NOTICE OF INTENT

Roadway Improvement Project

Route 40 (Groton Road) & Dunstable Road

MassDOT Project No. 608037

WESTFORD, MASSACHUSETTS

Prepared for: **Town of Westford**
Engineering Department
28 North Street
Westford, MA

Massachusetts Department of Transportation (MassDOT)
Highway Division
10 Park Plaza, Suite 4160
Boston, MA 02116

Prepared by: **TEC, Inc.**
146 Dascomb Road
Andover, MA 01810

March 5, 2018

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

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

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Westford
City/Town

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

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

A. General Information

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

Route 40 (Groton Road) — a. Street Address
Westford — b. City/Town
01886 — c. Zip Code

Latitude and Longitude:
d. Latitude
e. Longitude

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

2. Applicant:

Paul — a. First Name
Starratt — b. Last Name
Town of Westford Engineering Department — c. Organization
28 North Street — d. Street Address
Westford — e. City/Town
MA — f. State
01886 — g. Zip Code
978-692-5520 — h. Phone Number
978-399-2739 — i. Fax Number
pstarratt@westfordma.gov — j. Email Address

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

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

4. Representative (if any):

Peter — a. First Name
Ellison — b. Last Name
TEC, Inc. — c. Company
146 Dascomb Road — d. Street Address
Andover — e. City/Town
MA — f. State
01810 — g. Zip Code
978-794-1792 — h. Phone Number
i. Fax Number
pellison@theengineeringcorp.com, — j. Email address

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

Exempt — a. Total Fee Paid
Exempt — b. State Fee Paid
Exempt — c. City/Town Fee Paid

A. General Information (continued)

6. General Project Description:

The proposed project includes roadway widening, traffic signal installation, new sidewalks, new drainage infrastructure, and stormwater basin, installation of proposed water line, and mill and overlay of Groton Road and Dunstable Road within the project limits.

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

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

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

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

310 CMR 10.53(3)(f) "Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections…"

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

8. Property recorded at the Registry of Deeds for:

See attachment

a. County
b. Certificate # (if registered land)
c. Book
d. Page Number

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

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

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

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

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

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☒ Bordering Vegetated Wetland	Temp: 264 SF Permanent: 1,017 SF	34 SF & In lieu fee 2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	1. square feet 3. cubic feet of flood storage lost	2. square feet 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced

f. ☐ Riverfront Area

1. Name of Waterway (if available) - **specify coastal or inland**

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ 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? ☐ Yes ☐ No

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

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

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

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

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

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

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

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

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

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings | b. number of replacement stream crossings

C. Other Applicable Standards and Requirements

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

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

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

   a. ☐ Yes ☒ No

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

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

   10/2008 (MassGIS)
   b. Date of map

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

   c. Submit Supplemental Information for Endangered Species Review*

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

         (a) within wetland Resource Area _____ percentage/acreage

         (b) outside Resource Area _____ percentage/acreage

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

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

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

   (b) ☒ Photographs representative of the site

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

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

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

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

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

(d) ☐ Vegetation cover type map of site

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

(f) OR Check One of the Following

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

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

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

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

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

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

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

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
1213 Purchase Street – 3rd Floor
New Bedford, MA 02740-6694
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

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

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

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

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

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

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

   b. ACEC

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

   a. ☒ Yes ☒ No

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

   a. ☐ Yes ☒ No

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

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

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

      2. ☒ A portion of the site constitutes redevelopment

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

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

      1. ☐ Single-family house

      2. ☐ Emergency road repair

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

D. Additional Information

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

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

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

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

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

D. Additional Information (cont'd)

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

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

Transportation Improvement Project
a. Plan Title

TEC, INC.
b. Prepared By

Peter Ellision, P.E.
c. Signed and Stamped by

3/5/18
d. Final Revision Date

1" = 20'
e. Scale

f. Additional Plan or Document Title

g. Date

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

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

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

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

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

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

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Westford
City/Town

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 3-2-2018
3. Signature of Property Owner (if different)	4. Date
5. Signature of Representative (if any)	6. Date 3-2-2018

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

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

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

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

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

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

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

A. Applicant Information

1. Location of Project:

Route 40 (Groton Road)	Westford
a. Street Address	b. City/Town
Exempt	Exempt
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Paul	Starratt
a. First Name	b. Last Name

Town of Westford
c. Organization

28 North Street
d. Mailing Address

Westford	MA	01886
e. City/Town	f. State	g. Zip Code

978-692-5520	978-399-2739	pstarratt@westfordma.gov
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

See attachment	
a. First Name	b. Last Name

c. Organization

d. Mailing Address

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

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

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

B. Fees

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

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

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

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

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

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

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

B. Fees (continued)

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

Step 5/Total Project Fee: Exempt

Step 6/Fee Payments:

Total Project Fee:	Exempt a. Total Fee from Step 5
State share of filing Fee:	b. 1/2 Total Fee **less $**12.50
City/Town share of filling Fee:	c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

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

Department of Environmental Protection
Box 4062
Boston, MA 02211

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

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

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Narrative

Introduction and Purpose

The Town of Westford is proposing intersection improvements at Groton Road (Route 40) and Dunstable Road; with roadway improvements along Groton Road from Crocker Drive to 287 Groton Road. Improvements include new traffic signals at the intersection of Groton Road at Dunstable Road, realignment of Dunstable Road south of Groton Road, curb radii alterations, minor box widening along Groton Road, installation of new sidewalks, installation of new stormwater drainage infrastructure, a waterline extension and other utility installation, and reclaimed pavement of Groton Road and Dunstable Road within the project limits.

Construction for the project will be funded by the Massachusetts Department of Transportation Highway Division and the Federal Highway Administration and constructed by the awarded contractor. The purpose of this project is to provide a safer intersection of Dunstable Road with Groton Road by introduction of traffic signal control, realignment of Dunstable Road south of Groton Road and curb radii alterations to better accommodate the Town of Westford emergency vehicle access and egress through this intersection.

The project will also include drainage and stormwater improvements, including deep sump catch basins with hoods, construction of a new stormwater infiltration basin and a new outlet sediment trap.

Existing Conditions

Groton Road (Route 40) is classified as an urban principal arterial roadway and is designated as a primary evacuation route for both Westford and Groton by the Northeast Homeland Security Regional Advisory Council (NERAC). Groton Road is approximately 28 to 33-feet wide in the vicinity of Dunstable Road with marked shoulders.

Dunstable Road is classified as an urban minor arterial roadway north of Groton Road and an urban collector south of Groton road. Dunstable Road is approximately 30-feet wide north of Groton Road and approximately 20-feet wide south of Groton Road.

The existing closed drainage system within the project limits is comprised of catch basins, manholes, and pipes, and discharge into multiple bordering vegetated wetlands along Groton Road and at the intersection of Dunstable Road.

Jurisdictional resource areas within the project limits include Bordering Vegetated Wetlands (BVW) located along Groton Road and at the intersection of Dunstable Road.

The resource areas were delineated by Rimmer Environmental on March 11, 2014.

The project area is not within a NHESP estimated habitats of rare wildlife and priority habitats of rare species. According to MassGIS, there is a certified vernal pool at the southwestern side of the intersection of Route 40 (Groton Road) and Dunstable Road. Additionally, a potential vernal pool is located east of the Dunstable Road and Route 40 intersection.

According to the Natural Resource Conservation Service (NRCS), the site is comprised mostly of Hinckley Loamy Sand, Deerfield Loamy Sand and Paxton Fine Sandy Loam type soils (See Section 4). Hydrologic soil groups A, B, and C have been utilized for the hydrology calculations based on these soil types.

Scale: 1"=1,000'

Route 40 (Groton Rd) - Westford, MA

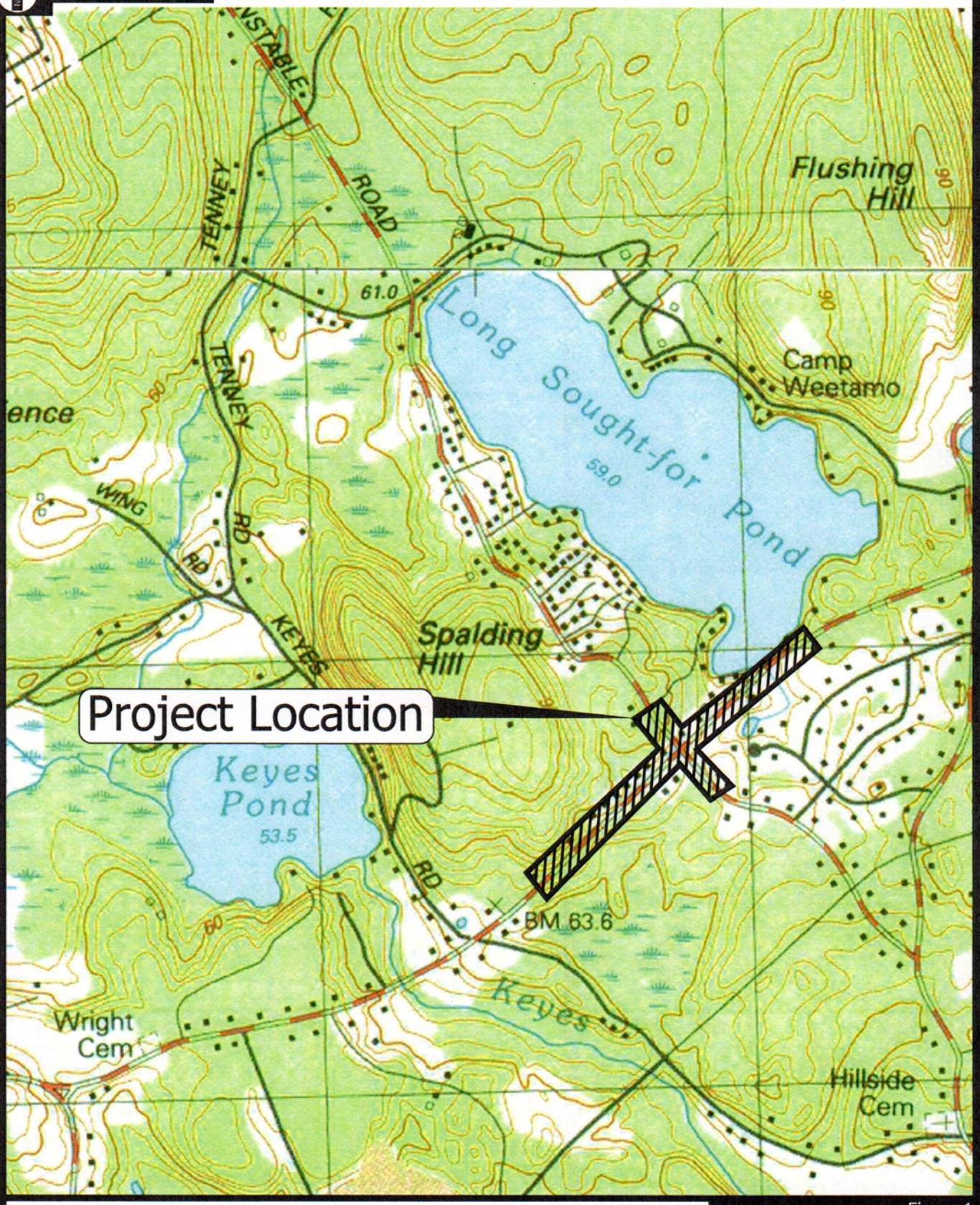


Figure 1

Project Location Map

TEC, Inc.

Proposed Improvements

The proposed project includes full depth reclamation of the existing pavement surface along Groton Road and Dunstable Road within the project area with minor curb radii alterations and sidewalk installation; as well as the installation of drainage infrastructure including 4-foot deep sump catch basins with hoods, outlet sediment trap, sediment forebay and infiltration basin. The proposed outlet sediment trap, sediment forebay and infiltration basin are proposed on private property and will require permanent easements from the current owner. The Town is currently in process of acquiring the required easements. Improvements to the intersection of Groton Road and Dunstable Road include realigning the south leg of Dunstable Road for a safer intersection with Groton Road, the installation of a traffic signal and new pavement markings within the project area.

This project qualifies as a limited project under 310 CMR 10.53(3)(f) of the Wetlands Protection Act. This regulation grants limited project status to projects that propose "maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving inadequate drainage systems."

Resource Area Impacts

The proposed project includes permanent and temporary impacts to the following bordering vegetated wetlands:

- A9 through A-11: Located on the north side of Groton Road, south of Long Sought-For Pond totaling 147 square feet (SF) of temporary impacts to construct a new headwall and stone for outlet protection and energy dissipation. Also, a total of 34 SF of permanent impacts is proposed for the rock-fill slope to facilitate the roadway widening on Groton Road. Wetland replication comprised of 34 SF is proposed between wetland flags A7 and A8.
- C-7 through C-10: Located east of the Dunstable Road and Groton Road intersection totaling 983 square feet to construct a rock-fill slope to facilitate the roadway widening.
- CL-1 through CL-4: Located on south side of Groton Road, approximately station 16+25, totaling 4 SF of temporary impacts to construct a new headwall and stone for outlet protection and energy dissipation
- E-1 through E-4: Located on south side of Groton Road, approximately station 20+25, totaling 9 SF of temporary impacts to construct a new headwall and stone for outlet protection and energy dissipation
- F-1 through F-6: Located on north side of Groton Road, approximately Station 16+25, totaling 104 SF of temporary impacts to construct a new headwall outlet and stone for outlet protection and energy dissipation

The minor 1,017 SF permanent impact/fill within the resource areas will be mitigated via the in-lieu fee program. This project will result in a long-term improvement to the impacted resource areas. The project will create four new headwall outlets with stone for outlet protection. The new headwalls and outlets will provide energy dissipation and will reduce scour and channel erosion. Permanent easements will be acquired at these new outlet locations, allowing the Town to maintain the drainage system and outlets over time.

The project proposes temporary impacts to approximately 264 SF of resource areas. The temporary impacts are at the stone for pipe ends located at the proposed headwalls. The stone will be embedded 6-inches below existing grade with native soil and wetland seed mix above to meet existing grade.

The project also includes construction within the 100-foot buffer zone to Bordering Vegetated Wetlands.

Construction Sequence

The following sequence is typical of intersection reconstruction; however, this may be modified based on input from the Conservation Commission (ConCom).

1. Obtain Order of Conditions from ConCom
2. Pre-construction meeting with ConCom agent
3. Install erosion control barriers and silt sacks
4. Perform excavation for drainage, water, utilities, and pavement reconstruction
5. Install traffic signals
6. Install curbing, sidewalks, rockfill slope, loam and seed and landscaping
7. Final paving
8. Install traffic signs, signals and pavement markings
9. Perform final inspection and address punch list items
10. Final acceptance by MassDOT & Town
11. Remove erosion control barriers and silt sacks
12. Obtain Certificate of Compliance from ConCom

Mitigation

Erosion control and sedimentation barriers will be installed prior to construction between the project area and resource areas to establish a limit-of-work. The erosion controls will be installed outside of any wetland areas that are not impacted. Additionally, silt sacks will be placed in all existing and proposed catch basins within the limits of work to intercept any construction sediments.

A drainage study was performed in order to assess the potential impacts of the proposed project. The drainage watersheds within the project limits are shown on the attached Pre-Development Drainage Areas graphic, Figures 2-1 and 2-2, and described below. The proposed project will allow for improvements to the existing stormwater management system and will incorporate additional Best Management Practices (BMP) to the maximum extent feasible. This analysis has been prepared to verify that the proposed improvements will not have an adverse effect on the stormwater discharged.

The proposed Stormwater Management Plan has been designed to meet the Stormwater Standards identified in the Massachusetts Stormwater Handbook to the maximum extent practicable. The proposed project reduces the risk of erosion and sedimentation and improves the quality of stormwater runoff by removing total suspended solids (TSS) prior to discharging to BVW. The Pre-Development and Post-Development flows were analyzed and are summarized below.

Due to existing topography and right-of-way constraints, onsite wetland replication is not practical. In-lieu of onsite wetland replication, MassDOT would pay a fee to the Army Corps of Engineers (ACOE) program with the Department of Fish and Game. The funds are disbursed on wetland creation, restoration and preservation projects regionally, but not necessarily in the Town of Westford. More information can be found here: http://www.mass.gov/eea/agencies/dfg/about/in-lieu-fee-mitigation-program-for-massachusetts.html.

310 CMR 10.53(3) states: “the Issuing Authority may issue an Order of Conditions and impose such conditions as will contribute to the interests identified in M.G.L. c. 131, § 40 permitting the following limited projects (although no such project may be permitted which will have any adverse effect on specified habitat sites of Rare Species, as identified by procedures established under 310 CMR 10.59). In determining whether to exercise its discretion to approve the limited projects listed in 310 CMR 10.53(3), the Issuing Authority shall consider the following factors: the magnitude of the alteration and the significance of the project site to the interests identified in M.G.L. c. 131, § 40, the availability of reasonable alternatives to the proposed activity, the extent to which adverse impacts are minimized, and the extent to which mitigation measures, including replication or restoration, are provided to contribute to the protection of the interests identified in M.G.L. c. 131, § 40.”

The project has considered reasonable alternatives, minimized site disturbance around the pool, enhanced the stormwater management system, and the in-lieu fee mitigation will contribute to the projection of WPA resources.

Alternatives Analysis

The following alternatives were considered during the development of the proposed stormwater infiltration BMP:

Alternative 1 – No Build

The No Build alternative would include no stormwater mitigation for the increase in impervious area flowing towards the wetlands located east of the Dunstable Road and Groton Road intersection. This option is not desirable because with the increase in impervious area due to the sidewalk addition and minor roadway widening, there would be an increase in runoff flow directed into the wetlands without any pre-treatment. In its current state, the degraded roadway and shoulders currently allow sediment and debris to flow untreated into the resource area.

Alternative 2 – Infiltration Basin Adjacent to Groton Road

The original design of the proposed stormwater infiltration basin was located adjacent to Groton Road in close proximity to a potential vernal pool. As a result, this option was determined to not be desirable after consultation with the U.S Army Corps of Engineers and MassDOT Environmental Section due to the proximity to the potential vernal pool.

Alternative 3 – New Configuration of the Infiltration Basin

Based on the presence of a potential vernal pool located at the wetlands east of the Dunstable Road and Groton Road intersection, the new design of the stormwater infiltration basin is located parallel to Dunstable Road, further away from the potential vernal pool. This is the preferred option since it will provide pre-treatment to stormwater runoff prior to flowing into the resource area while also minimizing direct impacts. This alternative has provided a balance of newly constructed stormwater improvements while also minimizing impacts in proximity to the potential vernal pool.

Methodology

The overall Stormwater Management Plan, which will be implemented as part of this project, will improve the collection, management, and treatment of the stormwater. The proposed stormwater management system will comply with the standards set forth in the Massachusetts Stormwater Handbook to the maximum extent feasible.

Existing and proposed drainage systems were analyzed using HydroCAD, an SCS TR-20 based program, to calculate existing and proposed peak discharge rates. This method takes into account all existing and proposed pervious and impervious areas including soil types and hydrologic classifications. The 2, 10, 25, and 100-year, 24-hour storm frequencies were used in the analysis in

accordance with the Massachusetts Department of Environmental Protection (DEP) and local requirements.

The "Regulatory Compliance" portion of this report addresses the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Performance Standards under the Wetlands Protection Act.

Pre-Development Runoff

The existing condition is depicted on the *Pre-Development Drainage Areas* in Figure 2-1.

Design Points

Peak flow rates were determined for the 2-year, 10-year, 25-year and 100-year, 24-hour Type III storm events. The project area drains to design point (DP) DP-1, DP-2, DP-3, DP-4, DP-5, and DP-6. DP-1 is located southwest of Groton Road. DP-2 is located at an existing 15" flared end pipe located at 231 Groton Road. DP-3 is located at the wetlands at 242 Groton Road. DP-4 is located at the wetlands west of the Dunstable Road and Groton Road intersection. DP-5 is located at the wetlands east of the Dunstable Road and Groton Road intersection. Lastly, DP-6 is located at the wetlands southeast of Long-Sought-For Pond. There is currently no pretreatment prior to discharging to the wetlands.

Existing Subcatchment area 1 (EX-1) is comprised of 14,070 SF of impervious pavement area and 2,418 SF of pervious area consisting of grassed areas. Runoff from EX-1 sheet flows down in a southwest direction along Groton Road to DP-1.

Existing Subcatchment area 2 (EX-2) is comprised of 12,044 SF of impervious pavement area and 1,872 SF of pervious area consisting of grassed areas. Runoff from EX-2 includes a portion of the driveway at St. Augustine Drive and a section of roadway in Groton Road that sheet flows into a closed drainage system and discharges through a 15" flared end pipe located at 231 Groton Road (DP-2).

Existing Subcatchment area 3 (EX-3) is comprised of 22,340 SF of impervious pavement area and 5,630 SF of pervious area consisting of grassed areas. Runoff from EX-3 flows along the shoulder of Groton Road and eventually discharges to the wetlands located on the south side of Groton Road (DP-3).

Existing Subcatchment area 4 (EX-4) is comprised of 22,294 SF of impervious pavement area and 7,643 SF of pervious area consisting of grassed and wooded areas. Runoff from EX-4 flows into a closed drainage system and eventually discharges to the wetlands located west of the Dunstable and Groton Road intersection (DP-4).

Existing Subcatchment area 5 (EX-5) is comprised of 10,450 SF of impervious pavement area and 28,869 SF of pervious area consisting of grassed and wooded areas. Runoff from EX-5 flows towards the existing wetlands located east of the Dunstable and Groton Road intersection (DP-5).

Existing Subcatchment area 6 (EX-6) is comprised of 25,854 SF of impervious pavement area and 5,852 SF of pervious area consisting of grassed areas. Runoff from EX-6 flows along the shoulder of Groton Road and eventually discharges to the wetlands located south of Long-Sought-For Pond (DP-6).

Post-Development Runoff

The proposed condition is depicted on the *Post-Development Drainage Areas* in Figure 2-2.

Proposed Subcatchment Area 1 (PR-1) is comprised of 4,899 SF of impervious pavement area. Runoff from PR-1 sheet flows in a southwest direction along Groton Road to DP-1.

Proposed Subcatchment area 2 (PR-2) is comprised of 25,103 SF of impervious pavement area and 883 SF of pervious area consisting of grassed areas. Runoff from PR-2 includes a portion of the driveway at St. Augustine Drive and a section of roadway in Groton Road that sheet flows into a new closed drainage system and discharges through the existing 15” flared end pipe located at 231 Groton Road (DP-2).

Proposed Subcatchment area 3 (PR-3) is comprised of 26,482 SF of impervious pavement area and 1,446 SF of pervious area consisting of grassed areas. Runoff from PR-3 flows into a new closed drainage system and eventually discharges to the wetlands located on the south side of Groton Road (DP-3).

Proposed Subcatchment area 4 (PR-4) is comprised of 7,673 SF of impervious pavement area and 4,295 SF of pervious area consisting of grassed areas. Runoff from PR-4 flows down the shoulder of Dunstable Road and eventually discharges to the wetlands located west of the Dunstable and Groton Road intersection (DP-4).

Proposed Subcatchment area 5 (PR-5) is comprised of 9,387 SF of impervious pavement area and 15,749 SF of pervious area consisting of grassed and wooded areas. Runoff from PR-5 flows towards the existing wetlands located east of the Dunstable and Groton Road intersection (DP-5).

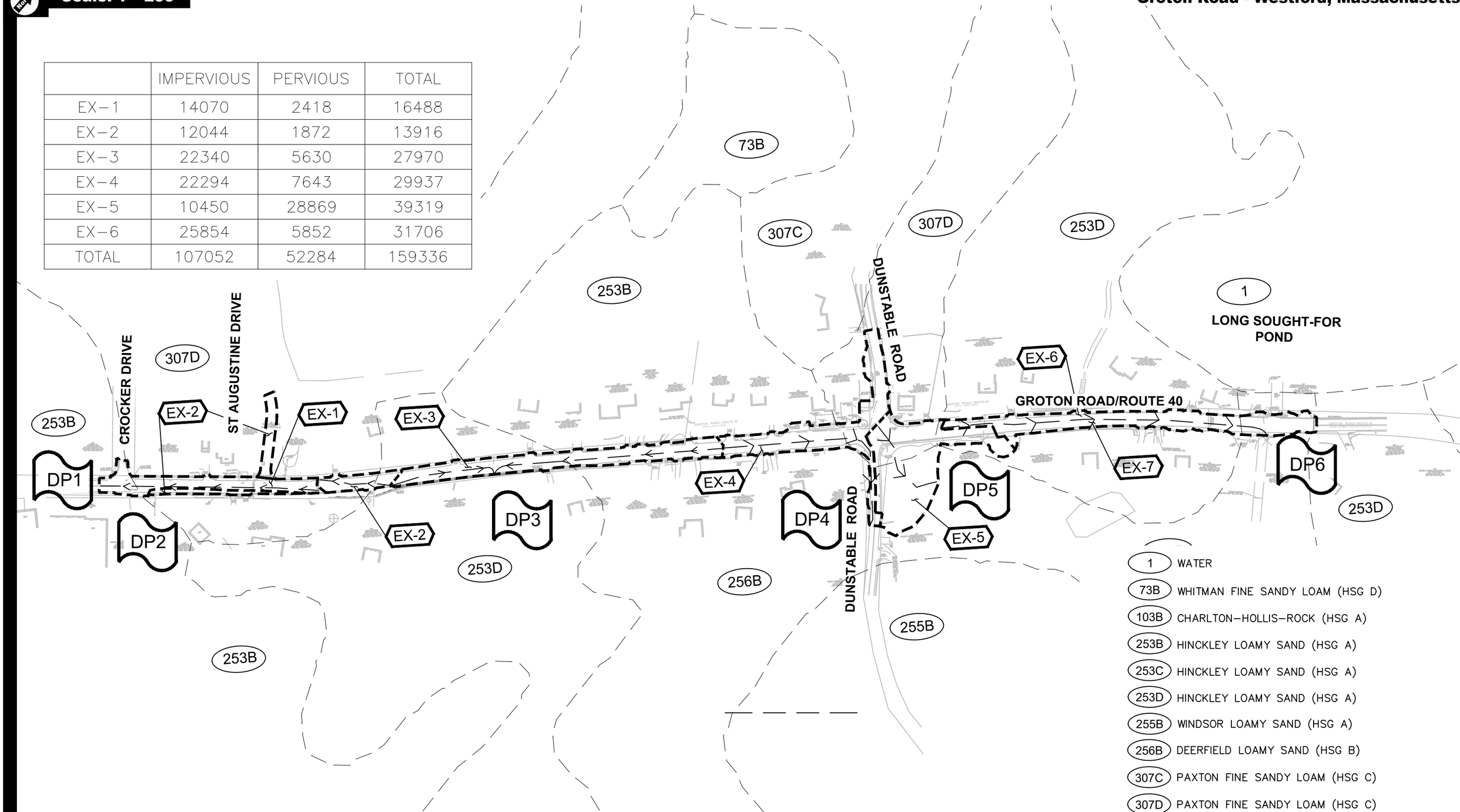
Proposed Subcatchment area 5b (PR-5b) is comprised of 25,075 SF of impervious pavement area and 9,725 SF of pervious area consisting of grassed areas. Runoff from PR-5 flows into a new closed drainage system and eventually discharges into the proposed infiltration basin and then to the wetlands located east of the Dunstable and Groton Road intersection (DP-5).

Proposed Subcatchment area 6 (PR-6) is comprised of 26,215 SF of impervious pavement area and 2,404 SF of pervious area consisting of grassed areas. Runoff from PR-6 flows into a new closed drainage system and eventually discharges to the wetlands associated with Long-Sought-For Pond (DP-6).

Scale: 1"=200'

Groton Road - Westford, Massachusetts

	IMPERVIOUS	PERVIOUS	TOTAL
EX-1	14070	2418	16488
EX-2	12044	1872	13916
EX-3	22340	5630	27970
EX-4	22294	7643	29937
EX-5	10450	28869	39319
EX-6	25854	5852	31706
TOTAL	107052	52284	159336



TEC, Inc.

LEGEND

EX-1 SUBCATCHMENT AREA

256B SOIL CLASSIFICATION

DP1 DESIGN POINT

SUBCATCHMENT AREA BOUNDARY

FLOW PATH

SOIL AREA BOUNDARY

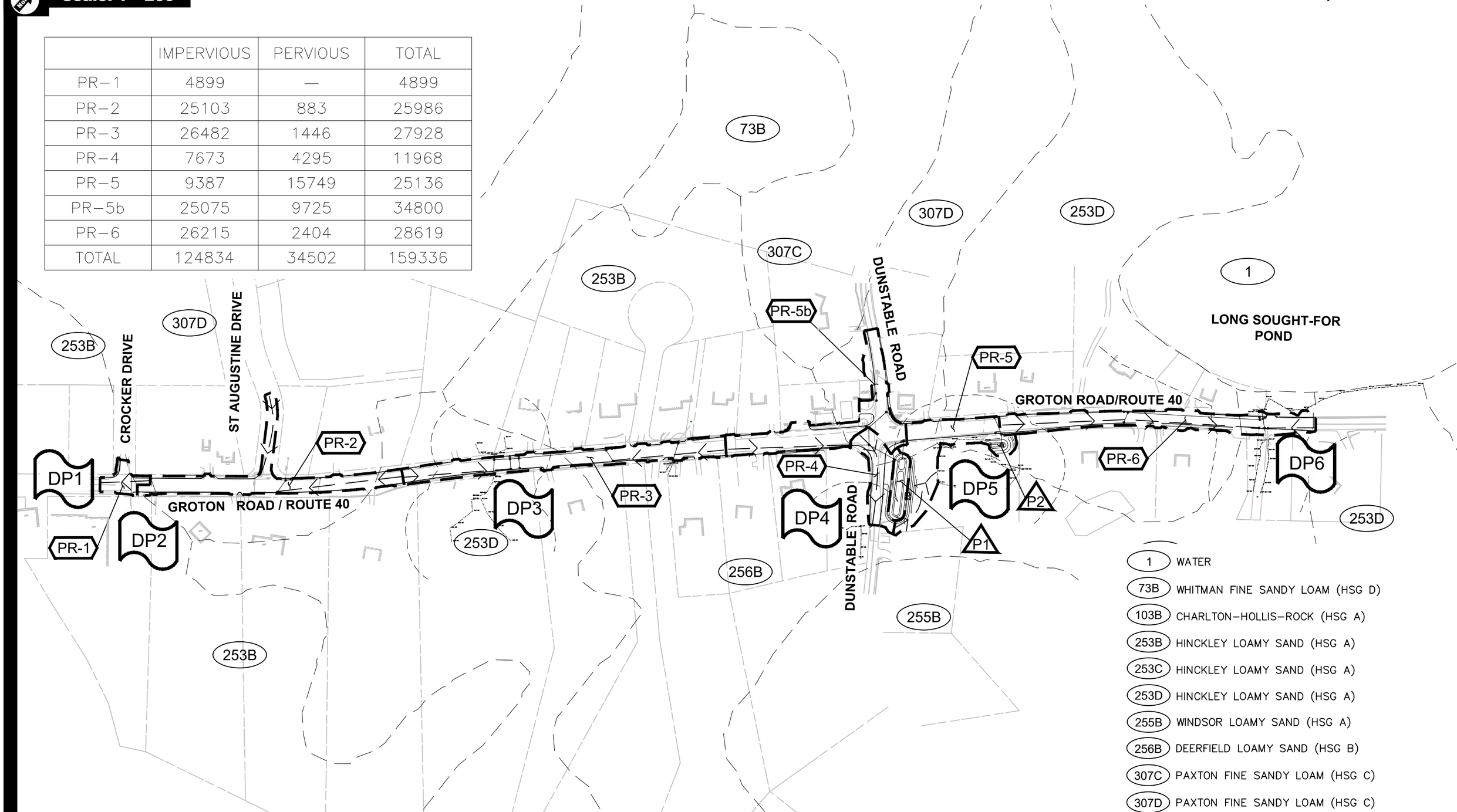
Figure 2-1

Pre-Development Drainage Areas

Scale: 1"=200'

Groton Road - Westford, Massachusetts

	IMPERVIOUS	PERVIOUS	TOTAL
PR–1	4899	—	4899
PR–2	25103	883	25986
PR–3	26482	1446	27928
PR–4	7673	4295	11968
PR–5	9387	15749	25136
PR–5b	25075	9725	34800
PR–6	26215	2404	28619
TOTAL	124834	34502	159336



TEC, Inc.

LEGEND

PR-1 SUBCATCHMENT AREA

256B SOIL CLASSIFICATION

DP1 DESIGN POINT

SUBCATCHMENT AREA BOUNDARY

FLOW PATH

SOIL AREA BOUNDARY

Figure 2-2

Post-Development Drainage Areas

Peak Flow Rates

The peak rates of runoff for all design points were determined by utilizing HydroCAD software and are summarized below in Table 1:

Table 1 (Peak Flow Summary)

	2-Yr Storm		10-Yr Storm		25-Yr Storm		100-Yr Storm	
Design Point	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)
DP-1	1.07	0.35	1.73	0.54	2.03	0.62	2.52	0.77
DP-2	0.91	1.82	1.46	2.83	1.71	3.29	2.12	4.05
DP-3	1.35	1.87	2.48	2.97	2.99	3.47	3.85	4.30
DP-4	1.51	0.55	2.72	1.03	3.27	1.25	4.19	1.62
DP-5	0.57	0.55	1.70	1.38	2.30	1.79	3.36	2.51
DP-6	1.67	1.86	2.95	3.00	3.54	3.52	4.51	4.37

As the project consists primarily of an impervious area and a closed drainage system, a time of concentration (TC) of 5 minutes (minimum) was used for both pre- and post- development.

As shown in Table 1, there is an increase in peak flows to the wetlands at DP-2, -3 and -6. The increase is resulting from the increase in impervious area from the existing conditions to the proposed conditions. The increased flows to DP-2 & -3 are considered to be negligible. These subcatchment areas flow to a large wetland system approximately 18 acres in area. During the 100-year storm event, there would be a total increase of 9,221 cubic feet of runoff entering this wetland. The increased runoff from this project would have negligible impacts on a wetland of this size, resulting in a water rise of 0.14 inches over the wetland's surface area during the 100-year storm event.

Due to the existing topography, adjacent development, close proximity of the wetlands to the roadway, and limited public right-of-way, there are no feasible opportunities to provide for peak-flow attenuation through the use of detention, retention, or infiltration basins; other than the proposed infiltration basin adjacent to the east side of Dunstable Road, south of Groton Road.

The overall limits of work and increase of impervious area is insignificant to the overall watershed size of the adjacent wetland areas. The watershed area, which eventually flows to Stony Brook, is approximately 6.19 square miles (3962 acres). The 3.5-acre project area and slight increase in runoff will not impact the overall peak flow rates contributing to this large wetland system.

The hydraulic analysis can be found within Section 2 of this report.

TSS Removal

Currently, pavement runoff from Groton Road and Dunstable Road sheet flows into adjacent pervious areas and resource areas without pretreatment. The proposed design will include a treatment train of deep sump catch basins with hoods, rock fill slope, an outlet sediment trap, sediment forebay and infiltration basin prior to discharging to the wetlands. The Town of Westford Highway Department currently utilizes a Mechanical Sweeper (Rotary Broom) semi-annually (twice per year), and as needed, along Route 40 (Groton Road). However, per the Massachusetts Stormwater Handbook Volume 2 Chapter 1 Table SS 1, this schedule would result in a 0% TSS removal credit.

For DP-1, there will be a 0% TSS removal rate since it will continue to sheet flow along Groton Road as per existing conditions. Street sweeping receives no credit.

Table 2a – TSS Removal Calculation for DP-1

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00
			Total TSS Removal =	**0%**

For DP-2, there will be a 25% TSS removal rate with the introduction of deep sump catch basins with hoods.

Table 2b – TSS Removal Calculation for DP-2

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00
Deep Sump Catch Basins w/ Hoods	0.25	1.00	0.25	0.75
			Total TSS Removal =	**25%**

For DP-3, there will be a 25% TSS removal rate with the introduction of deep sump catch basins with hoods.

Table 2c – TSS Removal Calculation for DP-3

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00
Deep Sump Catch Basins w/ Hoods	0.25	1.00	0.25	0.75
			Total TSS Removal =	**25%**

For DP-4, there will be a 0% TSS removal rate since it will continue to flow along the shoulder of Dunstable Road as per existing conditions. Street sweeping receives no credit.

Table 2d – TSS Removal Calculation for DP-4

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00

Total TSS Removal =	**0%**

For DP-5, there will be an aggregate TSS removal rate of 85% with the proposed treatment train of Deep Sump Catch Basins with Hoods and infiltration basin. Prior to entering the infiltration basin, the Deep Sump Catch Basins with Hoods and sediment forebay provide the required 44% minimum pretreatment.

Table 2e – TSS Removal Calculation for DP-5

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00
Deep Sump Catch Basins w/ Hoods	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
			Total TSS Removal =	**85%**

For DP-6, there will be a 25% TSS removal rate with the introduction of deep sump catch basins with hoods.

Table 2f – TSS Removal Calculation for DP-6

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load**	**Amount Removed (B*C)**	**Remaining Load (C-D)**
Street Sweeping	0.00	1.00	0.00	1.00
Deep Sump Catch Basins w/ Hoods	0.25	1.00	0.25	0.75
			Total TSS Removal =	**25%**

Regulatory Compliance

The proposed project includes impacts to BVW and the 100-foot buffer zone to Bordering Vegetated Wetlands. Under the Wetlands Protection Act, activities in the buffer zone may be permitted if they will not adversely affect the adjacent resource areas. For this project, mitigation measures are being undertaken to protect the resource area.

Stormwater Management Performance Standards

The DEP/CZM Stormwater Management Policy prescribes ten performance standards for site redevelopment projects. The proposed project has been designed in accordance with these standards to the maximum extent practicable. Compliance with the standards is outlined below.

1. **No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.**

   This project does not propose any new untreated stormwater discharges. Temporary and permanent measures have been included as to not cause erosion in the wetlands or waters of the Commonwealth.

2. **Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.**

   This project proposes a slight increase in peak discharge rates for design points 2, 3, and 6. Due to site constraints, such as existing topography and limited public right-of-way, there are no feasible opportunities to provide for peak-flow attenuation through the use of detention, retention, or infiltration basins. The increases in peak flows for the design points mentioned above are also due to the added impervious area associated with the newly proposed sidewalks, and minor roadway widening as described above.

3. **Loss of annual recharge to groundwater should be minimized through the use of infiltration measures where feasible.**

   The proposed infiltration basin proposed as part of this project will recharge groundwater.

   <u>Required Recharge Volume:</u>
   Rv=F x impervious area
   Rv= [(0.35 inches/12 inches/foot)][(25,075 square feet)]
   Rv =732 cubic feet (CF)
   Provided Recharge Volume: 7,903 CF

Confirm that the infiltration basin will empty within 72 hours:
Volume of storage below outlet = 7,903 CF
Infiltration Rate = 1.02 in/hr
Footprint area of Basin = 1,313 SF
Time to drain = 7,903 CF / (1.02 in/hr) x (1,313 SF) = 70.8 hr < 72 hr

4. **For new development, stormwater management systems must be designed to remove 80 percent of Total Suspended Solids.**

   As described within the Narrative Section, the project will improve the existing 0% TSS removal rate (bi-annual street sweeping only). A 25% TSS removal rate will be achieved for the project area through the introduction of deep sump catch basins with hoods and 85% by the new infiltration basin.

5. **Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs.**

   The proposed project is not considered a higher potential pollutant load.

6. **Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies.**

   Stormwater from the project ultimately discharges to various nearby wetlands, some of which flows to Outstanding Resource Waters (vernal pools). A certified vernal pool is located to the west of Dunstable Road, south of Groton Road and a potential vernal pool is located on the east side of the intersection. The proposed infiltration basin will treat and re-charge stormwater prior to entering the resource area.

7. **Redevelopment of previously developed areas must meet the Stormwater Management Standards to the maximum extent practicable.**

   The proposed project has been designed to improve the quality of runoff using Best Management Practices where feasible. The proposed stormwater management plan meets the Stormwater Management Standards to the maximum extent practicable.

8. **Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities.**

   The project has been designed to include erosion and sedimentation controls to prevent impacts to down gradient resource areas. Construction activities will be isolated from down gradient resource areas by creating an erosion control barrier with compost filter tubes, and silt sacks for existing and

proposed deep sump hooded catch basins will be installed during construction within the project limits.

9. **All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.**

   As described within Section 3, the project includes a long-term Operation and Maintenance Plan to provide efficient operation of the features of the proposed drainage system.

10. **Illicit Discharges**

    Only stormwater will be conveyed to the stormwater management system. No illicit discharges will be permitted.

Conclusion

The Town of Westford is proposing improvements along Groton Road (Route 40) from Crocker Drive to 287 Groton Road, as well as improvements to the intersection of Dunstable Road with Groton Road with impacts to the BVW. The project is proposing to mitigate these impacts by providing a stormwater infiltration basin. Additionally, deep sump hooded catch basins and a sediment forebay have been proposed for pretreatment prior to discharging to the resource area, providing an improvement as compared to the existing conditions.

The Applicant requests that the Conservation Commission finds that the project as described in this Notice of Intent successfully upholds the interest of the Wetlands Protection Act and subsequently issues an Order of Conditions for the proposed improvements.

2

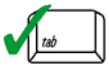
Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

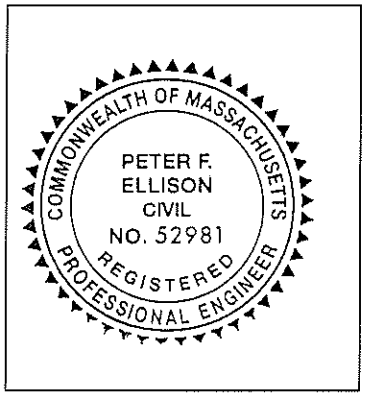
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



3/1/2018
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Infiltration Basin, Sediment Forebay, and Outlet Sediment Trap

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☒ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☒ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

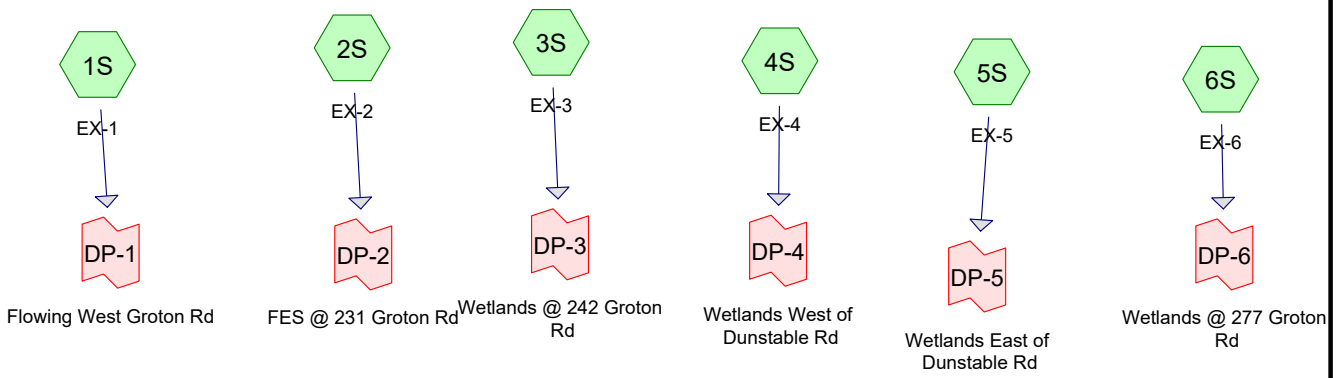
☒ An Illicit Discharge Compliance Statement is attached;

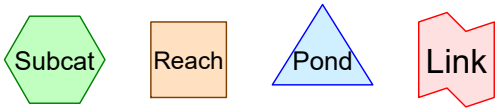
☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

3

Hydrologic & Hydraulic Calculations

Pre-Development HydroCAD Reports





Routing Diagram for T0519_Exist
Prepared by TEC, Inc., Printed 3/1/2018
HydroCAD® 10.00-19 s/n 02793 © 2016 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,460	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S)
2,814	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S)
8,906	74	>75% Grass cover, Good, HSG C (1S, 2S, 4S, 5S)
60,607	98	Paved roads w/curbs & sewers, HSG A (1S, 2S, 3S, 4S, 5S, 6S)
9,134	98	Paved roads w/curbs & sewers, HSG B (4S, 5S, 6S)
37,311	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 4S, 5S)
508	30	Woods, Good, HSG A (5S)
17,847	55	Woods, Good, HSG B (5S)
3,749	70	Woods, Good, HSG C (4S, 5S)
159,336	**83**	**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
18,460	2,814	8,906	0	0	30,180	>75% Grass cover, Good
60,607	9,134	37,311	0	0	107,052	Paved roads w/curbs & sewers
508	17,847	3,749	0	0	22,104	Woods, Good
79,575	**29,795**	**49,966**	**0**	**0**	**159,336**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=16,488 sf 85.33% Impervious Runoff Depth=2.45"
Tc=5.0 min CN=94 Runoff=1.07 cfs 3,362 cf

Subcatchment 2S: EX-2 Runoff Area=13,916 sf 86.55% Impervious Runoff Depth=2.45"
Tc=5.0 min CN=94 Runoff=0.91 cfs 2,838 cf

Subcatchment 3S: EX-3 Runoff Area=27,970 sf 79.87% Impervious Runoff Depth=1.75"
Tc=5.0 min CN=86 Runoff=1.35 cfs 4,075 cf

Subcatchment 4S: EX-4 Runoff Area=29,937 sf 74.47% Impervious Runoff Depth=1.83"
Tc=5.0 min CN=87 Runoff=1.51 cfs 4,557 cf

Subcatchment 5S: EX-5 Runoff Area=39,319 sf 26.58% Impervious Runoff Depth=0.64"
Tc=5.0 min CN=67 Runoff=0.57 cfs 2,082 cf

Subcatchment 6S: EX-6 Runoff Area=31,706 sf 81.54% Impervious Runoff Depth=1.91"
Tc=5.0 min CN=88 Runoff=1.67 cfs 5,039 cf

Link DP-1: Flowing West Groton Rd Inflow=1.07 cfs 3,362 cf
Primary=1.07 cfs 3,362 cf

Link DP-2: FES @ 231 Groton Rd Inflow=0.91 cfs 2,838 cf
Primary=0.91 cfs 2,838 cf

Link DP-3: Wetlands @ 242 Groton Rd Inflow=1.35 cfs 4,075 cf
Primary=1.35 cfs 4,075 cf

Link DP-4: Wetlands West of Dunstable Rd Inflow=1.51 cfs 4,557 cf
Primary=1.51 cfs 4,557 cf

Link DP-5: Wetlands East of Dunstable Rd Inflow=0.57 cfs 2,082 cf
Primary=0.57 cfs 2,082 cf

Link DP-6: Wetlands @ 277 Groton Rd Inflow=1.67 cfs 5,039 cf
Primary=1.67 cfs 5,039 cf

Total Runoff Area = 159,336 sf Runoff Volume = 21,953 cf Average Runoff Depth = 1.65"
32.81% Pervious = 52,284 sf 67.19% Impervious = 107,052 sf

Summary for Subcatchment 1S: EX-1

Runoff = 1.07 cfs @ 12.07 hrs, Volume= 3,362 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,964	98	Paved roads w/curbs & sewers, HSG A
292	39	>75% Grass cover, Good, HSG A
10,106	98	Paved roads w/curbs & sewers, HSG C
2,126	74	>75% Grass cover, Good, HSG C
16,488	94	Weighted Average
2,418		14.67% Pervious Area
14,070		85.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: EX-2

Runoff = 0.91 cfs @ 12.07 hrs, Volume= 2,838 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,329	98	Paved roads w/curbs & sewers, HSG A
251	39	>75% Grass cover, Good, HSG A
10,715	98	Paved roads w/curbs & sewers, HSG C
1,621	74	>75% Grass cover, Good, HSG C
13,916	94	Weighted Average
1,872		13.45% Pervious Area
12,044		86.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: EX-3

Runoff = 1.35 cfs @ 12.08 hrs, Volume= 4,075 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
22,340	98	Paved roads w/curbs & sewers, HSG A
5,630	39	>75% Grass cover, Good, HSG A
27,970	86	Weighted Average
5,630		20.13% Pervious Area
22,340		79.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: EX-4

Runoff = 1.51 cfs @ 12.07 hrs, Volume= 4,557 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
11,132	98	Paved roads w/curbs & sewers, HSG A
3,492	39	>75% Grass cover, Good, HSG A
1,656	98	Paved roads w/curbs & sewers, HSG B
374	61	>75% Grass cover, Good, HSG B
9,506	98	Paved roads w/curbs & sewers, HSG C
2,243	74	>75% Grass cover, Good, HSG C
1,534	70	Woods, Good, HSG C
29,937	87	Weighted Average
7,643		25.53% Pervious Area
22,294		74.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: EX-5

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 2,082 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,318	98	Paved roads w/curbs & sewers, HSG A
4,214	39	>75% Grass cover, Good, HSG A
508	30	Woods, Good, HSG A
1,148	98	Paved roads w/curbs & sewers, HSG B
1,169	61	>75% Grass cover, Good, HSG B
17,847	55	Woods, Good, HSG B
6,984	98	Paved roads w/curbs & sewers, HSG C
2,916	74	>75% Grass cover, Good, HSG C
2,215	70	Woods, Good, HSG C
39,319	67	Weighted Average
28,869		73.42% Pervious Area
10,450		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: EX-6

Runoff = 1.67 cfs @ 12.07 hrs, Volume= 5,039 cf, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
19,524	98	Paved roads w/curbs & sewers, HSG A
4,581	39	>75% Grass cover, Good, HSG A
6,330	98	Paved roads w/curbs & sewers, HSG B
1,271	61	>75% Grass cover, Good, HSG B
31,706	88	Weighted Average
5,852		18.46% Pervious Area
25,854		81.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Link DP-1: Flowing West Groton Rd

Inflow Area = 16,488 sf, 85.33% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 1.07 cfs @ 12.07 hrs, Volume= 3,362 cf
Primary = 1.07 cfs @ 12.07 hrs, Volume= 3,362 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: FES @ 231 Groton Rd

Inflow Area = 13,916 sf, 86.55% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.91 cfs @ 12.07 hrs, Volume= 2,838 cf
Primary = 0.91 cfs @ 12.07 hrs, Volume= 2,838 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Wetlands @ 242 Groton Rd

Inflow Area = 27,970 sf, 79.87% Impervious, Inflow Depth = 1.75" for 2-Year event
Inflow = 1.35 cfs @ 12.08 hrs, Volume= 4,075 cf
Primary = 1.35 cfs @ 12.08 hrs, Volume= 4,075 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-4: Wetlands West of Dunstable Rd

Inflow Area = 29,937 sf, 74.47% Impervious, Inflow Depth = 1.83" for 2-Year event
Inflow = 1.51 cfs @ 12.07 hrs, Volume= 4,557 cf
Primary = 1.51 cfs @ 12.07 hrs, Volume= 4,557 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-5: Wetlands East of Dunstable Rd

Inflow Area = 39,319 sf, 26.58% Impervious, Inflow Depth = 0.64" for 2-Year event
Inflow = 0.57 cfs @ 12.09 hrs, Volume= 2,082 cf
Primary = 0.57 cfs @ 12.09 hrs, Volume= 2,082 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-6: Wetlands @ 277 Groton Rd

Inflow Area = 31,706 sf, 81.54% Impervious, Inflow Depth = 1.91" for 2-Year event
Inflow = 1.67 cfs @ 12.07 hrs, Volume= 5,039 cf
Primary = 1.67 cfs @ 12.07 hrs, Volume= 5,039 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=16,488 sf 85.33% Impervious Runoff Depth=4.06"
Tc=5.0 min CN=94 Runoff=1.73 cfs 5,580 cf

Subcatchment 2S: EX-2 Runoff Area=13,916 sf 86.55% Impervious Runoff Depth=4.06"
Tc=5.0 min CN=94 Runoff=1.46 cfs 4,710 cf

Subcatchment 3S: EX-3 Runoff Area=27,970 sf 79.87% Impervious Runoff Depth=3.23"
Tc=5.0 min CN=86 Runoff=2.48 cfs 7,539 cf

Subcatchment 4S: EX-4 Runoff Area=29,937 sf 74.47% Impervious Runoff Depth=3.33"
Tc=5.0 min CN=87 Runoff=2.72 cfs 8,314 cf

Subcatchment 5S: EX-5 Runoff Area=39,319 sf 26.58% Impervious Runoff Depth=1.63"
Tc=5.0 min CN=67 Runoff=1.70 cfs 5,344 cf

Subcatchment 6S: EX-6 Runoff Area=31,706 sf 81.54% Impervious Runoff Depth=3.43"
Tc=5.0 min CN=88 Runoff=2.95 cfs 9,068 cf

Link DP-1: Flowing West Groton Rd Inflow=1.73 cfs 5,580 cf
Primary=1.73 cfs 5,580 cf

Link DP-2: FES @ 231 Groton Rd Inflow=1.46 cfs 4,710 cf
Primary=1.46 cfs 4,710 cf

Link DP-3: Wetlands @ 242 Groton Rd Inflow=2.48 cfs 7,539 cf
Primary=2.48 cfs 7,539 cf

Link DP-4: Wetlands West of Dunstable Rd Inflow=2.72 cfs 8,314 cf
Primary=2.72 cfs 8,314 cf

Link DP-5: Wetlands East of Dunstable Rd Inflow=1.70 cfs 5,344 cf
Primary=1.70 cfs 5,344 cf

Link DP-6: Wetlands @ 277 Groton Rd Inflow=2.95 cfs 9,068 cf
Primary=2.95 cfs 9,068 cf

Total Runoff Area = 159,336 sf Runoff Volume = 40,555 cf Average Runoff Depth = 3.05"
32.81% Pervious = 52,284 sf 67.19% Impervious = 107,052 sf

Summary for Subcatchment 1S: EX-1

Runoff = 1.73 cfs @ 12.07 hrs, Volume= 5,580 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
3,964	98	Paved roads w/curbs & sewers, HSG A
292	39	>75% Grass cover, Good, HSG A
10,106	98	Paved roads w/curbs & sewers, HSG C
2,126	74	>75% Grass cover, Good, HSG C
16,488	94	Weighted Average
2,418		14.67% Pervious Area
14,070		85.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: EX-2

Runoff = 1.46 cfs @ 12.07 hrs, Volume= 4,710 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
1,329	98	Paved roads w/curbs & sewers, HSG A
251	39	>75% Grass cover, Good, HSG A
10,715	98	Paved roads w/curbs & sewers, HSG C
1,621	74	>75% Grass cover, Good, HSG C
13,916	94	Weighted Average
1,872		13.45% Pervious Area
12,044		86.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: EX-3

Runoff = 2.48 cfs @ 12.07 hrs, Volume= 7,539 cf, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
22,340	98	Paved roads w/curbs & sewers, HSG A
5,630	39	>75% Grass cover, Good, HSG A
27,970	86	Weighted Average
5,630		20.13% Pervious Area
22,340		79.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: EX-4

Runoff = 2.72 cfs @ 12.07 hrs, Volume= 8,314 cf, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
11,132	98	Paved roads w/curbs & sewers, HSG A
3,492	39	>75% Grass cover, Good, HSG A
1,656	98	Paved roads w/curbs & sewers, HSG B
374	61	>75% Grass cover, Good, HSG B
9,506	98	Paved roads w/curbs & sewers, HSG C
2,243	74	>75% Grass cover, Good, HSG C
1,534	70	Woods, Good, HSG C
29,937	87	Weighted Average
7,643		25.53% Pervious Area
22,294		74.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: EX-5

Runoff = 1.70 cfs @ 12.08 hrs, Volume= 5,344 cf, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
2,318	98	Paved roads w/curbs & sewers, HSG A
4,214	39	>75% Grass cover, Good, HSG A
508	30	Woods, Good, HSG A
1,148	98	Paved roads w/curbs & sewers, HSG B
1,169	61	>75% Grass cover, Good, HSG B
17,847	55	Woods, Good, HSG B
6,984	98	Paved roads w/curbs & sewers, HSG C
2,916	74	>75% Grass cover, Good, HSG C
2,215	70	Woods, Good, HSG C
39,319	67	Weighted Average
28,869		73.42% Pervious Area
10,450		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: EX-6

Runoff = 2.95 cfs @ 12.07 hrs, Volume= 9,068 cf, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
19,524	98	Paved roads w/curbs & sewers, HSG A
4,581	39	>75% Grass cover, Good, HSG A
6,330	98	Paved roads w/curbs & sewers, HSG B
1,271	61	>75% Grass cover, Good, HSG B
31,706	88	Weighted Average
5,852		18.46% Pervious Area
25,854		81.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Link DP-1: Flowing West Groton Rd

Inflow Area = 16,488 sf, 85.33% Impervious, Inflow Depth = 4.06" for 10-Year event
Inflow = 1.73 cfs @ 12.07 hrs, Volume= 5,580 cf
Primary = 1.73 cfs @ 12.07 hrs, Volume= 5,580 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: FES @ 231 Groton Rd

Inflow Area = 13,916 sf, 86.55% Impervious, Inflow Depth = 4.06" for 10-Year event
Inflow = 1.46 cfs @ 12.07 hrs, Volume= 4,710 cf
Primary = 1.46 cfs @ 12.07 hrs, Volume= 4,710 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Wetlands @ 242 Groton Rd

Inflow Area = 27,970 sf, 79.87% Impervious, Inflow Depth = 3.23" for 10-Year event
Inflow = 2.48 cfs @ 12.07 hrs, Volume= 7,539 cf
Primary = 2.48 cfs @ 12.07 hrs, Volume= 7,539 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-4: Wetlands West of Dunstable Rd

Inflow Area = 29,937 sf, 74.47% Impervious, Inflow Depth = 3.33" for 10-Year event
Inflow = 2.72 cfs @ 12.07 hrs, Volume= 8,314 cf
Primary = 2.72 cfs @ 12.07 hrs, Volume= 8,314 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-5: Wetlands East of Dunstable Rd

Inflow Area = 39,319 sf, 26.58% Impervious, Inflow Depth = 1.63" for 10-Year event
Inflow = 1.70 cfs @ 12.08 hrs, Volume= 5,344 cf
Primary = 1.70 cfs @ 12.08 hrs, Volume= 5,344 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-6: Wetlands @ 277 Groton Rd

Inflow Area = 31,706 sf, 81.54% Impervious, Inflow Depth = 3.43" for 10-Year event
Inflow = 2.95 cfs @ 12.07 hrs, Volume= 9,068 cf
Primary = 2.95 cfs @ 12.07 hrs, Volume= 9,068 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=16,488 sf 85.33% Impervious Runoff Depth=4.80"
Tc=5.0 min CN=94 Runoff=2.03 cfs 6,598 cf

Subcatchment 2S: EX-2 Runoff Area=13,916 sf 86.55% Impervious Runoff Depth=4.80"
Tc=5.0 min CN=94 Runoff=1.71 cfs 5,569 cf

Subcatchment 3S: EX-3 Runoff Area=27,970 sf 79.87% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=86 Runoff=2.99 cfs 9,174 cf

Subcatchment 4S: EX-4 Runoff Area=29,937 sf 74.47% Impervious Runoff Depth=4.04"
Tc=5.0 min CN=87 Runoff=3.27 cfs 10,080 cf

Subcatchment 5S: EX-5 Runoff Area=39,319 sf 26.58% Impervious Runoff Depth=2.16"
Tc=5.0 min CN=67 Runoff=2.30 cfs 7,075 cf

Subcatchment 6S: EX-6 Runoff Area=31,706 sf 81.54% Impervious Runoff Depth=4.15"
Tc=5.0 min CN=88 Runoff=3.54 cfs 10,954 cf

Link DP-1: Flowing West Groton Rd Inflow=2.03 cfs 6,598 cf
Primary=2.03 cfs 6,598 cf

Link DP-2: FES @ 231 Groton Rd Inflow=1.71 cfs 5,569 cf
Primary=1.71 cfs 5,569 cf

Link DP-3: Wetlands @ 242 Groton Rd Inflow=2.99 cfs 9,174 cf
Primary=2.99 cfs 9,174 cf

Link DP-4: Wetlands West of Dunstable Rd Inflow=3.27 cfs 10,080 cf
Primary=3.27 cfs 10,080 cf

Link DP-5: Wetlands East of Dunstable Rd Inflow=2.30 cfs 7,075 cf
Primary=2.30 cfs 7,075 cf

Link DP-6: Wetlands @ 277 Groton Rd Inflow=3.54 cfs 10,954 cf
Primary=3.54 cfs 10,954 cf

Total Runoff Area = 159,336 sf Runoff Volume = 49,449 cf Average Runoff Depth = 3.72"
32.81% Pervious = 52,284 sf 67.19% Impervious = 107,052 sf

Summary for Subcatchment 1S: EX-1

Runoff = 2.03 cfs @ 12.07 hrs, Volume= 6,598 cf, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
3,964	98	Paved roads w/curbs & sewers, HSG A
292	39	>75% Grass cover, Good, HSG A
10,106	98	Paved roads w/curbs & sewers, HSG C
2,126	74	>75% Grass cover, Good, HSG C
16,488	94	Weighted Average
2,418		14.67% Pervious Area
14,070		85.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: EX-2

Runoff = 1.71 cfs @ 12.07 hrs, Volume= 5,569 cf, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
1,329	98	Paved roads w/curbs & sewers, HSG A
251	39	>75% Grass cover, Good, HSG A
10,715	98	Paved roads w/curbs & sewers, HSG C
1,621	74	>75% Grass cover, Good, HSG C
13,916	94	Weighted Average
1,872		13.45% Pervious Area
12,044		86.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: EX-3

Runoff = 2.99 cfs @ 12.07 hrs, Volume= 9,174 cf, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
22,340	98	Paved roads w/curbs & sewers, HSG A
5,630	39	>75% Grass cover, Good, HSG A
27,970	86	Weighted Average
5,630		20.13% Pervious Area
22,340		79.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: EX-4

Runoff = 3.27 cfs @ 12.07 hrs, Volume= 10,080 cf, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
11,132	98	Paved roads w/curbs & sewers, HSG A
3,492	39	>75% Grass cover, Good, HSG A
1,656	98	Paved roads w/curbs & sewers, HSG B
374	61	>75% Grass cover, Good, HSG B
9,506	98	Paved roads w/curbs & sewers, HSG C
2,243	74	>75% Grass cover, Good, HSG C
1,534	70	Woods, Good, HSG C
29,937	87	Weighted Average
7,643		25.53% Pervious Area
22,294		74.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: EX-5

Runoff = 2.30 cfs @ 12.08 hrs, Volume= 7,075 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
2,318	98	Paved roads w/curbs & sewers, HSG A
4,214	39	>75% Grass cover, Good, HSG A
508	30	Woods, Good, HSG A
1,148	98	Paved roads w/curbs & sewers, HSG B
1,169	61	>75% Grass cover, Good, HSG B
17,847	55	Woods, Good, HSG B
6,984	98	Paved roads w/curbs & sewers, HSG C
2,916	74	>75% Grass cover, Good, HSG C
2,215	70	Woods, Good, HSG C
39,319	67	Weighted Average
28,869		73.42% Pervious Area
10,450		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: EX-6

Runoff = 3.54 cfs @ 12.07 hrs, Volume= 10,954 cf, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
19,524	98	Paved roads w/curbs & sewers, HSG A
4,581	39	>75% Grass cover, Good, HSG A
6,330	98	Paved roads w/curbs & sewers, HSG B
1,271	61	>75% Grass cover, Good, HSG B
31,706	88	Weighted Average
5,852		18.46% Pervious Area
25,854		81.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Link DP-1: Flowing West Groton Rd

Inflow Area = 16,488 sf, 85.33% Impervious, Inflow Depth = 4.80" for 25-Year event
Inflow = 2.03 cfs @ 12.07 hrs, Volume= 6,598 cf
Primary = 2.03 cfs @ 12.07 hrs, Volume= 6,598 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: FES @ 231 Groton Rd

Inflow Area = 13,916 sf, 86.55% Impervious, Inflow Depth = 4.80" for 25-Year event
Inflow = 1.71 cfs @ 12.07 hrs, Volume= 5,569 cf
Primary = 1.71 cfs @ 12.07 hrs, Volume= 5,569 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Wetlands @ 242 Groton Rd

Inflow Area = 27,970 sf, 79.87% Impervious, Inflow Depth = 3.94" for 25-Year event
Inflow = 2.99 cfs @ 12.07 hrs, Volume= 9,174 cf
Primary = 2.99 cfs @ 12.07 hrs, Volume= 9,174 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-4: Wetlands West of Dunstable Rd

Inflow Area = 29,937 sf, 74.47% Impervious, Inflow Depth = 4.04" for 25-Year event
Inflow = 3.27 cfs @ 12.07 hrs, Volume= 10,080 cf
Primary = 3.27 cfs @ 12.07 hrs, Volume= 10,080 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-5: Wetlands East of Dunstable Rd

Inflow Area = 39,319 sf, 26.58% Impervious, Inflow Depth = 2.16" for 25-Year event
Inflow = 2.30 cfs @ 12.08 hrs, Volume= 7,075 cf
Primary = 2.30 cfs @ 12.08 hrs, Volume= 7,075 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-6: Wetlands @ 277 Groton Rd

Inflow Area = 31,706 sf, 81.54% Impervious, Inflow Depth = 4.15" for 25-Year event
Inflow = 3.54 cfs @ 12.07 hrs, Volume= 10,954 cf
Primary = 3.54 cfs @ 12.07 hrs, Volume= 10,954 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-1 Runoff Area=16,488 sf 85.33% Impervious Runoff Depth=6.04"
Tc=5.0 min CN=94 Runoff=2.52 cfs 8,299 cf

Subcatchment 2S: EX-2 Runoff Area=13,916 sf 86.55% Impervious Runoff Depth=6.04"
Tc=5.0 min CN=94 Runoff=2.12 cfs 7,005 cf

Subcatchment 3S: EX-3 Runoff Area=27,970 sf 79.87% Impervious Runoff Depth=5.13"
Tc=5.0 min CN=86 Runoff=3.85 cfs 11,947 cf

Subcatchment 4S: EX-4 Runoff Area=29,937 sf 74.47% Impervious Runoff Depth=5.24"
Tc=5.0 min CN=87 Runoff=4.19 cfs 13,067 cf

Subcatchment 5S: EX-5 Runoff Area=39,319 sf 26.58% Impervious Runoff Depth=3.11"
Tc=5.0 min CN=67 Runoff=3.36 cfs 10,186 cf

Subcatchment 6S: EX-6 Runoff Area=31,706 sf 81.54% Impervious Runoff Depth=5.35"
Tc=5.0 min CN=88 Runoff=4.51 cfs 14,138 cf

Link DP-1: Flowing West Groton Rd Inflow=2.52 cfs 8,299 cf
Primary=2.52 cfs 8,299 cf

Link DP-2: FES @ 231 Groton Rd Inflow=2.12 cfs 7,005 cf
Primary=2.12 cfs 7,005 cf

Link DP-3: Wetlands @ 242 Groton Rd Inflow=3.85 cfs 11,947 cf
Primary=3.85 cfs 11,947 cf

Link DP-4: Wetlands West of Dunstable Rd Inflow=4.19 cfs 13,067 cf
Primary=4.19 cfs 13,067 cf

Link DP-5: Wetlands East of Dunstable Rd Inflow=3.36 cfs 10,186 cf
Primary=3.36 cfs 10,186 cf

Link DP-6: Wetlands @ 277 Groton Rd Inflow=4.51 cfs 14,138 cf
Primary=4.51 cfs 14,138 cf

Total Runoff Area = 159,336 sf Runoff Volume = 64,642 cf Average Runoff Depth = 4.87"
32.81% Pervious = 52,284 sf 67.19% Impervious = 107,052 sf

Summary for Subcatchment 1S: EX-1

Runoff = 2.52 cfs @ 12.07 hrs, Volume= 8,299 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
3,964	98	Paved roads w/curbs & sewers, HSG A
292	39	>75% Grass cover, Good, HSG A
10,106	98	Paved roads w/curbs & sewers, HSG C
2,126	74	>75% Grass cover, Good, HSG C
16,488	94	Weighted Average
2,418		14.67% Pervious Area
14,070		85.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: EX-2

Runoff = 2.12 cfs @ 12.07 hrs, Volume= 7,005 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
1,329	98	Paved roads w/curbs & sewers, HSG A
251	39	>75% Grass cover, Good, HSG A
10,715	98	Paved roads w/curbs & sewers, HSG C
1,621	74	>75% Grass cover, Good, HSG C
13,916	94	Weighted Average
1,872		13.45% Pervious Area
12,044		86.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: EX-3

Runoff = 3.85 cfs @ 12.07 hrs, Volume= 11,947 cf, Depth= 5.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
22,340	98	Paved roads w/curbs & sewers, HSG A
5,630	39	>75% Grass cover, Good, HSG A
27,970	86	Weighted Average
5,630		20.13% Pervious Area
22,340		79.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: EX-4

Runoff = 4.19 cfs @ 12.07 hrs, Volume= 13,067 cf, Depth= 5.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
11,132	98	Paved roads w/curbs & sewers, HSG A
3,492	39	>75% Grass cover, Good, HSG A
1,656	98	Paved roads w/curbs & sewers, HSG B
374	61	>75% Grass cover, Good, HSG B
9,506	98	Paved roads w/curbs & sewers, HSG C
2,243	74	>75% Grass cover, Good, HSG C
1,534	70	Woods, Good, HSG C
29,937	87	Weighted Average
7,643		25.53% Pervious Area
22,294		74.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: EX-5

Runoff = 3.36 cfs @ 12.08 hrs, Volume= 10,186 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
2,318	98	Paved roads w/curbs & sewers, HSG A
4,214	39	>75% Grass cover, Good, HSG A
508	30	Woods, Good, HSG A
1,148	98	Paved roads w/curbs & sewers, HSG B
1,169	61	>75% Grass cover, Good, HSG B
17,847	55	Woods, Good, HSG B
6,984	98	Paved roads w/curbs & sewers, HSG C
2,916	74	>75% Grass cover, Good, HSG C
2,215	70	Woods, Good, HSG C
39,319	67	Weighted Average
28,869		73.42% Pervious Area
10,450		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: EX-6

Runoff = 4.51 cfs @ 12.07 hrs, Volume= 14,138 cf, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
19,524	98	Paved roads w/curbs & sewers, HSG A
4,581	39	>75% Grass cover, Good, HSG A
6,330	98	Paved roads w/curbs & sewers, HSG B
1,271	61	>75% Grass cover, Good, HSG B
31,706	88	Weighted Average
5,852		18.46% Pervious Area
25,854		81.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Link DP-1: Flowing West Groton Rd

Inflow Area = 16,488 sf, 85.33% Impervious, Inflow Depth = 6.04" for 100-Year event
Inflow = 2.52 cfs @ 12.07 hrs, Volume= 8,299 cf
Primary = 2.52 cfs @ 12.07 hrs, Volume= 8,299 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: FES @ 231 Groton Rd

Inflow Area = 13,916 sf, 86.55% Impervious, Inflow Depth = 6.04" for 100-Year event
Inflow = 2.12 cfs @ 12.07 hrs, Volume= 7,005 cf
Primary = 2.12 cfs @ 12.07 hrs, Volume= 7,005 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Wetlands @ 242 Groton Rd

Inflow Area = 27,970 sf, 79.87% Impervious, Inflow Depth = 5.13" for 100-Year event
Inflow = 3.85 cfs @ 12.07 hrs, Volume= 11,947 cf
Primary = 3.85 cfs @ 12.07 hrs, Volume= 11,947 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-4: Wetlands West of Dunstable Rd

Inflow Area = 29,937 sf, 74.47% Impervious, Inflow Depth = 5.24" for 100-Year event
Inflow = 4.19 cfs @ 12.07 hrs, Volume= 13,067 cf
Primary = 4.19 cfs @ 12.07 hrs, Volume= 13,067 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP-5: Wetlands East of Dunstable Rd

Inflow Area = 39,319 sf, 26.58% Impervious, Inflow Depth = 3.11" for 100-Year event
Inflow = 3.36 cfs @ 12.08 hrs, Volume= 10,186 cf
Primary = 3.36 cfs @ 12.08 hrs, Volume= 10,186 cf, Atten= 0%, Lag= 0.0 min

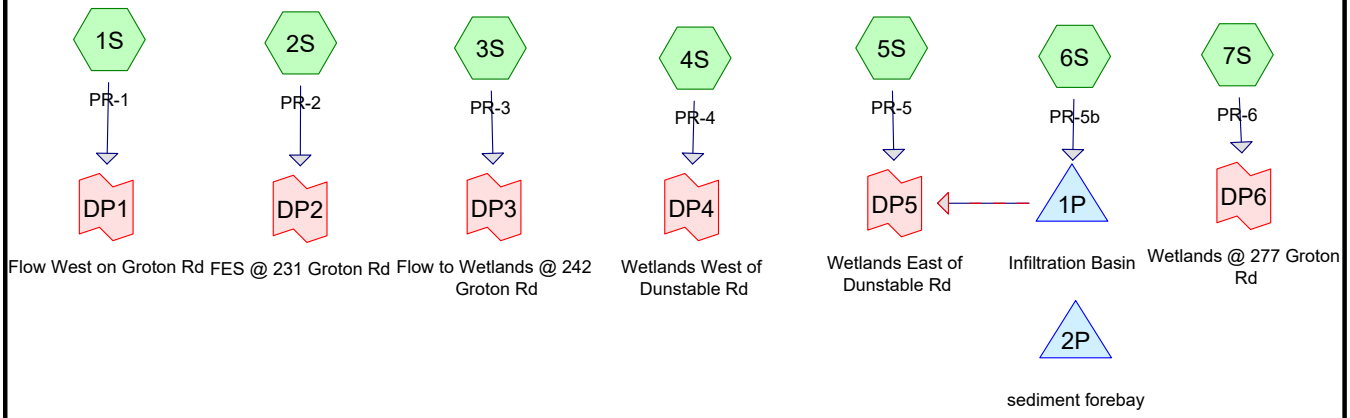
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

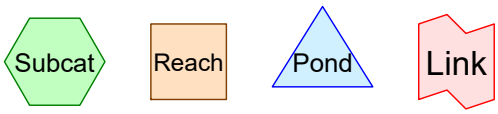
Summary for Link DP-6: Wetlands @ 277 Groton Rd

Inflow Area = 31,706 sf, 81.54% Impervious, Inflow Depth = 5.35" for 100-Year event
Inflow = 4.51 cfs @ 12.07 hrs, Volume= 14,138 cf
Primary = 4.51 cfs @ 12.07 hrs, Volume= 14,138 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Post-Development HydroCAD Reports





Routing Diagram for T0519_Post_2
Prepared by TEC, Inc., Printed 3/1/2018
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,359	39	>75% Grass cover, Good, HSG A (2S, 3S, 4S, 5S, 6S, 7S)
13,445	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 7S)
6,783	74	>75% Grass cover, Good, HSG C (2S, 4S, 5S, 6S)
698	96	Gravel surface, HSG A (5S)
80,579	98	Paved roads w/curbs & sewers, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S)
6,101	98	Paved roads w/curbs & sewers, HSG B (7S)
38,154	98	Paved roads w/curbs & sewers, HSG C (2S, 5S, 6S)
7,096	55	Woods, Good, HSG B (5S)
120	70	Woods, Good, HSG C (5S)
159,335	**90**	**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
6,359	13,445	6,783	0	0	26,587	>75% Grass cover, Good
698	0	0	0	0	698	Gravel surface
80,579	6,101	38,154	0	0	124,834	Paved roads w/curbs & sewers
0	7,096	120	0	0	7,216	Woods, Good
87,636	**26,642**	**45,057**	**0**	**0**	**159,335**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=4,899 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.35 cfs 1,171 cf

Subcatchment 2S: PR-2 Runoff Area=25,986 sf 96.60% Impervious Runoff Depth=2.76"
Tc=5.0 min CN=97 Runoff=1.82 cfs 5,971 cf

Subcatchment 3S: PR-3 Runoff Area=27,928 sf 94.82% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=95 Runoff=1.87 cfs 5,928 cf

Subcatchment 4S: PR-4 Runoff Area=11,967 sf 64.12% Impervious Runoff Depth=1.67"
Tc=5.0 min CN=85 Runoff=0.55 cfs 1,668 cf

Subcatchment 5S: PR-5 Runoff Area=25,136 sf 37.34% Impervious Runoff Depth=0.87"
Tc=5.0 min CN=72 Runoff=0.55 cfs 1,819 cf

Subcatchment 6S: PR-5b Runoff Area=34,800 sf 72.05% Impervious Runoff Depth=1.91"
Tc=5.0 min CN=88 Runoff=1.83 cfs 5,531 cf

Subcatchment 7S: PR-6 Runoff Area=28,619 sf 91.60% Impervious Runoff Depth=2.45"
Tc=5.0 min CN=94 Runoff=1.86 cfs 5,836 cf

Pond 1P: Infiltration Basin Peak Elev=224.51' Storage=3,280 cf Inflow=1.83 cfs 5,531 cf
Discarded=0.07 cfs 5,531 cf Secondary=0.00 cfs 0 cf Outflow=0.07 cfs 5,531 cf

Pond 2P: sediment forebay Peak Elev=0.00' Storage=0 cf

Link DP1: Flow West on Groton Rd Inflow=0.35 cfs 1,171 cf
Primary=0.35 cfs 1,171 cf

Link DP2: FES @ 231 Groton Rd Inflow=1.82 cfs 5,971 cf
Primary=1.82 cfs 5,971 cf

Link DP3: Flow to Wetlands @ 242 Groton Rd Inflow=1.87 cfs 5,928 cf
Primary=1.87 cfs 5,928 cf

Link DP4: Wetlands West of Dunstable Rd Inflow=0.55 cfs 1,668 cf
Primary=0.55 cfs 1,668 cf

Link DP5: Wetlands East of Dunstable Rd Inflow=0.55 cfs 1,819 cf
Primary=0.55 cfs 1,819 cf

Link DP6: Wetlands @ 277 Groton Rd Inflow=1.86 cfs 5,836 cf
Primary=1.86 cfs 5,836 cf

Total Runoff Area = 159,335 sf Runoff Volume = 27,924 cf Average Runoff Depth = 2.10"
21.65% Pervious = 34,501 sf 78.35% Impervious = 124,834 sf

Summary for Subcatchment 1S: PR-1

Runoff = 0.35 cfs @ 12.07 hrs, Volume= 1,171 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
4,899	98	Paved roads w/curbs & sewers, HSG A
4,899		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: PR-2

Runoff = 1.82 cfs @ 12.07 hrs, Volume= 5,971 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,125	98	Paved roads w/curbs & sewers, HSG A
115	39	>75% Grass cover, Good, HSG A
22,978	98	Paved roads w/curbs & sewers, HSG C
768	74	>75% Grass cover, Good, HSG C
25,986	97	Weighted Average
883		3.40% Pervious Area
25,103		96.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: PR-3

Runoff = 1.87 cfs @ 12.07 hrs, Volume= 5,928 cf, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
26,482	98	Paved roads w/curbs & sewers, HSG A
1,446	39	>75% Grass cover, Good, HSG A
27,928	95	Weighted Average
1,446		5.18% Pervious Area
26,482		94.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: PR-4

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 1,668 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
7,673	98	Paved roads w/curbs & sewers, HSG A
185	39	>75% Grass cover, Good, HSG A
3,340	61	>75% Grass cover, Good, HSG B
769	74	>75% Grass cover, Good, HSG C
11,967	85	Weighted Average
4,294		35.88% Pervious Area
7,673		64.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: PR-5

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 1,819 cf, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,231	98	Paved roads w/curbs & sewers, HSG A
3,117	39	>75% Grass cover, Good, HSG A
3,005	61	>75% Grass cover, Good, HSG B
7,096	55	Woods, Good, HSG B
3,156	98	Paved roads w/curbs & sewers, HSG C
1,713	74	>75% Grass cover, Good, HSG C
120	70	Woods, Good, HSG C
698	96	Gravel surface, HSG A
25,136	72	Weighted Average
15,749		62.66% Pervious Area
9,387		37.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: PR-5b

Runoff = 1.83 cfs @ 12.07 hrs, Volume= 5,531 cf, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,055	98	Paved roads w/curbs & sewers, HSG A
792	39	>75% Grass cover, Good, HSG A
12,020	98	Paved roads w/curbs & sewers, HSG C
3,533	74	>75% Grass cover, Good, HSG C
5,400	61	>75% Grass cover, Good, HSG B
34,800	88	Weighted Average
9,725		27.95% Pervious Area
25,075		72.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 7S: PR-6

Runoff = 1.86 cfs @ 12.07 hrs, Volume= 5,836 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
20,114	98	Paved roads w/curbs & sewers, HSG A
704	39	>75% Grass cover, Good, HSG A
6,101	98	Paved roads w/curbs & sewers, HSG B
1,700	61	>75% Grass cover, Good, HSG B
28,619	94	Weighted Average
2,404		8.40% Pervious Area
26,215		91.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin

Inflow Area = 34,800 sf, 72.05% Impervious, Inflow Depth = 1.91" for 2-Year event
Inflow = 1.83 cfs @ 12.07 hrs, Volume= 5,531 cf
Outflow = 0.07 cfs @ 15.53 hrs, Volume= 5,531 cf, Atten= 96%, Lag= 207.5 min
Discarded = 0.07 cfs @ 15.53 hrs, Volume= 5,531 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Peak Elev= 224.51' @ 15.53 hrs Surf.Area= 2,970 sf Storage= 3,280 cf

Plug-Flow detention time= 527.3 min calculated for 5,528 cf (100% of inflow)
Center-of-Mass det. time= 527.5 min (1,343.0 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	13,646 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
223.00	1,313	216.0	0	0	1,313
224.00	2,532	290.0	1,889	1,889	4,303
225.00	3,432	309.0	2,971	4,860	5,257
226.00	4,388	328.0	3,900	8,760	6,272
227.00	5,400	347.0	4,885	13,646	7,347

Device	Routing	Invert	Outlet Devices
#1	Discarded	223.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Secondary	225.80'	**12.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.07 cfs @ 15.53 hrs HW=224.51' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=223.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: sediment forebay

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	217 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.00	300	0	0
223.60	425	217	217

Summary for Link DP1: Flow West on Groton Rd

Inflow Area = 4,899 sf,100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.35 cfs @ 12.07 hrs, Volume= 1,171 cf
Primary = 0.35 cfs @ 12.07 hrs, Volume= 1,171 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: FES @ 231 Groton Rd

Inflow Area = 25,986 sf, 96.60% Impervious, Inflow Depth = 2.76" for 2-Year event
Inflow = 1.82 cfs @ 12.07 hrs, Volume= 5,971 cf
Primary = 1.82 cfs @ 12.07 hrs, Volume= 5,971 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP3: Flow to Wetlands @ 242 Groton Rd

Inflow Area = 27,928 sf, 94.82% Impervious, Inflow Depth = 2.55" for 2-Year event
Inflow = 1.87 cfs @ 12.07 hrs, Volume= 5,928 cf
Primary = 1.87 cfs @ 12.07 hrs, Volume= 5,928 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP4: Wetlands West of Dunstable Rd

Inflow Area = 11,967 sf, 64.12% Impervious, Inflow Depth = 1.67" for 2-Year event
Inflow = 0.55 cfs @ 12.08 hrs, Volume= 1,668 cf
Primary = 0.55 cfs @ 12.08 hrs, Volume= 1,668 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP5: Wetlands East of Dunstable Rd

Inflow Area = 59,936 sf, 57.50% Impervious, Inflow Depth = 0.36" for 2-Year event
Inflow = 0.55 cfs @ 12.09 hrs, Volume= 1,819 cf
Primary = 0.55 cfs @ 12.09 hrs, Volume= 1,819 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP6: Wetlands @ 277 Groton Rd

Inflow Area = 28,619 sf, 91.60% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 1.86 cfs @ 12.07 hrs, Volume= 5,836 cf
Primary = 1.86 cfs @ 12.07 hrs, Volume= 5,836 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=4,899 sf 100.00% Impervious Runoff Depth=4.51"
Tc=5.0 min CN=98 Runoff=0.54 cfs 1,843 cf

Subcatchment 2S: PR-2 Runoff Area=25,986 sf 96.60% Impervious Runoff Depth=4.40"
Tc=5.0 min CN=97 Runoff=2.83 cfs 9,524 cf

Subcatchment 3S: PR-3 Runoff Area=27,928 sf 94.82% Impervious Runoff Depth=4.17"
Tc=5.0 min CN=95 Runoff=2.97 cfs 9,710 cf

Subcatchment 4S: PR-4 Runoff Area=11,967 sf 64.12% Impervious Runoff Depth=3.14"
Tc=5.0 min CN=85 Runoff=1.03 cfs 3,129 cf

Subcatchment 5S: PR-5 Runoff Area=25,136 sf 37.34% Impervious Runoff Depth=2.01"
Tc=5.0 min CN=72 Runoff=1.38 cfs 4,204 cf

Subcatchment 6S: PR-5b Runoff Area=34,800 sf 72.05% Impervious Runoff Depth=3.43"
Tc=5.0 min CN=88 Runoff=3.24 cfs 9,953 cf

Subcatchment 7S: PR-6 Runoff Area=28,619 sf 91.60% Impervious Runoff Depth=4.06"
Tc=5.0 min CN=94 Runoff=3.00 cfs 9,686 cf

Pond 1P: Infiltration Basin Peak Elev=225.47' Storage=6,574 cf Inflow=3.24 cfs 9,953 cf
Discarded=0.09 cfs 9,751 cf Secondary=0.00 cfs 0 cf Outflow=0.09 cfs 9,751 cf

Pond 2P: sediment forebay Peak Elev=0.00' Storage=0 cf

Link DP1: Flow West on Groton Rd Inflow=0.54 cfs 1,843 cf
Primary=0.54 cfs 1,843 cf

Link DP2: FES @ 231 Groton Rd Inflow=2.83 cfs 9,524 cf
Primary=2.83 cfs 9,524 cf

Link DP3: Flow to Wetlands @ 242 Groton Rd Inflow=2.97 cfs 9,710 cf
Primary=2.97 cfs 9,710 cf

Link DP4: Wetlands West of Dunstable Rd Inflow=1.03 cfs 3,129 cf
Primary=1.03 cfs 3,129 cf

Link DP5: Wetlands East of Dunstable Rd Inflow=1.38 cfs 4,204 cf
Primary=1.38 cfs 4,204 cf

Link DP6: Wetlands @ 277 Groton Rd Inflow=3.00 cfs 9,686 cf
Primary=3.00 cfs 9,686 cf

Total Runoff Area = 159,335 sf Runoff Volume = 48,049 cf Average Runoff Depth = 3.62"
21.65% Pervious = 34,501 sf 78.35% Impervious = 124,834 sf

Summary for Subcatchment 1S: PR-1

Runoff = 0.54 cfs @ 12.07 hrs, Volume= 1,843 cf, Depth= 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
4,899	98	Paved roads w/curbs & sewers, HSG A
4,899		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: PR-2

Runoff = 2.83 cfs @ 12.07 hrs, Volume= 9,524 cf, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
2,125	98	Paved roads w/curbs & sewers, HSG A
115	39	>75% Grass cover, Good, HSG A
22,978	98	Paved roads w/curbs & sewers, HSG C
768	74	>75% Grass cover, Good, HSG C
25,986	97	Weighted Average
883		3.40% Pervious Area
25,103		96.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: PR-3

Runoff = 2.97 cfs @ 12.07 hrs, Volume= 9,710 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
26,482	98	Paved roads w/curbs & sewers, HSG A
1,446	39	>75% Grass cover, Good, HSG A
27,928	95	Weighted Average
1,446		5.18% Pervious Area
26,482		94.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: PR-4

Runoff = 1.03 cfs @ 12.07 hrs, Volume= 3,129 cf, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
7,673	98	Paved roads w/curbs & sewers, HSG A
185	39	>75% Grass cover, Good, HSG A
3,340	61	>75% Grass cover, Good, HSG B
769	74	>75% Grass cover, Good, HSG C
11,967	85	Weighted Average
4,294		35.88% Pervious Area
7,673		64.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: PR-5

Runoff = 1.38 cfs @ 12.08 hrs, Volume= 4,204 cf, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
6,231	98	Paved roads w/curbs & sewers, HSG A
3,117	39	>75% Grass cover, Good, HSG A
3,005	61	>75% Grass cover, Good, HSG B
7,096	55	Woods, Good, HSG B
3,156	98	Paved roads w/curbs & sewers, HSG C
1,713	74	>75% Grass cover, Good, HSG C
120	70	Woods, Good, HSG C
698	96	Gravel surface, HSG A
25,136	72	Weighted Average
15,749		62.66% Pervious Area
9,387		37.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: PR-5b

Runoff = 3.24 cfs @ 12.07 hrs, Volume= 9,953 cf, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
13,055	98	Paved roads w/curbs & sewers, HSG A
792	39	>75% Grass cover, Good, HSG A
12,020	98	Paved roads w/curbs & sewers, HSG C
3,533	74	>75% Grass cover, Good, HSG C
5,400	61	>75% Grass cover, Good, HSG B
34,800	88	Weighted Average
9,725		27.95% Pervious Area
25,075		72.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 7S: PR-6

Runoff = 3.00 cfs @ 12.07 hrs, Volume= 9,686 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Year Rainfall=4.75"

Area (sf)	CN	Description
20,114	98	Paved roads w/curbs & sewers, HSG A
704	39	>75% Grass cover, Good, HSG A
6,101	98	Paved roads w/curbs & sewers, HSG B
1,700	61	>75% Grass cover, Good, HSG B
28,619	94	Weighted Average
2,404		8.40% Pervious Area
26,215		91.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin

Inflow Area = 34,800 sf, 72.05% Impervious, Inflow Depth = 3.43" for 10-Year event
Inflow = 3.24 cfs @ 12.07 hrs, Volume= 9,953 cf
Outflow = 0.09 cfs @ 16.17 hrs, Volume= 9,751 cf, Atten= 97%, Lag= 245.8 min
Discarded = 0.09 cfs @ 16.17 hrs, Volume= 9,751 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Peak Elev= 225.47' @ 16.17 hrs Surf.Area= 3,867 sf Storage= 6,574 cf

Plug-Flow detention time= 797.9 min calculated for 9,751 cf (98% of inflow)
Center-of-Mass det. time= 785.6 min (1,584.4 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	13,646 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
223.00	1,313	216.0	0	0	1,313
224.00	2,532	290.0	1,889	1,889	4,303
225.00	3,432	309.0	2,971	4,860	5,257
226.00	4,388	328.0	3,900	8,760	6,272
227.00	5,400	347.0	4,885	13,646	7,347

Device	Routing	Invert	Outlet Devices
#1	Discarded	223.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Secondary	225.80'	**12.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.09 cfs @ 16.17 hrs HW=225.47' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=223.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: sediment forebay

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	217 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.00	300	0	0
223.60	425	217	217

Summary for Link DP1: Flow West on Groton Rd

Inflow Area = 4,899 sf,100.00% Impervious, Inflow Depth = 4.51" for 10-Year event
Inflow = 0.54 cfs @ 12.07 hrs, Volume= 1,843 cf
Primary = 0.54 cfs @ 12.07 hrs, Volume= 1,843 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: FES @ 231 Groton Rd

Inflow Area = 25,986 sf, 96.60% Impervious, Inflow Depth = 4.40" for 10-Year event
Inflow = 2.83 cfs @ 12.07 hrs, Volume= 9,524 cf
Primary = 2.83 cfs @ 12.07 hrs, Volume= 9,524 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP3: Flow to Wetlands @ 242 Groton Rd

Inflow Area = 27,928 sf, 94.82% Impervious, Inflow Depth = 4.17" for 10-Year event
Inflow = 2.97 cfs @ 12.07 hrs, Volume= 9,710 cf
Primary = 2.97 cfs @ 12.07 hrs, Volume= 9,710 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP4: Wetlands West of Dunstable Rd

Inflow Area = 11,967 sf, 64.12% Impervious, Inflow Depth = 3.14" for 10-Year event
Inflow = 1.03 cfs @ 12.07 hrs, Volume= 3,129 cf
Primary = 1.03 cfs @ 12.07 hrs, Volume= 3,129 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP5: Wetlands East of Dunstable Rd

Inflow Area = 59,936 sf, 57.50% Impervious, Inflow Depth = 0.84" for 10-Year event
Inflow = 1.38 cfs @ 12.08 hrs, Volume= 4,204 cf
Primary = 1.38 cfs @ 12.08 hrs, Volume= 4,204 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP6: Wetlands @ 277 Groton Rd

Inflow Area = 28,619 sf, 91.60% Impervious, Inflow Depth = 4.06" for 10-Year event
Inflow = 3.00 cfs @ 12.07 hrs, Volume= 9,686 cf
Primary = 3.00 cfs @ 12.07 hrs, Volume= 9,686 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=4,899 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.62 cfs 2,148 cf

Subcatchment 2S: PR-2 Runoff Area=25,986 sf 96.60% Impervious Runoff Depth=5.15"
Tc=5.0 min CN=97 Runoff=3.29 cfs 11,143 cf

Subcatchment 3S: PR-3 Runoff Area=27,928 sf 94.82% Impervious Runoff Depth=4.92"
Tc=5.0 min CN=95 Runoff=3.47 cfs 11,439 cf

Subcatchment 4S: PR-4 Runoff Area=11,967 sf 64.12% Impervious Runoff Depth=3.83"
Tc=5.0 min CN=85 Runoff=1.25 cfs 3,822 cf

Subcatchment 5S: PR-5 Runoff Area=25,136 sf 37.34% Impervious Runoff Depth=2.59"
Tc=5.0 min CN=72 Runoff=1.79 cfs 5,424 cf

Subcatchment 6S: PR-5b Runoff Area=34,800 sf 72.05% Impervious Runoff Depth=4.15"
Tc=5.0 min CN=88 Runoff=3.88 cfs 12,023 cf

Subcatchment 7S: PR-6 Runoff Area=28,619 sf 91.60% Impervious Runoff Depth=4.80"
Tc=5.0 min CN=94 Runoff=3.52 cfs 11,452 cf

Pond 1P: Infiltration Basin Peak Elev=225.81' Storage=7,947 cf Inflow=3.88 cfs 12,023 cf
Discarded=0.10 cfs 10,957 cf Secondary=0.06 cfs 265 cf Outflow=0.16 cfs 11,222 cf

Pond 2P: sediment forebay Peak Elev=0.00' Storage=0 cf

Link DP1: Flow West on Groton Rd Inflow=0.62 cfs 2,148 cf
Primary=0.62 cfs 2,148 cf

Link DP2: FES @ 231 Groton Rd Inflow=3.29 cfs 11,143 cf
Primary=3.29 cfs 11,143 cf

Link DP3: Flow to Wetlands @ 242 Groton Rd Inflow=3.47 cfs 11,439 cf
Primary=3.47 cfs 11,439 cf

Link DP4: Wetlands West of Dunstable Rd Inflow=1.25 cfs 3,822 cf
Primary=1.25 cfs 3,822 cf

Link DP5: Wetlands East of Dunstable Rd Inflow=1.79 cfs 5,689 cf
Primary=1.79 cfs 5,689 cf

Link DP6: Wetlands @ 277 Groton Rd Inflow=3.52 cfs 11,452 cf
Primary=3.52 cfs 11,452 cf

Total Runoff Area = 159,335 sf Runoff Volume = 57,452 cf Average Runoff Depth = 4.33"
21.65% Pervious = 34,501 sf 78.35% Impervious = 124,834 sf

Summary for Subcatchment 1S: PR-1

Runoff = 0.62 cfs @ 12.07 hrs, Volume= 2,148 cf, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
4,899	98	Paved roads w/curbs & sewers, HSG A
4,899		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: PR-2

Runoff = 3.29 cfs @ 12.07 hrs, Volume= 11,143 cf, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
2,125	98	Paved roads w/curbs & sewers, HSG A
115	39	>75% Grass cover, Good, HSG A
22,978	98	Paved roads w/curbs & sewers, HSG C
768	74	>75% Grass cover, Good, HSG C
25,986	97	Weighted Average
883		3.40% Pervious Area
25,103		96.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: PR-3

Runoff = 3.47 cfs @ 12.07 hrs, Volume= 11,439 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
26,482	98	Paved roads w/curbs & sewers, HSG A
1,446	39	>75% Grass cover, Good, HSG A
27,928	95	Weighted Average
1,446		5.18% Pervious Area
26,482		94.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: PR-4

Runoff = 1.25 cfs @ 12.07 hrs, Volume= 3,822 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
7,673	98	Paved roads w/curbs & sewers, HSG A
185	39	>75% Grass cover, Good, HSG A
3,340	61	>75% Grass cover, Good, HSG B
769	74	>75% Grass cover, Good, HSG C
11,967	85	Weighted Average
4,294		35.88% Pervious Area
7,673		64.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: PR-5

Runoff = 1.79 cfs @ 12.08 hrs, Volume= 5,424 cf, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
6,231	98	Paved roads w/curbs & sewers, HSG A
3,117	39	>75% Grass cover, Good, HSG A
3,005	61	>75% Grass cover, Good, HSG B
7,096	55	Woods, Good, HSG B
3,156	98	Paved roads w/curbs & sewers, HSG C
1,713	74	>75% Grass cover, Good, HSG C
120	70	Woods, Good, HSG C
698	96	Gravel surface, HSG A
25,136	72	Weighted Average
15,749		62.66% Pervious Area
9,387		37.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: PR-5b

Runoff = 3.88 cfs @ 12.07 hrs, Volume= 12,023 cf, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
13,055	98	Paved roads w/curbs & sewers, HSG A
792	39	>75% Grass cover, Good, HSG A
12,020	98	Paved roads w/curbs & sewers, HSG C
3,533	74	>75% Grass cover, Good, HSG C
5,400	61	>75% Grass cover, Good, HSG B
34,800	88	Weighted Average
9,725		27.95% Pervious Area
25,075		72.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 7S: PR-6

Runoff = 3.52 cfs @ 12.07 hrs, Volume= 11,452 cf, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
20,114	98	Paved roads w/curbs & sewers, HSG A
704	39	>75% Grass cover, Good, HSG A
6,101	98	Paved roads w/curbs & sewers, HSG B
1,700	61	>75% Grass cover, Good, HSG B
28,619	94	Weighted Average
2,404		8.40% Pervious Area
26,215		91.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin

Inflow Area = 34,800 sf, 72.05% Impervious, Inflow Depth = 4.15" for 25-Year event
Inflow = 3.88 cfs @ 12.07 hrs, Volume= 12,023 cf
Outflow = 0.16 cfs @ 15.00 hrs, Volume= 11,222 cf, Atten= 96%, Lag= 175.8 min
Discarded = 0.10 cfs @ 15.00 hrs, Volume= 10,957 cf
Secondary = 0.06 cfs @ 15.00 hrs, Volume= 265 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Peak Elev= 225.81' @ 15.00 hrs Surf.Area= 4,198 sf Storage= 7,947 cf

Plug-Flow detention time= 826.8 min calculated for 11,222 cf (93% of inflow)
Center-of-Mass det. time= 791.2 min (1,584.8 - 793.6)

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	13,646 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
223.00	1,313	216.0	0	0	1,313
224.00	2,532	290.0	1,889	1,889	4,303
225.00	3,432	309.0	2,971	4,860	5,257
226.00	4,388	328.0	3,900	8,760	6,272
227.00	5,400	347.0	4,885	13,646	7,347

Device	Routing	Invert	Outlet Devices
#1	Discarded	223.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Secondary	225.80'	**12.0' long x 8.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.10 cfs @ 15.00 hrs HW=225.81' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Secondary OutFlow Max=0.03 cfs @ 15.00 hrs HW=225.81' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.25 fps)

Summary for Pond 2P: sediment forebay

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	217 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.00	300	0	0
223.60	425	217	217

Summary for Link DP1: Flow West on Groton Rd

Inflow Area = 4,899 sf,100.00% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 2,148 cf
Primary = 0.62 cfs @ 12.07 hrs, Volume= 2,148 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: FES @ 231 Groton Rd

Inflow Area = 25,986 sf, 96.60% Impervious, Inflow Depth = 5.15" for 25-Year event
Inflow = 3.29 cfs @ 12.07 hrs, Volume= 11,143 cf
Primary = 3.29 cfs @ 12.07 hrs, Volume= 11,143 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP3: Flow to Wetlands @ 242 Groton Rd

Inflow Area = 27,928 sf, 94.82% Impervious, Inflow Depth = 4.92" for 25-Year event
Inflow = 3.47 cfs @ 12.07 hrs, Volume= 11,439 cf
Primary = 3.47 cfs @ 12.07 hrs, Volume= 11,439 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP4: Wetlands West of Dunstable Rd

Inflow Area = 11,967 sf, 64.12% Impervious, Inflow Depth = 3.83" for 25-Year event
Inflow = 1.25 cfs @ 12.07 hrs, Volume= 3,822 cf
Primary = 1.25 cfs @ 12.07 hrs, Volume= 3,822 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP5: Wetlands East of Dunstable Rd

Inflow Area = 59,936 sf, 57.50% Impervious, Inflow Depth = 1.14" for 25-Year event
Inflow = 1.79 cfs @ 12.08 hrs, Volume= 5,689 cf
Primary = 1.79 cfs @ 12.08 hrs, Volume= 5,689 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP6: Wetlands @ 277 Groton Rd

Inflow Area = 28,619 sf, 91.60% Impervious, Inflow Depth = 4.80" for 25-Year event
Inflow = 3.52 cfs @ 12.07 hrs, Volume= 11,452 cf
Primary = 3.52 cfs @ 12.07 hrs, Volume= 11,452 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PR-1 Runoff Area=4,899 sf 100.00% Impervious Runoff Depth=6.51"
Tc=5.0 min CN=98 Runoff=0.77 cfs 2,658 cf

Subcatchment 2S: PR-2 Runoff Area=25,986 sf 96.60% Impervious Runoff Depth=6.39"
Tc=5.0 min CN=97 Runoff=4.05 cfs 13,843 cf

Subcatchment 3S: PR-3 Runoff Area=27,928 sf 94.82% Impervious Runoff Depth=6.16"
Tc=5.0 min CN=95 Runoff=4.30 cfs 14,330 cf

Subcatchment 4S: PR-4 Runoff Area=11,967 sf 64.12% Impervious Runoff Depth=5.01"
Tc=5.0 min CN=85 Runoff=1.62 cfs 5,000 cf

Subcatchment 5S: PR-5 Runoff Area=25,136 sf 37.34% Impervious Runoff Depth=3.62"
Tc=5.0 min CN=72 Runoff=2.51 cfs 7,576 cf

Subcatchment 6S: PR-5b Runoff Area=34,800 sf 72.05% Impervious Runoff Depth=5.35"
Tc=5.0 min CN=88 Runoff=4.95 cfs 15,517 cf

Subcatchment 7S: PR-6 Runoff Area=28,619 sf 91.60% Impervious Runoff Depth=6.04"
Tc=5.0 min CN=94 Runoff=4.37 cfs 14,405 cf

Pond 1P: Infiltration Basin Peak Elev=225.89' Storage=8,301 cf Inflow=4.95 cfs 15,517 cf
Discarded=0.10 cfs 11,366 cf Secondary=0.85 cfs 3,199 cf Outflow=0.96 cfs 14,565 cf

Pond 2P: sediment forebay Peak Elev=0.00' Storage=0 cf

Link DP1: Flow West on Groton Rd Inflow=0.77 cfs 2,658 cf
Primary=0.77 cfs 2,658 cf

Link DP2: FES @ 231 Groton Rd Inflow=4.05 cfs 13,843 cf
Primary=4.05 cfs 13,843 cf

Link DP3: Flow to Wetlands @ 242 Groton Rd Inflow=4.30 cfs 14,330 cf
Primary=4.30 cfs 14,330 cf

Link DP4: Wetlands West of Dunstable Rd Inflow=1.62 cfs 5,000 cf
Primary=1.62 cfs 5,000 cf

Link DP5: Wetlands East of Dunstable Rd Inflow=2.51 cfs 10,775 cf
Primary=2.51 cfs 10,775 cf

Link DP6: Wetlands @ 277 Groton Rd Inflow=4.37 cfs 14,405 cf
Primary=4.37 cfs 14,405 cf

Total Runoff Area = 159,335 sf Runoff Volume = 73,330 cf Average Runoff Depth = 5.52"
21.65% Pervious = 34,501 sf 78.35% Impervious = 124,834 sf

Summary for Subcatchment 1S: PR-1

Runoff = 0.77 cfs @ 12.07 hrs, Volume= 2,658 cf, Depth= 6.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
4,899	98	Paved roads w/curbs & sewers, HSG A
4,899		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S: PR-2

Runoff = 4.05 cfs @ 12.07 hrs, Volume= 13,843 cf, Depth= 6.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
2,125	98	Paved roads w/curbs & sewers, HSG A
115	39	>75% Grass cover, Good, HSG A
22,978	98	Paved roads w/curbs & sewers, HSG C
768	74	>75% Grass cover, Good, HSG C
25,986	97	Weighted Average
883		3.40% Pervious Area
25,103		96.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 3S: PR-3

Runoff = 4.30 cfs @ 12.07 hrs, Volume= 14,330 cf, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
26,482	98	Paved roads w/curbs & sewers, HSG A
1,446	39	>75% Grass cover, Good, HSG A
27,928	95	Weighted Average
1,446		5.18% Pervious Area
26,482		94.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 4S: PR-4

Runoff = 1.62 cfs @ 12.07 hrs, Volume= 5,000 cf, Depth= 5.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
7,673	98	Paved roads w/curbs & sewers, HSG A
185	39	>75% Grass cover, Good, HSG A
3,340	61	>75% Grass cover, Good, HSG B
769	74	>75% Grass cover, Good, HSG C
11,967	85	Weighted Average
4,294		35.88% Pervious Area
7,673		64.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 5S: PR-5

Runoff = 2.51 cfs @ 12.08 hrs, Volume= 7,576 cf, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
6,231	98	Paved roads w/curbs & sewers, HSG A
3,117	39	>75% Grass cover, Good, HSG A
3,005	61	>75% Grass cover, Good, HSG B
7,096	55	Woods, Good, HSG B
3,156	98	Paved roads w/curbs & sewers, HSG C
1,713	74	>75% Grass cover, Good, HSG C
120	70	Woods, Good, HSG C
698	96	Gravel surface, HSG A
25,136	72	Weighted Average
15,749		62.66% Pervious Area
9,387		37.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 6S: PR-5b

Runoff = 4.95 cfs @ 12.07 hrs, Volume= 15,517 cf, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
13,055	98	Paved roads w/curbs & sewers, HSG A
792	39	>75% Grass cover, Good, HSG A
12,020	98	Paved roads w/curbs & sewers, HSG C
3,533	74	>75% Grass cover, Good, HSG C
5,400	61	>75% Grass cover, Good, HSG B
34,800	88	Weighted Average
9,725		27.95% Pervious Area
25,075		72.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 7S: PR-6

Runoff = 4.37 cfs @ 12.07 hrs, Volume= 14,405 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Year Rainfall=6.75"

Area (sf)	CN	Description
20,114	98	Paved roads w/curbs & sewers, HSG A
704	39	>75% Grass cover, Good, HSG A
6,101	98	Paved roads w/curbs & sewers, HSG B
1,700	61	>75% Grass cover, Good, HSG B
28,619	94	Weighted Average
2,404		8.40% Pervious Area
26,215		91.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin

Inflow Area = 34,800 sf, 72.05% Impervious, Inflow Depth = 5.35" for 100-Year event
Inflow = 4.95 cfs @ 12.07 hrs, Volume= 15,517 cf
Outflow = 0.96 cfs @ 12.50 hrs, Volume= 14,565 cf, Atten= 81%, Lag= 25.9 min
Discarded = 0.10 cfs @ 12.50 hrs, Volume= 11,366 cf
Secondary = 0.85 cfs @ 12.50 hrs, Volume= 3,199 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Peak Elev= 225.89' @ 12.50 hrs Surf.Area= 4,281 sf Storage= 8,301 cf

Plug-Flow detention time= 665.4 min calculated for 14,565 cf (94% of inflow)
Center-of-Mass det. time= 631.9 min (1,418.6 - 786.6)

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	13,646 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
223.00	1,313	216.0	0	0	1,313
224.00	2,532	290.0	1,889	1,889	4,303
225.00	3,432	309.0	2,971	4,860	5,257
226.00	4,388	328.0	3,900	8,760	6,272
227.00	5,400	347.0	4,885	13,646	7,347

Device	Routing	Invert	Outlet Devices
#1	Discarded	223.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Secondary	225.80'	**12.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.10 cfs @ 12.50 hrs HW=225.89' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Secondary OutFlow Max=0.84 cfs @ 12.50 hrs HW=225.89' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.84 cfs @ 0.74 fps)

Summary for Pond 2P: sediment forebay

Volume	Invert	Avail.Storage	Storage Description
#1	223.00'	217 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
223.00	300	0	0
223.60	425	217	217

Summary for Link DP1: Flow West on Groton Rd

Inflow Area = 4,899 sf,100.00% Impervious, Inflow Depth = 6.51" for 100-Year event
Inflow = 0.77 cfs @ 12.07 hrs, Volume= 2,658 cf
Primary = 0.77 cfs @ 12.07 hrs, Volume= 2,658 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: FES @ 231 Groton Rd

Inflow Area = 25,986 sf, 96.60% Impervious, Inflow Depth = 6.39" for 100-Year event
Inflow = 4.05 cfs @ 12.07 hrs, Volume= 13,843 cf
Primary = 4.05 cfs @ 12.07 hrs, Volume= 13,843 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP3: Flow to Wetlands @ 242 Groton Rd

Inflow Area = 27,928 sf, 94.82% Impervious, Inflow Depth = 6.16" for 100-Year event
Inflow = 4.30 cfs @ 12.07 hrs, Volume= 14,330 cf
Primary = 4.30 cfs @ 12.07 hrs, Volume= 14,330 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP4: Wetlands West of Dunstable Rd

Inflow Area = 11,967 sf, 64.12% Impervious, Inflow Depth = 5.01" for 100-Year event
Inflow = 1.62 cfs @ 12.07 hrs, Volume= 5,000 cf
Primary = 1.62 cfs @ 12.07 hrs, Volume= 5,000 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP5: Wetlands East of Dunstable Rd

Inflow Area = 59,936 sf, 57.50% Impervious, Inflow Depth = 2.16" for 100-Year event
Inflow = 2.51 cfs @ 12.08 hrs, Volume= 10,775 cf
Primary = 2.51 cfs @ 12.08 hrs, Volume= 10,775 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP6: Wetlands @ 277 Groton Rd

Inflow Area = 28,619 sf, 91.60% Impervious, Inflow Depth = 6.04" for 100-Year event
Inflow = 4.37 cfs @ 12.07 hrs, Volume= 14,405 cf
Primary = 4.37 cfs @ 12.07 hrs, Volume= 14,405 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Hydraulic Calculations

Storm Drainage Computations

Name	Groton Road (Route 40)	Proj. No.	519.02	Design Parameters	
Client	Town of Westford	Date	3/1/2018	100 Year Storm	
Subject	Stormdrain Calc	Comp.	MAA	12 "Min. Pipe Size	
		Check	PFE	Project File:	
	Location in Massachusetts		1	(1-Boston, 2-Barnstable, 3-Worcester, 4-Springfield, 5-Pittsfield)	
		Manning's roughness coefficient		0.013	

(NOTE ENTER CELLS AS HIGHLIGHTED IN FIRST ROW)

ENGLISH

Rainfall Data is For Boston

LOCATION FROM DRAINAGE NO.	LOCATION TO DRAINAGE NO.	RAINFALL CONCENTRATION PERIOD IN MINUTES PIPE	RAINFALL CONCENTRATION PERIOD IN MINUTES TOTAL	COMBINED RUNOFF COEFF. C	TRIBUTARY AREA IN ACRES INC	TRIBUTARY AREA IN ACRES TOTAL	C x A INC	C x A TOTAL	RAINFALL INTENSITY (i) IN/HR	PEAK FLOW CFS	PIPE SIZE IN	PIPE n VALUE	PIPE SLOPE FT/FT	PIPE LENGTH FT	PIPE FULL CAPACITY CFS	PIPE FULL VELOCITY FT/S	PIPE PEAK FLOW CONDITIONS VELOCITY FT/S	PIPE PEAK FLOW CONDITIONS d/D	PROFILE INVERT ELEVATION UPPER END	PROFILE INVERT ELEVATION LOWER END	PROFILE RIM ELEVATION & DEPTH OF COVER UPPER RIM	PROFILE RIM ELEVATION & DEPTH OF COVER DEPTH	Qf/Qd
CB 1	DMH 3		5.00	0.90	0.090	0.090	0.08	0.08	7.30	0.59	12	0.013	0.020	38	5.00	6.4	4.3	0.23	208.70	207.95	212.72	2.82	0.11817658
CB2	DMH 3		5.00	0.88	0.290	0.290	0.26	0.26	7.30	1.86	12	0.013	0.019	31	4.95	6.3	5.8	0.42	210.25	209.65	214.26	2.81	0.37598551
CB 4	DMH 5		5.00	0.90	0.030	0.030	0.03	0.03	7.30	0.20	12	0.013	0.005	28	2.61	3.3	1.9	0.18	223.40	223.25	227.25	2.65	0.07561055
CB 7	DMH 5		5.00	0.82	0.200	0.200	0.16	0.16	7.30	1.20	12	0.013	0.019	8	4.88	6.2	5.1	0.33	223.75	223.60	227.76	2.81	0.24548696
DMH 5	**DMH 6**	**0.24**	**5.24**			**0.230**	**0.00**	**0.19**	**7.30**	**1.39**	**12**	**0.013**	**0.025**	**2**	**5.63**	**7.2**	**5.9**	**0.33**	**223.15**	**223.10**	**227.38**	**3.03**	**0.24759883**
DMH 6	**EX DMH 3**	**0.01**	**5.25**			**0.230**	**0.00**	**0.19**	**7.30**	**1.39**	**15**	**0.013**	**0.016**	**65**	**8.21**	**6.7**	**4.9**	**0.27**	**223.60**	**222.55**	**227.55**	**2.50**	**0.16988456**
EX DMH 3	**EX DMH 2**	**0.22**	**5.47**			**0.230**	**0.00**	**0.19**	**7.30**	**1.39**	**15**	**0.013**	**0.019**	**31**	**8.98**	**7.3**	**5.2**	**0.26**	**222.30**	**221.70**	**224.91**	**1.16**	**0.15520193**
EX DMH 2	**DMH 3**	**0.10**	**5.57**			**0.230**	**0.00**	**0.19**	**7.30**	**1.39**	**15**	**0.013**	**0.047**	**216**	**13.96**	**11.4**	**7.2**	**0.21**	**221.60**	**211.50**	**225.20**	**2.15**	**0.0998523**
DMH 3	**EX FES**	**0.50**	**6.07**			**0.610**	**0.00**	**0.53**	**7.20**	**3.80**	**15**	**0.013**	**0.024**	**41**	**10.08**	**8.2**	**7.6**	**0.42**	**205.00**	**204.00**	**214.73**	**8.28**	**0.37638776**
CB 17	DMH 16		5.00	0.86	0.120	0.120	0.10	0.10	7.30	0.75	12	0.013	0.015	10	4.36	5.6	4.1	0.28	227.40	227.25	232.34	3.74	0.17271072
CB 18	DMH 16		5.00	0.86	0.110	0.110	0.09	0.09	7.30	0.69	12	0.013	0.022	25	5.28	6.7	4.6	0.24	227.75	227.20	232.36	3.41	0.13072692
DMH 16	**DMH 11**	**0.09**	**5.09**			**0.230**	**0.00**	**0.20**	**7.30**	**1.44**	**12**	**0.013**	**0.008**	**205**	**3.20**	**4.1**	**4.0**	**0.47**	**227.10**	**225.45**	**232.28**	**3.98**	**0.45190429**
CB 13	DMH 11		5.00	0.83	0.100	0.100	0.08	0.08	7.30	0.61	12	0.013	0.017	12	4.60	5.9	4.0	0.24	225.65	225.45	229.10	2.25	0.13177679
CB 15	DMH 11		5.00	0.87	0.090	0.090	0.08	0.08	7.30	0.57	12	0.013	0.015	17	4.32	5.5	3.8	0.24	225.70	225.45	229.10	2.20	0.13234314
CB 10	DMH 11		5.00	0.78	0.130	0.130	0.10	0.10	7.30	0.74	12	0.013	0.020	10	5.04	6.4	4.5	0.25	225.65	225.45	229.16	2.31	0.14696306
CB 12	DMH 11		5.00	0.90	0.090	0.090	0.08	0.08	7.30	0.59	12	0.013	0.017	15	4.60	5.9	4.0	0.24	225.70	225.45	229.16	2.26	0.12860145
DMH 11	**DMH 9**	**0.86**	**5.95**			**0.640**	**0.00**	**0.54**	**7.30**	**3.95**	**15**	**0.013**	**0.005**	**40**	**4.57**	**3.7**	**4.2**	**0.71**	**225.35**	**225.15**	**229.27**	**2.47**	**0.86570909**
HDWL 9A	DMH 9		5.00			0.000	0.00	0.00	7.30	0.00	24	0.013	0.051	33	51.02	16.2	#N/A	#N/A	227.38	225.70	-	#VALUE!	0
DMH 9	**HDWL 9B**	**0.16**	**6.11**			**0.640**	**0.00**	**0.54**	**7.20**	**3.90**	**24**	**0.013**	**0.005**	**10**	**15.99**	**5.1**	**4.2**	**0.33**	**225.05**	**225.00**	**229.58**	**2.33**	**0.2438157**
CB 24	DMH 25		5.00	0.90	0.020	0.020	0.02	0.02	7.30	0.13	12	0.013	0.008	6	3.25	4.1	2.0	0.13	226.05	226.00	229.84	2.59	0.04041554
DMH 25	**DMH 23**	**0.05**	**5.05**			**0.020**	**0.00**	**0.02**	**7.30**	**0.13**	**12**	**0.013**	**0.010**	**49**	**3.60**	**4.6**	**2.2**	**0.13**	**225.90**	**225.40**	**230.13**	**3.03**	**0.03652336**
CB 22	DMH 23		5.00	0.84	0.170	0.170	0.14	0.14	7.30	1.04	12	0.013	0.025	2	5.63	7.2	5.5	0.29	226.05	226.00	230.46	3.21	0.18511577
CB 26	EX DMH 44		5.00	0.76	0.090	0.090	0.07	0.07	7.30	0.50	12	0.013	0.017	12	4.60	5.9	3.8	0.22	227.25	227.05	231.94	3.49	0.10859678
EX DMH 44	**DMH 23**	**0.05**	**5.05**			**0.090**	**0.00**	**0.07**	**7.30**	**0.50**	**12**	**0.013**	**0.007**	**55**	**3.04**	**3.9**	**2.8**	**0.27**	**226.95**	**226.55**	**230.19**	**2.04**	**0.16439654**
DMH 23	**DMH 20**	**0.38**	**5.43**			**0.280**	**0.00**	**0.23**	**7.30**	**1.67**	**18**	**0.013**	**0.010**	**35**	**10.50**	**5.9**	**4.3**	**0.26**	**225.20**	**224.85**	**230.19**	**3.29**	**0.15933939**
CB 19	DMH 20		5.00	0.87	0.150	0.150	0.13	0.13	7.30	0.95	12	0.013	0.010	39	3.61	4.6	3.9	0.35	225.25	224.85	230.97	4.52	0.26411802
DMH 20	**FES 21**	**0.14**	**5.56**			**0.430**	**0.00**	**0.36**	**7.30**	**2.63**	**18**	**0.013**	**0.005**	**52**	**7.28**	**4.1**	**3.8**	**0.41**	**224.75**	**224.50**	**228.72**	**2.27**	**0.3606456**
CB 27	DMH 29		5.00	0.89	0.130	0.130	0.12	0.12	7.30	0.84	12	0.013	0.005	10	2.52	3.2	2.9	0.39	215.75	215.70	219.26	2.31	0.33537723
CB 28	DMH 29		5.00	0.90	0.070	0.070	0.06	0.06	7.30	0.46	12	0.013	0.005	37	2.62	3.3	2.5	0.28	215.90	215.70	219.26	2.16	0.17563523
DMH 29	**FES 30**	**0.25**	**5.25**			**0.200**	**0.00**	**0.18**	**7.30**	**1.30**	**12**	**0.013**	**0.006**	**18**	**2.65**	**3.4**	**3.3**	**0.49**	**215.60**	**215.50**	**219.71**	**2.91**	**0.4914123**
CB 31	DMH 33		5.00	0.83	0.170	0.170	0.14	0.14	7.30	1.03	12	0.013	0.010	20	3.56	4.5	3.9	0.36	208.90	208.70	214.11	4.01	0.28920929
CB 32	DMH 33		5.00	0.77	0.150	0.150	0.12	0.12	7.30	0.84	12	0.013	0.010	5	3.56	4.5	3.7	0.33	208.90	208.85	214.09	3.99	0.23673758
DMH 33	**DMH 38**	**0.09**	**5.09**			**0.320**	**0.00**	**0.26**	**7.30**	**1.87**	**12**	**0.013**	**0.035**	**301**	**6.67**	**8.5**	**7.3**	**0.36**	**207.00**	**196.45**	**213.61**	**5.41**	**0.2809305**
CB 34	DMH 38		5.00	0.86	0.110	0.110	0.09	0.09	7.30	0.69	12	0.013	0.038	8	6.90	8.8	5.6	0.21	196.50	196.20	201.65	3.95	0.10012919
CB 37	DMH 38		5.00	0.90	0.040	0.040	0.04	0.04	7.30	0.26	12	0.013	0.020	5	5.04	6.4	3.3	0.15	196.35	196.25	201.66	4.11	0.05217623
DMH 38	**DMH 40**	**0.69**	**5.78**			**0.470**	**0.00**	**0.39**	**7.30**	**2.83**	**18**	**0.013**	**0.004**	**12**	**6.78**	**3.8**	**3.7**	**0.45**	**193.35**	**193.30**	**201.72**	**6.67**	**0.41701291**
CB 35	DMH 40		5.00	0.84	0.160	0.160	0.13	0.13	7.30	0.98	12	0.013	0.009	11	3.40	4.3	3.7	0.36	196.45	196.35	201.65	4.00	0.28892215
CB 39	DMH 40		5.00	0.90	0.040	0.040	0.04	0.04	7.30	0.26	12	0.013	0.017	3	4.60	5.9	3.1	0.16	196.40	196.35	201.71	4.11	0.0571562
DMH 40	**EX HDWL**	**0.05**	**5.83**			**0.670**	**0.00**	**0.56**	**7.30**	**4.07**	**18**	**0.013**	**0.005**	**41**	**7.33**	**4.2**	**4.2**	**0.53**	**222.55**	**222.35**	**225.62**	**1.37**	**0.55501948**

4

Operations & Maintenance Plan

Stormwater Management Operations and Maintenance Plan
March 1, 2018

Name of Applicant:	**Town of Westford**
Name of Maintaining Entity:	**Town of Westford**
Name of Facility:	**Groton Road (Route 40) & Dunstable Road**
Location:	**Groton Road (Crocker Street to 287 Groton Road)**

Operations and maintenance of the facility will be in accordance with the Town of Westford Highway Department's current practices, procedures and record keeping.

MAINTENANCE SCHEDULE

Catch Basins: Inspect or clean deep sump basins at least once per year and at the end of foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever sediment accumulation reaches to within two feet of the outlet. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

Sediment Forebay/Infiltration Basin: At a minimum, the basin must be inspected after every major storm event greater than 0.5" for the first six months after construction; thereafter, inspections will occur at least once per year. At least once (or as needed) during growing seasons, the basin side slopes, embankments, and emergency spillway will be cleared of accumulated sediment, grass clippings, leaves and trash and then mowed. Eroded areas and slopes must be loamed, seeded, and mulched or stabilized with rip-rap. All flared end sections and rip-rap will be cleaned of all sediment and debris to ensure that stormwater flows coming into the basin are not being impeded.

ILLICIT DISCHARGE STATEMENT

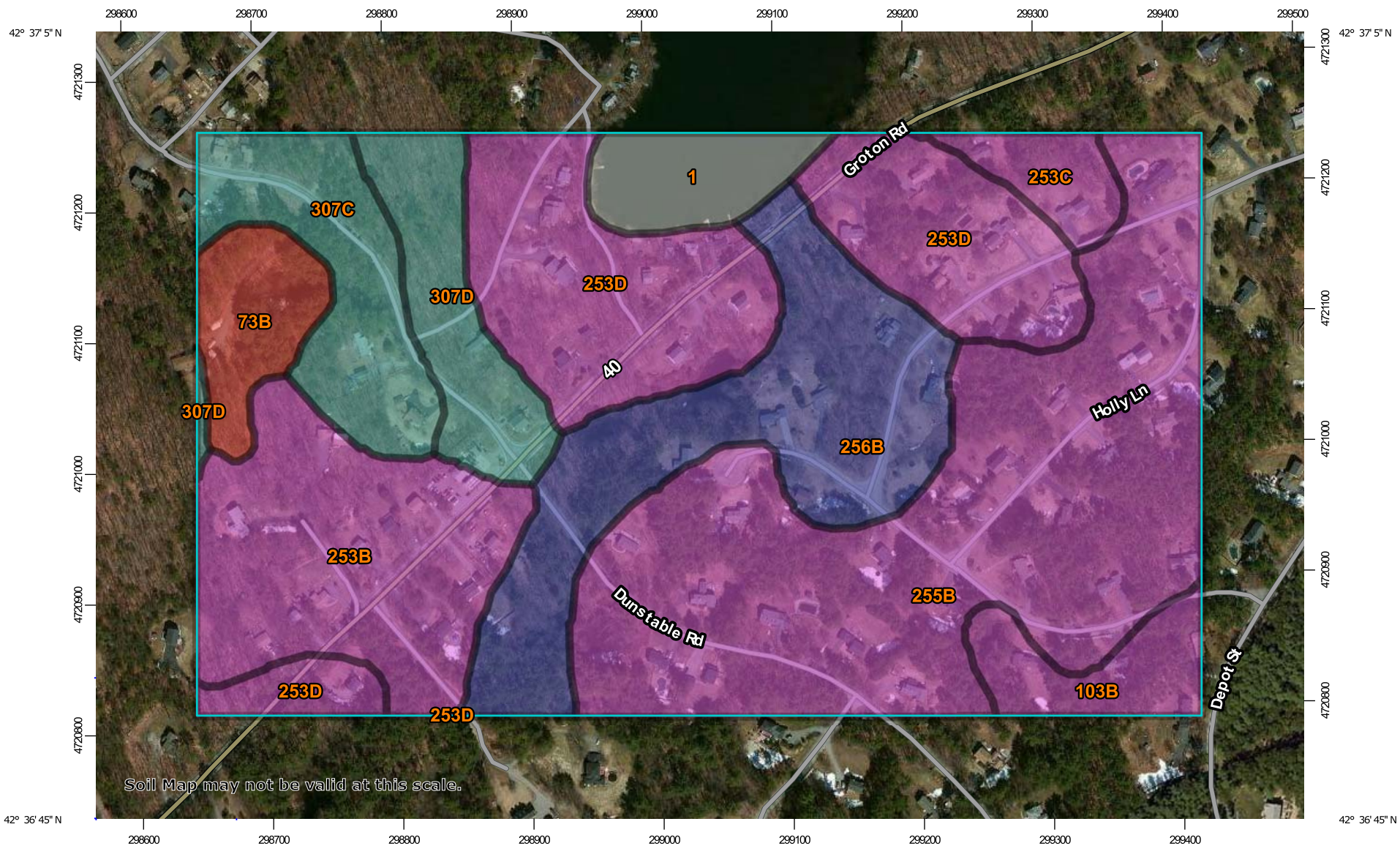
Per Standard No. 10 of the MassDEP Stormwater Management Standards, there shall be no illicit discharges to the stormwater management system. The Town of Westford is responsible for implementing the Operation and Maintenance Plan and overseeing activities at the facility to prevent illicit discharges to the drainage system from occurring.

5

Supporting Maps & Data

NRCS Soils Information

Hydrologic Soil Group—Middlesex County, Massachusetts
(Groton Road, Westford)



Map Scale: 1:4,240 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 17, Oct 6, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 8, 2011—Sep 19, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		2.7	3.2%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	3.0	3.5%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	A	2.7	3.2%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	10.7	12.5%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	1.8	2.1%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	15.8	18.5%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	26.1	30.6%
256B	Deerfield loamy sand, 3 to 8 percent slopes	B	12.1	14.1%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	5.8	6.8%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	C	4.6	5.4%
Totals for Area of Interest			**85.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

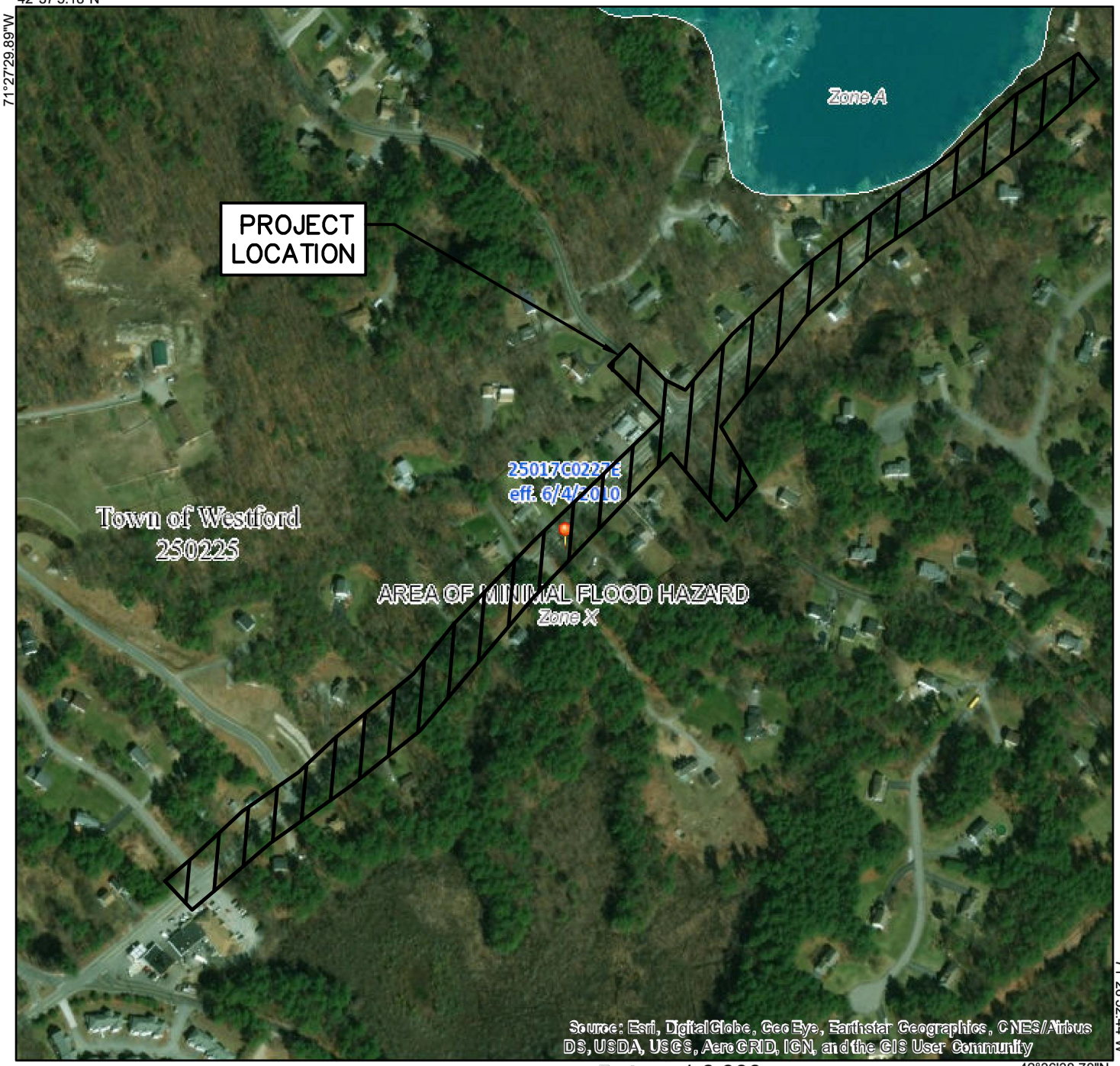
FEMA Flood Maps

National Flood Hazard Layer FIRMette

FEMA

42°37'5.18"N

71°27'29.89"W



71°26'52.44"W

42°36'38.70"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

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
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

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
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 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

N

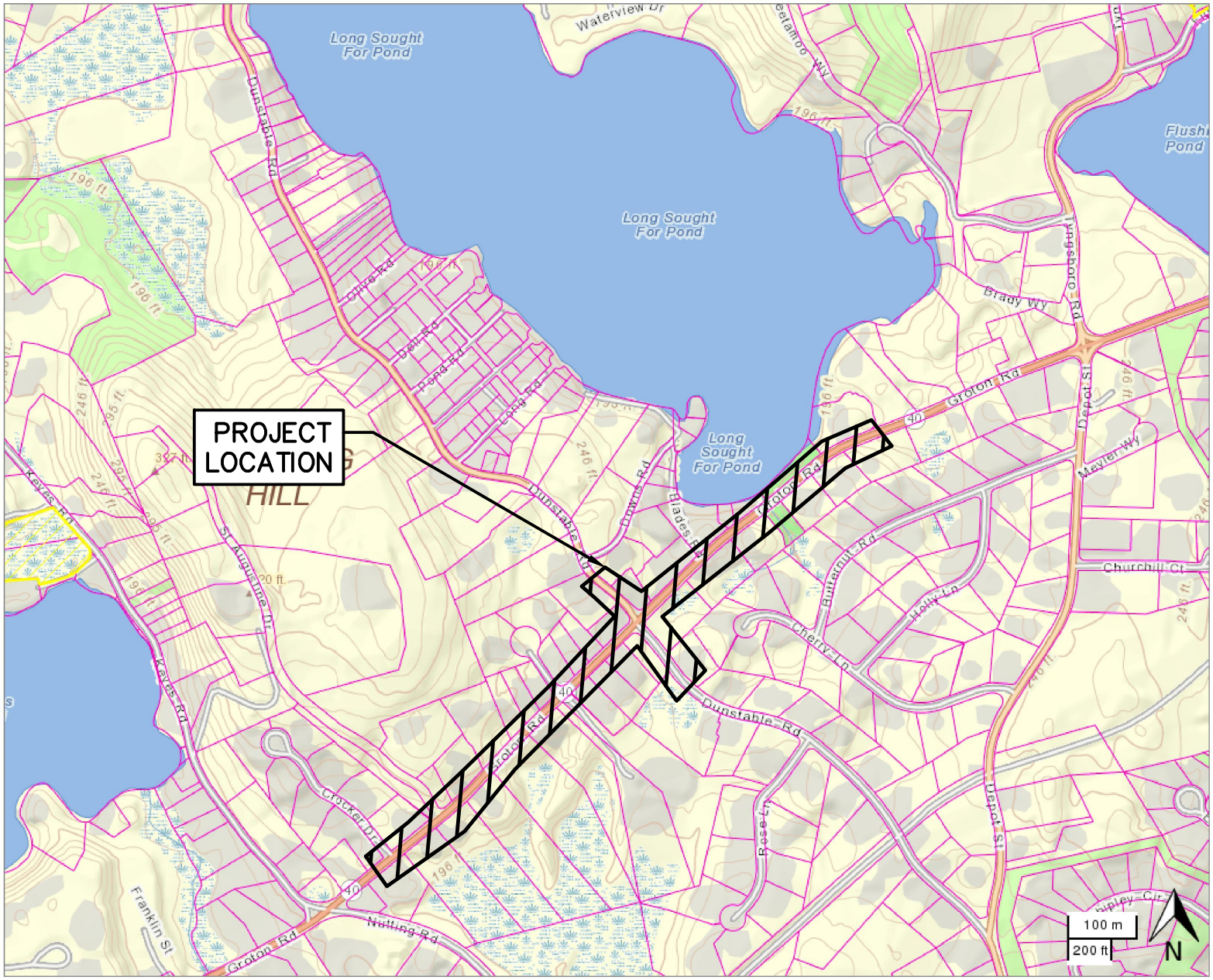
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/20/2018 at 10:36:06 AM 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: base map 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.

NHESP Priority Habitats of Rare Species Map

Dunstable Road, Westford - NHESP



NHESP Priority Habitats of Rare Species

NHESP Estimated Habitats of Rare Wildlife

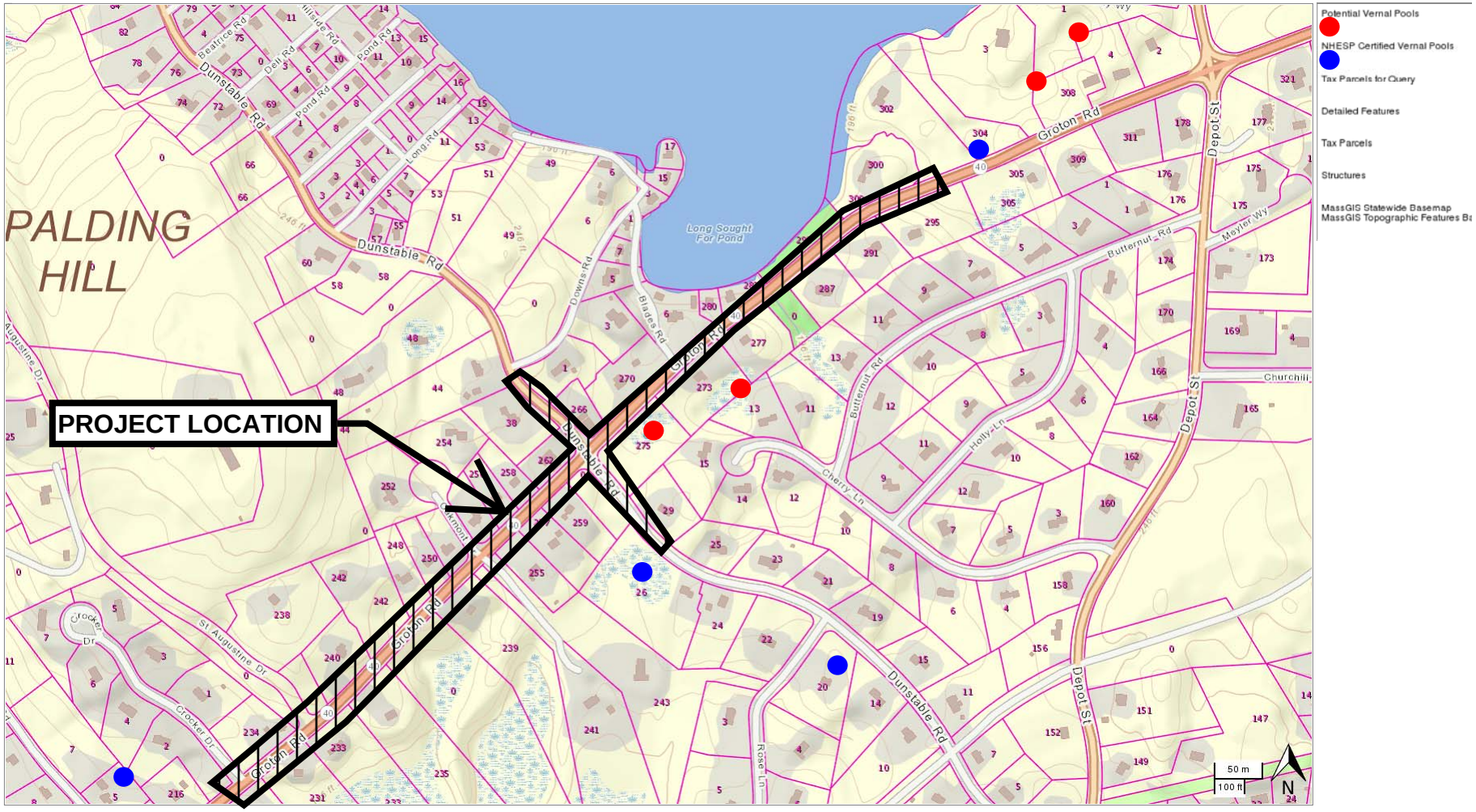
Tax Parcels

Detailed Features

MassGIS Statewide Basemap
MassGIS Topographic Features Basemap

NHESP Certified and Potential Vernal Pools

Certified


PALDING HILL
PROJECT LOCATION
Long Sought For Pond
Dunstable Rd
Groton Rd
Depot St
Butternut Rd
Downs Rd
Blades Rd
Long Rd
Pond Rd
Deil Rd
Beatrice Rd
Holly Ln
Cherry Ln
Rose Ln
Churchill
Meyler Wy
St Augustine Dr
Crocker Dr
Oxmont
Potential Vernal Pools
NHESP Certified Vernal Pools
Tax Parcels for Query
Detailed Features
Tax Parcels
Structures
MassGIS Statewide Basemap
MassGIS Topographic Features Ba
50 m
100 ft
N

6

Wetland Delineation Report

Wetland Delineation Report

Route 40 (Groton Road) Intersection Improvement Projects
Westford, Ma
April 15, 2014

Introduction/Site Description

The project site is the location of intersection improvements proposed on Route 40 (Groton Road) at the intersections with Oak Hill Road and at Dunstable Road in Westford, MA. Wetland resource areas subject to jurisdiction under the Massachusetts Act (MGL Ch 131 S. 40), and the Town of Westford Wetlands Protection Bylaw were delineated within 100 feet of the project area. The following is a summary of findings from investigations to determine the extent and nature of wetland resources on the site.

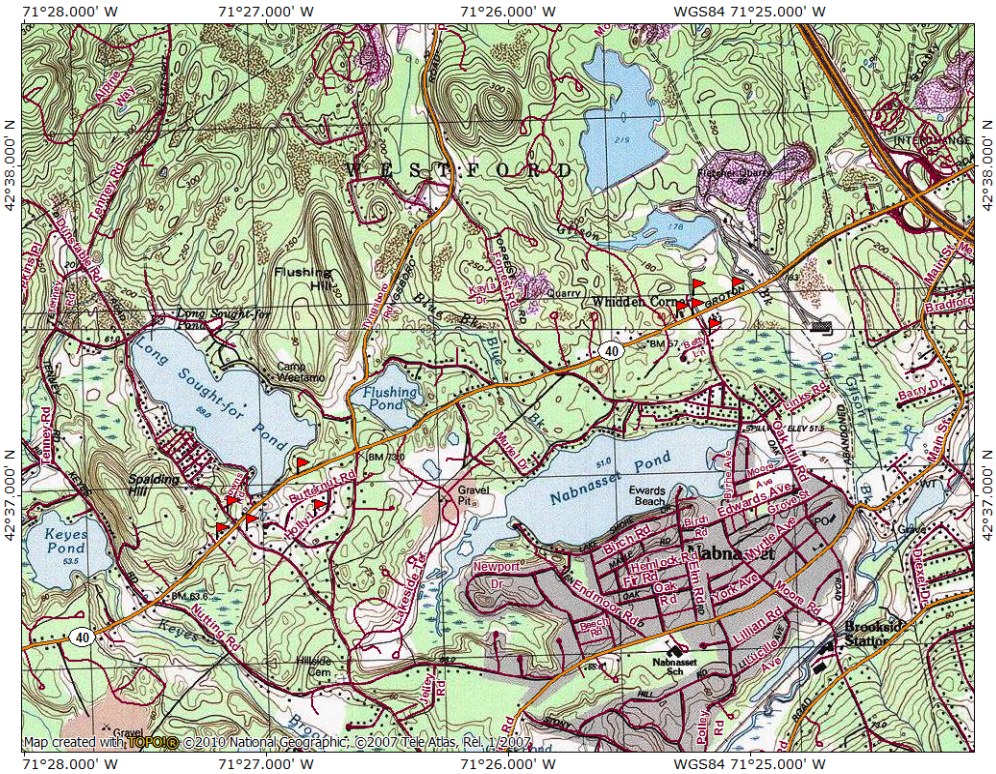


Fig. 1 USGS Project Locus

Methods

Rimmer Environmental Consulting (REC) conducted a field inspection of the project area on March 11, 2014. At that time, wetland resources subject to jurisdiction under the Massachusetts Wetlands Protection Act (MGL Ch 131 §. 40) and the Town of Westford Wetland Regulations within and immediately adjacent to the project area were identified. Wetlands were delineated with numbered sequence of flags placed on

vegetation, in accordance with the procedures described in the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and relevant town bylaw regulations. DEP Delineating Bordering Vegetated Wetlands Field Data Forms are attached and provide additional documentation of the wetland boundary.

Wetland Resources

Bordering Vegetated Wetland (BVW)

The limits of BVW were delineated primarily by vegetative indicators as the soil was still quite frozen at the time of inspection. However, these wetlands were well defined by a clear change in the plant communities from a predominance of upland species to a predominance of wetland species.

Flags A1-A11 delineate the BVW along the south side of Long Sought For Pond on the north side of Route 40, east of Dunstable Road. This wetland consists of an over story of red maple (*Acer rubrum*) with a well-developed understory of swamp azalea (*Rhododendron viscosum*), highbush blueberry (*Vaccinium corymbosum*) and sweet pepperbush (*Clethra alnifolia*).

Flags B1-B10 delineate an intermittent stream and narrow fringe of wetland along its banks on the south side of Groton Road. This stream is tributary to Long Sought For Pond. The banks contain American elm (*Ulmus americana*) and red maple and the understory is primarily poison ivy (*Toxicodendron radicans*).

Flags C1-C2 delineate a forested wetland on the south side of Groton Road, east of Dunstable Road. This wetland drains via an intermittent stream eastward behind the houses on Groton Road. It also contains red maple and American elm in the over story, but non-native and invasive species are typical in the understory, including glossy buckthorn (*Frangula Alnus*), common buckthorn *(Rhamnus cathartica*) and multiflora rose (*Rosa multiflora*).

Flags D1-D6 delineate the northern portion of a wetland located on the west side of Dunstable Road, just south of Groton Road. This wetland is indicated by MassGIS as containing a certified vernal pool.

Flags E1-E4 is a roadside ditch located at the far western end of the project area. This wetland may be more than 100 feet from the work limits. It contains a small drainage ditch that conveys surface flow south, away from Groton Road.

Bordering Land Subject to Flooding

This resource includes lands that are subject to inundation from floodwaters rising from rivers, creeks, ponds and lakes. The boundary is the maximum lateral extent of floodwater that will theoretically result from a 100-year frequency storm event, determined by reference to the most currently available flood maps from FEMA. Portions of the project area near Long Sought For Pond, near the intersection with Dunstable Road appear to be within the 100-year flood plain boundary as indicated in Figure 2 below.

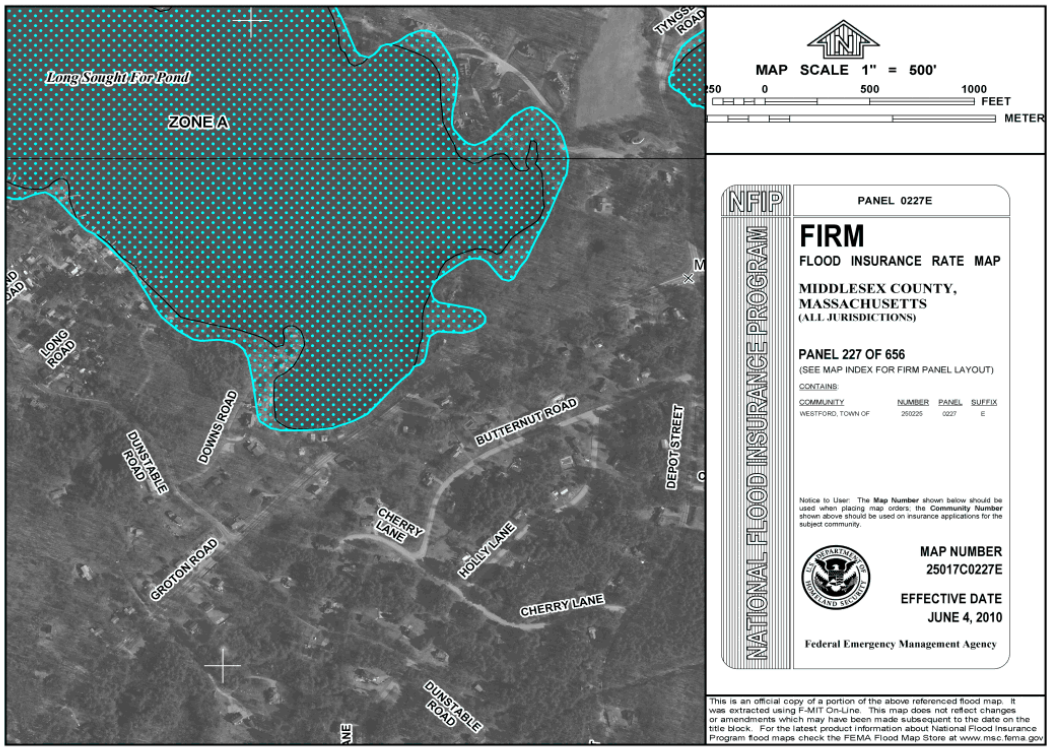


Fig. 2 FEMA Map

Other Resources

Portions of the project site appear to be located within or near Estimated Habitat of Rare Wetlands Wildlife and Priority Habitat as indicated in Figure 3 below. In addition, there is a certified vernal pool at the southwestern side of the intersection of Route 40 and Dunstable Road. Upon further clarification of work limits and project design, it may be necessary to consult with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) on potential impacts to these resources. Activities which are exempt from NHESP review include the "maintenance, repair or replacement, but not widening, of existing paved roads, shoulder repair that does not exceed 4 feet from an existing travel lane…and not including actions that are likely to result in changes to storm water drainage."

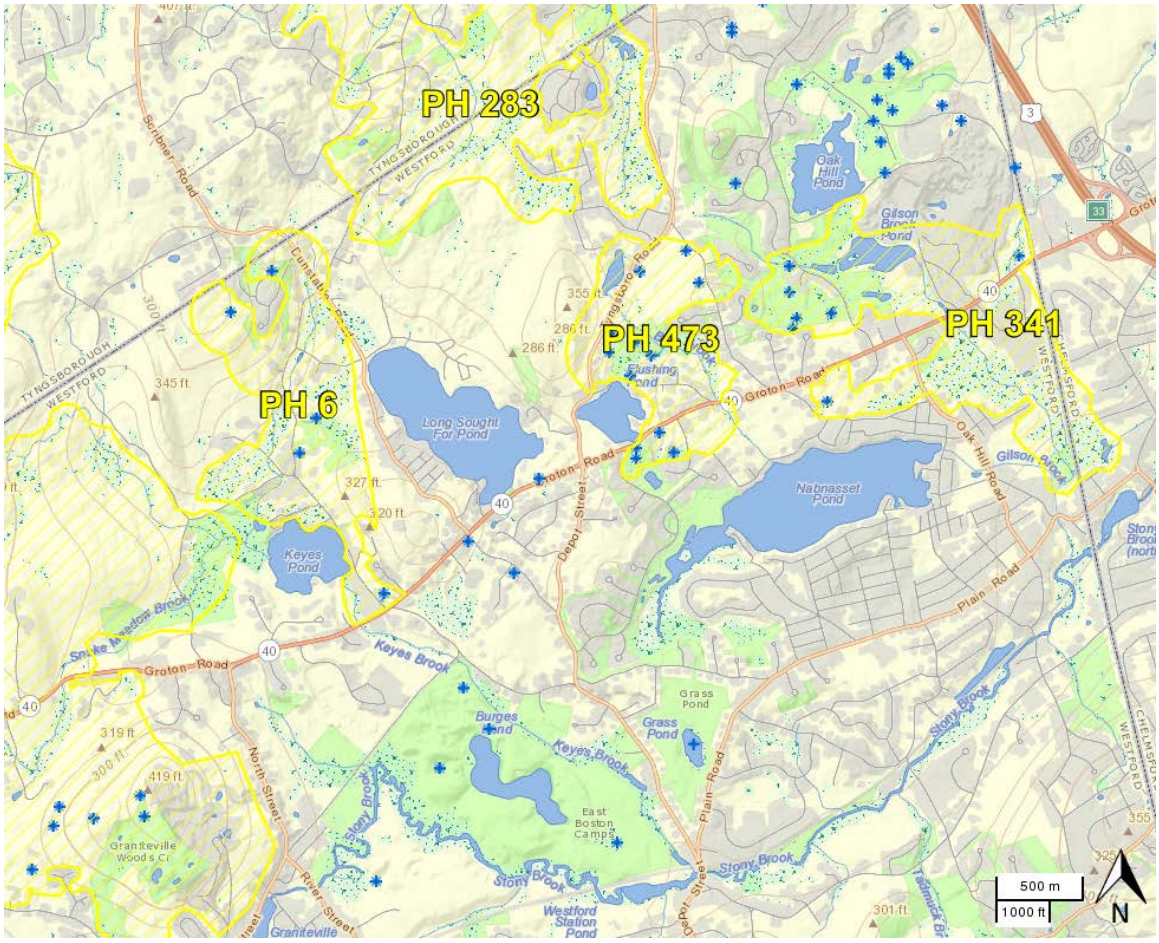
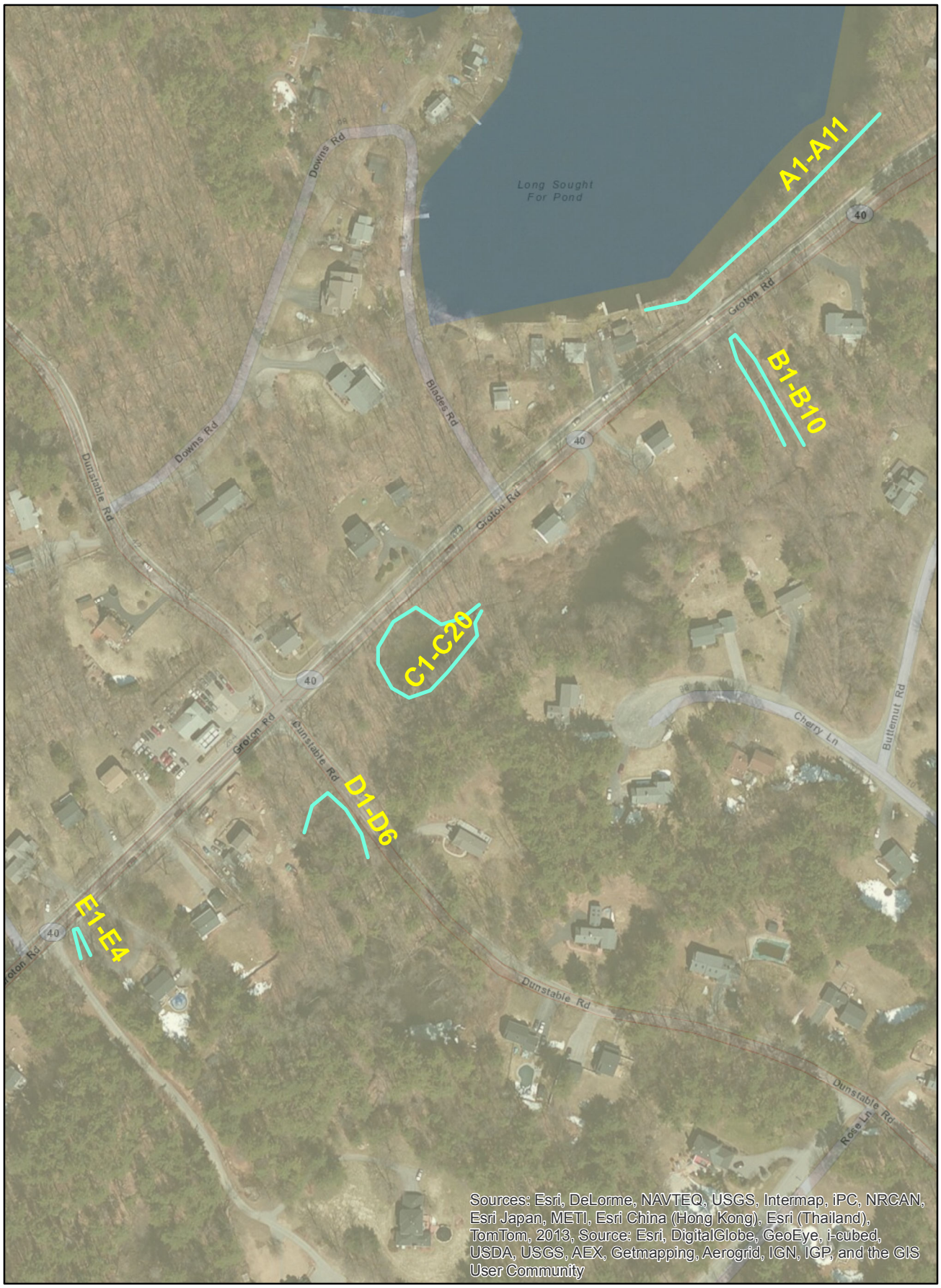


Fig. 3: NHESP Resources

Westford Wetlands by Route 40



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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:A7Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
red maple/Acer rubrum	38	100	Y	FAC*
Shrub				
swamp azalea/Rhododendron viscosum	20.5	20	Y	FACW*
highbush blueberry/Vaccinium corymbosum	20.5	20	Y	FACW*
sweet pepperbush/Clethra alnifolia	63	63	Y	FAC*

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:4 Number of dominant non-wetland plants: 0
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A			

Remarks

3. Other frozen conditions

Conclusion: Is soil hydric? ☐ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☐	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: _upl Transect number:A7 Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
white pine/Pinus strobus	38	50	Y	FACU
red oak/Quercus rubra	38	50	Y	FACU
Shrub				
white pine/Pinus strobus	10.5	33	Y	FACU
sweet pepperbush/Clethra alnifolia	20.5	66	Y	FAC*

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:1 Number of dominant non-wetland plants: 3
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☐ **yes** ☒ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color

Remarks

3. Other frozen conditions

Conclusion: Is soil hydric? ☐ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☐	☒
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☐	☐
Sample location is in a BVW	☐	☒

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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:B3Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
red maple/Acer rubrum	38	50	Y	FAC*
american elm/Ulmus americana	38	50	Y	FACW*
ground cover				
poison ivy/Toxicodendron radicans	20.5	100	Y	FAC*

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:3 Number of dominant non-wetland plants: 0
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A			

Remarks

3. Other frozen conditions

Conclusion: Is soil hydric? ☐ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☐	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: upl Transect number:B3Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	**B. Percent cover (or basal area)**	**C. Percent Dominance**	**D. Dominant Plant (yes or no)**	**E. Wetland Indicator Category***
Tree				
paper birch/Betula papyrifera	38	38	Y	FACU
Black birch/Betula lenta	63	63	Y	FACU
Sapling				
black birch/Betula lenta	20.5	100	Y	FACU
Shrub				
hop-hornbeam/Ostrya virginiana	10.5	100	Y	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:0 Number of dominant non-wetland plants: 4
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☐ **yes** ☒ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A			

Remarks

3. Other frozen conditions

Conclusion: Is soil hydric? ☐ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☐	☒
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☐	☐
Sample location is in a BVW	☐	☒

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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:C18Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
red maple/Acer rubrum	85.5	89	Y	FAC*
american elm/Ulmus americana	10.5	11	N	FACW*
Shrub				
common buckthorn/Rhamnus cathartica	3	11	N	FAC*
multiflora rose/Rosa multiflora	3	11	N	FACU
glossy buckthorn/Frangula alnus	20.5	77	Y	FAC

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:2 Number of dominant non-wetland plants: 0
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A	0-8"	10YR 2/1	
B	8-16"	10YR 6/1	

Remarks

3. Other frozen conditions

Conclusion: Is soil hydric? ☒ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☒	☐
Other indicators of hydrology present:	☐	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____Prepared by: M. Rimmer ____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: _upl Transect number:C18 Date of delineation:3/11/2014

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
Box elder/Acer negundo	63	100	Y	FAC*
Sapling				
box elder/Acer negundo	38	38	Y	FAC*
hop-hornbeam	63	62	Y	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:2 Number of dominant non-wetland plants: 1
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
O	1-0		
A	0-9"	10 YR 2/1	
B	9-15+"	10YR 6/5	

Remarks

3. Other

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☒
Other indicators of hydrology present:	☐	☒
Sample location is in a BVW	☐	☒

Wetland Delineation Report

Route 40 (Groton Road) Additional Intersection Improvements
Westford, Ma
January 22, 2015

Introduction/Site Description

The project site includes eastward and westward extensions of a previous project along Route 40 in Westford previously described in a report by Rimmer Environmental on April 15, 2014. This current project includes an extension of the scope of evaluation identified as west past Dunstable Road and east past Oak Hill Road in Westford, MA. Wetland resource areas subject to jurisdiction under the Massachusetts Act (MGL Ch 131 S. 40), and the Town of Westford Wetlands Protection Bylaw were delineated within 100 feet of the project area. The following is a summary of findings from investigations to determine the extent and nature of wetland resources within the limits of proposed work.

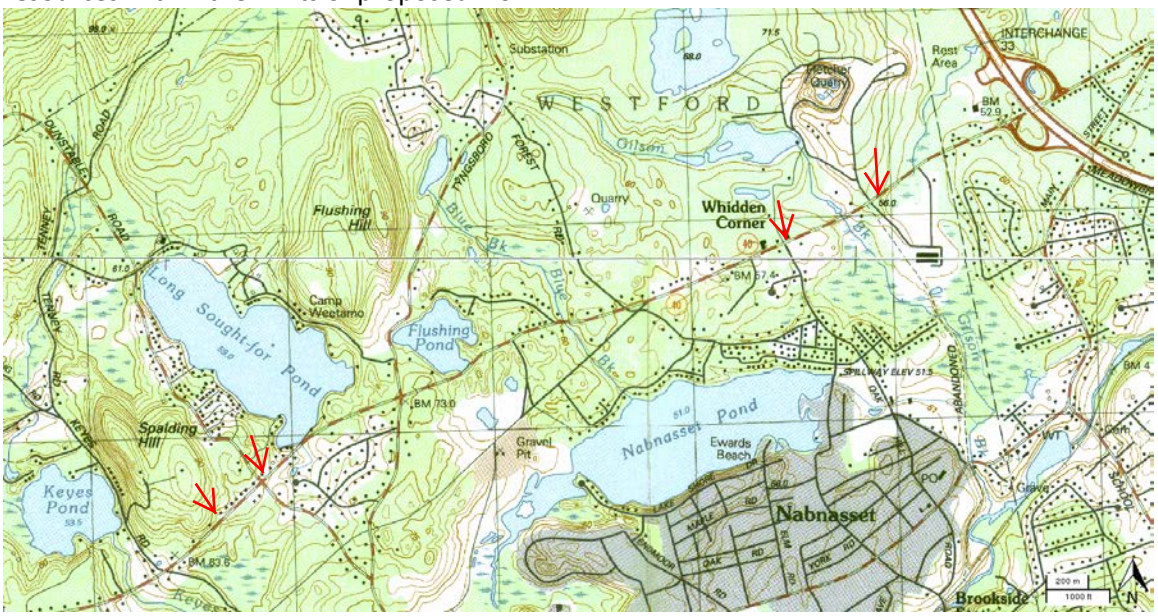


Fig. 1: USGS Topographic Map

Methods

Rimmer Environmental Consulting (REC) conducted a field inspection of the extended project areas on December 12, 2014. At that time, wetland resources subject to jurisdiction under the Massachusetts Wetlands Protection Act (MGL Ch 131 §. 40) and the Town of Westford Wetland Regulations within and immediately adjacent to the project area were identified. Wetlands were delineated with numbered sequence of flags placed on vegetation, in accordance with the procedures described in the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and relevant town bylaw regulations. DEP Delineating Bordering Vegetated Wetlands Field Data Forms are attached and provide additional documentation of the wetland boundary.

Wetland Resources

Bordering Vegetated Wetland (BVW)

The limits of BVW were delineated by the presence of 50% or more wetland vegetation as well as other indicators of wetland hydrology, including hydric soil. The following is a summary of resource areas present:

Flags F1-F6 includes a wetland area west of Oakmont Drive on the north side of Route 40, in the vicinity of utility pole 110. A very small wetland discharges to a 24 inch culvert under Route 40 at this location. The wetland includes an over story of red maple (*Acer rubrum*), American elm (*Ulmus americana*) and white pine (*Pinus strobus*) with an understory of highbush blueberry (*Vaccinium corymbosum*) and northern arrow-wood (*Viburnum recognitum*) along with poison ivy (*Toxicodendron radicans*) and spotted jewelweed (*Impatiens capensis*). Adjacent uplands include the road shoulder and slopes containing white pine and black oak (*Quercus velutina*).

At the downstream end of this culvert on the south side of Route 40 is a very narrow (1-2 feet in width) intermittent stream channel that discharges downslope to another forested wetland containing similar vegetation as the F-series described above. This wetland was delineated by flags G1-G9 and the centerline of the intermittent stream was delineated by flags CL-1 to CL-4.

Near Oak Hill Road on both sides of Route 40 is freshwater marsh dominated by common reed (*Phragmites australis*) up to the road shoulder. This wetland is associated with Gilson Brook. There is evidence of beaver activity in this marsh and it was flooded at the time of inspection. This wetland was delineated by flags H1-H12 on the south side of the road and J1-J10 on the north side.

Another wetland was found to be located approximately 50 feet from the northern road shoulder at the Oak Hill Road section of the improvements, immediately east of a child care center. This is an excavated area and appears to have been constructed as a stormwater management basin. Recent amendments to the Mass. Wetlands Protection Act Regulations clarified that stormwater structures constructed after 1996 that contain wetland features are not regulated as resource areas provided they were constructed in accordance with Stormwater Management Standards in place at the time. It is not known when this basin was constructed so it was delineated by flags K1-K7 so that it could be located should it be determined to be jurisdictional.

Riverfront Area

Gilson Brook flows through the site within the H and J series wetlands described above. It is indicated on the USGS topographic quadrangle as a perennial stream and therefore contains an associated 200-foot Riverfront Area extending from its mean annual high water (MAHW) line, pursuant to 310 CMR 10.58. MAHW was estimated from bankfull indicators and to be located on the south side of the road approximately near flag H7 for the east bank and 15 feet to the west of the existing headwall for the west bank. Due to inundation at the time of inspection, no further delineation could be made.

On the north side of the road, MAHW was estimated to be at flags J4 on the west bank and J8 on the east bank.

Bordering Land Subject to Flooding

This resource includes lands that are subject to inundation from floodwaters rising from rivers, creeks, ponds and lakes. The boundary is the maximum lateral extent of floodwater that will theoretically result from a 100-year frequency storm event, determined by reference to the most currently available flood maps from FEMA. Portions of the project area near, near the intersection with Dunstable Road and near Oak Hill Road are located within the 100-year flood plain boundary as indicated in Figure 2 below.

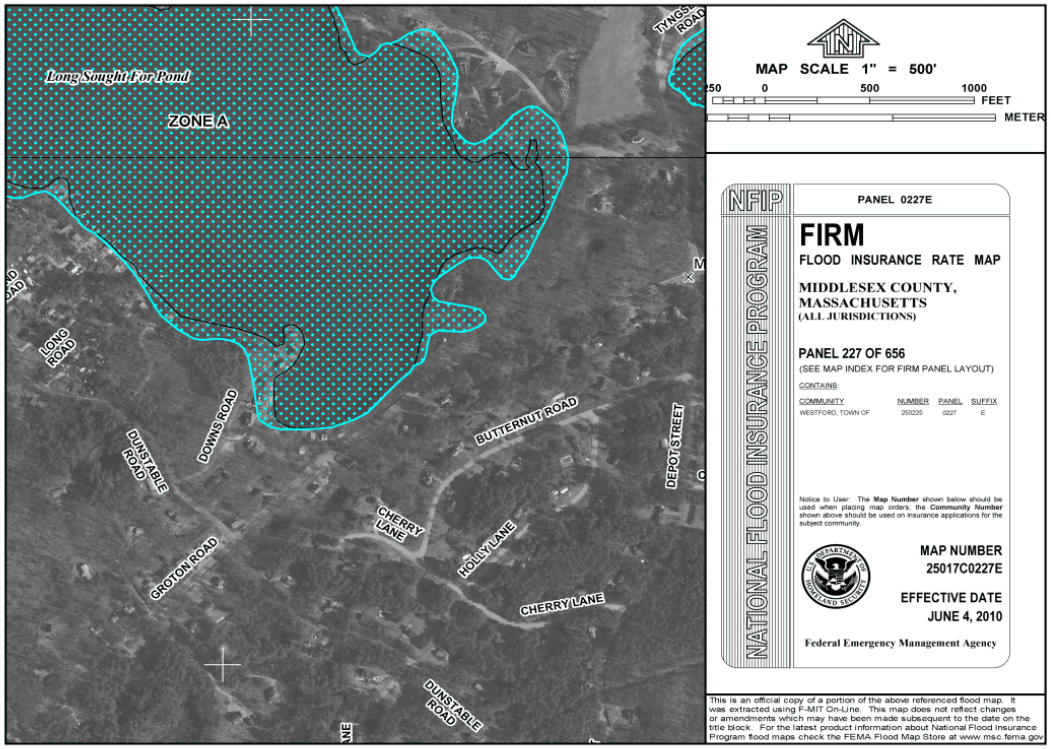


Fig. 2 FEMA Map

Other Resources

Portions of the project site appear to be located within or near Estimated Habitat of Rare Wetlands Wildlife and Priority Habitat as indicated in Figure 3 below. In addition, there is a certified vernal pool at the southwestern side of the intersection of Route 40 and Dunstable Road. Upon further clarification of work limits and project design, it may be necessary to consult with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) on potential impacts to these resources. Activities which are exempt from NHESP review include the "maintenance, repair or replacement, but not widening, of existing paved roads, shoulder repair that does not exceed 4 feet from an existing travel lane…and not including actions that are likely to result in changes to storm water drainage."

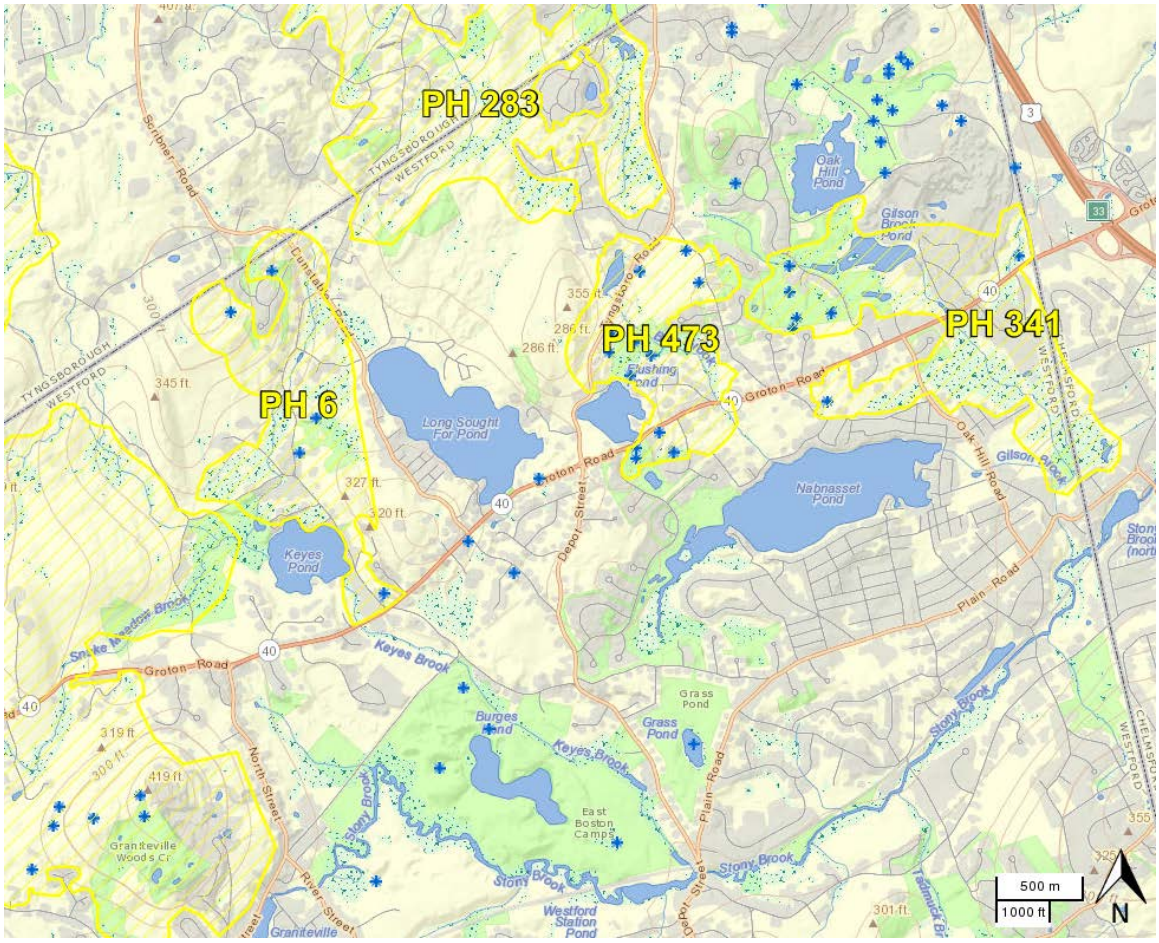


Fig. 3: NHESP Resources

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

Applicant:_____Prepared by: Rimmer Environmental_____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:F6 wetDate of delineation:12/12/14

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
red maple/Acer rubrum	63	100	Y	FAC*
Shrub				
black chokeberry/Aronia arbutifolia	20.5	49	Y	FACW*
highbush blueberry/Vaccinium corymbosum	10.5	25	Y	FACW*
hawthorne/Crataegus sp.	10.5	25	Y	NI
Herb				
poison ivy/Toxicodendron radicans	20.5	77	Y	FAC*
sheep laurel/Kalmia angustifolia	3.0	11	N	FAC*
teaberry/Gaultheria procumbens	3.0	11	N	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:5 Number of dominant non-wetland plants: 1
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A	0-4"	10YR 2/1	
B	4-13"	10YR 4/4	

Remarks

3. Other refusal at 13"

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☒ Drift lines: _____

☐ Sediment deposits: _____

☒ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☒
Other indicators of hydrology present:	☒	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____ Prepared by: Rimmer Environmental Project location: Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: up1 Transect number: F6 1 Date of delineation: 12/12/14

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
white pine/Pinus strobus	38	50	Y	FACU
black oak/Quercus velutina	38	50	Y	UPL
Shrub	20.5	49	Y	FACW*
highbush blueberry/Vaccinium corymbosum	10.5	33	Y	FACW*
white pine/Pinus strobus	33	66	Y	FACU
Sapling				
shagbark hickory/Carya ovata	10.5	100	Y	FACU
Herb				
red raspberry/Rubus ideaus	10.5	64	Y	FACU
teaberry/Gaultheria procumbens	3.0	18	N	FACU
white pine/Pinus strobus	3.0	18	N	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants: 2 Number of dominant non-wetland plants: 5
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☐ **yes** ☒ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A	0-4"	10YR 2/1	
B	4-13"	10YR 4/6	

Remarks

3. Other refusal at 13"

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☐	☒
Wetland hydrology present: Hydric soil present	☐	☒
Other indicators of hydrology present:	☐	☒
Sample location is in a BVW	☐	☒

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

Applicant:_____Prepared by: Rimmer Environmental_____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:G6 Date of delineation:12/12/14

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
red maple/Acer rubrum	20.5	26	Y	FAC*
American elm/Ulmus americana	20.5	26	Y	FACW*
white pine/Pinus strobus	38	48	Y	FACU
Sapling				
Green ash/Fraxinus pennsylvanica	10.5	100	Y	FACW*
Herb				
Cinnamon fern/Osmunda cinnammea	10.5	64	Y	FACW*
dewberry/Rubus hispidus	3.0	18	N	FACW*
partridgeberry/Mitchella repens	3.0	18	N	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:4 Number of dominant non-wetland plants: 1
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A	0-6"	10YR 2/2	
B	6-20"	10YR 4/4 and 2/2	

Remarks

3. Other mixed matrix

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☒ Drift lines: _____

☐ Sediment deposits: _____

☒ Drainage patterns in BVW: _____

☐ Oxidized rhizospheres: _____

☐ Water-stained leaves: _____

☐ Recorded data(stream, lake, or tidal gauge; aerial photo, other):__

☒ Other: buttressing_____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥number of non-wetland indicator plants:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☒
Other indicators of hydrology present:	☒	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____ Prepared by: Rimmer Environmental Project location: Route 40 Westford DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: up1 Transect number: G6 Date of delineation: 12/12/14

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree				
white pine/Pinus strobus	38	50	Y	FACU
Green ash/Faxinus pennsylvanica	38	50	Y	FACW*
Sapling				
white pine/Pinus strobus	10.5	100	Y	FACU
Shrub				
Herb				
cinnamon fern/Osmunda cinnamomea	10.5	44	Y	FACW*
partridgeberry/Mitchella repens	10.5	44	Y	FACU
christmas fern/Polystichum acrostichoides	3.0	12	N	FACU

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants: 2 Number of dominant non-wetland plants: 3
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☐ **yes** ☒ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color
A	0-6"	10YR 2/2	
B	6-20"	10YR 4/6	

Remarks

3. Other

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☐ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☐ Drainage patterns in BVW: _____

☐ 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:	☐	☒
Wetland hydrology present: Hydric soil present	☐	☒
Other indicators of hydrology present:	☐	☒
Sample location is in a BVW	☐	☒

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

Applicant:_____Prepared by: Rimmer Environmental_____Project location:Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: wetTransect number:J7 Date of delineation:12/12/14

A. Sample layer and plant species (by common name/scientific name)	**B. Percent cover (or basal area)**	**C. Percent Dominance**	**D. Dominant Plant (yes or no)**	**E. Wetland Indicator Category***
shrub				
silky dogwood/Cornus amomum	10.5	100	Y	FACW*
Herb				
common reed/Phragmites australis	85.5	100	Y	FACW*

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants:2 Number of dominant non-wetland plants: 0
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☒ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color

Remarks

3. Other mixed matrix

Conclusion: Is soil hydric? ☐ yes ☒ no

Other Indicators of Hydrology: (check all that apply and describe)

☒ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☒ Drainage patterns in BVW: _____

☐ 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:	☒	☐
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☒	☐
Sample location is in a BVW	☒	☐

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

Applicant:_____ Prepared by: Rimmer Environmental Project location: Route 40 Westford DEP File #: _____

Check all that apply:

- ☒ Vegetation alone presumed adequate BVW boundary: fill out section I only
- ☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I. Vegetation: Observation plot Number: upl Transect number: J7 Date of delineation: 12/12/14

A. Sample layer and plant species (by common name/scientific name)	B. Percent cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
mowed grasses and sidewalk				

Use an asterisk to mark wetland indicator plants: species listed in the Wetlands Protection Act (MGL c. 131, s. 40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:
Number of dominant wetland indicator plants: 0 Number of dominant non-wetland plants: 0
Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? ☐ **yes** ☐ **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date:
Map number:
Soil type mapped:
Hydric soil inclusions:

Are field observations consistent with soil survey? ☐ yes ☐ no
Remarks:

2. Soil description

Horizon	Depth	Matrix Color	Mottles Color

Remarks

3. Other

Conclusion: Is soil hydric? ☐ yes ☐ no

Other Indicators of Hydrology: (check all that apply and describe)

☒ Site inundated: _____

☐ Depth to free water in observation hole: _ _____

☐ Water marks: ___ _____

☐ Drift lines: _____

☐ Sediment deposits: _____

☒ Drainage patterns in BVW: _____

☐ 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:	☐	☒
Wetland hydrology present: Hydric soil present	☐	☐
Other indicators of hydrology present:	☐	☒
Sample location is in a BVW	☐	☒

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Certified Abutters List

TOWN OF WESTFORD
OFFICE OF THE ASSESSORS
55 Main Street
WESTFORD, MA 01886
(978) 692-5504 FAX (978) 399-2556

REQUEST FOR CERTIFIED ABUTTERS LIST
Requires $10 deposit

NOTICE: The Assessors Office has 10 business days to act on a request for C.A.L.
We will make every effort to process your request as quickly as possible
And WE will notify you by telephone when the list is ready for pick up.

Fees: **$10 for up to 25 parcels** **$20 for 25 or more parcels**
Mailing Labels - $5 per sheet (30 labels/sheet)

"RUSH REQUESTS" WILL BE CHARGED DOUBLED.

Date: 1/22/18 Requested by: Engineering Dept. Phone#: 978-692-5520

Please check the box for the Board you are requesting the Certified Abutters List:

☐ **Board of Health**
- ☐ State Regulations {Immediate & Across Street}
- ☐ Local Regulations {300 feet}

☑ **Conservation Commission** (100 feet)

☐ **Liquor License** {Immediate & across Street}

☐ **Planning/Zoning** (300 feet)

☐**RUSH** (4 BUSINESS DAYS)

☐ (2) sets of **mailing labels**

List of Property Owners notified in connection with Public Hearing on the petition of:

Owner's name: Town of Westford Engineering Dept.

For the premises located at **street address**: Groton Road (Various Locations - see attached)

Map & Parcel ID: n/a (various) relative to obtaining desirable relief from the Zoning Bylaw Of the Town of Westford.

To the Requesting Board/s:
We hereby certify the attached list, taken from our Real Estate Property Lists, includes the names and Addresses of all parties in interest under M.G.L. Ch. 40A, as amended to the best of our knowledge and belief.

Date Completed: _____ Signed: _____
Westford Board of Assessors

Deposit/parcel charge: $_____ _____
Charge for labels: $_____
Additional charge: $_____
Total due: $_____ _____

Completed C.A.L. received by: _____ Date: _____

Westford

Abutters List

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
035 0030 0002	2 CROCKER DR	XU HAILONG	ZHANG SHUHUA	2 CROCKER DR	WESTFORD	MA	01886
035 0030 0009	234 GROTON RD	BUTLAND DEREK JAMES	BUTLAND JENNIFER ALICE	234 GROTON RD	WESTFORD	MA	01886
035 0032 0002	240 GROTON RD	AMINPOUR SHAHLA		240 GROTON RD	WESTFORD	MA	01886
035 0032 0003	242 GROTON RD	RAN RUIJIANG	TIAN HONGXIA	242 GROTON RD	WESTFORD	MA	01886
035 0033 0000	231 GROTON RD	VINITH PRIYA	ABRAHAM VINITH	231 GROTON ROAD	WESTFORD	MA	01886
035 0034 0000	221 GROTON RD	GROTON ROAD CONVENIENCE PL		11 SUMMER ST - SUITE 8	CHELMSFORD	MA	01824
036 0017 0000	GROTON RD	SUDAK CHILDRENS GIFT FUND	DEAN P SUDAK - TR COURT	80 PLEASANT ST	WESTFORD	MA	01886
036 0018 0000	235 GROTON RD	O'DONNELL DIANNE		PO BOX 2122	WESTFORD	MA	01886
036 0019 0000	233 GROTON RD	TURNER ROBERT W	TURNER CONNIE D	233 GROTON RD	WESTFORD	MA	01886
040 0017 0002	0 PARCEL A ST AUGUSTINE DR	CONNELL REAL ESTATE TRUST U	CONNELL -TRUSTEES WILLI	P O BOX 1230	WESTFORD	MA	01886
040 0017 0003	PARCEL B ST AUGUSTINE DR	CONNELL REAL ESTATE TRUST U	CONNELL -TRUSTEES WILLI	P O BOX 1230	WESTFORD	MA	01886
041 0001 0000	248 GROTON RD	LONGWELL KEITH	WALSH KRISTINA	248 GROTON RD	WESTFORD	MA	01886
041 0002 0000	250 GROTON RD	TANNAHILL WILLIAM J	CADY SUSAN G	250 GROTON RD	WESTFORD	MA	01886
041 0003 0000	252 GROTON RD	BONECK DUANE L	BONECK DONNA	252 GROTON RD	WESTFORD	MA	01886
041 0004 0000	252 R GROTON RD	BIGDA STANLEY J & REGINA F		252 R GROTON RD	WESTFORD	MA	01886
041 0005 0000	254 R GROTON RD	STURTEVANT RONALD J	STURTEVANT ELLEN M	PO BOX 1426	WESTFORD	MA	01886
041 0006 0000	254 GROTON RD	FYFE, III WILLIAM A		254 GROTON RD	WESTFORD	MA	01886
041 0007 0000	256 GROTON RD	VENO RAYMOND J	SZABO VERONICA I F	256 GROTON RD	WESTFORD	MA	01886
041 0008 0000	258 GROTON RD	POWERS ROBERT E. JR	POWERS GAYLE M.	258 GROTON RD	WESTFORD	MA	01886
041 0009 0000	262 GROTON RD	LEEMILT'S PETROLEUM, INC	C/0 GETTY PETROLEUM MA	TWO JERICHO PLAZA	JERICHO	NY	11753
041 0010 0000	38 DUNSTABLE RD	PEASE JR W CLARK	PEASE ELLEN DOW	38 DUNSTABLE RD	WESTFORD	MA	01886
041 0034 0000	1 DOWNS RD	MAGEE MICHAEL STEPHEN	MAGEE KRISTINA BROWN	1 DOWNS RD	WESTFORD	MA	01886
041 0035 0000	266 GROTON RD	KIRBY JR DANIEL	LAVERY KELLY	266 GROTON RD	WESTFORD	MA	01886
041 0036 0001	270 GROTON RD	BISHOP JOCELYN A		270 GROTON RD	WESTFORD	MA	01886
041 0037 0000	6 BLD B BLADES RD	FLANAGAN JOSEPH F	FLANAGAN BETH A	6 BLADES RD	WESTFORD	MA	01886
041 0038 0000	280 GROTON RD	WASKIEWICZ ROBERT		120 GROTON RD	WESTFORD	MA	01886
041 0039 0000	282 GROTON RD	VIENNEAU REYNOLD J	MOORE KATHERINE A	282 GROTON ROAD	WESTFORD	MA	01886
041 0040 0000	290 GROTON RD	COMMONWEALTH OF MASSACHU	DIV OF FISHERIES & WILDLI	100 CAMBRIDGE ST	BOSTON	MA	02109
041 0070 0000	15 CHERRY LN	HAND ALAN J	HAND CATHERINE G	15 CHERRY LN	WESTFORD	MA	01886
041 0110 0000	287 GROTON RD	ROTHMEL ETHEL	ROTHMEL FREDERICK	287 GROTON RD	WESTFORD	MA	01886
041 0111 0001	277 GROTON RD	TEKADE UDAY	JAGTAP SHWETA	277 GROTON RD	WESTFORD	MA	01886
041 0111 0002	GROTON RD	COMMONWEALTH OF MASSACHU	DIVISION OF FISHERIES AN	100 CAMBRIDGE ST	BOSTON	MA	02110
041 0112 0001	275 GROTON RD	HOANG LISA		40 FAY ST	BOSTON	MA	02118
041 0112 0002	273 GROTON RD	DALLEY REALTY TRUST U/D/T 10/	WILLIAM N DALLEY - TR	273 GROTON RD	WESTFORD	MA	01886
041 0113 0000	29 DUNSTABLE RD	TAAFFE COLIN B	TAAFFE RANDI M	29 DUNSTABLE RD	WESTFORD	MA	01886
041 0120 0000	26 DUNSTABLE RD	BOMAL WILLIAM J	BOMAL DARRA S	26 DUNSTABLE RD	WESTFORD	MA	01886
041 0121 0000	DUNSTABLE RD	HOSFORD PAUL L	HOSFORD MARY T	259 GROTON RD	WESTFORD	MA	01886
041 0122 0000	259 GROTON RD	HOSFORD PAUL L	MCQUILKIN MARY T	259 GROTON RD	WESTFORD	MA	01886
041 0123 0000	257 GROTON RD	APTE SAMITA	APTE MILIND S	257 GROTON RD	WESTFORD	MA	01886
041 0124 0000	255 GROTON RD	SKINNER LESANDRA D	SKINNER LEWELL B	255 GROTON RD	WESTFORD	MA	01886
041 0125 0000	243 GROTON RD	MISHRA RAJESH KUMAR	AGARWAL KAITKI	243 GROTON RD	WESTFORD	MA	01886
041 0126 0000	241 GROTON RD	CHEN SHIXI		241 GROTON RD	WESTFORD	MA	01886
041 0127 0000	239 GROTON RD	ANSARI SHAMIN	PERVEEN NISHAT	239 GROTON RD	WESTFORD	MA	01886

Westford

Abutters List

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State Zip

End of Report

BOARD OF ASSESSORS
55 MAIN STREET
WESTFORD, MA 01886

CERTIFIED

BUTLAND DEREK JAMES
BUTLAND JENNIFER ALICE
234 GROTON RD
WESTFORD, MA 01886

AMINPOUR SHAHLA
240 GROTON RD
WESTFORD, MA 01886

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TIAN HONGXIA
242 GROTON RD
WESTFORD, MA 01886

VINITH PRIYA
ABRAHAM VINITH
231 GROTON ROAD
WESTFORD, MA 01886

SUDAK CHILDRENS GIFT
DEAN P SUDAK - TR
80 PLEASANT ST
WESTFORD, MA 01886

O`DONNELL DIANNE
PO BOX 2122
WESTFORD, MA 01886

TURNER ROBERT W
TURNER CONNIE D
233 GROTON RD
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JERICHO, NY 11753

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COMMONWEALTH OF
DIV OF FISHERIES &
100 CAMBRIDGE ST
BOSTON, MA 02109

HAND ALAN J
HAND CATHERINE G
15 CHERRY LN
WESTFORD, MA 01886

ROTHMEL ETHEL
ROTHMEL FREDERICK
287 GROTON RD
WESTFORD, MA 01886

TEKADE UDAY
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277 GROTON RD
WESTFORD, MA 01886

COMMONWEALTH OF
DIVISION OF FISHERIES
100 CAMBRIDGE ST
BOSTON, MA 02110

HOANG LISA
40 FAY ST
UNIT #203
BOSTON, MA 02118

DALLEY REALTY TRUST
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CONNELL -TRUSTEES
P O BOX 1230
WESTFORD, MA 01886

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CONNELL -TRUSTEES
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WESTFORD, MA 01886

STURTEVANT RONALD J
STURTEVANT ELLEN M
PO BOX 1426
245-R GROTON RD
WESTFORD, MA 01886

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Site Photographs

Photo 1 – View looking South along Dunstable Road at #262 Groton Road (BP Gas Station)

Photo 2 – View looking East at the wetlands located east of Route 40 and Dunstable Rd intersection

Photo 3 – View looking Northeast on Route 40 near Dunstable Rd intersection

Photo 4 – View looking Southwest along Route 40 at #255 Groton Rd

Photo 5 – View looking South along Dunstable Rd, southwest of Route 40

Photo 6 – View looking Northeast along Route 40 at #239 Groton Rd