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Howland Dam Fish Bypass

from **Engineering With Nature: An Atlas, Volume 2.**

by **US Army Engineer Research and Development Center**

Howland, Maine, United States

Constructing the largest nature-based fish bypass channel in the nation. Dams in the Penobscot River watershed, which drains into the Gulf of Maine, have blocked fish passage since the early nineteenth century. However, reconnecting this river is a major step towards restoring Atlantic salmon in the United States and the fishery and cultural heritage of the Penobscot Nation. Therefore, in 2016, the Penobscot River Restoration Trust completed a new bypass as part of the comprehensive Penobscot River Restoration. Located on the Piscataquis River just upstream of the confluence with the Penobscot, the effort included decommissioning the Howland hydroelectric station and constructing a 30-meter-wide, 300-meter-long fish bypass channel around the spillway. With the retrofitted dam in place to maintain impounded water levels, the naturalized bypass channel has pool-and-riffle features and natural substrates to provide aquatic organism passage over a range of flows. Overall, the restoration effort is an ecologically sensitive solution to better manage the basin's ongoing hydropower generation needs while facilitating the recovery of federally listed Atlantic salmon (*Salmo salar*) and other native fish. Just two

years after completion, fish and eels have returned to the river; and monitoring data provides a valuable record for future nature-based fishway designs.

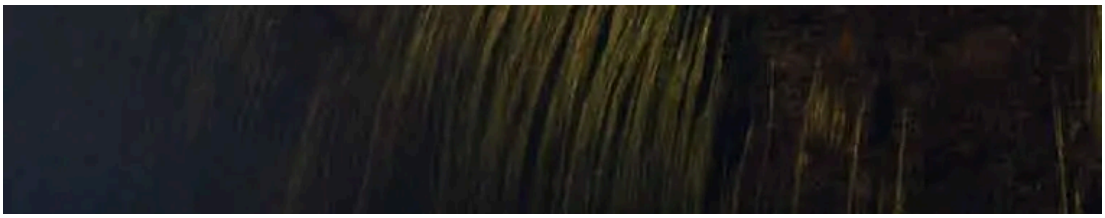
Article cover: Geomorphic features mimicking a natural stream in the bypass. (Photo by Inter-Fluve)

Producing Efficiencies

The project required an innovative blend of engineering disciplines to design the decommissioning of the powerhouse, maintain the reservoir level, and regulate high flows while also allowing for effective aquatic organism passage. In sharp contrast to most technical fishways, which have been repeated hundreds of times with relatively straightforward adjustments, natural bypass channel designs have far fewer templates or benchmarks. Therefore, because Howland is the largest and most complex bypass yet constructed in the United States—and has proven to be a successful and functional design—future projects designs now have a reference.

Using Natural Processes

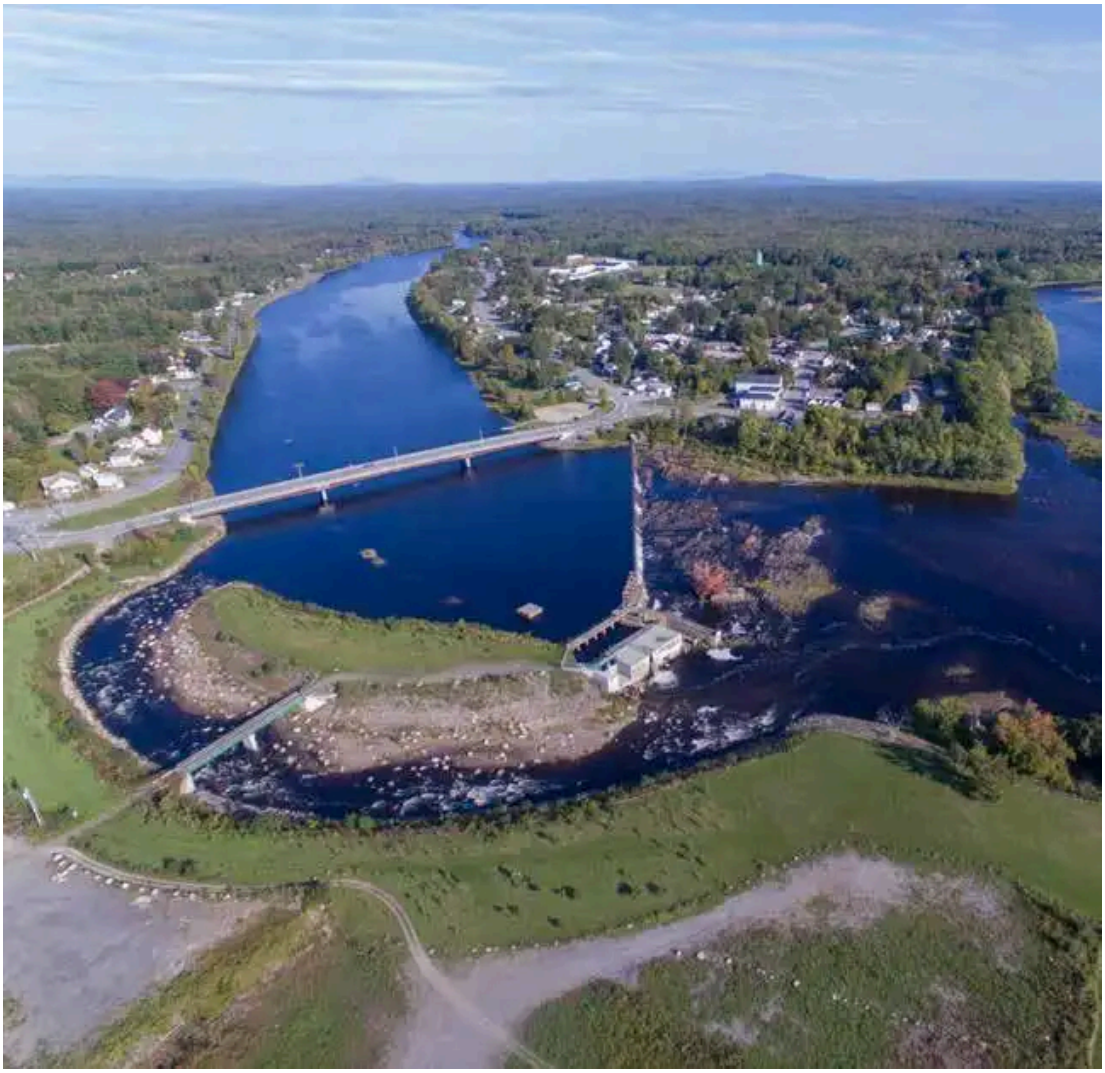
By emulating river patterns and forms closely aligned with those fish experience in a natural river network, this bypass channel will naturally allow a multitude of aquatic species to ascend past the dam. The natural pool-riffle sequences in the bypass, combined with rounded-boulder and cobble-substrate bed forms, give migrating fish a wide range of conditions to choose from, irrespective of flow levels. This bypass stands in stark contrast to traditional pool-and-weir fish ladders, which provide effective upstream passage during only narrow flow conditions.



Pools and riffles designed with hydraulic modeling.
(Photo by Inter-Fluve)

Broadening Benefits

Restoring habitat for native fish that the region relies on sustains the local and regional community. Ongoing monitoring studies have documented Atlantic salmon passage survival and efficiency at nearly 100%. Coevolved species, such as alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), are also using the fish bypass for passage and in some instances as habitat for rearing. Tied into a regional walking trail network along the river front, the project creates amenities for the town to enjoy, too. Economically, the passively functioning bypass structure minimizes ongoing and long-term operations and maintenance needs and costs.



Pools, riffles, bars, and boulders designed for stability during major flood events.
(Photo by Inter-Fluve)

A major regional trail spanning the bypass.
(Photo by Inter-Fluve)

Promoting Collaboration

Visitors marvel at the natural river channel running through the site that was, until recently, a degraded postindustrial eyesore. Led by the Penobscot River Restoration Trust, the project received monetary and technical support from more than ten different organizations, including collaborators in state and federal agencies, nongovernment agencies, the town of Howland, the Penobscot Nation, the hydropower utility in the basin, and design and construction contractors. The project serves as an outstanding example of balancing community needs while providing tangible ecosystem services to the region. Other entities are already looking to this success to inform their own designs.

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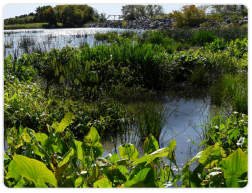

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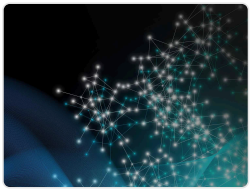

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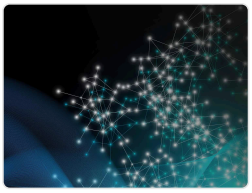

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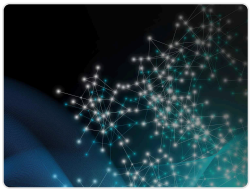

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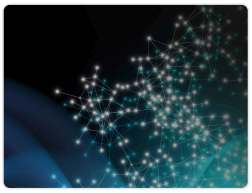

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