Notice of Intent Application

Massachusetts Wetlands Protection Act (M.G.L. c.131 s.40)
New Bedford Wetlands Ordinance

New Bedford Regional Airport
Runway 5 Perimeter Road Paving Project

Submitted to:
New Bedford Conservation Commission
133 William Street, Room 304
New Bedford, MA 02740

MassDEP Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

Prepared for:
New Bedford Regional Airport Commission
1569 Airport Road
New Bedford, MA 02746

Submitted by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

November 23, 2022

CONSULTING SCIENTISTS, PLANNERS & ENGINEERS

Epsilon
ASSOCIATES INC.

November 23, 2022

New Bedford Conservation Commission
133 William Street, Room 304
New Bedford, MA 02740

Subject: **Notice of Intent – Runway 5 Perimeter Road Paving Project, New Bedford Regional Airport, New Bedford, MA.**

Dear Commissioners:

Enclosed please find one copy of the above referenced Notice of Intent ("NOI") filed in accordance with the Massachusetts Wetlands Protection Act (M.G.L. c. 131 § 40) and implementing regulations (310 CMR 10.00) and the City of New Bedford Wetlands Ordinance. As per the Commission's filing requirements please also find two full sized plan sets and two copies of the stormwater report. The New Bedford Regional Airport is exempt from local and state filing fees because it is a municipal agency. Abutters to the property have been notified in accordance with state and local regulations.

As explained in further detail in the enclosed NOI, the New Bedford Regional Airport Commission (the "Applicant") is proposing to pave an existing gravel access road and conduct associated stormwater management improvements in the southwest portion of the Airport, near Runway 5. Portions of the proposed work will occur within Bordering Land Subject to Flooding (BLSF), the Commission's suggested 25-foot setback to Bordering Vegetated Wetland (BVW), and the 100-foot buffer zone to BVW. The work described herein has been designed to conform to the Wetlands Protection Act and Ordinance performance standards that are applicable to these resource areas.

The enclosed NOI is being submitted for the Commission's review at the **December 6, 2022** public hearing. If you have any questions about this application, please contact me at (603) 721-1642 or via email at rsommers@epsilonassociates.com.

Thank you.

Sincerely,
EPSILON ASSOCIATES, INC.

Rhianna Sommers

EPSILON ASSOCIATES, INC. **978-897-7100** **WWW.EPSILONASSOCIATES.COM**
3 MILL & MAIN PLACE, STE. 250
MAYNARD, MASSACHUSETTS 01754

Rhianna Sommers, PWS
Senior Scientist

Encl.
CC: DEP Southeast Regional Office
Amy Hoenig, Natural Heritage and Endangered Species Program
Scot Servis, New Bedford Regional Airport Manager
Steve Riesland, Airport Solutions Group, Inc.
File

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Prepared for:
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1569 Airport Road
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133 William Street, Room 304
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3 Mill & Main Place, Suite 250
Maynard, Massachusetts 01754

In Association With:
Airport Solutions Group, Inc.

November 23, 2022

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Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

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

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford
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.

A. General Information

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

1569 Airport Road	New Bedford	02746
a. Street Address	b. City/Town	c. Zip Code

Latitude and Longitude:	41.669086	-70.967194
	d. Latitude	e. Longitude

122-3, 124-28	
f. Assessors Map/Plat Number	g. Parcel /Lot Number

2. Applicant:

Scot	Servis
a. First Name	b. Last Name

New Bedford Regional Airport, Airport Manager
c. Organization

1569 Airport Road
d. Street Address

New Bedford	MA	02746
e. City/Town	f. State	g. Zip Code

(508) 991-6160		Scot.Servis@newbedford-ma.gov
h. Phone Number	i. Fax Number	j. Email Address

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

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

a. First Name	b. Last Name

City of New Bedford
c. Organization

133 William Street
d. Street Address

New Bedford	MA	02740
e. City/Town	f. State	g. Zip Code

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

4. Representative (if any):

Rhianna	Sommers
a. First Name	b. Last Name

Epsilon Associates, Inc.
c. Company

3 Mill & Main Place, Suite 250
d. Street Address

Maynard	MA	01754
e. City/Town	f. State	g. Zip Code

(978) 461-6225	(978) 897-0099	rsommers@epsilonassociates.com
h. Phone Number	i. Fax Number	j. Email address

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

Exempt - municipal project		
a. Total Fee Paid	b. State Fee Paid	c. City/Town Fee Paid

A. General Information (continued)

6. General Project Description:

The Applicant is proposing to pave an existing gravel access road that is located southwest of Runway 5 at the Airport. Portions of the work will occur within BLSF, the Commission's 25-foot setback to BVW, and the 100-foot buffer zone to BVW.

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)

2. Limited Project Type

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

8. Property recorded at the Registry of Deeds for:

Bristol
a. County

b. Certificate # (if registered land)

122-3 - Book: 949, Page: 295; 124-28 - Book: 930, Page: 214

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.

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

New Bedford
City/Town

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	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet	2. square feet
	3. cubic yards dredged	

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	94,235 sf 1. square feet	0 sf 2. square feet
	0 (net gain of ~ 6,800 cf) 3. cubic feet of flood storage lost	0 cf 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

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford
City/Town

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

2021
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 — 0.3%
percentage/acreage

(b) outside Resource Area — 0.7%
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 https://www.mass.gov/ma-endangered-species-act-mesa-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 https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
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, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; 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:	North Shore - Hull to New Hampshire border:
Division of Marine Fisheries - Southeast Marine Fisheries Station Attn: Environmental Reviewer 836 South Rodney French Blvd. New Bedford, MA 02744 Email: dmf.envreview-south@mass.gov	Division of Marine Fisheries - North Shore Office Attn: Environmental Reviewer 30 Emerson Avenue Gloucester, MA 01930 Email: dmf.envreview-north@mass.gov

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. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford
City/Town

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.

New Bedford Regional Airport Permit RW5 Perimeter Road
a. Plan Title

Airport Solutions Group, LLC
b. Prepared By

Craig Schuster
c. Signed and Stamped by

December 2022
d. Final Revision Date

1"=40'
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:

Exempt - municipal project
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

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.

Carlos A. DaCunha,
Chairperson
Digitally signed by Carlos A. DaCunha, Chairperson
DN: cn=Carlos A. DaCunha, Chairperson, o=New Bedford Airport Commission, ou, email=carlos.dacunha@newbedford-ma.gov, c=US
Date: 2022.11.01 07:55:55 -04'00'

1. Signature of Applicant

11/1/22

2. Date

3. Signature of Property Owner (if different)

4. Date

Rhianna Sammes

5. Signature of Representative (if any)

11/11/22

6. Date

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

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

Other:
If the applicant has checked the “yes” box in 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.

Proof of Ownership Form

CITY OF NEW BEDFORD

OFFICE OF THE CITY SOLICITOR
133 William Street, Room 203
New Bedford, MA 02740-6163

Tel.# (508) 979-1460
Fax.# (508) 979-1515

MEMORANDUM

TO:
Planning Board
Zoning Board of Appeals
[✓ Conservation Commission]
Board of Health
Licensing Department
Traffic Division

FROM: Irene B. Schall, City Solicitor

SUBJECT: APPLICATION INFORMATION

DATE: September 28, 2006

Effective immediately all applications for any permits issued by your respective boards must be accompanied by documentation showing the nature of the property interest(s) affected by the permit(s). Required will be: copies of deeds, certificates of title, leases and purchase and sales agreements and most recent plan or record showing the affected lot or lots. In addition, for ZBA applications, also include a copy of the deed or deeds of abutting parcels, if said parcels have been held in common ownership with the subject parcel at any time since January 1, 1976. If the applicant is not the owner, a signed and notarized letter from the record owner (or authorized representative) which authorizes the applicant to submit an application for the parcel or parcels affected will be required. If you are not provided with the necessary information or you require clarification on ownership, please contact this office.

This change should immediately be reflected in a change to your applications and may be attached to the Application as an Appendix (submitted herewith) or incorporated directly into the application itself.

Your cooperation will be greatly appreciated.

IBS/bar

Appendix

(1) Owner's/Landlord's Name: City of New Bedford

(2) Title Reference to Property: Parcel 122-3 - Book: 949, Page: 295; Parcel 124-28 - Book: 930, Page: 214

(Attach copy of Deed, Certificate of Title & most recent Recorded Plans showing affected lot or lots)

(3) If the Applicant is Not the Owner:

Provide:

1. Notarized authorization letter from owner to tenant or buyer for application for this permit (on letterhead);

2. Copy of Purchase & Sale agreement or lease, where applicable;

(In addition, for ZBA only)

3. Copy of the deed or deeds of abutting parcels if said parcels have been held in common ownership with the subject property at any time since January 1, 1976.

Attachment A

Project Narrative

ATTACHMENT A – PROJECT NARRATIVE

1.0 Introduction

On behalf of the City of New Bedford Regional Airport Commission (the "Applicant" or the "Airport"), Epsilon Associates, Inc. ("Epsilon") is pleased to submit this Notice of Intent ("NOI") to the New Bedford Conservation Commission (the "Commission"). This NOI was prepared in accordance with the Massachusetts Wetland Protection Act (MGL c.131 s.40) ("Act") and implementing Regulations (310 CMR 10.00) and the City of New Bedford Wetlands Ordinance.

As explained in further detail below, the Applicant is proposing to pave an existing gravel perimeter access road that wraps around Runway 5, at the southwestern perimeter of the Airport. Portions of the work will occur within Bordering Land Subject to Flooding, the 100-foot buffer zone to Bordering Vegetated Wetlands, and the Commission's suggested 25-foot setback. The proposed work has been designed to conform to the applicable Wetlands Protection Act ("WPA") and Ordinance performance standards. Additional information describing the proposed work is provided below.

2.0 Project Locus

The Project area is located at the New Bedford Regional Airport in New Bedford, Massachusetts (see Figure 1 – USGS Locus Map in Attachment B). Runway 5/23 is the Airport's primary and instrument landing runway, while Runway 14/32 is the Airport's crosswind runway (see Figure 2 – Aerial Map in Attachment B). The Project area consists of the existing gravel access road, which surrounds the southwest perimeter of the Airport, around the Runway 5 Runway Safety Area ("RSA"). Wetlands are located around the majority of the Airport, including extensive wetland systems located within the Runway 5 and 14 approaches (see Figure 3 – MassGIS Wetlands in Attachment B). A perennial tributary to the Paskamanset River exists south of the Project area and is approximately 160 feet from the Project area at its closest point. Thus, the 25-foot Riverfront Area associated with this stream does not fall within the Project area.

The 2022 Massachusetts Natural Heritage and Endangered Species Program ("NHESP") Atlas identifies estimated and priority habitat (310 CMR 10.59) for eastern box turtle (*Terrapene carolina carolina*) within and adjacent to the Project area. See Attachment B, Figure 5. There is one NHESP-mapped Certified Vernal Pool approximately 140 feet southwest of the Project area. A copy of this NOI has been forwarded to the NHESP for streamlined review under the WPA and Massachusetts Endangered Species Act ("MESA") regulations.

Wetland resource areas in the vicinity of the Project area are described below.

3.0 Wetland Resource Areas and Buffer Zones

On May 12, 2022, wetland scientists from Epsilon Associates, Inc. delineated wetland resource areas within the vicinity of the Project area. Wetlands were delineated in accordance with the U.S. Army Corps of Engineers *Wetland Delineation Manual* (USACE, 1987), the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, Version 2.0" (2012), the Massachusetts Wetlands Protection Act and implementing regulations (310 CMR 10.00), the Massachusetts Department of Environmental Protection's handbook, *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (MADEP, 1995), and the City of New Bedford Wetlands Ordinance. Wetland resource areas delineated in this area were identified as Wetland Series A through E and Bank Series BF/A.

Wetland resource areas in the vicinity of the Project area are described below.

3.1 Bordering Vegetated Wetlands

BVW is defined at 310 CMR 10.55 and, BVWs generally include freshwater wetlands that border on creeks, rivers, streams, ponds, and lakes. Types of freshwater wetlands include wet meadows, marshes, swamps, and bogs. BVWs are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The ground and surface water regime and the plant community that occur in each type of freshwater wetland are specified in the Act. The boundary of BVW is the line within which 50 percent or more of the plant community, based on visual inspection, consists of wetland indicator plants and saturated and inundated conditions exist. Pursuant to the Act, there is a 100-foot buffer zone associated with BVW and the Commission's suggested 25-foot minimum setback under the Ordinance.

Wetlands within the vicinity of the Project area consist of:

BVW Series A through E (Flags A-01 to A-41, B-01 to B-16, C-01 to C-03, D-01 to D-03, and E-01 to E-06):

This wetland series surrounds the southwestern end of the Airport, adjacent to the Project area. This wetland is a shallow marsh/shrub swamp system that borders on the Paskamanset River and an intermittent tributary. Dominant species included common reed (*Phragmites australis*), sensitive fern (*Onoclea sensibilis*), giant goldenrod (*Solidago gigantea*), and gray birch (*Betula populifolia*). Soils observed within the wetland were histosols. At the time of the delineation, the wetland contained saturation to the surface, and a high water table.

U.S. Army Corps of Engineers wetland determination data forms for this wetland series are included in Attachment H.

No work is proposed within this wetland; however, the access road paving work is located within the 100-foot buffer zone and 25-foot setback to this wetland.

3.2 Inland Bank & Land Under Water

Inland Bank is defined in the Wetlands Protection Act Regulations at 310 CMR 10.54 as the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a BVW and adjacent floodplain, or, in the absence of these, it occurs between a water body and an upland. The upper boundary of bank is the first observable break in slope or the mean annual flood level, whichever is lower. The lower boundary of bank is the mean annual low flow level. There is a 100-foot buffer zone associated with Inland Bank and the Commission's suggested 25-foot minimum setback under the Ordinance.

LUW is defined in the Wetlands Protection Act Regulations at 310 CMR 10.56 as land beneath any creek, river, stream, pond or lake. Said land may be composed of organic muck or peat, fine sediments, rocks or bedrock. The boundary of LUW is the mean annual low water level. There is no Buffer Zone associated with LUW.

Bank Series BF/A (Flags BF/A-1 to BF/A-6):

Bank Series BF/A delineates the bank of an intermittent tributary to the Paskamanset River, located on the western side of Runway 5. The stream is within the wetland series described above, and travels parallel to the runway adjacent to the Project area. The stream is conveyed via a concrete headwall. The stream is approximately 3 to 4 feet wide and contained 2 to 3 inches of water at the time of the delineation. Dominant bank vegetation included cattail (*Typha latifolia*), tussock sedge (*Carex stricta*), and multiflora rose (*Rosa multiflora*). The stream contained a sandy substrate.

The stream channel is mapped as intermittent on the current USGS quadrangle, and according to the USGS Stream Stats application, its watershed size is approximately 0.06 square miles. Therefore, the stream is not considered perennial in this stretch and does not contain an associated Riverfront Area.

No work is proposed within Bank or LUW; however, the access road paving work is located within the 100-foot buffer zone associated with the stream.

3.3 Bordering Land Subject to Flooding

According to the applicable Federal Emergency Management Agency - Flood Insurance Rate Maps ("FEMA-FIRM"), Community Panel Numbers # 25005C0614, portions of Project area are within the mapped 100-year floodplain (see Figure 4 in Attachment B). As part of the MassDEP Variance proceedings associated with the Runway 5/23 Safety Improvements Project (MassDEP File Number SE 049635), the elevation of the 100-year flood was refined and established to be 59.53 feet NGVD (National Geodetic Vertical Datum).

Portions of the access road paving work are proposed within the 100-year floodplain, regulated as Bordering Land Subject to Flooding (BLSF). However, the Project will not result in a displacement of flood storage, as described in further detail below.

4.0 Project Description

4.1 Project Purpose

As described in further detail below, the purpose of the Project is to (1) improve the condition of perimeter access road by paving it, creating a safer access point for fuel trucks; and (2) improve the quality of stormwater runoff exiting the site.

The Airport is a commercial airline service airport that is strategically located along the coastline of Southeastern Massachusetts and is a significant transportation gateway for the region and islands of Nantucket and Martha's Vineyard. One essential infrastructure improvement that has not yet been addressed is the paving of the Airport's perimeter access road. The Federal Aviation

Administration ("FAA") has identified this project as a critical safety improvement to the operation of the Airport. The Airport has continuously identified this project in their Five-Year Airport Capital Improvement Plan and FAA will be funding this project.

Due to a lack of a perimeter road connecting the south ramp and north ramp, fuel trucks must cross Runway 5/23, which is the Airport's main/active runway. This runway/taxiway intersection is also a designated hot spot at the Airport. An airport surface hot spot is a location on an airfield movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary. A hot spot is a runway safety related problem area on an airport that presents increased risk during surface operations. Typically, it is a complex or confusing taxiway/taxiway or taxiway/runway intersection. The area of increased risk has either a history of or potential for runway incursions or surface incidents, due to a variety of causes, such as, but not limited to, airport layout, traffic flow, airport marking, signage and lighting, situational awareness, and training. Currently, fuel trucks cross the active runway multiple times daily. In addition, airport operations and maintenance trucks also cross at this intersection daily. With the Bridgewater Flight School now established, and the addition of two more T-Hangers on the north ramp, these crossings will not only continue, but will continue to increase in the future.

4.2 Access Road Paving

The Airport is seeking to pave the existing perimeter road from the Bridgewater Apron along the south side of Taxiway B and the west side of Runway 5, continuing around the edge of the Runway 5 extended runway safety area and connecting to Taxiway A, a distance of approximately 6,235 linear feet (see Figures 1 and 2 in Attachment B and the Permit Drawings in Attachment F). The alignment will follow the same alignment as the existing perimeter road except that the new perimeter road will tie into the existing T-Hangar apron in front of the hangars as opposed to the rear.

Paving the access road will require excavating the gravel from the existing road, and then installing eight inches of dense graded crushed stone which will be overlayed by three inches of hot mix asphalt. Excavated material will likely be live-loaded into dump trucks and properly disposed of off-site; or, temporarily stockpiled outside the 100-foot buffer zone. Generally, the access road will be at similar elevations. The perimeter road will be approximately eleven feet wide, the same width as the existing access road. There will be a 4-foot shoulder on each side of the access road which will be restored with loam and seed once final grades have been achieved.

Two four-foot wide infiltration trenches will be constructed along the inside perimeter of the access road.

Portions of the access road paving work and infiltration trench construction will occur within BLSF. As shown in the table on Sheet NOI.3 of the permit drawings, proposed grading activities within BLSF will not result in a net fill of the floodplain at any elevation. The Project will actually result in a slight excavation of BLSF when compared to existing conditions. Thus, no flood storage will be displaced as a result of the project. Portions of the access road paving work will also occur within the Commission's 25-foot setback to BVW. Work within the 25-

foot setback is unavoidable given the proximity of wetlands to the existing perimeter road. The project does not propose any impacts to BVW. Sediment controls will be installed between the limits of grading and the adjacent wetlands to protect them during construction. The sediment controls will not be removed until work is complete and stabilization has been achieved.

4.3 Stormwater Management System

The proposed stormwater management system improvements have been designed to comply with MassDEP's stormwater management standards that were incorporated into the Wetlands Protection Act Regulations on January 2, 2008 (see 310 CMR 10.05(6)(k)); FAA Advisory Circular 150/5300-13A (Airport Design); and MassDOT Aeronautics approved aeronautical rules and regulations for public use airports (pursuant to 702 CMR, as amended; for airports subject to MassDOT Aeronautics certification pursuant to M.G.L. c.90, Section 39B).

For purposes of Stormwater Management Standard 7, "redevelopment projects" are defined to include the following:

- Maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving;
- Development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area; and
- Remedial projects specifically designed to provide improved stormwater management, such as projects to separate storm drains and sanitary sewers and stormwater retrofit projects.

Redevelopment projects, such as that associated with the Airport's phased terminal and apron projects, are required to meet the following Stormwater Management Standard only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

As demonstrated in the enclosed Stormwater Report prepared by Airport Solutions Group, the proposed project fully complies with Standard 1 (no untreated stormwater runoff), Standard 5 (BMPs approved for use in LUHPPL areas), Standard 6 (no stormwater discharges to Critical Areas), Standard 8 (implementation of a construction period erosion, sedimentation, and pollution prevention plan), Standard 9 (adherence to a long term operations and maintenance plan), and Standard 10 (no known illicit discharges).

With regard to Standard 2, as demonstrated in the pre-and post-development runoff tables provided in this report, the stormwater management system has been designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates for the modeled storm events to the maximum extent practicable. In those few instances where there is a nominal increase between pre- and post-development runoff rates, under certain modeled storm events, the differences are *de minimus* and will not impair the receiving wetland's ability to prevent storm damage and downstream off-site flooding.

With regard to Standard 3, the loss of annual recharge to groundwater has been minimized through the use of environmentally sensitive site design measures. Despite the challenges of high ground water throughout the Airport, the two proposed infiltration trenches will provide recharge based upon the type of fill placed for the construction of the safety area.

5.0 Mitigation Measures

5.1 Erosion and Sedimentation Controls

An erosion and sedimentation control program will minimize the risk of impacts to wetland resource areas during construction. The Applicant's erosion and sedimentation control program incorporates Best Management Practices ("BMPs") specified in guidelines developed by the MassDEP and the United States Environmental Protection Agency ("EPA") and will comply with the requirements of the National Pollutant Discharge Elimination System ("NPDES") General Permit for Storm Water Discharges from Construction Activities, as applicable. These measures will include the installation of temporary sediment controls (e.g., silt fence, straw wattles, compost filter tubes, straw bales), erosion prevention measures (e.g., seeding, stone, pavement, etc.) and construction sequencing. Areas of exposed soil will be kept to a minimum, and a permanent vegetative cover or other stabilized surface (pavement) will be established as soon as practicable after final grading. Sediment controls are depicted on the enclosed permit drawings.

5.2 Construction Monitoring

The Applicant will develop and maintain a Stormwater Pollution Prevention Plan (SWPPP) for the Project that will identify controls to be implemented to mitigate the potential for erosion and sedimentation from soil disturbance.

A qualified environmental monitor will perform regular site inspections and monitor compliance with the Project's SWPPP and with federal, state and local permit requirements and conditions.

5.3 Restoration

Temporarily disturbed areas will be seeded with appropriate seed mixes and mulched to stabilize soil disturbance, as necessary.

5.4 Soil and Construction Material Stockpile Locations

Soil and construction material stockpile locations will be located greater than 25 feet away from wetland resource areas. There will be no storage of soil, concrete, or construction debris within wetland resource areas. Construction debris will typically be placed in large roll-off containers (or dumpsters) and removed by a contract hauler.

5.5 Equipment Refueling

If on-site fueling of construction equipment is necessary, it will be conducted outside of wetland resource areas and the 100-foot buffer zone, within paved areas to the extent practical. The contractor will be required to maintain spill clean-up materials on site during construction.

6.0 Compliance with General Performance Standards

Compliance with the general performance standards for BLSF are discussed below.

6.1 Bordering Land Subject to Flooding

Portions of the access road paving work and infiltration trench construction will occur within BLSF. The Project satisfies the performance standards for projects affecting BLSF, which are found at 310 CMR 10.57(4)(a) and are discussed below.

[310 CMR 10.57 (4)(a)1.] Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding, when in the judgment of the issuing authority said loss will cause an increase or will contribute incrementally to an increase in the horizontal extent and level of flood waters during peak flows.

The project will not result in a displacement of flood storage volume. As indicated on the permit drawings, the proposed work will not result in a fill within the floodplain, and actually will result in an overall increase in flood storage volume.

(2) Work within Bordering Land Subject to Flooding, including that work required to provide the above-specified compensatory storage, shall not restrict flows so as to cause an increase in flood stage or velocity.

The project does not propose any net fill within BLSF. Overall, the project will result in an increase in flood storage volume of approximately 252 cubic yards (cy) (refer to the table of proposed cuts and fills within BLSF on Sheet NOI.3 of the Permit Drawings in Attachment F). Thus, the project will not result in a loss of flood storage volume and will not create an increase in flood stage or velocity.

(3) Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions. Except for work which would adversely affect vernal pool habitat, a project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold, or altering vernal pool habitat, may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.

The proposed work in BLSF conforms to the above referenced thresholds and is thus presumed to not impair the capacity of BLSF to provide important wildlife habitat functions.

A copy of the NOI has been forwarded to the NHESP for review and comment relative to the proposed work within Estimated and Priority Habitat. The NHESP has previously found that work within mapped habitat is unlikely to affect rare species and their habitats.

7.0 Conclusions

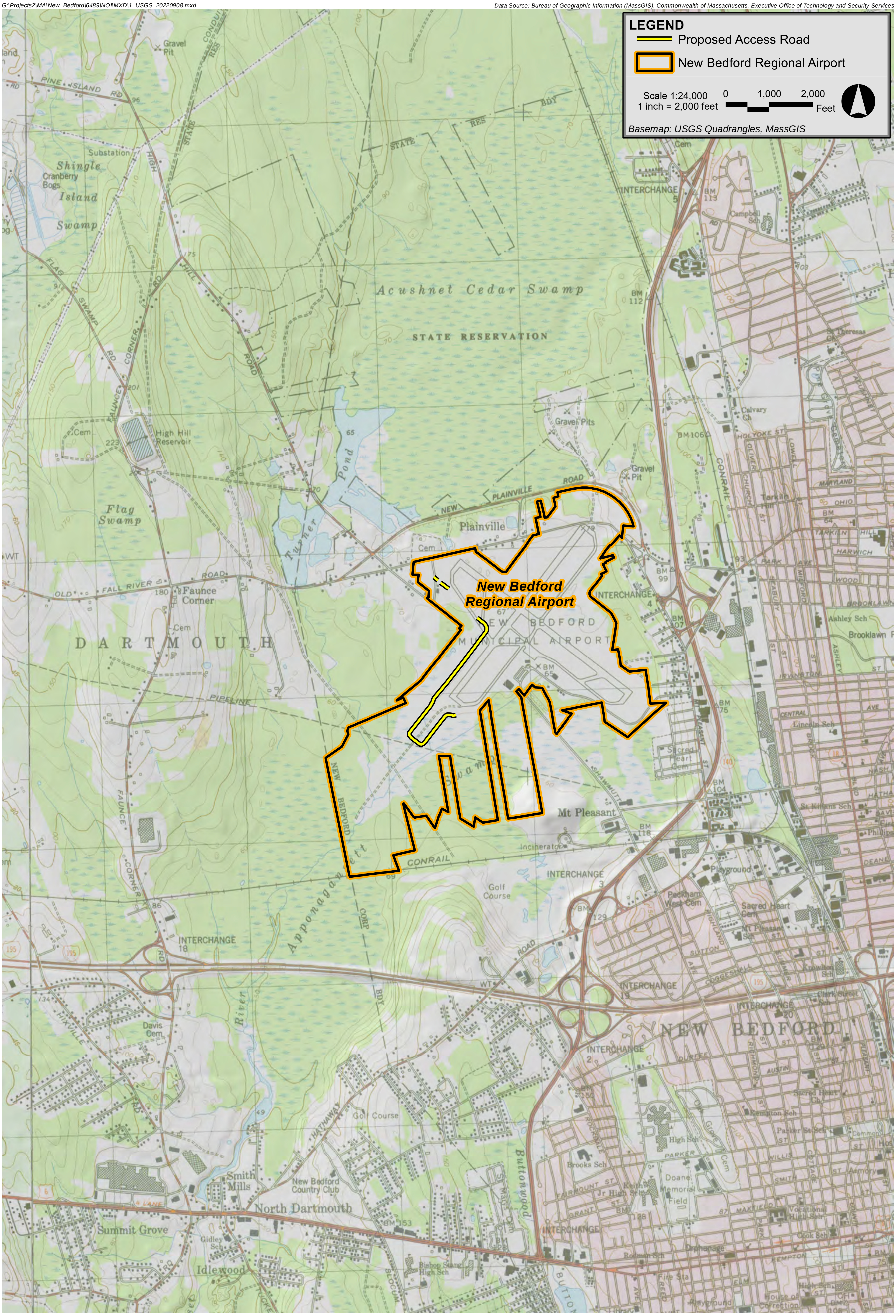
The information contained in this NOI and the accompanying plans describes the site, proposed work and compliance with the Regulations. The proposed work will contribute to the protection of the interests of the Act and Ordinance by complying with the general performance standards for BLSF established in the Regulations. The Applicant therefore respectfully requests that the Commission issue an Order of Conditions approving the Project with appropriate conditions to protect the interests identified in M.G.L. c. 131 §40 and the New Bedford Wetlands Ordinance.

Attachment B

Figures

G:\Projects2\MA\New_Bedford\6489\NOI\MXD\1_USGS_20220908.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



New Bedford Regional Airport Access Road Paving Project

Figure 1

USGS Locus Map

G:\Projects2\MA\New_Bedford\6489\NOI\MXD\2_Aerial_20220908.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

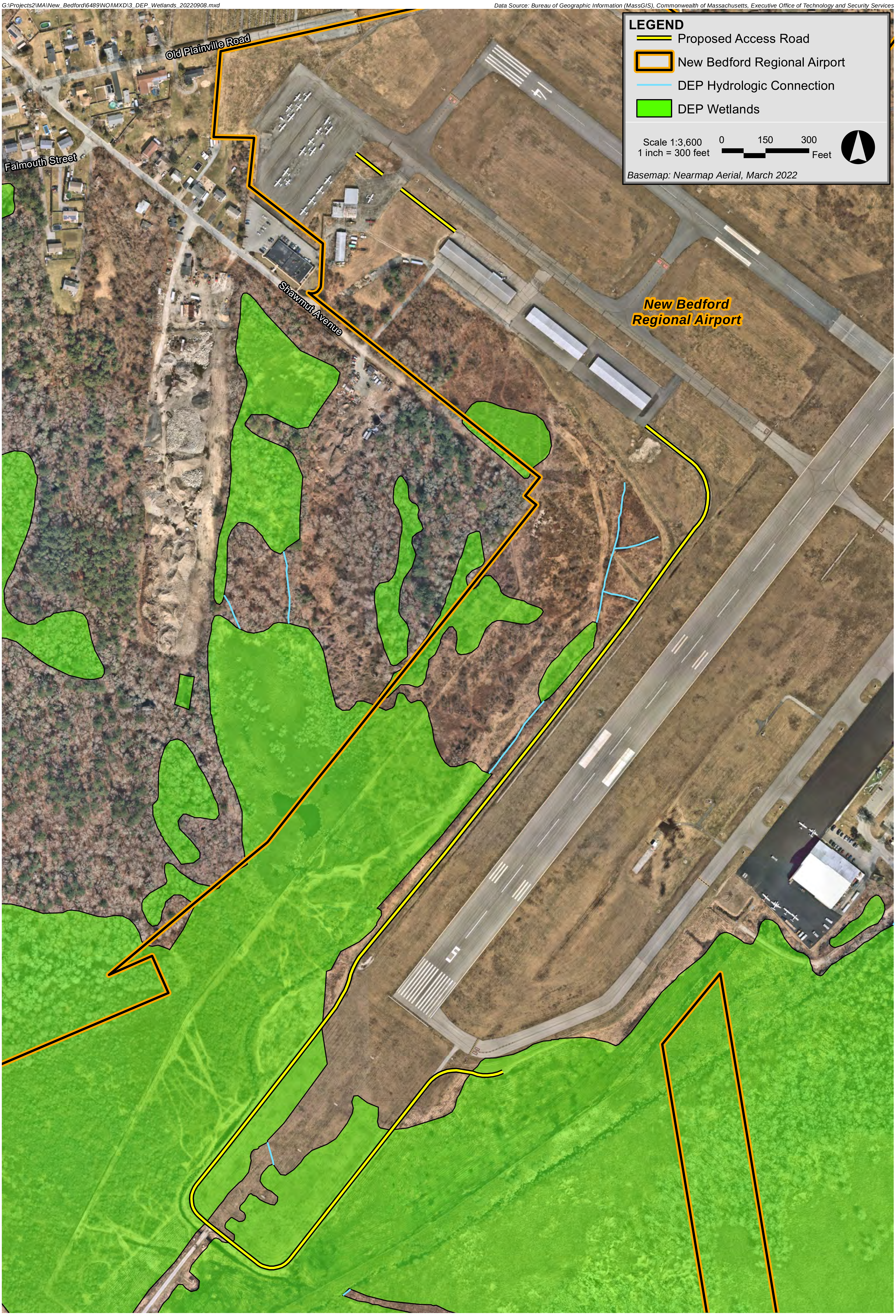
New Bedford Regional Airport Access Road Paving Project

Figure 2

Aerial Locus Map

G:\Projects2\MA\New_Bedford\6489\NOI\MXD\3_DEP_Wetlands_20220908.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



New Bedford Regional Airport Access Road Paving Project

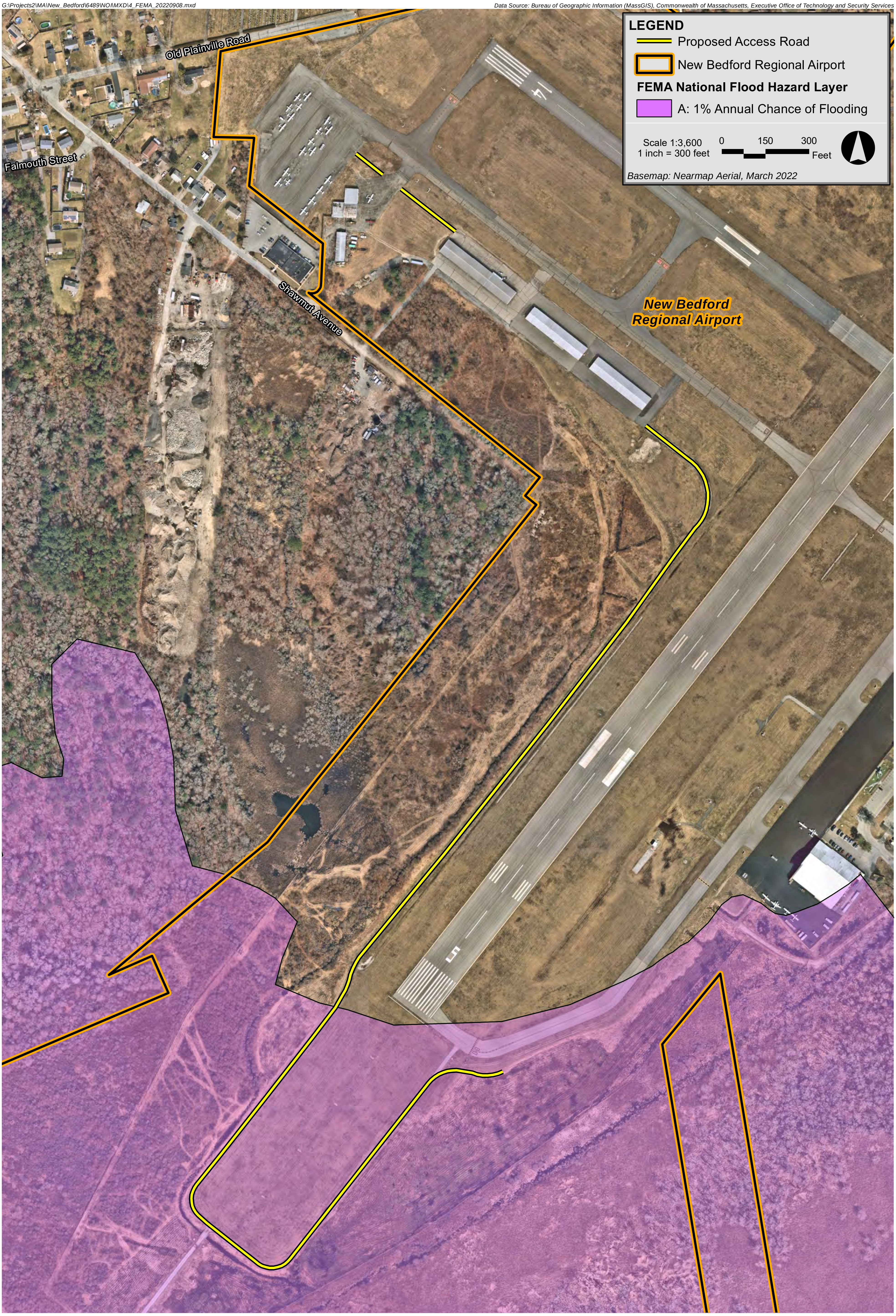
Epsilon
ASSOCIATES INC.

Figure 3

DEP Wetlands

G:\Projects2\MA\New_Bedford\6489\NOI\MXD\4_FEMA_20220908.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



New Bedford Regional Airport Access Road Paving Project

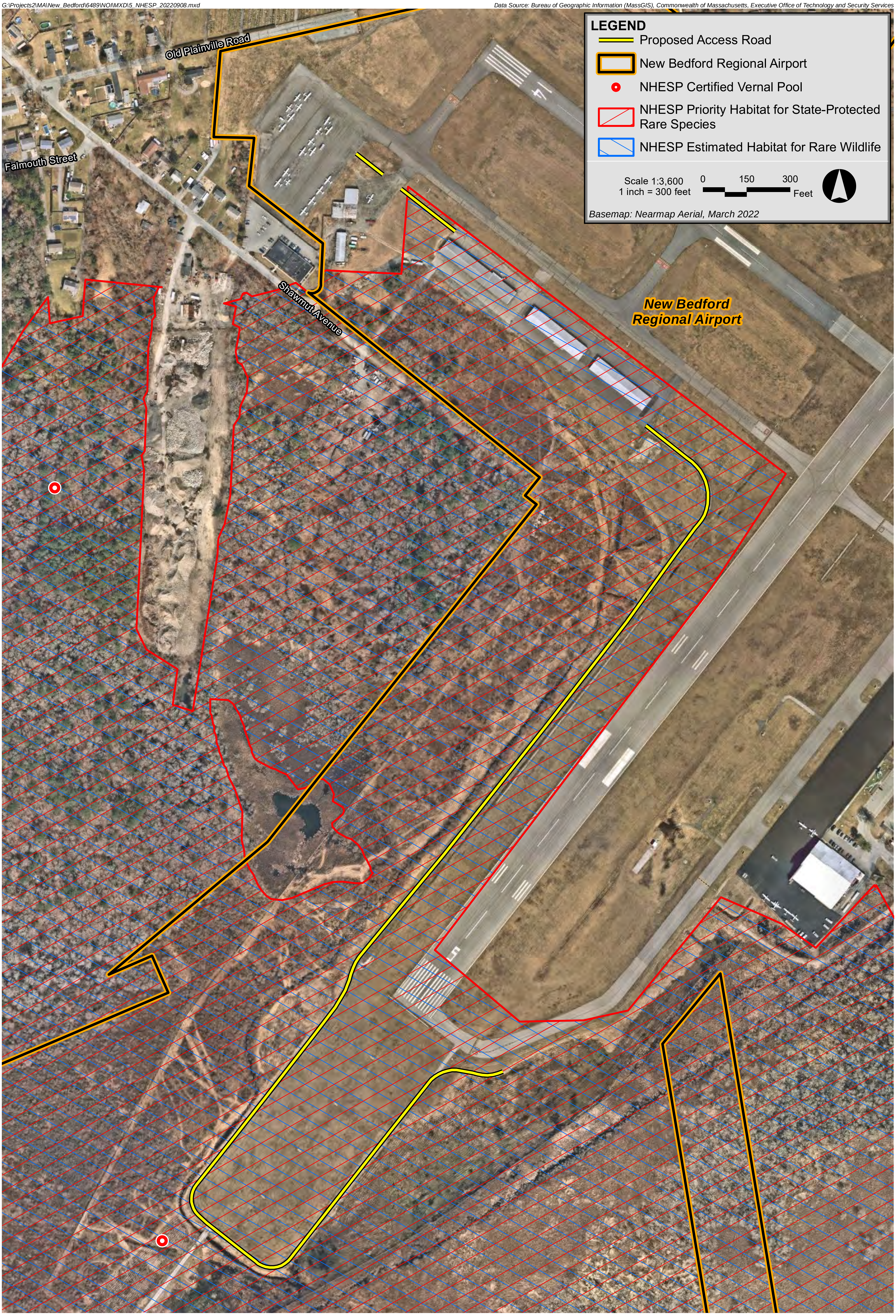
Epsilon

Figure 4

FEMA National Flood Hazard Layer (FIRM Panel 25005C0614)

G:\Projects2\MA\New_Bedford\6489\NOI\MXD\5_NHESP_20220908.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



New Bedford Regional Airport Access Road Paving Project

Epsilon ASSOCIATES INC.

Figure 5

Natural Heritage and Endangered Species Program

Attachment C

Site Photographs

Photo 1: View of BVW Series A, looking southwest along the access road towards the edge of Taxiway A.

Photo 2: View of the existing access road, looking north near Wetland Flag A-9, with BVW Series A to the east.

Photo 3: View of intermittent stream series BF/A.

Photo 4: View of the existing access road and adjacent BVW Series A.

Attachment D

Filing Fee Information

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:

1569 Airport Road
a. Street Address

New Bedford
b. City/Town

c. Check number

Exempt - municipal project
d. Fee amount

2. Applicant Mailing Address:

Scot
a. First Name

Servis
b. Last Name

New Bedford Regional Airport, Airport Manager
c. Organization

1569 Airport Road
d. Mailing Address

New Bedford
e. City/Town

MA
f. State

02746
g. Zip Code

(508) 991-6160
h. Phone Number

i. Fax Number

Scot.Servis@newbedford-ma.gov
j. Email Address

3. Property Owner (if different):

a. First Name

b. Last Name

City of New Bedford
c. Organization

133 William Street
d. Mailing Address

New Bedford
e. City/Town

MA
f. State

02740
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
Exempt - municipal project			

Step 5/Total Project Fee: ____________

Step 6/Fee Payments:

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

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

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

C. Submittal Requirements

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

Department of Environmental Protection
Box 4062
Boston, MA 02211

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

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

City of New Bedford Conservation Commission •
Department of Environmental Stewardship
133 William Street · Room 304 · New Bedford, Massachusetts 02740
Telephone: (508) 991.6188
Conservation • Environmental Stewardship • Resilience

MAYOR
JON MITCHELL

CITY OF NEW BEDFORD, MASSACHUSETTS

CONSERVATION COMMISSION
2022 FILING FEE CALCULATION WORKSHEET*

PROJECT LOCATION: 1569 Airport Road, New Bedford, MA

MAP(S) ______________ **LOT(S)** 122-3, 124-28

APPLICANT: New Bedford Regional Airport

CONSERVATION COMMISSION APPLICATION TYPE:

(☐) REQUEST FOR DETERMINATION OF APPLICABILITY
(☑) NOTICE OF INTENT
(☐) AMENDED ORDER OF CONDITIONS
(☐) EXTENSION PERMIT
(☐) CERTIFICATE OF COMPLIANCE

N/A - exempt (municipal project)

(A) ALTERATION FEES:

Application and field review of a project proposed in a Wetland Resource Area or its Buffer Zone is $200.00 plus the applicable alteration fee as follows:

	AMOUNT DUE:
• Application and Field Review Fee ($200.00)	$ 200.00
• $0.50 X ______________ SF Wetland Resource Area Fee shall not exceed $2000.00 per project	$__________
• $0.05 X ______________ SF of Isolated Land Subject to Flooding, Bordering Land Subject to Flooding or Land Subject to Coastal Storm Flowage Fee shall not exceed $500.00	$__________
• $0.50 X ______________ SF of altered 25’ Riverfront Area Fee shall not exceed $1,500.00	$__________
• $1.00 X ______________ SF of undeveloped 25’ Riverfront Area Fee shall not exceed $2000.00	$__________
• $5.00 X ______________ LF of Coastal or Inland Bank Fee shall not exceed $750.00	$__________

- $0.10 X ___________________ SF of Buffer Zone altered $ ____________
  Fee shall not exceed $6,500.00
- $10.00 X __________________ LF of dock $____________
- $10.00 X __________________ acres of aquaculture $ ____________

(B) EXTENSION OF AN ORDER OF CONDITIONS:

- Single family dwelling, or minor project (house addition, in ground pool dock etc.) = $200.00 $_____________
- Subdivision, commercial or industrial project = $400.00 $_____________

(C) AMENDING A PERMIT

- Single family dwelling or minor project (house addition, in ground pool dock etc.) = $200.00 + new alteration fee – refer to (A) above $_____________
- Subdivision, commercial or industrial project = $500.00 + new alteration fee – refer to (A) above $_____________

(D) WETLAND DELINEATION VERIFICATION (with or without proposed alteration)

- ½ acre or less
- ½ acre to 2 acres = $500.00 ($100/acre thereafter) not to exceed $3,500 $ _____________

(E) LEGAL AD FEE (fee set by local newspaper, subject to market price) $ ___250.00__

(F) CERTIFICATES OF COMPLIANCE

- One new house = $250.00 $_____________
- One activity at an existing house = $150.00 $_____________
- Residential or Commercial docks = $200.00 $_____________
- Commercial & Industrial Facilities = $1,500.00 $_____________
- New Roadways & Associated Stormwater Mgt. Systems = $1,500.00 $_____________

Partial Certificates of Compliance have the same fee as a Certificate of Compliance, But you only pay the fee once (you do not pay double to obtain a full Certificate of Compliance.

(G) AFTER THE FACT FILING FEE

- Notice of Intent or Amended Order of Conditions = $500.00 $______________
- Request for a Determination of Applicability = $250.00 $______________

TOTAL AMOUNT DUE: $_____________

Notes:

*Please refer to the Conservation Commission fee schedule – dated 02/2020

Please make check or Money Order payable to the City of New Bedford
Cash is not accepted.

Attachment E

Abutter Notification Information

NOTIFICATION TO ABUTTERS UNDER THE CITY OF NEW BEDFORD WETLANDS ORDINANCE AND THE MA WETLANDS PROTECTION ACT

In accordance with the City of New Bedford Wetlands Ordinance (New Bedford Code of Ordinances Sections 15-101 through 15-112) and the MA Wetlands Protection Act (M.G.L. c. 131 S.40) you are hereby notified of the following:

The name of the applicant is: New Bedford Regional Airport

The applicant has filed a Notice of Intent for the municipality of New Bedford, Massachusetts seeking permission to remove, fill, dredge or alter an area subject to protection under the City of New Bedford Wetlands Ordinance and MA Wetlands Protection Act.

The address of the lot where the activity is proposed is: 1569 Airport Road, New Bedford, MA
Assessors Map ______________; Lot Parcels 122-3 and 124-28

Copies of the Notice of Intent may be examined at the New Bedford Conservation Commission, Room 304 – City Hall, 133 William St. New Bedford, MA 02740 between the hours of 8:00 AM and 4:00 PM, Monday through Friday. For more information contact the New Bedford Conservation Commission at 508-991-6188.

Copies of the Notice of Intent may be obtained from either (check one) the applicant ________ or the applicant's representative X by calling this telephone number (978) 897-7100 between the hours of 8:00 AM and 4:00 PM Monday through Friday.

Information regarding the date, time and place of the Public Hearing may be obtained from the New Bedford Conservation Commission by calling 508-991-6188 between the hours of 8:00 AM and 4:00 PM Monday through Friday.

Note: Notice of the Public Hearing, including its date, time and place will be posted in the City Hall not less than forty eight (48) hours in advance of the meeting.

Note: Notice of the Public Hearing including its date, time and place will be published at least five (5) days in advance of the Public Hearing in the Standard Times newspaper.

Note: You may also contact the New Bedford Conservation Commission at 508-991-6188 for more information about this publication, the City of New Bedford Wetlands Ordinance or the MA Wetlands Protection Act.

City of New Bedford

REQUEST *for a* CERTIFIED ABUTTERS LIST

This information is needed so that an official abutters list as required by MA General Law may be created and used in notifying abutters. You, as applicant, are responsible for picking up and paying for the certified abutters list from the assessor's office (city hall, room #109).

SUBJECT PROPERTY

MAP #: 122 / 124

LOT(S)#: 3 / 28

ADDRESS: 1569 Airport Road

OWNER INFORMATION

NAME: City of New Bedford

MAILING ADDRESS:
133 William Street
New Bedford, MA 02740

APPLICANT/CONTACT PERSON INFORMATION

NAME (IF DIFFERENT): Rhianna Sommers (Epsilon Associates, Inc)

MAILING ADDRESS (IF DIFFERENT):
Epilson Associates, Inc., Attn: Rhianna Sommers
3 Mill & Main Place Suite 250, Maynard, MA 01754

TELEPHONE #: 603-721-1642

EMAIL ADDRESS: rsommers@epsilonassociates.com

REASON FOR THIS REQUEST: *Check appropriate*

- ☐ ZONING BOARD OF APPEALS APPLICATION
- ☐ PLANNING BOARD APPLICATION
- ☑ CONSERVATION COMMISSION APPLICATION
- ☐ LICENSING BOARD APPLICATION
- ☐ OTHER (*Please explain*):

Once obtained, the Certified List of Abutters must be attached to this Certification Letter. Submit this form to the Department of City Planning, Room 303 in City Hall, 133 William Street, or Email to Angela.Goncalves@newbedford-ma.gov. The applicant is responsible for picking up and paying for the certified abutters list from the Assessor's Office (city hall, room #109).

Official Use Only:

As Assistant City Assessor to the City of New Bedford's Board of Assessors, I do hereby certify that the names and addresses as identified on the attached "abutters list" are duly recorded and appear on the most recent tax.

Judith M. Serdahl
Printed Name

Judith M Serdahl
Signature

9/13/2022
Date

Amount Due	$11.00
Date Paid	9/12/2022
Confirmation Number	CHECK 52287

Paid 9/12/2022

CITY OF NEW BEDFORD
Schedule of Departmental Payments to Treasurer
Single Charge Code

Department/Contact: ASSESSORS
GL String: 01411160-439020
Treasury: TW05-101009

Date: 9/8/20
Charge Code ASSFEE

From Whom	Source (cash, check, etc)	Amount	Total
DEPARTMENTAL RECEIPT	CC	$ 11.00	
ABUTTERS LIST	Check-52287		
122-3 , 124-28			
1569 Airport Road			
Rhianna Sommers			
Epsilon Associates,Inc			
			$ 11.00

To the City Treasurer:

The above is a detailed list of revenue collected by me, amounting in the aggregate of

______________________ **Dollars**

Receipt# ______

Signature:

Title: PRINCIPAL CLERK

CITY OF NEW BEDFORD
Schedule of Departmental Payments to Treasurer
Single Charge Code

Department/Contact: ASSESSORS
GL String: 01411160-439020
Treasury: TW05-101009

Date: 9/8/20
Charge Code ASSFEE

From Whom	Source (cash, check, etc)	Amount	Total
DEPARTMENTAL RECEIPT	CC	$ 11.00	
ABUTTERS LIST	CHECK-52287		
122-3 , 124-28			
1569 Airport Road			
Rhianna Sommers			
Epsilon Associates,Inc			
			$ 11.00

To the Departmental Officer making the Payment

Received in Treasurer's Office ______________________, the sum of

______________________ Dollars

for collections, as per schedule of this date, filed in my office

____
City Treasurer

Receipt# ______

By ______________________

September 8, 2022
Dear Applicant,

Please find below the List of Abutters within 100 feet of the property known as 1569 Airport Road (Map: 122,124, Lot: 3, 28). The current ownership listed herein must be checked and verified by the City of New Bedford Assessor's Office. Following said verification, the list shall be considered a Certified List of Abutters.

Please note that multiple listed properties with identical owner name and mailing address shall be considered duplicates and shall require only 1 mailing. Additionally, City of New Bedford-Owned properties shall not require mailed notice.

Parcel	Location	Owner and Mailing Address
122-34	NO OF F R R R	CITY OF NEW BEDFORD, 133 WILLIAM STREET NEW BEDFORD, MA 02740
122-33	NO OF F R R R	CITY OF NEW BEDFORD, 133 WILLIAM STREET NEW BEDFORD, MA 02740
124-117	WS CARAVAN WAY	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
122-1	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
121-1	SOUTH OF F R R	CITY OF NEW BEDFORD, ADDITION TO GOLF COURSE 131 WILLIAM ST NEW BEDFORD, MA 02740
122-32	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
121-86	NS HATHAWAY RD	WHALING CITY GOLF CLUB INC, C/O CITY OF NEW BEDFORD 133 WILLIAM STREET NEW BEDFORD, MA 02740
122-37	SWAMP N OF F R R R	CYNTHIA H RITTER LLC, PETER J HAWES LLC, M E HAWES LLC, PO BOX 87121 DARTMOUTH, MA 02748-0702
121-42	RIGHT OF WAY	PENN CENTRAL CO, CONSOLIDATED RAIL CORP 500 WATER STREET DEPT J910 JACKSONVILLE, FL 32202
122-38	NO OF F R R R	CITY OF NEW BEDFORD, 133 WILLIAM STREET NEW BEDFORD, MA 02740
122-63	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
122-62	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
122-17	NO OF F R R R	CITY OF NEW BEDFORD, 133 WILLIAM STREET NEW BEDFORD, MA 02740

September 8, 2022
Dear Applicant,

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Parcel	Location	Owner and Mailing Address
123-24	1103 A SHAWMUT AVE	CITY OF NEW BEDFORD, BOARD OF HEALTH 131 WILLIAM ST NEW BEDFORD, MA 02740
122-60	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
122-61	NO OF F R R R	CITY OF NEW BEDFORD, CONSERVATION 131 WILLIAM ST NEW BEDFORD, MA 02740
122-2	NO OF F R R R	COUNTY OF BRISTOL, CONSERVATION NEW BEDFORD, MA 02740
122-25	WS SHAWMUT AVE	CUNNINGHAM GLENN G, CUNNINGHAM DORIS I 13 QUANAPOAG ROAD E FREETOWN, MA 02717
122-26	WS SHAWMUT AVE	A & L ENTERPRISES LLC, P O BOX 50540 NEW BEDFORD, MA 02745
122-46	WS SHAWMUT AVE	CUNNINGHAM GLENN G, CUNNINGHAM DORIS I 13 QUANAPOAG ROAD E FREETOWN, MA 02717
122-20	WS SHAWMUT AVE	CITY OF NEW BEDFORD, PROVENCAL ADELARD 131 WILLIAM ST NEW BEDFORD, MA 02740
122-39	ES SHAWMUT AVE	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
124-146	SS SHAWMUT AVE	DUPHILY RAYMOND G "TRS", A & R REALTY TRUST 34 FLAGSWAMP ROAD NO. DARTMOUTH, MA 02747
123-3-A	1513 1529 AIRPORT RD	SANDPIPER AIR, INC., 1529 AIRPORT ROAD NEW BEDFORD, MA 02746
122-3	WS SHAWMUT AVE	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
124-77	WS SHAWMUT AVE	CITY OF NEW BEDFORD, AIRPORT COMMISSION 133 WILLIAM ST NEW BEDFORD, MA 02740

September 8, 2022
Dear Applicant,

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Parcel	Location	Owner and Mailing Address
124-143	1800 SHAWMUT AVE	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
124-26	WS R SHAWMUT AVE	COUNTY OF BRISTOL, CONSERVATION NEW BEDFORD, MA 02740
124-116-A	1852 SHAWMUT AVE	BRIDGE WATER STATE COLLEGE, (DCAM) 131 SUMMER STREET BRIDGEWATER, MA 02325
124-28	SS OLD PLAINVILLE RD	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
124-164	1255 OLD PLAINVILLE RD	GALLIGAN ELEANOR L, 1255 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-118	SS OLD PLAINVILLE RD	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
125-22	SS NEW PLAINVILLE RD	CITY OF NEW BEDFORD, AIRPORT COMMISSION 131 WILLIAM ST NEW BEDFORD, MA 02740
124-163	1249 OLD PLAINVILLE RD	BOTELHO ALFRED M, BOTELHO MARIA A 1249 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-144	1196 OLD PLAINVILLE RD	DUPHILY GLADYS M, 1196 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-172	1248 OLD PLAINVILLE RD	GREENWOOD WILLIAM, GREENWOOD LINDA, 1248 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-173	1240 OLD PLAINVILLE RD	AMARAL EARL, AMARAL CATIA 1240 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-43	1234 OLD PLAINVILLE RD	PACHECO KEVIN, LYNCH NICOLE, 1234 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745
124-174	1222 1226 OLD PLAINVILLE RD	MELLO KENNETH, MACEDO ANA, 1226 OLD PLAINVILLE ROAD NEW BEDFORD, MA 02745

September 8, 2022
Dear Applicant,

Please find below the List of Abutters within 100 feet of the property known as 1569 Airport Road (Map: 122,124, Lot: 3, 28. The current ownership listed herein must be checked and verified by the City of New Bedford Assessor's Office. Following said verification, the list shall be considered a Certified List of Abutters.

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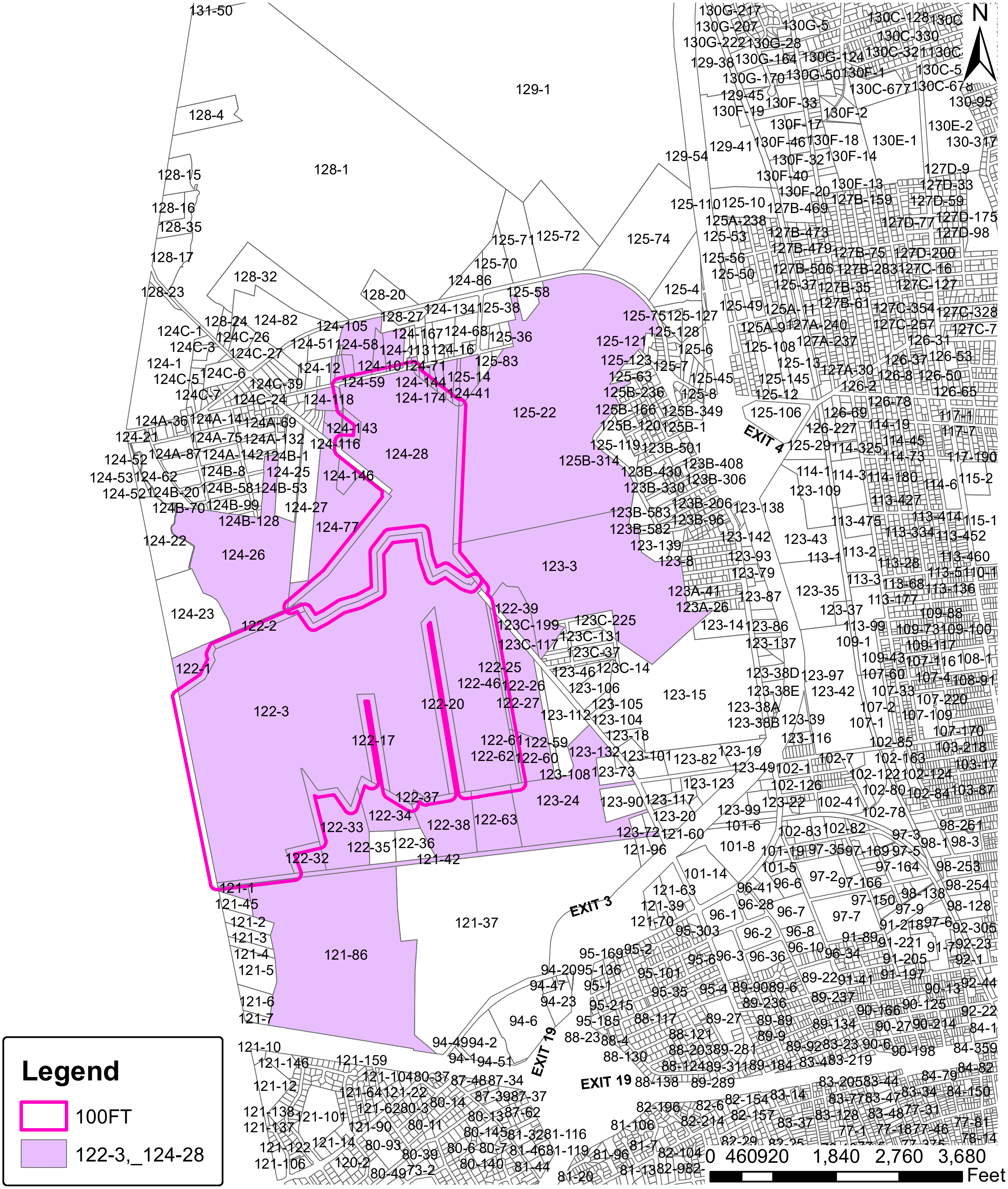
Parcel	Location	Owner and Mailing Address
124-69	NS OLD PLAINVILLE RD	CONGREGATION TIFERETH, ISRAEL 145 BROWNELL AVE NEW BEDFORD, MA 02740
124-42	NS OLD PLAINVILLE RD	CONGREGATION TIFERETH, ISRAEL SYNAGOGUE 145 BROWNELL AVE NEW BEDFORD, MA 02740
124-59	NS OLD PLAINVILLE RD	TIFERETH ISRAEL CONGREGATION OF NEW BEDFORD, 145 BROWNELL AVE NEW BEDFORD, MA 02740
125-14	1172 OLD PLAINVILLE RD	DAVID OCTAVIA J, 1172 OLD PLAINVILLE RD NEW BEDFORD, MA 02745
124-58	SS NEW PLAINVILLE RD	CONGREGATION TIFERETH, ISRAEL 145 BROWNELL AVE NEW BEDFORD, MA 02740
124-10	NS OLD PLAINVILLE RD	TIFERETH ISRAEL CONGREGATION, OF NEW BEDFORD INC 145 BROWNELL AVE NEW BEDFORD, MA 02740
124-113	NS OLD PLAINVILLE RD	TIFERETH ISRAEL CONGREGATION OF NEW BEDFORD, 145 BROWNELL AVE NEW BEDFORD, MA 02740
124-41	1194 OLD PLAINVILLE RD	SHERIDAN CAROL ANN "TRS", CAROL ANN SHERIDAN REVOCABLE TRUST (THE) 1194 OLD PLAINVILLE RD NEW BEDFORD, MA 02745
124-71	1210 OLD PLAINVILLE RD	BULLOCK CARLTON 1210 PLAINVILLE RD NEW BEDFORD, MA 02745

Note: This map was developed using the best available data and serves a guide rather than a determination. Data should be confirmed in the field to ensure accuracy.



City of New Bedford, Massachusetts
Department of City Planning

Parcel within 100FT

September 2022

CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, AIRPORT
COMMISSION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, AIRPORT
COMMISSION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, AIRPORT
COMMISSION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD,
CONSERVATION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD,
CONSERVATION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD,
CONSERVATION
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, ADDITION
TO GOLF COURSE
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, ADDITION
TO GOLF COURSE
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, ADDITION
TO GOLF COURSE
131 WILLIAM ST
NEW BEDFORD, MA 02740

WHALING CITY GOLF CLUB INC, C/O
CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

WHALING CITY GOLF CLUB INC, C/O
CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

WHALING CITY GOLF CLUB INC, C/O
CITY OF NEW BEDFORD
133 WILLIAM STREET
NEW BEDFORD, MA 02740

CYNTHIA H RITTER LLC, PETER J
HAWES LLC, M E HAWES LLC
PO BOX 87121
DARTMOUTH, MA 02748-0702

CYNTHIA H RITTER LLC, PETER J
HAWES LLC, M E HAWES LLC
PO BOX 87121
DARTMOUTH, MA 02748-0702

CYNTHIA H RITTER LLC, PETER J
HAWES LLC, M E HAWES LLC
PO BOX 87121
DARTMOUTH, MA 02748-0702

PENN CENTRAL CO, CONSOLIDATED
RAIL CORP
500 WATER STREET DEPT J910
JACKSONVILLE, FL 32202

PENN CENTRAL CO, CONSOLIDATED
RAIL CORP
500 WATER STREET DEPT J910
JACKSONVILLE, FL 32202

PENN CENTRAL CO, CONSOLIDATED
RAIL CORP
500 WATER STREET DEPT J910
JACKSONVILLE, FL 32202

CITY OF NEW BEDFORD, BOARD OF
HEALTH
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, BOARD OF
HEALTH
131 WILLIAM ST
NEW BEDFORD, MA 02740

CITY OF NEW BEDFORD, BOARD OF
HEALTH
131 WILLIAM ST
NEW BEDFORD, MA 02740

CUNNINGHAM GLENN G
CUNNINGHAM DORIS I
13 QUANAPOAG ROAD
E FREETOWN, MA 02717

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13 QUANAPOAG ROAD
E FREETOWN, MA 02717

A & L ENTERPRISES LLC
P O BOX 50540
NEW BEDFORD, MA 02745

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P O BOX 50540
NEW BEDFORD, MA 02745

A & L ENTERPRISES LLC
P O BOX 50540
NEW BEDFORD, MA 02745

CITY OF NEW BEDFORD, PROVENCAL
ADELARD
131 WILLIAM ST
NEW BEDFORD, MA 02740

DUPHILY RAYMOND G "TRS", A & R
REALTY TRUST
34 FLAGSWAMP ROAD
NO. DARTMOUTH, MA 02747

SANDPIPER AIR, INC.
1529 AIRPORT ROAD
NEW BEDFORD, MA 02746

BRIDGE WATER STATE COLLEGE,
(DCAM)
131 SUMMER STREET
BRIDGEWATER, MA 02325

GALLIGAN ELEANOR L,
1255 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

BOTELHO ALFRED M
BOTELHO MARIA A
1249 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

DUPHILY GLADYS M
1196 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

GREENWOOD WILLIAM
GREENWOOD LINDA
1248 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

AMARAL EARL, AMARAL CATIA
1240 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

PACHECO KEVIN, LYNCH NICOLE
1234 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

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ADELARD
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AMARAL EARL, AMARAL CATIA
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GREENWOOD LINDA
1248 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

AMARAL EARL, AMARAL CATIA
1240 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

PACHECO KEVIN, LYNCH NICOLE
1234 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

MELLO KENNETH, MACEDO ANA
1226 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

MELLO KENNETH, MACEDO ANA
1226 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

MELLO KENNETH, MACEDO ANA
1226 OLD PLAINVILLE ROAD
NEW BEDFORD, MA 02745

CONGREGATION TIFERETH, ISRAEL
145 BROWNELL AVE
NEW BEDFORD, MA 02740

CONGREGATION TIFERETH, ISRAEL
145 BROWNELL AVE
NEW BEDFORD, MA 02740

CONGREGATION TIFERETH, ISRAEL
145 BROWNELL AVE
NEW BEDFORD, MA 02740

CONGREGATION TIFERETH, ISRAEL
SYNAGOGUE
145 BROWNELL AVE
NEW BEDFORD, MA 02740

CONGREGATION TIFERETH, ISRAEL
SYNAGOGUE
145 BROWNELL AVE
NEW BEDFORD, MA 02740

CONGREGATION TIFERETH, ISRAEL
SYNAGOGUE
145 BROWNELL AVE
NEW BEDFORD, MA 02740

TIFERETH ISRAEL CONGREGATION OF
NEW BEDFORD
145 BROWNELL AVE
NEW BEDFORD, MA 02740

TIFERETH ISRAEL CONGREGATION OF
NEW BEDFORD
145 BROWNELL AVE
NEW BEDFORD, MA 02740

TIFERETH ISRAEL CONGREGATION OF
NEW BEDFORD
145 BROWNELL AVE
NEW BEDFORD, MA 02740

DAVID OCTAVIA J
1172 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

DAVID OCTAVIA J
1172 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

DAVID OCTAVIA J
1172 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

SHERIDAN CAROL ANN “TRS”, CAROL
ANN SHERIDAN REVOCABLE TRUST (THE)
1194 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

SHERIDAN CAROL ANN “TRS”, CAROL
ANN SHERIDAN REVOCABLE TRUST (THE)
1194 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

SHERIDAN CAROL ANN “TRS”, CAROL
ANN SHERIDAN REVOCABLE TRUST (THE)
1194 OLD PLAINVILLE RD
NEW BEDFORD, MA 02745

BULLOCK CARLTON
1210 PLAINVILLE RD
NEW BEDFORD, MA 02745

BULLOCK CARLTON
1210 PLAINVILLE RD
NEW BEDFORD, MA 02745

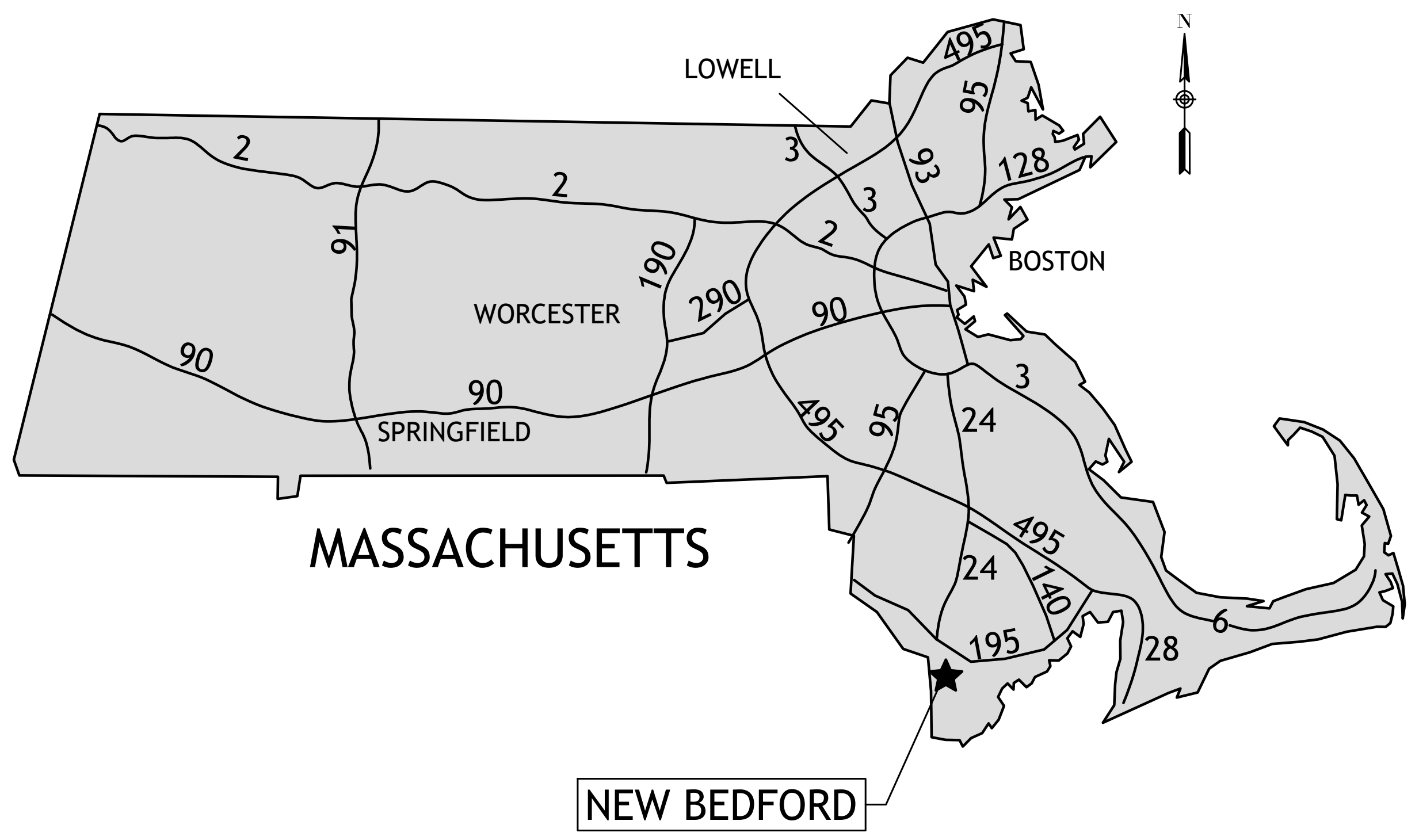
BULLOCK CARLTON
1210 PLAINVILLE RD
NEW BEDFORD, MA 02745`

Attachment F

Permit Drawings, prepared by Airport Solutions Group, LLC

NOI PLANS FOR

newbedford
regional airport

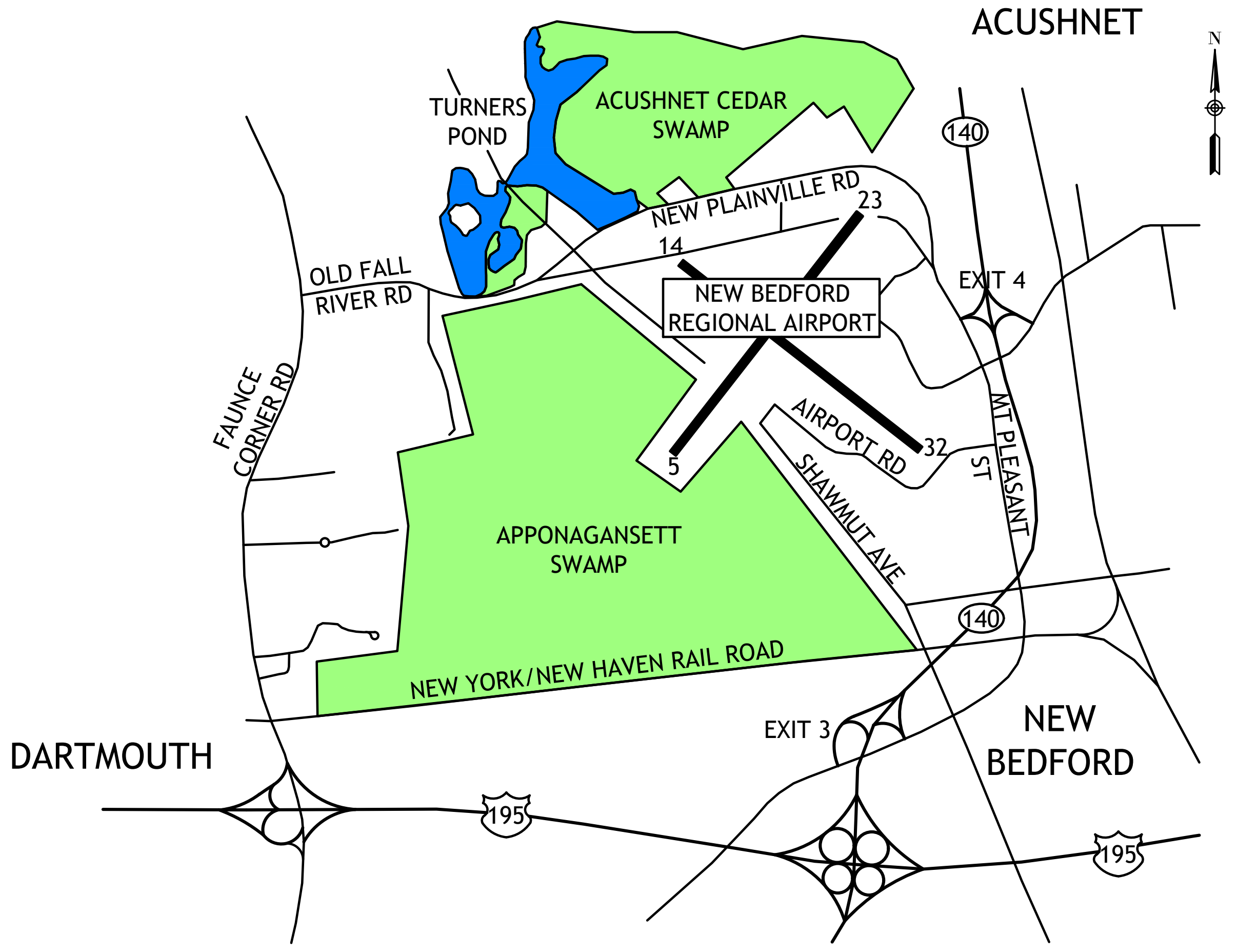


LOCATION MAP

0 30 60
SCALE IN MILES

CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT

1569 AIRPORT ROAD, NEW BEDFORD, MA 02746



LOCUS MAP

0 0.5 1
SCALE IN MILES

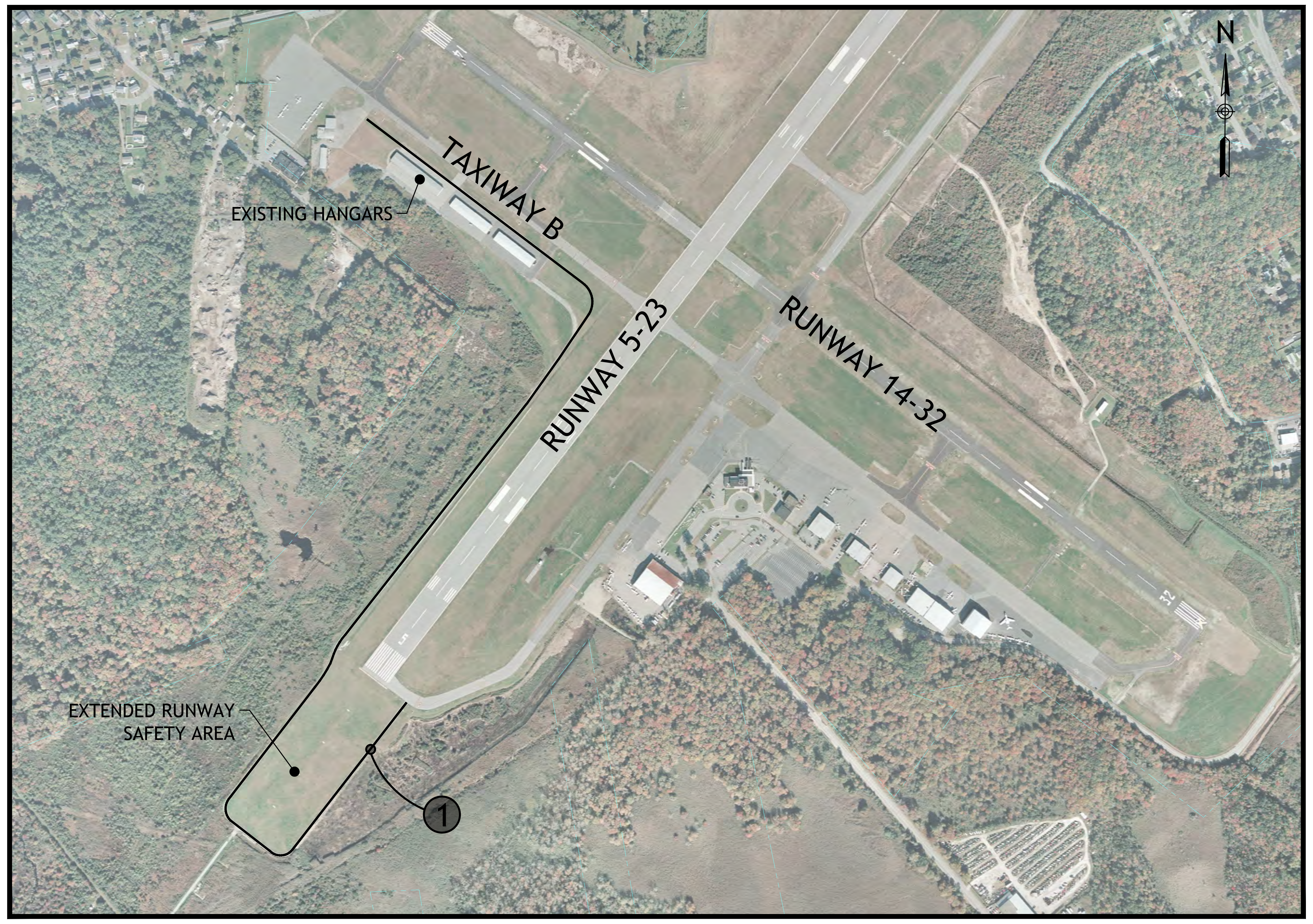
PERMIT RW5 PERIMETER ROAD

DECEMBER 2022

AIP NO. 3-25-0052-0XX-2022

GENERAL NOTES

1. THE INFORMATION INCLUDED IN THIS NOI PLAN SET IS CONSIDERED PRELIMINARY AND IS INTENDED FOR PERMITTING PURPOSES ONLY; IT IS NOT INTENDED FOR FINAL LAYOUT OR CONSTRUCTION. THE CONSTRUCTION BID SET WILL INCLUDE THE ORDER OF CONDITIONS ISSUED BY THE NEW BEDFORD CONSERVATION COMMISSION (NBCC). THE ORDER OF CONDITIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTING INFORMATION INCLUDED IN THIS NOI PLAN SET OR CONSTRUCTION BID SET.
2. EROSION CONTROL MATTING SHALL BE USED FOR SLOPE STABILIZATION ON ALL PROPOSED GRADING EXCEEDING A SLOPE OF 4:1 (H:V).



0' 500' 1000'

PROPOSED CONSTRUCTION

① - PAVE RW5 PERIMETER ROAD

PREPARED BY

ASG
AIRPORT SOLUTIONS GROUP, LLC
Innovation By Design

AIRPORT CONSULTANTS ● BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

NOI PERMIT DRAWINGS
NOT FOR CONSTRUCTION

CRAIG A. SCHUSTER
CIVIL
No. 37858

DRAWING NO.
NOI.1
1 OF 11

NOI SUBMISSION

11/22/2022 7:39:18 AM P:\ASG Data\Projects\ma - new bedford\054 permit rw5 access road\CADD\noi plans\010 103-054 NOI COVER SHEET.dwg (SG)

INDEX TO DRAWINGS

SHEET NO.	DWG NO.	SHEET TITLE
1	NOI.1	COVER SHEET
2	NOI.2	INDEX TO DRAWINGS
3	NOI.3	EXISTING CONDITIONS, CATCHMENT AREAS AND ANALYSIS POINTS
4	NOI.4	GRADING AND PROFILE PLAN (1 OF 6)
5	NOI.5	GRADING AND PROFILE PLAN (2 OF 6)
6	NOI.6	GRADING AND PROFILE PLAN (3 OF 6)
7	NOI.7	GRADING AND PROFILE PLAN (4 OF 6)
8	NOI.8	GRADING AND PROFILE PLAN (5 OF 6)
9	NOI.9	GRADING AND PROFILE PLAN (6 OF 6)
10	NOI.10	TYPICAL SECTIONS AND DRAINAGE DETAILS
11	NOI.11	DRAINAGE AND EROSION CONTROL DETAILS

CRAIG A. SCHUSTER
CIVIL
No. 37898
REGISTERED PROFESSIONAL ENGINEER

ASG
AIRPORT SOLUTIONS GROUP, LLC
Innovation By Design
AIRPORT CONSULTANT • BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

THIS DRAWING AND THE DESIGN AND CONSTRUCTION FEATURES DISCLOSED ARE PROPRIETARY TO AIRPORT SOLUTIONS GROUP, LLC AND SHALL NOT BE ALTERED OR REUSED IN WHOLE OR PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF AIRPORT SOLUTIONS GROUP, LLC

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	020 103-054 NOI GENERAL PLANS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
INDEX TO DRAWINGS

GRAPHIC SCALE
NTS

DRAWING NO.
NOI.2
2 OF 11

New Bedford Regional Airport							
Permit RW5 Perimeter Road / NOI Submission							
Pre-Development Flow Rate (cfs)				Post-Development Flow Rate (cfs)			
Analysis Point	2-Year Storm	10-Year Storm	100-Year Storm	Analysis Point	2-Year Storm	10-Year Storm	100-Year Storm
1	1.60	3.49	8.36	1	2.17	4.45	10.28
2	1.04	4.09	16.01	2	1.37	5.35	19.26
3	0.04	0.48	3.98	3	0	0	3.45
4	0.04	0.48	3.79	4	0	0	3.78
5	0.82	1.98	4.76	5	0.80	1.91	4.55

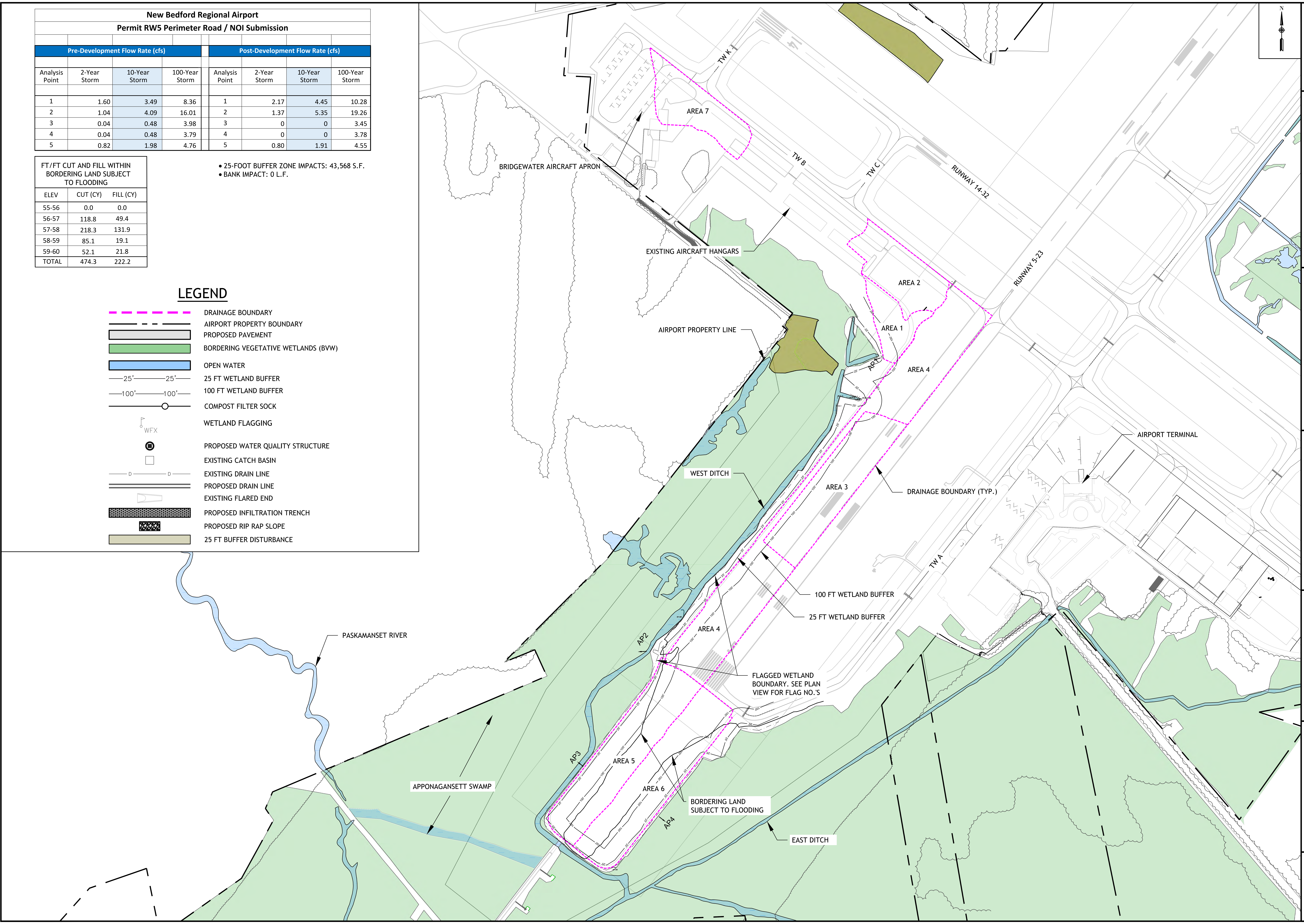
FT/FT CUT AND FILL WITHIN BORDERING LAND SUBJECT TO FLOODING

ELEV	CUT (CY)	FILL (CY)
55-56	0.0	0.0
56-57	118.8	49.4
57-58	218.3	131.9
58-59	85.1	19.1
59-60	52.1	21.8
TOTAL	474.3	222.2

- 25-FOOT BUFFER ZONE IMPACTS: 43,568 S.F.
- BANK IMPACT: 0 L.F.

LEGEND

- - -	DRAINAGE BOUNDARY
— - —	AIRPORT PROPERTY BOUNDARY
▭	PROPOSED PAVEMENT
🟩	BORDERING VEGETATIVE WETLANDS (BVW)
🟦	OPEN WATER
—25'—25'—	25 FT WETLAND BUFFER
—100'—100'—	100 FT WETLAND BUFFER
—○—	COMPOST FILTER SOCK
WFX	WETLAND FLAGGING
◉	PROPOSED WATER QUALITY STRUCTURE
□	EXISTING CATCH BASIN
—D—D—	EXISTING DRAIN LINE
═	PROPOSED DRAIN LINE
⏢	EXISTING FLARED END
▨	PROPOSED INFILTRATION TRENCH
▩	PROPOSED RIP RAP SLOPE
▭	25 FT BUFFER DISTURBANCE



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Innovation By Design
AIRPORT CONSULTANT • BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

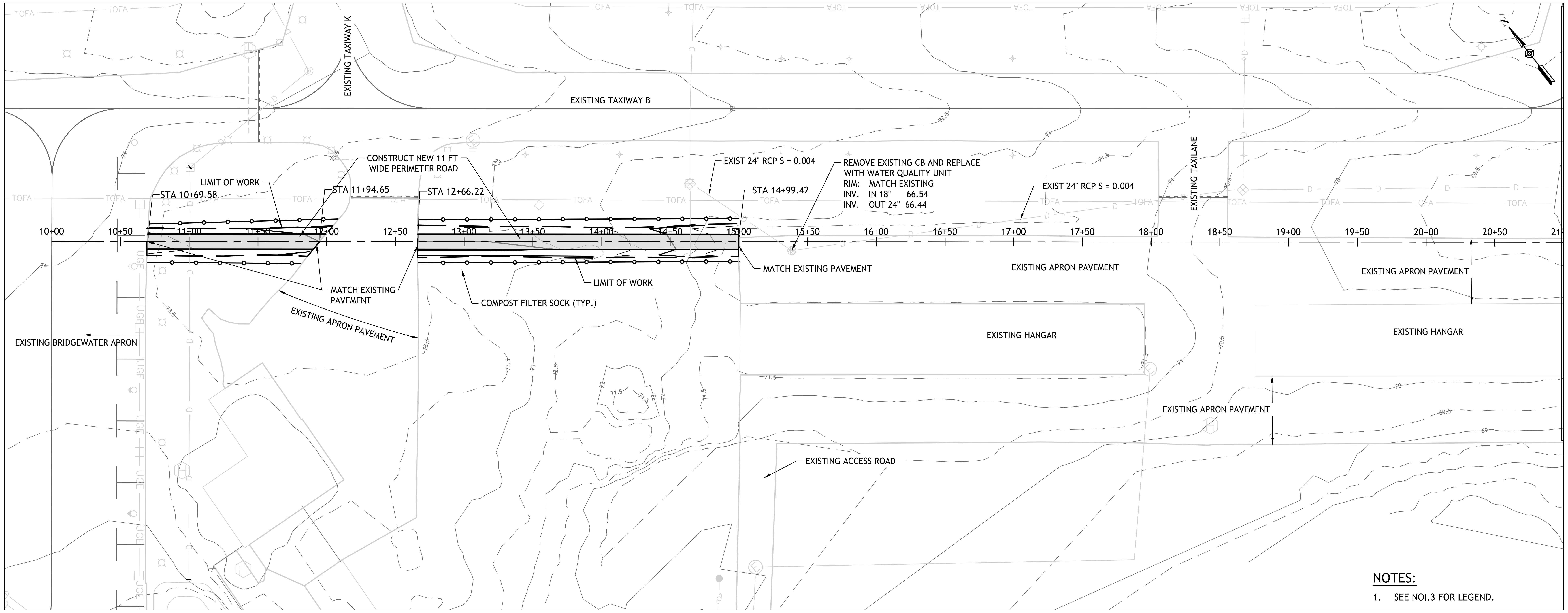
PROJECT NO.	103-054
CADD FILE	020 103-054 NOI GENERAL PLANS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 200'

SHEET TITLE
EXISTING CONDITIONS, CATCHMENT AREAS AND ANALYSIS POINTS

GRAPHIC SCALE
0 100' 200' 400'

DRAWING NO.
NOI.3
3 OF 11

11/22/2022 7:44:58 AM P:\ASG Data\Projects\ma – new bedford\054 permit rw5 access road\CADD\noi plans\020 103–054 NOI GENERAL PLANS.dwg (SG)

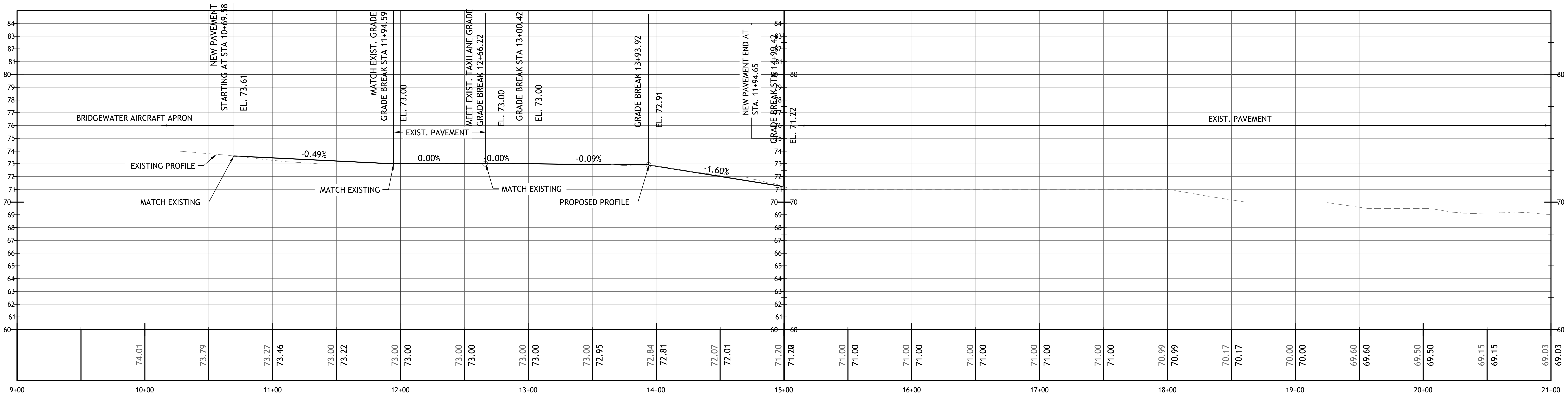


NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (1 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.4

4 OF 11

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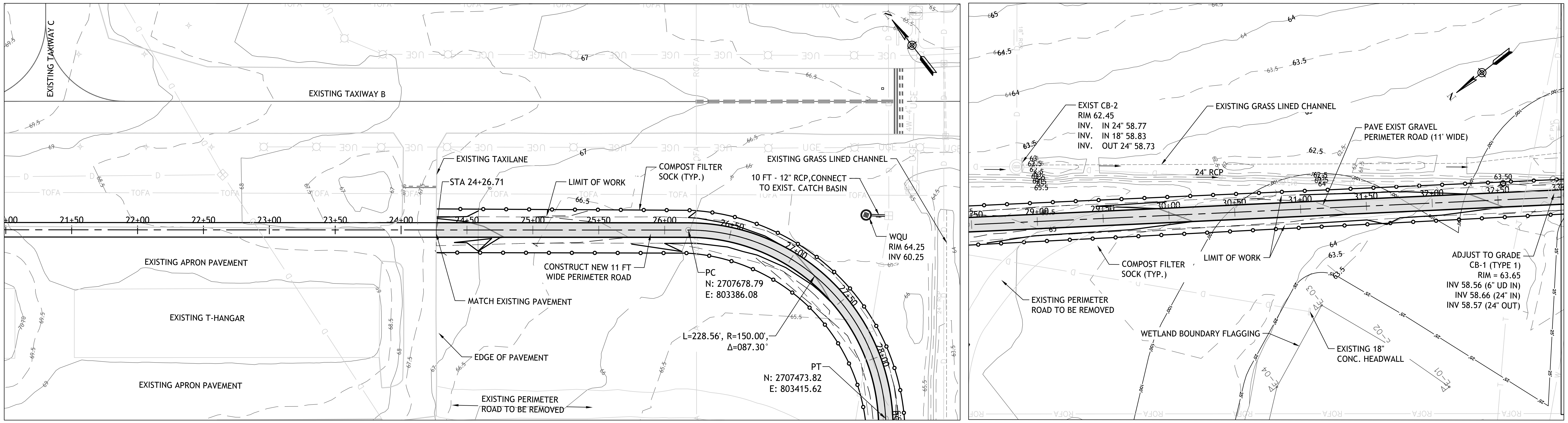
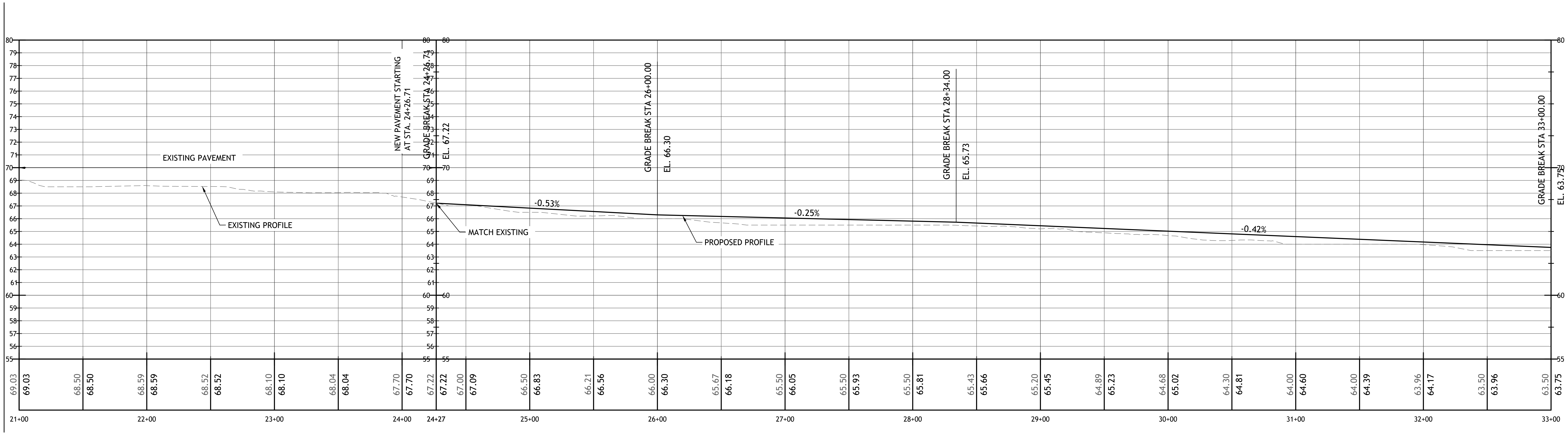


GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'

NOTES:

1. SEE NOI.3 FOR LEGEND.



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

COMMONWEALTH OF MASSACHUSETTS
CRAIG A. SCHUSTER
CIVIL
No. 37898
REGISTERED
PROFESSIONAL ENGINEER

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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

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CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE

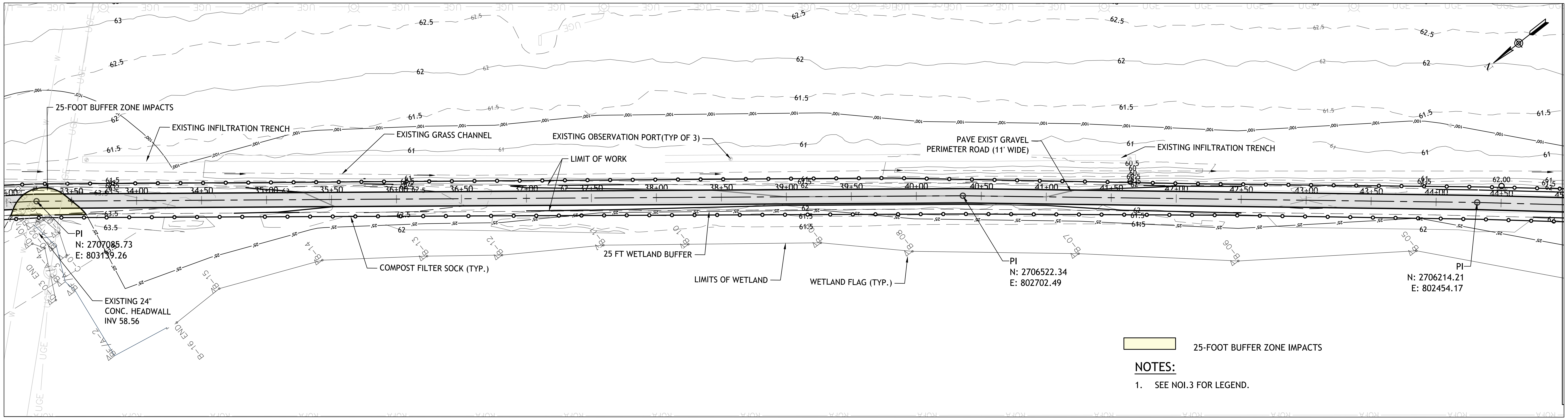
GRADING & PROFILE
PLANS (2 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.

NOI.5

5 OF 11



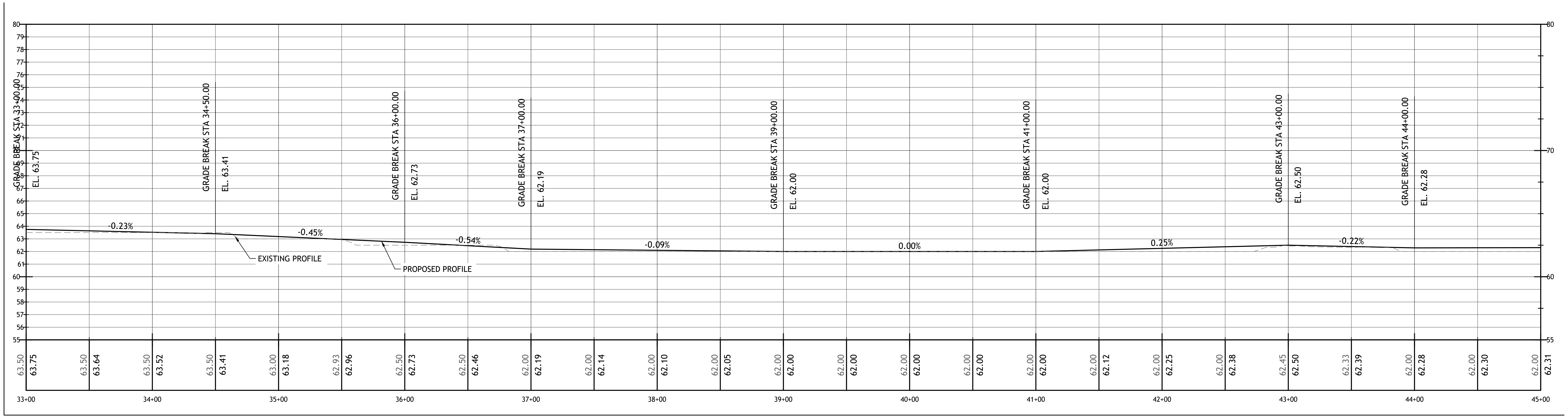
▭ 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
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OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (3 of 6)

GRAPHIC SCALE
0 20 40 80'

DRAWING NO.
NOI.6

6 OF 11

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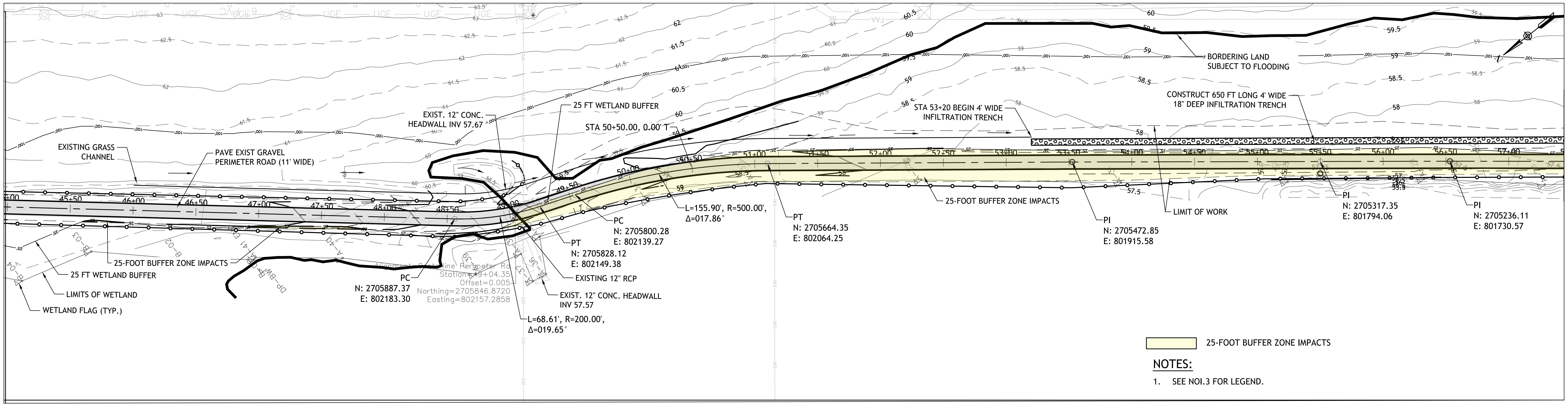


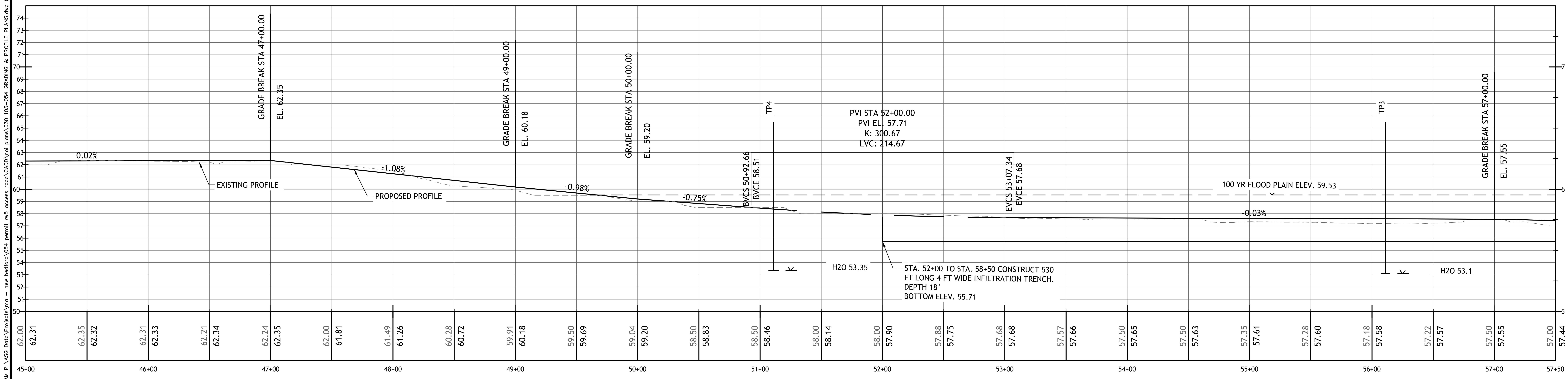
▨ 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

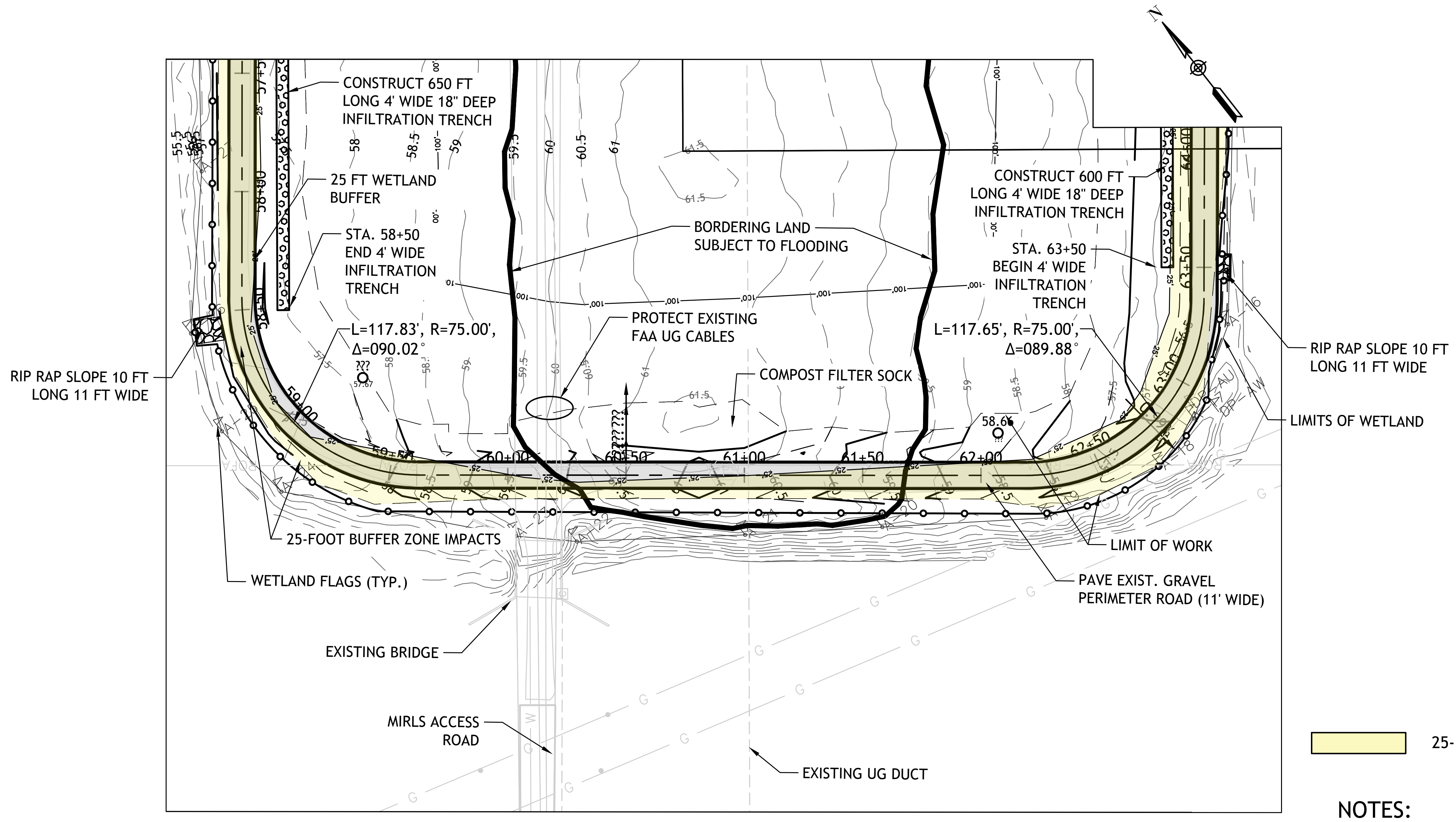
PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (4 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.7

7 OF 11



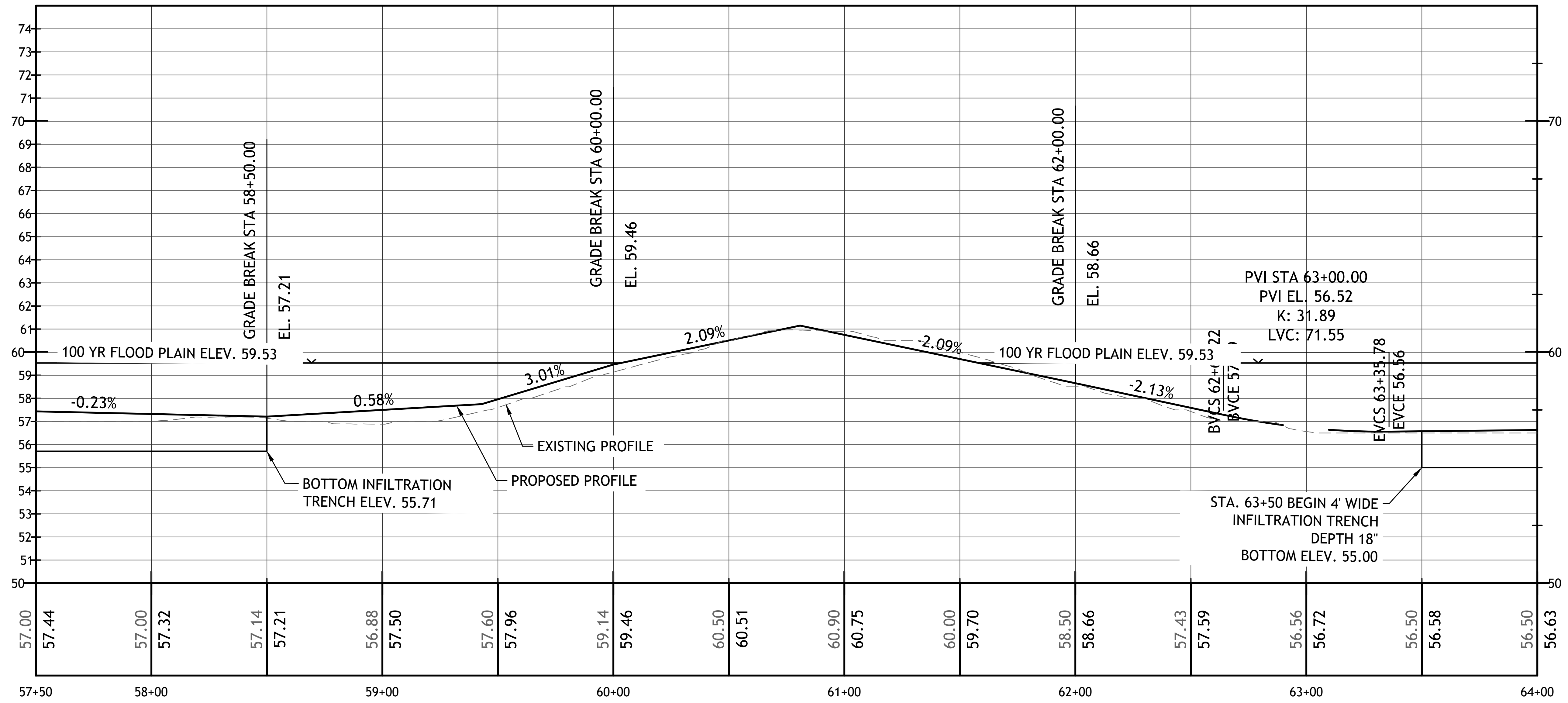
🟨 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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CRAIG A. SCHUSTER
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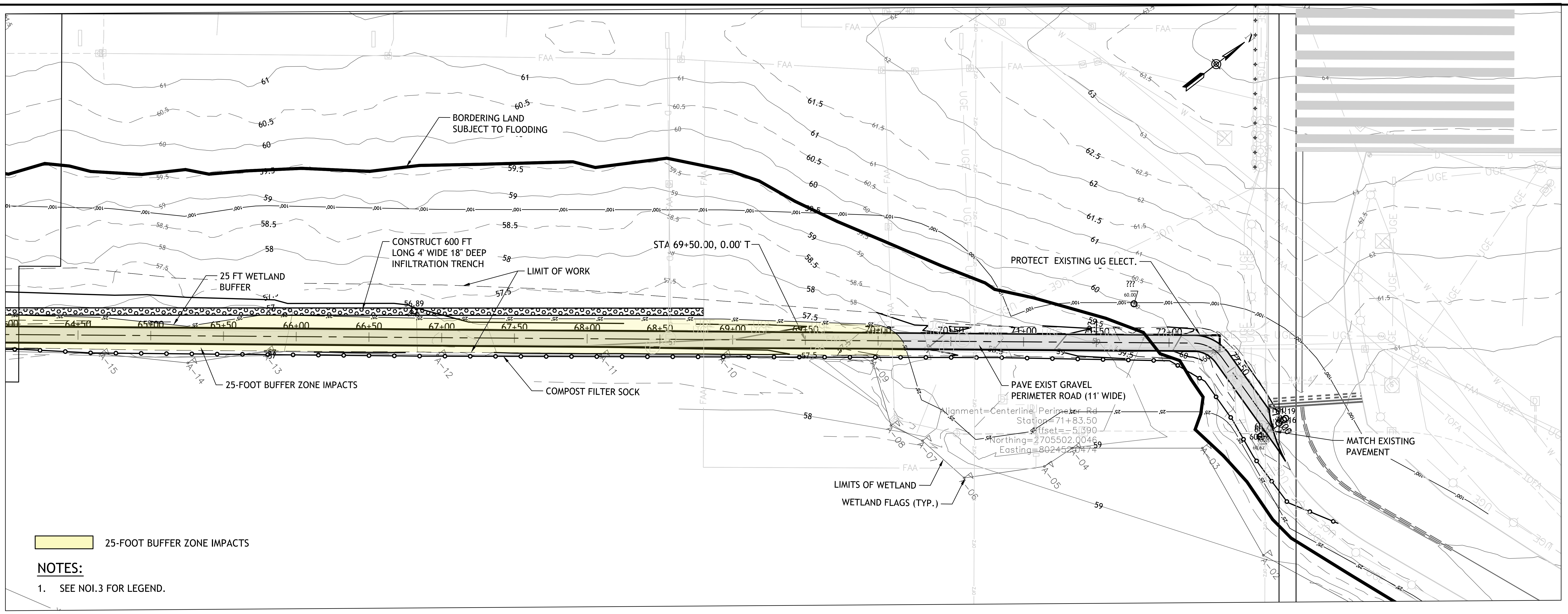
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (5 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.8

8 OF 11



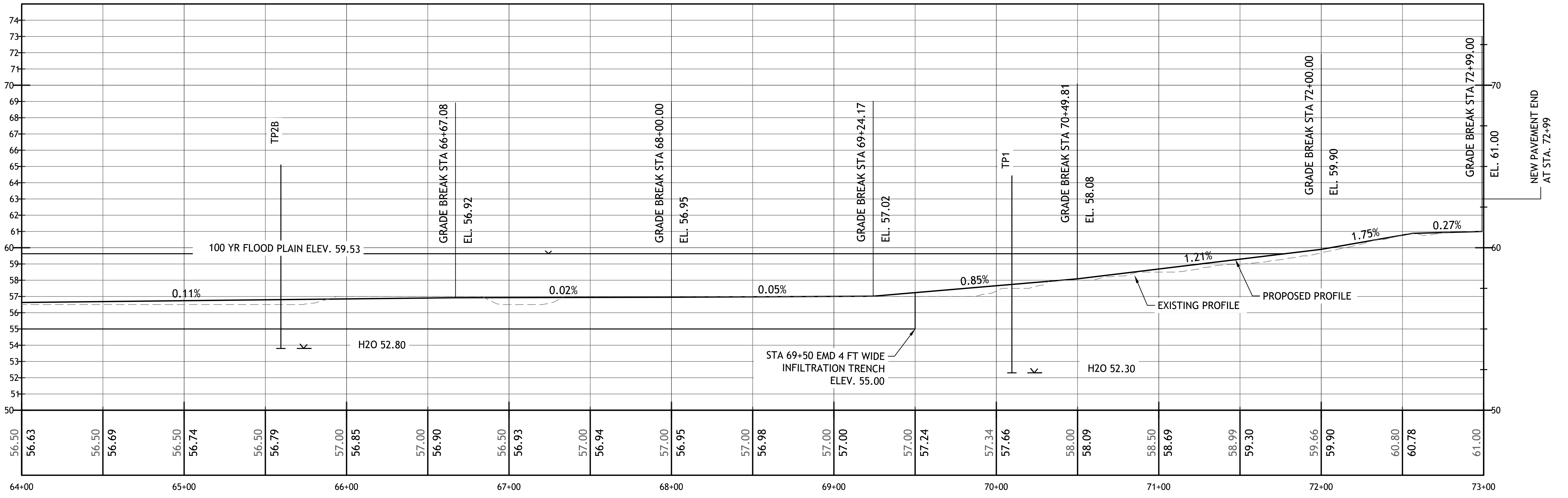
25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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NEW BEDFORD REGIONAL AIRPORT
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DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (6 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.9

9 OF 11

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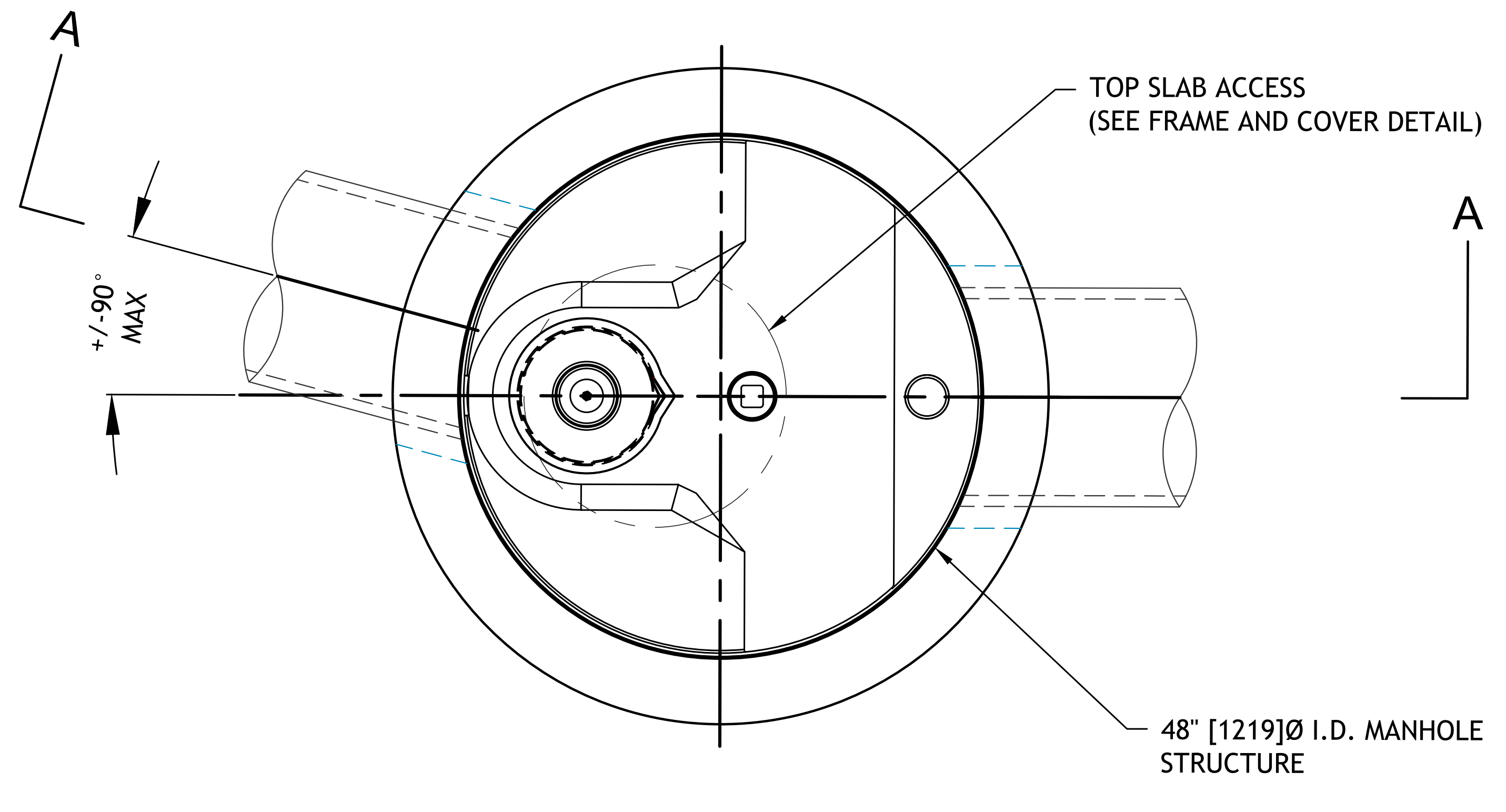
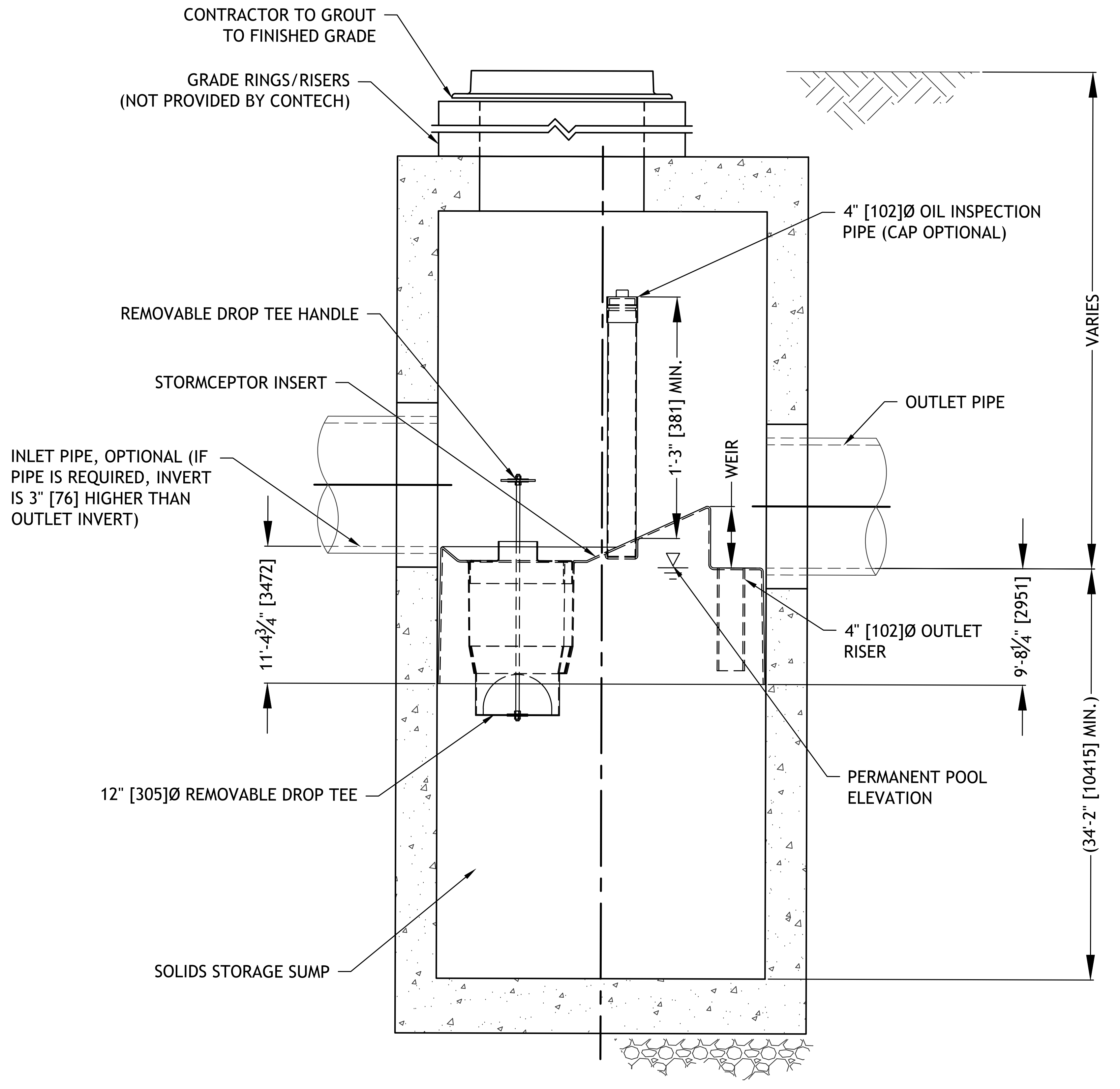


PLAN VIEW

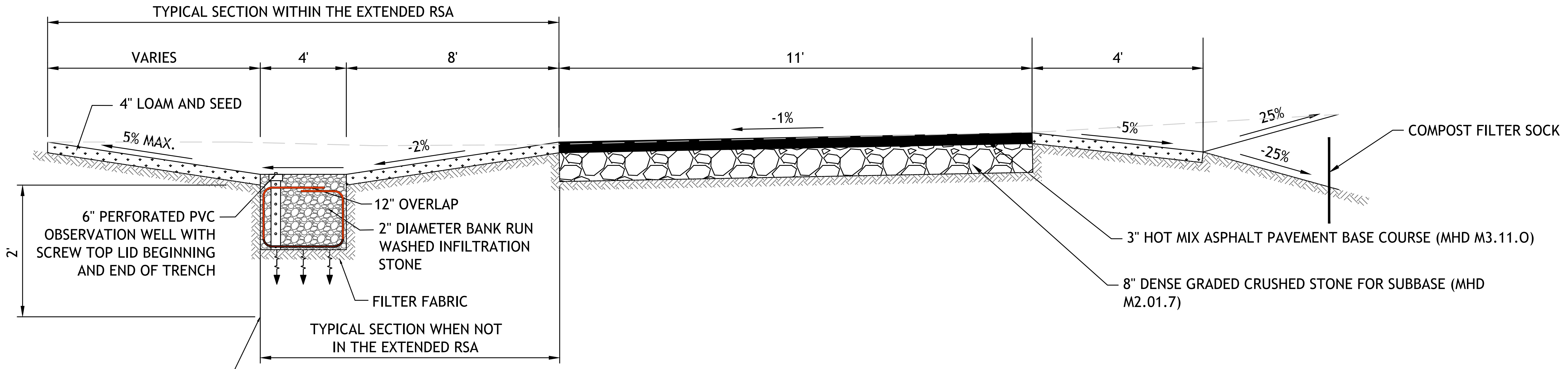
TOP SLAB NOT SHOWN



SECTION A-A

WATER QUALITY UNIT DETAIL (WQU)

SCALE: N.T.S.



INFILTRATION TRENCH DETAIL

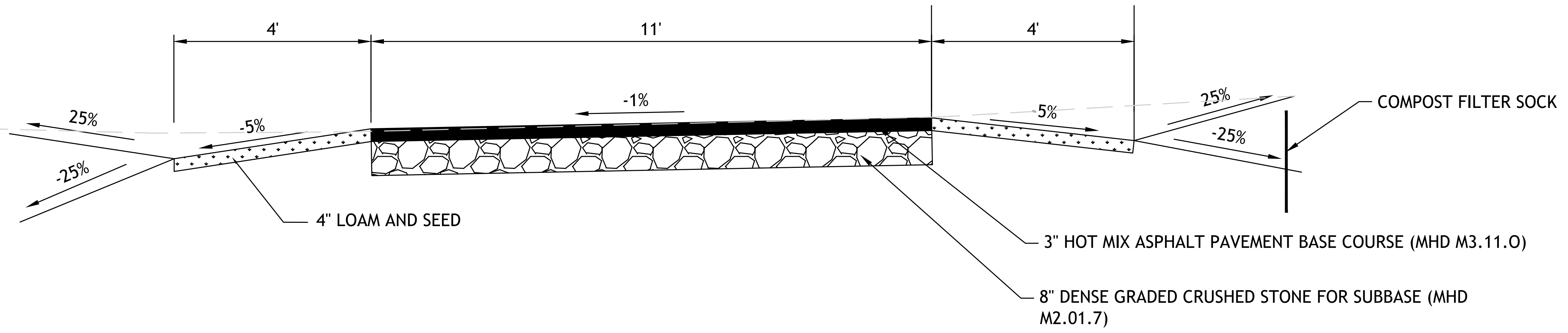
STA. 53+20 TO 58+50 BOTTOM ELEV. 55.71. DEPTH 18"

STA. 63+50 TO 68+80 BOTTOM ELEV. 55.00. DEPTH 18"

SCALE: NTS

TYPICAL SECTION WITHIN THE EXTENDED RSA

SCALE: NTS



TYPICAL SECTION OUTSIDE OF EXTENDED RSA

SCALE: NTS

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	040 103-054 NOI DETAILS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
TYPICAL SECTIONS AND DRAINAGE DETAILS
GRAPHIC SCALE
NTS

DRAWING NO.
NOI.10

NEW ENGLAND WETLAND PLANTS, INC

820 WEST STREET, AMHERST, MA 01002
PHONE: 413-548-8000   FAX 413-549-4000
EMAIL: INFO@NEWP.COM   WEB ADDRESS: WWW.NEWP.COM

New England Conservation/Wildlife Mix

Botanical Name	Common Name	Indicator
Elymus virginicus	Virginia Wild Rye	FACW-
Schizachyrium scoparium	Little Bluestem	FACU
Andropogon gerardii	Big Bluestem	FAC
Festuca rubra	Red Fescue	FACU
Sorghastrum nutans	Indian Grass	UPL
Panicum virgatum	Switch Grass	FAC
Chamaecrista fasciculata	Partridge Pea	FACU
Desmodium canadense	Showy Tick Trefoil	FAC
Asclepias tuberosa	Butterfly Milkweed	NI
Bidens frondosa	Beggar Ticks	FACW
Eupatorium purpureum (Eutrochium maculatum)	Purple Joe Pye Weed	FAC
Rudbeckia hirta	Black Eyed Susan	FACU-
Aster pilosus (Symphyotrichum pilosum)	Heath (or Hairy) Aster	UPL
Solidago juncea	Early Goldenrod	

PRICE PER LB. $39.50 MIN. QUANITY 2 LBS. **TOTAL:** $79.00 APPLY: 25 LBS/ACRE :1750 sq ft/lb

The New England Conservation/Wildlife Mix provides a permanent cover of grasses, wildflowers, and legumes For both good erosion control and wildlife habitat value. The mix is designed to be a no maintenance seeding, and is appropriate for cut and fill slopes, detention basin side slopes, and disturbed areas adjacent to commercial and residential projects.

New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, Plus SH and applicable taxes.

NEW ENGLAND WETLAND PLANTS, INC

820 WEST STREET, AMHERST, MA 01002
PHONE: 413-548-8000   FAX 413-549-4000
EMAIL: INFO@NEWP.COM   WEB ADDRESS: WWW.NEWP.COM

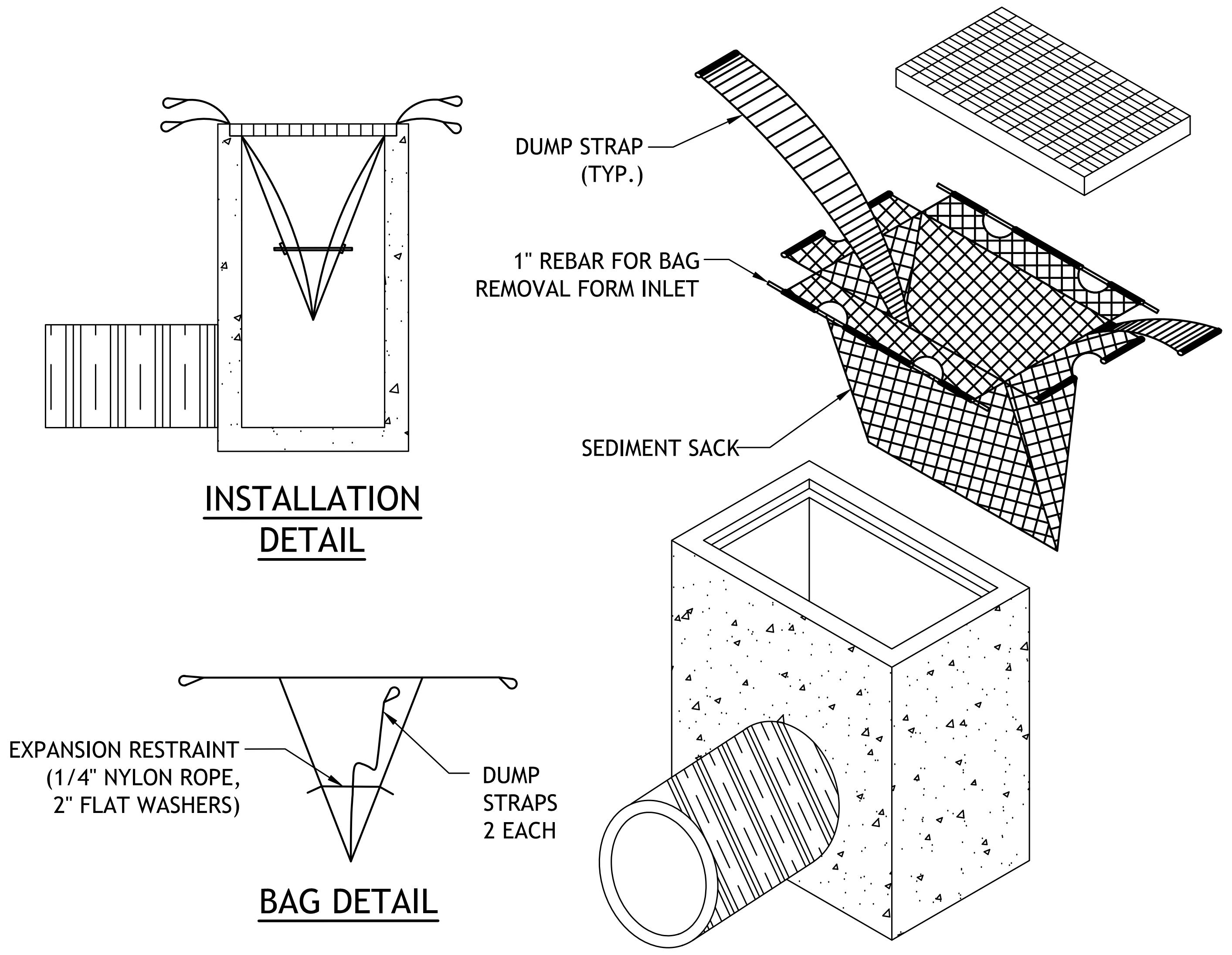
New England Erosion Control/Restoration Mix For Detention Basins and Moist Sites

Botanical Name	Common Name	Indicator
Elymus riparius	Riverbank Wild Rye	FACW
Schizachyrium scoparium	Little Bluestem	FACU
Festuca rubra	Red Fescue	FACU
Andropogon gerardii	Big Bluestem	FAC
Panicum virgatum	Switch Grass	FAC
Vernonia noveboracensis	New York Ironweed	FACW+
Agrostis perennans	Upland Bentgrass	FACU
Bidens frondosa	Beggar Ticks	FACW
Eupatorium maculatum (Eutrochium maculatum)	Spotted Joe Pye Weed	OBL
Eupatorium perfoliatum	Boneset	FACW
Aster novae-angliae (Symphyotrichum novae-anglia	New England Aster	FACW-
Scirpus cyperinus	Wool Grass	FACW
Juncus effusus	Soft Rush	FACW+

PRICE PER LB. $37.00 MIN. QUANITY 3 LBS. **TOTAL:** $111.00 APPLY: 35 LBS/ACRE :1250 sq ft/lb

The New England Erosion Control/Restoration Mix for Detention Basins and Moist Sites contains a selection of native grasses and wildflowers designed to colonize generally moist, recently disturbed sites where quick growth of vegetation is desired to stabilize the soil surface. It is an appropriate seed mix for ecologically sensitive restorations that require stabilization as well as long-term establishment of native vegetation. This mix is particularly appropriate for detention basins that do not hold standing water. Many of the plants in this mix can tolerate infrequent inundation, but not constant flooding. The mix may be applied by hand, by mechanical spreader, or by hydro-seeder. After sowing, lightly rake, roll or cultipack to insure good seed-to-soil contact. Best results are obtained with a Spring or late Summer seeding. Late Fall and Winter dormant seeding requires an increase in the application rate. A light mulching of clean, weed-free straw is recommended

New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, Plus SH and applicable taxes.



INSTALLATION DETAIL

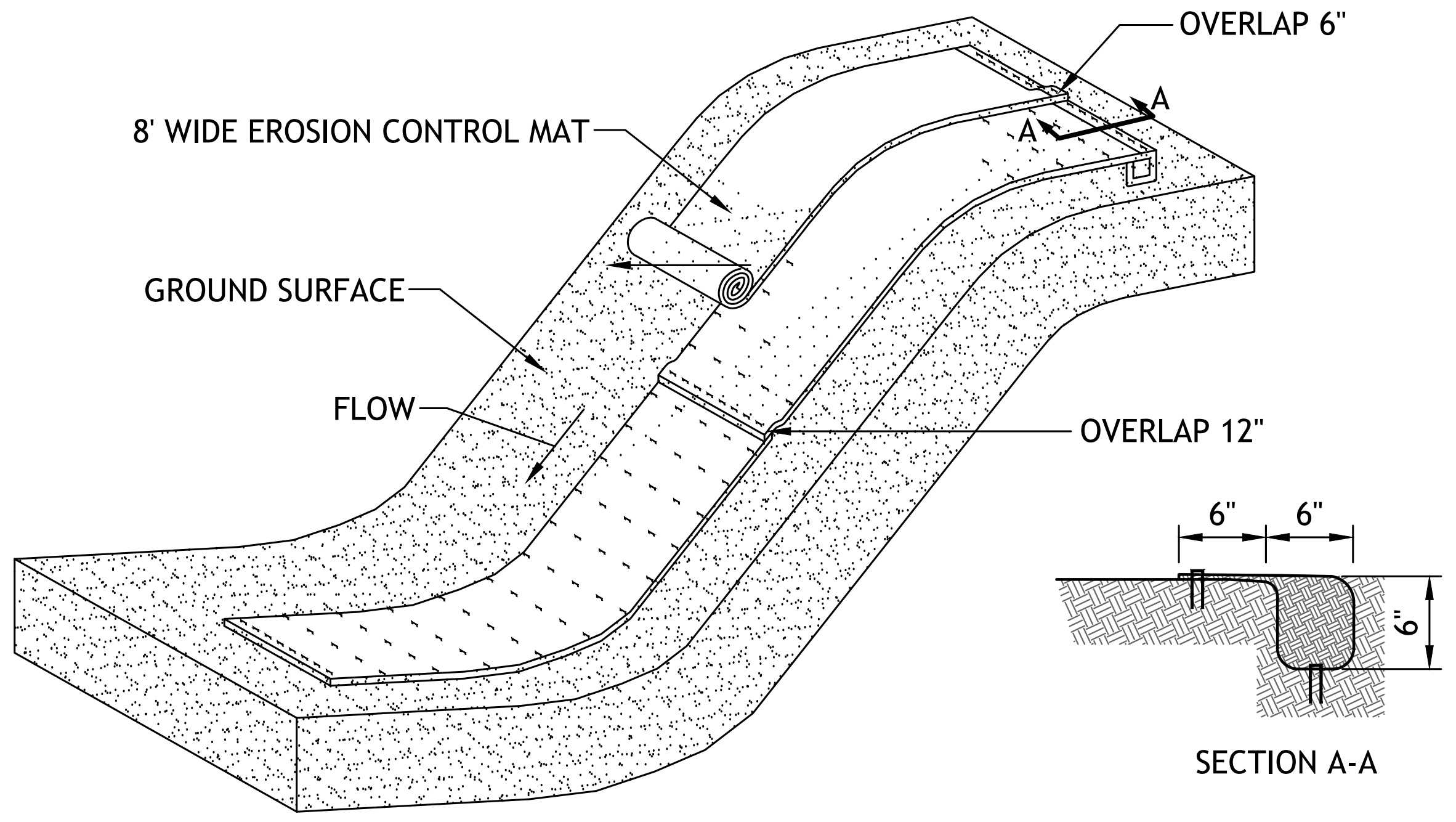
BAG DETAIL

CATCH BASIN INLET NOTES:

1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SEDIMENT SACK.
2. SEDIMENT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN THE CONSTRUCTION ZONE, INCLUDING NEW STRUCTURES, OR AS DIRECTED BY THE ENGINEER.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION SACKS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SEDIMENT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE THERE IS PLOW ACTIVITY. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

CATCH BASIN INLET PROTECTION

SCALE: N.T.S.

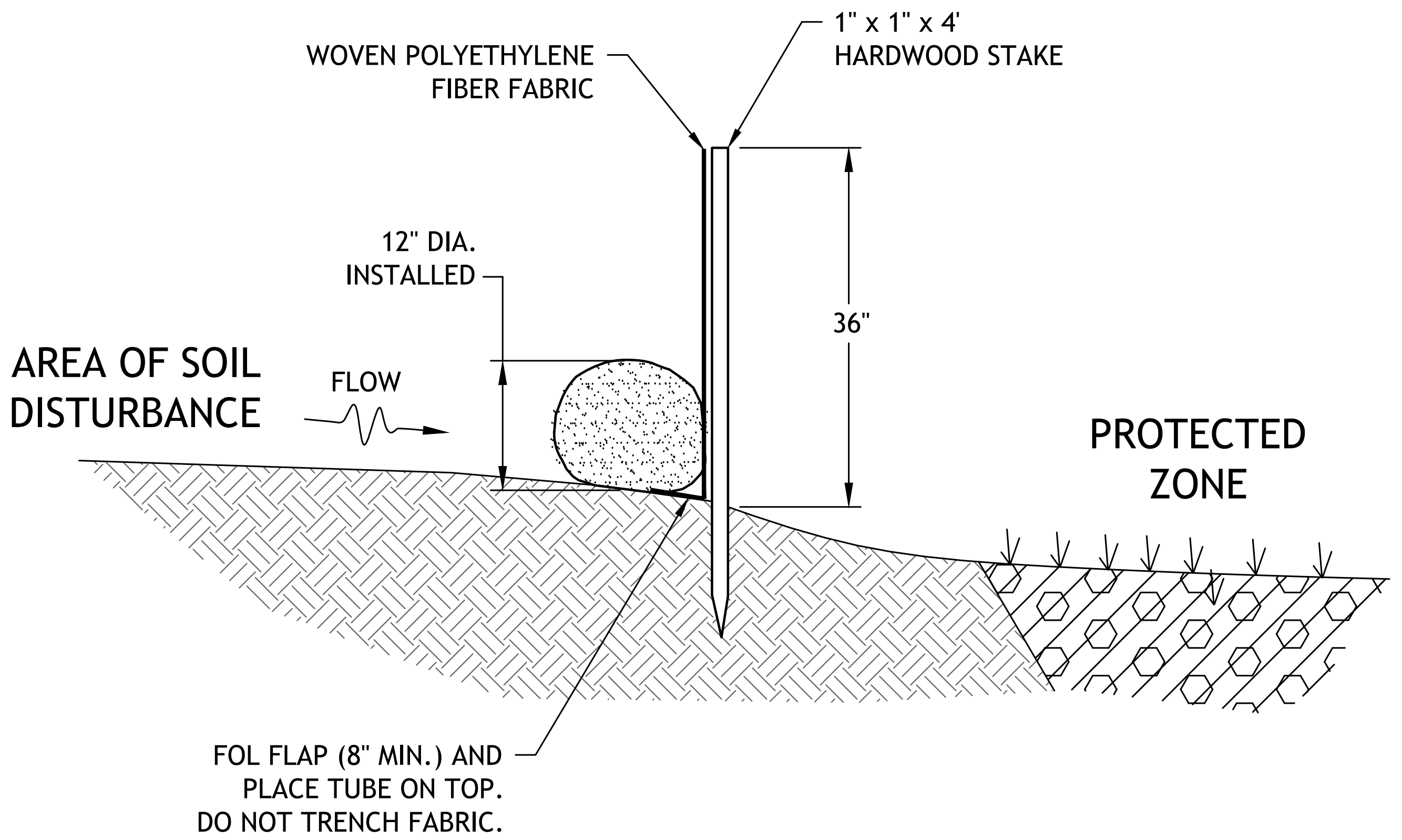


EROSION CONTROL MATTING NOTES:

1. PRIOR TO PLACING EROSION CONTROL MATTING, PREPARE THE SOIL BY RAKING AREA FREE OF CLODS AND LARGE STONES.
2. SEED, MULCH AND FERTILIZER SHALL BE DISTRIBUTED AS SPECIFIED OVER THE PREPARED SOIL PRIOR TO PLACING THE EROSION CONTROL MATTING.
3. ALL SEAMS SHALL BE OVERLAPPED A MINIMUM OF 6" AND SECURED WITH STAPLES 18" ON CENTER.
4. TO SECURE MAT TO GROUND, STAPLE RANDOMLY AT 24" INTERVALS THROUGHOUT
5. APPROXIMATELY 200 STAPLES PER ROLL
6. PLACE EROSION CONTROL MATTING AS DIRECTED BY THE ENGINEER AND ON SLOPES GREATER THAN 5:1.

EROSION CONTROL MATTING

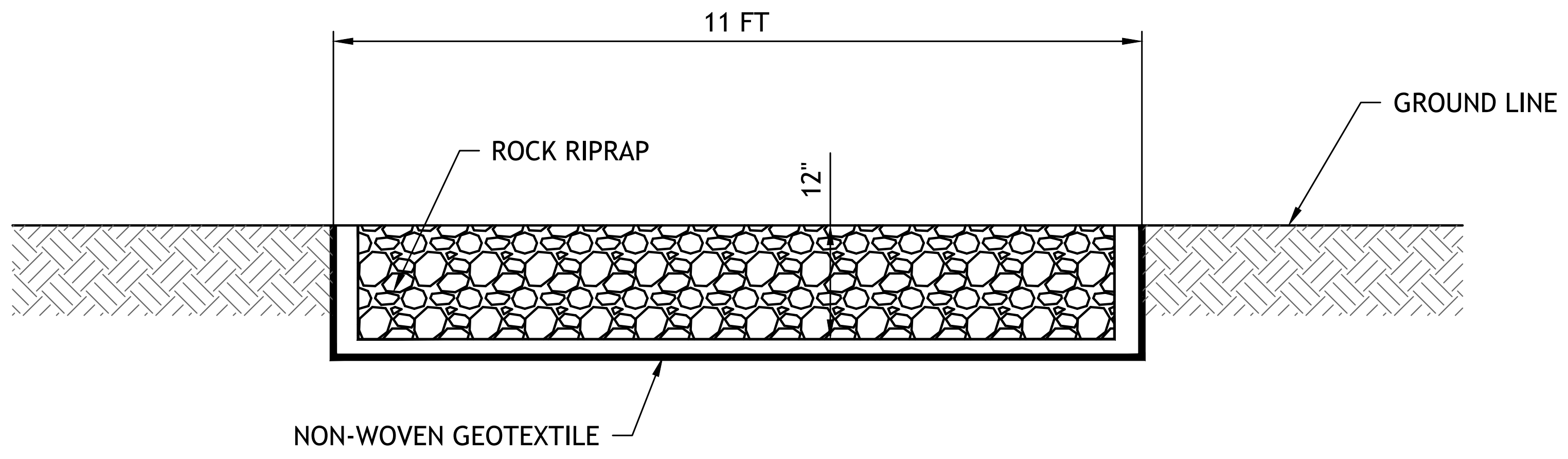
SCALE: N.T.S.



SECTION VIEW

COMPOST FILTER TUBE AND SILT FENCE

SCALE: N.T.S.



RIPRAP DETAILS

SCALE: N.T.S.

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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	040 103-054 NOI DETAILS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
DRAINAGE AND EROSION CONTROL DETAILS

GRAPHIC SCALE
NTS

DRAWING NO.
NOI.11
11 OF 11

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Attachment G

Stormwater Report, prepared by Airport Solutions Group, LLC

EWB

New Bedford Regional Airport

PERMIT RUNWAY 5 PERIMETER ROAD STORMWATER MANAGEMENT REPORT

Prepared By:

Airport Solutions Group

39 Winn Street,

Burlington, MA 01803

December 2022

TABLE OF CONTENTS

APPENDICES

STORMWATER MANAGEMENT REPORT

1. INTRODUCTION

The New Bedford Regional Airport ("Airport") is a commercial airline service airport that is strategically located along the coastline of Southeastern Massachusetts and is a significant transportation gateway for the region and islands of Nantucket and Martha's Vineyard. Since 2006, over $50M of airport capital infrastructure funding has been invested into the Airport to make significant airfield safety, environmental, and operational improvements. Several of the key safety and environmental improvement projects completed at the Airport since 2006 include the reconstruction of both the primary and crosswind runways, Runway 5-23 and Runway 14-32. Full Length reconstruction of Taxiway A was accomplished in 2016. Phase III of the Reconstruction of the Terminal Apron will be completed Fall 2022.

The next project to improve the airport is the paving of the existing perimeter road at the Runway 5 End. FAA has identified this project as a critical safety improvement to the operation of the airport. The Airport has continuously identified this project in their Five-Year Airport Capital Improvement Plan and FAA will be funding this project. Currently, airport maintenance vehicles and fuel trucks cross Runway 5-23 at the intersection with Taxiway B to access the west side of the airfield. FAA has identified this activity as a hazard that should be avoided.

Specifically, the Airport is seeking to pave the existing perimeter road from the Bridgewater Apron along the south side of Taxiway B and the west side of Runway 5, continuing around the edge of the RW 5 extended runway safety area and connecting to Taxiway A (approximately 6,235 linear feet). The alignment will follow the same alignment as the existing perimeter road except that this road will tie into the existing T-Hangar apron in front of the hangars as opposed to the rear.

The existing perimeter road is approximately 4,700 linear feet in length. The width of the existing gravel road varies from 9.3 feet to 12.6 feet averaging 11.1 feet. The total area of the existing road is approximately 67,100 SF and consists of gravel.

The proposed road will be eleven (11) feet wide with an area of approximately 57,440 SF, a reduction of approximately 9,660 SF from existing conditions. The alignment of the repaved road will closely match the existing alignment.

This project is considered a redevelopment project as defined by DEP.

For purposes of Stormwater Management Standard 7, redevelopment projects are defined to include the following:

- Maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving.
- Development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results *in no net increase in impervious area*; and

- Remedial projects specifically designed to provide improved stormwater management, such as projects to separate storm drains and sanitary sewers and stormwater retrofit projects.

Redevelopment projects, such as that associated with this project to pave the Runway 5 perimeter road is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

As described in further detail in the balance of this report and on the enclosed Stormwater Checklist, the proposed project complies with Standard 1.

2. METHODOLOGY

This drainage analysis conducted by ASG considers five (5) distinct points of analysis (AP-1 through AP-5) that discharge stormwater from Runway 5 End and an existing hangar located off from Taxiway B Figures 1 through 4, Existing and Proposed drainage conditions.

The existing and proposed watersheds were modeled utilizing HydroCad stormwater software, version 10.00-24. The watersheds were analyzed utilizing SCS TR-20 methodology for hydrograph development and TR-55 methodology for Time of Concentration (T_C) determination. Type III, 24-hour hydrographs were developed for the 2-year, 10-year, and 100-year storm events corresponding to 3.6”, 4.8”, and 7.1” of rainfall respectively as directed by the SCS *Technical Paper 40* (TP-40) and the MASS DEP *Hydrology Handbook for Conservation Commissioners*.

Existing topography and site features were obtained through a combination of aerial topography, on the ground survey, MASS GIS system, and USGS Topographical Mapping and drone imagery mapping. Existing soil conditions were derived from a combination of geotechnical investigations performed by R.W. Gillespie & Associates, test pits performed by ASG, MASS GIS soils, and the Natural Resources Conservation Services (NRCS) Web Soil Service Mapping Tool. The wetland resource area boundaries depicted on the enclosed drawings were reviewed and approved under MASS DEP File No. 049-0635 and remain valid.

3. EXISTING CONDITIONS

The existing airport watersheds for this analysis consist of approximately 28.573 acres which consists of the Runway 5 End safety area and a portion of the existing hangar area located off Taxiway B.

The airport is located in the north-east corner of the Apponagansett Swamp, between I-195 and New Plainville Road in New Bedford, MA. The airport watershed is located northeast of the Paskamanset River and includes portions of Turner Pond to the north and the Smith Mills Dam to the south. The existing airport watershed contains a mixture of forest, brush lands associated with immature woods, maintained grassed areas, shrub scrub wetlands, paved areas, and buildings. Watershed soils were determined to be a mixture of Hydrologic Soil Group (HSG) "A", "B", "C", & "D". All wetlands were classified hydrologic soil group "D". Runoff curve numbers associated with developed areas are based upon land usage.

Existing Drainage Areas and Analysis Points are depicted on Figures 1 through 4 and can be found in Appendix B and C. HydroCAD Pre and Post Development Routing Diagrams are shown in Appendix B and C as well.

Stormwater runoff from the redevelopment area (Runway 5 Safety Area and a portion of the existing hangar area located off Taxiway B on the Runway 14 End) drains into the Apponagansett Swamp from a combination of overland flow and existing closed drainage.

As previously noted, this drainage analysis considers five (5) distinct points (AP-1 through AP-5) that discharge stormwater from the Runway 5 safety area as well as a portion of the existing T-Hangars located off from Taxiway B and are depicted on Figures 1 through 4. The location of the discharge points are as follows:

- Analysis Point AP-1 is located west of the Taxiway B intersection with RW5-23 and consists of two outfalls approximately 200 FT apart. Runoff to this analysis point consists of Subcatchment Areas 1S, 2S and 7S as depicted on the pre and post drainage conditions plan.
- Analysis Point AP-2 is located at the existing outlet headwall immediately northwest of the RW 5 End. Contributing runoff to this point consists of Subcatchment Areas 3S and 4S as depicted on the drainage plans.
- Analysis Point AP-3 is located on the west side of the extended runway safety area. Contributing runoff to this point consists of Subcatchment Area 5S and consists of sheet flow from the grassed safety area as depicted on the drainage plans.
- Analysis Point AP-4 is located on the east side of the extended runway safety area. Contributing runoff to this point consists of Subcatchment Area 6S and consists of sheet flow from the grassed safety area as depicted on the drainage plans.
- Analysis Point AP-5 is located on the west side of the runway 5 side safety area immediately southwest of AP-1. Contributing runoff to this point consists of Subcatchment Area 3S, 4S and 8S and primarily consists of sheet flow from the grassed safety area as depicted on the drainage plans.

For analysis purposes, the total contributing drainage area of approximately 28.573 acres are divided into eight sub-catchments depicted on the drainage drawings Figure 1 and 2 for existing conditions and Figures 3 and 4 for post development drainage.

Figure 1 and 2 - Existing Drainage Plans

- 1S – Hangar Area contains 1.332 acres and is located west of the intersection of TW B with RW 5-23 - Runoff from this area sheet flows into the Apponagansett Swamp .
- 2S – Hangar Area contains 2.565 acres and is located immediately east of Subcatchment 1S. Drainage from this watershed drains into an existing CB immediately west of the

intersection of TW B with RW 5-23 and discharges to the Apponagansett Swamp via an existing drain pipe and concrete outfall.

- 3S - “EX-RW5-W1-E6” contains 4.016 acres and is located along the west side of RW 5. between Taxiway “B” and RW 5 End. Runoff from this watershed flows into an existing 800 FT long drainage infiltration trench. Any overflow from the trench drains into an existing grassed channel and is then conveyed to analysis point AP-2.
- 4S - “Runway Side Slope” contains 7.030 acres. Runoff from this watershed is collected in a vegetated drainage channel and discharges to analysis point AP-2.
- 5S - “West Side RSA” contains 4.748 acres. Runoff from this watershed flows overland across the side slope of the safety area then across the existing gravel perimeter road and into analysis point AP-3 which is the Apponagansett Swamp.
- 6S - “East Side RSA” contains 4.912 acres. Runoff from this watershed flows overland across the side slope of the safety area then across the existing gravel perimeter road and into analysis point AP-3 which is the Apponagansett Swamp.
- 7S - “Bridgewater” contains 2.483 acres. Runoff from this watershed flows from a portion of the Bridgewater aircraft parking lot then overland across both grassed and pavement to an existing catch basin located on the northerly corner of the T-Hangar apron. Runoff is then conveyed to the 6S - “East Side RSA” contains 4.748 acres. Runoff from this watershed flows overland across the side slope of the safety area then across the existing gravel perimeter road and into analysis point AP-3 which is the Apponagansett Swamp via closed drainage to a concrete outfall.
- 8S – “Exist” Contains 1.487 acres. Runoff from this watershed flows from an area located at the west quadrant of the Taxiway B intersection with Runway 5-23. Runoff from this area drains into an existing CB-2 located within an existing drainage channel. It is then conveyed to an existing headwall (AP-5) via a closed drainage system which then discharges into the Apponagansett Swamp.

The following table represents pre-development flows to the five (5) analysis points.

TABLE 1

EXISTING DRAINAGE SUMMARY
(Pre-development)

ANALYSIS POINT	2-YR	10-YR	100 YR
	PEAK DISCHARGE (CFS)	PEAK DISCHARGE (CFS)	PEAK DISCHARGE (CFS)
AP-1	1.60	3.49	8.36
AP-2	1.04	4.09	16.01
AP-3	0.04	0.48	3.98
AP-4	0.04	0.48	3.79
AP-5	0.82	1.98	4.76

4. PROPOSED CONDITIONS

Proposed Drainage Areas and Analysis Points AP-1 through AP-5 are depicted on Figures 3 and 4 of Appendix C. HydroCAD Pre and Post Development Routing Diagrams can be found in Appendix B and C.

Below are detailed descriptions of individual sub-catchment areas.

Figure 3 and 4 - Proposed Drainage Plans

- 1S – Hangar Area contains 2.299 acres and is located west of the intersection of TW B with RW 5-23 - Runoff from this area sheet flows across a grassed area and discharges into the Apponagansett Swamp.
- 2S – Hangar Area contains 1.599 acres and is located immediately east of Subcatchment 1S. Drainage from the newly constructed paved perimeter road will be collected along the roadway toe of slope and discharged into a new water quality treatment unit prior to discharging into the existing closed drainage system which conveys runoff to the Apponagansett Swamp.
- 3S - "EX-RW5-W1-E6" contains 4.016 acres and is located along the west side of RW 5. between Taxiway "B" and RW 5 End. Runoff from this watershed flows into an existing 800 FT long drainage infiltration trench. overflow from the trench drains into an existing grassed drainage ditch and is conveyed to analysis point AP-2.
- 4S - "Runway Side Slope" contains 7.625 acres. Runoff from this watershed flows across a vegetated filter strip into a very flat (0.0015 FT/FT) vegetated drainage channel and then discharges to analysis point AP-2 via a concrete culvert beneath the existing gravel perimeter road. This subcatchment will contain 0.513 acres of new pavement over the existing gravel road. Currently a portion of the existing road drains directly into the wetlands untreated. The new pavement will be superelevated away from the wetlands at a one percent slope to eliminate discharge directly into the wetlands.

  Average flow velocities and depth of water within the grassed drainage channel are presented in the following table:

  TABLE 2

DESIGN STORM	AVERAGE VELOCITY (FPS)	AVERAGE DEPTH OF WATER (Inches)
1	0.39	1
2	0.53	3.4
10	0.63	6
100	0.79	11.6

  Although DEP does not give credit for TSS removal for grassed channels without pretreatment, they do accomplish some removal of TSS.

- 5S - "West Side RSA" contains 4.748 acres. Runoff from this watershed flows overland across the side slope of the safety area spills over the existing gravel perimeter road and into analysis point AP-3 which is the Apponagansett Swamp.
- 6S - "East Side RSA" contains 4.912 acres. Runoff from this watershed flows overland across the side slope of the east side safety area spills over the existing gravel perimeter road and into analysis point AP-4 which is the Apponagansett Swamp.
- 7S - "Bridgewater" contains 2.483 acres. Runoff from this watershed flows from a portion of the Bridgewater aircraft parking apron then overland across both grassed and pavement areas to an existing catch basin located on the northerly corner of the T-

Hangar apron. Runoff is then conveyed to a headwall which is part of analysis point AP-1 which flows into the Apponagansett Swamp.

- 8S – "Exist" Contains 1.535 acres. Runoff from this watershed flows from an area located at the west quadrant of the Taxiway B intersection with Runway 5-23. Runoff from this area drains into an existing CB-2 located within an existing drainage channel. It is then conveyed to an existing headwall (AP-5) via a closed drainage system which then discharges into the Apponagansett Swamp.

The following table illustrates post development drainage conditions.

TABLE 3

PROPOSED DRAINAGE SUMMARY
(Post-development)

ANALYSIS POINT	2-YR	10-YR	100-YR
	PEAK DISCHARGE (CFS)	PEAK DISCHARGE (CFS)	PEAK DISCHARGE (CFS)
AP-1	2.17	4.45	10.28
AP-2	1.37	5.35	19.26
AP-3	0	0	3.45
AP-4	0	0	3.78
AP-5	0.80	1.91	4.55

5. COMPLIANCE WITH MASSDEP STORMWATER STANDARDS:

Standard #1: *No new stormwater conveyance (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The Project does not propose to construct any new outfalls. All stormwater associated with the paving of the perimeter road will be treated via an existing grassed channel, new infiltration trenches or new water quality units.

AP-1 – Runoff from the new pavement will be treated prior to discharge utilizing water quality units designed to remove a minimum of 80% TSS.

AP-2 will receive runoff from a portion of the newly paved perimeter road (0.513 Acres). It is not practical to install any new type of treatment prior to discharging runoff into an existing grassed line ditch. Although DEP does not recognize credit for TSS removal in grassed channel without pretreatment, there will be some treatment provided within the channel. It is over 2,000 linear feet long with a slope of approximately 0.00075 FT/FT.

AP-3 will receive runoff from half of the existing grassed extended runway safety area as well as 0.291 acres of new paved surface. A 650 FT long infiltration trench will be installed on the inside of the new paved road. It is not practicable to provide pretreatment of the roadway runoff prior to entering the infiltration trench. Chamber systems or deep sump catch basins are not an option due to high ground water. Five (5) test pits were conducted on August 23, 2022 within the extended runway safety area and observed depth to water table to be as high as 42" below grade.

AP-4 will receive runoff from half of the existing grassed extended runway safety area as well as 0.292 acres of new paved surface. A 600 FT long infiltration trench will be installed on the inside of the new paved road. It is not practicable to provide pretreatment of the roadway runoff prior to entering the infiltration trench. Chamber systems or deep sump catch basins are not an option due to high ground water.

AP-5 will receive runoff from Subcatchment 8S and includes approximately 0.028 Acres of new paved road. Runoff from the road will be treated in a twenty-five-foot filter strip prior to discharge into the existing grassed drainage ditch.

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

Consistent with the redevelopment requirements of Standard 7, the proposed stormwater design demonstrates that post development peak discharge rates do not exceed pre-development discharge rates to the extent practicable.

As detailed in the following table, the post-development peak discharge rates for Analysis Points AP-1, AP-2 indicate a modest increase in the rate of runoff for these two analysis points.

Analysis points AP-3, AP-4 and AP-5 will experience a decrease in their respective runoff rates

It should be noted that these variations will not have an appreciable impact to the overall Apponagansett Swamp. Construction of detention or infiltration facilities beyond those that already exist is not practicable due to the high-water table and unique space limitations associated with the location of the perimeter road in relation to the wetlands. Further, runoff from the existing gravel road currently drains directly into the wetlands. Whereas the new pavement will be superelevated to direct runoff away from the wetlands. This will be an improvement over existing conditions and will provide added protection of the wetlands.

The 100 YR increase in ac-ft over existing is 0.141 ac-ft (4.292 - 4.433). Converting ac-ft to inches over the approximately 116 acres of the Apponagansett Swamp immediately downstream yields an increase of only approximately 1/64th of an inch of runoff. This minute increase will have a negligible impact to the downstream swamp.

The following is a comparison of the Pre-development runoff rates to the Post-development peak stormwater discharge rates for the 2, 10 and 100-year storm events.

TABLE4

	RETURN PERIOD					
	2-YR		**10-YR**		**100 YR**	
ANALYSIS POINT	**PRE**	**POST**	**PRE**	**POST**	**PRE**	**POST**
AP-1	1.60	2.17	3.49	4.45	8.36	10.28
AP-2	1.04	1.37	4.09	5.35	16.01	19.26
AP-3	0.04	0	0.48	0	3.98	3.45
AP-4	0.04	0	0.48	0	3.79	3.78
AP-5	0.82	0.80	1.98	1.91	4.76	4.55

Standard #3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices and good operation and maintenance. At a minimum, the annual recharge from the post development site shall approximate the annual recharge from the pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The existing gravel road has an area of approximately 67,100 SF while the proposed paved road will have an area of approximately 57,440 SF resulting in a reduction of approximately 9,660 SF of surface area. Runoff rates and volume from the paved road will be less than existing. However, two infiltration trenches will be constructed in the runway safety area and will provide a total of approximately 3,000 CF of storage.

The following table illustrates a comparison of the rates of runoff expected from the existing gravel surface and the proposed paved surface

TABLE 5

RUNOFF RATES (cfs)			
	2-YR	**10-YR**	**100-YR**
Existing Gravel Road	4.75	6.44	9.63
Proposed Paved Road	4.18	5.60	8.32

The following table illustrates a comparison of the total volume of runoff expected from the existing gravel surface and the proposed paved surface

TABLE 6

VOLUME (ac-ft)			
	2-YR	**10-YR**	**100-YR**
Existing Gravel Road	0.404	0.556	0.850
Proposed Paved Road	0.370	0.501	0.754

The required cumulative recharge volume for this project, based on impervious area is 2,873 CF. The water quality volume provided is 3,000 CF within the two proposed infiltration trenches in the extended runway safety area. Despite the challenges of high ground water throughout the airport, the two proposed infiltration trenches will provide recharge based upon the type of fill placed for the construction of the safety area, i.e. loamy sand. Based upon the soil conditions and modeling, the standing water within the basins will infiltrate over a period of approximately 25 hours.

The supporting recharge calculations are summarized as follows:

Perimeter Road Impervious Area = 1.319 Acres

Soil Type (A) = 0.6 inches (From Table 2.3.2 Recharge Target Depth by Hydrologic Soil Group, Mass Stormwater Handbook)

Rv = 1.319 Acres x (43560 SF/Acre) x (0.6 Inches * 1 FT/12 inches) = 2,873 CF

Table 5 demonstrates that the proposed paved road will produce less runoff than that of the existing gravel road because the proposed surface area is less than existing.

Soils Analysis – Four (4) test pits were conducted within the runway extended safety area on August 23, 2022. The purpose of the test pits was to determine drainage classification and depth to high water. A representative sample of the receiving layer was tested by SW Cole on November 1, 2022 and is classified as a loamy sand. Loamy sand has a Rawls infiltration rate of 2.41 IN/HR which is what was used in the drainage calculations.

Standard #4: *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when (a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained; (b) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with Massachusetts Stormwater Handbook; and (c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Due to the close proximity of the existing wetlands that surround the Runway 5 end as well as the existing road being immediately adjacent to the wetlands, it is not possible to provide pretreatment at some of these locations. The paved roadway will be constructed such that the road will be superelevated toward the infield and away from the wetlands. This will result in an improvement over existing conditions where stormwater runoff currently discharges directly into the wetlands.

Subcatchment 1S – The existing gravel road currently discharges untreated runoff into the wetlands. This section of road will be removed and replaced with loam and seed. No sections of new paved perimeter road will be constructed in this subcatchment so treatment of runoff is not required.

Subcatchment 2S – Runoff from subcatchment 2S, including new paved sections of perimeter road, will be collected in a new water quality treatment unit prior to discharge into the existing airport drainage system. The water quality treatment unit will remove a minimum of 80% TSS. The outfall for this area is proposed analysis point AP-1.

Subcatchment 3S - Remains unchanged. Runoff from the runway flows across a 125' long grassed filter strip into an existing trench drain. Runoff from this area is being treated to remove a minimum of 80% TSS. Overflow from larger storm events discharges into an existing grassed channel.

Subcatchment 4S – Currently runoff from subcatchment area 4S is being treated to remove 80% of TSS by a 125 FT long grassed filter strip and a grassed channel.

Proposed runoff from the paved perimeter road will sheet flow into the existing grassed channel. There is no opportunity to provide pretreatment prior to discharging into the grassed channel due to the close proximity to wetlands and close proximity to the existing channel. However, the grassed lined channel will provide 50% TSS removal for this section of new pavement which is to the extent practicable for this section of the road. It should be noted that this road is only for the use of airport personnel.

Subcatchment 5S – The paved perimeter road will be superelevated away from the wetlands directing the runoff into the infield area into a 650 FT long, four foot wide, 18-inch deep infiltration trench. Runoff will flow across an eight (8) foot wide grassed shoulder prior to discharging into the trench drain. There is insufficient space to provide pretreatment prior to entering the trench drain. It should be noted that the perimeter road is only for occasional use by airport personnel and is not open to the public.

Subcatchment 6S - The paved perimeter road will be superelevated away from the wetlands directing the runoff into the infield area into a 600 FT long, four foot wide, 18-Inch deep infiltration trench. Runoff will flow across an eight (8) foot wide grassed shoulder prior to discharging into the trench drain. There is insufficient space to provide pretreatment prior to entering the trench drain. It should be noted that the perimeter road is only for occasional use by airport personnel and is not open to the public.

Subcatchment 7S – Two sections of new perimeter road will be constructed in this area that will allow airport vehicles to access the aircraft ramp areas without entering the active Taxiway B. Runoff from this section of perimeter road flows into the existing airport drainage system. Runoff from the new paved area as well as a portion of the existing paved areas will be treated in a new water quality unit. The new water quality unit will replace an existing catch basin located near the northeast corner of the most northerly T-Hangar as depicted on NOI.4. This treatment unit will remove a minimum of 80% TSS.

TSS removal calculations are included in Appendix D.

Standard #5: *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs. The use of infiltration practices without pre-treatment is prohibited.*

Not Applicable

Standard #6: *Stormwater discharges to critical areas must utilize certain stormwater BMPs approved for critical areas. Critical areas are Outstanding Resource Waters (ORWs), shellfish beds, swimming beaches, cold water fisheries, and recharge areas for public water supplies.*

Not Applicable

Standard #7: *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

Work associated with paving the existing perimeter road is considered to be a redevelopment project. The proposed work conforms to the requirements of Standard 7 as described above and below to the extent practicable. In addition, there will be a net reduction of the surface area of the road by approximately 9,700 SF.

Standard #8: *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

Erosion and sediment controls have been incorporated into the construction plans. A General Permit Construction Phase SWPPP will be developed by the Contractor for this construction project. The construction SWPPP will be prepared prior to the start of construction.

Standard #9: *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

ASG previously prepared a long-term operation and maintenance plan entitled "New Bedford Regional Airport – Storm Water Operations and Maintenance Plan" for the entire New Bedford Regional Airport facility. This Operations and Maintenance plan has been updated over time to reflect upgrades and improvements to the stormwater management system as different phases of construction have been completed. The referenced Operations and Maintenance plan has been updated again to reflect the improvements described herein (see Appendix F for additional detail).

Standard #10: *All illicit discharges to the stormwater management system are prohibited.*

All known existing illicit discharges associated with the Airport were removed / eliminated as part of the Variance Order issued by MASS DEP File Number 049-0635 (e.g., floor drains at various hangar facilities).

APPENDIX A

NOI DRAWINGS

NOI PLANS FOR

newbedford
regional airport

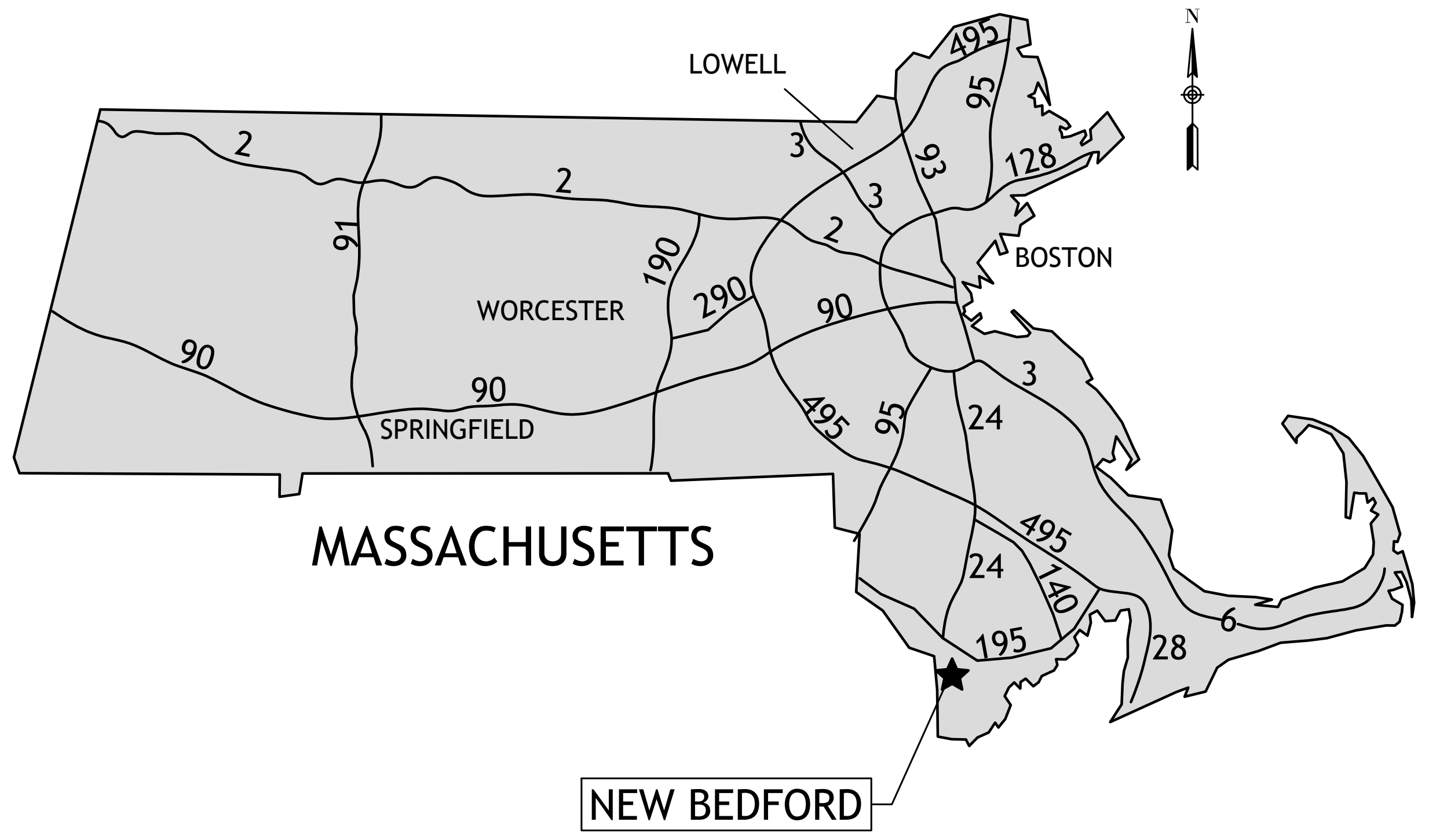
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT

1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PERMIT RW5 PERIMETER ROAD

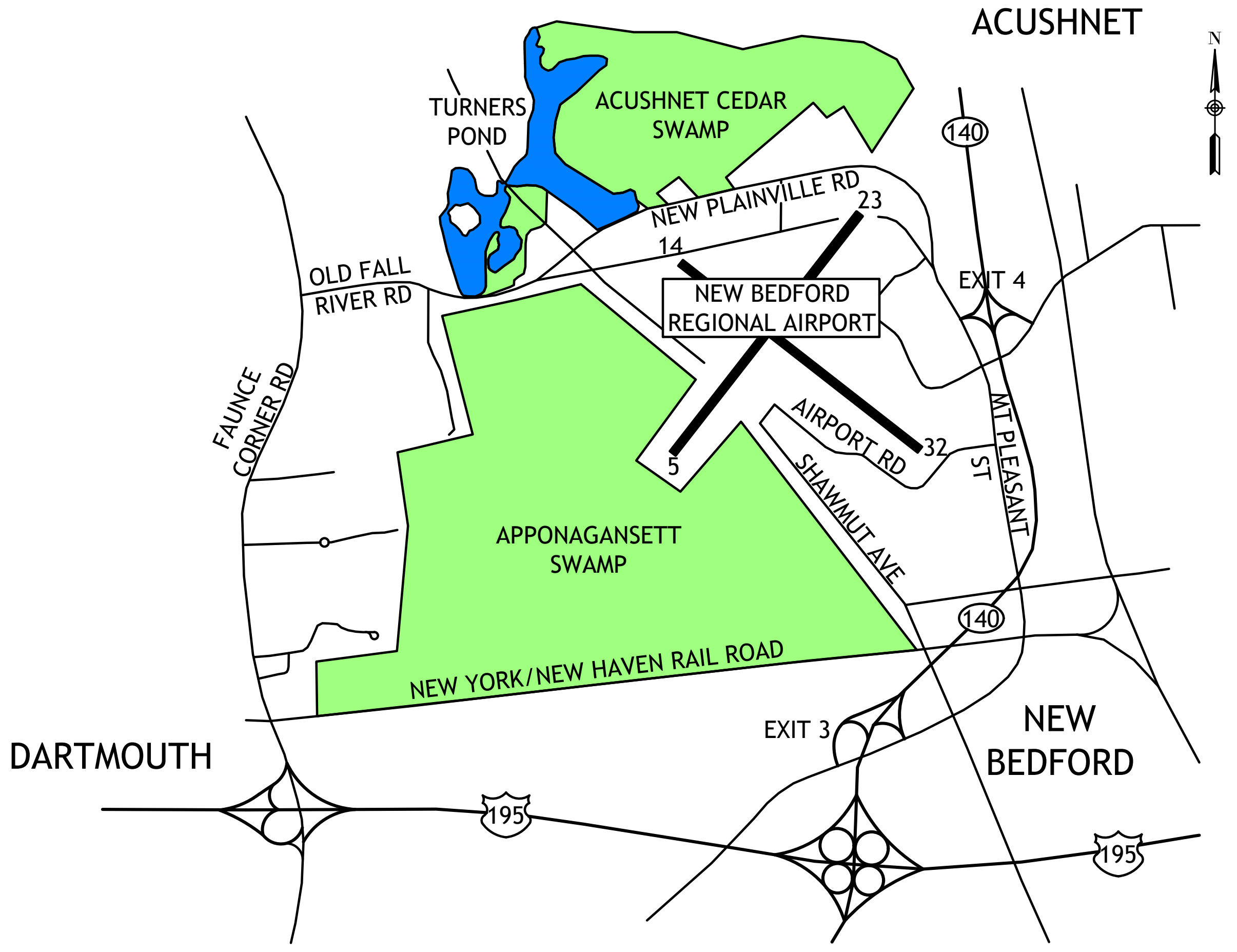
DECEMBER 2022

AIP NO. 3-25-0052-0XX-2022



LOCATION MAP

0 30 60
SCALE IN MILES

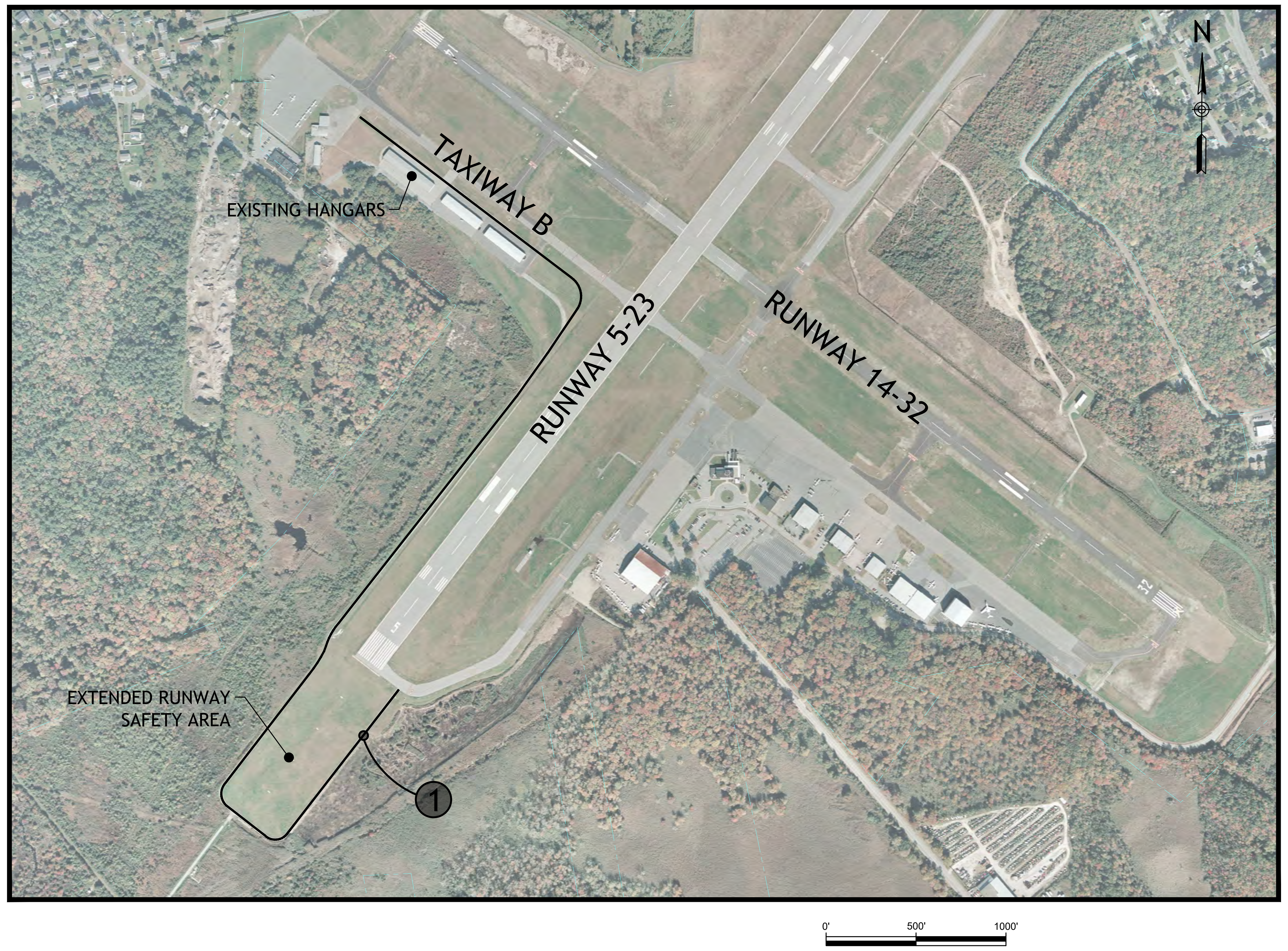


LOCUS MAP

0 0.5 1
SCALE IN MILES

GENERAL NOTES

1. THE INFORMATION INCLUDED IN THIS NOI PLAN SET IS CONSIDERED PRELIMINARY AND IS INTENDED FOR PERMITTING PURPOSES ONLY; IT IS NOT INTENDED FOR FINAL LAYOUT OR CONSTRUCTION. THE CONSTRUCTION BID SET WILL INCLUDE THE ORDER OF CONDITIONS ISSUED BY THE NEW BEDFORD CONSERVATION COMMISSION (NBCC). THE ORDER OF CONDITIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTING INFORMATION INCLUDED IN THIS NOI PLAN SET OR CONSTRUCTION BID SET.
2. EROSION CONTROL MATTING SHALL BE USED FOR SLOPE STABILIZATION ON ALL PROPOSED GRADING EXCEEDING A SLOPE OF 4:1 (H:V).



PROPOSED CONSTRUCTION

① - PAVE RW5 PERIMETER ROAD

PREPARED BY

ASG
AIRPORT SOLUTIONS GROUP, LLC
Innovation By Design
AIRPORT CONSULTANTS • BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

NOI PERMIT DRAWINGS
NOT FOR CONSTRUCTION

CRAIG A. SCHUSTER
CIVIL
No. 37898

DRAWING NO.
NOI.1
1 OF 11

NOI SUBMISSION

11/22/2022 7:39:18 AM P:\ASG Data\Projects\ma - new bedford\054 permit rw5 access road\CADD\noi plans\010 103-054 NOI COVER SHEET.dwg (SG)

INDEX TO DRAWINGS

SHEET NO.	DWG NO.	SHEET TITLE
1	NOI.1	COVER SHEET
2	NOI.2	INDEX TO DRAWINGS
3	NOI.3	EXISTING CONDITIONS, CATCHMENT AREAS AND ANALYSIS POINTS
4	NOI.4	GRADING AND PROFILE PLAN (1 OF 6)
5	NOI.5	GRADING AND PROFILE PLAN (2 OF 6)
6	NOI.6	GRADING AND PROFILE PLAN (3 OF 6)
7	NOI.7	GRADING AND PROFILE PLAN (4 OF 6)
8	NOI.8	GRADING AND PROFILE PLAN (5 OF 6)
9	NOI.9	GRADING AND PROFILE PLAN (6 OF 6)
10	NOI.10	TYPICAL SECTIONS AND DRAINAGE DETAILS
11	NOI.11	DRAINAGE AND EROSION CONTROL DETAILS

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	020 103-054 NOI GENERAL PLANS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
INDEX TO DRAWINGS

GRAPHIC SCALE
NTS

DRAWING NO.
NOI.2

2 OF 11

New Bedford Regional Airport

Permit RW5 Perimeter Road / NOI Submission

Pre-Development Flow Rate (cfs)				Post-Development Flow Rate (cfs)			
Analysis Point	2-Year Storm	10-Year Storm	100-Year Storm	Analysis Point	2-Year Storm	10-Year Storm	100-Year Storm
1	1.60	3.49	8.36	1	2.17	4.45	10.28
2	1.04	4.09	16.01	2	1.37	5.35	19.26
3	0.04	0.48	3.98	3	0	0	3.45
4	0.04	0.48	3.79	4	0	0	3.78
5	0.82	1.98	4.76	5	0.80	1.91	4.55

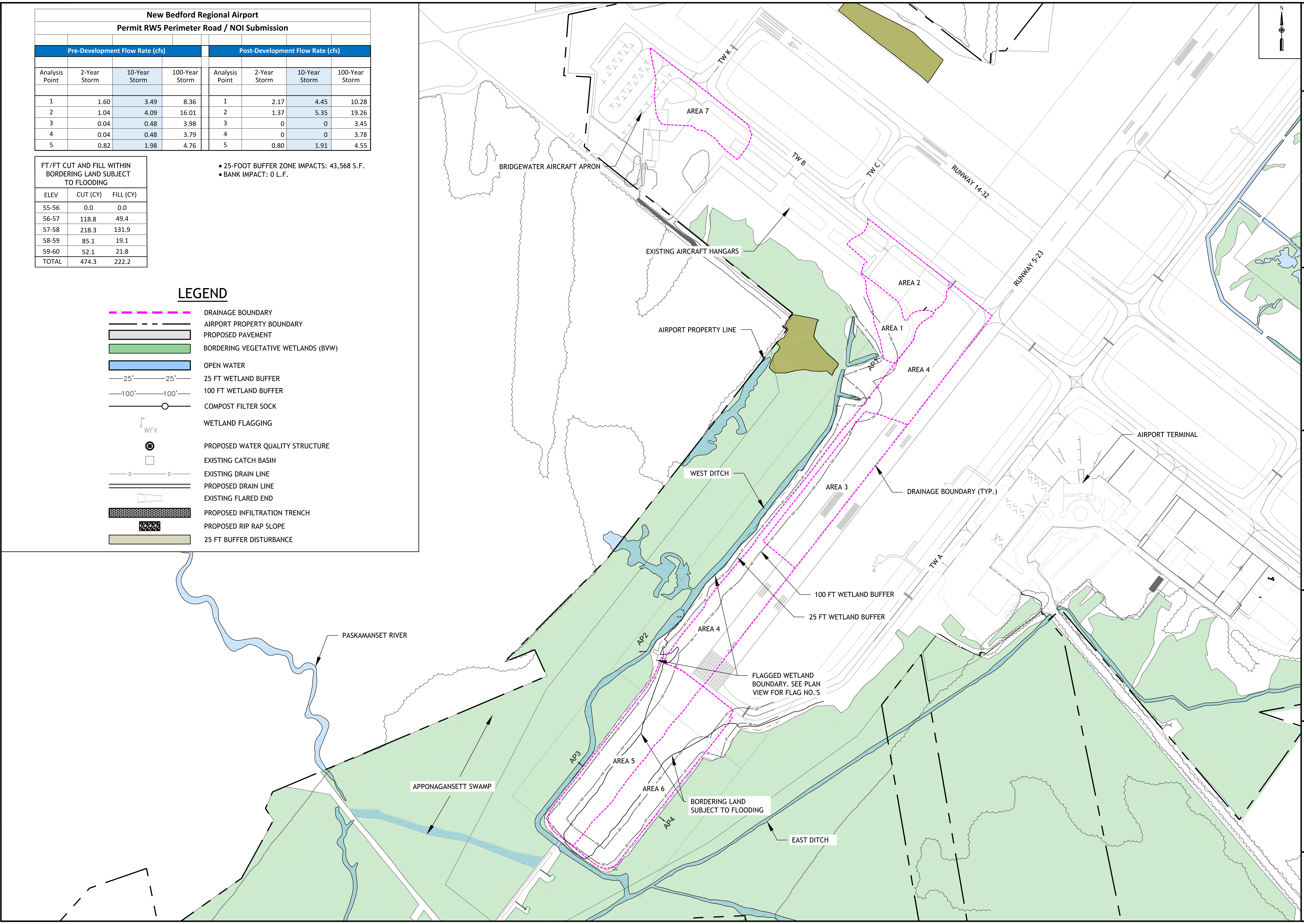
FT/FT CUT AND FILL WITHIN BORDERING LAND SUBJECT TO FLOODING

ELEV	CUT (CY)	FILL (CY)
55-56	0.0	0.0
56-57	118.8	49.4
57-58	218.3	131.9
58-59	85.1	19.1
59-60	52.1	21.8
TOTAL	474.3	222.2

- 25-FOOT BUFFER ZONE IMPACTS: 43,568 S.F.
- BANK IMPACT: 0 L.F.

LEGEND

- - -	DRAINAGE BOUNDARY
— - —	AIRPORT PROPERTY BOUNDARY
▭	PROPOSED PAVEMENT
🟩	BORDERING VEGETATIVE WETLANDS (BVW)
🟦	OPEN WATER
—25'—	25 FT WETLAND BUFFER
—100'—	100 FT WETLAND BUFFER
—○—	COMPOST FILTER SOCK
WFX	WETLAND FLAGGING
◉	PROPOSED WATER QUALITY STRUCTURE
□	EXISTING CATCH BASIN
—D—	EXISTING DRAIN LINE
═	PROPOSED DRAIN LINE
▷	EXISTING FLARED END
▨	PROPOSED INFILTRATION TRENCH
▩	PROPOSED RIP RAP SLOPE
▭	25 FT BUFFER DISTURBANCE



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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

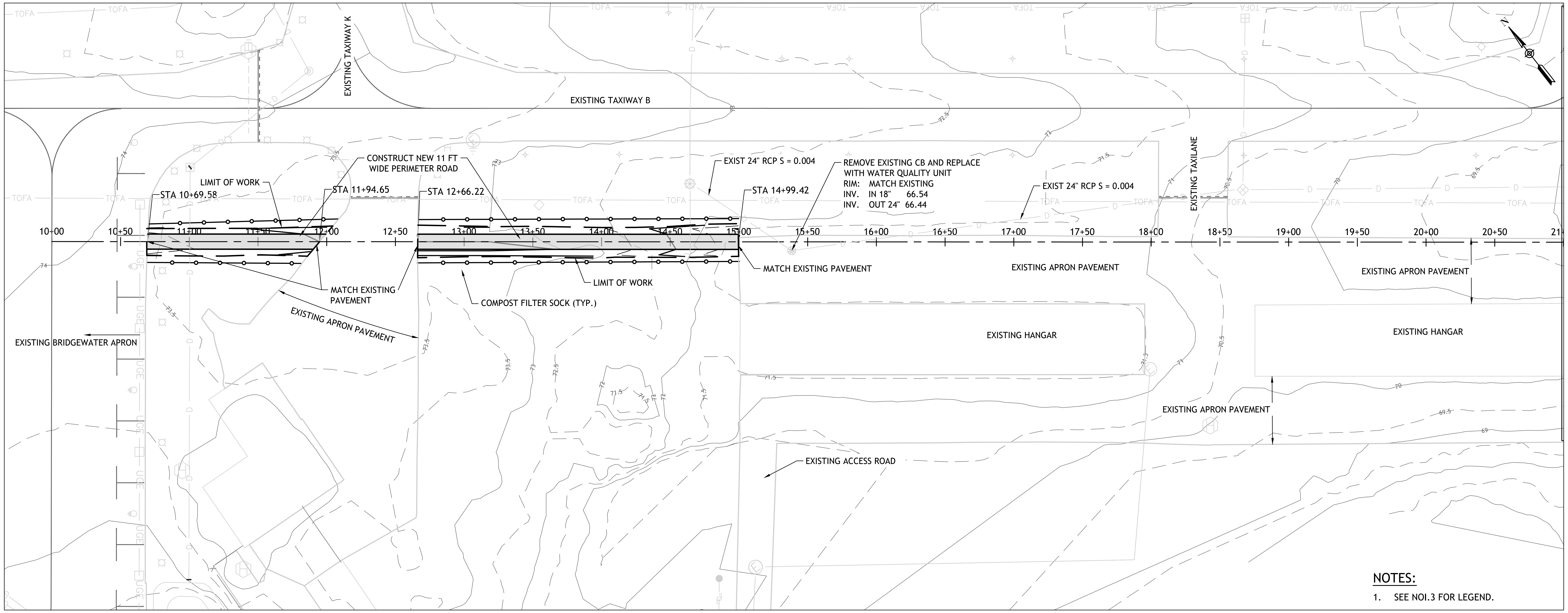
PROJECT NO.	103-054
CADD FILE	020 103-054 NOI GENERAL PLANS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 200'

SHEET TITLE
EXISTING CONDITIONS,
CATCHMENT AREAS
AND ANALYSIS POINTS

GRAPHIC SCALE
0 100' 200' 400'

DRAWING NO.
NOI.3
3 OF 11

11/22/2022 7:44:58 AM P:\ASG Data\Projects\ma - new bedford\054 permit rw5 access road\CADD\noi plans\020 103-054 NOI GENERAL PLANS.dwg (SG)

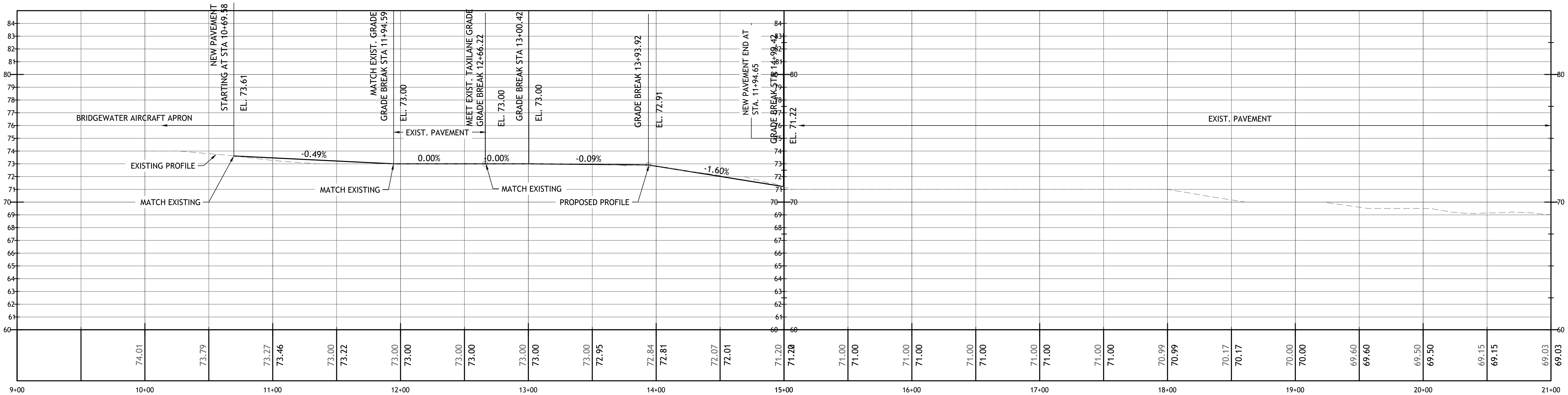


NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

11/22/2022 7:54:24 AM P:\ASG Data\Projects\ma -- new bedford\054 permit rw5 access road\CADD\noi plans\030 103-054 GRADING & PROFILE PLANS.dwg (SG)

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

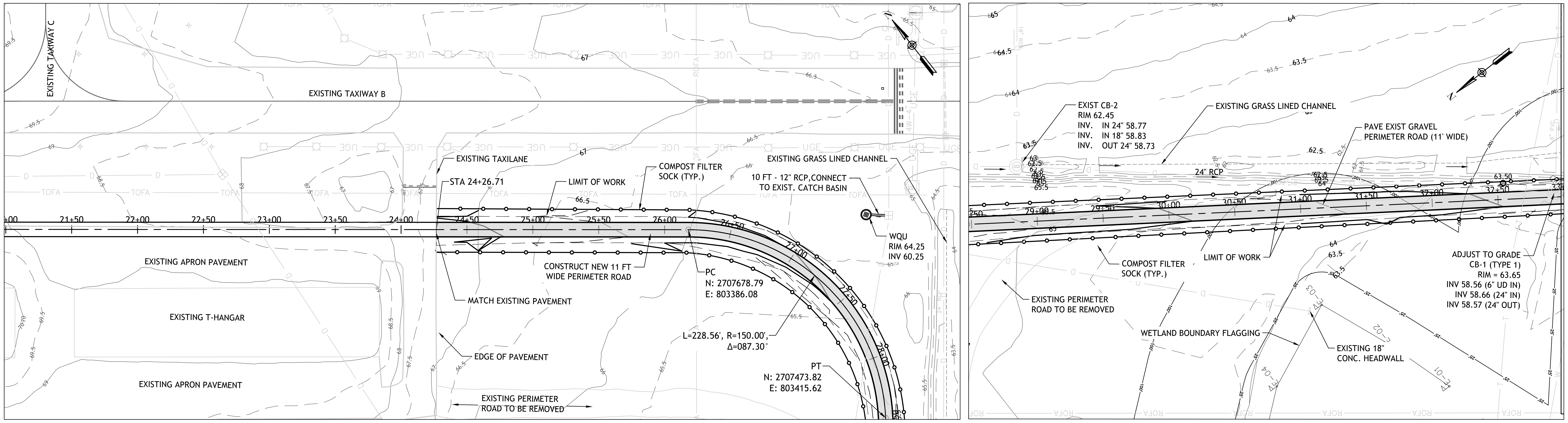
PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (1 of 6)

GRAPHIC SCALE
0 20 40 80'

DRAWING NO.
NOI.4

4 OF 11

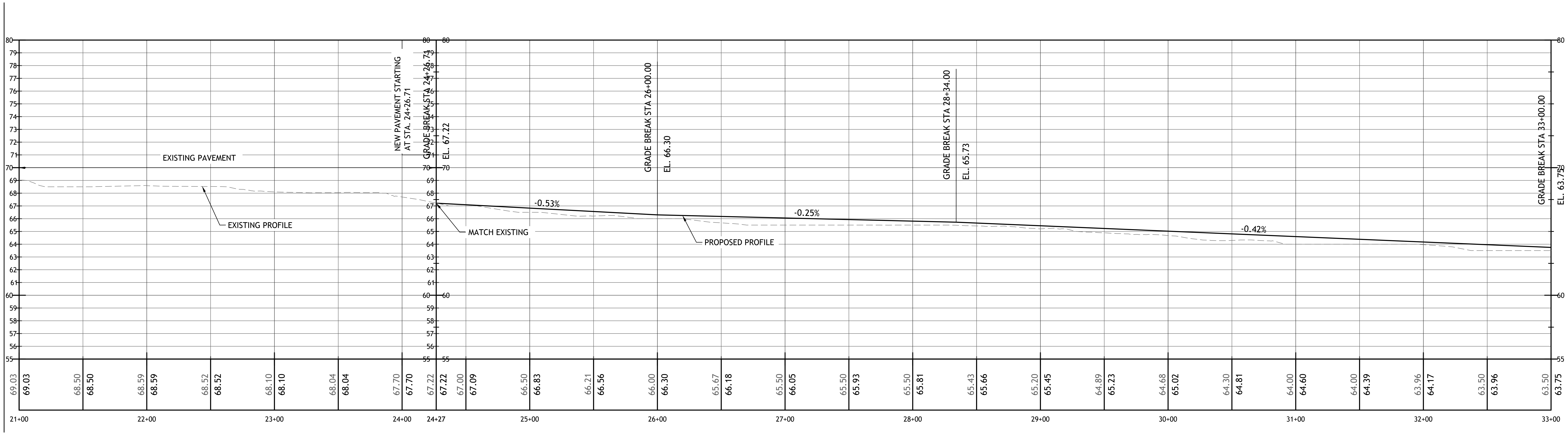


GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'

NOTES:

1. SEE NOI.3 FOR LEGEND.



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

11/22/2022 7:54:24 AM P:\ASG Data\Projects\mo -- new bedford\054 permit rw5 access road\CADD\noi plans\030 103-054 GRADING & PROFILE PLANS.dwg (SG)

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NO.	DATE	DESCRIPTION	BY

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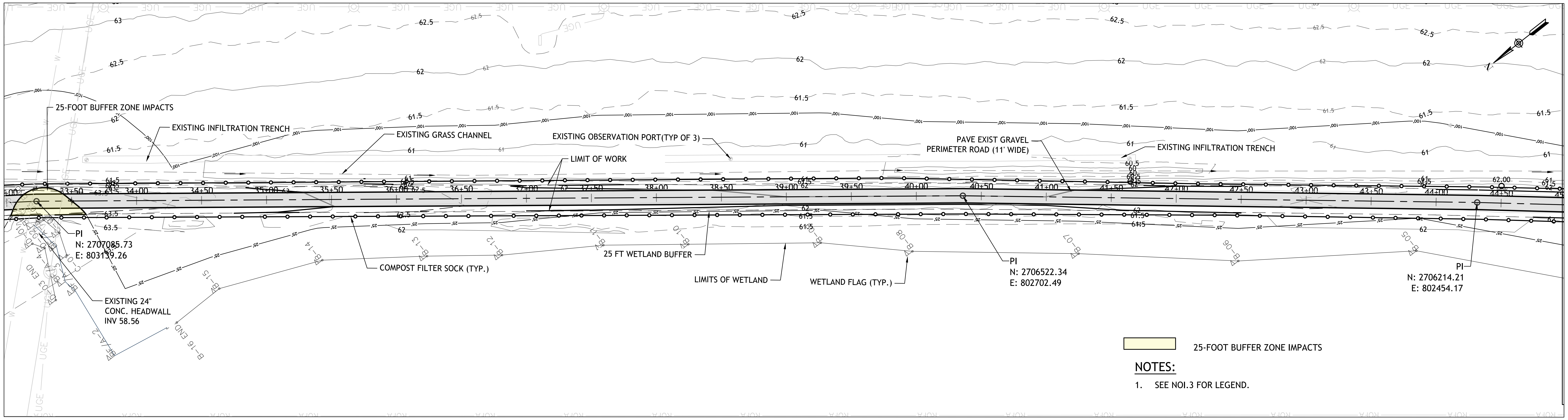
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (2 of 6)

GRAPHIC SCALE
0 20 40' 80'

DRAWING NO.
NOI.5



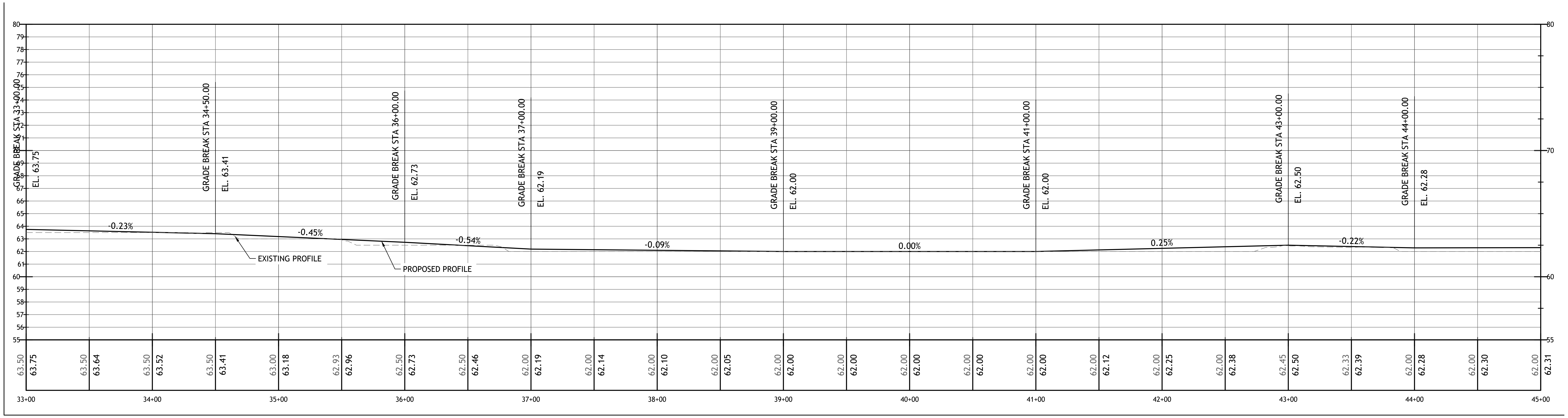
🟨 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

COMMONWEALTH OF MASSACHUSETTS
CRAIG A. SCHUSTER
CIVIL
No. 37636
REGISTERED PROFESSIONAL ENGINEER

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

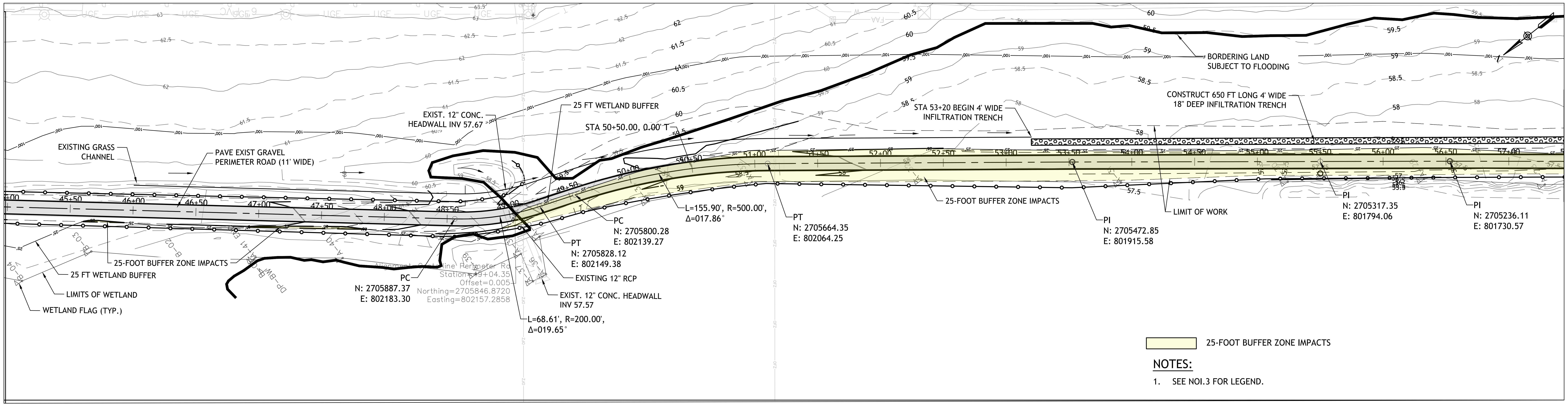
SHEET TITLE
GRADING & PROFILE PLANS (3 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.6

6 OF 11

11/22/2022 7:54:24 AM P:\ASG Data\Projects\ma - new bedford\054 permit rw5 access road\CADD\noi plans\030 103-054 GRADING & PROFILE PLANS.dwg (SG)



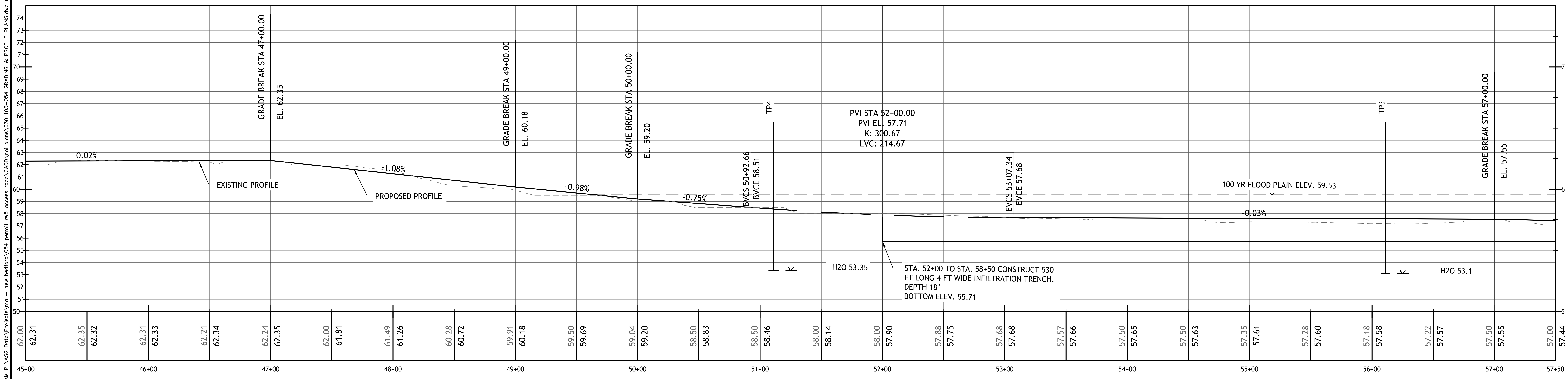
🟨 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

11/22/2022 7:54:24 AM P:\ASG Data\Projects\ma -- new bedford\054 permit rw5 access road\CADD\ma\ plans\030 103-054 GRADING & PROFILE PLANS.dwg (SG)

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

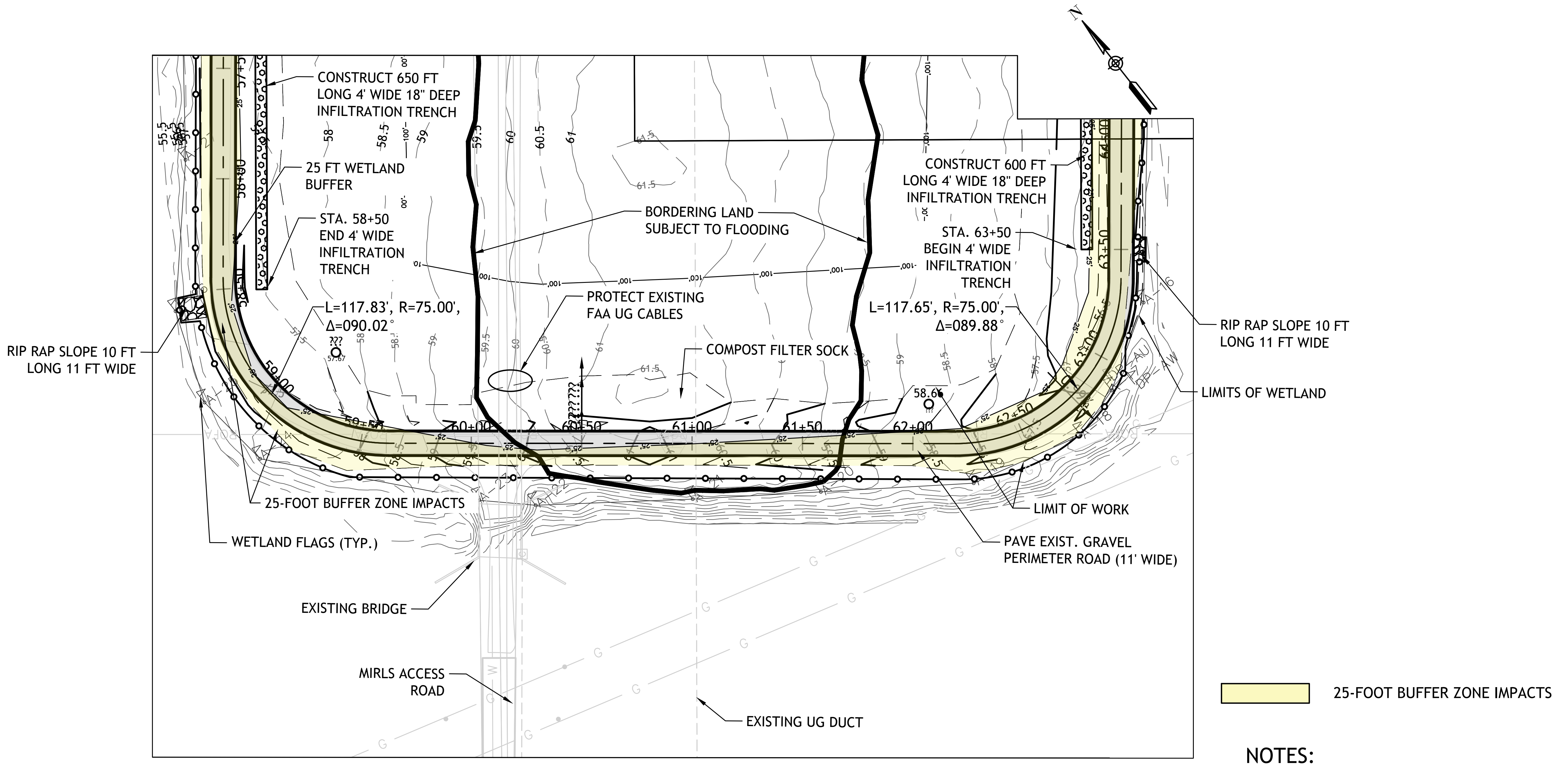
PROJECT NO.	103-054
CADD FILE	030 103-054 GRADING & PROFILE PLANS
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (4 of 6)

GRAPHIC SCALE
0 20 40 80'

DRAWING NO.
NOI.7

7 OF 11

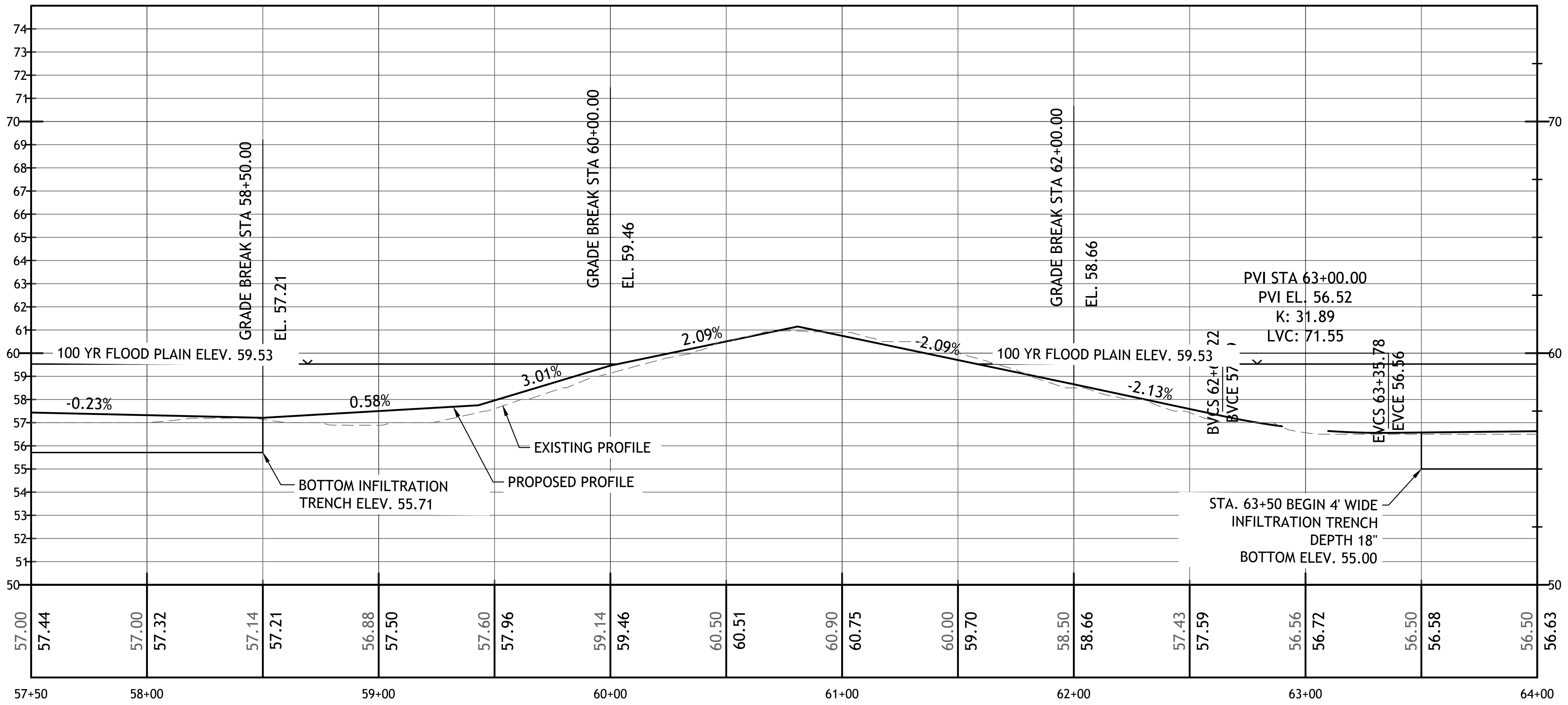


GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'

NOTES:

1. SEE NOI.3 FOR LEGEND.



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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CITY OF NEW BEDFORD
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PROJECT NO.	103-054
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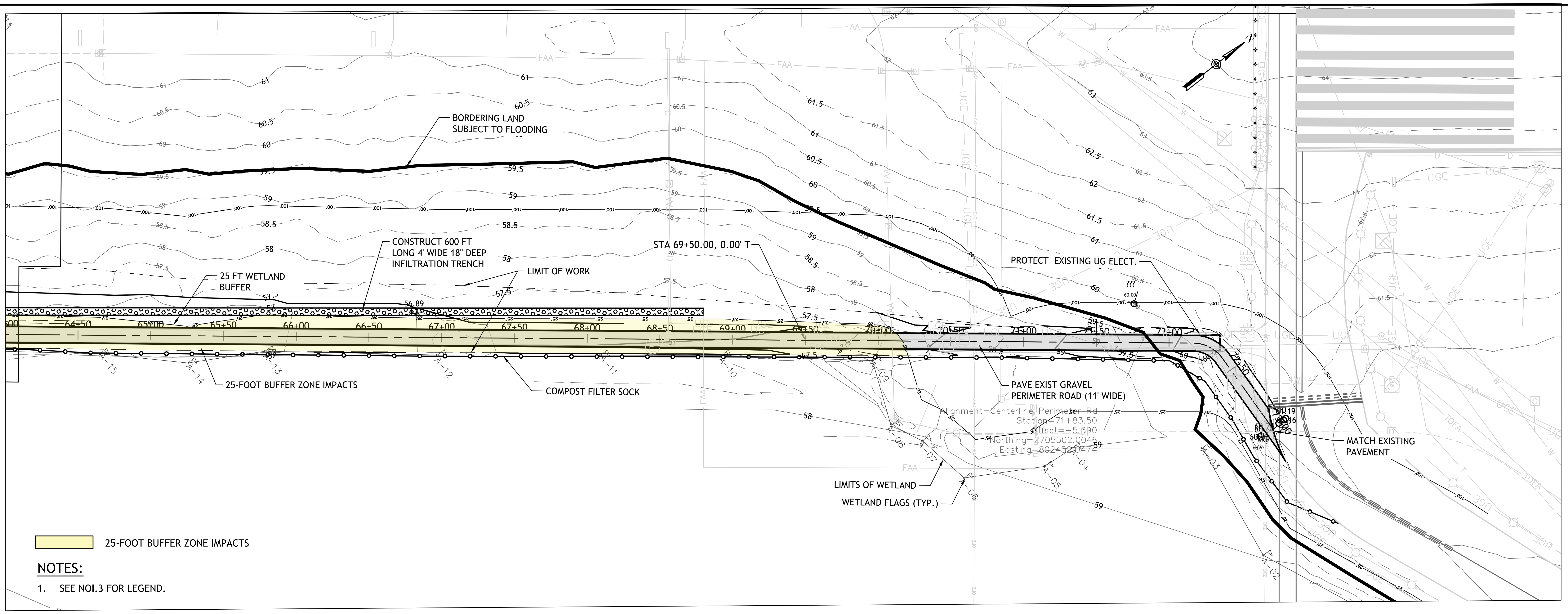
DESIGNED BY	SE
DRAWN BY	SE
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (5 of 6)

GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.8



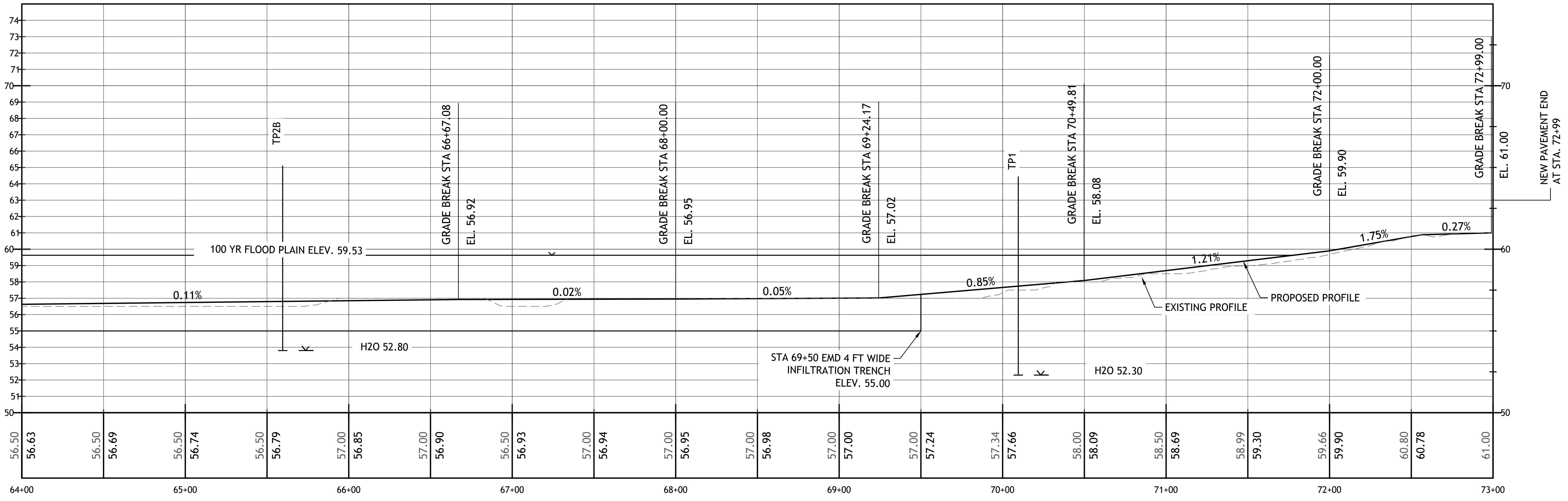
▭ 25-FOOT BUFFER ZONE IMPACTS

NOTES:

1. SEE NOI.3 FOR LEGEND.

GRADING PLAN PERIMETER ROAD

SCALE: 1" = 40'



PROFILE PERIMETER ROAD

SCALE: 1" = 40' (H)
1" = 4' (V)

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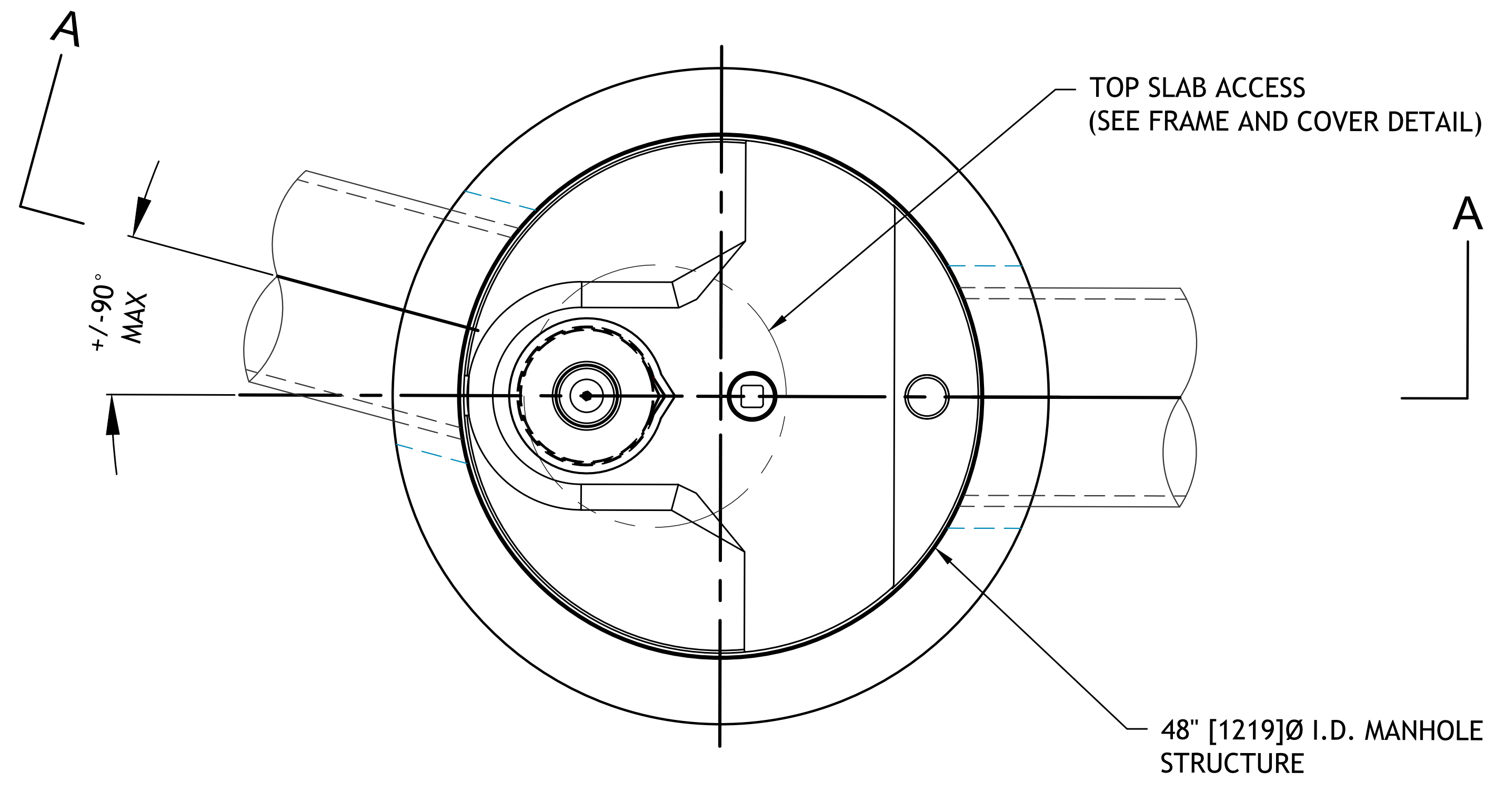
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	1" = 40'

SHEET TITLE
GRADING & PROFILE PLANS (6 of 6)

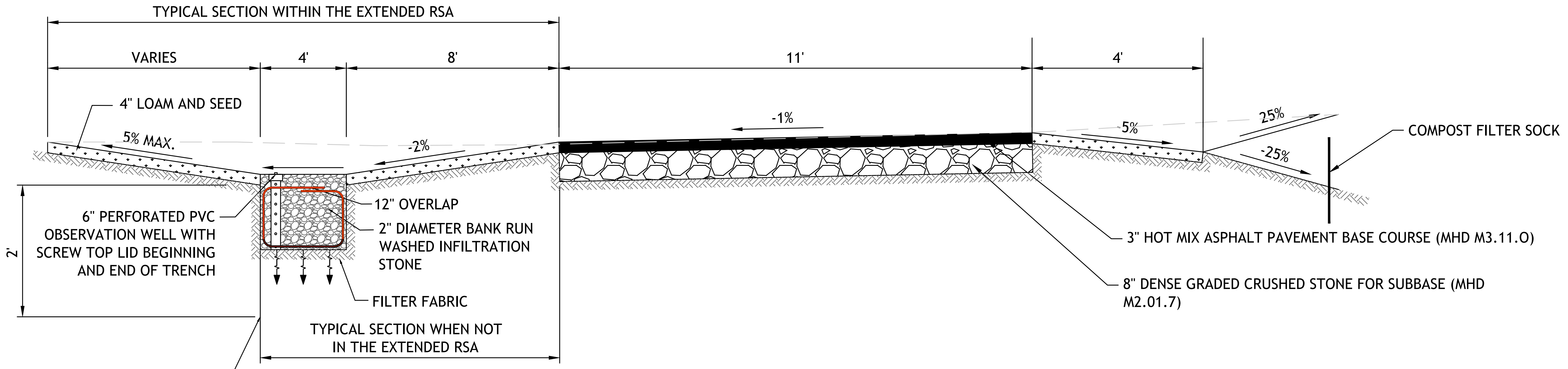
GRAPHIC SCALE
0 20' 40' 80'

DRAWING NO.
NOI.9

9 OF 11

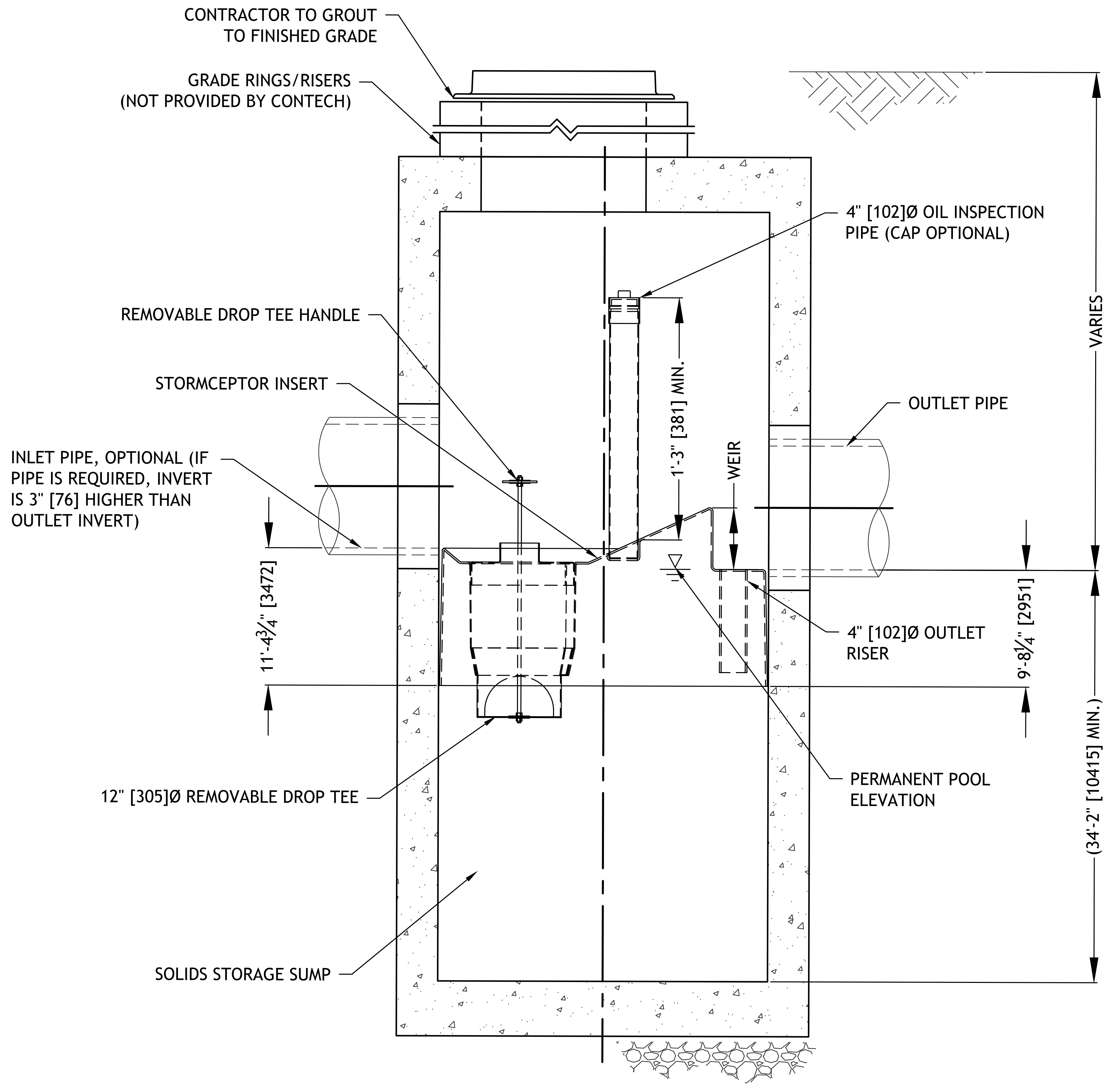


PLAN VIEW
TOP SLAB NOT SHOWN



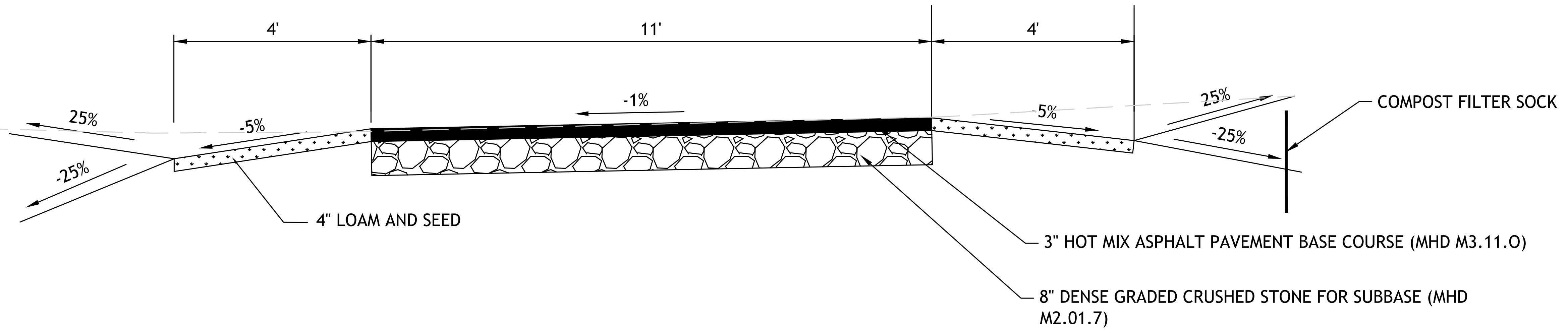
INFILTRATION TRENCH DETAIL
STA. 53+20 TO 58+50 BOTTOM ELEV. 55.71. DEPTH 18"
STA. 63+50 TO 68+80 BOTTOM ELEV. 55.00. DEPTH 18"
SCALE: NTS

TYPICAL SECTION WITHIN THE EXTENDED RSA
SCALE: NTS



SECTION A-A

WATER QUALITY UNIT DETAIL (WQU)
SCALE: N.T.S.



TYPICAL SECTION OUTSIDE OF EXTENDED RSA
SCALE: NTS

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	040 103-054 NOI DETAILS
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
TYPICAL SECTIONS AND DRAINAGE DETAILS

GRAPHIC SCALE
NTS

DRAWING NO.
NOI.10

10 OF 11

NEW ENGLAND WETLAND PLANTS, INC

820 WEST STREET, AMHERST, MA 01002
PHONE: 413-548-8000   FAX 413-549-4000
EMAIL: INFO@NEWP.COM   WEB ADDRESS: WWW.NEWP.COM

New England Conservation/Wildlife Mix

Botanical Name	Common Name	Indicator
Elymus virginicus	Virginia Wild Rye	FACW-
Schizachyrium scoparium	Little Bluestem	FACU
Andropogon gerardii	Big Bluestem	FAC
Festuca rubra	Red Fescue	FACU
Sorghastrum nutans	Indian Grass	UPL
Panicum virgatum	Switch Grass	FAC
Chamaecrista fasciculata	Partridge Pea	FACU
Desmodium canadense	Showy Tick Trefoil	FAC
Asclepias tuberosa	Butterfly Milkweed	NI
Bidens frondosa	Beggar Ticks	FACW
Eupatorium purpureum (Eutrochium maculatum)	Purple Joe Pye Weed	FAC
Rudbeckia hirta	Black Eyed Susan	FACU-
Aster pilosus (Symphyotrichum pilosum)	Heath (or Hairy) Aster	UPL
Solidago juncea	Early Goldenrod	

PRICE PER LB. $39.50 MIN. QUANITY 2 LBS. **TOTAL:** $79.00 APPLY: 25 LBS/ACRE :1750 sq ft/lb

The New England Conservation/Wildlife Mix provides a permanent cover of grasses, wildflowers, and legumes
For both good erosion control and wildlife habitat value. The mix is designed to be a no maintenance seeding, and is appropriate for cut and fill slopes, detention basin side slopes, and disturbed areas adjacent to commercial and residential projects.

New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, Plus SH and applicable taxes.

NEW ENGLAND WETLAND PLANTS, INC

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PHONE: 413-548-8000   FAX 413-549-4000
EMAIL: INFO@NEWP.COM   WEB ADDRESS: WWW.NEWP.COM

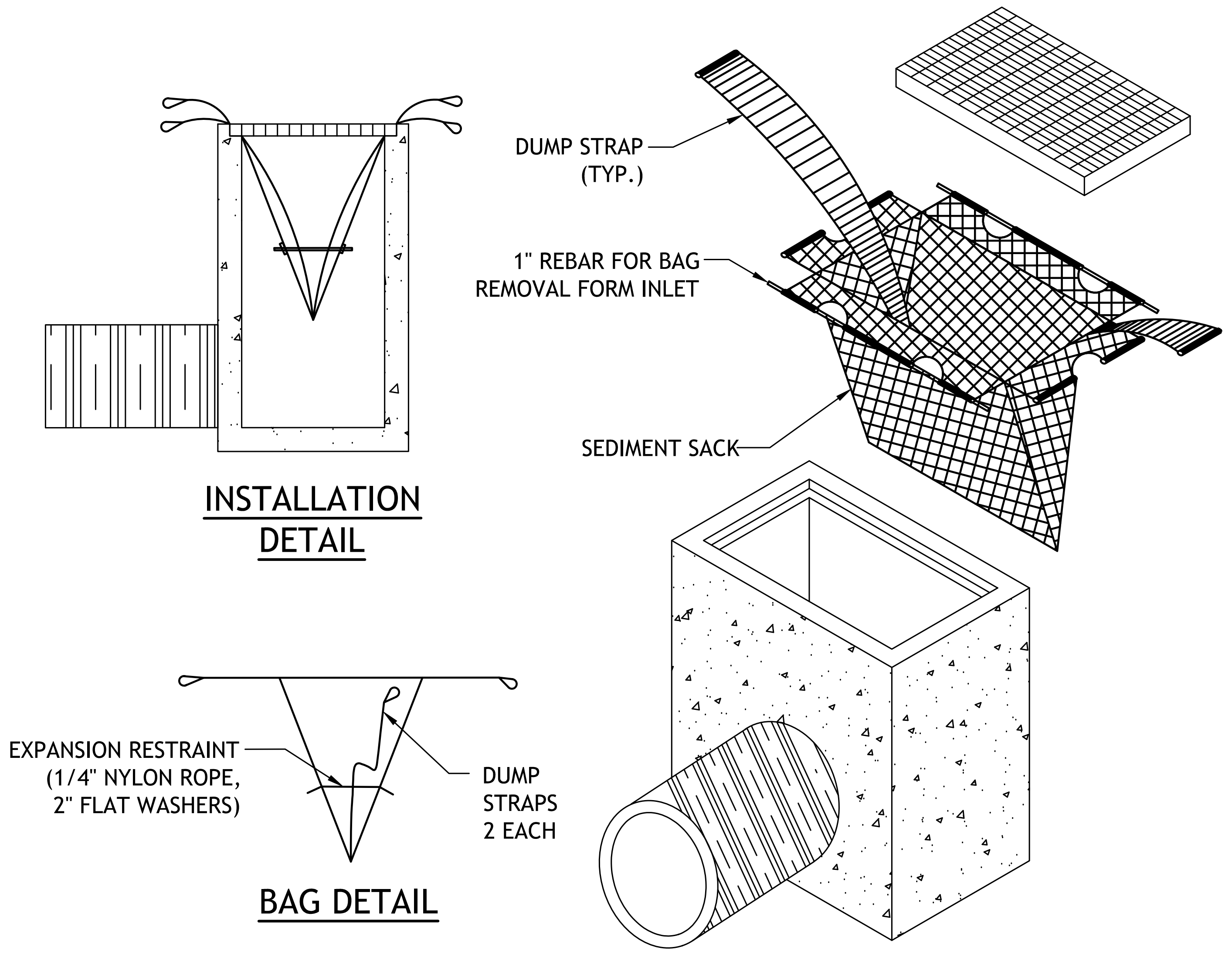
New England Erosion Control/Restoration Mix For Detention Basins and Moist Sites

Botanical Name	Common Name	Indicator
Elymus riparius	Riverbank Wild Rye	FACW
Schizachyrium scoparium	Little Bluestem	FACU
Festuca rubra	Red Fescue	FACU
Andropogon gerardii	Big Bluestem	FAC
Panicum virgatum	Switch Grass	FAC
Vernonia noveboracensis	New York Ironweed	FACW+
Agrostis perennans	Upland Bentgrass	FACU
Bidens frondosa	Beggar Ticks	FACW
Eupatorium maculatum (Eutrochium maculatum)	Spotted Joe Pye Weed	OBL
Eupatorium perfoliatum	Boneset	FACW
Aster novae-angliae (Symphyotrichum novae-anglia	New England Aster	FACW-
Scirpus cyperinus	Wool Grass	FACW
Juncus effusus	Soft Rush	FACW+

PRICE PER LB. $37.00 MIN. QUANITY 3 LBS. **TOTAL:** $111.00 APPLY: 35 LBS/ACRE :1250 sq ft/lb

The New England Erosion Control/Restoration Mix for Detention Basins and Moist Sites contains a selection of native grasses and wildflowers designed to colonize generally moist, recently disturbed sites where quick growth of vegetation is desired to stabilize the soil surface. It is an appropriate seed mix for ecologically sensitive restorations that require stabilization as well as long-term establishment of native vegetation. This mix is particularly appropriate for detention basins that do not hold standing water. Many of the plants in this mix can tolerate infrequent inundation, but not constant flooding. The mix may be applied by hand, by mechanical spreader, or by hydro-seeder. After sowing, lightly rake, roll or cultipack to insure good seed-to-soil contact. Best results are obtained with a Spring or late Summer seeding. Late Fall and Winter dormant seeding requires an increase in the application rate. A light mulching of clean, weed-free straw is recommended

New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, Plus SH and applicable taxes.



INSTALLATION DETAIL

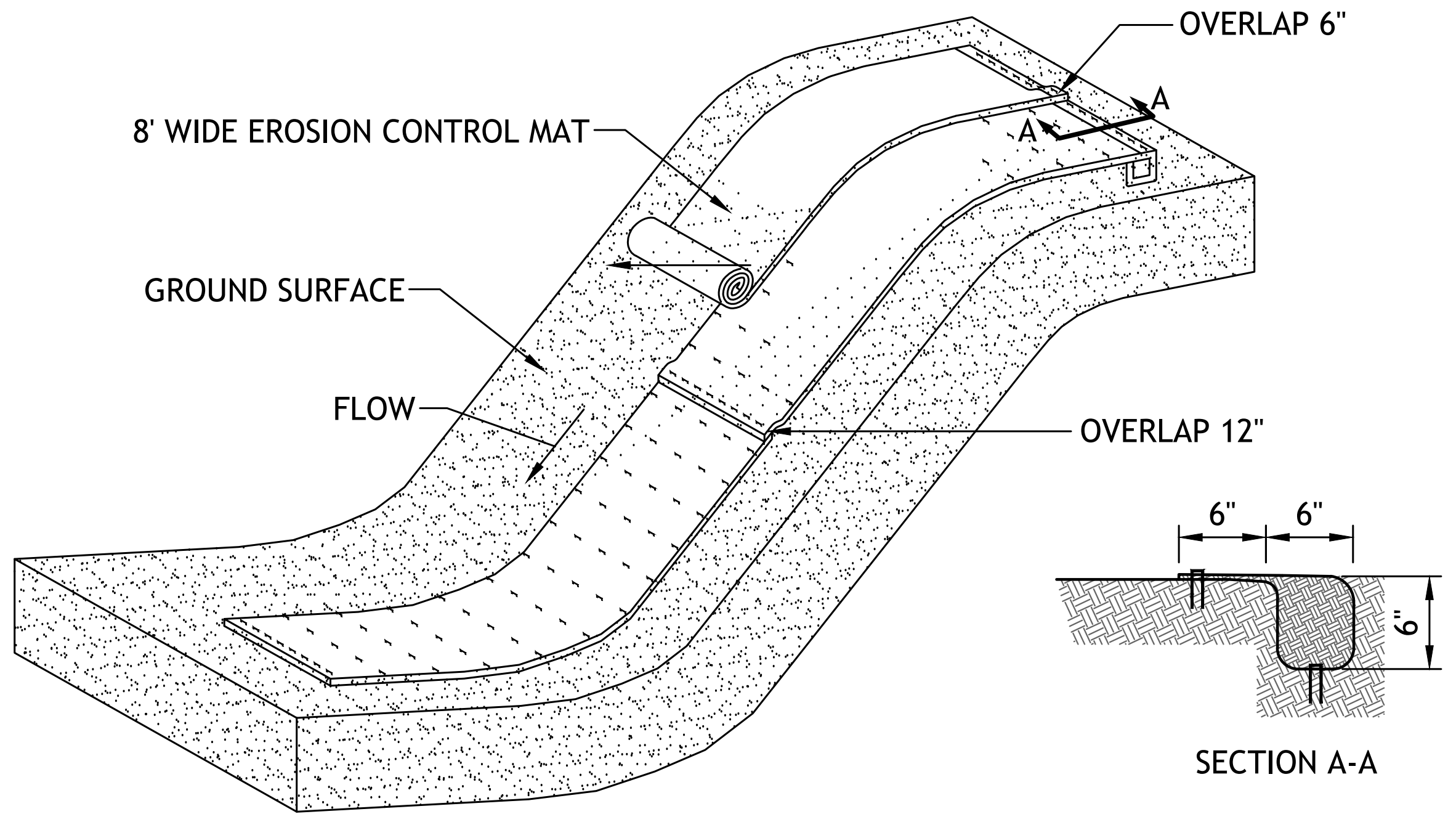
BAG DETAIL

CATCH BASIN INLET NOTES:

1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SEDIMENT SACK.
2. SEDIMENT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN THE CONSTRUCTION ZONE, INCLUDING NEW STRUCTURES, OR AS DIRECTED BY THE ENGINEER.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION SACKS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SEDIMENT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE THERE IS PLOW ACTIVITY. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

CATCH BASIN INLET PROTECTION

SCALE: N.T.S.



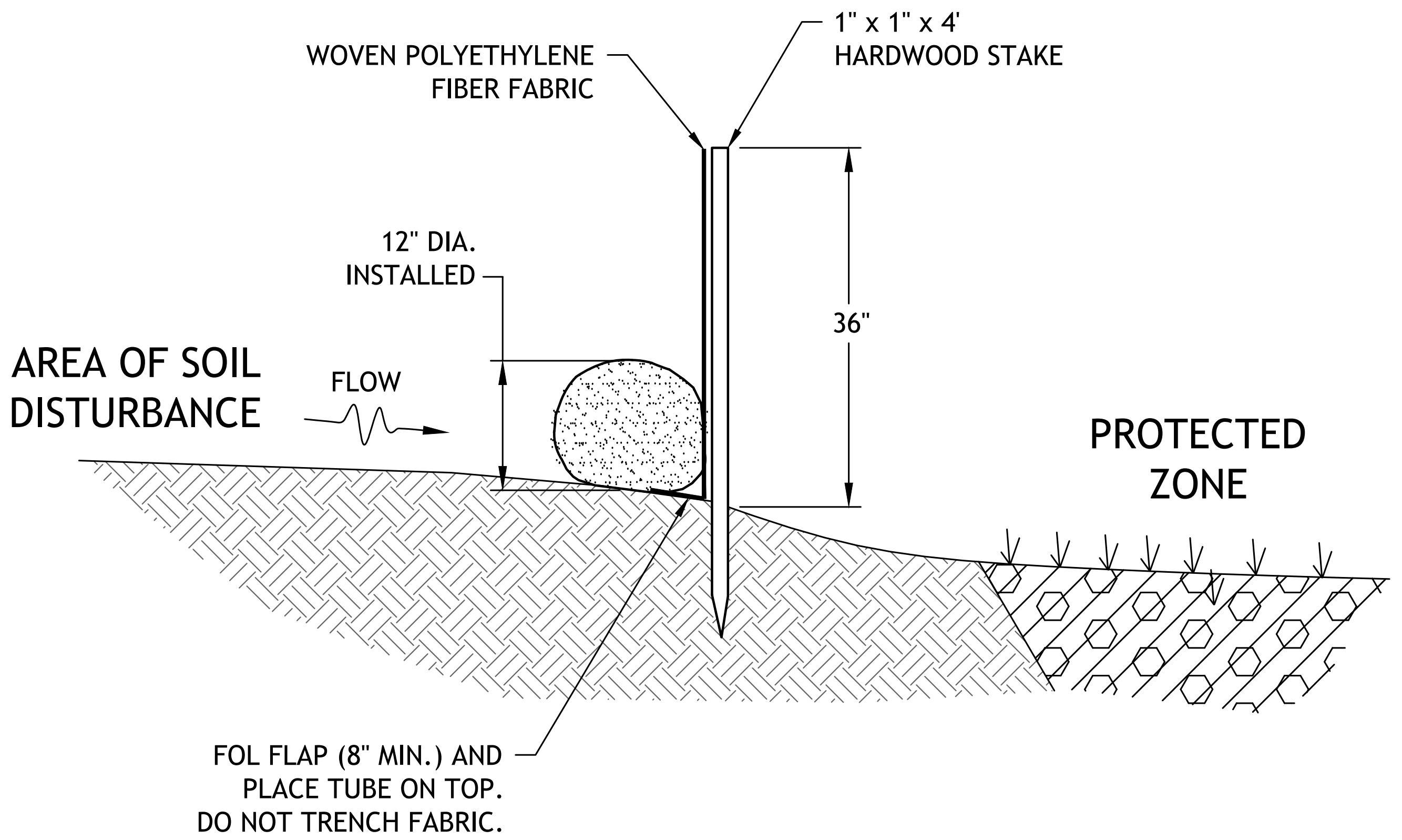
SECTION A-A

EROSION CONTROL MATTING NOTES:

1. PRIOR TO PLACING EROSION CONTROL MATTING, PREPARE THE SOIL BY RAKING AREA FREE OF CLODS AND LARGE STONES.
2. SEED, MULCH AND FERTILIZER SHALL BE DISTRIBUTED AS SPECIFIED OVER THE PREPARED SOIL PRIOR TO PLACING THE EROSION CONTROL MATTING.
3. ALL SEAMS SHALL BE OVERLAPPED A MINIMUM OF 6" AND SECURED WITH STAPLES 18" ON CENTER.
4. TO SECURE MAT TO GROUND, STAPLE RANDOMLY AT 24" INTERVALS THROUGHOUT
5. APPROXIMATELY 200 STAPLES PER ROLL
6. PLACE EROSION CONTROL MATTING AS DIRECTED BY THE ENGINEER AND ON SLOPES GREATER THAN 5:1.

EROSION CONTROL MATTING

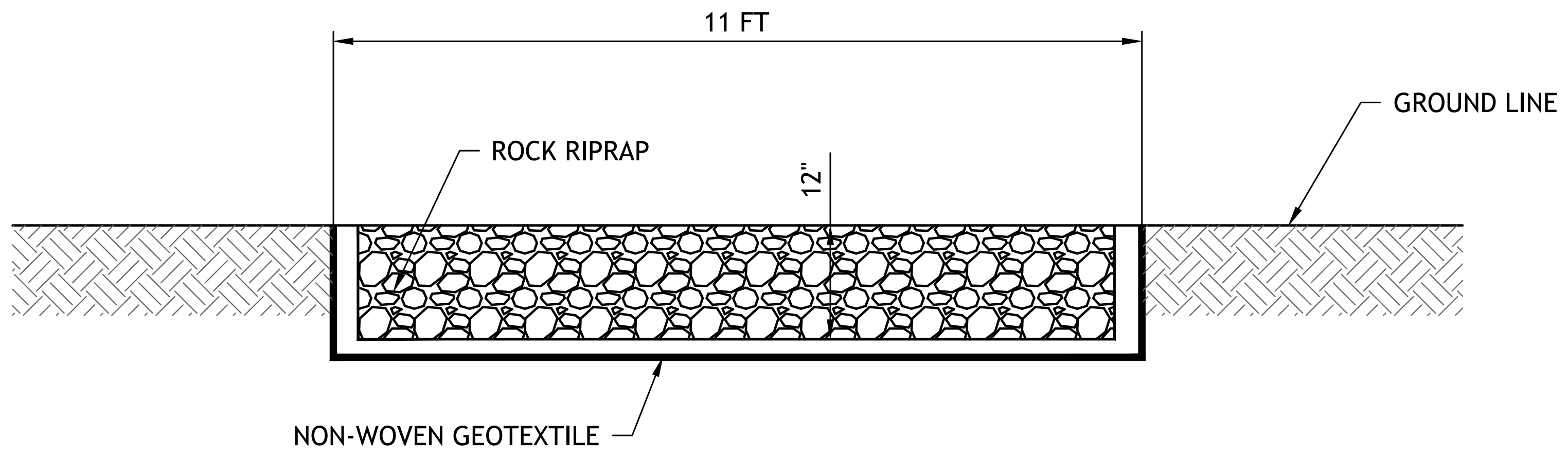
SCALE: N.T.S.



SECTION VIEW

COMPOST FILTER TUBE AND SILT FENCE

SCALE: N.T.S.



RIPRAP DETAILS

SCALE: N.T.S.

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NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
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1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
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DRAWN BY	SG
CHECKED BY	SJR
DATE	DECEMBER 2022
DRAWING SCALE	NTS

SHEET TITLE
DRAINAGE AND EROSION CONTROL DETAILS

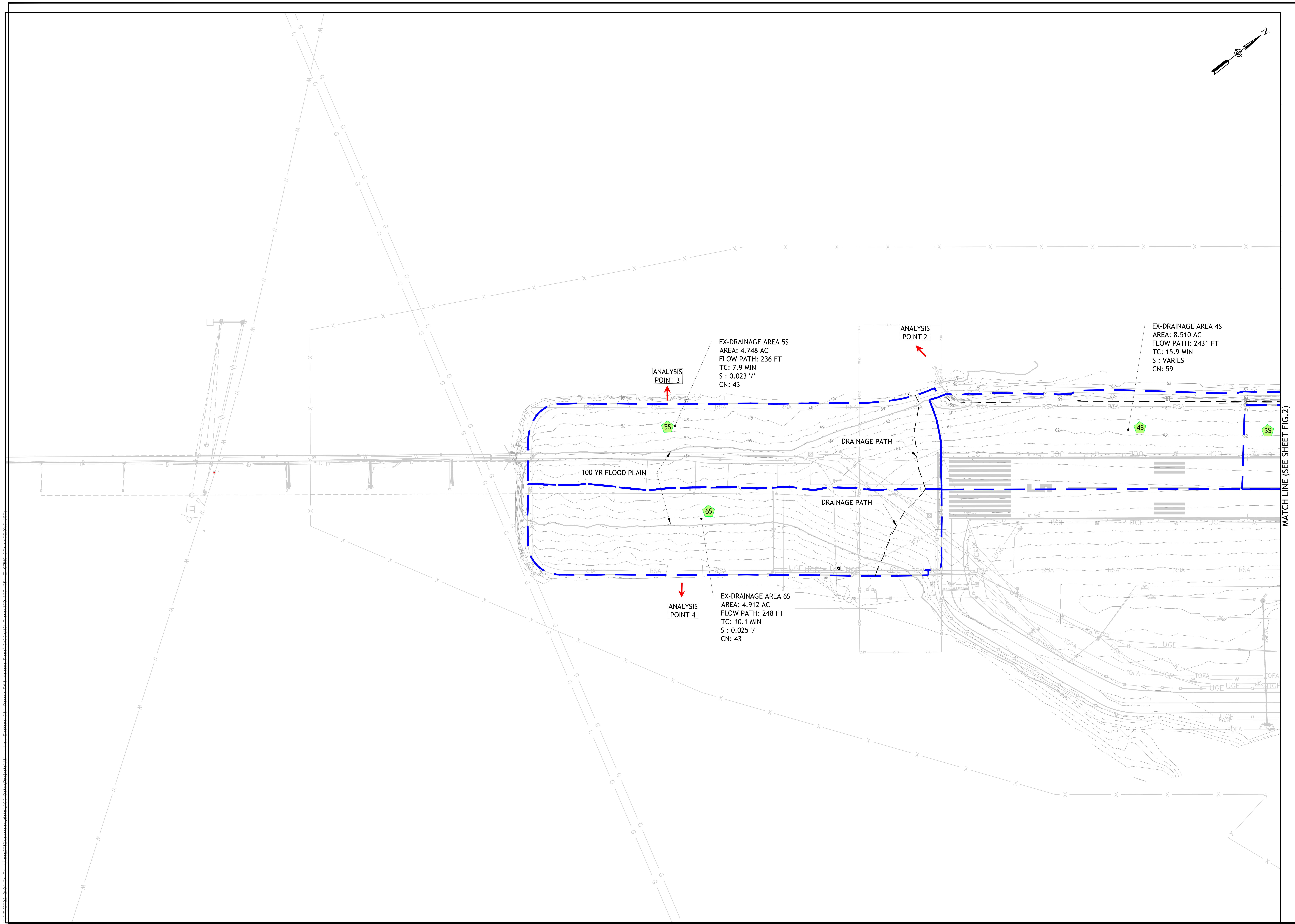
GRAPHIC SCALE
NTS

DRAWING NO.
NOI.11

11 OF 11

APPENDIX B

EXISTING HYDROCAD DRAINAGE CALCULATIONS



11/17/2022 2:04:04 PM \\asg2012\companydata\ASG Data\Projects\MA – New Bedford\054 Permit RW5 Access Road\CADD\NOI Plans\100 103-054 EXISTING DRAINAGE.DWG (SG)

AIRPORT SOLUTIONS GROUP, LLC
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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

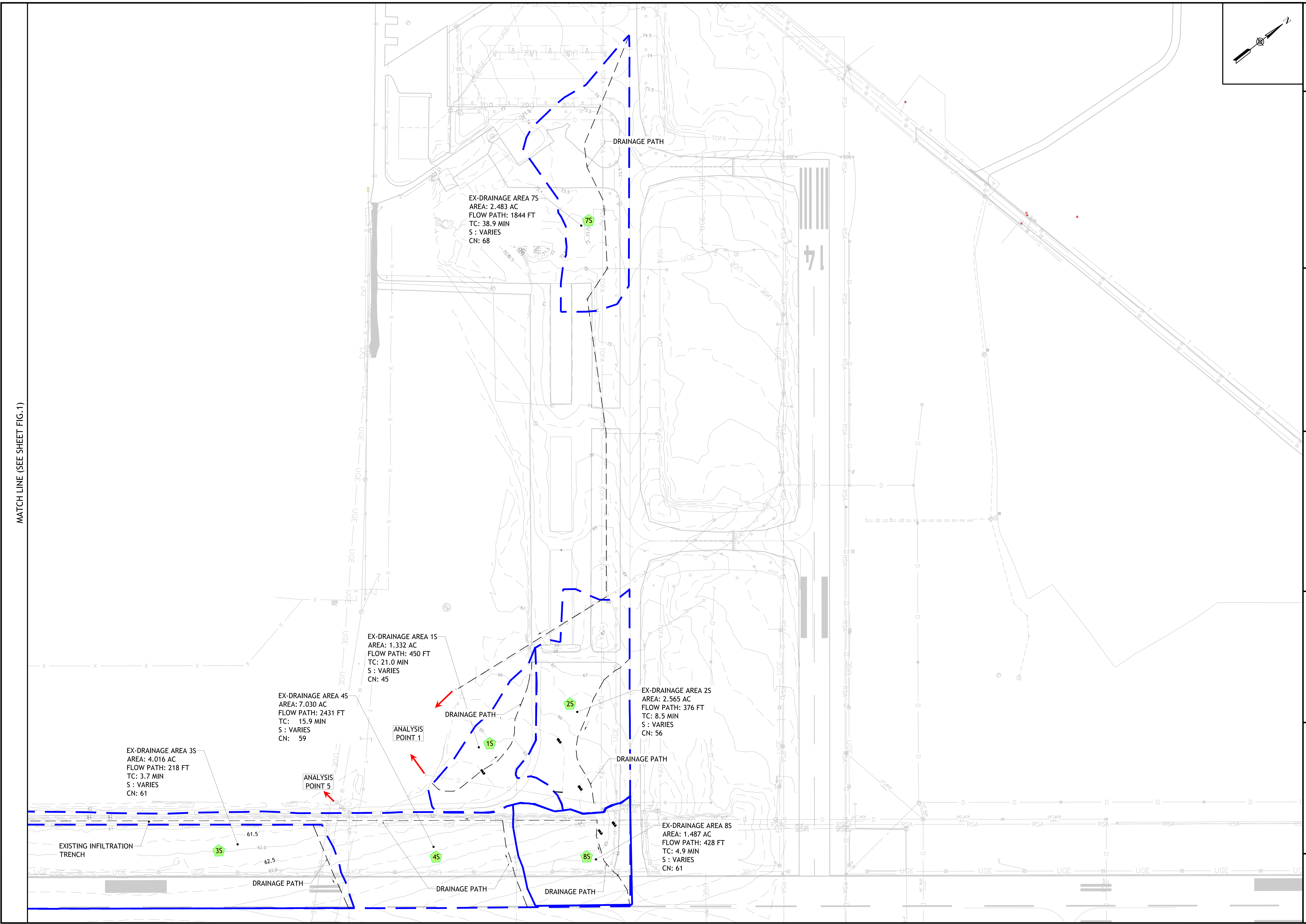
PROJECT NO.	103-054
CADD FILE	100 103-054 EXISTING DRAINAGE
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	NOVEMBER 2022
DRAWING SCALE	1" = 100'

SHEET TITLE
EXISTING DRAINAGE PLAN (1 OF 2)

GRAPHIC SCALE
0 50' 100' 200'

DRAWING NO.
FIG.1

1 OF 2



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CADD FILE	100 103-054 EXISTING DRAINAGE
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	NOVEMBER 2022
DRAWING SCALE	1" = 100'

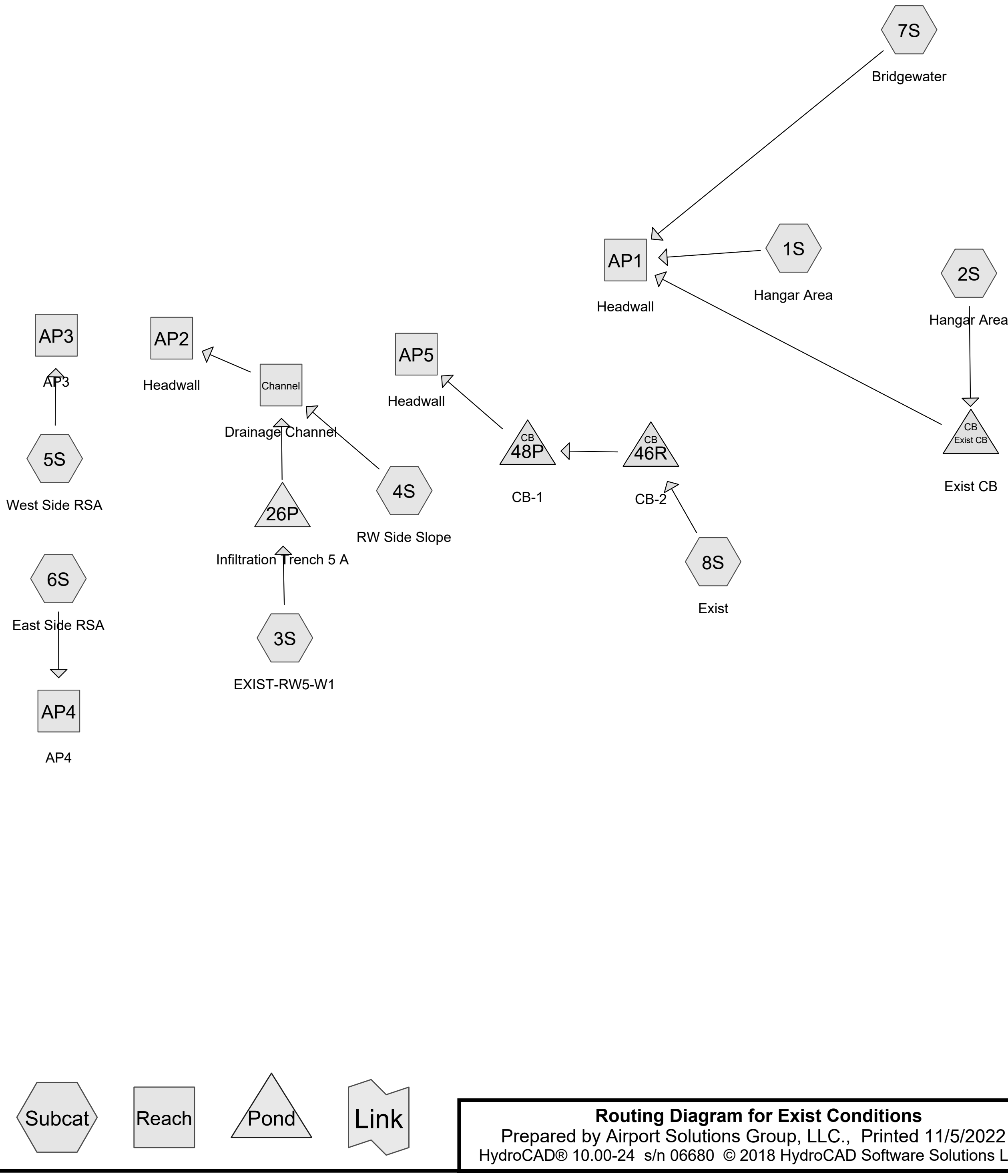
SHEET TITLE
EXISTING DRAINAGE PLAN (2 OF 2)

GRAPHIC SCALE
0 50' 100' 200'

DRAWING NO.
FIG.2

2 OF 2

11/18/2022 4:12:06 PM \\asg2012\companydata\ASG Data\Projects\MA – New Bedford\054 Permit RW5 Access Road\CADD\NOI Plans\100 103–054 EXISTING DRAINAGE.DWG (SJR)



Routing Diagram for Exist Conditions
Prepared by Airport Solutions Group, LLC., Printed 11/5/2022
HydroCAD® 10.00-24 s/n 06680 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
21.313	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
0.294	80	>75% Grass cover, Good, HSG D (4S)
0.162	96	Gravel Road (4S)
0.837	96	Gravel surface, HSG A (1S, 2S, 5S, 6S)
3.396	98	Paved parking, HSG A (2S, 3S, 7S)
2.016	98	RW Pavement (4S)
0.555	98	RW and TW Pavement (8S)
28.573	**54**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
25.546	HSG A	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	HSG B	
0.000	HSG C	
0.294	HSG D	4S
2.733	Other	4S, 8S
28.573		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
21.313	0.000	0.000	0.294	0.000	21.607	>75% Grass cover, Good	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	0.000	0.000	0.000	0.162	0.162	Gravel Road	4S
0.837	0.000	0.000	0.000	0.000	0.837	Gravel surface	1S, 2S, 5S, 6S
3.396	0.000	0.000	0.000	0.000	3.396	Paved parking	2S, 3S, 7S
0.000	0.000	0.000	0.000	2.016	2.016	RW Pavement	4S
0.000	0.000	0.000	0.000	0.555	0.555	RW and TW Pavement	8S
25.546	**0.000**	**0.000**	**0.294**	**2.733**	**28.573**	**TOTAL AREA**	

Summary for Subcatchment 1S: Hangar Area

Runoff = 0.02 cfs @ 14.79 hrs, Volume= 0.008 af, Depth> 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
0.136	96	Gravel surface, HSG A
1.196	39	>75% Grass cover, Good, HSG A
1.332	45	Weighted Average
1.332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	50	0.0040	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
6.3	400	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
21.0	450	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 0.58 cfs @ 12.21 hrs, Volume= 0.077 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
0.667	98	Paved parking, HSG A
0.084	96	Gravel surface, HSG A
1.814	39	>75% Grass cover, Good, HSG A
2.565	56	Weighted Average
1.898		74.00% Pervious Area
0.667		26.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	31	0.0150	1.03		**Sheet Flow, TW B** Smooth surfaces n= 0.011 P2= 3.60"
4.2	20	0.0150	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
3.8	325	0.0090	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.5	376	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

[49] Hint: Tc<2dt may require smaller dt

```
Runoff      =       2.26 cfs @   12.08 hrs,  Volume=         0.183 af,  Depth>  0.55"
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
1.519	98	Paved parking, HSG A
2.497	39	>75% Grass cover, Good, HSG A
4.016	61	Weighted Average
2.497		62.18% Pervious Area
1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0129	1.16		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.6	140	0.0160	0.89		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	218	Total			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 2.17 cfs @ 12.31 hrs, Volume= 0.272 af, Depth> 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	2.016	98	RW Pavement
*	0.162	96	Gravel Road
	4.558	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.030	59	Weighted Average
	5.014		71.32% Pervious Area
	2.016		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.0180	1.34		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	2,200	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
15.9	2,431	Total			

Summary for Subcatchment 5S: West Side RSA

Runoff = 0.04 cfs @ 15.11 hrs, Volume= 0.018 af, Depth> 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
4.434	39	>75% Grass cover, Good, HSG A
0.314	96	Gravel surface, HSG A
4.748	43	Weighted Average
4.748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 0.04 cfs @ 15.15 hrs, Volume= 0.018 af, Depth> 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
4.609	39	>75% Grass cover, Good, HSG A
0.303	96	Gravel surface, HSG A
4.912	43	Weighted Average
4.912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 1.26 cfs @ 12.60 hrs, Volume= 0.177 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
1.210	98	Paved parking, HSG A
1.273	39	>75% Grass cover, Good, HSG A
2.483	68	Weighted Average
1.273		51.27% Pervious Area
1.210		48.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
2.1	142	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	118	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	88	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.5	206	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.1	1,240	0.0010	2.04	3.60	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
38.9	1,844	Total			

Summary for Subcatchment 8S: Exist

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.82 cfs @ 12.10 hrs, Volume= 0.068 af, Depth> 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
	0.932	39	>75% Grass cover, Good, HSG A
	1.487	61	Weighted Average
	0.932		62.68% Pervious Area
	0.555		37.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total			

Summary for Reach AP1: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =        6.380 ac, 29.42% Impervious, Inflow Depth >   0.49"    for  2 event
Inflow      =        1.60 cfs @   12.51 hrs, Volume=          0.262 af
Outflow     =        1.60 cfs @   12.51 hrs, Volume=          0.262 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP2: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =        11.046 ac,  32.00% Impervious,  Inflow Depth >   0.27"    for  2 event
Inflow      =         1.04 cfs @   13.42 hrs,  Volume=            0.251 af
Outflow     =         1.04 cfs @   13.42 hrs,  Volume=            0.251 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP3: AP3

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =      4.748 ac,    0.00% Impervious,  Inflow Depth >   0.04"    for  2 event
Inflow      =      0.04 cfs @   15.11 hrs,  Volume=          0.018 af
Outflow     =      0.04 cfs @   15.11 hrs,  Volume=          0.018 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP4: AP4

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =        4.912 ac,    0.00% Impervious,  Inflow Depth >   0.04"    for  2 event
Inflow       =       0.04 cfs @   15.15 hrs,  Volume=            0.018 af
Outflow      =       0.04 cfs @   15.15 hrs,  Volume=            0.018 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP5: Headwall

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =          1.487 ac,  37.32% Impervious,  Inflow Depth >   0.55"    for  2 event
Inflow      =         0.82 cfs @   12.10 hrs,  Volume=            0.068 af
Outflow     =         0.82 cfs @   12.10 hrs,  Volume=            0.068 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach Channel: Drainage Channel

[81] Warning: Exceeded Pond 26P by 6.75' @ 5.00 hrs

```
Inflow Area =        11.046 ac, 32.00% Impervious, Inflow Depth >   0.30"    for  2 event
Inflow      =          2.17 cfs @   12.31 hrs, Volume=           0.277 af
Outflow     =          1.04 cfs @   13.42 hrs, Volume=           0.251 af,  Atten= 52%,  Lag= 66.6 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 41.5 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 61.2 min

Peak Storage= 2,604 cf @ 12.72 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 70.16 cfs

4.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 20.00'
Length= 2,220.0' Slope= 0.0020 '/'
Inlet Invert= 64.00', Outlet Invert= 59.65'

Summary for Pond 26P: Infiltration Trench 5 A

```
Inflow Area =      4.016 ac,  37.82% Impervious,  Inflow Depth >   0.55"    for  2 event
Inflow      =      2.26 cfs @   12.08 hrs,  Volume=          0.183 af
Outflow     =      0.31 cfs @   13.45 hrs,  Volume=          0.160 af,  Atten= 86%,  Lag= 81.8 min
Discarded  =       0.23 cfs @   13.45 hrs,  Volume=          0.155 af
Primary     =      0.08 cfs @   13.45 hrs,  Volume=          0.005 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 59.25' @ 13.45 hrs   Surf.Area= 4,055 sf   Storage= 2,915 cf

Plug-Flow detention time= 148.4 min calculated for 0.160 af (87% of inflow)
Center-of-Mass det. time= 109.2 min ( 954.3 - 845.1 )

Volume       Invert    Avail.Storage   Storage Description
   #1        57.25'        3,244 cf    60.0" W x 24.0" H  Box Pipe Storage
                                       L= 811.0'  S= 0.0005 '/'
                                       8,110 cf Overall  x 40.0% Voids

Device   Routing          Invert   Outlet Devices
   #1    Discarded        57.25'   2.410 in/hr Exfiltration over Surface area
                                   Conductivity to Groundwater Elevation = 0.00'
   #2    Primary          59.25'   811.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                   2.2' Crest Height

Discarded OutFlow  Max=0.23 cfs @ 13.45 hrs  HW=59.25'   (Free Discharge)
⮤1=Exfiltration  ( Controls 0.23 cfs)

Primary OutFlow  Max=0.01 cfs @ 13.45 hrs  HW=59.25'   (Free Discharge)
⮤2=Sharp-Crested Rectangular Weir (Weir Controls 0.01 cfs @ 0.05 fps)
```

Summary for Pond 46R: CB-2

[57] Hint: Peaked at 59.42' (Flood elevation advised)

Inflow Area = 1.487 ac, 37.32% Impervious, Inflow Depth > 0.55" for 2 event
Inflow = 0.82 cfs @ 12.10 hrs, Volume= 0.068 af
Outflow = 0.82 cfs @ 12.10 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.0 min
Primary = 0.82 cfs @ 12.10 hrs, Volume= 0.068 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.42' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 409.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 58.66' S= 0.0002 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=0.81 cfs @ 12.10 hrs HW=59.42' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.81 cfs @ 1.27 fps)

Summary for Pond 48P: CB-1

```
[57] Hint: Peaked at 59.07' (Flood elevation advised)
[79] Warning: Submerged Pond 46R Primary device # 1 INLET by 0.34'

Inflow Area =      1.487 ac,  37.32% Impervious,  Inflow Depth >   0.55"    for  2 event
Inflow      =      0.82 cfs @   12.10 hrs,  Volume=         0.068 af
Outflow     =      0.82 cfs @   12.10 hrs,  Volume=         0.068 af,  Atten= 0%,  Lag= 0.0 min
Primary     =      0.82 cfs @   12.10 hrs,  Volume=         0.068 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.07' @ 12.10 hrs

Device  Routing      Invert  Outlet Devices
  #1    Primary      58.57'  24.0"  Round Culvert
                             L= 36.0'   RCP, groove end projecting,  Ke= 0.200
                             Inlet / Outlet Invert= 58.57' / 58.56'   S= 0.0003 '/'   Cc= 0.900
                             n= 0.011  Concrete pipe, straight & clean,  Flow Area= 3.14 sf

Primary OutFlow  Max=0.81 cfs @ 12.10 hrs  HW=59.07'   (Free Discharge)
└─1=Culvert  (Barrel Controls 0.81 cfs @ 2.01 fps)
```

Summary for Pond Exist CB: Exist CB

```
[57] Hint: Peaked at 59.00' (Flood elevation advised)

Inflow Area =        2.565 ac,  26.00% Impervious,  Inflow Depth >   0.36"    for  2 event
Inflow      =       0.58 cfs @   12.21 hrs,  Volume=           0.077 af
Outflow     =       0.58 cfs @   12.21 hrs,  Volume=           0.077 af,  Atten= 0%,  Lag= 0.0 min
Primary     =       0.58 cfs @   12.21 hrs,  Volume=           0.077 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.00' @ 12.21 hrs

Device  Routing          Invert  Outlet Devices
   #1   Primary          58.73'  24.0"  Round Culvert
                                 L= 425.0'   RCP, groove end projecting,  Ke= 0.200
                                 Inlet / Outlet Invert= 58.73' / 52.36'   S= 0.0150 '/'   Cc= 0.900
                                 n= 0.011  Concrete pipe, straight & clean,  Flow Area= 3.14 sf

Primary OutFlow  Max=0.58 cfs @ 12.21 hrs  HW=59.00'   (Free Discharge)
└─1=Culvert  (Inlet Controls 0.58 cfs @ 2.23 fps)
```

Summary for Subcatchment 1S: Hangar Area

Runoff = 0.18 cfs @ 12.56 hrs, Volume= 0.035 af, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
0.136	96	Gravel surface, HSG A
1.196	39	>75% Grass cover, Good, HSG A
1.332	45	Weighted Average
1.332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	50	0.0040	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
6.3	400	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
21.0	450	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 2.03 cfs @ 12.15 hrs, Volume= 0.179 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
0.667	98	Paved parking, HSG A
0.084	96	Gravel surface, HSG A
1.814	39	>75% Grass cover, Good, HSG A
2.565	56	Weighted Average
1.898		74.00% Pervious Area
0.667		26.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	31	0.0150	1.03		**Sheet Flow, TW B** Smooth surfaces n= 0.011 P2= 3.60"
4.2	20	0.0150	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
3.8	325	0.0090	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.5	376	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.61 cfs @ 12.07 hrs, Volume= 0.378 af, Depth> 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
1.519	98	Paved parking, HSG A
2.497	39	>75% Grass cover, Good, HSG A
4.016	61	Weighted Average
2.497		62.18% Pervious Area
1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0129	1.16		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.6	140	0.0160	0.89		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	218	Total			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 5.82 cfs @ 12.26 hrs, Volume= 0.588 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	2.016	98	RW Pavement
*	0.162	96	Gravel Road
	4.558	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.030	59	Weighted Average
	5.014		71.32% Pervious Area
	2.016		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.0180	1.34		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	2,200	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
15.9	2,431	Total			

Summary for Subcatchment 5S: West Side RSA

Runoff = 0.48 cfs @ 12.41 hrs, Volume= 0.098 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
4.434	39	>75% Grass cover, Good, HSG A
0.314	96	Gravel surface, HSG A
4.748	43	Weighted Average
4.748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 0.48 cfs @ 12.45 hrs, Volume= 0.101 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
4.609	39	>75% Grass cover, Good, HSG A
0.303	96	Gravel surface, HSG A
4.912	43	Weighted Average
4.912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 2.43 cfs @ 12.58 hrs, Volume= 0.325 af, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
1.210	98	Paved parking, HSG A
1.273	39	>75% Grass cover, Good, HSG A
2.483	68	Weighted Average
1.273		51.27% Pervious Area
1.210		48.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
2.1	142	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	118	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	88	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.5	206	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.1	1,240	0.0010	2.04	3.60	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
38.9	1,844	Total			

Summary for Subcatchment 8S: Exist

[49] Hint: Tc<2dt may require smaller dt

```
Runoff      =        1.98 cfs @   12.09 hrs,  Volume=           0.140 af,  Depth>  1.13"
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
	0.932	39	>75% Grass cover, Good, HSG A
	1.487	61	Weighted Average
	0.932		62.68% Pervious Area
	0.555		37.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total			

Summary for Reach AP1: Headwall

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      6.380 ac, 29.42% Impervious, Inflow Depth >  1.01"   for 10 event
Inflow      =      3.49 cfs @  12.47 hrs, Volume=        0.539 af
Outflow     =      3.49 cfs @  12.47 hrs, Volume=        0.539 af, Atten= 0%, Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach AP2: Headwall

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        11.046 ac,  32.00% Impervious,  Inflow Depth >   0.73"    for  10 event
Inflow       =         4.09 cfs @   13.02 hrs,  Volume=            0.669 af
Outflow      =         4.09 cfs @   13.02 hrs,  Volume=            0.669 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach AP3: AP3

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      4.748 ac,   0.00% Impervious,  Inflow Depth >   0.25"   for  10 event
Inflow      =      0.48 cfs @  12.41 hrs,  Volume=          0.098 af
Outflow     =      0.48 cfs @  12.41 hrs,  Volume=          0.098 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach AP4: AP4

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        4.912 ac,    0.00% Impervious,  Inflow Depth >   0.25"    for  10 event
Inflow      =        0.48 cfs @   12.45 hrs,  Volume=           0.101 af
Outflow     =        0.48 cfs @   12.45 hrs,  Volume=           0.101 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach AP5: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =         1.487 ac,  37.32% Impervious,  Inflow Depth >   1.13"    for  10 event
Inflow      =         1.98 cfs @   12.09 hrs,  Volume=           0.140 af
Outflow     =         1.98 cfs @   12.09 hrs,  Volume=           0.140 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach Channel: Drainage Channel

```
[81] Warning: Exceeded Pond 26P by 6.75' @ 5.00 hrs

Inflow Area =      11.046 ac,  32.00% Impervious,  Inflow Depth >   0.76"    for  10 event
Inflow      =        7.04 cfs @   12.28 hrs,  Volume=          0.703 af
Outflow     =        4.09 cfs @   13.02 hrs,  Volume=          0.669 af,  Atten= 42%,  Lag= 44.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.36 fps,  Min. Travel Time= 27.3 min
Avg. Velocity = 0.78 fps,  Avg. Travel Time= 47.6 min

Peak Storage= 6,690 cf @ 12.57 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 2.00'  Flow Area= 24.0 sf,  Capacity= 70.16 cfs

4.00'  x  2.00'  deep channel,  n= 0.025  Earth, clean & winding
Side Slope Z-value= 4.0 '/'   Top Width= 20.00'
Length= 2,220.0'   Slope= 0.0020 '/'
Inlet Invert= 64.00',  Outlet Invert= 59.65'
```

‡

Summary for Pond 26P: Infiltration Trench 5 A

```
Inflow Area =      4.016 ac, 37.82% Impervious, Inflow Depth >  1.13"   for 10 event
Inflow      =     5.61 cfs @  12.07 hrs, Volume=        0.378 af
Outflow     =     1.65 cfs @  12.34 hrs, Volume=        0.277 af, Atten= 71%, Lag= 16.5 min
Discarded   =     0.23 cfs @  12.34 hrs, Volume=        0.161 af
Primary     =     1.42 cfs @  12.34 hrs, Volume=        0.115 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 59.25' @ 12.34 hrs   Surf.Area= 4,055 sf   Storage= 2,921 cf

Plug-Flow detention time= 127.2 min calculated for 0.277 af (73% of inflow)
Center-of-Mass det. time= 59.3 min ( 885.6 - 826.4 )

Volume     Invert    Avail.Storage  Storage Description
  #1       57.25'        3,244 cf   60.0" W x 24.0" H  Box Pipe Storage
                                    L= 811.0'  S= 0.0005 '/'
                                    8,110 cf Overall  x 40.0% Voids

Device  Routing        Invert   Outlet Devices
  #1    Discarded      57.25'   2.410 in/hr Exfiltration over Surface area
                                Conductivity to Groundwater Elevation = 0.00'
  #2    Primary        59.25'   811.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                2.2' Crest Height

Discarded OutFlow  Max=0.23 cfs @ 12.34 hrs  HW=59.25'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.23 cfs)

Primary OutFlow  Max=0.60 cfs @ 12.34 hrs  HW=59.25'   (Free Discharge)
└─2=Sharp-Crested Rectangular Weir (Weir Controls 0.60 cfs @ 0.20 fps)
```

Summary for Pond 46R: CB-2

[57] Hint: Peaked at 59.76' (Flood elevation advised)

Inflow Area = 1.487 ac, 37.32% Impervious, Inflow Depth > 1.13" for 10 event
Inflow = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af
Outflow = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min
Primary = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.76' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 409.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 58.66' S= 0.0002 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=1.93 cfs @ 12.09 hrs HW=59.75' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.93 cfs @ 1.75 fps)

Summary for Pond 48P: CB-1

[57] Hint: Peaked at 59.33' (Flood elevation advised)
[79] Warning: Submerged Pond 46R Primary device # 1 INLET by 0.60'

Inflow Area = 1.487 ac, 37.32% Impervious, Inflow Depth > 1.13" for 10 event
Inflow = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af
Outflow = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min
Primary = 1.98 cfs @ 12.09 hrs, Volume= 0.140 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.33' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.57'	**24.0" Round Culvert** L= 36.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.57' / 58.56' S= 0.0003 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=1.93 cfs @ 12.09 hrs HW=59.32' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.93 cfs @ 2.68 fps)

Summary for Pond Exist CB: Exist CB

```
[57] Hint: Peaked at 59.26' (Flood elevation advised)

Inflow Area =      2.565 ac, 26.00% Impervious, Inflow Depth >  0.84"   for 10 event
Inflow      =      2.03 cfs @  12.15 hrs, Volume=        0.179 af
Outflow     =      2.03 cfs @  12.15 hrs, Volume=        0.179 af, Atten= 0%, Lag= 0.0 min
Primary     =      2.03 cfs @  12.15 hrs, Volume=        0.179 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.26' @ 12.15 hrs

Device  Routing       Invert  Outlet Devices
  #1    Primary       58.73'  24.0"  Round Culvert
                              L= 425.0'  RCP, groove end projecting,  Ke= 0.200
                              Inlet / Outlet Invert= 58.73' / 52.36'  S= 0.0150 '/'  Cc= 0.900
                              n= 0.011  Concrete pipe, straight & clean,  Flow Area= 3.14 sf

Primary OutFlow  Max=2.03 cfs @ 12.15 hrs  HW=59.25'  (Free Discharge)
└─1=Culvert  (Inlet Controls 2.03 cfs @ 3.08 fps)
```

Summary for Subcatchment 1S: Hangar Area

Runoff = 1.02 cfs @ 12.37 hrs, Volume= 0.125 af, Depth> 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
0.136	96	Gravel surface, HSG A
1.196	39	>75% Grass cover, Good, HSG A
1.332	45	Weighted Average
1.332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	50	0.0040	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
6.3	400	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
21.0	450	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 5.82 cfs @ 12.13 hrs, Volume= 0.444 af, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
0.667	98	Paved parking, HSG A
0.084	96	Gravel surface, HSG A
1.814	39	>75% Grass cover, Good, HSG A
2.565	56	Weighted Average
1.898		74.00% Pervious Area
0.667		26.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	31	0.0150	1.03		**Sheet Flow, TW B** Smooth surfaces n= 0.011 P2= 3.60"
4.2	20	0.0150	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.60"
3.8	325	0.0090	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.5	376	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 13.57 cfs @ 12.06 hrs, Volume= 0.854 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
1.519	98	Paved parking, HSG A
2.497	39	>75% Grass cover, Good, HSG A
4.016	61	Weighted Average
2.497		62.18% Pervious Area
1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0129	1.16		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.6	140	0.0160	0.89		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	218	Total			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 14.97 cfs @ 12.23 hrs, Volume= 1.377 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	2.016	98	RW Pavement
*	0.162	96	Gravel Road
	4.558	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.030	59	Weighted Average
	5.014		71.32% Pervious Area
	2.016		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.0180	1.34		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	2,200	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
15.9	2,431	Total			

Summary for Subcatchment 5S: West Side RSA

Runoff = 3.98 cfs @ 12.15 hrs, Volume= 0.389 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
4.434	39	>75% Grass cover, Good, HSG A
0.314	96	Gravel surface, HSG A
4.748	43	Weighted Average
4.748		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 3.79 cfs @ 12.19 hrs, Volume= 0.402 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
4.609	39	>75% Grass cover, Good, HSG A
0.303	96	Gravel surface, HSG A
4.912	43	Weighted Average
4.912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 5.04 cfs @ 12.55 hrs, Volume= 0.662 af, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
1.210	98	Paved parking, HSG A
1.273	39	>75% Grass cover, Good, HSG A
2.483	68	Weighted Average
1.273		51.27% Pervious Area
1.210		48.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
2.1	142	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	118	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	88	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.5	206	0.0010	0.22		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.1	1,240	0.0010	2.04	3.60	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
38.9	1,844	Total			

Summary for Subcatchment 8S: Exist

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.76 cfs @ 12.08 hrs, Volume= 0.316 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
	0.932	39	>75% Grass cover, Good, HSG A
	1.487	61	Weighted Average
	0.932		62.68% Pervious Area
	0.555		37.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total			

Summary for Reach AP1: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =        6.380 ac,  29.42% Impervious,  Inflow Depth >   2.32"    for  100 event
Inflow       =        8.36 cfs @   12.40 hrs,  Volume=          1.232 af
Outflow      =        8.36 cfs @   12.40 hrs,  Volume=          1.232 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP2: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =      11.046 ac,  32.00% Impervious,  Inflow Depth >   2.12"    for  100 event
Inflow      =      16.01 cfs @   12.70 hrs,  Volume=           1.953 af
Outflow     =      16.01 cfs @   12.70 hrs,  Volume=           1.953 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP3: AP3

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =       4.748 ac,    0.00% Impervious,  Inflow Depth >   0.98"    for  100 event
Inflow      =       3.98 cfs @   12.15 hrs,  Volume=           0.389 af
Outflow     =       3.98 cfs @   12.15 hrs,  Volume=           0.389 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach AP4: AP4

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =          4.912 ac,    0.00% Impervious,  Inflow Depth >   0.98"    for  100 event
Inflow       =          3.79 cfs @   12.19 hrs,  Volume=            0.402 af
Outflow      =          3.79 cfs @   12.19 hrs,  Volume=            0.402 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach AP5: Headwall

```
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =       1.487 ac,  37.32% Impervious,  Inflow Depth >   2.55"    for  100 event
Inflow      =       4.76 cfs @   12.08 hrs,  Volume=          0.316 af
Outflow     =       4.76 cfs @   12.08 hrs,  Volume=          0.316 af,  Atten= 0%,  Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
```

Summary for Reach Channel: Drainage Channel

[81] Warning: Exceeded Pond 26P by 6.75' @ 5.00 hrs

```
Inflow Area =        11.046 ac,  32.00% Impervious,  Inflow Depth >   2.18"    for  100 event
Inflow      =        21.89 cfs @   12.10 hrs,  Volume=            2.006 af
Outflow     =        16.01 cfs @   12.70 hrs,  Volume=            1.953 af,  Atten= 27%,  Lag= 36.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.99 fps, Min. Travel Time= 18.6 min
Avg. Velocity = 0.96 fps, Avg. Travel Time= 38.4 min

Peak Storage= 17,920 cf @ 12.39 hrs
Average Depth at Peak Storage= 1.01'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 70.16 cfs

4.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 20.00'
Length= 2,220.0' Slope= 0.0020 '/'
Inlet Invert= 64.00', Outlet Invert= 59.65'

‡

Summary for Pond 26P: Infiltration Trench 5 A

```
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =      4.016 ac,  37.82% Impervious,  Inflow Depth >   2.55"    for  100 event
Inflow      =     13.57 cfs @   12.06 hrs,  Volume=          0.854 af
Outflow     =     14.00 cfs @   12.06 hrs,  Volume=          0.808 af,  Atten= 0%,  Lag= 0.0 min
Discarded   =      0.23 cfs @   12.06 hrs,  Volume=          0.180 af
Primary     =     13.77 cfs @   12.06 hrs,  Volume=          0.629 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 59.28' @ 12.06 hrs   Surf.Area= 4,055 sf   Storage= 2,960 cf

Plug-Flow detention time= 25.9 min calculated for 0.808 af (95% of inflow)
Center-of-Mass det. time= 6.9 min ( 814.7 - 807.7 )

Volume      Invert    Avail.Storage   Storage Description
  #1        57.25'         3,244 cf   60.0" W x 24.0" H  Box Pipe Storage
                                      L= 811.0'  S= 0.0005 '/'
                                      8,110 cf Overall  x 40.0% Voids

Device   Routing          Invert   Outlet Devices
  #1     Discarded        57.25'   2.410 in/hr Exfiltration over Surface area
                                   Conductivity to Groundwater Elevation = 0.00'
  #2     Primary          59.25'   811.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                   2.2' Crest Height

Discarded OutFlow  Max=0.23 cfs @ 12.06 hrs  HW=59.28'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.23 cfs)

Primary OutFlow  Max=12.58 cfs @ 12.06 hrs  HW=59.28'   (Free Discharge)
└─2=Sharp-Crested Rectangular Weir (Weir Controls 12.58 cfs @ 0.55 fps)
```

Summary for Pond 46R: CB-2

[57] Hint: Peaked at 60.31' (Flood elevation advised)

```
Inflow Area =       1.487 ac,  37.32% Impervious,  Inflow Depth >   2.55"    for  100 event
Inflow      =      4.76 cfs @   12.08 hrs,  Volume=           0.316 af
Outflow     =      4.76 cfs @   12.08 hrs,  Volume=           0.316 af,  Atten= 0%,  Lag= 0.0 min
Primary     =      4.76 cfs @   12.08 hrs,  Volume=           0.316 af
```

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 60.31' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 409.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 58.66' S= 0.0002 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=4.61 cfs @ 12.08 hrs HW=60.29' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 4.61 cfs @ 2.42 fps)

Summary for Pond 48P: CB-1

```
[57] Hint: Peaked at 59.75' (Flood elevation advised)
[79] Warning: Submerged Pond 46R Primary device # 1 INLET by 1.01'

Inflow Area =       1.487 ac, 37.32% Impervious, Inflow Depth >  2.55"   for 100 event
Inflow      =      4.76 cfs @  12.08 hrs, Volume=        0.316 af
Outflow     =      4.76 cfs @  12.08 hrs, Volume=        0.316 af, Atten= 0%, Lag= 0.0 min
Primary     =      4.76 cfs @  12.08 hrs, Volume=        0.316 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.75' @ 12.08 hrs

Device  Routing        Invert  Outlet Devices
  #1    Primary        58.57'  24.0"  Round Culvert
                               L= 36.0'  RCP, groove end projecting, Ke= 0.200
                               Inlet / Outlet Invert= 58.57' / 58.56'  S= 0.0003 '/'  Cc= 0.900
                               n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=4.61 cfs @ 12.08 hrs HW=59.73'  (Free Discharge)
└─1=Culvert (Barrel Controls 4.61 cfs @ 3.51 fps)
```

Summary for Pond Exist CB: Exist CB

[57] Hint: Peaked at 59.66' (Flood elevation advised)

Inflow Area = 2.565 ac, 26.00% Impervious, Inflow Depth > 2.08" for 100 event
Inflow = 5.82 cfs @ 12.13 hrs, Volume= 0.444 af
Outflow = 5.82 cfs @ 12.13 hrs, Volume= 0.444 af, Atten= 0%, Lag= 0.0 min
Primary = 5.82 cfs @ 12.13 hrs, Volume= 0.444 af

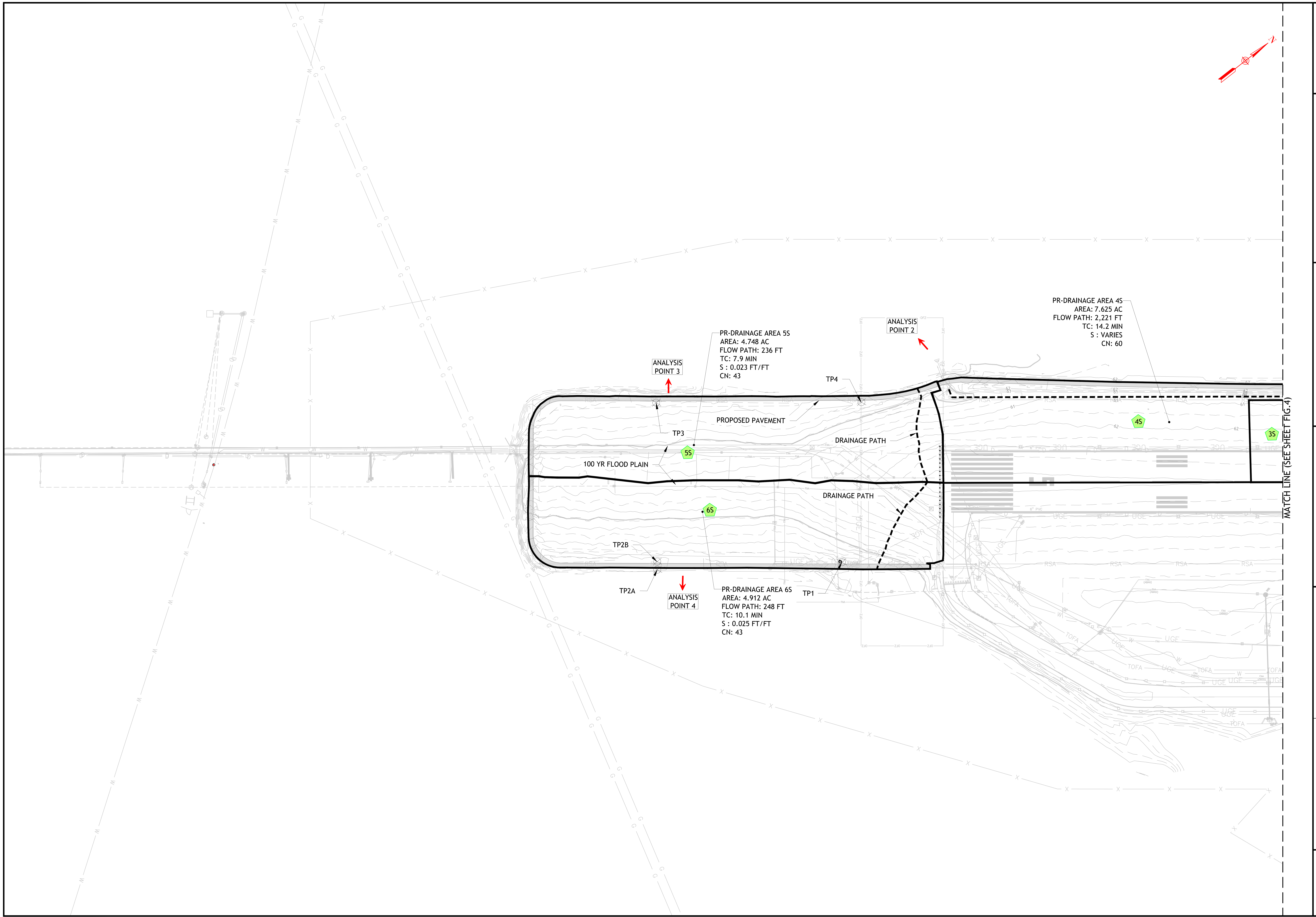
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 59.66' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 425.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 52.36' S= 0.0150 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=5.70 cfs @ 12.13 hrs HW=59.64' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 5.70 cfs @ 4.07 fps)

APPENDIX C

PROPOSED HYDROCAD DRAINAGE CALCULATIONS



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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
XXX

OWNER
XXX
XXX
XXXXXXXX

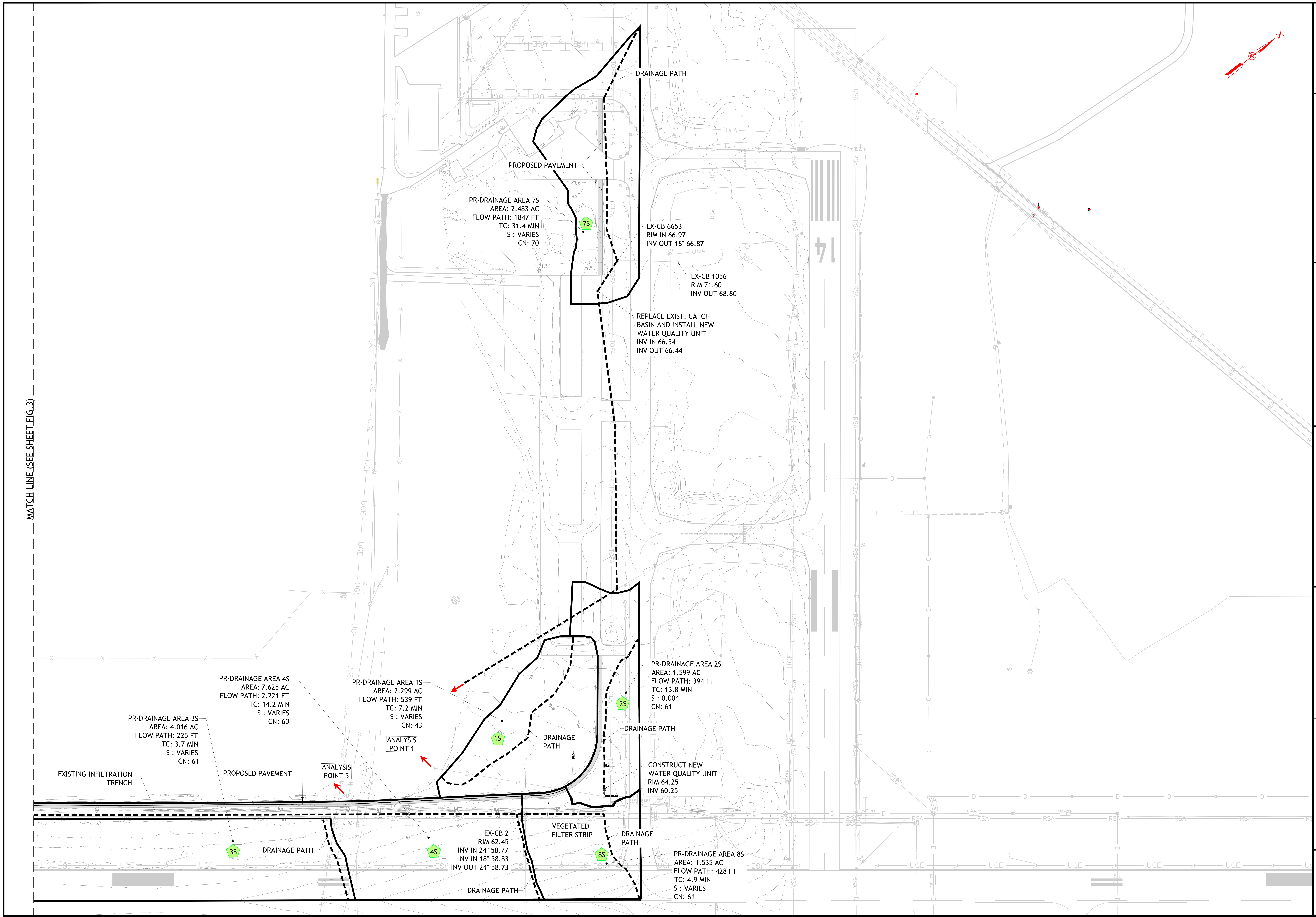
PROJECT NO. XXX-XXX
DESIGNED BY XXX
DRAWN BY XXX
CHECKED BY XXX
DATE XXX XXX
DRAWING SCALE 1" = XX'

SHEET TITLE
PROPOSED DRAINAGE PLAN (1 OF 2)

GRAPHIC SCALE
0 000 000 000

DRAWING NO.
FIG.3

3 OF 4



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PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
XXX

OWNER
XXX
XXX
XXXXXXXXX

PROJECT NO.	XXX-XXX
DESIGNED BY	XXX
DRAWN BY	XXX
CHECKED BY	XXX
DATE	XXX XXX
DRAWING SCALE	1" = XX'

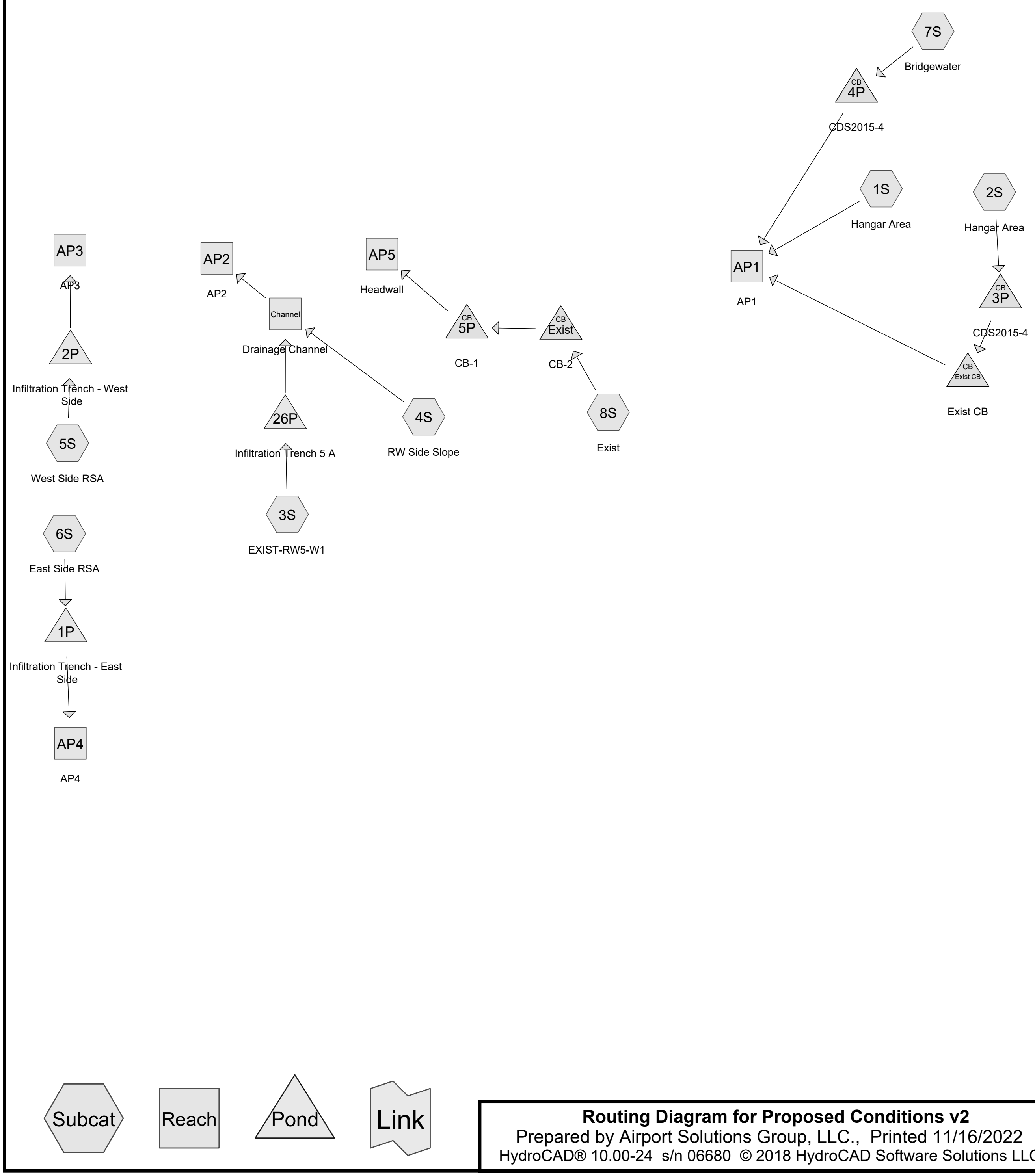
SHEET TITLE

PROPOSED DRAINAGE PLAN (2 OF 2)

GRAPHIC SCALE
0 000 000 000

DRAWING NO.

FIG.4



Routing Diagram for Proposed Conditions v2
Prepared by Airport Solutions Group, LLC., Printed 11/16/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
21.650	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
0.294	80	>75% Grass cover, Good, HSG D (4S)
0.517	98	Exist. Apron and TW Pavement (2S)
1.653	98	Paved parking, HSG A (1S, 6S, 7S)
0.513	98	Perimeter RD (4S)
0.500	98	Perimeter Road (2S, 5S, 7S, 8S)
0.555	98	RW and TW Pavement (8S)
3.535	98	Runway Pavement (3S, 4S)
29.217	**54**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
23.303	HSG A	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	HSG B	
0.000	HSG C	
0.294	HSG D	4S
5.620	Other	2S, 3S, 4S, 5S, 7S, 8S
29.217		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
21.650	0.000	0.000	0.294	0.000	21.944	>75% Grass cover, Good	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	0.000	0.000	0.000	0.517	0.517	Exist. Apron and TW Pavement	2S
1.653	0.000	0.000	0.000	0.000	1.653	Paved parking	1S, 6S, 7S
0.000	0.000	0.000	0.000	0.513	0.513	Perimeter RD	4S
0.000	0.000	0.000	0.000	0.500	0.500	Perimeter Road	2S, 5S, 7S, 8S
0.000	0.000	0.000	0.000	0.555	0.555	RW and TW Pavement	8S
0.000	0.000	0.000	0.000	3.535	3.535	Runway Pavement	3S, 4S
23.303	**0.000**	**0.000**	**0.294**	**5.620**	**29.217**	**TOTAL AREA**	

Summary for Subcatchment 1S: Hangar Area

Runoff = 0.02 cfs @ 15.10 hrs, Volume= 0.012 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	0.150	98	Paved parking, HSG A
	2.149	39	>75% Grass cover, Good, HSG A
	2.299	43	Weighted Average
	2.149		93.48% Pervious Area
	0.150		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	44	0.0450	1.71		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
6.8	495	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.2	539	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 0.65 cfs @ 12.26 hrs, Volume= 0.082 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	0.517	98	Exist. Apron and TW Pavement
*	0.090	98	Perimeter Road
	0.992	39	>75% Grass cover, Good, HSG A
	1.599	61	Weighted Average
	0.992		62.04% Pervious Area
	0.607		37.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0110	1.00		**Sheet Flow, Taxiway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
13.0	344	0.0040	0.44		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
13.8	394	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

Runoff = 2.08 cfs @ 12.13 hrs, Volume= 0.207 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	1.519	98	Runway Pavement
	2.497	39	>75% Grass cover, Good, HSG A
	4.016	61	Weighted Average
	2.497		62.18% Pervious Area
	1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	85	0.0129	1.19		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	225	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 2.73 cfs @ 12.28 hrs, Volume= 0.365 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	2.016	98	Runway Pavement
*	0.513	98	Perimeter RD
	4.802	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.625	60	Weighted Average
	5.096		66.83% Pervious Area
	2.529		33.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0140	1.20		**Sheet Flow, Runway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
10.6	2,003	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030
14.2	2,221	Total			

Summary for Subcatchment 5S: West Side RSA

```
Runoff      =        0.04 cfs @   15.12 hrs,  Volume=           0.025 af,  Depth=  0.06"
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
	4.457	39	>75% Grass cover, Good, HSG A
*	0.291	98	Perimeter Road
	4.748	43	Weighted Average
	4.457		93.87% Pervious Area
	0.291		6.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 0.04 cfs @ 15.15 hrs, Volume= 0.026 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

Area (ac)	CN	Description
4.620	39	>75% Grass cover, Good, HSG A
0.292	98	Paved parking, HSG A
4.912	43	Weighted Average
4.620		94.06% Pervious Area
0.292		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 1.64 cfs @ 12.46 hrs, Volume= 0.221 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	1.211	98	Paved parking, HSG A
*	0.091	98	Perimeter Road
	1.181	39	>75% Grass cover, Good, HSG A
	2.483	70	Weighted Average
	1.181		47.56% Pervious Area
	1.302		52.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.2	145	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.0	139	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	62	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	198	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	1,254	0.0010	2.04	3.60	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
29.4	1,848	Total			

Summary for Subcatchment 8S: Exist

Runoff = 0.80 cfs @ 12.13 hrs, Volume= 0.079 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 2 Rainfall=3.60"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
*	0.028	98	Perimeter Road
	0.952	39	>75% Grass cover, Good, HSG A
	1.535	61	Weighted Average
	0.952		62.02% Pervious Area
	0.583		37.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach AP1: AP1

```
Inflow Area =          6.381 ac,  32.27% Impervious,  Inflow Depth =   0.59"    for  2 event
Inflow       =         2.17 cfs @   12.42 hrs,  Volume=            0.316 af
Outflow      =         2.17 cfs @   12.42 hrs,  Volume=            0.316 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP2: AP2

```
Inflow Area =        11.641 ac,  34.77% Impervious,  Inflow Depth >   0.38"    for  2 event
Inflow       =          1.37 cfs @   13.28 hrs,  Volume=             0.367 af
Outflow      =          1.37 cfs @   13.28 hrs,  Volume=             0.367 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP3: AP3

```
Inflow Area =          4.748 ac,    6.13% Impervious,  Inflow Depth =   0.00"    for  2 event
Inflow      =          0.00 cfs @     1.00 hrs,  Volume=            0.000 af
Outflow     =          0.00 cfs @     1.00 hrs,  Volume=            0.000 af,  Atten= 0%,  Lag= 0.0 min
```

```
Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
```

Summary for Reach AP4: AP4

```
Inflow Area =          4.912 ac,    5.94% Impervious,  Inflow Depth =   0.00"    for  2 event
Inflow       =         0.00 cfs @     1.00 hrs,  Volume=             0.000 af
Outflow      =         0.00 cfs @     1.00 hrs,  Volume=             0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP5: Headwall

```
Inflow Area =          1.535 ac,  37.98% Impervious,  Inflow Depth =   0.62"    for  2 event
Inflow       =         0.80 cfs @   12.13 hrs,  Volume=             0.079 af
Outflow      =         0.80 cfs @   12.13 hrs,  Volume=             0.079 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach Channel: Drainage Channel

```
Inflow Area =        11.641 ac, 34.77% Impervious, Inflow Depth =   0.38"    for  2 event
Inflow      =          2.73 cfs @  12.28 hrs, Volume=          0.368 af
Outflow     =          1.37 cfs @  13.28 hrs, Volume=          0.367 af, Atten= 50%, Lag= 59.9 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 36.9 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 82.4 min

Peak Storage= 3,028 cf @ 12.66 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 86.58 cfs

4.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 20.00'
Length= 2,480.0' Slope= 0.0030 '/'
Inlet Invert= 63.20', Outlet Invert= 55.80'

Summary for Pond 1P: Infiltration Trench - East Side

```
Inflow Area =       4.912 ac,   5.94% Impervious,  Inflow Depth =   0.06"    for  2 event
Inflow      =      0.04 cfs @   15.15 hrs,  Volume=          0.026 af
Outflow     =      0.04 cfs @   15.33 hrs,  Volume=          0.026 af,  Atten= 0%,  Lag= 11.0 min
Discarded   =      0.04 cfs @   15.33 hrs,  Volume=          0.026 af
Primary     =      0.00 cfs @    1.00 hrs,  Volume=          0.000 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 55.09' @ 15.33 hrs   Surf.Area= 728 sf   Storage= 13 cf
Flood Elev= 55.58'   Surf.Area= 2,400 sf   Storage= 413 cf

Plug-Flow detention time= 4.0 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 4.0 min ( 1,092.2 - 1,088.2 )

Volume      Invert    Avail.Storage   Storage Description
#1          55.00'         1,440 cf   48.0" W x 18.0" H  Box Pipe Storage
                                      L= 600.0'  S= 0.0005 '/'
                                      3,600 cf Overall  x 40.0% Voids

Device   Routing          Invert   Outlet Devices
  #1     Discarded        55.00'   2.410 in/hr Exfiltration over Surface area
  #2     Primary          56.58'   10.0' long  x 11.0' breadth Broad-Crested Rectangular Weir
                                   Head (feet)  0.20  0.40  0.60  0.80  1.00  1.20  1.40  1.60
                                   Coef. (English)  2.53  2.59  2.70  2.68  2.67  2.68  2.66  2.64

Discarded OutFlow  Max=0.04 cfs @ 15.33 hrs  HW=55.09'   (Free Discharge)
└─1=Exfiltration  (Exfiltration Controls 0.04 cfs)

Primary OutFlow  Max=0.00 cfs @ 1.00 hrs  HW=55.00'   (Free Discharge)
└─2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)
```

Summary for Pond 2P: Infiltration Trench - West Side

Inflow Area = 4.748 ac, 6.13% Impervious, Inflow Depth = 0.06" for 2 event
Inflow = 0.04 cfs @ 15.12 hrs, Volume= 0.025 af
Outflow = 0.04 cfs @ 15.28 hrs, Volume= 0.025 af, Atten= 0%, Lag= 9.9 min
Discarded = 0.04 cfs @ 15.28 hrs, Volume= 0.025 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 3
Peak Elev= 55.80' @ 15.28 hrs Surf.Area= 704 sf Storage= 12 cf
Flood Elev= 57.26' Surf.Area= 2,600 sf Storage= 1,439 cf

Plug-Flow detention time= 4.0 min calculated for 0.025 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (1,090.0 - 1,086.1)

Volume	Invert	Avail.Storage	Storage Description
#1	55.71'	1,560 cf	**48.0" W x 18.0" H Box Pipe Storage** L= 650.0' S= 0.0005 '/' 3,900 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.71'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	57.27'	**10.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Discarded OutFlow Max=0.04 cfs @ 15.28 hrs HW=55.80' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=55.71' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: CDS2015-4

```
Inflow Area =         1.599 ac, 37.96% Impervious, Inflow Depth =   0.62"    for  2 event
Inflow      =        0.65 cfs @   12.26 hrs, Volume=          0.082 af
Outflow     =        0.65 cfs @   12.26 hrs, Volume=          0.082 af,  Atten= 0%,  Lag= 0.0 min
Primary     =        0.65 cfs @   12.26 hrs, Volume=          0.082 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 60.73' @ 12.26 hrs
Flood Elev= 64.25'

Device  Routing          Invert  Outlet Devices
    #1  Device 3         60.25'  8.1" Vert. Orifice/Grate   C= 0.600
    #2  Device 3         61.13'  1.9' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
    #3  Primary          60.25'  12.0"  Round Culvert
                                 L= 10.0'   RCP, groove end projecting,  Ke= 0.200
                                 Inlet / Outlet Invert= 60.25' / 60.00'   S= 0.0250 '/'   Cc= 0.900
                                 n= 0.012  Corrugated PP, smooth interior,  Flow Area= 0.79 sf

Primary OutFlow  Max=0.64 cfs @ 12.26 hrs  HW=60.73'   (Free Discharge)
└─3=Culvert  (Passes 0.64 cfs of 0.99 cfs potential flow)
    ├─1=Orifice/Grate  (Orifice Controls 0.64 cfs @ 2.35 fps)
    └─2=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
```

Summary for Pond 4P: CDS2015-4

```
Inflow Area =       2.483 ac,  52.44% Impervious,  Inflow Depth =   1.07"    for  2 event
Inflow      =      1.64 cfs @   12.46 hrs,  Volume=          0.221 af
Outflow     =      1.64 cfs @   12.46 hrs,  Volume=          0.221 af,  Atten= 0%,  Lag= 0.0 min
Primary     =      1.64 cfs @   12.46 hrs,  Volume=          0.221 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 67.44' @ 12.46 hrs

Device   Routing          Invert   Outlet Devices
  #1     Device 3         66.44'   8.1" Vert. Orifice/Grate   C= 0.600
  #2     Device 3         67.32'   1.9' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
  #3     Primary          66.44'   18.0"  Round Culvert
                                   L= 10.0'   RCP, groove end projecting,  Ke= 0.200
                                   Inlet / Outlet Invert= 66.44' / 59.30'   S= 0.7140 '/'   Cc= 0.900
                                   n= 0.012  Corrugated PP, smooth interior,  Flow Area= 1.77 sf

Primary OutFlow  Max=1.63 cfs @ 12.46 hrs  HW=67.43'   (Free Discharge)
└─3=Culvert  (Passes 1.63 cfs of 5.27 cfs potential flow)
   ├─1=Orifice/Grate  (Orifice Controls 1.40 cfs @ 3.90 fps)
   └─2=Sharp-Crested Rectangular Weir (Weir Controls 0.24 cfs @ 1.10 fps)
```

Summary for Pond 5P: CB-1

```
Inflow Area =        1.535 ac, 37.98% Impervious, Inflow Depth =   0.62"   for  2 event
Inflow      =       0.80 cfs @  12.13 hrs, Volume=          0.079 af
Outflow     =       0.80 cfs @  12.13 hrs, Volume=          0.079 af,  Atten= 0%,  Lag= 0.0 min
Primary     =       0.80 cfs @  12.13 hrs, Volume=          0.079 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 59.06' @ 12.13 hrs

Device  Routing          Invert  Outlet Devices
   #1   Primary          58.57'  24.0"  Round Culvert
                                 L= 36.0'   RCP, groove end projecting,  Ke= 0.200
                                 Inlet / Outlet Invert= 58.57' / 58.56'   S= 0.0003 '/'   Cc= 0.900
                                 n= 0.011  Concrete pipe, straight & clean,  Flow Area= 3.14 sf

Primary OutFlow  Max=0.77 cfs @ 12.13 hrs  HW=59.05'   (Free Discharge)
└─1=Culvert  (Barrel Controls 0.77 cfs @ 1.98 fps)
```

Summary for Pond 26P: Infiltration Trench 5 A

```
Inflow Area =        4.016 ac, 37.82% Impervious,  Inflow Depth =   0.62"    for  2 event
Inflow      =       2.08 cfs @  12.13 hrs,  Volume=           0.207 af
Outflow     =       0.28 cfs @  13.64 hrs,  Volume=           0.205 af,  Atten= 87%,  Lag= 90.8 min
Discarded   =       0.23 cfs @  13.64 hrs,  Volume=           0.202 af
Primary     =       0.04 cfs @  13.64 hrs,  Volume=           0.003 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 2
Peak Elev= 59.25' @ 13.64 hrs   Surf.Area= 4,055 sf   Storage= 2,915 cf

Plug-Flow detention time= 139.4 min calculated for 0.204 af (99% of inflow)
Center-of-Mass det. time= 133.2 min ( 1,034.1 - 900.9 )

Volume       Invert     Avail.Storage   Storage Description
   #1        57.25'          3,244 cf   60.0" W x 24.0" H  Box Pipe Storage
                                        L= 811.0'  S= 0.0005 '/'
                                        8,110 cf Overall  x 40.0% Voids

Device   Routing          Invert   Outlet Devices
   #1    Discarded        57.25'   2.410 in/hr Exfiltration over Surface area
                                   Conductivity to Groundwater Elevation = 0.00'
   #2    Primary          59.25'   811.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
                                   2.2' Crest Height

Discarded OutFlow  Max=0.23 cfs @ 13.64 hrs  HW=59.25'   (Free Discharge)
└─1=Exfiltration  ( Controls 0.23 cfs)

Primary OutFlow  Max=0.00 cfs @ 13.64 hrs  HW=59.25'   (Free Discharge)
└─2=Sharp-Crested Rectangular Weir (Weir Controls 0.00 cfs @ 0.03 fps)
```

Summary for Pond Exist: CB-2

Inflow Area = 1.535 ac, 37.98% Impervious, Inflow Depth = 0.62" for 2 event
Inflow = 0.80 cfs @ 12.13 hrs, Volume= 0.079 af
Outflow = 0.80 cfs @ 12.13 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min
Primary = 0.80 cfs @ 12.13 hrs, Volume= 0.079 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 59.41' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 409.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 58.66' S= 0.0002 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=0.77 cfs @ 12.13 hrs HW=59.40' (Free Discharge)
└─**1=Culvert** (Barrel Controls 0.77 cfs @ 1.24 fps)

Summary for Pond Exist CB: Exist CB

```
Inflow Area =        1.599 ac,  37.96% Impervious,  Inflow Depth =   0.62"    for  2 event
Inflow      =       0.65 cfs @   12.26 hrs,  Volume=           0.082 af
Outflow     =       0.65 cfs @   12.26 hrs,  Volume=           0.082 af,  Atten= 0%,  Lag= 0.0 min
Primary     =       0.65 cfs @   12.26 hrs,  Volume=           0.082 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 60.41' @ 12.26 hrs

Device   Routing            Invert   Outlet Devices
    #1   Primary            60.00'   18.0"  Round Culvert
                                     L= 420.0'   RCP, groove end projecting,  Ke= 0.200
                                     Inlet / Outlet Invert= 60.00' / 58.60'   S= 0.0033 '/'   Cc= 0.900
                                     n= 0.011  Concrete pipe, straight & clean,  Flow Area= 1.77 sf

Primary OutFlow  Max=0.64 cfs @ 12.26 hrs  HW=60.40'   (Free Discharge)
└─1=Culvert  (Barrel Controls 0.64 cfs @ 2.49 fps)
```

Summary for Subcatchment 1S: Hangar Area

Runoff = 0.23 cfs @ 12.40 hrs, Volume= 0.057 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	0.150	98	Paved parking, HSG A
	2.149	39	>75% Grass cover, Good, HSG A
	2.299	43	Weighted Average
	2.149		93.48% Pervious Area
	0.150		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	44	0.0450	1.71		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
6.8	495	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.2	539	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 1.61 cfs @ 12.22 hrs, Volume= 0.167 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	0.517	98	Exist. Apron and TW Pavement
*	0.090	98	Perimeter Road
	0.992	39	>75% Grass cover, Good, HSG A
	1.599	61	Weighted Average
	0.992		62.04% Pervious Area
	0.607		37.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0110	1.00		**Sheet Flow, Taxiway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
13.0	344	0.0040	0.44		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
13.8	394	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

Runoff = 4.99 cfs @ 12.12 hrs, Volume= 0.419 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	1.519	98	Runway Pavement
	2.497	39	>75% Grass cover, Good, HSG A
	4.016	61	Weighted Average
	2.497		62.18% Pervious Area
	1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	85	0.0129	1.19		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	225	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 7.10 cfs @ 12.23 hrs, Volume= 0.754 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	2.016	98	Runway Pavement
*	0.513	98	Perimeter RD
	4.802	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.625	60	Weighted Average
	5.096		66.83% Pervious Area
	2.529		33.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0140	1.20		**Sheet Flow, Runway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
10.6	2,003	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030
14.2	2,221	Total			

Summary for Subcatchment 5S: West Side RSA

Runoff = 0.48 cfs @ 12.41 hrs, Volume= 0.119 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
	4.457	39	>75% Grass cover, Good, HSG A
*	0.291	98	Perimeter Road
	4.748	43	Weighted Average
	4.457		93.87% Pervious Area
	0.291		6.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 0.48 cfs @ 12.45 hrs, Volume= 0.123 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

Area (ac)	CN	Description
4.620	39	>75% Grass cover, Good, HSG A
0.292	98	Paved parking, HSG A
4.912	43	Weighted Average
4.620		94.06% Pervious Area
0.292		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 3.05 cfs @ 12.43 hrs, Volume= 0.391 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	1.211	98	Paved parking, HSG A
*	0.091	98	Perimeter Road
	1.181	39	>75% Grass cover, Good, HSG A
	2.483	70	Weighted Average
	1.181		47.56% Pervious Area
	1.302		52.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.2	145	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.0	139	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	62	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	198	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	1,254	0.0010	2.04	3.60	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
29.4	1,848	Total			

Summary for Subcatchment 8S: Exist

Runoff = 1.91 cfs @ 12.12 hrs, Volume= 0.160 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 10 Rainfall=4.80"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
*	0.028	98	Perimeter Road
	0.952	39	>75% Grass cover, Good, HSG A
	1.535	61	Weighted Average
	0.952		62.02% Pervious Area
	0.583		37.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach AP1: AP1

```
Inflow Area =          6.381 ac,  32.27% Impervious,  Inflow Depth =   1.16"    for  10 event
Inflow        =        4.45 cfs @   12.38 hrs,  Volume=            0.615 af
Outflow      =        4.45 cfs @   12.38 hrs,  Volume=            0.615 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP2: AP2

```
Inflow Area =        11.641 ac,  34.77% Impervious,  Inflow Depth >   0.92"    for  10 event
Inflow       =         5.35 cfs @   12.92 hrs,  Volume=            0.890 af
Outflow      =         5.35 cfs @   12.92 hrs,  Volume=            0.890 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP3: AP3

```
Inflow Area =         4.748 ac,    6.13% Impervious,  Inflow Depth =   0.00"    for  10 event
Inflow      =        0.00 cfs @     1.00 hrs,  Volume=            0.000 af
Outflow     =        0.00 cfs @     1.00 hrs,  Volume=            0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP4: AP4

```
Inflow Area =          4.912 ac,    5.94% Impervious,  Inflow Depth =   0.00"    for  10 event
Inflow       =         0.00 cfs @     1.00 hrs,  Volume=             0.000 af
Outflow      =         0.00 cfs @     1.00 hrs,  Volume=             0.000 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP5: Headwall

```
Inflow Area =         1.535 ac,  37.98% Impervious,  Inflow Depth =   1.25"    for  10 event
Inflow      =          1.91 cfs @   12.12 hrs,  Volume=            0.160 af
Outflow     =          1.91 cfs @   12.12 hrs,  Volume=            0.160 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach Channel: Drainage Channel

```
Inflow Area =        11.641 ac,  34.77% Impervious,  Inflow Depth =   0.92"    for  10 event
Inflow      =        10.10 cfs @   12.23 hrs,  Volume=            0.891 af
Outflow     =         5.35 cfs @   12.92 hrs,  Volume=            0.890 af,  Atten= 47%,  Lag= 41.6 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 24.3 min
Avg. Velocity = 0.62 fps, Avg. Travel Time= 66.9 min

Peak Storage= 7,796 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 86.58 cfs

4.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 20.00'
Length= 2,480.0' Slope= 0.0030 '/'
Inlet Invert= 63.20', Outlet Invert= 55.80'

Summary for Pond 1P: Infiltration Trench - East Side

Inflow Area = 4.912 ac, 5.94% Impervious, Inflow Depth = 0.30" for 10 event
Inflow = 0.48 cfs @ 12.45 hrs, Volume= 0.123 af
Outflow = 0.13 cfs @ 12.44 hrs, Volume= 0.123 af, Atten= 72%, Lag= 0.0 min
Discarded = 0.13 cfs @ 12.44 hrs, Volume= 0.123 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 56.39' @ 15.99 hrs Surf.Area= 2,400 sf Storage= 1,193 cf
Flood Elev= 55.58' Surf.Area= 2,400 sf Storage= 413 cf

Plug-Flow detention time= 92.3 min calculated for 0.122 af (100% of inflow)
Center-of-Mass det. time= 92.1 min (1,069.1 - 977.0)

Volume	Invert	Avail.Storage	Storage Description
#1	55.00'	1,440 cf	**48.0" W x 18.0" H Box Pipe Storage** L= 600.0' S= 0.0005 '/' 3,600 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	56.58'	**10.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Discarded OutFlow Max=0.13 cfs @ 12.44 hrs HW=55.39' (Free Discharge)
↳**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=55.00' (Free Discharge)
↳**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Infiltration Trench - West Side

Inflow Area = 4.748 ac, 6.13% Impervious, Inflow Depth = 0.30" for 10 event
Inflow = 0.48 cfs @ 12.41 hrs, Volume= 0.119 af
Outflow = 0.15 cfs @ 12.44 hrs, Volume= 0.119 af, Atten= 70%, Lag= 1.6 min
Discarded = 0.15 cfs @ 12.44 hrs, Volume= 0.119 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 3
Peak Elev= 56.80' @ 15.58 hrs Surf.Area= 2,600 sf Storage= 964 cf
Flood Elev= 57.26' Surf.Area= 2,600 sf Storage= 1,439 cf

Plug-Flow detention time= 64.9 min calculated for 0.119 af (100% of inflow)
Center-of-Mass det. time= 64.9 min (1,039.8 - 974.9)

Volume	Invert	Avail.Storage	Storage Description
#1	55.71'	1,560 cf	**48.0" W x 18.0" H Box Pipe Storage** L= 650.0' S= 0.0005 '/' 3,900 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.71'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	57.27'	**10.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Discarded OutFlow Max=0.15 cfs @ 12.44 hrs HW=56.12' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=55.71' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: CDS2015-4

```
Inflow Area =        1.599 ac,  37.96% Impervious,  Inflow Depth =   1.25"    for  10 event
Inflow      =       1.61 cfs @   12.22 hrs,  Volume=           0.167 af
Outflow     =       1.61 cfs @   12.22 hrs,  Volume=           0.167 af,  Atten= 0%,  Lag= 0.0 min
Primary     =       1.61 cfs @   12.22 hrs,  Volume=           0.167 af
```

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 61.24' @ 12.23 hrs
Flood Elev= 64.25'

Device	Routing	Invert	Outlet Devices
#1	Device 3	60.25'	**8.1" Vert. Orifice/Grate** C= 0.600
#2	Device 3	61.13'	**1.9' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	60.25'	**12.0" Round Culvert** L= 10.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.25' / 60.00' S= 0.0250 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

```
Primary OutFlow  Max=1.56 cfs @ 12.22 hrs  HW=61.23'   (Free Discharge)
↑
└─3=Culvert  (Passes 1.56 cfs of 2.93 cfs potential flow)
   ↑
   ├─1=Orifice/Grate  (Orifice Controls 1.38 cfs @ 3.85 fps)
   └─2=Sharp-Crested Rectangular Weir (Weir Controls 0.18 cfs @ 1.02 fps)
```

Summary for Pond 4P: CDS2015-4

Inflow Area = 2.483 ac, 52.44% Impervious, Inflow Depth = 1.89" for 10 event
Inflow = 3.05 cfs @ 12.43 hrs, Volume= 0.391 af
Outflow = 3.05 cfs @ 12.43 hrs, Volume= 0.391 af, Atten= 0%, Lag= 0.0 min
Primary = 3.05 cfs @ 12.43 hrs, Volume= 0.391 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 67.70' @ 12.43 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 3	66.44'	**8.1" Vert. Orifice/Grate** C= 0.600
#2	Device 3	67.32'	**1.9' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	66.44'	**18.0" Round Culvert** L= 10.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 66.44' / 59.30' S= 0.7140 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

```
Primary OutFlow  Max=3.04 cfs @ 12.43 hrs  HW=67.70'   (Free Discharge)
└─3=Culvert  (Passes 3.04 cfs of 7.55 cfs potential flow)
    ├─1=Orifice/Grate  (Orifice Controls 1.65 cfs @ 4.62 fps)
    └─2=Sharp-Crested Rectangular Weir (Weir Controls 1.39 cfs @ 2.01 fps)
```

Summary for Pond 5P: CB-1

```
Inflow Area =         1.535 ac,  37.98% Impervious,  Inflow Depth =   1.25"    for  10 event
Inflow       =        1.91 cfs @   12.12 hrs,  Volume=          0.160 af
Outflow      =        1.91 cfs @   12.12 hrs,  Volume=          0.160 af,  Atten= 0%,  Lag= 0.0 min
Primary      =        1.91 cfs @   12.12 hrs,  Volume=          0.160 af
```

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 59.31' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.57'	**24.0" Round Culvert** L= 36.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.57' / 58.56' S= 0.0003 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=1.88 cfs @ 12.12 hrs HW=59.31' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.88 cfs @ 2.65 fps)

Summary for Pond 26P: Infiltration Trench 5 A

Inflow Area =	4.016 ac,	37.82% Impervious,	Inflow Depth = 1.25"	for 10 event	
Inflow =	4.99 cfs @	12.12 hrs,	Volume=	0.419 af	
Outflow =	3.24 cfs @	12.23 hrs,	Volume=	0.391 af,	Atten= 35%, Lag= 6.6 min
Discarded =	0.23 cfs @	12.20 hrs,	Volume=	0.253 af	
Primary =	3.00 cfs @	12.23 hrs,	Volume=	0.138 af	

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 2
Peak Elev= 59.26' @ 12.20 hrs Surf.Area= 4,055 sf Storage= 2,927 cf

Plug-Flow detention time= 145.7 min calculated for 0.391 af (93% of inflow)
Center-of-Mass det. time= 111.8 min (987.1 - 875.3)

Volume	Invert	Avail.Storage	Storage Description
#1	57.25'	3,244 cf	**60.0" W x 24.0" H Box Pipe Storage** L= 811.0' S= 0.0005 '/' 8,110 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	57.25'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	59.25'	**811.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.2' Crest Height

Discarded OutFlow Max=0.23 cfs @ 12.20 hrs HW=59.26' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.23 cfs)

Primary OutFlow Max=1.52 cfs @ 12.23 hrs HW=59.26' (Free Discharge)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.52 cfs @ 0.27 fps)

Summary for Pond Exist: CB-2

Inflow Area = 1.535 ac, 37.98% Impervious, Inflow Depth = 1.25" for 10 event
Inflow = 1.91 cfs @ 12.12 hrs, Volume= 0.160 af
Outflow = 1.91 cfs @ 12.12 hrs, Volume= 0.160 af, Atten= 0%, Lag= 0.0 min
Primary = 1.91 cfs @ 12.12 hrs, Volume= 0.160 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 59.74' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	58.73'	**24.0" Round Culvert** L= 409.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 58.73' / 58.66' S= 0.0002 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=1.88 cfs @ 12.12 hrs HW=59.74' (Free Discharge)
└—**1=Culvert** (Barrel Controls 1.88 cfs @ 1.74 fps)

Summary for Pond Exist CB: Exist CB

```
Inflow Area =       1.599 ac, 37.96% Impervious, Inflow Depth =   1.25"    for  10 event
Inflow      =       1.61 cfs @  12.22 hrs, Volume=          0.167 af
Outflow     =       1.61 cfs @  12.22 hrs, Volume=          0.167 af, Atten= 0%, Lag= 0.0 min
Primary     =       1.61 cfs @  12.22 hrs, Volume=          0.167 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 60.65' @ 12.22 hrs

Device  Routing          Invert  Outlet Devices
   #1   Primary          60.00'  18.0"  Round Culvert
                                 L= 420.0'   RCP, groove end projecting,  Ke= 0.200
                                 Inlet / Outlet Invert= 60.00' / 58.60'   S= 0.0033 '/'   Cc= 0.900
                                 n= 0.011  Concrete pipe, straight & clean,  Flow Area= 1.77 sf

Primary OutFlow  Max=1.56 cfs @ 12.22 hrs  HW=60.64'   (Free Discharge)
└─1=Culvert  (Barrel Controls 1.56 cfs @ 3.21 fps)
```

Summary for Subcatchment 1S: Hangar Area

Runoff = 1.97 cfs @ 12.15 hrs, Volume= 0.214 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	0.150	98	Paved parking, HSG A
	2.149	39	>75% Grass cover, Good, HSG A
	2.299	43	Weighted Average
	2.149		93.48% Pervious Area
	0.150		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	44	0.0450	1.71		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
6.8	495	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.2	539	Total			

Summary for Subcatchment 2S: Hangar Area

Runoff = 3.90 cfs @ 12.21 hrs, Volume= 0.370 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	0.517	98	Exist. Apron and TW Pavement
*	0.090	98	Perimeter Road
	0.992	39	>75% Grass cover, Good, HSG A
	1.599	61	Weighted Average
	0.992		62.04% Pervious Area
	0.607		37.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0110	1.00		**Sheet Flow, Taxiway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
13.0	344	0.0040	0.44		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
13.8	394	Total			

Summary for Subcatchment 3S: EXIST-RW5-W1

Runoff = 11.91 cfs @ 12.11 hrs, Volume= 0.928 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	1.519	98	Runway Pavement
	2.497	39	>75% Grass cover, Good, HSG A
	4.016	61	Weighted Average
	2.497		62.18% Pervious Area
	1.519		37.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	85	0.0129	1.19		**Sheet Flow, Sheet over Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
3.7	225	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 4S: RW Side Slope

Runoff = 17.68 cfs @ 12.21 hrs, Volume= 1.699 af, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	2.016	98	Runway Pavement
*	0.513	98	Perimeter RD
	4.802	39	>75% Grass cover, Good, HSG A
	0.294	80	>75% Grass cover, Good, HSG D
	7.625	60	Weighted Average
	5.096		66.83% Pervious Area
	2.529		33.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0140	1.20		**Sheet Flow, Runway Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.5	140	0.0180	0.94		**Shallow Concentrated Flow, Turf** Short Grass Pasture Kv= 7.0 fps
10.6	2,003	0.0016	3.15	75.48	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030
14.2	2,221	Total			

Summary for Subcatchment 5S: West Side RSA

```
Runoff       =          3.95 cfs @   12.16 hrs,  Volume=            0.442 af,  Depth=  1.12"
```

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
	4.457	39	>75% Grass cover, Good, HSG A
*	0.291	98	Perimeter Road
	4.748	43	Weighted Average
	4.457		93.87% Pervious Area
	0.291		6.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0230	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.60"
2.9	186	0.0230	1.06		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
7.9	236	Total			

Summary for Subcatchment 6S: East Side RSA

Runoff = 3.76 cfs @ 12.21 hrs, Volume= 0.458 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

Area (ac)	CN	Description
4.620	39	>75% Grass cover, Good, HSG A
0.292	98	Paved parking, HSG A
4.912	43	Weighted Average
4.620		94.06% Pervious Area
0.292		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0250	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.60"
3.0	198	0.0250	1.11		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.1	248	Total			

Summary for Subcatchment 7S: Bridgewater

Runoff = 6.11 cfs @ 12.42 hrs, Volume= 0.766 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	1.211	98	Paved parking, HSG A
*	0.091	98	Perimeter Road
	1.181	39	>75% Grass cover, Good, HSG A
	2.483	70	Weighted Average
	1.181		47.56% Pervious Area
	1.302		52.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	50	0.0030	0.59		**Sheet Flow, Apron Pavement** Smooth surfaces n= 0.011 P2= 3.60"
2.2	145	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.0	139	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	62	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.6	198	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	1,254	0.0010	2.04	3.60	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
29.4	1,848	Total			

Summary for Subcatchment 8S: Exist

Runoff = 4.55 cfs @ 12.11 hrs, Volume= 0.355 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Type III 24-hr 100 Rainfall=7.10"

	Area (ac)	CN	Description
*	0.555	98	RW and TW Pavement
*	0.028	98	Perimeter Road
	0.952	39	>75% Grass cover, Good, HSG A
	1.535	61	Weighted Average
	0.952		62.02% Pervious Area
	0.583		37.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	80	0.0125	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
3.2	151	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	197	0.0080	7.03	168.79	**Channel Flow,** Area= 24.0 sf Perim= 12.0' r= 2.00' n= 0.030 Earth, dense weeds
4.9	428	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach AP1: AP1

```
Inflow Area =         6.381 ac, 32.27% Impervious,  Inflow Depth =   2.54"    for  100 event
Inflow       =       10.28 cfs @   12.31 hrs,  Volume=             1.350 af
Outflow      =       10.28 cfs @   12.31 hrs,  Volume=             1.350 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP2: AP2

```
Inflow Area =         11.641 ac,  34.77% Impervious,  Inflow Depth >   2.47"    for  100 event
Inflow       =        19.26 cfs @   12.65 hrs,  Volume=             2.398 af
Outflow      =        19.26 cfs @   12.65 hrs,  Volume=             2.398 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP3: AP3

```
Inflow Area =       4.748 ac,   6.13% Impervious,  Inflow Depth =   0.66"    for  100 event
Inflow      =        3.45 cfs @   12.27 hrs,  Volume=          0.261 af
Outflow     =        3.45 cfs @   12.27 hrs,  Volume=          0.261 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach AP4: AP4

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      4.912 ac,    5.94% Impervious,  Inflow Depth =   0.71"    for  100 event
Inflow      =      3.78 cfs @   12.19 hrs,  Volume=          0.292 af
Outflow     =      3.78 cfs @   12.19 hrs,  Volume=          0.292 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind+Trans method, Time Span= 3.00-32.00 hrs, dt= 0.01 hrs

Summary for Reach AP5: Headwall

Inflow Area = 1.535 ac, 37.98% Impervious, Inflow Depth = 2.77" for 100 event
Inflow = 4.55 cfs @ 12.11 hrs, Volume= 0.355 af
Outflow = 4.55 cfs @ 12.11 hrs, Volume= 0.355 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs

Summary for Reach Channel: Drainage Channel

```
Inflow Area =        11.641 ac,  34.77% Impervious,  Inflow Depth =   2.47"    for  100 event
Inflow       =       28.25 cfs @   12.16 hrs,  Volume=             2.399 af
Outflow      =       19.26 cfs @   12.65 hrs,  Volume=             2.398 af,  Atten= 32%,  Lag= 29.8 min
```

Routing by Stor-Ind+Trans method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Max. Velocity= 2.44 fps, Min. Travel Time= 16.9 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 53.8 min

Peak Storage= 19,788 cf @ 12.37 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 86.58 cfs

4.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 20.00'
Length= 2,480.0' Slope= 0.0030 '/'
Inlet Invert= 63.20', Outlet Invert= 55.80'

Summary for Pond 1P: Infiltration Trench - East Side

Inflow Area = 4.912 ac, 5.94% Impervious, Inflow Depth = 1.12" for 100 event
Inflow = 3.76 cfs @ 12.21 hrs, Volume= 0.458 af
Outflow = 4.79 cfs @ 12.28 hrs, Volume= 0.458 af, Atten= 0%, Lag= 4.0 min
Discarded = 0.13 cfs @ 12.04 hrs, Volume= 0.166 af
Primary = 4.65 cfs @ 12.28 hrs, Volume= 0.291 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 56.90' @ 12.28 hrs Surf.Area= 2,400 sf Storage= 1,440 cf
Flood Elev= 55.58' Surf.Area= 2,400 sf Storage= 413 cf

Plug-Flow detention time= 55.8 min calculated for 0.456 af (100% of inflow)
Center-of-Mass det. time= 56.1 min (966.4 - 910.3)

Volume	Invert	Avail.Storage	Storage Description
#1	55.00'	1,440 cf	**48.0" W x 18.0" H Box Pipe Storage** L= 600.0' S= 0.0005 '/' 3,600 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	56.58'	**10.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Discarded OutFlow Max=0.13 cfs @ 12.04 hrs HW=55.37' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=4.47 cfs @ 12.28 hrs HW=56.89' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 4.47 cfs @ 1.43 fps)

Summary for Pond 2P: Infiltration Trench - West Side

Inflow Area = 4.748 ac, 6.13% Impervious, Inflow Depth = 1.12" for 100 event
Inflow = 3.95 cfs @ 12.16 hrs, Volume= 0.442 af
Outflow = 3.60 cfs @ 12.27 hrs, Volume= 0.439 af, Atten= 9%, Lag= 6.8 min
Discarded = 0.15 cfs @ 12.04 hrs, Volume= 0.178 af
Primary = 3.45 cfs @ 12.27 hrs, Volume= 0.261 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 3
Peak Elev= 57.53' @ 12.27 hrs Surf.Area= 2,600 sf Storage= 1,560 cf
Flood Elev= 57.26' Surf.Area= 2,600 sf Storage= 1,439 cf

Plug-Flow detention time= 66.7 min calculated for 0.439 af (99% of inflow)
Center-of-Mass det. time= 62.9 min (971.1 - 908.2)

Volume	Invert	Avail.Storage	Storage Description
#1	55.71'	1,560 cf	**48.0" W x 18.0" H Box Pipe Storage** L= 650.0' S= 0.0005 '/' 3,900 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.71'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	57.27'	**10.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Discarded OutFlow Max=0.15 cfs @ 12.04 hrs HW=56.19' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=3.36 cfs @ 12.27 hrs HW=57.53' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 3.36 cfs @ 1.30 fps)

Summary for Pond 3P: CDS2015-4

```
Inflow Area =        1.599 ac, 37.96% Impervious, Inflow Depth =   2.77"   for 100 event
Inflow      =       3.90 cfs @  12.21 hrs, Volume=          0.370 af
Outflow     =       3.90 cfs @  12.21 hrs, Volume=          0.370 af, Atten= 0%, Lag= 0.0 min
Primary     =       3.90 cfs @  12.21 hrs, Volume=          0.370 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 61.64' @ 12.21 hrs
Flood Elev= 64.25'

Device  Routing         Invert  Outlet Devices
   #1   Device 3        60.25'  8.1" Vert. Orifice/Grate   C= 0.600
   #2   Device 3        61.13'  1.9' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
   #3   Primary         60.25'  12.0" Round Culvert
                                L= 10.0'   RCP, groove end projecting,  Ke= 0.200
                                Inlet / Outlet Invert= 60.25' / 60.00'   S= 0.0250 '/'   Cc= 0.900
                                n= 0.012  Corrugated PP, smooth interior,  Flow Area= 0.79 sf

Primary OutFlow Max=3.84 cfs @ 12.21 hrs HW=61.63'   (Free Discharge)
└─3=Culvert (Passes 3.84 cfs of 4.13 cfs potential flow)
   ├─1=Orifice/Grate (Orifice Controls 1.76 cfs @ 4.92 fps)
   └─2=Sharp-Crested Rectangular Weir (Weir Controls 2.08 cfs @ 2.31 fps)
```

Summary for Pond 4P: CDS2015-4

```
Inflow Area =      2.483 ac,  52.44% Impervious,  Inflow Depth =   3.70"    for  100 event
Inflow      =     6.11 cfs @   12.42 hrs,  Volume=          0.766 af
Outflow     =     6.11 cfs @   12.42 hrs,  Volume=          0.766 af,  Atten= 0%,  Lag= 0.0 min
Primary     =     6.11 cfs @   12.42 hrs,  Volume=          0.766 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 68.12' @ 12.42 hrs

Device   Routing          Invert   Outlet Devices
   #1    Device 3         66.44'   8.1" Vert. Orifice/Grate   C= 0.600
   #2    Device 3         67.32'   1.9' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
   #3    Primary          66.44'   18.0"  Round Culvert
                                   L= 10.0'   RCP, groove end projecting,  Ke= 0.200
                                   Inlet / Outlet Invert= 66.44' / 59.30'   S= 0.7140 '/'   Cc= 0.900
                                   n= 0.012  Corrugated PP, smooth interior,  Flow Area= 1.77 sf

Primary OutFlow  Max=6.06 cfs @ 12.42 hrs  HW=68.12'   (Free Discharge)
└─3=Culvert  (Passes 6.06 cfs of 10.25 cfs potential flow)
  ├─1=Orifice/Grate  (Orifice Controls 2.00 cfs @ 5.58 fps)
  └─2=Sharp-Crested Rectangular Weir (Weir Controls 4.06 cfs @ 2.92 fps)
```

Summary for Pond 5P: CB-1

```
Inflow Area =         1.535 ac, 37.98% Impervious, Inflow Depth =  2.77"   for 100 event
Inflow      =       4.55 cfs @  12.11 hrs, Volume=          0.355 af
Outflow     =       4.55 cfs @  12.11 hrs, Volume=          0.355 af, Atten= 0%, Lag= 0.0 min
Primary     =       4.55 cfs @  12.11 hrs, Volume=          0.355 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 59.72' @ 12.11 hrs

Device  Routing          Invert  Outlet Devices
   #1   Primary          58.57'  24.0" Round Culvert
                                 L= 36.0'  RCP, groove end projecting, Ke= 0.200
                                 Inlet / Outlet Invert= 58.57' / 58.56'  S= 0.0003 '/'  Cc= 0.900
                                 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf

Primary OutFlow Max=4.40 cfs @ 12.11 hrs HW=59.70'  (Free Discharge)
└─1=Culvert (Barrel Controls 4.40 cfs @ 3.46 fps)
```

Summary for Pond 26P: Infiltration Trench 5 A

Inflow Area = 4.016 ac, 37.82% Impervious, Inflow Depth = 2.77" for 100 event
Inflow = 11.91 cfs @ 12.11 hrs, Volume= 0.928 af
Outflow = 13.66 cfs @ 12.10 hrs, Volume= 1.018 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.23 cfs @ 12.10 hrs, Volume= 0.319 af
Primary = 13.43 cfs @ 12.10 hrs, Volume= 0.700 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs / 2
Peak Elev= 59.28' @ 12.10 hrs Surf.Area= 4,055 sf Storage= 2,960 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 44.8 min (895.1 - 850.4)

Volume	Invert	Avail.Storage	Storage Description
#1	57.25'	3,244 cf	**60.0" W x 24.0" H Box Pipe Storage** L= 811.0' S= 0.0005 '/' 8,110 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	57.25'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	59.25'	**811.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.2' Crest Height

Discarded OutFlow Max=0.23 cfs @ 12.10 hrs HW=59.28' (Free Discharge)
└─**1=Exfiltration** (Controls 0.23 cfs)

Primary OutFlow Max=12.29 cfs @ 12.10 hrs HW=59.28' (Free Discharge)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 12.29 cfs @ 0.55 fps)

Summary for Pond Exist: CB-2

```
Inflow Area =        1.535 ac,  37.98% Impervious,  Inflow Depth =   2.77"    for  100 event
Inflow      =       4.55 cfs @   12.11 hrs,  Volume=            0.355 af
Outflow     =       4.55 cfs @   12.11 hrs,  Volume=            0.355 af,  Atten= 0%,  Lag= 0.0 min
Primary     =       4.55 cfs @   12.11 hrs,  Volume=            0.355 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 60.28' @ 12.11 hrs

Device   Routing            Invert   Outlet Devices
    #1   Primary            58.73'   24.0"  Round Culvert
                                     L= 409.0'   RCP, groove end projecting,  Ke= 0.200
                                     Inlet / Outlet Invert= 58.73' / 58.66'   S= 0.0002 '/'   Cc= 0.900
                                     n= 0.012  Concrete pipe, finished,  Flow Area= 3.14 sf

Primary OutFlow  Max=4.40 cfs @ 12.11 hrs  HW=60.25'   (Free Discharge)
└─1=Culvert  (Barrel Controls 4.40 cfs @ 2.38 fps)
```

Summary for Pond Exist CB: Exist CB

```
Inflow Area =         1.599 ac,  37.96% Impervious,  Inflow Depth =   2.77"    for  100 event
Inflow       =        3.90 cfs @   12.21 hrs,  Volume=            0.370 af
Outflow     =        3.90 cfs @   12.21 hrs,  Volume=            0.370 af,  Atten= 0%,  Lag= 0.0 min
Primary     =        3.90 cfs @   12.21 hrs,  Volume=            0.370 af

Routing by Stor-Ind method, Time Span= 1.00-32.04 hrs, dt= 0.08 hrs
Peak Elev= 61.06' @ 12.21 hrs

Device   Routing            Invert   Outlet Devices
    #1   Primary            60.00'   18.0"  Round Culvert
                                     L= 420.0'   RCP, groove end projecting,  Ke= 0.200
                                     Inlet / Outlet Invert= 60.00' / 58.60'   S= 0.0033 '/'   Cc= 0.900
                                     n= 0.011  Concrete pipe, straight & clean,  Flow Area= 1.77 sf

Primary OutFlow  Max=3.84 cfs @ 12.21 hrs  HW=61.05'   (Free Discharge)
└─1=Culvert  (Barrel Controls 3.84 cfs @ 4.07 fps)
```

APPENDIX D

TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: STA 27+50, 100' LT to STA 48+50, LT 40'

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Grass Channel	**0.50**	**1.00**	**0.50**	**0.50**
	0.00	**0.50**	**0.00**	**0.50**
	0.00	**0.50**	**0.00**	**0.50**
	0.00	**0.50**	**0.00**	**0.50**
	0.00	**0.50**	**0.00**	**0.50**

Total TSS Removal = 50%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Permit RW 5 Perimeter Road**

Prepared By: **Airport Solutions Group**

Date: **11/10/2022**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

V

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: STA 27+50 LT TO STA 28+00 LT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Vegetated Filter Strip >25 feet	**0.10**	**1.00**	**0.10**	**0.90**
	0.00	**0.90**	**0.00**	**0.90**
	0.00	**0.90**	**0.00**	**0.90**
	0.00	**0.90**	**0.00**	**0.90**
	0.00	**0.90**	**0.00**	**0.90**

Total TSS Removal = **10%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Permit RW 5 Perimeter Road**
Prepared By: **Airport Solutions Group**
Date: **11/8/2022**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

[1] From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

Brief Stormceptor Sizing Report - Unit 2S

Project Information & Location			
Project Name	Pave Existing Gravel Road - RW 5 End	**Project Number**	731708
City	New Bedford	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/4/2022
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech Engineered Solutions	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@conteches.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Unit 2S
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	97
STC 900	99
STC 1200	99
STC 1800	99
STC 2400	99
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	100
STC 11000	100
STC 13000	100
STC 16000	100

Sizing Details

Drainage Area

Total Area (acres)	0.09
Imperviousness %	100.0

Rainfall

Station Name	HYANNIS
State/Province	Massachusetts
Station ID #	3821
Years of Records	14
Latitude	41°24'0"N
Longitude	70°10'47"W

Water Quality Objective

TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	0.11

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - Unit 7S

Project Information & Location			
Project Name	Pave Existing Gravel Road - RW 5 End	**Project Number**	731708
City	New Bedford	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/4/2022
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech Engineered Solutions	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@conteches.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Unit 7S
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	97
STC 900	99
STC 1200	99
STC 1800	99
STC 2400	99
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	100
STC 11000	100
STC 13000	100
STC 16000	100

Sizing Details

Drainage Area

Total Area (acres)	0.09
Imperviousness %	100.0

Rainfall

Station Name	HYANNIS
State/Province	Massachusetts
Station ID #	3821
Years of Records	14
Latitude	41°24'0"N
Longitude	70°10'47"W

Water Quality Objective

TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	0.11

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

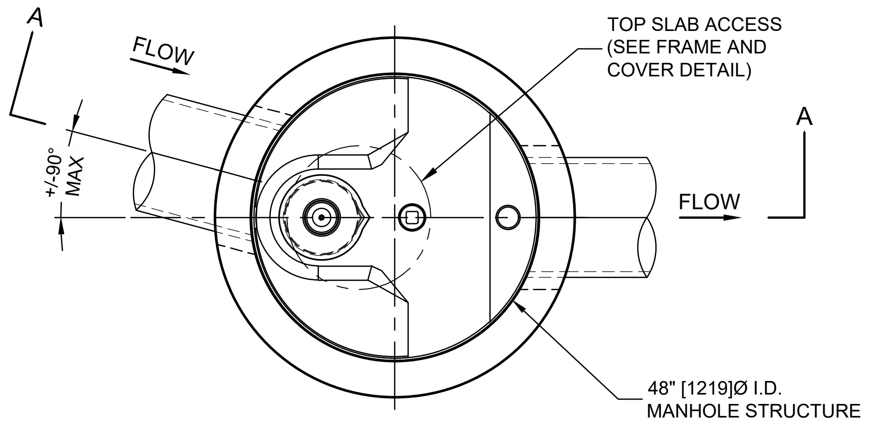
OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

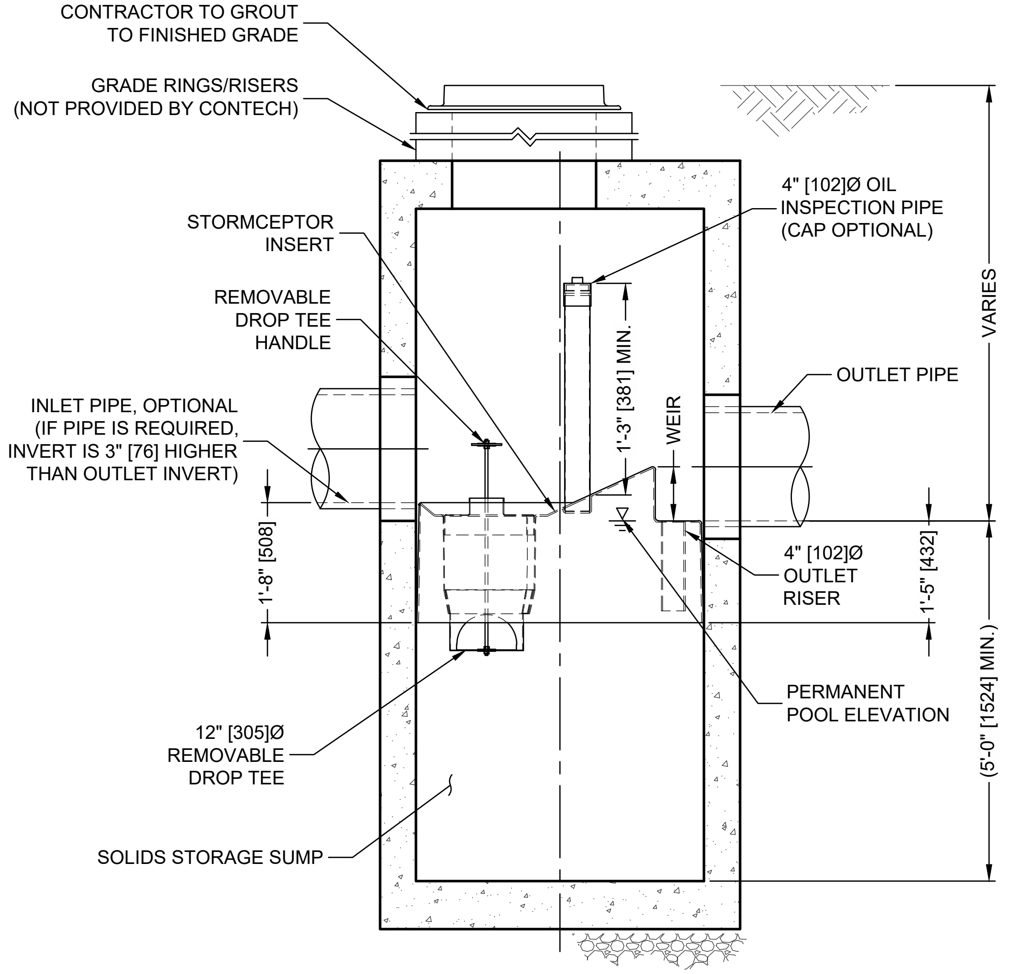
Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX



PLAN VIEW
TOP SLAB NOT SHOWN



SECTION A-A

FOR PATENT INFORMATION, GO TO www.ContechES.com/IP

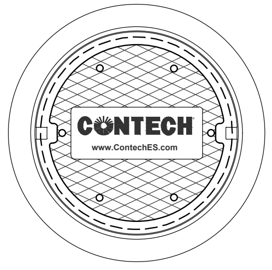
STORMCEPTOR DESIGN NOTES

THE STANDARD STC450I CONFIGURATION WITH ROUND, SOLID FRAME AND COVER, AND INLET PIPE IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.
STORMCEPTOR STC450I RATED TREATMENT CAPACITY IS 0.40 CFS, OR PER LOCAL REGULATIONS
CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES

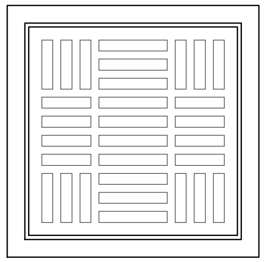
SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:



FRAME AND COVER
(MAY VARY)
NOT TO SCALE



FRAME AND GRATE
(MAY VARY)
NOT TO SCALE

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. STORMCEPTOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STORMCEPTOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. STORMCEPTOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMCEPTOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

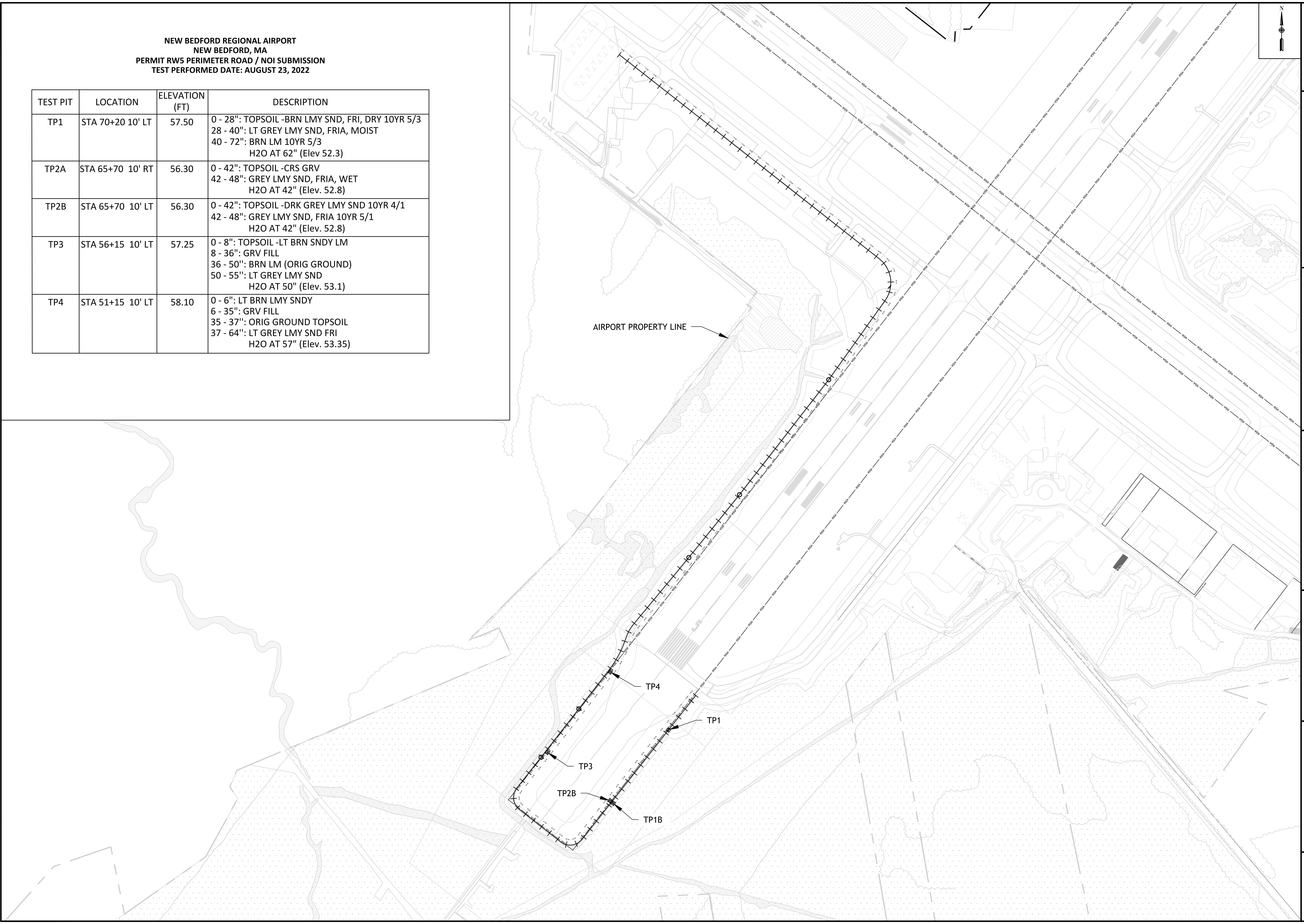
STC450i
STORMCEPTOR
STANDARD DETAIL

APPENDIX E

GEOTECH REPORT

NEW BEDFORD REGIONAL AIRPORT
NEW BEDFORD, MA
PERMIT RW5 PERIMETER ROAD / NOI SUBMISSION
TEST PERFORMED DATE: AUGUST 23, 2022

TEST PIT	LOCATION	ELEVATION (FT)	DESCRIPTION
TP1	STA 70+20 10' LT	57.50	0 - 28": TOPSOIL -BRN LMY SND, FRI, DRY 10YR 5/3 28 - 40": LT GREY LMY SND, FRIA, MOIST 40 - 72": BRN LM 10YR 5/3 H2O AT 62" (Elev 52.3)
TP2A	STA 65+70 10' RT	56.30	0 - 42": TOPSOIL -CRS GRV 42 - 48": GREY LMY SND, FRIA, WET H2O AT 42" (Elev. 52.8)
TP2B	STA 65+70 10' LT	56.30	0 - 42": TOPSOIL -DRK GREY LMY SND 10YR 4/1 42 - 48": GREY LMY SND, FRIA 10YR 5/1 H2O AT 42" (Elev. 52.8)
TP3	STA 56+15 10' LT	57.25	0 - 8": TOPSOIL -LT BRN SNDY LM 8 - 36": GRV FILL 36 - 50'': BRN LM (ORIG GROUND) 50 - 55'': LT GREY LMY SND H2O AT 50" (Elev. 53.1)
TP4	STA 51+15 10' LT	58.10	0 - 6": LT BRN LMY SNDY 6 - 35": GRV FILL 35 - 37'': ORIG GROUND TOPSOIL 37 - 64'': LT GREY LMY SND FRI H2O AT 57" (Elev. 53.35)



AIRPORT SOLUTIONS GROUP, LLC
Innovation By Design
AIRPORT CONSULTANT • BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT
PERMIT RW5 PERIMETER ROAD

OWNER
CITY OF NEW BEDFORD
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-054
CADD FILE	120 103-054 NOI TEST PIT LOCATIONS PLAN
DESIGNED BY	SG
DRAWN BY	SG
CHECKED BY	SJR
DATE	NOVEMBER 2022
DRAWING SCALE	1" = 200'

SHEET TITLE
TEST PIT LOCATIONS PLAN

GRAPHIC SCALE
0 100' 200' 400'

DRAWING NO.
FIG.1

New Bedford Regional Airport
New Bedford, MA
Permit Runway 5 Access Road

Test Pit Log

Test pits were performed on August 23, 2022

TP1

Location - STA 70+20 10' LT
Elev. 57.5

0 - 28"	Topsoil -BRN LMY SND, FRI, DRY 10YR 5/3
28 40"	LT GREY LMY SND, FRIA, MOIST
40 - 72"	BRN LM 10YR 5/3
	H2O AT 62" (Elev 52.3)

TP2A

Location - STA 65+70 10' RT
Elev. 56.3

0 - 42"	Topsoil -CRS GRV
42 48"	GREY LMY SND, FRIA, WET
	H2O AT 42" (Elev. 52.8)

TP2B

Location - STA 65+70 10' LT
Elev. 56.3

0 - 42"	Topsoil -DRK GREY LMY SND 10YR 4/1
42 - 52"	GREY LMY SND, FRIA 10YR 5/1
	H2O AT 42" (Elev. 52.8)

TP3

Location - STA 56+15 10' LT
Elev. 57.25

0 - 8"	Topsoil -LT BRN SNDY LM
8 - 36"	GRV FILL
36 - 50"	BRN LM (ORIG GROUND)
50 - 55"	LT GREY LMY SND
	H2O AT 50" Elev. 53.1

TP4

Location - STA 51+15 10' LT
Elev. 58.1

0 - 6"	LT BRN LMY SND
6 - 35"	GRV FILL
35 - 37"	ORIG GROUND TOPSOIL
37 - 64"	LT GREY LMY SND FRI
	H2O AT 57" Elev. 53.35

S.W.COLE
ENGINEERING, INC.

Report of Hydrometer

ASTM D422-63 (07)

Project Name: EWB RW 5 Permitting
Project Location: New Bedford, MA
Client: Airport Solutions Group, LLC
Material Description: Test Pit Sample
Material Source: In Place

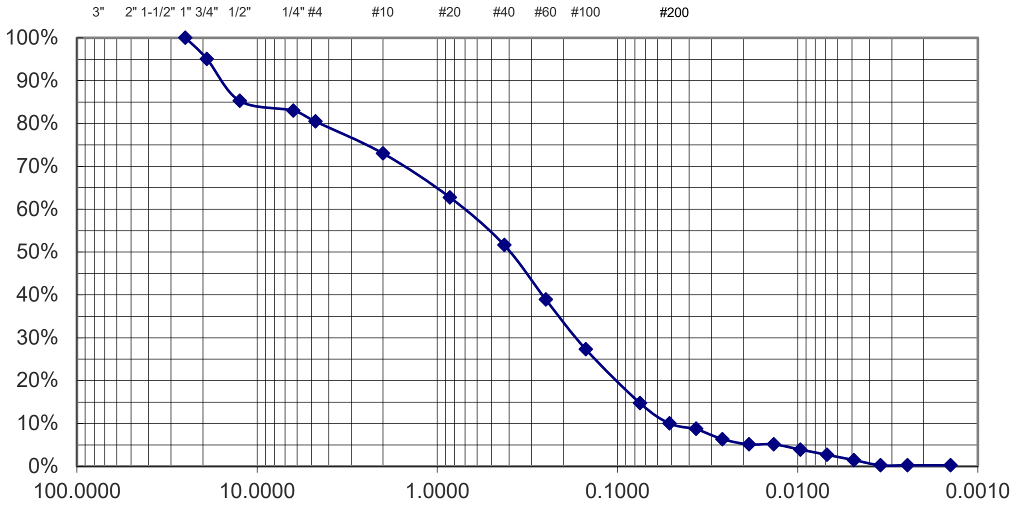
Project Number: 22-1844
Lab ID: 5511T
Date Received: 10/29/2022
Date Completed: 11/1/2022
Tested By: JP

Sieve Analysis

Sieve Size	Standard Designation (mm)	Amount Passing (%)	Specification (name)
3"	76	**100**	
2"	50	**100**	
1½"	38.1	**100**	
1"	25	**100**	
¾"	19	**95**	
½"	12.5	**85**	
¼"	6.3	**83**	
No. 4	4.75	**80**	
No. 10	2	**73**	
No. 20	0.85	**63**	
No. 40	0.425	**52**	
No. 60	0.25	**39**	
No. 100	0.15	**27**	
No. 200	0.075	**15**	

Hydrometer Analysis

Particle Size (mm)	Amount Passing (%)
0.05141	**10.0**
0.03657	**8.8**
0.02616	**6.3**
0.01860	**5.1**
0.01359	**5.1**
0.00966	**3.9**
0.00687	**2.7**
0.00488	**1.5**
0.00347	**0.2**
0.00246	**0.2**
0.00142	**0.2**



Particle Distribution:

Gravel (3" - No. 4)	**19.5%**	Fines (0.074 -0.005)	**13.3%**
Sand (No. 4 - No. 200)	**65.7%**	Clay (<0.005)	**1.5%**

Comments:

Reviewed By

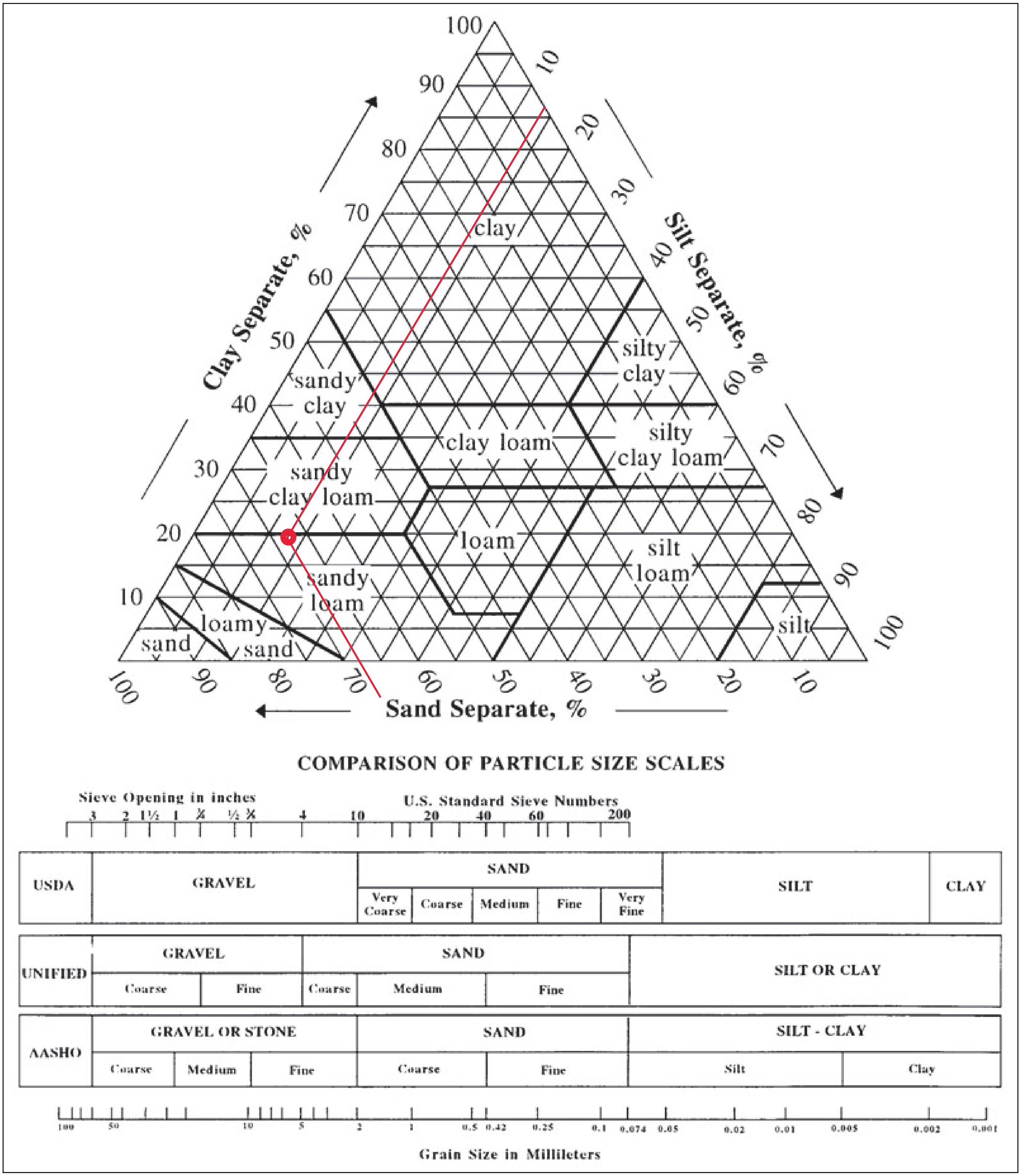


Figure 2.3.2: USDA, NRCS, 2007 National Soil Survey Handbook, Part 618, Exhibit 8, http://soils.usda.gov/technical/handbook/contents/part618ex.html#ex8

Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

APPENDIX F

STORMWATER MANAGEMENT SYSTEM OPERATIONAL AND MAINTENANCE PLAN

NEW BEDFORD REGIONAL AIRPORT
NEW BEDFORD, MASSACHUSETTS

STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN

City of New Bedford

DECEMBER 2022

Prepared For:

City of New Bedford Airport Commission
1569 Airport Road
New Bedford, Massachusetts

Prepared By:

Airport Solutions Group
39 Winn Street
Burlington, Massachusetts
(P) 780.491.0083

Table of Contents

1. Introduction

The airport will be paving the existing gravel perimeter road at the Runway 5 End. This project will include the installation of two (2) water quality treatment devices and two (2) infiltration trenches that will require updating of this O&M plan. This plan was formally created under the reconstruction of Runway 5-23 project (2014), MassDEP Wetland Variance/Order of Conditions (DEP File No. 049 0635) and Stormwater Standard No. 9 of the MassDEP's Stormwater Management Policy.

The airport, and any future responsible parties, shall be accountable for implementing this plan following the completion of the project's construction and the termination of the contractor's interim Storm Water Pollution Prevention Plan (SWPPP) per the National Pollutant Discharge Elimination System (NPDES) General Permit.

2. Purpose and Need

This document prescribes the methods required for the New Bedford Regional Airport to properly maintain the airport-wide stormwater management system. A program of regular stormwater drainage system field reviews and assessments, scheduled maintenance and repairs, as-needed, will be necessary. The program will be conducted by trained airport staff and/or licensed contractors, as required, familiar with the airport facility.

Included in this document is a list of Best Management Practices (BMP's) incorporated into the design of the stormwater management system, a summary of requirements and procedures for reviewing the BMP's, and a drainage system review checklist. It is understood that documentation of routine and non-routine maintenance of the system is not only required by the Massachusetts Stormwater Regulations, but is an important tool for the airport to access future maintenance requirements and improvements.

3. Stormwater Management System Owner

The New Bedford Regional Airport is publicly owned by the City of New Bedford, Massachusetts under the care, custody, and control of the New Bedford Airport Commission. The Airport Commission currently appoints a full time Airport Manager who is responsible for the management and operation of the airport.

New Bedford Regional Airport Commission
1569 Airport Road
New Bedford, MA 02746
Phone: 508.991.6161

Airport Manager
New Bedford Regional Airport
1569 Airport Road
New Bedford, MA 02746

4. Parties Responsible for Operation and Maintenance

The New Bedford Regional Airport is under the direct authority of the airport manager and the policies of the New Bedford Regional Airport Commission, for the maintenance of the airport and the airport's stormwater management systems. Therefore, the responsible party of this O & M Plan will be referred to collectively as the Airport.

The Airport keeps on file record plans of the Airport's stormwater management system, O & M plans developed during previous improvement projects, routine drainage system, review and maintenance reports, and the facilities Stormwater Pollution Prevention Plan per the EPA NPDES Multi-Sector General Permit.

In the event that the New Bedford Regional Airport was to change ownership, the above mentioned stormwater management system documentation and EPA NPDES Multi-Sector SWPPP would remain on file at the Airport.

This O & M plan shall be located in the Airport Manager's office. The O&M Plan located in the Airport Manager's office shall be the O&M plan of record and shall be maintained up-to-date at all times. Any changes to the stormwater system, runways, taxiways, or any stormwater BMP's shall be recorded in this O&M plan and all drawings or exhibits shall be updated to reflect said changes.

5. Routine and Non-Routine Maintenance Tasks

The New Bedford Regional Airport's stormwater management system has been designed to comply with the Massachusetts Stormwater Management Standards that were incorporated into the Wetlands Protection Act Regulations on January 2, 2008 (see 310 CMR 10.05(6)(k)). To ensure the proposed stormwater management systems are functioning adequately, routine and non-routine maintenance, system reviews, and preventative measures are necessary. The system utilizes Best Management Practices (BMP) source controls including the following:

1. Vegetative Filter Strips
   Description: Grassed Area
   Location: Adjacent pavement edges throughout the airport.
   Purpose: Pre-treat stormwater run-off from asphalt surfaces prior to discharging to catch basins or infiltration trenches.
   Review: At least once a year (every six months during first year) the edge of pavement and toe-of-slope shall be checked for sediment build up and vegetation reviewed for signs of erosion and bare spots.
   Maintenance: Mowing to occur on routine basis. Sediment, debris and trash removal from edge of pavement and reseeded as necessary to fill in bare spots.

2. Drainage Channels
   Description: Grass Channels
   Location: Various locations throughout the airport property.
   Purpose: To provide for non-erosive conveyance of stormwater to inlets, infiltration trenches and other bodies of water.
   Review: At least twice per year review channels for adequate vegetation growth, rilling or gullying.
   Maintenance: Mowing to occur on a routine basis. Sediment, debris and trash removal shall occur at least once per year or as necessary. Repair of any erosion and reseeding shall occur as necessary.

3. Grassed Channels
   Description: Grass Channels
   Location: Along airport gravel access roads.
   Purpose: To provide for pre-treatment for and conveyance of stormwater to inlets, infiltration trenches, sediment forebays, and other bodies of water
   Review: At least once per year review channels for adequate vegetation growth, rilling or gullying.
   Maintenance: Mowing to occur once a month during growing season. Sediment, debris and trash removal shall occur at least once per year or as necessary. Repair of any erosion and reseeding shall occur as necessary, but no less than once a year.

4. Catch Basin (Deep Sump Hooded)
   Description: Underground Retention Basins.
   Location: Various locations throughout the airport property.
   Purpose: Designed to remove trash debris and coarse sediment from stormwater runoff. Also serve as temporary spill containment devices for oils and grease.
   Review: At least four times per year, and at the end of foliage and snow-removal seasons, review structures for sedimentation, debris build-up, floatables and structural damage.
   Maintenance: Remove sediment debris at least four times per year or whenever depth of deposits is greater than or equal to one half the depth from the bottom of the sump to the invert of the lowest pipe in the basin. Remove trash and floatables as required. Replace structure as necessary.

5. Infiltration Trenches
   Description: Shallow Excavations Filled with Stone.
   Location: At the toe of slope of vegetative filter strips, typically at the edge of Runway and Taxiway Safety Areas. Two (2) additional infiltration trenches will be constructed on either side of the Runway 5 End extended runway safety area.
   Purpose: The stone trenches provide underground storage for stormwater runoff which gradually exfiltrates through the bottom and/or sides of the trench into the subsoil and eventually into the water table.
   Review: At least two times per year review for sedimentation, debris, trash and grass clippings within trench. Check pre-treatment BMP's as required, to maximize infiltration trench useable lifetime.
   Maintenance: At least two times per year remove sedimentation, debris, trash and grass clipping from trench and pretreatment BMP's. Rehabilitate the trench when required.

6. Proprietary Separator
   Description: Stormwater Treatment Units.
   Location: Adjacent to Aircraft Aprons or Hangars and other areas of the airport. Two additional water quality units will be installed as part of this perimeter paving project. One unit will be located within the existing taxilane pavement between an existing T-Hangar and Taxiway B. The second unit will be located between TW B hold line to RW 5 and the new perimeter road.
   Purpose: Removes heavy particulates, floating debris and hydrocarbons from stormwater.
   Review: At least once a month (and after every major storm) review for sediments and debris.
   Maintenance: At least twice per year, by qualified personnel, the unit shall be cleaned of oil, grease and sediments using a specialized vacuum truck.

7. Infiltration Basin
   Description: Stormwater runoff impoundment constructed over permeable soils.
   Location: Adjacent to the Colonial Hangar.
   Purpose: Stormwater runoff is stored until it exfiltrates through the soil of the basin floor, typically within 72 hours.
   Review: At least twice per year review for sediments and debris. Review pre-treatment BMP's, as specified, to reduce maintenance for basin.
   Maintenance: At least twice per year mow buffer area, side slopes and basin bottom (if grass) or rake (if stone bottom). Remove grass clippings, accumulated organic matter, trash and debris and eradicate any invasive plant species. Note: Remove sediment from basin as necessary but wait until basin floor is dry. Use light equipment to remove the top layer so as not to compact the underlying soil.

8. <u>Leaching Catch Basin</u>
   Description: Pre-cast concrete structure with an open bottom.
   Location: Throughout existing airport.
   Purpose: To permit runoff to infiltrate into the ground.
   Review: At once per year, and at the end of foliage and snow-removal seasons, review structures for sedimentation, debris build-up, floatables, grass clippings and structural damage.
   Maintenance: Remove sediment debris at once per year, 50% full or whenever deposits impact exfiltration. Replace structure as necessary.

9. <u>Outlet Erosion Control Protection</u>
   Description: Devices that controls the flow of stormwater from an outlet device (i.e. Rip-Rap)
   Location: Downstream of headwalls or any outlet.
   Purpose: To dissipate energy from stormwater runoff to control erosion as it enters streams and wetland areas.
   Review: At least two times per year review for erosion sedimentation, vegetation debris, trash and grass clippings. Review pre-treatment BMP's to reduce maintenance.
   Maintenance: At least two times per year remove sedimentation, debris, trash and grass clipping from outlet erosion control device and pretreatment BMP's.

10. <u>Check Dams</u>
    Description: A small earthen or stone dam constructed across a drainage ditch, swale or channel.
    Location: Various locations throughout the airport property.
    Purpose: To lower the velocity of flow to reduce erosion and gullying in a channel and allow sediments to settle out.
    Review: After every significant rainfall event review the check dams.
    Maintenance: Repair damage and remove sediment as necessary.

11. <u>Catch Basin Inlet Controls (Temporary during construction)</u>
    Description: Filter media insert that fits into a catch basin opening.
    Location: Currently none at the airport.
    Purpose: To remove a range of pollutants including debris, trash, fine sediments, oil/grease and metals depending on type of filter media.
    Review: Per manufacturer's schedule, review inserts for effectiveness and structural integrity. Must be OSHA certified to enter the structure.
    Maintenance: Per manufacturer's requirements, replace inserts as necessary or when ineffective.

12. <u>Drain Manholes</u>
    Description: Underground chambers with access from surface.
    Location: Various locations throughout the airport property.
    Purpose: Used for pipe connections, flow diversions and review access.
    Review: At least four times per year, and at the end of foliage and snow-removal seasons, review structures for sedimentation, debris build-up, floatables and structural damage. Must be OSHA certified to enter the structure.
    Maintenance: Remove sediment debris at least four times per year or whenever depth of deposits is greater than or equal to one half the depth from the bottom of the sump to the invert of the lowest pipe in the basin. Remove trash and floatables as required. Replace structure as necessary.

13. <u>Drainage Pipe</u>
    Description: Hollow cylindrical conduit of varying material such as steel, concrete, plastic and clay.
    Location: Throughout stormwater system, typically between catch basins, manholes and outfalls.
    Purpose: To convey stormwater throughout the system.
    Review: At least four times per year, and at the end of foliage and snow-removal seasons, review pipes for sedimentation, debris build-up, floatables and structural damage.
    Maintenance: Remove sediment debris at least four times per year or whenever depth of deposits is impeding stormwater conveyance. Remove trash and floatables as required. Replace pipe as necessary if structural failure is apparent.

14. <u>Culverts</u>
    Description: A covered channel that crosses under a roadway or other paved airport surface.
    Location: Throughout the airport property.
    Purpose: To convey stormwater under a roadway crossing.
    Review: At least four times per year review structures for sedimentation, debris build-up, floatables and structural damage.
    Maintenance: Remove sediment debris at least four times per year or as required. Replace structure as necessary.

Table 1 includes a summary all BMP's associated with the Airport's stormwater management system and routine and non-routine maintenance required:

Table 1 – Operation and Maintenance Requirements

BMP	Approx. Quantity	Maintenance Required	Frequency
Vegetative Filter Strips	*TBD* LF	Review edge of pavement and toe-of-slope for sediment build up. Review vegetation for signs of erosion, bare spots and overall health.	**1 Time/Year**; Every six months during first year.
		Mowing	**As Needed**
		Remove sediment from the tow of slope or edge of pavement. Reseed bare spots.	**As Needed**
Drainage Channels	*TBD* LF	Review Channels to ensure adequate vegetation growth and no rilling or gullying. Repair rills, gullies and dead vegetation.	**2 Times/Year**; and first few months after construction.
		Mowing	**As Necessary**; Grass height shall not exceed 6 inches.
		Manually remove sediment and debris	**1 Time/Year** (Minimum)
		Reseed	**As necessary**; Deicing will necessitate yearly reseeding in the spring.
Grassed Channels	*TBD* LF	Review Channels to ensure adequate vegetation growth and no rilling or gullying. Repair rills, gullies and dead vegetation.	**1 Time/Year** (Minimum)
		Mowing	**Once a month during growing season**
		Manually remove sediment and debris	**1 Time/Year** (Minimum)
		Reseed	**As necessary**; Deicing will necessitate yearly reseeding in the spring.
Catch Basins (deep sump hooded)	*TBD* EA	Review Units	**4 Times/Year**; And at the end of foliage and snow-removal seasons.
		Clean Units	**4 Times/Year**; Or whenever depth of deposits is greater than or equal to one half the depth from the bottom of the sump to the invert of the lowest pipe in the basin.
Infiltration Trench	*TBD* LF	Review units and remove debris.	**2 Times/Year; and after every major storm**
		Remove sediment from pretreatment BMP's	**2 Times/Year; and after every major storm**

BMP	Approx. Quantity	Maintenance Required	Frequency
Proprietary Separator	3 EA	Review Units	**1 Time/Month**; and after every major storm
		Clean Units	**2 Times/Year**
Infiltration Basins	2 EA	Preventative Maintenance	**2 Times/Year**
		Review to ensure proper functioning	**2 Times/Year**; After every major storm for first 3 months of operation; after discharges through high outlet orifice.
		Mow the buffer area, side slopes, and basin bottom if grass; Rake if stone bottom	**2 Times/Year**
Infiltration Basin (Cont'd)	1 EA	Remove trash, debris, grass clippings and accumulated organic matter from unit	**2 Times/Year**
		Review and clean pretreatment devices	**2 Times/Year (Minimum)**; Every Two Months (Recommended); After Every Major Storm.
Leaching Catch Basin	2 EA	Review Units	**1 Time/Year**; And at the end of foliage and snow-removal seasons.
		Clean Units	**1 Times/Year;** 50% Full; As required
Outlet Erosion Control	N/A	Review and clean sedimentation, debris, trash and **grass clippings**. Review pre-treatment BMP's.	**2 Times/Year**
Check Dams	N/A	Review and repair or remove sediment.	**Following significant rainfall**
Catch Basin Inlet Controls	All CB's	Review and Replace per manufacturer's requirements	**Per Manufacturer**
Drain Manhole	*TBD* EA	Review Units	**2 Times/Year**
		Clean Units	**As Required**
Drainage Pipe	*TBD* LF	Review Pipes	**2 Times/Year**
		Clean/Repair Pipes	**As Required**
Open Box Culvert	4 EA	Review Structure	**2 Times/Year**
		Clean/Repair	**As Required**
Invasive Species Removal		Review for the presence of invasive species.	**1 Time/Year**
		Mechanical removal preferred (i.e., hand tools); apply herbicides as necessary.	**As Required**

For reference, MassDEP Specifications from the Stormwater Management Standards have been included in **Appendix B** for all BMP's associated with the Airport's stormwater system.

6. Plan of Stormwater BMP's

Maps of the New Bedford Regional Airport's existing stormwater management system can be found in earlier versions of this Plan. Existing and Proposed Drainage Plans for the current project can be found in the Stormwater Management Report.

7. Public Safety Features

The proposed stormwater management system will mostly be constructed entirely within the Airport's restricted and fenced-in areas. These areas are controlled by the Airport and are closed to public access. There are a couple of areas which the drainage work is in public areas (road crossing; parking lot). Public safety measures (traffic control devices; barricades; traffic barrels, etc.) will be implemented to keep the public safe during construction.

The proposed systems have been, and will be designed to manage any changes in the existing rate of runoff due to airport improvements. System designs to control increases in runoff include infiltration trenches and basins that will be designed to infiltrate stormwater runoff quickly to prevent water retention and eliminate the migration of wildlife such as water fowl and the infestation of insects.

8. Estimated Operations and Maintenance Budget

The City of New Bedford owns and operates the Airport through the New Bedford Airport Commission. The Airport has a maintenance staff of municipal employees who are responsible for the maintenance of the Airport's facilities. The additional cost associated with reviewing and maintaining proposed Gravel Access Road drainage improvements would not add any significant burden onto the current maintenance budget for the entire Airport facility.

9. O & M Compliance Statement

The Airport shall report compliance with the following statements during all drainage system reviews and maintenance activities:

> The site has been reviewed for erosion and appropriate steps have been taken to permanently stabilize any eroded areas;
>
> 1. All aspects of the stormwater BMP's have been reviewed for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the stormwater at the site may be managed in accordance with the Stormwater Management Standards;
> 2. Future responsible parties must be notified of their continuing legal responsibility to operate and maintain the structure; and
> 3. The Operation and Maintenance Plan for the stormwater BMP's is being implemented.

10. Maintenance Log Book

All stormwater BMP's shall be operated and maintained in accordance with the design plans and this O&M Plan. The Airport will report on all drainage system reviews, repairs, replacement, and disposal (for disposal, the log shall indicate the type of material and the disposal location) activities. These reports will be kept on file for a minimum of three (3) years and will be made available to the MassDEP and the City of New Bedford Conservation Commission upon request. In addition, the Airport will escort members of the MassDEP and the City of New Bedford Conservation Commission onto the Airport premises to review, evaluate, and ensure compliance with this O&M Plan during regular business hours. A 24-hour advanced notice is requested to ensure proper escort is available and to prevent interference with airport operations.

An example copy of the drainage system review report for use by Airport Maintenance Staff is included in **Appendix C**.

11. Snow Removal

Snow shall not be plowed, deposited, or dumped into any Wetland Resource Area or buffer zone. Snow shall not be plowed, deposited, or dumped into stormwater management structures including infiltration trenches. Snow removal shall be directed away from these areas to the extent practicable.

Excess snow shall be stored in prescribed areas. Prescribed snow storage areas include:

a.) infield areas between taxiways and runways a minimum of 50’ from infiltration trenches,
b.) east of Taxiway “B” south of Runway 32,
c.) west of the Bridgewater State apron, and
d.) west of the T-hangar adjacent to the west end of Taxiway “B”.

Winter conditions and rates of accumulations of precipitation vary widely. Wind speed and direction, available equipment, and conditions may require special equipment and techniques collectively for snow storage. Snow shall be positioned off the movement area surfaces so all airplane propellers, engine pods, rotors, and wing tips will clear any snowdrift and snow bank as the airplane’s landing gear traverses any portion of the movement area.

Snow storage sites shall not compromise airplane operations, airport NAVAIDS, airport traffic, and ATCT operations such as ATCT line-of-sight requirements.

Depending on the amount of snow cleared and the size of the ramp, ramp signage directing pilots toward the runway could become obscured (covered with snow), and the resulting height of snow stockpiles could cause clearance issues between taxiing airplanes and the snow stockpile. Snow banks piled adjacent to paved Aircraft Operating Areas shall be in accordance with the FAA AC 150/5200-30D Airport Field Condition Assessments and Winter Operations Safety.

12. Pollution Prevention

A stormwater pollution prevention plan (SWPPP) was previously developed for the New Bedford Regional Airport. This SWPPP contains helpful information regarding pollution prevention, spill containment, and maintenance procedures to be enacted to limit the pollution potential from the Airport.

Operators and Maintenance Staff shall thoroughly read, understand, and enact all procedures as indicated in the SWPPP. Operators and Staff shall pay special attention to Section 3 – Stormwater Control Measures. The SWPPP shall be kept and maintained in the Airport Manager’s office. Any questions regarding the SWPPP shall be directed to the Airport Manager, or his/her designee.

Appendix A

Stormwater Management System Diagram

TERMINAL BUILDING INSET

SCALE: 1"=100'

RW23 INSET

SCALE: 1"=200'

CRAIG A. SCHUSTER
CIVIL
No. 37858

AIRPORT SOLUTIONS GROUP, LLC
Innovation By Design
AIRPORT CONSULTANT • BURLINGTON, MASSACHUSETTS
PHONE (781) 491-0083 FAX (781) 491-0360

NO.	DATE	DESCRIPTION	BY

PROJECT

RECONSTRUCT TERMINAL APRONS
PHASES 1, 2, AND 3
DESIGN ONLY

OWNER

NEW BEDFORD AIRPORT COMMISSION
NEW BEDFORD REGIONAL AIRPORT
1569 AIRPORT ROAD, NEW BEDFORD, MA 02746

PROJECT NO.	103-046
DESIGNED BY	TAV
DRAWN BY	TAV
CHECKED BY	SJR
DATE	January 2020
DRAWING SCALE	1" = 200'

SHEET TITLE

DRAINAGE SYSTEM DIAGRAM

GRAPHIC SCALE
0 100' 200' 400'

DRAWING NO.

FIG. 1

1 OF 1

PRELIMINARY - NOT FOR CONSTRUCTION

Appendix B

BMP Specifications

Vegetated Filter Strips

Description: Vegetated filter strips, also known as filter strips, grass buffer strips and grass filters, are uniformly graded vegetated surfaces (i.e., grass or close-growing native vegetation) that receive runoff from adjacent impervious areas. Vegetated filter strips typically treat sheet flow or small concentrated flows that can be distributed along the width of the strip using a level spreader. Vegetated filter strips are designed to slow runoff velocities, trap sediment, and promote infiltration, thereby reducing runoff volumes.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides some peak flow attenuation but usually not enough to achieve compliance with Standard 2
3 - Recharge	No recharge credit
4 - TSS Removal	If greater than or equal to 25' and less than 50' wide, 10% TSS removal. If greater than or equal to 50' wide, 45% TSS removal.
5 - Higher Pollutant Loading	May be used as part of a pretreatment train if lined
6 - Discharges near or to Critical Areas	May be used as part of a pretreatment train if lined. May be used near cold-water fisheries.
7 - Redevelopment	Suitable for pretreatment or as a stand-alone practice if sufficient land is available.

Advantages/Benefits:

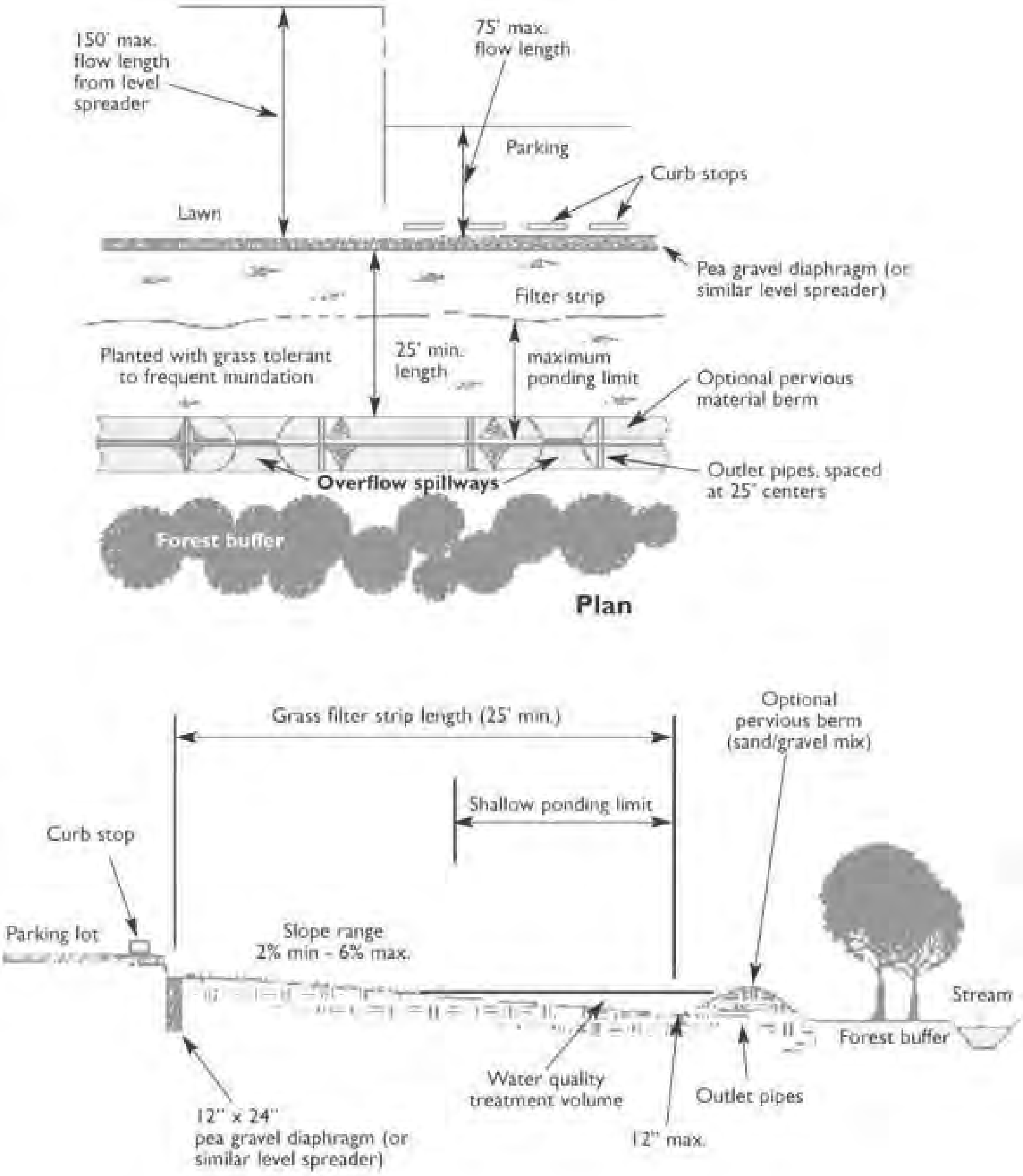
- Reduces runoff volumes and peak flows.
- Slows runoff velocities and removes sediment.
- Low maintenance requirements.
- Serves as an effective pretreatment for bioretention cells
- Can mimic natural hydrology
- Small filter strips may be used in certain urban settings.
- Ideal for residential settings and to treat runoff from small parking lots and roads.
- Can be used as part of runoff conveyance system in combination with other BMPs
- Little or no entrapment hazard for amphibians or other small creatures

Disadvantages/Limitations:

- Variability in removal efficiencies, depending on design
- Little or no treatment is provided if the filter strip is short-circuited by concentrated flows.
- Often a poor retrofit option due to large land requirements.
- Effective only on drainage areas with gentle slopes (less than 6 percent).
- Improper grading can greatly diminish pollutant removal.

Pollutant Removal Efficiencies

• TSS (if filter strip is 25 feet wide)	10% assumed (Regulatory)
• TSS (if filter strip is 50 feet wide)	45% assumed (Regulatory)
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data



adapted from the "Design of Stormwater Systems" 1996

Maintenance

Activity	Frequency
Inspect the level spreader for sediment buildup and the vegetation for signs of erosion, bare spots, and overall health.	Every six months during the first year. Annually thereafter.
Regularly mow the grass.	As needed
Remove sediment from the toe of slope or level spreader and reseed bare spots.	As needed

Special Features

Include an impermeable liner and underdrain for discharges from Land Use with Higher Potential Pollutant Loads and for discharges within Zone IIs and Interim Wellhead Protection Areas; for discharges near or to other critical areas or in soils with rapid infiltration rates greater than 2.4 inches per hour.

Vegetated Filter Strips

Applicability

Vegetated filter strips are used to pretreat sheet flow from roads, highways, and small parking lots. In residential settings, they are useful in pretreating sheet flow from driveways. They provide effective pretreatment, especially when combined with bioretention areas and stream buffers. Urban areas can sometimes accommodate small filter strips depending on available land area, making them potential retrofit options in certain urban settings. Vegetated filter strips can also be used as side slopes of grass channels or water quality swales to enhance infiltration and remove sediment.

Effectiveness

Variable TSS removal efficiencies have been reported for filter strips, depending on the size of the contributing drainage area, the width of the filter strip, the underlying parent soil, the land slope, the type of vegetation, how well the vegetation is established, and maintenance practices. Vegetated filter strips may remove nutrients and metals depending on the length and slope of the filter, soil permeability, size and characteristics of the drainage area, type of vegetative cover, and runoff velocity.

Planning Considerations

Vegetated filter strips may be used as a stand-alone practice for redevelopments, only where other practices are not feasible. Vegetated filter strips can be designed to fit within the open space and rights of way that are available along roads and highways. Do not design vegetated filter strips to accept runoff from land uses with higher potential pollutant loads (LUHHPL) without a liner. Vegetated filter strips function best for drainage areas of one acre or less with gentle slopes.

Design

Do not locate vegetated filter strips in soils with high clay content that have limited infiltration or in soils that cannot sustain grass cover.

The filter strip cannot extend more than 50 feet into a Buffer Zone to a wetland resource area.

The contributing drainage area to a vegetated filter strip is limited to one acre of less.

Design vegetated filter strips with slopes between 2 and 6 percent. Steeper slopes tend to create concentrated flows. Flatter slopes can cause ponding and create mosquito-breeding habitat.

Design the top and toe of the slope to be as flat as possible. Use a level spreader at the top of the slope to evenly distribute overland flows or concentrated runoff across the entire length of the filter strip. Many variations of level spreader designs may be used including level trenches, curbing and concrete weirs. The key to any level spreader design is creating a continuous overflow elevation along the entire width of the filter strip.

Velocity dissipation (e.g. by using riprap) may be required for concentrated flows.

Design the filter strip to drain within 24 hours after a storm. The design flow depth must not exceed 0.5 inches.

To recieve TSS removal credit, make the filter strip at least 25 feet long and generally as wide as the area draining to the strip. To prevent high-velocity concentrated flows, the length of the flow path must be limited to 75 feet if the filter strip handles runoff from impervious surfaces, and 150 feet if the filter strip handles runoff from pervious surfaces. The minimum width of the filter strip must be 20% of the length of the flow path or 8 feet, whichever is greater.

To prevent groundwater contamination, the filter strip must be constructed at least 2 feet above seasonal high groundwater and 2 to 4 feet above bedrock.

The filter strip must be planted with grasses that are relatively salt-tolerant. Select grasses to withstand high flow velocities under wet weather conditions.

A vegetated filter strip may be used as a qualifying pervious area for purposes of the LID Site Design Credits for disconnecting rooftop and nonroof top runoff.

Construction

Proper grading is essential to establish sheet flow from the level spreader and throughout the filter strip.

Implement soil stabilization measures until permanent vegetation is established.

Protect the area to be used for the filter strip by using upstream sediment traps.

Use as much of the existing topsoil on the site as possible to enhance plant growth.

Maintenance

Regular maintenance is critical for filter strips to be effective and to ensure that flow does not short-circuit the system. Conduct semi-annual inspections during the first year (and annually thereafter). Inspect the level spreader for sediment buildup and the vegetation for signs of erosion, bare spots, and overall health. Regular, frequent mowing of the grass is required. Remove sediment from the toe of slope or level spreader, and reseed bare spots as necessary. Periodically, remove sediment that accumulates near the top of the strip to maintain the appropriate slope and prevent formation of a "berm" that could impede the distribution of runoff as sheet flow.

When the filter strip is located in the buffer zone to a wetland resource area, the operation and maintenance plan must include strict measures to ensure that maintenance operations do not alter the wetland resource areas. Please note, filter strips are restricted to the outer 50 feet of the buffer zone.

Cold Climate Considerations

In cold climates such as Massachusetts, the depth of soil media that serves as the planting bed must extend below the frost line to minimize the effects of freezing. Avoid using peat and compost media, which retain water and freeze during the winter, and become impermeable and ineffective.

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Drainage Channels

Description: Drainage channels are traditional vegetated open channels that are designed to provide for non-erosive conveyance. They receive no infiltration or TSS removal credit (Standards 3 and 4).

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides negligible groundwater recharge.
4 - TSS Removal	0% TSS removal credit.
5 - Higher Pollutant Loading	Use as conveyance.
6 - Discharges near or to Critical Areas	May be used to achieve temperature reduction for runoff discharging to cold-water fisheries.
7 - Redevelopment	Limited applicability

Advantages/Benefits:

- Conveys stormwater
- Generally less expensive than curb and gutter systems.
- Accents natural landscape.
- Compatible with LID design practices
- Roadside channels reduce driving hazards by keeping stormwater flows away from street surfaces during storms

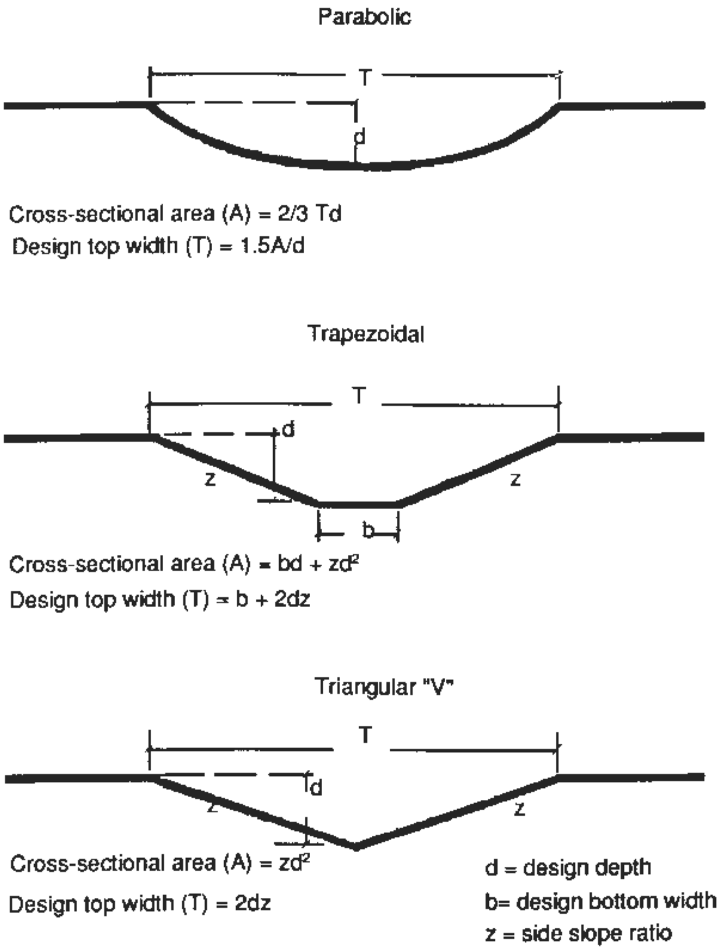
Disadvantages/Limitations:

- Higher degree of maintenance required than for curb and gutter systems.
- Roadside channels are subject to damage from off-street parking and snow removal.
- Provides limited pollutant removal compared to water quality swales
- May be impractical in areas with flat grades, steep topography or poorly drained soils
- Large area requirements for highly impervious sites.

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 0%
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data

Figure DC 1



adapted from the University of New Hampshire

Maintenance

Activity	Frequency
Inspect channels to make sure vegetation is adequate and for signs of rilling and gullying. Repair any rills or gullies. Replace dead vegetation.	The first few months after construction and twice a year thereafter.
Mow	As necessary. Grass height shall not exceed 6 inches.
Remove sediment and debris manually	At least once a year
Reseed	As necessary. Use of road salt or other deicers during the winter will necessitate yearly reseeding in the spring.

Special Features

Drainage channels cannot be used to meet the Stormwater Management Standards. They are a component of a larger stormwater management system and serve to convey runoff from impervious surfaces to or from stormwater treatment BMPs.

Drainage Channels

Drainage Channels versus Water Quality Swales

The distinction between drainage channels and water quality swales lies in the design and planned use of the open channel conveyance. Drainage channels are designed to have sufficient capacity to convey runoff safely during large storm events without causing erosion. Drainage channels typically have a cross-section with sufficient hydraulic capacity to handle the peak discharge for the 10-year storm. The dimensions (slope and bottom width) of a drainage channel must not exceed a critical erosive velocity during the peak discharge. They must be vegetated with grasses to maintain bank and slope integrity. Other than basic channel size and geometry, there are no other design modifications to enhance pollutant removal capabilities. Therefore, pollutant removal efficiency is typically low for drainage channels.

Water quality swales and grass channels, on the other hand, are designed for the required water quality volume and incorporate specific features to enhance their stormwater pollutant removal effectiveness. Pollutant removal rates are significantly higher for water quality swales and grass channels. A water quality swale or grass channel must be used in place of the drainage channel when a water quality treatment credit is sought.

Applicability

Drainage channels are suitable for residential and institutional areas of low to moderate density. The percentage of impervious cover in the contributing areas must be relatively small. Drainage channels can also be used in parking lots to break up areas of impervious cover.

Along the edge of roadways, drainage channels can be used in place of curb and gutter systems. However, the effectiveness of drainage channels may decrease as the number of driveway culverts increases. They are also generally not compatible with extensive sidewalk systems. When using drainage channels in combination with roadways and sidewalks, it is most appropriate to place the channel between the two impervious covers (e.g., between the sidewalk and roadway).

The topography of the site should allow for the design of a drainage channel with sufficient slope and cross-sectional area to maintain non-erosive flow velocities. The longitudinal slope of the swale should be as close to zero as possible and not greater than 5%.

Planning Considerations

The two primary considerations when designing a drainage channel are maximizing channel capacity and minimizing erosion. Use the maximum expected retardance when checking drainage channel capacity. Usually the greatest flow retardance occurs when vegetation is at its maximum growth for the year. This usually occurs during the early growing season and dormant periods.

Other factors to be considered when planning for the drainage channel are land availability, maintenance requirements and soil characteristics. The topography of the site should allow for the design of a drainage channel with sufficient slope and cross-sectional area to maintain a non-erosive flow velocity, generally less than five feet per second.

The shape of the cross-sectional channel is also an important planning consideration. Figure DC 1 shows three different design shapes. The V-shaped or triangular cross-section can result in higher velocities than other shapes, especially when combined with steeper side slopes, so use this design only if the quantity of flow is relatively small. The parabolic cross-section results in a wide shallow channel that is suited to handling larger flows and blends in well with natural settings. Use trapezoidal channels when deeper channels are needed to carry larger flows and conditions require relatively high velocities. Select a grass type for the channel lining that is appropriate for site conditions, including one that is able to resist shear from the design flow, is shade tolerant, is drainage tolerant, and has low maintenance requirements. Use vegetation that is water tolerant and has a dense root system. Alternatively, the drainage channel may be lined with stone.

Design

See the following for complete design references:
Site Planning for Urban Stream Protection. 1995. Schueler. Center for Watershed Protection.

The length of the drainage channel depends on the slope, contributing impervious surface area, and runoff volume. Because drainage channels with low velocities can act as sediment traps, add extra capacity to address sediment accumulation without reducing design capacity. Add an extra 0.3 to 0.5

feet of freeboard depth, if sediment accumulation is expected. Use side slopes of 3:1 or flatter to prevent side slope erosion. Make the longitudinal slope of the channel as flat as possible and not greater than 5%.

Install check dams in drainage channels when necessary to achieve velocities of 5 feet per second or less. Do not use earthen check dams because they tend to erode on the downstream side, and it is difficult to establish and maintain grass on the dams. The maximum ponding time behind the check dam should not exceed 24 hours. Use outlet protection at discharge points from a drainage channel to prevent scour at the outlet.

The design for the drainage channel must include access for maintenance. When located along a highway, provide a breakdown lane with a width of 15 feet. When located along a street, off-street parking can be doubled up as the access, provided signs are posted indicating no parking is allowed during maintenance periods. When locating drainage channels adjacent to pervious surfaces, include a 15-foot wide grass strip to provide access for maintenance trucks.

Construction

Use temporary erosion and sediment controls during construction. Soil amendments, such as aged compost that contains no biosolids, may be needed to encourage vegetation growth. Select a vegetation mix that suits the characteristics of the site. Seeding will require mulching with appropriate materials, such as mulch matting, straw, wood chips, other natural blankets, or synthetic blankets. Anchor blanket immediately after seeding. Provide new seedlings with adequate water until they are well established. Refer to the “Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas: A Guide for Planners, Designers, and Municipal Officials” for information regarding seeding, mulching, and use of blankets.

Maintenance

The maintenance and inspection schedule should take into consideration the effectiveness of the drainage channel. Inspect drainage channels the first few months after construction to make sure that there is no rilling or gullying, and that vegetation in the channels is adequate. Thereafter, inspect the channel twice a year for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sediment accumulation.

Regular maintenance tasks include mowing, fertilizing, liming, watering, pruning, weeding, and pest control. Mow channels at least once per year. Do not cut the grass shorter than three to four inches. Keep grass height under 6 inches to maintain the design depth necessary to serve as a conveyance. Do not mow excessively, because it may increase the design flow velocity.

Remove sediment and debris manually at least once per year. Re-seed periodically to maintain the dense growth of grass vegetation. Take care to protect drainage channels from snow removal procedures and off-street parking. When drainage channels are located on private residential property, the operation and maintenance plan must clearly specify the private property owner who is responsible for carrying out the required maintenance. If the operation and maintenance plan calls for maintenance of drainage channels on private properties to be performed by a public entity or an association (e.g. homeowners association), maintenance easements must be obtained.

Grassed Channel (Biofilter Swale)

Description: Grassed Channels (formerly known as Biofilter swales) are treatment systems with a longer hydraulic residence time than drainage channels. The removal mechanisms are sedimentation and gravity separation, rather than filtration. To receive TSS credit, a sediment forebay or equivalent must be provided for pretreatment. Note that the sediment forebay does not receive a separate TSS removal credit.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	No infiltration credit
4 - TSS Removal	50% TSS with adequate pretreatment
5 - Higher Pollutant Loading	N/A
6 - Discharges near or to Critical Areas	Not suitable for vernal pools or bathing beaches. At other critical areas, may be used as a pretreatment device.
7 - Redevelopment	Typically not suited for retrofits.

Advantages/Benefits:

- Provides pretreatment if used as the first part of a treatment train.
- Open drainage system aids maintenance
- Accepts sheet or pipe flow
- Compatible with LID design measures.
- Little or no entrapment hazard for amphibians or other small animals

Disadvantages/Limitations:

- Short retention time does not allow for full gravity separation·
- Limited biofiltration provided by grass lining.· Cannot alone achieve 80% TSS removal
- Must be designed carefully to achieve low flow rates for Water Quality Volume purposes (<1.0 fps)
- Mosquito control considerations

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	50%[1] for Regulatory Purposes (47%)[2]
• Total phosphorus (TP)	-121%[2]
• Total Nitrogen	Insufficient Data
• Metals (copper, lead, zinc, cadmium)	Insufficient Data
• Pathogens (coliform, e. coli)	Insufficient Data

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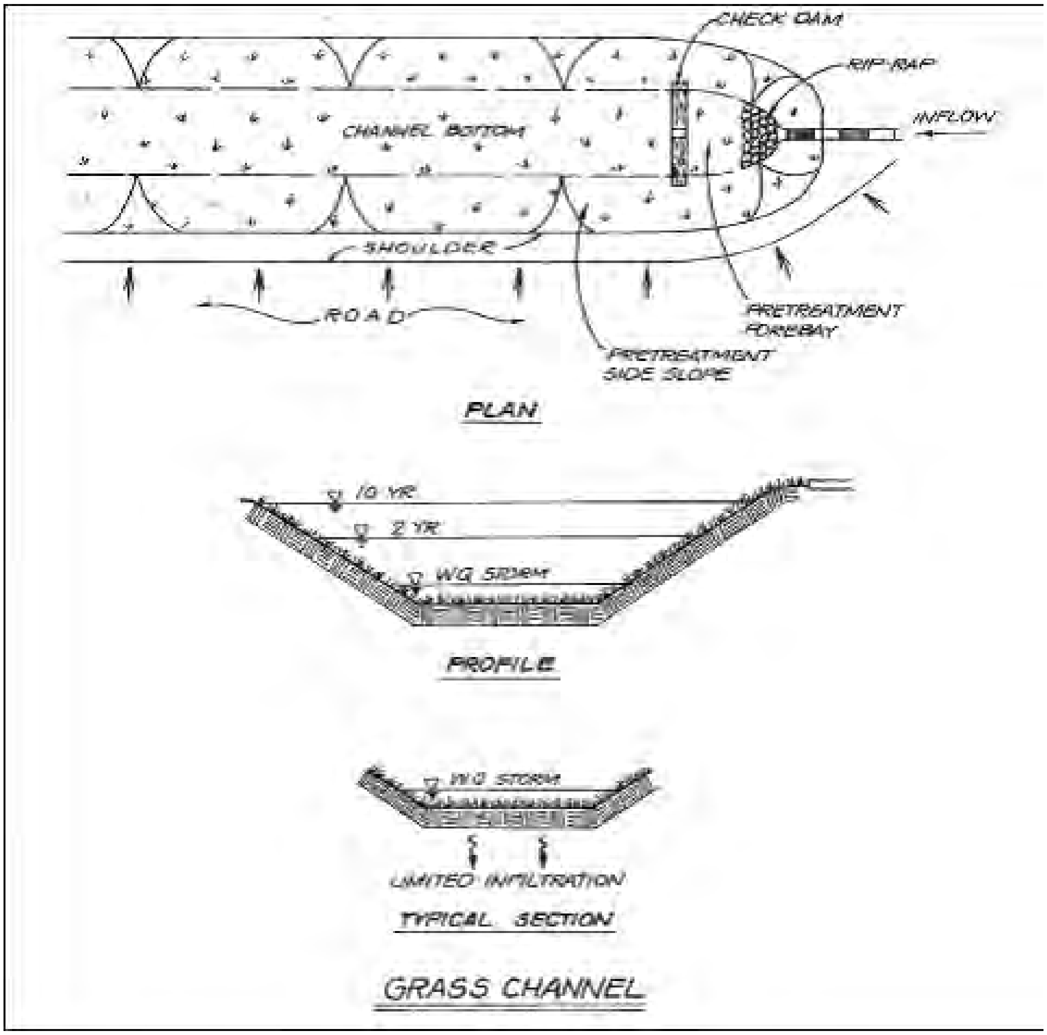
[1] Atlanta Regional Commission et al, 2001, Georgia Stormwater Manual, Volume 2, Section 3-3-2, http://georgiastormwater.com/vol2/3-3-2.pdf

[2] International Stormwater Database, based on MassDEP analysis of raw influent & effluent values reported in 2005.



adapted from the Vermont Stormwater Manual

Maintenance

Activity	Frequency
Remove sediment from forebay	Annually
Remove sediment from grass channel	Annually
Mow	Once a month during growing season
Repair areas of erosion and revegetate	As needed, but no less than once a year

Special Features

Reduces volume and rate of runoff.

Grass Channels

Grass channels convey and treat stormwater. Grass channels were referred to as biofilter swales in the 1996 MassDEP/CZM Stormwater Handbook, based on the nomenclature coined by the Center for Watershed Protection (CWP). The CWP is now referring to biofilter swales as grass channels – so MassDEP is adopting the same name as the CWP to minimize confusion.

Properly designed grass channels are ideal when used adjacent to roadways or parking lots, where runoff from the impervious surfaces can be directed to the channel via sheet flow. Runoff can also be piped to the channel. If piped, locate the sediment forebay at the pipe outlet and include a check dam separating the forebay from the channel. For sheet flow, use a vegetated filter strip on a gentle slope or a pea gravel diaphragm. Make the longitudinal slope as flat as possible. This increases the Hydraulic Residence Time (HRT) and allows gravity separation of solids and maximizes sediment removal. Install check dams to further increase the HRT.

Review of the International Stormwater Database, updated in 2005, indicates lower TSS removal when compared to similar treatment practices (dry water quality swales, wet water quality swales, and bioretention areas). The information in the International Stormwater Database indicates grass channels are likely to export phosphorus (hence the negative removal efficiency cited above). Grass channels are not a practice suitable for treating stormwater that discharges to waters impaired by phosphorus or for waters where phosphorus TMDLs have been established.

Differences from dry water quality swales, wet water quality swales, bioretention cells, and drainage channels: Dry water quality swales contain a specific soil media mix and underdrain, providing greater treatment than grass channels. Wet water quality swales are designed with a permanent wet channel, whereas grass channels must be designed to completely drain between storms. Bioretention areas, including rain gardens, are designed solely as a treatment practice, and not for conveyance. Lastly, drainage channels act solely as a conveyance, in contrast to properly designed grass channels where runoff flow is deliberately lagged to provide treatment.

Design Considerations

Sizing:

Water Quality Volume: Design grass channels to maximize contact with vegetation and soil surface to promote greater gravity separation of solids during the storm associated with the water quality event (either ½ inch or 1-inch runoff). Design the channel such that the velocity does not exceed 1 foot per second during the 24-hour storm associated with the water quality event. Do not allow the water depth during the storm associated with the water quality event to exceed 4 inches (for design purposes). Make sure the selected design storm provides at least 9 minutes of HRT within the channel. Increasing the HRT beyond 9 minutes increases the likelihood of achieving the 50% TSS removal efficiency. Adding meanders to the swale increases its length and may increase the HRT.

2-year and 10-year conveyance capacity: Design grass channels to convey both the 2-year and 10-year 24-hour storms. Provide a minimum of 1-foot freeboard above the 10-year storm. Make sure that the runoff velocities during the 2-year 24-hour storm do not cause erosion problems.

Channel Length: Length depends on design factors to achieve the minimum 9-minute residence time for the storm associated with the water quality event.

Channel Crossings: In residential settings, driveways will cross over the channel, typically via culverts (pre-cast concrete, PVC, or corrugated metal pipe).

Soils: Grass channels may be constructed from most parent soils, unless the soils are highly impermeable. Soils must be able to support a dense grass growth. MassDEP recommends sandy loams, with an organic content of 10 to 20%, and no more than 20% clay. Highly impermeable soils, such as clays, are not suitable for grass channels, because they do not support dense grass stands. Similarly, gravelly and coarse soils may not be suitable due to their lower moisture retention capability, leading to potential die-back of the grass lining during the summer when the inter-event period between storms is longer than during other times of the year.

Grasses: The grasses serve to stabilize the channel, and promote conditions suitable for sedimentation, such as offering resistance to flow, which reduces water velocities and turbulence. Select a grass height of 6 inches or less. Grasses over that height tend to flatten when water flows over them, inhibiting sedimentation. Select grasses that produce a fine, uniform and dense cover that can withstand varying moisture conditions. Regularly mow the channel to ensure that the grass height does not exceed 6 inches. Select grasses that are salt tolerant to withstand winter deicing of roadways. In the spring, replant any areas where grasses died off due to deicing. (Franklin 2002 and Knoxville 2003 provide recommendations for the best grass species.)

Pea Gravel Diaphragm: Use clean bank-run gravel, conforming to ASTM D 448, varying in size from 1/8 inch to 3/8 inch (No. 6 stone).

Outlet Protection: Must be used at discharge points to prevent scour downstream of the outlet.

Construction Considerations: Stabilize the channel after it is shaped before permanent turf is established, using natural or synthetic blankets. Never allow grass channels to receive construction period runoff.

Site Constraints

A proponent may not be able to install a grass channel swale because of:

- High groundwater;
- Presence of utilities; or
- Other site conditions that limit depth of excavation because of stability.

Maintenance

Access: Maintenance access must be designed as part of the grass channel. If located adjacent to a roadway, make the maintenance access at least 15 feet wide, which can also be combined with a breakdown lane along a highway or on-street parking along a residential street. When combined with on-street parking, post signs prohibiting parking when the swale is to be inspected and cleaned. Do not use travel lanes along highways and streets as the required maintenance access.

Mowing: Set the mower blades no lower than 3 to 4 inches above the ground. Do not mow beneath the depth of the design flow during the storm associated with the water quality event (e.g., if the design flow is no more than 4 inches, do not cut the grass shorter than 4 inches). Mow on an as-needed basis during the growing season so that the grass height does not exceed 6 inches.

Inspection: Inspect semi-annually the first year, and at least once a year thereafter. Inspect the grass for growth and the side slopes for signs of erosion and formation of rills and gullies. Plant an alternative grass species if the original grass cover is not successfully established. If grass growth is impaired by winter road salt or other deicer use, re-establish the grass in the spring.

Trash/Debris Removal: Remove accumulated trash and debris prior to mowing.

Sediment Removal: Check on a yearly basis and clean as needed. Use hand methods (i.e., a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils. Sediment build-up in the grass channel reduces its capacity to treat and convey the water quality event, 2-year and 10-year 24-hour storm.

References:

Atlanta Regional Commission et al, 2001, Georgia Stormwater Management Manual, Volume 2, Section 3-3-2, Grass Channel, http://georgiastormwater.com/vol2/3-3-2.pdf

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Deep Sump Catch Basin

Description: Deep sump catch basins, also known as oil and grease or hooded catch basins, are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides no groundwater recharge
4 - TSS Removal	25% TSS removal credit when used for pretreatment. Because of their limited effectiveness and storage capacity, deep sump catch basins receive credit for removing TSS only if they are used for pretreatment and designed as off-line systems.
5 - Higher Pollutant Loading	Recommended as pretreatment BMP. Although provides some spill control capability, a deep sump catch basin may not be used in place of an oil grit separator or sand filter for land uses that have the potential to generate runoff with high concentrations of oil and grease such as: high-intensity-use parking lots, gas stations, fleet storage areas, vehicle and/or equipment maintenance and service areas.
6 - Discharges near or to Critical Areas	May be used as pretreatment BMP. not an adequate spill control device for discharges near or to critical areas.
7 - Redevelopment	Highly suitable.

Advantages/Benefits:

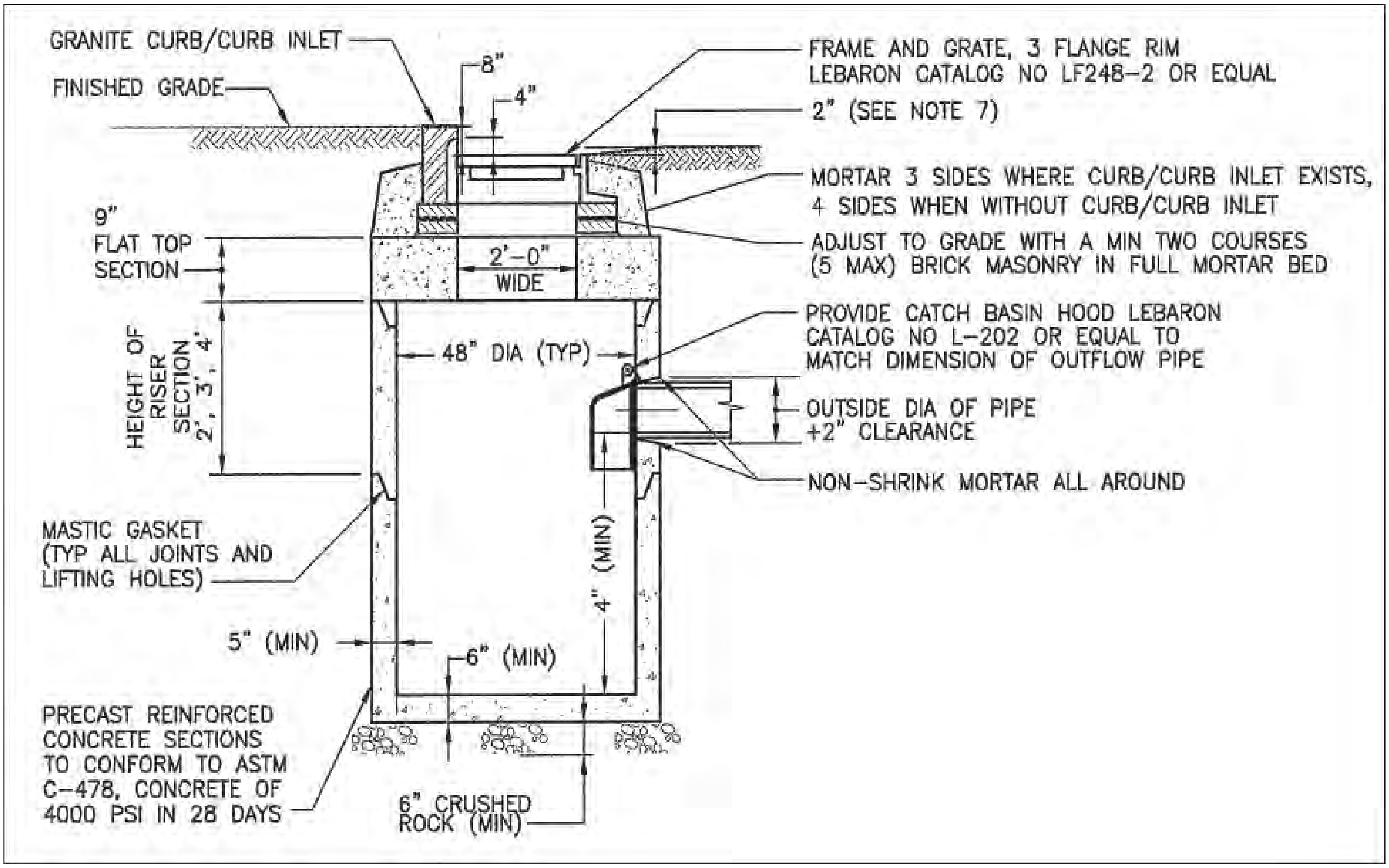
- Located underground, so limited lot size is not a deterrent.
- Compatible with subsurface storm drain systems.
- Can be used for retrofitting small urban lots where larger BMPs are not feasible.
- Provide pretreatment of runoff before it is delivered to other BMPs.
- Easily accessed for maintenance.
- Longevity is high with proper maintenance.

Disadvantages/Limitations:

- Limited pollutant removal.
- Expensive to install and maintain, resulting in high cost per unit area treated.
- No ability to control volume of stormwater
- Frequent maintenance is essential
- Requires proper disposal of trapped sediment and oil and grease
- Entrapment hazard for amphibians and other small animals

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 25% (for regulatory purposes)
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data



adapted from the University of New Hampshire

Maintenance

Activity	Frequency
Inspect units	Four times per year
Clean units	Four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Special Features

All deep sump catch basins must include hoods. For MassHighway projects, consult the Stormwater Handbook for Highways and Bridges for hood requirements.

LID Alternative

Reduce Impervious Surface
Disconnect rooftop and non-rooftop runoff
Vegetated Filter Strip

Deep Sump Catch Basin

Suitable Applications

- Pretreatment
- Residential subdivisions
- Office
- Retail

Design Considerations

- The contributing drainage area to any deep sump catch basin should not exceed ¼ acre of impervious cover.
- Design and construct deep sump catch basins as off-line systems.
- Size the drainage area so that the flow rate does not exceed the capacity of the inlet grate.
- Divert excess flows to another BMP intended to meet the water quantity requirements (peak rate attenuation) or to a storm drain system. An off-line design enhances pollutant removal efficiency, because it prevents the resuspension of sediments in large storms.

Make the sump depth (distance from the bottom of the outlet pipe to the bottom of the basin) at least four feet times the diameter of the outlet pipe and more if the contributing drainage area has a high sediment load. The minimum sump depth is 4 feet. Double catch basins, those with 2 inlet grates, may require deeper sumps. Install the invert of the outlet pipe at least 4 feet from the bottom of the catch basin grate.

The inlet grate serves to prevent larger debris from entering the sump. To be effective, the grate must have a separation between the grates of one square inch or less. The inlet openings must not allow flows greater than 3 cfs to enter the deep sump catch basin. If the inlet grate is designed with a curb cut, the grate must reach the back of the curb cut to prevent bypassing. The inlet grate must be constructed of a durable material and fit tightly into the frame so it won't be dislodged by automobile traffic. The inlet grate must not be welded to the frame so that sediments may be easily removed. To facilitate maintenance, the inlet grate must be placed along the road shoulder or curb line rather than a traffic lane.

Note that within parking garages, the State Plumbing Code regulates inlet grates and other stormwater management controls. Inlet grates inside parking garages are currently required to have much smaller openings than those described herein.

To receive the 25% removal credit, hoods must be used in deep sump catch basins. Hoods also help contain oil spills. MassHighway may install catch basins without hoods provided they are designed, constructed, operated, and maintained in accordance with the Mass Highway Stormwater Handbook.

Install the weep hole above the outlet pipe. Never install the weep hole in the bottom of the catch basin barrel.

Site Constraints

A proponent may not be able to install a deep sump catch basin because of:

- Depth to bedrock;
- High groundwater;
- Presence of utilities; or
- Other site conditions that limit depth of excavation because of stability.

Maintenance

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise the catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www. Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.

Proprietary Separators

Description: A proprietary separator is a flow-through structure with a settling or separation unit to remove sediments and other pollutants. They typically use the power of swirling or flowing water to separate floatables and coarser sediments, are typically designed and manufactured by private businesses, and come in different sizes to accommodate different design storms and flow conditions. Some rely solely on gravity separation and contain no swirl chamber. Since proprietary separators can be placed in almost any location on a site, they are particularly useful when either site constraints prevent the use of other stormwater techniques or as part of a larger treatment train. The effectiveness of proprietary separators varies greatly by size and design, so make sure that the units are sized correctly for the site's soil conditions and flow profiles, otherwise the unit will not work as designed.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides no groundwater recharge
4 - TSS Removal	Varies by unit. Must be used for pretreatment and be placed first in the treatment train to receive TSS removal credit. Follow procedures described in Chapter 4 to determine TSS credit.
5 - Higher Pollutant Loading	Suitable as pretreatment device.
6 - Discharges near or to Critical Areas	Suitable as pretreatment device or potentially a spill control device
7 - Redevelopment	Suitable as pretreatment device or treatment device if it is not possible to provide other BMPs.

Advantages/Benefits:

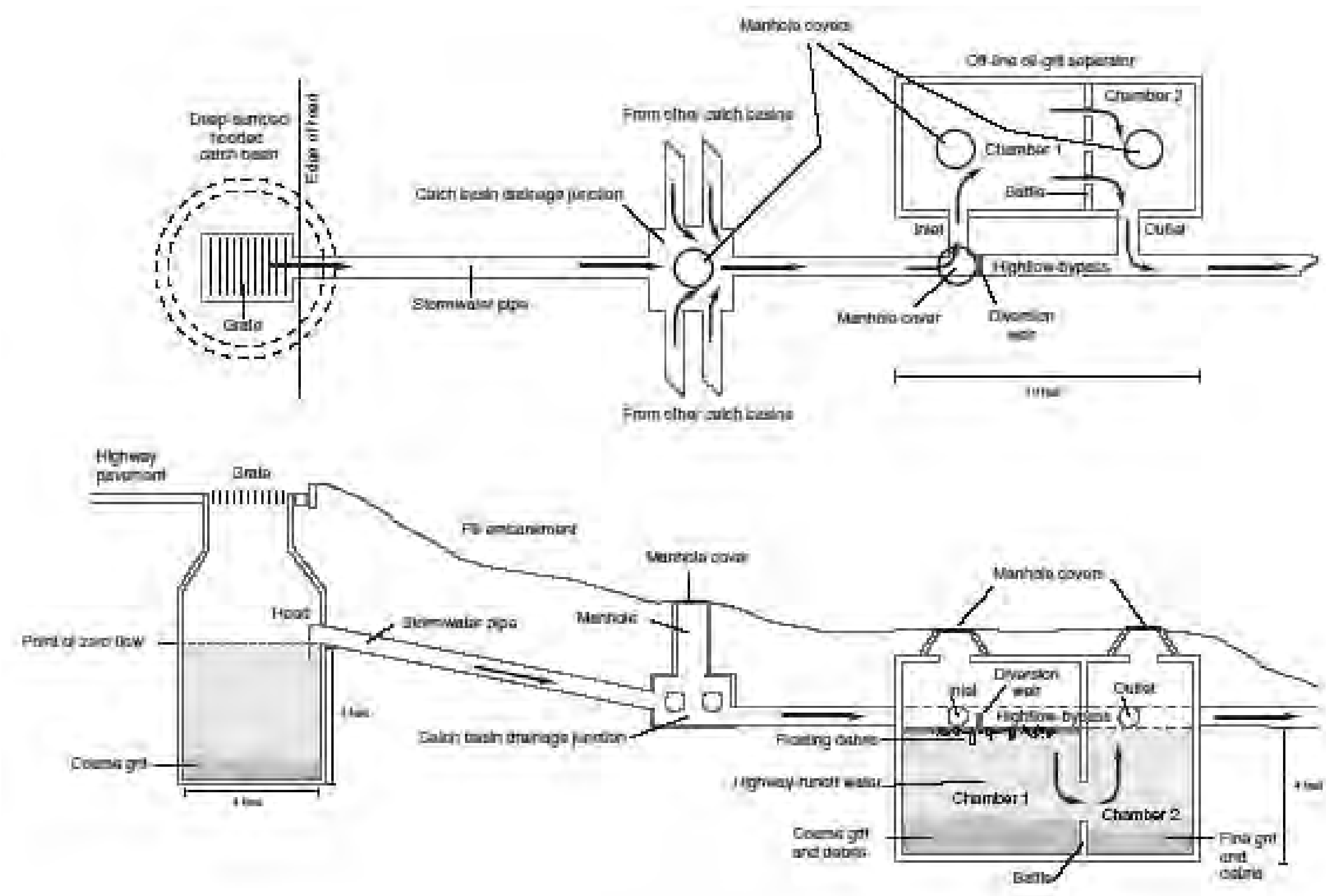
- Removes coarser sediment.
- Useful on constrained sites.
- Can be custom-designed to fit specific needs of a specific site.

Disadvantages/Limitations:

- Removes only coarse sediment fractions
- Provides no recharge to groundwater
- No control of the volume of runoff
- Frequent maintenance is essential

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - Varies.
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data



Schematic section of a deep-sump hooded catch basin and a 1,500-gallon off-line water quality inlet.

adapted from the MassHighway Storm Water Handbook for Highways

Maintenance

Activity	Frequency
Inspect in accordance with manufacturer requirements, but no less than twice a year following installation, and no less than once a year thereafter.	See activity
Remove sediment and other trapped pollutants at frequency or level specified by manufacturer.	See manufacturer information

Special Features

Can be custom-designed to fit specific needs at a specific site.

LID Alternative

Reduce impervious surfaces
Disconnect runoff from non-metal roofs, roadways, and driveways

Proprietary Separators

Applicability

Because they have limited pollutant removal and storage capacity, proprietary separators must be used for pretreatment only. Because they are placed underground, proprietary separators may be the only structural pretreatment BMPs feasible on certain constrained redevelopment sites where space or storage is not available for more effective BMPs. They may be especially useful in ultra-urban settings such as Boston or Worcester. Some proprietary separators may be used for spill control.

Effectiveness

Proprietary separators have a wide range of TSS efficiencies. To assess the ability of proprietary separators to remove TSS and other pollutants, a proponent should follow the procedures set forth in Chapter 4. The specific units proposed for a particular project cannot be effective unless they are sized correctly. Proprietary separators are usually sized based on flow rate. A proprietary separator must be sized to treat the required water quality volume. To be effective at removing TSS and other pollutants the system must be designed, constructed, and maintained in accordance with the manufacturer's specifications and the specifications in this Handbook.

Planning Considerations

To receive TSS removal credit, proprietary separators must be used for pretreatment and placed at the beginning of a stormwater treatment train. They can be configured either in-line or if subject to higher flows, off-line to reduce scouring. They must be sized in accordance with the manufacturer's specifications and the specifications in this Handbook. Proprietary separators used as spill control devices may have to be sized differently than those used for TSS removal.

Design

The design of proprietary separators varies by manufacturer. Units are typically precast concrete, but larger systems may be cast in place. Units may have baffles or other devices to direct incoming water into and through a series of chambers, slowing the water down to allow sediment to drop out into internal storage areas, then directing this pre-treated water to exit to other treatment or infiltration devices. In some cases, flow will be introduced tangentially, to induce swirl or vortex. Units may include skirts or weirs, to keep trapped sediments from becoming re-entrained. Some units combine a catch basin with the treatment function, providing off-line rather than in-line treatment.

Generally they are placed below ground on a gravel or stone base. Make sure all units contain inspection and access ports so that they may be inspected and cleaned. During design, take care to place the inspection and access ports where they will be accessible. Do not place the ports in locations such as travel lanes of roadways/highways and parking stalls.

Construction

Install construction barriers around the excavation area to prevent access by pedestrians. Use diversions and other soil erosion practices up-slope of the proprietary separator to prevent runoff from entering the site before construction of the units is complete. Implement practices to prevent construction period runoff from being discharged to the units until construction is complete and the soil is stabilized. Stabilize all surrounding area and any established outlets. Remove temporary structures after vegetation is established.

Maintenance

Inspect and clean these units in strict accordance with manufacturers' recommendations and requirements. Clean the units using the method specified by the manufacturer. Vactor trucks are typically used to clean these units. Clamshell buckets typically used for cleaning catch basins are almost never allowed by manufacturers. Sometimes it will be necessary to remove sediment manually.

Adapted from:
MassHighway. Storm Water Handbook for Highways and Bridges. May 2004.

Infiltration Trenches

Description: Infiltration trenches are shallow excavations filled with stone. They can be designed to capture sheet flow or piped inflow. The stone provides underground storage for stormwater runoff. The stored runoff gradually exfiltrates through the bottom and/or sides of the trench into the subsoil and eventually into the water table.

Advantages/Benefits:

- Provides groundwater recharge.
- Reduces downstream flooding and protects stream bank integrity for small storms.
- Preserves the natural water balance of the site.
- Provides a high degree of runoff pollution control when properly designed and maintained.
- Reduces the size and cost of downstream stormwater control facilities and/or storm drain systems by infiltrating stormwater in upland areas.
- Suitable where space is limited.

Disadvantages/Limitations:

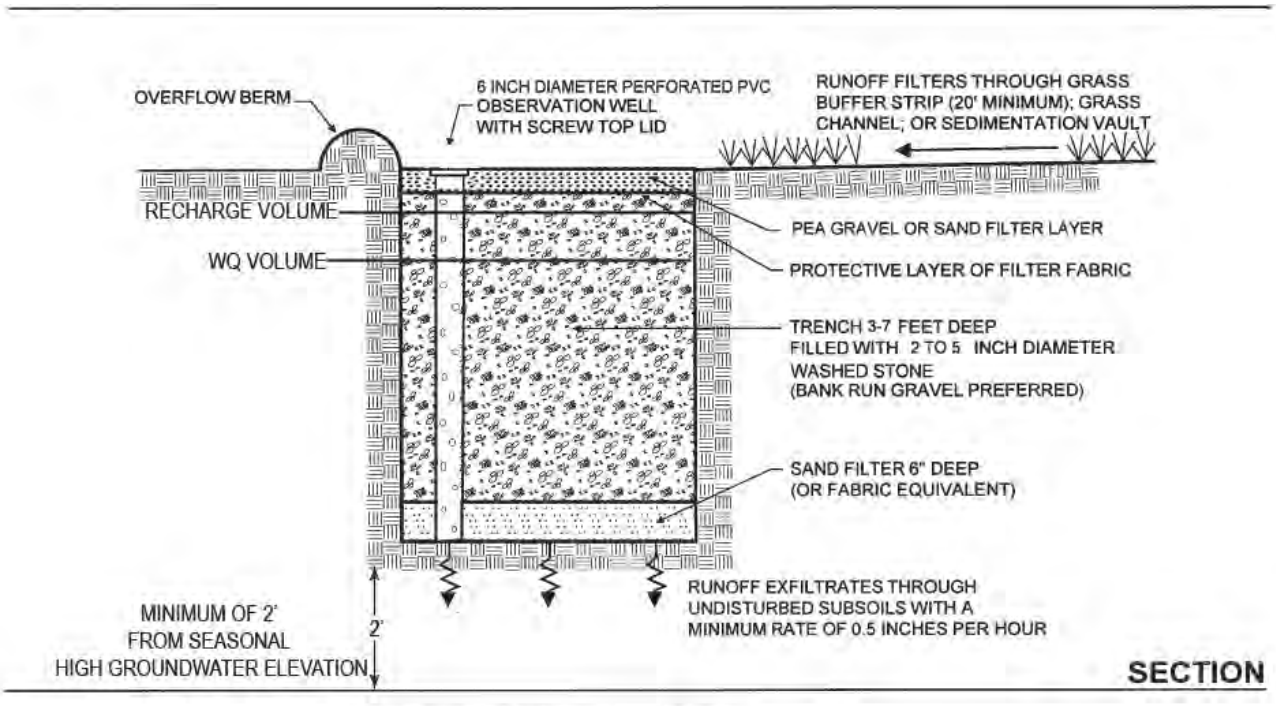
- High failure rates due to improper siting, inadequate pollution prevention and pretreatment, poor design, construction and maintenance.
- Use restricted to small drainage areas.
- Depending on runoff quality, potential risk of groundwater contamination.
- Requires frequent maintenance.
- Susceptible to clogging with sediment.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Full exfiltration trench systems may be designed for peak rate attenuation
3 - Recharge	Provides groundwater recharge.
4 - TSS Removal	80% TSS removal credit when combined with one or more pretreatment BMPs.
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. For some land uses with higher potential pollutant load an oil grit separator or equivalent must be used prior to discharge to the infiltration structure. Infiltration must be done in compliance with 314 CMR 5.00.
6 - Discharges near or to Critical Areas	Highly recommended with pretreatment to remove at least 44% TSS removal prior to discharge.
7 - Redevelopment	Suitable with pretreatment.

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80% with pretreatment
• Total Nitrogen	40% to 70%
• Total Phosphorus	40% to 70%
• Metals (copper, lead, zinc, cadmium)	85% to 90%
• Pathogens (coliform, e coli)	Up to 90%



Example of Infiltration Trench

adapted from the University of New Hampshire

Maintenance

Activity	Frequency
Inspect units and remove debris	Every 6 months and after every major storm
Remove sediment from pretreatment BMPs	Every 6 months and after every major storm

Special Features:

High failure rate without adequate pretreatment and regular maintenance

LID Alternative:

Reduce impervious areas
Bioretention areas

Infiltration Trenches

Infiltration trenches can be designed for complete exfiltration or partial exfiltration, where a portion of the runoff volume is directed to the trench and the remainder is conveyed to other BMPs.

Full Exfiltration Trench Systems

Infiltration trenches must be sized to provide storage and exfiltration of the required water quality volume. Full exfiltration systems also provide control of peak discharges and water quality treatment for all storm events equal to or less than the design storm selected. In selecting the design storm, the minimum peak rate attenuation storm event must include the 2- and 10-year 24-hour storm events and may include the 100-year 24-hour storm event, if the runoff from that storm will increase flooding up- or downstream of the site. An emergency overflow channel is required to discharge runoff volumes in excess of the design storm. Economic and physical constraints can restrict the use of full exfiltration systems. Generally, it is not practical to provide storage for large infrequent storms, such as the 100-year storm.

Partial or Water Quality Exfiltration Trench Systems

These systems exfiltrate a portion of the runoff, while the remainder is conveyed to other BMPs. At a minimum, they must be sized to exfiltrate the recharge volume required by Stormwater Management Standard 3. There are two methods of partial infiltration. The first relies on off-line treatment where a portion of the runoff, or the “first-flush,” is routed from the main channel to the trench by means of a weir or other diversion structure. The second method is on-line, and uses a perforated pipe at the top of the trench. This underdrain must be placed near the top of the trench. Refer to the design section below. After the trench fills to capacity, excess runoff is discharged through the perforated pipe and directed to other BMPs.

Applicability

Infiltration trenches always require a pretreatment BMP. For sheet flow, pretreatment BMP structures that may be used include vegetated filter strips and pea stone gravel diaphragms. For piped flow, a sediment forebay should be used.

Infiltration trenches are feasible at sites with gentle slopes, permeable soils, and where seasonal high groundwater levels are at least two feet below the bottom of the trench. MassDEP recommends providing greater depths from the bottom of the trench to seasonal high groundwater elevation to reduce the potential for failure. Depth to bedrock will need to be evaluated to determine if use of an infiltration trench is feasible.

Contributing drainage areas must be relatively small and not exceed 5 acres. Infiltration trenches are suitable for parking lots, rooftop areas, local roads, highways, and small residential developments.

Infiltration trenches are adaptable to many sites because of their thin profile. Table IT.1 lists the recommended site criteria. Infiltration trenches can be used in upland areas of larger sites to reduce the overall amount of runoff and improve water quality while reducing the size and costs of downgradient BMPs.

Infiltration trenches are effective at mimicking the natural, pre-development hydrological regime at a site. Full exfiltration systems that have been carefully designed may be capable of controlling peak discharges from the 2-year and 10-year 24-hour storm.

Planning Considerations

MassDEP highly recommends using infiltration trenches near Critical Areas. They may be used to treat stormwater discharges from areas of higher potential pollutant loads, provided 44% of TSS is removed prior to infiltration. For some land uses with higher potential pollutant load, an oil grit separator or equivalent device may be required prior to discharge to the infiltration trench. When an oil/grit separator is used, pipe the runoff to the infiltration trench. Discharges from land uses with higher potential pollutant loads require compliance with 314 CMR 5.00.

Before planning infiltration trenches, carefully evaluate the subsurface of the site including soils, depth to bedrock, and depth to the water table. Make sure soils have a minimum percolation rate of 0.17 inches per hour.

Make the slopes of the contributing drainage area less than 5%. Infiltration trenches have extremely high failure rates, usually due to clogging, so pretreatment is essential. Infiltration trenches are not intended to remove coarse particulate pollutants, and generally are difficult to rehabilitate once clogged. Typical pretreatment BMPs for infiltration trenches

Table IT.1 - Site Criteria for Infiltration Trenches

1. The contributing drainage area to any individual infiltration trench should be restricted to 5 acres or less.
2. The minimum depth to the seasonal high water table, bedrock, and/or impermeable layer should be 2 ft. from the bottom of the trench.
3. The minimum acceptable soil infiltration rate is 0.17 inches per hour. Infiltration trenches must be sized in accordance with the procedures set forth in Volume 3.
4. A minimum of 2 soil borings should be taken for each infiltration trench. Infiltration trenches over 100 ft. in length should include at least one additional boring location for each 50 ft. increment. Borings should be taken at the actual location of the proposed infiltration trench so that any localized soil conditions are detected.
5. Infiltration trenches should not be used at sites where soils have 30% or greater clay content, or 40% or greater silt clay content. Infiltration trenches will not function adequately in areas with hydrologic soils in group D and infiltration will be limited for hydrologic soils in group C.
6. Infiltration trenches should not be placed over fill materials.
7. The following setback requirements apply to infiltration trench installations:
    - Distance from any slope greater than 5% to any surface exposed trench: minimum of 100 ft.
    - Distance from any slope greater than 20% to any underground trench: minimum of 100 ft.
    - Distance from septic system soil absorption system: minimum of 50 ft.
    - Distance from any private well: minimum of 100 feet, additional setback distance may be required depending on hydrogeological conditions.
    - Distance from any public groundwater drinking water supplies: Zone I radius, additional setback distance may be required depending on hydrogeological conditions.
    - Distance from any surface water supply and its tributaries: Zone A
8. Distance from any surface water of the Commonwealth (other than surface drinking water supplies and their tributaries): minimum of 150 ft downslope and 100 ft upslope.
9. Distance from any building foundations including slab foundations without basements: minimum of 20 ft.

include oil grit separators, deep sump catch basins, vegetated filter strips, pea stone gravel diaphragms, or sediment forebays.

Clogging can be an issue even when infiltrating uncontaminated rooftop runoff as well, so it is important to implement some form of pretreatment to remove sediments, leaf litter, and debris to ensure the proper functioning of the trench and allow for longer periods between maintenance.

Consider the impacts of infiltrating stormwater on nearby resources. Infiltration trenches need to be set back outside Zone Is and Zone As for public drinking water supplies. Finally, avoid creating groundwater mounds near Chapter 21e sites that could alter subsurface flow patterns and spread groundwater pollution.

Design

See the following for complete design references:
Maryland Stormwater Design Manual, Volumes I and II. October 2000. Maryland Department of Environment. Baltimore, MD.

The volume and surface area of an infiltration trench relate to the quantity of runoff entering the trench from the contributing area, the void space, and the infiltration rate. Because the infiltration trench is filled with stone, only the space between the stone is available for runoff storage. Effective designs call for infiltration trenches to be filled with 1.5-inch to 3.0-inch diameter clean washed stone. Conduct a geotechnical study to determine the final soil infiltration rate below the trench. For sizing purposes, assume a void ratio of 0.4.

Take a minimum of two borings or observation pits for each infiltration trench. For trenches over 100 feet long, include at least one additional boring or pit for each 50-foot increment. Take borings or dig observation pits at the actual location of the proposed infiltration trench to determine localized soil conditions.

Base the design of the infiltration trench on the soil evaluation set forth in Volume 3. The minimum acceptable rate is 0.17 inches per hour. Never use the results of a Title 5 percolation test to estimate an infiltration rate, as these tend to greatly overestimate the rate that water will infiltrate into the subsurface.

Place the maximum depth of the trench at least two feet above the seasonal high water table or bedrock, and below the frost line.

Include vegetated buffers (20-foot minimum) around surface trenches. Place permeable filter fabric 6 to 12 inches below the surface of the trench, along the sides, and at the bottom of the trench. Use filter fabric, especially at the surface to prevent clogging; if failure does occur, it can be alleviated without reconstructing the infiltration trench. Another option is to place twelve inches of sand at the bottom of the trench.

Install an observation well at the center of the trench to monitor how quickly runoff is clearing the system. Use a well-anchored, vertical perforated PVC pipe with a lockable above-ground cap.

The visible surface of the trench may either be stone or grassed. Stone is easier to rake out when clogged. If it is vegetated with grasses, use fabric above the stone to keep the soil that serves as the planting medium from clogging the stone. When trenches are designed to accept sheet flow, take into account the grass surface when determining how much of the runoff will exfiltrate into the trench.

A perforated pipe underdrain is sometimes used as part of the design. The purpose of the underdrain is to facilitate exfiltration into the parent soil. Except for underdrains placed between different trench cells, MassDEP does not allow underdrains placed near the bottom of the trench. Placement of an underdrain near the bottom of the trench reduces the amount of treatment and exfiltration, because more water is conveyed through the underdrain to the outlet point when it rains than exfiltrates into the surrounding soils.

Construction

Table IT.2 presents the minimum construction criteria for infiltration trenches. Take precautions before and during construction to minimize the risk of premature failure of the infiltration trench. First, prevent heavy equipment from operating at the locations where infiltration trenches are planned. Heavy equipment will compact soil and adversely affect the performance of the trench. Isolate the areas where the trenches will be located by roping them off and flagging them.

Construct infiltration trenches only after the site has been stabilized. Never use trenches as temporary sediment traps during construction. Use diversion berms or staked and lined hay bales around the perimeter of the trenches during their construction. Excavate and build the trench manually or with light earth-moving equipment. Deposit all excavated material downgradient of the trench to prevent re-deposition during runoff events.

Line the sides and bottom of the trench with permeable geotextile fabric. Twelve inches of sand (clean, fine aggregate) may be substituted or used in addition on the bottom. Place one to three inches of clean, washed stone in the lined trench and lightly compact the stone with plate compactors, to within approximately one foot of the surface. Place fabric filter over the top, with at least a 12-inch overlap on both sides. An underground trench may be filled with topsoil and planted. A surface trench may be filled with additional aggregate stone.

Divert drainage away from the infiltration trench until the contributing drainage area is fully stabilized, including full establishment of any vegetation.

Table IT.2 - Construction Criteria for Infiltration Trenches
1. Infiltration trenches should never serve as temporary sediment traps for construction.
2. Before the development site is graded, the area of the infiltration trench should be roped off and flagged to prevent heavy equipment from compacting the underlying soils.
3. Infiltration trenches should not be constructed until the entire contributing drainage area has been stabilized. Diversion berms should be placed around the perimeter or the infiltration trench during all phases of construction. Sediment and erosion controls should be used to keep runoff and sediment away from the trench area.
4. During and after excavation, all excavated materials should be placed downstream, away from the infiltration trench, to prevent redeposition of these materials during runoff events. These materials should be properly handled and disposed of during and after construction.
Light earth-moving equipment should be used to excavate the infiltration trench. Use of heavy equipment causes compaction of the soils in the trench floor, resulting in reduced infiltration capacity.

Maintenance

Because infiltration trenches are prone to failure due to clogging, it is imperative that they be aggressively maintained on a regular schedule. Using pretreatment BMPs will significantly reduce the maintenance requirements for the trench itself. Removing accumulated sediment from a deep sump catch basin or a vegetated filter strip is considerably less difficult and less costly than rehabilitating a trench. Eventually, the infiltration trench will have to be rehabilitated, but regular maintenance will prolong its operational life and delay the day when rehabilitation is needed. With appropriate design and aggressive maintenance, rehabilitation can be delayed for a decade or more. Perform preventive maintenance at least twice a year.

Inspect and clean pretreatment BMPs every six months and after every major storm event (2 year return frequency). Check inlet and outlet pipes to determine if they are clogged. Remove accumulated sediment, trash, debris, leaves and grass clippings from mowing. Remove tree seedlings, before they become firmly established.

Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. If the top of the trench is grassed, it must be mowed on a seasonal basis. Grass height must be maintained to be no more than four inches. Routinely remove grass clippings leaves and accumulated sediment from the surface of the trench.

Inspect the trench 24 hours or several days after a rain event, to look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench surface is clogged. To address surface clogging, remove and replace the topsoil or first layer of stone aggregate and the filter fabric. If water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.

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Infiltration Basins

Description: Infiltration basins are stormwater runoff impoundments that are constructed over permeable soils. Pretreatment is critical for effective performance of infiltration basins. Runoff from the design storm is stored until it exfiltrates through the soil of the basin floor.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Can be designed to provide peak flow attenuation.
3 - Recharge	Provides groundwater recharge.
4 - TSS Removal	80% TSS removal, with adequate pretreatment
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. For some land uses with higher potential pollutant loads, use an oil grit separator, sand filter or equivalent for pretreatment prior to discharge to the infiltration basin. Infiltration must be done in compliance with 314 CMR 5.00
6 - Discharges near or to Critical Areas	Highly recommended, especially for discharges near cold-water fisheries. Requires 44% removal of TSS prior to discharge to infiltration basin
7 - Redevelopment	Typically not an option due to land area constraints

Advantages/Benefits:

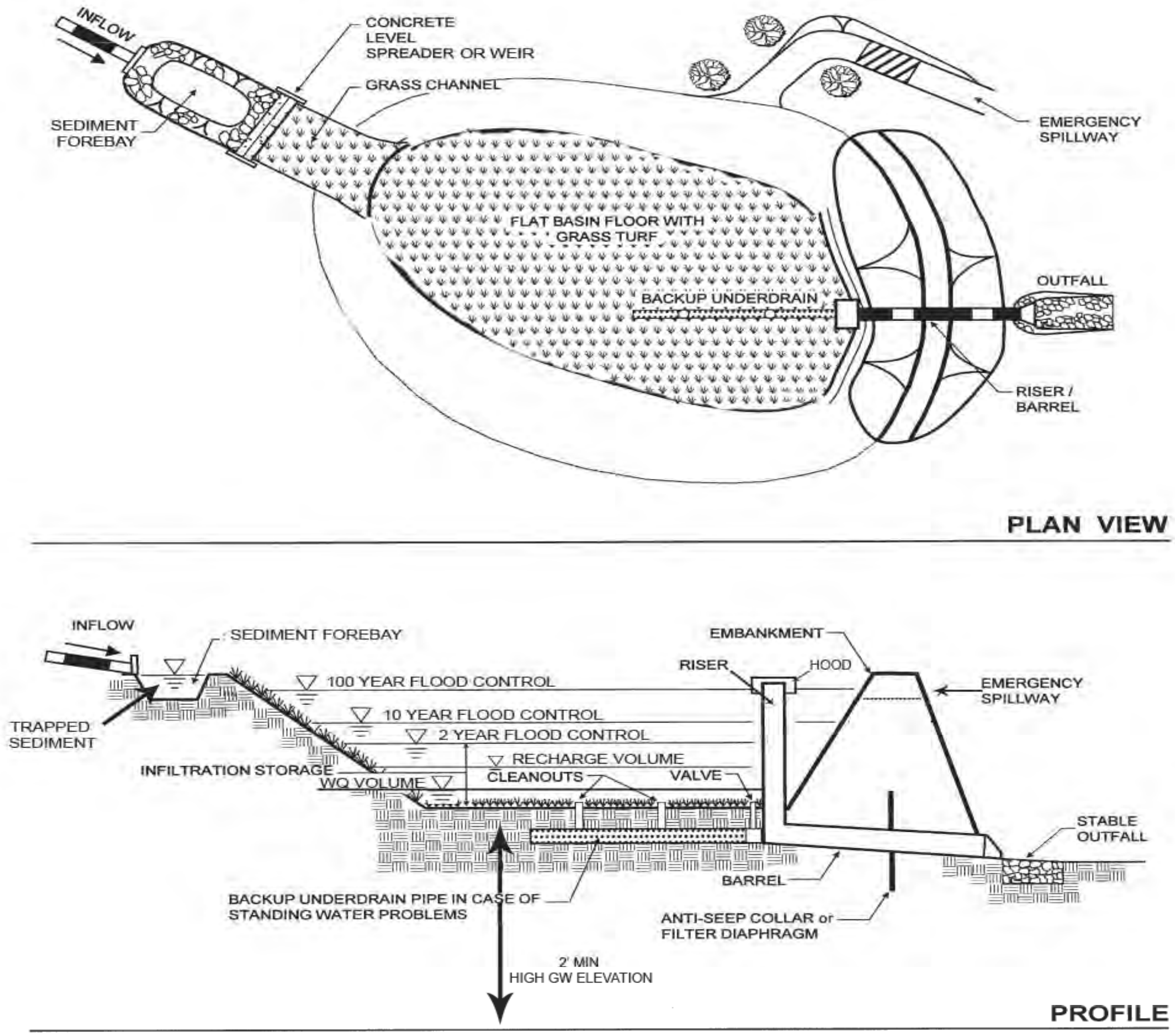
- Provides groundwater recharge.
- Reduces local flooding.
- Preserves the natural water balance of the site.
- Can be used for larger sites than infiltration trenches or structures.

Disadvantages/Limitations:

- High failure rates due to improper siting, inadequate pretreatment, poor design and lack of maintenance.
- Restricted to fairly small drainage areas.
- Not appropriate for treating significant loads of sediment and other pollutants.
- Requires frequent maintenance.
- Can serve as a “regional” stormwater treatment facility

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80% with pretreatment
• Total Nitrogen	50% to 60%
• Total Phosphorus	60% to 70%
• Metals (copper, lead, zinc, cadmium)	85% to 90%
• Pathogens (coliform, e coli)	90%



adapted from the Vermont Stormwater Manual

Maintenance

Activity	Frequency
Preventative maintenance	Twice a year
Inspect to ensure proper functioning	After every major storm during first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice.
Mow the buffer area, side slopes, and basin bottom if grassed floor; rake if stone bottom; remove trash and debris; remove grass clippings and accumulated organic matter	Twice a year
Inspect and clean pretreatment devices	Every other month recommended and at least twice a year and after every major storm event.

Special Features: High failure rate without adequate pretreatment and regular maintenance.

LID Alternative: Reduce impervious surfaces. Bioretention areas

Infiltration Basins

The following are variations of the infiltration basin design.

Full Exfiltration Basin Systems

These basin systems are sized to provide storage and exfiltration of the required recharge volume and treatment of the required water quality volume. They also attenuate peak discharges. Designs typically include an emergency overflow channel to discharge runoff volumes in excess of the design storm.

Partial or Off-line Exfiltration Basin Systems

Partial basin systems exfiltrate a portion of the runoff (usually the first flush or the first half inch), with the remaining runoff being directed to other BMPs. Flow splitters or weirs divert flows containing the first flush into the infiltration basin. This design is useful at sites where exfiltration cannot be achieved by downstream detention BMPs because of site condition limitations.

Applicability

The suitability of infiltration basins at a given site is restricted by several factors, including soils, slope, depth to water table, depth to bedrock, the presence of an impermeable layer, contributing watershed area, proximity to wells, surface waters, and foundations. Generally, infiltration basins are suitable at sites with gentle slopes, permeable soils, relatively deep bedrock and groundwater levels, and a contributing watershed area of approximately 2 to 15 acres. Table IB.1 presents the recommended site criteria for infiltration basins.

Pollution prevention and pretreatment are particularly important at sites where infiltration basins are located. A pollution prevention program that separates contaminated and uncontaminated runoff is essential. Uncontaminated runoff can be infiltrated directly, while contaminated runoff must be collected and pretreated using an appropriate combination of BMPs and then rerouted to the infiltration basin. This approach allows uncontaminated stormwater to be infiltrated during and immediately after the storm and permits the infiltration of contaminated stormwater after an appropriate detention time. The Pollution Prevention and Source Control Plan required by Stormwater Standard 4 must take these factors into account. For land uses with higher potential pollutant loads, provide a bypass to divert contaminated stormwater from the infiltration basin in storms larger than the design storm.

Table IB.1 - Site Criteria for Infiltration Basins
1. The contributing drainage area to any individual infiltration basin should be restricted to 15 acres or less.
2. The minimum depth to the seasonal high water table, bedrock, and/or impermeable layer should be 2 ft. from the bottom of the basin.
3. The minimum infiltration rate is 0.17 inches per hour. Infiltration basins must be sized in accordance with the procedures set forth in Volume 3.
4. One soil sample for every 5000 ft. of basin area is recommended, with a minimum of three samples for each infiltration basin. Samples should be taken at the actual location of the proposed infiltration basin so that any localized soil conditions are detected.
5. Infiltration basins should not be used at sites where soil have 30% or greater clay content, or 40% or greater silt clay content.
6. Infiltration basins should not be placed over fill materials.
7. The following setback requirements should apply to infiltration basin installations: • Distance from any slope greater than 15% - Minimum of 50 ft. • Distance from any soil absorption system- Minimum of 50 ft. • Distance from any private well - Minimum of 100 ft., additional setback distance may be required depending on hydrogeological conditions. • Distance from any public groundwater drinking supply wells - Zone I radius, additional setback distance may be required depending on hydrogeological conditions. • Distance from any surface drinking water supply - Zone A • Distance from any surface water of the commonwealth (other than surface water supplies and their tributaries) - Minimum of 50 ft. • Distance from any building foundations including slab foundations without basements - Minimum of 10 ft. downslope and 100 ft. upslope.

Prior to pretreatment, implement the pollution prevention and source control program specified in the Pollution Prevention and Source Control Plan to reduce the concentration of pollutants in the discharge. Program components include careful management of snow and deicing chemicals, fertilizers, herbicides, and pest control. The Plan must prohibit snow disposal in the basin and include measures to prevent runoff of stockpiled snow from entering the basin. Stockpiled snow contains concentrations of sand and deicing chemicals. At industrial sites, keep raw materials and wastes from being exposed to precipitation. Select pretreatment BMPs that remove coarse sediments, oil and grease, and floatable organic and inorganic materials, and soluble pollutants.

Effectiveness

Infiltration basins are highly effective treatment systems that remove many contaminants, including TSS. However, infiltration basins are not intended to remove coarse particulate pollutants. Use a pretreatment device to remove them before they enter the basin. The pollutant removal efficiency of the basin depends on how much runoff is exfiltrated by the basin.

Infiltration basins can be made to control peak discharges by incorporating additional stages in the design. To do this, design the riser outlet structure or weir with multiple orifices, with the lowest orifice set to achieve storage of the full recharge volume required by Standard 3. Design the upper orifices using the same procedures as extended detention basins. The basins can also be designed to achieve exfiltration of storms greater than the required recharge volume. However, in such cases, make sure the soils are permeable enough to allow the basin to exfiltrate the entire volume in a 72-hour period. This may necessitate increasing the size of the floor area of the basin. Generally, it is not economically feasible to provide storage for large infrequent storms, such as the 100-year 24-hour storm.

Planning Considerations

Carefully evaluate sites before planning infiltration basins, including investigating soils, depth to bedrock, and depth to water table. Suitable parent soils should have a minimum infiltration rate of 0.17 inches per hour. Infiltration basis must be sized in accordance with the procedures set forth in Volume 3. The slopes of the contributing drainage area for the infiltration basin must be less than 5%.

Design

Infiltration basins are highly effective treatment and disposal systems when designed properly. The first step before design is providing source control and implementing pollution prevention measures to minimize sediment and other contaminants in runoff discharged to the infiltration basin. Next, consider the appropriate pretreatment BMPs.

Design pretreatment BMPs to pretreat runoff before stormwater reaches the infiltration basin. For Critical Areas, land uses with potentially higher pollutant loads, and soils with rapid infiltration rates (greater than 2.4 inches/hour), pretreatment must remove at least 44% of the TSS. Proponents may comply with this requirement by proposing two pretreatment BMPs capable of removing 25% TSS. However, the issuing authorities (i.e., Conservation Commissions or MassDEP) may require additional pretreatment for other constituents beyond TSS for land uses with higher potential pollutant loads. If the land use has the potential to generate stormwater runoff with high concentrations of oil and grease, treatment by an oil grit separator or equivalent is required before discharge to the infiltration basin.

For discharges from areas other than Critical Areas, land uses with potentially higher pollutant loads, and soils with rapid infiltration rates, MassDEP also requires some TSS pretreatment. Common pretreatment for infiltration basins includes aggressive street sweeping, deep sump catch basins, oil/grit separators, vegetated filter strips, water quality swales, or sediment forebays. Fully stabilize all land surfaces contributing drainage to the infiltration practice after construction is complete to reduce the amount of sediment in runoff that flows to the pretreatment devices.

Always investigate site conditions. Infiltration basins must have a minimum separation from seasonal high groundwater of at least 2 feet. Greater separation is necessary for bedrock. If there is bedrock on the site, conduct an analysis to determine the appropriate vertical separation. The greater the distance from the bottom of the basin media to the seasonal high groundwater elevation, the less likely the basin will fail to drain in the 72-hour period following precipitation.

Determine soil infiltration rates using samples collected at the proposed location of the basin. Take one soil boring or dig one test pit for every 5,000 feet of basin area, with a minimum of three borings for each infiltration basin. Conduct the borings or test pits in the layer where infiltration is proposed. For example, if the A and B horizons are to be removed and the infiltration will be through the C horizon, conduct the borings or test pits through the C horizon. MassDEP requires that borings be at least 20 feet deep or extend to the depth of the limiting layer.

For each bore hole or test pit, evaluate the saturated hydraulic conductivity of the soil, depth to seasonal high groundwater, NRCS soil textural class, NRCS Hydrologic Soil Group, and the presence of fill materials in accordance with Volume 3. Never locate infiltration basins above fill. Never locate infiltration basins in Hydrologic Soil Group “D” soils. The minimum acceptable final soil infiltration rate is 0.17 inches per hour. Design the infiltration basin based on the soil evaluation set forth in Volume 3.

If the proposed basin is determined to be in Hydrologic Soil Group “C” soils, incorporate measures in the design to reduce the potential for clogging, such as providing more pretreatment or greater media depth to provide additional storage. Never use the results of a Title 5 percolation test to estimate a saturated hydraulic conductivity rate, because it tends to greatly overestimate the rate that water will infiltrate into the subsurface.

Estimate seasonal high groundwater based on soil mottles or through direct observation when borings are conducted in April or May, when groundwater levels are likely to be highest. If it is difficult to determine the seasonal high groundwater elevation from the borings or test pits, then use the Frimpter method developed by the USGS (Massachusetts/ Rhode Island District Office) to estimate seasonal high groundwater. After estimating the seasonal high groundwater using the Frimpter method, re-examine the bore holes or test pits to determine if there are any field indicators that corroborate the Frimpter method estimate.

Stabilize inlet channels to prevent incoming flow velocities from reaching erosive levels, which can scour the basin floor. Riprap is an excellent inlet stabilizer. Design the riprap so it terminates in a broad apron, thereby distributing runoff more evenly over the basin surface to promote better infiltration.

At a minimum, size the basin to hold the required recharge volume. Determine the required recharge volume using either the static or dynamic methods set forth in Volume 3. Remember that the required storage volume of an infiltration basin is the sum of the quantity of runoff entering the basin from the contributing area and the precipitation directly entering the basin. Include one foot of freeboard above the total of the required recharge volume and the direct precipitation volume to account for design uncertainty. When applying the dynamic method to size the basin, use only the bottom of the basin (i.e., do not include side wall exfiltration) for the effective infiltration area.

Design the infiltration basin to exfiltrate in no less than 72 hours. Consider only the basin floor as the effective infiltration area when determining whether the basin meets this requirement.

Design the basin floor to be as flat as possible to provide uniform ponding and exfiltration of the runoff. Design the basin floor to have as close to a 0% slope as possible. In no case shall the longitudinal slope exceed 1%. Enhanced deposition of sediment in low areas may clog the surface soils, resulting in reduced infiltration and wet areas. Design the side slopes of the basin to be no steeper than 3:1 (horizontal: vertical) to allow for proper vegetative stabilization, easier mowing, easier access, and better public safety.

For basins with a 1% longitudinal slope, it will be necessary to incorporate cells into the design, making sure that the depth of ponded water does not exceed 2 feet, because sloped basin floors cause water to move downhill, thereby decreasing the likelihood of infiltration. Make lateral slopes flat (i.e., 0% slope).

After the basin floor is shaped, place soil additives on the basin floor to amend the soil. The soil additives shall include compost, properly aged to kill any seed stock contained within the compost. Do not put biosolids in the compost. Mix native soils that were excavated from the A or B horizons to create the basin with the compost, and then scarify the native materials and compost into the parent material using a chisel plow or rotary device to a depth of 12 inches. Immediately after constructing the basin, stabilize its bottom and side slopes with a dense turf of water-tolerant grass. Use low-maintenance, rapidly germinating grasses, such as fescues. The selected grasses must be capable of surviving in both wet and dry conditions. Do not use sod, which can prevent roots from directly contacting the underlying soil. During the first two months, inspect the newly established vegetation several times to determine if any remedial actions (e.g., reseeding, irrigating) are necessary.

Never plant trees or shrubs within the basin or on the impounding embankments as they increase the chance of basin failure due to root decay or subsurface disturbance. The root penetration and thatch formation of the turf helps to maintain and may even enhance the original infiltration capacity. Soluble nutrients are taken up by the turf for growth, improving the pollutant removal capacity. Dense turf will impede soil erosion and scouring of the basin floor.

In place of turf, use a basin liner of 6 to 12 inches of fill material, such as coarse sand. Clean and replace this material as needed. Do not use loose stone, riprap, and other irregular materials requiring hand removal of debris and weeds.

Design embankments and spillways to conform to the regulatory guidelines of the state's Office of Dam Safety (302 CMR 10.00). Design infiltration basins to be below surrounding grade to avoid issues related to potential embankment failure. All infiltration basins must have an emergency spillway capable of bypassing runoff from large storms without damage to the impounding structure. Design the emergency spillway to divert the storm associated with brimful conditions without impinging upon the structural integrity of the basin. The brimful condition could be the required recharge volume or a design storm (such as the 2-year, 10-year, or 100-year storm if the basin is designed to provide peak rate attenuation in addition to exfiltration). The storm associated with the brimful conditions should not include the one foot of freeboard required to account for design uncertainty. Design the emergency spillway to shunt water toward a location where the water will not damage wetlands or buildings. A common error is to direct the spillway runoff toward an adjoining property not owned by an applicant. If the emergency spillway is designed to drain the emergency overflow toward an adjoining property, obtain a drainage easement and submit it to the Conservation Commission as part of the Wetlands NOI submission. Place vegetative buffers around the perimeter of the basin for erosion control and additional sediment and nutrient removal.

Monitoring wells: Install one monitoring well in the basin floor per every 5,000 square feet of basin floor. Make sure the monitoring well(s) extend 20 feet beneath the basin floor or to the limiting layer, whichever is higher.

Access: Include access in the basin design. The area at the top of the basin must provide unimpeded vehicular access around the entire basin perimeter. The access area shall be no less than 15 feet.

Inlet Structures: Place inlet structures at one longitudinal end of the basin, to maximize the flow path from the inlet to the overflow outlet. A common error is to design multiple inlet points around the entire basin perimeter.

Outlet structures: Infiltration basins must include an overflow outlet in addition to an emergency spillway. Whether using a single orifice or multiple orifices in the design, at a minimum, set the lowest orifice at or above the required recharge volume.

Drawdown device: Include a device to draw the basin down for maintenance purposes. If the basin includes multiple cells, include a drawdown device for each cell.

Fences: Do not place fences around basins located in Riverfront Areas, as required by 310 CMR 10.58(4)(d)1.d. to avoid impeding wildlife movement. In such cases, consider including a safety bench as part of the design.

Construction

Prior to construction, rope or fence off the area selected for the infiltration basin. Never allow construction equipment to drive across the area intended to serve as the infiltration basin.

Never use infiltration basins as temporary sediment traps for construction activities.

To limit smearing or compacting soils, never construct the basin in winter or when it is raining. Use light earth-moving equipment to excavate the infiltration basin because heavy equipment compacts the soils beneath the basin floor and side slopes and reduces infiltration capacity. Because some compaction of soils is inevitable during construction, add the required soil amendments and deeply till the basin floor with a rotary tiller or a disc harrow to a depth of 12 inches to restore infiltration rates after final grading.

Use proper erosion/sediment control during construction. Immediately following basin construction, stabilize the floor and side slopes of the basin with a dense turf of water-tolerant grass. Use low maintenance, rapidly germinating grasses, such as fescues. Do not sod the basin floor or side slopes. After the basin is completed, keep the basin roped or fenced off while construction proceeds on other parts of the site. Never direct construction period drainage to the infiltration basin. After construction is completed, do not direct runoff into the basin until the bottom and side slopes are fully stabilized.

Maintenance

Infiltration basins are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements for the basin.

The Operation and Maintenance Plan required by Standard 9 must include inspections and preventive maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. The Plan must require inspecting the pretreatment BMPs in accordance with the minimal requirements specified for those practices and after every major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts).

Once the basin is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging (such as upland sediment erosion, excessive compaction of soils, or low spots).

Thereafter, inspect the infiltration basin at least twice per year. Important items to check during the inspection include:

- Signs of differential settlement,
- Cracking,
- Erosion,
- Leakage in the embankments
- Tree growth on the embankments
- Condition of riprap,
- Sediment accumulation and
- The health of the turf.

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at the same time. Use deep tilling to break up clogged surfaces, and revegetate immediately.

Remove sediment from the basin as necessary, but wait until the floor of the basin is thoroughly dry. Use light equipment to remove the top layer so as to not compact the underlying soil. Deeply till the remaining soil, and revegetate as soon as possible. Inspect and clean pretreatment devices associated with basins at least twice a year, and ideally every other month.

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http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Infiltration%20Practice/Infiltration%20Basin.htm

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Leaching Catch Basins

Description: A leaching catch basin is pre-cast concrete barrel and riser with an open bottom that permits runoff to infiltrate into the ground. There are two configurations:

1. Stand-alone barrel/riser and
2. Barrel/riser combined with a deep sump catch basins that provides pretreatment.

80% TSS removal is awarded to the deep sump catch basin/leaching catch basin pretreatment combination provided the system is off-line.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	May provide some peak rate attenuation if sufficient number of leaching catch basins are provided to control 10-year storm
3 - Recharge	Provides groundwater recharge
4 - TSS Removal	80% TSS removal providing a deep sump catch basin is used for pretreatment and provided it is designed to be off-line
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. For land uses that have the potential to generate runoff with high concentrations of oil and grease, an oil grit separator or equivalent may be required for pretreatment prior to discharge to the leaching catch basin. Infiltration must be done in compliance with 314 CMR 5.00.
6 - Discharges near or to Critical Areas	Not suitable except as terminal treatment for discharges to or near cold-water fisheries.
7 - Redevelopment	May be a good retrofit for sites with existing catch basins

Advantages/Benefits:

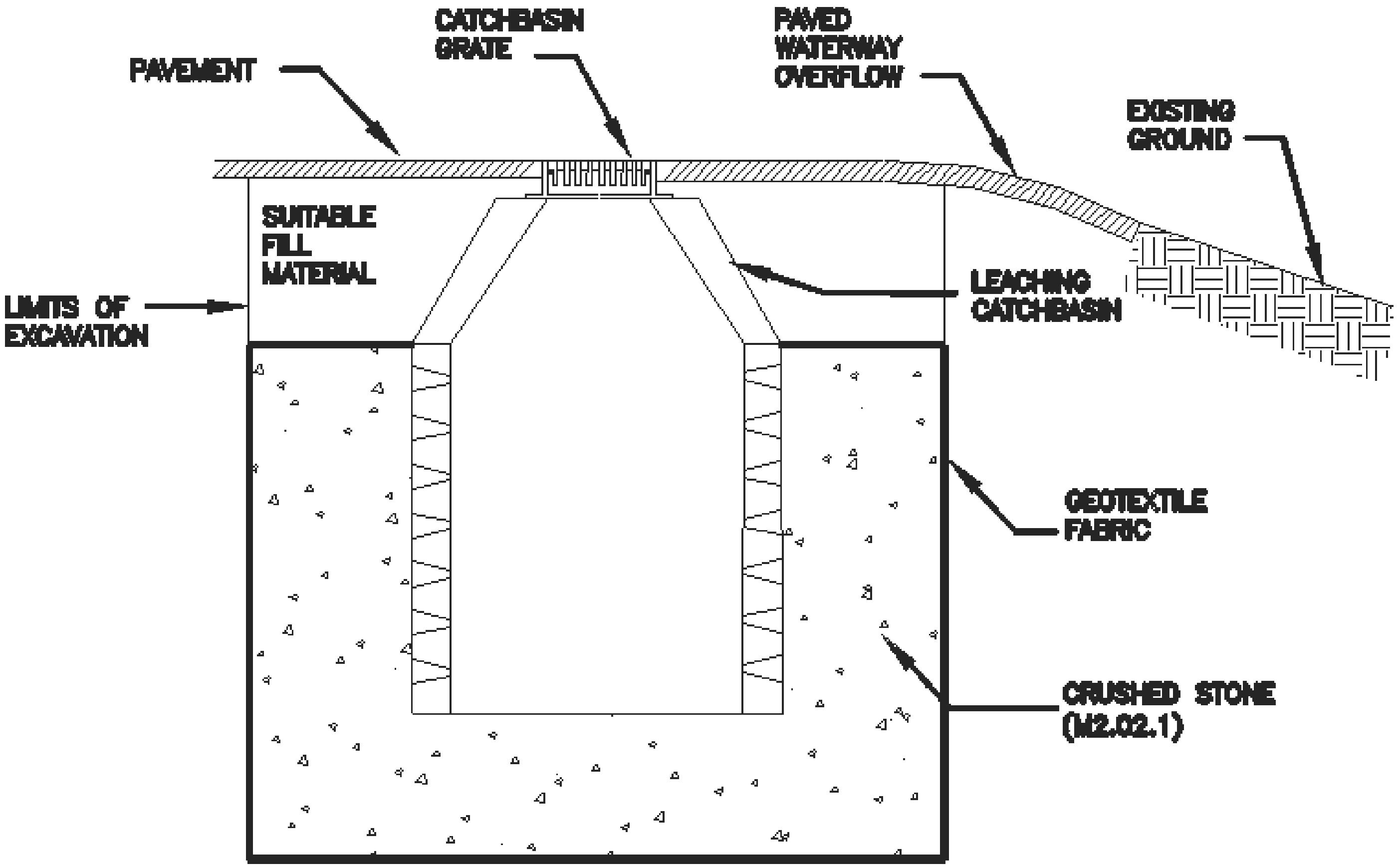
- Provide groundwater recharge.
- Remove coarse sediment

Disadvantages/Limitations:

- Need frequent maintenance. Can become a source of pollutants via resuspension if not properly maintained.
- Cannot effectively remove soluble pollutants or fine particles.
- Do not provide adequate treatment of runoff unless combined with deep sump catch basin
- Entrapment hazard for amphians and other small animals.

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80% if combined with deep sump catch basin and if designed to be off-line
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data



adapted from the MassHighway Department

Maintenance

Activity	Frequency
Inspect units and remove debris	Inspect annually or more frequently as indicated by structure performance
Remove sediment	When the basin is 50% filled
Rehabilitate the basin if it fails due to clogging	As needed

Special Features:

Use as off-line device

LID Alternative:

Reduce pervious areas
Bioretention areas and rain gardens

Leaching Catch Basins

Planning Considerations

Use leaching catch basins as off-line devices in areas with highly permeable soils. Provide for the safe overflow from these devices in severe storm events, or in the event of clogging of the soils surrounding the device. Because leaching catch basins discharge runoff to groundwater, do not use them in areas of higher potential pollutant loadings (such as gas stations) without adequate pretreatment such as an oil grit separator.

Design

Leaching catch basins are typically set in an excavation lined with a geotextile liner to prevent fine soil particles from migrating into the void spaces of the stone. The basin is placed on a pad of free-draining crushed stone, with the excavation around the basin back-filled with similar material. The base and barrel of the basin are perforated so that water entering the basin can enter the surrounding stone fill and infiltrate into the ground.

Use stone material with a void ratio of 0.39 or less. Make the depth to groundwater at least 2 feet below the bottom of the leaching catch basin. When designing structural components, design for dead and live loads as appropriate. Include provisions for overflows such as redundant devices and paved chutes.

The basin inlet cover is an important component. The openings must be no larger than 1 inch square to prevent coarse debris larger than 1 inch from entering the basin. The inlet grate must fit tightly into the underlying steel frame to prevent it from being dislodged by traffic. Do not weld the inlet grate to the underlying frame.

The riser section shall be mortared, grouted, gasketed, or otherwise sealed, to prevent exfiltration through the joint. Leaching catch basins shall contain no weep holes. Do not perforate the barrel section.

Make sure leaching catch basins contain no outlet pipes. The only pipe that is allowed in a leaching catch basin is an inlet pipe from an off-line deep sump catch basin paired with that leaching catch basin. Seal all pipe joints.

Construction

Install construction barriers around the excavation area to prevent access by pedestrians. Use diversions and other erosion control practices up-slope of the leaching catch basin to prevent runoff from entering the site before catch basins are complete. Stabilize the surrounding area and any established outlet. Put controls in place to prevent any drainage from being discharged to the leaching catch basin until the contributing drainage area is fully stabilized. Remove all temporary structures after the contributing drainage area and vegetation is stabilized.

Maintenance

- Inspect annually or more frequently as indicated by structure performance
- Remove sediment when the basin is 50% filled.
- Rehabilitate the basin if it fails due to clogging

Adapted from:
MassHighway. Storm Water Handbook for Highways and Bridges. May 2004.

BMP Accessories: Level Spreaders, Check Dams, Outlet Structures, Catch Basin Inserts

BMP accessories are not BMPs themselves but are required to facilitate the operation and function of BMPs. This section presents four of the most common and important BMP accessories: level spreaders, check dams, outlet structures, and catch basin inserts.

Level Spreaders

Description

A level spreader receives concentrated flow from channels, outlet structures, or other conveyance structures, and converts it to sheet flow where it can disperse uniformly across a stable slope. A level spreader is not a pollutant reduction device. It improves the efficiency of other BMPs, such as vegetated swales, filter strips, or infiltration systems that depend on sheet flow to operate properly.

Applicability and Planning Considerations

Level spreaders are used in wide, level areas where concentrated runoff occurs. They should be placed on undisturbed soil that has been stabilized with vegetation. Disturbed soils are more erodible. If the spreader is not absolutely level, flow will concentrate at the low point and may worsen erosion problems. Flows to the level spreader should be relatively free of sediment, or the level spreader could be quickly overwhelmed by sediment and lose its effectiveness.

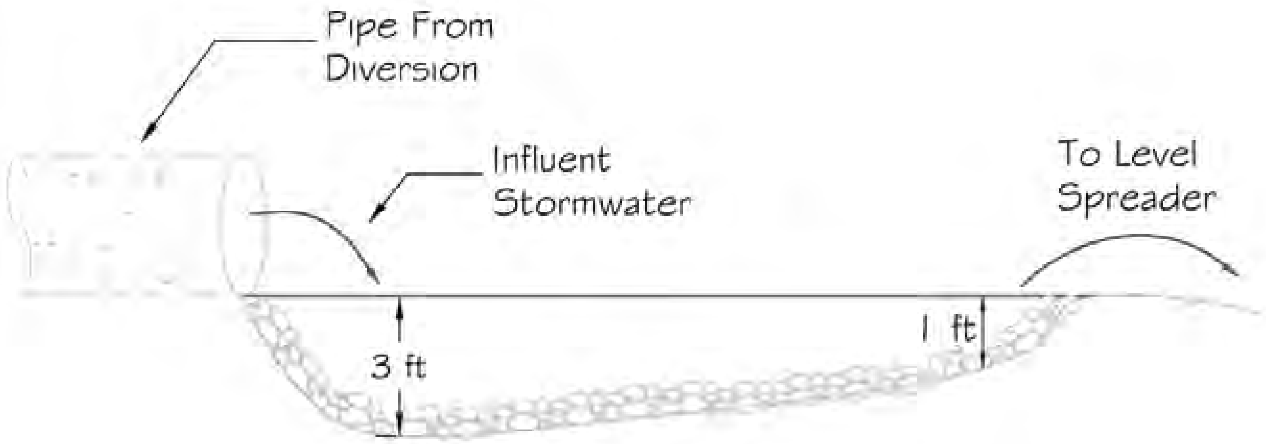
Design and Construction

Level spreaders are usually made of rocks, lumber, or concrete. Typical depths of flow behind each spreader range from 6 to 12 inches.

Construct level spreaders to be absolutely level. Small variations in height of even 0.25 inches can cause water to quickly concentrate and create erosion problems. A 4-inch variation in ground elevation across the entire length of the level spreader can make level construction difficult.

The height of the spreader is based on design flow, allowing for sediment and debris deposition. Design the length of the spreader based on the 10-year design flow for the site or the sheet flow path width, whichever is greater. When designing for the 10-year design flow, use the following table:

Level Spreader



adapted from the North Carolina State University

Drainage Area	Minimum spreader length
1 acre	10 feet
2 acres	10 feet
3 acres	15 feet
4 acres	18 feet
5 acres	20 feet

The slope leading to the level spreader should be less than 1% for at least 20 feet immediately upstream, to keep runoff velocities less than 2 feet per second during the 10-year storm event. The slope at the outlet of the spreader should be 6% or less.

Maintenance

Inspect level spreaders regularly, especially after large rainfall events. Note and repair any erosion or low spots in the spreader.

Adapted from:
Idaho Department of Environmental Quality. Catalog of Stormwater BMPs for Cities and Counties, 209-210.
MassDEP, Massachusetts Nonpoint Source Pollution Management Manual, 2006.
http://www.mass.gov/dep/water/laws/policies.htm#storm
Additional Resources:
Hunt, W.F. et al. Designing Level Spreaders to Treat Stormwater Runoff. North Carolina State University, as presented at North Carolina Department of Transportation Level Spreader Workshop, February 19, 2001, Raleigh, NC.

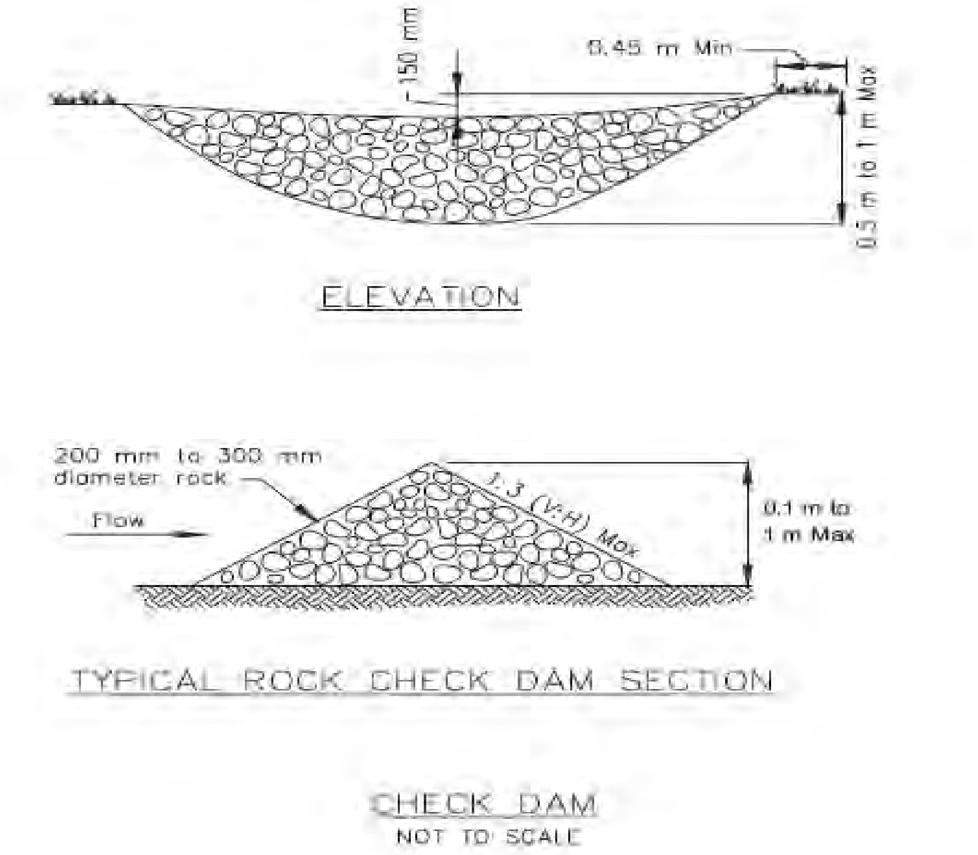
Check Dams

Description

A check dam is a small dam constructed across a drainage ditch, swale, or channel to lower the velocity of flow. Reduced runoff velocity reduces erosion and gullying in the channel and allows sediments to settle out. A check dam may be built from stone, sandbags (filled with pea gravel), logs, or concrete. Check dams are relatively easy and inexpensive to construct. Permanent check dams should be constructed from stone or concrete. Sandbag dams filled with pea gravel or logs are suitable only as temporary practices. Never use a filter fence or a hay bale as a check dam, either on a temporary or permanent basis.

Applicability

Use check dams where temporary channels or permanent channels are not yet vegetated, channel lining is infeasible, where velocity checks are needed, or to induce stormwater exfiltration into the ground within a BMP such as a dry water quality swale. Check dams may also be used as a temporary or emergency measure to limit erosion by reducing flow in small open channels. Other uses for



adapted from Caltrans Stormwater Handbooks check dams include:

- To reduce flow in small temporary channels that are presently undergoing degradation,
- Where permanent stabilization is impractical due to the temporary nature of the problem,
- To reduce flow in small eroding channels where construction delays or weather conditions prevent timely installation of non-erosive liners.

Check dams can be installed in small open channels that drain 10 acres or less, or channels where stormwater velocities exceed 5 feet per second. Note that some BMPs such as grass channels require flows to not exceed 1 foot per second for the water quality volume. Check dams cause water to pond. Under low-flow situations, water ponds behind the structure and then slowly seeps through the check dam and/or exfiltrates into the underlying soil, depending on the soil permeability. Under high-flow situations, water flows over and/or through the structure.

Advantages

- Inexpensive and easy to install.
- Reduces velocity and may provide aeration of the water.
- Prevents gully erosion from occurring before vegetation is established, and also causes a high proportion of the sediment load in runoff to settle out.
- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading, etc.
- They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to capture sediment coming off that site.
- They must be constructed in dry water quality swales to reduce velocity and induce exfiltration.

Disadvantages

- May kill grass linings in channels if the water level remains high after rainstorms or if there is significant sedimentation.
- Clogging by leaves in the fall may be a problem.
- Should not be used in live streams
- Promotes sediment trapping but resuspension can occur during subsequent storms
- Require extensive maintenance following high velocity flows
- Should not be made from straw bales or silt fences

Design

Install check dams at a distance and a height to allow small pools to form behind them. Install the first check dam about 15 feet from the outfall device and at regular intervals after that, depending on slope and soil type. In multiple check dam installations, design the system so that backwater from the downstream check dam reaches the toe of the next upstream dam. High flows (typically a 2-year or larger storm) should flow over the check dam without increasing upstream flooding or damaging the dam. Form check dams by hand or mechanically. Never dump rock directly into the channel or swale. Rock check dams should consist of well-graded stone consisting of a mixture of rock sizes.

When used in dry water quality swales, the height of the check dam shall be no less than the elevation associated with the Water Quality Volume (1/2 inch or 1-inch times contributing impervious surface).

Exercise care in designing the ends of a check dam to ensure that it is long enough and adequately anchored to prevent ponded water from scouring the soil at the ends, and flowing around the dam.

Some check dam designs may require weirs. For example, if the same check dam is used for water quality treatment (for the water quality volume), and to lag the peak rate of runoff (for the velocity associated with runoff from the 2-year storm), a weir must be included as part of the check dam design. In instances where a permanent check dam is to be used for both water quality treatment and lag peak flows with a weir, use a durable material such as concrete. If the check dam is constructed from stone such as pea gravel, the weir would most likely lose its shape when higher velocities occur.

Maintenance

Inspect check dams after every significant rainfall event. Repair damage as needed. Remove sediment as needed.

Adapted from:
Caltrans, Storm Water Quality Handbooks. Section 4. SC-4 P.
MassDEP, Massachusetts Nonpoint Source Pollution Management Manual, 2006. http://www.mass.gov/dep/water/laws/policies.htm#storm

OUTLET STRUCTURES

Description

Outlets of BMPs are devices that control the flow of stormwater out of the BMP to the conveyance system.

Outlet Protection Design in Relation to Receiving Wetlands

This section describes the various types of common outlets such as flared end structures, risers, single-stage outlets, and multi-stage outlets. Considerations include setting back the outlet from a brook, providing appropriate energy dissipation, and orientating the outlet to reduce scour effects on the opposite bank.

Alignment of Outlets into Regulatory Streams

The Wetlands and 401 regulations require that stormwater treatment be provided prior to discharge into wetland resource areas such as vegetated wetlands (BVW, IVW, salt marshes), land under water (streams, lakes, rivers, ponds, ocean), and other resource areas, except for Riverfront Areas ILSF, BLSF, and land subject to coastal zone flowage, where such practices may be sited, provided the structures meet the performance standards specified in the Wetland regulations applicable to all projects.

The impact of new pipe outfalls on wetlands can be significantly reduced by locating the outfall point back from the receiving stream, using a flared-end structure, installing riprap or bio-engineered splash pad, and either digging a channel from the outfall to the stream or designing the splash pad to act as a level spreader to sheet the discharged stormwater to the stream.

In addition to not placing the outfall and energy dissipation in a wetland resource area such as a BVW or LUW, care must be exercised in the outlet design to ensure its orientation is such to reduce scour at the entry point and opposite bank. The preferred approach is to end the outlet pipe at a headwall or flared-end structure with a riprap or bio-engineered splash pad, discharging to a manmade drainage swale that is aligned at no more than a 45 degree angle to a stream channel. Design the outlet point and riprap or bio-engineered splash pad to reduce the energy sufficiently to eliminate a need to install riprap on the bank opposite the outfall point to protect it from scour.

References for BMP Accessories:

Note that sections of the Massachusetts Stormwater Update were adapted from a variety of manuals, checklists and other references in the public domain previously developed by other states and federal agencies, including:

Caltrans, Storm Water Quality Handbooks. 2003. (http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm)

Connecticut Department of Environmental Protection. Connecticut Stormwater Quality Manual. 2004. (http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm)

Idaho Department of Environmental Quality. Catalog of Stormwater BMPs for Cities and Counties. March 2003. (http://www.google.com/u/DEQ?q=stormwater&domains=www.deq.idaho.gov&sitesearch=www.deq.idaho.gov)

Maine Department of Environmental Protection. Maine Stormwater Best Management Practices Manual. January 2006. (http://www.maine.gov/dep/blwq/docstand/stormwater/stormwaterbmps/index.htm)

Maryland Department of the Environment. Maryland Stormwater Design Manual, Volumes I and II, October 2000. (http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp)

New Jersey Department of Environmental Protection. New Jersey Stormwater Best Management Practices Manual. April 2004. http://www.state.nj.us/dep/stormwater/bmp_manual2.htm

U.S. Department of Transportation. Federal Highway Administration. Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring. (Undated). (http://www.fhwa.dot.gov/environment/ultraurb/index.htm)

U.S.Environmental Protection Agency. Office of Research and Development. The Use of Best Management Practices (BMPs) in Urban Watersheds. EPA/600/R-04/184. September 2004.

Vermont Agency of Natural Resources. The Vermont Stormwater Management Manual. April 2002. (http://www.vtwaterquality.org/stormwater.htm)

Catch Basin Inserts

Description

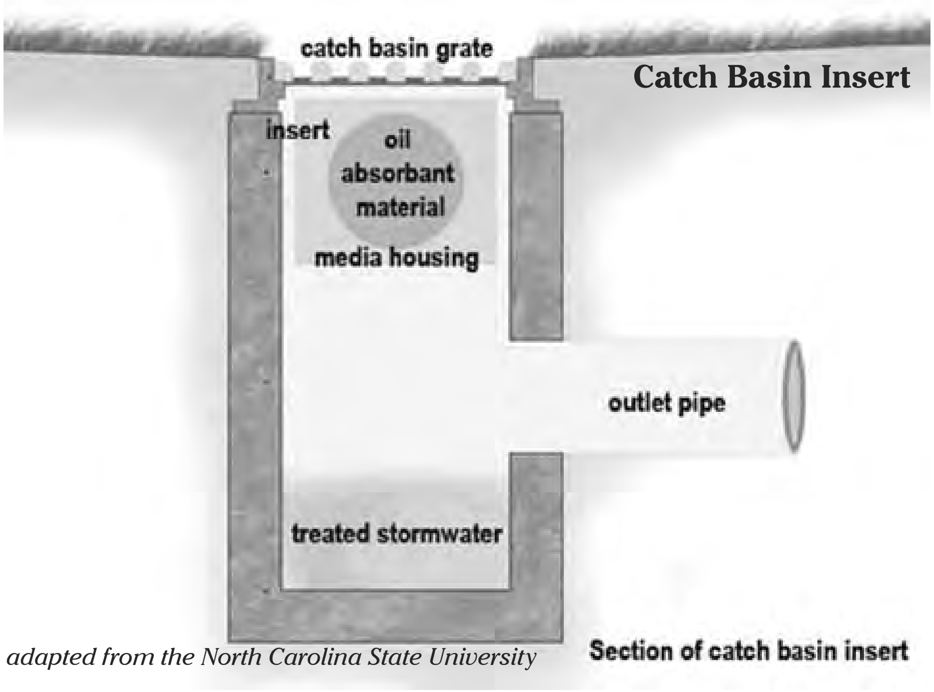
Catch Basin Inserts are a BMP accessory recently developed to add filtering efficiency to traditional catch basins. These proprietary BMPs are capable of removing a range of pollutants, from trash and debris to fine sediments and oil/grease and metals depending upon the filtering medium used. They typically have three components:

- an insert that fits in into the catch basin
- absorbent material (can be a single unit or a series of filters)
- a housing to hold the absorbent material

Applicability and Planning Considerations

Catch Basin Inserts can be useful for specialized applications, such as targeting specific pollutants other than TSS, at Land Uses with Higher Potential Pollution Loads, for oil control at small sites, for retrofits of existing catch basins with no or undersized sumps, to add TSS capability to areas with higher sediment loading, or to improve existing conditions at size-constrained sites (e.g., catch basins near bathing beaches).

If using a proprietary Catch Basin Insert, the manufacturer's specifications must be followed, which may include modifications to the catch basin. Such modifications may include a high flow bypass or other feature to handle clogging or larger storm events.



adapted from the North Carolina State University

Catch Basin Inserts are typically designed for and used for smaller volume applications. Additionally, larger sized sediment can clog and significantly reduce the effectiveness of some Catch Basin Insert filtering media. Therefore it is important to ensure that flow rates, sediment removal, and the frequency of inspection and maintenance are evaluated.

Design and Construction

Since Catch Basin Inserts are usually proprietary devices, the manufacturer should be asked to ensure that the device will work in the type of catch basin in which it is installed. Flow characteristics and sediment loading should be evaluated and any resulting modifications to the catch basin made before installation of the insert.

Maintenance

Inspect Catch Basin Inserts per the manufacturer's schedule, and especially after large rainfall events. Whoever is responsible for maintenance should explicitly agree to conduct the maintenance per the manufacturer's recommendation and to lawfully dispose of the cleanings or used filtration media.

Appendix C

Stormwater Management Review Reports

Name: Date:

General Notes/Comments: (Describe weather and general drainage system conditions)

Structure	Current Condition	Maintenance Performed
Vegetative Filter Strip:		
Review (Grass height, sediment, and debris)		
Drainage Channels:		
Review (Vegetated condition, sediment, and debris)		
Grassed Channels:		
Review (Vegetated condition, sediment, and debris)		
Catch Basin/Manhole:		
Review (Overall structure conditions, hood, sediment depth, and debris)		
Leaching Basin:		
Review (Overall structure condition, sediment depth, and debris)		
Infiltration Trench:		
Review (Signs of effective operation, sediment, and debris)		
Infiltration Basins:		
Review (Grass height, sediment, debris, signs of effective operation)		
Proprietary Separator:		
Review (Oil depth and debris)		
Outlets/Headwalls:		
Review (Structure integrity and debris)		
Pipes/Open Box Culvert:		
Review (structural integrity, silting, and clogging)		

APPENDIX G

CHECKLIST FOR STORMWATER REPORT

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.

✓ tab

return ✗

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.

---

[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.

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

CRAIG A. SCHUSTER
CIVIL
No. 37856

11/22/22

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 (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): ______________________

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 (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 (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 (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 (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 (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.

APPENDIX H

COMPLIANCE STATEMENT

Illicit Discharge Compliance Statement

New Bedford Regional Airport, New Bedford, MA.
Permit RW 5 End Perimeter Road

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER/APPLICANT: New Bedford Regional Airport
Scot Servis, Airport Manager
ADDRESS: 1569 Airport Road
New Bedford, Massachusetts 02746
TEL. NUMBER: 508-979-1410

Engineer's Compliance Statement:

To the best of my knowledge, this Stormwater Management Report meets the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no known illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

- All stormwater management systems contain no known connection to the site's wastewater system or to any other non-stormwater collection sytem.
- Groundwater collection systems on the site are not connected to the site's wastewater sewer system or to any other non-stormwater collection system.
- The facilities Operations and Maintenance Plan is designed to prevent any discharge of non-stormwater to the drainage system.
- Any illicit discharges identified during or after construction will be immediately disconnected

Craig Schuster, Airport Solutions Group

11/22/22
Date

Attachment H

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: New Bedford Municipal Airport City/County: New Bedford/Bristol Sampling Date: 05/12/22

Applicant/Owner: New Bedford Municipal Airport State: MA Sampling Point: DP-AW

Investigator(s): Joshua Surette CPESC, Keith Downing WPIT Section, Township, Range: ___

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): concave Slope (%): 5

Subregion (LRR or MLRA): LRR R Lat: 41.66877081227405 Long: -70.96632064857897 Datum: NAD83

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are “Normal Circumstances” present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___

Hydric Soil Present? Yes X No ___

Wetland Hydrology Present? Yes X No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

If yes, optional Wetland Site ID: ___

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): 12

Saturation Present? Yes X No ___ Depth (inches): 0

(includes capillary fringe)

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: DP-AW

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Herb Stratum (Plot size: 5')			
1. *Rubus allegheniensis*	20	Yes	FACU
2. *Phragmites australis*	15	Yes	FACW
3. *Onoclea sensibilis*	25	Yes	FACW
4. *Solidago gigantea*	15	Yes	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75 =Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	55	x 2 =	110	
FAC species	0	x 3 =	0	
FACU species	20	x 4 =	80	
UPL species	0	x 5 =	0	
Column Totals:	75	(A)	190	(B)

Prevalence Index = B/A = 2.53

Hydrophytic Vegetation Indicators:

1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP-AW

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	5Y 2.5/2	100					Muck	
6-24	5Y 2.5/1	100					Muck	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: New Bedford Municipal Airport City/County: New Bedford/Bristol Sampling Date: 05-12-2022

Applicant/Owner: New Bedford Municipal Airport State: MA Sampling Point: DP-AU

Investigator(s): Joshua Surette CPESC, Keith Downing WPIT Section, Township, Range: ______

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): concave Slope (%): 5

Subregion (LRR or MLRA): LRR R Lat: 41.66877081227405 Long: -70.96632064857897 Datum: NAD83

Soil Map Unit Name: Swansea muck, 0 to 1 percent slopes NWI classification: N/A (Upland)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?**	**Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	If yes, optional Wetland Site ID:	____
Wetland Hydrology Present?	Yes ____	No X		

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: DP-AU

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		

Herb Stratum (Plot size: 5')			
1. *Trifolium pratense*	40	Yes	FACU
2. *Plantago lanceolata*	20	Yes	FACU
3. *Potentilla simplex*	15	No	FACU
4. *Achillea ligustica*	15	No	N/C
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90 =Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	75 (A)		300 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP-AU

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
								Soil is entirely fill

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: New Bedford Municipal Airport City/County: New Bedford/Bristol Sampling Date: 05-12-2022
Applicant/Owner: New Bedford Municipal Airport State: MA Sampling Point: DP-BW
Investigator(s): Joshua Surette CPESC, Keith Downing WPIT Section, Township, Range: ____
Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): concave Slope (%): 5
Subregion (LRR or MLRA): LRR R Lat: 41.673131190398685 Long: -70.96478826080006 Datum: NAD83
Soil Map Unit Name: Freetown muck, ponded, 0 to 1 percent slopes NWI classification: PSS
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____
If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)
____ High Water Table (A2)
X Saturation (A3)
____ Water Marks (B1)
____ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water-Stained Leaves (B9)
____ Aquatic Fauna (B13)
____ Marl Deposits (B15)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres on Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Thin Muck Surface (C7)
____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

____ Surface Soil Cracks (B6)
____ Drainage Patterns (B10)
____ Moss Trim Lines (B16)
____ Dry-Season Water Table (C2)
____ Crayfish Burrows (C8)
____ Saturation Visible on Aerial Imagery (C9)
____ Stunted or Stressed Plants (D1)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ Microtopographic Relief (D4)
X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? Yes X No ____ Depth (inches): 4
(includes capillary fringe)

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: DP-BW

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula populifolia*	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. *Betula populifolia*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	

Herb Stratum (Plot size: 5')			
1. *Solidago gigantea*	30	Yes	FACW
2. *Phragmites australis*	30	Yes	FACW
3. *Onoclea sensibilis*	20	Yes	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=Total Cover	

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	80	x 2 =	160
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		235 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP-BW

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	5YR 2.5/2	100					Muck	
2-18	5YR 2.5/1	100					Muck	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

X Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: New Bedford Municipal Airport City/County: New Bedford/Bristol Sampling Date: 05-12-2022

Applicant/Owner: New Bedford Municipal Airport State: MA Sampling Point: DP-BU

Investigator(s): Joshua Surette CPESC, Keith Downing WPIT Section, Township, Range: ____

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): concave Slope (%): 10

Subregion (LRR or MLRA): LRR R Lat: 41.673131190398685 Long: -70.96478826080006 Datum: NAD83

Soil Map Unit Name: Hinckley loamy sand, 3 to 8 percent slopes NWI classification: N/A (Upland)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are “Normal Circumstances” present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? Yes ____ No ____ Depth (inches): ____

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: DP-BU

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		

Herb Stratum (Plot size: 5')			
1. *Solidago gigantea*	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40 =Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	40	(A)	80 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP-BU

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 3/3	100					Sandy	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ____________
Depth (inches): ____________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:
This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to reflect the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

Attachment I

Proof of Mailing to NHESP

Invoice: Date : 22Nov22 Shipping : 23.67
Customer : 6489 Weight : 5 LBS Special : 4.56
Phon: MASS DMF - NHES COD : Handling : 0.00
Dept : AMY HOENIG DV : 0.00 Total : 28.23

Svcs: PRIORITY OVERNIGHT
TRCK: 5637 2983 2070

ORIGIN ID:AYEA (978) 897-7100
RHIANNA SOMMERS
EPSILON ASSOCIATES
3 CLOCK TOWER PLACE
SUITE 250
MAYNARD, MA 01754
UNITED STATES US

SHIP DATE: 22NOV22
ACTWGT: 5.00 LB MAN
CAD: 0804148/CAFE3616

BILL SENDER

577C6/E4BB/432A

TO **AMY HOENIG**
MASS DMF – NHESP
1 RABBIT HILL ROAD

WESTBOROUGH MA 01581

REF: 6489

FedEx
Express

E

J222022032801uv

WED – 23 NOV 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **5637 2983 2070**

01 BBFA

01581
MA-US **BOS**

Part # 156148-434 RIT EXP 02/21