



# Water Resources Opportunities for Improved Water Quality & Increased Resiliency

Buzzards Bay Action Committee  
November 19, 2020

Nick Nelson  
Manny da Costa  
Inter-Fluve, Inc.  
[www.interfluve.com](http://www.interfluve.com)



[Inter-fluve.com](http://Inter-fluve.com)



## Outline

- Restoration opportunities
- Agencies doing this work
- Funding opportunities
- Project examples, timelines, logistics



## Buzzards Bay Watershed

- Acushnet
- Bourne
- Dartmouth
- Fairhaven
- Falmouth
- Gosnold
- Marion
- Mattapoissett
- New Bedford
- Rochester
- Wareham
- Westport
  
- Buzzards Bay National Estuary Program
- Buzzards Bay Coalition



*John Parker Road Bridge, replaced 2020, Falmouth*

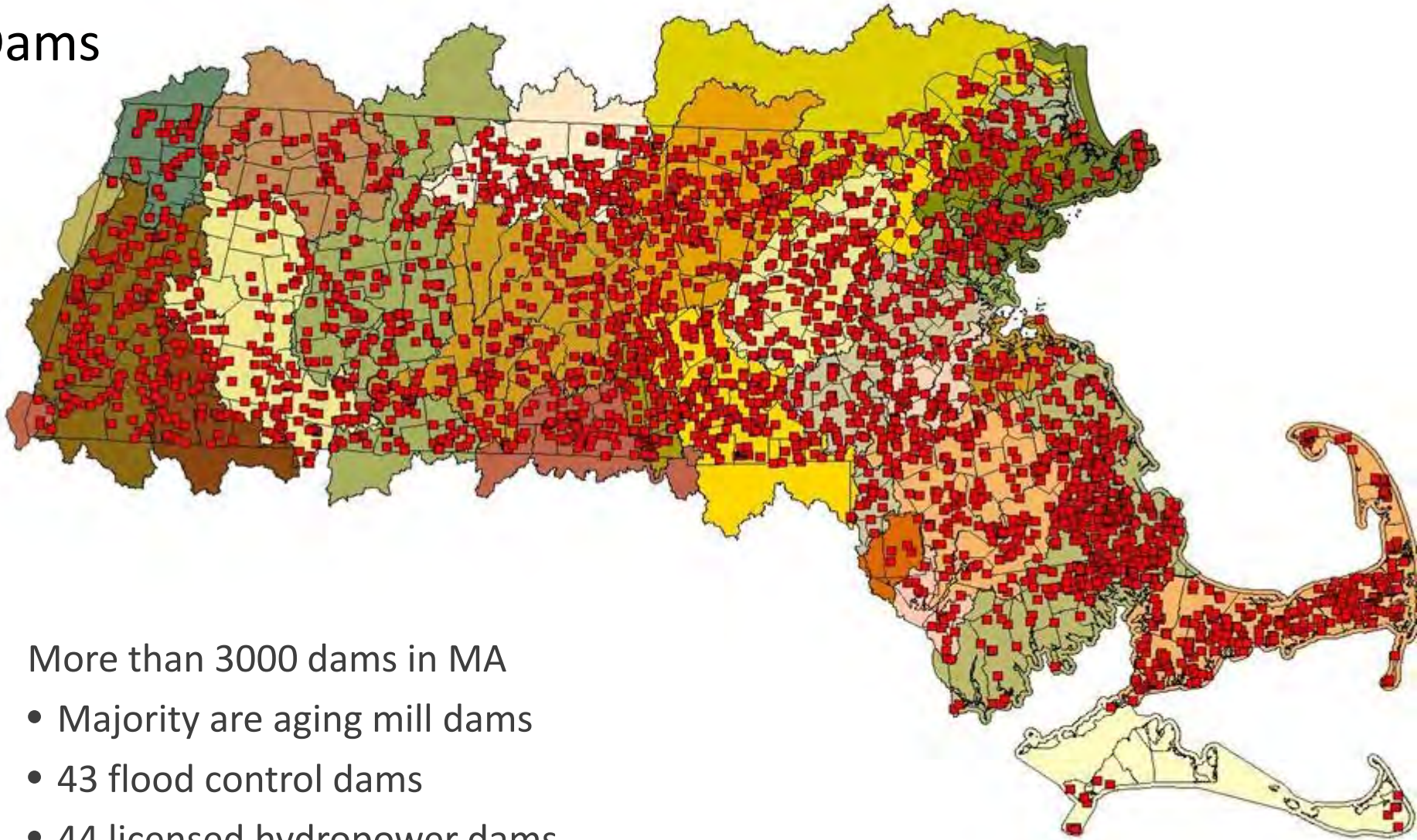
## Opportunities

- Dam removal
- Culvert/bridge updates
- Retired agriculture
- Stormwater

## Why?

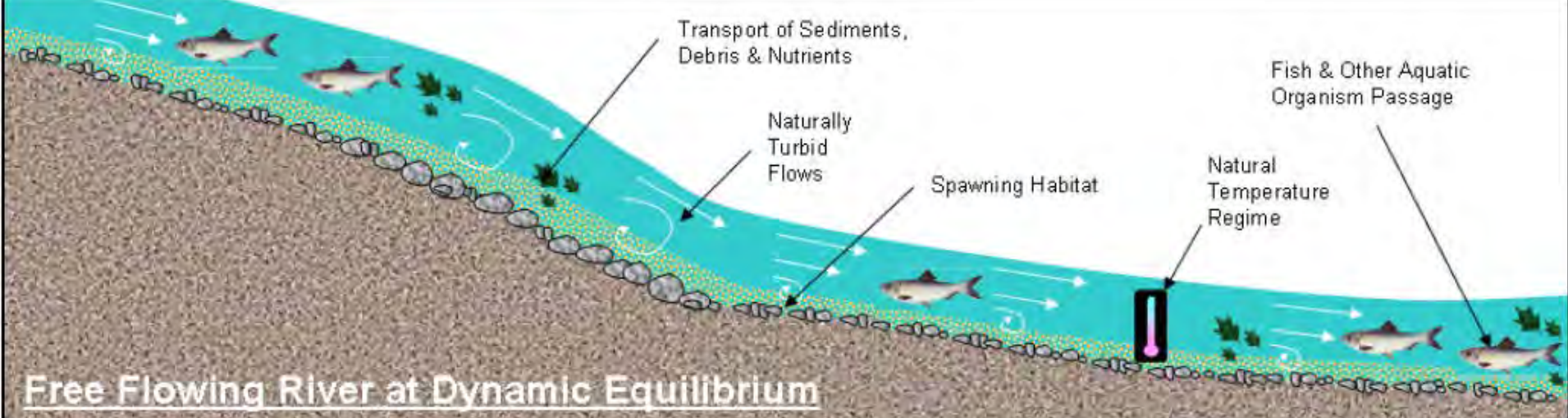
- Climate resiliency
- Infrastructure liability
- Long-term costs
- Improved ecosystem services
- Ecological restoration, recovery, rescue

# Dams



More than 3000 dams in MA

- Majority are aging mill dams
- 43 flood control dams
- 44 licensed hydropower dams
- 164 water supply dams



**UPSTREAM IMPACTS:**

Reduced:

Natural Function, Water Quality, Oxygen, Turbid Flow, Circulation, Available Habitat  
Rivers ability to adjust horizontally and vertically (reduced resilience to change)

Increased:

Pollutant Accumulation, Stratification, Temperatures, Algae Blooms

Loss of:

Natural Transport Processes of Sediments, Nutrients and Debris  
Fish & Other Aquatic Organism Passage  
Self-sustaining Nature

**DOWNSTREAM IMPACTS:**

Reduced:

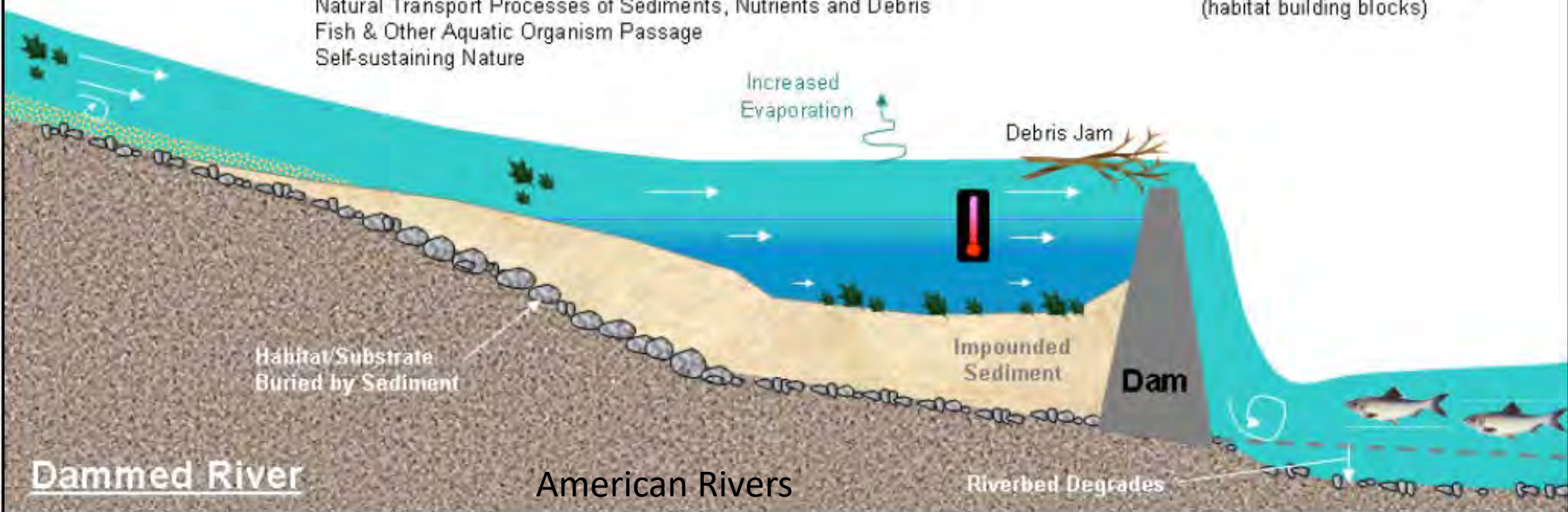
Water Quality & Riverbed Elevation

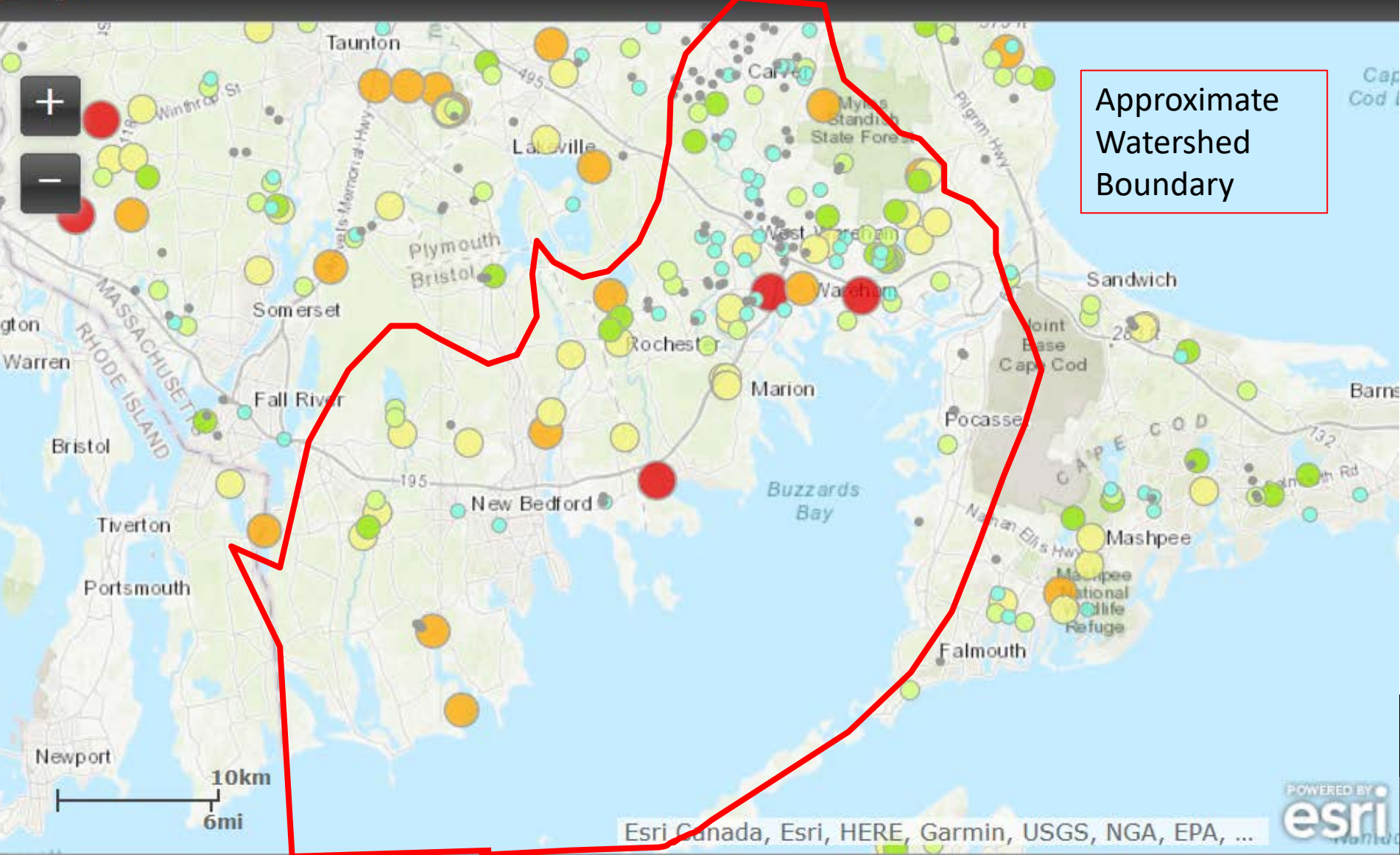
Altered:

Flow Regime & Temperatures

Starved of:

Sediment, Nutrients & Debris  
(habitat building blocks)





Approximate Watershed Boundary

<https://www.mass.gov/service-details/ders-restoration-potential-model-tool>





West Britannia Dam, Mill River, Taunton, 2017





West Britannia Dam, Mill River, Taunton, April 2020



- Climate resiliency
- Infrastructure liability
- Long-term costs
- Improved ecosystem services
- Ecological restoration, recovery, rescue

West Britannia Dam, Mill River, Taunton, August 2020

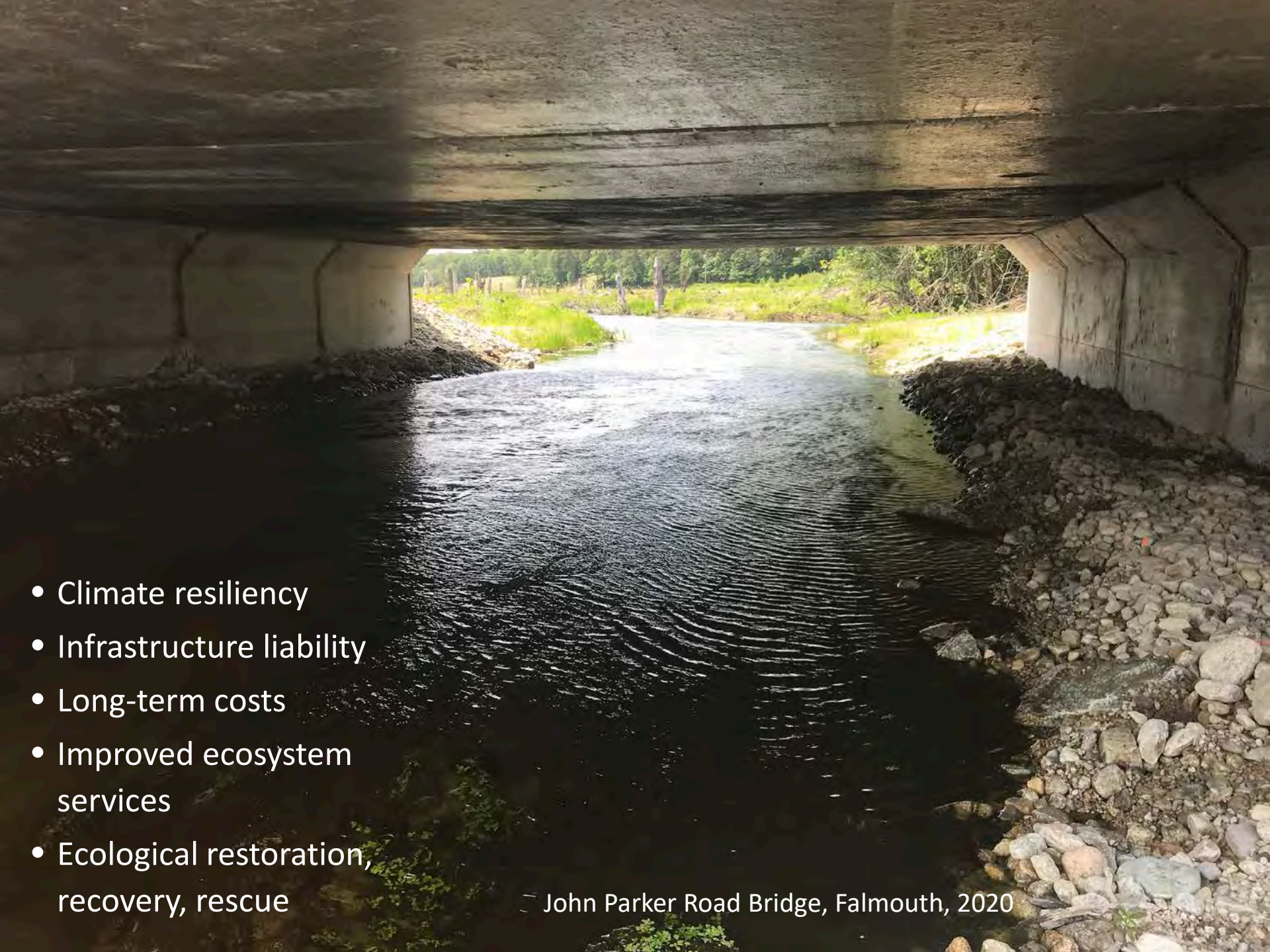
# Stream Crossings



John Parker Road culverts, Falmouth, 2017

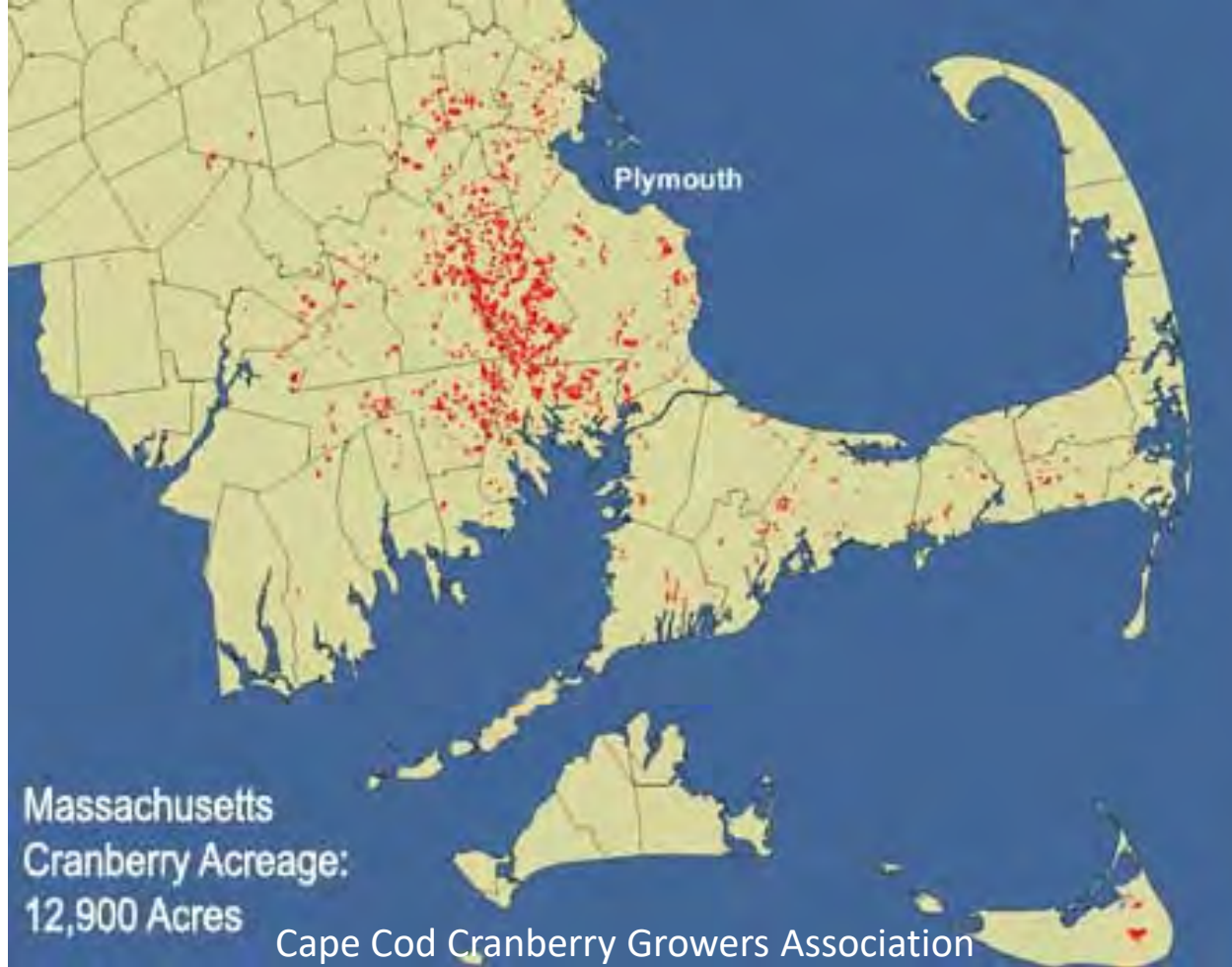


John Parker Road Bridge, Falmouth, 2020



- Climate resiliency
- Infrastructure liability
- Long-term costs
- Improved ecosystem services
- Ecological restoration, recovery, rescue

— John Parker Road Bridge, Falmouth, 2020



## Agriculture

Recognized important part of economy, livelihood, sustenance

Opportunities to restore streams and wetlands on lands being retired

Harvest in Harwich,  
late 1800s



Harwich Historical Society

## History of the cranberry

- Native to eastern and central U.S.
- Used by Native Americans: pemmican, sauce with maple sugar, eaten raw, poultice for wounds, dye
- Henry Hall, Harwich: first cultivation in 1816
- Recently, being outcompeted by farms in the Midwest and elsewhere



## Cranberry Bog Restoration Considerations

- Water table depth
- Excess sand
- Channel uniformity
- Ditches and berms
- Flow control structures
- Sediment balance
- Plant species uniformity
- Pesticides/herbicides/  
fertilizers



Eel River, Plymouth 2009



Eel River, Plymouth 2018



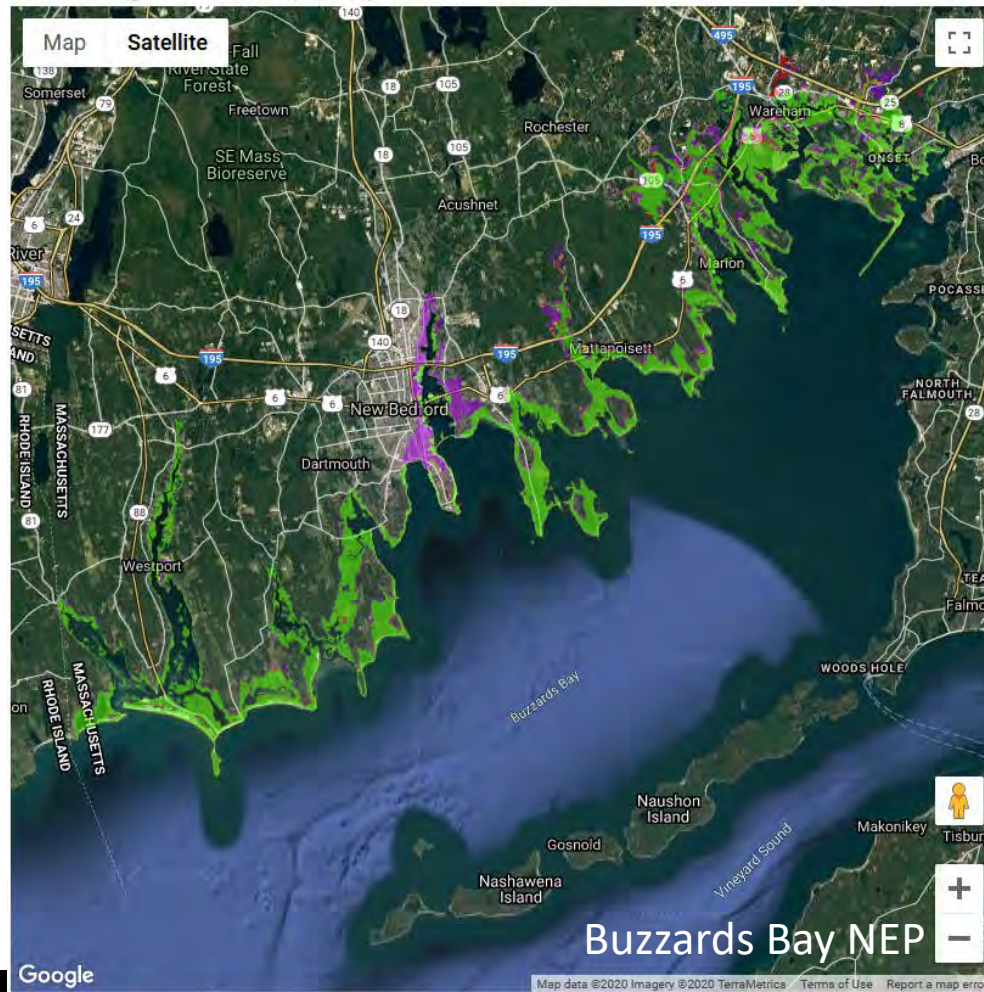
Eel River, Plymouth 2010



## Eel River, Plymouth 2019

- Climate resiliency
- Infrastructure liability
- Long-term costs
- Improved ecosystem services
- Ecological restoration, recovery, rescue

MAP showing Potential Floodplain Expansion with Sea Level Rise



Turn on Map Layers

There may be a delay on displaying data depending on your connection speed. See additional notes below.

- Westport
- Dartmouth
- New Bedford
- Acushnet, & Rochester
- Fairhaven
- Mattapoisett
- Marion
- Wareham

**Floodplain expansion with Sea Level Rise**

- Study Baseline Floodplain
- In Floodplain with 1 ft SLR
- In Floodplain with 2 ft SLR
- In Floodplain with 4 ft SLR

**BBNEP Baseline vs. FIRMs**

BBNEP baseline vs FIRM  
Useful to evaluate FIRMs. An explanation of these two coverages and methodologies used to compare them is contained in this [2013 draft BBNEP report](#).

**BB NEP Baseline vs FIRM**

- In Baseline and in FIRM Inland
- In Baseline, Not in FIRM
- In Both
- In FIRM, Not in Baseline
- Inland not Baseline
- Inland, Not Included

**More Information**

This map contains a floodplain used for a sea level rise planning study that may differ slightly from the official federal flood insurance program 1% floodplain.

# Resiliency and Adaptability to Climate Change and SLR

Expanded floodplain connectivity

Removal/replacement of old blockages and infrastructure



## Funding and Technical Partners

- MA Division of Ecological Restoration
  - <https://www.mass.gov/orgs/division-of-ecological-restoration>
    - Beth Lambert, Director: 617-626-1542; [beth.lambert@mass.gov](mailto:beth.lambert@mass.gov)
    - Kristen Ferry, Habitat Restoration Program Manager: 617-626-1264; [kristen.ferry@mass.gov](mailto:kristen.ferry@mass.gov)
  - Culvert replacements – assisting Town DPWs in training to properly size stream crossings
  - Stream flow restoration – addressing water shortages in streams/rivers
  - Priority Status
    - Dam removals – removing unnecessary dams
    - Restoration of retired cranberry bogs
    - Wetland restoration
    - Urban revitalization

## Funding and Technical Partners, continued

- MassDOT – District 5: (508) 824-6633
  - Tim Dexter – Fish and Wildlife Supervisor – good connection for replacement of road crossings
- Department of Conservation and Recreation (DCR) – evaluating dams for possible removal or fish passage opportunities
- USDA – NRCS – working with farmers to facilitate land easements; major funding partner with DER for the restoration of retired cranberry bogs
- USFWS – National Fish & Wildlife Foundation – federal grants to help projects that are enhancing fish and wildlife habitat within the region
- NOAA – federal grants for fish that migrate between fresh and salt water

## Funding and Technical Partners, continued

- SNEP grants – EPA funded grants focused on water quality – grants recently awarded to projects focused on dam removal, cranberry bog restoration, and stream/wetland restoration
- MET – MA Environmental Trust – grants up to ~\$60k that can cover early phases of the project: <https://www.mass.gov/orgs/massachusetts-environmental-trust>
- MVP – Municipal Vulnerability Preparedness Program: <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>
- CPC – Community Preservation Committee – funding has been used for boardwalk construction and stream/wetland restoration, ADA accessible facilities, etc.



- Dam removal
- Cranberry bog restoration
- Stream restoration
- Culvert replacement



Childs River – Falmouth & Mashpee

# STUDY AREA

Garner Bogs



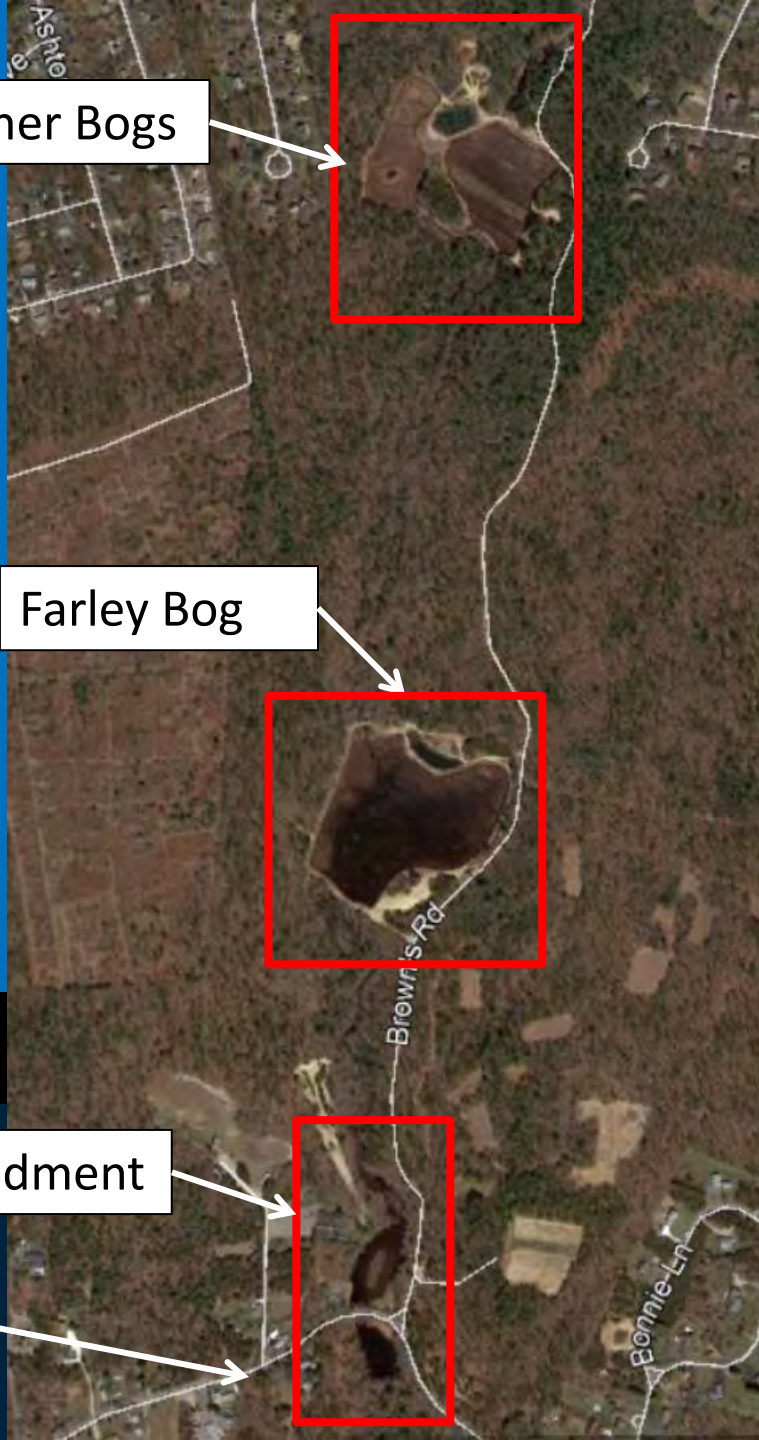
Farley Bog



Impoundment



Carriage Shop Road



- Assist in the improvement, conservation and preservation of the Cape Cod beach, lake, and forest areas
- Committed to wildlife and environmental protection of natural resources



Property and Project Owner: Falmouth Rod & Gun Club

>200 acres – one of largest private property owners in Falmouth and Mashpee

Most of land is within conservation easements

- Sporting, Safety, Conservation, and Education Fund
- U.S. Fish & Wildlife Service
- Town of Mashpee
- Town of Falmouth
- MassWildlife
- MA Division of Ecological Restoration
- Waquoit Bay National Estuarine Research Reserve
- Trout Unlimited
- Ducks Unlimited
- Falmouth & Mashpee's Community Preservation Committees
- Woodwell Climate Research Center
- USFWS National Coastal Wetland Conservation Grant program
- US EPA and Restore America's Estuaries SNEP grant
- MA Environmental Trust
- Cape Cod Foundation
- Sea Run Brook Trout Coalition
- Friends of the Mashpee National Wildlife Refuge
- Association to Preserve Cape Cod
- Restoration Engineer: Inter-Fluve, Inc.
- Culvert Engineer: Tighe & Bond, Inc.
- Contractor: Luciano's Excavation, Inc.

## Public – Private Partnership – many partners

Project is within the US Fish & Wildlife's Mashpee National Wildlife Refuge

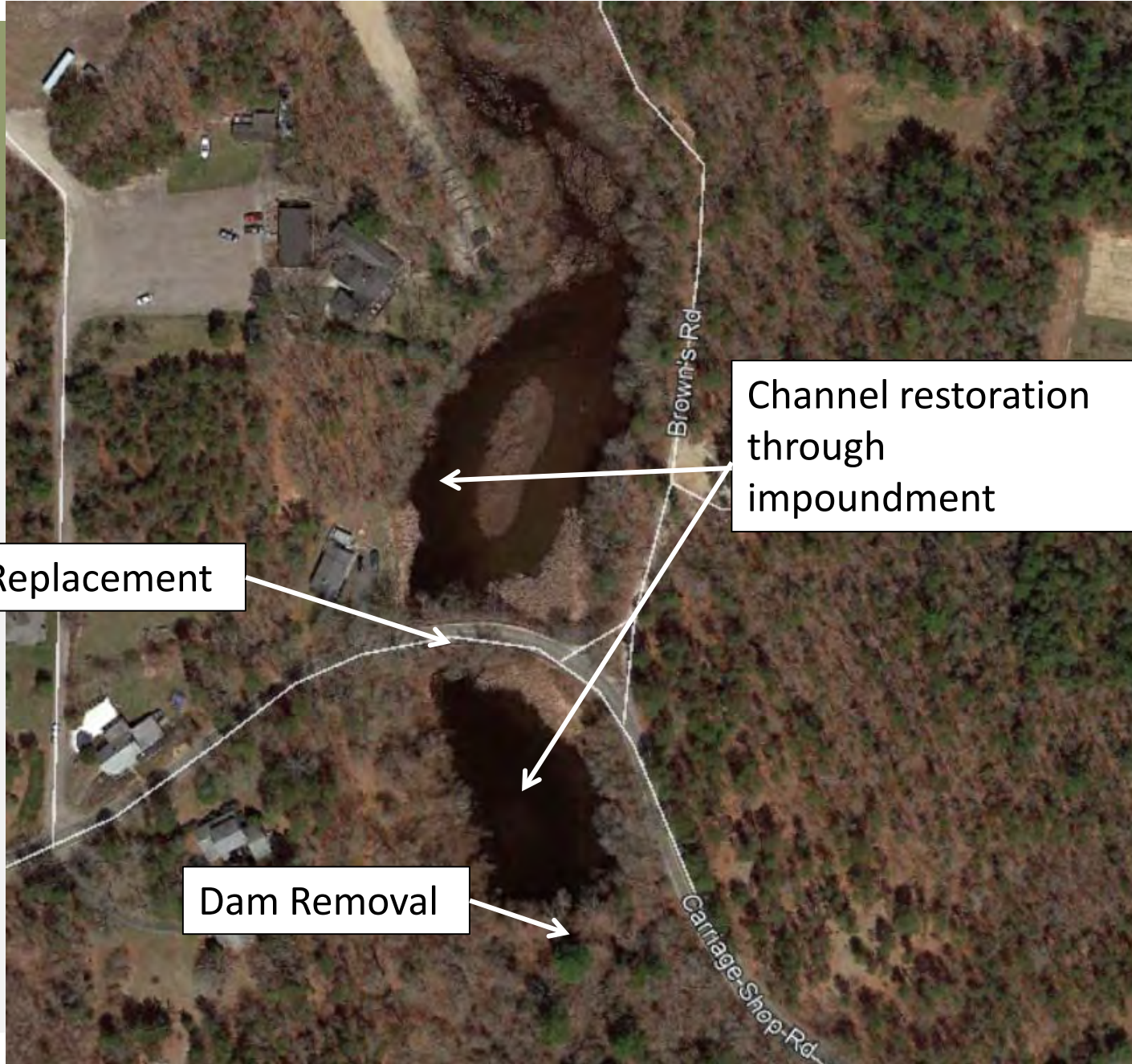
Property is maintained by the Club in coordination with the Refuge, Waquoit Bay National Estuarine Research Reserve, and MassWildlife



## Project Goals:

- Remove barriers to flow and passage
- Remove liability of dam ownership
- Improve resiliency
- Improve aquatic and terrestrial habitat
- Improve water quality
- Minimize long-term maintenance
- Maintain recreational opportunities





Channel restoration  
through  
impoundment

Culvert Replacement

Dam Removal

Brown's Rd

Carriage-Shop Rd

**Impoundment and Dam Existing Conditions**



**Impoundment Existing Conditions**

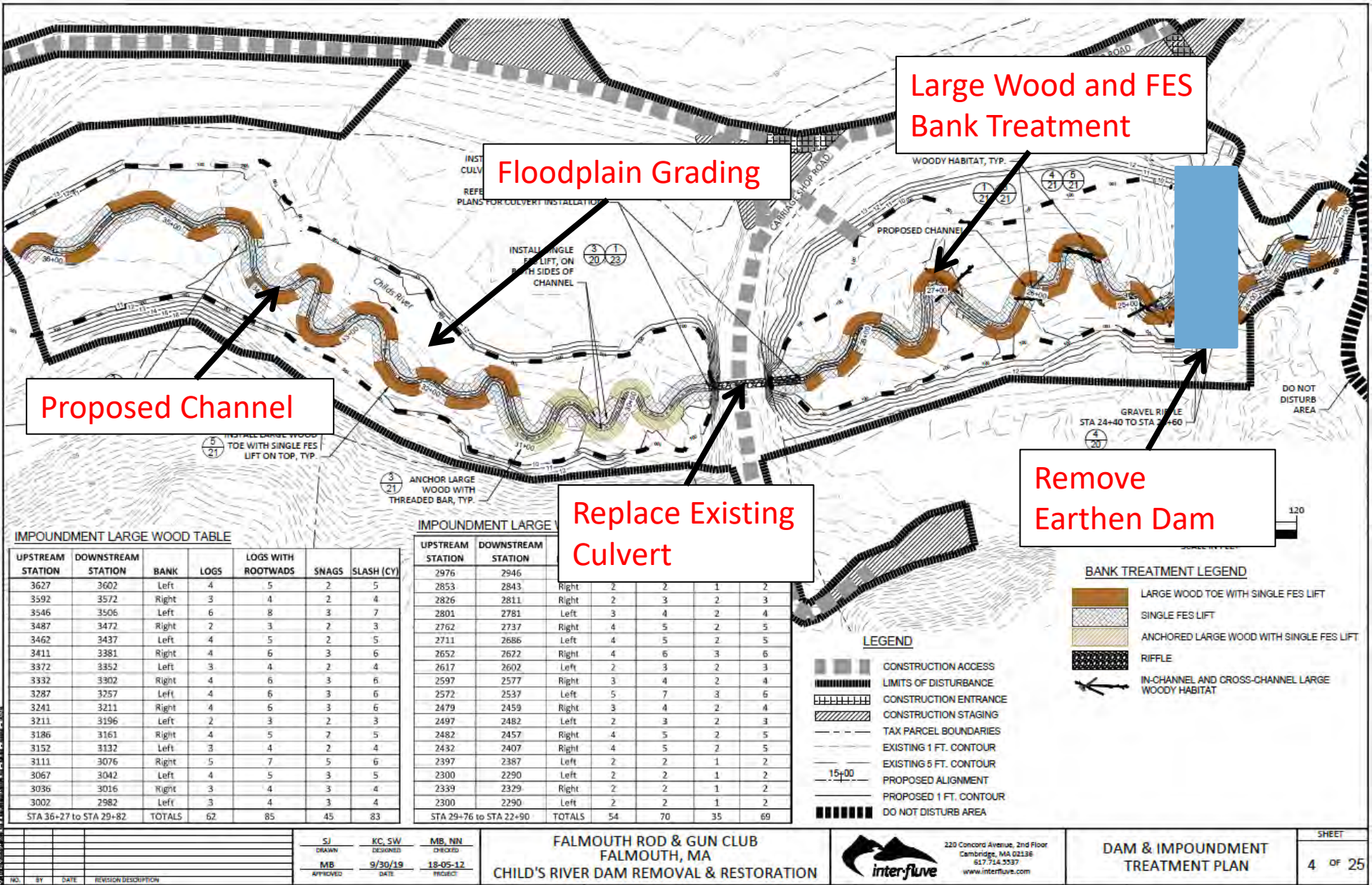


**Carriage Shop Road Culvert Existing Conditions**





**Earthen Dam Existing Conditions**



- Impoundment Designs**
- 351 pieces of large wood
  - Channel: 8ft wide, 1.5ft deep

|  |   |  |   |  |   |                         |
|--|---|--|---|--|---|-------------------------|
| SJ<br>DRAWN<br>MB<br>APPROVED<br>DATE<br>9/30/19 | KC, SW<br>DESIGNED<br>18-05-12<br>PROJECT | MB, NN<br>CHECKED<br>18-05-12<br>PROJECT | <b>FALMOUTH ROD &amp; GUN CLUB</b><br><b>FALMOUTH, MA</b><br><b>CHILD'S RIVER DAM REMOVAL &amp; RESTORATION</b> | 220 Concord Avenue, 2nd Floor<br>Cambridge, MA 02136<br>617.714.3537<br>www.interfluve.com | <b>DAM &amp; IMPOUNDMENT TREATMENT PLAN</b> | SHEET<br><b>4 OF 25</b> |
|--|---|--|---|--|---|-------------------------|

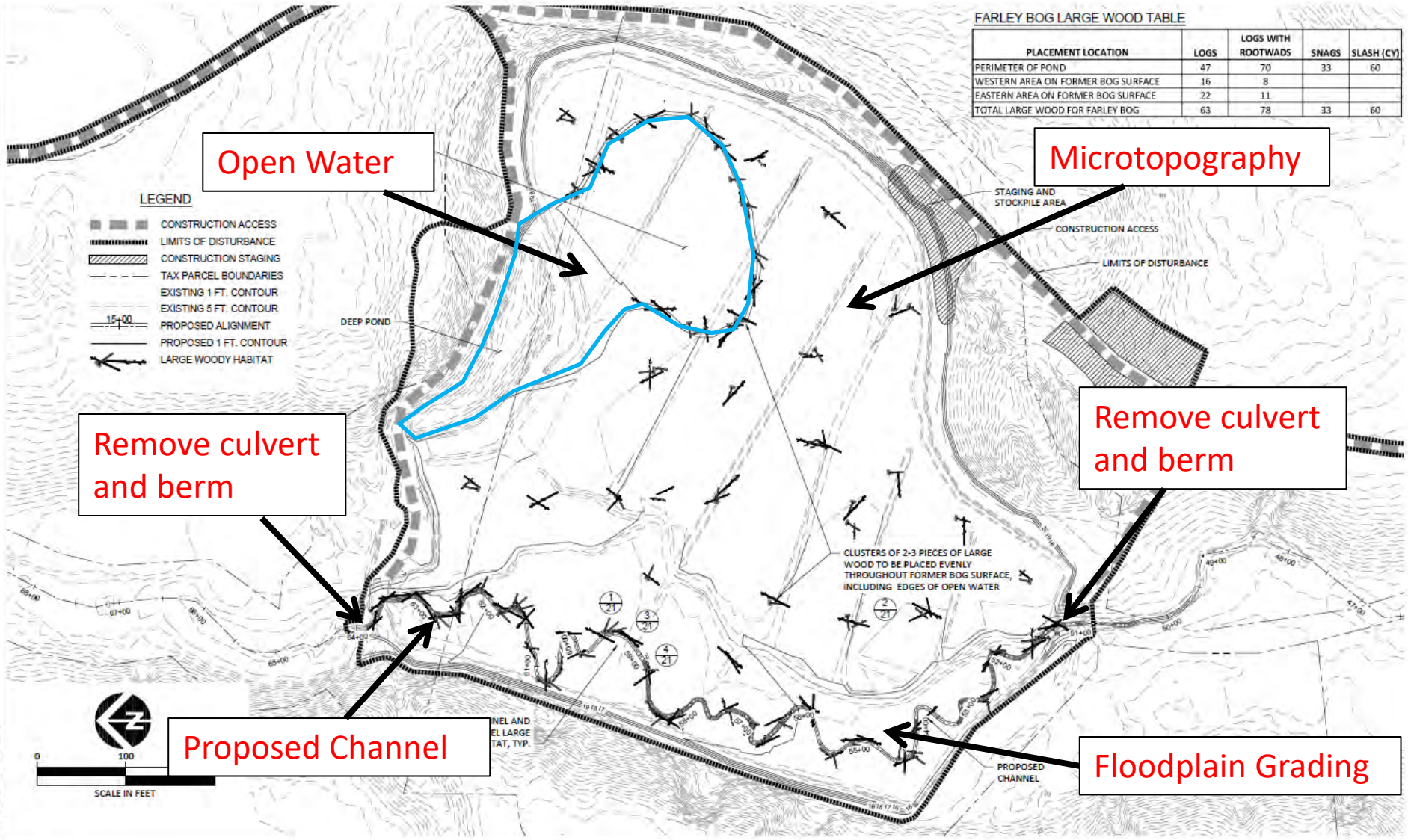



**Farley Bog Existing Conditions**



FARLEY BOG LARGE WOOD TABLE

| PLACEMENT LOCATION                 | LOGS | LOGS WITH ROOTWADS | SNAGS | SLASH (CY) |
|------------------------------------|------|--------------------|-------|------------|
| PERIMETER OF POND                  | 47   | 70                 | 33    | 60         |
| WESTERN AREA ON FORMER BOG SURFACE | 16   | 8                  |       |            |
| EASTERN AREA ON FORMER BOG SURFACE | 22   | 11                 |       |            |
| TOTAL LARGE WOOD FOR FARLEY BOG    | 63   | 78                 | 33    | 60         |



|     |    |                               |                      |                                       |  |  |  |  |  |  |  |                              |  |                   |  |
|-----|----|-------------------------------|----------------------|---------------------------------------|--|--|--|--|--|--|--|------------------------------|--|-------------------|--|
|     |    | SJ<br>DRAWN<br>MB<br>APPROVED |                      | KC, SW<br>DESIGNED<br>9/30/19<br>DATE |  | MB, NN<br>CHECKED<br>18-05-12<br>PROJECT |  | FALMOUTH ROD & GUN CLUB<br>FALMOUTH, MA<br>CHILD'S RIVER DAM REMOVAL & RESTORATION |  |  220 Concord Avenue, 2nd Floor<br>Cambridge, MA 02136<br>617.754.3337<br>www.interfluve.com |  | FARLEY BOG<br>TREATMENT PLAN |  | SHEET<br>10 OF 25 |  |
| NO. | BY | DATE                          | REVISION DESCRIPTION |                                       |  |  |  |  |  |  |  |                              |  |                   |  |

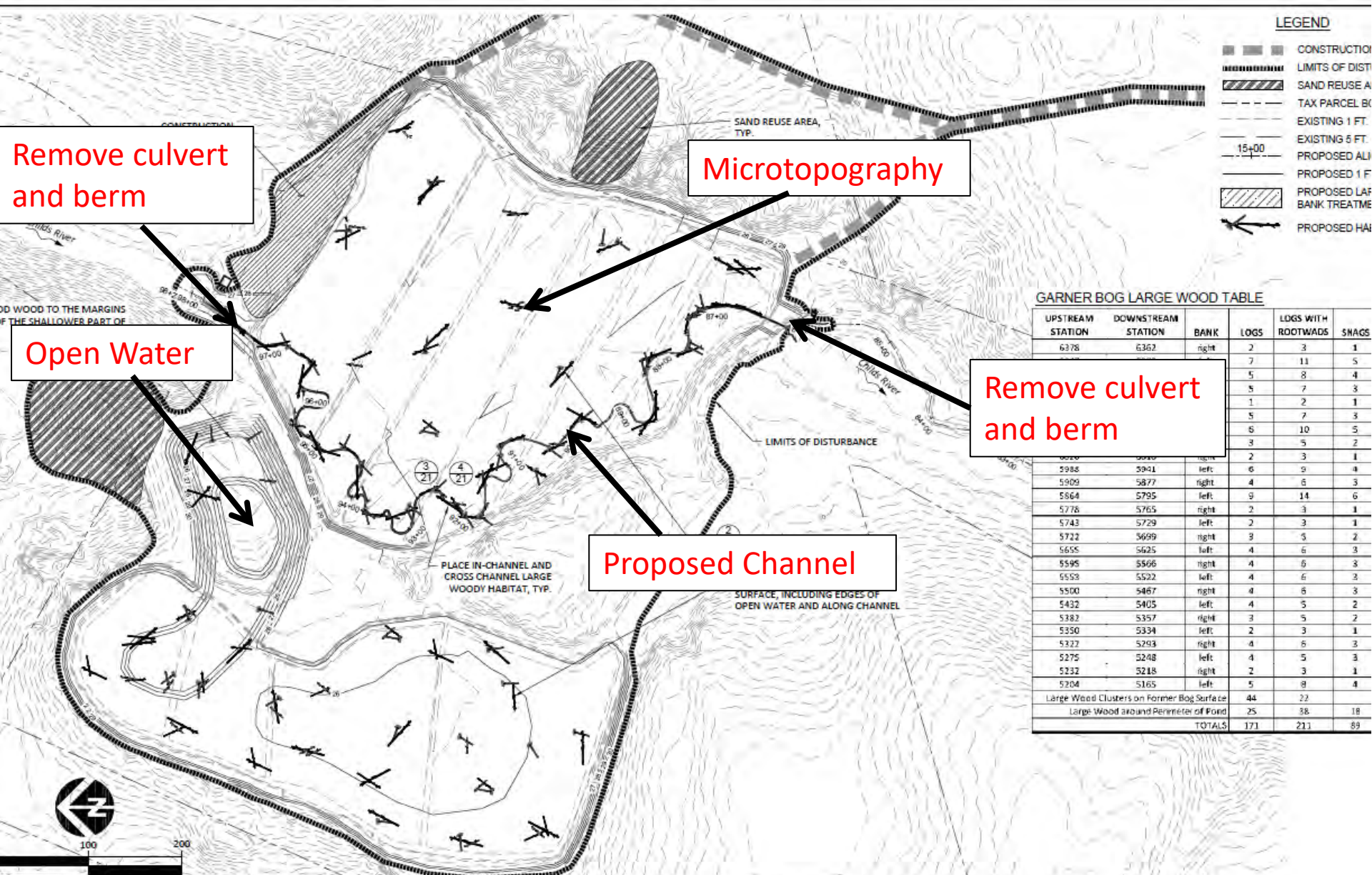
### Farley Bog Restoration Designs

- 174 pieces of large wood
- Channel: 5ft wide, 1.5ft deep



**Garner Bogs Existing Conditions**





Remove culvert and berm

Microtopography

Open Water

Remove culvert and berm

Proposed Channel

### Garner Bogs Restoration Designs

- 471 pieces of large wood
- Channel: 2ft wide, 1.5ft deep





Construction began in September  
2020





Dam notching and impoundment drawdown





Bypass channel construction

Stream construction  
Large woody habitat





Pond creation for waterfowl

Large wood are the stumps and logs unearthed from the peat

# Steps of Restoration & Schedule

- Feasibility and alternatives analysis – 2017-2018
  - Surveys
  - Sediment sampling
  - Concept designs
  - Fund raising
- Preliminary designs – 2018-2019
  - Hydrologic and hydraulic modeling
  - Engineering and ecological design
  - Cost estimation
  - Fund raising
- Permitting and final designs – 2019-2020
  - Permit
  - Refining designs and models
  - Refining cost estimates
  - Prepared bid documents
  - Fund raising

# Steps of Restoration & Schedule

- Bid process – 2020
  - Advertisement
  - Site visit
  - Bid reviews
  - Selection and contracting
- Construction – 2020-2021 (~8 months total)
  - Construction management
  - On-site observation
  - Permit requirements
  - Grant reporting
  - Payment of contractor invoices
- Total schedule ~3-4 years – this is fast!
- Total budget ~\$2 million
  - Falmouth Rod & Gun Club
  - CPC funding from both Falmouth and Mashpee
  - Town of Falmouth funds for the culvert
  - SNEP grants (>\$700,000)
  - NFWF Grant that DER obtained (>\$700,000)



**Nick Nelson**

(617) 714-5537

[nnelson@interfluve.com](mailto:nnelson@interfluve.com)



[Inter-fluve.com](http://Inter-fluve.com)