OVERVIEW

• PROJECT PURPOSE
• EXISTING ENVIRONMENT
• TECHNICAL ASSESSMENT
• RESTORATION ALTERNATIVES
• SUMMARY / NEXT STEPS
• QUESTIONS
PROJECT SUPPORT

• Partners/technical assistance:

- Project Lead
- Project Partners
- Project Consultants

• Funding:
  Nyanza Natural Resource Damages Settlement
PURPOSE
Evaluate the feasibility of restoring populations of diadromous fish to the Concord, Sudbury, and Assabet Rivers
WHY? – Reasons to Restore Passage

• **Importance of target species** – ecosystem functions, commercial/recreational fisheries, cultural values, range, etc.

• **History** – historical presence of diadromous species in the Concord River is well documented

• **Habitat** – significant lacustrine and riverine spawning and rearing habitat exists upstream of Talbot Mills Dam

• **Connectivity** – the Concord River is low in the Merrimack River watershed and fish must only navigate past one dam before reaching the it

• **Support** – active and involved watershed associations, volunteer organizations, community members, and state/federal agencies support restoration

• **Public Input** – one of 12 projects identified in the Nyanza Restoration Plan, which resulted from public input process
EXISTING ENVIRONMENT
TARGET SPECIES

Blueback herring

Alewife

American shad

American eel

Sea lamprey
TARGET SPECIES - Life Cycles

River Herring & American Shad

**SPRING:** Adults migrate to freshwater rivers to spawn, then return to the ocean.

**SUMMER:** Juveniles use rivers and estuarine waters as nursery areas.

**FALL:** Juveniles move out to the ocean, joining adults.

**WINTER:** Juveniles stay in near-shore ocean waters until sexual maturity at 3-6 years.

| FRESHWATER: 0 ppt (parts per thousand) salinity | ESTUARY: 0-30 ppt | OCEAN: 30-35 ppt |

- mature adults 3+ years
- immature 1 to 3 years
- juveniles 0 to 1 year
- eggs
TARGET SPECIES - Life Cycles

American Eel

Sea Lamprey

Sargasso Sea

Glass Eel

Larva, or “leptocephalus”

Eggs

Stages spent in freshwater

Yellow Eel

Stages spent at sea

Silver Eel

Eel
TARGET SPECIES - Importance

ECOSYSTEM FUNCTIONS

FISHERIES (COMMERCIAL & RECREATIONAL)

RANGE

CULTURAL VALUES
TARGET SPECIES – Population Trends

Fish returns for Merrimack River at Essex Dam in Lawrence, MA
WATERSHED – Potential Habitat

Fish passage at Talbot Mills Dam would open access to:

- **35 miles** (740 acres) of mainstem rivers
- **100 miles** of tributaries
- **260 acres** of lakes and ponds

(Not including areas that could be accessed with fish passage at upstream dams)
WATERSHED – State & Federal Recognition

Great Meadows National Wildlife Refuge
Concord/Sudbury Units

Great Cedar Swamp ACEC

Sudbury, Assabet, & Concord Wild and Scenic Rivers

Legend
Wind and Scenic River Designation

Concord River
6 miles ending at the River 3 Bridge in Billerica

Assabet River
4.4 miles beginning 1,000 feet below the Wisherd Dam Control Dam

Sudbury River
36.6 miles beginning at the Endicott St Bridge above the Sudbury Dam in Framingham
WATERSHED – Flooding

March 2010 Flood in Billerica
FISH PASSAGE OBSTACLES
OBSTACLES - Middlesex Falls

- Breached Middlesex Dam
- Fish Passage Route
- Former Mill Race / Power Canal
- Concord River

Imagery Source: Bing, 2015
OBSTACLES - Middlesex Falls

- Former Middlesex Dam (breached in 1980s)
- 2000 NRCS/USFWS survey
- Possible fish passage impedance at some flows
- Minor channel modifications may improve passage
- Potential use of former raceway channel
OBSTACLES - Centennial Falls Dam

- Impoundment
- Centennial Falls Dam
- Fish Ladder & Downstream Bypass
- Concord River Bypass Reach
- Power Canal
- Gatehouse

Imagery Source: Bing, 2014
OBSTACLES - Centennial Falls Dam

- 8-foot-high dam with hydropower (22-foot hydraulic head)
- Fish ladder & downstream bypass sluice added in 1990
- History of deficiencies
- More recent active management and coordination
- River herring observed in fish ladder in 2015
OBSTACLES - Talbot Mills Dam

- Faulkner Mills Complex
- Parking Lot
- Park
- Sluiceway
- Faulkner St Bridge
- Sluiceway Outlet
- Concord River
- Impoundment (Mill Pond)
- Former Intake Structure
- Former Warehouse
- Old Middlesex Canal Alignment

Imagery Source: Bing, 2015
OBSTACLES – Talbot Mills Dam

- 10-foot-high former mill dam
  - Primary spillway (127 ft)
  - Abutments
  - Non-overflow section
  - Former intake structure
  - Sluiceway

- Privately owned
  (CRT Development Realty, LLC)

- No current fish passage facilities
TALBOT M ILLS DAM – Dam Safety

• 2015 inspection
  • Intermediate size, significant hazard, fair condition
  • Deficiencies:
    • Lack of operation & maintenance plan, routine oversight
    • Lack of working controls, low level outlet, emergency bypass
    • Seepage in the abutments
    • Trees below spillway and on embankment
  • Estimated repair cost: $105,000+

• Feasibility study findings
  • Does not meet regulations to pass spillway design flood
  • NOT a flood control dam
The Concord River evolves over thousands of years post-glaciation without a dam

The site is a Native American encampment and fishing grounds with exposed falls

Pre-dam colonial use of river’s fisheries

~ 9000 BC 1653 1711
TALBOTT MILLS DAM – History

1710
First legal contest; dam owner ordered to pay restitution

1721
Dam removed by order of court

1722
Dam rebuilt

1723
Dam forcefully removed by angry band of farmers

Soon after 1723

1739
Sawmill added

1747
Clothworks added

1791
Fishway added

1798
New dam built

1809
Legal effort to remove dam; dam retained

~1800
Dam raised for new canal system

1815
Legal effort to remove dam. Dam retained

1829
New dam built; old dam retained just upstream

1839
Henry David Thoreau writes about removing the dam with a crow-bar

1859
Dam ordered removed again; dam owner compensated with steam-powered generator for mill

1861
Civil War starts; all efforts to remove dam cease

1861
Dam owner files to repeal dam removal decision, but loses appeal

1859
Canal charter revoked; Henry David Thoreau surveys river gathering evidence for the defendants looking to remove the dam

~1980
Fishway filled in with concrete

1983
Mill Dam area recognized as historically significant

1987
Textile Mill closes

2014-16
Feasibility study to restore fish passage

Pre-dam colonial use of river's fisheries
TALBOT MILL DAM - History

1798 "legacy dam" submerged upstream

Current (1828) dam

1798 "legacy dam" submerged upstream

Ingraham, 2009
“...so long as there shall be kept and upheld, a dam across Concord River, in the Town of Billerica...there shall be kept open at the usual place in said dam, a sluice or passage way for fish to pass up and down the river through said dam, from the first day of April to the twentieth day of May in each year...” (1820 Chap. 0070)
OTHER INFRASTRUCTURE

Middlesex Canal

Billerica Water Supply Intake

Faulkner St Bridge

Pollard St Bridge

Boston Rd/Rte 3A Bridge
TECHNICAL ASSESSMENT
PROJECT SCOPE

• TOPOGRAPHIC SURVEY

• SEDIMENT ANALYSIS

• HYDROLOGIC ANALYSIS

• HYDRAULIC ANALYSIS

• CULTURAL RESOURCES ANALYSIS
FIELD DATA - Topographic Survey

Middlesex Falls

Talbot Mills Dam
FIELD DATA - Sediment Quantity
FIELD DATA - Sediment Quality

- **Sediment quantity:**
  - ~18,200 CY total sediment
  - ~9,500 CY mobile sediment

- **Sediment quality:**
  - Overall low pollutant concentrations
ANALYSIS – Hydrology

- Flood Frequency Analysis (post-1970)
- Flood Frequency Analysis (full record, 1938-2014)
- Flood Frequency Analysis (pre-1970)
- Effective FIS (1983 Analysis)

Graph showing flood discharge (cfs) vs. recurrence interval (years).

Average Daily Flow Duration Curve for Concord River at Talbot Mills Dam

Graph showing percent of time flow is equalled or exceeded.
ANALYSIS - Hydraulics

Talbot Mills Dam

Middlesex Falls

Legend:
- WS Q500
- WS Q100
- WS Q2
- WS Normal
- WS Low
- Channel Bottom

Main Channel Distance (ft)
CULTURAL RESOURCES

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT (NHPA):

“...take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register”.

106 PROCESS (CONSULTATIVE):
1. Determine where the project may result in effects to historic properties (the APE)
2. Identify historic properties
3. Assess the potential impacts of the project to those properties
4. Seek ways to avoid, minimize, or mitigate adverse effects (M OA)

HISTORIC / ARCHAEOLOGICAL RESOURCES RECONNAISSANCE SURVEY (2015)
- Identified properties and sensitive archaeological areas
- Assessed potential effects for the project alternatives
CULTURAL RESOURCES – Architectural / Industrial

Talbot Mills Dam (aka Middlesex Canal Dam and Locks—MHC No. BIL.900/BIL-HA-09) within 2 historic districts listed in the National Register:

• Middlesex Canal Historic and Archaeological District (MHC Nos. BIL.T, BIL.K, BIL.P)

• A potential contributing resource to the Billerica Mills Historic District (MHC Nos. BIL.O, BIL.E)

Project APE contains multiple resources relating to the 2 districts.
Four recorded pre-contact Native American “village” sites upstream and downstream of the Talbot Mills Dam

Four contributing archaeological resources to the Middlesex Canal Historic and Archaeological District:
- Middlesex Canal Lock and Dam Site;
- Middlesex Canal Prism;
- Floating Towpath Peninsula;
- Anchor Stone

Potential for 1798 wood dam remains (underwater) a few feet upstream of the current dam site

Potential for belowground mid-19th c. dye/store house used by the Faulkner Manufacturing Company
RESTORATION

ALTERNATIVES
MIDDLESSEX FALLS

- No Action
- Channel Improvements (1A)
- Other concepts considered:
  - Former raceway channel
  - Fishway
  - Abutment removal
MIDDLESSEX FALLS
CENTENNIAL FALLS DAM

- No Action
- Fishway Improvements (2A)
  - Fish ladder entrance
  - Tailwater staff gage
  - Trash rack
- Volunteer Coordination (2B)
  - Part-time coordinator
  - Training & observation (video monitoring system)
  - Education & outreach
TALBOT M ILLS DAM

- No Action
- Technical Fishway (3A)
- Partial Dam Removal (3B)
- Other concepts considered:
  - Nature-like fishway
    - Rock ramp
  - Bypass channel
  - Sluiceway bypass channel
TALBOT MILLS DAM – Technical Fishway

- Denil fish ladder
- Eel ramp
- Downstream passage notch & plunge pool
- Water controls (stoplogs, flashboards)
TALBOT MILLS DAM - Technical Fishway
TALBOT M ILLS DAM - Dam Removal

- Removal of primary spillway & legacy dam
- One or both abutments could optionally remain
- Preliminary recommendation for instream sediment mgmt.
TALBOT MILLS DAM - Dam Removal
FACTORS TO CONSIDER

- Dam safety/liability
- Public water supply
- Cultural resources (historic structures, Native American artifacts, etc.)
- Fisheries (passage, assemblage, etc.)
- Water quality (sediment, temperature, etc.)
- Water quantity (upstream water levels, flooding, etc.)
- Wetlands
- Abutter interests
- Public access/recreation
- Aesthetic resources
- Economic impact (businesses, tourism, property taxes, etc.)
- Cost (additional studies, engineering, permitting, construction)
- Ongoing operation and maintenance
# TALBOT MILLS DAM – Decision Matrix

<table>
<thead>
<tr>
<th>ALTERNATIVE</th>
<th>No Action</th>
<th>Technical Fishway</th>
<th>Dam Removal</th>
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<tr>
<td><strong>POTENTIAL BENEFITS</strong></td>
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<tr>
<td>Upstream passage of target fish species</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>Downstream passage of target species</td>
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<tr>
<td>Passage of other species (connectivity)</td>
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<tr>
<td>Improved water quality &amp; aquatic habitat</td>
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<tr>
<td>Reduction of invasive species</td>
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<td>Restoration of natural wetland habitat</td>
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<tr>
<td>Restoration of ecological functions (e.g., sediment transport)</td>
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<td>Reduced upstream flooding</td>
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<tr>
<td>Improved recreation</td>
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<td>Subjective</td>
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<tr>
<td>Improved aesthetics</td>
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<td>Decommissioning of aging infrastructure</td>
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<td>Environmental justice for Nyanza</td>
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<tr>
<td><strong>POTENTIAL IMPACTS</strong></td>
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<td>Blockage of fish passage</td>
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<td>Impairment of water quality</td>
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<td>Fragmentation of aquatic habitat</td>
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<td>Rare/threatened/endangered species</td>
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<td>Loss of upstream wetlands</td>
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<td>Impoundment of sediment</td>
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<td>Sediment management impacts</td>
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<td>Artificial upstream flooding</td>
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<td>Reduction of spillway capacity</td>
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<td>Water supply impacts</td>
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<td>Infrastructure impacts (e.g., bridges)</td>
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<td>Cultural resources impacts</td>
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<tr>
<td>Recreation impacts</td>
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</tr>
<tr>
<td>Aesthetic impacts</td>
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</tr>
<tr>
<td><strong>OTHER FACTORS</strong></td>
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</tr>
<tr>
<td>Permitting effort</td>
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<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Operation &amp; maintenance</td>
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<td>High</td>
<td>None</td>
</tr>
<tr>
<td>Estimated cost (engineering, permitting, construction)</td>
<td>$105k+</td>
<td>$590k</td>
<td>$470k</td>
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</tbody>
</table>

*Note: The decision matrix highlights the potential benefits and impacts of alternative actions for the TALBOT MILLS DAM, focusing on fish passage, water quality, habitat restoration, and other factors. The decision process involves evaluating the potential benefits and impacts to make an informed choice.*
CULTURAL RESOURCES – Architectural/Industrial

IMPACTS/EFFECTS AND RECOMMENDATIONS – Fish Ladder

Design of fish ladder should conform to the Secretary of the Interior’s Standards for the Treatment of Historic Properties (36 CFR Part 68) to minimize potential adverse effects to the districts.

Notch in dam spillway would result in adverse effect—to the dam, also if the impoundment water level is so low that it changes relationship between canal components.

IMPACTS/EFFECTS – Partial Dam Removal

Adverse effect on the Middlesex Canal Historic and Archaeological District and the Billerica Mills Historic District.
CULTURAL RESOURCES – Archaeological

RECOMMENDATIONS – Technical Fishway
Archaeological monitoring and recordation in high sensitivity areas during construction, to identify and record any buried surviving components of the earlier dams and fishways.

RECOMMENDATIONS – Partial Dam Removal
Archaeological monitoring and recordation in high sensitivity dam area (same as above), plus archaeological walkover with close ground surface inspection of high sensitivity pond shoreline and exposed impoundment drawdown areas.
SUMMARY

• Feasibility study is not intended to identify a preferred alternative

• Found that fish passage restoration in the Concord River is technically feasible

• Possible to combine two or more alternatives together, implemented simultaneously or in phases

• Over 35 miles of diadromous fish habitat on the mainstem rivers, plus more than 100 miles of habitat on tributaries could be restored
NEXT STEPS

• Planning
• Feasibility
  • Public comments
  • Final report
  • Preferred alternative?
• Additional feasibility/consultation
• Design
• Permitting
COMMENTS

• Written comments welcome & encouraged
• Feasibility report:
  • http://tinyurl.com/ConcordRiverFishStudy
  • Hard copies available at Billerica Public Library
• Send comments by April 6, 2016 to:

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