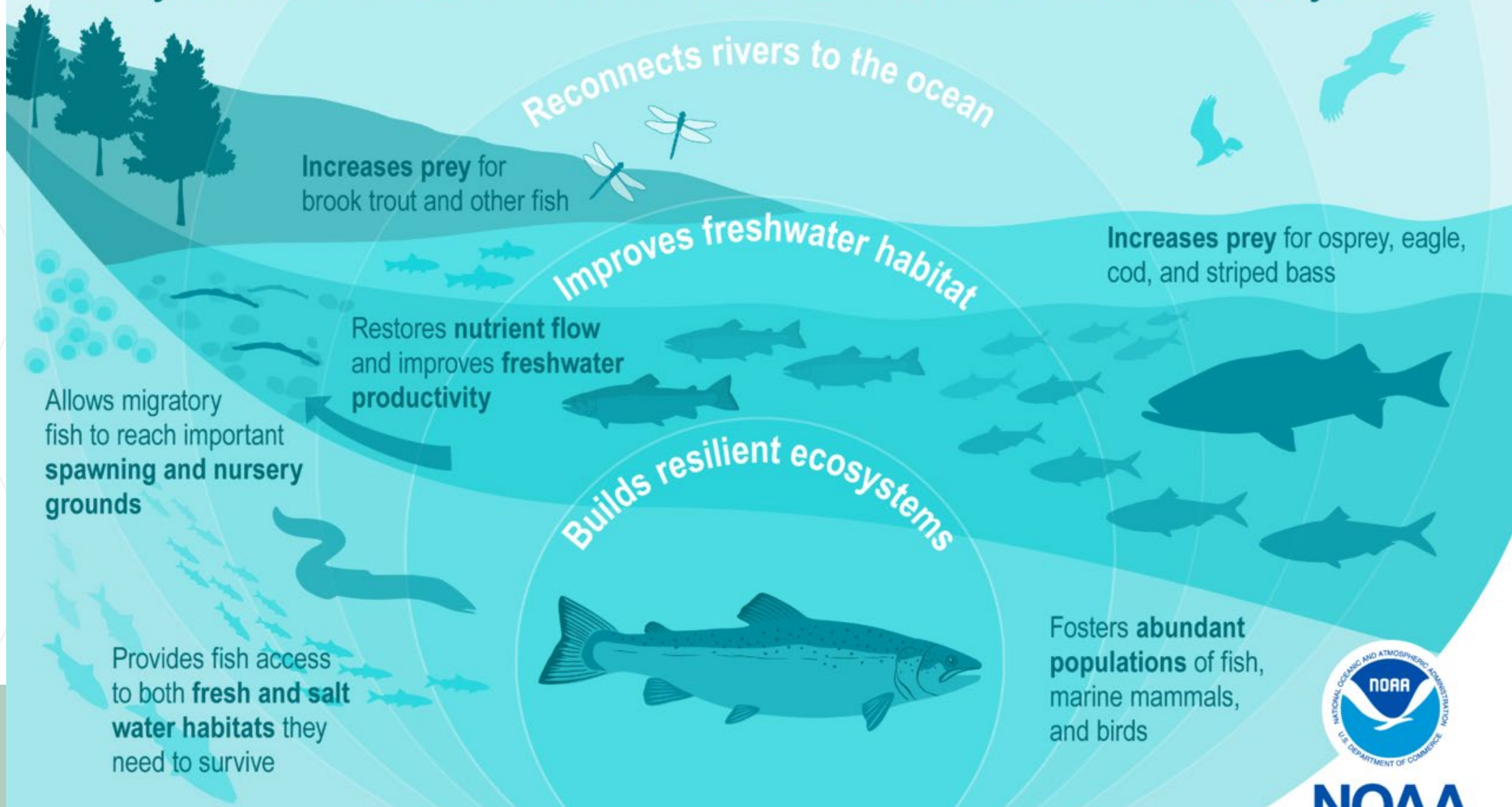
[www.patROUTINtheclassroom.org](http://www.patROUTINtheclassroom.org)



PC: Eric Harvey



# Did you know that salmon habitat restoration benefits the entire ecosystem?



The Ripple Effects of Atlantic Salmon Conservation



**NOAA**  
**FISHERIES**



# What is fish passage?

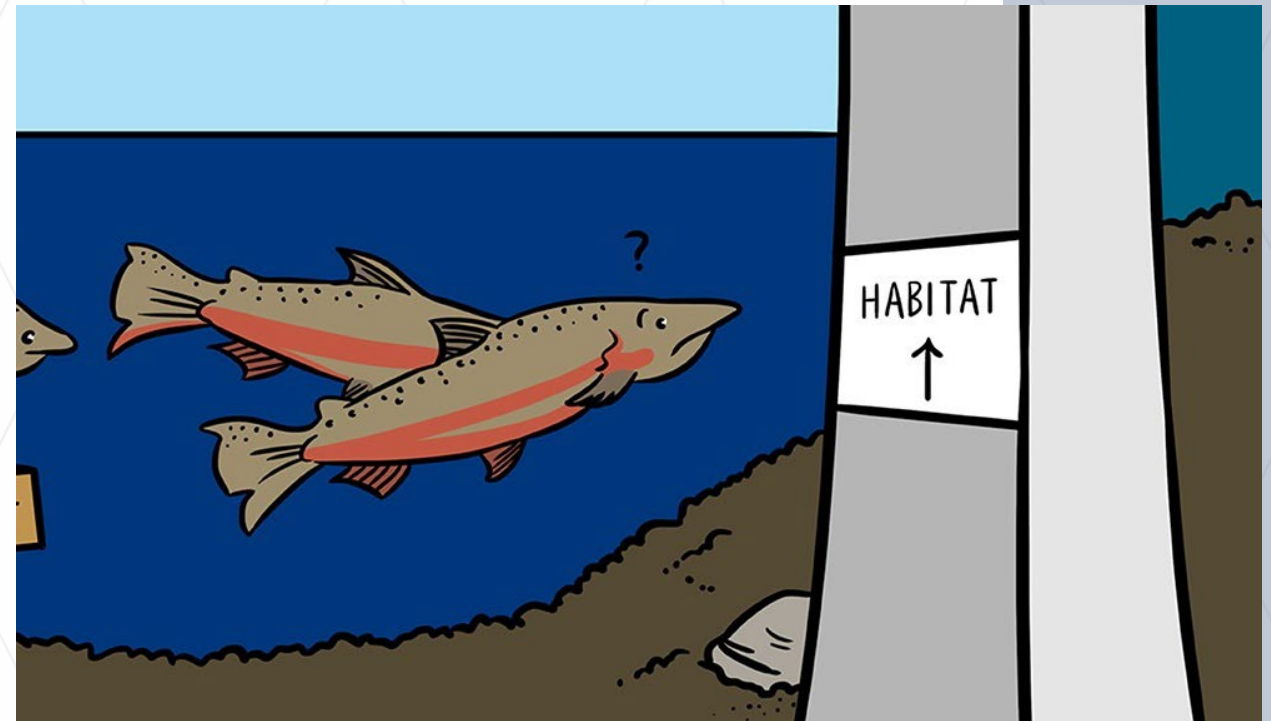
Fish passage is providing safe, timely, and effective upstream and downstream movement of fish past a barrier.





# Safe

- No death of the fish
- No delayed mortality or a physical condition that impairs subsequent migratory behavior, growth, or reproduction





# Timely

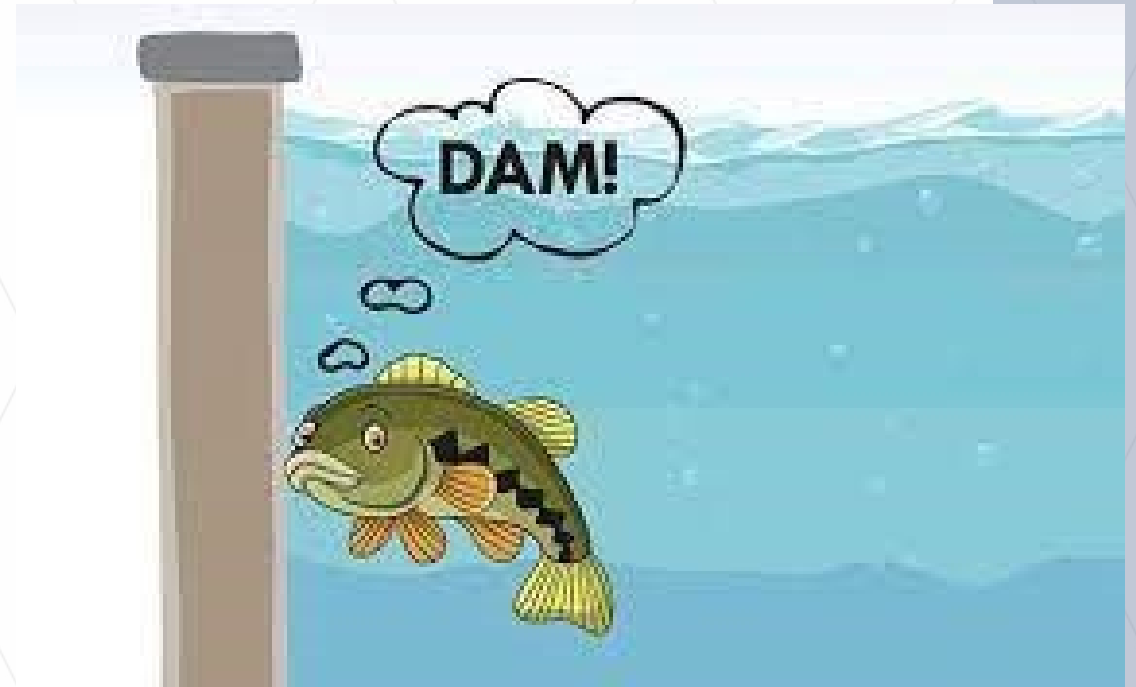
- No significant delay





# Effective

- Attraction to entrance
- Biological capacity
- Actual passage success
  - NMFS has set a performance standard of 95%



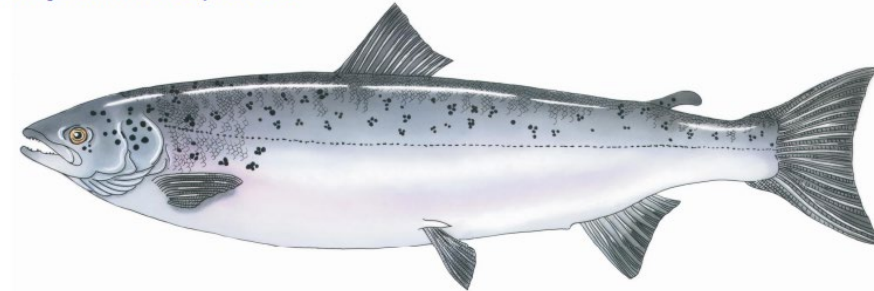


# Sea-run fish as required by fishery agencies:

- Current:
  - Atlantic salmon
  - American eel
  - Sea lamprey
- Potential future:
  - Blueback herring
  - Alewife
  - American shad

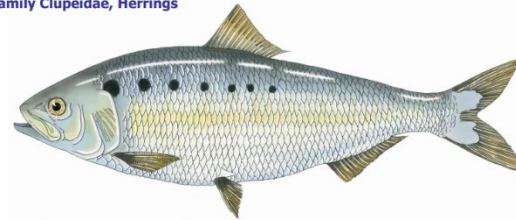
Atlantic Salmon (*Salmo salar*)

Family Salmonidae, Trouts



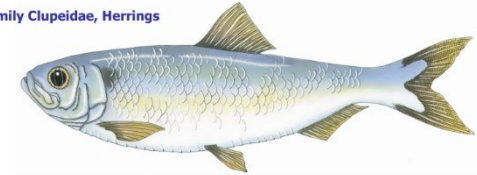
American Shad (*Alosa sapidissima*)

Family Clupeidae, Herrings



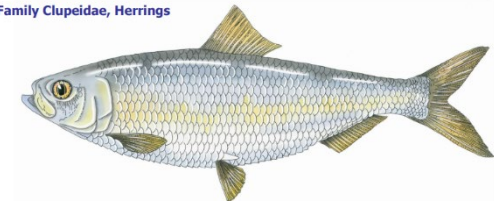
Alewife (*Alosa pseudoharengus*)

Family Clupeidae, Herrings



Blueback Herring (*Alosa aestivalis*)

Family Clupeidae, Herrings



AMERICAN EEL  
*ANGUILLA ROSTRATA*

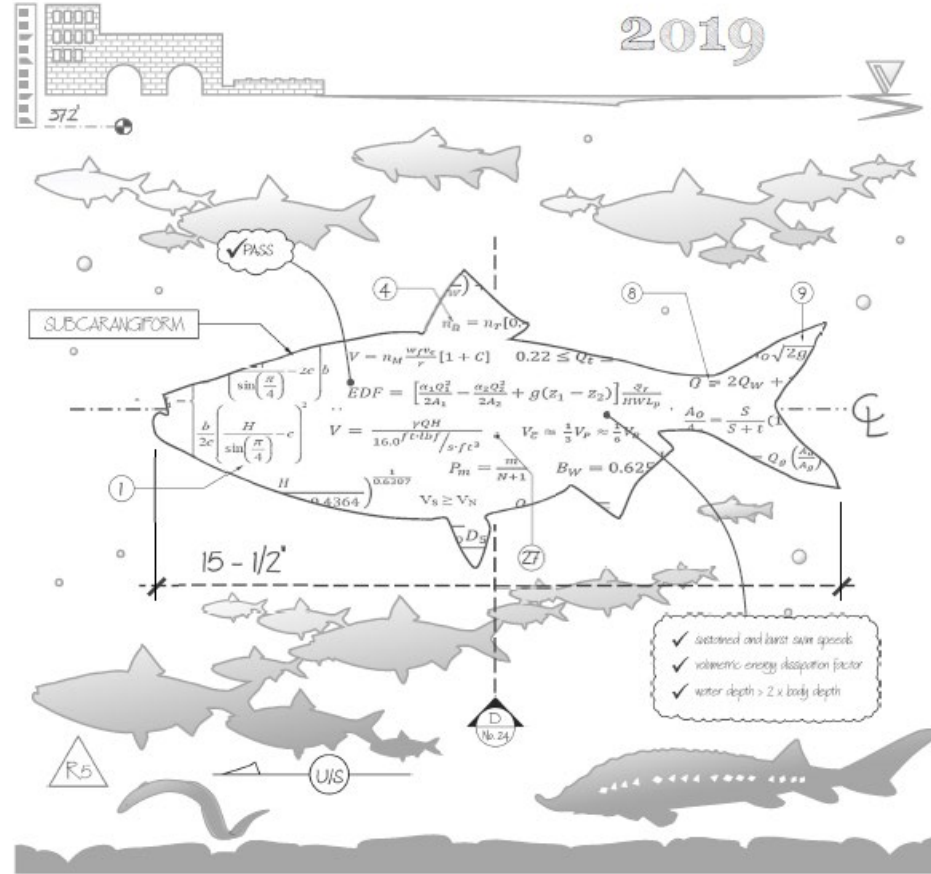


SEA LAMPREY  
*PETROMYZON MARINUS*



# FISH PASSAGE ENGINEERING DESIGN CRITERIA

2019

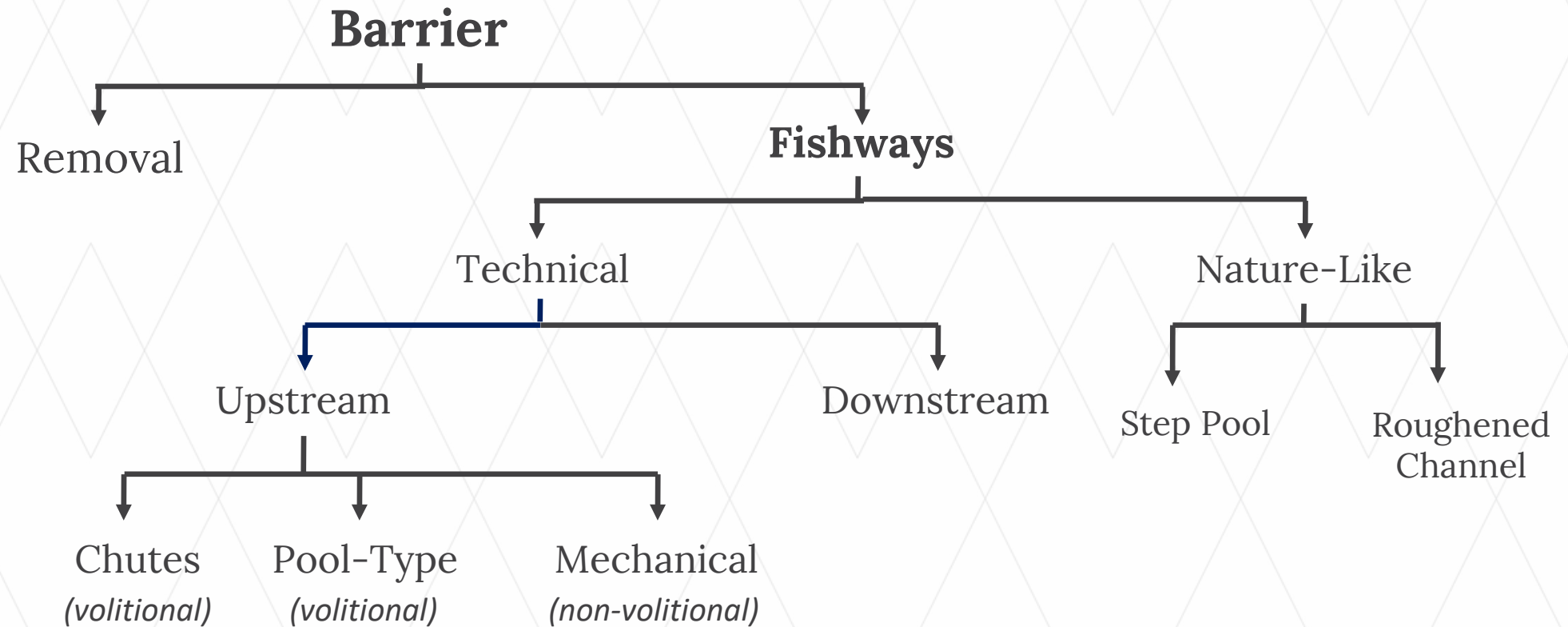


U.S. Fish and Wildlife Service Northeast Region June 2019

Fish and Aquatic Conservation, Fish Passage Engineering  
Ecological Services, Conservation Planning Assistance



# Fish Passage Options





# Attraction





# Attraction



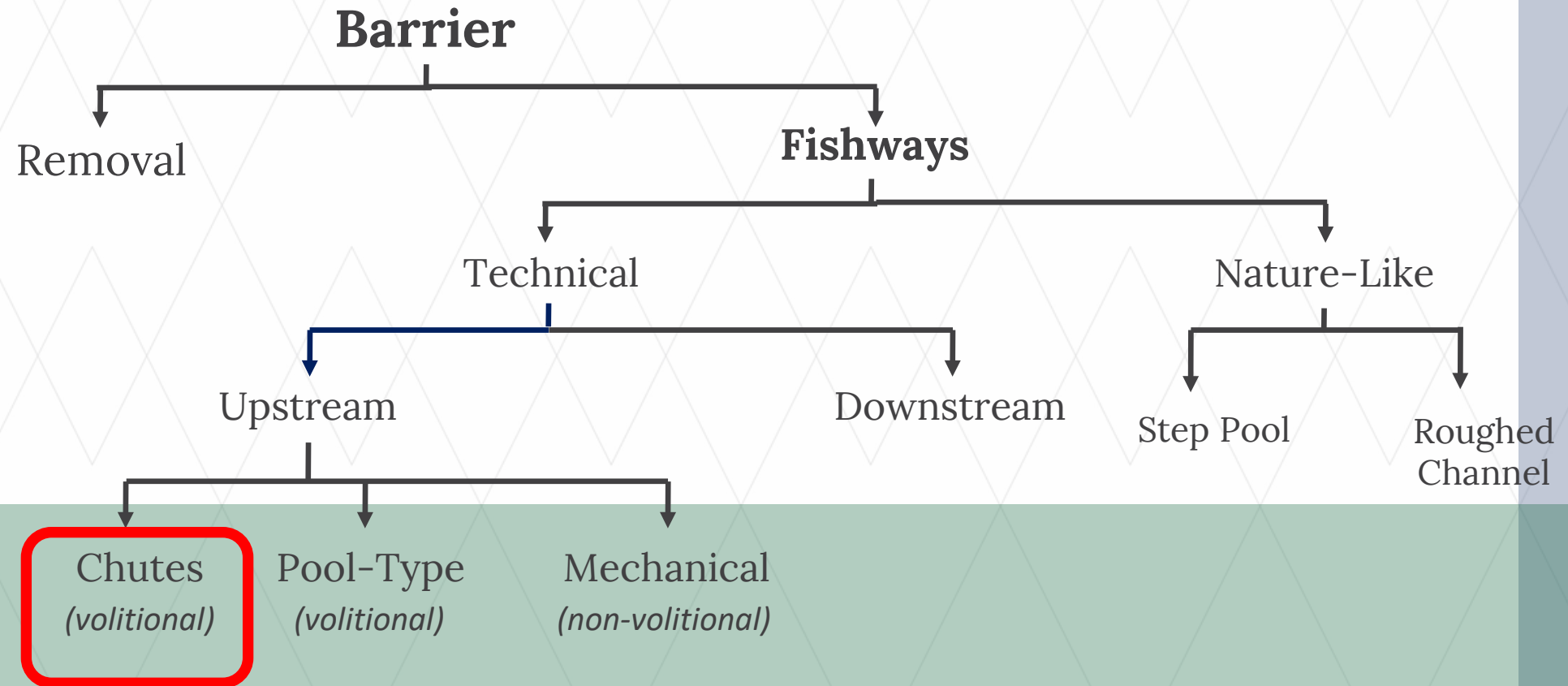


# Technical fish passage

- Made from concrete, steel or wood often comprised of uniform pools, channels, and moving parts
- Upstream and downstream are often separate fishways.
- Requires annual operation maintenance
- Ongoing assessments for standards compliance (safe, timely, effective)



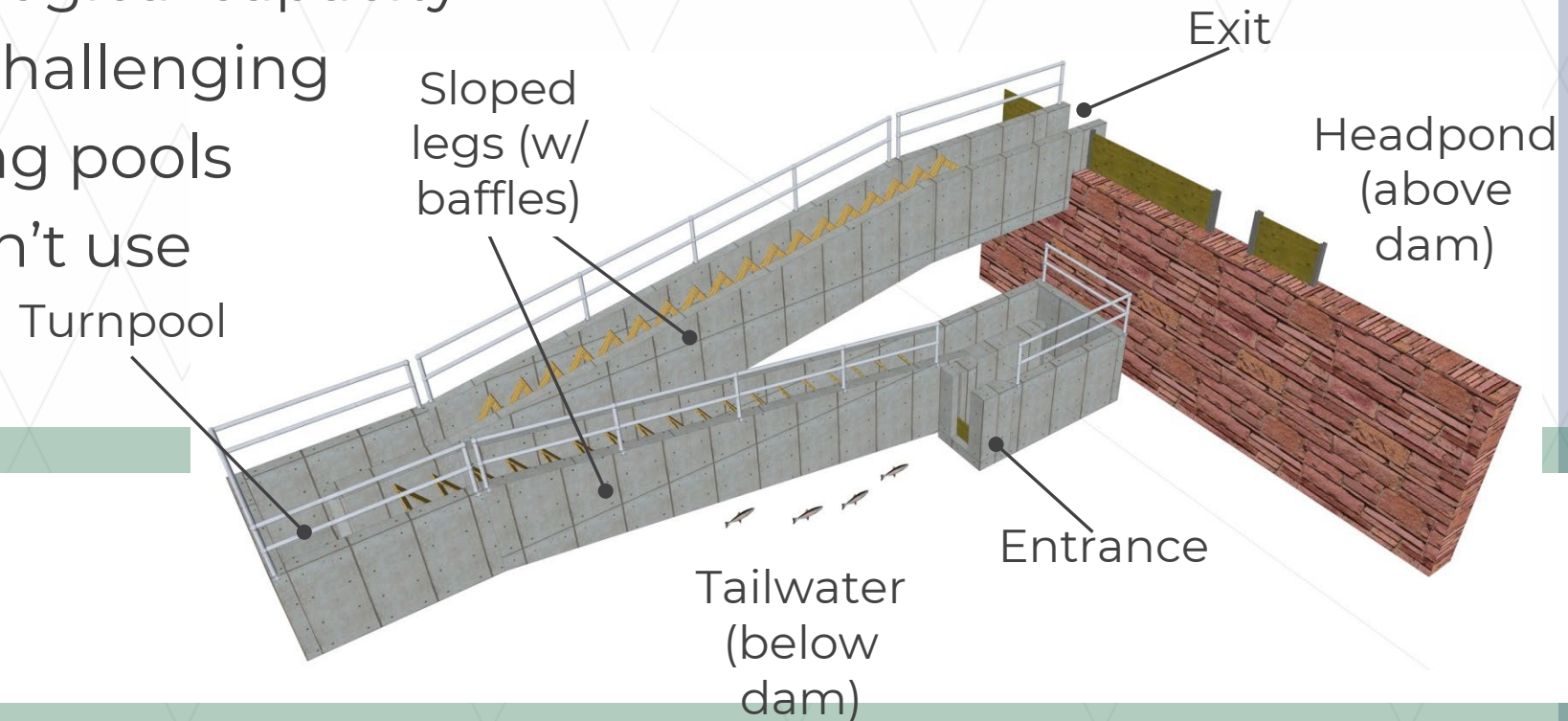
# Fish Passage Options





# Technical Denil Fishways

- Baffled-chute type fish ladder
- Typically 2-4 foot wide concrete, steel or wood channels
- Typical slopes 10-12.5%
- Flow Range – 5 to 40 cfs
- Moderate biological capacity
- Attraction is challenging
- Require resting pools
- Some fish won't use







Mayo Mill Dam, ME





Mayo Mill Dam, ME





Browns Mills Dam, ME



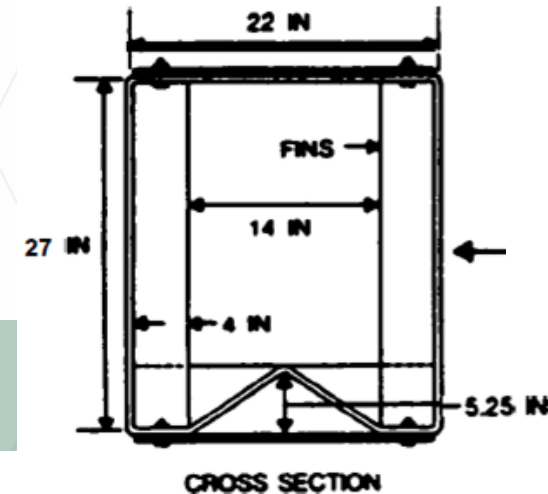
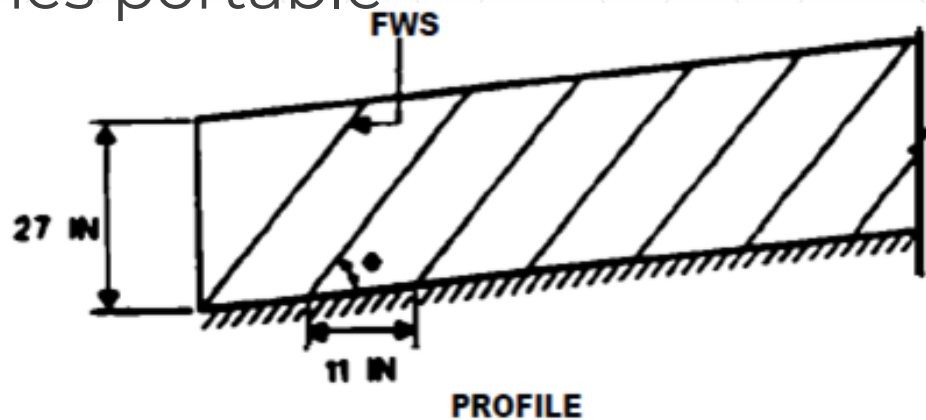


Pushaw Lake  
Hudson, ME



# Alaska Steeppass

- Baffled-chute type fish ladder
- Similar to but smaller than Denil
- Roughly 2 ft wide by 2-3 ft tall
- Typical for steep slopes (up to 25%)
- Flow Range – 3 to 15 cfs
- Lower biological capacity
- Sometimes portable





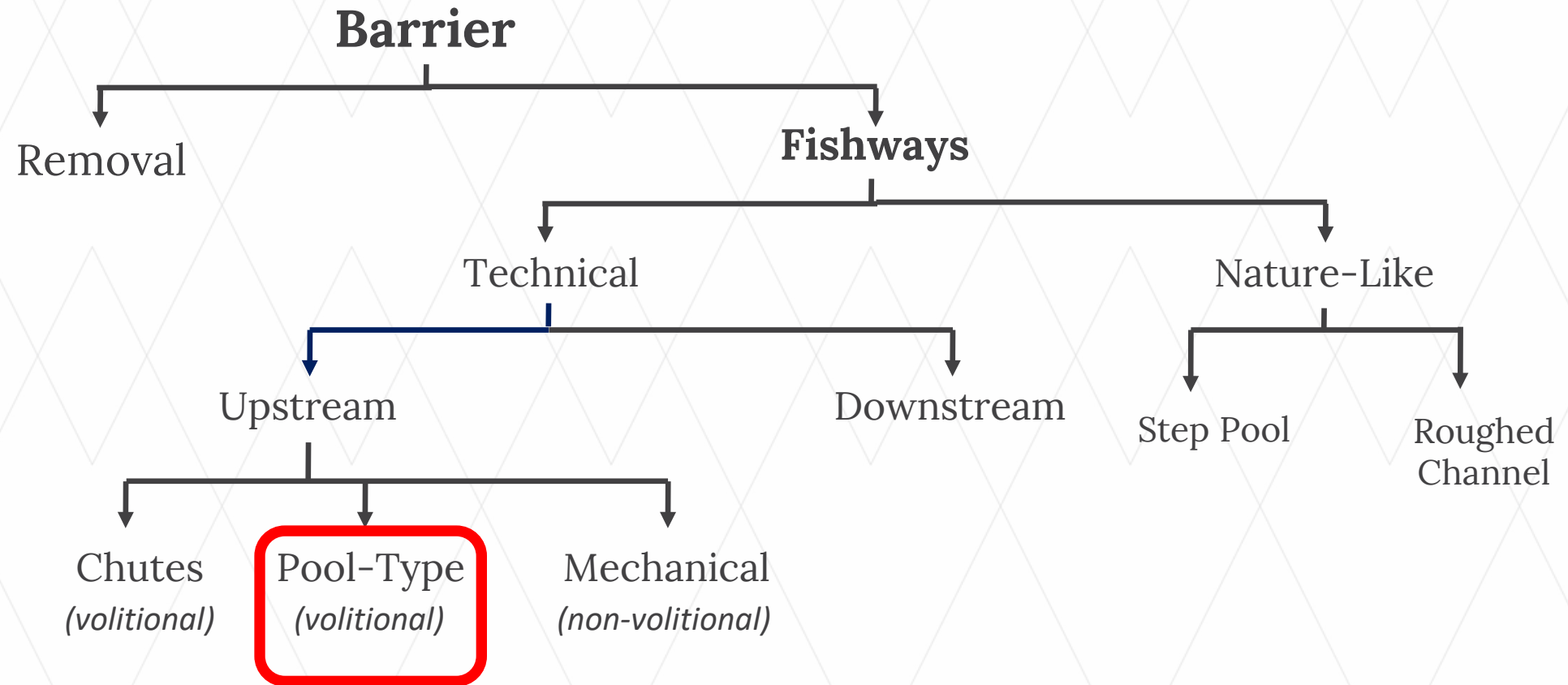
A wooden weir structure is positioned in a stream, with water flowing over it. The structure consists of a concrete or metal frame with several horizontal wooden planks across the top. A large log is resting against the left side of the weir. The water is dark and turbulent as it flows over the structure. The surrounding area is lush with green foliage, including trees and bushes, which are reflected in the water. The overall scene is a natural, outdoor setting.

Video

Davis Pond  
Eddington, ME



# Fish Passage Options





# Pool-Type (Technical)

- Category of technical fishways
- Provides resting areas between hydraulic drops
- Typically larger footprint than baffled chutes
- Max headpond swing and flows vary







Pool and weir fishway

Damariscotta, ME





Pool and weir fishway  
Maine Logging Museum, Bradley, ME



Pool and  
weir fishway

Togus Pond,  
ME





Pool and  
weir fishway

Togus Pond,  
ME







Pool and weir fishway

Bristol Mills,  
ME





# Pool-and-chute

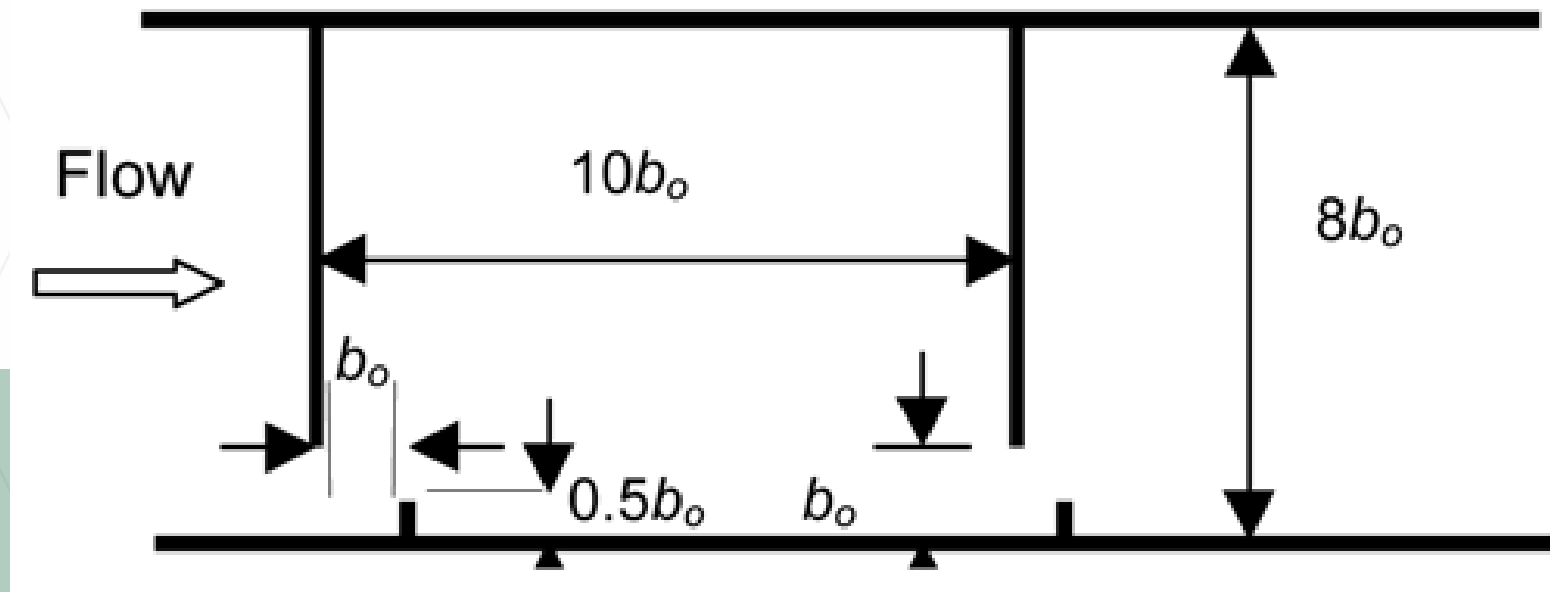
- Typical slopes (5-10%)
- Flow Range – 1-5 cfs





# Vertical Slot Fishway

- Typical slopes (10%)
- Typical Flow Range – 20 to 40 cfs (can go higher)
- Maximum headpond swing - unlimited (if you have the money of course)





# Vertical Slot Fishway (West Enfield, ME)

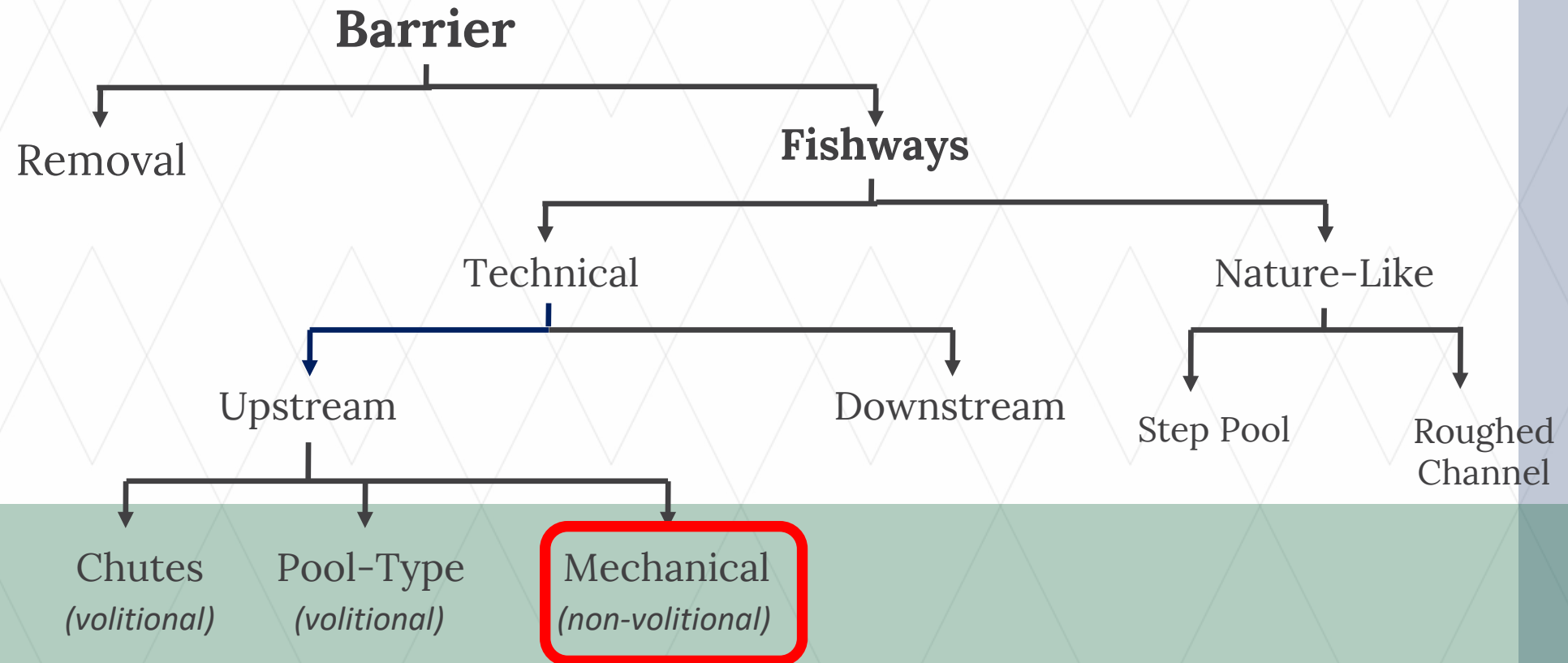


Flow Direction





# Fish Passage Options





Fish Lift, Milford Dam, ME





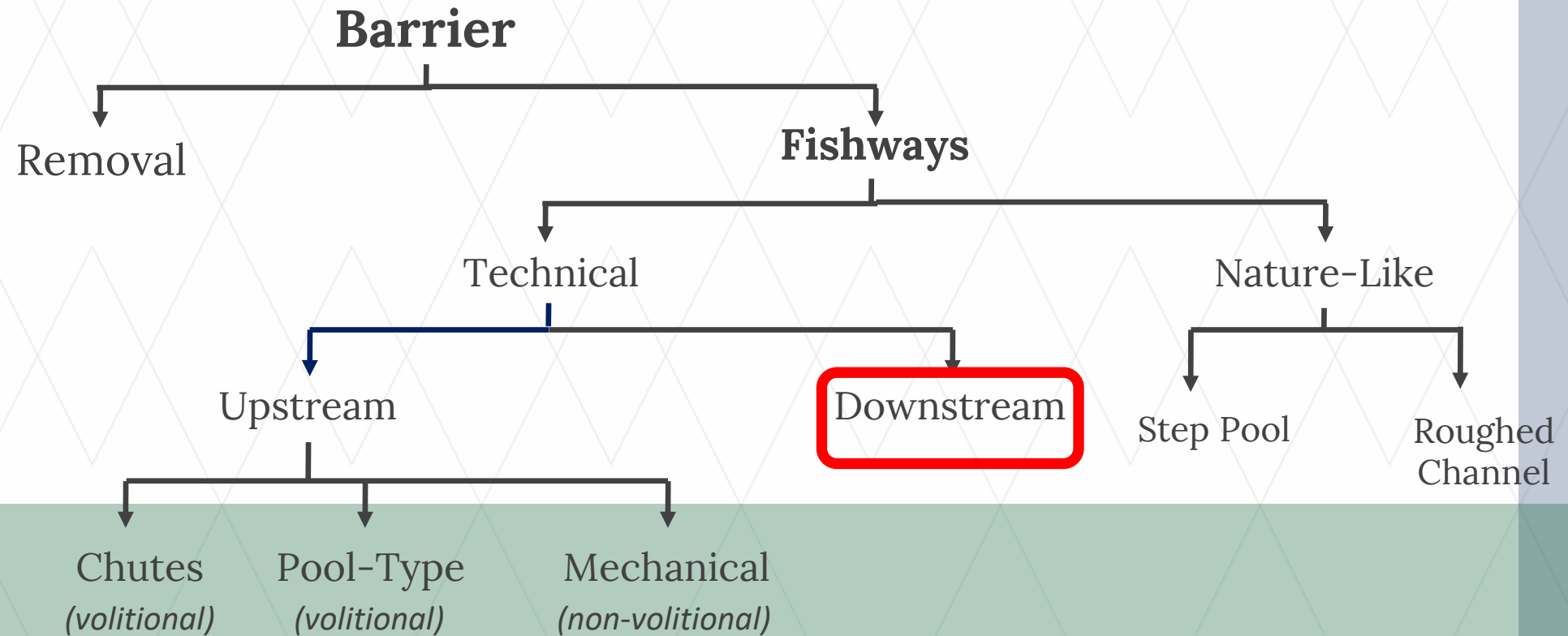


Fish lift, Milford, ME





# Fish Passage Options





# Downstream passage



Howland,  
ME



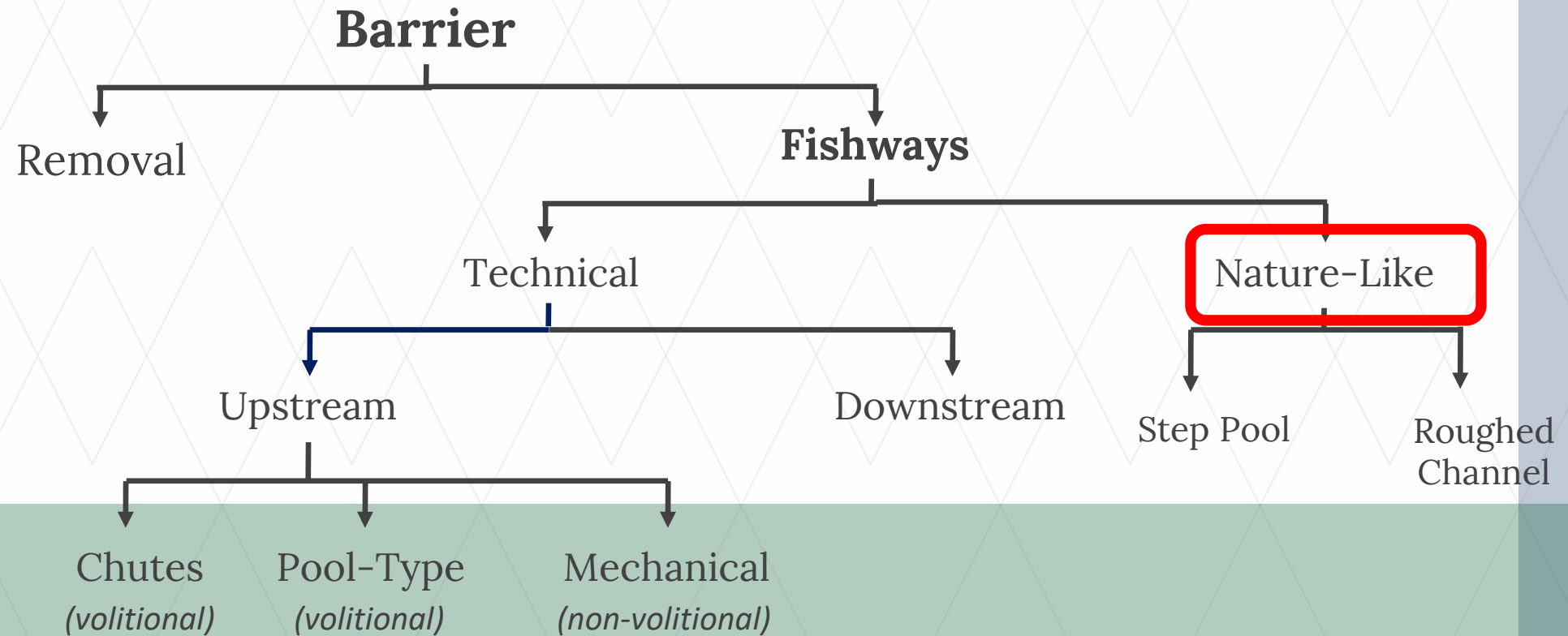


# Downstream passage





# Fish Passage Options



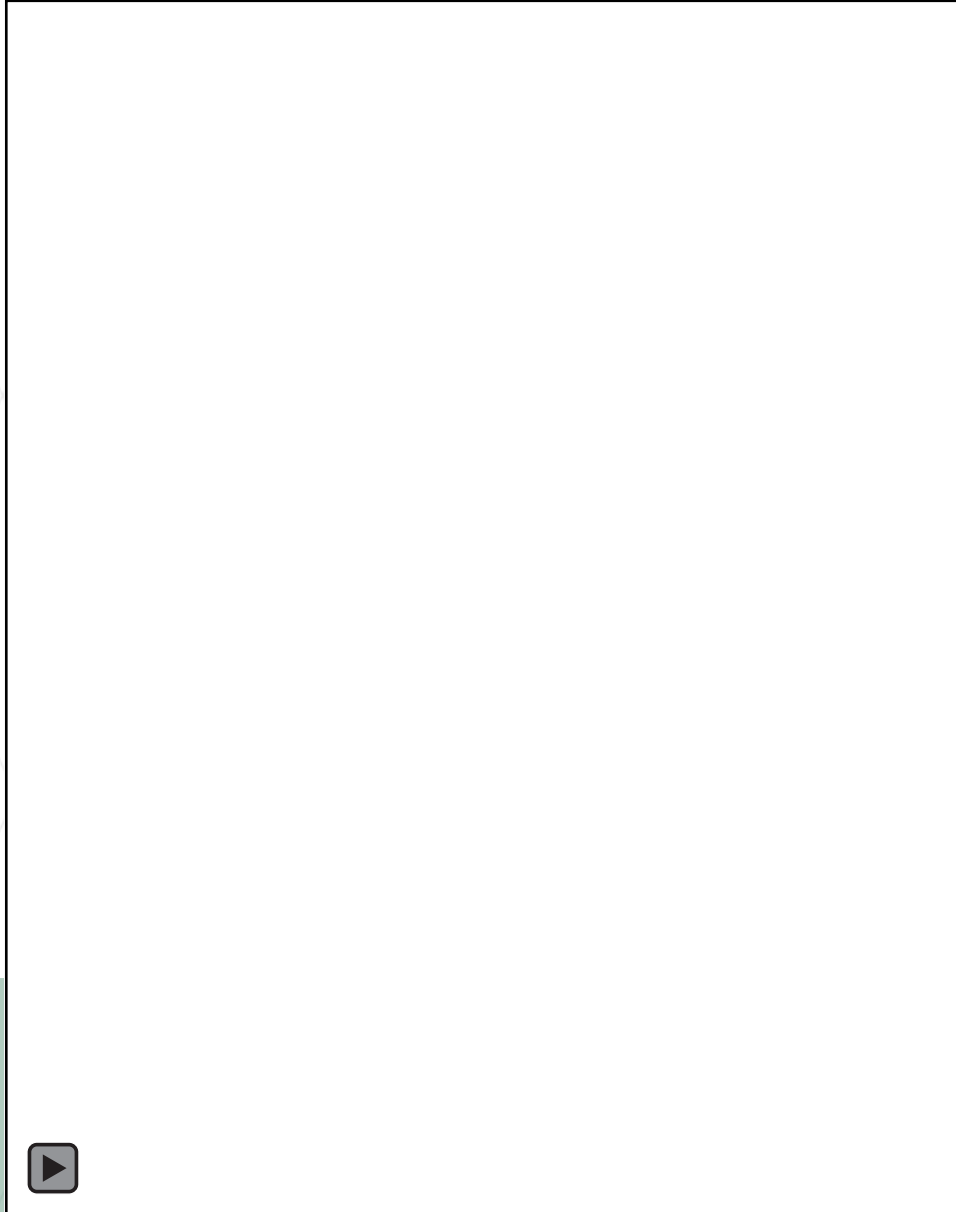


# Nature Like Fishway – Create Intuitive Currents





# Video of Step Pool Nature Like Fishway



East Branch Lake, ME



# Nature Like Fishway – Step Pool Examples





# Nature Like Fishway – Roughened Channel



South  
Branch  
Lake,  
ME



# Nature Like Fishway – Roughened Channel



Low-flow channel

Upstream Exit of nature-like fishway

V-shaped channel activated at higher flows

South  
Branch  
Lake,  
ME



# Nature Like Fishway – Roughened Channels



Photo of restored Trout Cr. (Wind R. basin) courtesy of USFS



# BEFORE Howland Fishway





# Howland Fishway - Bypass



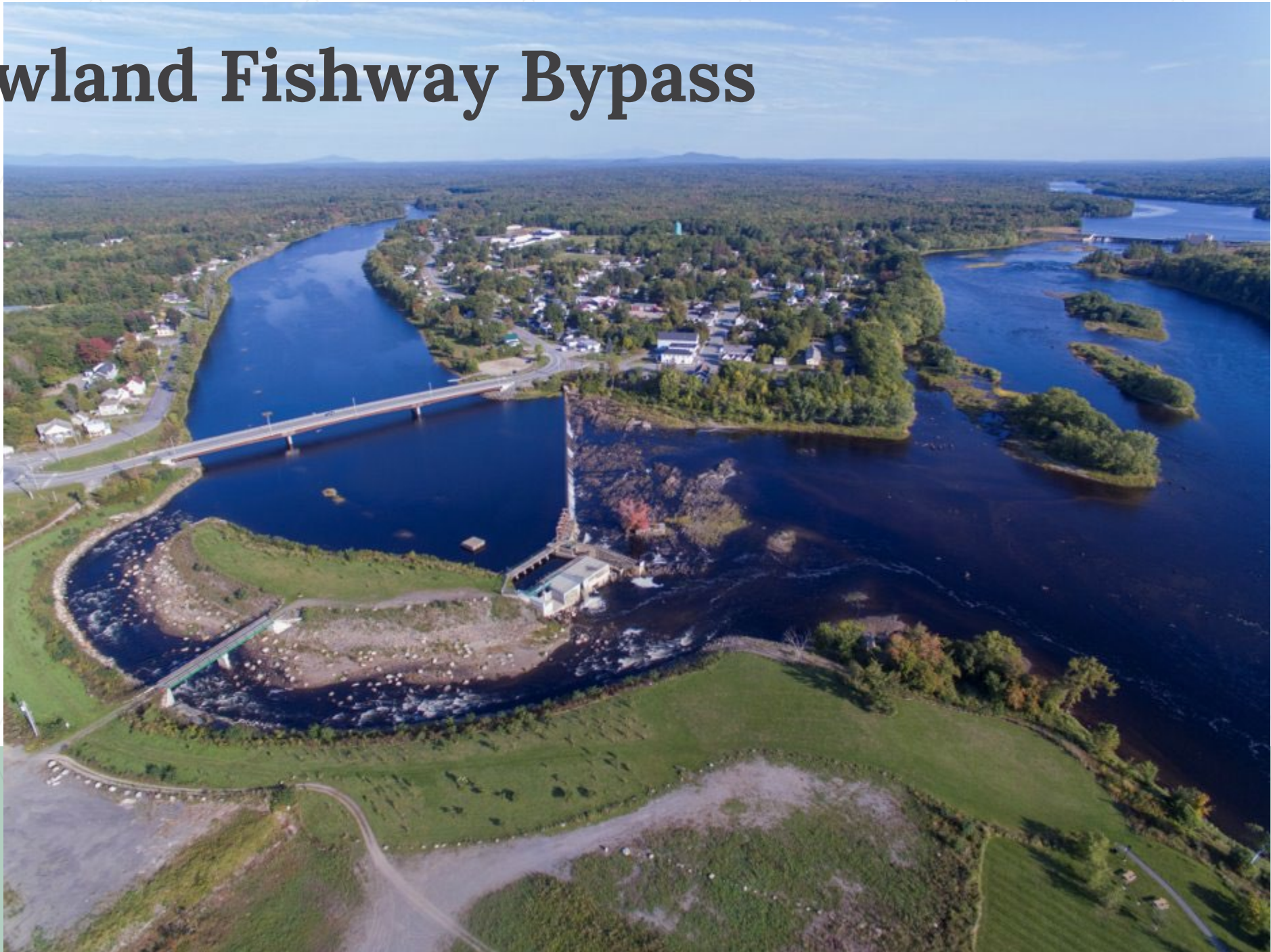


# BEFORE Howland Fishway Bypass





# Howland Fishway Bypass





# Nature Like Fishway + 2 Denil Fishways

Westbrook,  
ME

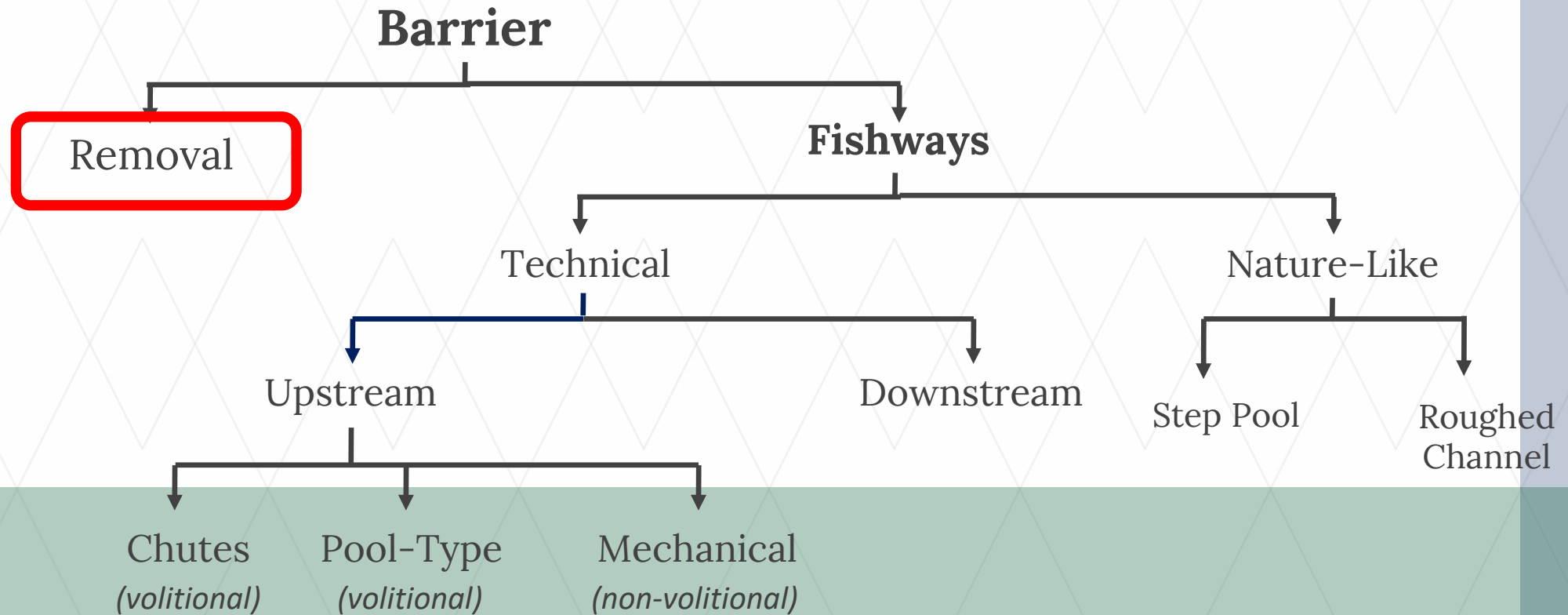


**Table 4.** Passage effectiveness rates of the double denil fishway (Denil), nature-like fishway (NLF) and the entire site.

Metric	Denil	NLF	Entire Site
Attempts	65.79%	96.00%	63.16%
Individuals	73.13%	95.92%	70.15%



# Fish Passage Options







West Winterport, ME



West Winterport, ME





# Farmington, ME





# Farmington, ME





# Coopers Mills, ME





# Coopers Mills, ME







Marland Place, MA





Marland Place, MA





Sandy River, ME





Sandy River, ME



**Questions?**



# Nature Like Fishway + 2 Denil Fishways

Westbrook,  
ME





# Coopers Mills, ME





# Coopers Mills, ME

