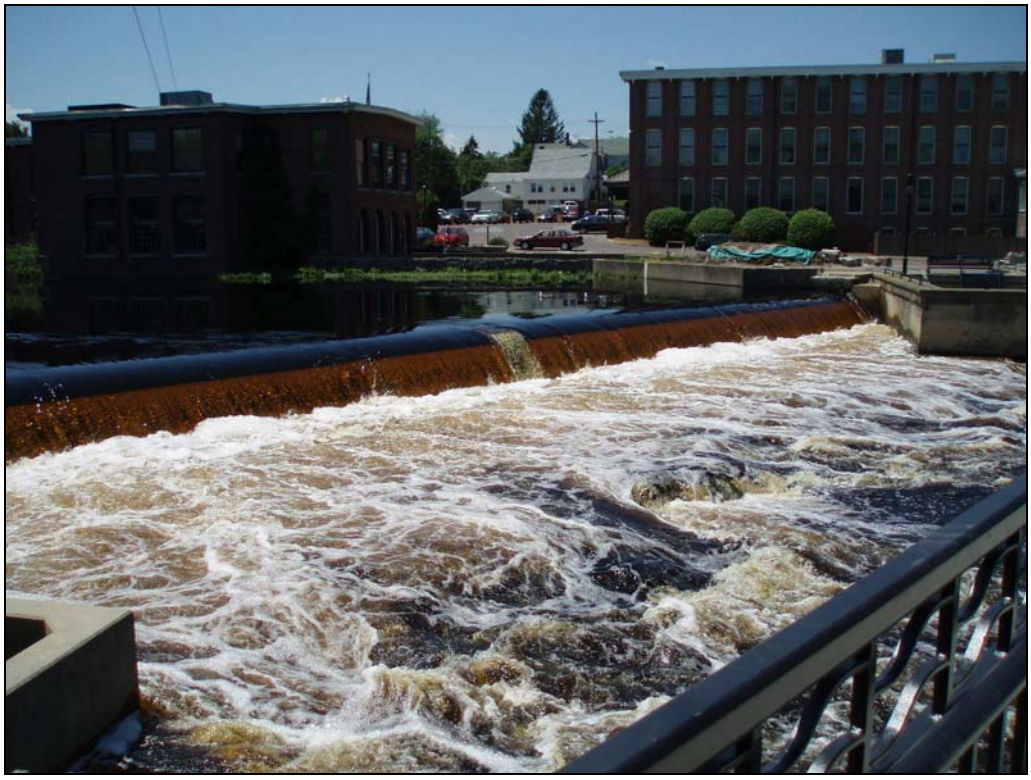
Site Reconnaissance for Ipswich River Dams

June 2006



Submitted to:

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1.0 IPSWICH RIVER DAMS

Two dams on the main stem of the Ipswich River were visited on June 16, 2006. The Bostik Dam (also known as the South Middleton Dam) is apparently owned by Bostik Inc. and located in the Town of South Middleton. It is the third dam on the main stem of the Ipswich River and is the most downstream dam without provisions for upstream fish passage. The EBSCO Dam is located in the Town of Ipswich, and is the most downstream dam on the Ipswich River.

These dams are relatively large structures and warrant detailed feasibility studies in the evaluation of removal.

1.1 Bostik Dam

1.1.1 General Site Conditions

The Bostik Dam is privately owned and currently provides water storage for an industrial facility. The primary use of the stored water is for fire suppression. The overall width of the dam is approximately 100 feet (ft), including a reported[1] spillway width of 47 ft long. A manually operated sluice gate with an approximate width of 10 ft is situated between the right abutment of the dam and the spillway. The hydraulic height of the dam was not measured during the site visit on account of high flows. The reported[1] height is six ft. The construction of the dam is reported as "stone and concrete."[1] Observations suggest that the dam is partially founded on bedrock.

A conduit located approximately 50 ft upstream of the right abutment was formally used to divert water to the adjacent Bostik industrial facility, but is no longer used for this purpose. This conduit discharges to an open channel on the east side of the Bostik industrial facility which flows back into the Ipswich River after passing under Boston Street approximately 600 ft downstream.

The owner of this dam currently maintains a warning sign to recreational boaters upstream of the dam. Limited access to the Bostik industrial facility and fencing adjacent to the right abutment precludes casual access to the dam. There are no physical restrictions to access to the left abutment. Conditions observed during the site visit suggest that hydraulic conditions immediately downstream of the dam form a "keeper" during periods of high flow; this represents a significant hazard to a person swept over the dam.

1.1.2 Restoration Overview

There appears to be wide private and public sector support for removal of the Bostik Dam, effectively clearing an initial and frequently controversial hurdle associated with dam removal. This support may provide an opportunity to leverage additional funding and support for removal. In particular, removal could provide substantial benefits to natural resources in the Ipswich River, including passage of diadromous fish, while reducing liability associated with dam ownership and maintenance.

The primary constraint on removal appears to be fire suppression needs at the adjacent Bostik industrial facility. Potential solutions to this constraint include the construction of a cistern for fire suppression or the use of municipal water service. The use of a cistern appears to be a good

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[1] Ipswich River Watershed Association Proposal to Gulf of Maine Council on the Marine Environment/NOAA Habitat Restoration Partnership

alternative, particularly during periods when the combination of low flows in the Ipswich River and leakage through the dam draw down the impoundment. Based on the observed size of the Bostik industrial facility, the use of municipal water for fire suppression may not be practical due to limited system capacity.

Construction of an upstream fish passage system may be considered as a restoration alternative at this site. This alternative would best be considered in conjunction with provisions for downstream fish passage to eliminate the possibility of trapping downstream migrating adult and juvenile fish. Provisions for downstream passage should consider limiting leakage through the dam (which has the potential to trap downstream migrating fish during periods of low flow) and providing suitable depths for downstream passage of adult fish over the spillway.

A fishpass at this site would need to pass a variety of fish, including river herring (*Alosa pseudoharengus and Alosa aestivalis*) and American shad (*Alosa sapidissima*). The need to pass American shad would likely set the minimum threshold for upstream fish passage. The most practical location for the construction of a fish passage facility appears to be adjacent to the left spillway abutment.

Denil and vertical slot fishways may be appropriate for this case. A "nature-like" bypass channel may also be appropriate, particularly given the relatively large area of undeveloped land adjacent to the left spillway abutment. The construction of a nature-like fishpass at this site is complicated by the apparent lack of sufficient spillway capacity during peak flow events. Overbank flow adjacent to the left abutment during periods of high flow could affect the stability of a bypass channel, and would need to be evaluated in the design of a bypass channel. A rock-ramp fishpass is not considered feasible at this site, as it would necessitate the placement of a large volume of fill within the river.

The existing penstock and channel system adjacent to the right abutment of the dam does not appear suitable for development as an upstream fish passage system. This is due to a drop structure at the upstream end of a culvert on the Bostik industrial facility property, the degraded condition of the culvert, and the proximity of the return discharge to the Ipswich River approximately 600 ft downstream from the dam.

Heavy equipment access to the Bostik Dam is available from the Bostik industrial facility adjacent to the right abutment and from land owned by Bostik adjacent to the left abutment.

1.1.3 Recommendations for Further Evaluation

A thorough feasibility study is recommended for evaluating alternatives associated with the removal of the Bostik Dam. While construction of a fish passage system may represent a viable alternative, a number of factors suggest that this may not be the most cost effective approach at this site. If fish passage is considered, costs should include those associated with the renovation of the dam, as the design life of a fish passage facility may exceed the expected life of the existing dam. Similarly, costs associated with dam removal should include costs connected with the replacement of critical infrastructure, such as a cistern for fire suppression water.

Following are suggested items for additional evaluation to examine the feasibility of dam removal at this site based on observations made during the site visit:

- Confirm dam ownership
- Fire suppression needs
- Backwater extent
- Socio-economic factors associated with the loss of the impoundment
- Volume of sediments upstream from the dam
- Sediment quality upstream from the dam

- Safety
- Economic analysis of dam removal versus long-term maintenance

Specific recommendations for proceeding with a feasibility study include:

- Perform a qualitative backwater assessment of the Bostik Dam impoundment.
- Obtain bathymetric and topographic data suitable for pre- and post-dam removal hydraulic modeling in and adjacent to the impoundment.
- Perform an audit of the volume of water required for fire suppression at the Bostik Facility.

1.2 EBSCO Dam

1.2.1 General Site Conditions

The EBSCO Dam is owned by the Town of Ipswich. The dam has an overall length of approximately 200 ft, including an overflow spillway approximately 120 ft long. There is no low-level outlet. A Denil fishpass was installed in 1995 adjacent to the right abutment to replace an abandoned pool-and-weir fishway.

The hydraulic height of the dam was not measured during the site visit on account of high flows, but observations suggest that this is approximately four ft during typical flow conditions. The construction of the dam was not determined as part of this study. Observations suggest that the dam is partially founded on bedrock.

Currently the dam has no functional use. The backwater extent, and volume and quality of sedimented material were not evaluated as part of this study. The lack of exclusionary fencing and ease of public access represent a potential hazard. The channel is confined by steep embankments and retaining wall downstream from the dam, representing a safety hazard during periods of high flow.

1.2.2 Restoration Overview

Removal of the EBSCO Dam could provide substantial benefits to natural resources in the Ipswich River, including passage of diadromous fish. Although a fishpass was recently constructed at this dam, it does not provide upstream passage for rainbow smelt (*Osmerus mordax*), which currently spawn in the Ipswich River downstream of the dam. In addition, there are no dedicated provisions for downstream fish passage.

Removal of the EBSCO dam would likely result in diminished flooding upstream of the dam and the restoration of riverine habitat in the Ipswich River. Constraints associated with dam removal include potential effects on two bridges downstream of the dam and loss of recreational opportunities associated with the upstream impoundment. The former constraint may be addressed through a detailed engineering analysis of flooding along this reach of the Ipswich River. Observations made during the site visit suggest that flood storage benefits associated with the upstream impoundment are minimal, due to 1) observations by others that the spillway was nearly “drown-out” during recent flood events, 2) the contraction in the river channel immediately downstream of the dam possibly acting as a hydraulic control during high flow events, and 3) the dam not being operated to maximize flood control benefits. Socio-economic constraints to dam removal may be addressed through the dissemination of information regarding potential benefits of dam removal, including reduced flooding and alternative recreational opportunities.

Heavy equipment access to the EBSCO Dam is available at both abutments.

1.2.3 Recommendations for Further Evaluation

A thorough feasibility study is recommended for evaluating alternatives associated with the removal of the EBSCO Dam. This should include technical analyses of factors associated with flooding, infrastructure effects, and sediment management and the dissemination of information relating to socio-economic benefits of dam removal.

Suggested technical analyses include unsteady (i.e., time-variant) hydraulic analyses and associated evaluations of pre- and post-removal effects on infrastructure (e.g., bridge scour) and flooding.

Following are specific items suggested for additional evaluation to examine the feasibility of dam removal at this site based on observations made during the site visit:

- Unsteady-flow hydraulic analysis
- Bridge scour analysis (pre- and post-removal)
- Improved fish passage, including rainbow smelt
- Socio-economic factors associated with the loss of the impoundment
- Volume of sediments upstream from the dam
- Sediment quality upstream from the dam
- Safety
- Economic analysis of dam removal versus long-term maintenance

2.0 CONCLUSIONS AND RECOMMENDATIONS

Dam removal appears to be a practical management for the Bostik and EBSCO dams on the Ipswich River. Although the Bostik Dam currently fulfills (i.e., provides fire suppression water), the long-term viability of this source should be evaluated along with practical alternatives. The cost of dam removal should also be evaluated relative the cost of long-term maintenance at these dams.

2.1 Probable Opinion of Cost

Probable opinions of cost were developed for the removal of the Bostik and EBSCO Dams. These cost estimates were developed using cost estimates developed for similar projects in New England.

Table 1:Probable Opinions of Cost

	Ipswich River Dams	
	Bostik Dam	**EBSCO Dam**
Feasibility Study and Conceptual Design	$45,000	$45,000
Notes		*3*
Engineering Design	$90,000	$70,000
Notes	*1*	*4*
Permitting	$100,000	$100,000
Notes		
Subtotal	**$235,000**	**$215,000**
Implementation		
Partial Breach	**N/A**	**N/A**
Notes		
Full Removal	$400,000	$350,000
Notes	*2*	*4*
Total		
Full Removal	**$635,000**	**$565,000**

General Notes

a) *Feasibility study includes evaluation of dam removal, preliminary resource determination, site-specific topographic and bathymetric survey, sediment sampling and analyses at four locations, preliminary engineering analyses (including hydrology and hydraulics), conceptual dam removal design, photo-simulations, and one pre-coordination meeting with regulatory agencies.*

b) *Implementation costs do not include removal or disposal of contaminated sediments.*

c) *Permitting costs include public meetings.*

d) *Permitting costs do not include the development of monitoring plans or post-removal monitoring.*

e) *Costs do not include those associated with Section 106 (National historic Preservation Act) Investigations.*

f) *"N/A" = Not Applicable*

g) *The opinion of probable cost presented above was developed using professional judgment and available estimated costs for similar projects.*

h) *Project benefits will offset mitigation requirements.*

i) *Different ratios of partial breach to full removal costs based on visual estimates of material requiring removal.*

j) *It was assumed that bundling of adjacent dams would not discount bundled permit cost.*

Specific Notes:

1) *Includes design of cistern for fire-suppression water storage.*

2) *Includes construction of cistern for fire-suppression water storage.*

3) *Includes preliminary evaluation of effects on bridge scour downstream from dam.*

4) *Assumes effects on bridge scour are minimal and do not require action.*

3.0 PHOTOS

3.1 Bostik Dam

Photo 1: Bostik Dam

Photo 2: Low-Level Outlet

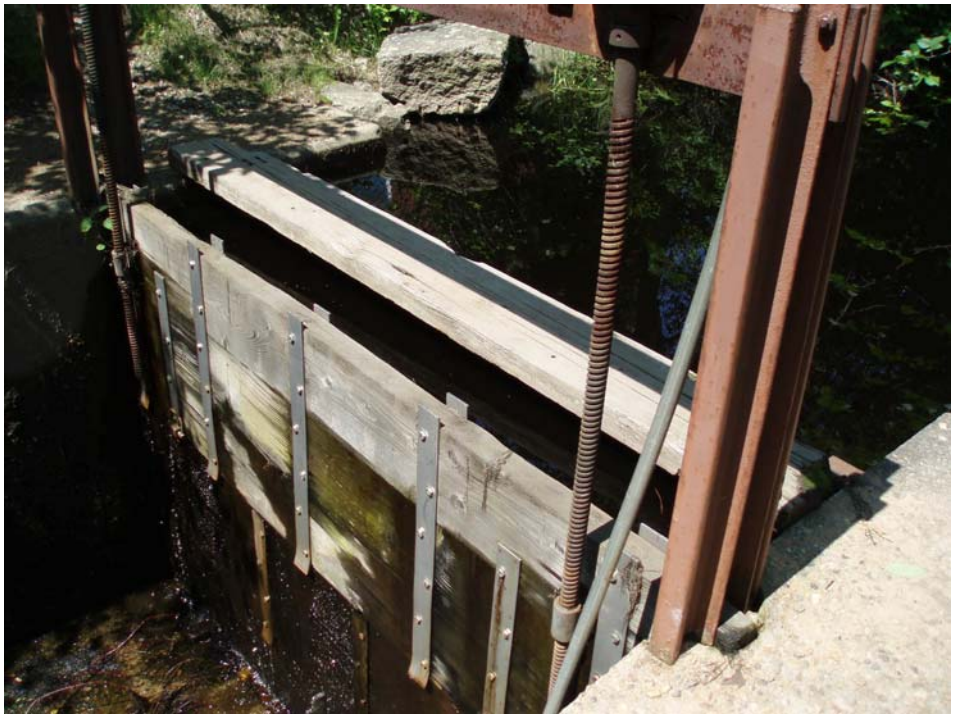


Photo 3: Low-Level Outlet and Spillway (background)

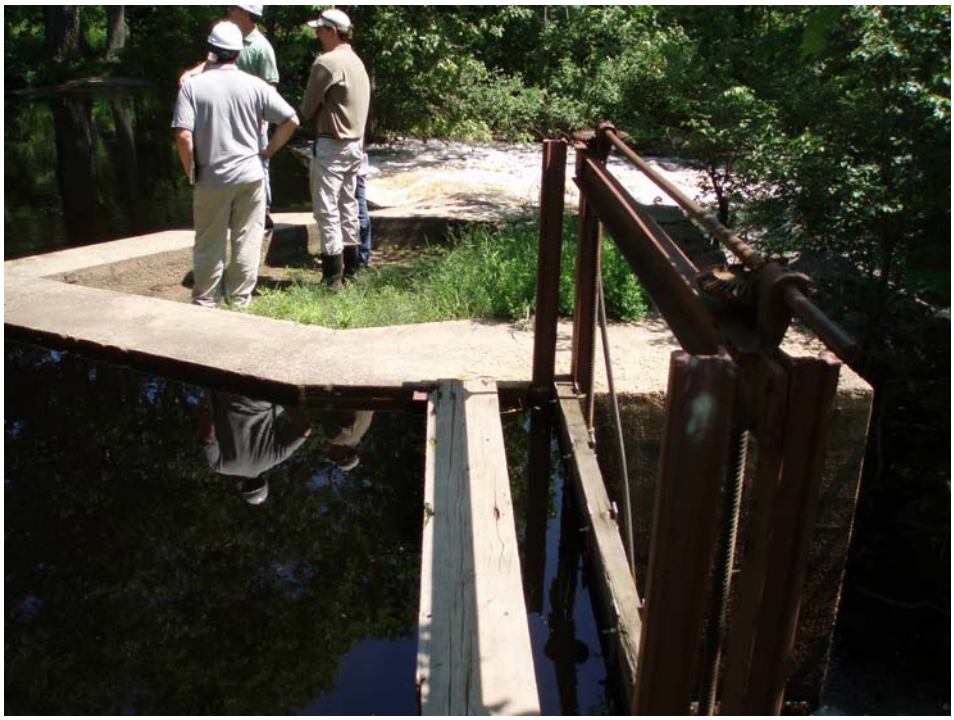
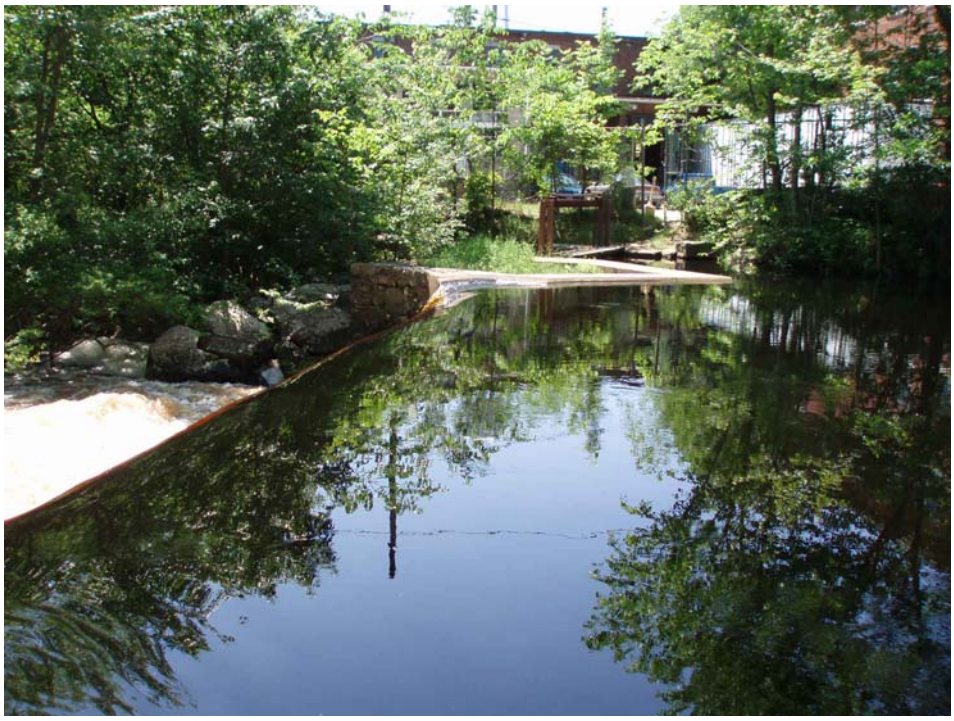


Photo 4: Spillway and Low-Level Outlet from Left Abutment



3.2 EBSCO Dam

Figure 1: EBSCO Dam

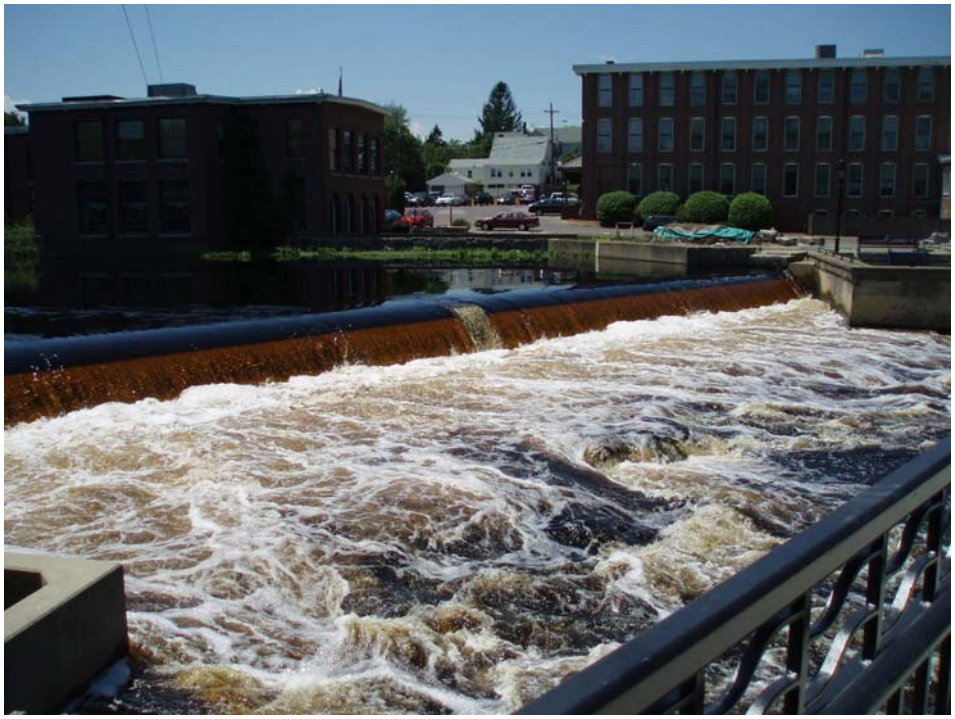


Figure 2: Abandoned Pools and Weir Fishpass (left) and Denil Fishpass (right)

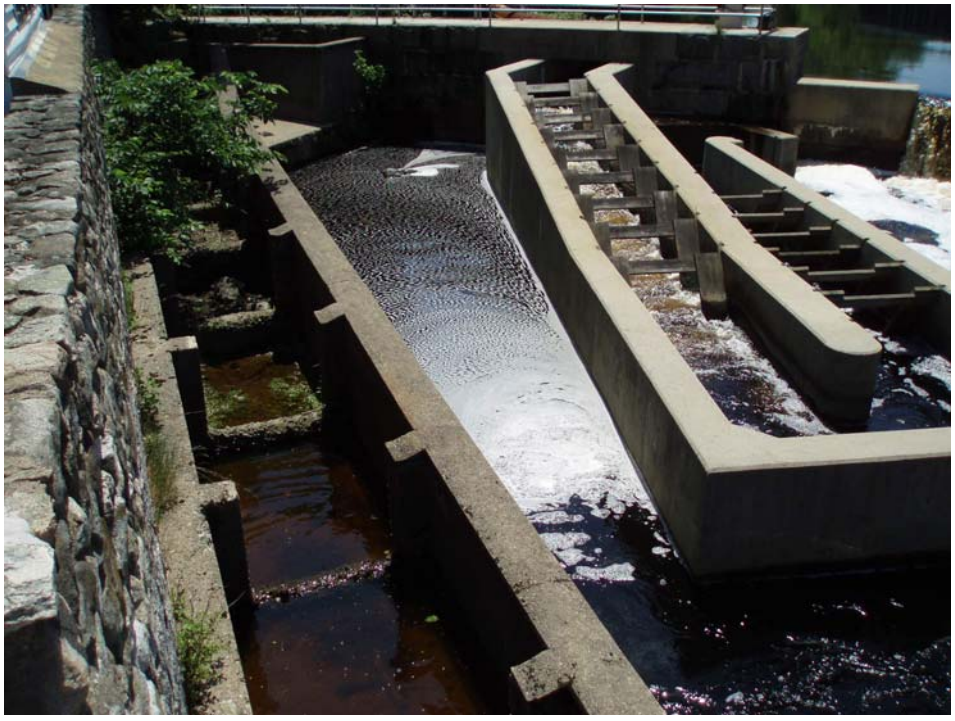


Figure 3: First Bridge over Ipswich River Downstream from EBSCO Dam