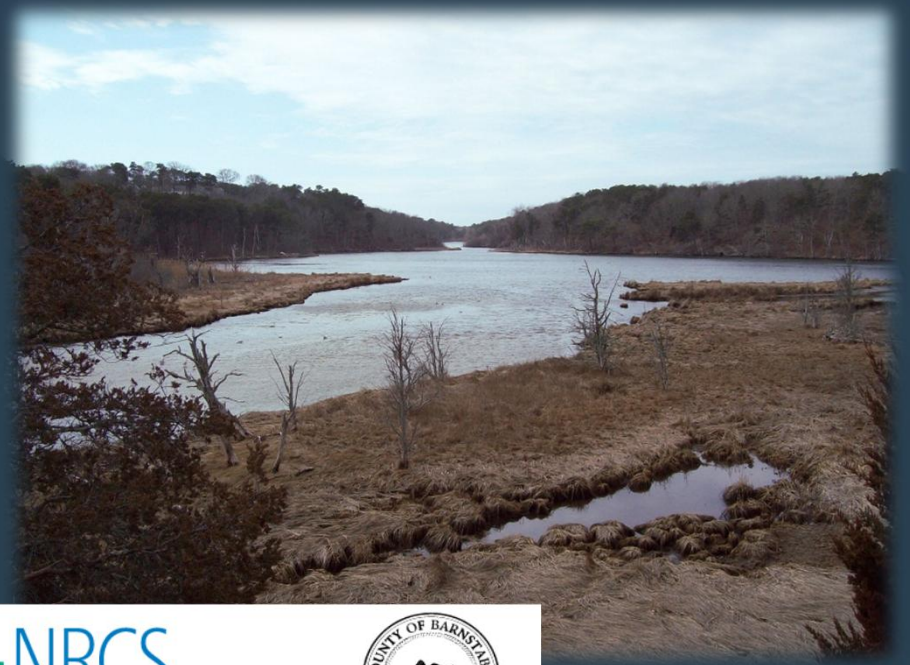
FUSS & O'NEILL

Muddy Creek Culvert Replacement Wetland Restoration Project



March 8, 2012

Cape Cod Water Resources Restoration Project

Cape Cod Conservation District

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

County of Barnstable Massachusetts

Town of Chatham Incorporated June 11 1712 Mass.

Orleans Chatham Brewster Harwich

Pleasant Bay Alliance

Seal of the Town of Harwich Incorporated Sept. 14, 1694 Adopted Sept. 4, 1897

Agenda

- Introductions and Background
- Review of Field Study Findings
  - Resource and Water Quality Assessments
  - Alternative Conceptual Designs/Costs
- Next Steps
- Questions and Answers

Background

2003 – 06	Studies of Alternatives to Improve Ecological Health - Chatham CWMP
2005	Bacterial TMDL for Muddy Creek - Reductions in Bacterial Load
2006	Total Nitrogen TMDLs Call for Reductions in Existing Watershed Nitrogen Loads • 100% in Lower Muddy Creek • 75% in Upper Muddy Creek
2006 - 08	*Resource Assessment to Evaluate Ecological & Hydrodynamic Responses to Reinstalling a Water Control Structure in the Muddy Creek Dike* • Provided Baseline Data for Tidal Conditions and Wetlands

Background

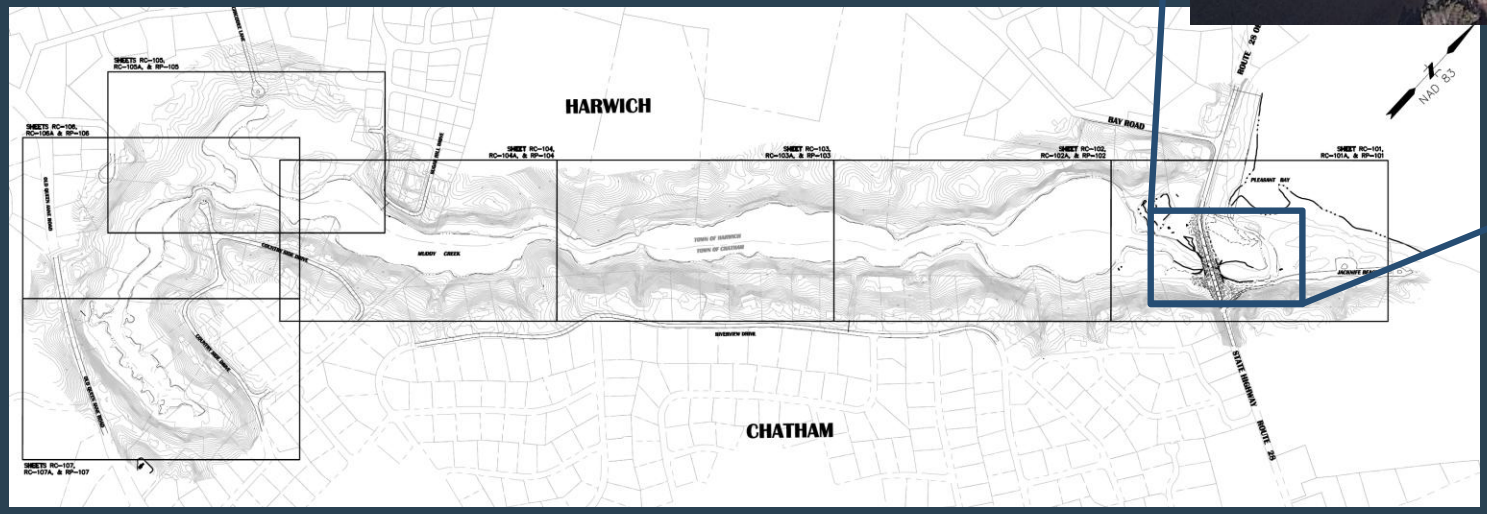
2008	Request Priority Project Status Under MA Wetlands Restoration Program for Culvert Widening Study
2009	Hydrodynamic Modeling to Determine Optimal Replacement Culvert Size (24 ft.)
2010	Water Quality Modeling to Assess Impacts of Installing 24-foot Wide Culvert
2010 - 11	Muddy Creek Chosen as a “Priority Project” Under the Cape Cod Water Resources Restoration Project
	CCWRPP Funding Provided to Study Resource Impacts and Design Concepts for 24 ft. Culvert

Project Study Outline

- Topographic and Wetland Survey
- Subsurface Borings and Geotechnical Study
- Natural Resource Assessments
  - Vegetative Communities
  - Migratory and Resident Fisheries
  - Shellfisheries
- Bacterial Water Quality Modeling and Assessment
- Replacement Structure Alternatives Evaluation

Topographic and Wetland Survey

- Detailed Survey of Project Area
  - Topographic and Bathymetric Survey
    - Located Buried Utilities
  - Mapped Upstream Wetland Areas
  - Wetland Flagging
  - Identified Existing Structures Along Muddy Creek



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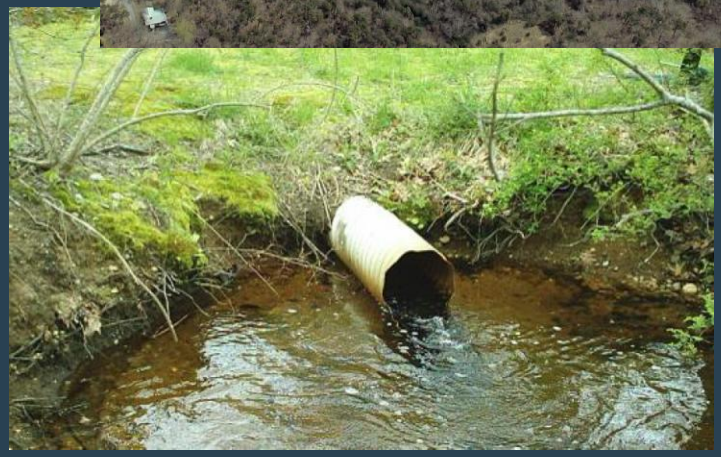
Vegetative Community Assessment

- Established 20 Vegetative Monitoring Transects
  - Baseline Condition for Future Monitoring
  - Quantitative Assessment of Community Composition at Each Transect
- Identified and Characterized Vegetative Communities
  - Invasive Species Stands (Common Reed Narrow Leaved Cattail)
  - Estuarine/Intertidal Salt and Brackish/Freshwater Marshes
  - Palustrine Shrub and Red Maple Swamps
  - Pitch Pine/Oak Forested Wetlands

Migratory and Resident Fisheries Assessment

- Primary Fish Species
  - River Herring (Alewife)
  - American Eel
  - White Perch
  - Blue Crab
- Identified and Assessed Existing Passage Barriers and Degraded Habitat
  - Route 28 Culvert
  - Shallow Depths at Remnant Dike Locations (Former Cranberry Bogs)
  - Culvert from Minister's Pond
  - Seasonal Algal Blooms

Maps Source: Microsoft Pictometry Bird's Eye



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Shellfish Habitat Assessment

- Established Four Monitoring Transects
  - Baseline Condition for Future Monitoring
  - Quantitative Assessment of Shellfish Numbers and Sizes at Each Transect
- Assessed Current and Historic Habitat
  - Former Commercial Harvests for Soft-Shelled Clams and Quahogs
  - Limited Harvesting Due Excessive Bacteria Levels
    - "Prohibited" Upstream of Route 28
    - "Conditionally Approved" Downstream of Route 28

Map Source: Microsoft Pictometry Bird's Eye

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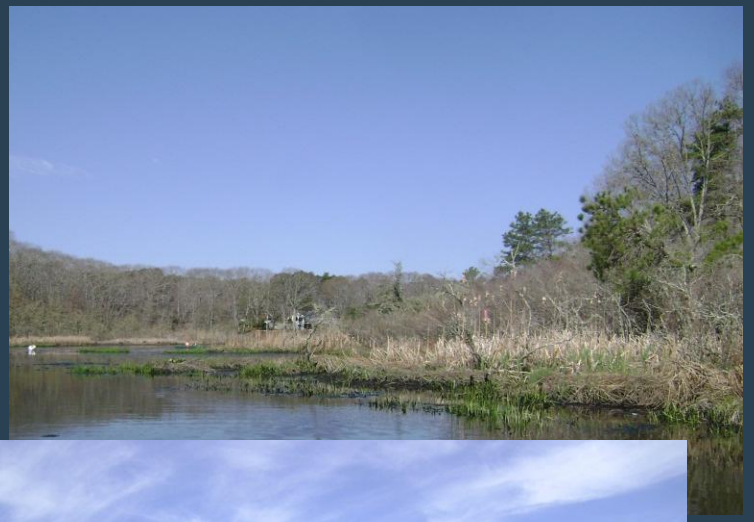
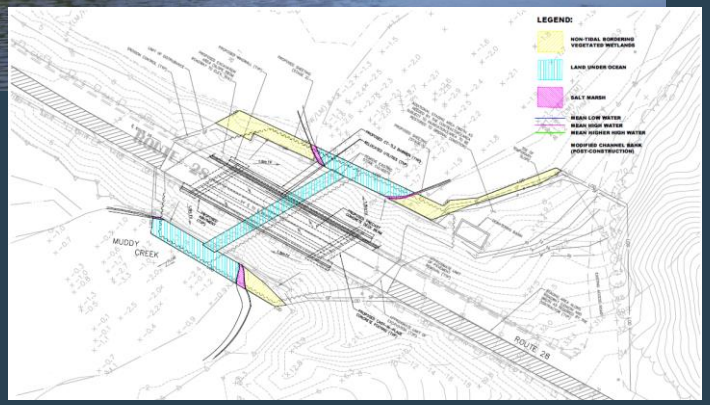
Anticipated Wetland Community Changes

- Long-Term Restoration Benefits
  - Increased Salinity and Tidal Range
  - Reduction of Invasive Stands - Improved Biodiversity
  - Expansion of Tidal Mud Flats and Low Marsh Communities
  - New and Expanded Brackish and High Marsh Communities
- Short-term Construction Impacts
  - Impacts Limited to Immediate Vicinity of Existing Culvert
  - Tidal Flow to Muddy Creek to be Maintained Throughout Construction





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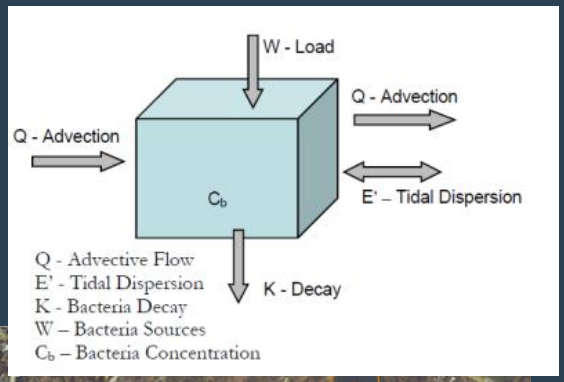
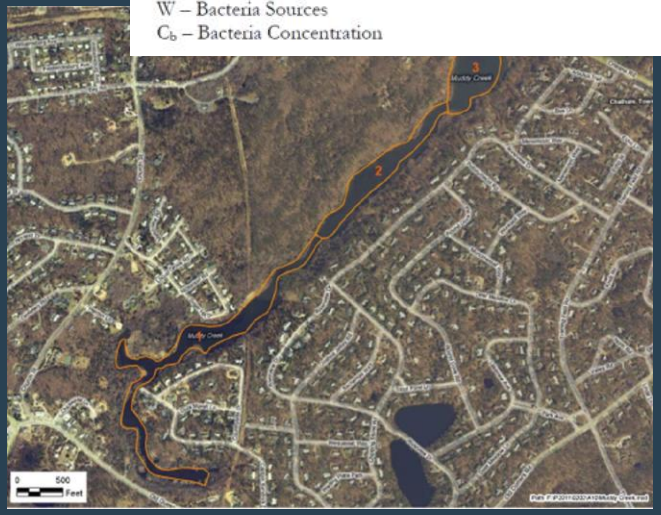
Anticipated Fish/Shellfish Habitat Changes

- Long-Term Restoration Benefits
  - Larger Channel Opening Will Improve Fish Passage Opportunities
    - Reduced Velocities, More Light
    - Increased Water Depths Upstream
  - Increased Tidal Exchange Will Improve Water and Habitat Quality
    - Reduced Severity / Extent of Algal Blooms
    - Reduced Organic Sediment Load to Shellfish Beds
- Short-term Construction Impacts
  - Temporary Water Bypass Channel
  - Temporary Impacts to Shellfish Beds

Nitrogen/Bacteria Water Quality Modeling

- Reviewed Existing Water Quality Data and Previous Modeling Studies
  - MA Division of Marine Fisheries, Dept. of Public Health, Pleasant Bay Alliance, Massachusetts Estuaries Program
- Current/Previous Modeling Findings
  - Nitrogen and Bacteria Levels Would be Reduced in Muddy Creek
    - Further Reductions Required to Meet Values Under Future Full-Buildout Conditions
  - No Significant Effect on Pleasant Bay Water Quality
    - No Negative Impacts to Beaches or Shellfish Beds Identified





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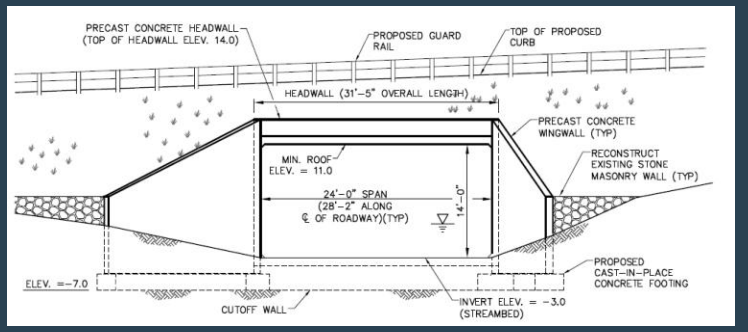
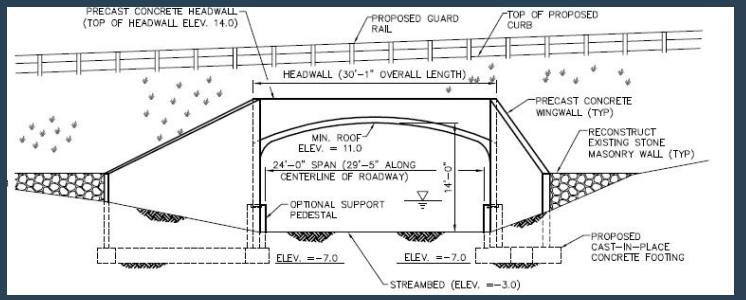
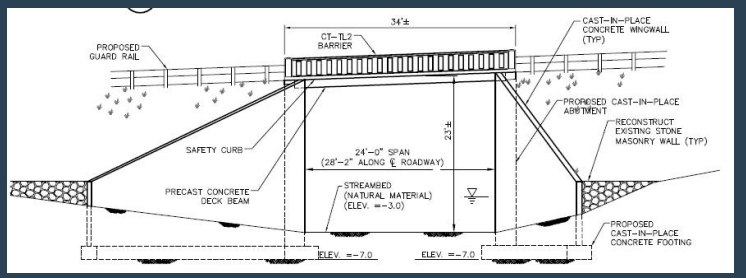
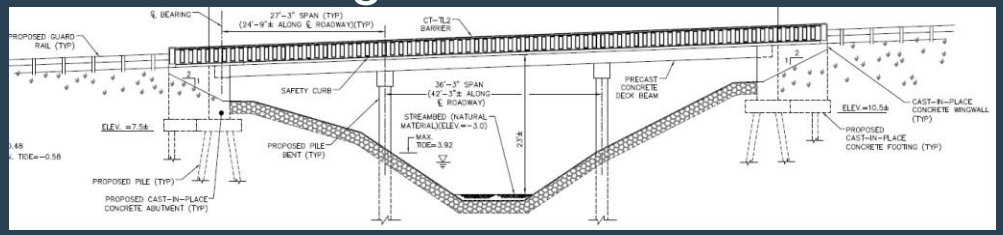
Replacement Structure Design Evaluation

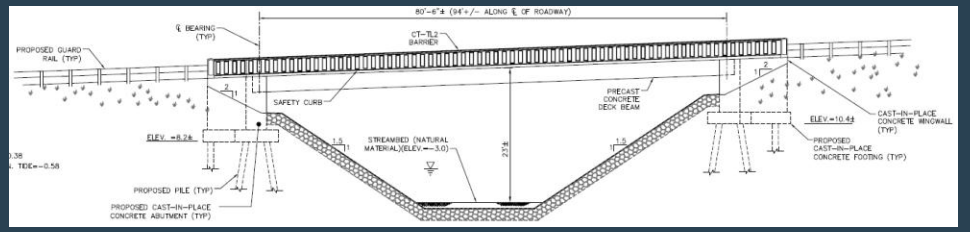
- Concrete Box Culvert
  - Highest Cost
  - Largest Wetland Impact Area During Construction
- Short-Span Concrete Bridges
  - Moderate Cost and Wetland Impact Area During Construction
- Long Span Concrete Bridges
  - Lowest Cost
  - Smallest Wetland Impact Area During Construction











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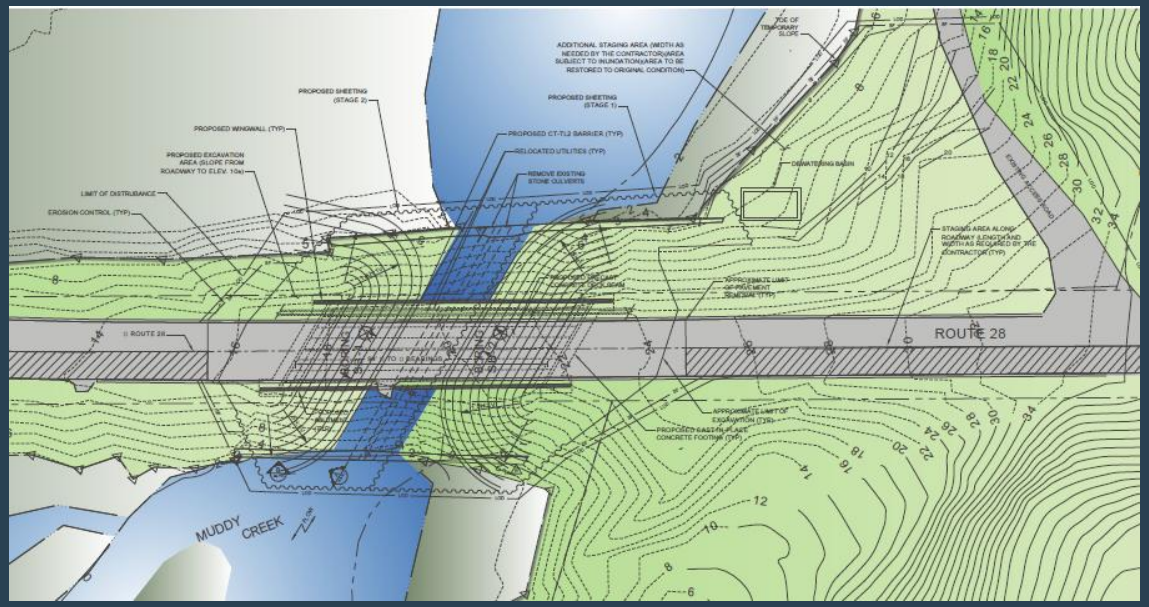
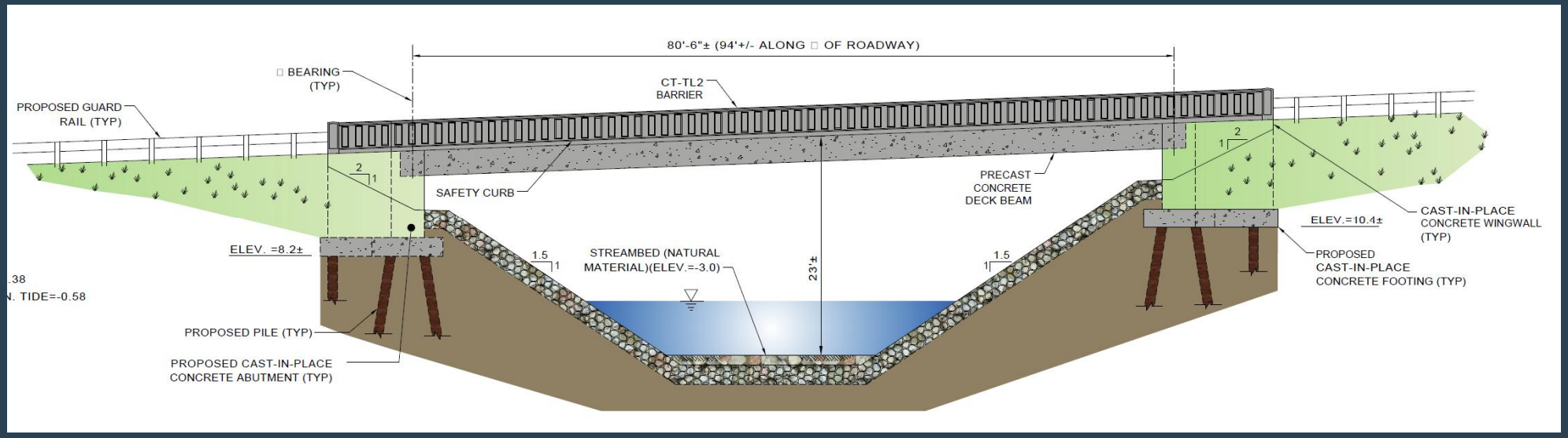
Recommended Replacement Structure

- Single Span Concrete Bridge
  - Open Channel Provides Safest Recreational Boating Passage
  - Estimated $3.3M Cost (Design & Construction)





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Next Steps

- Study information Presented to Towns of Chatham and Harwich for Consideration
- Placeholder for Engineering Design/Permitting Funding Pending Project Approval
- If Project Proceeds:
  - Final Design and Permitting
  - Bidding and Construction

Questions and Answers

The Project Report Can be Obtained from the Following Websites:

www.pleasantbay.org

www.chatham-ma.gov

www.town.harwich.ma.us