NOTICE OF INTENT

Muddy River Flood Damage Reduction Project (Phase 2)

City of Boston

Parks and Recreation Department

October 2018

CDM Smith

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Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 – Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Boston
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Leverett Pond, Riverway, Back Bay Fens	Boston	02215
a. Street Address	b. City/Town	c. Zip Code

Latitude and Longitude:

d. Latitude	e. Longitude

N/A	N/A
f. Assessors Map/Plat Number	g. Parcel /Lot Number

2. Applicant:

Christopher	Cook
a. First Name	b. Last Name

Boston Parks and Recreation Department
c. Organization

1010 Massachusetts Avenue, 3rd Floor
d. Street Address

Boston	MA	02118
e. City/Town	f. State	g. Zip Code

(617) 635-4505	N/A	christopher.cook@boston.gov
h. Phone Number	i. Fax Number	j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name	b. Last Name

c. Organization

d. Street Address

e. City/Town	f. State	g. Zip Code

h. Phone Number	i. Fax Number	j. Email address

4. Representative (if any):

Robert	Button
a. First Name	b. Last Name

CDM Smith
c. Company

75 State Street, Suite 701
d. Street Address

Boston	MA	02109
e. City/Town	f. State	g. Zip Code

(617) 452-6586	N/A	buttonro@cdmsmith.com
h. Phone Number	i. Fax Number	j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

n/a	n/a	n/a
a. Total Fee Paid	b. State Fee Paid	c. City/Town Fee Paid

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A. General Information (continued)

6. General Project Description:

Muddy River - Phase 2 Construction - Dredging/channel opening of Muddy River to insure proper flood conveyance to the Charles River (Leverett Pond, Riverway & Back Bay Fens). Project will also include invasive species management and restoration of impacted areas.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☒ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☒ Yes ☐ No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

Flood Control and Invasive Species Management
2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Suffolk - Chapter 185 Acts of 1875 and Chapter 403 Acts of 1954

b. Certificate # (if registered land)

c. Book

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area		Size of Proposed Alteration	Proposed Replacement (if any)
a. ☒	Bank	5,115 1. linear feet	5,115 2. linear feet
b. ☒	Bordering Vegetated Wetland	72,980 1. square feet	83,196 2. square feet
c. ☒	Land Under Waterbodies and Waterways	561,307 1. square feet 82,988 3. cubic yards dredged	561,307 2. square feet

Resource Area		Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒	Bordering Land Subject to Flooding	1,754,306 1. square feet 3. cubic feet of flood storage lost	1,754,306 2. square feet 4. cubic feet replaced
e. ☐	Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	 3. cubic feet replaced
f. ☒	Riverfront Area	Muddy River 1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

   ☒ 25 ft. - Designated Densely Developed Areas only

   ☐ 100 ft. - New agricultural projects only

   ☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 358,750 square feet

4. Proposed alteration of the Riverfront Area:

   358,750 a. total square feet
   ______ b. square feet within 100 ft.
   ______ c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI? ☒ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment
	Size of Proposed Alteration	**Proposed Replacement (if any)**
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings

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C. Other Applicable Standards and Requirements

☒ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☐ Yes ☐ No

If yes, include proof of mailing or hand delivery of NOI to:

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area ______ percentage/acreage

(b) outside Resource Area ______ percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

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C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm). Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. ____________ a. NHESP Tracking # ____________ b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

   a. ☐ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

   If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

   South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

   Division of Marine Fisheries -
   Southeast Marine Fisheries Station
   Attn: Environmental Reviewer
   836 South Rodney French Blvd.
   New Bedford, MA 02744
   Email: DMF.EnvReview-South@state.ma.us

   North Shore - Hull to New Hampshire border:

   Division of Marine Fisheries -
   North Shore Office
   Attn: Environmental Reviewer
   30 Emerson Avenue
   Gloucester, MA 01930
   Email: DMF.EnvReview-North@state.ma.us

   Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

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C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☐ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☐ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☐ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☐ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☐ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☒ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☐ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☐ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

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D. Additional Information (cont'd)

3. ☐ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☐ List the titles and dates for all plans and other materials submitted with this NOI.

a. Plan Title

b. Prepared By

c. Signed and Stamped by

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☐ Attach NOI Wetland Fee Transmittal Form

9. ☐ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

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F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant — 2. Date 10/24/18

3. Signature of Property Owner (if different) — 4. Date 10/24/18

Robert Button
5. Signature of Representative (if any) — 6. Date 10-24-2018

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

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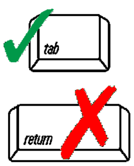


A. Applicant Information

1. Location of Project:

a. Street Address | b. City/Town
c. Check number | d. Fee amount

2. Applicant Mailing Address:

a. First Name | b. Last Name
c. Organization
d. Mailing Address
e. City/Town | f. State | g. Zip Code
h. Phone Number | i. Fax Number | j. Email Address

3. Property Owner (if different):

a. First Name | b. Last Name
c. Organization
d. Mailing Address
e. City/Town | f. State | g. Zip Code
h. Phone Number | i. Fax Number | j. Email Address

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

B. Fees

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee

Step 5/Total Project Fee: ____________

Step 6/Fee Payments:

Total Project Fee: ____________
a. Total Fee from Step 5

State share of filing Fee: ____________
b. 1/2 Total Fee **less $**12.50

City/Town share of filling Fee: ____________
c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

Eligibility Checklist

This Ecological Restoration Limited Project Eligibility Checklist guides the applicant in determining if their project is eligible to file as an Inland or Coastal Ecological Restoration Limited Project (310 CMR 10.53(4) or 310 CMR 10.24(8) respectively). These criteria must be met when submitting the Ecological Restoration Limited Project Notice of Intent to ensure that the restoration and improvement of the natural capacity of a Resource Area(s) to protect and sustain the interests identified in the WPA is **necessary** to achieve the project's ecological restoration goals.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

tab

return

Regulatory Features of All Coastal and Inland Ecological Restoration Limited Projects

(a) May result in the temporary or permanent loss of/or conversion of Resource Area: An Ecological Restoration Limited Project that meets the requirements of 310 CMR 10.24(8) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

(b) Exemption from wildlife habitat evaluation: A NOI for an Ecological Restoration Limited Project that meets the minimum requirements for Ecological Restoration Projects and for a MassDEP Combined Application outlined in 310 CMR 10.12(1) and (2) is exempt from providing a wildlife habitat evaluation (310 CMR 10.60).

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

(c) The following are considerations for applicants filing an Ecological Restoration Limited Project NOI and for the issuing authority approving a project as an Ecological Restoration Limited Project:

- ☒ The condition of existing and historic Resource Areas proposed for restoration.
- ☒ Evidence of the extent and severity of the impairment(s) that reduce the capacity of the Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40.
- ☒ The magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40.
- ☒ The magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the project will:

  a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals.

  b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals.

  c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to resource areas and the interests identified in M.G.L. c. 131, § 40.

Eligibility Criteria - Coastal Ecological Restoration Limited Projects (310 CMR 10.24(8))

Complete this Eligibility Criteria Checklist ***before*** filling out a Notice of Intent Application to determine if your project qualifies as a Coastal Ecological Restoration Limited Project. (310 CMR 10.24(8)) Sign the Eligibility Certification at the end of Appendix A, and attach the checklist with supporting documentation and the Eligibility Certification to your Notice of Intent Application.

General Eligibility Criteria for All Coastal Ecological Restoration Limited Projects

Notwithstanding the requirements of 310 CMR 10.25 through 10.35, 310 CMR 10.54 through 10.58, and the Wildlife Habitat evaluations in 310 CMR 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.24(8)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in the WPA M.G.L. provided that the project meets all the requirements in 310 CMR 10.24 (8).

- ☐ The project is an Ecological Restoration Project as defined in 310 CMR 10.04 and is a project type listed below [310 CMR 10.24(8)(e)].
- ☐ Tidal Restoration.
- ☐ Shellfish Habitat Restoration.
- ☐ Other Ecological Restoration Limited Project Type.
- ☐ The project will further at least one of the WPA (M.G.L. c. 131, § 40) interests identified below.
  - ☐ Protection of public or private water supply.
  - ☐ Protection of ground water supply.
  - ☐ Flood control.
  - ☐ Storm damage prevention.
  - ☐ Prevention of pollution.
  - ☐ Protection of land containing shellfish.
  - ☐ Protection of fisheries.
  - ☐ Protection of wildlife habitat.
- ☐ If the project will impact an area located within estimated habitat which is indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetlands, a NHESP preliminary written determination is attached to the NOI submittal that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species or the project will be carried out in accordance with an approved NHESP habitat management plan.

Eligibility Criteria - Coastal Ecological Restoration Limited Projects (310 CMR 10.24(8)) (Cont.)

General Eligibility Criteria for All Coastal Ecological Restoration Limited Projects (cont.)

- ☐ If the project is located in a Coastal Dune or Barrier Beach, the project avoids and minimizes armoring of the Coastal Dune or Barrier Beach to the maximum extent practicable.
- ☐ The project complies with all applicable provisions of 310 CMR 10.24(1) through (6) and 310 CMR 10.24(9) and (10).

Additional Eligibility Criteria for Specific Coastal Ecological Restoration Limited Project Types

These additional criteria must be met to qualify as an Ecological Restoration Limited Project to ensure that the restoration and improvement of the natural capacity of a Resource Area to protect and sustain the interests identified in the WPA is **necessary** to achieve the project's ecological restoration goals.

- ☐ This Ecological Restoration Limited Project application meets the eligibility criteria for Ecological Restoration Limited Project [310 CMR 10.24(8)(a) through (d) and as proposed, furthers at least one of the WPA interests is for the project type identified below.
  - ☐ **Tidal Restoration Projects**
    - ☐ A project to restore tidal flow that will not significantly increase flooding or storm damage impacts to the built environment, including without limitation, buildings, wells, septic systems, roads or other man-made structures or infrastructure.
  - ☐ **Shellfish Habitat Restoration Projects**
    - ☐ The project has received a Special Projects Permit from the Division of Marine Fisheries or, if a municipality, has received a shellfish propagation permit.
    - ☐ The project is made of cultch (e.g., shellfish shells from oyster, surf or ocean clam) or is a structure manufactured specifically for shellfish enhancement (e.g., reef blocks, reef balls, racks, floats, rafts, suspended gear).
  - ☐ **Other Ecological Restoration Projects** that meet the criteria set forth in 310 CMR 10.24(8)(a) through (d).
    - ☐ Restoration, enhancement, or management of Rare Species habitat.
    - ☐ Restoration of hydrologic and habitat connectivity.
    - ☐ Removal of aquatic nuisance vegetation to impede eutrophication.
    - ☐ Thinning or planting of vegetation to improve habitat value.
    - ☐ Fill removal and re-grading.
    - ☐ Riparian corridor re-naturalization.
    - ☐ River floodplain re-connection.

Eligibility Criteria - Coastal Ecological Restoration Limited Projects (310 CMR 10.24(8)) (Cont.)

Additional Eligibility Criteria for Specific Coastal Ecological Restoration Limited Project Types

- ☐ In-stream habitat enhancement.
- ☐ Remediation of historic tidal wetland ditching.
- ☐ Eelgrass restoration.
- ☐ Invasive species management.
- ☐ Installation of fish passage structures.
- ☐ Other. Describe: ______

☐ This project involves the construction, repair, replacement or expansion of public or private infrastructure (310 CMR 10.24(9).

- ☐ The NOI attachment labeled _____ is an operation and maintenance plan to ensure that the infrastructure will continue to function as designed.
- ☐ The operation and maintenance plan will be implemented as a continuing condition in the Order of Conditions and the Certificate of Compliance.
- ☐ This project proposes to replace an existing stream crossing (310 CMR 10.24(10). The crossing complies with the Massachusetts Stream Crossing Standards to the maximum extent practicable with details provided in the NOI. The crossing type:
  - ☐ Replaces an existing non-tidal crossing that is part of an Anadromous/Catadromous Fish Run (310 CMR 10.35)
  - ☐ Replaces an existing tidal crossing that restricts tidal flow. The tidal restriction will be eliminated to the maximum extent practicable.
- ☐ At a minimum, in evaluating the potential to comply with the standards to the maximum extent practicable the following criteria have been consider site constraints in meeting the standard, undesirable effects or risk in meeting the standard, and the environmental benefit of meeting the standard compared to the cost, by evaluating the following:
  - ☐ The potential for downstream flooding;
  - ☐ Upstream and downstream habitat (in-stream habitat, wetlands);
  - ☐ Potential for erosion and head-cutting;
  - ☐ Stream stability;
  - ☐ Habitat fragmentation caused by the crossing;
  - ☐ The amount of stream mileage made accessible by the improvements;
  - ☐ Storm flow conveyance;

Eligibility Criteria - Coastal Ecological Restoration Limited Projects (310 CMR 10.24(8)) (Cont.)

Additional Eligibility Criteria for Specific Coastal Ecological Restoration Limited Project Types

- ☐ Engineering design constraints specific to the crossing;
- ☐ Hydrologic constraints specific to the crossing;
- ☐ Impacts to wetlands that would occur by improving the crossing;
- ☐ Potential to affect property and infrastructure; and
- ☐ Cost of replacement.

Eligibility Criteria - Inland Ecological Restoration Limited Project (310 CMR 10.53(4))

Complete this Eligibility Criteria Checklist ***before*** filling out a Notice of Intent Application to determine if your project qualifies as an Inland Ecological Restoration Limited Project. (310 CMR 10.53(4)) Sign the Eligibility Certification at the end of Appendix A, and attach the checklist with supporting documentation and the Eligibility Certification to your Notice of Intent Application.

General Eligibility Criteria for All Inland Ecological Restoration Limited Projects

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 310 CMR 10.54 through 10.58, and 310 CMR 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

☒ The project is an Ecological Restoration Project as defined in 310 CMR 10.04 and is a project type listed below [310 CMR 10.53(4)(e)].

- ☐ Dam Removal
- ☐ Freshwater Stream Crossing Repair and Replacement
- ☐ Stream Daylighting
- ☐ Tidal Restoration
- ☐ Rare Species Habitat Restoration
- ☐ Restoring Fish Passageways
- ☒ Other (describe project type): Flood Control and Invasive Species Management

Eligibility Criteria - Inland Ecological Restoration Limited Project (310 CMR 10.53(4)) (cont.)

General Eligibility Criteria for All Inland Ecological Restoration Limited Projects

☒ The project will further at least one of the WPA (M.G.L. c. 131, § 40) interests identified below.

- ☐ Protection of public or private water supply
- ☐ Protection of ground water supply
- ☒ Flood control
- ☒ Storm damage prevention
- ☒ Prevention of pollution
- ☐ Protection of land containing shellfish
- ☒ Protection of fisheries
- ☒ Protection of wildlife habitat

☐ If the project will impact an area located within estimated habitat which is indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetlands, a NHESP preliminary written determination is attached to the NOI submittal that the project will have no adverse long-term and short-term effects on specified habitat sites of Rare Species or the project will be carried out in accordance with an approved NHESP habitat management plan.

☒ The project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3).

☒ If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, a Water Quality Certification has been applied for or obtained.

☒ The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

Eligibility Criteria - Inland Ecological Restoration Limited Project (310 CMR 10.53(4)) (cont.)

Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

These additional criteria must be met to qualify as an Ecological Restoration Limited Project to ensure that the restoration and improvement of the natural capacity of a Resource Area to protect and sustain the interests identified in the WPA is **necessary** to achieve the project's ecological restoration goals.

☒ This project application meets the eligibility criteria for Ecological Restoration Limited Project in accordance with [310 CMR 10.53(4)(a) through (d) and as proposed, furthers at least one of the WPA interests is for the project type identified below:

- ☐ **Dam Removal**
  - ☐ Project is consistent with MassDEP's 2007 Dam Removal Guidance.
- ☐ **Freshwater Stream Crossing Repair and Replacement**. The project as proposed and the NOI describes how:
  - ☐ Meeting the eligibility criteria set forth in 310 CMR 10.13 would result in significant stream instability or flooding hazard that cannot otherwise be mitigated, and site constraints make it impossible to meet said criteria.
  - ☐ The project design ensures that the stability of the bank is NOT impaired.
  - ☐ To the maximum extent practicable, the project provides for the restoration of the stream upstream and downstream of the structure as needed to restore stream continuity and eliminate barriers to aquatic organism movement.
  - ☐ The project complies with the requirements of 310 CMR 10.53(7) and (8).
- ☐ **Stream Daylighting Projects**
  - ☐ The project meets the eligibility criteria for Ecological Restoration Limited Project [310 CMR 10.53(4)(a) through (d)] and as proposed the NOI describes how the proposed project meets to the maximum extent practicable, consistent with the project's ecological restoration goals, all the performance standards for Bank and Land Under Water Bodies and Waterways.
  - ☐ The project meets the requirements of 310 CMR 10.12(1) and (2) and a wildlife habitat evaluation is not included in the NOI.
- ☐ **Tidal Restoration Project**
  - ☐ Restores tidal flow.
  - ☐ the project, including any proposed flood mitigation measures, will not significantly increase flooding or storm damage to the built environment, including without limitation, buildings, wells, septic systems, roads or other man-made structures or infrastructure.

Eligibility Criteria - Inland Ecological Restoration Limited Project (310 CMR 10.53(4)) (cont.)

☒ **Other Ecological Restoration Projects** that meet the criteria set forth in 310 CMR 10.53 (4) (a) through (d).

- ☐ Restoration, enhancement, or management of Rare Species habitat.
- ☐ Restoration of hydrologic and habitat connectivity.
- ☐ Removal of aquatic nuisance vegetation to impede eutrophication.
- ☒ Thinning or planting of vegetation to improve habitat value.
- ☐ Riparian corridor re-naturalization.
- ☐ River floodplain re-connection.
- ☒ In-stream habitat enhancement.
- ☒ Fill removal and re-grading.
- ☒ Flow restoration.
- ☐ Installation of fish passage structures.
- ☒ Invasive species management.
- ☐ Other. Describe: ____________________

☐ This project involves the construction, repair, replacement or expansion of public or private infrastructure. (310 CMR 10.53(7))

- ☐ The NOI attachment labeled _____ is an operation and maintenance plan to ensure that the infrastructure will continue to function as designed.
- ☐ The operation and maintenance plan will be implemented as a continuing condition in the Order of Conditions and the Certificate of Compliance.

☐ This project replaces an existing stream crossing (310 CMR 10.53(8)). The crossing type:

- ☐ Replaces an existing non-tidal crossing designed to comply with the Massachusetts Stream Crossing Standards to the maximum extent practicable with details provided in the NOI.
- ☐ Replaces an existing tidal crossing that restricts tidal flow. The tidal restriction will be eliminated to the maximum extent practicable.

Eligibility Criteria - Inland Ecological Restoration Limited Project (310 CMR 10.53(4)) (cont.)

- ☐ At a minimum, in evaluating the potential to comply with the standards to the maximum extent practicable the following criteria have been consider site constraints in meeting the standard, undesirable effects or risk in meeting the standard, and the environmental benefit of meeting the standard compared to the cost, by evaluating the following:
  - ☐ The potential for downstream flooding;
  - ☐ Upstream and downstream habitat (in-stream habitat, wetlands);
  - ☐ Potential for erosion and head-cutting;
  - ☐ Stream stability;
  - ☐ Habitat fragmentation caused by the crossing;
  - ☐ The amount of stream mileage made accessible by the improvements;
  - ☐ Storm flow conveyance;
  - ☐ Engineering design constraints specific to the crossing;
  - ☐ Hydrologic constraints specific to the crossing;
  - ☐ Impacts to wetlands that would occur by improving the crossing;
  - ☐ Potential to affect property and infrastructure; and
  - ☐ Cost of replacement.

WPA Form 3 – Notice of Intent

Appendix A: Ecological Restoration Limited Project Checklists

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Required Actions (310 CMR 10.11)

Complete the Required Actions before submitting a Notice of Intent Application for an Ecological Restoration Project and submit a completed copy of this Checklist with the Notice of Intent.

☒ **Massachusetts Environmental Policy Act (MEPA) / Environmental Monitor**
http://www.mass.gov/eea/agencies/mepa/submitting-notices-to-the-environmental-monitor.html

For Ecological Restoration Limited Projects, there are no changes to MEPA requirements.

☒ Submit written notification at least 14 days prior to the filing of a Notice of Intent (NOI) to the Environmental Monitor for publication. A copy of the written notification is attached and provides at minimum:

☒ A brief description of the proposed project.

☒ The anticipated NOI submission date to the conservation commission.

☒ The name and address of the conservation commission that will review the NOI.

☒ Specific details as to where copies of the NOI may be examined or acquired and where to obtain the date, time, and location of the public hearing.

☒ **Massachusetts Endangered Species Act (MESA) /Wetlands Protection Act Review**

☒ Preliminary Massachusetts Endangered Species Act Review from the Natural Heritage and Endangered Species Program (NHESP) has been met and the written determination is attached.

☒ Supplemental Information for Endangered Species Review has been submitted.

1. ☐ Percentage/acreage of property to be altered:

   a. Within Wetland Resource Area ____________ Percentage/acreage

   b. Outside Wetland Resource Area ____________ Percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

3. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work.

4. ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

5. ☐ Photographs representative of the site

6. ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm)

Required Actions (310 CMR 10.11) (cont.)

Make check payable to "Commonwealth of Massachusetts - NHESP" and mail to NHESP:

Natural Heritage & Endangered Species Program
MA Division of Fisheries & Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

7. Projects altering 10 or more acres of land, also submit:

   a. ☐ Vegetation cover type map of site

   b. ☐ Project plans showing Priority & Estimated Habitat boundaries

OR Check One of the Following:

1. ☐ Project is exempt from MESA review.

Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59 – see C4 below)

2. ☐ Separate MESA review ongoing.

a. NHESP Tracking # ____________ b. Date submitted to NHESP ____________

3. ☒ Separate MESA review completed. Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

☐ **Estimated Habitat Map of State-Listed Rare Wetlands Wildlife**

If a portion of the proposed project is located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP), complete the portion below. To view habitat maps, see the **Massachusetts Natural Heritage Atlas** or view the maps electronically at: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review

☐ A preliminary written determination from Natural Heritage and Endangered Species Program (NHESP) must be obtained indicating that:

☐ Project will NOT have long- or short-term adverse effect on the actual Resource Area located within estimated habitat indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetlands Wildlife published by NHESP.

☐ Project will have long- or short-term adverse effect on the actual Resource Area located within estimated habitat indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetlands Wildlife published by NHESP. A copy of NHESP's written preliminary determination in accordance with 310 CMR 10.11(2) is attached. This specifies:

☐ Date of the map: ____________

Required Actions (310 CMR 10.11) (cont.)

☐ If the Rare Species identified is/are likely to continue to be located on or near the project, and if so, whether the Resource Area to be altered is in fact part of the habitat of the Rare Species.

☐ That if the project alters Resource Area(s) within the habitat of a Rare Species:

☐ The Rare Species is identified;

☐ NHESP's recommended changes or conditions necessary to ensure that the project will have no short or long term adverse effect on the habitat of the local population of the Rare Species is provided; or

☐ An approved NHESP habitat management plan is attached with this Notice of Intent.

Send the request for a preliminary determination to:
Natural Heritage & Endangered Species Program
MA Division of Fisheries & Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

☒ **Division of Marine Fisheries**

☒ If the project will occur within a coastal waterbody with a restricted Time of Year, [see Appendix B of the Division of Marine Fisheries (DMF) Technical Report TR 47 "Marine Fisheries Time of Year Restrictions (TOYs) for Coastal Alteration Projects" dated April 2011 http://www.nae.usace.army.mil/Portals/74/docs/regulatory/StateGeneralPermits/NEGP/MADMFTR-47.pdf].

☒ Obtain a DMF written determination stating:

☐ The proposed work does NOT require a TOY restriction.

☒ The proposed work requires a TOY restriction. Specific recommended TOY restriction and recommended conditions on the proposed work is attached.

☐ If the project may affect a diadromous fish run [re: Division of Marine Fisheries (DMF) Technical Reports TR 15 through 18, dated 2004: http://www.mass.gov/eea/agencies/dfg/dmf/publications/technical.html]

☐ Obtain a DMF written determination stating:

☐ The design specifications and operational plan for the project are compatible with the passage requirements of the fish run.

☐ The design specifications and operational plan for the project are not compatible with the passage requirements of the fish run.

Required Actions (310 CMR 10.11) (cont.)

Send the request for a written or electronic determination to:

South Shore – Cohasset to Rhode Island border, and the Cape & Islands:
Division of Marine Fisheries –
South Coast Field Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: DMF.EnvReview-South@state.ma.us

North Shore – Hull to New Hampshire border:
Division of Marine Fisheries –
North Shore Field Station
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

☒ **Division of Fisheries and Wildlife – http://www.mass.gov/eea/agencies/dfg/dfw/**

- ☒ Projects that involve silt-generating, in-water work that will impact a non-tidal perennial river or stream and the in-water work will not occur between May 1 and August 30.
  - ☒ Obtain a written determination from the Division of Fisheries and Wildlife (DFW) as to whether the proposed work requires a TOY restriction.
    - ☐ The proposed work does NOT require a TOY restriction.
    - ☒ The proposed work requires a TOY restriction. The DFW determination with TOY restriction and other conditions is attached.

☒ **MassDEP Water Quality Certification**

- ☒ Project involves dredging of 100 cubic yards or more in a Resource Area or dredging of any amount in an Outstanding Resource Water (ORW). A copy and proof of the MassDEP Water Quality Certification pursuant to 314 CMR 9.00 is attached to the NOI.
- ☐ This project is a Combined Permit Application for 401 Dredging and Restoration (BRP WW 26).

☐ **MassDEP Wetlands Restriction Order**

Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

☐ Yes ☒ No

☐ **Department of Conservation and Recreation**

Office of Dam Safety

- ☐ For Dam Removal Projects, obtain a written determination from the Department of Conservation and Recreation Office of Dam Safety that the dam is not subject to the jurisdiction of the Office under 302 CMR 10.00, a written determination that the dam removal does not require a permit under 302 CMR 10.00 or a permit authorizing the dam removal in accordance with 302 CMR 10.00 has been issued.

Required Actions (310 CMR 10.11) (cont.)

Areas of Critical Environmental Concern (ACECs)

Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations).

Name of ACEC

Minimum Required Documents (310 CMR 10.12)

Complete the Required Documents Checklist below and provide supporting materials before submitting a Notice of Intent Application for an Ecological Restoration Project.

☒ This Notice of Intent meets all applicable requirements outlined in for Ecological Restoration Projects in 310 CMR 10.12. Use the checklist below to insure that all documentation is included with the NOI.

At a minimum, a Notice of Intent for an Ecological Restoration Project shall include the following:

☒ Description of the project's ecological restoration goals;

☒ The location of the Ecological Restoration Project;

☒ Description of the construction sequence for completing the project;

☒ A map of the Areas Subject to Protection Under M.G.L. c. 131, § 40, that will be temporarily or permanently altered by the project or include habitat for Rare Species, Habitat of Potential Regional and Statewide Importance, eel grass beds, or Shellfish Suitability Areas.

☒ The method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.) is attached with documentation methodology.

☒ List the titles and dates for all plans and other materials submitted with this NOI.

Muddy River Flood Damage Reduction Project (Phase 2)
a. Plan Title

USACE
b. Prepared by

c. Signed and Stamped by

September 2016
d. Final Revision Date

1"=40'
e. Scale

Determination of Applicability
f. Additional Plan or Document Title

May 2018
g. Date

☐ If there is more than one property owner, attach a list of these property owners not listed on this form.

☒ Attach NOI Wetland Fee Transmittal Form.

Minimum Required Documents (310 CMR 10.12)

- ☒ An evaluation of any flood impacts that may affect the built environment, including without limitation, buildings, wells, septic systems, roads or other man-made structures or infrastructure as well as any proposed flood impact mitigation measures;
- ☒ A plan for invasive species prevention and control;
- ☒ The Natural Heritage and Endangered Species Program written determination in accordance with 310 CMR 10.11(2), if needed;
- ☒ Any Time of Year restrictions and/or other conditions recommended by the Division of Marine Fisheries or the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3), (4), (5), if needed;
- ☒ Proof that notice was published in the Environmental Monitor as required by 310 CMR 10.11(1;
- ☒ A certification by the applicant under the penalties of perjury that the project meets the eligibility criteria set forth in 310 CMR 10.13;
- ☐ If the Ecological Restoration Project involves the construction, repair, replacement or expansion of infrastructure, an operation and maintenance plan to ensure that the infrastructure will continue to function as designed;
- ☒ If the project involves dredging of 100 cubic yards or more or dredging of any amount in an Outstanding Resource Water, a Water Quality Certification issued by the Department pursuant to 314 CMR 9.00;
- ☐ If the Ecological Restoration Project involves work on a stream crossing, information sufficient to make the showing required by 310 CMR 10.24(10) for work in a coastal resource area and 310 CMR 10.53(8) for work in an inland resource area; and
- ☐ If the Ecological Restoration Project involves work on a stream crossing, baseline photo-points that capture longitudinal views of the crossing inlet, the crossing outlet and the upstream and downstream channel beds during low flow conditions. The latitude and longitude coordinates of the photo-points shall be included in the baseline data.
- ☐ This project is subject to provisions of the MassDEP Stormwater Management Standards. A copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) is attached.
- ☐ Provide information as the whether the project has the potential to impact private water supply wells including agricultural or aquacultural wells or surface water withdrawal points.

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Boston
City/Town

Certification that the Ecological Restoration Project Meets the Eligibility Criteria

I hereby certify under penalties of perjury that the Ecological Restoration Project Notice of Intent application does not meet the Eligibility criteria for an Ecological Restoration Order of Conditions set forth in 310 CMR 10.13, but does meet the Eligibility Criteria for a Ecological Restoration Limited Project set forth in 10.24(8) or 10.53(4) whichever is applicable. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Robert Button

Signature of Applicant or Authorized Agent

Robert Button
Printed Name of Applicant or Authorized Agent

10-24-2018
Date

The certification must be signed by the applicant; however, it may be signed by a duly authorized agent (named in Item 2) if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

APPENDIX A

Project Narrative

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) for the Phase 2 Muddy River Flood Damage Reduction Project (the Project) as an Ecological Restoration Limited Project. The Project has been designed by the U.S. Army Corps of Engineers-New England District (ACOE) and aims to relieve the Muddy River of flooding, improve degraded riverine habitats, poor water quality, and other related water resource problems.

The construction of the Muddy River project requires the expertise of two different types of contractors. For this reason, the design and implementation of the project was conducted in two separate phases. The first phase consisted of the major structural features of the flood control improvements, daylighting of two sections (about 700 linear feet) of the Muddy River, and sediment removal from the Upper Fens Pond. Construction of Phase 1 began in 2013 and was substantially completed in August 2016. The work completed in Phase 1 included:

- Constructed 10’ by 24’ concrete culverts under both the Riverway and Brookline Avenue.
- Removed existing twin 72” pipes in the Old Sears Parking Lot and daylighted the river in this area.
- Removed existing twin 72” pipes in Brookline Avenue jug handle area and in the area just upstream of Avenue Louis Pasteur culvert. Daylighted the river in these two areas.
- Reconstructed culvert opening at upstream end of Avenue Louis Pasteur culvert.
- Dredged and reshaped the Upper Fens Pond section of the river to allow for increased flow.
- Installed temporary flow restriction structure upstream of the Riverway.
- Landscaping with trees, shrubs, and emergent plantings.
- Installed habitat logs and boulders for fish and turtles.
- Post construction vegetation monitoring and invasive species control.

The second phase of the Muddy River Flood Damage Reduction Project consists of removal of sediment for flow conveyance in the Fens, Riverway, and Leverett Pond. Phase 2 is proposed to begin construction during Spring of 2019, and will include the following work:

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.

- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Excavate deepened channel sections to delay need for maintenance dredging.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Management of invasives (Phragmites) in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction and improve ecological habitat quality.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where Phragmites or Japanese knotweed are eradicated by planting grass, trees and shrubs.
- Installation of habitat logs for fish and turtles.
- Removal of the temporary flow restriction structure upstream of the Riverway.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

All of this work will serve to further the interests of the Wetlands Protection Act (WPA) by restoring and improving the natural capacity of the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

In addition to the work proposed by the USACE, the City of Boston is also in the process of permitting an invasives management pilot program for pre-work in areas to be addressed by the USACE Phase 2 project and for areas impacted by invasives but not included within the USACE project. The invasives management pilot program will include work in the Riverway and Back Bay Fens segments of the Muddy River. The invasives management pilot program is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. This pilot program is also being permitted as an Ecological Restoration Limited Project as discussed in greater detail below.

The project has several objectives that serve to restore and protect the interests of the WPA (as noted in parentheses below):

1) Alleviate flooding along the river corridor and reduce flood damage to public and private property (flood control and storm damage prevention);

2) Improve the water quality of the river by restoring river hydraulics and removing contaminated sediments in dredged areas (prevention of pollution and protection of fisheries);

3) Restore shoreline plantings to increase plant species diversity and structural diversity to the riparian plant community compared to existing conditions (protection of wildlife habitat).

The objectives listed above serve to restore and protect five of the eight interests of the WPA and to satisfy related General Eligibility Criteria for Inland Ecological Restoration Limit Projects.

The dredging component of the project will improve the interests of flood control and storm damage prevention, as well as the wildlife habitat and fisheries interests in the Back Bay Fens and Riverway segments for areas impacted by construction as shown on the project documents. Removal of the contaminated river sediments will reduce a source of pollution and limit potential recontamination of downstream areas in the future, thus supporting the prevention of pollution interest. Restoration of the riparian plant community (in areas impacted by construction) will improve the wildlife habitat of the banks compared to existing conditions. Removal of the Phragmites stands (in areas impacted by dredging) within the river in the Fens and Riverway will improve habitat value of land underwater and bank areas. In addition, removal of phragmites in bank, BVW, and buffer zone areas through either the Phase 2 project or the invasives management pilot program will further the desired ecological restoration benefits.

The proposed work was developed to achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Fill Removal and Re-grading;
- Flow Restoration; and
- Invasive Species Management.

Written notices regarding the proposed Phase 2 project for work in both Boston and Brookline were submitted to the Massachusetts Environmental Policy Act (MEPA) Office, along with the written notice for the invasives management pilot program in Boston, for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission and the Brookline Conservation Commission on the Notices of Intent filed for the respective projects/jurisdictions.

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Mathew et al. (2011) determined that nutrient loading from algae, sediment, and waterfowl dominate the spatial pattern of water quality in the Muddy River. The study concluded that significant improvement in dissolved oxygen, biological oxygen demand, and total phosphorus could be expected from the sediment removal component of the Muddy River restoration project.

Sediment from Leverett Pond, the Riverway, and Fens contain elevated levels of metal, PAHs, petroleum hydrocarbons, and PAHs. PCBs and DDT and its metabolites are also frequently detected. Concentrations of contaminants are generally highest in surface sediments and decline with depth. Accumulation of contaminants in sediment is believed to be the result of years of loading from storm drains, combined sewer overflows, point source discharges (fuel oil), and atmospheric deposition (dust and precipitation). Conditions are exacerbated by the highly urbanized nature of the watershed, sluggish nature of the Muddy River and resulting lack of significant flushing, and low dissolved oxygen levels which slow decomposition of petroleum hydrocarbons and other organic contaminants.

Multiple lines of evidence indicate that chemicals in Muddy River sediment pose a risk to biota (see Appendix F in USACE (2003). Sediment is likely to adversely affect fish and benthic invertebrates. Principal lines of evidence in support of this assessment are comparison with probable effect concentrations (PECs) developed by McDonald et al. (2000) and bioassay test results. Levels of metals, PAHs, pesticides and PCBs in sediment from Leverett Pond, the

Riverway, and Back Bay Fens generally exceed PECs. In many cases, PECs are exceeded several fold, making adverse impacts on benthic invertebrate communities probable.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool.

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Back Bay Fens and vicinity (see USACE, 2003). The area supports resident (breeding) populations of many bird species and provides a valuable refuge for songbirds, wading birds, and waterfowl migrating through the Boston area. A large population of ducks, mostly black duck/ mallard hybrids, is present in the Riverway and Back Bay Fens throughout the year. Canada goose are also abundant. Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The Phase 2 Project Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the study area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees, shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although *Phragmites* is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Phase 2 work. The activities within wetlands resource areas are presented for each work area within Leverett Pond, the Riverway and the Back Bay Fens segments as proposed by the USACE. The combined benefits to the ecological restoration of wetlands resource areas from the both the Phase 1 Project, the proposed Phase 2 are also presented below. In addition, the invasives management program is described in greater detail for the work proposed in the City of Boston.

2.0 Summary of Work in Wetlands

The proposed Muddy River Flood Damage Reduction Project - Phase 2 includes dredging, ecological restoration (for areas impacted by construction) and flood proofing work in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area. The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides flood control and ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

3.0 Description of the Proposed Project by River Segment

3.1 Introduction

The following sections describe the proposed activities within thirteen work areas associated within the three geographic segments of the Flood Damage Reduction Project - Phase 2 (i.e. Leverett Pond, the Riverway and the Back Bay Fens). These sections describe the:

- Existing conditions of each work area/segment;
- Functions and values or "interests" supported within each work area/segment;
- Proposed work and impacts;
- Proposed construction methods and staging areas; and
- Proposed construction monitoring and mitigation measures.
- The construction methods, staging areas, monitoring and proposed mitigation measures for all work areas are presented herein.

The impacts to wetlands resource areas within each work area are presented for the respective work within each municipality. In addition to the proposed mitigation measures described herein, Section 3 describes the Benefits, Impacts and Restoration plan for the project.

3.2 Leverett Pond (Work Area No. 1) Boston and Brookline

The majority of work within wetland resource areas in Leverett Pond will occur within Land Under Water (in Boston and Brookline) for dredging, Inland Bank and Bordering Vegetated Wetland for restoration/ enhancement of areas impacted by construction (in Brookline) and buffer zone for restoration of construction access and staging areas (also in Brookline). This work will not adversely affect the principal functions and values of the pond. No loss of Inland Bank or BVW will occur as a result of this work.

The following sections describe the existing conditions and interests supported by the resource areas in Leverett Pond. Impacts, construction monitoring and proposed mitigation are discussed in Section 3.5.

3.2.1 Existing Conditions and Interests of the Act

Just upstream of the Riverway section of the Muddy River is Leverett Pond which is a shallow 7-acre pond with a maximum depth of 5 to 6 feet. The pond receives inflow from Willow Pond (Babbling Brook), the Daisy Field drain, Village Brook, and numerous smaller storm drains. The tributary area to the Village Drain is approximately 2,060 acres, the largest tributary area for storm water outfalls to the Muddy River. Material discharged from the Village Brook Drain has formed an extensive shoal area and an exposed sediment deposit near its outlet at the northern end of the pond.

Leverett Pond is bordered by grassed parkland along most of its perimeter. There is an earthen bank on the Boston side (east) and a gabion formed shoreline for the majority of the Brookline side (west). Roadways surround Leverett Pond and include Route 9 (to the north), The Jamaica Way (to the east), Willow Pond Road (to the south) and Pond Avenue (to the west). Leverett Pond contains three islands along its western edge. The land that is immediately adjacent to Leverett Pond consists of vegetated woodlands and grassy parklands with paved and unpaved paths. Beyond the woodlands and to the east is the Jamaica Way and to the west is Pond Avenue, which separates the residential areas from Leverett Pond.

The normal water surface elevation during dry-weather flow in Leverett Pond is approximately elevation 18 feet (Boston City Base), which is the same elevation as the downstream portions of the Muddy River and the Charles River.

3.2.2 Description of Work in Resource Areas and Impacts

The proposed Phase 2 project includes removal of sediment and the exposed sediment deposit in the vicinity of the Village Brook Drain and the outlet of the Pond. Approximately 5,350 cubic yards of materials will be removed. The proposed work in Leverett Pond will serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. Dredging in Leverett Pond will improve the capacity of the resource areas in Leverett Pond to protect fish habitat (protect fisheries) and provide pollution prevention along with storm damage protection and flood control benefits.

The following tables summarize the resource area impacts for each work area and municipality.

Table 1 Work Area No. 1 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land Under Water	**25,245**	**sq.ft.**
Excavation: Land Under Water	**4,457**	**cy**
Dredge Area (Length)	**222**	**lf**
Dredge Area (Width)	**30 to 160**	**lf**
Dredge Area (Depth)	**2.5 to 7**	**lf**
Alteration of Land Under Water	**25,245**	**sq.ft.**
Bordering Land Subject to Flooding (2)	**143,630**	**sq.ft.**

Table 2 Work Area No. 1 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land Under Water	**5,058**	**sq.ft.**
Excavation: Land Under Water	**893**	**cy**
Dredge Area (Length)	**222**	**lf**
Dredge Area (Width)	**30 to 160**	**lf**
Dredge Area (Depth)	**2.5 to 7**	**lf**
Temporary Fill (Access)	**203**	**sq.ft.**
Temporary Fill (Access)	**508**	**cy**
Alteration of Bank	**37**	**Lf**
Alteration of Bordering Vegetated Wetland	**203**	**sq.ft.**
Alteration of Land Under Water	**5,058**	**sq.ft.**
Bordering Land Subject to Flooding (2)	**179,697**	**sq.ft.**

3.3 The Riverway (Work Area Nos. 2 through 6) Boston and Brookline

Wetland resources in the Riverway include Land Under Water (LUW), Inland Bank, discrete patches of Bordering Vegetated Wetland (BVW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area (RFA). The RFA extends 25 feet horizontally from the river to the east (on the Boston side) and 200 feet horizontally on the west (Brookline side) of the river. The proposed work in the Riverway will serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. The Phase 2 project will improve the capacity of the resource areas in the Muddy River to provide flood control and prevent storm damage, while the removal of contaminated sediments and environmental restoration (in areas impacted by construction) will protect/improve the interests of pollution prevention, fisheries, and wildlife habitat.

The following sections describe the existing conditions and interests supported by the resource areas in the Riverway. Impacts, construction monitoring and proposed mitigation are discussed in Section 3.5.

3.3.1 Existing Conditions and Interests of the Act

The Riverway section of the Muddy River flows north from Leverett Pond for about 1 mile to Park Drive. Width of river ranges from about 20 to 120 ft., and averages about 40 feet. Water surface area is about 6.5 acres. Mean depth is about 1.5 feet, and maximum depth is 6.5 ft. based on a 1997 USGS survey. Flow is sluggish and elevation through the reach drops only about six inches. Outflow is also influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam. The historic downstream boundary was located at Brookline Avenue, before a 350 ft. segment was filled for construction of the Sears parking lot. The filled section was daylighted during Phase 1, and the Riverway now ends at the newly installed 10' by 24' culvert under Park Drive.

There was a need to provide a flow restriction after construction of the Phase 1 culverts such that flood flows higher than existing conditions are not discharged into the Fens prior to completion of the Phase 2 dredged channel that is be located downstream of these culverts. In 2015, a contractor for the Army USACE installed a flow restriction control structure (FRCS) as part of Phase 1 construction. The structure is sheet pile dam with rectangular weir openings and stop logs located just upstream of the 10 x 24 Riverway culvert (Photograph x). The structure maintains flow equivalent to the capacity of the former two 6-foot diameter culverts that conveyed flow to the Fens area downstream. The FRCS will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens and flood proofing of the Boston Fire Department – Fire Control Center.

The "Riverway" comprises a linear park along both sides of the Muddy River and consists of a maintained grassy parkland with paved and unpaved paths, and a mixture of mature Olmsted-planted trees, and younger volunteer trees and shrubs.

The Massachusetts Department of Conservation and Recreation (MassDCR) maintained Riverway parkway runs parallel along the River's east side (Boston) with the Massachusetts Bay Transportation Authority (MBTA) Green Line tracks running along the west side (Brookline) until Netherlands Road where local Brookline streets are encountered. Riparian vegetation is well developed along some sections of the river. In others, turf with some tree cover is often maintained nearly to the river's edge. The Riverway contains three islands along its length, all designed by Olmsted. The largest, Riverwalk Island, is accessible by footbridge.

The Riverway contains a number of stormwater outfalls. The largest are Huntington Avenue Drain, which discharges on the Boston side of the Muddy River, and Tannery Brook Drain, and the Longwood Avenue Drain, both of which are located in Brookline.

Considerable lengths of the bank are either eroding and/or being undercut by stormwater runoff and river flow. The channel is protected by riprap immediately downstream of the Route 9 bridge. The Town of Brookline has recently installed coir fiber roles to control bank erosion downstream of the Longwood Avenue Bridge.

Many areas of the Riverway have shoaled significantly since it was last dredged in 1963. Sediments from storm drains, accumulation of poorly decomposed organic material, encroachment by Phragmites, and streambank erosion all contribute to the problem. The channel is completely or nearly completely blocked by Phragmites in several areas, including upstream of Park Drive near the flow restriction control structure and at the Riverwalk Island.

3.3.2 Description of Work in Resource Areas and Impacts

The majority of work in the Riverway (i.e. area of alteration) involves dredging Land Under Water to remove accumulated sediment and eradicating Phragmites growing within the river channel (within the proposed work areas as shown on the drawings). The entire bank exhibits erosion at the water line, however, stabilization of the bank is only proposed within the limits of work/access.

Five areas with flow restrictions due to shoaling and sedimentation are proposed in areas impacted by work/access.

The five work areas in the Riverway section include:

- Area Two - upstream from Brookline Avenue;
- Area Three – on the Boston side of the Riverwalk Island;
- Area Four – downstream of Netherlands Road;
- Area Five is located about 900 ft. downstream from the Longwood Avenue bridge; and
- Area Six is at the downstream end of the Riverway where Phase 2 will connect to the Phase 1 improvements and flow restriction control structure (FRCS) will be removed.

Sediment excavated from these areas will likely be excavated in the dry, additionally dewatered if required, and tested for transportation to final disposal. Sediment removal in work Area 6 includes removal of a large area of Phragmites, which cannot be hydraulically dredged. Phragmites is also present in Work Areas 2, 3, and 4. The FRCS, constructed as part of Phase 1 construction, will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens and flood proofing of the Boston Fire Department – Fire Control Center.

Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increased temperatures, nutrient concentrations, and algal blooms. Dredging will improve fish habitat (protect fisheries) and provide pollution prevention along with storm damage protection and flood control benefits in accordance with the general eligibility criteria for ecological restoration limited projects.

The following tables summarize the resource area impacts for each work area and municipality.

Table 3 Work Area No. 2 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**17,242**	**sq. ft.**
Excavation: Land under water	**2,704**	**cy**
Excavation: Bordering vegetated wetland	**4,945**	**sq. ft.**
Excavation: Bordering vegetated wetland	**275**	**cy**
Dimension of dredge area (Length)	**877**	**lf.**
Dimension of dredge area (Width)	**20 to 65**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**3,577**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**0**	**sq. ft.**
Fill (wetland topsoil installed under water)	**1,675**	**sq. ft.**
Fill (stone installed under water)	**0**	**sq. ft.**
Temporary Fill (Access)	**9,659**	**sq. ft.**
Fill (wetland topsoil installed under water)	**93**	**cy**
Fill (stone installed under water)	**0**	**cy**
Temporary Fill (Access)	**24,148**	**cy**
Total area of Phragmites	**4,034**	**sq. ft.**
Total area of Phragmites Removed	**4,034**	**sq. ft.**
Total area of Phragmites Remaining	**0**	**sq. ft.**
Alteration - bank	**576**	**lf.**
Alteration - BVW	**10,299**	**sq. ft.**
Alteration – Land under water	**17,242**	**sq. ft.**
Riverfront (0 -25 ft.)	**25,764**	**sq. ft.**
Riverfront Area Disturbed	**5,488**	**sq. ft.**
Bordering land subject to flooding	**53,214**	**sq. ft.**

Table 4 Work Area No. 2 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**10,038**	**sq. ft.**
Excavation: Land under water	**1,574**	**cy**
Excavation: Bordering vegetated wetland	**3,215**	**sq. ft.**
Excavation: Bordering vegetated wetland	**179**	**cy**
Dimension of dredge area (Length)	**877**	**lf.**
Dimension of dredge area (Width)	**20 to 65**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,725**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**3,495**	**sq. ft.**
Total area of Phragmites Removed	**3,495**	**sq. ft.**
Total area of Phragmites Remaining	**3,495**	**sq. ft.**
Alteration - bank	**595**	**lf.**
Alteration - BVW	**3,215**	**sq. ft.**
Alteration – Land under water	**10,038**	**sq. ft.**
Riverfront (0 -100 ft.)	**80,000**	**sq. ft.**
Riverfront (100 – 200 ft.)	**78,000**	**sq. ft.**
Riverfront Area Disturbed	**6,801**	**sq. ft.**
Bordering land subject to flooding	**307,645**	**sq. ft.**

Table 5 Work Area No. 3 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**13,698**	**sq. ft.**
Excavation: Land under water	**877**	**cy**
Excavation: Bordering vegetated wetland	**8,594**	**sq. ft.**
Excavation: Bordering vegetated wetland	**477**	**cy**
Dimension of dredge area (Length)	**447**	**lf.**
Dimension of dredge area (Width)	**20 to 90**	**lf.**
Dimension of dredge area (Depth)	**2 to 4**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,599**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,514**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**8,785**	**cy**
Total area of Phragmites	**7,689**	**sq. ft.**
Total area of Phragmites Removed	**7,689**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**279**	**lf.**
Alteration - BVW	**11,104**	**sq. ft.**
Alteration – Land under water	**13,698**	**sq. ft.**
Riverfront (0 -25 ft.)	**16,225**	**sq. ft.**
Riverfront Area Disturbed	**3,949**	**sq. ft.**
Bordering land subject to flooding	**34,366**	**sq. ft.**

Table 6 Work Area No. 3 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**4,430**	**sq. ft.**
Excavation: Land under water	**284**	**cy**
Excavation: Bordering vegetated wetland	**2,088**	**sq. ft.**
Excavation: Bordering vegetated wetland	**116**	**cy**
Dimension of dredge area (Length)	**447**	**lf.**
Dimension of dredge area (Width)	**20 to 90**	**lf.**
Dimension of dredge area (Depth)	**2 to 4**	**lf.**
Area of BVW Restored (Emergent Veg)	**913**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**1,668**	**sq. ft.**
Total area of Phragmites Removed	**1,668**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**-**	**lf.**
Alteration - BVW	**2,088**	**sq. ft.**
Alteration – Land under water	**4,430**	**sq. ft.**
Riverfront (0 -100 ft.)	**50,300**	**sq. ft.**
Riverfront (100 – 200 ft.)	**80,300**	**sq. ft.**
Riverfront Area Disturbed	**7,159**	**sq. ft.**
Bordering land subject to flooding	**30,506**	**sq. ft.**

Table 7 Work Area No. 4 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**4,573**	**sq. ft.**
Excavation: Land under water	**375**	**cy**
Excavation: Bordering vegetated wetland	**-**	**sq. ft.**
Excavation: Bordering vegetated wetland	**-**	**cy**
Dimension of dredge area (Length)	**160**	**lf.**
Dimension of dredge area (Width)	**35 to 45**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 3.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**604**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**945**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**2,363**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**80**	**lf.**
Alteration - BVW	**-**	**sq. ft.**
Alteration – Land under water	**4,573**	**sq. ft.**
Riverfront (0 -25 ft.)	**5,329**	**sq. ft.**
Riverfront Area Disturbed	**1,271**	**sq. ft.**
Bordering land subject to flooding	**62,981**	**sq. ft.**

Table 8 Work Area No. 4 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**2,007**	**sq. ft.**
Excavation: Land under water	**165**	**cy**
Excavation: Bordering vegetated wetland	**-**	**sq. ft.**
Excavation: Bordering vegetated wetland	**-**	**cy**
Dimension of dredge area (Length)	**160**	**lf.**
Dimension of dredge area (Width)	**35 to 45**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 3.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**416**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**-**	**lf.**
Alteration - BVW	**-**	**sq. ft.**
Alteration – Land under water	**2,007**	**sq. ft.**
Riverfront (0 -100 ft.)	**41,800**	**sq. ft.**
Riverfront (100 – 200 ft.)	**71,400**	**sq. ft.**
Riverfront Area Disturbed	**-**	**sq. ft.**
Bordering land subject to flooding	**298,421**	**sq. ft.**

Table 9 Work Area No. 5 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**5,771**	**sq. ft.**
Excavation: Land under water	**515**	**cy**
Excavation: Bordering vegetated wetland	**2,755**	**sq. ft.**
Excavation: Bordering vegetated wetland	**153**	**cy**
Dimension of dredge area (Length)	**130**	**lf.**
Dimension of dredge area (Width)	**30 to 80**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,282**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**272**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**680**	**cy**
Total area of Phragmites	**8,076**	**sq. ft.**
Total area of Phragmites Removed	**2,475**	**sq. ft.**
Total area of Phragmites Remaining	**5,601**	**sq. ft.**
Alteration - bank	**133**	**lf.**
Alteration - BVW	**3,116**	**sq. ft.**
Alteration – Land under water	**5,771**	**sq. ft.**
Riverfront (0 -25 ft.)	**4,615**	**sq. ft.**
Riverfront Area Disturbed	**2,106**	**sq. ft.**
Bordering land subject to flooding	**69,468**	**sq. ft.**

Table 10 Work Area No. 5 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	-	sq. ft.
Excavation: Land under water	-	cy
Excavation: Bordering vegetated wetland	-	sq. ft.
Excavation: Bordering vegetated wetland	-	cy
Dimension of dredge area (Length)	130	lf.
Dimension of dredge area (Width)	30 to 80	lf.
Dimension of dredge area (Depth)	2.5 to 5	lf.
Area of BVW Restored (Emergent Veg)	-	sq. ft.
New Habitat Shelf (Non-Vegetated)	-	sq. ft.
Fill (wetland topsoil installed under water)	-	sq. ft.
Fill (stone installed under water)	-	sq. ft.
Temporary Fill (Access)	-	sq. ft.
Fill (wetland topsoil installed under water)	-	cy
Fill (stone installed under water)	-	cy
Temporary Fill (Access)	-	cy
Total area of Phragmites	9,746	sq. ft.
Total area of Phragmites Removed	-	sq. ft.
Total area of Phragmites Remaining	9,746	sq. ft.
Alteration - bank	-	lf.
Alteration - BVW	-	sq. ft.
Alteration – Land under water	-	sq. ft.
Riverfront (0 -100 ft.)	31,600	sq. ft.
Riverfront (100 – 200 ft.)	75,800	sq. ft.
Riverfront Area Disturbed	-	sq. ft.
Bordering land subject to flooding	176,834	sq. ft.

Table 11 Work Area No. 6 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**32,785**	**sq. ft.**
Excavation: Land under water	**4,777**	**cy**
Excavation: Bordering vegetated wetland	**11,568**	**sq. ft.**
Excavation: Bordering vegetated wetland	**643**	**cy**
Dimension of dredge area (Length)	**420**	**lf.**
Dimension of dredge area (Width)	**60 to 175**	**lf.**
Dimension of dredge area (Depth)	**4 to 8**	**lf.**
Area of BVW Restored (Emergent Veg)	**3,018**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**620**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,790**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**9,475**	**cy**
Total area of Phragmites	**22,234**	**sq. ft.**
Total area of Phragmites Removed	**22,234**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**448**	**lf.**
Alteration - BVW	**12,193**	**sq. ft.**
Alteration – Land under water	**32,785**	**sq. ft.**
Riverfront (0 -25 ft.)	**16,202**	**sq. ft.**
Riverfront Area Disturbed	**5,716**	**sq. ft.**
Bordering land subject to flooding	**99,428**	**sq. ft.**

Table 12 Work Area No. 6 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**14,630**	**sq. ft.**
Excavation: Land under water	**2,132**	**cy**
Excavation: Bordering vegetated wetland	**4,739**	**sq. ft.**
Excavation: Bordering vegetated wetland	**263**	**cy**
Dimension of dredge area (Length)	**420**	**lf.**
Dimension of dredge area (Width)	**60 to 175**	**lf.**
Dimension of dredge area (Depth)	**4 to 8**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,350**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,548**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**8,870**	**cy**
Total area of Phragmites	**10,216**	**sq. ft.**
Total area of Phragmites Removed	**10,216**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**212**	**lf.**
Alteration - BVW	**4,739**	**sq. ft.**
Alteration – Land under water	**14,630**	**sq. ft.**
Riverfront (0 -100 ft.)	**41,200**	**sq. ft.**
Riverfront (100 – 200 ft.)	**60,400**	**sq. ft.**
Riverfront Area Disturbed	**10,274**	**sq. ft.**
Bordering land subject to flooding	**352,025**	**sq. ft.**

3.4 The Back Bay Fens (Work Areas 7-13) Boston

Wetland resources in the Back Bay Fens include Land Under Water, Inland Bank, Bordering Vegetated Wetlands (BVW), Bordering Land Subject to Flooding (BLSF) and Riverfront Area (RFA), as well as the 100-foot buffer zone to Inland Bank and BVW. The RFA extends 25 feet horizontally from the river bank in Boston. The proposed work in the Back Bay Fens will also serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. The Phase 2 project will improve the capacity of the resource areas in the Muddy River to provide flood control and prevent storm damage, while the removal of contaminated sediments and environmental restoration (in areas impacted by construction) will protect/improve the interests of pollution prevention, fisheries, and wildlife habitat.

The following sections describe the existing conditions and interests supported by the resource areas in the Back Bay Fens followed by a discussion of impacts, construction monitoring and proposed mitigation are discussed at the end of the section.

3.4.1 Existing Conditions and Interests of the Act

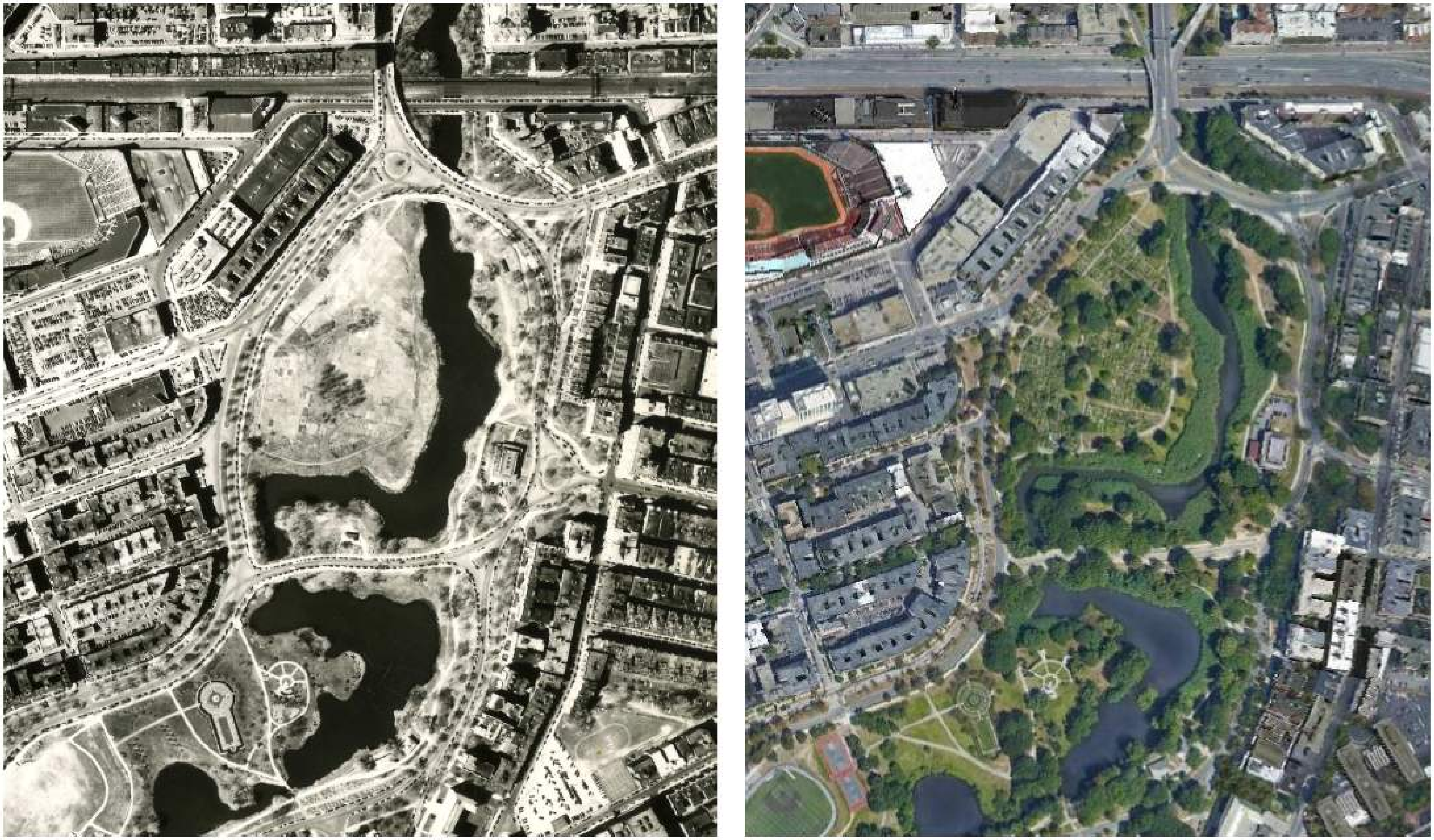
The Back Bay Fens (or Fens) section of the Muddy River is located between the Riverway and the Charlesgate section. The Fens is all that remains of the 750-acre Back Bay of the Charles River which was filled in the mid-nineteenth century. The area was modified by Olmsted in the 1890's to become part of the Emerald Necklace. The Fens, as envisioned by Olmsted, has been greatly altered over the last century. The area was a tidal marsh until about 1910 when a dam created the Charles River Basin and all but eliminated tidal influence. The park was substantially redesigned in the early 20th century but retained vital flood control functions and defining features from the Olmsted period. Various other endeavors encroached upon open water and intruded on parklands through the 1970's.

The total existing water surface area of the Fens today is about 20 acres, including 1.6 acres restored by daylighting during Phase 1. This area includes about 7 acres of emergent wetland, most of which is vegetated with Phragmites. Water depth generally ranges from 2 to 4 feet. The Muddy River flows from the lower fens to the Charlesgate section of the river, where it enters the Charles River Basin through a submerged conduit. Flow is sluggish, and the water level is influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam. A great deal of sediment has also accumulated in the Back Bay Fens.

Historic aerial imagery indicates most of the emergent Phragmites wetland has developed since 1951 (Figure 5-1). Phragmites is discussed in more detail in Section 5.

The Back Bay Fens is surrounded by park land. Public facilities near the river include the Victory Gardens, Boston Fire Department Fire Control Center, Mothers Rest Playground, athletic fields, the Agassiz Road (Longfellow) Duck House, the Kelleher Rose garden, Veterans Memorial Park, several monuments or memorials, and walking and biking paths. Parkland restored during Phase 1 is known as the Justine Mee Liff Park. The area is also near many institutions, including the Museum of Fine Arts (Boston), Emmanuel College, Simmons College, Isabella Stewart Gardner Museum, Massachusetts College of Art and Design, Wentworth Institute of Technology, Northeastern University, the Berklee Conservatory, and Fenway Park. Several of these significant institutions sustained damage from flooding.

Prior to construction of Phase 1, the Back Bay Fens included two sections where the original river channel was filled and the river piped through twin 6-ft. diameter culverts. These areas were located under the former Sears parking lot opposite the Landmark Center and between the former Upper Fens Pond and the Avenue de Louis Pasteur Bridge. Phase I removed the 6-ft. diameter culverts and restored about 800 ft. of river, an island, and associated parkland and riparian habitat. The restored river flows through 10 x 24 ft. culverts at Park Ave and Brookline Avenue. Phase 1 also removed several thousand cubic yards of sediment from the Upper Fens.



1951 2017

Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017.

Pond and sediment in the stone arch culvert under the Avenue Louis Pasteur Bridge. Banks in day lighted and restored areas were protected with stone and geocells and extensive planting.

Several shallow water “shelves” were installed along the banks and planted with emergent vegetation under the Phase 1 project. Created and restored riparian habitat was planted with native shrubs, trees, and ferns according to a plan developed by a historic landscape architect, consistent with Olmsted’s vision and species palette.

3.4.2 Description of Work in Resource Areas and Impacts

Work areas 7 through 12 are located in the Back Bay Fens and run together continuously from Avenue Louis Pasteur to Boylston Street. Sediment excavated from these areas may be excavated in the wet or dry dependent on water depth and other physical characteristics of the work area, additionally dewatered if required, and tested for transportation to final disposal. Some sediment removal in the Back Bay Fens includes removal of large area of Phragmites, which cannot be hydraulically dredged.

Work Area 13 is located at the Boston Fire Department (BFD) – Fire Control Center near the corner of Fenway and Agassiz Road. The USACE’s Decision Document noted that 100-yr flood protection will be required for the BFD site. The 100% design submittal details protection measures which include a floodwall topped with identical to existing security fencing with lighting and an interior underground pre-cast concrete storm water pumping station to convey storm water runoff within the Fire Department property when flood waters in the Muddy River prevent gravity storm water flow from the property.

The purpose of the work in the Back Bay Fens is primarily to improve the flood control function and provide environmental restoration in areas of the Muddy River impacted by the Phase 2 construction. Approximately 71,000 cubic yards of dredging is proposed for flood control.

Table 13 Work Area No. 7 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**43,237**	**sq. ft.**
Excavation: Land under water	**5,326**	**cy**
Excavation: Bordering vegetated wetland	**3,111**	**sq. ft.**
Excavation: Bordering vegetated wetland	**173**	**cy**
Dimension of dredge area (Length)	**655**	**lf.**
Dimension of dredge area (Width)	**50 to 190**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 7**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,875**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**4,529**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**6,595**	**sq. ft.**
Fill (wetland topsoil installed under water)	**252**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**16,488**	**cy**
Total area of Phragmites	**11,437**	**sq. ft.**
Total area of Phragmites Removed	**11,437**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**331**	**lf.**
Alteration - BVW	**3,111**	**sq. ft.**
Alteration – Land under water	**43,237**	**sq. ft.**
Riverfront (0 -25 ft.)	**38,178**	**sq. ft.**
Riverfront Area Disturbed	**7,101**	**sq. ft.**
Bordering land subject to flooding	**177,769**	**sq. ft.**

Table 14 Work Area No. 8 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**36,002**	**sq. ft.**
Excavation: Land under water	**4,900**	**cy**
Excavation: Bordering vegetated wetland	**116**	**sq. ft.**
Excavation: Bordering vegetated wetland	**6**	**cy**
Dimension of dredge area (Length)	**668**	**lf.**
Dimension of dredge area (Width)	**40 to 50**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 6**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,313**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**6,204**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**15,510**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**81**	**lf.**
Alteration - BVW	**203**	**sq. ft.**
Alteration – Land under water	**36,002**	**sq. ft.**
Riverfront (0 -25 ft.)	**36,270**	**sq. ft.**
Riverfront Area Disturbed	**2,799**	**sq. ft.**
Bordering land subject to flooding	**177,769**	**sq. ft.**

Table 15 Work Area No. 9 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**33,895**	**sq. ft.**
Excavation: Land under water	**5,860**	**cy**
Excavation: Bordering vegetated wetland	**451**	**sq. ft.**
Excavation: Bordering vegetated wetland	**25**	**cy**
Dimension of dredge area (Length)	**665**	**lf.**
Dimension of dredge area (Width)	**25 to 70**	**lf.**
Dimension of dredge area (Depth)	**1 to 6**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,029**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**2,070**	**sq. ft.**
Temporary Fill (Access)	**5,061**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**230**	**cy**
Temporary Fill (Access)	**12,653**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**209**	**lf.**
Alteration - BVW	**622**	**sq. ft.**
Alteration – Land under water	**33,895**	**sq. ft.**
Riverfront (0 -25 ft.)	**41,798**	**sq. ft.**
Riverfront Area Disturbed	**1,007**	**sq. ft.**
Bordering land subject to flooding	**263,980**	**sq. ft.**

Table 16 Work Area No. 10 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**178,236**	**sq. ft.**
Excavation: Land under water	**32,797**	**cy**
Excavation: Bordering vegetated wetland	**8,690**	**sq. ft.**
Excavation: Bordering vegetated wetland	**483**	**cy**
Dimension of dredge area (Length)	**1,499**	**lf.**
Dimension of dredge area (Width)	**30 to 260**	**lf.**
Dimension of dredge area (Depth)	**0.5 to 10**	**lf.**
Area of BVW Restored (Emergent Veg)	**11,246**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**745**	**sq. ft.**
Fill (wetland topsoil installed under water)	**662**	**sq. ft.**
Fill (stone installed under water)	**2,050**	**sq. ft.**
Temporary Fill (Access)	**25,224**	**sq. ft.**
Fill (wetland topsoil installed under water)	**37**	**cy**
Fill (stone installed under water)	**228**	**cy**
Temporary Fill (Access)	**63,060**	**cy**
Total area of Phragmites	**64,548**	**sq. ft.**
Total area of Phragmites Removed	**64,548**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**1,290**	**lf.**
Alteration - BVW	**8,751**	**sq. ft.**
Alteration – Land under water	**178,236**	**sq. ft.**
Riverfront (0 -25 ft.)	**76,356**	**sq. ft.**
Riverfront Area Disturbed	**18,833**	**sq. ft.**
Bordering land subject to flooding	**302,982**	**sq. ft.**

Table 17 Work Area No. 11 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**90,999**	**sq. ft.**
Excavation: Land under water	**9,652**	**cy**
Excavation: Bordering vegetated wetland	**23,881**	**sq. ft.**
Excavation: Bordering vegetated wetland	**1,327**	**cy**
Dimension of dredge area (Length)	**956**	**lf.**
Dimension of dredge area (Width)	**40 to 150**	**lf.**
Dimension of dredge area (Depth)	**0.5 to 9.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**5,814**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**2,116**	**sq. ft.**
Fill (wetland topsoil installed under water)	**997**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**38,681**	**sq. ft.**
Fill (wetland topsoil installed under water)	**55**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**96,703**	**cy**
Total area of Phragmites	**91,841**	**sq. ft.**
Total area of Phragmites Removed	**58,939**	**sq. ft.**
Total area of Phragmites Remaining	**32,902**	**sq. ft.**
Alteration - bank	**844**	**lf.**
Alteration - BVW	**24,928**	**sq. ft.**
Alteration – Land under water	**90,999**	**sq. ft.**
Riverfront (0 -25 ft.)	**53,065**	**sq. ft.**
Riverfront Area Disturbed	**8,329**	**sq. ft.**
Bordering land subject to flooding	**202,551**	**sq. ft.**

Table 18 Work Area No. 12 – City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**79,624**	**sq. ft.**
Excavation: Land under water	**10,748**	**cy**
Excavation: Bordering vegetated wetland	**8,869**	**sq. ft.**
Excavation: Bordering vegetated wetland	**493**	**cy**
Dimension of dredge area (Length)	**847**	**lf.**
Dimension of dredge area (Width)	**75 to 140**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 9**	**lf.**
Area of BVW Restored (Emergent Veg)	**7,414**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**1,446**	**sq. ft.**
Fill (wetland topsoil installed under water)	**1,486**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**20,758**	**sq. ft.**
Fill (wetland topsoil installed under water)	**83**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**51,895**	**cy**
Total area of Phragmites	**88,659**	**sq. ft.**
Total area of Phragmites Removed	**50,524**	**sq. ft.**
Total area of Phragmites Remaining	**38,135**	**sq. ft.**
Alteration - bank	**844**	**lf.**
Alteration - BVW	**8,869**	**sq. ft.**
Alteration – Land under water	**79,624**	**sq. ft.**
Riverfront (0 -25 ft.)	**44,948**	**sq. ft.**
Riverfront Area Disturbed	**11,017**	**sq. ft.**
Bordering land subject to flooding	**166,169**	**sq. ft.**

Work Area No. 13 – City of Boston

The USACE Decision Document noted that 100-yr flood protection will be required for the Boston Fire Department (BFD) – Fire Control Center, located near the corner of Fenway and Agassiz Road. The 100% design submittal details protection measures which include a floodwall topped with identical to existing security fencing with lighting and an interior underground pre-cast concrete storm water pumping station to convey storm water runoff within the Fire Department property when flood waters in the Muddy River prevent gravity storm water flow from the property. The pump station is a 7,000-gallon pre-cast concrete tank with twin 10 HP storm water pumps and a double catch basin frame and grate set at an elevation slightly above the elevation of gravity flow from the site. As floodwaters rise, a check valve in the gravity outflow pipe will prevent floodwater from backing into the site and the pump station will begin taking water and pumping.

The work at the BFD – Fire Control Center will include activities in the 100-foot Wetlands Buffer Zone as well as within Bordering Land Subject to Flooding (BLSF).

3.5 Construction Methods, Staging Areas, Monitoring and Mitigation (All Work Areas)

The Phase 2 100% permit package (Drawings and Specifications) submitted with this application describe the layout of the flood control channel, access, and storage areas, pedestrian and hauling routes, utility investigations and relocations, site restoration, construction sequencing, environmental protection, including measures to protect Blueback herring and sensitive areas within the park system, flood protection for the Boston Fire Department – Fire Control Center in the Back Bay Fens, and traffic management. The package also includes sediment quality information and quantity estimates of material to be excavated. The 100% permit package includes revisions based on comments received on the 95% design from the Town of Brookline, the City of Boston, Massachusetts Division of Marine Fisheries, Massachusetts DCR, and the Massachusetts DEP. The Muddy River Management and Maintenance Oversite Committee, Emerald Necklace Conservancy, and other stakeholders also provided comments.

Additional revisions to the Drawings and Specifications may be required upon receipt of Water Quality Certification from the Massachusetts DEP and Orders of Conditions from the Town of Brookline and City of Boston.

The Construction Contractor will be required to provide various submittals that will further describe means and methods, environmental protection, and construction sequencing. Some of the submittals will be provided to the MADEP and other agencies for review, others will be reviewed only by USACE.

Submittals will include, but are not limited to, the following:

Specification Section	Description of Submittal
01 57 20	Environmental Protection Plan
01 57 20	Surface Water and Wastewater Quality Monitoring Plan
01 57 20	Fish (Blueback Herring) Truck and Transport Plan (if needed)
31 00 00	Dewatering Work Plan
31 00 00	Excavation Work Plan
32 93 00	Restoration Work Plan
32 94 00	Invasive Species Control Work Plan

For a complete list of submittals see Specification Section 01 33 00.

The proposed method of sediment removal is primarily mechanical however either mechanical or hydraulic dredging is allowed within Leverett Pond. Other work areas are better suited for mechanical dredging as opposed to hydraulic dredging for several reasons. First, the existing channel is very shallow in some areas as well as narrow in others which prohibit even the smallest hydraulic dredge on a barge from accessing. Secondly, all sections of Muddy River exist in a highly urban environment where debris of all kinds ends up in the river which will clog or repeatedly disable hydraulic dredge equipment. This debris was observed during low flow periods and includes natural debris such as downed trees and limbs, stones, and layers of leaf litter mixed with brush as well as a large quantity of man-made debris including construction debris, tires, metal parts, safe doors, shopping carts, bicycles, bottles, cans and other household refuse, vehicle parts, and plastic. Third, hydraulic dredging cannot be used for *Phragmites* excavation and upland banks areas where channel slopes require cutting into uplands. Lastly, hydraulic dredging will require somewhat extensive staging, including access areas for dewatering presses, pump lines, frac tanks, and sludge handling areas. Given the location of the project within a major metropolitan city and park area, these staging and access areas are extremely limited.

Hydraulic dredging was required for the non-federal dredging of the Charlesgate Section of Muddy River, from Boylston Street to the Charles River prior to the USACE Phase 1 construction.t. After the contract was awarded, it was quickly determined hydraulic dredging was impossible due to many of the issues discussed above. The contract was modified to allow mechanical dredging and the portion of the project was completed with that method

Mechanical dredging was used within Upper Fens Pond in Phase I during the Spring/Summer of 2015. The flow within Upper Fens Pond was diverted around the work area, the area was then sectioned off using steel sheet pile walls and dewatered to excavate in the dry. The material was mixed in-situ with sawdust, loaded onto trucks and hauled to final disposal. A temporary access road was constructed along one river bank by excavating organic sediment to a more stable base and then using a 3" minus gravel as a temporary road base for excavators and site dump trucks. As the excavators backed out of the channel, the temporary road was shaped, some of the material removed, and slope stabilization installed.

The contractor may determine that dredging in the wet with specialized equipment may be more beneficial to work around fish windows or the sensitive nature of existing features within the park system. Working in the wet would minimize dewatering of aquatic habitat and stranding of turtles, fish, freshwater mussels, and other aquatic life. It would, however, require measures such as siltation curtains to isolate the work area and protect water quality.

Based on these considerations, the Leverett Pond work area, including the sand island, may be hydraulically dredged with small equipment on a barge and pumped onshore due to ample water access and depth for a small dredge. This material is predominately sand so excavation in the wet is a viable option as well. The sediment removed from this area may be dewatered using Geotubes or a filter press along the edge of the pond and then transported to a disposal site. Depending on the dewatering method, the water may require additional turbidity treatment prior to being returned to the river.

Two of the five Riverway work areas are upstream from Brookline Avenue, one is located on the Boston side of the Riverwalk Island, the fourth is located about 900 ft. downstream from the Longwood Avenue bridge, and the fifth is at the downstream end of the Riverway. Sediment excavated from these areas will likely be excavated in the dry, additionally dewatered if required, and tested for transportation to final disposal. Sediment removal in work Area 6 includes removal of a large area of Phragmites, which cannot be hydraulically dredged. Phragmites is also present in Work Areas 2, 3, and 4. The flow restriction control structure (FRCS), constructed as part of

Phase 1 construction, will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens.

Work areas 7 through 12 are located in the Back Bay Fens and run together continuously from Avenue Louis Pasteur to Boylston Street. Sediment excavated from these areas may be excavated in the wet or dry dependent on water depth and other physical characteristics of the work area, additionally dewatered if required, and tested for transportation to final disposal. Some sediment removal in the Back Bay Fens includes removal of large area of Phragmites, which cannot be hydraulically dredged.

Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increase temperatures and nutrient concentrations and algal blooms. See section 5 for a more detail description on the additional benefits associated with sediment removal.

Sequence of each individual work area is detailed in the notes on the “Sequencing, Dewatering, Staging & Access Plans” (GC101 thru GC105). Additionally, “Hauling Plans” (GC106 thru GC108) detail allowable hauling routes in and out of the work areas. It is likely that multiple crews will be required to complete the project within the intended 3-year construction window while working around the environmental (blueback herring migration) windows. The contractor will be required to submit a work plan that will be reviewed as part of the best value contract. Actual sequence of work will be reviewed at that time however the 100% plans and specifications allow contractor flexibility with their own means and methods to meet the 3-year construction duration.

Because the work will occur in a larger urban environment, there is very little open space available for staging in the vicinity of the project site except for the adjacent park land. Proposed staging and access areas are shown on the Drawings. The areas shown provide for truck and equipment access ways and storage locations, minimal material storage, and locations for dewatering equipment, if used. Existing gravel and paved walkways were used to access work areas to the maximum extent. Little or no tree clearing is required for staging and access to adjacent roadways. Tree root zones were avoided as much as possible. Where vehicular travel underneath tree canopy was unavoidable, root zones will be protected from soil compaction.

A meeting was held with USACE, MA DCR, City of Boston, Town of Brookline, and the MA State Police to discuss construction related hauling of the excavated material. Police details will be required during hauling activities for trucks entering and exiting designated work areas. Proposed hauling routes are shown on the “Hauling Plans” (GC106-GC108). Plans also include provisions for allowing pedestrian and bicycle traffic to safely bypass work areas.
Work areas will be fenced during construction and during establishment of turf and landscape planting. Fencing is shown on construction and landscaping plans.

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor will construct or install temporary and permanent erosion and sediment control best management practices

(BMPs) as indicated on the contract drawings and specifications. BMPs may include, but not be limited to, vegetation cover, slope stabilization, silt fences, and straw wattles. Any temporary measures shall be removed after the area has been stabilized. The project will be covered by a NPDES Construction General Permit. The construction contractor will submit an Environment Protection Plan for USACE approval before construction begins.

- Project plans propose to conduct most of the construction in the dry. Work areas will either be entirely dewatered, with flow maintained by a bypass pumping system or flow will be diverted from one side of the river to the other. Normal flow above Park Drive is estimated to be 6 cfs. Water diversion systems will be designed to pass displaced flows without exceeding 6 inches of river level change upstream or downstream of diversions at all times.

- The Contractor will be required to submit a detailed water control plan to the USACE for approval. The plan will be submitted for review and comment to the MADEP, Boston and Brookline Conservation Commissions, and the MA Division of Marine Fisheries (MADMF).

- The plan will detail Contractor's actions to operate and maintain or remove the diversion system for each work area during normal and flood events. The plan will include complete construction drawings and detail drawings showing all aspects of the Muddy River control and diversion system for all work areas. For all pumps, details shall include manufacturer's information on pump performance curves, specifications, a control diagram, and written sequence of control for the pumping system.

- The submittal will include construction and detail drawings for all work areas enclosed by temporary cofferdam structure; width and shape of channel opening remaining to pass flows; number, sizes, and locations of pumps required to pass equivalent river capacity; number, sizes, and locations of pumps required to dewater within cofferdam; locations of outlets for pump dewatering discharge; and method of treatment of discharge water. Temporary cofferdam structures may include steel sheet piling, bladder dams, portadams (or equivalent) but will not include placement of fill.

- Detailed calculations shall be submitted for structural, geotechnical and hydraulic design aspects of the diversion system(s). Hydraulic calculations documenting calculation of the displaced flow and demonstrating that the proposed diversion system(s) will pass displaced flow without exceeding 6 inches of river level change upstream or downstream of diversions at all times including high water and floods. Pump selection justification including pump curves and head. Pipe calculations justifying selected pipe size and thickness. Structural and geotechnical calculations documenting design of temporary cofferdam system including earth supports, pipe supports, pipe restraints, and equipment supports.

- Supplemental plans to restore any areas disturbed by water control activities which are not shown on 100% design landscape restoration drawings will also be submitted for review and approval. The supplemental drawings would be prepared by a historic restoration landscape architect approved by the USACE after consultation with project sponsors.

- To provide flood control benefits, the contractor will be required to remove the FRCS as soon as practical after completion of sediment removal from Work Areas 7 -12 and flood proofing of the Boston Fire Department facility. The entire structure, including sheet pile, stone protection, catwalk, and super sacks will be removed as discussed above.

- Any wastewater from dewatering or dredged material processing operations and other sources will not be discharged directly into surface waters, the storm drain system, sanitary sewers, or the Muddy River Conduit. Prior to discharge, water from dewatering operations will be treated by filtration, settling basins, or other approved methods to reduce the amount of sediment and contaminants contained in the water to allowable levels. Discharge standards for others parameter may be established by the MADEP during the permit process.

- Treated wastewater from dewatering, dredged material processing operations, or other activities that is discharged directly or indirectly into surface water will be tested daily for TSS and weekly for dissolved lead and dissolved oxygen. In work areas where sediment is excavated in the wet, surface water quality will be monitored daily at one station upstream of the work area and three downstream locations. Parameters measured will include dissolved oxygen, percent dissolved oxygen saturation, turbidity (NTU's), temperature, and conductivity.

- The contractor will prepare a plan for monitoring wastewater and surface water quality. The plan will include the following elements:

1) List of parameters to monitor and detection limits
2) Sampling method (s)
3) Frequency of monitoring
4) Monitoring locations (including a map)
5) Reporting
6) List of Personnel, Roles and Responsibilities
7) Analytical Laboratory
8) Equipment required
9) Safety Plan
10) Quality Assurance Project Plan (QAAP)

- Test results will be summarized in report(s) submitted to the Boston and Brookline Conservation Commissions and MADEP.

The USACE has developed a restoration plan for areas impacted by construction activities. The USACE worked closely with a landscape architect with extensive experience in historic landscape rehabilitation. The intent of the plan is to rehabilitate the landscape through a design that is compatible with the habit, form, scale and context of the historic vegetation and to restore wetland and riparian habitat. Historic conditions are known from surviving landscape plans and photographs. Plant species were selected based on a species list of historic plantings and plans from the Olmsted Archives (Frederick Law Olmsted National Historic Site) photographs, Boston Parks and Recreation Department records, site conditions, and availability of plant material from local or regional nurseries.

The Olmsted lists have been reviewed and native plants selected for significant majority of the project area. Species listed as invasive were avoided. Wetland seed mix and emergent species are entirely native, as are the ferns. In very limited cases non-native species with a track record of being noninvasive in this landscape were selected to support character defining features of the landscape. Of the 9,939 shrubs proposed 49 individuals are not native (forsythia) and of 119 trees, 19 individuals (London plane and willow) are not native but the species are already present in the landscape. Container grown plugs will be used to establish emergent vegetation and native wetland seed mix will be used in wet meadow areas. Substitutions consistent with historic landscape restoration goals may be required if planting success is not achieved during plant establishment period.

- The existing shoreline along the Riverway is severely eroded in many locations. This is likely due to fluctuating water levels, grazing by waterfowl, rill erosion caused by runoff, and steep slopes. The Phase 2 design includes placement of coir fiber rolls to hold the bank in most restored areas. The top of the rolls will be set at the normal water surface elevation, likely a few inches above EL 1.3 ft. In the Back Bay Fens coir rolls will also be used to retain fill placed to restore wetland vegetation. This will occur mostly downstream of the bridge adjacent to the Victory Gardens. The coir rolls will also be used to hold soil installed to create underwater shelves. The top of coir rolls will normally be set at EL 1.3 ft. in area without shelves and EL 0.3 where shelves are present. Above elevation 1.3 slopes greater than 3:1 (horizontal to vertical - h:v) will generally be stabilized with 100 percent biodegradable erosion control matting. Matting will not contain poly netting and strands of the matting will move independently to minimize the risk of wildlife entrapment.

- As previously mentioned, the Muddy River suffers from bank erosion. Multiple efforts have been under taken over the years to help restore and protect the river bank. This project provides an opportunity to improve the existing condition and provide restoration benefits. Banks will be restored to a less degraded state following this project and will result in reduced sediment loading, improved water quality (reduced suspended sediment) and improved ecological habitat (consistent with the goals of the WPA and the eligibility criteria for an Ecological Restoration Limited Project).

- Six inches of topsoil will generally be placed in area restored as area turf. No topsoil will be placed underwater except in areas to be planted with emergent plugs and emergent shelves where topsoil will be installed as backfill to meet desired grades. Topsoil will be obtained from off-site. The specifications require that topsoil be tested for TOC, pH, grain size, and nutrients. Contaminant levels in topsoil must meet MassDEP Reportable Concentration (RCS) 1 criteria. Topsoil will conform to the limits presented in the project specifications. The topsoil may be adjusted to meet composition requirements by adding compost or inorganic components. Compost used will be derived from organic wastes including leaf and yard residues.

- Little information is available regarding historic planting of freshwater emergent plants in Olmsted's Emerald Necklace park system. There is no evidence that emergents were planted. Planting of emergents is included in the design because historic pictures do show an emergent fringe along the river and such a fringe occurs today in some areas along the Riverway. Also, there is a desire to restore emergent vegetation to the extent possible. The design includes seeding areas above the normal water surface elevation with a wetland seed mix or planting masses of wetland shrubs. Planting emergent plugs is generally limited to emergent "shelf" areas. These areas will be planted with a variety of emergent plants native to eastern Massachusetts. Most of the species selected have low stature, a requirement for historic restoration and aesthetics. Based on Phase I plantings and observations, several species (e.g. swamp loosestrife, blue flag, and sweet flag) chosen are expected to be somewhat resistant to grazing. The emergent plants will be protected by an herbivore exclusion fence for at least two years to allow the roots system/rhizome system to become resistant to grazing. Effort to restore emergent vegetation during Phase I at created wetland shelves are still underway. Failed plantings are thought to be caused by grazing by carp which were able to swim under the Phase 1 exclusion fencing. Phase 2 design emphasizes planting of sweet flag which appears relatively resistant to grazing in Phase 1. Pickerelweed and bur-reed will be limited to near shore/bank areas where carp grazing should be less intense. The plant diversity gained through *Phragmites* removal and wetland vegetation restoration from the Phase 2 project will greatly improve the ecological value for aquatic, avian and terrestrial biota.

- Wetland areas will be seeded or planted with shrubs between elevation (EL) 1.3 and 2.3 feet. All trees and other shrubs will be planted above El 2.3 feet. Wetland shelves will be planted with plugs to a depth of about EL 0.8 feet. No upland species will be planted below EL 3.3 feet.

- There will be a two-year guarantee period for all plantings. In upland areas one-hundred percent survival of trees and shrubs will be required. Performance standards for wetland vegetation will be based on percent cover. Areas between EL 1.3 and 2.3 seeded with a wetland seed mix or planted with emergent and wetland shrubs will have > 75 percent cover by native wetland plants after two years.

- Temporary fencing will be installed to protect emergent plantings from grazing by ducks, geese, and fish (carp) during the plant establishment period. The fencing will be installed along the water-side edge of all emergent plantings. Fencing will be used on the water side of the shelf areas to exclude carp. Fencing will also be installed on the upland side of the emergent plantings to exclude waterfowl. The entire restored area will be fenced to prevent public access during construction and for a variable of time during restoration based on site conditions and consultation with the sponsors. The fencing is required to limit vandalism and unintentional incidental damage by the public to plant material and side slopes. Use of 4-foot-high coated chain link fencing is anticipated (similar to Phase 1).

- Seed mixes for lawn areas contain a mix of typical turf species, primarily fescues and ryegrasses. Mixes tailored for sun and shade areas and dense shade were specified. A seed mix of native wildflowers and grasses was developed for areas planted with trees and shrubs. The mix contains non-invasive species which typically grow less than about three ft. tall and includes species used by pollinators and species with aesthetic appeal. The wetland seed mix will be New England Wetland Plants "Wetmix" or an approved equal.

- Many trees occur within or near the limit of work. All trees to remain will be protected with fencing or trunk protectors as directed by an arborist. The condition of certain trees near work limits will be evaluated during construction. If an arborist determines the tree can be saved the construction contractor will be directed to do so. After consultation with USACE and the sponsors, the contractor will be required to remove hazardous trees and branches noted during the construction and maintenance period.

- Habitat logs will be installed to enhance fisheries and wildlife habitat. Habitat logs will be installed in restored areas. About 1/3 will extend into the water to provide basking locations for turtles and perches for wading birds. Logs will be hardwoods salvaged from on site with a minimum butt diameter of 8" and length between 8 and 12 feet.

- Watering will be required during the plant establishment period. Water will likely be supplied from watering trucks or an irrigation system connected to the local city water system. Pumping irrigation water from the river will not be permitted.

- Considerable grazing on shrubs by rabbit and possibly meadow voles occurred during Phase 1 restoration. Protectors on individual shrub plantings or other measures to deter stem damage (i.e., girdling) by herbivores will be required.

- Planted trees and shrubs will be pruned by an arborist during the plant establishment period to remove dead branches and improve growth form. Standard industry pruning practices will be adhered to. Wound dressing will not be applied. Weeding will be conducted as required to prevent shading of shrub and fern plantings by tall weeds such as burdock, hawkweed, and mugwort.

4.0 Wetlands Impacts/Benefits – Summary Phase 1 and Phase 2

The Muddy River Flood Control Project – Phase 1 and Phase 2 were split into two separate construction phases due to the nature and type of construction being different for each phase. However, when considering the interest of the Wetlands Protection Act (WPA) the impacts and benefits from the combined phases is significant. Not only do the combined phases provide significant flood control benefits, they also serve to significantly improve the natural capacity of the wetlands resource areas within the Muddy River project area to protect and sustain the interests identified in the WPA consistent with the eligibility criteria for an Ecological Restoration Limited Project. Extensive local, state and federal wetlands permitting for Phase 1 was completed prior to construction. Substantial completion for construction Phase 1 was achieved in 2016 and there are ongoing requirements for vegetation establishment and management of the temporary flood restriction control structure. The proponents are in the process of permitting the work in wetlands resource areas in Phase 2 as discussed above.

The daylighting of nearly 700 linear feet of the Muddy River in the upper reaches of the Back Bay Fens (from Phase 1 construction) serves to compensate for the alteration of resource areas elsewhere in the Back Bay Fens (as a result of Phase 2 construction) and yield a net increase in the area of Land Under Water (LUW), Inland Bank and Bordering Vegetated Wetland (BVW). The daylighting of the river in the two specified areas resulted in approximately 1 acre (43,560 square feet) of additional Land Under Water, 1,690 linear feet of Inland Bank, and approximately 6,760 square feet of BVW. Combined with the replication proposed in the daylighted areas, the project will result in the increase of 0.3 acres (12,415 square feet) of the BVW in the Back Bay Fens. This estimate is based on a 4-foot-wide planting shelf as shown in the Plans.

Table 2 summarizes wetlands impacts for both the Phase 1 and Phase 2 construction projects. The combined project elements will improve the capacity of resource areas along the Muddy River to protect the interests of the WPA and result in a net increase of resource areas along the Muddy River consistent with the goals of an Ecological Restoration Limited Project. As presented in Table 2, the project will result in re-classification of some wetland resource areas along with an increase in overall resource areas within the entire project corridor.

Table 19
Summary of Wetland Impacts for Each Phase

Wetland Resource Areas	Units	Phase 1 (Boston)	Phase 2 (Boston)	Phase 2 (Brookline)	Total (Phase 1 and 2)
Land Under Water					
Created	*sq. ft.*	69,706	-	-	69,706
Restored	*sq. ft.*	66,463	634,287	36,163	736,913
Bordering Vegetated Wetland (BVW)[1,2,3]					
Excavated or other alteration	*sq. ft.*	7,400[4]	83,196	10,245	100,841
Restored/ Created	*sq. ft.*	15,000[5]	50,987	5,607	71,594
Bank					
Created	*l.f.*	1,938	-	-	1,938
Restored	*l.f.*	1,692	5,115	844	7,651
Riverfront					
Created	*sq. ft.*	48,450	-	-	48,450

1. All BVW is also classified as Federal emergent wetland.
2. Nearly all BVW and Federal emergent wetland lost is Phragmites.
3. BVW delineation provided by project sponsors.

4. From Phase 1 NOI, includes 4,850 sq. ft. Phragmites.
5. Estimated, based on post construction monitoring and adaptive management.

The Muddy River Flood Damage Reduction project will create or restore approximately 18 acres of land under water. Phase 2 restoration involves restoration of former open water habitat by removal of Phragmites, restoration of open water habitat by removal of mudflats or sediment islands and deepening of existing open water habitat. Although the flood control project does not propose bank to bank dredging as propose for environmental restoration, a substantial proportion of the Back Bay Fens and Riverway will be dredged. The 2003 EA (USACE, 2013) mapped 11.1 acres of open water in the Back Bay Fens and 6.4 acres in the Riverway (see Figures 2-12 and 2-13). The acreage of open water habitat in the Back Bay Fens and Riverway following completion of Phase 2 will be approximately 15 and 7 acres, respectively.

The depth of dredging will be variable. Up to 7 feet of sediment will be excavated in Leveret Pond (Area 1), 6 feet in the Riverway, and 10 feet in the Back Bay Fens. Approximately 88,000 cubic yards (cy)of sediment will be removed. 14,000 cy of topsoil and rock fill will be installed underwater for wetland restoration or erosion control. The net increase in volume of land under water will be about 74,000 cy.

Shallow (0 – 12-inch deep) vegetated shelves created during Phase 1 and Phase 2 in the Back Bay Fens will provide nesting and nursery habitat for fish and foraging habitat for wading birds such as great blue heron. Eight shelves were constructed during Phase 1 and additional shelves will be constructed during Phase 2 as shown on the plans. Habitat logs installed in the Riverway and Fens will provide basking sites for turtles and cover for fish. These have proven to be well used by turtles in the area.

Excavation in Work Area 10 will remove mudflat and a sand island downstream of the Stonybrook gatehouse drain. Mudflat and a sand island will also be removed from Area 1 (Leverett Pond). Phase 2 will remove shallow mud flat areas present under normal flow conditions in Work Areas 2 through 5.

In addition to restoring stream habitat and land under water, Phase 1 and Phase 2 will significantly improve aquatic connectivity. Phase 1 removed over 700 ft. of culverts which isolated the Riverway from the Back Bay Fens. Phase 2 activities will include removal of the FRCS, which is the only remaining significant anthropogenic barrier between the Back Bay Fens and Leveret Pond. Restoration of connectivity will benefit both resident warm water species and blue back herring, an anadromous species which spawns in Leverett Pond.

Sediment removal is expected to somewhat improve water quality in the Back Bay Fens. Sediment removal will improve DO levels in surface waters by 1) reducing sediment oxygen demand (SOD) by exposing well decomposed (weathered) underlying sediment with lower SOD than existing surface sediment, and 2) increasing the volume of water in the Back Bay Fens and reducing the effect of SOD on DO levels. Removal of nutrient rich surface sediment may also reduce plant productivity and oxygen demand exerted by decomposing plant material. Water quality modeling by the USACE (USACE, 2003, Table EA-26) estimated that flood control project would reduce the percent area with low DO (< 5 mg/l) in the Back Bay Fens from 100% without sediment removal to 50 - 70 % 25 years after construction. Modeling showed flood control dredging to have no measurable effect on DO in the Riverway where 100% of the area is modeled to experience DO levels < 5 mg/l under both with and without project conditions.

A mathematical model developed by Mathew et al. (2011) attributed poor water quality in the Muddy River primarily to significant internal inputs, attributed to waterfowl, sediment, and algal production. The study postulated that sediment removal planned as part of the full restoration project should lead to significant improvements in DO and biological oxygen demand. Although the full restoration project evaluated by Mathew et al. is not being implemented, sediment is being removed from a significant portion of the Back Bay Fens, so some improvement in DO is likely to occur in the Fens, as also predicted by the USACE model.

Water quality may also be improved by bank stabilization of impacted areas during Phase 2 and continued implementation of BMP's in the watershed to reduce loading of sediment, organic material, nutrients, and contaminants to surface waters from storm drains and non-point sources.

Testing by CDM (2001) and the USACE (2003) show that contaminant levels in underlying sediment are generally lower than concentrations in existing surface sediments. CDM (2001) measured levels of metals, PAHs, PCBs, pesticides, and other chemicals at 2 ft. intervals ranging from 0-2 feet to 10-12 feet USACE (2003) used this information was used to predict the concentration of selected chemicals in sediment exposed by dredging. The proposed dredging will generally expose sediment with lower levels of contaminants than in surface sediments in the Back Bay Fens. Lead, cadmium, chromium, mercury, PAH, PCBs and DDT concentrations will be lower in exposed sediment. In the Riverway, PAH levels will be greatly lower in exposed sediment. PCB and some metal levels will also be lower, but DDT levels in exposed sediment may be higher than existing surface sediments at Riverway. Lower PCB concentrations in surface sediment will likely result in lower PCB levels in fish and aquatic invertebrates and less food chain exposure to wildlife.

Risk of PAH mixtures to benthic communities can be assessed using by using an equilibrium partitioning method developed by the USEPA (2000). An ESG greater than 1 is indicative of ecological risk. PAH mixture ESGs were above 1 at all locations in the Riverway and Back Bay Fens (USACE, 2003). Post construction PAH ESG levels will likely be less than 1 in restored areas.

Toxicity testing indicates sediments in the Riverway and Back Bay Fens are toxic to aquatic invertebrates (USACE, 2003). Lower levels of contaminants following excavation in Phase 2 work areas should reduce sediment toxicity but risk screening levels (MacDonald, 2002) for some contaminants will likely still be exceeded. Surface sediments in the daylighted sections in the Back Bay Fens and shallow (0-12 inch) shelves created during Phase 1 and Phase 2 in the Back Bay Fens are expected to have much lower contaminant levels than sediment elsewhere in the Muddy River. The shelves were created using clean topsoil.

Approximately 1.6 acres of emergent (mostly wet meadow) or wet meadow/scrub-shrub wetland will be restored during Phase 1 and 2. Most of the restored wetland will be in the Back Bay Fens, but a narrow wetland fringe will be restored in work areas along the Riverway. As described below, the restored wetland will have greater functional value than the existing Phragmites.

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are essentially monospecific. Monitoring of areas restored during Phase 1 indicates that the fridge wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored during Phase 2 along the Riverway and Back Bay Fens. Species noted in the Phase 1 fridge wetland in September of 2017 and/or 2018 include elderberry, water willow, sweet gale, pickerelweed, sweet flag, bugleweed, umbrella sedge, cattail, beggar-ticks, false nettle, boneset, Joe pye weed, blue vervain, soft rush, jewelweed, Pennsylvania smartweed, soft rush, spike rush, and water purslane.

The plant species community diversity in restored wetlands is expected to vary with time, but a moderate to high diversity community is expected to persist. To date wetlands restored during Phase 1 have not been colonized by Phragmites or Japanese knotweed despite the presence of potential seed sources upstream along the Riverway.

Phase 2 will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

The removal of Phragmites will be substantially mitigated by restoring wetland along the Back Bay Fens shoreline as shown on landscape plans included with project drawings. Restored wetlands will be seeded with a diverse wetland seed mix and planted with shrubs with high wildlife habitat value such as buttonbush, common elderberry, red osier dogwood, and summersweet. Wetland community diversity will be further enhanced by planting emergents such as pickerelweed, bur reed, blue flag iris, and sweet flag along the wetland shelf shoreline. Volunteer cattail, jewelweed, smartweed, Bidens, and other species will also likely colonize the shoreline and/or shallow water shelves. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

The restored wetland will be established on clean soils, so should have a healthier soil invertebrate community than in the existing Phragmites wetland where surface soils are contaminated with concentrations of metals and PAHs that exceed USEPA Eco-SSL's and other ecological risk-based screening values. Wildlife such as worm eating birds and small mammals which prey on soil invertebrates should benefit from the enhanced invertebrate community.

Nearly 2000 linear feet (l.f.) of bank was created by Phase 1 daylighting and 1,692 l.f. of bank was restored in Upper Fens Pond. An additional 5,959 l.f. of bank will be restored in the Leverett Pond, the Back Bay Fens and the Riverway during Phase 2.

Existing banks along the Riverway and Back Bay Fens are typically in very poor condition. The banks are eroding and often poorly vegetated. The restored banks will be stabilized with coir fiber rolls and plantings. Bank restoration will reduce erosion and sediment deposition in the Riverway and Back Bay Fens. Vegetation seeded or planted on the banks will be similar to the Phase 1 fringe wetland described above and provide better wildlife habitat value than existing banks. As for emergent wetlands, the non-federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of Phragmites and other invasive plants which could colonize and degrade the restored banks.

All Riverfront disturbed by Phase 2 construction activities will be restored. Restored areas will be planted with shrubs and trees and/or seeded with a native wildflower or native wetland plant seed mix. Restored riparian communities as expected to have greater plant diversity and better wildlife habitat value than the preexisting riparian communities. As with emergent wetlands and bank, the non-federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of. Japanese knotweed, Phragmites and other invasive plants which could colonize and degrade the restored riparian habitat.

Phase 1 created 1.1 acres of new riverfront in the Back Bay Fens and restored riparian habitat along the Upper Fens Pond. Monitoring of areas restored during Phase 1 indicates that the created and restored riparian habitat supports a diverse plant community (USACE, 2017, 2018). The community is free from invasive species and has been planted or seeded with many species with good wildlife habitat value, including shrubs and herbs used by pollinators. Riparian habitat restored during Phase 2 should have similar beneficial attributes.

The Phase 2 restored riparian habitat will be established on clean surface soils, which should have lower contaminant levels than are typical of urban soils. This should benefit the soil invertebrate community and wildlife which prey on soil invertebrates.

5.0 Invasives Management

5.1 Introduction

Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although some varieties of *Phragmites* are native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). *Phragmites* varieties occurring in the Muddy River were studied by Keller (2000).

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Additional *Phragmites* is present along embankments up to several ft. above the above the normal water elevation. *Phragmites* growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. *Phragmites* aboveground live standing crop near Park Drive in October, 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for *Phragmites* in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Some stands previous mapped by CDM (2001) and the USACE (2003) have disappeared, most notably upstream of the Footbridge. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

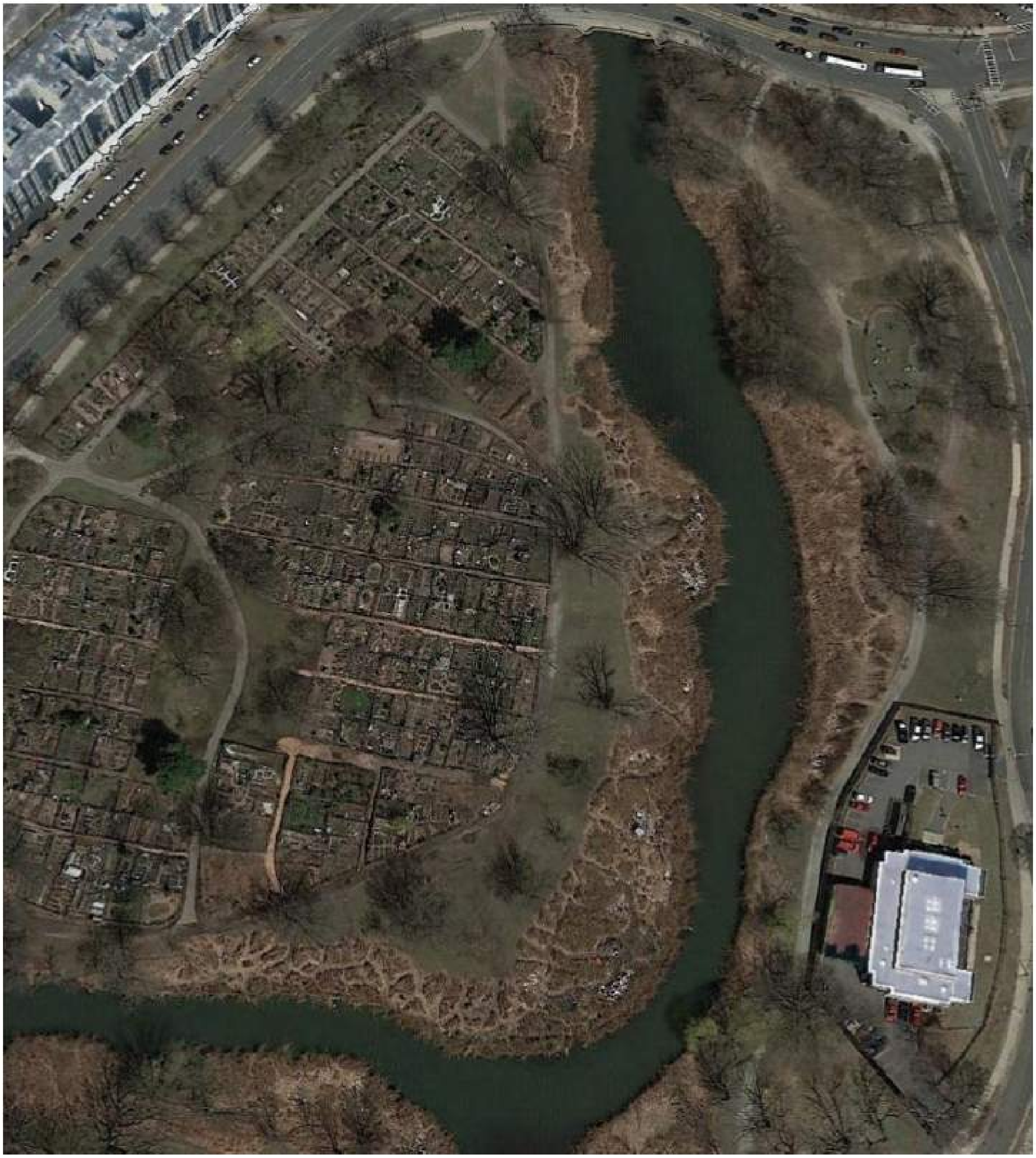
Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increase temperatures and nutrient concentrations and algal blooms.

5.2 Construction Phase – Invasives Management

In areas impacted by Phase 2 construction, invasives will be addressed through the dredging and removal activities discussed above. However, restored habitat will be vulnerable to colonization by invasive species present in adjacent areas. Reused or imported topsoil may also contain viable seeds of invasive species. Primary invasive species of concern include Norway maple, Tree of Heaven, European buckthorn, Oriental bittersweet, Japanese knotweed, Phragmites, and purple loosestrife. Colonization of other plant species classified as “invasive” by the Massachusetts Invasive Plant Advisory Group may also occur.

All invasive plant species will be controlled in restored areas during the 2-year establishment and monitoring period. Over the long term an Operation and Maintenance Manual will discuss invasive species management. Because *Phragmites* can readily spread by seed and will remain in the Riverway and Back Bay Fens proximal to the project area, annual monitoring and control efforts are required. USACE recommends zero tolerance for *Phragmites* in all restored areas to ensure the ecological and flood conveyance benefits are maintained.

An invasive plant species control plan will be developed by the contractor and approved by the USACE in accordance with the Specifications. The plan will rely on frequent meander surveys through restored areas to detect invasive species and the controlled use of herbicide when hand pulling would not be an effective control method. All herbicide use will be in accordance with label instructions, state and federal law, and the Order of Conditions received from the Boston



and Brookline Conservation Commissions. Herbicides will be applied by Massachusetts certified herbicide applicators.

Figure 2 Phragmites

5.3 Invasives Management – Pilot Program

With conditions favorable for continued expansion of Phragmites into the completed work areas throughout much of the Riverway and Back Bay Fens areas it is critical to develop a landscape rehabilitation invasives management plan to address areas of the work outside the limits of the USACE Phase 1 and Phase 2 projects. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth.

In addition to the Phase 2 work proposed by the USACE, the City of Boston has also submitted a Notice of Intent to the Boston Conservation Commission to allow for a pilot project involving low impact invasives management. This low impact project will include mowing of phragmites and over-seeding with a wetlands seed mix. The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River. This work is also being proposed as an Ecological Restoration Limited Project consistent with the eligibility criteria and the interests of the WPA.

The proposed work under this Notice of Intent will include:

- Landscape Rehabilitation outside of the USACE Phase 2 work area:
- Low impact mowing of phragmites and seeding of bordering vegetated wetland and bank with New England wetland seed mix;
- Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):
- Low impact mowing of phragmites and seeding of bordering vegetated wetland and bank with New England wetland seed mix;
- Long-Term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

6.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

6.1 General Eligibility

The Project is an Ecological Restoration Project as defined in 310 CMR 10.04, eligible as a Flood Control and Invasive Species Management Project. The Project will further the following WPA interests:

- Flood Control – The Phase 2 Project will excavate and deepen portions of the Muddy River to allow for increased flow and achieve and maintain flood damage protection.

- Storm damage prevention – By excavating and deepening the Muddy River, increased flow will be allowed to pass through the river, preventing future flooding and storm damage.

6.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

6.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries (DMF)

The Commonwealth of Massachusetts DMF has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

6.4 Water Quality Certification

The Project involves dredging over 100 cubic yards, therefore, the USACE has submitted a Water Quality Certification Application, included in Appendix B.

6.5 Ecological Benefits

In addition to furthering the WPA interests of flood control and storm damage prevention, the Project will provide significant ecological benefits, as described in Section 4 of this Narrative.

6.5.1 Streamflow

The Phase 2 project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

6.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Phase 2 project will restore former open water habitat by removing phragmites, mudflats, sand islands, and deepening existing open water habitat. The water quality benefits are described in detail in Section 4 of this Narrative.

6.5.3 Riprarian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The wetland vegetation in dredged areas by seeding and planting where appropriate. The plant community diversity is expected to be much higher in restored wetlands.

6.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Project area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

6.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 to ensure that the restoration and improvement of the natural capacity of a Resource Area and furthers the WPA interest for Other Ecological Restoration Projects, including:

- Fill removal and re-grading
- Invasive species management

7.0 Required Actions

7.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix D.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project in February of 2005 and received a Certificate on April 1, 2005. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

7.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Phase 2 Project Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Phase 2 Project Area.

7.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Phase 2 Project Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

7.4 Division of Marine Fisheries

The proposed Phase 2 project does not occur within a coastal waterbody.

7.5 Division of Fisheries and Wildlife

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

7.6 MassDEP Water Quality Certification

The USACE has submitted a Water Quality Certification Application to MassDEP for the Phase 2 Project. A copy of the application is included in Appendix B. When USACE receives a Water Quality Certificate, a copy will be provided to the Boston Conservation Commission.

7.7 MassDEP Wetlands Restriction Order

The Phase 2 Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

7.8 Department of Conservation and Recreation

7.8.1 Office of Dam Safety

The Phase 2 project does not include work on a dam.

7.8.2 Areas of Critical Environmental Concern (ACECs)

The Phase 2 Project area is not in an ACEC.

APPENDIX B

Water Quality Certification Application by U.S. Army Corps of Engineers (USACE)

401 Water Quality Certification Application

Muddy River Flood Damage Reduction Project
Phase 2

October 2018

US Army Corps
of Engineers ®
New England District

401 Water Quality Certification Application

Muddy River Flood Damage Reduction and Environmental Restoration Project Phase 2

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Form BRP WW 08

Form BRP WW 10

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Acronyms and Abbreviations	
BGH	Boston Gatehouse
BMP	Best Management Practice
BWSC	Boston water and Sewer Commission
CDM	Camp Dresser and McKee
cfs	Cubic foot per second
Corps	U.S. Army Corps of Engineers
CSO	Combined Sewer Overflow
cy	Cubic yard
D.A.	Drainage Area
DO	Dissolved Oxygen
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DBH	Diameter at Breast Height
EMC	Event Mean Concentration
FEMA	Federal Emergency Management Agency
Ft	Foot or feet
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability index
HU	Habitat Unit
MADEP	Massachusetts Department of Environmental Protection
MA NHESP	MA Natural Heritage and Endangered Species Program
MBTA	Massachusetts Bay Transit Authority
MDC	Metropolitan District Commission
mg	Milligram
Mg/l	Milligram per liter
MWRA	Massachusetts Water Resources Authority
NAVD88	North American Vertical Datum of 1988
NED	National Economic Development (plan)
NER	National Ecosystem Restoration (plan)
NPDES	National Pollutant Discharge Elimination System
PEC	Probable Effects Concentration
PCB	Polychlorinated Biphenyl
SPF	Standard Project Flood
SOD	Sediment Oxygen Demand
TCLP	Toxic Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1.0 Introduction

The U.S. Army Corps of Engineers-New England District (USACE) is proposing to construct Phase 2 of the Muddy River Flood Damage Reduction Project, in Boston and Brookline, Massachusetts. The Muddy River is a 3.5 mile long urban waterway with a 5.6 square mile drainage area situated in the greater Boston metropolitan area (Figure 1-1). The Muddy River originates at Jamaica Pond and flows in a general northeasterly direction through mainly Boston and Brookline to its confluence with the Charles River. The upper watershed is primarily residential with some commercial areas, while the lower watershed is characterized by high-density residential, institutional and commercial development. The river flows through the heart of Frederick Law Olmsted's famed "Emerald Necklace", one of the most carefully crafted park systems in America. Due to the historic significance of the park system, it is listed on the National Register of Historic Places.

Flooding, degraded riverine habitats, poor water quality, and other related water resource problems resulted in several studies of the river. In 1989, the Commonwealth of Massachusetts completed the Emerald Necklace Parks Master Plan which identified the need for environmental restoration and correction of potential flooding problems (MA DEM, 1989). After a flood in October 1996 which resulted in over $60 million in damages along and adjacent to the Muddy River, the Emerald Necklace Master Plan was updated in April 2001 (Pressley, 2001). Specific recommendations of the 2001 Master Plan include dredging the Muddy River system from Wards Pond to the Charles River Basin, increasing the channel capacity and removing flow restrictions, stabilizing riverbanks, removing invasive vegetation and rehabilitating the historic landscape.

A Draft Environmental Impact Report (EIR) for the first phase of the Master Plan, “Phase I Muddy River Flood Control, Water Quality, Habitat Enhancement, and Historic Preservation” was prepared pursuant to the Massachusetts Environmental Protection Act in 2002. The Final EIR and Supplemental Final EIR were completed, respectively, in 2003 and 2005. The Phase I EIR identified actions to reduce potential flood damages, improve water quality and aquatic/riparian habitat within the Muddy River, rehabilitate the historic landscape, and enhance recreational uses of adjacent parklands. A request for project change was approved in March of 2008. A second request for a project change is in preparation.

The Water Resources Development Act of 1999 (WRDA 1999) authorized the USACE to evaluate the plan outlined in an Environmental Notification Form (ENF) prepared by Boston to determine whether proposed improvements were cost effective, technically sound, environmentally acceptable, and in the Federal interest. A USACE Draft Evaluation Report, completed in June 2000, determined that the City’s Phase I Muddy River Master Plan met some of the requirements of a Federal project. However, continued involvement by the USACE would require preparation of a decision document that evaluates alternatives, identifies the plan that maximizes national economic development (NED) and national ecosystem restoration (NER) benefits, and satisfies the requirements of the National Environmental Policy Act (NEPA). Continued involvement by the USACE was provided in Section 522 of the Water Resources Development Act of 2000 (WRDA 2000). This Act authorized the Secretary “to carry out the project for flood damage reduction and environmental restoration, Muddy River, Brookline and Boston, Massachusetts, substantially in accordance with the plans, and subject to the conditions, described in the draft evaluation report of the New England District Engineer entitled “Phase I Muddy River Master Plan”, dated June 2000.” Initial funding to continue evaluation of the Muddy River was provided in the Fiscal Year 2001 Energy and Water Development Appropriations Act.

Congressional authorization required the preparation of a Decision Document (DD) that evaluated alternative solutions to identify flood control and ecosystem restoration needs, selected and recommended a plan based on economic, environmental, and public acceptability criteria, and demonstrated a Federal and non-Federal interest in proceeding to the project implementation phase.

The final USACE Muddy River Decision Document (dated September 2003) built upon the Master Plan and evaluated the flooding and environmental restoration problems and needs of this 3.5-mile long urban waterway. Evaluation of these concerns and development of alternative measures resulted in a comprehensive solution that was acceptable to the study sponsors. Major features of this recommended plan include:

1) Daylighting two sections of the Muddy River that are presently in culverts;
2) Sediment excavation for flood damage reduction in the Back Bay Fens, Charlesgate section of the Muddy River Riverway, and Leverett Pond;
3) Additional sediment removal in the Fens, Riverway, and Willow, and Wards Ponds for environmental restoration;
4) Eradication of *Phragmites* by excavation and herbicides for habitat restoration;
5) Flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens;
6) Preservation and restoration of the historic park shoreline and vegetation in construction areas.

Note: Restoration of the Charlesgate section of the Muddy River for flood flow conveyance was completed by the City of Boston in 2005.

USACE forwarded the Decision Document to the Assistant Secretary of the Army for Civil Works (ASA (CW)), recommending Federal participation in both the flood control and environmental restoration portions of the plan. After review, the ASA (CW) supported the flood control aspects of the project, but due to the high cost per acre for restoration, determined that stand-alone ecosystem restoration features were not justified. Given this determination, design focused on flood risk management (FRM) elements of the 2003 Decision Document. Despite this constraint, construction of the approved Phase 1 and Phase 2 flood control project will have significant ancillary environmental benefits, including restoration of open water, wetland, and riparian habitat, improved sediment and water quality, and enhanced anadromous fish passage.

Construction of the approved federal FRM project required the expertise of two different types of contractors. For this reason, the design and implementation of the project was conducted in two separate phases. The first phase consisted of the major structural features of the flood control improvements by daylighting two sections (about 700 linear feet) of the Muddy River, and sediment removal from the Upper Fens Pond. The second phase consists of removal of sediment for flow conveyance in the Fens, Riverway, and Leverett Pond.

Major elements of Phase 1 and 2 are described below:

Phase 1

- Construct 10’ by 24’ concrete culverts under both the Riverway and Brookline Avenue.
- Remove existing twin 72” pipes in the Old Sears Parking Lot and daylight the river in this area.
- Remove existing twin 72” pipes in Brookline Avenue jug handle area and in the area just upstream of Avenue Louis Pasteur culvert. Daylight the river in these two areas.
- Reconstruct culvert opening at upstream end of Avenue Louis Pasteur culvert.
- Dredge and reshape the Upper Fens Pond section of the river to allow for increased flow.
- Installation of temporary flow restriction structure upstream of the Back Bay Fens.
- Landscaping with trees, shrubs, and emergent plantings.
- Installation of habitat logs and boulders for fish and turtles.
- Post construction vegetation monitoring and invasive species control during the two year establishment period.

Phase 2

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.
- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Excavate deepened channel sections to delay need for maintenance dredging.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Eradicate *Phragmites* in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where *Phragmites* or Japanese knotweed are eradicated by planting grass, trees and shrubs.
- Installation of habitat logs for fish and turtles.
- Removal of the temporary flow restriction structure upstream of the Back Bay Fens.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

The Phase 2 work areas are shown on Figures 1-2, 1-3, and 1-4.

Construction of Phase 1 began in 2013 and was substantially completed in August of 2016 (Figure 1-5). Monitoring and adaptive maintenance of vegetation established during Phase 1 by USACE will continue through the fall of 2018.

The project will be returned to the non-Federal sponsors at the completion of construction for both Phase 1 and Phase 2 work. Long-term operation and maintenance of the Federal project is the responsibility of the non-federal sponsors pursuant to an Operation and Maintenance Plan prepared by USACE. Operation and maintenance of the Phase 1 portion of the project will be turned over to the non-Federal sponsors in November 2018.

Following dredging, sediment will gradually begin to re-accumulate as a result of loading of inorganic or organic matter from storm drains and non-point runoff (this rate will be reduced by BMPs currently underway by municipal governments and supported by improved conditions along the DCR parkways abutting the parks and waterway), organic matter from riparian and wetland vegetation and organic matter produced by algae and aquatic plants. With best management practices in place, sediment depths will not reach existing depths for at least 50 years in Leverett Pond and the Riverway. In the Back Bay Fens, existing depths may be reached within 30 years.

The 2005 Supplemental Final EIR includes a plan for stormwater management with the goal of decreasing sediment loading in the river by 30 percent relative to a year 2000 baseline. The Non-federal sponsors are required to implement various source control and treatment control Best Management Practices (BMPs), and annually report on the status of the stormwater BMP program.

The Secretary of the Executive Office of Environmental Affairs created an independent public oversight committee to ensure public participation, protect the public investment, and provide independent oversight of the maintenance and management of the park system after the completion of the Project. This oversight body is known as the Maintenance and Management Oversight Committee (MMOC).

2.0 Existing Environment

This section contains a baseline description of environmental resources of the study area. Information was obtained from previous studies of the Muddy River, including USACE (1992, 1998, 2003, 2014), MDWPC (1976), C.E. Maguire (1977), Metcalf and Eddy (1990), USGS (1997), Pressley Associates (2001), and CDM (2001, 2003, 2005).

2.1 General Description of the Study Area

The Muddy River is a small tributary of the Charles River located within the cities of Boston, Brookline and Newton. The river channel forms the boundary between Boston and Brookline for almost its entire length. It originates at Jamaica Pond (a 68-acre spring-fed "kettle" pond) flowing north through a series of ponds (Wards Pond, Willow Pond, Leverett Pond, and the Back Bay Fens) for approximately 2.9 miles before entering the Charles River Basin. The reach between Leverett Pond and the Back Bay Fens is known as the “Riverway”. Prior to construction of the original Charles River Dam (ca. 1910) the lower Charles River and the Muddy River (upstream to Leverett Pond) were tidally influenced. The Muddy River watershed has a drainage area of 5.6 square miles. Approximately 70 percent of the watershed is developed.

The USACE 2003 study area included elements of the historic park system that is known as the Emerald Necklace. The Emerald Necklace consists of a series of parks that was planned by Frederick Law Olmsted to extend from the Boston Public Gardens and along Commonwealth Avenue, encompassing the Muddy River through the Arnold Arboretum and Franklin Park and culminating at Castle Island. Elements of the park system in the Muddy River include:

- Charlesgate
- Back Bay Fens
- Riverway
- Olmsted Park (Leverett Pond, Willow Pond, and Wards Pond)
- Jamaica Pond

The Emerald Necklace and its components are listed on the National Register of Historic Places and located near several other districts, individual structures, and institutions that also are listed on the National Register in addition to being designated as landmarks by the Boston Landmarks Commission.

Phase 2 of the project involves work in Leverett Pond, the Riverway and the Back Bay Fens. Descriptions of these areas are provided below.

Leverett Pond

Leverett Pond is a shallow 7-acre pond with a maximum depth of about 5 to 6 feet. It is located in the Olmsted Park portion of the Emerald Necklace. The pond receives inflow from Willow Pond via Babbling Brook, the Daisy Field and Village Brook drains, and numerous smaller storm drains. Material discharged from Village Brook Drain has formed an extensive shoal area and a small island at the northern end of the pond (Photograph 1). The pond has been dredged at least three times since the late 1800’s, including 1963 when the entire pond was reportedly dredged. Leverett Pond is bordered with grassed and wooded parkland and has walkways along its shoreline. The shore near the Village Brook outlet is protected by gabion baskets.

Phase 2 includes removal of sediment and the sand island in the vicinity of the Village Brook Drain. As part of this work, which differs from previous dredging efforts, a deepened channel section will be constructed in Leverett Pond to extend the period between dredging and to ensure flood flows pass through the area.

Riverway Section of Muddy River

The Riverway section of the Muddy River flows north from Leverett Pond for about 1 mile to Park Drive. Width of river ranges from about 20 to 120 ft., and averages about 40 feet. Water surface area is about 6.5 acres. Mean depth is about 1.5 feet, and maximum depth is 6.5 ft. based on a 1997 USGS survey. Flow is sluggish and elevation through the reach drops only about six inches. Outflow is also influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam. The historic downstream boundary was located at Brookline Avenue, before a 350 ft. segment was filled for construction of the Sears parking lot. The filled section was daylighted during Phase 1, and the Riverway now ends at the newly installed 10' by 24' culvert under Park Drive. A temporary flow restriction control structure (FRCS) is located a short distance upstream of the culvert (Photographs 2 and 3). The FRCS will be removed during Phase 2.

The "Riverway" comprises a linear park along both sides of the Muddy River and consists of a maintained grassy parkland with paved and unpaved paths, and a mixture of mature Olmsted-planted trees, and younger volunteer trees and shrubs (Photographs 4 and 5).

The Massachusetts Department of Conservation and Recreation (MA DCR) maintained Riverway runs parallel along the River's east side (Boston) with the Massachusetts Bay Transportation Authority (MBTA) Green Line tracks running along the west side (Brookline) until Netherlands Road where local Brookline streets are encountered. Riparian vegetation is well developed along some sections of the river. In others, turf with some tree cover is often maintained nearly to the river's edge. The Riverway contains three islands along its length, all designed by Olmsted. The largest, Riverwalk Island, is accessible by footbridge.

The Riverway contains a number of stormwater outfalls (Photograph 6). The largest are Huntington Avenue Drain, which discharges on the Boston side of the Muddy River, and Tannery Brook Drain, and the Longwood Avenue Drain, both of which are located in Brookline.

Considerable lengths of the bank are either eroding and/or being undercut by stormwater runoff and river flow (Photograph 7). The channel is protected by riprap immediately downstream of the Route 9 Bridge. The Town of Brookline has recently installed coir fiber rolls to control bank erosion downstream of the Longwood Avenue Bridge (Photograph 8).

Many areas of the Riverway have shoaled significantly since it was last dredged in 1963. Sediments from storm drains, accumulation of poorly decomposed organic material, encroachment by *Phragmites,* and streambank erosion all contribute to the problem. The channel is completely or nearly completely blocked by *Phragmites* in several areas, including upstream of Park Drive near the flow restriction control structure and at the Riverwalk Island.

Five areas with flow restrictions due to shoaling and sedimentation are proposed for excavation during Phase 2 (Photographs 9 - 14). Deepened channel sections will also be constructed in three of five areas to reduce the frequency of maintenance dredging and facilitate sediment removal.

Back Bay Fens

The Back Bay Fens (or Fens) is a series of shallow ponds located between the Riverway and the

Charlesgate section of the Muddy River. The Fens is all that remains of the 750-acre Back Bay of the Charles River which was filled in the mid-nineteenth century. The area was modified by Olmsted in the 1890's to become part of the Emerald Necklace. The Fens, as envisioned by Olmsted, has been greatly altered over the last century. The area was a tidal marsh until about 1910 when a dam created the Charles River Basin and all but eliminated tidal influence. Various other endeavors encroached upon open water and intruded on parklands through the 1970's.

The total existing water surface area of the Fens today is about 20 acres, including 1.6 acres restored by daylighting of the river during Phase 1. This area includes about 7 acres of emergent wetland, most of which is vegetated with *Phragmites*. Water depth generally ranges from 2 to 4 feet. The Muddy River flows from the lower fens to the Charlesgate section of the river, where it enters the Charles River Basin through a submerged conduit. Flow is sluggish and the water level is influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam.

Historic aerial imagery indicates most of the emergent *Phragmites* wetland has developed since 1951 (Figure 2-1). *Phragmites* is discussed in more detail in Section 2.6.4.

The Back Bay Fens is surrounded by park land. Public facilities near the river include the Victory Gardens, Boston Fire Department Fire Control Center, Mothers Rest Playground, athletic fields, the Agassiz Road (Longfellow) Duck House, the Kelleher Rose garden, Veterans Memorial Park, several monuments or memorials, and walking and biking paths. Parkland restored during Phase 1 is known as the Justine Mee Liff Park.

The area is near many institutions, including the Museum of Fine Arts (Boston), Emmanuel College, Simmons College, Isabella Stewart Gardner Museum, Massachusetts College of Art and Design, Wentworth Institute of Technology, Northeastern University, the Berklee Conservatory, and Fenway Park.

A great deal of sediment has accumulated in the Fens. A main source of the sediment is the Stony Brook Combined Sewer Overflow (CSO) which enters the Fens at the Boston Gatehouse. The Fens also receives stormwater from the Emmanuel College storm drain and several smaller storm drains. Approximately 10,000 cubic yards of sediment discharged from the CSO was dredged by the Metropolitan District Commission (MDC) in 1978. A recent Massachusetts Institute of Technology/Sea Grant hydrographic study of the Charles River Basin found that sediment discharged from the Muddy River has formed an underwater mound in the Charles River Basin (see: http://seagrant.mit.edu/charleschart/).

Prior to construction of Phase 1, the Back Bay Fens included two sections where the original river channel was filled and the river piped through twin 6-ft. diameter culverts. These areas were located under the former Sears parking lot adjacent to the Landmark Center and between the former Upper Fens Pond and the Avenue de Louis Pasteur Bridge. Phase 1 removed the 6-ft. diameter culverts and restored about 800 ft. of river, an island, and associated parkland and riparian habitat. The restored river flows through 10 x 24 ft. culverts at Park Drive and Brookline Avenue. Phase 1 also removed several thousand cubic yards of sediment from the Upper Fens Pond and sediment in the stone arch culvert under the Avenue de Louis Pasteur Bridge. Banks in daylighted and restored areas were protected with stone and geocells planted with historic plantings.

Several shallow water "shelves" were installed along the banks and planted with emergent vegetation under the Phase 1 project. Created and restored riparian habitat was planted with shrubs, trees, and ferns according to a plan developed by a historic landscape architect, consistent with Olmsted's vision and species pallet.

Photographs 15 through 20 show existing conditions in Back Bay Fens Phase 2 work areas. Areas restored during Phase 1 are shown in Photographs 21 through 28.

2.2 Climatology

General. The Muddy River watershed has a variable climate characterized by frequent but usually short periods of precipitation. The basin lies in the path of a weather pattern known as the "prevailing westerlies" which often include cyclonic disturbances that cross the country from the west or southwest. It is also exposed to occasional coastal storms that travel up the Atlantic seaboard in the form of hurricanes of tropical origin and storms of extratropical nature, often called "nor'easters." Coastal storms are often the cause of flood-producing short-duration high intensity rainfall. Intense thunderstorms, either of local origin or associated with frontal systems, also occur during the summer months.

Temperature. Average monthly temperature in the Boston area varies from about 72 degrees F in July to near 20 degrees in January with an average annual temperature of about 51 degrees. Extremes in temperature range from a high of over 100 degrees to lows near minus 20 degrees.

Precipitation. The mean annual precipitation at Boston is 41.5 inches. At Blue Hills Reservation, about 10 miles southeast of the Muddy River watershed, the average annual precipitation is 47.2 inches. This station is located on a hill at elevation 628 ft. NAVD88.

Snow Fall and Snow Cover. The mean annual snowfall as recorded at Logan airport in Boston is 43 inches occurring mostly during December through March. There are no snow surveys available for the Muddy River but based on data recorded by the USACE within the inland Blackstone River watershed, it is estimated that the average water equivalent of the snow cover is in the 2 to 4 inch range normally reaching its maximum in early March. Snowmelt in combination with rainfall runoff can add to flooding in the Muddy River watershed, but snowmelt alone is seldom the cause of a flood.

2.3 Hydrology and Flood History

2.3.1 Watershed Description

a. General. The Muddy River watershed (drainage area (DA) approximately = 5.6 square miles), a tributary of the Charles River (DA = 309 square miles), is located within the communities of Boston, Brookline, and Newton. It originates at Jamaica Pond (a 68-acre spring and minor tributary fed "kettle" pond) and flows north for about 3 miles through a series of small ponds, the Riverway and Back Bay Fens to the Charles River.

The elevations in the Muddy River Basin range from approximately 290 ft. above North American Vertical Datum 1988 (NAVD88) in the western part of the basin in Newton to slightly under 10 ft. NAVD88 at the confluence of the Muddy River with the Charles River in Boston. There are small hills scattered throughout the upper basin with flat lands prevailing in the filled-in Back Bay portion of Boston. The basin is heavily urbanized.

b. Muddy River. The Muddy River loses 20 ft. in elevation in approximately 500 ft. of length between Jamaica Pond and Ward Pond. From Wards Pond, the river flows north as a small meandering stream to Willow Pond, a one-acre shallow pond. The drop is approximately 30 ft. in a distance of approximately 1,400 feet. The outlet from Willow Pond is a culvert which surfaces just above Leveret Pond. The river drops approximately 9 ft. in the 400-foot length between the ponds. Leverett Pond is a shallow (approximately 3 to 4 ft. deep during dry weather conditions), oblong, 12.8-acre pond surrounded by park land. Two moderately-sized drains contributing flow to the upper portion of the pond include Chestnut Street (which discharges to Willow Pond) and Daisy Field Drains. The largest tributary of the river (3.65 sq. mi.), draining over half the area above the Riverway, is the Village Brook Drain. This drain enters Leverett Pond from the northwest just upstream of the pond's outlet. Sediment discharged from the drain has formed a small island near the outlet.

From Leverett Pond, the Riverway section of the Muddy River flows north under Route 9 and under Brookline Avenue, continuing through park land and running parallel to the Riverway (roadway) and MBTA green line until it reaches Park Drive near the Landmark Center. The river generally ranges from about 15 to 30 ft. wide, with depths ranging from about 1 to 4 ft. Extensive areas of mudflat are present under normal flow conditions in several locations and in several locations the river channel is blocked or nearly blocked with *Phragmites*. The left channel at Riverwalk island is entirely blocked. Three large storm drains enter within this reach, the Huntington Avenue, Tannery Brook, and Longwood Avenue drains. At Park Drive, the river flows through 10x 24 ft. culvert installed during Phase 1 and enters the Back Bay Fens.

c. Muddy River Conduit and Brookline Avenue Gatehouse. The present function of the gated structure within the gatehouse is to divert flood flows of the Muddy River into the Muddy River Conduit which runs under Brookline Avenue, continuing under Kenmore Square to Deerfield Street, and eventually to the Charles River. The Brookline Avenue Gate House has been equipped with a new 92" x 78" gate (installed in 1995) so that during high flow conditions, the gate is overtopped and a portion of the flows is diverted through the Muddy River Conduit directly to the Charles River. Connection of the Muddy River to the Brookline Avenue gatehouse will be maintained with the proposed flood damage reduction improvements reported herein. The Brookline Avenue Gatehouse is connected to the Muddy River via the existing two 6-foot diameter conduits that were left in place during the Phase 1 construction.

d. Back Bay Fens. After the Muddy River Conduit and the new Brookline Avenue culvert constructed under Phase 1, the Muddy River enters the Upper Fens Pond and its new daylighted section upstream of Avenue Louis Pasteur. The Back Bay Fens is approximately 1.5 miles long and discharges to the Charles River just above the Massachusetts Avenue Bridge at the Charlesgate interchange. The total water surface area of the fens is about 20 acres, excluding about 7 acres of fringing emergent wetland mostly vegetated with *Phragmites*. The Muddy River enters the Charles River Basin, approximately 2.2 miles upstream from the Charles River Dam. During dry weather, the water level in the Fens fluctuates daily as a result of the MA DCR operation of the Charles River Dam. The daily fluctuations are often evident at the United States Geological Survey (USGS) gage near Netherlands Avenue Bridge in the Riverway.

e. Stony Brook Conduit. The Stony Brook Conduit collects flows from West Roxbury and Hyde Park and conveys them through Jamaica Plain into the Fenway area where it discharges into the Charles River at the Charlesgate Gate House located at the Charlesgate interchange of Storrow Drive. During times of significant wet weather, a combined sewage overflow from the Stony Brook Conduit can occur into the Muddy River at the Fens Pond at Boston Gate House No. 1 or at the Fens gate house into the Charles River. The overflow at Boston Gate House No. 1 is the result of water flowing over four 8-foot wide gates. Two of these gates are motorized to allow for more responsive opening. Recent estimates indicate overflows occur at Gate House No. 1 approximately twice per year.

f. Charles River Basin. Flows within the Charles River Basin are generally eastward from the Watertown Dam, Watertown, at river mile 9.8, through parts of Newton, Cambridge, and Boston to the present Charles River Dam, Boston, at river mile 0.8. The basin was a tidal estuary until a dam was constructed at Leverett Street in 1910. This dam was located approximately 0.4 mile upstream from the present dam. The primary objectives of the original dam were to create a fresh water pool eliminating the extensive mud flats and noxious odor at low tide, to protect the low areas in Boston and Cambridge from high tides, and to maintain a fairly constant basin level to stabilize the groundwater table in the adjacent areas. In addition to the old dam, marginal combined sewage conduits were constructed along both the Boston and Cambridge riverbanks to reduce the pollution in the basin by carrying sewage directly to the harbor.

The total contributing drainage area of the Charles River Basin is about 309 square miles. This drainage area can be divided into two distinct hydrologic areas. The upper Charles River has a drainage area of 251 square miles and is characterized by numerous natural storage areas which result in considerable flood storage and sluggish runoff. The lower basin has a local drainage area of 58 square miles and is almost totally urbanized. The current Charles River Dam was constructed in 1978 to provide for dependable flood protection of low-lying urban areas adjacent to the basin during major coincident fresh-water and/or tidal events. Major flood control components of the dam are 6 flood control pumps which have a total capacity of 8,400 cfs when pumping against 9 ft. of static head. In addition to this pumping capacity, the dam has two sluiceways and a boat lock system, which can be operated at low tide to release significant flow by gravity drainage.

2.3.2 Streamflow Records

A river stage gage was installed by the USGS in 1999. This gage is located 20 ft. downstream of Netherlands Road and records river stages at a location upstream of the Riverway. This gage aids in decision making for installation of the stoplog structure at the portal entrance along the MBTA "D" line. This structure is installed when high flood levels threaten the MBTA track and portal.

2.3.3 Historic Floods

a. General. Records of floods on the Muddy River (and lower Charles River watershed) prior to 1900 are meager. From available information, the largest flood prior to 1900 occurred in February 1886. Other noteworthy floods occurred in 1807 and 1818. Some major floods that have been experienced relatively recently, and would be considered more representative of today's conditions, which occurred in August 1955, October 1962, March 1968, and the most recent October 1996 and June 1998. The largest of these floods was by far the August 1955 event. This flood was the result of rainfall associated with Hurricane Diane. The total rainfall for this event (as recorded at Logan airport) was 11.9 inches with the peak hourly rainfall of 1.42 inches. The October 1962 event was the result of about 8 inches of rainfall in a 2-day period with a maximum 1 hour rainfall of about 0.6 inches. Both of these events resulted in extensive flooding along the Muddy River.

b. Recent Floods. Since installation of the USGS gage in 1999 there have been two significant floods, with flood stage defined as a gage elevation greater than 15 ft. Flood crests during this period are 16.63 ft. on December 10, 2014 and 15.41 ft. on March 15, 2010. The river also approached flood stage on October 16, 2005 when the river crested at 12.99 ft.

c. Design Flood. The design flood occurred as a result of heavy rainfall from a coastal storm that occurred on October 20-21, 1996. This storm produced the highest levels along the Muddy River since the record 1955 event. Rainfall totals ranged from 7.9 inches at Logan to 8.5 inches at Blue Hill, and over 10 inches at Reading, about 15 miles north of Boston. This flood resulted in extensive flooding along the Muddy River and Stony Brook. Flood water escaped the Muddy River above the Riverway, flowed down the MBTA rail tracks, through the MBTA tunnel portal and flooded the Kenmore Square station resulting in major flood damages and loss of Green Line services for an extensive period of time.

2.3.4 Hydrologic Analysis of Floods

a. General. Extensive past analyses of floods have been conducted for the Muddy River. Many of these studies were conducted by the engineering firm Camp Dresser & McKee (CDM) for USACE, City of Boston, and others. Since most (or all) of the tributary streams to the Muddy River, as well as sections of the Muddy River itself, are enclosed in pipes and conduits, the adopted analysis tool was the SWMM computer model. Hydrology of the Muddy River was developed using the RUNOFF block in SWMM, which produces flood hydrographs which are then input to the

EXTRAN model which is used to simulate the hydraulics of open channels and closed pipes and conduits. In addition to analysis of the Muddy River, CDM has analyzed the larger Stony Brook as part of flooding and CSO abatement studies conducted for others. As part of these studies, CDM has made estimates of overflows from Stony Brook to the Muddy River through Boston Gate House No. 1.

b. Effects of Improvements. A series of historic and synthetic storm events were analyzed in the development and calibration of the SWMM and other hydraulic models. The main event analyzed and used for model calibration was the October 1996 flood which is also the design event. Results of these simulations as well as past USACE of Engineers rainfall runoff and hydraulic routings for the with-project condition were reviewed and summarized (Table 2-1). Numerous other events were analyzed ranging from the 2-year event up to and including the Standard Project Flood (SPF). The hydraulic effect of the new structures and channel improvements, in general, is to reduce flooding by increasing floodplain storage and flood discharges. It is noted that the effect of the new conveyance structures at the Riverway and Brookline Avenue is to reduce flood levels above the Riverway and release more flows into the Fens. Therefore as part of the comprehensive flood reduction plan, a flood reduction channel is needed through the Fens to Boylston Street. This channel will help mitigate the increase in flood discharges, however there will be an increase in flood stages through the Fens.

Table 2-1: Muddy River Peak Discharges with Project Condition

Location	Oct 1996 Flood (cfs)	100 Year Flood (cfs)
D/S BGH #1*	2000	2500
U/S BGH #1	1100	1850

** BGH #1 is Boston Gate House No. 1*

2.3.5 Water Surface Profiles

a. Original Hydrologic Engineering Center-River Analysis System (HEC-RAS) Model.

Pre-project October 1996, 100-year and post-project October 1996 and 100-year flood profiles are shown on Figures 2-2 and 2-3. These profiles were computed by inputting pre- and post-discharges, as determined from the various computer modeling efforts, into a HEC RAS computer model. River cross-sectional input to the model was determined from 2006 river surveys as part of these design efforts. The HEC-RAS model was calibrated by estimating the experienced October 1996 flood discharges and comparing the computed profiles to surveyed high water marks. Mannings "n" coefficients ranged from 0.030 - 0.035 for the channel to 0.07 for overbanks. Note that the computed flood elevations in the lower Fens are considerably lower than the surveyed high water marks. This is due to the dredging that has been accomplished (since the occurrence of the 1996 event) from the Storrow Drive culvert to upstream of Ipswich Street. This dredging has had a significant effect on Muddy River flood stages in the lower Fens. Once the model was calibrated, the existing condition 100-year flood was analyzed by inputting the flood flows reported in Reference 2 and is shown on Figure 2-2. The with-project condition was analyzed by inputting the with-project flood discharges, the Riverway and Brookline Avenue structures, as well as the new open channels and dredged channel from downstream of Avenue Louis Pasteur to Charlesgate. The improved condition flood profiles for the October 1996 flood (design flood) and the 100-year improved condition profiles (with the October 1996 design) are shown on Figure 2-3. Comparison of flood profiles shows an increase in flood stages through the Back Bay Fens area. This area is mainly parkland with no increase in flood damages with the exception of the Boston Fire Department facility. This facility is located between Agassiz Road and Boylston Street and will need be flood-proofed with a low level (3.8 ft. high) ringed dike/wall.

b. Updated HEC-RAS Model.

In 2015, USACE ran an updated HEC-RAS model with improved topography from 2011 LIDAR and 2006 surveys, and the proposed Phase 2 improvements. The most recent version of HEC-RAS (3 August 2015) was used. It was run in the unsteady mode as that would give more accurate results than running it in the steady-flow mode, as was done with the original HEC-RAS model. Resulting water-surface profiles are shown on Figure 2-4 and are the same elevations or a little lower than the previous profiles in Figure 2-3.

2.3.6 Standard Project Flood

The flood damage reduction improvements for the Muddy River will not be designed to provide Standard Project Flood Protection (SPF); however, an SPF was hydrologically analyzed for comparison purposes and in compliance with ER 1110-2-1405, ETL 1110-2-230, and EC 1105-2-86. The Standard Project Flood Storm runoff was determined by applying Standard Project Storm rainfall to the developed SWMM computer model described earlier.

a. Rainfall. Standard Project Storm Rainfall for the Muddy River watershed was developed based on procedures presented in Civil Engineer Bulletin No. 52-8 and EM 1110-2-1411, "Standard Project Flood Determinations." The resulting SPS 24-hour rainfall was 12.06 inches.

b. Standard Project Flood Profiles. Standard Project Flood Profiles were computed by CDM (with the EXTRAN module of SWMM) for the with- and without-project condition. The results of these analyses show for the with-project condition, the SPF levels above the Riverway would be about four ft. lower than the SPF without the project. The SPF with-project condition would be about 2 ft. higher than the experienced October 1996 event with flood levels approaching overtopping of the Riverway or about 13 ft. NAVD88. The CDM analysis of the SPF (with October 1996 flood improvements) through the Fens shows elevations of about 10 ft. NAVD88.

c. Project Design Flood. Project design capacity is that required for a recurrence of the October 1996 event (approximately a 20-year event) as affected by the new conveyance structures at the Riverway and Brookline Avenue. In addition to the contributions from its various tributaries, the Muddy River also receives flow from Stony Brook which overflows into the Back Bay Fens during events such as October 1996. Estimates of this overflow have been included in the hydraulic modeling of the river. The model also includes flows from two storm drains under Brookline Avenue that originally discharged to the Muddy River conduit. As part of Phase 1 construction, these two drains have been redirected into a new constructed structure beneath Brookline Avenue which discharges the flows into the Muddy River inside the Brookline Avenue Culvert.

Rainfall records from Logan Airport during the August 1955 storm were used by CDM (2000) in their SWMM model to generate inflow hydrographs. These inflows were adjusted for use in the 2015 unsteady HEC-RAS model to simulate the design (20-year) and 100-year storms. For the design condition, the SWMM hydrographs were reduced to create an event that had peaks of 1,100 cfs upstream of the Riverway conduit and 2,000 cfs downstream of Boston Gatehouse No. 1. SWMM hydrographs were increased to simulate a 100-year event with peaks of 1,850 cfs upstream of the Riverway conduit and 2,500 cfs downstream of Boston Gatehouse No. 1.

2.3.7 Temporary Flow Restriction Control Structure

There was a need to provide a flow restriction after construction of the Phase 1 culverts such that flood flows higher than existing conditions are not discharged into the Fens prior to completion of the Phase 2 dredged channel that is be located downstream of these culverts. In 2015, a contractor for USACE installed a flow restriction control structure (FRCS) as part of Phase 1 construction. The structure is sheet pile dam with rectangular weir openings and stop logs located just upstream of the 10 x 24 Riverway culvert (Photographs 2 & 3). The structure maintains flow equivalent to the capacity of the former two 6 foot diameter culverts that conveyed flow to the Fens. The FRCS will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens.

2.4 Water Quality

2.4.1 Water Quality Classification

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP). Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality conditions within the Muddy River appear to have improved since 1986 when the Massachusetts DEP completed a water quality survey. However, the improvement has not been sufficient to meet state water quality classification criteria since waters of the Muddy River, with the exception of Jamaica Pond, still do not meet Class B standards. The most significant problem is high fecal coliform levels which can occur for the entire length below Jamaica Pond, followed in order by: low dissolved oxygen levels which occur regularly below the Route 9 bridge; high nutrient levels and associated excessive algal growth problems (significant variations in pH, DO, turbidity, etc,); high organic, metals, and trash releases from storm drain discharges; releases of organic acids, odors, and gasses from bottom sludges after DO has been depleted; and occasional accidental oil spills throughout the entire length. Waters also have occasional problems with floating debris and grease that form objectionable, aesthetic nuisances.

Many of the cross connections between sanitary sewers and combined sewers in the upstream portions of the Muddy River drainage system have been corrected and sewer separation work is continuing. Ongoing work by the BWSC and Brookline for sewer separation, the continuation of the Stony Brook Conduit Project, the implementation of the Boston Catch Basin Improvement Project, continuing effort to eliminate illegal cross connections, stormwater management programs, infiltration/inflow catch basin stenciling, public education programs, hazardous waste and used motor oil collections, permitting of large sewer users and regulation of industrial discharges, permitting of new or retrofitted building project through the BWSC's Site Plan Review procedure, and other NPDES-related compliance efforts. The street sweeping and catch basin cleaning programs in both municipalities continue. These programs have resulted in substantial water quality improvements by reducing the very high bacteriological contamination that past data show existed.

2.4.2 Dissolved Oxygen

The USEPA has established several dissolved oxygen criteria to protect warmwater fish (USEPA, 1986). For early life stages, the 7 day mean concentrations should not drop below 6.0 mg/l, and should be maintained above 5 mg/l at all times (1 day minimum). For other life stages, the 30 day mean is 5.5 mg/l, the 7 day minimum is 4.0 mg/l, and the 1 day minimum is 3.0 mg/l. DO levels should be maintained above 4 mg/l to avoid acute mortality of sensitive invertebrates and early life stages of fish, and above 3 mg/l to avoid acute mortality of other life stages. The criteria are meant to protect sensitive species such as white catfish and largemouth bass. Other species, including common carp and others which inhabit the study area, are able to tolerate temporary exposure to much lower dissolved oxygen levels.

The 2003 USACE Environmental Assessment (EA) summarized water quality studies conducted from the 1970's through 2001. Diurnal DO profiles were developed in 1995 by Northeastern University at ten different locations from Willow Pond to the Fens on four separate days throughout the summer during the daylight hours. DO levels varied from station to station along the length of the Muddy River (higher levels at the upstream end), as well as throughout the day; the lowest levels reached during the early morning hours after respiration of the algae and rooted aquatic plants had depleted the oxygen supply. Typical DO levels in the Fens vary as much as 8 mg/l over the course of one day. Concentrations during the summer ranged from occasional near-saturation conditions at Willow Pond to near-anaerobic conditions at the Fens. DO in Leverett Pond and areas upstream was 5 mg/l nearly all the time but dropped on numerous occasions below 5 mg/l downstream from Longwood Avenue drain.

Predicted average dissolved oxygen levels in the study area based on water quality modeling done for the 1998 USACE study are shown on Figure 2-5. The results show that baseline (without project) conditions are likely to improve slightly due to enhanced source controls, elimination of cross connections, and other improvements, but that DO levels in the Riverway and Back Bay Fens are likely to remain below 5 mg/l. Lower DO levels than shown on may occur due to diurnal fluctuations during low flow, warm dry weather periods and near the bottom of the waterbody at other times.

Mathew et al. (2011) sampled and modeled the river from Wards Pond to Charlesgate from 2007 through 2009 and found DO levels below 5 mg/l frequently occurred downstream of the Longwood Avenue Bridge. No sampling has been conducted since Phase 1 was completed.

2.4.3 Phosphorous

Phosphorous is usually the nutrient in shortest supply and becomes the limiting factor in plant growth in freshwater surface waters. Although there is no official EPA criterion for phosphorus, in order to prevent development of nuisance plant growth, the EPA recommends that total phosphorus (P) should not exceed 50 ug/l in any stream at the point where it enters a lake or reservoir or 25 ug/l within the lake or reservoir (USEPA, 1986). Testing in 1986, 1992, and 1995 indicates that phosphorus levels in the Fens and Riverway greatly exceed these recommendations. Generally, phosphorous levels needed to be above 0.05 mg/l in a flowing river to cause excessive algal growth. In more quiescent ponds, levels as low as 0.015 mg/l can produce algal blooms.

In 1995, Northeastern University noted levels of phosphorous in the Muddy River system, including the water column and sediments, higher than typical values for strongly eutrophic lakes and rivers (see USACE, 2003). Orthophosphate levels measured in the water column at several locations from Leverett Pond to the Fens ranged from 0.34 mg/l to 0.56 mg/l. Sediment release rates averaged 70 mg phosphorous/square meter/hr based on Northeastern's measurements for a 24-hour period using an in-situ measuring devise.

The EPA has approved two total maximum daily load (TMDLs) related to phosphorus discharges to the Charles River (Lower Charles TMDL - October 17, 2007 and the Upper/Middle Charles TMDL - June 10, 2011). A TMDL for a given pollutant and waterbody is composed of the sum of loading from regulated point sources, nonpoint sources, non-regulated point sources and natural background levels, and a safety factor to account for uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody.   Based on the TMDL studies, the EPA Small Watershed MS4 permit requires Boston and Brookline to reduce phosphorus loading to the lower Charles River by approximately 60 percent (US EPA, 2018). The permit was signed in 2016 and became effective in July of 2018.

A study conducted by Northeastern University (Mathew et al., 2011) estimated the total load of phosphorus from the Muddy River to the Charles River Basin is 1.1 kg/day. The loading is a small percentage of the TMDL for total phosphorus to the Lower Charles River.

2.4.4 Bacteria

Historical data (see USACE, 2003) noted elevated coliform levels in the Muddy River and storm drain outfall. Coliform (E. coli) levels in the Muddy River at Commonwealth Ave are monitored monthly by the Charles River Watershed Association (CRWA). In 2017, coliform levels at Commonwealth Ave. exceeded primary contact criteria in about 80 percent of the samples (CRWA, 2018). Elevated fecal coliform counts are an indication that human pathogens may be present, and that contact with the water poses an unacceptable health risk.

2.4.5 Key Factors Affecting Water Quality

Water quality of the Muddy River is controlled by numerous factors including: 1) flow regime of the lower Muddy River (*i.e.,* flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam; 2) organic loading from storm drains, illegal sewer connections, and combined sewers; 3) other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers; 4) sediment oxygen demand (SOD); 5) release of nutrients from anaerobic sediment; 6) organic loading from extensive submergent and emergent (*Phragmites*) vegetation, and leaf fall from deciduous trees and shrubs; 8) waste from geese and ducks; and 9) overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Mathew et al. (2011) determined that nutrient loading from algae, sediment, and waterfowl dominate the spatial pattern of water quality in the Muddy River. The study concluded that significant improvement in dissolved oxygen, biological oxygen demand, and total phosphorus could be expected from the sediment removal component of the Muddy River restoration project.   The study did not specifically evaluate the effects of the Phase 2 sediment removal footprint.

2.5 Sediment Quality

The most extensive recent studies of Muddy River sediment quality were conducted by USACE in 2014 and 2001, and CDM in 2000.

The CDM studies were conducted primarily to characterize material sufficiently to determine dredged material disposal requirements. Core samples were collected at 2-foot depth intervals to native material, which was typically encountered from 6-10 ft. below the surface of the sediment layer. Samples were analyzed for RCRA metals (silver, arsenic, barium, cadmium, chromium, mercury, lead, and selenium), volatile petroleum hydrocarbons, PAHs, PCBs, pesticides, TCLP metals, reactivity, conductance, and grain size (sieve and hydrometer).

The 2001 USACE testing was conducted primarily to characterize ecological risk. Surface sediment samples were analyzed for metals, PAHs, PCBs, pesticides, grain size, and biotoxicity.

The 2014 USACE study analyzed sediment cores from Leverett Pond, the Riverway, and Back Bay Fens to further evaluate sediment disposal requirements. Samples were analyzed for RCRA metals, volatile petroleum hydrocarbons, semi-volatile petroleum hydrocarbons, PCBs, pesticides, TCLP metals, reactivity, corrosivity, ignitability, total organic carbon (TOC), total solids, and grain size. Physical descriptions of the cores, including photographs, were also provided.

Numerous other studies have tested Muddy River sediments. These include studies by USACE in 1992, 1995, 1996, and 2000 and the USGS in 1997.

Results of all these studies are compiled in USACE (2017). Results of the 2014 USACE study are summarized in Tables 2-2 and 2-3.

2.5.1 Test Results

Sediment from Leverett Pond, the Riverway, and Fens contain elevated levels of metal, PAHs, petroleum hydrocarbons, and PAHs. PCBs and DDT and its metabolites are also frequently detected. Concentrations of contaminants are generally highest in surface sediments and decline with depth. Accumulation of contaminants in sediment is believed to be the result of years of loading from storm drains, combined sewer overflows, point source discharges (fuel oil), and atmospheric deposition (dust and precipitation). Conditions are exacerbated by the highly urbanized nature of the watershed, sluggish nature of the Muddy River and resulting lack of significant flushing, and low dissolved oxygen levels which slow decomposition of petroleum hydrocarbons and other organic contaminants.

a. <u>Metals</u>: Elevated levels of lead, copper, zinc cadmium, chromium, arsenic and mercury occur in Muddy River sediment. Lead levels are unusually high. Average lead concentrations in surface sediments tested by CDM ranged from about 500 to 700 ppm well above the average for Massachusetts freshwater sediments (Rojko, 1990). USGS and USACE studies also found high levels of lead in the Fens, Riverway, and Leverett Pond. CDM found that metal concentrations generally decline with depth, with lead levels in the underlying (2-4 feet.) sediment about half that in surface sediment (0-2 feet). In 2014, mean lead levels were highest in the Back Bay Fens and lowest in Leverett Pond (see Table 2-2 and 2-3). Other metals (arsenic, cadmium, chromium, and Mercury) showed a similar pattern.

b. <u>PCBs</u>: Most studies have detected PCBs in Muddy River sediment. Peak concentration reported is 9.1 mg/kg in the Fens, with most values reported less than 2 ppm. Most studies have found highest PCB levels in the Fens or the Riverway, with much lower concentrations in Leverett Pond, Willow Pond, and Wards Pond sediment. CDM found highest PCB levels in the Fens (1.4 mg/kg) and did not detect PCBs in Riverway sediment. Mean levels found by the USGS were 2.20 mg/kg in the Fens, 0.29, mg/kg in the Riverway, and 0.21 mg/kg in Leverett pond. In 2014 total PCBs ranged from non detect to 2.9 mg/kg in the Back Bay Fens. Maximum concentration was below 1 mg/kg in the Riverway and Leverett Pond.

c. <u>SVOCs</u>: Highly elevated levels of PAHs occur in Muddy River sediment. Average concentration sediments from the Fens, Riverway, and Leverett Pond range between about 50 and 250 mg/kg in studies by the USACE, USGS, and CDM. Pyrene, flouranthene, chrysene, benzo (a) anthracene, and phenanthrene are the most abundant PAHs detected. As with metals, CDM found PAH concentrations in underlying (2-4 feet) sediment about half that in surface sediment (0-2 feet). PAHs in the urban environments derive largely from automobile and diesel exhaust, and reach the river in urban runoff. In 2014, mean SVOC levels were ranged from xx in the Back Bay Fens and lowest in Leverett Pond (see Table 2-2 and 2-3).

d. <u>Petroleum Hydrocarbons</u>: Total petroleum hydrocarbon (TPH) levels in surficial sediments from the study area are extremely elevated. The average level found by the USACE in 1996 was about 22,000 g/kg (2.2 percent). In the 2000 USACE study, TPH levels in Willow Pond averaged more than 50,000 mg/kg (or 5 percent). TPH levels were also elevated in the 2014

USACE study.

e. Pesticides: DDT and its metabolites (DDE and DDD) and chlordane are the only pesticides normally detected in Muddy River sediment. Concentration of total DDT (DDT+DDD+DDE) range up to about 3 mg/kg, but is commonly less than 1 mg/kg. Concentrations generally increase with depth of sediment.

f. Toxicity Characteristic Leaching Procedure (TCLP): TCLP testing was conducted by the USACE in 1992, 1996, and 2014, the USGS in 1997, and CDM in 2000. Lead is the only contaminant for which the TCLP regularity limit was exceeded in any sample. The most extensive testing was conducted by CDM in 2000. TCLP regulatory exceedences occurred infrequently and only in the Back Bay Fens (Table 2-4). In 2014, one sample exceeded the TCLP regulatory limit. The sample was from within a *Phragmites* area in the Back Bay Fens but not within a Work Area.

g. Biotoxicty: In 1995, USACE analyzed surficial sediment samples from Leverett Pond, the Riverway, and Fens for biotoxicity using the fathead minnow (*Pimephales promelas*) and the amphipod, *Hyalella azteca*. Sediments from Leverett Pond and the Riverway were highly toxic to the amphipod, with survivorship < 30 %. Chronic (28 day) exposure to sediment from the Southern Fens Basin had a moderate impact on amphipod survival and greatly reduced growth. Sediment from the Northern Fens Basin was not acutely toxic to the amphipod. Exposure to sediment from the Fens significantly impacted fathead minnow survival. Sediment from Leverett Pond and the other two Riverway samples had no impact on fathead minnow survival or growth. There was no clear relationship between contaminant levels in sediment and toxicity.

In 2001, sediment samples were collected from 16 sampling stations including: one from Jamaica Pond, two from Wards Pond, one from Willow Pond, three from Leverett Pond, three from the Riverway, five from the Back Bay Fens, and one from a reference location (Turtle Pond in the Stony Brook Reservation). The Jamaica Pond and Stony Brook samples were reference stations, expected to have good sediment quality and high survivorship. A detailed description of the sediment sampling and testing methods is provided in Appendix J. Sediments were analyzed for contaminants with a 10-day sediment toxicity test using the midge *Chironomid tentans* conducted and 42 day sediment toxicity using *Hyalella azteca*.

Tables EA-9 and EA-10 of USACE (2003) summarize results of the 2001 toxicity tests. For *Hyalella*, percent survival at the end of the test (42 days) was significantly reduced in samples from the Back Bay Fens, the Riverway, Leverett Pond, and Willow Pond. Survivorship from these locations generally ranged between 50 and 80 percent, compared to above 90% at Jamaica Pond, Turtle Pond, and Wards Pond. The *Hyallela* test also detected effects on reproduction (average number of young/female) at all study locations, including Wards Pond. No effects on growth were evident at 42 days. For *Chironomus*, about 50 % of samples showed evidence of toxicity, including 4 or 5 samples from the Fens, 1 out of three samples from the Riverway and Leverett Pond, and the Willow Pond sample. Survivorship ranged from 20% at Willow Pond to over 90 % at Jamaica Pond, Turtle Pond, and Wards Pond. Growth was significantly reduced in all samples from the Fens, Riverway, Leverett Pond, and Willow Pond.

2.5.2 Sediment Quality Evaluation

Multiple lines of evidence indicate that chemicals in Muddy River sediment pose a risk to biota (see Appendix D in USACE (2003). Sediment is likely to adversely affect fish and benthic invertebrates at all stations, except Wards Pond. Principal lines of evidence in support of this assessment are comparison with probable effect concentrations (PECs) developed by McDonald et al. (2000) and bioassay test results. Levels of metals, PAHs, pesticides and PCBs in sediment from Willow Pond, Leverett Pond, the Riverway, and Back Bay Fens generally exceed PECs. In many cases, PECs are exceeded several fold, making adverse impacts on benthic invertebrate communities probable. Contaminant levels in Wards Pond are generally low, but PECs are exceeded for some pesticides and PAHs. Studies conducted in 1995 and 2001, found sediment from Willow, Pond, Leverett Pond, the Riverway, and the Back Bay Fens toxic to test organisms. Chronic studies conducted in 2001 using *Hyallela* noted effects on survivorship, growth, and reproduction. Food chain modeling also suggests that metals and/or PCBs in sediment may pose a risk to piscivorous wildlife and songbirds.

2.5.3 Sediment Disposal Considerations

The analytical chemistry results from the Muddy River historic and 2014 sediment sampling programs were compared to the requirements set forth in the MADEP Policy # COMM-97-0001: Reuse and Disposal of Contaminated Soil at Massachusetts Landfills (the Policy). The Policy defines specific contaminant level exceedances that may determine sediment disposal options. According to the Policy, sediment that does not exceed the contaminant levels indicated in the table for lined or unlined landfills may be used as daily cover, intermediate cover, and precapping contour material in the landfill type (lined or unlined) for which it qualifies without obtaining prior approval from MADEP.

The results of the Muddy River data comparison are displayed in Figures 2-6 through 2-8 for historical data and Figures 2-9 through 2-11 for 2014 data. 2014 Muddy River sediment samples contained concentrations that preclude reuse of the sediment at lined landfills (arsenic,TPH, total PCBs, and total SVOCs) and unlined landfills (arsenic, lead, TPH, total PCBs, total SVOCs, and total VOCs). Exceedances were frequently detected at all three study areas. However, two stations in Leverett Pond, six stations in the Riverway, and five stations in the Back Bay Fens contained no lined landfill policy exceedances. Exceedances were also frequently detected at all three study areas in older “historical” samples (see USACE, 2017a).

One sample of the 27 samples in the Back Bay Fens exceeded the regulatory limit of 5 mg/L for TCLP lead with a concentration of 5.97 mg/L; this material would be considered a hazardous waste. This sample, however, was located in an area which will not be excavated during Phase 2.

2.6 Biological Resources

2.6.1 Habitat

Community types in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area includes about 40 acres of wetland habitat and 120 acres of upland habitat. Mapped habitat in the area is shown on Figures 2-12 and 2-14. The figures do not reflect Phase 1 improvements and some minor changes since 2003, such as the unexplained disappearance of *Phragmites* from upstream of the footbridge near Work Area 5.

2.6.2 Fish

A list of fish species reported to occur in the study area is presented in Table 2-5. The list is a compilation from many observations made over the last 30 years that are summarized below. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations.

The Charles River and its tributaries once supported excellent runs of American shad, alewife, blueback herring, smelt, sea bass, and Atlantic salmon. These runs were virtually eliminated by the twentieth century by numerous dams which blocked access to spawning grounds and by poor water quality in the lower Charles River. Efforts to restore anadromous fish runs in the Charles River have been underway for many years. Passage facilities have been built or improved at several dams upstream of the Charles River Dam. The river currently has one of the most productive blueback herring fisheries in Massachusetts.

Blueback herring have been known to occur in Muddy River since the 1990’s and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Upon completion of Phase 1, river herring have unimpeded access to Leveret Pond (MA DMF indicates the FRCS is not a barrier to river herring migration). The Commonwealth of Massachusetts Division of Marine Fisheries has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

Fish collected from the Riverway and Fens in 1990 were analyzed for PCBs, mercury, and other metals (Maietta, 1990). Seven of the 14 fish analyzed had PCB levels, which met or exceeded the U.S. Department of Agriculture (USDA) action level of 2 ppm for commercial fish (see Appendix D). Common carp had the highest PCB levels. Concentrations of mercury and other metals in fish are low, and do not pose a public health risk (Oleo, 1992). Because of the elevated PCB levels a public health advisory was issued recommending people not consume carp, brown bullhead, or American eel from the Muddy River and limit consumption of other species to two meals per month.

2.6.3 Riparian and Emergent Wetland Vegetation

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees, shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native “volunteers”. Table 2-6 lists plant species noted to occur in the project area. Table 2-7 provides a list of plant species in areas restored by Phase 1. The Emerald Necklace Conservancy and the Olmsted Tree Society has inventoried over 7000 trees in the park system, including large “heritage trees” (ENC, 2018). Heritage trees occurring within or near work areas are shown on Phase 2 drawings.

<u>Leverett Pond</u>

The area in the vicinity of Work Area 1 is parkland landscaped with trees and turf. Little to no vegetation is growing on the bank which is armored with gabion baskets in the work area. The sand island is unvegetated.

<u>Riverway</u>

The Riverway area extends from Route 9 to Park Drive. A continuous footpath parallels the river on the eastern and western sides of the river south of Route 9. The areas landward of the footpath are vegetated by a mosaic of wooded riparian vegetation and turf. Trees present include oaks, maples, gray, white, and river birch, weeping willow, box elder, black cherry and others. Common small trees, shrubs, and vines include European (glossy) buckthorn, northern arrowwood, Japanese barberry, bittersweet, honeysuckles, red-panicled dogwood, and sweet perpperbush. Large stands of non-native invasive plants such as *Phragmites* and Japanese knotweed occur in some areas. *Phragmites* occurs at all work areas and has blocked or nearly blocked river channels at Work Areas 3, 5, and 6. *Phragmites* grows primarily in wet areas or along the channel while knotweed occurs mostly in drier areas on embankments. In areas without *Phragmites,* the bank is often eroding and sparsely vegetated. Emergent wetland plants noted along shore in areas free of *Phragmites* include cattail, purple loosestrife, sedges, grasses, smartweed, beggars-ticks, yellow flag, jewelweed, pickerelweed, and sweet fern. Unvegetated mudflat occurs at Work Areas 2, 3, 4, and 5 and elsewhere along the Riverway. In some locations such as upstream of the pedestrian bridge, a small drop in water surface elevation below about EL 8.0 can expose large areas of mudflat (under normal conditions the elevation of the river typically varies from about EL. 7.5 to EL 8.2).

Phase 1 Work Area (Park Drive to Avenue Louis Pasteur)

The area was graded and restored according to a planting plan developed to reflect Olmsted's original design and intent. As part of this effort approximately 206 trees and 11,508 shrubs were planted. Side slopes were also seeded with a mix of native grasses and wildflowers. Several shallow water "shelves" were constructed along shore and planted with pickerelweed and arrowhead. The stream channel was armored with stone below the normal water surface elevation and with geocellls filled with soil along the bank. The shoreline was planted with blue flag iris, sweet flag, water willow, sweet gale, elderberry, sweet pepperbush, and other wetland shrubs and emergents.

Construction was completed in 2016 and the area has been monitored and maintained through the 2018 growing season. Maintenance has included watering, replanting trees, shrubs, and emergent, reseeding, protecting shelves with enhanced fencing to protect emergent from carp, weeding, and invasive species control. Soil eroded from some geocells along the shoreline before vegetation became established. The eroded cells were refilled with soil and stone in 2018, reseeded, protected with erosion control matting, and replanted with water willow, and sweet gale and other wetland shrubs.

In September of 2018 restored riparian habitat was well vegetated with a diverse plant community (USACE, 2018). Embankments within several feet of the normal water surface elevation (ca. EL 1.3) are well vegetated with > 75 percent cover of native wetland plants. Riparian vegetation on side slopes is well established with a diverse herbaceous community, trees, and shrubs. Wetland shelves are vegetated with pickerelweed and sweet flag. Approximately 50% of the designed shelf areas are expected to eventually be vegetated with > 75 emergent cover.

Back Bay Fens below Avenue Louis Pasteur

Riparian vegetation is much less well developed along the Back Bay Fens section of the Muddy River downstream of the Avenue Louis Pasteur. This area is intensely landscaped and contains a War Memorial, a ball-field and playground, a Rose Garden, a large community garden (the Victory Gardens), and walking paths. Approximately 5 acres of *Phragmites* occurs in this area, located mostly on both sides of the river between Agassiz Road and Boylston Street (see below). Wooded riparian vegetation is well developed in some locations and there are numerous landscape trees near the water. Tree species include oaks, maples, birch, weeping willow, and others. Emergent species noted in the lower Fens include *Phragmites,* cattail, purple loosestrife, jewelweed, sedges, smartweed, beggars-ticks, yellow flag, sweet fern, and aquatic grasses. There is a ca. 7,500 sf cattail stand upstream of Agassiz Road which will not be altered during Phase 2.

2.6.4 *Phragmites*

Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although *Phragmites* is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). *Phragmites* varieties occurring in the Muddy River were studied by Keller (2000).

Riverway

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Additional *Phragmites* is present along embankments up to several ft. above the normal water elevation.

Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. *Phragmites* aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m^2 (dry weight), well above values typically reported for *Phragmites* in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Some stands previous mapped by CDM (2001) and the USACE (2003) have disappeared, most notably upstream of the Footbridge. Several thousand square ft *of Phragmites* was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of *Phragmites* throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current, and low salinity provide good conditions for *Phragmites* growth.

Back Bay Fens

Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, *Phragmites* stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. *Phragmites* also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. The large *Phragmites* stand adjacent to the Victory Garden is severely degraded by inappropriate human use. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the *Phragmites* stand adjacent to the Victory Garden (Figure 2-15). The encampments were recently removed by Boston Parks, with assistance from Clean Harbors. Based on historical aerial imagery, the trail network has been present for decades. The *Phragmites* stands are also prone to occasional fires (Photographs 29 and 30).

2.6.5 Wildlife

As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. The extensive *Phragmites* stands in the Northern Fens pool also provide excellent cover for songbirds and other wildlife.

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Back Bay Fens and vicinity (see USACE, 2003). The area supports resident (breeding) populations of many bird species and provides a valuable refuge for songbirds, wading birds, and waterfowl migrating through the Boston area. A large population of ducks, mostly black duck/ mallard hybrids, is present in the Riverway and Back Bay Fens throughout the year. Canada goose are also abundant. Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. PCB levels found in fish from the Fens pose a risk to fish eating birds such as belted kingfisher, double crested cormorant, black crowned night heron, and green-backed heron.

2.6.6 Aquatic Invertebrates

Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. Numerous mussels were stranded when the Upper Fens Pond was dewatered during Phase 1 construction.

2.6.7 Protected Species and Rare Species Habitat

The Phase 2 Project Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the study area.

3.0 Project Description

3.1 Overall Project Description

The recommended plan in the 2003 USACE Decision Document included the following components

- Daylighting two sections of the Muddy River that are presently in culverts;
- Sediment excavation for flood damage reduction in the Back Bay Fens, Charlesgate section of the Muddy River, Riverway, and Leverett Pond;
- Additional sediment removal in the Fens, Riverway, Willow, and Wards Ponds for environmental restoration;
- Eradication of *Phragmites* by excavation and herbicides;
- Flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens;
- Preservation and restoration of the historic park shoreline and vegetation in construction areas.

As discussed above, the approved Federal Plan funded only the flood control elements of the 2003 Decision Document. Due to the high cost per acre of environmental restoration (ER), the Assistant Secretary of the Army for Civil Works determined the ER features were not justified. However, the USACE and non-Federal sponsors designed the project to maximize ecological restoration as much as practicable within the footprint of the flood control project area. Implementation of Phase 1 and 2 incorporates many features of the Recommended Plan except the funded plan does not include environmental dredging of Willow and Wards Pond and the footprint of dredging within the river has been reduced. Major elements required to implement the flood control plan still contain significant ecological restoration benefits. The work includes:

Phase 1

- Construct 10' by 24' concrete culverts under both the Riverway and Brookline Avenue.
- Remove existing twin 72" pipes in the Old Sears Parking Lot and daylight the river in this area.
- Remove existing twin 72" pipes in Brookline Avenue jug handle area and in the area just upstream of Avenue Louis Pasteur culvert. Daylight the river in these two areas.
- Reconstruct culvert opening at upstream end of Avenue Louis Pasteur culvert.
- Dredge and reshape the Upper Fens Pond section of the river to allow for increased flow.
- Installation of temporary flow restriction structure upstream of the Back Bay Fens.
- Landscaping with trees, shrubs, and emergent plantings.
- Installation of habitat logs and boulders for fish and turtles.
- Post construction vegetation monitoring and invasive species control during the two year

establishment period.

Phase 2

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.
- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Excavate deepened channel sections to delay need for maintenance dredging.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Manage *Phragmites* in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction and improve ecological habitat quality.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where *Phragmites* or oriental knotweed are eradicated by planting grass, trees and shrubs.
- Install habitat logs for fish and turtles.
- Remove the temporary flow restriction structure upstream of the Back Bay Fens.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

Construction of Phase 1 began in 2013 and was substantially completed in August of 2016. Monitoring and adaptive maintenance of vegetation established during Phase 1 by USACE will continue through the fall of 2018.

The project will be returned to the non-Federal sponsors at the completion of construction for both Phase 1 and Phase 2 work. Long-term operation and maintenance of the Federal project is the responsibility of the non-federal sponsors pursuant to an Operation and Maintenance Plan prepared by USACE. Operation and maintenance of the Phase 1 portion of the project will be turned over to the non-Federal sponsors in November 2018.

3.2 Phase 2 Project Description and Design Considerations

3.2.1 General

The Phase 2 100% design package (Drawings and Specifications) submitted with this application describe the layout of the flood control channel, access, and storage areas, pedestrian and hauling routes, utility investigations and relocations, site restoration, construction sequencing, environmental protection, including measures to protect Blueback herring and sensitive areas within the park system, flood protection for the Fire Department Headquarters in the Back Bay Fens, and traffic management. The package also includes sediment quality information and quantity estimates of material to be excavated. The 100% design package includes revisions based on comments received on the 95% design from the Town of Brookline, the City of Boston, Massachusetts Division of Marine Fisheries, Massachusetts DCR, the Massachusetts DEP, and the Muddy River Management and Maintenance Oversight Committee (MMOC).

Additional revisions to the Drawings and Specifications may be required upon receipt of Water Quality Certification from the Massachusetts DEP and Orders of Conditions from the Town of Brookline and City of Boston.

The Construction Contractor will be required to provide various submittals that will further describe means and methods, environmental protection, and construction sequencing. Some of the submittals will be provided to the MADEP and other agencies for review, others will be reviewed only by USACE.

Submittals will include, but are not limited to, the following:

Specification Section	Description of Submittal
01 57 20	Environmental Protection Plan
01 57 20	Surface Water and Wastewater Quality Monitoring Plan
01 57 20	Fish (Blueback Herring) Truck and Transport Plan (if needed)
31 00 00	Dewatering Work Plan
31 00 00	Excavation Work Plan
32 93 00	Restoration Work Plan
32 94 00	Invasive Species Control Work Plan

For a complete list of submittals see Specification Section 01 33 00.

3.2.2 Work Areas

The Phase 2 project has been divided into 13 work areas as follows:

1) Work Area-1. Dredging Leverett Pond near Village Brook Drain inlet.

2) Work Area-2. Dredging the Riverway section upstream of Brookline Ave.

3) Work Area-3. Dredging the Riverway section directly downstream of Brookline Ave. on the Boston side of Riverwalk Island.

4) Work Area-4. Dredging the Riverway section directly downstream of Netherlands Rd.

5) Work Area-5. Dredging the Riverway section 900 ft. downstream of the Longwood Ave. Bridge.

6) Work Area-6. Dredging at the end portion of the Riverway and removal of the Flow Restriction Control Structure (FRCS).

7) Work Area-7. Dredging a 660 foot portion of the Back Bay Fens just downstream of Avenue Louis Pasteur.

8) Work Area-8. Dredging a 665 foot portion of the Back Bay Fens between The Fenway and Clemente Field.

9) Work Area-9. Dredging a 665 foot portion of the Back Bay Fens along The Fenway.

10) Work Area-10. Dredging a 1500 foot portion of the Back Bay Fens between the War Memorial and just downstream of the Agassiz Rd. bridge.

11) Work Area-11. Dredging a 960 foot portion of the Back Bay Fens between Agassiz Rd. and the Victory Gardens.

12) Work Area-12. Dredging an 845 foot portion of the Back Bay Fens between The Fenway and the Victory Gardens.

13) Work Area-13. Site Plan for flood protection measures at Fire Department Headquarters.

3.2.3 Sediment Removal

General

The proposed method of sediment removal is primarily mechanical however either mechanical or hydraulic dredging is allowed within Leverett Pond. Other work areas are better suited for mechanical dredging as opposed to hydraulic dredging for several reasons. First, the existing channel is very shallow in some areas as well as narrow in others which prohibit even the smallest hydraulic dredge on a barge from accessing. Secondly, all sections of Muddy River exist in a highly urban environment where debris of all kinds ends up in the river which will clog or repeatedly disable hydraulic dredge equipment. This debris was observed during low flow periods and includes natural debris such as downed trees and limbs, stones, and layers of leaf litter mixed with brush as well as a large quantity of man-made debris including construction debris, tires, metal parts, safe doors, shopping carts, bicycles, bottles, cans and other household refuse, vehicle parts, and plastic. Third, hydraulic dredging cannot be used for *Phragmites* excavation and upland bank areas where channel slopes require cutting into uplands. Lastly, hydraulic dredging will require somewhat extensive staging, including access areas for dewatering presses, pump lines, frac tanks, and sludge handling areas. Given the location of the project within a major metropolitan setting and park area, these staging and access areas are extremely limited.

Hydraulic dredging was required for the non-federal dredging of the Charlesgate Section of Muddy River, from Boylston Street to the Charles River prior to the USACE Phase 1 construction. After the contract was awarded, it was quickly determined hydraulic dredging was impossible due to many of the issues discussed above. The contract was modified to allow mechanical dredging and the portion of the project was completed with that method.

Mechanical dredging was used within Upper Fens Pond in Phase 1 during the Spring/Summer of 2015. The flow within Upper Fens Pond was diverted around the work area, the area was then sectioned off using steel sheet pile walls and dewatered to excavate in the dry. The material was mixed in-situ with sawdust, loaded onto trucks and hauled to final disposal. A temporary access road was constructed along one river bank by excavating organic sediment to a more stable base and then using a 3” minus gravel as a temporary road base for excavators and site dump trucks. As the excavators backed out of the channel, the temporary road was shaped, some of the material removed, and slope stabilization installed.

The contractor may determine that dredging in the wet with specialized equipment may be more beneficial to work around fish windows or the sensitive nature of existing features within the park system. Working in the wet would minimize dewatering of aquatic habitat and stranding of turtles, fish, freshwater mussels, and other aquatic life. It would, however, require measures such as siltation curtains to isolate the work area and protect water quality.

Leverett Pond

Based on these considerations, the Leverett Pond work area, including the sand island, may be hydraulically dredged with small equipment on a barge and pumped onshore due to ample water access and depth for a small dredge. This material is predominately sand so excavation in the wet is a viable option as well. The sediment removed from this area may be dewatered using Geotubes or a filter press along the edge of the pond and then transported to a disposal site. Depending on the dewatering method, the water may require additional turbidity treatment prior to being returned to the river.

Riverway

Two of the five Riverway work areas are upstream from Brookline Avenue, one is located on the Boston side of the Riverwalk Island, the fourth is located about 900 ft. downstream from the Longwood Avenue bridge, and the fifth is at the downstream end of the Riverway. Sediment excavated from these areas will likely be excavated in the dry, additionally dewatered if required, and tested for transportation to final disposal. Sediment removal in work Area 6 includes removal of a large area of *Phragmites*, which cannot be hydraulically dredged. *Phragmites* is also present in Work Areas 2, 3, and 4. The flow restriction control structure (FRCS), constructed as part of Phase 1 construction, will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens.

Back Bay Fens

Work areas 7 through 12 are located in the Back Bay Fens and run together continuously from Avenue Louis Pasteur to Boylston Street. Sediment excavated from these areas may be excavated in the wet or dry dependent on water depth and other physical characteristics of the work area, additionally dewatered if required, and tested for transportation to final disposal. Some sediment removal in the Back Bay Fens includes removal of large area of *Phragmites*, which cannot be hydraulically dredged.

Not only does removal of accumulated sediment and *Phragmites* improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increase temperatures and nutrient concentrations and algal blooms. See section 5 for a more detail description on the additional benefits associated with sediment removal

Deepened Channel Sections

Where flow velocities diminish, flood control improvements also include additional deepening of the river channel at 7 locations. Deepening these areas will allow sediments to collect without causing rapid loss of channel flow capacity. In addition, providing a deeper channel in areas where sediment has historically accumulated will reduce the frequency of maintenance dredging and facilitate its removal. The locations of the deepened channel sections are shown in the following table:

Location	Work Area	Bottom EL (ft)	Reach	Drawing Reference
Leverett Pond (Village Brook Drain)	1	-5.0	13+00 – 15+00	C-101, C-334
Riverway (Tannery Brook Drain)	2	-3.5	28+00 – 33+90	C-102, C-334
Riverway (Longwood Avenue Drain)	4	-2.5	44+60 – 46+10	C-103, C-335
Riverway (Near Park Drive)	6	-6.0	73+00 – 76+40	C-105, C-335
Back Bay Fens (Emmanuel College Drain)	7	-6.5	97+55 – 99+00	C-106, C-336
Back Bay Fens (BWSC Gatehouse No.1)	10	-8.0	121+60 – 130+60	C-108, C-337
Back Bay Fens (Near Victory Gardens)	11	-8.2	138+00 – 148+00	C-109, C-110, C-338

Excavation Quantities, Sediment Quality, and Disposal

The quantity of excavated sediment for each Work Area is provided in Table 3-1. These quantities account for the removal of sediment identified in each work area and include the removal volume required to construct access roads to complete the project. The "river access" roads are shown on the GC sheets and are intended to be constructed close to one bank where the sediment is likely to be shallower. A volume for sediment removal and replacement with gravel was calculated in addition to the sediment removal for flood control.

Existing information about sediment quality in the Phase 1 work area was summarized in Section 2-5. Data from the most recent sampling (2014) is summarized in Tables 2-2 and 2-3.

Based on an evaluation of test results, most of the material exceeds the contaminant levels for soil reuse at in-state lined or unlined landfills in accordance with Commonwealth of Massachusetts Department of Environmental Protection Policy# COMM-97-001. In-state disposal is usually precluded because of elevated PAH, petroleum hydrocarbon, and/or arsenic concentrations. None of the sediment to be excavated during Phase 2 meet the contaminant level requirements under 310 CMR 30.110 for classification as a hazardous (RCRA) waste material.

Table 3-1 and Drawings C-101 – C-110 present expected sediment disposal requirements for each work area based on existing test results. The analysis is conservative. For example, older data from CDM (2001) indicates that deep sediment (i.e. $\geq$6 ft. deep) from deepened channel sections in the Back Bay Fens may be suitable for in-state rather than out-of-state disposal. The Contractor will conduct additional testing during construction to characterize the material and comply with receiving landfill testing requirements. Material requiring out-of-state disposal is expected to be disposed in New Hampshire or Maine. All *Phragmites*, roots and rhizomes and associated soil/sediment will likely be disposed out of state.

3.2.4 Sequencing

Sequence of each individual work area is detailed in the notes on the "Sequencing, Dewatering, Staging & Access Plans" (GC101 thru GC105). Additionally, "Hauling Plans" (GC106 thru GC108) detail allowable hauling routes in and out of the work areas. It is likely that multiple crews will be required to complete the project within the intended 3 year construction window while working around the environmental (blueback herring migration) windows. The contractor will be required to submit a work plan that will be reviewed as part of the best value contract. Actual sequence of work will be reviewed at that time however the 100% plans and specifications allow contractor flexibility with their own means and methods to meet the 3 year construction duration.

3.2.5 Staging Areas and Access

Because the work will occur in a larger urban environment, there is very little open space available for staging in the vicinity of the project site except for the adjacent park land. Efforts have been made to minimize impacts on parkland resources. Proposed staging and access areas are shown on the Drawings. The areas shown provide for truck and equipment access ways and storage locations, minimal material storage, and locations for dewatering equipment, if used. Existing gravel and paved walkways were used to access work areas to the maximum extent. Removal of trees for staging and access to adjacent roadways was avoided wherever possible. Site walks were held during design to identify routes with least impact and greatest benefit. Tree root zones were avoided as much as possible. Where vehicular travel underneath tree canopy was unavoidable, root zones will be protected from soil compaction.

A meeting was held with USACE, MA DCR, City of Boston, Town of Brookline, and the MA State Police to discuss construction related hauling of the excavated material. Police details will be required during hauling activities for trucks entering and exiting designated work areas. Proposed hauling routes are shown on the “Hauling Plans” (GC106-GC108). Plans also include provisions for allowing pedestrian and bicycle traffic to safely bypass work areas.

Work areas will be fenced during construction and during establishment of turf and landscape planting. Fencing is shown on construction and landscaping plans.

3.2.6 Fire Department Headquarters Flood Protection

The Decision Document noted that 100-yr flood protection will be required for the Fire Department Headquarters, located near the corner of Fenway and Agassiz Road. The 100% design submittal includes protection measures which include a concrete floodwall topped with identical to existing security fencing with lighting and an interior underground pre-cast concrete storm water pumping station to convey storm water runoff within the Fire Department property when flood waters in the Muddy River prevent gravity storm water flow from the property. The pump station is a 7,000 gallon pre-cast concrete tank with twin 10 HP storm water pumps and a double catch basin frame and grate set at an elevation slightly above the elevation of gravity flow from the site. As floodwaters rise, a check valve in the gravity outflow pipe will prevent floodwater from backing into the site and the pump station will begin taking water and pumping.

3.2.7 Erosion Control and Stormwater Management During Construction

The Contractor will be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor will be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor will construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the contract drawings and specifications. BMPs may include, but not be limited to, vegetation cover, slope stabilization, silt fences, and straw wattles. Any temporary measures shall be removed after the area has been stabilized. The project will be covered by a NPDES Construction General Permit. The construction contractor will submit an Environment Protection Plan for USACE approval before construction begins.

3.2.8 Water Control

Project plans propose to conduct most of the construction in the dry. Work areas will either be entirely dewatered, with flow maintained by a bypass pumping system or flow will be diverted from one side of the river to the other. Normal flow above Park Drive is estimated to be 6 cfs. Water diversion systems will be designed to pass displaced flows without exceeding 6 inches of river level change upstream or downstream of diversions at all times.

The Contractor will be required to submit a detailed water control plan to the USACE for approval. The plan will be submitted for review and comment to the MADEP, Boston and Brookline Conservation Commissions, and the MA Division of Marine Fisheries (MADMF).

The plan will detail Contractor's actions to operate and maintain or remove the diversion system for each work area during normal and flood events. The plan will include complete construction drawings and detail drawings showing all aspects of the Muddy River control and diversion system for all work areas. For all pumps, details shall include manufacturer's information on pump performance curves, specifications, a control diagram, and written sequence of control for the pumping system.

The submittal will include construction and detail drawings for all work areas enclosed by temporary cofferdam structure; width and shape of channel opening remaining to pass flows; number, sizes, and locations of pumps required to pass equivalent river capacity; number, sizes, and locations of pumps required to dewater within cofferdam; locations of outlets for pump dewatering discharge; and method of treatment of discharge water. Temporary cofferdam structures may include steel sheet piling, bladder dams, portadams (or equivalent) but will not include placement of fill.

Detailed calculations shall be submitted for structural, geotechnical and hydraulic design aspects of the diversion system(s). Hydraulic calculations documenting calculation of the displaced flow and demonstrating that the proposed diversion system(s) will pass displaced flow without exceeding 6 inches of river level change upstream or downstream of diversions at all times including high water and floods. Pump selection justification including pump curves and head. Pipe calculations justifying selected pipe size and thickness. Structural and geotechnical calculations documenting design of temporary cofferdam system including earth supports, pipe supports, pipe restraints, and equipment supports.

Supplemental plans to restore any areas disturbed by water control activities which are not shown on 100% design landscape restoration drawings will also be submitted for review and approval. The supplemental drawings would be prepared by a historic restoration landscape architect and the drawings approved by USACE after consultation with project sponsors.

3.2.9 Removal of the FRCS

To provide flood control benefits, the contractor will be required to remove the FRCS as soon as practical after completion of sediment removal from Work Areas 7 -12 and flood proofing of the Boston Fire Department facility. The entire structure, including sheet pile, stone protection, catwalk, and super sacks will be removed.

3.2.10 Wastewater Management

Any wastewater from dewatering or dredged material processing operations and other sources will not be discharged directly into surface waters, the storm drain system, sanitary sewers, or the Muddy River Conduit. Prior to discharge, water from dewatering operations will be treated by filtration, settling basins, or other approved methods to reduce the amount of sediment and contaminants contained in the water to allowable levels.

The following standards shall apply to wastewater discharged directly or indirectly into the Leverett Pond, the Riverway, Muddy River, or Back Bay Fens:

Total Suspended Sediments: < 40 mg/l

Dissolved Lead: < 1.0 mg/l above background

Dissolved Oxygen: 5.0 mg/l

Discharge standards for others parameter may be established by the MADEP during the permit process.

3.2.11 Water Quality Monitoring

Treated wastewater from dewatering, dredged material processing operations, or other activities that is discharged directly or indirectly into surface water will be tested daily for TSS and weekly for dissolved lead and dissolved oxygen. In work areas where sediment is excavated in the wet, surface water quality will be monitored daily at one station upstream of the work area and three downstream locations. Parameters measured will include dissolved oxygen, percent dissolved oxygen saturation, turbidity (NTU's), temperature, and conductivity.

The contractor will prepare a plan for monitoring wastewater and surface water quality. The plan will include the following elements:

1) List of parameters to monitor and detection limits
2) Sampling method (s)
3) Frequency of monitoring
4) Monitoring locations (including a map)
5) Reporting
6) List of Personnel, Roles and Responsibilities
7) Analytical Laboratory
8) Equipment required
9) Safety Plan
10) Quality Assurance Project Plan (QAAP)

Test results will be summarized in a report submitted to the Boston and Brookline Conservation Commissions and MADEP.

3.2.12 Restoration

<u>General</u>

A landscape restoration plan was prepared with assistance from a landscape architect specializing in historic landscape restoration. The intent of the plan is to rehabilitate the landscape through a design that is compatible with the habit, form, scale, and context of the historic vegetation and to restore wetland and riparian habitat. Historic conditions are known from surviving historic landscape plans and historic photographs. Plant species were selected based on a species list of historic plantings and plans from the Olmsted Archives (Frederick Law Olmsted National Historic Site), photographs, Boston Parks and Recreation Department records, site conditions, and availability of plant material from local or regional nurseries. Although species listed as invasive were avoided, the plant list does include non-native varieties, consistent with historic landscape restoration objectives. Shrub plantings are sized and spaced to provide for rapid establishment of shrub cover. In general for trees, the largest size (caliper diameter) readily available from local growers was specified. Container grown plugs will be used to establish emergent vegetation. Substitutions consistent with historic landscape restoration goals may be required if planting success is not achieved during plant establishment period.

Shoreline Stabilization and Backfill

The existing shoreline along the Riverway is severely eroded in many locations. This is likely due to fluctuating water levels, grazing by waterfowl, rill erosion caused by runoff, and steep slopes. The Phase 2 design includes placement of coir fiber rolls to hold the bank in most restored areas. The top of the rolls will be set at the normal water surface elevation, likely a few inches above EL 1.3 ft. NAVD88. The areas will be re-vegetated consistent with the landscape specifications.

In the Back Bay Fens, coir rolls will also be used to retain fill placed to restore wetland vegetation. This will occur mostly downstream of the Agassiz Bridge adjacent to the Victory Gardens. The coir rolls will also be used to hold soil installed to create underwater shelves. The top of coir rolls will normally be set at EL 1.3 ft. NAVD88 in area without shelves and EL 0.3 where shelves are present. Above elevation 1.3 slopes greater than 3:1 Horizontal:Vertical (H:V) will generally be stabilized with 100 percent biodegradable erosion control matting. Matting will not contain poly netting and strands of the matting will move independently to minimize the risk of wildlife entrapment. The areas will be re-vegetated consistent with the landscape specifications.

As previously mentioned, some areas of the Muddy River suffers from extreme bank erosion. Multiple efforts have been under taken over the years to help restore and protect the river bank. This project provides an opportunity to improve the existing condition and provide restoration benefits. Banks will be restored to a less degraded state following this project and will result in reduced sediment loading, improved water quality (reduced suspended sediment) and improved ecological habitat.

Topsoil

Six inches of topsoil will generally be placed in area restored as area turf. No topsoil will be placed underwater except in areas to be planted with emergent plugs and emergent shelves where topsoil will be installed as backfill to meet desired grades. Topsoil will be obtained from off-site. The specifications require that topsoil be tested for TOC, pH, grain size, and nutrients. Contaminant levels in topsoil must meet MA DEP RCS 1 criteria.

Topsoil will conform to the following limits:

Silt (0.002–0.05mm)	15 to 30 percent
Clay (< 0.002 mm)	5 to 15 percent
Sand (0.05-2.0 mm)	60 – 75 percent
> ¼ inch	< 3 % by volume
> ¾ inch	< 1 % by volume
> 2 inch	none

pH	6.0 to 7.0
Soluble Salts	< 75 parts per million
Organic matter	6 to 12 percent (loss on ignition)
Contaminants	Concentrations not to exceed RS1 levels.

The topsoil may be adjusted to meet composition requirements by adding compost or inorganic components. Compost used will be derived from organic wastes including leaf and yard residues.

Restoration of Wetland and Emergent Vegetation

Little information is available regarding historic planting of freshwater emergent plants in Olmsted's Emerald Necklace park system. There is no evidence that emergents were specifically planted. However, planting of emergents is included in the design because historic pictures do show an emergent fringe along the river and such a fringe occurs today in some areas along the Riverway. Also, there is a desire to restore emergent vegetation to the extent possible. The design includes seeding areas above the normal water surface elevation with a wetland seed mix or planting masses of wetland shrubs. Planting emergent plugs is generally limited to emergent "shelf" areas. These areas will be planted with a variety of emergent plants native to eastern Massachusetts. Most of the species selected have low stature, a requirement for historic restoration and aesthetics. Based on Phase 1 plantings and observations, several species (e.g. swamp loosestrife, blue flag, and sweet flag) chosen are expected to be somewhat resistant to grazing. The emergent plants will be protected by an herbivore exclusion fence for at least two years to allow the roots system/rhizome system to become resistant to grazing. Effort to restore emergent vegetation during Phase 1 at created wetland shelves are still underway. Failed plantings are thought to be caused by grazing by carp which were able to swim under the Phase 1 exclusion fencing. Phase 2 design emphasizes planting of sweet flag which appears relatively resistant to grazing in Phase 1. Pickerelweed and bur-reed will be limited to near shore/bank areas where carp grazing should be less intense. The plant diversity gained through *Phragmites* removal and wetland vegetation restoration from the Phase 2 project will greatly improve the ecological value for aquatic, avian and terrestrial biota. See Section 5.0 for an expanded discussion on ecological benefits.

Planting Zones

Wetland areas will be seeded or planted with shrubs between EL 1.3 and 2.3 ft. NAVD88. All trees and other shrubs will be planted above El 2.3 ft. Wetland shelves will be planted with plugs to a depth of about EL 0.8 ft. No upland species will be planted below EL 3.3.

Plant Performance Standards and Guarantee Period

There will be a two year guarantee period for all plantings. In upland areas one-hundred percent survival of trees and shrubs will be required. Performance standards for wetland vegetation will be based on percent cover. Areas between EL 1.3 and 2.3 seeded with a wetland seed mix or planted with emergent and wetland shrubs will have > 75 percent cover by native wetland plants after two years.

Herbivore Exclusion Fencing

Temporary fencing will be installed to protect emergent plantings from grazing by ducks, geese, and fish (carp) during the plant establishment period. The fencing will be installed along the water-side edge of all emergent plantings. Chain link fencing buried 6” into the substrate will be used on the water side of the shelf areas to exclude carp. Fencing will also be installed on the upland side of the emergent plantings to exclude waterfowl.

Seed

Seed mixes for lawn areas contain a mix of typical turf species, primarily fescues and ryegrasses. Mixes tailored for sun and shade areas and dense shade were specified. A seed mix of native wildflowers and grasses was developed for areas planted with trees and shrubs. The mix contains non-invasive species which typically grow less than about three ft. tall and includes species used by pollinators and species with aesthetic appeal. The wetland seed mix will be New England Wetland Plants “Wetmix” or an approved equal.

Tree Protection and Hazards

Many trees occur within or near the limit of work. All trees to remain will be protected with fencing or trunk protectors as consistent with the plans and specifications. The condition of certain trees near work limits will be evaluated during construction. If an arborist determines the tree can be saved the construction contractor will be directed to do so. After consultation with USACE and the sponsors, the contractor will be required to remove hazardous trees and branches noted during the construction and maintenance period.

Habitat Logs

Habitat logs will be installed to enhance fisheries and wildlife habitat. Habitat logs will be installed in restored areas. About 1/3 will extend into the water to provide basking locations for turtles and perches for wading birds. Logs will be hardwoods salvaged from on site with a minimum butt diameter of 8” and length between 8 and 12 feet.

Perimeter Fencing

The entire restored area will be fenced to prevent public access during construction and for a variable of time during restoration based on site conditions and consultation with the sponsors. The fencing is required to limit vandalism and unintentional incidental damage by the public to plant material and side slopes. Use of 4 foot high coated chain link fencing is anticipated.

Watering

Watering will be required during the plant establishment period. Water will likely be supplied from watering trucks or an irrigation system connected to the local municipal water system. Pumping irrigation water from the river will not be permitted.

Staking

Trees will generally not be staked.

Tree Wrap or Tree Protectors

Considerable grazing on shrubs by rabbit and possibly meadow voles occurred during Phase 1 restoration. Protectors on individual shrub plantings or other measures to deter stem damage (i.e., girdling) by herbivores will be required

Pruning

Planted trees and shrubs will be pruned by an arborist during the plant establishment period to remove dead branches and improve growth form. Standard industry pruning practices will be adhered to. Wound dressing will not be applied.

Weeding

Weeding will be conducted as required to prevent shading of shrub and fern plantings by tall weeds such as burdock, hawkweed, and mugwort.

3.2.13 Invasive Plant Species Control

General

Restored habitat will be vulnerable to colonization by invasive species present in adjacent areas. Reused or imported topsoil may also contain viable seeds of invasive species. Primary invasive species of concern include Norway maple, Tree of Heaven, European buckthorn, Oriental bittersweet, Japanese knotweed, *Phragmites*, and purple loosestrife. Colonization of other plant species classified as "invasive" by the Massachusetts Invasive Plant Advisory Group may also occur.

All invasive plant species will be controlled in restored areas during the 2 year establishment and monitoring period. Over the long term, the updated Operation and Maintenance activities will include invasive species management. Because *Phragmites* can readily spread by seed and will remain in the Riverway and Back Bay Fens proximal to the project area, annual monitoring and control efforts are required. USACE recommends zero tolerance for *Phragmites* in all restored areas to ensure the ecological and flood conveyance benefits are maintained.

An invasive plant species control plan will be developed by the contractor and approved by the USACE. Elements of the plan are provided below and in Section 32 94 00 of the Specifications. The plan will rely on frequent meander surveys through restored areas to detect invasive species and the controlled use of herbicide when hand pulling would not be an effective control method.

As discussed above, the approved Federal Plan funded only the flood control elements of the 2003 Decision Document. Due to the high cost per acre of environmental restoration (ER), the Assistant Secretary of the Army for Civil Works determined the ER features were not justified. However, the USACE and non-Federal sponsors designed the project to maximize ecological restoration as much as practicable within the footprint of the flood control project area. While the flood control project does provide significant environmental benefits, it does not address invasive species and habitat restoration comprehensively through the system. Therefore the City of Boston is filing a Notice of Intent for an additional Ecological Rehabilitation Limited Project to support habitat enhancement. The effort will support the transition of the *Phragmites* monoculture to a diverse, native plant mix while reducing the re-infestation of areas restored in Phase 2.

Herbicide Use

In order to ensure the planted areas flourish and not be overtaken by invasives, frequent meander surveys through restored areas to detect invasive species and the careful use of herbicide when mechanical control (i.e., pulling) would not be an effective method will need to be part of the Operations and Maintenance activities. The following herbicide application methods are acceptable: foliar application using a wipe (cloth or glove) technique, cut stem or cut stump treatment, and injection (Japanese knotweed only). All herbicide use will be in accordance with label instructions, state and Federal law, and the Order of Conditions received from the Boston and Brookline Conservation Commissions. Herbicides will be applied by Massachusetts certified pesticide applicators.

Control of *Phragmites* will be achieved primarily through excavation and secondarily by the targeted application of herbicide in restored planting areas as required. Except for small seedlings, mechanical control (i.e. pulling) is not considered effective for knotweed, purple loosestrife, and *Phragmites* as these species can regrow from small pieces of rhizome remaining in the soil. Woody species such as Norway maple will readily regrow from cut stumps unless treated with herbicide. Control of other invasive species will generally be by hand pulling of small seedlings and by application of appropriate herbicides to larger plants. In all cases, herbicides must be used according to the USEPA approved product label.

Stem “cut and treat” herbicide applications involve the cutting and removal of the growing plant stems and then the spot application of herbicide to the freshly cut surface of the remaining rooted portion of the stem. This technique will be applied mostly to trees and shrubs with a basal diameter greater than ca. ¼ inches. The “spot” application should be accomplished with a swab and should occur immediately after the stem is cut. A marking dye will be used to identify which stems have been treated. Trees and shrubs will be cut using loping shears or a handsaw. Trees larger than 3” in diameter may be cut with a chain saw.

Per specification, herbicide application operations will be suspended when any one of the following conditions exist in a treatment area: 1) wind velocity exceeds ten (10) miles per hour; 2) heavy dew is present on leaf surfaces; 3) precipitation is expected to be received in quantities sufficient to wash chemicals off plants within 6 hours of application; 4) non-compliance with local, state, or federal regulations or the Product Label, and 5) as directed by the Contracting Officer.

Pesticide applicators will wear appropriate personal protective equipment, including long sleeved shirts, neoprene gloves, and other measures recommended in the product label. Although not required in the product label, gloves will be worn during application of herbicide containing glyphosate. The public will be excluded from all restoration areas by fencing during the invasive species control period. Signage will be installed to alert the public of herbicide application as required in local, state, and Federal pesticide control laws and regulations.

3.2.14 Environmental Protection

Landscape

The USACE has selected access points and staging areas in Leverett Pond, the Riverway and Back Bay Fens that will minimize impacts to heritage trees and other landscape features within the park system. The location of heritage trees has been identified on project specifications. Special care will be taken to avoid impacting the root zone of large trees, many of which are identified as heritage trees. In general, heritage trees will be protected by chain-link fencing installed at or beyond the drip line of individual trees or groups of trees. The location of fencing is shown on design plans, but may extend beyond those locations.

Because of the large amount of debris in the river, we anticipate that our contractor will remove most if not all of the sediment by excavation rather than hydraulic dredging thus reducing the acreage required for staging areas. The contract will require landscape elements disturbed by construction activities to be restored. This includes trees and shrubs, turfed areas, embankments, pathways, sidewalks, curbs, roadways and other features.

Water Quality

By conducting most of the work in the dry, water quality impacts associated with sediment removal will be minimized. The contract requires that water quality be monitored upstream and downstream of active work areas to assess compliance with surface water and wastewater standards established in the Environmental Impact Report (CDM, 2005) prepared pursuant to the Massachusetts Environmental Protection Act. The Contractor will measure surface water quality parameters including temperature, conductivity, dissolved oxygen, and turbidity. Waste water will be analyzed for total suspended solids, dissolved lead, and dissolved oxygen. The specifications require the contractor to submit a Surface Water and Wastewater Water Quality Monitoring Plan.

River Herring

The MA Division of Marine Fisheries (MADMF) has recommended that the Muddy River remain free flowing during the periods between April 1st to June 15th and between September 15th and November 1st, of any year. They recommended this restriction so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles. Blueback herring is an anadromous fish species, spawning in freshwater, and then migrating to the marine environment to mature. During the spring, adult pre-spawning blueback herring enter freshwater rivers and move upstream to spawn, generally in their natal habitat. The young then migrate downstream during the fall to mature in the ocean, and then return to freshwater in the spring to complete their life cycle. The post spawning adults generally move downstream right after spawning. Blueback herring generally migrate with Alewife, a similar species (*Alosa pseudoharengus*), and collectively the two species are referred to as river herring.

Blueback herring spawning habitat in the Muddy River is thought to be located at the southern (upstream) end of Leverett Pond near the discharge of Babbling Brook. Work proposed in Leverett Pond is in a limited area at the downstream end of the pond. In order for the blueback herring to complete their life cycle they will need unimpeded passage through the Muddy River from its confluence with the Charles River, all the way upstream to their spawning habitat in Leverett Pond (i.e. nearly the entire reach of the project) during their spawning season (spring) and out migration season (fall). The spring work window was established to allow passage of the up-migrating pre-spawning and down-migrating post-spawning blueback herring adults, and the fall work window was established to allow passage of the down-migrating juveniles. These windows preclude bypass pumping in the river during most of the spring and early summer as well as during most of the fall, which could have a significant effect on the completion time of this project.

Based on New England District's current rough construction schedule, we envision 3 spring migration periods and 4 fall migration periods. Careful timing of the work by our contractor will allow for unimpeded downstream passage of juveniles during the entire construction period. If the contractor demonstrates a compelling need to use bypass pumping during the upstream migration period, USACE has developed a conceptual trap and truck plan to allow upstream and downstream passage of adult herring around dewatered work areas (see Attachment C). By utilizing this plan, the contractor can perform his dredging without the need to suspend work during the spring migratory periods. The plan has been reviewed and approved by the

MADMF. The contractor will be required to provide additional site specific information in the Environmental Protection Plan or a stand-alone Herring Trap and Truck Plan.

Other Fish and Wildlife Concerns

Dewatering work areas will lead to stranding and some mortality of fish, aquatic invertebrates, and turtles. The specifications require fish and turtles trapped in dewatered areas to be relocated to adjacent undisturbed areas to the extent practicable. Relocation of American eel is likely to be especially difficult because eel will bury themselves in sediment in response to a drawdown. A large number of freshwater mussels were stranded and died during Phase 1 dewatering of the Upper Fens Pond. The specifications require that the contractor attempt to relocate some fresh water mussels during Phase 2 dewatering (relocating all freshwater mussels is not practicable). The USACE construction contractor will submit fish, turtle, and freshwater mussel relocation plans for review and approval by the MA Division of Fish and Wildlife.

4.0 Alternatives Analysis

A detailed alternative analysis of the Muddy River Flood Control and Environmental Restoration Project is provided in the Environmental Assessment prepared for the USACE Feasibility study (USACE 2003). The analysis explains why and how the recommended plan was formulated and selected.

4.1 Flood Control Alternatives

This section describes four flood control plans that were selected for further study in the 2003 Decision Document (Feasibility Study) which form the basis of the Phase 1 and Phase 2 Muddy River Flood Damage Reduction project. Three plans offer a comprehensive solution to flooding in the Muddy River and its major tributary, Stony Brook. To establish a plan that maximized economic benefits, three levels of flood protection were evaluated. These included the 20, 25 and 100-year floods. Since a large percentage of expected flood losses would occur to the MBTA system (see Section II of USACE (2003)), an independent plan to protect this essential public resource was also developed. The proposed plans are illustrated in Plates 6 through 27 of USACE (2003).

Alternative 1: MBTA Portal Barrier Plan

The extensive inundation damage to underground MBTA facilities during the October 1996 storm was caused by flood flows entering through a tunnel entrance portal located just east of the Fenway station on the Riverside line (see Plate 5, USACE 2003). This portal is currently protected by a stoplog structure about three ft. high that must be manually closed. Hydrologic analysis (see Appendix C, USACE 2003) indicates that flooding along the tracks does not become a serious concern until flows exceed about the 10-year flood event. Flows exceeding this event overtop the stop-log structure and flood the underground portions of the MBTA system.

To prevent the major flooding associated with floods exceeding the 10-year event, the feasibility of raising the portal walls and stop log structure was evaluated. Given the peak flows developed for the 1996 and 1955 events, preliminary studies indicate that the portal walls and stop log structure would need to be raised about 4 feet.

Although raising the stoplog structure and portal walls would be a relatively straightforward solution to flooding of the underground portions of the MBTA, it will induce flooding in other areas. These areas include adjacent parking lots, apartment buildings, and railroad tracks owned by the CSX Corporation. Since raising the height of protection at the portal will induce serious flooding in other areas, additional flood control measures were necessary to mitigate for this damage. Although the parking lots and apartment buildings could be protected by structural or non-structural means, preventing inundation of the CSX tracks would only transfer the flooding to other areas. Consequently, the only feasible solution was a tunnel/culvert to divert flows from the portal area to the Charles River Basin. Due to space limitations in the vicinity of the existing stoplog structure, the control structure needed to be moved to the west side of the Fenway station where a new floodwall (about 865 ft. long), gate structure and tunnel entrance would be situated at this point. The required tunnel to direct flows from the area of the new closure to the Charles River Basin would be 12 ft. in diameter and about 3200 ft. long. The tunnel alignment and other project features are shown on Plate 5 of USACE (2003).

The cost of this measure alone is approximately $24,283,100. However, it only serves to protect the MBTA system and does not reduce flooding to other areas along the Muddy River or alleviate flood conditions caused by Stony Brook Conduit overflows.

Alternative 2: Flood Improvements for a 20-year Storm

This is the selected plan being implemented during Phase 1 and Phase 2. Elements of the plan are outlined in Section 3 of this narrative. This plan provides flood control by implementing a variety of measures to increase flow conveyance in the Back Bay Fens, Riverway, and Leverett Pond. The major flood control features of this plan were adopted from the Phase I Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project developed by the City of Boston and Town of Brookline.

Alternative 3: Flood Improvements for a 25-Year Storm

The proposed flood improvements for a 25-year storm event would include all of the features just presented for the 20-year storm, with the following additions or changes. Plans are shown on Plates 16 and 17 of USACE (2003).

The first additional project requirement would be the removal of about 870 cubic yards of sediment from the Muddy River Conduit. With operation of the gate on the upstream end of the conduit, this would allow additional flow through the conduit (See Plate 16, USACE 2003). The Muddy River Conduit runs beneath Brookline Avenue from just west of the former Sears parking lot to Kenmore Square and then into the Charles River (see also Plate 4, USACE 2003). This conduit is approximately 3600 ft. long and is generally rectangular in shape with varying dimensions in the range of ten ft. by 11 ft. high. The Boston Sewer and Water Commission (BWSC) owns and maintains this conduit and uses it to collect stormwater from adjacent streets. Coordination with BWSC determined that utilizing the conduit for additional Muddy River flood flows would reduce its storm drainage effectiveness and cause flooding in the Queensbury Street section of the Back Bay Fens. To mitigate for this induced flooding, a 60-inch conduit would be required to convey flood flows from Queensbury Street to the Muddy River at a point downstream from Boylston Street.

The second change/addition to the 20-year plan is necessary to convey the higher flow associated with the 25-year storm at the Riverway at the former Sears parking lot. Where the 20-year plan called for retaining the existing twin six-foot culverts and constructing a single new 10 x 16-foot arch culvert, the 25-year plan would include construction of twin 10 x 22 arch culverts and removal of the existing twin 6-foot culverts. The last change to the 20-year plan would be the construction of twin 10 x 22-foot arch culverts instead of the single 10 x 24-foot arch proposed for the 20-year plan.

The cost of the 25-year flood control plan is $29,944,500. This excludes the cost of removing sediment from the Muddy River Conduit as this is considered a local maintenance requirement.

Alternative 4: Flood Improvements for a 100-Year Storm

The proposed improvements to the Muddy River for a 100-year storm event are the same as those proposed for the 20-year event (storm of October 1996) with the addition of two major drainage tunnels and the cleaning of the Muddy River Conduit. The tunnels are required to convey storm water from the Muddy River to the Charles River in the larger storms since there is insufficient capacity to discharge the stormwater through the Muddy River channel area. Plans are shown on Plates 18 - 22 of USACE (2003).

The first tunnel will begin at Boston Gatehouse #2 and run under the Charlesgate area to an outlet at the Charles River (See Plates 19 and 20, USACE 2003). The tunnel is estimated to be 3,800 ft. long with a diameter of 14 feet. The second tunnel, estimated at 3,600 ft. long with a 14-foot diameter, begins at the former Sears parking lot adjacent to the Muddy River Conduit, runs parallel to this conduit, and discharges to the Charles River (See Plate 22, USACE 2003). As in the 25-year flood alternative, the Muddy River Conduit also needs to be cleaned of sediments to pass sufficient flow during the 100-year flood to meet target elevations (See Plate 21, USACE 2003), and a 60-inch conduit would be required between Queensbury Street and the Muddy River.

The estimated cost for 100-year flood control improvements is about $72,558,100 (Note: This excludes the cost of removing sediment from the Muddy River Conduit as this is considered a local maintenance requirement).

4.2 Plan Selection

Cost and Benefits of Flood Control Plans

The following summary shows total first costs, and annual costs and benefits for the four flood control alternatives under consideration. Total annual costs include costs for maintenance dredging of the flood control channels and sedimentation basins. Additional information on cost estimation is provided in Appendix G of USACE (2003).

Costs and Benefits of Flood Control Alternatives (from USACE (2003)).

Alternative Plan	Total First Costs*	Total Annual Costs**	Annual Benefit	Net Annual Benefits	Benefit/Cost Ratio
MBTA Portal Barrier	$24,283,100	$1,711,800	$5,292,900	$3,581,100	3.1
20-Year Plan	$24,896,200	$1,823,700	$6,299,500	$4,475,700	3.5
25-Year Plan	$29,944,500	$2,177,500	$6,789,500	$4,612,400	3.1
100-Year Plan	$72,558,100	$5,163,900	$6,886,700	$1,722,800	1.3

Note: * Total First Costs do not include escalation

** Total annual costs include first costs, interest during construction and operation and maintenance costs. Please note that cost estimates presented in this economic analysis are from the 2003 USACE report and were for planning purposes only.

Selection of the NED Plan

USACE planning guidance (ER 1105-2-100) specifies that the plan that maximizes net benefits shall be selected and recommended for Federal implementation (the National Economic Development or NED Plan). Net annual benefits are defined as excess annual benefits over costs, or, simply, annual benefits minus annual costs. Using the cost and benefit information from Table EA-3, annual net benefits range from $1,722,800 for the 100-year plan to $4,612,000 for the 25-year plan. All evaluated flood control plans have annual benefits exceeding annual costs and are economically justified. However, the 25-year plan has the largest net benefits and is the NED Plan.

Selection of Preferred Flood Control Plan

Although the NED Plan provides a higher level of flood control protection, the 20-year plan was selected as the preferred plan. The NED plan was rejected because it was not compatible with the historic restoration goals outlined in the Emerald Necklace Master Plan (Pressley Associates, 2001). The Master Plan recommends recreating the landscape and watercourse in the former Sears parking lot area and stressed that a historically sensitive design was imperative. Considering the original width of the river in this area (about 30-35 feet), twin 10x22-foot culverts required for the NED plan are inappropriate. The NED plan also relied on full utilization of the Muddy River Conduit to convey flood flows. This would, however, worsen flood conditions in the Queensberry Street portion of the Back Bay Fens. For these reasons, the study Sponsors preferred that the 20-year plan be retained for further consideration and used as the basis upon which environmental restoration measures were added and evaluated.

4.3 Phase 2 Project Alternatives

Alternatives following completion of Phase 1 include:

- No further Federal action
- Construct Phase 2 (remaining flood control measures).
- Construct Phase 2 and Implement additional habitat restoration measures funded by non-federal sponsors.

Under the no further Federal action alternative, no further flood control improvements would be constructed. The project Sponsors would be responsible for maintaining Phase 1 improvements. The FRCS would remain in place to prevent increased flooding in the Fens and the $38.5 million dollar Phase 1 investment would provide little or no flood risk reduction benefits. Restored aquatic and riparian habitat would continue to provide habitat benefits. Maintenance would include periodic clearing of debris from the FRCS outlet. As the intent of the FRCS was to provide temporary control of flow downstream, the long term viability of the structure is unknown.

Under the construct phase 2 alternative, the flood control measures described in Section 3.0 above would be implemented. This alternative would provide all the flood control benefits intended for this project as well as support significant ecosystem improvements. Both the habitat impacts and improvements are more limited in this alternative than the full environmental restoration project that included extensive environmental dredging. All elements of the flood control project bring significant environmental improvements through the project area. The dredging and removal to increase capacity and conveyance is a very expensive and disruptive process; however, the ancillary environmental benefits are expected to be extensive. A monoculture of exotic invasives will be replaced by a diverse, native mix. Habitat that is very rare in urban areas, such as wet meadows and scrub/shrub areas will be created. In addition, wildlife, such as birds and small mammals, which typically do not have a supportive environment in an urban setting will benefit from the enhanced invertebrate community, as a result of the flood control project.

Under the construct phase 2 and implement additional habitat restoration measures funded by the non-Federal sponsors alternative, additional measures could include removal of additional sediment from the ponds, the Riverway, and Back Bay Fens, removal of additional *Phragmites* in the Riverway and Fens by excavation or use of herbicide, and additional bank restoration in the Riveway. As noted above, the City of Boston has proposed separate but supportive ecosystem restoration limited project specifically for *Phragmites* removal in the system. While this will not offer the improvements associated with benthic habitat provided by environmental dredging, it also does not have the associated resource area impacts but will provide a diverse, native plant mix while reducing the re-infestation of areas restored in Phase 2.

5.0 Environmental Consequences and Benefits

Flood risk reduction benefits were discussed in Section 4. This section discusses adverse impacts and benefits to environmental resources ancillary to construction of the flood control project. The effects of both Phase 1 and Phase 2 activities are integrated in the discussion.

Table 5-1 summarizes the impacts of Phase 1 and Phase 2 to state and federal wetland resource areas. A breakdown of impacts within each municipality and work area are provided. The daylighting of nearly 800 linear feet of the Muddy River during Phase 1 work serves to compensate for the alteration of resource areas in the Back Bay Fens during Phase 2 construction and will yield a net increase in the area of land under water, create and restore riverfront area (riparian habitat), and create and restore bank. There will be a net loss of Bordering Vegetated Wetland and Federal emergent wetland which will be offset by restoration of open water habitat, riparian habitat, and bank. In addition to the open water and riparian habitat created as a result of the Phase 1 and 2 work, water quality is expected to be improved through the removal of sediment from a significant portion of the river, resulting improvement of dissolved oxygen in the surface water. The impacts and benefits of the proposed plan on each resource area is discussed in further detail below.

Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ancillary ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increased temperatures, nutrient concentrations, and algal blooms. Dredging will improve fish habitat (protect fisheries) and provide pollution prevention along with storm damage protection and flood control benefits.

5.1 Land Under Water

<u>Physical Habitat</u>

The Muddy River Flood Damage Reduction project will create or restore approximately 18 acres of land under water. This includes approximately 3 acres of open water habitat that was created by daylighting ca. 800 ft. of the river and restoring Upper Fens Pond as part of Phase 1 work. Approximately 15 acres will be restored in the Riverway and the Back Bay Fens from sediment excavated during Phase 2 work, which involves restoration of former open water habitat by removal of *Phragmites*, restoration of open water habitat by removal of mudflats or sand islands, and deepening of existing open water habitat. Although the flood control project does not propose bank to bank dredging as proposed for environmental restoration, a substantial proportion of the Back Bay Fens and Riverway will be dredged. The 2003 EA (USACE, 2013) mapped 11.1 acres of open water in the Back Bay Fens and 6.4 acres in the Riverway (see Figures 2-12 and 2-13). The acreage of open water habitat in the Back Bay Fens and Riverway following completion of Phase 2 will be approximately 15 and 7 acres, respectively.

The depth of dredging will be variable. Up to 7 ft. of sediment will be excavated in Leverett Pond (Area 1), 6 ft. in the Riverway, and 10 ft. in the Back Bay Fens. Approximately 88,000 cubic yards of sediment will be removed from under water. 14,000 cy. of topsoil and rock fill will be installed underwater for wetland restoration or erosion control. The net increase in volume of land under water will be about 74,000 cy.

Shallow (0-12 inch deep) vegetated shelves created during Phase 1 and Phase 2 in the Back Bay Fens will provide nesting and nursery habitat for fish and foraging habitat for wading birds such as great blue heron. Eight shelves were constructed during Phase 1; and 5 will be constructed during Phase 2. Habitat logs and boulders installed in the Riverway and Fens will provide basking sites for turtles and cover for fish.

Excavation in Work Area 10 will remove mudflat and a sand island downstream of the Boston gatehouse drain. Mudflat and a sand island will also be removed from Area 1 (Leverett Pond). Phase 2 will remove shallow mud flat areas present under normal flow conditions in Work Areas 2 – 5. However, this project will not remove all mudflats in the system, including, for example, the low gradient area upstream of the footbridge near Work Area 5.

The system is dynamic and undergoes continual erosion and sedimentation which will continue following project completion. Continual maintenance to remove sedimentation will be required. Inclusion of deepened channel sections will reduce the frequency of required maintenance. Completion of the project is expected to have no impact of water surface elevation in the Back Bay Fens, which is strongly influenced by water surface elevation in Charles River Basin.

Connectivity

In addition to restoring stream habitat and land under water, Phase 1 and Phase 2 will significantly improve aquatic connectivity. Phase 1 removed over 700 ft. of culverts which isolated the Riverway from the Back Bay Fens. Phase 2 activities will include removal of the FRCS, which is the only remaining significant anthropogenic barrier between the Back Bay Fens and Leverett Pond. Restoration of connectivity will benefit both resident warm water species and blue back herring, an anadromous species which spawns in Leverett Pond.

Water Quality

Sediment removal is expected to somewhat improve water quality in the Back Bay Fens. Sediment removal will improve DO levels in surface waters by 1) reducing sediment oxygen demand (SOD) by exposing well decomposed (weathered) underlying sediment with lower SOD than existing surface sediment, and 2) increasing the volume of water in the Back Bay Ferns and reducing the effect of SOD on DO levels. Removal of nutrient rich surface sediment may also reduce plant productivity and oxygen demand exerted by decomposing plant material. Water quality modeling by the USACE (USACE, 2003, Table EA-26) estimated that flood control project would reduce the percent area with low DO (< 5 mg/l) in the Back Bay Fens from 100% without sediment removal to 50 - 70% 25 years after construction. Modeling showed flood control dredging to have no measureable effect on DO in the Riverway where 100% of the area is modeled to experience DO levels < 5 mg/l under both with and without project conditions.

A mathematical model developed by Mathew et al. (2011) attributed poor water quality in the Muddy River primarily to significant internal inputs, attributed to waterfowl, sediment, and algal production. The study postulated that sediment removal planned as part of the full restoration project should lead to significant improvements in DO and biological oxygen demand. Although the full restoration project evaluated by Mathew et al. is not being implemented, sediment is being removed from a significant portion of the Back Bay Fens, so some improvement in DO is expected to occur in the Fens, as also predicted by the USACE model.

Water quality will also be improved by bank stabilization of the Upper Fens Pond during Phase 1 work and the restoration of over 6,000 lf of bank during Phase 2 work. In addition, continued implementation of Best Management Practices (BMP's) by non-Federal sponsors to reduce loading of sediment, organic material, nutrients, and contaminants to surface waters from storm drains and non-point sources will also improve water quality.

<u>Sediment Quality</u>

Testing by CDM (2001) and the USACE (2003) show that contaminant levels in underlying sediment are generally lower than concentrations in existing surface sediments. CDM (2001) measured levels of metals, PAHs, PCBs, pesticides, and other chemicals at 2 ft. intervals ranging from 0-2 ft. to 10-12 ft. USACE (2003) used this information to predict the concentration of selected chemicals in sediment exposed by dredging. The proposed dredging will generally expose sediment with lower levels of contaminants than in surface sediments in the Back Bay Fens (Table 5-2). Lead, cadmium, chromium, mercury, PAH, PCBs and DDT concentrations will be lower in exposed sediment. In the Riverway, PAH levels will be greatly lower in exposed sediment. PCB and some metal levels will also be lower, but DDT levels in exposed sediment may be higher than existing surface sediments at Riverway. Lower PCB concentrations in surface sediment will likely result in lower PCB levels in fish and aquatic invertebrates and less food chain exposure to wildlife.

Risk of PAH mixtures to benthic communities can be assessed by using an equilibrium partitioning method developed by the USEPA (2000). An ESG greater than 1 is indicative of ecological risk. PAH mixture ESGs were above 1 at all locations in the Riverway and Back Bay Fens (USACE, 2003, Table D-12). Post construction PAH ESG levels will likely be less than 1 in restored areas.

Toxicity testing indicates sediments in the Riverway and Back Bay Fens are toxic to aquatic invertebrates (USACE, 2003). Lower levels of contaminants following excavation in Phase 2 work areas should reduce sediment toxicity but risk screening levels (MacDonald, 2002) for some contaminants will likely still be exceeded. Surface sediments in the daylighted sections in the Back Bay Fens and shallow (0-12 inch) shelves created during Phase 1 and Phase 2 in the Back Bay Fens are expected to have much lower contaminant levels than sediment elsewhere in the Muddy River. The shelves were created using clean topsoil. Sediment quality improvement benefits will likely persist but sediment redistribution from upstream unexcavated areas may eventually elevate contaminant levels in restored areas. The improvement in the sediment quality will benefit the fish and aquatic habitat health in the ecosystem.

5.2 Federal Emergent Wetland

The project will result in a net loss of about 4.2 acres of emergent wetland, most of which is vegetated with *Phragmites* in the Back Bay Fens. Approximately 1.6 acres of emergent (mostly wet meadow) or wet meadow/scrub-shrub wetland will be restored during Phase 1 and 2 (approx.. 0.3 acres restored/created in Phase 1 and 1.3 acres restored/created in Phase 2). Most of the restored wetland will be in the Back Bay Fens, but a narrow wetland fringe will be restored in work areas along the Riverway. As described below, the restored wetland will have greater functional and ecological value than the existing *Phragmites* marsh.

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River *Phragmites* stands which are essentially monospecific. Monitoring of areas restored during Phase 1 indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored during Phase 2 along the Riverway and Back Bay Fens. Species noted in the Phase 1 fringe wetland in September of 2017 and/or 2018 include elderberry, water willow, sweet gale, pickerelweed, sweet flag, bugleweed, umbrella sedge, cattail, beggar-ticks, false nettle, boneset, Joe pye weed, blue vervain, soft rush, jewelweed, Pennsylvania smartweed, soft rush, spike rush, and water purslane.

The plant species community diversity in restored wetlands is expected to vary with time, but a moderate to high diversity community is expected to persist. The non-Federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of *Phragmites* and other invasive plants which could colonize and degrade the restored wetlands. To date, wetlands restored during Phase 1 have not been colonized by *Phragmites* or Japanese knotweed despite the presence of potential seed sources upstream along the Riverway.

Phase 2 will avoid impacting a 7500 sf cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by *Phragmites*.

In the Back Bay Fens, loss of *Phragmites* habitat will have an adverse effect on songbirds and other wildlife that use the wetlands for cover in an otherwise highly urbanized area. About 1.7 acres of *Phragmites* will remain the Back Bay Fens after Phase 2 construction, mostly along the right bank of the river adjacent to the Boston Fire Department Headquarters. This stand will continue to provide nesting and foraging habitat, and valuable cover, especially in winter, for songbirds and other wildlife. The cattail stand located upstream of Agassiz Road will remain and will also provide nesting and cover habitat.

The loss of *Phragmites* will be substantially mitigated by restoring wetland along the Back Bay Fens shoreline as shown on landscape plans included with project drawings. Restored wetlands will be seeded with a diverse wetland seed mix and planted with shrubs with high wildlife habitat value such as buttonbush, common elderberry, red osier dogwood, and summersweet. Wetland community diversity will be further enhanced by planting emergents such as pickerelweed, bur reed, blue flag iris, and sweet flag along the wetland shelf shoreline. Volunteer cattail, jewelweed, smartweed, *Bidens*, and other species will also likely colonize the shoreline and/or shallow water shelves. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates. As discussed above, with proper management, the restored wetland community is expected to persist long-term.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by *Phragmites*. Many of species that will be planted or are expected to colonize in the restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

The restored wetland will be established on clean soils, so should have a healthier soil invertebrate community than in the existing *Phragmites* wetland where surface soils are contaminated with concentrations of metals and PAHs that exceed USEPA Eco-SSL's and other ecological risk-based screening values. Wildlife such as worm eating birds and small mammals which prey on soil invertebrates should benefit from the enhanced invertebrate community.

5.3 Bank

Nearly 2000 linear feet (lf.) of bank was created by Phase 1 daylighting and 1692 lf. of bank was restored in Upper Fens Pond. An additional 7651 lf. of bank will be restored in the Back Bay Fens and Riverway during Phase 2.

Existing banks along the Riverway and Back Bay Fens are typically in very poor condition. The banks are eroding and often poorly vegetated (Photograph 7). The restored banks will be stabilized with coir fiber rolls and plantings. Bank restoration will reduce erosion and sediment deposition in the Riverway and Back Bay Fens. Vegetation seeded or planted on the banks will be similar to the Phase 1 fringe wetland described above and provide better wildlife habitat value than existing banks. As for emergent wetlands, the non-Federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of *Phragmites* and other invasive plants which could colonize and degrade the restored banks.

5.4 Riverfront (Riparian) Habitat

All Riverfront disturbed by Phase 2 construction activities will be restored. Restored areas will be planted with shrubs and trees and/or seeded with a native wildflower or native wetland plant seed mix. Restored riparian communities are expected to have greater plant diversity and better wildlife habitat value than the preexisting riparian communities. As with emergent wetlands and bank, the non-Federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of Japanese knotweed, *Phragmites,* and other invasive plants which could colonize and degrade the restored riparian habitat.

Phase 1 created 1.1 acres of new riverfront in the Back Bay Fens and restored riparian habitat along the Upper Fens Pond. Monitoring of areas restored during Phase 1 indicates that the created and restored riparian habitat supports a diverse plant community (USACE, 2017, 2018). The community is free from invasive species and has been planted or seeded with many species with good wildlife habitat value, including shrubs and herbs used by pollinators. Riparian habitat restored during Phase 2 should have similar beneficial attributes.

The Phase 2 restored riparian habitat will be established on clean surface soils, which should have lower contaminant levels than are typical of urban soils. This should benefit the soil invertebrate community and wildlife which prey on soil invertebrates.

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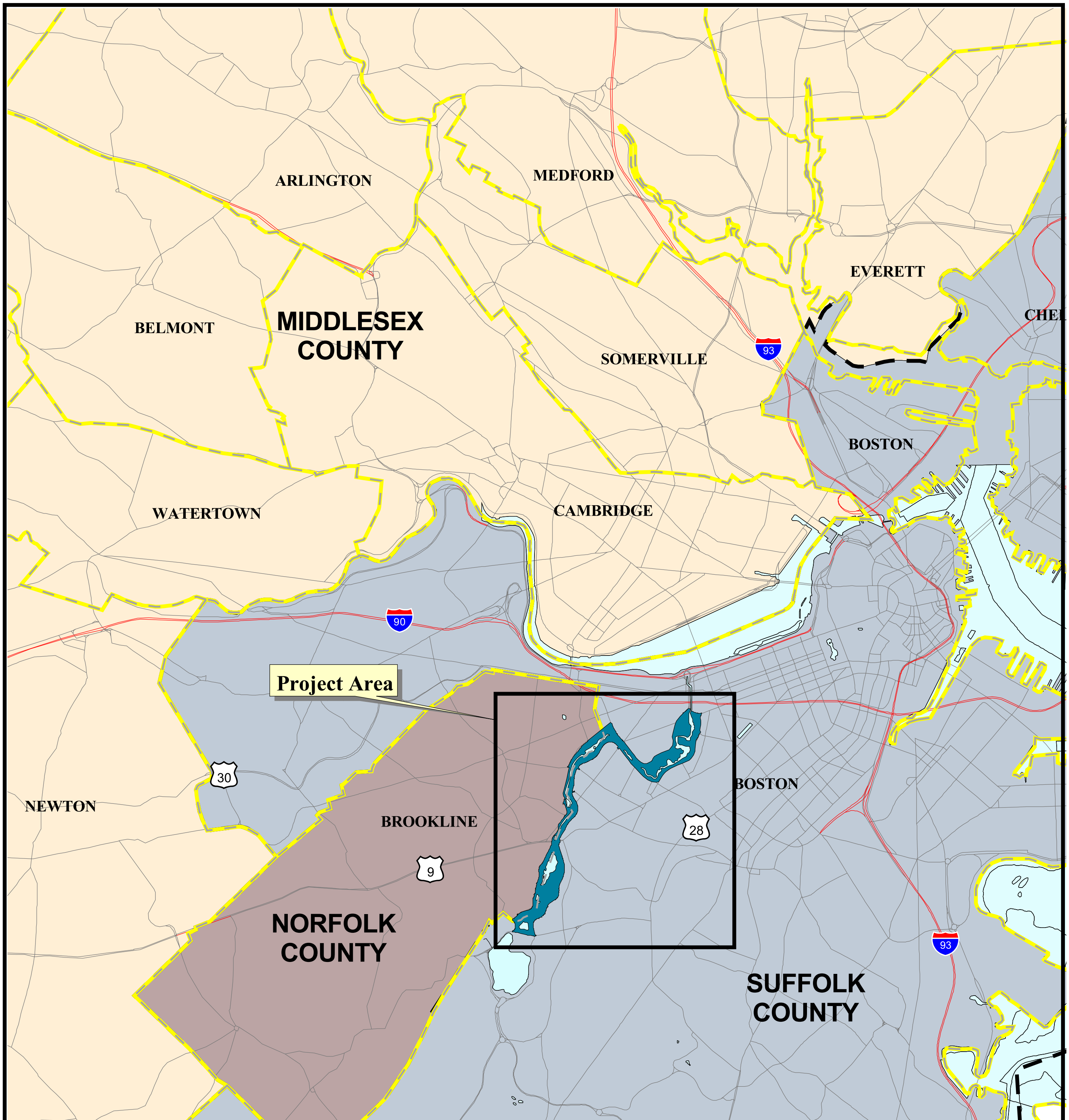
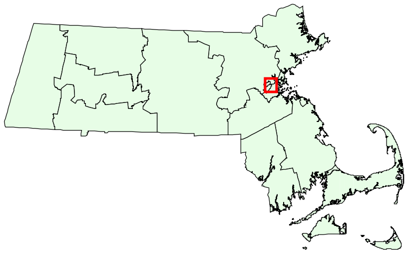
FIGURES





Project Area

N

3000 0 3000 6000 Feet

Data Source: MassGIS, Commonwealth of Massachusetts Executive Office of Environmental Affairs Data Layers

Figure 1. Vicinity Map
General Project Location

Muddy River
Boston and Brookline, Massachusetts
Draft Decision Document and Environmental Assessment

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Figure 1-2: Phase 2 Work Areas - Back Bay Fens

Figure 1-3: Phase 2 Work Areas - Riverway

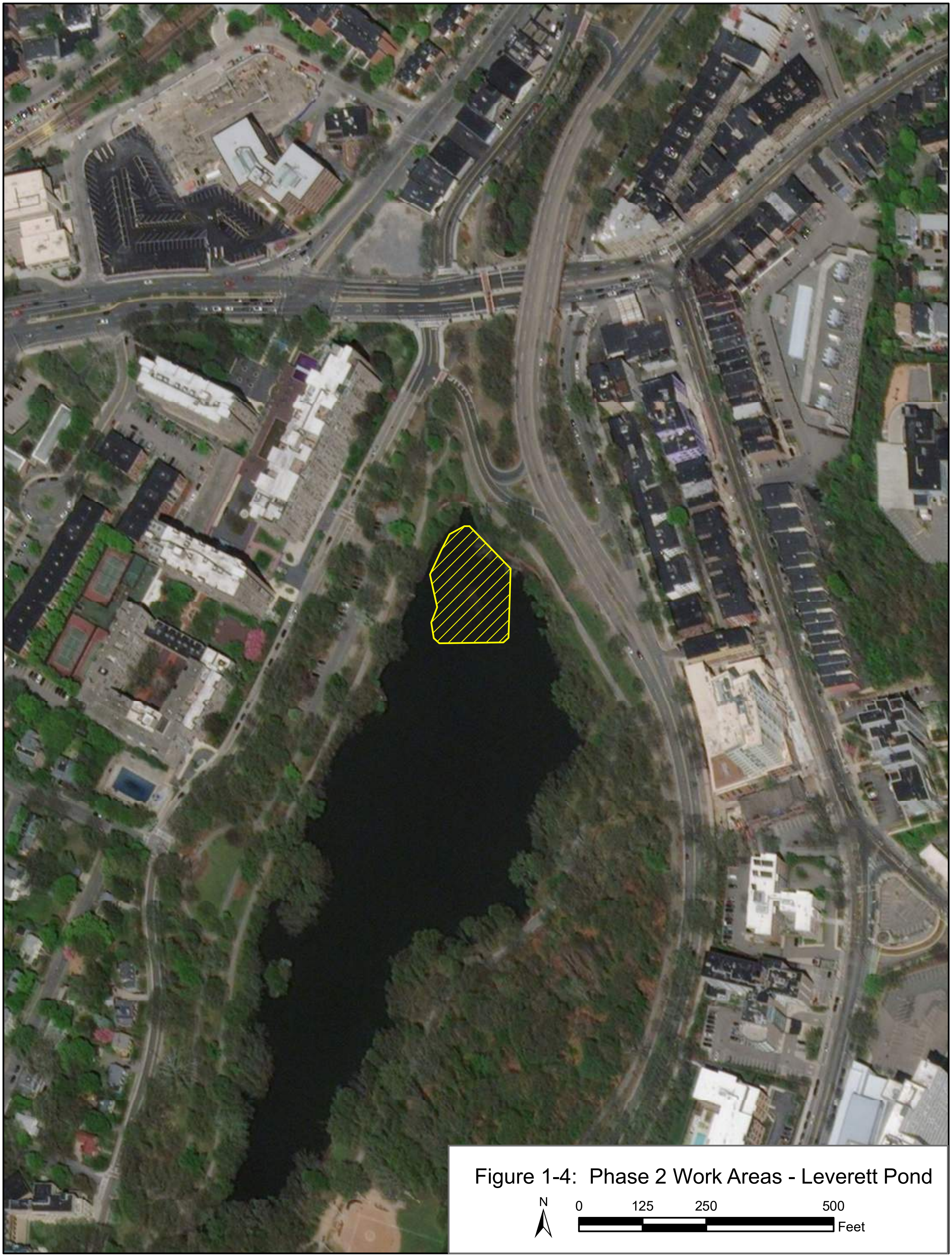
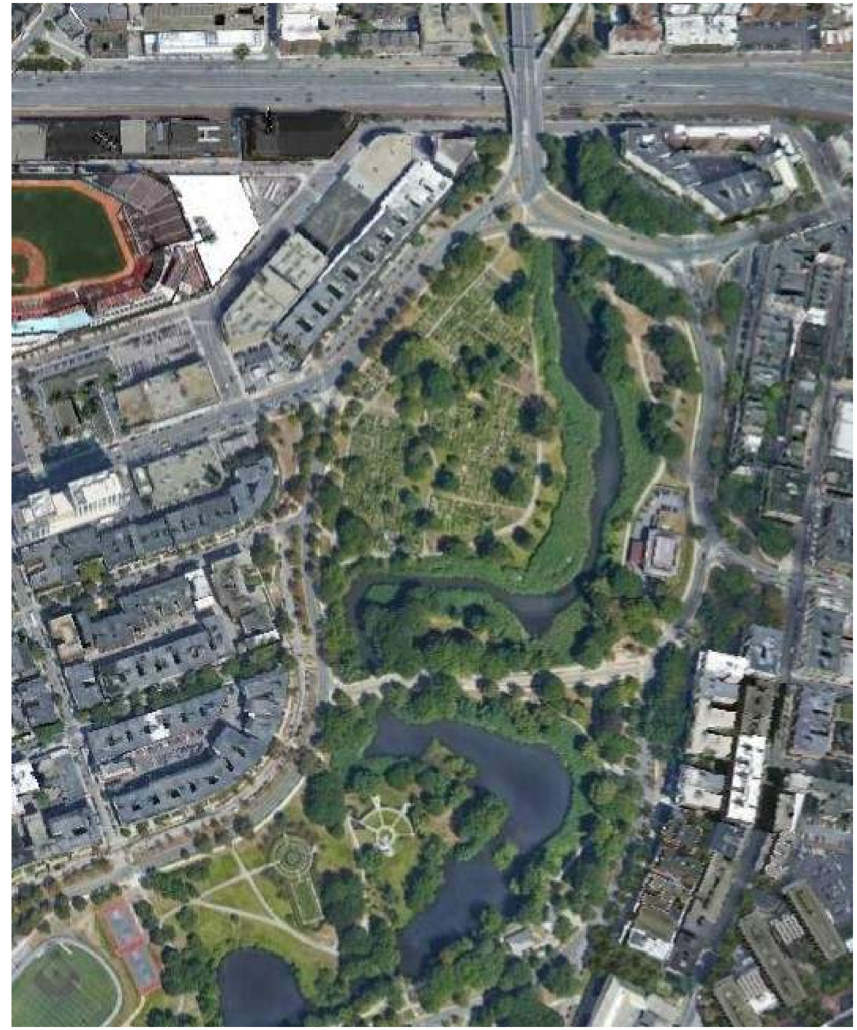


Figure 1-4: Phase 2 Work Areas - Leverett Pond

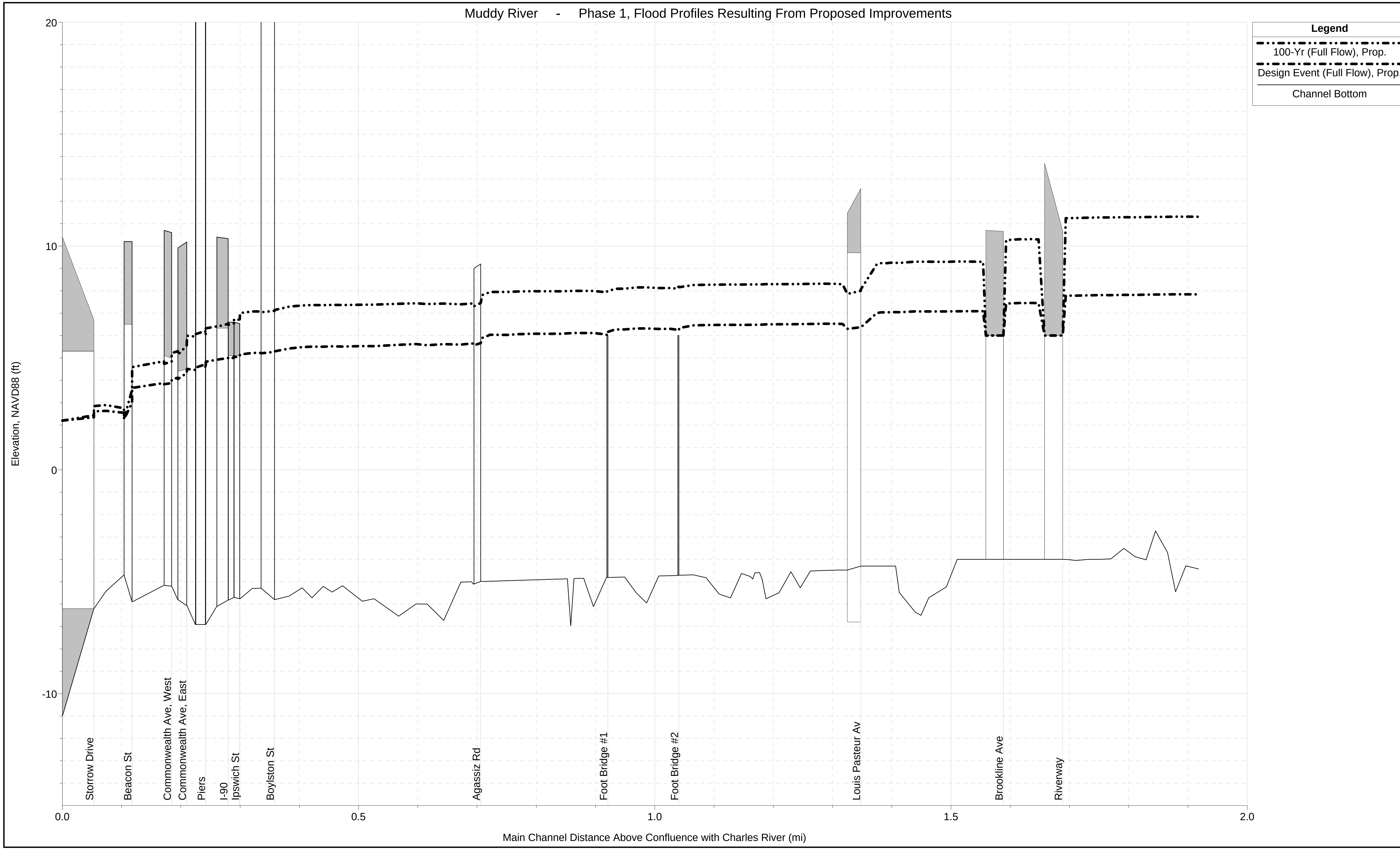
Figure 1-5: Phase 1 Restored Areas

1951



2017

Figure 2-1: Aerial Imagery of Back Bay Fens – 1951 and 2017.



Muddy River - Phase 1, Flood Profiles Resulting From Proposed Improvements
Legend
100-Yr (Full Flow), Prop.
Design Event (Full Flow), Prop.
Channel Bottom
Elevation, NAVD88 (ft)
20
10
0
-10
Storrow Drive
Beacon St
Commonwealth Ave, West
Commonwealth Ave, East
Piers
I-90
Ipswich St
Boylston St
Agassiz Rd
Foot Bridge #1
Foot Bridge #2
Louis Pasteur Av
Brookline Ave
Riverway
0.0
0.5
1.0
1.5
2.0
Main Channel Distance Above Confluence with Charles River (mi)

Figure 2-3

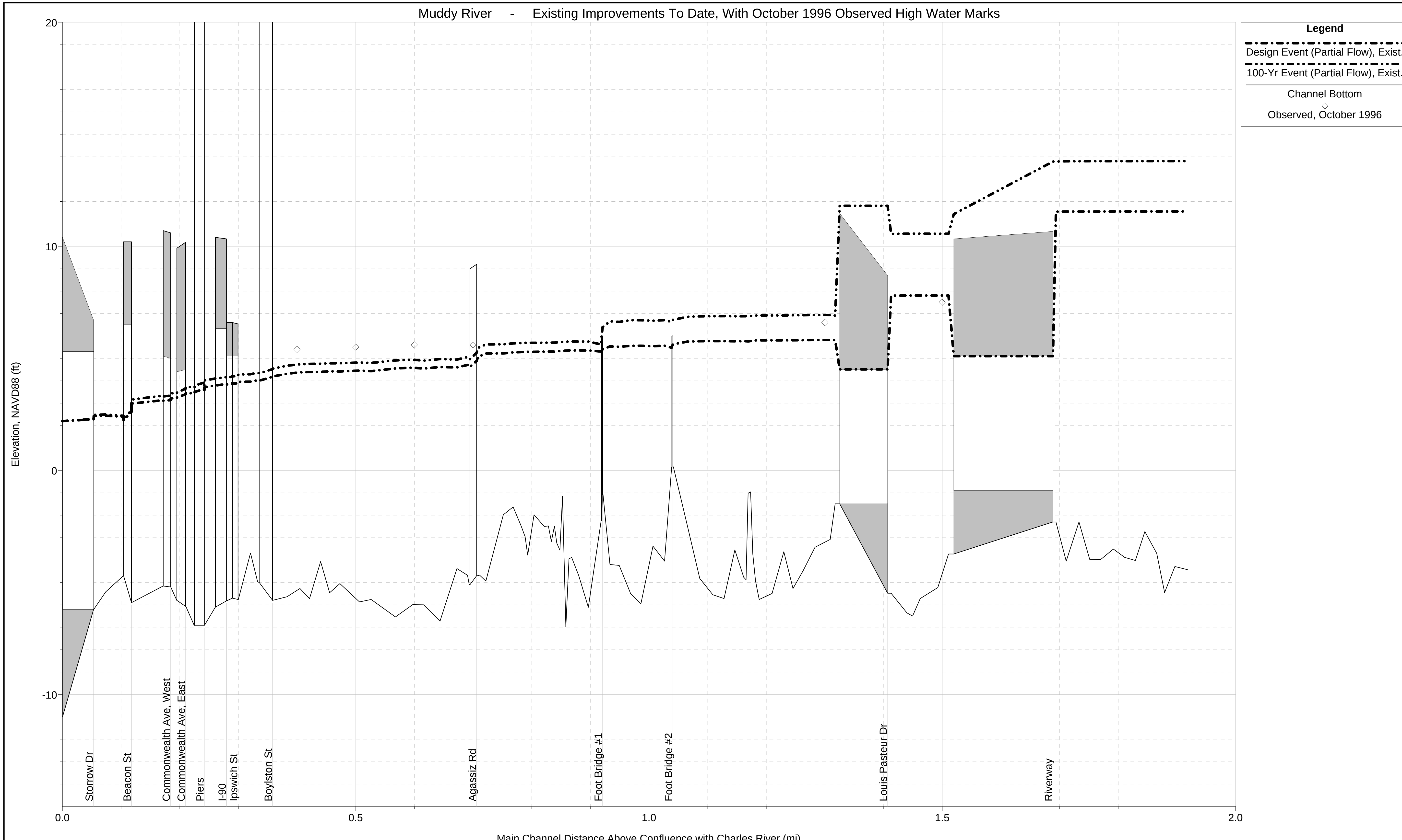
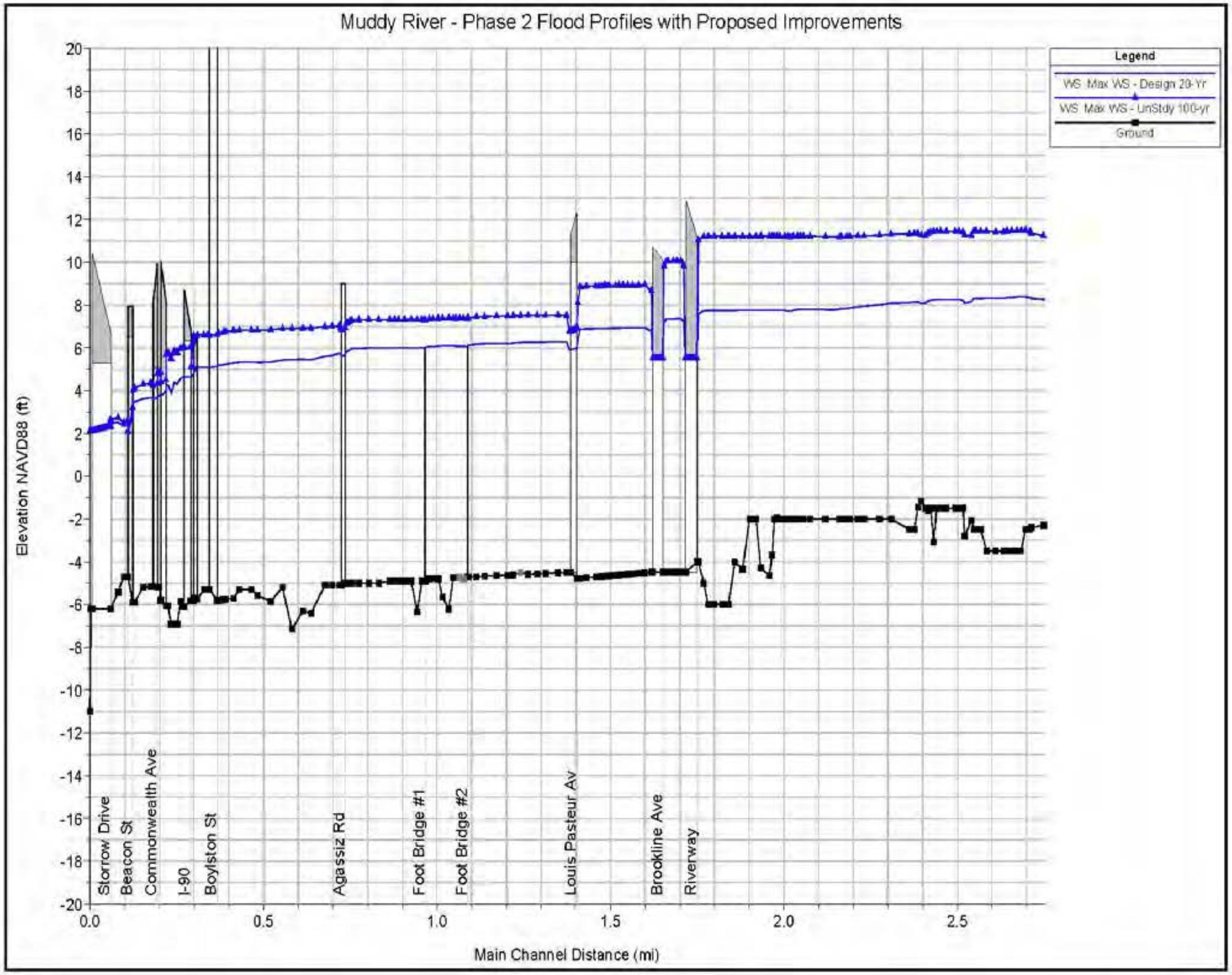

Muddy River - Existing Improvements To Date, With October 1996 Observed High Water Marks
Legend
Design Event (Partial Flow), Exist.
100-Yr Event (Partial Flow), Exist.
Channel Bottom
Observed, October 1996
Elevation, NAVD88 (ft)
20
10
0
-10
Storrow Dr
Beacon St
Commonwealth Ave, West
Commonwealth Ave, East
Piers
I-90
Ipswich St
Boylston St
Agassiz Rd
Foot Bridge #1
Foot Bridge #2
Louis Pasteur Dr
Riverway
0.0
0.5
1.0
1.5
2.0
Main Channel Distance Above Confluence with Charles River (mi)

Figure 2-2



Muddy River - Phase 2 Flood Profiles with Proposed Improvements
Legend
WS Max WS - Design 20-Yr
WS Max WS - UnStdy 100-yr
Ground
Elevation NAVD88 (ft)
Main Channel Distance (mi)
Storrow Drive
Beacon St
Commonwealth Ave
I-90
Boylston St
Agassiz Rd
Foot Bridge #1
Foot Bridge #2
Louis Pasteur Av
Brookline Ave
Riverway

Figure 2-4

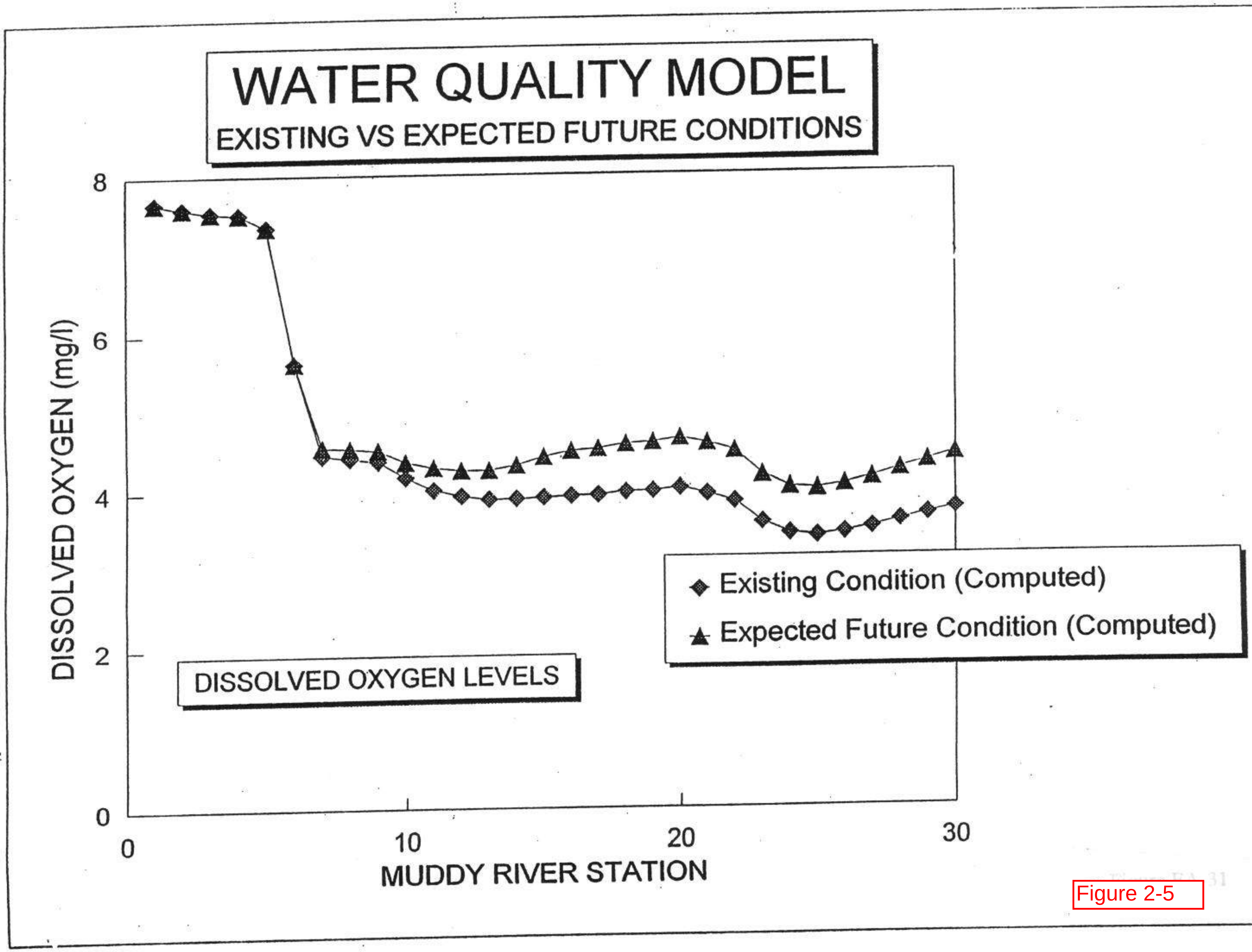

WATER QUALITY MODEL
EXISTING VS EXPECTED FUTURE CONDITIONS
DISSOLVED OXYGEN (mg/l)
8
6
4
2
0
0
10
20
30
MUDDY RIVER STATION
DISSOLVED OXYGEN LEVELS
Existing Condition (Computed)
Expected Future Condition (Computed)

Figure 2-5

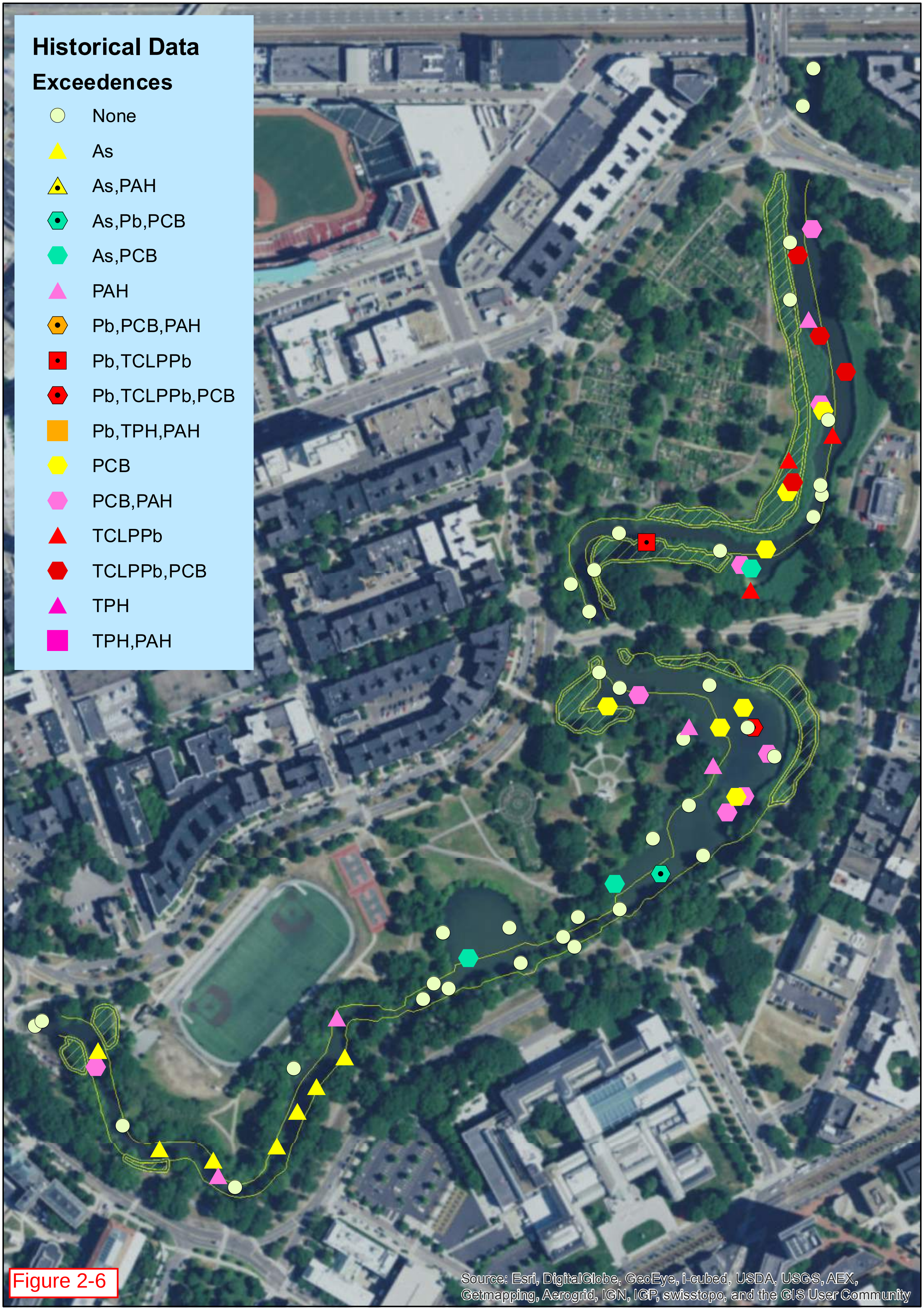
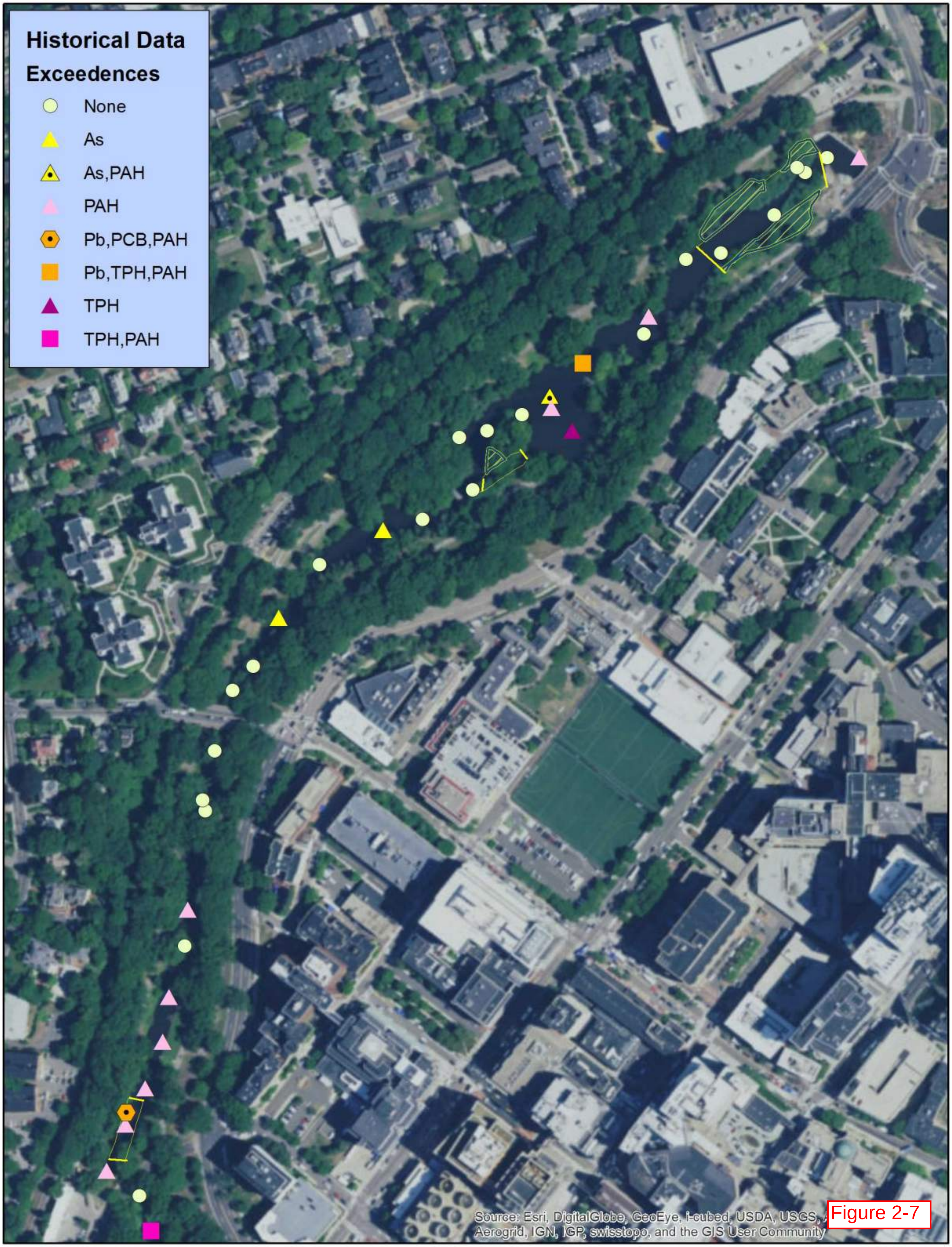

Historical Data
Exceedences
None
As
As,PAH
As,Pb,PCB
As,PCB
PAH
Pb,PCB,PAH
Pb,TCLPPb
Pb,TCLPPb,PCB
Pb,TPH,PAH
PCB
PCB,PAH
TCLPPb
TCLPPb,PCB
TPH
TPH,PAH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2-6


Historical Data
Exceedences
None
As
As,PAH
PAH
Pb,PCB,PAH
Pb,TPH,PAH
TPH
TPH,PAH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping,
Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Figure 2-7


Historical Data
Exceedences
None
As
As,PAH
PAH
Pb,PCB,PAH
Pb,TPH,PAH
TPH
TPH,PAH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Figure 2-8

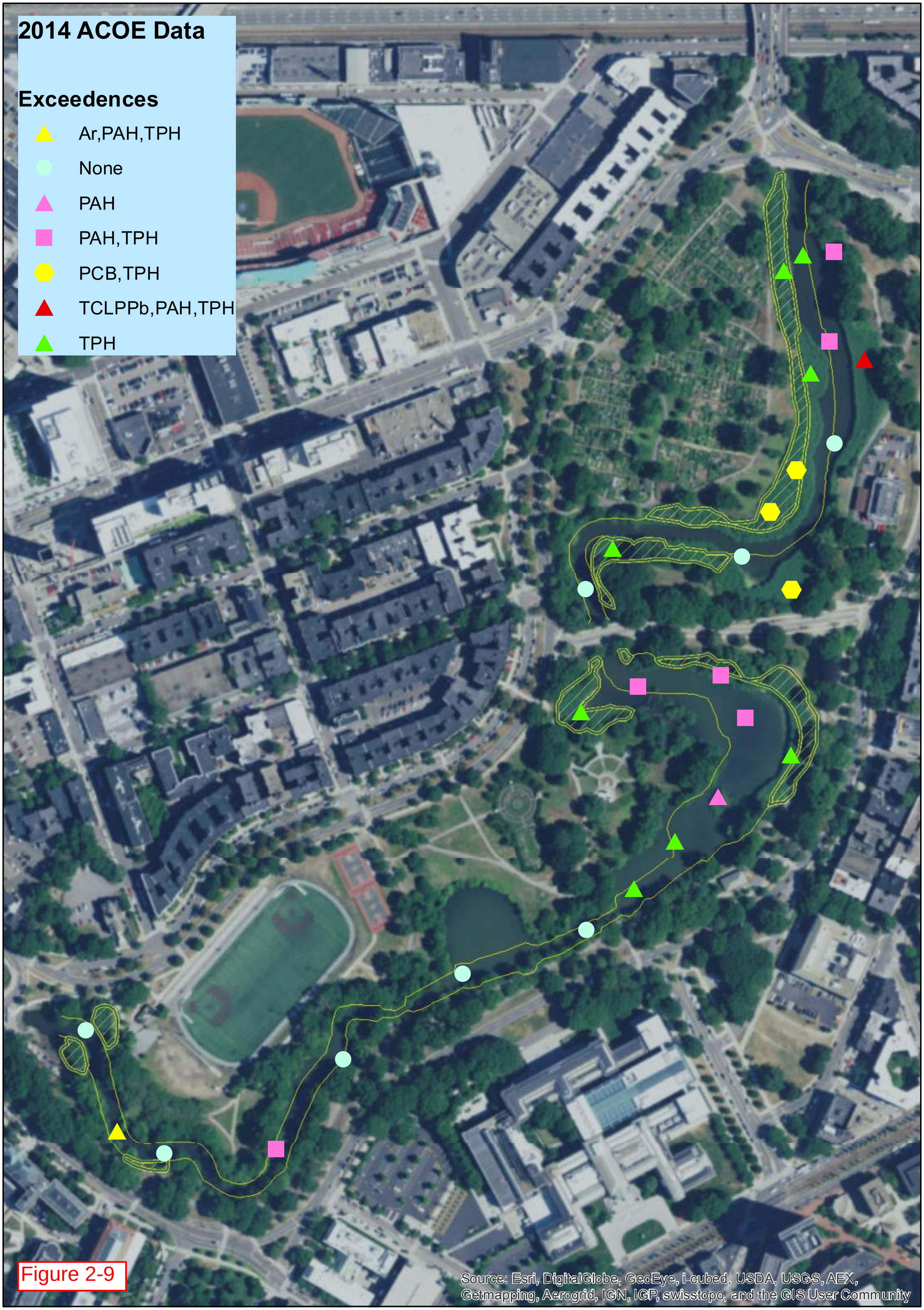
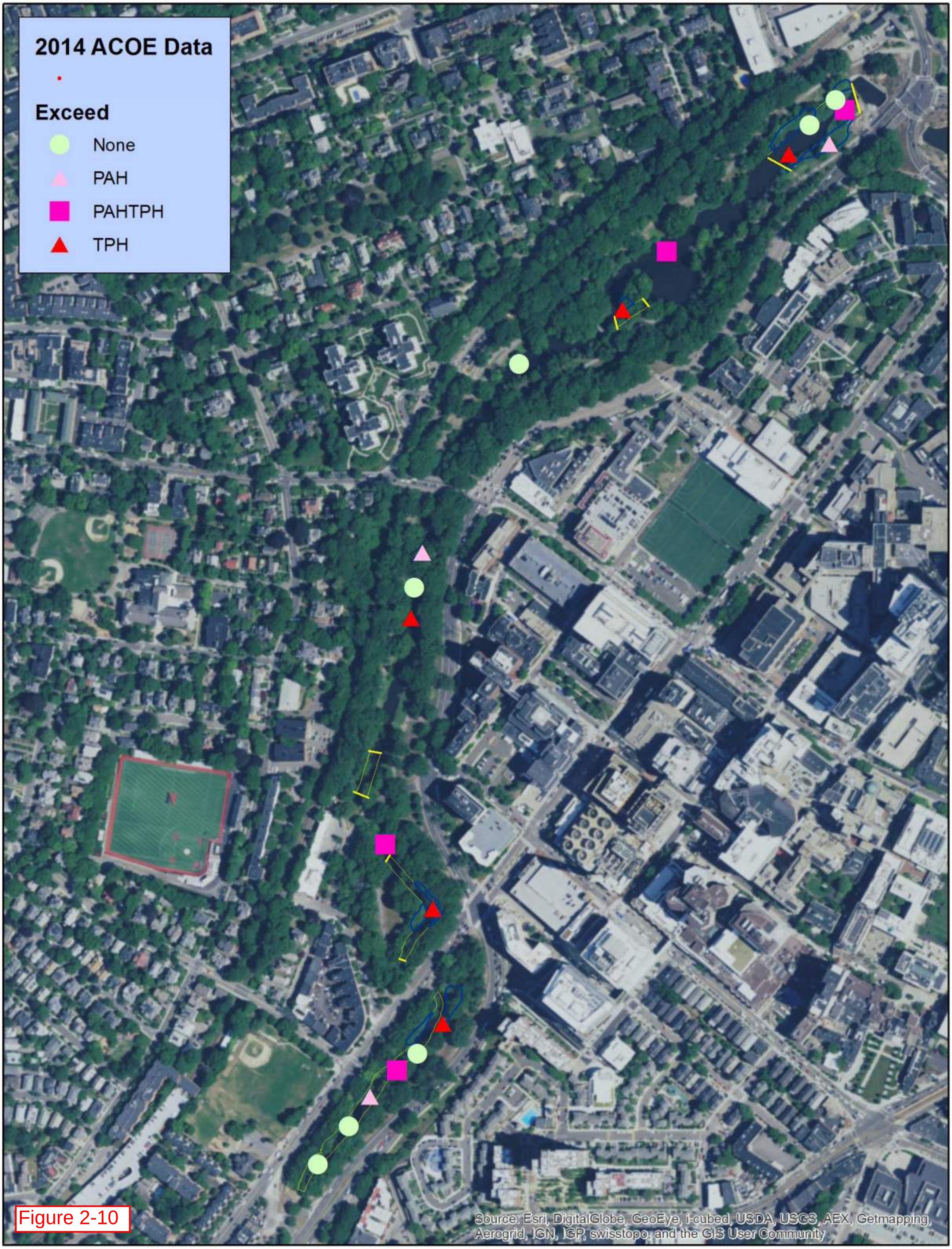

2014 ACOE Data
Exceedences
Ar,PAH,TPH
None
PAH
PAH,TPH
PCB,TPH
TCLPPb,PAH,TPH
TPH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2-9


2014 ACOE Data
Exceed
None
PAH
PAHTPH
TPH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Figure 2-10

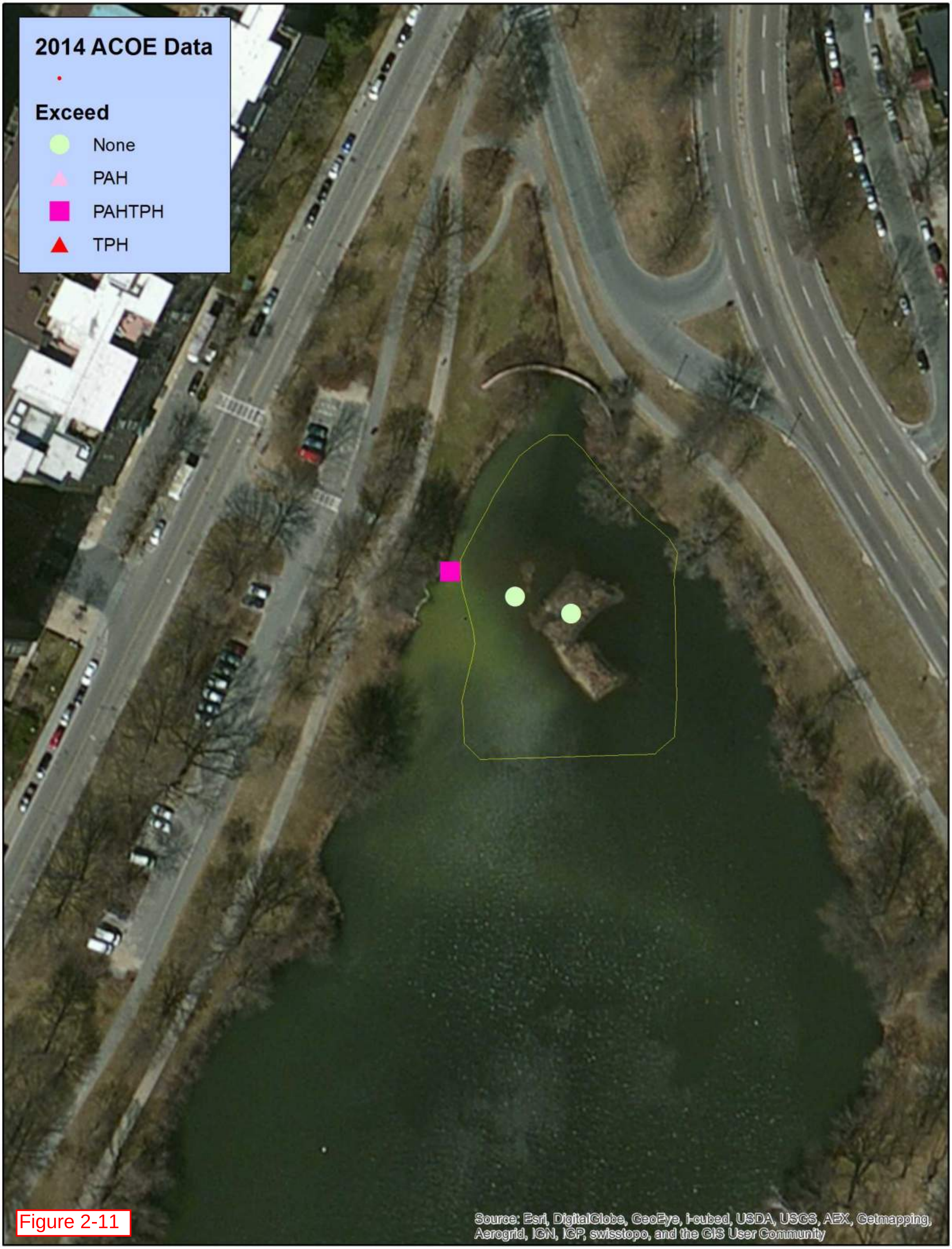

2014 ACOE Data
Exceed
None
PAH
PAHTPH
TPH
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2-11

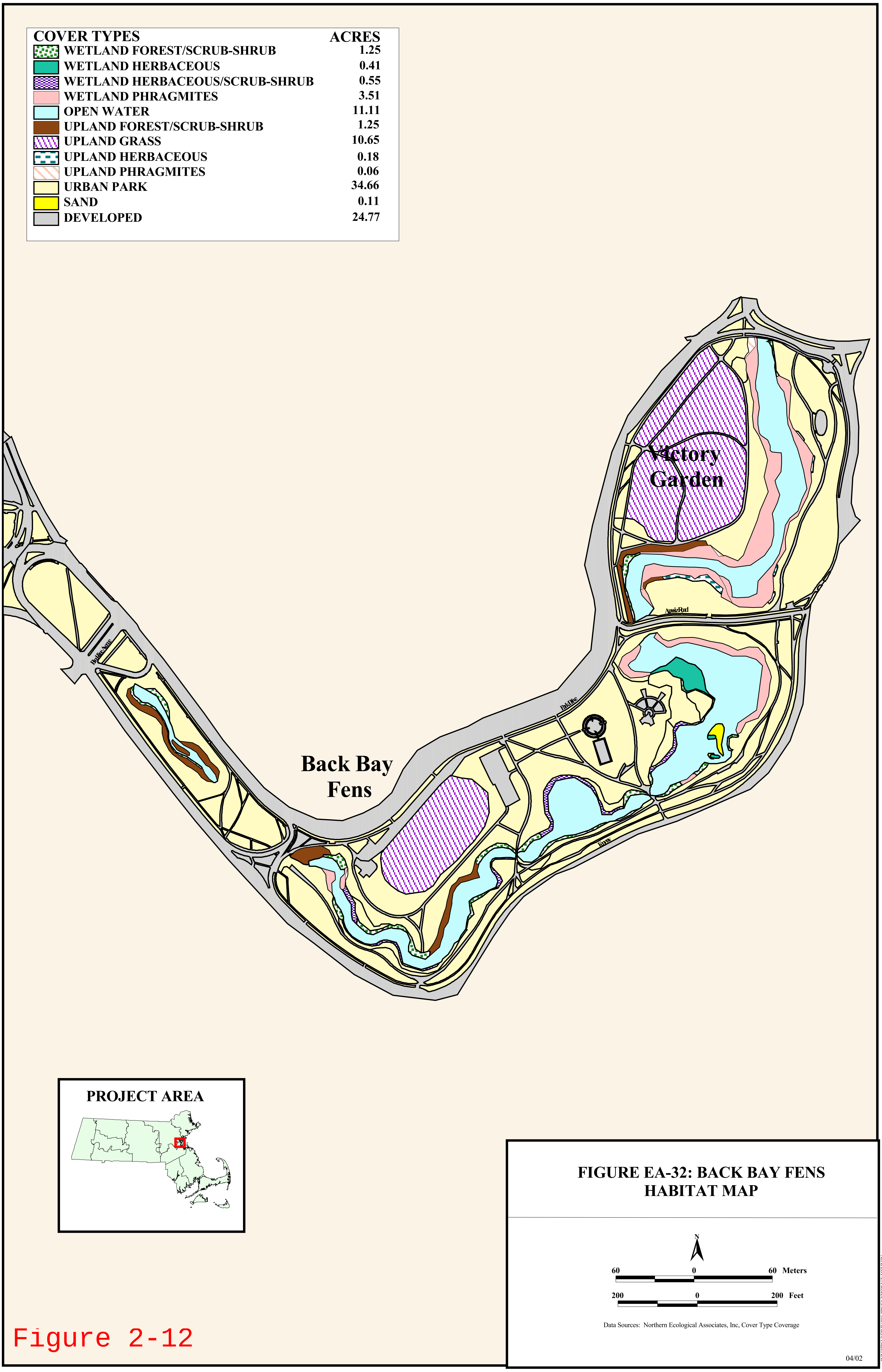


FIGURE EA-32: BACK BAY FENS HABITAT MAP

Figure 2-12


COVER TYPES ACRES
WETLAND HERBACEOUS/SCRUB-SHRUB 0.33
WETLAND PHRAGMITES 2.28
OPEN WATER 6.44
UPLAND FOREST/SCRUB-SHRUB 11.72
UPLAND HERBACEOUS 0.97
UPLAND HERBACEOUS/SCRUB-SHRUB 0.48
UPLAND PHRAGMITES 0.31
URBAN PARK 14.80
DEVELOPED 21.90
PROJECT AREA
Fens Study Area
Riverway Study Area
Ponds Study Area
FIGURE EA-33: RIVERWAY HABITAT MAP
N
200 0 200 Meters
500 0 500 Feet
Data Sources: Northern Ecological Associates, Inc, Cover Type Coverage
04/02

Figure 2-13

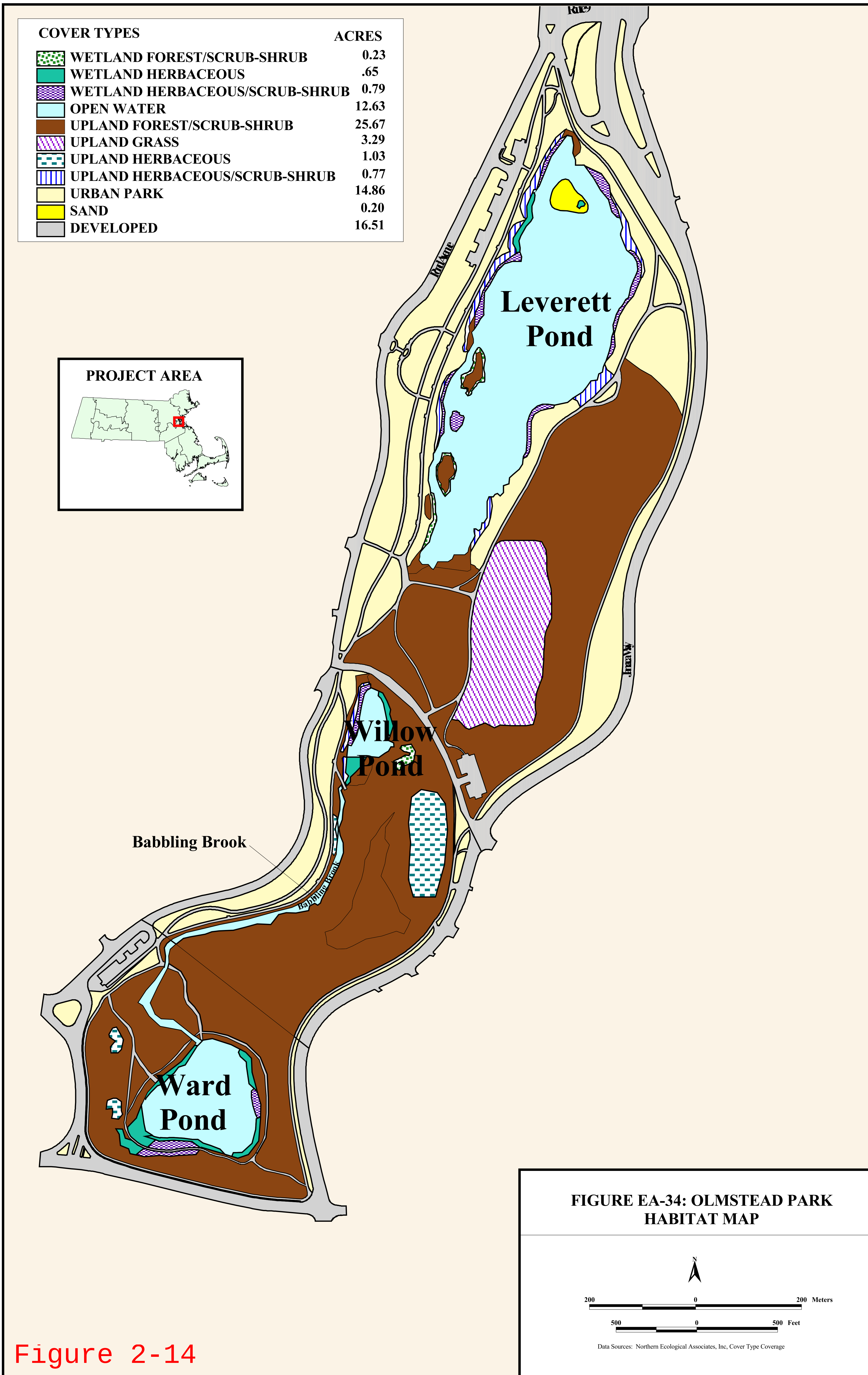

COVER TYPES
ACRES
WETLAND FOREST/SCRUB-SHRUB 0.23
WETLAND HERBACEOUS .65
WETLAND HERBACEOUS/SCRUB-SHRUB 0.79
OPEN WATER 12.63
UPLAND FOREST/SCRUB-SHRUB 25.67
UPLAND GRASS 3.29
UPLAND HERBACEOUS 1.03
UPLAND HERBACEOUS/SCRUB-SHRUB 0.77
URBAN PARK 14.86
SAND 0.20
DEVELOPED 16.51
PROJECT AREA
Leverett Pond
Willow Pond
Babbling Brook
Babbling Brook
Ward Pond
FIGURE EA-34: OLMSTEAD PARK HABITAT MAP
N
200 0 200 Meters
500 0 500 Feet
Data Sources: Northern Ecological Associates, Inc, Cover Type Coverage
04/02

Figure 2-14

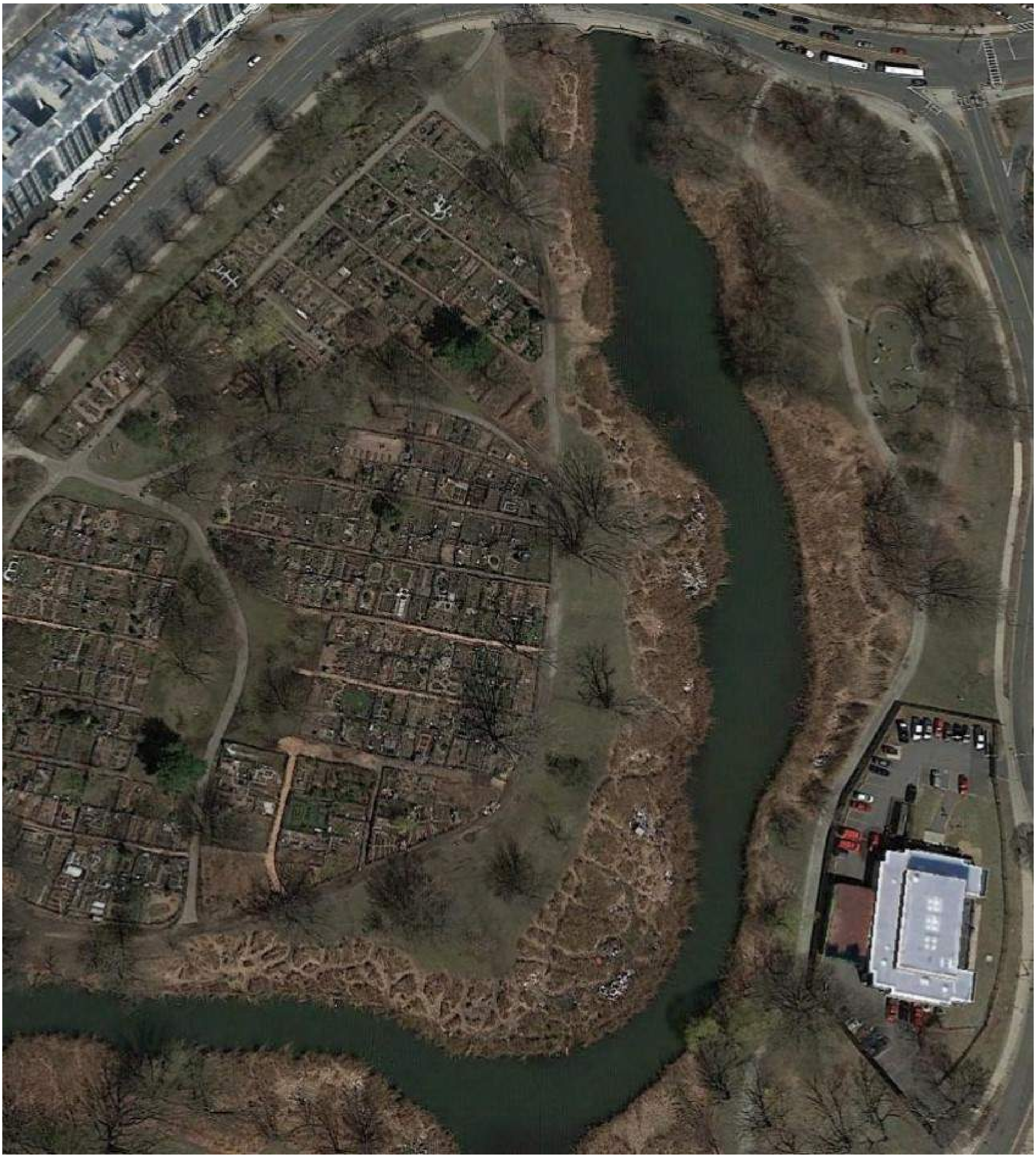


Figure 2-15: Human Activity in Back Bay Fens Phragmites (Google Earth, April 2018)

TABLES

Table 2-2: Summary of 2014 Corps sediment testing in the Back Bay Fens

Parameter	Reuse (MA Lined Landfill)	BBF01	BBF02	BBF03	BBF04	BBF05	BBF06	BBF07	BBF08	BBF09	BBF10	BBF11	BBF12	BBF13	BBF14
Metals (mg/Kg)															
Arsenic	40	26.3	43.3	19.6	37.9	23.8	12.6	19.9	23.0	22.1	2.38	15.0	22.4	22	21
Cadmium	80	5.02	11.1	-	6.98	-	-	2.37	6.1	2.88	1.79	5.36	4.69	5.84	4.29
Chromium	1000	123	176	-	137	-	-	32.9	46.7	41.3	60.2	120	43.2	76.2	37
Lead	2000	623	1080	-	962	-	287	269	979	1040	605	1220	1090	1430	1110
Mercury	10	4.22	4.88	-	3.67	-	-	1.13	2.77	3.68	0.748	1.95	3.97	4.66	3.1
TCLP Metals (ug/l)															
Lead, TCLP	5000	970	1300	-	636	930	449	274	818	1850	1930	1410	2980	3620	1950
Chromium, TCLP	5000		11	-	5.7	7.7	-	-	-	-	-	7.1	-	-	-
Mercury, TCLP	200	0.2	0.2	-	-	-	-	-	-	-	-	-	-	0.2	-
Reactive Cyanide (mg/Kg)	250	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reactive Sulfide (mg/Kg)	500	110	42	59	140	86	67	200	27	160	27	27	180	160	62
Total PCBs (ug/Kg)	< 2000	535.8	660	-	602	-	130	59	688	256.4	469.8	778	176	520	132
Total VOCs (ug/Kg)	10,000	518.1	764.3	-	702.4	-	-	517.6	1994.4	1297.6	88.9	131.3	608.6	946	1343.6
Total SVOCs (ug/Kg)	100,000	36820	121430	-	112370	-	-	41320	39600	96140	116550	79780	154140	136710	127240
TPH (mg/Kg)	5000	3930	6380	-	9290	-	-	1960	6290	5970	2130	11500	7390	10300	7330
pH	2 - 12.5	7.2	6.9	7.1	7.1	7	6.7	7.7	7.4	7.6	6.9	6.4	7.3	6.5	7.2
TOC (%)	n.a.	6.7	12	-	14	-	-	6	11	12	2.5	13	12	14	14
% Solids	n.a.	47	32	53	26	30	52	48	46	47	73	19	46	41	49

Parameter	BBF15	BBF16	BBF17	BBF18	BBF19	BBF20	BBF21	BBF22	BBF23	BBF24	BBF25	BBF26	BBF27	BBF28
Metals (mg/Kg)														
Arsenic	12.8	6.56	20.6	24.1	17	21.2	22	7.62	15.4	18.4	16.9	18.2	15	11
Cadmium	6.46	1.27	6.09	0.523	11.3	7.32	9.38	0.442	5.87	10.1	13.2	6.81	11.5	3.26
Chromium	94.8	37.5	53.5	54	92.9	74.5	78	34.9	57	88.4	194	87.3	116	50.3
Lead	1450	360	1280	403	1720	1110	1210	256	963	1450	1710	1150	1720	598
Mercury	2.05	1.66	2.69	6.44	3.32	2.64	2.49	2.55	3.06	2.81	3.2	3.05	2.06	2.35
TCLP Metals (ug/l)														
Lead, TCLP	1480	1180	1900	218	3180	2020	1090	351	1990	5970	2550	1860	3800	1930
Chromium, TCLP	-	-	-	-	-	-	-	-	-	-	5.5	-	4.3	-
Mercury, TCLP	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
Reactive Cyanide (mg/Kg)	1	1	1	1	1	1	1.1	1	1	1	1	1	1	1
Reactive Sulfide (mg/Kg)	27	110	75	27	160	54	30	19	27	58	27	200	50	59
Total PCBs (ug/Kg)	1418	68.4	754	0	2040	2100	2944	0	536.8	1364	3398	1882	1300	864
Total VOCs (ug/Kg)	999	256.9	1163.4	447	1209.1	736.8	498.1	288.9	230.6	1237.9	676.7	1812.7	1724.9	561
Total SVOCs (ug/Kg)	49080	34100	80740	22200	94350	75510	53070	10290	48130	104730	84140	58340	101950	105390
TPH (mg/Kg)	10400	2750	8100	410	16500	7500	12000	575	5880	8200	16400	11800	18700	7000
pH	6.7	7.4	4.9	7.8	6.6	6.9	6.4	7.4	5.3	5.8	5.9	7.1	6.7	7.3
TOC (%)	13	4.2	16	5	14	12	21	4	11	13	14	10	14	8.8
% Solids	33	61	44	52	38	40	28	54	52	44	37	43	38	49

Table 2-3: Summary of 2014 sediment testing in the Riverway and Leverett Pond

Parameter	Reuse (MA Lined Landfill)	RW01	RW02	RW03	RW04	RW05	RW06	RW07	RW08	RW09	RW10	RW11	RW12	RW13	RW14	RW15	RW16	RW17	RW18	RW19	LP01	LP02	LP03
Metals (mg/Kg)																							
Arsenic	40	1.47	1.92	5.17	4.46	-	12.7	9.15	7.05	11.7	-	-	12.6	12.8	11	11	16.9	7.1	33.8	38.1	12.1	5.64	3.28
Cadmium	80	0.58	0.342	1.28	1.68	-	3.85	3.69	3.9	5.08	-	-	-	6.82	5.2	4.67	1.99	3.93	4.88	1.36	1.54	0.414	0.719
Chromium	1000	16.6	12.6	26	44.2	-	153	67	113	135	-	-	-	144	80.1	86.2	54.7	23.4	136	35.3	30	23.8	23.9
Lead	2000	134	78.5	316	391	-	938	483	865	1630	-	-	-	1350	635	614	446	257	1020	292	465	164	290
Mercury	10	0.264	0.304	0.433	0.829	-	1.14	0.908	1.64	2.19	-	-	-	1.68	1.29	1.17	0.552	0.188	1.26	0.298	0.738	0.414	0.427
TCLP Metals (ug/l)																							
Lead, TCLP	5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, TCLP	5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury, TCLP	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reactive Cyanide (mg/Kg)	250	1	1	1.1	1	1	1	1	1	1	1	1	1.1	1.1	1	1	1	1	1	1	1	1	1
Reactive Sulfide (mg/Kg)	500	27	27	30	32	27	45	35	28	27	27	27	30	30	70	27	31	27	46	27	27	27	27
Total PCBs (ug/Kg)	< 2000	0	0	10.8	84.4	-	298	71.2	371	970	-	-	-	494	77.8	138.4	134.2	0	350	97.4	355.8	169.8	51.8
Total VOCs (ug/Kg)	10,000	74.4	68	189.2	817.6		5665.4	680.1	754.9	669.8	-	-	-	603.3	1156	871.6	357.8	254.8	679.3	289.1	580.2	60.8	138.3
Total SVOCs (ug/Kg)	100,000	31390	35285	151250	115740	75660	91060	61670	101140	79000	59330	365200	-	-	117720	67220	28490	202510	107730	17730	130430	44160	52020
TPH (mg/Kg)	5000	560	375	3490	5370	-	10600	9200	10200	12400	-	-	-	16300	24000	6900	4600	2671	16800	1750	5350	700	2530
pH	2 - 12.5	5.4	6.8	6.1	5.5	6.6	6.4	6.9	6.7	6.9	6.8	6.4	-	6.3	6.6	6.9	7.4	6.5	7	6.2	6.9	6.8	6.9
TOC (%)	n.a.	1.6	1.4	4.4	8.7	-	13	12	9.1	13	-	-	-	15	13	12	7.9	4.4	13	7.8	7.6	0.79	3
% Solids	n.a.	82	79	63	44	37	30	38	36	42	56	47	38	34	27	32	29	47	24	45	62	82	75

Table 2-4: Back Bay Fens – Lead and TCLP (CDM 2000)

All Sample Locations

Increment	N	Mean Pb (mg/kg)	TCLP Lead			
			Number of Tests	Exceed	Mean Pb (mg/kg)	
					TCLP Test	No Test
0 – 2 ft.	52	755	41	6	944	51
2 – 4 ft.	24	374	9	1	892	64
4 – 6 ft.	32	449	18	1	711	112

Samples collected at BBF6 through BBF58

Samples from BBF Excavation Footprint (95% design plans)

Increment	N	Mean Pb (mg/kg)	TCLP Lead			
			Number of Tests	Exceed	Mean Pb (mg/kg)	
					TCLP Test	No Test
0 – 2 ft.	45	790	34	5	1029	51
2 – 4 ft.	19	425	8	0	970	29
4 – 6 ft.	28	486	16	1	759	123

November, 17, 2017

Table 2-5

Fish Reported from the Muddy River

Species	Back Bay Fens	Riverway	Leverett Pond	Willow Pond	Wards Pond
<u>Anadromous</u>					
Blueback herring	•	•	•		
<u>Catadromous</u>					
American eel	•		•		
<u>Resident</u>					
Banded killifish	•	•			
Bluegill	•		•		•
Brown bulhead	•		•		
Chain pickerel		•	•		
Common carp	•	•	•		
Golden shiner	•	•	•		
Goldfish	•		•		•
Killifish					•
Largemouth bass	•		•		•
Pumpkinseed	•		•		
Yellow perch	•		•		
White bass	•				
Threespine stickleback				•	
Unidentifed species				•	

Table 2-6: Plant Species Occurring in the Muddy River Project Area (1 of 2)

Layer	Common Name	Scientific Name
Trees	Pumpkin Ash	*Fraxinus tomentosa*
	Green Ash	*Fraxinus pennsylvanica*
	Black Cherry	*Prunus serotina*
	Red Oak	*Quercus rubra*
	Weeping Willow	*Salix babylonica*
	Black Willow	*Salix nigra*
	Box Elder	*Acer negundo*
	Pin Oak	*Quercus palustris*
	Sugar Maple	*Acer saccharum*
	Silver Maple	*Acer saccharinum*
	Red Maple	*Acer rubrum*
	Norway maple	*Acer platanoides*
	Black Oak	*Quercus velutina*
	Swamp Oak	*Quercus palustris*
	Gray Birch	*Betula populifolia*
	Black Locust	*Robinia pseudoacacia*
	White Ash	*Fraxinusammericana*
	Sycamore	*Platanus occidentalis*
	Tupelo	*Nyssa sylvatica*
	Eastern Popular	*Polulus deltoides*
	Honey Locust	*Gleditsia triacanthos*
	River Birch	*Betula nigra*
	Sweet gum	*Liquidambar styraciflua*
Shrubs/ Vines	Indigobush	*Amorpha fruticosa*
	Northern Arrowwood	*Viburnum recognitum*
	Pumpkin Ash	*Fraxinus tomentosa*
	Green Ash	*Fraxinus pennsylvanica*
	Gray Birch	*Betula populifolia*
	Red Oak	*Quercus rubra*
	Black Cherry	*Prunus serotina*
	Glossy Buckthorn	*Rhamnus frangula*
	American Elm	*Ulmus americana*
	Silver Maple	*Acer saccharinum*
	Black Locust	*Robinia pseudoacacia*
	Elderberry	*Sambucus canadensis*
	Pin Cherry	*Prunus pensylvanica*
	Bittersweet Nightshade	*Solanum dulcamara*
	Asiatic Bittersweet	*Celastrus orbiculatus*
	Hawthorn Species	*Crataegus species*
	Japanese Honeysuckle	*Lonicera japonica*
	Multiflora Rose	*Rosa multiflora*
	Common Greenbriar	*Smilax rotundifolia*
	Raspberry Species	*Rubus species*
	Northern Honeysuckle	*Caprifoliaceae species*
	Japanese Barberry	*Berberis thunbergii*
	Silky Dogwood	*Cornus amomum*

Table 2-6: Plant Species Occurring in the Muddy River Project Area (2 of 2)

Layer	Common Name	Scientific Name
Shrubs/Vines	Red-osier Dogwood	*Cornus stolonifera*
	Sweet Pepperbush	*Clethera alnifolia*
	Multiflora Rose	*Rosa multiflora*
	Virginia Rose	*Rosa virginiana*
	Hazelnut	*Corylus americana*
Herbs	Aster Species	*Aster species*
	Water Smartweed	*Polygonum hydropiper*
	Pickerelweed	*Ponterederia cordata*
	Cattail	*Typha angustifolia*
	Broad-leaved cattail	*Typha latifolia*
	Goldenrod Species	*Solidago species*
	Water Horehound	*Marrubium vulgare*
	Common Reed	*Phragmites australis*
	Purple Loosestrife	*Lythrum salicaria*
	Lady's Thumb	*Polygonum persicaria*
	Beggars Tick	*Bidens connata, B. frondosa*
	New York Aster	*Aster novi-belgii*
	Lily Species	*Liliaceae*
	Bulrush	*Scirpus atrovirens*
	Blue flag Iris	*Iris versicolor*
	Yellow flag Iris	*Iris pseudocorus*
	Arrow Arum	*Peltandra virginica*
	Duckweed Species	*Lemna species*
	Water Meal	*Wolfia sp.*
	Coontail	*Ceratophyllum demersum*
	Fanwort	*Cabomba caroliniana*
	Common waterweed	*Elodea*
	Watercress	*nasturtium officnale*
	Water starwort	*Callitricha verna*
	Fragrant Waterlily	*Nymphaea odorata*
	Watershied	*Brassenia schreberi*
	Smartweeds	*Polygonum sp.*
	Spadderdock	*Nuphar luteum*
	Poison Ivy	*Rhus radicans*
	Swamp loosstrife	*Decodon verticillatus*
	Sweet Fern	*Comptonia peregrina*
	Sensitive Fern	*Onoclea sensibilis*
	Oriental Knotweed	*Polygunum cuspidatum*
	Wild Carrot	*Daucus carota*
	Barnyard Grass	*Echinocloa crusgalli*
	Mannagrass	*Glyceria canadensis*
	Grass Species	*Graminae*
	Sedge Species	*Carex species*

Table 2-7: Plant Species Occurring in the Phase 1 Prject Area (2017)

Scientific Name	Common Name	Planted or Seeded	Shoreline	Invasive	Wetland Indicator Status
Grasses and Herbs					
Acorus calamus	Sweet flag	x	x		OBL
Ambrosia artemisiifolia	Ragweed				FACU
Anaphalis margaritacea	Pearly everlasting				FACU
Arctium minus	Common burdock				FACU
Artemisia vulgaris	Mugwort				UPL
Asclepias syriaca	Common milkweed				UPL
Aster (Eurybia) divaricatus	White wood aster	x			NL
Aster (Symphyotrichum) novae-angliae	New England aster	x			FACW
Bidens sp.	Bidens sp.		x		
Boehmeria cylindrica	False nettle		x		OBL
Caltha palustris	Marsh marigold	x	x		OBL
Carex sp.	Sedge		x		
Centaurea stoebe	Spotted knapweed			x	NL
Chenopodium album	Lamb's quarters				FACU
Cirsium vulgare	Bull thistle				FACU
Cynodon dacctylon	Bermudagrass				FACU
Cyperus eragrostis	Umbrella sedge		x		FACW
Daucus carota	Queen Anne's lace				UPL
Decodon verticillatus	Water willow	x	x		OBL
Dichanthelium clandestinum	Deertongue	x			FACW
Elymus canadensis	Canada wild rye	x			FACU
Elymus virginicus	Virginia wild rye	x			FACU
Echinochloa crus-galli	Barnyard grass		x		FAC
Eupatorium perfoliatum	Bonset		x		FACW
Eupatorium (Eutochium) purpureum	Joe-pye weed		x		FAC
Euphorbia supina	Prostrate spurge				FACU
Euthamia graminifolia	Grass leaved goldenrod				FAC
Festuca rubra	Creeping red fescue	x			FACU
Galium sp.	Bedstraw		x		
Graminae spp.	unidentified grasses				
Heliopsis helianthoides	False sunflower				FACU
Hieracium lachenalii	Common hawkweed				NL
Impatiens capensis	Jewelweed		x		FACW
Iris versicolor	Blue flag iris	x	x		OBL
Juncus effusus	Soft rush		x		OBL
Lepidium virginicum	Virginia pepperweed				FACU
Ludwigula palustris	Water purslane		x		OBL
Lycopus americanus	Water horehound		x		OBL
Lythrum salicaria	Purple loosestrife		x	x	OBL
Mikania scandens	Climbing hempweed		x		OBL

Table 2-7: Plant Species Occurring in the Phase 1 Prject Area (2017)

Scientific Name	Common Name	Planted or Seeded	Shoreline	Invasive	Wetland Indicator Status
Grasses and Herbs					
Oenothera biennis	Common evening primrose				FACU
Oxalis stricta	Yelllow wood sorel				FACU
Peltandra virginica	Arrow arum	x	x		OBL
Phytolacca americana	Pokeweed				FACU
Polygonum cuspidatum	Japanese (Oriental) knotweed				NL
Polygonum sp.	Smartweed		x		
Polygonum (Persicaria) pensylvanicum	Pensylvania smartweed		x		FACW
Pontederia cordata	Pickerelweed	x	x		OBL
Rumex crispus	Dock		x		FAC
Rynchospora sp.	Beak rush		x		
Sagitaria latifolia	Duck Potato	x	x		OBL
Schizachyrium scoparium	Little bluestem	x			FACU
Scirpus cyperinus	Wool grass	x	x		OBL
Senna marilandica	Wild senna	x			FACW
Setaria sp.	Foxtail grass				
Sparganium eurycarpum	Bur-reed	x	x		OBL
Solanum dulcamara	Bittersweet nightshade		x		FAC
Solidago juncea	Early goldenrod	x			NL
Solidago elliotti	Elliott's goldenrod	x			OBL
Tradescandia (Commelina) communis	Asiatic dayflower				FAC
Trifolium arvense	Rabbit's foot clover				FACU
Typha latifolia	Broadleaf cattail		x		OBL
Verbascum thapsus	Common mullen				UPL
Verbena hastata	Blue vervain		x		FACW
Vicia americana	Purple vetch				FACU
Xanthium strumarium	Clotbur				FAC
Ferns					
Dennstaedtia punctilobula	Hay-scented fern	x			UPL
Dryopteris marginalis	Marginal shield fern	x			FACU
Onoclea sensibilis	Sensitive fern	x	x		FACW
Osmundastrum cinnamomeum	Cinnamon fern	x			FACW
Polystichum acrostichoides	Christmas fern	x			FACU
Trees and Shrubs					
Ailanthus altissima	Tree-of-Heaven			x	FACU
Fraxinus americana	White ash				FACU
Populus deltoides	Cottonwood				FAC
Populus tremuloides	Aspen				FACU
Quercus sp.	Oak seedlings				
Rhus hirta	Staghorn sumac				NL
Robinia pseudo-acacia	Black locust			x	FACU

Note: planted trees and shrubs are not included.

Table 3-1: Excavation quantities (cubic yards)

Work Area	Category						
	MA unlined	MA lined	Out of State	Phragmites	Total In-State	Total Out of State	Total
1	1340	4010			5350		5350
2	2120		2120	325	2120	2445	4565
3			970	210		1180	1180
4			540			540	540
5			430	85		515	515
6	2270		4000	1020	2270	5020	7290
7	1000	700	3300	700	1700	4000	5700
8			4900			4900	4900
9	4700		1160		4700	1160	5860
10	500	400	29930	2450	900	32380	33280
11		1580	6020	2400	1580	8420	10000
12			9600	1800		11400	11400
Culverts			400			400	400
Totals	11930	6690	63370	8990	16500	71060	90980

Table 5-1. Resource Area Impacts

Resource Area	Units	Phase 1	Phase 2		Phase 1 & 2
		Boston	Boston	Brookline	Total
Land Under Water					
Created	sq. ft.	69,706	-	-	69,706
Restored	sq. ft.	66,463	634,287	36,163	736,913
Bordering Vegetated Wetland[1,2,3]					
Excavated or other alteration	sq. ft.	7,400 (4)	83,196	10,245	100,841
Restored/Created	sq. ft.	15,000 (5)	50,987	5,607	71,594
Emergent (Federal) Wetland[1,2]					
Excavated or other alteration	sq. ft.	7,400 (4)	232,096	15,581	255,077
Restored/Created	sq. ft.	15,000	50,987	5,607	71,594
Bank					
Created	lf.	1,938	-	-	1,938
Restored	lf.	1,692	5,115	844	7,651
Riverfront					
Created	sq. ft.	48,450	-	-	48,450

Notes

1. All BVW is also classified as Federal emergent wetland.
2. Nearly all BVW and Federal emergent wetland lost is Phragmites.
3. BVW delineation provided by project sponsors.
4. From Phase 1 NOI, includes 4850 sq. ft. Phragmites.
5. Estimated, based on post construction monitoring and adaptive management.

Table 5-2: Muddy River Sediment Quality at Depth

Analyte	Sample Depth	Riverway	Fens
Lead	Surface	462	893
(mg/kg)	0 – 2	565	694
	2 – 4	**332**	352
	4 – 6	122	460
	6 – 8	67.5	154
	8 – 10	144	40
Arsenic	Surface	9.0	11.4
(mg/kg)	0 – 2	19.0	16.1
	2 – 4	13.9	11.8
	4 – 6	6.2	12.2
	6 – 8	16.5	7.3
	8 – 10	ND	0.8
Cadmium	Surface	2.8	5.3
(mg/kg)	0 – 2	3.5	4.9
	2 – 4	1.6	1.7
	4 – 6	0.7	1.7
	6 – 8	0.3	0.5
	8 – 10	ND	0.1
Chromium	Surface	74.6	116
(mg/kg)	0 – 2	53.7	69.6
	2 – 4	52.2	58.2
	4 – 6	25.1	34.0
	6 – 8	12.9	27.5
	8 – 10	9.3	18.9
Mercury	Surface	0.65	2.02
(mg/kg)	0 – 2	0.94	1.87
	2 – 4	0.53	0.85
	4 – 6	0.23	1.57
	6 – 8	0.13	0.7
	8 – 10	ND	0.45
PAHs	Surface	179	103
(mg/kg)	0 – 2	85.1	24.2
	2 – 4	35.0	10.3
	4 – 6	24.0	16.0
	6 – 8	7.8	3.9
	8 – 10	8.9	1.9
PCBs	Surface	144	893
(ug/kg)	0 – 2	ND	1350
	2 – 4	ND	370
	4 – 6	ND	690
	6 – 8	ND	240
	8 – 10	-	57
Total DDT	Surface	187	259
(ug/kg)	0 – 2	1260	562
	2 – 4	600	101
	4 – 6	60	148
	6 – 8	2	18
	8 - 10	-	2

Notes:

1. Surface data from Corps grab samples collected in 1995, 2000, and 2001 studies.
2. All other data from CDM (2001).
3. Shading indicates material below proposed dredging depths.
4. Concentration below detection limit in all samples.
5 "-" : no data available.

PHOTOGRAPHS

Photograph 1: Leverett Pond - Work Area 1.

Photograph 2: FRCS near Park Drive.

Photograph 3: FRCS.

Photograph 4: Riverway walking path and footbridge near Work Area 5.

Photograph 5: Riverway pathway s near Work Area 2.

Photograph 6: Tannery Brook storm drain at Work Area 2.

Photograph 7: Eroding stream banks along the Riverway .

Photograph 8: Erosion control downstream of the Longwood Avenue Bridge.

Photograph 9: Work Area 2.

Photograph 10: Work Area 3.

Photograph 11: Work Area 3.


Photograph 12: Parkland near work Area 3.

Photograph 13: Work Area 5.

Photograph 14: Work Area 6.

Photograph 15: Back Bay Fens, including Work Areas 10 – 12.

Photograph 16: Island near Boston Gatehouse , Work Area 10.

Photograph 17: Work Area 12 viewed from Boylston Street bridge.

Photograph 18: Work Area 12.

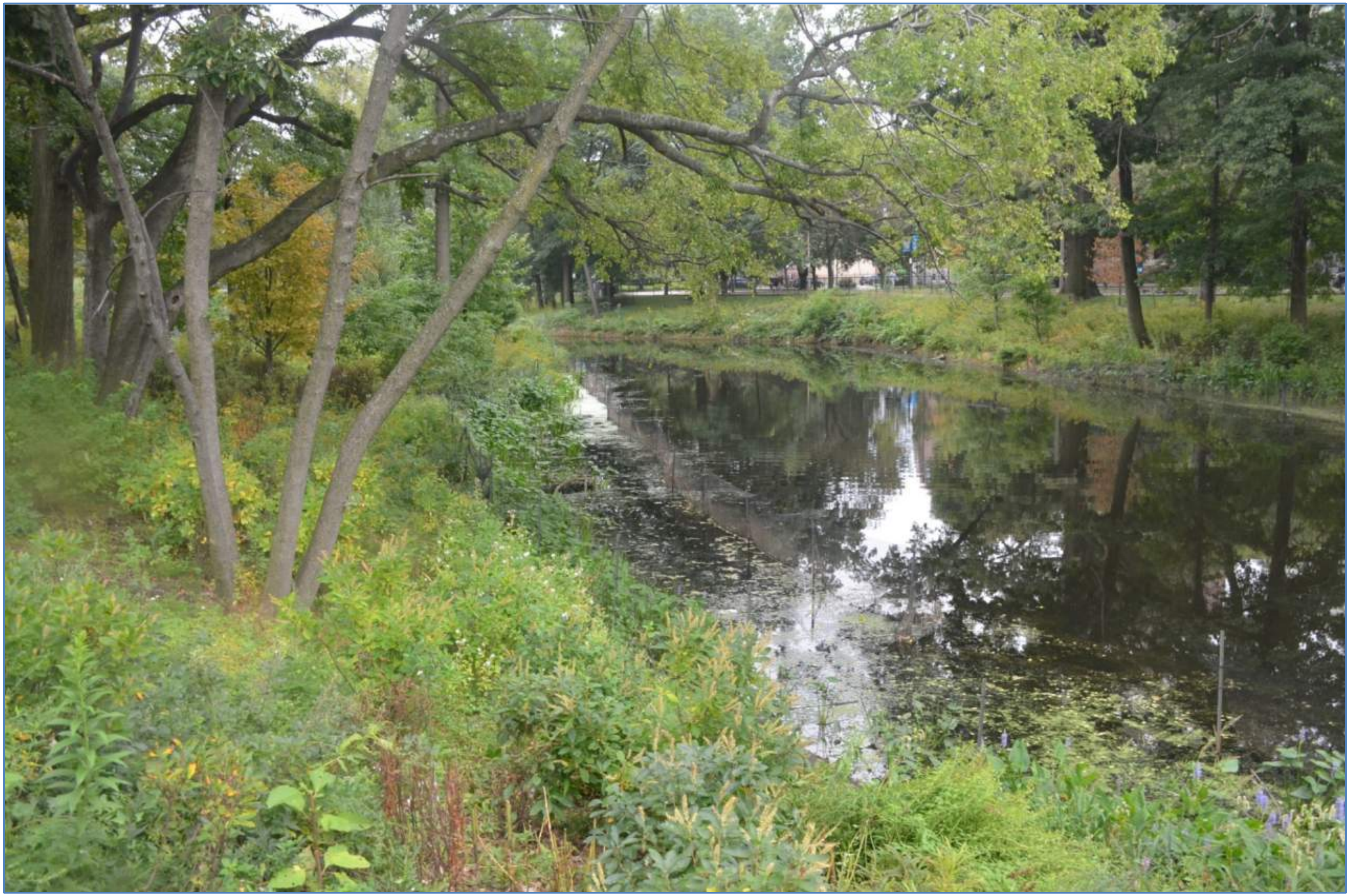
Photograph 19: Work Area 12.

Photograph 20: Boston Fire Department…

Photograph 21: Brookline Ave nue culvert installed during Phase 1.

Photograph 22: Phase 1 daylighed area looking upstream from Avenue Louis Pasteur.

Photograph 23: Island restored during Phase 1.

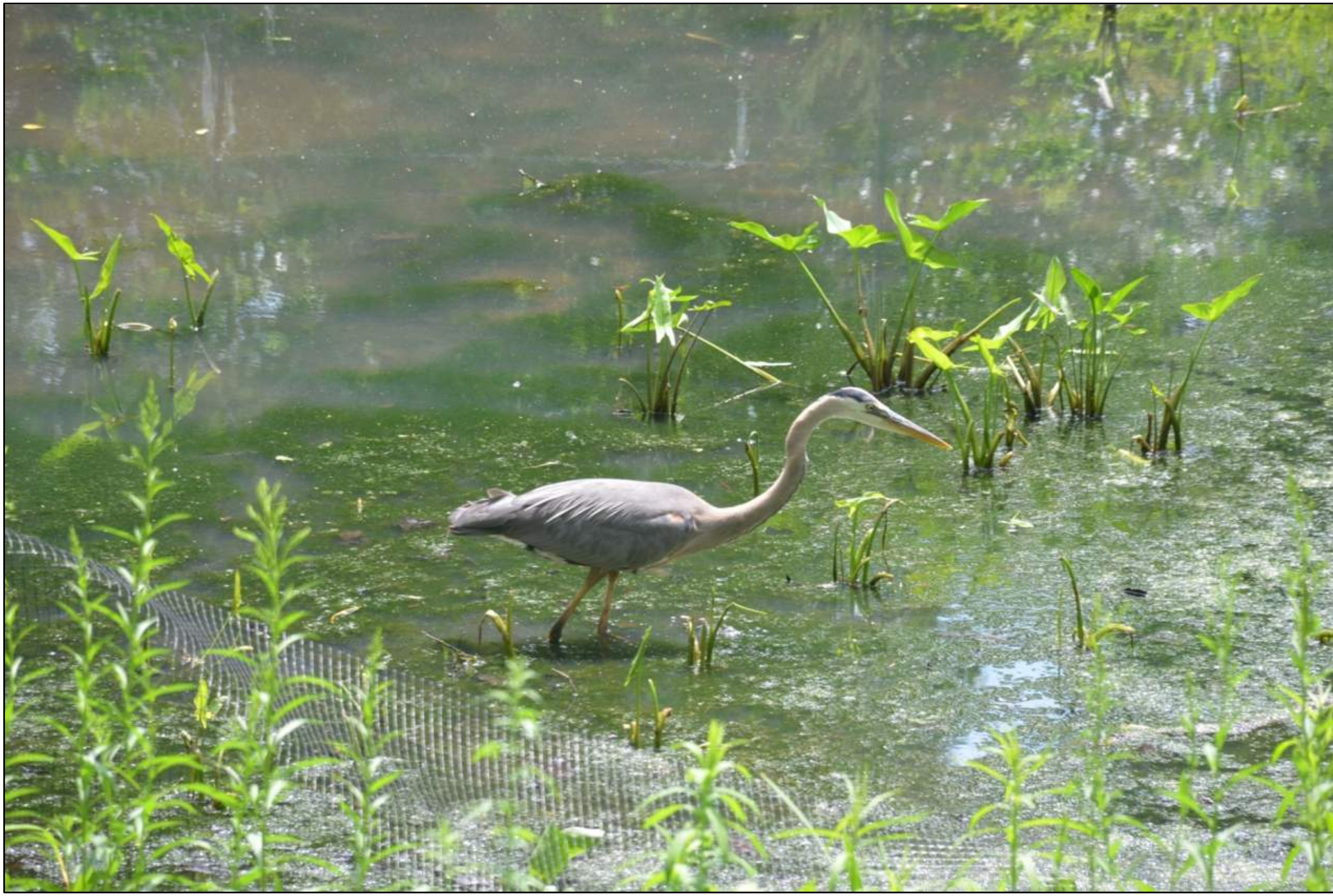


Photograph 24: Riparian habitat restored during Phase 1.

Photograph 25: Riparian habitat restored during Phase 1.

Photograph 26: Emergent wetland habitat restored during Phase 1.

Photograph 27: Emergent wetland habitat restored during Phase 1.



Photograph 28: Great blue heron foraging in habitat restored during Phase 1.


Photograph 29 and 30: April, 2016 Fire in Back Bay Fens (photos obtained on-line).

QUANTITIES

SUMMARY SHEET

08/06/2018

MUDDY RIVER PHASE I - ENVIRONMENTAL RESOURCE CREDITS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Area of Land under water created	69706	sq. ft.	F, N	Mitigation
Area of Land under water restored	66463	sq. ft.	N	Upper Fens Pond and downstream Avenue LP
Volume Flood Storage Created (Elev 5-6)	3280	cy.	F, N	Elev 6 is the 100 year flood level
Volume Flood Storage Created (Elev 4-5)	3125	cy.	F, N	
Volume Flood Storage Created (Elev 3-4)	2976	cy.	F, N	
Volume Flood Storage Created (Elev 2-3)	2782	cy.	F, N	Elev 2 is the typical conditions flow level
Area of new Riverfront created (25 ft)	48450	sq. ft.	N	Excludes Upper Fens Pond
Area of Riverfront Restored (25 ft)	25831	sq. ft.	N	Upper Fens Pond riverfront restored
Area of BVW created - Daylighted shelves	564	sq. ft.	F, N	Doesn't include new BVW shelf DS of Louis Pasteur
Area of BVW created - Daylighted fringe	9315	sq. ft.	F, N	
Area of BVW restored - Emergent shelves	10540	sq. ft.	F, N	BVW restoration efforts at Upper Fens Pond
Area of BVW restored - Emergent fringe	4440	sq. ft.	F, N	
Length of bank created	1938	lf.	N	Riverbank of daylighted areas
Length of bank restored	1692	lf.	N	Upper Fens Pond and downstream Avenue LP

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
- BOSTON -				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	561307	sq. ft.	F	
Excavation: Land under water	82988	cy	F	
Excavation: Bordering vegetated wetland	72980	sq. ft.	F	
Excavation: Bordering vegetated wetland	4054	cy	N	
Dimension of dredge area (Length)	7546	lf.	F	
Dimension of dredge area (Width)	Varies	lf.	F	See individual Work Areas
Dimension of dredge area (Depth)	Varies	lf.	F	See individual Work Areas
Area of BVW Restored (Emergent Vegetation)	40771	sq. ft.	F	Treatment A and B Fringe or Shelf planting
New Habitat Shelf (Non-Vegetated)	4927	sq. ft.	?	
Fill (wetland topsoil installed under water)	9349	sq. ft.	F	
Fill (stone installed under water)	4120	sq. ft.	F	
Temporary Fill (Access)	120703	sq. ft.	F	
Fill (wetland topsoil installed under water)	519	cy	N	
Fill (stone installed under water)	458	cy	N	
Temporary Fill (Access)	301758	cy	N	
Total area of Phragmites	298518	sq. ft.	N	
Total area of Phragmites Removed	221880	sq. ft.	N	
Total area of Phragmites Remaining	76638	sq. ft.	N	
Alteration - bank	5115	lf.	F	
Alteration - BVW	83196	sq. ft.	F	
Alteration – Land under water	561307	sq. ft.	F	
Riverfront (0 -25 ft.)	358750	sq. ft.	F	
Bordering land subject to flooding	1754306	sq. ft.	F	
Fish runs	561307	sq. ft.	F	
Volume of Flood Storage Lost (Elev 5-6)	447			Elev 6 is the 100 year flood level
Volume of Flood Storage Lost (Elev 4-5)	85			
Volume of Flood Storage Lost (Elev 3-4)	8	cy.	F, N	Elev 3 is the lowest Elev within the floodwall limits

SUMMARY SHEET

08/06/2018

- BROOKLINE -				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	36163	sq. ft.	F	
Excavation: Land under water	5047	cy	F	
Excavation: Bordering vegetated wetland	10042	sq. ft.	F	
Excavation: Bordering vegetated wetland	558	cy	N	
Dimension of dredge area (Length)	2256	lf.	F	
Dimension of dredge area (Width)	Varies	lf.	F	See individual Work Areas
Dimension of dredge area (Depth)	Varies	lf.	F	See individual Work Areas
Area of BVW Restored (Emergent Vegetation)	5404	sq. ft.	F	Treatment A and B Fringe or Shelf planting
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	
Fill (stone installed under water)	0	sq. ft.	F	
Temporary Fill (Access)	3751	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	
Fill (stone installed under water)	0	cy	N	
Temporary Fill (Access)	9378	cy	N	
Total area of Phragmites	25125	sq. ft.	N	
Total area of Phragmites Removed	15379	sq. ft.	N	
Total area of Phragmites Remaining	13241	sq. ft.	N	
Alteration - bank	844	lf.	F	
Alteration - BVW	10245	sq. ft.	F	
Alteration – Land under water	36163	sq. ft.	F	
Riverfront (0 -100 ft.)	244900	sq. ft.	F	
Riverfront (100 – 200 ft.)	365900	sq. ft.	F	
Bordering land subject to flooding	1345128	sq. ft.	F	
Fish runs	36163	sq. ft.	F	

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION

WORK AREA 1 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	25245	sq. ft.	F	
Excavation: Land under water	4457	cy	F	
Excavation: Bordering vegetated wetland	0	sq. ft.	F	No excavation of BVW
Excavation: Bordering vegetated wetland	0	cy	N	No excavation of BVW
Dimension of dredge area (Length)	222	lf.	F	Sta 13+08 to Sta 15+30
Dimension of dredge area (Width)	30 to 160	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 7	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	0	sq. ft.	F	
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	0	sq. ft.	F	No temporary fill on Boston side
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	0	cy	N	No temporary fill on Boston side
Total area of Phragmites	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Total area of Phragmites Removed	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Total area of Phragmites Remaining	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Alteration - bank	0	lf.	F	No bank alteration on Boston side
Alteration - BVW	0	sq. ft.	F	No alteration to BVW on Boston side
Alteration – Land under water	25245	sq. ft.	F	Should approx. = excavation of land under water
Riverfront Total (0 -25 ft.)	0	sq. ft.	F	
Riverfront Area Disturbed	0	sq. ft.	F	
Bordering land subject to flooding	143630	sq. ft.	F	Area extends to cover all of Leverett Pond
Fish runs	25245	sq. ft.	F	= alteration of land under water

WORK AREA 1 - BROOKLINE				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	5058	sq. ft.	F	
Excavation: Land under water	893	cy	F	
Excavation: Bordering vegetated wetland	0	sq. ft.	F	No excavation of BVW
Excavation: Bordering vegetated wetland	0	cy	N	No excavation of BVW
Dimension of dredge area (Length)	222	lf.	F	Sta 13+08 to Sta 15+30
Dimension of dredge area (Width)	30 to 160	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 7	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	0	sq. ft.	F	
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	203	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	508	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Total area of Phragmites Removed	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Total area of Phragmites Remaining	0	sq. ft.	N	Area extends to cover all of Leverett Pond
Alteration - bank	37	lf.	F	Temporary Alt: 37 LF, Permanent Alt: 0 LF
Alteration - BVW	203	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 203 SF
Alteration – Land under water	5058	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	0	sq. ft.	F	
Riverfront (100 – 200 ft.)	0	sq. ft.	F	
Riverfront Area Disturbed	0	sq. ft.	F	
Bordering land subject to flooding	179697	sq. ft.	F	Area extends to cover all of Leverett Pond
Fish runs	5058	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION

WORK AREA 2 - BOSTON

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	17242	sq. ft.	F	
Excavation: Land under water	2704	cy	F	
Excavation: Bordering vegetated wetland	4945	sq. ft.	F	Phrag: 3200 SF, Knot: 1444 SF, Other: 571 SF
Excavation: Bordering vegetated wetland	275	cy	N	
Dimension of dredge area (Length)	877	lf.	F	Sta 26+95 to Sta 35+72
Dimension of dredge area (Width)	20 to 65	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	3577	sq. ft.	F	Trt-A: 3061 SF, Trt-B: 516 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	1675	sq. ft.	F	
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	9659	sq. ft.	F	
Fill (wetland topsoil installed under water)	93	cy	N	
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	24148	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	4034	sq. ft.	N	
Total area of Phragmites Removed	4034	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	576	lf.	F	Temporary Alt: 151 LF, Permanent Alt: 425 LF
Alteration - BVW	10299	sq. ft.	F	Non-Excavation Alteration} Knotweed: 5354 SF, Other: 0 SF
Alteration – Land under water	17242	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	25764	sq. ft.	F	
Riverfront Area Disturbed	5488	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	53214	sq. ft.	F	1 % event
Fish runs	17242	sq. ft.	F	= alteration of land under water

WORK AREA 2 - BROOKLINE

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	10038	sq. ft.	F	
Excavation: Land under water	1574	cy	F	
Excavation: Bordering vegetated wetland	3215	sq. ft.	F	Phrag: 1893 SF, Knot: 674 SF, Other: 648 SF
Excavation: Bordering vegetated wetland	179	cy	N	
Dimension of dredge area (Length)	877	lf.	F	Sta 26+95 to Sta 35+72
Dimension of dredge area (Width)	20 to 65	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	2725	sq. ft.	F	Trt-A: 1290 SF, Trt-B: 1435 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.		
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	0	sq. ft.	F	No temporary fill on Brookline Side
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	0	cy	N	No temporary fill on Brookline Side
Total area of Phragmites	3495	sq. ft.	N	
Total area of Phragmites Removed	3495	sq. ft.	N	
Total area of Phragmites Remaining	3495	sq. ft.	N	
Alteration - bank	595	lf.	F	Temporary Alt: 0 LF, Permanent Alt: 595 LF
Alteration - BVW	3215	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	10038	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	80000	sq. ft.	F	
Riverfront (100 – 200 ft.)	78000	sq. ft.	F	
Riverfront Area Disturbed	6801	sq. ft.	F	
Bordering land subject to flooding	307645	sq. ft.	F	1 % event
Fish runs	10038	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 3 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	13698	sq. ft.	F	
Excavation: Land under water	877	cy	F	
Excavation: Bordering vegetated wetland	8594	sq. ft.	F	Phrag: 7379 SF, Knot: 1215 SF, Other: 0 SF
Excavation: Bordering vegetated wetland	477	cy	N	
Dimension of dredge area (Length)	447	lf.	F	Sta 37+53 to Sta 42+00
Dimension of dredge area (Width)	20 to 90	lf.	F	Varies
Dimension of dredge area (Depth)	2 to 4	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	1599	sq. ft.	F	Trt-A: 1599 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	3514	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	8785	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	7689	sq. ft.	N	
Total area of Phragmites Removed	7689	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	279	lf.	F	Temporary Alt: 120 LF, Permanent Alt: 159 LF
Alteration - BVW	11104	sq. ft.	F	Non-Excavation Alteration} Knotweed: 2232 SF, Other: 278 SF
Alteration – Land under water	13698	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	16225	sq. ft.	F	
Riverfront Area Disturbed	3949	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	34366	sq. ft.	F	1 % event
Fish runs	13698	sq. ft.	F	= alteration of land under water

WORK AREA 3 - BROOKLINE				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	4430	sq. ft.	F	
Excavation: Land under water	284	cy	F	
Excavation: Bordering vegetated wetland	2088	sq. ft.	F	Phrag: 1306 SF, Knot: 0 SF, Other: 782 SF
Excavation: Bordering vegetated wetland	116	cy	N	
Dimension of dredge area (Length)	447	lf.	F	Sta 37+53 to Sta 42+00
Dimension of dredge area (Width)	20 to 90	lf.	F	Varies
Dimension of dredge area (Depth)	2 to 4	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	913	sq. ft.	F	Trt-A: 599 SF, Trt-B: 314 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	0	sq. ft.	F	No temporary fill on Brookline Side
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	0	cy	N	No temporary fill on Brookline Side
Total area of Phragmites	1668	sq. ft.	N	
Total area of Phragmites Removed	1668	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	0	lf.	F	No bank alteration on Brookline Side
Alteration - BVW	2088	sq. ft.	F	Non-Excavation Alts.} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	4430	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	50300	sq. ft.	F	Riverfront is outside of Project Limits
Riverfront (100 – 200 ft.)	80300	sq. ft.	F	Riverfront is outside of Project Limits
Riverfront Area Disturbed	7159	sq. ft.	F	
Bordering land subject to flooding	30506	sq. ft.	F	1 % event
Fish runs	4430	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION

WORK AREA 4 - BOSTON

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	4573	sq. ft.	F	
Excavation: Land under water	375	cy	F	
Excavation: Bordering vegetated wetland	0	sq. ft.	F	No Excavation of BVW
Excavation: Bordering vegetated wetland	0	cy	N	No Excavation of BVW
Dimension of dredge area (Length)	160	lf.	F	Sta 46+20 to Sta 44+60
Dimension of dredge area (Width)	35 to 45	lf.	F	Varies
Dimension of dredge area (Depth)	1.5 to 3.5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	604	sq. ft.	F	Trt-A: 604 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	945	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	2363	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Total area of Phragmites Removed	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Total area of Phragmites Remaining	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Alteration - bank	80	lf.	F	Temporary Alt 52 LF, Permanent Alt: 28 LF
Alteration - BVW	0	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	4573	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	5329	sq. ft.	F	
Riverfront Area Disturbed	1271	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	62981	sq. ft.	F	From Netherlands Road Bridge to Longwood Ave Bridge
Fish runs	4573	sq. ft.	F	= alteration of land under water

WORK AREA 4 - BROOKLINE

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	2007	sq. ft.	F	
Excavation: Land under water	165	cy	F	
Excavation: Bordering vegetated wetland	0	sq. ft.	F	No excavation of BVW
Excavation: Bordering vegetated wetland	0	cy	N	No excavation of BVW
Dimension of dredge area (Length)	160	lf.	F	Sta 46+20 to Sta 44+60
Dimension of dredge area (Width)	35 to 45	lf.	F	Varies
Dimension of dredge area (Depth)	1.5 to 3.5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	416	sq. ft.	F	Trt-A: 416 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	0	sq. ft.	F	No temporary fill on Brookline side
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	0	cy	N	No temporary fill on Brookline side
Total area of Phragmites	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Total area of Phragmites Removed	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Total area of Phragmites Remaining	0	sq. ft.	N	From Netherlands Road Bridge to Longwood Ave Bridge
Alteration - bank	0	lf.	F	No bank alteration on Brookline Side
Alteration - BVW	0	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	2007	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	41800	sq. ft.	F	
Riverfront (100 – 200 ft.)	71400	sq. ft.	F	
Riverfront Area Disturbed	0	sq. ft.	F	
Bordering land subject to flooding	298421	sq. ft.	F	From Netherlands Road Bridge to Longwood Ave Bridge
Fish runs	2007	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION

WORK AREA 5 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	5771	sq. ft.	F	
Excavation: Land under water	515	cy	F	
Excavation: Bordering vegetated wetland	2755	sq. ft.	F	Phrag: 2475 SF, Knot: 0 SF, Other: 280 SF
Excavation: Bordering vegetated wetland	153	cy	N	
Dimension of dredge area (Length)	130	lf.	F	Sta 66+15 to Sta 64+85
Dimension of dredge area (Width)	30 to 80	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	1282	sq. ft.	F	Trt-A: 1282 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	272	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	680	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	8076	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Total area of Phragmites Removed	2475	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Total area of Phragmites Remaining	5601	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Alteration - bank	133	lf.	F	Temporary Alt: 56 LF, Permanent Alt: 77 LF
Alteration - BVW	3116	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 361 SF
Alteration – Land under water	5771	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	4615	sq. ft.	F	
Riverfront Area Disturbed	2106	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	69468	sq. ft.	F	1 % event
Fish runs	5771	sq. ft.	F	= alteration of land under water

WORK AREA 5 - BROOKLINE				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	0	sq. ft.	F	No excavation on Brookline side
Excavation: Land under water	0	cy	F	No excavation on Brookline side
Excavation: Bordering vegetated wetland	0	sq. ft.	F	No excavation of BVW
Excavation: Bordering vegetated wetland	0	cy	N	No excavation of BVW
Dimension of dredge area (Length)	130	lf.	F	Sta 66+15 to Sta 64+85
Dimension of dredge area (Width)	30 to 80	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	0	sq. ft.	F	
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	0	sq. ft.	F	No temporary fill on Brookline side
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	0	cy	N	No temporary fill on Brookline side
Total area of Phragmites	9746	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Total area of Phragmites Removed	0	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Total area of Phragmites Remaining	9746	sq. ft.	N	From Longwood Ave Bridge to Start of WA6
Alteration - bank	0	lf.	F	No bank alteration on Brookline side
Alteration - BVW	0	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	0	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	31600	sq. ft.	F	
Riverfront (100 – 200 ft.)	75800	sq. ft.	F	
Riverfront Area Disturbed	0	sq. ft.	F	
Bordering land subject to flooding	176834	sq. ft.	F	1 % event
Fish runs	0	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION

WORK AREA 6 - BOSTON

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	32785	sq. ft.	F	
Excavation: Land under water	4777	cy	F	
Excavation: Bordering vegetated wetland	11568	sq. ft.	F	Phrag: 11236 SF, Knot: 332 SF, Other: 0 SF
Excavation: Bordering vegetated wetland	643	cy	N	
Dimension of dredge area (Length)	420	lf.	F	Sta 72+80 to Sta77+00
Dimension of dredge area (Width)	60 to 175	lf.	F	Varies
Dimension of dredge area (Depth)	4 to 8	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	3018	sq. ft.	F	Trt-A: 2272 SF, Trt-B: 746 SF
New Habitat Shelf (Non-Vegetated)	620	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	3790	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	9475	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	22234	sq. ft.	N	
Total area of Phragmites Removed	22234	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	448	lf.	F	Temporary Alt: 21 LF, Permanent Alt: 427 LF
Alteration - BVW	12193	sq. ft.	F	Non-Excavation Alteration} Knotweed: 446 SF, Other: 179 SF
Alteration – Land under water	32785	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	16202	sq. ft.	F	
Riverfront Area Disturbed	5716	sq. ft.	F	
Bordering land subject to flooding	99428	sq. ft.	F	1 % event
Fish runs	32785	sq. ft.	F	= alteration of land under water

WORK AREA 6 - BROOKLINE

Resource Impact	Quantity	Units	Purpose	Notes
Excavation: Land under water	14630	sq. ft.	F	
Excavation: Land under water	2132	cy	F	
Excavation: Bordering vegetated wetland	4739	sq. ft.	F	Phrag: 4739 SF, Knot: 0 SF, Other: 0 SF
Excavation: Bordering vegetated wetland	263	cy	N	
Dimension of dredge area (Length)	420	lf.	F	Sta 72+80 to Sta77+00
Dimension of dredge area (Width)	60 to 175	lf.	F	Varies
Dimension of dredge area (Depth)	4 to 8	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	1350	sq. ft.	F	Trt-A: 1078 SF, Trt-B: 272 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	3548	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	8870	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	10216	sq. ft.	N	
Total area of Phragmites Removed	10216	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	212	lf.	F	Temporary Alt: 0 LF, Permanent Alt: 212 LF
Alteration - BVW	4739	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	14630	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -100 ft.)	41200	sq. ft.	F	
Riverfront (100 – 200 ft.)	60400	sq. ft.	F	
Riverfront Area Disturbed	10274	sq. ft.	F	
Bordering land subject to flooding	352025	sq. ft.	F	1 % event
Fish runs	14630	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 7 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	43237	sq. ft.	F	
Excavation: Land under water	5326	cy	F	
Excavation: Bordering vegetated wetland	3111	sq. ft.	F	Phrag: 3111 SF, Knot: 0 SF, Other: 0 SF
Excavation: Bordering vegetated wetland	173	cy	N	
Dimension of dredge area (Length)	655	lf.	F	Sta 97+45 to Sta 104+00
Dimension of dredge area (Width)	50 to 190	lf.	F	Varies
Dimension of dredge area (Depth)	1.5 to 7	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	2875	sq. ft.	F	Trt-A: 2356 SF, Trt-B: 519 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	4529	sq. ft.	F	
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	6595	sq. ft.	F	
Fill (wetland topsoil installed under water)	252	cy	N	
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	16488	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	11437	sq. ft.	N	
Total area of Phragmites Removed	11437	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	331	lf.	F	Temporary Alt: 0 LF, Permanent Alt: 331 LF
Alteration - BVW	3111	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	43237	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	38178	sq. ft.	F	
Riverfront Area Disturbed	7101	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	177768.5	sq. ft.	F	1 % event
Fish runs	43237	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 8 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	36002	sq. ft.	F	
Excavation: Land under water	4900	cy	F	
Excavation: Bordering vegetated wetland	116	sq. ft.	F	Phrag: 0 SF, Knot: 0 SF, Other: 116 SF
Excavation: Bordering vegetated wetland	6	cy	N	
Dimension of dredge area (Length)	668	lf.	F	Sta 110+68 to Sta 104+00
Dimension of dredge area (Width)	40 to 50	lf.	F	Varies
Dimension of dredge area (Depth)	2.5 to 6	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	1313	sq. ft.	F	
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	6204	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	15510	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	0	sq. ft.	N	
Total area of Phragmites Removed	0	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	81	lf.	F	Temporary Alt: 36 LF, Permanent Alt: 45 LF
Alteration - BVW	203	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 87 SF
Alteration – Land under water	36002	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	36270	sq. ft.	F	
Riverfront Area Disturbed	2799	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	177768.5	sq. ft.	F	1 % event
Fish runs	36002	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 9 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	33895	sq. ft.	F	
Excavation: Land under water	5860	cy	F	
Excavation: Bordering vegetated wetland	451	sq. ft.	F	Phrag: 0 SF, Knot: 0 SF, Other: 451 SF
Excavation: Bordering vegetated wetland	25	cy	N	
Dimension of dredge area (Length)	665	lf.	F	Sta 110+68 to Sta 117+33
Dimension of dredge area (Width)	25 to 70	lf.	F	Varies
Dimension of dredge area (Depth)	1 to 6	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	2029	sq. ft.	F	Trt-A: 1685 SF, Trt-B: 344 SF
New Habitat Shelf (Non-Vegetated)	0	sq. ft.	?	
Fill (wetland topsoil installed under water)	0	sq. ft.	F	No wetland fill
Fill (stone installed under water)	2070	sq. ft.	F	
Temporary Fill (Access)	5061	sq. ft.	F	
Fill (wetland topsoil installed under water)	0	cy	N	No wetland fill
Fill (stone installed under water)	230	cy	N	3 ft depth of riprap layers
Temporary Fill (Access)	12653	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	0	sq. ft.	N	
Total area of Phragmites Removed	0	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	209	lf.	F	Temporary Alt 64 LF, Permanent Alt: 145 LF
Alteration - BVW	622	sq. ft.	F	Non-Excavation Alteration} Knotweed: 171 SF, Other: 0 SF
Alteration – Land under water	33895	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	41798	sq. ft.	F	
Riverfront Area Disturbed	1007	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	263980	sq. ft.	F	1 % event
Fish runs	33895	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 10 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	178236	sq. ft.	F	
Excavation: Land under water	32797	cy	F	
Excavation: Bordering vegetated wetland	8690	sq. ft.	F	Phrag: 8602 SF, Knot: 31 SF, Other: 57 SF
Excavation: Bordering vegetated wetland	483	cy	N	
Dimension of dredge area (Length)	1499	lf.	F	Sta 117+33 + Sta132+32
Dimension of dredge area (Width)	30 to 260	lf.	F	Varies
Dimension of dredge area (Depth)	0.5 to 10	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	11246	sq. ft.	F	Trt-A: 10491 SF, Trt-B: 755 SF
New Habitat Shelf (Non-Vegetated)	745	sq. ft.	?	
Fill (wetland topsoil installed under water)	662	sq. ft.	F	
Fill (stone installed under water)	2050	sq. ft.	F	
Temporary Fill (Access)	25224	sq. ft.	F	
Fill (wetland topsoil installed under water)	36.77778	cy	N	
Fill (stone installed under water)	228	cy	N	3 ft depth of rirap layers
Temporary Fill (Access)	63060	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	64548	sq. ft.	N	
Total area of Phragmites Removed	64548	sq. ft.	N	
Total area of Phragmites Remaining	0	sq. ft.	N	
Alteration - bank	1290	lf.	F	Temporary Alt: 34 LF, Permanent Alt: 1256 LF
Alteration - BVW	8751	sq. ft.	F	Non-Excavation Alteration} Knotweed: 61 SF, Other: 0 SF
Alteration – Land under water	178236	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	76356	sq. ft.	F	
Riverfront Area Disturbed	18833	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	302982	sq. ft.	F	1 % event
Fish runs	178236	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 11 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	90999	sq. ft.	F	
Excavation: Land under water	9652	cy	F	
Excavation: Bordering vegetated wetland	23881	sq. ft.	F	Phrag: 23881 SF, Knot: 0 SF, Other: 0 SF
Excavation: Bordering vegetated wetland	1327	cy	N	
Dimension of dredge area (Length)	956	lf.	F	Sta 132+32 to Sta 141+88
Dimension of dredge area (Width)	40 to 150	lf.	F	Varies
Dimension of dredge area (Depth)	0.5 to 9.5	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	5814	sq. ft.	F	Trt-A: 4531 SF, Trt-B: 1283 SF
New Habitat Shelf (Non-Vegetated)	2116	sq. ft.	?	
Fill (wetland topsoil installed under water)	997	sq. ft.	F	
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	38681	sq. ft.	F	
Fill (wetland topsoil installed under water)	55	cy	N	
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	96702.5	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	91841	sq. ft.	N	
Total area of Phragmites Removed	58939	sq. ft.	N	
Total area of Phragmites Remaining	32902	sq. ft.	N	
Alteration - bank	844	lf.	F	Temporary Alt: 70 LF, Permanent Alt: 774 LF
Alteration - BVW	24928	sq. ft.	F	Non-Excavation Alteration} Knotweed: 1047 SF, Other: 0 SF
Alteration – Land under water	90999	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	53065	sq. ft.	F	
Riverfront Area Disturbed	8329	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	202551	sq. ft.	F	1 % event
Fish runs	90999	sq. ft.	F	= alteration of land under water

MUDDY RIVER PHASE II - ENVIRONMENTAL RESOURCE IMPACTS FOR WATERWAYS/WATER QUALITY CERTIFICATION				
WORK AREA 12 - BOSTON				
Resource Impact	**Quantity**	**Units**	**Purpose**	**Notes**
Excavation: Land under water	79624	sq. ft.	F	
Excavation: Land under water	10748	cy	F	
Excavation: Bordering vegetated wetland	8869	sq. ft.	F	Phrag: 8869 SF, Knot: 6546 SF mixed in w/ Phrag, Other: 0 SF
Excavation: Bordering vegetated wetland	493	cy	N	
Dimension of dredge area (Length)	847	lf.	F	Sta 141+88 to Sta 150+35
Dimension of dredge area (Width)	75 to 140	lf.	F	Varies
Dimension of dredge area (Depth)	1.5 to 9	lf.	F	Varies
Area of BVW Restored (Emergent Veg)	7414	sq. ft.	F	Trt-A: 6164 SF, Trt-B: 1250 SF
New Habitat Shelf (Non-Vegetated)	1446	sq. ft.	?	
Fill (wetland topsoil installed under water)	1486	sq. ft.	F	
Fill (stone installed under water)	0	sq. ft.	F	No riprap fill in this Work Area
Temporary Fill (Access)	20758	sq. ft.	F	
Fill (wetland topsoil installed under water)	83	cy	N	
Fill (stone installed under water)	0	cy	N	No riprap fill in this Work Area
Temporary Fill (Access)	51895	cy	N	2.5 ft assumed depth of temporary fill
Total area of Phragmites	88659	sq. ft.	N	
Total area of Phragmites Removed	50524	sq. ft.	N	
Total area of Phragmites Remaining	38135	sq. ft.	N	
Alteration - bank	844	lf.	F	Temporary Alt: 0 LF, Permanent Alt: 844 LF
Alteration - BVW	8869	sq. ft.	F	Non-Excavation Alteration} Knotweed: 0 SF, Other: 0 SF
Alteration – Land under water	79624	sq. ft.	F	Should approx. = excavation of land under water
Riverfront (0 -25 ft.)	44948	sq. ft.	F	
Riverfront Area Disturbed	11017	sq. ft.	F	
		sq. ft.	F	
Bordering land subject to flooding	166169	sq. ft.	F	1 % event
Fish runs	79624	sq. ft.	F	= alteration of land under water

ATTACHMENT A

ENGINEERING PLANS AND SPECIFICATIONS

ATTACHMENT B

SEDIMENT QUALITY COMPILATION

ATTACHMENT C

BLUEBACK HERRING TRP AND TRUCK PROPOSAL

Muddy River Flood Damage Reduction Project, Phase 2
Brookline/Boston, MA

Blueback Herring Trap and Truck Proposal

Draft Final

U.S. Army Corps of Engineers
New England District
Environmental Resources Section
696 Virginia Road
Concord MA 01742

December, 2017

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Brookline/Boston, MA

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Introduction

The Muddy River is a 3.5 mile long urban waterway with a 5.6 square mile drainage area situated in the greater Boston metropolitan area. The River originates at Jamaica Pond and flows in a generally northeasterly direction along the Boston-Brookline border, then turns into the Fenway neighborhood, and eventually flows into the Charles River. The upper watershed is primarily residential with some commercial areas, while the lower watershed is characterized by high-density residential, institutional and commercial development. The river also comprises part of Frederick Law Olmsted's "Emerald Necklace" park system. Due to the historic significance of the park system, the river is listed in the National Register of Historic Places.

The Boston Parks and Recreation Department, along with the Town of Brookline and Commonwealth of Massachusetts, commissioned a comprehensive basin wide plan entitled "The Emerald Necklace Environmental Improvements Master Plan, Phase 1 Muddy River Flood Control, Water Quality and Habitat Enhancement". This plan identified actions to reduce potential flood damages, improve water quality and habitat in the river, rehabilitate the historic landscape, and enhance recreational uses of adjacent parklands. Specific elements of the Master Plan included dredging the Muddy River system from Wards Pond to the Charles River basin, increasing the channel capacity and removing flow restrictions, stabilizing riverbanks, removing invasive vegetation, and rehabilitating the historic landscape.

Congress authorized the Corps of Engineers to evaluate the City of Boston's Master Plan and to determine whether these flood damage reduction and environmental restoration improvements were in the Federal interest. This required the preparation of a Decision Document. The September 2003 Final Decision Document evaluated alternative solutions to flood control and ecosystem problems. It selected and recommended a plan based on economic, environmental and public acceptability criteria. Flood control improvements to protect against a flood with a return frequency of 20 years were ultimately authorized for construction by the Secretary of the Army. Construction is being implemented in two phases.

Phase I involved removal of existing twin 72" culverts in three areas to daylight 700 ft. of the river and sediment removal from the Upper Fens Pond to allow for increased conveyance of flood flows. Construction of Phase 1 was largely completed in June of 2016.

Phase 2 includes removal of approximately 100,000 cubic yards of sediment from Leverett Pond, the Riverway, and Back Bay Fens. One hundred (100) percent design plans and specifications for Phase 2 are scheduled for completion in August of 2018. Construction of Phase 2 is expected to occur between October of 2019 and February of 2023. Most of the sediment to be removed is in the Back Bay Fens. Phase 2 construction will occur at twelve "work areas" (one in Leverett Pond, five in the Riverway, and six in the Back Bay Fens (see Attachment A)). Current plans call for sediment to be removed by excavation. All work areas will be dewatered prior to excavation. In most work areas flow will be diverted around dewatered work areas by bypass pumps. Upstream and downstream fish passage will be prevented during bypass pump operation.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended that the Muddy River remain free flowing during the periods between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring (*Alosa aestivalis*) can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

Blueback herring are an anadromous fish species, spawning in freshwater, and then migrating to the marine environment to mature. During the spring, adult pre spawning blueback herring enter freshwater rivers and move upstream to spawn, generally in their natal habitat. The young then migrate downstream during the summer and fall to mature in the ocean, and then return to freshwater after 3 to 5 years to complete their life cycle. The post spawning adults generally move downstream shortly after spawning. Blueback herring generally migrate with Alewife, a similar species (*Alosa pseudoharengus*), and collectively the two species are referred to as river herring. However, only blueback herring have been reported in the Muddy River.

Blueback herring spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. In order for the blueback herring to complete their life cycle they will need unimpeded passage through the Muddy River from its confluence with the Charles River, all the way upstream to their spawning habitat in Leverett Pond (i.e. nearly the entire reach of the project) during their spawning season (spring) and out migration season (fall). The spring work window was established to allow passage of the up-migrating pre-spawning and down-migrating post-spawning blueback herring adults, and the fall work window was established to allow passage of the down-migrating juveniles. These windows preclude bypass pumping in the river during most of the spring and early summer as well as during most of the fall, which could have a significant effect on the completion time of this project. If construction could occur during at least part of this timeframe without impacting the blueback herring, the project could be completed in less time. In addition, the costs associated with the contractor mobilization and de-mobilization could be avoided since work could continue during part of the migration season.

As currently envisioned, 3 spring migration periods and 4 fall migration periods would occur during Phase 2 construction. Careful timing of the work allows for unimpeded downstream passage of juveniles during the entire construction period. Bypass pumping of dewatered work areas would occur during the 2020 and 2022 spring migration periods. Bypass pumping would occur in the Back Bay Fens and prevent upstream migrating adults from reaching the Riverway and Leverett Pond. This Plan proposes to provide upstream and downstream passage of adult herring in 2020 and 2021 by trapping and trucking to bypass dewatered work areas. This would allow construction to occur without the need to suspend work during the 2020 and 2021 spring migratory periods. This would shorten the Phase 2 construction period and avoid costs associated with contractor de-mobilization and mobilization to accommodate fish the passage windows.

Proposed Trap and Transport of Fish around Active Work Areas

Fish trapping and transport of up-migrating pre-spawning adults is a practiced method of maintaining and/or re-establishing river herring populations (including blueback herring) in different river systems throughout Massachusetts, as well as in other New England states where river herring runs are present (i.e. Rhode Island, Maine, New Hampshire). Generally, these states (including Massachusetts) have one or more permanently constructed trapping facilities which allow the transfer of these fish with minimal stress. A similar methodology following the same concept, using either seines or traps (fyke nets) could be implemented for the blueback herring in the Muddy River in order to transport them around the work area while still allowing the adults to spawn and return to the ocean. The up-migrating blueback herring would be allowed to enter one of the impoundments on the Muddy River downstream from the active work area and be captured at that location (which could include the most upstream limit of migration at the location of the bypass pump discharge). The captured fish would then be transferred to a stocking truck and transported upstream to spawn in their historical spawning habitat in Leverett Pond. The post spawned adults are expected to migrate out of Leverett Pond downstream shortly after spawning (http://dnr2.maryland.gov/Fisheries/Pages/Fish-Facts.aspx?fishname=Alewife%20and%20Blueback%20Herring). These downstream migrating adults would be captured at a location upstream from the work area, and then transferred to a stocking truck and transported to a location downstream from the work area so that they can continue their migration to the sea.

The eggs that were spawned in Leverett Pond would hatch and the larvae would be expected to remain in Leverett Pond during the summer (i.e., June 15th to September 15th) where they would grow to their outmigration size. In September, connectivity of the river would be re-established to allow the juveniles to move downstream and complete their seaward migration. The connectivity would be maintained until the end of the November 15 migration window, when work would resume in these areas until April 1. This would allow additional work to be done during the April 1st to June 15th timeframe between Leverett Pond and Work Area 12 that could not be done if complete upstream passage (i.e. no work) was to be maintained in those areas (i.e., Work Areas 2-11) during the spring. Timing of dredging work in Leverett Pond shall be outside of the spawning and migration periods.

Because this method would require the trapping and netting of the fish, there is potential for mortality associated with handling, which could impact the overall spawning success and productivity of that year class. This may not be an acceptable impact to this species, since populations have been declining and they are currently listed as a federal species of concern http://www.greateratlantic.fisheries.noaa.gov/protected/pcp/soc/index.html, accessed, January, 2016). In addition, there may be difficulty in effectively timing the trapping operation to capture the up-migrating pre spawning adults as well as down migrating post spawning adults. In addition, the stress on the fish caused by handling and/or crowding in the transport truck may negatively affect spawning success having an overall negative effect on the year class.

This alternative would require traps and/or nets, one or more hatchery/tank trucks, and staff to deploy, tend and transfer the fish as well as to operate the truck to transport to the release area. There may also be logistical and technical concerns, in using the appropriate trap or net type, deployment of nets/traps in deep water and associated safety hazards, and the potential for any net or trap structure that is deployed to become fouled by debris floating down the river.

Proposed Capture Locations for Upstream Pre-Spawning Adult River Herring

Several possible capture locations for the up-migrating spawning adults on the Muddy River were investigated by Army Corps of Engineers New England District staff during a site visit on June 3, 2016. These included sections of the project near work Areas 10 and 11 (in the vicinity of the Boston Fire Department Communication Center off the Fenway), an area upstream from the footbridge in Area 9, as well as an area downstream from Area 12 located between Commonwealth Ave and Beacon Street, along Charlesgate East. Aerial (i.e. location) and ground level photographs of these areas are shown in Figures 1 through 6. Each of these areas has vehicle access that would allow equipment and staff to be delivered to the edge of the river, including a stocking truck, which would be loaded with the captured fish and driven to the release location in Leverett Pond. In addition to these possible capture locations, the fish could be captured at the most upstream limit of their migration, which would be at the bypass pump discharge (assuming that this area is accessible).

Figure 1. Proposed capture Area 1 for up-migrating blueback herring adults, Charlesgate.

Figure 2. Access road/path (from Commonwealth Ave) at proposed Charlesgate upstream collection Area 1. (Grassy area in background slopes down to the riverside on the right (looking upstream).

Figure 3. Charlesgate Collection Area 1 looking upstream showing rip-rapped left bank that would provide access to river.

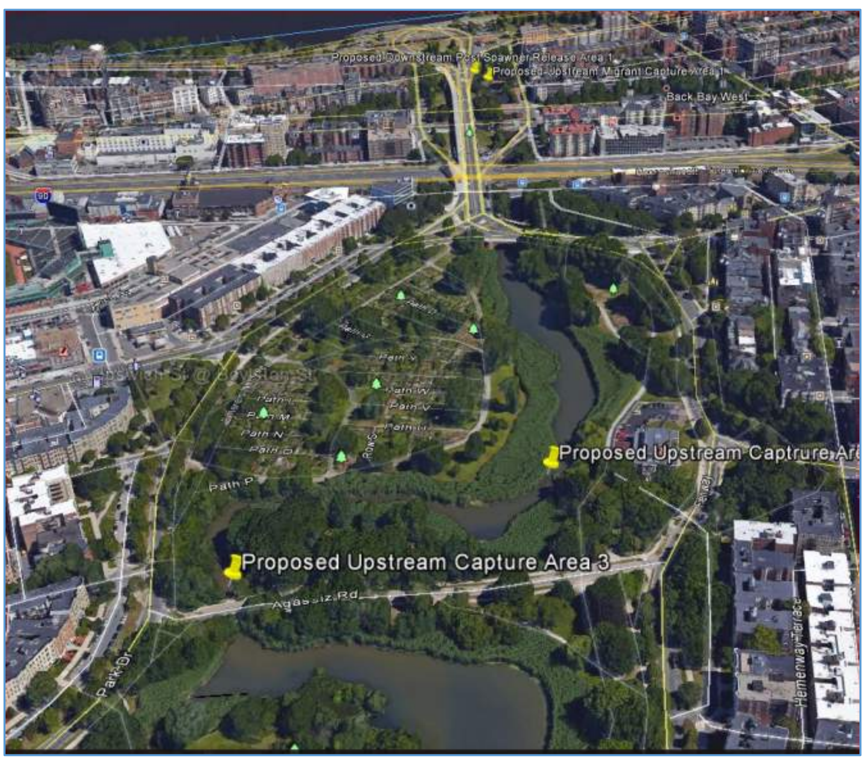

Figure 4. Proposed Upstream Capture Areas 2 and 3. Sections of Muddy River near Work Areas 11 and 12 (Capture Area 2) and Work Areas 9 and 10 (Capture Area 3).

Figure 5. View across river in Proposed Capture Area 2**.**

Figure 6. View across River in Proposed Capture Area 3**.**

Proposed Alternative Capture Methods

Two alternative methods are proposed for capture of the up-migrating fish. These include using a long haul/beach seine, or using one or more fyke nets/traps. These methods will be described in detail below.

Alternative Capture Method 1 - Beach/Haul Seine

Beach or haul seines are long rectangular nets generally ranging from 4 – 10 feet wide and from 25 to 300 or more feet long. There is a weighted/lead line that runs the entire length of the bottom of the net to keep the bottom submerged on the substrate, and a float line that runs along the top of the net to maintain buoyancy supporting it on the surface of water. Some seines incorporate a large bag in the center, where collected fish can be concentrated. The areas of the net on either side of the bag are called the wings. When deployed, the weighted bottom and floating top of the seine form a barrier across the water column (from surface to bottom) that will prevent the movement of fish in either direction. The wing ends usually have a length of rope that extends from the lead line and float lines, which can be attached to a wooden or fiberglass pole that allows the seine to be towed for deployment and retrieval. The seine is deployed so that that it can surround a school of fish, or fish habitat, and then be towed into shore (while maintaining the lead line on the bottom and the float line on the top). A beach or haul seine can be deployed in shallow water (4 feet or less) by two or more people, where one person anchors one wing end on the shore (by holding the pole upright) and one or two people (depending on the length of the seine) wade into the water towing the other wing end (maintaining it upright in the water column) to a predetermined distance to surround the fish or habitat, and then returning to shore planting the second wing end near or adjacent to the first. The seine can then be carefully drawn in to shore with the collected fish by pulling in the lead line and float line (generally the lead line is pulled in advance of the float line in order to close the bottom of the seine) while maintaining the lead line on the bottom. The bag end with the collected fish is then emptied (by netting) and the fish transferred to their designated location. In some seines, there is no bag, however as the net is drawn into shore the fish will become concentrated in the center of the net.

In water that is too deep to wade, a small boat can be used to deploy the seine. One wing end is planted on shore, and the rest of the net is loaded onto the bow of the boat. The boat is then slowly backed out into the water (preferably by rowing) so that the net can be dispensed off the bow of the boat (with the lead line sinking to the bottom and the float line remaining on the surface) and towed/extended by the boat to its full length surrounding the fish and returning the second wing end to shore. The net is then drawn in the same way as described above when deployed by wading. Seines have been used to collect river herring for population studies (Loesch and Lund, 1977; Atlantic States Marine Fisheries Commission, May, 2012; U.S. Fish and Wildlife Service, 2014) as well as for commercial harvesting of river herring (New York Dept. of Environmental Conservation http://www.dec.ny.gov/animals/76525.html accessed 13 June, 2016; Atlantic States Marine Fisheries Commission, May, 2012). A photo of a seine being deployed by two people wading is shown in Figure 7.

Figure 7. Beach seine being deployed in wadeable water.

Alternative Capture Method 2 - Fyke Net

Fyke nets or hoop nets are cylindrical or conical nets constructed by weaving a length of netting around a series of concentric rings spaced out along the length of the netting, forming a cylinder/cone. One end is open to form the entrance to the net, and the other end is closed (with a drawstring) to form a chamber for captured fish (cod end). There are generally between 4 and 8 rings in the net, and at two or more of the rings, an additional internal funnel net is placed to create a series of chambers into which fish moving from the entrance of the net can be funneled (See Figure 2). The largest ring is placed at the front of the net to frame the opening which is the diameter of that ring, and the length of netting extends to the next smaller ring in the series until the last ring (in some fyke nets the opening may be rectangular, rather than circular). Fish enter through the front of the net, and as they proceed toward the back, enter each of the internal funnels, which directs them into the next chamber, until the last chamber where they are trapped (i.e. the cod end). The fish are prevented from moving back to the opening by the smaller diameter of the funnel net, which they have difficulty locating, so they collect in the cod end.

Fyke nets are generally placed in rivers with the entrance facing downstream so that fish moving upstream can be trapped by the net (although they can also be placed with the opening facing upstream to capture fish moving downstream). A series of wings (constructed of netting) can be extended at angles along each side of the entrance in order to direct fish toward the opening of the net. With long enough wings, an entire stream or river can be blocked off so that any upstream or downstream moving fish (depending upon which direction the net is set) will be intercepted and directed into the net and be trapped. Nets can be deployed in shallower water (i.e. four feet or less) by using stakes and wading into the stream, and in deeper water by using a small boat with anchors and lines and/or in combination with stakes. This type of net is considered a passive method of capture, since it can collect fish continuously over a designated time period without having to be actively fished. At the end of a designated fishing/deployment period, the nets can be checked for captured fish which can be collected by netting from the cod end and transferring to a bucket, live well, or waiting hatchery truck.

Fyke nets have been deployed by the USFWS for the collection of up-migrating adult alewives in the Wreck Pond Inlet to the Wreck Pond River in New Jersey (New Jersey Office Field Notes, May, 2015), as well as in Alewife Brook in Cape Elizabeth Maine for the collection/monitoring of adult up-migrating alewives from Casco Bay (Alewife Brook Herring Monitoring, 2015 Pilot). It is assumed that the same methodology would collect blueback herring. An illustration of a fyke net is shown in Figure 8.

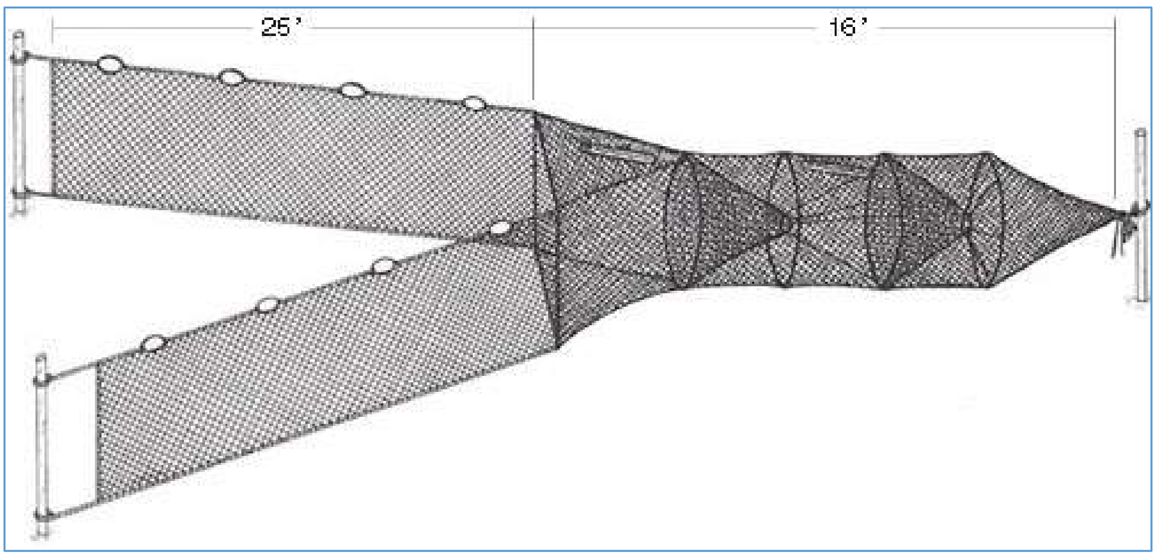

Figure 8. Fyke net showing wings that can be extended to form a barrier across the river to direct fish into the net.

<u>Proposed Method for Capture of Pre Spawning Adult Blueback Herring in the Muddy River Using Beach Seine (Preferred Alternative)</u>

1. A preliminary barrier net would be placed at the selected location for blue back herring capture, with a trash rack placed upstream from that net. The mesh size of the barrier net would be as large as possible, while still preventing the adult herring from moving beyond it (most likely a 3/4 inch mesh size). If there is a potential for the larger mesh net to act as a gill net for smaller resident fish that are attempting to move upstream or downstream, then a smaller mesh net could be used, however, it would need to be

tended more frequently in order to prevent fouling. If a larger mesh net is used, it would need to be checked approximately every two to three hours during the time of the spawning migration in order ensure that upmigrating blueback herring are not being caught and/or gillnetted by the nets and injured. Nets should be constructed of woven fibers or material other than monofilament in order to minimize the potential for injury that could result if the fish were to be inadvertently gillnetted by the net. Prior to setting any nets, the proposed capture area would be cleared of large debris that could potentially snag the bottoms of the nets or traps and prevent them from contacting the bottom of the river allowing fish to escape as well as preventing the net's retrieval (i.e. when using a seine). Alternatively, the fish could be collected at the location of the first barrier to upstream migration, downstream from the bypass pump discharge (if accessible). This may eliminate the need to set-up a barrier net, since the area near the discharge could be seined (assuming that it can be done safely).

2. During the spring up-migration, the adult herring would be prevented from moving beyond the barrier net and would gather in the area of the river immediately downstream from the net while attempting to move upstream (or below the discharge if the first barrier to upstream migration is used as the collection area).

3. An approximately 100 to 300 foot haul seine would then be deployed, starting from the shore approximately 50 to 100 feet downstream from the barrier seine and moving out to the opposite shore, and then moving along that shore (parallel to it) upstream to the barrier net, and then back toward the starting shore along the net in order to encircle/contain the fish. The seine would be closed by moving back toward the starting point (shore) along the barrier net. Since the depth of the river at the proposed capture locations is over four feet, a small flat bottomed row boat would need to be used to deploy the seines (including the barrier seine). A bagless seine would be used in order to minimize injury to the fish that could occur from being concentrated in the bag end when being hauled to shore.

4. Once the ends of the seine (i.e. the wing ends) are brought to shore, the net would be drawn in to concentrate the fish. In order to minimize stress to the fish, the net would remain submerged, with the fish being concentrated close to the shore to facilitate netting. Any non-target species captured in the seine would be released either upstream or downstream from the collection area.

5. Using rubberized nets, the fish would be collected from the concentrated seine, and transferred to a waiting hatchery truck. Salinity of the water in the truck would be increased to approximately (10 ppt) by using instant ocean or equivalent in (U.S. Fish and Wildlife Service, 2014) order to reduce stress on the transported fish as well as treat any scale abrasions and/or lacerations that may have resulted from the netting.

6. Depending on the amount of fish captured during each seine and the capacity and transfer density in the truck, the procedure would be repeated until all of the visible fish

in the capture area have been collected and/or maximum hatchery tank density has been reached (i.e. recommended as approximately one fish per gallon of water in the tank). In the event that the target density is not achieved within several seine hauls, the fish that have been collected in the hatchery tank will be transferred to the release site as noted below (in order to minimize the stress to the fish associated with being confined to the hatchery tank). It should be noted that the hatchery truck used should be equipped with circular holding tanks (for blueback herring), not square or rectangular.

7. The filled truck would then transport the fish to Leverett Pond, where it would be emptied (preferably by using the discharge pipe on the truck), or by netting the fish using a rubberized net, until all of the fish have been transferred. The number of fish transported and released alive would be counted and recorded along with any fish which died during transport.

8. The procedure would be repeated each day during the spawning season.

Proposed Method for Capture of Adult Upstream Migrating Blueback Herring in the Muddy River Using Fyke Net (Alternative 2)

1. A debris rack would be installed upstream at the selected collection location. Prior to setting any nets, the proposed capture area would be cleared of large debris that could potentially snag the bottom of the nets or traps preventing them from contacting the bottom of the river allowing fish to escape as well as preventing the net's retrieval (i.e. when using a seine). As noted previously in Alternative 1, the selected collection location could also be the upstream limit of migration, just downstream from the discharge of the bypass pump.

2. Just downstream from the debris trap, one or more fyke nets and/or hoop nets would be installed, with the wings extending to both sides of the river, and the trap oriented with is entrance facing downstream. Since the water in all of the proposed capture locations exceeds 5 feet, a boat will be needed to set both the fyke net and the wings. The wings would be wide enough to extend from the bottom of the river to the surface in order to effectively block fish from moving beyond them upstream. Alternatively, the fyke net could be set closer to shore in shallower water, with the wings still spanning the river, with one longer wing (stretching from the net to the opposite shore), and one shorter wing (from the net to the closer shore). However, if the net was set this way, it would not be in the thalweg, although the wings would be expected to direct all up-migrating fish into the fyke net. The approximate size of the net would depend upon the depths of the collection area, however it would be assumed that the opening would be at least three or four feet in diameter (or depth, if a square or rectangular opening is used).

3. Each day, or several times a day during the up migrating season, the holding bag of the fyke net would be examined for the presence of adult blueback herring. This could be done either by wading (if the net was set in shallower water) or by using a small boat, and rowing out to the end of the net. It should be noted that blueback herring tend to migrate in large numbers at the same approximate time. Therefore it is possible that the net could reach capacity very quickly requiring extremely frequent checking when this happens.

4. The bag would be emptied into a floating live car, or holding tank on the boat, and the adults would be transferred to a waiting hatchery truck. This would be repeated until the truck has been filled, and/or there are no additional captured fish. Net transfer would utilize rubberized nets in order to minimize scale abrasion/injury to the fish.

5. Alternatively, in the event that not all of the captured fish are collected, but are still in some of the chambers, the net could be pulled from the front, and then lifted so that all of the fish end up in the cod end. This could be done by boat, by pulling the net onto the boat from the entrance end while allowing the cod end to remain submerged.

6. The entire net, or the just the cod end (some nets have removable cod ends) would then be brought to shore and emptied/transferred to a waiting hatchery truck, and then the fish would be transported to their release location in Leverett Pond.

9. The truck would release the fish by opening the discharge pipe, or by using a rubberized net to move the fish to their spawning area. The number of fish transported and released alive would be counted and recorded along with any fish which died during transport.

<u>Proposed Capture Location of Post Spawned Downstream Migrating Adult Blueback Herring</u>

A proposed capture area for downstream migrating blueback herring is located near Work Area 6. A flow control structure upstream of Park Drive constricts flow at this location to a narrow, easily accessible channel. An aerial photo (location map) is shown in Figure 9, and photos of the river in that location are shown in photos 10 and 11.

Figure 9. Proposed location of blueback herring post spawned adult downstream migrant collection area (Work Area 6).

Figure 10. Downstream view of river in location of proposed post spawning adult blueback herring collection area**.**

Figure 11. Upstream View of river in location of proposed post spawning adult collection Area.

Method for Collecting Post Spawning Adults – Beach Seine (Preferred Alternative)

1. A preliminary barrier net would be placed slightly downstream at the selected location for adult blueback herring capture (in order prevent downstream migrants from moving further downstream) with a trash rack placed upstream (approximately 100 feet) from that net. The mesh size of the barrier net would be as large as possible, while still preventing the adult herring from moving beyond it (most likely a 3/4 inch mesh size). If there is a potential for the larger mesh net to act as a gill net for smaller resident fish that are attempting to move upstream or downstream, then a smaller mesh net could be used, however, it would need to be tended more frequently in order to prevent fouling. Nets should not be constructed of mono-filament, but rather have a woven and/or coated mesh to minimize the potential for injury if the fish become trapped by their gills. Prior to setting any nets, the proposed capture area would be cleared of large debris that could potentially snag the bottoms of the nets or traps preventing them from contacting the bottom of the river allowing fish to escape, as well as preventing the net's retrieval (i.e. when using a seine).

2. During the post spawning down-migration, the adult herring would be prevented from moving beyond the barrier net and would gather in the area of the river immediately upstream from the net while attempting to move downstream.

3. An approximately 100 foot (or less) haul seine would then be deployed, starting from the shore approximately 50 to 100 feet upstream from the barrier seine and moving out to the opposite shore, and then moving along that shore (parallel to it) downstream to the barrier net, and then back toward the starting shore along the net in order to encircle/contain the fish. The seine would be closed by moving back toward the starting point (shore) along the barrier net. If the depth of the river at the proposed capture locations is over four feet, a small flat bottomed row boat would need to be used to deploy the seines (including the barrier seine). A bagless seine would be used in order to minimize the potential for injury that could occur from being concentrated in the bag.

4. Once the ends of the seine (i.e. the wing ends) are brought to shore, the net would be drawn in to concentrate the fish. In order to minimize stress to the fish, the net would remain submerged, with the fish being concentrated close to the shore to facilitate netting. Any non-target species collected in the seines would be released either upstream or downstream of the collection area.

5. Using rubberized nets, the fish would be collected from the concentrated seine, and transferred to a waiting hatchery truck. Salinity of the water in the truck would be increased to approximately (10 ppt) by using instant ocean or equivalent in order to reduce stress on the transported fish (U.S. Fish and Wildlife Service, 2014), as well as treat any scale abrasions and/or lacerations that may have resulted from the netting.

6. Depending on the amount of fish captured during each seine and the capacity and transfer density in the truck, the procedure would be repeated until all of the visible fish in the capture area have been collected and/or maximum hatchery tank density has been reached (approximately one fish per gallon of hatchery tank water). However, if after several seines, the target density is not reached, the fish that have been collected in the hatchery truck will be transported to the release location noted below (in order to avoid stress related mortality).

7. The filled truck would then transport the fish to the discharge location, which would be located downstream from the upstream migration area, where it would be emptied (preferably by using the discharge pipe on the truck), or by netting the fish using a rubberized net, until all of the fish have been transferred.

Proposed Method of Capture for Post Spawned Adults (Alternative 2)

1. A debris rack would be installed upstream at the selected collection location (i.e. a point downstream of the historical spawning location in Leverett Pond). Prior to setting any nets, the proposed capture area would be cleared of large debris that could potentially snag the bottoms of the nets or traps preventing them from contacting the bottom of the river allowing fish to escape, as well as preventing the net's retrieval (i.e. when using a seine).

2. Just downstream from the debris trap, one or more fyke nets and/or hoop nets would be installed, with the wings extending to both sides of the river, and the trap oriented with is entrance facing upstream.

3. Each day, or several times a day during the outmigration season, the holding bag of the fyke net would be examined for the presence of adult blueback herring. This could be done either by wading or by using a small boat (the proposed capture area appears shallow enough to wade). Any non-target species collected in the nets would be released away from the trapping area. It should be noted that this net should be checked approximately every hour during the peak outmigration season, in order to prevent the impingement of exhausted downstream migrating blueback herring on the nets and resulting mortality.

4. The bag would be emptied into a floating live car, or holding tank on the boat, and the adults would be transferred to a waiting hatchery truck. This would be repeated until the truck has been filled, and/or there are no additional captured fish.

5. The fish would be transferred to the release area downstream from the work area, and released by opening the discharge pipe, or by netting using a rubberized net.

Proposed Release Location for Pre-spawning Adults in Leverett Pond

The captured pre-spawning adult blueback herring would be transported to Leverett Pond, and released at a proposed release area upstream from the River Road Bridge in Brookline. Aerial and ground level views of this location are shown in Figures 12 and 13. This section of Leverett Pond is downstream from the known blueback herring spawning habitat, and release at this location will allow the fish to continue their migration to the spawning area un-impeded. The area is accessible from the Emerald Necklace path off of Pond Ave.

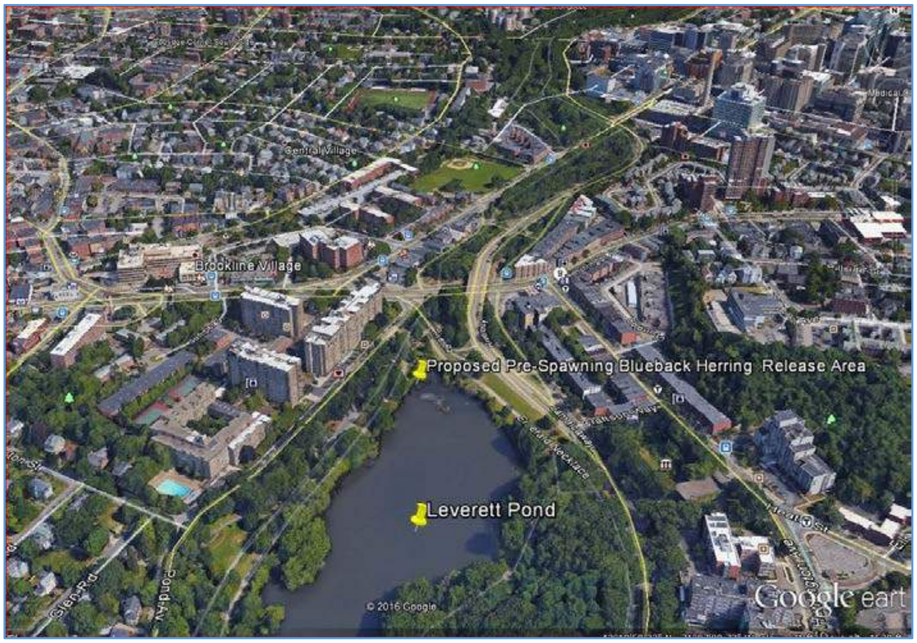

Figure 12. Proposed Blueback Herring Pre-spawning Adult Release Area

Figure 13. View of Leverett Pond from Proposed Pre-spawning Adult Blueback Herring Release Area looking downstream toward Emerald Necklace Path Bridge.

Proposed Method for Release of Pre-spawning Adult Blueback Herring in Leverett Pond

1. The tank/hatchery truck would be directed to the proposed release area adjacent to Leverett Pond.

2. The discharge pipe would be extended to the water to a depth of approximately 3 feet.

3. The gate would be opened releasing the fish into Leverett Pond. Fish that remain in the tank would be netted and moved to the water.

4. Alternatively if there is no discharge pipe on the hatchery truck, the fish would be netted from the tanks and transferred to the Leverett Pond Release Area.

Proposed Release Areas for Post Spawned Adult Blueback Herring in the Muddy River

The preferred release location for these post spawned adult blueback herring would be at the farthest location downstream, just upstream from Storrow Drive (Figure 14). This area appears to have vehicle access, although it has not been confirmed. In the event that this area is not accessible, the post spawned adult blueback herring can be released just downstream from any of the proposed capture locations discussed previously. The capture locations (i.e. barrier nets, seines or traps) would be initially set up so that there would be sufficient space on their downstream side to allow the release of the post spawned adults. The locations of the capture areas were shown above in Figures 1-6. .

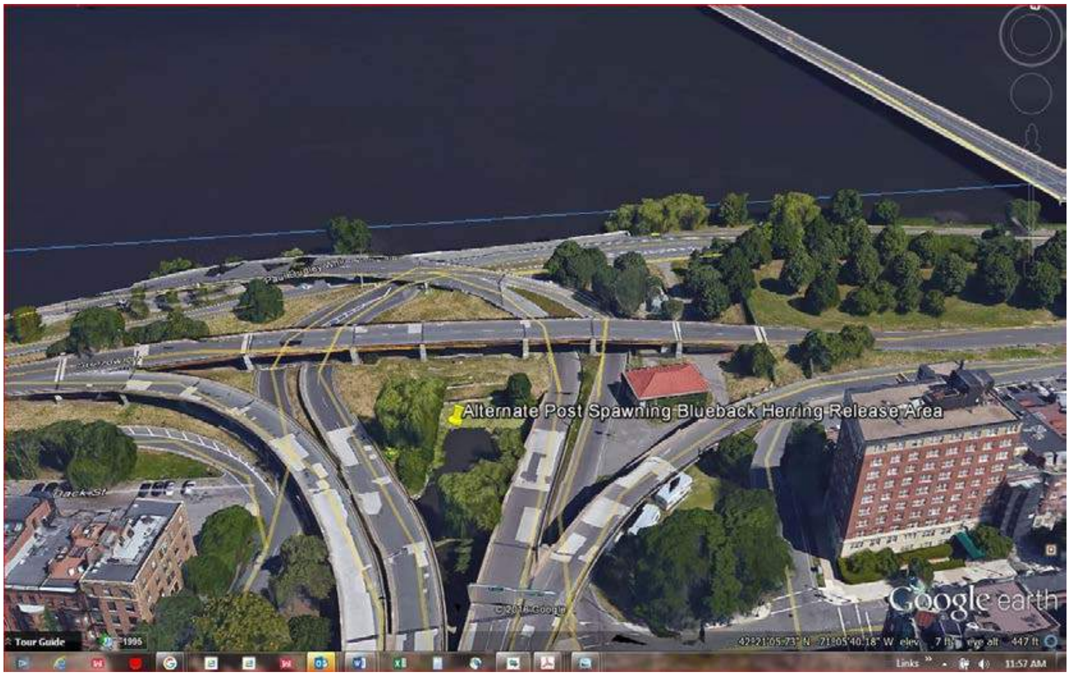

Figure 14. Proposed alternate release area for post spawned blueback herring adults**.**

Specifications for Hatchery Tank Trucks - Excerpted from USFWS (2014)

"The USFWS operates two trucks that carry a 750 gallon and a 1,000 gallon circular tank. Each tank has two water pumps and plumbing to provide both on-site water pick-up/filling and then switch to a closed/recycling flow, creating a circular flow in these tanks. Each truck also has oxygen that is applied at rate dependent on water temperature and fish density, generally at a rate of 4-6 mg/liter through fine grain air stones. Natural salt (water treatment brands) is applied prior to filling tanks with water to achieve approximately 10 ppt salt concentration when filled. A water quality multi-meter is used to monitor both salt concentration and dissolved oxygen levels. Data sheets to track number loaded, location, temperature, and other details are filled out on departure and also later at time of release."

Work Plan

The fish capture/transport program will be implemented by a contractor supervised by the Corps of Engineers. The contractor will be required to develop and submit a detailed work plan to the Corps of Engineers, Massachusetts Department of Marine Fisheries, and NOAA Fisheries for review and approval. The work plan will be submitted for review no later than 3 months prior to the herring migration season.

Reporting

A report describing the results of the fish capture/transport program will be submitted yearly after the herring migration season (approximately July of any year) to the Massachusetts Department of Marine Fisheries and NOAA Fisheries.

References/Literature Cited

Alewife Brook Herring Monitoring, 2015 Pilot. Prepared by Matt Craig, Casco Bay Estuary Partnership February 3, 2016.

Atlantic States Marine Fisheries Commission, 2012. Stock Assessment Report No. 12-02 of the Atlantic States Marine Fisheries Commission River Herring Benchmark Stock Assessment Volume II.

Fisheries Techniques, 2nd Edition. Brian R. Murphy and David W. Willis, Editors. American Fisheries Society; 2nd edition (January 1, 1996).

Joseph G. Loesch and William A. Lund, 1977. A Contribution to the Life History of the Blueback Herring, *Alosa aestivalis*. Trans. Am. Fish Soc., Vol 106, No.6, 1977.

Maryland Department of Natural Resources http://dnr2.maryland.gov/Fisheries/Pages/Fish-Facts.aspx?fishname=Alewife%20and%20Blueback%20Herring accessed 6/17/2016.

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U.S. Fish and Wildlife Service, 2015. New Jersey Field Office Field Notes. Alewife Monitoring at Wreck Pond Inlet, by Katie Conrad.

U.S. Fish and Wildlife Service, 2014. U.S. Fish and Wildlife Service Connecticut River Coordinator's Office. Adult River Herring Pre-Spawn Capture and Transfers in the Connecticut River Basin, December, 2014.

ATTACHMENT D

MEPA CERTIFICATES

ATTACHMENT E

PUBLIC NOTICE

ATTACHMENT F

NOTICE OF INTENT

(Boston and Brookline)

(To be Provided by Sponsors)

APPENDIX C

Abutter Information

Notification to Abutters under the Massachusetts Wetlands Protection Act

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40 you are hereby notified of the following public hearing on the matter described below.

A. The name of the applicant is: City of Boston.

B. The address of the lot where the activity is proposed is:

Muddy River (Leverett Pond, the Riverway, and the Back Bay Fens)

C. The work proposed is in the jurisdiction of the Wetlands Protection Act is as follows:

The U.S. Army Corps of Engineers-New England District (USACE) is proposing to construct the Muddy River Flood Damage Reduction Project - Phase 2, in Boston and Brookline, Massachusetts. The City of Boston is filing a Notice of Intent with the Boston Conservation Commission for the Project. The proposed Phase 2 project will include the following work:

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.
- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Manage Phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction and improve ecological habitat quality.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where Phragmites or Japanese knotweed are eradicated by planting grass, trees and shrubs.
- Install habitat logs for fish and turtles.
- Remove the temporary flow restriction structure.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

D. Copies of the Notice of Intent may be examined: at Boston City Hall, Environment Department, Room 709, between the hours of 8:00 a.m. to 4:00 p.m., Monday through Friday.

E. Copies of the Notice of Intent may be obtained from: the applicant's representative CDM Smith, by calling (617) 452-6381 between the hours of 8AM and 5PM, Monday through Friday.

F. The Public Hearing will be held on: November 7, 2018 at 6:00 pm at Boston City Hall, Piemonte Room, One City Hall Plaza, Floor 5.

NOTE: Notice of the public hearing, including its date, time, and place, will be published at least seven (7) days in advance in the Boston Herald.

NOTE: You also may contact the Boston Conservation Commission at 617-635-3850, or the Department of Environmental Protection Northeast Regional Office for more information about this application.

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
PARKSIDE TOWER LLC	C/O PARKSIDE TOWER LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	91 WESTLAND AV	BOSTON	02115
KOUTOUNIDIS STYLIANOS	C/O NIKOLAOS PSEUDOIKONOMOU	39 DONNA RD	NEWTON MA	02459	94 HEMENWAY ST	BOSTON	02115
MITCHELL ROBERT S TS	C/O BOBSON REALTY	4 COPLEY PL 110	BOSTON MA	02116	108 HEMENWAY ST	BOSTON	02115
MITCHELL ROBERT S TS	C/O BOBSON REALTY	4 COPLEY PL #110	BOSTON MA	02116	104 HEMENWAY ST	BOSTON	02115
BERKLEE SCHOOL OF MUSIC INC	C/O CHRIS SWEZEY	1140 BOYLSTON ST - MS 168 AX	BOSTON MA	02215	98 HEMENWAY ST	BOSTON	02115
MUSEUM OF FINE ARTS	C/O MUSEUM OF FINE ARTS	465 HUNTINGTON AV	BOSTON MA	02115	140 FENWAY ST	BOSTON	02115
MUSEUM OF FINE ARTS		465 HUNTINGTON AV	BOSTON MA	02115	HEMENWAY ST	BOSTON	02115
ONE 14 FENWAY INC THE		114 FENWAY	BOSTON MA	02115	114 FENWAY ST	BOSTON	02115
SANFORD ETHAN	C/O ETHAN SANFORD	114 FENWAY #G-1	BOSTON MA	02115	114 FENWAY ST Apt G-1	BOSTON	02115
GOLDEN GEORGE C	C/O GEORGE C GOLDEN	114 FENWAY ST # 18	BOSTON MA	02115	114 FENWAY ST Apt G-2	BOSTON	02115
SPAULDING DOROTHY E		114 FENWAY ST #1 ECOR	BOSTON MA	02115	114 FENWAY ST Apt 1	BOSTON	02115
JOYCE MARY BARBARA	C/O MARY BARBARA JOYCE	114 FENWAY ST #2	BOSTON MA	02115	114 FENWAY ST Apt 2	BOSTON	02115
MERRILL JOAN T	C/O JOAN T MERRILL	114 FENWAY ST #3	BOSTON MA	02115	114 FENWAY ST Apt 3	BOSTON	02115
MOULTON DANIEL J		114 FENWAY ST #4	BOSTON MA	02115	114 FENWAY ST Apt 4	BOSTON	02115
ROGAN MICHAEL J	C/O HUGH WILBURN	114 THE FENWAY #5	BOSTON MA	02115	114 FENWAY ST Apt 5	BOSTON	02115
KISH PATRICE M		114 FENWAY ST #6	BOSTON MA	02115	114 FENWAY ST Apt 6	BOSTON	02115
BERNIER ANNE	C/O ANNE BERNIER	114 FENWAY APT #7	BOSTON MA	02115	114 FENWAY ST Apt 7	BOSTON	02115
JOYCE EDWARD C		114 FENWAY ST #8 ECOR	BOSTON MA	02115	114 FENWAY ST Apt 8	BOSTON	02115
PETRAGLIA JOSEPH	C/O JOSEPH PETRAGLIA	114 FENWAY #9	BOSTON MA	02115	114 FENWAY ST Apt 9	BOSTON	02115
HE JINJIE	C/O JINJIE HE	114 FENWAY ST #10	BOSTON MA	02115	114 FENWAY ST Apt 10	BOSTON	02115
SHEA VANCE LLC	C/O SHEA VANCE LLC	20 RIESLING RD	PLYMOUTH MA	02360	114 FENWAY ST Apt 11	BOSTON	02115
MCKEAN JEFFREY T		114 FENWAY #12	BOSTON MA	02115	114 FENWAY ST Apt 12	BOSTON	02115
KRASON DAVID	C/O DAVID KRASON	114 FENWAY ST # 14	BOSTON MA	02115	114 FENWAY ST Apt 14	BOSTON	02115
SHEA VANCE LLC	C/O DENISE SPENCER	20 RIESLING RD	PLYMOUTH MA	02360	114 FENWAY ST Apt 15	BOSTON	02115
KAMAL SAJED ETAL		114 FENWAY ST #16 ECOR	BOSTON MA	02115	114 FENWAY ST Apt 16	BOSTON	02115
NORTHEASTERN UNIVERSITY		110 FENWAY	BOSTON MA	02115	110 FENWAY ST	BOSTON	02115
NORTHEASTERN UNIVERSITY		102 FENWAY	BOSTON MA	02115	102 FENWAY ST	BOSTON	02115
NORTHEASTERN UNIVERSITY		96 FENWAY	BOSTON MA	02115	96 FENWAY ST	BOSTON	02115
NORTHEASTERN UNIVERSITY		90 FENWAY	BOSTON MA	02115	90 FENWAY ST	BOSTON	02115
NORA LLC	C/O ALPHA MANAGEMENT CORP	1249 BEACON ST STE 1	BROOKLINE MA	02446	84 FENWAY ST	BOSTON	02115
LDJ DEVELOPMENT LLC	C/O PREMIER PROPRTY SOLUTIONS	311 SUMMER ST	BOSTON MA	02210	80 FENWAY ST	BOSTON	02115
ON THE FENS CONDO TR		74 FENWAY	BOSTON MA	02115	74 FENWAY ST	BOSTON	02115
WELCH BERNARD C JR	C/O BERNARD C WELCH JR	262 BRIDGE ST	NORTHAMPTON MA	01060	74 FENWAY ST Apt 74-11	BOSTON	02115
ANDERSON CURTIS N		PO BOX 230615	BOSTON MA	02123	74 FENWAY ST Apt 74-12	BOSTON	02115
KAITSUNG YEAN TS	C/O MICHAEL TSUNG	74 FENWAY UNIT 14	BOSTON MA	02115	74 FENWAY ST Apt 74-14	BOSTON	02115
LI HONG	C/O YING WANG	20 RIVER COURT APT #3606	NEW JERSEY CITY NJ	07310	74 FENWAY ST Apt 74-15	BOSTON	02115
WINGROVE BARBARA KESHIN	C/O BARBARA KESHIN WINGROVE	74 FENWAY ST #74-16	BOSTON MA	02115	74 FENWAY ST Apt 74-16	BOSTON	02115
PRATT SHELLY	C/O SHELLY PRATT	12 HOLLY ST	GLOUCESTER MA	01930	74 FENWAY ST Apt 74-17	BOSTON	02115
BASEL KI JONG	C/O KI JONG BASEL	74 FENWAY ST #21	BOSTON MA	02115	74 FENWAY ST Apt 74-21	BOSTON	02115
CALDWELL GEOFFREY J	C/O S CALDWELL	74 FENWAY ST #22	BOSTON MA	02115	74 FENWAY ST Apt 74-22	BOSTON	02115
SANKER SEAN M	C/O SEAN M SANKER	1 CHANNING ST	NEWTON MA	02458	74 FENWAY ST Apt 74-23	BOSTON	02115
PARSONS CATHERINE		74 FENWAY ST #74-24	BOSTON MA	02115	74 FENWAY ST Apt 74-24	BOSTON	02115
DIANE T PERGOLA REVOCABLE	C/O DIANE PERGOLA	44 WINDEMERE CIR #67	TYNGSBORO MA	01879	74 FENWAY ST Apt 74-25	BOSTON	02115
OLSON MARK	C/O MARK OLSON	74 FENWAY ST #74-26	BOSTON MA	02115	74 FENWAY ST Apt 74-26	BOSTON	02115
HAFFNER KATHERINE		74 THE FENWAY ST #74-31	BOSTON MA	02115	74 FENWAY ST Apt 74-31	BOSTON	02115
FISCHER JEFFREY R	C/O JEFFREY R FISCHER	74 FENWAY ST	BOSTON MA	02115	74 FENWAY ST Apt 74-32	BOSTON	02115
MANUELIAN HAIG DER	C/O H D MANUELIAN	25 LANTERN RD	BELMONT MA	02478	74 FENWAY ST Apt 74-33	BOSTON	02115
ZHANG SUNNY HY	C/O WEIDONG LI	6 NASSAU DRIVE	WINCHESTER MA	01890	74 FENWAY ST Apt 74-34	BOSTON	02115
SCHEIBEL DEBRA	C/O DEBRA SCHEIBEL	404 SALISBURY ST	HOLDEN ME	01520	74 FENWAY ST Apt 74-35	BOSTON	02115
AXELROD STEPHEN J	C/O STEPHEN AXELROD	74 THE FENWAY #36	BOSTON MA	02115	74 FENWAY ST Apt 74-36	BOSTON	02115
ERTEN BILGE	C/O BILGE ERTEN	74 FENWAY ST #74-41	BOSTON MA	02115	74 FENWAY ST Apt 74-41	BOSTON	02115
TERA NORTH REALTY LLC	C/O TERA NORTH REALTY LLC	74 FENWAY ST #74-42	BOSTON MA	02115	74 FENWAY ST Apt 74-42	BOSTON	02115
TAO ZHENGYI	C/O ZHENGYI TAO	6 NASSAU DR	WINCHESTER MA	01890	74 FENWAY ST Apt 74-43	BOSTON	02115
GEAR ROBERT G		74 FENWAY ST #74-44	BOSTON MA	02115	74 FENWAY ST Apt 74-44	BOSTON	02115
SCOTT ALEXANDER C		74 FENWAY ST # 74-45	BOSTON MA	02115	74 FENWAY ST Apt 74-45	BOSTON	02115
VOLLOCH VLADIMIR ETAL		75 PARK	BROOKLINE MA	02446	74 FENWAY ST Apt 74-46	BOSTON	02115
BEARMAN STEPHANIE ADORNATO A	C/O CLIVE BEARMAN	74 FENWAY ST #74-51	BOSTON MA	02115	74 FENWAY ST Apt 74-51	BOSTON	02115
MONDELLO PAMELA	C/O PAMELLA MONDELLO	74 FENWAY ST #52	BOSTON MA	02115	74 FENWAY ST Apt 74-52	BOSTON	02115
MEHTA RUSTOM TS	C/O DINATALE & CO	491 MAPLE ST #205	DANVERS MA	01923	74 FENWAY ST Apt 74-53	BOSTON	02115
SPENCER SARAH J	C/O SARAH J SPENCER	74 FENWAY ST #54	BOSTON MA	02115	74 FENWAY ST Apt 74-54	BOSTON	02115
CHAUDHARY VIKRAMJIT	C/O VIKRAMJIT CHAUDHARY	1087 MAY ST	NAUGATUCK CT	06770	74 FENWAY ST Apt 74-55	BOSTON	02115
SCHEIBEL DEBRA DURANTE	C/O DEBRA DURANTE SCHEIBEL	440 SALISBURY STREET	HOLDEN MA	01520	74 FENWAY ST Apt 74-56	BOSTON	02115
CHANG ERIC		70 FENWAY ST #70-11	BOSTON MA	02115	70 FENWAY ST Apt 70-11	BOSTON	02115

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
SHOHAM MARK		308 HOMER ST	NEWTON MA	02459	70 FENWAY ST Apt 70-12	BOSTON	02115
CARUSO RALPH		70 FENWAY #70-14	BOSTON MA	02115	70 FENWAY ST Apt 70-14	BOSTON	02115
DEMARTINO MICHAEL	C/O MICHAEL DEMARTINO	70 FENWAY ST #70-15	BOSTON MA	02115	70 FENWAY ST Apt 70-15	BOSTON	02115
HUANG CHUN-PI LIN	CC/O CHUN-PI LIN HUANG	12 FARLEY BROOK ROAD	CHELMSFORD MA	01824	70 FENWAY ST Apt 70-16	BOSTON	02115
GRASS KENNETH	C/O KENNETH GRASS	70 FENWAY ST #70-17	BOSTON MA	02115	70 FENWAY ST Apt 70-17	BOSTON	02115
ANGUS DAVID J	C/O DAVID ANGUS	22 DISCOVERY RD	ESSEX JUNCTION VT	05452	70 FENWAY ST Apt 70-21	BOSTON	02115
SLOANE JONATHAN		70 FENWAY ST #70-22	BOSTON MA	02115	70 FENWAY ST Apt 70-22	BOSTON	02115
GRAUPERA TARA KATHLEEN TS	C/O TARA K GRAUPERA	1100 EDGEHILL DR	BURLINGAME CA	94010	70 FENWAY ST Apt 70-23	BOSTON	02115
MARCHUK COURTNEY	C/O COURTNEY MARCHUK	70 FENWAY #24	BOSTON MA	02115	70 FENWAY ST Apt 70-24	BOSTON	02115
BULLINS MICHAEL L	C/O MICHAEL L BULLINS	70 FENWAY ST #70-25	BOSTON MA	02115	70 FENWAY ST Apt 70-25	BOSTON	02115
XIAO ZHIWEN	C/O ZHIWEN XIAO	MINZHI RD XINGHE DANTI A-403	SHENZHEN CHINA		70 FENWAY ST Apt 70-26	BOSTON	02115
BYRNE ELEANOR		70 FENWAY	BOSTON MA	02115	70 FENWAY ST Apt 70-31	BOSTON	02115
GATIM LLC	C/O GATIM LLC	70 FENWAY #70-32	BOSTON MA	02115	70 FENWAY ST Apt 70-32	BOSTON	02115
CAO TIANYI	C/O TIANYI CAO	70 FENWAY ST #33	BOSTON MA	02115	70 FENWAY ST Apt 70-33	BOSTON	02115
LI XIAOMING	C/O XIAOMING LI	70 FENWAY ST #70-34	BOSTON MA	02115	70 FENWAY ST Apt 70-34	BOSTON	02115
FARRELL FAMILY IRREVOCABLE	C/O CAMILLA S FARRELL	9 ROBIN RD	WESTBOROUGH MA	01581	70 FENWAY ST Apt 70-35	BOSTON	02115
RAWAL VISHAL BABULAL	C/O VISHAL BABULAL RAWAL	70 THE FENWAY #70-36	BOSTON MA	02115	70 FENWAY ST Apt 70-36	BOSTON	02115
JONES BONNIE S		70 FENWAY ST #70-41	BOSTON MA	02115	70 FENWAY ST Apt 70-41	BOSTON	02115
BROSNAN JOHN G	C/O JOHN G. BROSNAN	56 BUTLER RD	QUINCY MA	02169	70 FENWAY ST Apt 70-42	BOSTON	02115
BETHUNE JAMES D		306 DIVISION ST	E GREENWICH RI	02818	70 FENWAY ST Apt 70-43	BOSTON	02115
LEVIN SVETLANA	C/O SVETLANA LEVIN	61 ERIE AVENUE	NEWTON MA	02461	70 FENWAY ST Apt 70-44	BOSTON	02115
SAKDIYAKORN CHANNADDA	C/O CHANNADDA SAKDIYAKORN	70 FENWAY ST #45	BOSTON MA	02115	70 FENWAY ST Apt 70-45	BOSTON	02115
HADLEY ELEANOR F		70 FENWAY ST #70-46	BOSTON MA	02115	70 FENWAY ST Apt 70-46	BOSTON	02115
LEIGH CONSTANCE		70 THE FENWAY #70-51	BOSTON MA	02115	70 FENWAY ST Apt 70-51	BOSTON	02115
BAHHADY IMAD	C/O IMAD BAHHADY	70 FENWAY ST #70-52	BOSTON MA	02115	70 FENWAY ST Apt 70-52	BOSTON	02115
ALTUKHAIM SARA	SARA ALTUKHAIM	71 CIRCUIT STREET	MELROSE MA	02176	70 FENWAY ST Apt 70-53	BOSTON	02115
DOBRUSHKIN ALBERT	C/O ALBERT DOBRUSHKIN	70 FENWAY #44	BOSTON MA	02115	70 FENWAY ST Apt 70-54	BOSTON	02115
WHEATLEY RODNEY R		70 FENWAY ST #70-55	BOSTON MA	02115	70 FENWAY ST Apt 70-55	BOSTON	02115
BOSCA CARO-GRAY		70 FENWAY ST #70-56	BOSTON MA	02115	70 FENWAY ST Apt 70-56	BOSTON	02115
BOSTON REHAB ASSOCS I LPS		66 FENWAY	BOSTON MA	02115	66 FENWAY ST	BOSTON	02115
PIZZI SALVATORE TRSTS	C/O TOM BOWE	1372 HANCOCK ST #202	QUINCY MA	02169	60 FENWAY ST	BOSTON	02115
HEMENWAY APARTMENTS CO LPS		97 HEMENWAY	BOSTON MA	02115	97 HEMENWAY ST	BOSTON	02115
ONE 03 HEMENWAY ST CONDO TR	C/O SABET MNGMNT CO INC	105 PETERBOROUGH ST #2	BOSTON MA	02215	103 HEMENWAY ST Apartments	BOSTON	02115
NORTHEASTERN UNIVERSITY	C/O BUSINESS SERVICES-480 RP	360 HUNTINGTON AV	BOSTON MA	02199	109 HEMENWAY ST	BOSTON	02115
NORTHEASTERN UNIVERSITY	C/O BUSINESS SERVICES-480 RP	360 HUNTINGTON AV	BOSTON MA	02115	115 HEMENWAY ST	BOSTON	02115
NORTHEASTERN UNIV MASS		125 HEMENWAY	BOSTON MA	02115	125 HEMENWAY ST	BOSTON	02115
RETALS LLC	PARK PROPERTY MGT GROUP LLC	1963 COMMONWEALTH AV SUITE #1	BRIGHTON MA	02135	409 HUNTINGTON AV	BOSTON	02115
FIFTY-NINE HEMENWAY ST		59 HEMENWAY	BOSTON MA	02115	59 HEMENWAY ST	BOSTON	02115
GIBBS IRINA		59 HEMENWAY ST #1	BOSTON MA	02115	59 HEMENWAY ST Apt 1	BOSTON	02115
MEHTA ASHISH G		59 HEMENWAY ST #2	BOSTON MA	02115	59 HEMENWAY ST Apt 2	BOSTON	02115
FIFTY NINE HEMENWAY ST LLC	C/O 59 HEMENWAY STREET LLC	16 HARRISON ST	BROOKLINE MA	02446	59 HEMENWAY ST Apt 3	BOSTON	02115
WELCH BERNARD C JR	C/O BERNARD C WELCH JR	262 BRIDGE ST	NORTHAMPTON MA	01060	59 HEMENWAY ST Apt 4	BOSTON	02115
EPSTEIN DANIEL		59 HEMENWAY ST #5	BOSTON MA	02115	59 HEMENWAY ST Apt 5	BOSTON	02115
SR MINC LLC		779 WASHINGTON ST	BROOKLINE MA	02446	61 HEMENWAY ST	BOSTON	02115
SIXTY-5 HEMENWAY CONDO TR	C/O SIXTY 5 HEMENWAY LLC	79 WESTLAND AV	BOSTON MA	02115	65 HEMENWAY ST	BOSTON	02115
GLUMAKOV ALEXANDER	C/O ALEXANDER GLUMAKOV	14 BRYON RD #4	CHESTNUT HILL MA	02467	65 HEMENWAY ST Apt 1	BOSTON	02115
LESLIE DODDS LIBERMAN	C/O M CHARLES LIBERMAN	8 ROBBINS ST	MILTON MA	02186	65 HEMENWAY ST Apt 2	BOSTON	02115
POWERS HELENE M	C/O HELENE M POWERS	65 HEMENWAY ST #3	BOSTON MA	02115	65 HEMENWAY ST Apt 3	BOSTON	02115
PATTERSON GARY	C/O GARY PATTERSON	65 HEMENWAY ST # 4	BOSTON MA	02115	65 HEMENWAY ST Apt 4	BOSTON	02115
GOLDBERGER THOMAS	C/O THOMAS GOLDBERGER	32 DEVONSHIRE RD	NEWTON MA	02468	65 HEMENWAY ST Apt 5	BOSTON	02115
DONG SIKE	C/O SIKE DONG	1 PEARL ST	WALTHAM MA	02453	65 HEMENWAY ST Apt 6	BOSTON	02115
PELLAND MATTHEW T BE	MATTHEW T PELLAND	65 HEMENWAY ST #7	BOSTON MA	02115	65 HEMENWAY ST Apt 7	BOSTON	02115
FREYTSIS ILYA	C/O ILYA FREYTSIS	16 MILLETT RD	SWAMPSCOTT MA	01907	65 HEMENWAY ST Apt 8	BOSTON	02115
ACQUILANO DONNA	C/O D ACQUILANO + O LESLIE	2278 HIWAN DRIVE	EVERGREEN CO	80439	65 HEMENWAY ST Apt 9	BOSTON	02115
GZ PROPERTIES HEMENWAY LLC	C/O GZ PROPERTIES HEMENWAY LLC	30 PETERBOROUGH ST #34	BOSTON MA	02215	65 HEMENWAY ST Apt 10	BOSTON	02115
FENSGATE ASSOCS LP	C/O MACKIN GROUP INC	7 HARVARD ST	BROOKLINE MA	02445	73 HEMENWAY ST	BOSTON	02115
BOSTON CONSERV OF MUSIC		54 FENWAY	BOSTON MA	02115	54 FENWAY ST	BOSTON	02215
FIFTY TWO FENWAY CONDO TR		52 FENWAY	BOSTON MA	02215	52 FENWAY ST	BOSTON	02215
CONAN AND CONN NOMINEE TRUST	C/O ANTHONY STRAUSS	173 MASSACHUSETTS AVE	BOSTON MA	02115	52 FENWAY ST Apartments	BOSTON	02215
FIFTY THE FENWAY CONDO TR		50 FENWAY	BOSTON MA	02215	50 FENWAY ST	BOSTON	02215
ROSENTHAL LINDA	C/O LINDA ROSENTHAL	50 FENWAY #B	BOSTON MA	02215	50 FENWAY ST Apt B	BOSTON	02215
CUTLER WARREN R		50 FENWAY ST #1	BOSTON MA	02215	50 FENWAY ST Apt 1	BOSTON	02215
CELONA JENNIE M	C/O JENNIE M CELONA	3047 S ATLANTIC AV #1206	DAYTONA BEACH FL	32118	50 FENWAY ST Apt 2	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
CHEN YIWEI	C/O YIWEI CHEN	50 FENWAY ST #3	BOSTON MA	02215	50 FENWAY ST Apt 3	BOSTON	02215
HATCHER RYAN W	C/O RYAN W HATCHER	50 FENWAY ST #4	BOSTON MA	02215	50 FENWAY ST Apt 4	BOSTON	02215
DWYER JOHN TS		48 FENWAY	BOSTON MA	02115	48 FENWAY ST	BOSTON	02215
FORTY 6 THE FENWAY CONDO TR		P O BOX 736	WELLESLEY SQ MA	02182	46 FENWAY ST	BOSTON	02215
PHIFER J SCOTT TS	C/O J SCOTT PHIFER TS	PO BOX 812736	WELLESLEY MA	02482	46 FENWAY Apartments	BOSTON	02215
PHIFER J SCOTT TS	C/O J SCOTT PHIFER TS	PO BOX 812736	WELLESLEY MA	02482	44 FENWAY ST Apartments	BOSTON	02215
42 FENWAY CONDOMINIUM TRUST		42 FENWAY ST	BOSTON MA	02115	42 FENWAY ST	BOSTON	02215
42 FENWAY CONDO LLC	C/O 42 FENWAY CONDO LLC	295 HUNTINGTON AV SUITE 209	BOSTON MA	02115	42 FENWAY ST Apt 1	BOSTON	02215
GZ FENWAY LLC	C/O GZ FENWAY LLC	30 PETERBOROUGH ST #34	BOSTON MA	02215	42 FENWAY ST Apt 2	BOSTON	02215
JAW INVESTMENT PROPERTIES	C/O JAW INVESTMENT PROPERTIES	300 BOYLSTON ST UNIT 518	BOSTON MA	02116	42 FENWAY ST Apt 3	BOSTON	02215
GZ FENWAY LLC	C/O GZ FENWAY LLC	30 PETERBOROUGH ST UNIT 34	BOSTON MA	02215	42 FENWAY ST Apt 4	BOSTON	02215
TULLY DANIEL E	C/O DANIEL E TULLY	18 WOODLAND DRIVE	DUNSTABLE MA	01827	42 FENWAY ST Apt 5	BOSTON	02215
MKES LLC	C/O MKES LLC	61 CARY AVENUE	MILTON MA	02186	42 FENWAY ST Apt 6	BOSTON	02215
GZ FENWAY LLC	C/O GZ FENWAY LLC	PO BOX 231016	BOSTON MA	02123	42 FENWAY Apt PS-1	BOSTON	02215
GZ FENWAY LLC	C/O GZ FENWAY LLC	PO BOX 231016	BOSTON MA	02123	42 FENWAY Apt PS-2	BOSTON	02215
JAW INVESTMENT PROPERTIES	C/O JAW INVESTMENT PROPERTIES	300 BOYLSTON ST #518	BOSTON MA	02116	42 FENWAY Apt PS-3	BOSTON	02215
TULLY DANIEL E	C/O DANIEL E TULLY	18 WOODLAND DRIVE	DUNSTABLE MA	01827	42 FENWAY Apt PS-4	BOSTON	02215
ABBOTT BERNADETTE	C/O BERNADETTE ABBOTT	42 FENWAY ST #6	BOSTON MA	02215	42 FENWAY Apt PS-5	BOSTON	02215
BOSTON CONSERVATORY OF MUSIC		40 FENWAY	BOSTON MA	02115	40 FENWAY ST	BOSTON	02215
QUADRANGLE INVESTMENTS LLC	C/O CORPORATION SERVICE COMPANY	2711 CENTERVILLE RD STE 400	WILMINGTON DE	19808	38 FENWAY ST	BOSTON	02215
BOGOCH SAMUEL		36 FENWAY	BOSTON MA	02215	36 FENWAY ST	BOSTON	02215
X1 CHAPTER SIGMA ALPHA	C/O THE TREASURER	34 THE FENWAY	BOSTON MA	02215	34 FENWAY ST	BOSTON	02215
BOSTON CONSERVATORY		32 FENWAY	BOSTON MA	02115	32 FENWAY ST	BOSTON	02215
THIRTY FENWAY CONDO TR		30 FENWAY	BOSTON MA	02215	30 FENWAY ST	BOSTON	02215
BAKALARS THOMAS		30 FENWAY ST #1	BOSTON MA	02215	30 FENWAY ST Apt 1	BOSTON	02215
MILLS DANA TS	C/O CAROL LASKY	30 FENWAY ST #2	BOSTON MA	02215	30 FENWAY ST Apt 2	BOSTON	02215
LASKY CAROL ETAL		30 FENWAY ST #3	BOSTON MA	02215	30 FENWAY ST Apt 3	BOSTON	02215
KAPLAN RUTH TS		30 FENWAY ST #4-A	BOSTON MA	02215	30 FENWAY ST Apt 4-A	BOSTON	02215
LASKY CAROL ETAL		30 FENWAY ST #4-B	BOSTON MA	02215	30 FENWAY ST Apt 4-B	BOSTON	02215
KAPLAN RUTH TS	C/O THOMAS BAKALARS ARCHITECT	30 FENWAY ST #5	BOSTON MA	02215	30 FENWAY ST Apt 5	BOSTON	02215
MALCOLM COTTON BROWN	C/O ROBERT R MOHR	3317 DARTMOUTH AVE	DALLAS TX	75205	28 FENWAY ST	BOSTON	02215
BOSTON CONSERVATORY		26 FENWAY	BOSTON MA	02115	26 FENWAY ST	BOSTON	02215
BOSTON CONSERVATORY		24 FENWAY	BOSTON MA	02115	24 FENWAY ST	BOSTON	02215
BERKLEE COLLEGE OF MUSIC INC	C/O CHRIS SWEZEY	1140 BOYLSTON ST -MS 168 AX	BOSTON MA	02215	22 FENWAY ST	BOSTON	02215
BOSTON CONSERVATRY MUSIC		8 FENWAY	BOSTON MA	02115	8 FENWAY ST	BOSTON	02215
MUSEUM OF FINE ARTS		465 HUNTINGTON AVE	BOSTON MA	02115	465 HUNTINGTON AV	BOSTON	02115
MUSEUM OF FINE ARTS		230 FENWAY	BOSTON MA	02115	230 FENWAY ST	BOSTON	02115
WENTWORTH INSTITUTE		550 HUNTINGTON AV	BOSTON MA	02115	20 EVANS WY	BOSTON	02115
COMMONWLTH OF MASS BOARD		557 HUNTINGTON AVE	BOSTON MA	02115	557 HUNTINGTON AV	BOSTON	02115
WENTWORTH INSTITUTE		30 EVANS WAY	BOSTON MA	02115	30 EVANS WY	BOSTON	02115
WENTWORTH INSTITUTE		500 HUNTINGTON AV	BOSTON MA	02115	26 EVANS WY	BOSTON	02115
WENTWORTH INSTITUTE		500 HUNTINGTON AV	BOSTON MA	02115	22 EVANS WY	BOSTON	02115
TETLOW REALTY ASSO INC	C/O S GILBERT	11 TETLOW	BOSTON MA	02115	11 TETLOW ST	BOSTON	02115
TETLOW REALTY ASSOC INC	C/O TETLOW REALTY ASSN INC	11 TETLOW	BOSTON MA	02115	14 PALACE RD	BOSTON	02115
ISABELLA GARDNER MUSEUM	ISABELL	280 FENWAY ST	BOSTON MA	02115	280 FENWAY ST	BOSTON	02115
CROWLEY PETER (LESSEE)		114 WOODLAND ROAD	MILTON MA	02186	280 FENWAY	BOSTON	02115
ISABELLA STEWART GARDNER	ISABELLA STEWART GARDNER MUSEUM INC	31 EVANS WAY	BOSTON MA	02115	31 EVANS WY	BOSTON	02115
ISABELLA STEWART GARDNER	ISABELLA STEWART GARDNER MUSEUM INC	31 EVANS WAY	BOSTON MA	02115	31 EVANS WY	BOSTON	02115
ISABELLA STEWART GARDNER	ISABELLA STEDWART GARDNER MUSEUM INC	31 EVANS WAY	BOSTON MA	02115	TETLOW ST	BOSTON	02115
COMMWLTH OF MASS		115 PALACE RD	BOSTON MA	02115	115 PALACE RD	BOSTON	02115
SIMMONS COLLEGE		300 FENWAY ST	BOSTON MA	02115	300 FENWAY ST	BOSTON	02115
EMMANUEL COLLEGE TRUSTEES		274 BROOKLINE AV	BOSTON MA	02215	264 BROOKLINE AV	BOSTON	02115
NEDH CORP		185 PILGRIM RD	BOSTON MA	02215	334 RIVERWAY	BOSTON	02215
BETH ISRAEL DEACONESS	C/O KAREN L P WOOLFSON (TAX)	109 BROOKLINE AV # 300	BOSTON MA	02215	110 FRANCIS ST	BOSTON	02215
CHILDRENS HOSPITAL CORP		300 LONGWOOD AV	BOSTON MA	02115	1 AUTUMN ST	BOSTON	02215
CHILDRENS HOSPITAL CORP		300 LONGWOOD AV	BOSTON MA	02115	25 AUTUMN ST	BOSTON	02215
CHILDRENS HOSPITAL CORP		300 LONGWOOD AV	BOSTON MA	02115	21 AUTUMN ST	BOSTON	02215
CONGREGATION ADATH ISRAEL		405 LONGWOOD AVE	BOSTON MA	02215	477 LONGWOOD AV	BOSTON	02215
WINSOR SCHOOL THE		103 PILGRIM RD	BOSTON MA	02215	103 PILGRIM RD	BOSTON	02215
WHEELOCK COLLEGE		210 RIVERWAY	BOSTON MA	02215	210 RIVERWAY ST	BOSTON	02215
WHEELOCK COLLEGE		206 RIVERWAY	BOSTON MA	02115	206 RIVERWAY ST	BOSTON	02215
WHEELOCK COLLEGE		200 RIVERWAY	BOSTON MA	02215	200 RIVERWAY ST	BOSTON	02215
WHEELOCK COLLEGE		164 RIVERWAY	BOSTON MA	02215	164 RIVERWAY ST	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
ONE HUNDRED RIVERWAY		110 RIVERWAY	BOSTON MA	02115	110 RIVERWAY ST	BOSTON	02215
RIVERA CARLOS G	C/O KEVIN J VERRETTE	110 RIVERWAY #1	BOSTON MA	02115	110 RIVERWAY ST Apt 110-1	BOSTON	02215
NGUYEN VINH HY		110 RIVERWAY #2	BOSTON MA	02215	110 RIVERWAY ST Apt 110-2	BOSTON	02215
RICHARDS ALEC	C/O ALEC RICHARDS	110 RIVERWAY ST #3	BOSTON MA	02215	110 RIVERWAY ST Apt 110-3	BOSTON	02215
ARNER REBECCA L	C/O REBECCA L. ARNER	110 THE RIVERWAY #4	BOSTON MA	02115	110 RIVERWAY ST Apt 110-4	BOSTON	02215
THOMPSON JUDI	C/O JUDI THOMPSON	85485 TREVISO DR	INDIO CA	92203	110 RIVERWAY ST Apt 110-5	BOSTON	02215
MACLEAN FAMILY REVOCABLE	C/O KATE ERIN MACLEAN	110 RIVERWAY ST #6	BOSTON MA	02215	110 RIVERWAY ST Apt 110-6	BOSTON	02215
SIRANKO CHRISTINE	C/O CHRISTINE SIRANKO	110 RIVERWAY ST #110-7	BOSTON MA	02215	110 RIVERWAY ST Apt 110-7	BOSTON	02215
MIRZOEV ISKANDAR	C/O ISKANDAR MIRZOEV	110 RIVERWAY ST #110-8	BOSTON MA	02215	110 RIVERWAY ST Apt 110-8	BOSTON	02215
MCCABE SUSAN	C/O SUSAN MCCABE	100 RIVERWAY #1	BOSTON MA	02215	100 RIVERWAY ST Apt 100-1	BOSTON	02215
LEAO JOAO P		100 RIVERWAY #100-2	BOSTON MA	02215	100 RIVERWAY ST Apt 100-2	BOSTON	02215
100 RIVERWAY IRREVOCABLE	C/O DEEPAK A KUMAR	51 HEMENWAY ST #6	BOSTON MA	02115	100 RIVERWAY ST Apt 100-3	BOSTON	02215
RAHARDJO BUDDY	C/O BUDDY RAHARDJO	34 MEADOW RIDGE	AVON CT	06001	100 RIVERWAY ST Apt 100-4	BOSTON	02215
MELTZER ERIC	C/O ERIC MELTZER	100 REIVERWAY #5	BOSTON MA	02215	100 RIVERWAY ST Apt 100-5	BOSTON	02215
ARMIAN MEHDI ETAL	C/O SALEH ARMAIN	1343 LOCUST ST # 208	WALNUT CREEK CA	94596	100 RIVERWAY ST Apt 100-6	BOSTON	02215
NIEDRINGHAUS VALERIE	C/O VALERIE NIEDRINGHAUS	100 RIVERWAY ST #100-7	BOSTON MA	02215	100 RIVERWAY ST Apt 100-7	BOSTON	02215
BROWN DENNIS	C/O DENNIS BROWN	100 RIVERWAY ST #8	BOSTON MA	02215	100 RIVERWAY ST Apt 100-8	BOSTON	02215
WHEELOCK SCHOOL		31 PILGRIM RD	BOSTON MA	02215	31 PILGRIM RD	BOSTON	02215
WHEELOCK SCHOOL		180 RIVERWAY	BOSTON MA	02215	180 RIVERWAY	BOSTON	02215
METROPOLITAN DIST COMM		4 BOYLSTON	BOSTON MA	02116	4 BOYLSTON ST	BOSTON	02116
CITY OF BOSTON		59 FENWAY	BOSTON MA	02115	59 FENWAY ST	BOSTON	02115
BOYLSTON I HOLDING LLC	C/O FINEBEREG PROPERTY MGT INC	1 WASHINGTON ST SUITE #400	WELLESLEY MA	02481	1171 BOYLSTON ST	BOSTON	02215
BOYLSTON I HOLDING LLC	C/O FINEBEREG PROPERTY MGT INC	1 WASHINGTON ST SUITE #400	WELLESLEY MA	02481	1175 BOYLSTON ST	BOSTON	02215
BOYLSTON II HOLDING LLC	C/O FINEBERG MANAGEMENT INC	1 WASHINGTON ST SUITE #400	WELLESLEY MA	02481	1179 BOYLSTON ST	BOSTON	02215
BOYLSTON II HOLDING LLC	C/O FINEBERG MANAGEMENT INC	1 WASHINGTON ST SUITE #400	WELLESLEY MA	02481	1185 BOYLSTON ST	BOSTON	02215
BOYLSTON II HOLDING LLC	C/O FINEBERG MANAGEMENT INC	1 WASHINGTON ST SUITE #400	WELLESLEY MA	02481	1191 BOYLSTON ST	BOSTON	02215
BOYLSTON STREET LLC		1203 BOYLSTON ST	BOSTON MA	02215	1197 BOYLSTON ST	BOSTON	02215
BOYLSTON STREET LLC		1203 BOYLSTON ST	BOSTON MA	02215	1203 BOYLSTON ST	BOSTON	02215
BOYLSTON STREET LLC		1203 BOYLSTON ST	BOSTON MA	02215	1209 BOYLSTON ST	BOSTON	02215
PATRA FENWAY LLC		200 202 IPSWICH ST	BOSTON MA	02215	200 IPSWICH ST	BOSTON	02215
FENWAY ENTERPRISES	C/O SAMUELS & ASSOCIATES	136 BROOKLINE AVE	BOSTON MA	02215	1249 BOYLSTON ST	BOSTON	02215
PAPOULIDIS KOSTA TRST	C/O K E ANDREWS & COMPANY	1900 DALROCK RD	ROWLETT TX	75088	1250 BOYLSTON ST	BOSTON	02215
LINCOLN HALLS AT PARK DR		11 PARK DR	BOSTON MA	02215	11 PARK DR	BOSTON	02215
CASTLEMAN JAMES A TRSTS		24 ADAMS	QUINCY MA	02169	11 PARK DR Apt 11-B	BOSTON	02215
MARTINEZ-PEZ ADELAIDA	C/O ADELAIDA PAZ MARTINEZ	11 PARK DR #11-1	BOSTON MA	02215	11 PARK DR Apt 11-1	BOSTON	02215
SHARMA RAJ V	C/O RAJ V SHARMA	11 PARK DR #2	BOSTON MA	02215	11 PARK DR Apt 11-2	BOSTON	02215
WESTERHOFF MARILYN D TS	C/O WESTLETTE REALTY	P O BOX 620049	NEWTON LOWER FLS MA	02462	11 PARK DR Apt 11-3	BOSTON	02215
NIEWCZAS MONIKA ANNA	C/O MONIKA NIEWCZAS	11 PARK DR #6	BOSTON MA	02215	11 PARK DR Apt 11-4	BOSTON	02215
TEGELER LISA	C/O LISA TEGELER	137 PETERBOROUGH ST #5	BOSTON MA	02215	11 PARK DR Apt 11-5	BOSTON	02215
NIEWCZAS MONIKA A	C/O MONIKA A NIEWCZAS	11 PARK DRIVE #6	BOSTON MA	02215	11 PARK DR Apt 11-6	BOSTON	02215
WPB PROPERTIES LLC	C/O WPB PROPERTIES LLC	11 MEACHEN RD	SUDBURY MA	01776	11 PARK DR Apt 11-7	BOSTON	02215
WOLF STEVEN J		11 PARK DR #11-8	BOSTON MA	02215	11 PARK DR Apt 11-8	BOSTON	02215
NICKERSON KRISTINA S		11 PARK DR #9	BOSTON MA	02215	11 PARK DR Apt 11-9	BOSTON	02215
EVERETT D STANWOOD JR	C/O D STANWOOD EVERETT JR	11 PARK DR #11-10	BOSTON MA	02215	11 PARK DR Apt 11-10	BOSTON	02215
CASTLEMAN JAMES A TRSTS		24 ADAMS	QUINCY MA	02169	11 PARK DR Apt 11-11	BOSTON	02215
YUAN HAI-TAO		11 PARK DR #11-12	BOSTON MA	02215	11 PARK DR Apt 11-12	BOSTON	02215
NATELLA MICHELLE TS	C/O MICHELLE & NICHOLAS NATELLA	124 MERRIMAC ST #G	NEWBURYPORT MA	01950	11 PARK DR Apt 12-A	BOSTON	02215
DIBARTOLOMEO ANNAMARIA	C/O A DIBARTOLOMEO	11 PARK DR #11-14	BOSTON MA	02215	11 PARK DR Apt 11-14	BOSTON	02215
THOMSON JAMES T	C/O JAMES + ELLEN THOMSON	11 PARK DR	BOSTON MA	02215	11 PARK DR Apt 11-15	BOSTON	02215
WANG WEIGUANG		11 PARK DR #11-16	BOSTON MA	02215	11 PARK DR Apt 11-16	BOSTON	02215
ZHOU JINGYI	C/O JINGYI ZHOU	12 KESWICK ST UNIT 4	BOSTON MA	02215	11 PARK DR Apt 11-17	BOSTON	02215
JIA YANLIN	C/O YANLIN JIA	250 HAMMOND POND PW 1205N	NEWTON MA	02567	11 PARK DR Apt 11-18	BOSTON	02215
11 PARK DRIVE UNIT 19-BOSTON	C/O SUSAN WEBER	11 PARK DR #11-19	BOSTON MA	02215	11 PARK DR Apt 11-19	BOSTON	02215
DRURY SUSAN L	C/O SUSAN LISKA DRURY	11 PARK DRIVE #24	BOSTON MA	02215	11 PARK DR Apt 11-20	BOSTON	02215
CHUNG HOLLY	C/O CHARLESGATE PROPERTY MGMT	867 BOYLSTON ST 3RD FL	BOSTON MA	02116	11 PARK DR Apt 11-21	BOSTON	02215
COX HELEN KEENE		11 PARK DR #11-22	BOSTON MA	02215	11 PARK DR Apt 11-22	BOSTON	02215
DUTOIT PATRICK		11 PARK DR #11-23	BOSTON MA	02215	11 PARK DR Apt 11-23	BOSTON	02215
DRURY SUSAN LISKA	C/O SUSAN LISKA DRURY	11 PARK DRIVE #24	BOSTON MA	02215	11 PARK DR Apt 11-24	BOSTON	02215
CHOI YOO SANG	C/O YOO SANG CHOI	651B CONCORD AV	CAMBRIDGE MA	02138	11 PARK DR Apt 11-25	BOSTON	02215
CHIE LUCY YEN-CHAI	C/O LUCY CHIE	54 LAWTON ST #1	BROOKLINE MA	02446	11 PARK DR Apt 11-26	BOSTON	02215
LUCCIO PAULA A TS	C/O PAULA LUCCIO	11 PARK DR #27	BOSTON MA	02215	11 PARK DR Apt 11-27	BOSTON	02215
BURUCA CIRO	C/O CIRO BURUCA	11 PARK DR #28	BOSTON MA	02215	11 PARK DR Apt 11-28	BOSTON	02215
BO YOUP HWANG TRUST TC	C/O BO YOUP HWANG	25 STILLMEADOW RD	WESTON MA	02193	11 PARK DR Apt 11-29	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
PERRY DAVID H		11 PARK DR #11-30	BOSTON MA	02215	11 PARK DR Apt 11-30	BOSTON	02215
WISE JOHN D	C/O JOHN WISE	11 PARK DR #31	BOSTON MA	02215	11 PARK DR Apt 11-31	BOSTON	02215
DIANE C SKINNER TRUST	DIANE C SKINNER	1616 VINCENNES DR	SUN CITY CTR FL	33573	11 PARK DR Apt 11-32	BOSTON	02215
CURTIS ROBERT E JR		11 PARK DR #11-33	BOSTON MA	02215	11 PARK DR Apt 11-33	BOSTON	02215
BRILL LICA	C/O LICA BRILL TRUSTEE	193 OAK ST # 608E	NEWTON MA	02464	11 PARK DR Apt 11-34	BOSTON	02215
OREH LLC	C/O ORLYN J REESE	8 PLEASANT ST	DOVER MA	02030	11 PARK DR Apt 11-35	BOSTON	02215
WALDMAN JESSE	C/O JESSE WALDMAN	15 PARK DR #1	BOSTON MA	02215	15 PARK DR Apt 15-1	BOSTON	02215
SIMKINS BRUCE TS		11 GREY COACH RD	READING MA	01867	15 PARK DR Apt 15-2	BOSTON	02215
THORNTON MARTIN P		15 PARK DR #15-3	BOSTON MA	02215	15 PARK DR Apt 15-3	BOSTON	02215
LIMA KENNETH	C/O KENNETH LIMA	2 CLARENDAN ST #705	BOSTON MA	02116	15 PARK DR Apt 15-4	BOSTON	02215
BALOGLU ERKAN	C/O ERKAN BALOGLU	15 PARK DR # 15-5	BOSTON MA	02215	15 PARK DR Apt 15-5	BOSTON	02215
CORREA JOHN CARLOS		15 PARK DR #15-6	BOSTON MA	02215	15 PARK DR Apt 15-6	BOSTON	02215
CAMPA SIMON		15 PARK DR # 7	BOSTON MA	02215	15 PARK DR Apt 15-7	BOSTON	02215
MOBILIA KRISTEN	C/O KRISTEN MOBILIA	15 PARK DR #8	BOSTON MA	02115	15 PARK DR Apt 15-8	BOSTON	02215
XU HUI	C/O HUI XU	15 PARK DR #15-9	BOSTON MA	02215	15 PARK DR Apt 15-9	BOSTON	02215
ROPPOLO ROBERT		15 PARK DR #10	BOSTON MA	02215	15 PARK DR Apt 15-10	BOSTON	02215
GOMEZ ROSEMARIE		376 COMMERCIAL ST #2-D	BOSTON MA	02109	15 PARK DR Apt 15-11	BOSTON	02215
CASTLEMAN JAMES A TRSTS		24 ADAMS	QUINCY MA	02169	15 PARK DR Apt 15-12	BOSTON	02215
GATIM LLC	C/O GATIM LLC	15 WINN RD	NASHUA NH	03062	15 PARK DR Apt 15-12A	BOSTON	02215
SUN YI	C/O YI SUN	205 WELD ST	WEST ROXBURY MA	02132	15 PARK DR Apt 15-14	BOSTON	02215
JRNS LLC	C/O JOHN F. ROSSI	15 PARK DRIVE #15	BOSTON MA	02215	15 PARK DR Apt 15-15	BOSTON	02215
LIN ZHIKE	C/O ZHIKE LIN	15 PARK DR #15-16	BOSTON MA	02215	15 PARK DR Apt 15-16	BOSTON	02215
ROSQUETE ELIZABETH	C/O ELIZABETH ROSQUETE	15 PARK DR #15-17	BOSTON MA	02215	15 PARK DR Apt 15-17	BOSTON	02215
APONTA CESAR A		15 PARK DR #18	BOSTON MA	02115	15 PARK DR Apt 15-18	BOSTON	02215
LIMA KENNETH J	C/O KENNETH J LIMA	2 CLARENDON ST #705	BOSTON MA	02116	15 PARK DR Apt 15-19	BOSTON	02215
POPE BARBARA		15 PARK DR #15-20	BOSTON MA	02215	15 PARK DR Apt 15-20	BOSTON	02215
FIFTEEN PARK REALTY TRUST	C/O AMERIGO ZAMARRO III	21 INSTITUTE RD	WORCESTER MA	01609	15 PARK DR Apt 15-21	BOSTON	02215
BANNERMAN DOUGLAS	C/O DOUGLAS BANNERMAN	15 PARK DR #22	BOSTON MA	02215	15 PARK DR Apt 15-22	BOSTON	02215
NICKLA DEBORA L		15 PARK DR #15-23	BOSTON MA	02215	15 PARK DR Apt 15-23	BOSTON	02215
FERRARA CHARLES JR		15 PARK DR #15-24	BOSTON MA	02215	15 PARK DR Apt 15-24	BOSTON	02215
LORANGER THEODORE G	C/O THEODORE LORANGER	15 PARK DR #15-25	BOSTON MA	02215	15 PARK DR Apt 15-25	BOSTON	02215
TAMILIO-AWED KATHLEEN	C/O KATHLEEM TAMILIO-AWED	15 MASSACHUSETTS AV	WORCESTER MA	01609	15 PARK DR Apt 15-26	BOSTON	02215
HARTNETT KELLY A		15 PARK DR #27	BOSTON MA	02215	15 PARK DR Apt 15-27	BOSTON	02215
FAUCHET RENE	C/O RENE FAUCHET	610 ST NICHOLAS AV #4A	NEW YORK NY	10030	15 PARK DR Apt 15-28	BOSTON	02215
VIERA JAMES	C/O JAMES VIERA	15 PARK DR #15-29	BOSTON MA	02215	15 PARK DR Apt 15-29	BOSTON	02215
MULLANY TERENCE G	C/O TERRANCE G MULLANY	122 BUCKSKIN DR	WESTON MA	02493	15 PARK DR Apt 15-30	BOSTON	02215
YUAN XIN	C/O XIN YUAN	15 PARK DR #15-31	BOSTON MA	02215	15 PARK DR Apt 15-31	BOSTON	02215
BOSTON TOWNHOUSE LLC	C/O BOSTON TOWNHOUSE LLC	81 PARK DR #1	BOSTON MA	02215	15 PARK DR Apt 15-32	BOSTON	02215
TAMILIO-AWED KATHLEEN	C/O KATHLEEN TAMILIO-AWED	15 MASSACHUSETTS AV	WORCESTER MA	01608	15 PARK DR Apt 15-33	BOSTON	02215
TAMILIO-AWED KATHLEEN	C/O KATHLEEN TAMILIO-AWED	15 MASSACHUSETTS AV	WORCESTER MA	01609	15 PARK DR Apt 15-34	BOSTON	02215
DEON JANE	C/O JANE DEON	15 PARK DRIVE #35	BOSTON MA	02215	15 PARK DR Apt 15-35	BOSTON	02215
WAIT STREET ASSOCIATES	C/O L B ZIDE -BRAZILIAN LLP	1 EXETER PZ	BOSTON MA	02116	1 PETERBOROUGH ST	BOSTON	02215
SOLOMON REALTY TRUST	C/O BOBSON REALTY	4 COPLEY PL #110	BOSTON MA	02116	11 PETERBOROUGH ST	BOSTON	02215
MOSKOW MICHAEL B TS	C/O MICHAEL B MOSKOW	2 PARK SQ STE 407	BOSTON MA	02116	31 PARK DR	BOSTON	02215
LEVENSON NORMAN A TS		896 BEACON ST	BOSTON MA	02215	35 PARK DR	BOSTON	02215
ROBERT TREAT PAINE HOUSE		41 PARK DRIVE	BOSTON MA	02215	41 PARK DR	BOSTON	02215
RJ LEYDEN LLC	C/O LLOYD ROSENTHAL	41 PARK DR #B	BOSTON MA	02215	41 PARK DR Apt B	BOSTON	02215
JOHNSON CHRISTOPHER S	C/O CHRISTOPHER S JOHNSON	41 PARK DR #1A	BOSTON MA	02215	41 PARK DR Apt 1-A	BOSTON	02215
DECIMA TERRY O		41 PARK DRIVE #1B	BOSTON MA	02215	41 PARK DR Apt 1-B	BOSTON	02215
LOWENTHAL LINDA C		41 PARK DR #2A	BOSTON MA	02215	41 PARK DR Apt 2-A	BOSTON	02215
DIAMOND DAVID B		30 BRUCE LA	NEWTON MA	02458	41 PARK DR Apt 2-B	BOSTON	02215
PLATT LAUREN DEWEY		41 PARK DR #3A	BOSTON MA	02215	41 PARK DR Apt 3-A/B	BOSTON	02215
MESGAR AMIR S	C/O AMIR S MESGAR	41 PARK DR #PH	BOSTON MA	02215	41 PARK DR Apt PH	BOSTON	02215
MOPPETT ALISON C	C/O ALLISON C MOPPETT	41 PARK DR UNIT #TH	BOSTON MA	02215	41 PARK DR Apt TH	BOSTON	02215
FIFTY 1 PARK DRIVE CONDO		51 PARK DR	BOSTON MA	02215	51 PARK DR	BOSTON	02215
KEELEY DANIEL J	C/O DANIEL J KEELEY	7 WERNER PK	ROCHESTER NY	14620	51 PARK DR Apt B-1	BOSTON	02215
SHARMA BIMLA		754 OLD CONNECTICUT PATH	FRAMINGHAM MA	01701	51 PARK DR Apt 1	BOSTON	02215
DENNY DAVID E	C/O DAVID E DENNY	51 PARK DR #2	BOSTON MA	02215	51 PARK DR Apt 2	BOSTON	02215
FIRST COMMERCIAL REALTY LLC	C/O ALPHA MANAGEMENT CORP	1249 BEACON ST STE 1	BROOKLINE MA	02446	51 PARK DR Apt 3	BOSTON	02215
KLINE JEFFREY H		51 PARK DR #4	BOSTON MA	02215	51 PARK DR Apt 4	BOSTON	02215
LEE DANIEL S	C/O DANIEL S LEE	21 HAMMOND POND PW	CHESTNUT HILL MA	02467	51 PARK DR Apt 5	BOSTON	02215
CHAN ELSIE		59 WELLESLEY RD EXT	NATICK MA	01760	51 PARK DR Apt 6	BOSTON	02215
ARGINSKY RICHARD		66 WESTWOOD AV	ELLENVILLE NY	12428	51 PARK DR Apt 7	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
KRIGSMAN CRAIG L		51 PARK DR #8	BOSTON MA	02215	51 PARK DR Apt 8	BOSTON	02215
ST LAURENT ROBERT A	C/O ROBERT A ST LAURENT	51 PARK DR #9	BOSTON MA	02215	51 PARK DR Apt 9	BOSTON	02215
SALTZBERG DANIEL	C/O DANIEL SALTZBERG	1437 INNES AV	SAN FRANCISCO CA	94124	51 PARK DR Apt 10	BOSTON	02215
CHEN PAN	C/O PAN CHEN	89 SOUTH WALPOLE ST	SHARON MA	02067	51 PARK DR Apt 11	BOSTON	02215
KANODIA AMIT TS	C/O AMIT KANODIA	90 BROWNE ST #1	BROOKLINE MA	02446	51 PARK DR Apt 12	BOSTON	02215
CAO JUNWEI	C/O YU HAN	61 PARK DR #12A	BOSTON MA	02215	51 PARK DR Apt 12-A	BOSTON	02215
ZHANG ZHANG	C/O ZHANG ZHANG	51 PARK DR #14	BOSTON MA	02215	51 PARK DR Apt 14	BOSTON	02215
ZAK P SCOTT		51 PARK DR #15	BOSTON MA	02215	51 PARK DR Apt 15	BOSTON	02215
WEISS STANFORD L BE	C/O STANFORD L WEISS	2744 GLEN ARBOR DR	COLORADO SPRINGS CO	80920	51 PARK DR Apt 16	BOSTON	02215
JAM PARKSIDE LLC	C/O JAM PARKSIDE LLC	9 SNYDER ROAD	MEDFIELD MA	02052	51 PARK DR Apt 17	BOSTON	02215
JAW INVESTMENT PROPERTIES	C/O JAW INVESTMENT PROPERTIES LLC	300 BOYLSTON ST #518	BOSTON MA	02116	51 PARK DR Apt 18	BOSTON	02215
RICE DIANA M		51 PARK DR #19	BOSTON MA	02215	51 PARK DR Apt 19	BOSTON	02215
ANGEL LUIS GUILLERMO		51 PARK DR #20	BOSTON MA	02215	51 PARK DR Apt 20	BOSTON	02215
SCOTT BRUCE A		51 PARK DR #21	BOSTON MA	02215	51 PARK DR Apt 21	BOSTON	02215
GOH JIN XUN	C/O JIN XUN GOH	550 BROADWAY #209	SEATTLE WA	98122	51 PARK DR Apt 22	BOSTON	02215
DUNCAN GARY W		51 PARK DR #23	BOSTON MA	02215	51 PARK DR Apt 23	BOSTON	02215
SCHROMM JOHN W		51 PARK DR #24	BOSTON MA	02215	51 PARK DR Apt 24	BOSTON	02215
MATSOU NOBUKO TS	C/O PHILIP COOTEY	22 PHILLIPS DR	NEWBURYPORT MA	01950	51 PARK DR Apt 25	BOSTON	02215
MCKNIGHT ANDREA BENNETT	C/O ANDREA BENNETT MCKNIGHT	51 PARK DR #26	BOSTON MA	02215	51 PARK DR Apt 26	BOSTON	02215
JONES PAUL		51 PARK DR #27	BOSTON MA	02215	51 PARK DR Apt 27	BOSTON	02215
WOLF KAREN	C/O KAREN WOLFF	51 PARK DR #28	BOSTON MA	02215	51 PARK DR Apt 28	BOSTON	02215
PHILLIPS YVONNE M	C/O YVONNE M PHILLIPS	51 PARK DR	BOSTON MA	02215	51 PARK DR Apt 29	BOSTON	02215
CHUN CHRISTIAN W	C/O CHRISTIAN W CHUN	51 PARK DR #30	BOSTON MA	02215	51 PARK DR Apt 30	BOSTON	02215
MORAL-LINK LLC	C/O MORAL-LINK LLC	PO BOX 310	JERICHO NY	11753	51 PARK DR Apt 31	BOSTON	02215
MAYER LAUREN E	C/O LAUREN E MAYER	51 PARK DR # 32	BOSTON MA	02215	51 PARK DR Apt 32	BOSTON	02215
CHEN SZU-HUA	C/O SZU-HUA CHEN	51 PARK DR #33	BOSTON MA	02215	51 PARK DR Apt 33	BOSTON	02215
WHELAN TARA	C/O THOMAS COVENEY	34 MIDDLE ST	HINGHAM MA	02043	51 PARK DR Apt 34	BOSTON	02215
WITHAM MARGARET E	C/O MARGARET WITHAM	51 PARK DR #35	BOSTON MA	02215	51 PARK DR Apt 35	BOSTON	02215
PATT JANE P NESTEL	C/O JANE P NESTEL-PATT	51 PARK DR #B-2	BOSTON MA	02215	51 PARK DR Apt B-2	BOSTON	02215
NADER ANTHONY M		895 HUNTINGTON AV #1	BOSTON MA	02115	55 PARK DR	BOSTON	02215
FENS DRIVE CONDO TR		61 PARK DRIVE	BOSTON MA	02215	61 PARK DR	BOSTON	02215
BLAIR SCOTT	C/O SCOTT BLAIR	42 CHARLES ST	HINGHAM MA	02043	61 PARK DR Apt 21	BOSTON	02215
TOPKINS ELLIOT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 22	BOSTON	02215
TOPKINS ELLIOTT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 23	BOSTON	02215
VOOS RICHARD		61 PARK DR #1	BOSTON MA	02215	61 PARK DR Apt 1	BOSTON	02215
TOPKINS ELLIOT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 2	BOSTON	02215
BARRY MARK W TS		61 PARK DR #3	BOSTON MA	02215	61 PARK DR Apt 3	BOSTON	02215
TOPKINS ELLIOTT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 4	BOSTON	02215
ROSENFELD FAMILY REVOCABLE	C/O KETTY MUNAF ROSENFELD	676 DEDHAM ST	NEWTON MA	02459	61 PARK DR Apt 5	BOSTON	02215
TOPKINS ELLIOTT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 6	BOSTON	02215
THAN VINNIE B	C/O VINNIE B THAN	54 ANTHONY CIRCLE	NEWTON MA	02460	61 PARK DR Apt 7	BOSTON	02215
GRAPPO MICHAEL J	C/O MICHAEL J GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 8	BOSTON	02215
GRAPPO MICHAEL J	C/O M J GRAPPO & ASSOC INC	18 HILLCROFT RD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 9	BOSTON	02215
FIGGINS AND FIGGINS LLC	C/O FIGGINS AND FIGGINS	72 WEDGEMERE AVENUE	WINCHESTER MA	01890	61 PARK DR Apt 10	BOSTON	02215
PATCH TERESA M	C/O TERESA M PATCH	PO BOX 397	NORTH TROY VT	05859	61 PARK DR Apt 11	BOSTON	02215
MCGONAGLE HEATHER		PO BOX 12977	WILMINGTON NC	28405	61 PARK DR Apt 12	BOSTON	02215
GRAPPO MICHAEL J	C/O MICHAEL J GRAPPO	18 HILLCROFT RD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 14	BOSTON	02215
LEROY ANDREE M	C/O ANDREE M LEROY	61 PARK DR #15	BOSTON MA	02215	61 PARK DR Apt 15	BOSTON	02215
SINOWAY ADAM	C/O ADAM SINOWAY	72 WEDGEMERE AVENUE	WINCHESTER MA	01890	61 PARK DR Apt 16	BOSTON	02215
TOPKINS ELLIOTT S TS	C/O MICHAEL GRAPPO	18 HILLCROFT ROAD	JAMAICA PLAIN MA	02130	61 PARK DR Apt 17	BOSTON	02215
XIA ZONGQI	C/O ZONGQI XIA	61 PARK DR #18	BOSTON MA	02215	61 PARK DR Apt 18	BOSTON	02215
CABODI MARIO	C/O MARIO CABODI	61 PARK DR #19	BOSTON MA	02215	61 PARK DR Apt 19	BOSTON	02215
GRAPPO MICHAEL	C/O MICHAEL GRAPPO	896 BEACON ST	BOSTON MA	02115	61 PARK DR Apt 20	BOSTON	02215
VOOS RICHARD		61 PARK DR #1	BOSTON MA	02215	61 PARK DR Apt PS-A	BOSTON	02215
BARRY MARK W TS		61 PARK DR #3	BOSTON MA	02215	61 PARK DR Apt B	BOSTON	02215
GRAPPO MICHAEL	C/O MICHAEL GRAPPO	896 BEACON ST	BOSTON MA	02115	61 PARK DR Apt C	BOSTON	02215
BLAIR SCOTT	C/O SCOTT BLAIR	42 CHARLES ST	HINGHAM MA	02043	61 PARK DR Apt D	BOSTON	02215
EOVINE STEVE	C/O STEVE P EOVINE	65 PARK DR #65-19	BOSTON MA	02215	61 PARK DR Apt E	BOSTON	02215
FIGGINS AND FIGGINS LLC	C/O FIGGINS AND FIGGINS LLC	72 WEDGEMERE AV	WINCHESTER MA	01890	61 PARK DR Apt F	BOSTON	02215
XIA ZONGQI	C/O ZONGQI XIA	61 PARK DR #18	BOSTON MA	02215	61 PARK DR Apt PS-G	BOSTON	02215
PARK DRIVE CONDOMINIUM TR		63 PARK DR	BOSTON MA	02215	63 PARK DR	BOSTON	02215
WOOD DAVID	C/O DAVID WOOD	63 PARK DR #63-1	BOSTON MA	02215	63 PARK DR Apt 63-1	BOSTON	02215
BOYD TODD CHRISTOPHER	C/O TODD CHRISTOPHER BOYD	65 PARK DR #65-1	BOSTON MA	02215	65 PARK DR Apt 65-1	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
CRANE ALLEN PHILLIP		65 PARK DR #65-2	BOSTON MA	02215	65 PARK DR Apt 65-2	BOSTON	02215
RIGOFF GLENN	C/O ATLANTIC PROPERTIES	398 COLUMBUS AVE PMB 385	BOSTON MA	02116	65 PARK DR Apt 65-3	BOSTON	02215
YU TONY TS	C/O TONY YU	43 RIVERSIDE AV	MEDFORD MA	02155	65 PARK DR Apt 65-4	BOSTON	02215
ABGHARI HALEH	C/O HALEH ABGHARI	65 PARK DR #5	BOSTON MA	02215	65 PARK DR Apt 65-5	BOSTON	02215
PAQUETTE PAUL	C/O PAUL PAQUETTE	30 ARIES LANE	NOVATO CA	94947	65 PARK DR Apt 65-6	BOSTON	02215
KWONG MAK CHAI		65 PARK DR # 7	BOSTON MA	02215	65 PARK DR Apt 65-7	BOSTON	02215
VON EHREN SAMUEL	C/O SAMUEL VON EHREN	65 PARK DR #65-8	BOSTON MA	02215	65 PARK DR Apt 65-8	BOSTON	02215
BROWN ANASTASIA M TS		65 PARK DR #65-9	BOSTON MA	02215	65 PARK DR Apt 65-9	BOSTON	02215
RIGOFF GLENN	C/O ATLANTIC PROPERTIES	398 COLUMBUS AVE PMB 385	BOSTON MA	02116	65 PARK DR Apt 65-10	BOSTON	02215
DUTIL DANA R		65 PARK DR #11	BOSTON MA	02215	65 PARK DR Apt 65-11	BOSTON	02215
MIRANDA DIONISIO R		65 PARK DR #12	BOSTON MA	02215	65 PARK DR Apt 65-12	BOSTON	02215
MIRANDA DIONISIO R		65 PARK DR #12	BOSTON MA	02215	65 PARK DR Apt 65-14	BOSTON	02215
BASHIAN CHRISTOPHER		65 PARK DR #65-15	BOSTON MA	02215	65 PARK DR Apt 65-15	BOSTON	02215
CLAPHAM LLC	C/O LINDA HUMPHRIES	195 COURT RD	WINTHROP MA	02152	65 PARK DR Apt 65-16	BOSTON	02215
GENERAL REAL PROPERTIES LLC	C/O NICK GENERALOVICH	1200 PORT LANE	SARASOTA FL	34242	65 PARK DR Apt 65-17	BOSTON	02215
YUNG DERICK W	C/O DERICK WAI YUNG	9 WENHAM ST #3	JAMAICA PLAIN MA	02130	65 PARK DR Apt 65-18	BOSTON	02215
EOVINE STEVE P	C/O STEVE P EOVINE	65 PARK DR #65-19	BOSTON MA	02215	65 PARK DR Apt 65-19	BOSTON	02215
HEWITT JAMES R	C/O JAMES R HEWITT	17 EVERGREEN RD	NORFOLK MA	02056	65 PARK DR Apt 65-20	BOSTON	02215
CHASE STEPHEN		65 PARK DR #65-21	BOSTON MA	02215	65 PARK DR Apt 65-21	BOSTON	02215
SABACKIC BEGZADA		1 ARNOLD TE	SAUGUS MA	01906	65 PARK DR Apt 65-22	BOSTON	02215
BELOVICH JOSEPH	C/O JOSEPH BELOVICH	65 PARK DR # 23	BOSTON MA	02215	65 PARK DR Apt 65-23	BOSTON	02215
FARRELL CAMILLA B	C/O CAMILLA B FARRELL	65 PARK DR #65-24	BOSTON MA	02215	65 PARK DR Apt 65-24	BOSTON	02215
TITTL STEVEN P		65 PARK DR #65-25	BOSTON MA	02215	65 PARK DR Apt 65-25	BOSTON	02215
ZANG LAN	C/O LAN ZANG	37 MAPLE AV	WOBURN MA	01801	67 PARK DR Apt 67-1	BOSTON	02215
WOO KEVIN	C/O KEVIN WOO	246 CYPRESS ST #1	BROOKLINE MA	02445	67 PARK DR Apt 67-2	BOSTON	02215
ROETZEL MARY K	C/O MARY K ROEZEL	69 PARK DR #1	BOSTON MA	02215	69 PARK DR Apt 69-1	BOSTON	02215
LESKOSKI S DARREN	C/O S DARREN LESKOSKI	69 PARK DRIVE #2	BOSTON MA	02215	69 PARK DR Apt 69-2	BOSTON	02215
HAJJAR CHARLES C	C/O HAJJAR MGMT CO INC	30 ADAMS ST	MILTON MA	02186	69 PARK DR Apt 69-3	BOSTON	02215
RIGOFF GLENN	C/O ATLANTIC PROPERTIES	398 COLUMBUS AVE PMB 385	BOSTON MA	02116	69 PARK DR Apt 69-4	BOSTON	02215
JAMES RONALD J	C/O TERESA PATCH	PO BOX 397	NORTH TROY VT	05859	69 PARK DR Apt 69-5	BOSTON	02215
YANG MEIHENG	C/O MEIHENG YANG	11 TURNING MILL RD	SHARON MA	02067	69 PARK DR Apt 69-6	BOSTON	02215
LIMA KENNETH J	C/O KENNETH J LIMA	2 CLARENDON ST #705	BOSTON MA	02116	69 PARK DR Apt 69-7	BOSTON	02215
HIGH STREET PROPERTY	C/O HIGH STREET INVESTMENTS LL	158 CHARLES MCCOMBS BLVD	NEW BEDFORD MA	02745	69 PARK DR Apt 69-8	BOSTON	02215
TAM GEORGIANA		2 FAWN CI	RANDOLPH MA	02368	69 PARK DR Apt 69-9	BOSTON	02215
RIGOFF GLENN	C/O ATLANTIC PROPERTIES	398 COLUMBUS AVE PMB 385	BOSTON MA	02116	69 PARK DR Apt 69-10	BOSTON	02215
SLOTNICK IRMA C ETAL		1255 NORTH AVE APT 2C	NEW ROCHELLE NY	10804	69 PARK DR Apt 69-11	BOSTON	02215
CHAPRUT RIFAT		69 PARK DR #12	BOSTON MA	02215	69 PARK DR Apt 69-12	BOSTON	02215
BRADFORD JANE	C/O JANE BRADFORD	69 PARK DR #14	BOSTON MA	02215	69 PARK DR Apt 69-14	BOSTON	02215
CRM REALTY LLC	C/O CRM REALTY LLC	10 REDSTONE LA	MARBLEHEAD MA	01945	69 PARK DR Apt 69-15	BOSTON	02215
FARRETTA PETER		189 HUNTING ROAD	NEEDHAM MA	02494	69 PARK DR Apt 69-16	BOSTON	02215
PUSLYS RAY	C/O RAYMOND PUSLYS	181 COAKS LANE	GUILFORD CT	06437	69 PARK DR Apt 69-17	BOSTON	02215
THORNTON MARTIN		69 PARK DR #69-18	BOSTON MA	02215	69 PARK DR Apt 69-18	BOSTON	02215
LITVIN TAMARA	C/O STAN PASHKOVSKI	69 PARK DR # 19	BOSTON MA	02215	69 PARK DR Apt 69-19	BOSTON	02215
LIANG NAN	C/O NAN LIANG	69 PARK DR #20	BOSTON MA	02215	69 PARK DR Apt 69-20	BOSTON	02215
ZENG JIANXIA	C/O JIANXIA ZENG	1 SQUIRREL HILL RD	ACTON MA	01720	69 PARK DR Apt 69-21	BOSTON	02215
CIANO-RIVERA ANTOINETTE		69 PARK DR #22	BOSTON MA	02215	69 PARK DR Apt 69-22	BOSTON	02215
CLAPHAM LLC A MASS	C/O LINDA HUMPHRIES	195 COURT RD	WINTHROP MA	02152	69 PARK DR Apt 69-23	BOSTON	02215
SLOTNICK IRMA C ETAL		1255 NORTH AVE APT 2C	NEW ROCHELLE MA	10804	69 PARK DR Apt 69-24	BOSTON	02215
SEVENTY-3 PARK LLC	BLACKSTONE WILLIAMS PROPERTI	302 NEWBURY STREET	BOSTON MA	02115	73 PARK DR	BOSTON	02215
SEVENTY-7 PARK DRIVE LLC	C/O SIDNEY HANDLER	95 PEREGRINE DR	NEWTON MA	02459	77 PARK DR	BOSTON	02215
EIGHTY ONE PARK DR LLC		248 NEWBURY ST	BOSTON MA	02116	81 PARK DR	BOSTON	02215
FENVIEW CONDO TRUST		121 CAPTAINS ROW	CHELSEA MA	02150	85 PARK DR	BOSTON	02215
FENVIEW DEVELOPMENT LLC	C/O LUNDGREN MANAGEMENT	121 CAPTAIN'S ROW	CHELSEA MA	02150	85 PARK DR Apartments	BOSTON	02215
ZIPIN STEVEN		85 PARK DR #6	BOSTON MA	02215	85 PARK DR Apt 6	BOSTON	02215
KATZ JORDAN		85 PARK DR #7	BOSTON MA	02215	85 PARK DR Apt 7	BOSTON	02215
KOCON LORI B		85 PARK DR #9	BOSTON MA	02215	85 PARK DR Apt 9	BOSTON	02215
TWOMEY DANIEL P III	DANIEL TWOMEY & K VAN ORDEN	85 PARK DR #12	BOSTON MA	02215	85 PARK DR Apt 12	BOSTON	02215
DENG YANHUI	C/O YANHUI DENG	85 PARK DR #14	BOSTON MA	02215	85 PARK DR Apt 14	BOSTON	02215
THORNTON MARTIN P		85 PARK DR #15	BOSTON MA	02215	85 PARK DR Apt 15	BOSTON	02215
RAMOS-POLANCO ELBA		3554 ESTEPONA AVE	DORAL FL	33178	85 PARK DR Apt 18	BOSTON	02215
MANGALO GEORGE A		85 PARK DR #19	BOSTON MA	02215	85 PARK DR Apt 19	BOSTON	02215
OREH LLC	C/O ORLYN J REESE	8 PLEASANT ST	DOVER MA	02030	85 PARK DR Apt 25	BOSTON	02215
FENVIEW DEVELOPMENT LLC	C/O FENVIEW DEVELOPMENT LLC	121 CAPTAIN'S ROW	CHELSEA MA	02150	85 PARK DR Apt D	BOSTON	02215

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
HEMENWAY PARK DRIVE LLC	C/O HEMENWAY PARK DR LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	89 PARK DR	BOSTON	02215
HEMENWAY PARK DRIVE LLC	C/O HEMENWAY PARK DR LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	95 PARK DR	BOSTON	02215
COMMUNITY RESOURCES	C/O COMMUNITY RESOURCES FOR JUSTICE INC	500 HARRISON AVE	BOSTON MA	02118	107 PARK DR	BOSTON	02215
GUARINI ROSALYN E TRST	C/O COPLEY MANAGEMENT	896 BEACON ST	BOSTON MA	02215	111 PARK DR	BOSTON	02215
LEVENSON NORMAN A MTGEE	C/O COPLEY MGNTMENT	896 BEACON ST	BOSTON MA	02215	117 PARK DR	BOSTON	02215
HEMENWAY PARK DRIVE LLC	C/O HEMENWAY PARK DR LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	121 PARK DR	BOSTON	02215
FENWAY BY THE PARK CONDO TR		125 PARK DR	BOSTON MA	02215	125 PARK DR	BOSTON	02215
MANN KEVIN M	C/O KEVIN MANN	125 PARK DR #125B1	BOSTON MA	02215	125 PARK DR Apt 125B1	BOSTON	02215
MILONE PAUL ETAL	PAUL MILONE	4 WINSLOW SQ LANE	MARBLEHEAD MA	01945	125 PARK DR Apt 125-1	BOSTON	02215
BLETZER CURT F		300 MARKET ST	BRIGHTON MA	02135	125 PARK DR Apt 125-2	BOSTON	02215
TECSON NORBERTO	C/O NORBETO TECSON	125 PARK DR #3	BOSTON MA	02215	125 PARK DR Apt 125-3	BOSTON	02215
VAJAPEYAM SRIDHAR	C/O SRIDHAR VAJAPEYAM	125 PARK DR #125-4	BOSTON MA	02215	125 PARK DR Apt 125-4	BOSTON	02215
PATCH THERESA M	C/O THERESA PATCH	PO BOX 397	NORTH TROY VT	05859	125 PARK DR Apt 125-5	BOSTON	02215
POLANSKI MARYANNE		12 LATTIMER ST	MARBLEHEAD MA	01945	125 PARK DR Apt 125-6	BOSTON	02215
SCHIRMACHER ERNESTO		3 PLOWSHARE CT	MANSFIELD MA	02048	125 PARK DR Apt 125-7	BOSTON	02215
GRACE ALEXANDER	C/O ALEXANDER GRACE	125 PARK DR #8	BOSTON MA	02215	125 PARK DR Apt 125-8	BOSTON	02215
SMITH CRAIG D		125 PARK DR #125-9	BOSTON MA	02215	125 PARK DR Apt 125-9	BOSTON	02215
SEISLER BENJAMIN		125 PARK DR #125-10	BOSTON MA	02215	125 PARK DR Apt 125-10	BOSTON	02215
LEE DANIEL S	C/O DANIEL S LEE	21 HAMMOND POND PW #3	CHESTNUT HILL MA	02467	125 PARK DR Apt 125-11	BOSTON	02215
DONOVAN JOHN J		125 PARK DR #125-12	BOSTON MA	02215	125 PARK DR Apt 125-12	BOSTON	02215
BRESLER ALEXANDER	C/O ALEXANDER BRESLER	120 POND ST	OSTERVILLE MA	02655	125 PARK DR Apt 125-12A	BOSTON	02215
BARBIERI RICCARDO		125 PARK DR #125-14	BOSTON MA	02215	125 PARK DR Apt 125-14	BOSTON	02215
OZER ROSS J		5 COPLEY ST	NEWTON MA	02458	125 PARK DR Apt 125-15	BOSTON	02215
OZER ROSS J		125 PARK DR #125-16	BOSTON MA	02215	125 PARK DR Apt 125-16	BOSTON	02215
CHAUDHARY VIKRAMJIT	C/O VIKRAMJIT CHAUDHARY	1087 MAY ST	NAUGATUCK CT	06770	125 PARK DR Apt 125-17	BOSTON	02215
HAN HSIU-LIEN	C/O KENNY TANG	125 PARK DR #125-18	BOSTON MA	02215	125 PARK DR Apt 125-18	BOSTON	02215
YANG JIANZHUANG	C/O JIANZHUANG YANG	24 SAINT PAUL ST #5	BROOKLINE MA	02446	125 PARK DR Apt 125-19	BOSTON	02215
ELLISON KRISTINA J		125 PARK DR #20	BOSTON MA	02215	125 PARK DR Apt 125-20	BOSTON	02215
LOBKOV YEVGENY Y	C/O YEVGENY LOBKOV	125 PARK DR #125-21	BOSTON MA	02215	125 PARK DR Apt 125-21	BOSTON	02215
CURRY MICHAEL T		125 PARK DR #22	BOSTON MA	02122	125 PARK DR Apt 125-22	BOSTON	02215
BRESLER ALEXANDER TS	C/O ALEXANDER BRESLER	120 POND ST	OSTERVILLE MA	02655	125 PARK DR Apt 125-23	BOSTON	02215
THRYSELIUS BONNIE		125 PARK DR #125-24	BOSTON MA	02215	125 PARK DR Apt 125-24	BOSTON	02215
SIMON LISA		125 PARK DR #125-25	BOSTON MA	02215	125 PARK DR Apt 125-25	BOSTON	02215
SMITH MURRAY	C/O MURRAY SMITH	2522 ROUND POINTE DR	HAVERSTRAW NY	10927	125 PARK DR Apt 125-26	BOSTON	02215
DROUJININE ILIA	C/O ILIA DROUJININE	125 PARK DRIVE #27	BOSTON MA	02215	125 PARK DR Apt 125-27	BOSTON	02215
FUNG YIN NAM DALTON	C/O YIN NAM DALTON FUNG	125 PARK DR UNIT 28	BOSTON MA	02215	125 PARK DR Apt 125-28	BOSTON	02215
THOMAS PHAEDRA	C/O PHAEDRA THOMAS	125 PARK DR #125-29	BOSTON MA	02215	125 PARK DR Apt 125-29	BOSTON	02215
HASTIE DONALD W	C/O DONALD HASTIE	38 SPRAGUE ST	DEDHAM MA	02026	125 PARK DR Apt 125-30	BOSTON	02215
POPA TIBERIU		78 ARBORWAY	JAMAICA PLAIN MA	02130	125 PARK DR Apt 125-31	BOSTON	02215
HATTANGADI SHILPA		125 PARK DR #32	BOSTON MA	02215	125 PARK DR Apt 125-32	BOSTON	02215
BLETZER CURT F		300 MARKET ST	BRIGHTON MA	02135	125 PARK DR Apt 125-33	BOSTON	02215
RING BRUCE	C/O BRUCE RING	15 WEDGEWOOD DRIVE	NORTH EASTON MA	02356	125 PARK DR Apt 125-34	BOSTON	02215
DELGADO SYLVIA B		125 PARK DR #35	BOSTON MA	02215	125 PARK DR Apt 125-35	BOSTON	02215
DAWN ENTERPRISES LLC	C/O DEBORAH WEIDNER	265 HANKS HILL RD	STORRS CT	06268	125 PARK DR Apt 125-36	BOSTON	02215
BOSSERT JOHN M	C/O JOHN M BOSSERT	500 W MIDDLEFIELD RD #5	MOUNTAIN VIEW CA	94043	125 PARK DR Apt 125-37	BOSTON	02215
LIANG CHANTAO ANTHONY	C/O CHANTAO ANTHONY LIANG	75 THURSTON RD	NEWTON MA	02464	125 PARK DR Apt 125-38	BOSTON	02215
HASTIE DONALD W		38 SPRAGUE ST	DEDHAM MA	02026	125 PARK DR Apt 125-39	BOSTON	02215
TONG DAVID T S		20 DARBY DRIVE	MANSFIELD MA	02048	125 PARK DR Apt 125-40	BOSTON	02215
AGARWAL HARSH		125 PARK DR #41	BOSTON MA	02215	125 PARK DR Apt 125-41	BOSTON	02215
THORNTON MARTIN P		125 PARK DR #42	BOSTON MA	02215	125 PARK DR Apt 125-42	BOSTON	02215
LEMMON DIANNE S		125 PARK DR # 43	BOSTON MA	02215	125 PARK DR Apt 125-43	BOSTON	02215
DAWN ENTERPRISES LLC	C/O DEBORAH WEIDNER	265 HANKS HILL RD	STORRS CT	06268	125 PARK DR Apt 125-44	BOSTON	02215
SHANAMAN MATTHEW	C/O MATTHEW SHANAMAN	15424 W BECKER LN	SURPRISE AZ	85379	131 PARK DR Apt 131-G1	BOSTON	02215
QIN DEHAO	C/O DEHAO QIN	3 CRESTWOOD DRIVE	ANDOVER MA	01810	131 PARK DR Apt 131-1	BOSTON	02215
BROOKS ANNE N	C/O ANNE BROOKS	131 PARK DR #2	BOSTON MA	02215	131 PARK DR Apt 131-2	BOSTON	02215
FRAGOMENI FRANK L		7 RUTLAND SQ	BOSTON MA	02118	131 PARK DR Apt 131-3	BOSTON	02215
QIN DALE	C/O DEHAO QIN	3 CRESTWOOD DR	ANDOVER MA	01810	131 PARK DR Apt 131-4	BOSTON	02215
YAN ZHONG-HUA	C/O ZHONG-HUA YAN	39 PHILIP RD	LEXINGTON MA	02421	131 PARK DR Apt 131-5	BOSTON	02215
WONG NANCY MEI CHAI	C/O NANCY WONG	10666 MIRA LAGO TERRACE	SAN DIEGO CA	92131	131 PARK DR Apt 131-6	BOSTON	02215
BLETZER CURT F		300 MARKET ST	BRIGHTON MA	02135	131 PARK DR Apt 131-7	BOSTON	02215
WOO DAVID		131 PARK DR #8	BOSTON MA	02215	131 PARK DR Apt 131-8	BOSTON	02215
TRENT MARK S	C/O MARK TRENT	131 PARK DR #131-9	BOSTON MA	02215	131 PARK DR Apt 131-9	BOSTON	02215
BLETZER CURT F		300 MARKET ST	BRIGHTON MA	02135	131 PARK DR Apt 131-10	BOSTON	02215

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LALEHPOUR NEJAT	C/O NEJAT LALEHPOUR	131 PARK DRIVE #11	BOSTON MA	02215	131 PARK DR Apt 131-11	BOSTON	02215
TABRIZI BEHNAM	C/O BEHNAM TABRIZI	102 BROWN RD	HARVARD MA	01451	131 PARK DR Apt 131-12	BOSTON	02215
RYAN GEORGE A JR		131 PARK DR #12A	BOSTON MA	02215	131 PARK DR Apt 12A &	BOSTON	02215
JIN SHU	C/O SHU JIN & JUN ZHANG	131 PARK DR #14	BOSTON MA	02215	131 PARK DR Apt 131-14	BOSTON	02215
TSAI CHII-ELL ETAL		14 ROBBIN RD	CANTON MA	02021	131 PARK DR Apt 131-15	BOSTON	02215
GAYL MARINA	C/O MARINA GAYL	131 PARK DR UNIT 16	BOSTON MA	02215	131 PARK DR Apt 131-16	BOSTON	02215
RING ELLIOT S		131 PARK DR	BOSTON MA	02115	131 PARK DR Apt 131-17	BOSTON	02215
KRISHANAN MANIVAKKAM P TS	C/O NEERAJA KRISHNAN	1402 HARRIER CT	SUNNYVALE CA	94087	131 PARK DR Apt 131-18	BOSTON	02215
KLEIN IAN	C/O IAN KLEIN	96 DANA PLACE	NEEDHAM MA	02494	131 PARK DR Apt 131-19	BOSTON	02215
WESTERHOFF FRANK L III TS	C/O M WESTERHOFF-WESTLETTE RLTY	PO BOX 620049	NEWTON MA	02462	131 PARK DR Apt 131-20	BOSTON	02215
STEINBERG SHARON A	C/O SHARON A STEINBERG	1635 NORFOLK ST #1	HOUSTON TX	77006	131 PARK DR Apt 131-21	BOSTON	02215
WESTERHOFF FRANK L TS	C/O M WESTERHOFF-WESTLETTE RLTY	PO BOX 620049	NEWTON MA	02462	131 PARK DR Apt 131-22	BOSTON	02215
MORENO CLAUDIA		131 PARK DR #23	BOSTON MA	02215	131 PARK DR Apt 131-23	BOSTON	02215
BLETZER CURT F		300 MARKET ST	BRIGHTON MA	02135	131 PARK DR Apt 131-24	BOSTON	02215
LIU JAMES GAO	C/O JAMES GAO LIU	35 MERCURY DR	SCHREWSBURY MA	01545	131 PARK DR Apt 131-25	BOSTON	02215
FAUCON WILLIAM T		131 PARK DR #26	BOSTON MA	02215	131 PARK DR Apt 131-26	BOSTON	02215
STABILE TATIANA LUCENTE TS	C/O TATIANA LUCENTE STABILE	131 PARK DR #27	BOSTON MA	02215	131 PARK DR Apt 131-27	BOSTON	02215
PLATT WALTER M JR ETAL		41 PARK DR	BOSTON MA	02215	131 PARK DR Apt 131-28	BOSTON	02215
XIE YIFU	C/O YIFU XIE	131 PARK DR UNIT 29	BOSTON MA	02215	131 PARK DR Apt 131-29	BOSTON	02215
MATT LYND	C/O LYND MATT	131 PARK DR #30	BOSTON MA	02215	131 PARK DR Apt 131-30	BOSTON	02215
SHARMA SANJEEV TS	C/O ARCHANA SHAEMA	2061 WASHINGTON ST	NEWTON MA	02462	131 PARK DR Apt 131-31	BOSTON	02215
BERNIER MICHAEL	C/O MICHAEL BERNIER	131 PARK DR #32	BOSTON MA	02215	131 PARK DR Apt 131-32	BOSTON	02215
OZER ROSS J		131 PARK DR #33	BOSTON MA	02215	131 PARK DR Apt 131-33	BOSTON	02215
OCONNOR MARIA	C/O MARIA OCONNOR	131 PARK DR #131-34	BOSTON MA	02215	131 PARK DR Apt 131-34	BOSTON	02215
BERNAL HUMBERTO		131 PARK DR #131-35	BOSTON MA	02215	131 PARK DR Apt 131-35	BOSTON	02215
JAW INVESTMENT PROPERTIES	C/O JAW INVESTMENT PROPERTIES	300 BOYLSTON ST #518	BOSTON MA	02116	131 PARK DR Apt 131-36	BOSTON	02215
NARBY MARY JO EVANS BE	C/O MARY JO EVANS NARBY	131 PARK DR #131-37	BOSTON MA	02215	131 PARK DR Apt 131-37	BOSTON	02215
ARONOFF GREGG	C/O GREGG AND EVE ARONOFF	12 SANDY DRIVE	ACTON MA	01720	131 PARK DR Apt 131-38	BOSTON	02215
TSAI CHII-ELL ETAL		14 ROBBIN RD	CANTON MA	02021	131 PARK DR Apt 131-39	BOSTON	02215
GINGRAS MARION A	C/O MARION GINGRAS	127 SOUTH TWYCKENHAM DR	SOUTH BEND IN	46617	131 PARK DR Apt 131-40	BOSTON	02215
WOLTMANN KATJA	C/O KATJA WOLTMANN	131 PARK DR #131-41	BOSTON MA	02215	131 PARK DR Apt 131-41	BOSTON	02215
LONG TERM RENTALS LLC	C/O LONG TERM RENTALS LLC	13 JONES ROAD	PELHAM NH	03076	131 PARK DR Apt 131-42	BOSTON	02215
DRAPER GEORGE	C/O GEORGE DRAPER	444 EAST SIDE RD	SORRENTO ME	04677	131 PARK DR Apt 131-43	BOSTON	02215
PARK DRIVE RING REALTY TRUST	C/O BRUCE & MARY RING	15 WEDGEWOOD DR	N EASTON MA	02356	131 PARK DR Apt 131-44	BOSTON	02215
LEONARD WALTER ROZAMUS JR	C/O LEONARD W ROZAMUS JR	131 PARK DR #G2	BOSTON MA	02215	131 PARK DR Apt 131-G2	BOSTON	02215
SHERF DAVID E TS	C/O DAVID E. SHERF TS	131 PARK DR #G3	BOSTON MA	02215	131 PARK DR Apt 131-G3	BOSTON	02215
GILBERT JOY S TRST	C/O GILBERT RLTY TRST	11 TETLOW	BOSTON MA	02115	137 PARK DR	BOSTON	02215
GILBERT JOY S TRST	C/O GILBERT RLTY TRST	11 TETLOW	BOSTON MA	02115	143 PARK DR	BOSTON	02215
PARKSIDE TOWER LLC	C/O PARKSIDE TOWER LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	149 PARK DR	BOSTON	02215
PARKSIDE TOWER LLC	C/O PARKSIDE TOWER LLC	625 MT AUBURN ST STE 210	CAMBRIDGE MA	02138	151 PARK DR	BOSTON	02215
THE BRIGHAM AND WOMENS	C/O BRIGHAM AND WOMENS HOSP	75 FRANCIS ST	BOSTON MA	02115	80 FRANCIS ST	ROXBURY CROSSIN	02120
BRIGHAM AND WOMENS HOSP IN	C/O LING TAM	PO BOX 6240	BOSTON MA	02114	80 FRANCIS ST	ROXBURY CROSSIN	02120
RTH MISSION PARK REALTY	C/O RTH MISSION PK RLTY CORP	11 NEW WHITNEY ST	BOSTON MA	02110	15 ST ALBANS RD	BOSTON	02115
NADER ANTHONY M		895 HUNTINGTON AV #1	BOSTON MA	02115	881 HUNTINGTON AV	BOSTON	02115
NADER ANTHONY M		895 HUNTINGTON AV #1	BOSTON MA	02115	883 HUNTINGTON AV	BOSTON	02115
NADER ANTHONY M		895 HUNTINGTON AV #1	BOSTON MA	02115	887 HUNTINGTON AV	BOSTON	02115
THREE 94 RIVERWAY CONDO ASSN		901 HUNTINGTON AV	BOSTON MA	02114	901 HUNTINGTON AV	BOSTON	02115
KILEY DAVID TS	C/O DAVID KILEY TS	901 HUNTINGTON AV #E	BOSTON MA	02115	901 HUNTINGTON AV Apt E	BOSTON	02115
BERKSHIRE INVESTMENTS LLC	C/O BERKSHIRE INVESTMENTS LLC	11 WALNUT HILL RD	BROOKLINE MA	02146	903 HUNTINGTON AV Apt A	BOSTON	02115
MEDREK PAUL L	C/O PAUL L MEDREK	38 HANGDOG LANE	SOMERS CT	06071	903 HUNTINGTON AV Apt B	BOSTON	02115
BATTAT MARGARET S	C/O MARGARET BATTAT	394 RIVERWAY ST #C	BOSTON MA	02115	394 RIVERWAY ST Apt C	BOSTON	02115
SHELTON NAOMI L	C/O NAOMI SHELTON	394 RIVERWAY ST	BOSTON MA	02115	394 RIVERWAY ST Apt D	BOSTON	02115
SCHEIBEL STEVEN C BE	C/O STEVEN C SCHEIBEL	394 RIVERWAY #1	BOSTON MA	02115	394 RIVERWAY ST Apt 1	BOSTON	02115
PATEL SURBHI	C/O SURBHI PATEL	6 ST MARY LANE	TYNGSBORO MA	01879	394 RIVERWAY ST Apt 2	BOSTON	02115
AWE ADEGBOYEGA V	C/O ADEGBOYEGA V AWE	394 RIVERWAY #3	BOSTON MA	02115	394 RIVERWAY ST Apt 3	BOSTON	02115
MAURER JOHN		394 RIVERWAY ST #4	BOSTON MA	02115	394 RIVERWAY ST Apt 4	BOSTON	02115
PAN CHAO WEN	C/O CHAO WEN PAN	69/12 NANSEN ST	FOREST HILLS NY	11375	394 RIVERWAY ST Apt 5	BOSTON	02115
YANG DINGLIANG	C/O DINGLIANG YANG	394 RIVERWAY #6	BOSTON MA	02115	394 RIVERWAY ST Apt 6	BOSTON	02115
DEVANEY SHAWN M	C/O SHAWN M DEVANEY	394 RIVERWAY #7	BOSTON MA	02115	394 RIVERWAY ST Apt 7	BOSTON	02115
LI WEI	C/O WEI LI	394 RIVERWAY ST #8	BOSTON MA	02115	394 RIVERWAY ST Apt 8	BOSTON	02115
XIAOPING XIE		371 WORCESTER ST	WELLESLEY MA	02481	394 RIVERWAY ST Apt 9	BOSTON	02115
ZARITSKI KIRILL S		394 RIVERWAY ST #10	BOSTON MA	02115	394 RIVERWAY ST Apt 10	BOSTON	02115
DAWLABANI NASSIF E TS	C/O FENWAY PROPERTY SOLUTIONS	327 HUNTINGTON AV #6	BOSTON MA	02115	394 RIVERWAY ST Apt 11	BOSTON	02115

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
DU YIMING	C/O YIMING DU	394 RIVERWAY UNIT 12	BOSTON MA	02115	394 RIVERWAY ST Apt 12	BOSTON	02115
HOLMES TYLER J	C/O TYLER J HOLMES	394 RIVERWAY ST #12-A	BOSTON MA	02115	394 RIVERWAY ST Apt 12-A	BOSTON	02115
MARIANO AARON	C/O AARON MARIANO	394 RIVERWAY ST #14	BOSTON MA	02115	394 RIVERWAY ST Apt 14	BOSTON	02115
RANDALL RANDALL A		16101 KENT RD	LAUREL MD	20707	394 RIVERWAY ST Apt 15	BOSTON	02115
THREE 90 RIVERWAY CONDO ASSN		424 COMMONWEALTH AV	NEWTON CENTER MA	02459	392 RIVERWAY ST	BOSTON	02115
HORIZON 50 LLC	C/O HORIZON 50 LLC	127 MASON TERRACE UNIT 2	BROOKLINE MA	02446	390 RIVERWAY ST Apt 1	BOSTON	02115
TIRONE JOSEPH J		120 WINCHESTER RD	ARLINGTON MA	02474	390 RIVERWAY ST Apt 2	BOSTON	02115
PATRICK L ROBERT 2016	C/O PATRICK L ROBERT	390 RIVERWAY ST #3	BOSTON MA	02115	390 RIVERWAY ST Apt 3	BOSTON	02115
WAN QIAOQIAO	C/O QIAOQIAO WAN	15 WENDELLER ST #1	BOSTON MA	02127	390 RIVERWAY ST Apt 4	BOSTON	02115
HUANG SHANFAN	C/O SHANFAN HUANG	390 RIVERWAY #5	BOSTON MA	02115	390 RIVERWAY ST Apt 5	BOSTON	02115
CONSTABLE RICHES-ANN		390 RIVERWAY #6	BOSTON MA	02115	390 RIVERWAY ST Apt 6	BOSTON	02115
MENDOZA MIGUEL		390 RIVERWAY #7	BOSTON MA	02115	390 RIVERWAY ST Apt 7	BOSTON	02115
GREEN CHILIES LLC	C/O GREEN CHILIES LLC	15 WINN ROAD	NASHUA NH	03062	390 RIVERWAY ST Apt 8	BOSTON	02115
SHONGWE GLADYS S		390 RIVERWAY #9	BOSTON MA	02115	390 RIVERWAY ST Apt 9	BOSTON	02115
BIRNER TIMOTHY D BE	C/O TIMOTHY D BIRNER	390 RIVERWAY ST #10	BOSTON MA	02115	390 RIVERWAY ST Apt 10	BOSTON	02115
SILVA ADILSON M JR	C/O ADILSON M SILVA JR	1 WESTINGHOUSE PZ #C-320	HYDE PARK MA	02136	390 RIVERWAY ST Apt 11	BOSTON	02115
REZAEI SHAHRIAR	C/O SHAHRIAR REZAEI	24 SHUMAKER PATH	NEWTON MA	02459	390 RIVERWAY ST Apt 12	BOSTON	02115
BEPPU ROMI		390 RIVERWAY ST #13	BOSTON MA	02115	390 RIVERWAY ST Apt 13	BOSTON	02115
PATRICK L ROBERT 2016	C/O PATRICK ROBERT	390 RIVERWAY ST #14	BOSTON MA	02115	390 RIVERWAY ST Apt 14	BOSTON	02115
DOMINGOS ROCIO S	C/O ROCIO SOLANO	390 RIVERWAY #15	BOSTON MA	02115	390 RIVERWAY ST Apt 15	BOSTON	02115
HICKMAN TYLER	C/O TYLER HICKMAN	390 RIVERWAY #16	BOSTON MA	02115	390 RIVERWAY ST Apt 16	BOSTON	02115
LEVIT HAIM	C/O HAIM LEVIT	390 RIVERWAY #17	BOSTON MA	02115	390 RIVERWAY ST Apt 17	BOSTON	02115
GAI ELISHEVA	C/O CHARLESGATE REALTY	867 BOYLSTON ST 3RD FL	BOSTON MA	02116	390 RIVERWAY ST Apt 18	BOSTON	02115
PANUCCIO THERESA TS	C/O THERESA PANUCCIO	3011 FALCON HILL DR	APOPKA FL	32712	390 RIVERWAY ST Apt 19	BOSTON	02115
HOANG VY	C/O VY HOANG	390 RIVERWAY ST #20	BOSTON MA	02115	390 RIVERWAY ST Apt 20	BOSTON	02115
YATSENKO EDUARD	C/O EDUARD YATSENKO	390 RIVERWAY ST #21	BOSTON MA	02115	390 RIVERWAY ST Apt 21	BOSTON	02115
BLD HOLDINGS LLC	C/O BLD HOLDINGS LLC	43365 VESTALS PL	LEESBURG VA	20176	390 RIVERWAY ST Apt 22	BOSTON	02115
PANTALONE COLEEN CAREY		390 RIVERWAY ST #23	BOSTON MA	02115	390 RIVERWAY ST Apt 23	BOSTON	02115
LIEBESMAN LORI	C/O LORI LIEBESMAN	390 RIVERWAY #24	BOSTON MA	02115	390 RIVERWAY ST Apt 24	BOSTON	02115
FRIZZELL MICHAEL J		1362 PASADENA AV	ATLANTA GA	30306	390 RIVERWAY ST Apt 25	BOSTON	02115
THREE 78-386 RIVERWAY CONDO		386 RIVERWAY	BOSTON MA	02115	386 RIVERWAY ST	BOSTON	02115
GLANTZ KALMAN	C/O KALMAN GLANTZ	12 KINNAIRD ST	CAMBRIDGE MA	02139	386 RIVERWAY ST Apt 386-A	BOSTON	02115
MISTRAL LLC	C/O DAR SANDLER	100 ROCKVIEW ST #2	JAMAICA PLAIN MA	02130	386 RIVERWAY ST Apt 386-B	BOSTON	02115
POGARIAN ALAN R	C/O ALAN R POGARIAN	386 RIVERWAY ST #1	BOSTON MA	02115	386 RIVERWAY ST Apt 386-1	BOSTON	02115
DINES JEFFREY N	C/O JEFFREY N DINES	386 RIVERWAY ST #386-2	BOSTON MA	02115	386 RIVERWAY ST Apt 386-2	BOSTON	02115
MILJKOVIC KATARINA		386 RIVERWAY #3	BOSTON MA	02115	386 RIVERWAY ST Apt 386-3	BOSTON	02115
RICHARDSON ROBERT J		12763 BLACK ANGUS DR	JACKSONVILLE FL	32226	386 RIVERWAY ST Apt 386-4	BOSTON	02115
HUANG JING	C/O JING HUANG	4 APPLE HILL DRIVE	NATICK MA	01760	386 RIVERWAY ST Apt 386-5	BOSTON	02115
GRUB BARBARA	C/O BARBARA GRUB	386 RIVERWAY #6	BOSTON MA	02115	386 RIVERWAY ST Apt 386-6	BOSTON	02115
JIN HUI	C/O HUI JIN	286 RIVERWAY ST #7	BOSTON MA	02115	386 RIVERWAY ST Apt 386-7	BOSTON	02115
GOSS PAUL E	C/O PAUL E GOSS	904 WASHINGTON ST	WELLESLEY MA	02482	386 RIVERWAY ST Apt 386-8	BOSTON	02114
GIARGIARI MICHELLE		384 RIVERWAY #A	BOSTON MA	02115	384 RIVERWAY ST Apt 384-A	BOSTON	02115
CHAO EDWARD GEN	C/O FU-CHUAN TANG	14 BRISTOL ST	MANSFIELD MA	02048	384 RIVERWAY ST Apt 384-B	BOSTON	02115
GOSS PAUL E	C/O PAUL E GOSS	904 WASHINGTON ST	WELLESLEY MA	02482	384 RIVERWAY ST Apt 384-1	BOSTON	02115
FROST SCOTT C	C/O SYLVIA WELSH + SCOTT FROST	384 RIVERWAY ST #384-2	BOSTON MA	02115	384 RIVERWAY ST Apt 384-2	BOSTON	02115
KROELL AXEL GEORG	C/O AXEL GEORG KROELL	384 RIVERWAY #3	BOSTON MA	02115	384 RIVERWAY ST Apt 384-3	BOSTON	02115
SILVA GLENTIN FRANKLIN D	C/O GLENTIN FRANKLIN D SILVA	384 RIVERWAY ST #4	BOSTON MA	02115	384 RIVERWAY ST Apt 384-4	BOSTON	02115
MACAN EDO	C/O EDO MACAN	161 HIGHLAND AV	WINCHESTER MA	01890	384 RIVERWAY ST Apt 384-5	BOSTON	02115
MACAN EDO	C/O EDO MACAN	161 HIGHLAND AV	WINCHESTER MA	01890	384 RIVERWAY ST Apt 384-6	BOSTON	02115
ZHU YAOPING	C/O HONGWEI DAI CO/YAOPING ZHU	16 ROSECLIFF DR	NASHUA NH	03062	384 RIVERWAY ST Apt 384-7	BOSTON	02115
CHEN RENCHAO	C/O RENCHAO CHEN	378-386 RIVERWAY #384-4	BOSTON MA	02115	384 RIVERWAY ST Apt 384-8	BOSTON	02115
JOHNSON LAUREN	C/O LAUREN JOHNSON	382 A RIVERWAY ST #382-A	BOSTON MA	02115	382 RIVERWAY ST Apt 382-A	BOSTON	02115
GAUS ANDY		382 RIVERWAY ST #382-B	BOSTON MA	02115	382 RIVERWAY ST Apt 382-B	BOSTON	02115
ALLEN CAROL G	C/O CAROL G ALLEN	382 RIVERWAY ST #382-1	BOSTON MA	02115	382 RIVERWAY ST Apt 382-1	BOSTON	02115
GODOY CHARLES E		270 SHAWSHEEN ST	TEWSBURY MA	01876	382 RIVERWAY ST Apt 382-2	BOSTON	02115
FENG ZHAO	C/O YI-LI YANG	382 RIVERWAY ST #3	BOSTON MA	02115	382 RIVERWAY ST Apt 382-3	BOSTON	02115
AGGARWAL SUCHIT	C/O SUCHIT AGGARWAL	382 RIVERWAY ST #4	BOSTON MA	02115	382 RIVERWAY ST Apt 382-4	BOSTON	02115
DELSAVIO ROBERT	C/O MICHELLE REINSTEIN	382 RIVERWAY #5	BOSTON MA	02115	382 RIVERWAY ST Apt 382-5	BOSTON	02115
HANNA JOHN	C/O JOHN HANNA	382 RIVERWAY ST #382-6	BOSTON MA	02115	382 RIVERWAY ST Apt 382-6	BOSTON	02115
TSOLOV PLAMEN		382 RIVERWAY #382-7	BOSTON MA	02115	382 RIVERWAY ST Apt 382-7	BOSTON	02115
LIANG NAN	C/O NAN LIANG	382 RIVERWAY ST #8	BOSTON MA	02115	382 RIVERWAY ST Apt 382-8	BOSTON	02115
BATHIA SIDHARTH VINOD	C/O SIDHARTH VINOD BATHIA	380 RIVERWAY #380-A	BOSTON MA	02115	380 RIVERWAY ST Apt 380-A	BOSTON	02115
MITCHELL MICHAEL	C/O MICHAEL MITCHELL	380 RIVERWAY #B	BOSTON MA	02115	380 RIVERWAY ST Apt 380-B	BOSTON	02115

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
KASPER JEAN E		380 RIVERWAY ST #1	BOSTON MA	02115	380 RIVERWAY ST Apt 380-1	BOSTON	02115
HANLEY-BARBIERI ERIN M	C/O ERIN HANLEY-BARBIERI	15 DAISLEY PLACE	FRAMINGHAM MA	01702	380 RIVERWAY ST Apt 380-2	BOSTON	02115
STUART B LEVY TRUST	C/O CECILE PASTEL LEVY	1 AVERY ST #20B	BOSTON MA	02111	380 RIVERWAY ST Apt 380-3	BOSTON	02115
ABRAHAM M PRETORIUS LIVING	C/O ABRAHAM M PRETORIUS	6778 N 83RD STREET	SCOTTSDALE AZ	85250	380 RIVERWAY ST Apt 380-4	BOSTON	02115
EILON SHARON	C/O SHARON EILON	380 RIVERWAY #5	BOSTON MA	02115	380 RIVERWAY ST Apt 380-5	BOSTON	02115
YUAN MINSHENG		380 RIVERWAY ST #6	BOSTON MA	02115	380 RIVERWAY ST Apt 380-6	BOSTON	02115
FORTUNATO ANTHONY	C/O ANTHONY FORTUNATO	380 RIVERWAY #7	BOSTON MA	02115	380 RIVERWAY ST Apt 380-7	BOSTON	02115
LI QINGYU	C/O QINGYU LI & XIANING ZHU TS	380 RIVERWAY #8	BOSTON MA	02115	380 RIVERWAY ST Apt 380-8	BOSTON	02115
FASSIL JONATHAN		378 RIVERWAY ST #378-A	BOSTON MA	02115	378 RIVERWAY ST Apt 378-A	BOSTON	02115
RODRIGUEZ JOSEFINA		2108 B STREET	SAN DIEGO CA	92102	378 RIVERWAY ST Apt 378-B	BOSTON	02115
LORIE ISAAC		378 RIVERWAY ST #378-1	BOSTON MA	02115	378 RIVERWAY ST Apt 378-1	BOSTON	02115
SINGER STEVEN D TS	C/O MARTA PENA	344A BOYLSTON ST	NEWTON MA	02459	378 RIVERWAY ST Apt 378-2	BOSTON	02115
TANG NAIBIAO	C/O NAIBIAO TANG	2506 LONGHUA ST #503	SHANGHAI CHINA	00000	378 RIVERWAY ST Apt 378-3	BOSTON	02115
SUN YUE		378 RIVERWAY #4	BOSTON MA	02115	378 RIVERWAY ST Apt 378-4	BOSTON	02115
RAGAB MOUSTAFA S		378 RIVERWAY #5	BOSTON MA	02115	378 RIVERWAY ST Apt 378-5	BOSTON	02115
KOSHKHOO NEDA A	C/O NEDA A KOSHKHOO	378 RIVERWAY #6	BOSTON MA	02115	378 RIVERWAY ST Apt 378-6	BOSTON	02115
MURTAGH MARY		378 RIVERWAY #7	BOSTON MA	02115	378 RIVERWAY ST Apt 378-7	BOSTON	02115
GEMMETT KAREN	C/O KAREN GEMMETT	56 SHERIDAN ST	JAMAICA PLAIN MA	02130	378 RIVERWAY ST Apt 378-8	BOSTON	02115
MATARAZZO LEENA TRST	C/O SENTRY PROPERTY MNGT CP	PO BOX 327	ALLSTON MA	02134	376 RIVERWAY ST	BOSTON	02115
RIVERWAY LJS LLC		60 LEO M BIRMINGHAM PKWY	BRIGHTON MA	02135	368 RIVERWAY ST	BOSTON	02115
JHB MASSACHUSETTS PROP LLC	C/O INVESTMENTS LTD	215 NORTH FEDERAL	BOCA RATON FL	33432	364 RIVERWAY ST	BOSTON	02115
RIVERWAY MOSAIC PRIMARY	C/O ROXBURY TENANTS OF HARVARD	11 NEW WHITNEY ST	BOSTON MA	02115	80- FENWOOD RD	BOSTON	02115
LESSEE BRIGHAM & WOMENS HOSP	C/O MASS GENERAL LING TAM	P O BOX 6240	BOSTON MA	02114	60 FENWOOD RD	BOSTON	02115
CITY OF BOSTON		217 JAMAICAWAY	JAMAICA PLAIN MA	02130	156 JAMAICAWAY ST	JAMAICA PLAIN	02130
GEORGE PAGOUNIS TRUST		137 BALDPATE HILL RD	NEWTON CENTER MA	02459	914 HUNTINGTON AV	BOSTON	02115
S HUNTINGTON AV REALTY LLC	C/O KENNETH SHAPIRO	460 HILLSIDE AVENIE	NEEDHAM MA	02494	53 S HUNTINGTON AV	BOSTON	02116
CSOH PROPERITIES LLC	C/O HEATH PROPERTIES	74 CLARENDON ST SUITE A	BOSTON MA	02116	55 S HUNTINGTON AV	BOSTON	02199
S HUNTINGTON AV REALTY LLC	C/O KENNETH SHAPRIO	460 HILLSIDE AVENUE	NEEDHAM MA	02494	59 S HUNTINGTON AV	BOSTON	02199
CSOH PROPERTIES LLC	C/O HEATH PROPERTIES	74 CLARENDON ST SUITE A	BOSTON MA	02116	61 S HUNTINGTON AV	BOSTON	02199
CSOH PROPERTIES LLC	C/O HEATH PROPERTIES	74 CLARENDON ST SUITE A	BOSTON MA	02116	63 S HUNTINGTON AV	BOSTON	02199
PD LAND TRUST LLC TS	C/O PD LAND TRUST LLC TS	404 SOUTH HUNTINGTON AV	JAMAICA PLAIN MA	02130	65 S HUNTINGTON AV	BOSTON	02199
S HUNTINGTON AV REALTY LLC	C/O KENNETH SHAPIRO	460 HILLSIDE AVENUE	NEEDHAM MA	02494	67 S HUNTINGTON AV	BOSTON	02199
HATHAWAY RLTY INVESTMENTS	C/O SCOTT SCHNEIDER	36 STRAWBERRY HILL ST	DOVER MA	02030	69 S HUNTINGTON AV	BOSTON	02199
HATHAWAY REALTY INVESTMENTS	C/O SCOTT SCHNEIDER MGR	36 STRAWBERRY HILL ST	DOVER MA	02030	71 S HUNTINGTON AV	BOSTON	02199
SEVENTY 3 S HUNTINGTON LJS		60 LEO M BIRMINGHAM PKWY	BRIGHTON MA	02135	73 S HUNTINGTON AV	BOSTON	02199
SEVENTY-FIVE S HUNTINGTON	C/O SEVENTY-FIVE S HUNTINGTON LJS LLC	60 LEO M BIRMINGHAM PKWY	BRIGHTON MA	02135	75 S HUNTINGTON AV	BOSTON	02199
JAMAICA POND CONDO ASSN		70 JAMAICA WAY	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST	JAMAICA PLAIN	02130
LAM CHI K	C/O CHI K LAM	70 JAMAICAWAY ST UNIT 1	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST Apt 1	JAMAICA PLAIN	02130
CADOGAN JAMES JR		2001 MARINA DR #107W	QUINCY MA	02171	70 JAMAICAWAY ST Apt 2	JAMAICA PLAIN	02130
THIVIERGE DOUGLAS A		70 JAMAICAWAY #3	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST Apt 3	JAMAICA PLAIN	02130
JAMAICA POND CONDO ASSOC	LAWRANCE OCONNOR/STERLING PROP	P.O. BOX 140382	BOSTON MA	02114	70 JAMAICAWAY ST Apt 4	JAMAICA PLAIN	02130
KETTENDORF CHARLES W		23 COHASSET	ROSLINDALE MA	02131	70 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
SU YU	C/O YU SU	70 JAMAICAWAY ST #6	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST Apt 6	JAMAICA PLAIN	02130
KETTENDORF CHARLES W		23 COHASSET	ROSLINDALE MA	02131	70 JAMAICAWAY ST Apt 7	JAMAICA PLAIN	02130
COOK HENRY		79 ST ROSE ST	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST Apt 8	JAMAICA PLAIN	02130
KWAY LLC	C/O KWAY LLC	330 COCHITUATE RD #5044	FRAMINGHAM MA	01701	70 JAMAICAWAY ST Apt 9	JAMAICA PLAIN	02130
CADOGAN JAMES J JR		2001 MARINA DR #107W	QUINCY MA	02171	70 JAMAICAWAY ST Apt 10	JAMAICA PLAIN	02130
KWAY LLC	C/O KWAY LLC	330 COCHITUATE RD #5044	FRAMINGHAM MA	01701	70 JAMAICAWAY ST Apt 11	JAMAICA PLAIN	02130
CHU STANLEY C		70 JAMAICAWAY ST #12	JAMAICA PLAIN MA	02130	70 JAMAICAWAY ST Apt 12	JAMAICA PLAIN	02130
CAO YILI	C/O YILI CAO	74 CHRISTOPHER RD	WALTHAM MA	02451	70 JAMAICAWAY ST Apt 13	JAMAICA PLAIN	02130
KWAY LLC	C/O KWAY LLC	330 COCHITUATE RD #5044	FRAMINGHAM MA	01701	70 JAMAICAWAY ST Apt 14	JAMAICA PLAIN	02130
HANG LONG	C/O LONG HANG	660 LAGRANGE ST	WEST ROXBURY MA	02132	70 JAMAICAWAY ST Apt 15	JAMAICA PLAIN	02130
ZHANG JINGPING	C/O WENZHONG ZHAO/JINGPING ZHANG	184 COLLEGE FARM ROAD	WALTHAM MA	02451	70 JAMAICAWAY ST Apt 16	JAMAICA PLAIN	02130
JAMAICAWAY PLACE CONDO TR		60 JAMAICAWAY	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST	JAMAICA PLAIN	02130
KWAY LLC	C/O KWAY LLC	330 COCHITUATE RD #5044	FRAMINGHAM MA	01701	60 JAMAICAWAY ST Apt 60-1	JAMAICA PLAIN	02130
HUANG JING	C/O JING HUANG	26 TOBIN HILL DR	SHREWSBURY MA	01545	60 JAMAICAWAY ST Apt 60-2	JAMAICA PLAIN	02130
ZHANG JINXING	C/O JINXING ZHANG	78 HEMINGWAY ST	WINCHESTER MA	01890	60 JAMAICAWAY ST Apt 60-3	JAMAICA PLAIN	02130
PARKIN MARY J H	C/O MARY J H PARKIN	60 JAMAICAWAY #60-4	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-4	JAMAICA PLAIN	02130
ILKYS MODESTAS		60 JAMAICAWAY ST #60-5	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-5	JAMAICA PLAIN	02130
DO-DAI DANIEL D	C/O DANIEL D DO-DAI	60 JAMAICAWAY ST #60-6	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-6	JAMAICA PLAIN	02130
URREA MARK	C/O MARK URREA	60 JAMAICAWAY ST #60-7	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-7	JAMAICA PLAIN	02130
FOX MIRIAM M		60 JAMAICAWAY #60-8	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-8	JAMAICA PLAIN	02130
ARBOR PROPERTIES LLC	C/O ARBOR PROPERTIES LLC	390 COMMONWEALTH AV #407	BOSTON MA	02215	60 JAMAICAWAY ST Apt 60-9	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
VAINSHTEIN DINA M	C/O DINA M VAINSHTEIN	60 JAMAICAWAY ST # 60-10	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-10	JAMAICA PLAIN	02130
DELLI-CARPINI DOMENICO ETAL	DOMENICO DELLI-CARPINI	10 TOMOKA RIDGE WAY	ORMOND BEACH FL	32174	60 JAMAICAWAY ST Apt 60-11	JAMAICA PLAIN	02130
HAWES DAVID		60 JAMAICAWAY ST #60-12	JAMAICA PLAIN MA	02130	60 JAMAICAWAY ST Apt 60-12	JAMAICA PLAIN	02130
EINHORN ROBERT	C/O R EINHORN	65 EVERETT ST	ALLSTON MA	02134	60 JAMAICAWAY ST Apt 60B	JAMAICA PLAIN	02130
MCGEE BONNIE D	C/O BONNIE D MCGEE	50 JAMAICAWAY #1	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-1	JAMAICA PLAIN	02130
IDRIZI ENGELFRIDA	C/O ENGELFRIDA IDRIZI	50 JAMAICAWAY ST # 2	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-2	JAMAICA PLAIN	02130
LEE HANMIN		50 JAMAICAWAY #50-3	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-3	JAMAICA PLAIN	02130
WONG BARRY ETAL		325 ST PAUL ST	BROOKLINE MA	02446	50 JAMAICAWAY ST Apt 50-4	JAMAICA PLAIN	02130
HUANG JING	C/O JING HUANG	4 APPLE HILL DRIVE	NATICK MA	01760	50 JAMAICAWAY ST Apt 50-5	JAMAICA PLAIN	02130
CHEN CHONG-ZI	C/O CHONG-ZI CHEN	186 FLORENCE ST	ARLINGTON MA	02476	50 JAMAICAWAY ST Apt 50-6	JAMAICA PLAIN	02130
PENSYL WILLIAM RUSSELL	C/O WILLIAM RUSSELL PENSYL	50 JAMAICAWAY ST #50-7	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-7	JAMAICA PLAIN	02130
YUE LYNN	C/O LYNN YUE	63 FLINTLOCK LN	PHOENIXCILLE PA	19460	50 JAMAICAWAY ST Apt 50-8	JAMAICA PLAIN	02130
PARKER-OGRADY JEROME D	C/O JEROME D PARKER-OGRADY	50 JAMAICAWAY ST #9	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-9	JAMAICA PLAIN	02130
TSOLOV PLAMEN	C/O PLAMEN TSOLOV	50 JAMAICAWAY ST # 50-10	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-10	JAMAICA PLAIN	02130
KATZELNIK FAMILY REALTY	C/O SHMUEL KATZELNIK TS	50 JAMAICAWAY ST #50-11	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-11	JAMAICA PLAIN	02130
SENG SEYHA	C/O SEYHA SENG	50 JAMAICAWAY ST # 12	JAMAICA PLAIN MA	02130	50 JAMAICAWAY ST Apt 50-12	JAMAICA PLAIN	02130
QUINONES DAVID		40 JAMAICAWAY #1	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-1	JAMAICA PLAIN	02130
MIAO ADAM X	C/O ADAM X MIAO	40 JAMAICAWAY ST #40-2	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-2	JAMAICA PLAIN	02130
COUTURIER RENEE	C/O RENEE COUTURIER	40 JAMAICAWAY #40-3	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-3	JAMAICA PLAIN	02130
NAGANO ALISA	C/O ALISA NAGANO	40 JAMAICAWAY ST #40-4	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-4	JAMAICA PLAIN	02130
WHITE JOAN M		40 JAMAICAWAY ST #5	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-5	JAMAICA PLAIN	02130
NANNI ALFRED J JR	C/O ALFRED J NANNI JR	40 JAMAICAWAY ST #6	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-6	JAMAICA PLAIN	02130
JP ONE LLC	BARBARA HEDGES - J PONE LLC	210 PARK ST	W ROXBURY MA	02132	40 JAMAICAWAY ST Apt 40-7	JAMAICA PLAIN	02130
ANSCHUTZ KATHRYN S	C/O KATHRYN S ANSCHUTZ	40 JAMAICAWAY # 8	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-8	JAMAICA PLAIN	02130
PITTMAN ASHLEY G		47 COGSWELL AV #19	CAMBRIDGE MA	02140	40 JAMAICAWAY ST Apt 40-9	JAMAICA PLAIN	02130
LENBURG ARRON D	C/O AARON D LENBURG	385 BEALE ST #3	QUINCY MA	02170	40 JAMAICAWAY ST Apt 40-10	JAMAICA PLAIN	02130
PAPOU YURY	C/O YURY PAPOU	40 JAMAICAWAY ST #11	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-11	JAMAICA PLAIN	02130
COIRO-OUELLETTE DOMINIQUE	C/O DOMINQUE COIRO	40 JAMAICAWAY ST #40-12	JAMAICA PLAIN MA	02130	40 JAMAICAWAY ST Apt 40-12	JAMAICA PLAIN	02130
BROOKS POND CONDO ASSN		30 JAMAICAWAY	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST	JAMAICA PLAIN	02130
EINHORN ROBERT	C/O R EINHORN	65 EVERETT ST	ALLSTON MA	02134	30 JAMAICAWAY ST Apt 1	JAMAICA PLAIN	02130
DALY FAMILY TRUST	C/O MICHAEL DALY	15 OAK ST	BRAINTREE MA	02184	30 JAMAICAWAY ST Apt 2	JAMAICA PLAIN	02130
ZHOU CHENGXIA	C/O CHENGXIA ZHOU	30 JAMAICAWAY ST #3	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 3	JAMAICA PLAIN	02130
SKOBEL STEPHANIE		30 JAMAICAWAY #4	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 4	JAMAICA PLAIN	02130
LUO SHUQIN	C/O SHUQIN LUO	30 JAMAICAWAY ST #5	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
KEYDEL THOMAS M		95 PRINCE ST	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 6	JAMAICA PLAIN	02130
BORGOS GUERTIN IRREVOCABLE		30 JAMAICAWAY #7	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 7	JAMAICA PLAIN	02130
MELODY R SMITH REVOCABLE	C/O MELODY R SMITH	9901 EMMAUS	ST JOHN VI	00830	30 JAMAICAWAY ST Apt 8	JAMAICA PLAIN	02130
GUTNICK MICHAEL J	C/O MICHAEL J GUTNICK	30 JAMAICAWAY ST #9	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 9	JAMAICA PLAIN	02130
ZHU CHUNCHI	C/O CHUNCHI ZHU	30 JAMAICAWAY #10	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 10	JAMAICA PLAIN	02130
DOUGLAS WORTH TS	C/O WORTH DOUGLAS	10 DURLAND ST	BRIGHTON MA	02135	30 JAMAICAWAY ST Apt 11	JAMAICA PLAIN	02130
THIRTYJWAY12 LLC	C/O THIRTYJWAY 12 LLC	57 UPLAND RD	BROOKLINE MA	02445	30 JAMAICAWAY ST Apt 12	JAMAICA PLAIN	02130
WANG YAOYU E	C/O YAOYU E WANG	115 FRANKLIN ST UNIT 2	BROOKLINE MA	02445	30 JAMAICAWAY ST Apt 12-A	JAMAICA PLAIN	02130
NELSON LYNNE I		30 JAMAICAWAY #14	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 14	JAMAICA PLAIN	02130
MULLALEY LOUISE		30 JAMAICAWAY #15	JAMAICA PLAIN MA	02130	30 JAMAICAWAY ST Apt 15	JAMAICA PLAIN	02130
DALY FAMILY TRUST	C/O MICHAEL DALY	15 OAK ST	BRAINTREE MA	02184	30 JAMAICAWAY ST Apt 16	JAMAICA PLAIN	02130
DALY FAMILY TRUST	C/O MICHAEL DALY	15 OAK ST	BRAINTREE MA	02184	30 JAMAICAWAY ST Apt 17	JAMAICA PLAIN	02130
TWENTIETH JAMAICAWAY CONDO		20 JAMAICAWAY	JAMAICA PLAIN MA	02130	20 JAMAICAWAY ST	JAMAICA PLAIN	02130
TWENTY JAMWAY LLC	C/O TWENTY JAMWAY LLC	54 SARGENT RD	BROOKLINE MA	02445	20 JAMAICAWAY ST Apartments	JAMAICA PLAIN	02130
SHORES ANDREW D TS	C/O ANDREW SHORES	20 JAMAICAWAY ST #5	BOSTON MA	02130	20 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
SAMMONS LAURIE G	C/O LAURIE SAMMONS	20 JAMAICAWAY ST #6	BOSTON MA	02130	20 JAMAICAWAY ST Apt 6	JAMAICA PLAIN	02130
HELISCH ARMIN		29 EVENCHANCE RD	ENFIELD NH	03748	20 JAMAICAWAY ST Apt 7	JAMAICA PLAIN	02130
COIRO ERIC T		20 JAMAICAWAY ST #8	JAMAICA PLAIN MA	02130	20 JAMAICAWAY ST Apt 8	JAMAICA PLAIN	02130
KESSLER EDEN		20 JAMAICAWAY #10	JAMAICA PLAIN MA	02130	20 JAMAICAWAY ST Apt 10	JAMAICA PLAIN	02130
CESAR SONIA	C/O SONIA CESAR	20 JAMAICAWAY ST #11	JAMAICA PLAIN MA	02130	20 JAMAICAWAY ST Apt 11	JAMAICA PLAIN	02130
HYMBERT LAURIE H	C/O LAURIE HUMBERT	60 CLEMENTS RD	WALTHAM MA	02453	20 JAMAICAWAY ST Apt 14	JAMAICA PLAIN	02130
TEN JAMAICAWAY CONDO ASSN		10 JAMAICAWAY	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST	JAMAICA PLAIN	02130
FEBONIO ALEXANDER J	C/O ALEXANDER J FEBONIO	10 JAMAICAWAY ST # 1	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 1	JAMAICA PLAIN	02130
TETTEH NII	C/O NII A TETTEH	9 PARAGON ROAD	WEST ROXBURY MA	02132	10 JAMAICAWAY ST Apt 1-B	JAMAICA PLAIN	02130
ESPIRITU MARIE	C/O MARIE ESPIRITU	31 LEONARD RD	MELROSE MA	02176	10 JAMAICAWAY ST Apt 2	JAMAICA PLAIN	02130
ZHANG YIYING	C/O YIYING ZHANG	10 JAMAICAWAY ST #3	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 3	JAMAICA PLAIN	02130
RHODES HEIDI		10 JAMAICAWAY ST #4	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 4	JAMAICA PLAIN	02130
DOBBERFUHL ADAM P	C/O ADAM P DOBBERFUHL	10 JAMAICAWAY ST #5	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
LI WEI	C/O WEI LI	10 JAMAICAWAY ST #6	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 6	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
BALABHADRAPATRUNI SRINIVAS	C/O SRINIVAS BALABHADRAPATRUNI	6 ORION WAY	WESTFORD MA	01886	10 JAMAICAWAY ST Apt 7	JAMAICA PLAIN	02130
PARZYCH AMY		10 JAMAICAWAY ST #8	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 8	JAMAICA PLAIN	02130
FUENTES CYNTHIA E	C/O CYNTHIA E FUENTES	10 JAMAICAWAY #9	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 9	JAMAICA PLAIN	02130
KADHIRESAN SUBATHRA	C/O SUBATHRA KADHIRESAN	86 SUNSET RD	ARLINGTON MA	02474	10 JAMAICAWAY ST Apt 10	JAMAICA PLAIN	02130
MERBL YIFAT HAYA	C/O YIFAT HAYA MERBL	10 JAMAICAWAY ST #11	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 11	JAMAICA PLAIN	02130
SPARROW LAWRENCE		7 SOUTH TE	BEVERLY MA	01915	10 JAMAICAWAY ST Apt 12	JAMAICA PLAIN	02130
FILLER RACHEL L		10 JAMAICAWAY #12-A	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 12-A	JAMAICA PLAIN	02130
OCONNELL JEANNE		229 SCHOOL ST	WALTHAM MA	02451	10 JAMAICAWAY ST Apt 14	JAMAICA PLAIN	02130
IVANCICH RICHARD	C/O RICHARD IVANCICH	41 COLEMAN AV	E CHATHAM NJ	07928	10 JAMAICAWAY ST Apt 15	JAMAICA PLAIN	02130
ANDERSON MEREDITH		10 JAMAICAWAY ST	BOSTON MA	02130	10 JAMAICAWAY ST Apt 16	JAMAICA PLAIN	02130
MATUNAS ERIC A	C/O ERIC A MATUNAS	10 JAMAICAWAY ST #17	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 17	JAMAICA PLAIN	02130
FADEL CHARLES KENT	C/O CHARLES KENT FADEL	10 JAMAICAWAY ST #18	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 18	JAMAICA PLAIN	02130
SALTARES-DIAZ MYRIAM A		68 PRINCE ST	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 19	JAMAICA PLAIN	02130
EGAN THOMAS E		10 JAMAICAWAY ST #20	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 20	JAMAICA PLAIN	02130
NGUYEN CINDY M		10 JAMAICAWAY ST #21	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 21	JAMAICA PLAIN	02130
LIU CHARLES	C/O CHARLES LIU & CATHERINE WAN	50 SAINT PAUL STREET #5	BROOKLINE MA	02446	10 JAMAICAWAY ST Apt 22	JAMAICA PLAIN	02130
CASTILLO MORIS	C/O MORIS CASTILLO	10 JAMAICAWAY #23	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 23	JAMAICA PLAIN	02130
BURNS RICHARD		10 JAMAICAWAY ST #24 BX 2054	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 24	JAMAICA PLAIN	02130
MEUCCI LOUIS M		10 JAMAICAWAY ST #25	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 25	JAMAICA PLAIN	02130
CHISHOLM ALEXANDRA E S		10 JAMAICAWAY ST #26	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 26	JAMAICA PLAIN	02130
COBEY FREDERICK C		10 JAMAICAWAY #27	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 27	JAMAICA PLAIN	02130
YOUNG PHYLLIS M	C/O PHYLLIS YOUNG	10 JAMAICAWAY ST #28	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 28	JAMAICA PLAIN	02130
GADECKI WALTER F		10 JAMAICAWAY ST # 29	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 29	JAMAICA PLAIN	02130
FONAREV DMITRY	C/O DMITRY FONAREV	10 JOHN POULTER RD	LEXINGTON MA	02421	10 JAMAICAWAY ST Apt 30	JAMAICA PLAIN	02130
CHOU HSIAO-LAN	C/O HSIAO-LAN CHOU	10 JAMIACAWAY #31	JAMAICA PLAIN MA	02130	10 JAMAICAWAY ST Apt 31	JAMAICA PLAIN	02130
BERKSHIRE INVESTMENTS LLC	C/O BERKSHIRE INV LLC	11 WALNUT HILL RD	CHESTNUT HILL MA	02467	10 JAMAICAWAY ST Apt 32	JAMAICA PLAIN	02130
SDS HOSPITALITY LLC	C/O SDS HOSPITALITY LLC	81 SOUTH HUNTINGTON AVENUE	BOSTON MA	02130	81 S HUNTINGTON AV	BOSTON	02199
CEDAR VALLEY HOLDINGS LLC	C/O ANTHONY M NADER	895 HUNTINGTON AV STE 1	BOSTON MA	02115	S HUNTINGTON AV	BOSTON	02199
COMMONWEALTH OF MASS		105 HUNTINGTON AV	BOSTON MA	02199	105 S HUNTINGTON AV	BOSTON	02199
AMERICAN CANCER SOCIETY	C/O DONALD J SPEEN MGR	30 SPEEN STREET	FRAMINGHAM MA	02130	125 S HUNTINGTON AV	BOSTON	02199
TRINITY CH HOUSE AGED		135 SO HUNTINGTON AVE	JAMAICA PLAIN MA	02130	135 S HUNTINGTON AV	BOSTON	02199
SHERRILL HOUSE INC		135 SO HUNTINGTON AV	JAMAICA PLAIN MA	02130	147 S HUNTINGTON AV	BOSTON	02199
BELL OLMSTEAD PARK LLC	C/O BELL PARTNERS INC	700 S WASHINGTON ST SUITE 250	ALEXANDRIA VA	22314	161 S HUNTINGTON AV	BOSTON	02115
ES JWAY LLC	C/O SAMUELS & ASSOCIATES	136 BROOKLINE AV	BOSTON MA	02115	201 S HUNTINGTON AV	BOSTON	02115
MT PLEASANT HOME		301 SO HUNTINGTON AVE	JAMAICA PLAIN MA	02130	301 S HUNTINGTON AV	BOSTON	02115
GUINANE MARILYN J TS	C/O MARILYN GUINANE TS	PO BOX 542	MANCHESTER MA	01944	218 JAMAICAWAY ST	JAMAICA PLAIN	02130
SISTERS OF NOTRE DAME		37 CASTLETON	JAMAICA PLAIN MA	02130	37 CASTLETON ST	JAMAICA PLAIN	02130
MORALES OSCAR		236 JAMAICAWAY ST	JAMAICA PLAIN MA	02130	234 JAMAICAWAY ST	JAMAICA PLAIN	02130
TWO-32 JAMAICAWAY CONDO	C/O JOHN OMALLEY TS	232 JAMAICAWAY ST	JAMAICA PLAIN MA`	02130	232 JAMAICAWAY ST	JAMAICA PLAIN	02130
PASKO MARIAN L	C/O MARIAN L PASKO	232 JAMAICAWAY # 1	JAMAICA PLAIN MA	02130	232 JAMAICAWAY Apt 1	JAMAICA PLAIN	02130
WILLIM ROBERT D	C/O ROBERT D WILLIM	232 JAMAICAWAY # 2	JAMAICA PLAIN MA	02130	232 JAMAICAWAY Apt 2	JAMAICA PLAIN	02130
TWO 26 JAMAICAWAY CONDO TR		226 JAMAICAWAY	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST	JAMAICA PLAIN	02130
NELSON JEREMY P		226 JAMAICAWAY #S	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt S	JAMAICA PLAIN	02130
FULLWOOD ERIKA	C/O ERIKA FULLWOOD`	226 JAMAICAWAY ST #1	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 1	JAMAICA PLAIN	02130
CHARMCHI MAJID	C/O MAJID CHARMCHI	226 JAMAICAWAY ST #2	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 2	JAMAICA PLAIN	02130
YIP DESMOND	C/O DESMOND YIP	226 JAMAICAWAY ST #3	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 3	JAMAICA PLAIN	02130
MUKHERJEE PRITHWISH		226 JAMAICAWAY ST #4	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 4	JAMAICA PLAIN	02130
LIN WILLIAM Y	C/O WILLIAM Y LIN	226 JAMAICAWAY ST # 5	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
WENDY KWONG IRREVOCABLE	C/O CHEE KWONG	159 BEACON ST	BOSTON MA	02116	226 JAMAICAWAY ST Apt 6	JAMAICA PLAIN	02130
SANCHEZ EDGARD		145 ADAMS ST	MILTON MA	02186	226 JAMAICAWAY ST Apt 7	JAMAICA PLAIN	02130
O'MALLEY MAT		226 JAMAICAWAY #8	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 8	JAMAICA PLAIN	02130
LIN WILLIAM Y	C/O WILLIAM LIN	226 JAMAICAWAY #9	JAMAICA PLAIN MA	02130	226 JAMAICAWAY ST Apt 9	JAMAICA PLAIN	02130
224 JAMAICAWAY LLC	C/O 224 JAMAICAWAY LLC	575 BOYLSTON ST	BOSTON MA	02116	224 JAMAICAWAY ST	JAMAICA PLAIN	02130
COHEN JOSHUA	C/O CECILE M COHEN	240 JAMAICAWAY ST	JAMAICA PLAIN MA	02130	240 JAMAICAWAY ST	JAMAICA PLAIN	02130
GIBSON CHRISTOPHER S	C/O CHRISTOPHER S GIBSON	32 CASTLETON ST	JAMAICA PLAIN MA	02130	32 CASTLETON ST	JAMAICA PLAIN	02130
STAAB PETER	C/O PETER STAAB/RACHEL TUNICK	6 PARKWOOD TE	JAMAICA PLAIN MA	02130	6 PARKWOOD TE	JAMAICA PLAIN	02130
LIU JUNKE	C/O YAN QUI	244 JAMAICAWAY	JAMAICA PLAIN MA	02130	244 JAMAICAWAY ST	JAMAICA PLAIN	02130
FORESTVIEW CONDO TR	C/O KERRI PAYNE	630 SMITHFIELD RD #1116	N PROVIDENCE RI	02904	242 JAMAICAWAY ST	JAMAICA PLAIN	02130
HART XIOMARA	C/O XIOMARA HART	242 JAMAICAWAY #6	JAMAICA PLAIN MA	02130	242 JAMAICAWAY Apt 6	JAMAICA PLAIN	02130
NATHAN MUKUND	C/O MUKUND NATHAN	242 JAMAICAWAY #1	JAMAICA PLAIN MA	02130	242 JAMAICAWAY ST Apt 1	JAMAICA PLAIN	02130
WONG KIMBERLY A	WELLS FARGO / TAX DEPT	1 HOME CAMPUS	DES MOINES IA	02130	242 JAMAICAWAY ST Apt 2	JAMAICA PLAIN	02130
PLANTE RAYMOND J	C/O RAYMOND J PLANTE	242 JAMAICAWAY ST #3	JAMAICA PLAIN MA	02130	242 JAMAICAWAY ST Apt 3	JAMAICA PLAIN	02130
DESCHENES PAULA	C/O PAULA NARENKIRICIUS	242 JAMAICAWAY ST #4	JAMAICA PLAIN MA	02130	242 JAMAICAWAY ST Apt 4	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
GUARINO ANTHONY J	C/O ANTHONY J GUARINO	242 JAMAICAWAY #5	JAMAICA PLAIN MA	02130	242 JAMAICAWAY ST Apt 5	JAMAICA PLAIN	02130
SCHWANINGER SHERRI		5 PARKWOOD TE	JAMAICA PLAIN MA	02130	5 PARKWOOD TE	JAMAICA PLAIN	02130
JAMAICAWAY TOWER & TOWNHOUSE	JAMAICAWAY TOWER	111 PERKINS ST	JAMAICA PLAIN MA	02130	111 PERKINS ST	JAMAICA PLAIN	02130
MANSION HOUSE		332 JAMAICAWAY	JAMAICA PLAIN MA	02130	332 JAMAICAWAY ST	JAMAICA PLAIN	02130
MUEHE MICHAEL	C/O MICHAEL MUEHE	332 JAMAICAWAY #101	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 101	JAMAICA PLAIN	02130
HUTCHINSON KEVIN P		332 JAMAICAWAY #102	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 102	JAMAICA PLAIN	02130
NOWAK MICHAEL	C/O MICHAEL A NOWAK	247 HAMPSTEAD ST	METHUEN MA	01844	332 JAMAICAWAY Apt 104	JAMAICA PLAIN	02130
FELDMAN STEVEN		332 JAMAICAWAY #106	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 106	JAMAICA PLAIN	02130
ERGUN ZEYNEP	C/O ZEYNEP ERGUN	332 JAMAICAWAY #201	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 201	JAMAICA PLAIN	02130
GUO HAO	C/O HAO GUO	10 PERKINS SQ APT #11	BOSTON MA	02130	332 JAMAICAWAY Apt 202	JAMAICA PLAIN	02130
ZHANG HONGWEI	C/O HONGWEI ZHANG	332 JAMAICAWAY #203	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 203	JAMAICA PLAIN	02130
SHARIFI MAHNOOSH	C/O MAHNOOSH SHARIFI	332 JAMAICAWAY #204	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 204	JAMAICA PLAIN	02130
PARETO MARCOS POMPEU	C/O MARCOS POMPEU PARETO	6 SARGENT ST	CAMBRIDGE MA	02140	332 JAMAICAWAY Apt 205	JAMAICA PLAIN	02130
MCLEAN MARILYN	C/O MARILYN T MCLEAN	332 JAMAICAWAY #206	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 206	JAMAICA PLAIN	02130
JU AIHUA	C/O AIHUA JU	332 JAMAICAWAY #207	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 207	JAMAICA PLAIN	02130
NING PEI-CHEN		332 JAMAICAWAY #208	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 208	JAMAICA PLAIN	02130
DELANEY MIRIAM F		332 JAMAICAWAY #301	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 301	JAMAICA PLAIN	02130
PAPAZOVA PETYA T	C/O PETYA T PAPAZOVA	332 JAMAICAWAY #302	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 302	JAMAICA PLAIN	02130
SHANKAR RAVI N	C/O RAVI N SHANKAR	3 DOUGLAS RD	WESTFORD MA	01886	332 JAMAICAWAY Apt 303	JAMAICA PLAIN	02130
MA YIJIE	C/O YIJIE MA	332 JAMAICAWAY #304	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 304	JAMAICA PLAIN	02130
BERARDUCCI VILMA		PO BOX 130315	BOSTON MA	02113	332 JAMAICAWAY Apt 305	JAMAICA PLAIN	02130
RAHIMI HAJIR	C/O HAJIR RAHIMI	332 JAMAICAWAY #306	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 306	JAMAICA PLAIN	02130
KILLORAN FRANCIS X		332 JAMAICAWAY #307	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 307	JAMAICA PLAIN	02130
SCAROLA MICHAEL	C/O MICHAEL SCAROLA	332 JAMAICAWAY #308	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 308	JAMAICA PLAIN	02130
CRAWFORD-GREY HEATHER		332 JAMAICAWAY #401	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 401	JAMAICA PLAIN	02130
DELMA Y JARRETT REVOCABLE	C/O DELMAY JARRETT	332 JAMAICAWAY #402	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 402	JAMAICA PLAIN	02130
BUTANEY RANJAN		6 CYNTHIA RD	NEWTON MA	02459	332 JAMAICAWAY Apt 403	JAMAICA PLAIN	02130
LIN INVESTMENT LP	C/O LIN INVESTMENT LP	15550 S 5TH AV #227	PHOENIX AZ	85045	332 JAMAICAWAY Apt 404	JAMAICA PLAIN	02130
SMITH SHAWN		332 JAMAICAWAY #405	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 405	JAMAICA PLAIN	02130
DESANTIS-KINDER DOREEN		332 JAMAICAWAY # 406	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 406	JAMAICA PLAIN	02130
NING MINGMING	C/O MINGMING NING	332 JAMAICAWAY #1	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 1	JAMAICA PLAIN	02130
WONG SIU LING	C/O SIU LING WONG	332 JAMAICAWAY #2	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 2	JAMAICA PLAIN	02130
332 JAMAICAWAY UNIT 3 REALTY	FARAHMAND REAL ESTATE LLC	6 GRAYSTONE CIR	WINCHESTER MA	01890	332 JAMAICAWAY Apt 3	JAMAICA PLAIN	02130
CHILDRENS ORTHOPAEDIC	C/O CHILDRENS ORTHOPAEDIC SURGERY FOUNDATION INC	332 JAMAICAWAY #4	JAMAICA PLAIN MA	02130	332 JAMAICAWAY	JAMAICA PLAIN	02130
MINGUET FERNANDO BOSCH	C/O FERNANDO BOSCH MINGUET	332 JAMAICAWAY #5	JAMAICA PLAIN MA	02130	332 JAMAICAWAY Apt 5	JAMAICA PLAIN	02130
RUDIE CORAL	C/O CORAL RUDIE	137 PETERBOROUGH ST #32	BOSTON MA	02215	332 JAMAICAWAY Apt 6	JAMAICA PLAIN	02130
BARNES EVENLYN F	C/O EVENLYN F BARNES	120 PERKINS ST	JAMAICA PLAIN MA	02130	120 PERKINS ST	JAMAICA PLAIN	02130
CABOT ESTATE CONDO TR		241 PERKINS ST	JAMAICA PLAIN MA	02130	175 PERKINS ST	JAMAICA PLAIN	02130
GELINAS ELAINE T	C/O ELAINE T GELINAS	241 PERKINS ST #H101	JAMAICA PLAIN MA	02130	203 PERKINS ST Apt H-101	JAMAICA PLAIN	02130
VANDAM GERALD H		203 PERKINS ST #H102	JAMAICA PLAIN MA	02130	203 PERKINS ST Apt H-102	JAMAICA PLAIN	02130
SUDALTER ARLENE		205 PERKINS ST #H-201	JAMAICA PLAIN MA	02130	205 PERKINS ST Apt H-201	JAMAICA PLAIN	02130
LERAT ANDREE		241 PERKINS H202	JAMAICA PLAIN MA	02130	205 PERKINS ST Apt H-202	JAMAICA PLAIN	02130
ZITTING KIRSI-MARJA	C/O KIRSI-MARJA ZITTING	207 PERKINS ST #H-301	JAMAICA PLAIN MA	02130	207 PERKINS ST Apt H-301	JAMAICA PLAIN	02130
BAYLEY PATRICIA T	C/O PATRICIA TAGLIATELA	1621 STATE ST	NEW HAVEN CT	06511	207 PERKINS ST Apt H-302	JAMAICA PLAIN	02130
GREENE ALAN G		209 PERKINS ST #H-401	JAMAICA PLAIN MA	02130	209 PERKINS ST Apt H-401	JAMAICA PLAIN	02130
KOKOMO REALTY TRUST	C/O NANCY I BLUEWEISS TS	209 PERKINS ST #H-402	JAMAICA PLAIN MA	02130	209 PERKINS ST Apt H-402	JAMAICA PLAIN	02130
ARNOLD ROBERT	C/O ROBERT ARNOLD	241 PERKINS ST #H501	JAMAICA PLAIN MA	02130	211 PERKINS ST Apt H-501	JAMAICA PLAIN	02130
FINKELSTEIN ALEXANDER	C/O ALEXANDER FINKELSTEIN	241 PERKINS ST #H-502	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt H-502	JAMAICA PLAIN	02130
NGUYEN CHI HUU		213 PERKINS ST #H-601	JAMAICA PLAIN MA	02130	213 PERKINS ST Apt H-601	JAMAICA PLAIN	02130
BERMAN SARA		241 PERKINS ST #H-602	JAMAICA PLAIN MA	02130	213 PERKINS ST Apt H-602	JAMAICA PLAIN	02130
PECKINS CHRISTOPHER S	C/O CHRISTOPHER PECKINS	241 PERKINS ST #I-101	JAMAICA PLAIN MA	02130	201 PERKINS ST Apt I-101	JAMAICA PLAIN	02130
EAGLESON BEVERLY G		201 PERKINS ST #I-102	JAMAICA PLAIN MA	02130	201 PERKINS ST Apt I-102	JAMAICA PLAIN	02130
PHILIP A STYMFAL LIVING	C/O PHILIP A STYMFAL	241 PERKINS ST I-201	JAMAICA PLAIN MA	02130	199 PERKINS ST Apt I-201	JAMAICA PLAIN	02130
PANTEKIDIS JOHN		199 PERKINS ST # I-202	JAMAICA PLAIN MA	02130	199 PERKINS ST Apt I-202	JAMAICA PLAIN	02130
VOGEL TOBY P		241 PERKINS ST #I-301	JAMAICA PLAIN MA	02130	197 PERKINS ST Apt I-301	JAMAICA PLAIN	02130
FIRST CABOT LLC	C/O MARY ANN STEVENSON	130 LAGRANE ST	CHESTNUT HILL MA	02467	197 PERKINS ST Apt I-302	JAMAICA PLAIN	02130
JACOBSON ARTHUR B ETAL		241 PERKINS ST #1-401	JAMAICA PLAIN MA	02130	195 PERKINS ST Apt I-401	JAMAICA PLAIN	02130
BOBROFF CAREN K	C/O CAREN K BOBROFF	195 PERKINS ST #I-402	JAMAICA PLAIN MA	02130	195 PERKINS ST Apt I-402	JAMAICA PLAIN	02130
RENNKE HELMUT G	C/O HELMUT G RENNKE	241 PERKINS ST UNIT I-501	JAMAICA PLAIN MA	02130	193 PERKINS ST Apt I-501	JAMAICA PLAIN	02130
HENDERSON TANYA E	C/O TANYA E HENDERSON	326 HARVARD ST	CAMBRIDGE MA	02139	193 PERKINS ST Apt I-502	JAMAICA PLAIN	02130
NINO SUSANA VIRNA	C/O HERNAN KOPCOW	191 PERKINS ST #I 601	JAMAICA PLAIN MA	02130	191 PERKINS ST Apt I-601	JAMAICA PLAIN	02130
MONROE DANI	C/O DANI MONROE	191 PERKINS ST UNIT I-602	BOSTON MA	02130	191 PERKINS ST Apt I-602	JAMAICA PLAIN	02130
STUBBLEFIELD LINDA A TS	C/O LINDA STUBBLEFIELD TS	189 PERKINS ST #J-101	JAMAICA PLAIN MA	02130	189 PERKINS ST Apt J-101	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
MARKS MINDY	C/O MINDY MARKS	189 PERKINS ST # J-102	JAMAICA PLAIN MA	02130	189 PERKINS ST Apt J-102	JAMAICA PLAIN	02130
BENOFF MITCHELL J	C/O MITCHELL J BENOFF	187 PERKINS ST #J-201	JAMAICA PLAIN MA	02130	187 PERKINS ST Apt J-201	JAMAICA PLAIN	02130
BACHMAN KATHARINE E	C/O KATHARINE E BACHMAN	241 PERKINS ST J-202	JAMAICA PLAIN MA	02130	187 PERKINS ST Apt J-202	JAMAICA PLAIN	02130
SHORT CHARLES L JR		185 PERKINS ST #J-301	JAMAICA PLAIN MA	02130	185 PERKINS ST Apt J-301	JAMAICA PLAIN	02130
DHEKNE RASIKA	C/O RASIKA DHEKNE	185 PERKINS # J-302	JAMAICA PLAIN MA	02130	185 PERKINS ST Apt J-302	JAMAICA PLAIN	02130
BUKHMAN YEFIM		183 PERKINS ST #J-401	JAMAICA PLAIN MA	02130	183 PERKINS ST Apt J-401	JAMAICA PLAIN	02130
FIRST CABOT LLC	C/O MARY ANN STEVENSON	130 LAGRANGE ST	CHESTNUT HILL MA	02467	183 PERKINS ST Apt J-402	JAMAICA PLAIN	02130
FREEMAN PHYLLIS	C/O PHILLIS S FREEMAN	241 PERKINS ST # J-501	JAMAICA PLAIN MA	02130	181 PERKINS ST Apt J-501	JAMAICA PLAIN	02130
GLECKMAN BRENDA	C/O BRENDA GLECKMAN	241 PERKINS ST #J-502	JAMAICA PLAIN MA	02130	181 PERKINS ST Apt J-502	JAMAICA PLAIN	02130
FREEDMAN CAROL D	C/O CAROL FREEDMAN	241 PERKINS ST #J-601	BOSTON MA	02130	179 PERKINS ST Apt J-601	JAMAICA PLAIN	02130
BLANK HELAINE S		241 PERKINS ST #J-602	JAMAICA PLAIN MA	02130	179 PERKINS ST Apt J-602	JAMAICA PLAIN	02130
EDELSON FAMILY REALTY TRUST	C/O RAE T EDELSON	177 PERKINS ST #J-701 #	JAMAICA PLAIN MA	02130	177 PERKINS ST Apt J-701	JAMAICA PLAIN	02130
YOUN JENNY KIM	C/O JENNY KIM YOUN	177 PERKINS ST #J-702	JAMAICA PLAIN MA	02130	177 PERKINS ST Apt J-702	JAMAICA PLAIN	02130
GOLD BRUCE A	C/O BRUCE A GOLD	241 PERKINS ST #J-801	JAMAICA PLAIN MA	02130	175 PERKINS ST Apt J-801	JAMAICA PLAIN	02130
THANOS ELEANOR	C/O JO-AN GLADSTONE	175 PERKINS ST #J-802	JAMAICA PLAIN MA	02130	175 PERKINS ST Apt J-802	JAMAICA PLAIN	02130
BENNETT MICHAEL I MD	C/O MICHAEL I BENNETT MD	241 PERKINS ST #B- 801	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt B-801	JAMAICA PLAIN	02130
LEVINE RICHARD E TS	C/O RICHARD E LEVINE TS	281 PERKINS ST B-802	JAMAICA PLAIN MA	02130	281 PERKINS ST Apt B-802	JAMAICA PLAIN	02130
GROSS-TORRES ROBERTA		283 PERKINS ST #B-701	JAMAICA PLAIN MA	02130	283 PERKINS ST Apt B-701	JAMAICA PLAIN	02130
HERSCHBERG JUDITH		283 PERKINS ST #B-702	JAMAICA PLAIN MA	02130	283 PERKINS ST Apt B-702	JAMAICA PLAIN	02130
WALSH CHRISTOPHER T	C/O CHRISTOPHER T WALSH HEMENWAY & BARNES LLP	75 STATE ST 16TH FL	BOSTON MA	02109	285 PERKINS ST Apt B-601	JAMAICA PLAIN	02130
KEATING DANIEL J	C/O DANIEL J KEATING	285 PERKINS ST #B-602	JAMAICA PLAIN MA	02130	285 PERKINS ST Apt B-602	JAMAICA PLAIN	02130
GOORIN ALLEN		241 PERKINS ST #B-501	JAMAICA PLAIN MA	02130	287 PERKINS ST Apt B-501	JAMAICA PLAIN	02130
MITCHELL CHRISTINE I	C/O CHRISTINE I MITCHELL	241 PERKINS ST #B-502	JAMAICA PLAIN MA	02130	287 PERKINS ST Apt B-502	JAMAICA PLAIN	02130
BARON JOEL H	C/O JOEL H BARON	241 PERKINS ST #B-401	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt B-401	JAMAICA PLAIN	02130
FITZGERALD DANIEL J	C/O DANIEL J FITZGERALD	241 PERKINS ST UNIT B-402	BOSTON MA	02130	289 PERKINS ST Apt B-402	JAMAICA PLAIN	02130
NEW ENG MERCHANTS NATL BANK	C/O HARDING & CARBONE INC	1235 NORTH LOOP WEST #205	HOUSTON TX	77008	291 PERKINS ST Apt B-301	JAMAICA PLAIN	02130
LYONS WILLIAM C	C/O WILLIAM C. LYONS	291 PERKINS ST #B-302	JAMAICA PLAIN MA	02130	291 PERKINS ST Apt B-302	JAMAICA PLAIN	02130
FRANCESCHINI EDI	C/O EDI FRANCESCHINI	241 PERKINS ST # B201	JAMAICA PLAIN MA	02130	293 PERKINS ST Apt B-201	JAMAICA PLAIN	02130
SOLER ANDREA C		293 PERKINS ST #B202	JAMAICA PLAIN MA	02130	293 PERKINS ST Apt B-202	JAMAICA PLAIN	02130
LINK DAVID A	C/O DAVID A LINK	295 PERKINS ST #B-101	JAMAICA PLAIN MA	02130	295 PERKINS ST Apt B-101	JAMAICA PLAIN	02130
BERGER-SWEENEY JOANNE	C/O JOANNE BERGER-SWEENEY	241 PERKINS ST #B-102	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt B-102	JAMAICA PLAIN	02130
KANTROVITZ SHERWIN L		297 PERKINS ST #A-101	JAMAICA PLAIN MA	02130	297 PERKINS ST Apt A-101	JAMAICA PLAIN	02130
ROSS DEBRA A	C/O DEBRA A ROSS	241 PERKINS ST #A-102	JAMAICA PLAIN MA	02130	297 PERKINS ST Apt A-102	JAMAICA PLAIN	02130
OBRIEN JOHN	C/O JOHN OBRIEN	241 PERKINS ST #A-201	JAMAICA PLAIN MA	02130	299 PERKINS ST Apt A-201	JAMAICA PLAIN	02130
CAMILLERI JOHN C	C/O JOHN C CAMILLERI	241 PERKINS ST #A-202	JAMAICA PLAIN MA	02130	299 PERKINS ST Apt A-202	JAMAICA PLAIN	02130
DANIEL J FINN TRUST		303 PERKINS ST #A-301	JAMAICA PLAIN MA	02130	303 PERKINS ST Apt A-301	JAMAICA PLAIN	02130
PORTNOY SYLVIA TS		241 PERKINS ST #A-302	JAMAICA PLAIN MA	02130	303 PERKINS ST Apt A-302	JAMAICA PLAIN	02130
FREELEY ANN MARIE		305 PERKINS ST #A-401	JAMAICA PLAIN MA	02130	305 PERKINS ST Apt A-401	JAMAICA PLAIN	02130
MIZUNO IKUKO		305 PERKINS ST #A-402	JAMAICA PLAIN MA	02130	305 PERKINS ST Apt A-402	JAMAICA PLAIN	02130
SCHAFF GLEN	C/O GLEN SCHAFF	307 PERKINS ST #A-501	JAMAICA PLAIN MA	02130	307 PERKINS ST Apt A-501	JAMAICA PLAIN	02130
EIDELMAN GERALD P		307 PERKINS ST #A-502	JAMAICA PLAIN MA	02130	307 PERKINS ST Apt A-502	JAMAICA PLAIN	02130
GREENES ROBERT A ETAL		11821 S TUZIGOOT CT	PHOENIX AZ	85044	309 PERKINS ST Apt A-601	JAMAICA PLAIN	02130
BERNSTEIN DAVID P		241 PERKINS ST #A-602	JAMAICA PLAIN MA	02130	309 PERKINS ST Apt A-602	JAMAICA PLAIN	02130
UPTON LINDA		255 PERKINS ST #D-101	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-101	JAMAICA PLAIN	02130
FIREMAN ROBERT N		255 PERKINS ST #D-104	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-104	JAMAICA PLAIN	02130
DIANE R SCHODLATZ 2014	C/O DIANE R SCHODLATZ	241 PERKINS ST #D-201	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-201	JAMAICA PLAIN	02130
LOCHIATTO CONSTANCE BE	C/O CONSTANCE LOCHIATTO	255 PERKINS ST #D-204	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-204	JAMAICA PLAIN	02130
MAURI GIACOMO	C/O GIACOMO MAURI	241 PERKINS STREET UNIT D-301	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-301	JAMAICA PLAIN	02130
AL MUTABAGANI OSAMA M H	C/O HUGH STARKEY	50 CONGRESS SUITE 925	BOSTON MA	02109	255 PERKINS ST Apt D-302	JAMAICA PLAIN	02130
MARKS EMILIE	C/O EMILIE MARKS	255 PERKINS ST #D-304	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-304	JAMAICA PLAIN	02130
BAYS SAMUEL D		241 PERKINS ST UN D-401	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt D-401	JAMAICA PLAIN	02130
GENSER JOAN		241 PERKINS ST #D402	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-402	JAMAICA PLAIN	02130
DROOKER DAVID S TS	C/O EMILIE DROOKER	241 PERKINS ST #404D	BOSTON MA	02130	255 PERKINS ST Apt D-404	JAMAICA PLAIN	02130
AXELROD BARUCH		241 PERKINS ST #D-405	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-405	JAMAICA PLAIN	02130
ASHTON JUDITH		241 PERKINS ST # D-501	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-501	JAMAICA PLAIN	02130
SHAEVEL WILLIAM H TS		255 PERKINS ST # D-502	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-502	JAMAICA PLAIN	02130
LAWS EDWARD JR	C/O EDWARD LAWS JR	241 PERKINS ST #D-503	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-503	JAMAICA PLAIN	02130
WEYERHAEUSER ROBERT M TS		332 MINNESOTA ST #2100	ST PAUL MN	55101	255 PERKINS ST Apt D-505	JAMAICA PLAIN	02130
OSPREY REALTY TRUST	C/O CHARLES C CUNNINGHAM JR	241 PERKINS ST #D-601	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt D-601	JAMAICA PLAIN	02130
BLACKBURN SUSAN KELLY	C/O SUSAN KELLY BLACKBURN	241 PERKINS ST #D-602	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt D-602	JAMAICA PLAIN	02130
LITCHTENSTEIN NORMAN S	C/O NORMAN S LICHTENSTEIN	255 PERKINS ST #D604	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-604	JAMAICA PLAIN	02130
ALLEN HOWARD D TS	C/O HOWARD D ALLEN	241 PERKINS ST #D605	JAMAICA PLAIN MA	02130	255 PERKINS ST Apt D-605	JAMAICA PLAIN	02130
LYNNE G SALZMAN TRUST 2010	C/O LYNNE G SALZMAN	241 PERKINS ST #C101	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-101	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
CLINE LUCILLE G		241 PERKINS ST	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-103	JAMAICA PLAIN	02130
AARONS PAMELA	C/O PAMELA AARONS	1 GROVE ISLE DR PH2	COCONUT GROVE FL	33133	275 PERKINS ST Apt C-105	JAMAICA PLAIN	02130
BLOCK MOLLYE S	C/O FELDBERY FMY OFFICE/CINDY VALLEY	PO BOX 9195	FRAMINGHAM MA	01701	241 PERKINS ST Apt C-107	JAMAICA PLAIN	02130
SCHWARTZ JANICE H		275 PERKINS ST #C-201	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-201	JAMAICA PLAIN	02130
DAWN B COLSIA REVOCABLE	C/O DAWN B COLSIA	241 PERKINS ST. UNIT C-202	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt C-202	JAMAICA PLAIN	02130
LEVEY MITCHELL	C/O MITCHELL LEVEY	241 PERKINS #C-203	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-203	JAMAICA PLAIN	02130
WEBB STEPHEN		241 PERKINS ST # C-204	BOSTON MA	02130	275 PERKINS ST Apt C-204	JAMAICA PLAIN	02130
MORSE HERBERT E	C/O HERBERT E MORSE	241 PERKINS ST #C-205	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-205	JAMAICA PLAIN	02130
HYMAN ANDREW A	C/O ANDREW A HYMAN	241 PERKINS ST #C-206	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-206	JAMAICA PLAIN	02130
BOINVEST SA	C/O PATRICK RILEY	117 KENDRICK ST STE 800	NEEDHAM MA	02494	275 PERKINS ST Apt C-208	JAMAICA PLAIN	02130
KINGSDALE JON	C/O JON KINGSDALE	241 PERKINS ST #C-210	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-210	JAMAICA PLAIN	02130
DHEKNE RASIKA	C/O RASIKA DHEKNE	241 PERKINS ST #C302	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-302	JAMAICA PLAIN	02130
MARTIN GORDON A JR	C/O GORDON A MARTIN JR	241 PERKINS ST #C-303	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-303	JAMAICA PLAIN	02130
BONIN ROBERT M	C/O ROBERT M BONIN	241 PERKINS ST	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-304	JAMAICA PLAIN	02130
GIBBS SANDRA KAY	C/O SANDRA KAY GIBBS	241 PERKINS ST # C-305	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-305	JAMAICA PLAIN	02130
HADAR GIORA	C/O GIORA HADAR	241 PERKINS ST UNIT C-306	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-306	JAMAICA PLAIN	02130
MICHELSON JOSEPH S	C/O JOSEPH S MICHELSON	241 PERKINS ST #C-401	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-401	JAMAICA PLAIN	02130
RASKY LAWRENCE B	C/O LAWRENCE B RASKY	275 PERKINS ST UNIT C-402	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-402	JAMAICA PLAIN	02130
KASHKET SHELBY TS	C/O SHELBY KASHKET TS	275 PERKINS ST # C-403	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-403	JAMAICA PLAIN	02130
FARBER DAVID		241 PERKINS ST #C-404	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-404	JAMAICA PLAIN	02130
ROSENBLATT MALCOLM TS		275 PERKINS ST #C-405	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-405	JAMAICA PLAIN	02130
JONES ANN HOWARD	C/O ANN HOWARD JONES	241 PERKINS ST #C-406	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-406	JAMAICA PLAIN	02130
RINGVALD MIGUEL	C/O MIGUEL RINGVALD	275 PERKINS ST #C-407	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-407	JAMAICA PLAIN	02130
KATHERINE S TALLMAN TRUST	C/O KATHERINE S TALLMAN	241 PERKINS ST #C-504	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt C-504	JAMAICA PLAIN	02130
PORTER STEPHEN	C/O P KELLOGG & S PORTER	241 PERKINS ST C-505	BOSTON MA	02130	275 PERKINS ST Apt C-505	JAMAICA PLAIN	02130
MILLER DAVID		241 PERKINS ST 3C-601	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-601	JAMAICA PLAIN	02130
KETTELL JOHN D TS	C/O JOHN D KETTELL TS	241 PERKINS ST #C-603	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-603	JAMAICA PLAIN	02130
DUNKLESS JACK		241 PERKINS ST #C-605	JAMAICA PLAIN MA	02130	275 PERKINS ST Apt C-605	JAMAIA PLAIN	02130
HENNIG SUZANNE		241 PERKINS ST #E-101	JAMAICA PLAIN MA	02130	215 PERKINS ST Apt E-101	JAMAICA PLAIN	02130
LEVIN SUSAN R	C/O SUSAN LEVIN	241 PERKINS ST #E-102	JAMAICA PLAIN MA	02130	215 PERKINS ST Apt E-102	JAMAICA PLAIN	02130
LEHR DONNA H	C/O DONNA H LEHR	241 PERKINS ST #E-103	JAMAICA PLAIN MA	02130	215 PERKINS ST Apt E-103	JAMAICA PLAIN	02130
GLADYSHEVA INNA PAVLOVNA	C/O INNA PAVLOVNA GLADYSHEVA	215 PERKINS ST #E-104	JAMAICA PLAIN MA	02130	215 PERKINS ST Apt E-104	JAMAICA PLAIN	02130
NUNEZ LOIS A		217 PERKINS ST #E-201	JAMAICA PLAIN MA	02130	217 PERKINS ST Apt E-201	JAMAICA PLAIN	02130
KITCHEN NICHOLAS		217 PERKINS ST #E-202	JAMAICA PLAIN MA	02130	217 PERKINS ST Apt E-202	JAMAICA PLAIN	02130
EL-CHEMALI ZEINA		241 PERKINS ST #E-203	JAMAICA PLAIN MA	02130	217 PERKINS ST Apt E-203	JAMAICA PLAIN	02130
COPE RUTH S		241 PERKINS ST #E-204	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt E-204	JAMAICA PLAIN	02130
RISSMAN BARBARA		219 PERKINS ST #E-301	JAMAICA PLAIN MA	02130	219 PERKINS ST Apt E-301	JAMAICA PLAIN	02130
STEARNS ROBERT		241 PERKINS ST #E302	JAMAICA PLAIN MA	02130	219 PERKINS ST Apt E-302	JAMAICA PLAIN	02130
YANG EDWARD	C/O EDWARD YANG	241 PERKINS ST #E-303	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt E-303	JAMAICA PLAIN	02130
FIRESTONE JACOLYN TS		241 PERKINS ST #E-304	JAMAICA PLAIN MA	02130	219 PERKINS ST Apt E-304	JAMAICA PLAIN	02130
KRINSKY LESLIE		241 PERKINS ST #E-401	JAMAICA PLAIN MA	02130	221 PERKINS ST Apt E-401	JAMAICA PLAIN	02130
ASKIN SANDY X	C/O SANDY X ASKIN	241 PERKINS ST #E402	JAMAICA PLAIN MA	02130	221 PERKINS ST Apt E-402	JAMAICA PLAIN	02130
LAI MICHELLE	C/O MICHELLE LAI	241 PERKINS ST #E-403	JAMAICA PLAIN MA	02130	221 PERKINS ST Apt E-403	JAMAICA PLAIN	02130
FREILICH ANDREW		241 PERKINS ST # E404	JAMAICA PLAIN MA	02130	221 PERKINS ST Apt E-404	JAMAICA PLAIN	02130
CASSIDY MICHAEL P	C/O PAULA CASSIDY	223 PERKINS ST #E 501	JAMAICA PLAIN MA	02130	223 PERKINS ST Apt E-501	JAMAICA PLAIN	02130
NUTTING PATRICIA R	C/O PATRICIA R NUTTING	223 PERKINS ST #E502	JAMAICA PLAIN MA	02130	223 PERKINS ST Apt E-502	JAMAICA PLAIN	02130
LAPETS OKSANA	C/O OKSANA LAPETS	85 BRAINERD RD #2	ALLSTON MA	02134	223 PERKINS ST Apt E-503	JAMAICA PLAIN	02130
DEMAS VASILIKI	C/O VASILIKI DEMAS	241 PERKINS ST #E-504	JAMAICA PLAIN MA	02130	223 PERKINS ST Apt E-504	JAMAICA PLAIN	02130
RAWAL KADAMBARI	C/O KADAMBARI RAWAL	225 PERKINS ST #F-101	JAMAICA PLAIN MA	02130	225 PERKINS ST Apt F-101	JAMAICA PLAIN	02130
GHAYUR-MOHSINI REALTY TRUST	C/O TARIQ GHAYUR	241 PERKINS ST #F-102	JAMAICA PLAIN MA	02130	225 PERKINS ST Apt F-102	JAMAICA PLAIN	02130
REA PATRICIA A		241 PERKINS ST #F103	JAMAICA PLAIN MA	02130	225 PERKINS ST Apt F-103	JAMAICA PLAIN	02130
LEVEY DREW	C/O DREW LEVEY	241 PERKINS ST #F-104	JAMAICA PLAIN MA	02130	225 PERKINS ST Apt F-104	JAMAICA PLAIN	02130
SHUMAN ELIZABETH A	C/O ELIZABETH A SHUMAN	241 PERKINS ST #F-201	JAMAICA PLAIN MA	02130	227 PERKINS ST Apt F-201	JAMAICA PLAIN	02130
HASIDA KORPER TRUST	C/O MALKA RAISZ	241 PERKINS ST #F-202	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt F-202	JAMAICA PLAIN	02130
SHPIGEL NATALIE	C/O NATALIE SHPIGEL	227 PERKINS ST #F-203	BOSTON MA	02130	227 PERKINS ST Apt F-203	JAMAICA PLAIN	02130
LEVINE ELAINE P		241 PERKINS ST #F-204	JAMAICA PLAIN MA	02130	227 PERKINS ST Apt F-204	JAMAICA PLAIN	02130
LIMONIC ISAAC A		229 PERKINS ST #F-301	JAMAICA PLAIN MA	02130	229 PERKINS ST Apt F-301	JAMAICA PLAIN	02130
KREINDEL EDUARDO D	C/O EDUARDO D KREINDEL	229 PERKINS ST #F-302	JAMAICA PLAIN MA	02130	229 PERKINS ST Apt F-302	JAMAICA PLAIN	02130
PACINI STEFANO A		65 OLD ENGLAND RD &	NEWTON MA	02467	229 PERKINS ST Apt F-303	JAMAICA PLAIN	02130
PACINI ANGELA F		65 OLD ENGLAND RD &	NEWTON MA	02467	229 PERKINS ST Apt F-304	JAMAICA PLAIN	02130
CARBAJAL ANJELICA	C/O ANJELICA CARBAJAL	233 PERKINS ST F-401	JAMAICA PLAIN MA	02130	233 PERKINS ST Apt F-401	JAMAICA PLAIN	02130
KOTSIKONAS ANASTASIOS		241 PERKINS ST #F402	BOSTON MA	02130	233 PERKINS ST Apt F-402	JAMAICA PLAIN	02130
BODUR MURAT		241 PERKINS ST #F-403	JAMAICA PLAIN MA	02130	233 PERKINS ST Apt F-403	JAMAICA PLAIN	02130

OWNER	ADDRESSEE	MLG_ADDRESS	MLG_CITYSTATE	MLG_ZIPCODE	LOC_ADDRESS	LOC_CITY	LOC_ZIPCODE
MALKIN MACCABIT	C/O MACCABIT MALKIN	233 PERKINS ST #F-404	JAMAICA PLAIN MA	02130	233 PERKINS ST Apt F-404	JAMAICA PLAIN	02130
POLITCH JOSEPH		241 PERKINS ST #F-501	JAMAICA PLAIN MA	02130	235 PERKINS ST Apt F-501	JAMAICA PLAIN	02130
RIVERA RAMON A	C/O RAMON A RIVERA	241 PERKINS ST #F-502	JAMAICA PLAIN MA	02130	235 PERKINS ST Apt F-502	JAMAICA PLAIN	02130
KITCHEN NICHOLAS J		241 PERKINS ST #503	JAMAICA PLAIN MA	02130	235 PERKINS ST Apt F-503	JAMAICA PLAIN	02130
SINGH JYOTI	C/O JYOTI SINGH	241 PERKINS ST #F-504	JAMAICA PLAIN MA	02130	235 PERKINS ST Apt F-504	JAMAICA PLAIN	02130
WEISTROP JONATHAN S	C/O JONATHAN S WEISTROP	241 PERKINS ST #G-101	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt G-101	JAMAICA PLAIN	02130
MARINO SERGIO		241 PERKINS ST #G-102	JAMAICA PLAIN MA	02130	241 PERKINS ST Apt G-102	JAMAICA PLAIN	02130
PARISH OF HOLY TRINITY		165 PARK DRIVE	BOSTON MA	02215	165 PARK DR	BOSTON	02215
PRESIDENT & FELLOWS OF HARVARD COLLEGE		1350 MASSACHUSETTS AV	CAMBRIDGE MA	02138	PARK DR	BOSTON	02215
LEVENSON NORMAN A TRST		896 BEACON ST	BOSTON MA	02215	191 PARK DR	BOSTON	02215
LEVENSON NORMAN A TRST		896 BEACON ST	BOSTON MA	02215	195 PARK DR	BOSTON	02215
PRESIDENT & FELLOWS		199 PARK DR	BOSTON MA	02215	199 PARK DR	BOSTON	02215
LDJ DEVELOPMENT LLC	C/O PREMIER PROPERTY SOLUTIONS	311 SUMMER ST	BOSTON MA	02210	211 PARK DR	BOSTON	02215
PARK DRIVE INC	C/O PRUDENTIAL ASSET RESOURCES	PO BOX 10082	VAN NUYS CA	91410	219 PARK DR	BOSTON	02215
GUINANE MARILYN J	C/O MARILYN J GUINANE TS	PO BOX 542	MANCHESTER MA	01944	227 PARK DR	BOSTON	02215
PARK 231-235 ASSOC LLC		1 WASHINGTON ST	WELLESLEY MA	02481	231 PARK DR	BOSTON	02215
STAR MARKET CO	C/O PROP TAX	PO BOX 990	MINNEAPOLIS MN	55440	PETERBOROUGH ST	BOSTON	02215
STAR MARKETS COMPANY INC	C/O STAR MARKETS COMPANY INC	75O WEST CENTER STREET	WEST BRIDGEWATER MA	02379	1390 BOYLSTON ST	BOSTON	02215
MASS DEPT OF TRANSPORTATION		10 PARK PLAZA SUITE 5610	BOSTON MA	02116	PARK DR	BOSTON	02215
LANDMARK CENTER OWNER LP	C/O JP MORGAN INV MGMT INC	245 PARK AVE	NEW YORK NY	10167	201 BROOKLINE AV	BOSTON	02215
ONE-HUNDRED MONMOUTH ST LLC	C/O ALLEN ASSOCIATES	PO BOX 590249	NEWTON CENTER MA	02459	146 ST MARYS ST	BOSTON	02215
AUDUBON CONDO ASSN		448 PARK DR	BOSTON MA	02215	448 PARK DR	BOSTON	02215
WALEZYK JOHN	C/O JOHN WALEZYK	448 PARK DR #K	BOSTON MA	02215	448 PARK DR Apt K	BOSTON	02215
SMITH MURRAY	C/O MURRAY SMITH	2522 ROUND POINTE DR	HAVERSTRAW NY	10927	448 PARK DR Apt J	BOSTON	02215
MAGLOCZKI THOMAS G	C/O THOMAS G MAGLOCZKI	659 MASSACHUSETTS AV #C	BOSTON MA	02119	448 PARK DR Apt 1	BOSTON	02215
BARAN ALESSANDRA	C/O ALESSANDRA BARAN	448 PARK DRIVE #18	BOSTON MA	02215	448 PARK DR Apt 2	BOSTON	02215
NIAMIR PARIVASHE	C/O NIAMIR PARIVASHE TS	81 MOSS HILL RD	JAMAICA PLAIN MA	02130	448 PARK DR Apt 3	BOSTON	02215
ZAMIR MARK	C/O MARK ZAMIR	448 PARK DR # 4	BOSTON MA	02215	448 PARK DR Apt 4	BOSTON	02215
WONG CINDY	C/O CINDY WONG	PO BOX 170637	BOSTON MA	02117	448 PARK DR Apt 5	BOSTON	02215
GIVERTZMAN PETER	C/O PETER GIVERTZMAN	68 MOULTON ST 3RD FL	CAMBRIDGE MA	02138	448 PARK DR Apt 6	BOSTON	02215
NIAMIR PARIVASHE TRST		81 MOSS HILL RD	JAMAICA PLAIN MA	02130	448 PARK DR Apt 7	BOSTON	02215
LEVIN ERIC	C/O ERIC LEVIN	15 TAYLOR ST	NEEDHAM MA	02494	448 PARK DR Apt 8	BOSTON	02215
448 PARK DRIVE CONDOMINIUM	C/O 448 PARK DRIVE CONDOMINIUM TRUST	658 MASSACHUSETTS AV	BOSTON MA	02118	448 PARK DR Apt 9	BOSTON	02215
DEFEUDIS TODD	C/O TODD E DEFEUDIS	3435 E WASATCH GROVE LANE	COTTONWOOD HGTS UT	84121	448 PARK DR Apt 10	BOSTON	02215
WALCZYK JOHN	C/O JOHN WALCZYK	448 PARK DR # 11	BOSTON MA	02215	448 PARK DR Apt 11	BOSTON	02215
ENG DANNY		1254 LINDENWOOD LA 4	ATLANTA GA	30319	448 PARK DR Apt 12	BOSTON	02215
HODJAT HOSSEIN K		81 MOSS HILL RD	JAMAICA PLAIN MA	02130	448 PARK DR Apt 12-A	BOSTON	02215
HODJAT HOSSEIN	C/O HOSSEIN HIDJAT	81 MOSS HILL RD	JAMAICA PLAIN MA	02130	448 PARK DR Apt 14	BOSTON	02215
WALDEN POND REALTY LLC	C/O WALDEN PONS REALTY LLC	108 MOSSMAN RD	SUDBURY MA	01776	448 PARK DR Apt 15	BOSTON	02215
CORNELIO DONATO BE	C/O DONATO CORNELIO	407 BROADWAY	CAMBRIDGE MA	02139	448 PARK DR Apt 16	BOSTON	02215
YARDEN DANIEL		10576 EAST KEY DRIVE	BOCA RATON FLA	33498	448 PARK DR Apt 17	BOSTON	02215
FIGERS HOLDING TRUST	C/O COHEN & SALES LLC	221 CRESCENT ST STE 206	WALTHAM MA	02453	448 PARK DR Apt 18	BOSTON	02215
DEFEUDIS TODD E		3534 E WASATCH GROVE LANE	COTTONWOOD HGTS UT	84121	448 PARK DR Apt 19	BOSTON	02215
WALCZYK STANLEY	C/O STANLEY WALCZYK	448 PARK DR #20	BOSTON MA	02215	448 PARK DR Apt 20	BOSTON	02215
MASS BAY TRANSP AUTHORITY		10 PARK PLAZA SUITE 5610	BOSTON MA	02116	MUNSON	BOSTON	02115

APPENDIX D

MEPA Environmental Monitor Notification

Welcome to the *Environmental Monitor* page. In order to access previous issues of the *Environmental Monitor* published since the launch of the new MEPA website on September 23, 2009, please select the year and publication date from the following drop-down lists.

In order to access issues of the *Environmental Monitor* published from 2002 through September 9, 2009, please click on the Environmental Monitor Archives link.

Select Year: 2018 ▼
Select Publication Date: 10/10/2018 ▼

Back Environmental Monitor Archives

MEPA Environmental Monitor

Oct 10, 2018
Volume 90, Issue 11

The Environmental Monitor
a publication of the
Massachusetts Executive Office of Energy and Environmental Affairs
Charlie Baker, Governor
William F. Galvin, Secretary

The Environmental Monitor provides information on projects under review by the Massachusetts Environmental Policy Act (MEPA) office, recent MEPA decisions of the Secretary of Energy & Environmental Affairs, and public notices from environmental agencies. Please note that the links on this page require the use of Adobe Acrobat Reader®, which is available free of charge at http://www.adobe.com/products/acrobat/readstep.html.

Projects Submitted September 18 -October 1,

Environmental Notification Forms

EEA No.	Project Name	Location	Comments Due	For Copies	MEPA Analyst
15920	Bio - Med Innovations, LLC	Middleton	10/30/2018	Matthew Nekoroski (978) 729-8333	Erin Flaherty (617) 626-1128
15921	Village at Sudbury Station	Sudbury	10/30/2018	William Henchy (508) 246-6776	Alex Strysky (617) 626-1025
15922	300 Third Avenue	Waltham	10/30/2018	Paul Finger (781) 647-4900	Erin Flaherty (617) 626-1128
15923	Montvale Commons	Woburn	10/30/2018	Kyle Greaves (617) 607-2988	Purvi Patel (617) 626-1029

Environmental Notification Forms - Site Visits

EEA No.	Date	Time	Location
15920	10/19/2018	11:00 AM	Meet On Site 30 Log Bridge Road 2nd floor conference room, Middleton
15922	10/19/2018	2:00 PM	Meet on Site 300 Third Avenue, Waltham
15923	10/19/2018	10:00 AM	Meet at Guard Shack at the end of Hill Street, Woburn

Environmental Impact Reports

EEA No.	Project Name	Location	Document Type	Comments Due	For Copies	MEPA Analyst
15783	Suffolk Downs Redevelopment	Boston / Revere	Draft Environmental Impact Report	11/09/2018	Lauren DeVoe (617) 607-0091	Page Czepiga (617) 626-1021
15786	Lowell Area Gas Modernization Project	Lowell, Chelmsford and Tewksbury	Draft Environmental Impact Report	11/09/2018	Siona Patisteas (508) 513-2715	Alex Strysky (617) 626-1025
15849	Hood Park Master Plan	Boston / Charlestown	Draft Environmental Impact Report	11/14/2018	David Hewett (978) 461-6218	Purvi Patel (617) 626-1029

Notices of Project Change

EEA No.	Project Name	Location	Comments Due	For Copies	MEPA Analyst
14425	Proposed Tidal Flow Improvement in Lighthouse Pond	Edgartown	10/30/2018	Tara Marden (508) 397-9689	Anne Canaday (617) 626-1035

Other Projects Under Review

Environmental Notification Forms

EEA No.	Project Name	Location	Comments Due	For Copies	MEPA Analyst
15895	Proposed Cathodic Protection Ground Bed	Fall River	10/30/2018	Gene Crouch (617) 607-2783	Erin Flaherty (617) 626-1128
15897	Lynn Landfill Cap Repair Project	Lynn	10/16/2018	Bruce Haskell (617) 875-3693	Eve Schluter (617) 626-1131
15905	Weweantic River Restoration and Horseshoe Mill Dam Spillway Removal	Wareham	10/19/2018	Paul Woodworth (860) 652-8911	Erin Flaherty (617) 626-1128
15909	10 & 30 Reservoir Street	Mansfield	10/23/2018	Bob Rego (781) 536-4639	Purvi Patel (617) 626-1029
15910	Mystic Village	Medford	10/16/2018	Brian Cafferty (781) 321-7800 ext.321	Alex Strysky (617) 626-1025
15912	The Reserve	Oxford	10/02/2018	Peter Lavoie (508) 647-1919	Page Czepiga (617) 626-1021
15913	Chamberlain Farms	Berkley	10/16/2018	Patrick Matthews (508) 676-6900	Anne Canaday (617) 626-1035
15914	Jubilee Yacht Club Deck Expansion	Beverly	10/16/2018	Robert Griffin (978) 927-5111	Erin Flaherty (617) 626-1128
15915	Chamberlain Street and Whalen Road Subdivision	Hopkinton	10/16/2018	Scott Goddard (508) 393-3784	Page Czepiga (617) 626-1021
15916	Foothills Preserve and West Beaver Dam Brook Restoration Project	Plymouth	10/26/2018	Nick Nelson (617) 714-5537	Page Czepiga (617) 626-1021
15917	Long Beach Seawall Stabilization Improvements Project	Rockport	10/16/2018	Joseph Parisi (978)546-3525	Purvi Patel (617) 626-1029
15918	Herrick Farm	Rowley	10/16/2018	Frank Di Luna (978) 327-5216	Anne Canaday (617) 626-1035
15919	Intersection Improvements at Bay Street and Berkshire Avenue	Springfield	10/16/2018	Mathew Sokop (413) 784-4884	Alex Strysky (617) 626-1025

Environmental Impact Reports

EEA No.	Project Name	Location	Document Type	Comments Due	For Copies	MEPA Analyst
15692	L Street Station Redevelopment	Boston	Draft Environmental Impact Report	10/30/2018	Seth Lattrell (617) 607-2973	Alex Strysky (617) 626-1025
15787	Vineyard Wind Connector	Cape & Islands	Supplemental Draft Environmental Impact Report	10/05/2018	Erich Stephens (508) 717-8764	Purvi Patel (617) 626-1029
15812	Hopkinton to Ashland Gas Pipeline Replacement Project	Ashland and Hopkinton	Single Environmental Impact Report	10/05/2018	Richard Paquette (207) 274-2604	Erin Flaherty (617) 626-1128
4959	Lakeshore Center	Bridgewater	Draft	10/05/2018	Scott Goddard	Anne Canaday

			Supplemental Environmental Impact Report		(508) 393-3784	(617) 626-1035

Notices of Project Change

EEA No.	Project Name	Location	Comments Due	For Copies	MEPA Analyst
15768	Oak Bluffs Comprehensive Wastewater Management Planning Study and Draft Needs Assessment Report	Oak Bluffs	10/16/2018	Anastasia Rudenko (774) 470-1637	Alex Strysky (617) 626-1025

Secretary's Certificates September 28 - October 5,

Environmental Notification Forms

EEA No.	Project Name	Location	Action	Action Date
15900	Tree House Brewing	Charlton	Requires a Mandatory Environmental Impact Report	09/28/2018
15902	Elm Street Dam Removal	Kingston	Does not Require an Environmental Impact Report	09/28/2018
15907	The Parkway Apartments	Boston	Does not Require an Environmental Impact Report	10/05/2018
15908	1005 Broadway	Chelsea	Does not Require an Environmental Impact Report	10/05/2018
15911	Skating Club of Boston - Norwood	Norwood	Does not Require an Environmental Impact Report	10/05/2018

Environmental Impact Reports

No Data Found.

Notices of Project Change

EEA No.	Project Name	Location	Action	Action Date
15282	Paradise Pond Sediment Management Protocol	Northampton	Does not Require an Environmental Impact Report	10/05/2018
15704	Worcester Biomanufacturing Campus	Worcester	Does not Require an Environmental Impact Report	10/05/2018

Records of Decision

EEA No.	Project Name	Location	Comments Due	Action	Action Date
15902	Elm Street Dam Removal	Kingston	10/24/2018	Secretary Proposes to Grant Waiver	09/28/2018

Special Review Procedures

No Data Found.

Public Benefits Determinations

EEA No.	Project Name	Location	Action	Action Date
15575	254-272 and 282R Lynnway	Lynn	Will Have a Public Benefit	09/28/2018
15852	283 and 285 Derby Street	Salem	Will Have a Public Benefit	10/10/2018

Advisory Opinions

EEA No.	Project Name	Location	Action	Action Date
4325	Third Harbor Tunnel - South Boston Haul Road	Boston	Implementation of the Pilot Re-Evaluation Program for a 12-month period does not require a NPC	10/04/2018

Requests for Advisory Opinion

No Data Found.

Public Notices

Agency	Notice Type	Location
Boston Conservation Commission	Notice of Intent to Initiate an Ecological Restoration Plan for Muddy River Flood Damage Reduction (Phase 2)	Boston
Boston Conservation Commission	Notice of Intent to Initiate an Ecological Restoration Plan for Muddy River Invasive Species Mowing and Re-seeding	Boston
Brookline Conservation Commission	Notice of Intent to Initiate an Aquatic Plant Management Plan	Brookline
Brookline Conservation Commission	Notice of Intent to Initiate an Ecological Restoration Plan for Muddy River Flood Damage Reduction (Phase 2)	Brookline
CZM	Notice of Submission of a Request for a Notice to Proceed for the Town of Cohasset Municipal Harbor Plan	Cohasset
DAR	Notice of Public Hearings for a Vegetation Management Plan	Boston, Brookline, Braintree, Cambridge, Malden, Medford, Milton, Newton, Quincy, Revere and Somerville
DEP	Notice of Application for a 401 Water Quality Certificate	Pittsfield
DEP	Notice of Application and Issuance of a Draft Groundwater Discharge Permit	Hopkinton
DEP	Notice of Application and Issuance of a Draft Groundwater Discharge Permit	Harwich
DEP	Notice of Application for a Chapter 91 Waterways License	Lowell
DEP	Notice of Public Hearing re: Emission Control Plan Application for SEMASS Resource Recovery Facility	Rochester
DEP	Notice of Application for a 401 Water Quality Certificate	Essex
DEP	Notice of Application and Issuance of a Draft Groundwater Discharge Permit	Sharon
DEP	Notice of Application and Issuance of a Draft Groundwater Discharge Permit	Marshfield
DEP	Notice of Draft Water Management Act Permit Amendment	Blackstone
Falmouth Conservation Commission	Notice of Intent to Initiate an Ecological Restoration Plan	Falmouth
MassDOT	Notice of a Section 61 Finding for Campanelli Business Park Project EEA#15830	Uxbridge

Environmental Monitor Notification

Notice of Intent through the Boston Conservation Commission
Muddy River Flood Damage Reduction Project (Phase 2)

Project Description

The U.S. Army Corps of Engineers-New England District (Corps) is proposing to construct Phase 2 the Muddy River Flood Damage Reduction Project, in Boston and Brookline, Massachusetts. The City of Boston is filing a Notice of Intent with the Boston Conservation Commission for the Project. The proposed Phase 2 project will include the following work:

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.
- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Excavate deepened channel sections to delay need for maintenance dredging.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Manage Phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction and improve ecological habitat quality.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where Phragmites or oriental knotweed are eradicated by planting grass, trees and shrubs.
- Install habitat logs for fish and turtles.
- Remove the temporary flow restriction structure upstream of the Riverway.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

Filing Information

The Project will be filing the Notice of Intent with the Boston Conservation Commission on October 24, 2018.

Copies of the NOI may be requested through the Boston Conservation Commission by emailing cc@boston.gov or by phone at (617) 635-3850. Documents will be available for viewing at 1 City Hall Square, Room 709, Boston, MA 02201.

The public hearing will be held on November 7, 2018 at 6 PM in the Piemonte Room on the 5th Floor of Boston City Hall.

APPENDIX E

RDA (2018)/Confirmation of Boundaries

CITY OF BOSTON
THE ENVIRONMENT DEPARTMENT

Boston City Hall, Room 709 • Boston, MA 02201 • 617/635-3850 • FAX: 617/635-3435

May 17, 2018

Mary C. Mancini, P.E.
75 State Street, Suite 701
Boston, MA 02109

CERTIFIED MAIL: 7015 0640 0001 0462 1623

RE: Request for Determination of Applicability from CDM Smith on behalf of the Boston Parks and Recreation Department for the acceptance of the field delineated wetland resource area boundaries for the Phase 2 Muddy River Flood Damage Reduction and Environmental Restoration Project located along the Muddy River, Boston, MA.

Dear Ms. Mancini,

Pursuant to the Massachusetts Wetlands Protection Act, G.L. c. 131, § 40 (the "Act"), I have enclosed the Determination of Applicability (the "Determination") for the above referenced project, as voted by the Conservation Commission at the May 16, 2018 public meeting. The Determination is positive, as the Commission affirmed that the boundary delineations of the following resource areas described on the plans submitted are confirmed accurate. Therefore, the resource area boundaries confirmed in this Determination are binding as to all decisions rendered pursuant to the Wetlands Protection Act and its regulations regarding such boundaries for as long as this Determination is valid.

The Determination shall be valid for three years from the date of issuance in accordance with 310 CMR 10.05 (3)(b)(1).

If you should have any questions regarding the Determination I may be contacted at 617-635-4416.

For the Commission,

Amelia Croteau, Executive Secretary
Boston Conservation Commission

Cc: Christopher Cook, Boston Parks and Recreation Department

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

From:

Boston
Conservation Commission

To: Applicant

Boston Parks & Recreation Department
Name

1010 Massachusetts Avenue, 3rd Floor
Mailing Address

Boston	MA	02118
City/Town	State	Zip Code

Property Owner (if different from applicant):

Name

Mailing Address

City/Town	State	Zip Code

1. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

Muddy River Restoration Project Wetland Delineation	5/2018
Title	Date
Title	Date
Title	Date

2. Date Request Filed:

May 1, 2018

B. Determination

Pursuant to the authority of M.G.L. c. 131, § 40, the Conservation Commission considered your Request for Determination of Applicability, with its supporting documentation, and made the following Determination.

Project Description (if applicable):

The City of Boston Parks and Recreation Department is requesting concurrence of the wetland resource area boundaries as shown on sheets 7 through 32.

Project Location:

Wards Pond, Willow Pond, Leverett Pond, Riverway, Back Bay Fens (Park)

Boston
City/Town

NA
Assessors Map/Plat Number

NA
Parcel/Lot Number

B. Determination (cont.)

The following Determination(s) is/are applicable to the proposed site and/or project relative to the Wetlands Protection Act and regulations:

Positive Determination
Note: No work within the jurisdiction of the Wetlands Protection Act may proceed until a final Order of Conditions (issued following submittal of a Notice of Intent or Abbreviated Notice of Intent) or Order of Resource Area Delineation (issued following submittal of Simplified Review ANRAD) has been received from the issuing authority (i.e., Conservation Commission or the Department of Environmental Protection).

☐ 1. The area described on the referenced plan(s) is an area subject to protection under the Act. Removing, filling, dredging, or altering of the area requires the filing of a Notice of Intent.

☒ 2a. The boundary delineations of the following resource areas described on the referenced plan(s) are confirmed as accurate. Therefore, the resource area boundaries confirmed in this Determination are binding as to all decisions rendered pursuant to the Wetlands Protection Act and its regulations regarding such boundaries for as long as this Determination is valid.

☐ 2b. The boundaries of resource areas listed below are <u>not</u> confirmed by this Determination, regardless of whether such boundaries are contained on the plans attached to this Determination or to the Request for Determination.

☐ 3. The work described on referenced plan(s) and document(s) is within an area subject to protection under the Act and will remove, fill, dredge, or alter that area. Therefore, said work requires the filing of a Notice of Intent.

☐ 4. The work described on referenced plan(s) and document(s) is within the Buffer Zone and will alter an Area subject to protection under the Act. Therefore, said work requires the filing of a Notice of Intent or ANRAD Simplified Review (if work is limited to the Buffer Zone).

☐ 5. The area and/or work described on referenced plan(s) and document(s) is subject to review and approval by:

Name of Municipality

Pursuant to the following municipal wetland ordinance or bylaw:

Name | Ordinance or Bylaw Citation

B. Determination (cont.)

☐ 6. The following area and/or work, if any, is subject to a municipal ordinance or bylaw but <u>not</u> subject to the Massachusetts Wetlands Protection Act:

☐ 7. If a Notice of Intent is filed for the work in the Riverfront Area described on referenced plan(s) and document(s), which includes all or part of the work described in the Request, the applicant must consider the following alternatives. (Refer to the wetland regulations at 10.58(4)c. for more information about the scope of alternatives requirements):

- ☐ Alternatives limited to the lot on which the project is located.
- ☐ Alternatives limited to the lot on which the project is located, the subdivided lots, and any adjacent lots formerly or presently owned by the same owner.
- ☐ Alternatives limited to the original parcel on which the project is located, the subdivided parcels, any adjacent parcels, and any other land which can reasonably be obtained within the municipality.
- ☐ Alternatives extend to any sites which can reasonably be obtained within the appropriate region of the state.

Negative Determination

Note: No further action under the Wetlands Protection Act is required by the applicant. However, if the Department is requested to issue a Superseding Determination of Applicability, work may not proceed on this project unless the Department fails to act on such request within 35 days of the date the request is post-marked for certified mail or hand delivered to the Department. Work may then proceed at the owner's risk only upon notice to the Department and to the Conservation Commission. Requirements for requests for Superseding Determinations are listed at the end of this document.

☐ 1. The area described in the Request is not an area subject to protection under the Act or the Buffer Zone.

☐ 2. The work described in the Request is within an area subject to protection under the Act, but will not remove, fill, dredge, or alter that area. Therefore, said work does not require the filing of a Notice of Intent.

☐ 3. The work described in the Request is within the Buffer Zone, as defined in the regulations, but will not alter an Area subject to protection under the Act. Therefore, said work does not require the filing of a Notice of Intent, subject to the following conditions (if any).

☐ 4. The work described in the Request is not within an Area subject to protection under the Act (including the Buffer Zone). Therefore, said work does not require the filing of a Notice of Intent, unless and until said work alters an Area subject to protection under the Act.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 2 – Determination of Applicability
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Determination (cont.)

☐ 5. The area described in the Request is subject to protection under the Act. Since the work described therein meets the requirements for the following exemption, as specified in the Act and the regulations, no Notice of Intent is required:

Exempt Activity (site applicable statutory/regulatory provisions)

☐ 6. The area and/or work described in the Request is not subject to review and approval by:

Name of Municipality

Pursuant to a municipal wetlands ordinance or bylaw.

Name | Ordinance or Bylaw Citation

C. Authorization

This Determination is issued to the applicant and delivered as follows:

☐ by hand delivery on

☒ by certified mail, return receipt requested on

Date

5/17/2018
Date

This Determination is valid for **three years** from the date of issuance (except Determinations for Vegetation Management Plans which are valid for the duration of the Plan). This Determination does not relieve the applicant from complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.

This Determination must be signed by a majority of the Conservation Commission. A copy must be sent to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html) and the property owner (if different from the applicant).

Signatures:

Alice E Richmond

5/17/2018
Date

D. Appeals

The applicant, owner, any person aggrieved by this Determination, any owner of land abutting the land upon which the proposed work is to be done, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate Department of Environmental Protection Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html) to issue a Superseding Determination of Applicability. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and Fee Transmittal Form (see Request for Departmental Action Fee Transmittal Form) as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Determination. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant if he/she is not the appellant. The request shall state clearly and concisely the objections to the Determination which is being appealed. To the extent that the Determination is based on a municipal ordinance or bylaw and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

APPENDIX F

Engineering Plans and Details

US Army Corps
of Engineers®
New England
District

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)

BOSTON AND BROOKLINE,
MASSACHUSETTS

SOLICITATION #:

SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDEXED ON THIS SHEET

APPROVED FOR TECHNICAL ADEQUACY BY:

TECHNICAL LEAD ENGINEER — DATE

REVIEWED BY:

CHIEF, GEOTECHNICAL/WATER RESOURCES BRANCH — DATE

REVIEWED BY:

CHIEF, GEO-ENV BR/DEPUTY CHIEF, ENGINEERING/PLANNING DIV — DATE

APPROVAL RECOMMENDED BY:

CHIEF, DESIGN BRANCH — DATE

APPROVED BY:

CHIEF, ENGINEERING / PLANNING DIVISION — DATE

This project was designed by the U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents, within the scope of their employment as required by ER 1110-1-8152.

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: | DWN BY: SAF | CKD BY: MET | SUBMITTED BY: | PLOT SCALE: 1:1 | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_G-001.dgn

DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

COVER SHEET

SHEET IDENTIFICATION
G-001

SHEET 1 OF 110

INDEX TO DRAWINGS

	SHEET NO.	SHEET FILE	SHEET TITLE
1	G-001	MUD-2_G-001.DGN	COVER SHEET
2	G-002	MUD-2_G-002.DGN	INDEX TO DRAWINGS
3	G-003	MUD-2_G-003.DGN	GENERAL NOTES
4	G-101	MUD-2_G-101.DGN	GENERAL PLAN (SHEET KEY PLAN)
5	CD101	MUD-2_CD101.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
6	CD102	MUD-2_CD102.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
7	CD103	MUD-2_CD103.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
8	CD104	MUD-2_CD104.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
9	CD105	MUD-2_CD105.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
10	CD106	MUD-2_CD106.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
11	CD107	MUD-2_CD107.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
12	CD108	MUD-2_CD108.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
13	CD109	MUD-2_CD109.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
14	CD110	MUD-2_CD110.DGN	EXISTING CONDITIONS & DEMOLITION PLAN
15	GC101	MUD-2_GC101.DGN	SEQUENCING, DEWATERING, STAGING & ACCESS PLAN
16	GC102	MUD-2_GC102.DGN	SEQUENCING, DEWATERING, STAGING & ACCESS PLAN
17	GC103	MUD-2_GC103.DGN	SEQUENCING, DEWATERING, STAGING & ACCESS PLAN
18	GC104	MUD-2_GC104.DGN	SEQUENCING, DEWATERING, STAGING & ACCESS PLAN
19	GC105	MUD-2_GC105.DGN	SEQUENCING, DEWATERING, STAGING & ACCESS PLAN
20	GC106	MUD-2_GC106.DGN	HAULING PLAN
21	GC107	MUD-2_GC107.DGN	HAULING PLAN
22	GC108	MUD-2_GC108.DGN	HAULING PLAN
23	C-101	MUD-2_C-101.DGN	SITE PLAN
24	C-102	MUD-2_C-102.DGN	SITE PLAN
25	C-103	MUD-2_C-103.DGN	SITE PLAN
26	C-104	MUD-2_C-104.DGN	SITE PLAN
27	C-105	MUD-2_C-105.DGN	SITE PLAN
28	C-106	MUD-2_C-106.DGN	SITE PLAN
29	C-107	MUD-2_C-107.DGN	SITE PLAN
30	C-108	MUD-2_C-108.DGN	SITE PLAN
31	C-109	MUD-2_C-109.DGN	SITE PLAN
32	C-110	MUD-2_C-110.DGN	SITE PLAN
33	C-111	MUD-2_C-111.DGN	SITE PLAN FIRE ALARM HEADQUARTERS
34	C-301	MUD-2_C-301.DGN	SECTIONS LEVERETT POND
35	C-302	MUD-2_C-302.DGN	SECTIONS LEVERETT POND
36	C-303	MUD-2_C-303.DGN	SECTIONS AREA 2
37	C-304	MUD-2_C-304.DGN	SECTIONS AREA 2
38	C-305	MUD-2_C-305.DGN	SECTIONS AREA 2
39	C-306	MUD-2_C-306.DGN	SECTIONS AREA 3
40	C-307	MUD-2_C-307.DGN	SECTIONS AREA 3
41	C-308	MUD-2_C-308.DGN	SECTIONS AREA 4
42	C-309	MUD-2_C-309.DGN	SECTIONS AREA 5
43	C-310	MUD-2_C-310.DGN	SECTIONS AREA 6
44	C-311	MUD-2_C-311.DGN	SECTIONS AREA 6
45	C-312	MUD-2_C-312.DGN	SECTIONS AREA 7
46	C-313	MUD-2_C-313.DGN	SECTIONS AREA 7 & 8
47	C-314	MUD-2_C-314.DGN	SECTIONS AREA 8
48	C-315	MUD-2_C-315.DGN	SECTIONS AREA 8 & 9
49	C-316	MUD-2_C-316.DGN	SECTIONS AREA 9
50	C-317	MUD-2_C-317.DGN	SECTIONS AREA 9 & 10
51	C-318	MUD-2_C-318.DGN	SECTIONS AREA 10
52	C-319	MUD-2_C-319.DGN	SECTIONS AREA 10
53	C-320	MUD-2_C-320.DGN	SECTIONS AREA 10
54	C-321	MUD-2_C-321.DGN	SECTIONS AREA 10
55	C-322	MUD-2_C-322.DGN	SECTIONS AREA 10
56	C-323	MUD-2_C-323.DGN	SECTIONS AREA 10
57	C-324	MUD-2_C-324.DGN	SECTIONS AREA 10
58	C-325	MUD-2_C-325.DGN	SECTIONS AREA 10
59	C-326	MUD-2_C-326.DGN	SECTIONS AREA 10
60	C-327	MUD-2_C-327.DGN	SECTIONS AREA 11
61	C-328	MUD-2_C-328.DGN	SECTIONS AREA 11
62	C-329	MUD-2_C-329.DGN	SECTIONS AREA 11
63	C-330	MUD-2_C-330.DGN	SECTIONS AREA 11 & 12
64	C-331	MUD-2_C-331.DGN	SECTIONS AREA 12
65	C-332	MUD-2_C-332.DGN	SECTIONS AREA 12
66	C-333	MUD-2_C-333.DGN	SECTIONS AREA 12
67	C-334	MUD-2_C-334.DGN	TYPICAL SECTIONS
68	C-335	MUD-2_C-335.DGN	TYPICAL SECTIONS
69	C-336	MUD-2_C-336.DGN	TYPICAL SECTIONS
70	C-337	MUD-2_C-337.DGN	TYPICAL SECTIONS
71	C-338	MUD-2_C-338.DGN	TYPICAL SECTIONS
72	C-339	MUD-2_C-339.DGN	GEOTECHNICAL & ENVIRONMENTAL TYPICAL SECTIONS
73	C-501	MUD-2_C-501.DGN	CONSTRUCTION DETAILS
74	C-502	MUD-2_C-502.DGN	CONSTRUCTION DETAILS
75	C-503	MUD-2_C-503.DGN	CONSTRUCTION DETAILS
76	C-504	MUD-2_C-504.DGN	STORMWATER PUMP STATION DETAILS
77	C-505	MUD-2_C-505.DGN	EROSION & SEDIMENT CONTROL PLAN
78	L-100	MUD-2_L-100.DGN	LANDSCAPE KEY PLAN
79	L-101	MUD-2_L-101.DGN	LANDSCAPE PLAN
80	L-102	MUD-2_L-102.DGN	LANDSCAPE PLAN
81	L-103	MUD-2_L-103.DGN	LANDSCAPE PLAN
82	L-104	MUD-2_L-104.DGN	LANDSCAPE PLAN
83	L-105	MUD-2_L-105.DGN	LANDSCAPE PLAN
84	L-106	MUD-2_L-106.DGN	LANDSCAPE PLAN
85	L-107	MUD-2_L-107.DGN	LANDSCAPE PLAN
86	L-108	MUD-2_L-108.DGN	LANDSCAPE PLAN
87	L-109	MUD-2_L-109.DGN	LANDSCAPE PLAN
88	L-110	MUD-2_L-110.DGN	LANDSCAPE PLAN
89	L-111	MUD-2_L-111.DGN	LANDSCAPE PLAN
90	L-112	MUD-2_L-112.DGN	LANDSCAPE PLAN
91	L-113	MUD-2_L-113.DGN	LANDSCAPE PLAN
92	L-114	MUD-2_L-114.DGN	LANDSCAPE PLAN
93	L-115	MUD-2_L-115.DGN	LANDSCAPE PLAN
94	L-116	MUD-2_L-116.DGN	LANDSCAPE PLAN
95	L-117	MUD-2_L-117.DGN	LANDSCAPE PLAN
96	L-118	MUD-2_L-118.DGN	LANDSCAPE PLAN
97	L-301	MUD-2_L-301.DGN	LANDSCAPE SECTIONS
98	L-302	MUD-2_L-302.DGN	LANDSCAPE SECTIONS
99	L-303	MUD-2_L-303.DGN	LANDSCAPE SECTIONS
100	L-304	MUD-2_L-3014.DGN	LANDSCAPE SECTIONS
101	L-305	MUD-2_L-305.DGN	LANDSCAPE SECTIONS
102	L-501	MUD-2_L-501.DGN	LANDSCAPE DETAILS
103	L-502	MUD-2_L-502.DGN	LANDSCAPE DETAILS
104	L-601	MUD-2_L-601.DGN	PLANT SCHEDULE
105	S-101	MUD-2_S-101.DGN	STRUCTURAL SITE PLAN, WALL SECTION, AND JOINT DETAILS
106	S-501	MUD-2_S-501.DGN	RETAINING WALL ELEVATION AND DETAIL
107	E-101	MUD-2_E-101.DGN	ELECTRICAL FLOOR PLAN NEW & EXISTING
108	E-501	MUD-2_E-501.DGN	ELECTRICAL DETAILS & EQUIPMENT SCHEDULE
109	E-601	MUD-2_E-601.DGN	ELECTRICAL ONE LINE DIAGRAM
110	E-602	MUD-2_E-602.DGN	PUMP CONTROL CIRCUIT DIAGRAM

INDEX OF BENCHMARKS (NAVD 88)

ID	DESCRIPTION	ELEVATION	NORTHING	EASTING
ASP	STANDARD USACE ALUMINUM DISK ON A 1/2" STEEL REBAR. DISK IS 0.2' BELOW SURFACE OF GROUND	8.88	2947194.58	760897.03
ASP 2	PK NAIL IN THE NORTHWEST CORNER OF A STREET LIGHT BASE - CORNER BROOKLINE AVE & ASPINWALL AVE	12.24		
ASP 3	PK NAIL IN THE BITUMINOUS WALKWAY ON THE HIGH POINT OF BRIDGE	10.35		
ASP 5	1/4" STAINLESS STEEL BOLT & NUT IN THE FOUNDATION OF A CONCRETE BRIDGE FOOTING	10.70		
KELL	STANDARD USACE ALUMINUM DISK ON A 1/2" STEEL REBAR. DISK IS 0.2' BELOW SURFACE OF GROUND	6.37	2949782.99	765551.80
KELL 3	SURVEY TACK IN THE EASTERN CORNER OF THE FOUNDATION OF A CONCRETE LIGHT POST	6.14		
KELL 4	CHISLED SQUARE ON THE SOUTHWEST CORNER OF A CONCRETE BASE OF A CHAINLINK FENCE	5.90		
FIRE 1	MAG NAIL IN PAVEMENT	6.26	2950582.38	766637.51
FIRE 2	SPIKE IN CONCRETE SIDEWALK	11.37	2950707.32	766815.24

INDEX TO INFORMATION DRAWINGS

SHEET NO.	DATE	SHEET TITLE
0 THRU 7	JUNE 25, 1979	BACK BAY FENS BRIDGES BY CAROL R. JOHNSON & ASSOCIATES
0 THRU 8	MAY 27, 1980	BACK BAY FENS BRIDGES PHASE 2 BY CAROL R. JOHNSON & ASSOCIATES
N/A	MARCH 9, 2016	FLOW RESTRICTION CONTROL STRUCTURE AS-BUILT BY ALPHA SURVEYING AND ENGINEERING INC.
8 THRU 12		SOUTH METROPOLITAN SEWERAGE DISTRICT SOUTH CHARLES RELIEF SEWER - PLAN AND PROFILE
6A	DECEMBER 1999	RECORD PLAN - BWSC - MUDDY RIVER CONDUIT ISOLATION GATE BY FAY, SPOFFORD & THORNDIKE, INC.
1	SEPTEMBER 1891	RECORD PLAN METROPOLITAN SEWER - BOSTON & BROOKLINE SECTION B
2 THRU 3	OCTOBER 1891	RECORD PLAN - METROPOLITAN SEWER - BOSTON & BROOKLINE SECTION A
1 THRU 4	JANUARY 2009	MUDDY RIVER - BWSC PLANS - LMA

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY:
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_G-002.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

INDEX TO DRAWINGS

SHEET IDENTIFICATION
G-002

LEGEND

NEW	EXISTING	DESCRIPTION
	— — — Ex —	UNDERGROUND ELECTRIC
	—— Gx ——	GAS MAIN
	—— Wx ——	WATER MAIN
	— — — Cx —	UNDERGROUND TELEPHONE
—— FM ——	—— SDx ——	STORM DRAIN OR STORM FORCE MAIN
	—— SSx ——	SANITARY SEWER
	— — — 10 — — —	CONTOUR
		TREE LINE
		EDGE OF WATER
		HAND HOLE
		TRAFFIC CONTROL BOX
		LIGHT POLE
		CROSS WALK SIGNAL POLE
		SPAN POLE
CB	CB	CATCH BASIN
		TREE
		SIGN
		MANHOLE
	D	STORM DRAIN MANHOLE
		FIRE HYDRANT
	WG	WATER GATE
	GG	GAS GATE
	BORING ID TD (TOTAL DEPTH) WD (WATER DEPTH)	SOIL BORING
5.0	x15.2	SPOT ELEVATION
——×——	——×——	FENCING
		CUT
		FILL
		STONE PROTECTION
		MATERIAL REQUIRED TO BE REMOVED (SITE PLAN SHEETS)
— — — — — — —		BOTTOM TOE OF CHANNEL
——— · ———		LIMIT OF WORK
		LIMIT OF KNOTWEED
		LIMIT OF PHRAGMITIES
		LIMIT OF BORDERING VEGETATED WETLAND
		LIMIT OF RIVERFRONT AREA
		TOP OF BANK RESOURCE AREA
		LIMIT OF 100 YR FLOOD
	— — — — — — —	LIMIT OF 100 FT BUFFER ZONE
		POND OR RIVER ACCESS (GC SHEETS)
		STORAGE & DEWATERING AREA (GC SHEETS)
		ROOT PROTECTION ZONE (GC SHEETS)
		BITUMINOUS CONCRETE (C-100 SHEETS)
		FULL DEPTH SIDEWALK RESTORATION (C-100 SHEETS)
		TRUCK/EQUIPMENT ACCESS (GC SHEETS)
		TEMPORARY BENCH MARK
		TEMPORARY BYPASS PUMP LINE

ABBREVIATIONS:

APPROX.	APPROXIMATE
BIT.	BITUMINOUS
CONC.	CONCRETE
DIA.	DIAMETER
EL.	ELEVATION
EXIST.	EXISTING
INV.	INVERT
LF	LINEAR FEET
MH	MANHOLE
O.C.	ON CENTER
T.B.R.	TO BE REMOVED
TEMP.	TEMPORARY
T.R.	TO REMAIN
TYP.	TYPICAL
W/	WITH
COR	CONTRACTING OFFICERS REPRESENTATIVE

GENERAL NOTES:

1. EXISTING CROSS SECTION SPOT ELEVATIONS ARE FROM A FALL 2015/WINTER 2016 TOPOGRAPHIC SURVEY BY BRYANT ASSOCIATES, INC. EXISTING CONTOURS ARE FROM AN AERIAL SURVEY IN 2011 BY THE CITY OF BOSTON GIS DEPARTMENT. ALL EXISTING SITE FEATURES SHOWN ARE FROM SURVEYS AND AVAILABLE PLANS FROM VARIOUS YEARS. EXISTING TREE TYPES AND SIZES WERE UPDATED DURING A 2001 EMERALD NECKLACE MASTER PARKS PLAN.
2. UNLESS NOTED OTHERWISE, ELEVATIONS SHOWN ARE IN US SURVEY FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. COORDINATES SHOWN ARE BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM (MAINLAND ZONE). COORDINATES ARE IN US SURVEY FEET AND REFERENCE THE NORTH AMERICAN DATUM OF 1983 (NAD 1983).
4. THE LOCATIONS OF UNDERGROUND UTILITIES AS DEPICTED ARE APPROXIMATE AND BASED UPON THE FIELD LOCATION OF VISIBLE STRUCTURES AND COMPILATION FROM UTILITY PLANS SUPPLIED BY THE RESPECTIVE UTILITY COMPANIES AND MUNICIPAL AGENCIES. THESE PLANS SHALL NOT BE RELIED UPON FOR DETERMINING THE EXACT LOCATION OF ANY UTILITY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES THROUGH COORDINATION WITH EACH UTILITY COMPANY, THE FIRE DEPARTMENT HEADQUARTERS, OR MUNICIPAL AGENCY PRIOR TO COMMENCING WORK. ADDITIONALLY, CONTACT DIG SAFE SYSTEM, INC. AT 811 FOR UTILITY MARK OUT AT LEAST 72 HOURS IN ADVANCE PRIOR TO ANY EXCAVATION. ANY RECORD INFORMATION OBTAINED BY THE CONTRACTOR SHALL BE PROVIDED TO THE GOV ELECTRONICALLY.
5. CONTRACTOR MAY EXCAVATE MATERIAL MECHANICALLY IN THE WET OR BY IMPLEMENTING A CONTROL OF RIVER PLAN TO EXCAVATE IN THE DRY.
6. IF CONTRACTOR CHOOSES TO EXCAVATE IN THE DRY, CONTRACTOR SHALL DESIGN, CONSTRUCT, OPERATE, AND MAINTAIN A FLOW DIVERSION SYSTEM THAT PROVIDES FOR RIVER FLOWS TO BE CONTINUOUSLY MAINTAINED THROUGH EXISTING STRUCTURES AND/OR THROUGH ADEQUATE TEMPORARY FLOW DIVERSION OR PUMP STRUCTURES UNTIL CHANNELS ARE AS-BUILT SURVEYED, ACCEPTED BY THE GOV AND CAPABLE OF HANDLING DESIGN FLOWS. CONTRACTOR DESIGNED FLOW DIVERSION SYSTEM SHALL PASS FLOW WITHOUT EXCEEDING SIX INCHES OF RIVER LEVEL CHANGE UPSTREAM OR DOWNSTREAM OF DIVERSION AT ALL TIMES. REFER TO SPECIFICATIONS SECTION 02 40 00 FOR MORE INFORMATION. REFER TO SPECIFICATIONS SECTION 01 57 20 FOR REQUIREMENTS OF SPAWNING FISH PASSAGE AND SEE SHEETS GC101-GC105 FOR MORE INFORMATION ON CONSTRUCTION ACCESS AND STAGING.
7. THERE ARE NO ANTICIPATED RELOCATIONS OF MUNICIPALLY OWNED UTILITIES (E.G. WATER, SEWER, STORM DRAINS). THE CONTRACTOR SHALL COORDINATE FULLY WITH THE COR IF SUCH A UTILITY CONFLICTS WITH EXCAVATION OPERATIONS.
8. EXCAVATED SEDIMENT SHALL BE MANAGED AND DISPOSED OF AS REQUIRED BY PERMITS, PLANS AND THE SPECIFICATIONS. MATERIAL SHALL BE DEWATERED TO THE EXTENT SUITABLE FOR LOADING INTO TRUCKS AND HAULING WITHOUT SPILLING OR FALLING OUT OF TRUCKS DURING TRANSPORT.
9. THE CONTRACTOR SHALL GAIN ACCESS TO THE PROPOSED CHANNELS THROUGH THE PHRAGMITIES TO THE MAXIMUM EXTENT POSSIBLE. PHRAGMITIES SHALL BE MANAGED ACCORDING TO THE SPECIFICATIONS AND DETAILS. OTHERWISE RIVER ACCESS SHALL BE ALONG THE EDGE OF THE CHANNEL AS CLOSE TO THE EDGE OF NORMAL WATER LEVEL AS POSSIBLE UNLESS OTHERWISE NOTED ON DRAWINGS.
10. TEMPORARY ROADS MAY BE CONSTRUCTED FOR TRUCK AND EQUIPMENT ACCESS AND STREAM ACCESS AREAS. TEMPORARY ROADS TO BE COMPLETELY REMOVED IN ALL AREAS AND FILLED WITH EXCESS SEDIMENT EXCAVATION AND RESHAPED AS SIDE SLOPES WITHIN THE RIVER. SEE SPECIFICATIONS FOR MORE DETAIL.
11. ALL TREES AND ROOTS SHALL BE PROTECTED AS REQUIRED IN SPECIFICATIONS AND CONSTRUCTION DETAILS. ALL TREE REMOVAL, TREE PROTECTION, AND PRUNING SHALL BE SUPERVISED BY A MASSACHUSETTS CERTIFIED ARBORIST.
12. ALL TREES NOT LABELED AS SHOWN ON THE CD SHEETS ARE UNDER 10" IN SIZE.
13. CONTRACTOR SHALL AVOID DAMAGE TO EXISTING HISTORIC PARK FEATURES, LANDSCAPING, WALKWAYS, TREES, PAVED AREAS, BRIDGES, ADJACENT STRUCTURES, UTILITIES, AND GRASS COVER TO THE GREATEST EXTENT POSSIBLE. REFER TO SPECIFICATIONS SECTION 01 11 00 FOR MORE INFORMATION.
14. DEPTH TO NATURAL MATERIAL SHOWN ON BORING LOCATIONS ON SECTION SHEETS ARE BASED ON INTERPRETATION OF BORINGS AND GEOTECHNICAL LABORATORY TESTS. ACTUAL STRATA BOUNDARIES BETWEEN BORINGS MAY DIFFER FROM THE CONDITIONS SHOWN HEREIN. REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
15. THE FINISH GRADE SHOWN ON CROSS SECTIONS IS THE MINIMUM REQUIRED FLOW AREA TO BE ACHIEVED BY THE CONTRACTOR. IN AREAS WHERE THE SEDIMENT IS CHARACTERIZED AS PREDOMINATELY ORGANIC, THE DEEPER REQUIRED CHANNEL EXCAVATIONS MAY REQUIRE ADDITIONAL MATERIAL TO BE REMOVED ALONG THE CHANNEL SLOPES TO ACHIEVE PROPOSED ELEVATIONS. REFER TO SPECIFICATIONS SECTION 00 32 00 FOR A GENERAL DESCRIPTION OF THE ORGANIC MATERIAL AND SECTION 31 00 00 FOR MORE INFORMATION.
16. ALL BRIDGES CROSSING THE EMERALD NECKLACE PARK SYSTEM ARE UN-RATED. REFER TO SHEET GC106 THRU GD108 FOR REQUIRED HAULING ROUTES AROUND THE PROJECT LIMITS AND THE SPECIFICATIONS FOR ALLOWED HAULING TIMES.
17. THE 100 YEAR FLOOD ELEVATIONS ARE FROM FLOOD INSURANCE RATE MAP COMMUNITY PANEL NUMBERS 25025C0077J (MARCH 16, 2016), 25025C0079J (MARCH 16, 2016), 25025C0078G (SEPTEMBER 25, 2009), 25021C0053E (JULY 17, 2012). THE SITE IS WITHIN ZONES A AND AE WITH BASE FLOOD ELEVATIONS SHOWN FOR AREAS WITHIN AE ZONES. BASE FLOOD ELEVATIONS VARY FROM ELEVATION 4.0 AT I-90 TO ELEVATION 10.0 AT LEVERETT POND.
18. CONTRACTOR SHALL ABIDE BY ALL PERMIT CONDITIONS WHEN SUBMITTING REQUIRED SUBMITTALS. IF CONTRACTOR CHOOSES A WORK PLAN WHICH DIFFERS FROM PERMIT CONDITIONS, CONTRACTOR SHALL COORDINATE WITH COR AND PERMITTING AGENCY ON REVIEW OF PLAN. NO WORK SHALL BE CONDUCTED UNTIL COR AND AGENCY REVIEW TIMELINE IS COMPLETE WHICH MAY DIFFER FROM TIMEFRAMES DESCRIBED IN SPECIFICATIONS SECTION 01 33 00.
19. SIGN SCHEDULE DESIGNATION REFERS TO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) REGULATORY SIGNAGE DESIGNATION.
20. CONTRACTOR SHALL NOT STORE OR PARK ANY EQUIPMENT BENEATH TREE CANOPY DRIPLINE EXCEPT ON DESIGNATED PROTECTION LOCATIONS.
21. FOR EXCAVATED MATERIAL TESTING AND DISPOSAL, REFER TO SPECIFICATIONS SECTION 31 00 00.
22. ONLY HISTORIC STORMWATER OUTFALLS ARE SHOWN ON PLANS. CONTRACTOR TO IDENTIFY STORMWATER OUTFALLS AS NEEDED FOR DESIGN OF WATER CONTROL. CONTRACTOR TO PROVIDE FINAL OUTLET PROTECTION FOR EACH STORMWATER OUTFALL AS DETAILED ON SHEET C-502.

DATUM RELATIONSHIP:

EL. 100.00 — MDC (METROPOLITAN DISTRICT COMMISSION)

100'

EL. 0.00 — BCB (BOSTON CITY BASE)

5.65'

EL. -5.65 — 6.47' — NGVD 29 (NATIONAL GEODETIC VERTICAL DATUM OF 1929)

0.82'

EL. -6.47 — NAVD 88 (NORTH AMERICAN VERTICAL DATUM OF 1988)

NOTE NGVD29 TO NAVD88 CONVERSION TO AN APPROXIMATE VALUE WAS OBTAINED BY A CORPSCON CONVERSION OF AN EXISTING BENCHMARK AT THE MUDDY RIVER SITE. THIS CONVERSION MAY VARY AS MUCH AS +/- 0.2 FEET.

A — SECTION IDENTIFICATION LETTER

C-301 — SHEET ON WHICH SECTION IS DRAWN

SYMBOL WHERE SECTION IS TAKEN

RW-SED-19 — BORING IDENTIFICATION

APPROXIMATED TOP OF BORING

APPROXIMATED DEPTH OF RIVER SEDIMENT

APPROXIMATED NATURAL MATERIAL

TOTAL BORING DEPTH

BORING SHOWN ON SECTION SHEETS

* BORINGS SHOWN ON EACH SECTION ARE NEAREST TO ACTUAL SECTION. REFER TO EXISTING CONDITIONS & DEMOLITION SHEETS FOR ACTUAL BORING LOCATION. REFER TO GENERAL NOTE #13 ON THIS SHEET.

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION (SITE PLAN SHEETS)

* REFER TO GENERAL NOTE #20 ON THIS SHEET.

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

GENERAL SEQUENCING NOTES:

1. WORK WITHIN AREAS-1 THRU 12 CONSISTS OF EXCAVATING SEDIMENT FROM PORTIONS OF MUDDY RIVER. REFER TO GENERAL NOTES ON METHOD OF EXCAVATION. THE SEQUENCE BELOW IS INTENDED TO BE A GENERAL PLAN OF OPERATIONS.
2. MULTIPLE WORK AREAS MAY BE WORKED AT THE SAME TIME DUE TO FISH PASSAGE ENVIRONMENTAL WINDOWS. KNOTWEED REMOVAL TREATMENT SHALL BEGIN. REFER TO SPECIFICATIONS SECTION 01 57 20 FOR ADDITIONAL INFORMATION.
3. INSTALL TEMPORARY FENCING, TREE PROTECTION, ROOT PROTECTION, AND TEMPORARY TRUCK AND EQUIPMENT ACCESS ROADS. FENCING GATES SHALL NOT BLOCK WALKWAYS AND PATHWAYS.
4. INSTALL RIVER DIVERSION, IF REQUIRED.
5. CONTRACTOR TO LOCATE EACH STORM DRAIN INLET AND PROTECT FROM CONSTRUCTION OPERATIONS. CONTRACTOR TO PROVIDE BYPASS IF WORK IS BEING DONE IN THE DRY.
6. CONSTRUCT RIVER ACCESS TEMPORARY ROADWAYS BY REMOVING SEDIMENT AND INSTALLING A SUITABLE ROADBASE, IF REQUIRED. TREE ROOT PROTECTION FOR TEMPORARY ROADWAYS WITHIN THE STREAM CHANNEL IS NOT NECESSARY.
7. REMOVE LIMBS AND BRUSH ALONG RIVER ACCESS ROADWAY AS NECESSARY FOR EXCAVATION OF SEDIMENT. LIMBING SHALL BE MINIMIZED AND ONLY AUTHORIZED BY COR. REFER TO GENERAL NOTE #10.
8. EXCAVATE RIVER SEDIMENT AS SHOWN IN PLANS. SEDIMENT SHALL BE MANAGED, TESTED, AND DISPOSED OF ACCORDING TO SPECIFICATIONS. REFER TO GENERAL NOTE #5.
9. WHEN ALL REQUIRED RIVER SEDIMENT IS EXCAVATED, PERFORM REQUIRED AS-BUILT SURVEYS AND REMOVE ANY TEMPORARY RIVER ACCESS ROADWAYS. REFER TO GENERAL NOTE #9.
10. REMOVE RIVER DIVERSION EQUIPMENT, IF USED.
11. AT THE COMPLETION OF ALL DREDGING DOWNSTREAM OF AVENUE LOUIS PASTEUR, REMOVE THE FLOW RESTRICTION CONTROL STRUCTURE (FRCS) IN AREA-6.
12. CONSTRUCT RESTORATION ACCORDING TO LANDSCAPE PLANS. INSTALL TEMPORARY LANDSCAPING FENCING AS SHOWN ON LANDSCAPE PLANS. IF EXCAVATION OPERATIONS ARE COMPLETED OUTSIDE OF A GROWING SEASON, AREA SHALL BE STABILIZED ACCORDING TO THE EROSION AND SEDIMENT CONTROL PLAN UNTIL THE BEGINNING OF THE NEXT GROWING SEASON.
13. REMOVE TREE PROTECTION AND TEMPORARY ACCESS ROADWAYS FOR WORK AREA AS ALL ACTIVITIES ARE COMPLETED.
14. REMOVE TEMPORARY CONSTRUCTION FENCING AFTER LOAM AND SEEDING GUARANTEE PERIOD.

US Army Corps of Engineers New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

DESIGNED BY: | DWN BY: LT | CKD BY: MET | SUBMITTED BY: | PLOT SCALE: | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_G-003.dgn

U. S. ARMY CORPS OF ENGINEERS NEW ENGLAND DISTRICT CONCORD, MASSACHUSETTS

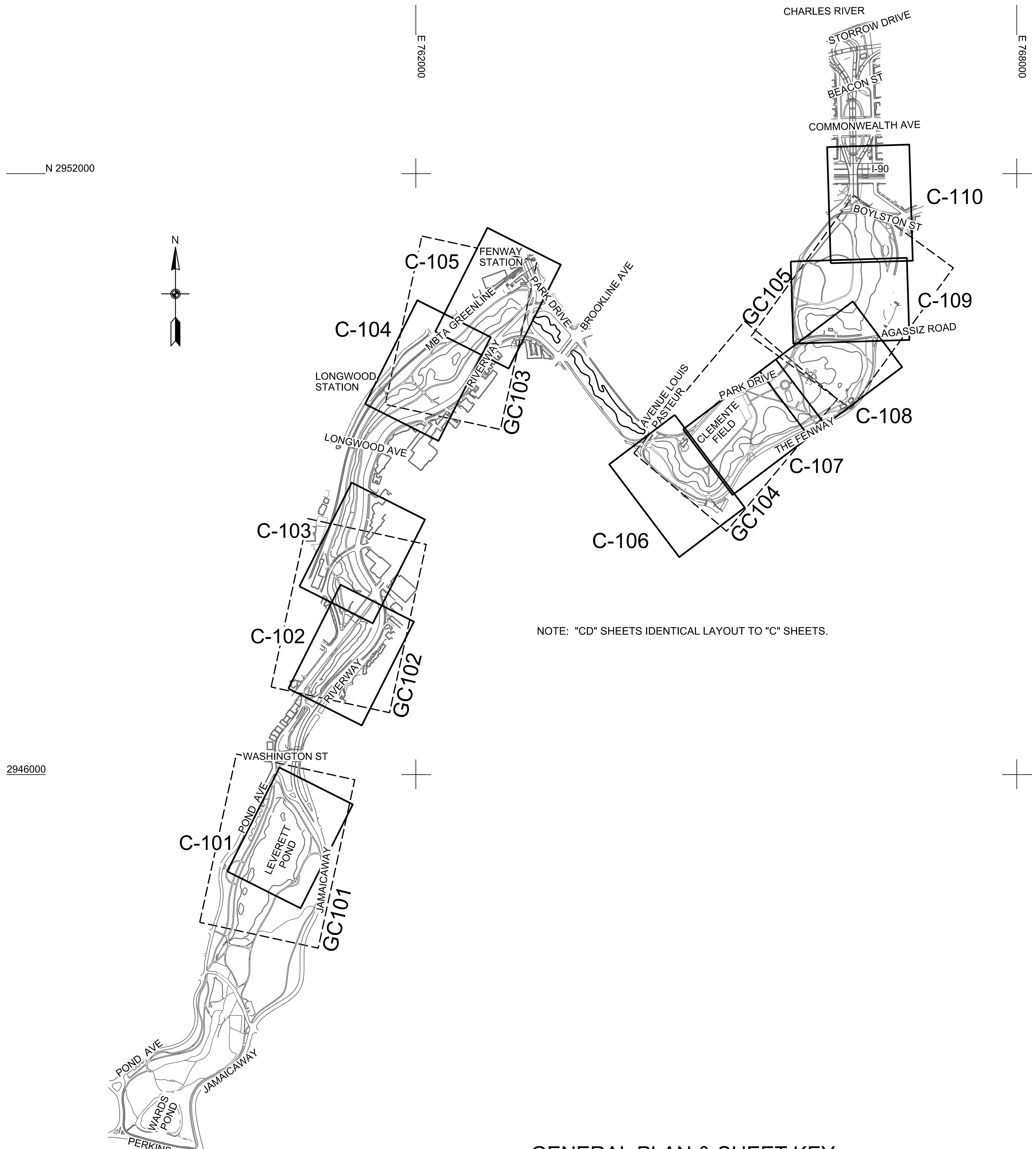
MUDDY RIVER FLOOD DAMAGE REDUCTION PROJECT (PHASE 2) BOSTON AND BROOKLINE, MASSACHUSETTS

GENERAL NOTES

SHEET IDENTIFICATION

G-003

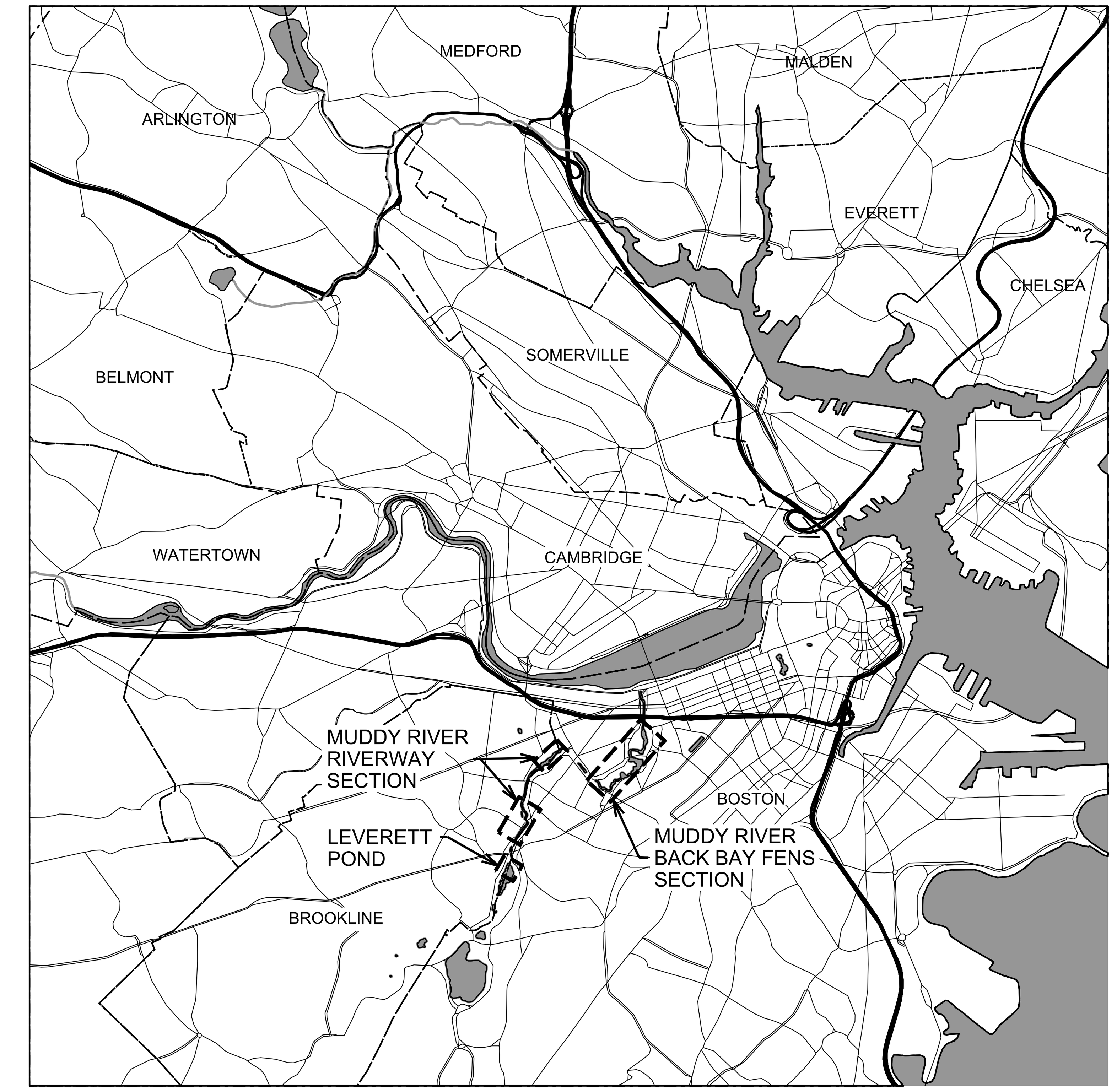
SHEET 3 OF 110



NOTE: "CD" SHEETS IDENTICAL LAYOUT TO "C" SHEETS.

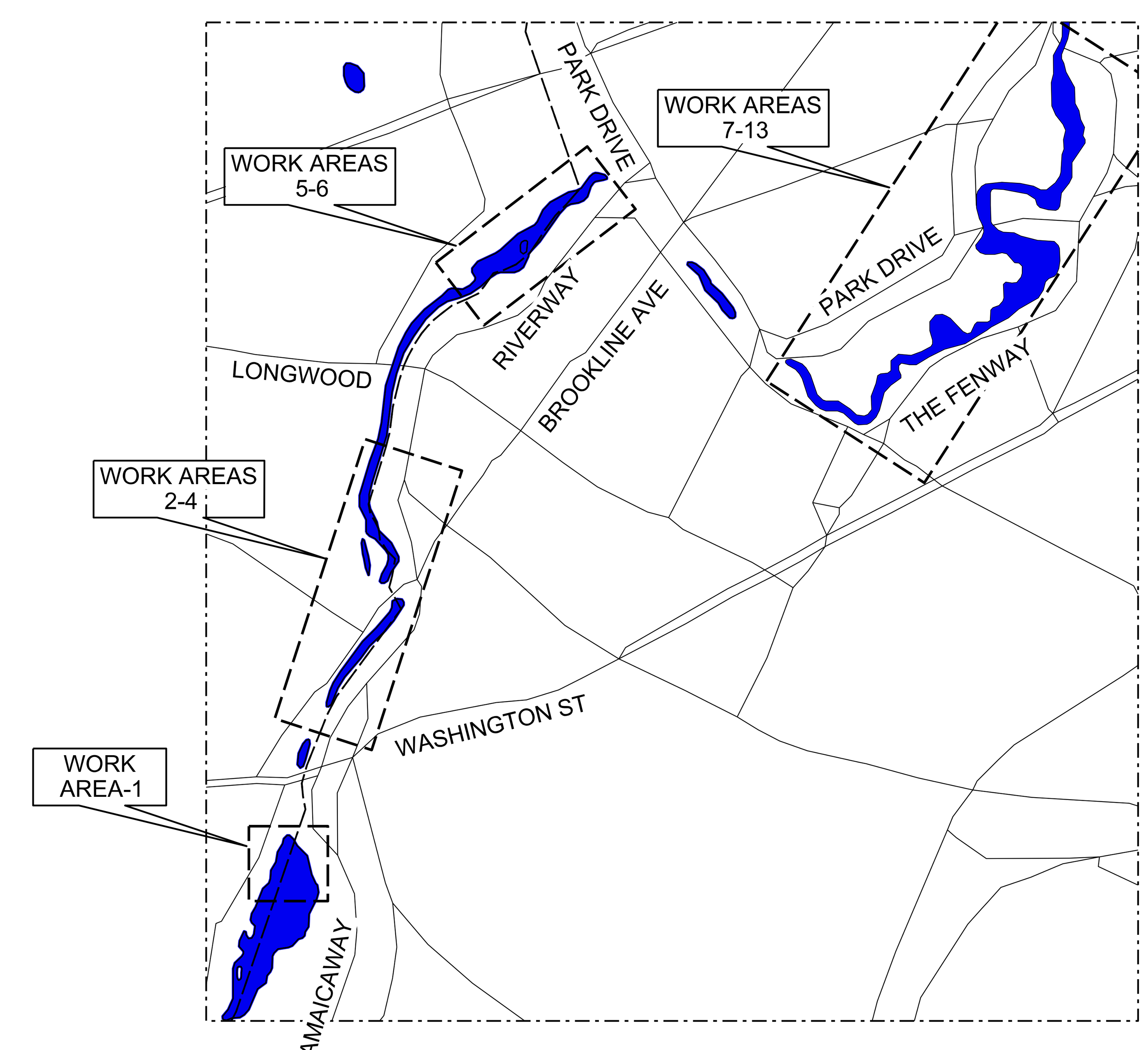
GENERAL PLAN & SHEET KEY

SCALE: 1" = 600'



LOCATION MAP

SCALE: 1"= 5000'



VICINITY MAP

SCALE: 1"= 500'

GRAPHIC SCALES:

1" = 5000' — 5000 0 5000 10000

1" = 500' — 500 0 500 1000

GRAPHIC SCALE:

1" = 600' — 600 0 300 1200

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

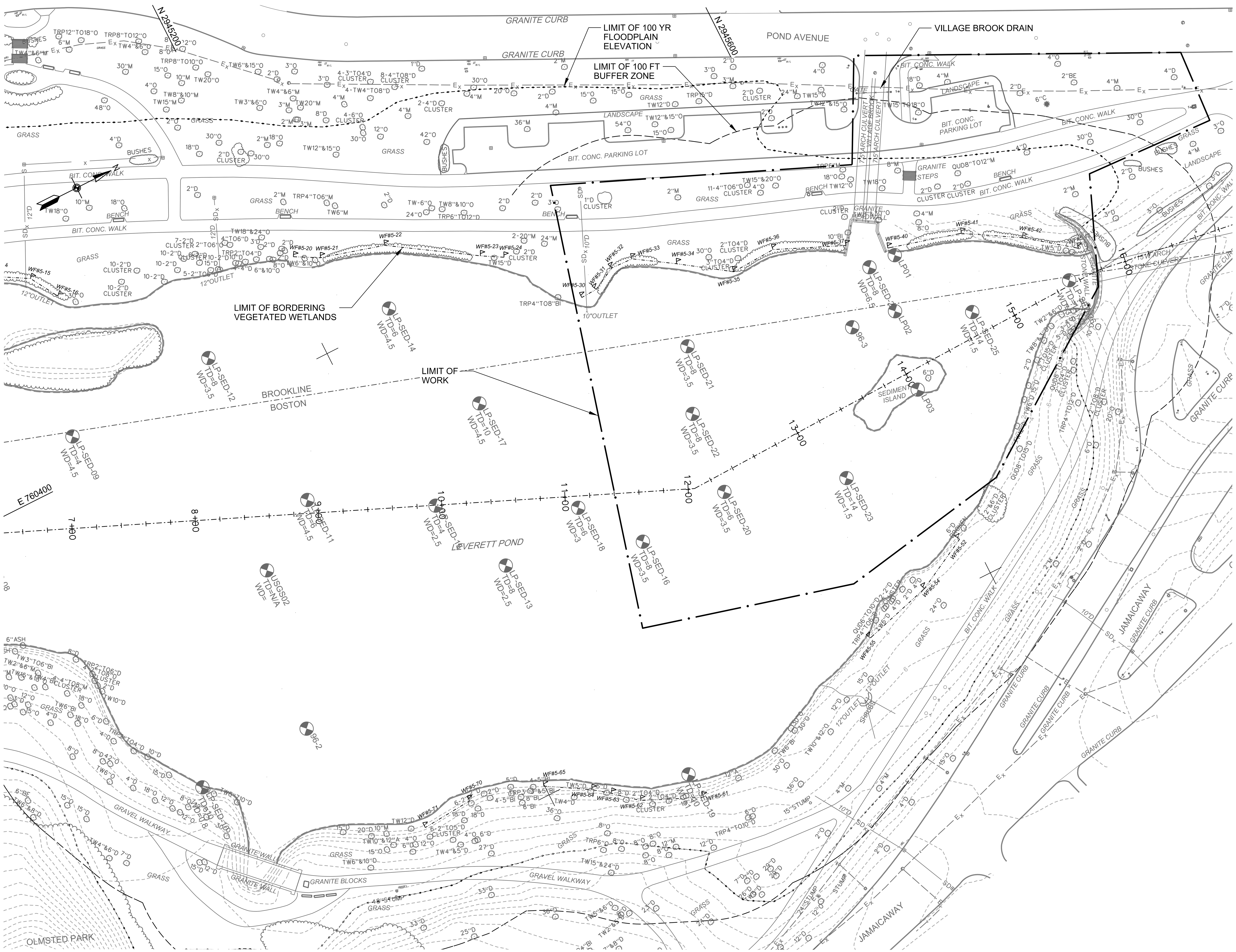
DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE:	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_G-101.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

GENERAL PLAN & SHEET KEY

SHEET IDENTIFICATION
G-101

SHEET 4 OF 110



EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

1" = 40'

40 0 40 80

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

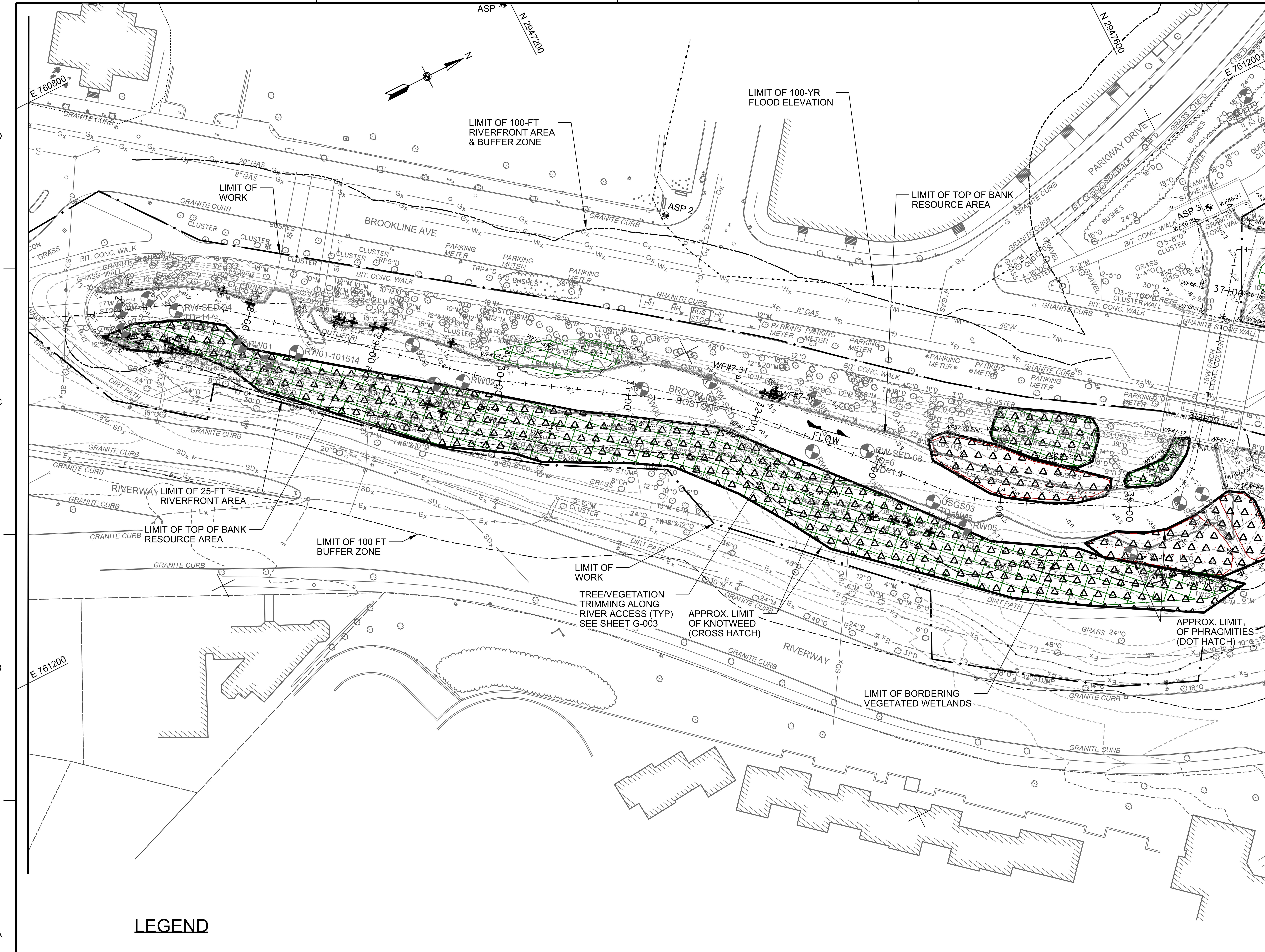
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: M. TESSIER
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_CD101.dgn
DATE: AUGUST 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION
CD101

SHEET 5 OF 110



LEGEND

× = TREE TO BE COMPLETELY REMOVED

△ △ △ = INVASIVE SPECIES TO BE ERADICATED

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

40 0 40 80

1" = 40'

US Army Corps of Engineers® New England District

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

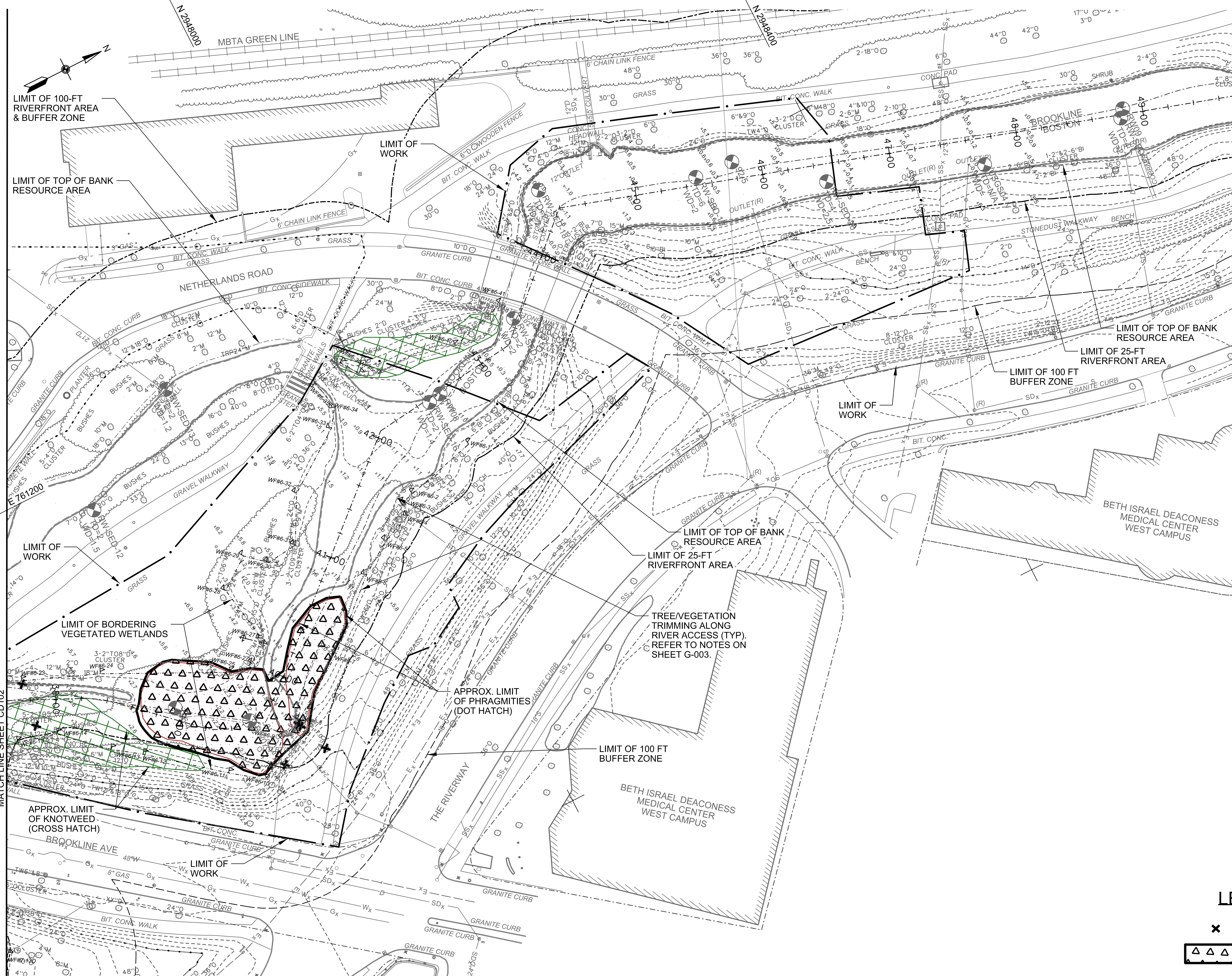
DESIGNED BY: L. THIBODEAU | DATE: SEPTEMBER 2016
DWN BY: LT | CKD BY: MET | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: 1" = 40' | PLOT DATE: | DRAWING CODE: MUD-2
SIZE: ANSI D | FILE NAME: MUD-2_CD102.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS &
DEMOLITION PLAN

SHEET IDENTIFICATION
CD102

SHEET 6 OF 110



EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

LEGEND

× = TREE TO BE COMPLETELY REMOVED

△ △ △ = INVASIVE SPECIES TO BE ERADICATED

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU	DWN BY: LT	CKD BY: MET
DATE: SEPTEMBER 2016	SOLICITATION NO.:	
SUBMITTED BY:	CONTRACT NO.:	
PLOT SCALE: 1" = 40'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_CD103.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION
CD103

SHEET 7 OF 110

LEGEND

× = TREE TO BE COMPLETELY REMOVED

△ △ △ = INVASIVE SPECIES TO BE ERADICATED

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

40 0 40 80

1" = 40'

US Army Corps of Engineers®
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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L.THIBODEAU
DWN BY: LT
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SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_CD104.dgn
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS &
DEMOLITION PLAN

SHEET
IDENTIFICATION
CD104

SHEET 8 OF 110

LEGEND

✖ = TREE TO BE COMPLETELY REMOVED

△ △ △ = INVASIVE SPECIES TO BE ERADICATED

SITE PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU | DATE: SEPTEMBER 2016 | SOLICITATION NO.:
DWN BY: LT | CKD BY: MET | CONTRACT NO.:
SUBMITTED BY:
PLOT SCALE: 1" = 40' | PLOT DATE: | DRAWING CODE: MUD-2
SIZE: ANSI D | FILE NAME: MUD-2_CD105.dgn

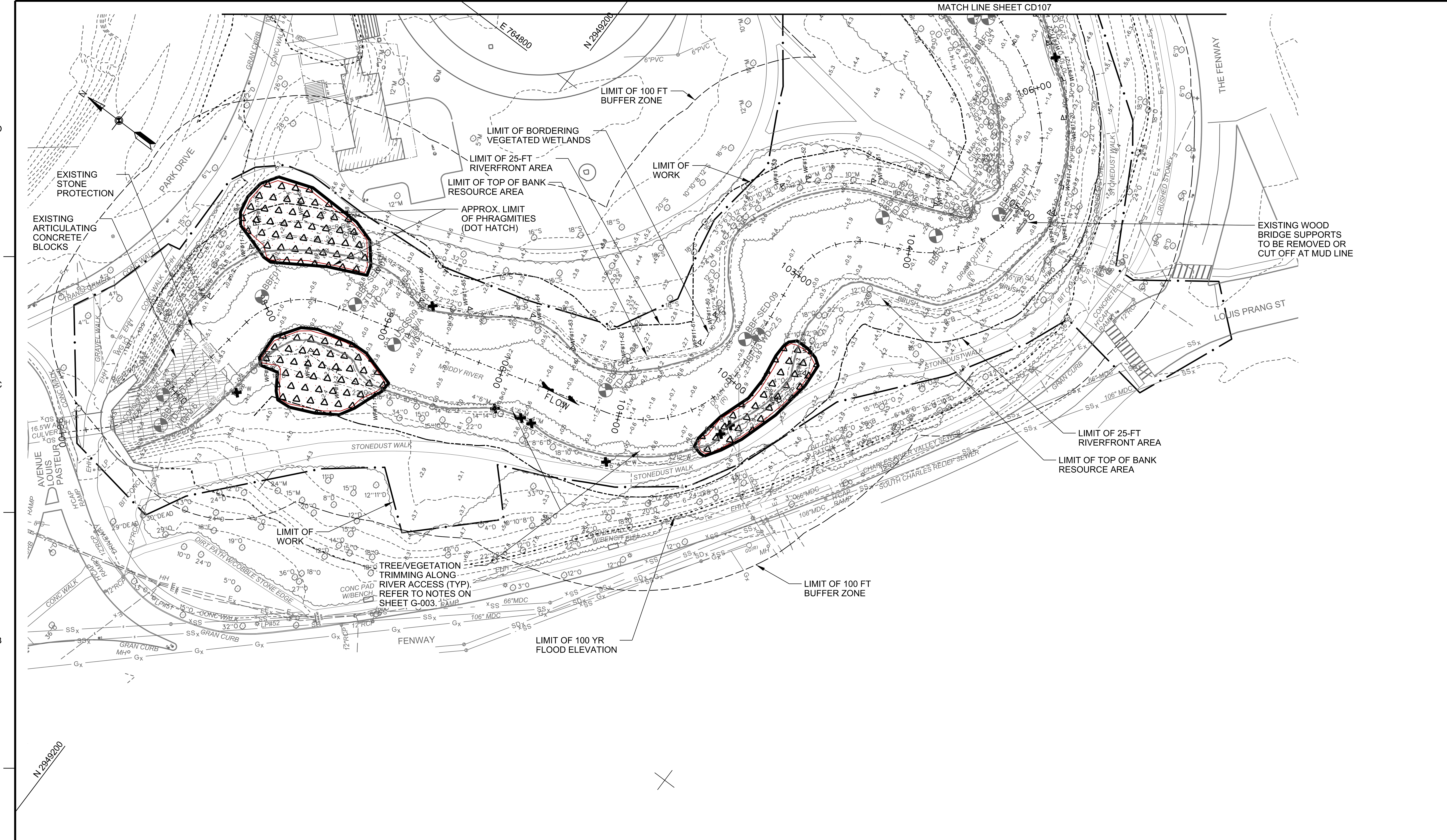
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION

CD105

SHEET 9 OF 110



EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

LEGEND

✕ = TREE TO BE COMPLETELY REMOVED

△△△ = INVASIVE SPECIES TO BE ERADICATED

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

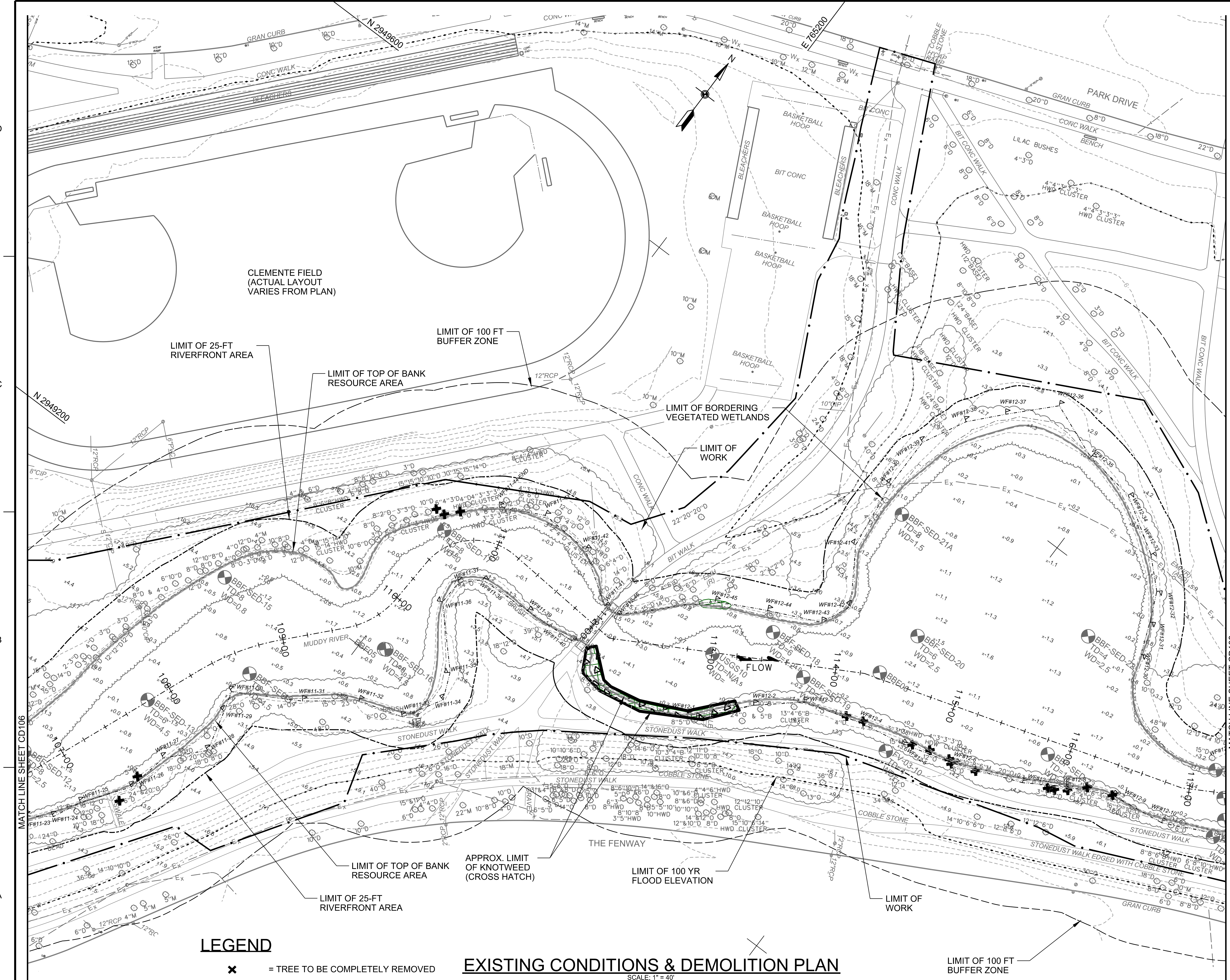
DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 40'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_CD106.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION
CD106

SHEET 10 OF 110



LEGEND

× = TREE TO BE COMPLETELY REMOVED

△△△ = INVASIVE SPECIES TO BE ERADICATED

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

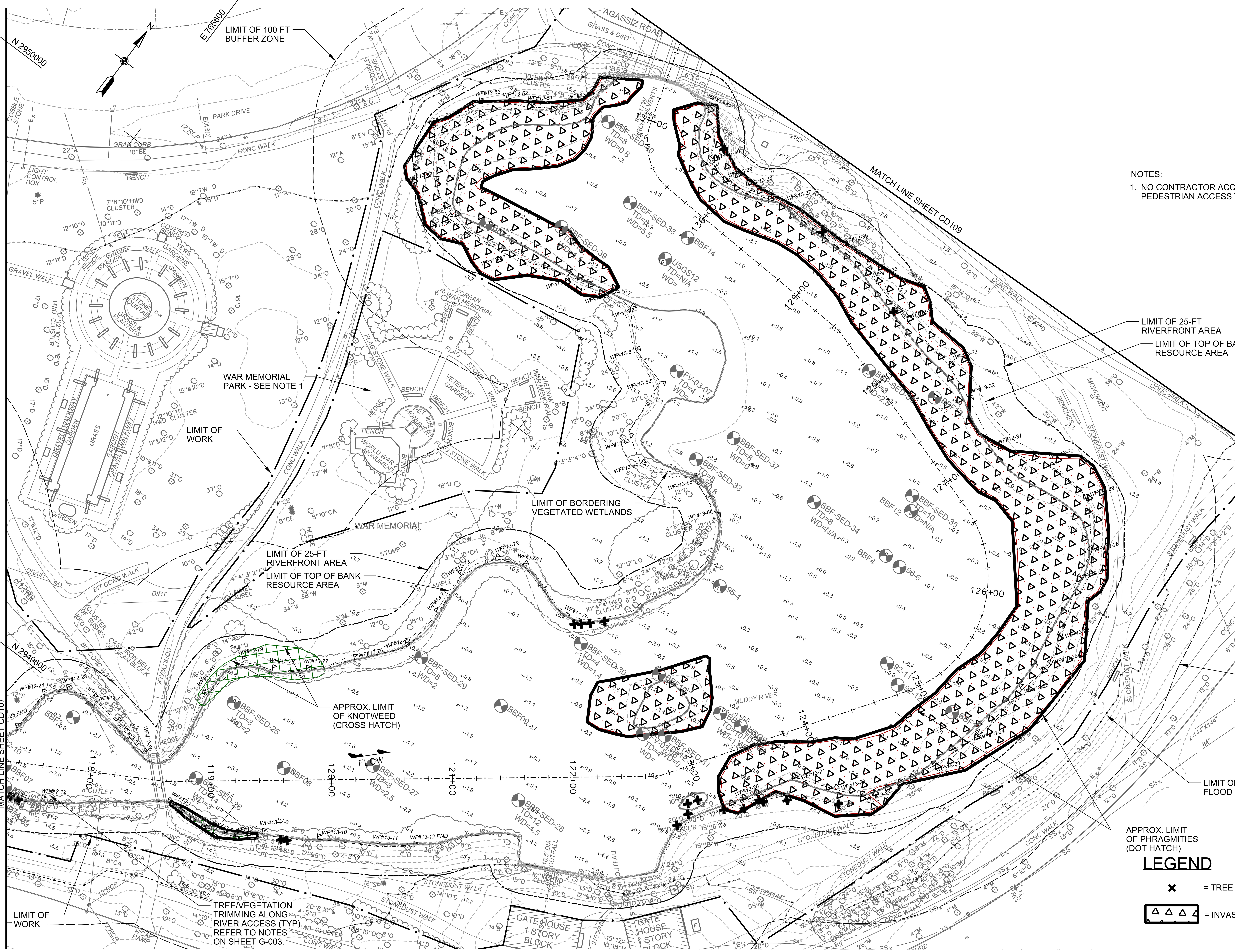
DESIGNED BY: L. THIBODEAU	DWN BY: LT	CKD BY: MET	DATE: SEPTEMBER 2016
SUBMITTED BY:			SOLICITATION NO.:
PLOT SCALE: 1" = 40'	PLOT DATE:		CONTRACT NO.:
SIZE: ANSI D	FILE NAME: MUD-2_CD107.dgn		DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS &
DEMOLITION PLAN

SHEET IDENTIFICATION
CD107

SHEET 11 OF 110



SITE PLAN

SCALE: 1" = 40'

NOTES:

1. NO CONTRACTOR ACCESS TO THE WAR MEMORIAL PARK. PEDESTRIAN ACCESS TO BE MAINTAINED AT ALL TIMES.

LEGEND

× = TREE TO BE COMPLETELY REMOVED

△ △ △ △ = INVASIVE SPECIES TO BE ERADICATED

GRAPHIC SCALE:

40 0 40 80

1" = 40'

US Army Corps of Engineers® New England District

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 40'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_CD108.dgn	

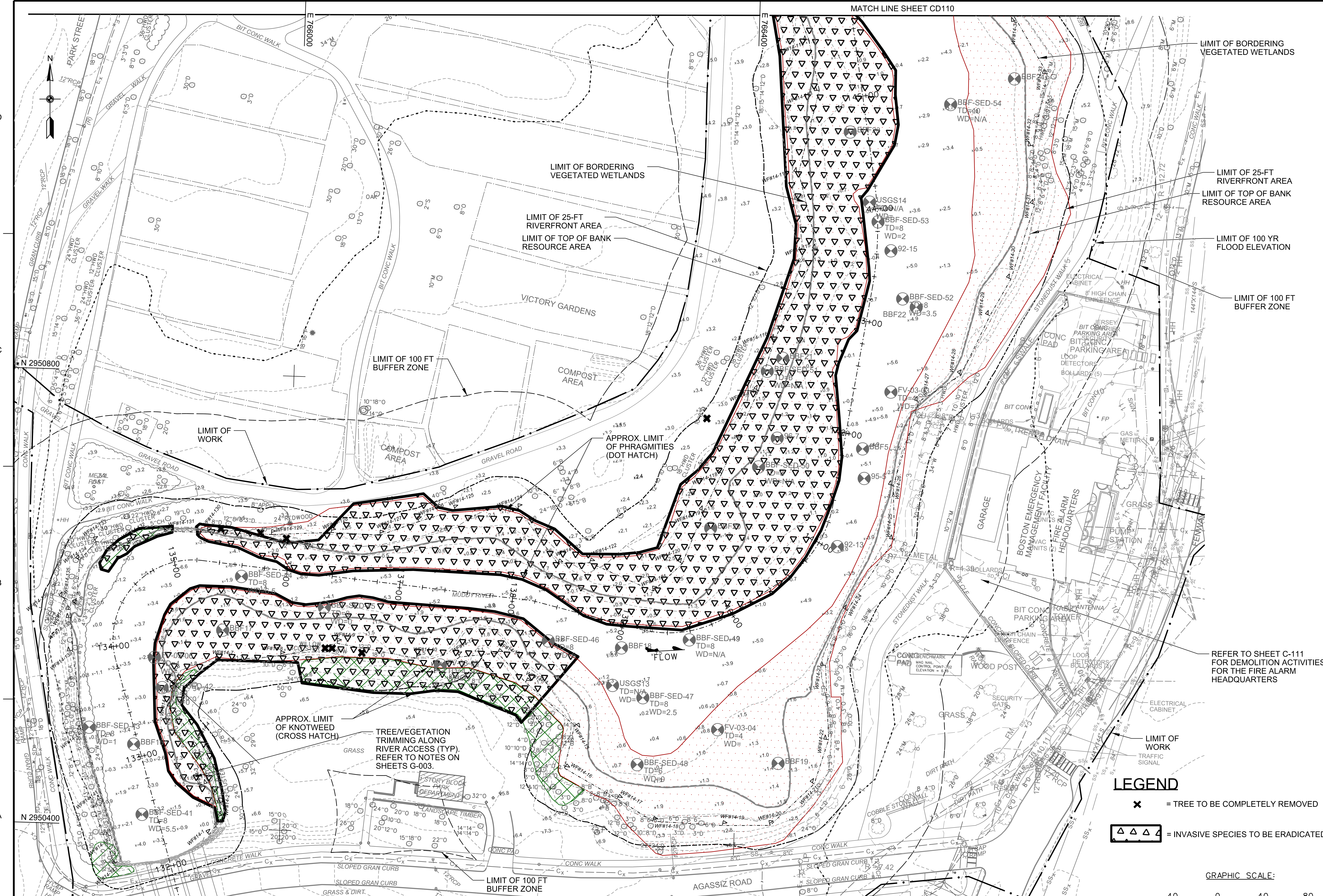
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION

CD108

SHEET 12 OF 110



EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

US Army Corps of Engineers® New England District

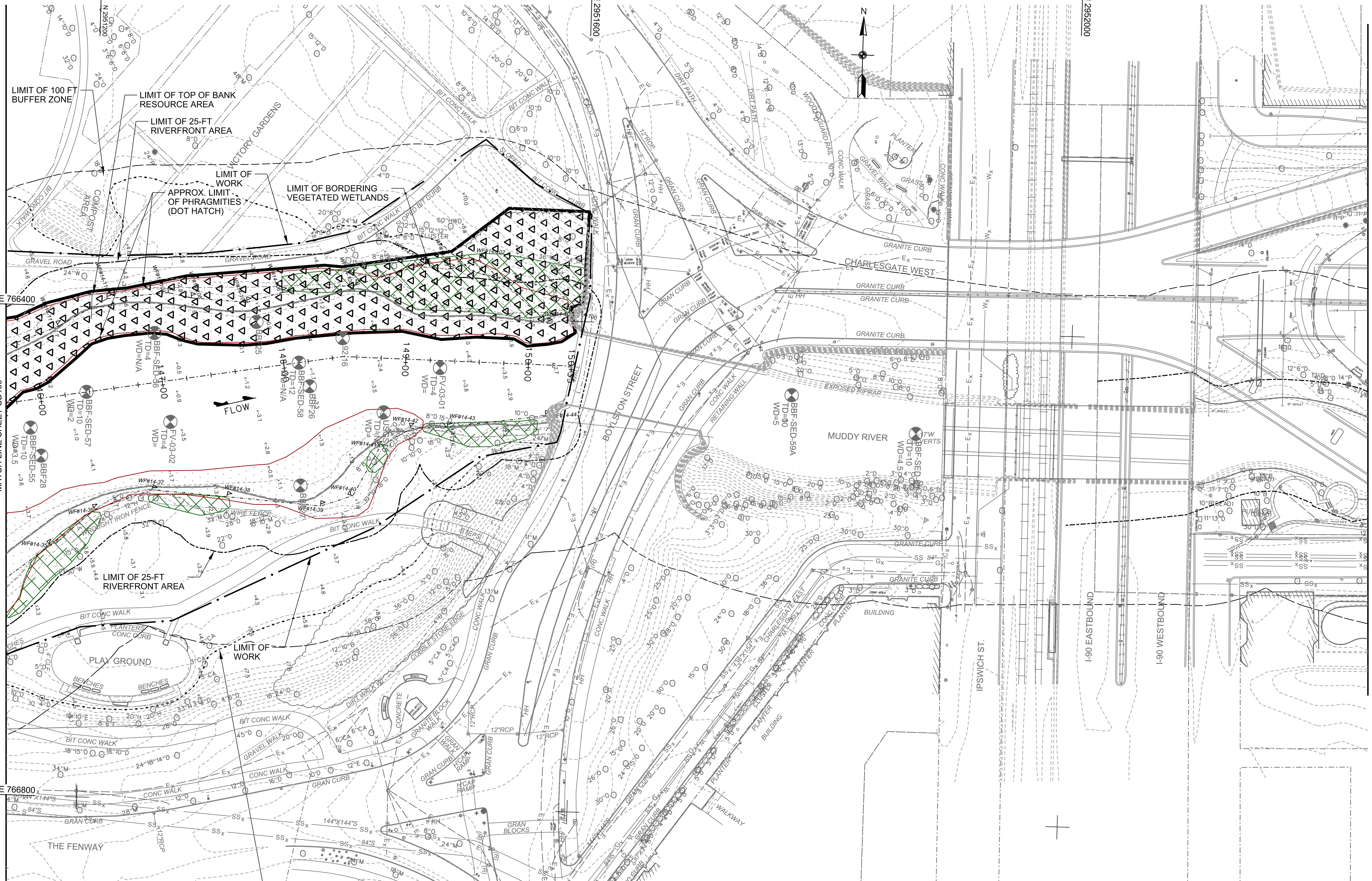
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_CD109.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION
CD109



LEGEND

× = TREE TO BE COMPLETELY REMOVED

△△△ = INVASIVE SPECIES TO BE ERADICATED

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 40'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_CD110.dgn	

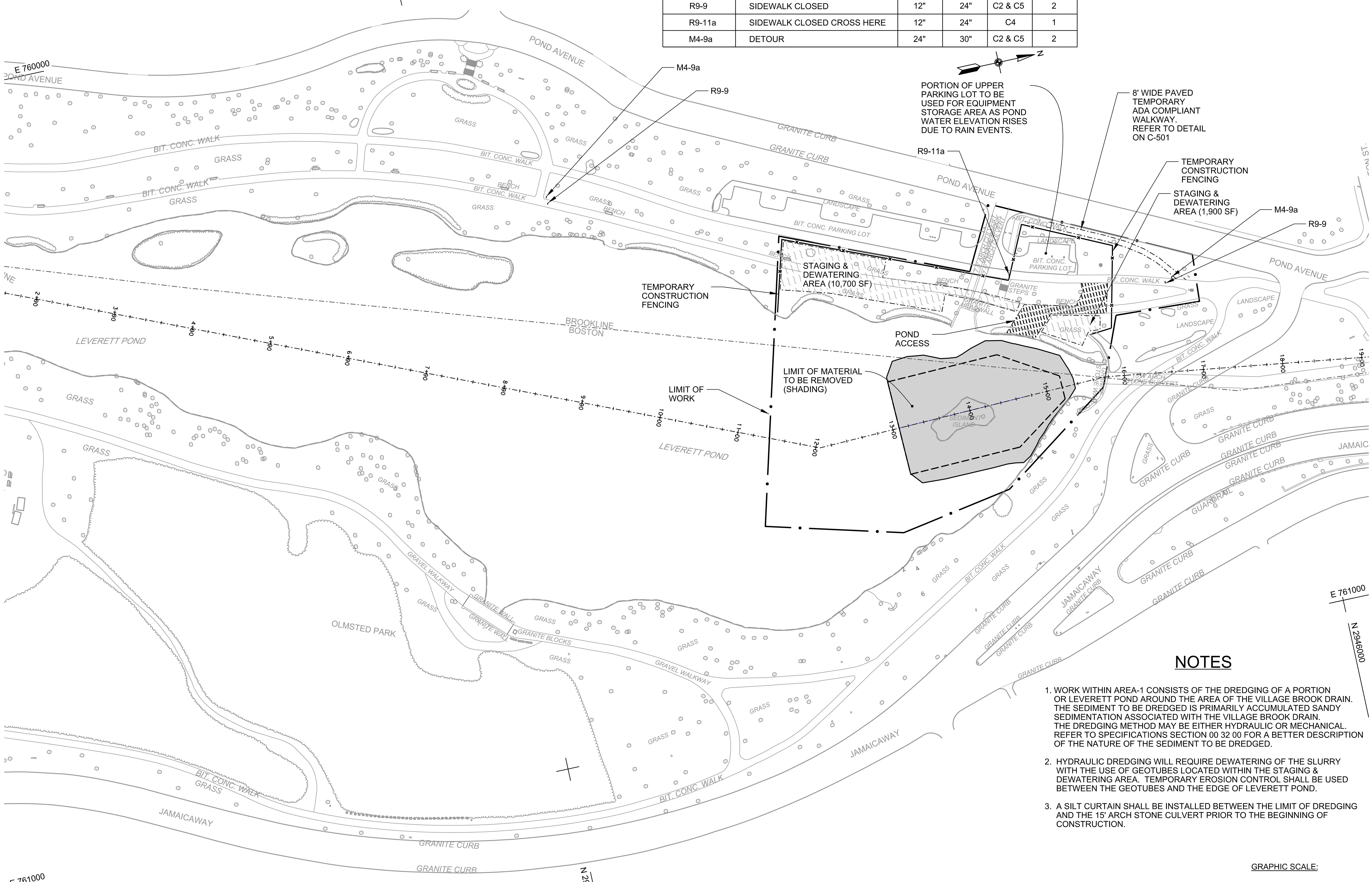
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EXISTING CONDITIONS & DEMOLITION PLAN

SHEET IDENTIFICATION
CD110
SHEET 14 OF 110

SIGN SCHEDULE

DESIGNATION	LEGEND	HEIGHT	WIDTH	SHT GRID	QUANTITY
R9-9	SIDEWALK CLOSED	12"	24"	C2 & C5	2
R9-11a	SIDEWALK CLOSED CROSS HERE	12"	24"	C4	1
M4-9a	DETOUR	24"	30"	C2 & C5	2



WORK AREA-1

SCALE: 1" = 60'

NOTES

1. WORK WITHIN AREA-1 CONSISTS OF THE DREDGING OF A PORTION OR LEVERETT POND AROUND THE AREA OF THE VILLAGE BROOK DRAIN. THE SEDIMENT TO BE DREDGED IS PRIMARILY ACCUMULATED SANDY SEDIMENTATION ASSOCIATED WITH THE VILLAGE BROOK DRAIN. THE DREDGING METHOD MAY BE EITHER HYDRAULIC OR MECHANICAL. REFER TO SPECIFICATIONS SECTION 00 32 00 FOR A BETTER DESCRIPTION OF THE NATURE OF THE SEDIMENT TO BE DREDGED.

2. HYDRAULIC DREDGING WILL REQUIRE DEWATERING OF THE SLURRY WITH THE USE OF GEOTUBES LOCATED WITHIN THE STAGING & DEWATERING AREA. TEMPORARY EROSION CONTROL SHALL BE USED BETWEEN THE GEOTUBES AND THE EDGE OF LEVERETT POND.

3. A SILT CURTAIN SHALL BE INSTALLED BETWEEN THE LIMIT OF DREDGING AND THE 15' ARCH STONE CULVERT PRIOR TO THE BEGINNING OF CONSTRUCTION.

GRAPHIC SCALE:

1" = 60' — 60' 0 30' 120'

US Army Corps of Engineers® New England District

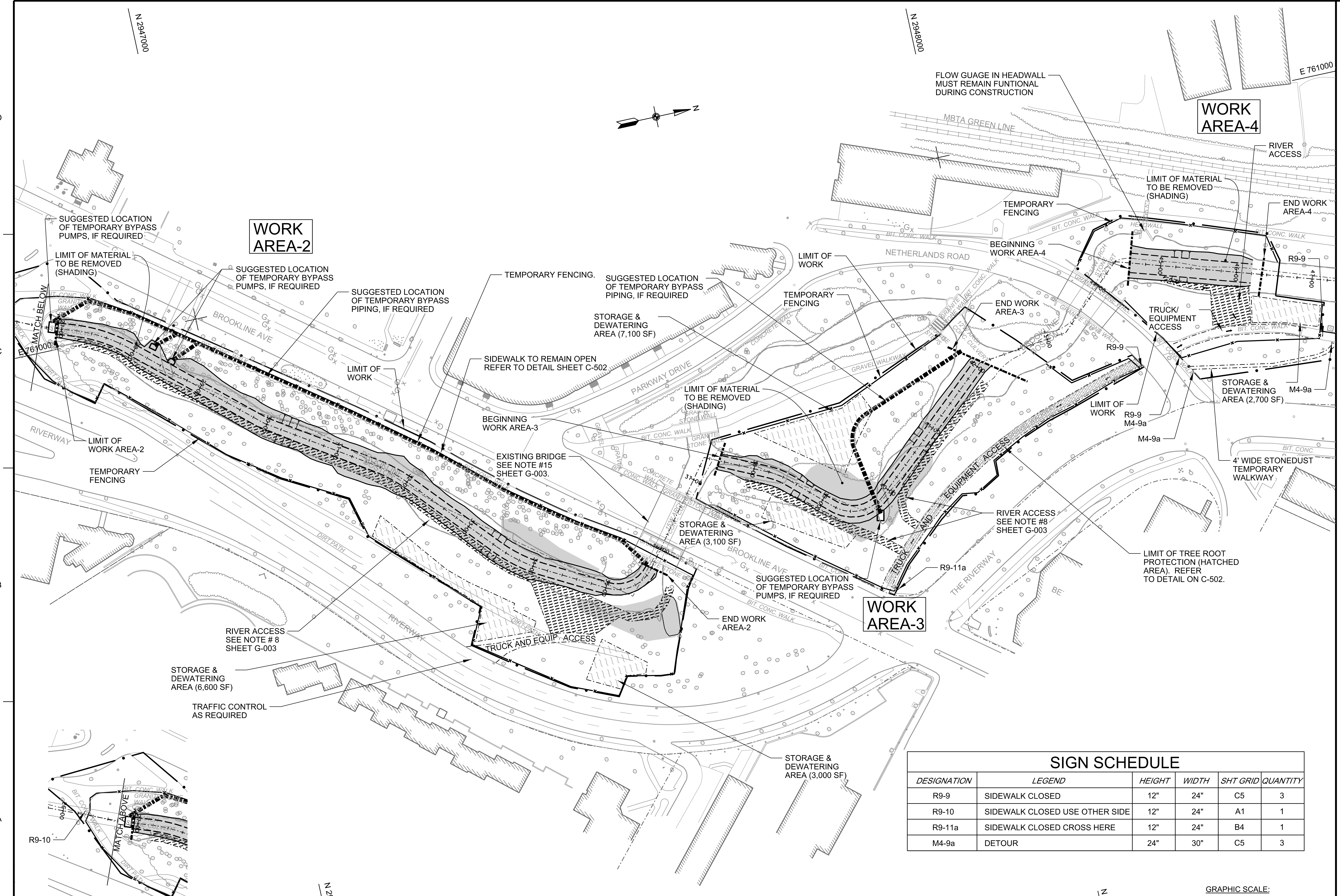
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 60'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_GC101.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION STAGING, ACCESS, AND PEDESTRIAN MANAGEMENT PLANS

SHEET IDENTIFICATION
GC101



SIGN SCHEDULE

DESIGNATION	LEGEND	HEIGHT	WIDTH	SHT GRID	QUANTITY
R9-9	SIDEWALK CLOSED	12"	24"	C5	3
R9-10	SIDEWALK CLOSED USE OTHER SIDE	12"	24"	A1	1
R9-11a	SIDEWALK CLOSED CROSS HERE	12"	24"	B4	1
M4-9a	DETOUR	24"	30"	C5	3

WORK AREAS-2, 3, & 4

SCALE: 1" = 60'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

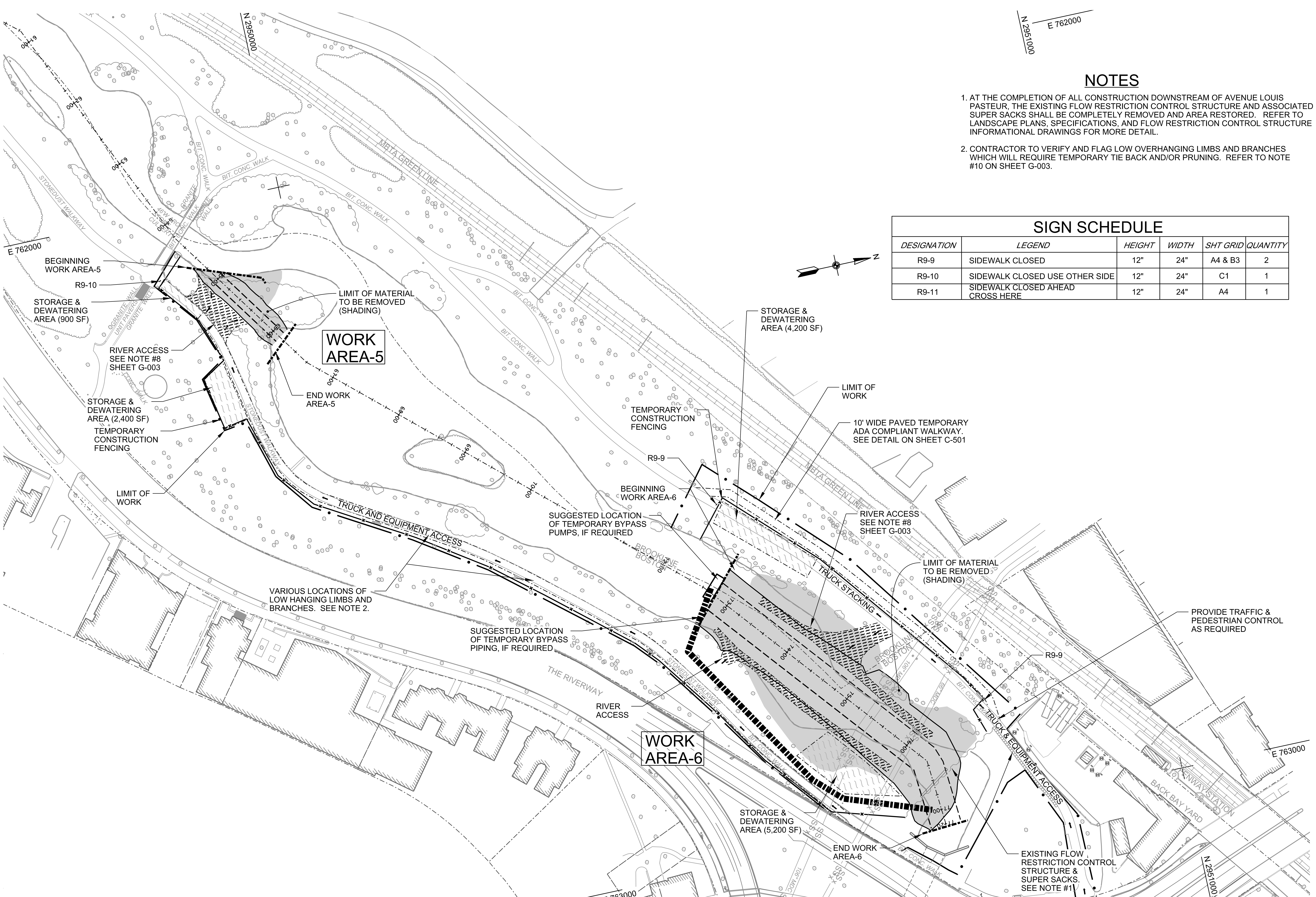
DESIGNED BY: L. THIBODEAU
DWN BY:
CKD BY: MET
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 60'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_GC102.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION STAGING, ACCESS, AND PEDESTRIAN MANAGEMENT PLANS

SHEET IDENTIFICATION
GC102

SHEET 16 OF 110



WORK AREAS-5 & 6

SCALE: 1" = 60'

GRAPHIC SCALE: 1" = 60'

NOTES

1. AT THE COMPLETION OF ALL CONSTRUCTION DOWNSTREAM OF AVENUE LOUIS PASTEUR, THE EXISTING FLOW RESTRICTION CONTROL STRUCTURE AND ASSOCIATED SUPER SACKS SHALL BE COMPLETELY REMOVED AND AREA RESTORED. REFER TO LANDSCAPE PLANS, SPECIFICATIONS, AND FLOW RESTRICTION CONTROL STRUCTURE INFORMATIONAL DRAWINGS FOR MORE DETAIL.
2. CONTRACTOR TO VERIFY AND FLAG LOW OVERHANGING LIMBS AND BRANCHES WHICH WILL REQUIRE TEMPORARY TIE BACK AND/OR PRUNING. REFER TO NOTE #10 ON SHEET G-003.

SIGN SCHEDULE

DESIGNATION	LEGEND	HEIGHT	WIDTH	SHT GRID	QUANTITY
R9-9	SIDEWALK CLOSED	12"	24"	A4 & B3	2
R9-10	SIDEWALK CLOSED USE OTHER SIDE	12"	24"	C1	1
R9-11	SIDEWALK CLOSED AHEAD CROSS HERE	12"	24"	A4	1

US Army Corps of Engineers® New England District

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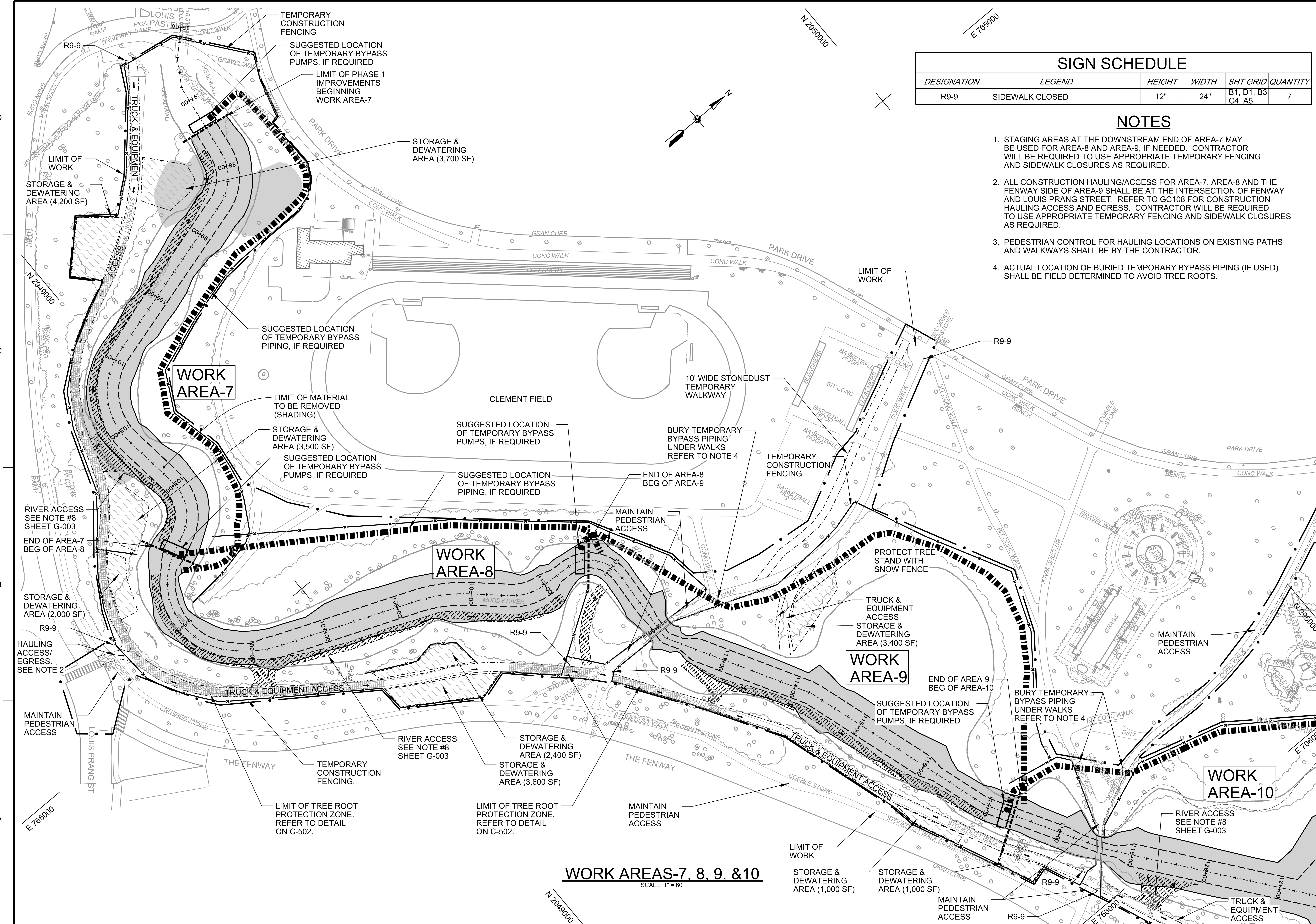
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU | DWN BY: LT | CKD BY: MET | SUBMITTED BY: | PLOT SCALE: 1" = 60' | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_GC103.dgn | DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION STAGING, ACCESS, AND PEDESTRIAN MANAGEMENT PLANS

SHEET IDENTIFICATION
GC103



WORK AREAS-7, 8, 9, &10
SCALE: 1" = 60'

SIGN SCHEDULE

DESIGNATION	LEGEND	HEIGHT	WIDTH	SHT GRID	QUANTITY
R9-9	SIDEWALK CLOSED	12"	24"	B1, D1, B3 C4, A5	7

NOTES

1. STAGING AREAS AT THE DOWNSTREAM END OF AREA-7 MAY BE USED FOR AREA-8 AND AREA-9, IF NEEDED. CONTRACTOR WILL BE REQUIRED TO USE APPROPRIATE TEMPORARY FENCING AND SIDEWALK CLOSURES AS REQUIRED.
2. ALL CONSTRUCTION HAULING/ACCESS FOR AREA-7, AREA-8 AND THE FENWAY SIDE OF AREA-9 SHALL BE AT THE INTERSECTION OF FENWAY AND LOUIS PRANG STREET. REFER TO GC108 FOR CONSTRUCTION HAULING ACCESS AND EGRESS. CONTRACTOR WILL BE REQUIRED TO USE APPROPRIATE TEMPORARY FENCING AND SIDEWALK CLOSURES AS REQUIRED.
3. PEDESTRIAN CONTROL FOR HAULING LOCATIONS ON EXISTING PATHS AND WALKWAYS SHALL BE BY THE CONTRACTOR.
4. ACTUAL LOCATION OF BURIED TEMPORARY BYPASS PIPING (IF USED) SHALL BE FIELD DETERMINED TO AVOID TREE ROOTS.

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

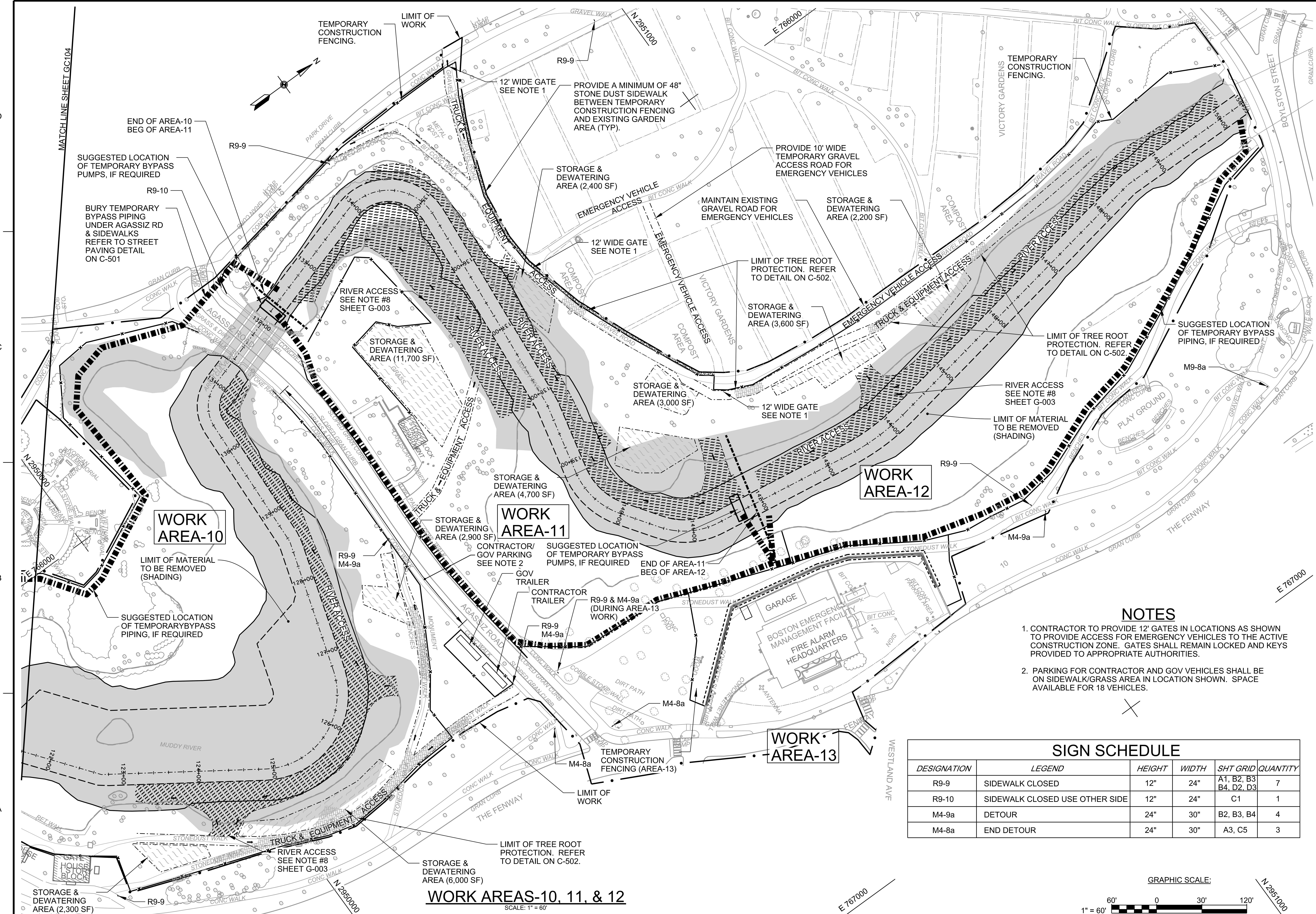
U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: | DWN BY: LT | CKD BY: MET | SUBMITTED BY: | PLOT SCALE: 1" = 60' | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_GC104.dgn | DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION STAGING, ACCESS, AND PEDESTRIAN MANAGEMENT PLANS

SHEET IDENTIFICATION
GC104
SHEET 18 OF 110



NOTES

1. CONTRACTOR TO PROVIDE 12' GATES IN LOCATIONS AS SHOWN TO PROVIDE ACCESS FOR EMERGENCY VEHICLES TO THE ACTIVE CONSTRUCTION ZONE. GATES SHALL REMAIN LOCKED AND KEYS PROVIDED TO APPROPRIATE AUTHORITIES.
2. PARKING FOR CONTRACTOR AND GOV VEHICLES SHALL BE ON SIDEWALK/GRASS AREA IN LOCATION SHOWN. SPACE AVAILABLE FOR 18 VEHICLES.

SIGN SCHEDULE

DESIGNATION	LEGEND	HEIGHT	WIDTH	SHT GRID	QUANTITY
R9-9	SIDEWALK CLOSED	12"	24"	A1, B2, B3 B4, D2, D3	7
R9-10	SIDEWALK CLOSED USE OTHER SIDE	12"	24"	C1	1
M4-9a	DETOUR	24"	30"	B2, B3, B4	4
M4-8a	END DETOUR	24"	30"	A3, C5	3

GRAPHIC SCALE:

60' 0 30' 120'

1" = 60'

WORK AREAS-10, 11, & 12

SCALE: 1" = 60'

US Army Corps of Engineers® New England District

U. S. ARMY CORPS OF ENGINEERS NEW ENGLAND DISTRICT CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU | DWN BY: LT | CKD BY: MET | SUBMITTED BY: | PLOT SCALE: 1" = 60' | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUDD-2_GC105.dgn | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2 | DATE:

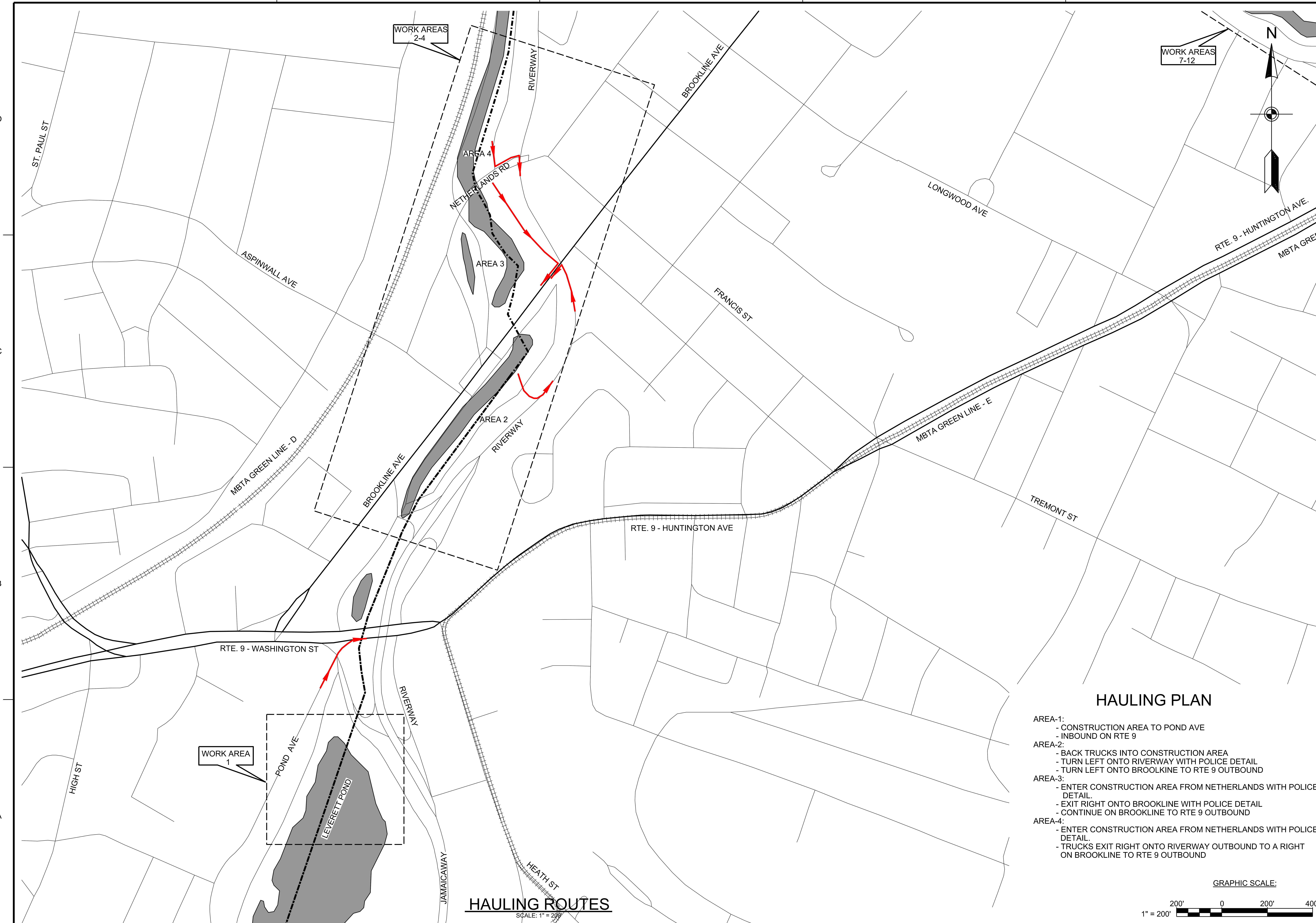
MUDDY RIVER FLOOD DAMAGE REDUCTION PROJECT (PHASE 2) BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION STAGING, ACCESS, AND PEDESTRIAN MANAGEMENT PLANS

SHEET IDENTIFICATION

GC105

SHEET 19 OF 110



HAULING ROUTES

SCALE: 1" = 200'

HAULING PLAN

AREA-1:
- CONSTRUCTION AREA TO POND AVE
- INBOUND ON RTE 9

AREA-2:
- BACK TRUCKS INTO CONSTRUCTION AREA
- TURN LEFT ONTO RIVERWAY WITH POLICE DETAIL
- TURN LEFT ONTO BROOLKINE TO RTE 9 OUTBOUND

AREA-3:
- ENTER CONSTRUCTION AREA FROM NETHERLANDS WITH POLICE DETAIL.
- EXIT RIGHT ONTO BROOKLINE WITH POLICE DETAIL
- CONTINUE ON BROOKLINE TO RTE 9 OUTBOUND

AREA-4:
- ENTER CONSTRUCTION AREA FROM NETHERLANDS WITH POLICE DETAIL.
- TRUCKS EXIT RIGHT ONTO RIVERWAY OUTBOUND TO A RIGHT ON BROOKLINE TO RTE 9 OUTBOUND

GRAPHIC SCALE:

200' 0 200' 400'

1" = 200'

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

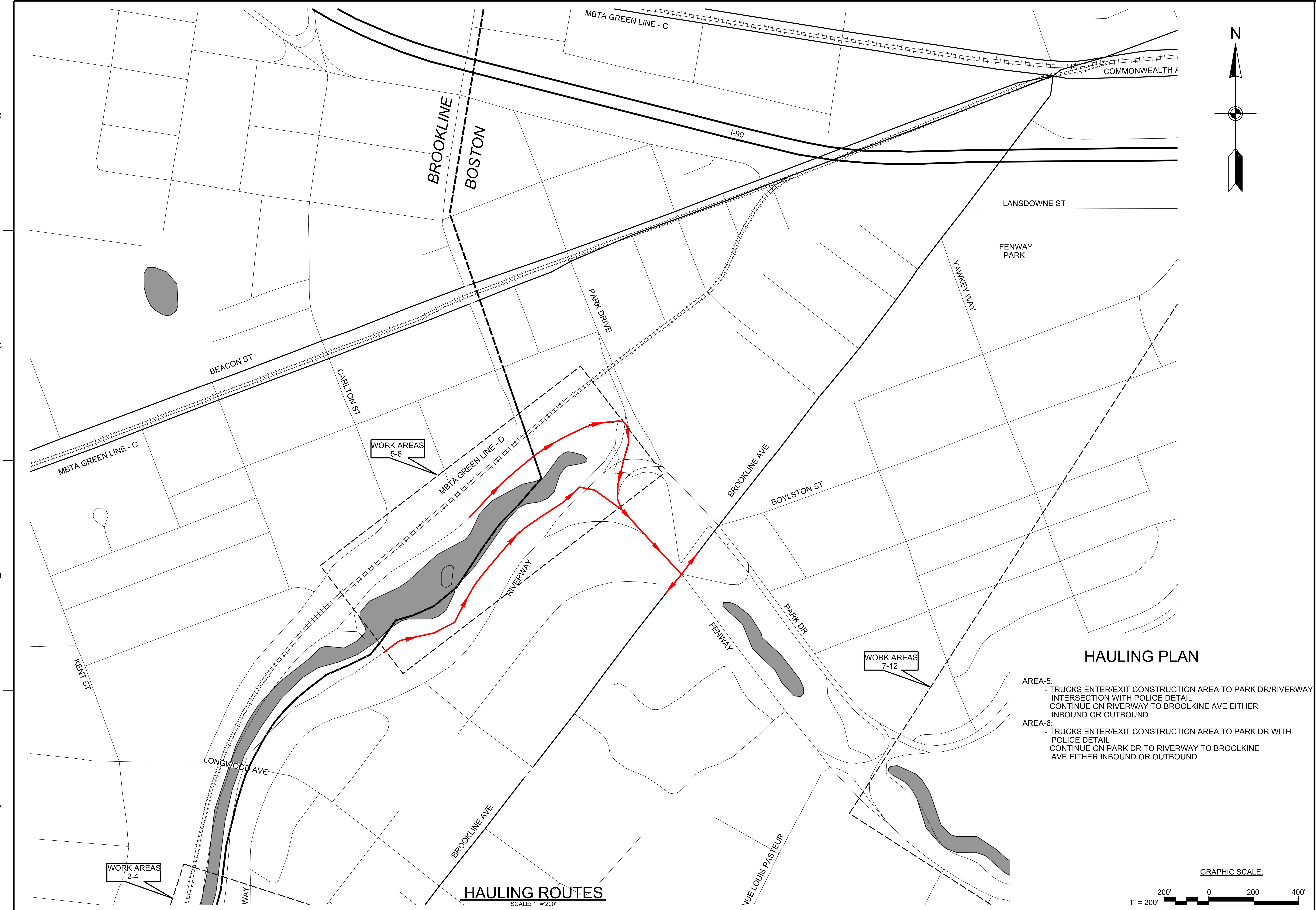
DESIGNED BY: L. THIBODEAU		DATE:	
DWN BY: LT	CKD BY:	SOLICITATION NO.:	
SUBMITTED BY:		CONTRACT NO.:	
PLOT SCALE: 1" = 200'	PLOT DATE:	DRAWING CODE: MUD-2	
SIZE: ANSI D	FILE NAME: MUD-2_GC106.dgn		

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

HAULING PLAN
AREAS 1-4

SHEET IDENTIFICATION
GC106

SHEET 20 OF 110



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U. S. ARMY CORPS OF ENGINEERS
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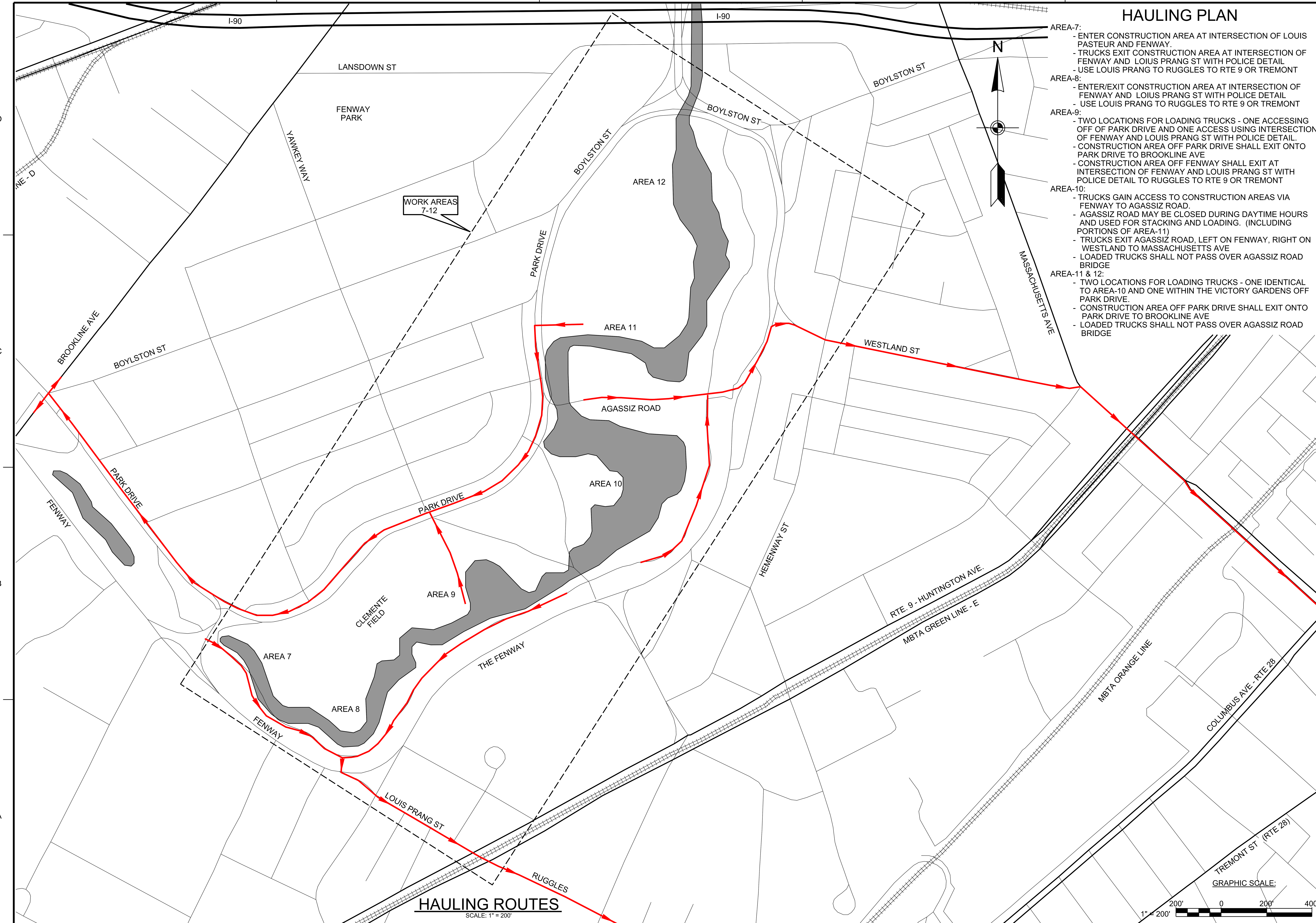
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 200'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_GC107.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

HAULING PLAN
AREAS 5 & 6

SHEET IDENTIFICATION
GC107

SHEET 21 OF 110



HAULING ROUTES

SCALE: 1" = 200'

HAULING PLAN

AREA-7:
- ENTER CONSTRUCTION AREA AT INTERSECTION OF LOUIS PASTEUR AND FENWAY.
- TRUCKS EXIT CONSTRUCTION AREA AT INTERSECTION OF FENWAY AND LOIUS PRANG ST WITH POLICE DETAIL
- USE LOUIS PRANG TO RUGGLES TO RTE 9 OR TREMONT

AREA-8:
- ENTER/EXIT CONSTRUCTION AREA AT INTERSECTION OF FENWAY AND LOIUS PRANG ST WITH POLICE DETAIL
- USE LOUIS PRANG TO RUGGLES TO RTE 9 OR TREMONT

AREA-9:
- TWO LOCATIONS FOR LOADING TRUCKS - ONE ACCESSING OFF OF PARK DRIVE AND ONE ACCESS USING INTERSECTION OF FENWAY AND LOUIS PRANG ST WITH POLICE DETAIL.
- CONSTRUCTION AREA OFF PARK DRIVE SHALL EXIT ONTO PARK DRIVE TO BROOKLINE AVE
- CONSTRUCTION AREA OFF FENWAY SHALL EXIT AT INTERSECTION OF FENWAY AND LOUIS PRANG ST WITH POLICE DETAIL TO RUGGLES TO RTE 9 OR TREMONT

AREA-10:
- TRUCKS GAIN ACCESS TO CONSTRUCTION AREAS VIA FENWAY TO AGASSIZ ROAD.
- AGASSIZ ROAD MAY BE CLOSED DURING DAYTIME HOURS AND USED FOR STACKING AND LOADING. (INCLUDING PORTIONS OF AREA-11)
- TRUCKS EXIT AGASSIZ ROAD, LEFT ON FENWAY, RIGHT ON WESTLAND TO MASSACHUSETTS AVE
- LOADED TRUCKS SHALL NOT PASS OVER AGASSIZ ROAD BRIDGE

AREA-11 & 12:
- TWO LOCATIONS FOR LOADING TRUCKS - ONE IDENTICAL TO AREA-10 AND ONE WITHIN THE VICTORY GARDENS OFF PARK DRIVE.
- CONSTRUCTION AREA OFF PARK DRIVE SHALL EXIT ONTO PARK DRIVE TO BROOKLINE AVE
- LOADED TRUCKS SHALL NOT PASS OVER AGASSIZ ROAD BRIDGE

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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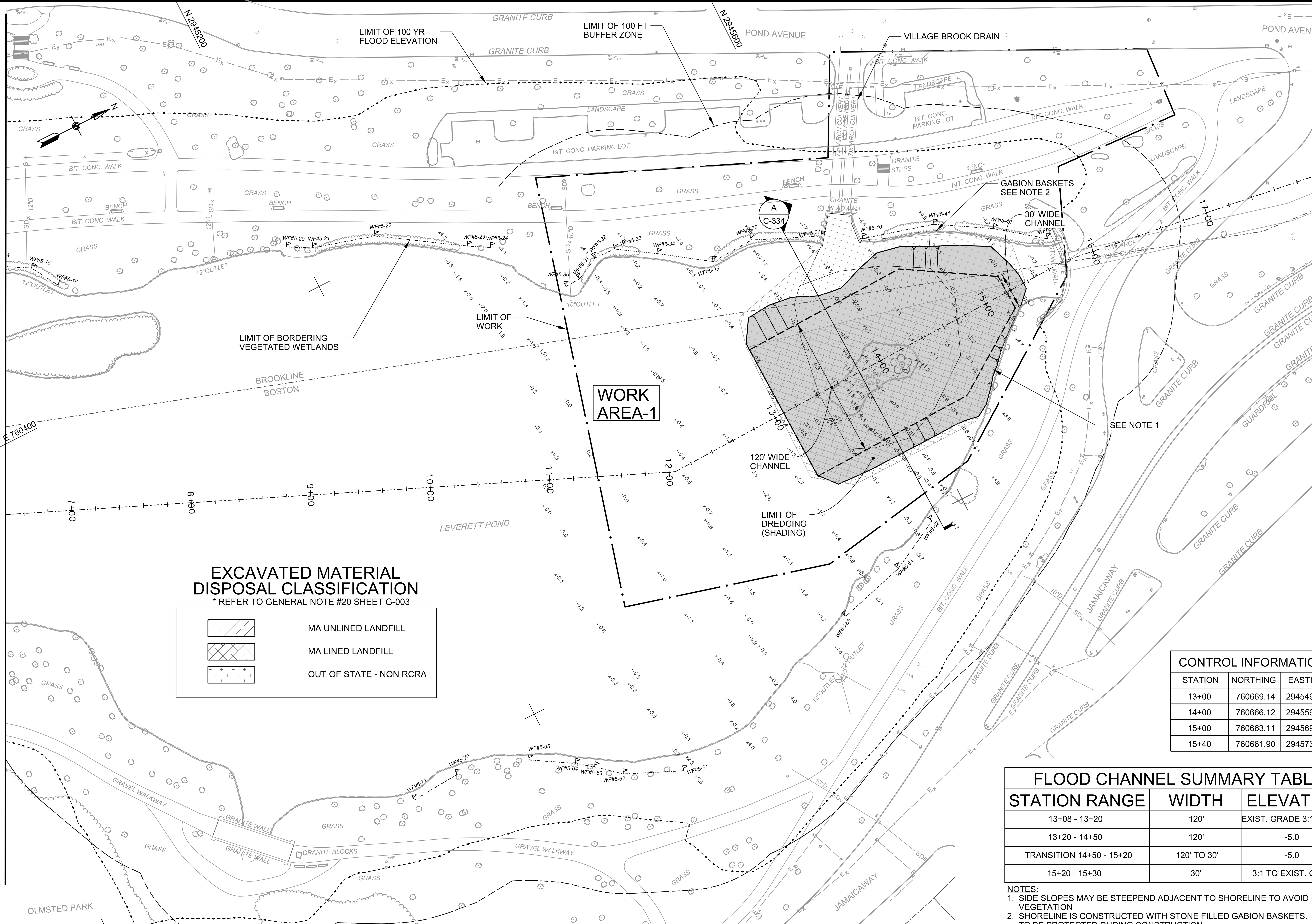
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 200'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_GC108.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

HAULING PLAN
AREAS 7-12

SHEET IDENTIFICATION
GC108

SHEET 22 OF 110



EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

CONTROL INFORMATION

STATION	NORTHING	EASTING
13+00	760669.14	2945491.10
14+00	760666.12	2945591.06
15+00	760663.11	2945691.01
15+40	760661.90	2945730.99

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
13+08 - 13+20	120'	EXIST. GRADE 3:1 TO -5.0
13+20 - 14+50	120'	-5.0
TRANSITION 14+50 - 15+20	120' TO 30'	-5.0
15+20 - 15+30	30'	3:1 TO EXIST. GRADE

NOTES:
1. SIDE SLOPES MAY BE STEEPEND ADJACENT TO SHORELINE TO AVOID GRADING INTO VEGETATION
2. SHORELINE IS CONSTRUCTED WITH STONE FILLED GABION BASKETS. BASKETS TO BE PROTECTED DURING CONSTRUCTION.

GRAPHIC SCALE:

40 0 40 80

1" = 40'

SITE PLAN

SCALE: 1" = 40'

US Army Corps of Engineers® New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 40'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-101.dgn	

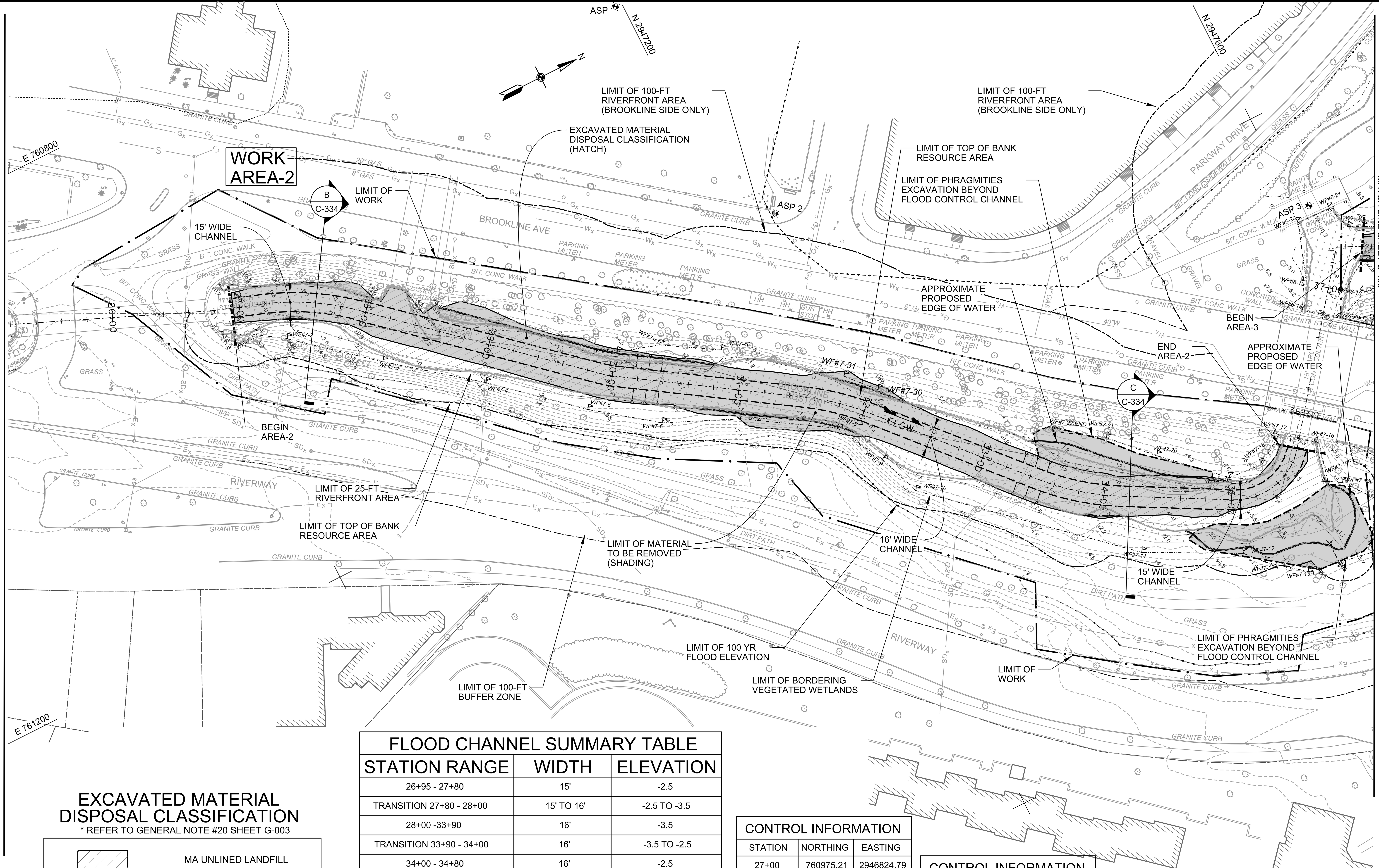
MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-101



FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
26+95 - 27+80	15'	-2.5
TRANSITION 27+80 - 28+00	15' TO 16'	-2.5 TO -3.5
28+00 -33+90	16'	-3.5
TRANSITION 33+90 - 34+00	16'	-3.5 TO -2.5
34+00 - 34+80	16'	-2.5
TRANSITION 34+80 - 35+00	16' TO 15'	-2.5
35+00 - 35+72	15'	-2.5

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

CONTROL INFORMATION

STATION	NORTHING	EASTING
27+00	760975.21	2946824.79
PC 27+16.80	760980.72	2946840.66
PT 27+94.39	761019.56	2946907.28
28+00	761023.27	2946911.48
29+00	761089.35	2946986.53
PI 29+96.49	761153.12	2947058.95
30+00	761155.03	2947061.89
31+00	761209.49	2947145.76
PC 31+51.96	761237.79	2947189.34
32+00	761268.52	2947226.12

CONTROL INFORMATION

STATION	NORTHING	EASTING
PT 32+04.93	761272.15	2947229.45
33+00	761343.00	2947292.85
PC 33+45.30	761376.77	2947323.06
34+00	761412.05	2947364.62
PT 34+13.77	761419.04	2947376.48
PC 35+01	761460.74	2947453.10
PT 35+71.56	761447.40	2947516.56

SITE PLAN

SCALE: 1" = 40'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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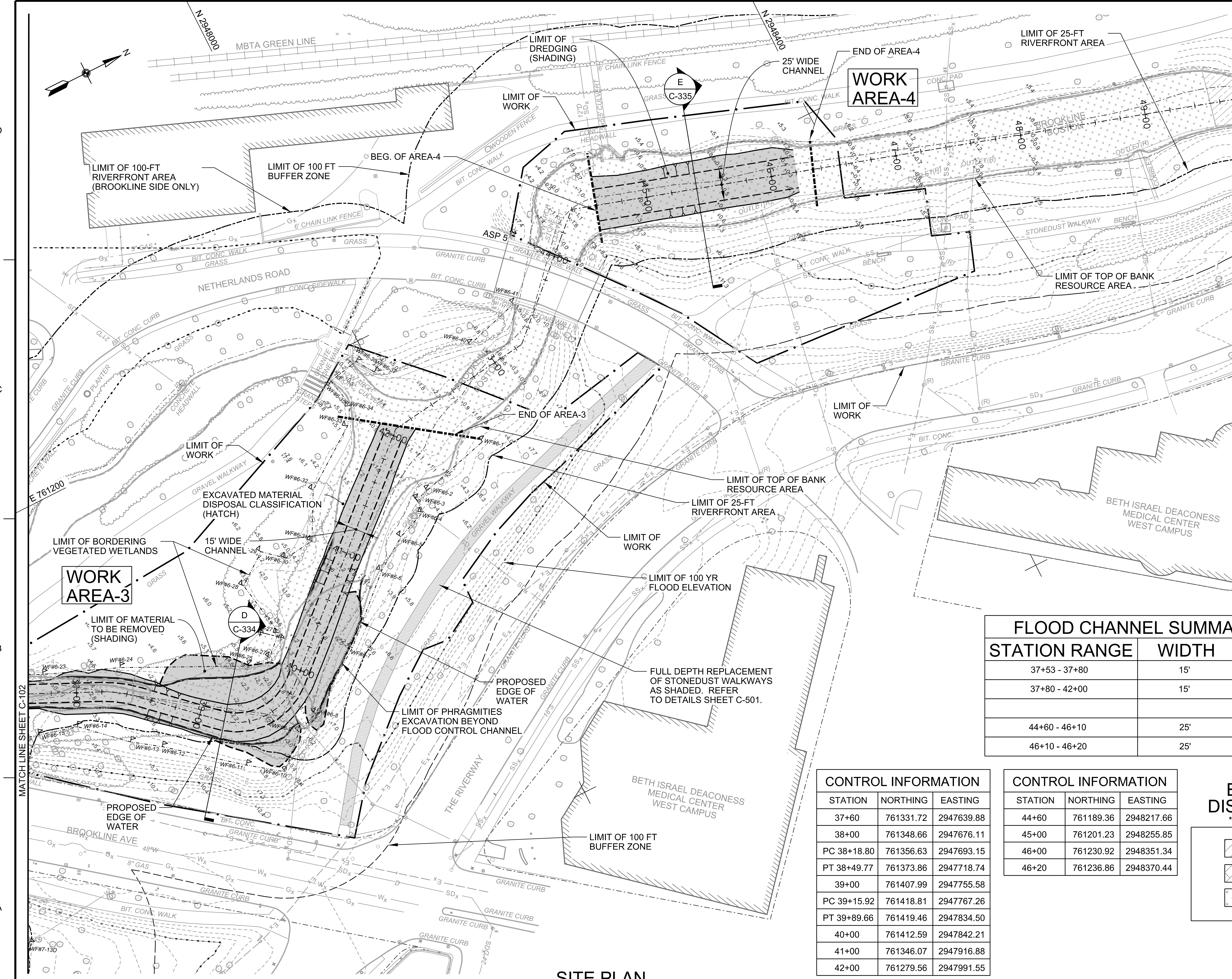
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-102.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-102

SHEET 24 OF 110



SITE PLAN

SCALE: 1" = 40'

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
37+53 - 37+80	15'	EXIST. GRADE 3:1 TO -1.0
37+80 - 42+00	15'	-1.0
44+60 - 46+10	25'	-2.5
46+10 - 46+20	25'	3:1 TO EXIST. GRADE

CONTROL INFORMATION

STATION	NORTHING	EASTING
37+60	761331.72	2947639.88
38+00	761348.66	2947676.11
PC 38+18.80	761356.63	2947693.15
PT 38+49.77	761373.86	2947718.74
39+00	761407.99	2947755.58
PC 39+15.92	761418.81	2947767.26
PT 39+89.66	761419.46	2947834.50
40+00	761412.59	2947842.21
41+00	761346.07	2947916.88
42+00	761279.56	2947991.55

CONTROL INFORMATION

STATION	NORTHING	EASTING
44+60	761189.36	2948217.66
45+00	761201.23	2948255.85
46+00	761230.92	2948351.34
46+20	761236.86	2948370.44

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

GRAPHIC SCALE:

40 0 40 80

1" = 40'

US Army Corps of Engineers® New England District

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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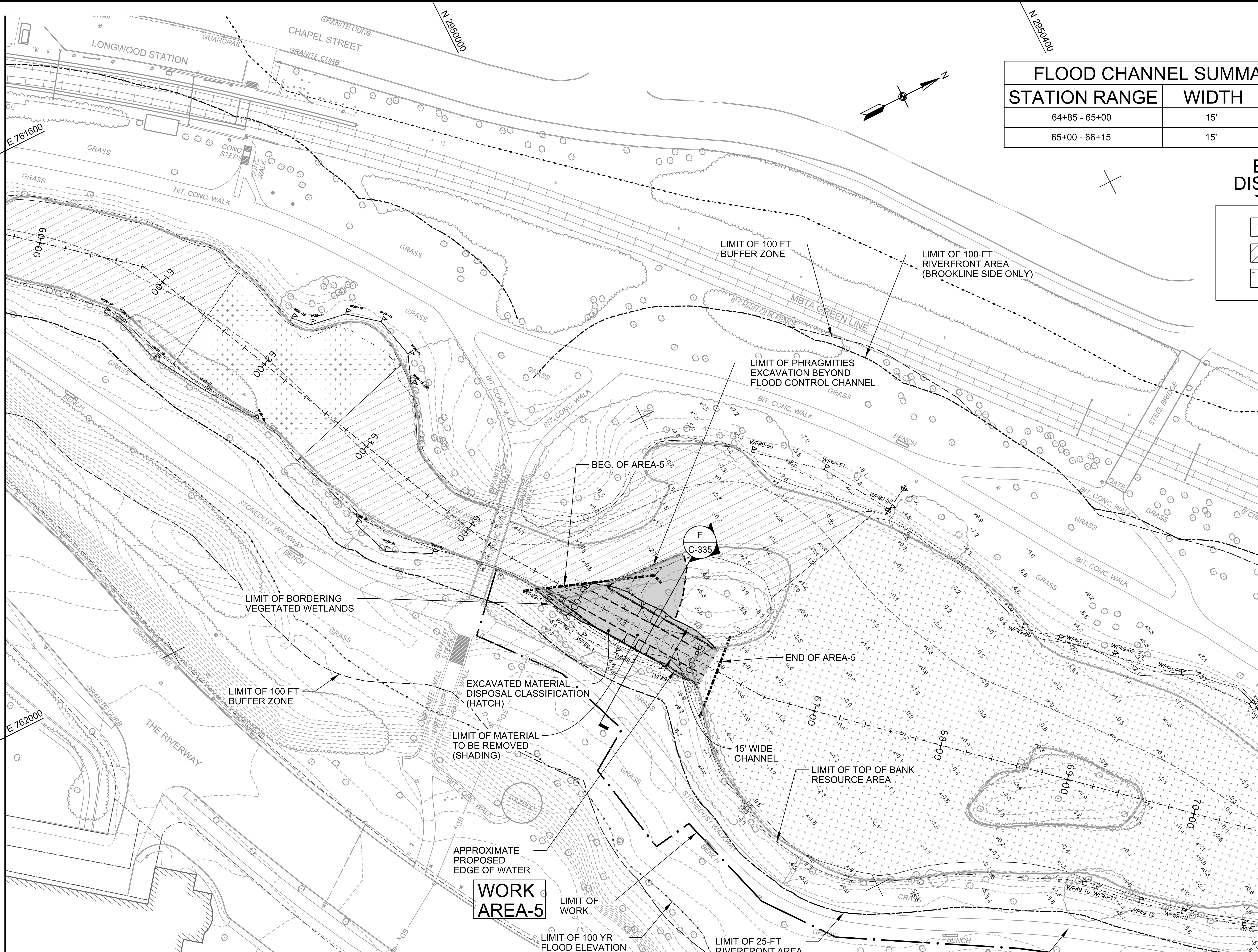
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-103

SHEET 25 OF 110



FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
64+85 - 65+00	15'	EXIST. GRADE 3:1 TO -2.0
65+00 - 66+15	15'	-2.0

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

CONTROL INFORMATION

STATION	NORTHING	EASTING
65+00	762100.98	2949896.88
66+00	762183.47	2949953.40

TOP DRESSED STONEDUST WALKWAYS USED FOR CONSTRUCTION (NON-SHADED) REFER TO DETAILS SHEET C-501 AND TO GENERAL NOTE 12 ON SHEET G-003.

SITE PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:
40 0 40 80
1" = 40'

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
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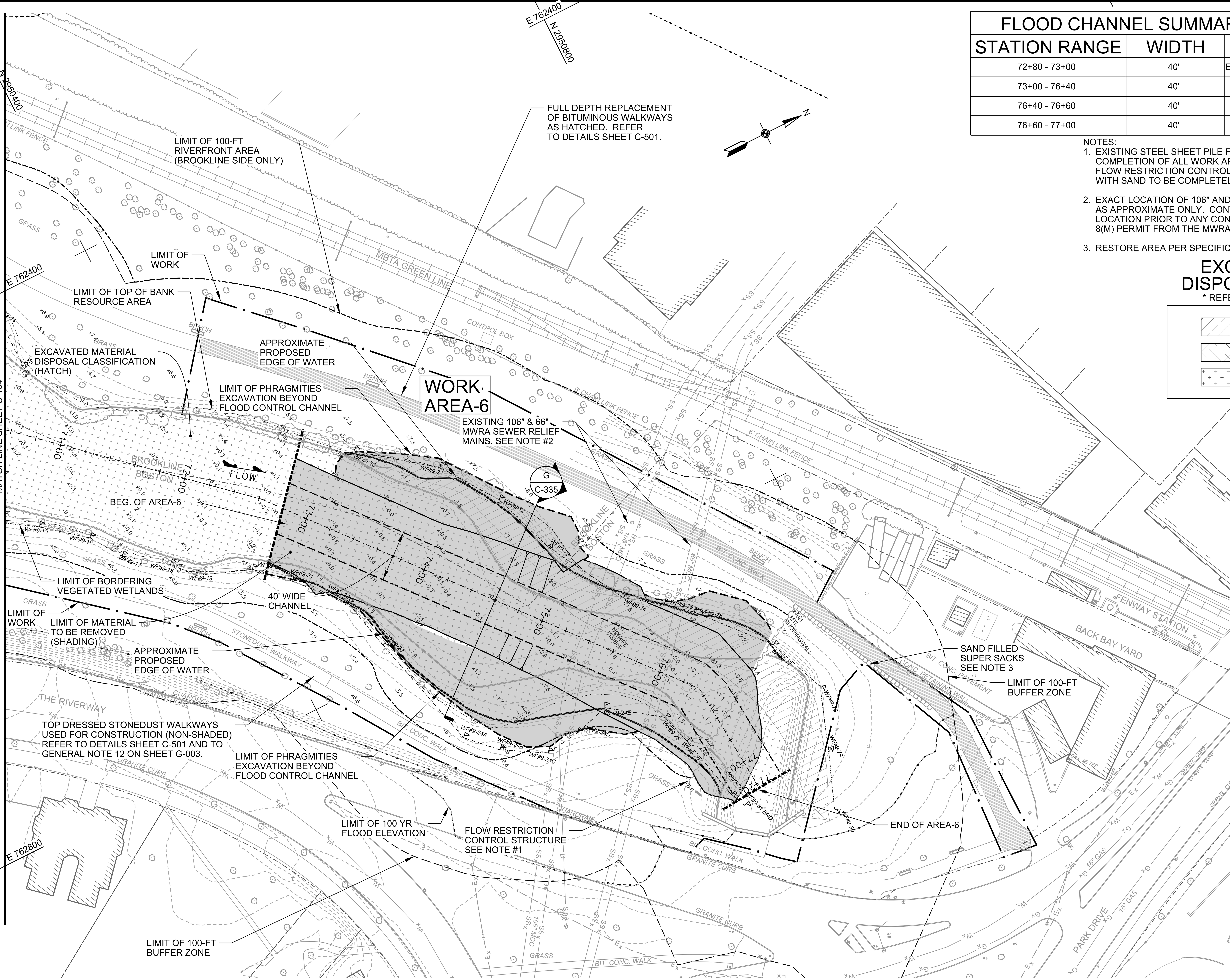
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-104.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-104



FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
72+80 - 73+00	40'	EXIST. GRADE 3:1 TO -6.0
73+00 - 76+40	40'	-6.0
76+40 - 76+60	40'	-6.0 TO -4.0
76+60 - 77+00	40'	-4.0

NOTES:
1. EXISTING STEEL SHEET PILE FLOW RESTRICTION CONTROL STRUCTURE. AT THE COMPLETION OF ALL WORK AREAS DOWNSTREAM OF AVENUE LOUIS PASTEUR, FLOW RESTRICTION CONTROL STRUCTURE AND ASSOCIATED SUPER SACKS FILLED WITH SAND TO BE COMPLETELY REMOVED.
2. EXACT LOCATION OF 106" AND 66" MDC SEWER RELIEF MAINS ARE SHOWN AS APPROXIMATE ONLY. CONTRACTOR TO VERIFY HORIZONTAL AND VERTICAL LOCATION PRIOR TO ANY CONSTRUCTION AND SHALL APPLY AND OBTAIN AN 8(M) PERMIT FROM THE MWRA.
3. RESTORE AREA PER SPECIFICATIONS SECTION 32 92 19.

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

CONTROL INFORMATION

STATION	NORTHING	EASTING
72+80	762648.45	2950447.24
73+00	762663.80	2950460.06
74+00	762740.54	2950524.18
75+00	762817.28	2950588.31
76+00	762894.01	2950652.43
PI 76+33.35	762919.61	2950673.81
77+00	762986.06	2950679.13

SITE PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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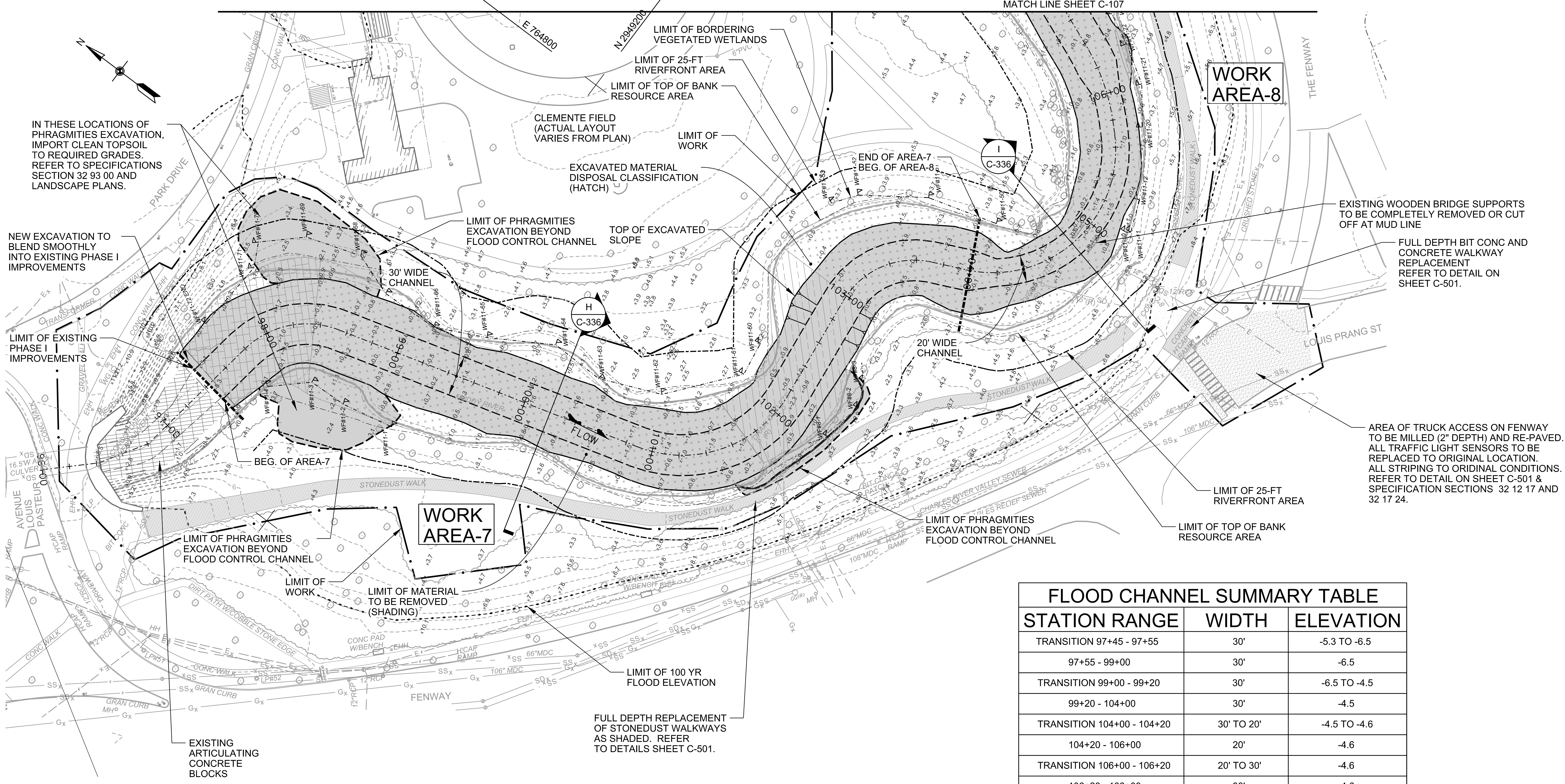
DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-105

MATCH LINE SHEET C-107



N 2949200

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

SITE PLAN

SCALE: 1" = 40'

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
TRANSITION 97+45 - 97+55	30'	-5.3 TO -6.5
97+55 - 99+00	30'	-6.5
TRANSITION 99+00 - 99+20	30'	-6.5 TO -4.5
99+20 - 104+00	30'	-4.5
TRANSITION 104+00 - 104+20	30' TO 20'	-4.5 TO -4.6
104+20 - 106+00	20'	-4.6
TRANSITION 106+00 - 106+20	20' TO 30'	-4.6
106+20 - 108+00	30'	-4.6

CONTROL INFORMATION

STATION	NORTHING	EASTING
97+40	764451.46	2949294.41
PC 97+79.19	764490.22	2949288.71
98+00	764509.99	2949282.46
PT 98+54.01	764543.35	2949241.96
99+00	764555.71	2949197.68
100+00	764582.79	2949101.40
PC 100+88.83	764606.79	2949015.87
101+00	764610.46	2949005.33
102+00	764689.66	2948961.18
PT 102+16.10	764703.93	2948950.80

CONTROL INFORMATION

STATION	NORTHING	EASTING
PC 102+95.75	764783.05	2948960.09
103+00	764787.28	2948960.44
PT 103+71.33	764844.63	2948925.40
PC 103+97.01	764855.29	2948902.04
104+00	764856.57	2948899.34
105+00	764937.31	2948849.40
PT 105+69.70	765000.21	2948875.16
PC 105+76.89	765005.34	2948880.20
106+00	765020.52	2948897.59
PT 106+38.72	765039.43	2948931.25

GRAPHIC SCALE:
1" = 40'
40 0 40 80

US Army Corps of Engineers New England District

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-106.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

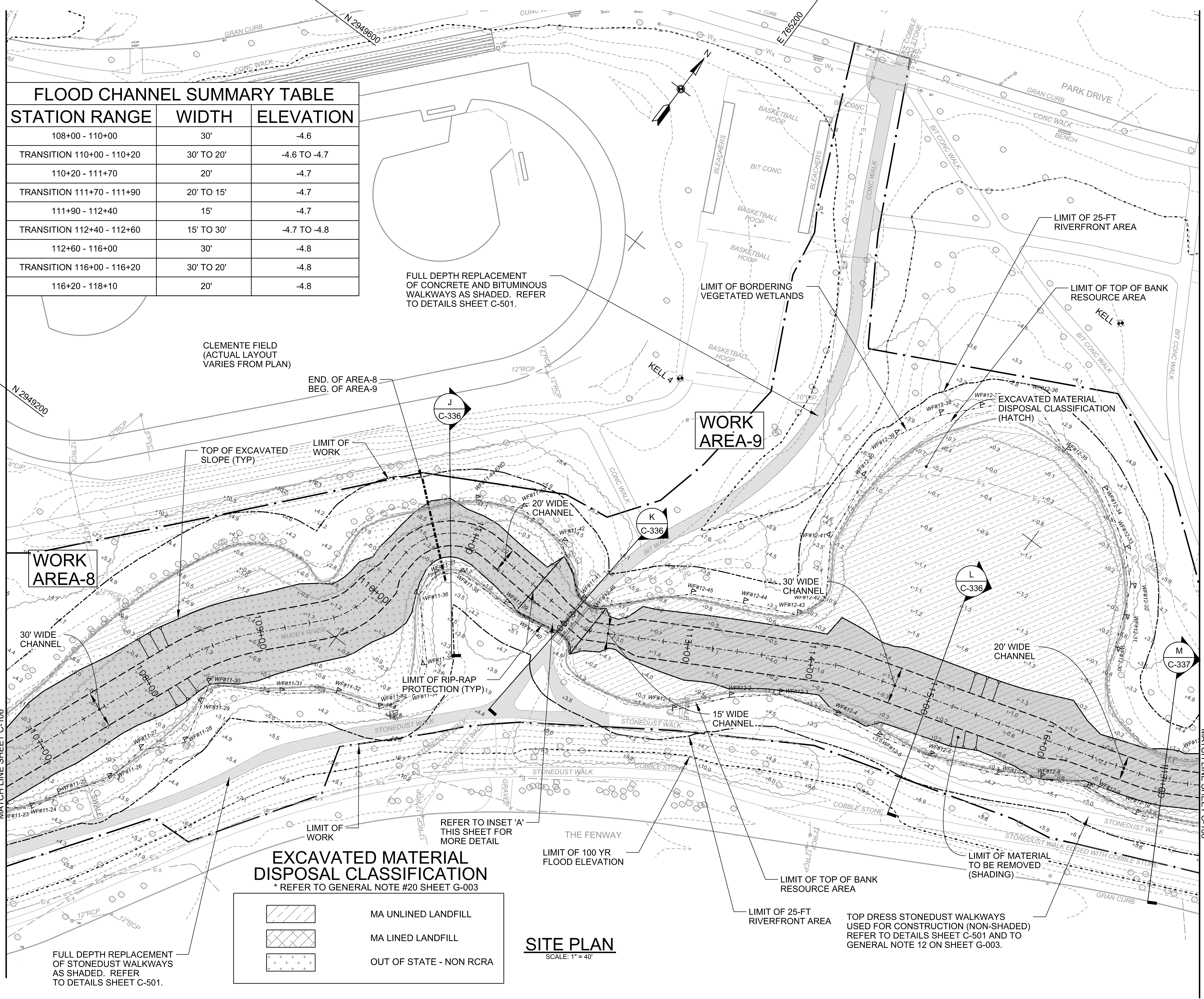
SITE PLAN

SHEET IDENTIFICATION
C-106

SHEET 28 OF 110

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
108+00 - 110+00	30'	-4.6
TRANSITION 110+00 - 110+20	30' TO 20'	-4.6 TO -4.7
110+20 - 111+70	20'	-4.7
TRANSITION 111+70 - 111+90	20' TO 15'	-4.7
111+90 - 112+40	15'	-4.7
TRANSITION 112+40 - 112+60	15' TO 30'	-4.7 TO -4.8
112+60 - 116+00	30'	-4.8
TRANSITION 116+00 - 116+20	30' TO 20'	-4.8
116+20 - 118+10	20'	-4.8



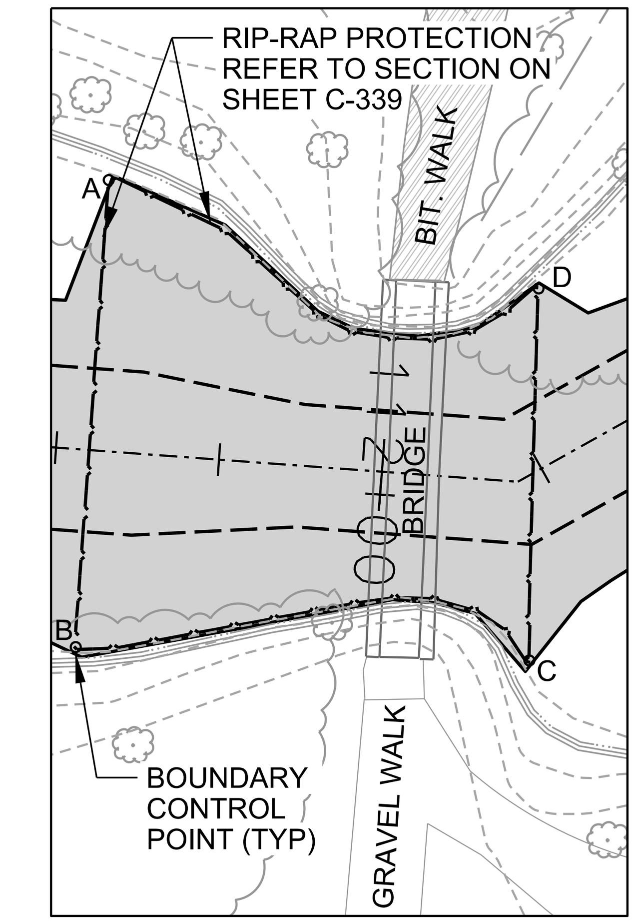
EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

SITE PLAN

SCALE: 1" = 40'



COORDINATE DATA FOR RIP-RAP INSTALLATION		
POINT	NORTHING	EASTING
A	N 2949362.6	E 765307.0
B	N 2949305.5	E 765303.0
C	N 2949303.9	E 765358.5
D	N 2949349.3	E 765359.6

INSET 'A'

SCALE: 1" = 20'

CONTROL INFORMATION

STATION	NORTHING	EASTING
107+00	765062.31	2948988.10
108+00	765099.65	2949080.87
PC 108+26.41	765109.51	2949105.37
PT 108+98.29	765147.63	2949165.85
109+00	765148.78	2949167.11
PC 109+51.16	765183.35	2949204.82
PT 109+99.68	765201.67	2949248.71
110+00	765201.69	2949249.03
PC 110+36.68	765203.48	2949285.67
111+00	765240.78	2949331.60
PT 111+16.47	765257.11	2949333.09
112+00	765340.41	2949326.93
PI 112+16.68	765357.04	2949325.69
113+00	765429.77	2949366.34
114+00	765517.07	2949415.13
PI 114+23.31	765537.42	2949426.50
115+00	765610.67	2949449.19
116+00	765706.20	2949478.77
PI 116+93.71	765795.71	2949506.50
117+00	765801.17	2949509.62

GRAPHIC SCALE:

1" = 20': 20' 0 20' 40'

1" = 40': 40' 0 40' 80'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
DATE: SEPTEMBER 2016
SOLICITATION NO.:
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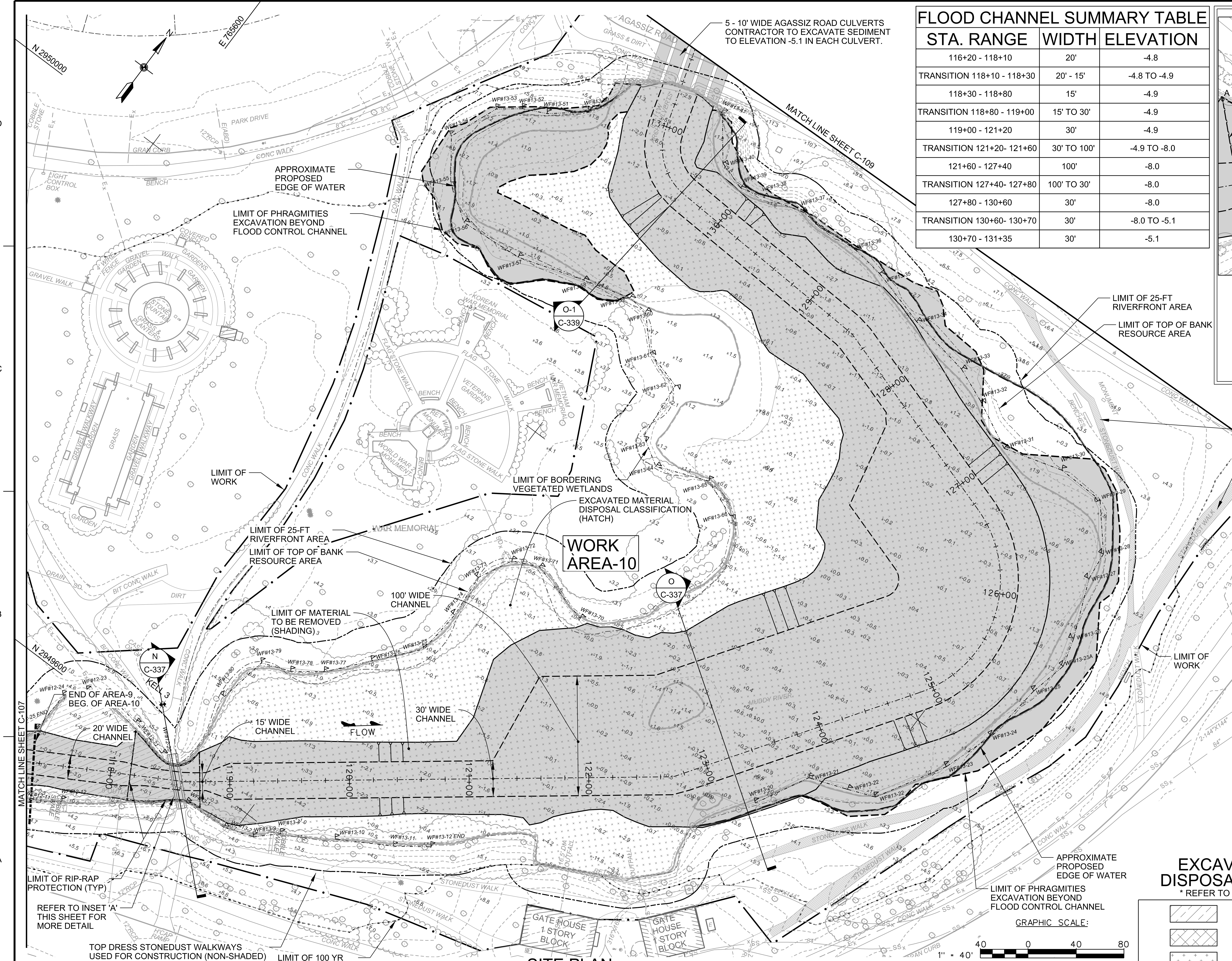
PLOT SCALE: 1" = 40'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-107.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-107

SHEET 29 OF 110

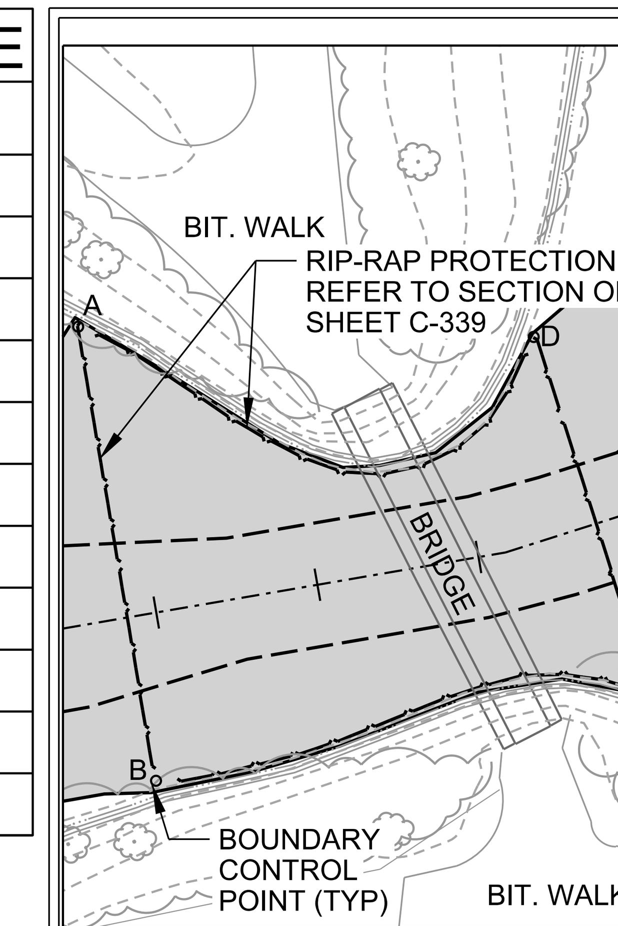


SITE PLAN

SCALE: 1" = 40'

FLOOD CHANNEL SUMMARY TABLE

STA. RANGE	WIDTH	ELEVATION
116+20 - 118+10	20'	-4.8
TRANSITION 118+10 - 118+30	20' - 15'	-4.8 TO -4.9
118+30 - 118+80	15'	-4.9
TRANSITION 118+80 - 119+00	15' TO 30'	-4.9
119+00 - 121+20	30'	-4.9
TRANSITION 121+20- 121+60	30' TO 100'	-4.9 TO -8.0
121+60 - 127+40	100'	-8.0
TRANSITION 127+40- 127+80	100' TO 30'	-8.0
127+80 - 130+60	30'	-8.0
TRANSITION 130+60- 130+70	30'	-8.0 TO -5.1
130+70 - 131+35	30'	-5.1



COORDINATE DATA FOR RIP-RAP INSTALLATION		
POINT	NORTHING	EASTING
A	N 2949598.8	E 765884.4
B	N 2949549.8	E 765912.3
C	N 2949581.0	E 765964.7
D	N 2949616.6	E 765937.2

INSET 'A'

SCALE: 1" = 20'

CONTROL INFORMATION

STATION	NORTHING	EASTING
118+00	765887.98	2949559.26
PI 118+63.35	765942.98	2949590.70
119+00	765972.01	2949613.07
120+00	766051.23	2949674.10
121+00	766130.44	2949735.13
122+00	766209.66	2949796.16
PI 122+70.63	766265.61	2949839.27
123+00	766282.08	2949863.58
124+00	766338.16	2949946.38
PC 124+88.05	766387.53	2950019.28
125+00	766393.63	2950029.55
126+00	766391.31	2950125.41
PT 126+74.37	766334.56	2950170.80
127+00	766310.10	2950178.45
128+00	766214.65	2950208.27
PI 128+54.98	766162.17	2950224.67
129+00	766117.20	2950226.80
130+00	766017.31	2950231.54
PC 130+37.59	765979.76	2950233.32
PT 130+99.14	765934.25	2950268.85
131+20	765928.24	2950288.83

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

	MA UNLINED LANDFILL
	MA LINED LANDFILL
	OUT OF STATE - NON RCRA

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-108.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

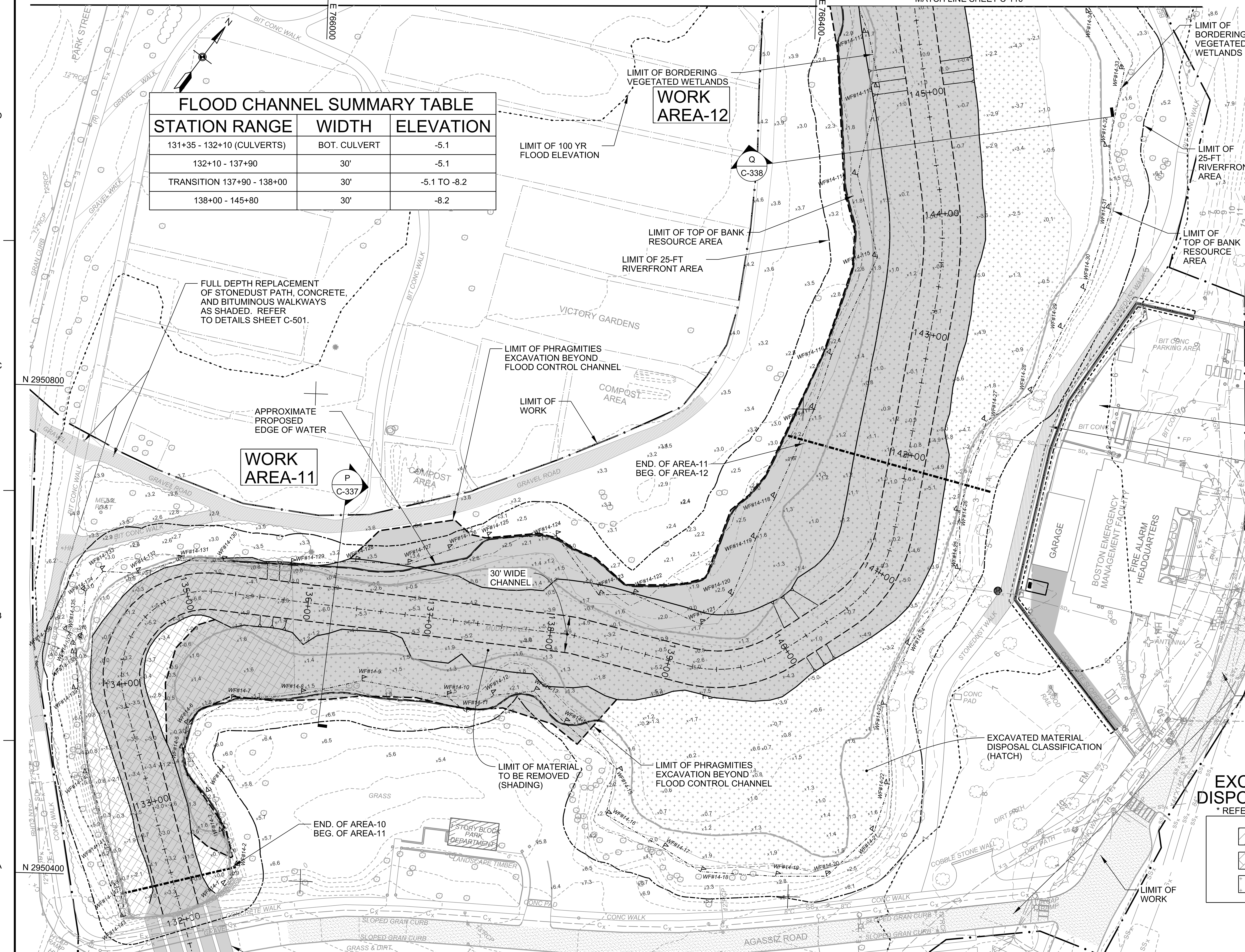
SITE PLAN

SHEET IDENTIFICATION
C-108
SHEET 30 OF 110

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
131+35 - 132+10 (CULVERTS)	BOT. CULVERT	-5.1
132+10 - 137+90	30'	-5.1
TRANSITION 137+90 - 138+00	30'	-5.1 TO -8.2
138+00 - 145+80	30'	-8.2

MATCH LINE SHEET C-110



MATCH LINE SHEET C-108

5 - 10' WIDE AGASSIZ ROAD CULVERTS CONTRACTOR TO EXCAVATE SEDIMENT TO ELEVATION -5.1 IN EACH CULVERT.

SITE PLAN

SCALE: 1" = 40'

CONTROL INFORMATION

STATION	NORTHING	EASTING
132+20	765899.40	2950384.58
133+00	765876.34	2950461.18
PC 133+87.90	765850.99	2950545.34
134+00	765848.52	2950557.18
135+00	765899.90	2950633.14
PT 134+84.60	765924.29	2950635.25
136+00	765999.38	2950628.49
137+00	766098.98	2950619.54
138+00	766198.58	2950610.59
PI 138+17.60	766216.11	2950609.01
139+00	766296.38	2950590.42
PC 139+15.12	766311.11	2950587.01
PT 139+98.86	766390.94	2950602.45
140+00	766391.88	2950603.11
PC 140+54.07	766436.20	2950634.07
141+00	766466.61	2950667.96
PT 141+35.31	766477.83	2950701.25
142+00	766487.40	2950765.23
143+00	766502.20	2950864.13
PC 143+28.86	766506.47	2950892.67
144+00	766508.59	2950963.61
PT 144+23.84	766505.54	2950987.24
145+00	766492.80	2951062.33

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

GRAPHIC SCALE:

40 0 40 80

1'' = 40'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

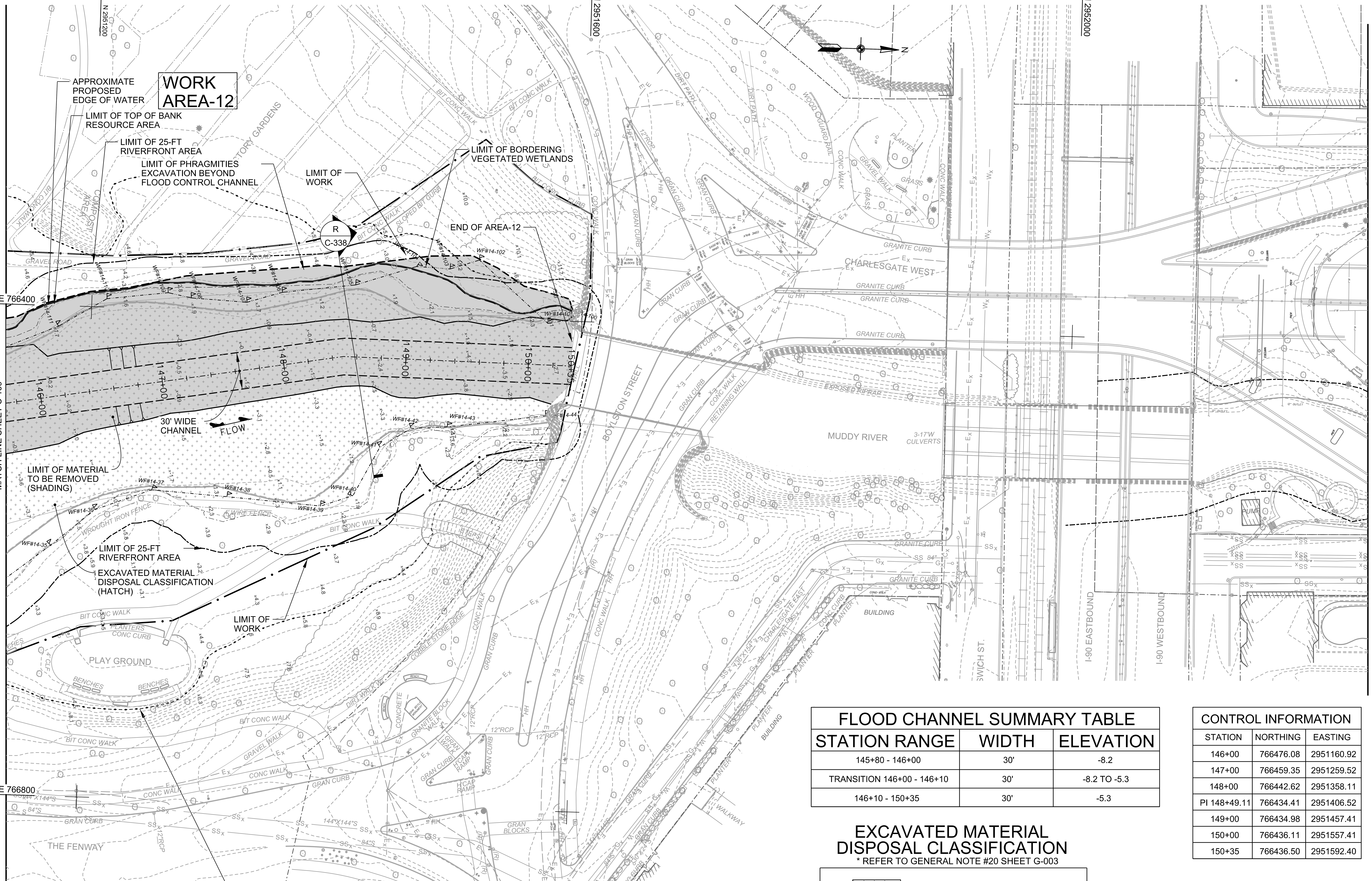
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 40'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-109.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-109

SHEET 31 OF 110



SITE PLAN

SCALE: 1" = 40'

FLOOD CHANNEL SUMMARY TABLE

STATION RANGE	WIDTH	ELEVATION
145+80 - 146+00	30'	-8.2
TRANSITION 146+00 - 146+10	30'	-8.2 TO -5.3
146+10 - 150+35	30'	-5.3

CONTROL INFORMATION

STATION	NORTHING	EASTING
146+00	766476.08	2951160.92
147+00	766459.35	2951259.52
148+00	766442.62	2951358.11
PI 148+49.11	766434.41	2951406.52
149+00	766434.98	2951457.41
150+00	766436.11	2951557.41
150+35	766436.50	2951592.40

EXCAVATED MATERIAL DISPOSAL CLASSIFICATION

* REFER TO GENERAL NOTE #20 SHEET G-003

- MA UNLINED LANDFILL
- MA LINED LANDFILL
- OUT OF STATE - NON RCRA

GRAPHIC SCALE:

1" = 40' 40 0 40 80

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 40'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-110.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN

SHEET IDENTIFICATION
C-110

SITE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

GENERAL NOTES:

1. EXISTING ELECTRICAL CONDUIT AND WIRING ASSOCIATED WITH THE EXISTING SECURITY LIGHTING TO BE REMOVED AND DISPOSED OF. NEW CONDUIT AND WIRING TO BE PROVIDED WITH THE RE-MOUNTING OF THE EXISTING SECURITY LIGHTING. REFER TO KEY NOTE 6.
2. EXISTING WALKWAYS, PAVEMENT, STORMWATER MITIGATION AREA, AND ANY OTHER SITE FEATURE DISTURBED DURING CONSTRUCTION SHALL BE RETURNED TO ORIGINAL CONDITION UNLESS OTHERWISE NOTED OR DETAILED.
3. EXISTING CATCH BASIN TO REMAIN UNDISTURBED. IF EXISTING STRUCTURE CONFLICTS WITH PROPOSED FLOODWALL FOOTING, CONTRACTOR SHALL NOTIFY COR IMMEDIATELY OF CONFLICT AND PROCEED WITH AS DIRECTED BY COR.
4. REMOVAL OF EXISTING SECURITY FENCE AND CONCRETE FOOTING AND INSTALLATION OF NEW CONCRETE FLOODWALL WILL REQUIRE TEMPORARY CLOSURE OF THE GRAVEL WALK BETWEEN THE RIVER AND FIRE HEADQUARTERS. CONTRACTOR TO COORDINATE CLOSURE WITH FIRE HEADQUARTERS AND INSTALL SIDWALK SIGNAGE AS SHOWN ON SHEET GC105.
5. CONTRACTOR SHALL COORDINATE WITH FIRE HEADQUARTERS DURING CONSTRUCTION OF WALL AND INSTALLATION OF PUMP CHAMBER TO PROVIDE AND MAINTAIN TEMPORARY SECURITY FENCING AND LIGHTING. LIGHTING SHALL BE OPERABLE DURING NIGHT TIME HOURS AND SHALL PROVIDE EXTENTS OF LIGHTING SIMILAR TO EXISTING SECURITY LIGHTING MOUNTED TO 8' SECURITY FENCE. FENCING MUST PROVIDE SITE SECURITY AT ALL TIMES AND PREVENT SCALING OR MOVING OF THE FENCE TO GAIN SITE ENTRY. ELECTRICITY FOR TEMPORARY LIGHTING MAY BE SOURCED FROM FIRE DEPARTMENT HEADQUARTERS.
TEMPORARY DAYTIME PARKING FOR DISPLACED PARKING DUE TO CONSTRUCTION SHALL BE COORDINATED WITH FIRE DEPARTEMENT, CONTRACTOR, CITY OF BOSTON, AND DCR AND MAY BE LOCATED WITHIN CLOSED PORTIONS OF AGASSIZ ROAD.

KEY NOTES:

1. LIMIT OF PROPOSED CONCRETE FLOODWALL. SEE SHEET S-101 FOR DETAILS.
2. LIMIT OF PROPOSED CONCRETE FLOODWALL FOOTING. SEE SHEET S-101 FOR DETAILS.
3. LIMIT OF EXISTING STORMWATER MITIGATION AREA.
4. EXISTING ABANDONED DRAIN PIPE.
5. REMOVE AND DISCARD EXISTING 8' HIGH SECURITY FENCE. REMOVE EXISTING CONCRETE FENCE FOOTING. TOTAL FOOTING DEPTH UNKNOWN BUT GREATER THAN 24". REMOVE AND STORE EXISTING SECURITY LIGHTING AT TOP OF FENCE.
6. PROVIDE NEW 8' HIGH SECURITY FENCE IDENTICAL TO EXISTING. INSTALL FENCE ALONG TOP OF CONCRETE FLOODWALL AND CONNECT TO EXISTING SECURITY FENCING. WHERE IT IS NOT POSSIBLE TO CONNECT EXISTING FENCE TO NEW FENCE, ANY GAPS SHALL BE 4" OR LESS. INSTALL STORED SECURITY LIGHTING IN SIMILAR LOCATIONS TO EXISTING. REFER TO SHEET S-501 AND SPECIFICATIONS SECTION 32 31 13.
7. PROPOSED 6' DIAMETER FLAT TOP CATCHBASIN WITH DOUBLE, LOW PROFILE, FRAME AND GRATE. CONNECT EXISTING 12" METAL DRAIN PIPE BOTH SIDES. INSTALL TIDEFLEX 37 CHECKVALVE OR APPROVED EQUAL. PROVIDE INVERTS FOR 6" FORCE MAIN OUTLETS.
REFER TO SHEET C-503.
RIM EL: 4.6
INV IN (2-6" DI): 2.3
INV IN (12" METAL): 2.1±
INV OUT (12" METAL): 2.1±
8. NEW 6" DUCTILE FORCE MAINS.
9. PROPOSED 7000 GALLON PRECAST CONCRETE COMMERCIAL TANK STORMWATER PUMP STATION.
10. REMOVE AND STORE CONCRETE CURB. CURB TO BE RE-SET AT THE COMPLETION OF CONSTRUCTION.
11. BITUMINOUS CONCRETE PARKING AREA SAWCUT AND REPAIR. REFER TO DETAIL ON SHEET C-501. MATCH EXISTING GRADE AT PAVEMENT SAWCUT.
12. 8" SCH 80 PVC VENT. SEE SHEET C-504
13. BLEND GRADE INTO TOP OF NEW FLOODWALL.
14. EXISTING CATCHBASIN TO REMAIN UNDISTURBED.
15. TEMPORARY CONSTRUCTION FENCING.
16. FULL DEPTH RECONSTRUCTION OF FLOATING PATH. REFER TO FIRE HEADQUARTERS PATH DETAIL ON SHEET C-501.
17. COMPOST FILTER SOCK. SEE DETAIL ON SHEET C-505.
18. WALL HEIGHT TO BE LOWERED TO ELEVATION 8.8 NAVD88 WITHIN THIS LOCATION. WALL HEIGHT TO BE ELEVATION 9.0 NAVD88 FOR REMAINDER OF WALL. ELEVATION OF BOTTOM OF SECURITY FENCING TO BE IDENTICAL TO WALL ELEVATION OF 9.0 TO PROVIDE SMALL GAP BETWEEN FENCING AND TOP OF WALL IN THIS LOCATION.

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

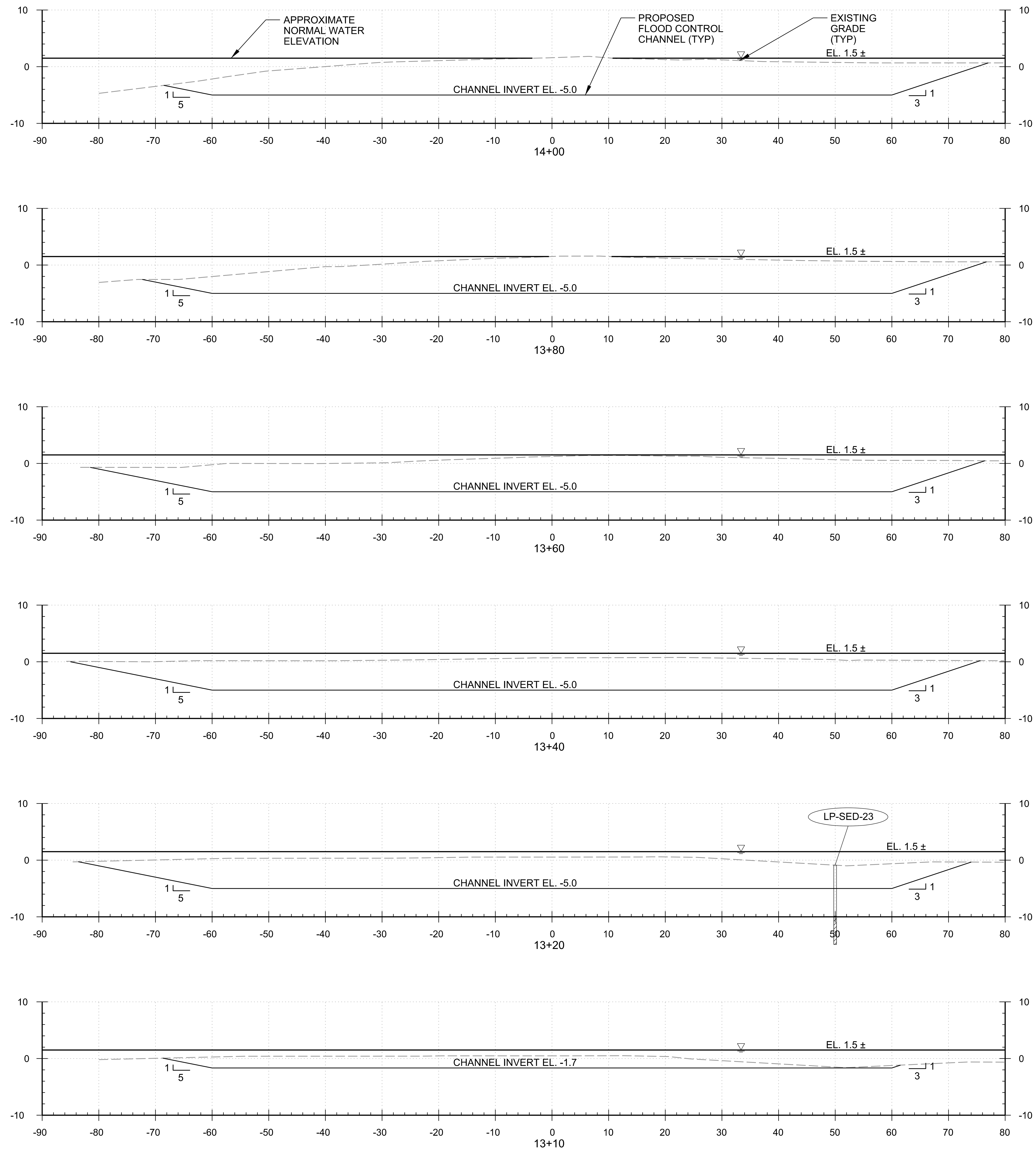
DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 20'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-111.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SITE PLAN
FIRE ALARM HEADQUARTERS

SHEET IDENTIFICATION
C-111

SHEET 33 OF 110



GRAPHIC SCALE:
1" = 10'

US Army Corps of Engineers® New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU	DATE: SEPTEMBER 2016
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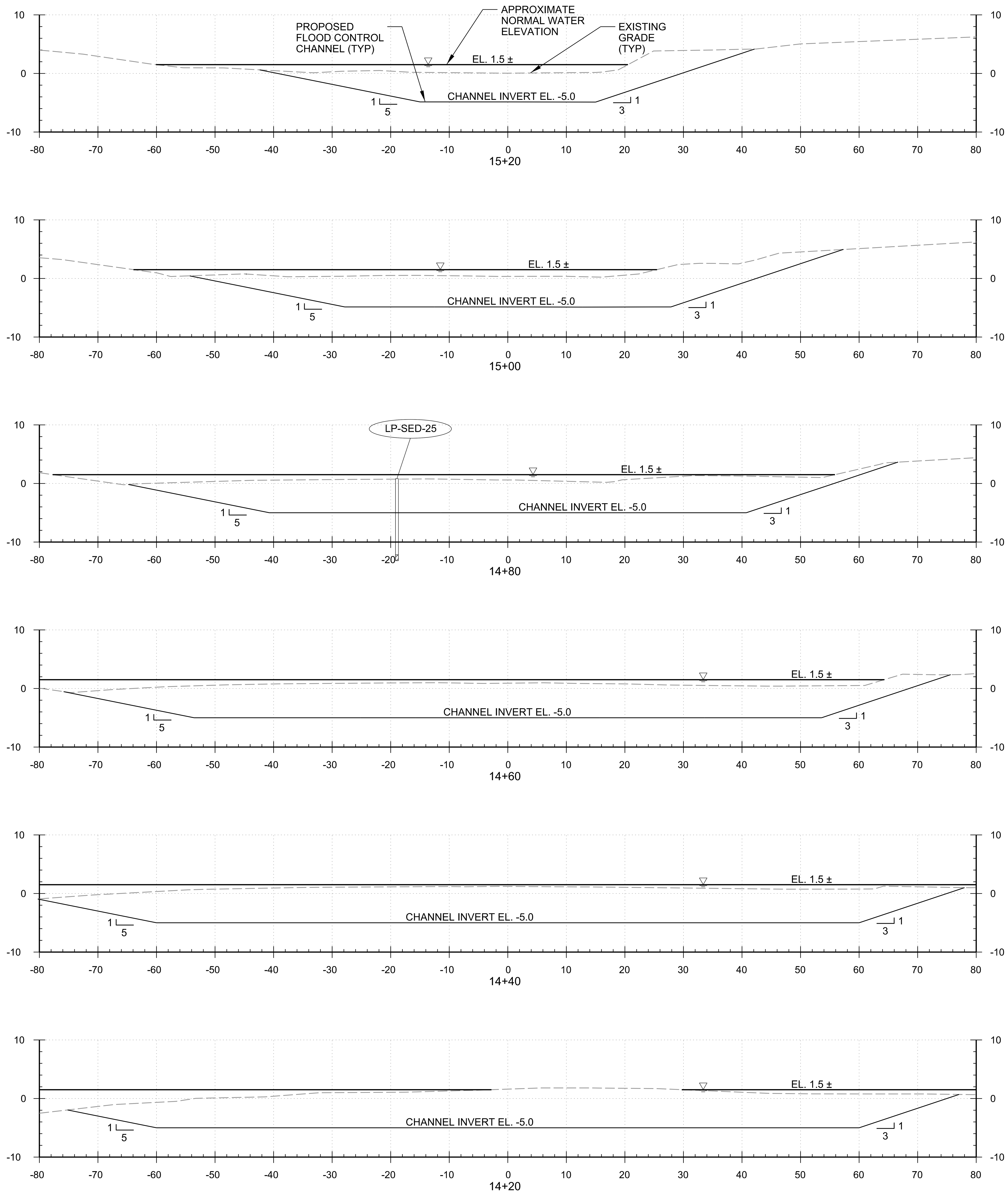
SOLICITATION NO.:	
SUBMITTED BY:	CONTRACT NO.:
PLOT SCALE: 1" = 20'	PLOT DATE:
DRAWING CODE: MUD-2	
SIZE: ANSI D	FILE NAME: MUD-2_C-301.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
LEVERETT POND

SHEET IDENTIFICATION
C-301
SHEET 34 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: L. THIBODEAU

DWN BY: LT

CKD BY: MET

SUBMITTED BY:

PLOT SCALE: 1" = 20'

PLOT DATE:

SIZE: ANSI D

FILE NAME: MUD-2_C-302.dgn

DATE: SEPTEMBER 2016

SOLICITATION NO.:

CONTRACT NO.:

DRAWING CODE: MUD-2

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

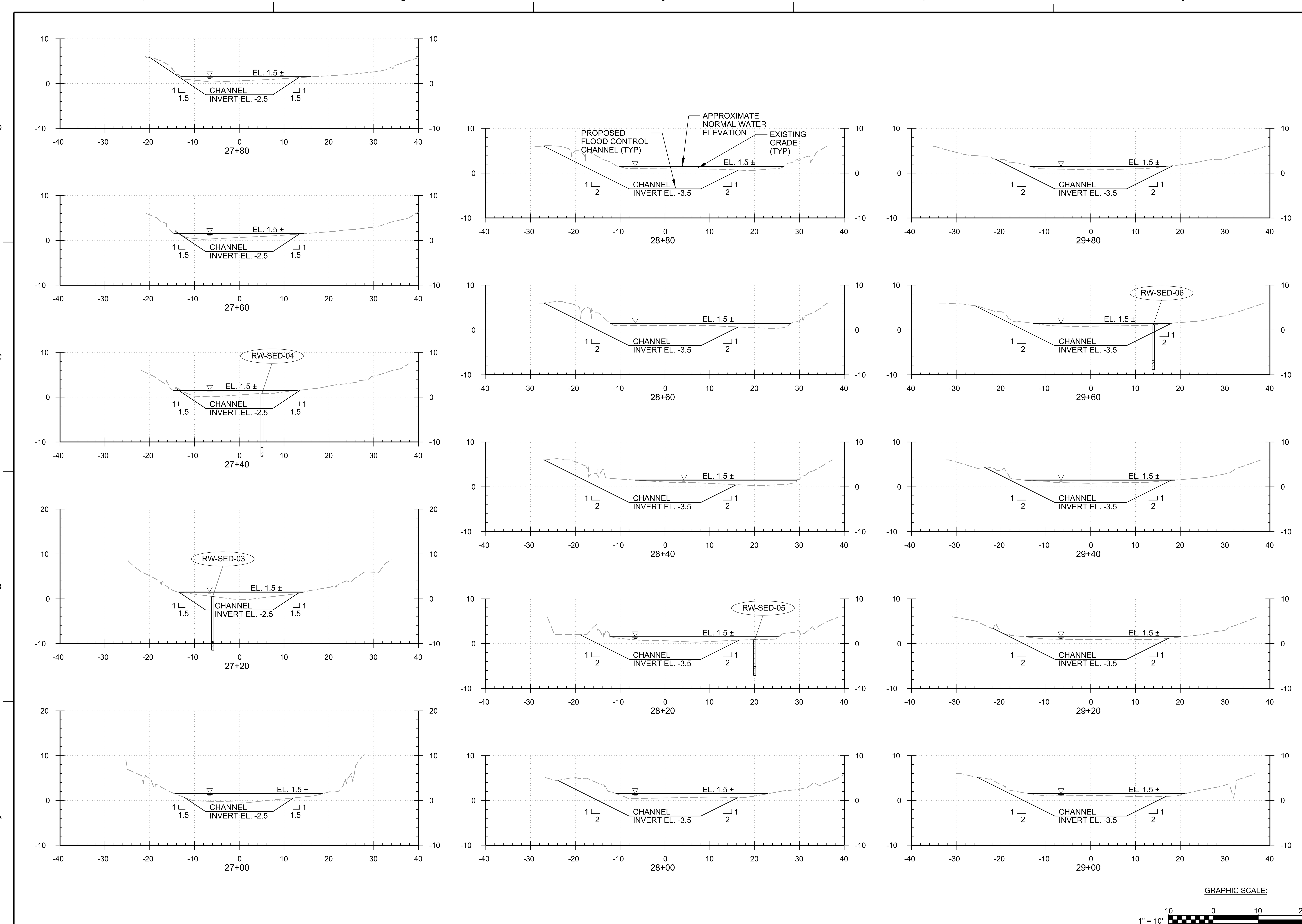
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
LEVERETT POND

SHEET IDENTIFICATION

C-302

SHEET 35 OF 110



US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 20'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-303.dgn

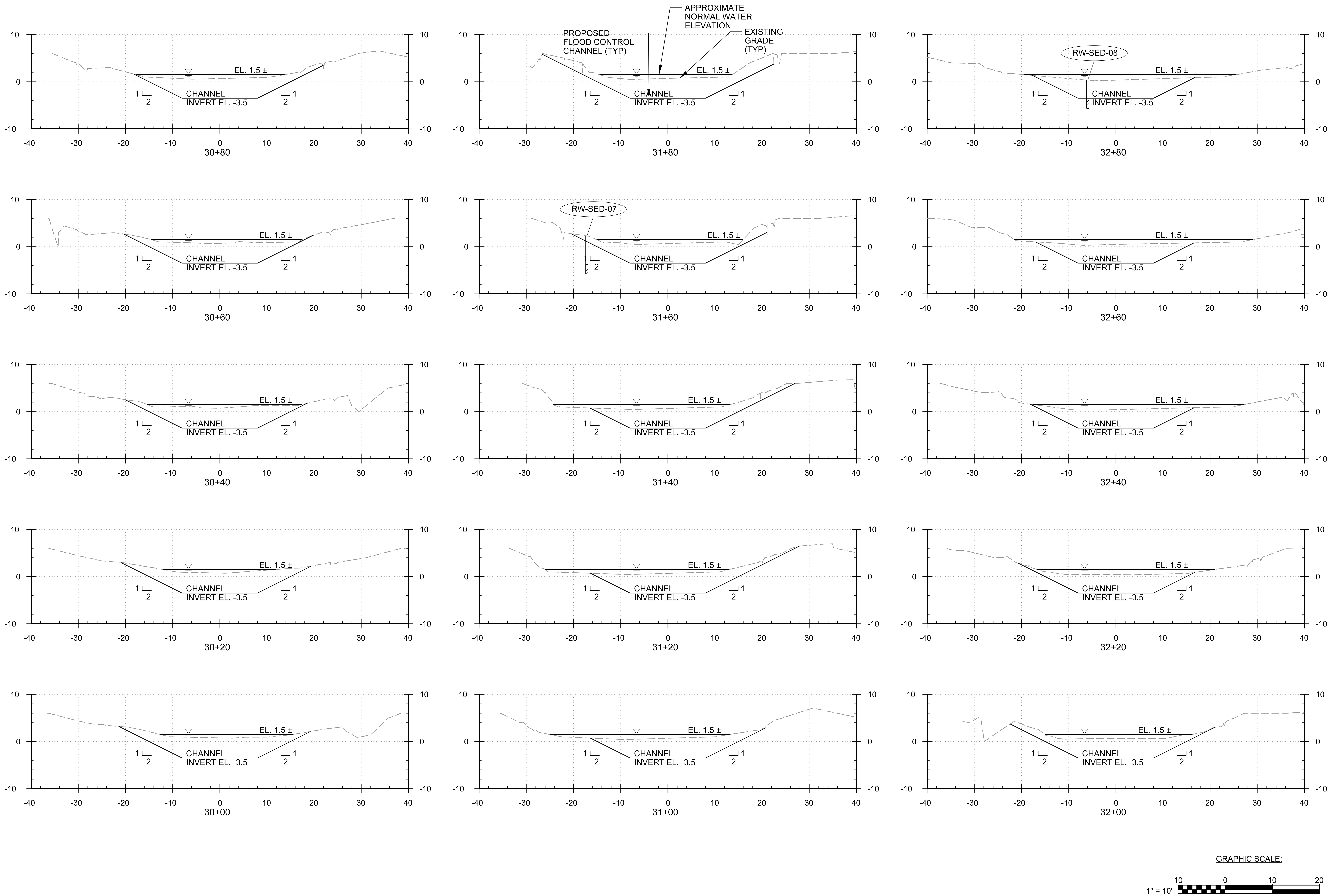
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 2

SHEET IDENTIFICATION
C-303

SHEET 36 OF 110



US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

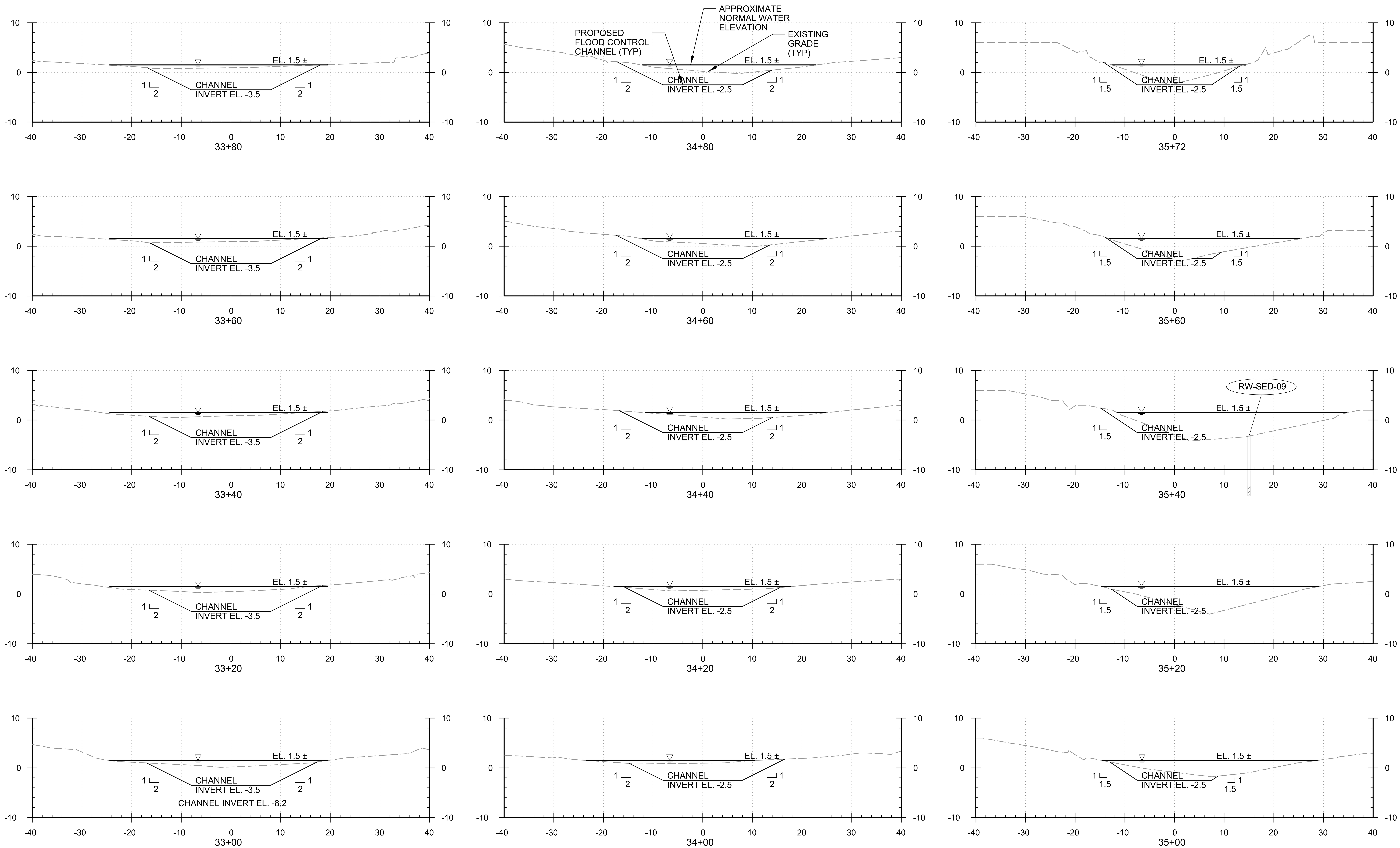
DESIGNED BY: L. THIBODEAU			DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET		SOLICITATION NO.:
SUBMITTED BY:			CONTRACT NO.:
PLOT SCALE: 1" = 20'	PLOT DATE:		DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-304.dgn		

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 2

SHEET
IDENTIFICATION
C-304

SHEET 37 OF 110



GRAPHIC SCALE:

1" = 10'   10   0   10   20

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

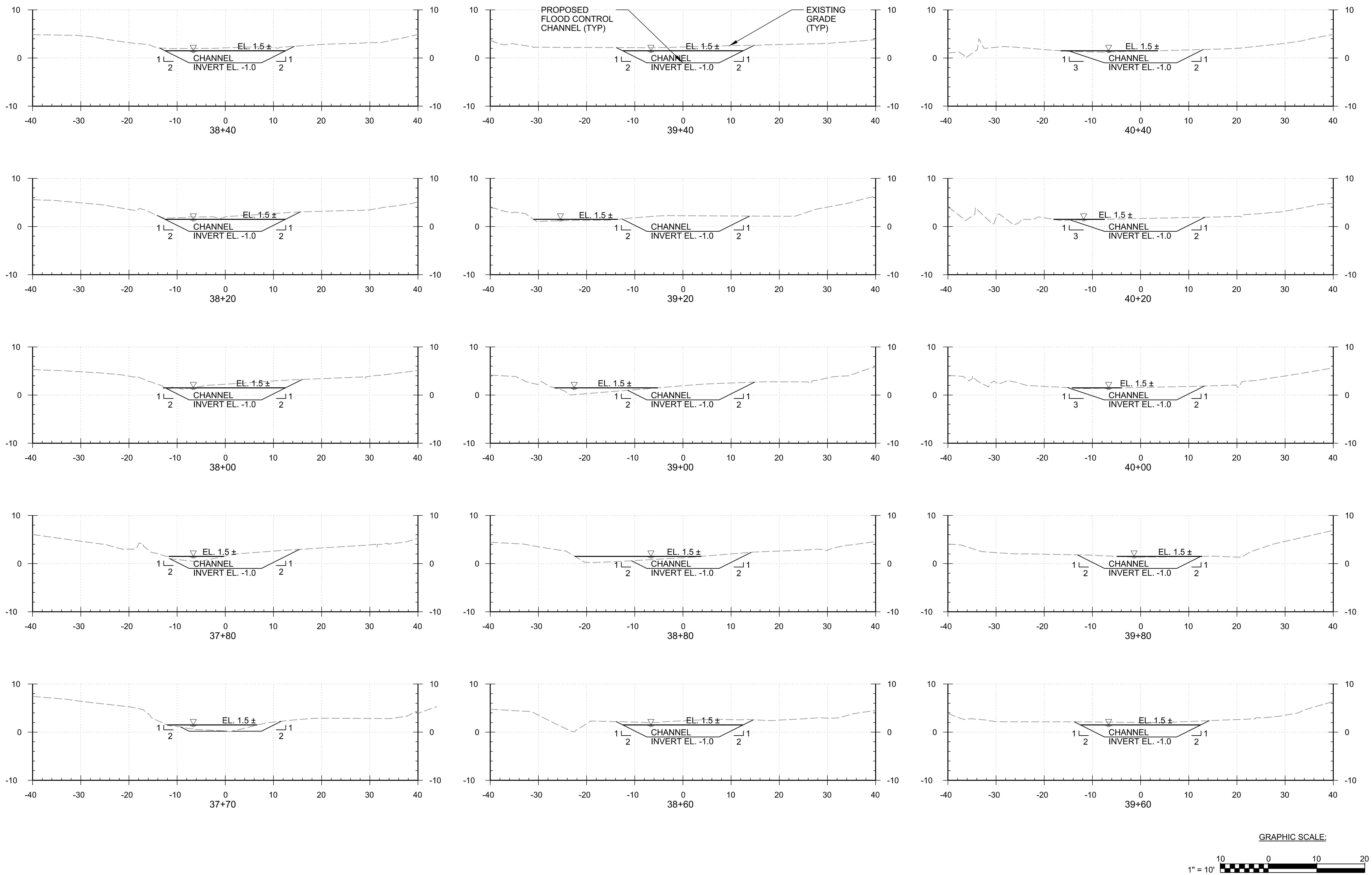
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 20'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-305.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 2

SHEET IDENTIFICATION
C-305

SHEET 38 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

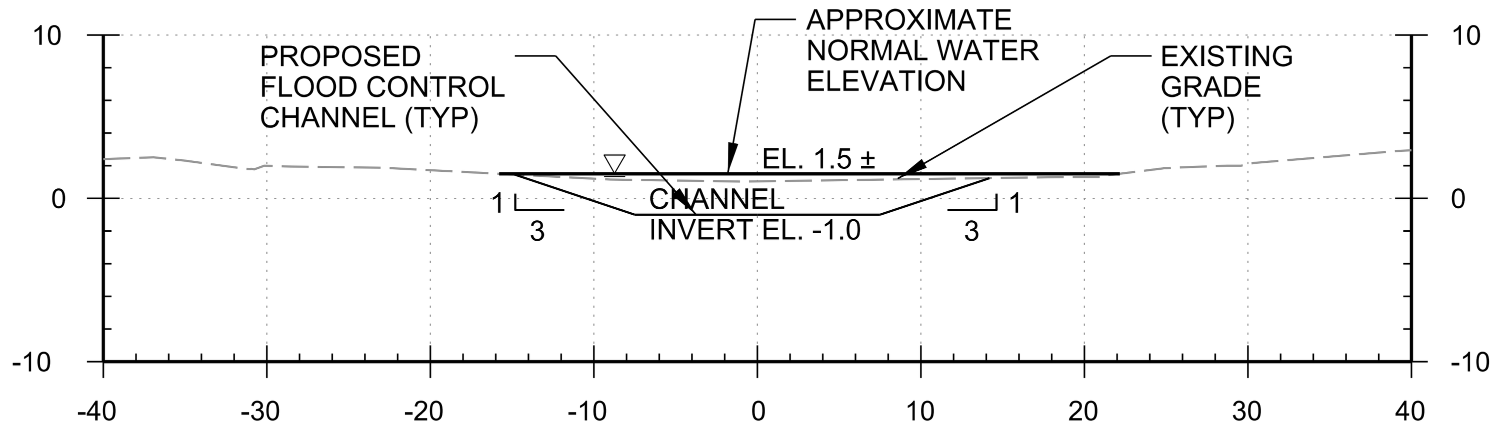
MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS NEW ENGLAND DISTRICT CONCORD, MASSACHUSETTS	DESIGNED BY: L. THIBODEAU	DATE: SEPTEMBER 2016	
	DWN BY: LT	CKD BY:	SOLICITATION NO.:
	SUBMITTED BY:		CONTRACT NO.:
	PLOT SCALE: 1" = 10'	PLOT DATE:	DRAWING CODE: MUD-2
	SIZE: ANSI D	FILE NAME: MUD-2_C-306.dgn	

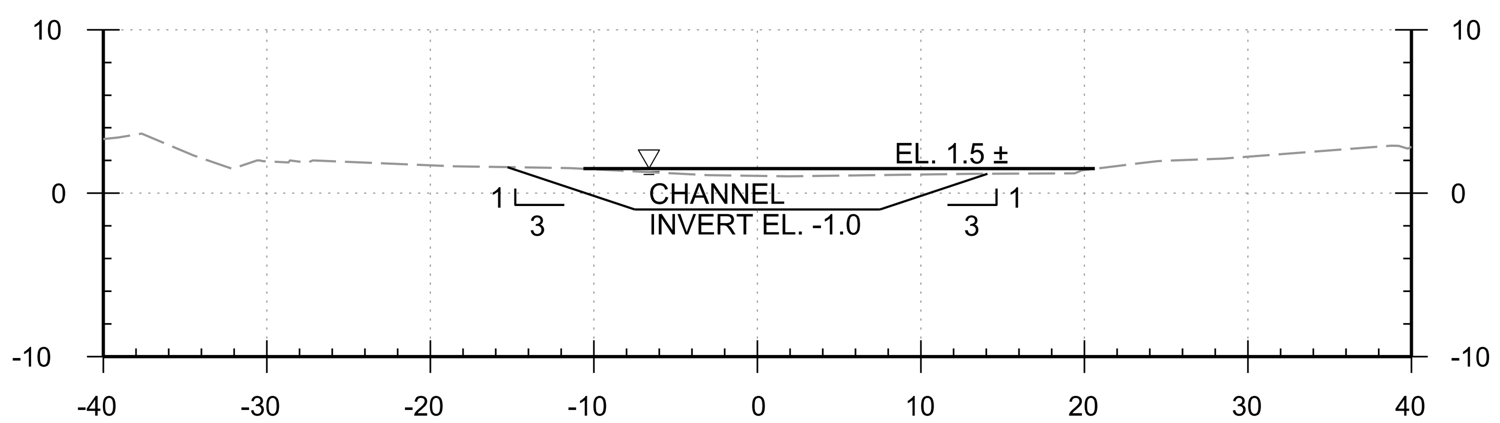
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 3

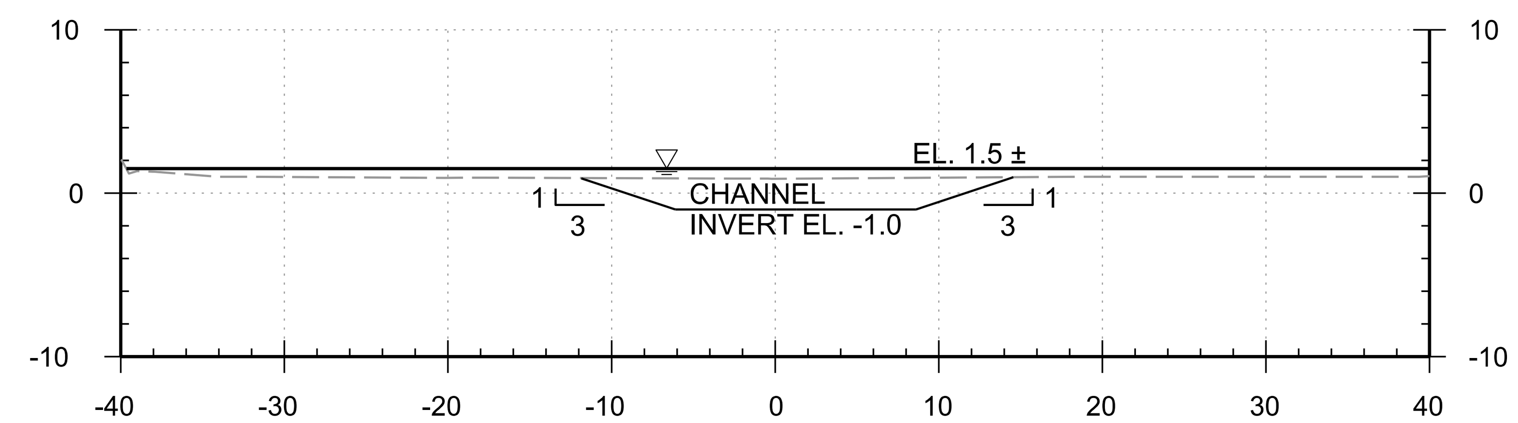
SHEET IDENTIFICATION
C-306



41+40



41+20



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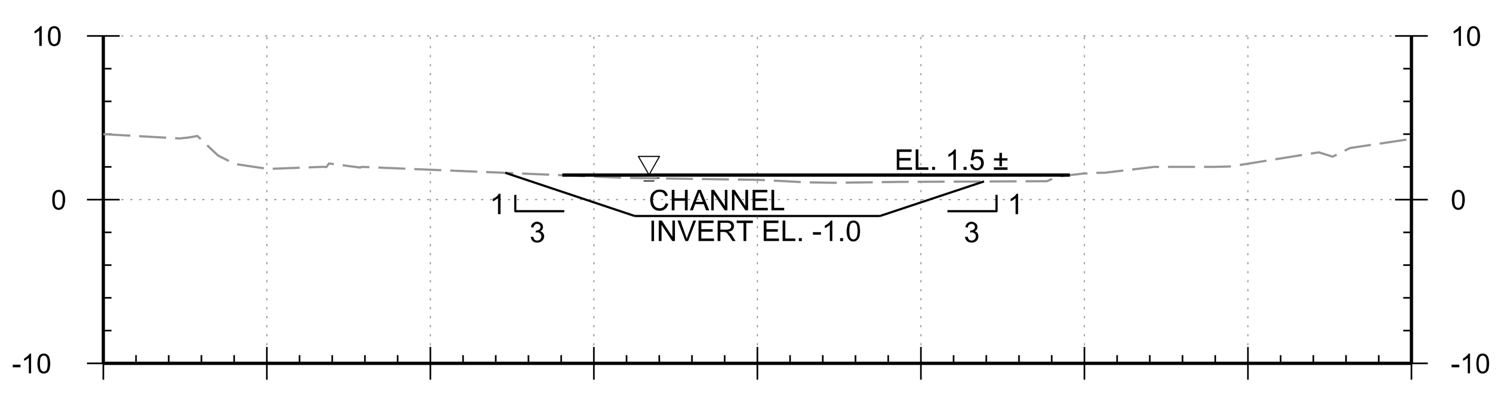

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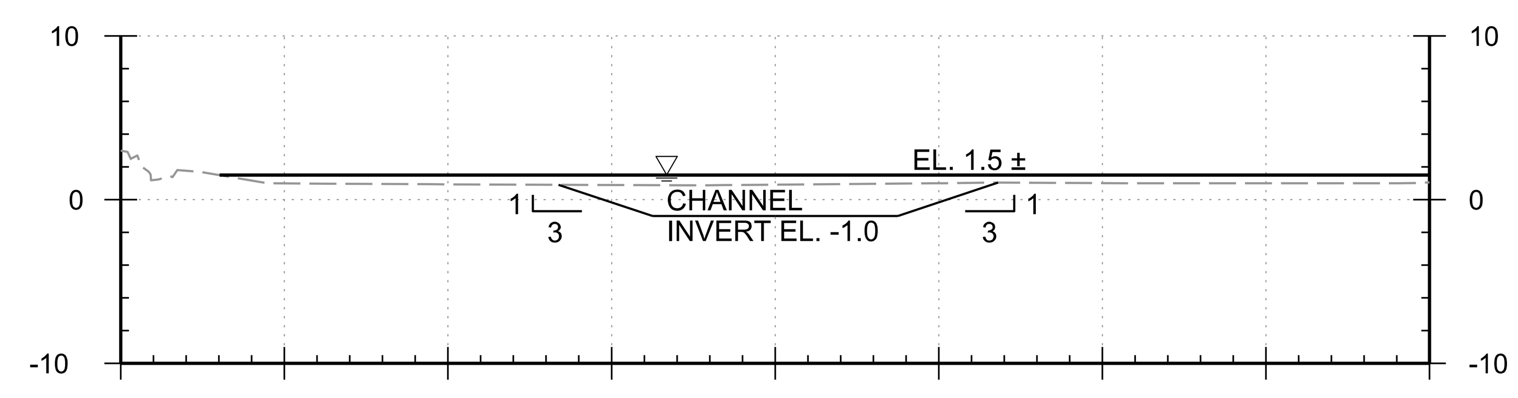

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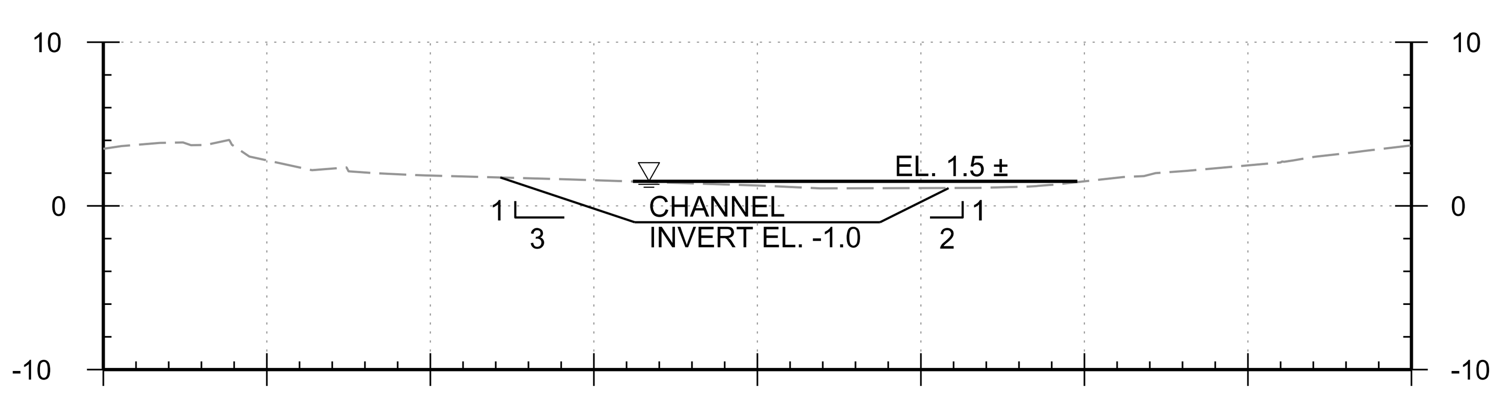

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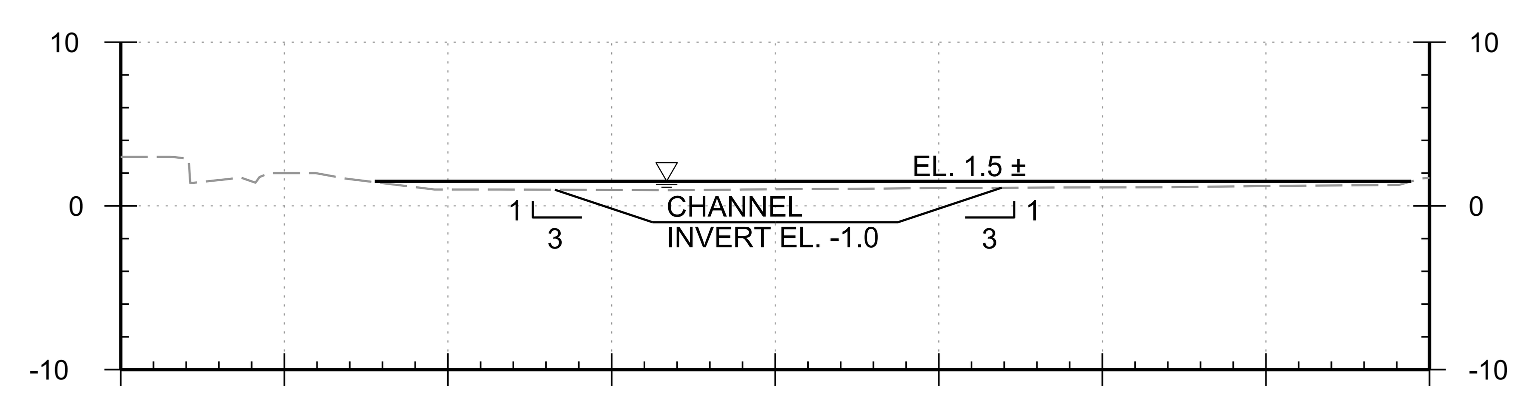

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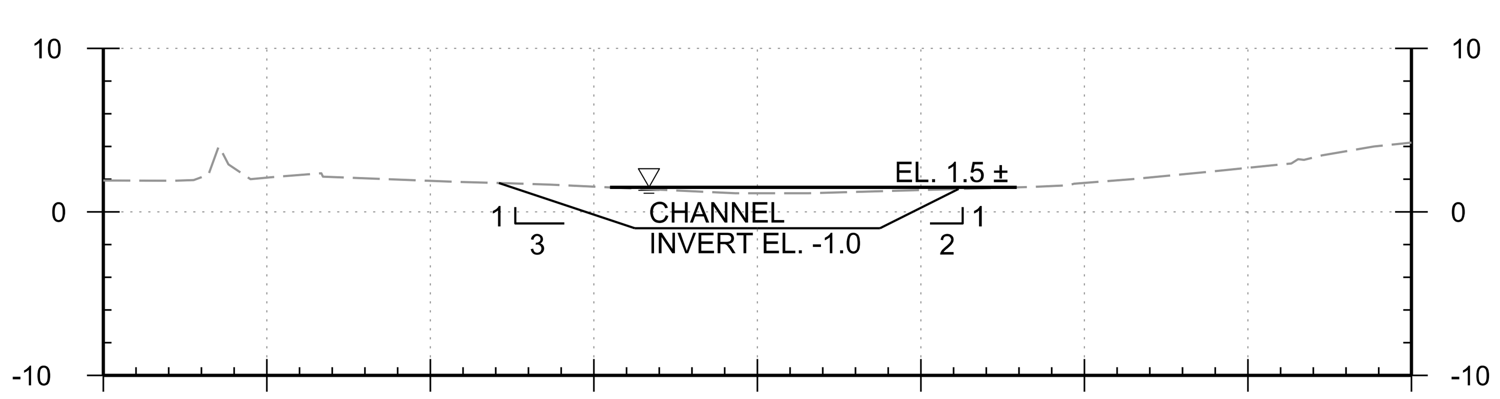

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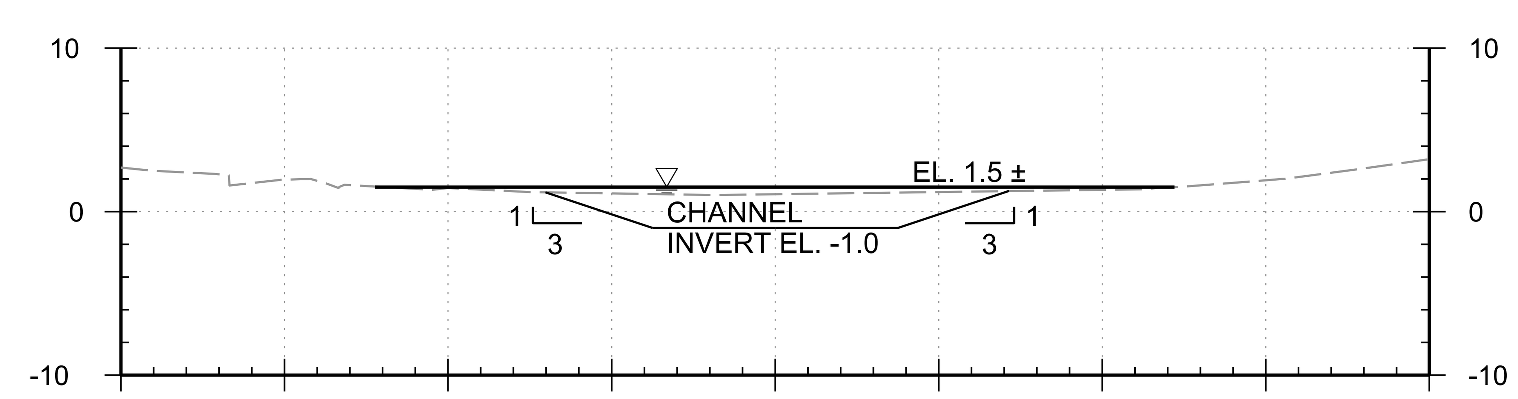


41+60

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

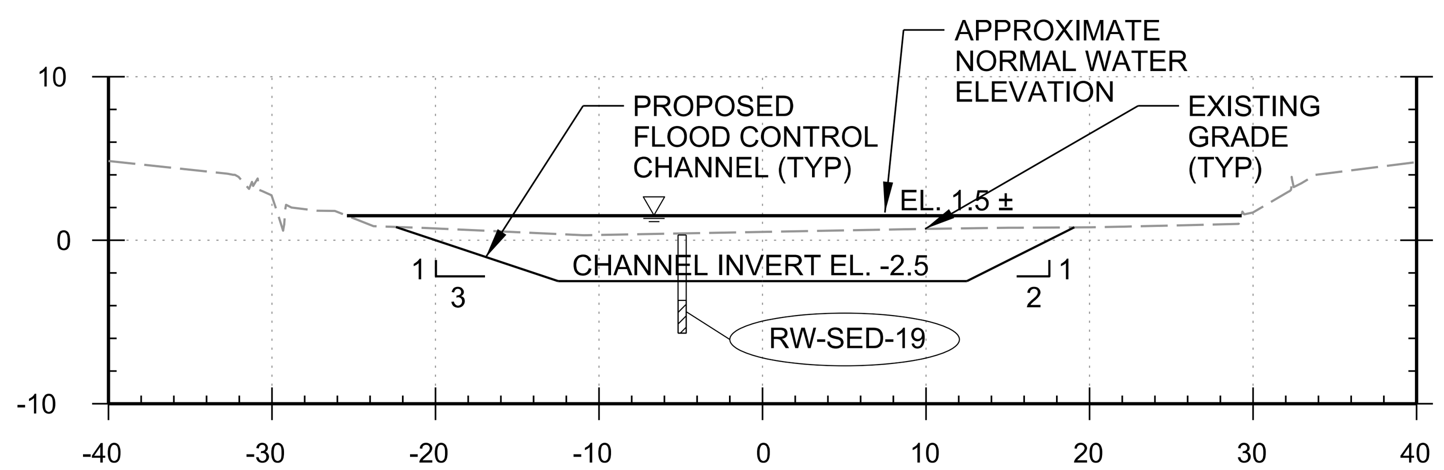
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
SIZE: ANSI D
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT DATE:
FILE NAME: MUD-2_C-307.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

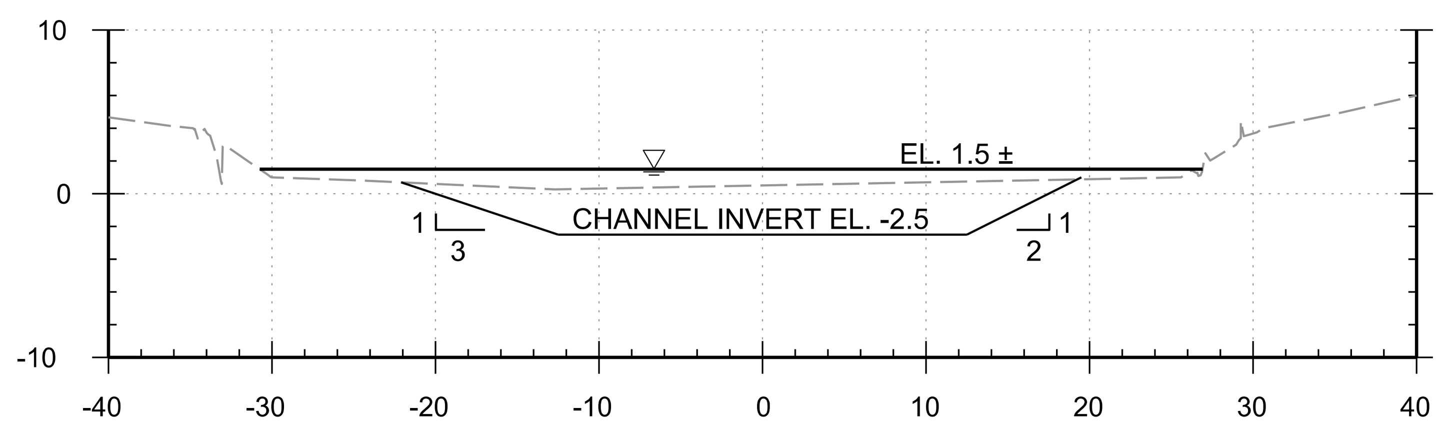
SECTIONS
AREA 3

SHEET IDENTIFICATION
C-307

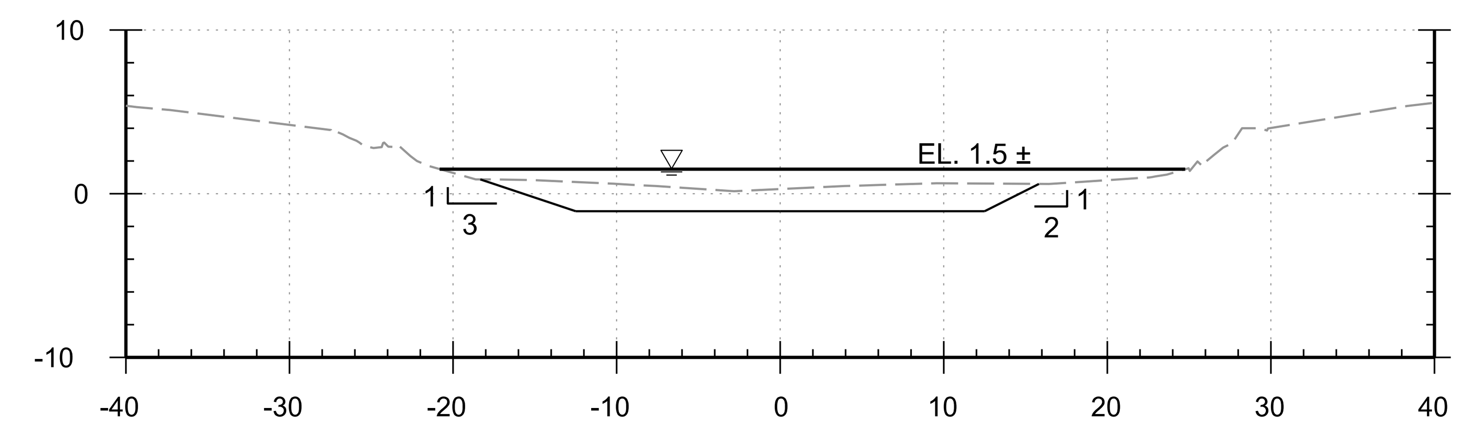
SHEET 40 OF 110



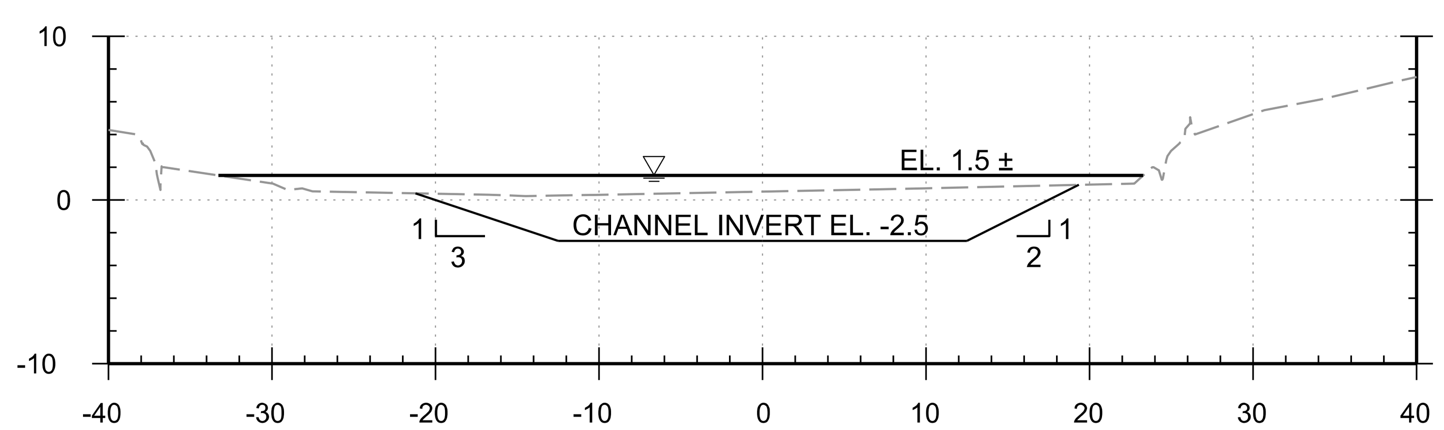
45+40



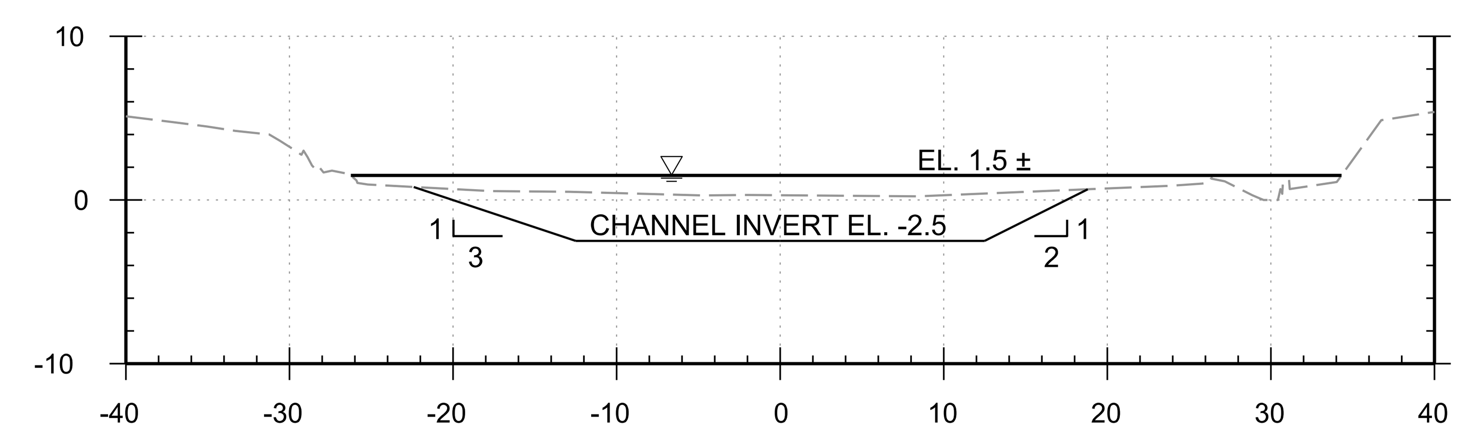
45+20



46+20



45+00



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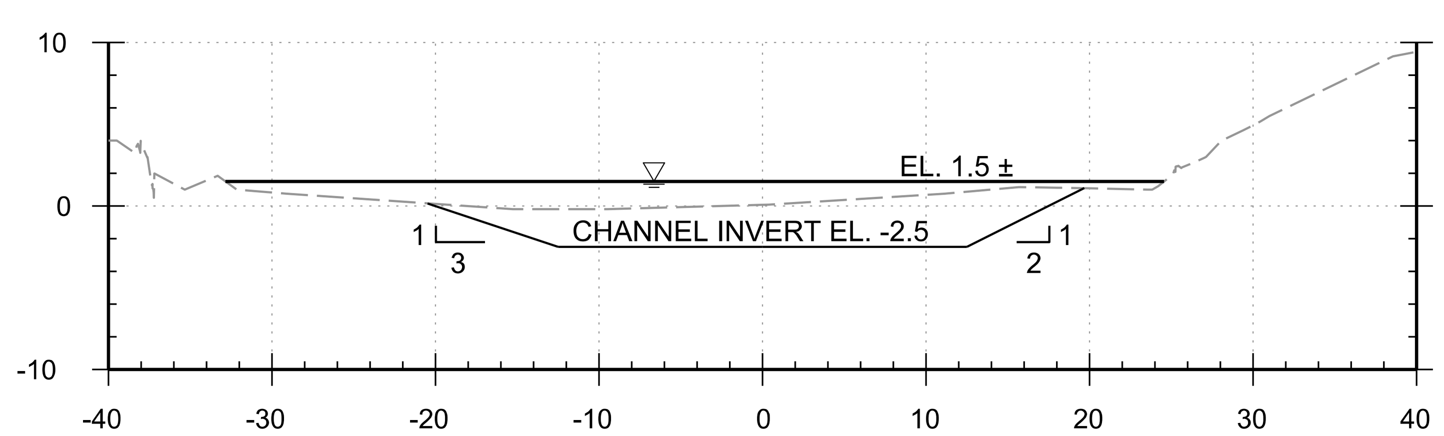
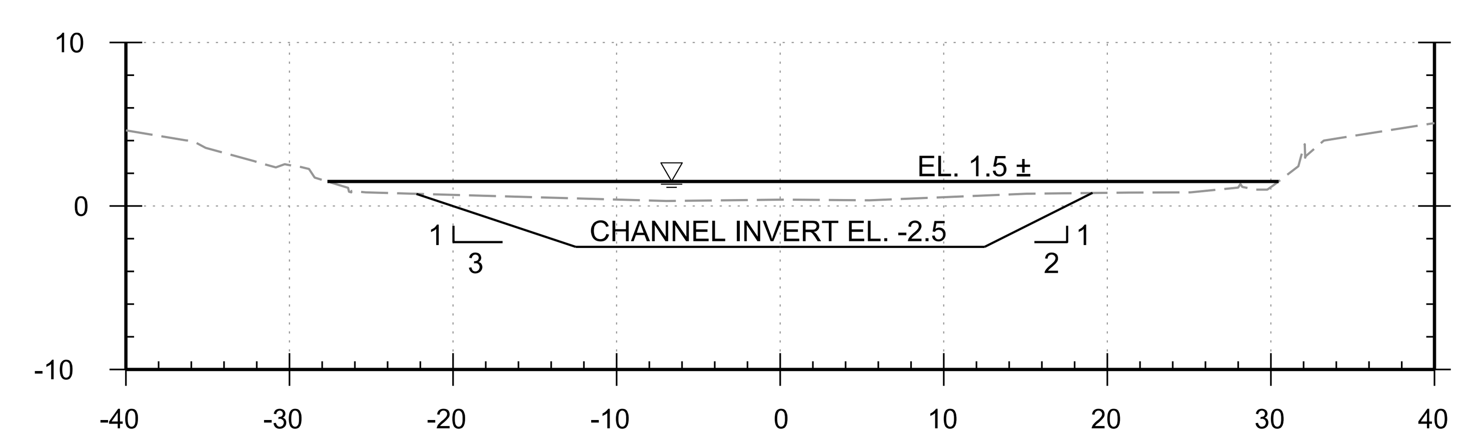


44+80



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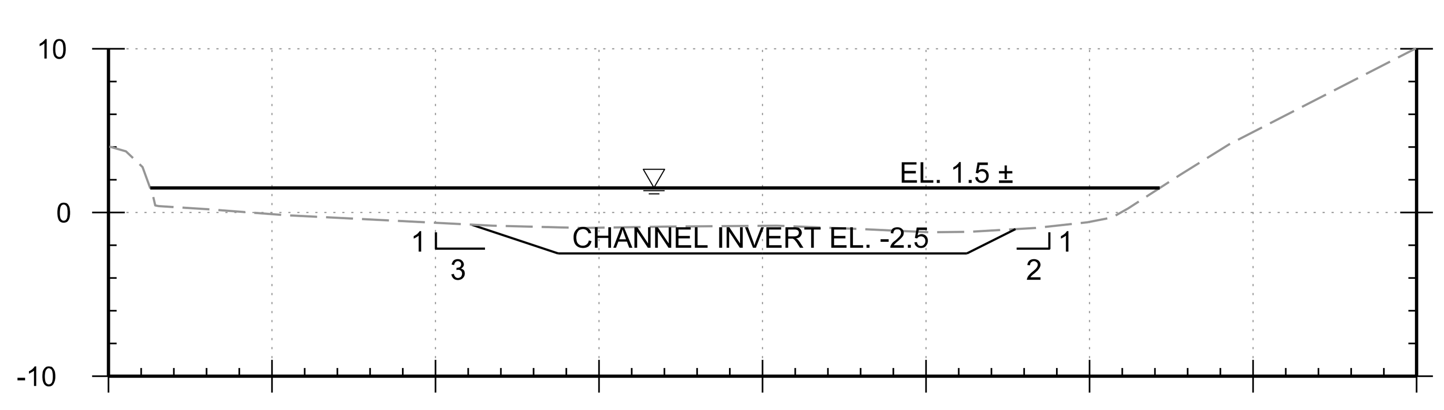

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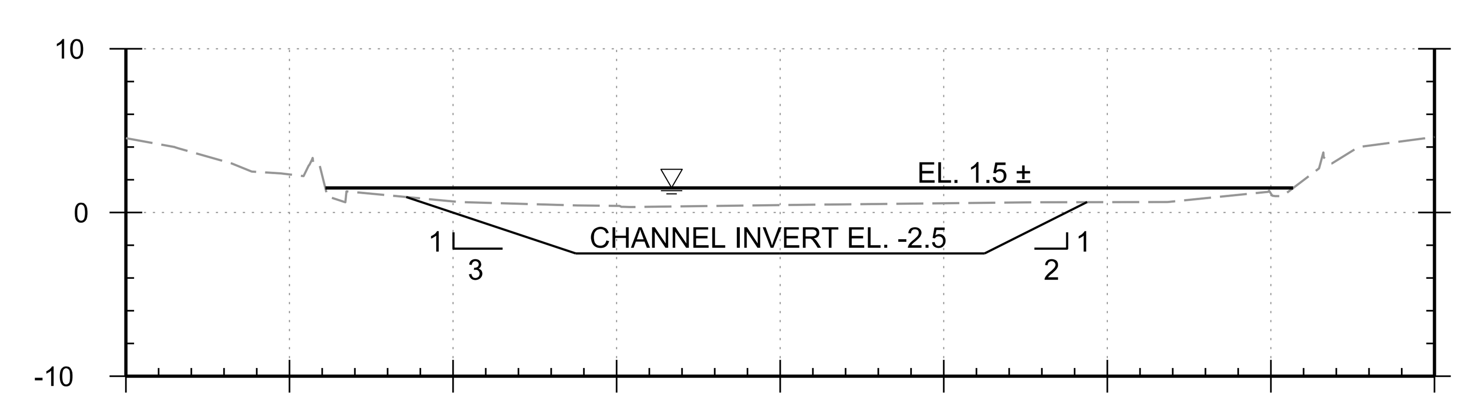


45+60

GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

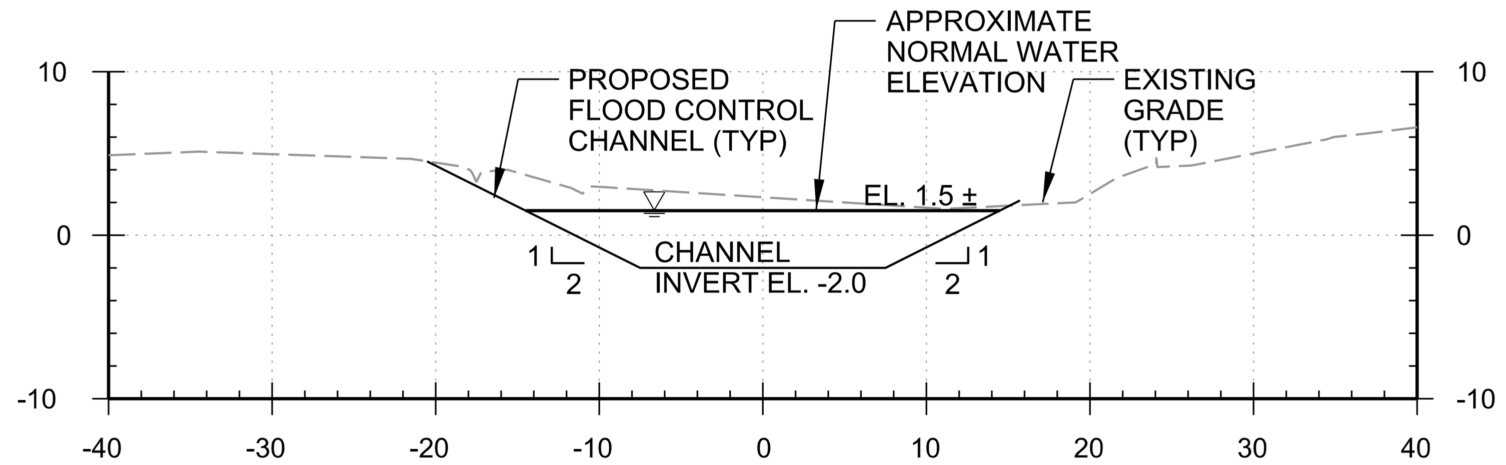
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 10'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-308.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

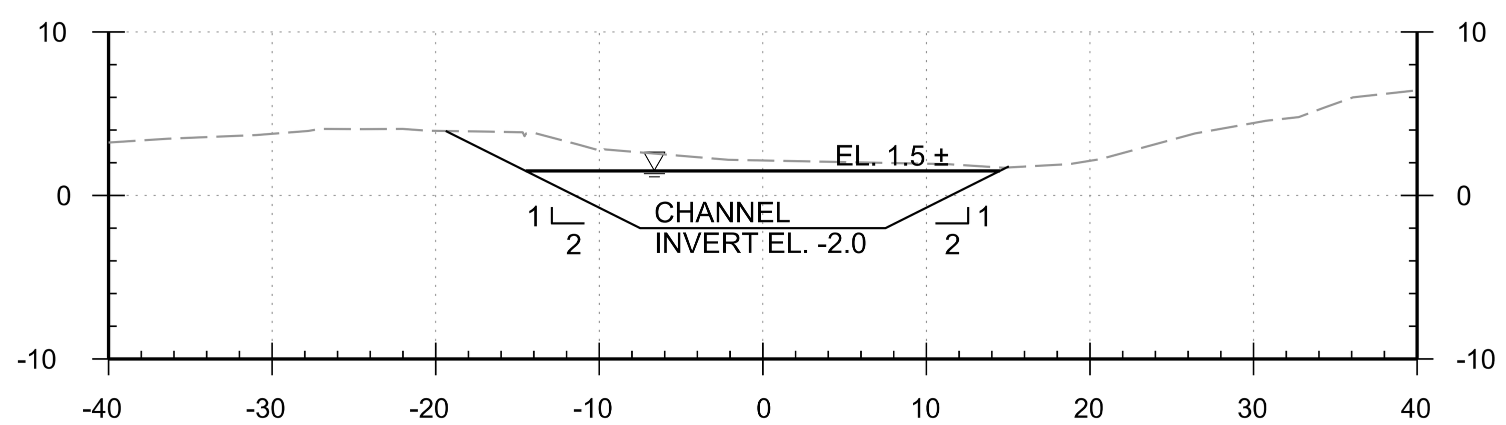
SECTIONS
AREA 4

SHEET IDENTIFICATION
C-308

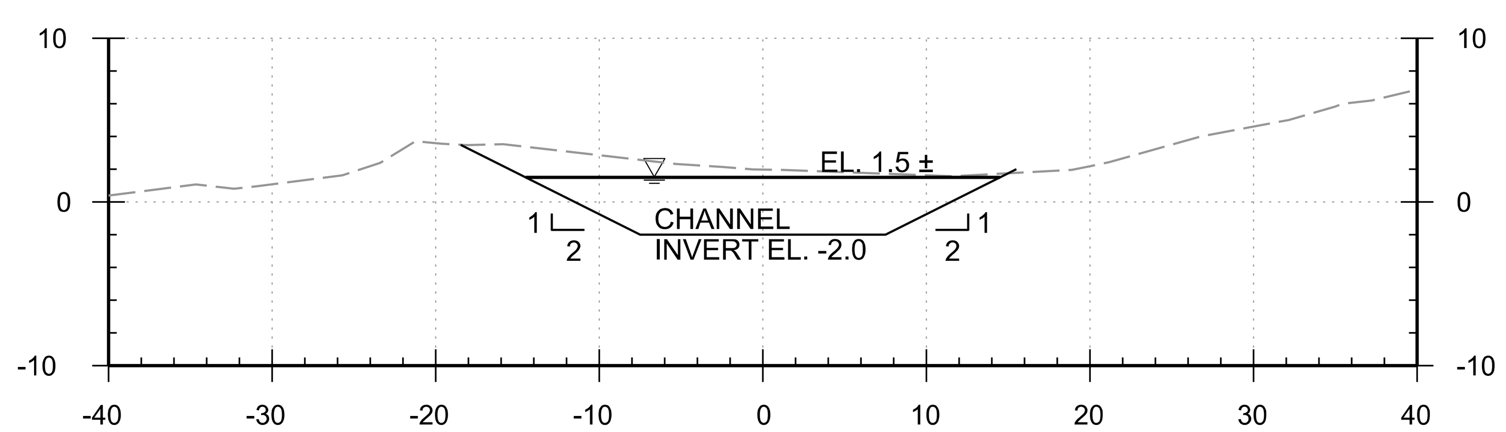
SHEET 41 OF 110



65+60



65+40



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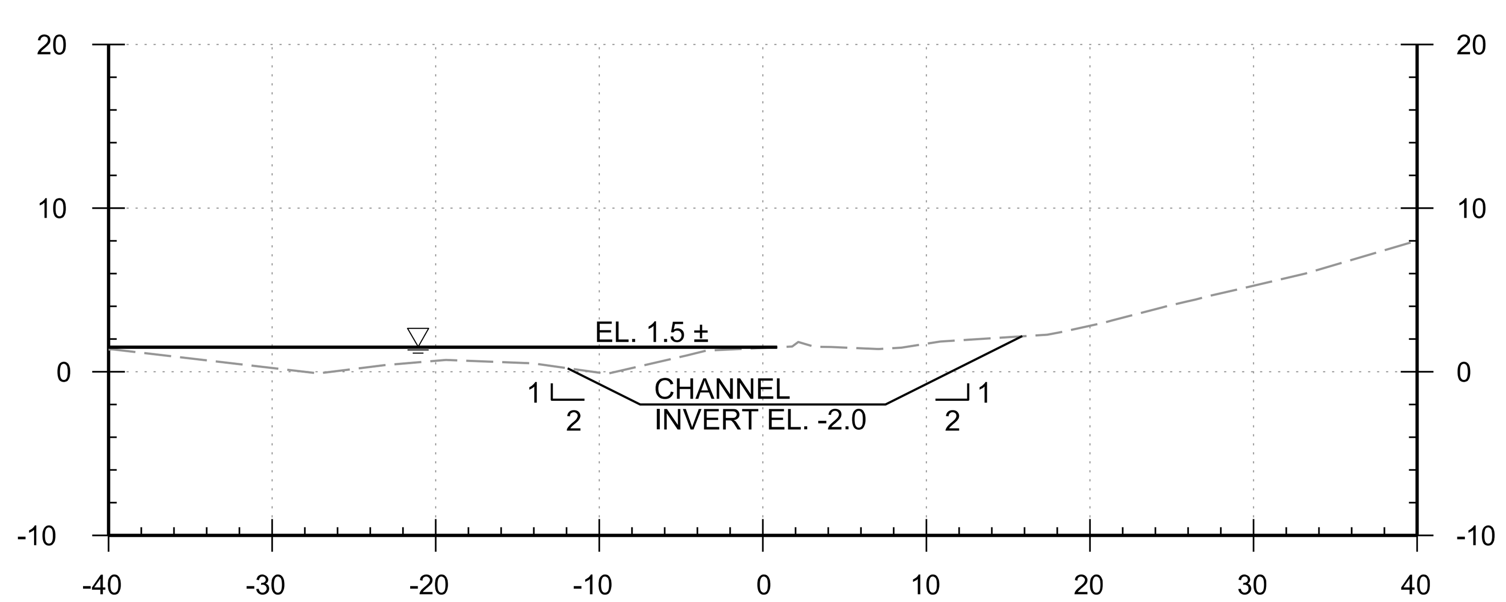

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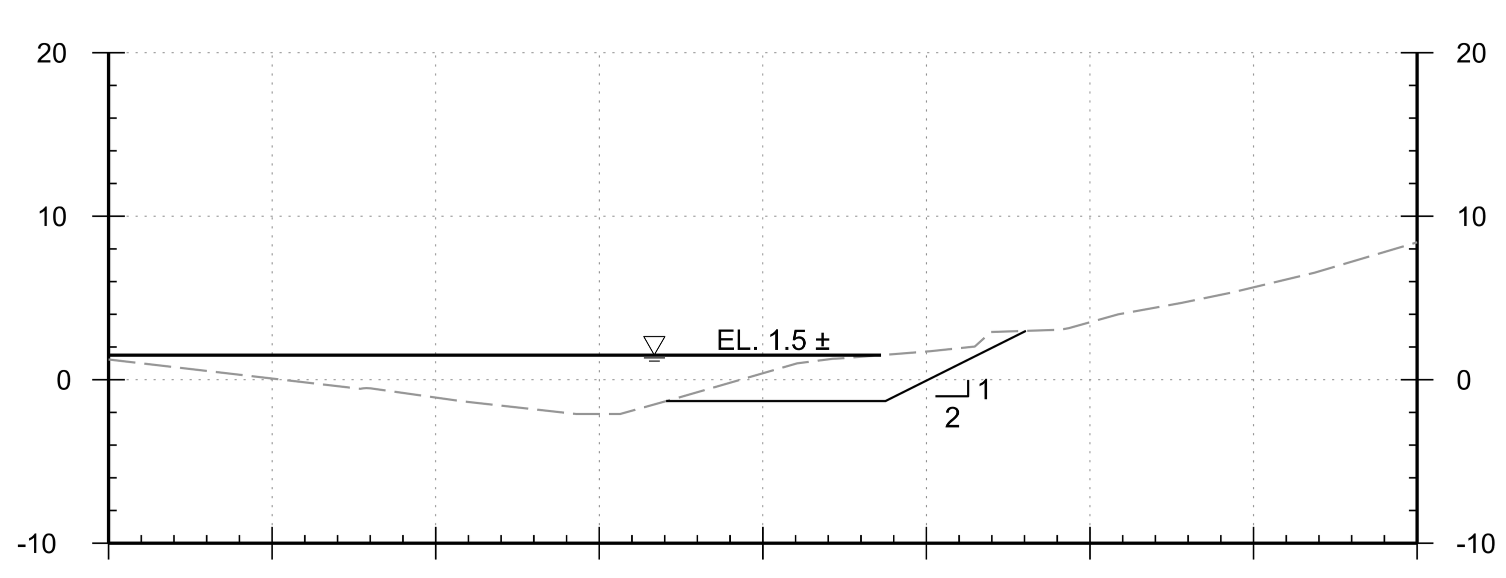
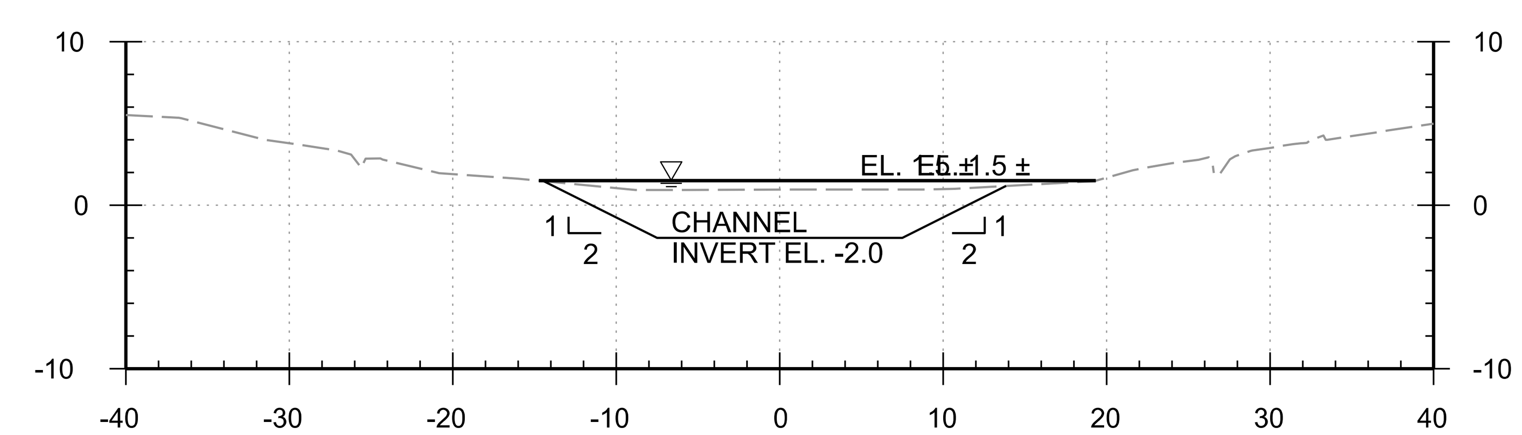


64+90



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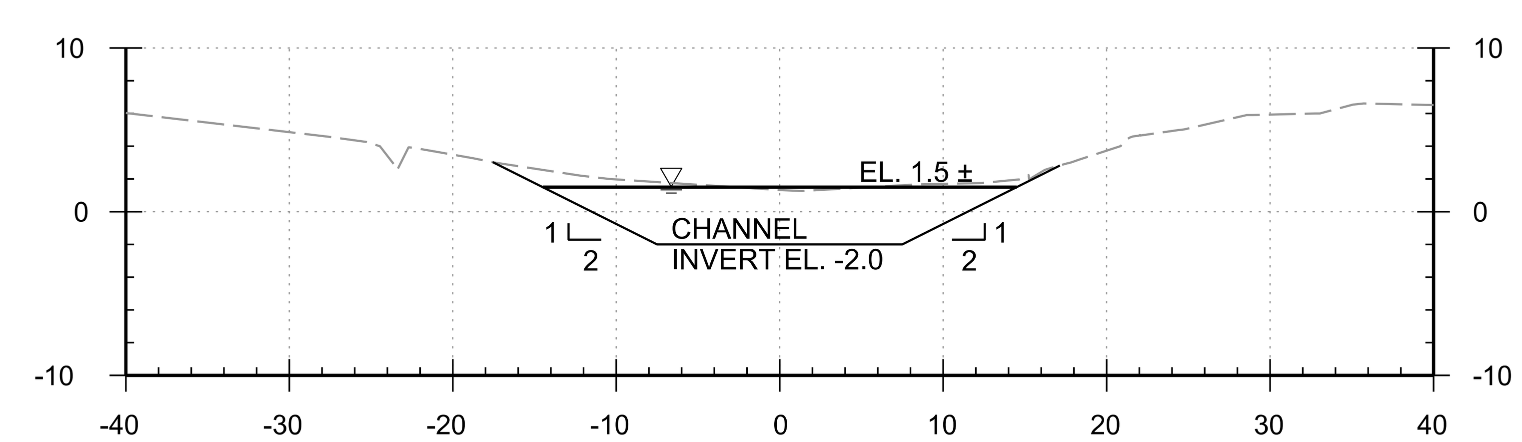

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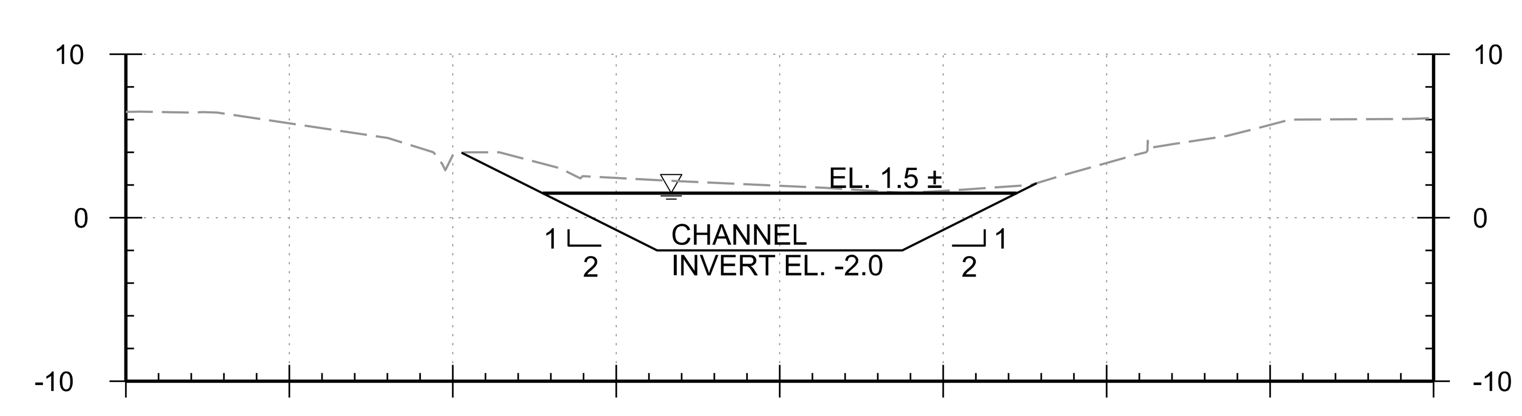
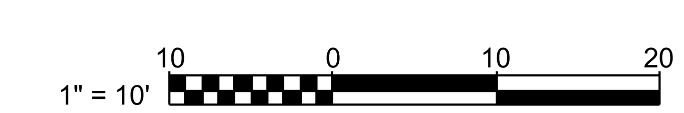


65+80

GRAPHIC SCALE:



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MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-309.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

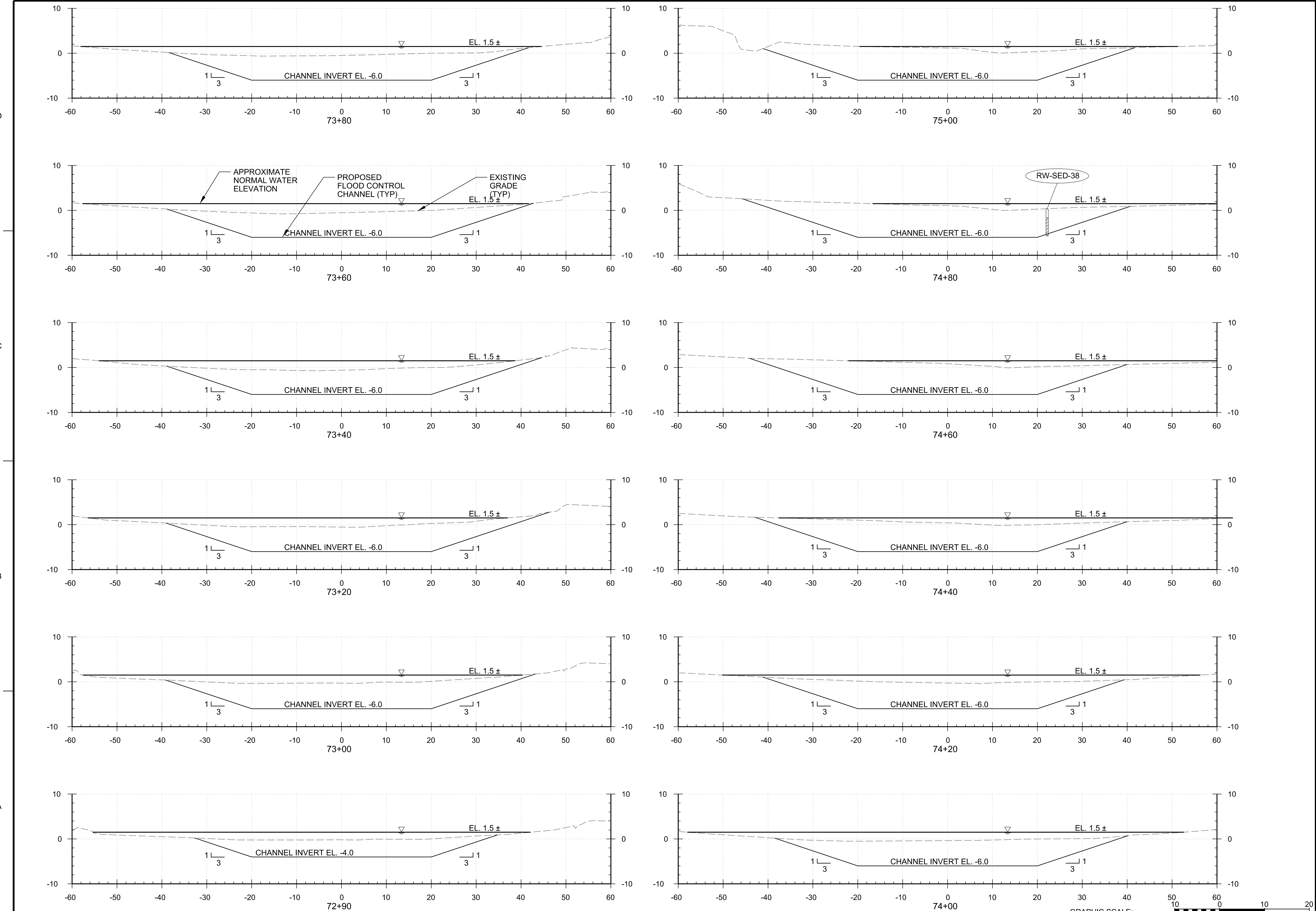
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 5

SHEET IDENTIFICATION
C-309

SHEET 42 OF 110



US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

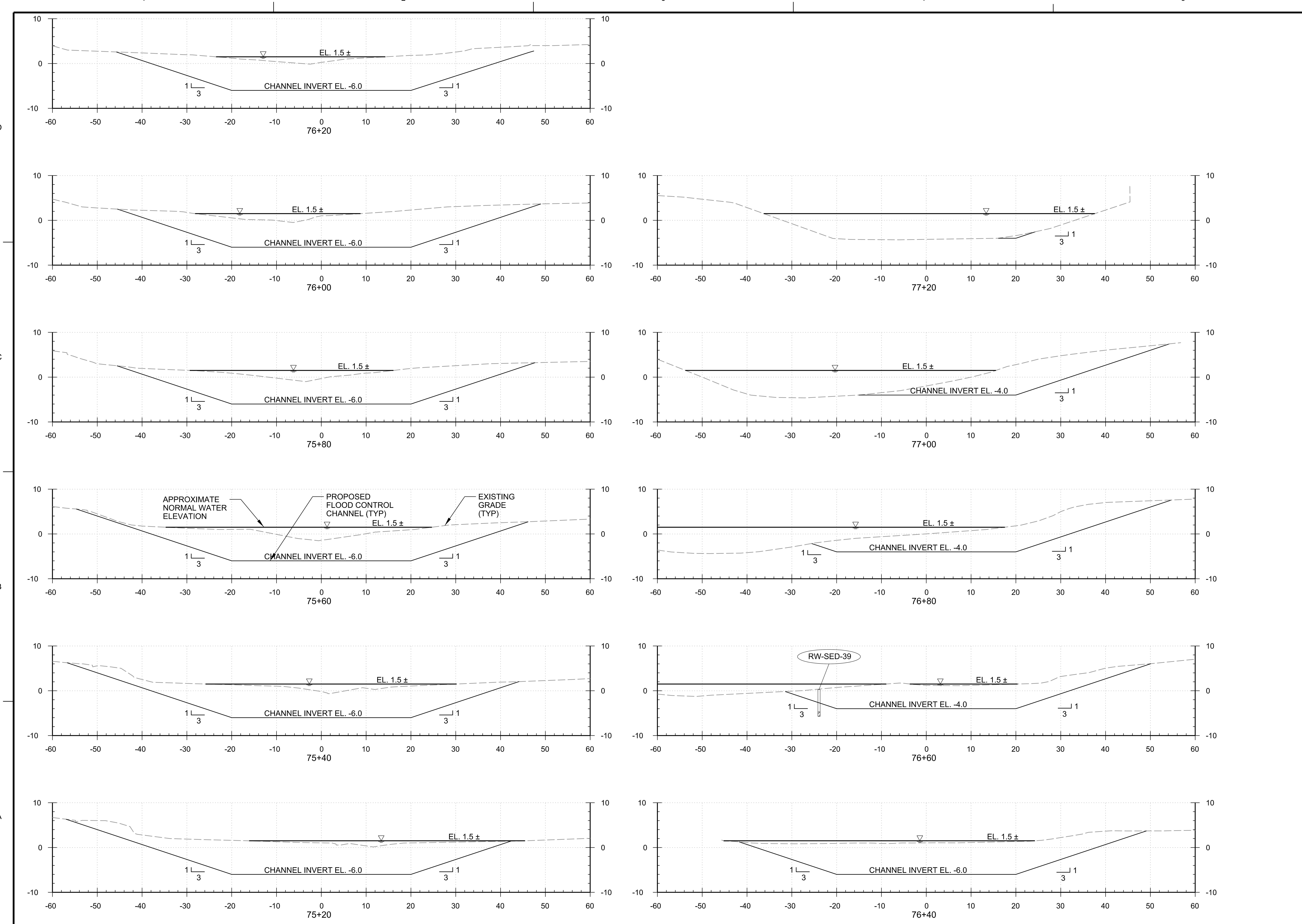
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-310.dgn

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 6

SHEET IDENTIFICATION
C-310



US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-311.dgn

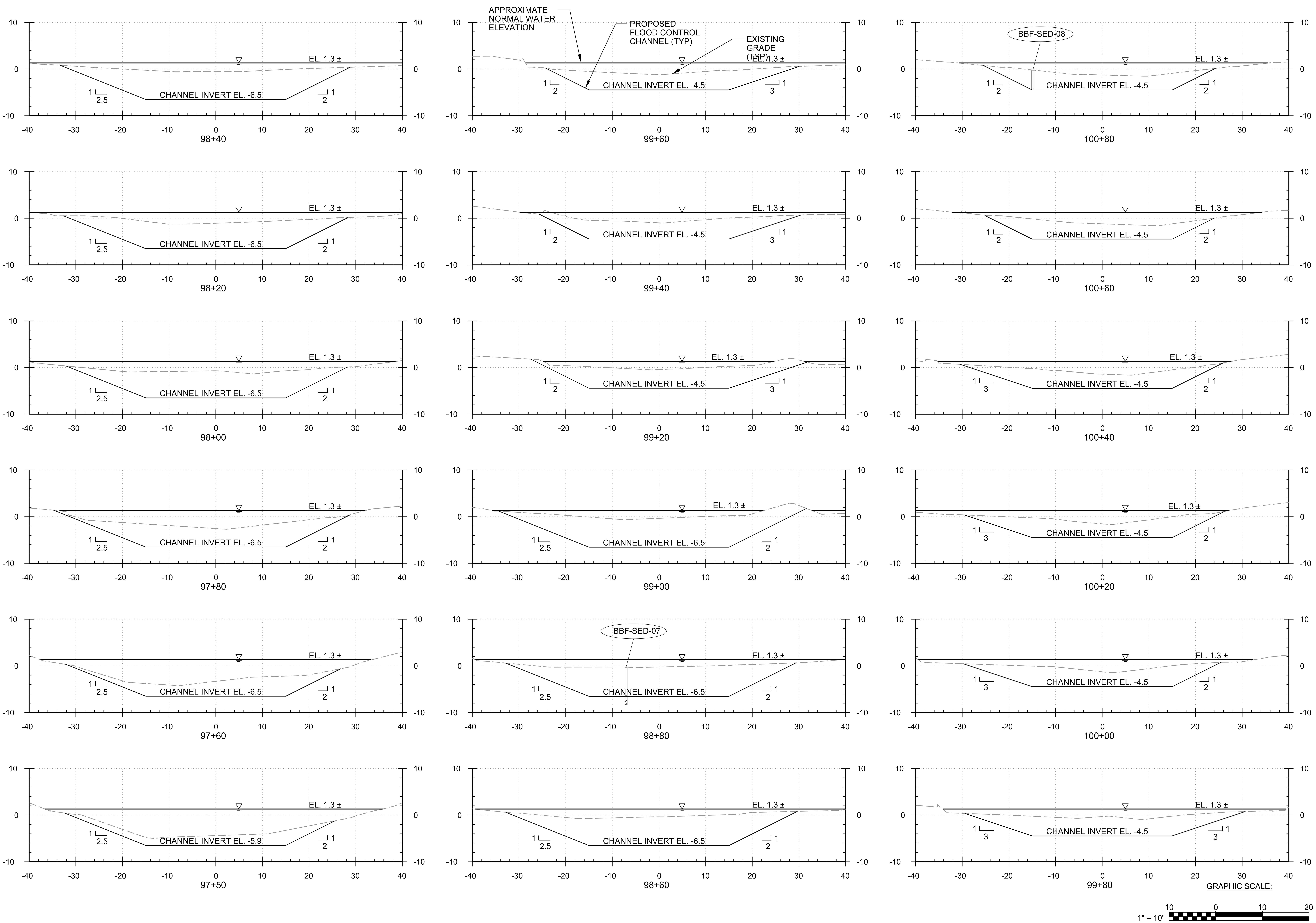
U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 6

SHEET IDENTIFICATION
C-311

SHEET 44 OF 110



US Army Corps of Engineers
New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

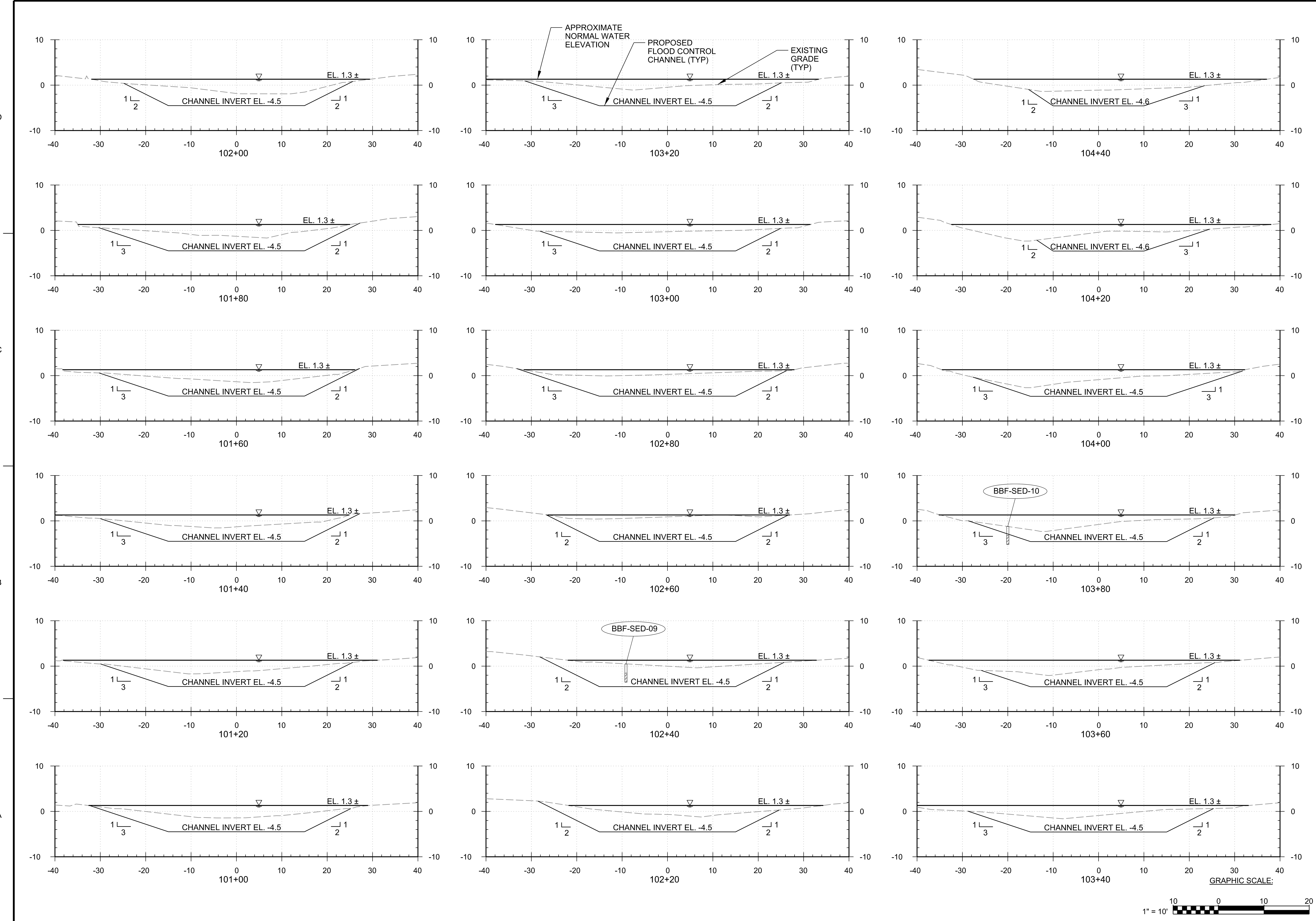
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-312.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 7

SHEET IDENTIFICATION
C-312

SHEET 45 OF 110



US Army Corps of Engineers® New England District

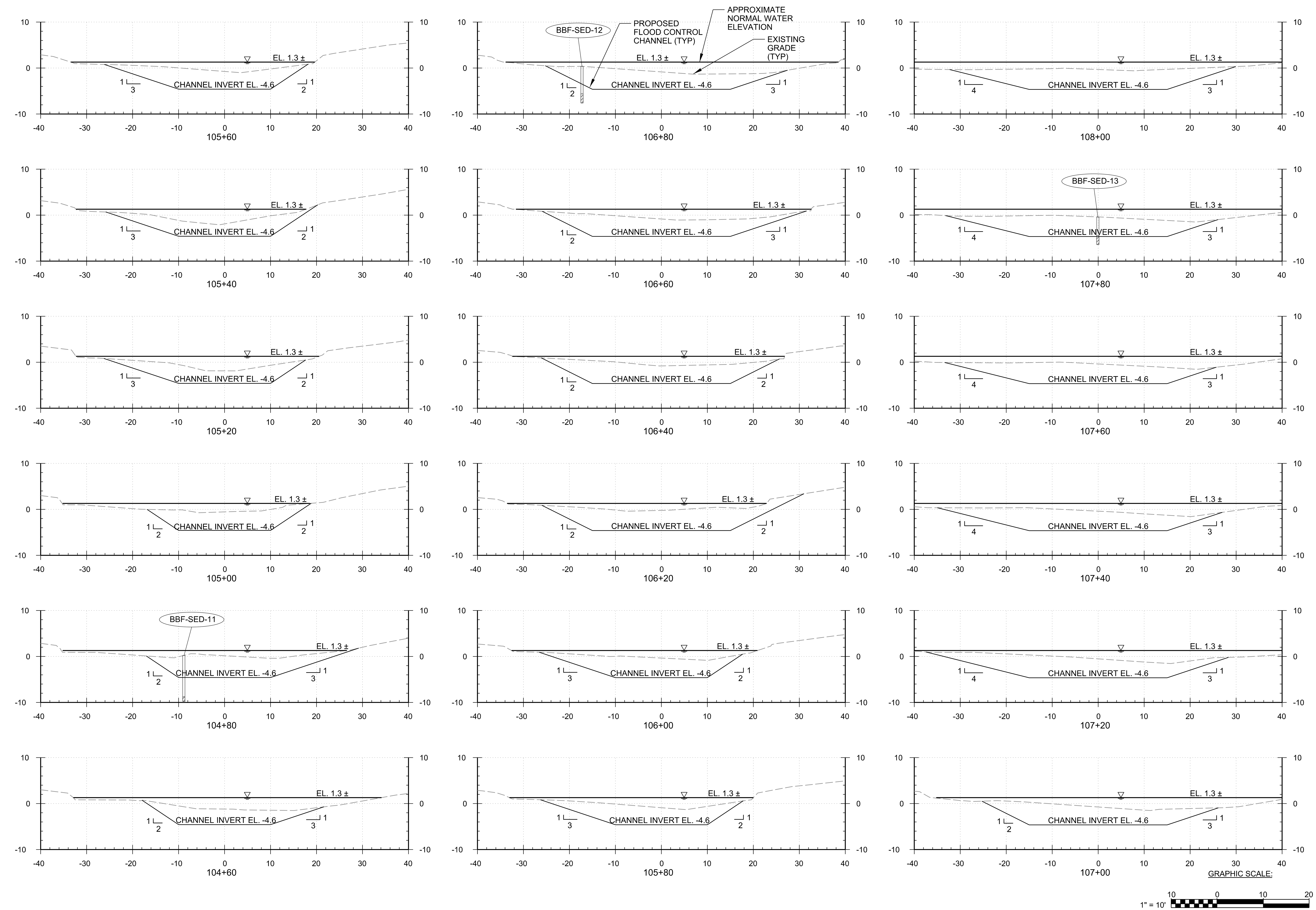
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-313.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 7 & 8

SHEET IDENTIFICATION
C-313
SHEET 46 OF 110



US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
FILE NAME: MUD-2_C-314.dgn
SIZE: ANSI D

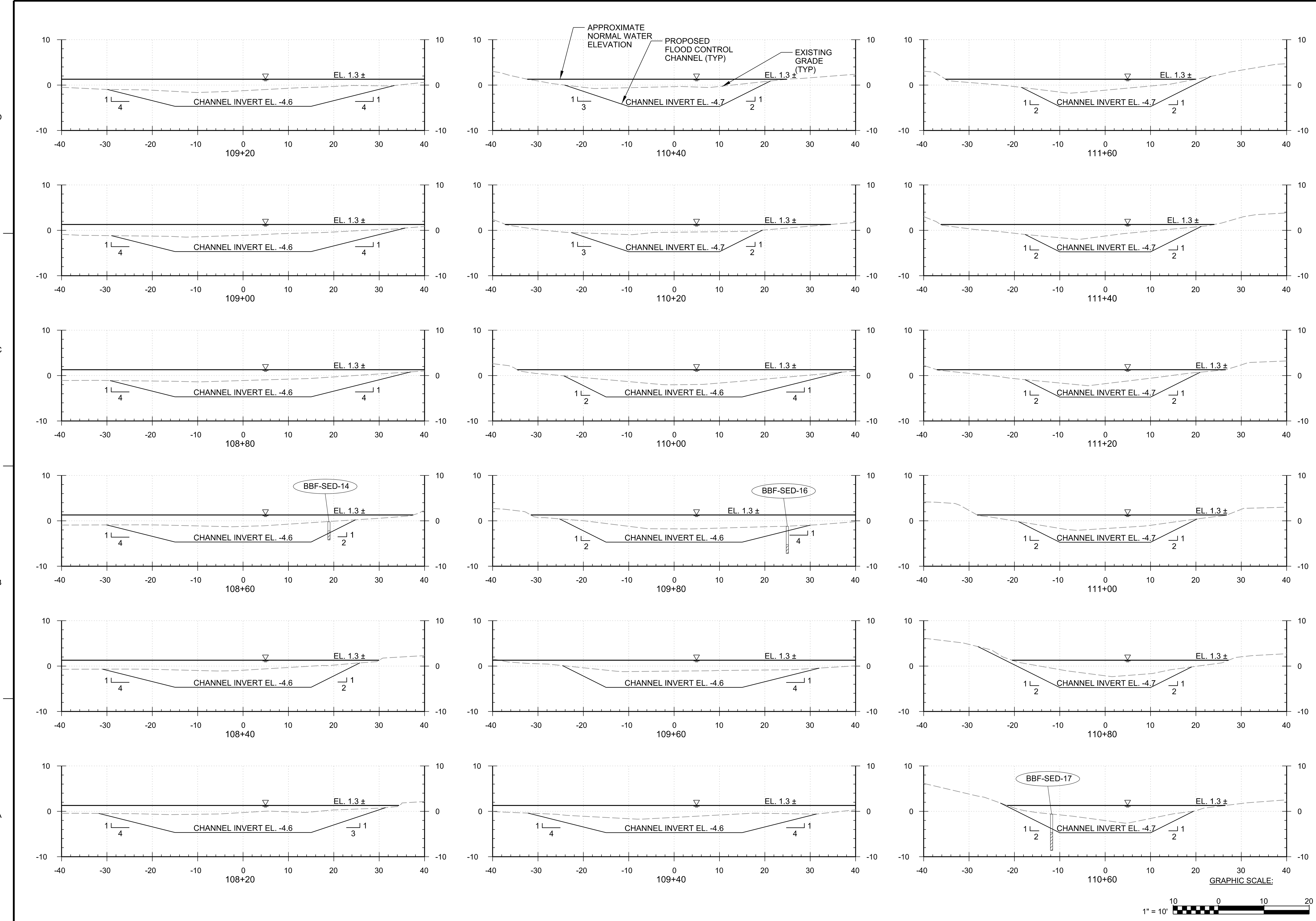
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 8

SHEET IDENTIFICATION
C-314

SHEET 47 OF 110



US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

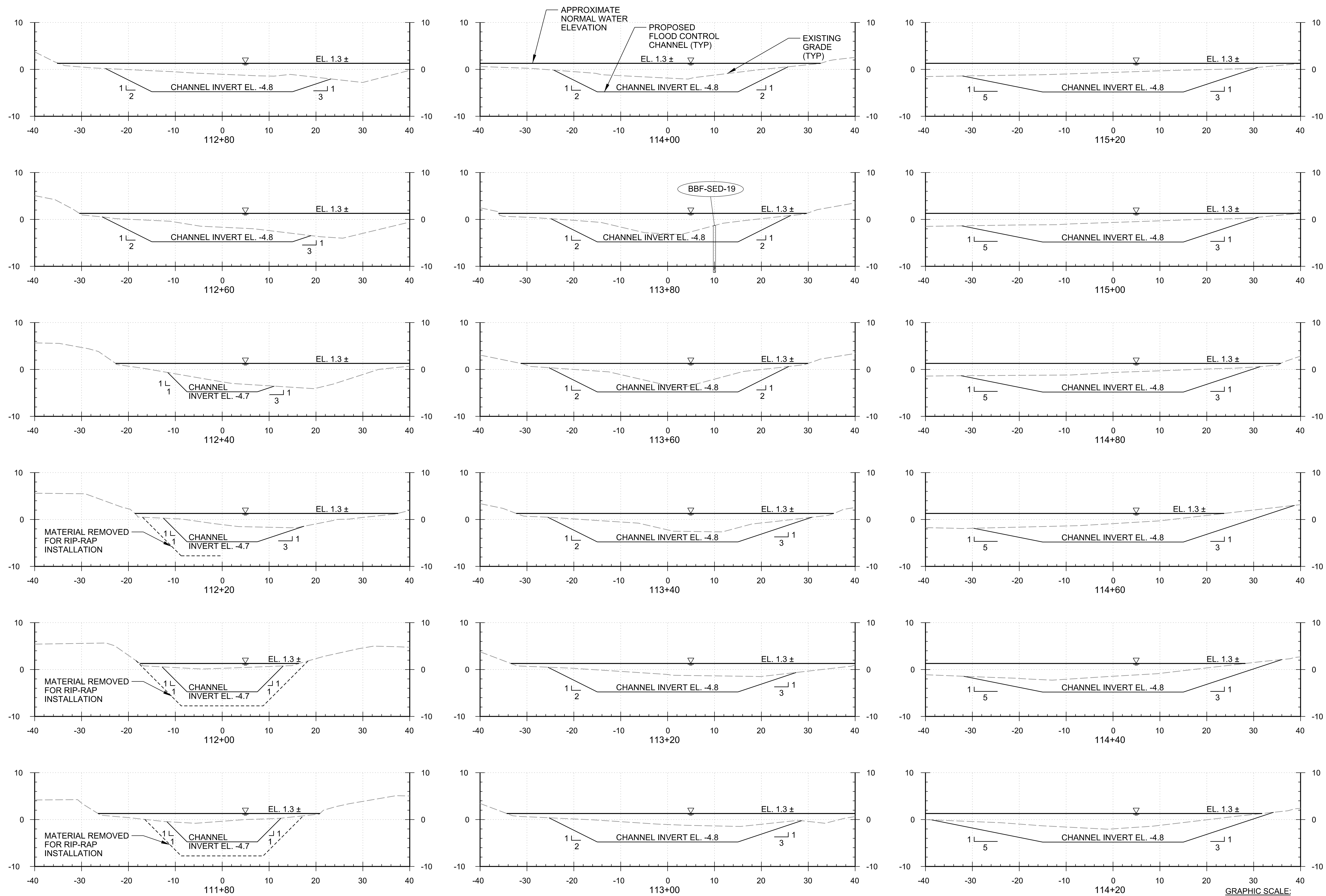
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016	
DWN BY: LT	CKD BY:	SOLICITATION NO.:	
SUBMITTED BY:		CONTRACT NO.:	
PLOT SCALE: 1" = 10'	PLOT DATE:	DRAWING CODE: MUD-2	
SIZE: ANSI D	FILE NAME: MUD-2_C-315.dgn		

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 8 & 9

SHEET IDENTIFICATION
C-315
SHEET 48 OF 110



GRAPHIC SCALE:
1" = 10'
10 0 10 20

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

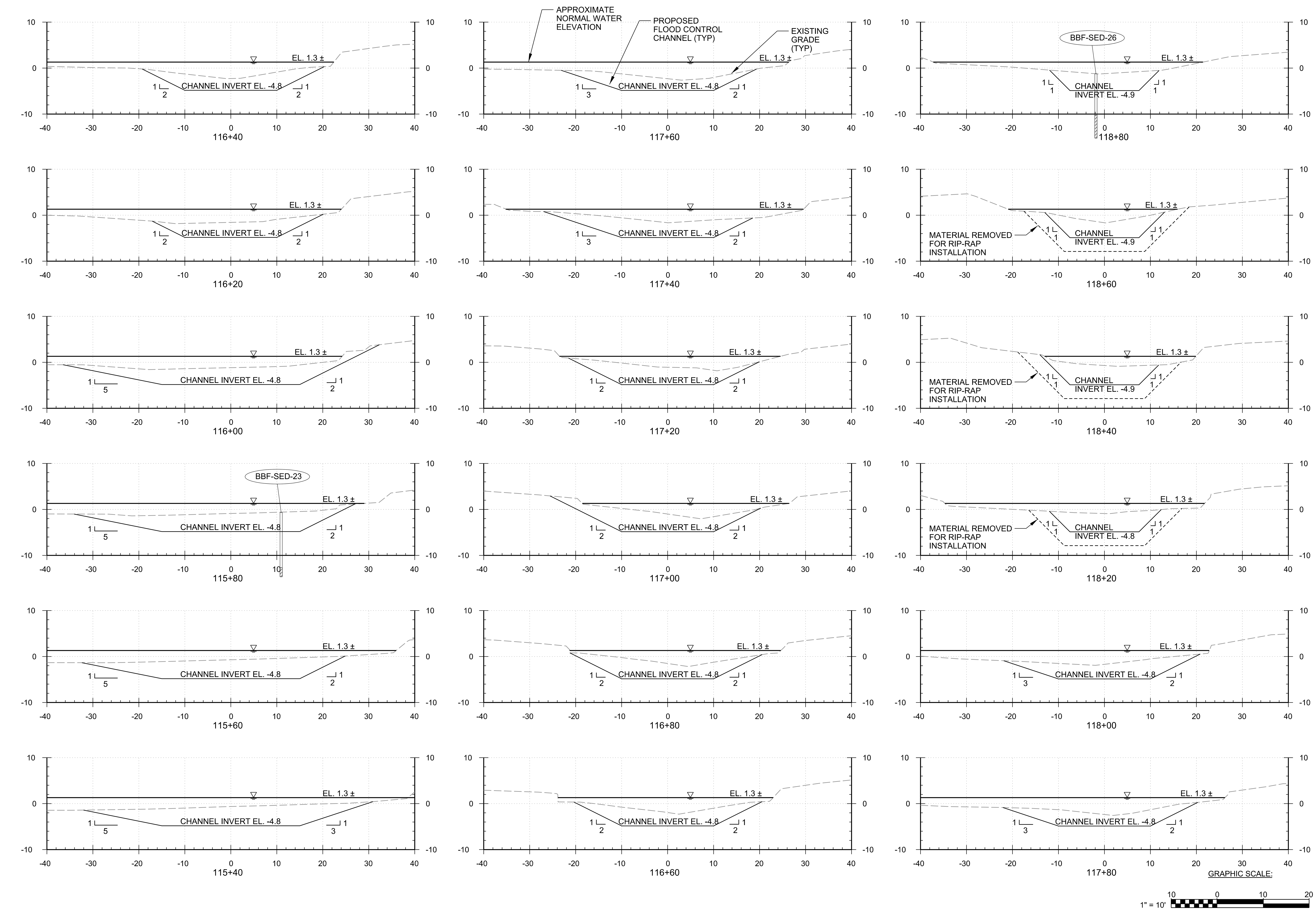
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
SIZE: ANSI D
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT DATE:
FILE NAME: MUD-2_C-316.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 9

SHEET IDENTIFICATION
C-316



US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

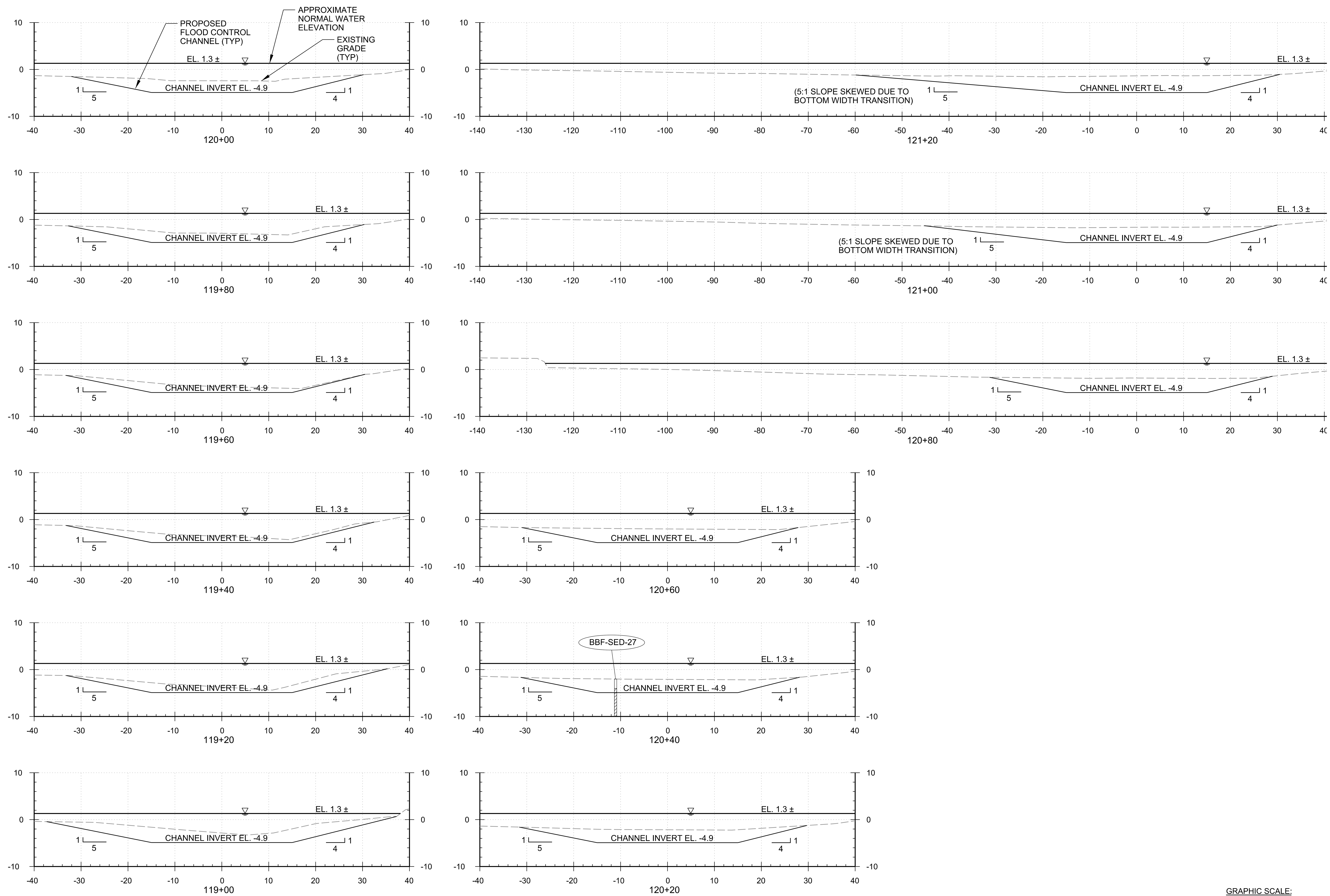
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY:	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 10'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-317.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 9 & 10

SHEET IDENTIFICATION
C-317
SHEET 50 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

MARK | DATE | DESCRIPTION | APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

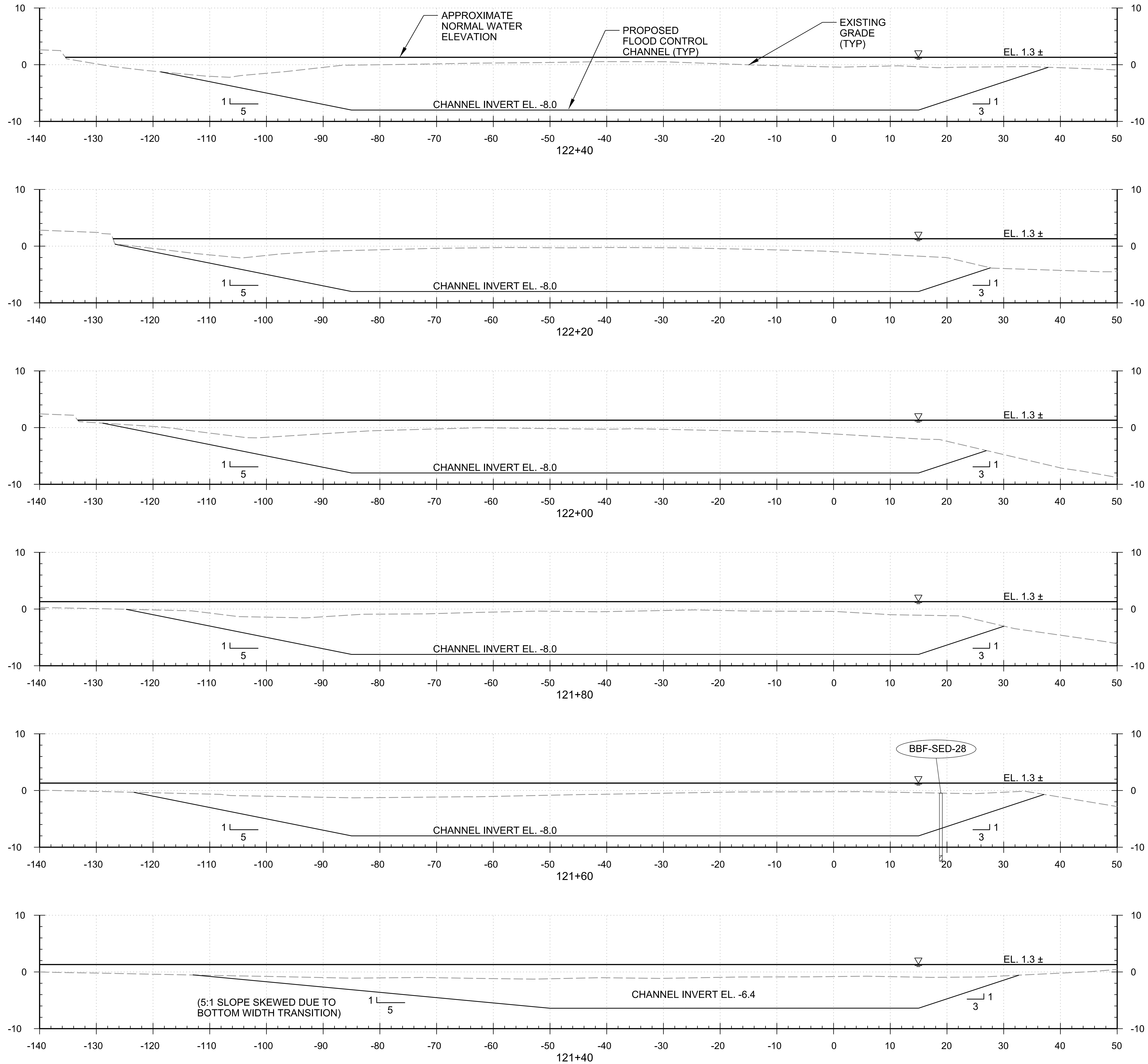
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 10'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-318.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-318

SHEET 51 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

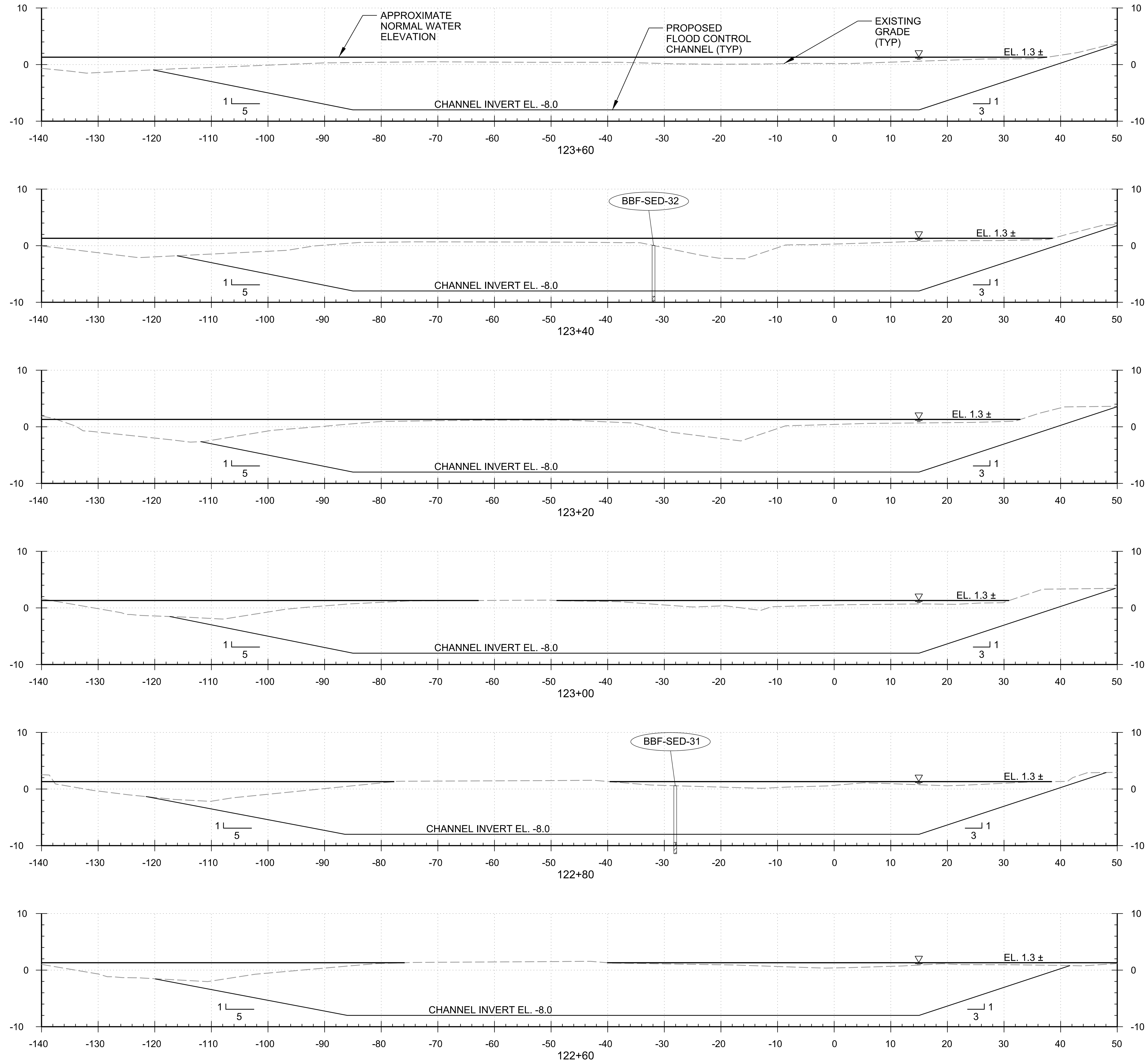
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-319.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-319



GRAPHIC SCALE:

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

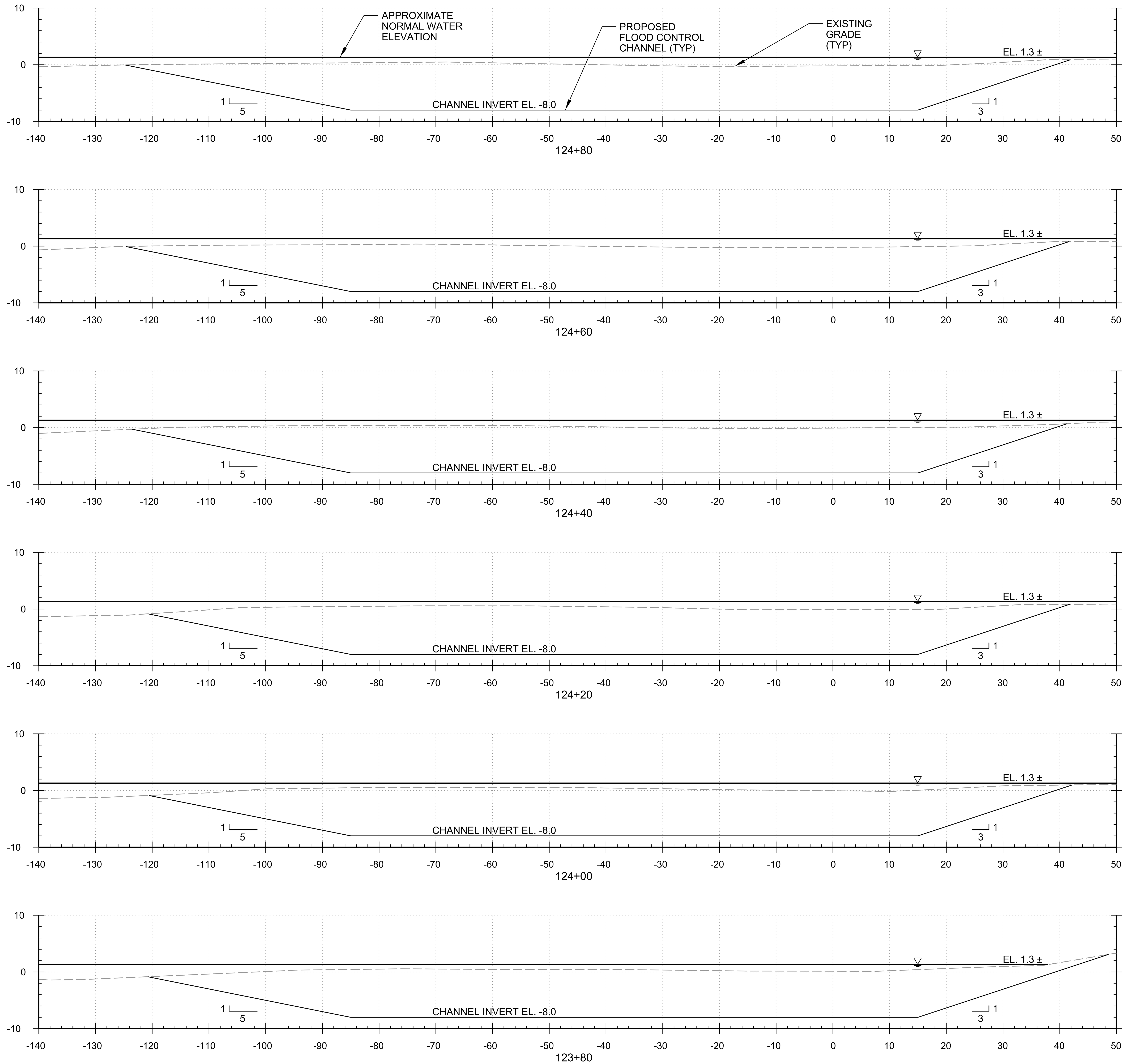
DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY:	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 10'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-320.dgn	

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-320

SHEET 53 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

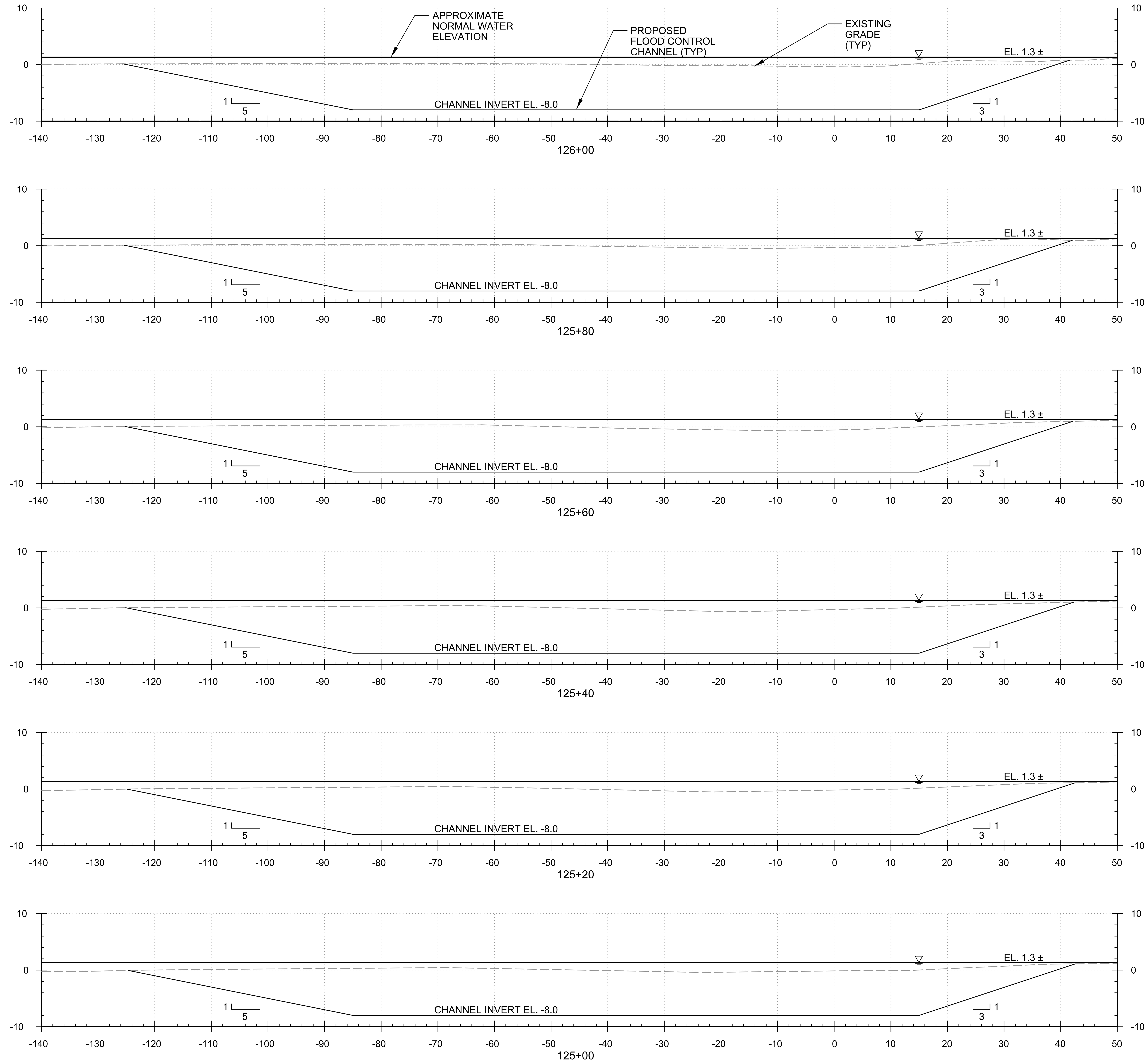
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-321.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-321

SHEET 54 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers®
New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

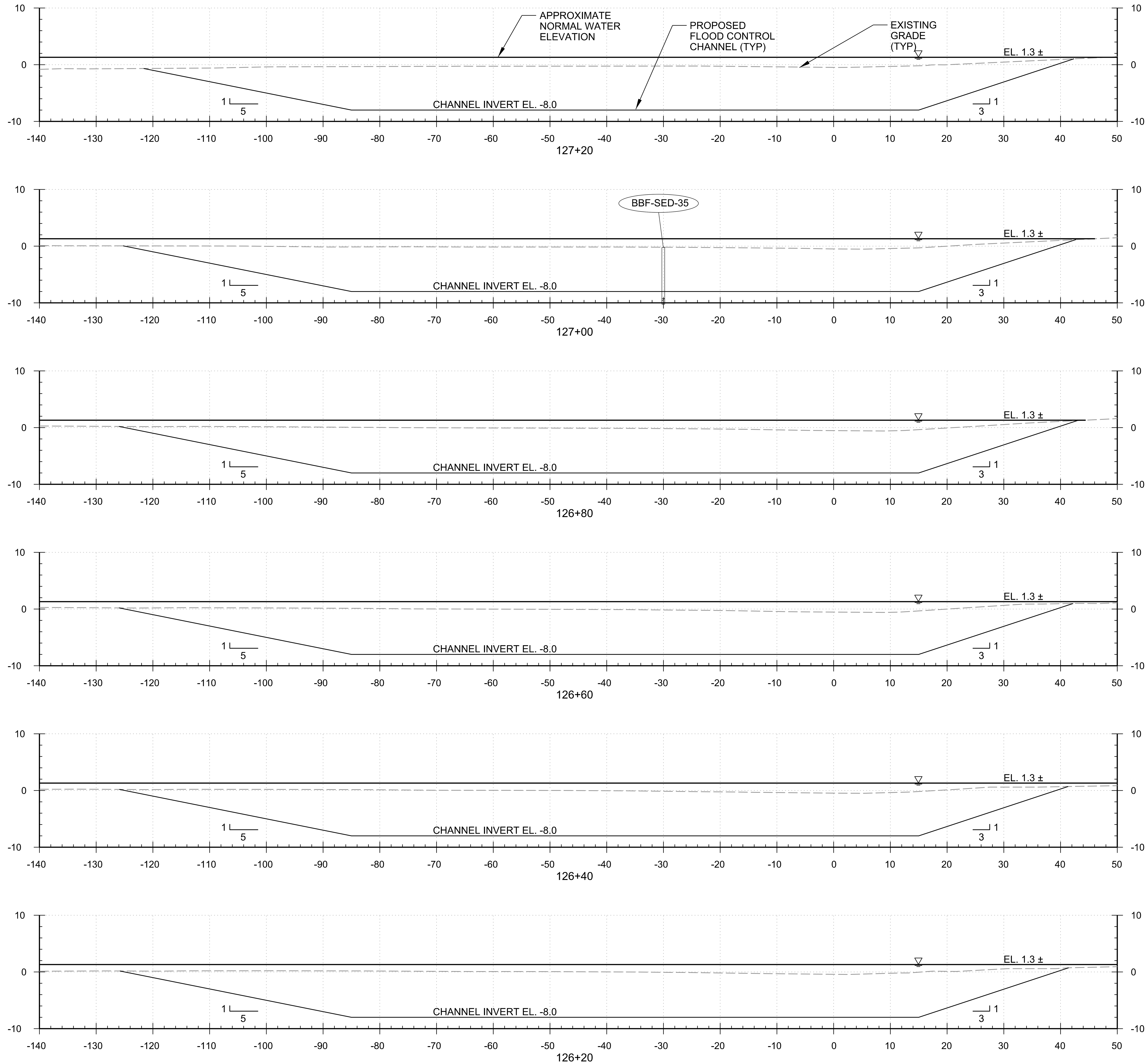
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 10'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-322.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-322

SHEET 55 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

MARK | DESCRIPTION | DATE | APPR.

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
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SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-323.dgn

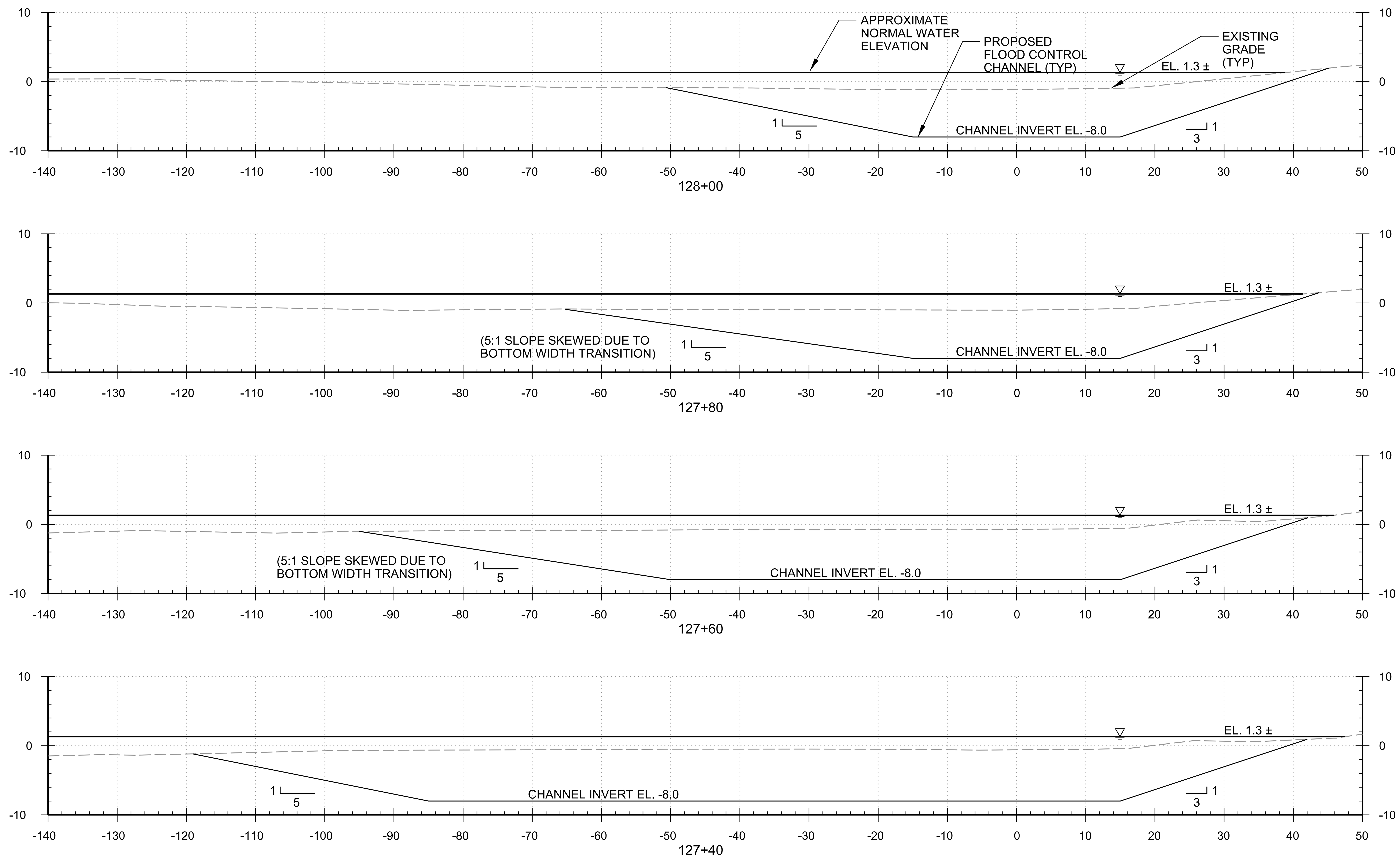
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-323

SHEET 56 OF 110



GRAPHIC SCALE:

1" = 10'

10 0 10 20

US Army Corps of Engineers® New England District

MARK | DATE | DESCRIPTION | APPR.

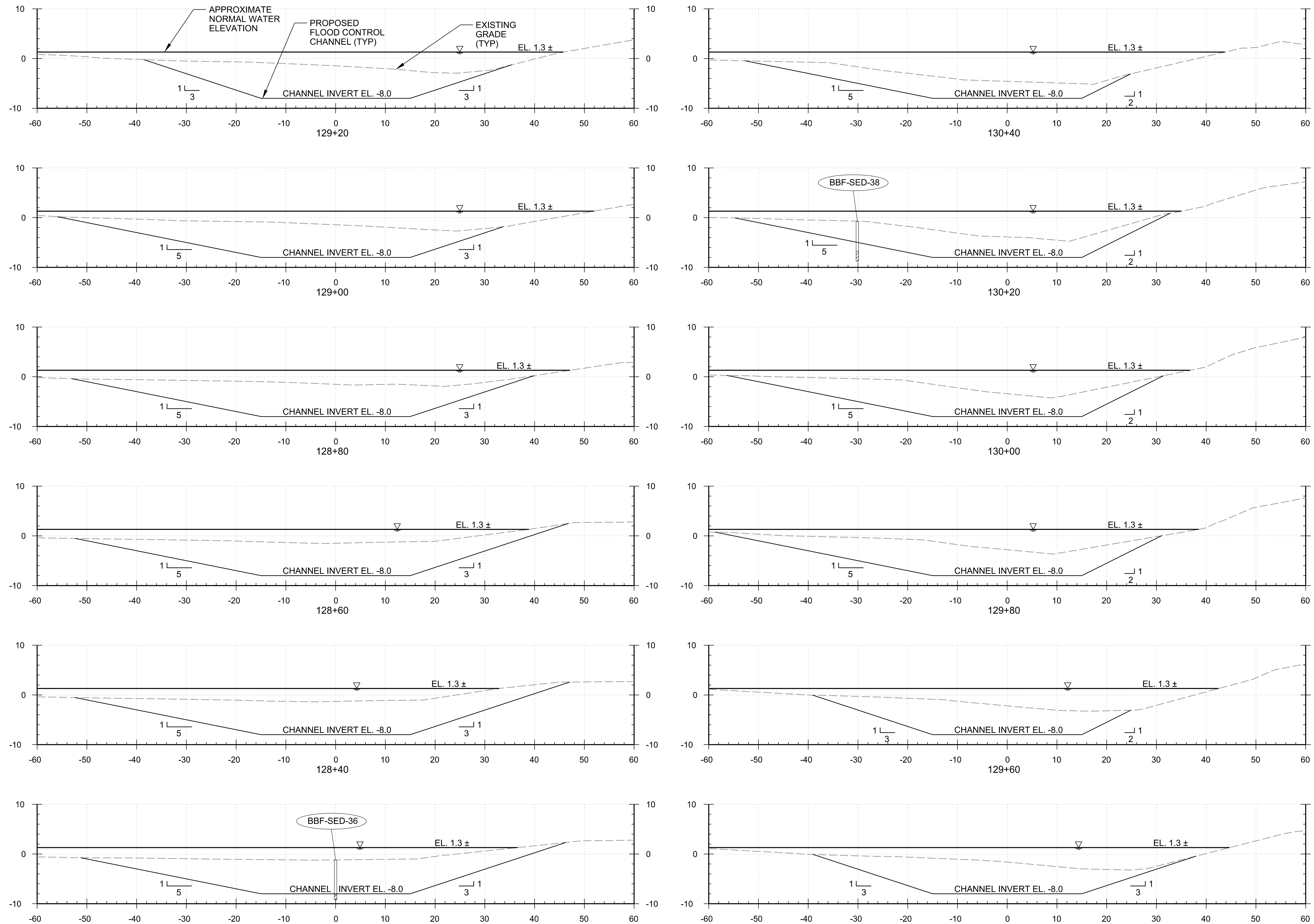
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1" = 10'
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-324.dgn

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-324
SHEET 57 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers®
New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

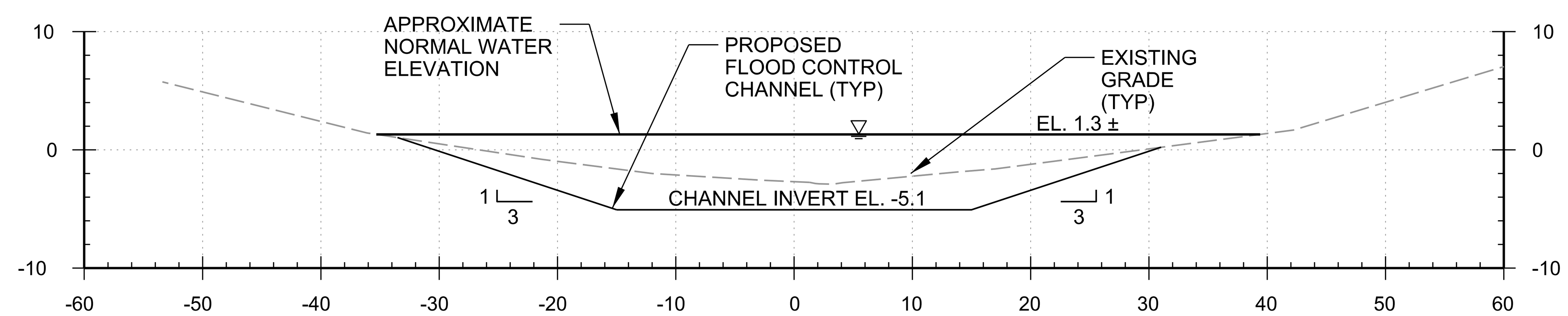
DESIGNED BY: L. THIBODEAU	DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY:
SOLICITATION NO.:	
SUBMITTED BY:	CONTRACT NO.:
PLOT SCALE: 1" = 10'	PLOT DATE:
DRAWING CODE: MUD-2	
SIZE: ANSI D	FILE NAME: MUD-2_C-325.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-325

SHEET 58 OF 110



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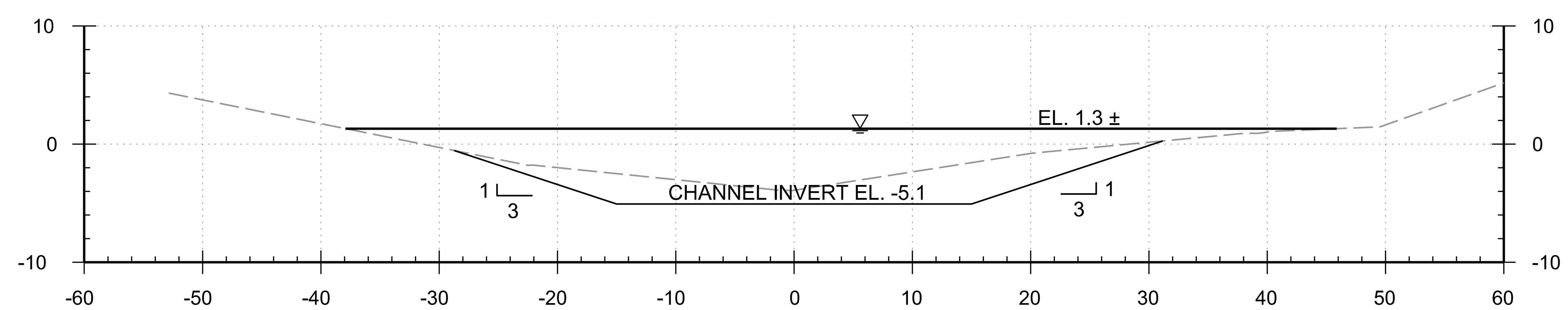

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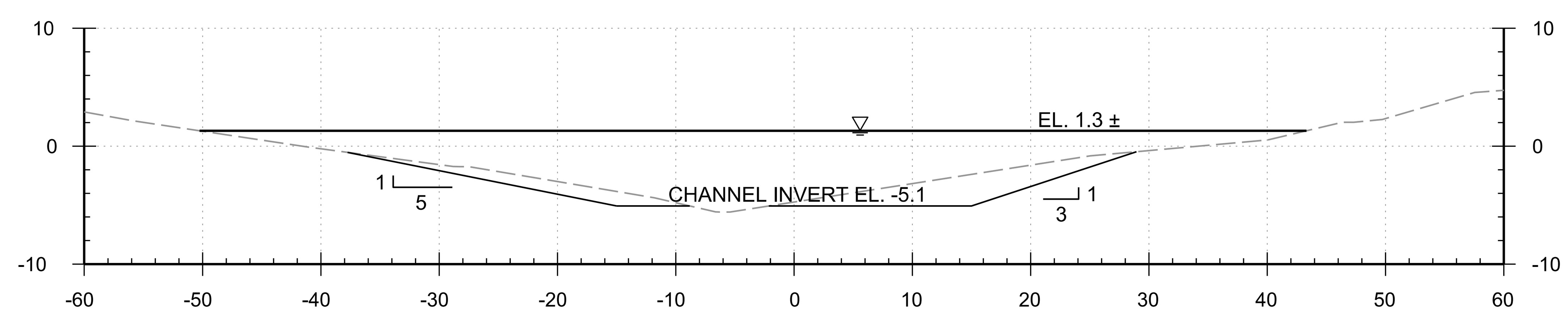

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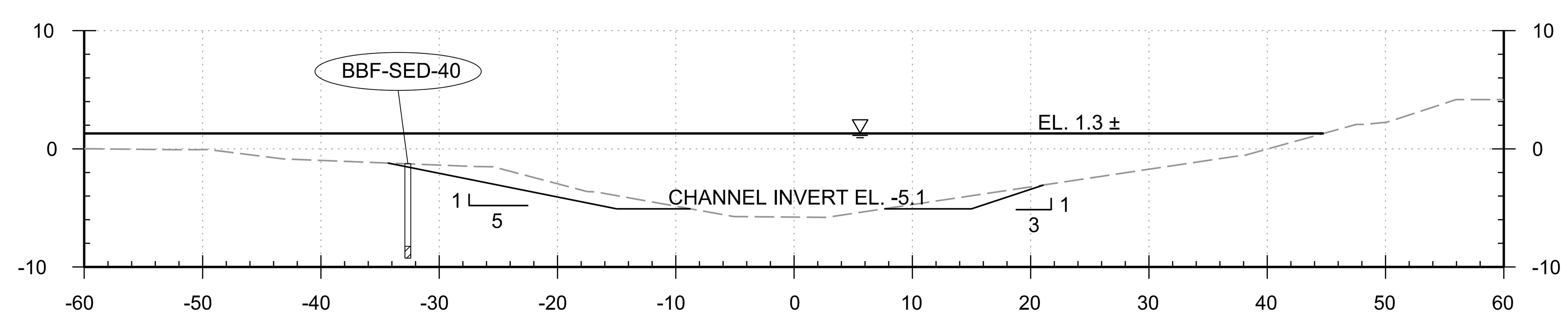
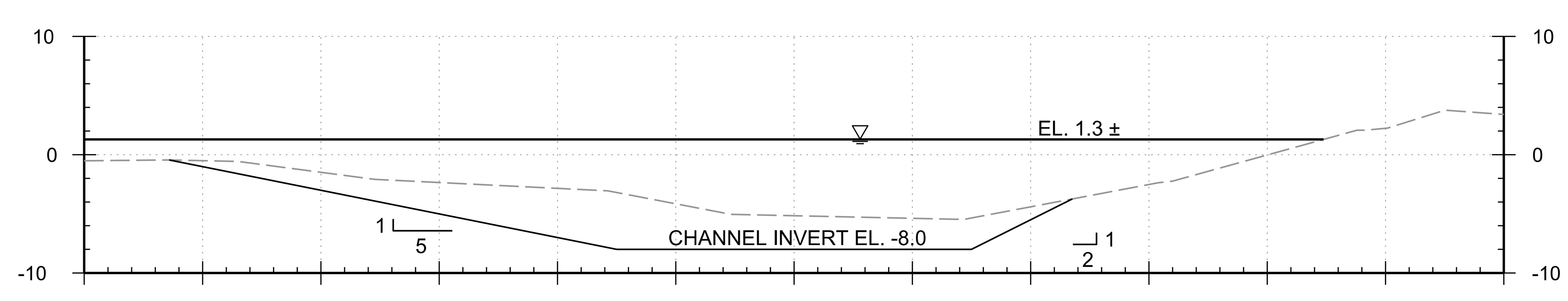


130+80



130+60

GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU | DWN BY: LT | CKD BY: | SUBMITTED BY:

DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

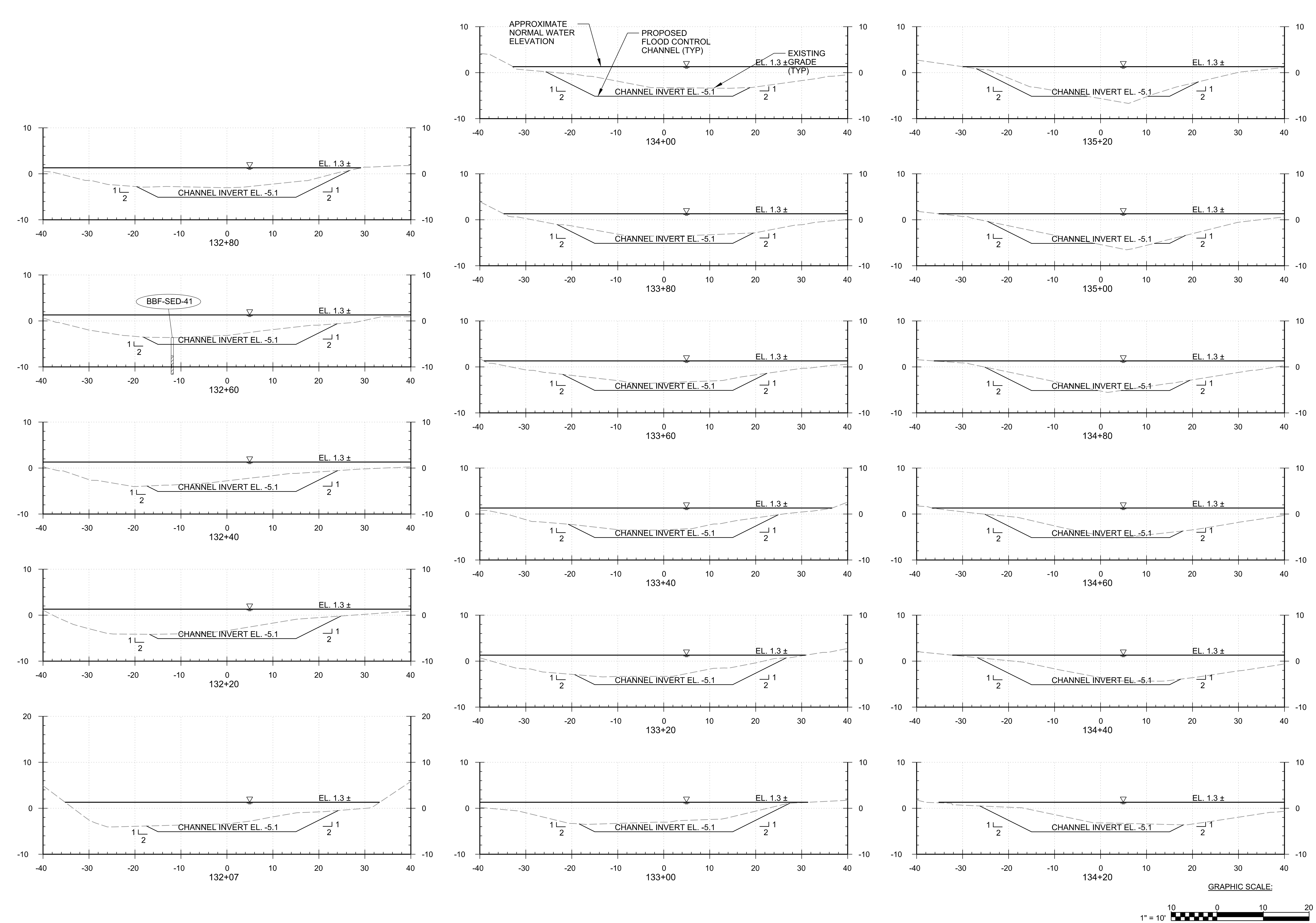
PLOT SCALE: 1" = 10' | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_C-326.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 10

SHEET IDENTIFICATION
C-326

SHEET 59 OF 110



US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

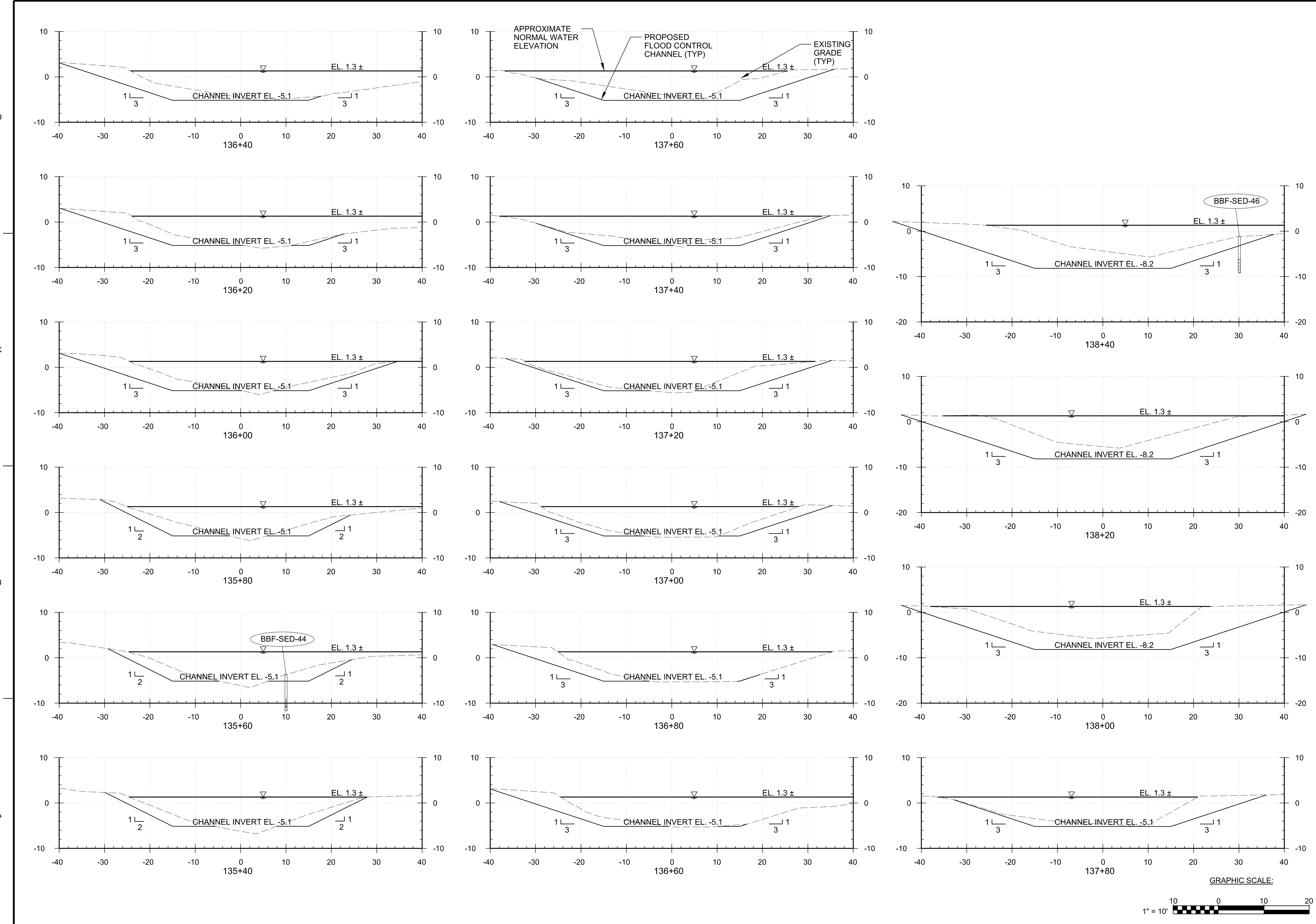
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-327.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 11

SHEET IDENTIFICATION
C-327

SHEET 60 OF 110



US Army Corps of Engineers® New England District

MARK | DESCRIPTION | DATE | APPR.

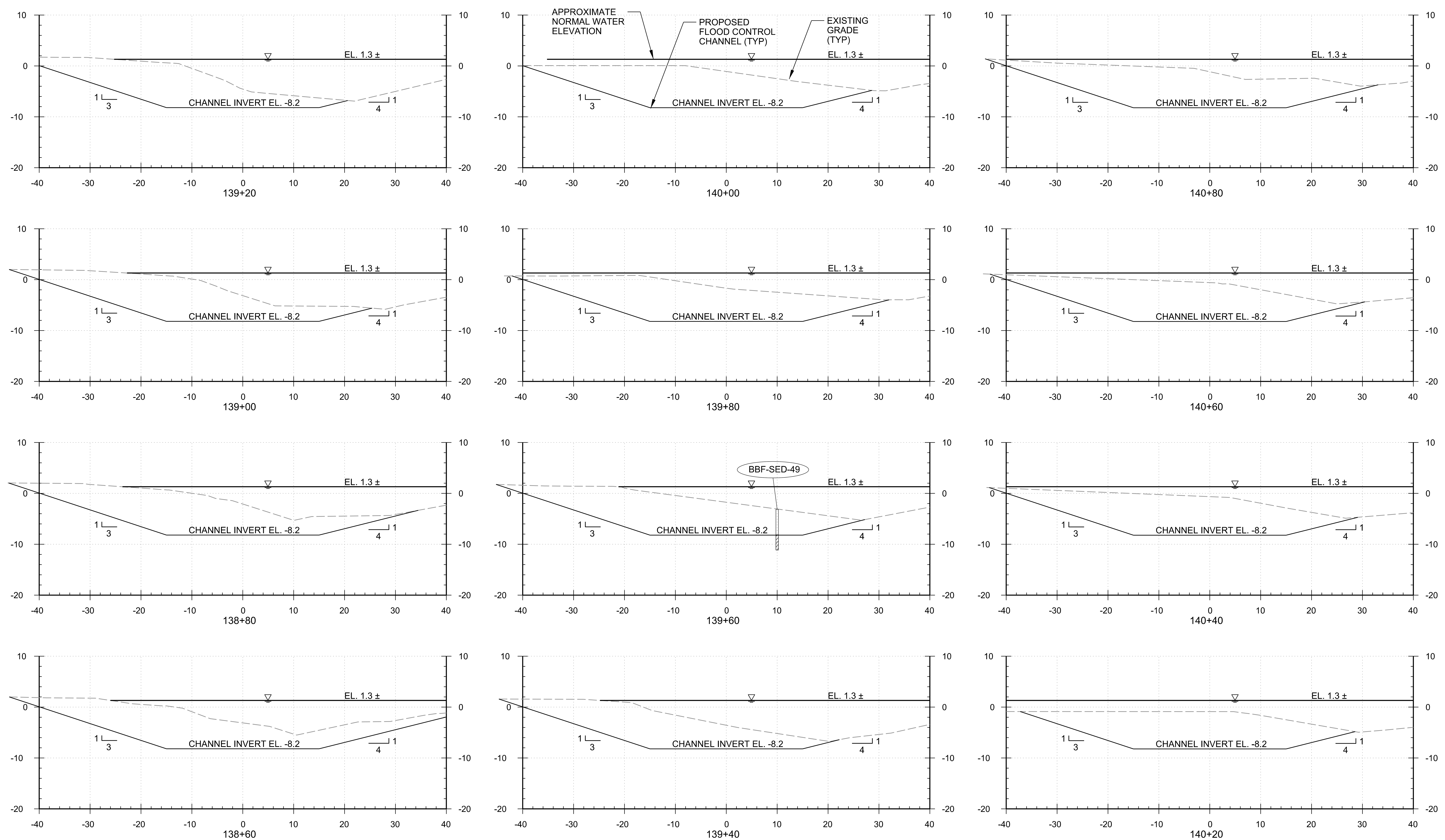
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-328.dgn

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 11

SHEET IDENTIFICATION
C-328
SHEET 61 OF 110



GRAPHIC SCALE:
1" = 10'
10 0 10 20

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

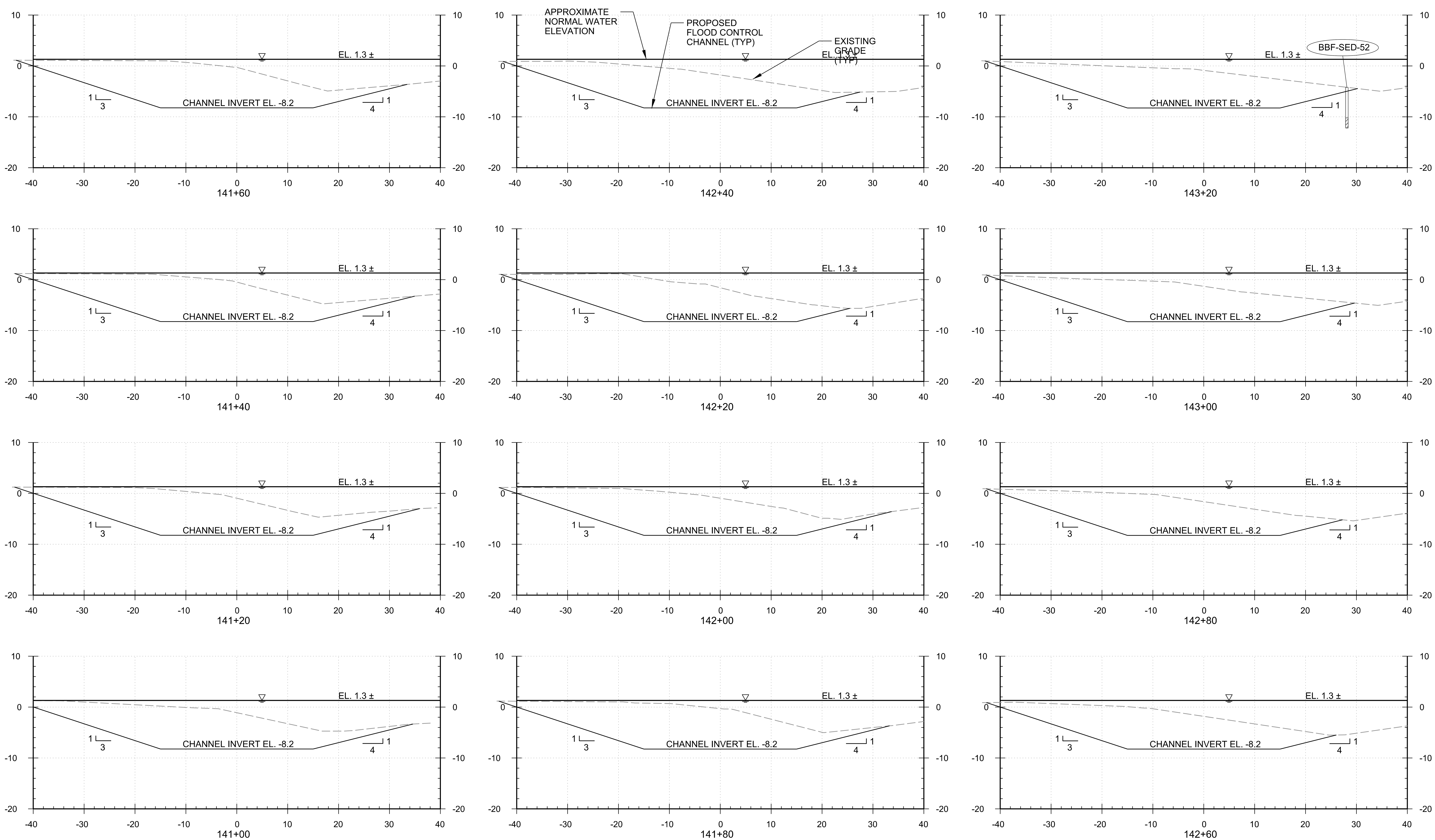
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-329.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 11

SHEET IDENTIFICATION
C-329



GRAPHIC SCALE:
1" = 10'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

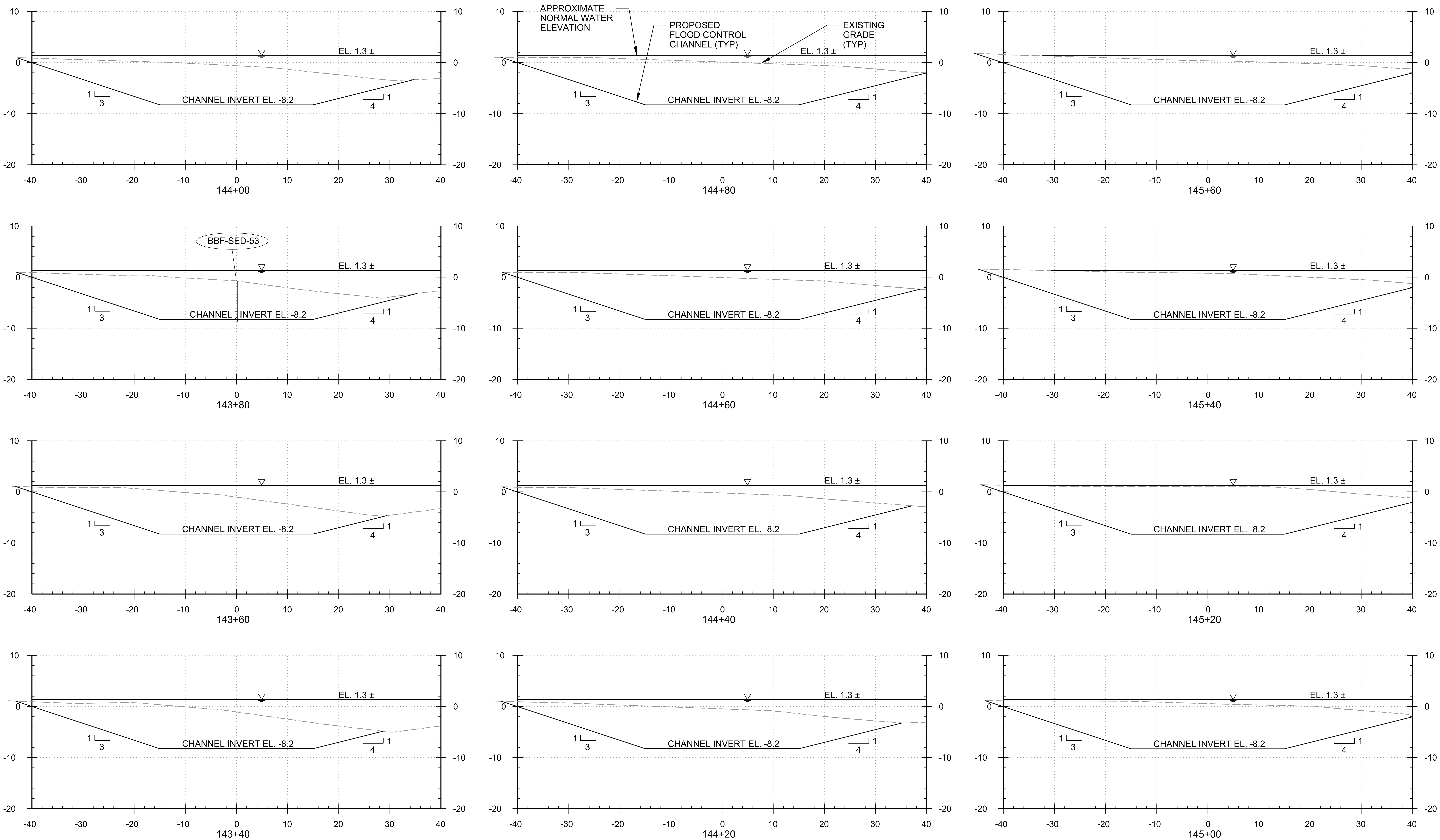
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 10'
PLOT DATE:
FILE NAME: MUD-2_C-330.dgn
SIZE: ANSI D

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 11 & 12

SHEET IDENTIFICATION
C-330

SHEET 63 OF 110



GRAPHIC SCALE:
1" = 10'
10 0 10 20

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

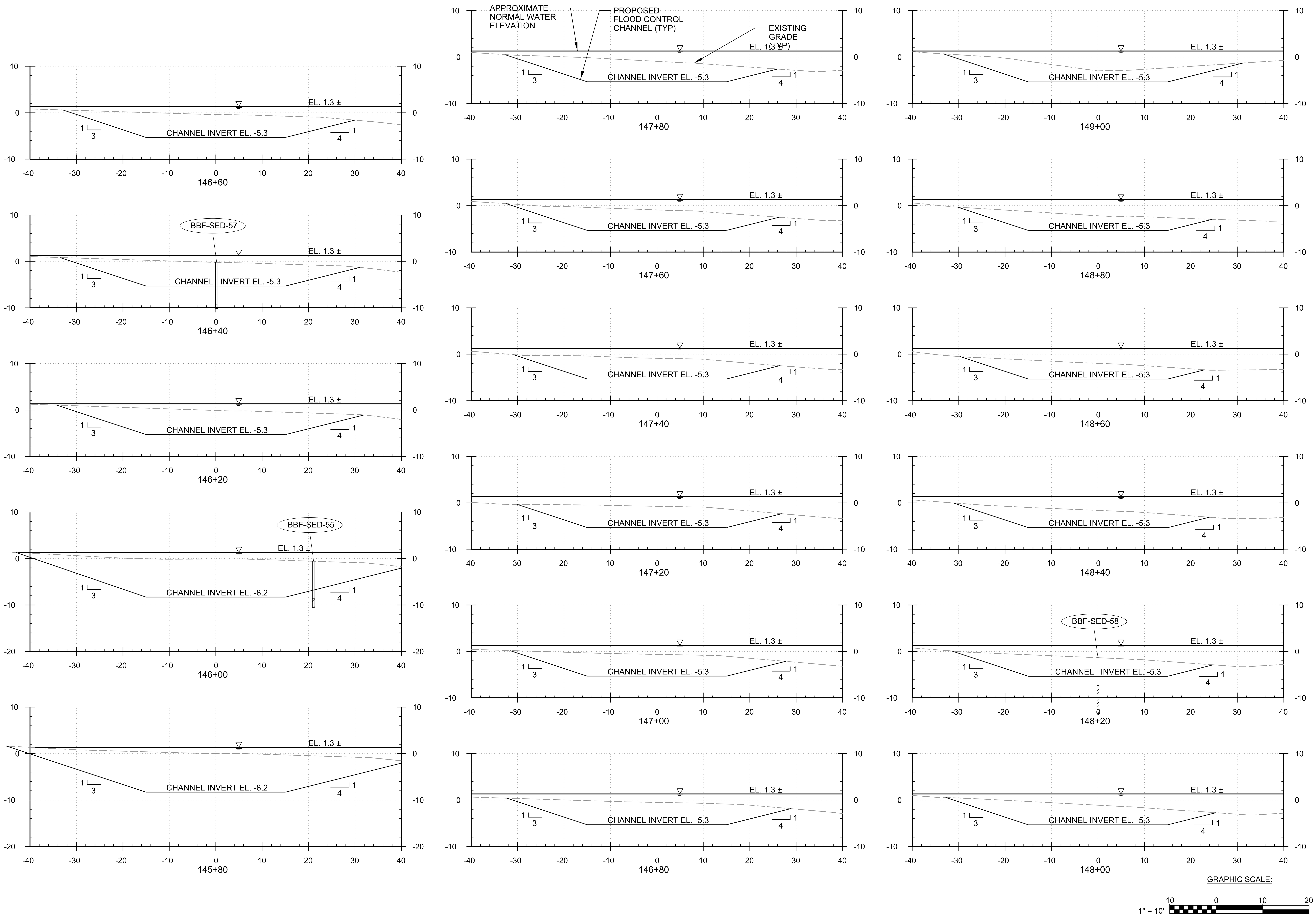
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-331.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 12

SHEET IDENTIFICATION
C-331

SHEET 64 OF 110



GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

MARK | DESCRIPTION | DATE | APPR.

DATE: SEPTEMBER 2016

SOLICITATION NO.:

CONTRACT NO.:

DRAWING CODE: MUD-2

DESIGNED BY: L. THIBODEAU

DWN BY: LT

CKD BY:

SUBMITTED BY:

PLOT SCALE: 1" = 10'

PLOT DATE:

SIZE: ANSI D

FILE NAME: MUD-2_C-332.dgn

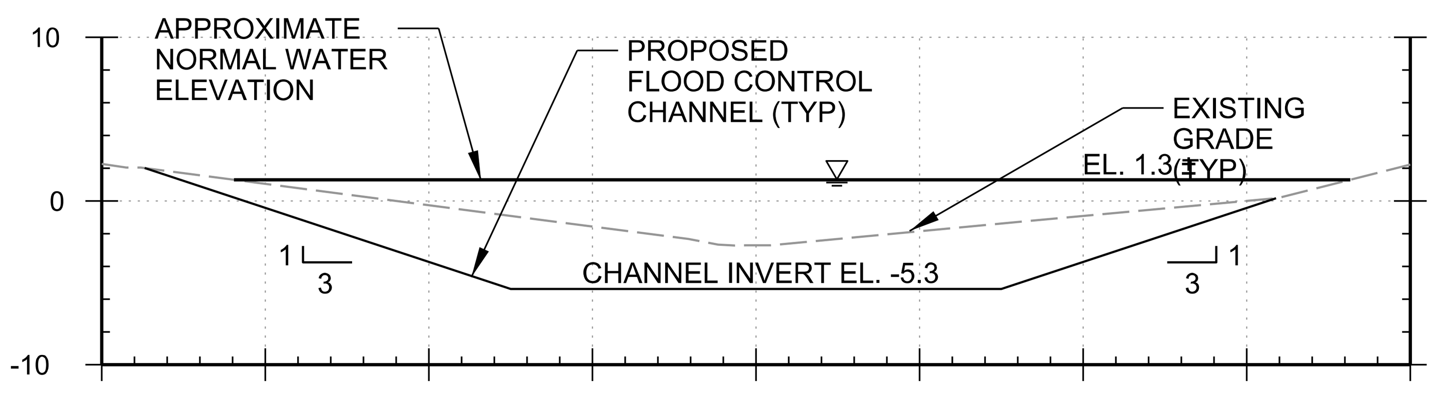
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

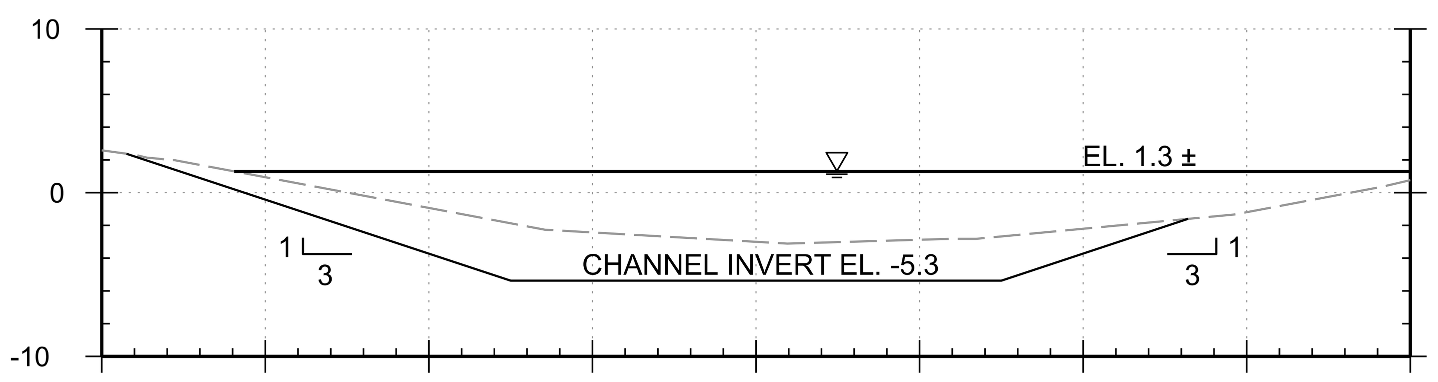
SECTIONS
AREA 12

SHEET IDENTIFICATION
C-332

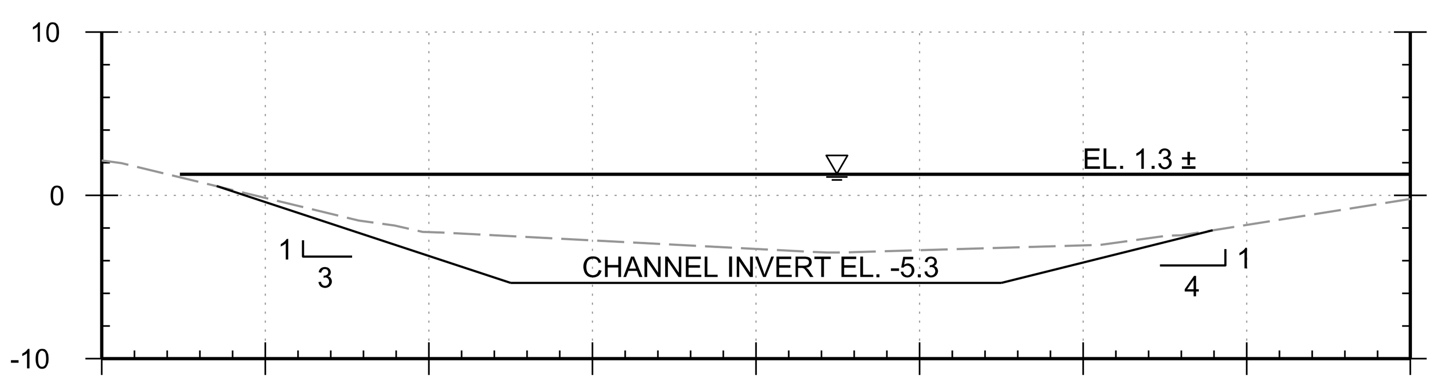
SHEET 65 OF 110



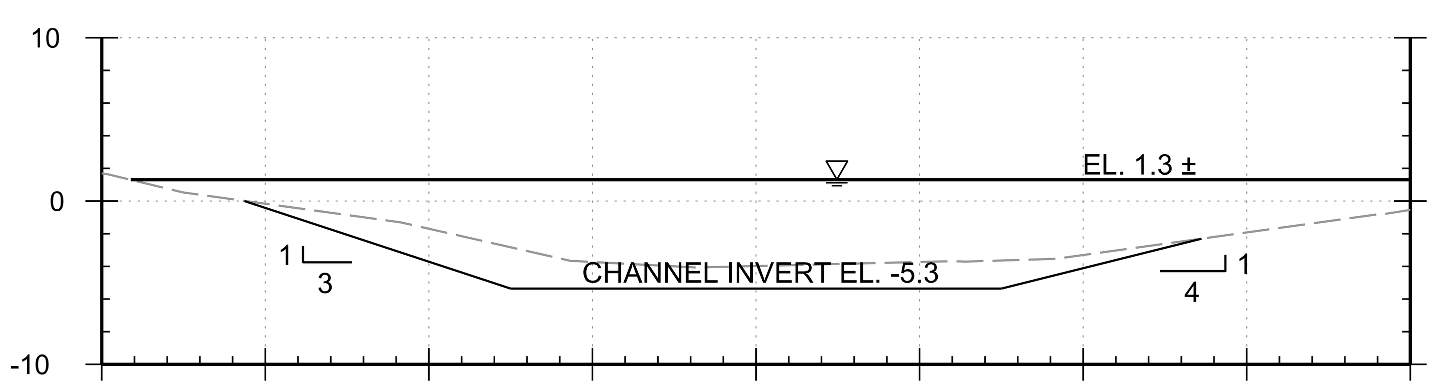
150+20



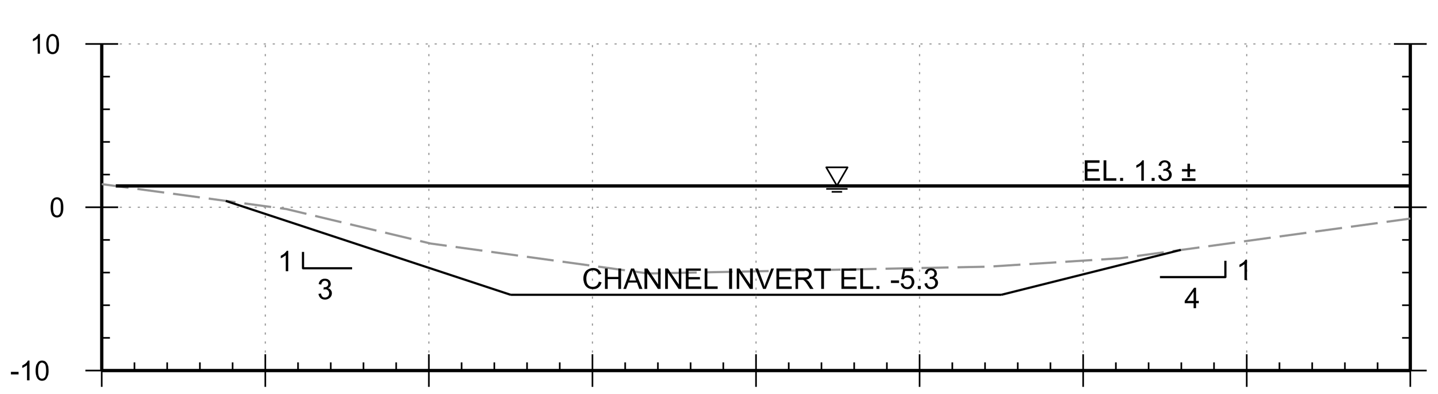
150+00



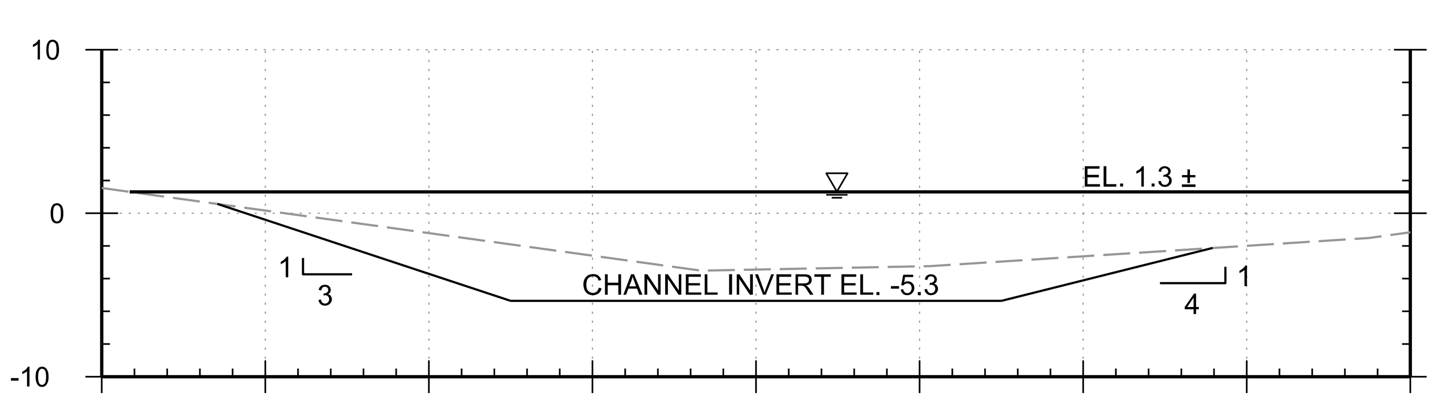
149+80



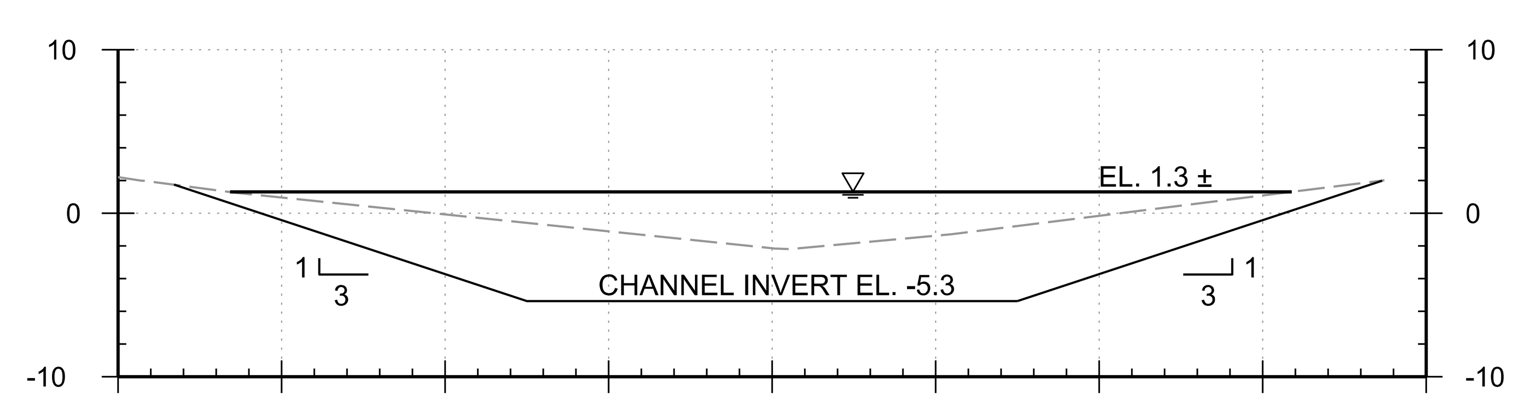
149+60



149+40



149+20



150+30

GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY:	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 10'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-333.dgn	

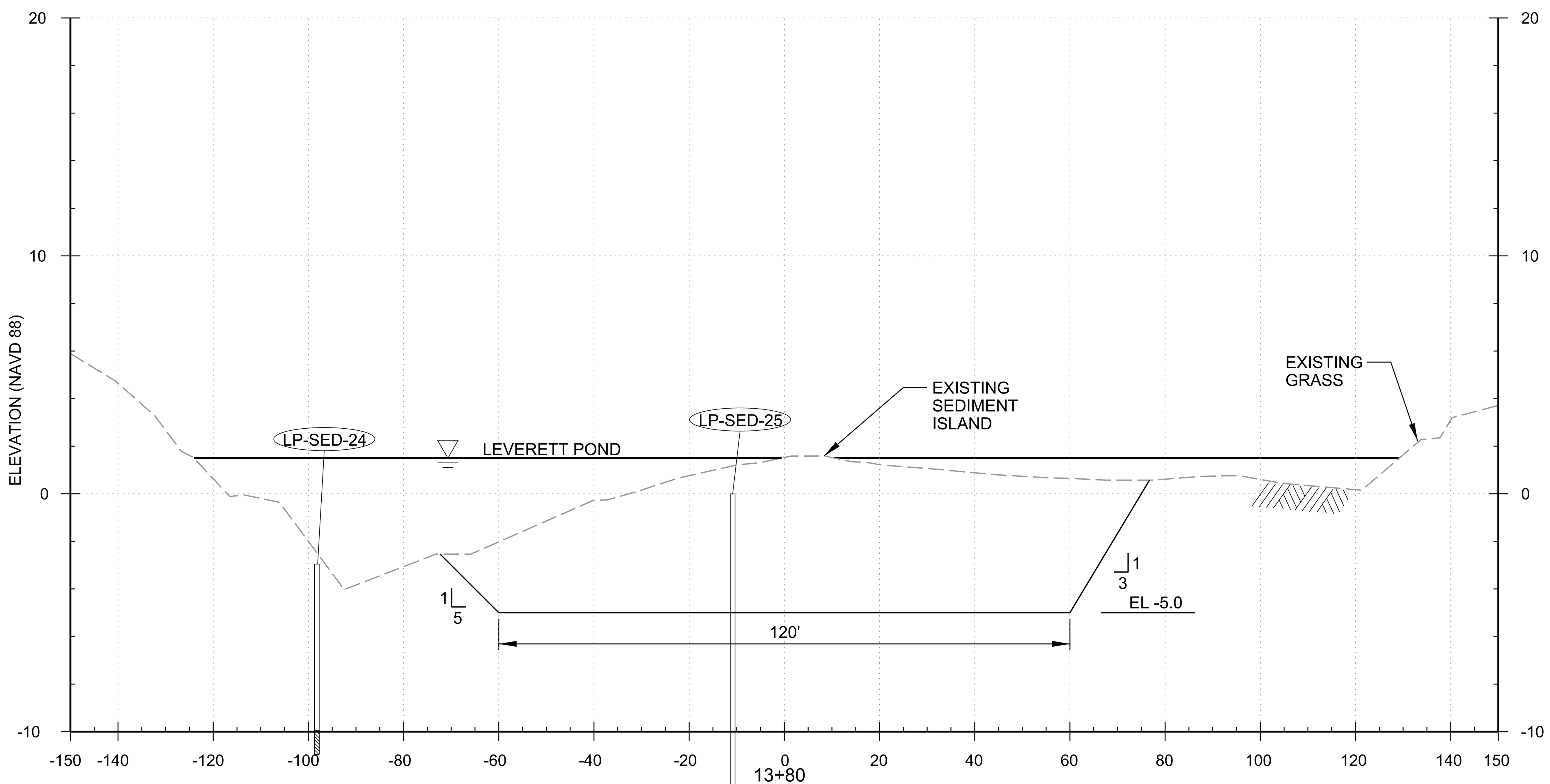
MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

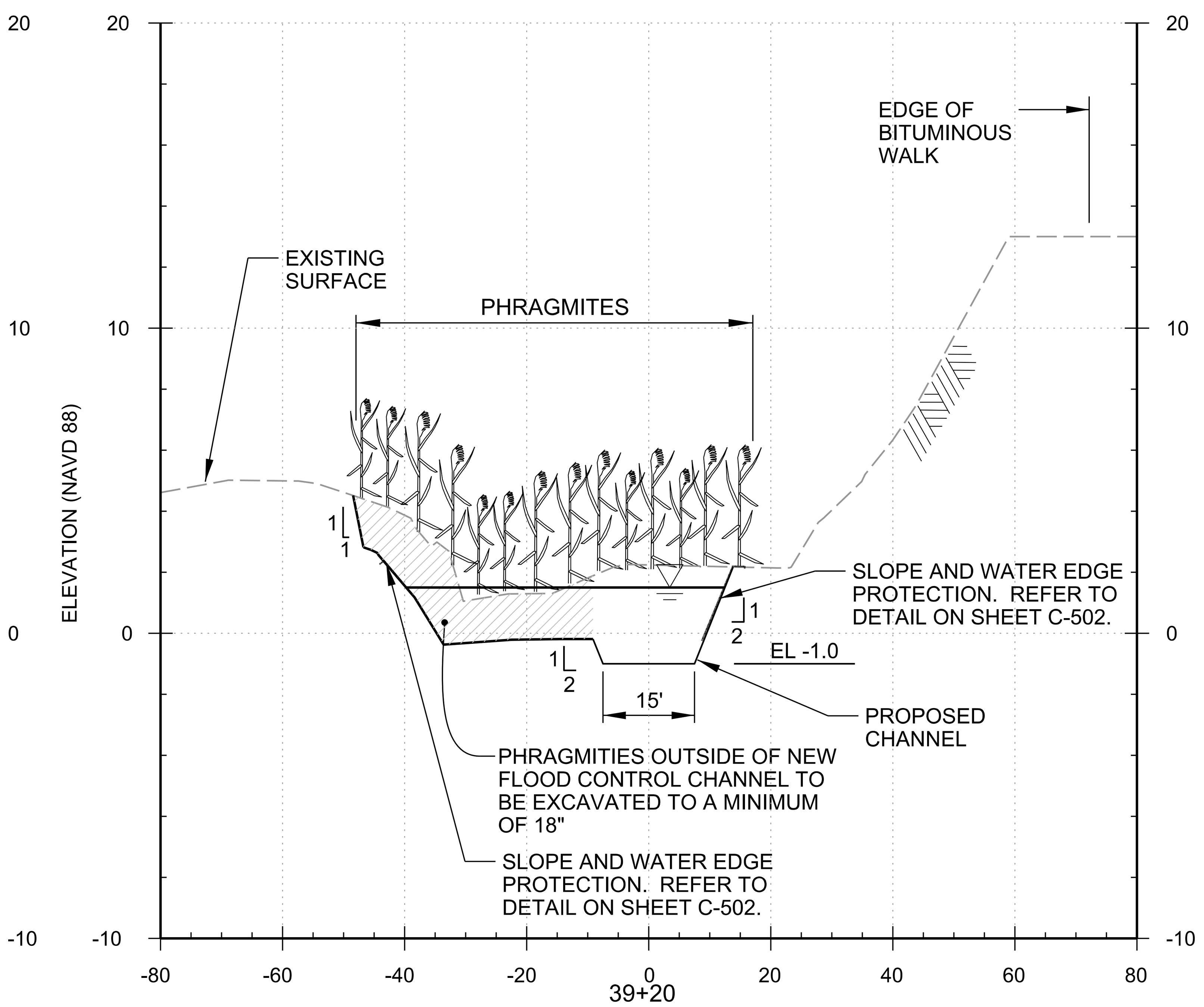
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

SECTIONS
AREA 12

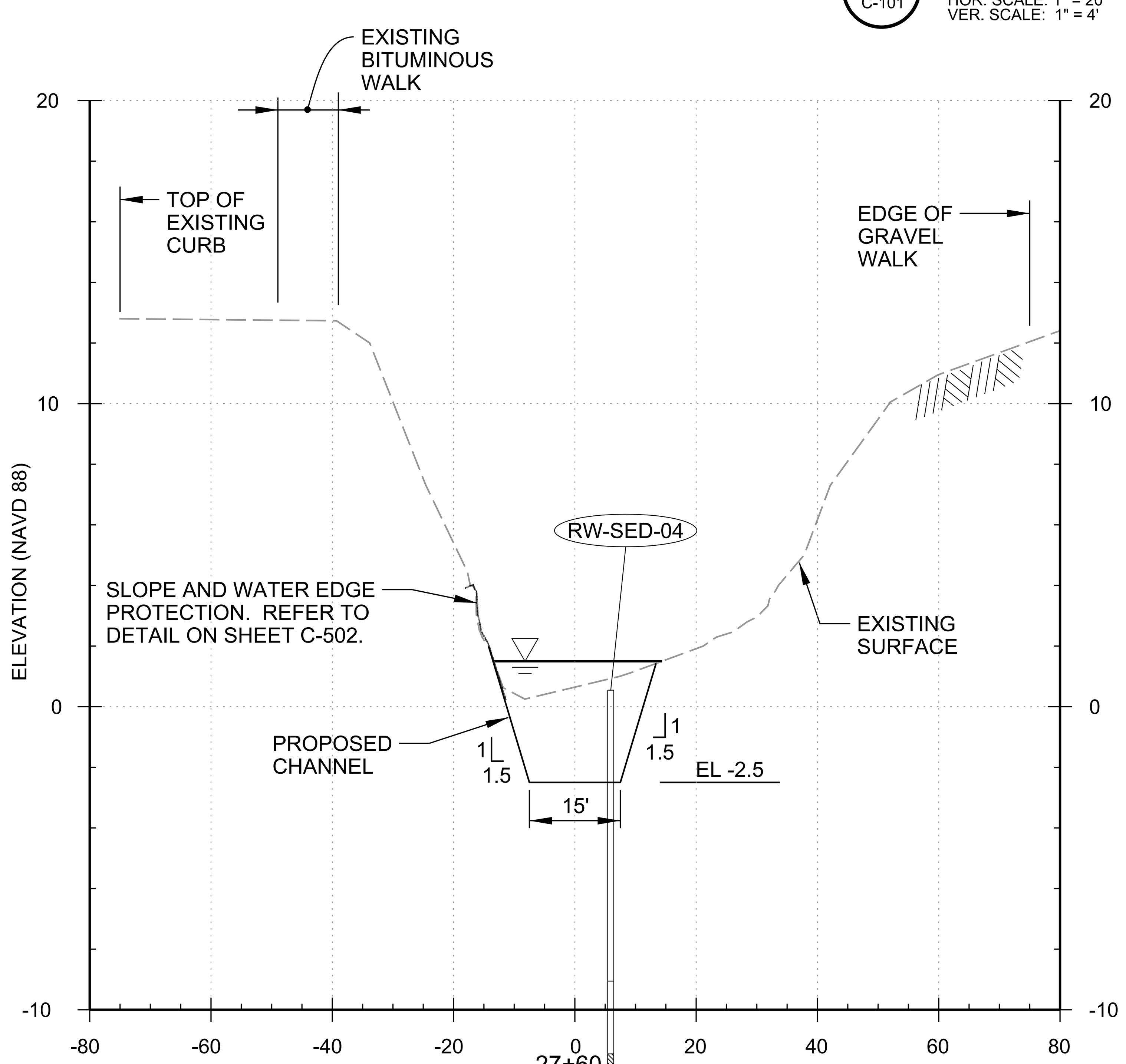
SHEET IDENTIFICATION
C-333



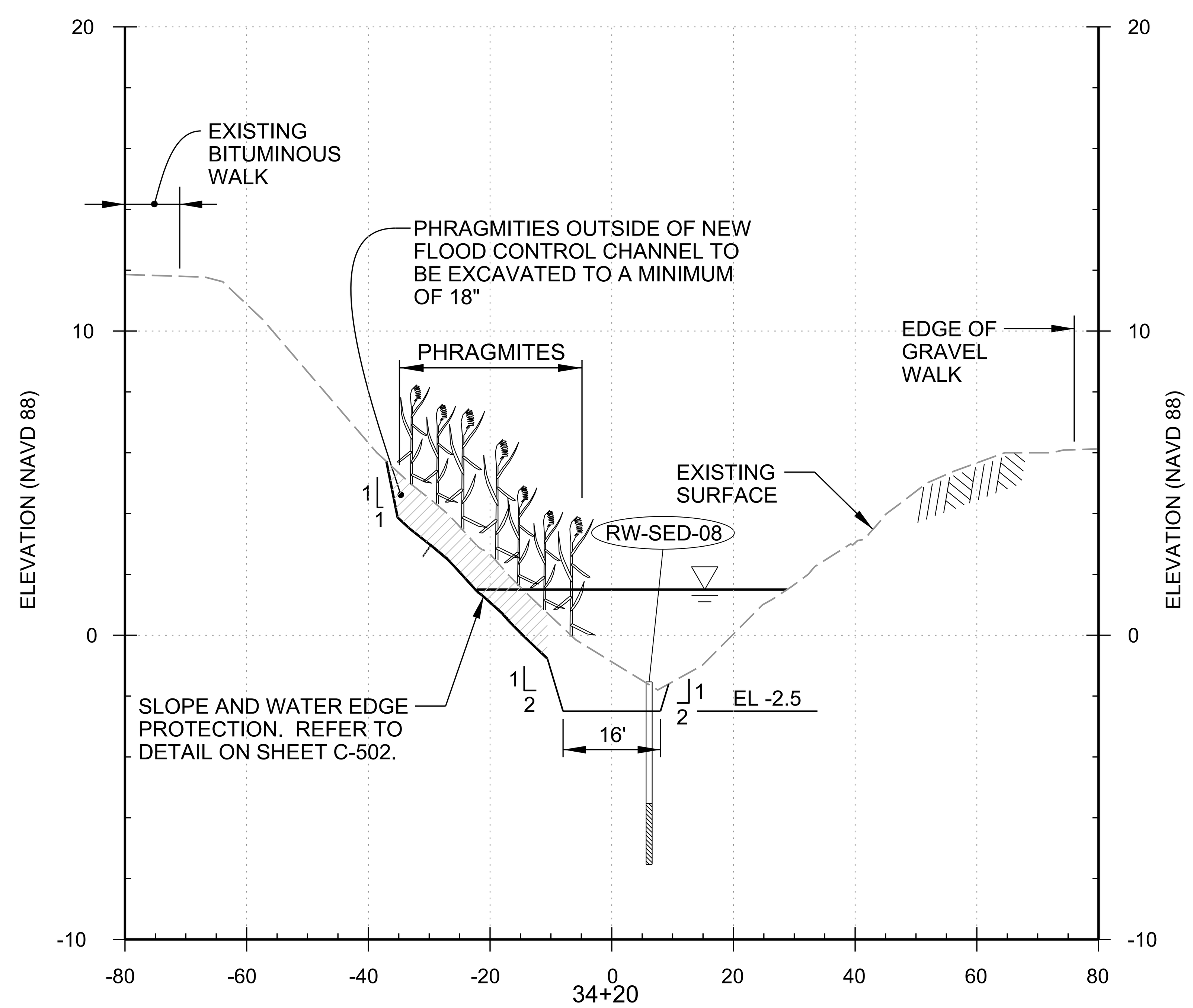
SECTION A C-101
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION D C-103
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION B C-102
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION C C-102
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'

GRAPHIC SCALE:

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

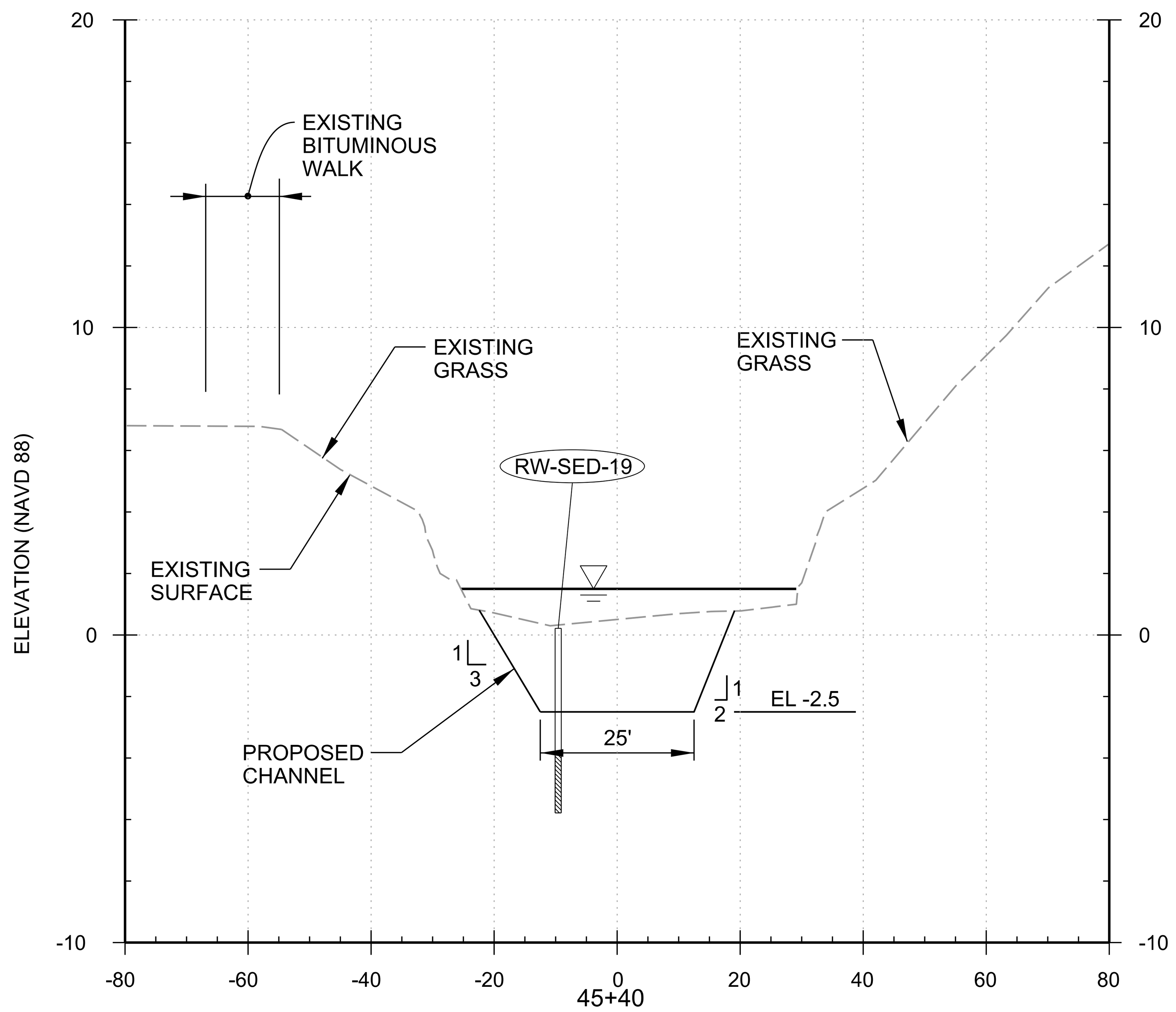
DESIGNED BY: L. THIBODEAU			DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET		SOLICITATION NO.:
SUBMITTED BY:			CONTRACT NO.:
PLOT SCALE: 1" = 20'	PLOT DATE:		DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-334.dgn		

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

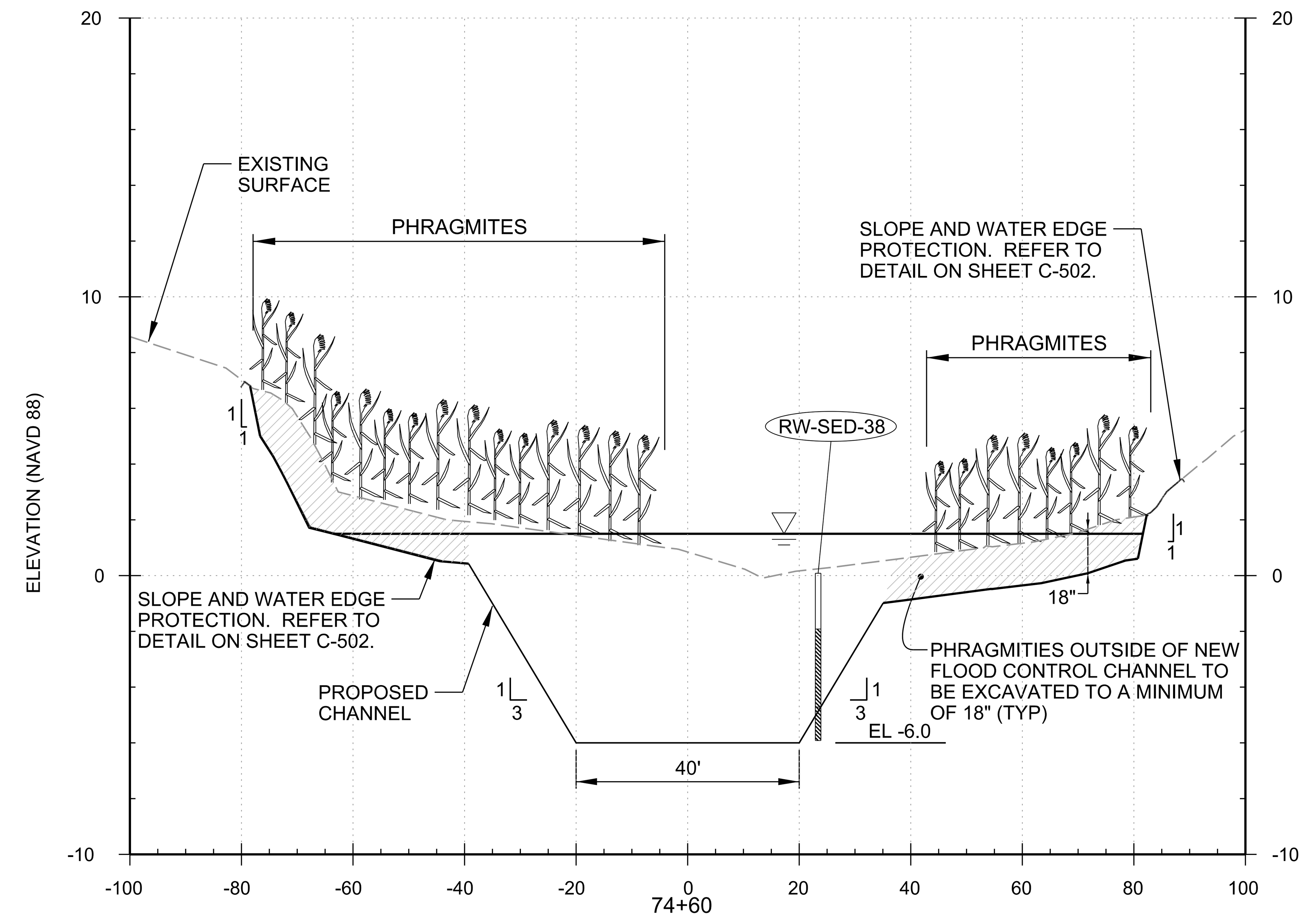
TYPICAL SECTIONS

SHEET
IDENTIFICATION
C-334

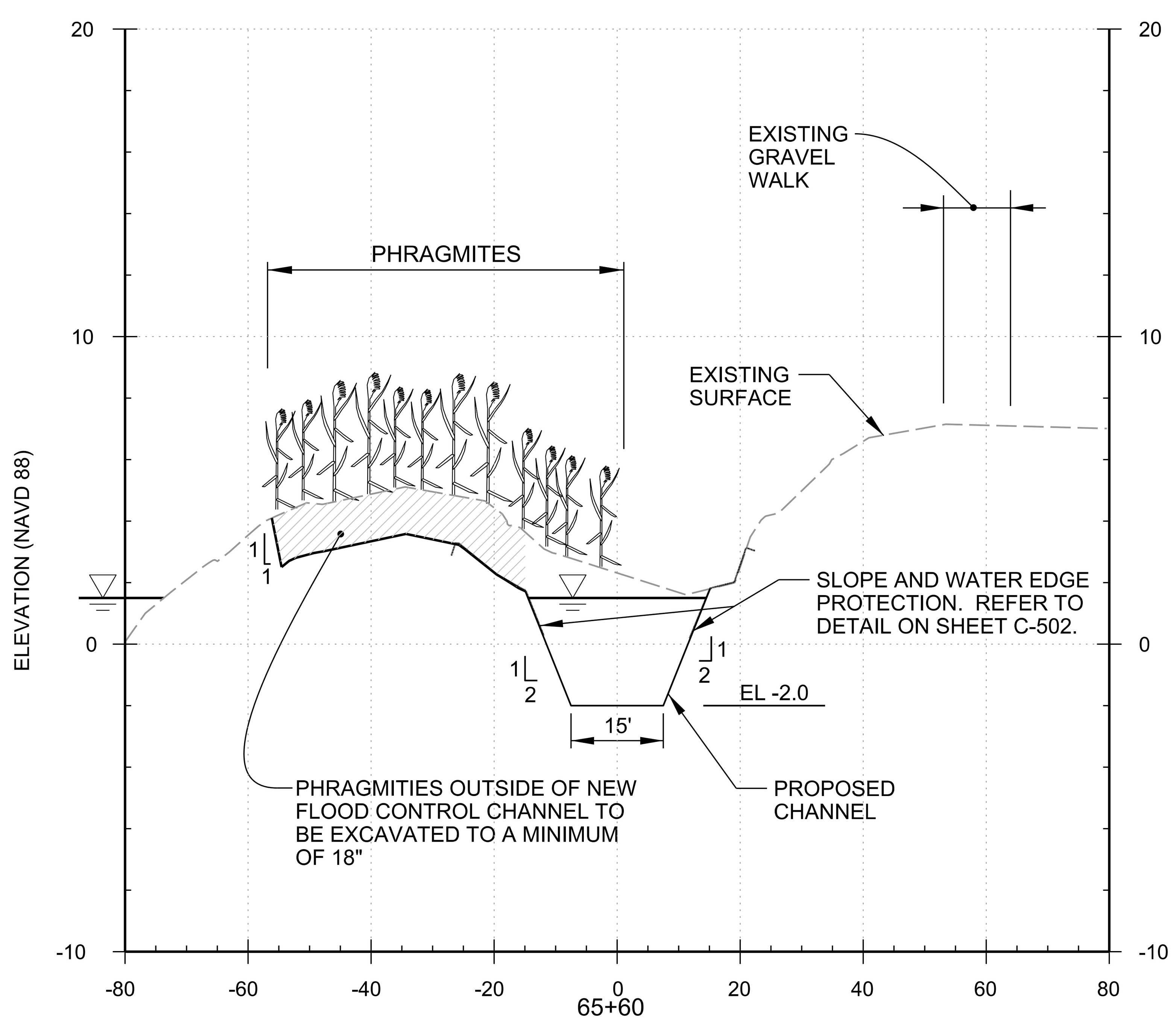
SHEET 67 OF 110



E
C-103
SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



G
C-105
SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



F
C-104
SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'

GRAPHIC SCALE:

1" = 20' — 20' 0 20' 40'

1" = 4' — 4' 0 4' 8'

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

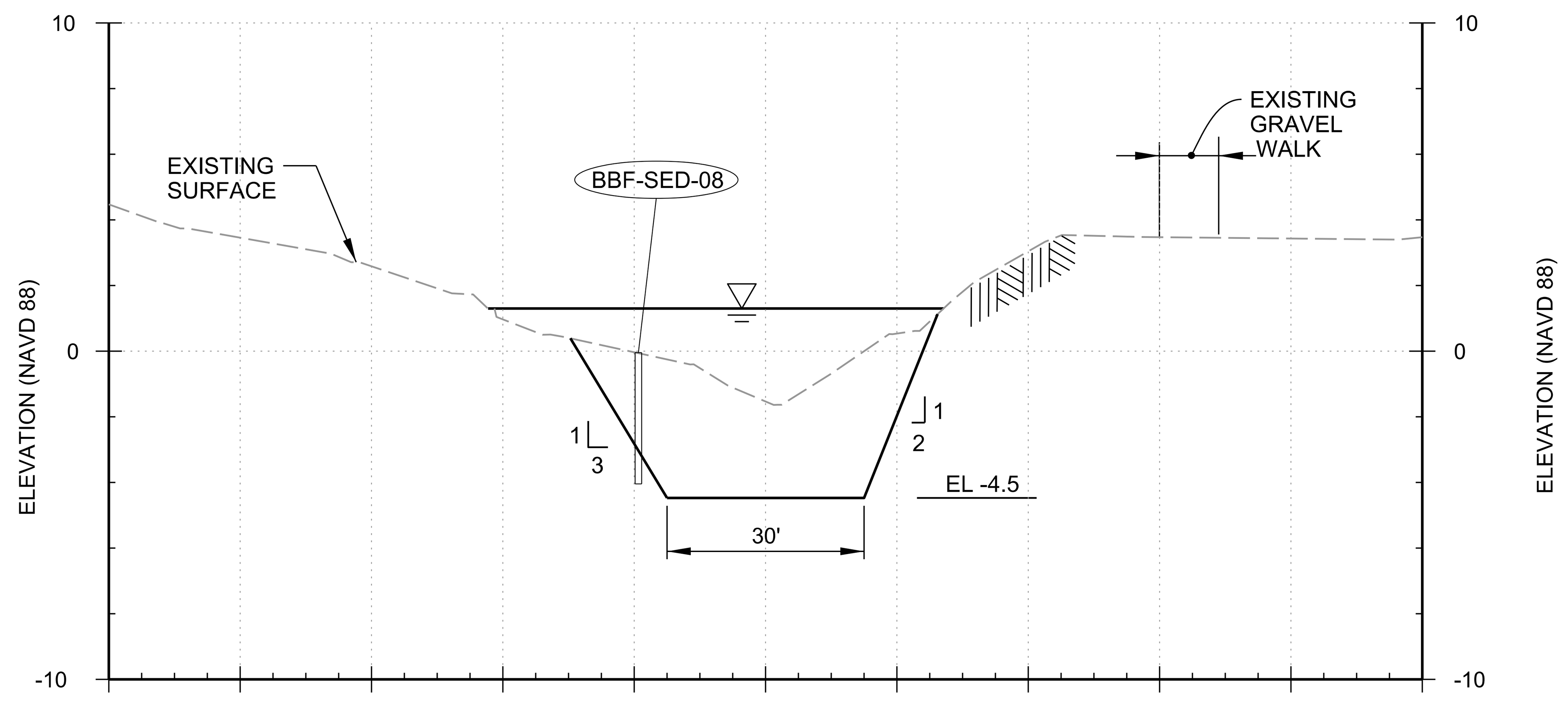
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU		DATE: SEPTEMBER 2016
DWN BY: LT	CKD BY: MET	SOLICITATION NO.:
SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1" = 20'	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_C-335.dgn	

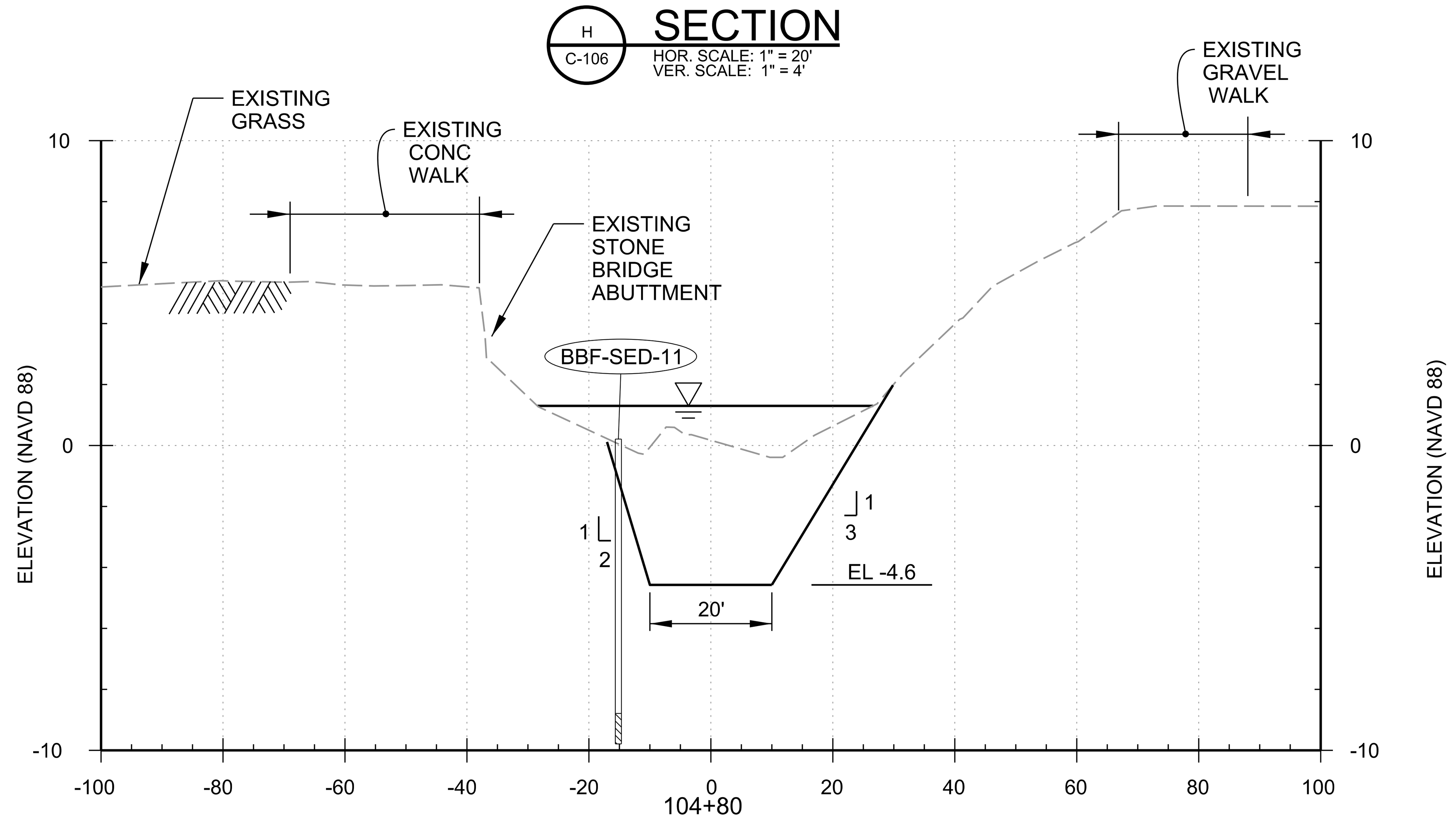
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

TYPICAL SECTIONS

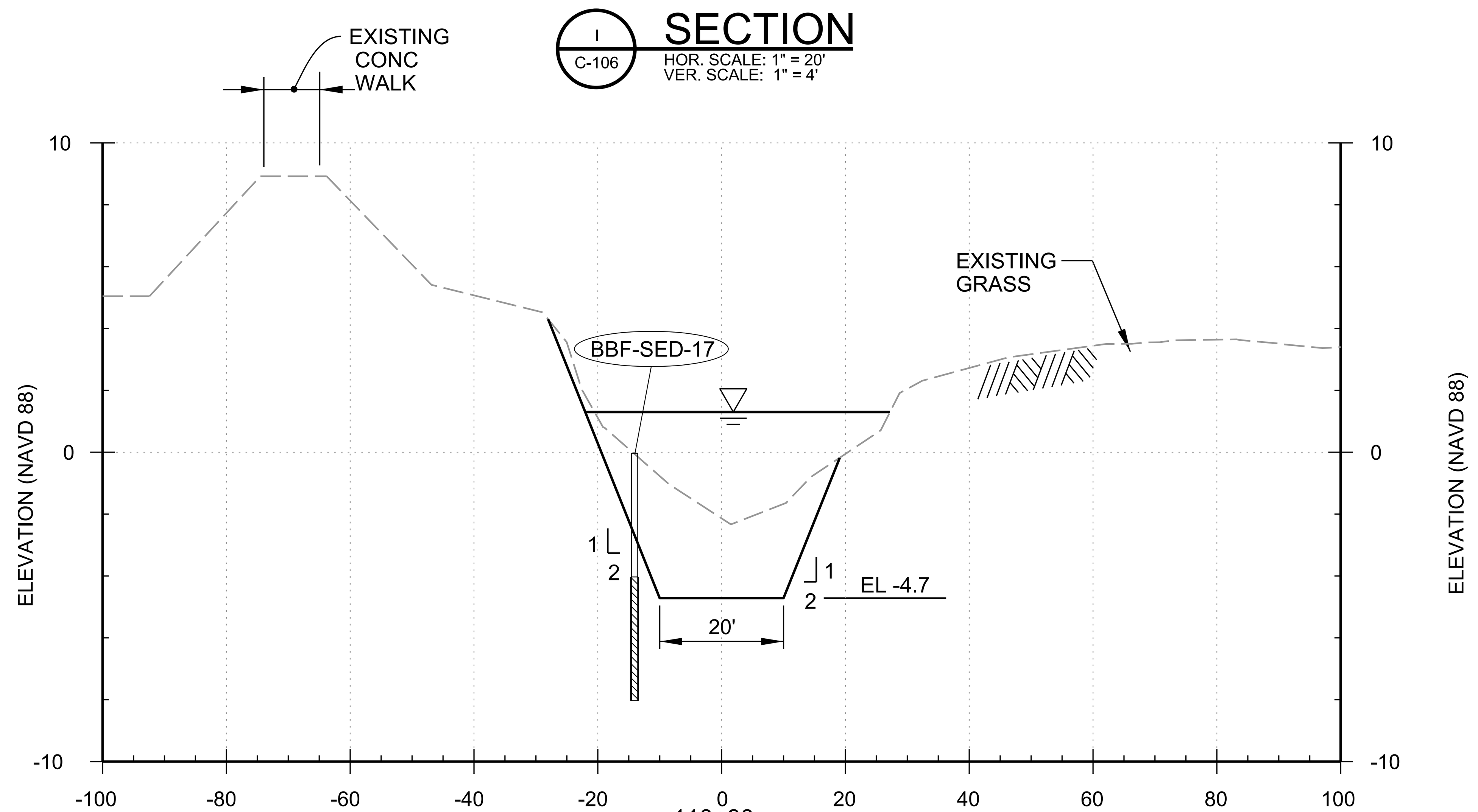
SHEET IDENTIFICATION
C-335



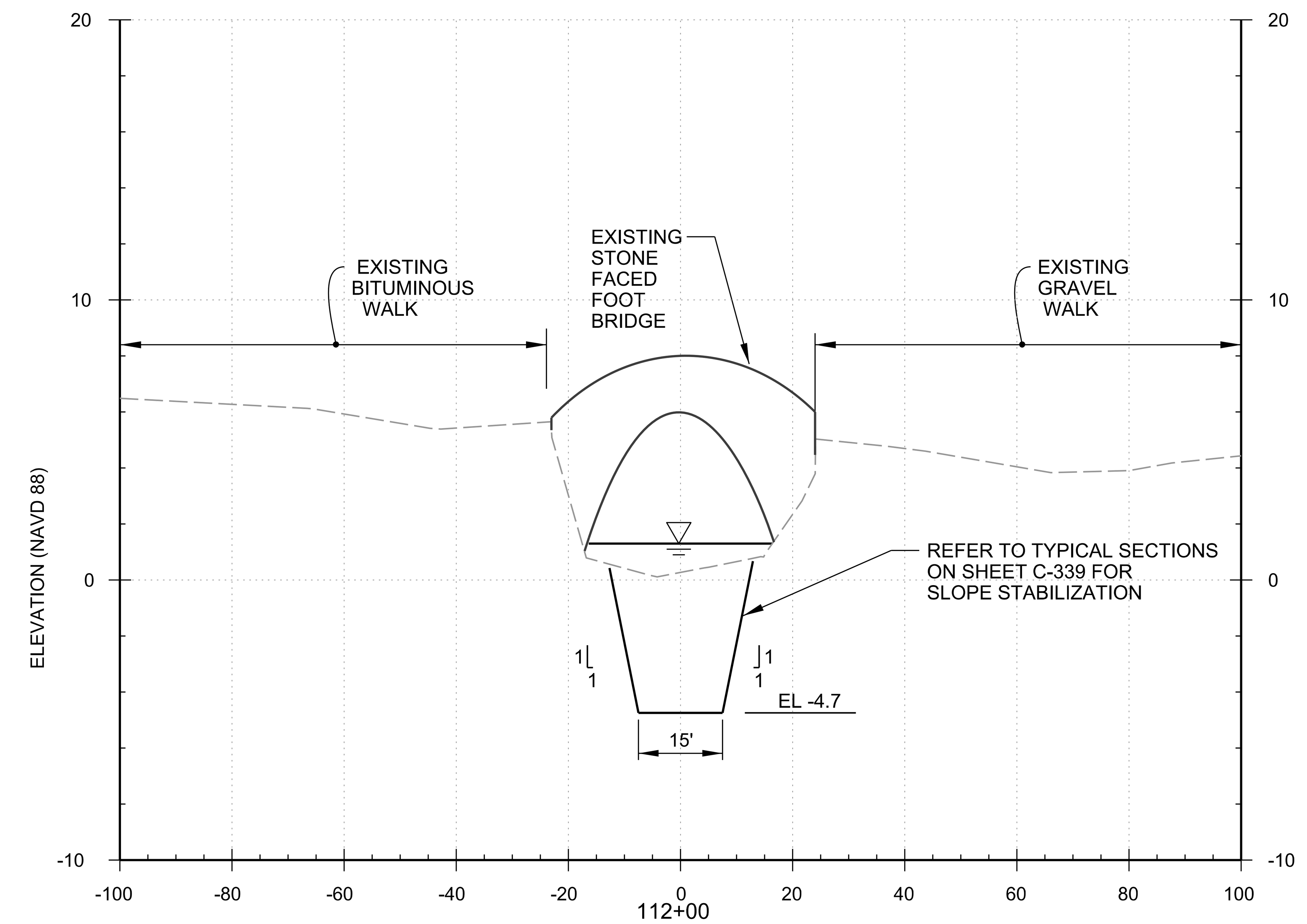
SECTION H C-106
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



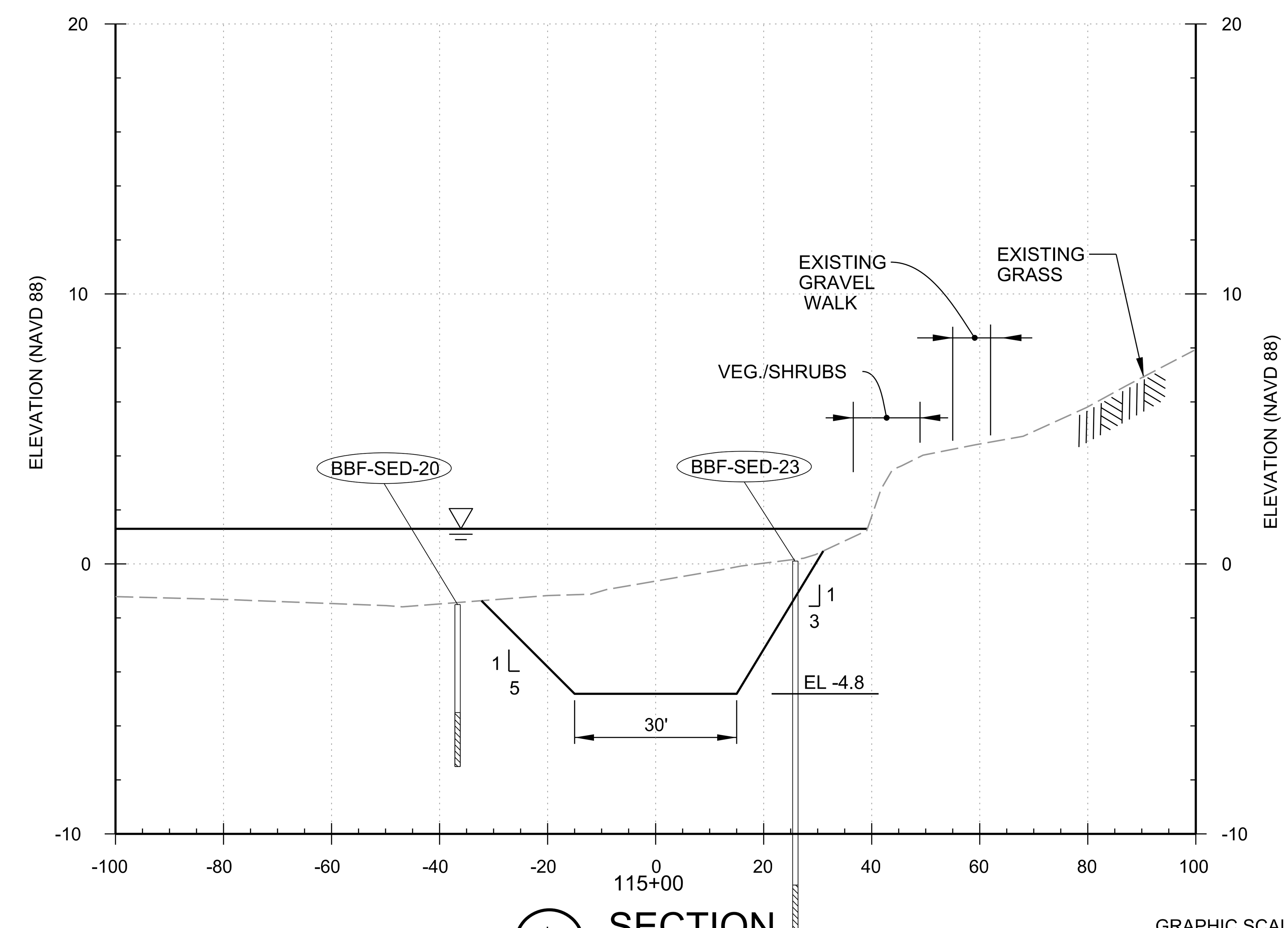
SECTION I C-106
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION J C-107
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION K C-107
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



SECTION L C-107
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

1" = 4' 4' 0 4' 8'

US Army Corps of Engineers®
New England District

MARK | DESCRIPTION | DATE | APPR.

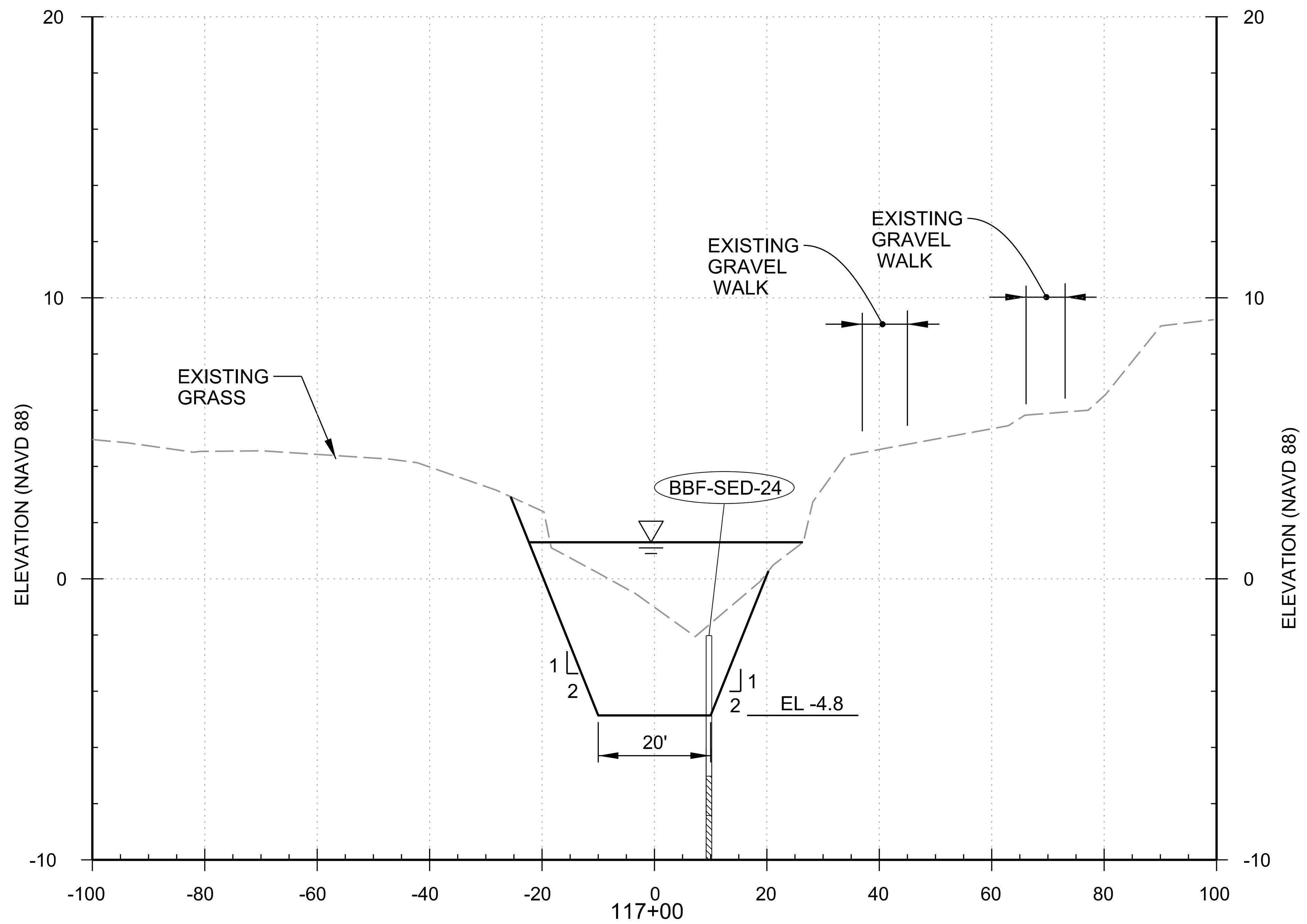
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1" = 20'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-336.dgn

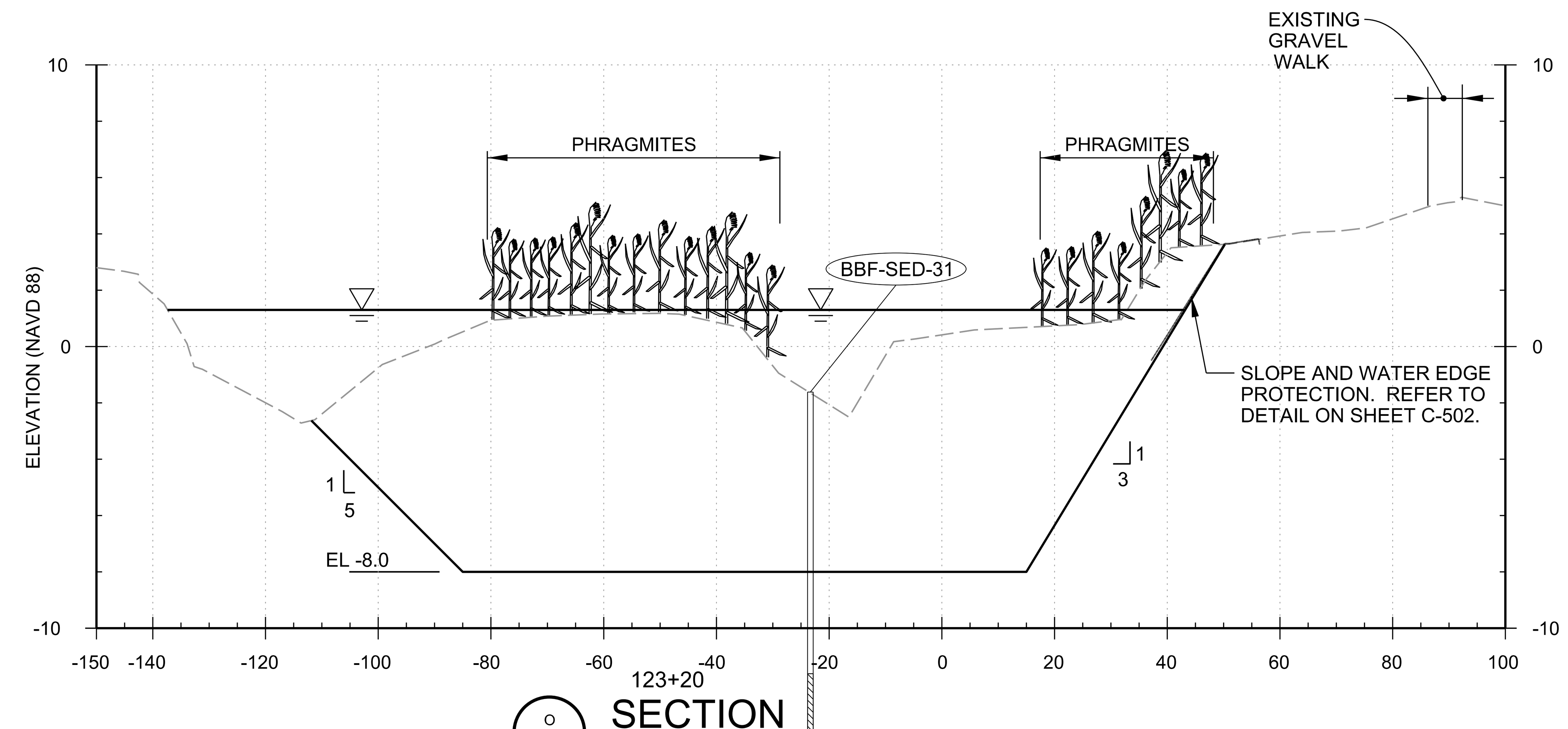
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS
TYPICAL SECTIONS

SHEET IDENTIFICATION
C-336

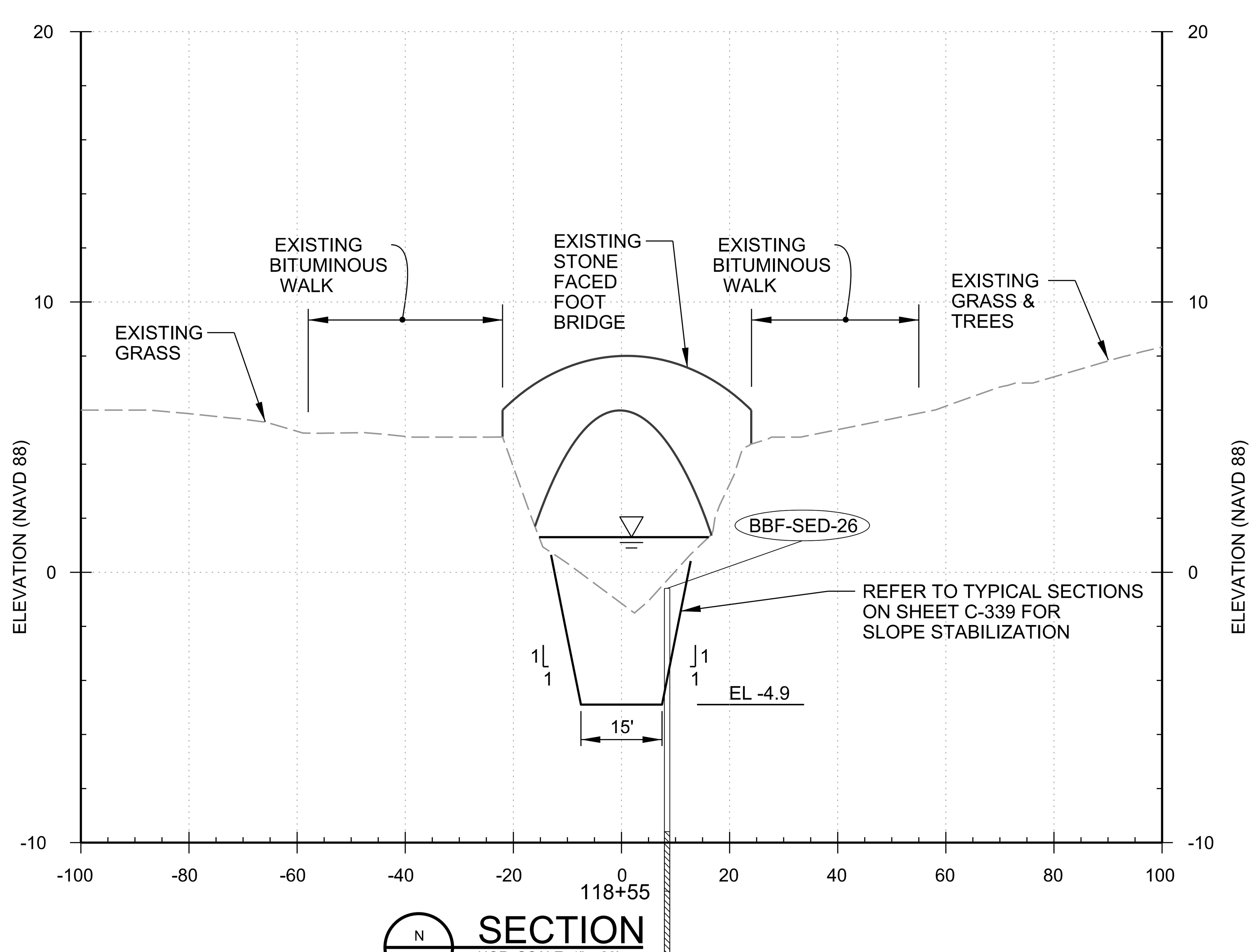
SHEET 69 OF 110



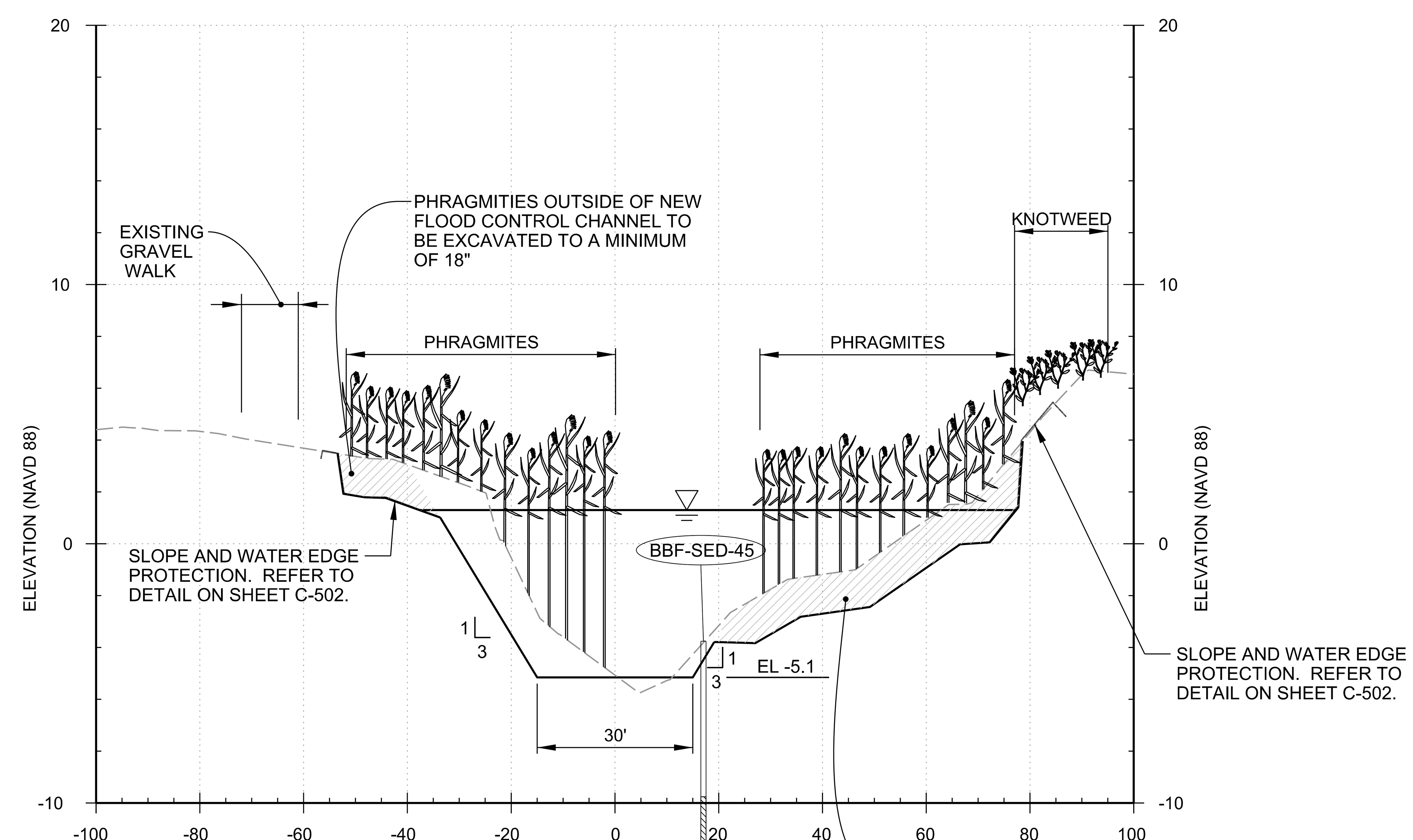
117+00
M / C-107 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



123+20
O / C-108 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



118+55
N / C-108 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



136+20
P / C-109 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'

GRAPHIC SCALE:
1" = 20' — 20' 0 20' 40'
1" = 4' — 4' 0 4' 8'

US Army Corps of Engineers® New England District

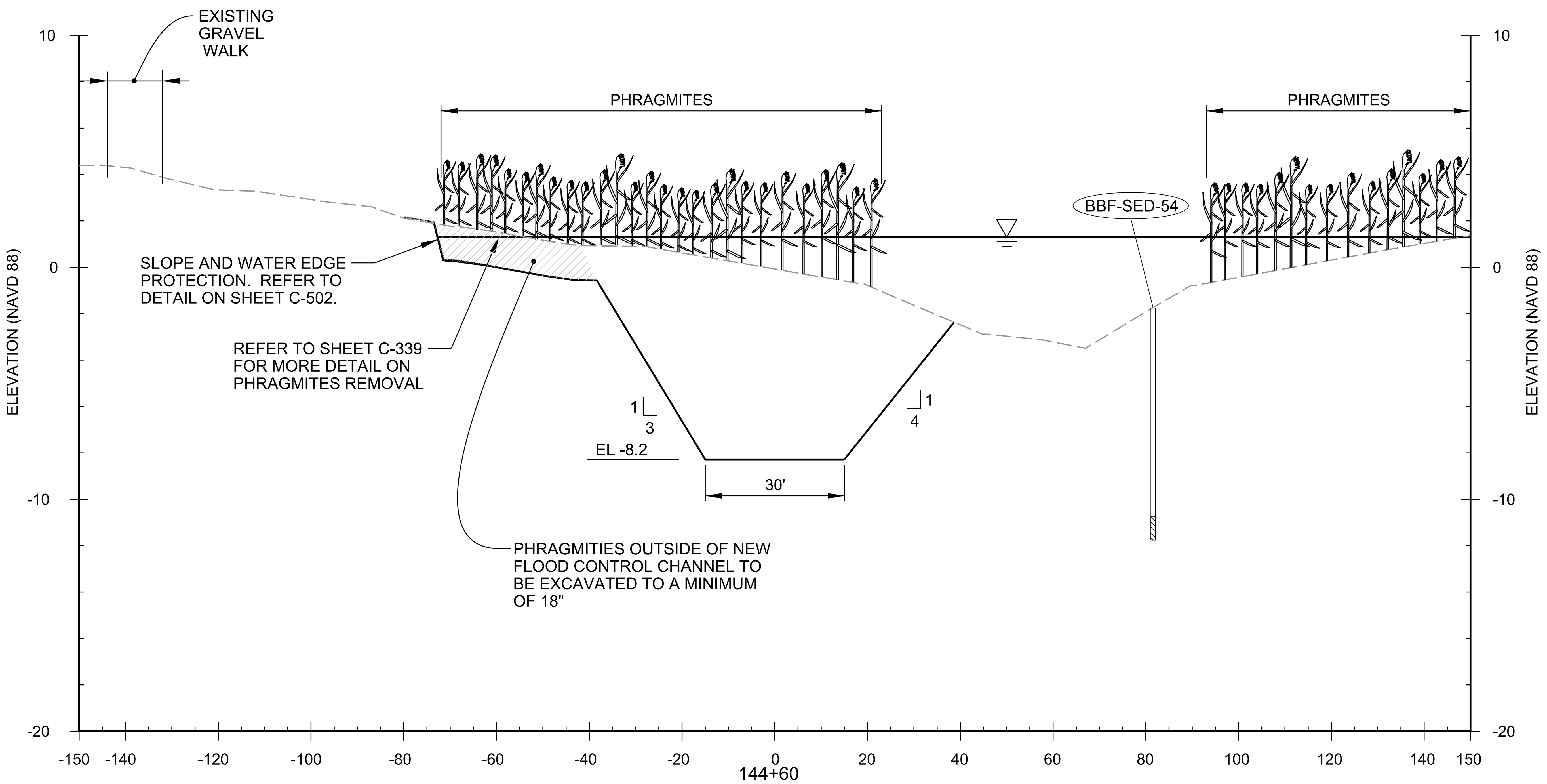
MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 20'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-337.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

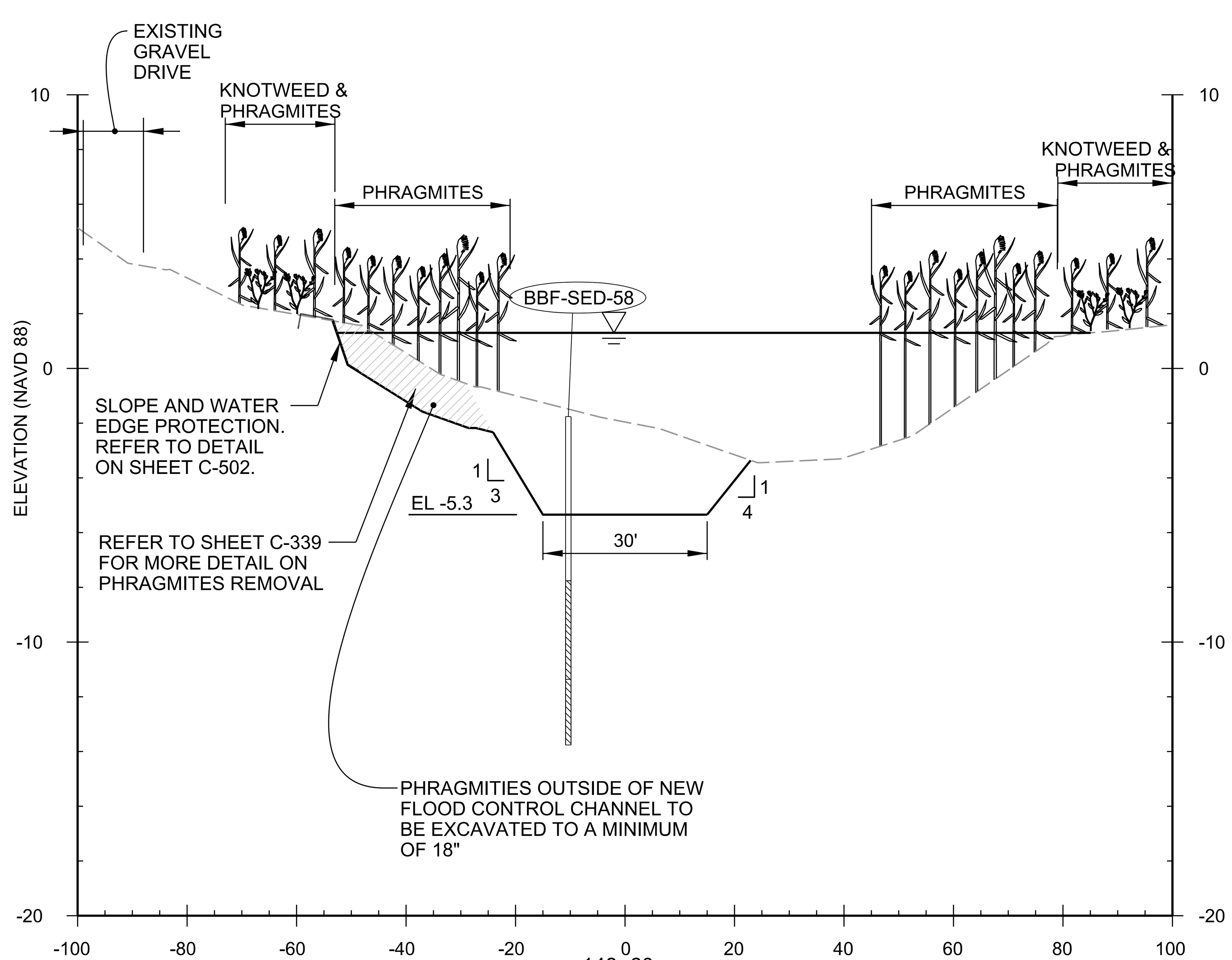
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS
TYPICAL SECTIONS

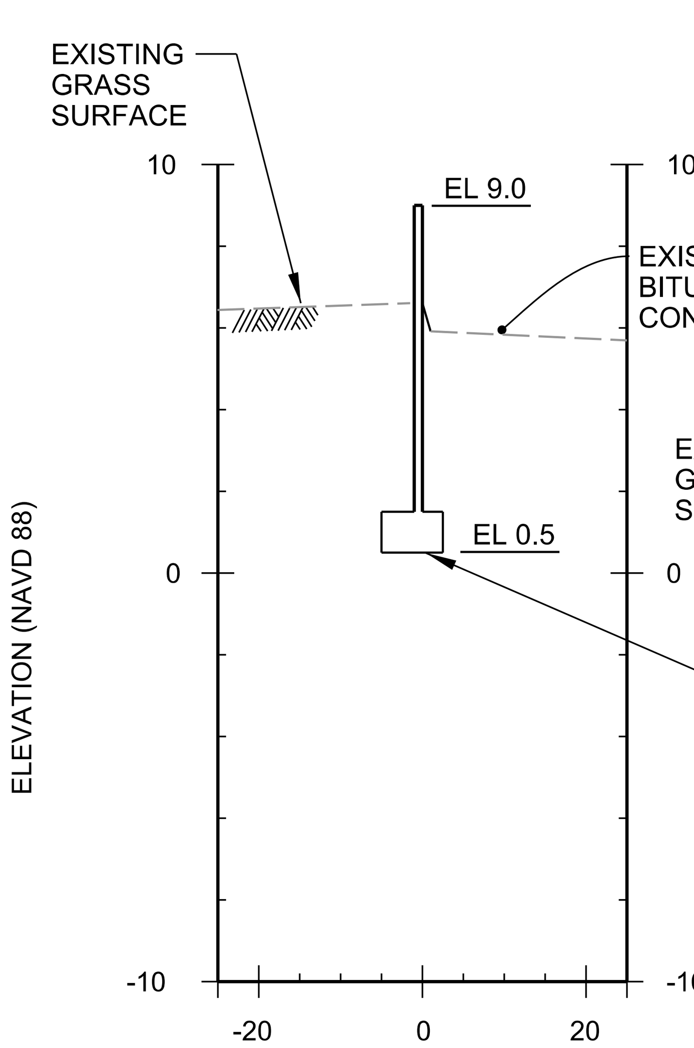
SHEET IDENTIFICATION
C-337
SHEET 70 OF 110



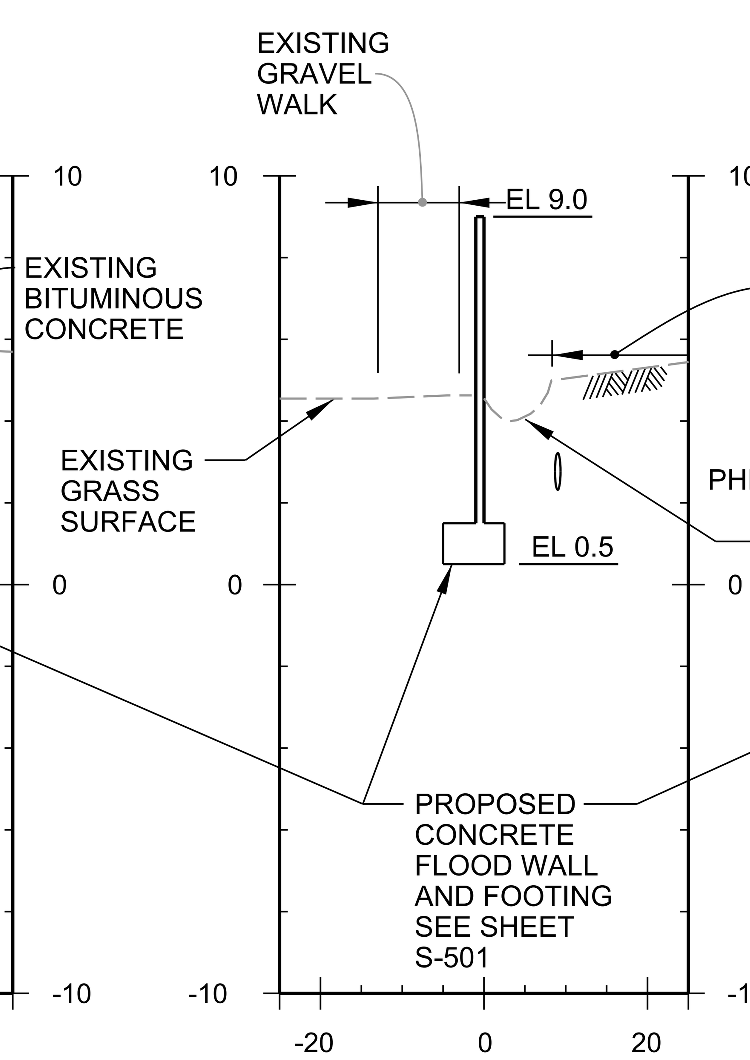
Q / C-109 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



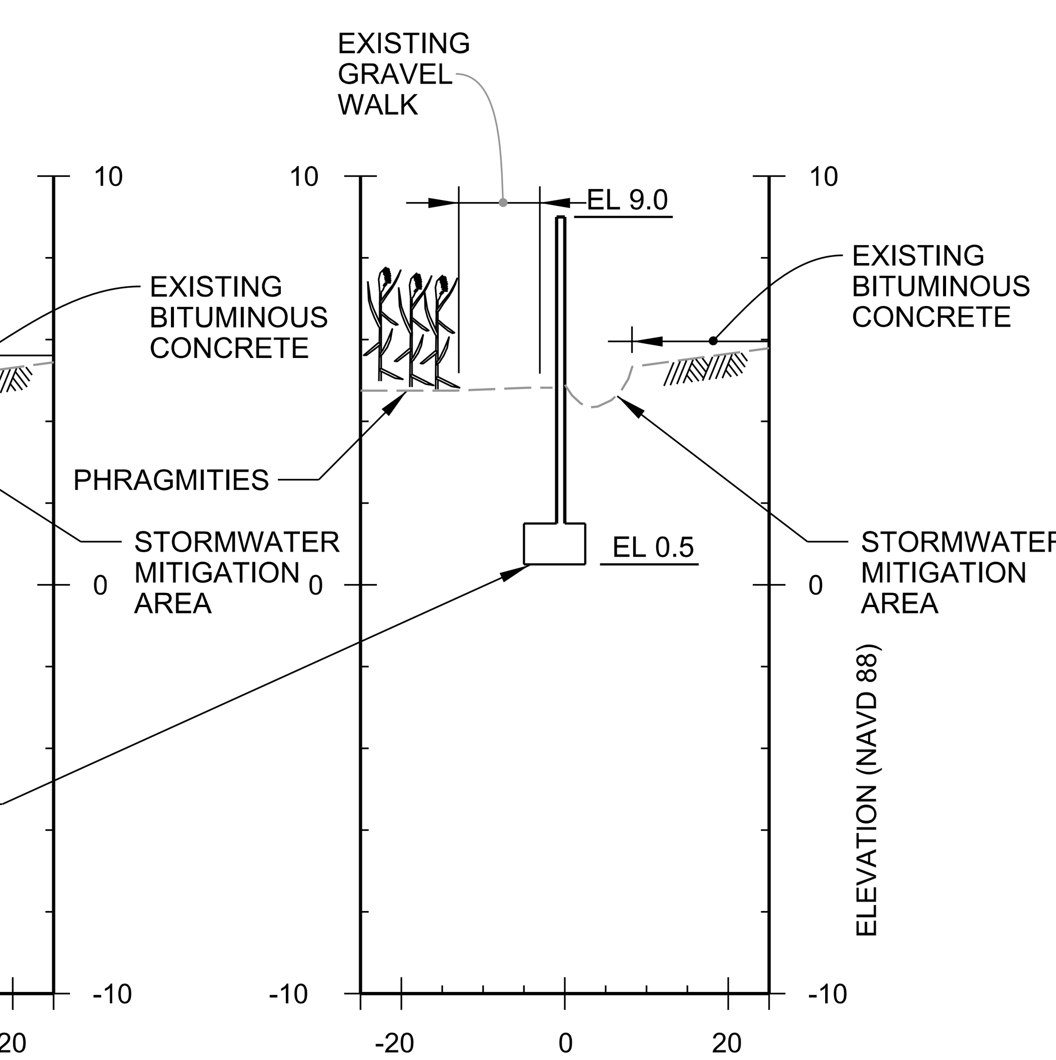
R / C-110 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



X / C-111 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



Y / C-111 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'



Z / C-111 SECTION
HOR. SCALE: 1" = 20'
VER. SCALE: 1" = 4'

GRAPHIC SCALE:

1" = 20' — 20' 0 20' 40'

1" = 4' — 4' 0 4' 8'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

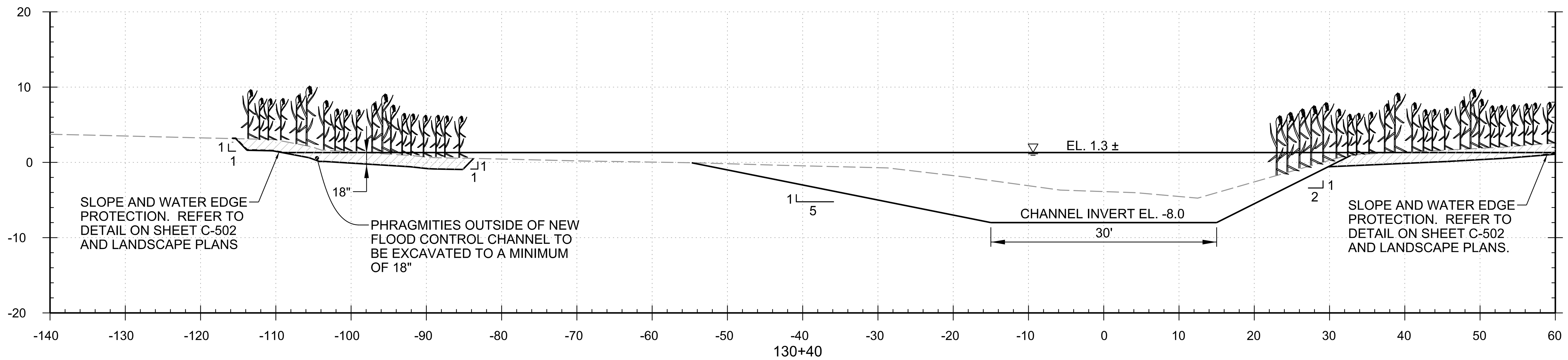
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 20'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-338.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

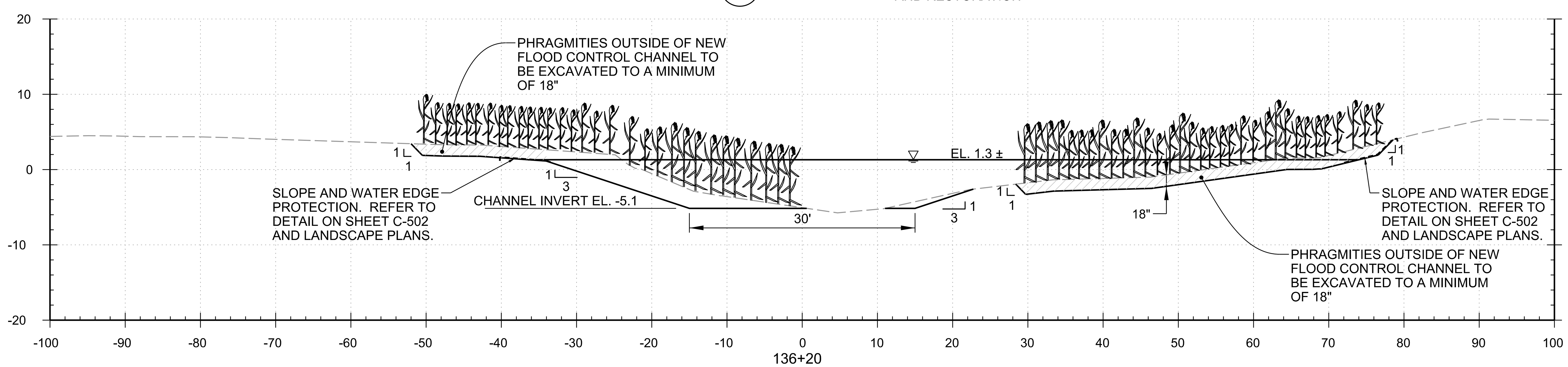
TYPICAL SECTIONS

SHEET IDENTIFICATION
C-338

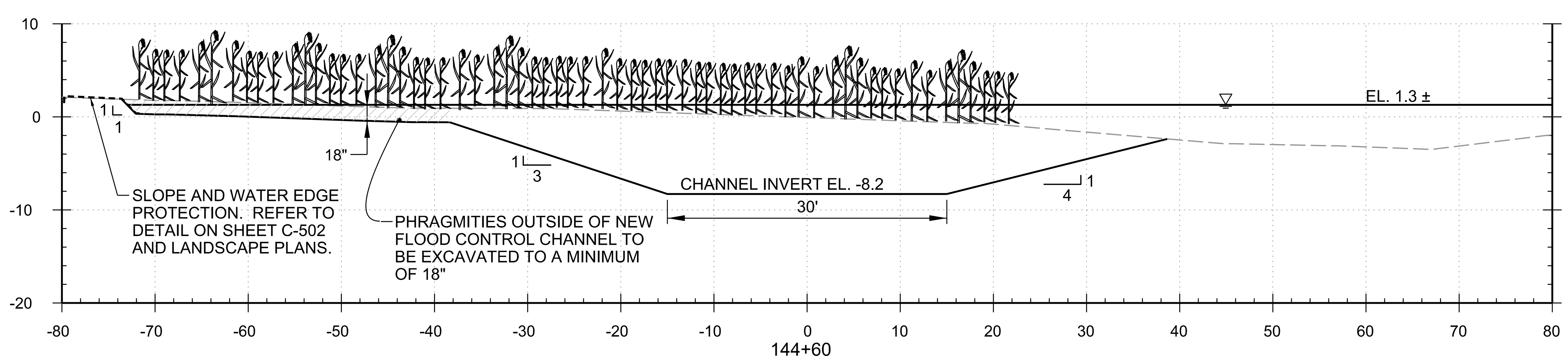
SHEET 71 OF 110



O-1 C-108 **SECTION** INVASIVE SPECIES REMOVAL AND RESTORATION
SCALE: 1" = 10'

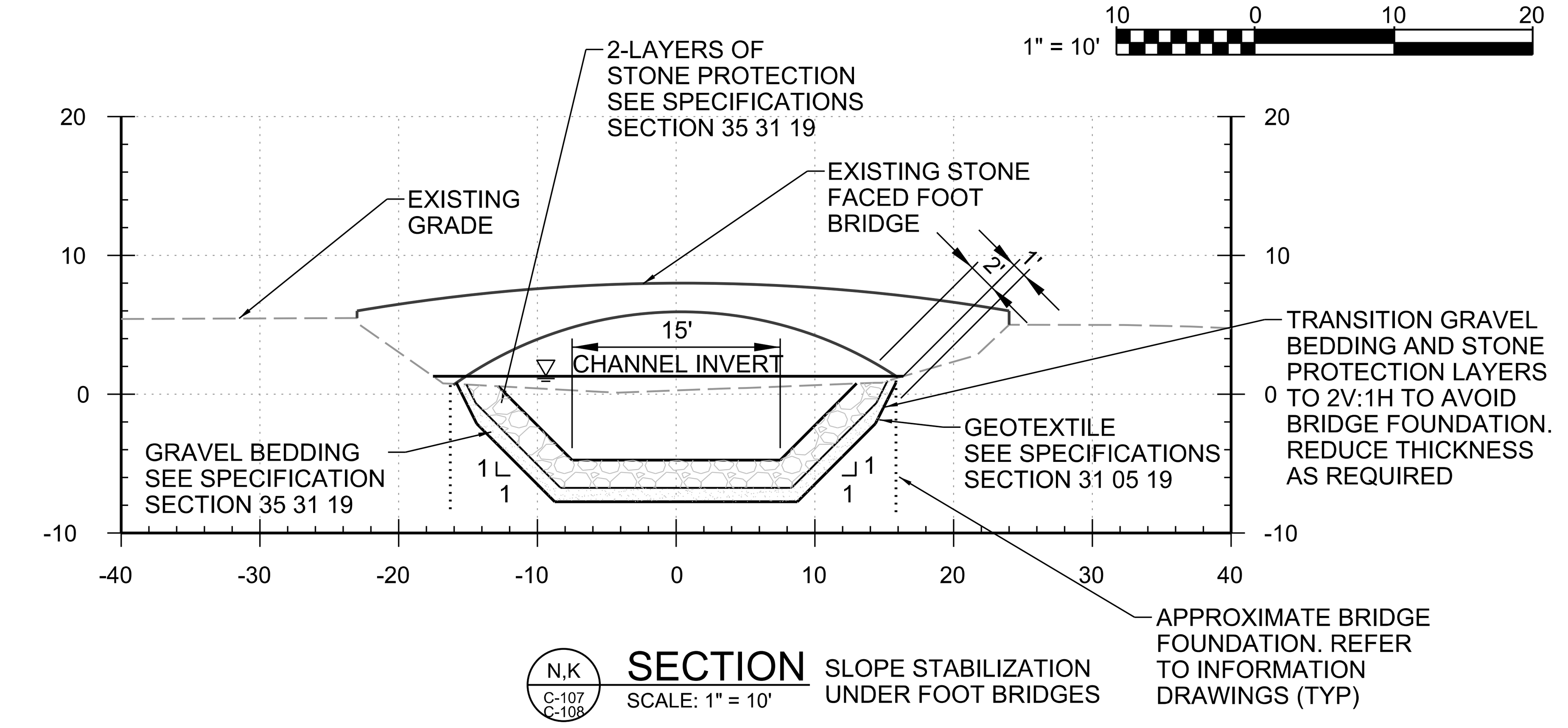


P C-109 **SECTION** INVASIVE SPECIES REMOVAL AND RESTORATION
SCALE: 1" = 10'

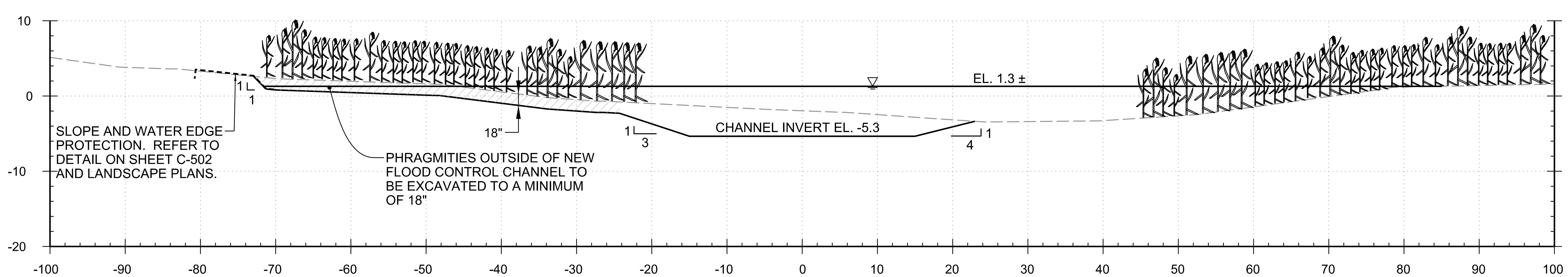


Q C-109 **SECTION** INVASIVE SPECIES REMOVAL AND RESTORATION
SCALE: 1" = 10'

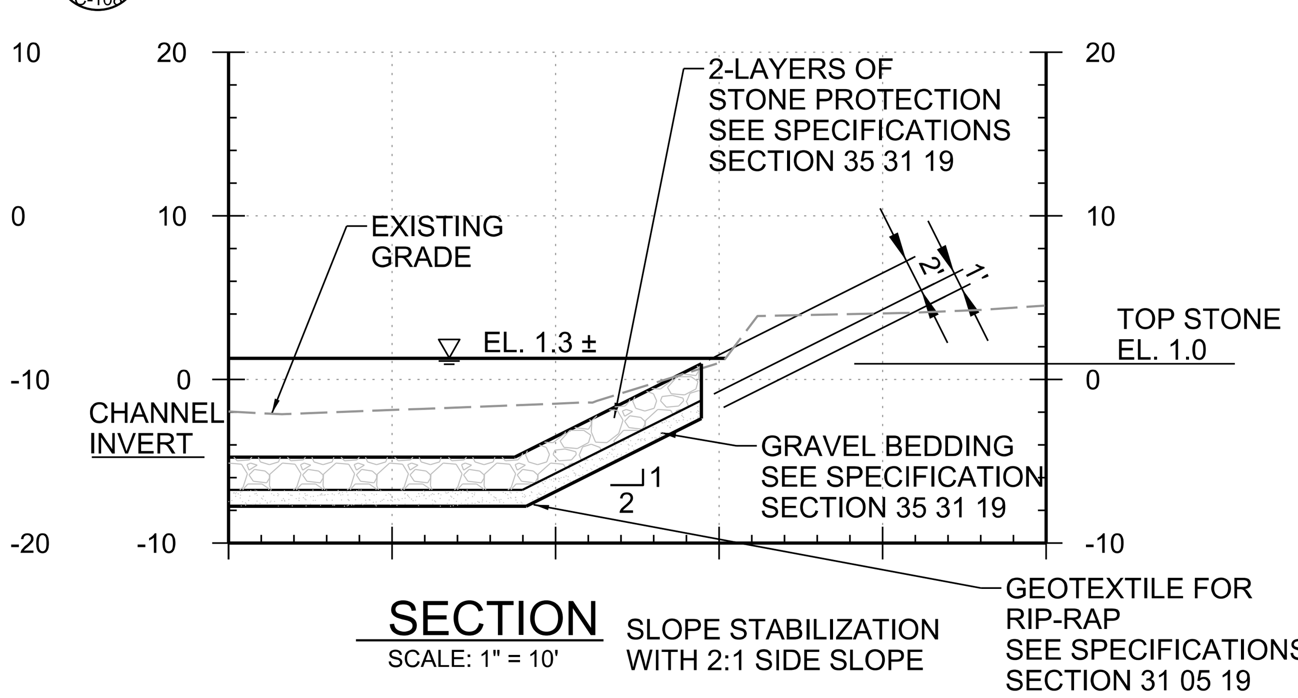
GRAPHIC SCALE:
1" = 10' 10 0 10 20



N,K C-107 C-108 **SECTION** SLOPE STABILIZATION UNDER FOOT BRIDGES
SCALE: 1" = 10'



R C-110 **SECTION**
SCALE: 1" = 10'



SECTION SLOPE STABILIZATION WITH 2:1 SIDE SLOPE
SCALE: 1" = 10'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

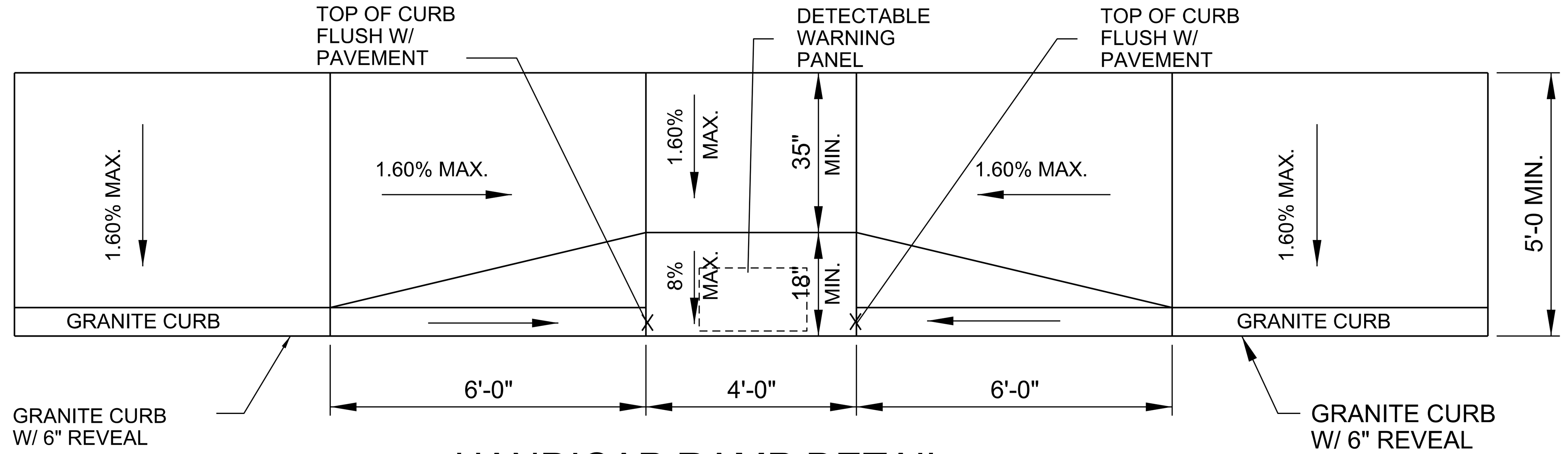
U. S. ARMY CORPS OF ENGINEERS NEW ENGLAND DISTRICT CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: 1" = 10'
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-339.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER FLOOD DAMAGE REDUCTION PROJECT (PHASE 2) BOSTON AND BROOKLINE, MASSACHUSETTS

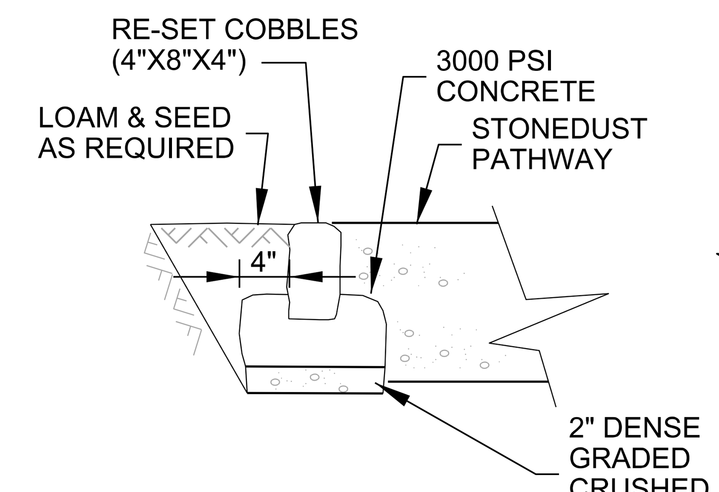
GEOTECHNICAL & ENVIRONMENTAL TYPICAL SECTIONS

SHEET IDENTIFICATION
C-339
SHEET 72 OF 110

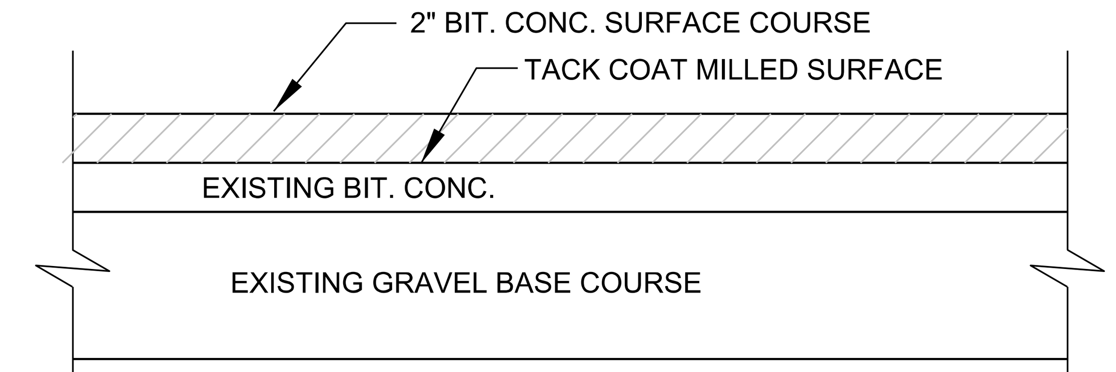


HANDICAP RAMP DETAIL

SCALE: ⅜" = 1'- 0"

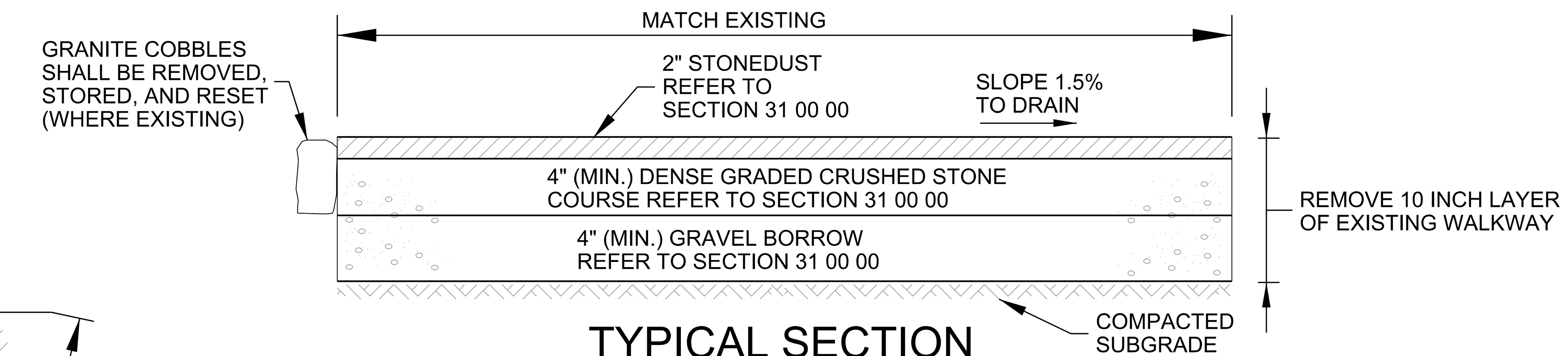


GRANITE COBBLE RESET



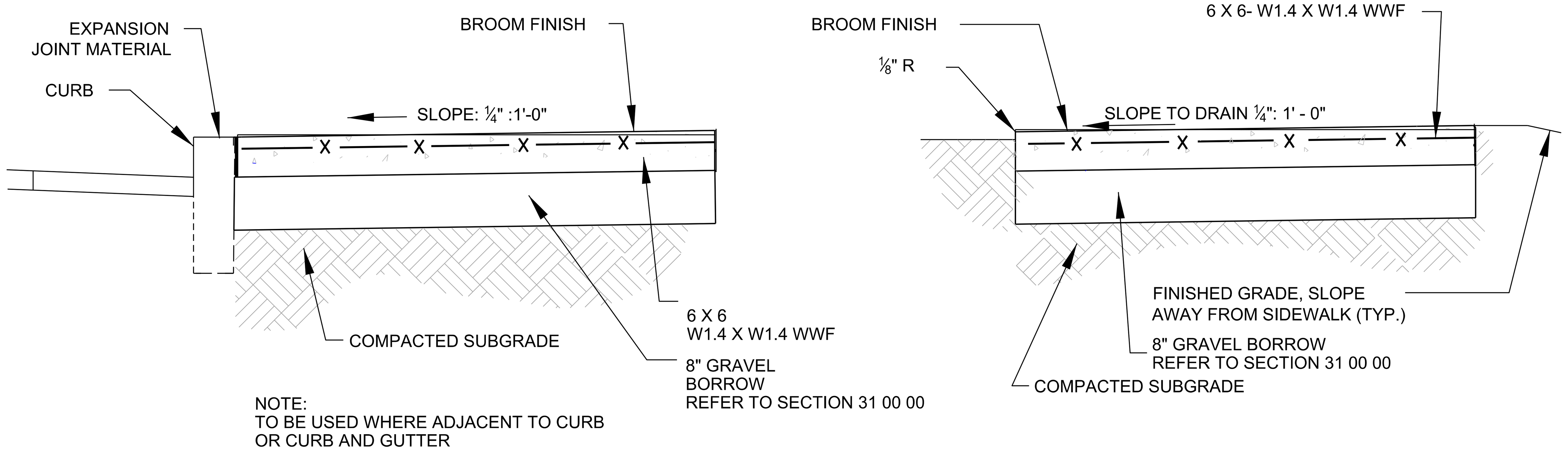
TYPICAL SECTION PAVEMENT MILLING

SCALE: N.T.S.



TYPICAL SECTION FULL DEPTH STONEDUST PATHS

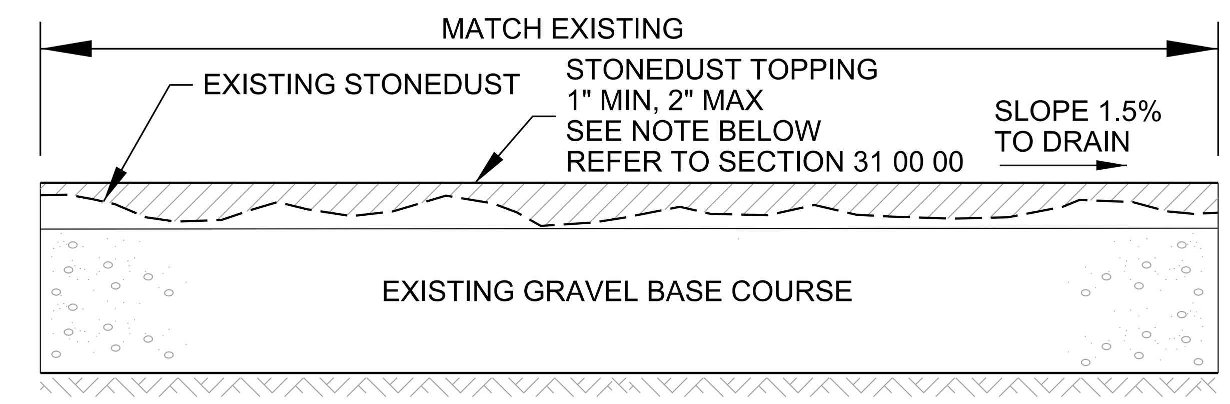
SCALE: N.T.S.



NOTE:
TO BE USED WHERE ADJACENT TO CURB OR CURB AND GUTTER

CONCRETE SIDEWALK DETAILS

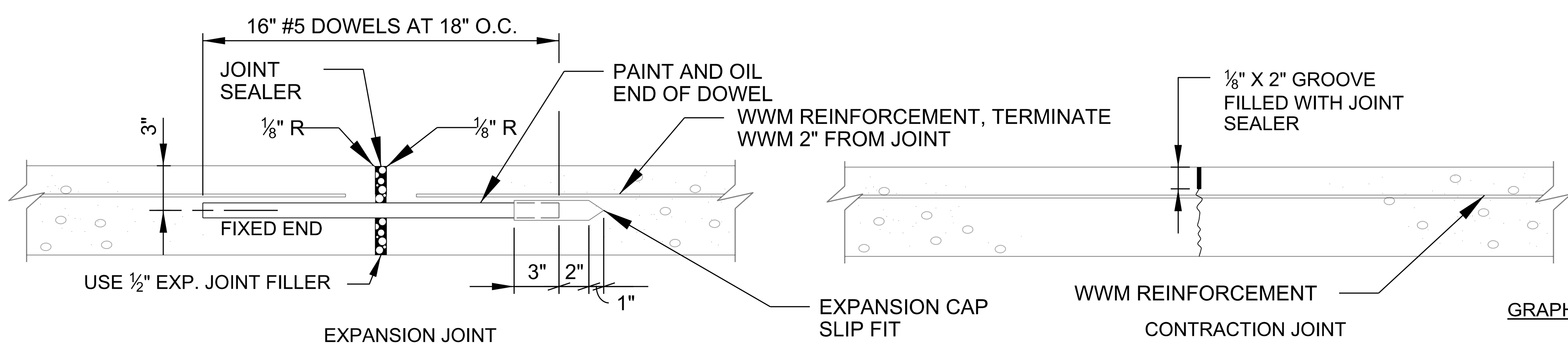
SCALE: ¾" = 1'- 0"



NOTE: ALL RUTS MUST BE FILLED WITH STONEDUST

TYPICAL SECTION TOP DRESSED STONEDUST PATHS

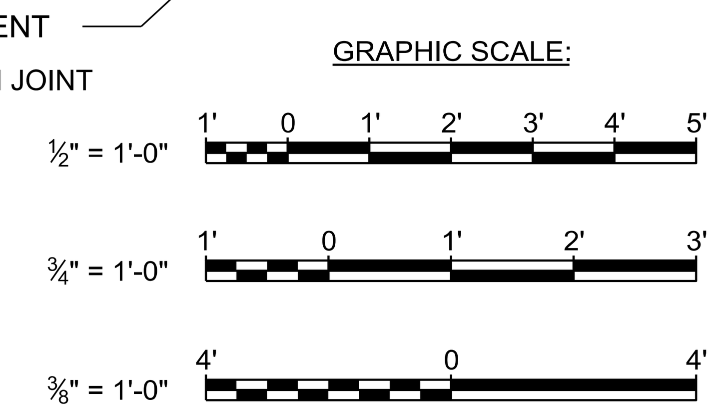
SCALE: N.T.S.

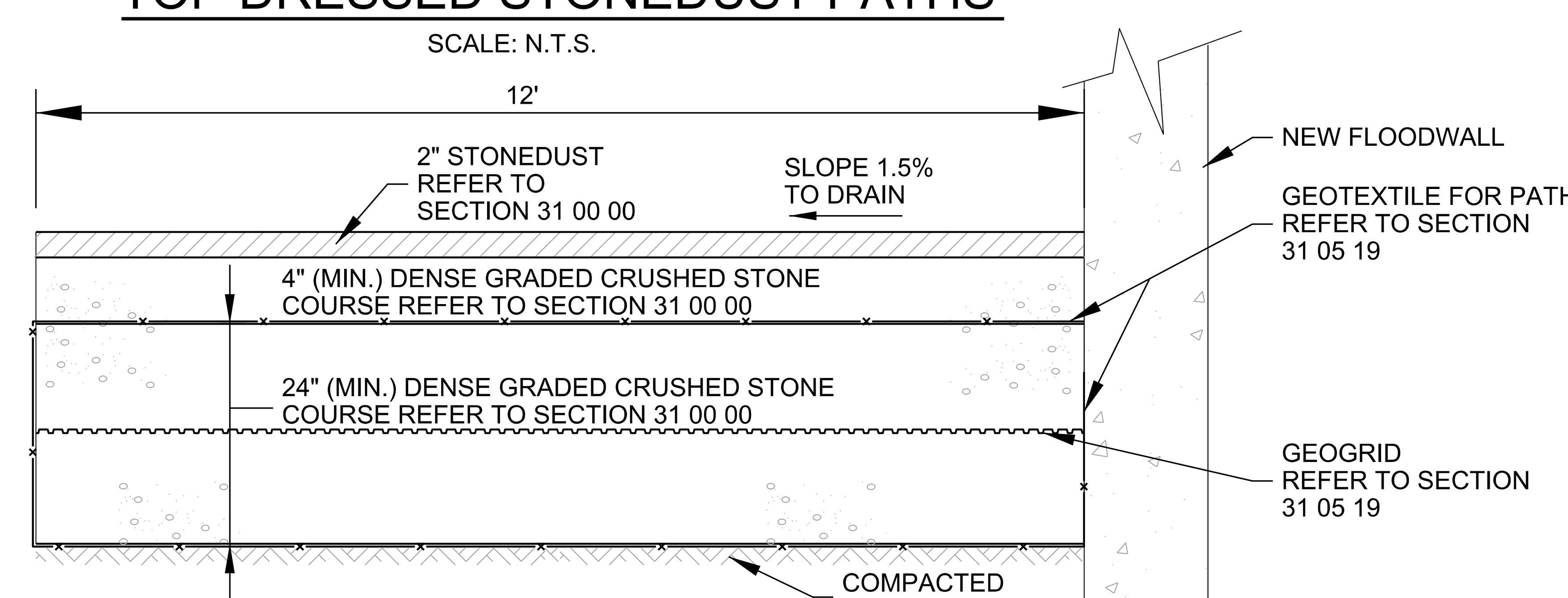


NOTE:
1. PLACE EXPANSION JOINTS AT ALL PC'S AND PT'S OF CURVES AND AT 20 FOOT INTERVALS ON STRAIGHT RUNS.

CONCRETE PAVING JOINTS

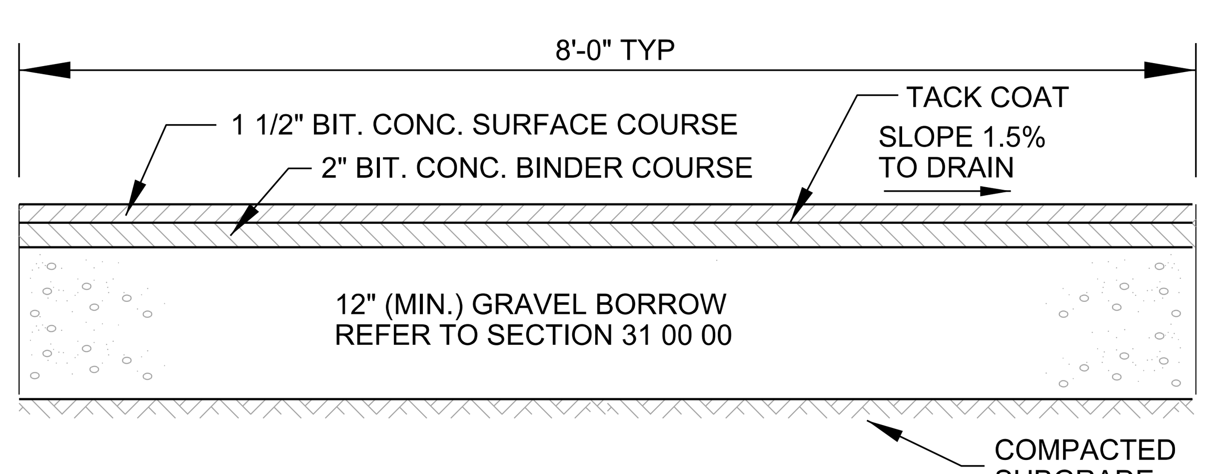
SCALE: 1½" = 1'- 0"





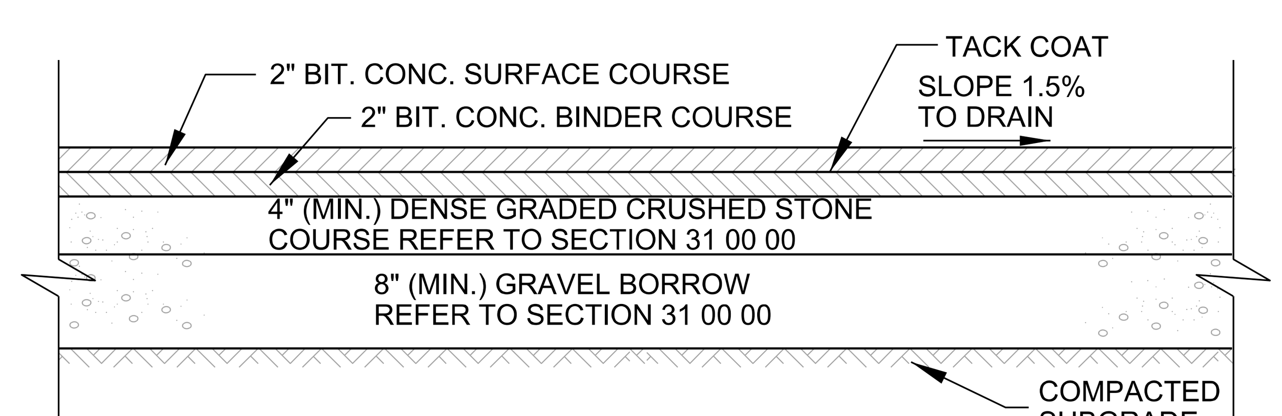
TYPICAL SECTION FIRE HEADQUARTERS PATH

SCALE: N.T.S.



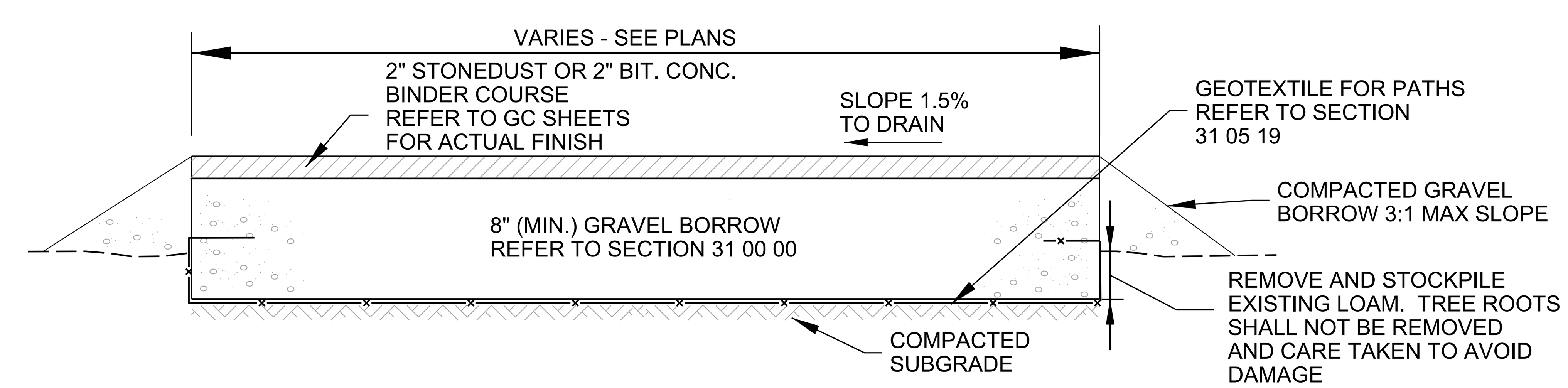
TYPICAL SECTION BITUMINOUS CONCRETE PATHS

SCALE: N.T.S.



TYPICAL SECTION FIRE DEPARTMENT HEADQUARTERS PARKING AREA

SCALE: N.T.S.



TYPICAL SECTION TEMPORARY WALKWAY

SCALE: N.T.S.

US Army Corps of Engineers® New England District

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

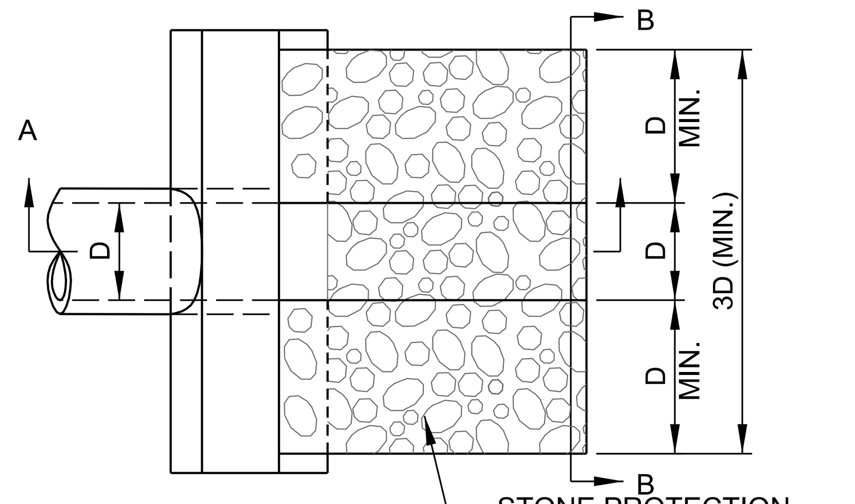
DESIGNED BY: L. THIBODEAU
DWN BY: LT
CKD BY: MET
SUBMITTED BY:
PLOT SCALE: N.T.S.
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_C-501.dgn
DATE: SEPTEMBER 2016
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

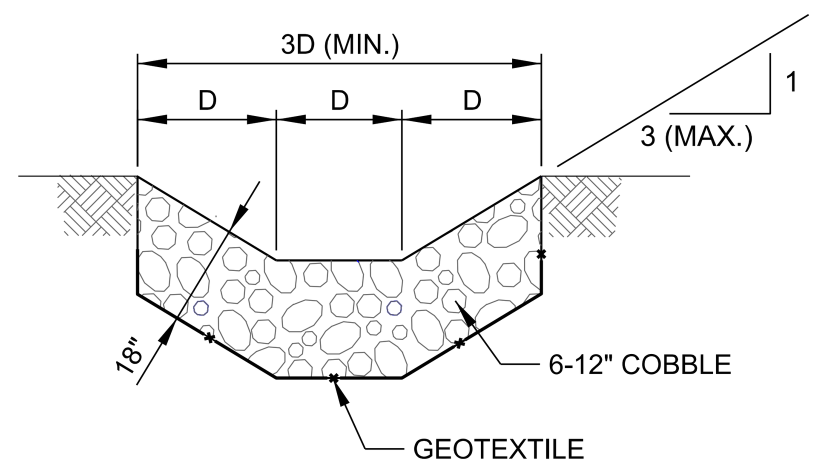
CONSTRUCTION DETAILS

SHEET IDENTIFICATION
C-501

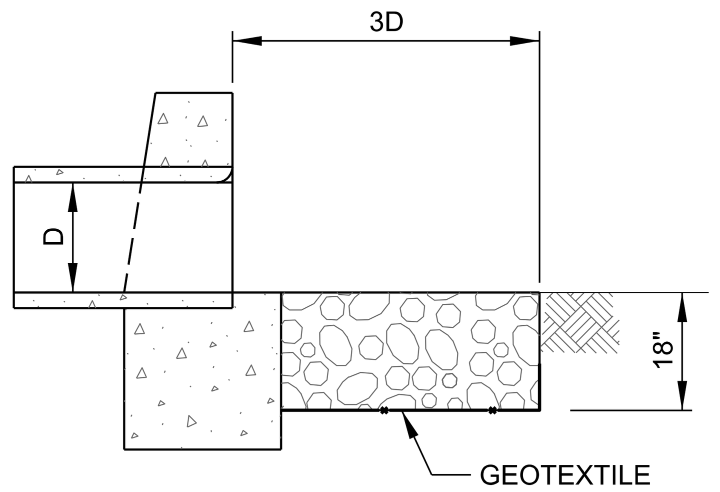
SHEET 73 OF 110



HEADWALL PLAN



SECTION B-B



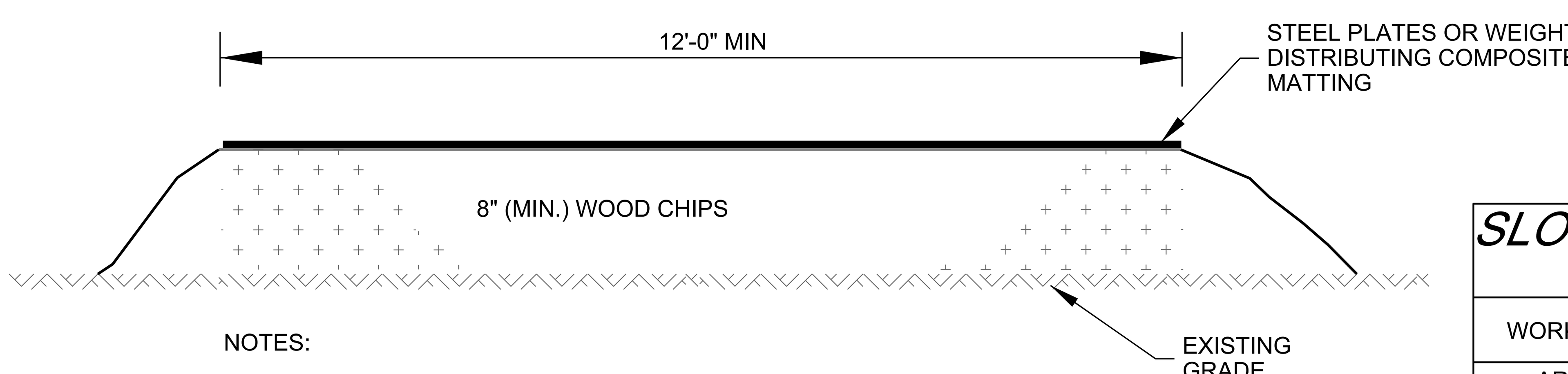
SECTION A-A

NOTES:

1. THIS DETAIL TO BE USED UPON FINDING EXISTING STORMWATER OUTLETS
2. EROSION CONTROL STONE APRONS WILL BE REQUIRED AT OUTLETS LOCATED THAT REQUIRE ADJUSTMENT DUE TO EXCAVATION.
3. THE SIDE SLOPES OF THE STONE APRON SHALL TRANSITION TO MEET THE STONE PROTECTION

DISCHARGE AREA EROSION CONTROL DETAIL

N.T.S.

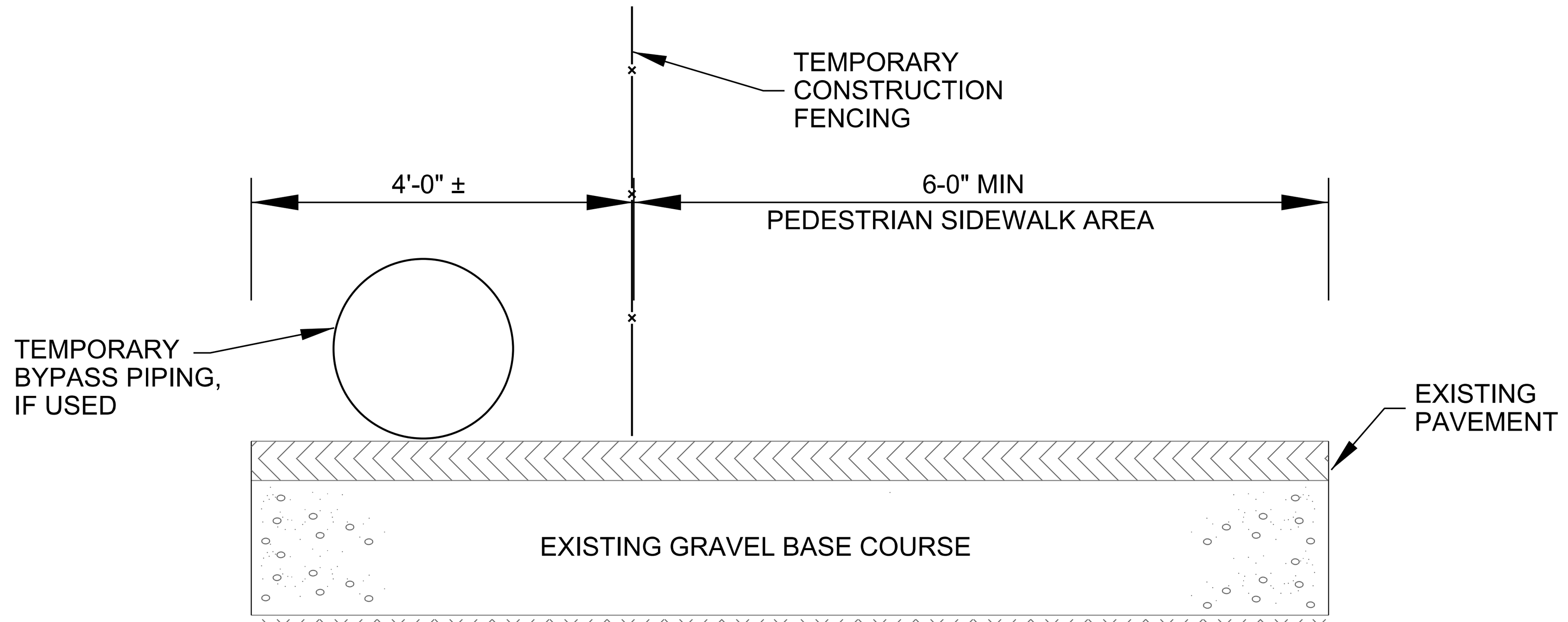


NOTES:

1. REFER TO GC SHEETS FOR LOCATIONS OF REQUIRED ROOT PROTECTION ZONES

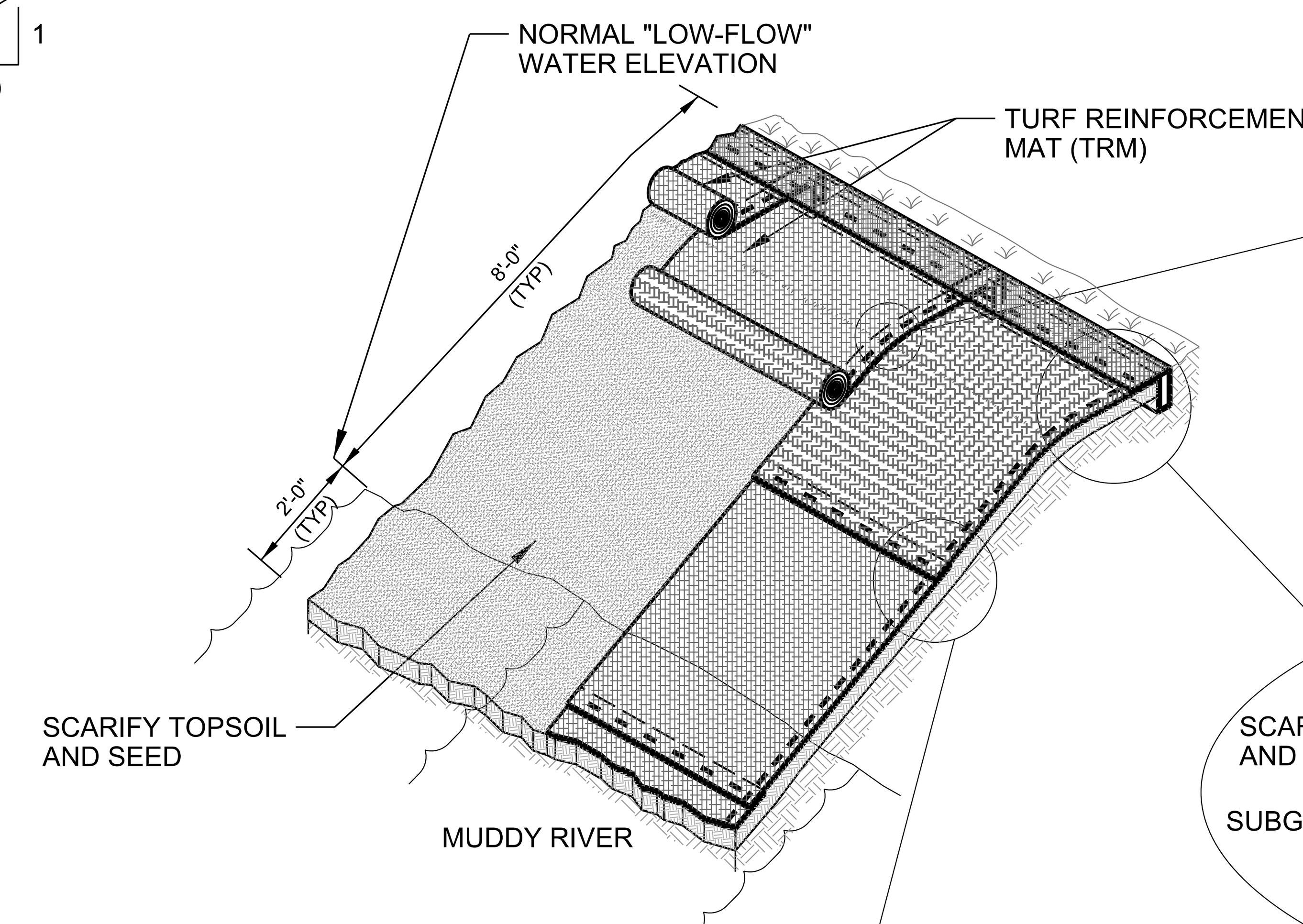
TYPICAL SECTION
TREE ROOT PROTECTION

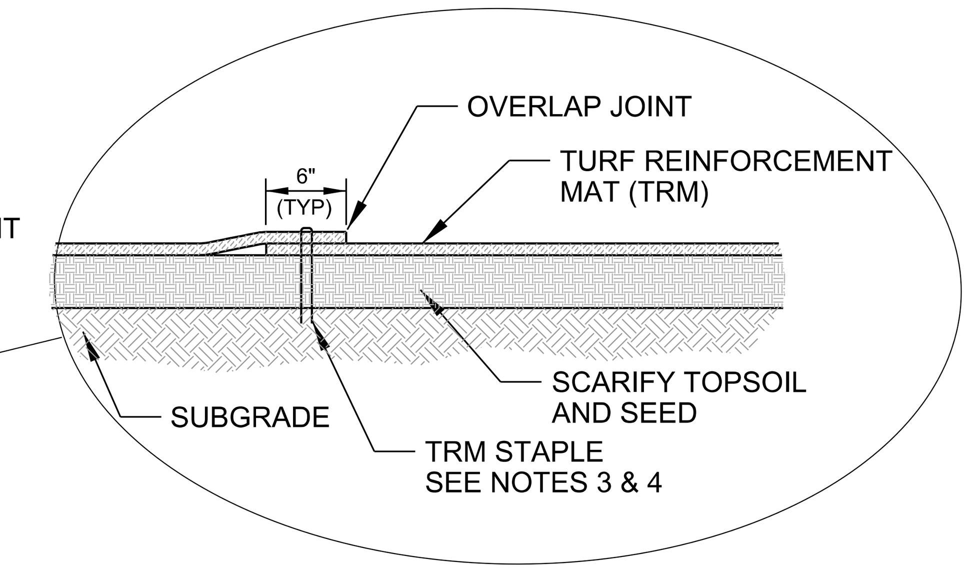
SCALE: N.T.S



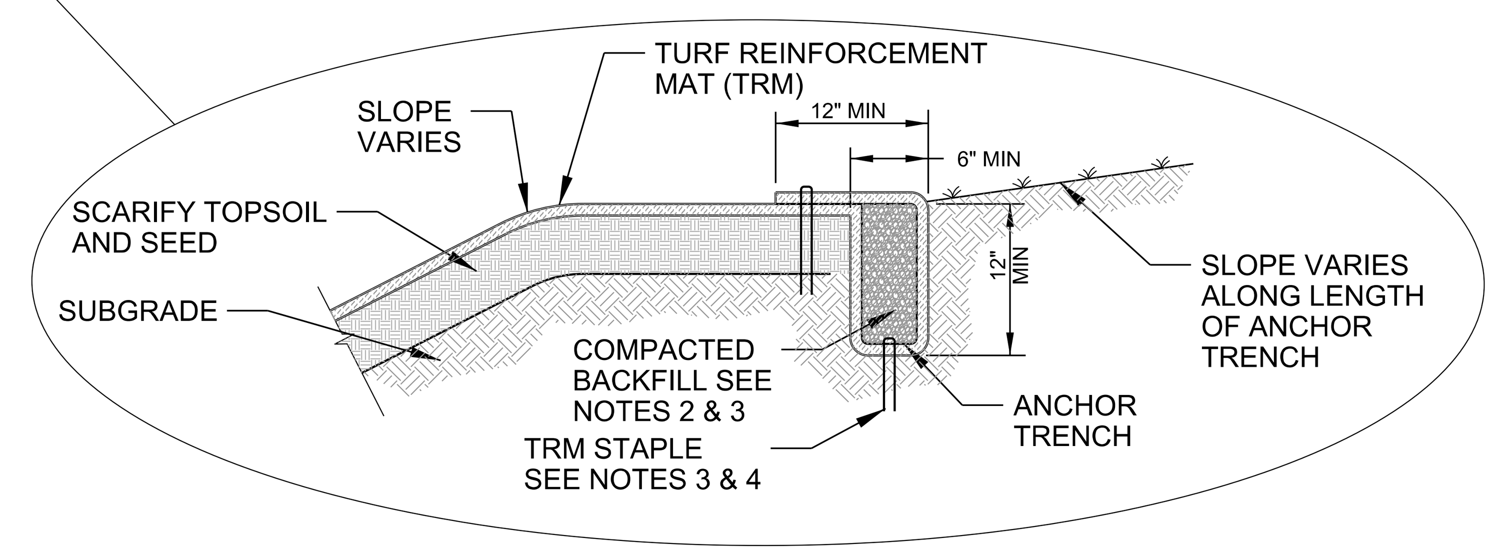
SIDEWALK MANAGEMENT PLAN
FOR DEWATERING PIPING - SEE SHEET GC-102

SCALE: N.T.S

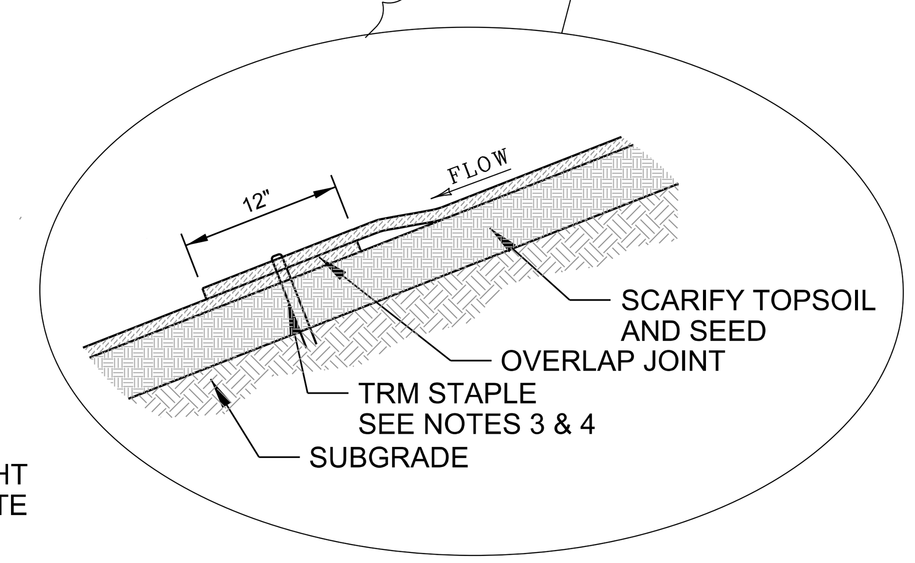




** TYPICAL DETAIL **
TRM PERPENDICULAR OVERLAP



** TYPICAL DETAIL **
TRM ANCHOR TRENCH



** TYPICAL DETAIL **
ECB PARALLEL OVERLAP

SLOPE AND SHORELINE PROTECTION INSTALLATION LOCATIONS

WORK AREA	STATION RANGE LEFT	STATION RANGE RIGHT
AREA-2	27+40 - 28+10	34+60 - 35+50
	28+50 - 30+90	
	31+60 - 32+40	
	33+25 - 35+00	
AREA-3	37+80 - 40+00	37+60 - 40+80
	40+50 - 41+20	
AREA-5	65+10 - 66+05	64+80 - 66+00
AREA-6	73+10 - 76+40	72+80 - 76+80
AREA-7		101+50 - 102+50
AREA-10	130+20 - 131+30	122+70 - 131+30
AREA-11	135+30 - 141+90	132+60 - 138+60
AREA-12	141+90 - 150+30	

NOTES:

1. SCARIFY THE EXISTING TOPSOIL IN AREAS THAT WILL RECEIVE THE TURF REINFORCEMENT MATS (TRM). APPLY SEED MIX AND TREATMENTS ACCORDING TO THE SPECIFICATIONS.
2. CONSTRUCT THE ANCHOR TRENCH AT LOCATIONS REQUIRED TO HOLD MATTING IN PLACE. PLACE COMPACTED BACKFILL AND TOPSOIL IN AND AROUND THE ANCHOR TRENCH IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS.
3. UPON COMPLETING THE SCARIFYING OF TOPSOIL AND SEEDING, PLACE THE TRM ALONG THE TOP OF THE TOPSOIL AND SEED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION REQUIREMENTS. THE TRM SHALL BE UNROLLED FROM THE ANCHOR TRENCH DOWN THE SLOPE IN THE DIRECTION OF WATER FLOW AND PLACED IN DIRECT CONTACT WITH THE TOPSOIL SURFACE. DO NOT STRETCH OR ALLOW THE MATERIAL TO BRIDGEOVER SURFACE INCONSISTENCIES. ENSURE THAT THE TRM IS IN DIRECT CONTACT WITH THE TOP OF THE SOIL SURFACE WITH NO VOIDS, PROJECTIONS, OR PROTRUSIONS. SECURELY FASTEN THE TRM THROUGH THE SOIL WITH STAPLES (ANCHOR STAKES) REQUIRED BY THE MANUFACTURER. INSTALL STAPLES ALONG SEAMS, EDGES, AND INTERIOR STAPLE PATTERNS AT A MINIMUM RATE TO MEET THE SLOPES AND TYPE OF SOILS AS REQUIRED BY THE MANUFACTURER. INSTALL THE TRM OVERLAP EDGES OF PARALLEL AND PERPENDICULAR JOINTS ALONG THE SLOPE AS PER THE ECB PARALLEL AND PERPENDICULAR OVERLAP DETAILS.
4. TRM STAPLES SHALL BE LONG ENOUGH SO THAT THEY EXTEND INTO THE SOIL WITH SUFFICIENT GROUND PENETRATION TO RESIST PULLOUT.
5. FOR CLARITY, STAPLES OTHER THAN AT OVERLAPS ARE NOT SHOWN ALONG THE SLOPES. STAPLE PATTERNS AND SPACING SHALL MEET THE REQUIREMENTS OF THE MANUFACTURER.

SLOPE AND WATER EDGE PROTECTION DETAIL

SCALE: NONE

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR

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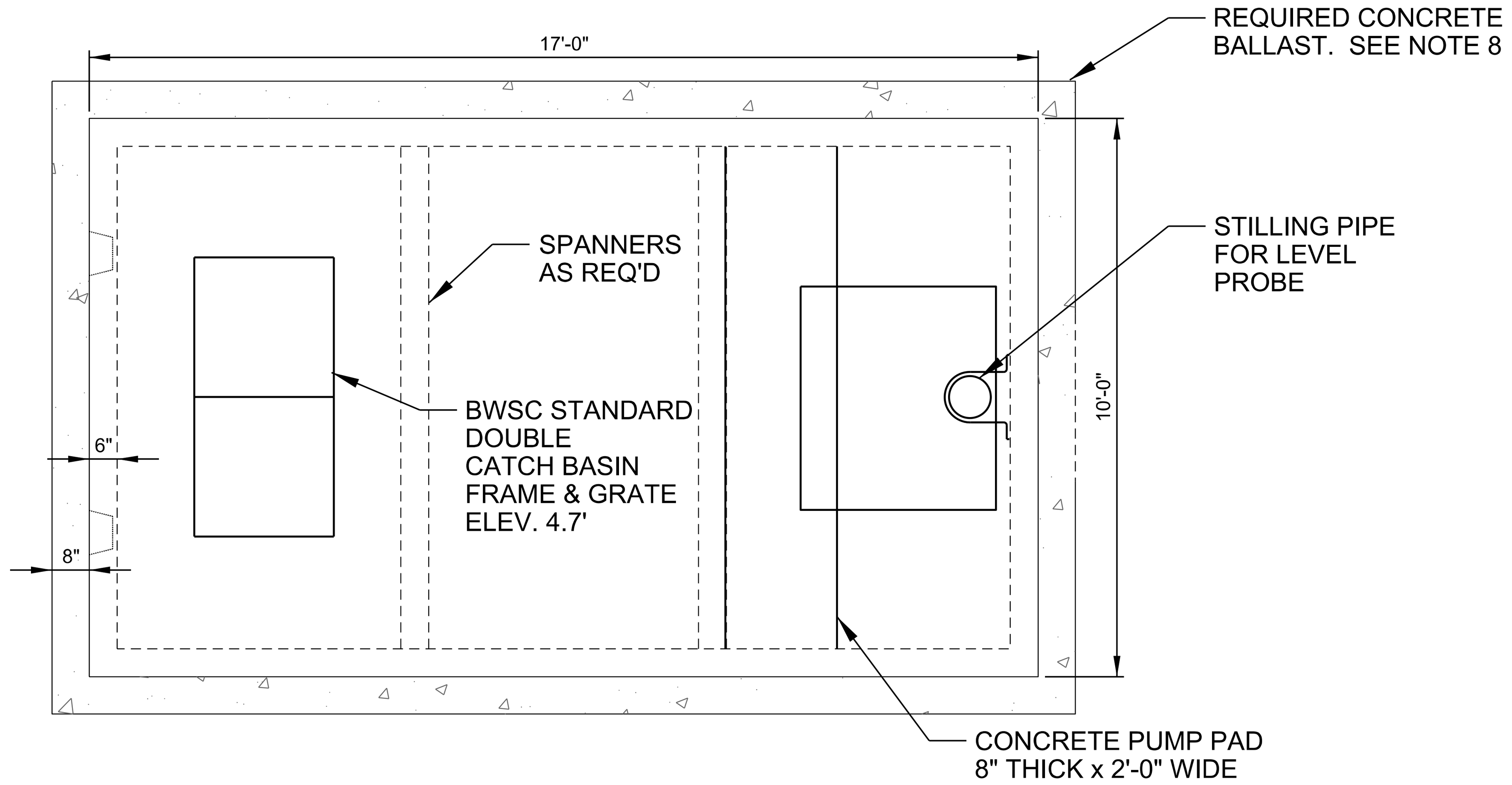
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU
DATE: SEPTEMBER 2016
DWN BY: LT
CKD BY: MET
SOLICITATION NO.:
SUBMITTED BY:
CONTRACT NO.:
PLOT SCALE: N.T.S.
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-502.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

CONSTRUCTION DETAILS

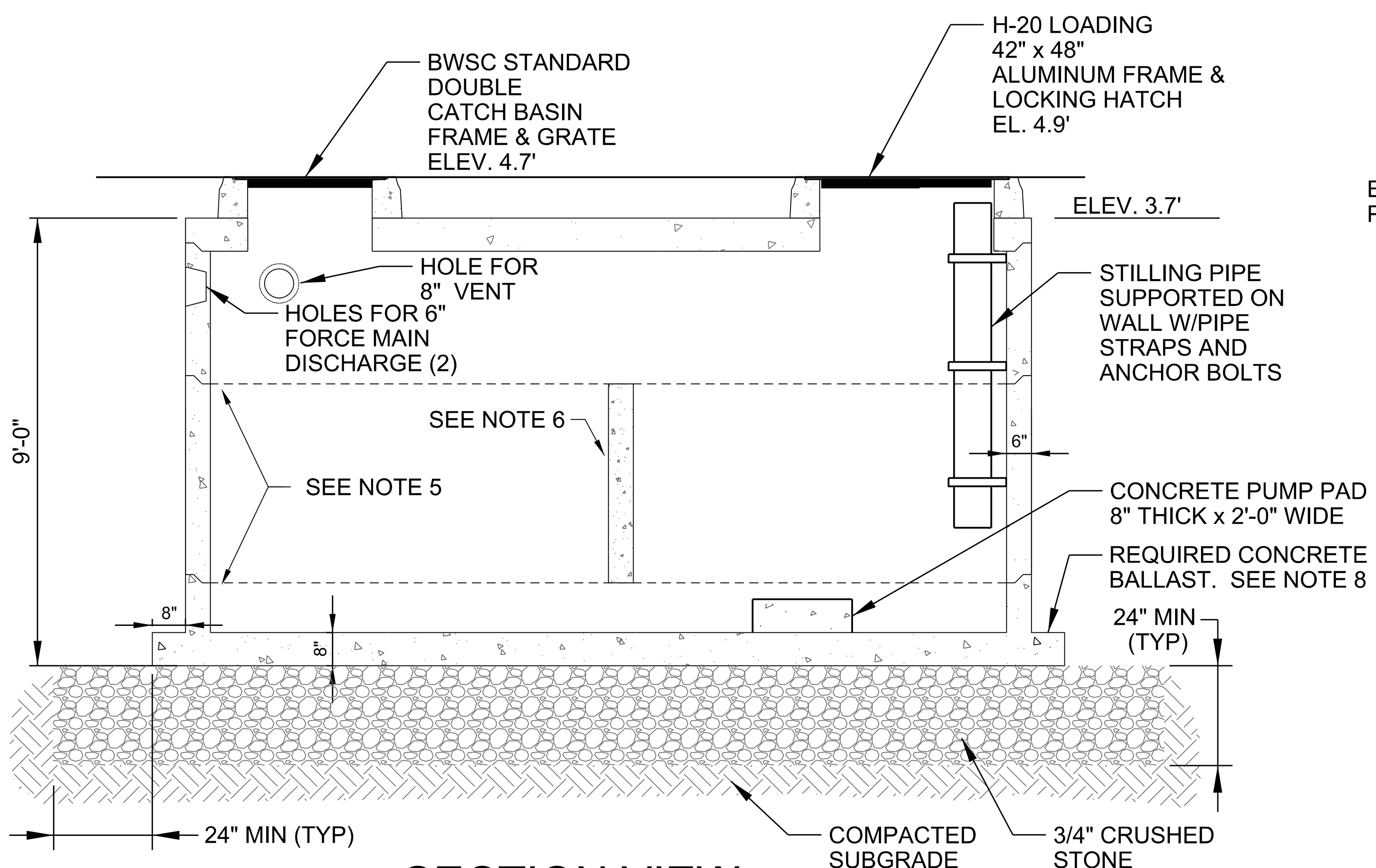
SHEET IDENTIFICATION
C-502
SHEET 74 OF 110



PLAN VIEW

NOTES:

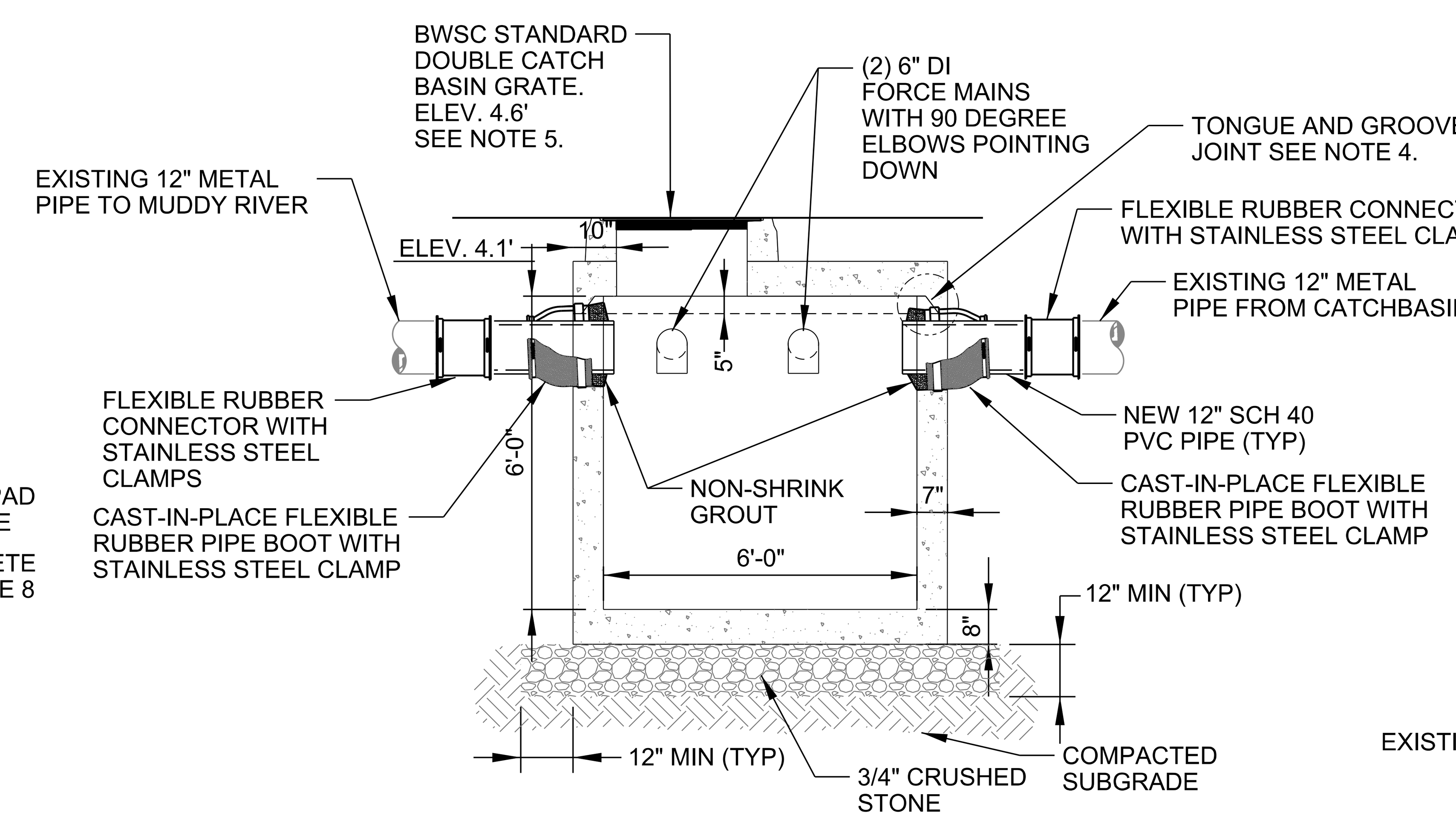
1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. PUMP STATION IS A REWORKED 7000 GAL COMMERCIAL LINE TANK, SHEA CONCRETE, CSI CONCRETE SYSTEMS, PEPIN PRECAST OR APPROVED EQUAL.
3. ALL REINFORCEMENT PER ASTM C1227-93.
4. SHALL MEET HL-93 VEHICULAR LIVE LOADING PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS 2012, COVER 1 TO 5 FEET.
5. TONGUE AND GROOVE JOINT SEALED WITH BUTYL RESIN. INLET HEIGHT MAY INCREASE SLIGHTLY DUE TO THE BUTYL RESIN USED.
6. SPANNERS USED IN CENTER SECTIONS FOR TANKS GREATER THAN 7000 GALLONS. CONTRACTOR SHALL COORDINATE LOCATION OF SPANNERS TO ALLOW FOR PUMP AND FORCE MAIN INSTALLATION LOCATIONS AS SHOWN ON SHEET C-504 AND SHALL ALLOW AMPLE CLEAR SPACE FOR FREE WATER FLOW TO THE PUMPS.
7. CONTRACTOR SHALL COORDINATE HOLE SIZE AND LOCATIONS WITH THE PRECASTER.
8. THE CONCRETE BALLAST SHOWN SHALL BE PART OF THE PRE-CAST STRUCTURE TO THE MINIMUM DIMENSIONS SHOWN.
9. PLANS DO NOT INDICATE TEMPORARY SUPPORT FOR EXCAVATION. REFER TO SPECIFICATIONS SECTION 31 01 00.
10. PLANS INDICATE STRUCTURAL FILL BENEATH TANK AND CATCHBASIN. REFER TO SPECIFICATIONS SECTION 31 00 00 FOR OTHER BACKFILL MATERIALS AND REQUIREMENTS.



SECTION VIEW

7000 GALLON PRECAST CONCRETE PUMP STATION

SCALE: N.T.S



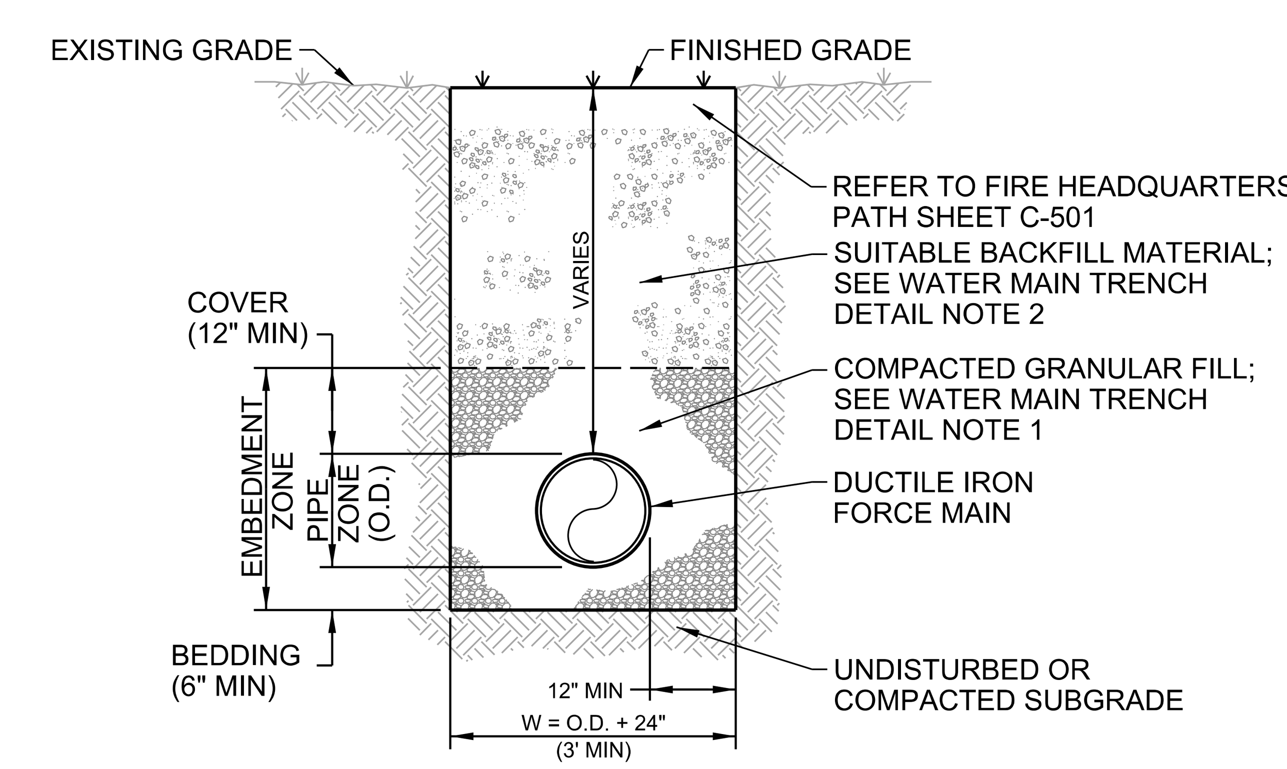
SECTION VIEW

PRECAST CATCH BASIN

NOT TO SCALE

NOTES:

1. CONCRETE: 4,000 PSI MINIMUM AFTER 28 DAYS.
2. ALL REINFORCEMENT PER ASTM A185 SPECIFICATION 0.18 SQ. IN./LINEAL FT. AND 0.18 SQ. IN. (BOTH WAYS) BASE BOTTOM.
3. SHALL MEET HL-93 VEHICULAR LIVE LOADING PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS 2012, COVER 1 TO 5 FEET.
4. TONGUE AND GROOVE JOINT SEALED WITH BUTYL RESIN CONFORMING TO LATEST ASTM C990 SPECIFICATION.
5. FRAME SHALL USE A 4"-5" SECTION TO REDUCE REQUIRED CORING OF TOP SLAB FOR EXISTING 12" METAL INVERT.
6. SHEA CONCRETE, CSI CONCRETE SYSTEMS, PEPIN PRECAST CATCHBASIN 72" DIA. OR APPROVED EQUAL.



WATER MAIN TRENCH NOTES:

1. COMPACTED GRANULAR FILL MATERIAL WITHIN EMBEDMENT ZONE SHALL BE SAND BORROW IN ACCORDANCE WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION (MASSDOT) STANDARD SPECIFICATIONS SECTION M1.04.0 (TYPE A).
2. SUITABLE BACKFILL MATERIAL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS, ORGANIC MATTER, TOP SOIL, ALL WET OR SOFT MUCK, PEAT OR CLAY, ALL ROCKS OVER SIX INCHES IN THE LARGEST DIMENSION, OR ANY MATERIAL WHICH, AS DETERMINED BY THE CONTRACTING OFFICER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION. SUITABLE MATERIAL SHALL BE PLACED IN 12 INCH LIFTS AND THOROUGHLY COMPACTED.

FORCE MAIN TRENCH DETAIL

SCALE: NONE

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

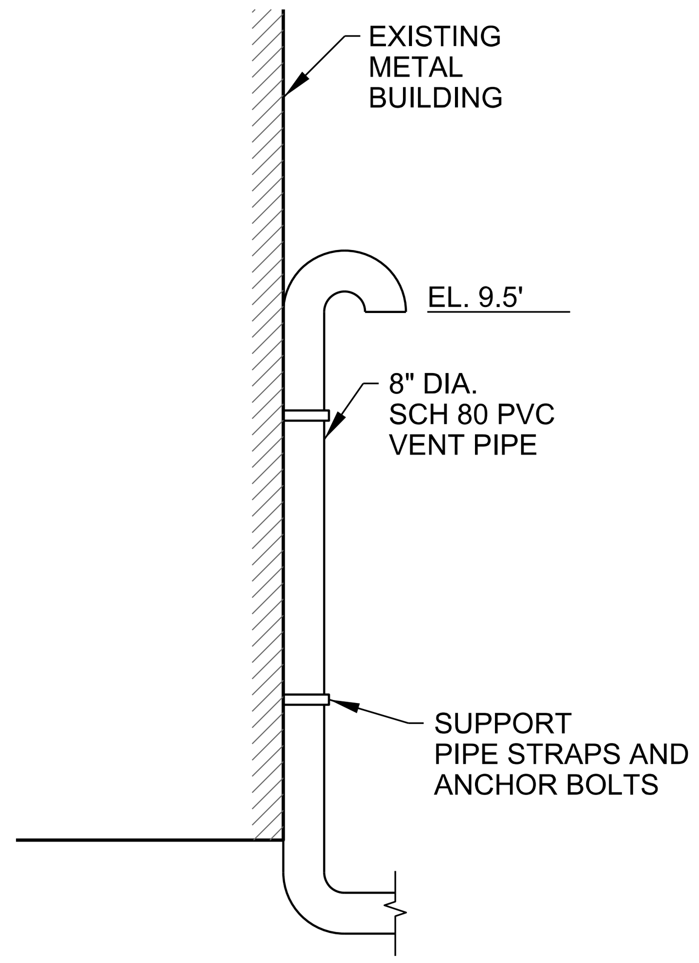
DESIGNED BY: L. THIBODEAU
DATE: SEPTEMBER 2016
DWN BY: LT
CKD BY: MET
SOLICITATION NO.:
SUBMITTED BY:
CONTRACT NO.:
PLOT SCALE: N.T.S.
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_C-503.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

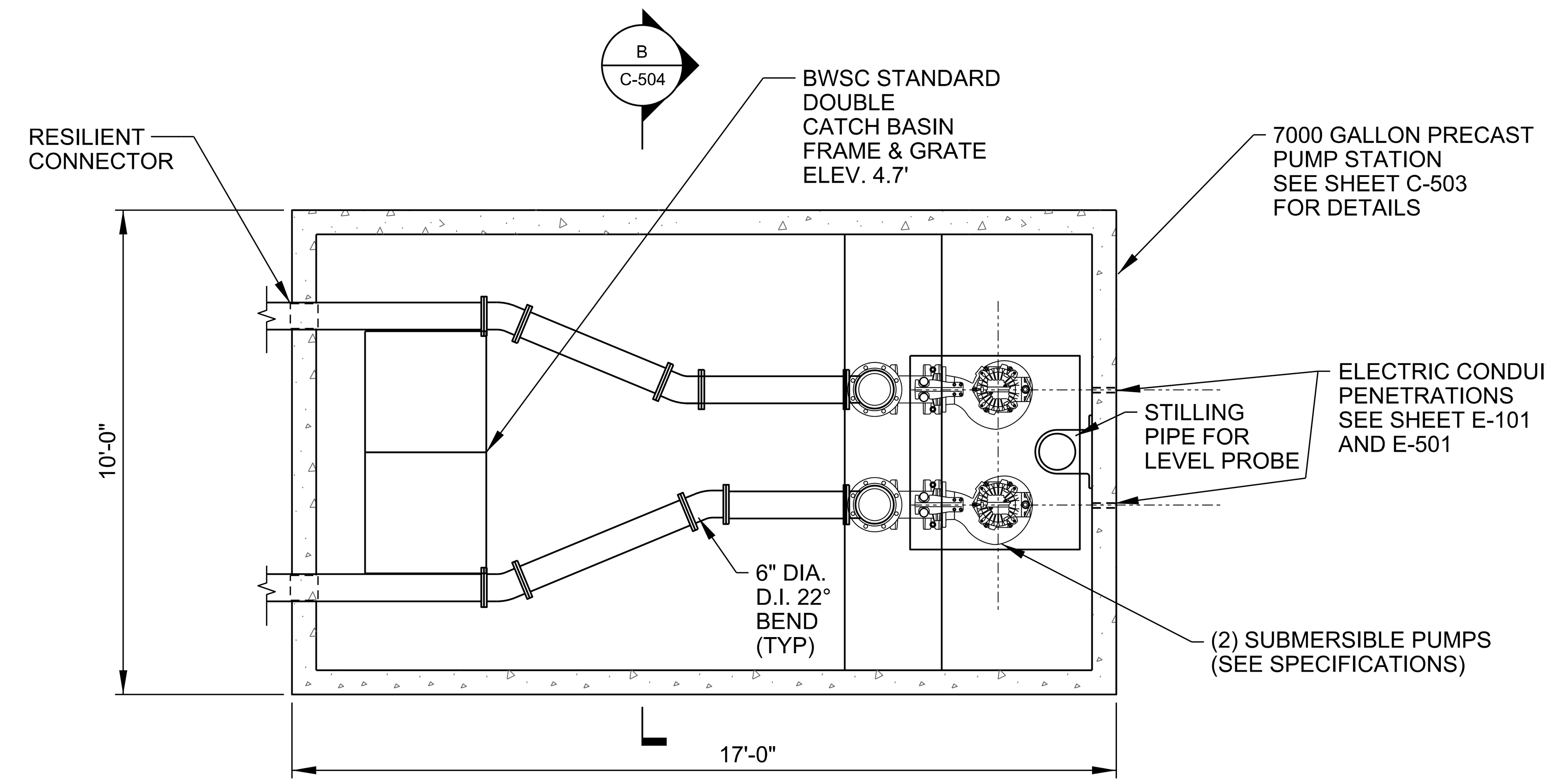
CONSTRUCTION DETAILS

SHEET IDENTIFICATION
C-503

SHEET 75 OF 110



VENT DETAIL
SCALE: N.T.S.



PLAN
SCALE: ⅜" = 1'-0"

MECHANICAL NOTES:

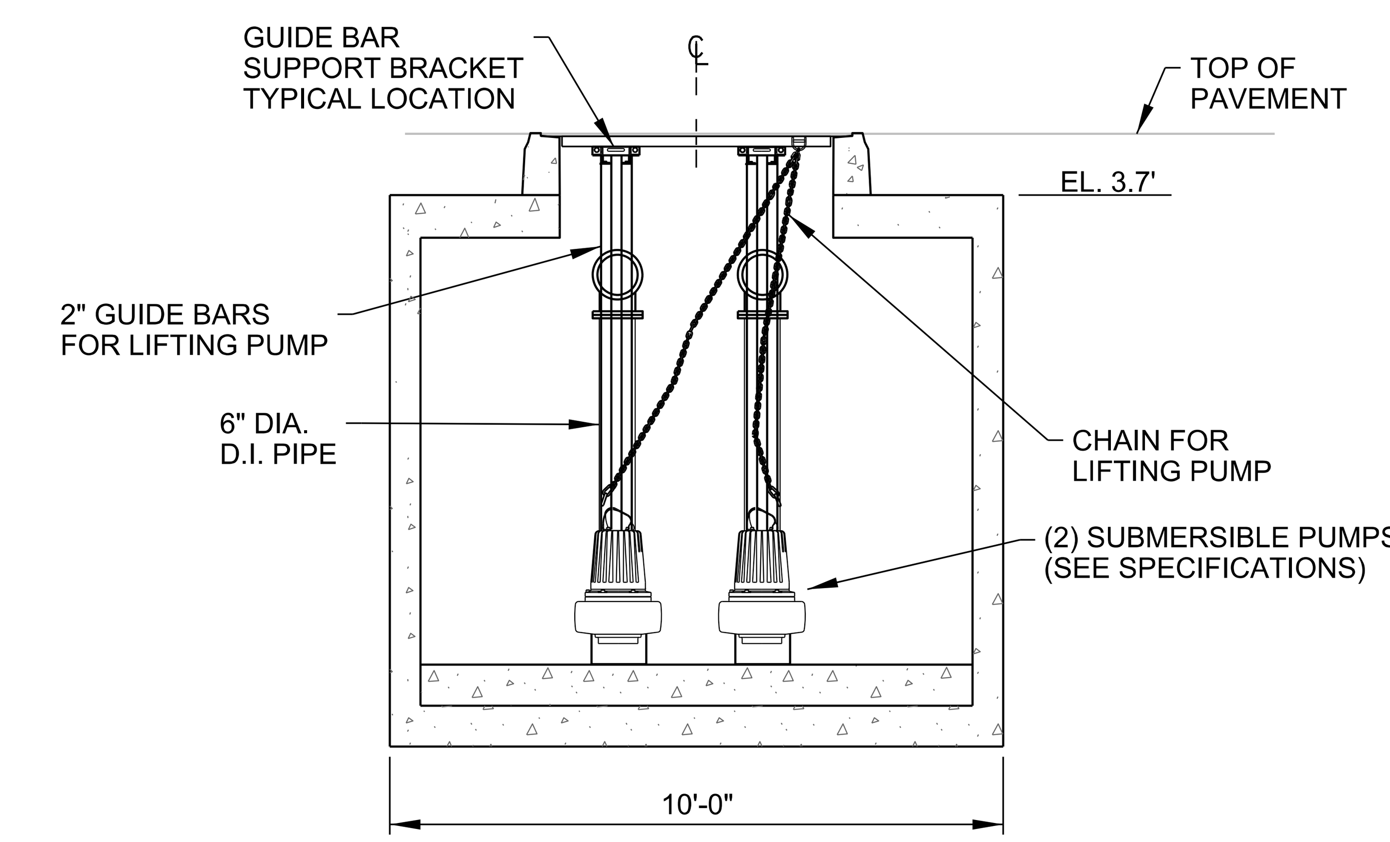
1. PROVIDE NON-CLOG SUBMERSIBLE PUMPS AS SHOWN AND SPECIFIED. (MODEL FLYGT MODEL NP 3127 LT 3~421, 202 MM IMPELLER DIAMETER OR APPROVED EQUAL)
2. PROVIDE CONCRETE PAD THICKNESS AND ANCHOR BOLTS AS REQUIRED BY THE PUMP MANUFACTURER.
3. PUMP DISCHARGE PIPING AND FITTINGS SHALL BE FLANGED DUCTILE IRON WITH COAL TAR EPOXY COATING. PROVIDE STEEL FLANGED PIPE SECTION THROUGH FLOODWALL PENETRATION. PROVIDE 6" DIA. DRESSER FLEXIBLE COUPLING MODEL 128-W FLANGED ADAPTER OR APPROVED EQUAL AS SHOWN ON THE DRAWING. PROVIDE RESILIENT CONNECTOR AT PRECAST PUMP STATION PENETRATIONS. DETAILS CAN BE FOUND IN SPECIFICATIONS.
4. ALL STAINLESS STEEL USED SHALL BE GRADE 316.
5. PUMP STATION VENT PIPE SHALL BE 8" DIA. SCH 80 PVC. PIPE SHALL PENETRATE THE ROOF OF THE PUMPING STATION AND BE FASTENED TO THE EXISTING STEEL BUILDING OR TO A P.T. 4"x4" POST ADJACENT TO THE BUILDING WITH STAINLESS STEEL STRAPS AS SHOWN.
6. ALL FASTENERS SHALL BE ½" DIA. STAINLESS STEEL.
7. PROVIDE PUMP GUIDE BARS OF 2" DIA. SCHEDULE 40 STAINLESS STEEL PIPE, TWO PER PUMP AS SHOWN. FIELD CUT TO FIT INSTALLATION. PUMP GUIDE BAR SUPPORT BRACKETS SHALL BE STAINLESS STEEL AND SUITABLE FOR ATTACHING THE 2" DIA. SCHEDULE 40 STAINLESS STEEL PIPES TO THE PRECAST CONCRETE PUMP STATION AS SHOWN ON THE CONTRACT DRAWINGS.
8. PROVIDE STILLING PIPE FOR LEVEL PROBE AS SHOWN. STILLING PIPE SHALL BE 8" DIA. PERFORATED SCH 80 PVC OPEN AT BOTH ENDS AND FASTENED TO PUMP STATION WALL WITH THREE STAINLESS STEEL PIPE STRAPS.
9. PROVIDE LEVEL PROBE IN STILLING PIPE AS SHOWN.
10. REFER TO SHEET E-101 FOR PUMP CONTROL PANEL LOCATION.

PUMP SEQUENCE OF CONTROL:

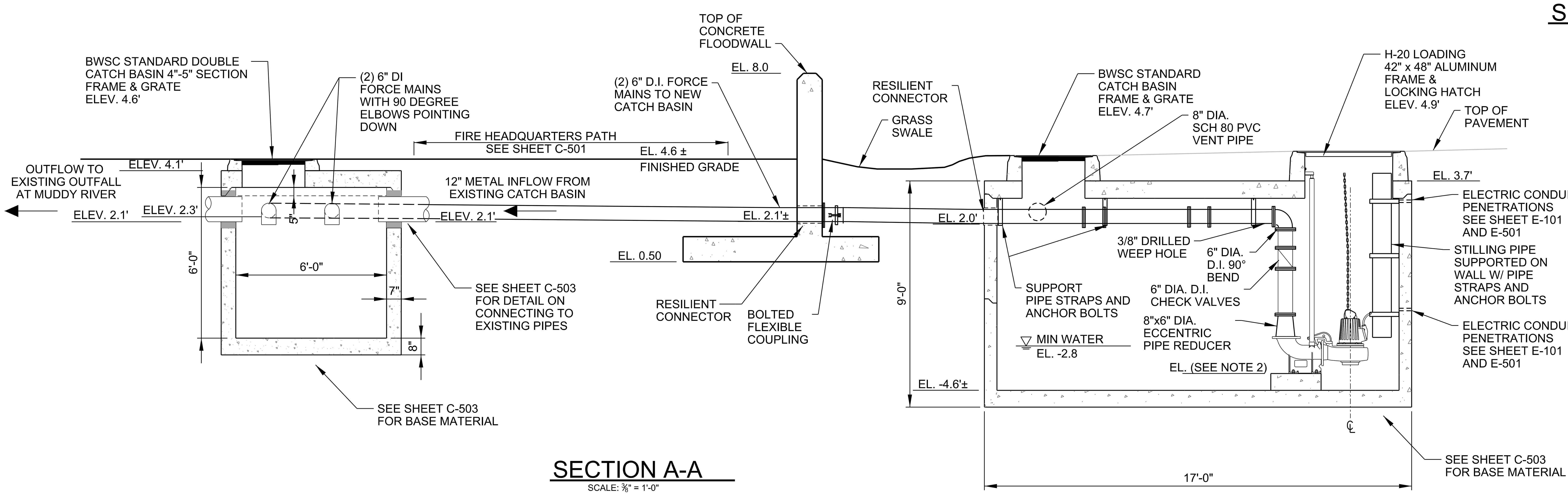
1. EACH PUMP SHALL START AUTOMATICALLY ON ITS HIGH LEVEL SETTING AND STOP ON ITS LOW LEVEL SETTING.

   PUMP #1 SHALL START AT ELEVATION +0.5 AND STOP AT +0.5 WITH A DELAY OF 105 SECONDS OF RUN TIME AFTER STOP
   PUMP #2 SHALL START AT ELEVATION +2.0 AND STOP AT +1.0 WITH A DELAY OF 60 SECONDS OF RUN TIME AFTER STOP

REFER TO SHEET E-602 FOR PUMP SEQUENCE OF CONTROL.



SECTION B-B
SCALE: ⅜" = 1'-0"



SECTION A-A
SCALE: ⅜" = 1'-0"

GRAPHIC SCALE:
⅜" = 1'-0" 4' 0 4'

US Army Corps of Engineers® New England District

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U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: L. THIBODEAU | DWN BY: LT | CKD BY: | SUBMITTED BY: | PLOT SCALE: 3/8" = 1' | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_C-504.dgn | DATE: SEPTEMBER 2016 | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

STORMWATER PUMP STATION DETAILS

SHEET IDENTIFICATION
C-504

SHEET 76 OF 110

SOIL EROSION AND SEDIMENTATION CONTROL

1. THE CONTRACTOR SHALL INSTALL THE SOIL EROSION AND SEDIMENTATION CONTROL MEASURES (HEREINAFTER REFERRED TO AS "CONTROL MEASURES") PRIOR TO THE START OF ANY CONSTRUCTION. CONTROL MEASURES INCLUDE, BUT ARE NOT LIMITED TO, COMPOST FILTER SOCKS AND SILT SACK TRAPS.

2. THE CONTROL MEASURES NOTED HERE AND DEPICTED ON THE CONTRACT DRAWINGS ARE INTENDED TO BE THE MINIMUM REQUIREMENTS TO MEET ANTICIPATED SITE CONDITIONS. AS CONSTRUCTION PROGRESSES AND UNEXPECTED OR SEASONAL CONDITIONS DICTATE, ADDITIONAL CONTROL MEASURES MAY BE NECESSARY TO ENSURE COMPLETE SEDIMENTATION CONTROL ON THE SITE. DURING THE COURSE OF CONSTRUCTION IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY THE CONTRACTOR'S ACTIVITIES AND TO PROVIDE ADDITIONAL CONTROL MEASURES, OVER AND ABOVE THE MINIMUM REQUIREMENTS, AS MAY BE NEEDED TO PROTECT ADJACENT PROPERTIES, SENSITIVE AREAS, NATURAL WATER COURSES, OR STORM DRAINAGE SYSTEMS.

3. THE CONTRACTOR SHALL PERFORM ROUTINE INSPECTION AND MAINTENANCE OF ALL CONTROL MEASURES TO ENSURE PROPER OPERATIONS AND COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE CONTROL MEASURES SHALL BE INSPECTED, AT A MINIMUM, EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM (RAIN) EVENT OF 1/4-INCH OR GREATER.

4. THE CONTRACTOR SHALL SCHEDULE WORK SO AS TO MINIMIZE THE PERIOD OF TIME THAT AN AREA IS DISTURBED AND EXPOSED. THE CONTRACTOR SHALL OBSERVE THE GRADING LIMITS AND LIMITS OF DISTURBANCE IN ACCORDANCE TO THE CONTRACT DRAWINGS. THE CONTRACTOR SHALL PROTECT UNDISTURBED VEGETATIVE AREAS OUTSIDE OF THE WORK LIMITS.

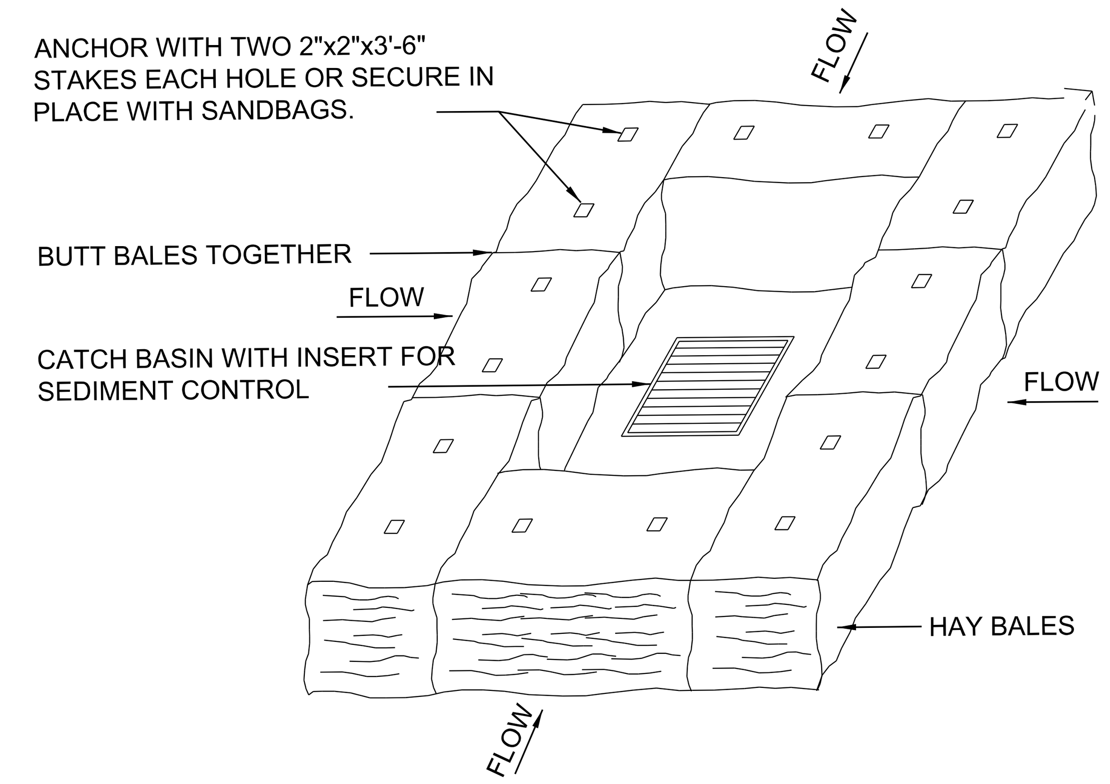
5. THE CONTRACTOR SHALL MAINTAIN THE AREAS OF ENTRANCE AND EXIT TO AND FROM THE SITE AND KEEP IT IN A CONDITION WHICH WILL PREVENT TRACKING OF SEDIMENT AND MUD ONTO PUBLIC RIGHT-OF-WAYS OR OTHER PATHWAYS. ALL SEDIMENT AND MUD TRACKED, WASHED, OR DROPPED SHALL BE REMOVED IMMEDIATELY.

6. THE CONTRACTOR SHALL KEEP ON SITE AT ALL TIMES AN ADDITIONAL QUANTITY OF CONTROL MEASURES FOR INSTALLATION AT THE DIRECTION OF THE COR OR TO MITIGATE AN EMERGENCY CONDITION.

7. MATERIAL STOCKPILES SHALL BE STABILIZED WITH VEGETATIVE GROWTH OR MATTED WITH STRAW DURING THE NON-GROWING SEASON TO PREVENT WIND AND WATER EROSION. A TEMPORARY SEDIMENT BARRIER SHALL ENCOMPASS ALL EARTHEN MATERIAL STOCKPILES.

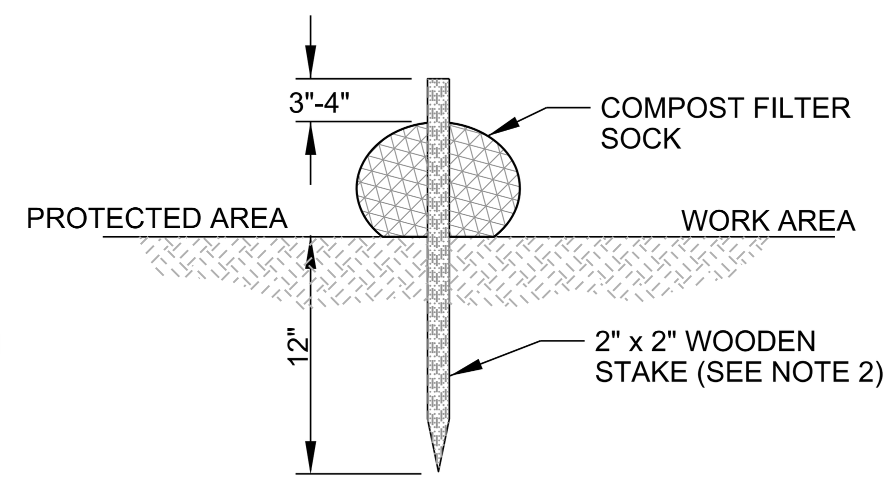
8. ALL DISTURBED AREAS OUTSIDE OF PAVED AREAS SHALL BE RESTORED WITHIN 15 DAYS OF FINISH GRADING. PROPOSED VEGETATIVE AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. DURING THE NON-GROWING SEASON, TEMPORARY STABILIZATION SHALL BE PROVIDED USING STRAW MATTING.

9. FOLLOWING COMPLETE SITE RESTORATION AND STABILIZATION, ALL CONTROL MEASURES SHALL BE REMOVED FROM THE SITE. ALL SEDIMENTATION COLLECTED SHALL BE DISPOSED OF OFF SITE. THE EXISTING CATCH BASINS SHALL BE PUMPED AND CLEANED.



HAYBALE FILTER AT CATCH BASIN

SCALE: NOT TO SCALE

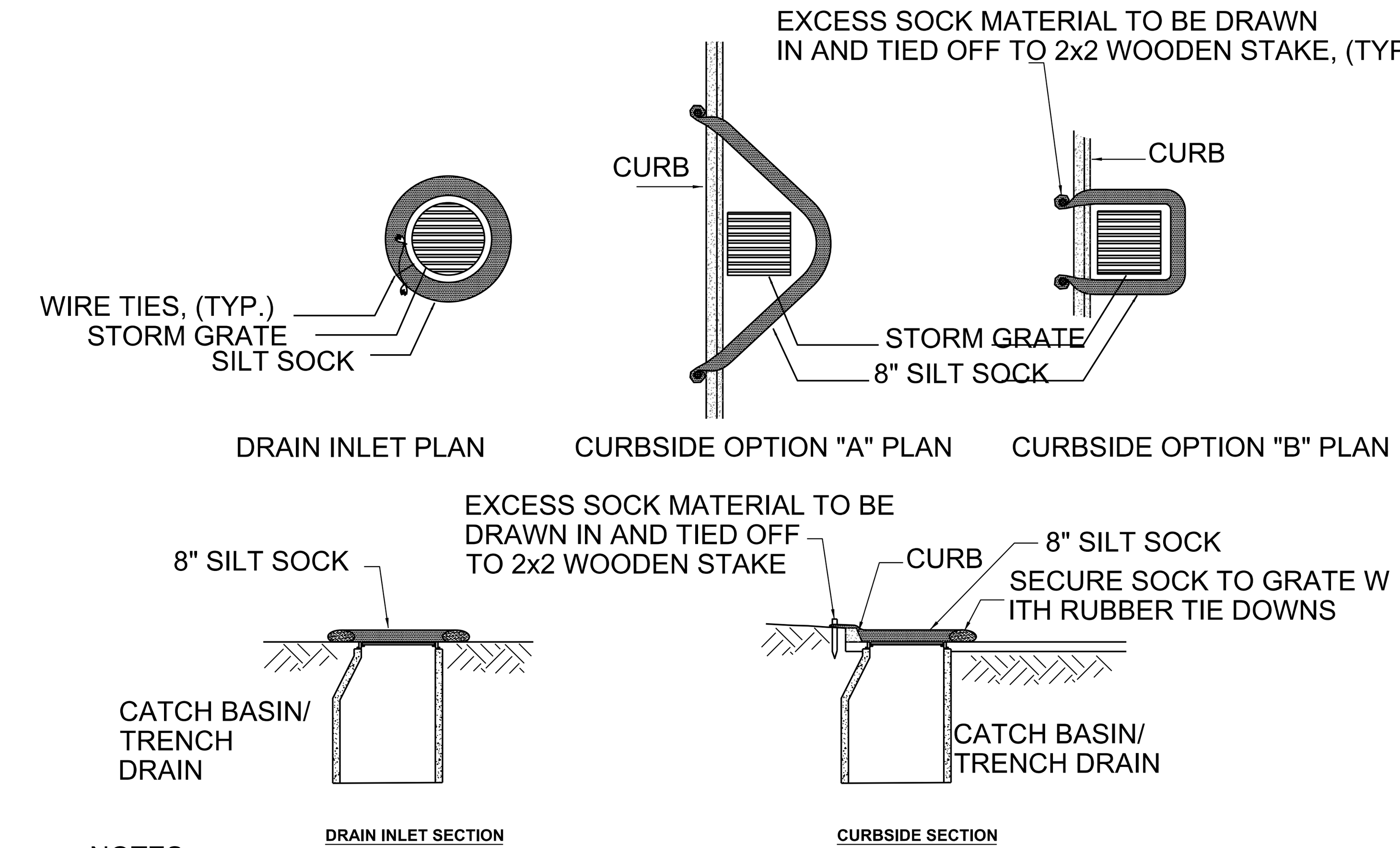


NOTES:

1. BOTTOM OF COMPOST FILTER SOCK SHALL BE IN FULL CONTACT WITH THE GROUND ALONG ITS ENTIRE LENGTH.
2. WOODEN STAKES SHALL BE SPACED EVERY 10' ALONG ENTIRE LINEAR LENGTH OF COMPOST FILTER SOCK.

COMPOST FILTER SOCK DETAIL

NOT TO SCALE



NOTES:
1. ALL MATERIAL TO MEET SILT SOCK SPECIFICATIONS.

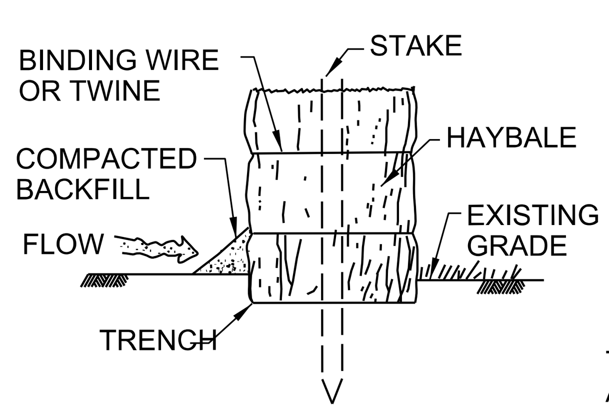
2. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.

3. ALL MATERIAL TO BE REMOVED FROM SITE ONCE SITE HAS BEEN STABILIZED.

4. CONTRACTOR SHALL INSPECT EROSION CONTROL AFTER EACH RAIN EVENT AND REPAIR IF REQUIRED.

SILT SOCK AT CATCHBASIN DETAIL

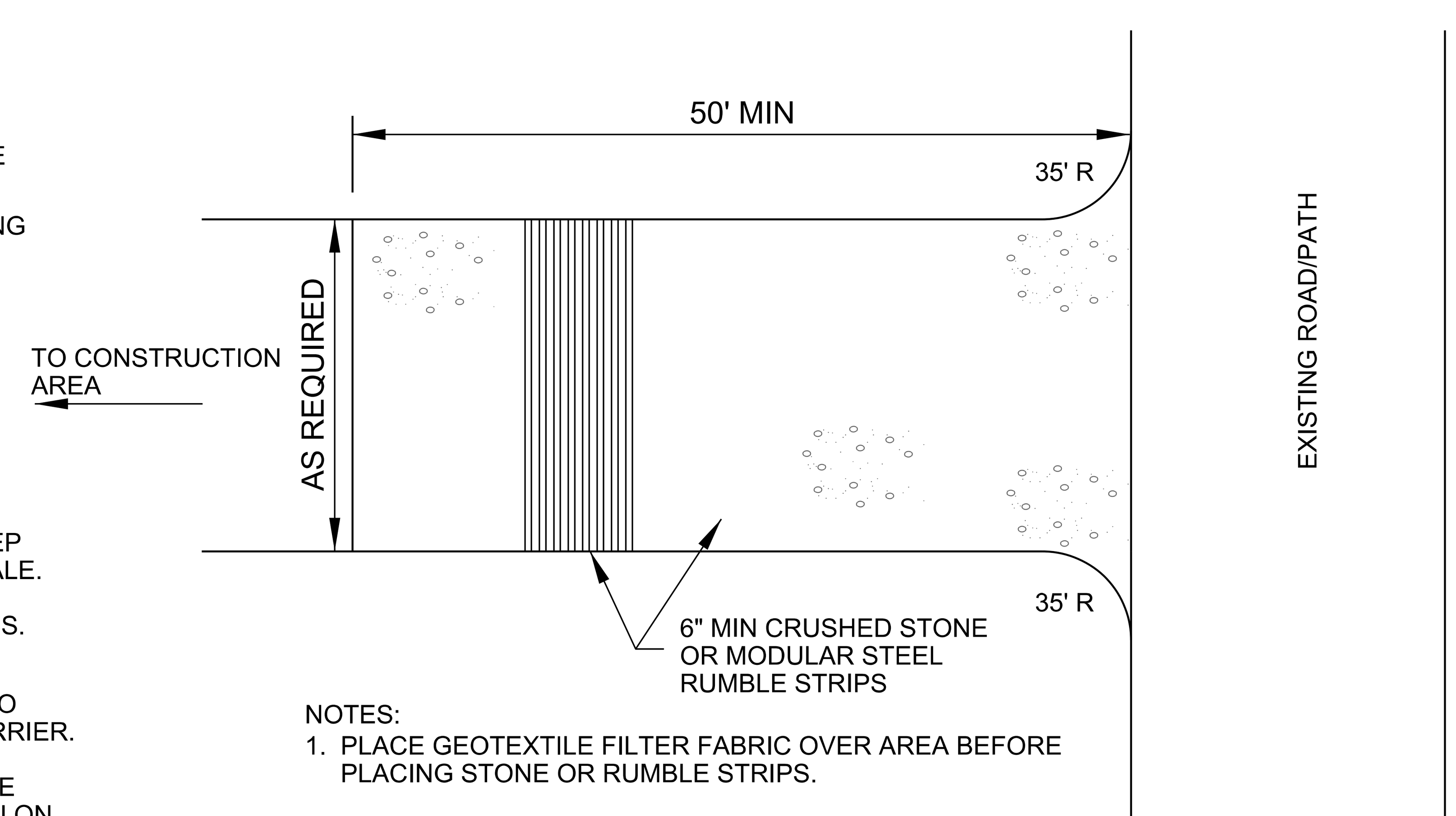
N.T.S



STAKED HAYBALE

NOTES:

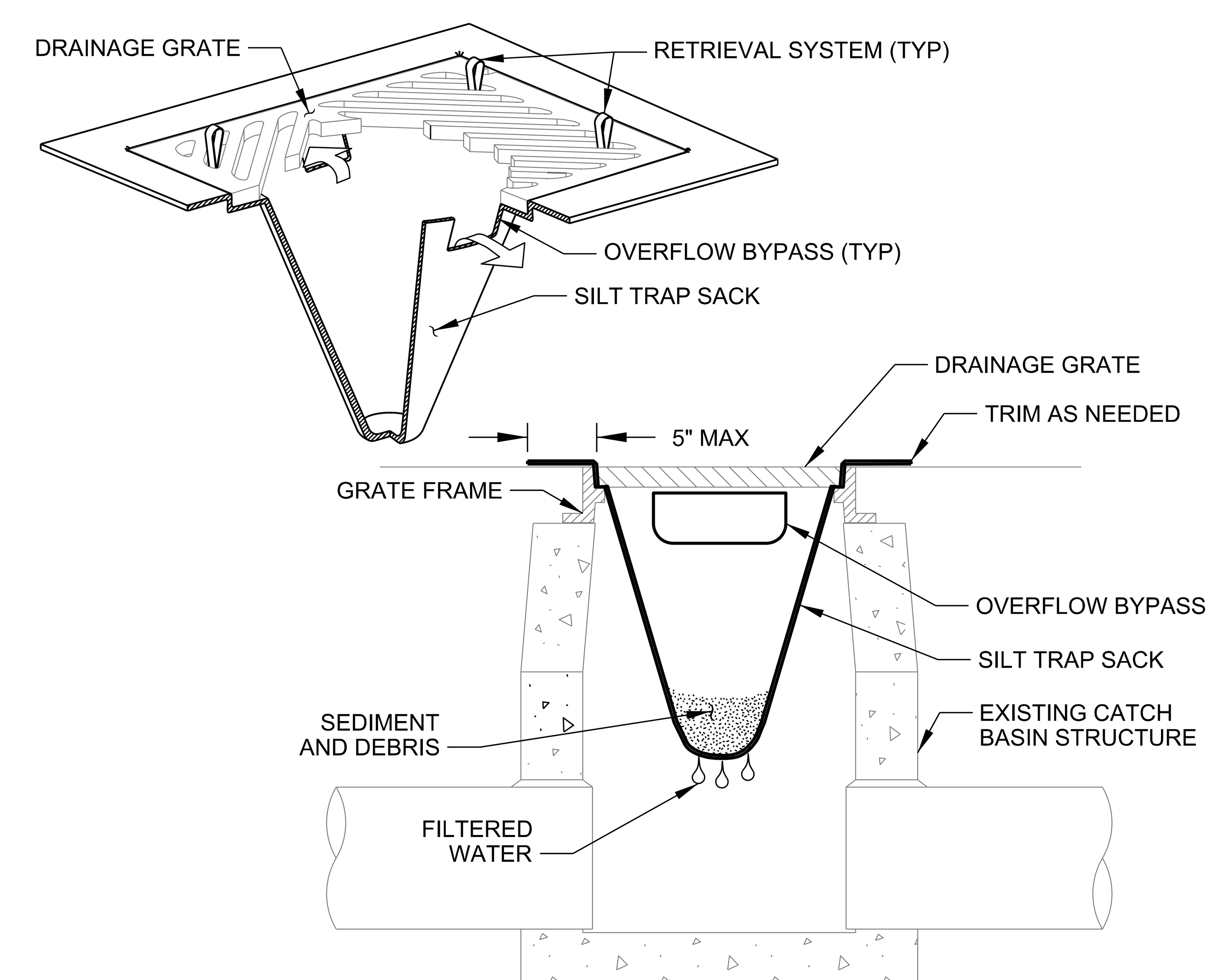
1. EXCAVATE A TRENCH 4" DEEP AND THE WIDTH OF A HAYBALE.
2. PLACE AND STAKE HAYBALES. TWO STAKES PER BALE.
3. WEDGE LOOSE HAYBALES TO CREATE A CONTINUOUS BARRIER.
4. BACKFILL AND COMPACT THE EXCAVATED SOIL AS SHOWN ON THE UPHILL SIDE OF THE BARRIER TO PREVENT PIPING.



NOTES:
1. PLACE GEOTEXTILE FILTER FABRIC OVER AREA BEFORE PLACING STONE OR RUMBLE STRIPS.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO UNDISTURBED ROAD/PATH AND AS INDICATED IN THE ORDER OF CONDITIONS. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE OR CLEANING OF THE RUMBLE STRIPS.
3. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO UNDISTURBED ROAD/PATH SHALL BE REMOVED AS DIRECTED BY THE COR.
4. STABILIZED ENTRANCE SHALL NOT INTERFER WITH ADA COMPLIANCY ON EXISTING SIDEWALKS.
5. TEMPORARY FENCING GATES SHALL NOT BLOCK EXISTING SIDEWALKS.

STABILIZED CONSTRUCTION ENTRANCE

SCALE: N.T.S.



NOTES:

1. GEOTEXTILE SHALL BE A BLACK NON-BIODEGRADABLE POLYPROPYLENE WOVEN MONOFILAMENT FABRIC STABILIZED TO RESIST DEGRADATION DUE TO ULTRAVIOLET LIGHT. FABRIC SHALL ALSO BE RESISTANT TO SOIL CHEMICALS, MILDEW, AND INSECTS.

2. REQUIRED PROPERTIES: PUNCTURE = 120 LBS; UV RESISTANCE = 80%; APPARENT OPENING SIZE (AOS) = 40 US STD. SIEVE; PERMITTIVITY = 0.05 SEC-1; AND WATER FLOW RATE = 60 GPM/FT.

SILT TRAP SACK (INLET PROTECTION) DETAIL

NOT TO SCALE

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

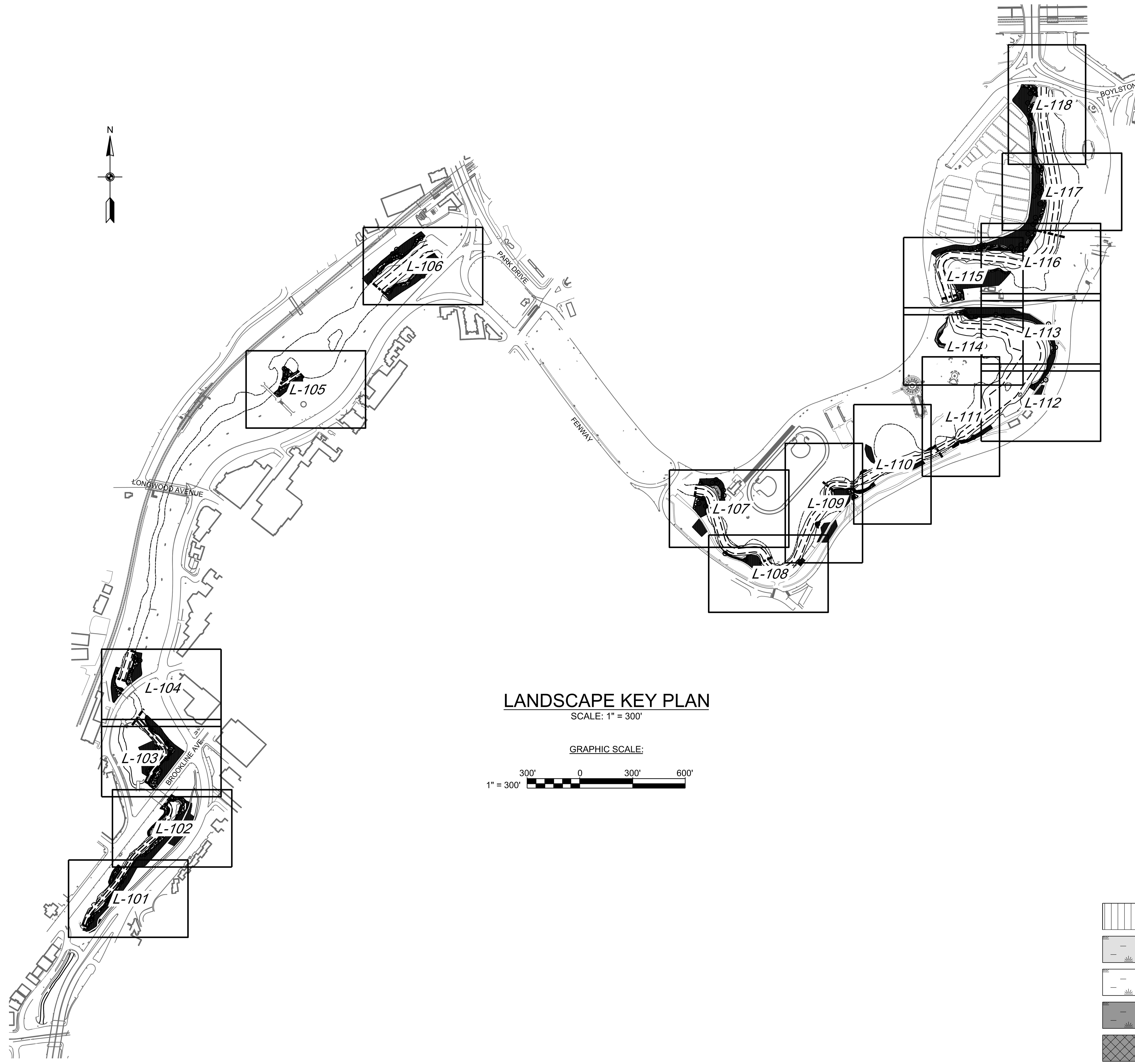
DESIGNED BY: L. THIBODEAU | DWN BY: LT | CKD BY: | SUBMITTED BY: | PLOT SCALE: N.T.S. | PLOT DATE: | SIZE: ANSI D | FILE NAME: MUD-2_C-505.dgn | DATE: | SOLICITATION NO.: | CONTRACT NO.: | DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

EROSION & SEDIMENT CONTROL PLAN

SHEET IDENTIFICATION
C-505

1 2 3 4 5



LANDSCAPE KEY PLAN

SCALE: 1" = 300'

GRAPHIC SCALE:

1" = 300' — 300' 0 300' 600'

LANDSCAPE GENERAL NOTES:

1. ALL DESIGNATED RESTORED AREAS TO BE CLEAR & GRUBBED OF ALL SHRUBS AND VEGETATION. TREES WITHIN THE RESTORED AREAS OF 4" CALIPER OR LESS TO BE REMOVED AND STUMPED.
2. EXISTING TREES ARE NOT SHOWN ON THE LANDSCAPE DRAWINGS. LARGER TREES WITHIN THE RESTORATION AREA TO BE REMOVED AND STUMPED ARE SHOWN ON THE CIVIL DRAWINGS (CD101 TO CD111).
3. ALL LARGER TREES (>4"CALIPER) TO BE REMOVED SHALL BE MARKED AT ITS BASE WITH TREE PAINT. THE NEED TO REMOVE EACH TREE SHALL BE CONFIRMED BY THE CONTRACTING OFFICER PRIOR TO REMOVAL.
4. NO TREES SHALL BE PLANTED WITHIN 20 FEET OF EXISTING TREES UNLESS INSTALLATION IS APPROVED BY THE CONTRACTING OFFICER.
5. THE CONTRACTING OFFICER, AFTER CONSULTING WITH THE PROJECT SPONSORS, MAY REQUIRE THE CONTRACTOR TO REMOVE DEAD OR DYING TREES WITHIN THE WORK AREA. PROMPT REMOVAL OF HAZARDOUS LIMBS OR BRANCHES MAY ALSO BE REQUIRED BY THE CONTRACTING OFFICER.
6. WETLAND TREATMENT AREAS

   TREATMENT "A": SEED WITH NEW ENGLAND WETLAND PLANTS "WET MIX"OR APPROVED EQUAL (EL. 1.3 TO EL. 2.3).

   TREATMENT "B": WETLAND SHELF, PLANT WITH PICKEREL WEED PLUGS AT 18" CENTERS FROM EL. 0.8 TO THE WATER LINE (EL. 1.3±).

   TREATMENT AREA "C": WETLAND SHELF, PLANT WITH THREE ROWS OF SWEET FLAG AT 18" CENTERS FROM EL. 0.8 TO THE WATER LINE (EL. 1.3±). SWEET FLAG SHALL NOT BE PLANTED IN WATER DEEPER THAN 6 INCHES UNLESS DIRECTED BY THE CONTRACTING OFFICER.

   TREATMENT AREA "D": HABITAT SHELF, NO PLANTINGS (EL. 0.3 TO EL. 0.8).
7. OTHER AREAS TO BE SEEDED

   LOAM AND SEED (TURF) - USE APPROPRIATE SUN OR SHADE MIX AS DIRECTED BY THE LANDSCAPE ARCHITECT OR RESTORATION SPECIALIST.

   RESTORED AREAS PLANTED WITH SHRUB MASS BETWEEN EL. 1.3 AND EL. 2.3 - SEED AREAS BETWEEN SHRUBS NOT PROTECTED WITH MULCH WITH 15 LBS/ACRE RIVERBANK WILD RYE.

   RESTORED AREAS PLANTED WITH TREES AND SHRUBS ABOVE EL. 2.3 - SEED AREAS NOT PROTECTED WITH MULCH WITH UPLAND CONSERVATION MIX.
8. WEEDING

   AREAS PLANTED WITH SHRUBS SHALL BE WEEDED TO REMOVE WEEDS WHICH COULD OVERTOP AND SHADE SHRUB PLANTINGS. SPECIES REQUIRING REMOVAL INCLUDE, BUT ARE NOT LIMITED TO, MUGWORT, BURDOCK, POKEWEED, AND COMMON HAWKWEED.
9. RESTORATION

   THE EXTENT OF RESTORATION REQUIRED MAY VARY FROM THE EXTENT SHOWN ON THE DRAWINGS BASED ON ACTUAL CONSTRUCTION MEANS AND METHODS. THE CONTRACTOR WILL BE RESPONSIBLE FOR RESTORING ALL AREAS DISTURBED BY CONSTRUCTION, INCLUDING AREAS DISTURBED NEAR PATHWAYS AND SIDEWALKS NOT SHOWN ON THE LANDSCAPE PLANS. IF ADDITONAL CLEARING OF TREES AND SHRUBS IS PROPOSED BY THE CONTRACTOR AND APPROVED BY THE CONTRACTING OFFICER AND PROJECT SPONSORS, A PLANTING PLAN MUST BE SUBMITTED FOR APPROVAL AND IMPLEMENTED FOR THESE AREAS.
10. HABITAT LOGS

    THREE HABITAT LOGS SHALL BE INSTALLED WITHIN EACH WETLAND SHELF AS SHOWN ON THE PLANS. AN ADDITIONAL 30 HABITAT LOGS (NOT SHOWN) SHALL BE INSTALLED ALONG THE RIVERWAY AND BACK BAY FENS SHORELINE, EXCLUSIVE OF WETLAND SHELF AREAS. SPECIFIC LOCATIONS OF THESE HABITAT LOGS SHALL BE PROPOSED BY THE RESTORATION SPECIALIST AND APPROVED BY THE CONTRACTING OFFICER. APPROXIMATELY 1/3 OF EACH HABITAT LOG SHALL BE PLACED ON THE BANK ABOVE THE NORMAL WATER LEVEL (EL. 1.3). HABITAT LOGS SHALL BE ANCHORED AS INDICATED IN THE SPECIFICATIONS.

LANDSCAPE PLAN LEGEND:

- NEW LOAM AND SEED
- WETLAND TREATMENT AREA "A"
- WETLAND TREATMENT AREA "B" WETLAND SHELF
- WETLAND TREATMENT AREA "C" WETLAND SHELF
- WETLAND TREATMENT AREA "D" HABITAT SHELF
- WORK LIMITS
- WATERLINE
- NEW TREE
- NEW PLANTING
- HABITAT LOG

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CONCORD, MASSACHUSETTS

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SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: 1:1 | PLOT DATE: | DRAWING CODE: MUD-2
SIZE: ANSI D | FILE NAME: MUD-2_L-100.dgn

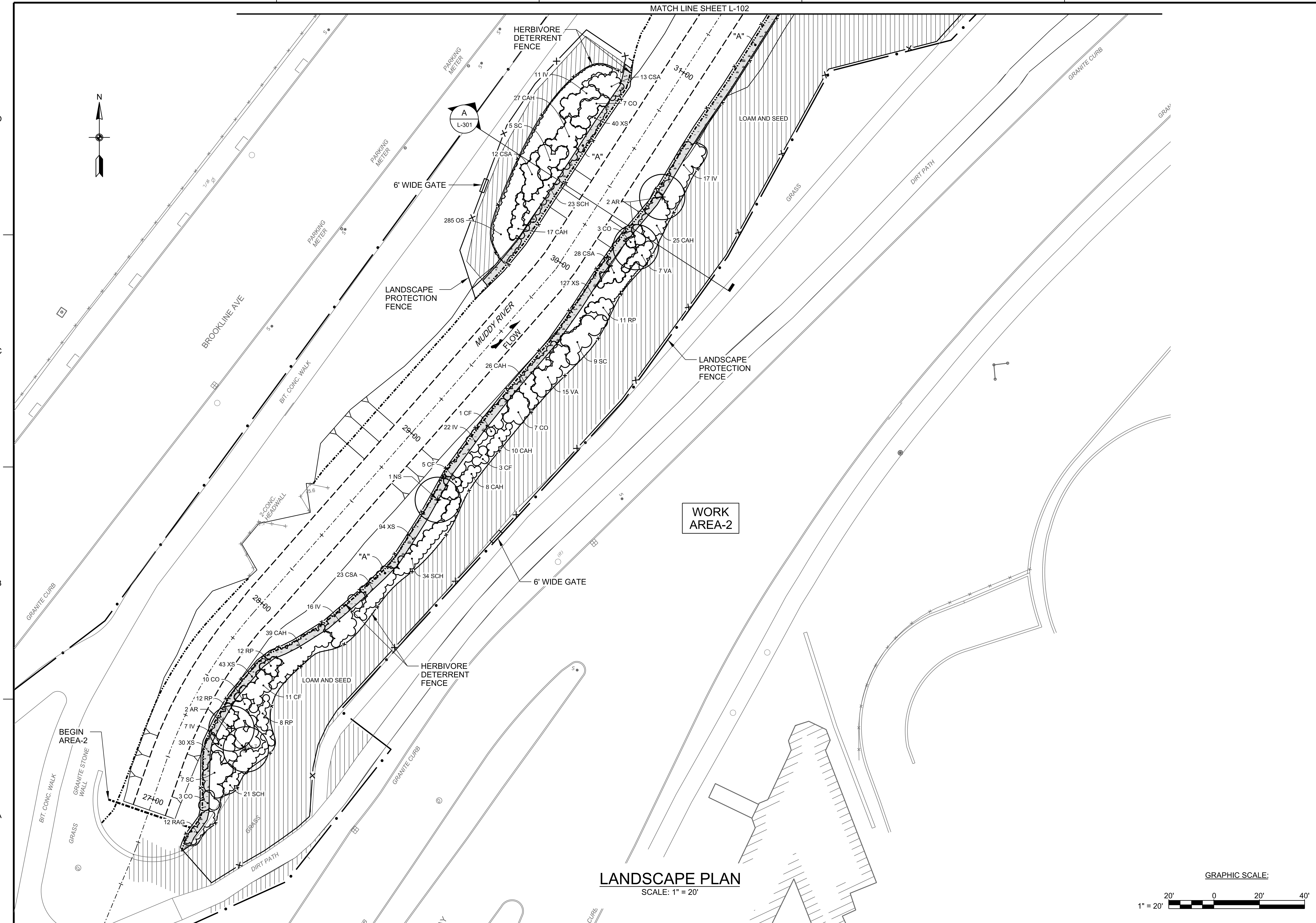
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE KEY PLAN

SHEET IDENTIFICATION
L-100

SHEET 78 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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SIZE: ANSI D
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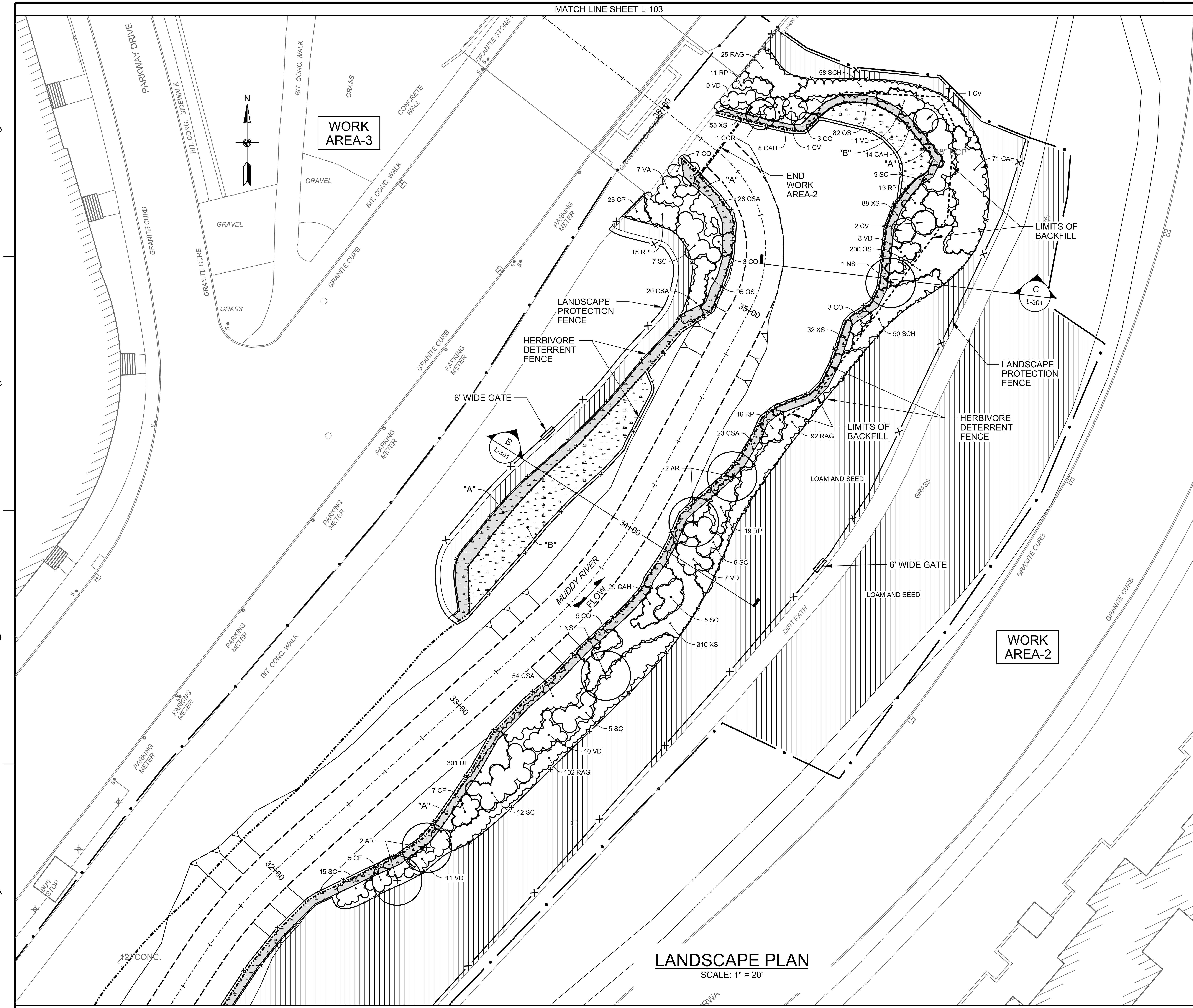
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-101
SHEET 79 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

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U. S. ARMY CORPS OF ENGINEERS
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PLOT SCALE: 1:1	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_L-102.dgn	

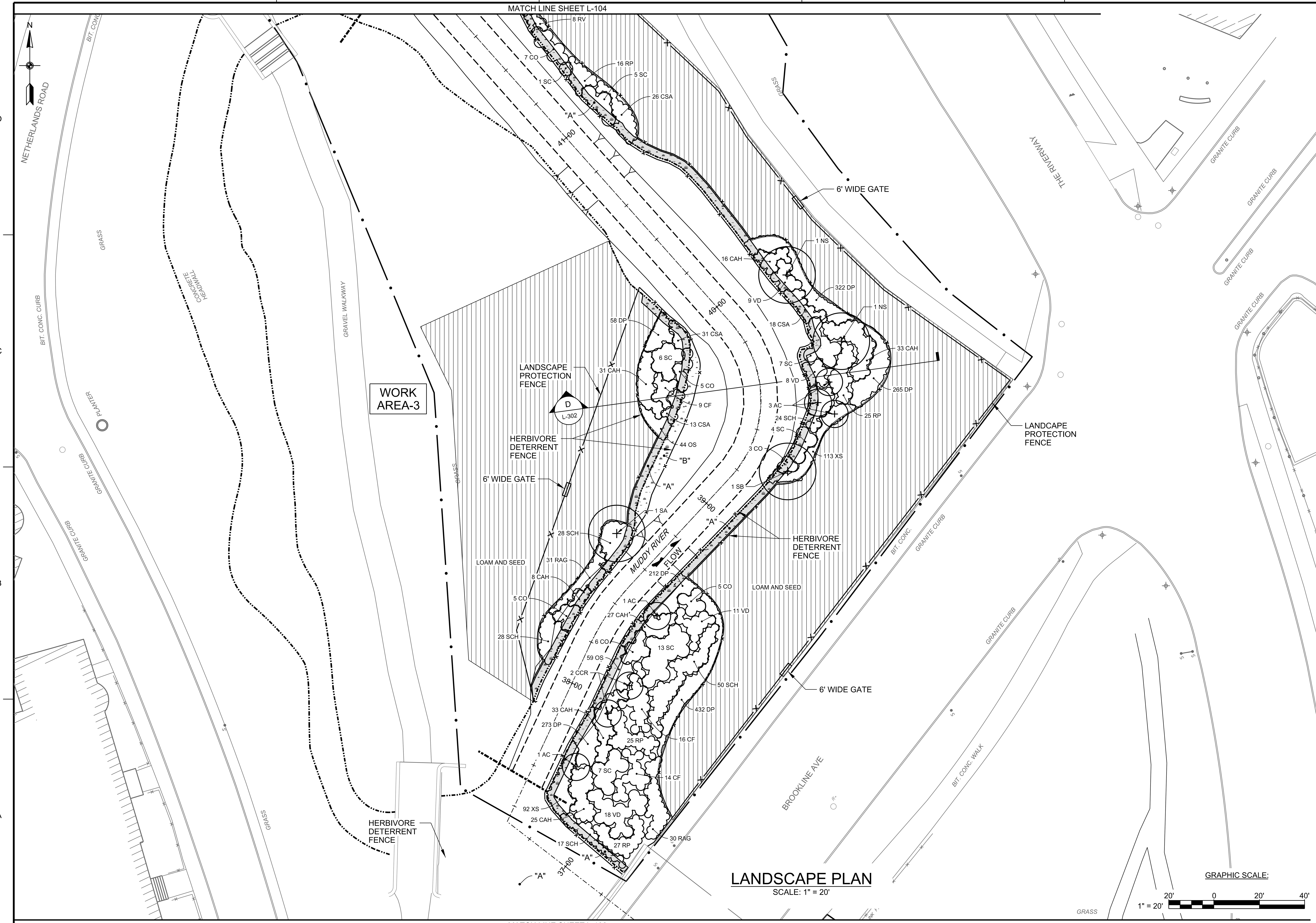
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-102

SHEET 80 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

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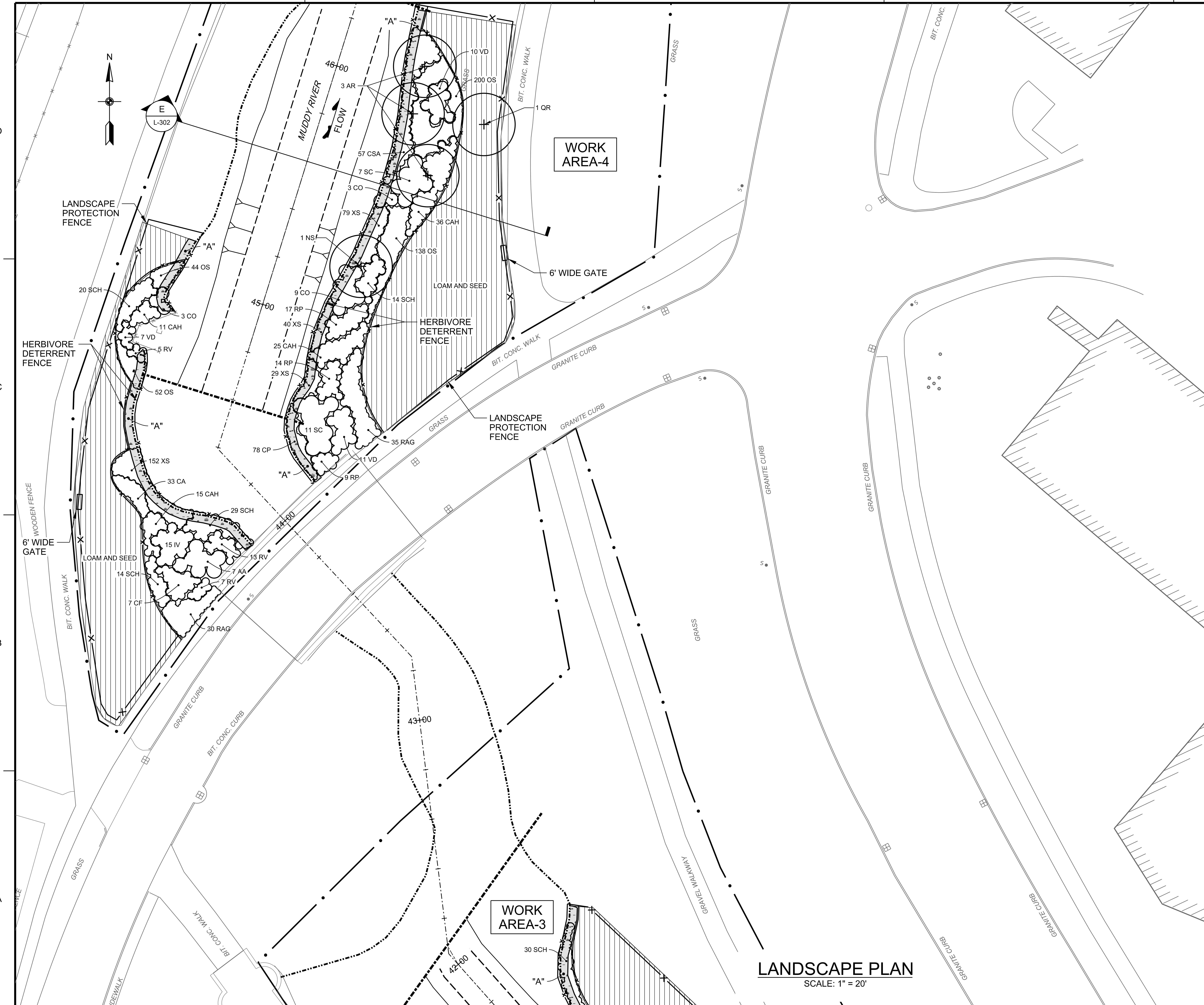
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-103

SHEET 81 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

MATCH LINE SHEET L-103

GRAPHIC SCALE:

20' 0 20' 40'

1" = 20'

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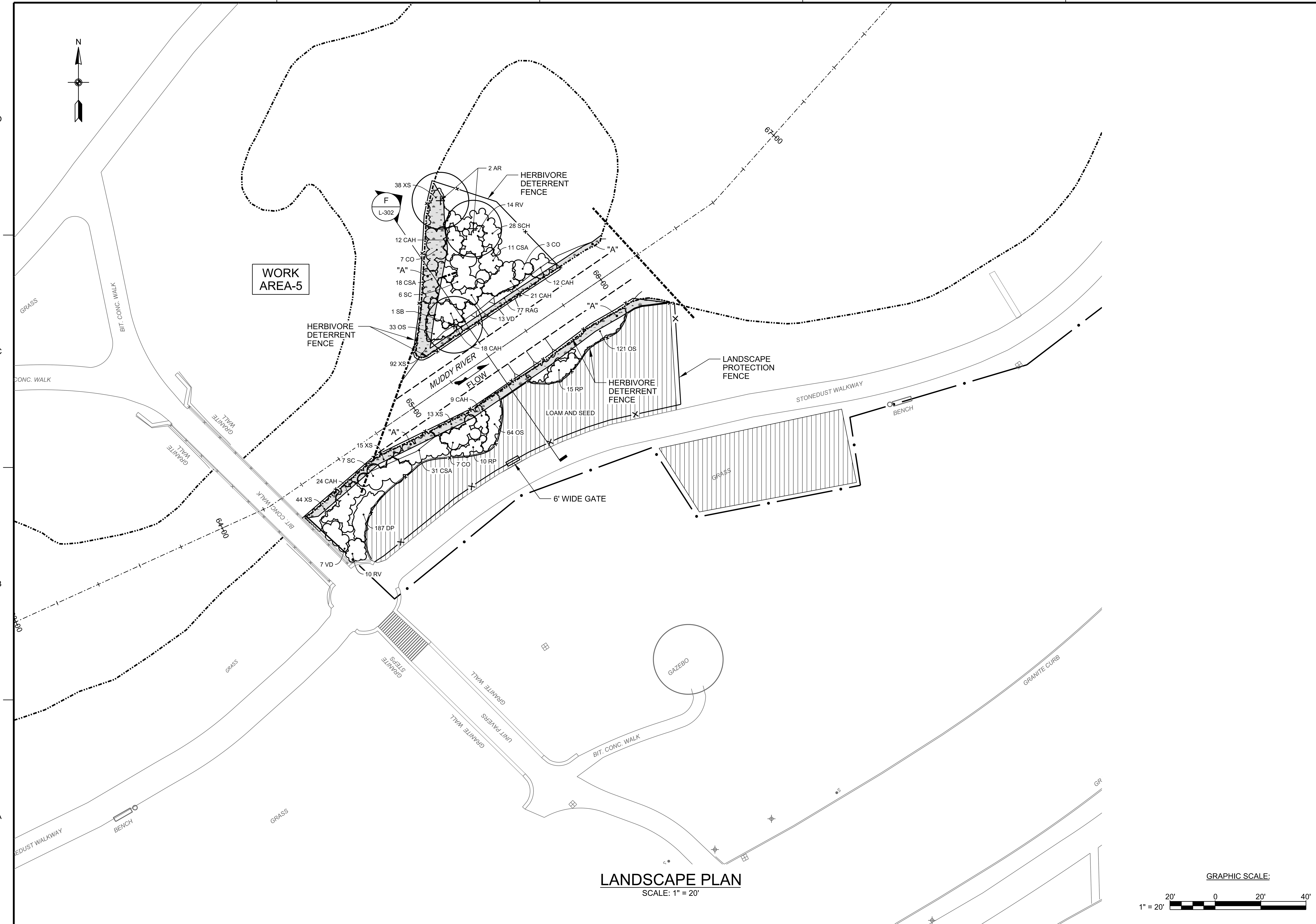
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-104

SHEET 82 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

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CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-105

SHEET 83 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION

LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

US Army Corps of Engineers® New England District

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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DRAWING CODE: MUD-2

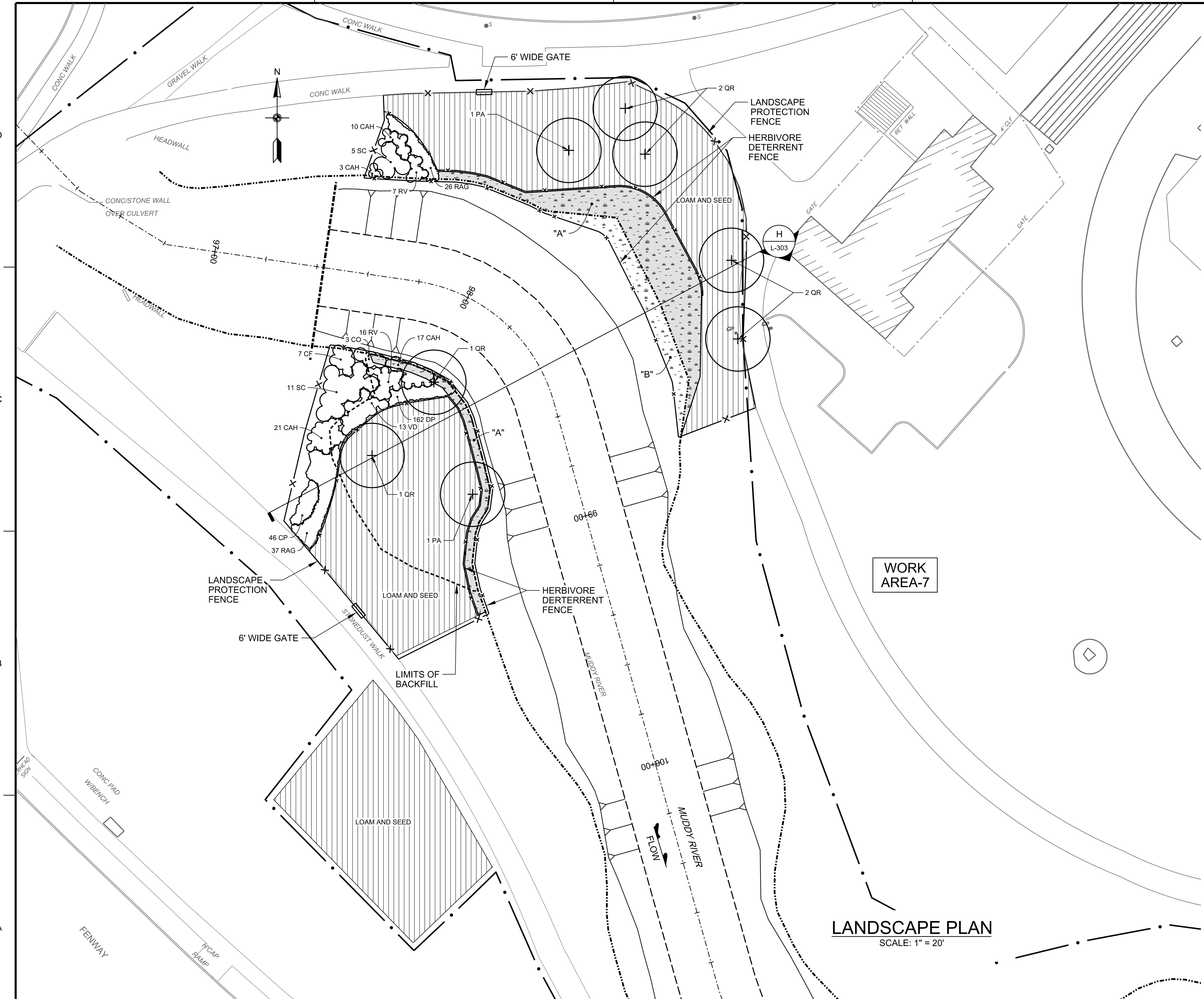
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-106

SHEET 84 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

MATCH LINE SHEET L-108

GRAPHIC SCALE:

1" = 20' — 20' 0 20' 40'

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U. S. ARMY CORPS OF ENGINEERS
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CONCORD, MASSACHUSETTS

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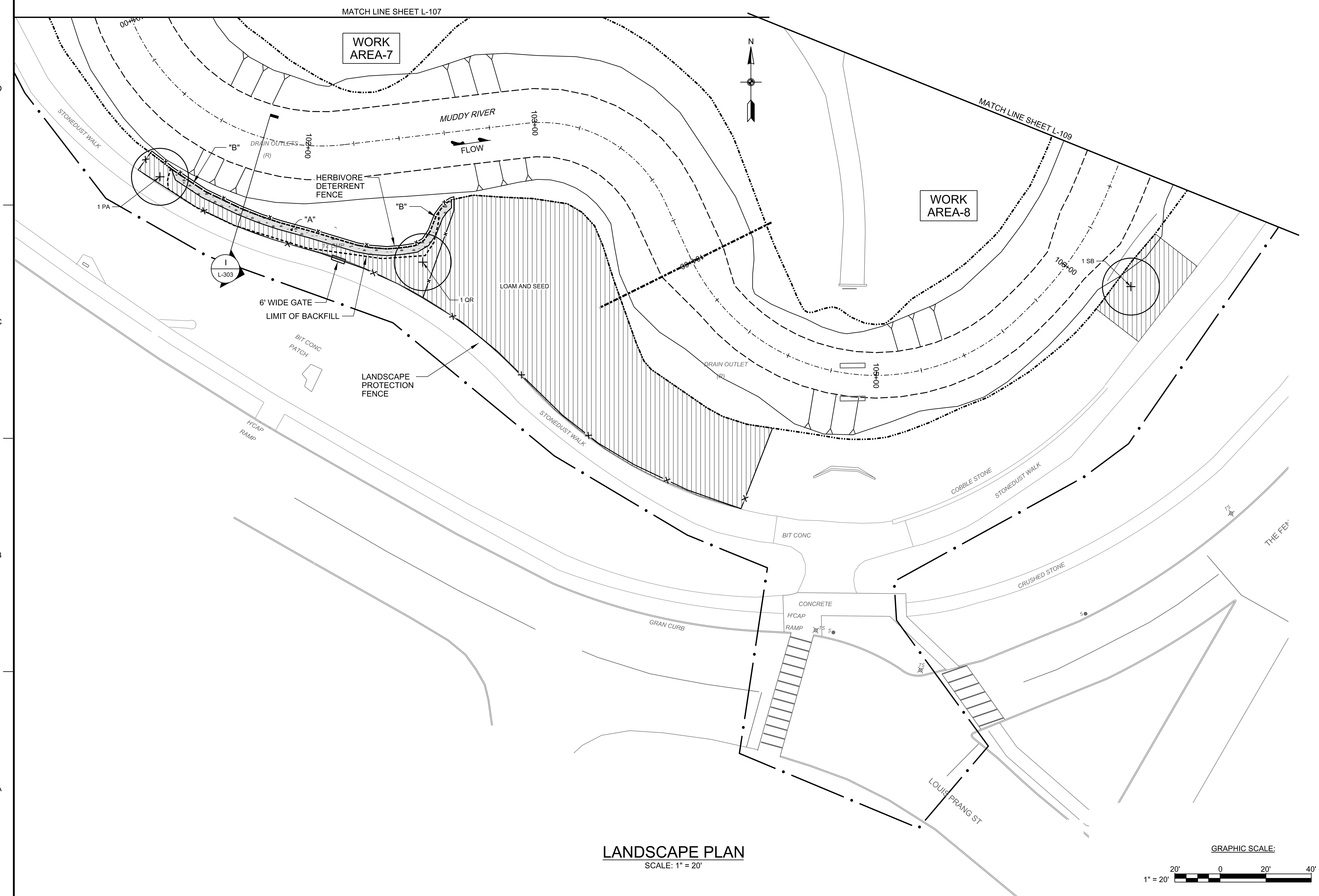
SIZE: ANSI D	FILE NAME: MUD-2_L-107.dgn		

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-107

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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SUBMITTED BY:		CONTRACT NO.:
PLOT SCALE: 1:1	PLOT DATE:	DRAWING CODE: MUD-2
SIZE: ANSI D	FILE NAME: MUD-2_L-108.dgn	

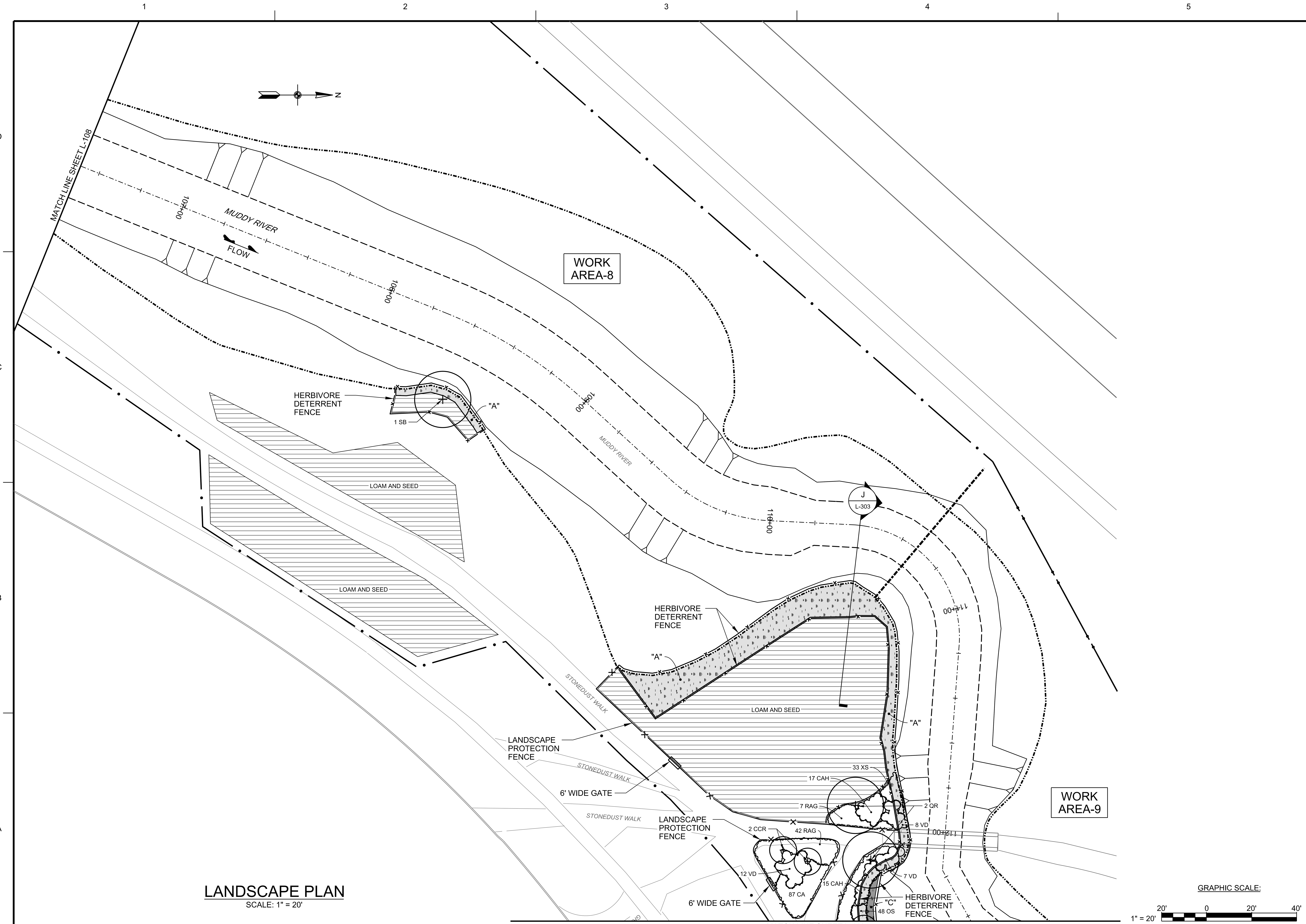
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-108

SHEET 86 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

US Army Corps of Engineers®
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SIZE: ANSI D | FILE NAME: MUD-2_L-109.dgn

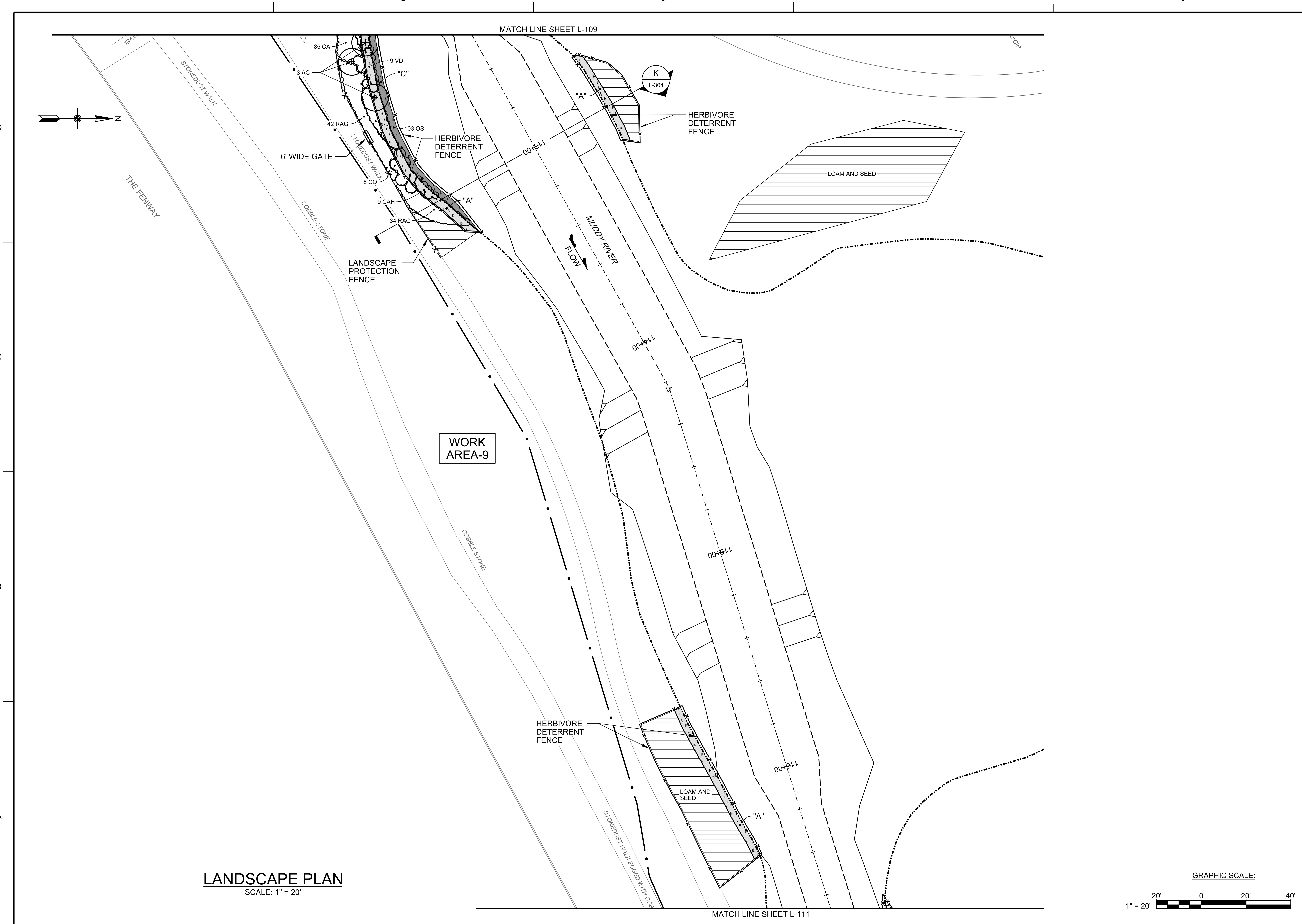
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-109

SHEET 87 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

US Army Corps of Engineers® New England District

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MARK	DESCRIPTION	DATE	APPR.

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CONCORD, MASSACHUSETTS

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PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-110.dgn
DATE:
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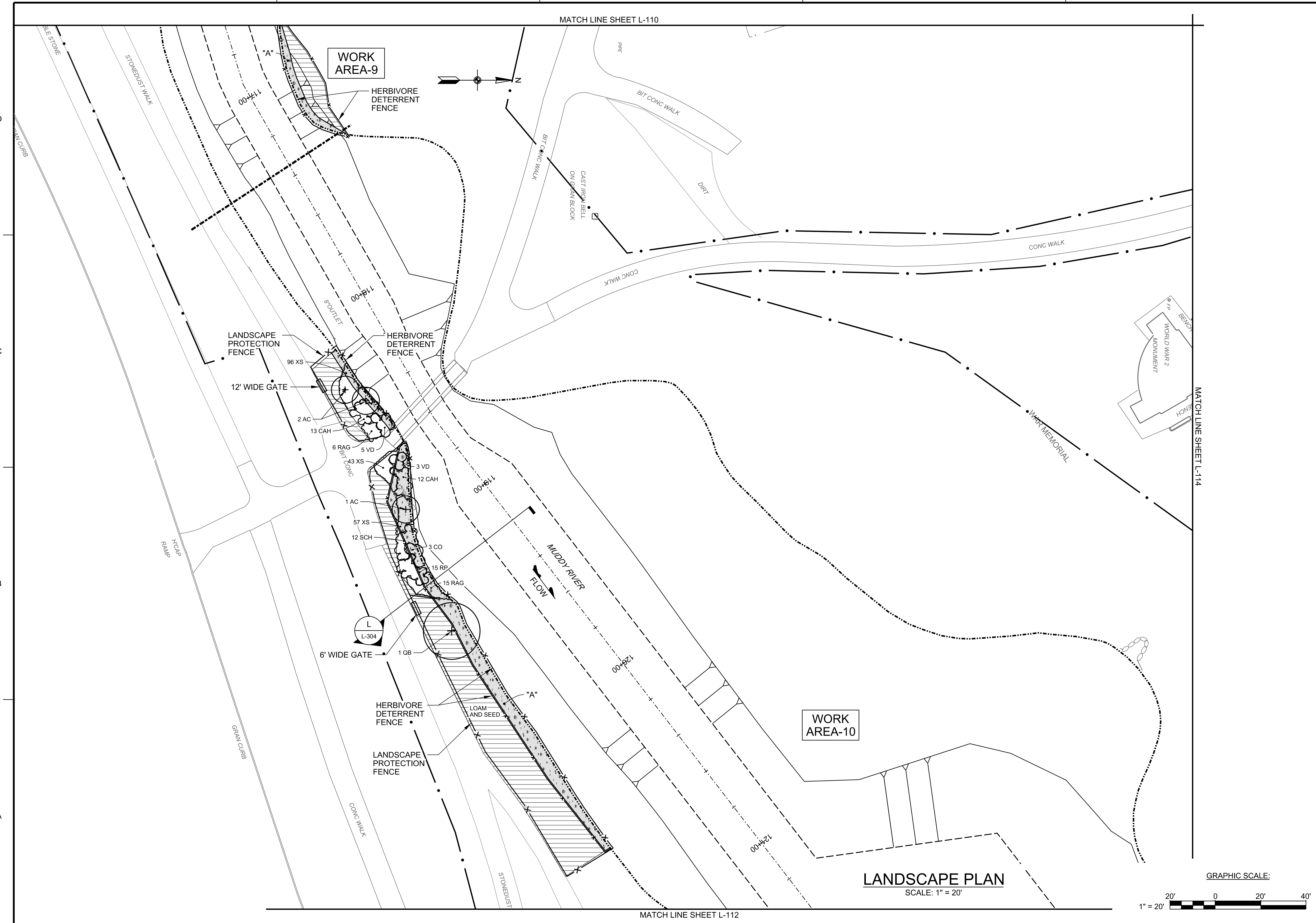
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-110

PRELIMINARY-NOT FOR CONSTRUCTION



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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-111.dgn
DRAWING CODE: MUD-2

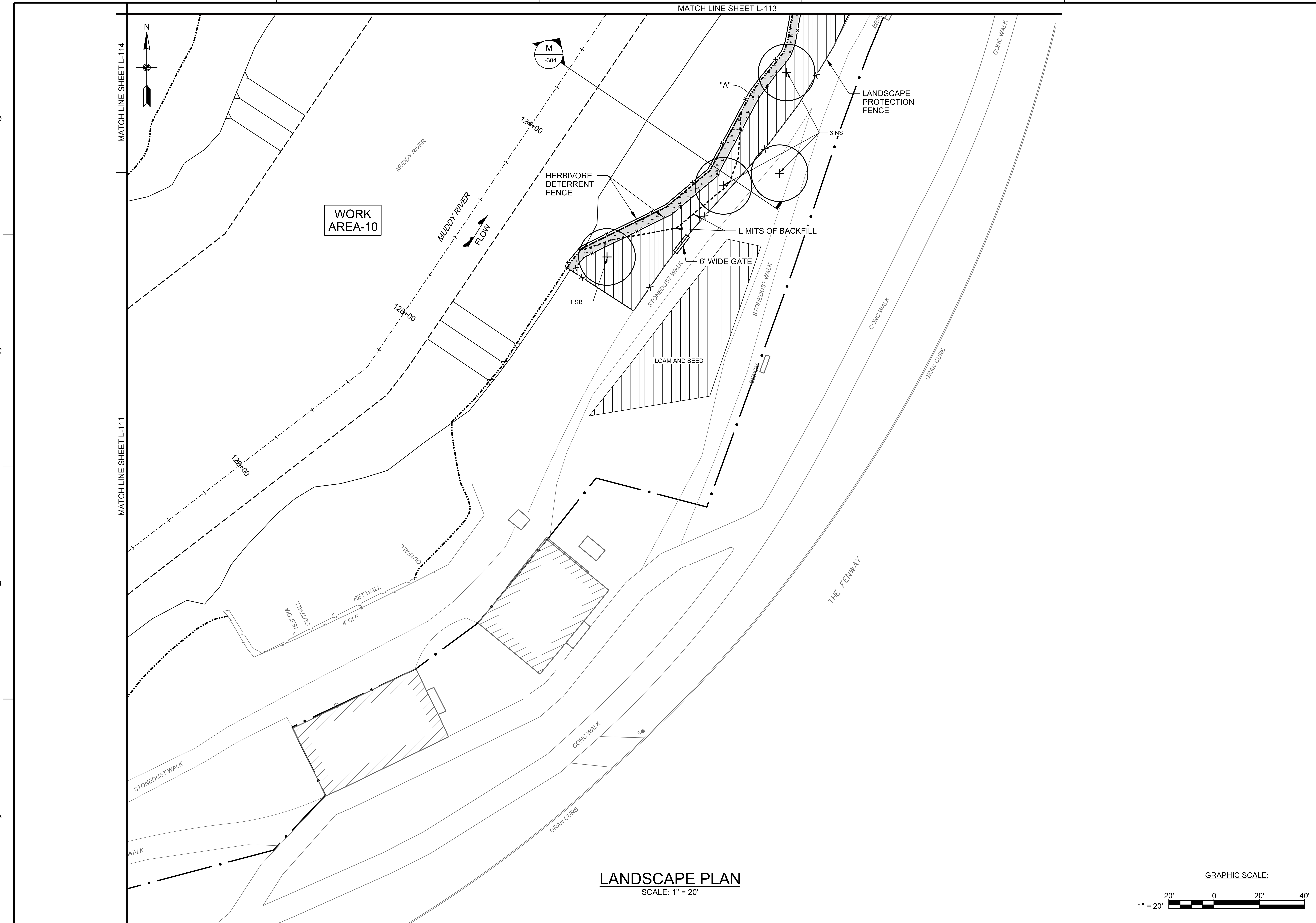
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-111

SHEET 89 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

20' 0 20' 40'

1" = 20'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

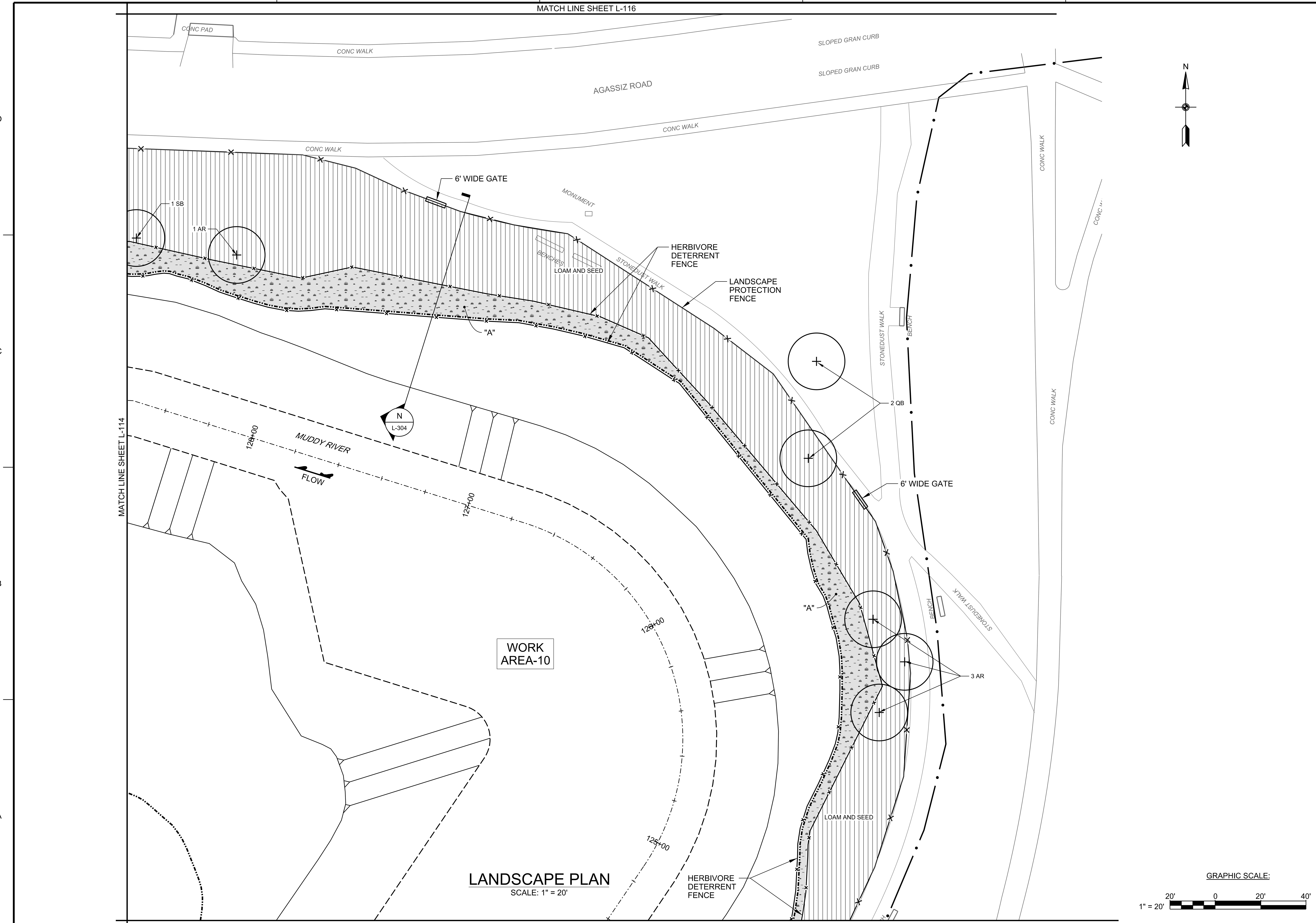
DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-112.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-112
SHEET 90 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

20' 0 20' 40'

1" = 20'

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
SIZE: ANSI D
PLOT DATE:
FILE NAME: MUD-2_L-113.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

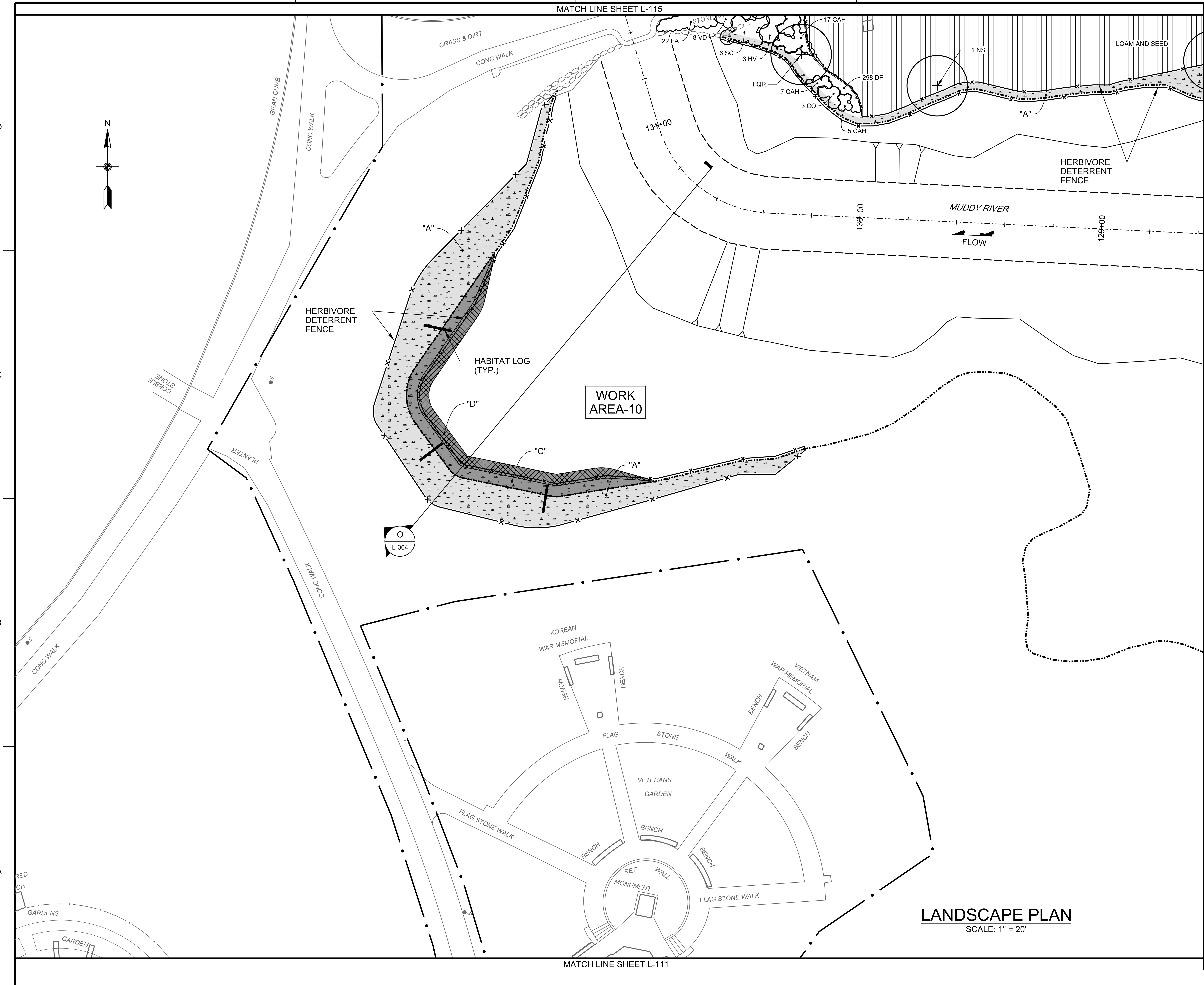
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-113

SHEET 91 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-114.dgn
DRAWING CODE: MUD-2

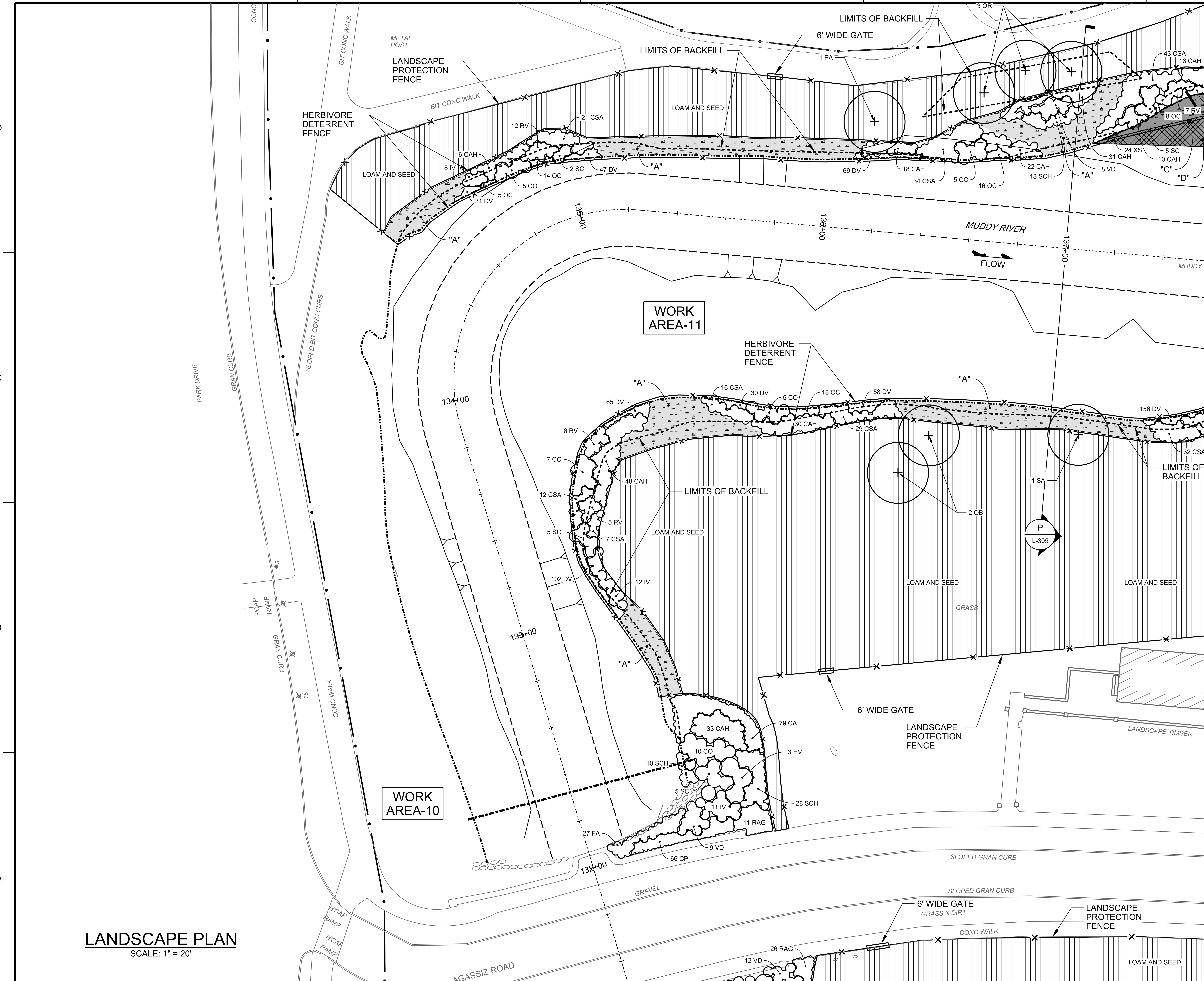
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-114

SHEET 92 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' 20' 0 20' 40'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
FILE NAME: MUD-2_L-115.dgn
SIZE: ANSI D
DRAWING CODE: MUD-2

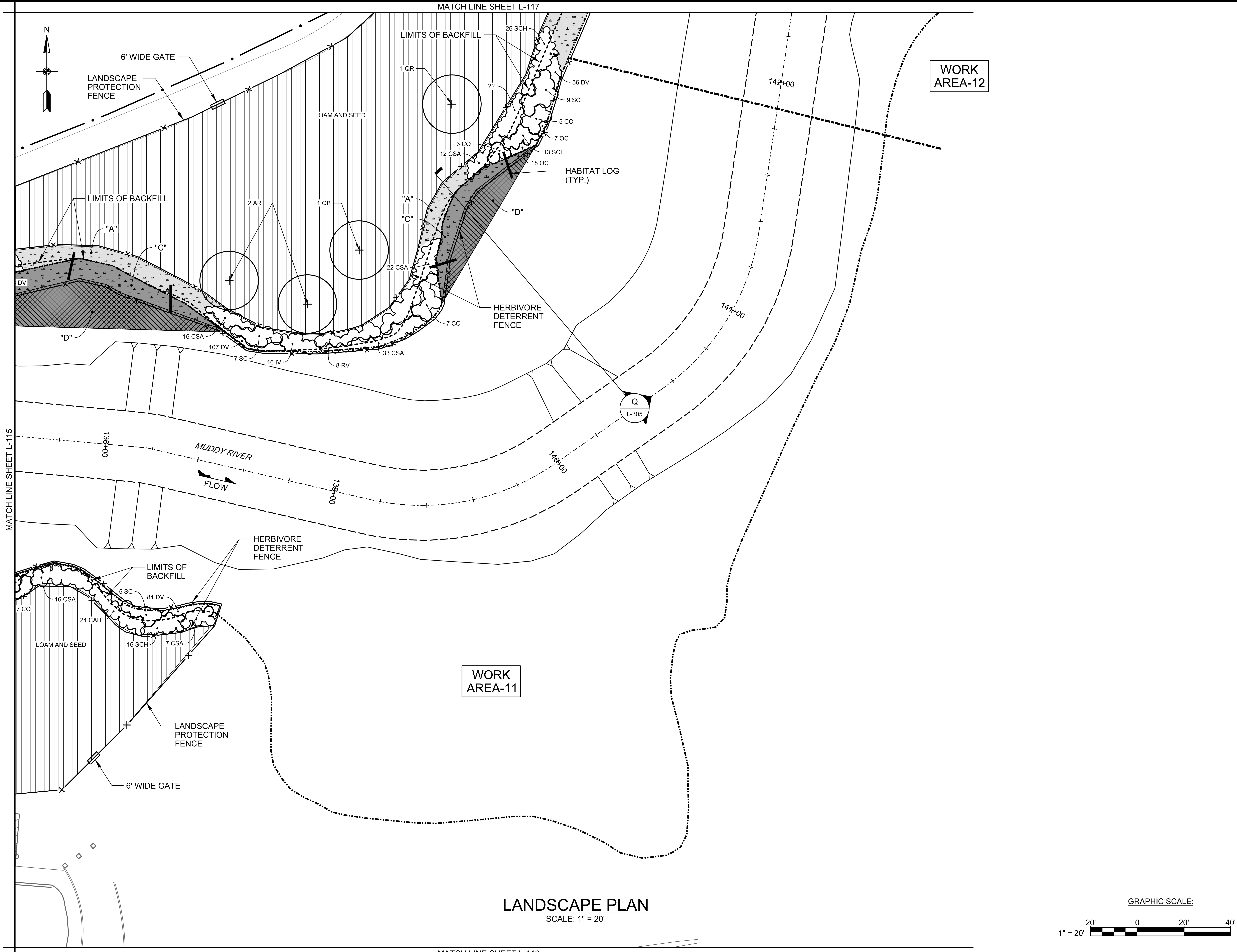
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-115

SHEET 93 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-116.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

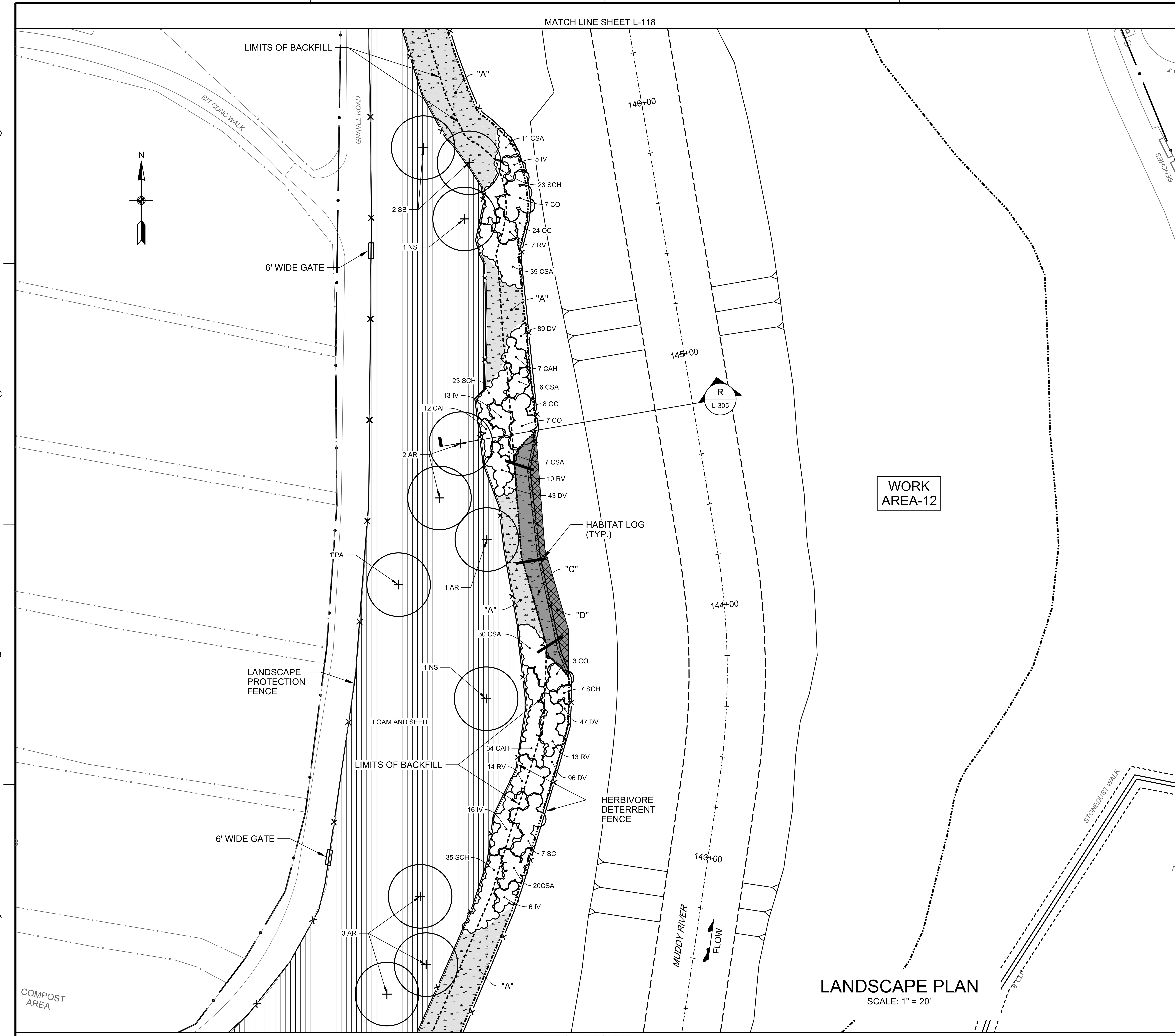
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET IDENTIFICATION
L-116

SHEET 94 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

20' 0 20' 40'

1" = 20'

US Army Corps
of Engineers®
New England
District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO	DATE: JUNE 2017		
DWN BY: SAF	CKD BY:	SOLICITATION NO.:	
SUBMITTED BY:		CONTRACT NO.:	
PLOT SCALE: 1:1	PLOT DATE:	DRAWING CODE: MUD-2	
SIZE: ANSI D	FILE NAME: MUD-2_L-117.dgn		

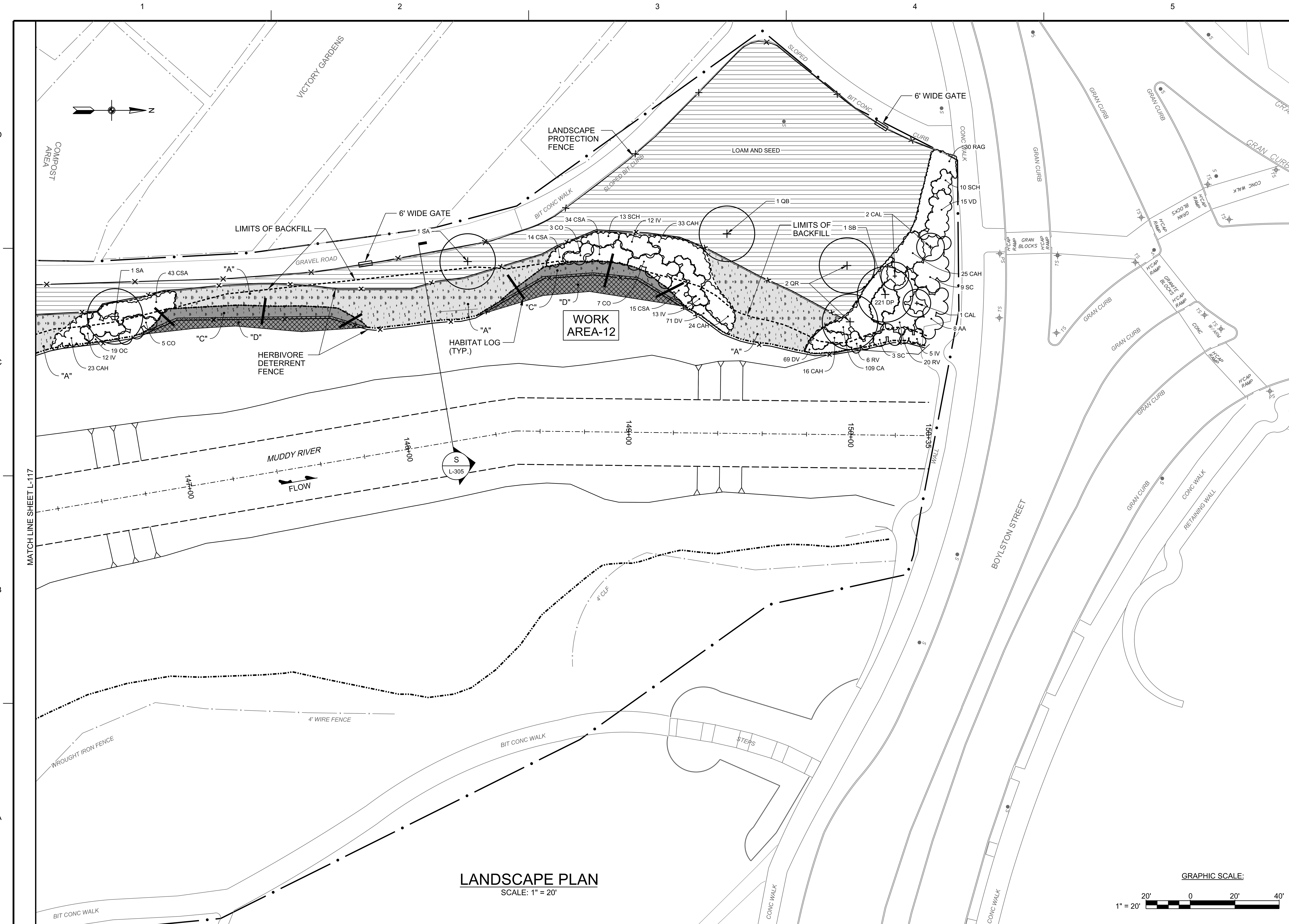
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

SHEET
IDENTIFICATION
L-117

SHEET 95 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION



LANDSCAPE PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:

1" = 20' — 20' 0 20' 40'

US Army Corps of Engineers® New England District

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-118.dgn

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

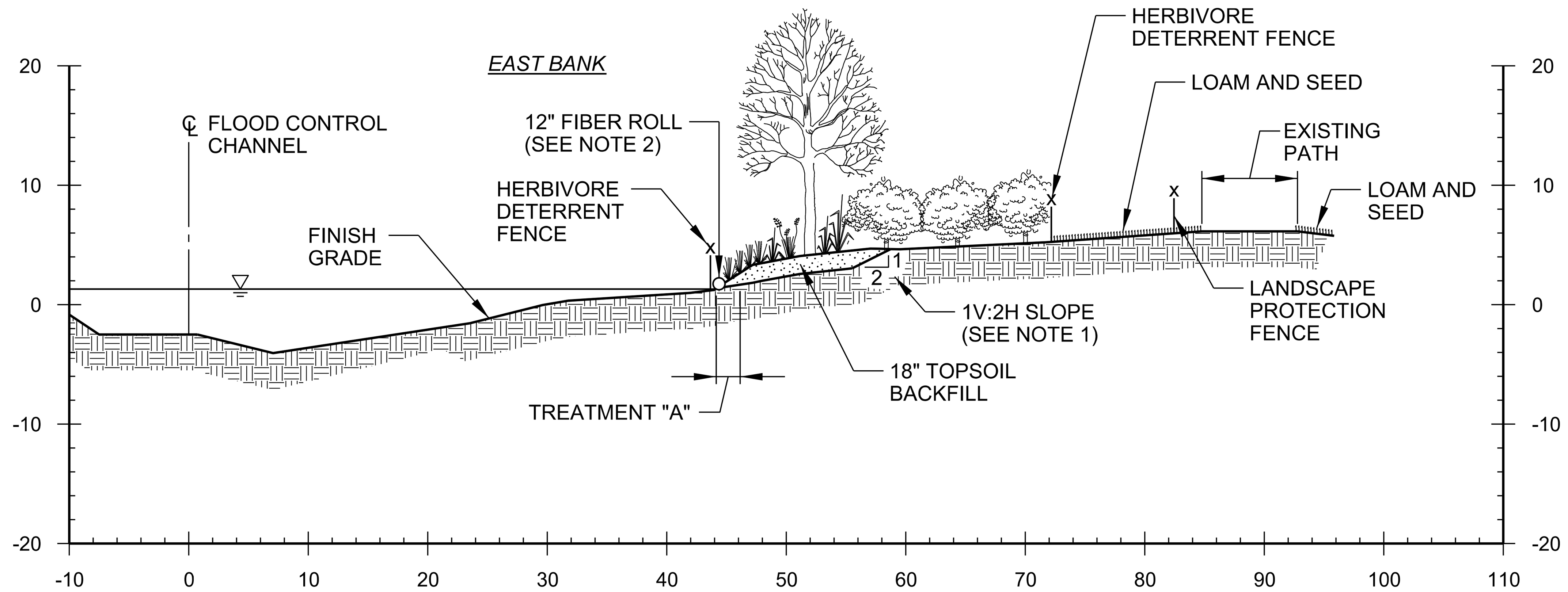
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE PLAN

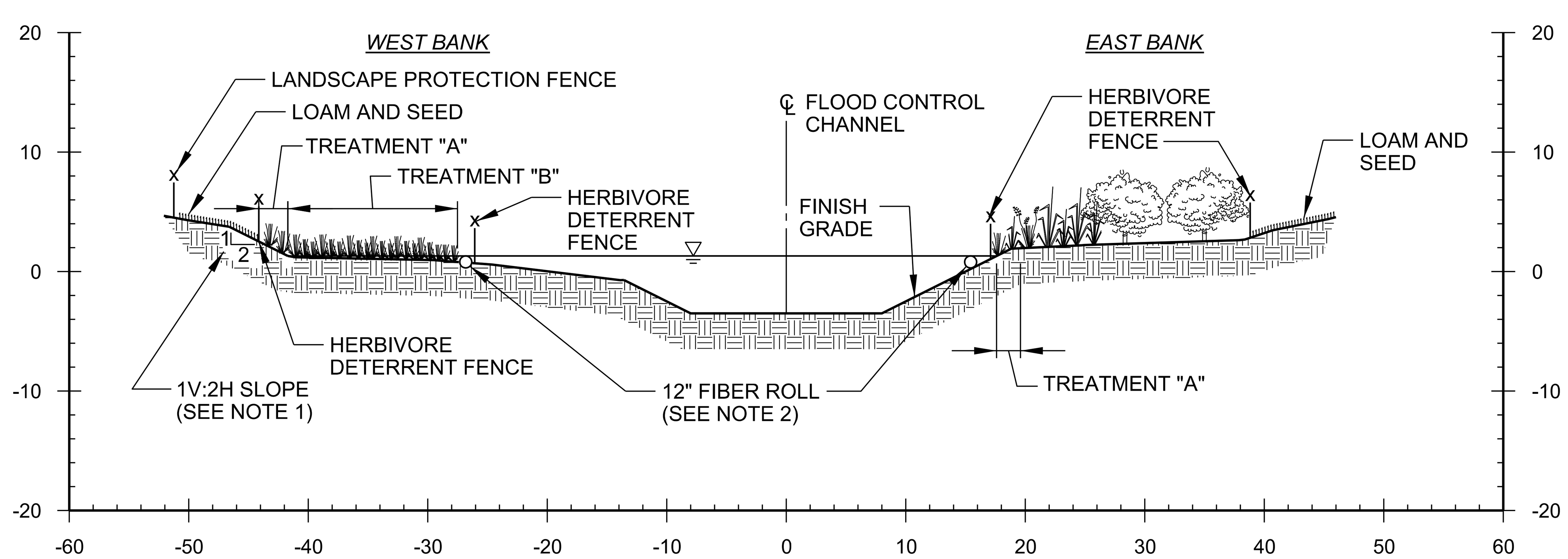
SHEET IDENTIFICATION
L-118

SHEET 96 OF 110

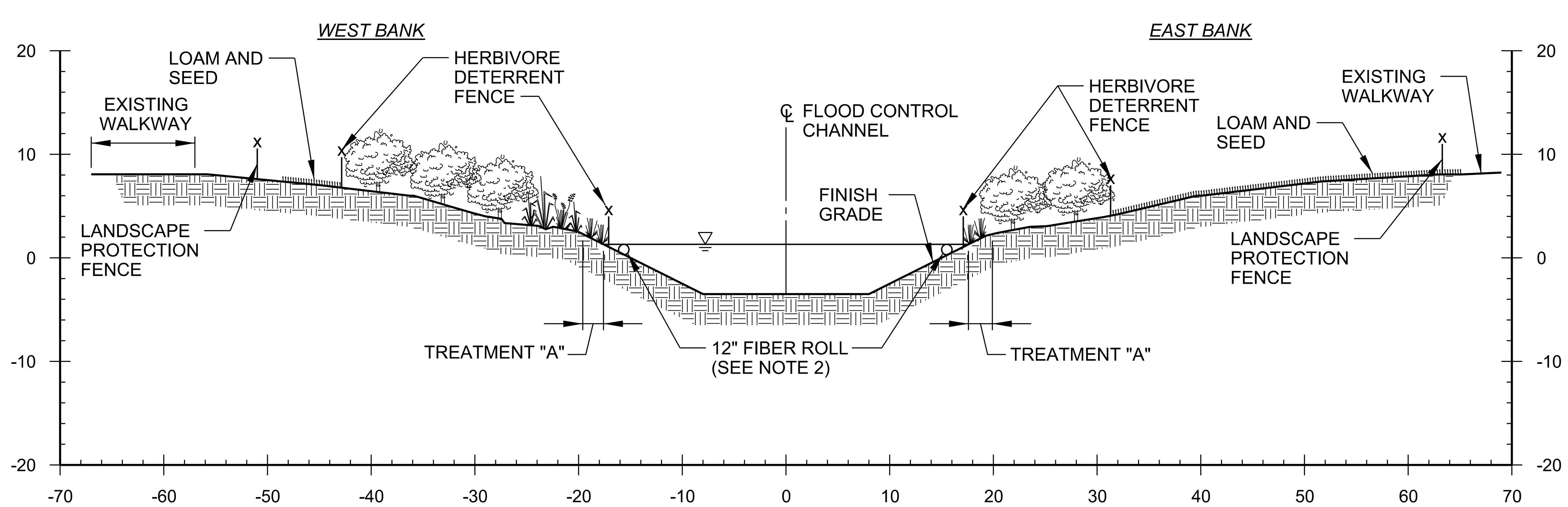
PRELIMINARY-NOT FOR CONSTRUCTION



C / L-102 **SECTION**
SCALE: 1" = 10'



B / L-102 **SECTION**
SCALE: 1" = 10'



A / L-101 **SECTION**
SCALE: 1" = 10'

SHEET NOTES:

1. THE MAXIMUM FINAL GRADE SLOPE IN ALL AREAS WHERE PHRAGMITES ARE REMOVED SHALL NOT EXCEED 50 PERCENT.
2. FIBER ROLLS SHALL BE INSTALLED EITHER ALONG BANK (EL. 1.3±) OR ALONG OUTER EDGE OF EMERGENT SHELVES. SITE SPECIFIC PLACEMENT OF FIBER ROLLS WILL BE DIRECTED BY THE RESTORATION SPECIALIST. THE BANK BETWEEN APPROX. EL. 0.3 AND EL. 3.3 SHALL BE PROTECTED WITH A TURF RENFORFCEMENT MAT (NOT SHOWN).

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

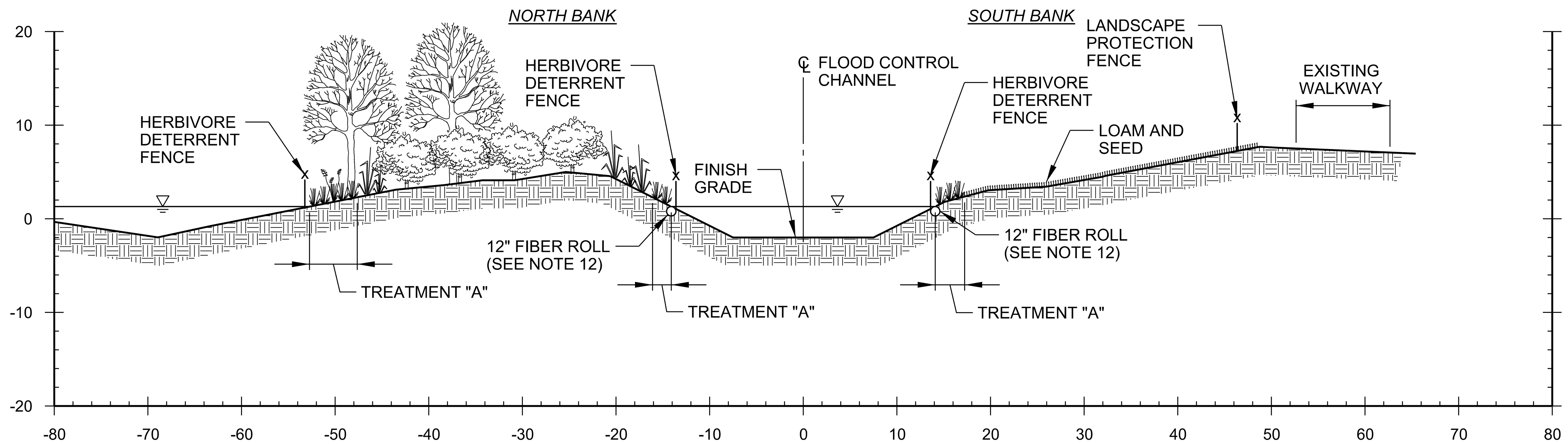
DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_L-301.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

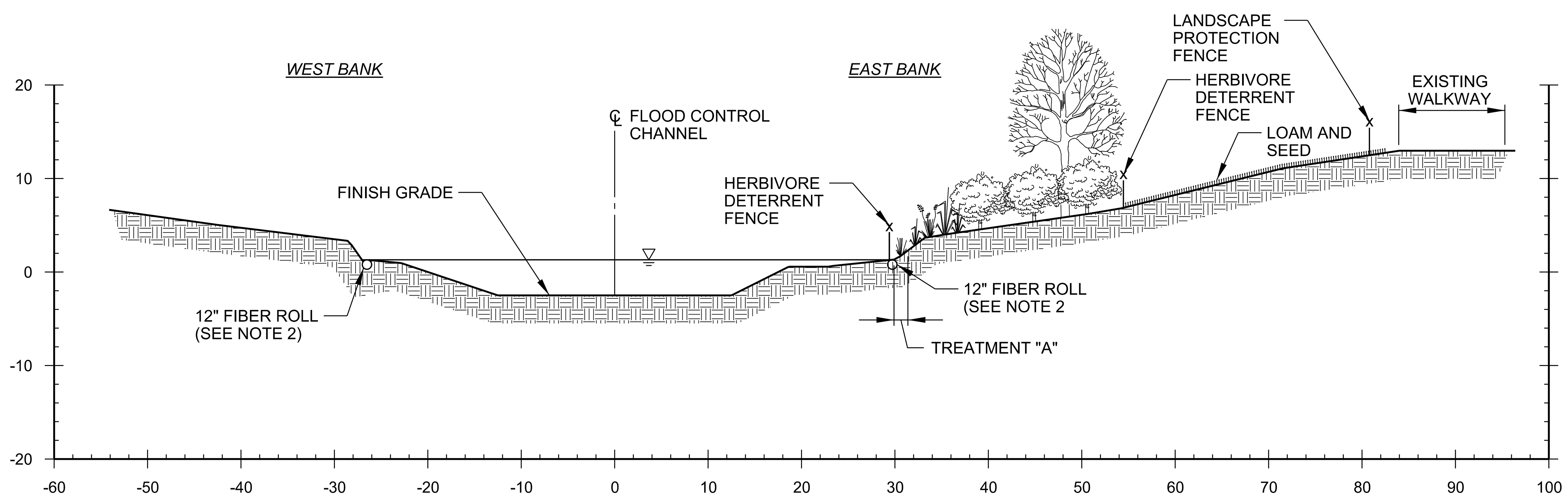
LANDSCAPE SECTIONS

SHEET IDENTIFICATION
L-301

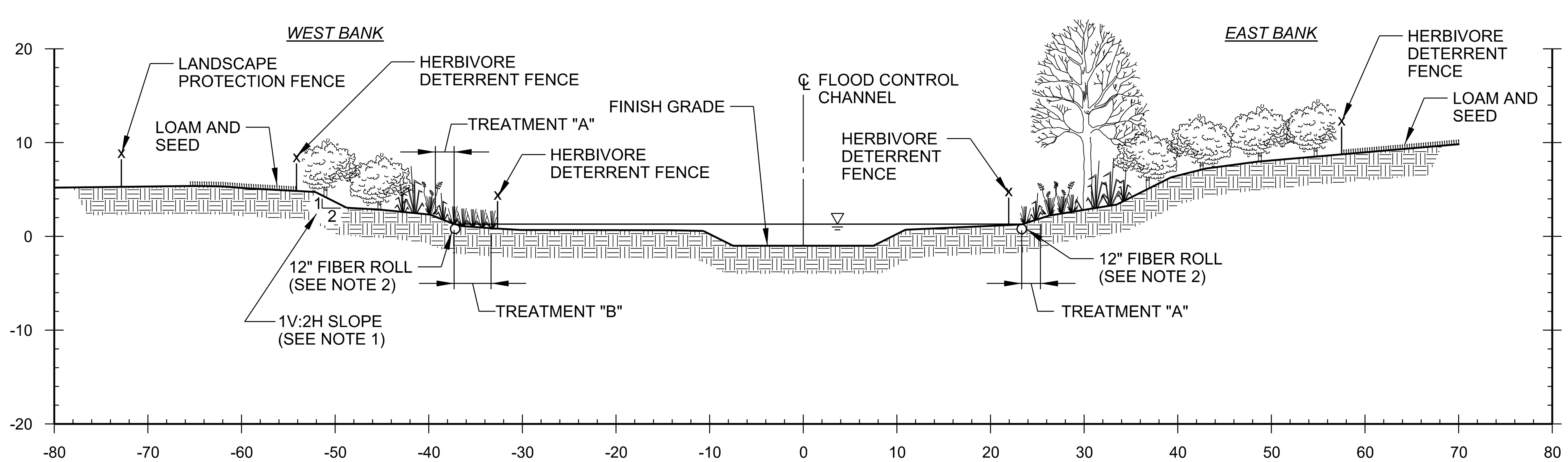
SHEET 97 OF 110



F
L-105
SECTION
SCALE: 1" = 10'



E
L-104
SECTION
SCALE: 1" = 10'



D
L-103
SECTION
SCALE: 1" = 10'

SHEET NOTES:

1. THE MAXIMUM FINAL GRADE SLOPE IN ALL AREAS WHERE PHRAGMITES ARE REMOVED SHALL NOT EXCEED 50 PERCENT.
2. FIBER ROLLS SHALL BE INSTALLED EITHER ALONG BANK (EL. 1.3±) OR ALONG OUTER EDGE OF EMERGENT SHELVES. SITE SPECIFIC PLACEMENT OF FIBER ROLLS WILL BE DIRECTED BY THE RESTORATION SPECIALIST. THE BANK BETWEEN APPROX. EL. 0.3 AND EL. 3.3 SHALL BE PROTECTED WITH A TURF RENFORFCEMENT MAT (NOT SHOWN).

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers®
New England District

MARK	DESCRIPTION	DATE	APPR.

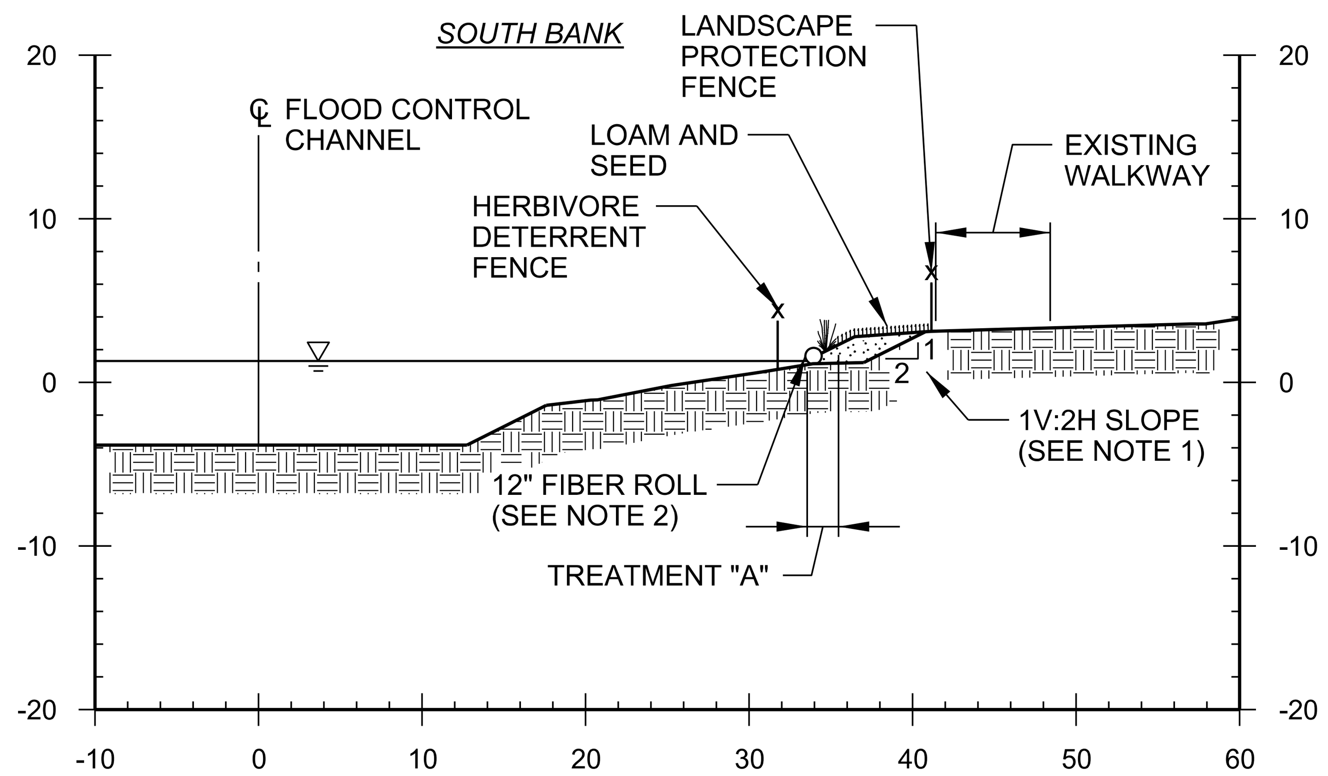
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-302.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

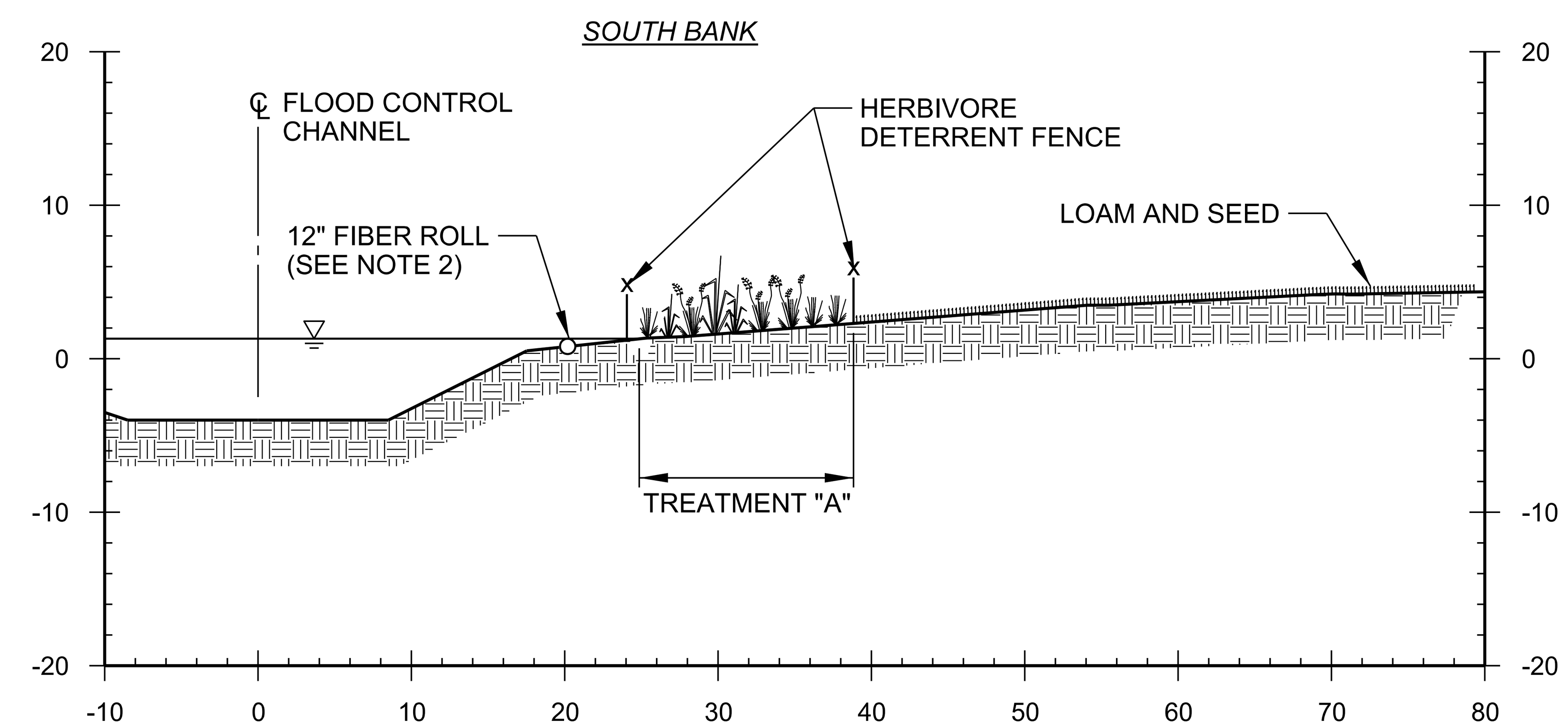
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE SECTIONS

SHEET IDENTIFICATION
L-302
SHEET 98 OF 110



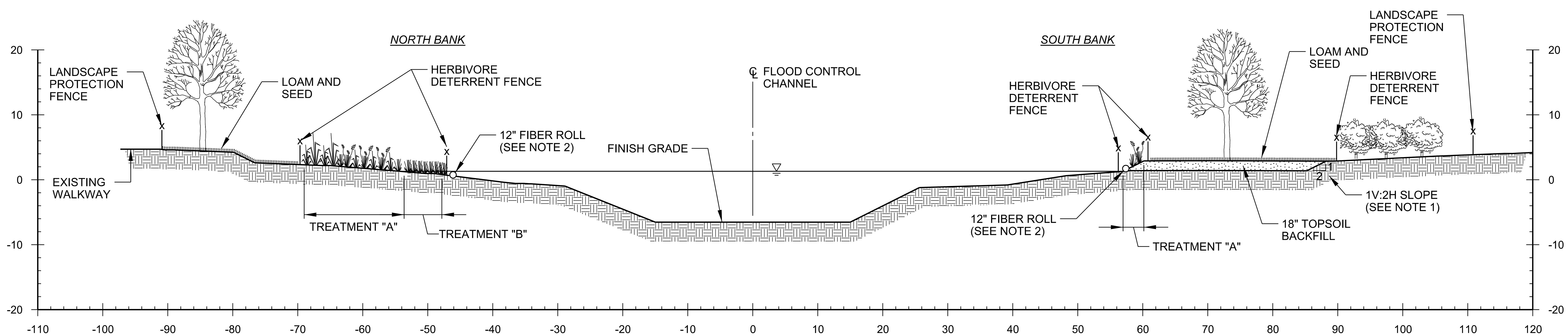
I SECTION L-108
SCALE: 1" = 10'



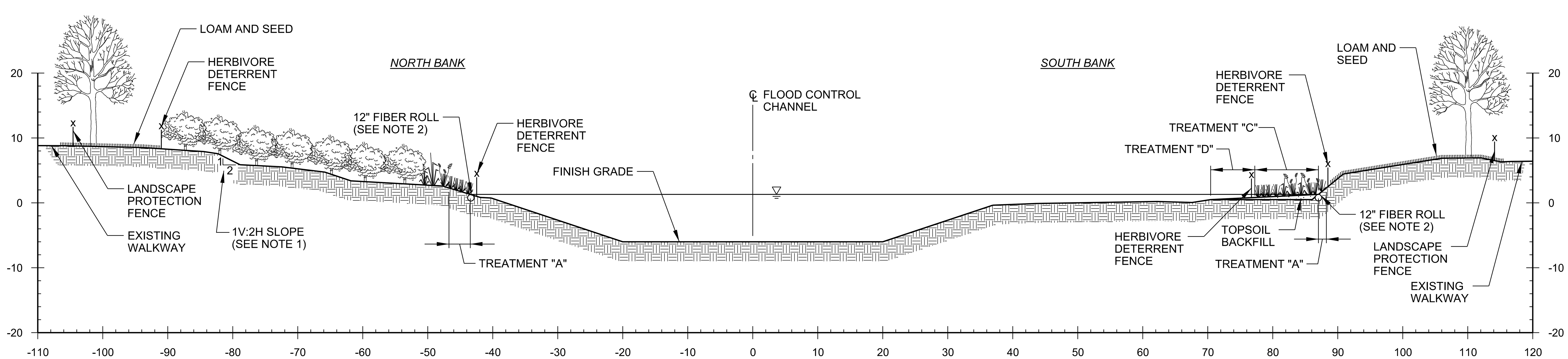
J SECTION L-109
SCALE: 1" = 10'

SHEET NOTES:

1. THE MAXIMUM FINAL GRADE SLOPE IN ALL AREAS WHERE PHRAGMITES ARE REMOVED SHALL NOT EXCEED 50 PERCENT.
2. FIBER ROLLS SHALL BE INSTALLED EITHER ALONG BANK (EL. 1.3±) OR ALONG OUTER EDGE OF EMERGENT SHELVES. SITE SPECIFIC PLACEMENT OF FIBER ROLLS WILL BE DIRECTED BY THE RESTORATION SPECIALIST. THE BANK BETWEEN APPROX. EL. 0.3 AND EL. 3.3 SHALL BE PROTECTED WITH A TURF RENFORFCEMENT MAT (NOT SHOWN).



H SECTION L-107
SCALE: 1" = 10'



G SECTION L-106
SCALE: 1" = 10'

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

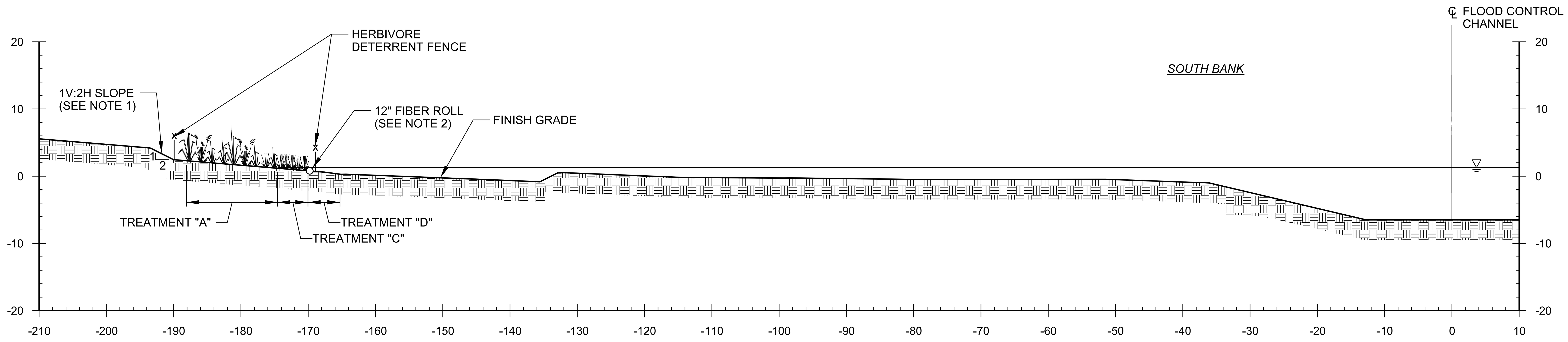
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO | DWN BY: SAP | CKD BY: | SUBMITTED BY: | DATE: | SOLICITATION NO.: | CONTRACT NO.: | PLOT SCALE: 1:1 | PLOT DATE: | DRAWING CODE: MUD-2 | SIZE: ARCH D | FILE NAME: MUD-2_L-303.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE SECTIONS

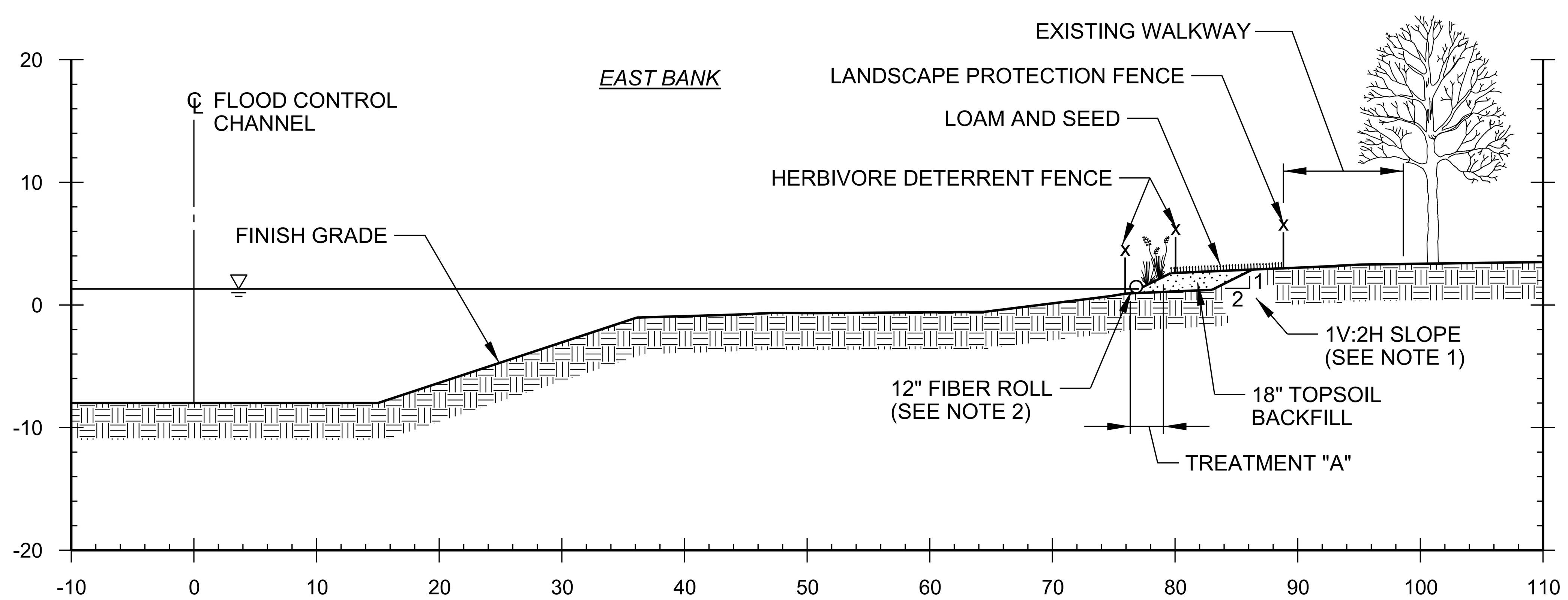
SHEET IDENTIFICATION
L-303
SHEET 99 OF 110



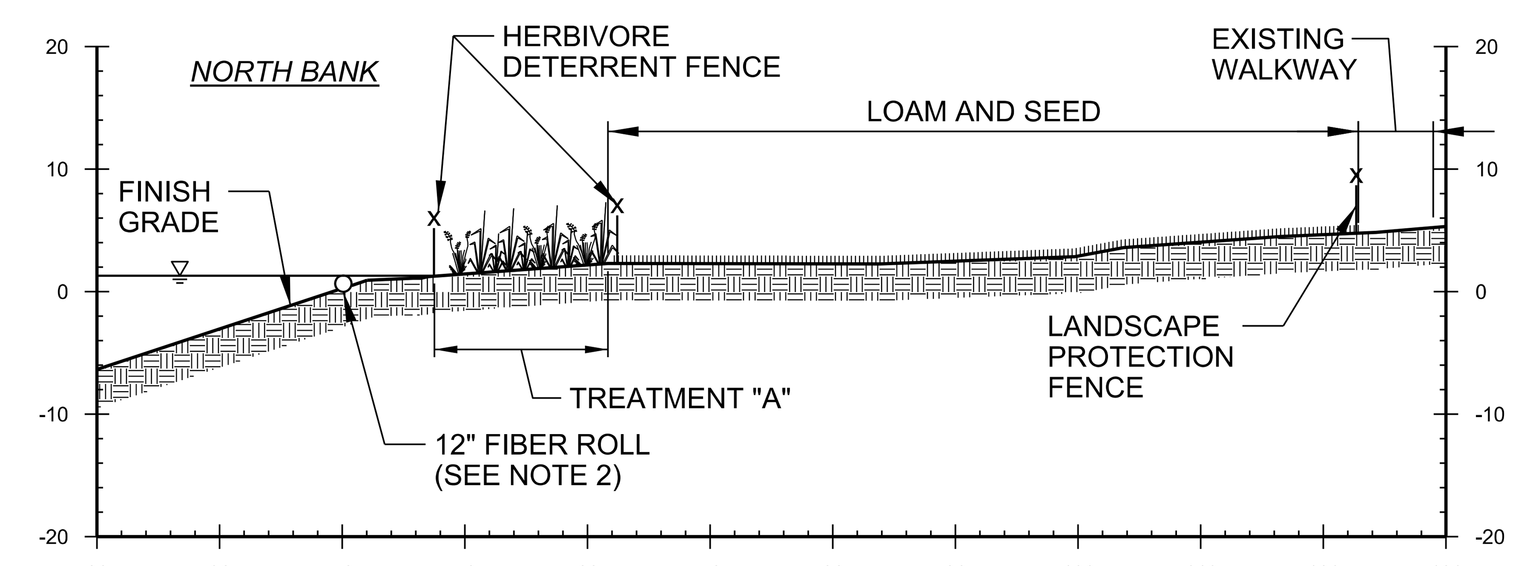
SECTION O L-114
SCALE: 1" = 10'

SHEET NOTES:

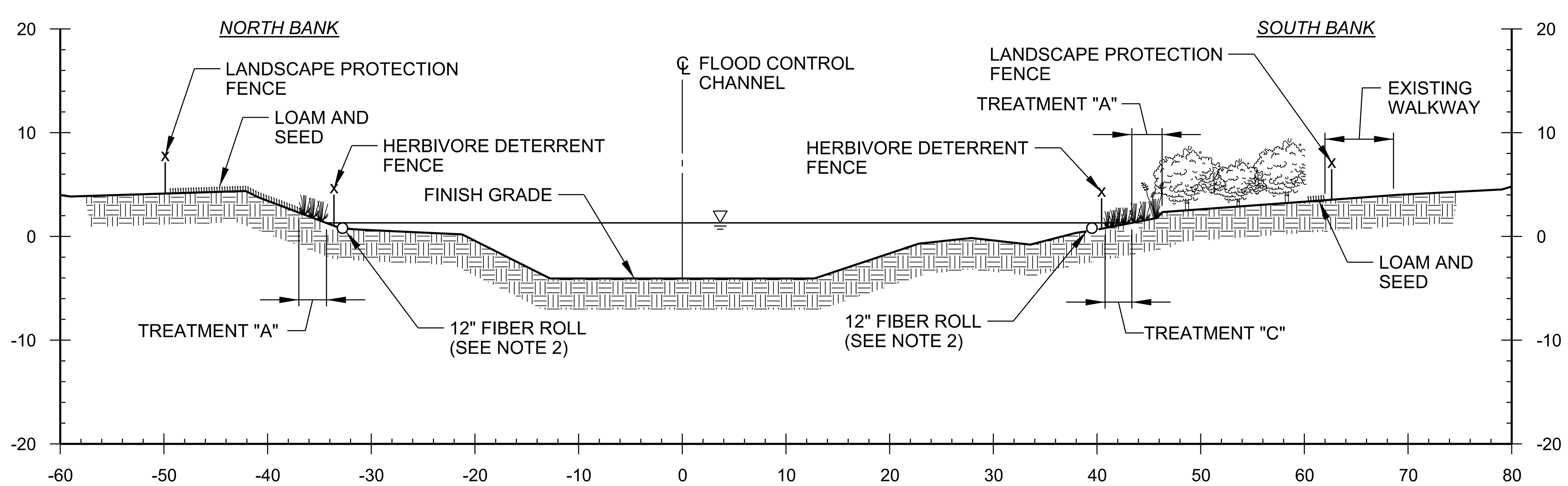
1. THE MAXIMUM FINAL GRADE SLOPE IN ALL AREAS WHERE PHRAGMITES ARE REMOVED SHALL NOT EXCEED 50 PERCENT.
2. FIBER ROLLS SHALL BE INSTALLED EITHER ALONG BANK (EL. 1.3±) OR ALONG OUTER EDGE OF EMERGENT SHELVES. SITE SPECIFIC PLACEMENT OF FIBER ROLLS WILL BE DIRECTED BY THE RESTORATION SPECIALIST. THE BANK BETWEEN APPROX. EL. 0.3 AND EL. 3.3 SHALL BE PROTECTED WITH A TURF RENFORFCEMENT MAT (NOT SHOWN).



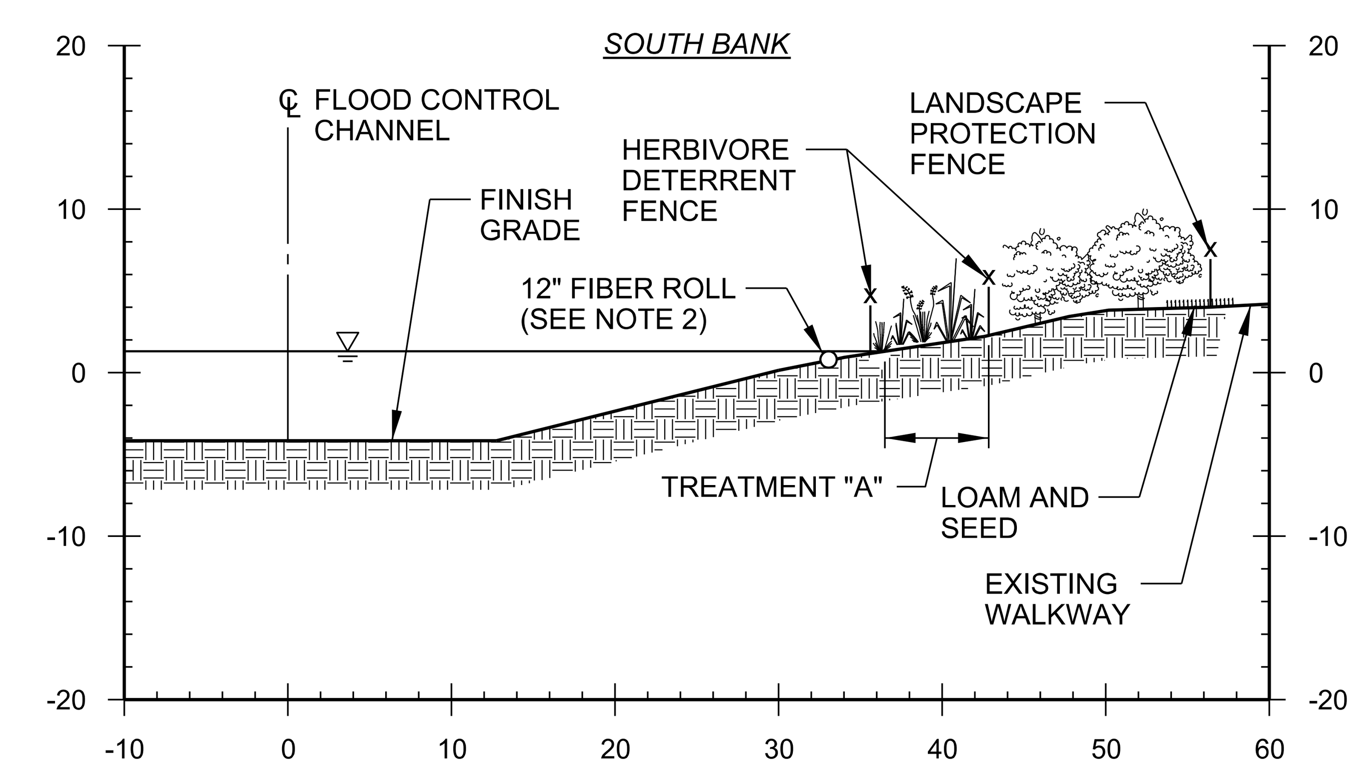
SECTION M L-112
SCALE: 1" = 10'



SECTION N L-113
SCALE: 1" = 10'



SECTION K L-110
SCALE: 1" = 10'



SECTION L L-111
SCALE: 1" = 10'

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers® New England District

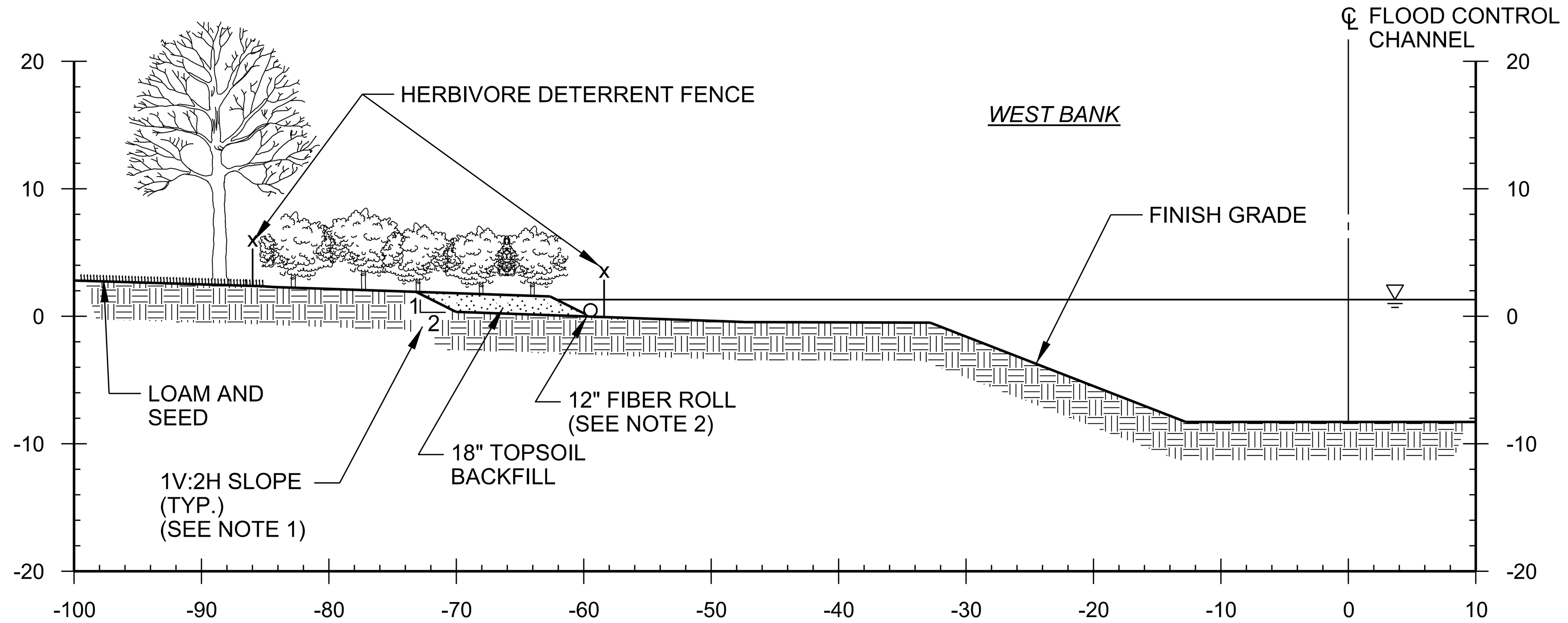
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-304.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2

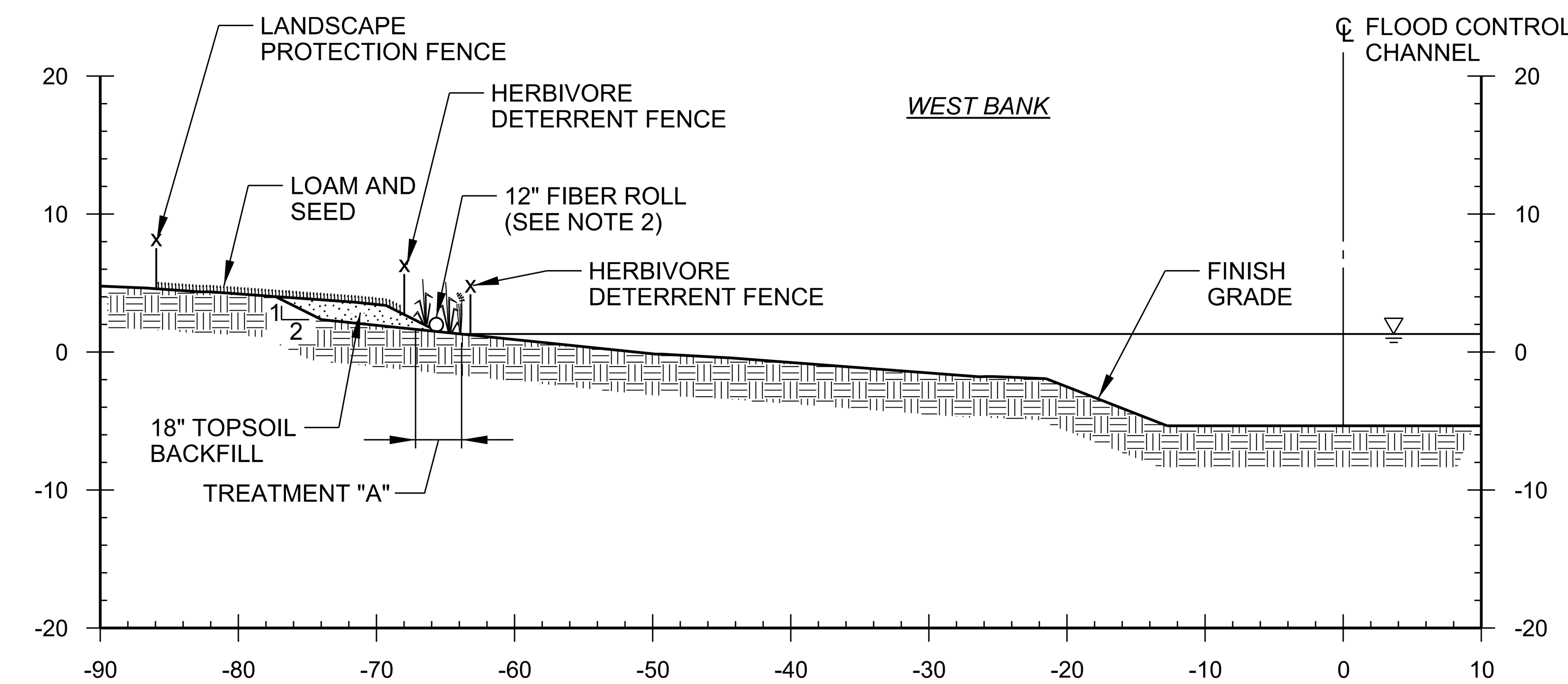
MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE SECTIONS

SHEET IDENTIFICATION
L-304
SHEET 100 OF 110



R
L-117
SECTION
SCALE: 1" = 10'

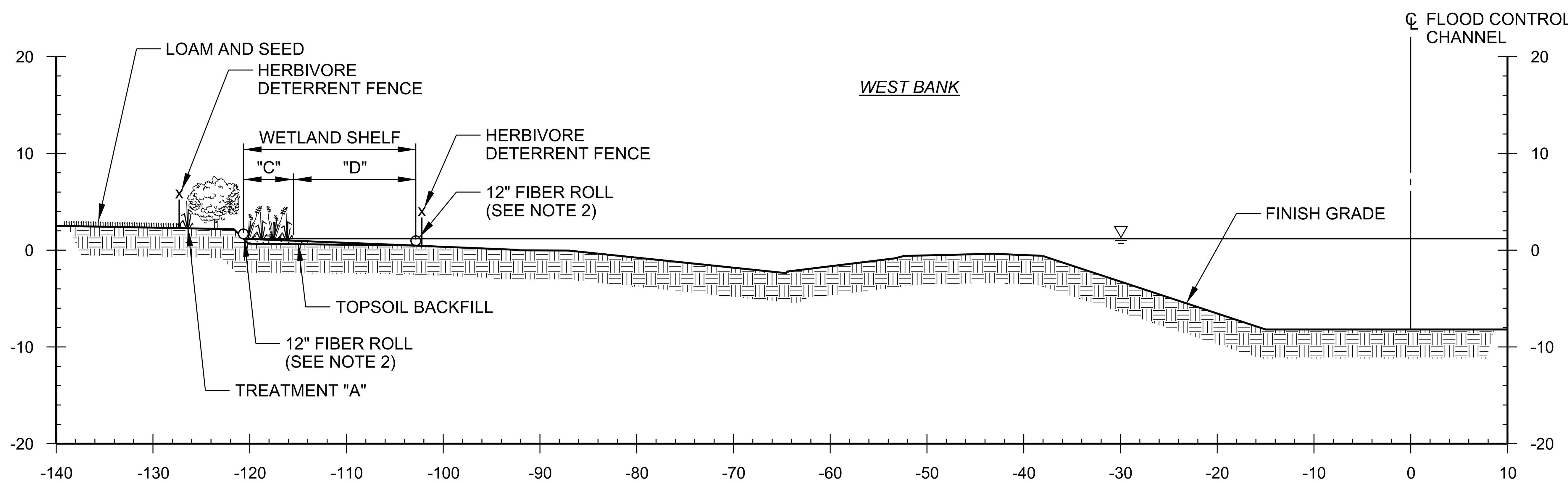


S
L-118
SECTION
SCALE: 1" = 10'

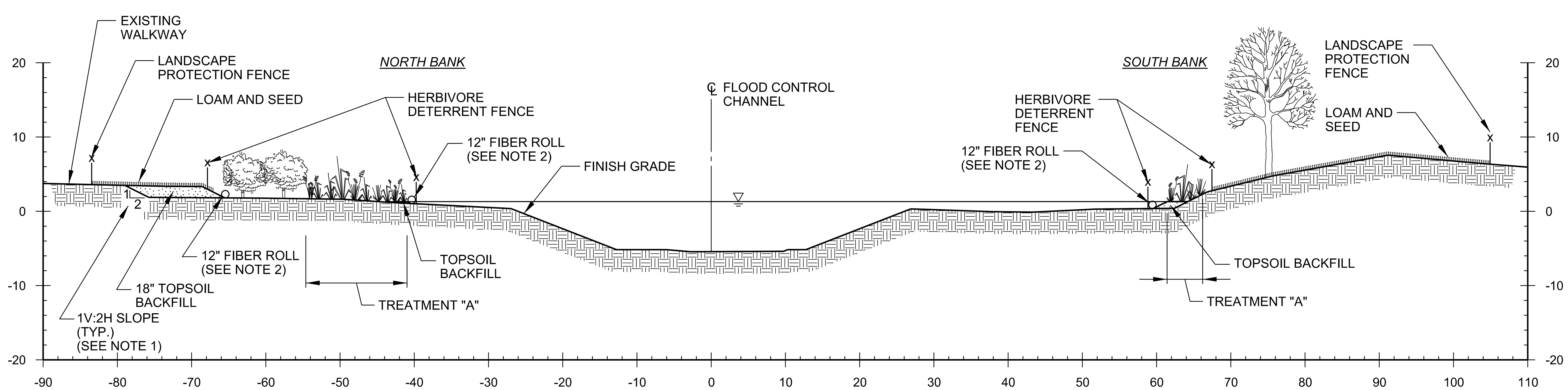
SHEET NOTES:

1. THE MAXIMUM FINAL GRADE SLOPE IN ALL AREAS WHERE PHRAGMITES ARE REMOVED SHALL NOT EXCEED 50 PERCENT.

2. FIBER ROLLS SHALL BE INSTALLED EITHER ALONG BANK (EL. 1.3±) OR ALONG OUTER EDGE OF EMERGENT SHELVES. SITE SPECIFIC PLACEMENT OF FIBER ROLLS WILL BE DIRECTED BY THE RESTORATION SPECIALIST. THE BANK BETWEEN APPROX. EL. 0.3 AND EL. 3.3 SHALL BE PROTECTED WITH A TURF RENFORFCEMENT MAT (NOT SHOWN).



Q
L-116
SECTION
SCALE: 1" = 10'



P
L-115
SECTION
SCALE: 1" = 10'

GRAPHIC SCALE:
1" = 10' 10 0 10 20

US Army Corps of Engineers® New England District

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_L-305.dgn

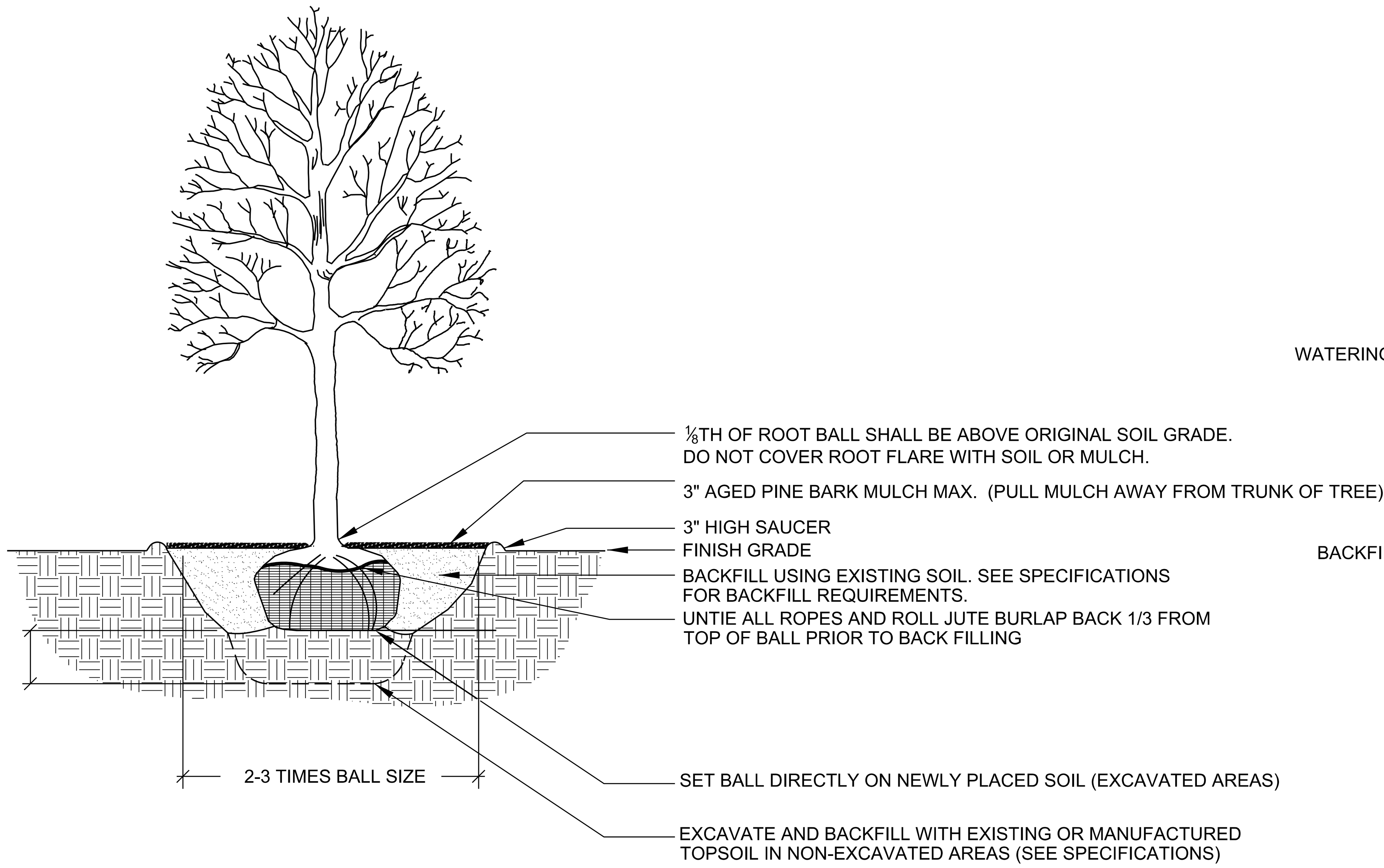
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE SECTIONS

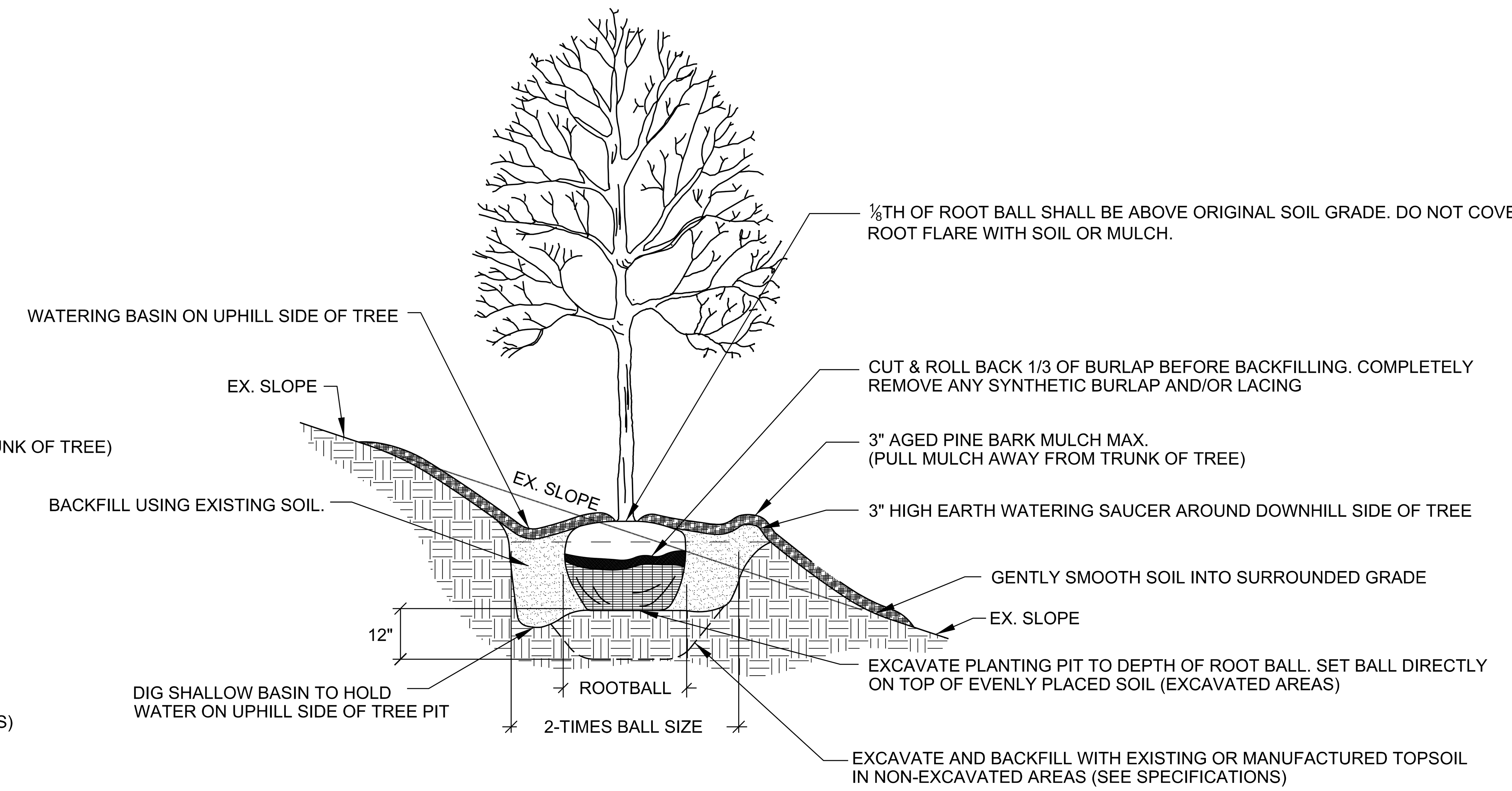
SHEET IDENTIFICATION
L-305

SHEET 101 OF 110



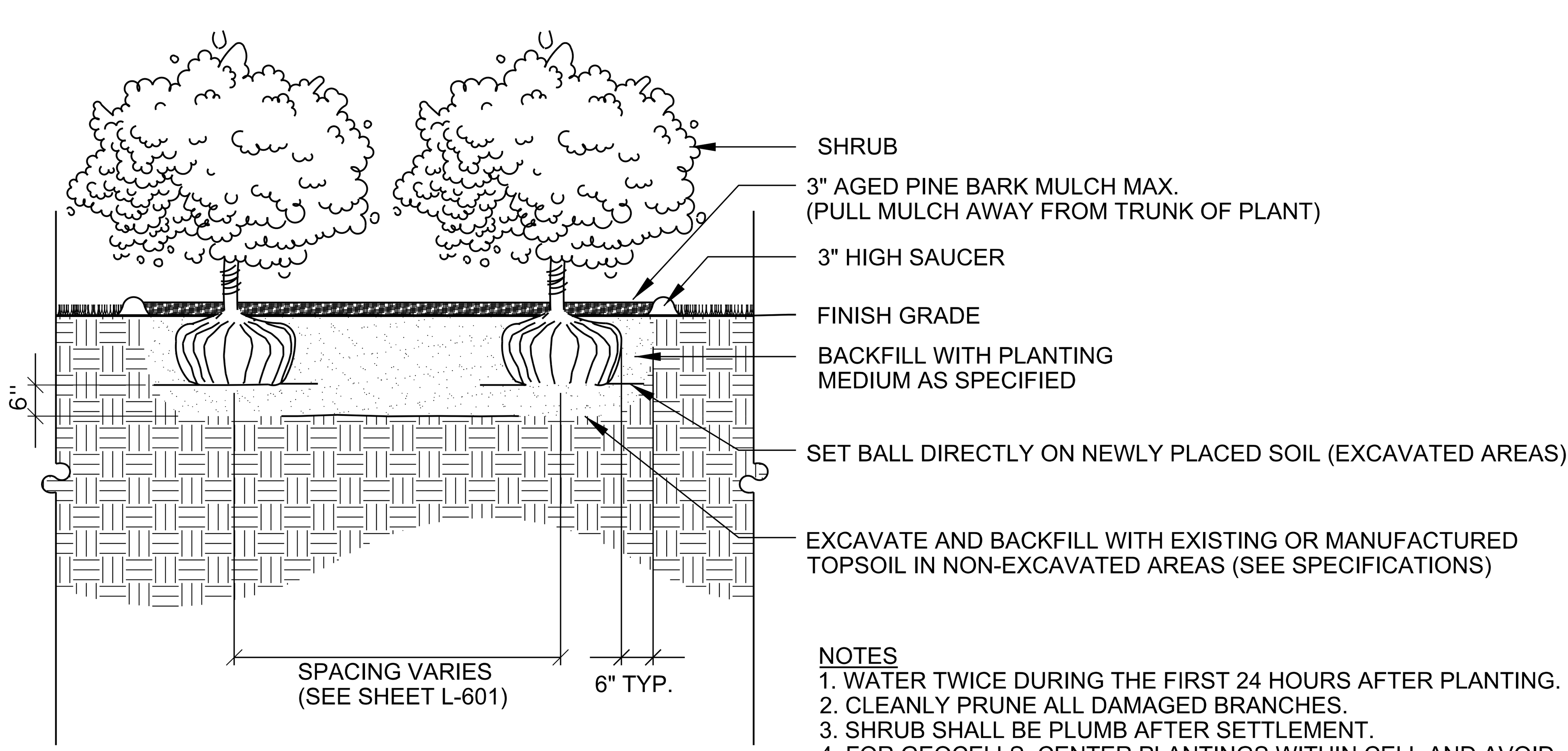
NOTES
1. WATER TWICE DURING THE FIRST 24 HOURS AFTER PLANTING (SEE SPECIFICATIONS).
2. DO NOT CUT LEADER.
3. CLEANLY PRUNE ALL DAMAGED BRANCHES.
4. TREE SHALL HAVE STRAIGHT TRUNK AND BE PLUMB AFTER SETTLEMENT.
5. REMOVE ALL TREE WRAP FROM TRUNK OF TREE.

DECIDUOUS TREE PLANTING
N.T.S.



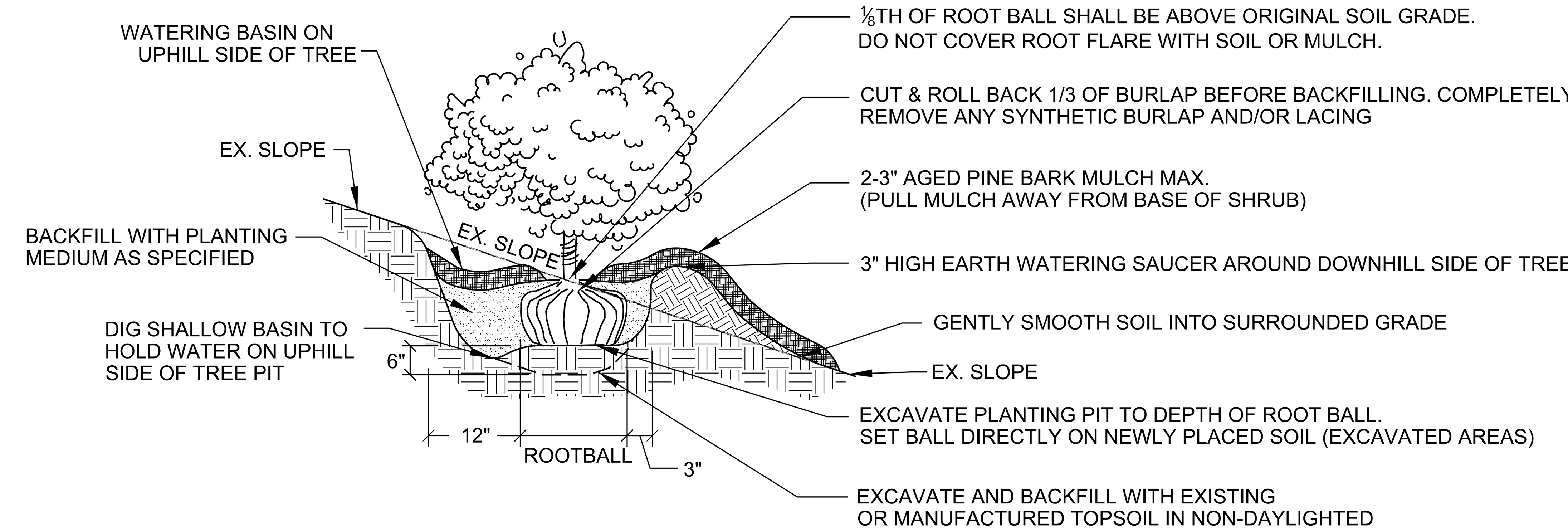
NOTES
1. WATER TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
2. DO NOT CUT LEADER.
3. CLEANLY PRUNE ALL DAMAGED BRANCHES.
4. TREE SHALL HAVE STRAIGHT TRUNK AND BE PLUMB AFTER SETTLEMENT.
5. REMOVE ALL TREE WRAP FROM TRUNK OF TREE.

DECIDUOUS TREE PLANTING ON SLOPE
N.T.S.



NOTES
1. WATER TWICE DURING THE FIRST 24 HOURS AFTER PLANTING (SEE SPECIFICATIONS).
2. CLEANLY PRUNE ALL DAMAGED BRANCHES.
3. SHRUB SHALL BE PLUMB AFTER SETTLEMENT.
4. FOR GEOCELLS, CENTER PLANTINGS WITHIN CELL AND AVOID CUTTING GEOCELLS (SEE SHEET L-601).

SHRUB PLANTING
N.T.S.



NOTES
1. WATER TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
2. CLEANLY PRUNE ALL DAMAGED BRANCHES.
3. SHRUB SHALL BE PLUMB AFTER SETTLEMENT.
4. FOR GEOCELLS, CENTER PLANTINGS WITHIN CELL AND AVOID CUTTING GEOCELLS (SEE SHEET L-601).

SHRUB PLANTING ON SLOPE
N.T.S.

GENERAL NOTES:

1. PLANT MATERIAL SHALL NOT BE BROUGHT TO THE SITE IN WIRE BASKETS OR IN POLY-BURLAP.

2. ROOT BALL KITS SHALL BE USED TO ANCHOR TREES PLANTED WITHIN 15 FEET OF ROADS AND PATHS (SEE SPECIFICATIONS).

US Army Corps of Engineers®
New England District

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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DWN BY: LT
SIZE: ANSI D
FILE NAME: MUD-2_L-501.dgn
DRAWING CODE: MUD-2

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

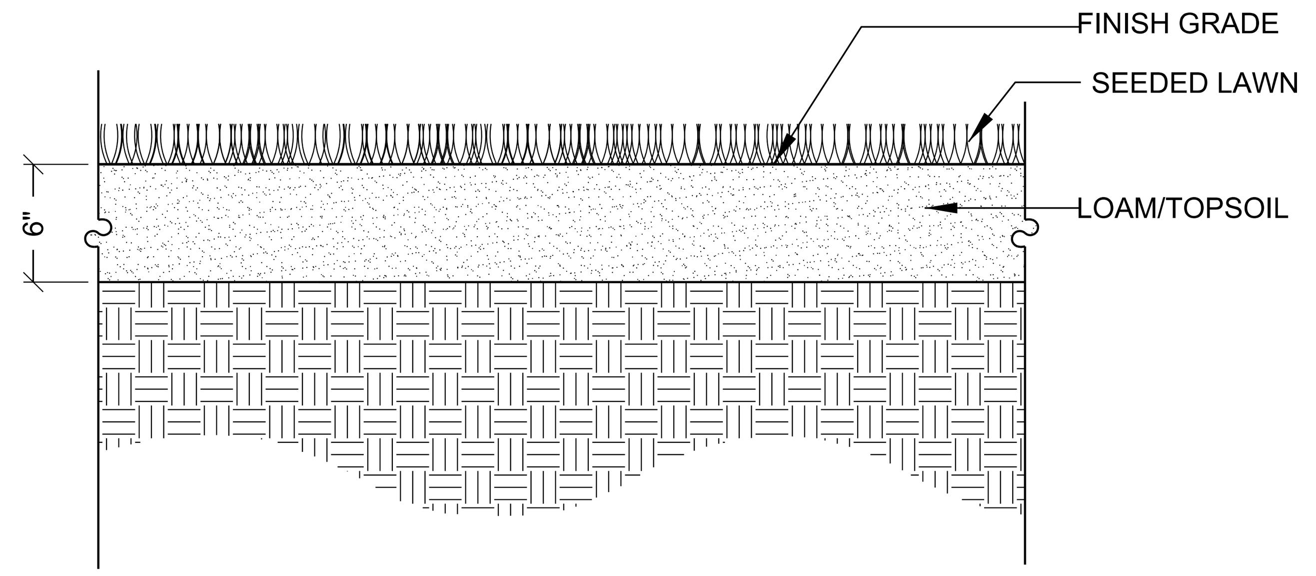
LANDSCAPE DETAILS

SHEET IDENTIFICATION
L-501
SHEET 102 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION

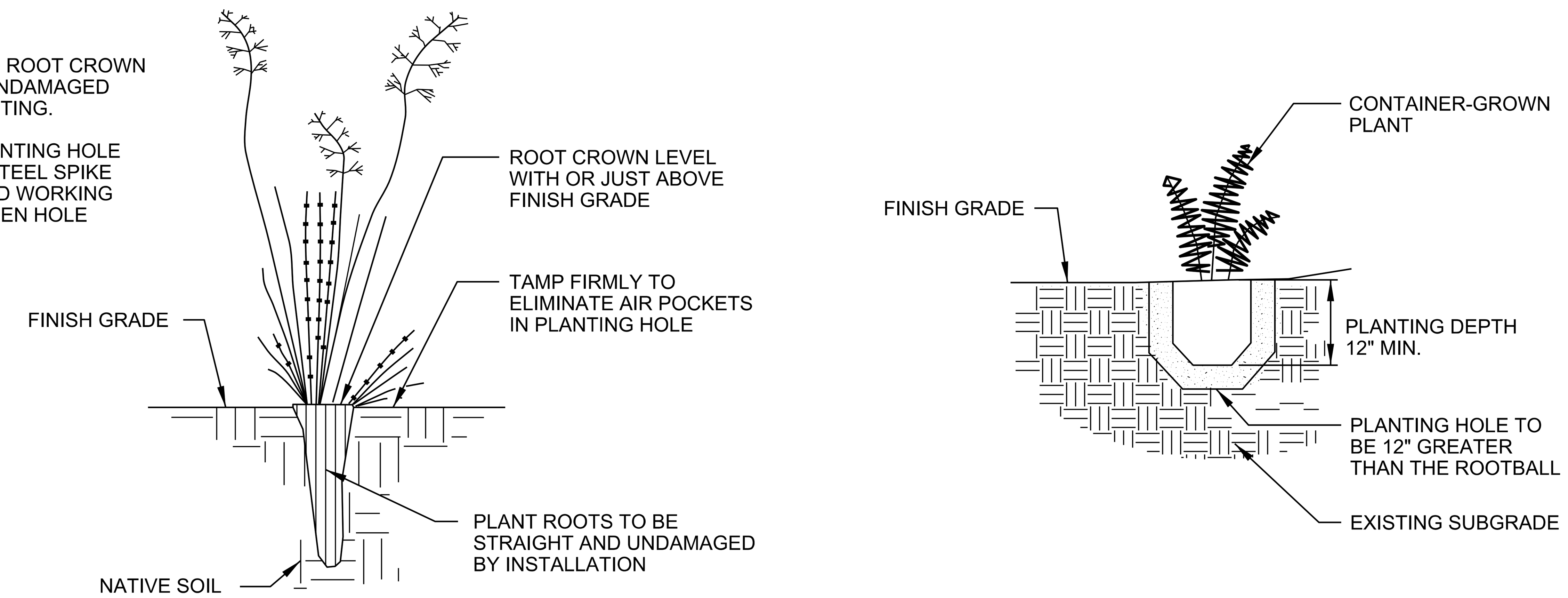
NOTES:

1. LEAVES AND ROOT CROWN TO REMAIN UNDAMAGED DURING PLANTING.
2. CREATE PLANTING HOLE BY DRIVING STEEL SPIKE INTO SOIL AND WORKING SPIKE TO WIDEN HOLE



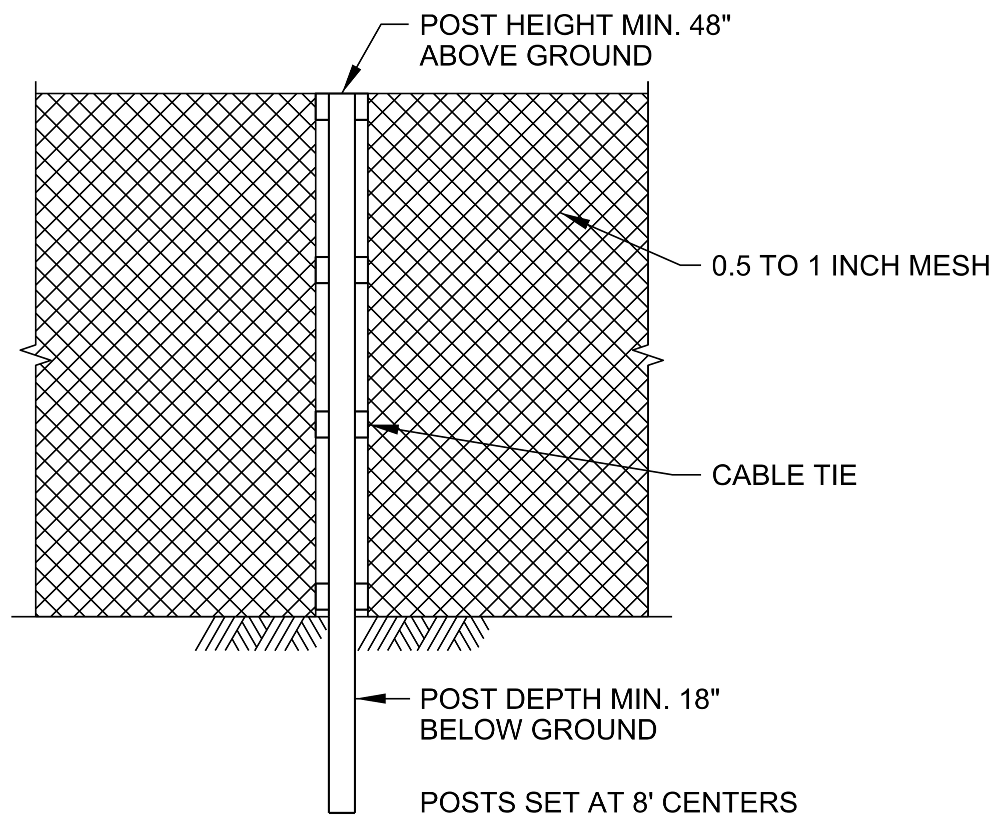
DETAIL-SEEDED LAWN

N.T.S.

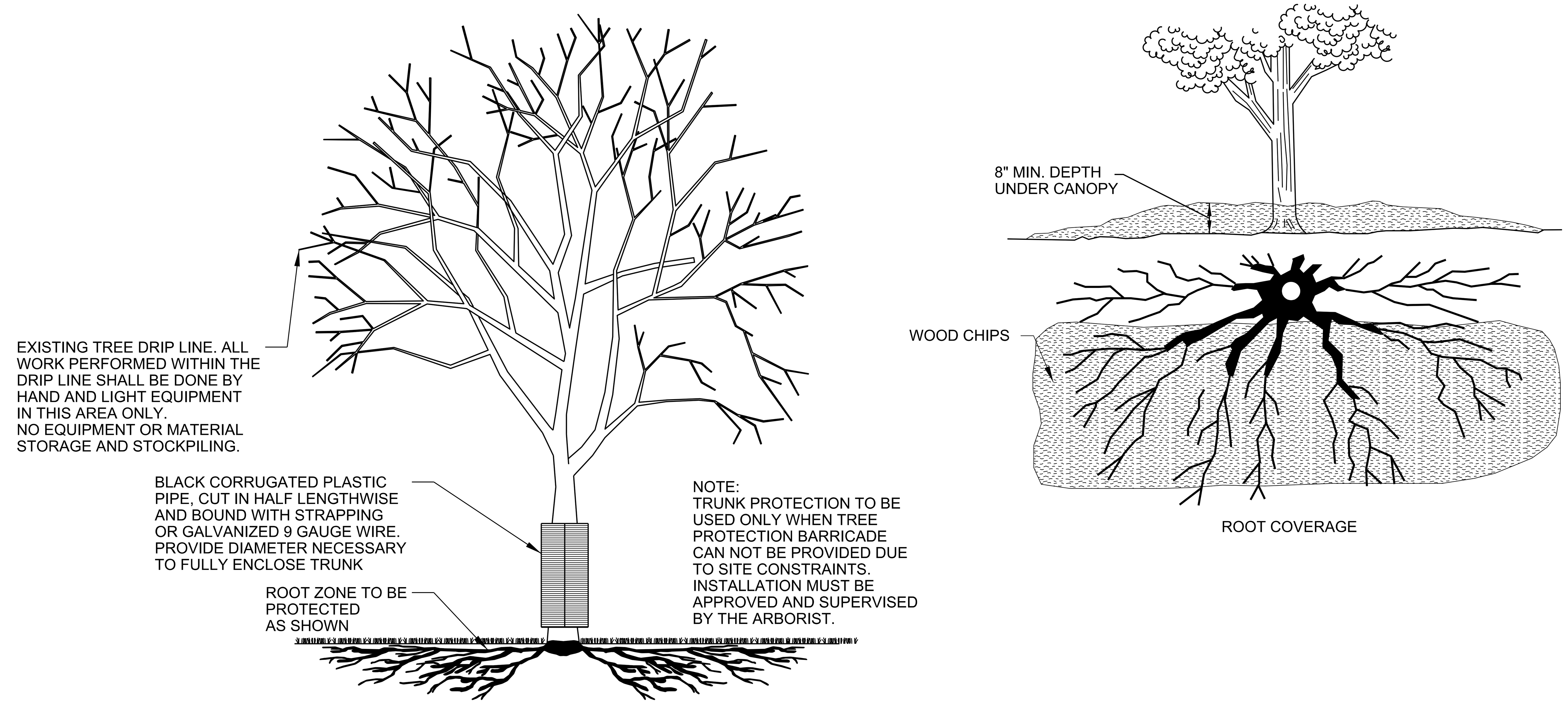


DETAIL-HERBACEOUS PLANTING

N.T.S.

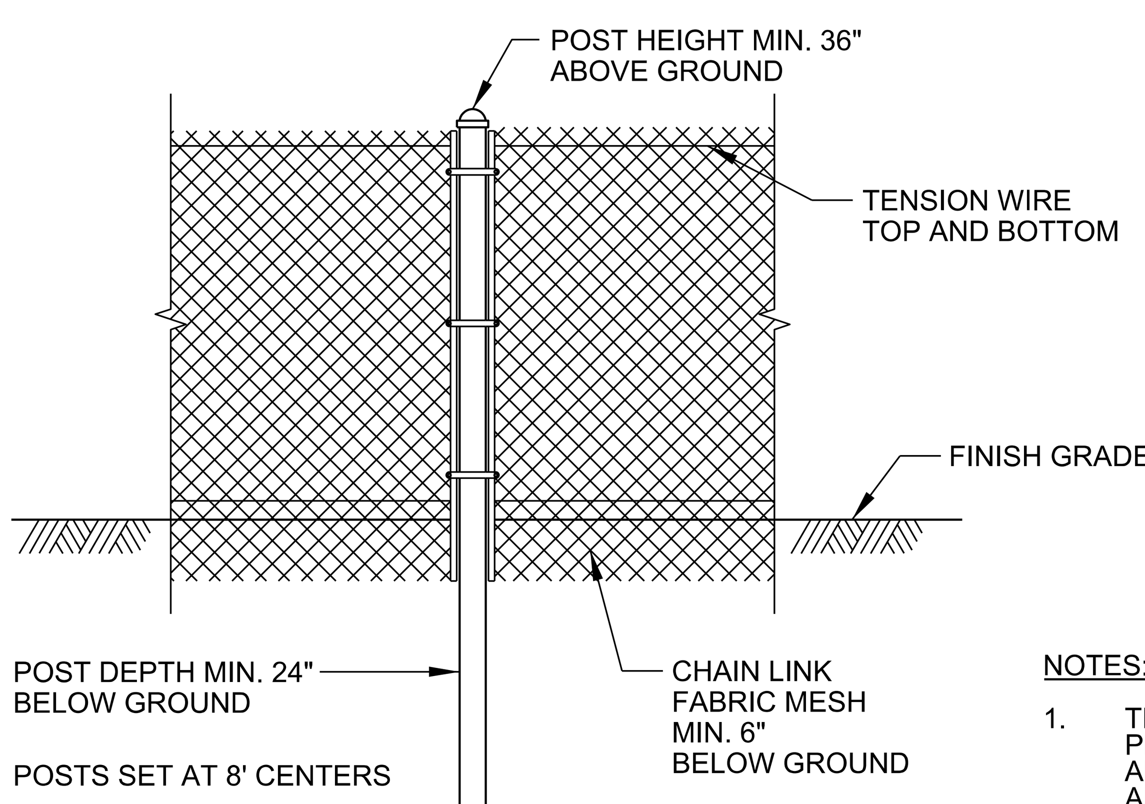


PLASTIC MESH FENCE



DETAILS-TREE PROTECTION

N.T.S.



CHAIN LINK FENCE

NOTES:

1. THE PLASTIC MESH FENCE SHALL BE PLACED ON THE UPLAND SIDE OF ALL WETLAND TREATMENT AREAS AND ON THE WATER SIDE EXCEPT WHERE THERE IS A TREATMENT "B" OR "C" WETLAND SHELF.
2. THE CHAIN LINK FENCE SHALL BE PLACED ON THE WATER SIDE OF ALL TREATMENT "B" AND "C" SHELVES.

DETAILS-HERBIVORE DETERRENT FENCING

N.T.S.

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NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: 1:1 | PLOT DATE: | DRAWING CODE: MUD-2
SIZE: ANSI D | FILE NAME: MUD-2_L-502.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

LANDSCAPE DETAILS

SHEET IDENTIFICATION
L-502

SHEET 103 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION

PLANT SCHEDULE

TREES

SYMBOL	QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE	COMMENTS
AC	11	AMELANCHIER CANADENSIS	SHADBLOW SERVICEBERRY	10-12' HT.	MULTI-STEMMED
AR	30	ACER RUBRUM	RED MAPLE	3.5-4" CAL	
CV	6	CHIONANTHUS VIRGINICUS	FRINGETREE	6-8' HT.	
CCR	9	CRATAEGUS CRUSGALLI VAR. INERMIS	THORNLESS HAWTHORNE	10-12' HT.	
CAL	3	CORNUS ALTERNIFOLIA	PAGODA DOGWOOD	6-8' HT.	
NS	11	NYSSA SYLVATICA	BLACK TUPELO	3.5-4" CAL.	
PA	5	PLATANUS ACERIFOLIA	LONDON PLANE	4-4.5" CAL.	
QB	12	QUERCUS BICOLOR	SWAMP WHITE OAK	4-4.5" CAL.	
QR	18	QUERCUS RUBRA	RED OAK	4-4.5" CAL.	SPECIMEN QUALITY
SA	4	SALIX ALBA 'TRISTIS'	GOLDEN WEEPING WILLOW	3.5-4" CAL.	
SB	10	SALIX BABYLONICA	WEEPING WILLOW	3.5-4" CAL	

SHRUBS

SYMBOL	QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE	SPACING	COMMENTS
AA	18	ARONIA ARBUTIFOLIA	RED CHOKEBERRY	#5	6' OC	CONT
CF	96	CALYCANTHUS FLORIDUS	COMMON SWEETSHRUB	#3	4' OC	CONT
CAH	1389	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	HUMMINGBIRD SUMMERSWEET	#2	3' OC	CONT
CA	393	CEANOTHUS AMERICANUS	NEW JERSEY TEA	#1	2' OC	CONT
CO	220	CEPHALANTHUS OCCIDENTALIS	BUTTONBUSH	#5	5' OC	CONT
CP	215	COMPTONIA PEREGRINA	SWEETFERN	#1	18" OC	CONT
CSA	1090	CORNUS SERICEA 'ARTIC FIRE'	REDOISER DOGWOOD	#3	3' OC	CONT
DV	1268	DECODON VERTICILLATUS	SWAMP LOOSESTRIFE	#1	12" OC	CONT
FA	49	FORSYTHIA 'ARNOLD DWARF'	SPREADING FORSYTHIA	2-3'.SP.	3' OC	CONT
HV	6	HAMAMELIS VIRGINIANA	COMMON WITCHHAZEL	3-4' HT.	8' OC	B&B
IV	234	ILEX VERTICILLATA 'RED SPRITE'	RED SPRITE WINTERBERRY	3-4' HT.	4' OC	B&B
RP	290	RHODODENDRON PERICLYMENOIDES	PINXTERBLOOM AZALEA	3-4' HT.	3' OC	B&B
RV	196	RHODODENDRON VISCOSUM	SWAMP AZALEA	#5	3' OC	CONT
RAG	1078	RHUS AROMATICA 'GRO-LOW'	GLOW LOW FRAGRANT SUMAC	#3	3' OC	CONT
SC	304	SAMBUCUS CANADENSIS	COMMON ELDERBERRY	#5	6' OC	CONT
SCH	928	SYMPHORICARPUS X CHENAULTII 'HANCOCK'	HANCOCK CORALBERRY	#3	3' OC	CONT
VA	29	VIBURNUM ACERIFOLIUM	MAPLELEAF VIBURNUM	#3	4' OC	CONT
VD	357	VIBURNUM DENTATUM 'CHRISTOM'	ARROWWOOD VIBURNUM	#5	4' OC	CONT
XS	1779	XANTHORHIZA SIMPLICISSIMA	YELLOWROOT	#1	18" OC	CONT

FERNS

SYMBOL	QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE	SPACING	COMMENTS
DP	5244	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	#1	12" OC	CONT
OC	137	OSMUNDA CINNAMOMEA	CINNAMON FERN	#1	18" OC	CONT
OS	1587	ONOCLEA SENSIBILIS	SENSITIVE FERN	#1	18" OC	CONT

EMERGENTS

SYMBOL	QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE	PLANTING LOCATION
AC	2200	ACORUS CALAMUS	SWEET FLAG	2" PLUG	TREATMENT "C" (WETLAND SHELF)
DV	640	DECODON VERTICILLATUS	WATER WILLOW	#1	
IVE	600	IRIS VERSICOLOR	BLUE FLAG IRIS	2" PLUG	
PC	1600	PONTEDERIA CORDATA	PICKEREL WEED	2" PLUG	TREATMENT "B" (WETLAND SHELF)
SE	600	SPARGANIUM EURYCARPUM	BUR-REED	2" PLUG	

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: M. PENKO
DWN BY: SAF
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE: MUD-2
PLOT SCALE: 1:1
PLOT DATE:
SIZE: ANSI D
FILE NAME: MUD-2_L-601.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

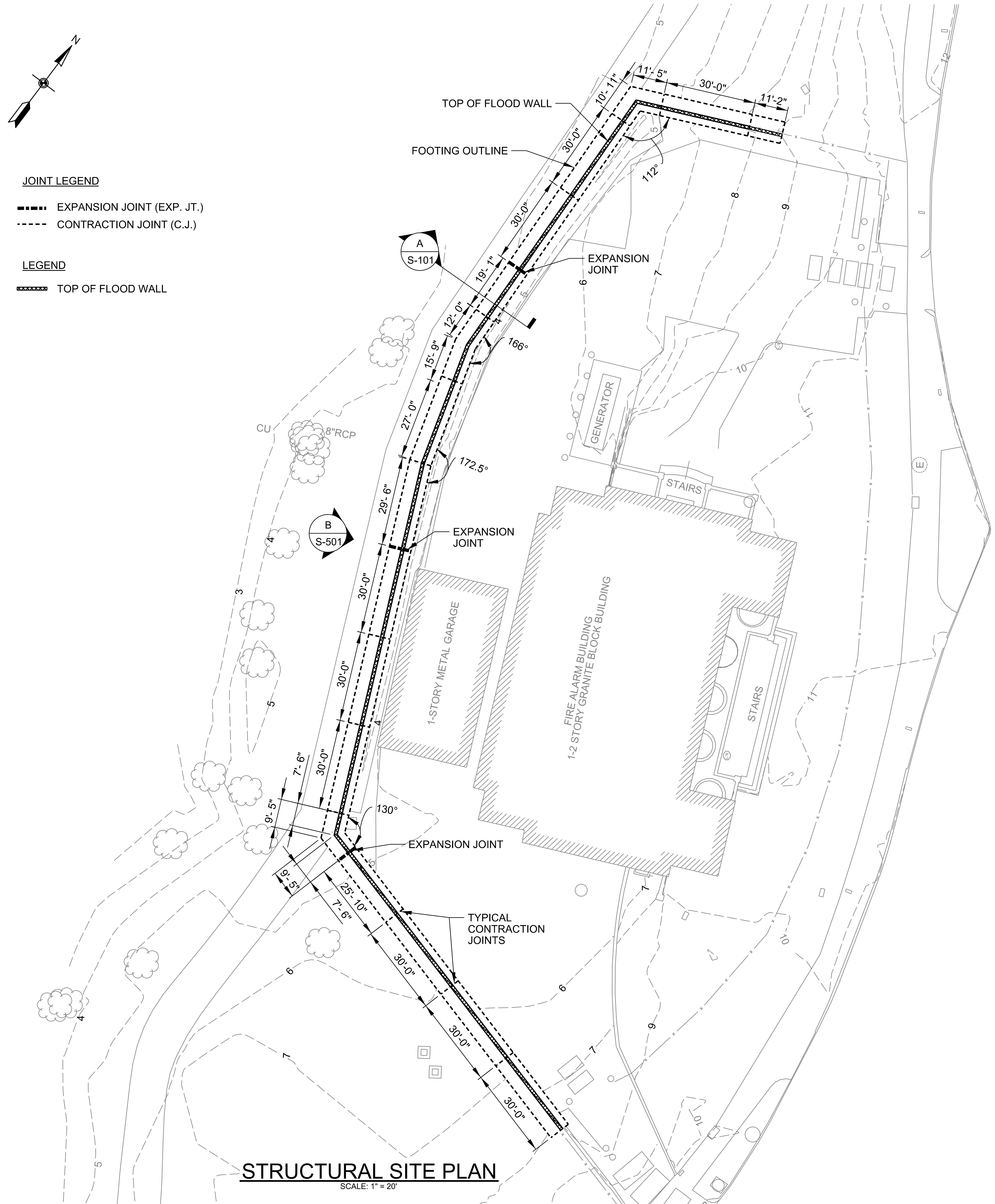
PLANT SCHEDULE

SHEET IDENTIFICATION
L-601
SHEET 104 OF 110

PRELIMINARY-NOT FOR CONSTRUCTION

GENERAL NOTES:

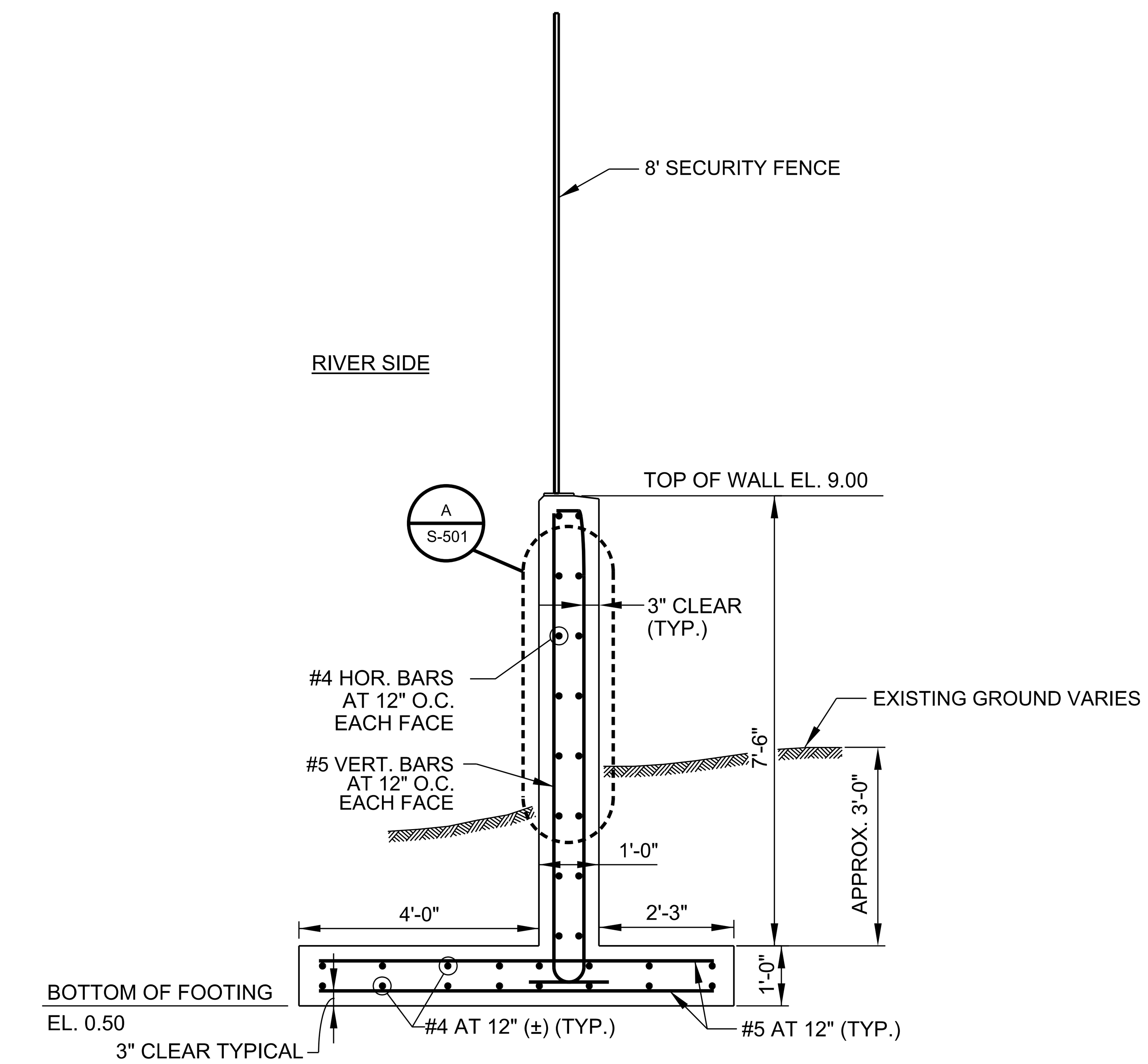
1. BOTTOM OF FLOOD WALL FOOTING ELEVATION 0.50.
2. THE KEY IN THE EXPANSION JOINT SHALL STOP AT THE TOP OF THE FOOTING AND 6" FROM THE TOP OF THE WALL. THE JOINT ACROSS THE FOOTING AND THE TOP OF THE WALL SHALL BE A STRAIGHT LINE.
3. SEE SHEET S-501 FOR MORE INFORMATION ON STRUCTURAL DETAILS.
4. SEE SHEET C-111 FOR MORE INFORMATION ON CIVIL DETAILS.
5. SEE SPECIFICATIONS FOR ARCHITECTURAL CONCRETE FINISH REQUIREMENTS FOR THE FLOODWALL.



STRUCTURAL SITE PLAN

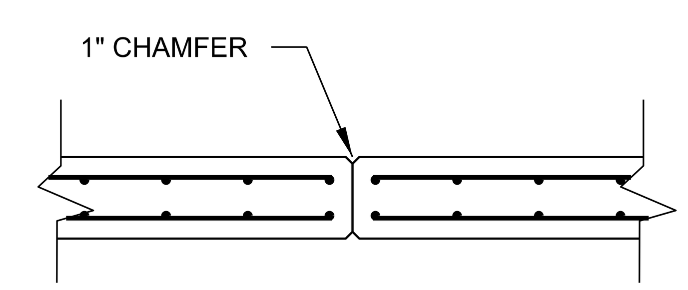
SCALE: 1" = 20'

RIVER SIDE



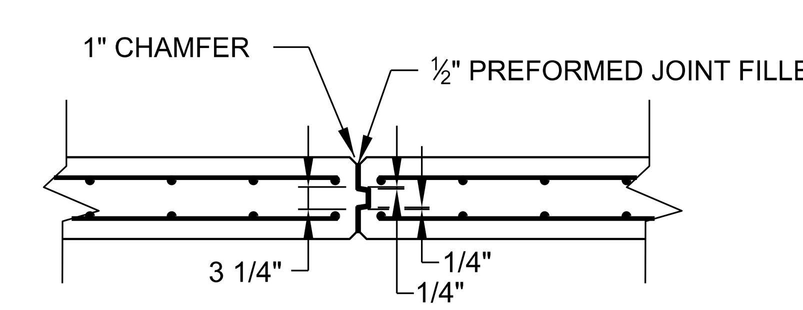
A S-101 TYPICAL RETAINING WALL SECTION

SCALE: 1/2" = 1' - 0"



CONTRACTION JOINT

SCALE: 1/2" = 1' - 0"



EXPANSION JOINT

SCALE: 1/2" = 1' - 0"

GRAPHIC SCALES:

½" = 1'-0" 1' 0 1' 2' 3' 4' 5'

1" = 20' 20' 0 20' 40'

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U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

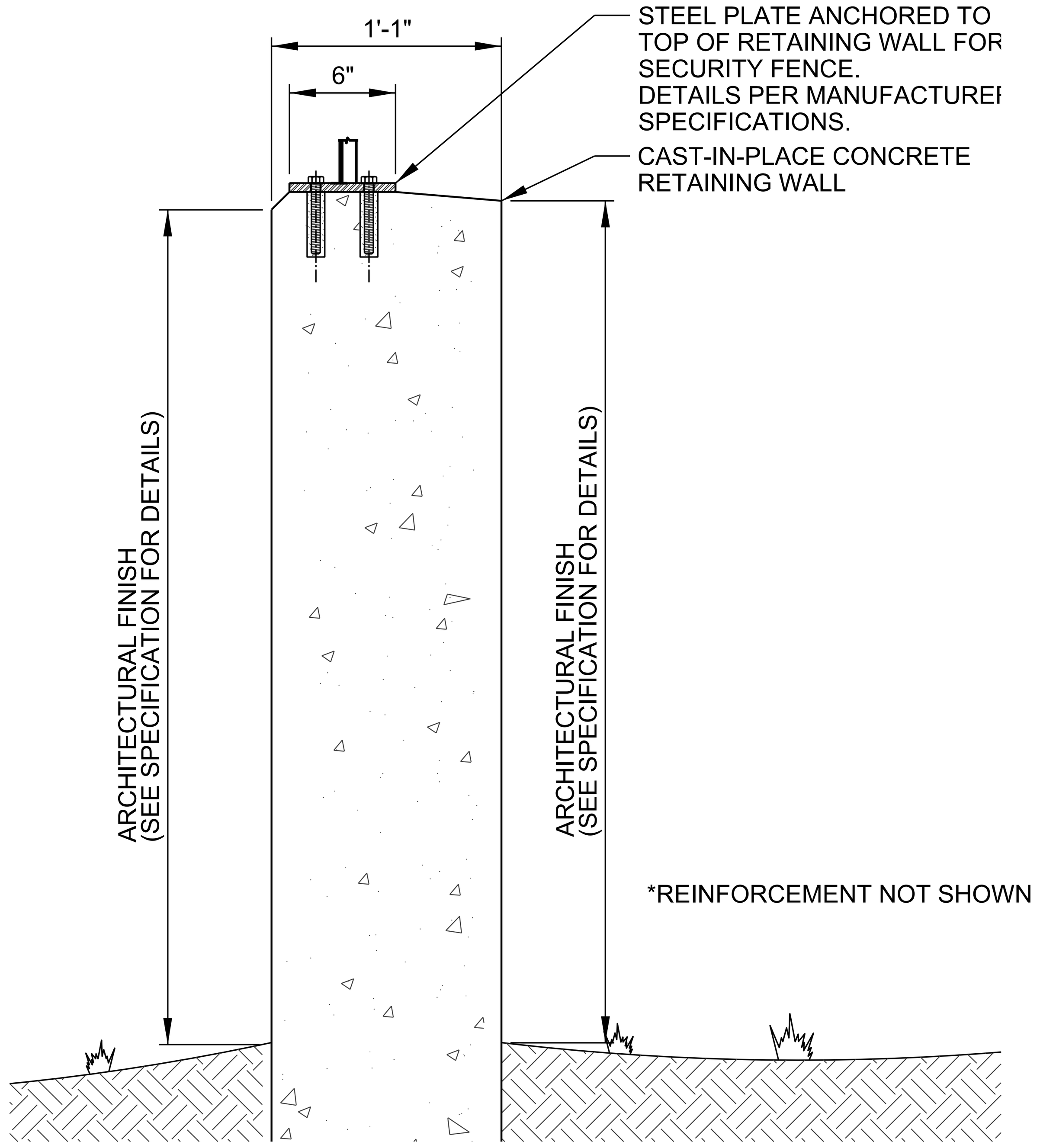
DATE: SEPT 2017

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

STRUCTURAL SITE PLAN
WALL SECTION
AND JOINT DETAILS

SHEET IDENTIFICATION
S-101

SHEET 105 OF 110



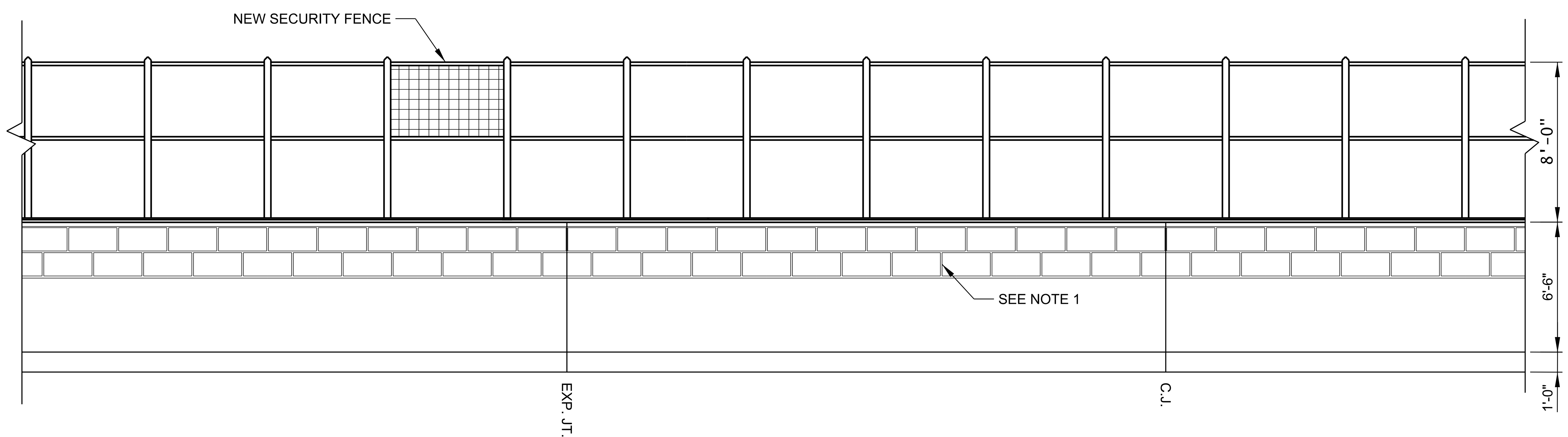
A
S-101

FLOOD WALL DETAIL

SCALE: 1 1/2" = 1'-0"

NOTES:

SUBMITTAL OF SHOP DRAWINGS IS REQUIRED PRIOR TO CONSTRUCTION. SHOP DRAWINGS MUST SHOW ALL JOINT LOCATIONS INCLUDING CONSTRUCTION AND CONTROL JOINTS

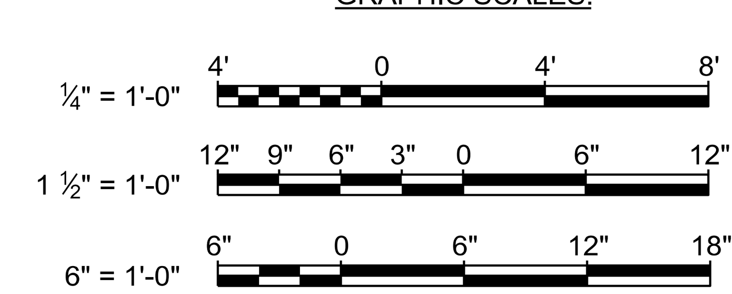


B
S-101

PARTIAL FLOOD WALL ELEVATION

SCALE: 1/4" = 1'-0"

GRAPHIC SCALES:



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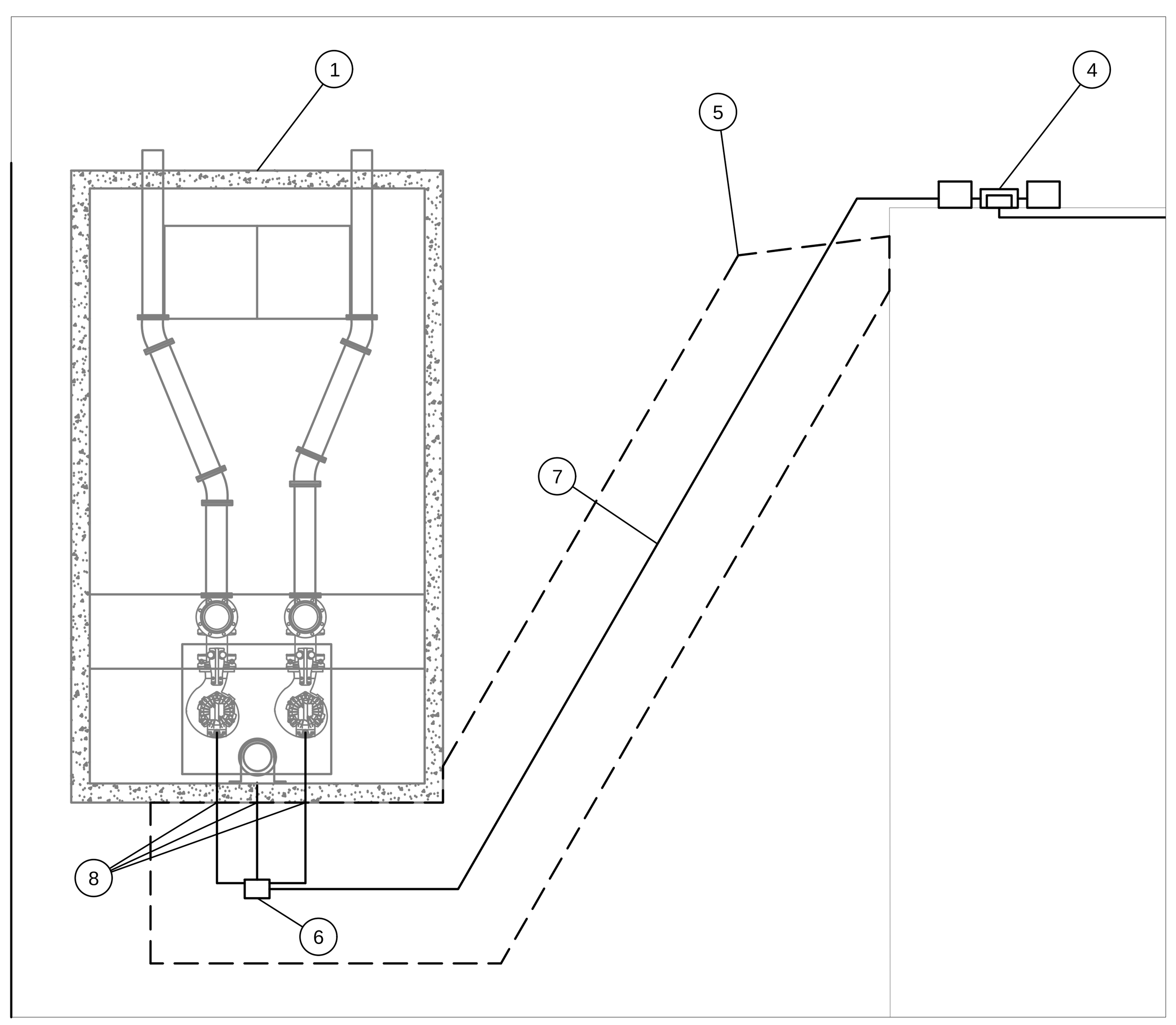
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: T. BEAL
DATE: SEPT 2017
DWN BY: D. HASSETT
CKD BY:
SOLICITATION NO.:
SUBMITTED BY: J. GARTLAND
CONTRACT NO.:
PLOT SCALE: 1:1
PLOT DATE:
DRAWING CODE: MUD-2
SIZE: ANSI D
FILE NAME: MUD-2_S-501.dgn

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

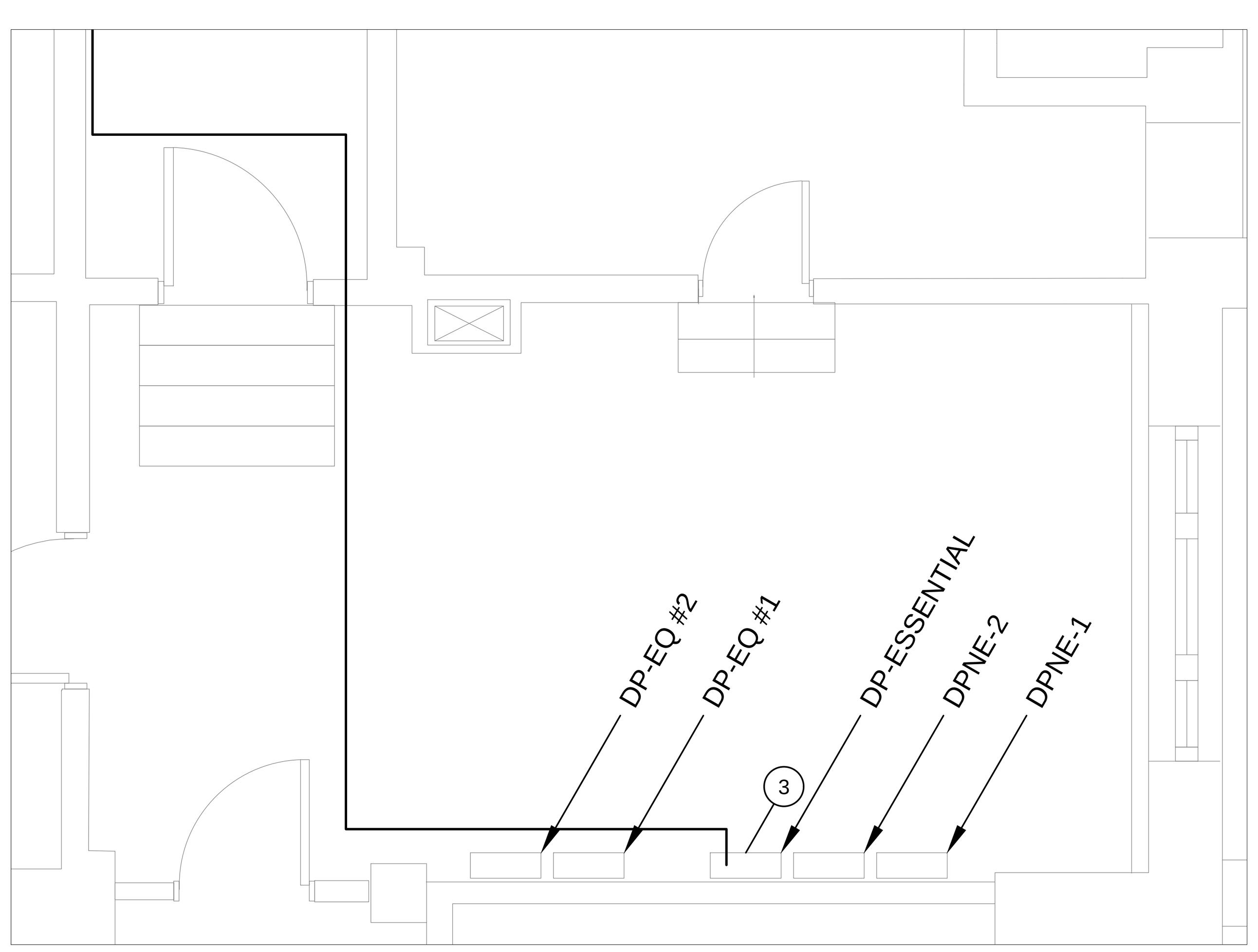
RETAINING WALL ELEVATION AND DETAIL

SHEET IDENTIFICATION
S-501
SHEET 106 OF 106



PUMP STATION PLAN

SCALE: 1/4" = 1'-0"

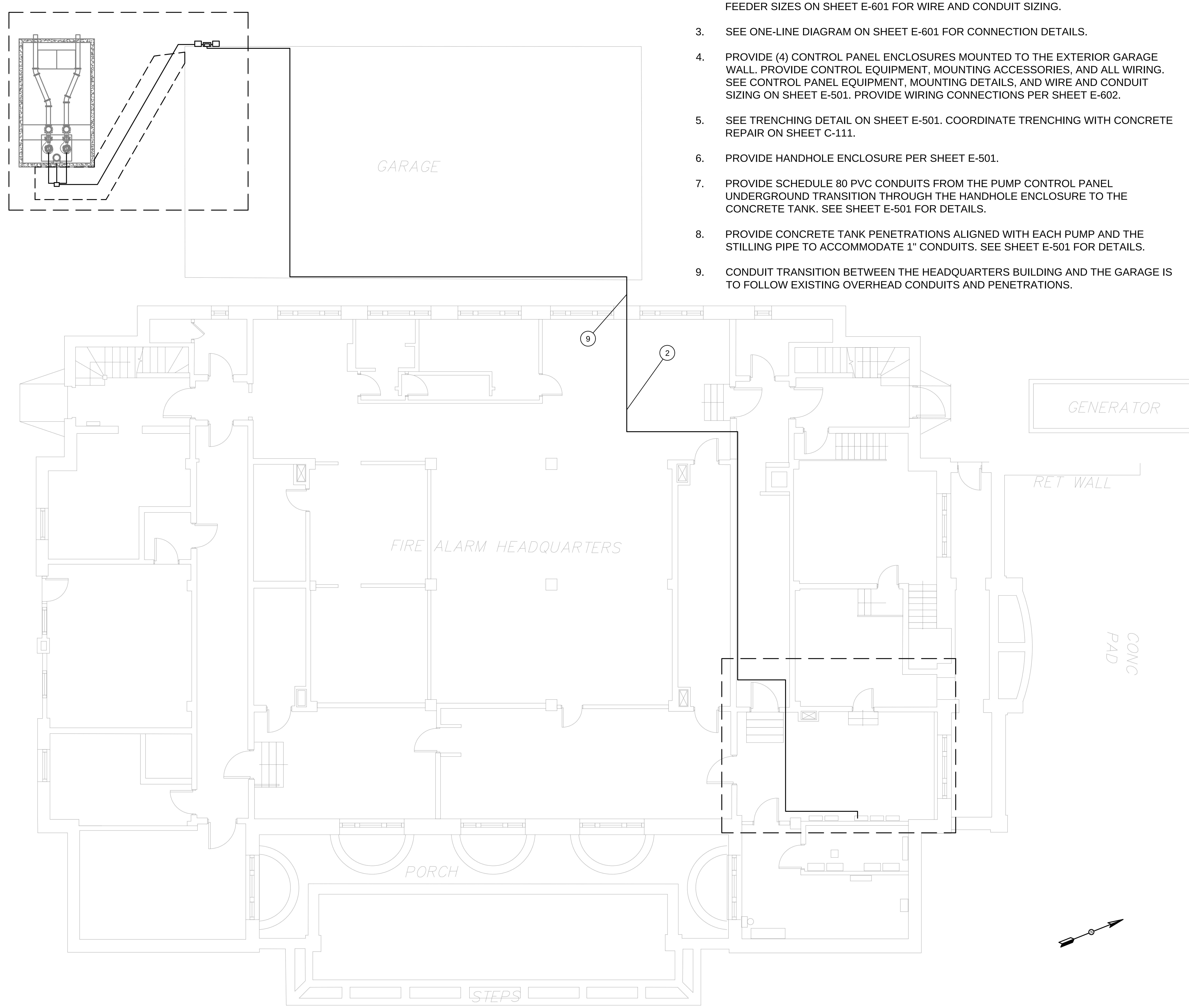


ELECTRICAL ROOM FLOOR PLAN

SCALE: 1/4" = 1'-0"

KEY NOTES:

1. PUMP STATION TO BE INSTALLED PER SHEET C-503 & C-504.
2. PROVIDE WIRE AND CONDUIT FROM PANEL DP-ESSENTIAL TO THE NEW PUMP CONTROL PANEL TAP BOX. RUN CONDUIT ALONG CEILINGS AND WALLS ON THE INTERIOR OF EACH BUILDING WITH THE EXCEPTION OF THE TRANSITION BETWEEN BUILDINGS WHICH WILL BE EXTERIOR. UTILIZE EXISTING WALL PENETRATIONS WHERE POSSIBLE AND MAKE NEW PENETRATIONS WHERE NECESSARY. PROVIDE FIRESTOPPING AND WEATHERPROOFING SEALS AT PENETRATIONS WHERE NECESSARY. PROVIDE PULL BOXES ALONG THE ROUTE SUCH THAT NO MORE THAN (4) 90 DEGREE BENDS OCCUR BETWEEN PULL BOXES. PULL BOXES MUST BE SIZED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ARTICLE 314. SEE LEGEND OF FEEDER SIZES ON SHEET E-601 FOR WIRE AND CONDUIT SIZING.
3. SEE ONE-LINE DIAGRAM ON SHEET E-601 FOR CONNECTION DETAILS.
4. PROVIDE (4) CONTROL PANEL ENCLOSURES MOUNTED TO THE EXTERIOR GARAGE WALL. PROVIDE CONTROL EQUIPMENT, MOUNTING ACCESSORIES, AND ALL WIRING. SEE CONTROL PANEL EQUIPMENT, MOUNTING DETAILS, AND WIRE AND CONDUIT SIZING ON SHEET E-501. PROVIDE WIRING CONNECTIONS PER SHEET E-602.
5. SEE TRENCHING DETAIL ON SHEET E-501. COORDINATE TRENCHING WITH CONCRETE REPAIR ON SHEET C-111.
6. PROVIDE HANDHOLE ENCLOSURE PER SHEET E-501.
7. PROVIDE SCHEDULE 80 PVC CONDUITS FROM THE PUMP CONTROL PANEL UNDERGROUND TRANSITION THROUGH THE HANDHOLE ENCLOSURE TO THE CONCRETE TANK. SEE SHEET E-501 FOR DETAILS.
8. PROVIDE CONCRETE TANK PENETRATIONS ALIGNED WITH EACH PUMP AND THE STILLING PIPE TO ACCOMMODATE 1" CONDUITS. SEE SHEET E-501 FOR DETAILS.
9. CONDUIT TRANSITION BETWEEN THE HEADQUARTERS BUILDING AND THE GARAGE IS TO FOLLOW EXISTING OVERHEAD CONDUITS AND PENETRATIONS.



FLOOR PLAN

SCALE: 1/8" = 1'-0"

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MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS

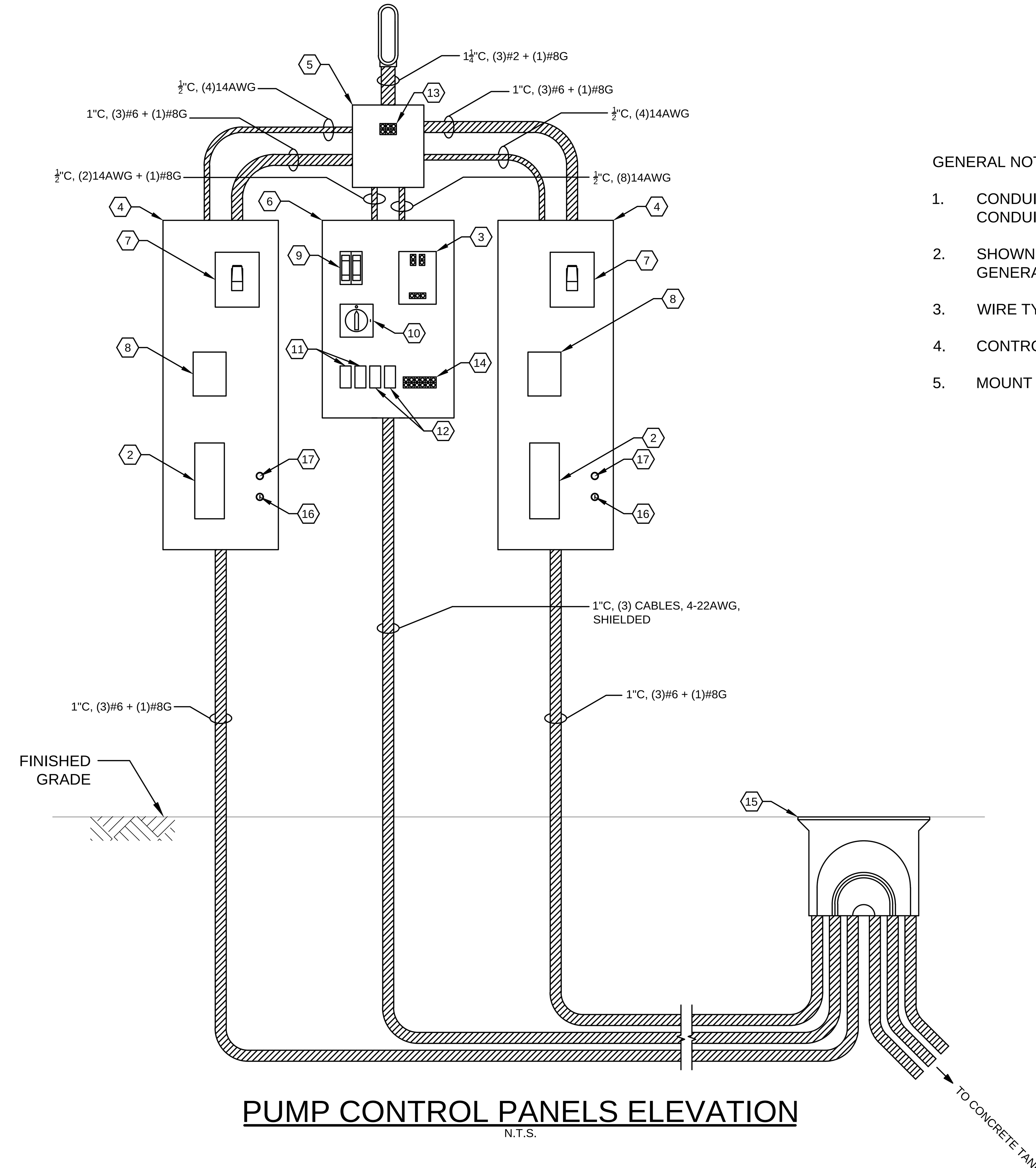
ELECTRICAL FLOOR PLAN
NEW AND EXISTING CONDITIONS

SHEET IDENTIFICATION
E-101
SHEET 0 OF 0

EQUIPMENT SCHEDULE

SYMBOL	DESCRIPTION	MANUFACTURER	PART NUMBER
1	24VDC SUBMERSIBLE CAPACITANCE LIQUID LEVEL SENSOR RELAY W/ 50' CABLE	FLOWLINE	LP15-1405
2	REDUCED VOLTAGE MOTOR SOFT STARTER	EATON	S801+N37N3S
3	24VDC POWER SUPPLY	EATON	PSG240E
4	COMBINATION PUMP DISCONNECT ENCLOSURE	EATON	BOX NO. A1, TYPE 4X
5	JUNCTION BOX 6.5"X7.5"X3" MINIMUM NEMA 4X		
6	ENCLOSURE 12"X18"X5" MINIMUM NEMA 4X		
7	CIRCUIT BREAKER 80A, 208VAC, 3 POLE		
8	CONTACTOR 208VAC, 3 POLE, 80A, 24VDC COIL		
9	FUSE W/ FUSEHOLDER, 10A	COOPER BUSSMANN	FWX-10A14F
10	ISOLATOR SWITCH 10A MIN., 208VAC MIN., 2 POLE		
11	TIME-DELAY RELAY, OFF (DROP-OUT) MIN RANGE 60-105SEC, 24VDC		
12	TIME-DELAY RELAY, ON (PICK-UP) 60SEC, 24VDC		
13	TAP KIT 3 PAIRS, #2 & #6 WIRE		
14	TERMINAL STRIP 6 PAIRS, 14AWG		
15	HANDHOLE ENCLOSURE 8"X8"X9" MINIMUM H20 RATED		
16	KEYED BYPASS SWITCH 24VDC		
17	INDICATOR LIGHT LED, 24VDC, GREEN		

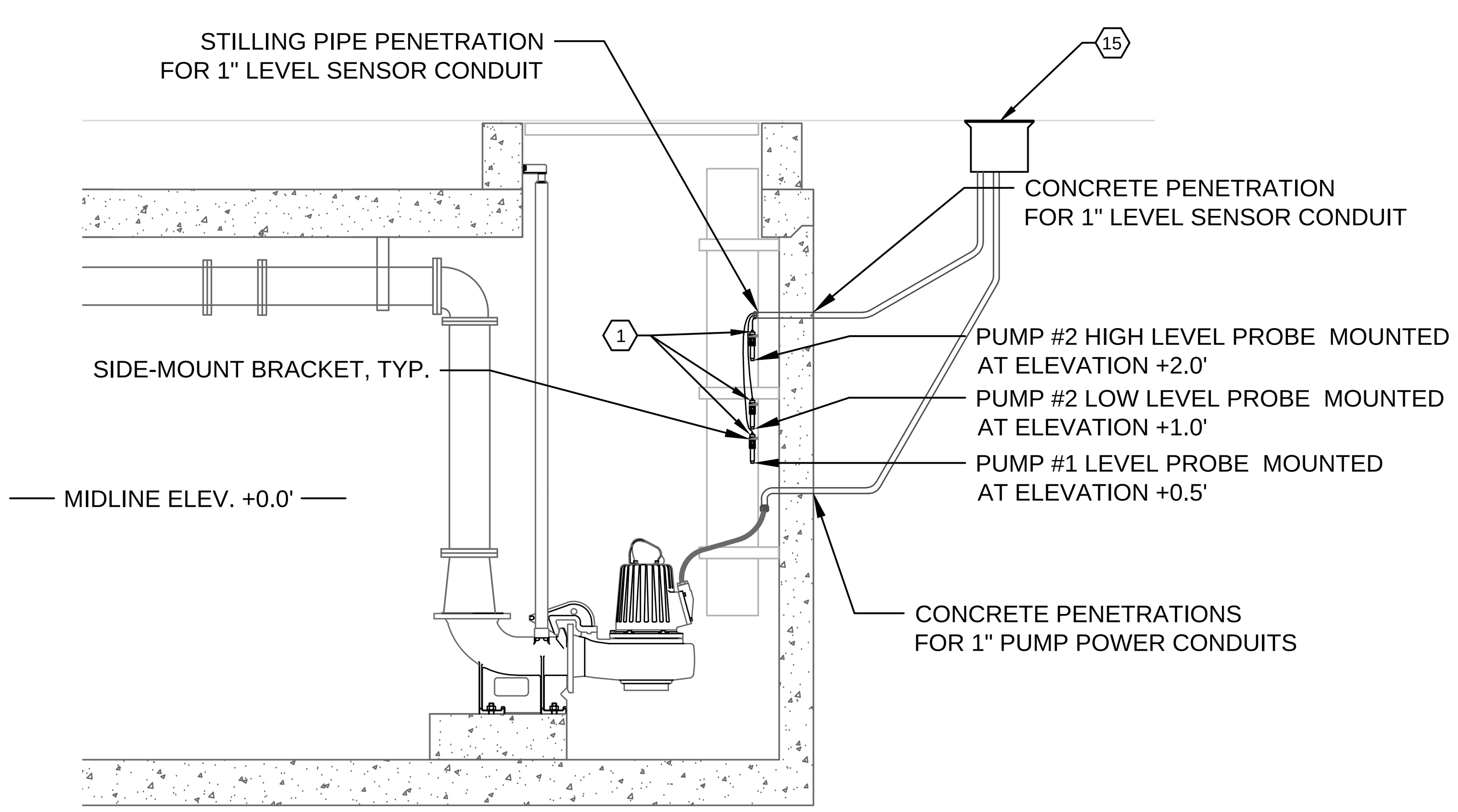
NOTE: LISTED MANUFACTURERS AND PART NUMBERS ARE RECOMMENDATIONS. APPROVED EQUIVALENT PARTS MAY BE USED.



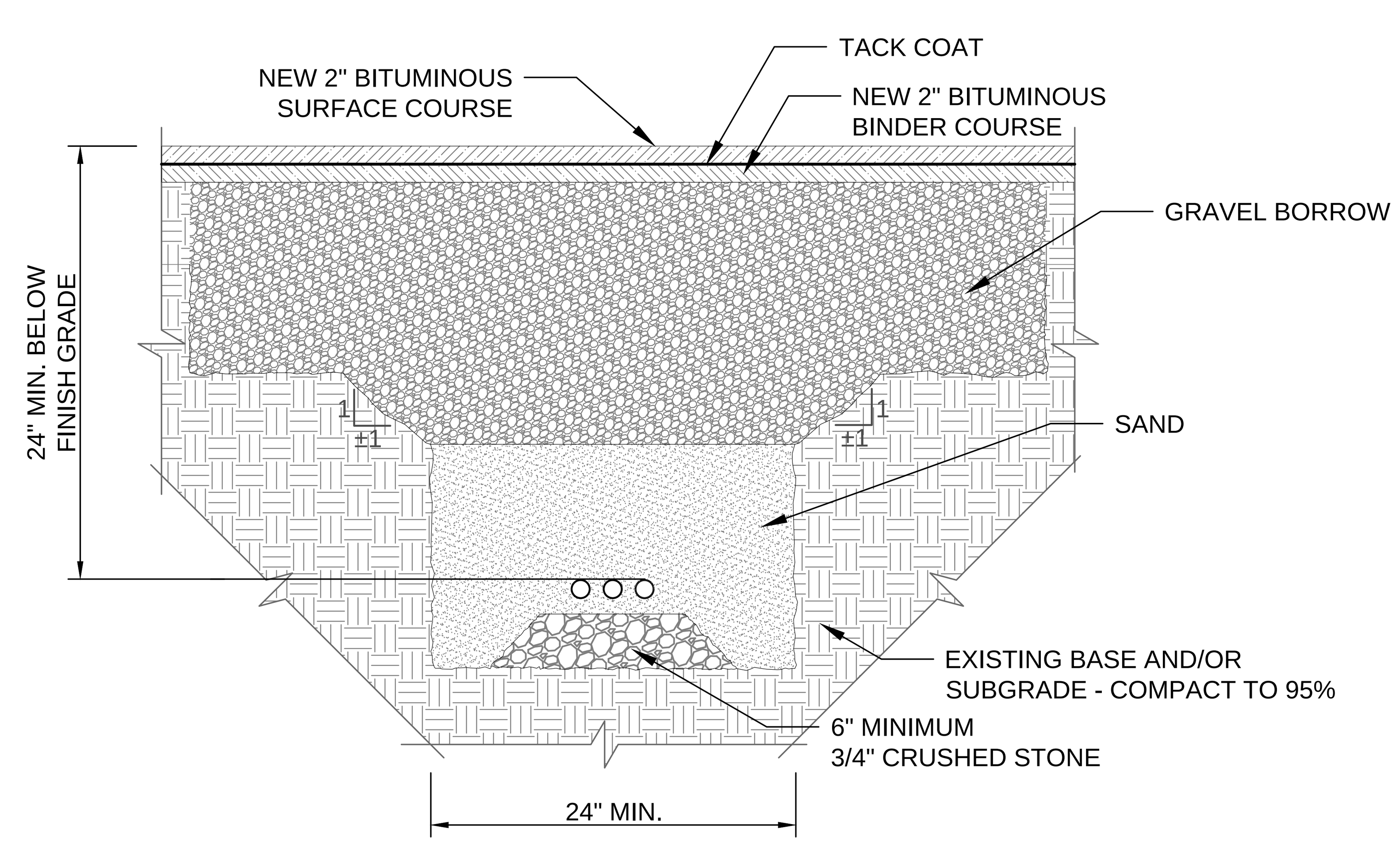
PUMP CONTROL PANELS ELEVATION
N.T.S.

GENERAL NOTES:

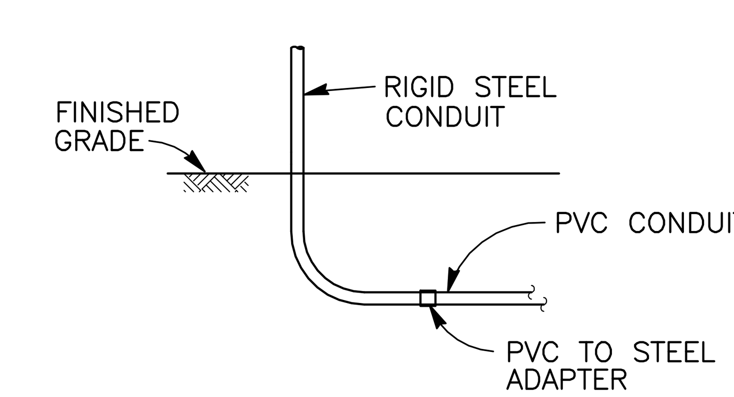
1. CONDUITS ABOVE GROUND SHALL BE GALVANIZED RIGID STEEL. CONDUITS BELOW GROUND SHALL BE SCHEDULE 80 PVC.
2. SHOWN LOCATIONS OF COMPONENTS ON THE PANEL ELEVATION ARE GENERAL. FIELD INSTALLATION OF COMPONENTS MAY VARY FOR BEST FIT.
3. WIRE TYPE THROUGHOUT SHALL BE XHHW.
4. CONTROL WIRING SHALL BE 14AWG.
5. MOUNT LIQUID LEVEL SENSORS PER MANUFACTURER'S INSTRUCTIONS.



LEVEL SENSORS AND PUMP POWER DETAIL
SCALE: 1/2" = 1'-0"



ELECTRICAL TRENCH DETAIL
SCALE: 1-1/2" = 1'-0"



NOTE: THIS DETAIL IS TYPICAL FOR ALL ELECTRICAL CONDUIT TRANSITIONS BETWEEN DIRECT BURIED AND DAYLIGHT.

CONVERSION FROM STEEL TO PVC CONDUIT
N.T.S.

US Army Corps of Engineers® New England District

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DWN BY: D. NGUYEN
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:1
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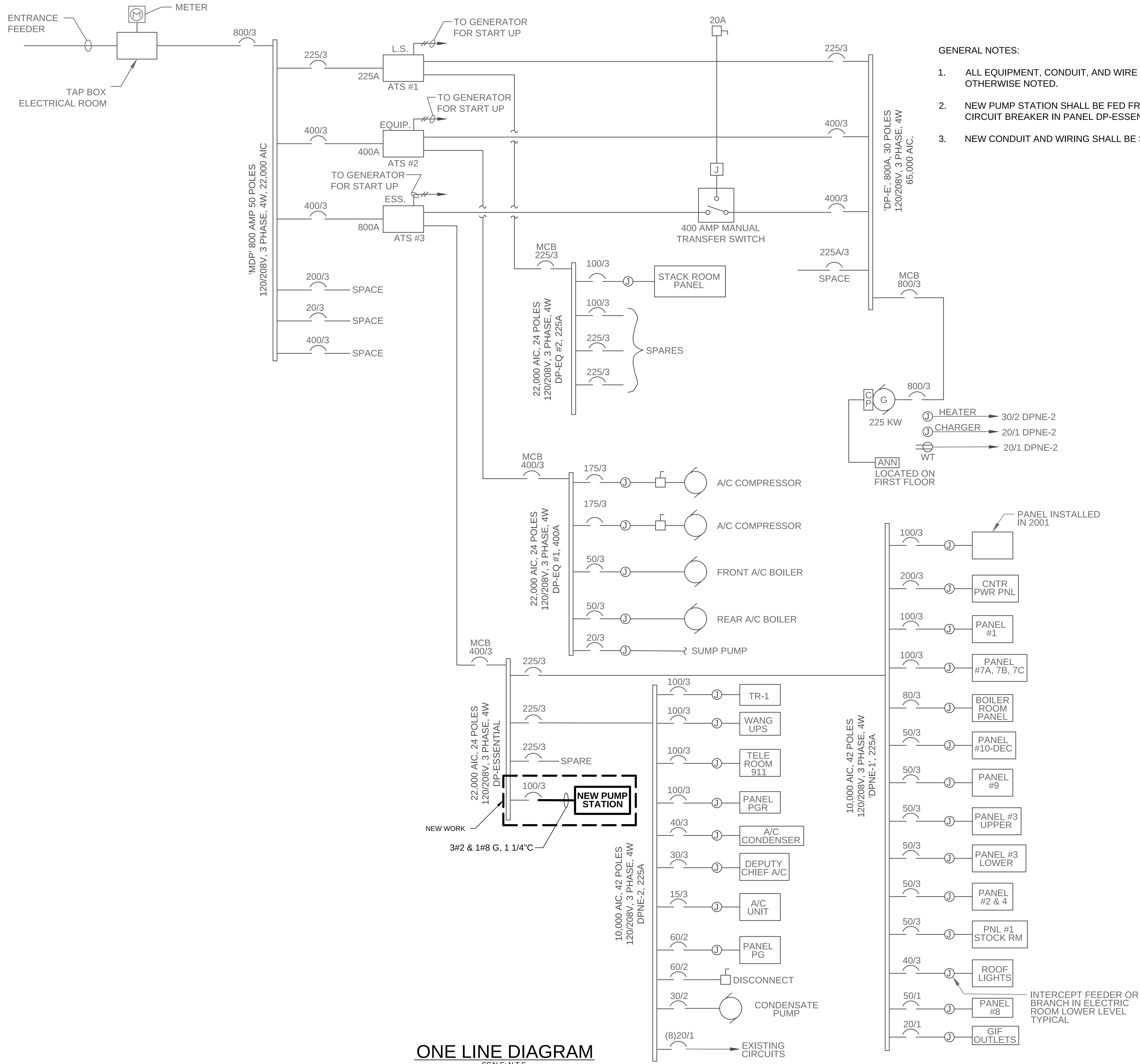
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS
ELECTRICAL DETAILS & EQUIPMENT SCHEDULE

SHEET IDENTIFICATION
E-501
SHEET 0 OF 0



ONE LINE DIAGRAM

SCALE: N.T.S.

GENERAL NOTES:

1. ALL EQUIPMENT, CONDUIT, AND WIRE IS EXISTING TO REMAIN UNLESS OTHERWISE NOTED.
2. NEW PUMP STATION SHALL BE FED FROM THE EXISTING 'SPARE' 100A 3-POLE CIRCUIT BREAKER IN PANEL DP-ESSENTIAL.
3. NEW CONDUIT AND WIRING SHALL BE SIZED AS NOTED.

US Army Corps of Engineers® New England District

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DESIGNED BY: D. NGUYEN
DWN BY:
CKD BY:
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
SIZE:
FILE NAME:
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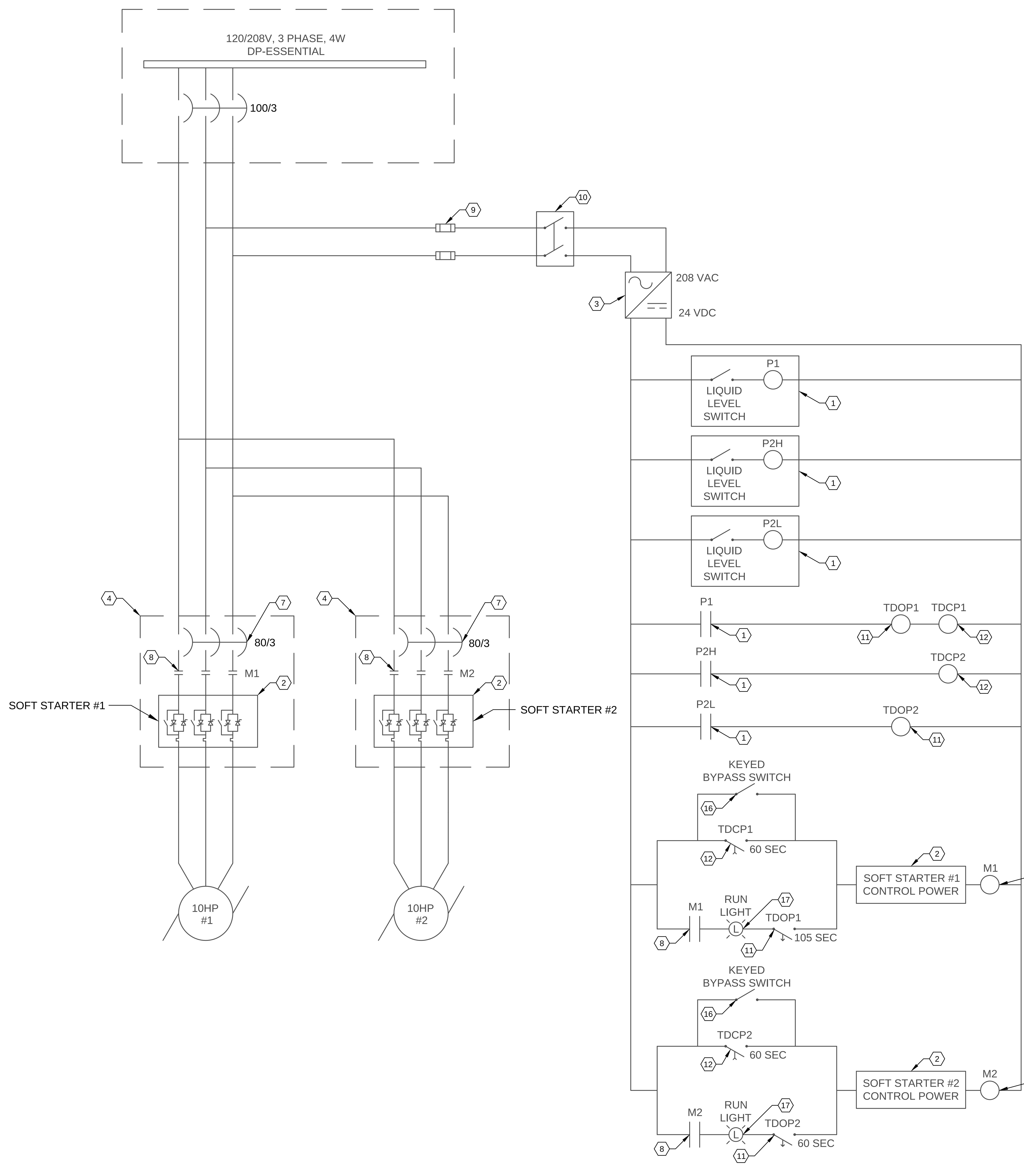
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS

MUDDY RIVER FLOOD DAMAGE REDUCTION PROJECT (PHASE 2) BOSTON AND BROOKLINE, MASSACHUSETTS

ELECTRICAL ONE LINE DIAGRAM

SHEET IDENTIFICATION

E-601



PUMP CONTROL CIRCUIT DIAGRAM

SCALE: N.T.S.

GENERAL NOTES:

1. HEX NOTES CORRESPOND WITH EQUIPMENT SCHEDULE AND PUMP CONTROL PANELS ELEVATION ON SHEET E-501.
2. CONTRACTOR IS RESPONSIBLE FOR PROVIDING AND ASSEMBLING CONTROL EQUIPMENT AND WIRING. MAKE ADJUSTMENTS AS NECESSARY TO MEET THE INTENT OF THE PUMP SEQUENCE OF OPERATION.

PUMP SEQUENCE OF OPERATION:

1. PUMP #1 IS ASSOCIATED WITH LEVEL SENSOR P1. PUMP #2 IS ASSOCIATED WITH LEVEL SENSORS P2H & P2L.
2. THE PUMP #1 LEVEL SENSOR (P1) IS MOUNTED AT ELEVATION +0.5'. THE PUMP #2 HIGH LEVEL SENSOR (P2H) IS MOUNTED AT ELEVATION +2.0'. THE PUMP #2 LOW LEVEL SENSOR (P2L) IS MOUNTED AT ELEVATION +1.0'.
3. TIME DELAY RELAYS ARE INCORPORATED INTO THE SENSOR SIGNALS TO MINIMIZE RAPID CYCLING OF THE PUMPS AND CONTROL COMPONENTS WHEN THE WATER LEVEL IS AT SENSOR THRESHOLDS.
4. ASSUME RESTING WATER LEVEL AT -2.8'. WHEN WATER LEVEL RISES TO +0.5' AND CLOSES SENSOR P1 FOR 60 SECONDS CONTINUOUSLY, THE MAIN CONTACTOR (M1) FOR PUMP #1 WILL CLOSE AND THE SOFT STARTER WILL RAMP UP THE PUMP TO FULL SPEED.
5. WHEN WATER LEVEL CONTINUES TO RISE TO ELEVATION +2.0' AND CLOSES SENSOR P2H FOR 60 SECONDS CONTINUOUSLY, THE MAIN CONTACTOR (M2) FOR PUMP #2 WILL CLOSE AND THE SOFT STARTER WILL RAMP UP THE PUMP TO FULL SPEED. BOTH PUMPS ARE OPERATING AT THIS TIME.
6. WHEN WATER LEVEL DROPS BELOW ELEVATION +1.0' AND SENSOR P2L OPENS FOR 60 SECONDS CONTINUOUSLY, MAIN CONTACTOR M2 WILL OPEN AND PUMP #2 WILL STOP.
7. WHEN WATER LEVEL DROPS BELOW ELEVATION +0.5' AND SENSOR P1 OPENS FOR 105 SECONDS CONTINUOUSLY, MAIN CONTACTOR M1 WILL OPEN AND PUMP #1 WILL STOP.
8. THE 105 SECOND (1 MIN 45 SEC) DROP-OUT DELAY FOR SENSOR P1 WILL ALLOW SIGNIFICANT REDUCTION OF WATER LEVEL BELOW +0.5' BUT STILL ALLOW WATER LEVEL TO REMAIN ABOVE THE MINIMUM -2.8' UPON PUMP STOP.

LEGEND OF SYMBOLS

SYMBOL	DESCRIPTION
	SWITCH
	BREAKER
	FUSE
	RELAY CONTACTS
	LIGHT
	RELAY COIL
	TIMED DROP-OUT RELAY
	TIMED PICK-UP RELAY
	PUMP MOTOR

US Army Corps of Engineers® New England District

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

DESIGNED BY: D. NGUYEN
DWN BY: D. NGUYEN
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE:
PLOT SCALE:
PLOT DATE:
SIZE: ANSI D
FILE NAME:

MUDDY RIVER
FLOOD DAMAGE REDUCTION PROJECT
(PHASE 2)
BOSTON AND BROOKLINE, MASSACHUSETTS
PUMP CONTROL DIAGRAM

SHEET IDENTIFICATION
E-602

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cdmsmith.com

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) for the Phase 2 Muddy River Flood Damage Reduction Project (the Project) as an Ecological Restoration Limited Project. The Project has been designed by the U.S. Army Corps of Engineers-New England District (ACOE) and aims to relieve the Muddy River of flooding, improve degraded riverine habitats, poor water quality, and other related water resource problems.

The construction of the Muddy River project requires the expertise of two different types of contractors. For this reason, the design and implementation of the project was conducted in two separate phases. The first phase consisted of the major structural features of the flood control improvements, daylighting of two sections (about 700 linear feet) of the Muddy River, and sediment removal from the Upper Fens Pond. Construction of Phase 1 began in 2013 and was substantially completed in August 2016. The work completed in Phase 1 included:

- Constructed 10' by 24' concrete culverts under both the Riverway and Brookline Avenue.
- Removed existing twin 72" pipes in the Old Sears Parking Lot and daylighted the river in this area.
- Removed existing twin 72" pipes in Brookline Avenue jug handle area and in the area just upstream of Avenue Louis Pasteur culvert. Daylighted the river in these two areas.
- Reconstructed culvert opening at upstream end of Avenue Louis Pasteur culvert.
- Dredged and reshaped the Upper Fens Pond section of the river to allow for increased flow.
- Installed temporary flow restriction structure upstream of the Riverway.
- Landscaping with trees, shrubs, and emergent plantings.
- Installed habitat logs and boulders for fish and turtles.
- Post construction vegetation monitoring and invasive species control.

The second phase of the Muddy River Flood Damage Reduction Project consists of removal of sediment for flow conveyance in the Fens, Riverway, and Leverett Pond. Phase 2 is proposed to begin construction during Spring of 2019, and will include the following work:

- Excavate the river in the Back Bay Fens area to allow for increased flows and reduce flood damage.

- Excavate five stretches of the Riverway section of the river to allow for increased flows and reduce flood damage.
- Excavate the sandbar and island at Leverett Pond to allow for increased flows and reduce flood damage.
- Excavate deepened channel sections to delay need for maintenance dredging.
- Provide additional flood proofing at the Boston Fire Department Fire Control Center in the Back Bay Fens.
- Management of invasives (Phragmites) in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction and improve ecological habitat quality.
- Restore wetland vegetation in dredged areas by seeding or planting appropriate wet meadow and emergent wetland plants.
- Restore riparian vegetation in upland areas where Phragmites or Japanese knotweed are eradicated by planting grass, trees and shrubs.
- Installation of habitat logs for fish and turtles.
- Removal of the temporary flow restriction structure upstream of the Riverway.
- Restore vegetation and other landscape features following removal of temporary access roads, staging areas, and the flow restriction structure.
- Post construction vegetation monitoring and invasive species control.

All of this work will serve to further the interests of the Wetlands Protection Act (WPA) by restoring and improving the natural capacity of the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

In addition to the work proposed by the USACE, the City of Boston is also in the process of permitting an invasives management pilot program for pre-work in areas to be addressed by the USACE Phase 2 project and for areas impacted by invasives but not included within the USACE project. The invasives management pilot program will include work in the Riverway and Back Bay Fens segments of the Muddy River. The invasives management pilot program is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. This pilot program is also being permitted as an Ecological Restoration Limited Project as discussed in greater detail below.

The project has several objectives that serve to restore and protect the interests of the WPA (as noted in parentheses below):

1) Alleviate flooding along the river corridor and reduce flood damage to public and private property (flood control and storm damage prevention);

2) Improve the water quality of the river by restoring river hydraulics and removing contaminated sediments in dredged areas (prevention of pollution and protection of fisheries);

3) Restore shoreline plantings to increase plant species diversity and structural diversity to the riparian plant community compared to existing conditions (protection of wildlife habitat).

The objectives listed above serve to restore and protect five of the eight interests of the WPA and to satisfy related General Eligibility Criteria for Inland Ecological Restoration Limit Projects.

The dredging component of the project will improve the interests of flood control and storm damage prevention, as well as the wildlife habitat and fisheries interests in the Back Bay Fens and Riverway segments for areas impacted by construction as shown on the project documents. Removal of the contaminated river sediments will reduce a source of pollution and limit potential recontamination of downstream areas in the future, thus supporting the prevention of pollution interest. Restoration of the riparian plant community (in areas impacted by construction) will improve the wildlife habitat of the banks compared to existing conditions. Removal of the Phragmites stands (in areas impacted by dredging) within the river in the Fens and Riverway will improve habitat value of land underwater and bank areas. In addition, removal of phragmites in bank, BVW, and buffer zone areas through either the Phase 2 project or the invasives management pilot program will further the desired ecological restoration benefits.

The proposed work was developed to achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Fill Removal and Re-grading;
- Flow Restoration; and
- Invasive Species Management.

Written notices regarding the proposed Phase 2 project for work in both Boston and Brookline were submitted to the Massachusetts Environmental Policy Act (MEPA) Office, along with the written notice for the invasives management pilot program in Boston, for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission and the Brookline Conservation Commission on the Notices of Intent filed for the respective projects/jurisdictions.

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;
2) Organic loading from storm drains, illegal sewer connections, and combined sewers;
3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;
4) Sediment oxygen demand (SOD);
5) Release of nutrients from anaerobic sediment;
6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;
7) Waste geese and ducks; and
8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Mathew et al. (2011) determined that nutrient loading from algae, sediment, and waterfowl dominate the spatial pattern of water quality in the Muddy River. The study concluded that significant improvement in dissolved oxygen, biological oxygen demand, and total phosphorus could be expected from the sediment removal component of the Muddy River restoration project.

Sediment from Leverett Pond, the Riverway, and Fens contain elevated levels of metal, PAHs, petroleum hydrocarbons, and PAHs. PCBs and DDT and its metabolites are also frequently detected. Concentrations of contaminants are generally highest in surface sediments and decline with depth. Accumulation of contaminants in sediment is believed to be the result of years of loading from storm drains, combined sewer overflows, point source discharges (fuel oil), and atmospheric deposition (dust and precipitation). Conditions are exacerbated by the highly urbanized nature of the watershed, sluggish nature of the Muddy River and resulting lack of significant flushing, and low dissolved oxygen levels which slow decomposition of petroleum hydrocarbons and other organic contaminants.

Multiple lines of evidence indicate that chemicals in Muddy River sediment pose a risk to biota (see Appendix F in USACE (2003). Sediment is likely to adversely affect fish and benthic invertebrates. Principal lines of evidence in support of this assessment are comparison with probable effect concentrations (PECs) developed by McDonald et al. (2000) and bioassay test results. Levels of metals, PAHs, pesticides and PCBs in sediment from Leverett Pond, the

Riverway, and Back Bay Fens generally exceed PECs. In many cases, PECs are exceeded several fold, making adverse impacts on benthic invertebrate communities probable.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool.

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Back Bay Fens and vicinity (see USACE, 2003). The area supports resident (breeding) populations of many bird species and provides a valuable refuge for songbirds, wading birds, and waterfowl migrating through the Boston area. A large population of ducks, mostly black duck/ mallard hybrids, is present in the Riverway and Back Bay Fens throughout the year. Canada goose are also abundant. Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990’s and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The Phase 2 Project Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the study area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees, shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native ”volunteers”. Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although *Phragmites* is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Phase 2 work. The activities within wetlands resource areas are presented for each work area within Leverett Pond, the Riverway and the Back Bay Fens segments as proposed by the USACE. The combined benefits to the ecological restoration of wetlands resource areas from the both the Phase 1 Project, the proposed Phase 2 are also presented below. In addition, the invasives management program is described in greater detail for the work proposed in the City of Boston.

2.0 Summary of Work in Wetlands

The proposed Muddy River Flood Damage Reduction Project - Phase 2 includes dredging, ecological restoration (for areas impacted by construction) and flood proofing work in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area. The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides flood control and ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

2.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;
2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);

4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and
    c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

2.2 Bank

For the project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;

4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during construction, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards. Details regarding the proposed work in the bank resource areas and the proposed mitigation and restoration measures is described in greater detail in Section 3 and the attachments to this NOI.

2.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat. For this project, a portion of the BVW area will be converted to other resource types to complete the ecological restoration as proposed.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

2.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

2.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

2.6 Bordering Land Subject to Flooding

For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Flood Control) which is intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

2.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide flood control and invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).

3.0 Description of the Proposed Project by River Segment

3.1 Introduction

The following sections describe the proposed activities within thirteen work areas associated within the three geographic segments of the Flood Damage Reduction Project - Phase 2 (i.e. Leverett Pond, the Riverway and the Back Bay Fens). These sections describe the:

- Existing conditions of each work area/segment;
- Functions and values or "interests" supported within each work area/segment;
- Proposed work and impacts;
- Proposed construction methods and staging areas; and
- Proposed construction monitoring and mitigation measures.
- The construction methods, staging areas, monitoring and proposed mitigation measures for all work areas are presented herein.

The impacts to wetlands resource areas within each work area are presented for the respective work within each municipality. In addition to the proposed mitigation measures described herein, Section 3 describes the Benefits, Impacts and Restoration plan for the project.

3.2 Leverett Pond (Work Area No. 1) Boston and Brookline

The majority of work within wetland resource areas in Leverett Pond will occur within Land Under Water (in Boston and Brookline) for dredging, Inland Bank and Bordering Vegetated Wetland for restoration/ enhancement of areas impacted by construction (in Brookline) and buffer zone for restoration of construction access and staging areas (also in Brookline). This work will not adversely affect the principal functions and values of the pond. No loss of Inland Bank or BVW will occur as a result of this work.

The following sections describe the existing conditions and interests supported by the resource areas in Leverett Pond. Impacts, construction monitoring and proposed mitigation are discussed in Section 3.5.

3.2.1 Existing Conditions and Interests of the Act

Just upstream of the Riverway section of the Muddy River is Leverett Pond which is a shallow 7-acre pond with a maximum depth of 5 to 6 feet. The pond receives inflow from Willow Pond (Babbling Brook), the Daisy Field drain, Village Brook, and numerous smaller storm drains. The tributary area to the Village Drain is approximately 2,060 acres, the largest tributary area for storm water outfalls to the Muddy River. Material discharged from the Village Brook Drain has formed an extensive shoal area and an exposed sediment deposit near its outlet at the northern end of the pond.

Leverett Pond is bordered by grassed parkland along most of its perimeter. There is an earthen bank on the Boston side (east) and a gabion formed shoreline for the majority of the Brookline side (west). Roadways surround Leverett Pond and include Route 9 (to the north), The Jamaica

Way (to the east), Willow Pond Road (to the south) and Pond Avenue (to the west). Leverett Pond contains three islands along its western edge. The land that is immediately adjacent to Leverett Pond consists of vegetated woodlands and grassy parklands with paved and unpaved paths. Beyond the woodlands and to the east is the Jamaica Way and to the west is Pond Avenue, which separates the residential areas from Leverett Pond.

The normal water surface elevation during dry-weather flow in Leverett Pond is approximately elevation 18 feet (Boston City Base), which is the same elevation as the downstream portions of the Muddy River and the Charles River.

3.2.2 Description of Work in Resource Areas and Impacts

The proposed Phase 2 project includes removal of sediment and the exposed sediment deposit in the vicinity of the Village Brook Drain and the outlet of the Pond. Approximately 5,350 cubic yards of materials will be removed. The proposed work in Leverett Pond will serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. Dredging in Leverett Pond will improve the capacity of the resource areas in Leverett Pond to protect fish habitat (protect fisheries) and provide pollution prevention along with storm damage protection and flood control benefits.

The following tables summarize the resource area impacts for each work area and municipality.

Table 1 Work Area No. 1 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land Under Water	**25,245**	**sq.ft.**
Excavation: Land Under Water	**4,457**	**cy**
Dredge Area (Length)	**222**	**lf**
Dredge Area (Width)	**30 to 160**	**lf**
Dredge Area (Depth)	**2.5 to 7**	**lf**
Alteration of Land Under Water	**25,245**	**sq.ft.**
Bordering Land Subject to Flooding (2)	**143,630**	**sq.ft.**

Table 2 Work Area No. 1 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land Under Water	**5,058**	**sq.ft.**
Excavation: Land Under Water	**893**	**cy**
Dredge Area (Length)	**222**	**lf**
Dredge Area (Width)	**30 to 160**	**lf**
Dredge Area (Depth)	**2.5 to 7**	**lf**
Temporary Fill (Access)	**203**	**sq.ft.**
Temporary Fill (Access)	**508**	**cy**
Alteration of Bank	**37**	**Lf**
Alteration of Bordering Vegetated Wetland	**203**	**sq.ft.**
Alteration of Land Under Water	**5,058**	**sq.ft.**
Bordering Land Subject to Flooding (2)	**179,697**	**sq.ft.**

3.3 The Riverway (Work Area Nos. 2 through 6) Boston and Brookline

Wetland resources in the Riverway include Land Under Water (LUW), Inland Bank, discrete patches of Bordering Vegetated Wetland (BVW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area (RFA). The RFA extends 25 feet horizontally from the river to the east (on the Boston side) and 200 feet horizontally on the west (Brookline side) of the river. The proposed work in the Riverway will serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. The Phase 2 project will improve the capacity of the resource areas in the Muddy River to provide flood control and prevent storm damage, while the removal of contaminated sediments and environmental restoration (in areas impacted by construction) will protect/improve the interests of pollution prevention, fisheries, and wildlife habitat.

The following sections describe the existing conditions and interests supported by the resource areas in the Riverway. Impacts, construction monitoring and proposed mitigation are discussed in Section 3.5.

3.3.1 Existing Conditions and Interests of the Act

The Riverway section of the Muddy River flows north from Leverett Pond for about 1 mile to Park Drive. Width of river ranges from about 20 to 120 ft., and averages about 40 feet. Water surface area is about 6.5 acres. Mean depth is about 1.5 feet, and maximum depth is 6.5 ft. based on a 1997 USGS survey. Flow is sluggish and elevation through the reach drops only about six inches. Outflow is also influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam. The historic downstream boundary was located at Brookline Avenue, before a 350 ft. segment was filled for construction of the Sears parking lot. The filled section was daylighted during Phase 1, and the Riverway now ends at the newly installed 10' by 24' culvert under Park Drive.

There was a need to provide a flow restriction after construction of the Phase 1 culverts such that flood flows higher than existing conditions are not discharged into the Fens prior to completion of the Phase 2 dredged channel that is be located downstream of these culverts. In 2015, a contractor for the Army USACE installed a flow restriction control structure (FRCS) as part of Phase 1 construction. The structure is sheet pile dam with rectangular weir openings and stop logs located just upstream of the 10 x 24 Riverway culvert (Photograph x). The structure maintains flow equivalent to the capacity of the former two 6-foot diameter culverts that conveyed flow to the Fens area downstream. The FRCS will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens and flood proofing of the Boston Fire Department – Fire Control Center.

The "Riverway" comprises a linear park along both sides of the Muddy River and consists of a maintained grassy parkland with paved and unpaved paths, and a mixture of mature Olmsted-planted trees, and younger volunteer trees and shrubs.

The Massachusetts Department of Conservation and Recreation (MassDCR) maintained Riverway parkway runs parallel along the River's east side (Boston) with the Massachusetts Bay Transportation Authority (MBTA) Green Line tracks running along the west side (Brookline) until Netherlands Road where local Brookline streets are encountered. Riparian vegetation is well developed along some sections of the river. In others, turf with some tree cover is often maintained nearly to the river's edge. The Riverway contains three islands along its length, all designed by Olmsted. The largest, Riverwalk Island, is accessible by footbridge.

The Riverway contains a number of stormwater outfalls. The largest are Huntington Avenue Drain, which discharges on the Boston side of the Muddy River, and Tannery Brook Drain, and the Longwood Avenue Drain, both of which are located in Brookline.

Considerable lengths of the bank are either eroding and/or being undercut by stormwater runoff and river flow. The channel is protected by riprap immediately downstream of the Route 9 bridge. The Town of Brookline has recently installed coir fiber roles to control bank erosion downstream of the Longwood Avenue Bridge.

Many areas of the Riverway have shoaled significantly since it was last dredged in 1963. Sediments from storm drains, accumulation of poorly decomposed organic material, encroachment by Phragmites, and streambank erosion all contribute to the problem. The channel is completely or nearly completely blocked by Phragmites in several areas, including upstream of Park Drive near the flow restriction control structure and at the Riverwalk Island.

3.3.2 Description of Work in Resource Areas and Impacts

The majority of work in the Riverway (i.e. area of alteration) involves dredging Land Under Water to remove accumulated sediment and eradicating Phragmites growing within the river channel (within the proposed work areas as shown on the drawings). The entire bank exhibits erosion at the water line, however, stabilization of the bank is only proposed within the limits of work/access.

Five areas with flow restrictions due to shoaling and sedimentation are proposed in areas impacted by work/access.

The five work areas in the Riverway section include:

- Area Two - upstream from Brookline Avenue;
- Area Three – on the Boston side of the Riverwalk Island;
- Area Four – downstream of Netherlands Road;
- Area Five is located about 900 ft. downstream from the Longwood Avenue bridge; and
- Area Six is at the downstream end of the Riverway where Phase 2 will connect to the Phase 1 improvements and flow restriction control structure (FRCS) will be removed.

Sediment excavated from these areas will likely be excavated in the dry, additionally dewatered if required, and tested for transportation to final disposal. Sediment removal in work Area 6 includes removal of a large area of Phragmites, which cannot be hydraulically dredged. Phragmites is also present in Work Areas 2, 3, and 4. The FRCS, constructed as part of Phase 1 construction, will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens and flood proofing of the Boston Fire Department – Fire Control Center.

Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increased temperatures, nutrient concentrations, and algal blooms. Dredging will improve fish habitat (protect fisheries) and provide pollution prevention along with storm damage protection and flood control benefits in accordance with the general eligibility criteria for ecological restoration limited projects.

The following tables summarize the resource area impacts for each work area and municipality.

Table 3 Work Area No. 2 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**17,242**	**sq. ft.**
Excavation: Land under water	**2,704**	**cy**
Excavation: Bordering vegetated wetland	**4,945**	**sq. ft.**
Excavation: Bordering vegetated wetland	**275**	**cy**
Dimension of dredge area (Length)	**877**	**lf.**
Dimension of dredge area (Width)	**20 to 65**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**3,577**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**0**	**sq. ft.**
Fill (wetland topsoil installed under water)	**1,675**	**sq. ft.**
Fill (stone installed under water)	**0**	**sq. ft.**
Temporary Fill (Access)	**9,659**	**sq. ft.**
Fill (wetland topsoil installed under water)	**93**	**cy**
Fill (stone installed under water)	**0**	**cy**
Temporary Fill (Access)	**24,148**	**cy**
Total area of Phragmites	**4,034**	**sq. ft.**
Total area of Phragmites Removed	**4,034**	**sq. ft.**
Total area of Phragmites Remaining	**0**	**sq. ft.**
Alteration - bank	**576**	**lf.**
Alteration - BVW	**10,299**	**sq. ft.**
Alteration – Land under water	**17,242**	**sq. ft.**
Riverfront (0 -25 ft.)	**25,764**	**sq. ft.**
Riverfront Area Disturbed	**5,488**	**sq. ft.**
Bordering land subject to flooding	**53,214**	**sq. ft.**

Table 4 Work Area No. 2 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**10,038**	**sq. ft.**
Excavation: Land under water	**1,574**	**cy**
Excavation: Bordering vegetated wetland	**3,215**	**sq. ft.**
Excavation: Bordering vegetated wetland	**179**	**cy**
Dimension of dredge area (Length)	**877**	**lf.**
Dimension of dredge area (Width)	**20 to 65**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,725**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**3,495**	**sq. ft.**
Total area of Phragmites Removed	**3,495**	**sq. ft.**
Total area of Phragmites Remaining	**3,495**	**sq. ft.**
Alteration - bank	**595**	**lf.**
Alteration - BVW	**3,215**	**sq. ft.**
Alteration – Land under water	**10,038**	**sq. ft.**
Riverfront (0 -100 ft.)	**80,000**	**sq. ft.**
Riverfront (100 – 200 ft.)	**78,000**	**sq. ft.**
Riverfront Area Disturbed	**6,801**	**sq. ft.**
Bordering land subject to flooding	**307,645**	**sq. ft.**

Table 5 Work Area No. 3 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**13,698**	**sq. ft.**
Excavation: Land under water	**877**	**cy**
Excavation: Bordering vegetated wetland	**8,594**	**sq. ft.**
Excavation: Bordering vegetated wetland	**477**	**cy**
Dimension of dredge area (Length)	**447**	**lf.**
Dimension of dredge area (Width)	**20 to 90**	**lf.**
Dimension of dredge area (Depth)	**2 to 4**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,599**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,514**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**8,785**	**cy**
Total area of Phragmites	**7,689**	**sq. ft.**
Total area of Phragmites Removed	**7,689**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**279**	**lf.**
Alteration - BVW	**11,104**	**sq. ft.**
Alteration – Land under water	**13,698**	**sq. ft.**
Riverfront (0 -25 ft.)	**16,225**	**sq. ft.**
Riverfront Area Disturbed	**3,949**	**sq. ft.**
Bordering land subject to flooding	**34,366**	**sq. ft.**

Table 6 Work Area No. 3 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**4,430**	**sq. ft.**
Excavation: Land under water	**284**	**cy**
Excavation: Bordering vegetated wetland	**2,088**	**sq. ft.**
Excavation: Bordering vegetated wetland	**116**	**cy**
Dimension of dredge area (Length)	**447**	**lf.**
Dimension of dredge area (Width)	**20 to 90**	**lf.**
Dimension of dredge area (Depth)	**2 to 4**	**lf.**
Area of BVW Restored (Emergent Veg)	**913**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**1,668**	**sq. ft.**
Total area of Phragmites Removed	**1,668**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**-**	**lf.**
Alteration - BVW	**2,088**	**sq. ft.**
Alteration – Land under water	**4,430**	**sq. ft.**
Riverfront (0 -100 ft.)	**50,300**	**sq. ft.**
Riverfront (100 – 200 ft.)	**80,300**	**sq. ft.**
Riverfront Area Disturbed	**7,159**	**sq. ft.**
Bordering land subject to flooding	**30,506**	**sq. ft.**

Table 7 Work Area No. 4 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**4,573**	**sq. ft.**
Excavation: Land under water	**375**	**cy**
Excavation: Bordering vegetated wetland	**-**	**sq. ft.**
Excavation: Bordering vegetated wetland	**-**	**cy**
Dimension of dredge area (Length)	**160**	**lf.**
Dimension of dredge area (Width)	**35 to 45**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 3.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**604**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**945**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**2,363**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**80**	**lf.**
Alteration - BVW	**-**	**sq. ft.**
Alteration – Land under water	**4,573**	**sq. ft.**
Riverfront (0 -25 ft.)	**5,329**	**sq. ft.**
Riverfront Area Disturbed	**1,271**	**sq. ft.**
Bordering land subject to flooding	**62,981**	**sq. ft.**

Table 8 Work Area No. 4 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**2,007**	**sq. ft.**
Excavation: Land under water	**165**	**cy**
Excavation: Bordering vegetated wetland	**-**	**sq. ft.**
Excavation: Bordering vegetated wetland	**-**	**cy**
Dimension of dredge area (Length)	**160**	**lf.**
Dimension of dredge area (Width)	**35 to 45**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 3.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**416**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**-**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**-**	**lf.**
Alteration - BVW	**-**	**sq. ft.**
Alteration – Land under water	**2,007**	**sq. ft.**
Riverfront (0 -100 ft.)	**41,800**	**sq. ft.**
Riverfront (100 – 200 ft.)	**71,400**	**sq. ft.**
Riverfront Area Disturbed	**-**	**sq. ft.**
Bordering land subject to flooding	**298,421**	**sq. ft.**

Table 9 Work Area No. 5 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**5,771**	**sq. ft.**
Excavation: Land under water	**515**	**cy**
Excavation: Bordering vegetated wetland	**2,755**	**sq. ft.**
Excavation: Bordering vegetated wetland	**153**	**cy**
Dimension of dredge area (Length)	**130**	**lf.**
Dimension of dredge area (Width)	**30 to 80**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 5**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,282**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**272**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**680**	**cy**
Total area of Phragmites	**8,076**	**sq. ft.**
Total area of Phragmites Removed	**2,475**	**sq. ft.**
Total area of Phragmites Remaining	**5,601**	**sq. ft.**
Alteration - bank	**133**	**lf.**
Alteration - BVW	**3,116**	**sq. ft.**
Alteration – Land under water	**5,771**	**sq. ft.**
Riverfront (0 -25 ft.)	**4,615**	**sq. ft.**
Riverfront Area Disturbed	**2,106**	**sq. ft.**
Bordering land subject to flooding	**69,468**	**sq. ft.**

Table 10 Work Area No. 5 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	-	sq. ft.
Excavation: Land under water	-	cy
Excavation: Bordering vegetated wetland	-	sq. ft.
Excavation: Bordering vegetated wetland	-	cy
Dimension of dredge area (Length)	130	lf.
Dimension of dredge area (Width)	30 to 80	lf.
Dimension of dredge area (Depth)	2.5 to 5	lf.
Area of BVW Restored (Emergent Veg)	-	sq. ft.
New Habitat Shelf (Non-Vegetated)	-	sq. ft.
Fill (wetland topsoil installed under water)	-	sq. ft.
Fill (stone installed under water)	-	sq. ft.
Temporary Fill (Access)	-	sq. ft.
Fill (wetland topsoil installed under water)	-	cy
Fill (stone installed under water)	-	cy
Temporary Fill (Access)	-	cy
Total area of Phragmites	9,746	sq. ft.
Total area of Phragmites Removed	-	sq. ft.
Total area of Phragmites Remaining	9,746	sq. ft.
Alteration - bank	-	lf.
Alteration - BVW	-	sq. ft.
Alteration – Land under water	-	sq. ft.
Riverfront (0 -100 ft.)	31,600	sq. ft.
Riverfront (100 – 200 ft.)	75,800	sq. ft.
Riverfront Area Disturbed	-	sq. ft.
Bordering land subject to flooding	176,834	sq. ft.

Table 11 Work Area No. 6 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**32,785**	**sq. ft.**
Excavation: Land under water	**4,777**	**cy**
Excavation: Bordering vegetated wetland	**11,568**	**sq. ft.**
Excavation: Bordering vegetated wetland	**643**	**cy**
Dimension of dredge area (Length)	**420**	**lf.**
Dimension of dredge area (Width)	**60 to 175**	**lf.**
Dimension of dredge area (Depth)	**4 to 8**	**lf.**
Area of BVW Restored (Emergent Veg)	**3,018**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**620**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,790**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**9,475**	**cy**
Total area of Phragmites	**22,234**	**sq. ft.**
Total area of Phragmites Removed	**22,234**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**448**	**lf.**
Alteration - BVW	**12,193**	**sq. ft.**
Alteration – Land under water	**32,785**	**sq. ft.**
Riverfront (0 -25 ft.)	**16,202**	**sq. ft.**
Riverfront Area Disturbed	**5,716**	**sq. ft.**
Bordering land subject to flooding	**99,428**	**sq. ft.**

Table 12 Work Area No. 6 – Town of Brookline

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**14,630**	**sq. ft.**
Excavation: Land under water	**2,132**	**cy**
Excavation: Bordering vegetated wetland	**4,739**	**sq. ft.**
Excavation: Bordering vegetated wetland	**263**	**cy**
Dimension of dredge area (Length)	**420**	**lf.**
Dimension of dredge area (Width)	**60 to 175**	**lf.**
Dimension of dredge area (Depth)	**4 to 8**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,350**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**3,548**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**8,870**	**cy**
Total area of Phragmites	**10,216**	**sq. ft.**
Total area of Phragmites Removed	**10,216**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**212**	**lf.**
Alteration - BVW	**4,739**	**sq. ft.**
Alteration – Land under water	**14,630**	**sq. ft.**
Riverfront (0 -100 ft.)	**41,200**	**sq. ft.**
Riverfront (100 – 200 ft.)	**60,400**	**sq. ft.**
Riverfront Area Disturbed	**10,274**	**sq. ft.**
Bordering land subject to flooding	**352,025**	**sq. ft.**

3.4 The Back Bay Fens (Work Areas 7-13) Boston

Wetland resources in the Back Bay Fens include Land Under Water, Inland Bank, Bordering Vegetated Wetlands (BVW), Bordering Land Subject to Flooding (BLSF) and Riverfront Area (RFA), as well as the 100-foot buffer zone to Inland Bank and BVW. The RFA extends 25 feet horizontally from the river bank in Boston. The proposed work in the Back Bay Fens will also serve to protect and sustain the interests identified in the WPA and meet the general eligibility criteria for an inland Ecological Restoration Limited Project. The Phase 2 project will improve the capacity of the resource areas in the Muddy River to provide flood control and prevent storm damage, while the removal of contaminated sediments and environmental restoration (in areas impacted by construction) will protect/improve the interests of pollution prevention, fisheries, and wildlife habitat.

The following sections describe the existing conditions and interests supported by the resource areas in the Back Bay Fens followed by a discussion of impacts, construction monitoring and proposed mitigation are discussed at the end of the section.

3.4.1 Existing Conditions and Interests of the Act

The Back Bay Fens (or Fens) section of the Muddy River is located between the Riverway and the Charlesgate section. The Fens is all that remains of the 750-acre Back Bay of the Charles River which was filled in the mid-nineteenth century. The area was modified by Olmsted in the 1890's to become part of the Emerald Necklace. The Fens, as envisioned by Olmsted, has been greatly altered over the last century. The area was a tidal marsh until about 1910 when a dam created the Charles River Basin and all but eliminated tidal influence. The park was substantially redesigned in the early 20th century but retained vital flood control functions and defining features from the Olmsted period. Various other endeavors encroached upon open water and intruded on parklands through the 1970's.

The total existing water surface area of the Fens today is about 20 acres, including 1.6 acres restored by daylighting during Phase 1. This area includes about 7 acres of emergent wetland, most of which is vegetated with Phragmites. Water depth generally ranges from 2 to 4 feet. The Muddy River flows from the lower fens to the Charlesgate section of the river, where it enters the Charles River Basin through a submerged conduit. Flow is sluggish, and the water level is influenced by water level in the Charles River Basin, which is controlled by operation of the Charles River Dam. A great deal of sediment has also accumulated in the Back Bay Fens.

Historic aerial imagery indicates most of the emergent Phragmites wetland has developed since 1951 (Figure 5-1). Phragmites is discussed in more detail in Section 5.

The Back Bay Fens is surrounded by park land. Public facilities near the river include the Victory Gardens, Boston Fire Department Fire Control Center, Mothers Rest Playground, athletic fields, the Agassiz Road (Longfellow) Duck House, the Kelleher Rose garden, Veterans Memorial Park, several monuments or memorials, and walking and biking paths. Parkland restored during Phase 1 is known as the Justine Mee Liff Park. The area is also near many institutions, including the Museum of Fine Arts (Boston), Emmanuel College, Simmons College, Isabella Stewart Gardner Museum, Massachusetts College of Art and Design, Wentworth Institute of Technology, Northeastern University, the Berklee Conservatory, and Fenway Park. Several of these significant institutions sustained damage from flooding.

Prior to construction of Phase 1, the Back Bay Fens included two sections where the original river channel was filled and the river piped through twin 6-ft. diameter culverts. These areas were located under the former Sears parking lot opposite the Landmark Center and between the former Upper Fens Pond and the Avenue de Louis Pasteur Bridge. Phase I removed the 6-ft. diameter culverts and restored about 800 ft. of river, an island, and associated parkland and riparian habitat. The restored river flows through 10 x 24 ft. culverts at Park Ave and Brookline Avenue. Phase 1 also removed several thousand cubic yards of sediment from the Upper Fens.

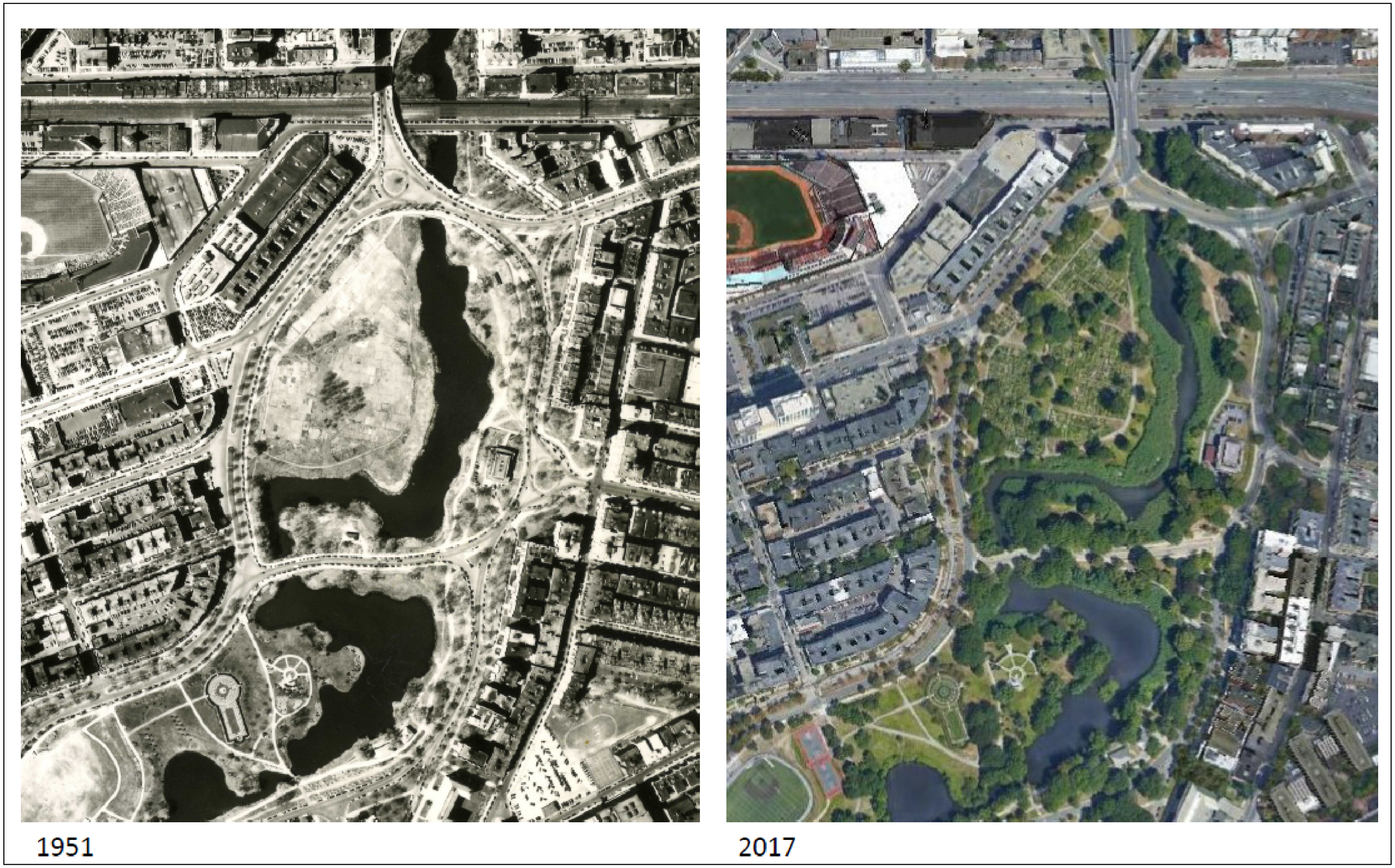


Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017.

Pond and sediment in the stone arch culvert under the Avenue Louis Pasteur Bridge. Banks in day lighted and restored areas were protected with stone and geocells and extensive planting.

Several shallow water "shelves" were installed along the banks and planted with emergent vegetation under the Phase 1 project. Created and restored riparian habitat was planted with native shrubs, trees, and ferns according to a plan developed by a historic landscape architect, consistent with Olmsted's vision and species palette.

3.4.2 Description of Work in Resource Areas and Impacts

Work areas 7 through 12 are located in the Back Bay Fens and run together continuously from Avenue Louis Pasteur to Boylston Street. Sediment excavated from these areas may be excavated in the wet or dry dependent on water depth and other physical characteristics of the work area, additionally dewatered if required, and tested for transportation to final disposal. Some sediment removal in the Back Bay Fens includes removal of large area of Phragmites, which cannot be hydraulically dredged.

Work Area 13 is located at the Boston Fire Department (BFD) – Fire Control Center near the corner of Fenway and Agassiz Road. The USACE's Decision Document noted that 100-yr flood protection will be required for the BFD site. The 100% design submittal details protection measures which include a floodwall topped with identical to existing security fencing with lighting and an interior underground pre-cast concrete storm water pumping station to convey storm water runoff within the Fire Department property when flood waters in the Muddy River prevent gravity storm water flow from the property.

The purpose of the work in the Back Bay Fens is primarily to improve the flood control function and provide environmental restoration in areas of the Muddy River impacted by the Phase 2 construction. Approximately 71,000 cubic yards of dredging is proposed for flood control.

Table 13 Work Area No. 7 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**43,237**	**sq. ft.**
Excavation: Land under water	**5,326**	**cy**
Excavation: Bordering vegetated wetland	**3,111**	**sq. ft.**
Excavation: Bordering vegetated wetland	**173**	**cy**
Dimension of dredge area (Length)	**655**	**lf.**
Dimension of dredge area (Width)	**50 to 190**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 7**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,875**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**4,529**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**6,595**	**sq. ft.**
Fill (wetland topsoil installed under water)	**252**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**16,488**	**cy**
Total area of Phragmites	**11,437**	**sq. ft.**
Total area of Phragmites Removed	**11,437**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**331**	**lf.**
Alteration - BVW	**3,111**	**sq. ft.**
Alteration – Land under water	**43,237**	**sq. ft.**
Riverfront (0 -25 ft.)	**38,178**	**sq. ft.**
Riverfront Area Disturbed	**7,101**	**sq. ft.**
Bordering land subject to flooding	**177,769**	**sq. ft.**

Table 14 Work Area No. 8 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**36,002**	**sq. ft.**
Excavation: Land under water	**4,900**	**cy**
Excavation: Bordering vegetated wetland	**116**	**sq. ft.**
Excavation: Bordering vegetated wetland	**6**	**cy**
Dimension of dredge area (Length)	**668**	**lf.**
Dimension of dredge area (Width)	**40 to 50**	**lf.**
Dimension of dredge area (Depth)	**2.5 to 6**	**lf.**
Area of BVW Restored (Emergent Veg)	**1,313**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**6,204**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**15,510**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**81**	**lf.**
Alteration - BVW	**203**	**sq. ft.**
Alteration – Land under water	**36,002**	**sq. ft.**
Riverfront (0 -25 ft.)	**36,270**	**sq. ft.**
Riverfront Area Disturbed	**2,799**	**sq. ft.**
Bordering land subject to flooding	**177,769**	**sq. ft.**

Table 15 Work Area No. 9 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**33,895**	**sq. ft.**
Excavation: Land under water	**5,860**	**cy**
Excavation: Bordering vegetated wetland	**451**	**sq. ft.**
Excavation: Bordering vegetated wetland	**25**	**cy**
Dimension of dredge area (Length)	**665**	**lf.**
Dimension of dredge area (Width)	**25 to 70**	**lf.**
Dimension of dredge area (Depth)	**1 to 6**	**lf.**
Area of BVW Restored (Emergent Veg)	**2,029**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**-**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**sq. ft.**
Fill (stone installed under water)	**2,070**	**sq. ft.**
Temporary Fill (Access)	**5,061**	**sq. ft.**
Fill (wetland topsoil installed under water)	**-**	**cy**
Fill (stone installed under water)	**230**	**cy**
Temporary Fill (Access)	**12,653**	**cy**
Total area of Phragmites	**-**	**sq. ft.**
Total area of Phragmites Removed	**-**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**209**	**lf.**
Alteration - BVW	**622**	**sq. ft.**
Alteration – Land under water	**33,895**	**sq. ft.**
Riverfront (0 -25 ft.)	**41,798**	**sq. ft.**
Riverfront Area Disturbed	**1,007**	**sq. ft.**
Bordering land subject to flooding	**263,980**	**sq. ft.**

Table 16 Work Area No. 10 - City of Boston

Resource Impact [1]	Quantity	Units
Excavation: Land under water	**178,236**	**sq. ft.**
Excavation: Land under water	**32,797**	**cy**
Excavation: Bordering vegetated wetland	**8,690**	**sq. ft.**
Excavation: Bordering vegetated wetland	**483**	**cy**
Dimension of dredge area (Length)	**1,499**	**lf.**
Dimension of dredge area (Width)	**30 to 260**	**lf.**
Dimension of dredge area (Depth)	**0.5 to 10**	**lf.**
Area of BVW Restored (Emergent Veg)	**11,246**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**745**	**sq. ft.**
Fill (wetland topsoil installed under water)	**662**	**sq. ft.**
Fill (stone installed under water)	**2,050**	**sq. ft.**
Temporary Fill (Access)	**25,224**	**sq. ft.**
Fill (wetland topsoil installed under water)	**37**	**cy**
Fill (stone installed under water)	**228**	**cy**
Temporary Fill (Access)	**63,060**	**cy**
Total area of Phragmites	**64,548**	**sq. ft.**
Total area of Phragmites Removed	**64,548**	**sq. ft.**
Total area of Phragmites Remaining	**-**	**sq. ft.**
Alteration - bank	**1,290**	**lf.**
Alteration - BVW	**8,751**	**sq. ft.**
Alteration – Land under water	**178,236**	**sq. ft.**
Riverfront (0 -25 ft.)	**76,356**	**sq. ft.**
Riverfront Area Disturbed	**18,833**	**sq. ft.**
Bordering land subject to flooding	**302,982**	**sq. ft.**

Table 17 Work Area No. 11 - City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**90,999**	**sq. ft.**
Excavation: Land under water	**9,652**	**cy**
Excavation: Bordering vegetated wetland	**23,881**	**sq. ft.**
Excavation: Bordering vegetated wetland	**1,327**	**cy**
Dimension of dredge area (Length)	**956**	**lf.**
Dimension of dredge area (Width)	**40 to 150**	**lf.**
Dimension of dredge area (Depth)	**0.5 to 9.5**	**lf.**
Area of BVW Restored (Emergent Veg)	**5,814**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**2,116**	**sq. ft.**
Fill (wetland topsoil installed under water)	**997**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**38,681**	**sq. ft.**
Fill (wetland topsoil installed under water)	**55**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**96,703**	**cy**
Total area of Phragmites	**91,841**	**sq. ft.**
Total area of Phragmites Removed	**58,939**	**sq. ft.**
Total area of Phragmites Remaining	**32,902**	**sq. ft.**
Alteration - bank	**844**	**lf.**
Alteration - BVW	**24,928**	**sq. ft.**
Alteration – Land under water	**90,999**	**sq. ft.**
Riverfront (0 -25 ft.)	**53,065**	**sq. ft.**
Riverfront Area Disturbed	**8,329**	**sq. ft.**
Bordering land subject to flooding	**202,551**	**sq. ft.**

Table 18 Work Area No. 12 – City of Boston

Resource Impact (1)	Quantity	Units
Excavation: Land under water	**79,624**	**sq. ft.**
Excavation: Land under water	**10,748**	**cy**
Excavation: Bordering vegetated wetland	**8,869**	**sq. ft.**
Excavation: Bordering vegetated wetland	**493**	**cy**
Dimension of dredge area (Length)	**847**	**lf.**
Dimension of dredge area (Width)	**75 to 140**	**lf.**
Dimension of dredge area (Depth)	**1.5 to 9**	**lf.**
Area of BVW Restored (Emergent Veg)	**7,414**	**sq. ft.**
New Habitat Shelf (Non-Vegetated)	**1,446**	**sq. ft.**
Fill (wetland topsoil installed under water)	**1,486**	**sq. ft.**
Fill (stone installed under water)	**-**	**sq. ft.**
Temporary Fill (Access)	**20,758**	**sq. ft.**
Fill (wetland topsoil installed under water)	**83**	**cy**
Fill (stone installed under water)	**-**	**cy**
Temporary Fill (Access)	**51,895**	**cy**
Total area of Phragmites	**88,659**	**sq. ft.**
Total area of Phragmites Removed	**50,524**	**sq. ft.**
Total area of Phragmites Remaining	**38,135**	**sq. ft.**
Alteration - bank	**844**	**lf.**
Alteration - BVW	**8,869**	**sq. ft.**
Alteration – Land under water	**79,624**	**sq. ft.**
Riverfront (0 -25 ft.)	**44,948**	**sq. ft.**
Riverfront Area Disturbed	**11,017**	**sq. ft.**
Bordering land subject to flooding	**166,169**	**sq. ft.**

Work Area No. 13 – City of Boston

The USACE Decision Document noted that 100-yr flood protection will be required for the Boston Fire Department (BFD) – Fire Control Center, located near the corner of Fenway and Agassiz Road. The 100% design submittal details protection measures which include a floodwall topped with identical to existing security fencing with lighting and an interior underground pre-cast concrete storm water pumping station to convey storm water runoff within the Fire Department property when flood waters in the Muddy River prevent gravity storm water flow from the property. The pump station is a 7,000-gallon pre-cast concrete tank with twin 10 HP storm water pumps and a double catch basin frame and grate set at an elevation slightly above the elevation of gravity flow from the site. As floodwaters rise, a check valve in the gravity outflow pipe will prevent floodwater from backing into the site and the pump station will begin taking water and pumping.

The work at the BFD – Fire Control Center will include activities in the 100-foot Wetlands Buffer Zone as well as within Bordering Land Subject to Flooding (BLSF).

3.5 Construction Methods, Staging Areas, Monitoring and Mitigation (All Work Areas)

The Phase 2 100% permit package (Drawings and Specifications) submitted with this application describe the layout of the flood control channel, access, and storage areas, pedestrian and hauling routes, utility investigations and relocations, site restoration, construction sequencing, environmental protection, including measures to protect Blueback herring and sensitive areas within the park system, flood protection for the Boston Fire Department – Fire Control Center in the Back Bay Fens, and traffic management. The package also includes sediment quality information and quantity estimates of material to be excavated. The 100% permit package includes revisions based on comments received on the 95% design from the Town of Brookline, the City of Boston, Massachusetts Division of Marine Fisheries, Massachusetts DCR, and the Massachusetts DEP. The Muddy River Management and Maintenance Oversite Committee, Emerald Necklace Conservancy, and other stakeholders also provided comments.

Additional revisions to the Drawings and Specifications may be required upon receipt of Water Quality Certification from the Massachusetts DEP and Orders of Conditions from the Town of Brookline and City of Boston.

The Construction Contractor will be required to provide various submittals that will further describe means and methods, environmental protection, and construction sequencing. Some of the submittals will be provided to the MADEP and other agencies for review, others will be reviewed only by USACE.

Submittals will include, but are not limited to, the following:

Specification Section	Description of Submittal
01 57 20	Environmental Protection Plan
01 57 20	Surface Water and Wastewater Quality Monitoring Plan
01 57 20	Fish (Blueback Herring) Truck and Transport Plan (if needed)
31 00 00	Dewatering Work Plan
31 00 00	Excavation Work Plan
32 93 00	Restoration Work Plan
32 94 00	Invasive Species Control Work Plan

For a complete list of submittals see Specification Section 01 33 00.

The proposed method of sediment removal is primarily mechanical however either mechanical or hydraulic dredging is allowed within Leverett Pond. Other work areas are better suited for mechanical dredging as opposed to hydraulic dredging for several reasons. First, the existing channel is very shallow in some areas as well as narrow in others which prohibit even the smallest hydraulic dredge on a barge from accessing. Secondly, all sections of Muddy River exist in a highly urban environment where debris of all kinds ends up in the river which will clog or repeatedly disable hydraulic dredge equipment. This debris was observed during low flow periods and includes natural debris such as downed trees and limbs, stones, and layers of leaf litter mixed with brush as well as a large quantity of man-made debris including construction debris, tires, metal parts, safe doors, shopping carts, bicycles, bottles, cans and other household refuse, vehicle parts, and plastic. Third, hydraulic dredging cannot be used for *Phragmites* excavation and upland banks areas where channel slopes require cutting into uplands. Lastly, hydraulic dredging will require somewhat extensive staging, including access areas for dewatering presses, pump lines, frac tanks, and sludge handling areas. Given the location of the project within a major metropolitan city and park area, these staging and access areas are extremely limited.

Hydraulic dredging was required for the non-federal dredging of the Charlesgate Section of Muddy River, from Boylston Street to the Charles River prior to the USACE Phase 1 construction.t. After the contract was awarded, it was quickly determined hydraulic dredging was impossible due to many of the issues discussed above. The contract was modified to allow mechanical dredging and the portion of the project was completed with that method

Mechanical dredging was used within Upper Fens Pond in Phase I during the Spring/Summer of 2015. The flow within Upper Fens Pond was diverted around the work area, the area was then sectioned off using steel sheet pile walls and dewatered to excavate in the dry. The material was mixed in-situ with sawdust, loaded onto trucks and hauled to final disposal. A temporary access road was constructed along one river bank by excavating organic sediment to a more stable base and then using a 3” minus gravel as a temporary road base for excavators and site dump trucks. As the excavators backed out of the channel, the temporary road was shaped, some of the material removed, and slope stabilization installed.

The contractor may determine that dredging in the wet with specialized equipment may be more beneficial to work around fish windows or the sensitive nature of existing features within the park system. Working in the wet would minimize dewatering of aquatic habitat and stranding of turtles, fish, freshwater mussels, and other aquatic life. It would, however, require measures such as siltation curtains to isolate the work area and protect water quality.

Based on these considerations, the Leverett Pond work area, including the sand island, may be hydraulically dredged with small equipment on a barge and pumped onshore due to ample water access and depth for a small dredge. This material is predominately sand so excavation in the wet is a viable option as well. The sediment removed from this area may be dewatered using Geotubes or a filter press along the edge of the pond and then transported to a disposal site. Depending on the dewatering method, the water may require additional turbidity treatment prior to being returned to the river.

Two of the five Riverway work areas are upstream from Brookline Avenue, one is located on the Boston side of the Riverwalk Island, the fourth is located about 900 ft. downstream from the Longwood Avenue bridge, and the fifth is at the downstream end of the Riverway. Sediment excavated from these areas will likely be excavated in the dry, additionally dewatered if required, and tested for transportation to final disposal. Sediment removal in work Area 6 includes removal of a large area of Phragmites, which cannot be hydraulically dredged. Phragmites is also present in Work Areas 2, 3, and 4. The flow restriction control structure (FRCS), constructed as part of

Phase 1 construction, will be removed after completion of the Phase 2 flood control channel in the Back Bay Fens.

Work areas 7 through 12 are located in the Back Bay Fens and run together continuously from Avenue Louis Pasteur to Boylston Street. Sediment excavated from these areas may be excavated in the wet or dry dependent on water depth and other physical characteristics of the work area, additionally dewatered if required, and tested for transportation to final disposal. Some sediment removal in the Back Bay Fens includes removal of large area of Phragmites, which cannot be hydraulically dredged.

Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increase temperatures and nutrient concentrations and algal blooms. See section 5 for a more detail description on the additional benefits associated with sediment removal.

Sequence of each individual work area is detailed in the notes on the "Sequencing, Dewatering, Staging & Access Plans" (GC101 thru GC105). Additionally, "Hauling Plans" (GC106 thru GC108) detail allowable hauling routes in and out of the work areas. It is likely that multiple crews will be required to complete the project within the intended 3-year construction window while working around the environmental (blueback herring migration) windows. The contractor will be required to submit a work plan that will be reviewed as part of the best value contract. Actual sequence of work will be reviewed at that time however the 100% plans and specifications allow contractor flexibility with their own means and methods to meet the 3-year construction duration.

Because the work will occur in a larger urban environment, there is very little open space available for staging in the vicinity of the project site except for the adjacent park land. Proposed staging and access areas are shown on the Drawings. The areas shown provide for truck and equipment access ways and storage locations, minimal material storage, and locations for dewatering equipment, if used. Existing gravel and paved walkways were used to access work areas to the maximum extent. Little or no tree clearing is required for staging and access to adjacent roadways. Tree root zones were avoided as much as possible. Where vehicular travel underneath tree canopy was unavoidable, root zones will be protected from soil compaction.

A meeting was held with USACE, MA DCR, City of Boston, Town of Brookline, and the MA State Police to discuss construction related hauling of the excavated material. Police details will be required during hauling activities for trucks entering and exiting designated work areas. Proposed hauling routes are shown on the "Hauling Plans" (GC106-GC108). Plans also include provisions for allowing pedestrian and bicycle traffic to safely bypass work areas.
Work areas will be fenced during construction and during establishment of turf and landscape planting. Fencing is shown on construction and landscaping plans.

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor will construct or install temporary and permanent erosion and sediment control best management practices

(BMPs) as indicated on the contract drawings and specifications. BMPs may include, but not be limited to, vegetation cover, slope stabilization, silt fences, and straw wattles. Any temporary measures shall be removed after the area has been stabilized. The project will be covered by a NPDES Construction General Permit. The construction contractor will submit an Environment Protection Plan for USACE approval before construction begins.

- Project plans propose to conduct most of the construction in the dry. Work areas will either be entirely dewatered, with flow maintained by a bypass pumping system or flow will be diverted from one side of the river to the other. Normal flow above Park Drive is estimated to be 6 cfs. Water diversion systems will be designed to pass displaced flows without exceeding 6 inches of river level change upstream or downstream of diversions at all times.

- The Contractor will be required to submit a detailed water control plan to the USACE for approval. The plan will be submitted for review and comment to the MADEP, Boston and Brookline Conservation Commissions, and the MA Division of Marine Fisheries (MADMF).

- The plan will detail Contractor's actions to operate and maintain or remove the diversion system for each work area during normal and flood events. The plan will include complete construction drawings and detail drawings showing all aspects of the Muddy River control and diversion system for all work areas. For all pumps, details shall include manufacturer's information on pump performance curves, specifications, a control diagram, and written sequence of control for the pumping system.

- The submittal will include construction and detail drawings for all work areas enclosed by temporary cofferdam structure; width and shape of channel opening remaining to pass flows; number, sizes, and locations of pumps required to pass equivalent river capacity; number, sizes, and locations of pumps required to dewater within cofferdam; locations of outlets for pump dewatering discharge; and method of treatment of discharge water. Temporary cofferdam structures may include steel sheet piling, bladder dams, portadams (or equivalent) but will not include placement of fill.

- Detailed calculations shall be submitted for structural, geotechnical and hydraulic design aspects of the diversion system(s). Hydraulic calculations documenting calculation of the displaced flow and demonstrating that the proposed diversion system(s) will pass displaced flow without exceeding 6 inches of river level change upstream or downstream of diversions at all times including high water and floods. Pump selection justification including pump curves and head. Pipe calculations justifying selected pipe size and thickness. Structural and geotechnical calculations documenting design of temporary cofferdam system including earth supports, pipe supports, pipe restraints, and equipment supports.

- Supplemental plans to restore any areas disturbed by water control activities which are not shown on 100% design landscape restoration drawings will also be submitted for review and approval. The supplemental drawings would be prepared by a historic restoration landscape architect approved by the USACE after consultation with project sponsors.

- To provide flood control benefits, the contractor will be required to remove the FRCS as soon as practical after completion of sediment removal from Work Areas 7 -12 and flood proofing of the Boston Fire Department facility. The entire structure, including sheet pile, stone protection, catwalk, and super sacks will be removed as discussed above.

- Any wastewater from dewatering or dredged material processing operations and other sources will not be discharged directly into surface waters, the storm drain system, sanitary sewers, or the Muddy River Conduit. Prior to discharge, water from dewatering operations will be treated by filtration, settling basins, or other approved methods to reduce the amount of sediment and contaminants contained in the water to allowable levels. Discharge standards for others parameter may be established by the MADEP during the permit process.

- Treated wastewater from dewatering, dredged material processing operations, or other activities that is discharged directly or indirectly into surface water will be tested daily for TSS and weekly for dissolved lead and dissolved oxygen. In work areas where sediment is excavated in the wet, surface water quality will be monitored daily at one station upstream of the work area and three downstream locations. Parameters measured will include dissolved oxygen, percent dissolved oxygen saturation, turbidity (NTU's), temperature, and conductivity.

- The contractor will prepare a plan for monitoring wastewater and surface water quality. The plan will include the following elements:

1) List of parameters to monitor and detection limits
2) Sampling method (s)
3) Frequency of monitoring
4) Monitoring locations (including a map)
5) Reporting
6) List of Personnel, Roles and Responsibilities
7) Analytical Laboratory
8) Equipment required
9) Safety Plan
10) Quality Assurance Project Plan (QAAP)

- Test results will be summarized in report(s) submitted to the Boston and Brookline Conservation Commissions and MADEP.

The USACE has developed a restoration plan for areas impacted by construction activities. The USACE worked closely with a landscape architect with extensive experience in historic landscape rehabilitation. The intent of the plan is to rehabilitate the landscape through a design that is compatible with the habit, form, scale and context of the historic vegetation and to restore wetland and riparian habitat. Historic conditions are known from surviving landscape plans and photographs. Plant species were selected based on a species list of historic plantings and plans from the Olmsted Archives (Frederick Law Olmsted National Historic Site) photographs, Boston Parks and Recreation Department records, site conditions, and availability of plant material from local or regional nurseries.

The Olmsted lists have been reviewed and native plants selected for significant majority of the project area. Species listed as invasive were avoided. Wetland seed mix and emergent species are entirely native, as are the ferns. In very limited cases non-native species with a track record of being noninvasive in this landscape were selected to support character defining features of the landscape. Of the 9,939 shrubs proposed 49 individuals are not native (forsythia) and of 119 trees, 19 individuals (London plane and willow) are not native but the species are already present in the landscape. Container grown plugs will be used to establish emergent vegetation and native wetland seed mix will be used in wet meadow areas. Substitutions consistent with historic landscape restoration goals may be required if planting success is not achieved during plant establishment period.

- The existing shoreline along the Riverway is severely eroded in many locations. This is likely due to fluctuating water levels, grazing by waterfowl, rill erosion caused by runoff, and steep slopes. The Phase 2 design includes placement of coir fiber rolls to hold the bank in most restored areas. The top of the rolls will be set at the normal water surface elevation, likely a few inches above EL 1.3 ft. In the Back Bay Fens coir rolls will also be used to retain fill placed to restore wetland vegetation. This will occur mostly downstream of the bridge adjacent to the Victory Gardens. The coir rolls will also be used to hold soil installed to create underwater shelves. The top of coir rolls will normally be set at EL 1.3 ft. in area without shelves and EL 0.3 where shelves are present. Above elevation 1.3 slopes greater than 3:1 (horizontal to vertical - h:v) will generally be stabilized with 100 percent biodegradable erosion control matting. Matting will not contain poly netting and strands of the matting will move independently to minimize the risk of wildlife entrapment.

- As previously mentioned, the Muddy River suffers from bank erosion. Multiple efforts have been under taken over the years to help restore and protect the river bank. This project provides an opportunity to improve the existing condition and provide restoration benefits. Banks will be restored to a less degraded state following this project and will result in reduced sediment loading, improved water quality (reduced suspended sediment) and improved ecological habitat (consistent with the goals of the WPA and the eligibility criteria for an Ecological Restoration Limited Project).

- Six inches of topsoil will generally be placed in area restored as area turf. No topsoil will be placed underwater except in areas to be planted with emergent plugs and emergent shelves where topsoil will be installed as backfill to meet desired grades. Topsoil will be obtained from off-site. The specifications require that topsoil be tested for TOC, pH, grain size, and nutrients. Contaminant levels in topsoil must meet MassDEP Reportable Concentration (RCS) 1 criteria. Topsoil will conform to the limits presented in the project specifications. The topsoil may be adjusted to meet composition requirements by adding compost or inorganic components. Compost used will be derived from organic wastes including leaf and yard residues.

- Little information is available regarding historic planting of freshwater emergent plants in Olmsted's Emerald Necklace park system. There is no evidence that emergents were planted. Planting of emergents is included in the design because historic pictures do show an emergent fringe along the river and such a fringe occurs today in some areas along the Riverway. Also, there is a desire to restore emergent vegetation to the extent possible. The design includes seeding areas above the normal water surface elevation with a wetland seed mix or planting masses of wetland shrubs. Planting emergent plugs is generally limited to emergent "shelf" areas. These areas will be planted with a variety of emergent plants native to eastern Massachusetts. Most of the species selected have low stature, a requirement for historic restoration and aesthetics. Based on Phase I plantings and observations, several species (e.g. swamp loosestrife, blue flag, and sweet flag) chosen are expected to be somewhat resistant to grazing. The emergent plants will be protected by an herbivore exclusion fence for at least two years to allow the roots system/rhizome system to become resistant to grazing. Effort to restore emergent vegetation during Phase I at created wetland shelves are still underway. Failed plantings are thought to be caused by grazing by carp which were able to swim under the Phase 1 exclusion fencing. Phase 2 design emphasizes planting of sweet flag which appears relatively resistant to grazing in Phase 1. Pickerelweed and bur-reed will be limited to near shore/bank areas where carp grazing should be less intense. The plant diversity gained through *Phragmites* removal and wetland vegetation restoration from the Phase 2 project will greatly improve the ecological value for aquatic, avian and terrestrial biota.

- Wetland areas will be seeded or planted with shrubs between elevation (EL) 1.3 and 2.3 feet. All trees and other shrubs will be planted above El 2.3 feet. Wetland shelves will be planted with plugs to a depth of about EL 0.8 feet. No upland species will be planted below EL 3.3 feet.

- There will be a two-year guarantee period for all plantings. In upland areas one-hundred percent survival of trees and shrubs will be required. Performance standards for wetland vegetation will be based on percent cover. Areas between EL 1.3 and 2.3 seeded with a wetland seed mix or planted with emergent and wetland shrubs will have > 75 percent cover by native wetland plants after two years.

- Temporary fencing will be installed to protect emergent plantings from grazing by ducks, geese, and fish (carp) during the plant establishment period. The fencing will be installed along the water-side edge of all emergent plantings. Fencing will be used on the water side of the shelf areas to exclude carp. Fencing will also be installed on the upland side of the emergent plantings to exclude waterfowl. The entire restored area will be fenced to prevent public access during construction and for a variable of time during restoration based on site conditions and consultation with the sponsors. The fencing is required to limit vandalism and unintentional incidental damage by the public to plant material and side slopes. Use of 4-foot-high coated chain link fencing is anticipated (similar to Phase 1).

- Seed mixes for lawn areas contain a mix of typical turf species, primarily fescues and ryegrasses. Mixes tailored for sun and shade areas and dense shade were specified. A seed mix of native wildflowers and grasses was developed for areas planted with trees and shrubs. The mix contains non-invasive species which typically grow less than about three ft. tall and includes species used by pollinators and species with aesthetic appeal. The wetland seed mix will be New England Wetland Plants "Wetmix" or an approved equal.

- Many trees occur within or near the limit of work. All trees to remain will be protected with fencing or trunk protectors as directed by an arborist. The condition of certain trees near work limits will be evaluated during construction. If an arborist determines the tree can be saved the construction contractor will be directed to do so. After consultation with USACE and the sponsors, the contractor will be required to remove hazardous trees and branches noted during the construction and maintenance period.

- Habitat logs will be installed to enhance fisheries and wildlife habitat. Habitat logs will be installed in restored areas. About 1/3 will extend into the water to provide basking locations for turtles and perches for wading birds. Logs will be hardwoods salvaged from on site with a minimum butt diameter of 8" and length between 8 and 12 feet.

- Watering will be required during the plant establishment period. Water will likely be supplied from watering trucks or an irrigation system connected to the local city water system. Pumping irrigation water from the river will not be permitted.

- Considerable grazing on shrubs by rabbit and possibly meadow voles occurred during Phase 1 restoration. Protectors on individual shrub plantings or other measures to deter stem damage (i.e., girdling) by herbivores will be required.

- Planted trees and shrubs will be pruned by an arborist during the plant establishment period to remove dead branches and improve growth form. Standard industry pruning practices will be adhered to. Wound dressing will not be applied. Weeding will be conducted as required to prevent shading of shrub and fern plantings by tall weeds such as burdock, hawkweed, and mugwort.

4.0 Wetlands Impacts/Benefits – Summary Phase 1 and Phase 2

The Muddy River Flood Control Project – Phase 1 and Phase 2 were split into two separate construction phases due to the nature and type of construction being different for each phase. However, when considering the interest of the Wetlands Protection Act (WPA) the impacts and benefits from the combined phases is significant. Not only do the combined phases provide significant flood control benefits, they also serve to significantly improve the natural capacity of the wetlands resource areas within the Muddy River project area to protect and sustain the interests identified in the WPA consistent with the eligibility criteria for an Ecological Restoration Limited Project. Extensive local, state and federal wetlands permitting for Phase 1 was completed prior to construction. Substantial completion for construction Phase 1 was achieved in 2016 and there are ongoing requirements for vegetation establishment and management of the temporary flood restriction control structure. The proponents are in the process of permitting the work in wetlands resource areas in Phase 2 as discussed above.

The daylighting of nearly 700 linear feet of the Muddy River in the upper reaches of the Back Bay Fens (from Phase 1 construction) serves to compensate for the alteration of resource areas elsewhere in the Back Bay Fens (as a result of Phase 2 construction) and yield a net increase in the area of Land Under Water (LUW), Inland Bank and Bordering Vegetated Wetland (BVW). The daylighting of the river in the two specified areas resulted in approximately 1 acre (43,560 square feet) of additional Land Under Water, 1,690 linear feet of Inland Bank, and approximately 6,760 square feet of BVW. Combined with the replication proposed in the daylighted areas, the project will result in the increase of 0.3 acres (12,415 square feet) of the BVW in the Back Bay Fens. This estimate is based on a 4-foot-wide planting shelf as shown in the Plans.

Table 2 summarizes wetlands impacts for both the Phase 1 and Phase 2 construction projects. The combined project elements will improve the capacity of resource areas along the Muddy River to protect the interests of the WPA and result in a net increase of resource areas along the Muddy River consistent with the goals of an Ecological Restoration Limited Project. As presented in Table 2, the project will result in re-classification of some wetland resource areas along with an increase in overall resource areas within the entire project corridor.

Table 19
Summary of Wetland Impacts for Each Phase

Wetland Resource Areas	Units	Phase 1 (Boston)	Phase 2 (Boston)	Phase 2 (Brookline)	Total (Phase 1 and 2)
Land Under Water					
Created	*sq. ft.*	69,706	-	-	69,706
Restored	*sq. ft.*	66,463	634,287	36,163	736,913
Bordering Vegetated Wetland (BVW)[1,2,3]					
Excavated or other alteration	*sq. ft.*	7,400[4]	83,196	10,245	100,841
Restored/ Created	*sq. ft.*	15,000[5]	50,987	5,607	71,594
Bank					
Created	*l.f.*	1,938	-	-	1,938
Restored	*l.f.*	1,692	5,115	844	7,651
Riverfront					
Created	*sq. ft.*	48,450	-	-	48,450

1. All BVW is also classified as Federal emergent wetland.
2. Nearly all BVW and Federal emergent wetland lost is Phragmites.
3. BVW delineation provided by project sponsors.

4. From Phase 1 NOI, includes 4,850 sq. ft. Phragmites.
5. Estimated, based on post construction monitoring and adaptive management.

The Muddy River Flood Damage Reduction project will create or restore approximately 18 acres of land under water. Phase 2 restoration involves restoration of former open water habitat by removal of Phragmites, restoration of open water habitat by removal of mudflats or sediment islands and deepening of existing open water habitat. Although the flood control project does not propose bank to bank dredging as propose for environmental restoration, a substantial proportion of the Back Bay Fens and Riverway will be dredged. The 2003 EA (USACE, 2013) mapped 11.1 acres of open water in the Back Bay Fens and 6.4 acres in the Riverway (see Figures 2-12 and 2-13). The acreage of open water habitat in the Back Bay Fens and Riverway following completion of Phase 2 will be approximately 15 and 7 acres, respectively.

The depth of dredging will be variable. Up to 7 feet of sediment will be excavated in Leveret Pond (Area 1), 6 feet in the Riverway, and 10 feet in the Back Bay Fens. Approximately 88,000 cubic yards (cy)of sediment will be removed. 14,000 cy of topsoil and rock fill will be installed underwater for wetland restoration or erosion control. The net increase in volume of land under water will be about 74,000 cy.

Shallow (0 – 12-inch deep) vegetated shelves created during Phase 1 and Phase 2 in the Back Bay Fens will provide nesting and nursery habitat for fish and foraging habitat for wading birds such as great blue heron. Eight shelves were constructed during Phase 1 and additional shelves will be constructed during Phase 2 as shown on the plans. Habitat logs installed in the Riverway and Fens will provide basking sites for turtles and cover for fish. These have proven to be well used by turtles in the area.

Excavation in Work Area 10 will remove mudflat and a sand island downstream of the Stonybrook gatehouse drain. Mudflat and a sand island will also be removed from Area 1 (Leverett Pond). Phase 2 will remove shallow mud flat areas present under normal flow conditions in Work Areas 2 through 5.

In addition to restoring stream habitat and land under water, Phase 1 and Phase 2 will significantly improve aquatic connectivity. Phase 1 removed over 700 ft. of culverts which isolated the Riverway from the Back Bay Fens. Phase 2 activities will include removal of the FRCS, which is the only remaining significant anthropogenic barrier between the Back Bay Fens and Leveret Pond. Restoration of connectivity will benefit both resident warm water species and blue back herring, an anadromous species which spawns in Leverett Pond.

Sediment removal is expected to somewhat improve water quality in the Back Bay Fens. Sediment removal will improve DO levels in surface waters by 1) reducing sediment oxygen demand (SOD) by exposing well decomposed (weathered) underlying sediment with lower SOD than existing surface sediment, and 2) increasing the volume of water in the Back Bay Fens and reducing the effect of SOD on DO levels. Removal of nutrient rich surface sediment may also reduce plant productivity and oxygen demand exerted by decomposing plant material. Water quality modeling by the USACE (USACE, 2003, Table EA-26) estimated that flood control project would reduce the percent area with low DO (< 5 mg/l) in the Back Bay Fens from 100% without sediment removal to 50 - 70 % 25 years after construction. Modeling showed flood control dredging to have no measurable effect on DO in the Riverway where 100% of the area is modeled to experience DO levels < 5 mg/l under both with and without project conditions.

A mathematical model developed by Mathew et al. (2011) attributed poor water quality in the Muddy River primarily to significant internal inputs, attributed to waterfowl, sediment, and algal production. The study postulated that sediment removal planned as part of the full restoration project should lead to significant improvements in DO and biological oxygen demand. Although the full restoration project evaluated by Mathew et al. is not being implemented, sediment is being removed from a significant portion of the Back Bay Fens, so some improvement in DO is likely to occur in the Fens, as also predicted by the USACE model.

Water quality may also be improved by bank stabilization of impacted areas during Phase 2 and continued implementation of BMP's in the watershed to reduce loading of sediment, organic material, nutrients, and contaminants to surface waters from storm drains and non-point sources.

Testing by CDM (2001) and the USACE (2003) show that contaminant levels in underlying sediment are generally lower than concentrations in existing surface sediments. CDM (2001) measured levels of metals, PAHs, PCBs, pesticides, and other chemicals at 2 ft. intervals ranging from 0-2 feet to 10-12 feet USACE (2003) used this information was used to predict the concentration of selected chemicals in sediment exposed by dredging. The proposed dredging will generally expose sediment with lower levels of contaminants than in surface sediments in the Back Bay Fens. Lead, cadmium, chromium, mercury, PAH, PCBs and DDT concentrations will be lower in exposed sediment. In the Riverway, PAH levels will be greatly lower in exposed sediment. PCB and some metal levels will also be lower, but DDT levels in exposed sediment may be higher than existing surface sediments at Riverway. Lower PCB concentrations in surface sediment will likely result in lower PCB levels in fish and aquatic invertebrates and less food chain exposure to wildlife.

Risk of PAH mixtures to benthic communities can be assessed using by using an equilibrium partitioning method developed by the USEPA (2000). An ESG greater than 1 is indicative of ecological risk. PAH mixture ESGs were above 1 at all locations in the Riverway and Back Bay Fens (USACE, 2003). Post construction PAH ESG levels will likely be less than 1 in restored areas.

Toxicity testing indicates sediments in the Riverway and Back Bay Fens are toxic to aquatic invertebrates (USACE, 2003). Lower levels of contaminants following excavation in Phase 2 work areas should reduce sediment toxicity but risk screening levels (MacDonald, 2002) for some contaminants will likely still be exceeded. Surface sediments in the daylighted sections in the Back Bay Fens and shallow (0-12 inch) shelves created during Phase 1 and Phase 2 in the Back Bay Fens are expected to have much lower contaminant levels than sediment elsewhere in the Muddy River. The shelves were created using clean topsoil.

Approximately 1.6 acres of emergent (mostly wet meadow) or wet meadow/scrub-shrub wetland will be restored during Phase 1 and 2. Most of the restored wetland will be in the Back Bay Fens, but a narrow wetland fringe will be restored in work areas along the Riverway. As described below, the restored wetland will have greater functional value than the existing Phragmites.

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are essentially monospecific. Monitoring of areas restored during Phase 1 indicates that the fridge wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored during Phase 2 along the Riverway and Back Bay Fens. Species noted in the Phase 1 fridge wetland in September of 2017 and/or 2018 include elderberry, water willow, sweet gale, pickerelweed, sweet flag, bugleweed, umbrella sedge, cattail, beggar-ticks, false nettle, boneset, Joe pye weed, blue vervain, soft rush, jewelweed, Pennsylvania smartweed, soft rush, spike rush, and water purslane.

The plant species community diversity in restored wetlands is expected to vary with time, but a moderate to high diversity community is expected to persist. To date wetlands restored during Phase 1 have not been colonized by Phragmites or Japanese knotweed despite the presence of potential seed sources upstream along the Riverway.

Phase 2 will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

The removal of Phragmites will be substantially mitigated by restoring wetland along the Back Bay Fens shoreline as shown on landscape plans included with project drawings. Restored wetlands will be seeded with a diverse wetland seed mix and planted with shrubs with high wildlife habitat value such as buttonbush, common elderberry, red osier dogwood, and summersweet. Wetland community diversity will be further enhanced by planting emergents such as pickerelweed, bur reed, blue flag iris, and sweet flag along the wetland shelf shoreline. Volunteer cattail, jewelweed, smartweed, Bidens, and other species will also likely colonize the shoreline and/or shallow water shelves. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

The restored wetland will be established on clean soils, so should have a healthier soil invertebrate community than in the existing Phragmites wetland where surface soils are contaminated with concentrations of metals and PAHs that exceed USEPA Eco-SSL's and other ecological risk-based screening values. Wildlife such as worm eating birds and small mammals which prey on soil invertebrates should benefit from the enhanced invertebrate community.

Nearly 2000 linear feet (l.f.) of bank was created by Phase 1 daylighting and 1,692 l.f. of bank was restored in Upper Fens Pond. An additional 5,959 l.f. of bank will be restored in the Leverett Pond, the Back Bay Fens and the Riverway during Phase 2.

Existing banks along the Riverway and Back Bay Fens are typically in very poor condition. The banks are eroding and often poorly vegetated. The restored banks will be stabilized with coir fiber rolls and plantings. Bank restoration will reduce erosion and sediment deposition in the Riverway and Back Bay Fens. Vegetation seeded or planted on the banks will be similar to the Phase 1 fringe wetland described above and provide better wildlife habitat value than existing banks. As for emergent wetlands, the non-federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of Phragmites and other invasive plants which could colonize and degrade the restored banks.

All Riverfront disturbed by Phase 2 construction activities will be restored. Restored areas will be planted with shrubs and trees and/or seeded with a native wildflower or native wetland plant seed mix. Restored riparian communities as expected to have greater plant diversity and better wildlife habitat value than the preexisting riparian communities. As with emergent wetlands and bank, the non-federal sponsors will be required to implement an Operations and Maintenance Plan developed by USACE which will include control of. Japanese knotweed, Phragmites and other invasive plants which could colonize and degrade the restored riparian habitat.

Phase 1 created 1.1 acres of new riverfront in the Back Bay Fens and restored riparian habitat along the Upper Fens Pond. Monitoring of areas restored during Phase 1 indicates that the created and restored riparian habitat supports a diverse plant community (USACE, 2017, 2018). The community is free from invasive species and has been planted or seeded with many species with good wildlife habitat value, including shrubs and herbs used by pollinators. Riparian habitat restored during Phase 2 should have similar beneficial attributes.

The Phase 2 restored riparian habitat will be established on clean surface soils, which should have lower contaminant levels than are typical of urban soils. This should benefit the soil invertebrate community and wildlife which prey on soil invertebrates.

5.0 Invasives Management

5.1 Introduction

Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although some varieties of *Phragmites* are native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). *Phragmites* varieties occurring in the Muddy River were studied by Keller (2000).

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Additional *Phragmites* is present along embankments up to several ft. above the above the normal water elevation. *Phragmites* growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. *Phragmites* aboveground live standing crop near Park Drive in October, 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for *Phragmites* in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Some stands previous mapped by CDM (2001) and the USACE (2003) have disappeared, most notably upstream of the Footbridge. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

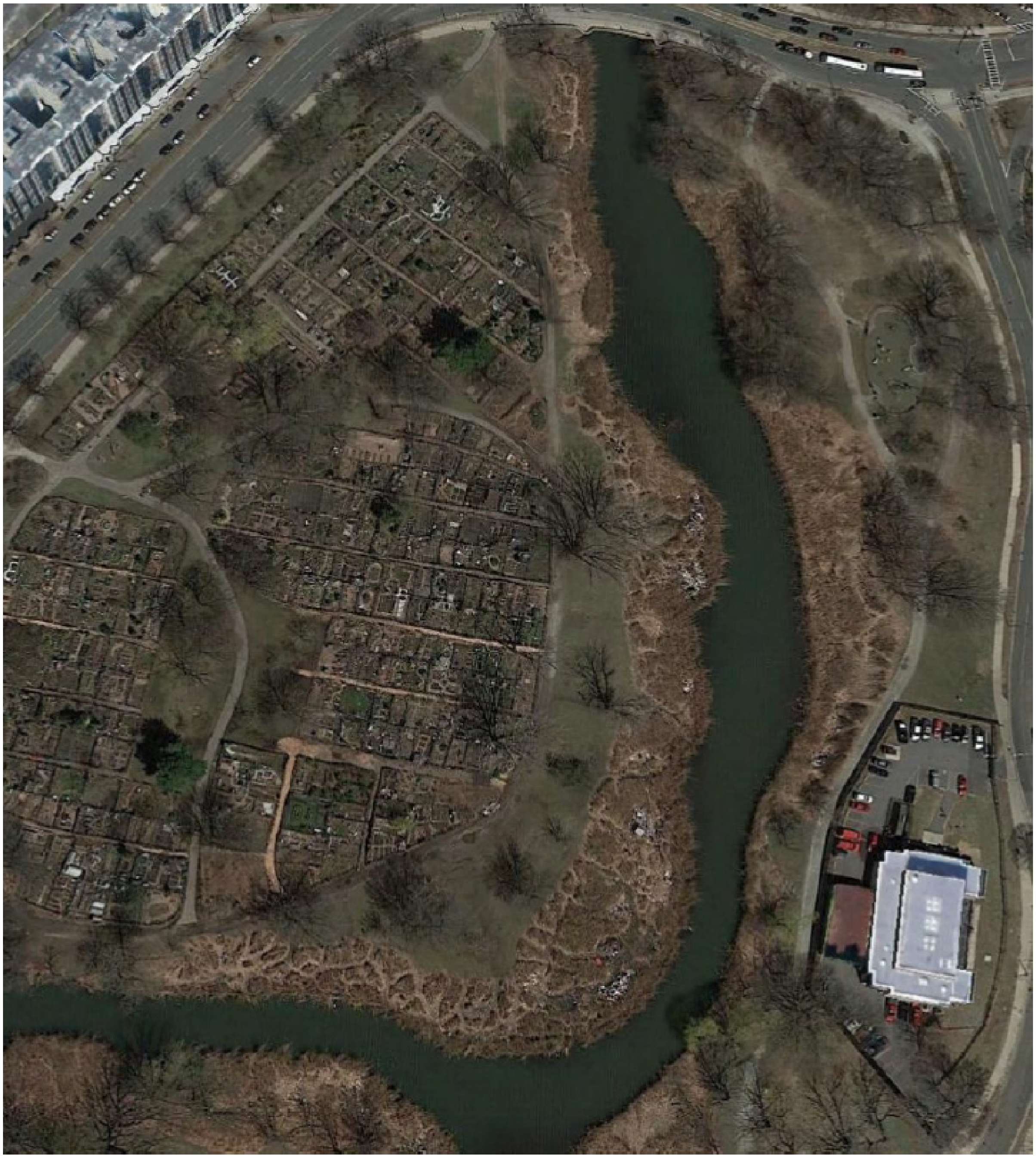
Not only does removal of accumulated sediment and Phragmites improve water conveyance preventing flooding, it provides significant ecological restoration benefits. Benthic substrate quality is improved for invertebrate colonization which become a food source for fish, including anadromous fish. Improving water flow minimizes stagnation that can lead to depressed oxygen, increase temperatures and nutrient concentrations and algal blooms.

5.2 Construction Phase – Invasives Management

In areas impacted by Phase 2 construction, invasives will be addressed through the dredging and removal activities discussed above. However, restored habitat will be vulnerable to colonization by invasive species present in adjacent areas. Reused or imported topsoil may also contain viable seeds of invasive species. Primary invasive species of concern include Norway maple, Tree of Heaven, European buckthorn, Oriental bittersweet, Japanese knotweed, Phragmites, and purple loosestrife. Colonization of other plant species classified as “invasive” by the Massachusetts Invasive Plant Advisory Group may also occur.

All invasive plant species will be controlled in restored areas during the 2-year establishment and monitoring period. Over the long term an Operation and Maintenance Manual will discuss invasive species management. Because *Phragmites* can readily spread by seed and will remain in the Riverway and Back Bay Fens proximal to the project area, annual monitoring and control efforts are required. USACE recommends zero tolerance for *Phragmites* in all restored areas to ensure the ecological and flood conveyance benefits are maintained.

An invasive plant species control plan will be developed by the contractor and approved by the USACE in accordance with the Specifications. The plan will rely on frequent meander surveys through restored areas to detect invasive species and the controlled use of herbicide when hand pulling would not be an effective control method. All herbicide use will be in accordance with label instructions, state and federal law, and the Order of Conditions received from the Boston



and Brookline Conservation Commissions. Herbicides will be applied by Massachusetts certified herbicide applicators.

Figure 2 Phragmites

5.3 Invasives Management – Pilot Program

With conditions favorable for continued expansion of Phragmites into the completed work areas throughout much of the Riverway and Back Bay Fens areas it is critical to develop a landscape rehabilitation invasives management plan to address areas of the work outside the limits of the USACE Phase 1 and Phase 2 projects. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth.

In addition to the Phase 2 work proposed by the USACE, the City of Boston has also submitted a Notice of Intent to the Boston Conservation Commission to allow for a pilot project involving low impact invasives management. This low impact project will include mowing of phragmites and over-seeding with a wetlands seed mix. The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River. This work is also being proposed as an Ecological Restoration Limited Project consistent with the eligibility criteria and the interests of the WPA.

The proposed work under this Notice of Intent will include:

- Landscape Rehabilitation outside of the USACE Phase 2 work area:
- Low impact mowing of phragmites and seeding of bordering vegetated wetland and bank with New England wetland seed mix;
- Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):
- Low impact mowing of phragmites and seeding of bordering vegetated wetland and bank with New England wetland seed mix;
- Long-Term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

6.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

6.1 General Eligibility

The Project is an Ecological Restoration Project as defined in 310 CMR 10.04, eligible as a Flood Control and Invasive Species Management Project. The Project will further the following WPA interests:

- Flood Control – The Phase 2 Project will excavate and deepen portions of the Muddy River to allow for increased flow and achieve and maintain flood damage protection.

- Storm damage prevention – By excavating and deepening the Muddy River, increased flow will be allowed to pass through the river, preventing future flooding and storm damage.

6.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

6.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries (DMF)

The Commonwealth of Massachusetts DMF has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

6.4 Water Quality Certification

The Project involves dredging over 100 cubic yards, therefore, the USACE has submitted a Water Quality Certification Application, included in Appendix B.

6.5 Ecological Benefits

In addition to furthering the WPA interests of flood control and storm damage prevention, the Project will provide significant ecological benefits, as described in Section 4 of this Narrative.

6.5.1 Streamflow

The Phase 2 project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

6.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Phase 2 project will restore former open water habitat by removing phragmites, mudflats, sand islands, and deepening existing open water habitat. The water quality benefits are described in detail in Section 4 of this Narrative.

6.5.3 Riprarian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The wetland vegetation in dredged areas by seeding and planting where appropriate. The plant community diversity is expected to be much higher in restored wetlands.

6.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Project area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

6.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 to ensure that the restoration and improvement of the natural capacity of a Resource Area and furthers the WPA interest for Other Ecological Restoration Projects, including:

- Fill removal and re-grading
- Invasive species management

7.0 Required Actions

7.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix D.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project in February of 2005 and received a Certificate on April 1, 2005. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

7.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Phase 2 Project Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Phase 2 Project Area.

7.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Phase 2 Project Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

7.4 Division of Marine Fisheries

The proposed Phase 2 project does not occur within a coastal waterbody.

7.5 Division of Fisheries and Wildlife

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

7.6 MassDEP Water Quality Certification

The USACE has submitted a Water Quality Certification Application to MassDEP for the Phase 2 Project. A copy of the application is included in Appendix B. When USACE receives a Water Quality Certificate, a copy will be provided to the Boston Conservation Commission.

7.7 MassDEP Wetlands Restriction Order

The Phase 2 Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

7.8 Department of Conservation and Recreation

7.8.1 Office of Dam Safety

The Phase 2 project does not include work on a dam.

7.8.2 Areas of Critical Environmental Concern (ACECs)

The Phase 2 Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
   a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
   b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).

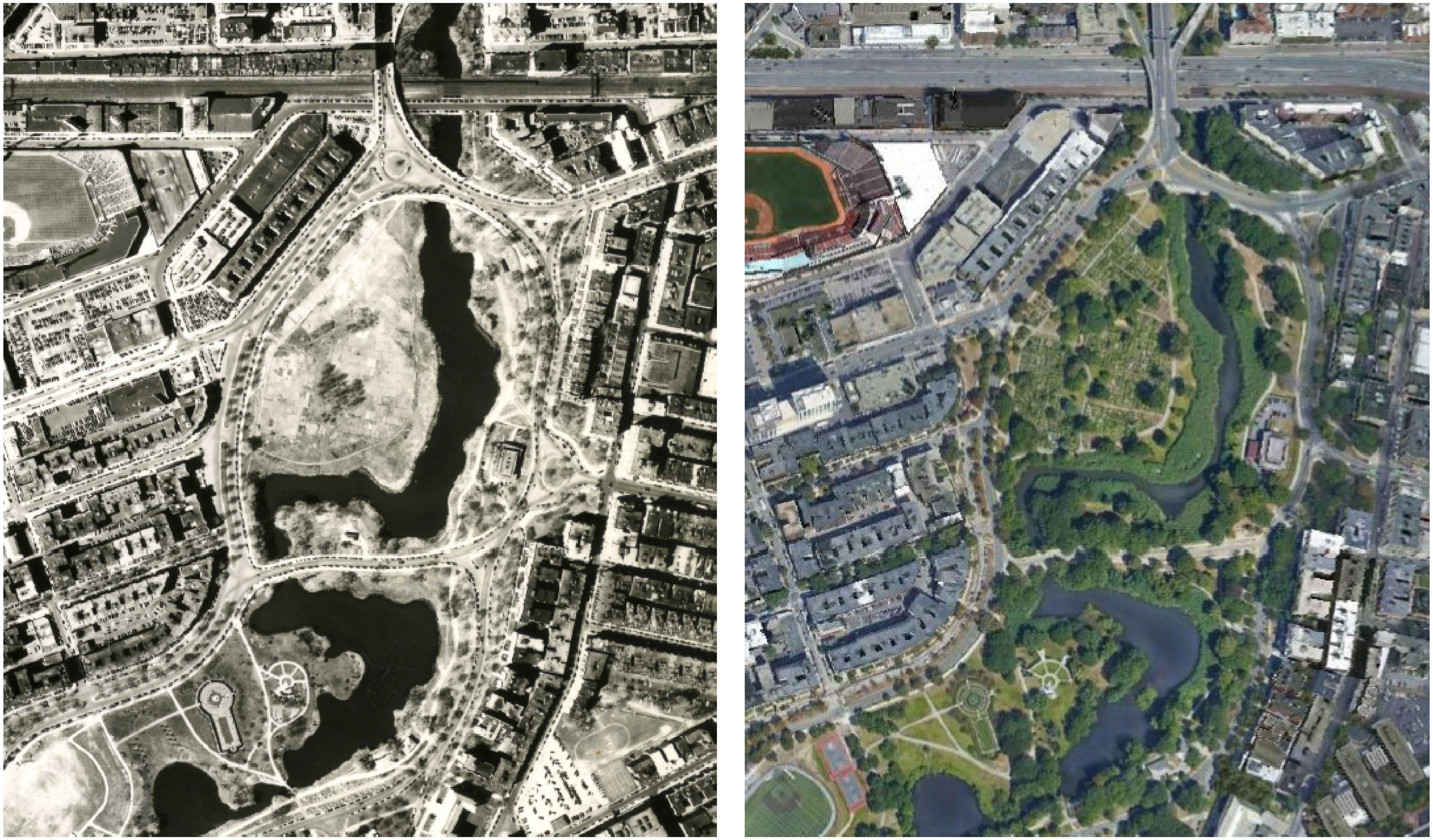


Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

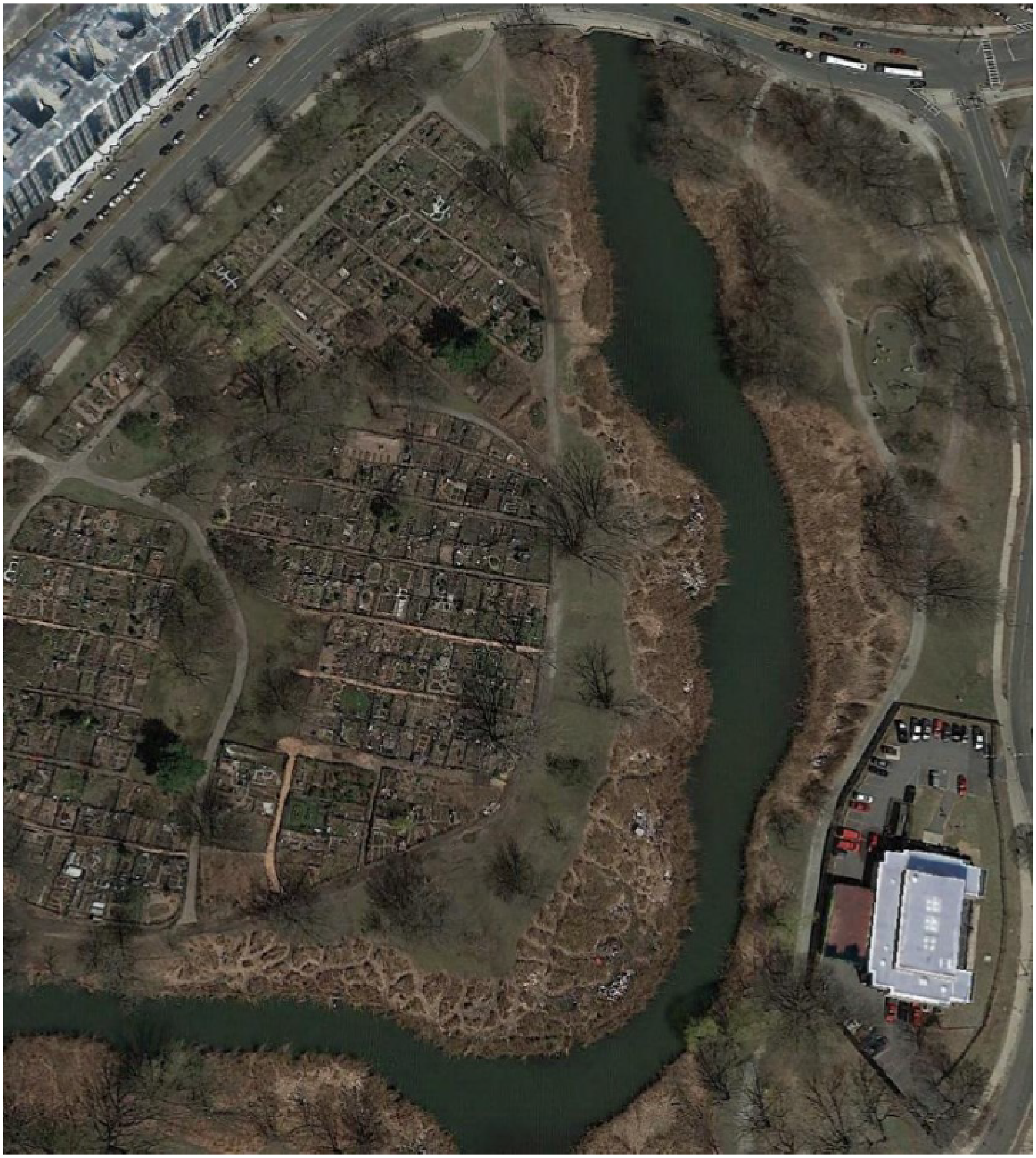
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native ”volunteers”. Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

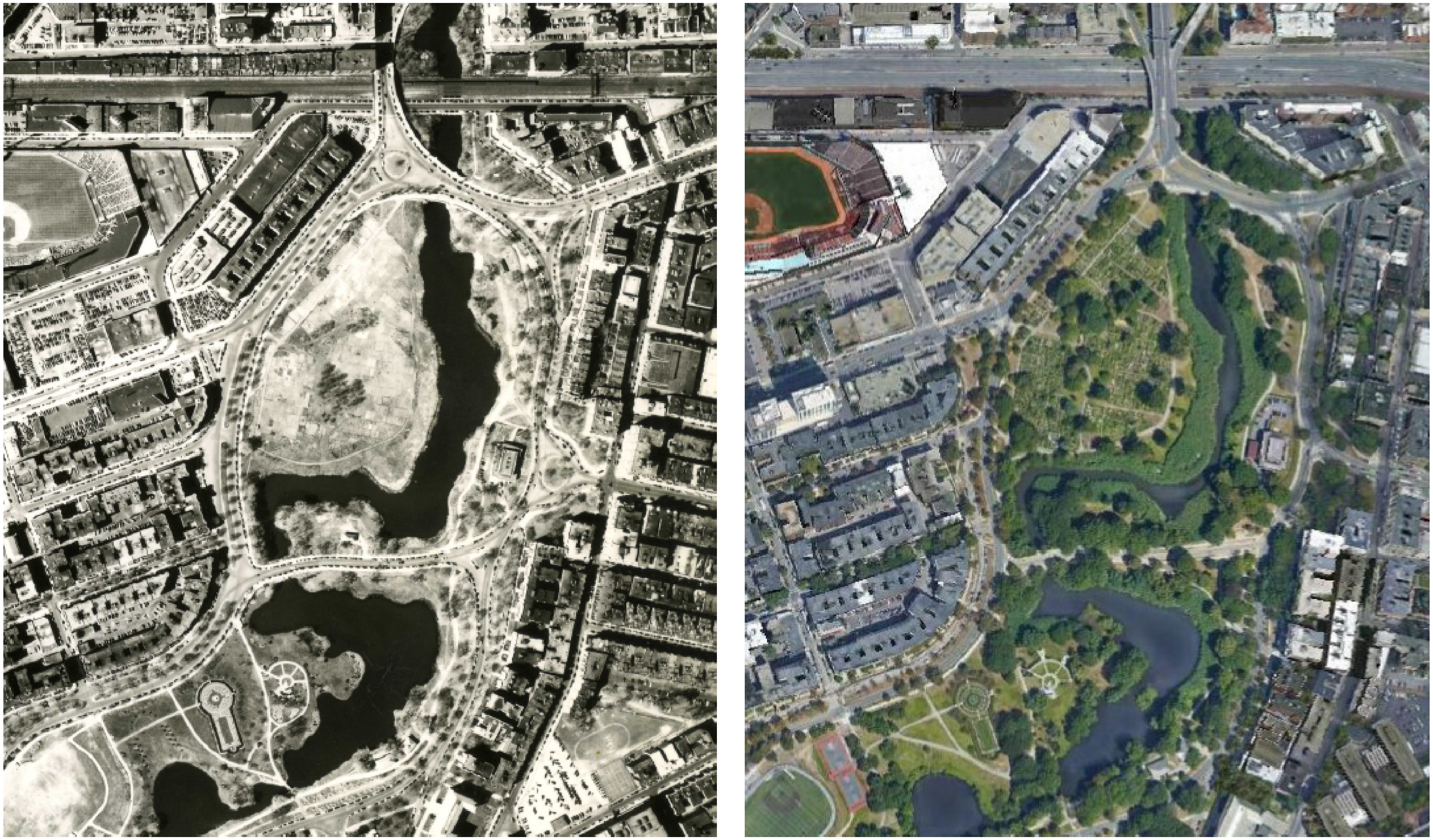
For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).



1951 2017

Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

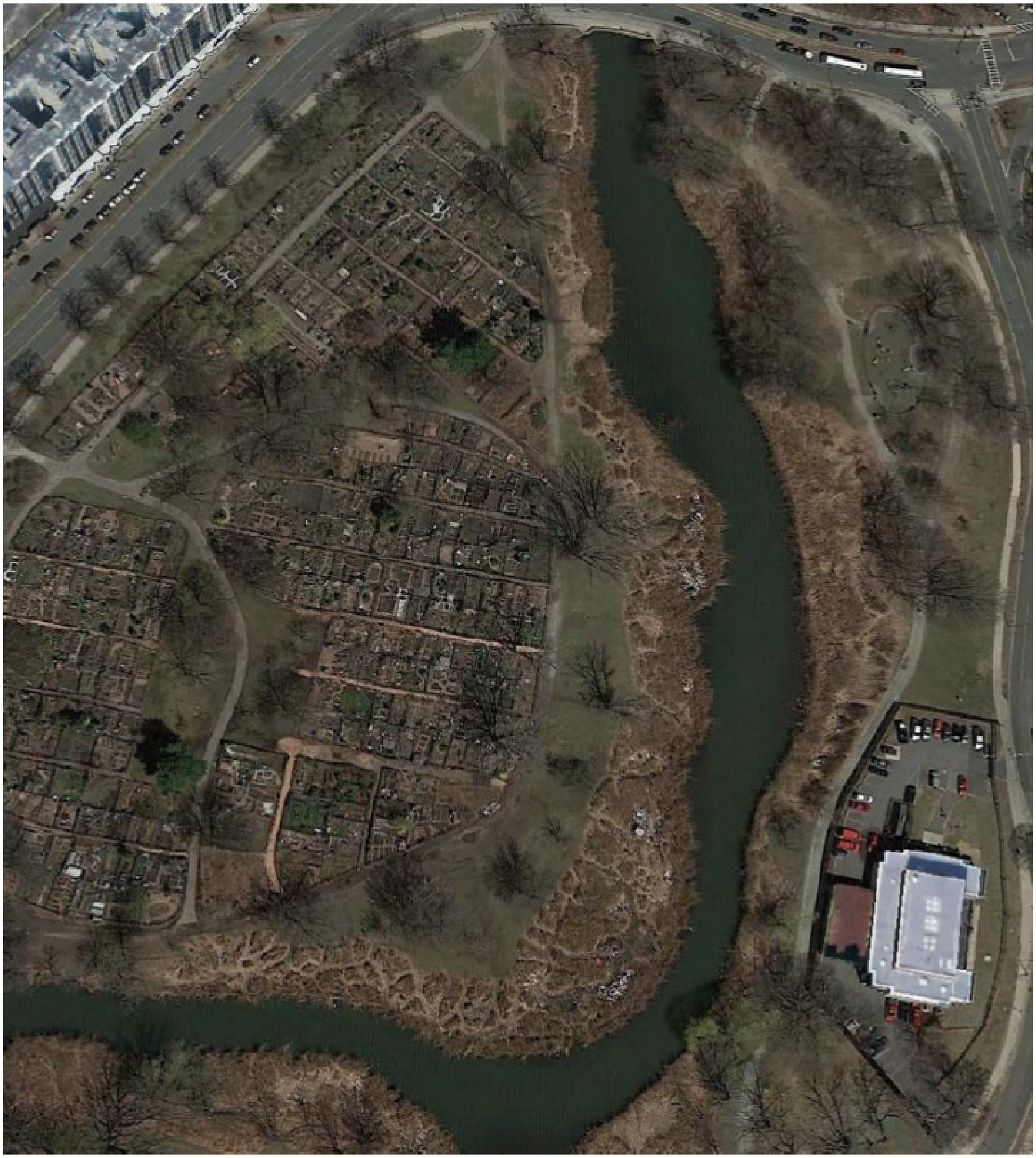
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).

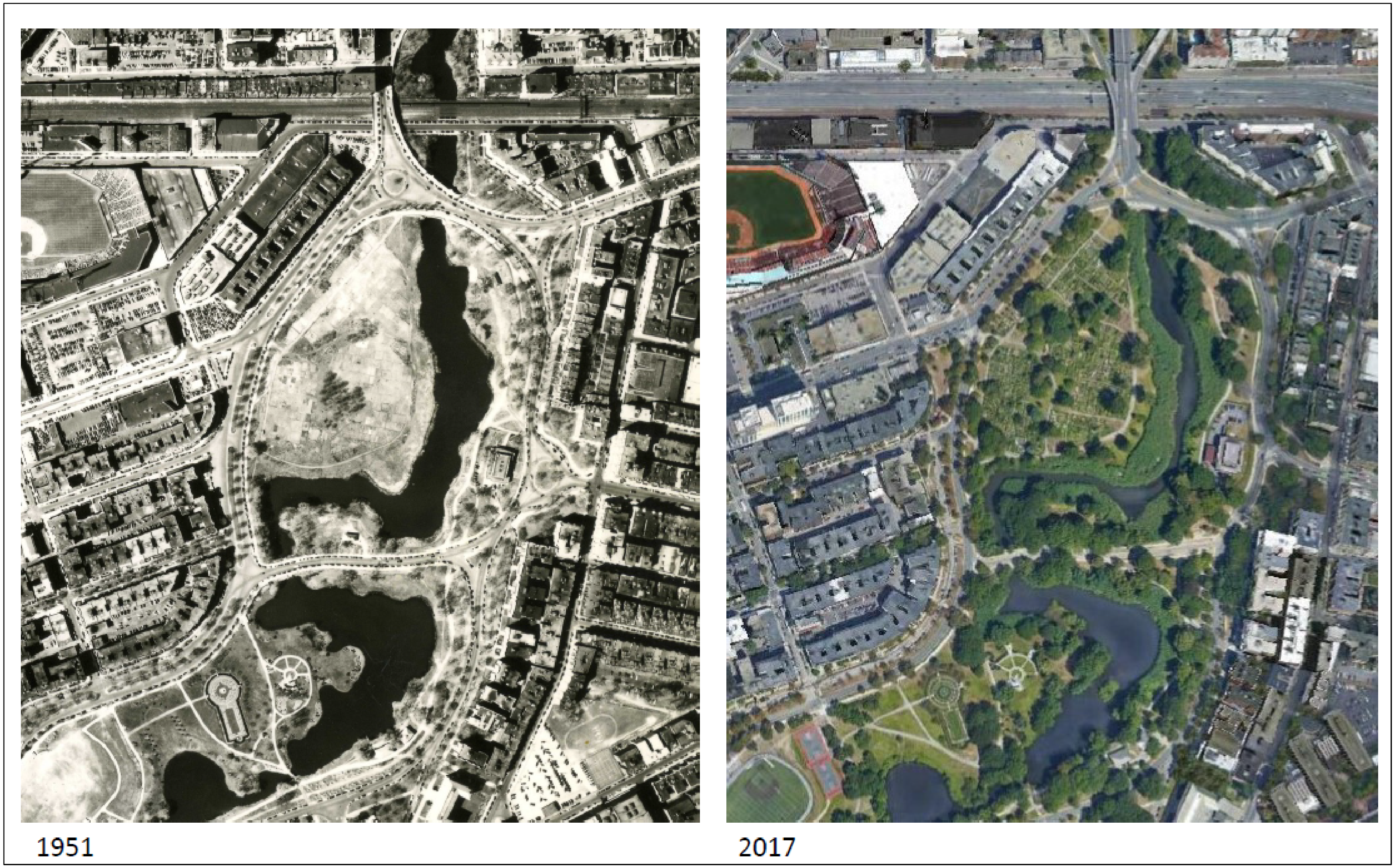


Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

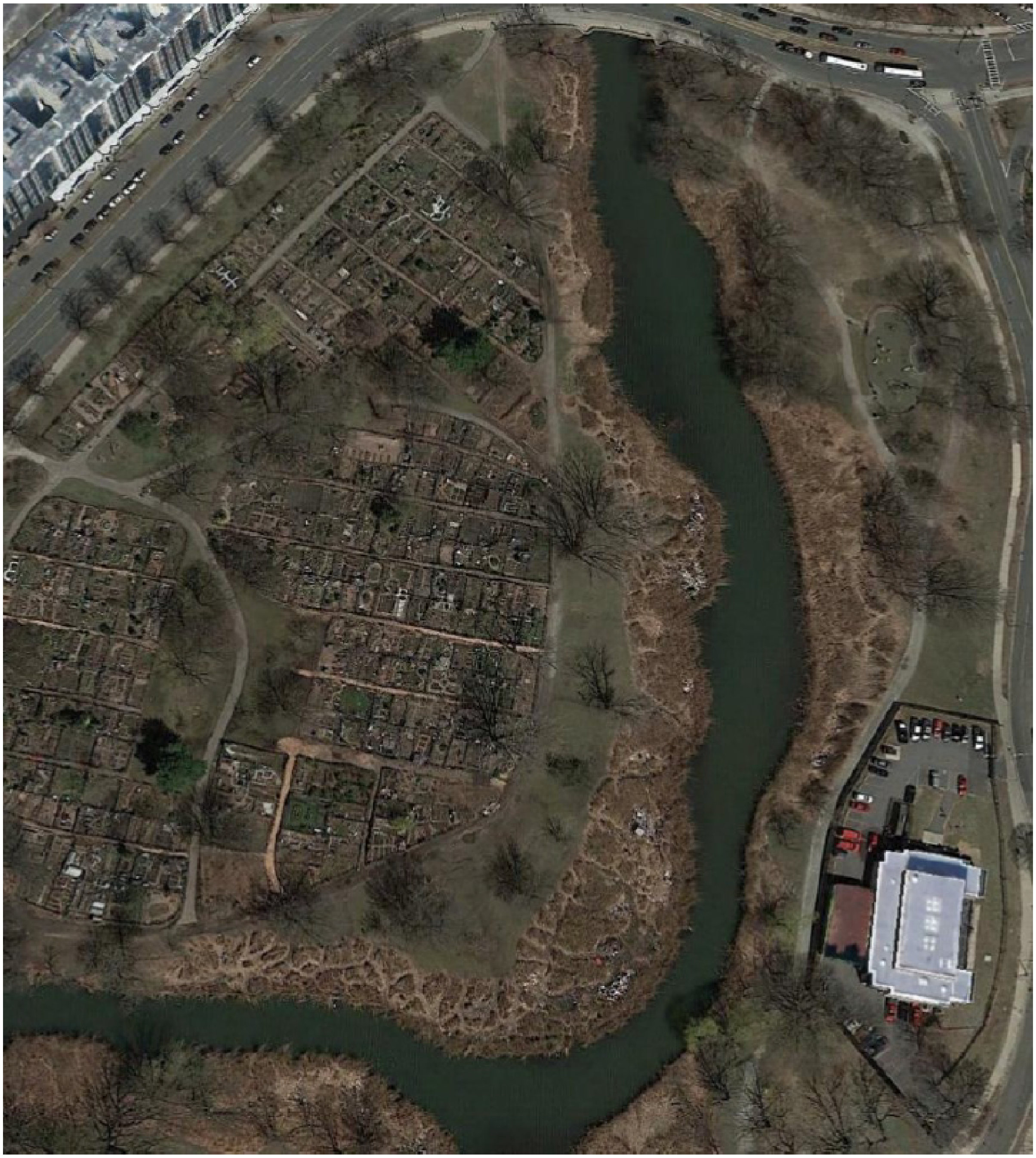
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

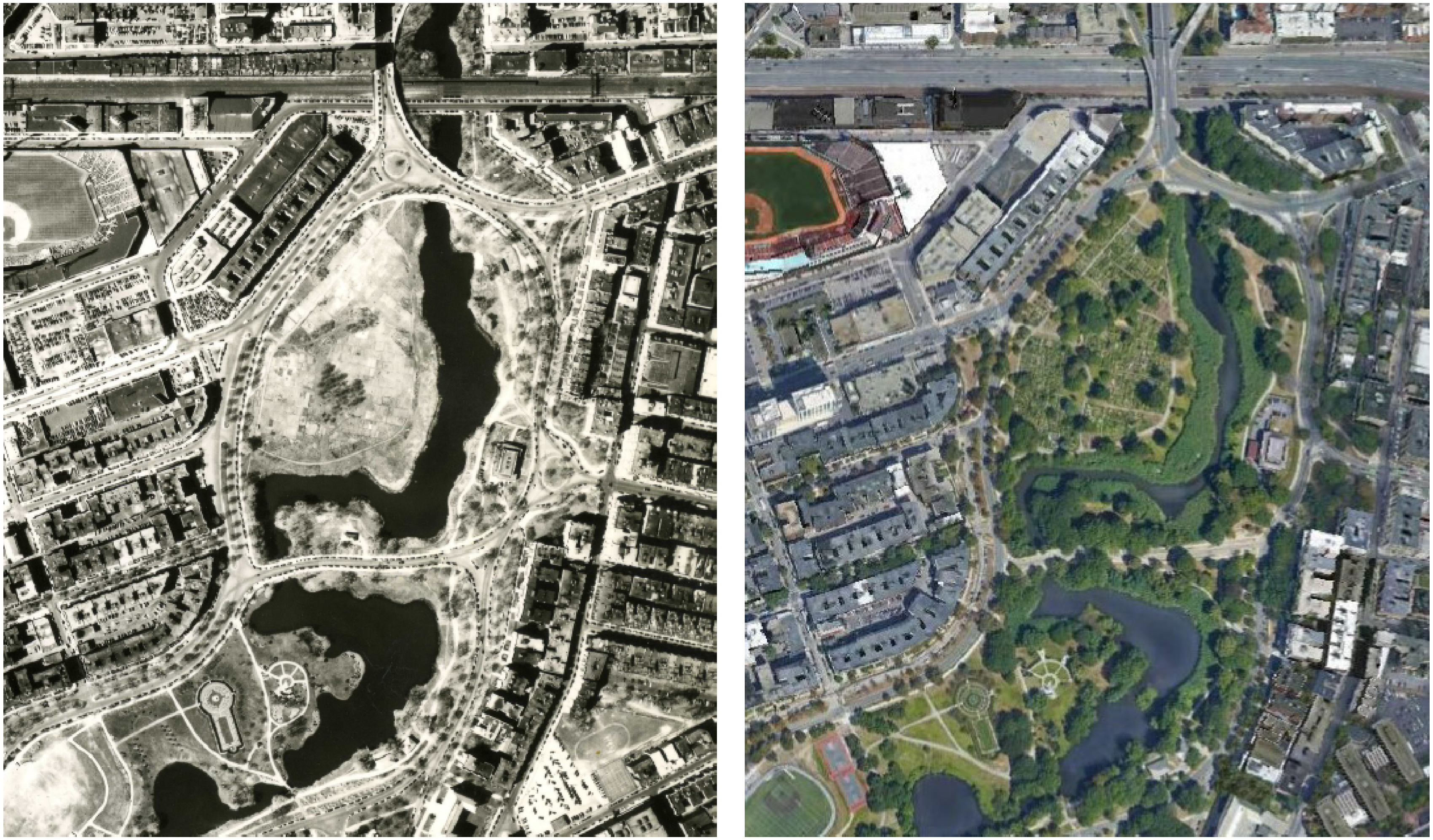
For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).



1951 2017

Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

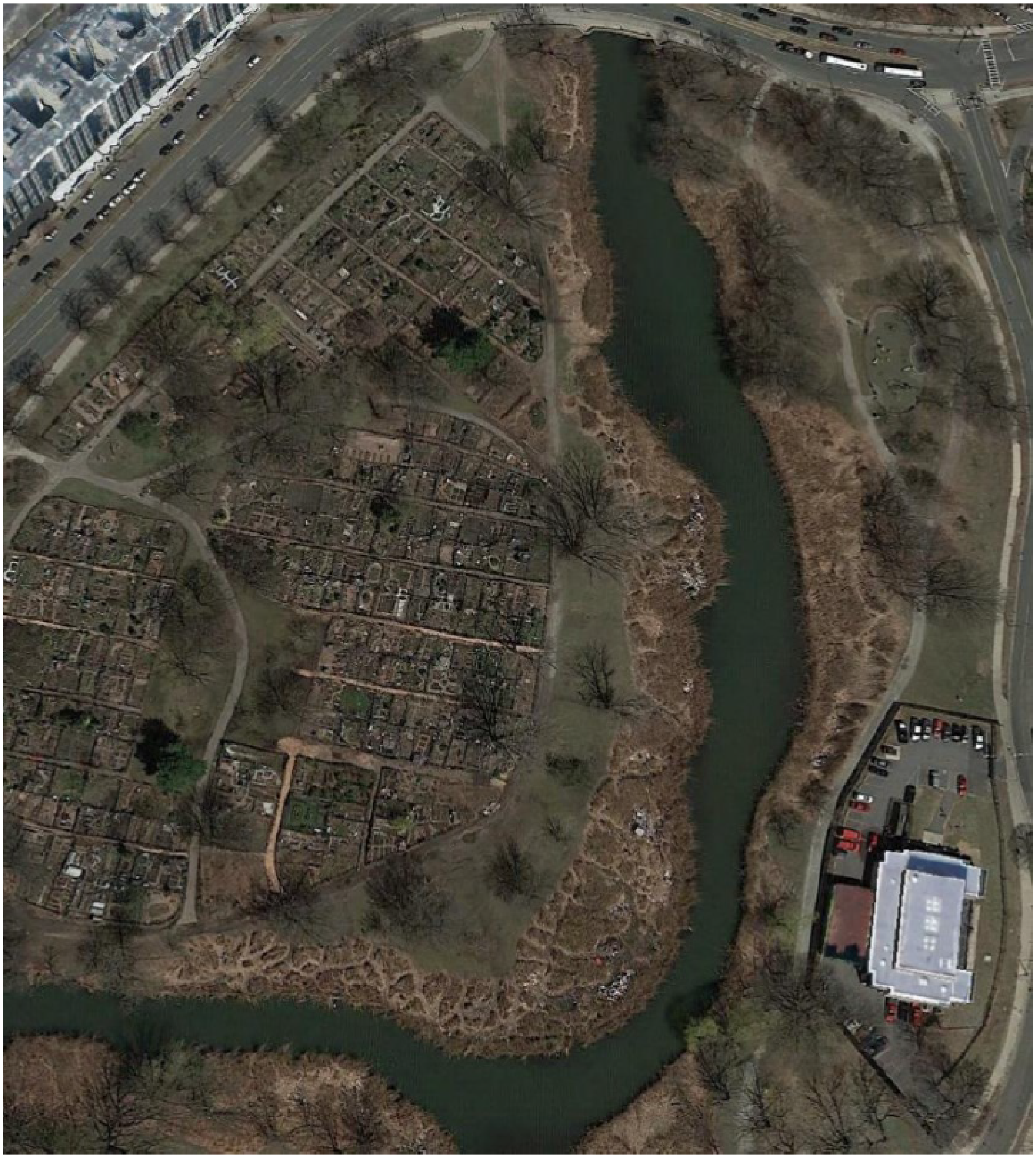
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990’s and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).

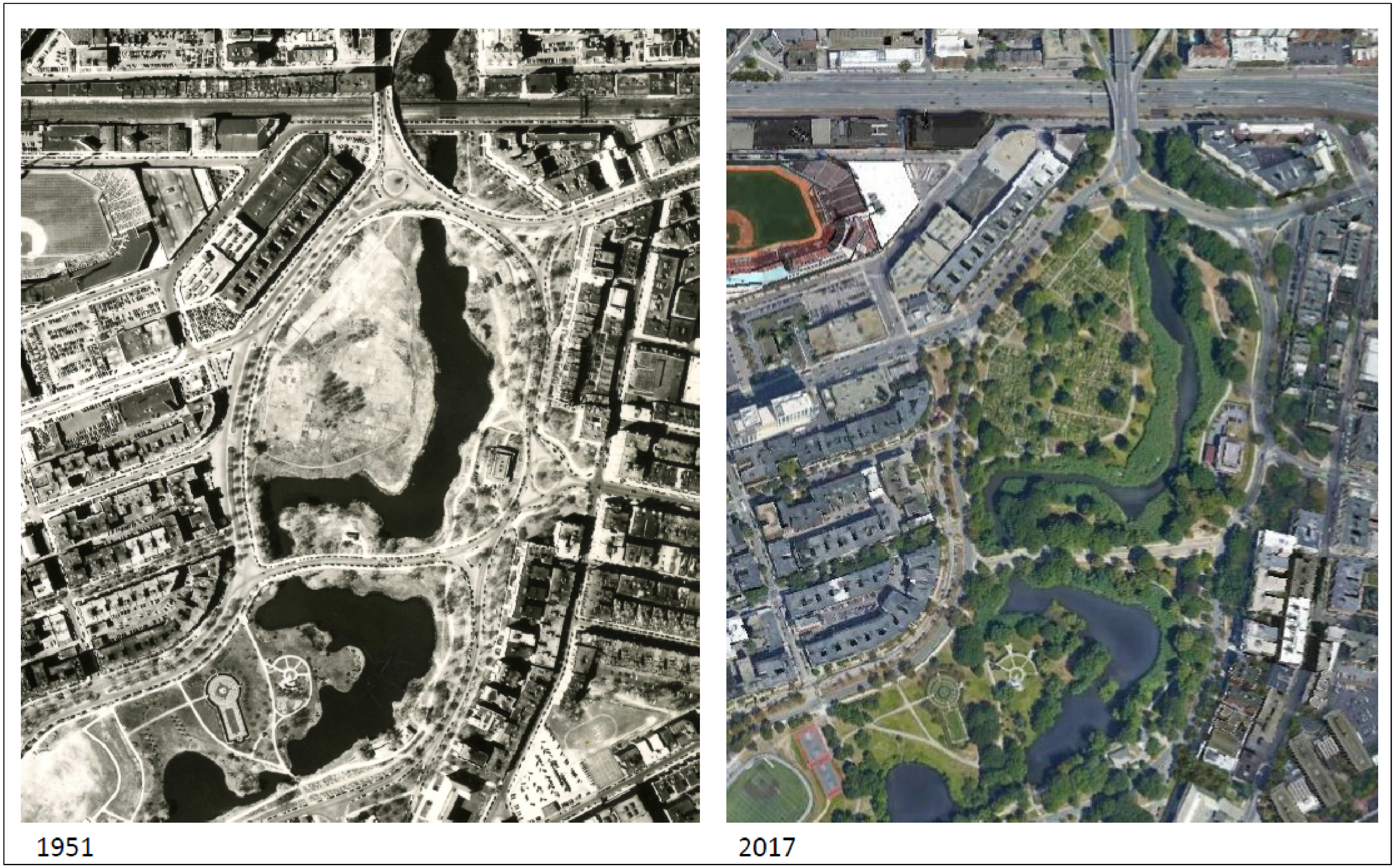


Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

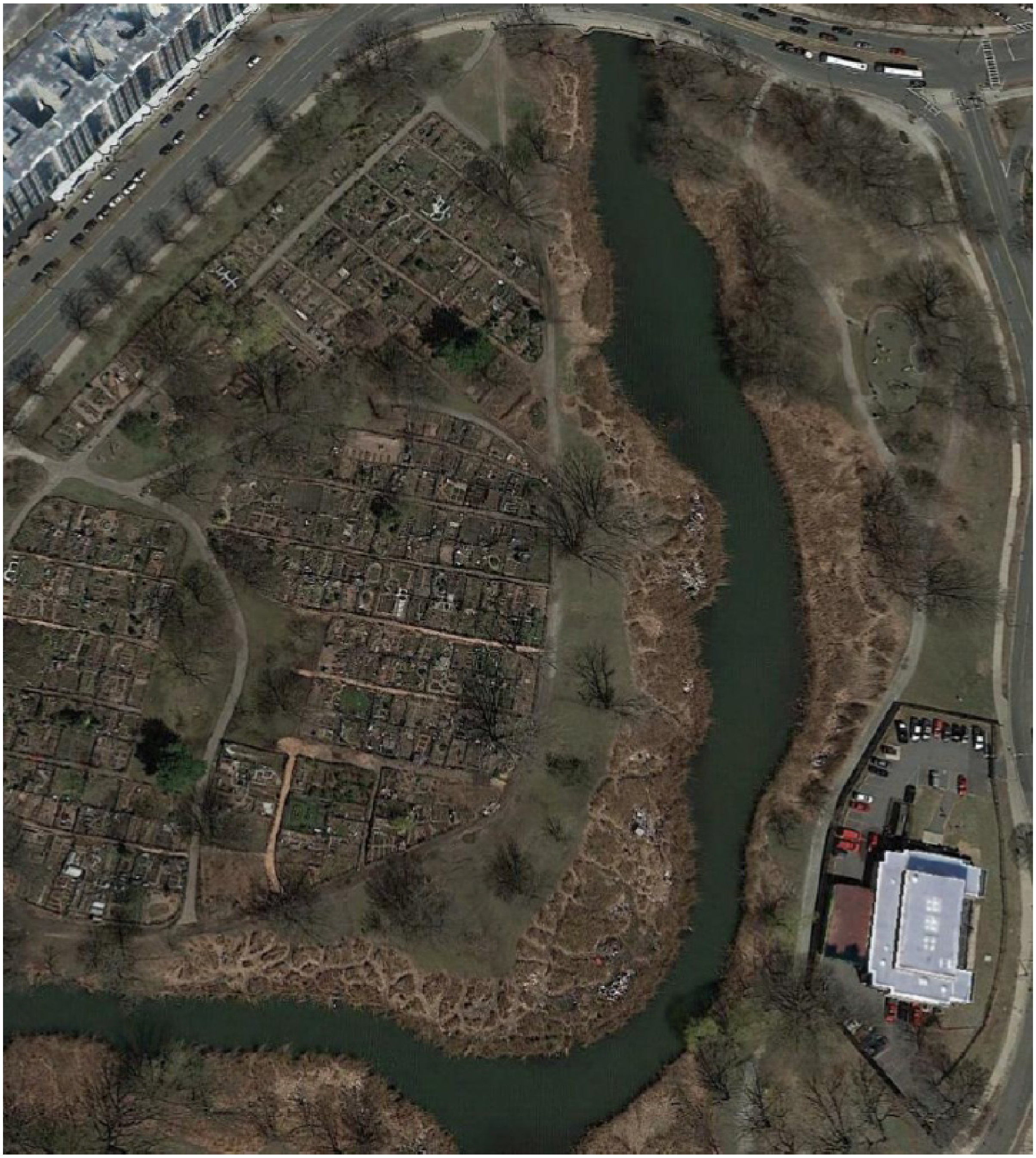
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native ”volunteers”. Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).

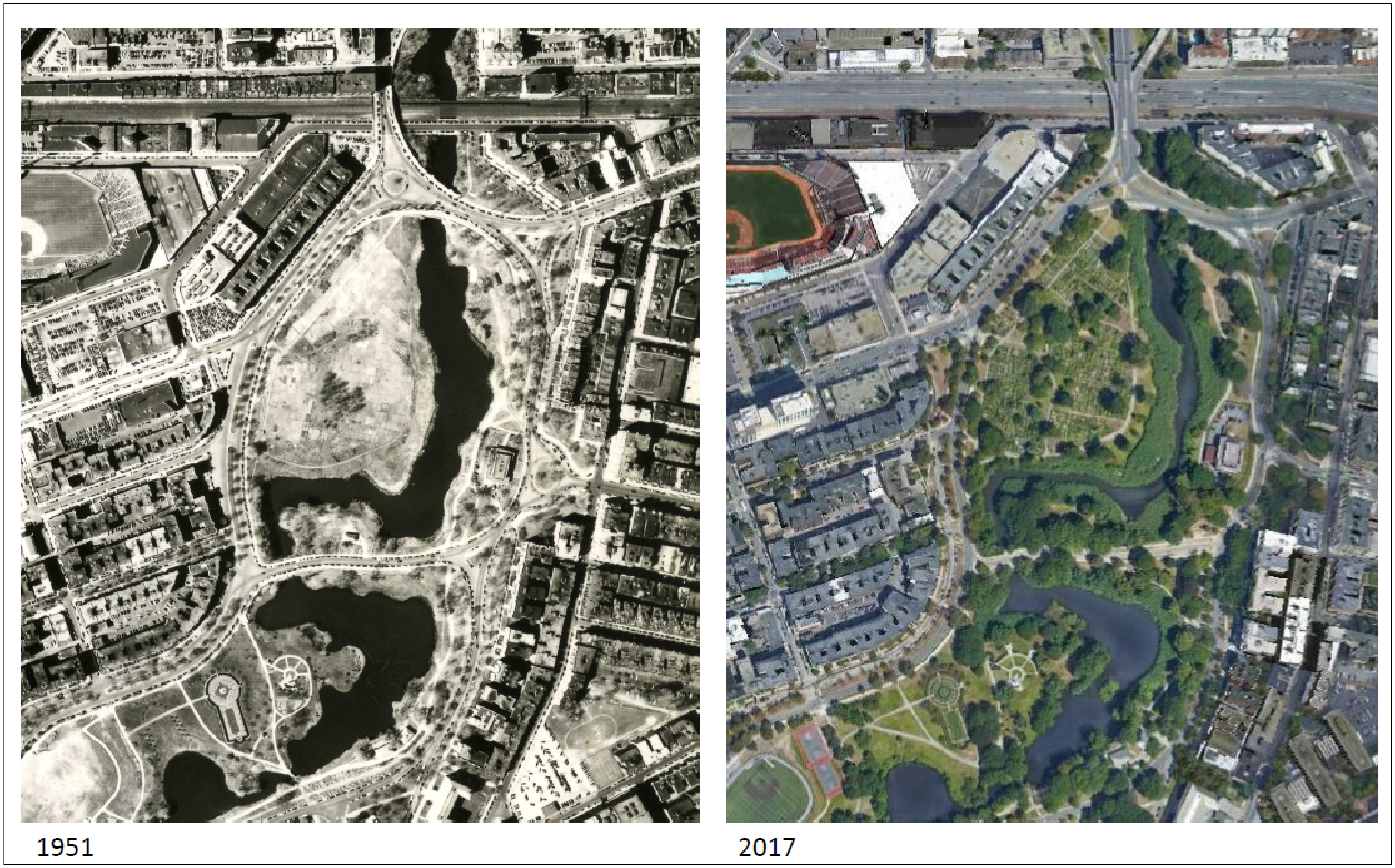


Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

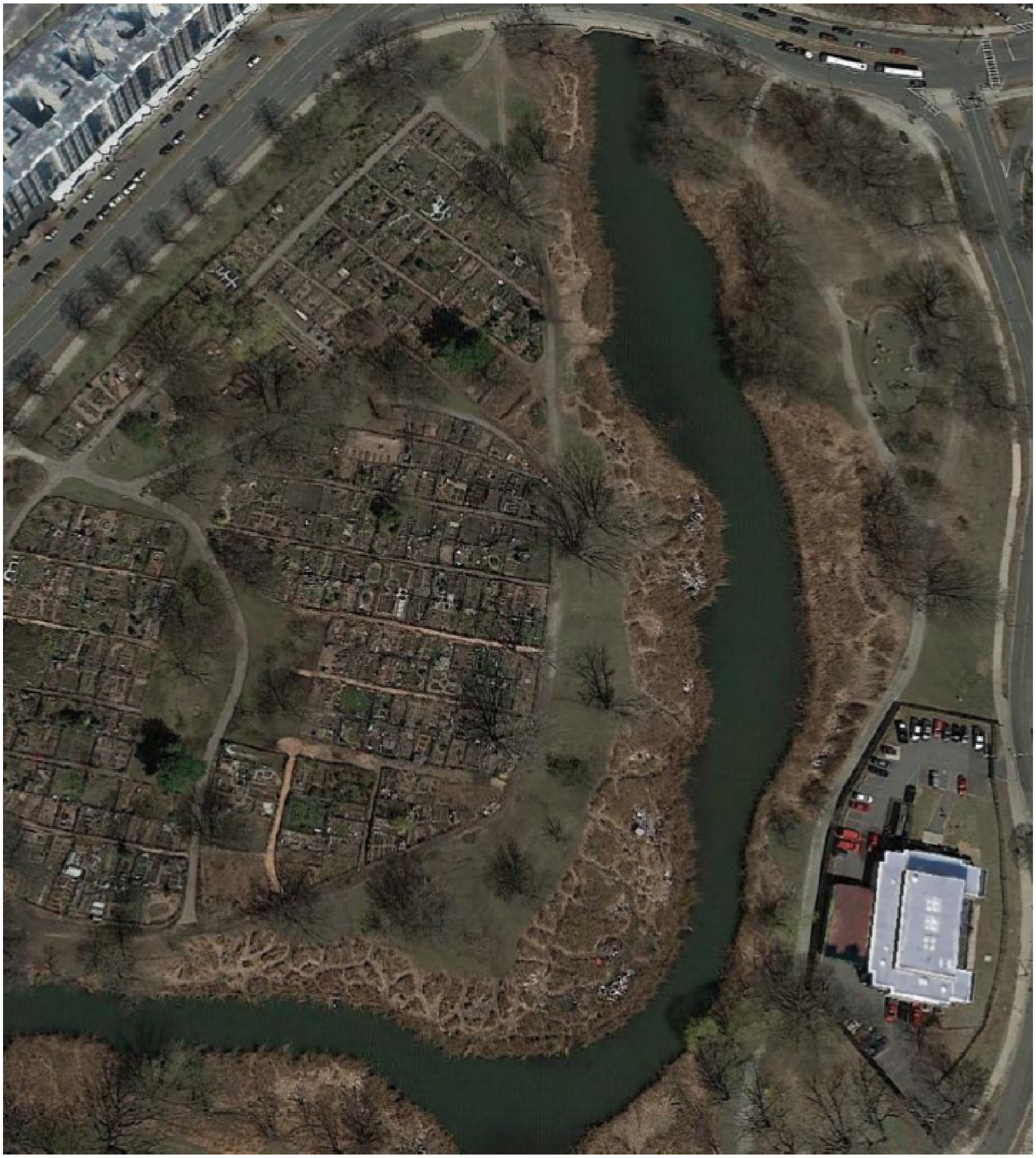
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

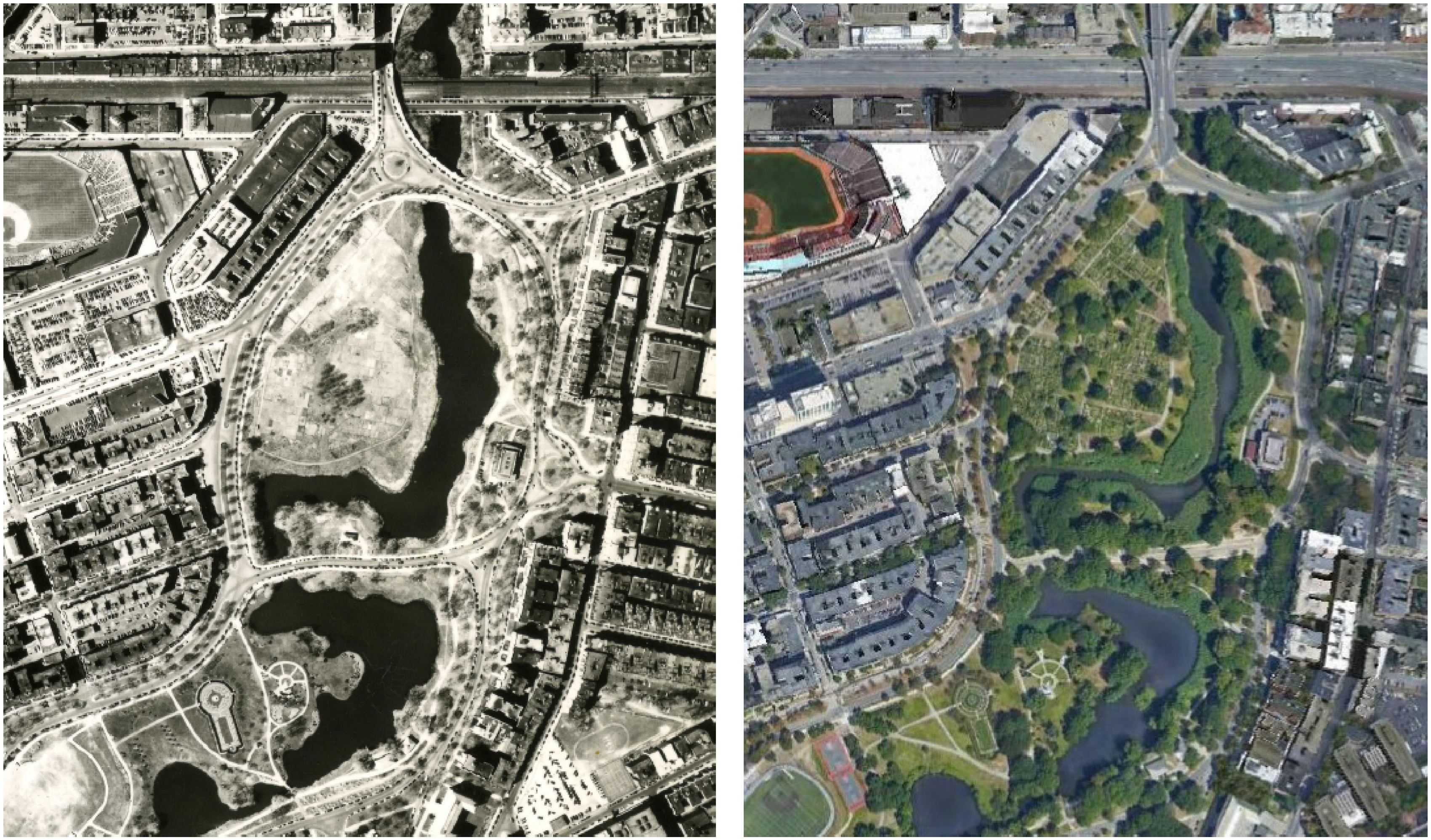
For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).



1951 2017

Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

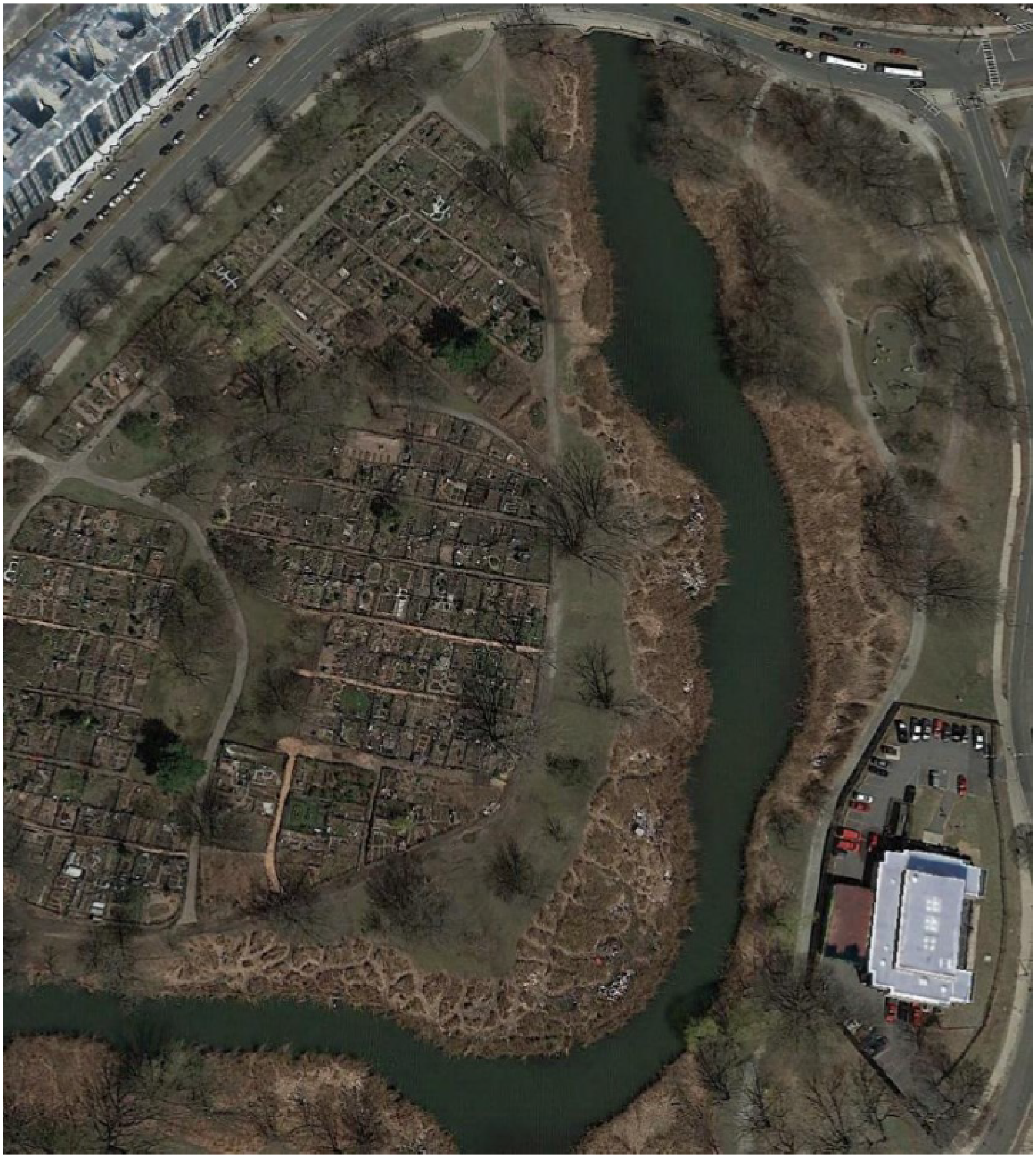
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

Project Narrative

1.0 Introduction

The City of Boston is submitting this Notice of Intent (NOI) as an Ecological Restoration Limited Project for landscape rehabilitation through mowing of phragmites, top dressing with loam (as needed) and seeding with a diverse native wetlands seed mix (in all areas except land under water). This Landscape Rehabilitation Pilot project (Rehabilitation Pilot) is being proposed in conjunction with the Muddy River Flood Damage Reduction Project - Phase 2 (the Phase 2 Muddy River Project), designed by the U.S. Army Corps of Engineers-New England District (USACE). Both efforts will serve to further the interests of the Wetlands Protection Act (WPA) by restoring the Muddy River wetlands resource areas in accordance with the goals of an Ecological Restoration Limited Project.

This Rehabilitation Pilot is proposed as an invasives management program in two key areas within the Muddy River: USACE Project areas to be impacted by the Phase 2 construction and areas impacted by invasives but not included within the USACE project.

Habitat that is very rare in urban areas - including wet meadows and scrub/shrub areas - will be created through these two efforts. Cities are barren barriers for many forms of wildlife. Linear systems like rivers and associated parks can provide a unique opportunity to support wildlife corridors through urban areas while providing recreational and educational resources for people. This opportunity is squandered when these narrow areas are further limited by a lack of species diversity and absence of native plants.

The Rehabilitation Pilot will include work in the Riverway and Back Bay Fens segments of the Muddy River and will aim to improve and diversify wetland habitat areas, improve degraded riverine habitats, poor water quality, and other related water resource problems. (The Phase 2 Muddy River project will also provide flood damage reduction and stormwater management benefits - see below.) The top dressing with loam and over seeding will occur in all areas except land under water where the phragmites present as floating mat. Floating mat areas will only be mowed and the cuttings removed. after the goal of the pilot is to transition from a monoculture of exotic invasives to a diverse, native mix.

The Phase 2 Muddy River Project will eradicate phragmites through remove the root mass and replanting with management of the newly planted areas. The project is designed to reduce damage from flooding and to improve the management of stormwater through this system.

The Rehabilitation Pilot is consistent with the overall project goals of restoring the Muddy River's wetlands resources and the natural capacity of these resource areas to protect and sustain the interests identified in the WPA. Written notices regarding the proposed project for work in Boston were submitted to the Massachusetts Environmental Policy Act (MEPA) Office for publication in the Environmental Monitor (on October 10, 2018) in advance of the hearings held by the Boston Conservation Commission on the Notices of Intent filed for the respective project.

2.0 Project Description - Invasives Management – Pilot Program

A landscape rehabilitation invasives management plan is required to protect the habitat and resource area improvements made in the Muddy River Project Phase 1 and Phase 2 work areas. Much of the area outside the limits of the USACE project still have large stands of phragmites that are not being addressed as part of the Phase 1 and Phase 2 construction. In addition to the large stands (which will serve as a continuous seed source) the areas not impacted by construction include mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments and slow current which provide good conditions for Phragmites growth. While Ecological Restoration Limited projects for phragmites management have been permitted in many areas of the Commonwealth, most of these begin with spraying of glysophate and depend on existing seedbanks of native species to populate the area. The Rehabilitation Pilot is designed to test the effectiveness of repeated mowing and over seeding to achieve the resource area improvement.

The proposed limit of work is with the Riverway and Back Bay Fens areas of the Muddy River (as shown on Drawings in Appendix D).

The proposed work under this Notice of Intent will include the following key elements.

<u>Landscape Rehabilitation outside of the USACE Phase 2 work area:</u>

- Mowing of phragmites and seeding in buffer zone, bordering vegetated wetland and bank with New England wetland seed mix; and
- Mowing of phragmites in floating mat areas (Land Under Water).

<u>Landscape Rehabilitation in the USACE Phase 2 area (in advance of construction):</u>

- Mowing of phragmites, top dressing with organic rich loam and seeding of buffer zone, bordering vegetated wetland and bank with New England wetlands seed mix;
- Mowing of phragmites in floating mat areas (Land Under Water); and
- Long-term management of phragmites and vegetation monitoring in the Riverway and Back Bay Fens areas of the Muddy River.

Management of phragmites in bank, bordering vegetated wetlands (BVW) and buffer zone areas through the Rehabilitation Pilot will further the desired ecological restoration benefits. In conjunction with the Phase 2 Muddy River Project, this pilot program was developed to support achieve the flood control benefits and to fulfill the requirements for an inland Ecological Restoration Limited Project (Other Category) including:

- Thinning or Planting of Vegetation to Improve Habitat Value;
- Flow Restoration; and
- Invasive Species Management.

3.0 Current Conditions

3.1 Phragmites

The Massachusetts Audubon Society issued a **Massachusetts Wetlands Restoration Technical Note** entitled *Phragmites: Controlling the All-Too-Common Common Reed*. The document describes the proliferation of this aggressive, invasive plant and the consequences to wetland resources.

> *Eventually, Phragmites becomes the sole dominant plant in many of these wetlands. It is doing so at the expense of native flora and animals dependent on these native habitats. The tall grass often forms monotypic stands where it is virtually the only species present. The change in plant structure (from short grasses to tall grass), in biodiversity (from many species to a single species), and in wildlife food production has reduced the habitat value of these marshes for many fish and wildlife species. In addition to ecological concerns, stands of common reed may represent a potential fire hazard . . .*

In Boston, the phragmites[1] in the Back Bay Fens are typical of the conditions described by the *Note*. As seen on **Figure 1,** common reeds (Phragmites) dominate the wetlands. The diversity of plants has been lost. Native plants are rare. Even Massachusetts Audubon's warning about fire danger was prescient. Fires have swept through the reeds more than once. Extensive stands of phragmites are also present in the Riverway section of the Muddy River.

Various methods of control and management have been tried within the confines of the laws and regulations. A trial with black plastic proved ineffective. The plants seemed unfazed by the change, lifting the plastic as they grew. A plot was permitted to test cut and drip application of herbicide. It demonstrated the effectiveness of a stem by stem treatment but even the small test plot took extensive effort. In some upland areas, regular cutting and mowing over three years supported the transition from phragmites to a more typical turf mix.

In 2014 the Annals of Botany's AoBPlants (Oxford University Press) published Phragmites Australis management in the United States: 40 years of methods and outcomes. The article reviewed a number of control methods including:

- Mechanical Control
- Mowing and Cutting
- Burning
- Excavation
- Chemical Control
- Biological Control
- Herbivory

- Classical Biocontrol Organisms
- Novel Methods in Phragmites Management

[1] Hazelton, E. L. G., Mozdzer, T. J., Burdick, D. M., Kettenring, K. M., & Whigham, D. F. (2014). *Phragmites Australis* management in the United States: 40 years of methods and outcomes. *AoB Plants*, *6*, plu001. http://doi.org/10.1093/aobpla/plu001

The analysis presented in this paper, indicated that "Excavation provides complete Phragmites control, and is likely the only landscape-scale option for mechanical removal, but requires disproportionally greater costs in both time and resources." The paper found that mowing alone was of limited effectiveness however this seemed to be based on a single annual more. Regular removal of top growth in the form of herbivory was more effective but carried with it the disturbance to other vegetation (consistently preferred by the herbivores) and the impact of animal waste from the herds on the water body. Hazelton reports, *"In a Great Lakes study, Carlson* et al. *(2009) found that the diversity of vegetation after* Phragmites *removal depended upon the diversity of the native seed bank. It has also been shown that a diverse native seed bank can persist in monocultures of* Phragmites *(Baldwin* et al. *2010)."* However, the Muddy River is a manmade and frequently altered waterway so dependence on the seed bank is risky.

The dredging and removal to increase capacity and conveyance as part of the Phase 2 Muddy River Project is a very expensive and disruptive process, but in addition to the stormwater management improvements, the outcome for the wetland is expected to be profound Therefore, within the limits of the Riverway and Back Bay Fens sections of the Muddy River, the proponent is trying to further evaluate and implement a landscape restoration program that will support the USACE efforts while limiting impacts.

The intent of this pilot program is to support the extensive efforts of the USACE to date by providing a management tool for control of invasives in areas adjacent to/upstream of the USACE projects

3.2 Water Quality, Habitat, and Plantings

Waters in the Muddy River are currently classified as Class B according to the Massachusetts Department of Environmental Protection (MA DEP) While swimming, fishing and boating are prohibited by park rules, Class B waters are considered acceptable for bathing and other recreational purposes, protection and propagation of fish, other aquatic life and wildlife, and after adequate treatment, for use as water supplies. In addition, the Muddy River has been classified as a warm water fishery. Massachusetts Class B standards require a minimum dissolved oxygen (DO) concentration of 5.0 mg/l for warm water fisheries, pH in the range of 6.5 to 8.0 standard units or as naturally occurring, fecal coliform not to exceed 200 colonies/100 ml, and color, turbidity, and suspended solids in concentrations that would exceed the recommended limits of the most sensitive receiving water use. Also, Class B waters shall be free of floating oils, grease, petrochemicals, and pollutants that form objectionable deposits or nuisances.

Water quality of the Muddy River is controlled by numerous factors including:

1) Flow regime of the lower Muddy River (i.e., flat gradient of the river and non-varying backwater elevation controlled by Charles River Dam;)

2) Organic loading from storm drains, illegal sewer connections, and combined sewers;

3) Other pollutant loads (nutrients, heavy metals, oils, floatables) from storm drains and combined sewers;

4) Sediment oxygen demand (SOD);

5) Release of nutrients from anaerobic sediment;

6) Organic loading from extensive submergent and emergent (Phragmites) vegetation, and leaf fall from deciduous trees and shrubs;

7) Waste from geese and ducks; and

8) Overland loading of sediment and nutrients from surrounding park lands and erosion from unprotected shoreline.

Community types (habitat) in the Muddy River study area were mapped by USACE (2003). The entire Muddy River study area (from Wards Pond through the Back Bay Fens) includes about 40 acres of wetland habitat and 120 acres of upland habitat. As natural areas linked together in a highly urbanized setting, Jamaica Park, Olmsted Park comprised of Wards Pond, Spring Pond, the Babbling Brook, Willow Pond and Leverett Pond, the Riverway, and the Back Bay Fens provide extremely valuable wildlife habitat in a local landscape context. The parks are also valuable on a wider scale, because of linkage with the Arnold Arboretum to the south through Jamaica Park, and proximity to Franklin Park to the east and the Charles River Basin to the north. The most valuable wildlife habitat is the wooded habitat in the vicinity of Wards and Willow Pond, islands and riparian habitat at the southern end of Leverett Pond, naturalized areas along the Riverway, and wooded riparian habitat along the Upper Fens pool. These areas have a more diverse plant mix and therefor support

Painted turtle, snapping turtle, and red eared sliders (a non-native species) are common in the Fens. Fish likely to be present in the project area include Common carp, golden shiner, bluegill, brown bullhead, and goldfish. Common carp, and to a lesser extent the other dominant species are tolerant of periodic exposure to low dissolved oxygen concentrations. Blueback herring have been known to occur in Muddy River since the 1990's and were observed in the river during Phase 1 construction. Spawning habitat in the Muddy River is thought to be located at the southern end of Leverett Pond near the discharge of Babbling Brook. Freshwater mussels including the common eliptio (*Elliptio complanata)* are abundant. The proposed limits of work (Riverway and Back Bay Fens) are not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2017). No Federally-listed species occur in the work area.

Plant communities along the Muddy River originate from plantings made in the 1890's during construction of the Emerald Necklace parks. Plans called for planting a great variety of trees,

shrubs, and herbaceous species (see Zaitzevsky, 1982). However, much of the intended design has been lost over the years due to the growth of native and non-native "volunteers". Extensive stands of *Phragmites* are present in the Riverway and Back Bay Fens. Although there is a variety of *Phragmites* that is native to the northeastern United States, studies indicate that all native New England varieties have been supplanted by a highly invasive Eurasian variety (Saltonstall, 2002). Phragmites varieties occurring in the Muddy River were studied by Keller (2000). *Phragmites* is present along embankments up to several feet above the above the normal water elevation. *Phragmites* growth in the project area is robust with *Phragmites* reducing habitat value by outcompeting native plants and constricting the river channel in numerous locations.

The following sections describe the ecological restoration activities proposed in each of the wetlands resource areas to meet the projects restoration goals following completion of the Pilot Program.

4.0 Summary of Work in Wetlands

The proposed program includes ecological restoration activities (i.e. management of invasives) in the following wetlands resource areas:

- Bank;
- Bordering Vegetated Wetlands (BVW);
- Land Under Water (LUW); and
- Buffer Zone.

In addition to these resource areas, the project also includes work in Bordering Land Subject to Flooding (BLSF) and Riverfront Area.

For all resource areas except Land Under Water, the pilot program will include mowing, top dressing with organic loam and over-seeding with native New England wetlands seed mix. For invasives removal in LUW, the proponent will mow the invasive(s) and remove the cuttings.

The proponent has submitted Notices of Intent to the local conservation commissions to permit the project as an Ecological Restoration Limited Project that provides ecological restoration benefits through improvements to the above wetland resource areas along with invasive species management and pollution prevention as discussed below.

4.1 Ecological Restoration Limited Project

Notwithstanding the requirements of any other provision of 310 CMR 10.25 through 10.35, 10.54 through 10.58, and 10.60, the Issuing Authority may issue an Order of Conditions permitting an Ecological Restoration Project listed in 310 CMR 10.53(4)(e) as an Ecological Restoration Limited Project and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40, provided that:

1. The Issuing Authority determines that the project is an Ecological Restoration Project as defined in 310 CMR 10.04;

2. If the project will impact an area located within estimated habitat which is indicated on the most recent *Estimated Habitat Map of State-listed Rare Wetlands Wildlife* published by the Natural Heritage and Endangered Species Program (Program), the applicant has obtained a preliminary written determination from the Program in accordance with 310 CMR 10.11(2) that the project will not have any adverse long-term and short-term effects on specified habitat sites of Rare Species, or the project will be carried out in accordance with a habitat management plan that has been approved in writing by the Natural Heritage and Endangered Species Program and submitted with the Notice of Intent;
3. The applicant demonstrates that the project will be carried out in accordance with any time of year restrictions or other conditions recommended by the Division of Marine Fisheries for coastal waters and the Division of Fisheries and Wildlife in accordance with 310 CMR 10.11(3);
4. If the project involves the dredging of 100 cubic yards of sediment or more or dredging of any amount in an Outstanding Resource Water, the applicant has applied for or obtained a Water Quality Certification by the Department; and
5. The project complies with all applicable provisions of 310 CMR 10.53(1), (2), (7), and (8).

An Ecological Restoration Project permitted as an Ecological Restoration Limited Project in accordance with 310 CMR 10.53(4) may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals.

In determining whether to approve a project as an Ecological Restoration Limited Project, the issuing authority shall consider the following:

1. the condition of existing and historic coastal Resource Areas proposed for restoration including evidence of the extent and severity of the impairment(s) that reduce the capacity of said Resource Areas to protect and sustain the interests identified in M.G.L. c. 131, § 40;
2. the magnitude and significance of the benefits of the Ecological Restoration Project in improving the capacity of the affected Resource Areas to protect and sustain the other interests identified in M.G.L. c. 131, § 40; and
1. the magnitude and significance of the impacts of the Ecological Restoration Project on existing Resource Areas that may be modified, converted and/or lost and the interests for which said Resource Areas are presumed significant in 310 CMR 10.00, and the extent to which the applicant will:
    a. avoid adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that can be avoided without impeding the achievement of the project's ecological restoration goals;
    b. minimize adverse impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40, that are necessary to the achievement of the project's ecological restoration goals; and

c. utilize best management practices such as erosion and siltation controls and proper construction sequencing to avoid and minimize adverse construction impacts to Resource Areas and the interests identified in M.G.L. c. 131, § 40.

The proposed Muddy River Flood Control Project – Phase 2 meets the applicable criteria described above. The project can be permitted as an Ecological Restoration Limited Project as discussed in this NOI and attachments.

4.2 Bank

For the Landscape Rehabilitation project, banks are presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on bank resource areas are as follows:

1. The physical stability of the Bank;
2. The water carrying capacity of the existing channel within the Bank;
3. Ground water and surface water quality;
4. The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
5. The capacity of the Bank to provide important wildlife habitat functions.

The proposed project will include temporary impacts during landscape rehabilitation, however, the completed Ecological Restoration Project as proposed is intended to improve the capacity of the resource area to meet the above performance standards.

4.3 Bordering Vegetated Wetlands (BVW)

For the project, Bordering Vegetated Wetlands are likely to be significant to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

The General Performance Standards for work in bordering vegetated wetland resource areas are as follows:

1. Any proposed work in a Bordering Vegetated Wetland shall not destroy or otherwise impair any portion of said area.
2. Which results in the loss of more than 5,000 square feet of Bordering Vegetated Wetland;
3. No project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species; and
4. Any proposed work shall not destroy or otherwise impair any portion of a BVW that is within an Area of Critical Environmental Concern (ACEC).

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. The temporary construction impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. As an Ecological Restoration Project under (310 CMR 10.53 (4)) the project is not subject to the 5,000 square foot threshold. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species. The project does not impact an ACEC.

4.4 Land Under Water

For the project, land under water is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. The General Performance Standards for work on land under water resource areas are as follows:

1. The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
2. Ground and surface water quality;
3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries;
5. The capacity of said land to provide important wildlife habitat functions;
6. Work on a stream crossing; and
7. Have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species.

The intent of the project is to complete an Ecological Restoration project intended to improve the resource area conditions. Removal of invasive species will improve the existing conditions land under water. The project does not include a stream crossing. In addition, the project does not impact any habitat sites of rare vertebrate or invertebrate species.

4.5 Buffer Zone

For the project, buffer zone is presumed to be significant to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. For work in the Buffer Zone the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area.

4.6 Bordering Land Subject to Flooding

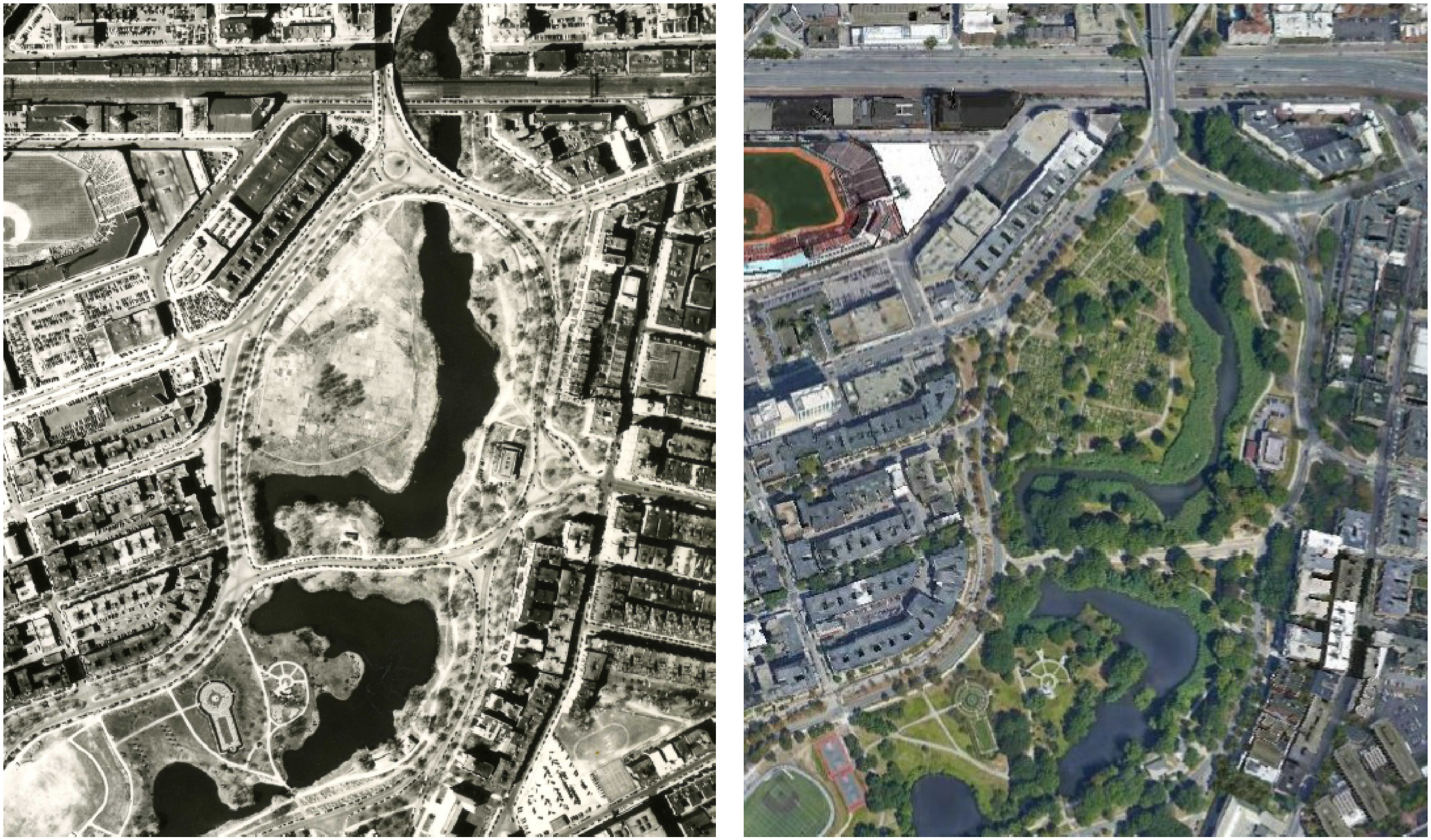
For the project, bordering land subject to flooding is presumed to be significant to flood control, to storm damage prevention and to the protection of wildlife habitat. Bordering Land Subject to Flooding is an area which floods from a rise in a bordering waterway or water body. Bordering Land Subject to Flooding provides a temporary storage area for flood water which has overtopped the bank of the main channel of the river. The General Performance Standards for work in bordering land subject to flooding resource areas are as follows:

1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project.
2. Work shall not restrict flows so as to cause an increase in flood stage or velocity.
3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions.

The intent of the project is to complete an Ecological Restoration project (i.e. Invasive Species Management) which is intended to improve the resource area conditions. The temporary landscape rehabilitation impacts will be mitigated by the proposed restoration activities as described in detail in this NOI. This project does not impact any wildlife habitat sites.

4.7 Riverfront Area

For the project, riverfront area is presumed to be significant to protect groundwater; to provide flood control; to prevent storm damage; to prevent pollution; to protect wildlife habitat; and to protect fisheries. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 25 feet away in the City of Boston. The General Performance Standard for work in riverfront area is that there is no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. As an Ecological Restoration Project intended to provide invasive species management this project meets the Riverfront Area requirements of 310 CMR 10.53 (4).



1951 2017

Figure 1 - Aerial Imagery of Back Bay Fens – 1951 and 2017

5.0 Invasives Management

Extensive stands of Phragmites are present in the Riverway and Back Bay Fens, as seen in **Figure 2**.

Phragmites currently occurs along about 20 percent of the Riverway shoreline. Where they are present, Phragmites outcompete native plants. The stands effective monocultures. Additional Phragmites is present along embankments up to several ft. above the above the normal water elevation. Phragmites growth in the Riverway is robust. In well-established stands, shoots frequently exceed 3 meters in height, and range up to nearly 7 m. Phragmites aboveground live standing crop near Park Drive in October 1992 was about 4,000 g/m2 (dry weight), well above values typically reported for Phragmites in North America.

Phragmites has constricted the river channel in numerous locations. Growth is most extensive from the Footbridge downstream to Park Drive, near Riverwalk Island, and downstream of Route 9. Stands extend along both banks of the river for about 400 ft upstream of the Park Drive culverts. In some locations, the inner edge of this stand appears to be semi-floating in about 4 ft. of water. Several thousand square ft of Phragmites was excavated during installation of the Riverway culvert and the FRCS during Phase 1.

Conditions are favorable for continued expansion of Phragmites throughout much of the Riverway. Mudflat and shallow water habitat, lack of heavy shading, nutrient rich sediments, slow current provide good conditions for Phragmites growth.

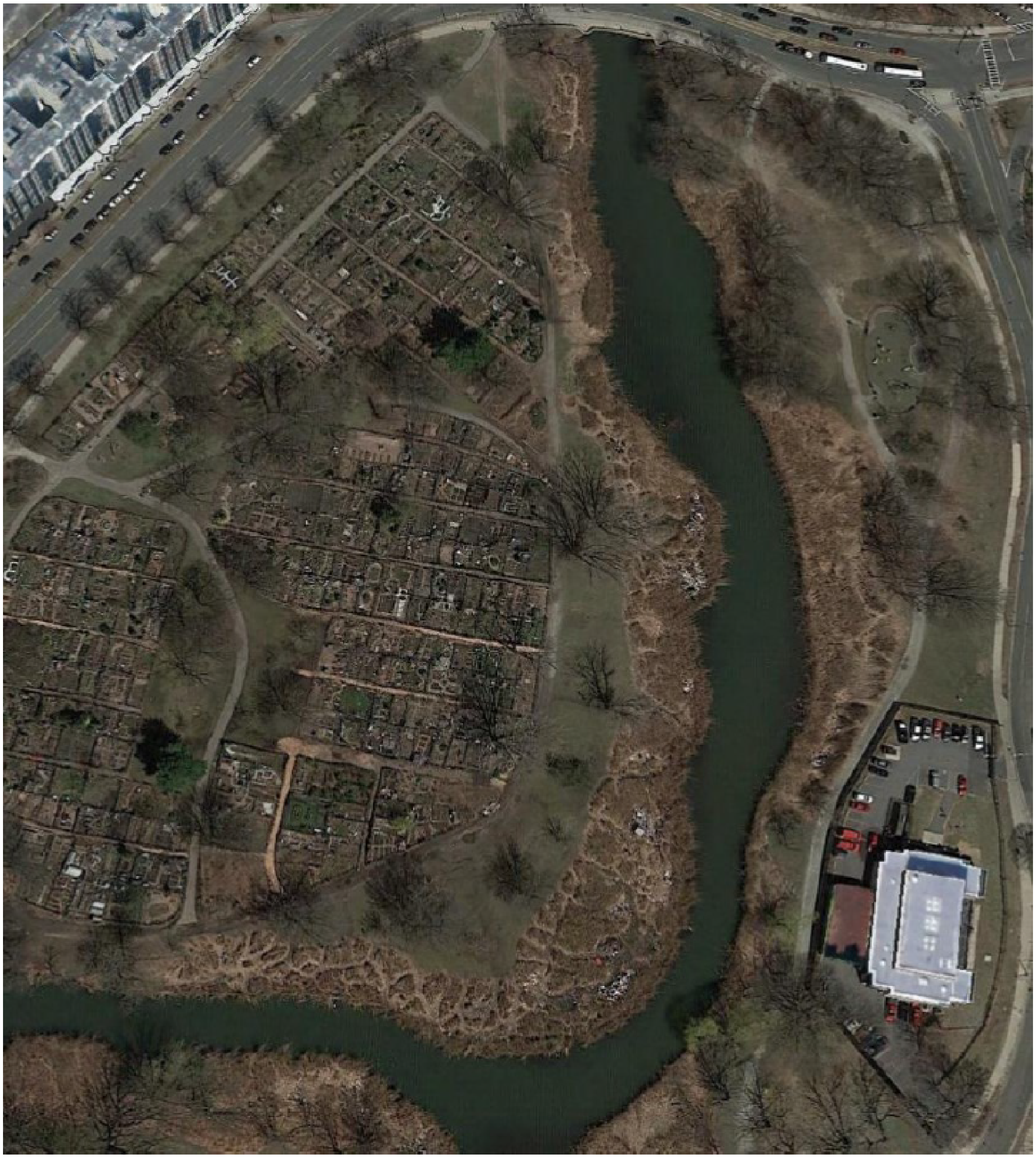
Phragmites occupies about 6 acres in the Back Bay Fens. As along other areas of the Muddy River, Phragmites stands in the Fens are extremely robust (maximum shoot height is 6-7 meters). The monoculture represents a lost opportunity to provide a comparatively large scale diverse wetland resource area in the heart of the city. Habitat values are limited by a lack of species diversity and absence of native plants. In addition, the stands have eliminated scenic vistas envisioned by Olmsted and strongly detract from the aesthetics of the area. Phragmites also poses a threat to the environment and to public safety as a result of illicit activity and illegal dumping. Trash and debris accumulate rapidly in these resource areas. Google Earth imagery from April 2018 shows an extensive network of trails and several homeless encampments within the Phragmites. The encampments were recently addressed in conjunction with two Emergency Orders issued by the Boston Conservation Commission. The first effort removed seven dumpster loads of waste from this rare urban wetland. The second, a few months later removed five dumpster loads form the same resource area. The Phragmites stands are also prone to occasional fires, several of which have been quite severe.

6.0 Wetlands Impacts/Benefits

Plant community diversity is expected to be much higher in restored wetlands than in existing Muddy River Phragmites stands which are effectively monospecific. Monitoring of areas restored during Phase 1 construction indicates that the fringe wetland on the bank supports a diverse native wetland plant community (USACE 2017b, 2018). A similar diverse wetland community is expected to develop in wetlands restored along the Phase 2 project area. By mowing and over

seeding the adjacent areas of invasives this project will further support he ecological restoration goals of the completed and proposed work by USACE.

Figure 2 Phragmites



This project will avoid impacting a 7,500 square foot cattail wetland located in the Back Bay Fens upstream of Agassiz Road. This wetland is the only sizable emergent wetland in the Riverway or Back Bay Fens not dominated by Phragmites.

Volunteer cattail, jewelweed, smartweed, Bidens, and other species will likely colonize the shoreline and/or shallow water shelves in areas where invasives have been removed. Water willow and sweet gale are expected to drape over and into the water providing habitat for young fish and aquatic invertebrates.

Restored wetlands in the Riverway and Back Bay Fens will support a diverse pollinator community (bees, wasps, butterflies, and hummingbirds) not currently supported by Phragmites. Many of species that will be planted or are expected to colonize restored wetlands have high value for pollinators. These include but are not limited to water willow, boneset, jewelweed, beggar-ticks, Joe pye weed, bugleweed, blue vervain, and pickerelweed.

7.0 Eligibility Criteria for Inland Ecological Restoration Limited Project

7.1 General Eligibility

The landscape restoration pilot program is proposed as an Ecological Restoration Limited Project as defined in 310 CMR 10.04, and therefore is eligible in the Other Category as an Invasive Species Management Project. The Project will further the following WPA interests:

- Protection of wildlife habitat – By removing the invasives as described herein and topdressing with loam/over-seeding with wetlands seed mix, the project will thin/plant invasive, non-native vegetation to improve/restore a more diverse wetlands habitat in the buffer zone, bank and BVW areas. This will support/enhance the work done by USACE in the Phase 1 and Phase 2 projects.

- Flood control/storm damage prevention/protection of fisheries – By managing the invasives in LUW (i.e. floating mat) as described herein increased flow will be allowed to pass through the river, preventing future flooding and storm damage. In addition, the restoration of LUW will improve the area as a fishery resource.

7.2 Estimated Habitat Map of State-Listed Rare Wetlands

The Project is not located within estimated habitat areas per Natural Heritage Endangered Species Program (NHESP) 2018 mapping.

7.3 Time of Year Restrictions Recommended by the Division of Marine Fisheries

The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has recommended that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. The Project will comply with the recommendations from DMF.

7.4 Water Quality Certification

The Pilot Project does not involve dredging over 100 cubic yards, therefore, Water Quality Certification is not required.

7.5 Ecological Benefits

In addition to providing significant ecological benefits the Rehabilitation Pilot furthers the WPA interests of flood control and storm damage prevention, as described in Section 4 of this Narrative.

7.5.1 Streamflow

The Project will eradicate phragmites in the Back Bay Fens and Riverway areas where necessary to achieve and maintain flood damage reduction. In some places, phragmites are completely or nearly completely blocking the channel. The implementation of the Project will, over time serve to alleviate these flow restrictions and improve efforts to restore anadromous fish runs.

7.5.2 Water Quality

Additionally, organic loading from emergent vegetation (phragmites) is currently contributing to the degraded water quality of the Muddy River. The Project will over time, serve to restore former open water habitat by removing phragmites present in the floating mat.

7.5.3 Riparian and Emergent Wetland Vegetation

Much of the intended diversity in the Muddy River has been lost over the years due to the introduction of non-native exotics such as Oriental knotweed, purple loosestrife, Phragmites, Norway maple, and glossy buckthorn. The removal of vegetation such as phragmites will improve the habitat value of the resource area. The plant community diversity is expected to be much higher in restored wetlands.

7.5.4 Wildlife

Numerous birds, mammals, amphibians, and reptiles are known to occur in the Rehabilitation Pilot area. Ecological restoration will provide improved conditions for bird species, ducks, Canada goose, turtles, and fish.

7.6 Additional Eligibility Criteria for Specific Inland Ecological Restoration Limited Project Types

This project meets the eligibility criteria for Ecological Restoration Limited Project in accordance with 310 CMR 10.53 through the restoration and improvement of the natural capacity of the Resource Area. In addition, as described above the landscape rehabilitation efforts proposed herein, furthers the WPA interests for Other Ecological Restoration Projects including:

- Thinning or planting of vegetation to improve habitat value;
- Flow restoration (over time); and

- Invasive species management.

8.0 Required Actions

8.1 Massachusetts Environmental Policy Act (MEPA)/Environmental Monitor

The City of Boston submitted written notification for the Notice of Intent for Ecological Restoration of a Limited Project to the MEPA Environmental Monitor and was published on October 10, 2018. A copy of the written notification is included in Appendix C.

The City of Boston and the Town of Brookline previously submitted a Supplemental Final Environmental Impact Report in February of 2005 to MEPA for the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project and received a Certificate on April 1, 2005. A Notice of Project Change was submitted in 2008 to allow for the project to be completed in two phases. A certificate was also received for the 2008 NPC. A Notice of Project Change is being submitted to MEPA in November 2018 for the Phase 2 Project.

8.2 Massachusetts Endangered Species Act (MESA)/Wetlands Protection Act Review

The Rehabilitation Pilot Area is not mapped as priority habitat of rare species or estimated habitat of rare wetlands wildlife (MA NHESP, 2018). No Federally-listed threatened or endangered species occur in the Project Area.

8.3 Estimated Habitat Map of State-Listed Rare Wetlands Wildlife

The Rehabilitation Pilot Area is not mapped as an Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by Natural Heritage and Endangered Species Program (NHESP, 2018).

8.4 Division of Marine Fisheries

The proposed project does not occur within a coastal waterbody.

8.5 Division of Fisheries and Wildlife

. No flow restrictions in the Muddy River are proposed as part of this Rehabilitation Pilot.

The Commonwealth of Massachusetts Division of Marine Fisheries has recommended to USACE that the Muddy River remain free flowing during Phase 2 construction between April 1st to June 15th and between September 15th and November 1st, of any year. This restriction was recommended so that blueback herring can complete their spring upstream adult spawning migration and fall downstream out-migration of juveniles.

8.6 MassDEP Water Quality Certification

A Water Quality Certificate is not required for this Project.

8.7 MassDEP Wetlands Restriction Order

The Project area is not subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act.

8.8 Department of Conservation and Recreation

8.8.1 Office of Dam Safety

The Project area does not include work on a dam.

8.8.2 Areas of Critical Environmental Concern (ACECs)

The Project area is not in an ACEC.

AP

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

31 March 2003

RECEIVED

APR 2 2003

MEPA

Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
Attention: MEPA Office
Arthur Pugsley, EOEA No. 11865
251 Causeway St., Suite 900
Boston, Massachusetts 02114

Project Name:	Phase I Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project (Muddy River project)
Proponent:	Boston Parks and Recreation Department and Brookline Department of Public Works
Location:	Muddy River, Boston, Brookline
Document Reviewed:	Final Environmental Impact Report
NHESP File Number:	99-4172

Dear Secretary Roy Herzfelder,

The Natural Heritage & Endangered Species Program (NHESP) of the MA Division of Fisheries & Wildlife has reviewed the Final Environmental Impact Report for the Muddy River project and would like to offer the following comments regarding impacts to state-protected rare species. The FEIR clearly describes the steps involved in protection of the endangered Three-spine Stickleback (*Gasterosteus aculeatus*). We support the proposed changes to protect the two separate populations of this species. It is our opinion that the project will not aversely affect habitat for the Three-spine Stickleback.

We recommend one change to the "Survey and Capture Protocols." To avoid killing sticklebacks, the water temperature in the transfer buckets must be equalized with water in the temporary holding pond prior to releasing the captured fish. 3.1

We appreciate the opportunity to comment on this project.

Sincerely,

Patricia Huckery
NHESP Endangered Species Project Analyst

www.masswildlife.org

Division of Fisheries and Wildlife
Field Headquarters, One Rabbit Hill Road, Westborough, MA 01581 (508) 792-7270 Fax (508) 792-7275
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane mainland zone (FIPSZONE 2001). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital form by Massachusetts Geographic Information System (MassGIS). Ortho imagery was produced at a scale of 1:5,000. Aerial photography is dated April 2005.

This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data*) may reflect stream channel distances that differ from what is shown on this map.

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Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 - - - 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000m N	1000-meter Universal Transverse Mercator grid, zone 19
6000000 M	5000-foot grid : Massachusetts State Plane coordinate system, mainland zone (FIPSZONE 2001), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 25, 2009
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0076G

FIRM

FLOOD INSURANCE RATE MAP

SUFFOLK COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 76 OF 151

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOSTON, CITY OF	250286	0076	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 25025C0076G

EFFECTIVE DATE SEPTEMBER 25, 2009

Federal Emergency Management Agency

NOTES TO USERS

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To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

The AE Zone category has been divided by a **Limit of Moderate Wave Action (LiMWA)**. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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Base map information shown on this FIRM is derived from Massachusetts Geographic Information System (MassGIS) digital ortho-photography produced at 45 centimeter (2005) and 30 centimeter (2008) resolution. Aerial photography is dated Spring 2005 and Spring 2008.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data Tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Only coastal structures that are certified to provide protection from the 1-percent-annual chance flood are shown on this panel. However, all structures taken into consideration for the purpose of coastal flood hazard analysis and mapping are present in the DFIRM database in S_Gen_Struct.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
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ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

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OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

Limit of Moderate Wave Action

Limit of Moderate Wave Action coincident with Zone Break

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4989000 M	1000-meter grid: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator tick values, zone 19N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 25, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

March 16, 2016 - to change Base Flood Elevations and Special Flood Hazard Areas, to change zone designations, to update the effects of wave action, to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision and to modify Coastal Barrier Resource System units.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

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N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0077J

FIRM

FLOOD INSURANCE RATE MAP

SUFFOLK COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 77 OF 176
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOSTON, CITY OF	250286	0077	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25025C0077J

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

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Silver Spring, MD 20910- 3282

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LEGEND

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The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)——(A)	Cross section line
(23)- - - - - - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid , zone 19
6000000 M	5000-foot grid : Massachusetts State Plane coordinate system, mainland zone (FIPSZONE 2001), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 25, 2009
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0078G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SUFFOLK COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 78 OF 151

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOSTON, CITY OF	250286	0078	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 25025C0078G

EFFECTIVE DATE SEPTEMBER 25, 2009

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

The AE Zone category has been divided by a **Limit of Moderate Wave Action (LiMWA)**. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM is derived from Massachusetts Geographic Information System (MassGIS) digital ortho-photography produced at 45 centimeter (2005) and 30 centimeter (2008) resolution. Aerial photography is dated Spring 2005 and Spring 2008.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data Tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Only coastal structures that are certified to provide protection from the 1-percent-annual chance flood are shown on this panel. However, all structures taken into consideration for the purpose of coastal flood hazard analysis and mapping are present in the DFIRM database in S_Gen_Struct.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

Limit of Moderate Wave Action

Limit of Moderate Wave Action coincident with Zone Break

~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)——(A) Cross section line

(23) - - - - (23) Transect line

Culvert

Bridge

45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

4989000 M 1000-meter grid: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection

$^{49}89^{000m}$ N 1000-meter Universal Transverse Mercator tick values, zone 19N

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 25, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

March 16, 2016 - to change Base Flood Elevations and Special Flood Hazard Areas, to change zone designations, to update the effects of wave action, to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision and to modify Coastal Barrier Resource System units.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0079J

FIRM

FLOOD INSURANCE RATE MAP

SUFFOLK COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 79 OF 176

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOSTON, CITY OF	250286	0079	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 25025C0079J

MAP REVISED MARCH 16, 2016

Federal Emergency Management Agency
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