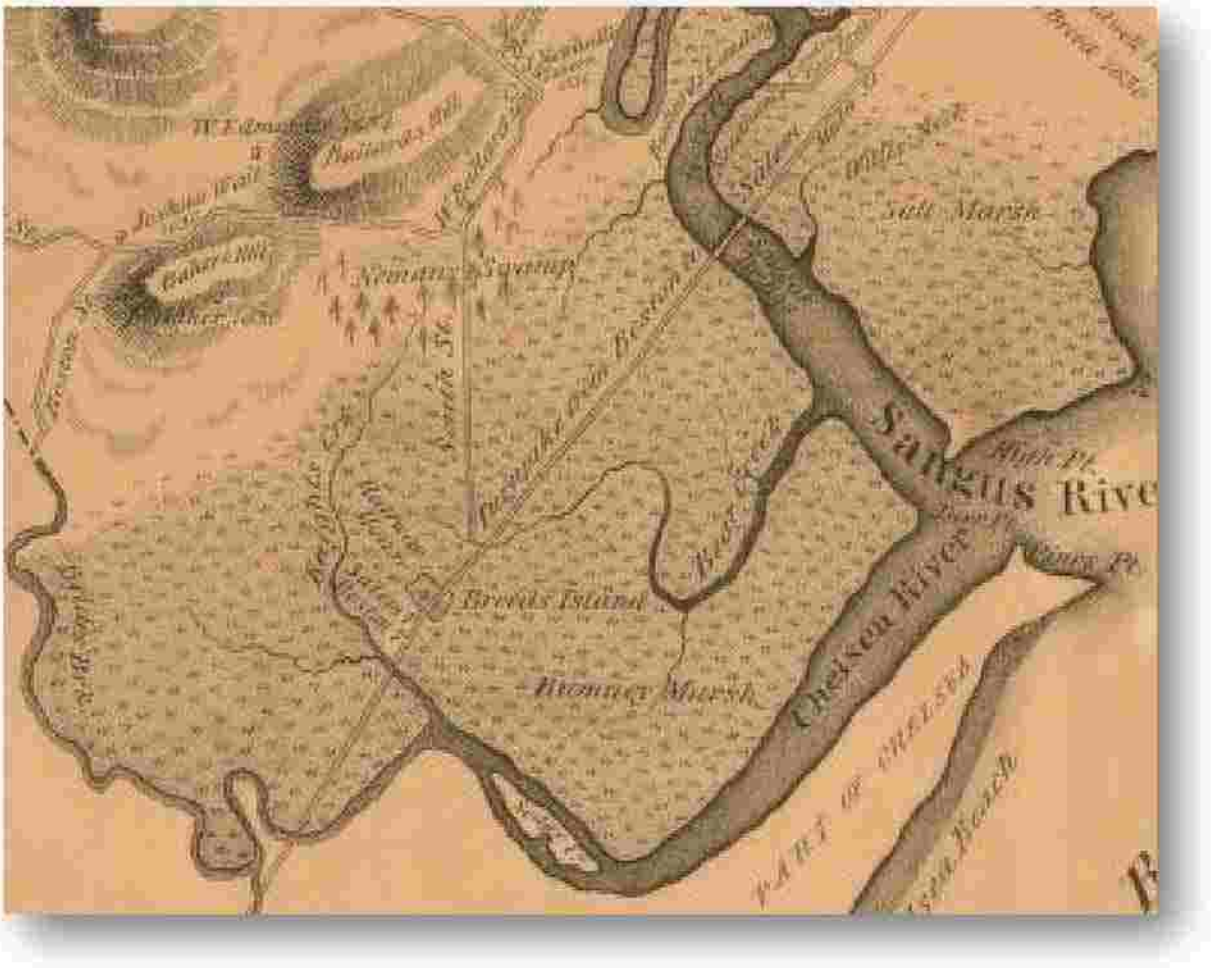
EXPANDED ENVIRONMENTAL NOTIFICATION FORM

MEPA MGL c. 30 ss 61-62I

Ballard Street Salt Marsh Restoration

Eastern Avenue and Ballard Street
Saugus, MA

March 16, 2015



Prepared for: dcr **Department of Conservation and Recreation**

Prepared by: PARSONS BRINCKERHOFF **Parsons Brinckerhoff, Inc.**

Applied Coastal Research & Engineering, Inc.
Boelter & Associates

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ENF DISTRIBUTION LIST

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Boston, MA 02108

DEP Northeast Regional Office
Attn: MEPA Coordinator
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Wilmington, MA 01887

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10 Park Plaza
Boston, MA 02116

Massachusetts DOT District #4
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519 Appleton Street
Arlington, MA 02476

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ENVIRONMENTAL NOTIFICATION FORM

See following pages.

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Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: _____

MEPA Analyst: _____

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **Ballard Street Salt Marsh Restoration**		
Street Address: **Ballard Street and Eastern Avenue**		
Municipality: **Saugus**	Watershed: **North Coastal**	
Universal Transverse Mercator Coordinates:	Latitude: 42° 26' 51.8" Longitude: -70° 59' 5.0"	
Estimated commencement date: **Fall 2015**	Estimated completion date: **Spring 2017**	
Project Type: **Salt Marsh Restoration**	Status of project design: **75%** %complete	
Proponent: **Department of Conservation and Recreation**		
Street Address: **251 Causeway Street**		
Municipality: **Boston**	State: **MA**	Zip Code: **02114**
Name of Contact Person: **Rachel J. Burckardt**		
Firm/Agency: **Parsons Brinckerhoff**	Street Address: **75 Arlington Street, 9th Fl.**	
Municipality: **Boston**	State: **MA**	Zip Code: **02116**
Phone: **617-960-4861**	Fax: **617-482-8487**	E-mail: **burckardt@pbworld.com**

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☒Yes ☐No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09)	☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11)	☒Yes ☐No
a Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☒No

(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)
See Section 1.6 of EENF Narrative

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?
Alteration of one or more acres of salt marsh 301 CMR 11.03(3)(1)(a)
Alteration of ten or more acres of other wetlands 301 CMR 11.03(3)(1)(b)
Location within ACEC 301 CMR 11.03(11)(b)
Direct alteration of 25 acres or more of land 301 CMR 11.03(1)(b)(1)

Which State Agency Permits will the project require?
DEP Chapter 91 License and Permit (possible)
DEP 401 Water Quality Certification
Mass Wetlands Protection Act Order of Conditions
MassDOT Temporary Highway Access Permit (existing permit # 4-2014-0128 for Winthrop Beach Nourishment Project will be extended)

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

DCR funded under Capital Projects

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	54		
New acres of land altered		0	
Acres of impervious area	1.0	0	1.0
Square feet of new bordering vegetated wetlands alteration		0	
Square feet of new other wetland alteration		36.9	
Acres of new non-water dependent use of tidelands or waterways		0	
STRUCTURES			
Gross square footage	None	0	0
Number of housing units	None	0	0
Maximum height (feet)	N/A	N/A	N/A
TRANSPORTATION			
Vehicle trips per day	N/A	N/A	N/A
Parking spaces	N/A	N/A	N/A
WASTEWATER			
Water Use (Gallons per day)	N/A	N/A	N/A
Water withdrawal (GPD)	N/A	N/A	N/A
Wastewater generation/treatment (GPD)	N/A	N/A	N/A
Length of water mains (miles)	N/A	N/A	N/A
Length of sewer mains (miles)	N/A	N/A	N/A

Has this project been filed with MEPA before?
☐ Yes (EEA #) ☒ No

Has any project on this site been filed with MEPA before?
☒ Yes (EEA **#12889, 13993 , 10113**) ☐No

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

This Project will restore quality habitat within areas of former and degraded salt marsh, and improve flood protection for residents in the adjacent neighborhood. Currently less than 1/3 of its original size, much of the salt marsh has converted to freshwater marsh dominated by non-native and invasive common reed (*Phragmites australis*), or trended to forested upland. Restoration of this nearly 37 acre portion is the highest priority project in Rumney Marsh for the MA Division of Fish and Game-- Department of Ecological Restoration

Tidal water formerly flowed in this area from three sources, the Saugus and Pines Rivers and Bear Creek. However, flows have been severely impeded by land fill and obstructed culverts, etc. causing poorly functioning salt marsh as well as exacerbated flooding in the adjacent area.

The Project will restore tidal flow with excavation of 15 acres of remnant marsh; removal of a broken tide gate on the Ballard St. culvert and obstructions at the Bristow St. culvert; two new culverts west of Bristow Street to provide tidal flow from the Pines River; construction of a dike with a 1-foot diameter culvert near Ballard Street to hydraulically separate the east and west marsh cells while maintaining a Saugus River connection; installation of one-way duckbill valves on the existing Eastern Avenue culverts, and excavation of new creeks within the new marsh to convey tidal flow. The Project will address flooding issues in the East Saugus neighborhood with installation of a one-way, 48-inch auxiliary culvert under Eastern Avenue to improve discharge of inland runoff.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:
Alternative methods would require either more marsh excavation or more structures requiring oversight and maintenance difficult to ensure over time; See Section 3.0 of Narrative

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:
As the project qualifies as a limited project, the restoration of tidal connection to the Eastern Marsh and restoration of historically filled and degraded marsh and tidal creeks in the Western Marsh is sufficient mitigation considering the ancillary impacts from installing the projects elements described herein necessary to balance restoration of resources, fish access, improve flood protection, and protect health and human safety. See Section 6.0 in the Narrative for more information

If the project is proposed to be constructed in phases, please describe each phase:
N/A

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:
Is the project within or adjacent to an Area of Critical Environmental Concern?
☒Yes (Specify **Rumney Marsh ACEC)**
☐No
if yes, does the ACEC have an approved Resource Management Plan? ___ Yes _x__ No;
If yes, describe how the project complies with this plan.

Will there be stormwater runoff or discharge to the designated ACEC? _x_ Yes ___ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.
Existing runoff from East Saugus drains to the Project Area. The Project results in no change in volume or rate of runoff to the ACEC.

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☐Yes (Specify_____) ☒No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☒Yes (Specify___**MHC-19-ES-258**_____) ☐No
If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify_____) ☒No

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site?
_x__Yes ___No;
if yes, identify the ORW and its location. **Rumney Marsh ACEC**
(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain *waters* within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? ___Yes _X__No; if yes, identify the water body and pollutant(s) causing the impairment: _____.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes _X__No

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:
N/A – The Project is salt marsh restoration and Project neither increases nor decreases volume of stormwater runoff. It will have a positive benefit in conveying stormwater runoff from the adjacent residential neighborhood.

MASSACHUSETTS CONTINGENCY PLAN:
Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ No _X__ ; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):
____**N/A**____

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ No _X__;

if yes, describe which portion of the site and how the project will be consistent with the AUL: _____.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN? Yes ___ No _X__ ; if yes, please describe:_____

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood: **N/A**

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ No _X__ ;
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment: **Vehicles and equipment will be turned off when not in use for more than 5 minutes in accordance with Mass. Anti Idling Laws.**

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No _X__ ;
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?
Yes ___ No ___ ; if yes, specify name of river and designation: _____;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___ ;
if yes,describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1.	List of all attachments to this document.	**See Table of Contents**
2.	U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.	**See page USGS-1 and Fig. 1.02**
3..	Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.	**See Figs. 2.01, 2.02, 2.05, and 2.17**
4.	Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the	**ACEC – Fig. 1.01;**

	project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.	**Ch. 91 areas – Fig. 7.01** **WRAs – Fig. 2.15**
5.	Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).	**See Fig 4.01 and Attachment 4-1 at the end of Section 4.0 of the narrative**
6.	List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).	**See ENF Distribution List page v**
7.	List of municipal and federal permits and reviews required by the project, as applicable.	**See Section 7.0**

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LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) ___ Yes _**X**_ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	_____	_____	_____
Internal roadways	_____	_____	_____
Parking and other paved areas	**1.0**	**0**	**1.0**
Other altered areas	**21.2**	**-5.1**	**16.1**
Undeveloped areas	**31.8**	**+5.1**	**36.9**
Total: Project Site Acreage	**54**	**0**	**54**

Has any part of the project site been in active agricultural use in the last five years? ___ Yes __**X**_ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

Is any part of the project site currently or proposed to be in active forestry use? ___ Yes __**X**_ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _**X**__ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes__**X**_ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _**X**__ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No __**X**_; if yes, describe:

III. Consistency

Identify the current municipal comprehensive land use plan

Title: **Land Use Plan – Town of Saugus** Date **1990**

Describe the project's consistency with that plan with regard to:

1) economic development **N/A**
2) adequacy of infrastructure **No Impact**
3) open space impacts **consistent with goals to develop open space of conservation and recreation areas including the Saugus Marsh**
4) compatibility with adjacent land uses **preserves existing residential neighborhood**

Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)

RPA: **MAPC – Metropolitan Area Planning Council**

Title: **Metro Future** Date **May 2008**

Describe the project's consistency with that plan with regard to:

1) economic development **N/A**
2) adequacy of infrastructure **N/A**
3) open space impacts **consistent with goals of improving condition of wetlands for enhanced wildlife and recreational use**

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RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes _**X**_ No; if yes, specify, in quantitative terms:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes _**X**__ No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes _**X**__ No.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

4. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? **X** Yes ___ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? **X** Yes ___ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? **X** Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes **X** No; if yes, list the date and MassDEP file number: _____; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes ___ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site: **Please refer to Section 5.1 of the attached Narrative**

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean	0	
Designated Port Areas	0	
Coastal Beaches	0	
Coastal Dunes	0	
Barrier Beaches	0	
Coastal Banks	0	
Rocky Intertidal Shores	0	
Salt Marshes	31.8 acres	31.7 Temporary (Marsh Restoration)/0.1 Permanent (dike/culverts)
Land Under Salt Ponds	0	
Land Containing Shellfish	0	
Fish Runs	0	
Land Subject to Coastal Storm Flowage	721,306 SF 2400 SF 1600 SF	Temporary – Marsh Restoration Permanent – Fill for Dike Temporary – excavation for culvert
Inland Wetlands		
Bank (lf)	0	
Bordering Vegetated Wetlands	0	
Isolated Vegetated Wetlands	0	
Land under Water	0	
Isolated Land Subject to Flooding	0	
Bordering Land Subject to Flooding	0	
Riverfront Area	165,783 SF 2400 SF	Temporary – Marsh Restoration Permanent – Fill for dike

D. Is any part of the project:

1. proposed as a **limited project**? _X__ Yes ___ No; if yes, what is the area (in sf)? **31 acres ecological restoration under 310 CMR 10.24 (8)**
2. the construction or alteration of a **dam**? ___ Yes _X__ No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes _X__ No
4. dredging or disposal of dredged material? ___ Yes _X__ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? _X__ Yes ___ No
6. subject to a wetlands restriction order? ___ Yes __X_ No; if yes, identify the area (in sf):
7. located in buffer zones? _X__Yes ___No; if yes, how much (in sf) _____

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? _X__ Yes _ __ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes _X_ No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? _X__ Yes ___ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? _X__ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands: **See Figure 7.01 in attached narrative and license no. 10289.**

Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes _X__ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current _0__ Change _0__ Total _0__

If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following:

Area of filled tidelands on the site:_____

Area of filled tidelands covered by buildings:_____

For portions of site on filled tidelands, list ground floor uses and area of each use:

_____

Does the project include new non-water-dependent uses located over flowed tidelands? Yes ___ No ___

height of building on filled tidelands_____

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes _X__ No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes _X_ No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes _X__

No;(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? ___ Yes _**X**__ No; if yes, answer the following questions:
What type of dredging? Improvement ___ Maintenance ___ Both ____
What is the proposed dredge volume, in cubic yards (cys) _____
What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft);
Will dredging impact the following resource areas?
Intertidal Yes__ No__; if yes, ___ sq ft
Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft
Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__; if yes __ sq ft
If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?
If no to any of the above, what information or documentation was used to support this determination?
Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.
Sediment Characterization
Existing gradation analysis results? __Yes ___No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes ____No; if yes, provide results.
Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____
(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? _**X**_ Yes ___ No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

The Project is consistent with CZM's policies, especially in reducing coastal hazards (Coastal Hazards Policies #1 & #2), protection of habitat (Habitat Policies #1 & #2) and providing public access. CZM consistency review will be required as part of the Army Corps Section 404 review of this Project as well.

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _**X**_ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _**X**_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _**X**_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	_____	_____	_____
Withdrawal from groundwater	_____	_____	_____
Withdrawal from surface water	_____	_____	_____
Interbasin transfer	_____	_____	_____

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. _____

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? _____

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_____	_____	_____	_____
Capacity of water treatment plant (gpd)	_____	_____	_____	_____

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

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WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _**X**_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _**X**_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	_____	_____	_____
Discharge of industrial wastewater	_____	_____	_____
TOTAL	_____	_____	_____

	Existing	Change	Total
Discharge to groundwater	_____	_____	_____
Discharge to outstanding resource water	_____	_____	_____
Discharge to surface water	_____	_____	_____
Discharge to municipal or regional wastewater facility	_____	_____	_____
TOTAL	_____	_____	_____

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow
Total Wastewater treatment plant capacity (in gallons per day) _____	_____	_____	_____

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	_____	_____	_____
Treatment	_____	_____	_____
Processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

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TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _**X**_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to state-controlled roadways? _**X**_ Yes ___ No; if yes, specify which permit: **Temporary Highway Access Permit – Rt. 107 – Existing Permit #4-2014-128 will be extended for duration of construction**

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_____	_____	_____
Number of vehicle trips per day	_____	_____	_____
ITE Land Use Code(s):	_____	_____	_____

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes _**X**__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _**X**__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? _____
2. Cutting of living public shade trees (number)? _____
3. Elimination of stone wall (in linear feet)? _____

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

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ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))?
___ Yes _**X**_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _ **X** __ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)			
Length of fuel line (in miles)			
Length of transmission lines (in miles)			
Capacity of transmission lines (in kilovolts)			

B. If the project involves construction or expansion of an electric generating facility, what are:
1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

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AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _ **X** __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _ **X** __ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter			
Carbon monoxide			
Sulfur dioxide			
Volatile organic compounds			
Oxides of nitrogen			
Lead			
Any hazardous air pollutant			
Carbon dioxide			

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan.

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

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SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _ **X** __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes __ **X** _ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Treatment, processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Recycling	_____	_____	_____
Treatment	_____	_____	_____
Disposal	_____	_____	_____

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos? ___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

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HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? ___ Yes _ **X** _ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes __ **X** _ No; if yes, attach correspondence

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _ **X** __ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _**X**__ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes _**X**__ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

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CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

(Name) Saugus Advertiser (Date) March 26, 2015

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

3/16/15 [signature] 3/16/15 [signature]

Date Signature of Responsible Officer or Proponent

Date Signature of person preparing ENF (if different from above)

Kevin Whalen, Deputy Commissioner for Operations
Name (print or type)

Dept. of Conservation & Recreation
Firm/Agency

251 Causeway Street, Suite 700
Street

Boston, MA 02114
Municipality/State/Zip

(617)-626-1250
Phone

Rachel J. Burckardt, PE, Project Manager
Name (print or type)

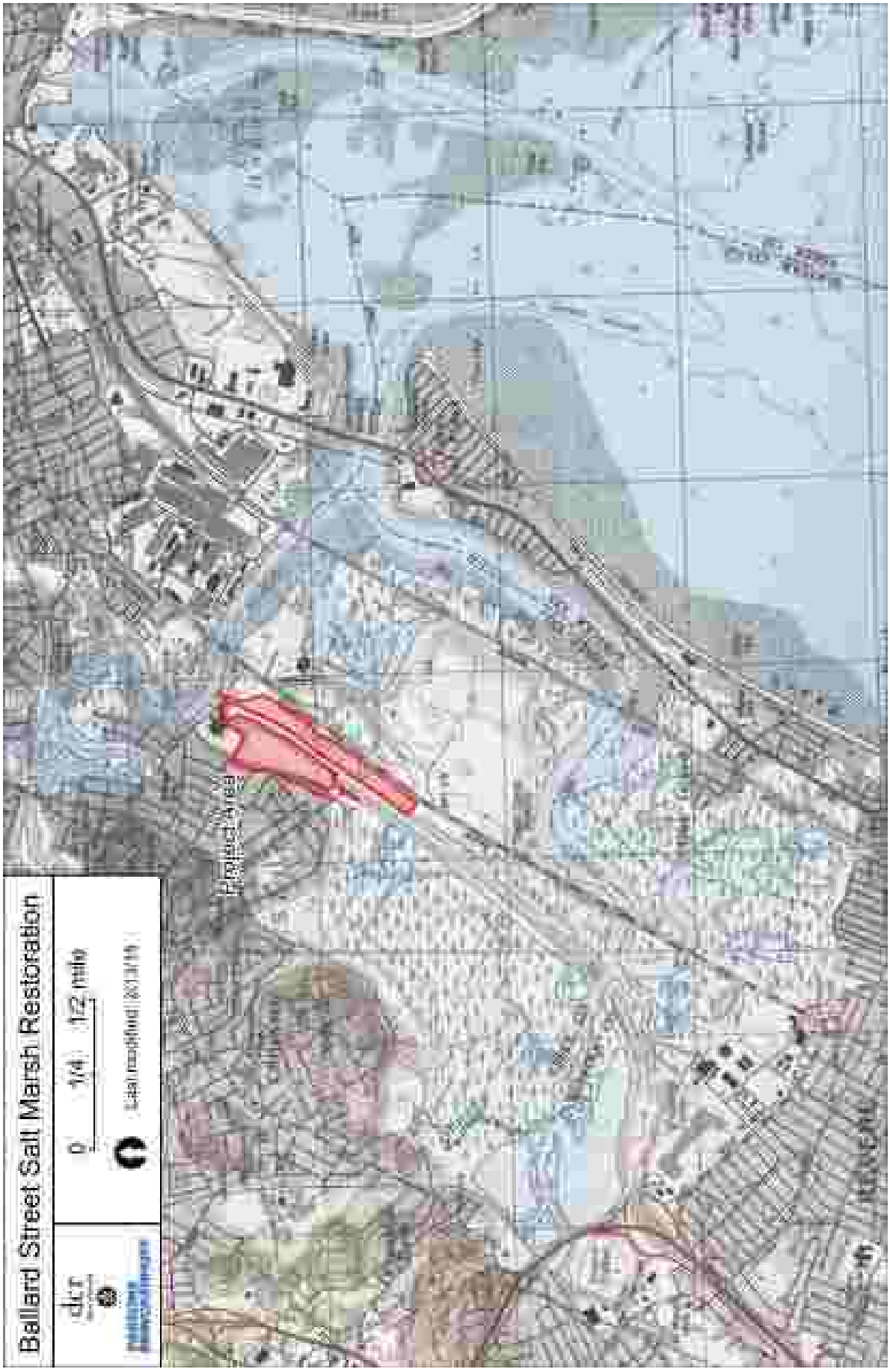
Parsons Brinckerhoff, Inc.
Firm/Agency

75 Arlington Street, 9th Floor
Street

Boston, MA 02116
Municipality/State/Zip

(617) 427-7330
Phone

USGS Map


Ballard Street Salt Marsh Restoration
Project Area
0
1/4
1/2 mile

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1.0 Project Overview

1.1 Introduction

This document is an Expanded Environmental Notification Form (EENF) and Request for a Waiver of the requirements for preparation of an Environmental Impact Report for the Ballard Street Salt Marsh Restoration Project (the Project) in the Town of Saugus, Massachusetts. The location of the Project is shown on the USGS topographic quadrangle identified as Fig. 1.02. This EENF is submitted on behalf of the Massachusetts Department of Conservation and Recreation (DCR) to the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) under the Massachusetts Environmental Policy Act (MEPA), in accordance with 301 Code of Massachusetts Regulations (CMR) 11.00 and with General Laws Chapter 30, Sections 61 through 62H. In accordance with 301 CMR 11.05(4), this EENF includes a concise and accurate description of the Project and its alternatives, identification of review thresholds and agency actions, and an assessment of potential environmental impacts and mitigation measures.

The Project is categorically included for preparation of an Environmental Impact Report (EIR) as noted in Section 1.4. DCR believes this Project meets all of the requirements for a Waiver of the EIR as described in 301 CMR 11.11(1) and (3) and discussed in Section 8.0.

1.2 Description of Project Area

The Ballard Street salt marshes are located within the 2,363-acre Rumney Marsh system in the North Coastal Watershed of Massachusetts, as shown in Fig. 1.03. The upland watershed includes most of the coastal drainage areas north of Boston. Rumney Marsh and the 422-acre Belle Isle Marsh to the south comprise the 2,785-acre Rumney Marsh Area of Critical Environmental Concern (ACEC) and drain an area of approximately 65 square miles. See Fig. 1.01.

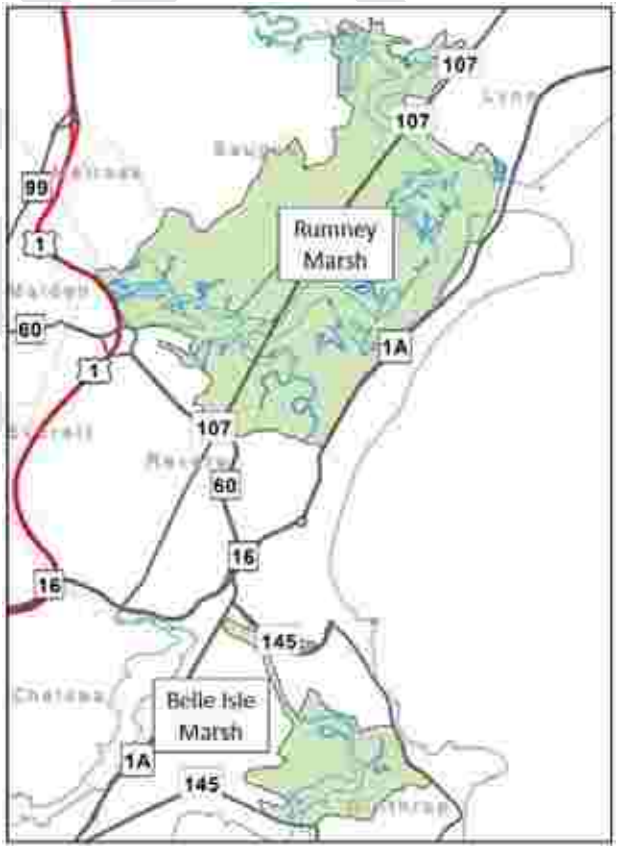

Fig. 1.01 Rumney Marshes ACEC includes Belle Isle Marsh to the south

The 54-acre Project Area is located within East Saugus and is generally bordered by Eastern Avenue on the west, Ballard Street on the north, Salem Turnpike (Route 107) on the east and the abandoned Bristow Street right-of-way on the south. See Figures 1.02, 1.03 and 1.04. Lands within the Project Area are owned by either DCR or by the Town of Saugus (the Town), with some parcels also subject to a care and control agreement between DCR and the Town.

The Project Area contains two areas of historically filled and/or degraded salt marshes, hereafter referred to as the Eastern and Western Marshes, which are bifurcated by a large linear embankment of sand and gravel fill placed in the late 1960s for the layout of I-95 (see Fig. 1.04). At that time, I-95 was planned to run from the circle at Route 60 in Revere, passing through the Rumney Marsh in a gentle arc, and then crossing the Saugus River into Lynn.

In the intervening years, little by little, agencies of the Commonwealth have been removing portions of the embankment for beneficial use, including roadway subbase and beach nourishment at Revere and Winthrop. The most recent extraction is part of the DCR's Winthrop Beach Nourishment Project (Contract No. P11-2686-C4A, EEA #10113), which is ongoing.

The remains of the embankment can be seen in Fig. 1.04.

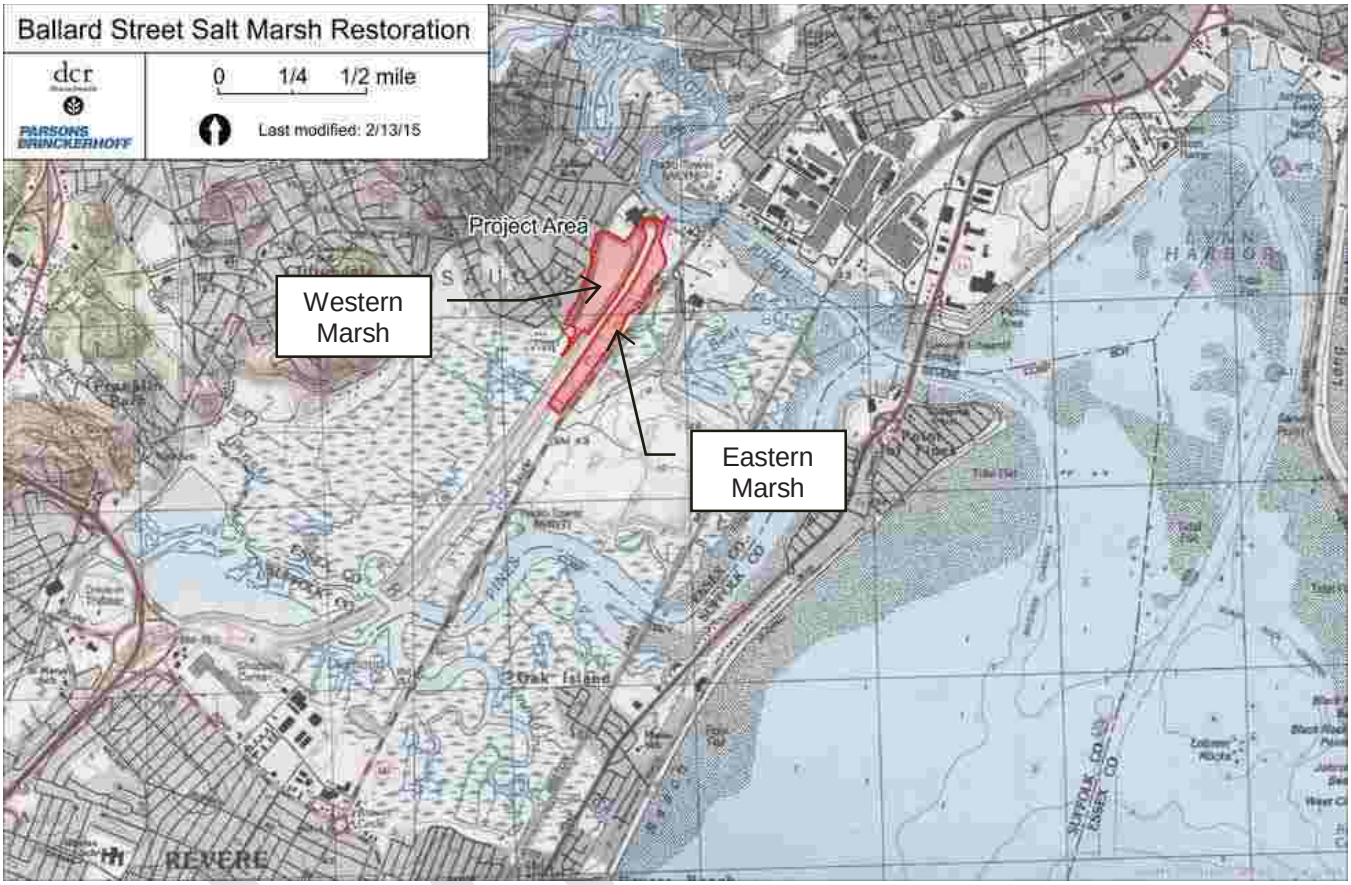

Fig. 1.02 USGS Project Locus

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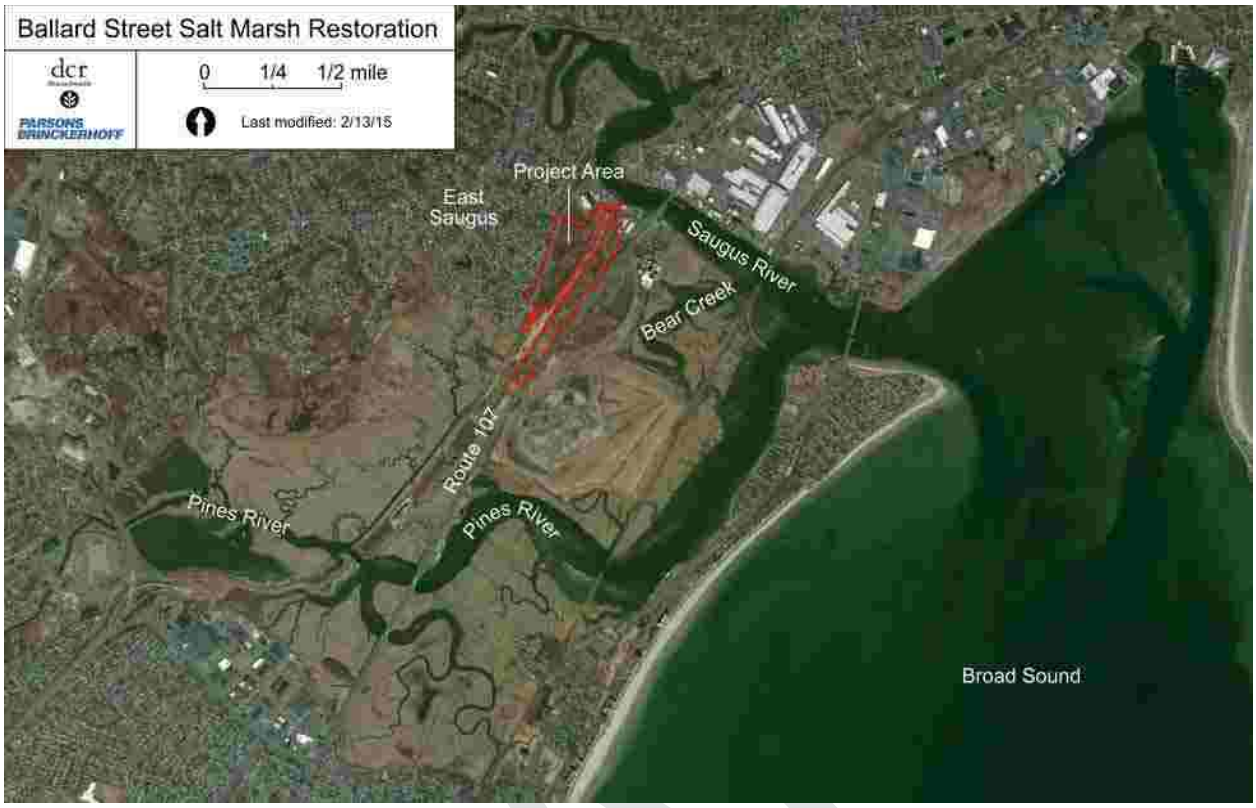

Fig. 1.03 Project Area in Relation to Overall Rumney Marsh

Fig. 1.04 Aerial Project Locus

1.3 Project Purpose and Need

1.3.1 History of Project Area

Historically, the Ballard Street salt marsh received tidal water from three sources: the Saugus River to the north, Bear Creek to the east, and the Pines River to the south (formerly the Chelsea River as seen in Fig. 1.05). See historic maps from 1829 and 1872 in Figs. 1.05 and 1.06. The Project Area was once contiguous to 150 acres of salt marsh, extending west from the present day Route 107 (Salem Turnpike) nearly to Lincoln Avenue at the fringes of the East Saugus drumlin. Evidence of construction of the Salem Turnpike (now Route 107), first emerges in the 1829 map. "South Street" is believed to be an early version of Bristow Street. Note that Ballard Street has not been built and a stream drains the Project Area into the Saugus River.

By 1872, Ballard Street was in place and the drainage pattern changed, with the link to the Saugus River not shown. In its place, a series of channels along the west side of the Turnpike drain the Project Area to the Bear Creek.

Development in the East Saugus neighborhood has filled in this area, as shown on Fig. 1.08.

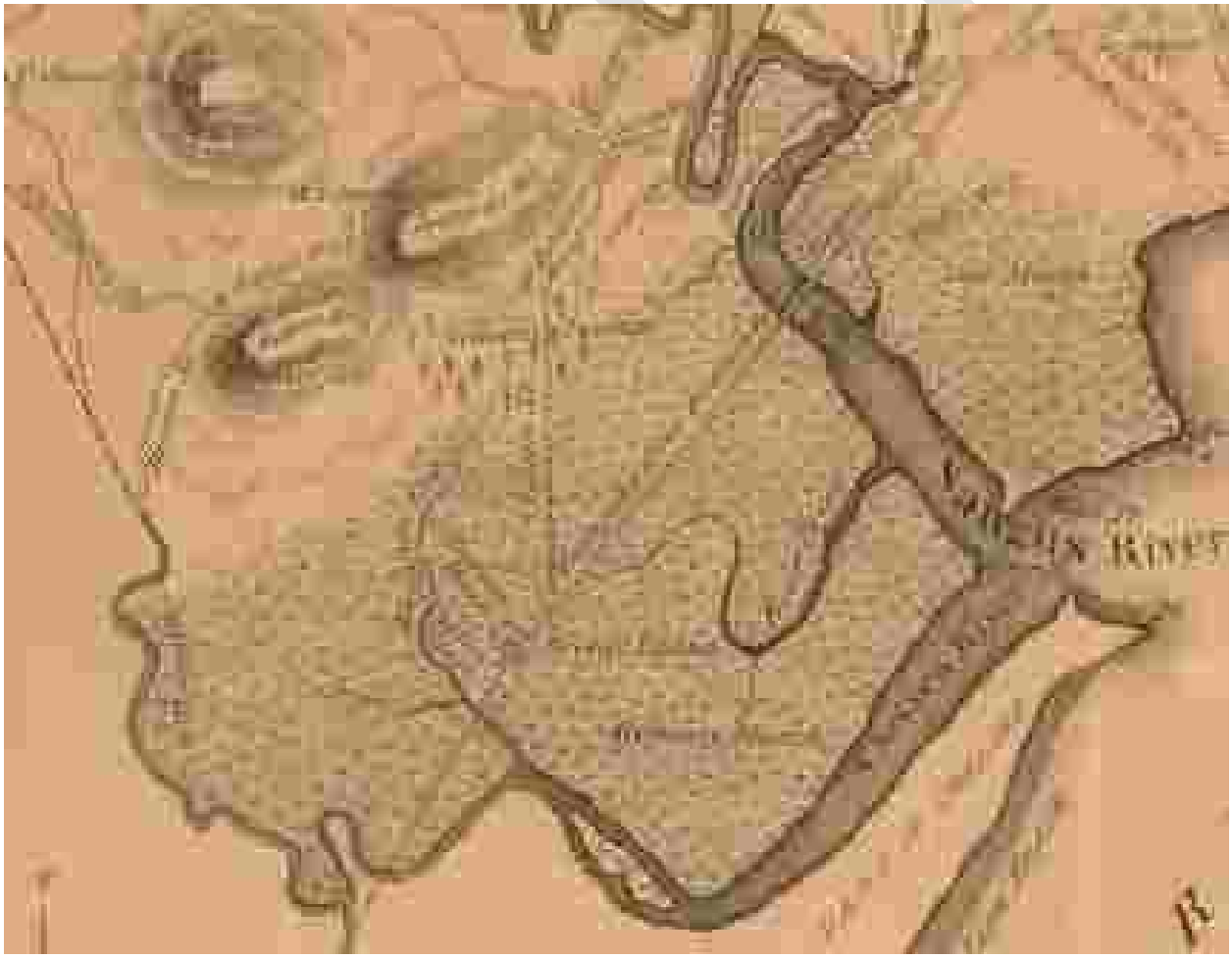

Fig. 1.05 1829 Historic Map of Project Area

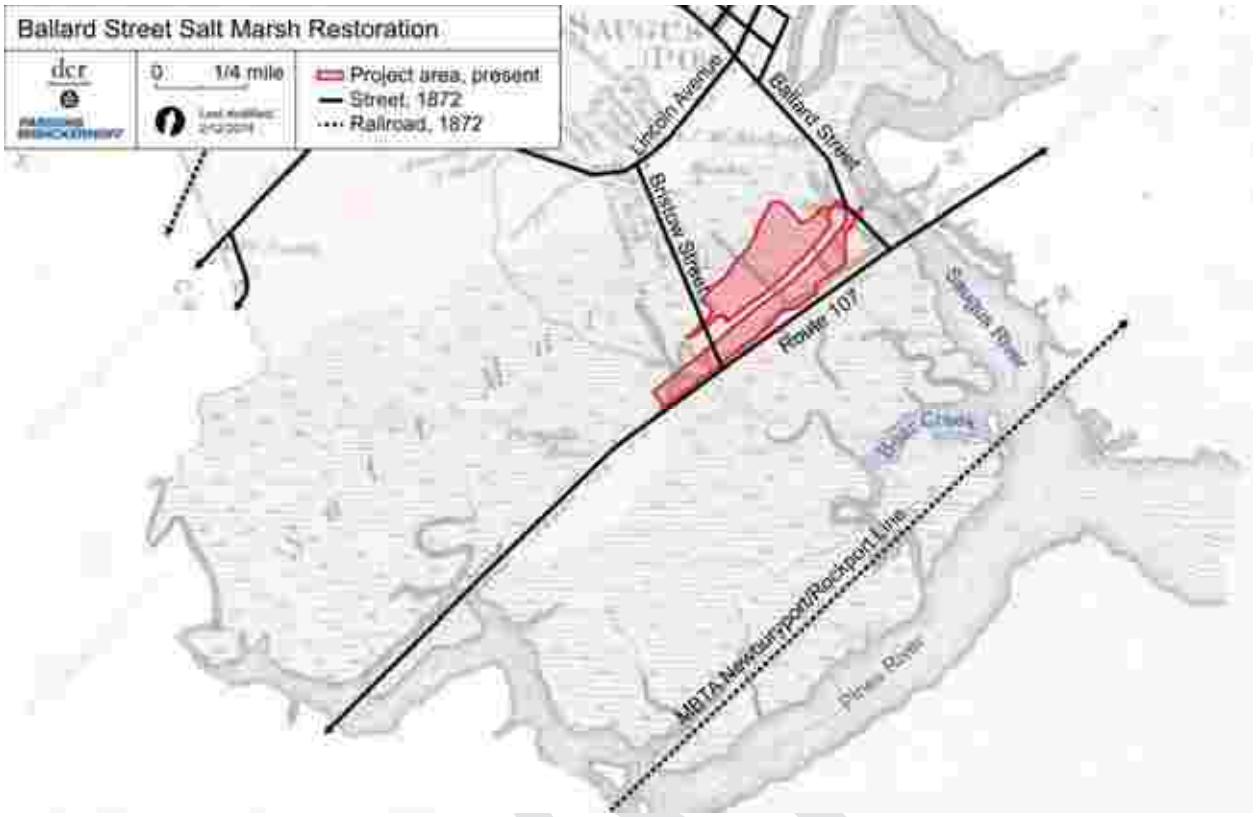

Fig. 1.06 1872 Historic Map of Project Area

Fig. 1.07 USGS Map from 1943.
Left: Showing the Project Area with apparent culverts under Bristow Street, the Salem Turnpike (Rt. 107) and Ballard Street. Right: Close-up showing stream passing under Ballard Street with a symbol indicating a bridge.

Today, tidal exchange is limited within the salt marsh because of significant anthropogenic alterations including past installation of culverts, tide gates, and filling of salt marsh. The result is that a once contiguous area of salt marsh within the Rumney Marsh (see Fig. 1.05, 1.06 and 1.07) is now degraded and the remaining marsh is isolated as two tenuously connected but distinct marsh cells (referenced herein

as the Eastern and Western Marshes – see Fig. 1.04) with severely restricted tidal connections due to five specific conditions:

1. The primary tidal restriction occurs at Ballard Street where an improvised tide gate (see Fig. 2.20) affixed to the downstream end of a 4-ft. diameter culvert under Ballard Street (culvert "BA-1") severely restricts flow from the Saugus River. While installed as a stop-gap measure to replace an historic tide gate and to provide some flood protection by blocking flow from the Saugus River into the Western Marsh, the improvised tide gate at Ballard Street leaks, allowing roughly only 30% of the Saugus River tidal range to pass through the culvert.

2. A second historic tidal connection along the Pines Creek, which once also functioned via a tide gate at Bristow Street (culvert "BR-1") (east of the I-95 embankment) providing flow to the Eastern Marsh, is now blocked entirely from tidal flow by a wooden board (Fig. 2.21).

3. A third tidal restriction occurs at the Western Marsh, where the absence of a culvert directly along the Pines River Channel occurs at Bristow Street (west of the I-95 embankment).

4. Directly east of the project area, an additional restriction is the result of past filling for the solid waste facility, where non-functioning culverts and Route 107 all block flows from Bear Creek.

5. Finally, the major contributor negatively affecting the quality of the salt marsh is the presence of the fill material associated with construction of the abandoned extension to I-95.

The combined result of these obstructions is a highly muted tidal flow and one that is not able to support a viable salt marsh to the extent that once existed in this now degraded system.

Fig. 1.08 Fill placement since 1872

Fig. 1.09 Hydraulic Constrictions to Tidal Connectivity of the Project Area

1.3.2 Project Need

The restrictions in tidal exchange and physical obstructions contribute to the poor drainage of freshwater from the flood-prone East Saugus neighborhood to the Saugus River. As a result, the area has poorly functioning salt marsh and the adjacent residential neighborhood experiences exacerbated flooding. The cumulative effect of these alterations is the significantly reduced coverage of salt marsh resource in the vicinity of the Project Area from more than 54 acres to the present estimate of approximately 9 acres. The remaining 45 acres have converted to either freshwater marsh dominated by non-native and invasive common reed (*Phragmites australis*), or have begun the process of succession to forested upland. The monotypic coverage of *Phragmites* is the dominant visual and structural feature of the Project Area covering more than 75% of the remaining wetland and greatly limiting its function and value.

Fig. 1.10 Photos from Eastern Avenue showing freshwater invasives (left) and succession to forested upland (right)

1.3.3 Project Purpose

The Project is proposed in order to accomplish two primary goals:

1) The restoration of former and degraded salt marsh in an Area of Critical Environmental Concern (ACEC), thereby improving wildlife, fisheries, and potential shellfish habitat; and

2) Enhancement of flood control and storm damage prevention for area residents through improved drainage providing for better control of water levels from coastal and inland storm events.

The Division of Ecological Restoration (DER) of the Massachusetts Department of Fish & Game has determined this Project to be the highest priority project within the Rumney Marsh given the extent of potentially restorable salt marsh and the potential improvements to flood control, water quality, and other ecological benefits for fisheries and wildlife (Rumney Marshes Area of Critical Environmental Concern Restoration Plan, WRP, 2002). The Project is also a federal Coastal America Project based on a "Resolution to Restore Massachusetts Wetlands," which the Executive Office of Environmental Affairs (EOEA), the Mass. Department of Transportation, and six federal agencies representing the federal Coastal America Partnership signed in 1994. As such the Project has benefitted significantly from the past input of the United States Environmental Protection Agency (EPA), the United States Department of Agriculture's Natural Resource Conservation Service (NRCS), and the United States Army Corps of Engineers (ACOE).

1.4 Project History

The Project has developed from multiple past collaborative efforts among many federal, state, and municipal stakeholders including ACOE, EPA, NRCS, the Town, the MA Department of Conservation and Recreation (DCR, formerly known as the MDC), and DER.

1.4.1 Early Versions of the Project with NRCS as Proponent

Recurrent flooding during and following inland storm events in the adjacent East Saugus neighborhood led to initial investigation by NRCS (USDA NRCS, 1999). The other stakeholders recognized the Project's simultaneous potential to provide significant wetland restoration of the degraded salt marsh in the Project Area.

Between 1999 and 2007, NRCS, in conjunction with the Town, EPA, DER, and others, advanced the design of improvements to address flood control and salt marsh restoration. This work included the filing of an ENF for which the Secretary issued a Certificate under EOEA #12889, dated December 30, 2002. Construction was proposed in three phases:

- Phase 1 included the installation of a new culvert and tide control gates at the I-95 embankment terminus near Ballard Street (about 200 ft. upstream of the culvert under Ballard Street). These gates would control the tidal range in the Western Marsh;
- Phase 2 included excavation to lower the marsh plain and create stormwater storage in the Western Marsh between the I-95 embankment and Eastern Avenue; and
- Phase 3 provided for tidal restoration via removal of objects that obstruct flow at Ballard and Bristow Street culverts ("BA-1" and BR-1," respectively) and simultaneous operation of the culverts and tide gates previously installed in Phase 1.

Subsequently, the Town, with support from NRCS, submitted a Phase 1 waiver request under EEA #13993 on April 20, 2007. Refer to Appendix 4 for copies of the ENF Certificates for EOEA[1] #12889 and EEA #13993.

NRCS advanced the design to secure the permits required to implement Phase 1, but the final two phases required further design before permits could be secured to allow that work. Even though Phase 1 permitting was partially completed, its implementation was put on hold for several reasons:

1) Uncertain funding for design/construction of remaining phases;
2) Errors discovered in the original ground survey which caused NRCS to withdraw the original permitted Phase 1 construction designs; and
3) The need for additional tidal data and updated modeling capability on the flow dynamics of the existing marsh system, work that would ultimately lead to the development of the current design.

The project never advanced to Phase 1 installation.

1.4.2 Role of the Winthrop Beach Restoration and DCR as Project Proponent

In 2010 DCR, which had undertaken the Winthrop Beach Nourishment Project (included in EEA #10113) Investigations by DCR determined that sand and gravel embankment installed in the late 1960s to support large portions of the I-95 extension immediately adjacent to the Project Area would be suitable for nourishment. The US Army Corps of Engineers used material from this embankment for the successful beach nourishment of Revere Beach in the 1990s. DCR proposed extracting the sand and restoring portions of the underlying salt marsh which had been buried by the I-95 embankment. The Winthrop Beach Nourishment Project proved an opportunity to revive the dormant salt marsh restoration and flood control enhancement project.

DCR recognized that the restoration of wetland acreage underlying the I-95 embankment, to be exposed by the extraction of sand for the Winthrop Beach Nourishment Project could and should be beneficially combined with reviving efforts at the Ballard Street salt marsh to ensure coordinated design and construction of each. In fact, the Superseding Order of Conditions (DEP File # 067-1001) issued for DCR's sand removal requires such coordination prior to commencement of the salt marsh restoration under the embankment. This synergy, combined with the realization of significant new project funding via a USFWS National Coastal Wetland Conservation Grant awarded to DCR and DER made the Project feasible.

DCR and DER secured new ground survey data along with more complete tidal flow data within the Project Area, including data from tide gauges and salinity testing at multiple site locations, as described in a report prepared by Woods Hole Group, Inc. (2014, see Appendix 1). DCR, through Applied Coastal Research and Engineering, Inc. in 2014-2015, performed additional hydraulic and hydrologic modeling of the Project Area to test and predict tidal dynamics of the Project Area under a range of conditions and design alternatives, described in Appendix 2.

The current design was developed based upon its ability to balance complicated site conditions and (at times) competing interests in order to provide the maximum amount of salt marsh restoration with as natural a tidal flow as possible while also mitigating flooding effects to the adjacent residential neighborhood. This proactive salt marsh restoration project is the single largest restoration opportunity

[1] EOEA, or Executive Office of Environmental Affairs, is the predecessor of the current EEA (Executive Office of Energy and Environmental Affairs).

within Rumney Marsh and is consistent with the *Rumney Marshes Area of Critical Environmental Concern Salt Marsh Restoration Plan* (May, 2002).

For description, see Section 4.0.

1.5 MEPA Review Thresholds

Under current MEPA review thresholds the Project requires an ENF and a mandatory EIR for alteration of one or more acres of salt marsh or bordering vegetating wetlands [301 CMR 11.03(3) (1) (a)], and alteration of ten or more acres of any other wetlands [301 CMR 11.03(3) (1) (b)]. The Project also triggers an ENF and other MEPA review, if the Secretary so requires, as it is within a designated ACEC [301 CMR 11.03(11) (b)], and because the Project will result in direct alteration of 25 acres or more of land [301 CMR 11.03(1) (b) (1)].

This application will demonstrate that construction of the Project described in this EENF, meets the standards for a waiver of the mandatory EIR, as described in 301 CMR 11.11 (1-3). The standards and demonstration of compliance with the waiver criteria are described in Section 8.0.

1.6 Greenhouse Gas Emissions Compliance

The project is believed to qualify for a de minimus exemption from the MEPA Greenhouse Gas Emissions Policy and Protocol as an ecological restoration project.

1.7 Vertical Datum

All vertical elevations in this report refer to the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

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2.0 Existing Conditions

The 54-acre Project Area, located within the 2,363-acre Rumney Marsh system (see Fig. 1.01), is shown in Fig. 2.01. The Project Area is located within East Saugus and is generally bordered by Eastern Avenue on the west, Ballard Street on the north, Salem Turnpike (Route 107) on the east and the abandoned Bristow Street right-of-way on the south. The Project Area contains two areas of degraded salt marshes, hereafter referred to as the Eastern and Western Marshes, which are bifurcated by a large linear embankment of sand and gravel fill placed in the late 1960s for the layout of I-95.

Fig. 2.01 Project Area

2.1 Wetland Resources

The Project Area formerly contained a thriving salt marsh. Today it is a low-quality brackish/freshwater marsh dominated by the non-native and invasive common reed (*Phragmites australis*). The salt marsh resource in the Project Area is 31.8 acres, based on field delineation. The Western Marsh contains 15.4 acres of poorly functioning *Phragmites* marsh. The monotypic coverage of *Phragmites* is the dominant visual and structural feature of the Project Area covering more than 75% of the remaining wetland and greatly limiting its function and value. The Eastern Marsh contains 16.4 acres in a similar condition.

Wetlands subject to Section 404 of the Clean Water Act, the Massachusetts Wetland Protection Act (MGL Ch. 131 S. 40) and Regulations, and the Saugus Wetland Bylaw, Article 508 have been delineated several times within the Project Area. In 2002, the Saugus Conservation Commission approved the boundaries for Phase 1 of the NRCS proposed project under DEP File #67-806, which has been periodically extended by the Saugus Conservation Commission and remains current. Wetlands were again delineated in June 2005 by GeoSyntec and most recently in August 2012 by Rimmer Environmental

Consulting (REC) for the sand extraction project, approved under a Superseding Order of Conditions (DEP File #67-1001). Additional flagging along Eastern Avenue and historic peat stockpiles in the Eastern Marsh were delineated by REC in September 2014. The extent of the wetland resources within the Project Area has been compiled from the delineations as described above and is depicted on the Wetland Resource Map, Fig. 2.02.

Fig. 2.02 Wetland Resource Map

Wetland Resource Areas (WRAs) subject to the Massachusetts Wetlands Protection Act present within and immediately adjacent to the Project Area include Salt Marsh, Riverfront Area, and Land Subject to Coastal Storm Flowage.

2.1.1 Salt Marsh

The Project Area contains primarily areas of former salt marsh that are converting from brackish to freshwater marsh due to the lack of adequate tidal exchange. Approximately 15.4 acres of salt marsh are located west of the I-95 embankment and 16.4 acres to the east. These figures are based on field delineation, as described in Section 2.1. Species composition is similar on both sides of the embankment. Dominant vegetation within both the Eastern and Western Marshes is *Phragmites*. However, interspersed within the *Phragmites* stands are small pockets of salt marsh species such as *Spartina alterniflora, Spartina patens, Juncus gerardii, Salicornia europaea, Sueada linearis,* and *Atriplex patula*. Several ditched channels are present within the salt marsh. The wetland areas closest to Ballard Street reflect the larger concentration of coastal wetland plants, as these are closest to the limited tidal exchange at the failed tide gate.

Though delineated as the Salt Marsh (310 CMR 10.32), the Western Marsh is now functioning mostly as a freshwater Bordering Vegetated Wetlands (BVW) with some tidal influence confined mostly to the main channel along the northern edge. The Western Marsh is dominated by *Phragmites australis*, and

several ditched channels are present. A large fill pile of peat excavated from under what is now the I-95 embankment is present within the Eastern Marsh.

Nearest the upland areas the salt marsh transitions to a scrub shrub wetland including species such as grey birch, sweet gale, swamp rose, purple loosestrife, and sensitive fern occurring near the base of the I-95 embankment.

2.1.2 Riverfront Area

The Saugus River and portions of an unnamed tributary to the Saugus River near Ballard Street are indicated on the USGS topographic quadrangle as perennial streams and are therefore presumed under 310 CMR 10.58 to contain a 200-ft. Riverfront Area extending from mean high water. A small portion of the northern part of the Project Area is within the Riverfront Area to the Saugus River and a larger portion is within Riverfront Area to the on-site unnamed tributary. See Fig. 2.02.

2.1.3 Land Subject to Coastal Storm Flowage (LSCSF)

This resource is defined under 310 CMR 10.04 as, "land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater." The current Flood Insurance Rate (FIRM) maps for this area, depicted as Fig. 2.03 indicate that the 100-year storm extends up to elevation +9.0 ft. and encompasses virtually the entire Project Area.

Fig. 2.03 FEMA Flood Map

Based upon a survey profile, Saugus River tidal elevations greater than +7.1 ft. will overtop Ballard Street and enter the marsh. This would occur with a frequency greater than the 10-year tidal flood of 8.4 ft.. The southeast end of the Project Area at Bristow Street is subject to tidal flooding from the Pines River at

approximately the same frequency. The intersection of Bristow Street and Eastern Avenue is just barely above elevation +7 ft. Eastern Avenue varies in elevation up to elevation +10 ft. Surface flooding of the residential properties in the upgradient East Saugus neighborhood currently begins at elevation +5.4 ft.

2.2 Wildlife/Fisheries Habitat

The wildlife habitat functions of the existing marsh are severely restricted by the lack of adequate tidal exchange and the subsequent colonization of a majority of the area by non-native and invasive plant species, especially *Phragmites*. The tendency of *Phragmites* to grow in mono-typic stands, greatly limits other native plant species as demonstrated by the Project Area's low diversity of vegetative cover. Low plant species diversity reduces the range of ecological niches for native wildlife, given the limited variety of forage, cover and overwintering sites. The result is a corresponding drop in wildlife diversity. While still found in small numbers, many of the shore birds, waders and waterfowl typically inhabiting New England salt marshes are largely absent from this Project Area. The lack of tidal exchange limits opportunities for fish to enter into the ditches located through the Project Area and for shellfish to occupy tidal flats, pannes, and pools that are typically present in an undisturbed salt marsh. In the Western Marsh, there is no tidal access (i.e., inundation at MHW) to the marsh other than immediately adjacent to the tidal stream along the northerly boundary. Overall, there is presently tidal access only to 3 acres for the remaining 31.8 acres in the Eastern and Western Marshes.

2.3 Water Quality

Because the Project is located within the Rumney Marshes ACEC, its wetlands and water bodies are designated as Outstanding Resource Waters (ORW) per 314 CMR 4.06. This protection reflects the waters' outstanding socio-economic, recreational, ecological, and/or aesthetic values. Protection of the existing water quality is required, and a new or increased discharge is generally prohibited.

2.4 Rare Species

The Project Area is not located within the Estimated Habitat of Rare Wetlands Wildlife or within Priority Habitat, as identified by information provided by the Mass. Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program available on MassGIS.

2.5 Soils

GeoSyntec Consultants conducted soil testing in the Western Marsh with a hand-held steel auger in 2005. Probes extended 3 ft. in depth. Testing indicates that the southern two thirds of the Western Marsh contain a higher water table elevation and is dominated by *Phragmites*. The sediment is dark brown peat to a depth of at least 1 ft. underlain by fine to medium sand. The north section is primarily covered by trees, shrubs and grasses with sediment consisting of about 1 ft. of black to dark brown peat underlain by brown sand to sandy silt. Boston Blue Clay appears below the peat layer at one of the sampling stations (S-11). See Appendix 6.

2.6 Parklands and Open Space

2.6.1 Rumney Marsh Reservation

The Project Area is located within the DCR's Rumney Marsh Reservation, which consists of a 600+ acres reservation within the Saugus and Pines River estuary. See Fig. 2.04. The reservation provides recreational opportunities such as boating, fishing, walking, and bird watching. While most of the reservation is undeveloped, there is an existing gravel parking lot located at the corner of Eastern Avenue and Bristow Street. As part of the Winthrop Beach Nourishment Project, the DCR will construct an additional small parking lot at Ballard Street that will be the trailhead of a walking path traversing the embankment to a point just south of Bristow Street. See Fig. 2.05

Fig. 2.04 DCR Rumney Marsh Reservation

Fig. 2.05 A linear path will be constructed along the length of the embankment from Ballard Street to a point south of Bristow Street.

Fig. 2.06 Cross section showing the location of the linear path along the embankment

2.6.2 Harold L. Vitale Memorial Park

Adjacent to the Saugus River and directly north of the DCR reservation at Ballard Street is the Town of Saugus' Harold L. Vitale Memorial Park. The park includes benches, picnic tables, pathways, and a memorial statue. It also includes a parking lot, docks, and a small building.

Fig. 2.07 The Ballard Street culvert ("BA-1") is immediately adjacent to recreational facilities, including Vitale Memorial Park, the new parking lot at Ballard Street, and the footbridge over the tidal stream upstream of the culvert.
For a discussion of the hazards of the existing culvert, see Section 2.8.4.

Fig. 2.08 Vitale Memorial Park includes benches, picnic tables, pathways, and a memorial statue.

2.7 Stormwater Runoff Patterns and Drainage Facilities

Two upland and two wetland watersheds - totaling 144 acres - contribute stormwater runoff to the Ballard Street culvert. These are delineated as Watersheds 2 and 4 for the uplands and 6 and 8 for the wetland watersheds, as delineated in the 1999 NRCS analysis and shown in Fig. 2.09. These watersheds contribute respectively to the North Segment and South Segment of the Eastern Avenue Ditch, as described in Section 2.7.1.

The two upland watersheds include densely developed residential areas in East Saugus. West of Lincoln Avenue, Fig. 2.09 indicates that the upper reaches of Watersheds 2 and 4 extend to the easterly portion of the East Saugus drumlin. East of Lincoln Avenue, are low-lying neighborhoods that are prone to frequent flooding during rain events. These areas are also subject to coastal flooding contributed by both the Saugus and Pines Rivers. For these reasons, most of this neighborhood is within the 100-year floodplain (see Fig. 2.03). Portions of these low-lying areas were originally marsh, as can be seen by comparing Figures 1.05 and 1.06 with Fig. 1.07.

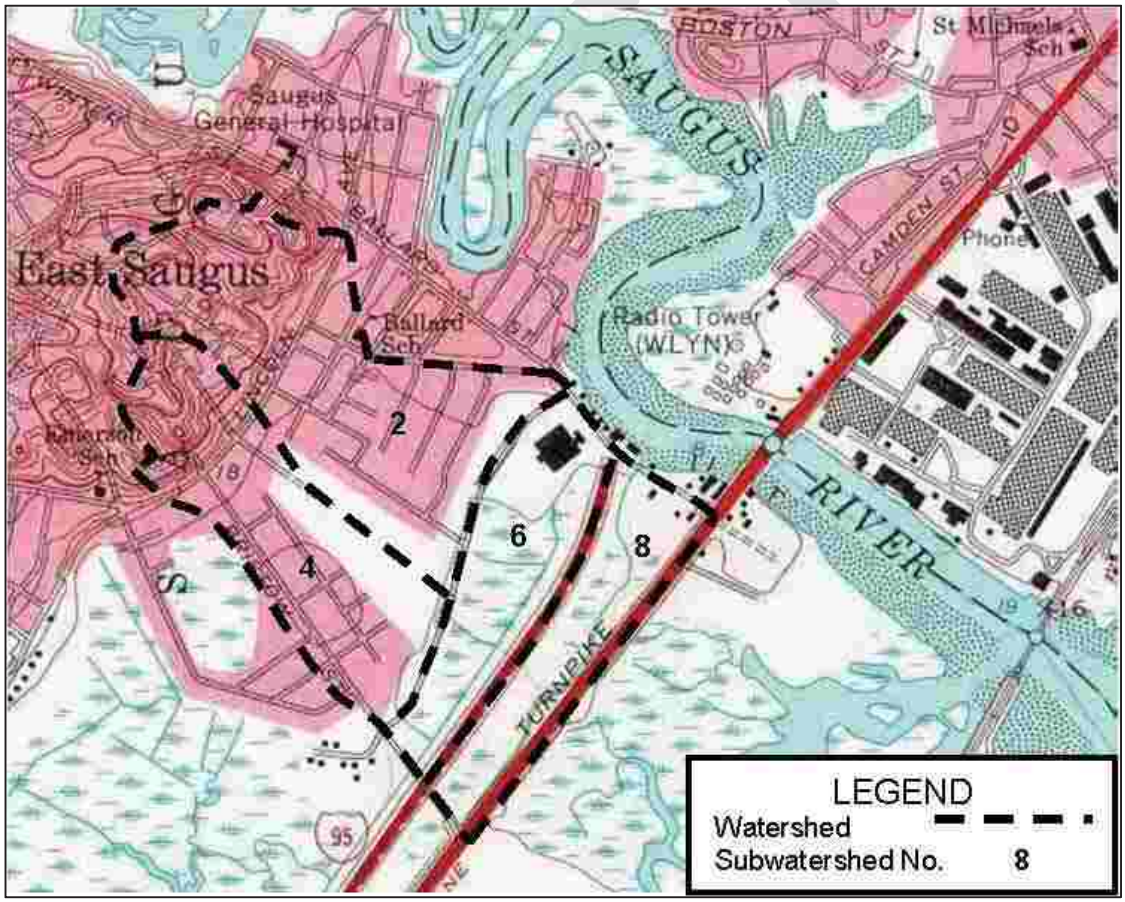

Fig. 2.09: Watershed delineation from the 1999 NRCS Ballard Street Marsh analysis

Watersheds 6 and 8 represent the Western and Eastern Marshes in the NRCS delineation (Fig. 2.09). Each of these areas is defined by bordering fills for roadways:

- Watershed 6 – Western Marsh: Ballard Street (north), Eastern Avenue (west), Bristow Street (south) and abandoned I-95 embankment (east)
- Watershed 8 – Eastern Marsh: Ballard Street (north), abandoned I-95 embankment (west), abandoned Bristow Street embankment (south) and Route 107 (east)

2.7.1 Eastern Avenue Drainage Ditch

Currently runoff from East Saugus (Watersheds 2 and 4) flows overland and through closed drainage systems to a drainage ditch over which the Town of Saugus maintains an easement along the west side of Eastern Avenue. The ditch was constructed along with Eastern Avenue as part of the I-95 embankment project. There are multiple outfalls of the Town storm drainage system that discharge to this ditch. The Eastern Avenue ditch consists of two segments, a connecting culvert and a spur:

- **North Segment** extends from 150 ft. south of Gates Road to approximately 800 ft. north of Gates Road. This segment flows to a 72-in. culvert under Eastern Avenue (henceforth referred to as culvert "E-2"), located 300 ft. north of Gates Road. (See Fig. 2.10.) As seen in Fig. 2.11, north of Gates Road the ditch is an open, tidally influenced waterway. However, south of the 60-in. concrete pipe culvert at Gates Road ("E-4"), the ditch is overgrown with invasive vegetation.
- **South Segment** extends from Bristow Street to Mersea Street. (See Fig. 2.10.) This segment of the ditch is overgrown by invasive vegetation and a repository for discarded items. (See Fig. 2.12.) This segment drains into the existing Western Marsh via a 24-in. culvert under Eastern Avenue (henceforth referred to as culvert "E-1"), located about 150 ft. north of Bristow Street. Four storm drain outfalls discharge into the southern segment. Given the overgrown condition and poorly defined outlets, improved stormwater capacity is needed in this segment of the Eastern Avenue ditch.

Fig. 2.10 Eastern Avenue Ditch and Related Culverts

- **Connecting Culvert:** The two segments of the Eastern Avenue ditch are connected by a 400-ft. long "perched" culvert – a culvert which has inverts higher than the inverts of the ditch. This culvert, designated "E-5," can function as an equalizer, allowing flow from one segment to the other, depending on the relative water elevations at a particular point in time. The culvert appears to have been built to allow for construction on residential subdivision lots.
- **Spur Channel:** An open "spur" channel tributary to the Eastern Avenue drainage ditch extends to the west, about 100 ft. north of Gates Road. (In Fig. 2.10 this is labeled as the Spur Channel.)

Runoff from the East Saugus neighborhood reaches the Eastern Avenue ditch via surface flow and through storm drain pipes. It then drains through the two culverts under Eastern Avenue into the Western Marsh (Watershed 6 in Fig. 2.09).

- Watershed 2 in Fig. 2.09 drains to the North Segment, which, in turn, drains to the 72-in. culvert ("E-2") located about 300 ft. north of Gates Road. For continuation, see Section 2.7.2.
- Watershed 4 in Fig. 2.09 drains to the South Segment. This would generally drain to the 24 in. culvert ("E-1") located about 150 ft. north of Bristow Street. See Fig. 2.10. However, it could also drain towards the North Segment via the Connecting Culvert ("E-5"). For further discussion, see Section 2.7.3.

Fig. 2.11 Eastern Ave. Drainage Ditch – North Segment
Left: Looking north from Gates Road; Right: Looking south from Gates Road

Fig. 2.12 Eastern Ave. Drainage Ditch – South Segment –
Left: Overgrown with invasive vegetation; looking north from Bristow Street;
Right: Items dumped in ditch. (Photo credit Woods Hole Group, Inc., Appendix 1)

Fig. 2.13 Downstream end of Eastern Avenue Ditch Connecting Culvert "E-5"
(Photo by Woods Hole Group, Inc., Appendix 1)

2.7.2 Downstream of Culvert "E-2"

The North Segment drains through the 72-in. culvert "E-2" and via a defined tidal channel towards the Ballard Street culvert ("BA-1"), where it then flows into the Saugus River. See Fig. 2.14. The improvised tide gate affixed to the down gradient or northern side of the Ballard Street culvert ("BA-1") (shown in Fig. 2.20) allows passage of freshwater runoff from the Project Area but only a very limited flow of salt water into the marsh.

Fig. 2.14 Channel downstream of the 72-in. culvert ("E-2") on Eastern Avenue, looking towards Ballard Street.

2.7.3 Downstream of Culvert "E-1"

Stormwater entering the Southern Segment of the Eastern Avenue ditch may be discharged through 24-in. culvert "E-1" to the Western Marsh. Within this area, there is a series of poorly defined ditches, some partially filled. There is no direct connectivity of these ditches to the defined channel (shown in Fig. 2.14), located at the northerly end of the Western Marsh. This lack of direct connectivity may be, in part, a cause of poor drainage during rain events in the residential neighborhood.

2.8 Tidal Hydraulics

Factors influencing the current tidal hydraulics in the Eastern and Western Marshes include the impact of prior filling and the existing sizes, configurations, and improvised modifications of the two culverts connecting the marshes to adjacent tidal waters.

2.8.1 Impact of Prior Marsh Filling on Current Tidal Flows

Prior to roadways and other development altering the natural drainage patterns, the Project Area contained tidal estuaries and a salt marsh system, which linked the Saugus River to the north, with the Pines River (formerly the Chelsea River) to the south and Bear Creek to the east. This can be seen in the 1829 map (Fig. 1.05) and the 1872 map (Fig. 1.06). Based on the 1829 map, the Project Area was contiguous with approximately 150 acres of the Rumney Marsh, west of Route 107 and between Bristow Street (noted as "South St." on the map) and the Saugus River. At that point in time, the Project Area had unrestricted tidal exchange with the Saugus River.

In the 1872 map, Ballard Street (not shown on the 1829 map) is shown, and the map shows a series of waterways within the Project Area. Ballard Street separates the Project Area salt marsh from the Saugus River, so after the street was constructed, the river could no longer provide unrestricted tidal exchange with the marsh. This map is not detailed enough to indicate if there were culverts or bridges allowing some degree of tidal connection. The 1943 USGS map (Fig. 1.07) appears to indicate a tidal connection under Ballard Street, close to or at the current culvert location. This map also shows the beginning of residential development in the western fringes of what was salt marsh in the 1829 and 1872 maps.

Today, tidal connections are now severely restricted, due to the past filling of salt marsh for transportation and land development. Filling has extended the East Saugus neighborhood eastward from beyond the limits shown in the 1943 USGS map (Fig. 1.07) to Eastern Avenue, which was built at the time of the filling for the I-95 embankment. Industrial development has filled in land along Ballard Street and Route 107. The I-95 embankment also significantly alters drainage patterns and bifurcates the remaining unfilled marsh into two cells. Fig. 2.15 illustrates the extent of post-1872 filling in the Saugus section of the Rumney Marsh.

Fig. 2.15 Constraints to Tidal Flows

Fig. 2.16 Location of Culverts at Ballard Street ("BA-1") and Bristow Street east ("BR-1")

2.8.2 Tidal Connections to the Eastern and Western Marshes

Today the Eastern and Western Marshes have two tidal connections via culverts, one to the north at Ballard Street ("BA-1") (currently restricted) and one to the south on the east side of the I-95 embankment at Bristow Street ("BR-1") (currently blocked). The current configuration and improvised modifications of these culverts are the keys to understanding the present-day tidal hydraulics.

2.8.2.1 Ballard Street Culvert ("BA-1")

The northern tidal connection to the Eastern and Western Marshes is the 4-ft. diameter concrete culvert under Ballard Street. See Fig. 2.16 for key plan and Fig. 2.17 for site plan. Also see Fig. 2.19 for photographs showing the ends of the culvert.

This culvert is set low in the tidal range with its invert at -3.14 to -3.23 ft. based on a survey by Bryant Associates in 2014, which is shown in Fig. 2.17. Therefore the culvert is submerged for nearly half of the tidal cycle.

The culvert passes under seven underground utility pipes in Ballard Street including an 18-in. MWRA (Massachusetts Water Resources Authority) water main, a gravity sewer, a sewer force main, a 12-in. water main and two gas lines. See Fig. 2.18, which illustrates the culvert in relationship to the other utilities in Ballard Street.

The Ballard Street culvert presently has a poorly functioning improvised tide gate, consisting of a corroding steel plate affixed at the Saugus River end, as shown in Fig. 2.20. The flap does not close properly, and under current conditions the leaking flap allows some water in to the Eastern and Western Marshes on a flooding tide. Previously, this culvert was fitted with a round hinged tide gate that completely closed, thus only allowing outflow, and therefore preventing the flooding tide from entering the Project Area. The current plate was hung to replace the original hinged gate, which fell off.

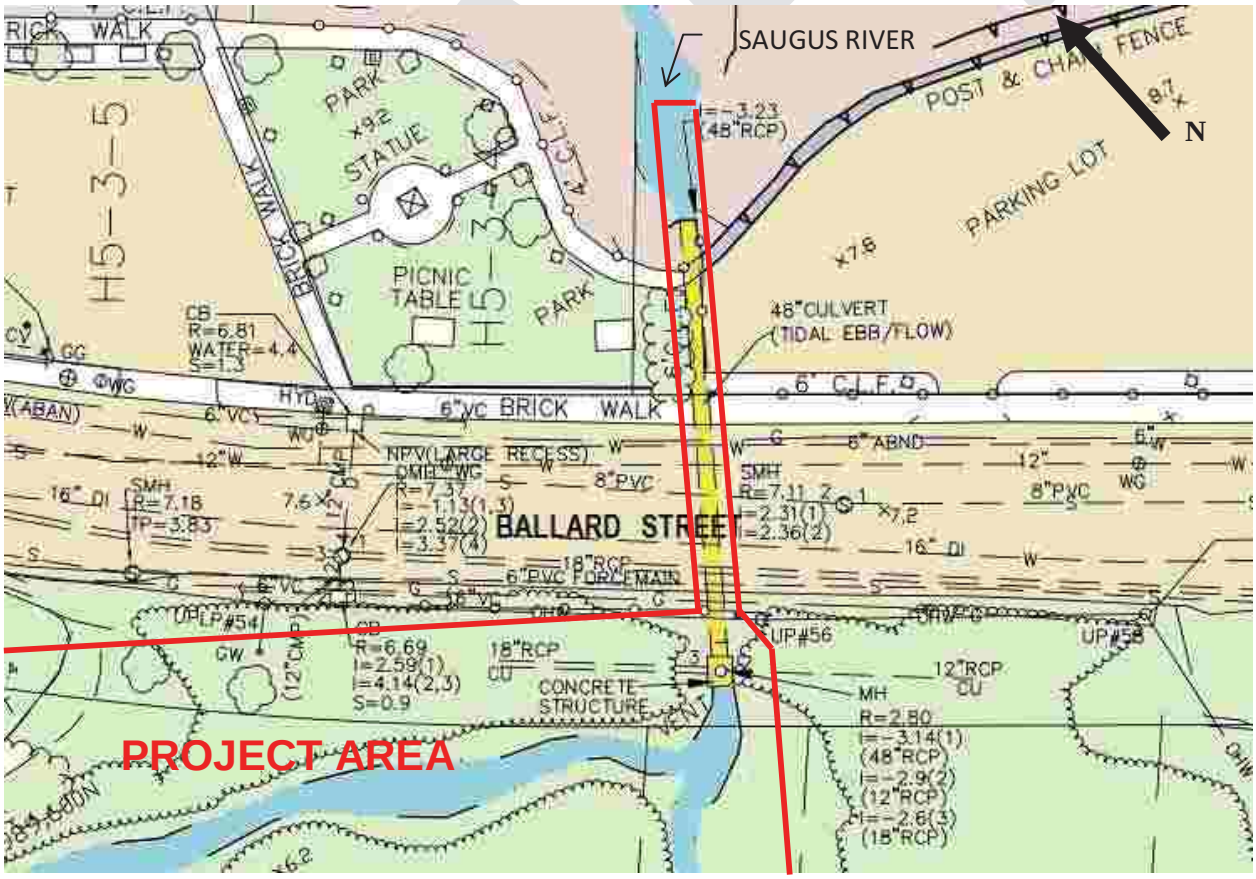

Fig. 2.17 Ballard Street Culvert ("BA-1") – Survey Plan

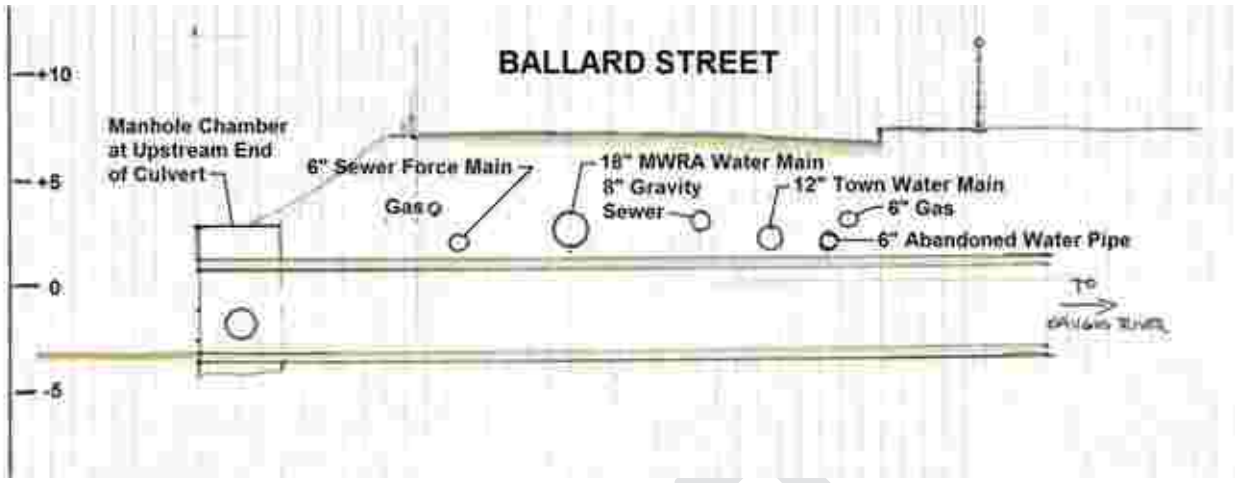

Fig. 2.18 Profile of Ballard Street Culvert ("BA-1") Showing Utility Pipes Below Roadway

Fig. 2.19: Ballard Street Culvert ("BA-1")
Upper Left: Flap Gate on Downstream End of Ballard Street Culvert
Upper Right: View of 48-In. pipe in Upstream Manhole
Lower Left and Right: Rectangular Manhole at Upstream End of Ballard Street Culvert

Fig. 2.20 Enlarged View of Improvised Tide Gate on North End of Ballard Street Culvert ("BA-1")

2.8.2.2 Bristow Street Culvert (East) ("BR-1")

In addition to the connection of the Ballard Street culvert to the Saugus River, there is also a connection to the south from the Pines Creek via a 7.3 ft wide by 4.5 ft. high[2] culvert under the abandoned portion of Bristow Street (between the I-95 embankment and Route 107). See Fig. 2.21. Observations made by Woods Hole Group, Inc. (Appendix 1) indicated that the invert has an accumulation of sediment. Most of the tidal influence of the Pines Creek is prevented by a board that blocks the culvert at Bristow Street. There are metal remnants of a flow control structure within the culvert, indicating that at one time a gate was deemed necessary for flow control.

Fig. 2.21 Bristow Street Culvert (East) ("BR-1") Adjacent to Route 107. The existing board on the south end is shown at below at left. The north end is shown on the right

[2] Measurements were made by Woods Hole Group, Inc. (Appendix 1).

2.8.3 Tide Data Collection

Tidal data is necessary as input to the hydrodynamic model developed to simulate the proposed restoration alternatives for the Ballard Street Salt Marsh. Tidal data within the Eastern and Western Marshes were collected by Woods Hole Group, Inc. in May through June, 2010. (See Appendix 1 and Fig. 2.22)

Fig. 2.22 Tide gauge deployment by Woods Hole Group, Inc., May through June, 2010. (Source: Appendix 1)

Supplemental tide data were collected at three locations in the Pines River and associated estuaries between May 15 and May 29, 2014 by Applied Coastal Research & Engineering, Inc. See Fig. 2.23. The new data were needed in order to:

- determine if the tide range in the Pines River immediately west of Route 107 was damped by the highway bridge, and
- collect concurrent additional tide data in the two channels that potentially could be used to connect the Pines River to the Eastern and Western Marshes:
  - Pines River Channel (west of the I-95 embankment)
  - Pines Creek (east of I-95 embankment)

Fig. 2.23 Map of the tide gauge locations used for the May 2014 deployment in the Project Area

Fig. 2.24 Pines River Channel, along the west side of the I-95 embankment
Left: Looking north from a point south of the tide gauge location. Right: Looking south from Bristow Street

Plots of the tide data from the three gauges are shown in Fig. 2.25 for the 15-day deployment. The spring-to-neap variation in tide range is visible in these plots. The data record begins during a period of spring tides. A week later there is a period of neap tides, which occurs around the time of the half moon on May 21. Following this neap tide is a return to a period of spring tides around the time of the new moon on May 28. The minimum neap tide range in the Pines River record is 9.5 ft. (May 23), while the maximum spring tide range is 11.7 ft. (May 17).

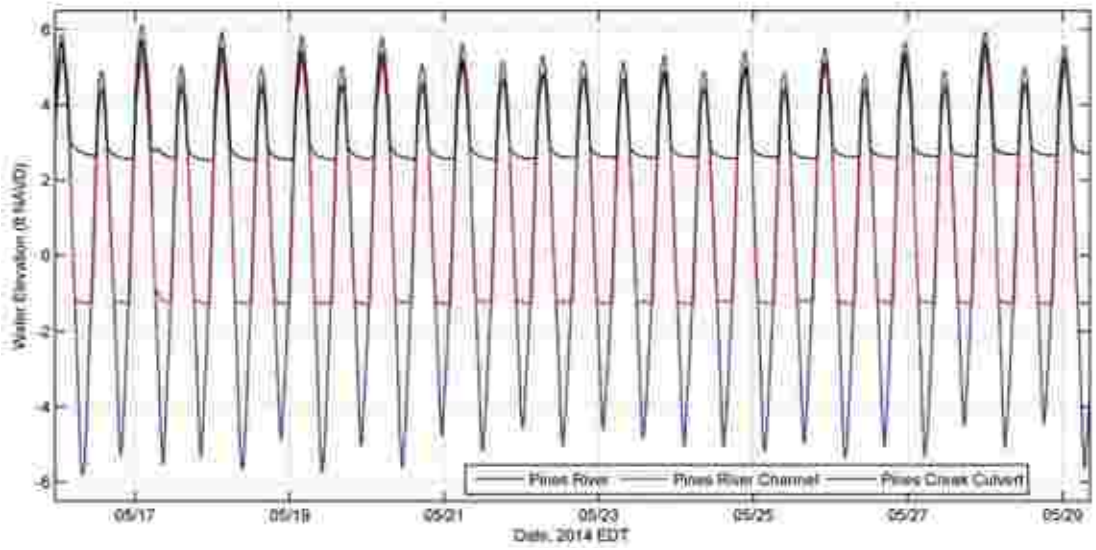

Fig. 2.25 Tide data from the May 2014 deployment in the Pines River

Table 2.01 presents the standard tide datums and computed tidal harmonics determined for the three gauge records. The tide datums presented in Table 2.1 show how the tide range is attenuated by the marsh channels. The mean tide range in the Pines River is 10.4 ft., while in the Pines River Channel the range is reduced by nearly one half. The reduction of the tide range is caused by the minimum elevation of the channel. Greater attenuation of the tide occurs in the Pines Creek at the Bristow Street east culvert ("BR-1," referred to as "Pines Creek Culvert" in Fig. 2.25), which has a mean range only slightly greater than 2 ft.

Table 2.01
Tide Datums Computed from 30-Day Records Collected
Pines River Marsh System in May 2014.

Tide Datum	Pines River	Pines River Channel	Pines Creek at Bristow St. east culvert ("BR-1")
Maximum Tide	6.1	6.3	5.7
MHHW	5.7	5.9	5.3
MHW	5.3	5.6	4.9
MTL	0.1	2.6	3.7
MLW	-5.1	-0.4	2.6
MLLW	-5.3	-0.5	2.6
Minimum Tide	-5.8	-0.5	2.5
Mean Range	10.4	6.0	2.3

Additional tide gauge measurements were within the Pine River Channel by Normandeau Associates, Inc. (July 1, 2014 through August 1, 2014 – See Appendix 5).. The data collected by Normandeau Associates within the Pines River channel exhibited a similar tide range as that measured by Applied Coastal.

2.8.4 Dampened Tidal Range in the Project Area

Fig. 2.26 illustrates the dampened tidal range in the Project Area, namely the Eastern and Western Marshes. This dampening is a result of the conditions at the two existing culverts at Ballard Street ("BA-1") and Bristow Street east ("BR-2").

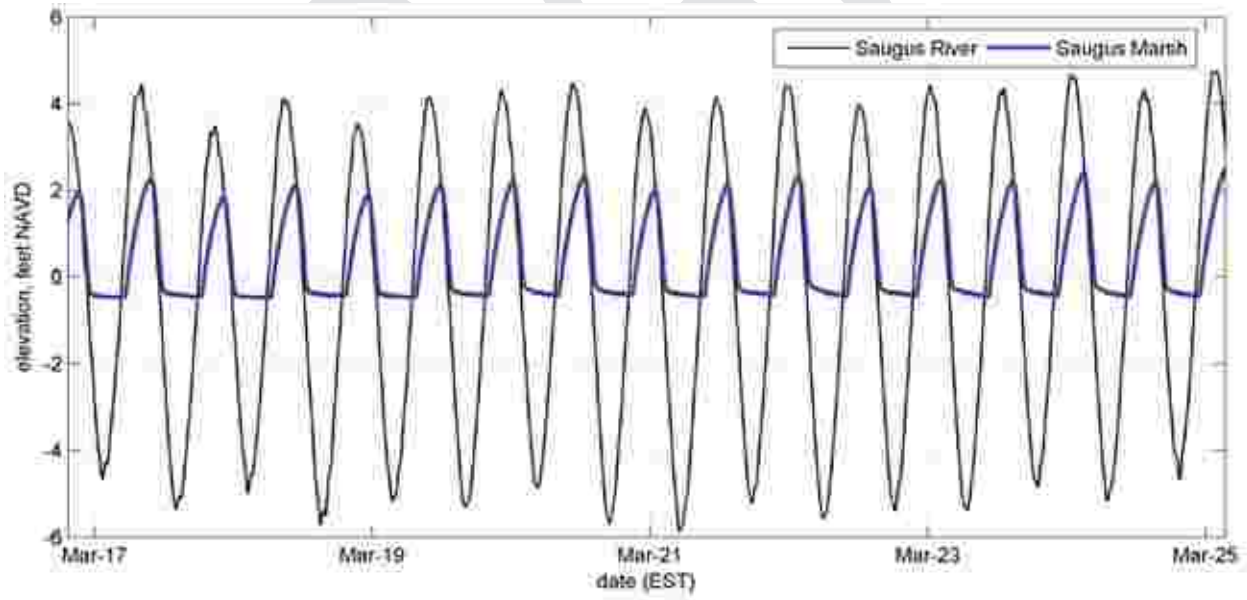

Fig. 2.26: Tidal Hydrograph upstream of the Ballard Street Culvert ("BA-1")

Most of the tidal influence of the Pines Creek is prevented by a plywood board that blocks the culvert at Bristow Street ("BR-1"). In addition, the blocked flow at this location has facilitated deposition of sediment on the south side of the culvert over time, further dampening the potential tidal range. Woods Hole Group, Inc. identified three locations where significant shoals and blockages are present in the

channel north of this culvert. See Fig. 2.27. Therefore, effectively, the Pines Creek does not contribute to the tidal exchange in the Project Area.

Fig. 2.27: Obstructions in Pines Channel (Eastern Channel) North of Bristow Street East Culvert ("BR-1")
(Source: Woods Hole Group, Inc., 2013, Fig. 6-3 – See Appendix 1)

Therefore, tidal flow only enters the Project Area from the Saugus River through the Ballard Street culvert ("BA-1"), with its poorly functioning improvised tide gate. (See Fig. 2.20) Both Woods Hole Group, Inc. in 2013-2014 and Applied Coastal Research & Engineering, Inc. in 2014-2015 conducted detailed hydrodynamic studies and modeling of the Project Area. (See Appendices 1 and 2.) These studies confirmed that if the flap were functioning correctly, it would only allow water to discharge from the Eastern and Western Marshes to the Saugus River. However, under current conditions the leaking flap allows some water into the Eastern and Western Marshes on a flooding tide.

As a result, while the Saugus River has a mean tide range of approximately 9.4 ft., it is only 3.7 ft. in the marsh just upstream of the Ballard Street culvert. The hydrograph in Fig. 2.26 illustrates the reduced tidal range of salt marsh in blue compared with that of the Saugus River in black. The net result is an approximately 70% reduction in tide range caused by the Ballard Street culvert and flap gate.

Once the limited tidal flow reaches the Project Area, high tide water levels are fairly uniform throughout, with only slightly higher high tides upstream in the system due to freshwater runoff entering from the surrounding watershed.

2.8.4 Tidal Flows and Public Safety Issues at the Ballard Street Culvert ("BA-1")

Another result of its low elevation and being undersized are safety concerns with the operations of the Ballard Street Culvert ("BA-1"). The two concerns are the following:

- high flow velocities during conditions when the culvert runs full
- lack of "head room" in the culvert under maximum flow conditions (i.e., minimum top clearance for a person to travel through the culvert with their head above water)

2.8.4.1 Public Safety with High Velocities

Many studies on safe flow velocities demonstrate a critical relationship between flow velocities, water depth and human safety. For example, Cox, *et al.* (2010) developed a plot illustrating potentially dangerous conditions for both adults and children, as shown in Fig. 2.29. This shows how different combinations of flow depth and flow velocities present different levels of hazard to children and adults.

Note that the chart indicates that about 1.2 m (about 3.9 ft.) is the limiting flow depth for adults. This means that when the culvert is running full (i.e., at 4 ft. depth), it is not a safe condition for adults. For children, the maximum safe depth is 0.5 m (about 1.7 ft.), which is less than half full flow for this culvert.

2.8.4.2 Public Safety with Limited Headroom

The safety issue with limited head room occurs when the culvert is flowing full or within 1 ft. of flowing full. Under these conditions, should a person be swept into the culvert, there is no opportunity to get one's head above the water and breathe. Fig. 2.28 shows the Ballard Street culvert flowing full with no headroom at mid-tide. The culvert is completely submerged at high tide.

Fig. 2.28 Ballard Street Culvert ("BA-1") flowing full with no headroom at mid-tide.

2.8.4.3 Evaluation of Public Safety Based on Hydraulic Modeling

Modeling by Woods Hole Group, Inc. and Applied Coastal Research & Engineering, Inc. has determined the anticipated depths of flow and velocities for the culvert under various flow conditions. These results were evaluated in the context of Fig. 2.29. For existing conditions, the conclusions with regard to the hazards for children and adults are summarized in Table 2.02. For a further discussion of the analysis, see Appendix 7.

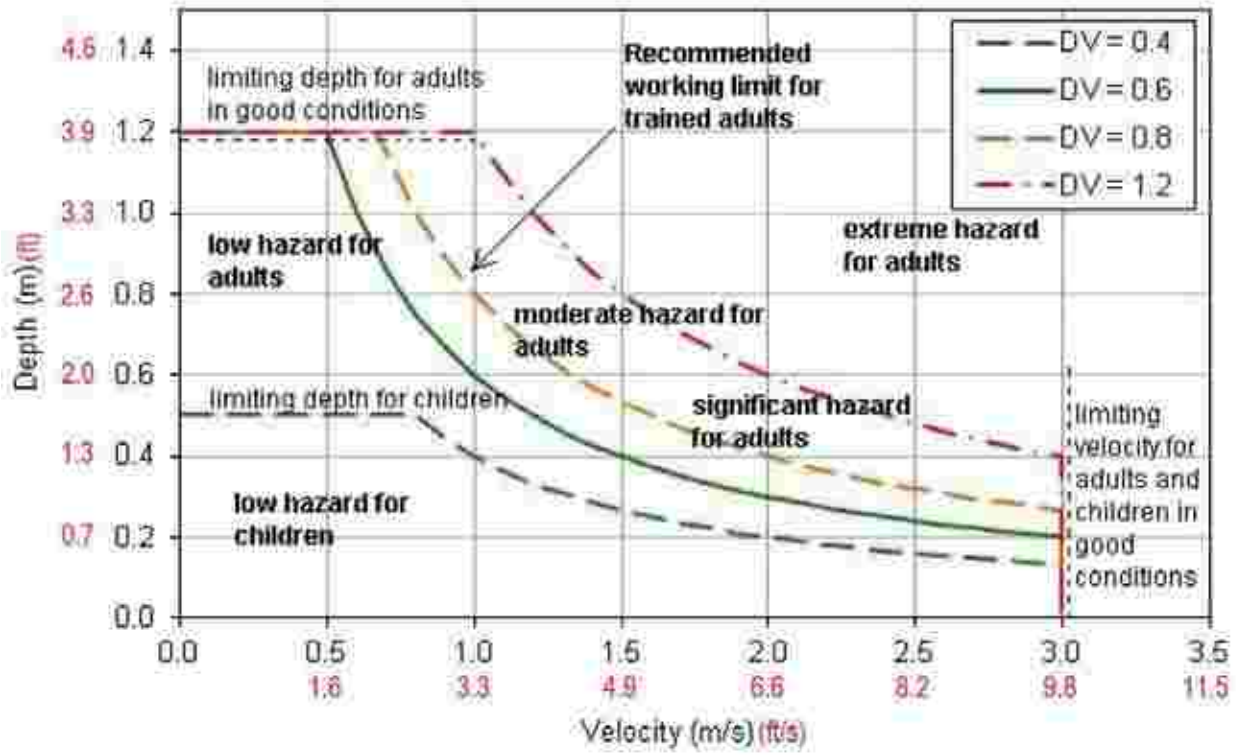

Fig. 2.29 Flow velocities versus depth indicating safe flow conditions associated with both adults and children (plot from Cox *et al.*, 2010).
(Note: velocities in black are in meters per second and depths in black are in meters. Values in red for velocity in feet per second and depth in feet have been added by Parsons Brinckerhoff.)

Table 2.02
Hazard for Adults & Children as Portion of Tidal Cycle
Ballard Street Culvert ("BA-1")

	Hazard for Adults	Hazard for Children
	Approx. Hrs. per 12-hr. Tide Cycle	Approx. Hrs./12-hr. Tide Cycle
Culvert with flap	4 hrs. (33%)	9 to 10 hrs. (80%)

The summary in Table 2.02 must be viewed in the context of the proximity of the culvert to existing DCR and Town parklands, as show in Fig. 2.07. These parklands are places where the public is invited. The

high velocity ebb flows with a single submerged outlet represent a public safety issue if a child or adult were to accidentally fall into the tidal waterway near the culvert.

It is not acceptable from an engineering perspective to either exacerbate or even accept a known public safety hazard as part of the Project. This consideration will be included in the evaluation of all alternatives. Any modification to this culvert, as well as any proposed structure, must meet minimum safety requirements relative to flow velocities and "head room." The project engineers cannot move forward with a design that does not meet minimum standard safety requirements, and the Commonwealth cannot accept an alternative that does not rectify the currently unsafe conditions.

2.8.5 Existing Ebb-Dominant Tidal Exchange

In addition to having a reduced tidal range, the single inefficient culvert at Ballard Street results in a slow filling of the Eastern and Western Marshes during the incoming tide. However, modeling shows that as the tide recedes, flow rates increase resulting in an ebb-dominant as opposed to flood-dominant tidal regime. Higher velocity ebb flows generally result in a net export of sediment and nutrients from the marsh rather than a gradual accumulation of sediment that would occur in a flood-dominant system. A flood dominant tidal regime is generally considered to be a favorable, natural New England salt marsh tidal regime (Friedrichs and Perry, 2001).

A significant ebb dominant flow, such as that which currently exists, can limit the ability of a salt marsh to continue to accrete sediment and outpace sea level rise by raising the marsh plain. Rates of sea level rise are expected to vary regionally and are estimated to range from 0.43-2.08 ft. within the next 50 years according to various combined sources as described in Appendix 1, section 4.5.4.

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3.0 Alternatives Analysis

This section presents a summary of alternatives considered to achieve and maximize the dual Project goals of:

1) Salt marsh restoration and
2) Enhancement of flood control and storm damage protection

3.1 Development of Alternatives

DCR's engineering team evaluated a number of potential project designs to develop a concise yet representative list of alternatives to be evaluated. The development of this list of alternatives included consideration of previous investigations as well as hydrodynamic modeling to evaluate how each would meet the stated Project goals of enhancing tidal flowages so as to create sustainable salt marsh as well as handling stormwater runoff to enhance flood control and storm damage prevention for the adjacent East Saugus neighborhood.

The previous designs evaluated included the project developed by NRCS in 2002 and analysis on behalf of DER included in Woods Hole Group Inc.'s October 2014 report (Appendix 1). Both of these approaches depend primarily on tidal flushing and stormwater discharge as provided by the undersized and low culvert at Ballard Street ("BA-1") with some limited additional drainage through the Bristow Street east culvert ("BR-1"). Review of the modeling performed by NRCS and Woods Hole Group, Inc. revealed that reliance on the Ballard Street culvert results in a project with the following limitations:

- The existing 4-ft diameter Ballard Street culvert ("BA-1") does not have the capacity to provide enough tidal exchange and stormwater discharge if the Western Marsh plain is significantly lowered (2 to 3 ft. lower than the existing marsh plain elevation.
- The lowered marsh plain requires the manipulation of the tide signal by regulation with tide gates. This is needed to sustain a dampened mean high water (MHW) elevation in the Western Marsh. (MHW should be below the marsh plain, with only the spring tides inundating the marsh plain).
- Lowering the plain of the Western Marsh is not sustainable in consideration of anticipated sea level rise. With sea level rise, the tide gates would be required to be closed more and more of the day, limiting habitat connectivity to the Saugus River. A 1 ft. sea level rise would require the gates to be closed an additional 2 hrs. per tidal cycle, or 4 hrs. per day.
- The low invert of the Ballard Street culvert results in an ebb-dominant tidal flow, in contrast to the desired flood-dominant flow recommended by Friedrich and Perry (2001). A flood-dominant flow allows the marsh to accrete, and therefore raise itself in the face of sea level rise.
- The existing 4-ft diameter Ballard Street culvert ("BA-1") experiences high velocities for several hours of every tide cycle when the culvert runs full, resulting in a public safety concern. (See discussion in Section 2.8.4.)

With these concerns identified, additional alternatives were considered. The first and most-obvious approach was to consider replacing the inadequate existing Ballard Street culvert with a larger culvert, one at a higher invert elevation, or even removing the culvert and reconstructing Ballard Street with a bridge so as to eliminate any tidal restriction. Historic maps (e.g, the 1943 USGS map, Fig. 1.07) suggest a bridge existed at this location at one time.

However, a significant amount of underground utility infrastructure is located in Ballard Street directly above the culvert, including an MWRA transmission water main, a gravity sewer, a gas line, other water mains, and other utilities (see Fig. 2.18). In addition to the MWRA, some utilities are owned by the

Town of Saugus, while others are owned by private utility companies. Based on a 2014 survey and record plans from the respective utilities, the MWRA water main and other pipes appear to be immediately above the culvert. To construct a bridge or a culvert at the ideal invert elevation, many (if not all) of these utilities would need to be relocated. These relocations would be complicated by the requirement to retain service to customers during the relocation. In addition, a taller culvert or a bridge would interrupt the profile of the gravity sewer, likely resulting in the need for a pump station. As a result, the Project proponent concluded that scope and cost of these improvements far exceeded DCR's jurisdiction and available funding. Therefore this alternative was rejected without advancing to the level of further modeling.

As a result of this initial evaluation, the following designs were selected for further evaluation:

- Alternative 1 - No Action
- Alternative 2 - Installation of a Self-Regulating Tide Gate (SRT) near Ballard Street
- Alternative 3 - Installation of SRT at Bristow –West ("BR-2" and BR-3) and Closing the Ballard Street Culvert ("BA-1")
- Alternative 4 - Installation of SRT at Bristow –West ("BR-2" and BR-3) and Install Dike With Culvert ("BA-2")

3.2 Evaluation Criteria

Similar to many urban marsh restoration programs, the Ballard Street Salt Marsh Restoration requires balancing multiple competing interests including: restoration of tidal flow to the degraded marsh system to enhance the overall ecological value; enhancement of flood protection for the East Saugus neighborhood; consideration of Sea Level Rise impacts and sustainability; and protection of public safety. Achieving balance between these competing interests involves exploring a wide range of marsh restoration options, followed by a screening process to select the most appropriate alternative.

To provide a baseline assessment of potential alternatives, typically a project team develops a series of exclusionary and discretionary criteria to provide an objective approach for screening alternatives. In general, this process follows the "Highway Methodology", developed by the U.S. Army Corps New England District in 1987, as a means of integrating design requirements and environmental permit regulations for the determination of the Least Environmentally Damaging Practicable Alternative (LEDPA). 3.2.1 Exclusionary Criteria

Exclusionary criteria reflect a regulatory prohibition regarding the specific option or a project that does not meet the engineering requirements of the project. For example, a project that increases the tide range within the marsh system, but also increases flooding potential in the adjacent neighborhood would not meet the engineering requirements for this Project.

Based on project-specific information available for the Ballard Street Salt Marsh system, the following exclusionary criteria were developed for the screening process:

Maximize Marsh Restoration Area – The purpose of the Ballard Street Salt Marsh Restoration Project is to restore tidal wetland functions and values historically lost with the placement of fill along the I-95 embankment and through past filling of the adjacent areas for residential and industrial development. Under existing conditions, there are two distinct wetland areas bifurcated by the remaining embankment, known as the Eastern Marsh and the Western Marsh, with significant wetland restoration potential. An existing U.S Fish and Wildlife funding grant for the Project requires a minimum tidal restoration area of 30 acres. Therefore, to meet the overall Project purpose, the restoration effort is targeting 30+ acres of

restoration, where this area is defined as either improved (i.e. increased area of tidal inundation, primarily within the Eastern Marsh) or new tidal inundation (primarily within the Western Marsh). It is also understood that it may not be possible to achieve 30+ acres of tidal restoration; therefore, the exclusionary criteria is to maximize restoration to the extent practicable. A project that does not provide large-scale restoration to both the Eastern and Western Marshes would not meet the exclusionary criteria.

Safeguard Public Safety – The Project must meet minimum safety requirements for culverts and inlet structures. It is understood *a priori* that the existing 4-ft diameter Ballard Street culvert ("BA-1") – the direct connection of the existing degraded marsh system to the Saugus River – is dangerous due to the high flow velocities and flow depths (see Section 2.8.4), as entrainment in the culvert could lead to loss of life. Therefore, it is not acceptable from an engineering perspective either to exacerbate or even to accept a known public safety hazard as part of the restoration project. In addition, any proposed structure must meet minimum safety requirements relative to flow velocities and "head room" (minimum top clearance for a person to travel through the culvert with their head above water). The engineers cannot move forward with a design that does not meet minimum standard safety requirements, and the Commonwealth cannot accept an alternative that does not rectify the currently unsafe conditions.

Mitigation for this safety concern could be provided by a grate or "trash rack" over the culvert. See Fig. 3.01. In general guidance for trash racks produced by Urban Drainage and Flood Control District (UDFCD) (2001), a maximum safe flow velocity at the front of the trash rack was determined to be 2 feet per second at every stage of the flow entering the culvert. A principal concern in the use of trash racks is clogging, which can reduce hydraulic capacity. During the flood tide, clogging can reduce tidal exchange and rob the marsh of salinity. In the case of the ebb tide and rain events, loss of hydraulic capacity would lead to upland flooding.

Fig. 3.01 Blocked culvert grate ("trash rack") with wide bar spacing (*photo credit*: environment-agency.gov.uk).

Therefore the application of this mitigation should be limited to locations where clogging and loss of hydraulic capacity will not lead to a decrease in tidal exchange and/or lead to upland flooding.

Enhance Flood Control – Through a series of drainage ditches and culverts, the existing marsh system transmits stormwater runoff (associated with rain events) from the East Saugus residential neighborhood located west of the Western Marsh. This stormwater runoff discharges to the Saugus River via the 4-ft diameter Ballard Street culvert ("BA-1"). Upon re-introduction of significant tidal flow to the marsh system, there is a concern that the restored Ballard Street Salt Marsh area could not handle the anticipated stormwater runoff without other mitigating strategies. A project that exacerbates stormwater-related flooding would not meet the exclusionary criteria.

3.2.2 Discretionary Criteria

Discretionary criteria are those that meet secondary project goals, such as the protection and enhancement of fish and wildlife habitat. In this example, alternatives will be favored that enhance overall fish and wildlife.

The application of discretionary criteria is the main component of the screening process, and it is the process by which the alternatives are compared amongst themselves, using site-specific information to prioritize project appropriateness. For the purpose of this marsh restoration screening analysis, "appropriate" is defined as those alternatives that best meet the LEDPA standard, that are permittable under federal and state environmental law, that meet standard best-practices of engineering design, that are acceptable to the DCR and the Saugus community, and that are capable of being implemented at reasonable cost (both in the short- and long-term).

Based on project-specific information available for the Ballard Street Salt Marsh system, the following discretionary criteria were developed for the screening process:

Enhance and/or Maintain Fish and Wildlife Habitat – One of the primary reasons for restoring tidal marsh systems is to enhance fish habitat. As part of the planned restoration, there is an opportunity to improve the ecological habitat on a system-wide basis, where the increased tide range and improved water circulation will presumably create a broader range of higher quality fisheries habitat throughout the marsh system. The ecological salt marsh enhancement can be quantified based on the changes to the inundated area for each of the alternatives, with consideration of the source of tidal waters (i.e. the relative distance of these source waters[3] from Lynn Harbor). Both NMFS and Massachusetts DMF personnel have indicated that the direct hydraulic connection to Saugus River is important to marine fisheries. Specifically, the distance that fish need to travel through shallow estuarine and/or salt marsh creeks is an important consideration relative to habitat enhancement associated with the restored marsh, where the greater distance through the Pines River Channel is deemed less satisfactory than the partially blocked Ballard Street culvert that links directly to the Saugus River.

Minimize Mechanical Manipulation of the System – Due to the complexity of the interconnected channels/culverts, the historical upland drainage modifications and wetland infilling, and the alteration of the original tidal creeks by roadway/railroad construction, it is not possible to restore the Ballard Street Salt Marsh system to a functioning salt marsh and accomplish all of the other project requirements without some manipulation of the incoming tide during certain conditions. However, minimizing this manipulation is critical for developing a salt marsh that can emulate a natural marsh system. Specifically, the goal for this criterion is to minimize both the number of adjustable tide gates within the system and to also minimize the duration of gate closures during the tidal cycle.

Minimize Maintenance and Inspection Requirements – Similar to the system manipulation described above, system maintenance and inspection are required to some extent, as all solutions require structural modifications. For this criterion, the goal is to provide structures with relatively modest maintenance and inspection requirements. Specifically, the goal is to make onerous and potentially dangerous inspections/maintenance during storm events unnecessary.

Minimize Excavation Requirements – As part of all marsh restoration options being considered, excavation of the marsh plain within the Western Marsh is required to achieve all of the exclusionary criteria listed above. Approximately 40,000 cubic yards of excavation is required to lower the plain of the Western Marsh one foot. Minimizing the excavation while still achieving the marsh restoration and upland drainage enhancement goals will achieve other benefits:

- substantially reducing the project cost,
- avoiding or minimizing the need for off-site disposal,
- shortening the duration of the project, and

[3] "Source waters" refers to the river or stream providing the tidal inflow to the salt marsh.

- reducing inconvenience to area residents by minimizing construction duration and traffic impacts of off-site disposal.

Create a Sustainable Marsh System – A long-term goal of the Project is sustainability of the marsh system in response to sea-level rise. To this end, maintaining a marsh level at the highest elevation possible relative to the more natural surrounding marsh systems allows the Ballard Street Salt Marsh Restoration to provide the greatest longevity and resiliency.

In addition, maintaining typical 'flood dominance' within the marsh system will promote accretion to keep up with sea level rise. (Reference: Friedrichs and Perry, 2001) With flood-dominance sediment is imported into the salt marsh under the stronger incoming currents and it is deposited within the marsh system, as the outgoing tides are not of sufficient velocity to allow the sediments to exit the marsh. In general, this criterion is met by establishing a marsh system that mimics the surrounding natural marsh elevations and maintains a tidal regime that imports sediments to the extent practical.

3.3 Description of Alternatives

3.3.1 Alternative 1 - No Action

The No Action alternative maintains the existing culvert with its leaking improvised tide gate at Ballard Street ("BA-1") and the existing board at the Bristow Street east culvert ("BR-1"). Under this condition, the remnant salt marshes will continue to degrade because of restricted tidal flushing. Existing and extensive stands of *Phragmites* are likely to increase in height, vigor and density, and the remaining fragments of salt marsh vegetation will likely be completely overtaken by *Phragmites*. The dense rhizomes (shallow, spreading "roots" of *Phragmites*) will likely clog small creeks and impair drainage and the dead stems will become a fire hazard. The maintenance of the existing condition also results in continuing degraded estuarine function within the marsh creeks for fish, crabs, snails, and invertebrates.

3.3.2 Alternative 2 - Installation of a Self-Regulating Tide Gate (SRT) near Ballard Street

This alternative involves providing tidal exchange from the Saugus River by removing the improvised tide gate at the existing Ballard Street culvert ("BA-1") and from the Pines Creek by removing the board at the existing Bristow Street East culvert ("BR-1"). Tidal exchange to the Western Marsh would be regulated by the installation of a dike with two SRTs in the creek channel approximately 200 ft. upstream of the existing Ballard Street culvert. (This SRT arrangement is similar to that proposed by the NRCS design in 2002, as well as similar to the alternative identified in Section 7.0 in the WHG report included in Appendix 1).

This alternative lowers the existing western marsh plain by 2-3 ft. to accommodate the lower invert at Ballard Street. Tidal flow would be provided from the Saugus River via an unrestricted Ballard Street culvert and from the Pines River via the Bristow Street east culvert ("BR-1") on the Pines Creek. However, existing blockages (see Fig. 2.27) north of this culvert within the eastern channel (i.e., Pines Creek) would remain, thereby restricting the tidal contribution from the Pines River to the south. This alternative is depicted graphically in as Fig. 3.02, as well as in Appendix 1, Fig. 7-10.

This alternative requires complicated tide gate operation to maintain tidal flows 2-3 ft. below high tide in the Saugus River to ensure that the restored marsh ground surface is only submerged during spring tides. At least one of the two tide gates would require closing during portions of each tide. Therefore the operation and maintenance of structures associated with this alternative is more complex than that for other alternatives. Also the tidal regime created would be muted and strongly ebb-dominant as under current conditions, therefore offering no improvement over existing tidal regime conditions.

This alternative includes grates (trash racks) over each end of the Ballard Street culvert ("BA-1") to address the safety considerations due to flow velocity and depth. (See Appendix 7.)

Fig. 3.02 Alternative 2 with SRT at Ballard Street

3.3.3 Alternative 3 - Installation of SRT at Bristow –West ("BR-2" and BR-3) and Closing the Ballard Street Culvert (BA-1)

This alternative involves providing tidal exchange from the Pines River Channel to the south by a new open-topped culvert ("BR-2") and SRT at Bristow Street west of the I-95 embankment. It also includes closing the Ballard Street culvert ("BA-1") to incoming tides, while still allowing for the outflow of tidal and storm waters. This alternative includes removing the board blocking the existing Bristow Street east culvert ("BR-1").

This alternative lowers the Western Marsh by approximately 1-1.5 ft. Since the new culvert at Bristow Street west ("BR-2") can be set at an optimal elevation for tidal exchange, a larger tide range could be

accommodated. Therefore the required lowering of the marsh plain is less than in Alternative 2, which depends on tidal exchange from the lower elevation of the existing Ballard Street culvert ("BA-1").

An additional 4 ft. by 4 ft. culvert will be installed adjacent to the proposed Bristow West ("BR-2") to serve as additional egress for waters during tidal events. This culvert ("BR-3") will be outfitted with a duckbill to allow water to escape the marsh, but not add additional inflow to the system. In order that this culvert will not induce ebb-dominant tidal flows, this culvert will have a drop inlet with a weir set above the normal high tide elevation in the Western Marsh. This will ensure that during normal tide cycles it does not convey water out of the Western Marsh.

Fig. 3.03 Alternative 3 with SRT at Bristow ("BR-2" and "BR-3") and Ballard Street Closed

This alternative includes flood control enhancement features at Eastern Avenue:

- The two existing culverts under Eastern Avenue ("E-1" and "E-2") would be fitted with one-way duck-bill valves to prevent tidal flow into the Eastern Avenue ditch from the Western Marsh, while still allowing stormwater runoff from rain events to discharge into the Western Marsh.
- A new auxiliary culvert ("E-3") under Eastern Avenue will be added to improve drainage from the residential neighborhood via the South Segment of the Eastern Avenue ditch.

A schematic of this alternative is shown in Fig. 3.03 as well as in Fig. 5 of Appendix 2.

3.3.4 Alternative 4 - Installation of SRT at Bristow –West ("BR-2" and "BR-3") and Install Dike

This alternative (shown in Fig. 3.04 and in Fig. 6 in Appendix 2) includes all of the components of Alternative 3 above but also entails the removal of the improvised tide gate at Ballard Street ("BA-1") as described in Alternative 2 to allow unrestricted tidal flow to the Eastern Marsh. It includes installation of an earthen dike across the stream channel near the north end of the I-95 embankment. This dike separates the Eastern and Western Marshes, allowing each to experience full tidal flow, but each operating in a slightly different tidal regime.

Fig. 3.04 Alternative 4 with SRT at Bristow-West ("BR-2" and "BR-3") and Install dike in East Channel which includes the 12-inch culvert through the dike ("BA-2").

Full tidal flow is provided to the Western Marsh by a new open-topped culvert ("BR-2") and SRT at Bristow Street west allowing tidal flow via the Pines River Channel to the south. The SRT will control the high tide elevation in the Western Marsh to be approximately 1 ft. lower than in the Eastern Marsh. This alternative significantly reduces the amount of excavation to lower the Western Marsh when compared to Alternative 2. This is because Alternative 4 establishes a higher tide range in the Western Marsh than Alternative 2, so that, in Alternative 4, the marsh plain can be set at a higher elevation.

Unlike Alternative 3, this alternative maintains the connection between the Saugus River and the Western Marsh at a level that would not affect flood protection. This is achieved by the inclusion of a 1-ft. diameter culvert ("BA-2") through the proposed dike. A culvert at a diameter greater than 1-ft. (or multiple 1-ft. culverts) will affect flooding as well causing increased velocities in the Ballard Street Culvert ("BA-1").

Alternative 4 also results in some minor additional impact for the placement of 1400 square ft. of fill material within an existing stream channel to construct the dike. However, this impact is more than offset by the additional salt marsh created.

This alternative also provides for the excavation of small ditches within the restored Western Marsh to improve tidal flushing in all areas of the marsh.

Finally, this alternative includes grates (trash racks) over each end of the Ballard Street culvert ("BA-1") to address the safety considerations.

3.3.5 Summary of Design Alternatives

Table 3.01 presents a summary of the proposed work of each alternative at each marsh and at each culvert location.

Table 3.01
Summary of Work for Each Alternative

Alt.	Alteration of Marshes		Work at Culverts							
	Eastern Marsh	Western Marsh	"BA-1"	"BA-2"	"BR-1"	"BR-2"	"BR-3"	"E-1"	"E-2"	"E-3"
1	--	--	--	N/A	--	N/A	N/A	--	--	N/A
2	--	Lower 2-3 ft.; add channels	Remove tide gate; Add trash racks	Dike with 2 culverts w/SRTs	Remove board	N/A	N/A	--	--	N/A
3	--	Lower 1-1.5 ft.; add channels	Closed	N/A	Remove board	Open top culvert w/SRT	Out only culvert	Add duck bill	Add duck bill	Out only culvert
4	--	Lower 1-1.5 ft.; add channels	Remove tide gate; Add trash racks	Dike w/ 12 in. culvert	Remove board	Open top culvert w/SRT	Out only culvert	Add duck bill	Add duck bill	Out only culvert

Note: "--" = No action proposed at this location
"N/A" = This location is not applicable

3.4 Evaluation of Alternatives

For the Ballard Street marsh restoration, development of a long-term sustainable marsh system with substantial engineering and ecological constraints is complex. To the extent possible, a series of objective criteria were developed to assess a series of four alternatives. Within this context, both exclusionary and discretionary criteria were utilized to evaluate each alternative. Consistent with the Highway Methodology approach promoted by the U.S. Army Corps of Engineers, the exclusionary criteria consisted of a pass/fail grading. A more diverse set of evaluations was provided for the discretionary criteria, where the assessment included the following ratings: poor, fair, and good.

3.4.1 Summary of Evaluation

The exclusionary and discretionary criteria were applied to each of the alternatives. This process was aided by the results from hydrodynamic modeling. These results were used to compute overall restoration area achieved by each alternative, variations in both tidal currents and water elevations throughout the marsh system, and potential flood levels for selected alternatives. Along with existing tidal conditions, the existing conditions model and preferred alternative were evaluated for the 50-year extreme rainfall event based on data from the Northeast Regional Climate Center (NRCC), to ensure that proposed conditions would not exacerbate upland flooding.

The results of the alternatives analysis is summarized in Table 3.02.

Table 3.02
Comparison of Modeled Alternatives

Alternative	Exclusionary Criteria			Discretionary Criteria				
	Maximize Restoration Area	Safeguard Public Safety	Enhance Flood Control	Enhance Fish Habitat	Minimize Mechanical Manipulation	Minimize Maintenance and Inspection	Minimize Excavation	Create a Sustainable Marsh
1	Fail	Fail	Fail	N/A	N/A	N/A	N/A	N/A
2	Pass	Fail	Pass	Fair	Poor	Poor	Poor	Poor
3	Pass	Pass	Pass	Poor	Good	Good	Good	Good
4	Pass	Pass	Pass	Good	Good	Fair	Good	Good

Table 3.02 indicates that Alternatives 3 and 4 pass the exclusionary criteria. In the discretionary criteria, Alternative 4 scores the highest and is the preferred alternative for the Project.

Section 3.4.2 presents details of the application of the exclusionary criteria, while Section 3.4.3 presents the details of the application of the discretionary criteria.

3.4.2 Application of Exclusionary Criteria

3.4.2.1 Maximize Marsh Restoration Area

Table 3.03 compares the alternatives in terms of parameters that measure salt marsh restoration. The "maximum wetted area" represents the acreage that is inundated by tidal flow at spring high tide. The "maximum tide elevations" indicate the highest water elevations during normal (non-storm) conditions. The values in Table 3.03 are based on hydraulic modeling that is presented in Appendices 1 and 2.

Table 3.03
Results of Modeled Restoration Alternatives

Maximum wetted areas and maximum tide elevations are provided for spring tide conditions.

Alternative	Maximum wetted area (acre)			Maximum tide elevation (ft.)		Rating
	Eastern Marsh	Western Marsh	Total	Eastern Marsh	Western Marsh	
Alternative 1	1.6	1.4	3.0	2.4	2.4	Fail
Alternative 2	5.1	19.6*	24.7*	1.9	1.8	Fail
Alternative 3	9.1	20.7	29.8	5.3	5.3	Pass
Alternative 4	10.5	26.4*	36.9*	5.6	4.8	Pass

*Alternatives 2 and 4 include additional excavation of the marsh plain associated with the 'footprint' of the embankment removal that was used for Winthrop Beach Nourishment.

As depicted in Table 3.03 above, Alternative 4 maximizes salt marsh restoration potential

i. *Alternative 1* – This alternative only maintains 3 acres of inter-tidal and sub-tidal area; therefore, this option does not achieve minimal potential restoration goals.

   Rating based on evaluation criteria: **Fail.**

ii. *Alternative 2* – This alternative creates a salt marsh system with 24.7 acres of inter-tidal and sub-tidal area which represents an increase of over 21 acres of salt marsh area compared to existing conditions. However only 3.5 acres of new marsh is restored in the Eastern Marsh, and the restoration goal of 30+ acres is not achieved.

   Rating based on evaluation criteria: **Fail**

iii. *Alternative 3* – This alternative creates a salt marsh system with 29.8 acres of inter-tidal and sub-tidal area which represents an increase of over 26 acres of salt marsh area compared to existing conditions. It provides full tidal restoration to 9.1 acres in the Eastern Marsh, which is more than five times the area of the existing Eastern Marsh intertidal and sub-tidal marsh system. The restoration goal of 30+ acres is not achieved; however, this alternative is very close to the restoration area goal, where the difference is within the margin of error associated with the analysis.

   Rating based on evaluation criteria: **Pass**

iv. *Alternative 4* – This alternative creates a salt marsh system with 36.9 acres of inter-tidal and sub-tidal area which represents an increase of over 33 acres of salt marsh area compared to existing conditions. Due to the full tidal restoration to the Eastern Marsh, this alternative restores a substantial area of the higher quality marsh associated with the Eastern Marsh. The 10.5 acres of marsh restored in the Eastern Marsh is six times the area of the existing Eastern Marsh intertidal and sub-tidal marsh system. In addition, the restoration goal of 30+ acres is achieved.

   Rating based on evaluation criteria: **Pass**

3.4.2.2 Safeguard Public Safety

The criterion is applied to the culvert or culverts that provide tidal exchange to the Eastern and Western Marshes. This includes the Ballard Street Culvert ("BA-1") as well as the new Bristow Street west culvert ("BR-2"). As noted in Appendix 7, both culverts have flow velocity and flow depths that present hazards to adults and/or children. In addition, both culverts are near public open spaces and the parking

lots where the public can access them. Therefore both culverts were evaluated for each of the alternatives.

It should be noted that the existing Bristow Street east culvert ("BR-1") was not evaluated. This was due to the presence of blockages in the Pines Creek north of the culvert. (See Fig. 2.27.) These blockages would prevent full flow through this culvert. Removal of these blockages is not part of this Project.

Measures can be taken to mitigate the hazard:

- If the culvert is short in length (40 ft. or less) and with headroom (at least 1 ft. between water elevation and the crown of the culvert), a person can safely pass through the culvert. No other mitigation measures are needed.
- If the culvert is longer or does not have headroom, a grate (trash rack) could be installed.

A grating or trash rack is considered practicable in only those locations where it is not the sole conduit for tidal exchange and stormwater discharge. A summary of this evaluation is presented in Table 3.04.

Table 3.04
Mitigation for Flow Conditions at Culverts

Alternative	Ballard Street - ("BA-1")		Bristow Street west - ("BR-2")		Rating
	Short culvert with headroom?	Grating ("trash rack") practicable?	Short culvert with headroom?	Grating ("trash rack") practicable?	
Alternative 1	No	Not existing	N/A	N/A	Fail
Alternative 2	No	No (see discussion)	N/A	N/A	Fail
Alternative 3	(closed)	(closed)	Yes	Not required	Pass
Alternative 4	No	Yes (see discussion)	Yes	Not required	Pass

N/A = not applicable. The culvert is not part of the alternative.

i. *Alternative 1* – Flow conditions in the Ballard Street culvert ("BA-1") indicate the need for mitigation. The culvert runs full without headroom for much of the tidal cycle, as well as during storm events. As noted in Section 2.8.4, this is a public safety hazard.

Rating based on evaluation criteria: **Fail**.

ii. *Alternative 2* - Flow conditions for Alternative 2 are less safe than Alternative 1 at the Ballard Street culvert ("BA-1"). There are substantially higher velocities than existing conditions at the culvert. Due to the fact that the culvert runs full for a significant portion of the tidal cycle, the danger associated with the flow velocities is substantially increased for a baseline that is already a public safety hazard. (See Section 2.8.4.) This fails the exclusionary criteria.

Mitigation of the safety concern by installation of a grate (trash rack) would introduce a concern of clogging under high flow conditions, the very time that the full hydraulic capacity is needed. (See Fig. 3.01.) Since this culvert provides the principal discharge of stormwater during rain events, the reduction in hydraulic capacity due to a clogged grating could lead to upland flooding.

Rating based on evaluation criteria: **Fail**.

iii. *Alternative 3:*

Ballard Street culvert ("BA-1") – Alternative 3 results in closure of the Ballard Street culvert ("BA-1"), mitigating many of the safety concerns. High velocity flows through a completely submerged culvert do not exist as part of this scenario.

Bristow Street Culvert west with SRT ("BR-2") – Although flow velocities (see Appendix 7) are high in relation to the safety criteria shown in Fig. 2.29, this culvert is short (~40 ft. in length) and does not run full. Therefore, a person can safely float through the culvert and there is no need for a trash rack to mitigate for public safety hazards.

Rating based on evaluation criteria: **Pass**.

iv. *Alternative 4:*

Ballard Street culvert ("BA-1") – This alternative has similar safety concerns to Alternative 2 due to high velocity flows through the completely submerged culvert at Ballard Street. For this alternative, the use of gratings is practicable. The reason is that Alternative 4 provides an alternative outlet for stormwater runoff from East Saugus, namely, via the two new culverts at Bristow Street west: the 4-ft. open-topped culvert and the SRT ("BR-2") and the "out only 4-ft. diameter culvert ("BR-3"). Therefore, if the grating at the culvert at Ballard Street ("BA-1") were clogged, it would not result in upstream flooding as the Western Marsh would drain to the south through culverts "BR-2" and "BR-3."

Bristow Street Culvert west ("BR-2") – Although flow velocities (Fig. 5 in Appendix 7) are high in relation to the safety criteria shown in Fig. 2.29, this culvert is short (~40 ft. in length) and does not run full. Therefore, a person can safely float through the culvert and there is no need for a trash rack to mitigate for public safety hazards.

Dike with Culvert ("BA-2") – The dike placed in the existing tidal channel near Ballard Street will have a one-foot diameter culvert installed to allow for fish passage. The size of this culvert does not create any additional public safety issues, as it is too small for people to pass through. No trash rack would be needed as mitigation

Rating based on evaluation criteria: **Pass**.

3.4.2.3 Enhance Flood Control

i. *Alternative 1* – The existing conditions provides no improvements for the poor existing upland drainage conditions that are caused by the inability of the existing Ballard Street culvert ("BA-1") to adequately convey flows generated by severe rainfall events.

Rating based on evaluation criteria: **Fail**.

ii. *Alternative 2* – Alternative 2 provides substantial improvements to upland drainage as the modeling included in Appendix 1 demonstrates. The modeling indicates that the upland structures will not flood during a 50-year rainfall event. Under existing conditions, the neighborhood floods during much more frequent rainfall events; therefore, Alternative 2 represents a significant improvement. However, a major concern for the Project remains the potential mitigation for the above safety concerns as previously noted. Mitigation of the safety concern by installation of a grate (trash rack) would introduce a concern of clogging under high flow conditions, the very time that the full hydraulic capacity is needed. (See Fig. 3.01) The reduction in hydraulic capacity could lead to upland flooding if the culvert is completely, or even partially, blocked during a high freshwater inflow event.

Rating based on evaluation criteria: **Pass**.

iii. *Alternative 3* – Alternative 3 provides substantial enhancement to flood control, through the incorporation of duckbill gates at the seaward limit of the drainage culverts running under Eastern Avenue to prevent tidal surges from flooding upstream into the residential neighborhood. In addition, the installation of larger culverts will facilitate more rapid drainage from the residential neighborhood when offshore tide elevations are lower than the marsh water level. This includes a new 4-ft. culvert under Eastern Avenue ("E-3") as well as two new culverts under Bristow Street west of the I-95 embankment: the new 4-ft. open-topped culvert and the SRT ("BR-2") and the new out-only 4-ft. diameter culvert ("BR-3").

Rating based on evaluation criteria: **Pass**

iv. *Alternative 4* – Similar to Alternative 3, Alternative 4 provides substantial improvements to upland drainage, both through the incorporation of duckbill gates at the seaward limit of the drainage culverts running under Eastern Avenue and the installation of larger culverts to facilitate rapid drainage of the upland when offshore tide elevations are lower than the marsh water level. This includes a new 4-ft. culvert under Eastern Avenue ("E-3") as well as two new culverts under Bristow Street west of the I-95 embankment: the new 4-ft. open-topped culvert and the SRT ("BR-2") and the new out-only 4-ft. diameter culvert ("BR-3").

Rating based on evaluation criteria: **Pass**

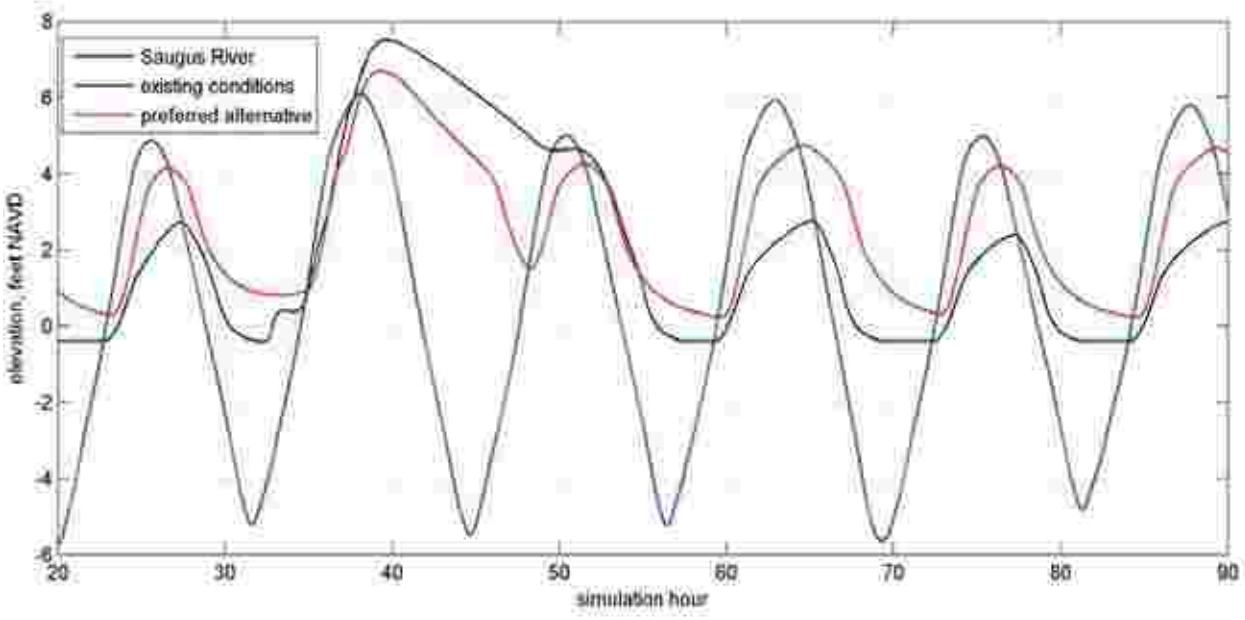

Fig. 3.05 Comparison of modeled tides in the Western Marsh for existing conditions and the preferred alternative (Alternative 4) during the simulation of the 50-year rainfall event. The peak water elevations are nearly 1 ft lower for Alternative 4 relative to existing conditions, and the additional culverts for the preferred alternative allow more rapid draining of floodwaters.

3.4.3 Application of Discretionary Criteria

The Discretionary Criteria are only applied to the "action" alternatives, namely Alternatives 2, 3 and 4.

3.4.3.1 Enhance and/or Maintain Fish Habitat

The measures used for this criterion include the increase in inundated tidal area at spring tide (based on values in Table 3.03), and connectivity with tidal waterways, with connection to the Saugus River as the most important connection related to marine fisheries. These measures are presented in Table 3.05.

Table 3.05
Comparison of Fish Habitat Enhancements

Alternative	Maximum wetted area during spring tide (acre)	Connectivity to Saugus River		Connectivity to Pines River Marsh System		Rating
		Eastern Marsh	Western Marsh	Eastern Marsh	Western Marsh	
Alternative 2	24.7	Direct	Through SRTs at dike ("BA-2")	Limited due to blockages in Pines Channel north of Bristow Street	No direct connection	Fair
Alternative 3	29.8	Blocked	Blocked		New connection ("BR-2")	Poor
Alternative 4	36.9	Direct	Through 1-ft. culvert at dike ("BA-2")		New connection ("BR-2")	Good

i. – *Alternative 2:*

Connectivity to Saugus River: The removal of the flap at the Ballard Street culvert ("BA-1") allows for unrestricted tidal flow in the Eastern Marsh.

However, unrestricted tidal flow in the Eastern Marsh necessitates closure of the SRTs leading to the Western Marsh for several hours every tide cycle, based on modeling. This will inhibit fish passage during certain tidal conditions. As the Western Marsh contains nearly 80% of the restored salt marsh area for this alternative, mechanical restriction of tidal flow to a majority of the restored marsh diminishes the enhancement to fish habitat.

Rating based on evaluation criteria: **Fair**.

ii. *Alternative 3:*

Connectivity to Saugus River: The connectivity is eliminated by closing the Ballard Street culvert..

Connectivity of Western Marsh to Pines River: This is added by a new culvert with SRT.

Rating based on evaluation criteria: **Poor**

iii. *Alternative 4:*

Connectivity to Saugus River: The removal of the flap at the Ballard Street culvert ("BA-1") allows for unrestricted tidal flow in the Eastern Marsh.

Connectivity to the Western Marsh is provided via a 1-ft. culvert through a dike separating the Eastern and Western Marshes.

Connectivity of Western Marsh to Pines River: This is added by a new culvert with SRT.

Rating based on evaluation criteria: **Good**

3.4.3.2 Minimize Mechanical Manipulation of the System

Measures employed for this criterion are minimizing the number of adjustable tide gates and minimizing the duration of gate closures. See Table 3.06.

Table 3.06
Comparison of Mechanical Manipulation of the System

Alternative	No. of SRTs to Control Tide Signals		Frequency of Operation of SRTs (Tidal Cycles per 30-Day Month)		Rating
	Eastern Marsh	Western Marsh	Eastern Marsh	Western Marsh	
Alternative 2	0	2	N/A	60	Poor
Alternative 3	1	1	4	4	Good
Alternative 4	0	1	N/A	4	Good

i. *Alternative 2* – Alternative 2 will initially require manipulation of one of the two installed tide gates to artificially attenuate the tide signal from the Saugus River into the Western Marsh. This manipulation will require that the tide gate operate continuously, where failure of the gate will either lead to long-term inundation of the marsh plain or no flooding of the marsh plain. Therefore, failure or partial failure of the tide gate will lead to loss of the restored salt marsh resources.

   Rating based on evaluation criteria: **Poor**

ii. *Alternative 3* – With the introduction of tidal flow through an open-topped culvert at Bristow West ("BR-2"), manipulation of tide gates is no longer required except during infrequent storm surge events. The proposed tide gate on the Bristow West culvert will only operate to close the culvert once the water level in the Pines River marsh system has exceeded +5.0 ft. Overall, this alternative represents a low level of tidal manipulation.

   Rating based on evaluation criteria: **Good**

iii. *Alternative 4* – With the introduction of tidal flow through an open-topped culvert at Bristow West ("BR-2"), manipulation of tide gates is no longer required except during infrequent storm surge events. The proposed tide gate on the Bristow West culvert will only operate to close the culvert once the water level in the Pines River marsh system has exceeded +5.0 ft. As the Eastern and Western Marshes are hydraulically separated for Alternative 4, no tide gates will exist within the Eastern Marsh, allowing full tidal exchange for all conditions. Overall, this alternative represents the minimum tidal manipulation of all scenarios evaluated.

   Rating based on evaluation criteria: **Good**

3.4.3.3 Minimize Maintenance and Inspection Requirements

The measures employed include the number of items requiring inspection and maintenance, the frequency of that inspection, and the criticality of performing maintenance, particularly onerous and potentially dangerous maintenance during storm events. See Table 3.07.

Table 3.07
Comparison of Inspection & Maintenance Requirements

Alternative	Maintenance Items			Rating (See Narrative)
	Duckbills	SRTs	Grates (Trash Rack)	
Alternative 2	0	2	2	**Poor**
Alternative 3	4	1	0	**Good**
Alternative 4	4	1	2	**Good**

i. *Alternative 2:*

SRTs: The operation of SRTs are critical to maintaining the tidal range in the Western Marsh during each tidal cycle. Failure of the SRTs could deprive the Western Marsh of adequate salinity from tidal exchange as well as cause upstream flooding either from failure to close during tidal surges or failure to open to discharge stormwater events. Therefore, maintenance of the SRTs has a high criticality.

Culvert Gratings: As the only means of floodwater exiting the marsh, it is critical that both the proposed tide gates and the Ballard Street culvert remain fully open during inland flooding events to prevent flooding of the neighborhood. Therefore frequent inspection and maintenance will be necessary. Debris removal will be necessary, both on a periodic basis and potentially also emergency cleaning during hazardous high-flow conditions if the grating becomes clogged during a major storm event.

Rating based on evaluation criteria: **Poor**

ii. *Alternative 3:*

Duckbills: As duckbills are self-cleaning and low maintenance, they are rated as a low criticality.

SRTs: The SRT only needs to function in tidal surges. With the duckbills on the culverts under Eastern Avenue, failure of the SRT would not lead to upstream flooding, as it would in Alternative 2. Therefore, maintenance of the SRTs has a moderate criticality.

Rating based on evaluation criteria: **Good**

iii. *Alternative 4:*

Duckbills: As duckbills are self-cleaning and low maintenance, they are rated as a low criticality.

SRTs: The SRT only needs to function in tidal surges. With the duckbills on the culverts under Eastern Avenue, failure of the SRT would not lead to upstream flooding, as it would in Alternative 2. Therefore, maintenance of the SRTs has a moderate criticality.

Culvert Gratings: In Alternative 4, the Ballard Street culvert is not critical to providing stormwater discharge in order to prevent flooding of the neighborhood. Rather, the

stormwater can be discharged via the culverts at Bristow Street west ("BR-2" and "BR-3"). Therefore the inspection and maintenance of the gratings has a low criticality.

Rating based on evaluation criteria: **Good**

3.4.3.4 Minimize Excavation Requirements

The measures employed include the volume of material excavated to lower the Western Marsh plain and the volume of excess material that cannot be disposed on site. See Table 3.08.

Table 3.08
Comparison of Excavation Requirements

Alternative	Volume of Excavation (CY)	Volume of Off-Site Disposal	Rating
Alternative 2	120,000	45,000	Poor
Alternative 3	50,000	0	Good
Alternative 4	50,000	0	Good

i. *Alternative 2* – As part of all marsh restoration options being considered, large-scale excavation of the marsh plain is required. Alternative 2 requires the maximum excavation of any of the evaluated options (total excavation volume of 120,000 cubic yards), creating the maximum excavation cost.

   Rating based on evaluation criteria: **Poor**

ii. *Alternative 3* – As part of all marsh restoration options being considered, large-scale excavation of the marsh plain is required. Alternative 3 requires excavation of the marsh plain to finished elevation of between +3.5 and +4.5 ft., requiring a total excavation volume of 50,000 cubic yards. The excavation volumes required for Alternatives 3 and 4 are identical.

   Rating based on evaluation criteria: **Good**

iii. *Alternative 4* – As part of all marsh restoration options being considered, large-scale excavation of the marsh plain is required. Alternative 4 requires excavation of the marsh plain to finished elevation of between +3.5 and +4.5 ft., requiring a total excavation volume of 50,000 cubic yards. The excavation volumes required for Alternatives 3 and 4 are identical.

   Rating based on evaluation criteria: **Good**

3.4.3.5 Create a Sustainable Marsh System

The measures employed include the elevation of the lowered Western Marsh plain relative to the marsh plain surrounding the Project Area and whether the restored marsh has a flood-dominant tidal exchange. See Table 3.09.

Table 3.09
Comparison of Sustainability of Alternatives

Alternative	Elevation of Lowered Western Marsh Plain Below Adjacent Marsh Plain	Flood Dominance	Rating
Alternative 2	2.8 to 3.6	No	Poor
Alternative 3	0.5 to 1.5	Yes	Good
Alternative 4	0.5 to 1.5	Yes	Good

i. *Alternative 2:*

Relative marsh elevation: For Alternative 2, the excavated marsh plain elevation varies between +1.4 and +2.2 ft. This elevation is substantially below the adjacent Pines River marsh plain (approximately +5.0 ft.) and would require substantial manipulation of the tide gates to allow a marsh to exist at this low elevation.

Flood or Ebb Dominance: As shown in Fig. 3 of Appendix 7, the tidal currents through the Ballard Street culvert ("BA-1") for Alternative 2 are substantially greater during the ebbing portion of the tide. Therefore, the marsh system created by Alternative 2 would export sediment and not be able to keep up with sea level rise or be sustainable in the long-term.

Rating based on evaluation criteria: **Poor**

ii. *Alternative 3:*

Relative marsh elevation: For Alternative 3, the excavated marsh plain elevation varies between +3.5 and +4.5 ft. This elevation is slightly below the adjacent Pines River marsh plain (approximately +5.0 ft.).

Flood or Ebb Dominance: As shown in Fig. 4 in Appendix 7, the tidal currents through the Bristow West culvert ("BR-2") for Alternative 3 are substantially lower during the ebbing portion of the tidal cycle. Therefore, the marsh system created by Alternative 3 would import sediment and facilitate the marsh in keeping up with sea level rise and have a higher likelihood of being sustainable in the long-term.

Rating based on evaluation criteria: **Good**

iii. *Alternative 4:*

Relative marsh elevation: For Alternative 4, the excavated marsh plain elevation varies between +3.5 and +4.5 ft. This elevation is slightly below the adjacent Pines River marsh plain (approximately +5.0 ft.).

Flood or Ebb Dominance: As shown in Appendix 7, the tidal currents through the Bristow West culvert ("BR-2") for Alternative 4 are substantially lower during the ebbing portion of the tidal cycle. Therefore, the marsh system created by Alternative 4 would import sediment and facilitate the marsh in keeping up with sea level rise and have a higher likelihood of being sustainable in the long-term. Some flow will still exit the system via the Ballard Street

culvert ("BA-1") via the 1-ft. diameter culvert ("BA-2") in the new dike, however the small size of this culvert negates any possible effects on sediment transport.

Rating based on evaluation criteria: **Good**

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4.0 Project Description

Alternative 4 is the preferred alternative and the basis of the Project. The Project elements are shown in Fig. 4.01 and include the following:

Modifications to the Western Marsh:

- The lowering of 15.4 acres of the Western Marsh plain by 1-1.5 ft., representing approximately 50,000 cubic yards of material.
- Placement of this spoils material to backfill the over-excavated portions of the western side of the I-95 embankment ("Area C") as well as over existing mounds located east of the embankment (designated as "Fill Area 1" and "Fill Area 3" in Fig. 4.01).
- Excavation of new auxiliary channels within the restored marsh will facilitate full tidal flow to all areas of the Western Marsh.

Modifications to the Eastern Marsh:

- No excavation of the Eastern Marsh is proposed. Cleaning of the existing channel, which runs parallel to Route 107, is not included this Project, but is anticipated to be performed in the future through a Northeast Mosquito Control project. Modeling described in Appendix 2 indicates that the Ballard Street and Bristow East culverts provide enough tidal exchange within the Eastern Marsh to raise the high tide level above the observed blockages in the channels. It is anticipated that the larger tidal flow and higher salinity may also "naturally" clear some of the observed channel shoaling.

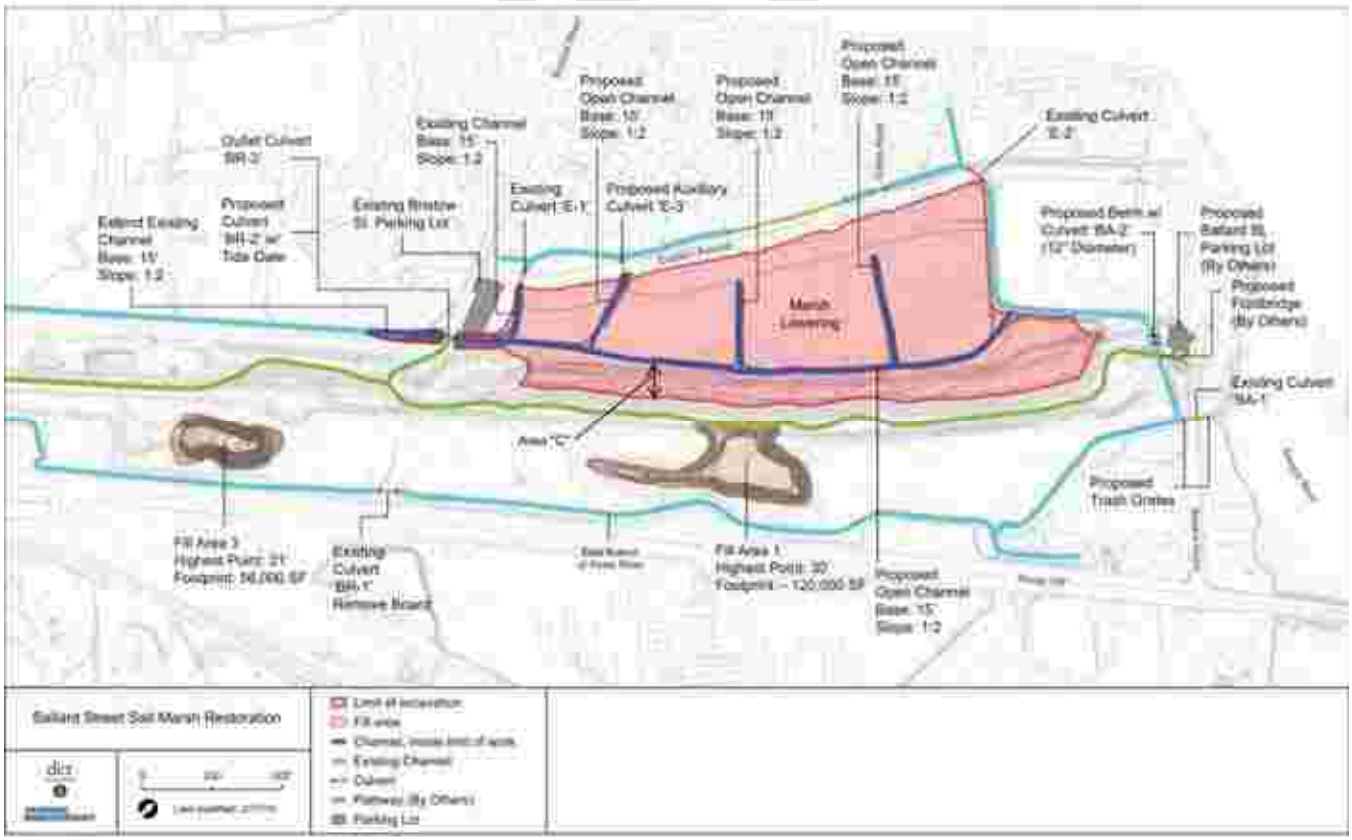


Fig. 4.01 Overview of Preferred Alternative

New Culverts and SRTs:

- Installation of a pair of new culverts at Bristow Street west of the I-95 embankment at the location of an historic channel. The existing Pines River Channel (See Fig. 2.24) will be extended north to this location.
    - A new open-topped culvert ("BR-2") and SRT to provide the primary source of tidal flow for the Western Marsh from the Pines River Channel.
    - An auxiliary "out only" 4-ft. culvert ("BR-3") with a one-way duckbill valve to prevent tidal flow into the Western Marsh. This culvert is intended to enhance stormwater discharge from the Western Marsh to the Pines River Channel. It also provides an emergency fail-safe to allow tidal and stormwater discharge in the event that the primary culvert and SRT ("BR-2") fails in the closed position.
- Installation of a new auxiliary culvert ("E-3") under Eastern Avenue in the vicinity of Mersea Street, to improve drainage from the residential neighborhood. The new culvert would be fitted with a one-way duckbill valve to prevent tidal flow into the Eastern Ave. ditch.
- Construction of a 8-ft. high earthen dike across the channel on the west side of the northerly terminus of the I-95 embankment, approximately 200 ft. upstream of the Ballard Street culvert. This dike would contain a 1-ft. diameter culvert ("BA-2") to allow restricted flow to the Western Marsh from the Saugus River.

Modifications to Existing Culverts:

- Removal of the existing improvised tide gate at the Ballard Street culvert ("BA-1") to allow unrestricted flow into the Eastern Marsh.
- Removal of board and remnants of internal flow controls from the Bristow Street culvert east ("BR-1") to allow flow from the Pines Creek into the Eastern Marsh (see Fig. 4.02).
- Installation of one-way duckbill valves on the two existing Eastern Avenue culverts (24-in. "E-1" and 72-in. "E-2") to prevent tidal flow into the Eastern Avenue ditch.

4.1 Description of Project Elements

This section provides additional detail of the Project elements necessary to achieve the Project goals.

4.1.1 Lowering of Western Marsh Plain and Material Handling

4.1.1.1 Lowering of Marsh Plain

The Project will lower approximately 15.4 acres of the Western Marsh plain by 1-1.5 ft. to create tidal conditions suitable to restore salt marsh vegetation. The resultant marsh plain will coincide with the range of high tide conditions, allowing full inundation only in spring high tides.

4.1.1.2 Material Handling and On-Site Disposal

The contractor would move approximately 50,000 cubic yards of this material to backfill three areas:

- The additional excavation of the western side of the I-95 embankment ("Area C" in Fig. 4.01).
- Two of the existing mounds located east of the embankment (designated as "Fill Area 1" and "Fill Area 3" in Fig. 4.01).

A total of five on-site locations were considered for on-site disposal:

- Area C, which is proposed to be excavated to elevation -1.0 by the Winthrop Beach Nourishment – Northern Segment (DCR Project No. P11-2686-C4A)
- Fill Areas 1 to 4: These are existing upland areas east of the I-95 embankment, identified by Geosyntec and shown in Fig. 4.02.

Area C

Presently, Area C has been excavated only to elevation +5.0 ft. as part of the extraction associated with the Winthrop Beach project. This is pursuant to a condition of the Superseding Order of Conditions (DEP File #67-1001). This condition does not allow the excavation below elevation +5.0 to occur until it can be done concurrent with the Ballard Street Western Marsh lowering. When the Ballard Street Project is underway, Area C will be excavated from elevation +5.0 to -1.0 ft., providing for the on-site disposal of approximately 25,000 cubic yards of material from the Western Marsh lowering to achieve a level marsh plain.

Fill Areas 1 to 4

In 2009, Geosyntec identified 4 locations where spoils of marsh lowering could be placed. See Fig. 4.02. All the areas were upland (above the marsh plain) and all but Area 2 are existing mounds of peat and other spoils that date back to the original embankment placement. These areas were identified in consideration of the long range plans for marsh restoration. There is considerable material in each mound, and removal and disposal would be prohibitedly expensive. Therefore, placement of spoils atop these existing mounds was considered acceptable.

Fig. 4.02 Potential On-Site Disposal Locations. (Geosyntec, 2009)

Two other fill areas were considered and rejected:

- Fill Area 2, immediately north of Bristow Street, is a potential location for future marsh restoration, as it is only a few feet higher than the current desired marsh plain. It has the potential to be lowered at a future time so it can be restored to salt marsh.
- Fill Area 4, immediately south of Area 3, was rejected in that it is under a power transmission line. Filling on top of the mound would violate the power company's required vertical clearance under high voltage transmission lines.

Material containing *Phragmites* will be handled to minimize the potential for further spread into areas of restored marsh, including burial at least 5 ft. below final grade.

Fill Area 1 is closer to the Western Marsh and would be the first choice to place the excess 25,000 cubic yards of material that could not be placed in Area C. "Fill Area 3" is located south of Bristow Street. It is included as a contingency on-site location. Though fill will be placed on these existing mounds, fill placement will not alter existing salt marsh as the footprint of each mound will not increase.
No material will be taken off-site for disposal.

4.1.1.3 Channels within the Lowered Western Marsh

New auxiliary channels within the restored marsh will facilitate full tidal flow to all areas of the Western Marsh. See Fig. 4.03. The design of these auxiliary channels will be completed prior to final permitting of the Project. The concept will include a system of primary new channels with auxiliary ditches:

- New primary channels/creeks will be created in the Western Marsh to ensure tidal flow reaches the entire restoration area.
- Additional secondary creeks may be added as a field adjustment during the construction or restoration process if determined to be necessary to ensure full restoration. Similarly tidal flow restrictions caused by slumping channel banks within the existing marsh channels in the Eastern Marsh may be removed as inspection deems necessary.

Material removed from channel improvements will be placed on site in the same locations as the spoils from marsh lowering. See Section 4.1.1.2 above.

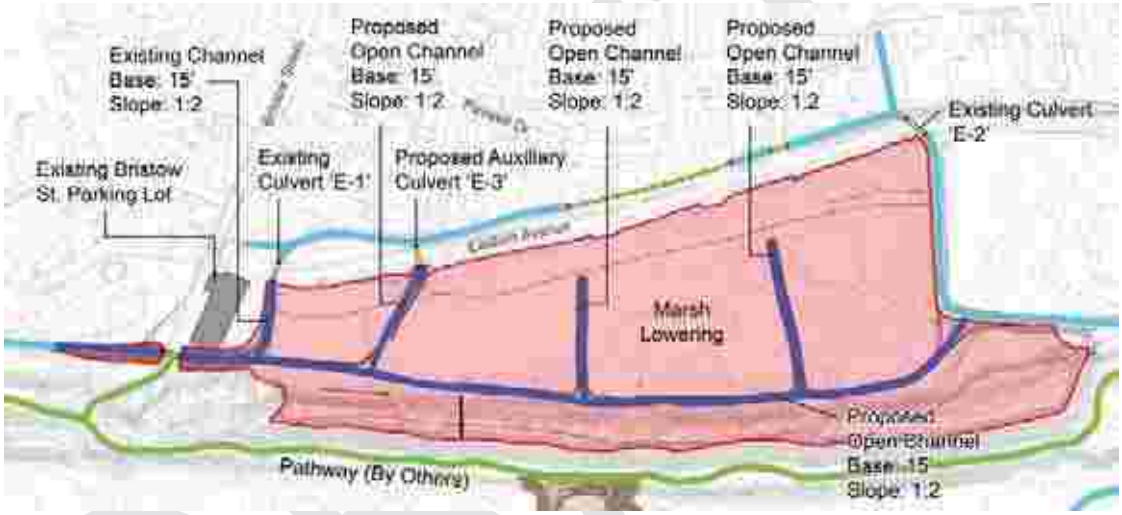


Fig. 4.03 Conceptual layout of channels and auxiliary ditches for the lowered Western Marsh

4.1.2 New Culverts at Bristow Street West ("BR-2" & "BR-3")

4.1.2.1 New Culvert for Tidal Exchange

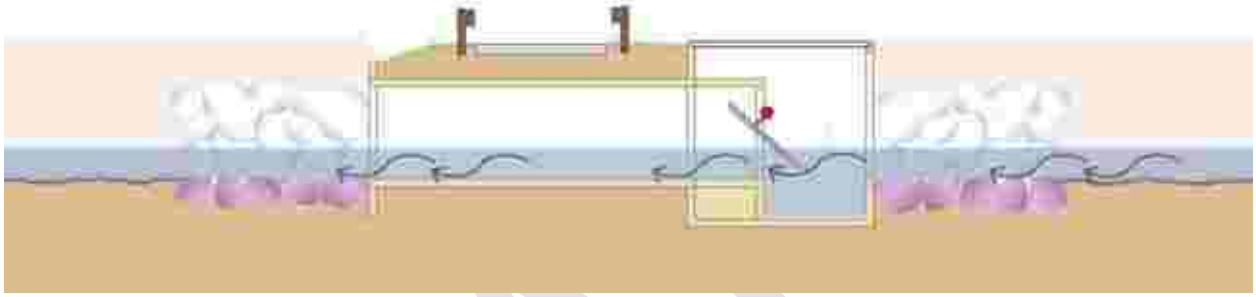
The Project will add a new open-topped culvert ("BR-2") and SRT at Bristow Street west of the I-95 embankment. The culvert invert will be set at elevation 0.0 to optimize hydraulic performance, as this elevation corresponds to the typical marsh channel elevations south of the proposed culvert in the Pines River marsh system. The culvert will be rectangular in shape, 4 ft. wide and be open topped. The height will be set to ensure it never runs full under tidal and storm conditions.

Fig. 4.04 New culvert "BR-2" & "BR-3" at Bristow Street west, near the parking lot

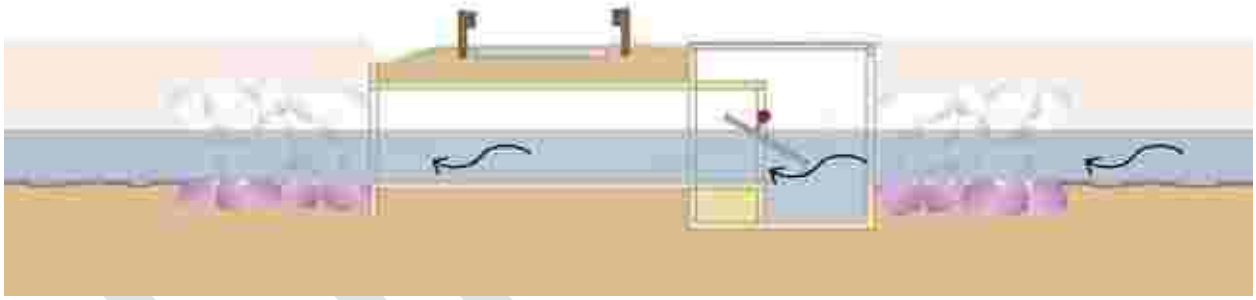
The new culvert will cross the end of Bristow Street, just east of the existing parking lot. New channels will be excavated north and south of the culvert. To the south, the channel will extend the Pines River Channel and provide tidal exchange (See Fig. 4.04). To the north, it will connect to the lowered Western Marsh via a series of channels and auxiliary ditches (as shown in Fig. 4.03).

The SRT is a float-activated tide gate that allows the passage of normal tidal flows and is fully adjustable to limit the passage of extreme tides or flood surges. See sequence of operation in Fig. 4.05.

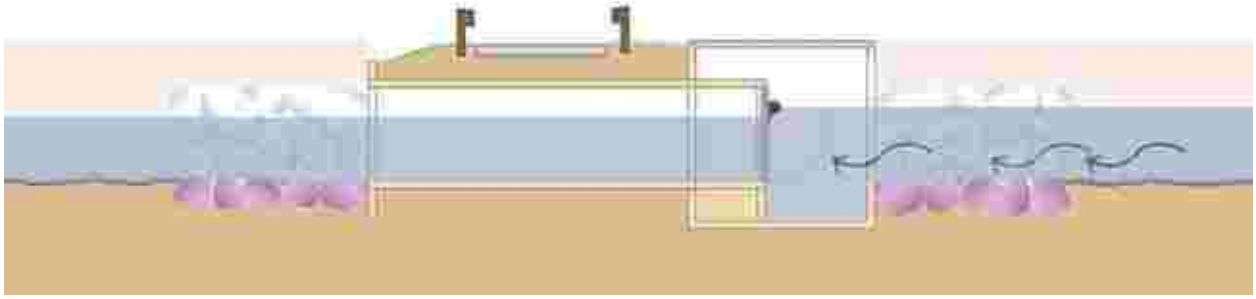
If flows exceed the set elevation, counter floats automatically close the tide gate, which then remains closed during the flood event. The SRT automatically re-opens as the tide or flood event recedes. The SRT will be installed within a 4 ft. wide open topped concrete culvert with an invert elevation of 0 ft. A typical SRT is shown in Fig. 4.06.



a)



b)



c)

Fig. 4.05 Sequence of Operation of SRT
a) Gate floats open to let tide in
b) Gate stays open during rising tide
c) Gate closes when tide is above a set elevation

Fig. 4.06 Photographs of Typical SRT, installed (at left) and prior to installation (right)

4.1.2.2 Auxiliary Culvert for Stormwater Discharge

An auxiliary "out only" 48 in. culvert ("BR-3") will be provided with a one-way duckbill valve to prevent tidal flow into the Western Marsh. This culvert is intended to enhance stormwater discharge from the Western Marsh during major rain events.

4.1.3 New Dike and Culvert ("BA-2")

The new dike would serve the purpose of separating the Eastern Marsh and Western Marsh, allowing for maximum salt marsh restoration overall. It would allow for different tidal ranges in the Eastern and Western Marshes. The Eastern Marsh can operate with unrestricted tidal flow without causing the flooding of properties at high spring tides and without detrimental effect of the ebb-dominate flow under the influence of the low Ballard Street culvert.

However, hydraulic modeling has indicated that it is necessary to restrict the hydraulic influence of the Ballard Street culvert in order to establish the desired flood-dominant flow in the Western Marsh. While ideally a solid dike would completely eliminate the influence of the Ballard Street culvert, a small culvert can be provided to provide habitat connectivity between the Saugus River and the Western Marsh. Modeling shows that a 12-inch culvert can provide the connectivity without significant degradation of flood-dominant flow. Modeling also shows that adding a second culvert shifts the operation of the Western Marsh to ebb-dominant, as the greater hydraulic capacity results in a greater influence of the ebb-dominant operation of the Ballard Street culvert.

The dike also reduces the amount of Western Marsh plain excavation otherwise required because of the low invert at the Ballard Street culvert. The dike height is set to match the elevation of Ballard Street and therefore the dike would overtop during a coastal storm surge associated with an approximate 2-year storm event (or 50% probability of occurring in a year). In the event that the new dike would be overtopped, a second line of flood control is provided by the provision of one-way duckbill tide valves on the Eastern Avenue culverts. These duckbills would keep spring tides and storm surges from backflowing into the residential neighborhoods west of Eastern Avenue. See further discussion in Section 4.1.4.

4.1.4 Eastern Avenue Culverts ("E-1," "E-2," and "E-3")

The proposed design utilizes Eastern Avenue to serve as a barrier against tidal flows and storm surges, so as to protect the residential East Saugus neighborhood located west of Eastern Avenue from associated flood damage. To ensure this objective while also allowing stormwater runoff to pass through the Western Marsh, the Project will add one-way duckbill valves on the existing Eastern Avenue Culverts. This includes the 24 in. culvert ("E-1") just north of Bristow Street and the 72 in. culvert ("E-2") north of Gates Road.

The duckbill valves are made of rubber and remain closed when there is not stormwater flow from upstream. As the Western Marsh receives tidal flow, the valve remains closed. However, under the force of stormwater from upstream, the duckbill opens up, allowing stormwater to enter the Western Marsh. For photographs of typical duckbill valves, see Fig. 4.07.

Fig. 4.07 Photographs of Typical duckbill Tide Valves

The Project also includes construction of a 48-inch diameter auxiliary culvert ("E-3") under Eastern Avenue in the vicinity of Mersea Street (see Fig. 4.08). This would improve the conveyance of inland floodwaters and stormwater runoff from the residential neighborhood along Eastern Avenue into the newly created salt marsh area. This culvert will also be fitted with a one-way duckbill to prevent flooding from coastal storm events from backing up into the culvert and then into the drainage ditch along Eastern Avenue, as currently occurs. This will alleviate some of persistent flooding in this area.

Fig. 4.08 Location of Proposed Auxiliary Culvert "E-3"

4.1.5 Removal of Culvert Obstructions

Obstructions will be removed at the existing culverts at Ballard Street ("BA-1") and Bristow Street east of the I-95 embankment ("BR-1"). For culvert locations, see Fig. 4.09.

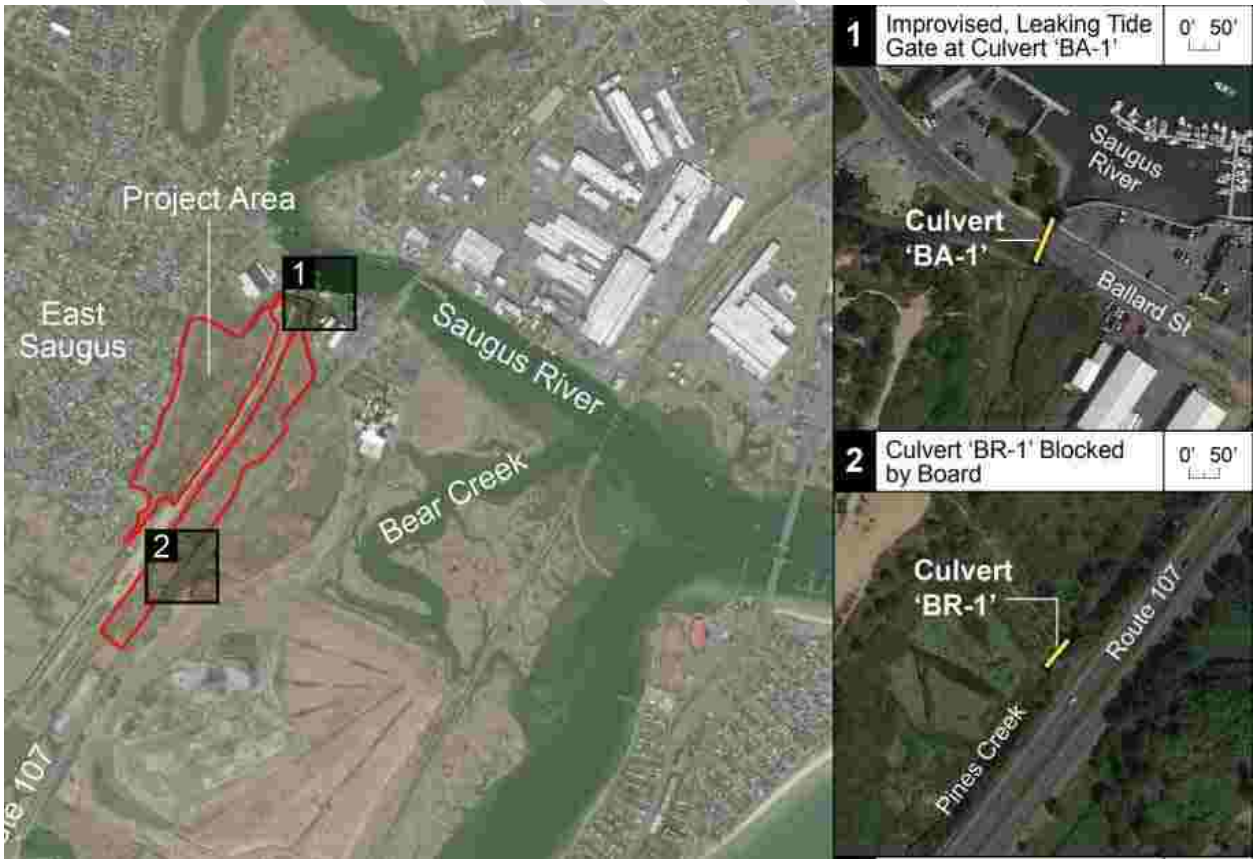


Fig. 4.09 Location of Obstructed Culverts at Ballard Street ("BA-1") and Bristow Street east ("BR-1")

4.1.5.1 Ballard Street Culvert ("BA-1")

At Ballard Street, the poorly functioning improvised tide gate (a corroding steel plate affixed to the end of the culvert) will be removed, allowing full tidal exchange, to the extent of the culvert's capacity.

Hydrological modeling has indicated that excessive velocities will occur at this culvert with the improvised tide gate removed. Combinations of flow depth and velocity can be strong enough to knock over a person standing in the stream, as illustrated in Fig. 2.28. As this culvert is adjacent to state and town parklands, this safety hazard must be mitigated. One approach would be to install a grate at such a distance from the culvert ends that the velocities would be under 2 fps.

Fig. 4.10 Enlarged View of Improvised Tide Gate on North End of Ballard Street Culvert

4.1.5.2 Bristow Street Culvert East ("BR-1")

The board blocking this culvert will be removed. See Fig. 4.11. This will provide an additional source of tidal flushing from the Pines River, south of the Project Area.

Fig. 4.11 Enlarged View of board on North End of Bristow Street Culvert

4.2 Flood Control Benefits

The Project provides for the enhancement of flood control and storm damage protection during both rain events and coastal tidal surges in the following ways:

- Stomrwater drainage from the Eastern Avenue ditch – southern segment is significantly improved by providing enhanced downstream capacity:
  - New 48-in. culvert ("E-3") under Eastern Avenue.
  - New channel from this culvert through the Western Marsh
  - New culverts at Bristow Street west ("BR-2" and "BR-3")

- Stormwater drainage from both segments of the Eastern Avenue ditch is significantly improved by the improved channels and lowering of the marsh plain in the Western Marsh. For the design storm (50-yr. storm), these improvements lower the peak water elevation in the Western Marsh by nearly 1 ft. when compared to existing conditions. See Fig. 4.12.

- The Project will prevent the backup of tidal surge waters from reaching the Eastern Avenue ditch and Town storm drains upstream of the ditch during spring high tides and storm surges up to the low point of Bristow Street (elevation +7, equivalent of the 2-year storm),. This will keep these surges from backflowing into the East Saugus neighborhood. However, should severe coastal flooding overtop Ballard Street with wind or wave-driven storm surges, and overwhelm tide gates at any location in the Project Area, local flooding will reach the neighborhood directly from the Saugus River and from the marsh south of Bristow Street. Though the Project is unable to fully

protect the adjacent East Saugus neighborhood from flooding caused by extreme coastal storm surge, there will be a reduction in frequency and severity of flooding in the neighborhood.

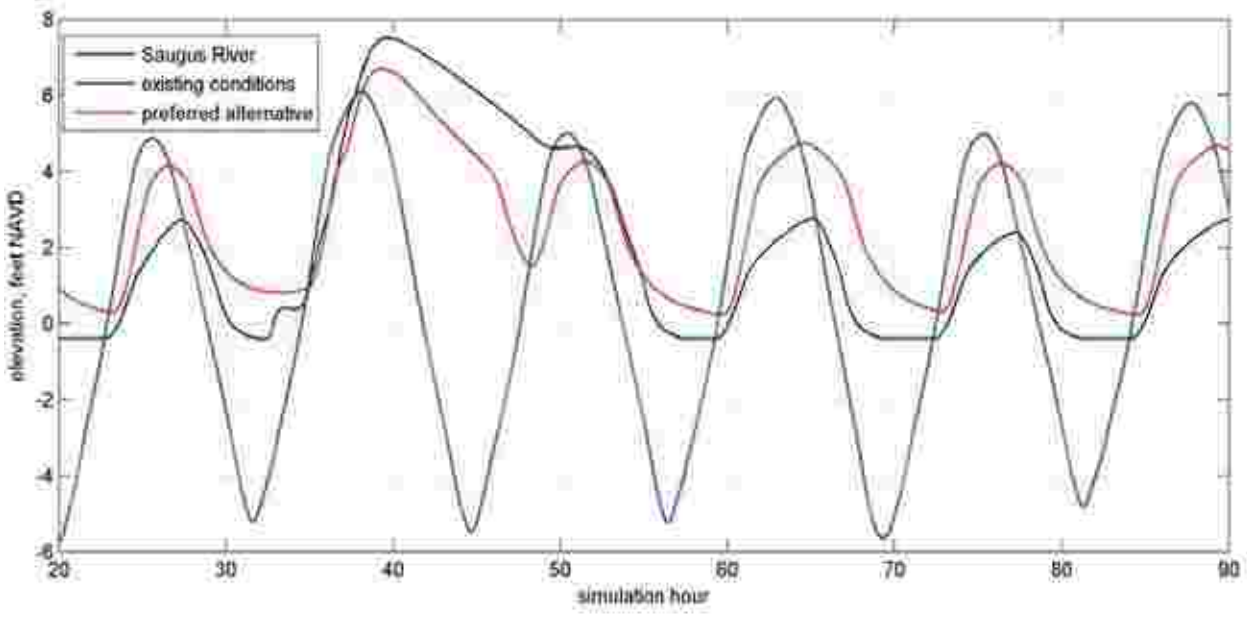


Fig. 4.12 Comparison of modeled tides in the Western Marsh for existing conditions and the preferred alternative (Alternative 4) during the simulation of the 50-year rainfall event.
The peak water elevations are nearly 1 ft lower for Alternative 4 relative to existing conditions. The peak flows of the 50-yr. storm occurs during simulation hours 35 to 55. The peak runoff occurs at simulation hour 39..

4.3 Proposed Project Schedule and Costs

Construction of the Project is currently anticipated to commence late in 2015 or early 2016. The proposed construction sequencing and methodology is presented in Section 6.1. The Project will likely require approximately 12 to 18 months to complete, at an estimated cost of $2.2 million. See Table 4.01.

Table 4.01
Construction Cost Estimate

Items of Work	Estimated Costs
Culverts & Structures	$657,000.00
Material Extraction & On-Site Disposal	$1,054,000.00
Paving, Site Restoration, and General Requirements	$505,000.00
Total	**$2,216,000.00**

Note: Costs are for mid-2015

4.4 O&M Considerations

Future maintenance of the culverts and tide gate will be the responsibility of the DCR in accordance with an Operation and Maintenance (O&M) Plan prepared as part of a Notice of Intent to be filed for this Project. Appendix 3 contains a sample O & M Plan showing typical measures to maintain structures included in the design. Upon completion of the SRT specifications, a final plan will be developed. The tide gate proposed has a minimum of moving parts and manual controls both to reduce monitoring requirements and the potential for unintended adjustments or vandalism. The design will allow for adjustments as necessary in order to calibrate for changing field conditions, including sea level rise.

DER will conduct post-construction tidal hydrology monitoring of the salt marsh and coordinate additional post-restoration monitoring with the project proponent as appropriate. Given the restoration area's size re-planting is not practical. The plan will rely upon establishment of suitable coastal hydrology in order to promote and encourage the growth of native coastal salt marsh species. This monitoring will include evaluation of encroachment by non-native plants, especially *Phragmites*.

4.5 Attachment 4-1: Plan of Proposed Conditions

A plan of proposed conditions is included as Attachment 4-1 following this page.

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5.0 Potential Environmental Effects of the Project

5.1 Wetlands and Waterways

The total area of wetland to be restored is estimated to be 36.9 acres, which includes improving the existing 3.0 acres of degraded salt marsh. This includes temporary alteration to the existing 31.8 acres of the presently delineated wetland resource, (which includes only an estimated 9 acres of presently viable native salt marsh habitat) as well as an additional 5.1 acres of restoration to be created by the removal of the I-95 embankment.

Most of the impacts to wetland resources associated with the construction of this project are temporary and will be fully restored upon project completion and restoration of tidal flow to support a new salt marsh. These temporary impacts include excavation to create a lowered marsh plain and channel construction. This includes temporary impacts to 15.4 acres of existing degraded marsh in the western marsh. Approximately 5.9 acres of formerly filled marsh will also be included in the new marsh plain consisting of 5.1 acres of the I-95 embankment and 0.8 acres of new channels to culverts "BR-2" and "BR-3"

Some minor permanent impacts will be required for the construction of the dike at the northern end of the project site, as well as culvert and headwall installation. The total area of permanent impacts is expected to be approximately 4,000 square feet or 0.1 acre. These impacts are necessary in order to provide the necessary tidal flow to support the new salt marsh.

Approximately 2.9 acres of the proposed restoration activities are located within Riverfront Area. All of those impacts will also be temporary, with the exception of approximately 2,400 square feet for installation of structures.

These impacts are offset by the Project's capacity to create or restore up to 36.9 acres of salt marsh.

Measures will be employed to minimize adverse impacts to wetland resources during construction. These include preparation of a Stormwater Pollution Prevention Plan (SWPPP) by the selected site contractor which will detail measures proposed to control runoff, and to minimize soil erosion and sedimentation of wetland resource areas. Tidal flow will be blocked from the Project Area during the period of construction, in particular, the marsh lowering activities. Other impact mitigation measures include use of standard erosion and sedimentation controls at the wetland/upland interface, use of low ground pressure equipment within the restoration area to minimize compaction, as well as stockpiling of materials and equipment outside of wetland areas wherever possible. Construction will be sequenced as described in Section 6.1.2 in order to minimize the potential for downstream impacts to other wetlands.

Table 5.01
Summary of Salt Marsh Restoration for the Project

	Maximum wetted area (acre) for spring tide conditions		
	Eastern Marsh	**Western Marsh**	**Total**
Existing Conditions	1.6	1.4	3.0
Net increase	+8.9	+25.0	+33.9
After Project completion	**10.5**	**26.4**	**36.9**

5.2 Flood Protection

While the Project will not be capable of completely solving the flooding issues plaguing the East Saugus neighborhood during coastal, wind-driven storms (as discussed in Section 4.2), the Project does include a number of features for enhancing flood protection. For example, the inclusion of one-way duck bill devices on the culverts connecting the Eastern Avenue drainage ditch ("E-1", "E-2" and "E-3") will prevent tidal waters (e.g., spring tides, tidal surges up to approximately elevation +7[4] from backflowing from the Western Marsh into the Eastern Avenue ditch.

The project enhances flood protection during rain events by improving the drainage path from the Eastern Avenue ditch through the Western Marsh. A new 4-ft. culvert ("E-3") is added under Eastern Avenue to drain the southern segment of the Eastern Avenue ditch. Presently this segment drains only through a 24-inch culvert "E-1" and then through a series of poorly defined and partially filled channels through the Western Marsh. From this point today, the stormwater runoff has to reach the existing channel along the northern edge of the Western Marsh. This condition will be greatly improved by new channels from both culverts "E-1" and "E-3" that will direct stormwater runoff to the two new culverts at Bristow Street West ("BR-2" and "BR-3"), which will significantly shorten the drainage path through the Western Marsh.

These improvements will enhance the current standard of flood control that the neighborhood experiences. The level of improvement is illustrated in Fig. 4.12 which shows that during the design 50-year storm, the peak water elevations in the Western Marsh and Eastern Avenue ditch are approximately 1 ft lower for preferred alternative relative to existing conditions. In addition, with the project, the peak water elevation will be below the low point (elevation +7.0 ft.) at Eastern Avenue and Bristow Street. See also Table 5.02.

Table 5.02
Reduction in Flood Elevation for 50-Yr. Design Storm

	Peak Water Elevation in Western Marsh (ft.)
Existing Conditions	+7.5
With Project	+6.5

5.3 Water Quality

The Project will improve water quality by reestablishing regular tidal flushing and salinity supportive of salt marsh vegetation. Healthy salt marshes filter pollutants from stormwater contained within non-point source runoff from developed areas and promote the growth of micro-fauna that also filter both fresh and salt water.

Proper construction methods deployed during construction will minimize erosion and siltation of adjacent undisturbed resource areas. Most work can be done without interference from the daily tidal cycle. The Western Marsh will be isolated by temporary dikes from the existing channel to the north (connecting culvert "E-2" to "BA-2" and a new channel to the south connecting culvert "E-1" to the new Bristow Street west culvert "BR-2"). This approach will maintain upstream stormwater water discharges while protecting the channels and downstream wetland resources from sediment-laden runoff from the excavation operations.

[4] Above elevation +7, tidal surges in the Saugus and Pines Rivers will overtop Ballard and Bristow Streets.

Re-use of the excavated organic material as cover or topsoil on the remaining portions of the I-95 embankment will also promote improved growth of vegetation providing stabilization to side slopes and reducing the potential for erosion. Such re-use will occur with attention to minimizing the potential spread of *Phragmites* onto the restored embankment.

5.4 Wildlife and Protected Species

Salt marshes are regarded as one of the most productive ecosystems in the world, and provide habitat for many species of fish, shellfish, invertebrates, birds, and other terrestrial and aquatic species. Re-establishment of viable salt marsh will enhance and improve ecological functions and values for numerous species. The Project Area will shift however, from its present state of a largely terrestrial ecosystem to a wetland ecosystem over time. This will involve loss of some scrub-shrub and tree cover leading to a temporary disruption of the wildlife community. Upon completion, however, the species and habitat diversity provided by the restored salt marsh should be significantly greater than current conditions.

Fish access to the site is currently limited to the few able to pass beyond the broken flap gate at Ballard Street culvert ("BA-1"). Upon Project completion, fish passage will be fully restored between the Saugus River and the Eastern Marsh through the Ballard Street culvert, and between the Pines River and the Eastern and Western Marshes through the new Bristow Street west culvert ("BR-2"). In addition, the one-foot diameter culvert ("BA-2") proposed through the dike will provide a passage between the Saugus River and the Western Marsh. Table 5.01 shows the increase in fish habitat area, represented by the acreage that is inundated by tidal flow at spring high tide.

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6.0 Proposed Mitigation Measures

6.1 Construction Sequencing and Methodology

As noted in Section 4.3, construction will likely require 12 to 18 months.

6.1.1 Sequencing Constraint based on SOC DEP File No. 67-1001

Per Conditions #37, 38 and 39 of Superseding Order of Conditions for DEP File No. 67-1001, the salt marsh restoration must dovetail with the on-going I-95 sand extraction efforts related to the Winthrop Beach Nourishment Project. DEP sought to guarantee completion of the salt marsh restoration work by recognizing the overlap of the footprint of these two projects at the western edge of the I-95 embankment. Therefore a 5-acre section of the western portion of the extraction footprint (Area C in Fig. 4.01) will be excavated below the elevation of the adjacent salt marsh. This area will accommodate spoils from the lowering of the Western Marsh. As designed, the Project will not haul spoils for off-site disposal.

This constraint is incorporated into Stage 3 of this Project, as described below.

6.1.2 Proposed Construction Sequencing

The following outline construction sequence was developed based on the experience gained with the extraction and marsh restoration work performed as part of the Winthrop Beach Nourishment Project. The final construction sequence, pending completion of final design, construction plans and specifications will be determined in conjunction with the contractor and interested parties, and may vary from the general order of events described below. Proper construction sequence and methods will result in minimization of potential adverse impacts to wetland resources.

Prior to the start of construction, erosion and sedimentation controls will be installed to protect those wetland resources that will not be disturbed by this Project.

Stage 1: Culverts "BR-2" and "BR-3"
These culverts at Bristow Street will be constructed to allow flow from the southerly Eastern Ave. culvert ("E-1") to drain into the marsh south of Bristow Street. Culvert "BR-2" will initially have the SRT locked and closed, while Culvert "BR-3" will be installed with the one-way duckbill tide valve preventing tidal flow into the Project Area during construction. This work also includes the relocation of a Town water main and a telephone ductbank in Bristow Street.

Stage 2: Site Preparation and Isolation of the Marsh Plain
The Project will then hydraulically isolate the Western Marsh to allow excavation "in the dry." Temporary dikes would be constructed along the channels at the north and south ends of the marsh. These temporary dikes will be built high enough so that, during rain events, stormwater discharges from west of the Project Areas would pass through without inundating the excavation area. This would also allow tidal surges to pass through the construction area without flooding the marsh lowering work area.

Stage 3: Marsh Plain Lowering and Material Handling
With the majority of the Western Marsh isolated from the two channels, the area will be first cleared and grubbed of the upland and invasive vegetation. Organic topsoils will be segregated. Soils with *Phragmites* rhizomes will be separated for deep burial to prevent re-propagation. This work may require low ground pressure equipment.

Spoils will be initially backfilled into "Area C" in close coordination with the contractor performing the extraction as part of the Winthrop Beach Nourishment Project. (See discussion above in Section 6.1.1.) The remaining spoils will be placed in "Fill Area 1" and/or "Fill Area 3."

The channels and auxiliary ditches will be constructed through the lowered marsh.

Stage 4: Eastern Avenue Culverts
The new auxiliary culvert "E-3" will be constructed and the duck bills added onto the existing culverts "E-1" and "E-2."

Stage 5: Marsh Flooding
The dike and 12-in. culvert ("BA-2) near the Ballard Street parking lot will be installed. The temporary dikes isolating the lowered marsh plain will be removed, and the SRT on culvert "BR-2" will be activated. This will result in tidal flooding of the Western Marsh.

Stage 6: Other Culvert Work
The new grates will be installed at the Ballard Street culvert ("BA-1"). The flap will be removed from the Ballard Street culvert and the board removed from Bristow Street culvert east ("BR-1").

Stage 7: Completion
All disturbed upland areas will be stabilized. Upland areas will be seeded with a native mix. Pavement will be restored in areas where it was removed (e.g., for the utility relocations in Bristow Street and for the new culvert ("E-3") in Eastern Avenue). The site will be cleaned and the contractor will demobilize.

6.2 Construction Traffic, Access and Staging

6.2.1 Construction Access and Staging

Access to the Project Area will be off Bristow Street and from the Route 107 access to the I-95 embankment. The access off Route 107 is currently used for the DCR contractor performing the material extraction from the embankment for the Winthrop Beach Nourishment Project. It is assumed this temporary access would be maintained during the Ballard Street Salt Marsh Restoration. After both projects are completed, the access will be restored to pre-construction conditions.

The Bristow Street parking lot may be used for staging and stockpiling of materials and equipment as needed. Other staging areas within the Winthrop Beach project's extraction area may be allowed. After both projects are completed, all staging areas will be restored. Areas within the embankment will be restored per the final planting plans for the Winthrop Beach project (DEP File #67-1001). The Bristow Street parking lot will be restored to pre-construction conditions, including the existing gravel surface.

6.2.2 Construction Traffic

6.2.2.1 Construction Traffic – Remaining Embankment Excavation
The material associated with the remaining excavation below elevation +5.0 in "Area C" is planned to be transported off site for beneficial reuse at Winthrop Beach by the contractor working on that project. Some material that is unsuitable for the beach may remain on site. This truck traffic will continue to use the direct access to and from Route 107 and these trucks will not traverse the residential area to the west. This associated truck traffic has been accounted for in EEA #10113 for the Winthrop Beach Project, and, as such, is not part of this Project. This removal will be a relatively minor operation compared to the peak of trucking to Winthrop Beach from last summer, when approximately 20 trucks per day made two to three round trips. The additional removal will involve approximately 10 trucks per day making two to three round trips for 3 to 6 weeks.

6.2.2.2 Construction Traffic – Ballard Street Marsh Restoration

As the Project will not be exporting material, there will be limited daily construction traffic to and from the Project Area. The daily project workforce is estimated at 5 to 10 workers.

Construction traffic to the site will include the following:

- Mobilization of earth moving equipment
- Temporary construction materials:
  - Erosion control materials
  - Temporary fencing
  - Temporary signage and traffic control devices
- Materials for the culverts:
  - Precast concrete pipe and box culvert sections
  - Estimated 5 to 10 truckloads of concrete
  - Stone for culvert ends
  - SRTs and duck bills
  - Gratings
  - Pipe, fittings, conduit, and related materials to relocate the utilities in Bristow Street
- Restoration materials:
  - Pavement materials to restore Bristow Street and
  - Loam and seed to restore disturbed upland areas
  - Miscellaneous other material to restore site to pre-construction conditions
- Removal of unreusable materials (e.g., old water main pipe, rubbish and debris found on site, etc.)
- Demobilization of earth moving equipment

Daily construction traffic to and from the site is estimated at 5 to 10 trucks, with many days of no truck trips, and possibly up to 10 days of over 10 truck trips. In general, this truck traffic will be directed to the direct connection to Route 107, so as to avoid travel through the residential neighborhood. Truck traffic associated with the work on the new and existing culverts under Eastern Avenue would need to traverse that roadway. Note that these trips are in addition to any truck trips associated with the embankment excavation, as described in Section 6.2.2.1.

Work activities will be coordinated with local police and fire departments.

6.3 Erosion and Sedimentation Control

Erosion and sedimentation control procedures will be implemented prior to and during construction to minimize sedimentation of adjacent wetlands and waterways during construction. A SWPPP developed by the contractor will be implemented prior to construction. Hydrologic connections between the excavation areas and tidal creeks will be made gradually, while the excavated area is stabilized so risk of downstream turbidity is minimized. The suggested sequence would involve deploying a flexible cofferdam in the waterway while the bank is breached. Once the channel excavation work is completed, the cofferdam would be removed and the area flooded.

6.4 Dust Control

During excavation the contractor will deploy measures necessary to control fugitive dust. Dust control measures include only wet suppression consisting of sprinkler pipelines, tanks, tank trucks, or other

devices capable of providing regulated flow, uniform spray, and positive shut-off. Several such applications may be necessary each day, depending upon meteorological conditions and work activity.

Hydroseeding for dust control may be used to produce a temporary stand of grass that will effectively control dust.

6.5 Noise Control

During excavation of the marsh plain, construction operations will result in temporary, localized impacts to ambient noise levels. Mitigation measures such as the following will be used to minimize noise impacts resulting from construction:

- Using appropriate mufflers on equipment;
- Turning off idling equipment;
- Shielding equipment from or locating at a distance from sensitive receptors; and
- Scheduling operations to keep average noise levels low and uniform.

Every effort will be made to minimize construction related noise associated with the Project out of respect for Project Area neighbors. Should additional noise control measures be required during the course of the Project, DCR, its contractor and its engineer will work with local authorities to implement these measures.

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7.0 Regulatory Permitting

7.1 Environmental Review and Required Permits

DCR anticipates the Project will require permits from federal, state and local permit authorities.

Table 7.01
Regulatory Permits and Reviews

Regulatory Permits and Reviews	
Agency	Permit or Review
Federal Permits	
Army Corps of Engineers	Amendment or modification to existing Massachusetts Programmatic General Permit II – Section 404 of the Clean Water Act for the Winthrop Shores Reservation portion of the Project Area Individual Permit– Section 404 of the Clean Water Act.
Environmental Protection Agency	National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for Construction Activities
State Permits and Reviews	
Massachusetts Environmental Policy Act (MEPA)	Expanded Environmental Notification Form (EENF)
Massachusetts Office of Coastal Zone Management	Federal Consistency Certification
Department of Environmental Protection – Waterways Regulation Program	Chapter 91 Waterways License and Permit *(not anticipated, see Fig. 7.02)*
Department of Environmental Protection – Division of Wetlands and Waterways Office of Watershed Management	401 Water Quality Certification (WQC)
Mass. Historical Commission	Project Notification
Mass. Underwater Archaeological Research Board	Project Notification
Massachusetts Department of Transportation	Temporary Access Permit *(Existing Permit 4-2014-128 will be extended for use in construction)*
Department of Environmental Protection – Wetlands Program	Order of Conditions: Wetlands Protection Act
MA Department of Conservation and Recreation	Access and Construction Permit

DCR avers that the Project fully complies with Mass CZM Coastal Program Policies and will result in significant enhancements to coastal resources. This will be demonstrated in DCR's request for consistency concurrence which will be filed along with the US Army Corps permit application.

Fig. 7.01 and Fig. 7.02 depict the extent of Chapter 91 jurisdiction estimated within the Project Area, based upon reference to the most recently available data from Mass GIS. This information indicates that very little of the Project Area is within flowed or historic tidelands, with the exception of the east channel which is not proposed to be altered as part of this current Project.

Fig. 7.01 Chapter 91 Jurisdiction

A 401 Water Quality Certificate will be required given the salt marsh alteration required to excavate the marsh plain in the Western Marsh. Some dredging of channels, such as at the new structures proposed at Bristow Street ("BR-2" and "BR-3") and other locations are anticipated to trigger a 401 Dredge Permit. Other excavation is mostly above the current mean high water line and therefore not considered dredge.

The Massachusetts Historical Commission commented on the ENF filed in 2002 for Phase I of this Project and indicated that while there was a Native American site within or near the Project site, there are likely not any significant archaeological resources remaining following the alterations from the construction of the I-95 embankment. MHC's comments from 2002 are included in Appendix 3. The Army Corps of Engineers Section 404 review will require notification to Native American Tribes. DCR will submit a copy of this EENF to the Underwater Archaeological Research Board for review and comment.

Fig. 7.02 Chapter 91 Jurisdiction within Project Area

Also, DCR continues to discuss the Project progress with the Saugus Conservation Commission and will file a Notice of Intent with the Commission after the filing of this EENF.

The Project exceeds the area thresholds of 0.5 acres of tidal areas necessary to qualify under Massachusetts General Permit 22 for ecological restoration activities and is presumed at this time to require an Individual Permit. Work associated with the final grading of the I-95 embankment area will require a modification to the existing 404 Authorization for the Winthrop Beach Nourishment Project.

7.2 Initial Agency Consultation

Prior to the development of this EENF, a series of meetings was held between the proponent, project consultant team, and various agencies that will have a role in the project reviews and permitting. At each meeting, the project team presented the project objectives and a description of project elements. Discussions followed and comments were received regarding the details of the project, issues of concern to the various agencies, and which permits would be required. Table 7.02 presents a list of these meetings

Table 7.02
Initial Agency Consultation

Date	Location	Agencies Attending
8/3/14	DCR Boston	EPA
8/10/14	DCR Boston	EPA
8/19/14	Saugus Town Hall Annex	Saugus ConCom
9/23/14	DCR Botume House, Stoneham	Saugus ConCom
9/23/14	DCR Botume House, Stoneham; Project Areas, Saugus	NMFS, DMF, EPA
9/24/14	ACOE, Concord	ACOE, EPA
10/9/14	Parsons Brinkerhoff, Boston	MEPA, ACOE, DEP (Ch. 91 & WQC), CZM, EPA, NMFS, DMF
10/29/14	MEPA	MEPA, ACOE, DEP (Ch. 91 & WQC), CZM, EPA, NMFS, DMF

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8.0 Request for Waiver

The Ballard Street Salt Marsh Restoration Project entails alteration of one or more acres of saltmarsh or bordering vegetating wetlands, cited in 301 CMR 11.03(3)(1)(a) as an example of a project requiring an ENF and Mandatory EIR. It also causes alteration of ten or more acres of other wetlands cited in 301 CMR 11.03(3) (1) (b) which also triggers an ENF and Mandatory EIR. Further, the Project location within the Rumney Marshes ACEC triggers an ENF and other MEPA review if the Secretary so requires pursuant to 301 CMR 11.03(11) (b). It will cause direct alteration of 25 acres or more of land which triggers the same ENF and other MEPA review if the Secretary so requires pursuant to 301 CMR 11.03(1) (b) (1).

According to 301 CMR 11.11 (1) Standards for all Waivers, "the Secretary may waive any provision or requirement in 301 CMR 11.00 not specifically required by MEPA and may impose appropriate and relevant conditions or restrictions, provided that the Secretary finds that strict compliance with the provisions would:

- Result in an undue hardship for the Proponent, unless based on delay in compliance by the Proponent; and
- Not serve to avoid or minimize Damage to the Environment."

8.1 Hardship

Not only the Proponent, but also the general public will experience hardship should an EIR be required. Such an action would delay a worthwhile and long-anticipated project and impose additional cost both for EIR preparation and the loss of anticipated savings from DCR's coordination of this effort with other nearby salt marsh restoration endeavors. Given the extent of environmental analysis already undertaken for this Project, the ongoing collaboration with local, state and federal officials, and the thoughtful coordination of project officials on this effort with the adjacent restoration by others, an EIR will not generate more environmental protection, but will delay the onset of the Project benefit. East Saugus residents and Rumney Marsh visitors will lose confidence in the Commonwealth's ability to ever undertake this eagerly anticipated salt marsh restoration, and the neighborhood will continue to have flood protection concerns. Finally, DCR, and the Commonwealth for that matter, cannot afford to lose the cost-benefit and potential cost savings from coordinating two high profile jobs in the area.

DCR intends to use the contractor already on site for the sand extraction related to the Winthrop Beach Nourishment Project, thereby saving time and money in procurement. Should an EIR be required, its preparation/review would necessitate a separate procurement process with added costs. This would also delay implementation of flood control measures sought by East Saugus residents. This imposes undue hardship not only on DCR but the surrounding community.

DCR is eager to proceed. The proposed Project, its impacts and benefits have already been detailed in this EENF. An EIR will not provide new information and will only add cost as well as significant delay to project implementation. This in turn could slow other nearby salt marsh restoration efforts and the Winthrop Beach Nourishment Project. The Project will provide immediate potential flood protection to the residents of the East Saugus neighborhood in the event of failure of the existing leaking tide gate at Ballard Street. Delay in onset of Project improvements would postpone such flood protection.

8.2 Damage to the Environment

Rather than causing damage to the environment, the Project will address damage to the environment resulting from previous human disturbance including construction of the I-95 embankment and tidal obstructions on Ballard Street and Route 107. Delaying this restoration work only extends the proliferation of *Phragmites* and resulting diminution of the salt marsh resource.

Habitat Enhancement: The Project will support the enhancement of fish and wildlife habitat by reducing the height, vigor, and density of the dominant common reed and by promoting the recolonization or spread of salt marsh vegetation. The expansion of salt marsh vegetation will provide food, cover, and nesting/breeding areas for a variety of native species and, potentially, rarer salt marsh species such as sharp-tailed sparrow (*Ammodrammus caudacutus*) and seaside sparrow (*Ammodrammus maritimus*).

Scenic Enhancement: Currently hikers and others enjoying the scenic open space find their views obscured by tall (>10'), dense stands of common reed. The salt marsh restoration activities, specifically the restoration and enhancement of tidal flushing, will decrease the height, vigor, and density of these tall monotypic stands, allowing improved views of the remaining marsh. They will also expand salt marsh vegetation of marsh areas and the diverse wildlife afforded by that vegetation.

Public Safety Benefits: The Project will increase tidal flushing which will, in turn, reduce mosquito habitat along with odors typically associated with stagnant water in obstructed drainage ditches. Restoration activities will increase habitat for killifish (*Fundulus* sp.) in the marsh. This breed feeds on mosquito larvae and is an essential component to mosquito population control.

As noted, the majority of the Ballard Street salt marshes are dominated by tall and dense stands of common reed. Common reed stands are highly productive, tend to accumulate significant litter layers, and their dry, dead stems tend to remain upright for several years. Common reed stands burn fiercely, especially during the non-growing season, thereby posing a significant risk of fire damage in urban areas. The preferred Alternative 4b will provide the greatest measure of control of common reed on both the Route 107 and Eastern Avenue sides of the Ballard Street Salt Marsh.

The salt marsh restoration activities, specifically restoration and enhancement of tidal flushing, will decrease the height, vigor, and density of these tall monotypic stands. Increasing tidal flushing will also regularly saturate the surface of the marshes, further reducing the risk of fire damage to the adjacent East Saugus residential neighborhood.

Salt marshes in an urban landscape are critical for ecological and public health/safety reasons. Salt marshes provide attenuation of peak run-off velocities, water quality improvement, flood storage, and maintenance of fish and wildlife habitat. Of the Project alternatives identified in Section 4.0 above, only Alternative 4 allows for the restoration of a significant acreage of salt marsh while improving local flood protection.

The construction components outlined in Section 3.0 along with the methodology and measures to minimize impacts provided in Section 6.0 demonstrate the considerable analysis already undertaken to ensure the overriding environmental benefit of this salt marsh restoration/flood control improvement project. For the reasons stated in Section 7.0 and the information provided in this EENF, DCR avers that the Project meets the standard for all waivers pursuant to Section 11.11.(1).

Based on this, DCR believes that an EIR is not needed to provide necessary protection of the environment during the course of Project construction and urges the Secretary to conclude similarly. If there are any questions, DCR would be pleased to meet with you or your MEPA staff to address them.

9.0 References

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