



## **EcoTec, Inc.**

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ENVIRONMENTAL CONSULTING SERVICES  
102 Grove Street  
Worcester, MA 01605-2629  
508-752-9666 / Fax: 508-752-9494

### **NOTICE OF INTENT**

**Culverts Nos. 110 & 149 Old Sudbury Road  
Sudbury, MA**

**March, 2021**

#### TABLE OF CONTENTS

1. eDEP WPA Form 3 (Notice of Intent)
2. Abutters Lists & Locus Maps (for both culvert sites)
3. Technical Memorandum by Woodard & Curran, Inc. (including project description, alternatives analysis, wetland report, USGS & other map figures)
4. Project Plans





Massachusetts Department of Environmental Protection

# eDEP Transaction Copy

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Here is the file you requested for your records.

To retain a copy of this file you must save and/or print.

Username: **ECOTEC**

Transaction ID: **1261988**

Document: **WPA Form 3 - NOI**

Size of File: **248.02K**

Status of Transaction: **In Process**

Date and Time Created: **3/4/2021:8:22:49 AM**

**Note:** This file only includes forms that were part of your transaction as of the date and time indicated above. If you need a more current copy of your transaction, return to eDEP and select to "Download a Copy" from the Current Submittals page.

**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 #:  
eDEP Transaction #:1261988  
City/Town:SUDBURY

**A.General Information**

1. Project Location:

a. Street Address	OLD SUDBURY ROAD		
b. City/Town	SUDBURY	c. Zip Code	01776
d. Latitude	42.37936N	e. Longitude	71.40669W
f. Map/Plat #	N/A	g.Parcel/Lot #	N/A

2. Applicant:

Individual  Organization

a. First Name	DANIEL	b.Last Name	NASON		
c. Organization	TOWN OF SUDBURY DEPT. OF PUBLIC WORKS				
d. Mailing Address	275 OLD LANCASTER ROAD				
e. City/Town	SUDBURY	f. State	MA	g. Zip Code	01776
h. Phone Number	978-443-2209	i. Fax		j. Email	nasond@sudbury.ma.us

3.Property Owner:

more than one owner

a. First Name	DANIEL	b. Last Name	NASON		
c. Organization	TOWN OF SUDBURY DEPT. OF PUBLIC WORKS				
d. Mailing Address	102 GROVE STREET				
e. City/Town	WORCESTER	f.State	MA	g. Zip Code	01605
h. Phone Number	508-752-9666	i. Fax		j.Email	aallen@ecotecinc.com

4.Representative:

a. First Name	ARTHUR	b. Last Name	ALLEN		
c. Organization	ECOTEC, INC.				
d. Mailing Address	102 GROVE STREET				
e. City/Town	WORCESTER	f. State		g. Zip Code	01605
h.Phone Number	508-752-9666	i.Fax		j.Email	aallen@ecotecinc.com

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

a.Total Fee Paid	0.00	b.State Fee Paid	0.00	c.City/Town Fee Paid	0.00
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6.General Project Description:

REPLACEMENT OF TWO CULVERTS CONNECTING WETLANDS UNDER OLD SUDBURY ROAD.

7a.Project Type:

- |   |  |
|---|--|
| 1. <input type="checkbox"/> Single Family Home                | 2. <input type="checkbox"/> Residential Subdivision                  |
| 3. <input type="checkbox"/> Limited Project Driveway Crossing | 4. <input type="checkbox"/> Commercial/Industrial                    |
| 5. <input type="checkbox"/> Dock/Pier                         | 6. <input type="checkbox"/> Utilities                                |
| 7. <input type="checkbox"/> Coastal Engineering Structure     | 8. <input type="checkbox"/> Agriculture (eg., cranberries, forestry) |
| 9. <input checked="" type="checkbox"/> Transportation         | 10. <input type="checkbox"/> Other                                   |

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

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1.  Yes  No If yes, describe which limited project applies to this project:  
 2. Limited Project

8. Property recorded at the Registry of Deeds for:

<b>a. County:</b>	<b>b. Certificate:</b>	<b>c. Book:</b>	<b>d. Page:</b>
SOUTHERN MIDDLESEX		N/A	N/A

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

1. Buffer Zone & Resource Area Impacts (temporary & permanent):

This is a Buffer Zone only project - 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)

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. <input checked="" type="checkbox"/> Bank	95 1. linear feet	95 2. linear feet
b. <input type="checkbox"/> Bordering Vegetated Wetland	1. square feet	2. square feet
c. <input type="checkbox"/> Land under Waterbodies and Waterways	1. Square feet	2. square feet
	3. cubic yards dredged	
d. <input checked="" type="checkbox"/> Bordering Land Subject to Flooding	1805 1. square feet 0 3. cubic feet of flood storage lost	1168 2. square feet 0 4. cubic feet replaced
e. <input type="checkbox"/> Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. <input type="checkbox"/> Riverfront Area	1. Name of Waterway (if any)	
2. Width of Riverfront Area (check one)	<input type="checkbox"/> 25 ft. - Designated Densely Developed Areas only <input type="checkbox"/> 100 ft. - New agricultural projects only <input type="checkbox"/> 200 ft. - All other projects	
3. Total area of Riverfront Area on the site of the proposed project	square feet	
4. Proposed Alteration of the Riverfront Area:		
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?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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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)**

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. <input type="checkbox"/> Designated Port Areas	Indicate size under	Land under the ocean below,
b. <input type="checkbox"/> Land Under the Ocean	1. square feet	
	2. cubic yards dredged	
c. <input type="checkbox"/> Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes, below	
d. <input type="checkbox"/> Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. <input type="checkbox"/> Coastal Dunes	1. square feet	2. cubic yards dune nourishment
f. <input type="checkbox"/> Coastal Banks	1. linear feet	
g. <input type="checkbox"/> Rocky Intertidal Shores	1. square feet	
h. <input type="checkbox"/> Salt Marshes	1. square feet	2. sq ft restoration, rehab, crea.
i. <input type="checkbox"/> Land Under Salt Ponds	1. square feet	
	2. cubic yards dredged	
j. <input type="checkbox"/> Land Containing Shellfish	1. square feet	
k. <input type="checkbox"/> 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. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	1. square feet	

**4.Restoration/Enhancement**

Restoration/Replacement

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 entered the additional amount here.

a. square feet of BVW b. square feet of Salt Marsh

**5.Projects Involves Stream Crossings**

Project Involves Streams Crossings

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

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a. number of new stream crossings

b. number of replacement stream crossings

**C. Other Applicable Standards and Requirements**

**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 of Endangered Species program (NHESP)?

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:11/3/2020

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18)...

c. Submit Supplemental Information for Endangered Species Review \* (Check boxes as they apply)

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

3.  Project plans for entire project site, including wetland resource areas and areas outside of wetland 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

c.  MESA filing fee (fee information available at: <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/mesa-fee-schedule.html> )

Make check payable to "Natural Heritage & Endangered Species Fund" 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

d. 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/laws-regulations/cmr/321-cmr-1000-massachusetts-endangered-species-act.html#10.14>; 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 Number

b. Date submitted to NHESP

3.  Separate MESA review completed.

□ **Massachusetts Department of Environmental Protection**

Bureau of Resource Protection - Wetlands

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Provided by MassDEP:

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eDEP Transaction #:1261988

City/Town:SUDBURY

Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

\* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review...

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

a.  Not applicable - project is in inland resource area only

b.  Yes  No

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

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

North Shore - Hull to New Hampshire:

Division of Marine Fisheries -  
Southeast Marine Fisheries Station  
Attn: Environmental Reviewer  
836 S. Rodney French Blvd  
New Bedford, MA 02744

Division of Marine Fisheries -  
North Shore Office  
Attn: Environmental Reviewer  
30 Emerson Avenue  
Gloucester, MA 01930

If yes, it 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.

3. 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 DEP Website for ACEC locations). **Note:** electronic filers click on Website.

b. ACEC Name

4. 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

5. 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

6. 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, Explain why the project is exempt:

1.  Single Family Home

2.  Emergency Road Repair



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- 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**

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 by regular mail delivery.

- 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.
- 3. Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s).)
- 4. List the titles and dates for all plans and other materials submitted with this NOI.

**a. Plan Title:                      b. Plan Prepared By:      c. Plan Signed/Stamped By:      c. Revised Final Date:      e. Scale:**

ENGINEER'S TECH

MEMO WITH PLANS      WOODARD &  
& WETLAND              CURRAN

2/18/2021

DOCUMENTS

- 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.

□ **Massachusetts Department of Environmental Protection**  
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Provided by MassDEP:  
MassDEP File #:  
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City/Town:SUDBURY

**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. Payer name on check: First Name	7. Payer name on check: Last Name

**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
_____	_____
3. Signature of Property Owner(if different)	4. Date
Arthur Allen	3/4/2021
_____	_____
5. Signature of Representative (if any)	6. Date

**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 Section C, Items 1-3, 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.

**Massachusetts Department of Environmental Protection**  
 Bureau of Resource Protection - Wetlands  
**WPA Form 3 - Notice of Wetland Fee Transmittal**  
**Form**  
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:  
 MassDEP File #:  
 eDEP Transaction #:1261988  
 City/Town:SUDBURY

**A. Applicant Information**

1. Applicant:

a. First Name	DANIEL	b. Last Name	NASON		
c. Organization	TOWN OF SUDBURY DEPT. OF PUBLIC WORKS				
d. Mailing Address	275 OLD LANCASTER ROAD				
e. City/Town	SUDBURY	f. State	MA	g. Zip Code	01776
h. Phone Number	9784432209	i. Fax		j. Email	nasond@sudbury.ma.us

2. Property Owner:(if different)

a. First Name	DANIEL	b. Last Name	NASON		
c. Organization	TOWN OF SUDBURY DEPT. OF PUBLIC WORKS				
d. Mailing Address	102 GROVE STREET				
e. City/Town	WORCESTER	f. State	MA	g. Zip Code	01605
h. Phone Number	5087529666	i. Fax		j. Email	aallen@ecotecinc.com

3. Project Location:

a. Street Address	OLD SUDBURY ROAD	b. City/Town	SUDBURY
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Are you exempted from Fee?  (YOU HAVE SELECTED 'YES')

**Note:** Fee will be exempted if you are one of the following:

- City/Town/County/District
- Municipal Housing Authority
- Indian Tribe Housing Authority
- MBTA

State agencies are only exempt if the fee is less than \$100

**B. Fees**

Activity Type	Activity Number	Activity Fee	RF Multiplier	Sub Total
	City/Town share of filing fee	\$0.00	State share of filing fee	\$0.00
			Total Project Fee	\$0.00



<b>abutters_id_field</b>	<b>abutters_owner1</b>
H09-0054	RYAN MATTHEW E & BERNICE M
H09-0057	HAWLEY SHERVIN B & CAROLYN S
H09-0062	TOWN OF SUDBURY
H09-0105	BOSE SAMRAT &
H09-0106	LOUIE STEVE & CINDY
H09-0107	CORIN ALAN F & MCCOON PATRICIA E
H09-0109	PULLEN THOMAS W &
H10-0005	CHISHOLM BENJAMIN & SUSAN
H10-0006	CERVANTES JOEL & MARIA
H10-0007	COUGHLIN TIMOTHY & DONNA
H10-0008	GIFFORD ELIZABETH A & COLIN G
H10-0009	CLARK THOMAS PAUL &
H10-0019	MANDEL RICHARD P & CANDACE
H10-0020	TOWN OF SUDBURY
H10-0021	QUIRK THOMAS J & NANCY H
H10-0023	FRANCIS JAMES E & JEVON
H10-0100	SUMITO AGUSTINA TRS
H10-0108	SUDBURY WATER DIST
H10-0111	MIAO JUN & LI ZHENGJIAN
H10-0112	JOHNSON WILLIAM & SANDRA
H10-0301	TOWN OF SUDBURY
H10-0400	TOWN OF SUDBURY
H10-0900	SUMITO AGUSTINA TRS

<b>abutters_owner2</b>	<b>abutters_address</b>	<b>abutters_address2</b>
	241 OLD SUDBURY RD	
	250 OLD SUDBURY RD	
TOWN / SCHOOL BUILDINGS	278 OLD SUDBURY ROAD	
GILVIN AMANDA KAY	46 BREWSTER RD	
	54 BREWSTER RD	
	64 BREWSTER RD	
BRECKENRIDGE SALLY W	63 BREWSTER RD	
	213 OLD SUDBURY RD	
	197 OLD SUDBURY RD	
	209 OLD SUDBURY RD	
	187 OLD SUDBURY RD	
RUSSELL PAMELA	173 OLD SUDBURY RD	
	218 OLD SUDBURY RD	
NOYES SCHOOL LAND	40 FAIRBANK ROAD	
	45 CANDY HILL LN	
	230 OLD SUDBURY RD	
LEEYA REALTY TRUST	75 DOUBLET HILL RD	
	199 RAYMOND ROAD	
	67 BREWSTER RD	
	103 PURITAN LANE	
CONSERVATION	278 OLD SUDBURY RD	
	278 OLD SUDBURY RD	
JAB REALTY TRUST	75 DOUBLET HILL RD	

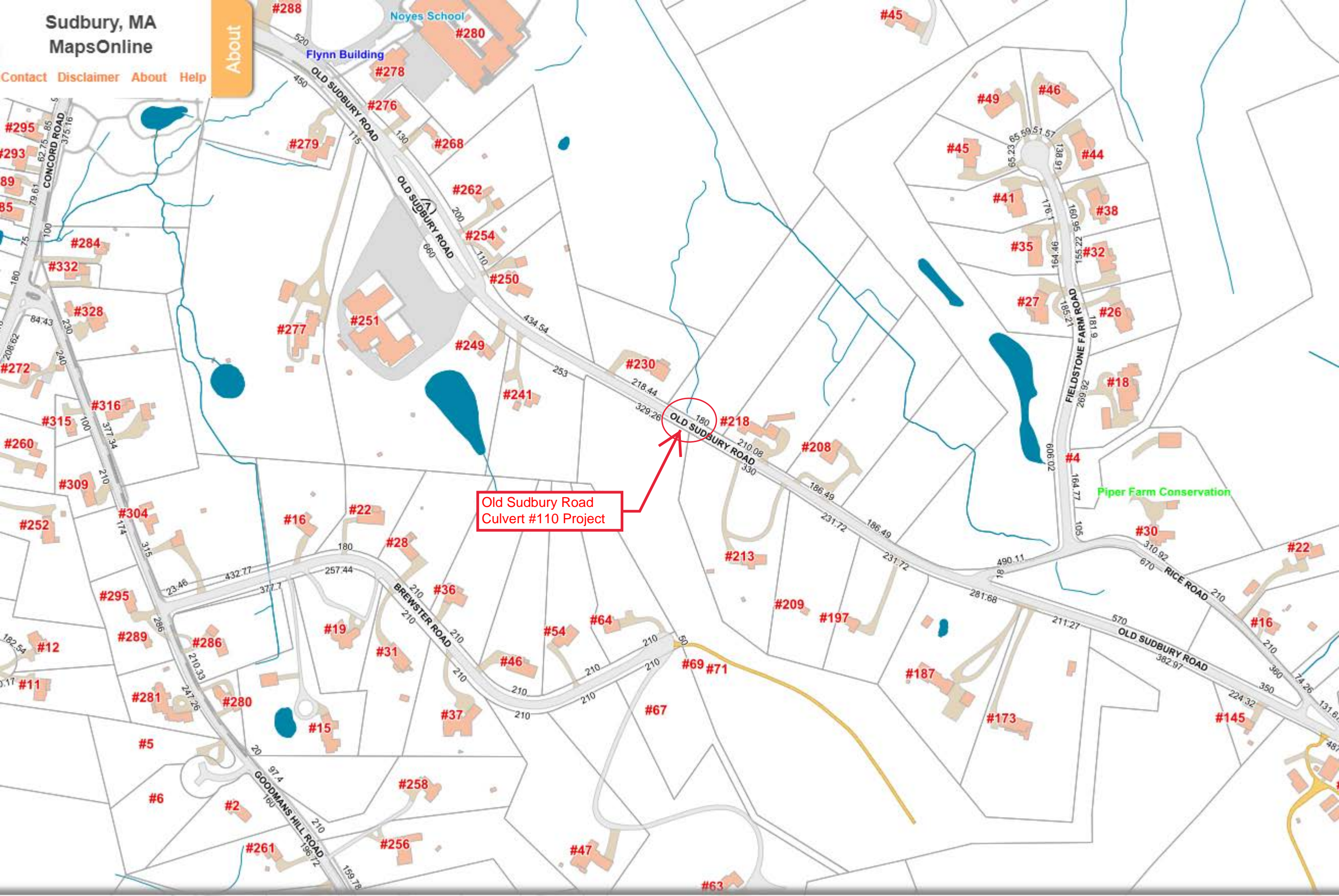
<b>abutters_town</b>	<b>abutters_state</b>	<b>abutters_zip</b>	<b>abutters_bookpage</b>
SUDBURY	MA	01776	26629-118
SUDBURY	MA	01776	70360-315
SUDBURY	MA	01776	7428-247
SUDBURY	MA	01776	76459-4
SUDBURY	MA	01776	67739-129
SUDBURY	MA	01776	29231-400
SUDBURY	MA	01776	48652-216
SUDBURY	MA	01776	68208-531
SUDBURY	MA	01776	71984-395
SUDBURY	MA	01776	69809-173
SUDBURY	MA	01776	23205-368
SUDBURY	MA	01776	73164-215
SUDBURY	MA	01776	13096-105
SUDBURY	MA	01776	11595-496
SUDBURY	MA	01776	30966-308
SUDBURY	MA	01776	49535-17
WESTON	MA	02493	47283-413
SUDBURY	MA	01776	203722
SUDBURY	MA	01776	62579-442
SUDBURY	MA	01776	178779
SUDBURY	MA	01776	31975-451
SUDBURY	MA	01776	29986-357
WESTON	MA	02493	47283-413

**abutters\_location**

241 OLD SUDBURY RD
250 OLD SUDBURY RD
322 CONCORD RD
46 BREWSTER RD
54 BREWSTER RD
64 BREWSTER RD
63 BREWSTER RD
213 OLD SUDBURY RD
197 OLD SUDBURY RD
209 OLD SUDBURY RD
187 OLD SUDBURY RD
173 OLD SUDBURY RD
218 OLD SUDBURY RD
OLD SUDBURY RD
45 CANDY HILL LN
230 OLD SUDBURY RD
69 BREWSTER RD
BREWSTER RD
67 BREWSTER RD
PURITAN LN
RICE RD
RICE RD
71 BREWSTER RD



About



<b>abutters_id_field</b>	<b>abutters_owner1</b>
H10-0300	TOWN OF SUDBURY
H11-0015	TOWN OF SUDBURY
H11-0100	SUDBURY VALLEY TRUSTEES INC
H11-0101	UNITED STATES OF AMERICA
H11-0102	SUDBURY VALLEY TRUSTEES INC
H11-0300	COMMONWEALTH OF MASSACHUSETTS
H11-0305	TOWN OF SUDBURY
H11-0307	WACHOVIA BANK NATIONAL ASSOCAT
H11-0400	IBRAHIM HAUWA
H12-0100	COMMONWEALTH OF MASSACHUSETTS
H11-0105	SUDBURY VALLEY TRUSTEES INC
H11-0401	TOWN OF SUDBURY

**Town of Wayland  
Planning Department  
41 Cochituate Road  
Wayland, MA 01778**

**abutters\_owner2**

CONSERVATION  
CONSERVATION

US FISH & WILDLIFE, REALTY OFF

DEP OF ENV MGMT& DIV OF FISHER

DEP OF ENV MGMT&DIV OF FISHERI

CONSERVATION

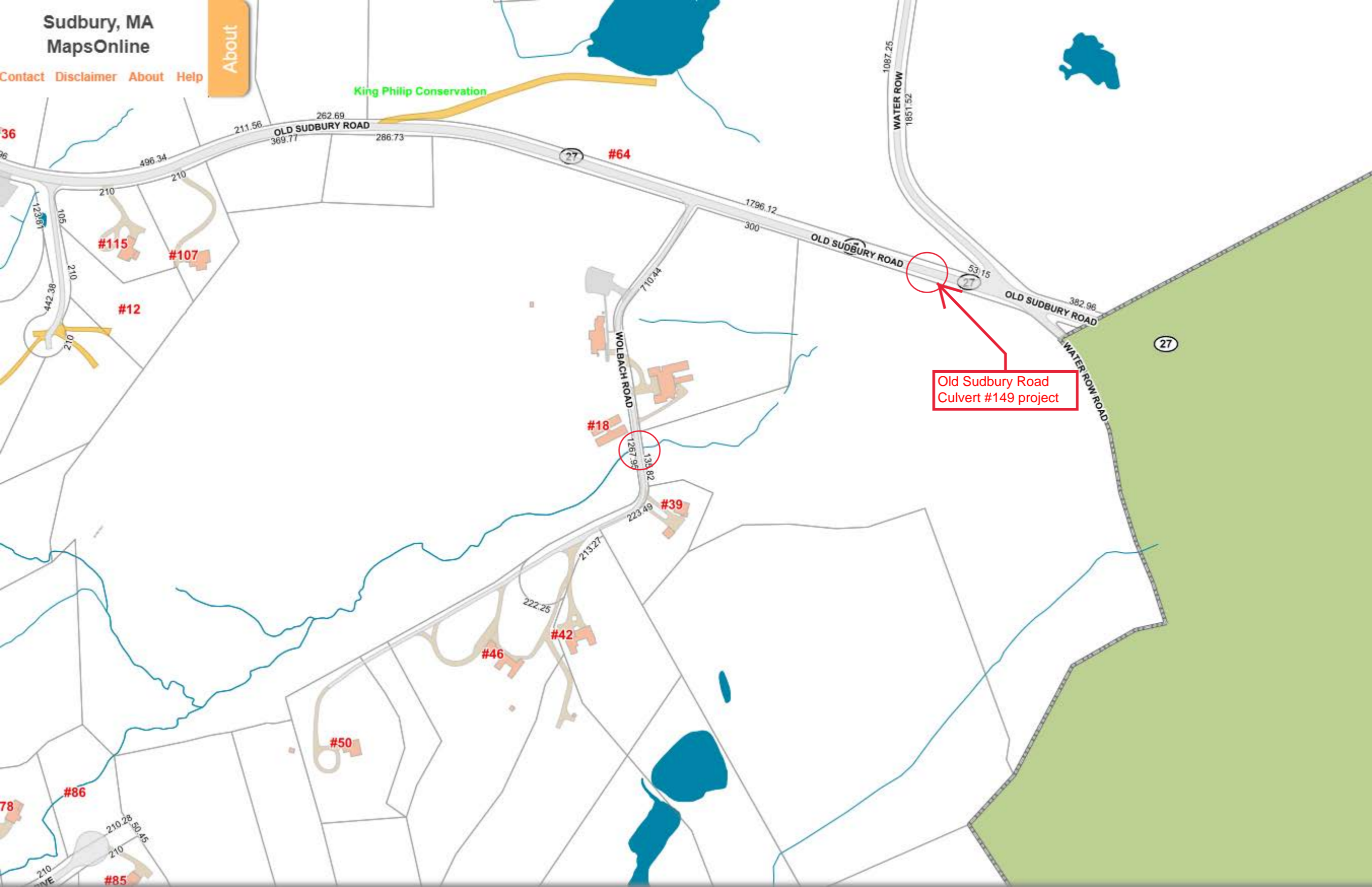
**abutters\_address**

278 OLD SUDBURY RD  
278 OLD SUDBURY ROAD  
18 WOLBACH RD  
300 WESTGATE CTR DR  
18 WOLBACH RD  
100 CAMBRIDGE ST 9TH FLOOR  
278 OLD SUDBURY RD  
P.O. BOX 13519  
77 WATER ROW  
100 CAMBRIDGE ST 9th floor  
18 WOLBACH RD  
278 OLD SUDBURY RD

<b>abutters_address2</b>	<b>abutters_town</b>	<b>abutters_state</b>	<b>abutters_zip</b>
	SUDBURY	MA	01776
	SUDBURY	MA	01776
	SUDBURY	MA	01776
	HADLEY	MA	01035
	SUDBURY	MA	01776
	BOSTON	MA	02114
	SUDBURY	MA	01776
	ARLINGTON	TX	13519
	SUDBURY	MA	01776
	BOSTON	MA	02114
	SUDBURY	MA	01776
	SUDBURY	MA	01776

<b>abutters_bookpage</b>	<b>abutters_location</b>
31975-451	RICE RD
12961-275	WATER ROW
00P2515	18 WOLBACH RD
193536	WOLBACH RD
00P2515	WOLBACH RD
18737-217	WATER ROW
39630-344	WATER ROW
52060-325 & 329	OLD SUDBURY RD
1545-11	77 WATER ROW
18737-217	WATER ROW
00P2515	LOT 5 OLD SUDBURY RD
1310-144	0 WATER ROW

King Philip Conservation



Old Sudbury Road  
Culvert #149 project

# TECHNICAL MEMORANDUM

TO: Arthur Allen, EcoTec, Inc.  
PREPARED BY: Daniel Pasquale & Kevin Trainor, Woodard & Curran  
REVIEWED BY: Scott Salvucci, Woodard & Curran  
DATE: February 18, 2021  
RE: Old Sudbury Road Culvert Replacement (#110 & #149) – Hydraulic Analysis

---

## 1. INTRODUCTION

Woodard & Curran has performed a hydraulic analysis of culverts crossing Old Sudbury Road (MA Route 27) in Sudbury, MA. The culverts are identified as Culvert #110 and Culvert #149 and are located approximately 0.4 miles and 200 feet northwest of the intersection of Old Sudbury Road and Water Row. Based on the results of culvert and bridge inspections documented in the “Crossing (Culvert & Bridge) Management Program,” prepared by Tighe & Bond and updated April 30, 2019, these culverts have been identified for replacement. The purpose of this memorandum is to summarize Woodard & Curran’s hydraulic evaluation of these culverts and support development of a Notice of Intent to file an application with the Conservation Commission for authorization to replace both culverts. Please refer to Figures 1 through 3 for Site Location Map and Project Area figures for each culvert location.

## 2. EXISTING CONDITIONS EVALUATION

Culvert #110 is an approximately six to eight-inch diameter corrugated metal equalization culvert built into the existing stacked stone wall that runs along Old Sudbury Road in the vicinity. The culvert does not convey a mapped stream; it allows roadway runoff and runoff from a small, wooded catchment to cross Old Sudbury Road, flowing from south to north generally toward Pantry Brook. This crossing was identified as a high priority for replacement due to complete pipe section loss and the potential for roadway materials to erode.

Culvert #149 is an approximately 3-foot diameter corrugated metal pipe equalization culvert with stacked stone headwalls at the inlet and outlet of the culvert. Culvert #149 does not convey a mapped stream; it allows exchange of surface water between wetlands on either side of Old Sudbury Road, generally flowing southwest to northeast toward the Sudbury River. This crossing was identified as a high priority for replacement due to severe pipe section loss and deteriorating headwalls.

### 2.1 Survey

An existing conditions survey of both culverts was performed by Chappell Engineering Associates in November 2020. Culvert #110 is 42.6 feet long, flowing south to north beneath Old Sudbury Road with maximum cover of approximately 4.3 feet. The inlet end of the culvert is located on land owned by the Augustina Sumito Trust, and the outlet end of the culvert is located on land owned by the Town of Sudbury.

Culvert #149 is 55.4 feet long with maximum cover of approximately 5.8 feet. The inlet end of the culvert is located on land owned by the United States of America, and the outlet end of the culvert is located on land owned by the Commonwealth of Massachusetts. The outlet pipe end is located on private property. Survey of both culverts is included as Attachment A.



## **2.2 Wetland Resource Evaluation**

### **2.2.1 Culvert #110**

A wetland resource evaluation was performed by EcoTec, Inc. on November 5, 2020 to evaluate the presence of resource areas within the project area. The crossing was identified as an “equalization culvert,” with no streams in the project vicinity, based upon review of the current USGS map of the area; therefore, regulations pertaining to the Riverfront Area are not applicable to this site. Wetland flags were delineated for the boundary of bordering vegetated wetlands (BVW) associated with the wetland complexes located to the south and to the north of Old Sudbury Road, labeled A1-A9 and B1–B6, respectively. A 100-foot buffer zone extends horizontally from the A series and B series flags; the entire project area will be within the 100-foot buffer zone. Wetland Resource Evaluations for both culverts are included in Attachment B.

### **2.2.2 Culvert #149**

A wetland resource evaluation was performed by EcoTec, Inc. on November 5, 2020 to evaluate the presence of resource areas within the project area. The crossing was identified as an “equalization culvert,” with no streams in the project vicinity, based upon review of the current USGS map of the area; therefore, regulations pertaining to the Riverfront Area are not applicable to this site. Wetland flags were delineated for the boundary of bordering vegetated wetlands (BVW) associated with the wetland complexes located to the south and to the north of Old Sudbury Road, labeled A1-A8 and B1–B9, respectively. A 100-foot buffer zone extends horizontally from the A series and B series flags; the entire project area will be within the 100-foot buffer zone. In addition, the project site is within the AE flood zone; therefore, the project area is also within Bordering Land Subject to Flooding. Wetland Resource Evaluations for both culverts are included in Attachment B.

## **2.3 Channel Conditions**

### **2.3.1 Culvert #110**

The crossing at Culvert #110 is an equalization culvert connecting two wetlands on either side of Old Sudbury Road and is not considered a stream. The channel on both sides of Old Sudbury Road is not well defined and consists generally of wetland vegetation.

### **2.3.2 Culvert #149**

The crossing at Culvert #149 is an equalization culvert connecting two wetlands on either side of Old Sudbury Road and is not considered a stream. The channel south of Old Sudbury Road is not well defined and consists generally of wetland vegetation. The channel north of Old Sudbury Road is controlled by the nearby crossing on Water Row. There is some evidence of scour on the outlet end of the culvert resulting from elevated discharge velocities.

## **2.4 Geotechnical Exploration**

### **2.4.1 Culvert #110**

GZA GeoEnvironmental, Inc. completed subsurface exploration and compiled a geotechnical memorandum dated January 7, 2021 presenting the subsurface findings. Boring B-3 was drilled on December 11, 2020 at Culvert #110. Subsurface conditions at the site consist of very dense sand fill overlying a thin layer of peat, over very dense sand. GZA recommends excavating the existing peat layer in the wet to prevent destabilization of adjacent soils. The geotechnical exploration report for both culverts is included as Attachment C.





## **2.4.2 Culvert #149**

GZA GeoEnvironmental, Inc. completed subsurface exploration and compiled a geotechnical memorandum dated January 7, 2021 presenting the subsurface findings. Borings B-1 and B-2 were drilled on November 17, 2020 at Culvert #149. Subsurface conditions at the site consist of medium dense sand fill overlying peat, and medium dense silty fine sand, with no gravel. Soils generally became denser with depth. The groundwater level was found to be generally consistent with the surface water elevation in the vicinity of the crossing.

Geotechnical recommendations include overexcavating three feet of existing peat and installing the replacement culvert over approximately 3 feet of 1-1/4" crushed stone. Installation should occur in the wet, as traditional dewatering may destabilize the surrounding soils. Footings for abutments and headwalls are recommended to extend to four feet below finished grade to provide frost protection. The geotechnical exploration report for both culverts is included as Attachment C.

## **2.5 FEMA FIRM Review**

### **2.5.1 Culvert #110**

Based on our review of Flood Insurance Rate Maps for the Town of Sudbury, Culvert #110 is not located in a mapped flood zone.

### **2.5.2 Culvert #149**

Culvert #149 is located within an AE Zone with a base flood elevation (BFE) of 121 feet NAVD88. Culvert #149 is located on panel 25017C0369F, effective July 7, 2014. Flooding in this area is dominated by the Sudbury River. The Flood Insurance Study (FIS) for Middlesex County, MA, corrected April 4, 2017 was used to establish downstream boundary conditions for hydraulic analysis based on the Flood Profile on Panel 507P. The road elevation in the vicinity of Culvert #149 ranges between 120 and 121 feet NAVD88. The FIRM panel is included as Attachment D.

## **2.6 USGS Hydrology Review**

### **2.6.1 Culvert #110**

Culvert #110 does not convey a stream defined by the United States Geological Survey (USGS) StreamStats application for determining stream flow and basin characteristics. Approximately 500 feet to the northeast (of the Culvert #110 outlet, a stream channel is defined. This point was used to establish flows used for hydrologic and hydraulic analysis and design purposes. The StreamStats reports for both locations are attached as Appendix E.

### **2.6.2 Culvert #149**

Culvert #149 crosses a wetland which drains to the Sudbury River, connecting wetlands on either side of Old Sudbury Road. The contributing area is primarily forested with limited development. The channel is defined by StreamStats, and USGS regression equations were used to establish flows used for hydrologic and hydraulic analysis and design purposes. The StreamStats reports for both locations are attached as Attachment E.

## 2.7 Hydrologic & Hydraulic Analysis

### 2.7.1 Culvert #110



The Crossing (Culvert & Bridge) Management Program recommended performing a hydrologic analysis of Culvert #110 to determine whether the crossing should be replaced or abandoned. Woodard & Curran reviewed topography data in the area using a 1-meter DEM. Culvert #110 is located near the low point of an approximately 400-foot long sag along the southwesterly edge of Old Sudbury Road with approximately 30 acres of contributing area. Abandoning the crossing could result in trapping water up to 1.5 feet deep on the southwest side of the road and potentially overtopping Old Sudbury Road before reaching another crossing. Maintaining an equalization culvert in this location is recommended.

Woodard & Curran performed a hydraulic analysis of Culvert #110 using hydrology data obtained from USGS. Flows for 4% annual-chance, 2% annual-chance, and 1% annual-chance precipitation events were simulated for the existing culvert and two replacement alternatives. The culvert was simulated using the Environmental Protection Agency (EPA) Storm Water Management Model, version 5.1.015 (SWMM5) on the PCSWMM v7.3.3095 platform based on field survey data. The boundary conditions simulated are summarized in Table 2-1 below.

**Table 2-1: Culvert #110 Boundary Conditions**

Storm Event	Flow (cfs)	Outfall Condition
4% Annual-Chance; 24-hour	11.8	Normal flow depth
2% Annual-Chance; 24-hour	14.6	Normal flow depth
1% Annual-Chance; 24-hour	17.6	Normal flow depth

### 2.7.2 Culvert #149

Woodard & Curran performed a hydraulic analysis of Culvert #149 using hydrology data obtained from USGS. Flows for 10% annual-chance, 4% annual-chance, 2% annual-chance, and 1% annual-chance precipitation events were simulated for the existing culvert and two replacement alternatives. The culvert was simulated using the Hydraulic Engineering Center-River Analysis System (HEC-RAS) version 5.07. The reach geometry was developed using field survey supplemented with a 1-meter digital elevation model (DEM) obtained from the National Map database. Boundary conditions simulated are summarized in Table 2-2 below.

**Table 2-2: Culvert #149 Boundary Conditions**

Storm Event	Flow (cfs)	Tailwater (NAVD88)
4% Annual-Chance; 24-hour	39.6	120.00
2% Annual-Chance; 24-hour	48.6	120.5
1% Annual-Chance; 24-hour	58.3	121.00



### 3. DESIGN CONSIDERATIONS

The purpose of this project is to replace structurally deficient crossings, while improving hydraulic capacity and habitat conditions at the crossing where possible. The design considerations of the culvert replacement concentrated on maintaining or improving on existing flood conditions for the 25-year, 50-year, and 100-year storm events. Hydraulic performance, potential for downstream flooding; effect on habitat on either side of Old Sudbury Road; potential for erosion and overall effect on stream stability were taken into consideration. We evaluated the following alternatives for each culvert location.

#### Culvert #110

- In-kind replacement of 8-inch (presumed) culvert matching existing invert elevations
- Replacement with 18-inch HDPE culvert matching existing invert elevations
- Replacement with 36-inch HDPE culvert embedded 12 inches

#### Culvert #149

- In-kind replacement of 36-inch diameter culvert matching existing invert elevations
- Replacement with 48-inch diameter culvert matching existing invert elevations
- Replacement with 60-inch wide by 84-inch tall box culvert, embedded 24 inches

Design considerations also included utility and roadway elevation constraints. Culvert #110 has a maximum cover of approximately 4.3 feet, and underground gas and water utilities cross the culvert at unknown depths. Assuming typical cover for underground gas utilities of 30-36 inches, the gas likely crosses over the Culvert #110. Assuming the underground water utility is below frost depth (four feet or greater), the water utility may pass underneath Culvert #110. Utility depths should be confirmed by test pit prior to project bidding. Increasing the culvert size may require limited utility relocation.

Survey of Culvert #149 did not indicate the presence of other underground utilities in the vicinity of the crossing. The existing culvert has a maximum cover of approximately 5.8 feet.

#### 3.1 Hydraulic Analysis Results

The following tables summarize the results of hydraulic analysis. Only the 4%, 2%, and 1% annual-chance events are included, assuming the level of service for recommended replacements should equal or exceed what is considered the “25-year,” 24-hour design storm event. Detailed SWMM results for Culvert #110 and detailed HEC-RAS results for Culvert #149 are included in Attachment F.



**Table 3-1: Culvert #110 Hydraulic Summary of Options**

Alternative	Description	4% Annual-Chance Event WSE South of Old Sudbury Rd	2% Annual-Chance Event WSE South of Old Sudbury Rd	1% Annual-Chance Event WSE South of Old Sudbury Rd
<b>1: In-Kind Replacement</b>	8-inch HDPE @ 0.1% slope	<b>232.87</b>	<b>232.87</b>	<b>232.91</b>
<b>2: 18-inch HDPE</b>	18-inch HDPE @ 0.1% slope	230.87	231.57	<b>232.49</b>
<b>3: 30-inch Embedded HDPE</b>	30-inch HDPE embedded 12 inches @ 0.0% slope	229.44	229.68	229.96

Note: Roadway elevation is approximately 232.5. Scenarios highlighted in yellow and bold result in roadway overtopping.

**Table 3-2: Culvert #149 Hydraulic Summary of Options**

Alternative	Description	4% Annual-Chance Event WSE South of Old Sudbury Rd	2% Annual-Chance Event WSE South of Old Sudbury Rd	1% Annual-Chance Event WSE South of Old Sudbury Rd
<b>1: In-Kind Replacement</b>	36-inch HDPE @ 0.4% slope	<b>120.60</b>	<b>120.71</b>	<b>121.00</b>
<b>2: 48-inch HDPE</b>	48-inch HDPE @ 0.4% slope	120.37	<b>120.65</b>	<b>121.00</b>
<b>3: 60-inch by 84-inch Embedded Box Culvert</b>	60-inch wide by 84-inch tall box embedded 24 inches @ 0.4% slope	120.05	<b>120.57</b>	<b>121.01</b>

Note: Roadway elevation is approximately 120.5. Scenarios highlighted in yellow and bold result in roadway overtopping.

### 3.2 Results Discussion

The following sections address the results in the context of hydraulic performance, effect on habitat on either side of Old Sudbury Road, and potential for erosion. Neither crossing is considered a stream crossing, and

Massachusetts Stream Crossing Standards are not applicable. However, where appropriate, goals of the Stream Crossing Standards are considered.

### **3.2.1 Culvert #110**



#### **3.2.1.1 Alternative 1**

Alternative 1 will restore hydraulic performance associated with the existing crossing prior to deterioration during the 4%, 2%, and 1% annual-chance, 24-hour design storm event and will not change water levels on either side of Old Sudbury Road. Roadway overtopping remains a concern based on hydraulic analysis. Alternative 1 will also continue to separate habitat on either side of Old Sudbury Road. Material deposition south of Old Sudbury Road of the culvert and erosion north of Old Sudbury Road will likely continue. Erosion may be mitigated by construction of energy dissipation measures to prevent further scour.

#### **3.2.1.2 Alternative 2**

Alternative 2 is likely to reduce the water level south of Old Sudbury Road during the 4%, 2%, and 1% annual-chance, 24-hour design storm events and most lighter precipitation events, as well as during dry weather. Roadway overtopping is unlikely during the 4% and 2% annual-chance, 24-hour design storms, though minor overtopping may occur during the 1% annual-chance 24-hour design storm. Alternative 2 would not provide a habitat connection between the north and south sides of Old Sudbury Road; however, material deposition at the inlet end and erosion at the outlet end of the culvert will likely be mitigated by this option due to reduced ponding at the entrance and reduced velocity at the culvert exit.

#### **3.2.1.3 Alternative 3**

Alternative 3 is likely to reduce the water level south of Old Sudbury Road during the 4%, 2%, and 1% annual-chance, 24-hour design storm events and most lighter precipitation events, as well as during dry weather. Roadway overtopping is not expected during any of the scenarios simulated. Alternative 3 would provide an improved habitat connection between the two sides of Old Sudbury Road for small animals, and the embedment would provide additional natural substrate; however the length of the crossing and the height limitations due to shallow cover result in a low openness ratio, and the crossing may not ultimately be utilized by wildlife.

### **3.2.2 Culvert #149**

#### **3.2.2.1 Alternative 1**

Alternative 1 will restore hydraulic performance associated with the existing crossing prior to deterioration during the 4%, 2%, and 1% annual-chance, 24-hour design storm event and will not change water levels on either side of Old Sudbury Road. Roadway overtopping will remain a concern during all scenarios simulated. Alternative 1 will also continue to separate habitat on either side of the culvert.

#### **3.2.2.2 Alternative 2**

Alternative 2 is likely to reduce the water level south of Old Sudbury Road during the 4%, 2%, and 1% annual-chance, 24-hour design storm events and most lighter precipitation events, as well as during dry weather. Roadway overtopping is not anticipated during the 4% annual-chance, 24-hour design storm; however, overtopping is still expected for greater storm events. Alternative 2 would not provide a significant habitat connection between the inlet and outlet ends of the culvert; however, material deposition at the inlet end and erosion at the outlet end of the culvert will likely be mitigated by this option due to reduced ponding at the entrance and reduced velocity at the culvert exit.



### 3.2.2.3 Alternative 3

Alternative 3 is likely to reduce the water level south of Old Sudbury Road during the 4%, 2%, and 1% annual-chance, 24-hour design storm events and most lighter precipitation events, as well as during dry weather. Roadway overtopping is not anticipated during the 4% annual-chance, 24-hour design storm, and minor overtopping may occur during the 2% annual-chance, 24-hour design storm. Flooding during the 1% annual-chance design storm in this location is controlled by the Sudbury River, and is likely to occur in any scenario that does not elevate the roadway. Alternative 3 would provide an improved habitat connection between the inlet and outlet ends of the culvert for small animals, and the embedment would provide additional natural substrate; however the length of the crossing and the height limitations due to shallow cover result in a low openness ratio, and the crossing may not ultimately be utilized by wildlife.

## 4. RECOMMENDED REPLACEMENT ALTERNATIVE

Based upon the design considerations and hydraulic calculations, the recommended replacement for Culvert #110 is Alternative 2, 18-inch HDPE. The recommended replacement for Culvert #149 is Alternative 3. Please refer to Figures 4 and 5 for conceptual culvert sections.

## 5. CONCEPTUAL SEQUENCE OF CONSTRUCTION

Plans depicting erosion control measures, proposed grading, and other features for the project are currently under development. It is expected that the replacements will occur in two phases to allow one-way traffic in alternating directions during construction. The anticipated sequence of construction is as follows:

1. Install temporary erosion and sedimentation control measures, including cofferdam, flow diffuser, and/or flow diversion;
2. Protection of existing utilities, including water, natural gas, and telecommunications;
3. Remove and dispose of the existing culvert, headwalls, and emergency repair gabions and riprap up to approximately the roadway centerline, maintaining alternating one-way traffic with flaggers;
4. Install new culvert and headwall;
5. Reconstruct road to approximate centerline;
6. Repeat steps 3 through 5 for the remaining side of the roadway;
7. Stabilize side slopes;
8. Install erosion control matting, loam, and seed on all disturbed areas; and
9. Remove temporary erosion and sedimentation control measures and cofferdam.

## 6. ATTACHMENTS

### Figures

Figure 1 – Site Location Map, Culvert #110 & Culvert #149

Figure 2 – Project Area & Conceptual Hydraulic Model, Culvert #149

Figure 3 – Project Area & Conceptual Hydraulic Model, Culvert #110

Figure 4 – Replacement Culvert Concept, Culvert #149

Figure 5 – Replacement Culvert Concept, Culvert #110

Figure 6 – Resource Area Impact Figure, Culvert #149

Figure 7 – Resource Area Impact Figure, Culvert #110

### Attachments

Attachments A1 and A2 – Existing Conditions Surveys, Culvert #110 & Culvert #149

Attachments B1 and B2 – Wetland Resource Evaluation, Culvert #110 & Culvert #149

Attachment C – Geotechnical Evaluation, Culvert #110 & Culvert #149

Attachment D – FEMA FIRM Panel

Attachments E1 and E2 – StreamStats Reports, Culvert #110 & Culvert #149

Attachments F1 and F2 – Culvert Analysis Reports, Culvert #110 & Culvert #149

## 7. REFERENCES

USGS StreamStats Peak-Flow Statistics. Accessed electronically December 2020.

Environmental Protection Agency Storm Water Management Model User's Manual, Version 5.1. Revised September 2015.

Hydraulic Engineering Center – River Analysis System (HEC-RAS) Hydraulic Reference Manual, Version 5.0

*Extreme Precipitation in New York & New England*, Northeast Regional Climate Center, Extreme Precipitation Tables obtained December 2020

*Soil Survey Geographic (SSURGO) database for Middlesex County, Massachusetts*, Natural Resources Conservation Service Web Soil Survey, accessed online December 2020.

Concord River HUC 8 LiDAR FY 2010, Middlesex County, Massachusetts CID 25017C, Worcester County, Massachusetts CID 25027C. Federal Emergency Management Agency. DEM generated from LiDAR by MassGIS. Accessed electronically December, 2020.

FEMA FIRM Panel 25017C0369F, effective July 7, 2014

Massachusetts River and Stream Crossing Standards, River & Stream Continuity Partnership





## Figure 1: Site Location Maps



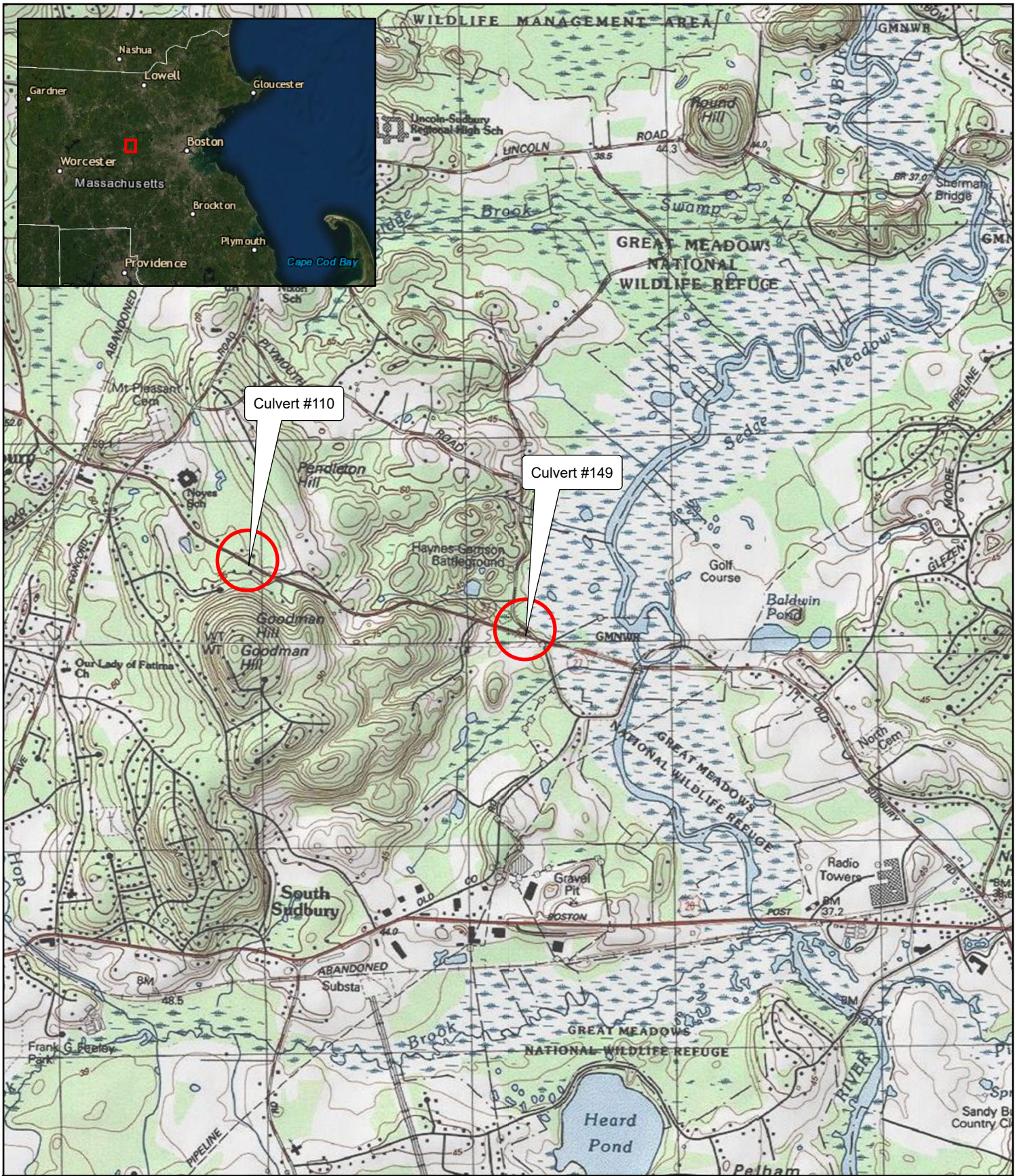
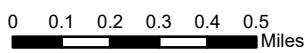


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## OLD SUDBURY ROAD CULVERT #110 & #149 REPLACEMENT

SUDBURY, MA  
**FIGURE 1 - SITE LOCATION MAP**



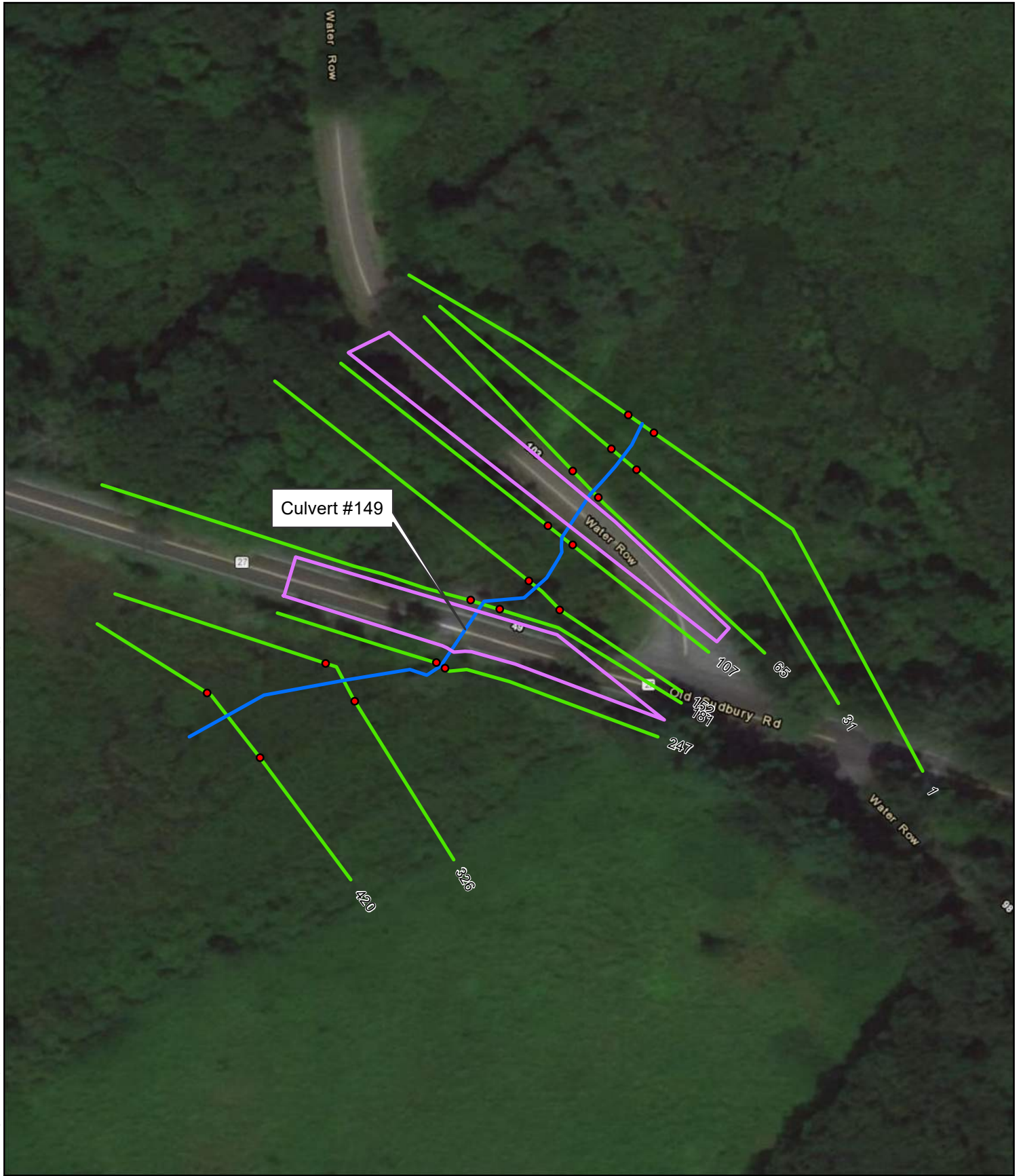
Project #: 0233335.00  
Map Created: January 2021

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:** ESRI, National Geographic



## Figures 2 & 3: Project Area & Conceptual Hydraulic Models

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**Legend**

- Stream Bank Locations
- Structure
- Stream
- Cross-Section (Stationing in ft.)

0 0.0045 0.009 0.0135 0.018 0.0225 Miles

## OLD SUDBURY ROAD CULVERT #149 REPLACEMENT

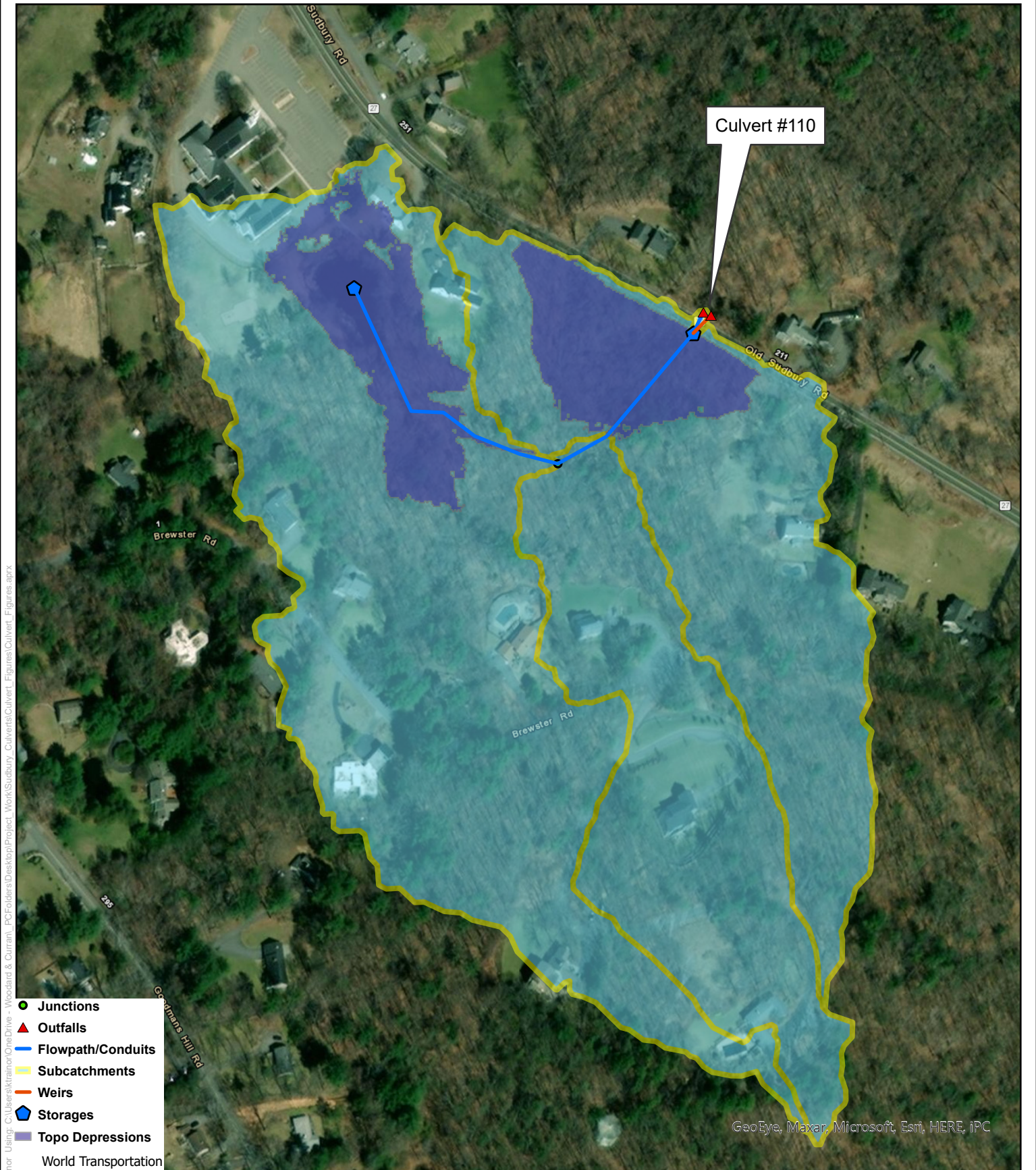
SUDBURY, MA

### FIGURE 2 - PROJECT AREA & CONCEPTUAL HYDRAULIC MODEL



Project #: 0233335.00  
Map Created: January 2021

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:** ESRI, National Geographic



Culvert #110

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- Junctions
- ▲ Outfalls
- Flowpath/Conduits
- Subcatchments
- Weirs
- ◊ Storages
- Topo Depressions
- World Transportation

GeoEye, Maxar, Microsoft, Esri, HERE, IPC

<p><b>Legend</b></p>	<h2 style="margin: 0;">OLD SUDBURY ROAD CULVERT #110 REPLACEMENT</h2> <p style="margin: 5px 0;">SUDBURY, MA</p> <h3 style="margin: 0;">FIGURE 3 - PROJECT AREA &amp; CONCEPTUAL HYDRAULIC MODEL</h3>		<p style="font-size: small; margin: 5px 0;">Project #: 0233335.00 Map Created: January 2021</p>
<p>0 50 100 150 200 250 Feet</p>	<p style="font-size: x-small;">Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. <b>Data Sources:</b> ESRI, National Geographic</p>		



## Figures 4 & 5: Replacement Culvert Concepts

# TOWN OF SUDBURY, MA PUBLIC WORKS DEPARTMENT OLD SUDBURY ROAD CULVERTS 110 AND 149 REPLACEMENT

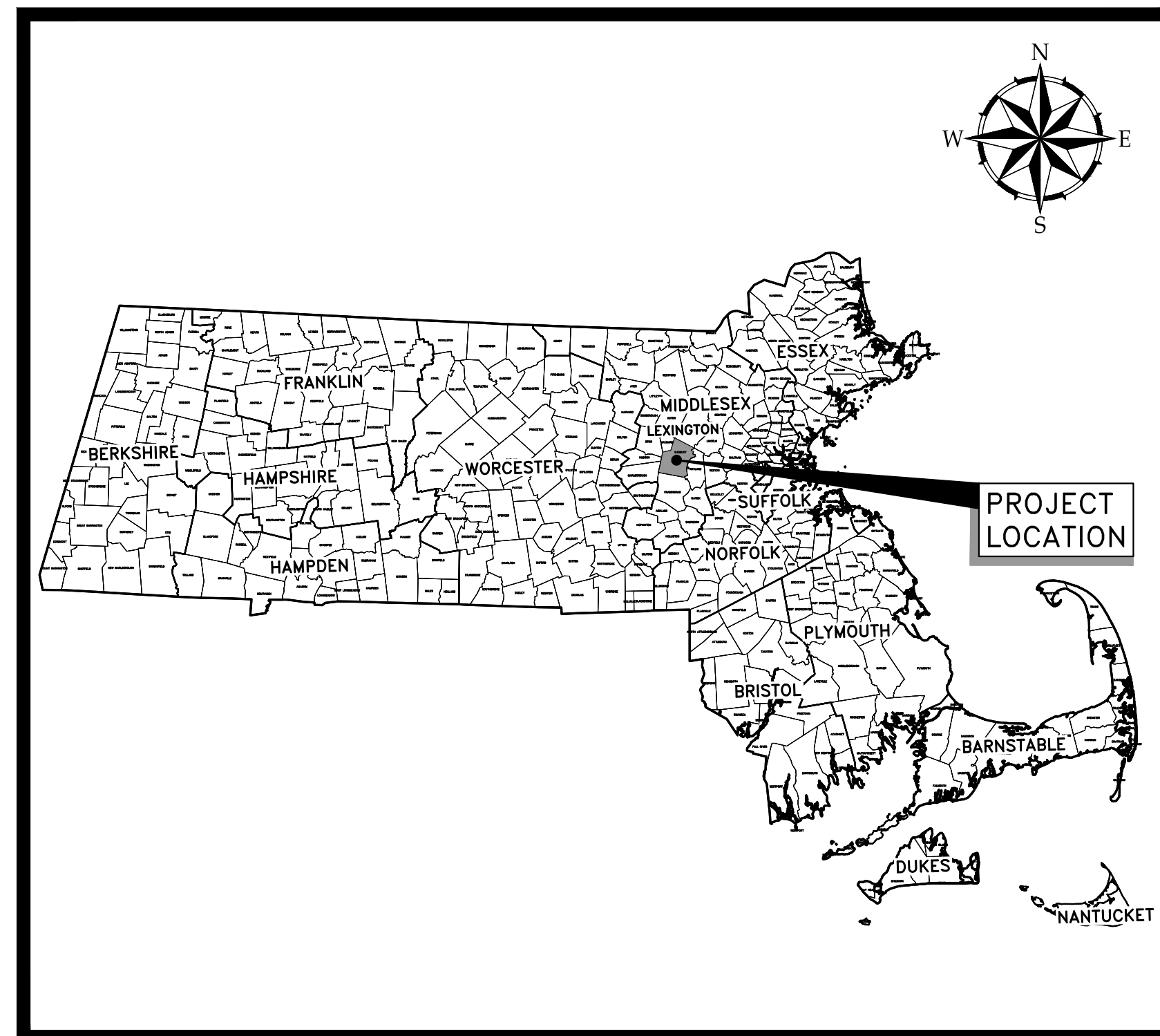
PROJECT NO.

0233335.01

FEBRUARY 2021

NOTICE OF INTENT

PERMITTING ONLY - NOT FOR CONSTRUCTION

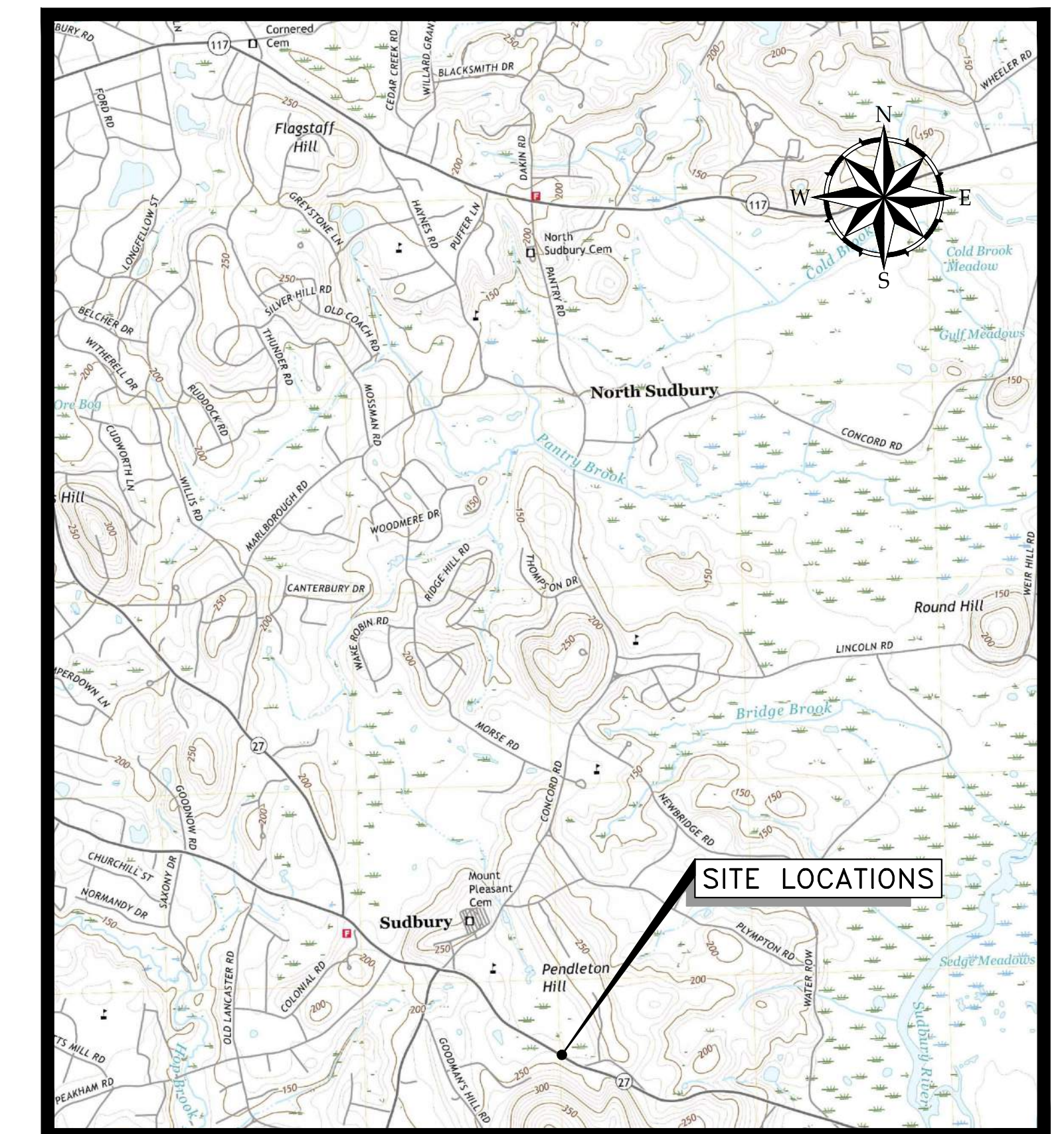


PROJECT LOCATION MAP



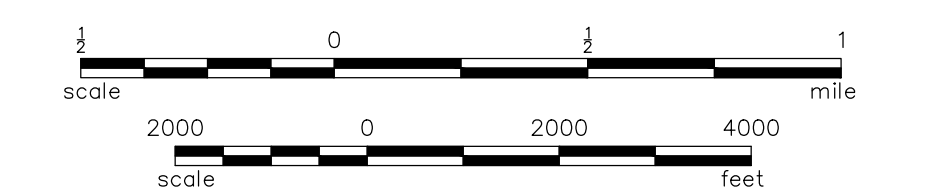
250 Royall Street Suite 200E  
Canton, Massachusetts 02021  
800.446.5518 | [www.woodardcurran.com](http://www.woodardcurran.com)

COMMITMENT & INTEGRITY DRIVE RESULTS



SOURCE: USGS MAP

SITE LOCATION MAP



GENERAL NOTES:

- 1. EXISTING CONDITIONS ARE BASED ON SURVEYS PERFORMED BY CHAPPELL ENGINEERING ASSOCIATES, DATED JANUARY 19, 2021.
2. CHAPPELL ENGINEERING ASSOCIATES IS LOCATED AT THE FOLLOWING ADDRESS: 201 BOSTON POST ROAD WEST, SUITE 101 MARLBOROUGH, MA 01752 (508) 481-7400 EXT. 18
3. CONTRACTOR SHALL INVESTIGATE EXISTING CONDITIONS AND FIELD VERIFY LOCATIONS, DEPTH, AND SIZE OF UTILITIES AND SUB-SURFACE STRUCTURES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY CONFLICTS OR DISCREPANCIES WITH THE EXISTING AND PROPOSED UTILITY LOCATIONS.
4. THE HORIZONTAL DATUM DEPICTED ON THE MAPS HEREON IS BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, MAINLAND ZONE, REFERENCED TO THE NORTH AMERICAN DATUM OF 1983. THE VERTICAL DATUM IS BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. ANY PROPERTY AND RIGHT OF WAY LOCATIONS THAT MAY BE SHOWN HEREON ARE APPROXIMATE AND DO NOT REPRESENT A PROPERTY BOUNDARY SURVEY.
6. WOODARD & CURRAN ASSUMES NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN.
7. COORDINATE CONSTRUCTION ACTIVITY WITH UTILITY COMPANIES, EMERGENCY SERVICES AND TOWN. CONTRACTOR SHALL NOTIFY ALL UTILITIES PRIOR TO COMMENCING WORK, ALLOWING SUFFICIENT TIME TO LOCATE AND MARK THE LOCATION OF BURIED UTILITIES. CONTRACTOR SHALL CONTACT "DIG SAFE", TELEPHONE 811, PRIOR TO EXCAVATION.
8. RESTORE ALL AREAS DISTURBED BY CONTRACTOR'S OPERATIONS TO ORIGINAL FINISH (GRAVEL, PAVEMENT, GRASS, ETC.) UNLESS NOTED OTHERWISE ON THE PLANS. RESTORATION OF PAVED SURFACES, GRAVEL SURFACES, DRIVEWAYS, AND LAWNS DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE PERFORMED AT NO ADDITIONAL COST TO OWNER. ANY CURB DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE REPLACED IN KIND AND SHALL CONFORM TO TOWN OF SUDBURY AND MASSACHUSETTS DOT SPECIFICATIONS AT NO ADDITIONAL COST TO OWNER.
9. PROPERLY PROTECT AND DO NOT DISTURB PROPERTY IRONS AND MONUMENTS. IF DISTURBED, THE PROPERTY MONUMENT SHALL BE RESET AT THE CONTRACTOR'S EXPENSE BY A LICENSED LAND SURVEYOR ACCEPTABLE TO THE TOWN.
10. EXISTING FACILITIES (I.E. TREES, POLES, LIGHT POSTS, CATCH BASINS, STONE FROM CULVERT, ETC.) SHALL BE REMOVED AND/OR PROTECTED DURING CONSTRUCTION. THE TOWN RETAINS RIGHT TO KEEP ANY AND ALL REMOVED FACILITIES. CONTRACTOR SHALL DISPOSE OF ANY REMOVED FACILITY AT THE REQUEST OF THE TOWN AT NO ADDITIONAL COST TO OWNER.
11. ALL TREES NOT NOTED TO BE REMOVED OR RELOCATED SHALL BE PROTECTED BY CONTRACTOR DURING CONSTRUCTION.
12. RESTRICT ACCESS TO SITE THROUGH THE USE OF APPROPRIATE SIGNAGE, BARRIERS, FENCES, ETC. SITE SHALL BE LEFT WITH APPROPRIATE SAFETY MEASURES IN PLACE DURING NON-WORKING HOURS. SITE SAFETY IS THE RESPONSIBILITY OF CONTRACTOR, DURING BOTH WORKING AND NON-WORKING HOURS.
13. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY CONSTRUCTION PERMITS INCLUDING "PERMIT TO CONSTRUCT WITHIN A PUBLIC WAY" FROM THE TOWN. PERMIT APPLICATIONS SHALL BE SUBMITTED WITH ADEQUATE TIME SO AS NOT TO DELAY CONSTRUCTION.
14. ALL WORK ASSOCIATED WITH THE PROJECT SHALL BE COMPLETED IN ACCORDANCE WITH THE TOWN OF SUDBURY BYLAW AND LOCAL REGULATIONS AND MASSACHUSETTS DOT STANDARD SPECIFICATIONS.
15. UPON COMPLETION OF CONSTRUCTION, A COMPLETE SET OF "RECORD" DRAWINGS SHALL BE SUBMITTED TO THE TOWN ENGINEER. THESE DRAWINGS SHALL BE SUBMITTED IN BOTH DIGITAL AND HARD COPY FORMAT AS DEFINED IN THE SPECIFICATIONS PRIOR TO PAYMENT OF FINAL RETAINAGE.
16. PROTECTION OF EXISTING UTILITIES DURING CONSTRUCTION SHALL BE PROVIDED AT NO ADDITIONAL COST.
17. CONTRACTOR SHALL BE RESPONSIBLE FOR SWEEPING OLD SUDBURY ROAD EVERY FRIDAY AND AS NECESSARY DURING THE DURATION OF THE WORK.
18. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL ATTEND A PRE-CONSTRUCTION MEETING HELD AT THE PROJECT SITE WITH THE CONTRACTOR, ENGINEER, OWNER, AND CONSERVATION OFFICE TO REVIEW THE CONSTRUCTION SCHEDULE AND SEQUENCING, ORDER OF CONDITIONS, STOCKPILE LOCATIONS AND CRITICAL ASPECTS OF THE PROJECT.
19. ALL DISTURBED UPLAND AREAS SHALL BE BROUGHT TO FINAL GRADE AND SHALL BE PERMANENTLY STABILIZED WITHIN 30 DAYS AFTER DISTURBANCE. BARE GROUND AND DISTURBED AREAS THAT CANNOT BE PERMANENTLY VEGETATED WITHIN 30 DAYS SHALL BE TEMPORARY STABILIZED BY AN APPROVED METHOD.
20. CONTRACTOR SHALL DEMARCAT CONSTRUCTION EQUIPMENT AND MATERIAL STORAGE AREAS PRIOR TO CONSTRUCTION.
21. THE CONSTRUCTION SITE SHALL BE MAINTAINED IN CLEAN CONDITIONS AT ALL TIMES AND CONSTRUCTION REFUSE AND DEBRIS SHALL BE DISPOSED OF PROMPTLY AND IN A LEGAL MANNER.
22. STORING, SERVICING, OR CLEANING OF TRUCKS OR EQUIPMENT SHALL BE PERFORMED IN AN UPLAND AREA AT A HORIZONTAL DISTANCE GREATER THAN 100 FEET FROM THE WETLAND RESOURCE AREAS.
23. CONTRACTOR SHALL REFER TO SPECIFICATION XXX MASSACHUSETTS COVID ORDER AND CONSTRUCTION GUIDELINES AND EXECUTE CONSTRUCTION IN COMPLIANCE WITH APPLICABLE SOCIAL DISTANCING PROTOCOLS.
24. GEOTECHNICAL INVESTIGATION WAS CONDUCTED BY GZA GEOENVIRONMENTAL ON NOVEMBER 17, 2020 AND DECEMBER 11, 2020 AND DOCUMENTED IN A REPORT DATED JANUARY 7, 2021.
25. WETLAND DELINEATION WAS PREPARED BY ECOTEC, INC. 102 GROVE STREET, WORCESTER, MA 01605. THE WETLAND RESOURCE EVALUATION REPORT IS DATED XX XX, 2021 AND WETLAND FIELD INSPECTION WAS CONDUCTED ON NOVEMBER 4, 2020.
26. DO NOT PARK, IMPEDE ACCESS TO, OR STORE EQUIPMENT BEYOND LIMIT OF WORK, UNLESS PERMISSION HAS BEEN GRANTED IN WRITING BY TOWN AND/OR LAND OWNER.
27. PRIOR TO THE START OF WORK, CONTRACTOR SHALL CONFIRM EXISTING WETLAND FLAGS ARE IN PLACE AND SHALL BE MAINTAINED DURING CONSTRUCTION. MISSING FLAGS SHALL BE RESET PRIOR TO CONSTRUCTION. AN AUTOCAD FILE OF THE WETLAND FLAG LOCATIONS SHALL BE PROVIDED FOR CONTRACTOR'S USE IN RESETTING WETLAND FLAGS.
28. NO EQUIPMENT IS TO CROSS OR ENTER WETLAND RESOURCE AREAS AT ANY TIME UNLESS THE LOCATION OF DISTURBANCE IS MARKED ON THE PLANS REFERENCED IN THE ORDER OF CONDITIONS AND FLAGGED IN THE FIELD (DEP FILE #XXX-XXXX).
29. THE CONTRACTOR, SITE ENGINEER, OR OTHER INDIVIDUAL IN CHARGE OF WORK ON THE SITE SHALL HAVE A COPY OF THE ORDER OF CONDITIONS AT ALL TIMES (DEP FILE #XXX-XXXX).

EROSION CONTROL NOTES:

- 1. EROSION CONTROL DEVICES SHALL REMAIN IN PLACE, UNTIL ALL DISTURBED SURFACES HAVE BEEN STABILIZED WITH FINAL VEGETATION COVER OR THE COMMISSION HAS AUTHORIZED THEIR REMOVAL.
2. EROSION CONTROL MEASURES AND BARRIERS SHALL BE MONITORED DAILY AND MAINTAINED, OR REINFORCED AS NECESSARY TO ENSURE AND PREVENT EROSION AND SILTATION OF SOILS TO WETLAND RESOURCE AREAS. ADDITIONAL FILTER FABRIC AND STRAW WATTLES SHALL BE STORED ON SITE FOR EMERGENCY USE.
3. DURING ALL PHASES OF CONSTRUCTION, ALL DISTURBED OR EXPOSED AREAS OUTSIDE THE ROADWAY SHALL BE BROUGHT TO FINISHED GRADE AND EITHER A) LOAMED AND SEEDED FOR PERMANENT STABILIZATION, IN ACCORDANCE WITH U.S. SOIL CONSERVATION SERVICE PROCEDURES, OR B) STABILIZED IN ANOTHER WAY APPROVED BY THE COMMISSION. AREAS THAT CANNOT BE PERMANENTLY STABILIZED WITHIN 30 DAYS OF DISTURBANCE SHALL BE STABILIZED WITH HAY, STRAW, MULCH OR ANY OTHER PROTECTIVE COVERING AND/OR METHOD APPROVED BY THE U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE OR BY OTHER TEMPORARY MEASURES ACCEPTABLE TO THE COMMISSION.
4. PROJECT IS SUBJECT TO THE CONDITIONS SET FORTH IN PERMITS ISSUED BY THE US ARMY CORPS OF ENGINEERS, SUDBURY CONSERVATION COMMISSION, AND MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, SPECIFICALLY RELATED TO LIMITS OF IMPACT, EROSION CONTROL MEASURES, RESTORATION ACTIVITIES, AND TIMEFRAME RESTRICTIONS. CONTRACTOR SHALL READ PERMIT DOCUMENTS FULLY AND CARRY OUT WORK IN ACCORDANCE WITH PERMIT DOCUMENTS. COPIES OF PERMIT DOCUMENTS ARE APPENDED TO THE PROJECT SPECIFICATIONS.
5. AN ADEQUATE STOCKPILE OF EROSION AND SEDIMENTATION CONTROL MATERIALS SHALL BE ON SITE AT ALL TIMES FOR EMERGENCY OR ROUTINE REPLACEMENT.
6. ANY DAMAGE CAUSED AS A DIRECT RESULT OF CONSTRUCTION TO THE WETLAND RESOURCE AREAS SHALL BE REPAIRED, RESTORED AND/OR REPLACED. SEDIMENTATION OR EROSION SHALL BE CONSIDERED DAMAGE TO THE WETLAND RESOURCE AREAS. IF SEDIMENTATION REACHES THESE AREAS, THE CONSERVATION COMMISSION SHALL BE CONTACTED AND A PLAN FOR THE PROPOSED RESTORATION SHALL BE SUBMITTED FOR APPROVAL.
7. THE SILT FENCE AND STRAW BALES MUST BE INSPECTED PRIOR TO THE START OF ANY WORK OR A \$100 PER DAY FINE WILL BE LEVED ON THE CONTRACTOR.

DEWATERING NOTES

- 1. LOCATE DISCHARGE SITE ON FLAT UPLAND AREAS AS FAR AWAY AS POSSIBLE FROM STREAMS, WETLANDS, OTHER RESOURCES AND POINTS OF CONCENTRATED FLOW.
2. NEVER DISCHARGE TO AREAS THAT ARE BARE OR NEWLY VEGETATED.
3. DIRT BAG MATERIAL BASED ON PARTICLE SIZE IN DIRTY WATER, I.E., FOR COARSE PARTICLES A WOVEN MATERIAL; FOR SILTS/CLAYS A NON-WOVEN MATERIAL.
4. DO NOT OVER PRESSURIZE DIRT BAG OR USE BEYOND CAPACITY.
5. CHANNELS DUG FOR DISCHARGING WATER FROM THE EXCAVATED AREA NEED TO BE STABLE. IF FLOW VELOCITIES CAUSE EROSION WITHIN THE CHANNEL THEN A DITCH LINING SHOULD BE USED.
6. BUCKETED WATER SHOULD BE DISCHARGED IN A STABLE MANNER TO THE SEDIMENT REMOVAL AREA. A SPLASH PAD OF RIPRAP UNDERLAIN WITH GEOTEXTILE MAY BE NECESSARY TO PREVENT SCOURING OF SOIL.
7. DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHOULD BE AVOIDED.
8. INSTALL DIVERSION DITCHES OR BERMS TO MINIMIZE THE AMOUNT OF CLEAN STORMWATER RUNOFF ALLOWED INTO THE EXCAVATED AREA.
9. DURING THE ACTIVE DEWATERING PROCESS, INSPECTION OF THE DEWATERING FACILITY SHOULD BE REVIEWED FREQUENTLY. SPECIAL ATTENTION SHOULD BE PAID TO THE BUFFER AREA FOR ANY SIGN OF EROSION AND CONCENTRATION OF FLOW THAT MAY COMPROMISE THE BUFFER AREA. OBSERVE WHERE POSSIBLE THE VISUAL QUALITY OF THE EFFLUENT AND DETERMINE IF ADDITIONAL TREATMENT CAN BE PROVIDED.
10. EROSION CONTROL REQUIRED AROUND DEWATERING DISCHARGE SEDIMENT CONTROL DEVICE.

ABBREVIATIONS

Table listing abbreviations and their meanings: & ABOVE GROUND, BIT BITUMINOUS, B/W BETWEEN, BVW BORDERING VEGETATED WETLAND, CB CATCH BASIN, CBDH CONCRETE BOUND DRILL HOLE, CI CAST IRON, CMP CORRUGATED METAL PIPE, CONC CONCRETE, D STORM DRAIN, DI DUCTILE IRON, DIA DIAMETER, DIP DUCTILE IRON PIPE, DMH DRAIN MANHOLE, DOT DEPARTMENT OF TRANSPORTATION, DTL DETAIL, E UNDERGROUND ELECTRICAL, EHH ELECTRIC HAND HOLE, EL ELEVATION, E.O.P. EDGE OF PAVEMENT, EXIST. EXISTING, FF FINISH FLOOR, FT FOOT/FEET, G GAS MAIN, GS GAS SERVICE, GALV GALVANIZED, GRAN GRANITE, HDPE HIGH DENSITY POLYETHYLENE, HDPP HIGH DENSITY POLYPROPYLENE, HYD HYDRANT, INV. INVERT, LF LINEAR FEET, MASSDEP MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, MADOT MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, MAX. MAXIMUM, MB MAILBOX, MIN. MINIMUM, MON MONUMENT, N.I.C. NOT IN CONTRACT, NO. NUMBER, NR NO REFUSAL, N.T.S. NOT TO SCALE, OE OVERHEAD ELECTRIC, OH OVERHEAD, +/- PLUS OR MINUS, LLS LICENSED LAND SURVEYOR, PROP. PROPOSED, PT. POINT, PVC POLYVINYL CHLORIDE, R.O.W. RIGHT-OF-WAY, RCP REINFORCED CONCRETE PIPE, REINF. REINFORCED, REQ'D REQUIRED, RPP RIBBED PLASTIC PIPE, S SLOPE (FT./FT.), S SEWER, SBDH STONE BOUND DRILL HOLE, SMH SEWER MANHOLE, SCH SCHEDULE, STA STATION, TOWN TOWN OF SUDBURY, TYP. TYPICAL, UNO UNLESS NOTED OTHERWISE, UP UTILITY POLE, VC VITRIFIED CLAY, VT. VITRIFIED CLAY, W WEST, W WATER, W/W WITH, W WATERMAIN, WS WATER SERVICE, WV WATER VALVE

SYMBOLS

Table listing symbols and their descriptions: UTILITY POLE, CATCH BASIN, WETLAND FLAG LOCATION, BENCHMARK, MANHOLE, TREE

SHEET INDEX table listing sheet numbers and titles: G-001 COVER SHEET, G-002 GENERAL NOTES, LEGEND AND ABBREVIATIONS, C-100 EXISTING CONDITIONS PLAN - CULVERT 110, C-101 EXISTING CONDITIONS PLAN - CULVERT 149, C-200 EROSION CONTROL AND DEMOLITION PLAN - CULVERT 110, C-201 EROSION CONTROL AND DEMOLITION PLAN - CULVERT 149, C-300 SITE PLAN AND PROFILE - CULVERT 110, C-301 SITE PLAN AND PROFILE - CULVERT 149, C-400 CIVIL DETAILS 1, C-401 CIVIL DETAILS 2

RESOURCE AREA LEGEND

Table showing resource area legends: BORDERING VEGETATED WETLAND (BVW), EDGE OF WATER/FLOW PATH, NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM (NHESP) PRIORITY HABITATS OF RARE SPECIES, COFFERDAM, LIMIT OF WORK, SEDIMENT BARRIER, TURBIDITY CURTAIN

- NOTE:
1. CULVERT 110 AND CULVERT 149 PROJECT AREAS ENTIRELY WITHIN BORDERING VEGETATED WETLAND (BVW) BUFFER.
2. CULVERT 149 PROJECT AREA ENTIRELY WITHIN BORDERING LAND SUBJECT TO FLOODING (100-YEAR FLOOD ZONE).

LINE TYPES & HATCHES

Table showing line types and hatches for various features: RIGHT OF WAY/PROPERTY LINE, CONTOUR (2' INTERVAL), CONTOUR (INDEX), BITUMINOUS CURB, EDGE OF PAVEMENT, STORM DRAIN LINE, UNDERGROUND GAS, WATER LINE, GUARDRAIL, LIMIT OF WORK, SEDIMENT BARRIER/COFFERDAM, SEDIMENT BARRIER/SILT/STOX/SILT FENCE, SAWCUT, RETAINING WALL, STONE WALL, RIPRAP, BITUMINOUS PAVEMENT, MILL AND OVERLAY, PAVEMENT TO BE REMOVED

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Table with columns for REV, DESCRIPTION, DATE, CHECKED BY, HIC/ISS, DESIGNED BY, MB/DLP, DRAWN BY, MB

GENERAL NOTES, LEGEND AND ABBREVIATIONS

TOWN OF SUDBURY, MA PUBLIC WORKS DEPARTMENT, OLD SUDBURY ROAD CULVERTS 110 AND 149 REPLACEMENT

Table with project details: JOB NO: 023335.01, DATE: FEBRUARY 2021, SCALE: N.T.S., SHEET: 2 OF 9

G-002

Vertical text on the left margin: W:\woodardcurran\wetland\Projects\023335\01\_sudbury\_ma\_015\_sudbury\_rd\_culvert\_replacement\dwg\023335.01\_G-002.dwg, Feb 18, 2021, 3:17pm MBRCWVW





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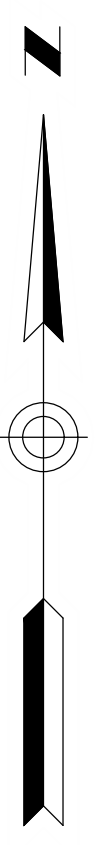
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0 WATER ROW  
N/F  
COMMONWEALTH OF MASSACHUSETTS  
BK. 18737 PG. 217  
MAP 12 LOT 100

0 WATER ROW  
N/F  
COMMONWEALTH OF MASSACHUSETTS  
BK. 18737 PG. 217  
MAP 11 LOT 300

BENCHMARK: MAGNAIL IN UTILITY POLE  
EL=121.85'

36" CONCRETE BOX CULVERT  
ELEV.=112.38'

36" CONCRETE BOX CULVERT  
ELEV.=112.10'

1949 COUNTY LAYOUT

**OLD SUBBURY ROAD**  
(PUBLIC - 50' WIDE)

1949 COUNTY LAYOUT

MARSH

11  
N: 2961993.703'  
E: 686051.634'  
EL: 120.793'  
MAGNAIL

12" CPP  
ELEV.=112.04'

2  
N: 2962040.481'  
E: 686224.644'  
EL: 116.366'  
SPIKE

CBLP

114  
EOP

36" STONE BOX CULVERT  
ELEV.=112.31'

MARSH

0 WOLBACH ROAD  
N/F  
UNITED STATES OF AMERICA  
BK. 1097 PG. 186  
MAP 11 LOT 101

BENCHMARK: MAGNAIL IN UTILITY POLE  
EL=121.87'

1949 COUNTY LAYOUT

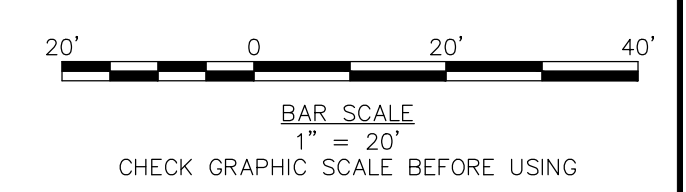
**OLD SUBBURY ROAD**  
(PUBLIC - 50' WIDE)

1949 COUNTY LAYOUT

**RESOURCE AREA LEGEND**

- BORDERING VEGETATED WETLAND (BWV) - - - - -
- EDGE OF WATER/FLOW PATH - - - - -
- NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM (NHESP) PRIORITY HABITATS OF RARE SPECIES - - - - -

- NOTE:**
1. CULVERT 149 PROJECT AREA ENTIRELY WITHIN BORDERING VEGETATED WETLAND (BWV) BUFFER.
  2. CULVERT 149 PROJECT AREA ENTIRELY WITHIN BORDERING LAND SUBJECT TO FLOODING (100-YEAR FLOOD ZONE).



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REV	DESCRIPTION	DATE	DESIGNED BY	CHECKED BY	DATE

**EXISTING CONDITIONS PLAN -  
CULVERT 149**

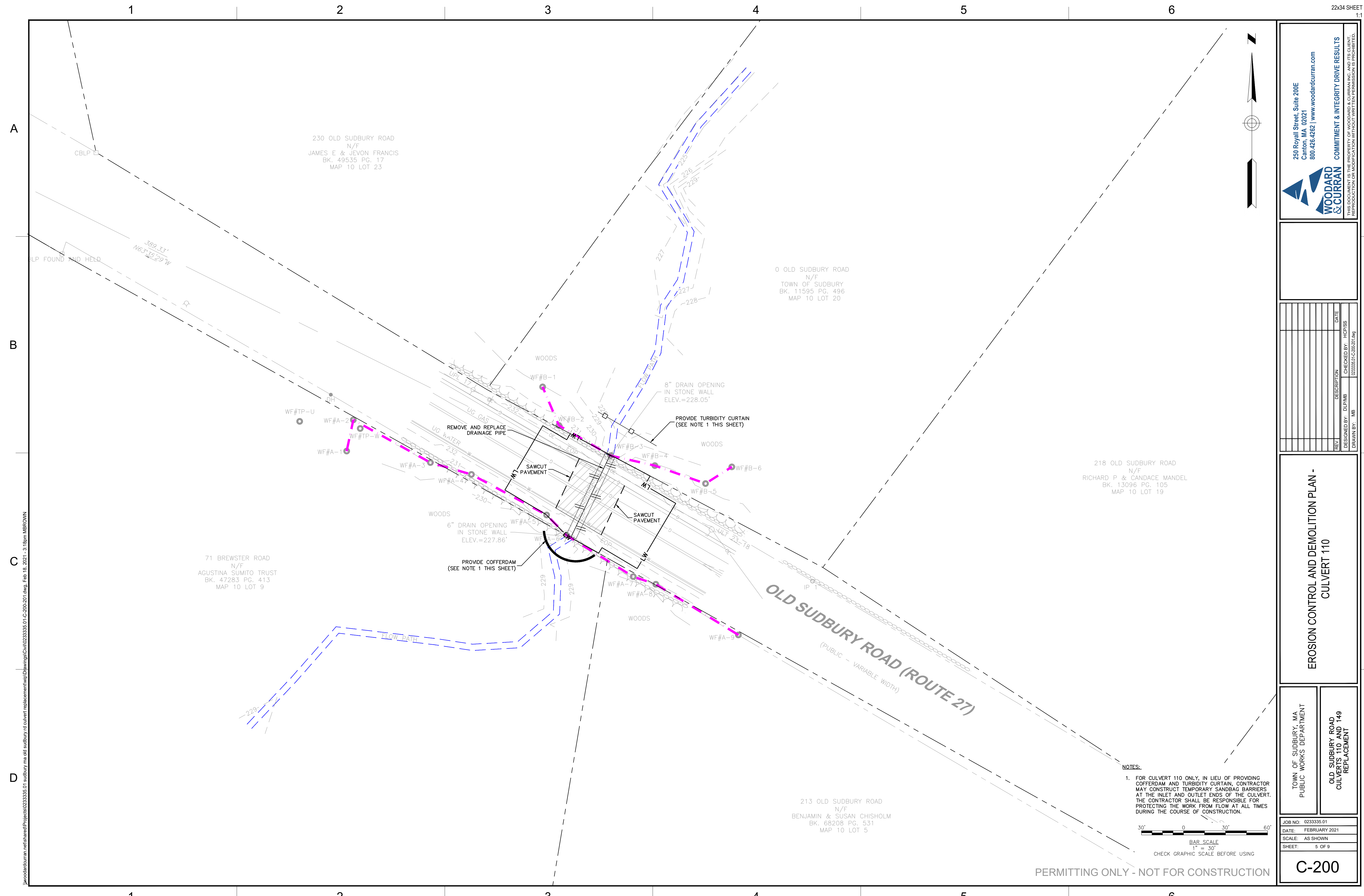
TOWN OF SUDBURY, MA  
PUBLIC WORKS DEPARTMENT

OLD SUBBURY ROAD  
CULVERTS 110 AND 149  
REPLACEMENT

JOB NO: 023335.01  
DATE: FEBRUARY 2021  
SCALE: AS SHOWN  
SHEET: 4 OF 9

**C-101**

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2	CHECKED BY: HCP/SS	
3	PROJECT: 023335.01-C-200-01.dwg	
4	DESIGNED BY: MB	
5	DRAWN BY: MB	

**EROSION CONTROL AND DEMOLITION PLAN -  
CULVERT 110**

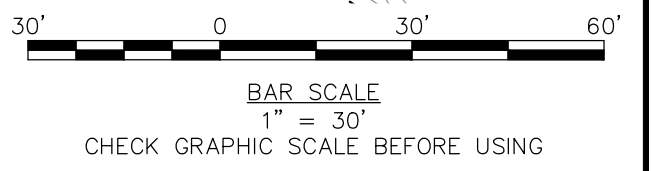
TOWN OF SUDBURY, MA  
PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD  
CULVERTS 110 AND 149  
REPLACEMENT

JOB NO: 023335.01
DATE: FEBRUARY 2021
SCALE: AS SHOWN
SHEET: 5 OF 9

**C-200**

**NOTES:**  
1. FOR CULVERT 110 ONLY, IN LIEU OF PROVIDING COFFERDAM AND TURBIDITY CURTAIN, CONTRACTOR MAY CONSTRUCT TEMPORARY SANDBAG BARRIERS AT THE INLET AND OUTLET ENDS OF THE CULVERT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING THE WORK FROM FLOW AT ALL TIMES DURING THE COURSE OF CONSTRUCTION.



PERMITTING ONLY - NOT FOR CONSTRUCTION

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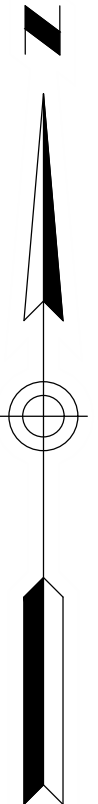
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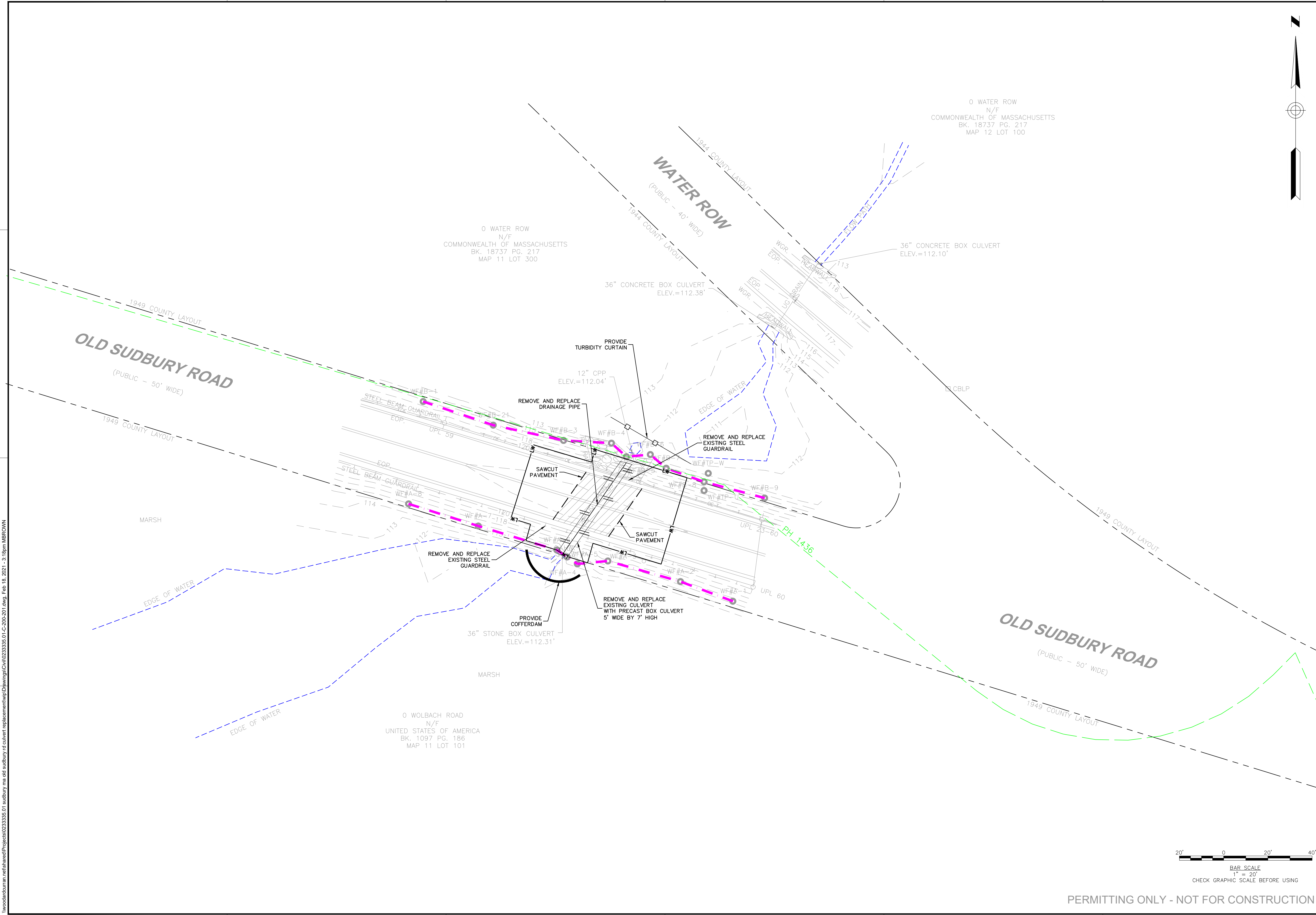


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**EROSION CONTROL AND DEMOLITION PLAN -  
 CULVERT 149**

TOWN OF SUDBURY, MA  
 PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD  
 CULVERTS 110 AND 149  
 REPLACEMENT

JOB NO: 023335.01  
 DATE: FEBRUARY 2021  
 SCALE: AS SHOWN  
 SHEET: 6 OF 9

**C-201**



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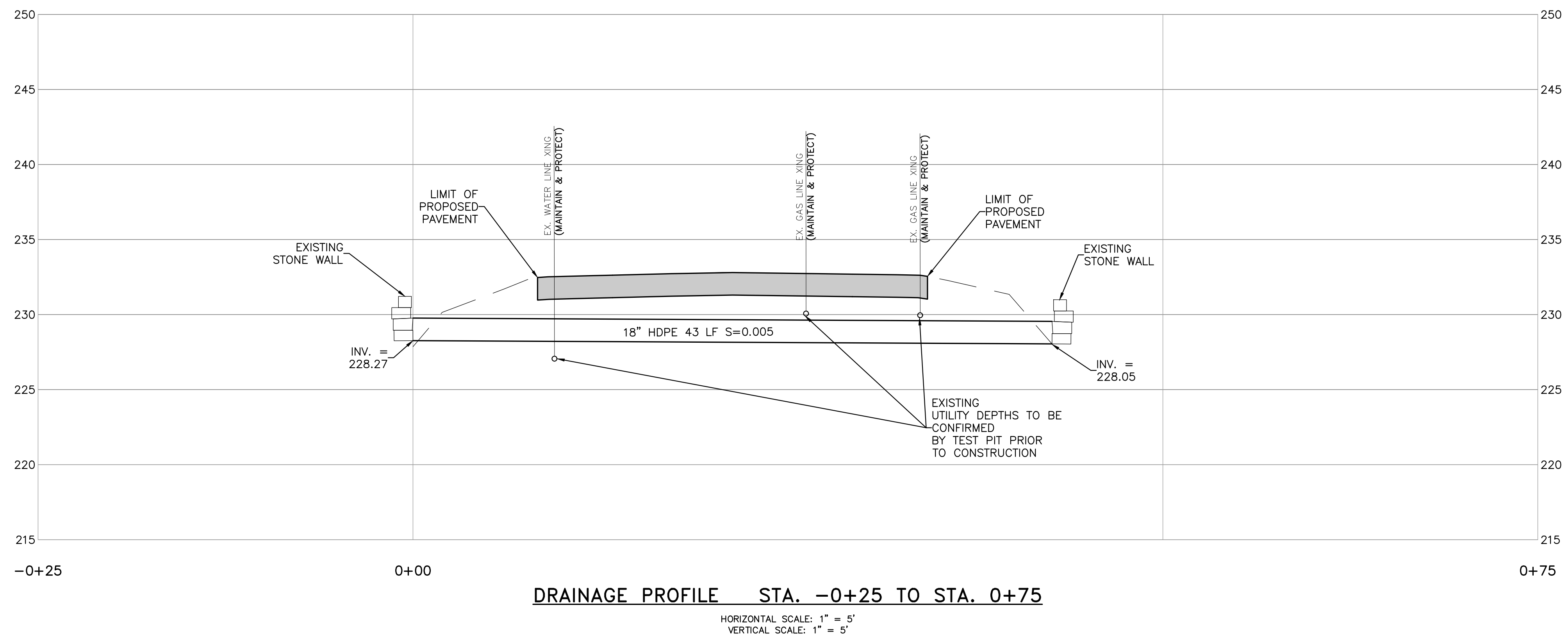
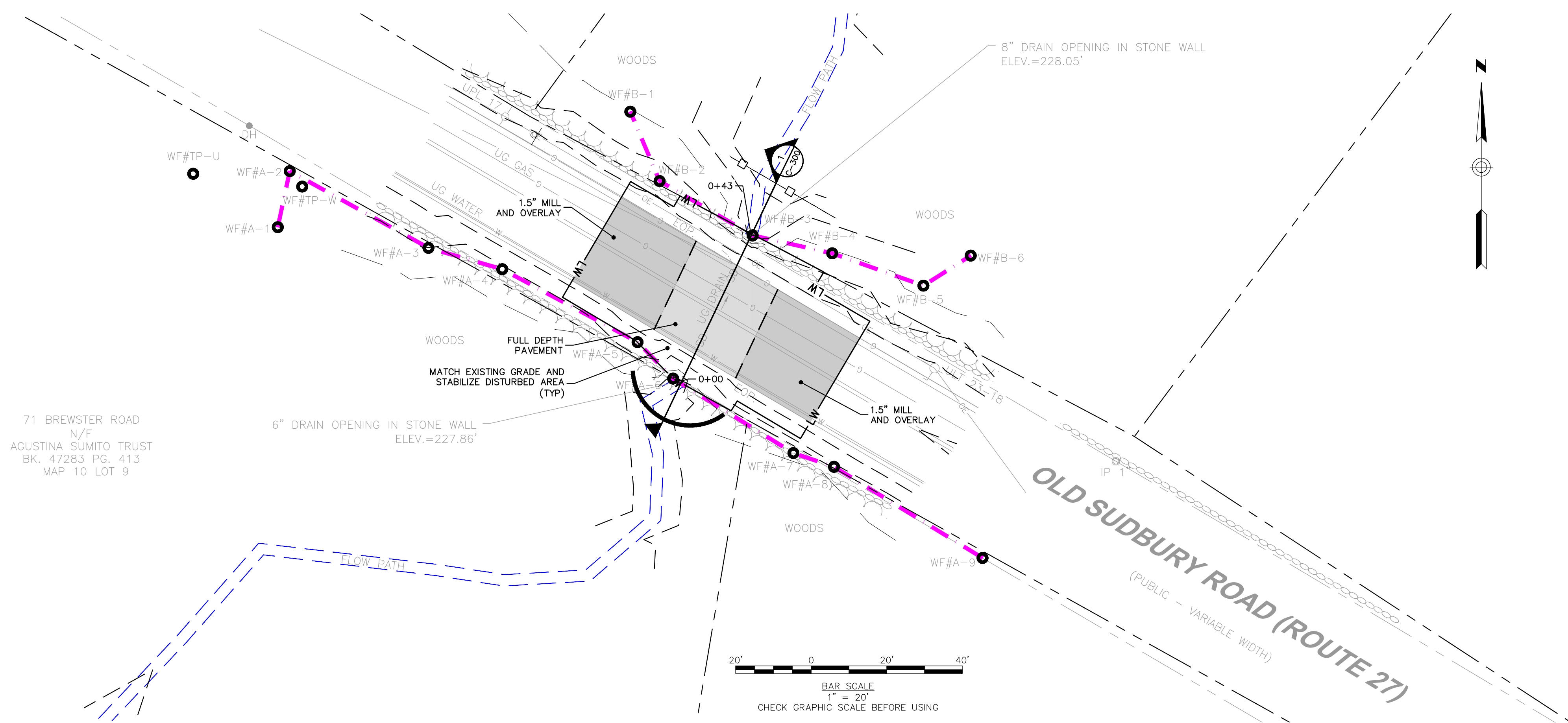
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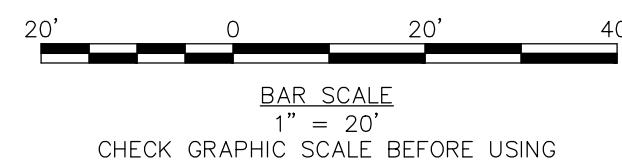
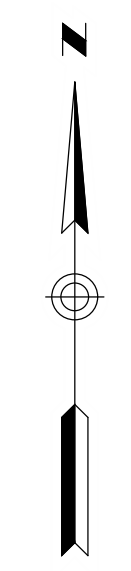
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**DRAINAGE PROFILE STA. -0+25 TO STA. 0+75**  
 HORIZONTAL SCALE: 1" = 5'  
 VERTICAL SCALE: 1" = 5'



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 023335.01-C-300-1.dwg

**SITE PLAN AND PROFILE -  
 CULVERT 110**

TOWN OF SUDBURY, MA  
 PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD  
 CULVERTS 110 AND 149  
 REPLACEMENT

JOB NO: 023335.01  
 DATE: FEBRUARY 2021  
 SCALE: AS SHOWN  
 SHEET: 7 OF 9

**C-300**

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CHECKED BY: HCF/SS  
DRAWN BY: MB

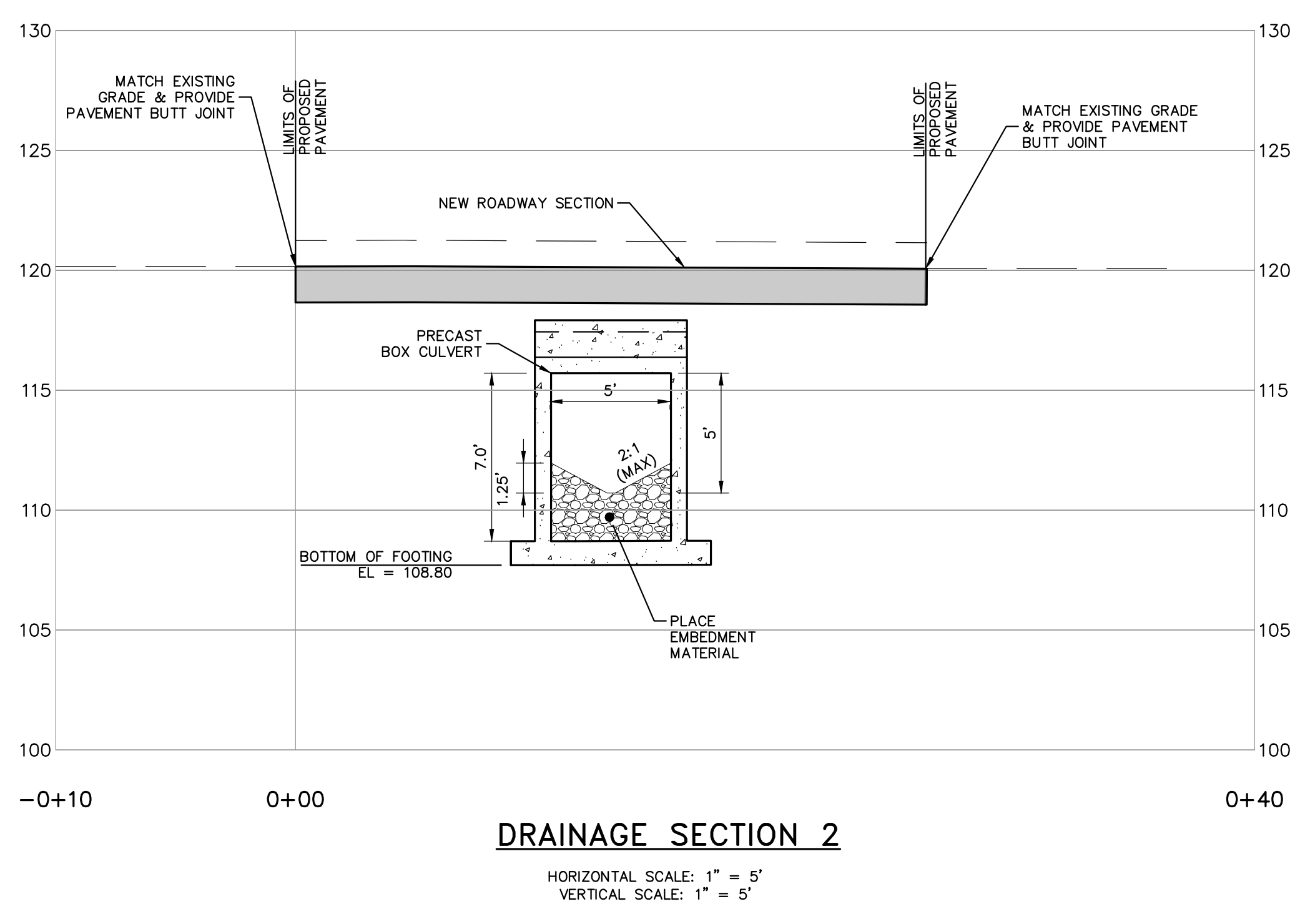
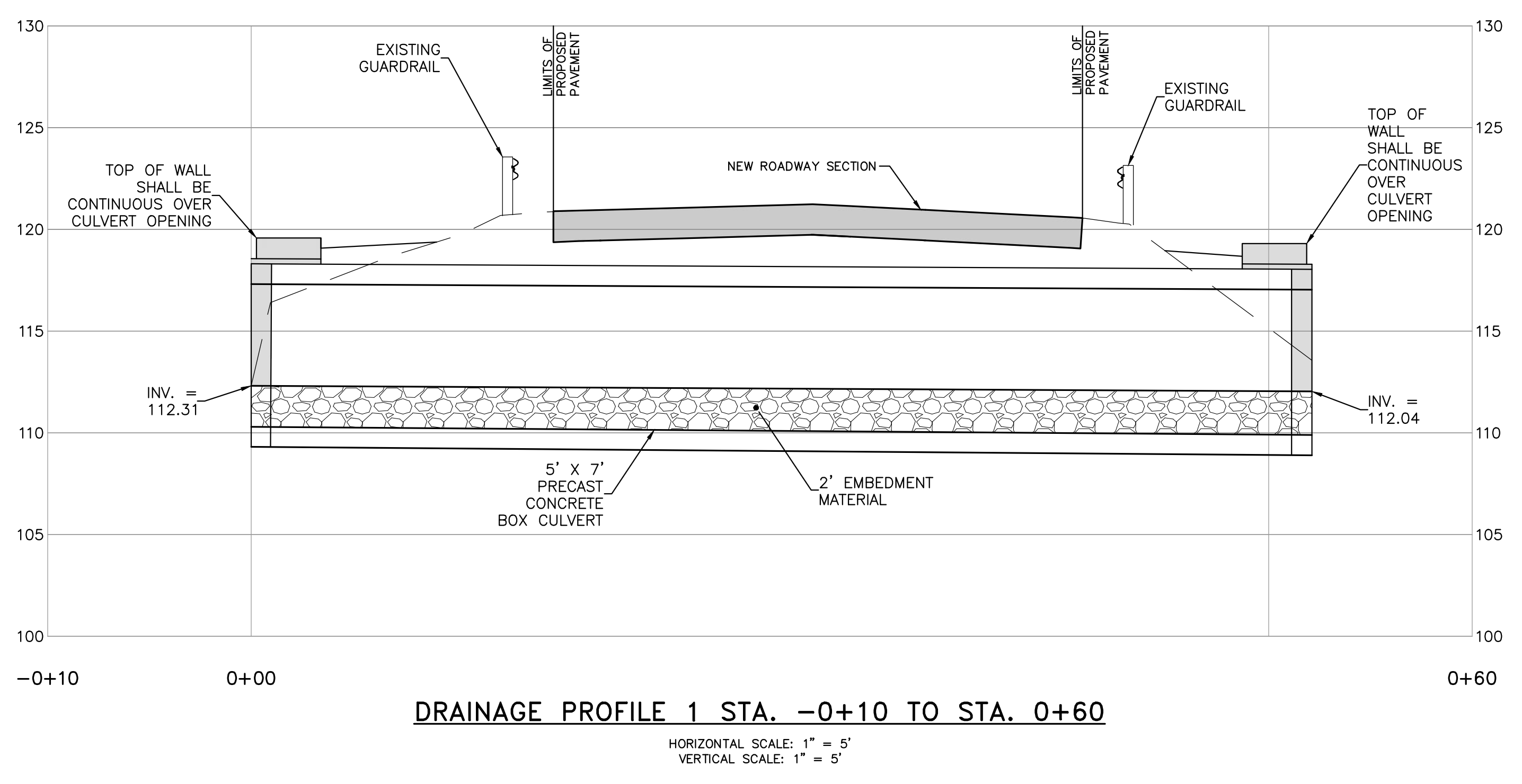
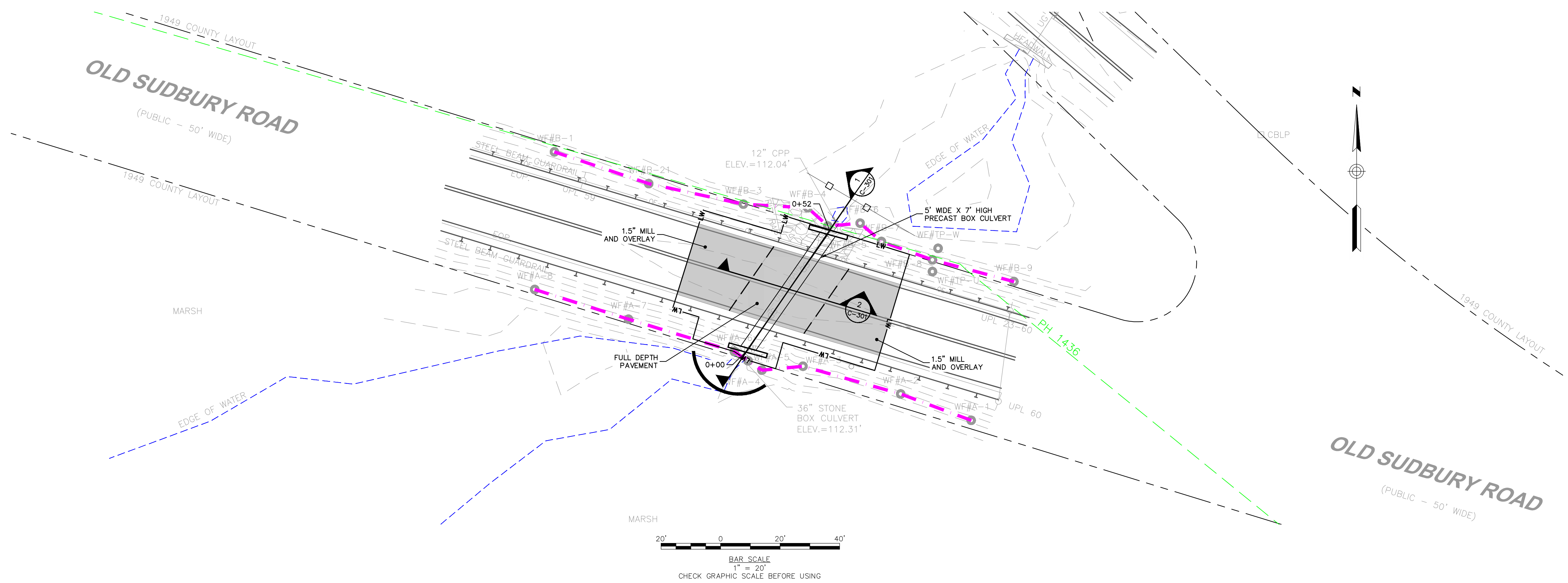
**SITE PLAN AND PROFILE -  
CULVERT 149**

TOWN OF SUDBURY, MA  
PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD  
CULVERTS 110 AND 149  
REPLACEMENT

JOB NO: 023335.01  
DATE: FEBRUARY 2021  
SCALE: AS SHOWN  
SHEET: 8 OF 9

**C-301**



# EROSION AND SEDIMENT CONTROL NOTES

## Temporary Erosion Control

Measure	Dates For Use	Timing, Activity, and Location
Sedimentation Barrier	ALL	Before soil disturbance, install downhill of areas to be disturbed and around material stockpiles.
Up-slope Diversion	ALL	Before soil disturbance, install uphill of areas to be disturbed and around material stockpiles.
Catch Basin Protection	ALL	Before soil or pavement disturbance, install ACF Environmental, Inc. High Flow Siltsock, SiltSaver Inlet Filter, or equal, installed per manufacturer's requirements.
Dust Control	ALL	During dry weather, apply water and calcium chloride to control dust.
Temporary Seeding	April 15 to Oct. 15	Soil stockpiles that are not covered and disturbed areas that will not be disturbed again within 14 days. If grass growth provides less than 95% soil coverage by Nov. 1, apply mulch and anchor with erosion control blanket.
Mulch	April 15 to Sept. 15	On all areas of exposed soil prior to rain events apply 100-150 lbs (2.5 bales) per 1,000 sq. ft. by mechanical blower.
Winter Mulch	Sept. 16 to Oct. 31 Nov. 1 to April 14	On all areas of exposed soil prior to precipitation apply 150 to 170 lbs. mulch (4 bales) per 1,000 sq. ft. by mechanical blower. Erosion control blanket may be used as a substitute for winter mulch. On all areas of exposed soil, apply 150 to 170 lbs. mulch (4 bales) per 1,000 sq. ft. and anchor with netting at the end of each working day. Erosion control blanket may be used as a substitute for winter mulch.
Inspections	Until site is permanently stabilized	Inspect the erosion and sedimentation control measures daily, and after rainfall of half inch or greater in a 24-hour period, and maintain and repair as necessary.

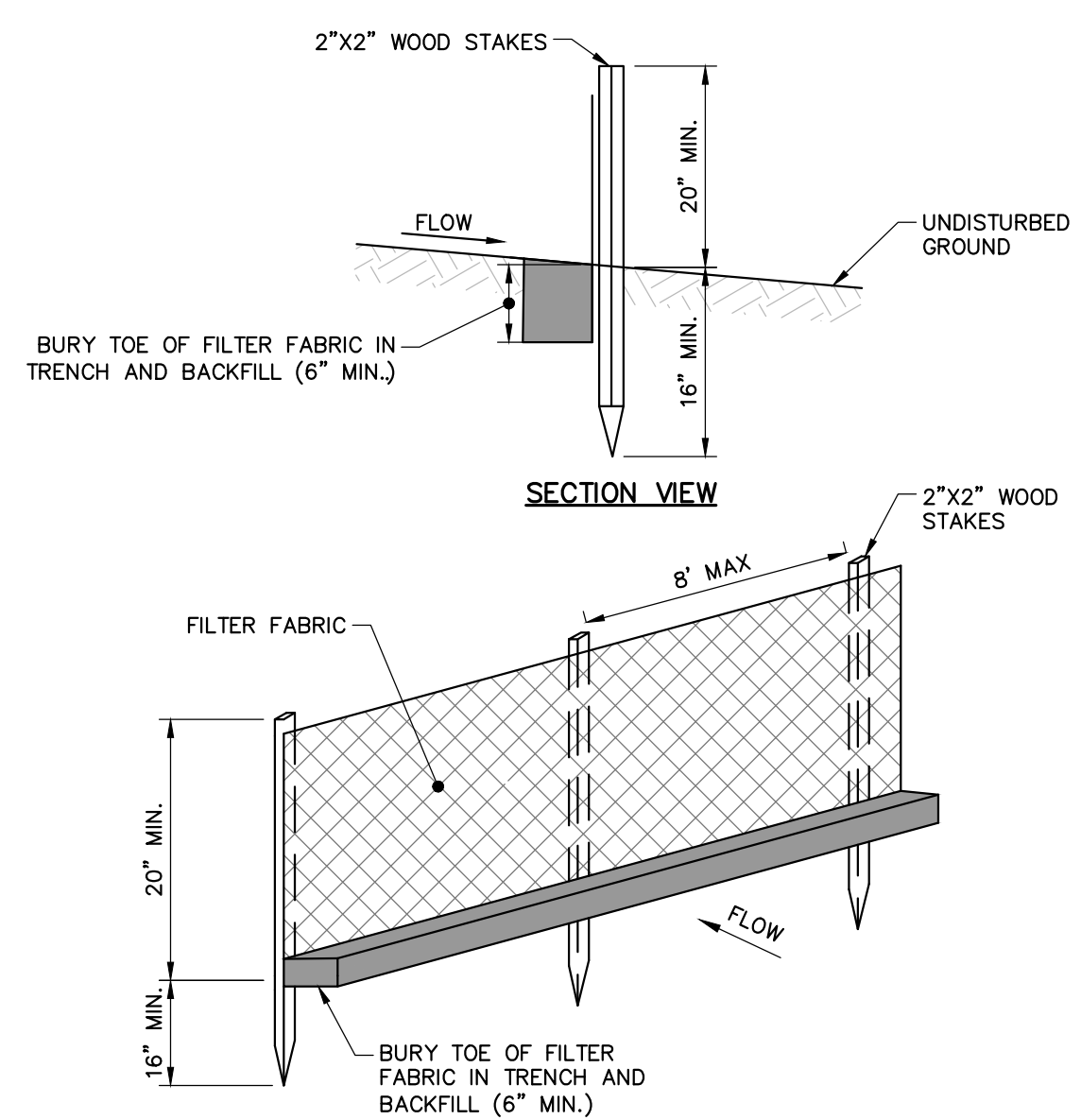
## Permanent Erosion Control:

Measure	Dates For Use	Timing, Activity, and Location
Pavement - Base Course - Final Course	When no frost is in ground	Install only in areas shown on the plan, shortly after pavement base is brought to final grade. Install near completion of project.
Permanent Seeding	April 15 to Sept. 15	On final grade areas, within 7 days of grade preparation, prepare topsoil, followed by seed and mulch application.
Dormant Seeding	Sept. 16 to April 15	On final grade areas, with prepared topsoil. Apply seed at double the specified rate on bare soil, and follow with an application of winter mulch.
Ground Cover, Trees, Shrubs	April 15 to Nov. 1	Install with final landscaping.
Permanent Mulch	ALL	Install with final landscaping.

## Inspections:

Regular inspections of all erosion and sedimentation controls shall be made at least weekly and prior to and following storm events. Minimum inspections shall be made as listed in the table below.

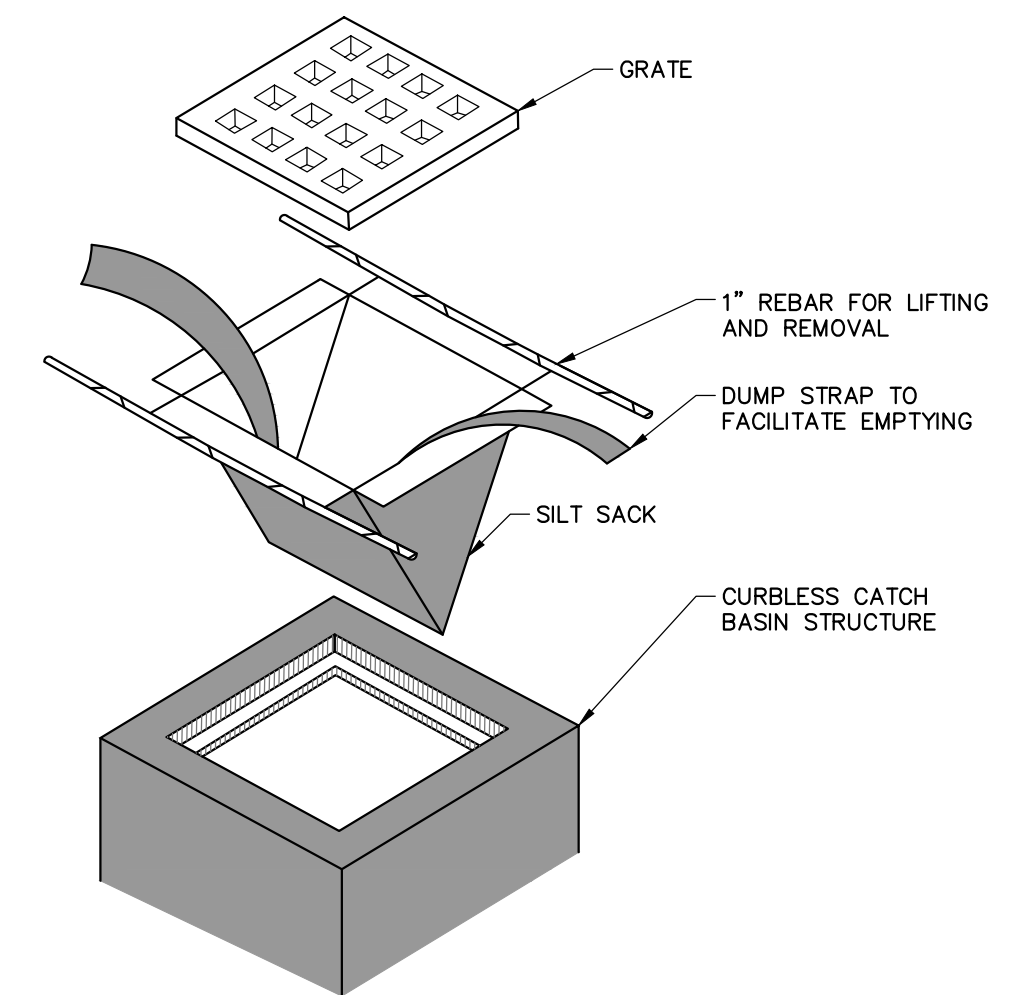
Inspected Item	Look For
Mulched Surfaces	Thin mulch or inadequate application. Wind movement.
Seeded Surfaces	Poor seed germination. Loss of mulch. Development of rivulets.
Sediment Barrier	Sediment build-up to one half the height of the barrier. Undermining of the barrier. Supporting stakes loose, toppled, or unmarked. Breaks in barrier.
Perimeter Diversion	Discharge is to stabilized area. Erosion or breaks in barrier. Supporting stakes loose, toppled or unmarked.
Catch Basin Protection	Sediment build-up and structure blockages. Slow flow/ponding water. Breaks in fabric or voids in barrier.
Site Roadways	Sedimentation of roadways. Off-site dust complaints.



- NOTES:**
- INSTALL FABRIC ON UPSLOPE SIDE OF WOOD STAKES.
  - SPACING BETWEEN WOOD STAKES PER MANUFACTURER'S RECOMMENDATION.
  - SILT FENCE WILL NOT BE USED IN DRAINAGE WAYS.
  - MAINTENANCE: INSPECT FOR TEARS IN THE FABRIC OR DAMAGE TO SUPPORTS. REPAIR AS NECESSARY. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES A DEPTH OF SIX-INCHES OR MORE.
  - REMOVAL: WHEN UPSLOPE AREAS ARE STABILIZED, THE STRUCTURE AND ANY ACCUMULATED SEDIMENT WILL BE REMOVED.

## SILT FENCE

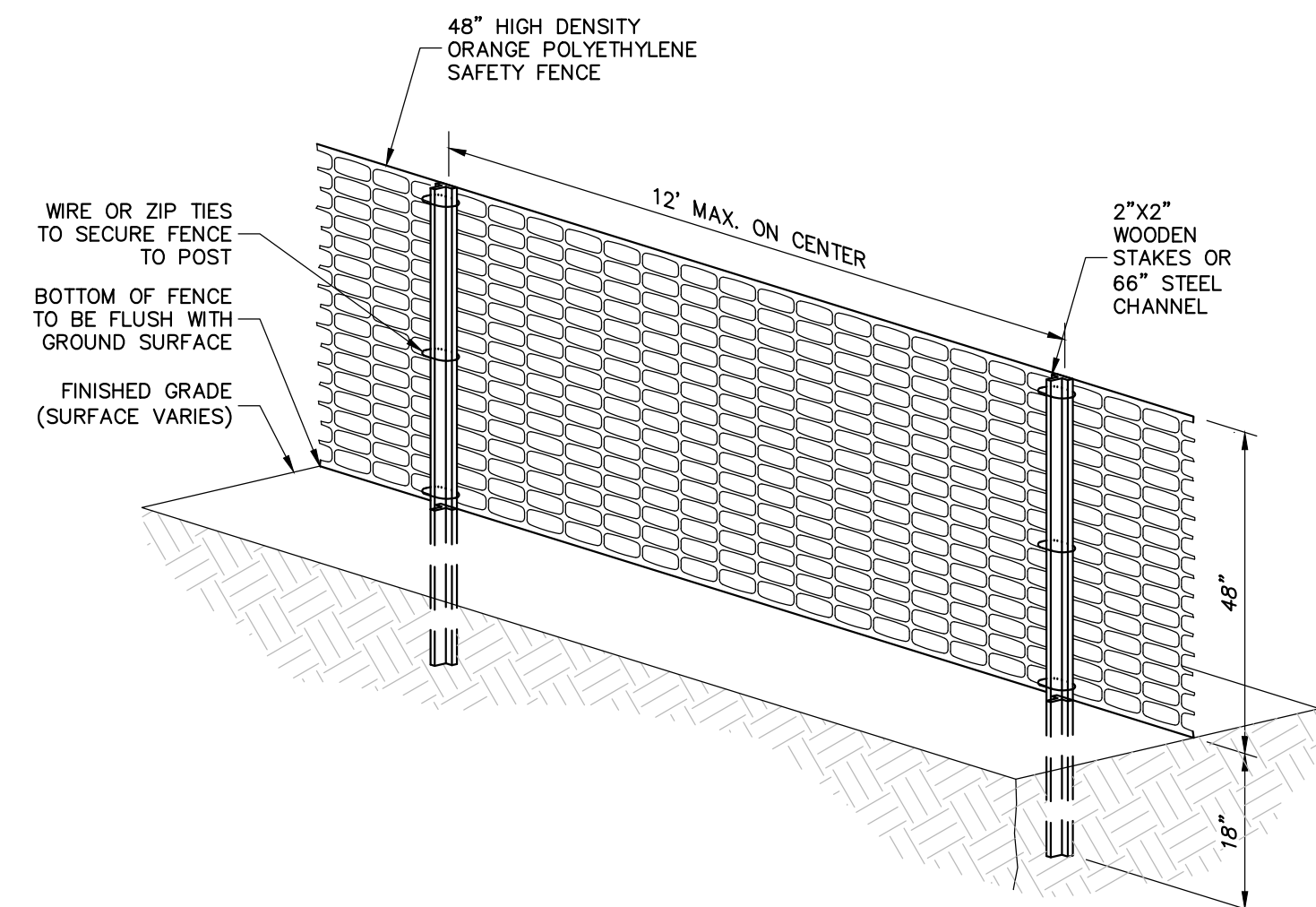
N.T.S.



- NOTES:**
- INSTALL SILTSACK PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
  - EMPTY OR REMOVE SEDIMENT FROM SILTSACK WHEN RESTRAINT CORD IS NO LONGER VISIBLE. CLEAN, RINSE, AND REPLACE AS NEEDED.
  - SILT SACKS TO BE INSTALLED WHEN THE POTENTIAL FOR SEDIMENT TO ENTER EXISTING & PROPOSED BASINS EXISTS.

## SILTSACK- CURBLESS INLET

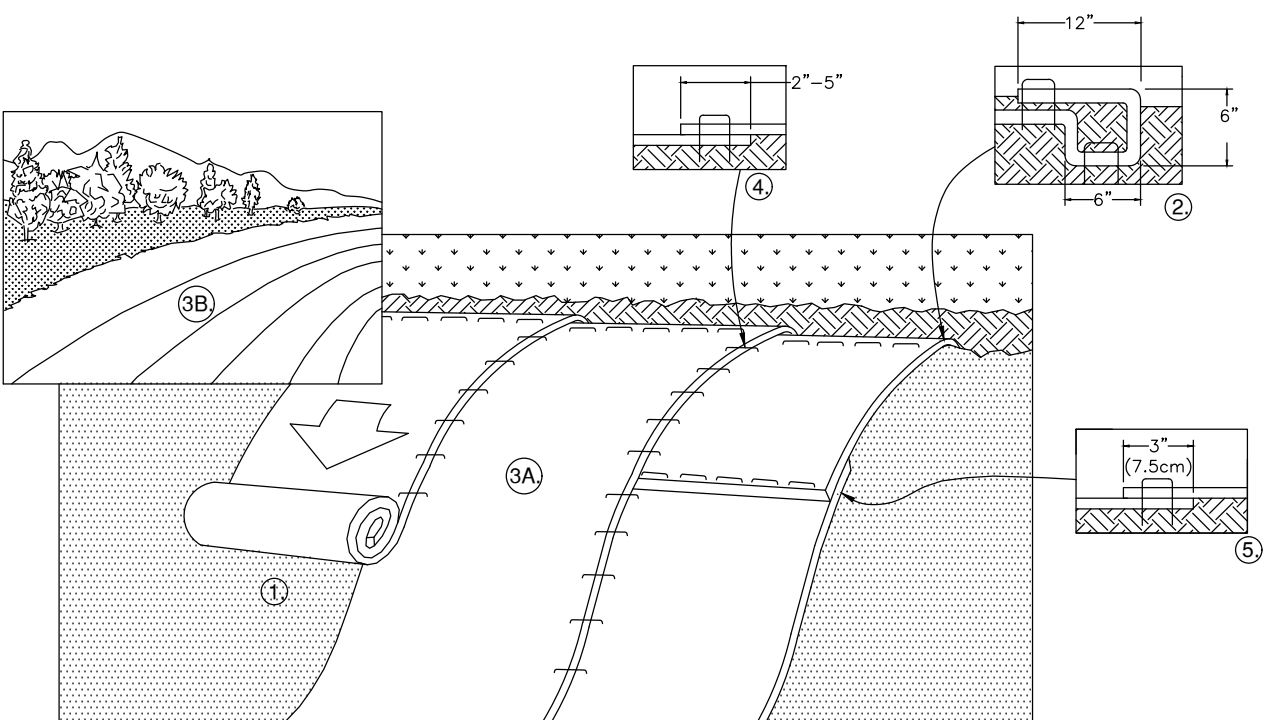
NOT TO SCALE



- NOTE:**
- MAINTAIN TENSION ACROSS FULL HEIGHT AND LENGTH OF FENCE.
  - PROVIDE PERIODIC INSPECTION AND MAINTENANCE OF FENCE.
  - FENCE SHALL BE HIGH DENSITY ORANGE POLYETHYLENE SAFETY FENCE AS MANUFACTURED BY EROSION RUNNER® OR APPROVED EQUAL.

## PLASTIC CONSTRUCTION SAFETY FENCE

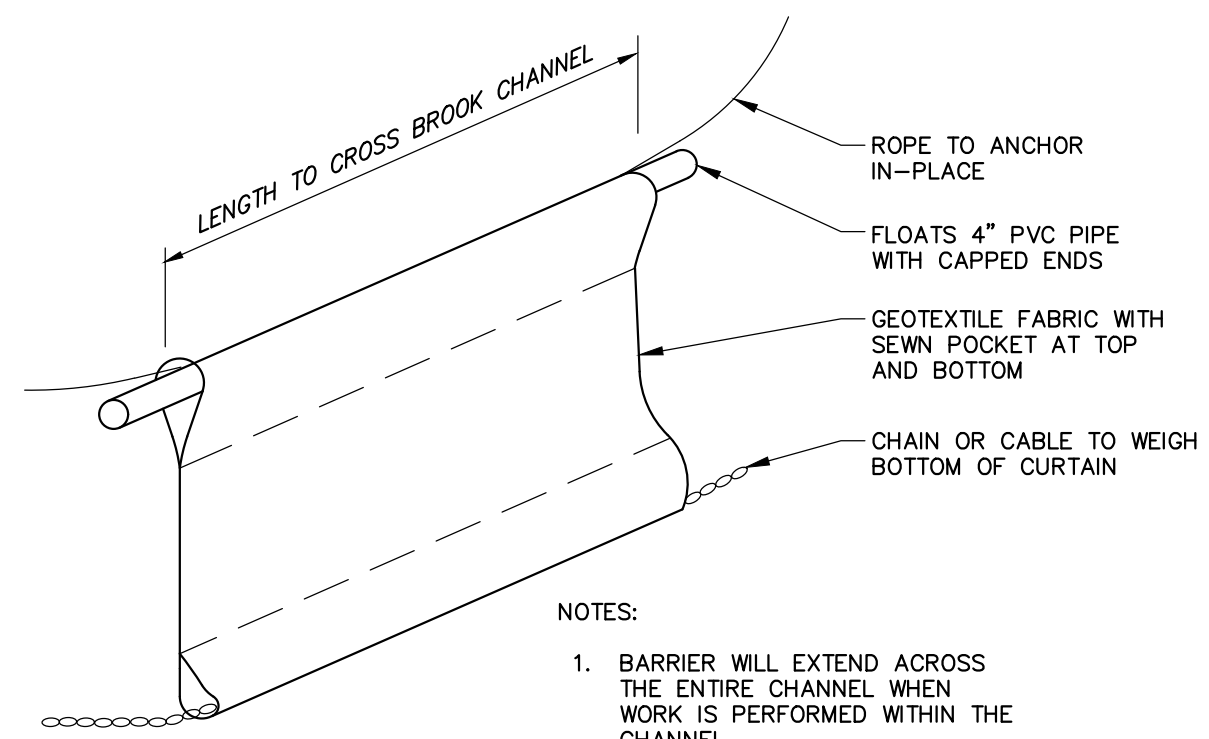
N.T.S.



- PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED AS WELL AS REMOVING ANY PROTRUDING ROCKS, STUMPS OR ROOTS. DURING THE GROWING SEASON (APRIL 15 - SEPTEMBER 15) USE RECP'S ON SLOPES HAVING A GRADE GREATER THAN 15% OR ANYWHERE WHERE HAY MULCH HAS PROVEN TO BE INEFFECTIVE AT CONTROLLING SHEET EROSION. RECP'S ARE A MANUFACTURED COMBINATION OF MULCH AND NETTING DESIGNED TO PREVENT EROSION AND RETAIN SOIL MOISTURE. FOR OVER WINTER PROTECTION, APPLY RECP'S ON SLOPES STEEPER THAN AN 8% GRADE.
- BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP'S IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF RECP'S EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP'S WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH (USE OF METAL STAPLES IS PROHIBITED). BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF RECP'S BACK OVER SEED AND COMPACTED SOIL. SECURE RECP'S OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE RECP'S.
- ROLL THE RECP'S (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
- THE EDGES OF PARALLEL RECP'S MUST BE STAPLED WITH APPROXIMATELY 2" - 5" OVERLAP DEPENDING ON RECP'S TYPE.
- CONSECUTIVE RECP'S SPICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE RECP'S WIDTH. NOTE: \*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE RECP'S.
- UNTIL GRASS HAS GOOD COVERAGE, INSPECT PERIODICALLY AND AFTER EACH RAINSTORM TO CHECK FOR EROSION. IMMEDIATELY REPAIR AND ADD MORE MULCH UNTIL GRASSES ARE FIRMLY ESTABLISHED. DO NOT MOW THE FIRST YEAR.
- EROSION CONTROL MATTING AND GROUND FASTENERS SHALL BE 100% BIODEGRADABLE.

## EROSION CONTROL MATTING

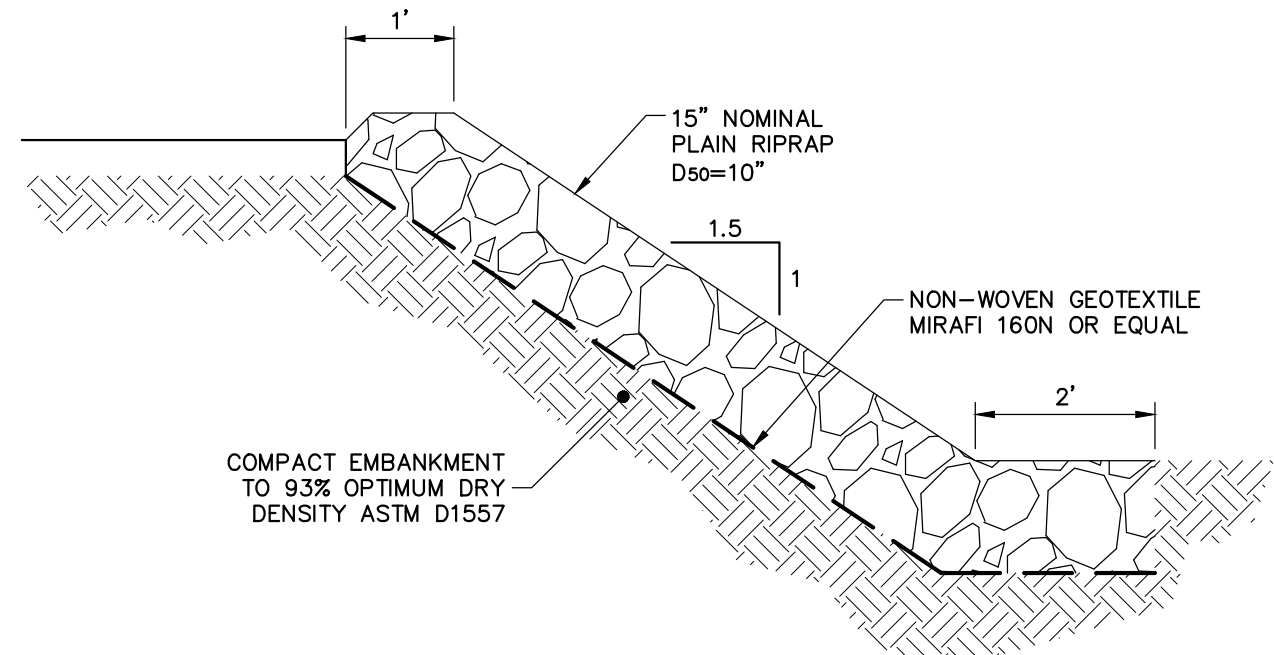
N.T.S.



- NOTES:**
- BARRIER WILL EXTEND ACROSS THE ENTIRE CHANNEL WHEN WORK IS PERFORMED WITHIN THE CHANNEL.
  - ROPE SHALL BE 1/2" NYLON OR MANILA.

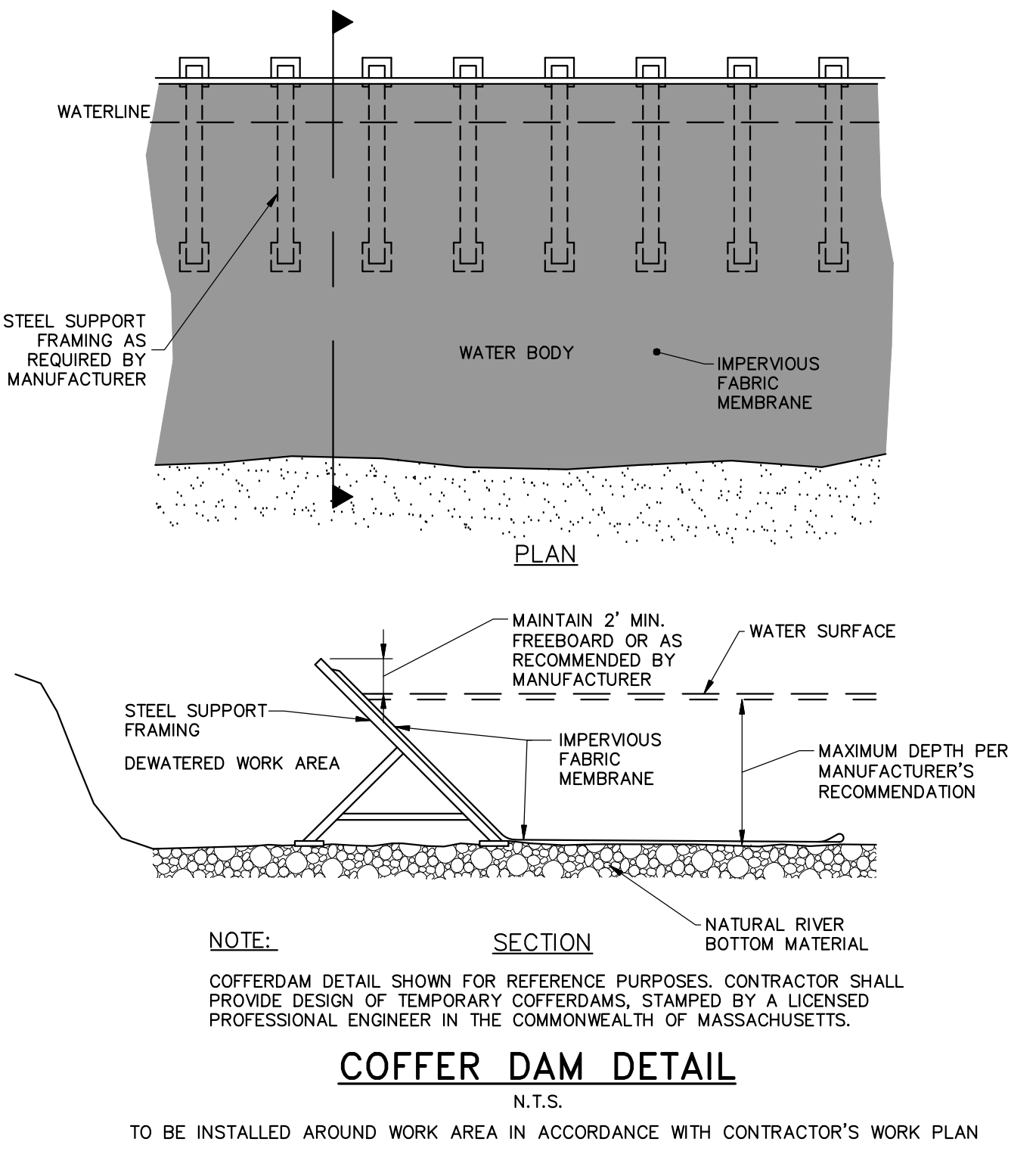
## FLOATING TURBIDITY BARRIER

N.T.S.



## RIPRAP SLOPE DETAIL

N.T.S.



**NOTE:**  
COFFERDAM DETAIL SHOWN FOR REFERENCE PURPOSES. CONTRACTOR SHALL PROVIDE DESIGN OF TEMPORARY COFFERDAMS, STAMPED BY A LICENSED PROFESSIONAL ENGINEER IN THE COMMONWEALTH OF MASSACHUSETTS.

## COFFER DAM DETAIL

N.T.S.

TO BE INSTALLED AROUND WORK AREA IN ACCORDANCE WITH CONTRACTOR'S WORK PLAN

250 Royal Street, Suite 210E  
Canton, MA 02021  
800.426.4262 | www.woodardcurran.com

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REV	DESCRIPTION	CHECKED BY	DATE

CIVIL DETAILS 1

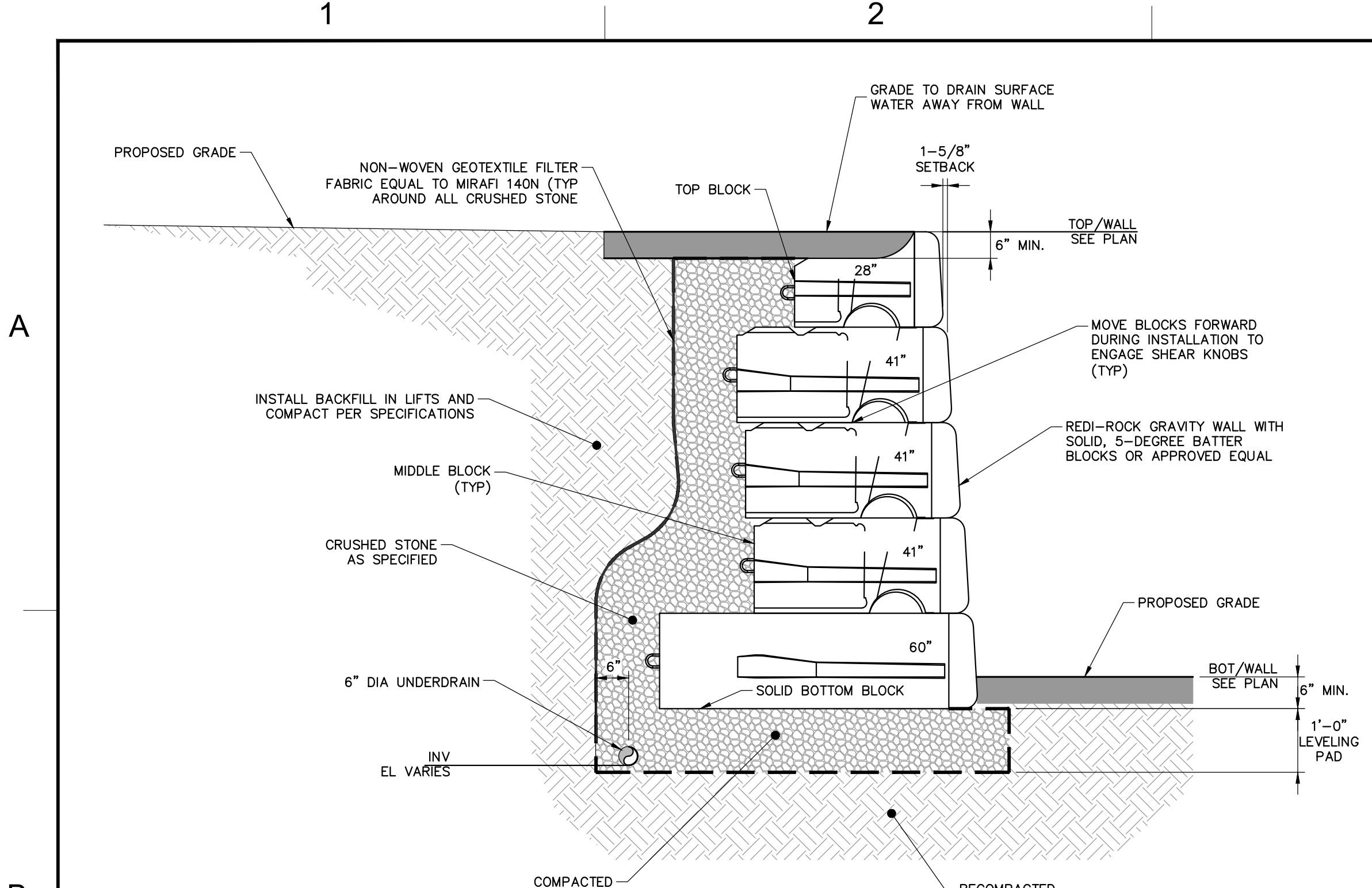
TOWN OF SUDBURY, MA  
PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD AND 149  
CULVERTS 110 AND 149  
REPLACEMENT

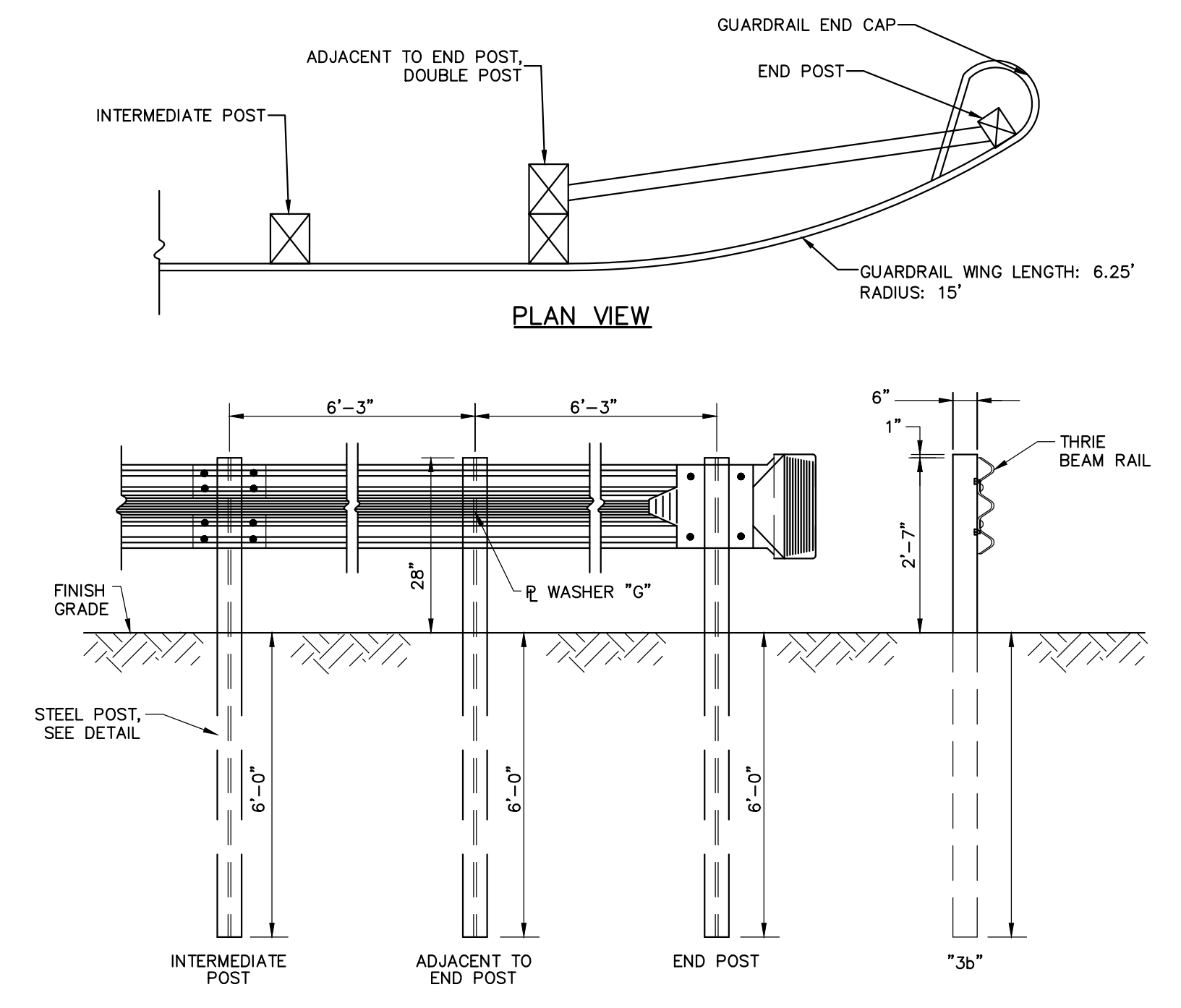
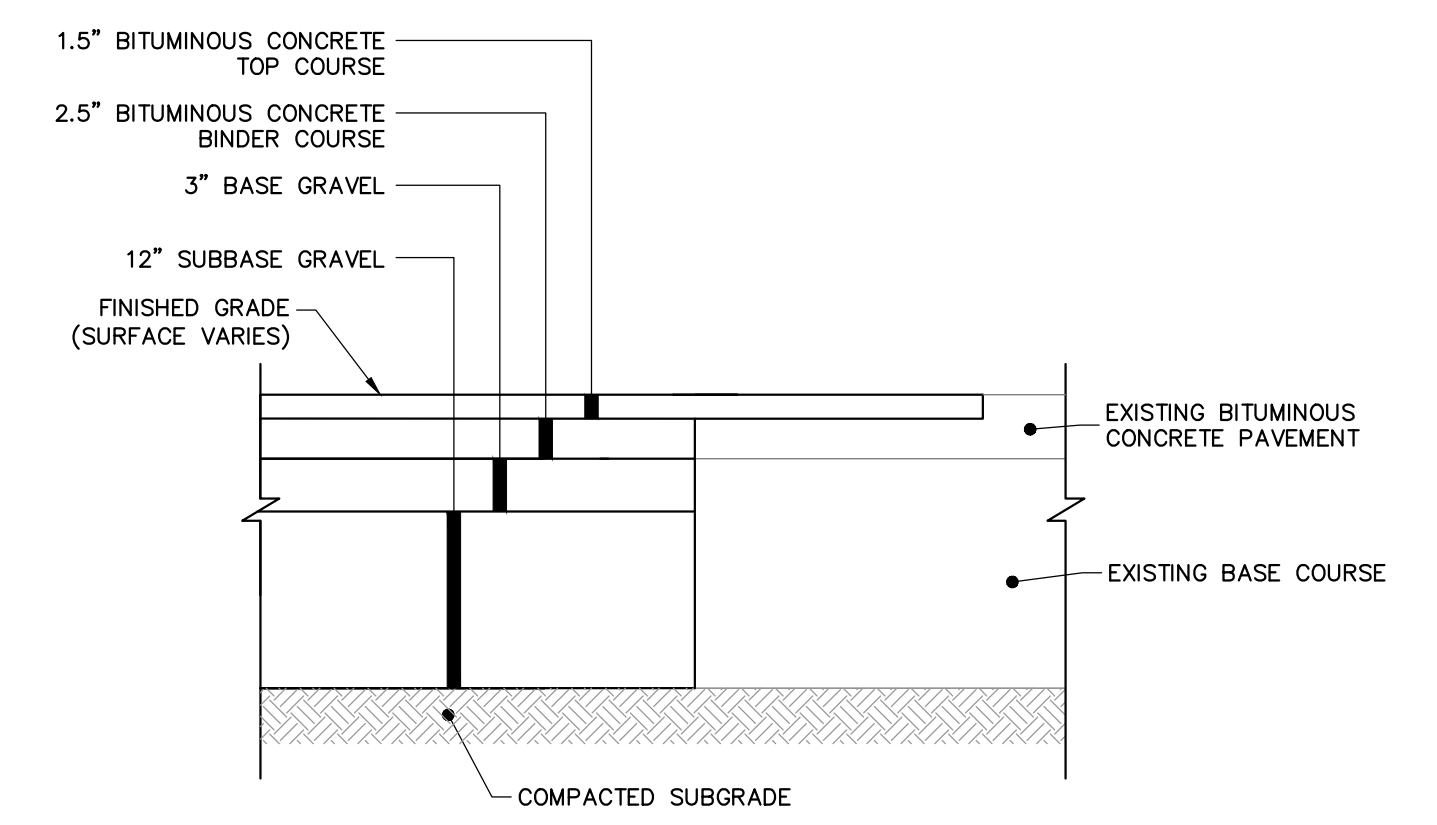
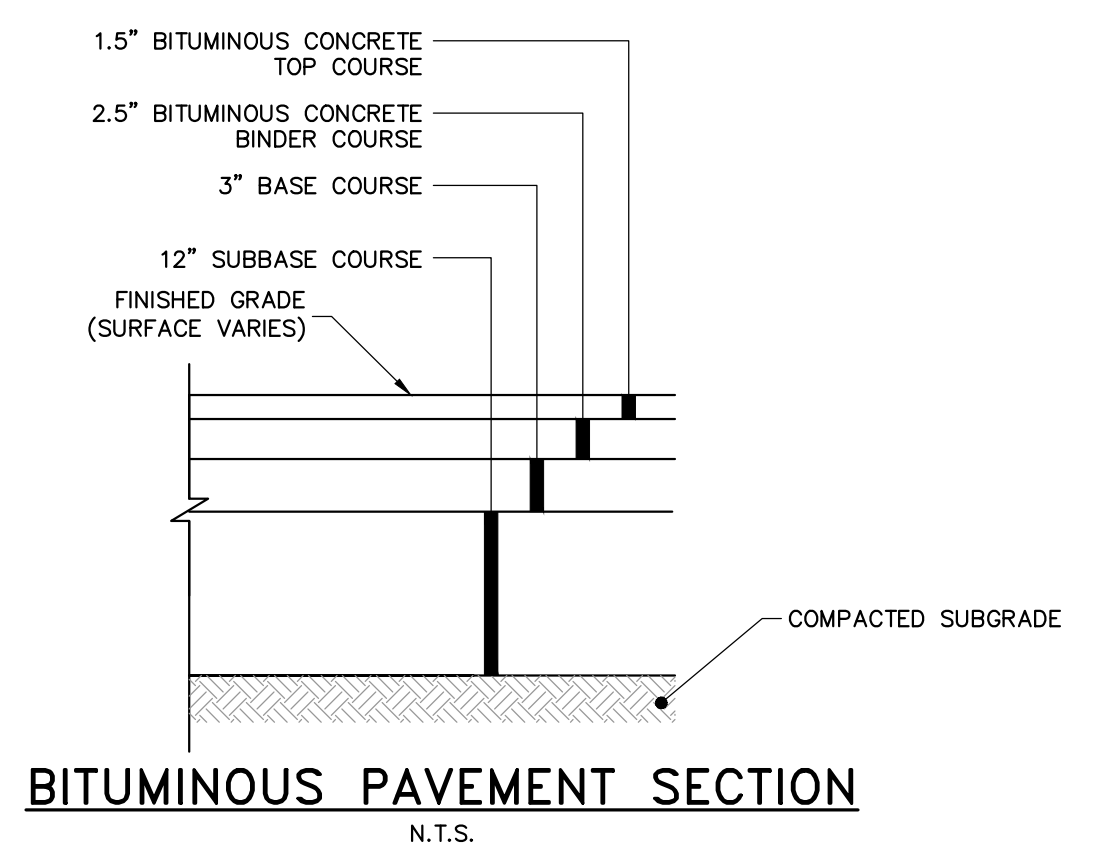
JOB NO: 023335 01  
DATE: FEBRUARY 2021  
SCALE: AS SHOWN  
SHEET: 9 OF 9

**C-400**

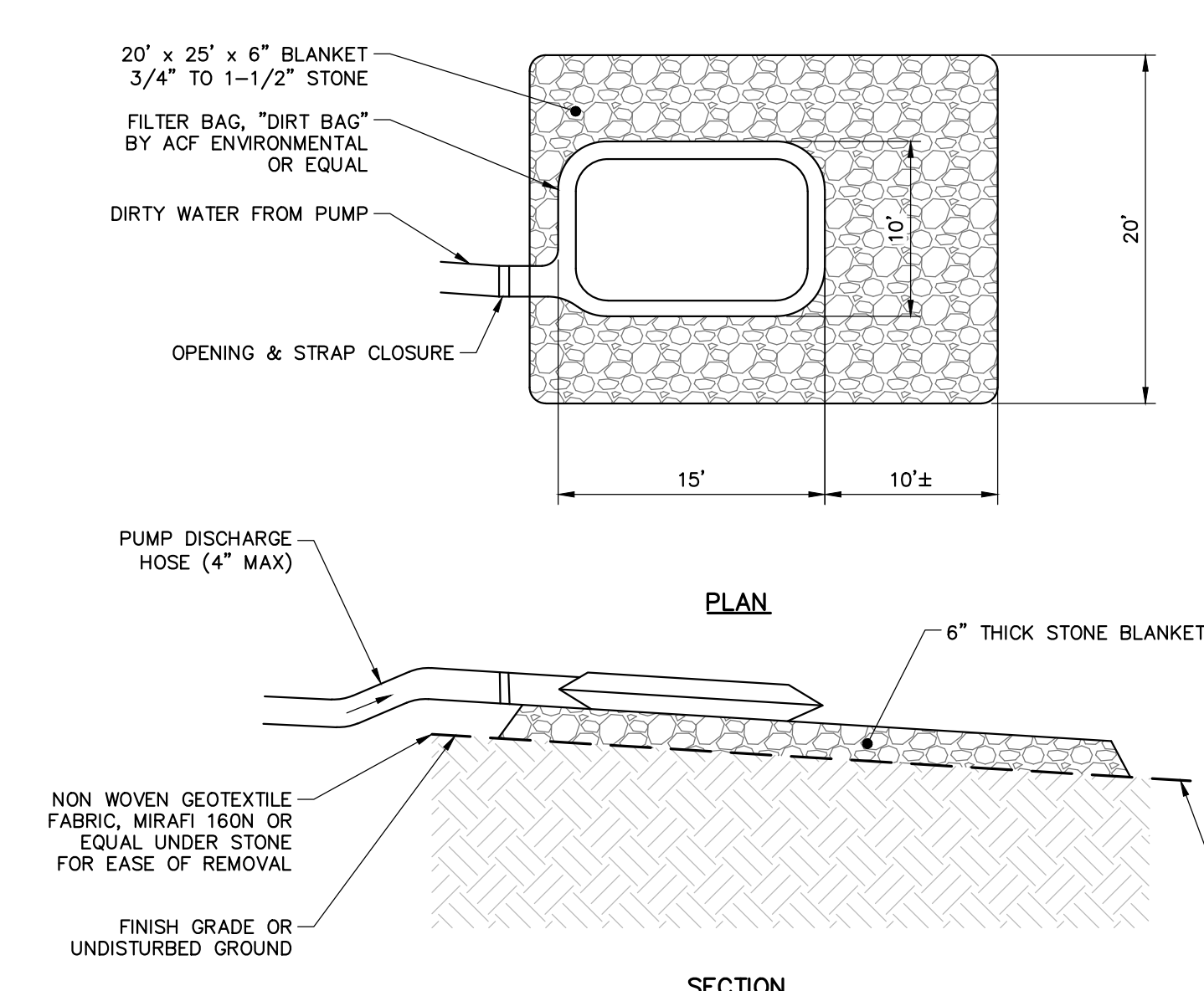
PERMITTING ONLY - NOT FOR CONSTRUCTION



- NOTES:**
- RETAINING WALL SECTIONS ARE CONCEPTUAL IN NATURE AND FOR REFERENCE PURPOSES TO AID IN THE LAYOUT AND DEVELOPMENT OF WALL DESIGN (BY OTHERS). GRAVITY WALL ENGINEER SHALL PROVIDE FINAL WALL DESIGN AND CALCULATIONS, STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF MASSACHUSETTS SUBJECT TO REVIEW OF THE ENGINEER.
  - REFER TO SHEET C-102 FOR PLAN VIEW AND LIMITS OF PROPOSED RETAINING WALL.
  - REFER TO SPECIFICATION SECTION 31 00 00 FOR MATERIAL GRADATIONS AND REQUIREMENTS.
  - ELEVATIONS SHOWN ARE APPROXIMATE AND SHALL BE FIELD VERIFIED.
  - REFER TO SECTIONS AND PLANS FOR BACK FILL INFORMATION.



- NOTES:**
- ALL POST SPACING SHALL BE 6'-3" UNLESS OTHERWISE DIRECTED BY ENGINEER.
  - GUARDRAIL SHALL MEET ALL MASSDOT SPECIFICATIONS
  - ALL HOLES IN BEAM SHALL BE SHOP-PUNCHED BEFORE GALVANIZING.
  - GUARD RAIL SHALL MEET NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP) 350



- NOTES:**
- LOCATE DISCHARGE SITE ON FLAT UPLAND AREAS AS FAR AWAY AS POSSIBLE FROM STREAMS, WETLANDS, OTHER RESOURCES AND POINTS OF CONCENTRATED FLOW.
  - DISCHARGE NOT PERMITTED WITHIN 200' OF A STREAM OR 100' OF A WETLAND.
  - DOWNGRADIENT RECEIVING AREA MUST BE WELL VEGETATED OR OTHERWISE STABLE FROM EROSION, I.E. FOREST FLOOR OR COARSE GRAVEL/STONE.
  - NEVER DISCHARGE TO AREAS THAT ARE BARE OR NEWLY VEGETATED.
  - DIRT BAG MATERIAL BASED ON PARTICLE SIZE IN DIRTY WATER, I.E., FOR COARSE PARTICLES A WOVEN MATERIAL; FOR SILTS/CLAYS A NON-WOVEN MATERIAL.
  - DO NOT OVER PRESSURIZE DIRT BAG OR USE BEYOND CAPACITY.
  - CHANNELS DUG FOR DISCHARGING WATER FROM THE EXCAVATED AREA NEED TO BE STABLE. IF FLOW VELOCITIES CAUSE EROSION WITHIN THE CHANNEL THEN A DITCH LINING SHOULD BE USED.
  - BUCKETED WATER SHOULD BE DISCHARGED IN A STABLE MANNER TO THE SEDIMENT REMOVAL AREA. A SPLASH PAD OF RIPRAP UNDERLAIN WITH GEOTEXTILE MAY BE NECESSARY TO PREVENT SCOURING OF SOIL.
  - DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHOULD BE AVOIDED.
  - INSTALL DIVERSION DITCHES OR BERMS TO MINIMIZE THE AMOUNT OF CLEAN STORMWATER RUNOFF ALLOWED INTO THE EXCAVATED AREA.
  - DURING THE ACTIVE DEWATERING PROCESS, INSPECTION OF THE DEWATERING FACILITY SHOULD BE REVIEWED FREQUENTLY. SPECIAL ATTENTION SHOULD BE PAID TO THE BUFFER AREA FOR ANY SIGN OF EROSION AND CONCENTRATION OF FLOW THAT MAY COMPROMISE THE BUFFER AREA. OBSERVE WHERE POSSIBLE THE VISUAL QUALITY OF THE EFFLUENT AND DETERMINE IF ADDITIONAL TREATMENT CAN BE PROVIDED.
  - EROSION CONTROL REQUIRED AROUND DEWATERING DISCHARGE SEDIMENT CONTROL DEVICE.

250 Royal Street, Suite 200E  
Canton, MA 02021  
800.426.4262 | www.woodardcurran.com

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REV	DESCRIPTION	DATE	DESIGNED BY	CHECKED BY	DRAWN BY
			DUPMB	HCP/SS	MB

**CIVIL DETAILS 2**

TOWN OF SUDBURY, MA  
PUBLIC WORKS DEPARTMENT

OLD SUDBURY ROAD  
CULVERTS 110 AND 149  
REPLACEMENT

JOB NO: 023335 01  
DATE: FEBRUARY 2021  
SCALE: AS SHOWN  
SHEET: 10 OF 9

**C-401**

## Figures 6 & 7: Resource Area Impact Figures



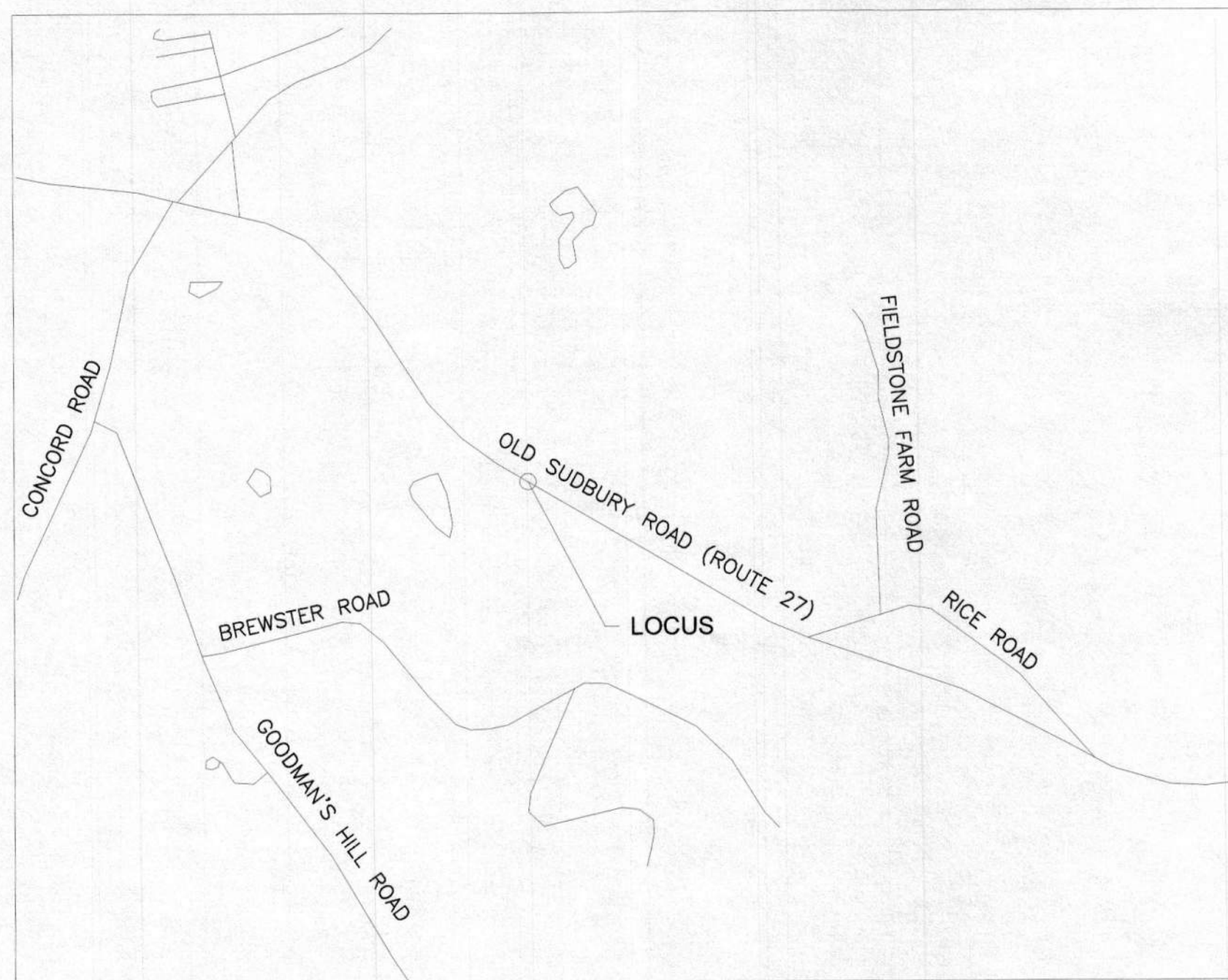






**ATTACHMENTS A1 AND A2 – EXISTING CONDITIONS SURVEYS, CULVERT #110  
& CULVERT #149**

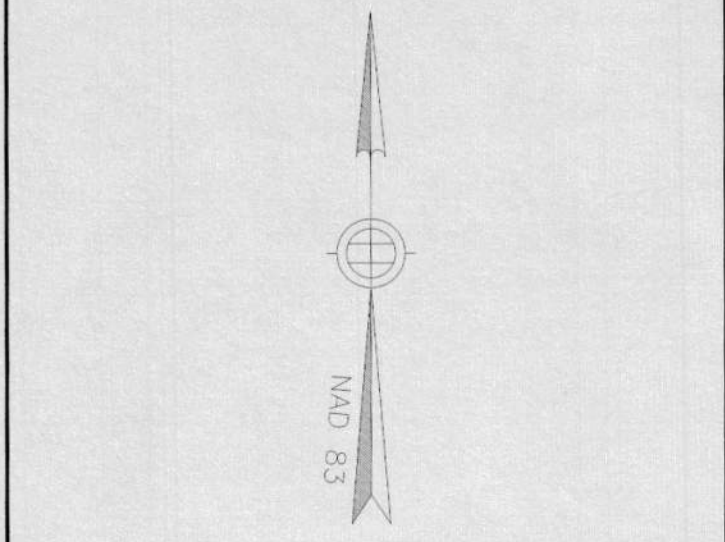




LOCUS MAP

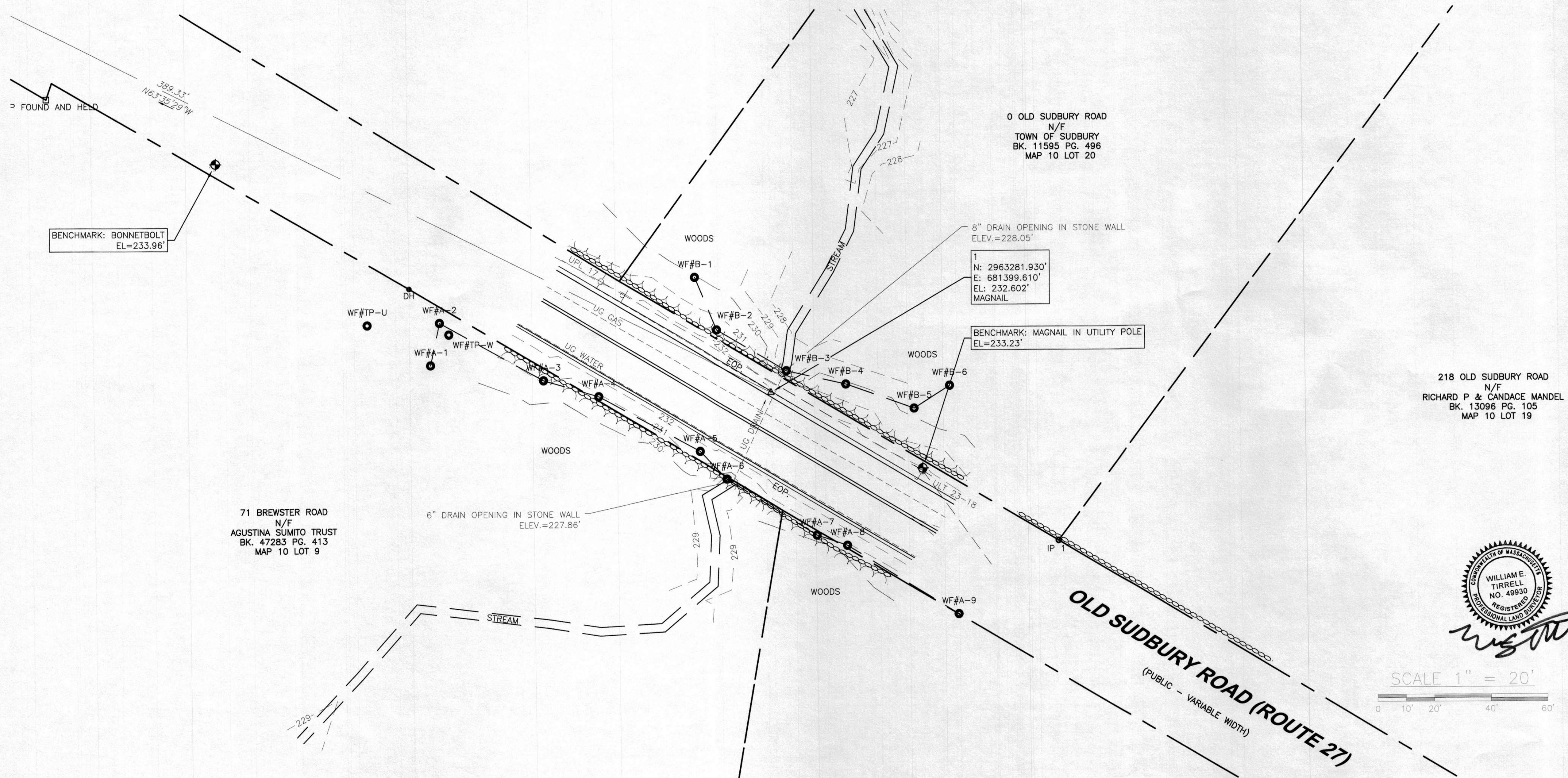
GENERAL NOTES:

1. THE EXISTING CONDITIONS INFORMATION SHOWN HEREON IS THE RESULT OF AN ON-THE-GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ASSOCIATES, LLC., BETWEEN OCTOBER 26TH - 30TH, 2020.
2. ALL DEED/PLAN REFERENCES ARE TO MIDDLESEX REGISTRY OF DEEDS SOUTHERN DISTRICT.
3. THE PROJECT AREA IS LOCATED IN FLOOD ZONE "X" AS SHOWN ON FLOOD INSURANCE RATE MAP FOR THE TOWN OF SUDBURY, COMMUNITY PANEL NUMBER 25017C 0369F, EFFECTIVE DATE JULY 7, 2014.
4. PROPERTY DOES NOT RESIDE IN A WATER RESOURCE PROTECTION DISTRICT.
5. ZONING DISTRICT RESIDENCE A.
6. LOCATION OF SUBSURFACE UTILITIES SHOWN HEREON ARE APPROXIMATE AND ADDITIONAL UTILITIES MAY EXIST THAT ARE NOT SHOWN ON THIS PLAN. LOCATIONS ARE COMPILED FROM UTILITY PLANS OF RECORD AND DIG-SAFE FIELD MARKINGS. RIM AND INVERT INFORMATION HAS BEEN FIELD VERIFIED WHERE POSSIBLE. THIS INFORMATION IS NOT TO BE USED FOR CONSTRUCTION. PRIOR TO ANY CONSTRUCTION, CONTACT DIG-SAFE (1-800-344-7233) TO FIELD VERIFY LOCATION OF ALL UTILITIES.
7. PLAN REFERENCES: (PLAN NO. / PLAN YEAR)  
9063-449 227 OF 1947 1501 OF 1962 1181 OF 1996 620 OF 2002
8. BORDERING WETLAND LOCATION FLAGS SET BY ECOTEC, LLC. ON OCTOBER 15TH, 2020.
9. HORIZONTAL DATUM: NAD 83 MASS STATE PLANE MAINLAND ZONE HORIZONTAL CONTROL SYSTEM.
10. VERTICAL DATUM: NAVD 88 VERTICAL CONTROL SYSTEM.



LEGEND

- STREET R.O.W. LINE
- ABUTTER PROPERTY LINE
- EASEMENT LINES
- EDGE OF PAVEMENT
- VGC VERT. GRAN. CURB
- o IRON HAND RAIL
- x CHAIN-LINK FENCE
- PAINTED TRAFFIC LINES
- OVERHEAD WIRES
- GUARD RAIL
- ⊙ DRAIN MANHOLE
- ⊙ SEWER MANHOLE
- ⊙ CATCH BASIN
- ⊙ FIRE HYDRANT
- ⊙ WATER GATE
- ⊙ GAS VALVE
- GUY WIRE
- ⊙ LIGHT POLE
- ⊙ UTILITY POLE
- 24" ● TREE
- CBDH MONUMENT
- ⊙ BENCHMARK
- ⊙ SIGN
- ⊙ CONCRETE
- WF#A-14 ● BORDERING VEGETATIVE WETLAND FLAG
- ⊙ DH DRILL HOLE OR IRON ROD
- STONE OR CONC. BOUND
- TRAVERSE POINT



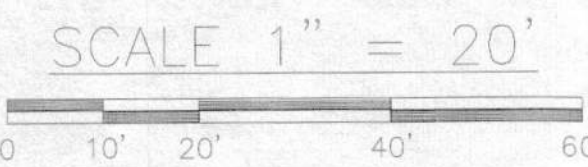
0 OLD SUDBURY ROAD  
N/F  
TOWN OF SUDBURY  
BK. 11595 PG. 496  
MAP 10 LOT 20

1  
N: 2963281.930'  
E: 681399.610'  
EL: 232.602'  
MAGNAIL

BENCHMARK: MAGNAIL IN UTILITY POLE  
EL=233.23'

218 OLD SUDBURY ROAD  
N/F  
RICHARD P & CANDACE MANDEL  
BK. 13096 PG. 105  
MAP 10 LOT 19

71 BREWSTER ROAD  
N/F  
AGUSTINA SUMITO TRUST  
BK. 47283 PG. 413  
MAP 10 LOT 9



**CHAPPELL ENGINEERING ASSOCIATES, LLC**  
Civil Structural Land Surveying  
201 BOSTON POST ROAD WEST-SUITE 101  
MARLBOROUGH, MA 01752  
TEL (508) 481-7400  
WWW.CHAPPELLENGINEERING.COM

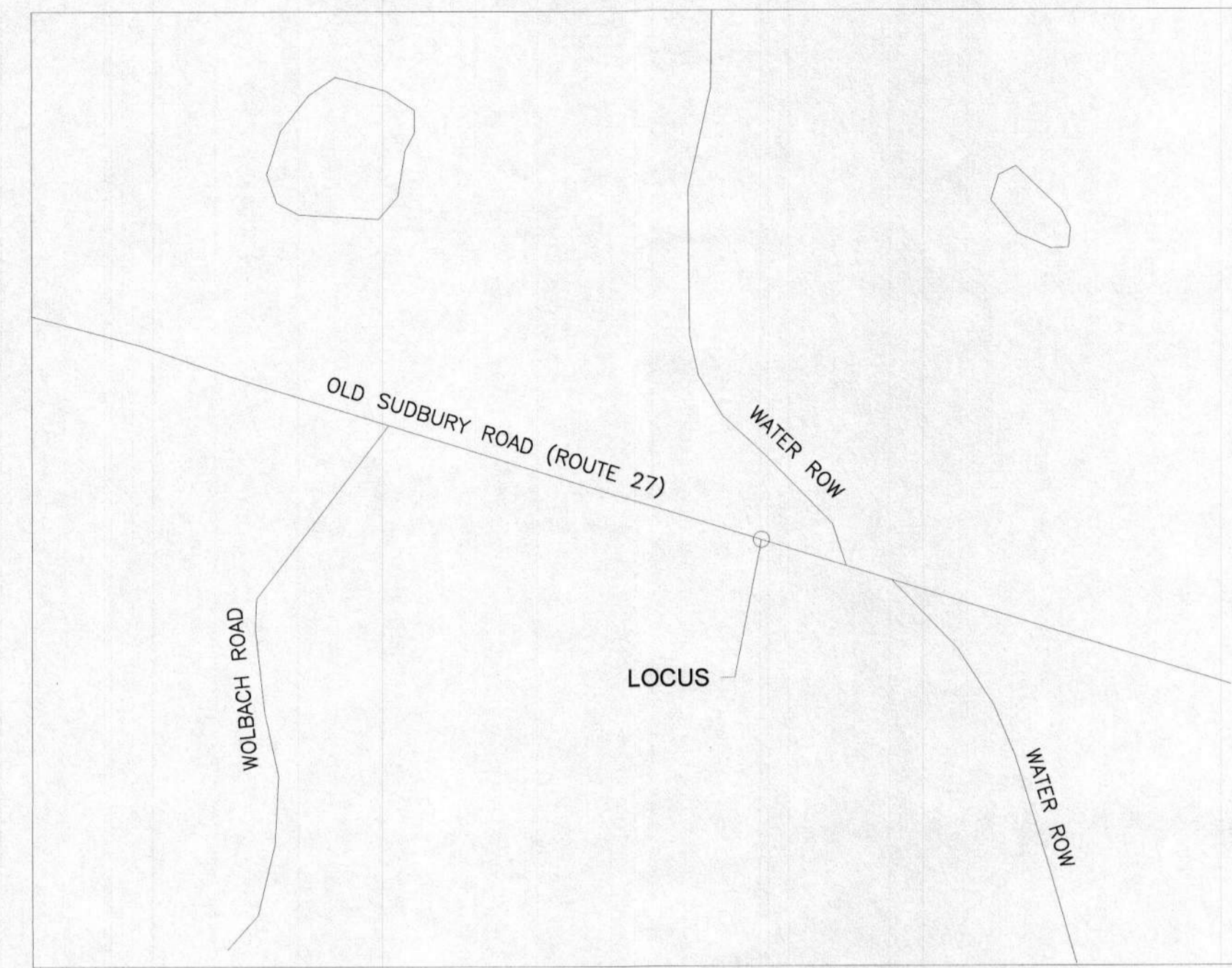
REVISIONS		
REV. #	DATE	DESCRIPTION
1		
0		

PROJECT NO.	DRAWN BY:	MLT	SCALE:
XXXXX	CHECKED BY:	TPC	1" = 20'

EXISTING CONDITIONS SURVEY

CULVERT #110  
OLD SUDBURY ROAD,  
SUDBURY, MASSACHUSETTS

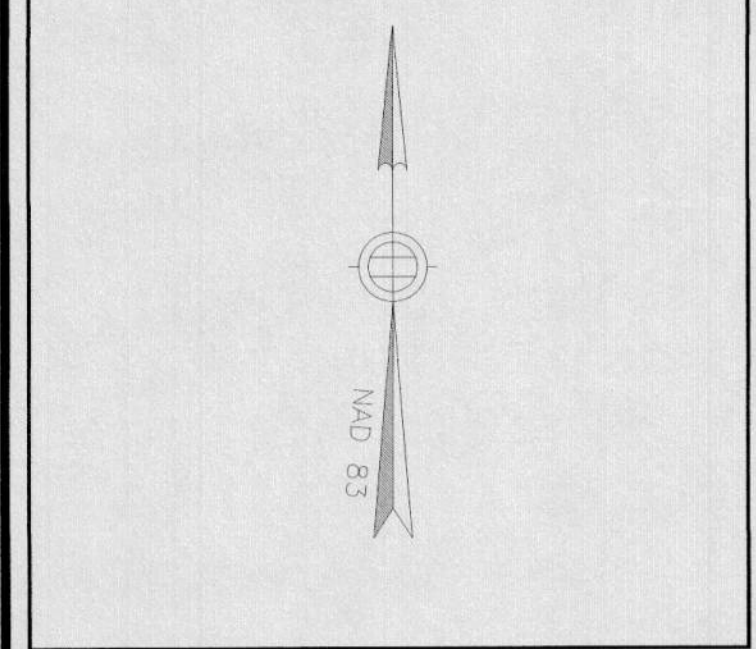
JANUARY 19, 2021  
SHEET 1 OF 1



LOCUS MAP

GENERAL NOTES:

1. THE EXISTING CONDITIONS INFORMATION SHOWN HEREON IS THE RESULT OF AN ON-THE-GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING ASSOCIATES, LLC., BETWEEN OCTOBER 26TH - 30TH, 2020.
2. ALL DEED/PLAN REFERENCES ARE TO MIDDLESEX REGISTRY OF DEEDS SOUTHERN DISTRICT.
3. THE ENTIRE PROJECT AREA IS LOCATED IN FLOOD ZONE "AE" AS SHOWN ON FLOOD INSURANCE RATE MAP FOR THE TOWN OF SUDBURY, COMMUNITY PANEL NUMBER 25017C 0369F, EFFECTIVE DATE JULY 7, 2014.
4. PROPERTY DOES NOT RESIDE IN A WATER RESOURCE PROTECTION DISTRICT.
5. ZONING DISTRICT RESIDENCE C.
6. LOCATION OF SUBSURFACE UTILITIES SHOWN HEREON ARE APPROXIMATE AND ADDITIONAL UTILITIES MAY EXIST THAT ARE NOT SHOWN ON THIS PLAN. LOCATIONS ARE COMPILED FROM UTILITY PLANS OF RECORD AND DIG-SAFE FIELD MARKINGS. RIM AND INVERT INFORMATION HAS BEEN FIELD VERIFIED WHERE POSSIBLE. THIS INFORMATION IS NOT TO BE USED FOR CONSTRUCTION. PRIOR TO ANY CONSTRUCTION, CONTACT DIG-SAFE (1-800-344-7233) TO FIELD VERIFY LOCATION OF ALL UTILITIES.
7. PLAN REFERENCES: 436-35 OF 1949
8. BORDERING WETLAND LOCATION FLAGS SET BY ECOTEC, LLC. ON OCTOBER 15TH, 2020.
9. HORIZONTAL DATUM: NAD 83 MASS STATE PLANE MAINLAND ZONE HORIZONTAL CONTROL SYSTEM.
10. VERTICAL DATUM: NAVD 88 VERTICAL CONTROL SYSTEM.



LEGEND

- STREET R.O.W. LINE
- - - ABUTTER PROPERTY LINE
- - - EASEMENT LINES
- ==== EDGE OF PAVEMENT
- ==== VGC VERT. GRAN. CURB
- o IRON HAND RAIL
- x CHAIN-LINK FENCE
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- ⊙ SEWER MANHOLE
- ⊙ CATCH BASIN
- ⊙ FIRE HYDRANT
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- ⊙ TRAVERSE POINT

**CHAPPELL ENGINEERING ASSOCIATES, LLC**  
 Civil Structural Land Surveying  
 201 BOSTON POST ROAD WEST-SUITE 101  
 MARLBOROUGH, MA 01752  
 TEL (508) 481-7400  
 WWW.CHAPPELLENGINEERING.COM

REVISIONS

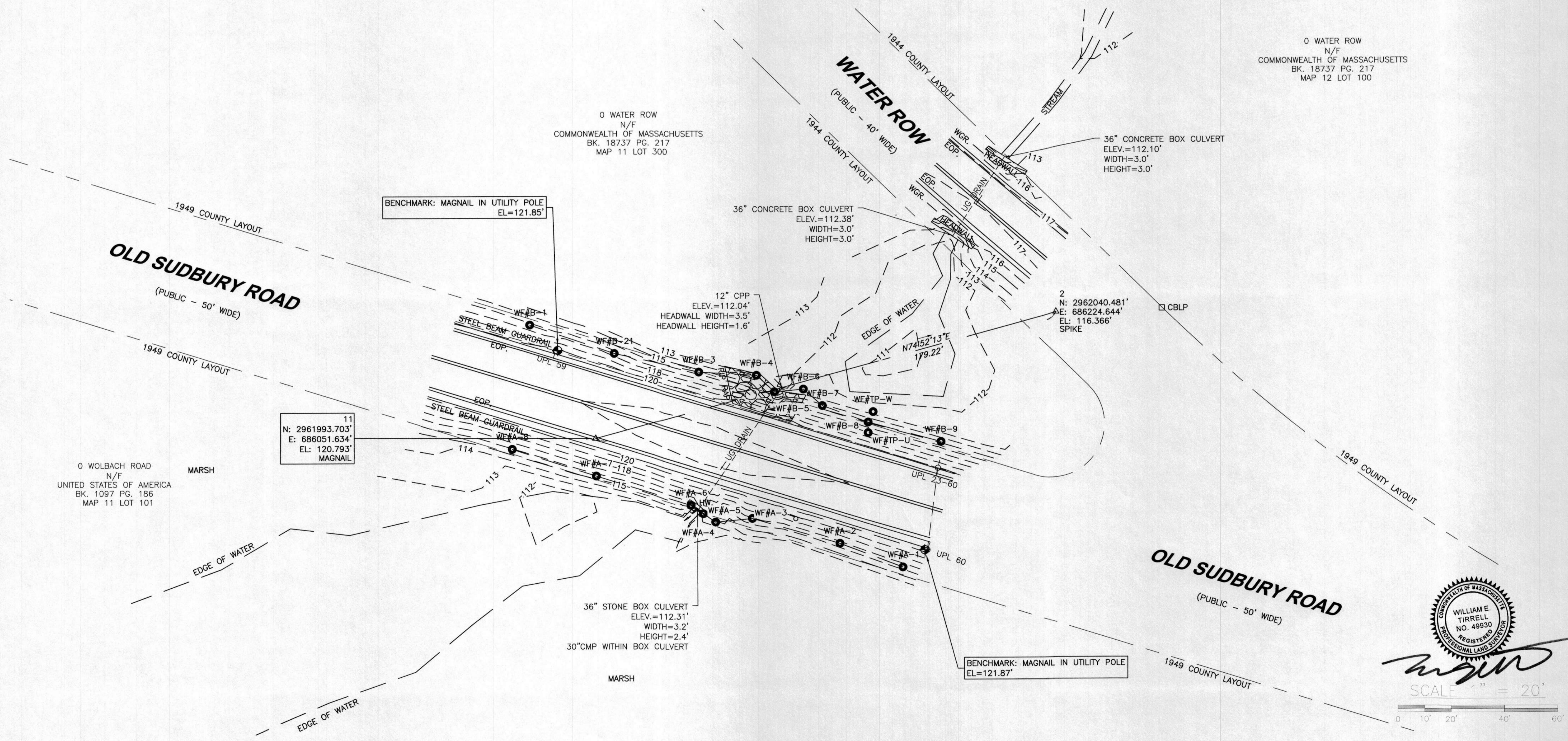
REV. #	DATE	DESCRIPTION
1		
0		

PROJECT NO. xxxxxx	DRAWN BY: MLT	SCALE: 1" = 20'
	CHECK'D BY: TPC	

EXISTING CONDITIONS SURVEY

CULVERT #149  
 OLD SUDBURY ROAD,  
 SUDBURY, MASSACHUSETTS

JANUARY 19, 2021  
 SHEET 1 OF 1



**ATTACHMENTS B1 AND B2 – WETLAND RESOURCE EVALUATION, CULVERT  
#110 & CULVERT #149**



**EcoTec, Inc.**  
**ENVIRONMENTAL CONSULTING SERVICES**  
102 Grove Street  
Worcester, MA 01605-2629  
508-752-9666 – Fax: 508-752-9494

November 9, 2020

Scott Salvucci, P.E.  
Woodard & Curran, Inc.  
980 Washington St., Suite 325  
Dedham, MA 02026

RE: Wetland Resource Evaluation, Culvert #110, Old Sudbury Road, Sudbury, MA

Dear Scott:

On November 4, 2020, EcoTec, Inc. inspected the above-referenced property for the presence of wetland resources as defined by: (1) the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, § 40; the “Act”) and its implementing regulations (310 CMR 10.00 *et seq.*; the “Regulations”); and (2) the U.S. Clean Water Act (i.e., Section 404 and 401 wetlands). Arthur Allen, CPSS, CWS conducted the inspection.

The subject site consists of the vicinity of an existing culvert equalizing flood flows under Old Sudbury Road. The upland portions of the site consist of a public roadway and vegetated side slopes. The wetland resources observed on the site are described below.

**Methodology**

The site was inspected, and areas suspected to qualify as wetland resources were identified. The boundary of Bordering Vegetated Wetlands was delineated in the field in accordance with the definition set forth in the regulations at 310 CMR 10.55(2)(c). Section 10.55(2)(c) states that “The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.” The methodology used to delineate Bordering Vegetated Wetlands is further described in: (1) the BVW Policy “*BVW: Bordering Vegetated Wetlands Delineation Criteria and Methodology*,” issued March 1, 1995; and (2) “*Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook*,” produced by the Massachusetts Department of Environmental Protection, dated March 1995. The plant taxonomy used in this report is based on the *National List of Plant Species that Occur in Wetlands: Massachusetts* (Fish and Wildlife Service, U.S. Department of the Interior, 1988). Federal wetlands were presumed to have boundaries conterminous with the delineated Bordering Vegetated Wetlands. One set of DEP Bordering Vegetated Wetland Delineation Field Data Forms completed for observation plots located in the wetlands and uplands near flag A-1

is attached. The table below provides the Flag Numbers, Flag Type, and Wetland Types and Locations for the delineated wetland resources.

Flag Numbers	Flag Type	Wetland Types and Locations
A-1 to A-9 (Test Plots at A-1)	Blue Flags	Boundary of Bordering Vegetated Wetlands located on the south side of Old Sudbury Road. Flag A-6 connects to equalization culvert.
B-1 to B-6	Blue Flags	Boundary of Bordering Vegetated Wetlands located on the north side of Old Sudbury Road. Flag B-3 connects to equalization culvert.

### Findings

Wetland A/B consists of a wooded swamp that is associated with an off-site, intermittent stream. Plant species observed include red maple (*Acer rubrum*) and American elm (*Ulmus americana*) trees and/or saplings; highbush blueberry (*Vaccinium corymbosum*), common winterberry (*Ilex verticillata*), arrow-wood (*Viburnum dentatum*), white-rod (*Viburnum cassinoides*), swamp rose (*Rosa palustris*), speckled alder (*Alnus rugosa*), maleberry (*Lyonia ligustrina*), glossy buckthorn (*Rhamnus frangula*), and American elderberry (*Sambucus canadensis*) shrubs; and sheep-laurel (*Kalmia angustifolia*), bristly blackberry (*Rubus hispidus*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), sensitive fern (*Onoclea sensibilis*), subarctic lady fern (*Athyrium filix-femina*), marsh fern (*Thelypteris thelypteroides*), Massachusetts fern (*Thelypteris simulata*), spinulose woodfern (*Dryopteris spinulosa*), skunk-cabbage (*Symplocarpus foetidus*), swamp Jack-in-the-pulpit (*Arisaema triphyllum*), spotted touch-me-not (*Impatiens capensis*) and sphagnum moss (*Sphagnum sp.*) ground cover. Evidence of wetland hydrology, including hydric soils, high groundwater, saturated soils, pore linings, evidence of flooding, and drainage patterns, was observed within the delineated wetland. This vegetated wetland borders an intermittent stream; accordingly, the vegetated wetlands would be regulated as Bordering Vegetated Wetlands under the Act. A 100-foot Buffer Zone extends horizontally outward from the edge of Bordering Vegetated Wetlands under the Act.

Bordering Land Subject to Flooding is an area that floods due to a rise in floodwaters from a bordering waterway or water body. Where flood studies have been completed, the boundary of Bordering Land Subject to Flooding is based upon flood profile data prepared by the National Flood Insurance Program. Section 10.57(2)(a)3. states that "The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm." The project engineer should evaluate the most recent National Flood Insurance Program flood profile data to confirm the absence of Bordering Land Subject to Flooding on the site. Bordering Land Subject to Flooding would occur in areas where the 100-year flood elevation is located outside of or upgradient of the delineated Bordering Vegetated Wetlands boundary. Bordering Land Subject to Flooding does not have a Buffer Zone under the Act.



The Massachusetts Rivers Protection Act amended the Act to establish an additional wetland resource area: Riverfront Area. Based upon a review of the current USGS Map (attached), there are no streams within 200-feet of the project site. Furthermore, based upon observations made during the site inspection, there are no unmapped streams located within 200 feet of the site. Accordingly, except as noted above, Riverfront Area would not occur on the site. Riverfront Area does not have a Buffer Zone under the Act, but may overlap other wetland resources and their Buffer Zones.

The Regulations require that no project may be permitted that will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures set forth at 310 CMR 10.59. Based upon a review of the *Massachusetts Natural Heritage Atlas*, 14<sup>th</sup> edition, Priority Habitats and Estimated Habitats from the NHESP Interactive Viewer, valid from August 1, 2017, and Certified Vernal Pools from MassGIS, there is no Estimated Habitat [for use with the Act and Regulations (310 CMR 10.00 *et seq.*)] and no Priority Habitat [for use with Massachusetts Endangered Species Act (M.G.L. Ch. 131A; "MESA") and MESA Regulations (321 CMR 10.00 *et seq.*)]. There are no Certified Vernal Pools on or in the immediate vicinity of the site. A copy of this map is attached.

The reader should be aware that the regulatory authority for determining wetland jurisdiction rests with local, state, and federal authorities. A brief description of my experience and qualifications is attached. If you have any questions, please feel free to contact me at any time.

Cordially,  
ECOTEC, INC.



Arthur Allen, CWS, CPSS  
Vice President

Attachments (5, 8 pages)

AA/NOI/Sudbury Old Sudbury 110 EcoTec Wet Report 1.12.2021



## EcoTec, Inc.

### ENVIRONMENTAL CONSULTING SERVICES

102 Grove Street  
Worcester, MA 01605-2629  
508-752-9666 / Fax: 508-752-9494

**Arthur Allen, CPSS, CWS, CESSWI**  
**Vice President**  
**Soil & Wetland Scientist**

Arthur Allen is the Vice President of EcoTec, Inc. and has been a senior environmental scientist there since 1995. His work with EcoTec has involved wetland delineation, wildlife habitat evaluation, environmental permitting (federal, state and local), environmental monitoring, expert testimony, peer reviews, contaminated site assessment and the description, mapping and interpretation of soils. His clients have included private landowners, developers, major corporations and regulatory agencies. Prior to joining EcoTec, Mr. Allen mapped and interpreted soils in Franklin County, MA for the U.S.D.A. Natural Resources Conservation Service (formerly Soil Conservation Service) and was a research soil scientist at Harvard University's Harvard Forest. Since 1994, Mr. Allen has assisted the Massachusetts Department of Environmental Protection and the Massachusetts Association of Conservation Commissions as an instructor in the interpretation of soils for wetland delineation and for the Title V Soil Evaluator program.

Mr. Allen has a civil service rating as a soil scientist, an undergraduate degree in Natural Resource Studies and a graduate certificate in Soil Studies. His work on the Franklin County soil survey involved interpretation of landscape-soil-water relationships, classifying soils and drainage, and determining use and limitation of the soil units that he delineated. As a soil scientist at the Harvard Forest, Mr. Allen was involved in identifying the legacies of historical land-use in modern soil and vegetation at a number of study sites across southern New England. He has a working knowledge of the chemical and physical properties of soil and water and how these properties interact with the plants that grow on a given site. While at Harvard Forest he authored and presented several papers describing his research results which were later published. In addition to his aforementioned experience, Mr. Allen was previously employed by the Trustees of Reservations as a land manager and by the Town of North Andover, MA as a conservation commission intern.

#### **Education:**

1993-Graduate Certificate in Soil Studies, University of New Hampshire  
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#### **Professional Affiliations:**

Certified Professional Soil Scientist (ARCPACS CPSS #22529)  
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Certified Erosion, Sediment & Stormwater Inspector (#965)  
Massachusetts Approved Soil Evaluator (#13764)  
Massachusetts Arborists Association-Certified Arborist (1982 – 1998)  
New England Hydric Soils Technical Committee member  
Massachusetts Association of Conservation Commissions member  
Society of Wetland Scientists member

#### **Refereed Publications:**

*Soil Science and Survey at Harvard Forest.* A.Allen. In: Soil Survey Horizons. Vol. 36, No. 4, 1995, pp. 133-142.  
*Controlling Site to Evaluate History: Vegetation Patterns of a New England Sand Plain.* G.Motzkin, D.Foster, A.Allen, J.Harrold, & R.Boone. In: Ecological Monographs 66(3), 1996, pp. 345-365.  
*Vegetation Patterns in Heterogeneous Landscapes: The Importance of History and Environment.* G.Motzkin, P.Wilson, D.R.Foster & A.Allen. In: Journal of Vegetation Science 10, 1999, pp. 903-920.

## DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [REDACTED]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (110), Sudbury

DEP File #

**Section I. Vegetation**

Number: TPU

Transect # A1

Date of Delin: 11/4/2020

A. Sample layer and plant species (Enter largest to smallest % cover by layer)		Percent Cover (or basal area)	Percent Dominance	Dominant Plant?	Wetland Indicator Category
Tree	Red Oak <i>Quercus rubra</i>	20	20.0	YES	FACU-
	Red Maple <i>Acer rubrum</i>	60	60.0	YES	FAC *
	White Pine <i>Pinus strobus</i>	20	20.0	YES	FACU
Sapling	White Pine <i>Pinus strobus</i>	20	100.0	YES	FACU
Shrub	White Pine <i>Pinus strobus</i>	10	20.0	YES	FACU
	Speckled Alder <i>Alnus rugosa</i>	15	30.0	YES	FACW+ *
	Highbush Blueberry <i>Vaccinium corymbosum</i>	15	30.0	YES	FACW- *
	Glossy Buckthorn <i>Rhamnus frangula</i>	10	20.0	YES	FAC *
Ground	Bracken Fern <i>Pteridium aquilinum</i>	20	100.0	YES	FACU
Vine					

**Vegetation Conclusions**

Number of dominant wetland indicator plants

4

Number of dominant non-wetland indicator plants

5

Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants?

NO

# DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [REDACTED]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (110), Sudbury DEP File #

**Section II. Indicators of Hydrology**

Number: TPU

Transect # A1

Date of Delin: 11/4/2020

**1. Soil Survey**

Is there a published soil survey for this site? [REDACTED]

title/date  
map number  
soil type mapped  
hydric soil inclusions

Are field observations consistent with soil survey? [REDACTED]

Remarks: [REDACTED]

**2. Soil Description**

Horizon	Depth (inches)	Matrix Color	Mottle Color
Litter	2	[REDACTED]	[REDACTED]
O	2-0	[REDACTED]	[REDACTED]
A	0-6	10YR 3/2	[REDACTED]
Bw	6-15	10YR 4/6	[REDACTED]

Remarks Fine Sandy Loams

**3. Other** [REDACTED]

**Conclusion: Is the soil hydric?** No

**Other Indicators of hydrology (check all that apply):**

- Site Inundated [REDACTED]
- Depth to free water in observation hole [REDACTED]
- Depth to soil saturation in observation hole [REDACTED]
- Water marks [REDACTED]
- Drift lines [REDACTED]
- Sediment Deposits [REDACTED]
- Drainage patterns in BVWs [REDACTED]
- Oxidized rhizospheres [REDACTED]
- Water stained leaves [REDACTED]
- Recorded data (stream, lake, or tidal gauge; aerial photo; other): [REDACTED]
- Other: [REDACTED]

**Vegetation and Hydrology Conclusion**

	Yes	No
Number of wetland indicator plants ≥ number of non-wetland indicator plants	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Wetland hydrology present:		
Hydric soil present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other indicators of hydrology present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample Location is in a BVW	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (110), Sudbury

DEP File #

**Section I. Vegetation**

Number: TPW

Transect # A1

Date of Delin: 11/4/2020

A. Sample layer and plant species (Enter largest to smallest % cover by layer)			Percent Cover (or basal area)	Percent Dominance	Dominant Plant?	Wetland Indicator Category
Tree	American Elm	Ulmus americana	10		10.0 YES	FACW- *
	Red Maple	Acer rubrum	90		90.0 YES	FAC *
Sapling	American Elm	Ulmus americana	10		50.0 YES	FACW- *
	Red Oak	Quercus rubra	10		50.0 YES	FACU-
Shrub	Winterberry	Ilex verticillata	20		33.3 YES	FACW+ *
	Maleberry	Lyonia ligustrina	30		50.0 YES	FACW *
	Highbush Blueberry	Vaccinium corymbosum	10		16.7 NO	FACW- *
Ground	Sheep Laurel	Kalmia angustifolia	10		100.0 YES	FAC *
Vine						

**Vegetation Conclusions**

Number of dominant wetland indicator plants

**6**

Number of dominant non-wetland indicator plants

**1**

Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants?

YES

# DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [REDACTED]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (110), Sudbury DEP File #

**Section II. Indicators of Hydrology**

Number: TPW

Transect # A1

Date of Delin: 11/4/2020

**1. Soil Survey**

Is there a published soil survey for this site? [REDACTED]

title/date [REDACTED]  
 map number [REDACTED]  
 soil type mapped [REDACTED]  
 hydric soil inclusions [REDACTED]

Are field observations consistent with soil survey? [REDACTED]

Remarks: [REDACTED]

**2. Soil Description**

Horizon	Depth (inches)	Matrix Color	Mottle Color
Litter	2	[REDACTED]	[REDACTED]
O	1-0	[REDACTED]	[REDACTED]
A	0-8	10YR 2/1	[REDACTED]
Bs	8-16	7.5YR 4/4	10% 5YR 4/6

Remarks Fine Sandy Loams

**3. Other** [REDACTED]

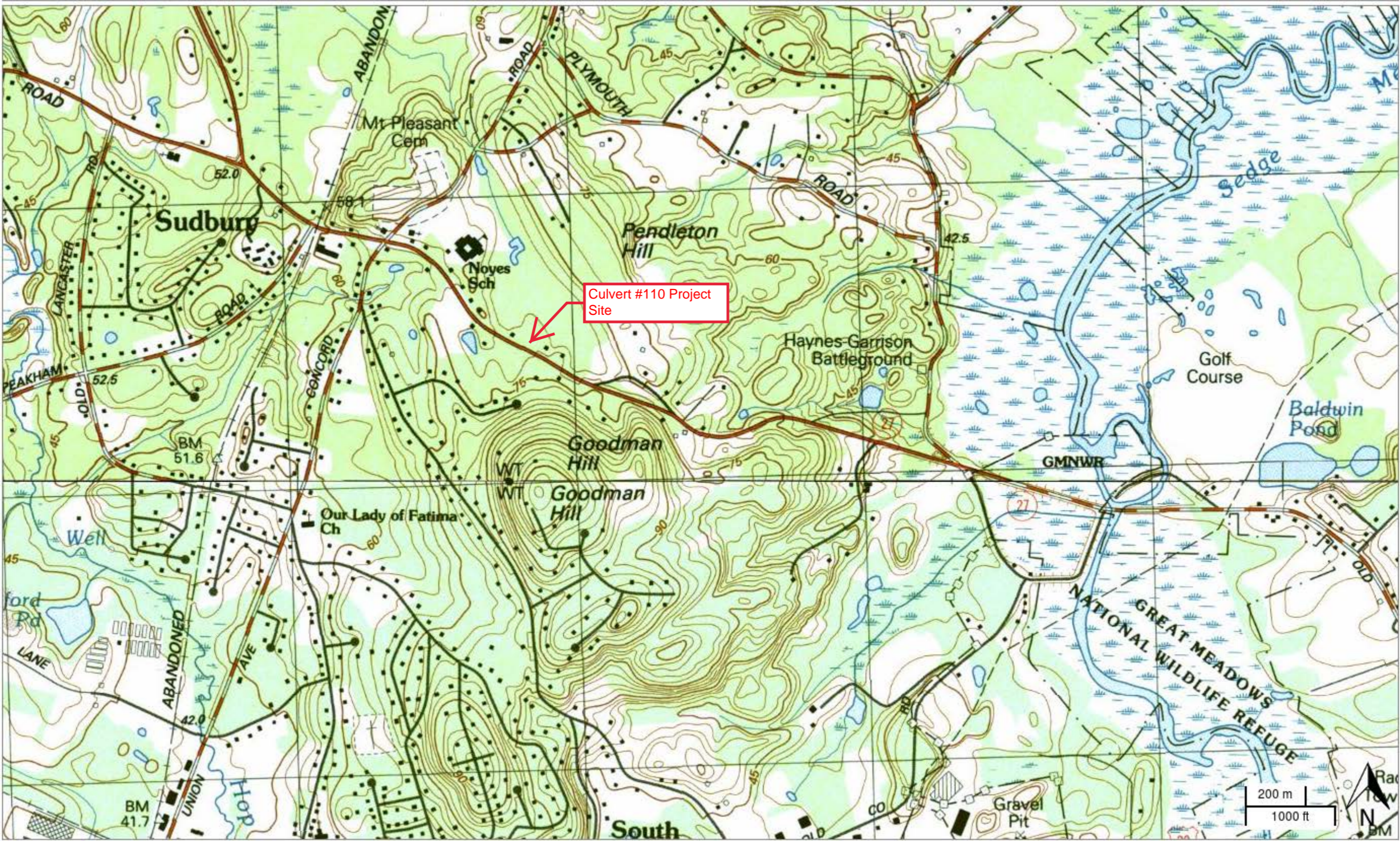
**Conclusion: Is the soil hydric?** Yes

**Other Indicators of hydrology (check all that apply):**

- Site Inundated [REDACTED]
- Depth to free water in observation hole [REDACTED]
- Depth to soil saturation in observation hole [REDACTED]
- Water marks [REDACTED]
- Drift lines [REDACTED]
- Sediment Deposits [REDACTED]
- Drainage patterns in BVWs [REDACTED]
- Oxidized rhizospheres [REDACTED]
- Water stained leaves [REDACTED]
- Recorded data (stream, lake, or tidal gauge; aerial photo; other): [REDACTED]
- Other: [REDACTED]

**Vegetation and Hydrology Conclusion**

	Yes	No
Number of wetland indicator plants ≥ number of non-wetland indicator plants	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetland hydrology present:		
Hydric soil present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Other indicators of hydrology present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample Location is in a BVW	<input checked="" type="checkbox"/>	<input type="checkbox"/>



# National Flood Hazard Layer FIRMMette



71°24'44"W 42°23'N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>

OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
		Area of Undetermined Flood Hazard <i>Zone D</i>

GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall

OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature

MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **11/3/2020 at 5:21 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

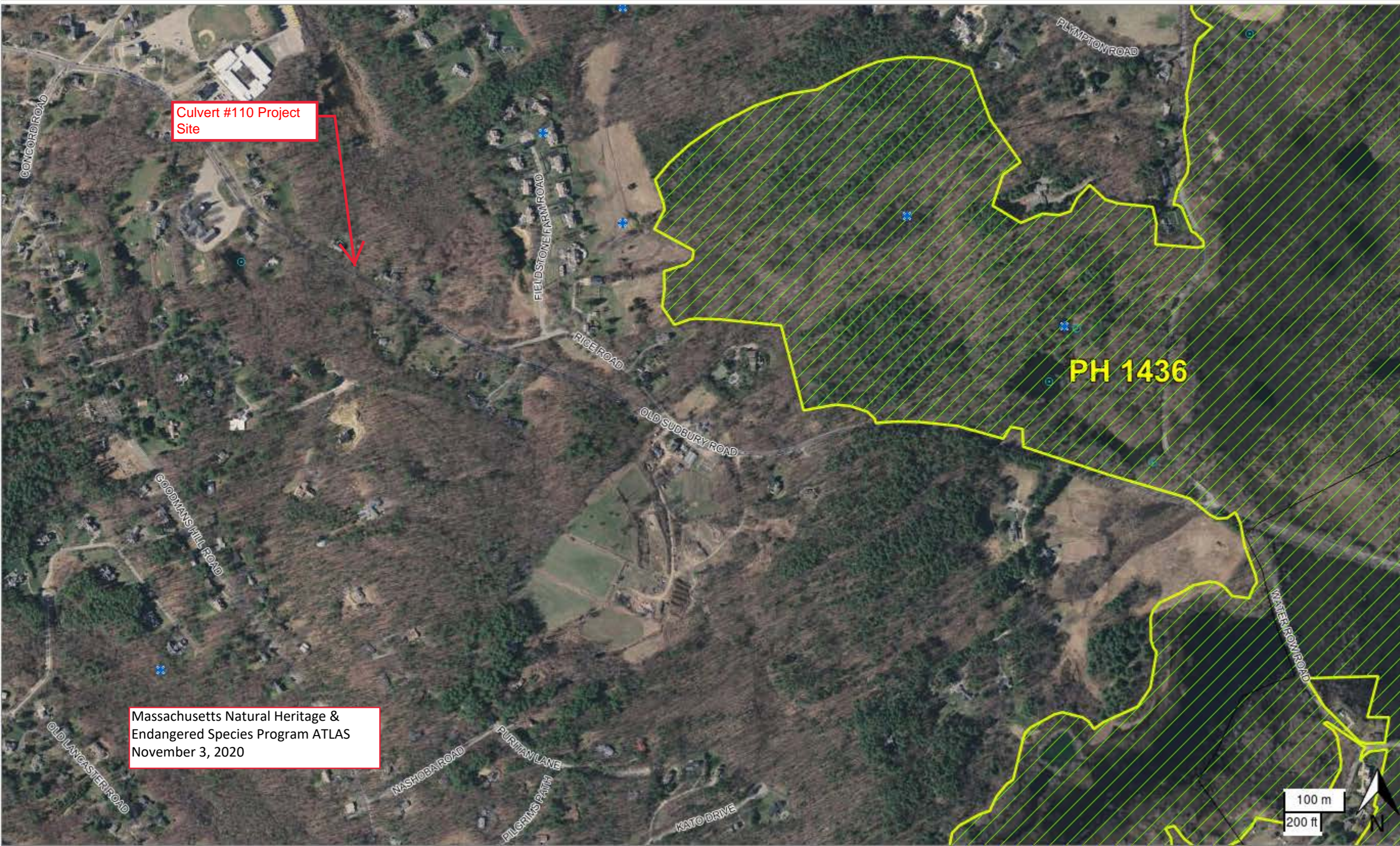
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

USGS The National Map: Orthoimagery. Data refreshed October, 2020.



71°24'6"W 42°22'34"N





Culvert #110 Project Site

PH 1436

Massachusetts Natural Heritage & Endangered Species Program ATLAS  
November 3, 2020

- Potential Vernal Pools
- NHESP Certified Vernal Pools
- MassDOT Roads Street Names
- Major MassDOT Routes
  - Interstate Highways
  - US Roads
  - State
- Massachusetts Towns
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- 2013-2014 Color Orthos (USGS)
- Orthos 2019
- 2019 Color Orthos (USGS)

100 m  
200 ft



**EcoTec, Inc.**  
**ENVIRONMENTAL CONSULTING SERVICES**  
102 Grove Street  
Worcester, MA 01605-2629  
508-752-9666 – Fax: 508-752-9494

November 5, 2020

Scott Salvucci, P.E.  
Woodard & Curran, Inc.  
980 Washington St., Suite 325  
Dedham, MA 02026

RE: Wetland Resource Evaluation, Culvert 149 Old Sudbury Road, Sudbury, MA

Dear Scott:

On November 4, 2020, EcoTec, Inc. inspected the above-referenced property for the presence of wetland resources as defined by: (1) the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, § 40; the “Act”) and its implementing regulations (310 CMR 10.00 *et seq.*; the “Regulations”); and (2) the U.S. Clean Water Act (i.e., Section 404 and 401 wetlands). Arthur Allen, CPSS, CWS conducted the inspection.

The subject site consists of the vicinity of an existing culvert equalizing flood flows under Old Sudbury Road. The upland portions of the site consist of a public roadway and vegetated side slopes. The wetland resources observed on the site are described below.

**Methodology**

The site was inspected, and areas suspected to qualify as wetland resources were identified. The boundary of Bordering Vegetated Wetlands was delineated in the field in accordance with the definition set forth in the regulations at 310 CMR 10.55(2)(c). Section 10.55(2)(c) states that “The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.” The methodology used to delineate Bordering Vegetated Wetlands is further described in: (1) the BVW Policy “*BVW: Bordering Vegetated Wetlands Delineation Criteria and Methodology*,” issued March 1, 1995; and (2) “*Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook*,” produced by the Massachusetts Department of Environmental Protection, dated March 1995. The plant taxonomy used in this report is based on the *National List of Plant Species that Occur in Wetlands: Massachusetts* (Fish and Wildlife Service, U.S. Department of the Interior, 1988). Federal wetlands were presumed to have boundaries conterminous with the delineated Bordering Vegetated Wetlands. One set of DEP Bordering Vegetated Wetland Delineation Field Data Forms completed for observation plots located in the wetlands and uplands near flag B-8

is attached. The table below provides the Flag Numbers, Flag Type, and Wetland Types and Locations for the delineated wetland resources.

Flag Numbers	Flag Type	Wetland Types and Locations
A-1 to A-8	Blue Flags	Boundary of Bordering Vegetated Wetlands located on the south side of Old Sudbury Road. Flags A-5 & A-6 connect to equalization culvert.
B-1 to B-9 (Test Plots at B-8)	Blue Flags	Boundary of Bordering Vegetated Wetlands located on the north side of Old Sudbury Road. Flags B-5 & B-6 connect to equalization culvert.

### Findings

Wetland A/B consists of shrub swamp that is associated with the floodplain of the Sudbury River. Plant species observed include red maple (*Acer rubrum*) and swamp white oak (*Quercus bicolor*) trees and/or saplings; buttonbush (*Cephalanthus occidentalis*), highbush blueberry (*Vaccinium corymbosum*), common winterberry (*Ilex verticillata*), arrow-wood (*Viburnum dentatum*), withe-rod (*Viburnum cassinoides*), swamp rose (*Rosa palustris*), speckled alder (*Alnus rugosa*), maleberry (*Lyonia ligustrina*), glossy buckthorn (*Rhamnus frangula*), and American elderberry (*Sambucus canadensis*) shrubs; and sheep-laurel (*Kalmia angustifolia*), bristly blackberry (*Rubus hispidus*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), sensitive fern (*Onoclea sensibilis*), subarctic lady fern (*Athyrium filix-femina*), marsh fern (*Thelypteris thelypteroides*), Massachusetts fern (*Thelypteris simulata*), spinulose woodfern (*Dryopteris spinulosa*), skunk-cabbage (*Symplocarpus foetidus*), swamp Jack-in-the-pulpit (*Arisaema triphyllum*), spotted touch-me-not (*Impatiens capensis*) and sphagnum moss (*Sphagnum sp.*) ground cover. Evidence of wetland hydrology, including hydric soils, high groundwater, saturated soils, pore linings, evidence of flooding, and drainage patterns, was observed within the delineated wetland. This vegetated wetland borders a perennial stream floodplain; accordingly, the vegetated wetlands would be regulated as Bordering Vegetated Wetlands under the Act. A 100-foot Buffer Zone extends horizontally outward from the edge of Bordering Vegetated Wetlands under the Act.

Bordering Land Subject to Flooding is an area that floods due to a rise in floodwaters from a bordering waterway or water body. Where flood studies have been completed, the boundary of Bordering Land Subject to Flooding is based upon flood profile data prepared by the National Flood Insurance Program. Section 10.57(2)(a)3. states that “The boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm.” The project engineer should evaluate the most recent National Flood Insurance Program flood profile data to confirm the extent and elevation of Bordering Land Subject to Flooding on the site. Bordering Land Subject to Flooding would occur in areas where the 100-year flood elevation is located outside of or upgradient of the delineated Bordering Vegetated Wetlands boundary. Bordering Land Subject to Flooding does not have a Buffer Zone under the Act.

The Massachusetts Rivers Protection Act amended the Act to establish an additional wetland resource area: Riverfront Area. Based upon a review of the current USGS Map (attached), there are no streams within 200-feet of the project site. Furthermore, based upon observations made during the site inspection, there are no unmapped streams located within 200 feet of the site. Accordingly, except as noted above, Riverfront Area would not occur on the site. Riverfront Area does not have a Buffer Zone under the Act, but may overlap other wetland resources and their Buffer Zones.

The Regulations require that no project may be permitted that will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures set forth at 310 CMR 10.59. Based upon a review of the *Massachusetts Natural Heritage Atlas*, 14<sup>th</sup> edition, Priority Habitats and Estimated Habitats from the NHESP Interactive Viewer, valid from August 1, 2017, and Certified Vernal Pools from MassGIS, there is Estimated Habitat [for use with the Act and Regulations (310 CMR 10.00 *et seq.*)] and Priority Habitat [for use with Massachusetts Endangered Species Act (M.G.L. Ch. 131A; "MESA") and MESA Regulations (321 CMR 10.00 *et seq.*)]. The habitat area is labeled as PH 1436. There are no Certified Vernal Pools on or in the immediate vicinity of the site. A copy of this map is attached.

The reader should be aware that the regulatory authority for determining wetland jurisdiction rests with local, state, and federal authorities. A brief description of my experience and qualifications is attached. If you have any questions, please feel free to contact me at any time.

Cordially,  
ECOTEC, INC.



Arthur Allen, CWS, CPSS  
Vice President

Attachments (5, 8 pages)

AA/NOI/Sudbury Old Sudbury 149 EcoTec Wet Report 1.7.2021



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New England Hydric Soils Technical Committee member  
Massachusetts Association of Conservation Commissions member  
Society of Wetland Scientists member

#### **Refereed Publications:**

*Soil Science and Survey at Harvard Forest.* A.Allen. In: Soil Survey Horizons. Vol. 36, No. 4, 1995, pp. 133-142.  
*Controlling Site to Evaluate History: Vegetation Patterns of a New England Sand Plain.* G.Motzkin, D.Foster, A.Allen, J.Harrold, & R.Boone. In: Ecological Monographs 66(3), 1996, pp. 345-365.  
*Vegetation Patterns in Heterogeneous Landscapes: The Importance of History and Environment.* G.Motzkin, P.Wilson, D.R.Foster & A.Allen. In: Journal of Vegetation Science 10, 1999, pp. 903-920.

## DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [Redacted]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (149), Sudbury

DEP File #

**Section I. Vegetation**

Number: TPU

Transect # B8

Date of Delin: 11/4/2020

A. Sample layer and plant species (Enter largest to smallest % cover by layer)			Percent Cover (or basal area)	Percent Dominance	Dominant Plant?	Wetland Indicator Category
Tree	none					
Sapling	American Elm	Ulmus americana	10		100.0 YES	FACW- *
Shrub	Red Maple	Acer rubrum	10		50.0 YES	FAC *
	Swamp White Oak	Quercus bicolor	10		50.0 YES	FACW *
Ground	Asiatic Dayflower	Commelina communis	20		28.6 YES	FAC-
	timothy gras	Phleum pretense	50		71.4 YES	FACU
Vine						

**Vegetation Conclusions**

Number of dominant wetland indicator plants

**3**

Number of dominant non-wetland indicator plants

**2**

Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants?

YES

# DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [redacted]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (149), Sudbury DEP File #

**Section II. Indicators of Hydrology**

Number: TPU

Transect # B8

Date of Delin: 11/4/2020

**1. Soil Survey**

Is there a published soil survey for this site? [redacted]

title/date [redacted]  
 map number [redacted]  
 soil type mapped [redacted]  
 hydric soil inclusions [redacted]

Are field observations consistent with soil survey? [redacted]

Remarks: [redacted]

**2. Soil Description**

Horizon	Depth (inches)	Matrix Color	Mottle Color
Litter	1	[redacted]	[redacted]
A	0-8	10YR 3/2	[redacted]
C	8-16	10YR 5/4	[redacted]

Remarks Gravelly loamy sands

**3. Other** [redacted]

**Conclusion: Is the soil hydric?** No

**Other Indicators of hydrology (check all that apply):**

- Site Inundated [redacted]
- Depth to free water in observation hole [redacted]
- Depth to soil saturation in observation hole [redacted]
- Water marks [redacted]
- Drift lines [redacted]
- Sediment Deposits [redacted]
- Drainage patterns in BVWs [redacted]
- Oxidized rhizospheres [redacted]
- Water stained leaves [redacted]
- Recorded data (stream, lake, or tidal gauge; aerial photo; other): [redacted]
- Other: [redacted]

**Vegetation and Hydrology Conclusion**

	Yes	No
Number of wetland indicator plants ≥ number of non-wetland indicator plants	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetland hydrology present:		
Hydric soil present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other indicators of hydrology present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample Location is in a BVW	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [REDACTED]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (149), Sudbury

DEP File #

**Section I. Vegetation**

Number: TPW

Transect # B8

Date of Delin: 11/4/2020

A. Sample layer and plant species (Enter largest to smallest % cover by layer)			Percent Cover (or basal area)	Percent Dominance	Dominant Plant?	Wetland Indicator Category
Tree	none					
Sapling	American Elm	Ulmus americana	10		100.0 YES	FACW- *
Shrub	Buttonbush	Cephalanthus occidentalis	30		50.0 YES	OBL *
	Silky Dogwood	Cornus amomum	30		50.0 YES	FACW *
Ground	Purple Loosestrife	Lythrum salicaria	20		100.0 YES	FACW+ *
Vine						

**Vegetation Conclusions**

Number of dominant wetland indicator plants

**4**

Number of dominant non-wetland indicator plants

**0**

Is the number of dominant wetland plants equal or greater than the number of dominant non-wetland plants?

YES



# DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Form

Applicant [redacted]

Prepared by: EcoTec, Inc

Project Location: Old Sudbury Rd. (149), Sudbury DEP File #

**Section II. Indicators of Hydrology**

Number: TPW

Transect # B8

Date of Delin: 11/4/2020

**1. Soil Survey**

Is there a published soil survey for this site? [redacted]

title/date  
map number  
soil type mapped  
hydric soil inclusions

Are field observations consistent with soil survey? [redacted]

Remarks: [redacted]

**2. Soil Description**

Horizon	Depth (inches)	Matrix Color	Mottle Color
Litter	1	[redacted]	[redacted]
Oa	0-10	10YR 2/1	[redacted]

Remarks Oa - Muck

**3. Other** [redacted]

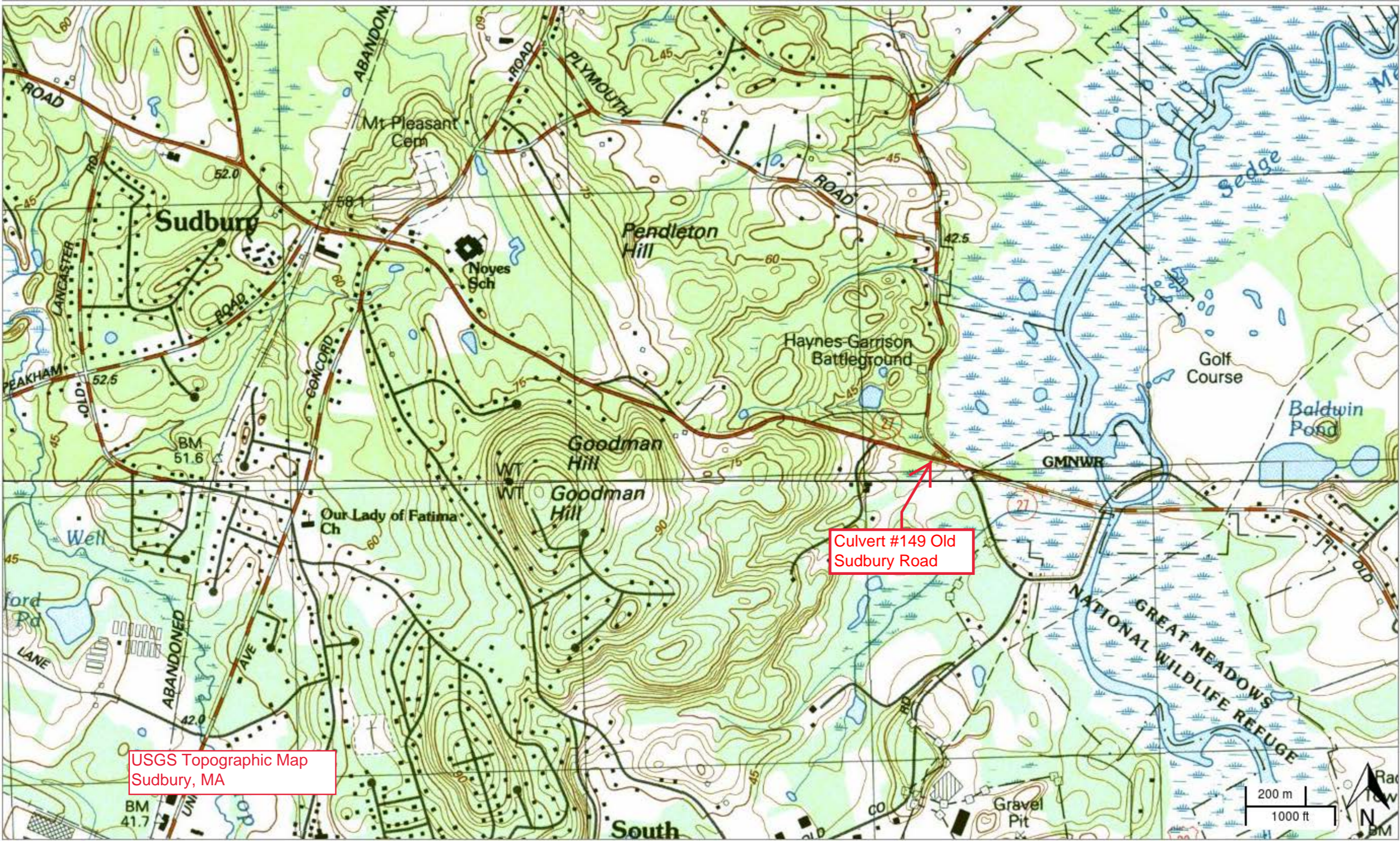
**Conclusion: Is the soil hydric?** Yes

**Other Indicators of hydrology (check all that apply):**

- Site Inundated 2"
- Depth to free water in observation hole
- Depth to soil saturation in observation hole
- Water marks
- Drift lines
- Sediment Deposits
- Drainage patterns in BVWs
- Oxidized rhizospheres
- Water stained leaves
- Recorded data (stream, lake, or tidal gauge; aerial photo; other):
- Other:

**Vegetation and Hydrology Conclusion**

	Yes	No
Number of wetland indicator plants ≥ number of non-wetland indicator plants	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetland hydrology present:		
Hydric soil present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Other indicators of hydrology present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample Location is in a BVW	<input checked="" type="checkbox"/>	<input type="checkbox"/>



Culvert #149 Old  
Sudbury Road

USGS Topographic Map  
Sudbury, MA

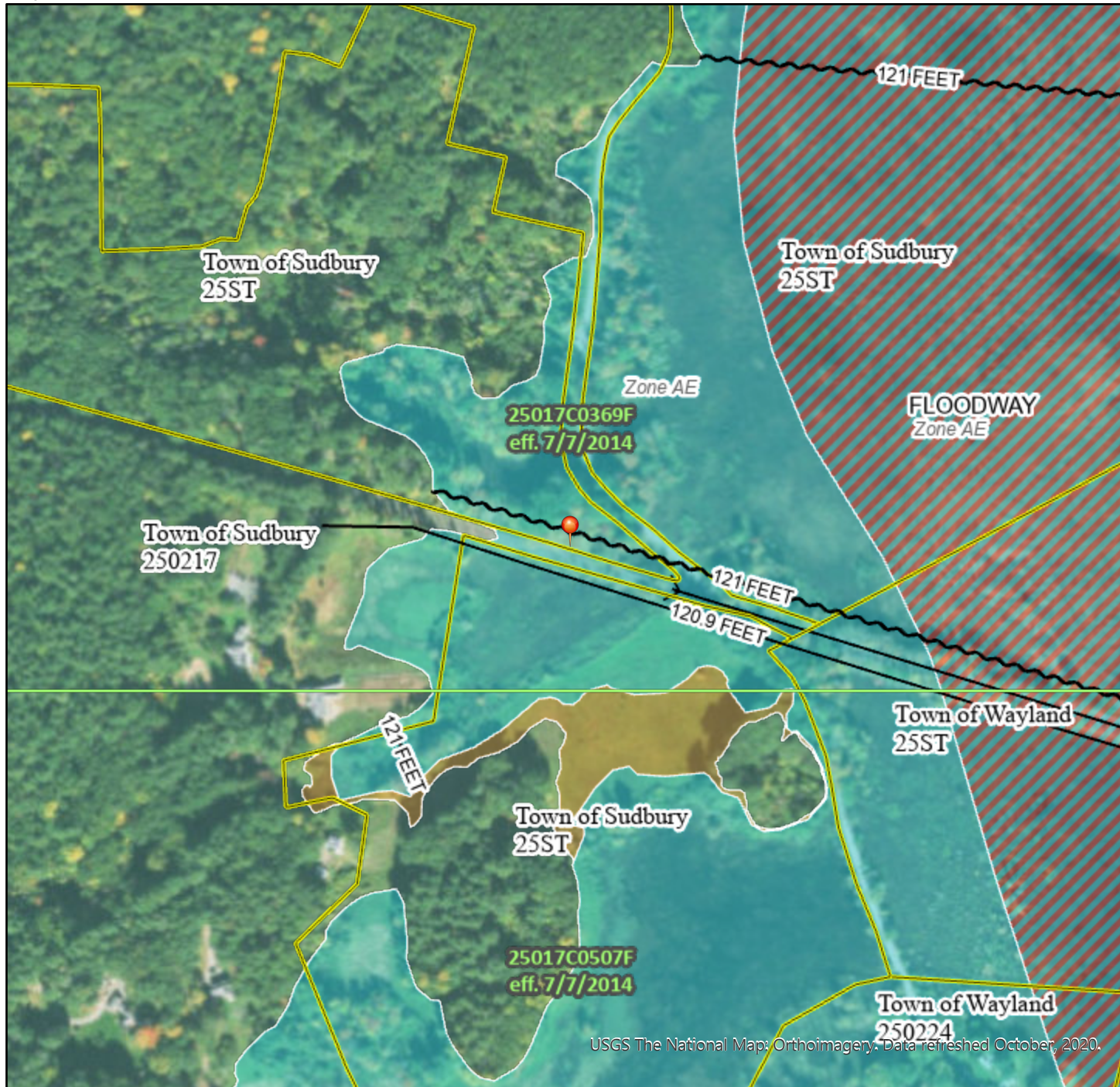
200 m  
1000 ft



# National Flood Hazard Layer FIRMette



71°23'41"W 42°22'47"N



71°23'4"W 42°22'20"N

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**

- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

**OTHER AREAS**

- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

**GENERAL STRUCTURES**

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**

- 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
- 17.5 Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**

- Digital Data Available
- No Digital Data Available
- Unmapped

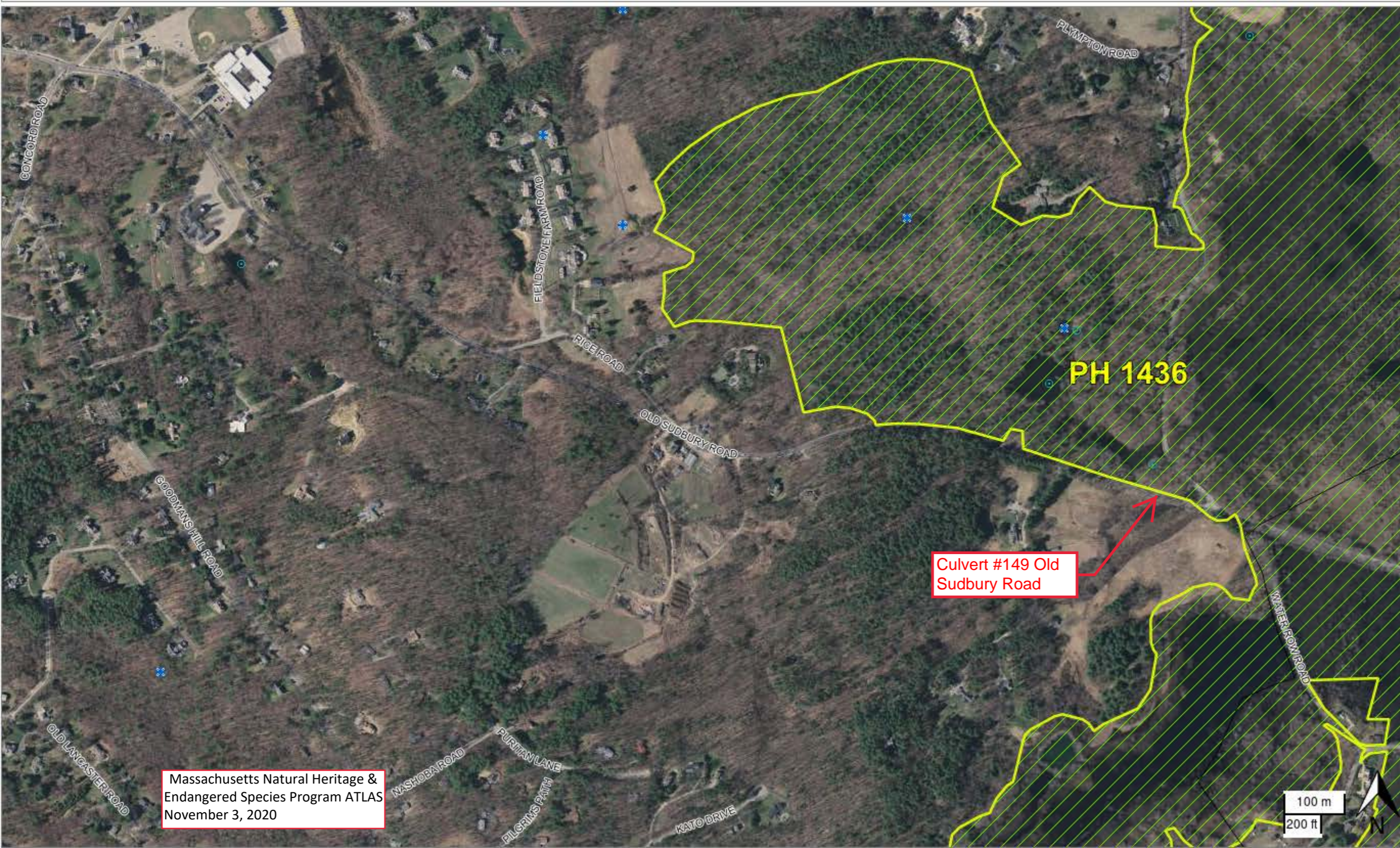
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/3/2020 at 5:13 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

USGS The National Map; Orthoimagery. Data refreshed October, 2020.



- Potential Vernal Pools
- NHESP Certified Vernal Pools
- MassDOT Roads Street Names
- Major MassDOT Routes
  - Interstate Highways
  - US Roads
  - State
- Massachusetts Towns
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- 2013-2014 Color Orthos (USGS)
- Orthos 2019  
2019 Color Orthos (USGS)

Massachusetts Natural Heritage & Endangered Species Program ATLAS  
November 3, 2020

**ATTACHMENT C: GEOTECHNICAL EVALUATION, CULVERT #110 & CULVERT #149**





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## MEMORANDUM

To: Mr. Scott Salvucci  
Woodard & Curran, Inc. (W&C)

From: Mirsad Alihodzic and Bruce W. Fairless, P.E.  
GZA GeoEnvironmental, Inc. (GZA)

Date: January 7, 2021

File No.: 04.0191167.00

Re: Geotechnical Engineering Memorandum  
Old Sudbury Road Culverts #110 and #149  
Sudbury, Massachusetts

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This memorandum presents the results of the subsurface exploration program performed at the above-referenced sites by GZA. The subsurface exploration program was completed in accordance with GZA's Proposal for Geotechnical Services dated October 7, 2020. GZA's objectives were to evaluate subsurface conditions and provide geotechnical recommendations for the proposed culvert replacements. The contents of this report are subject to the **Limitations** contained in **Appendix A** and the Terms and Conditions of our agreement. Note that elevations in this memorandum are in feet referenced to the North American Vertical Datum of 1988 (NAVD 88).

### BACKGROUND/SITE DESCRIPTION

Based on discussions with you, we understand that the existing Culvert #110, located near 230 Old Sudbury Road, and Culvert #149, located near the intersection of Old Sudbury Road and Water Row, need to be replaced because of their current undersized hydraulic capacities and the historic flooding conditions which occur at Culvert #149. See **Figure 1, Locus Plan** for relative culvert locations.

#### CULVERT #110

The existing Culvert #110 allows an unnamed stream to pass under the roadway and flow downstream to the south. The current culvert is approximately 43 feet long and spans the width of the roadway and slopes down from the north to the south.

Based on the survey plan provided to us by W&C on November 17, 2020, the typical water elevation of the stream upstream is about Elevation 228 feet, with the pipe invert on the north (inlet) side at about Elevation 228 and the south (outlet) side at about Elevation 227.8 feet. Based on a review of the plans provided and our visual observations in the field, an approximately 2-foot-wide, 6-foot-long, 2-foot-tall stacked stone headwall with an 8-inch-diameter drain opening (drain pipe was not observed) located at the inlet side of the culvert, while at the outlet side the culvert is incorporated into an approximately 2-foot-wide, 5-foot-long, 2-foot-tall stacked stone headwall, with a 6-inch drain opening (drain pipe was not observed).



The 8-inch-diameter inlet opening and stone stacked headwall at the upstream (north) side of the culvert can be seen on **Photograph 1** below, while the 6-inch-diameter outlet opening and stone stacked headwall at the downstream (south) is shown in **Photograph 2** below.

The roadway at this culvert area currently slopes from the northwest to the southeast with stone walls on each side of the road. Based on the plans and information provided by W&C, it is our understating that multiple utilities are present under Old Sudbury Road in the area of Culvert #110, including an 8-inch-diameter water main on the south side of the roadway and a 2-inch-diameter gas main on the north side of the roadway. An overhead utility is also present on the north side of the roadway.



Photograph 1 – Stone headwall Culvert # 110 inlet



Photograph 2 – Stone headwall Culvert #110 outlet

At this time, the proposed culvert replacement being considered for Culvert #110 is a single 18-inch-diameter Reinforced Concrete Pipe (RCP) culvert at approximately the same elevation as the existing culvert, or a 30-inch-diameter RCP culvert that would be embedded approximately 1 foot. The new culvert would be in the same approximate alignment as the existing culvert. The existing stacked stone headwalls would be rebuilt on both sides.

#### CULVERT #149

The existing Culvert #149, located near the intersection of Old Sudbury Road and Water Row, connects the wetlands of the Bay Circuit Trail by allowing an unnamed stream to pass under the roadway and flow downstream to the north towards the Sudbury River. The current culvert, which is approximately 56 feet long, spans the width of the roadway and slopes down from the south to the north. Based on information provided by W&C, it is our understanding that flooding occurs in this area due to the fluctuating levels of the Sudbury River which is located approximately 1,500 feet to the northeast.

Based on the survey plan provided to us by W&C on November 17, 2020, the typical water elevation of the stream/wetland area upstream is about Elevation 113 feet, with the pipe invert on the south (inlet) side at about Elevation 112.3 and the north (outlet) side at about Elevation 112 feet. Based on our review of the plans provided and our visual observations in the field, a 2-foot-wide, 6-foot-long, 3-foot-tall stone headwall with an approximately 3-foot-wide stone box culvert opening is located at the inlet side of the culvert, while the outlet side of the culvert is incorporated into an approximately 2-foot-wide, 12-foot-long, 2-foot-tall stacked stone headwall, with a 6-inch corrugated plastic pipe at the outlet side of the culvert which discharges into the wetland area at the north side of the road. The 3-foot-wide stone box culvert opening with a metal grate screen grate at



the upstream side (south) of the culvert can be seen on **Photograph 3** below, while the 6-inch-diameter storm drain pipe outlet opening with the headwall at the downstream side (north) of the culvert to the east is shown in **Photograph 4** below.

The roadway in this area currently slopes from the west to the east with steel beam guard rail on each side of the road. An overhead utility is present on the north side of the roadway and based on the plans and information provided by the Town of Sudbury and W&C, underground utilities are not present in this section of the Old Sudbury Road.



Photograph 3 – Stone headwall Culvert # 149 inlet



Photograph 4 – Stacked stone headwall Culvert #149 outlet

Based on our communications with you, we understand that the proposed culvert replacement being considered for Culvert #149 is a single 5-foot-wide, 7-foot-tall, 4-sided concrete box culvert with a 5-foot opening and 2-foot embedment and would be installed at approximately elevation 109, and in the same approximate alignment as the existing culvert. The stacked stone walls would be replaced with block stone headwalls on both the inlet and outlet sides.

## SUBSURFACE EXPLORATIONS

GZA performed a subsurface exploration program to evaluate subsurface conditions in the vicinity of the proposed culverts. New England Boring Contractors of Derry, New Hampshire coordinated utility clearance and drilled test borings B-1 and B-2 on November 17, 2020, and test boring B-3 on December 11, 2020. Boring B-1 was drilled in the roadway to the northwest of the existing Culvert #149 and extended to a depth of about 31 feet below ground surface (bgs). Boring B-2 was drilled in the roadway to the southeast of the existing Culvert # 149 and extended to a depth of about 25 feet bgs. Boring B-3 was drilled in the roadway to the northwest of the existing Culvert #110 to a depth of about 15 feet bgs. GZA field personnel located the test borings by tape measurements from prominent site features. The approximate locations of the test borings are shown on **Figure 2 – Exploration Location Plan at Culvert #149** and **Figure 3 – Exploration Location Plan at Culvert #110**.

Borings B-1 and B-2 were drilled using a truck-mounted drill rig with 4-inch-inside-diameter (ID), flush-joint casing and drive-and-wash drilling methods. Standard Penetration Testing and split spoon sampling were performed generally at 5-foot intervals.





Boring B-3 was drilled using a truck-mounted drill rig with 2.25-inch-ID, hollow stem augers. Standard Penetration Testing and split spoon sampling were performed continuously for the first 10 feet and then at 5-foot intervals thereafter.

Samples were classified in accordance with the Modified Burmister System. The test borings were backfilled with drill cuttings upon the completion of the drilling and repaired at the surface with asphalt cold-patch. GZA field personnel monitored the drilling and prepared the test boring logs which are included in **Appendix B**.

**GEOTECHNICAL LABORATORY TESTING**

Four soil samples obtained from test borings were submitted to GZA’s geotechnical laboratory subcontractor, Thielsch Engineering, for grain size distribution analyses and organic content. Laboratory test results for these samples are attached as **Appendix C** and are summarized in the table below.

Test Boring No.	Sample ID	Depth Below Grade (ft)	Stratum	Soil Description	Test Performed
B-1	S-2	4-6	Fill	Brown, fine to coarse SAND, some Clayey Silt, little fine Gravel.	Index (Gradation, Moisture)
B-1	S-4	14-16	Sand	Gray, fine SAND, some Silt	Index (Gradation, Moisture)
B-2	S-3B	9-11	Peat	Black, fine grained PEAT	Organic Content, Moisture
B-2	S-5	19-21	Sand	Brown, fine SAND, some Silt.	Index (Gradation, Moisture)

**GENERALIZED SUBSURFACE CONDITIONS**

Based on the completed test borings, subsurface conditions at the site consisted of very loose to very dense sand fill over natural peat over sand, with the soils encountered generally becoming denser with depth. Descriptions of the geologic units encountered are as follows, in general order of occurrence below ground surface at each culvert location.

GENERALIZED SUBSURFACE CONDITIONS NEAR CULVERT 110 (Boring B-3)		
Soil Unit	Approx. Depth Range (feet)	Generalized Description
Asphalt	0 to 0.8	10 inches of bituminous asphalt pavement was encountered at the ground surface in boring B-3.
Fill (Silty Sand)	0.8 to 4.0	Approximately 3 feet of Sand was encountered directly below the asphalt in boring B-3. The material generally consisted of very dense, gray, fine to coarse SAND, with up to about 35 percent Silt and up to 20 percent Gravel.
Peat	4 to 5	Approximately 1 foot of PEAT was encountered directly below the Fill in boring B-3. The PEAT consisted of dense, black fine-grained PEAT, with up to 35 percent sand.
Sand	9.5 to 28.5	Approximately 10 feet of Sand was encountered at a depth of 5 feet bgs in boring B-3; the Sand was not fully penetrated as the boring was terminated in the Sand. The Sand generally consisted of dense to very dense, gray, fine to coarse SAND, with up to 35 percent Silt and up to 20 percent of Gravel. Based on drilling observations, cobbles and/or boulders were encountered from approximately 5 to 15 feet bgs in boring B-3.



GENERALIZED SUBSURFACE CONDITIONS NEAR CULVERT 149 (Borings B-1 and B-2)		
Soil Unit	Approx. Depth Range (feet)	Generalized Description
Asphalt	0 to 0.8	8 to 10 inches of bituminous asphalt pavement was encountered at the ground surface in borings B-1 and B-2.
Fill (Silty Sand)	0.8 to 10.9	Approximately 10 and 11 feet of Fill was encountered directly below the asphalt in borings B-1 and B-2, respectively. The Fill generally consisted of medium dense to very dense, brown to gray, fine to coarse SAND, with up to about 35 percent Silt and/or Gravel.
Peat	1.9 to 2	Approximately 2 feet of PEAT was encountered directly below the Fill in borings B-1 and B-2. The PEAT consisted of medium dense, black fine-grained PEAT, with more than 50 percent fine sand/ and or silt. Laboratory testing indicated a PEAT moisture content of 110 percent and an organic content of 19.1 percent by weight.
Sand	12.5 to 18	Sand was encountered below the Peat at a depth of about 13 feet bgs in borings B-1 and B-2. The material generally consisted of loose to medium dense, gray or brown, fine SAND, with up to 35 percent Silt.

Detailed descriptions of the materials encountered are presented on the boring logs in **Appendix B**.

GROUNDWATER

Groundwater was measured in test borings B-1 and B-2 at approximately 9 and 8 feet bgs (corresponding to Elevations 111.6 and 112.4), respectively, as shown on the boring logs included in **Appendix B**. Groundwater depths and elevations are approximate representations of the hydrostatic groundwater level, as the drive-and-wash method of drilling introduces drill water to stabilize the borehole and remove drill spoils. Therefore, the groundwater level observed in the test borings B-1 and B-2 may not represent stabilized groundwater levels. The stream/wetland level at the time the borings were completed in this area was at approximately Elevation ±112.

Groundwater was measured in test boring B-3 at approximately 7.4 feet bgs (corresponding to Elevation 224.6) as shown on the boring logs included in **Appendix B**. This depth and elevation are an approximate groundwater level observed at the time the test boring was performed. Therefore, the groundwater level observed in the test boring B-3 may not represent stabilized groundwater levels. The stream level at the time the boring was completed in this area was at approximately Elevation ±228.

Water level readings were made in the borings at the time and under conditions stated on the logs. Note that fluctuations in the level of the groundwater will occur due to variations in season, rainfall, temperature, construction, and other factors occurring since the time measurements were made.

BEDROCK

Bedrock was not encountered beneath the sand in borings B-1 and B-2. Based on observed drill action including auger and split spoon refusal, probable bedrock may have been encountered in test boring B-3 at approximately 15.1 feet bgs, corresponding to approximately elevation 216.9. No split spoon samples were retrieved, and rock coring was not attempted. Bedrock underlying each site area is mapped as quartzite, schist, calc-silicate quartzite, and amphibolite which are part of the Westboro Formation.



## **IMPLICATIONS OF SUBSURFACE CONDITIONS**

### CULVERT #110

The subsurface conditions at Culvert #110 site, based on boring B-3, generally consist of very dense sand fill overlying a thin layer of peat, over very dense sand. Based on plans provided by W&C, the estimated elevation of the bottom of the proposed culvert at this site will be about Elevation  $\pm 226$  feet or  $\pm 228$  feet. Based on the test boring, soils at this elevation are likely to be within the peat stratum with an estimated bottom of peat elevation of 227.

### CULVERT #149

The subsurface conditions at the Culvert #149 site generally consist of medium dense sand fill overlying peat, and medium dense silty fine sand, with no gravel. Based on plans provided by W&C, the estimated elevation of the bottom of the proposed culvert at this site will be about Elevation  $\pm 110$  feet. Based on the borings, soils at this elevation are likely to be within the peat stratum with an estimated bottom of peat elevation of 108.

### GENERAL

Supporting the new culverts over compressible peat will cause the culverts to settle over time. Thus, if peat is observed to be present along the culvert alignment during construction, over-excavation to remove the peat is recommended at both proposed culvert alignments. Backfill with crushed stone to the culvert subgrade elevations.

Based on the borings, the anticipated over-excavation depth to remove peat will be up to about 3 feet. Dewatering to remove the peat "in the dry" may be difficult. It is likely to be more practical to attempt to remove the peat along the culvert alignments "in the wet" to mitigate (but not eliminate) the settlement risk. The excavation process and excavated subgrade, before backfilling, should be observed by a qualified geotechnical engineer to confirm that the subgrade is suitable for placement of crushed stone, bearing the pipe or proposed concrete box culvert.

## **RECOMMENDATIONS**

The following recommendations are based on the assumption that the peat stratum will be removed at Culvert #110 in the wet. In addition, the proposed 5-foot-wide, 7-foot-tall concrete box culvert at Culvert #149 will be installed at about Elevation 110 feet on about 3 feet of 1¼-inch crushed stone placed in the wet following overexcavation of the peat.

### DEWATERING

Based on the survey plans provided to GZA on November 17, 2020, the typical water elevation of the brook at Culvert #149 upstream is about Elevation  $\pm 112$  feet. Temporary construction dewatering to control groundwater seepage, precipitation, and surface inflow in excavations, to maintain the integrity of soil bearing surfaces, and allow construction in-the-dry will be difficult without utilizing steel sheeting. The anticipated excavated sand subgrade can become unstable if exposed to high dewatering gradients. Excavation in the wet is recommended with careful construction protocols established with the contractor.



FROST PROTECTION

Typical frost depth in the Commonwealth of Massachusetts is 4 feet bgs. We recommend that spread footings for abutments and wingwalls be supported a minimum of 4 feet below the lowest adjacent ground surface to provide frost protection.

BEARING PRESSURE

The proposed RCP at Culvert #110 and the concrete box culvert at Culvert #149 can be supported over the natural undisturbed Sand, once the peat is removed, and replaced with 1¼-inch crushed stone, assuming up to about 3 feet of over excavation. Recommended maximum net allowable bearing pressure for the proposed abutments and wingwalls bearing on at least 1 foot of dense-graded crushed stone over the 1¼-inch crushed stone is 2,000 pounds per square foot. Potential settlement is difficult to estimate as there may be limited peat remaining below the crushed stone, even after the over-excavation process in the wet.

**CONCLUSION**

We appreciate the opportunity to work with Woodard & Curran, Inc. on this project. If you have any questions regarding this memorandum, please contact Mirsad Alihodzic at 603-232-8755 or Bruce Fairless at 781-603-2254.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Mirsad Alihodzic  
Project Manager

David G. Lamothe, P.E.  
Consultant/Reviewer

Bruce W. Fairless, P.E., LEED AP  
Associate Principal

MA/BWF/DGL:tmd

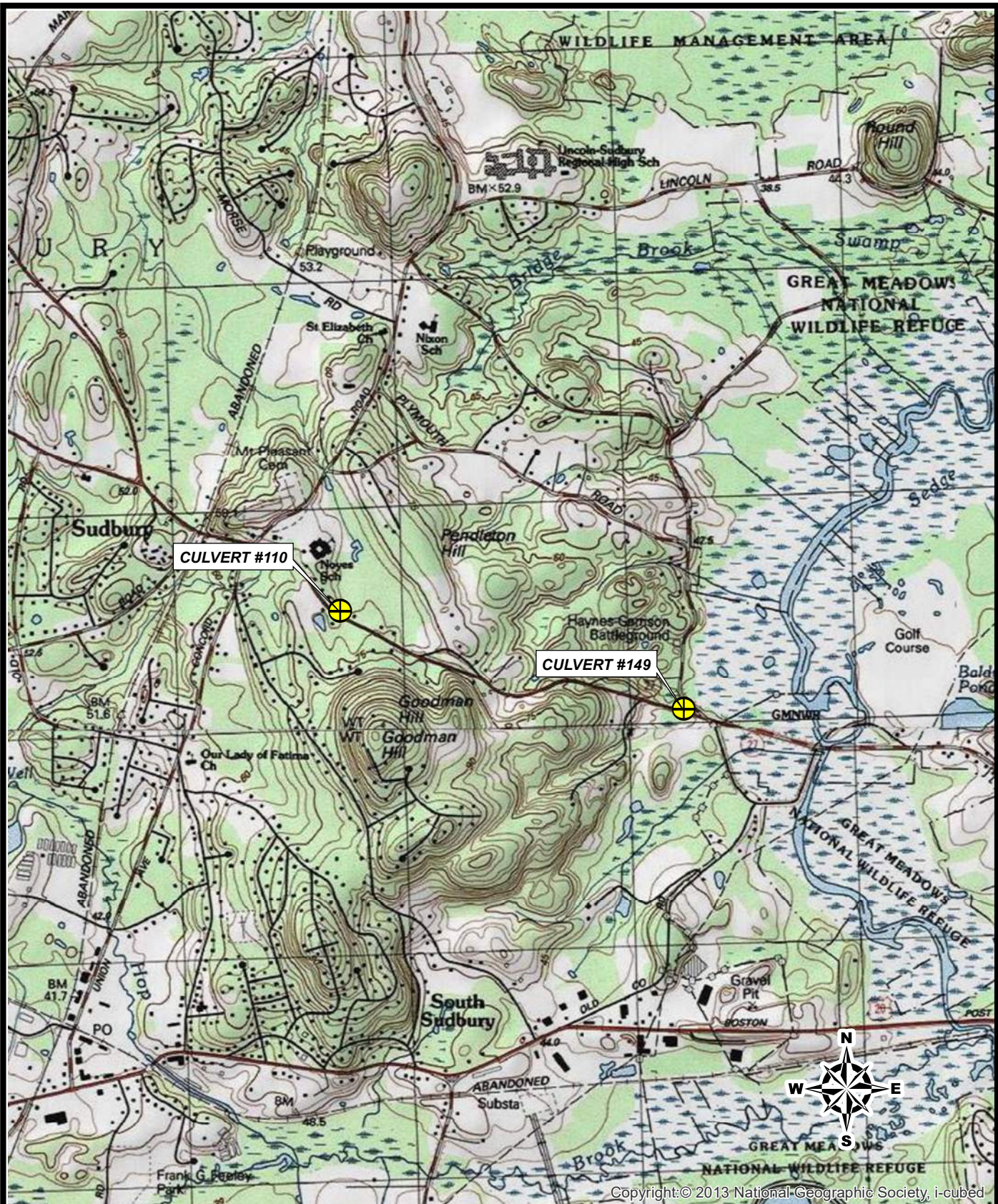
\\gzabedford\jobs\04\jobs\0191100s\04.0191167.00\report\final 04.0191167.00 geotech memo 172021.docx

- Attachments:
- Figure 1 – Locus Plan
  - Figure 2 – Exploration Location Plan at Culvert #149
  - Figure 3 – Exploration Location Plan at Culvert #110
  - Appendix A – Limitations
  - Appendix B – Boring Logs
  - Appendix C – Laboratory Test Results



## Figures

© 2021 - GZA GeoEnvironmental, Inc. C:\Users\lindsey.white\Desktop\191167 Locus\Figure 1 - Locus.mxd, 1/6/2021, 8:23:24 AM, lindsey.white



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NO.	ISSUE / DESCRIPTION	BY	DATE

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com	PREPARED FOR: WOODARD & CURRAN, INC.
PROJ MGR: MA DESIGNED BY: MA DATE: JANUARY 2021	REVIEWED BY: BF DRAWN BY: LW PROJECT NO: 04.0191167.00
CHECKED BY: DL SCALE: 1 in = 2,000 ft REVISION NO.	FIGURE 1

OLD SUDBURY ROAD  
CULVERTS #110 AND #149

LOCUS PLAN



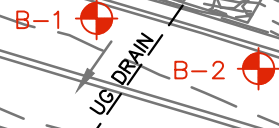
0 WATER ROW  
N/F  
COMMONWEALTH OF MASSACHUSETTS  
BK. 18737 PG. 217  
MAP 11 LOT 300

36" CONCRETE BOX CULVERT  
ELEV.=112.38'

12" CPP  
ELEV.=112.04'

WATER ROW  
(PUBLIC - 40' WIDE)

STEEL BEAM GUARDRAIL  
EOP.  
UPL 59  
113  
115  
118  
120  
OLD SUBBURY ROAD  
(PUBLIC - 50' WIDE)  
STEEL BEAM GUARDRAIL  
EOP.  
114  
113  
112  
115  
120  
118  
115



36" STONE BOX CULVERT  
ELEV.=112.31'

UPL 23-60  
UPL 60

MARSH  
EDGE OF WATER

**NOTES:**

1. BASE PLAN WAS DEVELOPED FROM AN ELECTRONIC BASE PLAN ENTITLED "CULVERT 149" DATED NOVEMBER 17, 2020; PREPARED BY CHAPPELL ENGINEERING ASSOCIATES, LLC OF MARLBOROUGH, MASSACHUSETTS PROVIDED BY WOODARD AND CURRAN VIA EMAIL ON NOVEMBER 18, 2020.
2. TEST BORINGS B-1 AND B-2 WERE PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE ON NOVEMBER 17, 2020 AND WERE OBSERVED AND LOGGED BY GZA PERSONNEL.
3. TEST BORING B-1 AND B-2 LOCATIONS WERE DETERMINED BY GZA USING TAPE MEASUREMENTS FROM EXISTING TOPOGRAPHIC FEATURES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

**LEGEND:**

B-1 APPROXIMATE BORING LOCATION AND DESIGNATION



UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

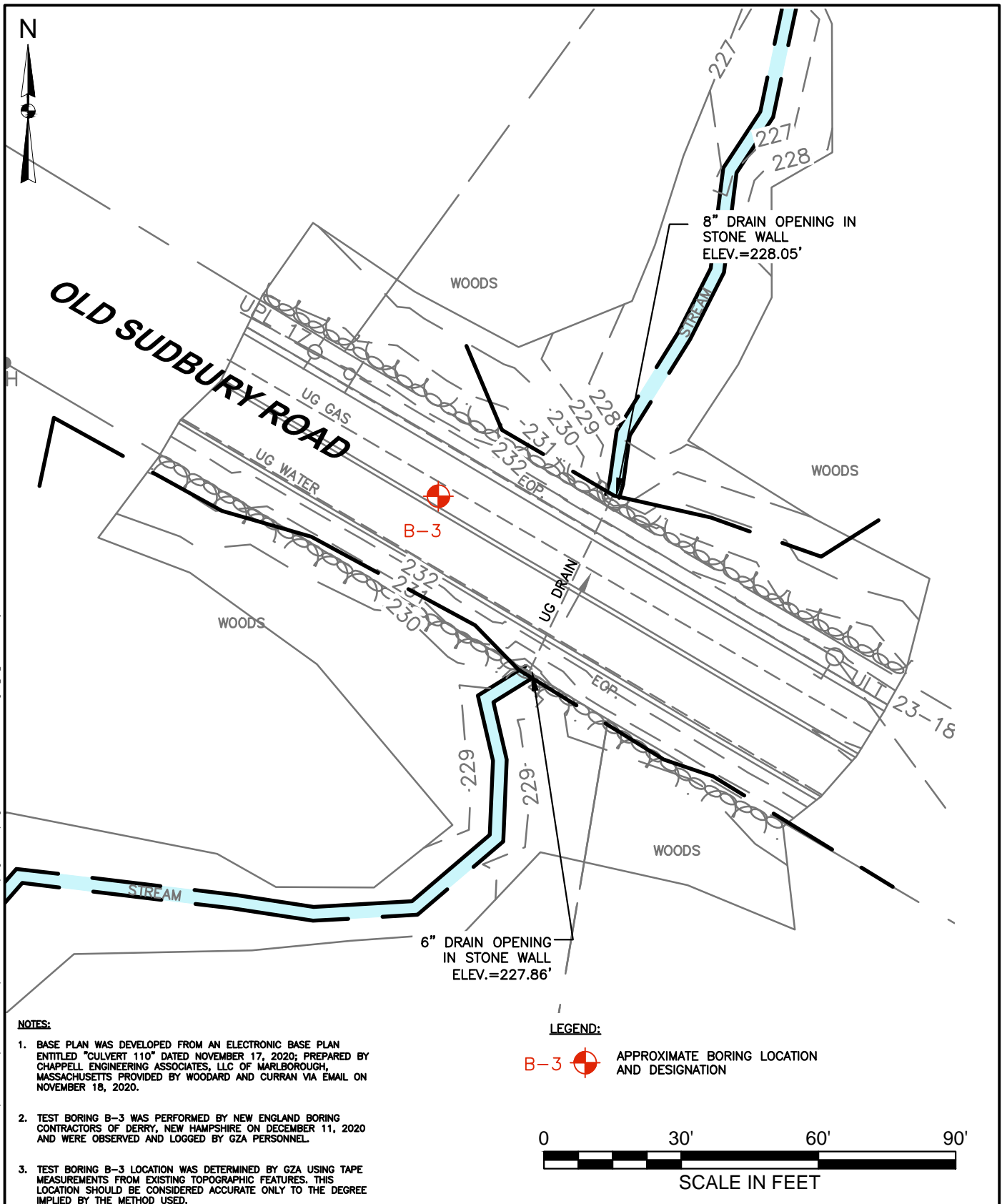
NO.	ISSUE/DESCRIPTION	BY	DATE
PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		WOODARD & CURRAN, INC	
PROJ MGR: MA	REVIEWED BY: BWF	CHECKED BY: DGL	FIGURE <b>2</b> SHEET NO.
DESIGNED BY: MA	DRAWN BY: MA	SCALE: AS SHOWN	
DATE: JANUARY, 2021	PROJECT NO. 04.0191167.00	REVISION NO.	

OLD SUBBURY ROAD CULVERT #149  
SUBBURY, MA

EXPLORATION LOCATION PLAN

© 2021 - GZA GeoEnvironmental, Inc. GZA-P:\04Jobs\0191100s\04-0191167.00\Figures\Figures 2 and 3.dwg [2] January 06, 2021 - 9:30am mrsad.alihodzic

© 2021 - GZA GeoEnvironmental, Inc. GZA-P:\04Jobs\0191100s\04-0191167.00\Figures\Figures 2 and 3.dwg [3] January 06, 2021 - 9:32am mirsad.alihodzic



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<p>OLD SUDBURY ROAD CULVERT #110 SUDBURY, MA</p>		<p>PREPARED BY:  GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com</p>	
<p>EXPLORATION LOCATION PLAN</p>		<p>PREPARED FOR: WOODARD &amp; CURRAN, INC</p>	
<p>PROJ MGR: MA</p> <p>DESIGNED BY: MA</p> <p>DATE: JANUARY, 2021</p>	<p>REVIEWED BY: BWF</p> <p>DRAWN BY: MA</p> <p>PROJECT NO. 04.0191167.00</p>	<p>CHECKED BY: DGL</p> <p>SCALE: AS SHOWN</p> <p>REVISION NO.</p>	<p>FIGURE <b>3</b> SHEET NO.</p>





## **Appendix A – Limitations**



## USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the contract documents, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

## STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions .
3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.
4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

## SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.
6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.
7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.



8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.
9. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

#### **COMPLIANCE WITH CODES AND REGULATIONS**

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

#### **COST ESTIMATES**

11. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

#### **ADDITIONAL SERVICES**

12. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.



## **Appendix B – Boring Logs**

### TEST BORING LOG



**GZA**  
**GeoEnvironmental, Inc.**  
*Engineers and Scientists*

**Woodard and Curran**  
Old Sudbury Road Culverts  
Sudbury, MA

**EXPLORATION NO.:** B-1 (Culvert 149)  
**SHEET:** 1 of 1  
**PROJECT NO:** 04.0191167.00  
**REVIEWED BY:** MA

**Logged By:** D. Shaffer  
**Drilling Co.:** New England Boring Contractors  
**Foreman:** P. Schofield

**Type of Rig:** Truck  
**Rig Model:** MB-48  
**Drilling Method:** Drive  
& Wash

**Boring Location:** See Plan  
**Ground Surface Elev. (ft.):** 120.5  
**Final Boring Depth (ft.):** 31  
**Date Start - Finish:** 11/17/2020 - 11/17/2020

**H. Datum:** NAD83  
**V. Datum:** NAVD88

**Hammer Type:** Automatic Hammer  
**Hammer Weight (lb.):** 140  
**Hammer Fall (in.):** 30  
**Auger or Casing O.D./I.D Dia (in.):** 4

**Sampler Type:** SS  
**Sampler O.D. (in.):** 2  
**Sampler Length (in.):** 24  
**Rock Core Size:** None

**Groundwater Depth (ft.)**

Date	Time	Water Depth	Stab. Time
11/17/2020	1:12 p.m.	8.96	10 min.
11/17/2020	1:27 p.m.	9.19	25 min

Depth (ft)	Casing Blows/ Core Rate	Sample					Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)
		No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)						
5		S-1	0.8-2.0	15	13	26 37	S-1: Very dense, brown, fine to coarse SAND, some Clayey Silt, little Gravel, moist. S-2: Medium dense, brown, fine to coarse SAND, some Silt, trace Gravel, moist.	1		0.8	ASPHALT	119.7
		S-2	2-4	24	14	50/3" 15 15 7 5				FILL		
10		S-3	9-11	24	12	4 2 1 1	S-3: Very loose, gray, fine SAND, some Silt, little Gravel, wet.	2		11.2		109.3
										13	POSSIBLE PEAT	107.5
15		S-4	14-16	24	12	5 9 7 7	S-4: Medium dense, gray, fine SAND, some Silt, wet.	3				
20		S-5	19-21	24	14	7 10 12 13	S-5: Medium dense, brown, fine SAND, some Silt, wet.					
25		S-6	24-26	24	15	3 5 5 6	S-6: Medium dense, gray, fine SAND, some Silt, wet.					
30		S-7	29-31	24	12	5 6 7 11	S-7: Medium dense, gray, fine SAND, some Silt, wet.	4				
							End of exploration at 31 feet.			31		89.5

**REMARKS**

- 1 - The ground surface elevation at the this test boring location is based on interpolation of topographic contours shown on Figure 2 - Exploration Location Plan. Elevations shown are in feet and refer to NAVD 1988 from the provided site plans.
- 2 - A color change from gray to black was observed during drilling in wash water between 11.2 feet and 13 feet below ground surface (b.g.s).
- 3 - Drilling difficulty increased at approximately 15 feet b.g.s.
- 4 - Test boring was terminated at approximately 31 feet b.g.s. Borehole was backfilled with drill cuttings upon completion.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Exploration No.:**  
**B-1 (Culvert 149)**

### TEST BORING LOG



**GZA**  
**GeoEnvironmental, Inc.**  
*Engineers and Scientists*

**Woodard and Curran**  
Old Sudbury Road Culverts  
Sudbury, MA

**EXPLORATION NO.:** B-2 (Culvert 149)  
**SHEET:** 1 of 1  
**PROJECT NO:** 04.0191167.00  
**REVIEWED BY:** MA

**Logged By:** D. Shaffer  
**Drilling Co.:** New England Boring Contractors  
**Foreman:** P. Schofield

**Type of Rig:** Truck  
**Rig Model:** MB-48  
**Drilling Method:** Drive  
& Wash

**Boring Location:** See Plan  
**Ground Surface Elev. (ft.):** 120.5  
**Final Boring Depth (ft.):** 25  
**Date Start - Finish:** 11/17/2020 - 11/17/2020

**H. Datum:** NAD83  
**V. Datum:** NAVD88

**Hammer Type:** Automatic Hammer  
**Hammer Weight (lb.):** 140  
**Hammer Fall (in.):** 30  
**Auger or Casing O.D./I.D Dia (in.):** 4

**Sampler Type:** SS  
**Sampler O.D. (in.):** 2  
**Sampler Length (in.):** 24  
**Rock Core Size:** None

**Groundwater Depth (ft.)**

Date	Time	Water Depth	Stab. Time
11/17/2020	3:38 p.m.	8.08	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample					Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)			
		No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)									
5  10  15  20  25  30		S-1	0.7-2.1	17	11	28 35 50/5"	S-1: Very dense, brown, fine to coarse SAND, some Clayey Silt, little Gravel, moist.	1		0.7	ASPHALT	119.8			
		S-2	4-6	24	5	12 10 6 3	S-2: Medium dense, brown, fine to coarse SAND, some Gravel, some Silt, moist.					FILL			
		S-3	9-11	24	5	19 6 5 5	S-3: A: (Top 3-inches) Medium dense, brown, fine to coarse SAND, some Silt, little Gravel, wet. S-3 B: (Bottom 2-inches) Medium dense, black, fine grained PEAT, wet.			10.6			109.9		
		S-4	14-16	24	13	7 9 12 12	S-4: Medium dense, gray, fine SAND, some Silt, wet.				12.5	PEAT		108.0	
		S-5	19-21	24	13	5 8 10 10	S-5: Medium dense, gray, fine SAND, some Silt, wet.		2				SAND		
		S-6	21-23	24	19	11 9 10 10	S-6: Medium dense, gray, fine SAND, some Silt, wet.								
		S-7	23-25	24	22	5 4 5 6	S-7: Loose, gray, fine SAND, some Silt, wet.				25				95.5
						End of exploration at 25 feet.									

**REMARKS**

1 - The ground surface elevation at the this test boring location is based on interpolation of topographic contours shown on Figure 2 - Exploration Location Plan. Elevations shown are in feet and refer to NAVD 1988 from the provided site plans.  
2 - Test boring was terminated at approximately 25 feet below ground surface (b.g.s). Borehole was backfilled with drill cuttings upon completion.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Exploration No.:**  
**B-2 (Culvert 149)**

**TEST BORING LOG**



**GZA**  
**GeoEnvironmental, Inc.**  
*Engineers and Scientists*

**Woodard and Curran**  
**Old Sudbury Road Culverts**  
**Sudbury, MA**

**EXPLORATION NO.: B-3 (Culvert 110)**  
**SHEET: 1 of 1**  
**PROJECT NO: 04.0191167.00**  
**REVIEWED BY: MA**

**Logged By:** M. Alihodzic  
**Drilling Co.:** New England Boring Contractors  
**Foreman:** P. Schofield

**Type of Rig:** Truck  
**Rig Model:** MB-48  
**Drilling Method:** HSA

**Boring Location:** See Plan  
**Ground Surface Elev. (ft.):** 232.0  
**Final Boring Depth (ft.):** 15.1  
**Date Start - Finish:** 12/11/2020 - 12/11/2020

**H. Datum:** NAD83  
**V. Datum:** NAVD88

**Hammer Type:** Automatic Hammer  
**Hammer Weight (lb.):** 140  
**Hammer Fall (in.):** 30  
**Auger or Casing O.D./I.D Dia (in.):** 2.25

**Sampler Type:** SS  
**Sampler O.D. (in.):** 2  
**Sampler Length (in.):** 24  
**Rock Core Size:** None

**Groundwater Depth (ft.)**

Date	Time	Water Depth	Stab. Time
12/11/2020	10:37 a.m.	7.41	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample					Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)			
		No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)									
5		S-1	1-3	24	20	24 22 23 24	S-1: Very dense, gray fine to coarse SAND, some Silt, little Gravel, dry.  S-2: A: (Top 6-inches) Dense, black, fine grained PEAT, some Sand, wet. S-2 B: (Bottom 6-inches) Dense, gray, fine to medium SAND, some Silt, wet. S-3: Dense, gray, fine to coarse SAND, some Silt, little Gravel, wet. S-4: Very dense, gray, fine to coarse SAND, some Silt, little Gravel, wet.  S-5: Very dense, gray, fine to coarse SAND, some Silt, little Gravel, wet.  End of exploration at 15.1 feet.	1		0.8	ASPHALT	231.2			
		4								228.0					
		5								227.0					
10		S-3	6-8	24	20	12 21 21 23	2								
		S-4	8-10	24	24	15 24 66 36									
15		S-5	14-14.7	8	8	23 50/2"	3		15.1		216.9				
20							4								
25															
30															

**REMARKS**

- The ground surface elevation at this test boring location is based on interpolation of topographic contours shown on Figure 3 - Exploration Location Plan. Elevations shown are in feet and refer to NAVD 1988 from the provided site plans.
- Cobbles and/or boulders were encountered during drilling from approximately 5 to 15 feet b.g.s.
- Test boring was terminated at approximately 15.1 feet below ground surface (b.g.s).
- Auger refusal encountered at approximately 15.1 feet b.g.s. Borehole was backfilled with drill cuttings upon completion.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

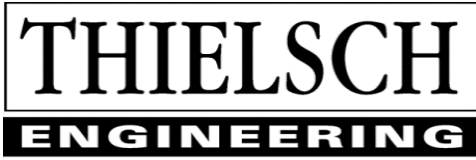
**Exploration No.: B-3 (Culvert 110)**

04.0191167.00 - OLD SUDBURY ROAD CULVERTS W&C.GPJ.GZA TEMPLATE TEST BORING 300; GZA TEMPLATE 0210.GDT; LIBRARY - COPY.GLB; 1/7/2021; 7:31:45 AM



## **Appendix C – Laboratory Test Results**





195 Frances Avenue  
 Cranston RI, 02910  
 Phone: (401)-467-6454  
 Fax: (401)-467-2398  
[thielsch.com](http://thielsch.com)  
*Let's Build a Solid Foundation*

Client Information:  
 GZA GeoEnvironmental  
 Bedford, NH  
 PM: Mirsad Alihodzic  
 Assigned By: Mirsad Alihodzic  
 Collected By: Dylan S.

Project Information:  
**Old Sudbury Rd. Culvert**  
**Sudbury, MA**  
 GZA Project Number: 04.0191167.00  
 Summary Page: 1 of 1  
 Report Date: 12.15.2020

**LABORATORY TESTING DATA SHEET, Report No.: 7420-L-169, Rev.1**

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests							Laboratory Log and Soil Description	
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G <sub>s</sub>	Dry unit wt. pcf	Test Water Content %	$\gamma_d$ MAX (pcf) / W <sub>opt</sub> (%)	$\gamma_d$ MAX (pcf) / W <sub>opt</sub> (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"		Permeability cm/sec
				D2216	D4318		D6913			D2974	D854			D1557						
B-1	S-2	4-6	20-S-3594	15.4			10.6	60.4	29.0											Brown f-c SAND, some Clayey Silt, little fine Gravel
B-1	S-4	14-16	20-S-3595	21.1			0.0	69.7	30.3											Gray fine SAND, some Silt
B-2	S-3B	9-11	20-S-3596	110						19.1										Fine Grained Peat
B-2	S-5	19-21	20-S-3597	27.1			0.0	70.9	29.1											Light Brown fine SAND, some Silt
Organic Content test completed by JM on 11.25.2020.																				

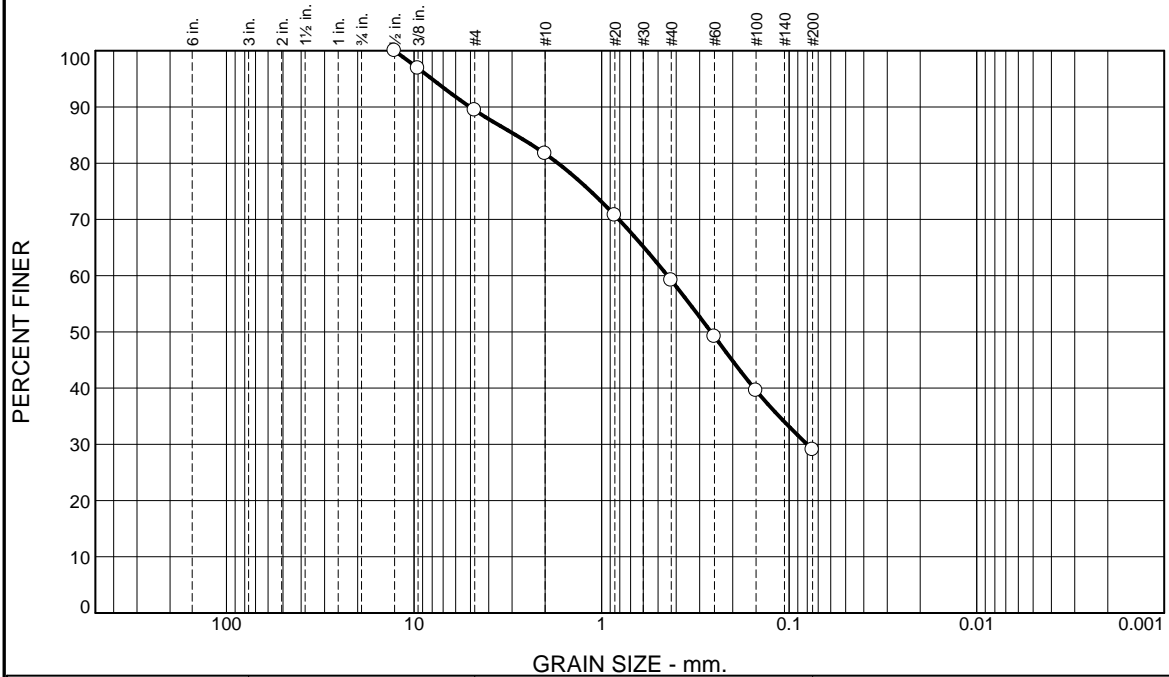
Date Received: 11.23.2020

Reviewed By:

Date Reviewed: 12.15.2020

This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.  
 This report shall not be reproduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.6	7.7	22.5	30.2	29.0	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	96.9		
#4	89.4		
#10	81.7		
#20	70.7		
#40	59.2		
#60	49.2		
#100	39.6		
#200	29.0		

\* (no specification provided)

**Material Description**

Brown f-c SAND, some Clayey Silt, little fine Gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= SM      AASHTO (M 145)= A-2-4(0)

**Coefficients**

D<sub>90</sub>= 5.0301      D<sub>85</sub>= 2.8658      D<sub>60</sub>= 0.4453  
D<sub>50</sub>= 0.2611      D<sub>30</sub>= 0.0803      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 11.23.2020      Date Tested: 11.30.2020

Tested By: JM

Checked By: Steven Accetta

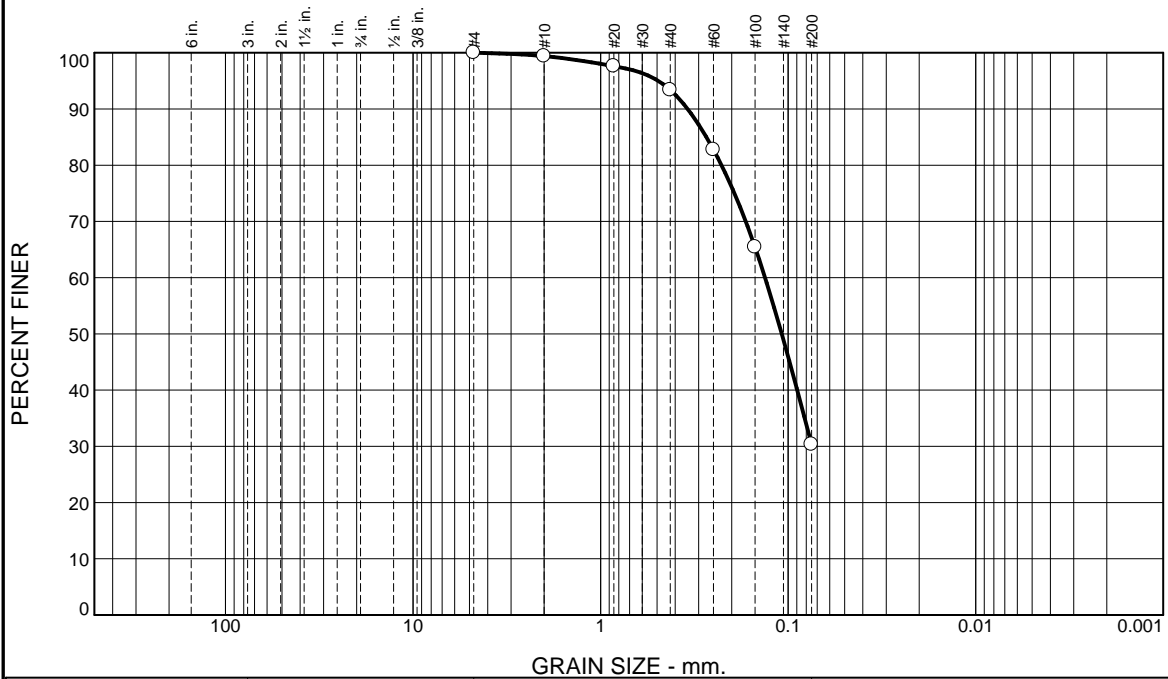
Title: Laboratory Coordinator

Source of Sample: Boring      Depth: 4-6'  
Sample Number: B-1 / S-2

Date Sampled: \_\_\_\_\_

<b>Thielsch Engineering Inc.</b>  <b>Cranston, RI</b>	<b>Client:</b> GZA GeoEnvironmental <b>Project:</b> Old Sudbury Rd Culvert Sudbury, MA <b>Project No:</b> 04.0191167.00
<b>Figure</b> 20-S-3594	

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	6.0	63.1	30.3	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.4		
#20	97.6		
#40	93.4		
#60	82.8		
#100	65.4		
#200	30.3		

\* (no specification provided)

**Material Description**

Gray fine SAND, some Silt

**Atterberg Limits (ASTM D 4318)**

PL= NP                      LL= NV                      PI= NP

**Classification**

USCS (D 2487)= SM                      AASHTO (M 145)= A-2-4(0)

**Coefficients**

D<sub>90</sub>= 0.3432                      D<sub>85</sub>= 0.2728                      D<sub>60</sub>= 0.1327  
D<sub>50</sub>= 0.1082                      D<sub>30</sub>=                                      D<sub>15</sub>=  
D<sub>10</sub>=                                      C<sub>u</sub>=                                      C<sub>c</sub>=

**Remarks**

Sample visually classified as non-plastic.

Date Received: 11.23.2020      Date Tested: 11.30.2020

Tested By: JM

Checked By: Steven Accetta

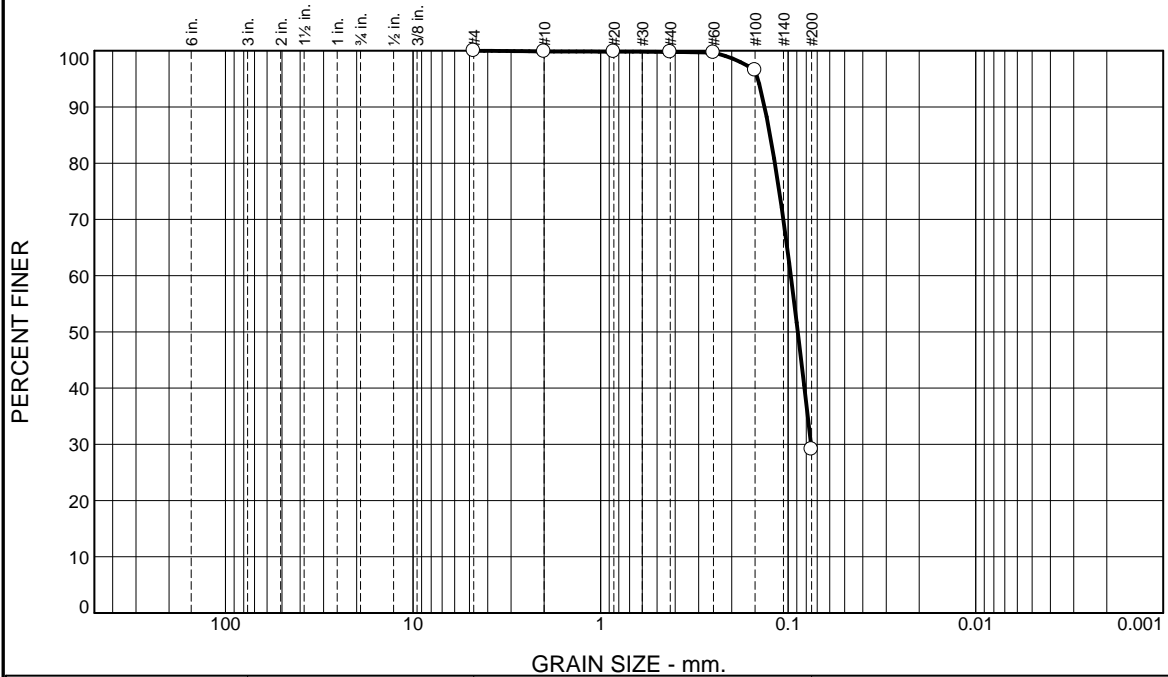
Title: Laboratory Coordinator

Source of Sample: Boring                      Depth: 14-16'  
Sample Number: B-1 / S-4

Date Sampled:

<b>Thielsch Engineering Inc.</b>	Client: GZA GeoEnvironmental
<b>Cranston, RI</b>	Project: Old Sudbury Rd Culvert Sudbury, MA
	Project No: 04.0191167.00
	Figure 20-S-3595

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	70.7	29.1	

Test Results (D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.8		
#60	99.7		
#100	96.5		
#200	29.1		

**Material Description**

Light Brown fine SAND, some Silt

**Atterberg Limits (ASTM D 4318)**

PL= NP      LL= NV      PI= NP

**Classification**

USCS (D 2487)= SM      AASHTO (M 145)= A-2-4(0)

**Coefficients**

D<sub>90</sub>= 0.1334      D<sub>85</sub>= 0.1247      D<sub>60</sub>= 0.0968  
D<sub>50</sub>= 0.0889      D<sub>30</sub>= 0.0755      D<sub>15</sub>=  
D<sub>10</sub>=              C<sub>u</sub>=              C<sub>c</sub>=

**Remarks**

Sample visually classified as non-plastic.

---

Date Received: 11.23.2020      Date Tested: 11.30.2020

Tested By: JM

Checked By: Steven Accetta

Title: Laboratory Coordinator

\* (no specification provided)

Source of Sample: Boring      Depth: 19-21'  
Sample Number: B-2 / S-5

Date Sampled:

<b>Thielsch Engineering Inc.</b>	Client: GZA GeoEnvironmental
<b>Cranston, RI</b>	Project: Old Sudbury Rd Culvert Sudbury, MA
	Project No: 04.0191167.00
	Figure 20-S-3597

## ATTACHMENT D: FEMA FIRM PANEL





USGS The National Map: Orthoimagery, Data refreshed October, 2020.

**FLOOD HAZARD INFORMATION**

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee See Notes Zone X
	Area with Flood Risk due to Levee Zone D
	NO SCREEN Area of Minimal Flood Hazard Zone X
	Effective LOMRs
	Area of Undetermined Flood Hazard Zone D
	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	20.2 Cross Sections with 1% Annual Chance
	17.5 Cross Sections with 1% Annual Chance
	Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

**NOTES TO USERS**

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-6627) or visit the FEMA Flood Map Service Center website at <https://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 website.

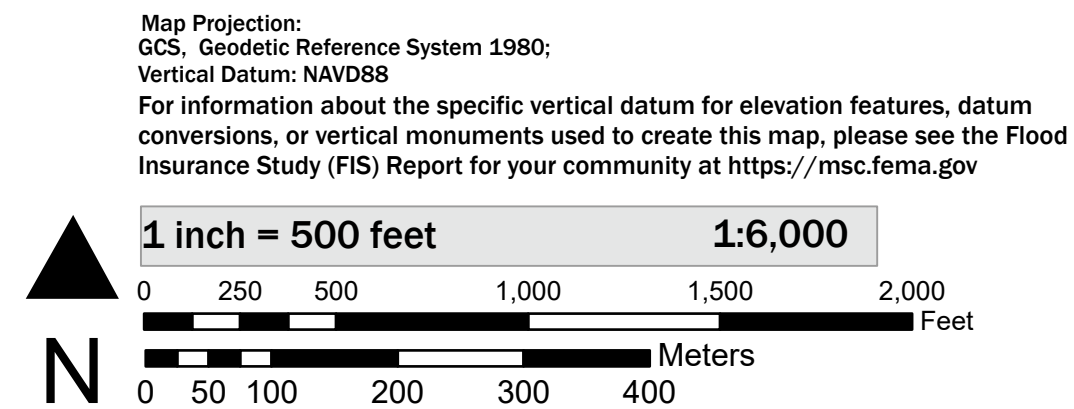
Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to 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. This information was derived from NAIP, dated April 11, 2018.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018. This map was exported from FEMA's National Flood Hazard Layer (NFHL) on 12/6/2020 5:13 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at <https://www.fema.gov/media-library/assets/documents/118418>

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

**SCALE**



**NATIONAL FLOOD INSURANCE PROGRAM**  
FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY,  
MASSACHUSETTS  
ALL JURISDICTIONS  
PANEL 369 OF 654

Panel Contains:

COMMUNITY	NUMBER	PANEL
TOWN OF SUDBURY	250217	0369
TOWN OF WAYLAND	250224	0369

**ATTACHMENTS E1 AND E2 – STREAMSTATS REPORTS, CULVERT #110 &  
CULVERT #149**



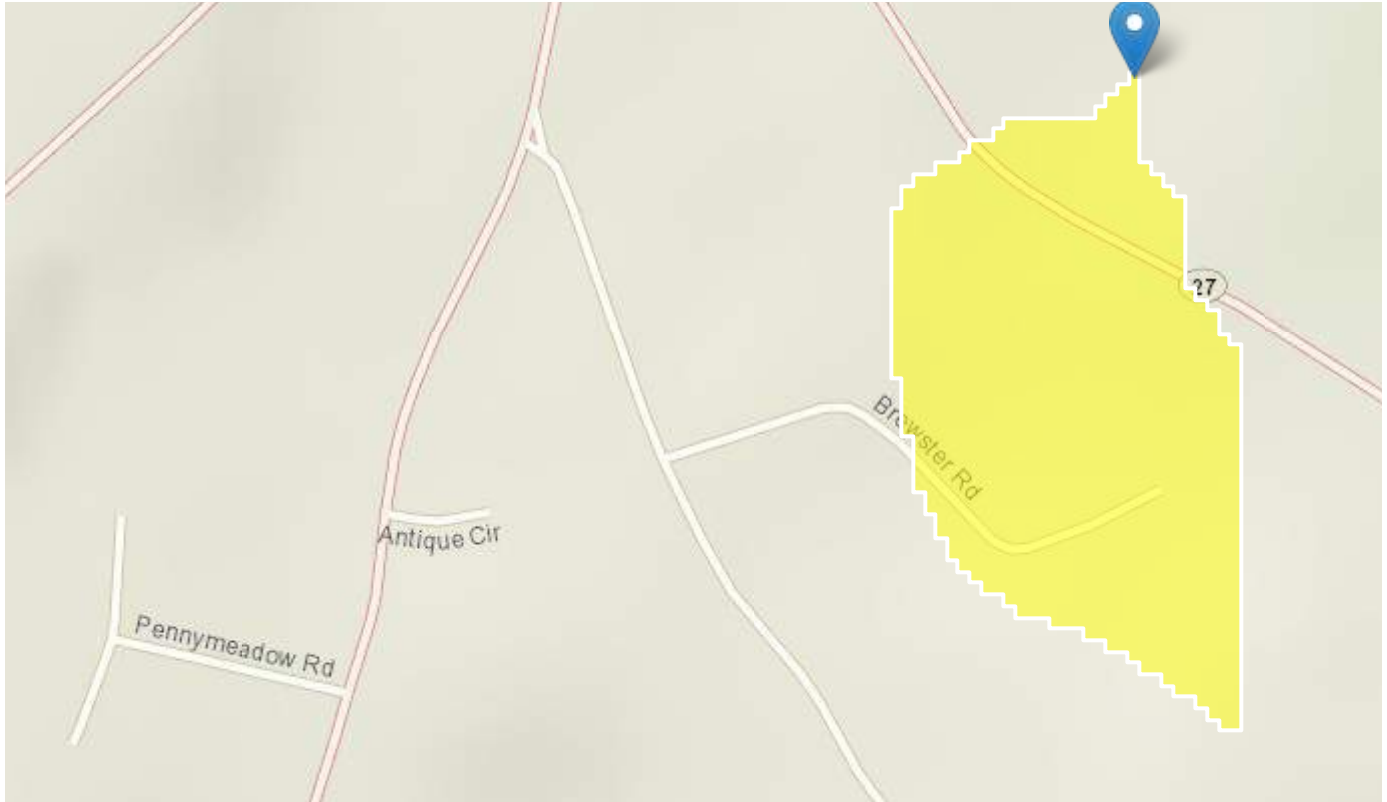
# StreamStats Report

**Region ID:** MA

**Workspace ID:** MA20201216183229601000

**Clicked Point (Latitude, Longitude):** 42.38085, -71.40703

**Time:** 2020-12-16 13:32:45 -0500



## Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.0474	square miles
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	0	percent
FOREST	Percentage of area covered by forest	65.64	percent
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
ELEV	Mean Basin Elevation	253	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	4.89	percent



**Parameter**

<b>Parameter Code</b>	<b>Parameter Description</b>	<b>Value</b>	<b>Unit</b>
BSLDEM10M	Mean basin slope computed from 10 m DEM	7.16	percent

Probability Statistics Parameters<sup>[Perennial Flow Probability]</sup>

<b>Parameter Code</b>	<b>Parameter Name</b>	<b>Value</b>	<b>Units</b>	<b>Min Limit</b>	<b>Max Limit</b>
DRNAREA	Drainage Area	0.0474	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	0	percent	0	100
FOREST	Percent Forest	65.64	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

Probability Statistics Flow Report<sup>[Perennial Flow Probability]</sup>

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

<b>Statistic</b>	<b>Value</b>	<b>Unit</b>	<b>PC</b>
Probability Stream Flowing Perennially	0.15	dim	71

*Probability Statistics Citations*

**Bent, G.C., and Steeves, P.A., 2006, A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006-5031, 107 p. ([http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR\\_2006-5031rev.pdf](http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf))**

Peak-Flow Statistics Parameters<sup>[Peak Statewide 2016 5156]</sup>

<b>Parameter Code</b>	<b>Parameter Name</b>	<b>Value</b>	<b>Units</b>	<b>Min Limit</b>	<b>Max Limit</b>
DRNAREA	Drainage Area	0.0474	square miles	0.16	512
ELEV	Mean Basin Elevation	253	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	4.89	percent	0	32.3

Peak-Flow Statistics Disclaimers<sup>[Peak Statewide 2016 5156]</sup>

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report<sup>[Peak Statewide 2016 5156]</sup>

Statistic	Value	Unit
2 Year Peak Flood	3.63	ft <sup>3</sup> /s
5 Year Peak Flood	6.31	ft <sup>3</sup> /s
10 Year Peak Flood	8.53	ft <sup>3</sup> /s
25 Year Peak Flood	11.8	ft <sup>3</sup> /s
50 Year Peak Flood	14.6	ft <sup>3</sup> /s
100 Year Peak Flood	17.6	ft <sup>3</sup> /s
200 Year Peak Flood	20.9	ft <sup>3</sup> /s
500 Year Peak Flood	25.7	ft <sup>3</sup> /s

*Peak-Flow Statistics Citations*

**Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (<https://dx.doi.org/10.3133/sir20165156>)**

Bankfull Statistics Parameters<sup>[Bankfull Statewide SIR2013 5155]</sup>

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0474	square miles	0.6	329
BSLDEM10M	Mean Basin Slope from 10m DEM	7.16	percent	2.2	23.9

Bankfull Statistics Disclaimers<sup>[Bankfull Statewide SIR2013 5155]</sup>

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Bankfull Statistics Flow Report<sup>[Bankfull Statewide SIR2013 5155]</sup>

<b>Statistic</b>	<b>Value</b>	<b>Unit</b>
Bankfull Width	4.53	ft
Bankfull Depth	0.395	ft
Bankfull Area	1.75	ft <sup>2</sup>
Bankfull Streamflow	3.73	ft <sup>3</sup> /s

*Bankfull Statistics Citations*

**Bent, G.C., and Waite, A.M., 2013, Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013–5155, 62 p., (<http://pubs.usgs.gov/sir/2013/5155/>)**

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Application Version: 4.4.0

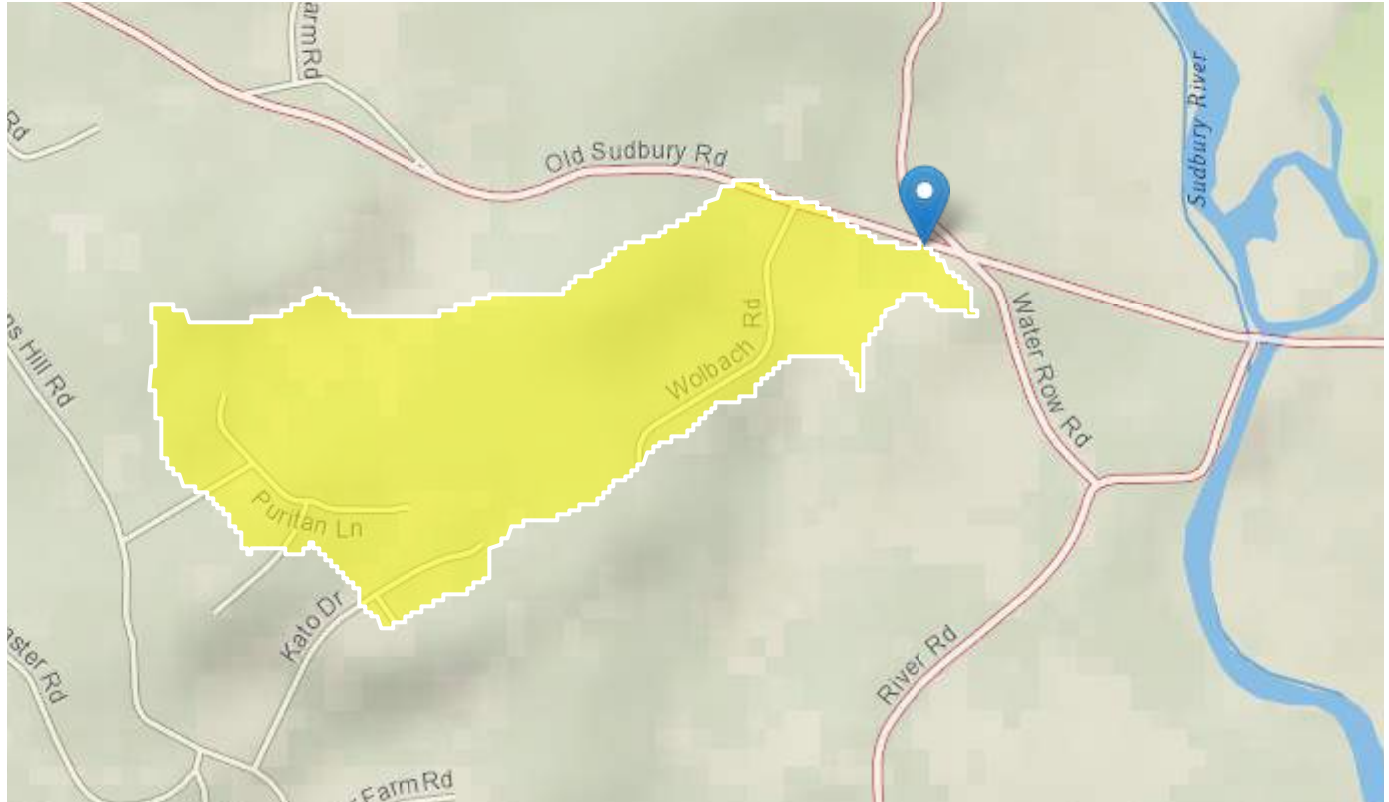
# Culvert 149 - StreamStats Report

Region ID: MA

Workspace ID: MA20201206220028441000

Clicked Point (Latitude, Longitude): 42.37568, -71.38910

Time: 2020-12-06 17:00:45 -0500



## Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.2	square miles
ELEV	Mean Basin Elevation	244	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	1.28	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	9.223	percent
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	9.3	percent
FOREST	Percentage of area covered by forest	56.19	percent

Parameter Code	Parameter Description	Value	Unit
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless

Peak-Flow Statistics Parameters<sup>[Peak Statewide 2016 5156]</sup>

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.2	square miles	0.16	512
ELEV	Mean Basin Elevation	244	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	1.28	percent	0	32.3

Peak-Flow Statistics Flow Report<sup>[Peak Statewide 2016 5156]</sup>

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SEp
2 Year Peak Flood	12.6	ft <sup>3</sup> /s	6.32	25.1	42.3
5 Year Peak Flood	21.5	ft <sup>3</sup> /s	10.6	43.6	43.4
10 Year Peak Flood	28.8	ft <sup>3</sup> /s	13.8	59.9	44.7
25 Year Peak Flood	39.5	ft <sup>3</sup> /s	18.3	85.3	47.1
50 Year Peak Flood	48.4	ft <sup>3</sup> /s	21.7	108	49.4
100 Year Peak Flood	58.1	ft <sup>3</sup> /s	25.2	134	51.8
200 Year Peak Flood	68.7	ft <sup>3</sup> /s	28.8	164	54.1
500 Year Peak Flood	84.2	ft <sup>3</sup> /s	33.6	211	57.6

*Peak-Flow Statistics Citations*

**Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (<https://dx.doi.org/10.3133/sir20165156>)**

Bankfull Statistics Parameters<sup>[Bankfull Statewide SIR2013 5155]</sup>

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.2	square miles	0.6	329
BSLDEM10M	Mean Basin Slope from 10m DEM	9.223	percent	2.2	23.9

#### Bankfull Statistics Disclaimers<sup>[Bankfull Statewide SIR2013 5155]</sup>

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

#### Bankfull Statistics Flow Report<sup>[Bankfull Statewide SIR2013 5155]</sup>

Statistic	Value	Unit
Bankfull Width	8.35	ft
Bankfull Depth	0.619	ft
Bankfull Area	5.08	ft <sup>2</sup>
Bankfull Streamflow	13.4	ft <sup>3</sup> /s

#### Bankfull Statistics Citations

**Bent, G.C., and Waite, A.M., 2013, Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013–5155, 62 p., (<http://pubs.usgs.gov/sir/2013/5155/>)**

#### Probability Statistics Parameters<sup>[Perennial Flow Probability]</sup>

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.2	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	9.3	percent	0	100
FOREST	Percent Forest	56.19	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

#### Probability Statistics Flow Report<sup>[Perennial Flow Probability]</sup>

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEP: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PC
Probability Stream Flowing Perennially	0.503	dim	71

*Probability Statistics Citations*

**Bent, G.C., and Steeves, P.A., 2006, A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006-5031, 107 p. ([http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR\\_2006-5031rev.pdf](http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf))**

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Application Version: 4.4.0

**ATTACHMENTS F1 AND F2 – CULVERT ANALYSIS REPORTS, CULVERT #110 &  
CULVERT #149**





# PCSWMM Report

Sudbury110  
Model Sudbury\_110.inp

January 27, 2021

# Table of Contents

## Summaries

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Summary 2: Model inventory ..... 4

## Maps

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## Graphs

Figure 2: UpstreamWSE ..... 6

DRAFT

## Summary 1: Options

Name	Sudbury_110
Flow Units	CFS
Infiltration method	Horton
Flow routing method	Dynamic Wave
Link offsets defined by	Depth
Allow ponding	No
Skip steady flow periods	No
Inertial dampening	Partial
Define supercritical flow by	Both
Force Main Equation	H-W
Variable time step	On
Adjustment factor (%)	75
Conduit lengthening (s)	0
Minimum surface area (ft <sup>2</sup> )	0
Starting date	Dec-16-2020 12:00:00 AM
Ending date	Dec-17-2020 12:00:00 AM
Duration of simulation (hours)	24
Antecedent dry days (days)	0
Rain interval (h:mm)	0:06
Report time step (h:mm:ss)	00:01:00
Wet time step (h:mm:ss)	00:05:00
Dry time step (h:mm:ss)	00:05:00
Routing time step (s)	5
Minimum time step used (s)	0.93
Average time step used (s)	5
Minimum conduit slope	0
Ignore rainfall/runoff	No
Ignore snow melt	No
Ignore groundwater	No
Ignore flow routing	No
Ignore water quality	No
Report average results	No

## Summary 2: Model inventory

Name	Sudbury_110
Raingages	1
Subcatchments	1
Aquifers	0
Snowpacks	0
RDII hydrographs	0
Junction nodes	0
Outfall nodes	2
Flow divider nodes	0
Storage unit nodes	1
Conduit links	1
Pump links	0
Orifice links	0
Weir links	1
Outlet links	0
Treatment units	0
Transects	0
Control rules	0
Pollutants	0
Land Uses	0
Control Curves	0
Diversion Curves	0
Pump Curves	0
Rating Curves	0
Shape Curves	0
Storage Curves	0
Tidal Curves	0
Weir Curves	0
Time Series	1
Time Patterns	0

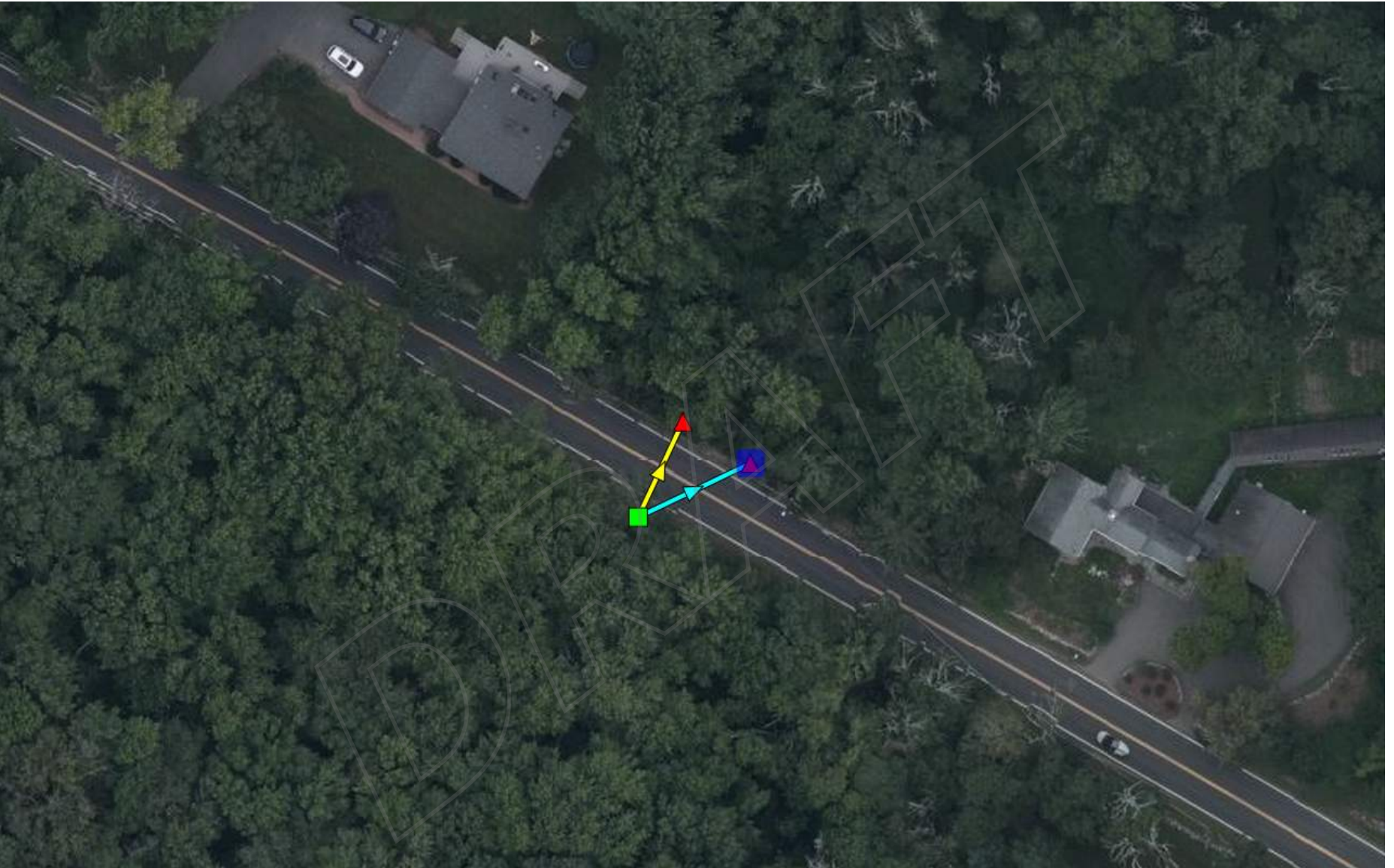


Figure 1: Extent 1

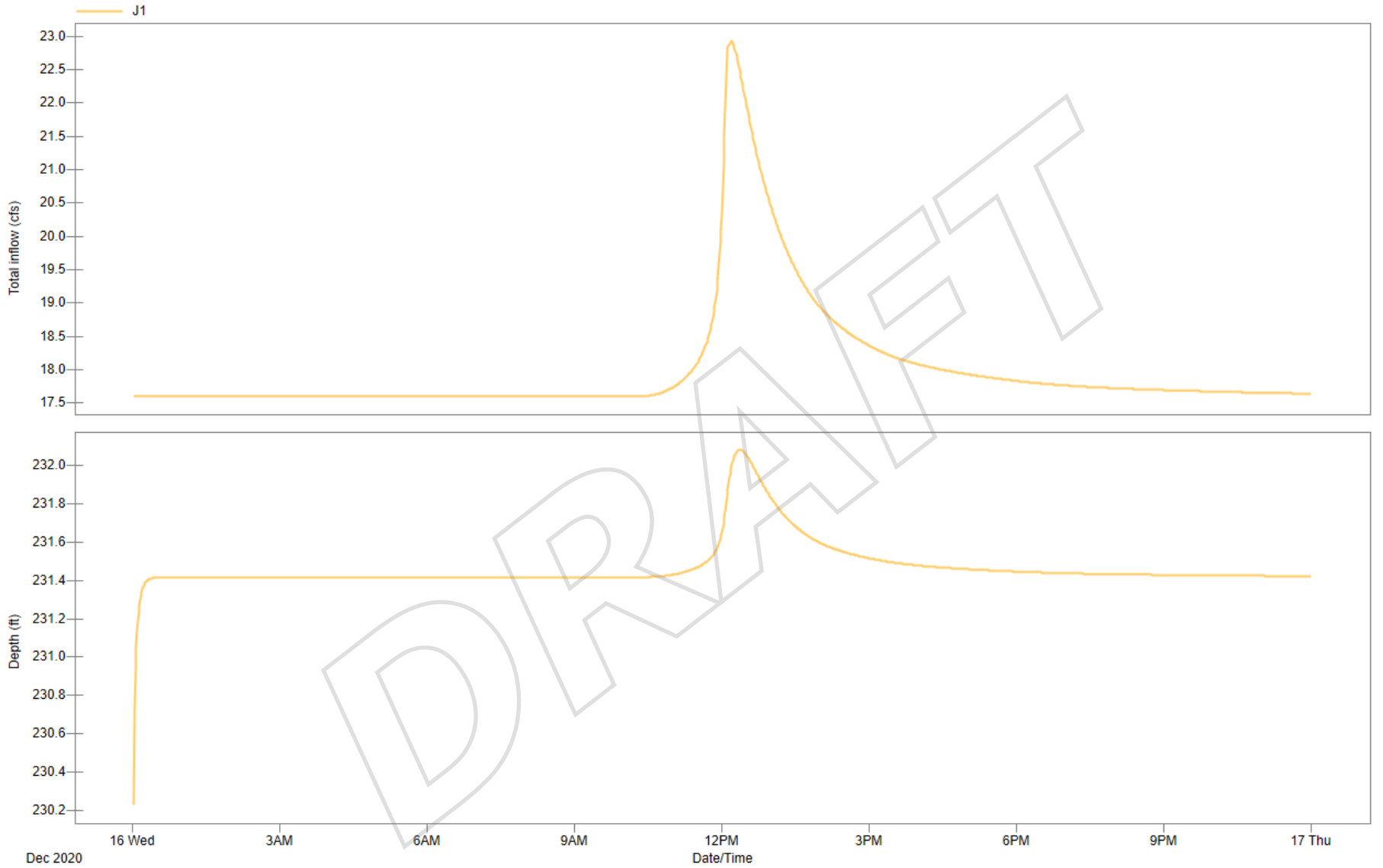


Figure 2: UpstreamWSE

HEC-RAS Plan: Alt3 River: River 1 Reach: Reach 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	420	1_PCTAC	58.30	112.33	121.01		121.01	0.000000	0.04	2057.60	280.90	0.00
Reach 1	420	2_PCTAC	48.60	112.33	120.57		120.57	0.000000	0.04	1933.64	280.90	0.00
Reach 1	420	4_PCTAC	39.60	112.33	120.05		120.05	0.000000	0.04	1786.38	280.90	0.00
Reach 1	420	10_PCTAC	28.90	112.33	118.53		118.53	0.000000	0.03	1358.77	280.90	0.00
Reach 1	326	1_PCTAC	58.30	112.43	121.01		121.01	0.000000	0.04	2406.27	352.20	0.00
Reach 1	326	2_PCTAC	48.60	112.43	120.57		120.57	0.000000	0.04	2250.85	352.20	0.00
Reach 1	326	4_PCTAC	39.60	112.43	120.05		120.05	0.000000	0.03	2066.21	352.20	0.00
Reach 1	326	10_PCTAC	28.90	112.43	118.53		118.53	0.000000	0.03	1530.05	352.20	0.00
Reach 1	247	1_PCTAC	58.30	112.31	121.01	114.53	121.01	0.000002	0.23	696.13	308.90	0.01
Reach 1	247	2_PCTAC	48.60	112.31	120.57	114.46	120.57	0.000002	0.25	559.80	308.90	0.02
Reach 1	247	4_PCTAC	39.60	112.31	120.05	114.39	120.05	0.000004	0.29	397.77	308.90	0.02
Reach 1	247	10_PCTAC	28.90	112.31	118.53	114.12	118.53	0.000002	0.16	282.80	308.90	0.01
Reach 1	214		Bridge									
Reach 1	181	1_PCTAC	58.30	112.04	121.00		121.00	0.000001	0.16	1008.22	477.80	0.01
Reach 1	181	2_PCTAC	48.60	112.04	120.50		120.50	0.000001	0.16	775.75	433.57	0.01
Reach 1	181	4_PCTAC	39.60	112.04	120.00		120.00	0.000000	0.10	568.04	407.45	0.01
Reach 1	181	10_PCTAC	28.90	112.04	118.50		118.50	0.000000	0.10	433.06	402.06	0.01
Reach 1	152	1_PCTAC	58.30	110.79	121.00		121.00	0.000000	0.06	2182.61	393.40	0.00
Reach 1	152	2_PCTAC	48.60	110.79	120.50		120.50	0.000000	0.05	1988.44	375.53	0.00
Reach 1	152	4_PCTAC	39.60	110.79	120.00		120.00	0.000000	0.04	1807.27	347.91	0.00
Reach 1	152	10_PCTAC	28.90	110.79	118.50		118.50	0.000000	0.05	1302.18	332.25	0.00
Reach 1	107	1_PCTAC	58.30	112.38	121.00	113.18	121.00	0.000000	0.08	1612.97	359.10	0.00
Reach 1	107	2_PCTAC	48.60	112.38	120.50	113.11	120.50	0.000000	0.08	1433.42	359.10	0.00
Reach 1	107	4_PCTAC	39.60	112.38	120.00	113.03	120.00	0.000000	0.07	1253.88	359.10	0.00
Reach 1	107	10_PCTAC	28.90	112.38	118.50	112.93	118.50	0.000000	0.09	740.82	320.49	0.01
Reach 1	87		Bridge									
Reach 1	65	1_PCTAC	58.30	112.10	121.00		121.00	0.000000	0.07	1687.97	367.60	0.00
Reach 1	65	2_PCTAC	48.60	112.10	120.50		120.50	0.000000	0.07	1504.16	367.60	0.00
Reach 1	65	4_PCTAC	39.60	112.10	120.00		120.00	0.000000	0.06	1320.37	367.60	0.00
Reach 1	65	10_PCTAC	28.90	112.10	118.50		118.50	0.000000	0.09	768.96	367.60	0.01
Reach 1	31	1_PCTAC	58.30	112.16	121.00		121.00	0.000000	0.04	2983.47	436.70	0.00
Reach 1	31	2_PCTAC	48.60	112.16	120.50		120.50	0.000000	0.03	2765.12	436.70	0.00
Reach 1	31	4_PCTAC	39.60	112.16	120.00		120.00	0.000000	0.03	2546.77	436.70	0.00
Reach 1	31	10_PCTAC	28.90	112.16	118.50		118.50	0.000000	0.03	1891.72	436.70	0.00
Reach 1	1	1_PCTAC	58.30	111.89	121.00	112.88	121.00	0.000000	0.03	3703.86	564.40	0.00
Reach 1	1	2_PCTAC	48.60	111.89	120.50	112.73	120.50	0.000000	0.03	3422.92	554.33	0.00
Reach 1	1	4_PCTAC	39.60	111.89	120.00	112.62	120.00	0.000000	0.02	3149.32	537.18	0.00
Reach 1	1	10_PCTAC	28.90	111.89	118.50	112.50	118.50	0.000000	0.02	2352.48	527.15	0.00