Town of Groveland

Economic Development
Planning & Conservation Department
Planning Board
183 Main Street
Groveland, MA 01834

MEETING NOTICE
(M.G.L Chapter 30A Sections 18-25)

Board/Committee Name:	PLANNING BOARD
Date:	TUESDAY, November 19, 2024
Time of Meeting:	7:00 PM
Location:	Town Hall 183 Main Street Groveland, MA 01834
Signature:	*Annie Schindler*

Zoom Information
Meeting ID: 939 9517 4414
Passcode: 948618

AGENDA

For discussion and possible vote:

38 BENJMAIN STREET EXTENSION
Accept the as-built plans, release the bond, and close out 53G account for 38 Benjamin Street Extension.

PUBLIC HEARING
***CONTINUED* 181R SCHOOL STREET**:
A hearing in accordance with M.G.L. Chapter 41, Section 81T, the Town of Groveland Subdivision Rules and Regulations and Article 14 of the Groveland General Bylaws, to hear the application of Groveland Redevelopment LLC. c/o Louis Minicucci Jr, 231 Sutton St, Suite 1B, North Andover MA 01845, requesting approval of a six (6) lot Definitive Subdivision Plan labeled 181R School Street, Groveland, Massachusetts and associated Stormwater Management & Land Disturbance Permit. The site is located in the Residential 2 (R-2) Zoning District. The proposed subdivision is located at 181R School Street Groveland, MA 01834. (Assessors Map 34, Parcel 13).

MEETING MINUTES
Approval of October 29, 2024, meeting minutes.

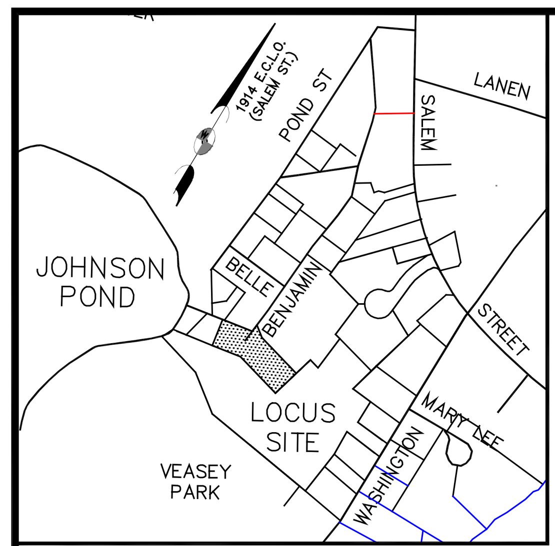
TOWN PLANNER UPDATE
- Housing Public Workshop on November 21st from 6:30pm – 8:30pm at Town Hall.

OTHER ITEMS NOT REASONABLE ANTICIPATED AT TIME OF POSTING

NEXT MEETING: To be determined.

ADJOURNMENT

NOTE - Notices and agendas are to be posted 48 hours in advance of the meeting excluding Saturdays, Sundays, and legal holidays.

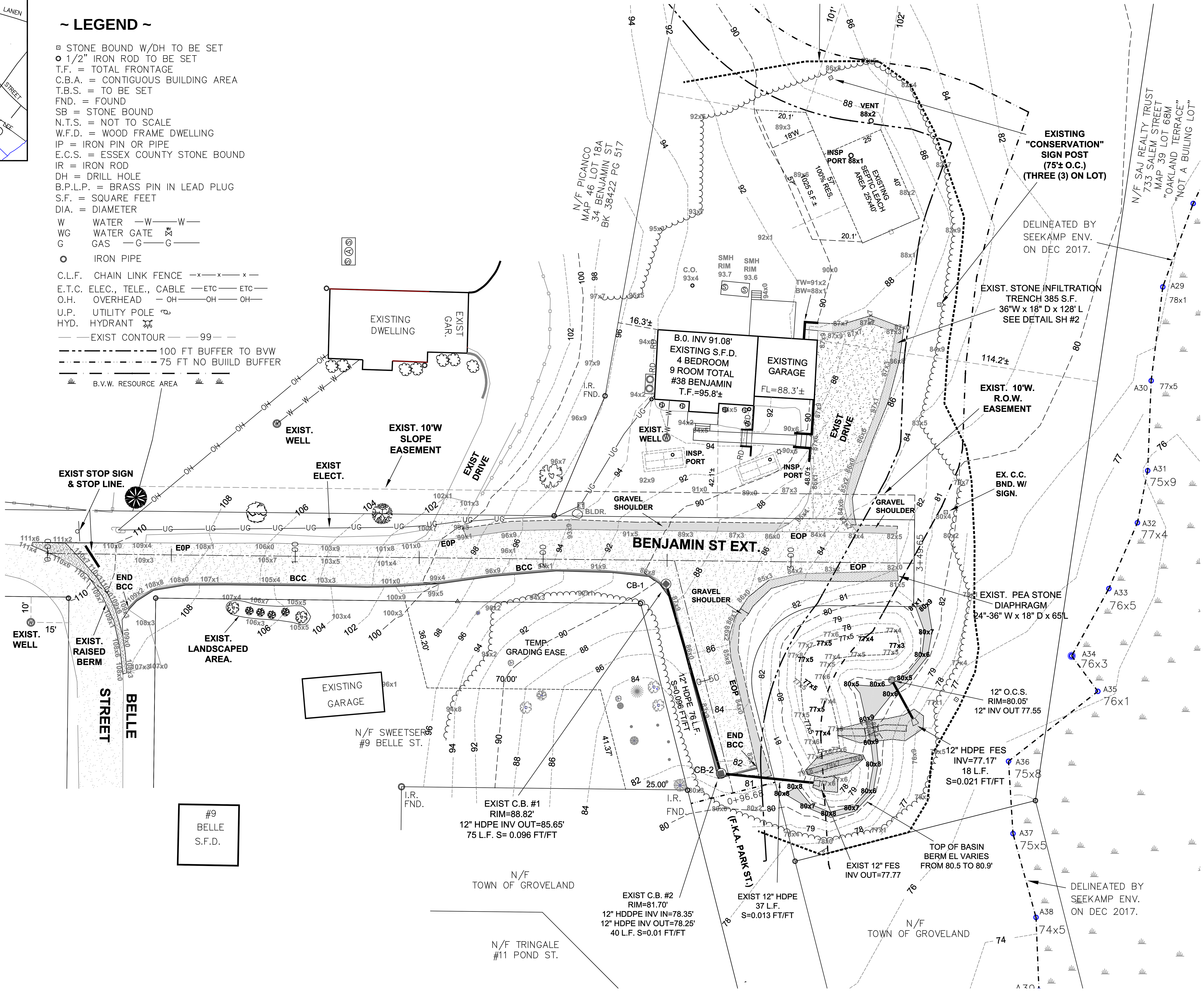


~ LOCUS ~

1"=1000'

~ LEGEND ~

- STONE BOUND W/DH TO BE SET
- 1/2" IRON ROD TO BE SET
- T.F. = TOTAL FRONTAGE
- C.B.A. = CONTIGUOUS BUILDING AREA
- T.B.S. = TO BE SET
- FND. = FOUND
- SB = STONE BOUND
- N.T.S. = NOT TO SCALE
- W.F.D. = WOOD FRAME DWELLING
- IP = IRON PIN OR PIPE
- E.C.S. = ESSEX COUNTY STONE BOUND
- IR = IRON ROD
- DH = DRILL HOLE
- B.P.L.P. = BRASS PIN IN LEAD PLUG
- S.F. = SQUARE FEET
- DIA. = DIAMETER
- W WATER —W——W—
- WG WATER GATE
- G GAS —G——G—
- IRON PIPE
- C.L.F. CHAIN LINK FENCE —x——x——x—
- E.T.C. ELEC., TELE., CABLE —ETC——ETC—
- O.H. OVERHEAD —OH——OH——OH—
- U.P. UTILITY POLE
- HYD. HYDRANT
- EXIST CONTOUR —99—
- 100 FT BUFFER TO BVW
- 75 FT NO BUIILD BUFFER
- B.V.W. RESOURCE AREA



~ SITE PLAN ~

1" = 20'

CALL
TOLL FREE
1-888-DIG-SAFE
(1-888-344-7233)
72 HOURS IN ADVANCE

THAD D. BERRY, PE
9/28/24

FOR REGISTRY USE ONLY

PLAN OF LAND
BENJAMIN STREET EXT. ROADWAY AS-BUILT
LOCATED IN
GROVELAND MASSACHUSETTS

PREPARED FOR

APPLICANT(S): DEHULLU HOMES
38 WOOD STREET
GROVELAND, MA 01834

OWNER(S): SAJ REALTY TRUST
38 WOOD STREET
GROVELAND, MA 01834
(733 SALEM ST, MAP 39 LOT 68)

PREPARED BY

WGH LAND SURVEY & DESIGN
83 W. MAIN STREET
MERRIMAC, MA 01860
TEL: (978) 346-7873
EMAIL: BILLGHOLT@AOL.COM

ASSESSOR DATA:

GROVELAND: MAP: 46
PARCEL: 18B

I HEREBY CERTIFY THAT THIS PLAN CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTRY OF DEEDS.

9/28/24
WILLIAM G. HOLT PLS #39688

GRAPHIC SCALE
1 inch = 20 ft.
(IN FEET)
20 0' 10 20 40
6 0 6 12
(IN METERS)

SHEET TITLE:
BENJAMIN STREET EXT. ROADWAY AS-BUILT SITE PLAN

DRAWN:	SEH, WGH
DESIGNED:	WGH, TDB
CHECKED:	WGH, TDB
DATE:	7/10/23
CAD FILE:	WGH/DEH/BENJ EXT AB
JOB No.	23-005 RD AB
LOCUS DEED(S):	TITLE BK 36,661 PG 271 PL BK 469 PLAN 92

REVISION :	BY
9/26/24 ADD STOP SIGN & BAR	WGH

SHEET No. **AB S1**

TEC
The Engineering Corp

282 Merrimack Street, 2nd Floor
Lawrence, MA 01843
978.794.1792
TheEngineeringCorp.com
Create | Design | Innovate

Annie Schindler
Town Planner
Town of Groveland
183 Main Street
Groveland, MA 01834

August 21, 2023

Re: As-Built Peer Review
Benjamin Street Extension – Groveland, MA

Dear Ms. Schindler,

On behalf of the Town of Groveland Planning Board, TEC, Inc. has performed a peer review of the As-Built Plan for the roadway extension and single-family dwelling at 38 Benjamin Street in Groveland, MA. TEC staff visited the site on Monday, August 21, 2023, to assess work completed to date. Below is a list of documents utilized by TEC as part of the peer review:

- Benjamin Street Ext. Roadway As-Built Site Plan, dated August 15, 2023, prepared by WGH Land Survey & Design

Upon review of the documents, TEC has compiled the following comments:

- The existing ~24" tree used as construction TBM is surveyed on the northern side of the 34/38 Benjamin Street property line on the As-Built Plan. In the most recent Landscaping Plan dated 05/28/2020, the existing ~24" tree was surveyed on the southern side of the 34/38 Benjamin Street property line. The contractor should confirm the locations of the property line and this landmark.
- The electrical connection to 38 Benjamin Street was observed to be underground.
- Near the connection to Belle Street, the two northernmost symbols denoting trees were not observed on site.
- The surveyed property lines do not display bearing and distance.
- The property owner of 38 Benjamin Street is not displayed on the plan.

Please do not hesitate to contact me directly if you have any questions concerning our comments at 978-794-1792. Thank you for your consideration.

Sincerely,
TEC, Inc.
"The Engineering Corporation"

Peter F. Ellison, PE
Director of Strategic Land Planning

Figure 1 – Status of Benjamin Street Extension connection to Belle Street. Photo taken facing south.

Figure 2 – Overview along the Extension. Photo taken facing south.

Figure 3 – Overview along the Extension. Photo taken facing south.

Figure 4 – Status of the Extension turnarounds. Photo taken facing southwest.

Figure 5 – Status of the extension, from the southern end. Photo taken facing north.

Figure 6 – Overview of the Infiltration Basin. Photo taken facing east.

FORM C

APPLICATION FOR APPROVAL OF A DEFINITIVE PLAN

PLANNING BOARD - TOWN OF GROVELAND, MASSACHUSETTS
DATE August 1, 2024

SUBDIVISION NAME 181R School Street PLAN#______

To the Planning Board of the Town of Groveland

The undersigned, being the Applicant as defined under Chapter 41, Section 81-L, for approval of a proposed subdivision shown on a plan entitled "Definitive Subdivision for a Street to be Named in Groveland, Massachusetts at 181R School Street by The Morin-Cameron Group, Inc. dated August 1, 2024 being bounded by land as follows:
See Exhibit A.

Assessor Maps dated 01/01/2019 Plan (s) # 34 lots(s) # 13
Hereby submits said plan as a Definitive Subdivision Plan in accordance with the Rules and Regulations of the Groveland Planning Board and makes application to the Board for approval of said plan.

The undersigned's title to said land is derived from Frank J Franzone by deed dated 06/28/2017, and recorded in the Essex South Country Registry of Deeds. Book 35976, Pate (s) 077 registered in the Essex South Registry District Of the Land Court, Certificate of Title No. n/a and is free of encumbrances except for the following:

Said plan has (x) has not () evolved from a preliminary plan submitted to the Board on And approved (with modifications) (x) disapproved ( ) on (date) 04/19/2023

The undersigned hereby applies for the approval of said Definitive Plan by the Board, and in furtherance thereof hereby agrees to abide by the Board's Rules and Regulations. The undersigned hereby further covenants and agrees with the Town of Groveland, upon the approval of said Definitive Plan by the Board:

1. to install utilities in accordance with the Rules and Regulations of the Planning Board, Road Commissioner/Public Works Director, the Board of Health, Water and Sewer Board, Municipal Light Department, all general bylaws, and all Zoning Bylaws of the Town of Groveland, as are applicable to the subdivision of land and installation of utilities within the limits of ways and streets:

2. to complete and construct the streets or ways shown thereon in accordance with the Rules and Regulations of the Planning Board and the approved Definitive plan, profiles, and cross sections of the same. Said plan, profiles, cross sections, and construction specifications are specifically, by reference, incorporated herein ai1d made a part of the application. This application and the covenants and agreements herein shall be binding

FORMC

APPLICATION FOR APPROVAL OF A DEFINITIVE PLAN

upon all heirs, executors, administrators, successors, grantees of the whole or part of said land, and assigns of the undersigned; and

3.

(a) to complete, except in the case of any portion of the subdivision for which a surety company performance bond, or a performance bond secured by a deposit of money or negotiable securities, or a tripartite agreement shall have been filed pursuant to these regulations, the required improvements for the subdivisions within three (3) years of the date of such approval, or

(b) to complete the required improvement for any portion of the subdivision, for which a surety company performance bond, or a performance bond secured by a deposit of money or negotiable securities, or a tripartite agreement shall have been filed , within two (2) years of the date of the performance surety or within three (3) years of the date of the Board's approval of the Definitive Plan, whichever date shall occur the earlier, and

(c) that no structure will be occupied until at least the base course of the bituminous concrete has been applied to the streets which serve those structures.

Received by Town Clerk

Date 8/1/2024

Time 11:05 AM

Signature [signature]

Applicant's Signature [signature]
Louis Minicucci Jr Manager

Applicant's Address Groveland Redevelopment, LLC
231 Sutton Street, Suite 1B
North Andover, MA 01845
Andover Real Property Management, Inc., Mgr

Owner's Signature (If not the applicant) [signature]

Owner's Address 181R School Street, LLC
5 Atkinson Farm Road
Atkinson, NH 03811

Received by Planning Board

Date 8/1/2024

Signature Anne Schinella

2024 AUG -1 AM 11:05

Exhibit A

An undeveloped parcel of land in Groveland, Essex County, Massachusetts, situated on the Westerly side of School Street, bounded and described as follows:

Beginning at the Westerly corner thereof on said School Street at land now or formerly of Ricker and thence running

SOUTHEASTERLY, by School Street to land now or formerly of Donald McGlew; thence

SOUTHWESTERLY, by said land of Donald McGlew in two courses, 212.73 feet to a point; thence

SOUTHEASTERLY, still by said land of Donald McGlew, 250 feet to land now or formerly of Mitchell and land now or formerly of Drew; thence

SOUTHWESTERLY, by land now or formerly of Mitchell and Drew to land now or formerly of Benjamin Morse; thence

NORTHWESTERLY, by land now or formerly of Benjamin Morse to land now or formerly of Thomas Jacques; thence

NORTHEASTERLY, by land now or formerly of Jacques and land now or formerly of Picker to School Street and the point begun at.

FORM D

LAND SURVEYOR'S CERTIFICATE

PLANNING BOARD - TOWN OF GROVELAND, MASSACHUSETTS
DATE August 1, 2024

SUBDIVISION NAME 181R School Street PLAN# ______

To the Planning Board of the Town of Groveland

In preparing the plan entitled "Definitive Subdivision for a Street To Be Named in Groveland, Massachusetts at 181R School Street", I hereby certify that the above named plan and accompanying data are true and correct to the accuracy required by the current Rules and Regulations Governing the Subdivision of Land in Groveland, Massachusetts, and my source of information about the location of boundaries shown on said plan was one or more of the following:

1. Deed from Frank J. Franzone to 181R School Street, LLC dated 06/28/17 and recorded in the Essex South Registry in Book 35976
Page(s) 77

2. Other plans, as follows:
1984 E.C.L.O. #3203

3. Oral information furnished by:
N/A

4. Actual measurements on the ground from a starting point established by:
1989 Essex County, Layout

5. Other sources:
N/A

Seal of Professional Land Surveyor

COMMONWEALTH OF MASSACHUSETTS
MICHAEL J. SERGI
No.33191
PROFESSIONAL LAND SURVEYOR

Signed [signature]
(Professional Land Surveyor)

Address ______________________

____

FORMD-1

PROFESSIONAL ENGINEER'S CERTIFICATE

PLANNING BOARD - TOWN OF GROVELAND, MASSACHUSETTS
DATE August 1, 2024

SUBDIVISION NAME 181R School Street PLAN# ______

To the Planning Board of the Town of Groveland

In preparing the plan entitled "Definitive Subdivision for a Street To Be Named in Groveland, Massachusetts at 181R School Street". I hereby certify that the above named plan and accompanying data are true and correct to the accuracy required by the current Rules and Regulations Governing the Subdivision of Land in Groveland, Massachusetts, and that the designs contained herein are in accordance with cornn10nly accepted engineering practice and in compliance with applicable laws and regulations of the Commonwealth of Massachusetts and Bylaws of the Town.

1. Sources of data are listed as follows:
Existing topography, natural features and utilities are based on an instrument survey by The Morin-Cameron Group Inc. Dimensional controls are per the Groveland Zoning By-law & Subdivision Regulation.

2. Oral information furnished by:
Scott P. Cameron, P.E.

3. Actual basis of designs, source of soil and groundwater determinations, and other field determinations made:
Soil determination is as per the Natural Resources Conservation Service (NRCS) by the United States Department of Agriculture (USDA) & in-situ soil testing.

4. Other sources
Sight Distances information are as per American Association of State Highway and Transportation Officials (AASHTO). Traffic memo data are as per Institute of Transportation Engineers (ITE).
Massachusetts Stormwater Handbook for stormwater design.

Seal of Professional Engineer

COMMONWEALTH OF MASSACHUSETTS
SCOTT P. CAMERON
CIVIL
No. 47601
REGISTERED
PROFESSIONAL ENGINEER

Signed ______
(Registered Professional Engineer)

Address 25 Kenoza Ave
Haverhill MA 01830

FORM E

CERTIFIED LIST OF ABUTTERS

PLANNING BOARD - TOWN OF GROVELAND, MASSACHUSETTS
DATE August 1, 2024

SUBDIVISION NAME 181R School Street PLAN#___

To the Planning Board of the Town of Groveland:

The undersigned, being an applicant for approval of Preliminary/Definitive Plan of a proposed subdivision entitled

Definitive Subdivision for a Street to be Named at 181R School Street, Groveland, Massachusetts.

submits the following sketch of the land in the subdivision listing the names of the adjoining owners and the abutters to the adjoining owners in their relative positions and indicating the address of each abutter on the sketch and in a separate list, including owners of land separated from the subdivision only by a street. **The owners of all parcels within three hundred feet (300') of the applicants property shall be included on the certified list.**

Andover Real Property Management Inc. Manager

[signature]

Signature of Applicant

Groveland Redevelopment, LLC
231 Sutton Street, Suite 1B
North Andover, MA 01845

Address

To the Planning Board of the Town of Groveland

This is to certify that at the time of the last assessment for taxation made by the Town of Groveland the names and addresses of the parties assessed as adjoining owners to the parcel of land including all owners within three hundred feet (300'), shown above are as indicated on the attach list.

Date

Assessor

E.1.

FORM E

CERTIFIED LIST OF ABUTTERS

PLANNING BOARD - TOWN OF GROVELAND, MASSACHUSETTS
DATE August 1, 2024

SUBDIVISION NAME 181R School Street PLAN#___

To the Planning Board of the Town of Groveland:

The undersigned, being an applicant for approval of Preliminary/Definitive Plan of a proposed subdivision entitled

Definitive Subdivision for a Street to be Named at 181R School Street, Groveland, Massachusetts.

submits the following sketch of the land in the subdivision listing the names of the adjoining owners and the abutters to the adjoining owners in their relative positions and indicating the address of each abutter on the sketch and in a separate list, including owners of land separated from the subdivision only by a street. **The owners of all parcels within three hundred feet (300') of the applicants property shall be included on the certified list.**

Andover Real Property Management Inc.
Manager

James [signature]
Signature of Applicant

Groveland Redevelopment, LLC
231 Sutton Street, Suite 1B
North Andover, MA 01845
Address

To the Planning Board of the Town of Groveland

This is to certify that at the time of the last assessment for taxation made by the Town of Groveland the names and addresses of the parties assessed as adjoining owners to the parcel of land including all owners within three hundred feet (300'), shown above are as indicated on the attach list.

Date ______

Julie Gebba
Assessor

E.1.

July 31, 2024

Groveland Planning Board
183 Main Street
Groveland, MA 01834

RE: Definitive Subdivision Application
181R School Street
Groveland, MA 01834

Dear members of the Board:

As authorized signer for, 181R School Street LLC, I grant permission to the Planning Board and its agents to enter the property for necessary on-site walks and visits.

Sincerely,
Frank J. Franzone, Manager

181R School Street, LLC
5 Atkison Farm Rd
Atkison, NH

The Morin-Cameron GROUP, INC.

August 1, 2024

Groveland Planning Board
c/o Annie Schindler, Town Planner
Groveland Town Hall – 183 Main Street
Groveland, MA 01834

RE: Definitive Subdivision Application
181R School Street, Groveland, Massachusetts
Map 34, Lot 13

Dear Members of the Board:

On behalf of the applicant, Groveland Redevelopment, LLC and 181R School Street, LLC, The Morin-Cameron Group, Inc. (MCG) herby submits by hand delivery, in accordance with Groveland Subdivision Regulations (Chapter 70-3.4), the following:

- 3 copies of Form C, Application for Approval of a Definitive Plan
- 3 copies of Form D-1, Professional Engineer's Certificate
- 3 copies of Form D, Land Surveyor's Certificate
- 3 copies of Form E, Certified list of Abutters
- 12 copies of plans entitled "Definitive Subdivision for a Street to be Named in Groveland, Massachusetts at 181R School Street – (Groveland Assessor's Map 34 Lot 13) – Prepared for Groveland Redevelopment, LLC dated 7/31/24.
- Letter from owner granting permission to the Planning Board and its agents to enter the property for necessary on-site walks and visits.
- Check for $8,000.00 made payable to Town of Groveland
- Transportation Report dated 08/01/24.
- 7 copies of Technical Report dated 07/31/24.
- 7 copies of Environmental Statement Assessment dated 08/01/24.
- Waiver Request Letter dated 08/01/24.

Please contact the undersigned at (978) 373-0310 if you have any questions or comments.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Scott P. Cameron, P.E.

The Morin-Cameron GROUP, INC.

PLANNING BOARD FEE CALCULATION SHEET:

In accordance the Town of Groveland Planning Board fee schedule, the fee for a Definitive Subdivision Plan if the Preliminary Plan was not approved or more than seven months has elapsed since approval is:

$ 2,000 + $1,000 per lot

The proposed Definitive Subdivision plan proposes six lots:

Fee = $2,000 + $1,000 x 6 lots
Fee = $2,000 + $6,000

Fee = $8,000

A check for $8,000.00 made payable to Town of Groveland has been included with the Form C herewith.

Town of Groveland
Economic Development Planning & Conservation Department
183 Main Street
Groveland, MA 01834

MONEY RECEIVED

DATE	8/1/2024
AMOUNT	$8,000.00
NAME ON CHECK	Minco Development Corp
ADDRESS ON CHECK	231 Sutton St, Ste 1B, North Andover MA
CHECK NUMBER	4591
PROJECT NAME	181R School St Def. Subdivision App
PROJECT ACCOUNT	1001-040-43204-800-000-000
CONTACT	
NOTES	

MINCO DEVELOPMENT CORPORATION
231 SUTTON ST., STE 1B
NORTH ANDOVER, MA 01845

SalemFive
53-7055/2113

4591

7/30/2024

PAY TO THE ORDER OF Town of Groveland

$ **8,000.00

Eight Thousand and 00/100** DOLLARS

Town of Groveland

Security features. Details on back.

MEMO

AUTHORIZED SIGNATURE

004591 211370558 10000764864

The Morin-Cameron
GROUP, INC.

July 31, 2024

Groveland Planning Board
c/o Annie Schindler, Town Planner
Groveland Town Hall – 183 Main Street
Groveland, MA 01834

RE: Definitive Subdivision – Municipality Application Notification
181R School Street, Groveland, Massachusetts
Map 31, Lot 13

Dear Members of the Board:

On behalf of the applicant, Groveland Redevelopment, LLC and 181R School Street, LLC, The Morin-Cameron Group, Inc. (MCG) has sent notice of the Application to all Municipalities abutting the Town of Groveland including the following:

- **Town of Boxford** - Planning Board, 7A Spofford Road Boxford, MA 01921
- **Town of Georgetown** – Planning Board, 1 Library Street Georgetown, MA 01833
- **City of Haverhill** - Planning Board, City Hall, 4 Summer Street, Room 201, Haverhill MA 01830
- **Town of Newbury** – Planning Board, Town Hall, 12 Kent Way, Byfield MA 01922
- **Town of West Newbury** – Planning Board, 381 Main Street, West Newbury, MA 01985

Please contact the undersigned at (978) 373-0310 if you have any questions or comments.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Lindsay Ferlauto
Executive Assistant

Town of Groveland

07/09/202

Data Sources: Produced by Merrimack Valley Planning Commission (MVPC) using data provided by the Town of Groveland & MassIT/MassGIS

MVPC AND THE TOWN OF GROVELAND MAKES NO WARRANTIES EXPRESSED OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF THESE DATA. THE TOWN OF GROVELAND AND MVPC DOES NOT ASSUME ANY LIABILITY ASSOCIATED WITH THE USE OR MISUSE OF THIS INFORMATION

Legend

MVPC Boundary | Local Road | Parcels | Easements | Building Footprint | Road Right of Way | Roads | Hydrographic Features | Interstate | Streams | Major Road | Wetlands

Merrimack Valley Planning Commi

25-001-0
WINNING JR EDWARD
WINNING JULIE
3 ANNE ST
GROVELAND, MA 01834

25-002-0
PAROLISI JEFFREY
PAROLISI SHANNON
1 ANNE ST
GROVELAND, MA 01834

25-003-0
CONDON ELAINE M
CONDON WAYNE M
169 SCHOOL ST
GROVELAND, MA 01834

25-012-701
SILVA CARLA
701 ALYSSA DR
GROVELAND, MA 01834

25-012-702
SMITH LIFE ESTATE EUGENE E
SMITH LIFE ESTATE PATRICIA P
702 ALYSSA DR
GROVELAND, MA 01834

25-012-703
LEONARDI DAVID TRS
LEONARDI CYNTHIA TRS
703 ALYSSA DR
GROVELAND, MA 01834

25-012-704
WILSON TRS RONALD J
WILSON FAMILY TRUST
704 ALYSSA DR
GROVELAND, MA 01834

25-012-705
TRULL AUDREY B
TRULL H BAILEY JR
705 ALYSSA DR
GROVELAND, MA 01834

25-012-706
FLYNN PAUL
FLYNN GAYLE
706 ALYSSA DR
GROVELAND, MA 01834

25-012-707
DUVALL ELIZABETH
707 ALYSSA DR
GROVELAND, MA 01834

25-012-708
REID BENJAMIN G
SMITH REID JUDITH A
708 ALYSSA DR
GROVELAND, MA 01834

25-012-801
TWOMEY GERALDINE
DOHERTY MAUREEN
801 ALYSSA DR
GROVELAND, MA 01834

25-012-802
MARTIN PATRICIA
802 ALYSSA DR
GROVELAND, MA 01834

25-012-803
DEWOLFE JANUS I
803 ALYSSA DR
GROVELAND, MA 01834

25-012-804
AUCOIN SANDRA A TRS
THE SANDRA A AUCOIN REV TRUST
804 ALYSSA DR
GROVELAND, MA 01834

25-012-805
FIELDS FAMILY TRUST
FIELDS DAVID M
805 ALYSSA DR
GROVELAND, MA 01834

25-012-806
DIFELICE TR MARY
MARY P DIFELICE TRUST
806 ALYSSA DR
GROVELAND, MA 01834

25-012-807
SCHEPIS JR TR PAUL A
SCHEPIS TR ANN M
807 ALYSSA DR
GROVELAND, MA 01834

25-012-808
BUCCO TRS MICHAEL D
BUCCO TRS PATRICK J
808 ALYSSA DR
GROVELAND, MA 01834

25-012-901
CAPELSON ROBERTA
901 ALYSSA DR
Groveland, MA 01834

25-012-902
KAGAN KIRCHICK ROBIN
KIRCHICK STEVEN JEFFERY
902 ALYSSA DR
GROVELAND, MA 01834

25-012-903
RODENHISER HOWARD C
RODENHISER MARGARET L
903 ALYSSA DR
GROVELAND, MA 01834

25-012-904
RIVA SUZANNE L
RIVA ANGELO JR
904 ALYSSA DR
GROVELAND, MA 01834

25-012-905
LENZIE A DAVID
LENZIE JACKIE G
905 ALYSSA DR
GROVELAND, MA 01834

25-012-906
GRAHAM ANN M
906 ALYSSA DR
GROVELAND, MA 01834

25-012-1001
MOORE TRS LINDA A
MOORE TRS DONALD P
1001 ALYSSA DR
GROVELAND, MA 01834

25-012-1002
RUSSO DONALD T
RUSSO DONNA MARIE
1002 ALYSSA DR
GROVELAND, MA 01834

25-012-1003
GAUVIN RICHARD
GAUVIN BARBARA ANN
1003 ALYSSA DR
GROVELAND, MA 01834

25-012-1004
FRIEL TRS CHARLES M
FRIEL TRS LINDA DE LYON
1004 ALYSSA DR
GROVELAND, MA 01834

25-012-1005
LOMBARDI DAVID A TRS
DAVID A LOMBARDI TRUST
1005 ALYSSA DR
GROVELAND, MA 01834

25-012-1006
STRAUSS ROGER C
STRAUSS RITA R
1006 ALYSSA DR
GROVELAND, MA 01834

25-012-1007
TOMASELLI LINDA A
1007 ALYSSA DR
GROVELAND, MA 01834

25-012-1008
SHERIDAN REV TRUST 2022 RICHARD P
SHERIDAN REV TRUST 2022 PATRICIA A
1008 ALYSSA DR
GROVELAND, MA 01834

25-012-1101
PARADY-TONDREAU ELAINE
TONDREAU LAWRENCE
1101 ALYSSA DR
GROVELAND, MA 01834

25-012-1102
DELMONACO JR THOMAS M
1102 ALYSSA DR
GROVELAND, MA 01834

25-012-1103
SZCZECHOWICZ JOSEPH
SZCZECHOWICZ KAREN L
1103 ALYSSA DR
GROVELAND, MA 01834

25-012-1104
SMITH TRS MICHELLE C
RONALD P SHWETZ IRV TRUST 2021
1104 ALYSSA DR
GROVELAND, MA 01834

25-012-1105
FAZELL JOANNE Y
1105 ALYSSA DR
GROVELAND, MA 01834

25-012-1106
MATHEWS DAVID
MATHEWS MARYBETH
1106 ALYSSA DR
GROVELAND, MA 01834

25-012-1107
FRANCIS SHEILA A
1107 ALYSSA DR
GROVELAND, MA 01834

25-012-1108
SAVASTA TRS JUDY
SAVATA FAMILY TRUST
1108 ALYSSA DR
GROVELAND, MA 01834

25-012-1201
MORAN ROCHE TRS PAMELA
JOANNE L MORAN IRREV TRUST
1201 ALYSSA DR
GROVELAND, MA 01834

25-012-1202
DARDENO (LF EST) BEVERLY R
1202 ALYSSA DR REALTY TRUST
1202 ALYSSA DR
GROVELAND, MA 01834

25-012-1203
STEHLIN TRS KEVIN T
MAMAKOS TRS KARA E
1203 ALYSSA DR
GROVELAND, MA 01834

25-012-1204
GAVIN TRS KERI
MCCOY TRS JAKE M
1204 ALYSSA DR
GROVELAND, MA 01834

25-012-1205
FIANDACA FRANK A
FIANDACA JACKIE A
1205 ALYSSA DR
GROVELAND, MA 01834

25-012-1206
FANDEL TRS ILANA M
SHUMAN TRS BARNET
1206 ALYSSA DR
GROVELAND, MA 01834

25-012-1301
MCGRANACHAN CATHERINE
MCGRANACHAN CATHY
1301 ALYSSA DR
GROVELAND, MA 01834

25-012-1302
RUSSO PHILIP LIF EST
RUSSO PATRICIA LIF EST
1302 ALYSSA DR
GROVELAND, MA 01834

25-012-1303
CHADWICK CATHLEEN
1303 ALYSSA DR
GROVELAND, MA 01834

25-012-1304
MOULISON TR MICHAEL W
MOULISON IRV TRUST
1304 ALYSSA DR
GROVELAND, MA 01834

25-012-1305
MCDEVITT CATHLEEN
1305 ALYSSSA DR
GROVELAND, MA 01834

25-012-1306
FEMINO LIFE EST PAUL A
FEMINO LIFE EST BERNADETTE M
1306 ALYSSA DR
GROVELAND, MA 01834

25-012-1307
MEDUGNO JAMES
MEDUGNO JANET
1307 ALYSSA DR
GROVELAND, MA 01834

25-012-1308
RUSSO MARY L LIF EST
RUSSO MICHAEL
1308 ALYSSA DR
GROVELAND, MA 01834

25-012-1401
CONNOR TRS THOMAS P
CONNOR TRS MARY B
1401 ALYSSA DR
GROVELAND, MA 01834

25-012-1402
KENT 2021 TRUST
KENT TR MARIE ARTHUR H
1402 ALYSSA DR
GROVELAND, MA 01834

25-012-1403
MARTINDALE TRS ANITA C
ANITA C MARTINDALE TRUST
1403 ALYSSA DR
GROVELAND, MA 01834

25-012-1404
LUCCA MARIE
FISCHER CURTIS
1404 ALYSSA DR
GROVELAND, MA 01834

25-012-1405
DRISCOLL (LF EST) DIANE T
DIANE T DRISCOLL IRV TRUST
1405 ALYSSA DR
GROVELAND, MA 01834

25-012-1406
GRAOZZO (LF EST) PRISCO
GRAOZZO (LF EST) CATERINA
1406 ALYSSA DR
GROVELAND, MA 01834

25-012-1407
FORD PAUL N
FORD MURIEL
1407 ALYSSA DR
GROVELAND, MA 01834

25-012-1408
COGLIANO TRS IDA R
SCOTINA TRS DIANE
1408 ALYSSA DR
GROVELAND, MA 01834

25-141-0
LIGOLS ALEXANDRA
SMITH DYLAN R
16 EVERGREEN LN
GROVELAND, MA 01834

25-142-0
BURKE DANA
BURKE MEMARIE
6 PARKER RD
GROVELAND, MA 01834

25-143-0
HOOD JOHN P
HOOD SUSAN M
8 PARKER RD
GROVELAND, MA 01834

25-147-0
FITZGERALD RICHARD D LIF EST
FITZGERALD NANCY J LIF EST
180 SCHOOL ST
GROVELAND, MA 01834

25-148-0
PROVENCAL TRS GEORGE R
PROVENCAL TRS MARY R
182 SCHOOL ST
GROVELAND, MA 01834

25-149-0
GORE JASON E
MACHIA-GORE HEATHER A
184 SCHOOL ST
GROVELAND, MA 01834

34-010-101
TOPHAM TRS LAURA R
LAURA R TOPHAM 2020 REV TR
101 DIANE CR
GROVELAND, MA 01834

34-010-102
ENSTAD SONJA L TRS
MCDONALD MARY BETH TRS
102 DIANE CR
GROVELAND, MA 01834

34-010-103
BEIDLER GARY
BEIDLER MARY F
103 DIANE CR
GROVELAND, MA 01834

34-010-104
SALOIS TR PATRICIA M
104 DIANE CIRCLE NOMINEE TR
104 DIANE CR
GROVELAND, MA 01834

34-010-105
PEABODY AUDREY J
105 DIANE CR
GROVELAND, MA 01834

34-010-106
MURRAY LIFE ESTATE RICHARD J
MURRAY LIFE ESTATE D ELIZABETH
106 DIANE CR
GROVELAND, MA 01834

34-010-201
CEDORCHUK TRS KARA B
MCWALTERS FAMILY IRREV TRUST LINDA J
201 DIANE CIR
GROVELAND, MA 01834

34-010-202
SHEEHAN HOLLY
SHEEHAN JOHN
202 DIANE CR
Groveland, MA 01834

34-010-203
SHIMMIN CANDENCE E
BUCCHIERE CANDICE A
203 DIANE CR
GROVELAND, MA 01834

34-010-204
HALUPOWSKI TRS NOEL J
JANET NOLAN IRREV TRUST
204 DIANE CIR
GROVELAND, MA 01834

34-010-205
SELLERS TRS ROBERT J
COOKE TRS KAREN L
205 DIANE CR
GROVELAND, MA 01834

34-010-206
SADOWSKI SUSAN R
SADOWSKI FRANCIS J
206 DIANE CR
GROVELAND, MA 01834

34-010-301
PERRY TR DAVID C
JOHN C PERRY LIVING TRUST
9 SUMMER ST APT 314
DANVERS, MA 01923

34-010-302
DIORIO JOHN C TRS
DIORIO MARLENE L TRS
302 DIANE CR
GROVELAND, MA 01834

34-010-303
GARABEDIAN RICHARD
GARABEDIAN SHIRLEY
303 DIANE CR
GROVELAND, MA 01834

34-010-304
WHITE JOSEPH A LIF EST
WHITE ANN L LIF EST
304 DIANE CR
GROVELAND, MA 01834

34-010-305
BAXTER (LE EST) LEAMAN
BAXTER (LF EST) PATRICIA M
305 DIANE CR
GROVELAND, MA 01834

34-010-306
DORLANDO KAREN
306 DIANE CIR
GROVELAND, MA 01834

34-010-401
MCCORMACK HELEN L
401 DIANE CR
GROVELAND, MA 01834

34-010-402
CASEY WILLIAM J
CASEY ELAINE R
402 DIANE CR
GROVELAND, MA 01834

34-010-403
KERIVAN JOHN E
KERIVAN DIANE M
403 DIANE CIR
GROVELAND, MA 01834

34-010-404
OCONNOR LIFE ESTATE ROBERT J
OCONNOR LIFE ESTATE JOAN K
404 DIANE CIR
GROVELAND, MA 01834

34-010-405
WALLACE MARGARET
WALLACE RICHARD H
405 DIANE CR
GROVELAND, MA 01834

34-010-406
GREEN LORRAINE
406 DIANE CIR
GROVELAND, MA 01834

34-010-407
LUCEY SUSAN
407 DIANE CR
GROVELAND, MA 01834

34-010-408
LEONE MICHAEL
LEONE MELINDA
408 DIANE CR
GROVELAND, MA 01834

34-010-501
DOHERTY PAUL E
DOHERTY JOAN M
501 DIANE CR
GROVELAND, MA 01834

34-010-502
DEWHIRST PATRICIA
C/O DONALD GREANEY
2 MILL ST EXT
GROVELAND, MA 01834

34-010-503
MARTINESE ANN MARIE
503 DIANE CR
GROVELAND, MA 01834

34-010-504
CHOUINARD TRS MARTIN
CHOUINARD TRS JOCELYN E
504 DIANE CIR
GROVELAND, MA 01834

34-010-505
MCCAFFREY TRS JUDITH A
MCCAFFREY 2013 FAMILY TRUST
505 DIANE CR
GROVELAND, MA 01834

34-010-506
GOLDEN JOSEPH TRS
GOLDEN IRENE TRS
506 DIANE CR
GROVELAND, MA 01834

34-010-601
REID WILLIAM
REID NANCY
601 DIANE CIR
GROVELAND, MA 01834

34-010-602
MELCHER JOHN
MELCHER CAROL
602 ALYSSA DR
GROVELAND, MA 01834

34-010-603
FROST SHAWN
MICHELE E FROST REV TRUST
603 DIANE CR
GROVELAND, MA 01834

34-010-604
COSTELLO JOHN J
COSTELLO MARY LOU
604 ALYSSA DR
GROVELAND, MA 01834

34-010-605
DEVOE TR ANDREA
BARBARA GIANNATTASIO IRV TRUST
605 ALYSSA DR
GROVELAND, MA 01834

34-010-606
CARDINALE TRS PAUL A
JOAN F CARDINALE TRUST 2015
606 DIANE CR
GROVELAND, MA 01834

34-010-607
EGENBERG JANICE D TRS
THE HARVEY IRREVOCABLE TRUST
607 DIANE CR
GROVELAND, MA 01834

34-010-608
BRUGMAN TRS TERESA
TERESA BRUGMAN REV TRUST
608 ALYSSA
GROVELAND, MA 01834

34-010-A
HILEMAN REALTY TRUST
HILEMAN TR BARBARA
185 SCHOOL ST
GROVELAND, MA 01834

34-010-B
HART NEIL
187 SCHOOL ST
GROVELAND, MA 01834

34-012-0
DEVEAU DERRICK M
RHOADES ANDREA M
181 SCHOOL ST
GROVELAND, MA 01834

34-013-0
181R SCHOOL STREET LLC
5 ATKINSON FARM RD
ATKINSON, NH 03811

34-014-0
HOMES OF CARE III INC
102 GLENN ST
LAWRENCE, MA 01843

34-015-0
MASSERO STEVEN
MASSERO JESSICA
4 ANNE ST
GROVELAND, MA 01834

34-016-0
MANISCALCO JEFFREY
MANISCALCO ASHLEY KATE
6 ANNE ST
GROVELAND, MA 01834

34-017-0
RHODES GARY
8 ANNE ST
GROVELAND, MA 01834

34-018-0
STAUBLE ERIC
120 MADBURY RD
DURHAM, NH 03824

34-019-0
SANFORD WARREN R (LF EST)
SANFORD ROSEMARIE (LF EST)
5 ANNE ST
GROVELAND, MA 01834

34-020-0
BERUBE TRS SCOTT
BERUBE REALTY TRUST
186 SCHOOL ST
GROVELAND, MA 01834

34-021-0
KOWALICK KEITH C
KOWALICK ANNE MARIE
188 SCHOOL ST
GROVELAND, MA 01834

34-022-0
ARSENAULT KENNETH J
ARSENAULT GAIL A
2 PARKER RD
GROVELAND, MA 01834

34-023-0
COPELAS ALETHEA B
COPELAS CHAD
3 PARKER RD
GROVELAND, MA 01834

34-024-0
PERKINS WILLIAM L
PERKINS JANICE
1 PARKER RD
GROVELAND, MA 01834

34-025-0
SCOTT JR ALFRED A
SCOTT MAUREEN C
190 SCHOOL ST
GROVELAND, MA 01834

34-026-0
BEDARD BRUCE R
192 SCHOOL ST
GROVELAND, MA 01834

34-027-0
WINNINGHAM JAMES T
WINNINGHAM ERIN G
1 PARKER CR
GROVELAND, MA 01834

41-041-0
NEIMAR FARM LLC
2 ORCHARD RD
GLOUCESTER, MA 01930

42-062-0
MASSACHUSETTS ELECTRIC CO
PROPERTY TAX DEPT
40 SYLVAN RD
WALTHAM, MA 02451

CERTIFIED
Board of Assessors
Groveland, MA

H. Dana Moody

ENVIRONMENTAL ASSESSMENT
181R School Street Subdivision

The following environmental impact assessment has been prepared in accordance with the Groveland Subdivision Regulations "Schedule A".

A. Physical Environment

- ***Describe the general physical conditions of the site, including amounts and varieties of vegetation; general topography; unusual geologic, scenic, and historical features; trails, and open space links; and indigenous wildlife.***
  The existing site consists of a parcel located at 181R School Street, which encompasses a total area of approximately 345,495 square feet (5.65 acres). The site is comprised by a mix of deciduous and evergreen trees, and understory vegetation such as shrubs and grasses. The site topography is generally uniform and features slopes varying from 4% to 12%, with no steep slopes, making the area suitable for residential development while maintaining the natural drainage patterns. Soil testing has been performed on-site and no unusual geologic formations were noted. The soil composition is primarily sandy loam, but loamy sand and gravelly sand soils have been encountered as well. There are no known historical landmarks or features on the site, nor designated trails and open space links within the site itself. The site contains some indigenous wildlife mammals and birds.

- ***Describe how the project will affect these features.***
  The project will involve the construction of a road, installation of a stormwater management system, installation of new utilities and landscape improvements to service the proposed six lots. Associated with the construction of the items mentioned previously some disturbance will need to occur, including the removal of existing vegetation, grading, and earthwork. Although the proposed project will impact some of the site features, some measures will be taken to mitigate the adverse effects on the site features, such as preserving a wooded buffer to the extent possible around the perimeter of the property and, planting native tree species and landscaping throughout the site; maintaining natural drainage patterns to maximum extent practicable including incorporation of sustainable best management practices permeable pavement and rain gardens; and managing stormwater runoff on-site, that will reduce the volume and peak rates of stormwater running off to abutting properties.

- ***Provide a complete physical description of the project and relationship to surrounding area***.
  The site is located within a predominantly residential area of Groveland. The surrounding proprieties are single-family and multi-family homes on similar or smaller lots than what is proposed. The lots fully comply with the Groveland Zoning and Subdivision regulations (note 2 waivers requested to better conform to neighborhood and sustainable practices) and best practices.

B. *Surface Water and Soil*

- ***Describe location, extent, and type of existing water and wetland, including existing surface drainage characteristics, both within and adjacent to the project.***
  The project site does not contain wetlands or major water bodies. The nearest wetlands and a small stream are located on an open-space area more than 500 feet to the west of the site. The stream carries stormwater runoff to the Merrimack River, which is located more than 4,000 feet north of the property. The adjacent properties exhibit similar drainage characteristics, with stormwater runoff flowing west towards the stream referenced previously. The proposed project will alter the existing surface drainage patterns temporarily during development. The stormwater management system has been designed to mitigate any impacts and replicate or improve existing stormwater conditions. The project will maintain the drainage characteristics to the maximum extent practicable, will utilize of best management practices (BMPs), will provide groundwater recharge and, attenuate the peak flow and volume of stormwater flowing to the adjacent properties.

- ***Describe the methods to be used during construction to control erosion and sedimentation i.e. use of sediment -basins and type of mulching, matting, or temporary vegetation.***
  The project proposes to clear approximately 4.4 acres of land, and maintain a tree buffer around the perimeter, to the extent possible. During construction, disturbed soils within this area will need to be managed to ensure that dust and erosion are contained on site. Erosion control details are included in the Definitive Subdivision Plans and Construction Phase Best Management Practices Operations and Maintenance Plan is included within the Technical Report. The plan contains provisions for erosion and sediment control measures including, silt fence, mulch sock, inlet protection, grading, topsoiling, seeding, dust control and inspection/maintenance. These good housekeeping and oversight measures have a long-standing track record, endorsed by the EPA and DEP for effectively managing erosion and pollution sources during construction.

  The project falls under the Environmental Protection Agency (EPA) Construction General Permit (CGP). An eNOI from the EPA will be required and obtained prior to construction. This will involve preparation Stormwater Pollution Prevention Plan and weekly inspections of erosion and sediment controls that will ensure the controls are effective throughout construction. Minimum weekly monitoring by a licensed SWPPP Inspector is required throughout the duration of construction until the site reaches a stabilized condition.

- ***Describe approximate size and location of land to be cleared at any given time and length of time and exposure; covering of soil; stockpiles; and other control methods used. Evaluate effectiveness of proposed methods on the site and on the surrounding areas.***
  The road is expected to take 3-4 months to construct to binder. Each home will take up to 12-months to construct, multiple homes will be constructed concurrently. The total duration of the road and home construction is expected to take 2 to 3 years depending on market conditions, supply of materials and availability of labor.

- ***Describe the permanent methods to be used to control erosion and sedimentation. Include description of:***
  (1) ***Any areas subject to flooding or ponding.***
  A surface drainage system with capacity to convey the 100-year storm event has been designed to prevent flooding or ponding within the site and abutting properties, and to minimize erosion.
  (2) ***Proposed surface drainage system.***
  Two infiltration basins and four rain gardens are being proposed to mitigate, renew, and infiltrate stormwater runoff to avoid flooding or ponding on site and surrounding areas. These systems will feature appropriate treatment BMPs to remove sediment from stormwater prior to discharge.
  (3) ***Proposed land grading and permanent vegetative cover.***
  All vegetated areas will be loamed and seeded to stabilize exposed soils and will feature plantings with root systems that will provide further stabilization. Slopes are intended to be no steeper than three horizontal to one vertical unless a retaining wall, rock or manufactured product is used.
  (4) ***Methods to be used to protect existing vegetation.***
  A limit of work has been established and a silt fence will be installed around it. A mulch sock fence and a temporary sediment forebay are being proposed to manage sedimentation control. A wooded tree buffer is intended to be preserved to the maximum extent possible. The silt fence will be installed at the start of construction to establish the limit of work for the road and lots. Some lots may desire to clear more or less trees based on owner preference. A conservative limit of clearing and impervious coverage was presumed for the design to account for this variability in the lot construction.
  (5) ***The relationship of the development to the topography.***
  Throughout the site, the topography has been maintained to the maximum extent practicable, with finished grades varying no more than two feet from existing conditions to proposed conditions.
  (6) ***Any proposed alterations of shorelines, marshes or seasonal wet areas.***
  No alteration of shorelines, marshes or seasonal wet areas are proposed.
  (7) ***Any existing or proposed flood control or wetland easements.***
  There are no flood controls or wetlands within the site.
  (8) ***Estimated increase of peak runoff caused by altered surface conditions, and methods to be used to return water to the soils and best management practices (BMP's) to be used to meet the requirements of the Massachusetts Stormwater Policy Act [Handbook].***
  The stormwater management system has been designed to decrease the peak rate of runoff from all storm events. The project will provide a total of 1,903 cubic feet of ground water recharge where 1,648 cubic feet is required through the proposed infiltration basins and rain gardens, see Stormwater Management Calculations within the Technical Report. Additionally, water quality volume will be provided by the utilization of hydrodynamic separators and infiltration.

- ***Completely describe sewage disposal methods. Evaluate impact of disposal methods on surface water, soils, and vegetation.***
  The design will utilize individual ejector pumps to a common force main in the new road. A manhole near School Street will receive the wastewater and by gravity, direct it to the

municipal main in School Street. All sewage is expected to be domestic wastewater and will comply with any Town of Groveland requirements.

C. Subsurface Conditions

- ***Describe any limitations on the proposed project caused by sub-surface soil and water conditions, and methods to be used to overcome them.***
  The soils encountered on-site are very well drained soils with medium to high infiltration rates. Therefore, limitations on the proposed project caused by sub-surface soil and water conditions are not anticipated.
- ***Describe procedures and findings of percolation tests conducted on the site.***
  Test holes were excavated to determine soil type, consistency, and depth to seasonal high-water table. A high-water table was not identified in any test holes, so it occurs below the depth of the test hole excavation. Percolation tests are for onsite wastewater disposal systems and not applicable to this development because it has municipal sewer available.
- ***Evaluate impact of sewage disposal methods on quality of subsurface water.***
  The proposed sewage disposal method utilized is via a closed system to the municipal sewer. There are no impacts to subsurface water quality at the site due to wastewater.

D. Town Services

- ***Describe estimated traffic flow at peak periods and proposed circulation pattern.***
  A Transportation Report dated July 31, 2024, has been included within this submittal. The results of the trip generation estimate that the proposed subdivision will generate a negligible impact on the public network.
- ***Describe locations and number of vehicles accommodated in off street parking areas.***
  The final lot design has not yet been completed. However, the road was designed in full compliance with the Groveland Zoning regulations and will comply with the required off-street parking.
- ***Describe effect of project on police and fire protection services.***
  The project will not have a measurable impact on police and fire due to its small size. Both police and fire departments are located nearby the site so in the event of an emergency, response time will be minimal. Two fire hydrants have been proposed on-site and the road was designed to ensure emergency vehicle access to facilitate these services.
- ***Describe effect of project on educational services.***
  The proposed subdivision will likely increase the number of school-aged children in the area, resulting in a modest rise in demand for educational services. Tax revenue generated from the new homes will offset some of the cost of new school children entering the school system. According to US census data from 2020, Groveland has approximately 2.58 persons per household and 21.8% of its population is under 18 years old. Assuming all children go to Groveland elementary or Pentucket Regional High School, it is expected that 4 to 5 school age children reside in this development at a given time. It should be noted that the Regional Whittier Technical High School is nearby, and some children are placed in private schools. This estimate is conservative.
- ***Describe effect of project on public works department services.***
  The road, once constructed, would be sought to become a public road. Plowing and maintenance will be required by the public works department thereafter. New tax revenue

generated by the homes will offset the cost of maintenance of the road. The new road would also be subject to additional state funds under Ch.90.

- ***Describe the effect of the project on the Town water supply and distribution system.*** Based on a conservative five bedrooms per dwelling, water consumption is expected to be no more than 2,200 gallons per day based on 50% of the Title 5 flows. Water utility bills will offset the cost of this water consumption.

- ***Describe the effect of the project on the Town sewer system if the area is to be sewered.***
Based on title 5 flows, the project will generate approximately 4,400 gallons per day of total wastewater flow. Sewer impacts will be mitigated with sewer fees that the homeowners pay based on usage.

E. Human Environment

- ***Provide a tabulation of proposed buildings by type, size (number of bedrooms, floor area), ground coverage, and a summary showing the percentage of the tract to be occupied by buildings, parking and other paved vehicular areas, and usable open space.***
Final lot design has not yet been completed; therefore, the type and size of buildings have not been established. The Site Plan on the Definitive Subdivision Plan depicts conceptual lot improvements for the purpose of demonstrating constructability. Sheet C-3 includes dimensional and lot coverage information for each lot. Each lot complies with the zoning bylaw with respect to shape, size, and frontage. Open space will be private on each lot.

- ***Describe type of construction, building materials used, location of common areas, location and types of service facilities (laundry, trash. garbage disposal).***
The homes are not designed until after the road is constructed when a building permit can be obtained. It is anticipated that they will be of wood frame construction in a style that is marketable for the region. They will include all services available including natural gas.

- ***State proximity to transportation, shopping, and educational facilities, including active and passive types; and age groups participating, and state whether recreational facilities and open space are available to all residents.***
School Street connects southerly Main Street, Route 113, providing access to Interstate 95. Northerly, School Street connects with Route 133 and Interstate 95. The Haverhill MBTA is located approximately 4 miles from the site and there is a bus stop less than a mile away from the site on Main Street. Grocery stores are located less than 3 miles away. Dr. Elmer Bagnall Elementary school is located about 0.6 miles from the site, Pentucket Regional Middle and High Schools are located approximately 3.5 miles from the site. There are various parks nearby the property such as Veasey Memorial Park and Groveland Pines Recreation Area, both within 2 miles from the property.

F. General Impact

- ***Summarize briefly the environmental impact on the entire Town with supporting reasons.***
  According to US Census data, Groveland has a 2023 population of 6,743 residents and 2,613 households. The project will add 8 new dwellings and approximately 20 new residents. This represents only a 0.12% increase in population and 0.3% increase in households. It is a very small project that will have a de minimis impact on the community when compared to the additional tax revenue that it generates for 8 dwellings compared to undeveloped land in the current condition. Housing is also in severe demand regionally and this project provides a positive step towards adding this housing. The mix of single- and two-family dwellings provides a variety of housing options. The two-family dwellings are within financial reach of more families than a single-family dwelling. The project fully complies with current stormwater regulations and best practices.

The Morin-Cameron GROUP, INC.

August 1, 2024

Groveland Planning Board
c/o Annie Schindler, Town Planner
Groveland Town Hall – 183 Main Street
Groveland, MA 01834

RE: Waiver Request Letter – Definitive Subdivision Application
181R School Street, Groveland, Massachusetts
Map 34, Lot 13

Dear Members of the Board:

On behalf of the applicant, Groveland Redevelopment, LLC and 181R School Street, LLC, The Morin-Cameron Group, Inc. (MCG) hereby requests for the following waivers from the Town of Groveland Subdivision Rules and Regulations:

- ***70-4.3. (H)(5) "Proposed new intersections along one side of an existing street shall, wherever practicable, coincide with any existing intersections on the opposite side of such street. Where streets intersect major streets, their alignment shall be continuous. Intersections of major streets shall be at least 800 feet apart, and minor streets shall be at least 400 feet apart."***
  The applicant requests a waiver to reduce the intersection separation of 400 feet to 300 feet. This waiver is in the public interest by allowing access to land for development of much needed housing. The housing types include two-family dwellings which are more economically accessible to younger families. It is in keeping with the neighborhood in that adjacent intersections with adjacent minor streets range from 217 feet (Doris to Wilbert), 300 feet (Anne to Georgia) to 320' (Carilda to Abbott). The proposed intersection meets AASHTO standard for stopping sight distance, is a very low volume minor road and is geometrically designed in accordance with the Groveland Subdivision Regulations.

- ***70-4.9(B) "Bituminous concrete sidewalks shall conform to the material and construction methods as specified in Section 701 of the MassDOT Standard Specifications."***
  A waiver is requested from the technical requirements for sidewalk and driveway apron construction to install permeable pavement. Modern best engineering practice weighs heavily on sustainable design, and this is in the public interest of environmental protection. The homes will be constructed to the current Mass Building Code which is highly energy and water efficient. The road and site design also took into consideration sustainable measures in implementing bioretention rain gardens and infiltration basins as well as proprietary treatment practices to meet and exceed the state and Groveland stormwater standards. As part of this effort of sustainable design, the sidewalks and driveways were earmarked to be permeable pavement. This are low volume or no traffic volume surfaces that will hold up well as permeable pavement. Permeable pavement typically stays drier which means less chance of ice forming on sidewalk/pedestrian areas.

Finally, as a conservative design measure, the sidewalks and driveways were assumed to be impervious, so granting of this waiver does not reduce size of other infiltration stormwater practices in the project.

Please contact the undersigned at (978) 777-8586 if you have any questions or comments.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Scott P. Cameron, P.E.
Vice President

The Morin-Cameron GROUP, INC.

August 1, 2023

Groveland Planning Board
c/o Annie Schindler, Town Planner
Groveland Town Hall – 183 Main Street
Groveland, MA 01834

RE: Transportation Report
Definitive Subdivision - 181R School Street

Dear Members of the Board:

On behalf of the applicant, Groveland Redevelopment, LLC & 181R School Street, The Morin-Cameron Group, Inc. (MCG) hereby submits this Transportation Report associated with a 6-lot Definitive Subdivision located at 181R School Street in Groveland, Massachusetts. The project proposes to subdivide the existing parcel into 4 single-family and 2 two-family residence lots with frontage to a proposed road for a total of 8 potential dwellings. The access and egress will be through a 'Proposed Street to be Named' that will intersect with School Street. This report is intended to satisfy the points of Section 70-43-.4(A)(20) of the Groveland Subdivision Regulations.

Trip Generation

The Institute of Transportation Engineers (ITE) publication Trip Generation Manual, 11th Edition – Volume 3, is the industry accepted source for trip generation information for various land uses throughout the United States. Trip rates from the ITE Land Use Code (LUC) 210 – Single-family detached housing – was utilized to estimate the trips generated by the proposed subdivision during the weekday and weekend morning and evening peak hours. The single-family attached housing includes any single-family housing detached homes on individual lots. A two-family dwelling may have less trips so for this analysis, they were conservatively assumed to have the same trips as a larger, single-family dwelling. A typical site surveyed is a suburban subdivision. The trip data is attached to this document. Calculations and a summary of the ITE Trip Generation is noted below:

Average Rate (by ITE) x Number of Dwellings = Average Trip number

Average Weekday Daily:

Average Rate = 9.43

Number of dwellings = 8

Average trip number = 9.43 x 8 => Average trip number = 75 (vehicles entering and exiting)

Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.:

Average Rate = 0.70

Number of dwellings = 8

Average trip number = 0.7 x 8 => Average trip number = 6

Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.:

Average Rate = 0.94

Number of dwellings = 8

Average trip number = 0.94 x 8 => Average trip number = 8

Saturday Entire Day:

Average Rate = 9.48

Number of dwellings = 8

Average trip number = 9.48 x 8 => Average trip number = 76

Sunday Entire Day:

Average Rate = 8.48

Number of dwellings = 8

Average trip number = 8.48 x 8 => Average trip number = 68

Time Period/Direction	**ITE LUC 210**
Average Weekday Daily	75 vehicle trips
Weekday AM Peak Hour	
Enter	1 vehicle trips
Exit	5 vehicle trips
Total	6 vehicle trips
Weekday PM Peak Hour	
Enter	5 vehicle trips
Exit	3 vehicle trips
Total	8 vehicle trips
Saturday Entire Day	
Enter	38 vehicle trips
Exit	38 vehicle trips
Total	76 vehicle trips
Sunday Entire Day	
Enter	34 vehicle trips
Exit	34 vehicle trips
Total	68 vehicle trips

The number of vehicle trips depicted in the table hereon are calculated based on the number of dwellings. According to those calculations, the proposed development is anticipated to generate an average of 75 new vehicle trips entering and exiting during a weekday. During the peak hours, 1 new car every 20 minutes or 6 trips in the AM peak hour, 8 new trips or 1 car every 15 minutes in the PM peak hour. During weekend days, 76 daily trips on Saturday and 68 daily trips on Sunday.

Sight Distance

To identify possible safety hazards associated with site access and egress, MCG has prepared a sight distance evaluation at the proposed intersection. This evaluation is to determine if the available sight distances for vehicles exiting the site are adequate. The available sight distances were compared with minimum requirements established by the American Association of Highway and Transportation Officials (AASHTO) – "A policy On Geometric Design of Highways and Streets; 2018 & 2004". Vehicle speeds were not measured for this site due to the small size of the project. Conservatively, the posted speed limit of 40 miles per hour (MPH) was utilized. The site is also near the Bagnell School which has a lower posted speed limit of 20 MPH during school hours (commuter hours). This section of road is also heavily monitored by local law enforcement. Therefore, the posted speed limit is an acceptable design speed for this analysis.

Stopping Sight Distance (SSD) is the minimum distance required for a vehicle traveling at a certain speed to safely stop before reaching a stationary object in the road. It is measured from an eye height of 3.5 feet to an object height of 2 feet above the street level.

The SSD at the proposed intersection was measured and compared to minimum requirements as established by AASHTO based on the posted speed limit of 40 MPH. A left-turn from stop requires the longest SSD.

Location/Direction	**Required SSD (40 MPH)**	**Measured**
North of Prop. Street	305 feet	>500 feet
South of Prop. Street	305 feet	>500 feet

Intersection Sight Distance (ISD) measures a line of sight from the height of driver's eye (3.5 feet), seated 15 feet back from the fog line or edge of a travelled way, to the right and to the left, to an object in the highway that is 3.5 feet high.

The ISD at the proposed intersection was measured and compared to minimum requirements as established by AASHTO based on the posted speed limit of 40 MPH.

Location/Direction	**Required ISD (40 MPH)**	**Measured**
North of Prop. Street	445 feet	>500 feet
South of Prop. Street	445 feet	>500 feet

As shown on the tables, the available SSD and ISD exceeds AASHTO's minimum recommendations for safe operations at the site driveway.

Conclusion

The results of the trip generation estimate indicate that the proposed 6-lot single-family and two-family subdivision will be not have noticeable impact on School Street. Given the very small scale of this project, only 1 new car every 20 minutes will be generated in the AM peak hour and 7 new trips, or 1 car every 15 min will be generated in the PM peak hour: averaging 76 vehicle trips during a weekday. During the weekend entire day, 76 daily trips on Saturday and 68 daily trips on Sunday. These minimal increases will not be noticeable on the adjacent roadway network. Sight lines at the proposed driveway will exceed AASHTO recommendations for safe operations, indicating no safety issues at the proposed driveway.

Should you have any questions or require additional information, please contact the undersigned at (978) 373-0310.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Scott P. Cameron, PE
Vice-President

Enclosures

Cc: Groveland Redevelopment, LLC

Land Use: 210
Single-Family Detached Housing

Description

A single-family detached housing site includes any single-family detached home on an individual lot. A typical site surveyed is a suburban subdivision.

Specialized Land Use

Data have been submitted for several single-family detached housing developments with homes that are commonly referred to as patio homes. A patio home is a detached housing unit that is located on a small lot with little (or no) front or back yard. In some subdivisions, communal maintenance of outside grounds is provided for the patio homes. The three patio home sites total 299 dwelling units with overall weighted average trip generation rates of 5.35 vehicle trips per dwelling unit for weekday, 0.26 for the AM adjacent street peak hour, and 0.47 for the PM adjacent street peak hour. These patio home rates based on a small sample of sites are lower than those for single-family detached housing (Land Use 210), lower than those for single-family attached housing (Land Use 251), and higher than those for senior adult housing -- single-family (Land Use 251). Further analysis of this housing type will be conducted in a future edition of *Trip Generation Manual.*

Additional Data

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

For 30 of the study sites, data on the number of residents and number of household vehicles are available. The overall averages for the 30 sites are 3.6 residents per dwelling unit and 1.5 vehicles per dwelling unit.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Arizona, California, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Jersey, North Carolina, Ohio, Ontario (CAN), Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, Virginia, and West Virginia.

Source Numbers

100, 105, 114, 126, 157, 167, 177, 197, 207, 211, 217, 267, 275, 293, 300, 319, 320, 356, 357, 367, 384, 387, 407, 435, 522, 550, 552, 579, 598, 601, 603, 614, 637, 711, 716, 720, 728, 735, 868, 869, 903, 925, 936, 1005, 1007, 1008, 1010, 1033, 1066, 1077,1078, 1079

Single-Family Detached Housing
(210)

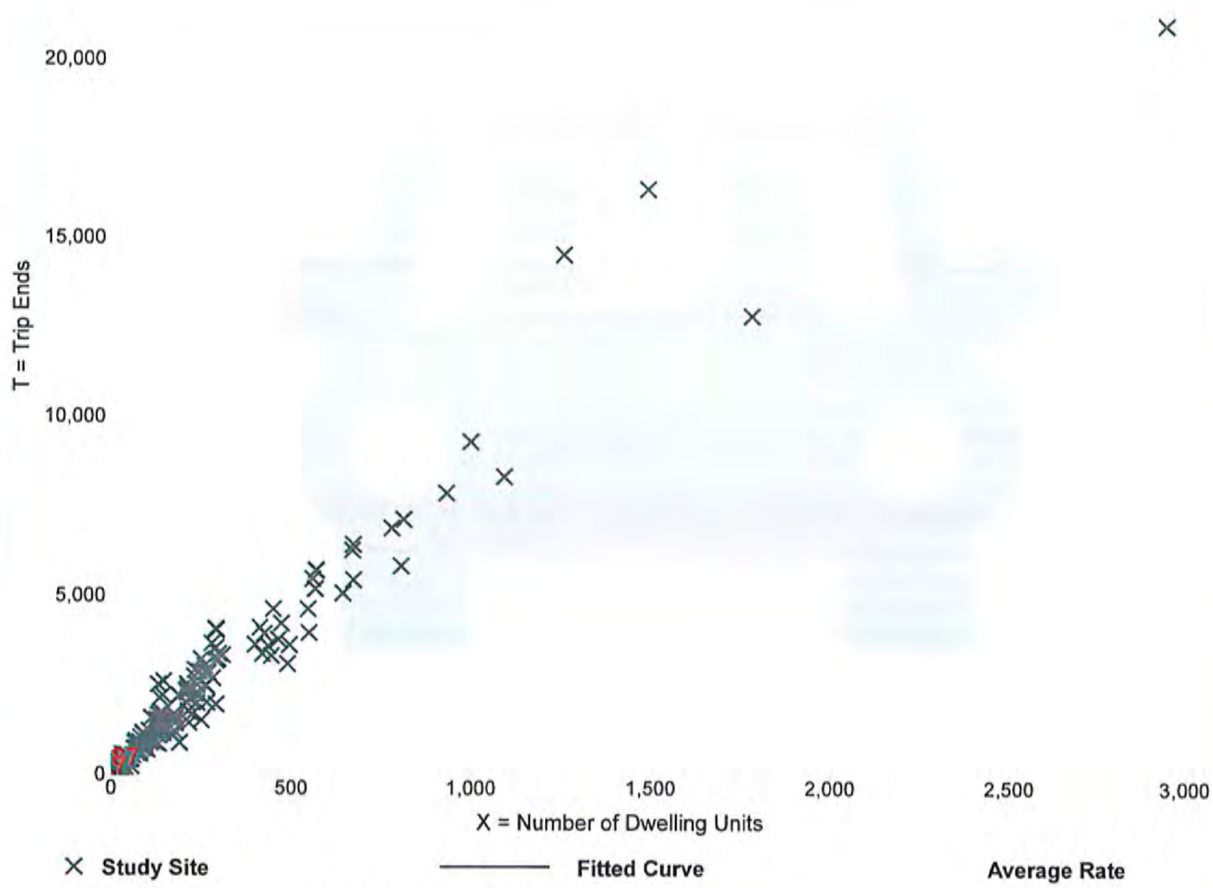
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 174
Avg. Num. of Dwelling Units: 246
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.68 **R^2= 0.95**

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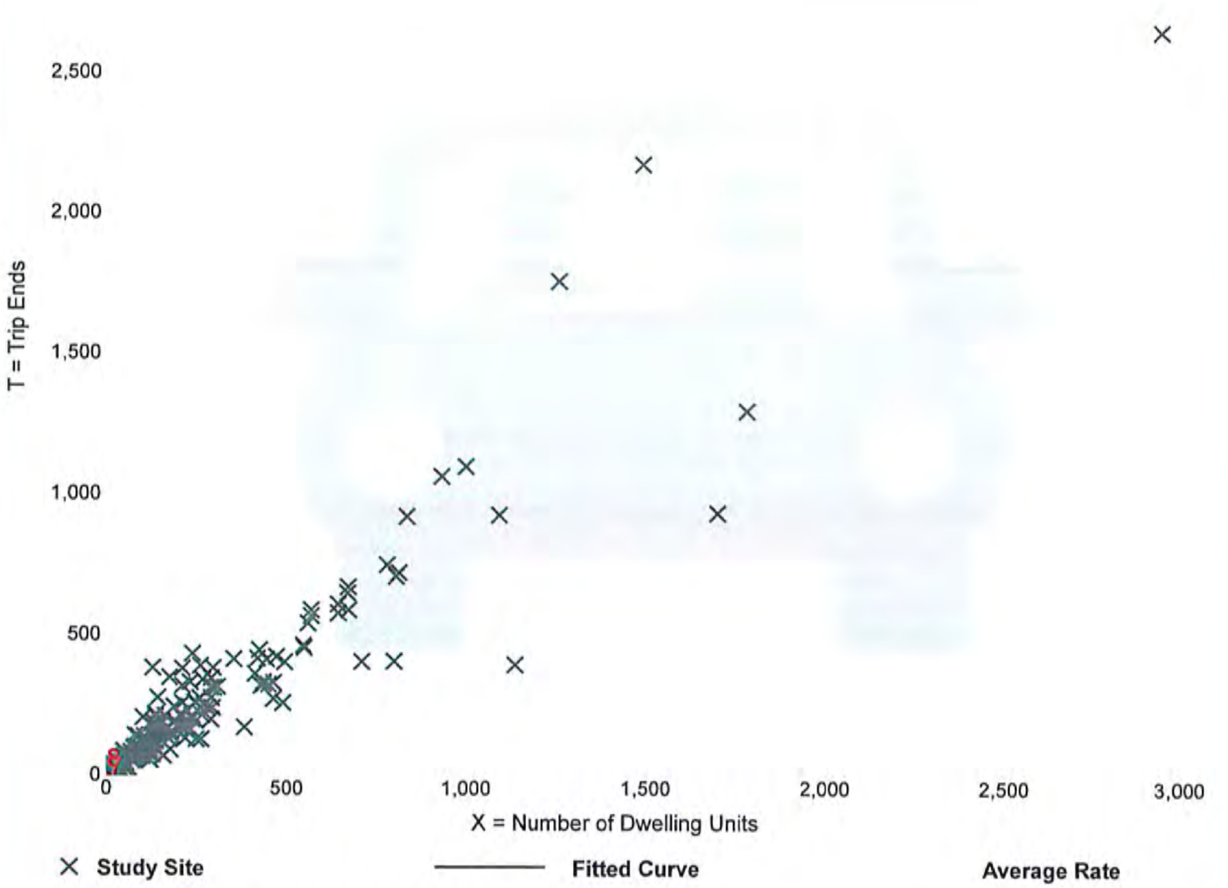
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	208
Avg. Num. of Dwelling Units:	248
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.94 Ln(X) + 0.27

R^2= 0.92

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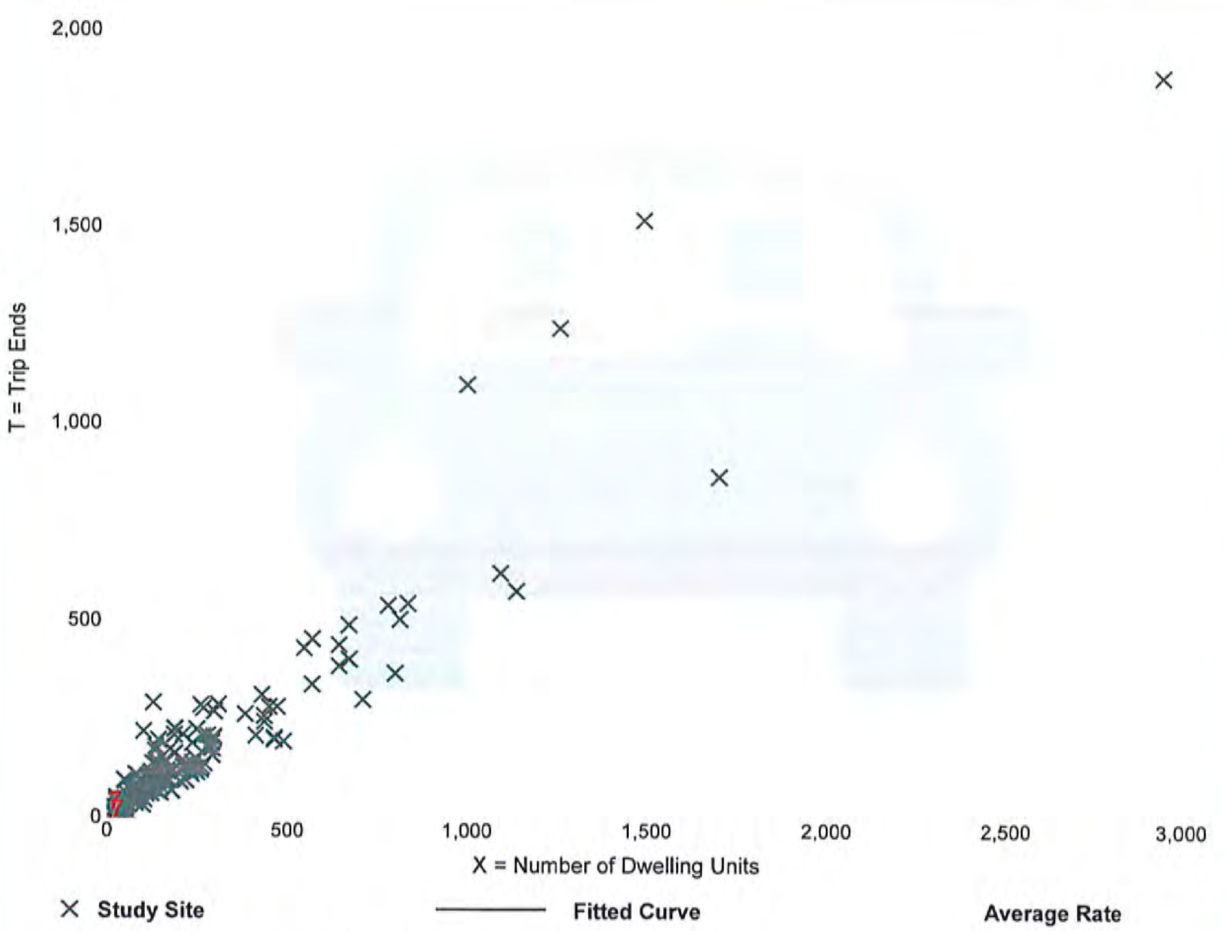
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	192
Avg. Num. of Dwelling Units:	226
Directional Distribution:	25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.91 Ln(X) + 0.12 **R^2 = 0.90**

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Single-Family Detached Housing
(210)

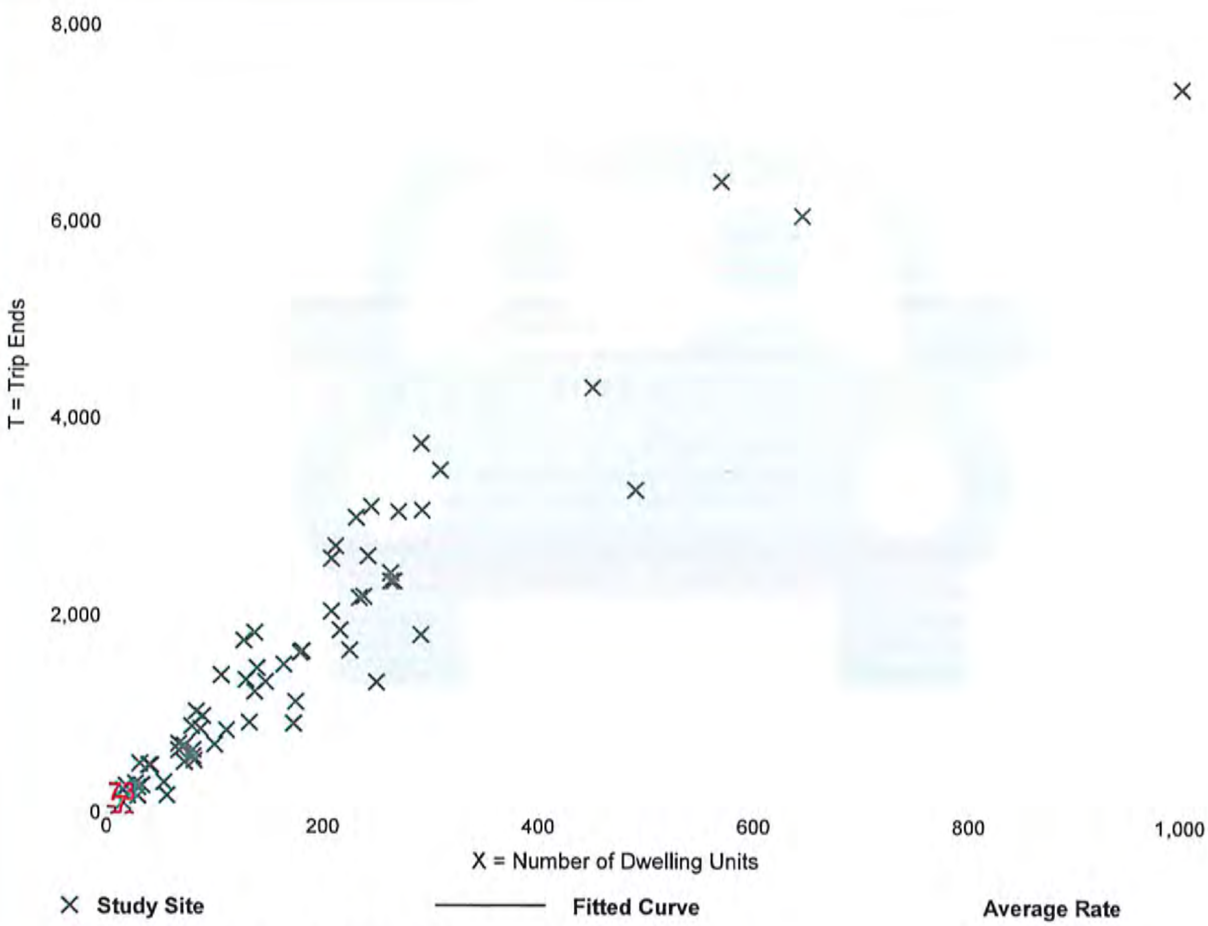
Vehicle Trip Ends vs: Dwelling Units
On a: Saturday

Setting/Location: General Urban/Suburban
Number of Studies: 63
Avg. Num. of Dwelling Units: 179
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.48	3.36 - 16.52	2.26

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.97 Ln(X) + 2.40 **R^2= 0.91**

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Single-Family Detached Housing
(210)

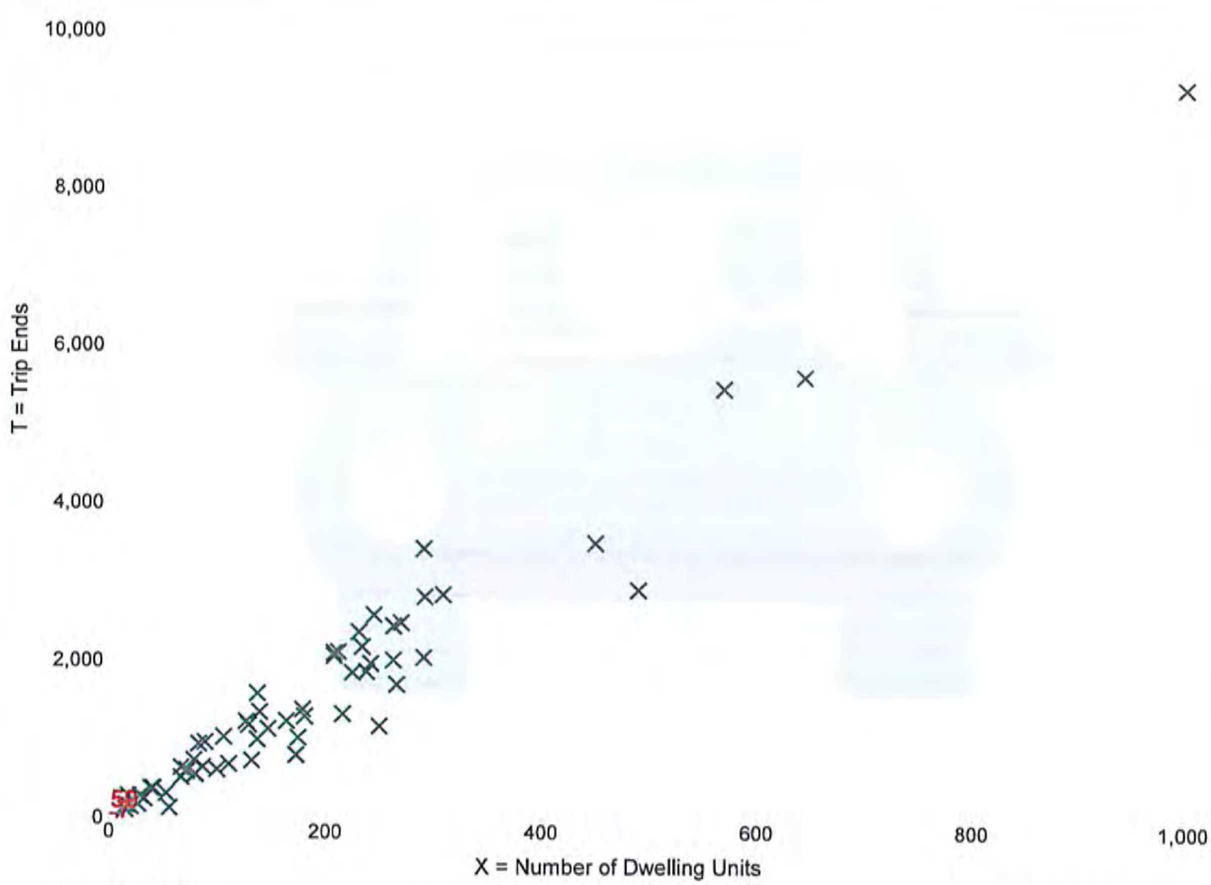
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Sunday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 60
Avg. Num. of Dwelling Units: 186
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
8.48	2.61 - 16.44	1.74

Data Plot and Equation



X **Study Site** ——— **Fitted Curve** **Average Rate**

Fitted Curve Equation: $T = 8.86(X) - 70.09$ **$R^2 = 0.94$**

Trip Gen Manual, 11th Edition • Institute of Transportation Engineers

DEFINITIVE SUBDIVISION
181R SCHOOL STREET
GROVELAND, MASSACHUSETTS
(ASSESSOR'S MAP 34 LOT 13)

FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE

SCHEDULE OF PLAN SET DRAWINGS:

C-1	COVER SHEET
C-2	EXISTING CONDITIONS PLAN
C-3	LOTTING PLAN
C-4	EROSION CONTROL & DEMOLITION PLAN
C-5	SITE PLAN
C-6	GRADING AND DRAINAGE PLAN
C-7	UTILITIES & PROFILE PLAN
C-8	SEWER DETAILS PLAN
C-9	SITE DETAILS PLAN
C-10	UTILITY DETAILS PLAN
C-11	DRAINAGE DETAILS PLAN
C-12	DRAINAGE DETAILS PLAN
L-1	LANDSCAPE PLAN

LEGEND:

100	MAJOR TOPOGRAPHIC CONTOUR
98	MINOR TOPOGRAPHIC CONTOUR
x x x	CHAIN LINK FENCE
	EDGE OF LAWN
G	GAS MAIN
OHW	OVERHEAD WIRES
S	SEWER MAIN
D	STORM DRAIN
T	TELEPHONE SERVICE
	TREE LINE
W	WATER MAIN
	CATCH BASIN
	DRAIN MANHOLE
	GUY WIRE
	HYDRANT
	SEWER MANHOLE
	SIGN
	TELEPHONE MANHOLE
	UTILITY POLE
	WATER GATE

ABBREVIATIONS:

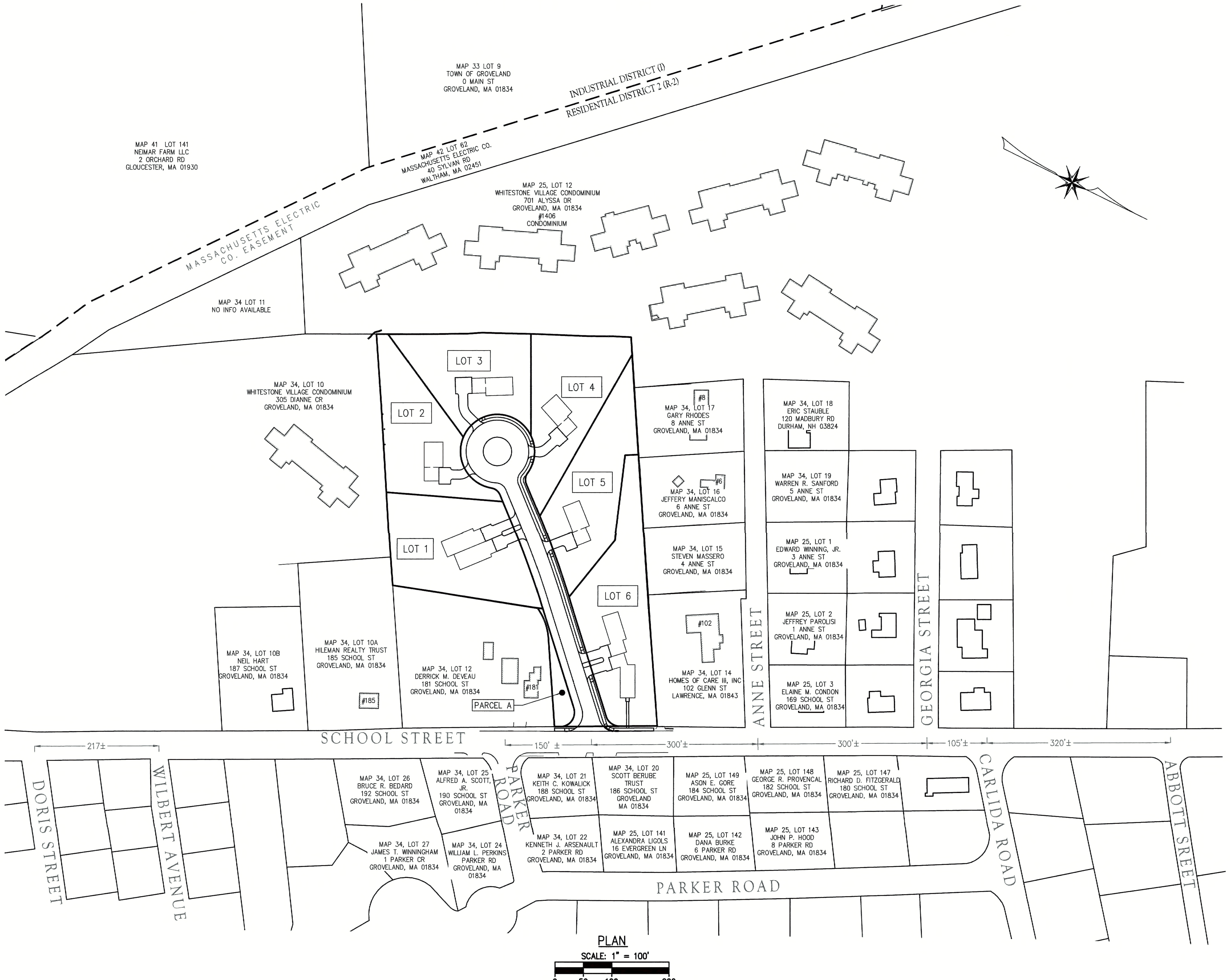
AC	ACRES
ACR	ACCESSIBLE RAMP
APPROX	APPROXIMATE
BIT	BITUMINOUS
CB	CATCH BASIN
CLF	CHAIN LINK FENCE
CO	CLEAN OUT
CONC	CONCRETE
DMH	DRAIN MANHOLE
DYL	DOUBLE YELLOW LINE
EOL	EDGE OF LAWN
EP	EDGE OF PAVEMENT
INV	INVERT
MAX	MAXIMUM
MIN	MINIMUM
M/F	NOW OR FORMERLY
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
RET	RETAINING
S	SLOPE
SF	SQUARE FEET
SL	STOP LINE
SMH	SEWER MANHOLE
SWL	SINGLE WHITE LINE
TMH	TELEPHONE MANHOLE
TYP	TYPICAL
VGC	VERTICAL GRANITE CURB
WSO	WATER SHUT-OFF

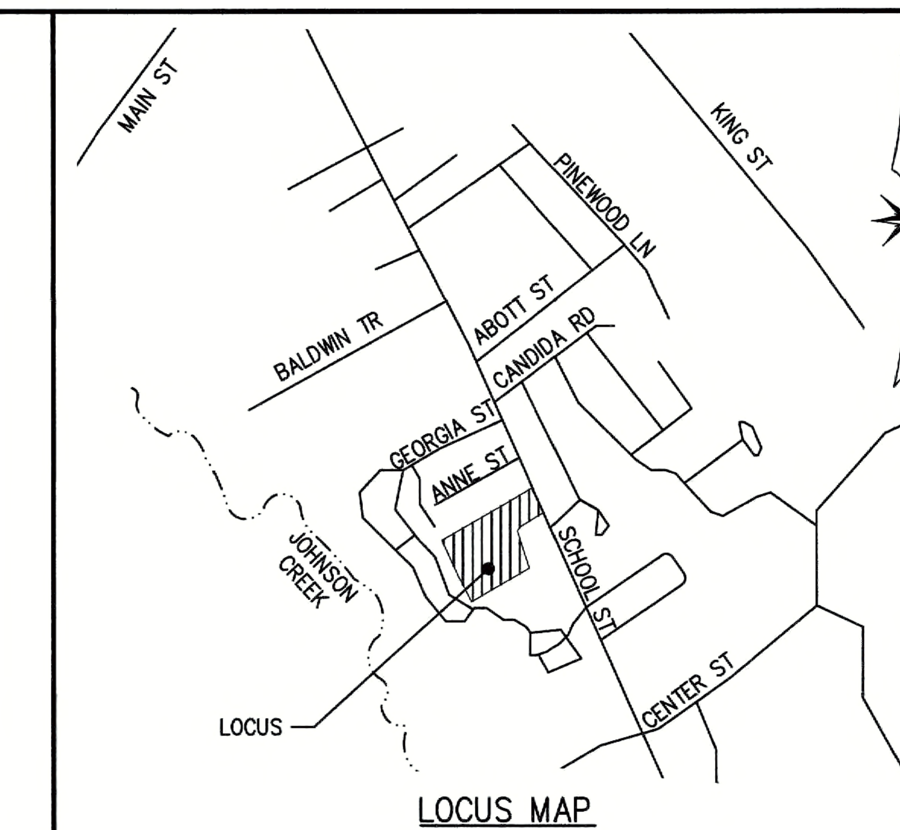
WAIVER:

- SUBDIVISION REGULATION – CHAPTER 70: 70.4.3.(H)(5):
  NEW INTERSECTIONS ALONG ONE SIDE OF AN EXISTING STREET
  REQUIRED: 400 FEET APART FROM A MINOR STREET
  PROPOSED: 300 FEET APART FROM ANNE STREET

GENERAL NOTE:
THESE PLANS ARE PREPARED FOR PERMITTING WITH THE TOWN OF GROVELAND. THE PLANS SHALL NOT BE USED FOR CONSTRUCTION OR FOR ANY OTHER PURPOSES WITHOUT WRITTEN PERMISSION FROM THE MORIN-CAMERON GROUP, INC.

DRAWING: 3634 MAIN.dwg





LOCUS MAP
SCALE: 1" = 1000'

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON __________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U
DATE: __________
APPROVED BY:

APPROVED __________, __________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, __________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, __________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________, __________ GROVELAND PLANNING BOARD.

COMMONWEALTH OF MASSACHUSETTS
SCOTT P. CAMERON
CIVIL
No 47601
REGISTERED PROFESSIONAL ENGINEER
11/5/24

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)
PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845
OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811
JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS I ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS I LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

COVER SHEET

DRAWING NO. C-1

JULY 31, 2024
REVISED ON NOVEMBER 5, 2024

FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE

RECORD OWNER:

181R SCHOOL STREET, LLC
5 ATKINSON FARM RD
ATKINSON, NH 03811
DEED BOOK 35976 PAGE 77
ASSESSORS MAP 34 LOT 13

GENERAL NOTES:

1. THIS PLAN IS PREPARED FOR OUR CLIENTS USE ONLY FOR THE SPECIFIC PURPOSE OF DEPICTING EXISTING CONDITIONS OBTAINED BY AN ON-THE-GROUND FIELD SURVEY BY THE MORIN-CAMERON GROUP IN MARCH 2019.
2. ABUTTER INFORMATION SHOW HEREON WAS TAKEN FROM THE GROVELAND GIS DATABASE.

FLOOD NOTE:

THE SUBJECT PROPERTY IS LOCATED ENTIRELY WITHIN A ZONE X: AREA OF MINIMAL FLOOD HAZARD ABOVE THE 500-YEAR FLOOD LEVEL AS ILLUSTRATED ON THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL NO. 25009C0232F, WHICH HAS AN EFFECTIVE DATE OF JULY 3, 2012.

DATUM:

ELEVATIONS HEREON REFER TO NAVD88 VERTICAL DATUM AND MassSPC NAD 1983 HORIZONTAL DATUM.

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE ONLY AND ARE BASED ON LOCATIONS OF OBSERVABLE FIELD EVIDENCE AND RECORDS OBTAINED FROM VARIOUS GROVELAND MUNICIPAL DEPARTMENTS. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD. BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION, REPAVING OR OTHER CONSTRUCTION, ALL UTILITY COMPANIES MUST BE NOTIFIED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370, ACTS OF 1963, MASSACHUSETTS. CALL "DIG SAFE" AT 1-888-344-7233. THE MORIN-CAMERON GROUP, INC. ASSUMES NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE FUTURE CONNECTIONS, THE APPROPRIATE UTILITY ENGINEERING DEPARTMENTS MUST BE CONSULTED.

ZONING NOTE:

THE LOT LIES WITHIN THE RESIDENTIAL DISTRICT (R-2) & AQUIFER PROTECTION DISTRICT (ZONE III).

RESIDENCE DISTRICT R-2 ZONING DISTRICT

SETBACK	REQUIRED	EXISTING
MIN. AREA	30,000 S.F. (1)	245,945± S.F.
MIN. FRONTAGE	150 FT. (1)	180.26± FT
FRONT	30 FT. (3)	N/A
SIDE	15 FT. (2)	N/A
REAR	15 FT.	N/A
MAX. BUILDING HEIGHT	35 FT.	N/A
MAX. % LOT COVERAGE	25%	0%
MAX. % IMPERVIOUS AREA	50%	0%
% OF MIN. REQUIRED LOT AREA AS CONTIGUOUS BUILDABLE AREA	60% (4)	100%

(1) TWO-FAMILY OR DUPLEX STRUCTURES REQUIRE A MIN. OF TWO HUNDRED (200) FEET OF FRONTAGE AND 40,000 SF AREA IN THE R-2 DISTRICT.

(2) ON A LOT WITH LESS THAN ON HUNDRED FIFTY (150) FEET OF FRONTAGE AND IN EXISTENCE AT THE TIME THIS BY-LAW IS PASSED, NO BUILDING SHALL BE ERECTED WITHIN TEN (10) FEET OF A SIDE LOT LINE.

(3) IN ANY RESIDENTIAL DISTRICT NO BUILDING OR ROADSIDE STAND SHALL BE ERECTED OR PLACED WITHIN THIRTY (30) FEET OF A STREET LINE UNLESS IT IS DETERMINED THAT THE LINE OF HOUSES EXISTING AT THE TIME THIS BY-LAW IS ADOPTED IS LESS THAN THIRTY (30) FEET FROM THE STREET LINE, AND NO BUILDING OR ACCESSORY USE OR FARM OR POULTRY FARM BUILDING OTHER THAN A DWELLING, OR ROADSIDE STAND, OR PRIVATE GARAGE, SHALL BE BUILT WITHIN SIXTY (60) FEET OF A STREET LINE.

(4) FIFTY (50) PERCENT IF PARCEL IS SERVICED BY TOWN WATER AND SEWER.

CONTIGUOUS BUILDABLE AREA:

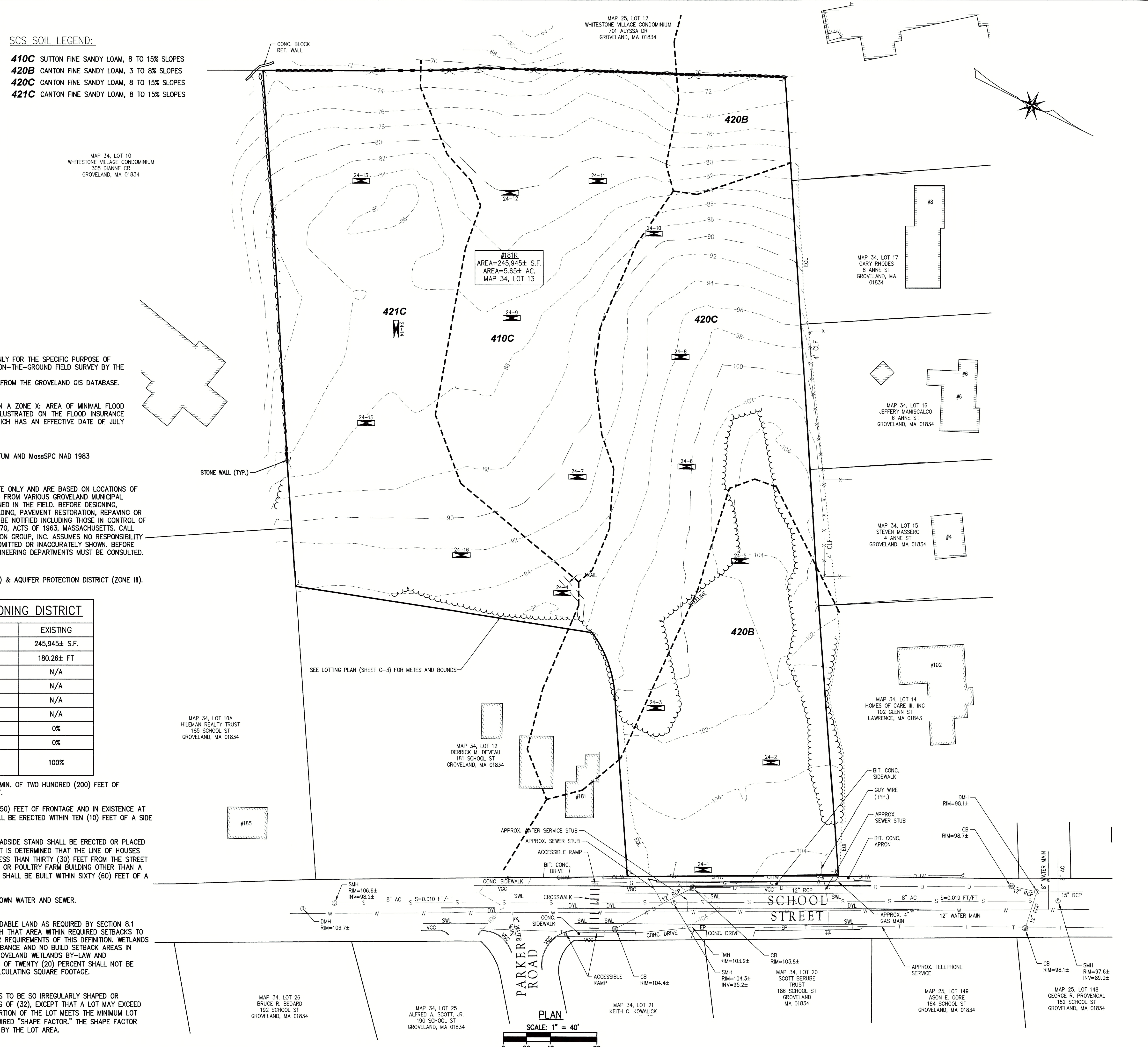
THAT AREA OF A LOT THAT IS CONTIGUOUS AND BUILDABLE LAND AS REQUIRED BY SECTION 8.1 TABLE OF DIMENSIONAL REQUIREMENTS, TOGETHER WITH THAT AREA WITHIN REQUIRED SETBACKS TO THE EXTENT SUCH AREA COMPLIES WITH THE FURTHER REQUIREMENTS OF THIS DEFINITION. WETLANDS DESCRIBED BY G.L. C. 131, INCLUDING ANY NO DISTURBANCE AND NO BUILD SETBACK AREAS IN ACCORDANCE WITH G.L. C. 131, AND THE TOWN OF GROVELAND WETLANDS BY-LAW AND ACCOMPANYING REGULATIONS, AND SLOPES IN EXCESS OF TWENTY (20) PERCENT SHALL NOT BE CONSIDERED AS BUILDABLE FOR THE PURPOSE OF CALCULATING SQUARE FOOTAGE.

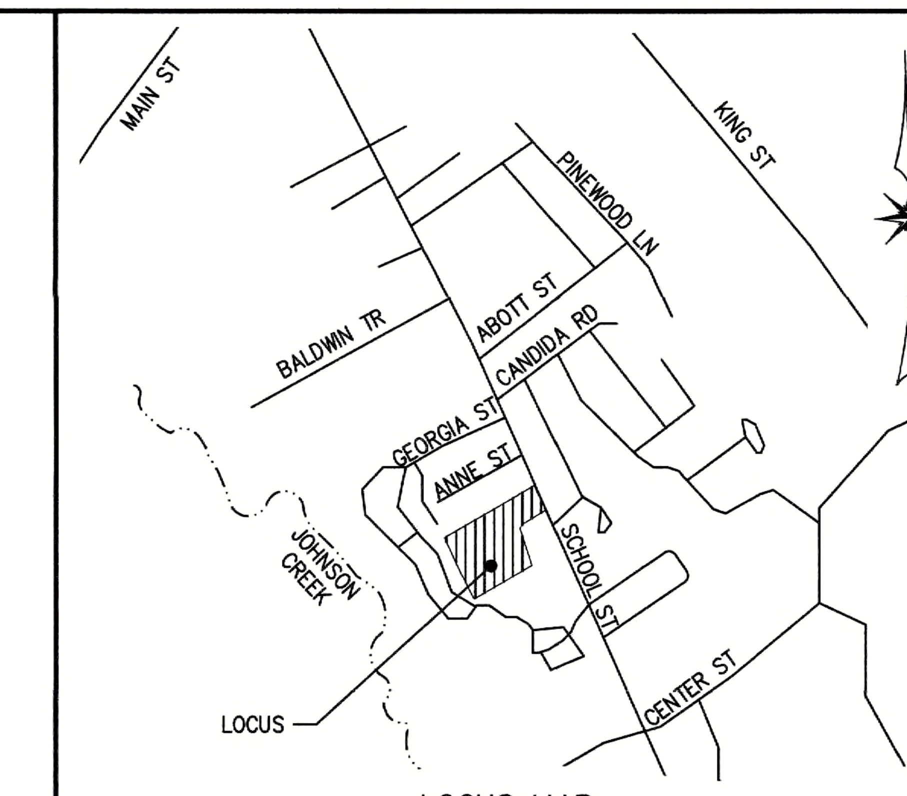
LOT REGULARITY:

SECTION 50-8.2.A: NO LOT SHALL BE CREATED SO AS TO BE SO IRREGULARLY SHAPED OR EXTENDED THAT IT HAS A "SHAPE FACTOR" IN EXCESS OF (32), EXCEPT THAT A LOT MAY EXCEED THE REQUIRED "SHAPE FACTOR" IF A CONTIGUOUS PORTION OF THE LOT MEETS THE MINIMUM LOT AREA REQUIREMENT AND DOES NOT EXCEED THE REQUIRED "SHAPE FACTOR." THE SHAPE FACTOR EQUALS THE SQUARE OF THE LOT PERIMETER DIVIDED BY THE LOT AREA.

SHAPE FACTOR = $(\text{LOT PERIMETER})^2/\text{LOT AREA}$

DRAWING: 3634 MAIN.dwg





LOCUS MAP
SCALE: 1" = 1000'

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CLERK DATE

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APPROVED BY:

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COMMONWEALTH OF MASSACHUSETTS SCOTT P. CAMERON CIVIL No. 47801 REGISTERED PROFESSIONAL ENGINEER
11/5/24

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FOR A
STREET TO BE NAMED
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JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

EXISTING CONDITIONS

DRAWING NO. C-2

FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

MICHAEL J. SERGI, PLS No.33191 DATE

ASSESSOR REFERENCE:

MAP 34 LOT 13

NOTES:

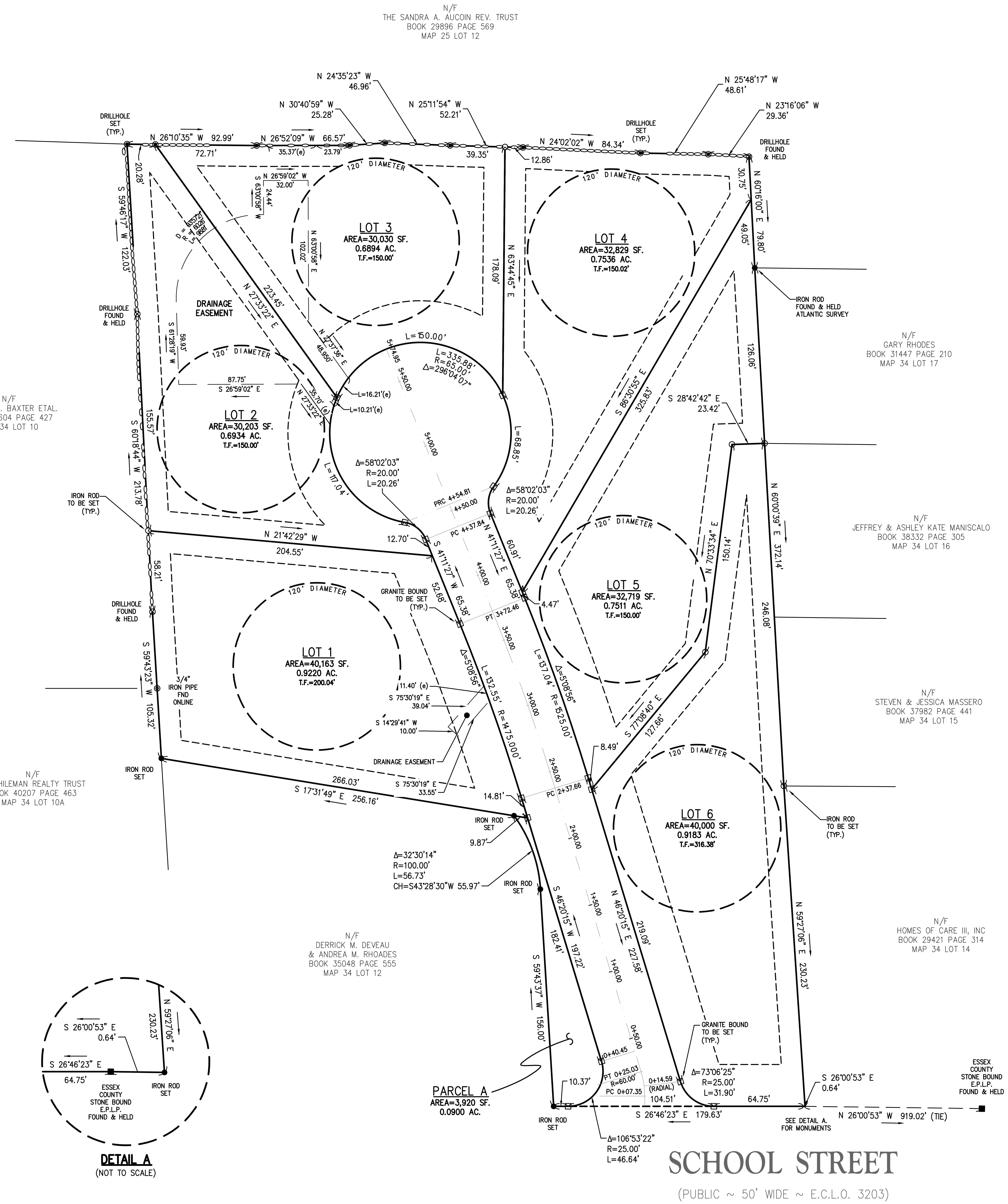
1. ORIENTATION IS TO NAD83 MASSACHUSETTS STATE PLANE COORDINATES.

KEY REFERENCE DEED:

1. DEED FROM FRANK J. FRANZONE TO 181R SCHOOL STREET, LLC. DATED JUNE 23 2017 AND RECORDED AT THE SOUTH ESSEX REGISTRY OF DEEDS BOOK 35976 PAGE 77.

KEY REFERENCE PLANS:

1. A PLAN OF A PORTION OF SCHOOL, GARDNER AND ELM PARK STREETS FROM SALEM STREET TO MAIN STREET IN THE TOWN OF GROVELAND AS RELOCATED. DRAWN BY F. RICHARD GELOTTI, SENIOR ASSISTANT COUNTY ENGINEER. DATED DEC. 18, 1984, E.C.L.O. No. 3203 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS.
2. PLAN OF LAND AT 171 SCHOOL STREET IN GROVELAND, MASSACHUSETTS BY ATLANTIC ENGINEERING & SURVEY CONSULTANTS INC. DATED MARCH 2, 2010 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS PLAN BOOK 423 PLAN 27.
3. PLAN OF LAND IN GROVELAND, MASS. OCCUPIED BY CHARLES A. & NORMA J. MCGLEW BY PHILLIP A. BEVELAQUA. RLS DATED OCT. 25, 1965 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS PLAN 667 OF 1965.
4. PLAN OF LAND FOR WHITESTONE VILLAGE II AT SCHOOL STREET IN GROVELAND, MASSACHUSETTS BY ATLANTIC ENGINEERING & SURVEY CONSULTANTS INC. DATED OCT. 21, 2004 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS PLAN BOOK 381 PLAN 79.
5. PLAN OF LAND IN GROVELAND, MASS. AS SURVEYED FOR RAY B. DREW. BY ROBERT G. GOODWIN, RLS. DATED MAY 2, 1983 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS PLAN BOOK 178 PLAN 67.
6. PLAN OF LAND IN GROVELAND, MASS. AS SURVEYED FOR DAVID DALE CORP. BY CHARLES H. MORSE & SON, ENGINEERS. DATED JULY 1968 AND RECORDED IN THE SOUTH ESSEX REGISTRY OF DEEDS PLAN 301 OF 1968.



DETAIL A
(NOT TO SCALE)

SCALE: 1" = 40'

0 20 40 80 160

LOT REGULARITY CALCULATIONS

LOT#	PERIMETER (L.F.)	AREA (S.F.)	P²/A	STATUS
1	834	40,163	17	PASS
2	876	30,203	25	PASS
3	802	30,030	21	PASS
4	860	32,829	22	PASS
5	952	32,719	28	PASS
6	1,094	40,000	30	PASS

*PARCEL A IS NOT A BUILDABLE LOT

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON _______________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U

DATE: ____________

APPROVED BY:

APPROVED ___________, _________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED ___________, _________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, _________ _____. A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE ___________, _________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED ___________, _________ ___________, ___________ GROVELAND PLANNING BOARD.

SURVEY STAMP INTENTIONALLY OMITTED FROM THIS PLAN UNTIL THE DRAINAGE EASEMENT ARE FINALIZED.

MICHAEL J. SERGI, PLS

DEFINITIVE SUBDIVISION

FOR A

STREET TO BE NAMED

IN

GROVELAND, MASSACHUSETTS

AT

181R SCHOOL STREET

(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:

GROVELAND REDEVELOPMENT, LLC

231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:

181R SCHOOL STREET, LLC

5 ATKINSON FARM ROAD
ATKINSON, NH 03811

JULY, 2024

The Morin-Cameron GROUP, INC.

CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
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REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/05/2024

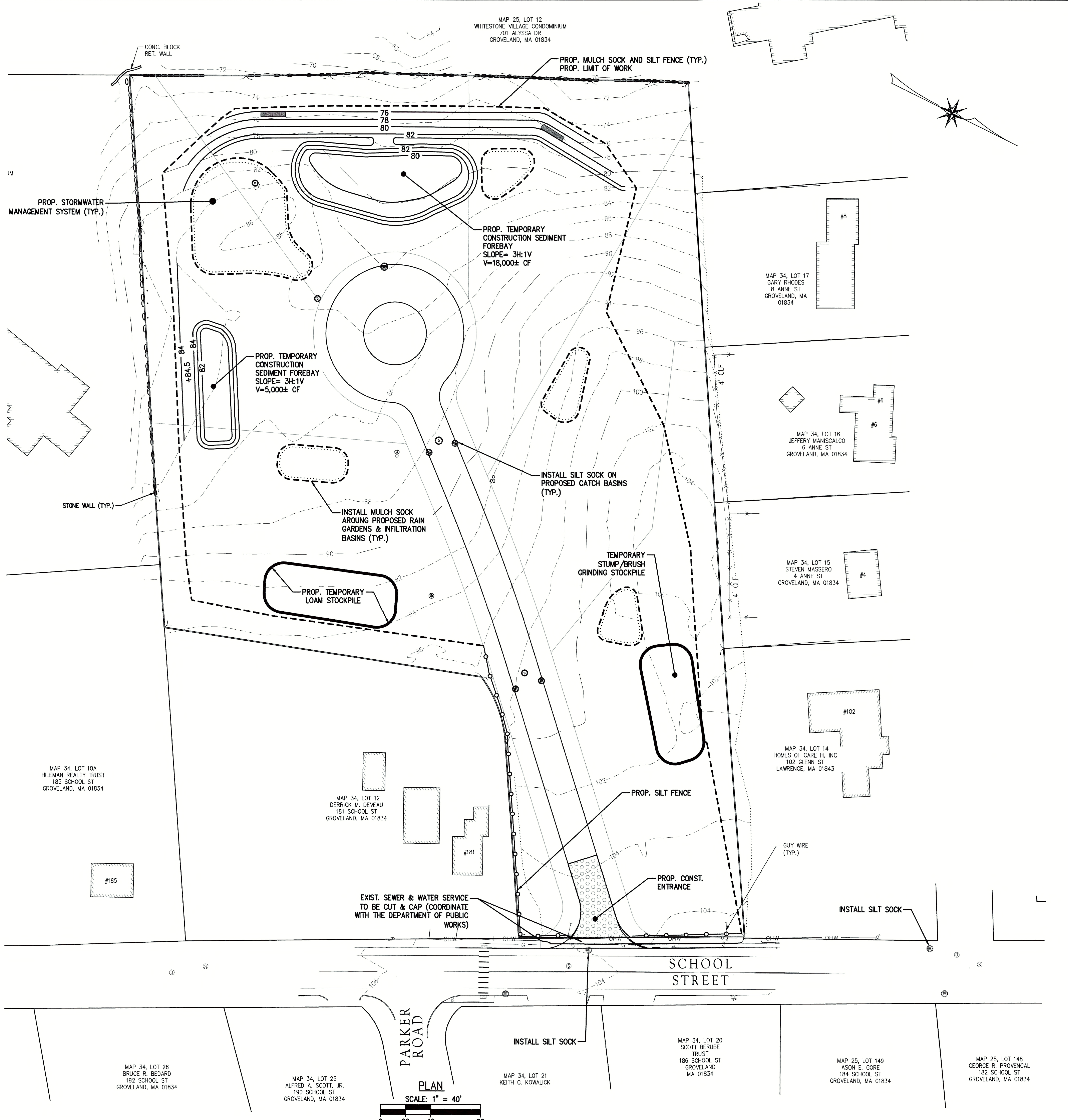
LOTTING PLAN

DRAWING NO. C-3

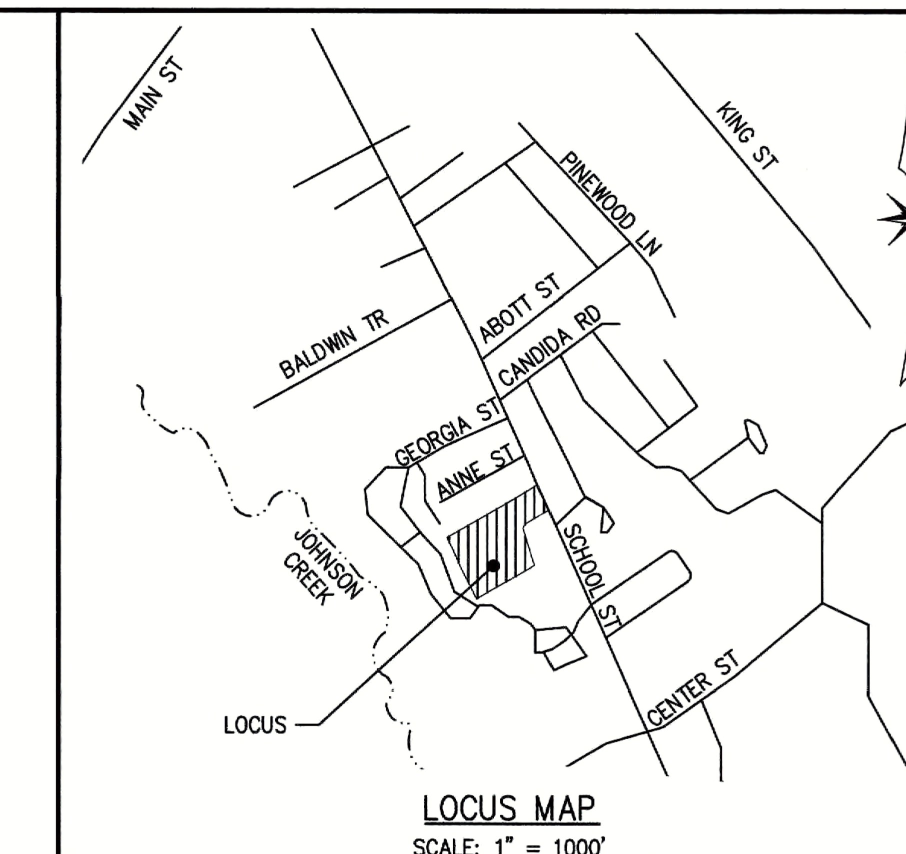
FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE



PLAN
SCALE: 1" = 40'



LOCUS MAP
SCALE: 1" = 1000'

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ____________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U
DATE: ____________
APPROVED BY:

APPROVED ________, ________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED ________, ________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, ________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE ________, ________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED ________, ________ ________ GROVELAND PLANNING BOARD.

COMMONWEALTH OF MASSACHUSETTS
SCOTT P. CAMERON
CIVIL
No. 47001
REGISTERED PROFESSIONAL ENGINEER
11/5/24

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)
PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845
OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811
JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
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REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

EROSION CONTROL & DEMO

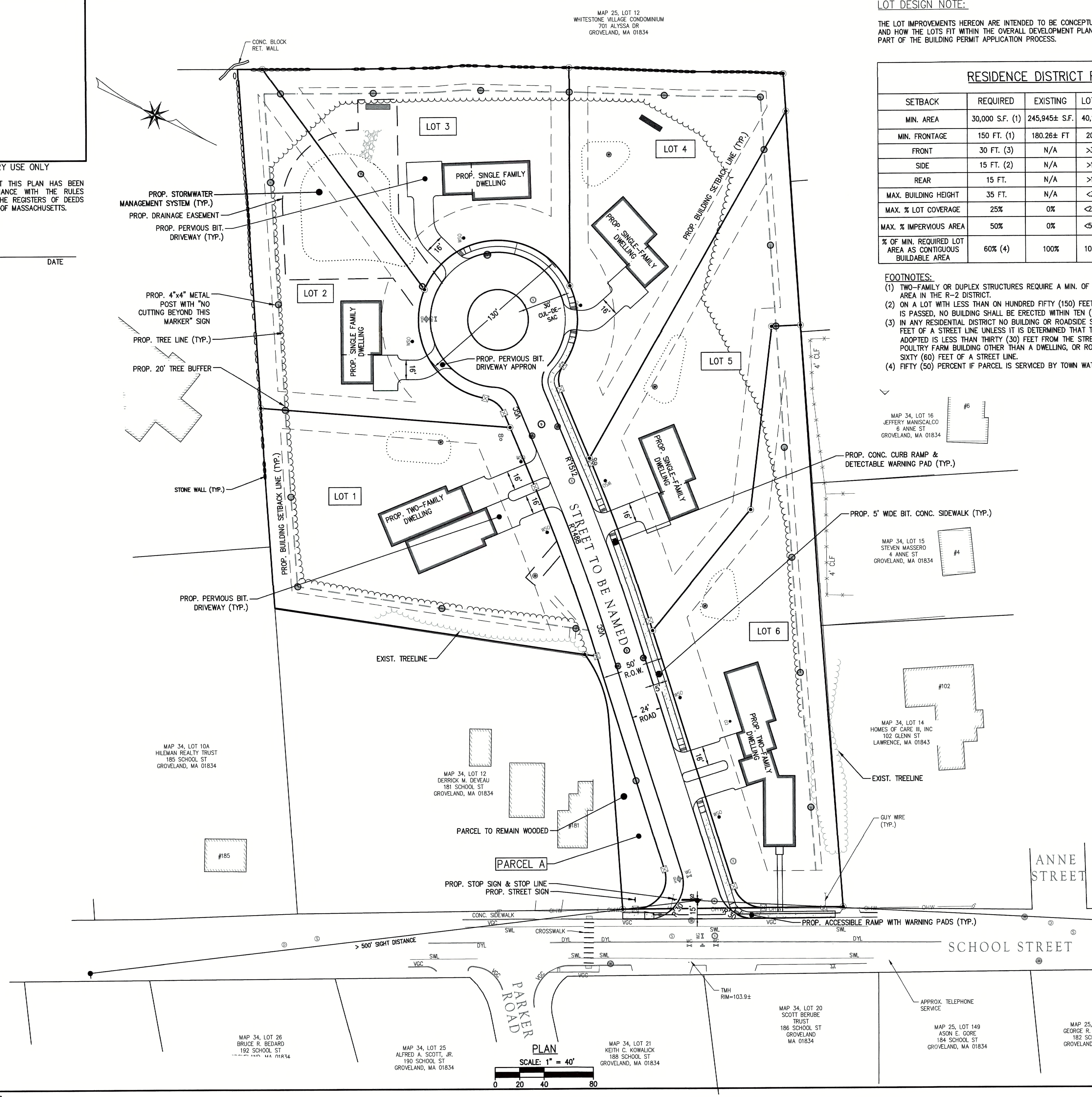
DRAWING NO. C-4

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE



LOT DESIGN NOTE:

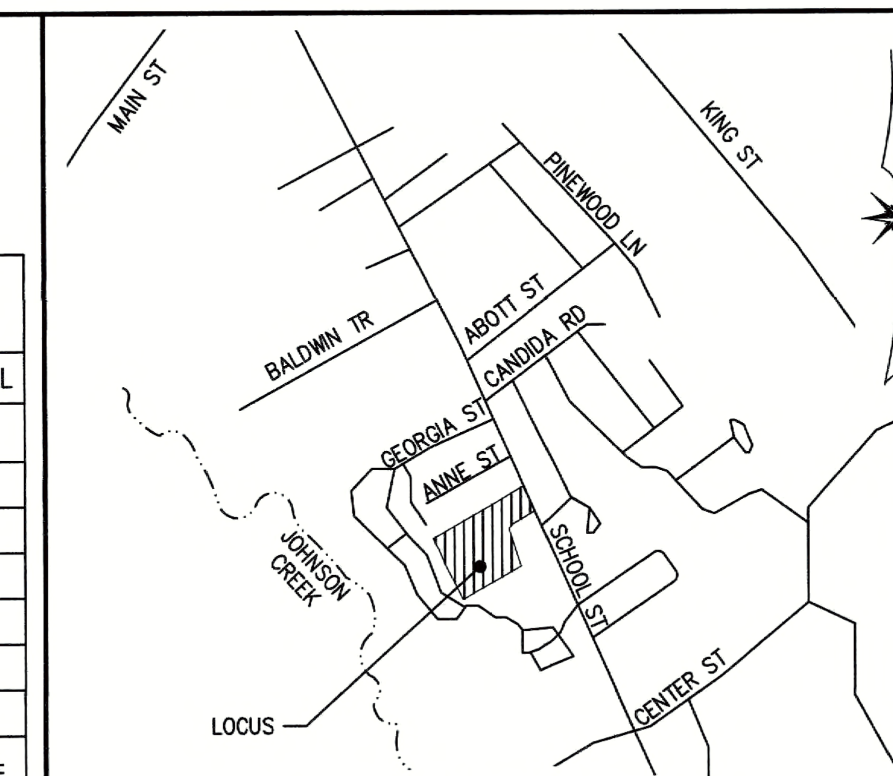
THE LOT IMPROVEMENTS HEREON ARE INTENDED TO BE CONCEPTUAL FOR THE PURPOSE OF DEMONSTRATING CONSTRUCTABILITY AND HOW THE LOTS FIT WITHIN THE OVERALL DEVELOPMENT PLAN. FINAL LOT DESIGN SHALL BE COMPLETED BY OTHERS AS PART OF THE BUILDING PERMIT APPLICATION PROCESS.

RESIDENCE DISTRICT R-2 ZONING DISTRICT

SETBACK	REQUIRED	EXISTING	LOT 1	LOT 2	LOT 3	LOT 4	LOT 5	LOT 6	OVERALL
MIN. AREA	30,000 S.F. (1)	245,945± S.F.	40,163	30,203	30,030	32,829	32,719	40,000	–
MIN. FRONTAGE	150 FT. (1)	180.26± FT	200	150	150	150	150	251	–
FRONT	30 FT. (3)	N/A	>30	>30	>30	>30	>30	>30	–
SIDE	15 FT. (2)	N/A	>15	>15	>15	>15	>15	>15	–
REAR	15 FT.	N/A	>15	>15	>15	>15	>15	>15	–
MAX. BUILDING HEIGHT	35 FT.	N/A	<35	<35	<35	<35	<35	<35	–
MAX. % LOT COVERAGE	25%	0%	<25%	<25%	<25%	<25%	<25%	<25%	21%±
MAX. % IMPERVIOUS AREA	50%	0%	<50%	<50%	<50%	<50%	<50%	<50%	14.98%±
% OF MIN. REQUIRED LOT AREA AS CONTIGUOUS BUILDABLE AREA	60% (4)	100%	100%	100%	100%	100%	100%	100%	–

FOOTNOTES:

(1) TWO-FAMILY OR DUPLEX STRUCTURES REQUIRE A MIN. OF TWO HUNDRED (200) FEET OF FRONTAGE AND 40,000 SF AREA IN THE R-2 DISTRICT.
(2) ON A LOT WITH LESS THAN ON HUNDRED FIFTY (150) FEET OF FRONTAGE AND IN EXISTENCE AT THE TIME THIS BY-LAW IS PASSED, NO BUILDING SHALL BE ERECTED WITHIN TEN (10) FEET OF A SIDE LOT LINE.
(3) IN ANY RESIDENTIAL DISTRICT NO BUILDING OR ROADSIDE STAND SHALL BE ERECTED OR PLACED WITHIN THIRTY (30) FEET OF A STREET LINE UNLESS IT IS DETERMINED THAT THE LINE OF HOUSES EXISTING AT THE TIME THIS BY-LAW IS ADOPTED IS LESS THAN THIRTY (30) FEET FROM THE STREET LINE, AND NO BUILDING OR ACCESSORY USE OR FARM OR POULTRY FARM BUILDING OTHER THAN A DWELLING, OR ROADSIDE STAND, OR PRIVATE GARAGE, SHALL BE BUILT WITHIN SIXTY (60) FEET OF A STREET LINE.
(4) FIFTY (50) PERCENT IF PARCEL IS SERVICED BY TOWN WATER AND SEWER.



LOCUS MAP

SCALE: 1" = 1000'

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

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CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U

DATE: ______________

APPROVED BY:

APPROVED __________, __________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, __________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, __________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________. SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________, __________. __________, __________ GROVELAND PLANNING BOARD.

COMMONWEALTH OF MASSACHUSETTS SCOTT P. CAMERON CIVIL No. 47601 REGISTERED PROFESSIONAL ENGINEER

11/5/24

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:

GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:

181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811

JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS I ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS I LAND USE PLANNERS
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REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

SITE LAYOUT

DRAWING NO. C-5

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

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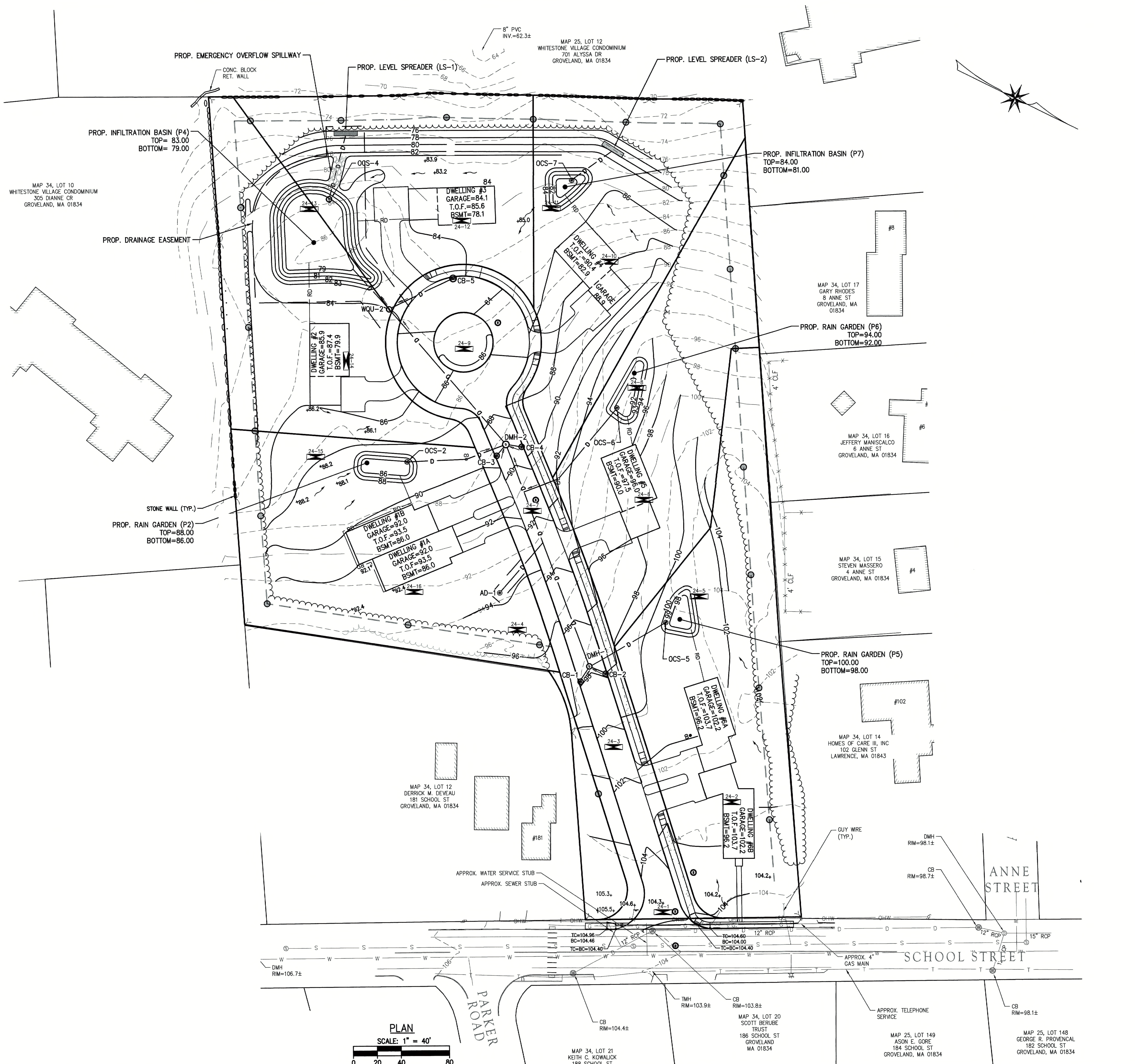
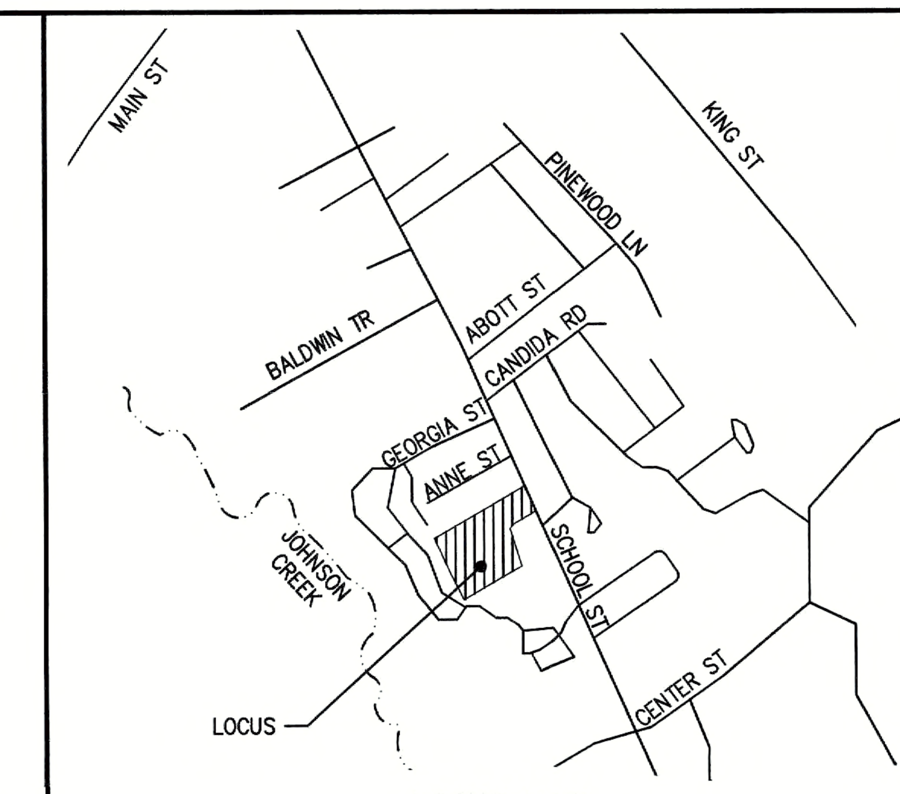
DATE





LOCUS MAP

SCALE: 1" = 1000'

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

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CLERK DATE

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DATE: ______________

APPROVED BY:

____

APPROVED __________, ________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, ________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, ________ ____, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________ __________, __________ GROVELAND PLANNING BOARD.

COMMONWEALTH OF MASSACHUSETTS SCOTT P. CAMERON CIVIL No. 47001 REGISTERED PROFESSIONAL ENGINEER

11/5/24

DEFINITIVE SUBDIVISION

FOR A

STREET TO BE NAMED

IN

GROVELAND, MASSACHUSETTS

AT

181R SCHOOL STREET

(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:

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231 SUTTON STREET, SUITE 1B

NORTH ANDOVER, MA 01845

OWNER:

181R SCHOOL STREET, LLC

5 ATKINSON FARM ROAD

ATKINSON, NH 03811

JULY 31, 2024

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REVISIONS		
NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

GRADING & DRAINAGE

DRAWING NO. C-6

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

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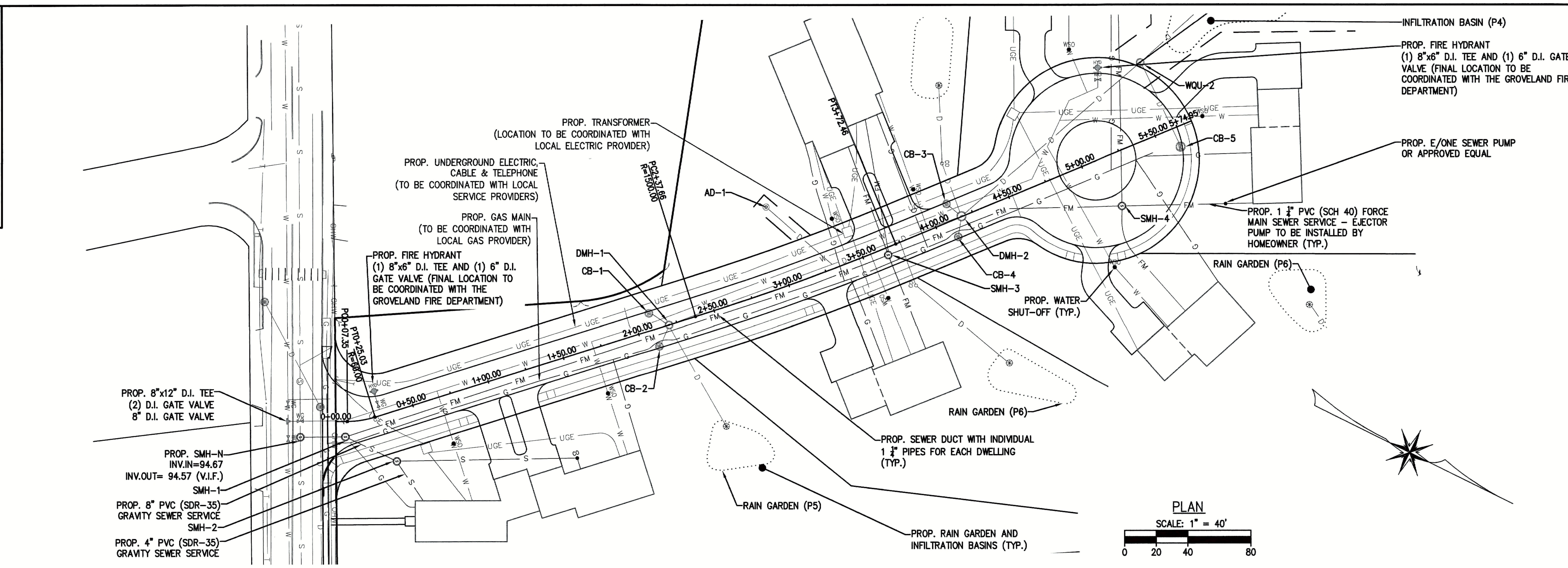
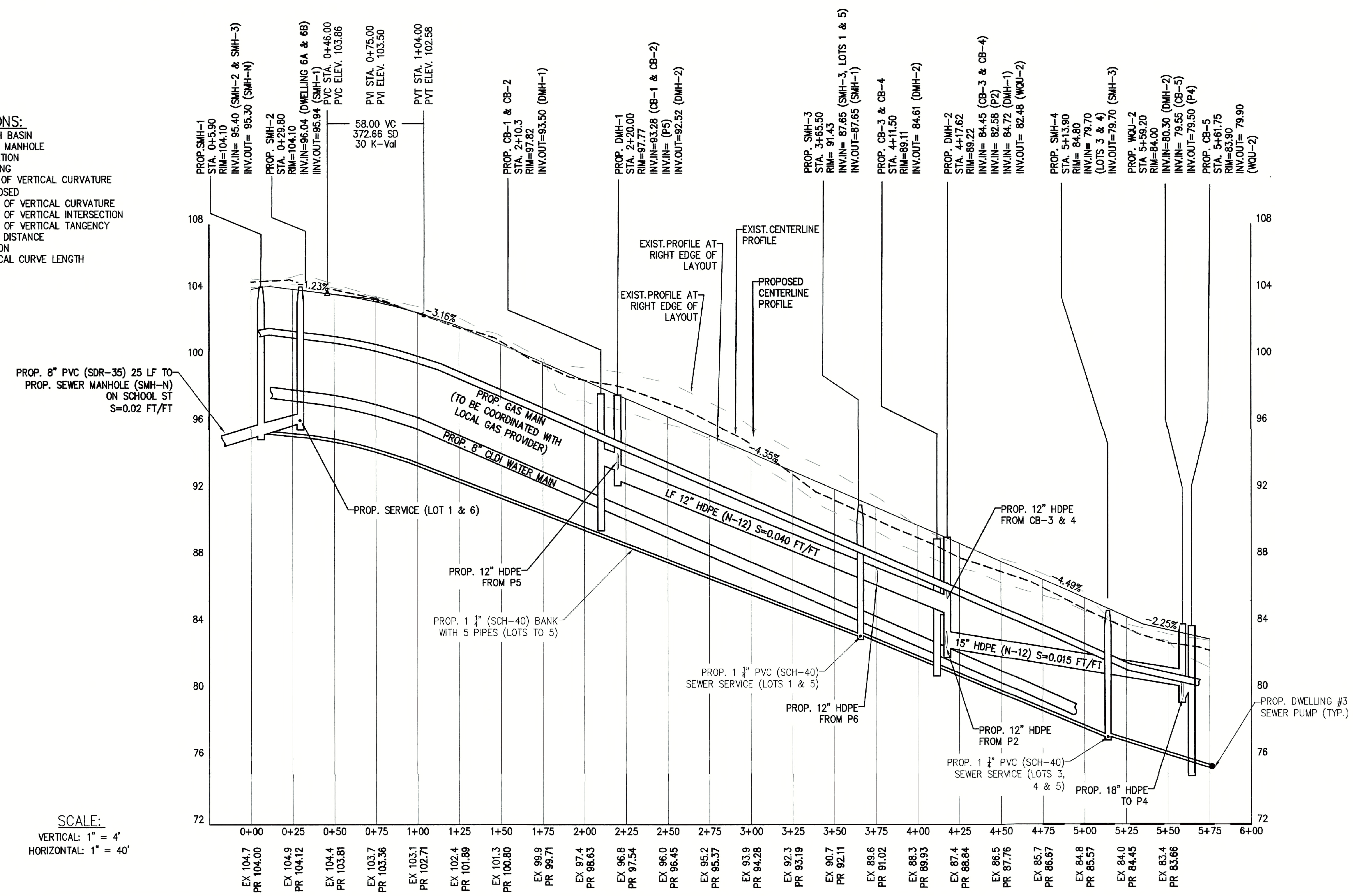
DATE

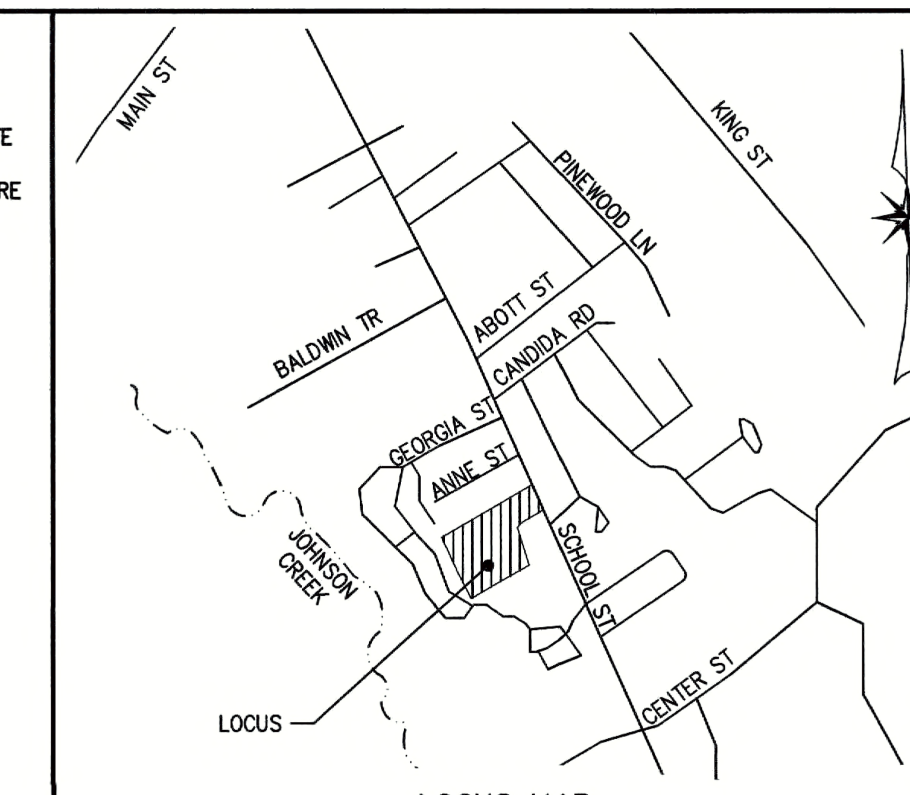


ABBREVIATIONS:

CB	CATCH BASIN
DMH	DRAIN MANHOLE
ELEV	ELEVATION
EX	EXISTING
K	RATE OF VERTICAL CURVATURE
PR/PROP.	PROPOSED
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
SD	SIGHT DISTANCE
STA.	STATION
VC	VERTICAL CURVE LENGTH



SCALE:
VERTICAL: 1" = 4'
HORIZONTAL: 1" = 40'



LOCUS MAP
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TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

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CLERK DATE

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COMMONWEALTH OF MASSACHUSETTS SCOTT P. CAMERON CIVIL No. 47601 REGISTERED PROFESSIONAL ENGINEER

11/5/24

DEFINITIVE SUBDIVISION

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REVISIONS

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UTILITIES & ROAD PROFILE

DRAWING NO. C-7

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

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DATE

PUMP CALCULATIONS:

– DWELLING 2:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 77.48 = 17.93
- @ SMH-1 – PUMP OFF = 95.40 – 77.15 = 18.26

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (6x0.8) = 29.6'

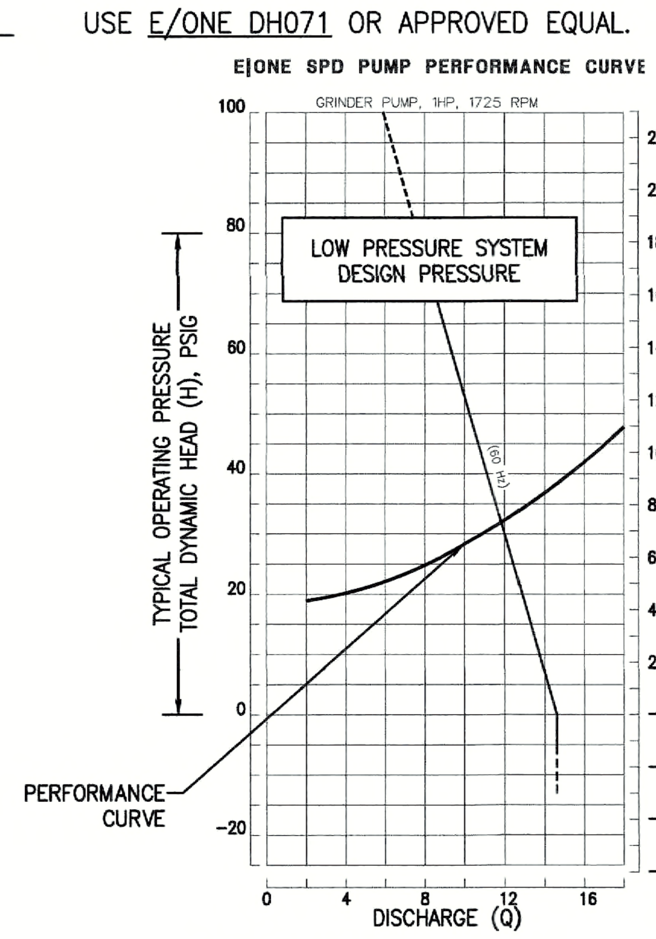
TOTAL LENGTH = 619' + 29.6' = 648.6'

HEAD LOSS IN PIPE @ 12 GPM = 2.24 FT/100 FT

HD = 648.6' X (2.24 FT / 100 FT) = 14.53'

PUMP PARAMETERS:
T.D.H. = 32.45' – 32.78' @ 12 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



– DWELLING 4:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 79.88 = 15.53
- @ SMH-1 – PUMP OFF = 95.40 – 79.55 = 15.86

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (6x0.8) = 29.6'

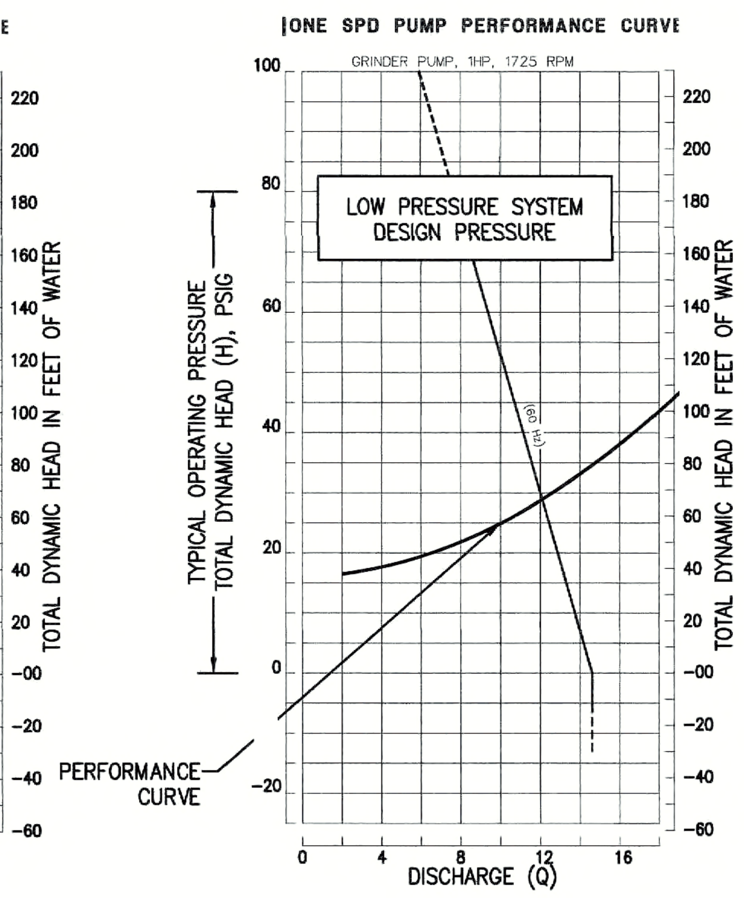
TOTAL LENGTH = 589' + 29.6' = 618.6'

HEAD LOSS IN PIPE @ 12 GPM = 2.24 FT/100 FT

HD = 618.6' X (2.24 FT / 100 FT) = 13.86'

PUMP PARAMETERS:
T.D.H. = 29.38' – 29.71' @ 12 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



– DWELLING 5:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 87.38 = 8.03
- @ SMH-1 – PUMP OFF = 95.40 – 87.05 = 8.36

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (3x0.8) = 27.20'

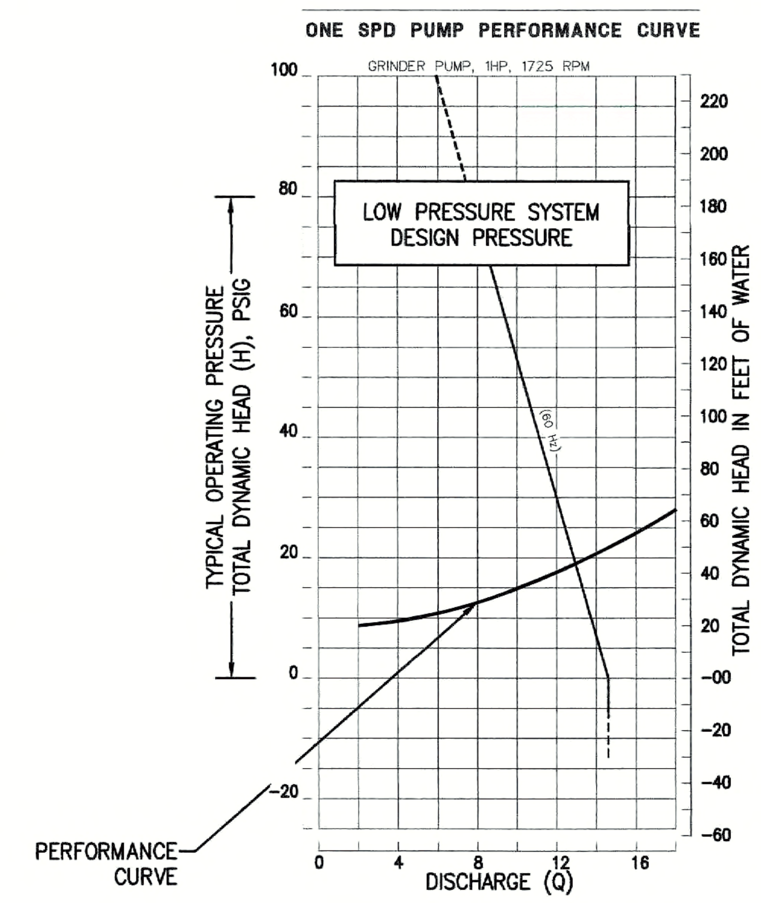
TOTAL LENGTH = 411' + 27.2' = 438.2'

HEAD LOSS IN PIPE @ 13 GPM = 2.59 FT/100 FT

HD = 438.2' X (2.59 FT / 100 FT) = 11.35'

PUMP PARAMETERS:
T.D.H. = 19.37' – 19.70' @ 13 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



– DWELLING 1A:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 81.14 = 13.26
- @ SMH-1 – PUMP OFF = 95.40 – 81.81 = 13.59

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EEQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (3x0.8) = 27.20'

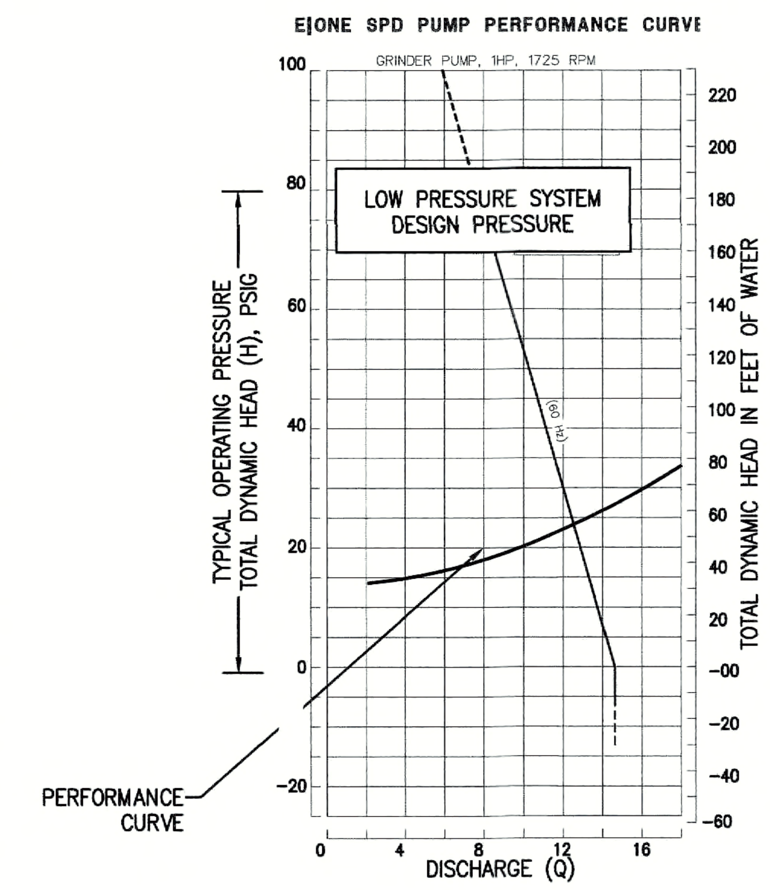
TOTAL LENGTH = 419' + 27.20' = 446.2'

HEAD LOSS IN PIPE @ 12 GPM = 2.24 FT/100 FT

HD = 443.8' X (2.24 FT / 100 FT) = 9.99'

PUMP PARAMETERS:
T.D.H. = 23.25' – 23.58' @ 12 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



– DWELLING 1B:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 82.14 = 13.26
- @ SMH-1 – PUMP OFF = 95.40 – 81.81 = 13.59

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (3x0.8) = 27.20'

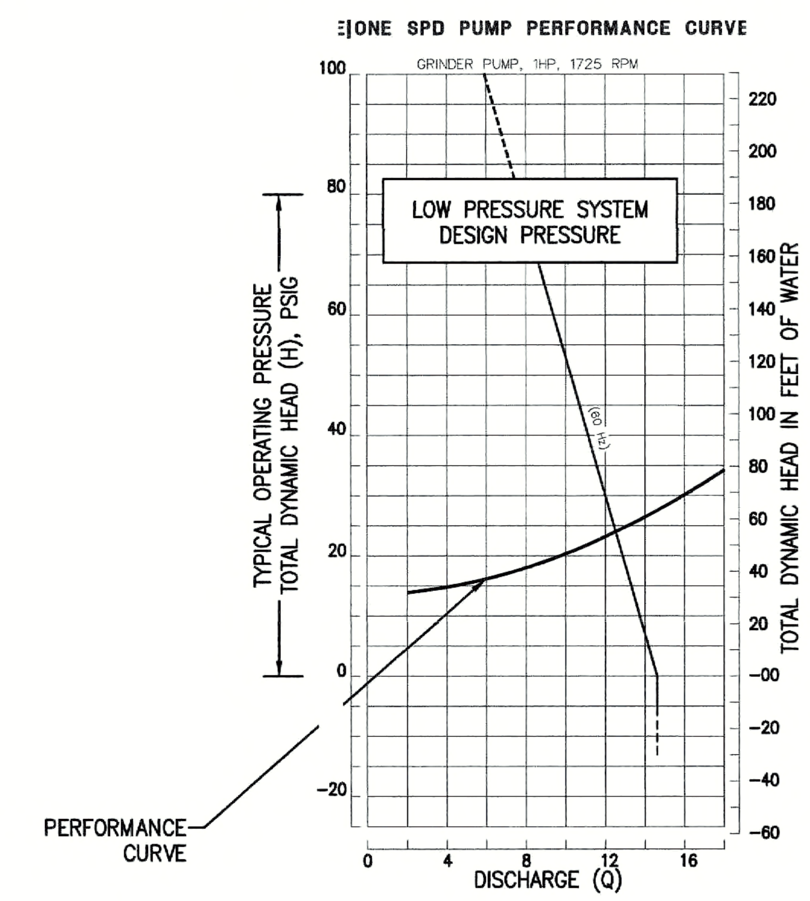
TOTAL LENGTH = 434' + 27.2' = 461.2'

HEAD LOSS IN PIPE @ 12 GPM = 2.24 FT/100 FT

HD = 461.2' X (2.24 FT / 100 FT) = 11.95'

PUMP PARAMETERS:
T.D.H. = 25.20' – 25.53' @ 12 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



– DWELLING 3:

STATIC HEAD(HS):
- @ SMH-1 – PUMP ON = 95.40 – 74.66 = 20.75
- @ SMH-1 – PUMP OFF = 95.40 – 74.33 = 21.08

DYNAMIC HEAD (HD):
FORCE MAIN: 1 1/4" DIAMETER

EQUIVALENT LENGTH METHOD:
1-90° ELBOW + 1-BALL VALVE + 1-180° BEND + 1-CHECK VALVE + 6-GATE VALVE
6.7' + 0.8' + 8.3' + 9.0' + (6x0.8) = 29.6'

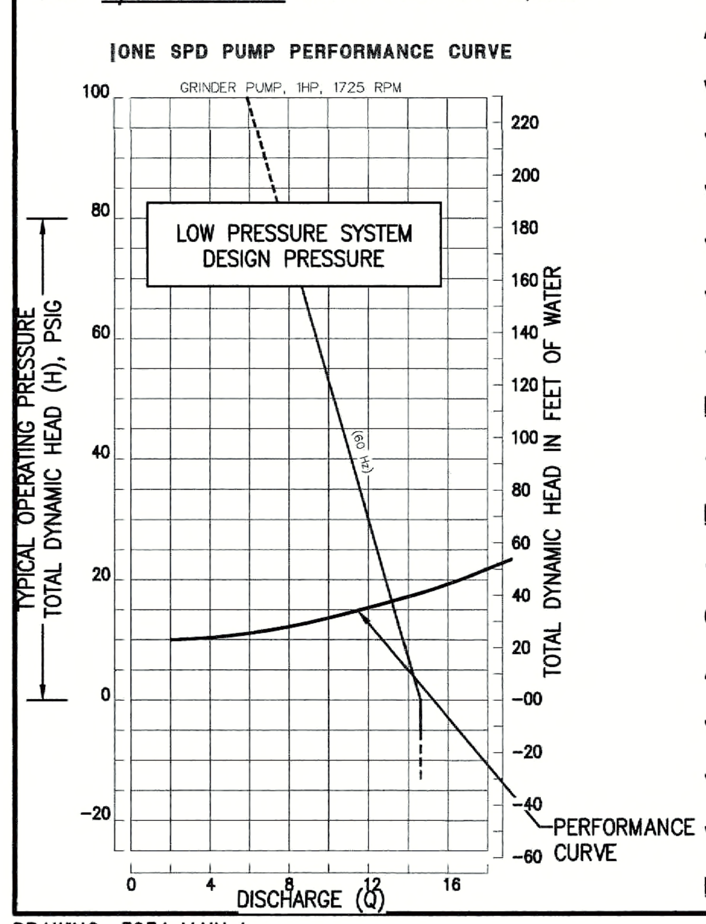
TOTAL LENGTH = 577' + 29.6' = 606.6'

HEAD LOSS IN PIPE @ 13 GPM = 2.59 FT/100 FT

HD = 606.6' X (2.59 FT / 100 FT) = 15.71'

PUMP PARAMETERS:
T.D.H. = 36.46' – 36.79' @ 13 GPM

USE E/ONE DH071 OR APPROVED EQUAL.



HYDRAULIC GRADIENT LINE (HGL):

CALCULATED FOR DWELLING 3 (LOWEST ELEVATION)

HGL = ENERGY ADDED BY THE PUMP (EP) + HEADLOSS IN PIPELINE + ELEVATION (PUMP-OFF)

- AT PUMP [CALCULATED FOR DWELLING 3 (LOWEST ELEVATION) CONSIDERING THE PIPE RUNNING FULL ON SMH-1):

HGL = (95.40' + 0.67') – 74.66' + 15.71' + 74.66'

HGL = 111.78

- AT SEWER MANHOLE 1:

HGL= TOP OF PIPE = 95.40 + 0.67 = 96.07

- AT SEWER MANHOLE N:

HGL= TOP OF PIPE = 94.67 + 0.67 = 95.34

ENERGY GRADIENT LINE (HGL):

EGL = VELOCITY HEAD + HGL

V= Q/A

Q= 13 GPM = 13 GPM X (1 CF/7.48 GALLONS) x (1 MIN/ 60 SEC) = 0.029 CFS

A= $\pi R^2 = \pi \times (0.625")^2$ = 1.227 SI x (1 SF/ 144 SI) = 0.0085 SF

V = 0.029 CFS / 0.0085 SF = 3.42 FT/S

VELOCITY HEAD:

$V_{HEAD} = V^2/2g$

V_{HEAD}= (3.42 FT/SEC)^2 / 2x(32.1740 FT/SEC^2)

V_{HEAD}= 0.18 FT

- EGL AT PUMP = 0.18' + 111.78'

EGL AT PUMP = 111.96'

- EGL AT SMH-1 = 0.18' + 96.07'

EGL AT SMH-1 = 96.25'

- EGL AT SMH N:

Q = SUM OF ALL SERVICES = 0.552 CFS

A = $\pi R^2 = \pi \times (4")^2$ = 50.26 SI x (1 SF/ 144 SI) = 0.35 SF

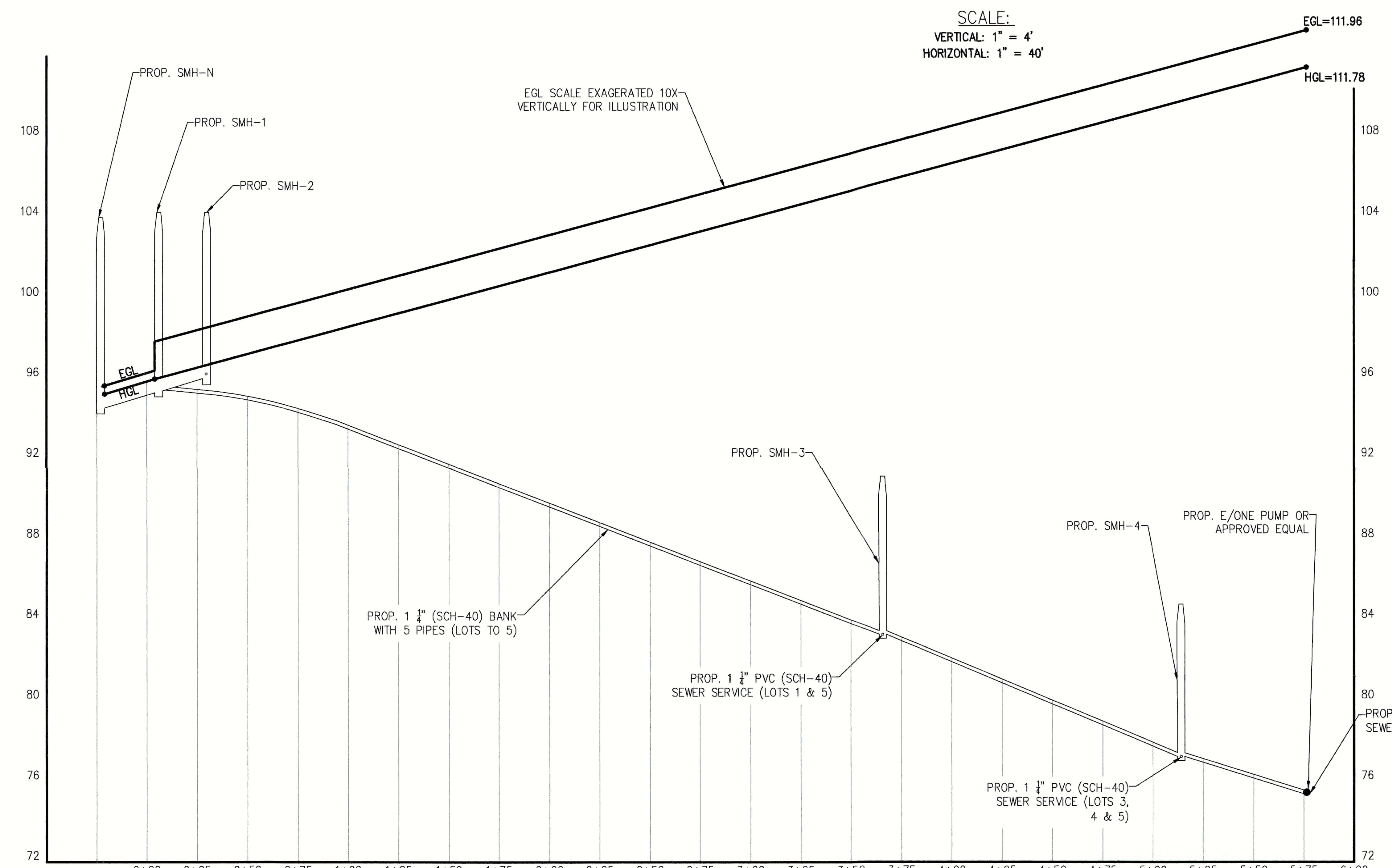
V = Q/A = 0.552 CFS / 0.352 SF= 1.58 FT/SEC

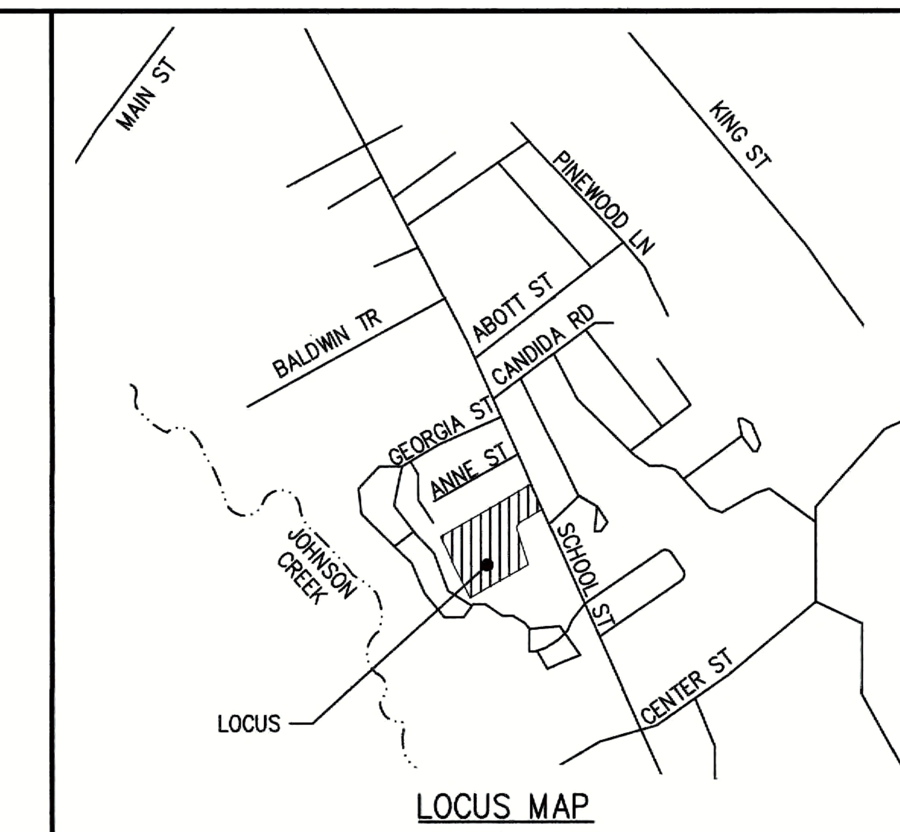
$V_{HEAD} = V^2/2g$ = (1.58 FT/SEC)^2 / 2x(32.1740 FT/SEC^2)

V_{HEAD}= 0.039 FT

EGL AT SMH-N= 95.34 + 0.039 = 95.38

SCALE:
VERTICAL: 1" = 4'
HORIZONTAL: 1" = 40'





LOCUS MAP
SCALE: 1" = 1000'

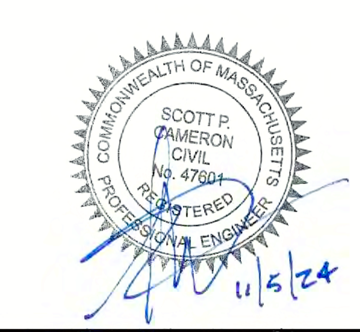
TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ______________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U
DATE: ______________
APPROVED BY:

APPROVED ______________, ______________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED ______________, ______________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, ______________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE ______________, ______________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED ______________, ______________ GROVELAND PLANNING BOARD.



DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811

JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

SEWER DETAILS

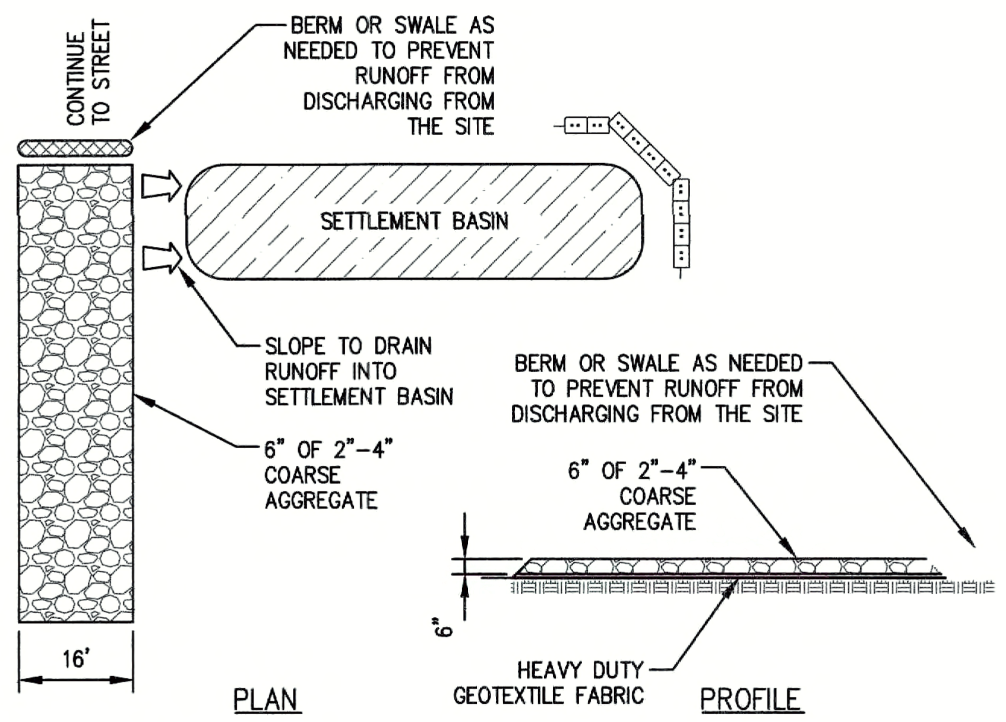
DRAWING NO. C-8

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE

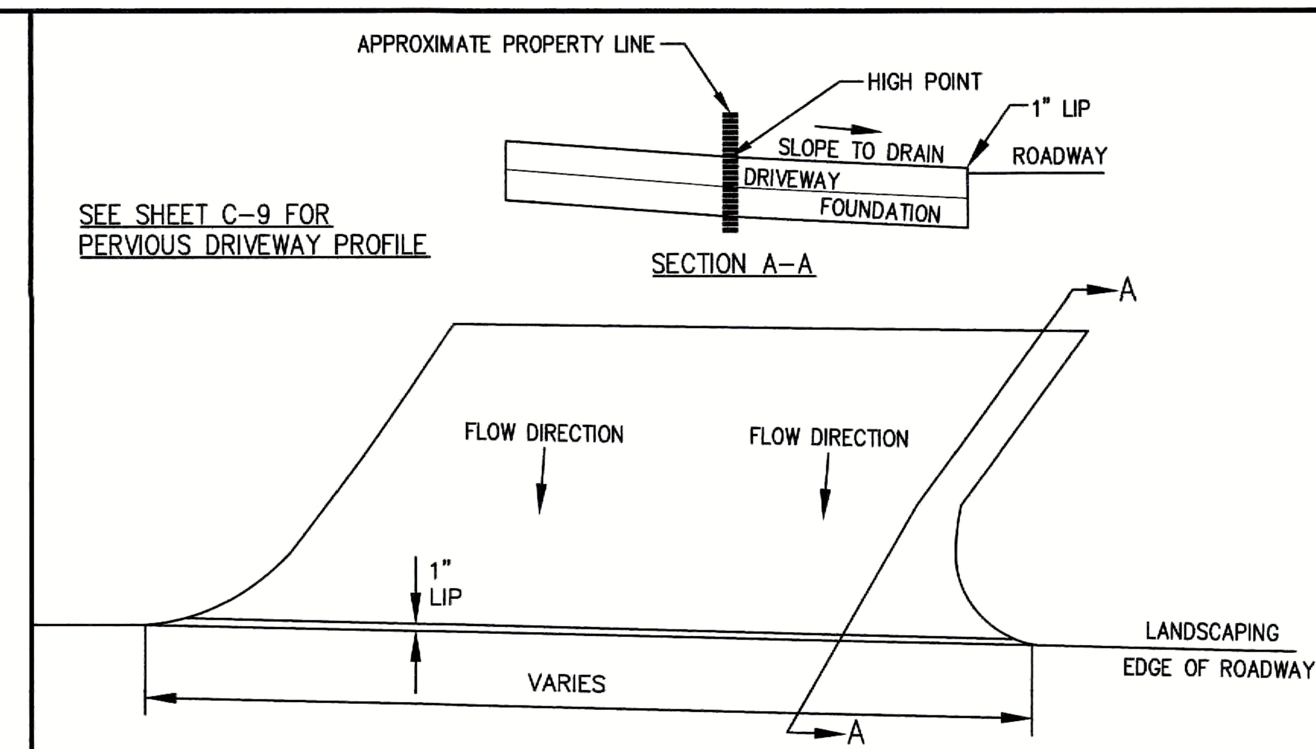


SITE CONSTRUCTION EXIT SPECIFICATIONS FOR BOSTON WAY:

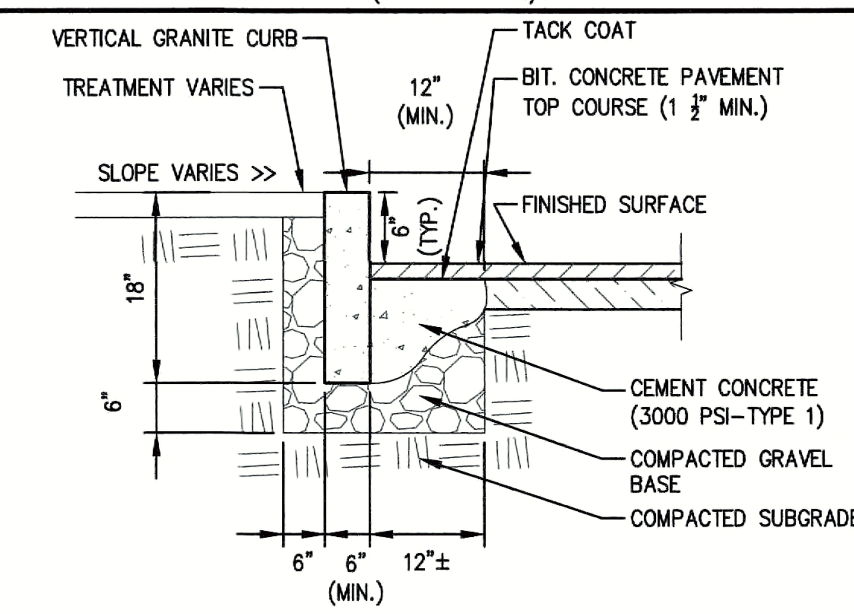
1. STONE FOR STABILIZATION CONSTRUCTION ENTRANCE SHALL BE 2"-4" STONE.
2. THE LENGTH OF THE STABILIZED ENTRANCE SHALL NOT BE LESS THAN 40 FEET.
3. THE WIDTH OF THE ENTRANCE SHALL BE NO LESS THAN THE WIDTH OF THE INGRESS OR EGRESS DRIVE, OR 16 FEET, WHICHEVER IS GREATER.
4. GEOTEXTILE FILTER FABRIC SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
5. ALL SURFACE WATER THAT IS FLOWING TO OR DIVERTED TOWARDS THE CONSTRUCTION ENTRANCE SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A BERM WITH MINIMUM 1 TO 5 SLOPES THAT CAN BE CROSSED BY VEHICLES CAN BE SUBSTITUTED.
6. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO RIGHTS OF WAY. THIS MAY REQUIRE PERIODIC TOPDRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. SEDIMENT SPILLED, WASHED OR TRACKED ONTO THE RIGHT OF WAY MUST BE REMOVED IMMEDIATELY.

STABILIZED CONSTRUCTION ENTRANCE DETAIL
(NOT TO SCALE)

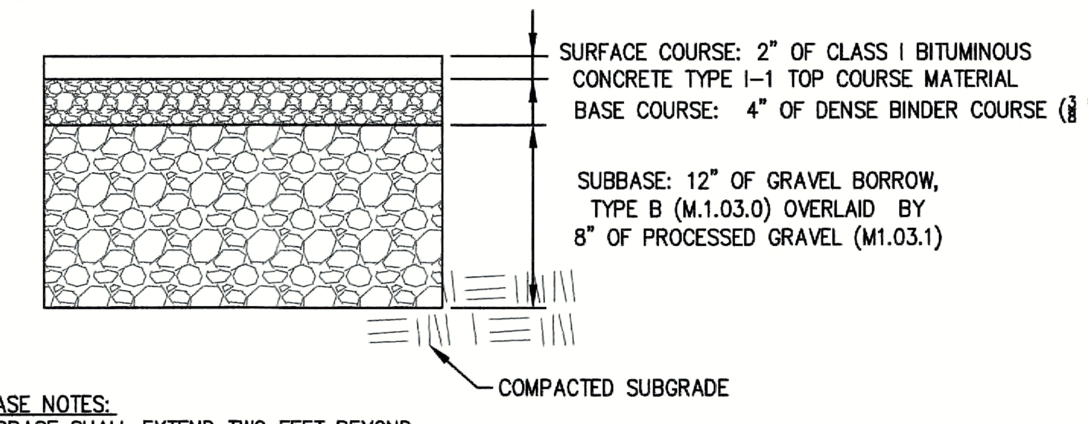
SEE SHEET C-9 FOR PERVIOUS DRIVEWAY PROFILE



PERVIOUS DRIVEWAY APRON
(NOT TO SCALE)



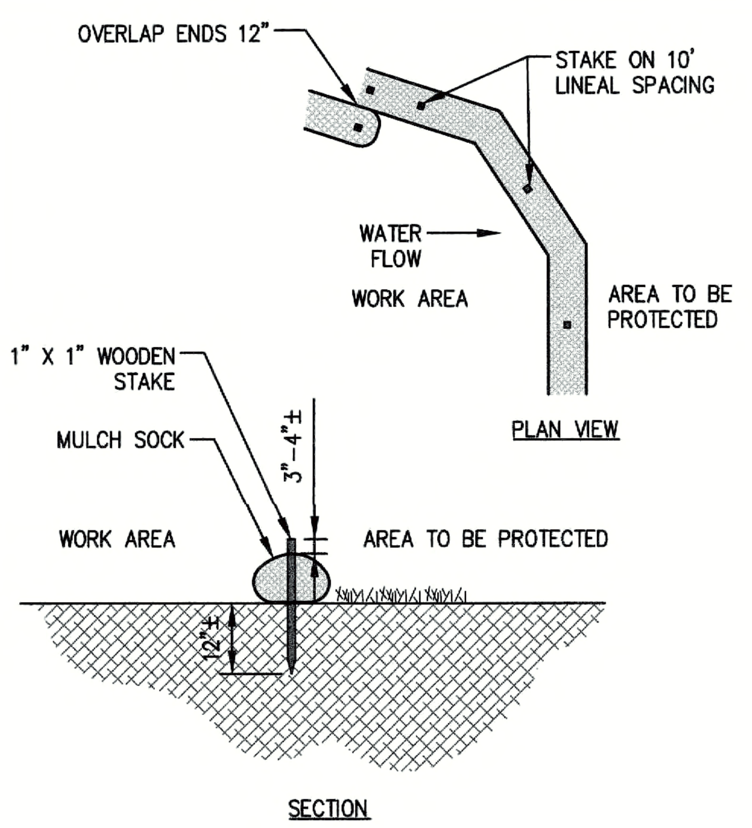
VERTICAL GRANITE CURB (VGC)
(NOT TO SCALE)



SUBBASE NOTES:
1. SUBBASE SHALL EXTEND TWO FEET BEYOND THE EDGE OF THE BINDER COURSE, ON EACHSIDE OF THE ROADWAY, FOR STABILIZATION OF THE ROADWAY SHOULDERS.
2. PROCESSED GRAVEL SHALL BE PLACED IN TWO 4" COMPACTED COURSES AS REQUIRED FOR THE GRAVEL BORROW COURSES.
3. GRAVEL BORROW SHALL BE PLACED IN TWO 6" COURSED ON THE PREPARED SUBGRADE.

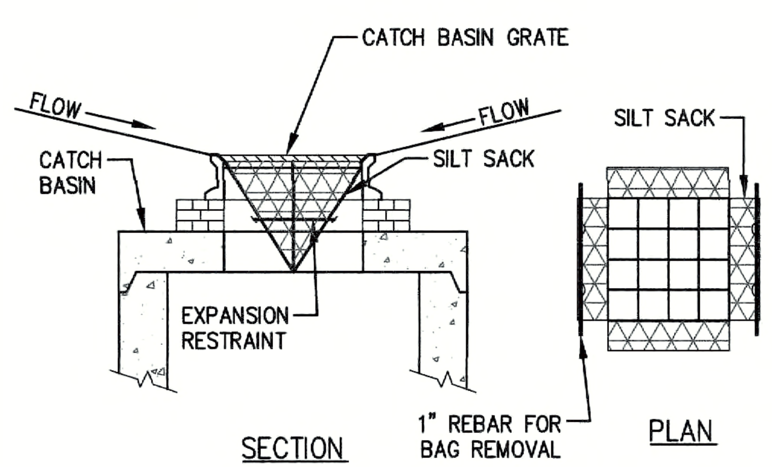
SUBSOIL NOTE:
SUBSOILS TO BE INSPECTED PRIOR TO INSTALLATION OF PAVEMENT SUBBASE. IF UNCOMPACTED FILL OR UNSUITABLE SOIL IS PRESENT IT SHALL BE REMOVED TO UNDISTURBED NATIVE SOIL AND REPLACED WITH STRUCTURAL FILL COMPACTED TO 95% R.C.

TYPICAL PAVEMENT SECTION – MINOR STREET
(NOT TO SCALE)

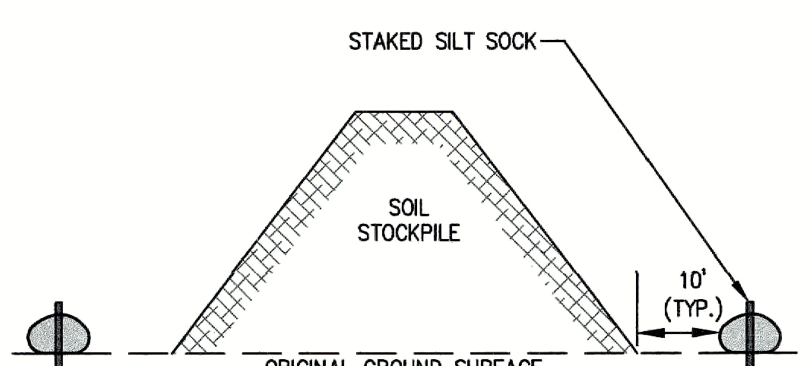


MULCH SOCK
(NOT TO SCALE)

SILT SACK NOTES:
1. INSTALL SILT SACKS IN EXISTING CATCH BASINS. INSTALL SILT SACKS IN NEW CATCH BASINS AFTER INSTALLATION.
2. GRATES TO BE PLACED OVER SILT SACKS.
3. SILTSACK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS AND CLEANING OR REPLACEMENT SHALL BE PERFORMED WHEN DEPTH OF SEDIMENT IS WITHIN 6" OF GRATE.

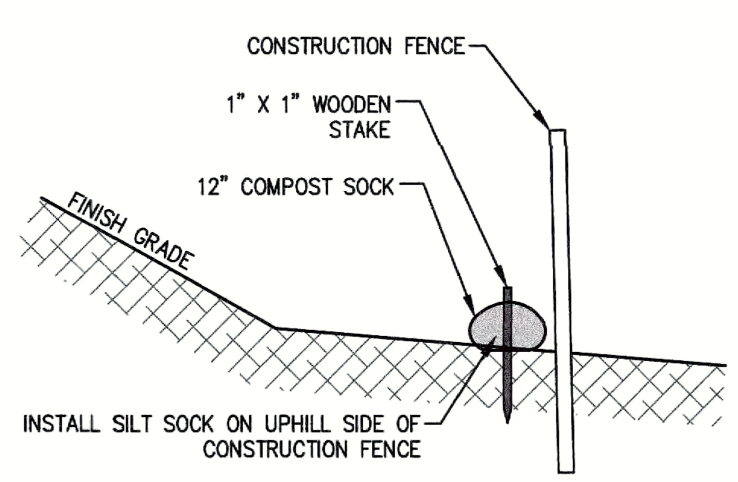


SILT SACK SEDIMENT TRAP
(NOT TO SCALE)

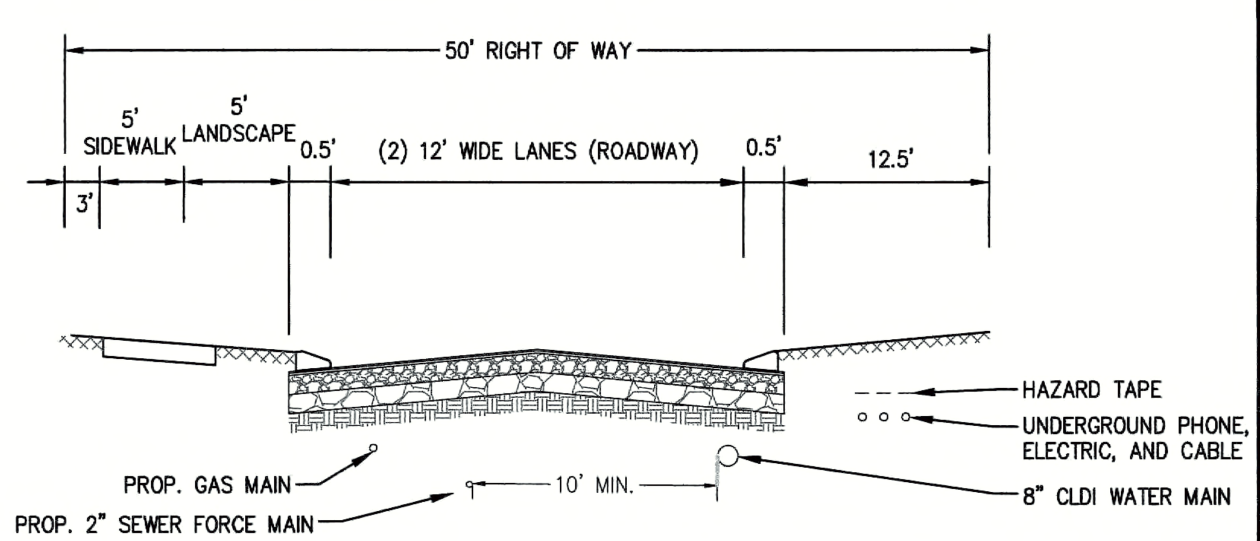


NOTES:
1. SILT SOCK TO EXTEND AROUND ENTIRE PERIMETER OF STOCKPILE IF ON LEVEL GROUND OR TO EXTEND AROUND DOWNGRADIENT PORTION STOCKPILE IS ON SLOPE.
2. IF THE STOCKPILE IS TO REMAIN FOR MORE THAN 14 DAYS IT SHALL BE STABILIZED WITH AN EROSION CONTROL BLANKET OR SEEDED (IF LOAM).
3. INSPECTION OF SILT SOCKS SHALL BE AT LEAST ONCE PER WEEK AND AFTER RAIN EVENTS IN EXCESS OF 1/2". REPAIR OR REPLACEMENT OF SILT SOCK SHALL BE MADE PROMPTLY AS NEEDED.
4. SEDIMENT TRAPPED BY SILT SOCKS SHALL BE REMOVED AND PROPERLY DISPOSED OF WHEN SEDIMENT DEPTH REACHES 12".
5. SILT SOCKS SHALL BE MAINTAINED UNTIL STOCKPILE IS ELIMINATED.

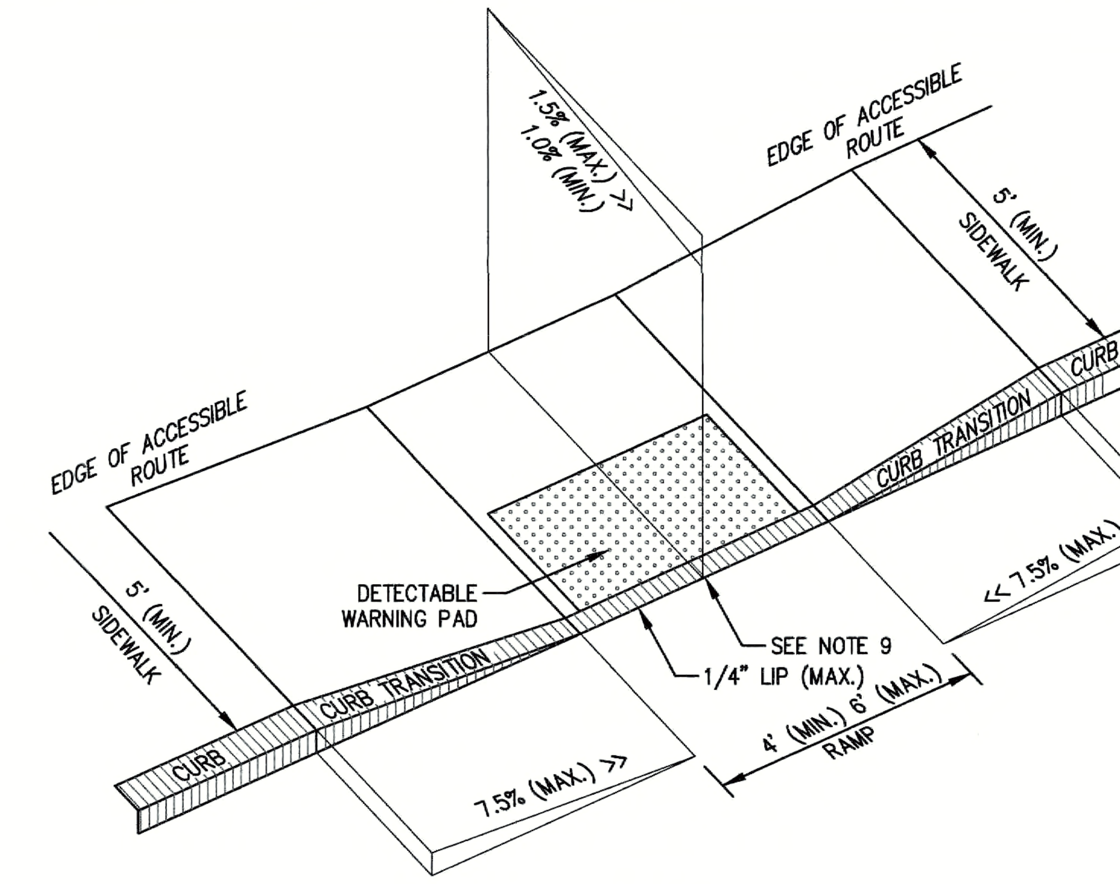
TEMPORARY SOIL STOCKPILE
(NOT TO SCALE)



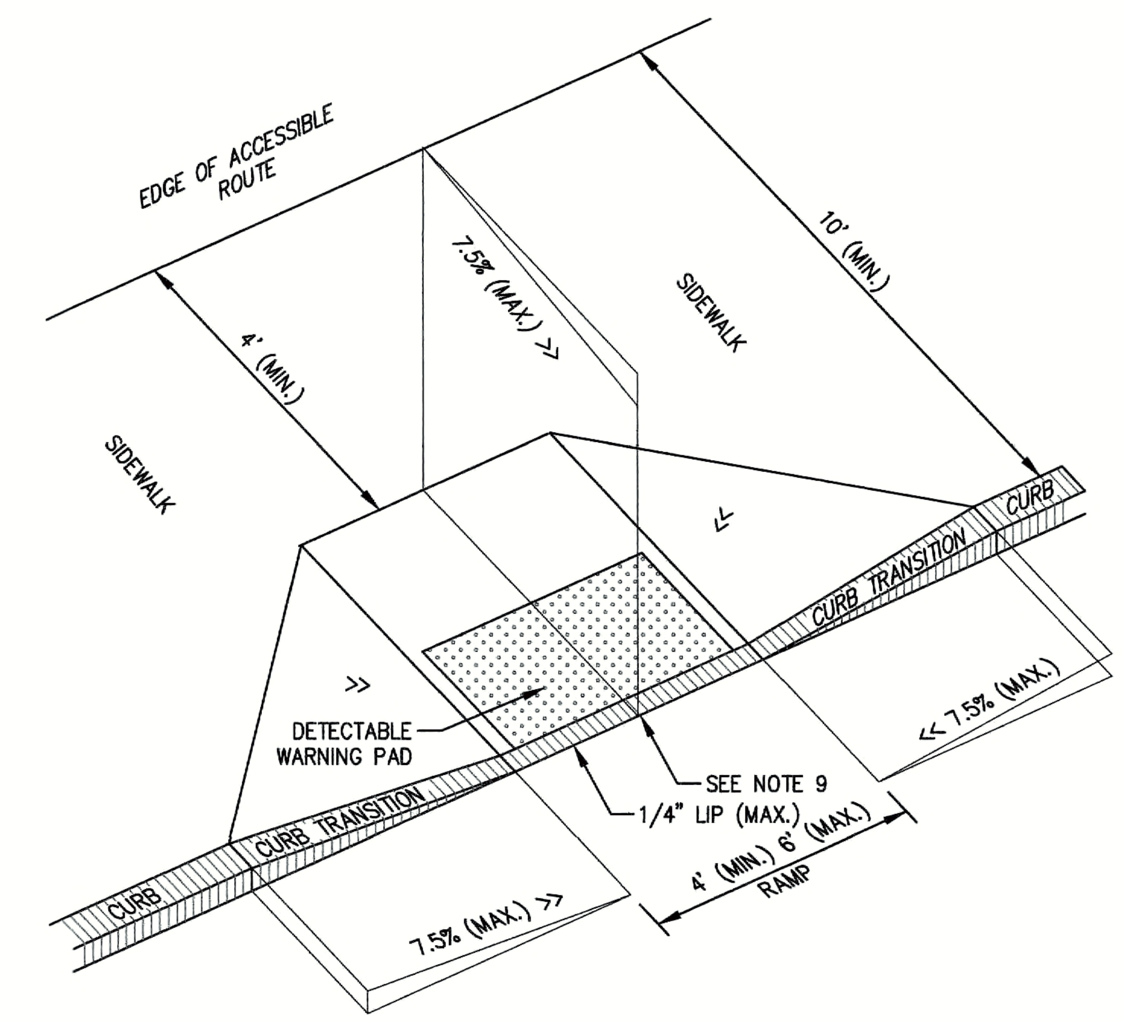
MULCH SOCK BACKED WITH CONSTRUCTION FENCE
(NOT TO SCALE)



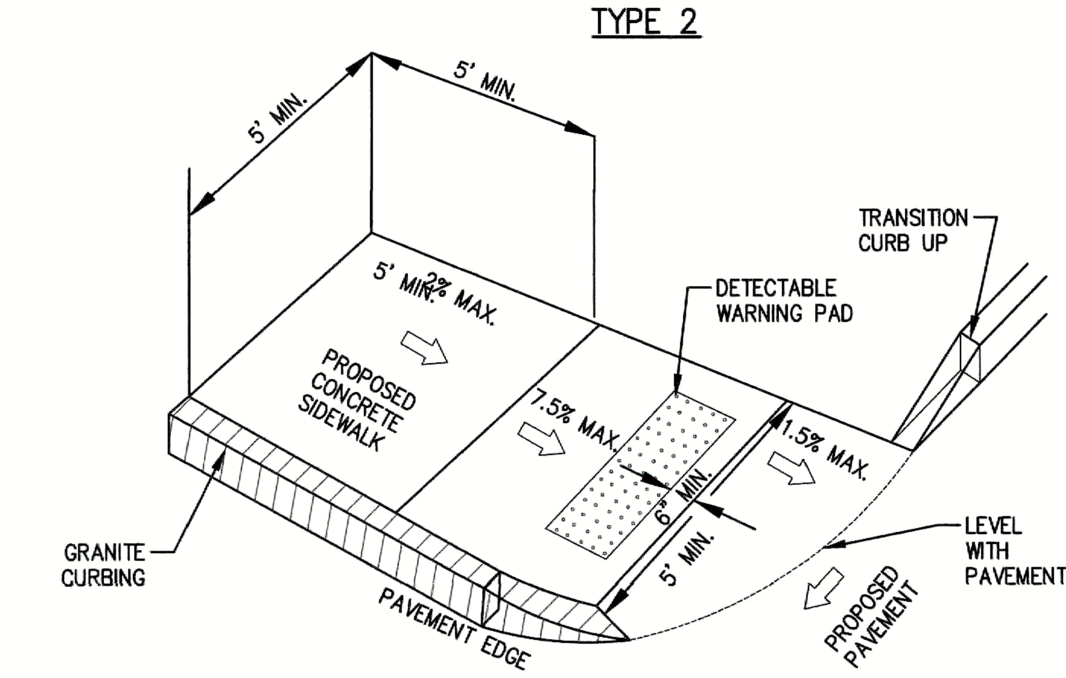
TYPICAL ROAD CROSS SECTION
(NOT TO SCALE)



TYPE 1



TYPE 2



TYPE 3

NOTES:

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5% (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.)
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. BASE OF RAMP SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE ALL CURBING AT RAMP (OTHER THAN VERTICAL CURBING, WHICH SHALL BE SET FLUSH) WHERE IT ABUTS ROADWAY.

WHEELCHAIR ACCESS RAMP DETAILS
(NOT TO SCALE.)

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ______________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U
DATE: ______________
APPROVED BY:

APPROVED __________, __________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, __________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, __________ , A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________, __________ __________, __________ GROVELAND PLANNING BOARD.

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)
PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845
OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811
JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

SITE DETAILS

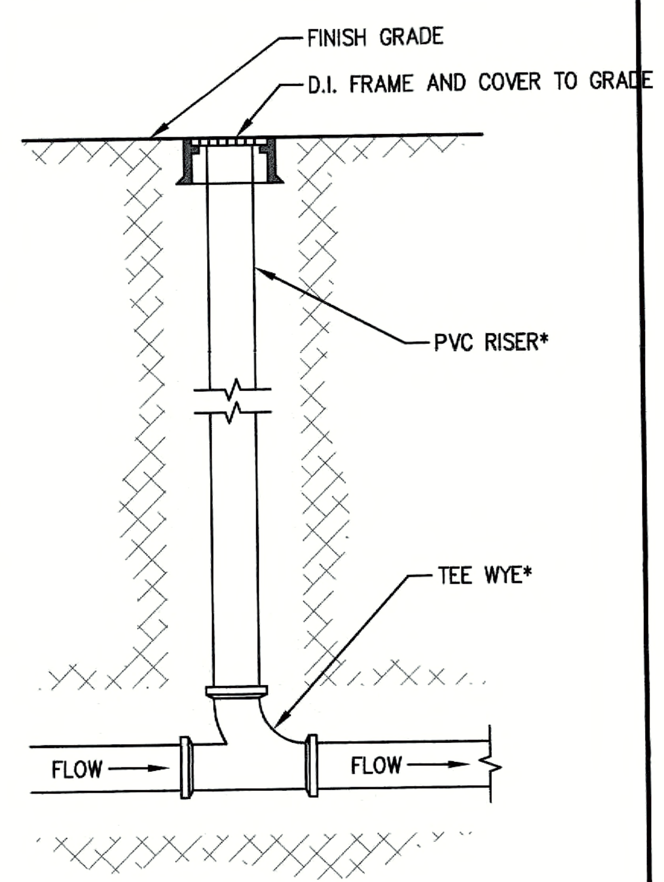
DRAWING NO. C-9

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

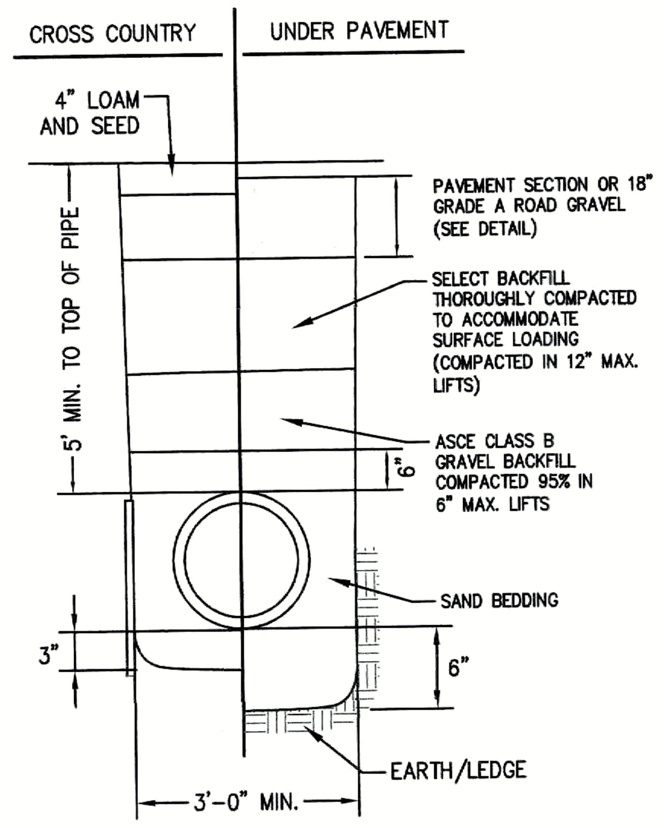
I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE

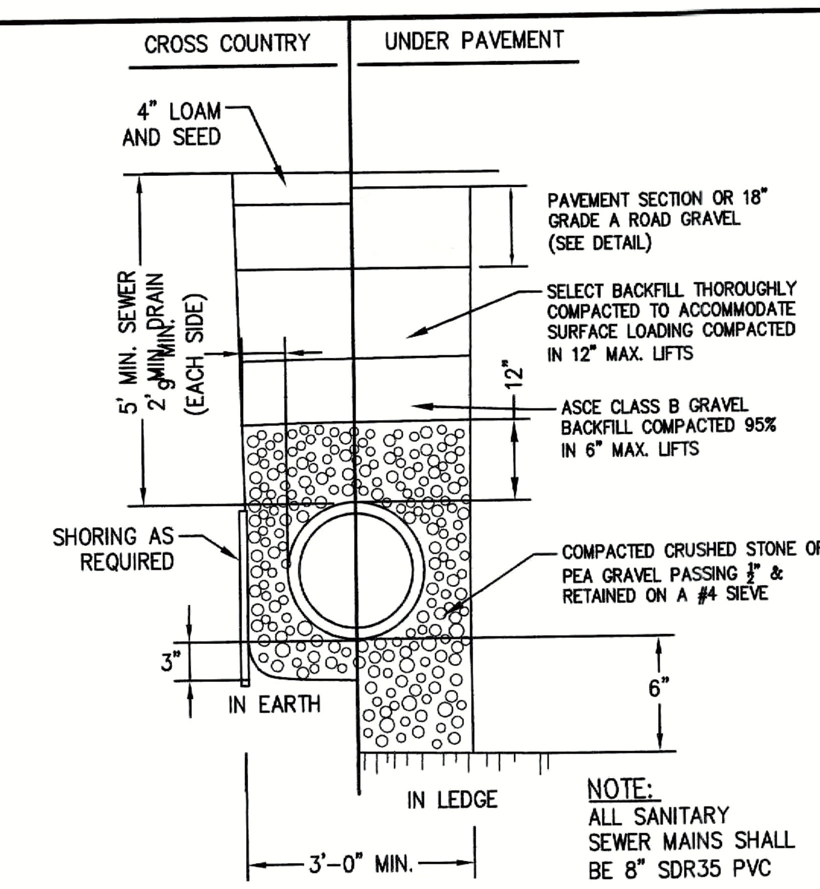


*FITTINGS TO MATCH DIAMENTER OF MAIN

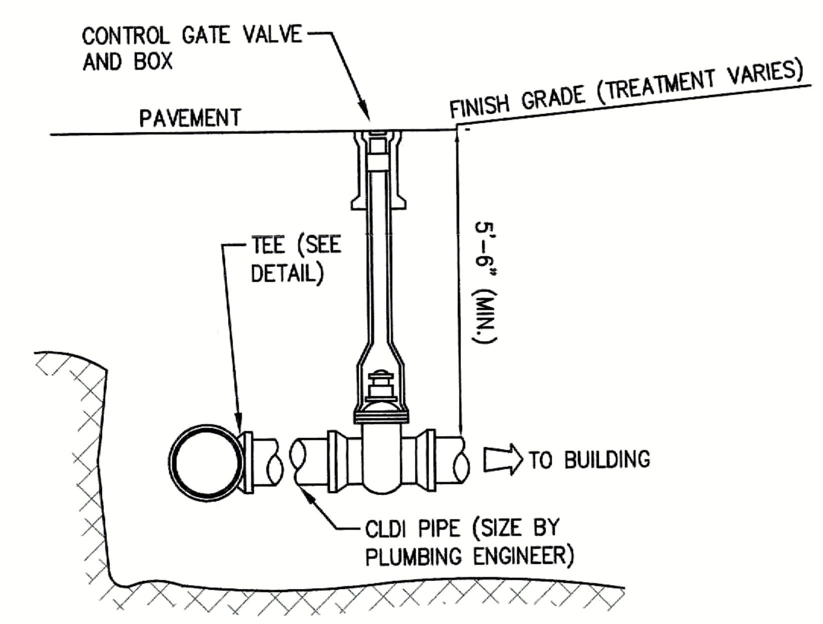
SEWER CLEANOUT
(NOT TO SCALE)



TYPICAL WATER TRENCH DETAIL
(NOT TO SCALE)



TYPICAL SEWER/DRAIN TRENCH DETAIL
(NOT TO SCALE)



GATE VALVE DETAIL
(NOT TO SCALE)

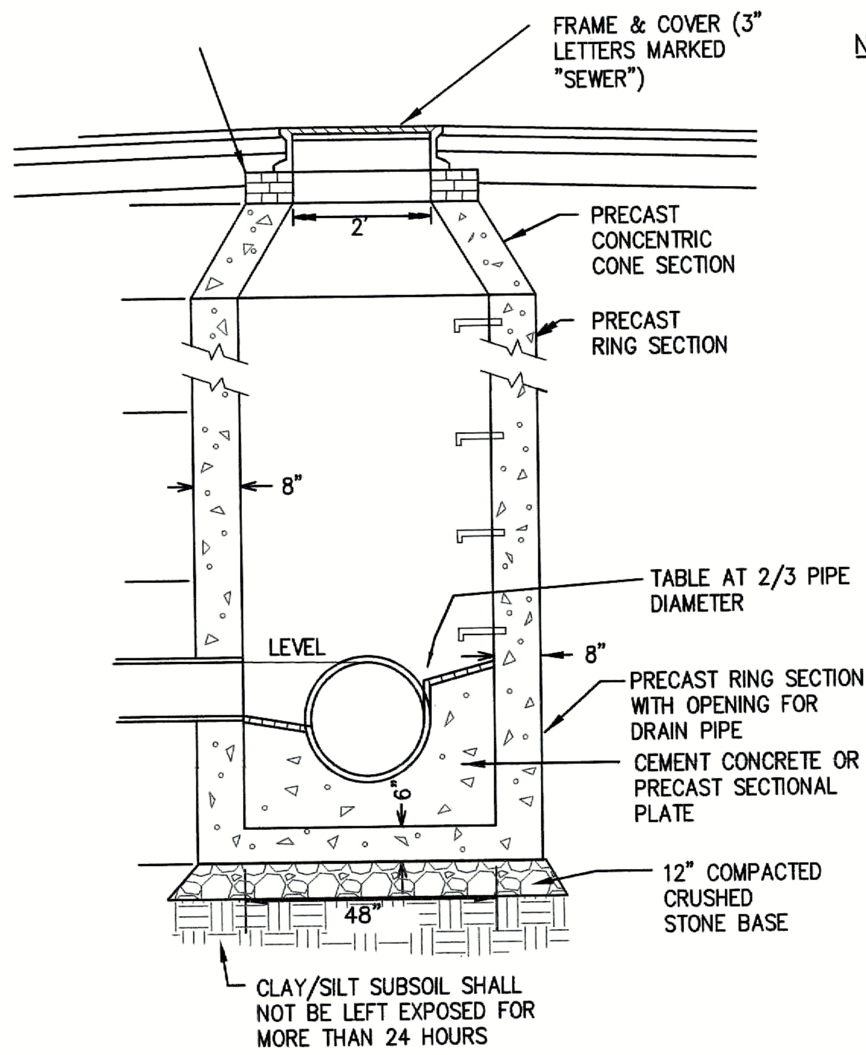
TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ____________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

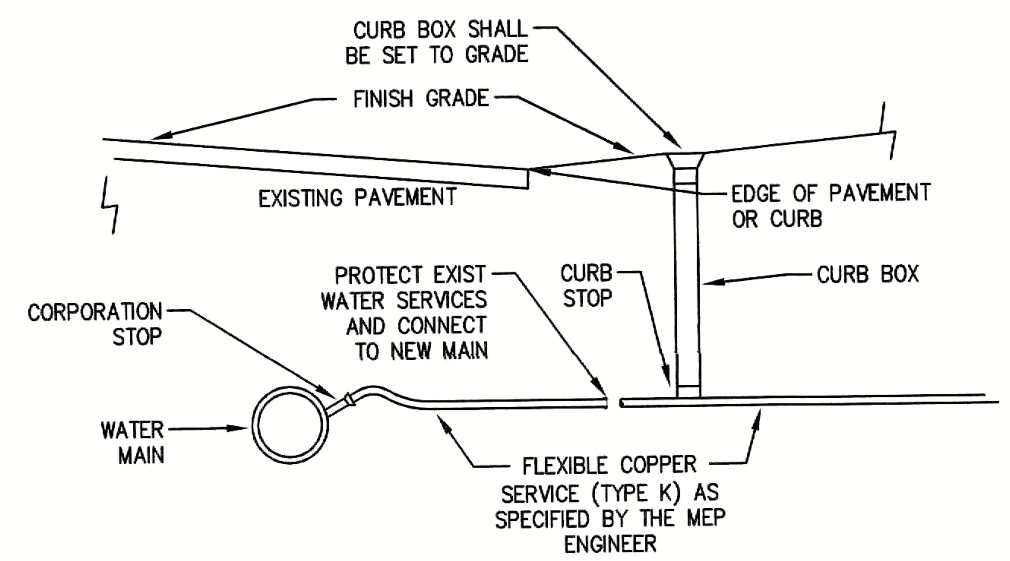
APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U
DATE: ____________
APPROVED BY:

APPROVED ________, ________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED ________, ________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, ________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE ________, ________. SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED ________, ________ GROVELAND PLANNING BOARD.



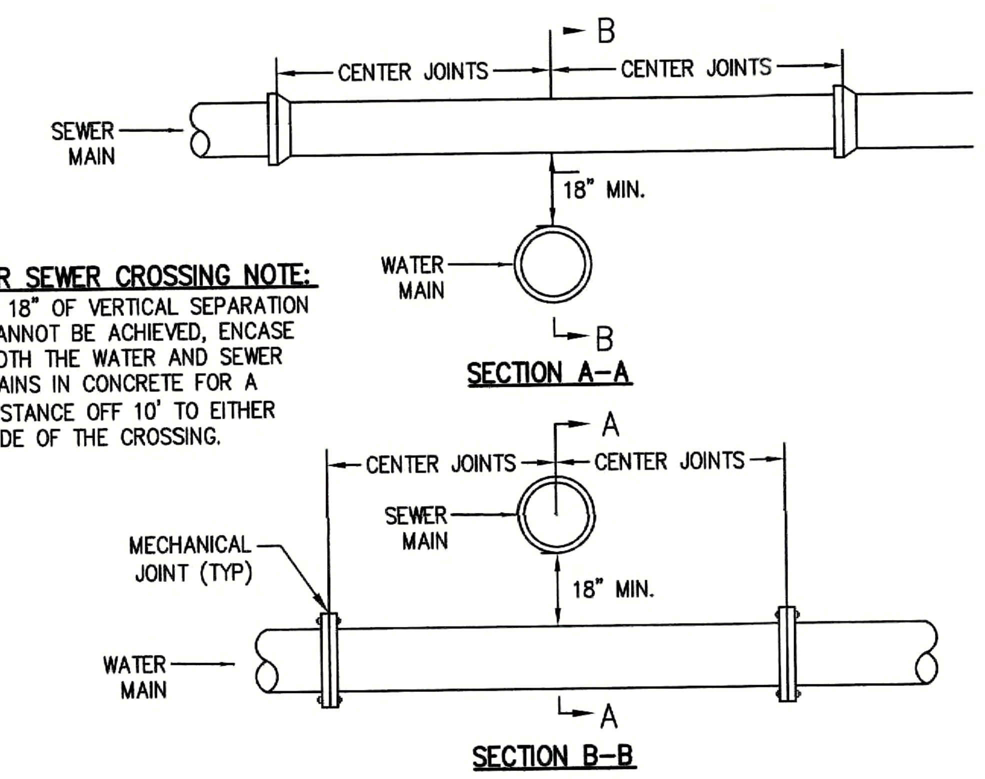
NOTES:
1) SUBSOILS TO BE INSPECTED PRIOR TO INSTALLATION OF ALL STRUCTURES. IF UNCOMPACTED FILL OR UNSUITABLE SOIL IS PRESENT IT SHALL BE REMOVED TO UNDISTURBED NATIVE SOIL AND REPLACED WITH STRUCTURAL FILL COMPACTED TO 95% R.C.
2) OUTLET INVERT IS A MINIMUM 0.10' LOWER THAN INLET INVERT

TYPICAL SEWER MANHOLE
(NOT TO SCALE)



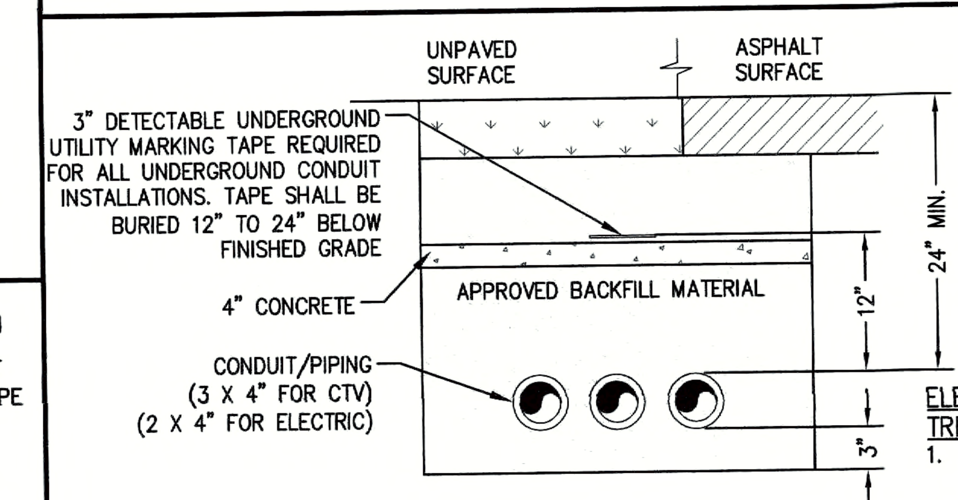
NOTES:
1. EXISTING WATER SERVICE SHALL BE SHUT OFF AT EXISTING CURB STOP AND SERVICE LINE CUT AND CAPPED JUST BEYOND CURB STOP.
2. TAP EXISTING WATER MAIN WITH NEW CORPORATION STOP AND INSTALL NEW CURB STOP AND CURB BOX WITHIN EXISTING SIDEWALK
3. SAW CUT EXISTING PAVEMENT AND SIDEWALK TO MINIMIZE REPAIRS. REPLACE ASPHALT PAVEMENT AND CONCRETE SIDEWALK TO MATCH EXISTING ELEVATIONS.

WATER SERVICE CORPORATION
(NOT TO SCALE)

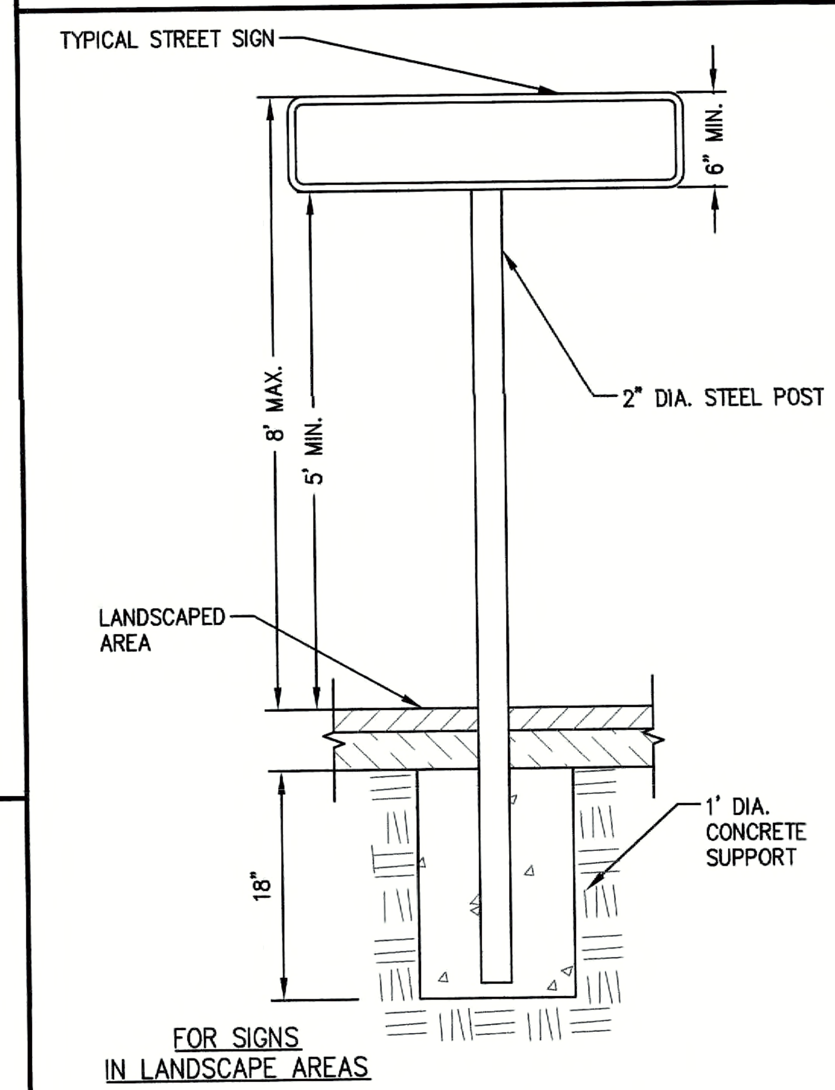


WATER SEWER CROSSING NOTE:
1. IF 18" OF VERTICAL SEPARATION CANNOT BE ACHIEVED, ENCASE BOTH THE WATER AND SEWER MAINS IN CONCRETE FOR A DISTANCE OFF 10' TO EITHER SIDE OF THE CROSSING.

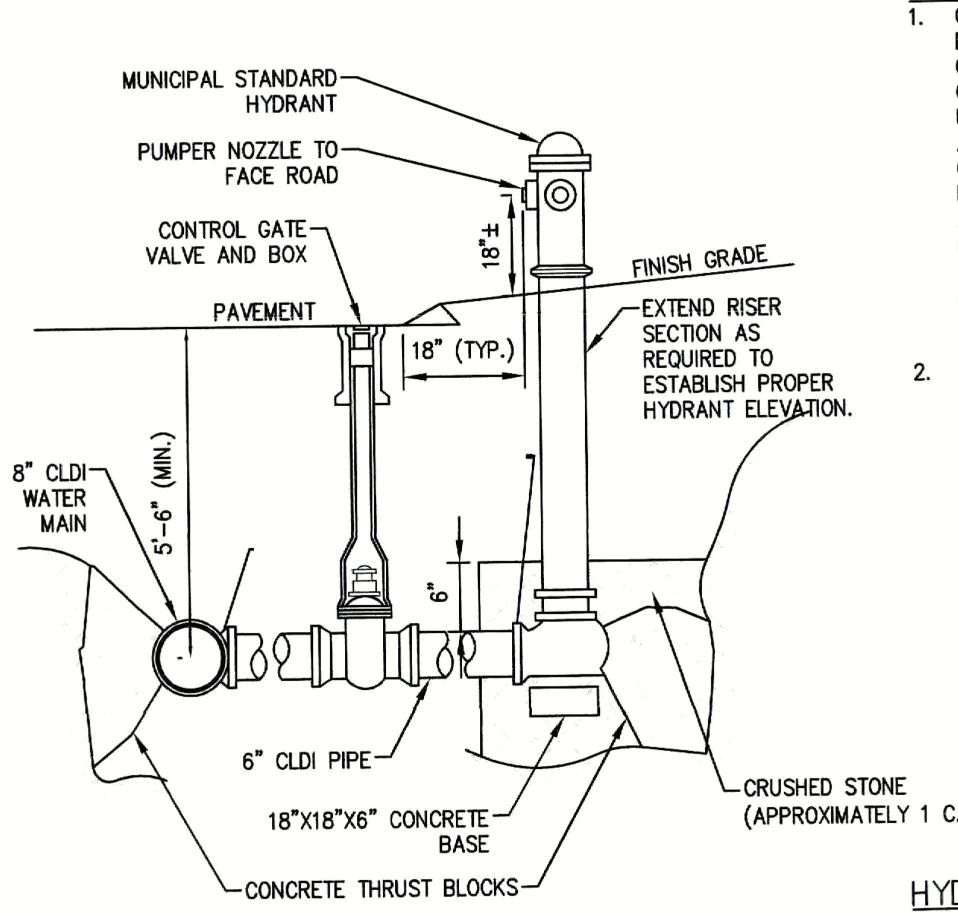
WATER/SEWER CROSSING DETAIL
(NOT TO SCALE)



ELECTRICAL CONDUIT TRENCH DETAIL NOTES:
1. ADJUST FOR ANY LOCAL MODIFICATIONS TO NFPA 70/NEC
2. COORDINATE CONDUITS WITH APPLICABLE SERVICE PROVIDERS.

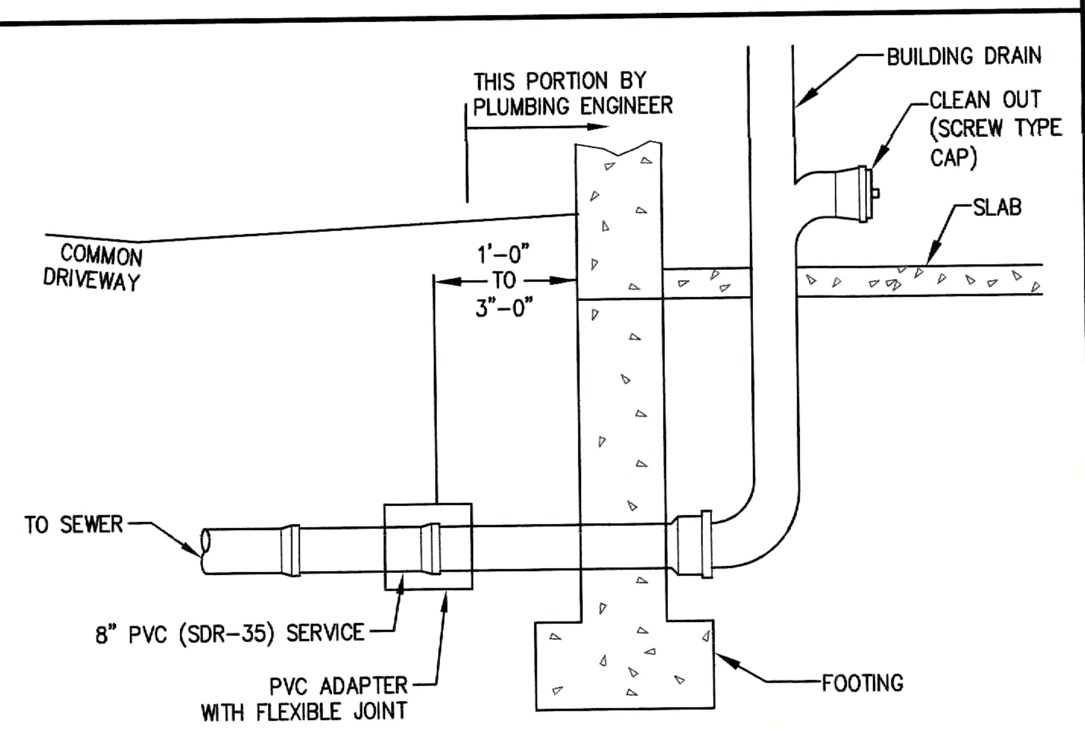


STREET SIGN POST
(NOT TO SCALE)

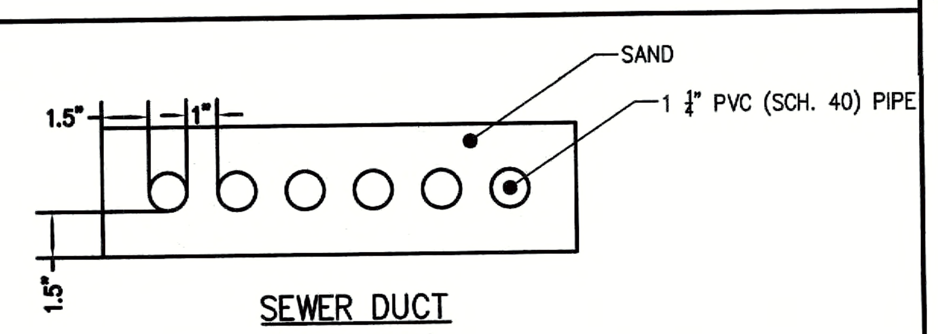


NOTES:
1. CONCRETE THRUST BLOCKS TO BE USED ONLY WHERE THEY CAN BEAR ON UNDISTURBED EARTH AS SHOWN. USE CLAMPS AND TIE RODS OR OTHER ACCEPTABLE METHOD OF JOINT RESTRAINT WHERE SOIL CONDITIONS PROHIBIT THE USE OF THRUST BLOCKS.
2. HYDRANT IN SIDEWALK AREAS TO BE LOCATED TO PROVIDE MINIMUM CLEAR SIDEWALK PASSAGE WIDTH OF 3 FEET AT HYDRANT.

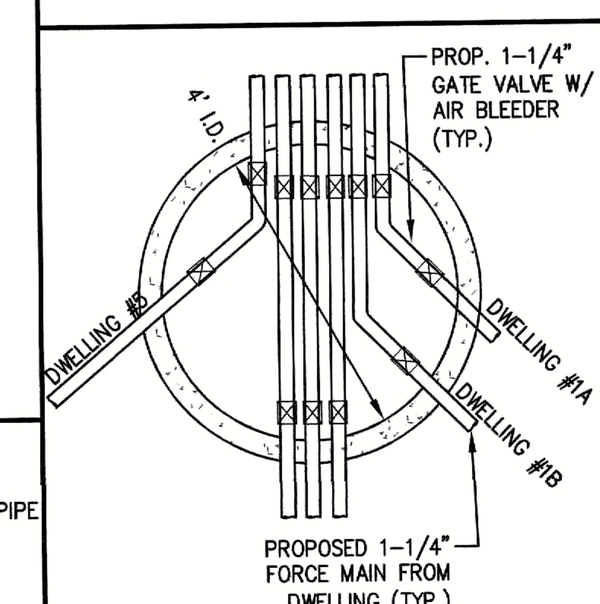
HYDRANT DETAIL
(NOT TO SCALE)



TYPICAL BUILDING SEWER SERVICE BELOW SLAB
(NOT TO SCALE)

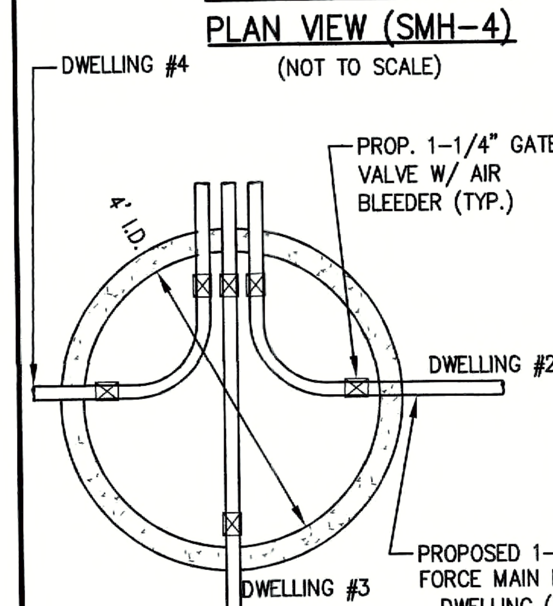


SEWER DUCT
(NOT TO SCALE)



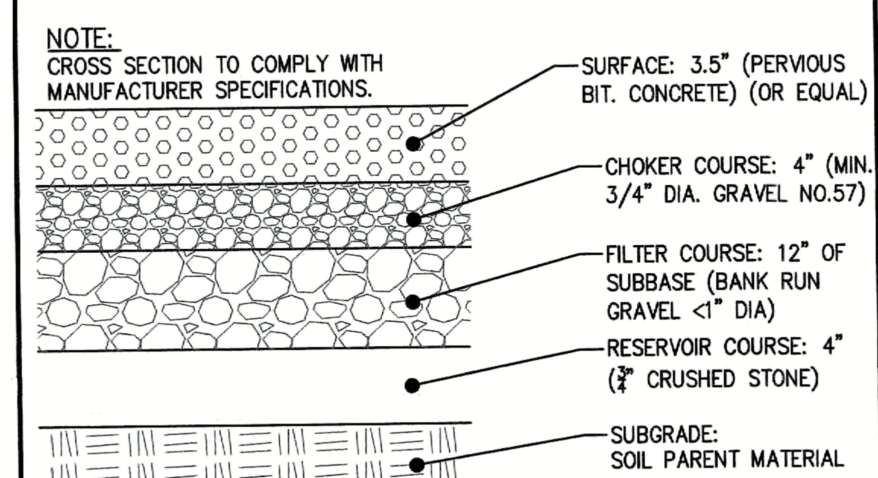
FORCE MAIN TRENCH PLAN VIEW (SMH-3)
(NOT TO SCALE)

FORCE MAIN TRENCH PLAN VIEW (SMH-4)
(NOT TO SCALE)



GRADATION REQUIREMENTS FOR SUBBASE	
SIEVE DESIGNATION	PERCENT PASSING
3 IN.	100
1 1/2 IN.	70-100
3/4 IN.	50-85
NO. 4	30-60
NO. 200	0-10

NOTE:
CROSS SECTION TO COMPLY WITH MANUFACTURER SPECIFICATIONS.



TYPICAL PERVIOUS DRIVEWAY
(NOT TO SCALE)

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811

JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS		
NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

UTILITIES & SITE DETAILS

DRAWING NO. C-10

DRAWING: 3634 MAIN.dwg

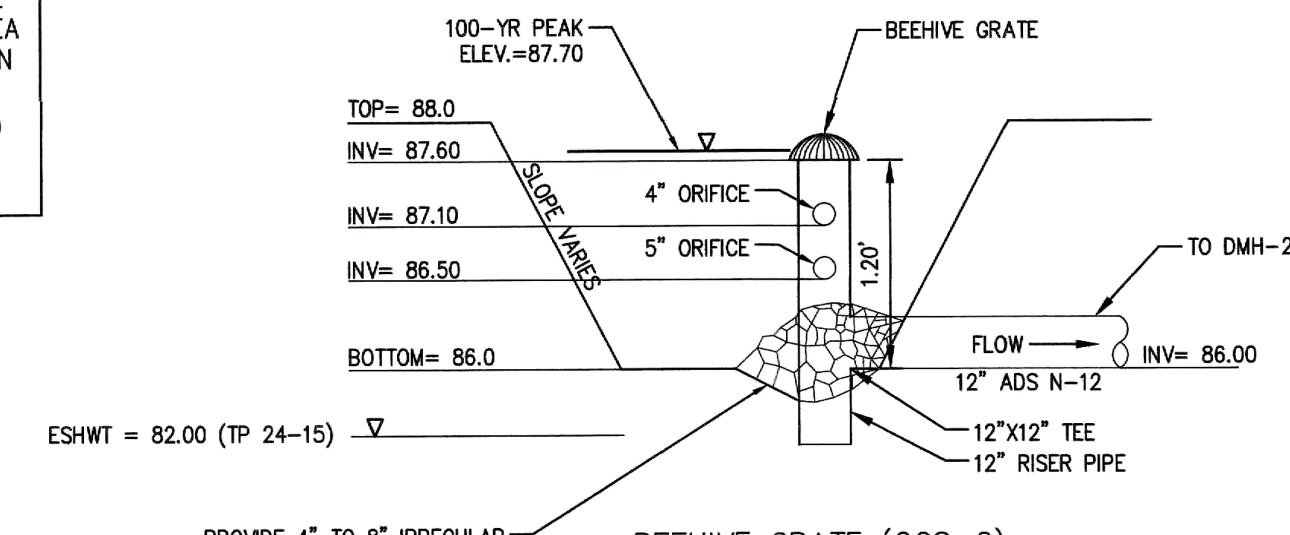
FOR REGISTRY USE ONLY

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

DATE

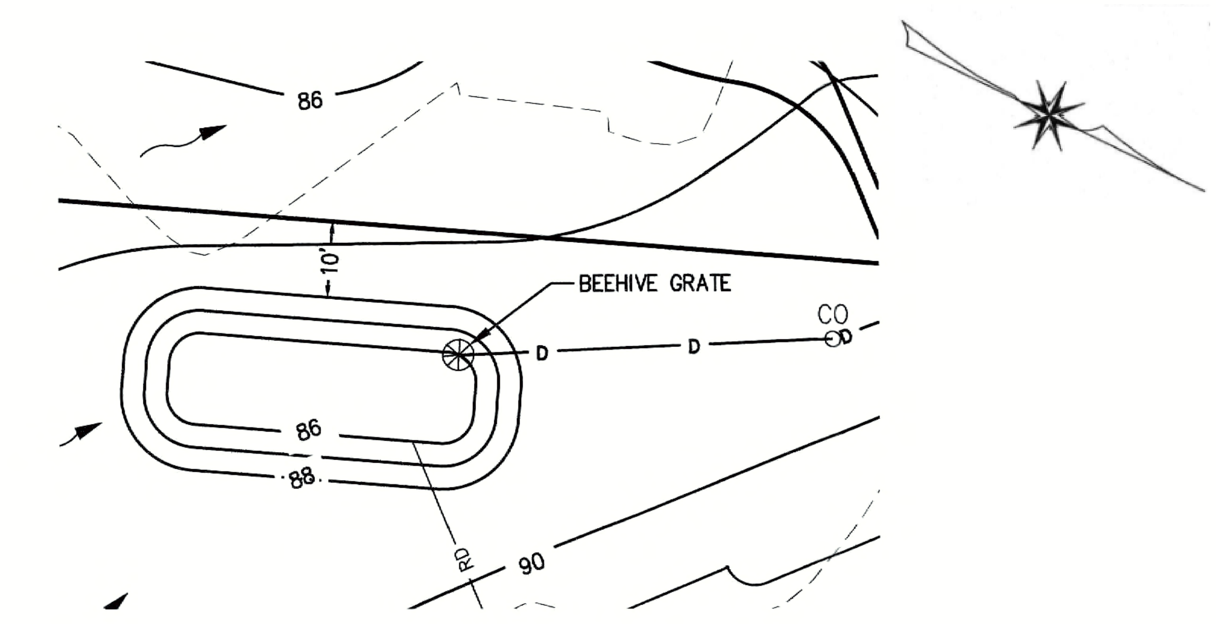
GENERAL RAIN GARDEN NOTE:

DURING CONSTRUCTION, TO AVOID COMPACTION OF THE PARENT MATERIAL, WORK FROM THE EDGE OF THE AREA PROPOSED AS THE LOCATION OF AN EXFILTRATING RAIN GARDENS/INFILTRATION BASIN. NEVER DIRECT RUNOFF TO THE BASIN/GARDEN UNTIL THE BASIN/GARDEN AND THE CONTRIBUTING DRAINAGE AREAS ARE FULLY STABILIZED.

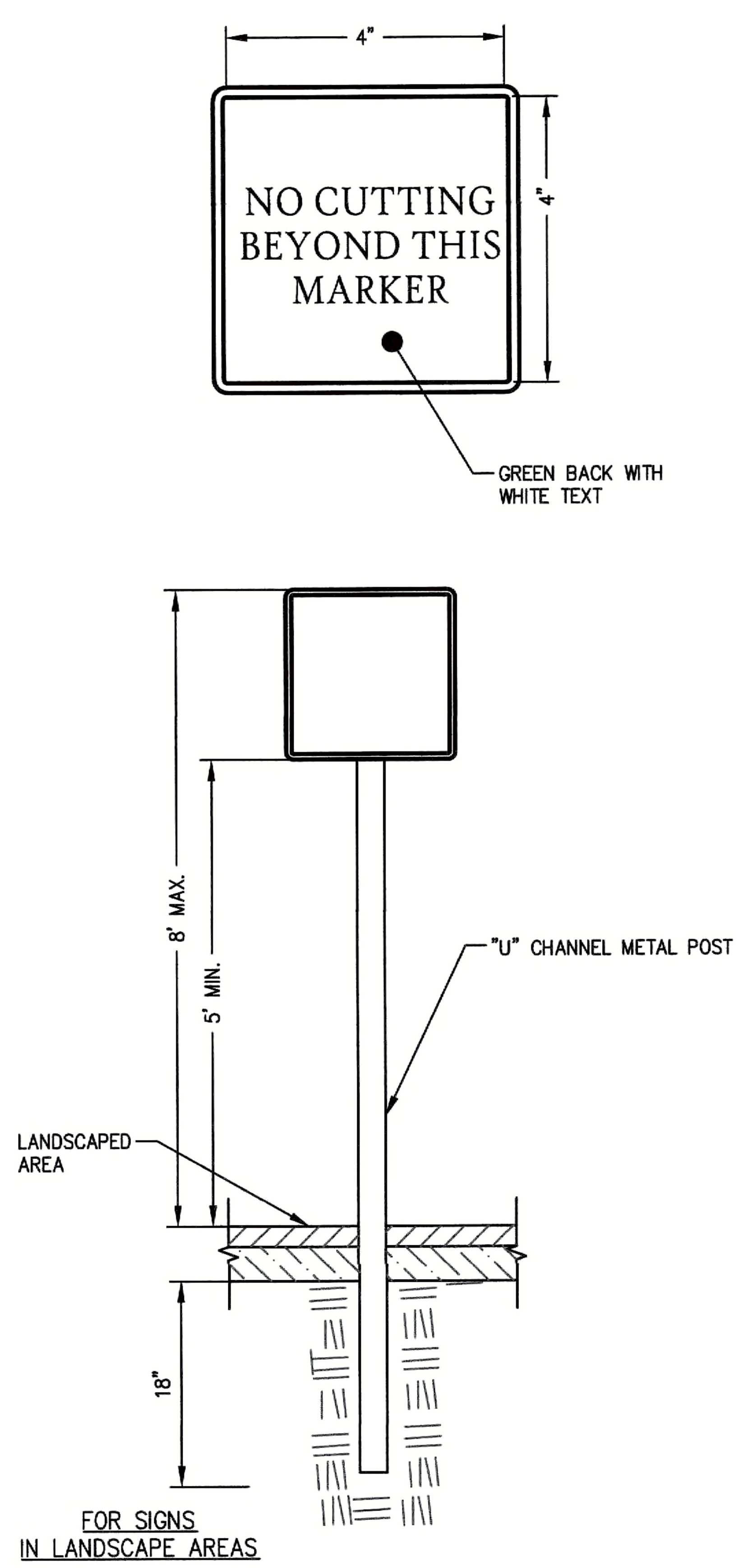


BEEHIVE GRATE (OCS-2)
(NOT TO SCALE)

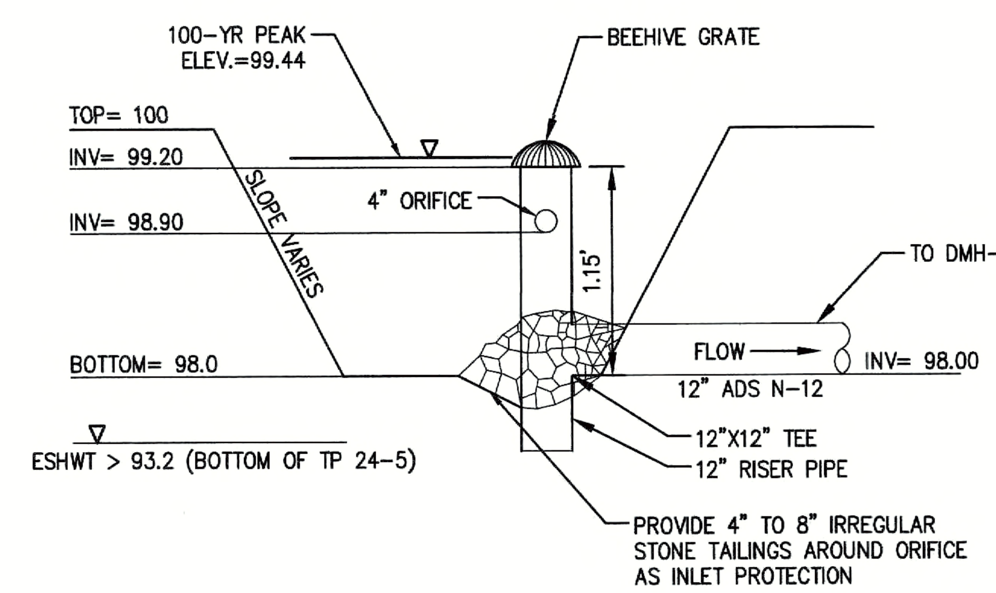
2-YEAR STORM ELEV. = 86.57	
10-YEAR STORM ELEV. = 87.05	
25-YEAR STORM ELEV. = 87.36	
100-YEAR STORM ELEV. = 87.70	



RAIN GARDEN (P2)
(NOT TO SCALE)

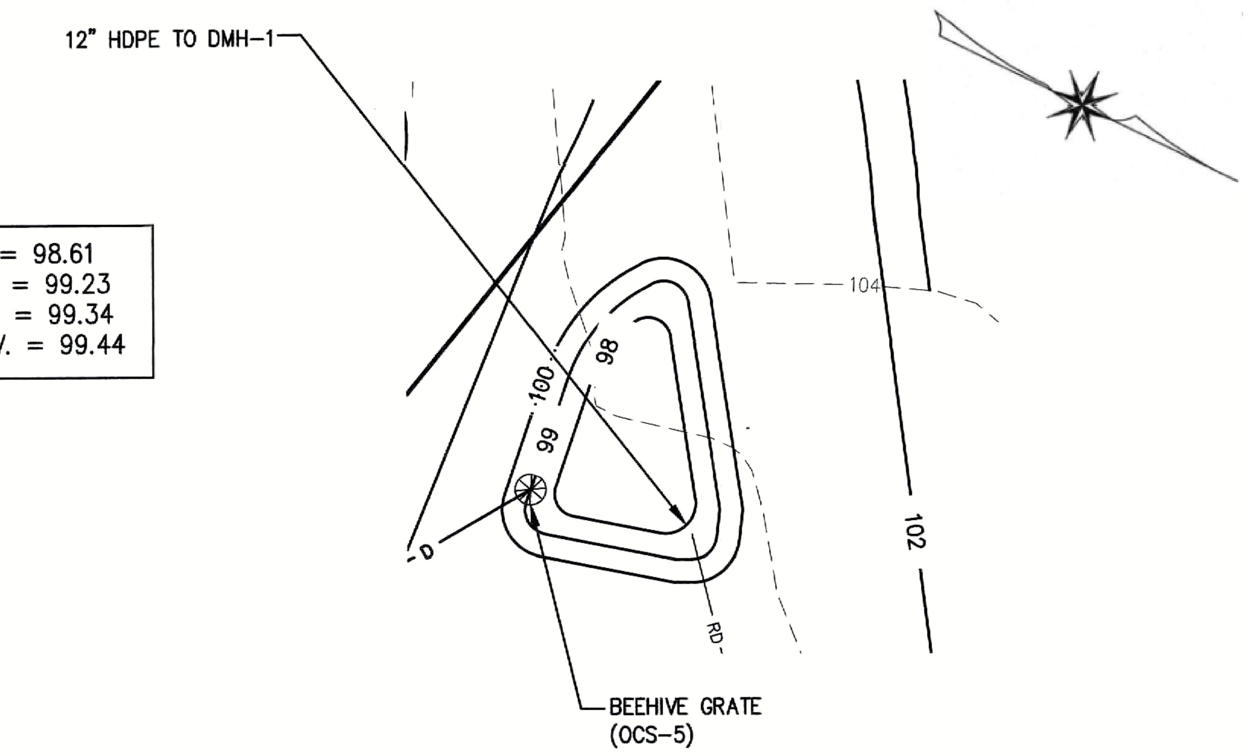


TREE BUFFER SIGN
(NOT TO SCALE)

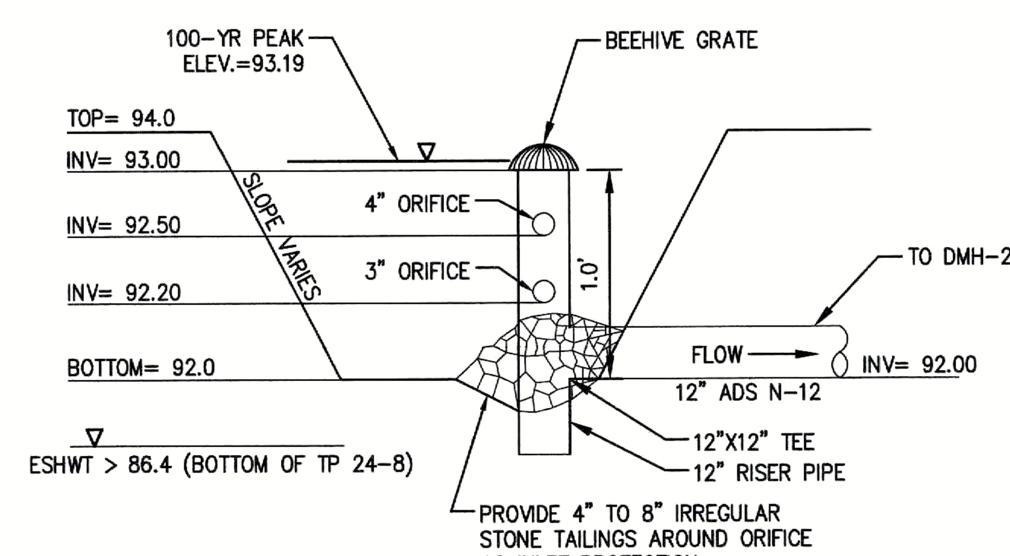


BEEHIVE GRATE (OCS-5)
(NOT TO SCALE)

2-YEAR STORM ELEV. = 98.61	
10-YEAR STORM ELEV. = 99.23	
25-YEAR STORM ELEV. = 99.34	
100-YEAR STORM ELEV. = 99.44	

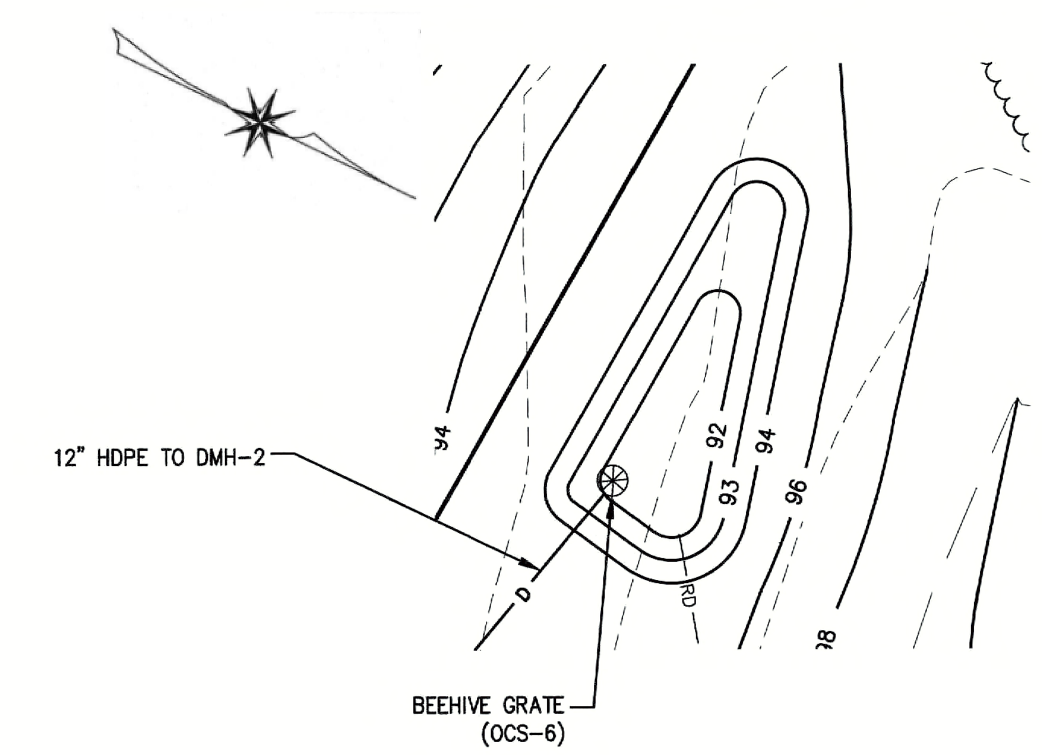


RAIN GARDEN (P5)
(NOT TO SCALE)

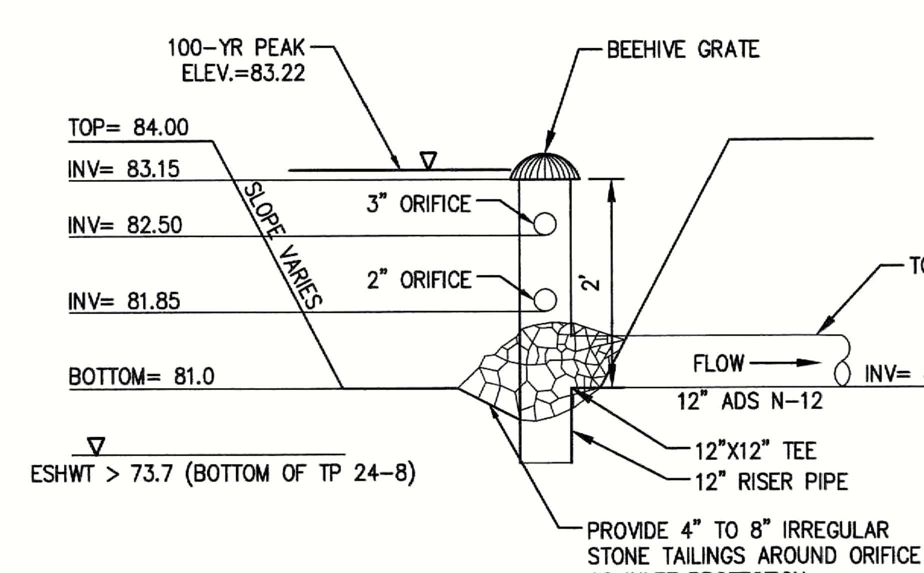


BEEHIVE GRATE (OCS-6)
(NOT TO SCALE)

2-YEAR STORM ELEV. = 92.43	
10-YEAR STORM ELEV. = 92.88	
25-YEAR STORM ELEV. = 93.08	
100-YEAR STORM ELEV. = 93.19	

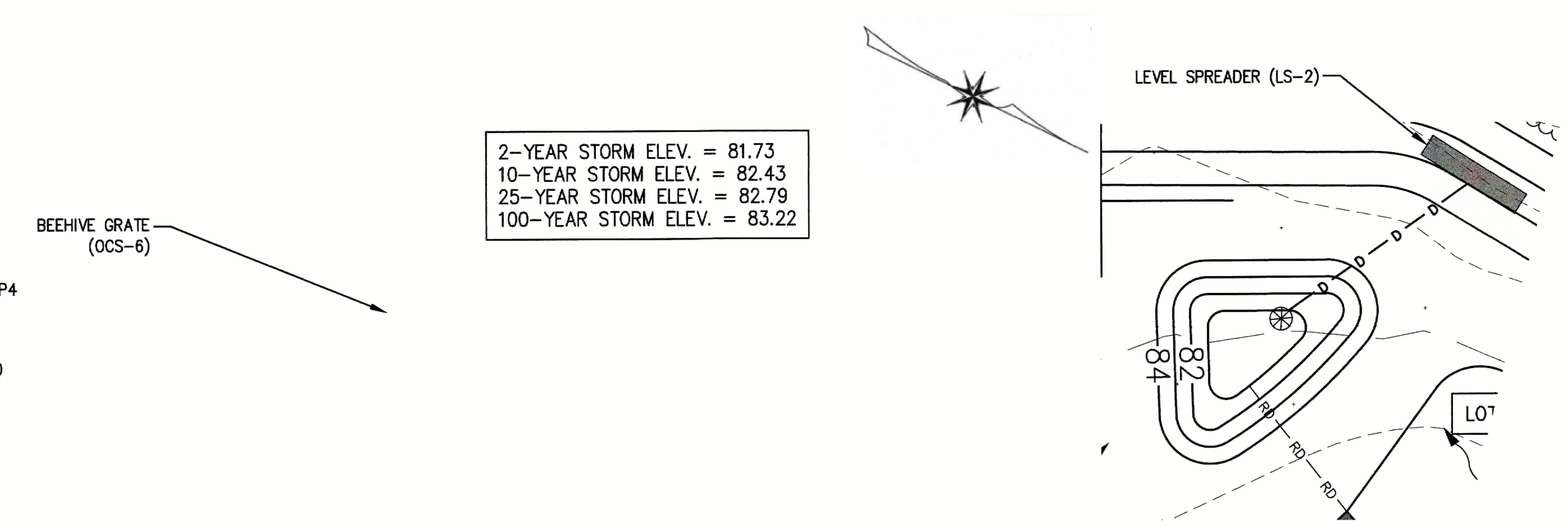


RAIN GARDEN (P6)
(NOT TO SCALE)



BEEHIVE GRATE (OCS-7)
(NOT TO SCALE)

2-YEAR STORM ELEV. = 81.73	
10-YEAR STORM ELEV. = 82.43	
25-YEAR STORM ELEV. = 82.79	
100-YEAR STORM ELEV. = 83.22	



RAIN GARDEN (P7)
(NOT TO SCALE)

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ______________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

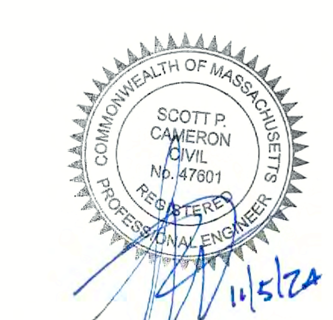
CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U

DATE: ______________

APPROVED BY:

APPROVED __________, __________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, __________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, __________, A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________, SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________, __________ GROVELAND PLANNING BOARD.



DEFINITIVE SUBDIVISION

FOR A

STREET TO BE NAMED

IN

GROVELAND, MASSACHUSETTS

AT

181R SCHOOL STREET

(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:

GROVELAND REDEVELOPMENT, LLC

231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:

181R SCHOOL STREET, LLC

5 ATKINSON FARM ROAD
ATKINSON, NH 03811

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REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

DRAINAGE DETAILS

DRAWING NO. C-11

DRAWING: 3634 MAIN.dwg

FOR REGISTRY USE ONLY

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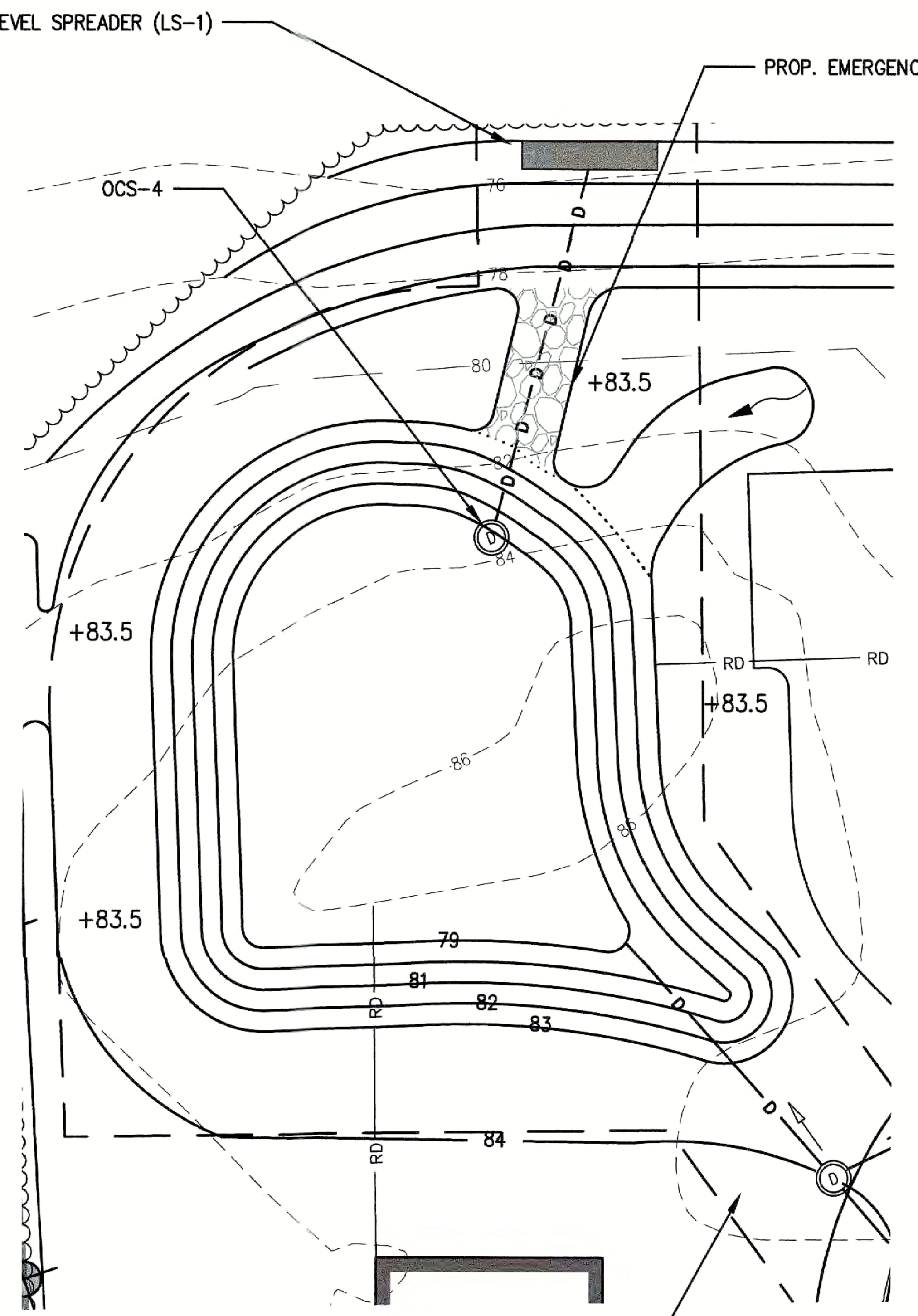
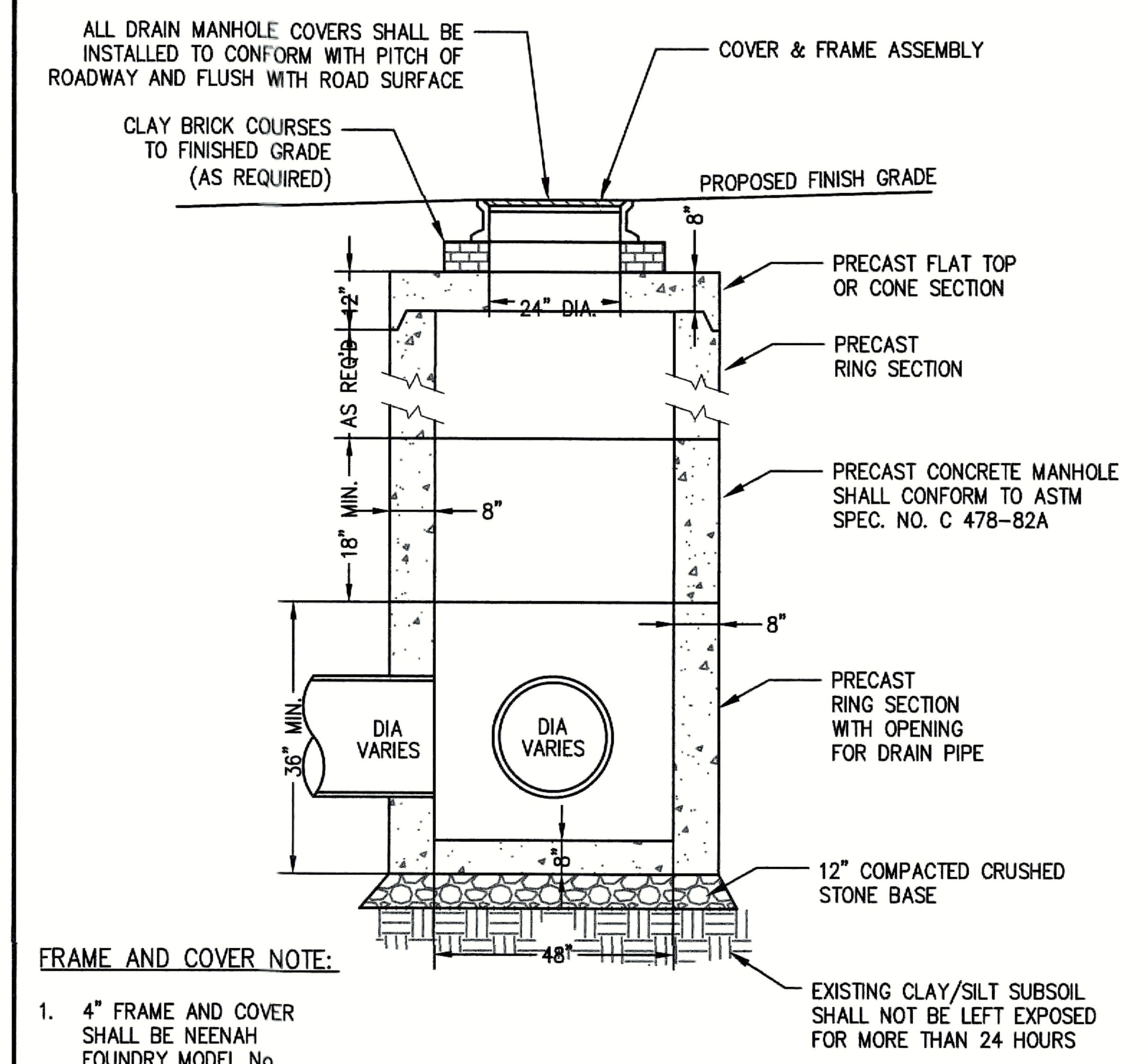
DATE



2-YEAR STORM ELEV. = 79.68
10-YEAR STORM ELEV. = 80.53
25-YEAR STORM ELEV. = 81.15
100-YEAR STORM ELEV. = 81.98

ESHWT > 77.0 (BOTTOM OF TP 24-13)



FRAME AND COVER NOTE:

1. 4" FRAME AND COVER SHALL BE NEENAH FOUNDRY MODEL No. R-1706-1 OR APPROVED EQUIVALENT.
2. 8" FRAME AND COVER SHALL BE NEENAH FOUNDRY MODEL No. R-1670-A OR APPROVED EQUIVALENT.

SUBSOIL NOTE:

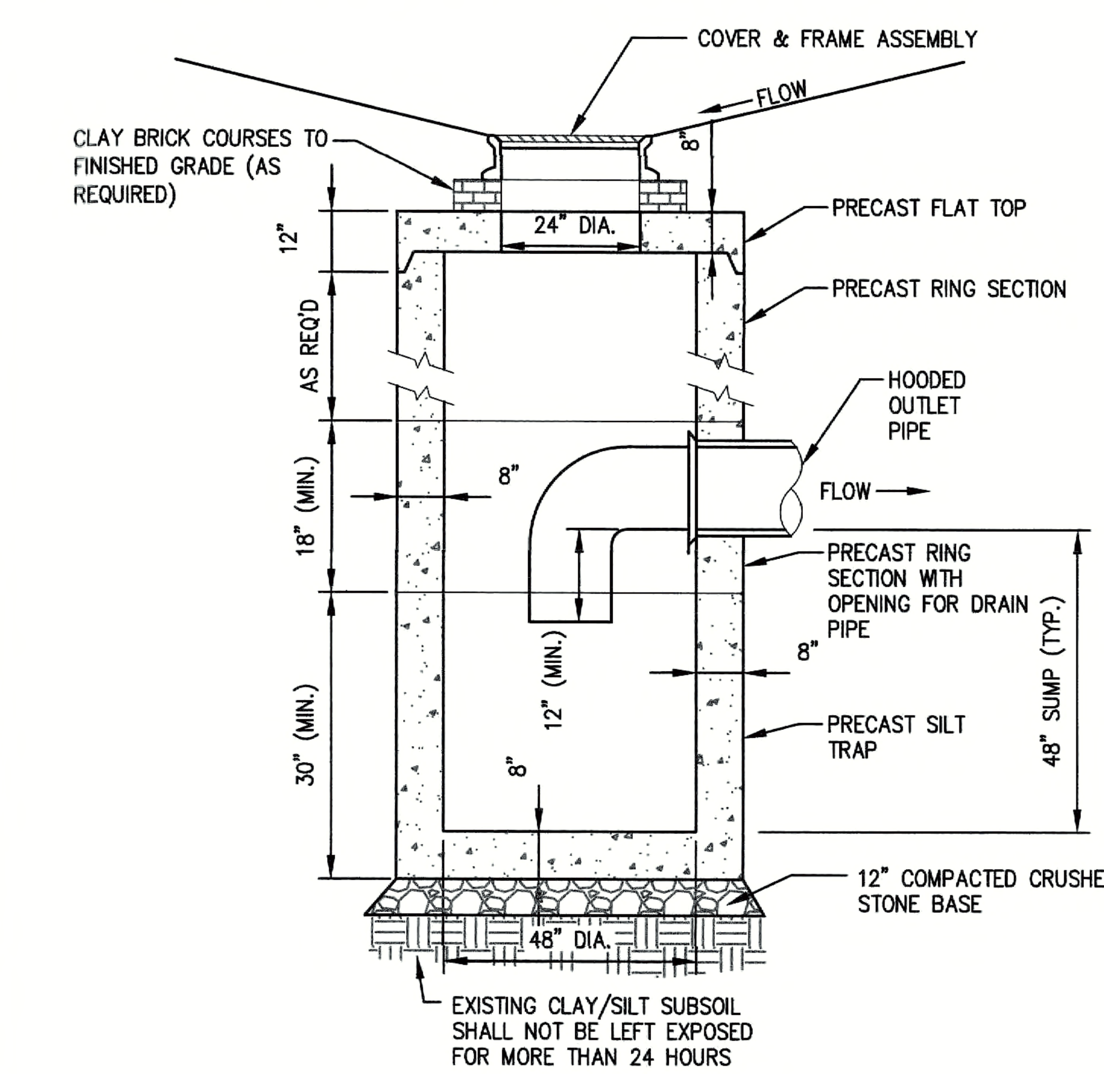
SUBSOILS TO BE INSPECTED PRIOR TO INSTALLATION OF ALL STRUCTURES. IF UNCOMPACTED FILL OR UNSUITABLE SOIL IS PRESENT IT SHALL BE REMOVED TO UNDISTURBED NATIVE SOIL AND REPLACED WITH STRUCTURAL FILL COMPACTED TO 95% R.C.

TYPICAL DRAIN MANHOLE

(NOT TO SCALE)

NOTE:

1. ECCENTRIC CONE SECTION MAY BE SUBSTITUTED



SUBSOIL NOTE:

SUBSOILS TO BE INSPECTED PRIOR TO INSTALLATION OF ALL STRUCTURES. IF UNCOMPACTED FILL OR UNSUITABLE SOIL IS PRESENT IT SHALL BE REMOVED TO UNDISTURBED NATIVE SOIL AND REPLACED WITH STRUCTURAL FILL COMPACTED TO 95% R.C.

FRAME AND COVER NOTE:

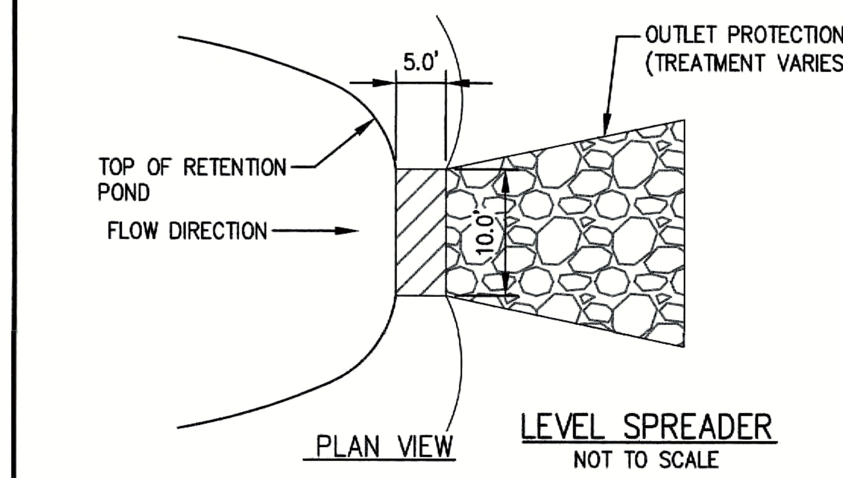
1. 3" FRAME AND COVER SHALL BE NEENAH FOUNDRY MODEL No. R-3560 OR APPROVED EQUIVALENT.
2. 6" FRAME AND COVER SHALL BE NEENAH FOUNDRY MODEL No. R-3405 OR APPROVED EQUIVALENT.

TYPICAL CATCH BASIN

(NOT TO SCALE)

LEVEL SPREADER NOTES:

1. IT IS CRITICAL FOR THE CURB TO BE SET LEVEL ACROSS ITS ENTIRE LENGTH TO ENSURE PROPER LEVEL SPREADER FUNCTION.
2. MAXIMUM ALLOWABLE TOLERANCE FOR LEVELING CURB IS <0.25".
3. PRECAST CURB IS A SUITABLE SUBSTITUTE FOR GRANITE CURB.
4. CURB JOINTS SHALL BE MORTARED TO CREATE A SMOOTH TRANSITION BETWEEN SECTIONS. MAXIMUM SECTION LENGTHS SHALL BE USED TO MINIMIZE JOINTS.
5. ALL EXPOSED SOIL AREAS SHALL BE REINFORCEMENT WITH AN EROSION CONTROL BLANKET (JUTE MESH) OR EQUIVALENT. SEED SHALL BE APPLIED AT A RATE OF 4 LBS PER 1000 SF AND SHALL INCLUDE A MAJORITY OF PERENNIAL RYE FOR QUICK GERMINATION TIMES.



LEVEL SPREADER

NOT TO SCALE

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

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CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U

DATE: ______________

APPROVED BY:

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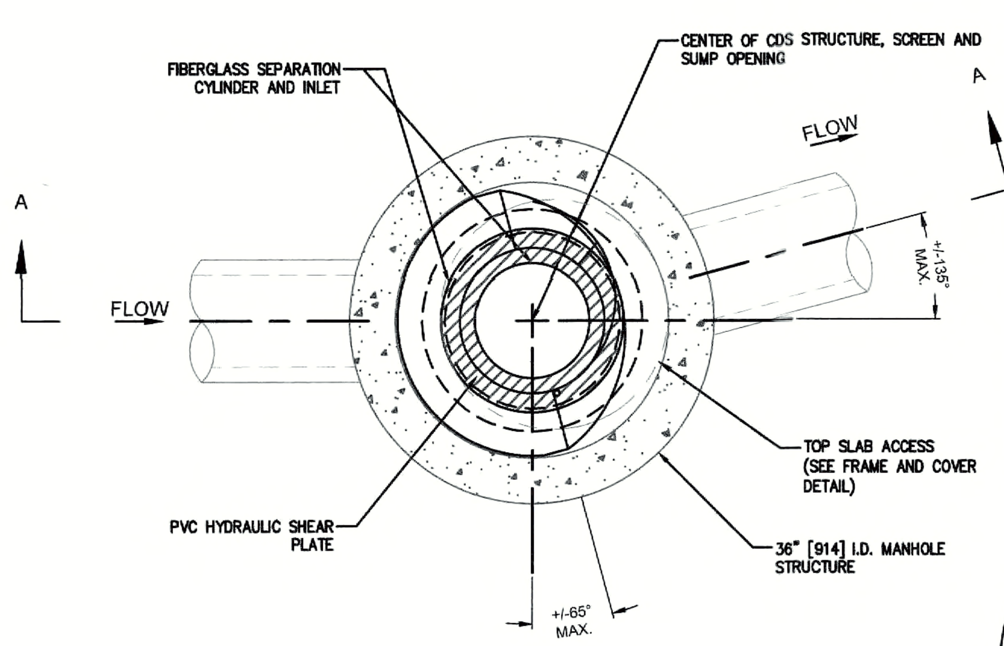
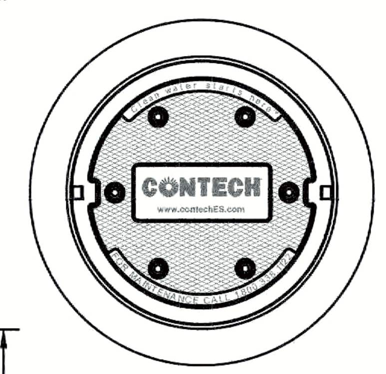


PLAN VIEW B-B

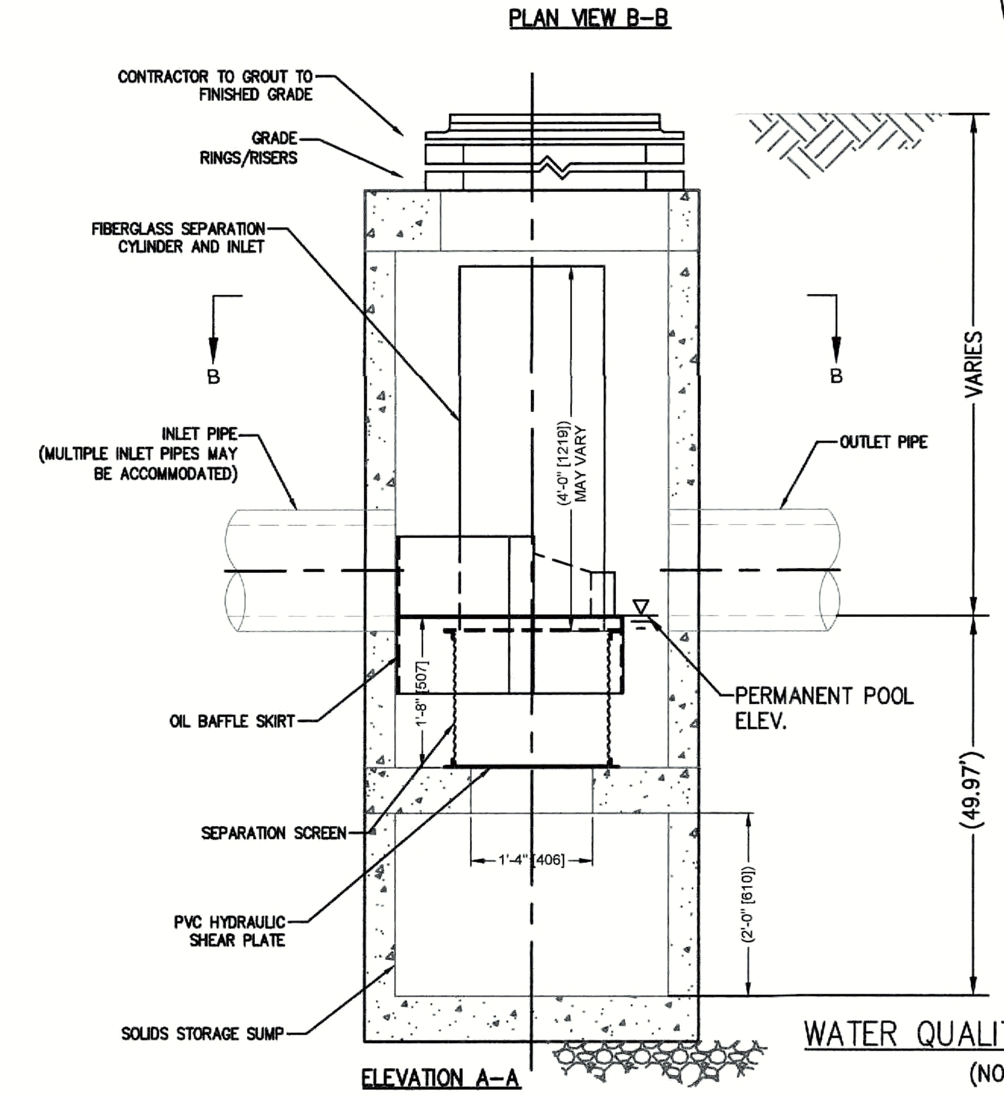
GENERAL NOTE:

DURING CONSTRUCTION, TO AVOID COMPACTION OF THE PARENT MATERIAL, WORK FROM THE EDGE OF THE AREA PROPOSED AS THE LOCATION OF AN EXFILTRATING RAIN GARDENS/INFILTRATION BASIN. NEVER DIRECT RUNOFF TO THE BASIN/GARDEN UNTIL THE BASIN/GARDEN AND THE CONTRIBUTING DRAINAGE AREAS ARE FULLY STABILIZED.



FRAME AND COVER

(DIAMETER VARIES)

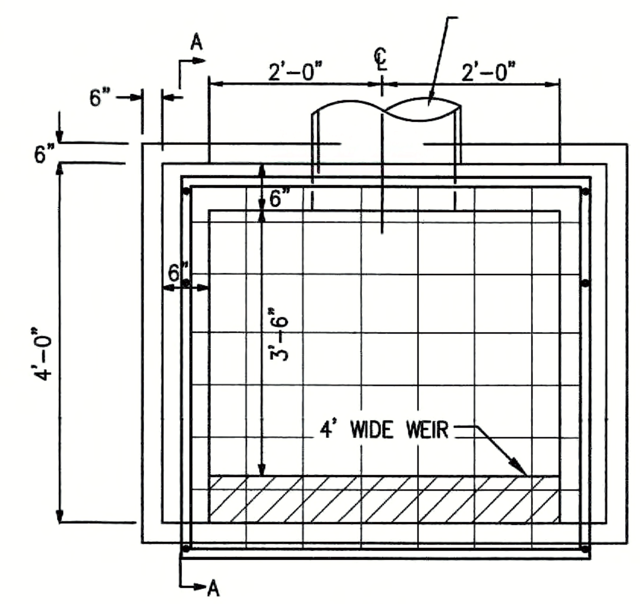


ELEVATION A-A

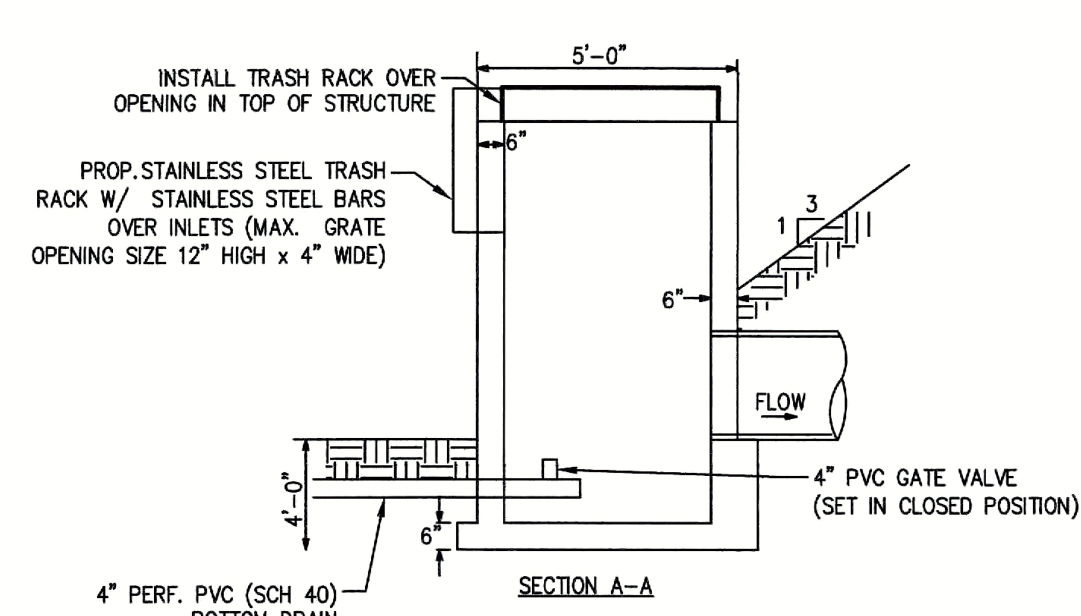
SEE DRAIN PIPE SCHEDULE ON PAGE C5.0 (GRADING & DRAINAGE PLAN) FOR INVERTS INFORMATION

WATER QUALITY UNIT 2 (WQU-2)

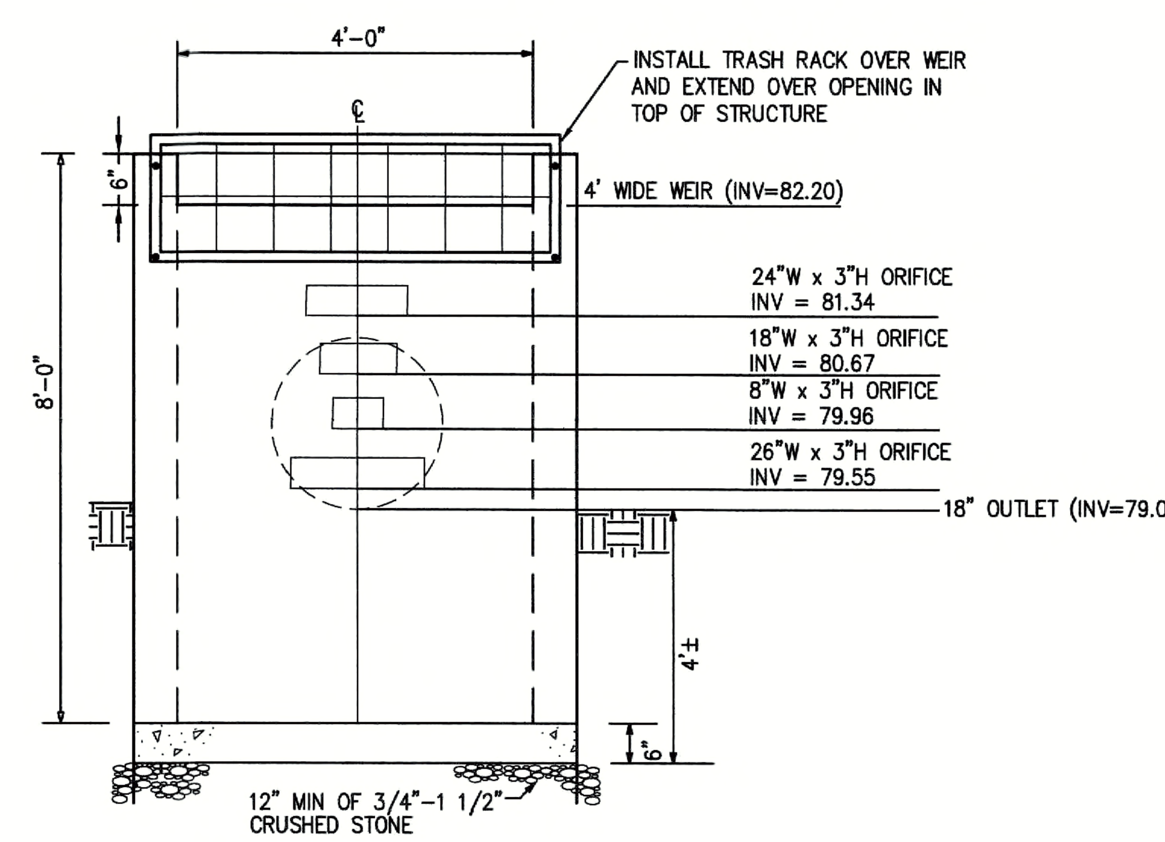
(NOT TO SCALE)



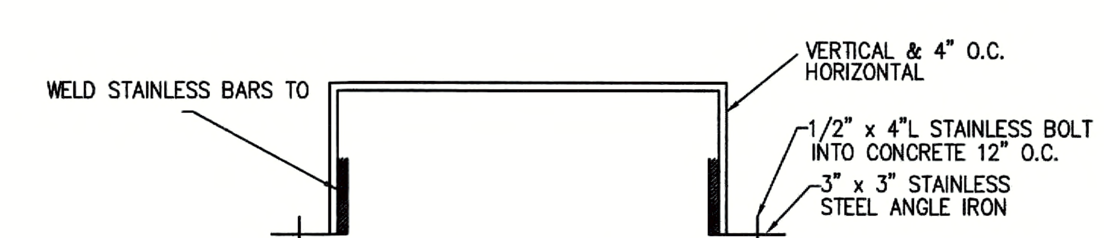
PLAN



SECTION A-A



FRONT ELEVATION



TRASH RACK DETAIL

OUTLET CONTROL STRUCTURE (OCS-1)

(NOT TO SCALE)

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:

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DRAINAGE DETAILS

DRAWING NO. C-12

DRAWING: 3634 MAIN.dwg

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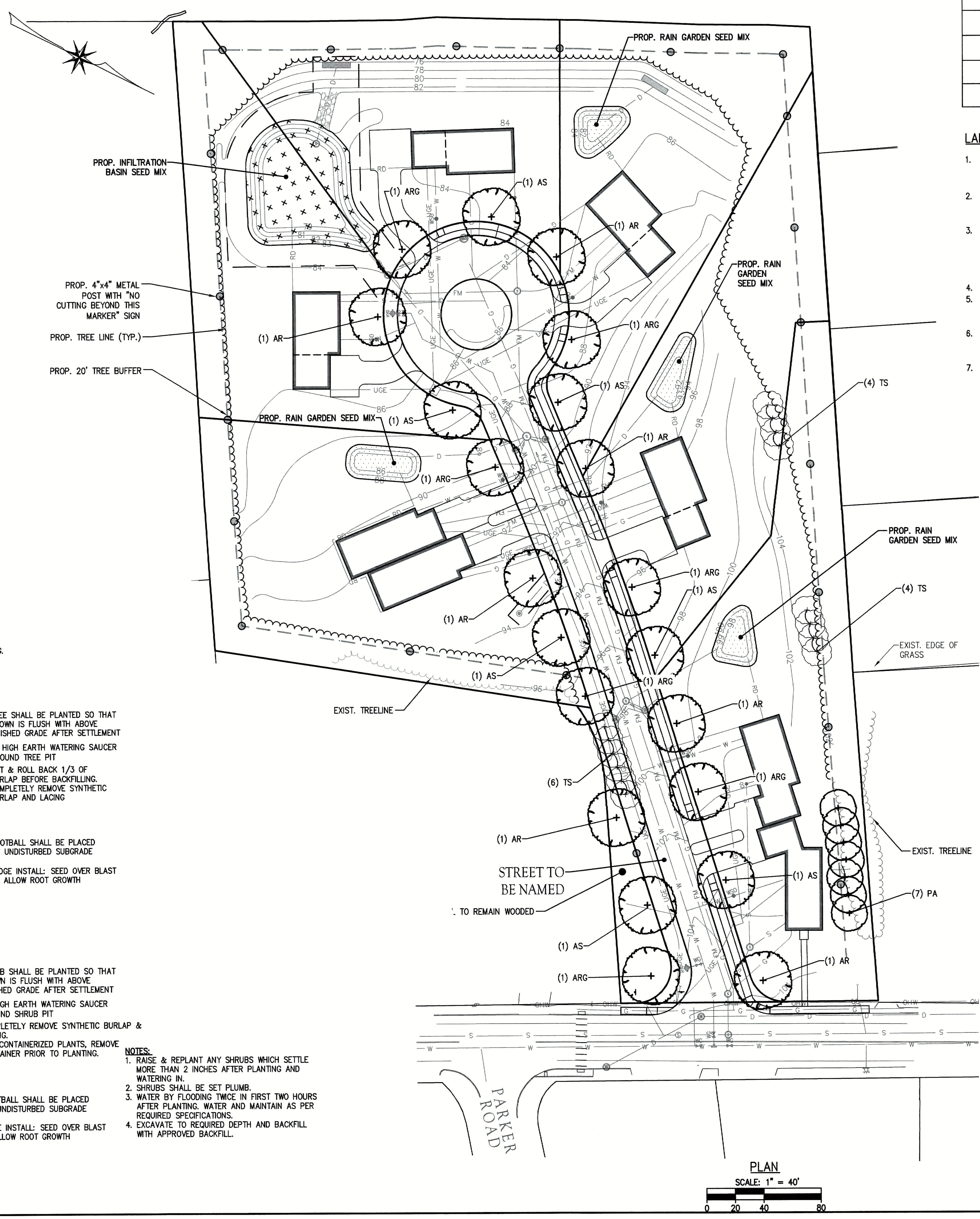
DATE

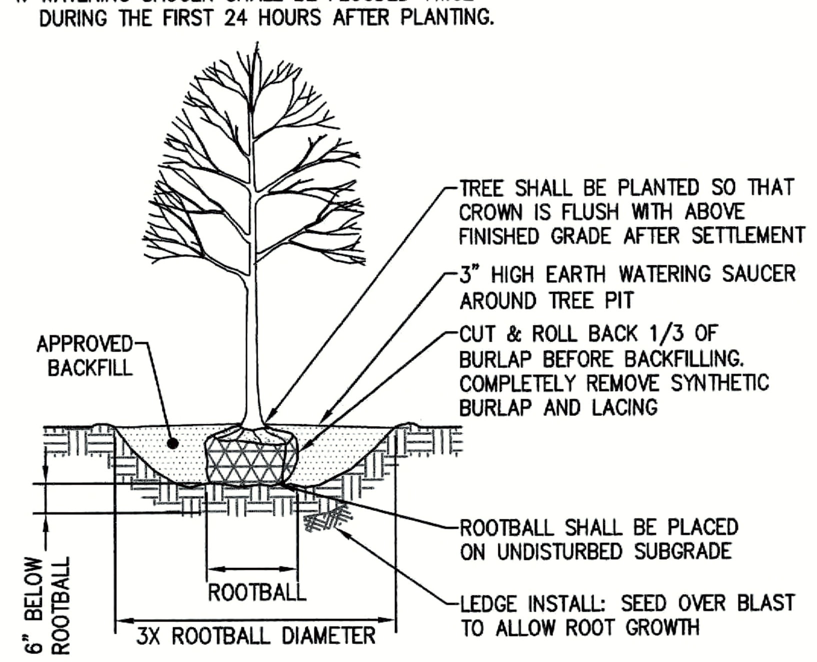


PLAN

SCALE: 1" = 40'

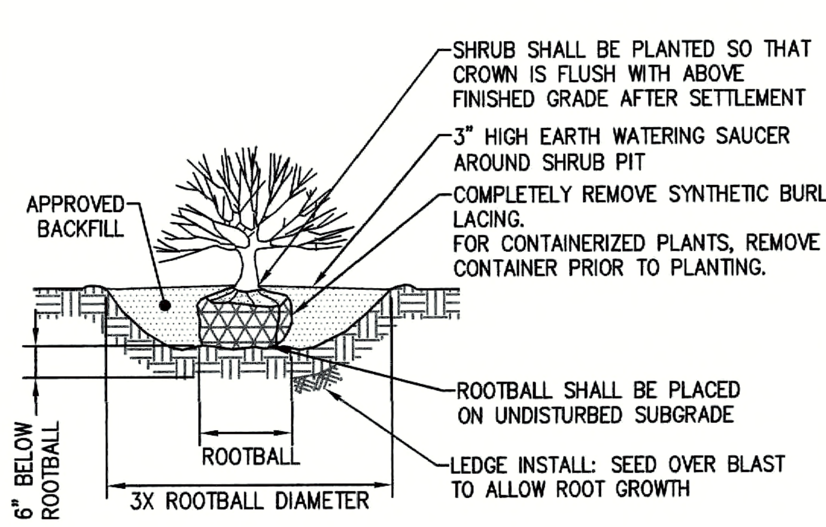
0 20 40 80

NOTES:
1. DO NOT CUT LEADER.
2. TREE WRAP SHALL NOT BE USED.
3. TREE SHALL BE SET PLUMB.
4. WATERING SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.



TREE PLANTING

(NOT TO SCALE)



SHRUB PLANTING

(NOT TO SCALE)

NOTES:
1. RAISE & REPLANT ANY SHRUBS WHICH SETTLE MORE THAN 2 INCHES AFTER PLANTING AND WATERING IN.
2. SHRUBS SHALL BE SET PLUMB.
3. WATER BY FLOODING TWICE IN FIRST TWO HOURS AFTER PLANTING. WATER AND MAINTAIN AS PER REQUIRED SPECIFICATIONS.
4. EXCAVATE TO REQUIRED DEPTH AND BACKFILL WITH APPROVED BACKFILL.

DRAWING: 3634 MAIN.dwg

PLANT SCHEDULE

ABBREVIATION	COMMON NAME	SCIENTIFIC NAME	SIZE	SPACING	QUANTITY
TREES					
AR	RED SUNSET MAPLE	*Acer rubrum*	12' HEIGHT/3" CALIPER MIN.	50'/AS SHOWN	7
ARG	OCTOBER GLORY	*Acer rubrum*	12' HEIGHT/3" CALIPER MIN.	50'/AS SHOWN	7
AS	SUGAR MAPLE	*Acer saccharum*	12' HEIGHT/3" CALIPER MIN.	50'/AS SHOWN	7
PA	NORWAY SPRUCE	*Picea abies*	15' HEIGHT/ 3" CALIPER MIN.	13'/AS SHOWN	7
TS	GREEN GIANT	*Thuja standishii*	15' HEIGHT/ 3" CALIPER MIN.	10'/AS SHOWN	14

LANDSCAPING NOTES:

1. LANDSCAPE DESIGN BY JARRET BASTYS, E.I.T., B.S.EnvE (ENVIRONMENTAL ENGINEERING & LANDSCAPE ARCHITECTURE).
2. WHERE DISCREPANCIES OCCUR BETWEEN DRAWING AND PLANT NOTES OR SCHEDULE, DRAWINGS SHALL SUPERCEDE.
3. PLANTS SHALL BE TRUE TO SPECIES AND VARIETY SPECIFIED AND NURSERY GROWN IN ACCORDANCE WITH THE AMERICAN STANDARD FOR NURSERY STOCK UNDER CLIMATIC CONDITIONS SIMILAR THOSE IN THE LOCALITY OF THE PROGRAM.
4. WATER ALL PLANTS IMMEDIATELY AFTER PLANTING.
5. CONTRACTOR TO MAINTAIN POSITIVE DRAINAGE AWAY FROM BUILDING FOUNDATIONS, STRUCTURES AND PLANTING BEDS.
6. PLANTS SHALL HAVE THE SAME RELATIONSHIP TO FINISHED GRADE AS ORIGINAL GRADES BEFORE INSTALLATION.
7. PLANT MATERIALS AND TRANSPLANTING SHALL BE DONE IN ACCORDANCE WITH THE AMERICAN STANDARD OF NURSERY STOCK.
8. ALL LANDSCAPED AREAS WITH SHRUBS AND TREES HAVE A MINIMUM OF 2' OF TOPSOIL. USE OF PEAT MOSS IS PROHIBITED.
9. ALL LAWN AREAS HAVE A MINIMUM OF 6" OF TOPSOIL. USE OF PEAT MOSS IS PROHIBITED
10. ALL EXPOSED BURLAP, WIRE BASKETS, AND OTHER MATERIALS ATTACHED TO THE PLANTS SHALL BE REMOVE PRIOR TO PLANTING. CARE SHALL BE TAKEN NOT TO DISTURB THE ROOT BALL OF PALATES.
11. NO IRRIGATION SYSTEM FOR THE RIGHT-OF-WAY IS PROPOSED.
12. ALL PROPOSED PLANT SPECIES ARE NATIVE TO THIS REGION.
13. EXACT PLANT PLACEMENT SHALL BE COORDINATED WITH FINAL LOT DESIGN. ADJUSTMENTS MAY BE NECESSARY BASED ON FINAL DRIVEWAY LOCATION OR UTILITY DESIGN.
14. ALL WORK AND MATERIALS SHALL COMPLY WITH THE TOWN OF GROVELAND SUBDIVISION REGULATIONS §70-4.14 & §70-5.12.

ERNST SEEDS

Ernst Conservation Seeds
8884 Mercer Pike
Meadville, PA 16335
(800) 873-3321 Fax (814) 336-5191
www.ernstseed.com

Date: October 22, 2024

Retention Basin Floor Mix - Low Maintenance - ERNMX-126

	Botanical Name	Common Name
20.00 %	*Panicum clandestinum, Tioga*	Deertongue, Tioga
20.00 %	*Puccinellia distans, Fults*	Alkaligrass, Fults
18.00 %	*Elymus virginicus, Madison-NY Ecotype*	Virginia Wildrye, Madison-NY Ecotype
15.00 %	*Agrostis stolonifera, 'Penncross'*	Creeping Bentgrass, 'Penncross'
15.00 %	*Poa palustris*	Fowl Bluegrass
10.00 %	*Carex vulpinoidea, PA Ecotype*	Fox Sedge, PA Ecotype
1.00 %	*Carex scoparia, PA Ecotype*	Blunt Broom Sedge, PA Ecotype
1.00 %	*Juncus effusus*	Soft Rush
100.00 %		

Seeding Rate: 20-40 lbs per acre, or 0.5-1 lb/1,000 sq ft with a cover crop. For a cover crop use one of the following: grain rye (1 Sep to 30 Apr; 30 lbs/acre), Japanese millet (1 May to 31 Aug; 10 lbs/acre), or barnyard grass (1 May to 31 Aug; 10 lbs/acre).

Grasses & Grass-like Species - Herbaceous Perennial; Stormwater Management

The hardy inexpensive grass and grass-like species are ideal for retention basins that may have high salt inflows and where mowing may be required. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

INFILTRATION BASIN SEED MIX

Rain Garden Mix - ERNMX-180

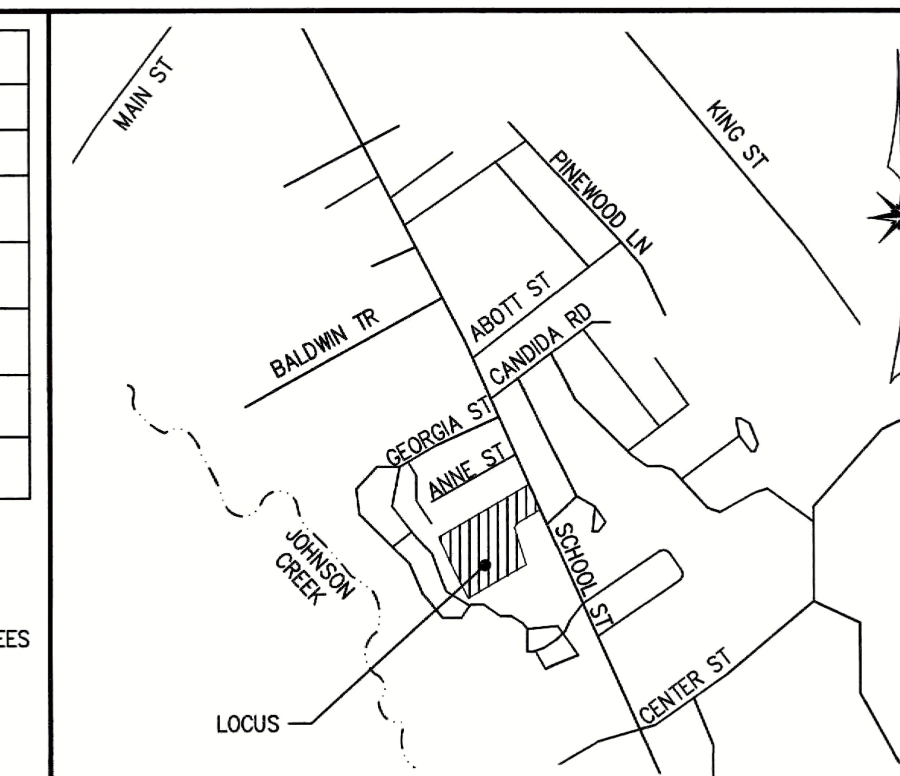
	Botanical Name	Common Name
29.50 %	*Schizachyrium scoparium, Fort Indiantown Gap-PA Ecotype*	Little Bluestem, Fort Indiantown Gap-PA Ecotype
20.00 %	*Elymus virginicus, Madison-NY Ecotype*	Virginia Wildrye, Madison-NY Ecotype
9.00 %	*Carex vulpinoidea, PA Ecotype*	Fox Sedge, PA Ecotype
8.00 %	*Echinacea purpurea*	Purple Coneflower
5.80 %	*Panicum rigidulum, PA Ecotype*	Redtop Panicgrass, PA Ecotype
5.30 %	*Chasmanthium latifolium, WV Ecotype*	River Oats, WV Ecotype
3.00 %	*Coreopsis lanceolata*	Lanceleaf Coreopsis
3.00 %	*Rudbeckia hirta*	Blackeyed Susan
2.50 %	*Verbena hastata, PA Ecotype*	Blue Vervain, PA Ecotype
2.00 %	*Panicum clandestinum, Tioga*	Deertongue, Tioga
1.80 %	*Heliopsis helianthoides, PA Ecotype*	Oxeye Sunflower, PA Ecotype
1.50 %	*Asclepias incarnata, PA Ecotype*	Swamp Milkweed, PA Ecotype
1.30 %	*Penstemon digitalis, PA Ecotype*	Tall White Beardtongue, PA Ecotype
1.00 %	*Carex scoparia, PA Ecotype*	Blunt Broom Sedge, PA Ecotype
1.00 %	*Senna hebecarpa, VA & WV Ecotype*	Wild Senna, VA & WV Ecotype
1.00 %	*Zizia aurea, PA Ecotype*	Golden Alexanders, PA Ecotype
0.50 %	*Baptisia australis, Southern WV Ecotype*	Blue False Indigo, Southern WV Ecotype
0.50 %	*Juncus effusus*	Soft Rush
0.50 %	*Juncus tenuis, PA Ecotype*	Path Rush, PA Ecotype
0.50 %	*Pycnanthemum tenuifolium*	Narrowleaf Mountainmint
0.50 %	*Vernonia noveboracensis, PA Ecotype*	New York Ironweed, PA Ecotype
0.40 %	*Aster novae-angliae, PA Ecotype*	New England Aster, PA Ecotype
0.40 %	*Monarda fistulosa, Fort Indiantown Gap-PA Ecotype*	Wild Bergamot, Fort Indiantown Gap-PA Ecotype
0.20 %	*Aster prenanthoides, PA Ecotype*	Zigzag Aster, PA Ecotype
0.10 %	*Aster lanceolatus*	Lance Leaved Aster
0.10 %	*Aster lateriflorus*	Calico Aster
0.10 %	*Aster pilosus, PA Ecotype*	Heath Aster, PA Ecotype
0.10 %	*Eupatorium perfoliatum, PA Ecotype*	Boneset, PA Ecotype
0.10 %	*Mimulus ringens, PA Ecotype*	Square Stemmed Monkeyflower, PA Ecotype
0.10 %	*Solidago juncea, PA Ecotype*	Early Goldenrod, PA Ecotype
0.10 %	*Solidago nemoralis, PA Ecotype*	Gray Goldenrod, PA Ecotype
0.10 %	*Solidago rugosa, PA Ecotype*	Wrinkleleaf Goldenrod, PA Ecotype
100.00 %		

Seeding Rate: 20 lb per acre with a cover crop. For sites that drain within 24 hours of a rain event use one of the following cover crops:Oats (1 Jan to 31 Jul; 30 lbs/acre), Japanese Millet (1 May to 31 Aug; 10 lbs/acre), or grain rye (1 Aug to 31 Dec; 30 lbs/acre).

Grasses & Grass-like Species - Herbaceous Perennial; Herbaceous Flowering Species - Herbaceous Perennial; Stormwater Management; Uplands & Meadows

The native perennial forbs and grasses provide food and cover for rain garden biodiversity. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

RAIN GARDEN SEED MIX



LOCUS MAP

SCALE: 1" = 1000'

TOWN OF GROVELAND OFFICE OF THE TOWN CLERK

THIS IS TO CERTIFY THAT ON ______________ I RECEIVED FROM THE GROVELAND PLANNING BOARD CERTICATION OF TIS APPROVAL OF THIS PLAN AND THAT DURING THE TWENTY (20) DAYS NEXT FOLLWOGIN I HAVE RECEIVED NO NOTICE OF ANY APPEAL FROM SAID DECISION.

CLERK DATE

APPROVED UNDER SUBDIVISION CONTROL LAW M.G.L. CHAPT. 141 SEC. 81U

DATE: ______________

APPROVED BY:

APPROVED __________, __________ SUBJECT TO TERMS AND CONDITIONS STATED IN A MEMORANDUM OF DECISION DATED __________, __________ BETWEEN THE GROVELAND PLANNING BOARD, ON BEHALF OF THE TOWN OF GROVELAND, ________ _____. A COPY OF WHICH DECISION IS RECORDED HEREWITH AND SUBJECT ALSO TO RECORDING OF THIS PLAN AND SAID DECISION IN THE SOUTH ESSEX REGISTRY OF DEED ON OR BEFORE __________, __________. SUBJECT TO TERMS AND CONDITIONS OF A COVENANT DATED __________, __________. __________, __________ GROVELAND PLANNING BOARD.

DEFINITIVE SUBDIVISION
FOR A
STREET TO BE NAMED
IN
GROVELAND, MASSACHUSETTS
AT
181R SCHOOL STREET
(GROVELAND ASSESSOR'S MAP 34 LOT 13)

PREPARED FOR/APPLICANT:
GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MA 01845

OWNER:
181R SCHOOL STREET, LLC
5 ATKINSON FARM ROAD
ATKINSON, NH 03811

JULY 31, 2024

The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
25 KENOZA AVENUE, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

LANDSCAPE PLAN

DRAWING NO. L-1

TECHNICAL REPORT

181R SCHOOL STREET

GROVELAND, MASSACHUSETTS

JULY 31, 2024

REVISED ON NOVEMBER 5, 2024

<u>SUBMITTED TO:</u>

TOWN OF GROVELAND
PLANNING BOARD
183 MAIN STREET
GROVELAND, MA 01834

<u>APPLICANT:</u>

GROVELAND REDEVELOPMENT, LLC
231 SUTTON STREET, SUITE 1B
NORTH ANDOVER, MASSACHUSETTS, 01845

COMMONWEALTH OF MASSACHUSETTS
SCOTT P. CAMERON
CIVIL
No. 47601
REGISTERED
PROFESSIONAL ENGINEER

11/5/24

NARRATIVE

Table of Contents

TECHNICAL REPORT NARRATIVE
181R School Street Subdivision

I. Executive Summary

Groveland Redevelopment, LLC, the 'applicant,' proposes to develop the property located at 181R School Street in Groveland, Massachusetts ("site") to a six (6) lot subdivision with frontage on a new road. A preliminary subdivision plan entitled "Preliminary Subdivision for a Street to be Named in Groveland, Massachusetts at 181R School Street" dated March 2, 2023, was previously submitted to the Town of Groveland, and denied by the Planning Board on April 19, 2023. Comments from that process included notably concerns with the shape of the lots, insufficient buffering around the development and how stormwater would be managed. These comments were taken into consideration in the project design.

The project was designed for six (6) lots meeting the new Zoning Regulations for lot shape which makes all of the lots more regular in shape. Two (2) lots are large enough to accommodate a 2-family dwelling for a maximum number of eight (8) dwellings. The lots were engineered using conservative assumptions for house footprints, driveways and clearing limits to account for the impacts of the full buildout of the project. Stormwater management is addressed on site and fully complies with applicable Groveland stormwater regulations and the MassDEP Stormwater Management Handbook. The stormwater design will be discussed in more detail later in this report. In addition to the lot designs, the road was engineered in compliance with the Groveland Subdivision Regulations.

The road consists of a 575-foot-long road ending in a cul-de-sac. The design meets the geometric requirements and specifications for road construction per the Groveland Subdivision Regulations. A waiver has been requested to reduce the road-to-road intersection distance from 400-feet to 300-feet which is consistent with the neighborhood. Another waiver has been requested to provide permeable pavement for the sidewalks and driveways which is a best practice in keeping with sustainable design that will be required for the house construction under the current Massachusetts Building code. The waivers will be discussed later in this report. The road includes a sidewalk along one side and street trees per the Regulations.

The following report, supporting documents and definitive subdivision plans document how the project complies with Groveland regulations and bylaws, state regulations and best engineering and construction practices.

II. Existing Site Description

The site consists of a total land area of 245,945 square feet (5.65± acres) and is shown on the Town of Groveland Assessor's Map 34, Lot 13. It is situated in the Residential (R-2) District and the Aquifer Protection District (Zone III). The site is bounded to the east by School Street (Route 97), to the West by the Whitestone Village residential development and to the South by a developed single-family residence and to the north by a developed single-family. Refer to Figure 1: Ortho Map and Figure 2: USGS Locus Map for illustrations of the site and surrounding features.

The site can generally be described as undeveloped with most of it being wooded and a small portion near school street that is cleared, but overgrown. Topography on the site varies, with slopes ranging from 4% to 12%. The site has a high elevation of approximately 104.5 near School

Street and low elevation of approximately 72.0 along the rear/western side of the site. Soils on site are mapped as Canton fine sandy loam (420B, 420C & 421C) and Sutton Fine Sandy Loam (410C) according to the Natural Resources Conservation Service (NRCS). In situ soil testing performed on July 2, 2024, confirmed the soils throughout the site. The underlying parent soils are well drained loamy sands and sand. No refusal or estimated seasonal high-water table was encountered. See Figure 3: SCS Soils Map for an illustration of the soil types.

The applicant previously applied for a Request for Determination of Applicability (RDA) with the Conservation Commission for confirmation that there are no wetlands or buffer zones located on the property. The Conservation Commission issued a negative determination confirming this.

The entire site is shown to be within Zone X on the FEMA Federal Insurance Rate Map (FIRM) # 25009C0232F, dated June 03, 2012 (See Figure 4: FEMA Flood Map).

III. Proposed Site Description

The applicant proposes to divide the lot into six (6) residential lots, an unbuildable parcel, and the roadway. Two (2) of the lots are large enough to accommodate a2-family dwelling for a maximum of eight (8) dwelling units on the site. The proposed road will intersect with School Street and will be approximately 575 feet in length, as measured from School Street curb cut to the end of the proposed cul-de-sac. The road will be 24 feet wide, with planting strips, curb and a sidewalk situated within a 50 feet wide right-of-way. The development of the road will include street trees, stormwater management system and new water, sanitary sewer, electric, communications and natural gas.

The development on the individual lots will occur after the road is improved to a condition suitable to access them and will comply to the Town of Groveland Zoning Bylaw.

An 8" water main will be extended from School Street along the road. Two (2) fire hydrants will be constructed along the new road. A sewer main will be extended into the property, to receive wastewater from private ejector pumps that are necessary to lift the wastewater from the lots to School Street, which is higher in elevation. Electric, gas and individual communications will be underground and will be coordinated with their respective service providers. Closed drainage catch basins, manholes and pipes will convey runoff from the road and lots to a stormwater management system. The measures to be implemented at the site include two infiltration basins, four rain gardens, hydrodynamic separators from Contech (Refer to the Grading & Drainage Plan and associated construction details for more information). The stormwater flow will be treated and infiltrated within the property. The existing watershed characteristics, flow paths and drainage patterns were matched to the extent practicable in the proposed condition to demonstrate that there are no adverse impacts to adjacent properties.

The project will require Definitive Subdivision Approval and a Stormwater and Land Disturbance Permit by the Groveland Planning Board. As part of the project permitting, the proponent must demonstrate compliance with applicable stormwater best management practices and regulations. The following narrative contains a description of existing and proposed site conditions, stormwater management design methodology, result summaries and other supplemental information in support of the stormwater best management system design.

IV. Stormwater Management

A. Existing Watershed Characteristics

Stormwater runoff at the site in the existing condition flows to five (5) distinct location. Design Point 1 (DP1) is the public drainage system on School Street. Design Point 2 (DP2) is the southeastern abutting property, Design Points 3 and 4 (DP3 & DP4) are the southern abutting properties, and Design Point (5) is the eastern abutting property. The design point and the tributary watersheds (or subcatchments) are illustrated on Figure 5: Existing Site Development Watershed Plan, included herein. The table below lists the total area associated with the subcatchment area.

Summary of Existing Subcatchments

Existing Drainage Area (E)	Total Area (SF)	% Impervious	Composite Curve Number
ES-1	4,887	0.00	61
ES-2	96,774	2.02	57
ES-3	160,264	0.63	57
ES-4	33,665	0.00	55
ES-5	10,871	0.00	57
Total	**306,461 (7.04 acres)**	**0.97%**	**57**

Description of Existing Subcatchments

The subcatchments analyzed in the existing condition can be described as follows:

- **Subcatchment ES1:** Consists of a small portion of the property frontage, it comprises of lawn only. This area flows to School Street and towards to the public drainage system.
- **Subcatchment ES2:** Consists of the eastern portion of the site and the abutting property located at 181 School St. It includes roof, lawn, pavement, and woods.
- **Subcatchment ES3:** Consists of the central portion of the property, it comprises wood, lawn and roofs. This area flows towards the southern abutting property.
- **Subcatchment ES4:** Consists of the southwestern portion of the property, it comprises only wood. This area flows towards the abutting property southern of the site.
- **Subcatchment ES5:** Consists of a small portion on the northern side of the property, it includes lawn and wood. This area flows towards the abutting properties on the north side of the site.

B. Proposed Watershed Characteristics

The proposed development of the site will maintain the design points identified in the existing watershed analysis. To understand and analyze the proposed development, smaller subcatchments were delineated to analyze stormwater impacts on more detailed scale. The table below provides the total drainage area and the percentage that will be impervious in the post-development condition. The design points and the tributary watersheds (or subcatchments) are illustrated on Figure 6 – Proposed Watershed Plan.

Summary of Proposed Subcatchments:

Proposed Drainage Area	Total Area (SF)	% Impervious	Composite Curve Number
PS-1	3,438	13.35	66
PS-2	66,550	2.93	59
PS-3	17,043	0.00	59
PS-4	24,213	0.00	56
PS-5	7,933	0.00	56
PS-N1	130,464	37.61	75
PS-N2	18,062	25.00	70
PS-N5	14,263	25.00	70
PS-N6	14,010	25.00	70
PS-7	10,485	25.00	70
TOTALS	**306,461 (7.03 acres)**	**21.43%**	**67**

Description of Proposed Subcatchments

- **Subcatchment PS-1:** Includes a small portion of the frontage of lot 6 on School Street, includes landscape and a small area of the proposed road. The runoff from this area is di-minimus and flows towards School Street.
- **Subcatchment PS-2:** Includes the south and southern portion of the lot, it comprises the abutting property located at 181 School St, which contains buildings, pavement, woods, and landscape, it also comprises the undisturbed woods from the site, and new landscape. The runoff from this area will sheet flow through the site and discharge to DP2 on the southern abutting property.
- **Subcatchment PS-3:** Includes the southwestern portion of the site, it comprises of undisturbed woods and landscaped area. The runoff from this subcatchment sheet flows towards the southwestern abutting property (DP3).
- **Subcatchment PS-4:** Consists of the western portion of the site, it comprises undisturbed woods and a small, landscaped area. The runoff from this area flows towards the western abutting property.
- **Subcatchment PS-5:** Consists of the northern portion of the site, it comprises undisturbed woods and a small, landscaped area. The runoff from this rea flows towards the northern abutting properties.
- **Subcatchment PS-N1:** Consists of portion of proposed road, the front lawn of lots 1, 4, 5 and 6, majority of lots 2 and 3, and existing abutting property (181 School St). The runoff from this area sheet flows from the high towards the proposed infiltration basin (P1), and also sheet flows to a proposed catch basin, then through a water quality unit prior to entering the proposed infiltration basin (P1).
- **Subcatchment PS-N2:** Consists of the roof and some landscaped area of proposed Lot 2. The runoff from this area flows towards the proposed rain garden (P2) on lot 2.
- **Subcatchment PS-N5:** Consists of the roof and some landscaped area of proposed Lot 6. The runoff from this area flows towards the proposed rain garden (P5) on lot 6.
- **Subcatchment PS-N6:** Consists of the roof and some landscaped area of proposed Lot 5. The runoff from this area flows towards the proposed rain garden (P6) on lot 5.
- **Subcatchment PS-7:** Consists of the roof and some landscaped area of proposed Lot 7. The runoff from this area flows towards the proposed rain garden (P7) on lot 7.

100-yr	Outflow	0.4	0.3	-0.1

DP2 Peak Discharge Rates (CFS)				
Storm Event		**Existing Conditions**	**Proposed Conditions**	**Change in Peak**
2-yr	Outflow	0.4	0.3	-0.1
10-yr	Outflow	2.9	1.9	-1.0
25-yr	Outflow	4.9	3.1	-1.8
100-yr	Outflow	8.4	5.2	-3.2

DP3 Peak Discharge Rates (CFS)				
Storm Event		**Existing Conditions**	**Proposed Conditions**	**Change in Peak**
2-yr	Outflow	0.4	0.4	0
10-yr	Outflow	3.3	3.2	-0.1
25-yr	Outflow	5.7	5.6	-0.1
100-yr	Outflow	9.9	9.7	-0.2

DP4 Peak Discharge Rates (CFS)				
Storm Event		**Existing Conditions**	**Proposed Conditions**	**Change in Peak**
2-yr	Outflow	0	0	0
10-yr	Outflow	0.5	0.5	0
25-yr	Outflow	1	0.9	-0.1
100-yr	Outflow	1.8	1.7	-0.1

DP5 Peak Discharge Rates (CFS)				
Storm Event		**Existing Conditions**	**Proposed Conditions**	**Change in Peak**
2-yr	Outflow	0	0	0
10-yr	Outflow	0.2	0.1	-0.1
25-yr	Outflow	0.3	0.2	-0.1
100-yr	Outflow	0.5	0.3	-0.2

DP1 Volume (CF)				
Storm Event		**Existing Conditions**	**Proposed Conditions**	**Change in Volume**
2-yr	Outflow	188	190	2
10-yr	Outflow	587	519	-68
25-yr	Outflow	900	763	-137

100-yr	Outflow	1437	1174	-263

DP2 Volume (CF)				
Storm Event		Existing Conditions	Proposed Conditions	Change in Volume
2-yr	Outflow	2606	2157	-449
10-yr	Outflow	9428	7226	-2202
25-yr	Outflow	15008	11275	-3733
100-yr	Outflow	28844	18322	-10522

DP3 Volume (CF)				
Storm Event		Existing Conditions	Proposed Conditions	Change in Volume
2-yr	Outflow	4316	959	-3357
10-yr	Outflow	15613	10205	-5408
25-yr	Outflow	24855	18664	-6191
100-yr	Outflow	41143	34419	-6724

DP4 Volume (CF)				
Storm Event		Existing Conditions	Proposed Conditions	Change in Volume
2-yr	Outflow	737	590	-147
10-yr	Outflow	2919	2719	-200
25-yr	Outflow	4750	4613	-137
100-yr	Outflow	8022	8061	39

DP5 Volume (CF)				
Storm Event		Existing Conditions	Proposed Conditions	Change in Volume
2-yr	Outflow	293	193	-100
10-yr	Outflow	1059	730	-329
25-yr	Outflow	1686	1174	-512
100-yr	Outflow	2791	1963	-828

D. Review of Stormwater Management Standards

The project is considered a new development and therefore must fully comply with the stormwater regulations. The proposed drainage system has been designed to attenuate peak rates of stormwater runoff and volume for all storm events up to and including the 100-year event. Measures will be implemented to provide the required 90% total suspended solids (TSS) removal and 60% total phosphorous (TP) removal, to ensure stormwater runoff is renovated prior to discharge. The following is an assessment of each Standard as it relates to the proposed subdivision development:

1. No stormwater conveyance system discharges untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

   The project meets this standard. All stormwater runoff from the impervious areas on site will receive at least 90% Total Suspended Solids removal and 60 to 70% phosphorous treatment prior to discharge.

2. The stormwater management system shall be designed such that post-development peak rates of stormwater runoff do not exceed pre-development rates for the 2- and 10-year storm events.

   The project meets this standard. Two infiltration basins and 4 rain gardens will be implemented to promote groundwater recharge and to mitigate the post development rate of runoff and volume prior to discharging to the design points.

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 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 project meets this standard. Groundwater will be recharged within the proposed infiltration basins and rain gardens. See "Appendix D - Stormwater Calculations" attached herewith.

4. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

   The project meets this standard. All stormwater runoff from paved areas of the site will pass through a treatment train consisting of catch basins, proprietary pretreatment CDS units and infiltration basins.

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

   This standard is not applicable.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural

stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Management handbook.

This standard is not applicable.

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 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.

This standard is not applicable.

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).

The project meets this standard. Refer to "Appendix E - Construction Phase Best Management Practices" prepared by The Morin-Cameron Group, Inc., dated July 31, 2024. A SWPPP will be submitted prior to the beginning of the construction.

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

The project meets this standard. Refer to "Appendix F - Long-Term Best Management Practices Operation and Maintenance Plan prepared by The Morin-Cameron Group, Inc., dated July 31, 2024.

10. There shall be no new illicit discharges created as a result of the project.

The project meets this standard. To the best of our knowledge and belief there are no illicit discharges being created as a result of the proposed project. An illicit discharge statement is included herein.

V. Conclusion

The proposed definitive subdivision has been carefully designed, with input from the public, to comply with applicable regulations and following best engineering and construction practices. The housing type and variety fits with the surrounding neighborhood. The two-family dwellings offer a more economically accessible housing option for young families. The project will generate more tax revenue for the town than the current, undeveloped condition. Finally, best stormwater management practices were implemented throughout the project to meet and exceed current standards for stormwater design to ensure that there are no impacts to abutting properties or the environment.

FIGURES

THE MORIN-CAMERON GROUP, INC.

66 ELM STREET, DANVERS, MA 01923

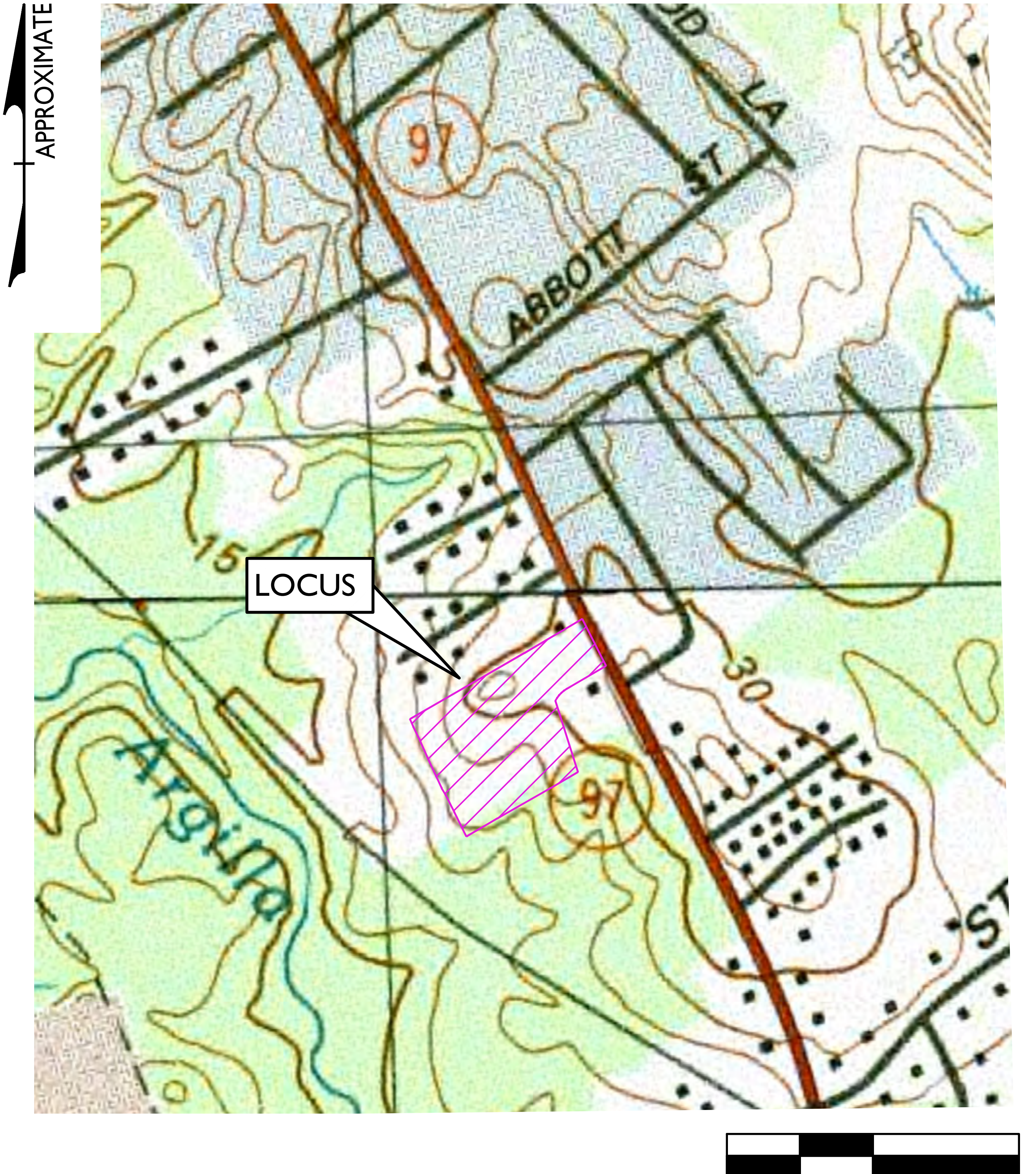
P: **978-777-8586**

WWW.MORINCAMERON.COM

ORTHO MAP

181R SCHOOL STREET
IN
GROVELAND, MA

DATE: JULY 31, 2024	Scale: 1" = 300'	**FIGURE #1**



THE MORIN-CAMERON GROUP, INC.
66 ELM STREET, DANVERS, MA 01923
P: **978-777-8586**
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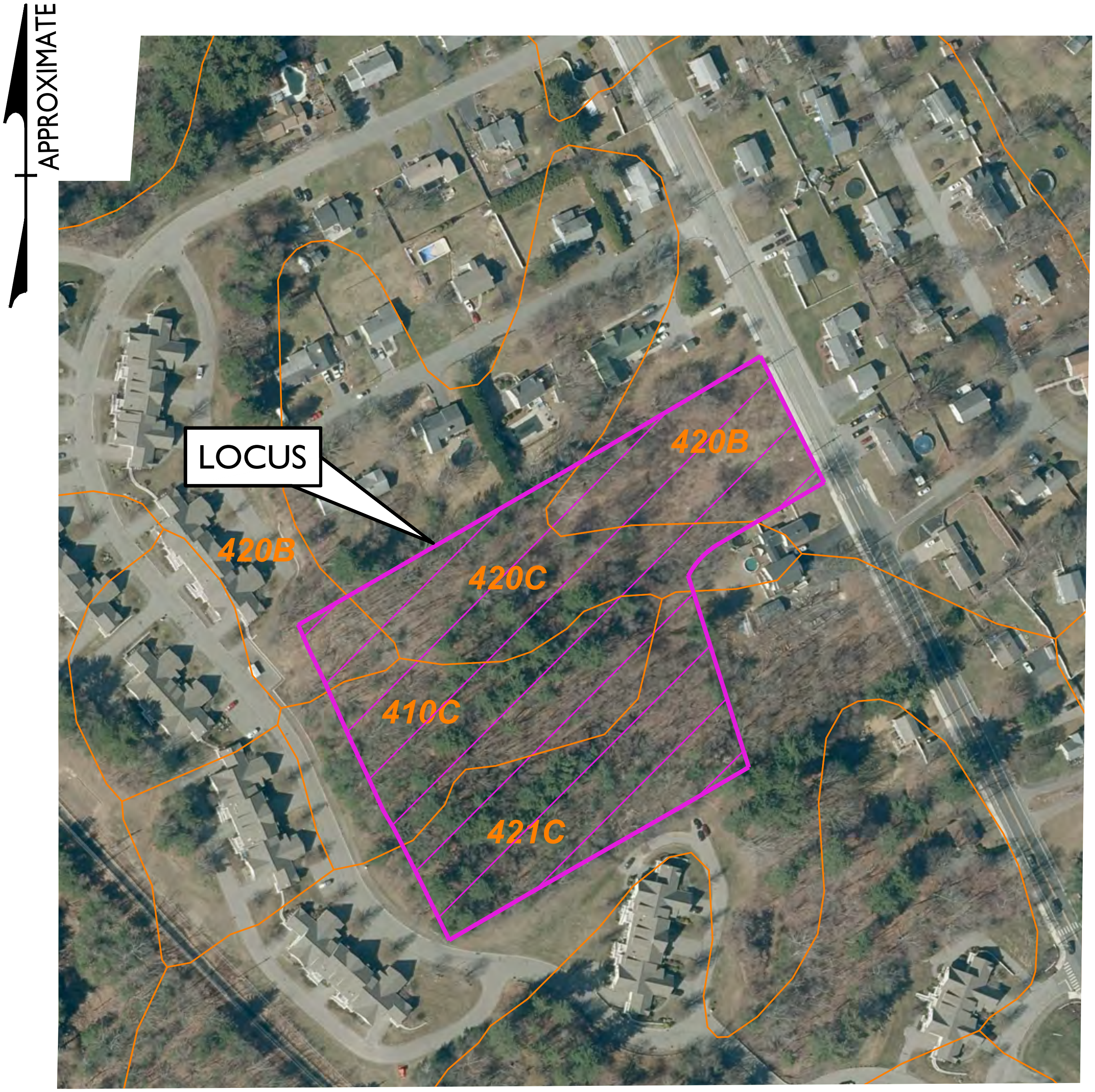
USGS MAP
181R SCHOOL STREET IN GROVELAND, MA

DATE: JULY 31, 2024	SCALE: 1" = 500'	FIGURE #2



SCS SOIL LEGEND:

410C SUTTON FINE SANDY LOAM, 8 TO 15% SLOPES
420B CANTON FINE SANDY LOAM, 3 TO 8% SLOPES
420C CANTON FINE SANDY LOAM, 8 TO 15% SLOPES
421C CANTON FINE SANDY LOAM, 8 TO 15% SLOPES

0 100 200 400

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66 ELM STREET, DANVERS, MA 01923
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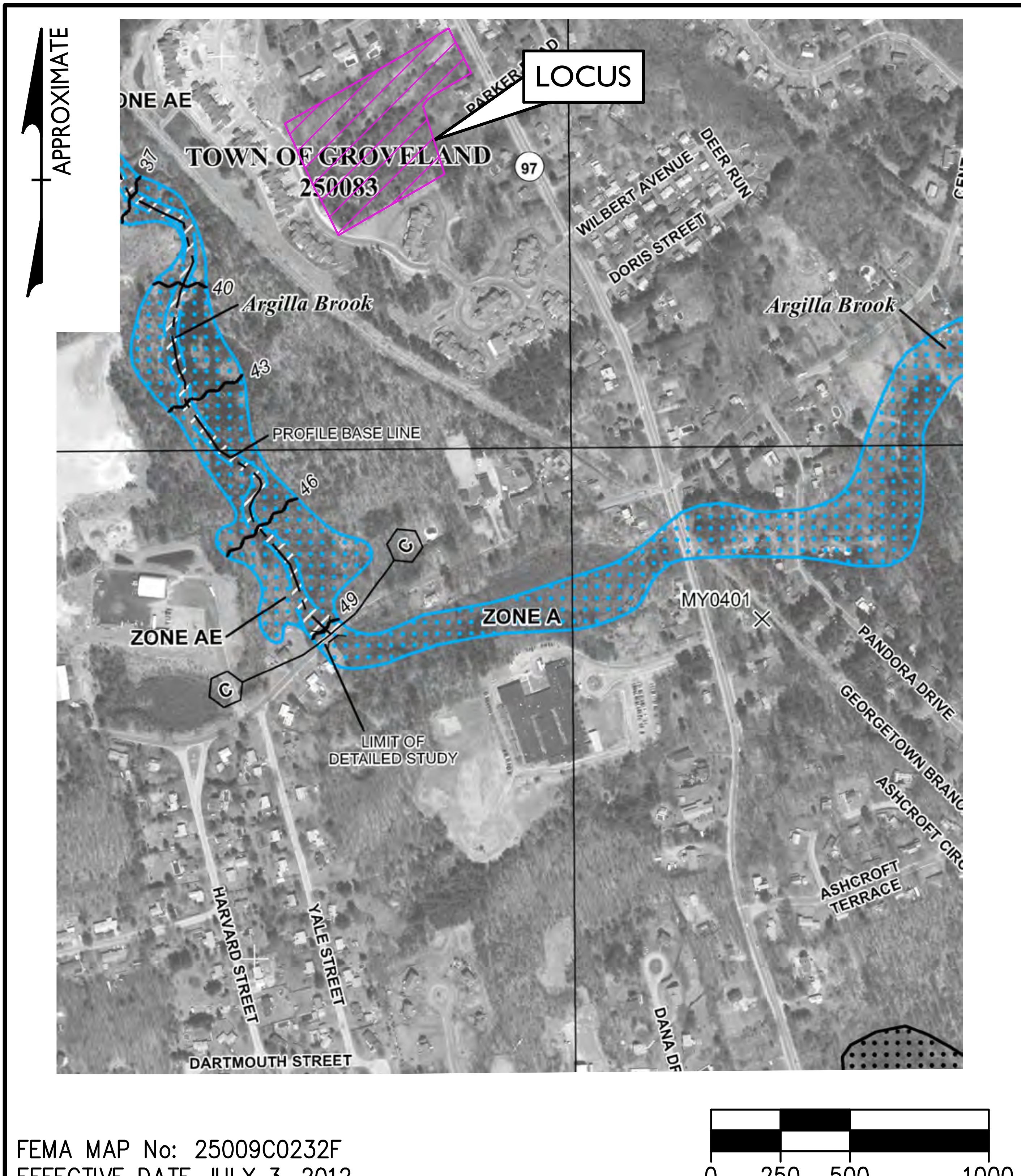
SCS SOILS MAP
181R SCHOOL STREET
GROVELAND, MA

DATE: JULY 31, 2024

SCALE: 1" =200'

FIGURE #3



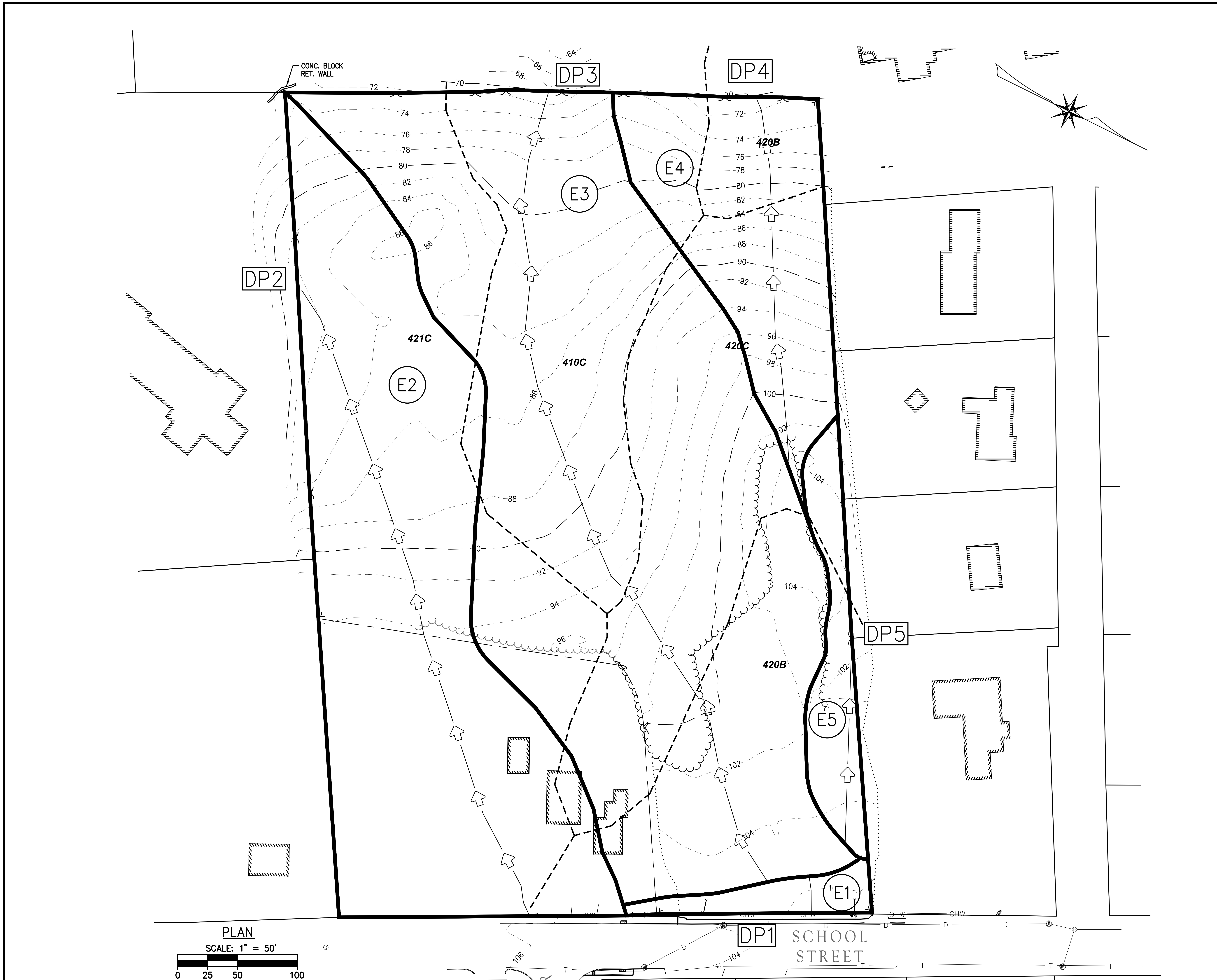
FEMA MAP No: 25009C0232F
EFFECTIVE DATE JULY 3, 2012

THE MORIN-CAMERON GROUP, INC.
66 ELM STREET, DANVERS, MA 01923
P: **978-777-8586**
WWW.MORINCAMERON.COM

FEMA MAP

181R SCHOOL STREET IN
GROVELAND, MA

DATE: JULY 31, 2024	Scale: 1" = 500'	**FIGURE #4**



The Morin-Cameron GROUP, INC.

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FIELD SURVEY BY: MCG
DRAFTED BY: LNO
CHECKED BY: SPC
APPROVED BY: SPC
SCALE: 1"=50'
DATE: JULY 31, 2024

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

FIGURE 5: EXISTING WATERSHED PLAN

IN

GROVELAND, MASSACHUSETTS 181R SCHOOL ST

PROJ. NO. 3634

SHEET NO. 1 OF 1

DRAWING: 3634 Watersheds.dwg

FIGURE 6: PROPOSED WATERSHED PLAN

IN

GROVELAND, MASSACHUSETTS
181R SCHOOL ST

The Morin-Cameron GROUP, INC.

CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
66 ELM STREET, DANVERS, MASSACHUSETTS 01923
P: 978-777-8586, W: WWW.MORINCAMERON.COM

FIELD SURVEY BY: MCG
DRAFTED BY: LNO
CHECKED BY: SPC
APPROVED BY: SPC
SCALE: 1"=50'
DATE: JULY 31, 2024

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

PROJ. NO. 3634

SHEET NO. 1 OF 1

DRAWING: 3634 Watersheds.dwg

APPENDIX A:

MASSDEP STORMWATER

MANAGEMENT REPORT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
SCOTT P. CAMERON
CIVIL
No. 47601
REGISTERED
PROFESSIONAL ENGINEER

7/31/24

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

  ☐ Credit 1

  ☐ Credit 2

  ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): ______________________

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 for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

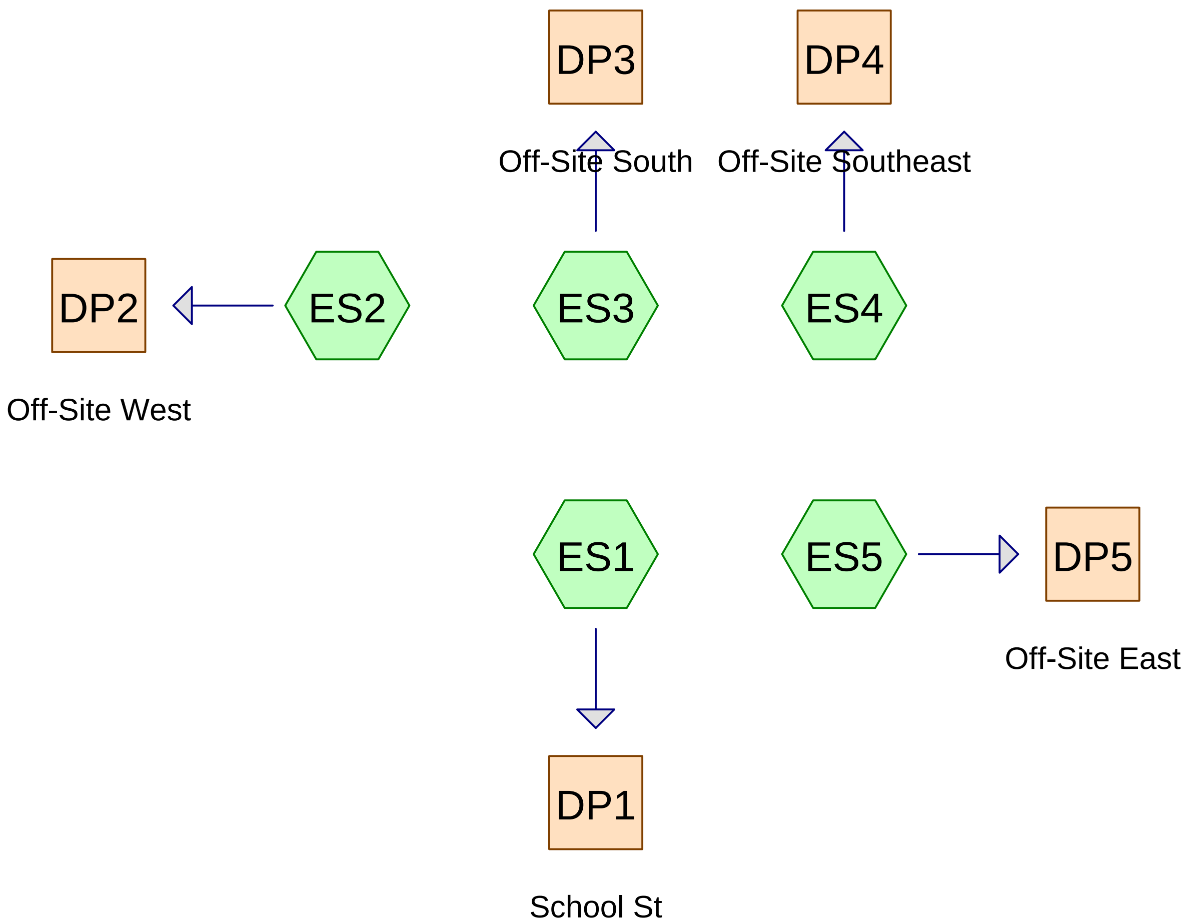
☒ An Illicit Discharge Compliance Statement is attached;

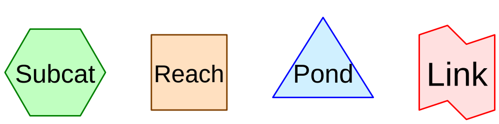
☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX B:

EXISTING CONDITIONS

HYDROLOGIC ANALYSIS





Routing Diagram for 3634 Existing
Prepared by The Morin-Cameron Group, Inc, Printed 7/30/2024
HydroCAD® 10.20-5a s/n 00401 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.24	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.12	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.30	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.11	2

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
306,461	HSG B	ES1, ES2, ES3, ES4, ES5
0	HSG C	
0	HSG D	
0	Other	
306,461		**TOTAL AREA**

Summary for Subcatchment ES1:

Runoff = 0.0 cfs @ 12.21 hrs, Volume= 188 cf, Depth= 0.46"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
4,887	61	>75% Grass cover, Good, HSG B
4,887		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	30	0.0100	0.05		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.24"

Summary for Subcatchment ES2:

Runoff = 0.3 cfs @ 12.22 hrs, Volume= 2,606 cf, Depth= 0.32"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
18,408	61	>75% Grass cover, Good, HSG B
76,415	55	Woods, Good, HSG B
96,774	57	Weighted Average
94,823		97.98% Pervious Area
1,951		2.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.24"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.7					**Direct Entry, Adjustment to 0.16 hr**
10.0	553	Total			

Summary for Subcatchment ES3:

Runoff = 0.4 cfs @ 12.29 hrs, Volume= 4,316 cf, Depth= 0.32"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
1,010	98	Roofs, HSG B
45,860	61	>75% Grass cover, Good, HSG B
113,394	55	Woods, Good, HSG B
160,264	57	Weighted Average
159,254		99.37% Pervious Area
1,010		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.24"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.2	728	Total			

Summary for Subcatchment ES4:

Runoff = 0.0 cfs @ 12.37 hrs, Volume= 737 cf, Depth= 0.26"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
33,665	55	Woods, Good, HSG B
33,665		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.4	315	Total			

Summary for Subcatchment ES5:

Runoff = 0.0 cfs @ 12.49 hrs, Volume= 293 cf, Depth= 0.32"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
3,375	61	>75% Grass cover, Good, HSG B
7,496	55	Woods, Good, HSG B
10,871	57	Weighted Average
10,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
1.0	122	0.0155	2.00		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
25.6	172	Total			

Summary for Reach DP1: School St

Inflow Area = 4,887 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-Year event
Inflow = 0.0 cfs @ 12.21 hrs, Volume= 188 cf
Outflow = 0.0 cfs @ 12.21 hrs, Volume= 188 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 96,774 sf, 2.02% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 0.3 cfs @ 12.22 hrs, Volume= 2,606 cf
Outflow = 0.3 cfs @ 12.22 hrs, Volume= 2,606 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 160,264 sf, 0.63% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 0.4 cfs @ 12.29 hrs, Volume= 4,316 cf
Outflow = 0.4 cfs @ 12.29 hrs, Volume= 4,316 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area =	33,665 sf, 0.00% Impervious,	Inflow Depth = 0.26" for 2-Year event
Inflow =	0.0 cfs @ 12.37 hrs, Volume=	737 cf
Outflow =	0.0 cfs @ 12.37 hrs, Volume=	737 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area =	10,871 sf, 0.00% Impervious,	Inflow Depth = 0.32" for 2-Year event
Inflow =	0.0 cfs @ 12.49 hrs, Volume=	293 cf
Outflow =	0.0 cfs @ 12.49 hrs, Volume=	293 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ES1:

Runoff = 0.2 cfs @ 12.19 hrs, Volume= 587 cf, Depth= 1.44"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
4,887	61	>75% Grass cover, Good, HSG B
4,887		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	30	0.0100	0.05		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.24"

Summary for Subcatchment ES2:

Runoff = 2.4 cfs @ 12.18 hrs, Volume= 9,428 cf, Depth= 1.17"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
18,408	61	>75% Grass cover, Good, HSG B
76,415	55	Woods, Good, HSG B
96,774	57	Weighted Average
94,823		97.98% Pervious Area
1,951		2.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.24"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.7					**Direct Entry, Adjustment to 0.16 hr**
10.0	553	Total			

Summary for Subcatchment ES3:

Runoff = 3.3 cfs @ 12.23 hrs, Volume= 15,613 cf, Depth= 1.17"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
1,010	98	Roofs, HSG B
45,860	61	>75% Grass cover, Good, HSG B
113,394	55	Woods, Good, HSG B
160,264	57	Weighted Average
159,254		99.37% Pervious Area
1,010		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.24"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.2	728	Total			

Summary for Subcatchment ES4:

Runoff = 0.5 cfs @ 12.27 hrs, Volume= 2,919 cf, Depth= 1.04"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
33,665	55	Woods, Good, HSG B
33,665		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.4	315	Total			

Summary for Subcatchment ES5:

Runoff = 0.2 cfs @ 12.38 hrs, Volume= 1,059 cf, Depth= 1.17"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
3,375	61	>75% Grass cover, Good, HSG B
7,496	55	Woods, Good, HSG B
10,871	57	Weighted Average
10,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
1.0	122	0.0155	2.00		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
25.6	172	Total			

Summary for Reach DP1: School St

Inflow Area = 4,887 sf, 0.00% Impervious, Inflow Depth = 1.44" for 10-Year event
Inflow = 0.2 cfs @ 12.19 hrs, Volume= 587 cf
Outflow = 0.2 cfs @ 12.19 hrs, Volume= 587 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 96,774 sf, 2.02% Impervious, Inflow Depth = 1.17" for 10-Year event
Inflow = 2.4 cfs @ 12.18 hrs, Volume= 9,428 cf
Outflow = 2.4 cfs @ 12.18 hrs, Volume= 9,428 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 160,264 sf, 0.63% Impervious, Inflow Depth = 1.17" for 10-Year event
Inflow = 3.3 cfs @ 12.23 hrs, Volume= 15,613 cf
Outflow = 3.3 cfs @ 12.23 hrs, Volume= 15,613 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area =	33,665 sf, 0.00% Impervious,	Inflow Depth = 1.04"	for 10-Year event
Inflow =	0.5 cfs @ 12.27 hrs, Volume=	2,919 cf	
Outflow =	0.5 cfs @ 12.27 hrs, Volume=	2,919 cf, Atten= 0%, Lag= 0.0 min	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area =	10,871 sf, 0.00% Impervious,	Inflow Depth = 1.17"	for 10-Year event
Inflow =	0.2 cfs @ 12.38 hrs, Volume=	1,059 cf	
Outflow =	0.2 cfs @ 12.38 hrs, Volume=	1,059 cf, Atten= 0%, Lag= 0.0 min	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ES1:

Runoff = 0.2 cfs @ 12.19 hrs, Volume= 900 cf, Depth= 2.21"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
4,887	61	>75% Grass cover, Good, HSG B
4,887		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	30	0.0100	0.05		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.24"

Summary for Subcatchment ES2:

Runoff = 4.1 cfs @ 12.18 hrs, Volume= 15,008 cf, Depth= 1.86"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
18,408	61	>75% Grass cover, Good, HSG B
76,415	55	Woods, Good, HSG B
96,774	57	Weighted Average
94,823		97.98% Pervious Area
1,951		2.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.24"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.7					**Direct Entry, Adjustment to 0.16 hr**
10.0	553	Total			

Summary for Subcatchment ES3:

Runoff = 5.7 cfs @ 12.23 hrs, Volume= 24,855 cf, Depth= 1.86"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,010	98	Roofs, HSG B
45,860	61	>75% Grass cover, Good, HSG B
113,394	55	Woods, Good, HSG B
160,264	57	Weighted Average
159,254		99.37% Pervious Area
1,010		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.24"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.2	728	Total			

Summary for Subcatchment ES4:

Runoff = 1.0 cfs @ 12.26 hrs, Volume= 4,750 cf, Depth= 1.69"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
33,665	55	Woods, Good, HSG B
33,665		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.4	315	Total			

Summary for Subcatchment ES5:

Runoff = 0.3 cfs @ 12.37 hrs, Volume= 1,686 cf, Depth= 1.86"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
3,375	61	>75% Grass cover, Good, HSG B
7,496	55	Woods, Good, HSG B
10,871	57	Weighted Average
10,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
1.0	122	0.0155	2.00		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
25.6	172	Total			

Summary for Reach DP1: School St

Inflow Area = 4,887 sf, 0.00% Impervious, Inflow Depth = 2.21" for 25-Year event
Inflow = 0.2 cfs @ 12.19 hrs, Volume= 900 cf
Outflow = 0.2 cfs @ 12.19 hrs, Volume= 900 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 96,774 sf, 2.02% Impervious, Inflow Depth = 1.86" for 25-Year event
Inflow = 4.1 cfs @ 12.18 hrs, Volume= 15,008 cf
Outflow = 4.1 cfs @ 12.18 hrs, Volume= 15,008 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 160,264 sf, 0.63% Impervious, Inflow Depth = 1.86" for 25-Year event
Inflow = 5.7 cfs @ 12.23 hrs, Volume= 24,855 cf
Outflow = 5.7 cfs @ 12.23 hrs, Volume= 24,855 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area =	33,665 sf,	0.00% Impervious,	Inflow Depth = 1.69"	for 25-Year event
Inflow =	1.0 cfs @	12.26 hrs, Volume=	4,750 cf	
Outflow =	1.0 cfs @	12.26 hrs, Volume=	4,750 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area =	10,871 sf,	0.00% Impervious,	Inflow Depth = 1.86"	for 25-Year event
Inflow =	0.3 cfs @	12.37 hrs, Volume=	1,686 cf	
Outflow =	0.3 cfs @	12.37 hrs, Volume=	1,686 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ES1:

Runoff = 0.4 cfs @ 12.18 hrs, Volume= 1,437 cf, Depth= 3.53"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
4,887	61	>75% Grass cover, Good, HSG B
4,887		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	30	0.0100	0.05		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.24"

Summary for Subcatchment ES2:

Runoff = 7.1 cfs @ 12.18 hrs, Volume= 24,844 cf, Depth= 3.08"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
18,408	61	>75% Grass cover, Good, HSG B
76,415	55	Woods, Good, HSG B
96,774	57	Weighted Average
94,823		97.98% Pervious Area
1,951		2.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.24"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.7					**Direct Entry, Adjustment to 0.16 hr**
10.0	553	Total			

Summary for Subcatchment ES3:

Runoff = 9.9 cfs @ 12.23 hrs, Volume= 41,143 cf, Depth= 3.08"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
1,010	98	Roofs, HSG B
45,860	61	>75% Grass cover, Good, HSG B
113,394	55	Woods, Good, HSG B
160,264	57	Weighted Average
159,254		99.37% Pervious Area
1,010		0.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.24"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.2	728	Total			

Summary for Subcatchment ES4:

Runoff = 1.8 cfs @ 12.26 hrs, Volume= 8,022 cf, Depth= 2.86"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
33,665	55	Woods, Good, HSG B
33,665		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.4	315	Total			

Summary for Subcatchment ES5:

Runoff = 0.5 cfs @ 12.37 hrs, Volume= 2,791 cf, Depth= 3.08"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
3,375	61	>75% Grass cover, Good, HSG B
7,496	55	Woods, Good, HSG B
10,871	57	Weighted Average
10,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.24"
1.0	122	0.0155	2.00		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
25.6	172	Total			

Summary for Reach DP1: School St

Inflow Area = 4,887 sf, 0.00% Impervious, Inflow Depth = 3.53" for 100-Year event
Inflow = 0.4 cfs @ 12.18 hrs, Volume= 1,437 cf
Outflow = 0.4 cfs @ 12.18 hrs, Volume= 1,437 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 96,774 sf, 2.02% Impervious, Inflow Depth = 3.08" for 100-Year event
Inflow = 7.1 cfs @ 12.18 hrs, Volume= 24,844 cf
Outflow = 7.1 cfs @ 12.18 hrs, Volume= 24,844 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 160,264 sf, 0.63% Impervious, Inflow Depth = 3.08" for 100-Year event
Inflow = 9.9 cfs @ 12.23 hrs, Volume= 41,143 cf
Outflow = 9.9 cfs @ 12.23 hrs, Volume= 41,143 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area =	33,665 sf,	0.00% Impervious,	Inflow Depth = 2.86"	for 100-Year event
Inflow =	1.8 cfs @	12.26 hrs, Volume=	8,022 cf	
Outflow =	1.8 cfs @	12.26 hrs, Volume=	8,022 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

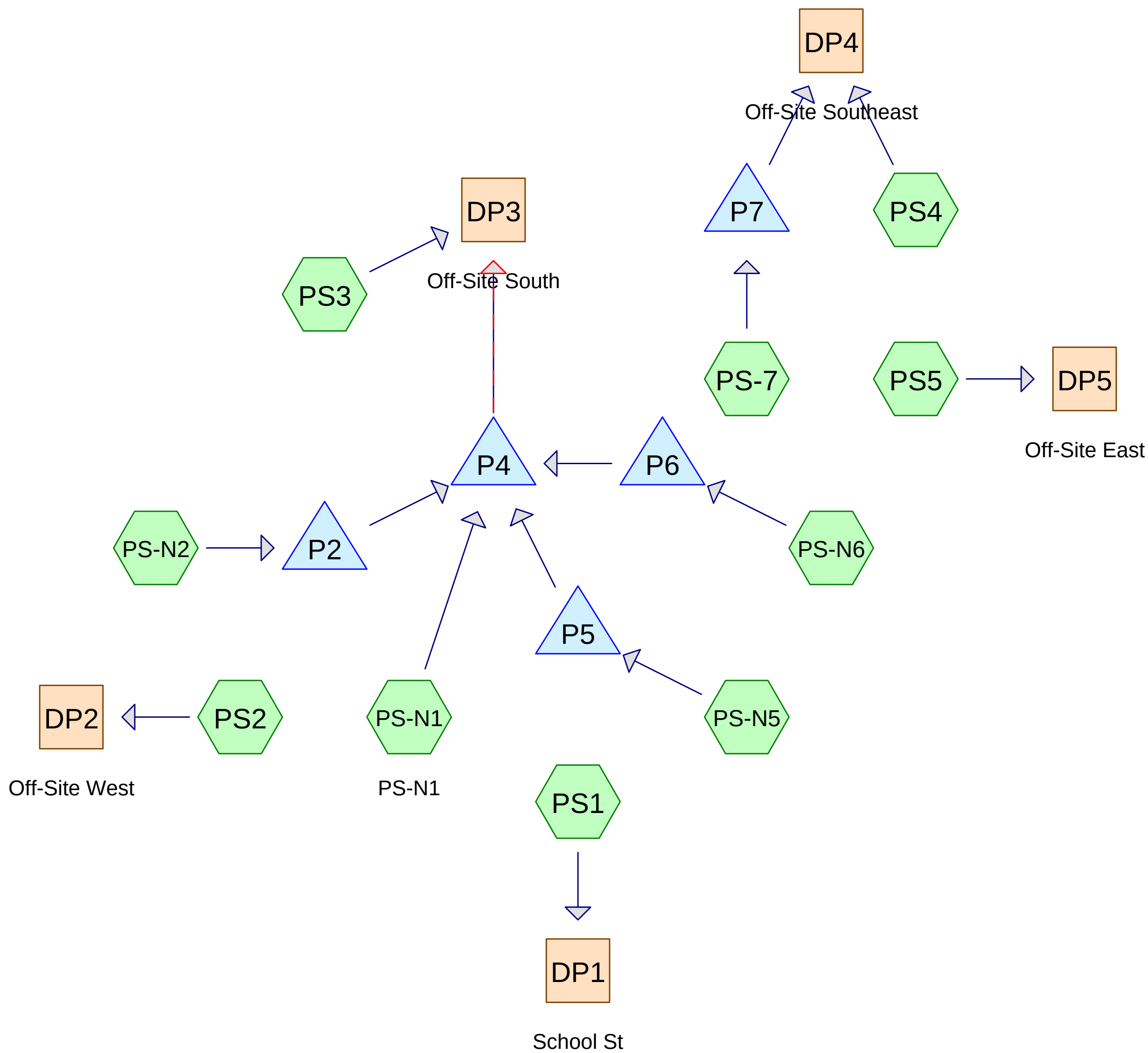
Inflow Area =	10,871 sf,	0.00% Impervious,	Inflow Depth = 3.08"	for 100-Year event
Inflow =	0.5 cfs @	12.37 hrs, Volume=	2,791 cf	
Outflow =	0.5 cfs @	12.37 hrs, Volume=	2,791 cf,	Atten= 0%, Lag= 0.0 min

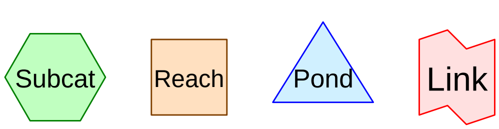
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

APPENDIX C:

PROPOSED CONDITIONS

HYDROLOGIC ANALYSIS





Routing Diagram for 3634 Proposed
Prepared by The Morin-Cameron Group, Inc, Printed 11/5/2024
HydroCAD® 10.20-5a s/n 00401 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.24	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.12	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.30	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.11	2

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
306,461	HSG B	PS-7, PS-N1, PS-N2, PS-N5, PS-N6, PS1, PS2, PS3, PS4, PS5
0	HSG C	
0	HSG D	
0	Other	
306,461		**TOTAL AREA**

Summary for Subcatchment PS-7:

Runoff = 0.2 cfs @ 12.18 hrs, Volume= 744 cf, Depth= 0.85"
Routed to Pond P7 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
10,485	70	1/2 acre lots, 25% imp, HSG B
7,864		75.00% Pervious Area
2,621		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.3	45	0.0200	2.87		**Shallow Concentrated Flow, Roof Drain Pipe** Paved Kv= 20.3 fps
9.0					**Direct Entry, Adjustment for 0.16 hr**
10.0	95	Total			

Summary for Subcatchment PS-N1: PS-N1

Runoff = 3.4 cfs @ 12.18 hrs, Volume= 12,189 cf, Depth= 1.12"
Routed to Pond P4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
21,940	98	Paved parking, HSG B
108,524	70	1/2 acre lots, 25% imp, HSG B
130,464	75	Weighted Average
81,393		62.39% Pervious Area
49,071		37.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3					**Direct Entry, Adjusted 0.1 hr**
1.1	50	0.0060	0.73		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.6	154	0.0380	3.96		**Shallow Concentrated Flow, Shallow** Paved Kv= 20.3 fps
10.0	204	Total			

Summary for Subcatchment PS-N2:

Runoff = 0.3 cfs @ 12.18 hrs, Volume= 1,282 cf, Depth= 0.85"
Routed to Pond P2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
18,062	70	1/2 acre lots, 25% imp, HSG B
13,547		75.00% Pervious Area
4,516		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.1 hr**

Summary for Subcatchment PS-N5:

Runoff = 0.3 cfs @ 12.18 hrs, Volume= 1,012 cf, Depth= 0.85"
Routed to Pond P5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

	Area (sf)	CN	Description
*	14,263	70	1/2 acre lots, 25% imp, HSG B
	10,697		75.00% Pervious Area
	3,566		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.16 hr**

Summary for Subcatchment PS-N6:

Runoff = 0.3 cfs @ 12.18 hrs, Volume= 994 cf, Depth= 0.85"
Routed to Pond P6 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
14,010	70	1/2 acre lots, 25% imp, HSG B
10,508		75.00% Pervious Area
3,503		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.16 hrs**

Summary for Subcatchment PS1:

Runoff = 0.0 cfs @ 12.19 hrs, Volume= 190 cf, Depth= 0.66"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
2,979	61	>75% Grass cover, Good, HSG B
459	98	Paved parking, HSG B
3,438	66	Weighted Average
2,979		86.65% Pervious Area
459		13.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.167 hr**

Summary for Subcatchment PS2:

Runoff = 0.3 cfs @ 12.20 hrs, Volume= 2,157 cf, Depth= 0.39"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
25,338	61	>75% Grass cover, Good, HSG B
39,261	55	Woods, Good, HSG B
66,550	59	Weighted Average
64,599		97.07% Pervious Area
1,951		2.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.6					**Direct Entry, Adjustment for 0.167 hrs**
10.0	553	Total			

Summary for Subcatchment PS3:

Runoff = 0.1 cfs @ 12.27 hrs, Volume= 553 cf, Depth= 0.39"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
10,484	61	>75% Grass cover, Good, HSG B
6,559	55	Woods, Good, HSG B
17,043	59	Weighted Average
17,043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.5	728	Total			

Summary for Subcatchment PS4:

Runoff = 0.0 cfs @ 12.34 hrs, Volume= 590 cf, Depth= 0.29"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

	Area (sf)	CN	Description
	19,363	55	Woods, Good, HSG B
*	4,850	61	>75% Grass cover, Good, HSG B
	24,213	56	Weighted Average
	24,213		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.7	315	Total			

Summary for Subcatchment PS5:

Runoff = 0.0 cfs @ 12.52 hrs, Volume= 193 cf, Depth= 0.29"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
1,870	61	>75% Grass cover, Good, HSG B
6,063	55	Woods, Good, HSG B
7,933	56	Weighted Average
7,933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.2	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	122	0.0150	1.97		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
26.2	172	Total			

Summary for Reach DP1: School St

Inflow Area = 3,438 sf, 13.35% Impervious, Inflow Depth = 0.66" for 2-Year event
Inflow = 0.0 cfs @ 12.19 hrs, Volume= 190 cf
Outflow = 0.0 cfs @ 12.19 hrs, Volume= 190 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 66,550 sf, 2.93% Impervious, Inflow Depth = 0.39" for 2-Year event
Inflow = 0.3 cfs @ 12.20 hrs, Volume= 2,157 cf
Outflow = 0.3 cfs @ 12.20 hrs, Volume= 2,157 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 193,842 sf, 31.29% Impervious, Inflow Depth = 0.06" for 2-Year event
Inflow = 0.4 cfs @ 12.42 hrs, Volume= 959 cf
Outflow = 0.4 cfs @ 12.42 hrs, Volume= 959 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area = 34,698 sf, 7.55% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.0 cfs @ 12.34 hrs, Volume= 590 cf
Outflow = 0.0 cfs @ 12.34 hrs, Volume= 590 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area = 7,933 sf, 0.00% Impervious, Inflow Depth = 0.29" for 2-Year event
Inflow = 0.0 cfs @ 12.52 hrs, Volume= 193 cf
Outflow = 0.0 cfs @ 12.52 hrs, Volume= 193 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond P2:

Inflow Area = 18,062 sf, 25.00% Impervious, Inflow Depth = 0.85" for 2-Year event
Inflow = 0.3 cfs @ 12.18 hrs, Volume= 1,282 cf
Outflow = 0.1 cfs @ 12.82 hrs, Volume= 1,282 cf, Atten= 85%, Lag= 38.1 min
Discarded = 0.0 cfs @ 12.82 hrs, Volume= 1,235 cf
Primary = 0.0 cfs @ 12.82 hrs, Volume= 47 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 86.57' @ 12.82 hrs Surf.Area= 640 sf Storage= 313 cf

Plug-Flow detention time= 70.5 min calculated for 1,281 cf (100% of inflow)
Center-of-Mass det. time= 70.4 min (993.3 - 922.9)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	1,583 cf	**P1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	471	85.0	0	0	471
87.00	786	111.0	622	622	888
88.00	1,147	130.0	961	1,583	1,272

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" Round Culvert** L= 150.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.00' / 82.58' S= 0.0228 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Device 1	86.50'	**5.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.10'	**4.0" Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	87.60'	**12.0" Horiz. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	86.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.82 hrs HW=86.57' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 12.82 hrs HW=86.57' TW=79.58' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.0 cfs of 1.2 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.0 cfs @ 0.88 fps)
  ├─**3=Orifice/Grate-25yr** (Controls 0.0 cfs)
  └─**4=Orifice/Grate-100yr** (Controls 0.0 cfs)

Summary for Pond P4:

Inflow Area = 176,799 sf, 34.31% Impervious, Inflow Depth = 0.84" for 2-Year event
Inflow = 3.4 cfs @ 12.18 hrs, Volume= 12,423 cf
Outflow = 1.1 cfs @ 12.43 hrs, Volume= 12,423 cf, Atten= 69%, Lag= 15.0 min
Discarded = 0.7 cfs @ 12.43 hrs, Volume= 12,017 cf
Primary = 0.3 cfs @ 12.43 hrs, Volume= 407 cf
Routed to Reach DP3 : Off-Site South
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP3 : Off-Site South

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 79.68' @ 12.43 hrs Surf.Area= 3,472 sf Storage= 2,194 cf

Plug-Flow detention time= 15.0 min calculated for 12,423 cf (100% of inflow)
Center-of-Mass det. time= 15.0 min (913.5 - 898.5)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	18,373 cf	**Infiltration Basin (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	2,988	222.0	0	0	2,988
80.00	3,712	256.0	3,343	3,343	4,303
81.00	4,507	274.0	4,103	7,447	5,107
82.00	5,358	293.0	4,926	12,373	6,010
83.00	6,667	580.0	6,001	18,373	25,953

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**18.0" Round 18" HDPE** L= 66.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 79.00' / 76.00' S= 0.0455 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Device 1	79.55'	**26.0" W x 3.0" H Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	79.96'	**8.0" W x 3.0" H Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	80.67'	**18.0" W x 3.0" H Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Device 1	81.34'	**24.0" W x 3.0" H Vert. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#6	Device 1	82.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#7	Secondary	82.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#8	Discarded	79.00'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.7 cfs @ 12.43 hrs HW=79.68' (Free Discharge)
└─**8=Exfiltration** (Exfiltration Controls 0.7 cfs)

Primary OutFlow Max=0.3 cfs @ 12.43 hrs HW=79.68' TW=0.00' (Dynamic Tailwater)
└─**1=18" HDPE** (Passes 0.3 cfs of 1.7 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.3 cfs @ 1.16 fps)
  ├─**3=Orifice/Grate-10yr** (Controls 0.0 cfs)
  ├─**4=Orifice/Grate-25yr** (Controls 0.0 cfs)
  ├─**5=Orifice/Grate-100yr** (Controls 0.0 cfs)
  └─**6=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=79.00' TW=0.00' (Dynamic Tailwater)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P5:

Inflow Area = 14,263 sf, 25.00% Impervious, Inflow Depth = 0.85" for 2-Year event
Inflow = 0.3 cfs @ 12.18 hrs, Volume= 1,012 cf
Outflow = 0.0 cfs @ 13.42 hrs, Volume= 1,012 cf, Atten= 88%, Lag= 74.2 min
Discarded = 0.0 cfs @ 13.42 hrs, Volume= 1,012 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 98.61' @ 13.42 hrs Surf.Area= 526 sf Storage= 267 cf

Plug-Flow detention time= 79.4 min calculated for 1,012 cf (100% of inflow)
Center-of-Mass det. time= 79.4 min (1,002.3 - 922.9)

Volume	Invert	Avail.Storage	Storage Description
#1	98.00'	1,309 cf	**P5 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
98.00	361	77.0	0	0	361
99.00	650	102.0	498	498	728
100.00	983	125.0	811	1,309	1,159

Device	Routing	Invert	Outlet Devices
#1	Primary	98.00'	**12.0" Round Culvert** L= 195.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 98.00' / 93.27' S= 0.0243 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	98.90'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	99.20'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Discarded	98.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 13.42 hrs HW=98.61' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=98.00' TW=79.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.0 cfs)
  ├─**2=Orifice/Grate-10yr** (Controls 0.0 cfs)
  └─**3=Orifice/Grate-25yr** (Controls 0.0 cfs)

Summary for Pond P6:

Inflow Area = 14,010 sf, 25.00% Impervious, Inflow Depth = 0.85" for 2-Year event
Inflow = 0.3 cfs @ 12.18 hrs, Volume= 994 cf
Outflow = 0.1 cfs @ 12.36 hrs, Volume= 994 cf, Atten= 58%, Lag= 10.7 min
Discarded = 0.0 cfs @ 12.36 hrs, Volume= 807 cf
Primary = 0.1 cfs @ 12.36 hrs, Volume= 187 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 92.43' @ 12.36 hrs Surf.Area= 454 sf Storage= 166 cf

Plug-Flow detention time= 25.8 min calculated for 994 cf (100% of inflow)
Center-of-Mass det. time= 25.8 min (948.6 - 922.9)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	1,355 cf	**Rain Garden P6 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	318	80.0	0	0	318
93.00	670	122.0	483	483	1,001
94.00	1,091	141.0	872	1,355	1,419

Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	**12.0" Round Culvert** L= 104.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.00' / 86.40' S= 0.0538 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.20'	**3.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	92.50'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	93.00'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	92.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.36 hrs HW=92.43' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.36 hrs HW=92.43' TW=79.67' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.1 cfs of 0.6 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.1 cfs @ 1.64 fps)
  ├─**3=Orifice/Grate-10yr** (Controls 0.0 cfs)
  └─**4=Orifice/Grate-25yr** (Controls 0.0 cfs)

Summary for Pond P7:

Inflow Area =	10,485 sf, 25.00% Impervious,	Inflow Depth = 0.85"	for 2-Year event
Inflow =	0.2 cfs @ 12.18 hrs, Volume=	744 cf	
Outflow =	0.0 cfs @ 13.34 hrs, Volume=	744 cf, Atten= 88%, Lag= 69.4 min	
Discarded =	0.0 cfs @ 13.34 hrs, Volume=	744 cf	
Primary =	0.0 cfs @ 0.00 hrs, Volume=	0 cf	

Routed to Reach DP4 : Off-Site Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 81.73' @ 13.34 hrs Surf.Area= 360 sf Storage= 198 cf

Plug-Flow detention time= 85.7 min calculated for 744 cf (100% of inflow)
Center-of-Mass det. time= 85.7 min (1,008.6 - 922.9)

Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,798 cf	**Rain Garden (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
81.00	194	55.0	0	0	194
82.00	436	86.0	307	307	549
83.00	741	105.0	582	889	853
84.00	1,089	125.0	909	1,798	1,237

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 81.00' / 80.00' S= 0.0345 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Device 1	81.85'	**2.0" Vert. Orifice/Grate 10-yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	82.50'	**3.0" Vert. Orifice/Grate 25-yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	83.15'	**12.0" Horiz. Orifice/Grate 100-yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	81.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 13.34 hrs HW=81.73' (Free Discharge)
└5=**Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=81.00' TW=0.00' (Dynamic Tailwater)
└1=**Culvert** (Controls 0.0 cfs)
  ├2=**Orifice/Grate 10-yr** (Controls 0.0 cfs)
  ├3=**Orifice/Grate 25-yr** (Controls 0.0 cfs)
  └4=**Orifice/Grate 100-yr** (Controls 0.0 cfs)

Summary for Subcatchment PS-7:

Runoff = 0.5 cfs @ 12.18 hrs, Volume= 1,857 cf, Depth= 2.13"
Routed to Pond P7 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
10,485	70	1/2 acre lots, 25% imp, HSG B
7,864		75.00% Pervious Area
2,621		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.3	45	0.0200	2.87		**Shallow Concentrated Flow, Roof Drain Pipe** Paved Kv= 20.3 fps
9.0					**Direct Entry, Adjustment for 0.16 hr**
10.0	95	Total			

Summary for Subcatchment PS-N1: PS-N1

Runoff = 8.0 cfs @ 12.18 hrs, Volume= 27,690 cf, Depth= 2.55"
Routed to Pond P4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
21,940	98	Paved parking, HSG B
108,524	70	1/2 acre lots, 25% imp, HSG B
130,464	75	Weighted Average
81,393		62.39% Pervious Area
49,071		37.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3					**Direct Entry, Adjusted 0.1 hr**
1.1	50	0.0060	0.73		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.6	154	0.0380	3.96		**Shallow Concentrated Flow, Shallow** Paved Kv= 20.3 fps
10.0	204	Total			

Summary for Subcatchment PS-N2:

Runoff = 0.9 cfs @ 12.18 hrs, Volume= 3,200 cf, Depth= 2.13"
Routed to Pond P2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
18,062	70	1/2 acre lots, 25% imp, HSG B
13,547		75.00% Pervious Area
4,516		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.1 hr**

Summary for Subcatchment PS-N5:

Runoff = 0.7 cfs @ 12.18 hrs, Volume= 2,527 cf, Depth= 2.13"
Routed to Pond P5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

	Area (sf)	CN	Description
*	14,263	70	1/2 acre lots, 25% imp, HSG B
	10,697		75.00% Pervious Area
	3,566		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.16 hr**

Summary for Subcatchment PS-N6:

Runoff = 0.7 cfs @ 12.18 hrs, Volume= 2,482 cf, Depth= 2.13"
Routed to Pond P6 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
14,010	70	1/2 acre lots, 25% imp, HSG B
10,508		75.00% Pervious Area
3,503		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.16 hrs**

Summary for Subcatchment PS1:

Runoff = 0.1 cfs @ 12.18 hrs, Volume= 519 cf, Depth= 1.81"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
2,979	61	>75% Grass cover, Good, HSG B
459	98	Paved parking, HSG B
3,438	66	Weighted Average
2,979		86.65% Pervious Area
459		13.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.167 hr**

Summary for Subcatchment PS2:

Runoff = 1.9 cfs @ 12.18 hrs, Volume= 7,226 cf, Depth= 1.30"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
25,338	61	>75% Grass cover, Good, HSG B
39,261	55	Woods, Good, HSG B
66,550	59	Weighted Average
64,599		97.07% Pervious Area
1,951		2.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.6					**Direct Entry, Adjustment for 0.167 hrs**
10.0	553	Total			

Summary for Subcatchment PS3:

Runoff = 0.4 cfs @ 12.24 hrs, Volume= 1,850 cf, Depth= 1.30"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
10,484	61	>75% Grass cover, Good, HSG B
6,559	55	Woods, Good, HSG B
17,043	59	Weighted Average
17,043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.5	728	Total			

Summary for Subcatchment PS4:

Runoff = 0.4 cfs @ 12.27 hrs, Volume= 2,228 cf, Depth= 1.10"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

	Area (sf)	CN	Description
	19,363	55	Woods, Good, HSG B
*	4,850	61	>75% Grass cover, Good, HSG B
	24,213	56	Weighted Average
	24,213		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.7	315	Total			

Summary for Subcatchment PS5:

Runoff = 0.1 cfs @ 12.40 hrs, Volume= 730 cf, Depth= 1.10"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
1,870	61	>75% Grass cover, Good, HSG B
6,063	55	Woods, Good, HSG B
7,933	56	Weighted Average
7,933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.2	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	122	0.0150	1.97		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
26.2	172	Total			

Summary for Reach DP1: School St

Inflow Area = 3,438 sf, 13.35% Impervious, Inflow Depth = 1.81" for 10-Year event
Inflow = 0.1 cfs @ 12.18 hrs, Volume= 519 cf
Outflow = 0.1 cfs @ 12.18 hrs, Volume= 519 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 66,550 sf, 2.93% Impervious, Inflow Depth = 1.30" for 10-Year event
Inflow = 1.9 cfs @ 12.18 hrs, Volume= 7,226 cf
Outflow = 1.9 cfs @ 12.18 hrs, Volume= 7,226 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 193,842 sf, 31.29% Impervious, Inflow Depth = 0.63" for 10-Year event
Inflow = 3.2 cfs @ 12.32 hrs, Volume= 10,205 cf
Outflow = 3.2 cfs @ 12.32 hrs, Volume= 10,205 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area = 34,698 sf, 7.55% Impervious, Inflow Depth = 0.94" for 10-Year event
Inflow = 0.5 cfs @ 12.27 hrs, Volume= 2,719 cf
Outflow = 0.5 cfs @ 12.27 hrs, Volume= 2,719 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area = 7,933 sf, 0.00% Impervious, Inflow Depth = 1.10" for 10-Year event
Inflow = 0.1 cfs @ 12.40 hrs, Volume= 730 cf
Outflow = 0.1 cfs @ 12.40 hrs, Volume= 730 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond P2:

Inflow Area = 18,062 sf, 25.00% Impervious, Inflow Depth = 2.13" for 10-Year event
Inflow = 0.9 cfs @ 12.18 hrs, Volume= 3,200 cf
Outflow = 0.4 cfs @ 12.32 hrs, Volume= 3,200 cf, Atten= 53%, Lag= 8.7 min
Discarded = 0.1 cfs @ 12.32 hrs, Volume= 2,004 cf
Primary = 0.4 cfs @ 12.32 hrs, Volume= 1,196 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 87.05' @ 12.32 hrs Surf.Area= 802 sf Storage= 659 cf

Plug-Flow detention time= 69.7 min calculated for 3,199 cf (100% of inflow)
Center-of-Mass det. time= 69.7 min (955.2 - 885.5)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	1,583 cf	**P1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	471	85.0	0	0	471
87.00	786	111.0	622	622	888
88.00	1,147	130.0	961	1,583	1,272

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" Round Culvert** L= 150.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.00' / 82.58' S= 0.0228 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Device 1	86.50'	**5.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.10'	**4.0" Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	87.60'	**12.0" Horiz. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	86.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.32 hrs HW=87.05' (Free Discharge)
└—**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.4 cfs @ 12.32 hrs HW=87.05' TW=80.52' (Dynamic Tailwater)
└—**1=Culvert** (Passes 0.4 cfs of 3.6 cfs potential flow)
 ├—**2=Orifice/Grate-2yr** (Orifice Controls 0.4 cfs @ 2.80 fps)
 ├—**3=Orifice/Grate-25yr** (Controls 0.0 cfs)
 └—**4=Orifice/Grate-100yr** (Controls 0.0 cfs)

Summary for Pond P4:

Inflow Area = 176,799 sf, 34.31% Impervious, Inflow Depth = 2.08" for 10-Year event
Inflow = 8.5 cfs @ 12.18 hrs, Volume= 30,593 cf
Outflow = 3.8 cfs @ 12.37 hrs, Volume= 30,593 cf, Atten= 55%, Lag= 11.1 min
Discarded = 0.9 cfs @ 12.37 hrs, Volume= 22,238 cf
Primary = 2.9 cfs @ 12.37 hrs, Volume= 8,355 cf
Routed to Reach DP3 : Off-Site South
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP3 : Off-Site South

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 80.53' @ 12.37 hrs Surf.Area= 4,124 sf Storage= 5,421 cf

Plug-Flow detention time= 17.9 min calculated for 30,585 cf (100% of inflow)
Center-of-Mass det. time= 17.9 min (878.7 - 860.8)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	18,373 cf	**Infiltration Basin (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	2,988	222.0	0	0	2,988
80.00	3,712	256.0	3,343	3,343	4,303
81.00	4,507	274.0	4,103	7,447	5,107
82.00	5,358	293.0	4,926	12,373	6,010
83.00	6,667	580.0	6,001	18,373	25,953

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**18.0" Round 18" HDPE** L= 66.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 79.00' / 76.00' S= 0.0455 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Device 1	79.55'	**26.0" W x 3.0" H Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	79.96'	**8.0" W x 3.0" H Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	80.67'	**18.0" W x 3.0" H Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Device 1	81.34'	**24.0" W x 3.0" H Vert. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#6	Device 1	82.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#7	Secondary	82.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#8	Discarded	79.00'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.9 cfs @ 12.37 hrs HW=80.53' (Free Discharge)
└─**8=Exfiltration** (Exfiltration Controls 0.9 cfs)

Primary OutFlow Max=2.9 cfs @ 12.37 hrs HW=80.53' TW=0.00' (Dynamic Tailwater)
└─**1=18" HDPE** (Passes 2.9 cfs of 5.9 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 2.4 cfs @ 4.45 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 0.5 cfs @ 3.20 fps)
  ├─**4=Orifice/Grate-25yr** (Controls 0.0 cfs)
  ├─**5=Orifice/Grate-100yr** (Controls 0.0 cfs)
  └─**6=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=79.00' TW=0.00' (Dynamic Tailwater)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P5:

Inflow Area = 14,263 sf, 25.00% Impervious, Inflow Depth = 2.13" for 10-Year event
Inflow = 0.7 cfs @ 12.18 hrs, Volume= 2,527 cf
Outflow = 0.3 cfs @ 12.38 hrs, Volume= 2,527 cf, Atten= 64%, Lag= 12.0 min
Discarded = 0.0 cfs @ 12.38 hrs, Volume= 1,942 cf
Primary = 0.2 cfs @ 12.38 hrs, Volume= 584 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 99.23' @ 12.38 hrs Surf.Area= 719 sf Storage= 653 cf

Plug-Flow detention time= 118.4 min calculated for 2,526 cf (100% of inflow)
Center-of-Mass det. time= 118.4 min (1,003.8 - 885.5)

Volume	Invert	Avail.Storage	Storage Description
#1	98.00'	1,309 cf	**P5 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
98.00	361	77.0	0	0	361
99.00	650	102.0	498	498	728
100.00	983	125.0	811	1,309	1,159

Device	Routing	Invert	Outlet Devices
#1	Primary	98.00'	**12.0" Round Culvert** L= 195.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 98.00' / 93.27' S= 0.0243 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	98.90'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	99.20'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Discarded	98.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.38 hrs HW=99.23' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.38 hrs HW=99.23' TW=80.53' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.2 cfs of 2.5 cfs potential flow)
  ├─**2=Orifice/Grate-10yr** (Orifice Controls 0.2 cfs @ 1.94 fps)
  └─**3=Orifice/Grate-25yr** (Weir Controls 0.0 cfs @ 0.53 fps)

Summary for Pond P6:

Inflow Area =	14,010 sf,	25.00% Impervious, Inflow Depth = 2.13"	for 10-Year event
Inflow =	0.7 cfs @	12.18 hrs, Volume=	2,482 cf
Outflow =	0.4 cfs @	12.29 hrs, Volume=	2,482 cf, Atten= 41%, Lag= 6.5 min
Discarded =	0.1 cfs @	12.29 hrs, Volume=	1,359 cf
Primary =	0.4 cfs @	12.29 hrs, Volume=	1,123 cf

Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 92.88' @ 12.29 hrs Surf.Area= 620 sf Storage= 404 cf

Plug-Flow detention time= 31.3 min calculated for 2,481 cf (100% of inflow)
Center-of-Mass det. time= 31.3 min (916.8 - 885.5)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	1,355 cf	**Rain Garden P6 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	318	80.0	0	0	318
93.00	670	122.0	483	483	1,001
94.00	1,091	141.0	872	1,355	1,419

Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	**12.0" Round Culvert** L= 104.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.00' / 86.40' S= 0.0538 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.20'	**3.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	92.50'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	93.00'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	92.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.29 hrs HW=92.88' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.4 cfs @ 12.29 hrs HW=92.88' TW=80.48' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.4 cfs of 1.8 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.2 cfs @ 3.58 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 0.2 cfs @ 2.21 fps)
  └─**4=Orifice/Grate-25yr** (Controls 0.0 cfs)

Summary for Pond P7:

Inflow Area = 10,485 sf, 25.00% Impervious, Inflow Depth = 2.13" for 10-Year event
Inflow = 0.5 cfs @ 12.18 hrs, Volume= 1,857 cf
Outflow = 0.1 cfs @ 12.51 hrs, Volume= 1,857 cf, Atten= 79%, Lag= 20.0 min
Discarded = 0.0 cfs @ 12.51 hrs, Volume= 1,366 cf
Primary = 0.1 cfs @ 12.51 hrs, Volume= 492 cf
Routed to Reach DP4 : Off-Site Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 82.43' @ 12.51 hrs Surf.Area= 558 sf Storage= 522 cf

Plug-Flow detention time= 100.2 min calculated for 1,857 cf (100% of inflow)
Center-of-Mass det. time= 100.2 min (985.6 - 885.5)

Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,798 cf	**Rain Garden (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
81.00	194	55.0	0	0	194
82.00	436	86.0	307	307	549
83.00	741	105.0	582	889	853
84.00	1,089	125.0	909	1,798	1,237

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 81.00' / 80.00' S= 0.0345 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Device 1	81.85'	**2.0" Vert. Orifice/Grate 10-yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	82.50'	**3.0" Vert. Orifice/Grate 25-yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	83.15'	**12.0" Horiz. Orifice/Grate 100-yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	81.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.51 hrs HW=82.43' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.51 hrs HW=82.43' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.1 cfs of 1.4 cfs potential flow)
  ├─**2=Orifice/Grate 10-yr** (Orifice Controls 0.1 cfs @ 3.40 fps)
  ├─**3=Orifice/Grate 25-yr** (Controls 0.0 cfs)
  └─**4=Orifice/Grate 100-yr** (Controls 0.0 cfs)

Summary for Subcatchment PS-7:

Runoff = 0.8 cfs @ 12.18 hrs, Volume= 2,661 cf, Depth= 3.05"
Routed to Pond P7 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
10,485	70	1/2 acre lots, 25% imp, HSG B
7,864		75.00% Pervious Area
2,621		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.3	45	0.0200	2.87		**Shallow Concentrated Flow, Roof Drain Pipe** Paved Kv= 20.3 fps
9.0					**Direct Entry, Adjustment for 0.16 hr**
10.0	95	Total			

Summary for Subcatchment PS-N1: PS-N1

Runoff = 11.1 cfs @ 12.17 hrs, Volume= 38,478 cf, Depth= 3.54"
Routed to Pond P4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
21,940	98	Paved parking, HSG B
108,524	70	1/2 acre lots, 25% imp, HSG B
130,464	75	Weighted Average
81,393		62.39% Pervious Area
49,071		37.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3					**Direct Entry, Adjusted 0.1 hr**
1.1	50	0.0060	0.73		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.6	154	0.0380	3.96		**Shallow Concentrated Flow, Shallow** Paved Kv= 20.3 fps
10.0	204	Total			

Summary for Subcatchment PS-N2:

Runoff = 1.3 cfs @ 12.18 hrs, Volume= 4,583 cf, Depth= 3.05"
Routed to Pond P2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
18,062	70	1/2 acre lots, 25% imp, HSG B
13,547		75.00% Pervious Area
4,516		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.1 hr**

Summary for Subcatchment PS-N5:

Runoff = 1.0 cfs @ 12.18 hrs, Volume= 3,619 cf, Depth= 3.05"
Routed to Pond P5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

	Area (sf)	CN	Description
*	14,263	70	1/2 acre lots, 25% imp, HSG B
	10,697		75.00% Pervious Area
	3,566		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.16 hr**

Summary for Subcatchment PS-N6:

Runoff = 1.0 cfs @ 12.18 hrs, Volume= 3,555 cf, Depth= 3.05"
Routed to Pond P6 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
14,010	70	1/2 acre lots, 25% imp, HSG B
10,508		75.00% Pervious Area
3,503		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.16 hrs**

Summary for Subcatchment PS1:

Runoff = 0.2 cfs @ 12.18 hrs, Volume= 763 cf, Depth= 2.66"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
2,979	61	>75% Grass cover, Good, HSG B
459	98	Paved parking, HSG B
3,438	66	Weighted Average
2,979		86.65% Pervious Area
459		13.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.167 hr**

Summary for Subcatchment PS2:

Runoff = 3.1 cfs @ 12.18 hrs, Volume= 11,275 cf, Depth= 2.03"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
25,338	61	>75% Grass cover, Good, HSG B
39,261	55	Woods, Good, HSG B
66,550	59	Weighted Average
64,599		97.07% Pervious Area
1,951		2.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.6					**Direct Entry, Adjustment for 0.167 hrs**
10.0	553	Total			

Summary for Subcatchment PS3:

Runoff = 0.7 cfs @ 12.23 hrs, Volume= 2,887 cf, Depth= 2.03"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
10,484	61	>75% Grass cover, Good, HSG B
6,559	55	Woods, Good, HSG B
17,043	59	Weighted Average
17,043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.5	728	Total			

Summary for Subcatchment PS4:

Runoff = 0.8 cfs @ 12.26 hrs, Volume= 3,585 cf, Depth= 1.78"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

	Area (sf)	CN	Description
	19,363	55	Woods, Good, HSG B
*	4,850	61	>75% Grass cover, Good, HSG B
	24,213	56	Weighted Average
	24,213		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.7	315	Total			

Summary for Subcatchment PS5:

Runoff = 0.2 cfs @ 12.38 hrs, Volume= 1,174 cf, Depth= 1.78"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,870	61	>75% Grass cover, Good, HSG B
6,063	55	Woods, Good, HSG B
7,933	56	Weighted Average
7,933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.2	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	122	0.0150	1.97		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
26.2	172	Total			

Summary for Reach DP1: School St

Inflow Area = 3,438 sf, 13.35% Impervious, Inflow Depth = 2.66" for 25-Year event
Inflow = 0.2 cfs @ 12.18 hrs, Volume= 763 cf
Outflow = 0.2 cfs @ 12.18 hrs, Volume= 763 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 66,550 sf, 2.93% Impervious, Inflow Depth = 2.03" for 25-Year event
Inflow = 3.1 cfs @ 12.18 hrs, Volume= 11,275 cf
Outflow = 3.1 cfs @ 12.18 hrs, Volume= 11,275 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 193,842 sf, 31.29% Impervious, Inflow Depth = 1.16" for 25-Year event
Inflow = 5.6 cfs @ 12.32 hrs, Volume= 18,664 cf
Outflow = 5.6 cfs @ 12.32 hrs, Volume= 18,664 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area = 34,698 sf, 7.55% Impervious, Inflow Depth = 1.60" for 25-Year event
Inflow = 0.9 cfs @ 12.28 hrs, Volume= 4,613 cf
Outflow = 0.9 cfs @ 12.28 hrs, Volume= 4,613 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area = 7,933 sf, 0.00% Impervious, Inflow Depth = 1.78" for 25-Year event
Inflow = 0.2 cfs @ 12.38 hrs, Volume= 1,174 cf
Outflow = 0.2 cfs @ 12.38 hrs, Volume= 1,174 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond P2:

Inflow Area = 18,062 sf, 25.00% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 1.3 cfs @ 12.18 hrs, Volume= 4,583 cf
Outflow = 0.7 cfs @ 12.30 hrs, Volume= 4,583 cf, Atten= 46%, Lag= 7.3 min
Discarded = 0.1 cfs @ 12.30 hrs, Volume= 2,294 cf
Primary = 0.7 cfs @ 12.30 hrs, Volume= 2,290 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 87.36' @ 12.30 hrs Surf.Area= 906 sf Storage= 922 cf

Plug-Flow detention time= 60.1 min calculated for 4,582 cf (100% of inflow)
Center-of-Mass det. time= 60.1 min (931.3 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	1,583 cf	**P1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	471	85.0	0	0	471
87.00	786	111.0	622	622	888
88.00	1,147	130.0	961	1,583	1,272

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" Round Culvert** L= 150.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.00' / 82.58' S= 0.0228 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Device 1	86.50'	**5.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.10'	**4.0" Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	87.60'	**12.0" Horiz. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	86.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.30 hrs HW=87.36' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.7 cfs @ 12.30 hrs HW=87.36' TW=81.12' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.7 cfs of 5.3 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.5 cfs @ 3.87 fps)
  ├─**3=Orifice/Grate-25yr** (Orifice Controls 0.1 cfs @ 1.72 fps)
  └─**4=Orifice/Grate-100yr** (Controls 0.0 cfs)

Summary for Pond P4:

Inflow Area = 176,799 sf, 34.31% Impervious, Inflow Depth = 2.99" for 25-Year event
Inflow = 12.4 cfs @ 12.19 hrs, Volume= 44,097 cf
Outflow = 6.1 cfs @ 12.34 hrs, Volume= 44,097 cf, Atten= 51%, Lag= 9.5 min
Discarded = 1.0 cfs @ 12.34 hrs, Volume= 28,319 cf
Primary = 5.1 cfs @ 12.34 hrs, Volume= 15,777 cf
Routed to Reach DP3 : Off-Site South
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP3 : Off-Site South

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 81.15' @ 12.34 hrs Surf.Area= 4,631 sf Storage= 8,138 cf

Plug-Flow detention time= 19.9 min calculated for 44,097 cf (100% of inflow)
Center-of-Mass det. time= 19.9 min (869.0 - 849.1)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	18,373 cf	**Infiltration Basin (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	2,988	222.0	0	0	2,988
80.00	3,712	256.0	3,343	3,343	4,303
81.00	4,507	274.0	4,103	7,447	5,107
82.00	5,358	293.0	4,926	12,373	6,010
83.00	6,667	580.0	6,001	18,373	25,953

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**18.0" Round 18" HDPE** L= 66.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 79.00' / 76.00' S= 0.0455 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Device 1	79.55'	**26.0" W x 3.0" H Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	79.96'	**8.0" W x 3.0" H Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	80.67'	**18.0" W x 3.0" H Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Device 1	81.34'	**24.0" W x 3.0" H Vert. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#6	Device 1	82.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#7	Secondary	82.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#8	Discarded	79.00'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=1.0 cfs @ 12.34 hrs HW=81.15' (Free Discharge)
└─**8=Exfiltration** (Exfiltration Controls 1.0 cfs)

Primary OutFlow Max=5.1 cfs @ 12.34 hrs HW=81.15' TW=0.00' (Dynamic Tailwater)
└─**1=18" HDPE** (Passes 5.1 cfs of 8.0 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 3.2 cfs @ 5.85 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 0.8 cfs @ 4.97 fps)
  ├─**4=Orifice/Grate-25yr** (Orifice Controls 1.1 cfs @ 2.86 fps)
  ├─**5=Orifice/Grate-100yr** (Controls 0.0 cfs)
  └─**6=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=79.00' TW=0.00' (Dynamic Tailwater)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P5:

Inflow Area = 14,263 sf, 25.00% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 1.0 cfs @ 12.18 hrs, Volume= 3,619 cf
Outflow = 0.8 cfs @ 12.24 hrs, Volume= 3,619 cf, Atten= 20%, Lag= 3.7 min
Discarded = 0.0 cfs @ 12.24 hrs, Volume= 2,272 cf
Primary = 0.8 cfs @ 12.24 hrs, Volume= 1,347 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 99.34' @ 12.24 hrs Surf.Area= 757 sf Storage= 741 cf

Plug-Flow detention time= 102.4 min calculated for 3,618 cf (100% of inflow)
Center-of-Mass det. time= 102.5 min (973.6 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	98.00'	1,309 cf	**P5 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
98.00	361	77.0	0	0	361
99.00	650	102.0	498	498	728
100.00	983	125.0	811	1,309	1,159

Device	Routing	Invert	Outlet Devices
#1	Primary	98.00'	**12.0" Round Culvert** L= 195.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 98.00' / 93.27' S= 0.0243 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	98.90'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	99.20'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Discarded	98.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.24 hrs HW=99.34' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.8 cfs @ 12.24 hrs HW=99.34' TW=80.95' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.8 cfs of 2.7 cfs potential flow)
  ├─**2=Orifice/Grate-10yr** (Orifice Controls 0.2 cfs @ 2.54 fps)
  └─**3=Orifice/Grate-25yr** (Weir Controls 0.6 cfs @ 1.24 fps)

Summary for Pond P6:

Inflow Area = 14,010 sf, 25.00% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 1.0 cfs @ 12.18 hrs, Volume= 3,555 cf
Outflow = 0.8 cfs @ 12.25 hrs, Volume= 3,555 cf, Atten= 27%, Lag= 4.5 min
Discarded = 0.1 cfs @ 12.25 hrs, Volume= 1,573 cf
Primary = 0.7 cfs @ 12.25 hrs, Volume= 1,982 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 93.08' @ 12.25 hrs Surf.Area= 699 sf Storage= 536 cf

Plug-Flow detention time= 28.3 min calculated for 3,554 cf (100% of inflow)
Center-of-Mass det. time= 28.3 min (899.5 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	1,355 cf	**Rain Garden P6 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	318	80.0	0	0	318
93.00	670	122.0	483	483	1,001
94.00	1,091	141.0	872	1,355	1,419

Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	**12.0" Round Culvert** L= 104.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.00' / 86.40' S= 0.0538 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.20'	**3.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	92.50'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	93.00'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	92.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.25 hrs HW=93.08' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.7 cfs @ 12.25 hrs HW=93.08' TW=81.01' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.7 cfs of 2.3 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.2 cfs @ 4.18 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 0.3 cfs @ 3.08 fps)
  └─**4=Orifice/Grate-25yr** (Weir Controls 0.2 cfs @ 0.91 fps)

Summary for Pond P7:

Inflow Area = 10,485 sf, 25.00% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 0.8 cfs @ 12.18 hrs, Volume= 2,661 cf
Outflow = 0.2 cfs @ 12.40 hrs, Volume= 2,661 cf, Atten= 69%, Lag= 13.5 min
Discarded = 0.0 cfs @ 12.40 hrs, Volume= 1,632 cf
Primary = 0.2 cfs @ 12.40 hrs, Volume= 1,028 cf
Routed to Reach DP4 : Off-Site Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 82.79' @ 12.40 hrs Surf.Area= 671 sf Storage= 741 cf

Plug-Flow detention time= 92.7 min calculated for 2,660 cf (100% of inflow)
Center-of-Mass det. time= 92.7 min (963.9 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,798 cf	**Rain Garden (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
81.00	194	55.0	0	0	194
82.00	436	86.0	307	307	549
83.00	741	105.0	582	889	853
84.00	1,089	125.0	909	1,798	1,237

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 81.00' / 80.00' S= 0.0345 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Device 1	81.85'	**2.0" Vert. Orifice/Grate 10-yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	82.50'	**3.0" Vert. Orifice/Grate 25-yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	83.15'	**12.0" Horiz. Orifice/Grate 100-yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	81.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 12.40 hrs HW=82.79' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.40 hrs HW=82.79' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.2 cfs of 1.6 cfs potential flow)
  ├─**2=Orifice/Grate 10-yr** (Orifice Controls 0.1 cfs @ 4.46 fps)
  ├─**3=Orifice/Grate 25-yr** (Orifice Controls 0.1 cfs @ 1.96 fps)
  └─**4=Orifice/Grate 100-yr** (Controls 0.0 cfs)

Summary for Subcatchment PS-7:

Runoff = 1.1 cfs @ 12.17 hrs, Volume= 3,983 cf, Depth= 4.56"
Routed to Pond P7 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
10,485	70	1/2 acre lots, 25% imp, HSG B
7,864		75.00% Pervious Area
2,621		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.3	45	0.0200	2.87		**Shallow Concentrated Flow, Roof Drain Pipe** Paved Kv= 20.3 fps
9.0					**Direct Entry, Adjustment for 0.16 hr**
10.0	95	Total			

Summary for Subcatchment PS-N1: PS-N1

Runoff = 16.0 cfs @ 12.17 hrs, Volume= 55,893 cf, Depth= 5.14"
Routed to Pond P4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
21,940	98	Paved parking, HSG B
108,524	70	1/2 acre lots, 25% imp, HSG B
130,464	75	Weighted Average
81,393		62.39% Pervious Area
49,071		37.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3					**Direct Entry, Adjusted 0.1 hr**
1.1	50	0.0060	0.73		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.6	154	0.0380	3.96		**Shallow Concentrated Flow, Shallow** Paved Kv= 20.3 fps
10.0	204	Total			

Summary for Subcatchment PS-N2:

Runoff = 2.0 cfs @ 12.17 hrs, Volume= 6,862 cf, Depth= 4.56"
Routed to Pond P2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

	Area (sf)	CN	Description
	18,062	70	1/2 acre lots, 25% imp, HSG B
	13,547		75.00% Pervious Area
	4,516		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.1 hr**

Summary for Subcatchment PS-N5:

Runoff = 1.6 cfs @ 12.17 hrs, Volume= 5,419 cf, Depth= 4.56"
Routed to Pond P5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

	Area (sf)	CN	Description
*	14,263	70	1/2 acre lots, 25% imp, HSG B
	10,697		75.00% Pervious Area
	3,566		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.16 hr**

Summary for Subcatchment PS-N6:

Runoff = 1.5 cfs @ 12.17 hrs, Volume= 5,323 cf, Depth= 4.56"
Routed to Pond P6 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

	Area (sf)	CN	Description
	14,010	70	1/2 acre lots, 25% imp, HSG B
	10,508		75.00% Pervious Area
	3,503		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment for 0.16 hrs**

Summary for Subcatchment PS1:

Runoff = 0.3 cfs @ 12.18 hrs, Volume= 1,174 cf, Depth= 4.10"
Routed to Reach DP1 : School St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
2,979	61	>75% Grass cover, Good, HSG B
459	98	Paved parking, HSG B
3,438	66	Weighted Average
2,979		86.65% Pervious Area
459		13.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Adjustment to 0.167 hr**

Summary for Subcatchment PS2:

Runoff = 5.2 cfs @ 12.18 hrs, Volume= 18,322 cf, Depth= 3.30"
Routed to Reach DP2 : Off-Site West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
1,951	98	Roofs, HSG B
25,338	61	>75% Grass cover, Good, HSG B
39,261	55	Woods, Good, HSG B
66,550	59	Weighted Average
64,599		97.07% Pervious Area
1,951		2.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.10"
0.4	100	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	100	0.0200	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.6	303	0.0400	3.22		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
3.6					**Direct Entry, Adjustment for 0.167 hrs**
10.0	553	Total			

Summary for Subcatchment PS3:

Runoff = 1.1 cfs @ 12.23 hrs, Volume= 4,692 cf, Depth= 3.30"
Routed to Reach DP3 : Off-Site South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

	Area (sf)	CN	Description
	10,484	61	>75% Grass cover, Good, HSG B
	6,559	55	Woods, Good, HSG B
	17,043	59	Weighted Average
	17,043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0100	0.08		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
1.8	359	0.0440	3.38		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.7	319	0.0390	3.18		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
14.5	728	Total			

Summary for Subcatchment PS4:

Runoff = 1.3 cfs @ 12.26 hrs, Volume= 5,992 cf, Depth= 2.97"
Routed to Reach DP4 : Off-Site Southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

	Area (sf)	CN	Description
	19,363	55	Woods, Good, HSG B
*	4,850	61	>75% Grass cover, Good, HSG B
	24,213	56	Weighted Average
	24,213		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	50	0.0440	0.05		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	265	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
16.7	315	Total			

Summary for Subcatchment PS5:

Runoff = 0.3 cfs @ 12.37 hrs, Volume= 1,963 cf, Depth= 2.97"
Routed to Reach DP5 : Off-Site East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
1,870	61	>75% Grass cover, Good, HSG B
6,063	55	Woods, Good, HSG B
7,933	56	Weighted Average
7,933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.2	50	0.0140	0.03		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.0	122	0.0150	1.97		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
26.2	172	Total			

Summary for Reach DP1: School St

Inflow Area = 3,438 sf, 13.35% Impervious, Inflow Depth = 4.10" for 100-Year event
Inflow = 0.3 cfs @ 12.18 hrs, Volume= 1,174 cf
Outflow = 0.3 cfs @ 12.18 hrs, Volume= 1,174 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP2: Off-Site West

Inflow Area = 66,550 sf, 2.93% Impervious, Inflow Depth = 3.30" for 100-Year event
Inflow = 5.2 cfs @ 12.18 hrs, Volume= 18,322 cf
Outflow = 5.2 cfs @ 12.18 hrs, Volume= 18,322 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP3: Off-Site South

Inflow Area = 193,842 sf, 31.29% Impervious, Inflow Depth = 2.13" for 100-Year event
Inflow = 9.7 cfs @ 12.30 hrs, Volume= 34,419 cf
Outflow = 9.7 cfs @ 12.30 hrs, Volume= 34,419 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP4: Off-Site Southeast

Inflow Area = 34,698 sf, 7.55% Impervious, Inflow Depth = 2.79" for 100-Year event
Inflow = 1.7 cfs @ 12.29 hrs, Volume= 8,061 cf
Outflow = 1.7 cfs @ 12.29 hrs, Volume= 8,061 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DP5: Off-Site East

Inflow Area = 7,933 sf, 0.00% Impervious, Inflow Depth = 2.97" for 100-Year event
Inflow = 0.3 cfs @ 12.37 hrs, Volume= 1,963 cf
Outflow = 0.3 cfs @ 12.37 hrs, Volume= 1,963 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond P2:

Inflow Area = 18,062 sf, 25.00% Impervious, Inflow Depth = 4.56" for 100-Year event
Inflow = 2.0 cfs @ 12.17 hrs, Volume= 6,862 cf
Outflow = 1.3 cfs @ 12.26 hrs, Volume= 6,862 cf, Atten= 34%, Lag= 5.4 min
Discarded = 0.1 cfs @ 12.26 hrs, Volume= 2,588 cf
Primary = 1.2 cfs @ 12.26 hrs, Volume= 4,274 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 87.70' @ 12.26 hrs Surf.Area= 1,031 sf Storage= 1,253 cf

Plug-Flow detention time= 48.8 min calculated for 6,860 cf (100% of inflow)
Center-of-Mass det. time= 48.9 min (904.0 - 855.1)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	1,583 cf	**P1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	471	85.0	0	0	471
87.00	786	111.0	622	622	888
88.00	1,147	130.0	961	1,583	1,272

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" Round Culvert** L= 150.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.00' / 82.58' S= 0.0228 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Device 1	86.50'	**5.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.10'	**4.0" Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	87.60'	**12.0" Horiz. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	86.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.26 hrs HW=87.70' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.2 cfs @ 12.26 hrs HW=87.70' TW=81.91' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.2 cfs of 6.5 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.7 cfs @ 4.79 fps)
  ├─**3=Orifice/Grate-25yr** (Orifice Controls 0.3 cfs @ 3.16 fps)
  └─**4=Orifice/Grate-100yr** (Weir Controls 0.3 cfs @ 1.02 fps)

Summary for Pond P4:

Inflow Area = 176,799 sf, 34.31% Impervious, Inflow Depth = 4.51" for 100-Year event
Inflow = 19.4 cfs @ 12.18 hrs, Volume= 66,501 cf
Outflow = 9.9 cfs @ 12.32 hrs, Volume= 66,501 cf, Atten= 49%, Lag= 8.5 min
Discarded = 1.1 cfs @ 12.32 hrs, Volume= 36,774 cf
Primary = 8.8 cfs @ 12.32 hrs, Volume= 29,727 cf
Routed to Reach DP3 : Off-Site South
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP3 : Off-Site South

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 81.98' @ 12.32 hrs Surf.Area= 5,344 sf Storage= 12,288 cf

Plug-Flow detention time= 23.0 min calculated for 66,482 cf (100% of inflow)
Center-of-Mass det. time= 23.0 min (860.8 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	18,373 cf	**Infiltration Basin (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	2,988	222.0	0	0	2,988
80.00	3,712	256.0	3,343	3,343	4,303
81.00	4,507	274.0	4,103	7,447	5,107
82.00	5,358	293.0	4,926	12,373	6,010
83.00	6,667	580.0	6,001	18,373	25,953

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**18.0" Round 18" HDPE** L= 66.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 79.00' / 76.00' S= 0.0455 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Device 1	79.55'	**26.0" W x 3.0" H Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	79.96'	**8.0" W x 3.0" H Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	80.67'	**18.0" W x 3.0" H Vert. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Device 1	81.34'	**24.0" W x 3.0" H Vert. Orifice/Grate-100yr** C= 0.600 Limited to weir flow at low heads
#6	Device 1	82.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#7	Secondary	82.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#8	Discarded	79.00'	**8.270 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=1.1 cfs @ 12.32 hrs HW=81.98' (Free Discharge)
└─**8=Exfiltration** (Exfiltration Controls 1.1 cfs)

Primary OutFlow Max=8.8 cfs @ 12.32 hrs HW=81.98' TW=0.00' (Dynamic Tailwater)
└─**1=18" HDPE** (Passes 8.8 cfs of 10.0 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 4.0 cfs @ 7.32 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 1.1 cfs @ 6.63 fps)
  ├─**4=Orifice/Grate-25yr** (Orifice Controls 2.0 cfs @ 5.25 fps)
  ├─**5=Orifice/Grate-100yr** (Orifice Controls 1.7 cfs @ 3.46 fps)
  └─**6=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=79.00' TW=0.00' (Dynamic Tailwater)
└─**7=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P5:

Inflow Area =	14,263 sf,	25.00% Impervious,	Inflow Depth = 4.56"	for 100-Year event
Inflow =	1.6 cfs @	12.17 hrs, Volume=	5,419 cf	
Outflow =	1.5 cfs @	12.20 hrs, Volume=	5,419 cf,	Atten= 5%, Lag= 1.6 min
Discarded =	0.1 cfs @	12.20 hrs, Volume=	2,594 cf	
Primary =	1.4 cfs @	12.20 hrs, Volume=	2,824 cf	

Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 99.44' @ 12.20 hrs Surf.Area= 787 sf Storage= 812 cf

Plug-Flow detention time= 81.2 min calculated for 5,417 cf (100% of inflow)
Center-of-Mass det. time= 81.3 min (936.4 - 855.1)

Volume	Invert	Avail.Storage	Storage Description
#1	98.00'	1,309 cf	**P5 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
98.00	361	77.0	0	0	361
99.00	650	102.0	498	498	728
100.00	983	125.0	811	1,309	1,159

Device	Routing	Invert	Outlet Devices
#1	Primary	98.00'	**12.0" Round Culvert** L= 195.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 98.00' / 93.27' S= 0.0243 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	98.90'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	99.20'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#4	Discarded	98.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.20 hrs HW=99.44' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.4 cfs @ 12.20 hrs HW=99.44' TW=81.57' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.4 cfs of 2.9 cfs potential flow)
  ├─**2=Orifice/Grate-10yr** (Orifice Controls 0.3 cfs @ 2.93 fps)
  └─**3=Orifice/Grate-25yr** (Weir Controls 1.2 cfs @ 1.59 fps)

Summary for Pond P6:

Inflow Area = 14,010 sf, 25.00% Impervious, Inflow Depth = 4.56" for 100-Year event
Inflow = 1.5 cfs @ 12.17 hrs, Volume= 5,323 cf
Outflow = 1.4 cfs @ 12.21 hrs, Volume= 5,323 cf, Atten= 8%, Lag= 2.1 min
Discarded = 0.1 cfs @ 12.21 hrs, Volume= 1,813 cf
Primary = 1.4 cfs @ 12.21 hrs, Volume= 3,509 cf
Routed to Pond P4 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 93.19' @ 12.21 hrs Surf.Area= 741 sf Storage= 615 cf

Plug-Flow detention time= 24.1 min calculated for 5,321 cf (100% of inflow)
Center-of-Mass det. time= 24.1 min (879.3 - 855.1)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	1,355 cf	**Rain Garden P6 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	318	80.0	0	0	318
93.00	670	122.0	483	483	1,001
94.00	1,091	141.0	872	1,355	1,419

Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	**12.0" Round Culvert** L= 104.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.00' / 86.40' S= 0.0538 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	92.20'	**3.0" Vert. Orifice/Grate-2yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	92.50'	**4.0" Vert. Orifice/Grate-10yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	93.00'	**12.0" Horiz. Orifice/Grate-25yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	92.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.21 hrs HW=93.19' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.4 cfs @ 12.21 hrs HW=93.19' TW=81.63' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.4 cfs of 2.5 cfs potential flow)
  ├─**2=Orifice/Grate-2yr** (Orifice Controls 0.2 cfs @ 4.47 fps)
  ├─**3=Orifice/Grate-10yr** (Orifice Controls 0.3 cfs @ 3.47 fps)
  └─**4=Orifice/Grate-25yr** (Weir Controls 0.8 cfs @ 1.41 fps)

Summary for Pond P7:

Inflow Area = 10,485 sf, 25.00% Impervious, Inflow Depth = 4.56" for 100-Year event
Inflow = 1.1 cfs @ 12.17 hrs, Volume= 3,983 cf
Outflow = 0.5 cfs @ 12.32 hrs, Volume= 3,983 cf, Atten= 53%, Lag= 8.5 min
Discarded = 0.1 cfs @ 12.32 hrs, Volume= 1,915 cf
Primary = 0.5 cfs @ 12.32 hrs, Volume= 2,069 cf
Routed to Reach DP4 : Off-Site Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 83.22' @ 12.32 hrs Surf.Area= 812 sf Storage= 1,059 cf

Plug-Flow detention time= 79.2 min calculated for 3,982 cf (100% of inflow)
Center-of-Mass det. time= 79.3 min (934.4 - 855.1)

Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,798 cf	**Rain Garden (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
81.00	194	55.0	0	0	194
82.00	436	86.0	307	307	549
83.00	741	105.0	582	889	853
84.00	1,089	125.0	909	1,798	1,237

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 81.00' / 80.00' S= 0.0345 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Device 1	81.85'	**2.0" Vert. Orifice/Grate 10-yr** C= 0.600 Limited to weir flow at low heads
#3	Device 1	82.50'	**3.0" Vert. Orifice/Grate 25-yr** C= 0.600 Limited to weir flow at low heads
#4	Device 1	83.15'	**12.0" Horiz. Orifice/Grate 100-yr** C= 0.600 Limited to weir flow at low heads
#5	Discarded	81.00'	**2.410 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.32 hrs HW=83.22' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.5 cfs @ 12.32 hrs HW=83.22' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.5 cfs of 1.8 cfs potential flow)
 ├─**2=Orifice/Grate 10-yr** (Orifice Controls 0.1 cfs @ 5.46 fps)
 ├─**3=Orifice/Grate 25-yr** (Orifice Controls 0.2 cfs @ 3.71 fps)
 └─**4=Orifice/Grate 100-yr** (Weir Controls 0.2 cfs @ 0.86 fps)

APPENDIX D:

STORMWATER

MANAGEMENT CALCULATIONS

Stormwater Management Calculations

STANDARD 3: Recharge To Groundwater: Static Method

- Calculate Impervious Area *(From HydroCAD Model)*
  New Impervious Area (HSG B Soil) = 56,478 SF

  The HydroCAD Model was designed utilizing a conservative approach. Although the sidewalk and driveways are proposed to be pervious surfaces, they were modelled as impervious.

- Determine Rainfall Depth to be Recharged
  (MassDEP Stormwater Management Handbook: Table 2.3.2)

Hydrologic Soil Group	Recharge Rainfall Depth
B	0.35"

- Calculate Recharge Volume
  'Rv' = [0.35" x (56,478SF)] / 12 SF-In = 1647.27 CF
  ***'Rv'* = 1648 CF**

- Calculate Provided Recharge
  Proposed Recharge System provided in infiltration basins and rain gardens:

HCAD System ID	Bottom of System	Lowest System Outlet	Total Recharge Volume Provided
P2	84	86.50	**272**
P4	79	79.55	**1749**
P5	98	98.80	**435**
P6	92	92.20	**70**
P7	81	81.85	**253**

The table above depicts the recharge volume provided measured to lowest system outlet. The total volume provided is 2,779 CF.

Verify Drawdown, Maximum 72-Hours: Static Method

HCAD System ID	Recharge Volume (CF)	Bottom Surface Area (SF)	Infiltration Rate Inches/Hour	Drawdown Time Rv / (K x A) (Hours)	Description
P2	272	618	2.41	2.19	Rain Garden
P4	1749	3376	8.27	0.75	Infiltration Basin
P5	435	617	2.41	3.51	Rain Garden
P6	70	378	2.41	0.92	Rain Garden
P7	253	399	2.41	3.16	Rain Garden

*****Design Complies with Recharge Volume Standard*****

STANDARD 4: Water Quality Volume

The Town of Groveland Stormwater Management and Erosion Control Bylaw, section 14.11 requires 60% removal of Total Phosphorous and 90% of Total Suspended Solids from redevelopment sites.

The proposed development will utilize two hydrodynamic separators from Contech) to remove TSS. For Total Phosphorous, the project will install best management practices, such as infiltration basins. See calculations attached.

Stage-Area-Storage for Pond P2:

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
86.00	471	471	0
86.01	474	475	5
86.02	477	478	9
86.03	479	482	14
86.04	482	486	19
86.05	485	489	24
86.06	488	493	29
86.07	490	497	34
86.08	493	500	39
86.09	496	504	44
86.10	499	508	48
86.11	502	511	53
86.12	505	515	59
86.13	507	519	64
86.14	510	523	69
86.15	513	527	74
86.16	516	530	79
86.17	519	534	84
86.18	522	538	89
86.19	525	542	95
86.20	528	546	100
86.21	530	549	105
86.22	533	553	110
86.23	536	557	116
86.24	539	561	121
86.25	542	565	127
86.26	545	569	132
86.27	548	573	137
86.28	551	577	143
86.29	554	581	148
86.30	557	585	154
86.31	560	588	160
86.32	563	592	165
86.33	566	596	171
86.34	569	600	177
86.35	572	604	182
86.36	575	608	188
86.37	578	612	194
86.38	581	616	200
86.39	584	621	205
86.40	587	625	211
86.41	590	629	217
86.42	594	633	223
86.43	597	637	229
86.44	600	641	235
86.45	603	645	241
86.46	606	649	247
86.47	609	653	253
86.48	612	657	259
86.49	615	662	265
86.50	618	666	272
86.51	622	670	278
86.52	625	674	284

Stage-Area-Storage for Pond P6:

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
92.00	318	318	0
92.05	333	345	16
92.10	347	373	33
92.15	363	402	51
92.20	378	432	70
92.25	394	462	89
92.30	410	493	109
92.35	426	525	130
92.40	443	557	152
92.45	460	590	174
92.50	478	624	198
92.55	496	658	222
92.60	514	694	247
92.65	532	729	273
92.70	551	766	300
92.75	570	803	328
92.80	589	841	357
92.85	609	880	387
92.90	629	920	418
92.95	649	960	450
93.00	670	1,001	483
93.05	689	1,020	517
93.10	708	1,040	552
93.15	727	1,060	588
93.20	746	1,080	625
93.25	766	1,100	663
93.30	786	1,120	701
93.35	806	1,140	741
93.40	826	1,161	782
93.45	847	1,182	824
93.50	868	1,202	867
93.55	889	1,224	910
93.60	910	1,245	955
93.65	932	1,266	1,002
93.70	954	1,287	1,049
93.75	976	1,309	1,097
93.80	999	1,331	1,146
93.85	1,021	1,353	1,197
93.90	1,044	1,375	1,248
93.95	1,068	1,397	1,301
94.00	**1,091**	**1,419**	**1,355**

Stage-Area-Storage for Pond P7: (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
81.53	310	363	132
81.54	313	366	136
81.55	315	370	139
81.56	318	374	142
81.57	320	377	145
81.58	323	381	148
81.59	325	385	151
81.60	328	388	155
81.61	330	392	158
81.62	333	396	161
81.63	335	399	165
81.64	338	403	168
81.65	340	407	171
81.66	343	411	175
81.67	345	415	178
81.68	348	418	182
81.69	351	422	185
81.70	353	426	189
81.71	356	430	192
81.72	358	434	196
81.73	361	438	199
81.74	364	442	203
81.75	366	446	207
81.76	369	449	210
81.77	372	453	214
81.78	374	457	218
81.79	377	461	222
81.80	380	465	225
81.81	383	469	229
81.82	385	474	233
81.83	388	478	237
81.84	391	482	241
81.85	394	486	245
81.86	396	490	249
81.87	399	494	253
81.88	402	498	257
81.89	405	502	261
81.90	407	506	265
81.91	410	511	269
81.92	413	515	273
81.93	416	519	277
81.94	419	523	281
81.95	422	527	286
81.96	424	532	290
81.97	427	536	294
81.98	430	540	298
81.99	433	545	303
82.00	436	549	307
82.01	439	552	311
82.02	441	554	316
82.03	444	557	320
82.04	447	560	325
82.05	449	563	329

Stage-Area-Storage for Pond P4: (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
79.53	3,362	3,662	1,682
79.54	3,369	3,675	1,715
79.55	3,376	3,688	1,749
79.56	3,384	3,701	1,783
79.57	3,391	3,715	1,817
79.58	3,398	3,728	1,851
79.59	3,406	3,741	1,885
79.60	3,413	3,755	1,919
79.61	3,420	3,768	1,953
79.62	3,428	3,781	1,987
79.63	3,435	3,795	2,022
79.64	3,442	3,808	2,056
79.65	3,450	3,822	2,090
79.66	3,457	3,835	2,125
79.67	3,464	3,848	2,160
79.68	3,472	3,862	2,194
79.69	3,479	3,875	2,229
79.70	3,487	3,889	2,264
79.71	3,494	3,903	2,299
79.72	3,501	3,916	2,334
79.73	3,509	3,930	2,369
79.74	3,516	3,943	2,404
79.75	3,524	3,957	2,439
79.76	3,531	3,970	2,474
79.77	3,539	3,984	2,510
79.78	3,546	3,998	2,545
79.79	3,553	4,011	2,581
79.80	3,561	4,025	2,616
79.81	3,568	4,039	2,652
79.82	3,576	4,053	2,688
79.83	3,583	4,066	2,723
79.84	3,591	4,080	2,759
79.85	3,598	4,094	2,795
79.86	3,606	4,108	2,831
79.87	3,613	4,122	2,867
79.88	3,621	4,135	2,903
79.89	3,629	4,149	2,940
79.90	3,636	4,163	2,976
79.91	3,644	4,177	3,012
79.92	3,651	4,191	3,049
79.93	3,659	4,205	3,085
79.94	3,666	4,219	3,122
79.95	3,674	4,233	3,159
79.96	3,682	4,247	3,196
79.97	3,689	4,261	3,232
79.98	3,697	4,275	3,269
79.99	3,704	4,289	3,306
80.00	3,712	4,303	3,343
80.01	3,720	4,311	3,381
80.02	3,727	4,319	3,418
80.03	3,735	4,327	3,455
80.04	3,742	4,334	3,493
80.05	3,750	4,342	3,530

Stage-Area-Storage for Pond P5:

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
98.00	361	361	0
98.05	373	377	18
98.10	386	393	37
98.15	399	410	57
98.20	412	426	77
98.25	425	443	98
98.30	439	460	120
98.35	453	478	142
98.40	466	496	165
98.45	481	514	189
98.50	495	532	213
98.55	510	550	238
98.60	524	569	264
98.65	539	588	291
98.70	554	607	318
98.75	570	627	346
98.80	585	647	375
98.85	601	667	405
98.90	617	687	435
98.95	634	707	466
99.00	650	728	498
99.05	665	748	531
99.10	680	767	565
99.15	696	787	599
99.20	711	807	635
99.25	727	828	670
99.30	743	848	707
99.35	759	869	745
99.40	775	890	783
99.45	791	911	822
99.50	808	933	862
99.55	825	954	903
99.60	842	976	945
99.65	859	998	987
99.70	876	1,021	1,031
99.75	893	1,043	1,075
99.80	911	1,066	1,120
99.85	929	1,089	1,166
99.90	947	1,112	1,213
99.95	965	1,135	1,261
100.00	**983**	**1,159**	**1,309**

THE MORIN-CAMERON GROUP, INC.
25 Kenoza Avenue,
Haverhill, MA 01830
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Standard 4: Total Suspended Solids Calculation for P4

Name:
Location: 181R School St
Groveland, MA
County: Essex
Applicant: Groveland Redevelopment, LLC

Proj. No.: 3634
Date: 7/30/2024
Revised:
Computed by: Leticia Oliveira
Checked by: Scott P. Cameron, P.E.

TSS Removal Calculation Worksheet

B BMP	C TSS Removal Rate	D Starting TSS Load (*F)	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Proprietary Treatment Practice	0.89	0.75	0.67	0.08
Infiltration Basin	0.80	0.08	0.06	0.02
	0.00	0.02	0.00	0.02
	0.00	0.02	0.00	0.02

Total TSS Removal = 98%

Note: Subsurface Infiltration Structures are precast concrete galleys

*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

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

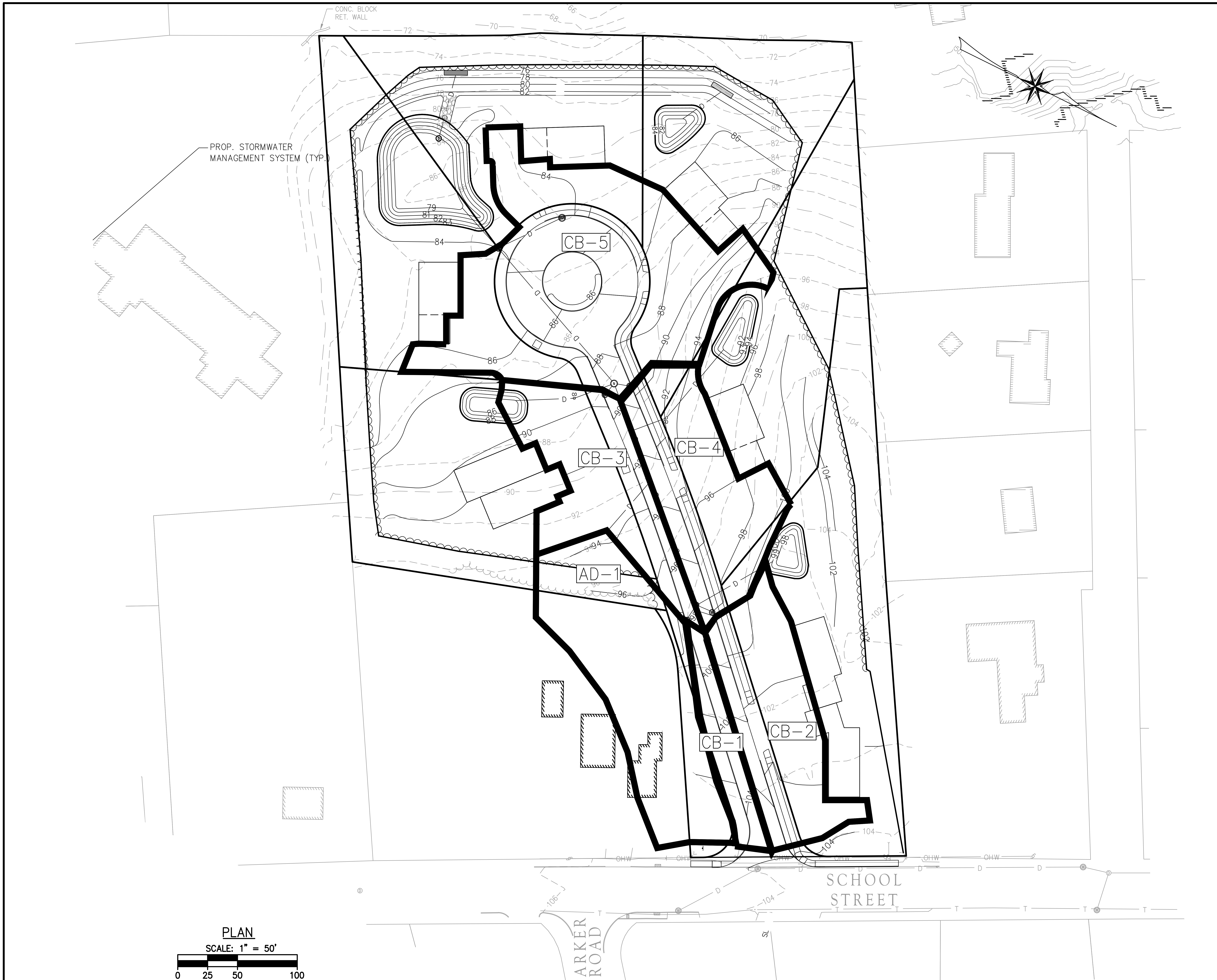
181R SCHOOL ST SUBDIVISION
GROVELAND, MA

Area	0.75 ac	Unit Site Designation	WQU 1
Weighted C	0.9	Rainfall Station #	67
t_c	6 min		
CDS Model	2015-4	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.08	41.0%	41.0%	0.05	0.05	38.8
0.16	23.9%	64.9%	0.11	0.11	22.0
0.24	11.5%	76.5%	0.16	0.16	10.3
0.32	7.4%	83.9%	0.22	0.22	6.4
0.40	4.4%	88.3%	0.27	0.27	3.7
0.48	2.9%	91.2%	0.32	0.32	2.4
0.56	1.8%	93.0%	0.38	0.38	1.4
0.64	1.2%	94.2%	0.43	0.43	0.9
0.72	1.6%	95.8%	0.49	0.49	1.2
0.80	0.8%	96.6%	0.54	0.54	0.6
1.00	0.6%	97.1%	0.68	0.68	0.4
1.40	1.4%	98.6%	0.95	0.95	0.7
1.80	0.9%	99.5%	1.22	1.22	0.3
2.20	0.5%	100.0%	1.49	1.40	0.1
					89.2
				Removal Efficiency Adjustment[2] =	0.0%
				Predicted % Annual Rainfall Treated =	100.0%
				Predicted Net Annual Load Removal Efficiency =	**89.2%**

1 - Based on 7 years of data from NCDC station #3276, Groveland, Essex County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



The Morin-Cameron GROUP, INC.
CIVIL ENGINEERS | ENVIRONMENTAL CONSULTANTS
LAND SURVEYORS | LAND USE PLANNERS
66 ELM STREET, DANVERS, MASSACHUSETTS 01923
P: 978-777-8586, W: WWW.MORINCAMERON.COM

FIELD SURVEY BY: MCG
DRAFTED BY: LNO
CHECKED BY: SPC
APPROVED BY: SPC
SCALE: 1"=50'
DATE: JULY 31, 2024

REVISIONS

NO.	DESCRIPTION	DATE
1	PER PEER REVIEW	11/5/24

RATIONAL CALCULATION PLAN

IN

GROVELAND, MASSACHUSETTS
181R SCHOOL ST

PROJ. NO. 3634

SHEET NO. 1 OF 1

DRAWING: 3634 Watersheds.dwg

Weighted Runoff Coefficients "C" for Rational Method

THE MORIN-CAMERON GROUP, INC.
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C'- Coefficients	
Pervious Soil	0.35
Impervious	0.9

Description of Area CB-1	Area (acres)	Runoff Coefficient	A x C
Pervious	0.169	0.35	0.06
Impervious	0.062	0.90	0.06
Totals =	**0.231**		0.11

Weighted Runoff Coefficient = **S(AxC) / SA = 0.50**

Description of Area CB-2	Area (acres)	Runoff Coefficient	A x C
Pervious	0.199	0.35	0.07
Impervious	0.123	0.90	0.11
Totals =	**0.322**		0.18

Weighted Runoff Coefficient = **S(AxC) / SA = 0.56**

Description of Area CB-3	Area (acres)	Runoff Coefficient	A x C
Pervious	0.711	0.35	0.25
Impervious	0.118	0.90	0.11
Totals =	**0.829**		0.36

Weighted Runoff Coefficient = **S(AxC) / SA = 0.43**

Description of Area CB-4	Area (acres)	Runoff Coefficient	A x C
Pervious	0.241	0.35	0.08
Impervious	0.118	0.90	0.11
Totals =	**0.359**		0.19

Weighted Runoff Coefficient = **S(AxC) / SA = 0.53**

Description of Area CB-5	Area (acres)	Runoff Coefficient	A x C
Pervious	0.056	0.35	0.02
Impervious	0.104	0.90	0.09
Totals =	**0.161**		0.11

Weighted Runoff Coefficient = **S(AxC) / SA = 0.71**

Description of Area AD-1	Area (acres)	Runoff Coefficient	A x C
Pervious	0.463	0.35	0.16
Impervious	0.226	0.90	0.20
Totals =	**0.689**		0.37

Weighted Runoff Coefficient = **S(AxC) / SA = 0.53**

VERIFY PIP+A12:X67E CAPACITY-100 YEAR STORM

Pipe Sizing Calculation Spreadsheet:

THE MORIN-CAMERON GROUP, INC.
66 Elm Street
Danvers, MA 01923
P: (978) 777-8586
F: (978) 774-3488
W: www.morincameron.com

Name: Groveland Subdivision
Location: 181R School St
Groveland, MA
County: Essex County

Proj. No.: 3634
Date: 7/24/2024
Revised: 10/28/2024
Computed by: Leticia Oliveira
Checked by: Scott P, Cameron, P.E.

Design Parameters:
IDF Curve
25 Year Storm Boston, MA
k_e= 0.2

DESCRIPTION	LOCATION		AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PIPE PROFILE				
	FROM	TO					PIPE	CONC. TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER
CB-1	CB-1	DMH-1	0.23	0.50	0.11	0.11	0.05	10.0	4.9	0.6	3.5	0.012	12	0.020	5.5	6.9	11	0.22	97.82	93.50	93.28
CB-2	CB-2	DMH-1	0.32	0.56	0.18	0.18	0.04	10.0	4.9	0.9	4.2	0.012	12	0.020	5.5	6.9	11	0.22	97.82	93.50	93.28
P5	P5	DMH-1	-	-	-	-	0.19	10.0	4.9	0.9	6.1	0.012	12	0.070	10.2	13.0	68	4.73	99.20	98.00	93.27
DMH-1	DMH-1	DMH-2	-	-	-	0.30	0.44	10.0	4.9	2.4	7.3	0.012	12	0.040	7.8	9.9	193	7.80	97.77	92.52	84.72
CB-3	CB-3	DMH-2	0.83	0.43	0.36	0.36	0.03	10.0	4.9	1.7	5.3	0.012	12	0.020	5.5	6.9	8	0.16	89.11	84.61	84.45
CB-4	CB-4	DMH-2	0.36	0.53	0.19	0.19	0.04	10.0	4.9	0.9	4.1	0.012	12	0.018	5.1	6.6	9	0.16	89.11	84.61	84.45
P6	P6	DMH-2	-	-	-	-	0.26	10.0	4.9	1.1	6.6	0.012	12	0.070	10.2	13.0	104	7.28	93.00	92.00	84.72
P2	P2	DMH-2	-	-	-	-	0.72	10.0	4.9	0.5	3.5	0.012	12	0.023	5.8	7.4	150	3.42	87.45	86.00	82.58
AD-1	AD-1	DMH-2	0.69	0.53	0.37	0.37	0.18	10.0	4.9	1.5	4.9	0.012	12	0.020	5.5	6.9	54	1.08	93.50	89.28	88.20
DMH-2	DMH-2	WQU-2	-	-	-	1.21	0.33	10.0	4.9	8.1	7.3	0.012	15	0.015	8.6	7.0	145	2.18	89.22	82.48	80.30
CB-5	CB-5	WQU-2	0.16	0.71	0.11	0.11	0.37	10.0	4.9	0.6	2.5	0.012	12	0.006	3.1	3.9	55	0.35	83.90	79.90	79.55
WQU-2	WQU-2	P4	-	-	-	-	0.11	10.0	4.9	8.7	6.5	0.012	18	0.011	12.1	6.9	44	0.50	84.00	79.50	79.00

PHOSPHOROUS REMOVAL CALCULATION - 181R SCHOOL STREET, GROVELAND, MA

Infiltration Basin P4

ID	Land Use	Cover	Area (Ac)	PLER (lb/ac/yr)
1	Multi-Family	Impervious	1.14	2.32
2	Landscaped (B)	Pervious	1.91	0.12

BMP Load P [Sum (Area x PLER)]	2.874 lb/ac/yr
Available BMP Volume (HydroCAD)	18373 cf
Rainfall Depth (Table 3-4)	0.5 inch
Runoff Depth (Table 3-4)	0.01 inch

BMP Volume $_{(IA-in)}$ = Available BMP Vol/Impervious Area
BMP Volume $_{(IA-in)}$ = 4.44 inch

BMP Volume $_{(PA-in)}$ = Pervious Area x Runoff Depth
BMP volume $_{(PA-in)}$ = 69.3 cf

BMP volume $_{(IA-cf)2}$ = Available BMP Vol - BMP volume $_{(PA-in)}$
BMP volume $_{(IA-cf)2}$ = 18303.7 cf

BMP volume $_{(IA-in)2}$ = BMP volume $_{(IA-in)2}$ / Imperv. Area
BMP volume IA = 4.42 inch

% Difference = BMP Vol. $_{(IA-in)}$ - BMP Vol. $_{(IA-in)2}$/BMP Vol. $_{(IA-in)2}$
% Difference = 0.4% < 5% ⇒ **OK**

Infiltration Rate = 8.27 inch/hr
⇒ Use Figure 3-17

BMP-Volume $_{Net\ IA-in}$ = 4.42 inch

BMP Reduction $_{\%-p}$ = 95 % (Figure 3-17)
⇒ Use 70% max per MassDEP SWMH

BMP Reduction $_{lbs-p}$ = BMP Load P x Reduction %
BMP Reduction $_{lbs-p}$ = 2.01 lb/ac/year

Rain Garden P2

ID	Land Use	Cover	Area (Ac)	PLER (lb/ac/yr)
1	Multi-Family	Impervious	0.090	2.32
2	Landscaped (B)	Pervious	0.270	0.12

BMP Load P [Sum (Area x PLER)]	0.24 lb/ac/yr
Available BMP Volume (HydroCAD)	1583 cf
Rainfall Depth (Table 3-4)	0.5 inch
Runoff Depth (Table 3-4)	0.01 inch

BMP Volume $_{(IA-in)}$ = Available BMP Vol/Impervious Area
BMP Volume $_{(IA-in)}$ = 4.84 inch

BMP Volume $_{(PA-in)}$ = Pervious Area x Runoff Depth
BMP volume $_{(PA-in)}$ = 9.8 cf

BMP volume $_{(IA-cf)2}$ = Available BMP Vol - BMP volume $_{(PA-in)}$
BMP volume $_{(IA-cf)2}$ = 1573.2 cf

BMP volume $_{(IA-in)2}$ = BMP volume $_{(IA-in)2}$ / Imperv. Area
BMP volume IA = 4.81 inch

% Difference = BMP Vol. $_{(IA-in)}$ - BMP Vol. $_{(IA-in)2}$/BMP Vol. $_{(IA-in)2}$
% Difference = 0.6% < 5% ⇒ **OK**

Infiltration Rate = 2.41 inch/hr
⇒ Use Figure 3-16

BMP-Volume $_{Net\ IA-in}$ = 4.81 inch

BMP Reduction $_{\%-p}$ = 83 % (Figure 3-16)
⇒ Use 70% max per MassDEP SWMH

BMP Reduction $_{lbs-p}$ = BMP Load P x Reduction %
BMP Reduction $_{lbs-p}$ = 0.17 lb/ac/year

Rain Garden P5

ID	Land Use	Cover	Area (Ac)	PLER (lb/ac/yr)
1	Multi-Family	Impervious	0.082	2.32
2	Landscaped (B)	Pervious	0.246	0.12

BMP Load P [Sum (Area x PLER)]	0.22 lb/ac/yr
Available BMP Volume (HydroCAD)	1309 cf
Rainfall Depth (Table 3-4)	0.5 inch
Runoff Depth (Table 3-4)	0.01 inch

BMP Volume $_{(IA-in)}$ = Available BMP Vol/Impervious Area
BMP Volume $_{(IA-in)}$ = 4.40 inch

BMP Volume $_{(PA-in)}$ = Pervious Area x Runoff Depth
BMP volume $_{(PA-in)}$ = 8.9 cf

BMP volume $_{(IA-cf)2}$ = Available BMP Vol - BMP volume $_{(PA-in)}$
BMP volume $_{(IA-cf)2}$ = 1300.1 cf

BMP volume $_{(IA-in)2}$ = BMP volume $_{(IA-in)2}$ / Imperv. Area
BMP volume IA = 4.37 inch

% Difference = BMP Vol. $_{(IA-in)}$ - BMP Vol. $_{(IA-in)2}$/BMP Vol. $_{(IA-in)2}$
% Difference = 0.7% < 5% ⇒ **OK**

Infiltration Rate = 2.41 inch/hr
⇒ Use Figure 3-16

BMP-Volume $_{Net\ IA-in}$ = 4.37 inch

BMP Reduction $_{\%-p}$ = 83 % (Figure 3-16)
⇒ Use 70% max per MassDEP SWMH

BMP Reduction $_{lbs-p}$ = BMP Load P x Reduction %
BMP Reduction $_{lbs-p}$ = 0.15 lb/ac/year

PHOSPHOROUS REMOVAL CALCULATION - 181R SCHOOL STREET, GROVELAND, MA

Infiltration Basin P6

ID	Land Use	Cover	Area (Ac)	PLER (lb/ac/yr)
1	Multi-Family	Impervious	0.08	2.32
2	Landscaped (B)	Pervious	0.241	0.12

BMP Load P [Sum (Area x PLER)]	0.21 lb/ac/yr
Available BMP Volume (HydroCAD)	1355 cf
Rainfall Depth (Table 3-4)	0.5 inch
Runoff Depth (Table 3-4)	0.01 inch

BMP Volume (IA-in) = Available BMP Vol/Impervious Area
BMP Volume (IA-in) = 4.67 inch

BMP Volume (PA-in) = Pervious Area x Runoff Depth
BMP volume (PA-in) = 8.7 cf

BMP volume (IA-cf)2 = Available BMP Vol - BMP volume (PA-in)
BMP volume (IA-cf)2 = 1346.3 cf

BMP volume (IA-in)2 = BMP volume (IA-in)2 / Imperv. Area
BMP volume IA = 4.64 inch

% Difference = BMP Vol. $_{(IA-in)}$ - BMP Vol. $_{(IA-in)2}$/BMP Vol. $_{(IA-in)2}$
% Difference = 0.6% < 5% ⇒ OK

Infiltration Rate = 2.41 inch/hr
⇒ Use Figure 3-16

BMP-Volume Net IA-in = 4.64 inch

BMP Reduction $_{\%-p}$ = 83 % (Figure 3-16)
⇒ Use 70% max per MassDEP SWMH

BMP Reduction lbs-p = BMP Load P x Reduction %
BMP Reduction lbs-p = 0.15 lb/ac/year

Rain Garden P7

ID	Land Use	Cover	Area (Ac)	PLER (lb/ac/yr)
1	Multi-Family	Impervious	0.060	2.32
2	Landscaped (B)	Pervious	0.181	0.12

BMP Load P [Sum (Area x PLER)]	0.16 lb/ac/yr
Available BMP Volume (HydroCAD)	1798 cf
Rainfall Depth (Table 3-4)	0.5 inch
Runoff Depth (Table 3-4)	0.01 inch

BMP Volume (IA-in) = Available BMP Vol/Impervious Area
BMP Volume (IA-in) = 8.26 inch

BMP Volume (PA-in) = Pervious Area x Runoff Depth
BMP volume (PA-in) = 6.6 cf

BMP volume (IA-cf)2 = Available BMP Vol - BMP volume (PA-in)
BMP volume (IA-cf)2 = 1791.4 cf

BMP volume (IA-in)2 = BMP volume (IA-in)2 / Imperv. Area
BMP volume IA = 8.23 inch

% Difference = BMP Vol. $_{(IA-in)}$ - BMP Vol. $_{(IA-in)2}$/BMP Vol. $_{(IA-in)2}$
% Difference = 0.4% < 5% ⇒ OK

Infiltration Rate = 2.41 inch/hr
⇒ Use Figure 3-16

BMP-Volume Net IA-in = 8.23 inch

BMP Reduction $_{\%-p}$ = 83 % (Figure 3-16)
⇒ Use 70% max per MassDEP SWMH

BMP Reduction lbs-p = BMP Load P x Reduction %
BMP Reduction lbs-p = 0.11 lb/ac/year

Table 3- 16: Surface Infiltration (2.41 in/hr) BMP Performance Table

Surface Infiltration (2.41 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	32.8%	53.8%	77.8%	88.4%	93.4%	96.0%	98.8%	99.8%
Cumulative Phosphorus Load Reduction	46%	67%	87%	94%	97%	98%	100%	100%
Cumulative Nitrogen Load Reduction	64%	82%	95%	98%	99%	100%	100%	100%

Figure 3- 11: BMP Performance Curve: Infiltration Basin (infiltration rate = 2.41 in/hr)

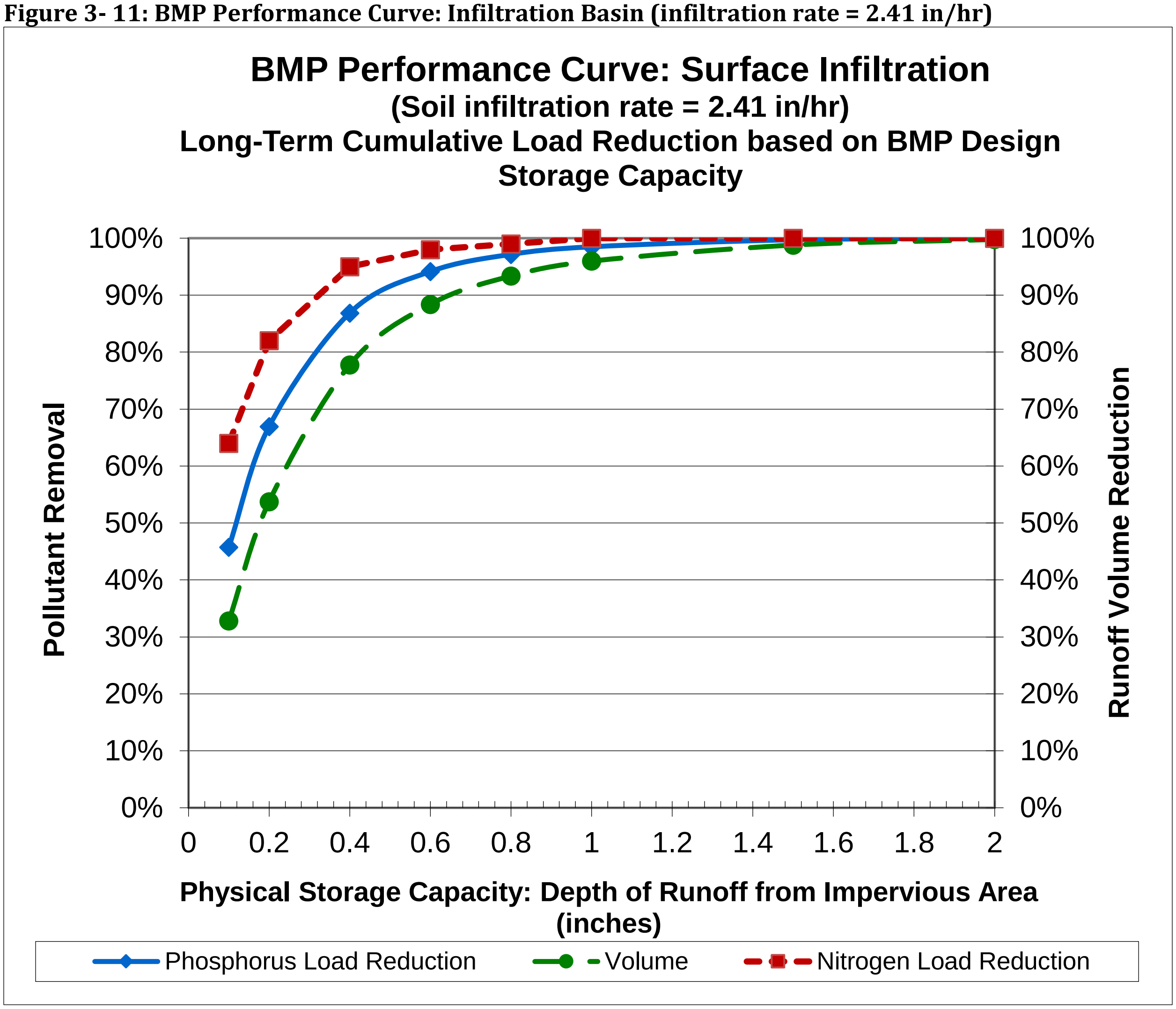
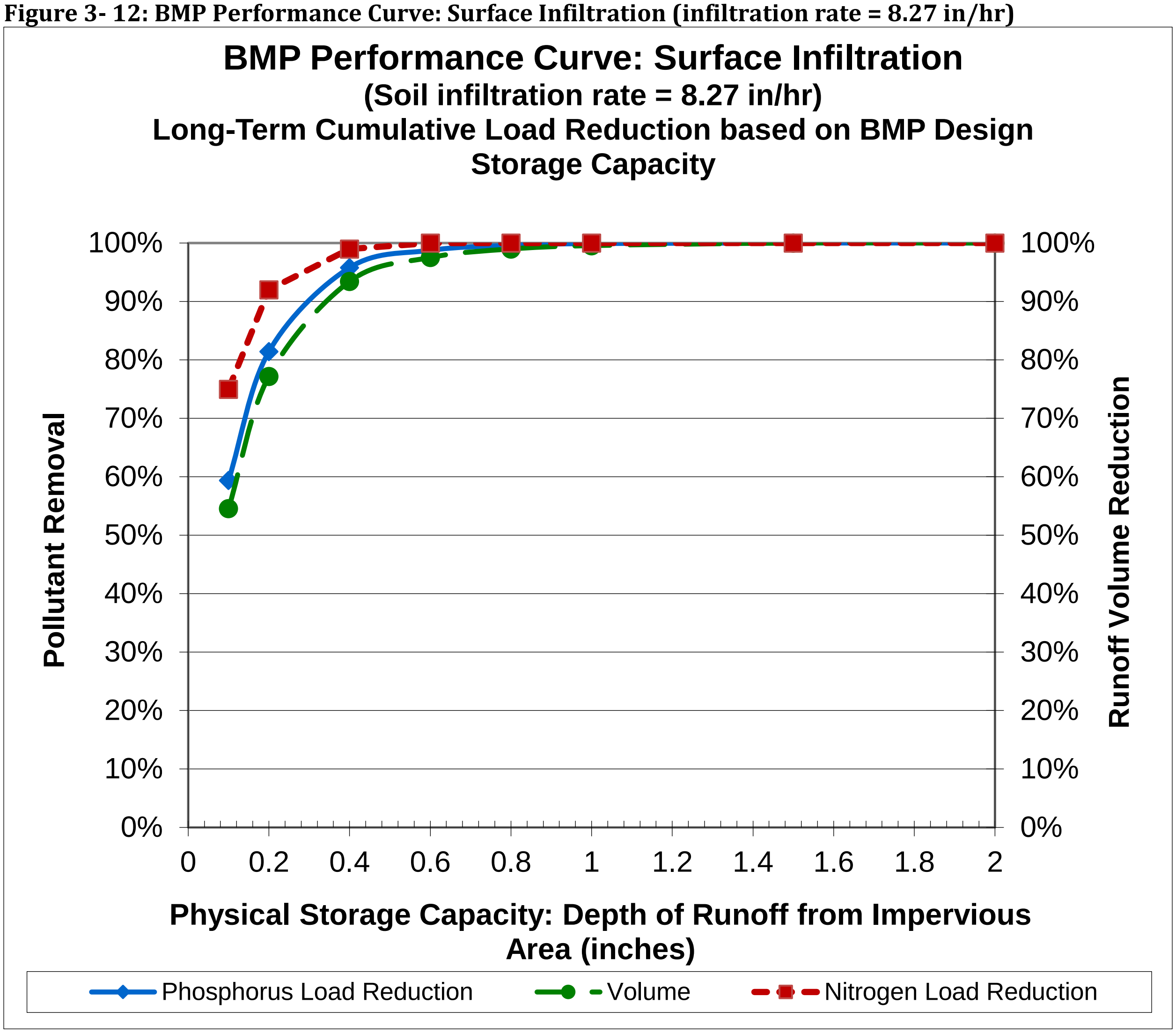


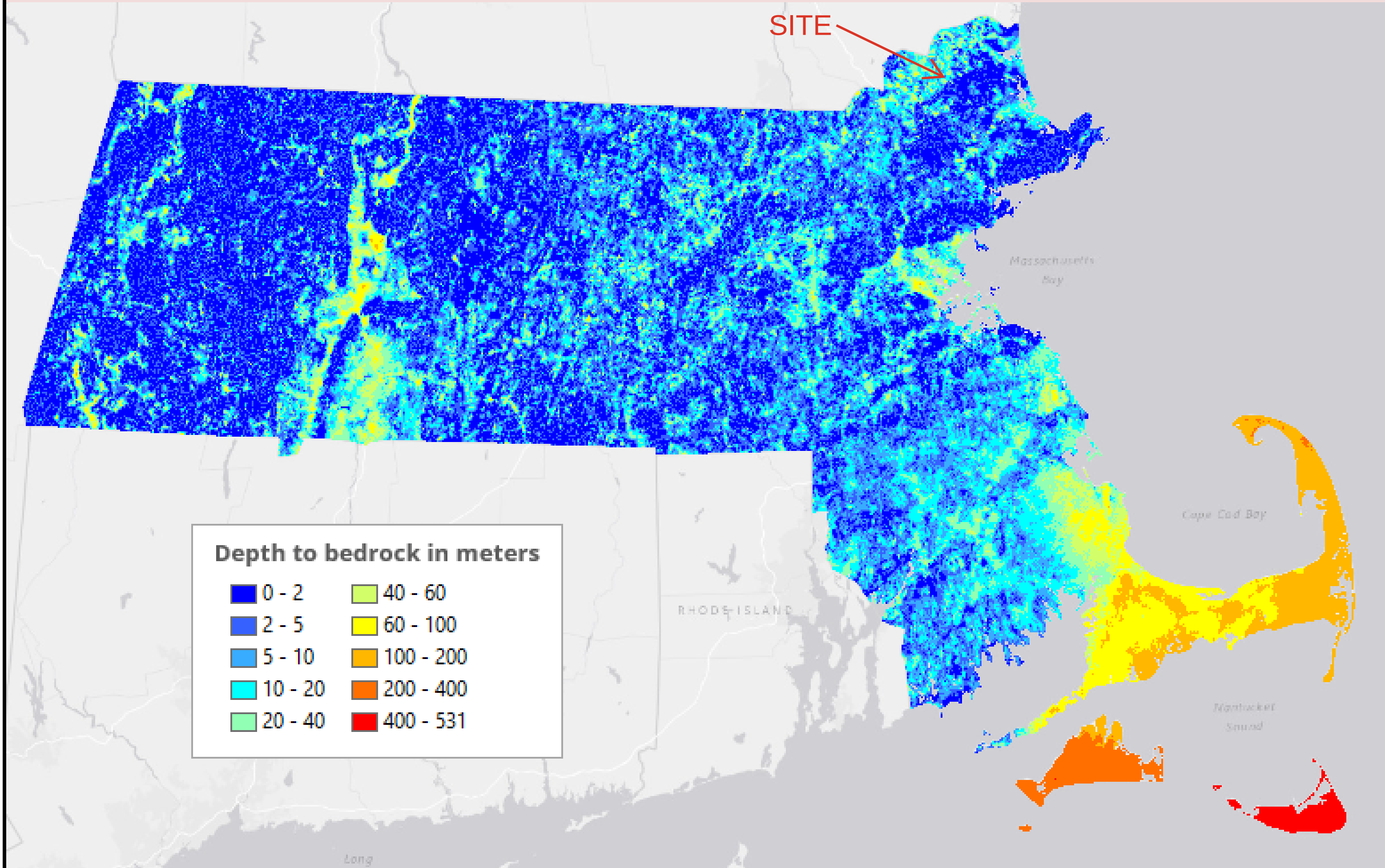
Table 3- 17: Surface Infiltration (8.27 in/hr) BMP Performance Table

Surface Infiltration (8.27 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	54.6%	77.2%	93.4%	97.5%	99.0%	99.6%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	59%	81%	96%	99%	100%	100%	100%	100%
Cumulative Nitrogen Load Reduction	75%	92%	99%	100%	100%	100%	100%	100%

Figure 3- 12: BMP Performance Curve: Surface Infiltration (infiltration rate = 8.27 in/hr)



Depth to Bedrock Raster Dataset (MassGIS)



use consistent units (e.g. feet & days **or** inches & hours)

P2

Input Values

4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.260	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
9.900	**x**	**1/2 length of basin (x direction, in feet)**
12.350	**y**	**1/2 width of basin (y direction, in feet)**
1.090	**t**	**duration of infiltration period (days)**
100.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

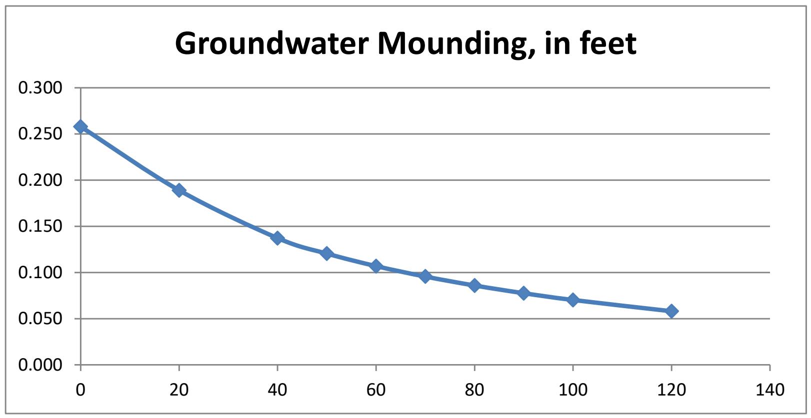
inch/hour	**feet/day**
2.41	4.82
2.00	4.00
hours	**days**
26	1.09

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

100.258	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.258	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.258	**0**
0.189	**20**
0.137	**40**
0.120	**50**
0.107	**60**
0.096	**70**
0.086	**80**
0.078	**90**
0.070	**100**
0.058	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

use consistent units (e.g. feet & days **or** inches & hours)

P4

Input Values		
16.5400	*R*	**Recharge (infiltration) rate (feet/day)**
0.340	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
165.40	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
23.110	x	**1/2 length of basin (x direction, in feet)**
31.050	y	**1/2 width of basin (y direction, in feet)**
1.042	t	**duration of infiltration period (days)**
100.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
8.27	16.54
2.00	4.00

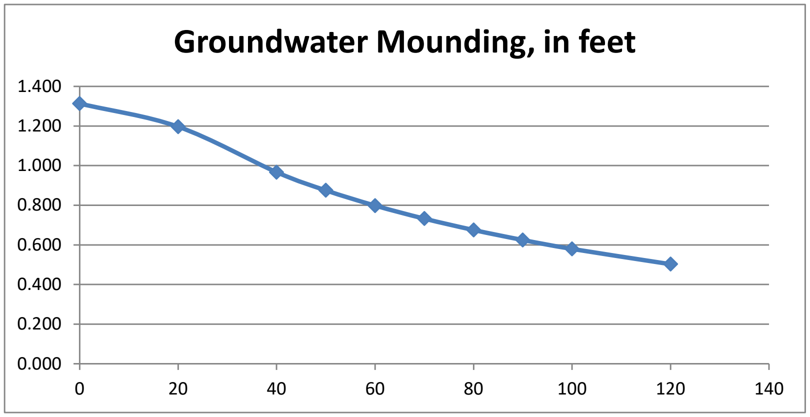
hours	days
25	1.04

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

101.313	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.313	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.313	0
1.196	20
0.967	40
0.875	50
0.798	60
0.732	70
0.675	80
0.625	90
0.580	100
0.503	120

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

P5

Input Values			
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**	
0.260	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**	
48.20	K	**Horizontal hydraulic conductivity, Kh (feet/day)***	
8.100	x	**1/2 length of basin (x direction, in feet)**	
13.760	y	**1/2 width of basin (y direction, in feet)**	
1.146	t	**duration of infiltration period (days)**	
100.000	hi(0)	**initial thickness of saturated zone (feet)**	

Conversion Table

inch/hour	feet/day
2.41	4.82
2.00	4.00

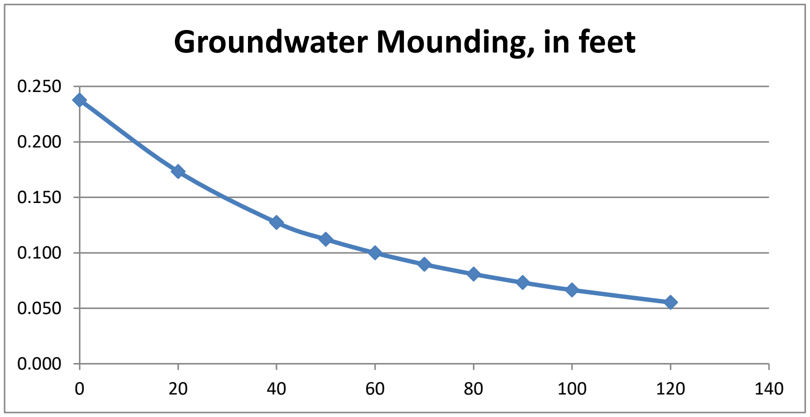
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

100.238	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.238	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.238	0
0.173	20
0.127	40
0.112	50
0.100	60
0.090	70
0.081	80
0.073	90
0.066	100
0.055	120

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

P6

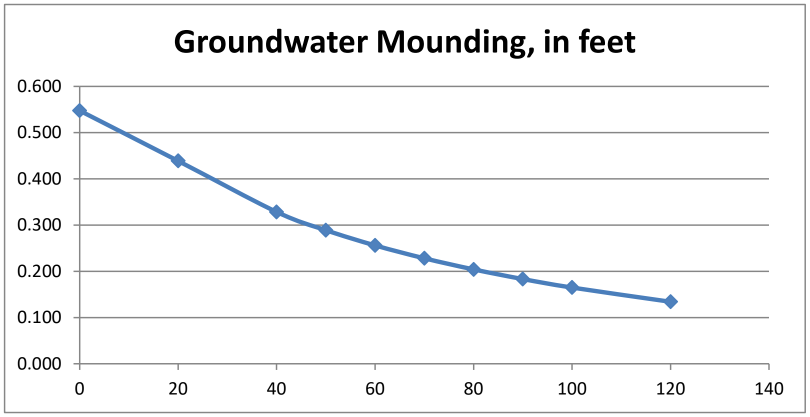
Input Values			inch/hour	feet/day
4.8200	***R***	**Recharge (infiltration) rate (feet/day)**	2.41	4.82
0.260	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**		
48.20	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
11.500	**x**	**1/2 length of basin (x direction, in feet)**		
27.500	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
1.040	**t**	**duration of infiltration period (days)**	1	0.04
100.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

100.548	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.548	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.548	**0**
0.439	**20**
0.328	**40**
0.289	**50**
0.256	**60**
0.228	**70**
0.204	**80**
0.183	**90**
0.165	**100**
0.134	**120**

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

P7

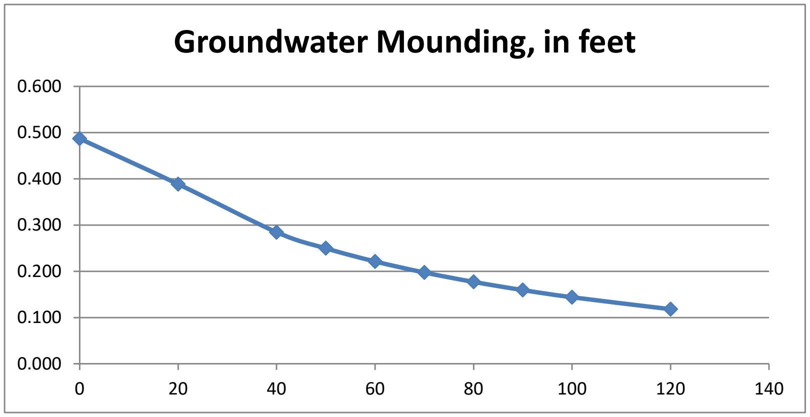
Input Values			Conversion Table	
			inch/hour	feet/day
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**	2.41	4.82
0.260	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**		
48.20	K	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
14.000	x	**1/2 length of basin (x direction, in feet)**		
18.500	y	**1/2 width of basin (y direction, in feet)**	hours	days
1.130	t	**duration of infiltration period (days)**	3	0.13
100.000	hi(0)	**initial thickness of saturated zone (feet)**		

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

100.487	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.487	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.487	0
0.389	20
0.284	40
0.250	50
0.221	60
0.197	70
0.177	80
0.159	90
0.144	100
0.118	120

Re-Calculate Now



Disclaimer

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- **Proposed Average Daily Water and Sewer Demand:**

The project proposes 8 residential dwellings. A total of 5 bedrooms per dwelling is estimated. Utilizing the 310 CMR 15.00 "Title 5" rates, the existing average sewer demand is calculated below:

Use	Bedroom	Title 5 Flow Rate	Average Sewer Demand (GPD)
Single-family dwelling	5 bedrooms	110 GPD per bedroom	550 GPD (0.00085 cfs)

➔ The total average sewer demand for all units is 4400 GPD (0.0068 cfs)

To confirm velocity of the gravity pipes, TR-16 Guides for the Design of Wastewater Treatment Works and Manning's equation is used. TR-16 recommends a minimum slope of 0.004 ft/ft for an 8" pipe, with velocity of 2 to 10 feet per second (ft/s) when flowing full.

$$Q = VA = \frac{1.49}{n} A R^{\frac{2}{3}} \sqrt{S}$$

$Where:$
$Q = Flow\ Rate, (ft^3/s)$
$V = Velocity, (ft/s)$
$A = Flow\ Area, (ft^2)$
$n = Manning's\ Roughness\ Coefficent = 0.013$
$R = Hydraulic\ Radius, (ft) = \frac{A}{P} = \frac{\pi r^2}{2\pi r} = \frac{r}{2}$
$S = Slope, (ft/ft)$
$P = Wetted\ Perimeter, (ft)$
$r = Pipe\ Radius, (ft)$

Eliminating A from the equation, solving for V and simplifying the equation it becomes:

$$V = \frac{1.49}{0.013} \left(\frac{r}{2}\right)^{2/3} \sqrt{S}$$

For the 8" PVC pipe, the velocity is calculated as:

$$V = \frac{1.49}{0.013} \left(\frac{0.34}{2}\right)^{2/3} \sqrt{0.014} = 4.16\, ft/s$$

Therefore, this pipe is within the TR-16 guidelines for velocity (2-10 ft/s).

To confirm capacity, TR-16 recommends a peak design flow on an hourly basis. The project proposes 8 residential. The residential units are comprised of 5-bedrooms each. Utilizing Title 5 flow rates the existing average and peak daily sewer demand in gallons per day (GPD) is calculated below:

Use	Unit	Title 5 Flow Rate	Average Sewer Demand (GPD)	Peaking Factor	Peak Sewer Demand (GPD)
5 Bedroom Dwelling	8 Units	110 GPD per bedroom	4,400	6	26,400
Total			**4,400**		**26,400**

The peak flow, in cubic feet per hour can then be calculated:

$$Q = \frac{26{,}400\ GPD}{24\ hours\ per\ day} = 1{,}100\ \frac{gallons}{hr} \times \frac{1\ ft^3}{7.48\ gallons} = 147.06 \frac{ft^3}{hr} = 0.041\ cfs$$

To confirm the capacity of the pipes the following equation is used:

$$Q = VA$$

For the 8" PVC pipe, the flow rate is calculated as:

$$Q = 4.16\pi(0.34)^2 = 1.51 \frac{ft^3}{s} \times 3{,}600 \frac{s}{hr} = 5{,}436\ \frac{ft^3}{hr}$$

$$Q = 1.51\ cfs$$

The capacity of the pipe is greater than the design peak flow rate and therefore, both pipes have sufficient capacity.

APPENDIX E:

CONSTRUCTION PHASE

BEST MANAGEMENT PRACTICES PLAN

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Definitive Subdivision Plan for a Street to be Named in Groveland, Massachusetts at 181R School Street (Groveland Assessors Map 34 Lot 13)"" prepared by The Morin-Cameron Group, Inc. dated July 31, 2024 and revised on November 5, 2024.

Responsible Party Contact Information:

Stormwater Management System Owner:	Groveland Redevelopment, LLC 231 Sutton Street, Suite 1B North Andover, MA 01945 P: (978) 687-6200
Groveland Planning Board:	Groveland Town Hall 183 Main Street Groveland, MA 01834 P: (781) 665-0142

*The stormwater management system owner shall be responsible for implementation and compliance of the construction period pollution prevention plan or may choose to designate a responsible party prior to the start of construction (i.e. site contractor, site supervisor).

Structural Practices:

1) **Silt Sock** – A silt sock barrier shall be installed in accordance with the approved plans where high rates of stormwater runoff are anticipated.
    a) Installation Schedule: Prior to Start of land disturbance.
    b) Maintenance and Inspection: The site supervisor shall inspect the barrier at least once per week or after a major storm (1.0 inch of rainfall within a twenty-four-hour period). event and shall repair any damaged or affected areas of the barrier at the time they are noted. Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the barrier. Sediment will be removed from in front of the barrier when it becomes about 4" deep at the barrier. Take care to avoid undermining the barrier during cleanout.

(2) Sediment Track-Out – Stabilized Construction Entrance/Exit: Prior to the commencement of site work, crushed stone anti-tracking pads will be installed at the entrance to the site. This will prevent trucks from tracking material onto the road from the construction site. If, at any point during the project, the tracking pad becomes ineffective due to accumulation of soil, the crushed stone shall be replaced. Details for construction of the stabilized entrance can be found in the Construction Details sheet that is part of the plan set associated with the project. The site supervisor will inspect the tracking pads weekly to ensure that they are properly limiting the tracking of soil onto the road. If tracking onto the roadway is noted, it shall be removed immediately via a mechanical street sweeper.

(3) Inlet Protection – Inlet Protection will be utilized around the catch basin grates in the street layout in the closest down gradient structure and existing onsite catch basins. The inlet protection will allow the storm drain inlets to be used before final stabilization. This structural practice will allow early use of the drainage system. Siltsack or equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 800-448-3636. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements *

a) The silt sack trapping devices and the catch basins should be inspected after every rain storm and repairs made as necessary.
b) Sediment should be removed from the silt sack after the sediment has reached a maximum depth of one-half the depth of the trap.
c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.
d) The silt sack must be replaced if it is ripped or torn in any way.
e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.
- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

   Temporary Seeding Planting Procedures *
   a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.
   b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.
   c) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.
b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the

application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Straw) Materials and Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance *

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.
b) Straw or grass mulches that blow or wash away should be repaired promptly.
c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.
d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.
b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.
c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.
d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.
e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance *

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.
b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.
c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

5) **Topsoiling *** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.
b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.
c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.

6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.
b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.
c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.
c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance *

a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.
b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.
c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.
d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction access; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Construction Period Inspection and Maintenance Log Form, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes as required.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Operation and Maintenance Plan to control or eliminate unforeseen pollution of storm water.

APPENDIX F:

LONG TERM BEST MANAGEMENT PRACTICES O&M PLAN

Long Term Stormwater Best Management Practices
Operation and Maintenance Plan
for
181R School Street
Groveland, Massachusetts
July 31, 2024 – Revised on November 5, 2024

The following operation and maintenance plan has been provided to satisfy the requirements of Standard 9 of the Mass DEP Stormwater Management Handbook associated with development of the site and associated infrastructure. The success of the Stormwater Management Plan depends on the proper implementation, operation and maintenance of several management components. The following procedures shall be implemented to ensure success of the Stormwater Management Plan:

1. The contractor shall comply with the details of construction of the site as shown on the approved plans.
2. The stormwater management system shall be inspected and maintained as indicated below.
3. Effective erosion control measurers during and after construction shall be maintained until a stable turf is established on all altered areas.
4. A Stormwater Management Maintenance Log is included at the end of this Appendix.

Basic Information

Stormwater Management System Owner:	Groveland Redevelopment, LLC 231 Sutton Street, Suite 1B North Andover, MA 01945 P: (978) 687-6200
Groveland Planning Board:	Groveland Town Hall 183 Main Street Groveland, MA 01834 P: (781) 665-0142

Erosion and Sedimentation Controls during Construction:
The site and drainage construction contractor shall be responsible for managing stormwater during construction. Routine monitoring of disturbed soils shall be performed to ensure adequate runoff and pollution control during construction.

A sediment and erosion control barrier will be placed as shown on the Site Plan prior to the commencement of any clearing, grubbing, and earth removal or construction activity. The integrity of the erosion control barrier will be maintained by periodic inspection and replacement as necessary. The erosion control barrier will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Silt sacks shall be placed in new catch basins once constructed while construction activities are ongoing.

Operations and maintenance plans for the Stormwater Management construction phase and long term operation of the system have been attached to this report.

General Conditions

1. The site contractor shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's until the project has been completed. The BMP maintenance shall be conducted as detailed in the following long-term pollution prevention plan and on the approved design plans:
   Definitive Subdivision Plan for a Street to be Named in Groveland, Massachusetts at 181R School Street (Groveland Assessors Map 34 Lot 13)", prepared for Groveland Redevelopment, LLC by The Morin-Cameron Group, Inc. dated July 31, 2024 and revised on October 28, 2024.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Pollution Prevention Plan.
3. The owner shall:
   a. Maintain an Operation and Maintenance Log for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
   b. Make the log available to the Melrose Planning Board and Department of Public Works upon request;
   c. Allow members and agents of the Melrose Planning Board and Department of Public Works to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule shall be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule shall be determined based on the level of service for this site.

Vegetated Areas:
Immediately after construction, monitoring of the erosion control systems shall occur until establishment of natural vegetation. Afterwards, vegetated areas shall be maintained as such. Vegetation shall be replaced as necessary to ensure proper stabilization of the site.

Cost: Included with annual landscaping budget. Consult with local landscape contractors.

Paved Areas:
Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system.

Cost: Consult with local contractor companies for associated costs if necessary.

Salt used for de-icing on the roadway during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Debris & Litter:

All debris and litter shall be removed from the roadway and parking lots as necessary to prevent migration into the drainage system.

Roof Leaders, Gutters and Downspouts :
The roof leaders, gutters and downspouts shall be inspected after every major storm event for the first 3 months after construction; a major storm event is 3.30 inches of rainfall in a 24-hour period (2 year storm). Thereafter, the gutters and downspouts shall be inspected and cleaned at least once per year to remove any debris accumulation (i.e. leafs, sticks). The roof leaders shall be inspected and cleaned at least twice per year (April and October) to confirm that the roof leaders are not obstructed by debris. The outlet control devices (2 total) located on the building downspouts shall be inspected and cleaned to ensure there are no obstructions, the screens are in place and there is no damage to the devices.

Cost: $200-300 per cleaning for the gutters as needed. The owner should consult local contractors for a detailed cost estimate.

CDS Water Quality Units:

The CDS water quality pretreatment units shall be inspected twice per year in April and October. The unit shall be cleaned per manufacturer instructions included herein.
Cost: Consult with local landscaping or pumping companies for associated costs if necessary.

Subsurface Infiltration Chambers:
The subsurface infiltration chambers shall be checked for debris accumulation twice per year. Each system is equipped with an inspection port. Additional inspections should be scheduled during the first few months to make sure that the facility is functioning as intended. Trash, leaves, branches, etc. shall be removed from facility. Silt, sand and sediment, if significant accumulation occurs, shall be removed annually. Material removed from the system shall be disposed of in accordance with all

applicable local, state, and federal regulations. In the case that water remains in the infiltration facilities for greater than three (3) days after a storm event an inspection is warranted, and necessary maintenance or repairs should be addressed as necessary.

Cost: Consult with local landscaping companies for associated costs if necessary.

Public Safety Concerns: The inspection port covers shall not be left open and unattended at any time during inspection, cleaning or otherwise. Broken covers or frames shall be replaced immediately. At no time shall any person enter the subsurface structure unless measures have been taken to ensure safe access in accordance with OSHA enclosed space regulations.

Rain Gardens:

The best management practices shall be inspected after every major storm event for the first 3 months after construction; a major storm event is 3.30 inches of rainfall in a 24 hour period (2 year storm). Thereafter, the basin shall be inspected twice per year, typically in the spring and fall. If erosion or loss of vegetation is observed in the basin, it shall be repaired immediately and new vegetation shall be established. Trash, leaves, branches, etc. shall be removed from basins. The infiltration basin shall be mowed twice per year. Reseed as required. Inspect swales to make sure vegetation is adequate, check dams are in place and functioning and slopes are not eroding. Check for rilling and gullying. Repair eroded areas and revegetate as needed.

The outlet structures shall be inspected annually for obstructions, structural integrity and trash accumulations. The inspections shall be conducted by qualified personnel.

Cost: Consult with local landscaping companies for associated costs if necessary.

Rip-Rap Outfalls:

The rip-rap outfalls shall be checked for debris accumulation twice per year. Additional inspections should be scheduled during the first few months to make sure that the outfall is functioning as intended. Trash, leaves, branches, etc. shall be removed from outfall. Silt, sand and sediment, if significant accumulation occurs, shall be removed as required by means of mechanical excavation. Material removed shall be disposed of in accordance with all applicable local, state, and federal regulations. The outfall shall be kept free of woody vegetation and removal of woody vegetation shall be conducted between October 15th and April 15th. Any slope erosion within the outfall shall be stabilized and repaired immediately and additional rip-rap added as required.

Cost: Consult with local landscaping companies for associated costs if necessary.

Pesticides, Herbicides, and Fertilizers:

Pesticides and herbicides shall be used sparingly. Fertilizers shall be restricted to the use of organic fertilizers only. All fertilizers, herbicides, pesticides, sand and salt for deicing and the like shall be stored in dry area that is protected from weather.

Cost: Included in the routine landscaping maintenance schedule. The Owner shall consult local landscaping contractors for details.

Public Safety Concerns: Chemicals shall be stored in a secure area to prevent children from obtaining access to them. Any major spills shall be reported to municipal officials.

Prevention of Illicit Discharges:

Illicit discharges to the stormwater management system are not allowed. Illicit discharges are discharges that are not comprised entirely of stormwater. Pursuant to Mass DEP Stormwater Standards the following activities or facilities are not considered illicit discharges: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, De-chlorinated water from swimming pools, water used for street washing and water used to clean residential building without detergents.

To prevent illicit discharges to the stormwater management system the following policies should be implemented:

1. Good Housekeeping Practices
   - The site shall be kept clean of litter and debris and continuously maintained in accordance with the Long-Term Pollution Prevention Plan as noted above. All chemicals shall be covered and stored in secured location. Any land disturbances that change drainage characteristics shall be remedied to pre-disturbance characteristics (i.e. shoulder rutting from vehicles, land disturbance from plowing, etc.) as soon as possible to ensure proper treatment of all stormwater runoff.
2. Provisions for Storing Materials and Waste Products Inside or Under Cover
   - All chemicals and chemical waste products shall be stored inside or in a secured covered location to prevent potential discharge. Any major spills shall be reported to municipal officials and a remediation plan shall be implemented immediately.
3. Vehicle Maintenance
   - Any vehicle maintenance shall be done with care to prevent discharge of illicit fluids. If fluids are accidentally spilled, immediate action shall be implemented to clean and remove the fluid to prevent discharge into the stormwater management system and/or infiltrating into the groundwater.
4. Pet Waste Management Provisions
   - Pet waste shall be picked up and disposed of in an appropriate individual waste refuse area.
5. Spill Prevention and Response Plans
   - If a major spill of an illicit substance occurs, town officials (including but not limited to the Fire Department and Police Department) shall be notified immediately. A response plan shall then be implemented immediately to prevent any illicit discharges from entering the stormwater management system and ultimately surface waters of the Commonwealth.
6. Solid waste
   - All domestic solid waste shall be disposed of in accordance with all applicable local, state and federal regulations. Waste shall be placed into covered dumpsters and/or covered waste bins to prevent water intrusion and potentially contaminated runoff. No household chemicals, hazardous materials, construction debris or non-household generated refuse shall be disposed of in the on-site waste disposal containers.

Snow Storage:

Property owner shall inform their snow removal contractor of the designated areas for snow storage.

TABLE 1: MAINTENANCE SCHEDULE FOR DRAINAGE STRUCTURES

Structure	Inspection	Maintenance
Infiltration Basins, Rain Graden, Water Quality Units, Outlet Control Structures Drain Manhole, Catch Basins	Inspect after every major storm event for first 3 months after construction to ensure the structures are working properly.* Thereafter, twice a year (April / October) Inspections should include the following: • Signs of differential settlement • Erosion • Tree growth on the embankments that were not part of the design plan • Sediment accumulation • Health of turf • Cracked/Disconnected Roof Leaders • Clogged orifices, pipe obstructions	Rehabilitate structure if it fails due to clogging as generally evidenced by retention of water for more than 72 hours after a storm event Remove any obstructions from outlets/pipes Remove accumulated sediment

* Major storm event: 3.2 inches of rainfall in a 24 hour period (2 year storm)

Stormwater System Maintenance Log

181R School St, Groveland, MA

The Following structures shall be inspected and maintained by the owner.

BMP STRUCTURE	INSPECTION DATE	WORK PERFORMED	DATE WORK PERFORMED	COMMENTS
Stormwater Management Infrastructure				
CB-1				
CB-2				
CB-3				
CB-4				
CB-5				
AD-1				

DMH-1				
DMH-2				
WQU-2				
OCS-2				
OCS-4				
OCS-5				
OCS-6				

OCS-7				
Infiltration Basin (P4)				
Rain Garden (P2)				
Rain Garden (P5)				
Rain Garden (P6)				
Rain Garden (P7)				

APPENDIX G:

ILLICIT DISCHARGE STATEMENT

Illicit Discharge Compliance Statement

I, Scott P. Cameron, P.E., hereby notify the Groveland Planning Board that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 181R School Street in Groveland, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "Definitive Subdivision Plan for a Street to be Named in Groveland, Massachusetts at 181R School Street (Groveland Assessors Map 34 Lot 13) prepared for/applicant Groveland Redevelopment, LLC," prepared by The Morin-Cameron Group, Inc. dated August 1, 2024 and as revised and approved by the Town of Groveland Planning Board and maintenance thereof in accordance with the "Construction Phase Pollution Prevention Plan" and "Long-Term Pollution Prevention Plan" prepared by The Morin-Cameron Group, Inc dated July 31, 2024 and as revised and approved by the Groveland Planning Board will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Scott P. Cameron, P.E.

Company: The Morin-Cameron Group, Inc.

Title: Owner's Representative

Signature: [signature]

Date: 7/31/24

APPENDIX H:
SOIL REPORT

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

181R School Street LLC
Owner Name

181R School Street — Street Address
Map 34, Lot 13 — Map/Lot #

Groveland — City
MA — State
01834 — Zip Code

B. Site Information

1. (Check one) ☐ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS (Source) 420B,420C,410C,421C (Soil Map Unit)

   Sutton fine sandy loam, Canton fine sandy loam (Soil Name) None (Soil Limitations)

   Loamy sand/ sandy loam (Soil Parent material) Moraine (Landform)

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/Stone, Stone, DiGiacomo-Cohen Coarse deposits (Map Unit)

   Gravel deposits, sand and gravel deposits, and sand deposits.
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): 07/2024 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: MassMapper

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP 24-1 (Hole #) 7/2/24 (Date) 8:30 am (Time) 80°F, Sunny (Weather) **42.7493** (Latitude) **-71.0256°** (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Overgrowth (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3% (Slope (%))

   Description of Location: East side of lot, 5 feet off sidewalk

2. Soil Parent Material: Loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: __ Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	FILL	Loamy sand	10YR4/4								
16-22	Ab	Loamy sand	10YR3/2						Granular	Friable	
22-32	Bw	Loamy sand	10YR5/6						Massive	Friable	
32-96	C	Loamy sand	2.5Y5/4						Massive	Friable	

Additional Notes:
No refusal – boulder @ 96", Roots to 60"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-2 (Hole #) 7/2/24 (Date) 9:06 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Overgrowth (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3% (Slope (%))

   Description of Location: East side of lot

2. Soil Parent Material: Loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit __ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	Ap	Loamy fine sand	10YR4/4						Granular	Friable	
8-20	Bw	Loamy fine sand	10YR5/6						Massive	Friable	
20-84	C	Loamy sand	2.5Y6/3						Weak blocky	Friable	

Additional Notes:
Refusal @ 84", roots to 24"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-3 (Hole #) 7/2/24 (Date) 9:40 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: East side of lot

2. Soil Parent Material: Loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	Ap	Loamy fine sand	10YR4/4						Granular	Friable	
16-24	Bw	Loamy fine sand	10YR5/6						Massive	Friable	
24-96	C	Loamy sand	2.5Y5/4						Weak blocky	Friable	

Additional Notes:
No refusal, roots to 36"

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-4 (Hole #) 7/2/24 (Date) 11:00 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: East side of lot

2. Soil Parent Material: Sandy loam Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet
4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	Ap	Loamy fine sand	10YR4/4						Granular	Friable	
16-30	Bw	Loamy fine sand	10YR5/6						Massive	Friable	
30-48	C1	Fine sand	2.5Y6/3						Single grain	Loose	
48-96	C2	Sandy loam	2.5Y4/3	42"	C: 7.5YR5/8 D: 5Y 6/2				Weak blocky	Firm	

Additional Notes:
No refusal, Roots to 30"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-5 (Hole #) 7/2/24 (Date) 11:55 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: Northeast side of lot

2. Soil Parent Material: Loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sand	10YR4/4						Granular	Friable	
12-22	Bw	Fine sand	10YR5/6						Single grain	Loose	
22-48	C1	Fine sand	2.5Y6/3						Single grain	Loose	
48-108	C2	Loamy sand	2.5Y5/3				10%		Massive	Friable	

Additional Notes:
No refusal, Roots to 48"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-6 (Hole #) 7/2/24 (Date) 12:40 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: North/ center of lot

2. Soil Parent Material: Sandy loam Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sandy loamy	10YR4/4						Granular	Friable	
12-32	Bw	Fine sandy loam	10YR5/6						Massive	Friable	
32-112	C	Sandy loam	2.5Y5/4				5%		Massive	Friable	

Additional Notes:
No refusal, Roots to 48"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-7 (Hole #) 7/2/24 (Date) 1:15 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: Center of lot

2. Soil Parent Material: Sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 60" Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sand	10YR4/4						Granular	Friable	
12-28	Bw	Fine sand	10YR5/6						Single grain	Loose	
28-112	C	Sand	2.5Y5/3	32"	C: 7.5YR5/8 D: 2.5Y6/2				Single grain	Loose	

Additional Notes:
No refusal

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-8 (Hole #) 7/2/24 (Date) 2:00 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: North side of lot

2. Soil Parent Material: Sandy loam Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	Fine sand	10YR3/3						Granular	Friable	
10-28	Bw	Fine sand	10YR4/6						Single grain	Loose	
28-60	C1	Very fine sand	2.5Y6/4						Single grain	Loose	
60-108	C2	Loamy sand	2.5Y5/4				10%		Massive	Friable	

Additional Notes:
No refusal, Roots to 48"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-9 (Hole #) 7/2/24 (Date) 2:30 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: Center of lot

2. Soil Parent Material: Sandy loam Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-14	Ap	Loamy sand	10YR3/2						Granular	Friable	
14-26	Bw	Loamy sand	10YR5/6						Massive	Friable	
26-60	C1	Sand	2.5Y6/4						Single grain	Loose	
60-80	C2	Sandy loam	2.5Y5/3	30"	C: 7.5YR5/8 D: 5Y 6/2		10%		Massive	Friable	

Additional Notes:
No refusal, Roots to 24"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-10 (Hole #) 7/2/24 (Date) 3:00 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: Northwest side of lot

2. Soil Parent Material: Loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sand	10YR4/4						Granular	Friable	
12-28	Bw	Fine sand	10YR5/6						Single grain	Loose	
28-48	C1	Very fine sand	2.5Y6/4						Single grain	Loose	
48-96	C2	Loamy sand	2.5Y5/4				10%		Massive	Friable	

Additional Notes:
No refusal, Roots to 55"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-11 (Hole #) 7/2/24 (Date) 3:25 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: West side of lot

2. Soil Parent Material: Loamy sand   Moraine (Landform)   Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet   Drainage Way >100 feet   Wetlands >100 feet
   Property Line >10 feet   Drinking Water Well >100 feet   Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No   If yes: Depth Weeping from Pit   Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sand	10YR4/4						Granular	Friable	
12-28	Bw	Fine sand	10YR5/6						Single grain	Loose	
28-48	C1	Very fine sand	2.5Y6/4	36"	C: 7.5YR5/8 D: 5Y 6/2				Single grain	Loose	
48-96	C2	Loamy sand	2.5Y5/4				10%		Massive	Friable	

Additional Notes:
No refusal, Roots to 44"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-12 (Hole #) 7/2/24 (Date) 3:50 pm (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: West side of lot

2. Soil Parent Material: Gravelly loamy sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	Fine sand	10YR3/3						Granular	Friable	
12-20	Bw	Fine sand	10YR5/6						Massive	Friable	
20-80	C	Gravelly loamy sand	2.5Y5/4	32"	C: 7.5YR5/8 D: 5Y 6/2		20%		Massive	Friable	
									Massive	Friable	

Additional Notes:
No refusal, Roots to 24"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-13 (Hole #) 7/3/24 (Date) 8:39 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: Southwest side of lot

2. Soil Parent Material: Gravelly sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	Ap	Fine sand	10YR4/4						Granular	Friable	
6-16	Bw	Fine sand	10YR5/6						Single grain	Loose	
16-36	C1	Fine sand	2.5Y6/4						Single grain	Loose	
36-84	C2	Gravelly sand	2.5Y5/4				20%		Single grain	Loose	

Additional Notes:
No refusal, Roots to 64"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-14 (Hole #) 7/3/24 (Date) 9:10 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: South side of lot

2. Soil Parent Material: Fine sand Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet

   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-18	Ap	Fine sand	10YR3/3						Granular	Friable	
18-24	Bw	Fine sand	10YR5/6						Single grain	Loose	
24-80	C	Fine sand	2.5Y5/6	48"	C: 7.5YR5/8 D: 2.5Y 6/2				Single grain	Loose	
									Massive	Friable	

Additional Notes:
No refusal – boulder @ 80", Roots to 32"

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-15 (Hole #) | 7/3/24 (Date) | 9:40 am (Time) | 80° F, Sunny (Weather) | 42.7493 (Latitude) | -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) | Oak, white pine (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

   Description of Location: West side of lot

2. Soil Parent Material: Loamy sand | Moraine (Landform) | Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands >100 feet
   Property Line >10 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-18	Ap	Fine sand	10YR3/3						Granular	Friable	
18-28	Bw	Fine sand	10YR5/6						Single grain	Loose	
28-60	C1	Fine sand	2.5Y5/6	48"	C: 7.5YR5/8 D: 5Y 6/2				Single grain	Loose	
60-96	C2	Gravelly loamy sand	2.5Y5/4						Massive	Friable	

Additional Notes:
No refusal, Roots to 36"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP24-16 (Hole #) 7/3/24 (Date) 10:20 am (Time) 80° F, Sunny (Weather) 42.7493 (Latitude) -71.0256° (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Oak, white pine (Vegetation) None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 5-10% (Slope (%))

   Description of Location: South side of lot

2. Soil Parent Material: Sandy loam Moraine (Landform) Midslope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >10 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 94" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-18	Ap	Fine sand	10YR3/3						Single grain	Loose	
18-28	Bw	Fine sand	10YR5/6						Single grain	Loose	
28-50	C1	Fine sand	2.5Y6/3	42"	C: 7.5YR5/8 D: 5Y 6/2				Single grain	Loose	
50-108	C2	Sandy loam	2.5Y4/3						Massive	Friable	

Additional Notes:
No refusal, Roots to 56"

Commonwealth of Massachusetts
City/Town of Groveland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:	Obs. Hole TP24-7	Obs. Hole TP24-9
☐ Depth observed standing water in observation hole	____ inches	inches
☐ Depth weeping from side of observation hole	inches	inches
☒ Depth to soil redoximorphic features (mottles)	32 inches	30 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	____ inches	____ inches

Index Well Number ____________ Reading Date ____________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

2. Estimated Depth to High Groundwater: inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: 20 inches Lower boundary: 112 inches

c. If no, at what depth was impervious material observed? Upper boundary: ____ inches Lower boundary: ____ inches

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Eric Brown	7/26/2024
Signature of Soil Evaluator	Date
Eric Brown, SE #14653	11/1/2025
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

SEE DESIGN PLAN

United States Department of Agriculture

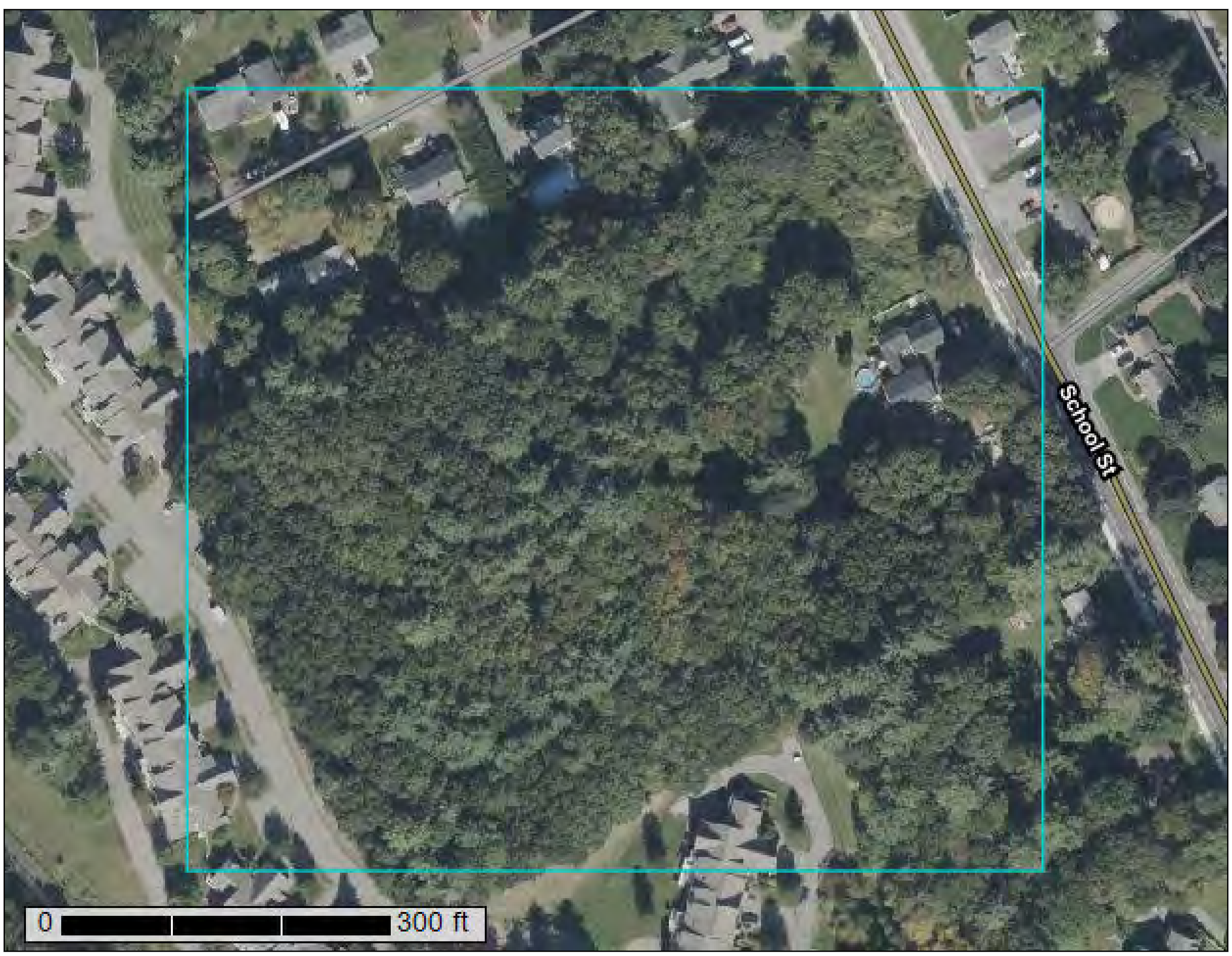
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Essex County, Massachusetts, Northern Part



July 31, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 19, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
255B	Windsor loamy sand, 3 to 8 percent slopes	0.0	0.1%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	0.3	2.2%
410C	Sutton fine sandy loam, 8 to 15 percent slopes	1.8	14.2%
411B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	0.6	4.5%
420B	Canton fine sandy loam, 3 to 8 percent slopes	2.6	20.4%
420C	Canton fine sandy loam, 8 to 15 percent slopes	3.5	27.8%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	3.9	30.8%
Totals for Area of Interest		**12.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 percent
Landform: Eskers
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Outwash terraces, outwash deltas, outwash plains, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 11.0
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Outwash terraces, kame terraces, outwash deltas, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Wareham

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent
Landform: Outwash plains, kame terraces, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Kame terraces, outwash plains, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

410C—Sutton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2xffk
Elevation: 10 to 260 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sutton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sutton

Setting

Landform: Ground moraines, ridges, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 5 inches: fine sandy loam
Bw1 - 5 to 17 inches: fine sandy loam
Bw2 - 17 to 25 inches: sandy loam
C1 - 25 to 39 inches: gravelly sandy loam
C2 - 39 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 12 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B/D

Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 5 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 5 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Canton

Percent of map unit: 3 percent
Landform: Hills, moraines, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Leicester

Percent of map unit: 2 percent
Landform: Drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

411B—Sutton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2xfff
Elevation: 0 to 1,410 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sutton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sutton, Very Stony

Setting

Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: fine sandy loam
Bw1 - 7 to 19 inches: fine sandy loam
Bw2 - 19 to 27 inches: sandy loam
C1 - 27 to 41 inches: gravelly sandy loam
C2 - 41 to 62 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 12 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B/D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Charlton, very stony

Percent of map unit: 7 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony

Percent of map unit: 4 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 3 percent
Landform: Depressions, ground moraines, drainageways, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, very stony

Percent of map unit: 1 percent
Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex

Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 6 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

421C—Canton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w814

Elevation: 0 to 1,160 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Very Stony

Setting

Landform: Moraines, ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk, very stony

Percent of map unit: 6 percent
Landform: Recessional moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, very stony

Percent of map unit: 3 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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APPENDIX I:
BROCHURES

CONTECH®
ENGINEERED SOLUTIONS

CDS®
Hydrodynamic Separator

The experts you need to solve your stormwater management challenges

Your Contech Team

Contech is the leader in stormwater management solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Unique screening technology for stormwater runoff – CDS®

The CDS hydrodynamic separator uses swirl concentration and continuous deflective separation to screen, separate and trap trash, debris, sediment, and hydrocarbons from stormwater runoff.

At the heart of the CDS system is a unique screening technology used to capture and retain trash and debris. The screen face is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder. This results in a screen that is self-cleaning and provides 100% removal of floatables and neutrally buoyant material debris 4.7 mm or larger, without blinding.

CDS is used to meet trash Total Maximum Daily Load (TMDL) requirements, for stormwater quality control, inlet and outlet pollution control, and as pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and a variety of green infrastructure practices.

CDS® Features and Benefits

FEATURE	BENEFIT
Captures and retains 100% of floatables and neutrally buoyant debris 4.7mm or larger	Superior pollutant removal
Self-cleaning screen	Ease of maintenance
Isolated storage sump eliminates scour potential	Excellent pollutant retention
Internal bypass	Eliminates the need for additional structures
Multiple pipe inlets and 90-180º angles	Design flexibility
Clear access to sump and stored pollutants	Fast, easy maintenance

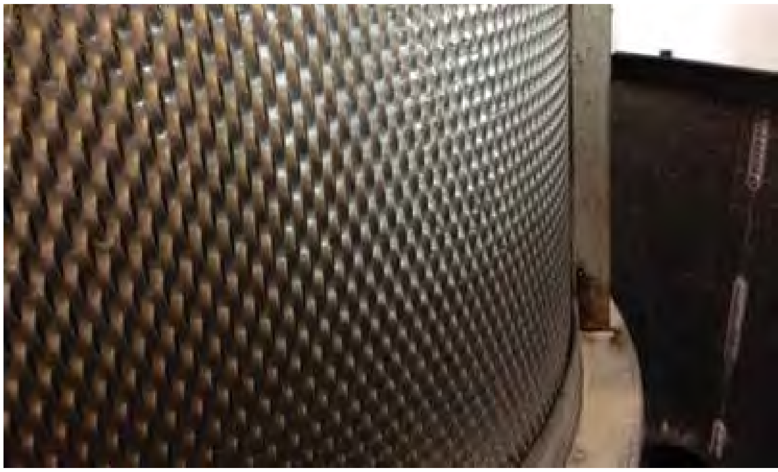
APPLICATION TIPS

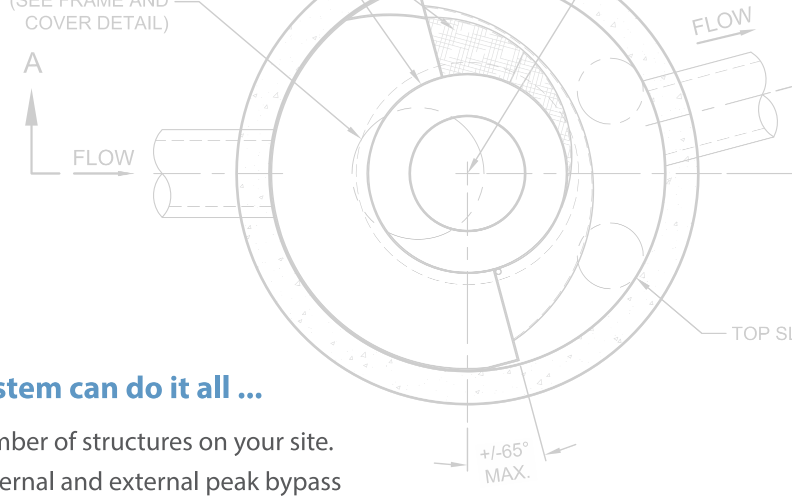
- Because of its internal peak bypass weirs, CDS systems can provide cost savings by eliminating the need for additional structures.
- Pretreating detention, infiltration, and green infrastructure practices with CDS can protect downstream structures and provide for easy maintenance.
- The CDS an ideal solution for retrofit applications due to its compact footprint and configuration flexibility.

The CDS® Screen

A fundamentally different approach to trash control ...

Traditional approaches to trash control typically involve “direct screening” that can easily become clogged, as trash is pinned to the screen as water passes through. Clogged screens can lead to flooding as water backs up. The design of the CDS screen is fundamentally different. Flow is introduced to the screen face which is louvered so that it is smooth in the downstream direction. The effect created is called “Continuous Deflective Separation.” The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder.

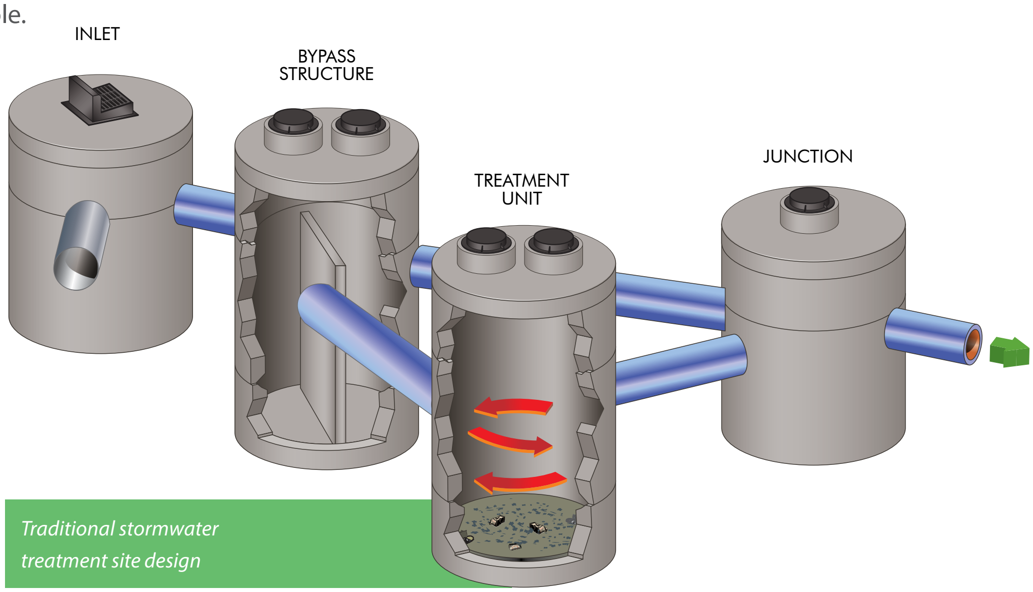




CDS® Design Configuration

Why use traditional stormwater design when ONE system can do it all ...

The CDS effectively treats stormwater runoff while reducing the number of structures on your site. Inline, offline, grate inlet, and drop inlet configurations available. Internal and external peak bypass options also available.

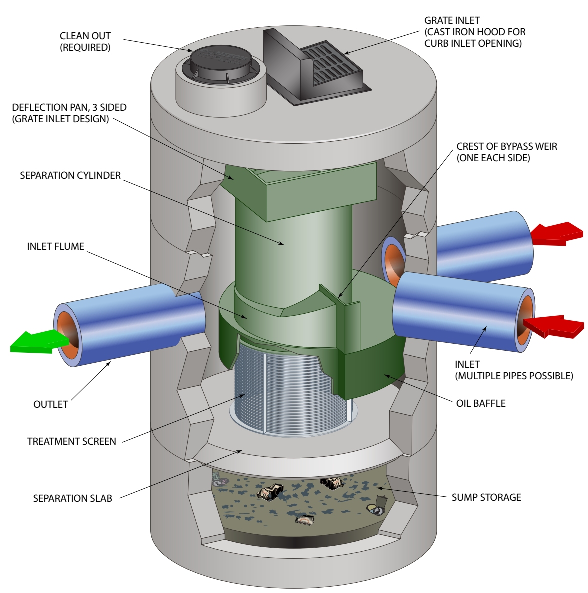


Traditional stormwater treatment site design

A Traditional Stormwater Treatment Site Design would require several structures on your site. With CDS, one system can do it all!

CDS® Advantages

- Grate inlet option available
- Internal bypass weir
- Accepts multiple inlets at a variety of angles
- Advanced hydrodynamic separator
- Captures and retains 100% of floatables and neutrally buoyant debris 4.7 mm or larger
- Indirect screening capability keeps screen from clogging
- Retention of all captured pollutants, even at high flows
- Performance verified by NJCAT, WA Ecology, and ETV Canada



Learn More:

www.ContechES.com/cds

CDS® Applications

CDS is commonly used in the following stormwater applications:

- Stormwater quality control – trash, debris, sediment, and hydrocarbon removal
- Urban retrofit and redevelopment
- Inlet and outlet protection
- Pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and Low Impact Development designs

CDS® provides trash control

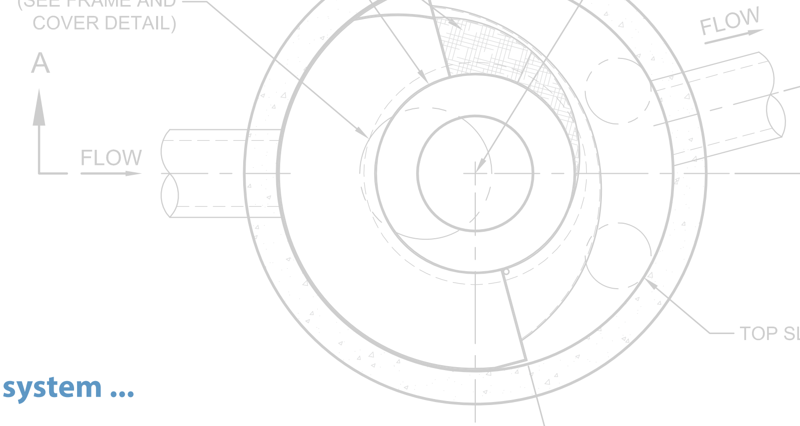
CDS® pretreats a bioswale

Select CDS® Certifications and Verifications

CDS has been verified by some of the most stringent stormwater technology evaluation organizations in North America, including:

- Washington State Department of Ecology (GULD) - Pretreatment
- Canadian Environmental Technology Verification (ETV)
- California Statewide Trash Amendments Full Capture System Certified*

**The CDS System has been certified by the California State Water Resources Control Board as a Full Capture System provided that it is sized to treat the peak flow rate from the region specific 1-year, 1-hour design storm, or the peak flow capacity of the corresponding storm drain, whichever is less.*



CDS® Maintenance

Select a cost-effective and easy-to-access treatment system ...

Systems vary in their maintenance needs, and the selection of a cost-effective and easy-to-access treatment system can mean a huge difference in maintenance expenses for years to come.

A CDS unit is designed to minimize maintenance and make it as easy and inexpensive as possible to keep our systems working properly.

INSPECTION

Inspection is the key to effective maintenance. Pollutant deposition and transport may vary from year to year and site to site. Semi-annual inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed more frequently where site conditions may cause rapid accumulation of pollutants.

Most CDS® units can easily be cleaned within thirty minutes.

RECOMMENDATIONS FOR CDS MAINTENANCE

The recommended cleanout of solids within the CDS unit's sump should occur at 75% of the sump capacity. Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber and sump, and another allows inspection and cleanout of sediment captured and retained behind the screen. A vacuum truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30 minutes for most installations.

Hydrodynamic Separator Selection & Sizing Tool

Quickly prepare designs for estimates and project meetings ...

Part of the Contech Design Center, this free, online tool fully automates the layout process for identifying the proper hydrodynamic separator for your site.

- Multiple sizing methods available.
- Site-specific questions ensure the selected unit will comply with site constraints.
- Multiple treatment options may be available based on regulations and site parameters.
- Follow up reports contain a site-specific design, sizing summary, standard detail, and specification.

Learn More:
www.ContechES.com/designcenter

A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

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CONTECH® ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

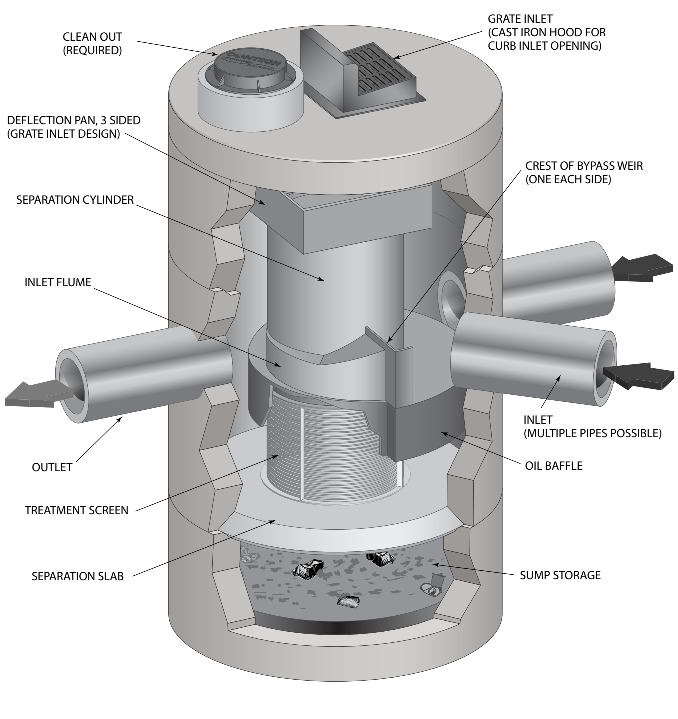
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

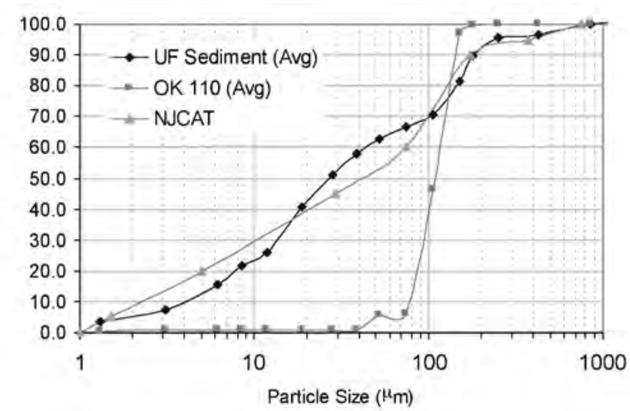


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

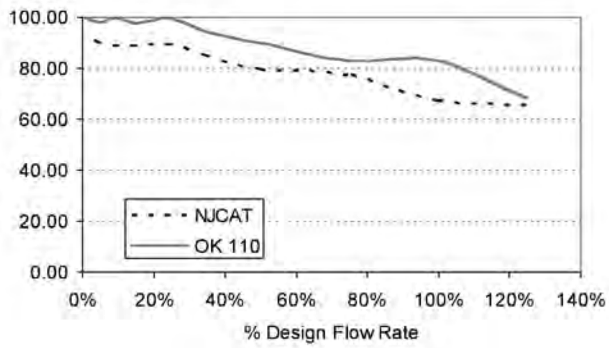


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

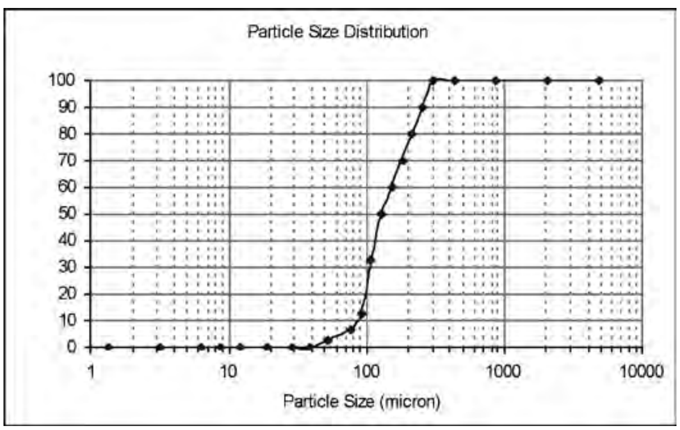


Figure 3. WASDOE PSD

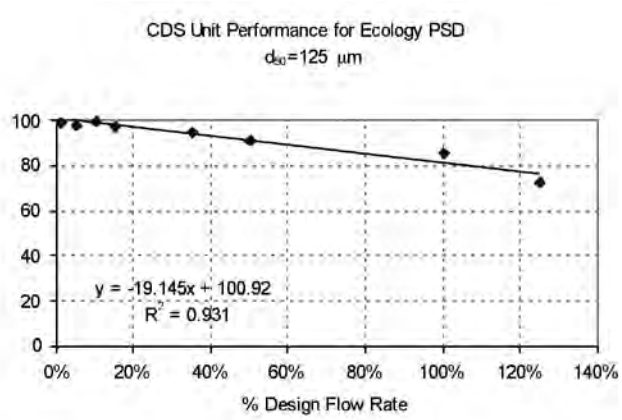


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

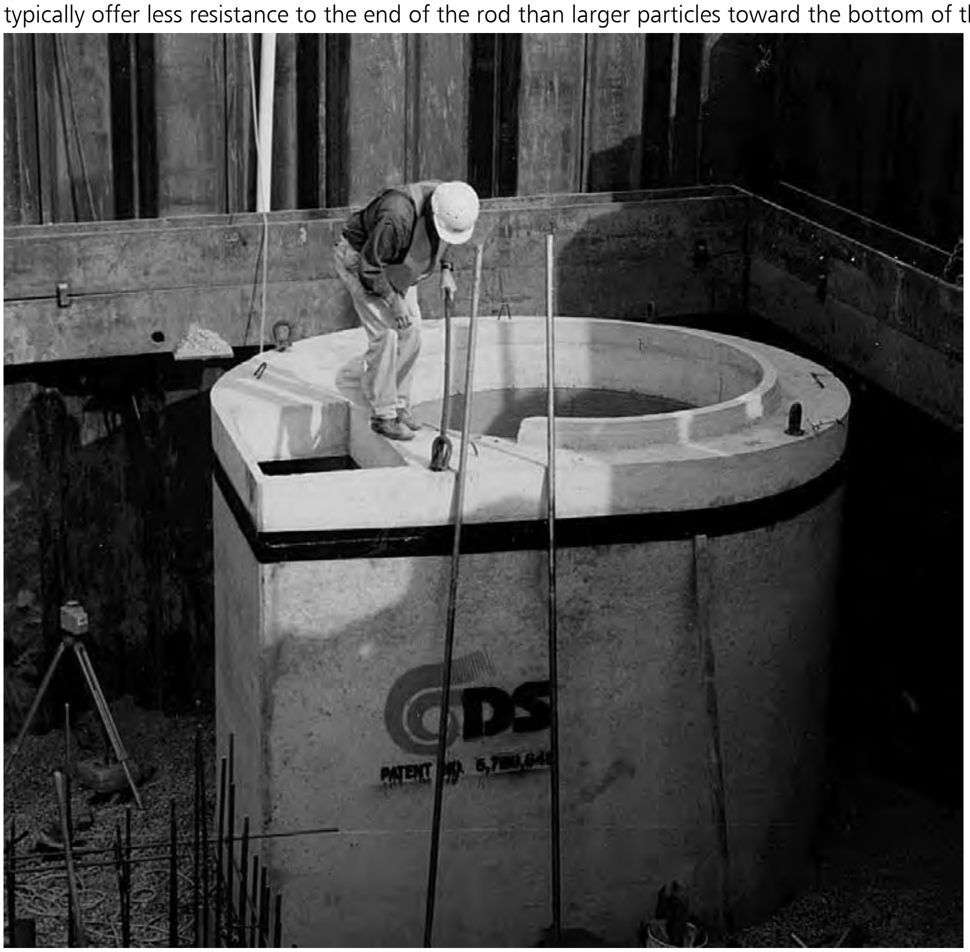
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y³	m³
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

cds_manual 3/17 PDF

APPENDIX I:

REFERENCES AND SOURCES

References and Sources:

- Massachusetts Stormwater Handbook and Stormwater Standards – Massachusetts Department of Environmental Protection
- Town of Groveland Bylaws & Regulations
- Town of Groveland GIS database
- United States Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey
- "A policy On Geometric Design of Highways and Streets; 2018" - American Association of Highway and Transportation Officials (AASHTO)
- Lindeburg, M. R. (10th Edition, 2006). Civil Engineering Reference Manual for the PE EXAM. Professional Publications, Inc.
- Wurbs, R. A. James, W. P. (2002). Water Resources Engineering. Pearsons Education, Inc.
- The New England Interstate Water Pollution Control Commission. (2016) Guides for the Design of Wastewater Treatment Works (TR-16).

The Morin-Cameron GROUP, INC.

November 5, 2024

Rebecca Oldham
Town Administrator & Town Planner
Town of Groveland
183 Main Street
Groveland, MA 01834

RE: Peer Review #1
Definitive Subdivision: 181R School Street

Dear Ms. Oldham and Board Members,

On behalf of Groveland Redevelopment, LLC, The Morin-Cameron Group, Inc. (MCG) has provided the following responses to the peer review letter prepared by The Engineering Corp (TEC) on September 24, 2024. TEC comments are italicized. We offer the following in response to the comments:

Zoning Bylaw

1. ***TEC Comment 50.8.2:*** *The lot regularity calculations provided on Sheet C-3 do not include Parcel A. Parcel A should be added to this table. Considering Parcel A is detailed as a non-buildable lot, the applicant should specify the intended owner of this parcel (i.e. a neighboring parcel, the Town of Groveland, etc.).*
MCG Response: The calculations for Parcel A were not provided because it is not a buildable lot, therefore does not need to comply with the lot regularity requirements. The parcel is currently planned to remain as a vegetated buffer that will not require maintenance. The applicant would consider an offer to sell this parcel at fair market value.

Groveland Subdivision Regulations

2. ***TEC Comment 70.3.4.B.6:*** *The applicant should provide a list of proposed street names.*
MCG Response: The applicant will present street names in a future submission.

3. ***TEC Comment 70.4.3.H.5:*** *The waiver requested should be modified to include the 150' distance to the intersection with Parker Road.*
MCG Response: Parker Road is located on the opposite side of the proposed street and falls under Section 70.4.3.H.1 of the Groveland Subdivision Regulations as a street jog. Section 70.4.3.H.1 states "*Street jogs with center-line offsets of less than 150 feet shall not be permitted*". The proposed road complies with the 150' street jog requirement and no waiver is necessary or requested. In contrast, Section 70.4.3.h.5 states: "*Proposed new intersections*

*on **one side** of an existing street should, wherever practicable, align with any existing intersections on the opposite side. When streets intersect major streets, their alignment should be continuous. Intersections of major streets should be spaced at least 800 feet apart, and those of minor streets at least 400 feet apart."* The waiver is requested from Section 70.4.3.H.5 to reduce the intersection distance between minor streets from 400 feet to 300 feet.

4. ***TEC Comment 70.4.4.B.1:*** *The applicant has utilized rainfall data that differs from the table provided in the subdivision regulations. However, the applicants model represents a more conservative evaluation of each design storm event.*
   MCG Response: The rainfall data utilized is from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server (PFDS). No changes were made as MCG's calculations were conservative as noted by TEC.

5. ***TEC Comment* 70.4.4.B.3*:*** *Multiple time of concentration values provided within the technical report do not comply with the minimum of 10 minutes specified within the subdivision regulations. The applicant should revise their calculations accordingly.*
   MCG Response: MCG implemented actual time of concentration (ToC)'s as the HydroCAD application is very accurate and the minimum 10-minute ToC derives from the original, hand calculation methodology which was not as accurate. The time of concentration has nonetheless been updated to a minimum of 10-minutes. There was a slight reduction in the pre- and post- development rates of runoff from this change.

6. ***TEC Comment 70.4.4.B.4.A:*** *The pipe sizing calculations provided had multiple values that did not match the proposed design (i.e. pipe slope, rim elevations, etc.). The applicant should revise the calculations appropriately.*
   MCG Response: The calculations have been updated to match the proposed design.

7. ***TEC Comment 70.4.5.A.6:*** *Quantity and velocity proposed sewage flow have not been provided. A hydraulic gradient and the energy gradient for each run of pipe should also be provided for the proposed sewage pump system.*
   MCG Response: An average daily sewer demand has been provided, in accordance with 310 CMR 15.00 "Title V". See Calculation in the Technical Report revised on November 5, 2024. Hydraulic and energy gradient have been calculated and depicted on the plan set, see Sewer Details, sheet C-8.

8. ***TEC Comment 70.4.7.C:*** *No proposed street lighting or lighting plan has been provided with this submission. TEC refers to the Planning Board to determine whether proposed street lighting is necessary with this subdivision.*
   MCG Response: The applicant does not wish to install lighting on this small subdivision road. The dwellings typically include their own driveway and house lighting that is sufficient for a small, rural road such as this.

9. ***TEC Comment 70.4.9:*** *The applicant has requested a waiver to use pervious bituminous concrete. Additional maintenance would likely be needed to maintain the pervious bituminous concrete's functionality compared to impervious sidewalks. Specific maintenance practices for these sidewalks' sections should be included. TEC refers to the Planning Board to determine whether pervious bituminous concrete sidewalks are acceptable for use.*
   MCG Response: The proposed plans have been update to remove the pervious concrete.

The sidewalks are proposed to be bituminous concrete.

10. ***TEC Comment 70.4.12:*** *A detail of the proposed street sign should be provided.*
MCG Response: A sign detail has been added to the plans. See sheet C-9 "Sing Post" detail.

11. ***TEC Comment 70.4.14***: *Twenty-six street trees have been displayed as part of the proposed submission. A registered landscape architect should provide a proposed landscape plan as part of this submission. The type of each tree proposed should also be detailed.*
MCG Response: A landscape plan designed by Jarret Bastys, E.I.T., LEED Green Associate, B.S. in Environmental Engineering & Landscape Architecture has been included with this submittal, see sheet C-8.

<u>Groveland Stormwater Management and Land Disturbance Regulations</u>

12. ***TEC Comment:*** *14.10.C.14 – Estimated seasonal high groundwater table (ESHGWT) elevations are provided for multiple test pits referenced within the technical report. No ESHGWT elevations are provided for the test pits within the limits of Infiltration Basin 4P, Rain Garden 5P, or Rain Garden 6P. The test pits surrounding Rain Garden 5P and 6P detail similar results or an ESHGWT greater than 2' below the bottom of the garden(s). However, Infiltration Basin P4 shows a test pit (24-13) down to two feet below bottom of proposed basin and no groundwater table noted. This could be due to the high elevation point within the existing conditions. Bedrock could exist at a higher elevation which could potentially divert water away from the test pit (24-13) location. According to surrounding test pits (24-9,24-12, and 24-14), the seasonal high groundwater could potentially be higher than 2 feet below the bottom of the proposed basin after excavation.*
MCG Response: Pond P4 complies with the 2-foot separation to groundwater (elevation 77 ESHGW to 79 bottom of basin). No bedrock was encountered in any test holes on this site and there is no evidence of shallow bedrock or outcroppings on the site or surrounding area. According to US Geologic Survey Data, the depth to bedrock in this area can range from 60 to 130' below grade. The test holes which indicated a shallower water table is due to a perched condition following the slope of the land. Test holes 12 and 14 are not indicative of the soil conditions in test hole 13, which rests on a small moraine hill. Test holes 12 and 14 are on the side slope of a hill closer to a natural valley which would be expected to have a higher, perched water table.

13. ***TEC Comment:*** *14.10.C.16 – The proposed drainage area of leading to DP-1 does not appear accurate given the proposed grading and roadway layout seen on sheets C-6 and C-7. The applicant should revise their plans and associated calculations accordingly.*
MCG Response: Additional spot grades were added to clarify the grading intent.

14. ***TEC Comment:*** *14.10.C.19 – Multiple drainage structures appear to have errors present with their current
design:*

a. *The overflow control structure for Basin P4 (OCS-4) appears to be intended to be installed within a roadway rather than within the limits of an infiltration basin. The proposed manhole rim would be difficult to access from the rim of the basin. The 12" inlet pipe also is not clearly displayed on the site plans.*
MCG Response: The outlet control structure (OCS-4) was changed to an open structure with a trash rack.
b. *The beehive grate for infiltration basin 1 (OCS-1) references a pipe invert of 98.00 to*

DMH-1 while the top of the grate is set at 92.90. Along with this, the same detail references a 10-year storm. The applicant should revise these values accordingly.
MCG Response: The values were revised.

c. *On Sheet C-6, The bottom contour (elevation 97) appears to be missing from rain garden P5.*
MCG Response: The bottom contour is 98 ft. The text has been updated to reflect that.

d. *On Sheet C-7, there is no label detailing the prosed rim or invert elevation(s) for proposed catch basin 2 (CB-2).*
MCG Response: The rim and inverts elevations for CB-2 are the same as CB-1. The text callout has been updated to clarify that.

e. *On Sheet C-7, water quality unit 2 (WQU-2) appears to have pipe inverts leaving the structure that are higher than the inverts in.*
MCG Response: The inverts have been updated.

15. ***TEC Comment 14.10.C.25:*** *Phasing of the project should be detailed/displayed on the construction plans.*
MCG Response: The project is not phased. It will be constructed in a single build.

16. ***TEC Comment:*** *14.11.C – Total suspended solids (TSS) removal calculations are provided with the technical report detailing the proposed stormwater management system meeting the required 90% removal rate. However, similar calculations have not been completed for the required 60% removal rate for total phosphorus (TP). The applicant should provide these calculations in line with their current stormwater management system.*
MCG Response: Total phosphorous removal calculations have been attached to the Technical Report. See "Stormwater Management Calculations".

<u>Stormwater Management Review</u>

17. ***TEC Comment:*** *Infiltration basin P1 is approximately 16' away from Dwelling #1A. Volume 2 Chapter 2 of the Massachusetts Stormwater Handbook states that a building needs to be 100' away from an infiltration basin upslope of that building. Dwelling 1 has basement, garage, and T.O.F. elevations set below or within the depth range of Basin P1. Dwelling's 2, 3, 4, and 5 have similar conditions present with their surrounding infiltration basin(s) and rain garden(s). This design could lead to basements, and more, being flooded within the proposed dwellings. The applicant should revise their stormwater design appropriately.*
MCG Response: Basin P1 has been removed from the design to accommodate a vegetated tree buffer behind 181 School Street, the abutting parcel. The rain gardens receive a small amount of stormwater runoff, and the Stormwater Handbook does not require any setbacks to foundations for these systems, for this reason. An infiltration pond in contrast receives more stormwater and the handbook includes setbacks. Pond P4 complies with the 10-foot downgradient and 100-foot upgradient to foundation setback requirements.

18. ***TEC Comment:*** *Given the proposed use of multiple infiltration basins and rain gardens, TEC recommends the applicant add a note detailing the following "During construction, to avoid compaction of the parent material, work from the edge of the area proposed as the location of an exfiltrating rain gardens/infiltration basin. Never direct runoff to the basin/garden until the basin/garden and the contributing drainage areas are fully stabilized." TEC Also recommends adding a physical barrier (i.e. silt fence, compost filter tubes, etc.) around these*

infiltration basins/rain gardens to protect them during construction.
MCG Response: This note was added to Sheets C-11 & C-12.

19. ***TEC Comment:*** *Infiltration basin P1 shows an ESHGWT (92.0') two feet above the proposed bottom of basin (90.0'). Chapter 2 Volume 2 of the Massachusetts Stormwater Handbook requires a minimum of two feet of separation between the bottom of a proposed infiltration basin and the ESHGWT.*
MCG Response: Basin P1 has been removed from the design to accommodate a vegetated tree buffer behind 181 School Street, the abutting parcel.

20. ***TEC Comment:*** *TEC recommends mounding analysis to be completed for each proposed rain garden and infiltration basin.*
MCG Response: A mounding analysis calculation has been completed. See Stormwater Calculation in the Technical Report.

21. ***TEC Comment:*** *For rain garden P6 shown on sheet C-6 of the site plans, the top of garden elevation is lower than the bottom of garden elevation. The applicant should revise this label accordingly.*
MCG Response: The label has been updated to clarify that.

22. ***TEC Comment:*** *On sheet C-10 of the site plans, the detail is labeled as OCS-2 instead of OCS-5.*
MCG Response: The plan has been revised.

<u>**Site Plan Review - General**</u>

23. ***TEC Comment:*** *TEC recommends the applicant coordinate their design with the Groveland Water and Sewer Department to ensure the proposed injector pump system is an acceptable sewage disposal system. The applicant should also specify who is responsible for the maintenance of the system components (i.e. pumps, piping, manholes, etc.).*
MCG Response: The applicant has received a comment from the Water and Sewer Department stating that they have requested a peer review from their engineers and that the applicant will be required to meet with the Water and Sewer Board once this project is approved with the Planning Board to coordinate the design. The maintenance of the sewer pumps will be by the homeowners.

24. ***TEC Comment:*** *No rim elevation is provided for SMH-1.*
MCG Response: The profile has been updated to include rim and inverts elevation for SMH-1. See Sheet C-7.

25. ***TEC Comment:*** *Pipe sizing and proposed material type should be provided for the proposed sewer connection from Lot 6.*
MCG Response: The plan has been revised to include the pipe size and material for lot 6. See Sheet C-7.

26. ***TEC Comment:*** *Two utility conflicts can be observed on Sheet C-7:*

a. *SMH-3 appears to be in the middle of the proposed drainage line connection, between Rain Garden P5 and DMH-1.*

MCG Response: The plan has been updated to move SMH-3 away from P5 and DMH-1. See Sheet C-7.

b. *The forced main connection between SMH-4 and the Lot 2 dwelling appears to conflict with the drainage line between DMH-2 and WQU-2.*
MCG Response: The proposed force main connection crosses under the drain line, but a vertical separation of 1.5 ft.

27. ***TEC Comment:*** *Locations of proposed silt sacks in existing and proposed catch basins should be detailed on the plans provided.*
MCG Response: The location of the proposed silt sacks in existing catch basins is detailed on the "Erosion Control & Demo" Plan. See sheet C-4.

28. ***TEC Comment:*** *TEC recommends specifying a maximum slope of 3H:1V on the temporary soil stockpile detail.*
MCG Response: The plan has been revised to specify this requirement. See sheet C-4.

29. ***TEC Comment:*** *TEC recommends adding the title of Sheet C-3 to the title block for clarity.*
MCG Response: The plan has been revised. See Sheet C-3.

30. ***TEC Comment:*** *Multiple drainage easements are detailed on the provided plans. Additional drainage easements may be needed for Basins P2, P5, and P6 given their connections to the central drainage line leading to the bottom of the existing hill.*
MCG Response: Additional easements for basins P2, P5 and P6 are not necessary, as these basins do not cross through other properties and connect directly to the street drainage. Maintenance of these systems will be by the lot owners.

31. ***TEC Comment:*** *At the front of each proposed dwelling (except for the eastern most unit in lot 6), there are no apparent walkways/paths to the front and/or rear doors of each unit.*
MCG Response: The house footprints and driveways are included on the plans to depict a possible building scenario and for calculating impervious area for use in stormwater design. These are not intended to depict actual house designs. The impervious areas used are conservative. Final lot designs will be by the lot owners following the same requirements as any other lot construction in Groveland.

32. ***TEC Comment:*** *There are no proposed gas line connections or gas shutoff valves to each proposed dwelling. TEC recommends these connections be added to avoid potential conflicts.*
MCG Response: The plans have been revised to depict gas connection. However, the final gas design will be done by the local gas provider.

33. ***TEC Comment:*** *The proposed intersection between School Street and the proposed road appears to afford sight lines that meet or exceed industry requirements. The eight proposed lots are not anticipated to generate sufficient traffic to warrant a project-specific traffic study because the impacts at the adjacent key municipal intersections are not likely going to be measurable or noticeable.*
MCG Response: No response necessary.

34. ***TEC Comment:*** *The Applicant should explore the feasibility of an emergency access connection near the end of the cul de sac that can be considered within an easement*

between two of the proposed lots. This will require coordination with one of the abutting property owners to evaluate if a connection is possible and an easement for emergency access can be reasonably obtained.
MCG Response: The rear property is a developed condominium. There is not possibility of this site connecting to that site due to the developed nature of it and also the vertical grade differential between the two properties. Emergency access would not be feasible due to the slope. A blanket easement from the condominium to the town to access an abutting property is also not feasible. The project complies with the maximum length requirement of the regulations which is established based on allowing close access to the dwellings from the intersecting road.

Massachusetts Stormwater Standards

1. ***TEC Comment:*** *Standard 1 (Untreated discharges): No new stormwater conveyance may discharge untreated stormwater directly to or cause erosion in wetlands or water of the Commonwealth. The standard has been met.*
MCG Response: No response necessary.

2. ***TEC Comment:*** *Standard 2 (Peak rate control and flood prevention): Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage. Multiple stormwater BMP's require adjustment/redesign. Refer to the comments above.*
MCG Response: The plans have been adjusted and the project complies with Standard 2.

3. ***TEC Comment:*** *Standard 3 (Recharge to Ground water): Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, 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's Stormwater Handbook.*

   Based on the findings mentioned above regarding the proposed infiltration basins and rain gardens, the applicant should revise their proposed recharge calculations appropriately.
MCG Response: The recharge calculations have been updated. See the revised Technical Report.

4. ***TEC Comment:*** *Standard 4 (80% TSS removal): Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).*
Based on the comments in the sections above, the applicant should revise their TSS removal calculations appropriately.
MCG Response: No response necessary.

5. ***TEC Comment:*** *Standard 5 (Higher Potential Pollutant Loads): For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.*

This standard has been met.
MCG Response: No response necessary.

6. ***TEC Comment:*** *Standard 6 (Critical Areas): Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to Zone I or Zone A are prohibited unless essential to the operation of the public water supply.*
This standard is not applicable.
MCG Response: No response necessary.

7. ***TEC Comment:*** *Standard 7 (Redevelopment): A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met, and the project shall improve existing conditions.*
This standard is not applicable.
MCG Response: No response necessary.

8. ***TEC Comment:*** *Standard 8 (Erosion, Sediment Control): 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), must be developed, and implemented.*
See comments 18, 27, and 28 above. The applicant should revise their plans appropriately.
MCG Response: The comments have been addressed.

9. ***TEC Comment:*** *Standard 9 (Operation and Maintenance): A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.*
See comments 9 and 30 above. The applicant should revise their plans appropriately.
MCG Response: See response to comments 9 and 30.

10. ***TEC Comment:*** *Standard 10 (Illicit Discharges): All illicit discharges to the stormwater management system are prohibited.*
This standard has been met.
MCG Response: No response necessary.

We trust this information adequately addresses the peer review comments by The Engineering Corp about the proposed Groveland Redevelopment project.

If you have any questions, please do not hesitate to contact our office at (978) 777-8586.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Scott P. Cameron, P.E.
Vice President

Attachments

cc: Groveland Redevelopment, LLC

November 5, 2024

Mrs. Annie Schindler, Executive Coordinator
Groveland Planning Board
183 Main Street
Groveland, MA 01834

RE: 181R School Street Subdivision

Mrs. Schindler:

On behalf of the applicant, Groveland Redevelopment, LLC, The Morin-Cameron Group, Inc. (MCG) provides the following responses to the "Department Comments" received on September 5, 2024. The Town Department comments are italicized. We offer the following in response to the comments:

Groveland Economic Development, Planning & Conservation Department (GEDPC):

1. ***GEDPC Comment:*** *What is the approximate size of land to be cleared?*

   MCG Response: The area to be cleared is approximately 191,750 square feet.

2. ***GEDPC Comment:*** *Are the rain gardens to remain private? How will it be ensured they remain maintained?*

   MCG Response: Yes, the rain gardens are to remain private and will be the responsibility of the owner to maintain.

3. ***GEDPC Comment:*** *What is the plan with Parcel A? The Town has had issues with small parcels like this not being maintained/going into tax title/etc. Can it be offered to 181 School St?*
   MCG Response: The parcel is currently planned to remain as a vegetated buffer that will not require maintenance. The applicant would consider an offer to sell this parcel at fair market value.

Groveland Police Department (GPD):

1. ***GPD Comment:*** *I have reviewed the plans. I don't have any concerns with the roadway, it appears there is a good line of sight on School St. at the egress. If possible, I would suggest a street light at the entrance of School St. at the entrance to the new development. I would ask that the roadway accommodate emergency vehicles being able to maneuver and turn*

around but I am sure the Fire Chief will address this. The only other thing I thought of was having a sidewalk connected to the School St. sidewalk but I see they have that in the plans so I would like to see that happen."
MCG Response: No response necessary.

Groveland Fire Department (GFD):

1. ***GFD Comment:*** *This development will need two fire hydrants, in accordance with NFPA, residential zones require a hydrant every 500 feet, if memory serves me this road exceeds 500 feet. The hydrant locations will be at beginning of the road and at the top of the cul-de-sac. Each home will need fire detection in accordance with Massachusetts General law 148, 527 CMR 1 of the fire codes and any applicable NFPA codes adopted or referenced by the Commonwealth of Massachusetts.*
   MCG Response: The project proposes two fire hydrants. One hydrant is located in front of Lot 1, about 27 feet from the beginning of the road centerline. The second hydrant is located at the end of the cul-de-sac, about 550 feet from the beginning of the road. All homes will have individual fire detection.

Groveland Municipal Light Department (GMLD):

1. ***GMLD Comment:*** *GMLD has just upgraded the distribution system in front of the subject area. There will be no issue with supplying the project.*
   MCG Response: No response necessary.

2. ***GMLD Comment:*** *We will need CAD and PDF copies of the proposed layout of houses and other utilities. GMLD will send these to our engineering firm, GML Utility Services, to design the layout of the electrical distribution system. The developer will be responsible for reimbursement of this cost.*
   MCG Response: This requirement is acknowledged. A CAD file and PDF copies of the proposed houses and other utilities will be submitted to GMLD once this project is approved and advances to a Building Permitting phase.

3. ***GMLD Comment:*** *GMLD will need the anticipated loading for each unit so we can properly size transformers and conductors.*
   MCG Response: This requirement is acknowledged. The loading for each unit will be submitted to GMLD once the project moves into construction phase.

4. ***GMLD Comment:*** *Conduit will be installed by the developer at their expense and will meet the design requirements of GMLD's URD Specifications Packet. Conduit installations need to be inspected by GMLD before backfilling.*
   MCG Response: This requirement is understood.

5. ***GMLD Comment:*** *GMLD will install all primary conductors and connections, transformers, secondary handholes and connections, and streetlights. Developer will be responsible for reimbursement of installation to GMLD.*
   MCG Response: This requirement is understood.

6. ***GMLD Comment:*** *GMLD currently has all the stock on-hand for development, though stock levels canvary. Transformer lead times, if more are needed to be ordered, are approximately 1 year.*
   MCG Response: No response necessary.

7. ***GMLD Comment:*** *Upon acceptance of the road, developer will convey all easements for the installed electrical system to the Groveland Municipal Light Department. At that time the system will become the property of GMLD.*
   MCG Response: This requirement is understood.

8. ***GMLD Comment:*** *If the location is not approved, GMLD will reject the installation.*
   MCG Response: This requirement is understood.

Groveland Inspection Services (GIS):

1. ***GIS Comment:*** *No zoning issues but the "parcel A" should be dealt with. Possibly give a waiver and attach to the closest parcel so it doesn't end up being an abandoned sliver of land."*
   MCG Response: The parcel is currently planned to remain as a vegetated buffer that will not require maintenance. The applicant would consider an offer to sell this parcel at fair market value.

Groveland Conservation Commission (GCC):

1. ***GCC Comment:*** *"The Commission has no comment on the project other than that we previously ruled that the property is not within our jurisdiction. Please see the attached Determination of Applicability."*
   MCG Response: No response necessary.

Groveland Water & Sewer Department (GWSD):

1. ***GWSD Comment:*** *I have requested a peer review proposal from our engineers. My only comments now would be to let them know that they will be required to follow our regulations, and they will be required to come in front of the Water and Sewer Board if they are approved at the Planning Board.*
   MCG Response: This requirement is understood.

Groveland Assessing Department (GAD):

1. ***GAD Comment:*** *I have no comments on the actual project itself. I do feel however that any new growth in the community will be beneficial to the town's revenue.*
   MCG Response: This requirement is understood.

Groveland Board of Health (GBH):

1. ***GBH Comment:*** *After reviewing the information provided, it does not appear that this project will be within the jurisdiction of the Board of Health.*

   MCG Response: No response necessary.

Groveland Select Board (GSB):

1. ***GSB Comment:*** *The development does not align with the community's characteristics. It is overdeveloped.*
   MCG Response: The proposed development complies with the Town of Groveland Zoning Bylaw and it is less dense than the surrounding single-family dwellings. Most of the lots surrounding this property are half acre lots, while the proposed developed proposes 0.6 acres per dwelling and lot sizes from 0.7 to 0.9 acres.

2. ***GSB Comment:*** *The site distance from the road to the existing side streets is inadequate.*
   MCG Response: The proposed road is a very low volume minor road and it is in keeping with the neighborhood in that adjacent intersections with adjacent minor streets range from 217 feet and 320 feet. The intersection meets AASHTO requirements for stopping sight distance and it is geometrically designed in accordance with the Town of Groveland Subdivision Regulations.

3. ***GSB Comment:*** *The use of individual ejector pumps for the sewer system is not preferred.*
   MCG Response: The proposed sewer system design complies with the Town of Groveland Sewer Regulations.

4. ***GSB Comment:*** *The town does not have the resources to maintain porous sidewalks.*
   MCG Response: The plans have been updated to remove the proposed porous sidewalks.

5. ***GSB Comment:*** *Sidewalks should be on both sides.*
   MCG Response: The project complies with the sidewalks section 70-4.4.9C of the Town of Groveland Subdivision Regulations. Sidewalks shall be constructed on one side of the roadway in a subdivision of 10 or less homes. This subdivision project proposes 8 homes.

We look forward to future correspondence on this project. If you have any questions, please do not hesitate to contact our office at (978) 777-8586.

Sincerely,
THE MORIN-CAMERON GROUP, INC.

Scott P. Cameron, P.E.
Vice-President

CC: Groveland Redevelopment, LLC
181R School Street, LLC

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TEC
The Engineering Corp

Rebecca Oldham
Town Administrator & Town Planner
Town of Groveland
183 Main Street
Groveland, MA 01834

November 14, 2024

Re: Peer Review #2
Definitive Subdivision: 181R School Street

Dear Ms. Oldham:

On behalf of the Town of Groveland, TEC, Inc. reviewed documents as part of the civil engineering peer review for the proposed site plan to be located at 181R School Street in Groveland Massachusetts. The Morin Cameron Group, Inc. has submitted the following documents which were reviewed by TEC for conformance with the Town of Groveland Zoning Bylaw, Subdivision Regulations, Groveland Stormwater Management and Land Disturbance Regulations, Massachusetts Stormwater Standards, industry standards and best management practices:

- *Definitive Subdivision Plans of 181R School Street, Groveland, MA*; Prepared by The Morin Cameron Group, Inc.; dated July 31,2024 Revised November 5, 2024
- *Technical Report for 181R School Street, Groveland, MA*; Prepared by The Morin Cameron Group, Inc.; dated July 31,2024 Revised November 5, 2024
- *Application for Approval of a Definitive Subdivision Plan: 181R School Street*; Prepared by The Morin Cameron Group, Inc.; dated August 1, 2024
- *Response to Department Comments for 181R School Street*; Prepared by The Morin Cameron Group, Inc.; Dated November 5, 2024
- *Outside Consultant Escrow Agreement*; Prepared by Groveland Redevelopment, LLC; Dated October 25, 2024

For consistency, the original comment numbers have been retained from the most recent TEC Peer Review letter on September 24, 2024. The Applicant's responses to the comments are shown as **bold**; TEC's responses are shown as *italic.* Upon review of the documents and plans, TEC has compiled the following comments for the Board's consideration:

Zoning Bylaw

1. **50.8.2 –** The lot regularity calculations provided on Sheet C-3 do not include Parcel A. Parcel A should be added to this table. Considering Parcel A is detailed as a non-buildable lot, the applicant should specify the intended owner of this parcel (i.e. a neighboring parcel, the Town of Groveland, etc.).
   MCG Response: The calculations for Parcel A were not provided because it is not a buildable lot, therefore does not need to comply with the lot regularity requirements. The parcel is currently planned to remain as a vegetated buffer that will not require maintenance. The applicant would consider an offer to sell this parcel at fair market value.
   TEC: TEC defers to Groveland Planning Board regarding approval of the proposed non-building buildable lot.

Groveland Subdivision Regulations

2. **70.3.4.B.6 –** The applicant should provide a list of proposed street names.
   MCG Response: The applicant will present street names in a future submission.
   TEC: Comment Addressed.

3. **70.4.3.H.5 –** The waiver requested should be modified to include the 150' distance to the intersection with Parker Road.
   MCG Response: Parker Road is located on the opposite side of the proposed street and falls under Section 70.4.3.H.1 of the Groveland Subdivision Regulations as a street jog. Section 70.4.3.H.1 states "Street jogs with center-line offsets of less than 750 feet shall not be permitted'. The proposed road complies with the 150' street jog requirement and no waiver is necessary or requested. In contrast, Section 70.4.3.h.5 states: "Proposed new intersections on one side of an existing street should, wherever practicable, align with any existing intersections on the opposite side. When streets intersect major streets, their alignment should be continuous. intersections of major streets should be spaced at least 800 feet apart, and those of minor streets at least 400 feet apart." The waiver is requested from Section 70.4.3.H.5 to reduce the intersection distance between minor streets from 400 feet to 300 feet.
   TEC: Regarding the 150' distance to the intersection with Parker Road, Comment Addressed. Regarding the waiver requested for reducing the intersection distance between minor streets from 400 feet to 300 feet, TEC concurs with the applicants request. The location of the intersection meets the industry standards for engineering design and safety requirements.

4. **70.4.4.B.1 –** The applicant has utilized rainfall data that differs from the table provided in the subdivision regulations. However, the applicants model represents a more conservative evaluation of each design storm event.
   MCG Response: The rainfall data utilized is from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server (PFDS). No changes were made as MCG's calculations were conservative as noted by TEC.
   TEC: Comment Addressed.

5. **70.4.4.B.3 –** Multiple time of concentration values provided within the technical report do not comply with the minimum of 10 minutes specified within the subdivision regulations. The applicant should revise their calculations accordingly.
   MCG Response: MCG implemented actual time of concentration (ToC)'s as the HydroCAD application is very accurate and the minimum 10-minute TOC derives from the original, hand calculation methodology which was not as accurate. The time of concentration has nonetheless been updated to a minimum of 10-minutes. There was a slight reduction in the pre- and post- development rates of runoff from this change.
   TEC: Comment Addressed.

6. **70.4.4.B.4.A –** The pipe sizing calculations provided had multiple values that did not match the proposed design (i.e. pipe slope, rim elevations, etc.). The applicant should revise the calculations appropriately.
   MCG Response: The calculations have been updated to match the proposed design.
   TEC: Commend Addressed.

7. **70.4.5.A.6 –** Quantity and velocity proposed sewage flow have not been provided. A hydraulic gradient and the energy gradient for each run of pipe should also be provided for the proposed sewage pump system.
   MCG Response: An average daily sewer demand has been provided, in accordance with 310 CMR 15.00 "Title V". See Calculation in the Technical Report revised on November 5, 2024. Hydraulic and energy gradient have been calculated and depicted on the plan set, see Sewer Details, sheet C-8.
   TEC: TEC defers to the Groveland Water and Sewer Department for review of the proposed hydraulic gradient and the energy gradient of each run of pipe proposed for the proposed sewage pump system.

8. **70.4.7.C –** No proposed street lighting or lighting plan has been provided with this submission. TEC refers to the Planning Board to determine whether proposed street lighting is necessary with this subdivision.
   MCG Response: The applicant does not wish to install lighting on this small subdivision road. The dwellings typically include their own driveway and house lighting that is sufficient for a small, rural road such as this.
   TEC: TEC defers to the Planning Board regarding proposed lighting along the subdivision.

9. **70.4.9 –** The applicant has requested a waiver to use pervious bituminous concrete. Additional maintenance would likely be needed to maintain the pervious bituminous concrete's functionality compared to impervious sidewalks. Specific maintenance practices for these sidewalks' sections should be included. TEC refers to the Planning Board to determine whether pervious bituminous concrete sidewalks are acceptable for use.
   MCG Response: The proposed plans have been update to remove the pervious concrete.The sidewalks are proposed to be bituminous concrete.
   TEC: TEC acknowledges the addition of bituminous concrete sidewalks; however, no detail has been provided of the proposed cross section for proposed sidewalks. TEC recommends the O&M requirements for the pervious pavement driveways be added to each lot's deed prior to final approval.

10. **70.4.12 –** A detail of the proposed street sign should be provided.
    MCG Response: A sign detail has been added to the plans. See sheet C-9 "Sing Post" detail.

TEC: Comment Addressed.

11. **70.4.14 –** Twenty-six street trees have been displayed as part of the proposed submission. A registered landscape architect should provide a proposed landscape plan as part of this submission. The type of each tree proposed should also be detailed.
MCG Response: A landscape plan designed by Jarret Bastys, E.I.T., LEED Green Associate, B.S. in Environmental Engineering & Landscape Architecture has been included with this submittal, see sheet C-8.
TEC: TEC recommends a special condition that all proposed street tree locations shall be verified in the field by the Town prior to final approval.

Groveland Stormwater Management and Land Disturbance Regulations

12. **14.10.C.14 –** Estimated seasonal high groundwater table (ESHGWT) elevations are provided for multiple test pits referenced within the technical report. No ESHGWT elevations are provided for the test pits within the limits of Infiltration Basin 4P, Rain Garden 5P, or Rain Garden 6P. The test pits surrounding Rain Garden 5P and 6P detail similar results or an ESHGWT greater than 2' below the bottom of the garden(s). However, Infiltration Basin P4 shows a test pit (24-13) down to two feet below bottom of proposed basin and no groundwater table noted. This could be due to the high elevation point within the existing conditions. Bedrock could exist at a higher elevation which could potentially divert water away from the test pit (24-13) location. According to surrounding test pits (24-9, 24-12, and 24-14), the seasonal high groundwater could potentially be higher than 2 feet below the bottom of the proposed basin after excavation.
MCG Response: Pond P4 complies with the 2-foot separation to groundwater (elevation 77 ESHGW to 79 bottom of basin). No bedrock was encountered in any test holes on this site and there is no evidence of shallow bedrock or outcroppings on the site or surrounding area. According to US Geologic Survey Data, the depth to bedrock in this area can range from 60 to 130' below grade. The test holes which indicated a shallower water table is due to a perched condition following the slope of the land. Test holes 12 and 14 are not indicative of the soil conditions in test hole 13, which rests on a small moraine hill. Test holes 12 and 14 are on the side slope of a hill closer to a natural valley which would be expected to have a higher, perched water table.
TEC: TEC recommends a special condition stating that final approval of each pond's constructed condition be confirmed by the Town or its agent prior to finalization of the constructed condition. Any required adjustments in design to be made shall be approved by the Town.

13. **14.10.C.16 –** The proposed drainage area of leading to DP-1 does not appear accurate given the proposed grading and roadway layout seen on sheets C-6 and C-7. The applicant should revise their plans and associated calculations accordingly.
MCG Response: Additional spot grades were added to clarify the grading intent.
TEC: Comment Addressed.

14. **14.10.C.19 –** Multiple drainage structures appear to have errors present with their current design:

   a. The overflow control structure for Basin P4 (OCS-4) appears to be intended to be installed within a roadway rather than within the limits of an infiltration basin. The proposed manhole rim would be difficult to access from the rim of the basin. The 12" inlet pipe also is not clearly displayed on the site plans.
   b. The beehive grate for infiltration basin 1 (OCS-1) references a pipe invert of 98.00 to DMH-1 while the top of the grate is set at 92.90. Along with this, the same detail references a 910-year storm. The applicant should revise these values accordingly.
   c. On Sheet C-6, The bottom contour (elevation 97) appears to be missing from rain garden P5.
   d. On Sheet C-7, there is no label detailing the prosed rim or invert elevation(s) for proposed catch basin 2 (CB-2).
   e. On Sheet C-7, water quality unit 2 (WQU-2) appears to have pipe inverts leaving the structure that are higher than the inverts in.

   MCG Response
   a. The outlet control structure (OCS-4) was changed to an open structure with a trash rack.
   b. The values were revised.
   c. The bottom contour is 98 ft. The text has been updated to reflect that.
   d. The rim and inverts elevations for CB-2 are the same as CB-I. The text callout has been updated to clarify that.
   e. The inverts have been updated.

   TEC:
   a. Comment addressed.
   b. TEC acknowledges that addition of structure AD-1, however, no rim or invert information was observed on the plans. Along with this, AD-1 does not appear to be piped towards a manhole structure. OCS-6 was noted being connected to the proposed trunkline without the junction of a manhole structure as well. TEC recommends the applicant connect both proposed structures to a manhole prior to being connected within the proposed roadway drainage trunkline.
   c. Comment Addressed.
   d. Comment Addressed.
   e. Comment Addressed.

15. **14.10.C.25 –** Phasing of the project should be detailed/displayed on the construction plans.
   MCG Response: The project is not phased. It will be constructed in a single build.
   TEC: Comment Addressed.

16. **14.11.C –** Total suspended solids (TSS) removal calculations are provided with the technical report detailing the proposed stormwater management system meeting the required 90% removal rate. However, similar calculations have not been completed for the required 60% removal rate for total phosphorus (TP). The applicant should provide these calculations in line with their current stormwater management system.
MCG Response: Total phosphorous removal calculations have been attached to the Technical Report. See "Stormwater Management Calculations".
TEC: Comment Addressed.

Stormwater Management Review

17. Infiltration basin P1 is approximately 16' away from Dwelling #1A. Volume 2 Chapter 2 of the Massachusetts Stormwater Handbook states that a building needs to be 100' away from an infiltration basin upslope of that building. Dwelling 1 has basement, garage, and T.O.F. elevations set below or within the depth range of Basin P1. Dwelling's 2, 3, 4, and 5 have similar conditions present with their surrounding infiltration basin(s) and rain garden(s). This design could lead to basements, and more, being flooded within the proposed dwellings. The applicant should revise their stormwater design appropriately.
MCG Response: Basin PI has been removed from the design to accommodate a vegetated tree buffer behind 181 School Street, the abutting parcel. The rain gardens receive a small amount of stormwater runoff, and the Stormwater Handbook does not require any setbacks to foundations for these systems, for this reason. An infiltration pond in contrast receives more stormwater and the handbook includes setbacks. Pond P4 complies with the 10-foot downgradient and 100-foot upgradient to foundation setback requirements.
TEC: Comment Addressed.

18. Given the proposed use of multiple infiltration basins and rain gardens, TEC recommends the applicant add a note detailing the following "During construction, to avoid compaction of the parent material, work from the edge of the area proposed as the location of an exfiltrating rain gardens/infiltration basin. Never direct runoff to the basin/garden until the basin/garden and the contributing drainage areas are fully stabilized." TEC Also recommends adding a physical barrier (i.e. silt fence, compost filter tubes, etc.) around these infiltration basins/rain gardens to protect them during construction.
MCG Response: This note was added to Sheets C-11 & C-12.
TEC: Comment Addressed.

19. Infiltration basin P1 shows an ESHGWT (92.0') two feet above the proposed bottom of basin (90.0'). Chapter 2 Volume 2 of the Massachusetts Stormwater Handbook requires a minimum of two feet of separation between the bottom of a proposed infiltration basin and the ESHGWT.
MCG Response: Basin PI has been removed from the design to accommodate a vegetated tree buffer behind 181 School Street, the abutting parcel.
TEC: Comment Addressed.

20. TEC recommends mounding analysis to be completed for each proposed rain garden and infiltration basin.
MCG Response: A mounding analysis calculation has been completed. See Stormwater Calculation in the Technical Report.
TEC: Comment Addressed.

21. For rain garden P6 shown on sheet C-6 of the site plans, the top of garden elevation is lower than the bottom of garden elevation. The applicant should revise this label accordingly.
MCG Response: The label has been updated to clarify that.
TEC: Comment Addressed.

22. On sheet C-10 of the site plans, the detail is labeled as OCS-2 instead of OCS-5.
MCG Response: The plan has been revised.
TEC: Comment Addressed.

Site Plan Review - General

23. TEC recommends the applicant coordinate their design with the Groveland Water and Sewer Department to ensure the proposed injector pump system is an acceptable sewage disposal system. The applicant should also specify who is responsible for the maintenance of the system components (i.e. pumps, piping, manholes, etc.).
MCG Response: The applicant has received a comment from the Water and Sewer Department stating that they have requested a peer review from their engineers and that the applicant will be required to meet with the Water and Sewer Board once this project is approved with the Planning Board to coordinate the design. The maintenance of the sewer pumps will be by the homeowners.
TEC: TEC defers to the Groveland water and sewer department to coordinate this design and maintenance requirements for this system.

24. No rim elevation is provided for SMH-1.
MCG Response: The profile has been updated to include rim and inverts elevation for SMH-I . see Sheet C-7.
TEC: Comment Addressed.

25. Pipe sizing and proposed material type should be provided for the proposed sewer connection from Lot 6.
MCG Response: The plan has been revised to include the pipe size and material for lot 6. See Sheet C-7.
TEC: Commend Addressed.

26. Two utility conflicts can be observed on Sheet C-7:

    a. SMH-3 appears to be in the middle of the proposed drainage line connection, between Rain Garden P5 and DMH-1.
    b. The forced main connection between SMH-4 and the Lot 2 dwelling appears to conflict with the drainage line between DMH-2 and WQU-2.

    a. MCG Response: The plan has been updated to move SMH-3 away from P5 and DMH-I. See Sheet C-7.
    b. MCG Response: The proposed force main connection crosses under the drain line, but a vertical separation of 1.5 ft.

    TEC: Comment Addressed.

27. Locations of proposed silt sacks in existing and proposed catch basins should be detailed on the plans provided.
    MCG Response: The location of the proposed silt sacks in existing catch basins is detailed on the "Erosion Control & Demo" Plan. See sheet C-4.
    TEC: Comment Addressed.

28. TEC recommends specifying a maximum slope of 3H:1V on the temporary soil stockpile detail.
    MCG Response: The plan has been revised to specify this requirement. See sheet C-4.
    TEC: TEC notes the addition of the 3H:1V maximum slope detail on Sheet C-4 for the temporary construction sediment forebays. However, the temporary soil stockpile detail on Sheet C-9 has not been updated.

29. TEC recommends adding the title of Sheet C-3 to the title block for clarity.
    MCG Response: The plan has been revised. See Sheet C-3.
    TEC: Comment Addressed.

30. Multiple drainage easements are detailed on the provided plans. Additional drainage easements may be needed for Basins P2, P5, and P6 given their connections to the central drainage line leading to the bottom of the existing hill.
    MCG Response: Additional easements for basins P2, P5 and P6 are not necessary, as these basins do not cross through other properties and connect directly to the street drainage. Maintenance of these systems will be by the lot owners.
    TEC: Commend Addressed.

31. At the front of each proposed dwelling (except for the eastern most unit in lot 6), there are no apparent walkways/paths to the front and/or rear doors of each unit.
MCG Response: The house footprints and driveways are included on the plans to depict a possible building scenario and for calculating impervious area for use in stormwater design. These are not intended to depict actual house designs. The impervious areas used are conservative. Final lot designs will be by the lot owners following the same requirements as any other lot construction in Groveland.
TEC: Comment Addressed.

32. There are no proposed gas line connections or gas shutoff valves to each proposed dwelling. TEC recommends these connections be added to avoid potential conflicts.
MCG Response: The plans have been revised to depict gas connection. However, the final gas design will be done by the local gas provider.
TEC: Comment Addressed.

33. The proposed intersection between School Street and the proposed road appears to afford sight lines that meet or exceed industry requirements. The eight proposed lots are not anticipated to generate sufficient traffic to warrant a project-specific traffic study because the impacts at the adjacent key municipal intersections are not likely going to be measurable or noticeable.
MCG Response: No response necessary.
TEC: Comment Addressed.

34. The Applicant should explore the feasibility of an emergency access connection near the end of the cul de sac that can be considered within an easement between two of the proposed lots. This will require coordination with one of the abutting property owners to evaluate if a connection is possible and an easement for emergency access can be reasonably obtained.
MCG Response: The rear property is a developed condominium. There is not possibility of this site connecting to that site due to the developed nature of it and also the vertical grade differential between the two properties. Emergency access would not be feasible due to the slope. A blanket easement from the condominium to the town to access an abutting property is also not feasible. The project complies with the maximum length requirement of the regulations which is established based on allowing close access to the dwellings from the intersecting road.
TEC: Comment Addressed.

Massachusetts Stormwater Standards

1) Standard 1 (Untreated discharges): *No new stormwater conveyance may discharge untreated stormwater directly to or cause erosion in wetlands or water of the Commonwealth.*

The standard has been met.

MCG Response: No response necessary.

TEC: Comment Addressed.

2) Standard 2 (Peak rate control and flood prevention): *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.*

Multiple stormwater BMP's require adjustment/redesign. Refer to the comments above.

MCG Response: The plans have been adjusted and the project complies with Standard 2.

TEC: The Peak discharge rates for DP-1, displayed within the Technical Report, have been cut off between sheets 7 and 8. The Existing Conditions discharge rates from the summary of reach DP-2 for all 4 storms do not match the peak discharge rates shown in the attached HydroCAD report.

3) Standard 3 (Recharge to Ground water): *Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, 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's Stormwater Handbook.*

Based on the findings mentioned above regarding the proposed infiltration basins and rain gardens, the applicant should revise their proposed recharge calculations appropriately.

MCG Response: The recharge calculations have been updated. See the revised Technical Report.

TEC: Comment Addressed.

4) Standard 4 (80% TSS removal): *Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).*

Based on the comments in the sections above, the applicant should revise their TSS removal calculations appropriately.

MCG Response: No response necessary.

TEC: Comment Addressed.

5) Standard 5 (Higher Potential Pollutant Loads): *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.*

This standard has been met.

MCG Response: No response necessary.

TEC: Comment Addressed.

6) Standard 6 (Critical Areas): *Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to Zone I or Zone A are prohibited unless essential to the operation of the public water supply.*

This standard is not applicable.

MCG Response: No response necessary.

TEC: Comment Addressed.

7) Standard 7 (Redevelopment): *A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met, and the project shall improve existing conditions.*

This standard is not applicable.

MCG Response: No response necessary.

TEC: Comment Addressed.

8) Standard 8 (Erosion, Sediment Control): *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), must be developed, and implemented.*

See comments 18, 27, and 28 above. The applicant should revise their plans appropriately.

MCG Response: The comments have been addressed.

TEC: Comment Addressed.

9) Standard 9 (Operation and Maintenance): *A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.*

See comments 9 and 30 above. The applicant should revise their plans appropriately.

MCG Response: See response to comments 9 and 30.

TEC: Comment Addressed.

10) Standard 10 (Illicit Discharges): *All illicit discharges to the stormwater management system are prohibited.*

This standard has been met.

MCG Response: No response necessary.

TEC: Comment Addressed.

Please do not hesitate to contact me directly if you have any questions concerning our comments at 978-794-1792.Thank you for your consideration.

Sincerely,
TEC, Inc.
*"**T**he **E**ngineering **C**orporation"*

Peter Ellison, PE
Director of Strategic Land Planning

Combined Resident Comments as of October 28, 2024

- Are driveways and sidewalks going to be permeable material as well?
    - If this surface fails how will the town remedy this?
- How will Groveland ensure that once homes are built, homeowners are following the rules to prevent water runoff onto WSV?
- We also propose an annual check for enforcement. What would the enforcement be if residents fail to adhere to these “rules”?
- If this project is approved how will the town of Groveland ensure that stormwater does not drain onto the property at WhiteStone Village or the other abutters?
- What is our recourse if this stormwater plan fails?
- What mitigation action will the Town of Groveland take to remedy any water problems that arise?
- All storm water must remain on the 181R property. What is the repercussion if the stormwater plan is not successful, and water drains onto our property? This should not be the responsibility of WhiteStone Village.
- What is the plan for the trees which could/ should visually screen the proposed development from Whitestone Village?
- Is it possible to bid out and confirm the construction to one builder for the total number of homes?
- Will there be fencing or some other mechanism to define land boundary and provide security onto WhiteStone Village Private Property?
- I know drainage appears to be good, but was winter (when ground is frozen) run-off and drainage considered?
- Infiltration Basins and Rain Gardens may work at first (first year) but if not maintained will become less effective. So is there a plan to maintain them?
- With the increase of the intensities and regularity of severe storms in recent years I question the ability of the storm water drainage plans will prevent runoƯ from a ‘100 year storm’ onto the property of White stone Village. We already are experiencing excessive water drainage behind Building Six in our development and have hired a company to improve our drainage. Is there a guarantee that there will not be an increase of water onto our property? If not, who would be liable for property damage caused by excess water? If there is an increase in water draining on our property in the winter months that would potentially cause unsafe conditions for a 55 years of age community.
- The use of permeable berms and driveways will mitigate the amount of surface water but there is only a percentage of water that percolates through those permeable surfaces on heavy rain events. What volume of water will the rain gardens and sediment basins be able to handle before there is an overflow that the spillway and level spreaders will be able to disperse and drain properly? Will residents be advised on the proper use of permeable surfaces, as I’m told that applications of sand will inhibit its’ permeability.
- Permeable hardscape materials have proven to be beneficial for drainage but is the Town of Groveland confident that as stewards of our land that future residents of the abutters will be satisfied with the decisions made on this project?
- Can you define what the Proposed Tree Line on the plan represents? Will there be vegetative screening planted along most of the perimeter as shown in the plan?

- I was not able to locate the drill holes along the stone wall. Can you help me understand where the property lines between 181R School Street and the abutters?

WhiteStone Village concerns regarding 181R School Street, Groveland, MA.
October 11, 2024

To The Groveland Planning Board,

A group of concerned WSV residents met and discussed all our concerns regarding the project at 181R School Street, Groveland MA. We hope that this project is not rushed to approval due to major concerns regarding storm water issues. We feel that 6 building lots with 8 residences on this property is too many. Our concerns, questions and requests are outlined below.

Our primary concern for this proposed project is storm water management and runoff onto WhiteStone Village property. After reviewing the plans of the proposed project and attending the planning board meeting on September 9, 2024 it appears that considerable effort was made to address the drainage of water onto the abutter's properties, though we still have concerns.

You may or may not know that we are currently experiencing excessive water drainage issues behind Building 6, directly abutting the hill next to 181R School Street, which we are trying to mitigate. We are working with an engineer, Willliams & Sparages, Peter Niche, EJ Paving, and the Groveland Conservation Commission to resolve our drainage issues. This is a considerable expense to our community in the hope that this will solve our existing water issues. We don't want to have additional stormwater drainage onto our property from the proposed project.

<u>Stormwater Drainage</u>

The proposed plan at 181R School indicates that all storm water will remain on that property. We have basement condo units at ground level in buildings 14 and 6 bordering the proposed building lots that could potentially be exposed to flooding if the storm water drainage plan fails. In addition, all the townhouses have basements that could flood as well.

- We are concerned about the ability of the permeable roadway to handle large amounts of stormwater
    - Are driveways and sidewalks going to be permeable material as well?
    - If this surface fails how will the town remedy this?
- We want to ensure that buffer zone trees are not removed, now or in the future, within 20-25 feet of the property line around the entire property.
    - Don't allow the developer to clear cut the trees on the lot.
    - In addition, we would like evergreen trees planted inside the buffer zone to assist with stormwater management
- How will Groveland ensure that once homes are built, homeowners are following the rules to prevent water runoff onto WSV? i.e. maintenance of driveways, maintenance of rain gardens, maintenance of detention areas, prohibition of the removal of trees, maintenance of fence around perimeter, etc. We feel that there should be some type of long-term oversite.
    - We propose the creation of covenants or the creation of an HOA to ensure these requirements are adhered to and they be filed with registry of deeds that follows each lot/home sold.
    - We also propose an annual check for enforcement. What would the enforcement be if residents fail to adhere to these "rules"?

1. If this project is approved how will the town of Groveland ensure that stormwater does not drain onto the property at WhiteStone Village or the other abutters?
2. What is our recourse if this stormwater plan fails?
3. What mitigation action will the Town of Groveland take to remedy any water problems that arise?
4. All storm water must remain on the 181R property. What is the repercussion if the stormwater plan is not successful, and water drains onto our property? This should not be the responsibility of WhiteStone Village.

Privacy

- As a private property, we request that a fence be placed around the perimeter of the entire property at 181R School Street. There is very little privacy in the winter when the trees drop their leaves. Buildings 6, 7, 8, 13 and 14 directly face this proposed project.

- We are opposed to the sale of individual lots with different builders completing the homes. We feel that one developer and builder would ensure that all the proposed stormwater requirements would be adhered to. In addition, we will ask the town to require a large bond if this project moves forward.

Construction

- During construction, ensure that no construction vehicles will enter WhiteStone Village
- Limit the days/hours that construction can occur
- If there is excessive debris on our abutting buildings the developer would take responsibility to power wash all those buildings and clean all windows after construction is completed

We apologize for the late submission of this document. Thank you in advance for taking the time to read, review and address our concerns going forward. If you are not familiar with WSV or have questions about anything stated above, we invite you to come to the property and take a look around. We look forward to the meeting on October 15th and hope that these issues will be addressed.

Respectfully submitted by concerned residents of WhiteStone Village,

Janet Nolan, Cathy Chadwick, Paul Ford, Muriel Ford, Joe Szczechowicz, Don Soini, Robin Kirchick, Ann Graham, and Karen D'Orlando

Annie Schindler

From: Mary Lou Costello <mlcostel@comcast.net>
Sent: Tuesday, September 10, 2024 6:00 PM
To: TownPlanner
Subject: 181R School Street

Hello,
My name is Mary Lou Costello. I live at 604 Alyssa Drive, Groveland MA 01834.
Building 6 in Whitestone Village directly abuts this proposed development.
The land behind building 6, directly abutting the subdivision, is already extremely wet, so much so, that we lost two mature trees this past year. There is a variety of wildlife which currently inhabit that property.
What is the plan for the trees which could/ should visually screen the proposed development from Whitestone Village? It doesn't seem apparent in the plans.
I will attend your meeting this evening via Zoom.
Regards,
Mary Lou Costello
978-469-0656

I just looked at the revised subdivision plans Sent from my iPad

Annie Schindler

From: cynthia leonardi <cjleonardi@comcast.net>
Sent: Tuesday, September 24, 2024 10:52 AM
To: Annie Schindler
Subject: Proposed Development 181R School Street

TO: Groveland Planning Board
Groveland Town Hall

SUBJECT: Proposed Development 181R School St

Gentlemen:

Having attended the Planning Board meeting of Sept 10, 2024, we would like to offer observations and comments.

As background, we have been residents of Groveland and WhiteStone Village since 2005. We have been subject to statutes and amendments by the town. For example, a “no salt zone” during snow removal and restrictions on the use of Georgia Street. Making a public street such as Georgia Street a one way for WhiteStone Village residents only.

At the 9/10/24 meeting we were presented with preliminary developers plans and were struck with what appeared to be a density of housing in the development lot and the potential for individual lot buyers to hire contractors for <u>each</u> lot.

We believe this offered the problem of lot development in ways that might be deleterious, for one, to the overall integrity of boundaries, lot lines, and setbacks.

Question: Is it possible to bid out and <u>confirm</u> the construction to one builder for the total number of homes?

Question: What are the specific plans for rainwater mitigation and assurances that retention ponds will work to prevent water runoff to Whitestone Village? Living at the base of the backside of the development, we are concerned about run off onto our properties.

Question: Will there be fencing or some other mechanism to define land boundary and provide security onto WhiteStone Village Private Property?

Thank you for your consideration.

David and Cynthia Leonardi
703 Alyssa Drive
Groveland, MA

Annie Schindler

From: Jessica Massero <jessicamassero@danvers.org>
Sent: Wednesday, September 11, 2024 1:11 PM
To: Annie Schindler
Subject: 181R School Street
Attachments: Massero Pool.heic

Hi Annie,

Following up from last night's planning board meeting.
Please share this letter and photos with the Planning Board regarding 181R School Street.
The attached photo is what happens with a heavy rain, the water comes through the retaining wall on the left hand side and floods the yard/pool.

Please forward my contact information to the board and to the developer, they requested to visit on site and see firsthand some of the concerns. We are home most days from 4:00 on.

Jessica Massero
4 Anne Street, Groveland
(978) 790-7677

Dear Members of the Planning Board,

Thank you for the opportunity to speak tonight. I stand before you not just as a concerned resident but as someone deeply invested in the character and future of our beloved town, Groveland. 5 Years ago my husband and I carefully chose Groveland for its unique blend of greenery, space, and tranquility—qualities that are becoming increasingly rare as other towns give way to rampant overdevelopment.

The proposal before you to cram eight housing units onto this lot is not only alarming but also a direct threat to the very fabric of our community. This is a small, tightly-knit neighborhood characterized by single-family homes that sit on MODEST, well-maintained lots. The idea of squeezing eight units into this acreage is utterly out of step with the character of our neighborhood. This isn't just about adding a few new homes; THE scale of this development is simply out of character with our neighborhood.

It goes beyond just talking about more traffic or a few extra cars on the road; we're talking about fundamentally altering the nature of our neighborhood. The charm of Groveland lies in its open spaces, the privacy that each of us enjoys, and the sense of peace that comes from living in a community that values these attributes. This development would not only disrupt that balance but will directly damage it.

Let's not forget the environmental impact - to the area and to individual homeowners. Many of us have already invested in expensive drainage management systems to combat the existing water issues on our properties. Despite the developers' assurances, adding more impermeable surfaces—roads, driveways, and sidewalks—will only worsen the flooding issues we're already grappling with. The stormwater management plan may meet regulatory requirements, but it does nothing to alleviate our very real concerns about the potential for increased water damage to our homes.

Furthermore, the need for waivers—whether it's reducing the intersection distance or using permeable pavement—signals that this development is being forced into a space that simply cannot handle associated values and sizing and goes against the spirit of what Groveland represents. This is more of a compromise of our town's values for the profit of a developer.

In closing, this proposal represents a clear departure from what Groveland stands for. It prioritizes density over quality of life, short-term gain over long-term sustainability. I urge you to reject this development, not just for the sake of the current residents, but for the future of Groveland as the peaceful, spacious, and green community where our young families can thrive and grow.

Thank you.
Jessica Massero

Jessica Massero
Reading Specialist
Great Oak Elementary
Danvers Public Schools
x4109

Annie Schindler

From: coachdsoini@aol.com
Sent: Monday, September 9, 2024 7:03 AM
To: Annie Schindler
Subject: Re: 181r school Street sub division

Hi Annie, not sure i will get to talk so hoping i can get this letter in to the planning board.

Dear Planning Board Members
My name is Don Soini and i live at 608 Alyssa Drive (also known as 608 Dianne Circle). I moved from Georgetown to Groveland's 55+ community because of its country setting. Unfortunately the zoning board has let me and the resident of White Stone Village down. Wild turkeys and deer will probably be no more. So we are now hoping that the planning board will minimize the impact this development will have on us and all concerned residents. I believe you have the power to increase set backs maintaining the privacy White Stone Village thought they had or at least keeping the developers from cutting down trees from 25 to 50 feet from the boarder. And/or maybe even planting 15 to 20 foot high ever green trees to help with noise. We have noise regulations which won't make sense with neighbors, (lawn mowers, leaf blowers, etc). All of which will be there right but can be minimized. Another bigger concern is drainage, there appears to already be some problems now that don't need to be increased. It is there engineers that are drawing up the plans and it is all about money. So you know they are only doing what they have to, so would it not make sense to have the town hire someone at there expense to review these plans. It will only avoid possible future problems that will and should become town problems for allowing this development. Finaly i would just like to say that the residents of White Stone Village pay taxes and a good part of that money probably goes to schools and I am sure we don't have children in those schools. So maybe you can go the extra mile looking out for us and the other concerned residents. Thank you for your time and appreciate all you do for our town.

Thank You
Don Soini

On Thursday, September 5, 2024 at 01:04:15 PM EDT, Annie Schindler <aschindler@grovelandma.com> wrote:

Hi Don,

Thank you for your email. I will share it with the Planning Board.

Best,

Annie Schindler
Executive Coordinator
Town of Groveland | 978.556.7205

-----Original Message-----
From: coachdsoini (null) <coachdsoini@aol.com>
Sent: Thursday, September 5, 2024 1:02 PM
To: Annie Schindler <ASchindler@Grovelandma.com>
Subject: 181r school Street sub division

Hi my name is Don Soini and I live at 608 Alyssa Drive (also known as 608 Dianne Circle) and I am concerned on the effects this subdivision will have on the community. This is a 55+ community and I believe noise, wildlife and drainage will all be impacted. Many of us who moved here was because of the quiet and peaceful setting. I hope this will all be considered.
Thanks
Don Soini
Sent from my iPhone

Annie Schindler

From: coachdsoini@aol.com
Sent: Monday, September 16, 2024 7:38 AM
To: Annie Schindler
Subject: Re: 181r school Street subdivision

Hi Annie,
Had to leave meeting early because of debate but going to take the board members up on writing a letter of my concerns. If you could also let me know when next meeting is I would appreciate it.
Thanks

Dear Planning Board Members
My name is Don Soini and I live at 608 Alyssa Drive (also known as 608 Dianne Circle). We are the building on their plan as 305 Dianne Circle and I believe we will be the most impacted by this sub-division. After attending this meeting I have many concerns and will try to keep it brief, but I am concerned of what this will do to my property value and many of the White Stone Village properties. If this subdivision is allowed our living conditions of the sounds and sights of gobbling turkeys and deer will change to houses and sounds of lawn mowers, leaf blowers, snow blowers, and who knows what. I am thinking White Stone Village would not of built so close to the lot line had they known this land could be considered for development. When asked how far buildings would be from lot lines their engineer could not answers. As stated by their engineer they are not going to be the ones building the homes. All they want to do is make lots and get out of there and leave the headaches to whoever buys the lots. Headaches like how close to the buffer area can they build, where is the roof runoff going and how will that effect drainage can they have patios, pools, etc. Bigger houses will have greater amounts of roof runoff. I'm not sure how they can even draw up accurate drainage plans without knowing all this.

They say all drainage will stay on sight, maybe for first year. All Infiltration Basin and Rain Gardens will require some type of maintenance. Leaves will create liners at the bottom of the basins allowing them to fill faster. The basin will naturally fill with leaves and sticks and in some cases homeowners looking to get rid of grass clippings. Buffer areas will slowly be cleared by homeowners looking to create more area for their children to play or cleared naturally by children just playing in them. Who is going to be responsible for the maintenance and keeping buffer areas natural. All this is crucial to White Stone Village from flooding.

White Stone Village is a quite community who takes care of itself, we have our own trash pickup and plow our own streets. We contribute to the town whenever we can and are now asking the town to minimize the impact this subdivision if allowed will have on us. Maybe by paying for White Stone to plant 15+ foot high Evergreen Trees along the entire lot line for privacy and noise, increasing the buffer area to 50 feet (25 feet in the fall/winter doesn't create much privacy) and fencing in the buffer area from the homeowners side to keep it from being disturbed. And all this still can't create what we have but would help and possibly minimize any future drainage issues.

I thank you for your time and realize this is a lot but hope you will take the time to review.

Thanks
Don Soini

On Tuesday, September 10, 2024 at 11:06:33 AM EDT, Annie Schindler <aschindler@grovelandma.com> wrote:

Hi Don,

The meeting packet for this evenings meeting went out to the Board last week, so this most recent email was not included. Your email dated September 5th was included. I have forwarded it to the Chair and will make copies for the meeting but the Board will not have had time to review it. It will be in the meeting packet for their next meeting.

Please let me know if you have any questions.

Best,

Annie Schindler

Executive Coordinator

Town of Groveland | 978.556.7205

The Secretary of the Commonwealth's Office has determined that most e-mails to and from municipal offices and officials are public records. Consequently, confidentiality should not be expected.

From: coachdsoini@aol.com <coachdsoini@aol.com>
Sent: Monday, September 9, 2024 7:03 AM
To: Annie Schindler <ASchindler@Grovelandma.com>
Subject: Re: 181r school Street sub division

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Dear Planning Board Members

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Stone Village pay taxes and a good part of that money probably goes to schools and I am sure we don't have children in those schools. So maybe you can go the extra mile looking out for us and the other concerned residents. Thank you for your time and appreciate all you do for our town.

Thank You

Don Soini

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Executive Coordinator
Town of Groveland | 978.556.7205

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Sent: Thursday, September 5, 2024 1:02 PM
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Thanks
Don Soini
Sent from my iPhone

Annie Schindler

From:	coachdsoini@aol.com
Sent:	Thursday, October 17, 2024 10:24 AM
To:	Annie Schindler
Subject:	Re: 181r school Street subdivision

Hi Annie
Attended the meeting and was hoping to get some questions answered that were just for the planning board. Unfortunately for me I will be out of town until the 30th, but I am hoping I can attend by zoom. Is it possible that you could send me the directions so I can attend if on zoom, would appreciate. But if not could you see that these questions could get answered at the meeting.

1. I know drainage appears to be good, but was winter (when ground is frozen) run-off and drainage considered?

2. Infiltration Basins and Rain Gardens may work at first (first year) but if not maintained will become less effective. So is there a plan to maintain them?

3. A 25 foot buffer zones is not nearly enough to replace the quite, private, peaceful, secluded setting we have now especially in the fall when leaves are gone.

a. Is anything going to be done to keep residents from entering and clearing buffer area (fencing)?
b. Is any type of ever green tree (15 foot) going to be planted to help with privacy and sound?

The board has the power to demand this, after all this is all about money for them. 8 residents on 5 1/2 acres with no consideration for abutters. This property should house 3 to 4 properties at best and surprised it got by zoning. I am now hoping the planning board will minimize the effect this development will have on White Stone Village. There gain will effect our property values. Especially mine (608) and the others that will directly abut the project.
Thank You for your time
Don Soini

On Monday, September 16, 2024 at 09:49:34 AM EDT, Annie Schindler <aschindler@grovelandma.com> wrote:

> Hi Don,
>
> Thank you for your email. I will share this with the Planning Board. The Board's next meeting is September 24th, but the next meeting at which they will discuss 181R School Street will be October 15th. Please let me know if you have any questions.

Annie Schindler

From: Joe Szczechowicz <joe@sls-landscapes.com>
Sent: Tuesday, September 10, 2024 9:41 AM
To: TownPlanner
Subject: 181R School Street

To Groveland Planning Board,

My wife and I reside at 1103 Alyssa Drive in Groveland, MA. I will be attending the meeting this evening and I was assuming there would be time allotted for a Q&A period but that may not be the case, so I have a few concerns. I was able to view the plans of the proposed project and even though I couldn't attend the last meeting it looks like considerable effort was taken to address the drainage of water on this property and the existing soil conditions are favorable for good percolation.

1) With the increase of the intensities and regularity of severe storms in recent years I question the ability of the storm water drainage plans will prevent runoff from a '100 year storm' onto the property of White stone Village. We already are experiencing excessive water drainage behind Building Six in our development and have hired a company to improve our drainage. Is there a guarantee that there will not be an increase of water onto our property? If not, who would be liable for property damage caused by excess water? If there is an increase in water draining on our property in the winter months that would potentially cause unsafe conditions for a 55 years of age community.
2) The use of permeable berms and driveways will mitigate the amount of surface water but there is only a percentage of water that percolates through those permeable surfaces on heavy rain events. What volume of water will the rain gardens and sediment basins be able to handle before there is an overflow that the spillway and level spreaders will be able to disperse and drain properly? Will residents be advised on the proper use of permeable surfaces, as I'm told that applications of sand will inhibit its' permeability.
3) Permeable hardscape materials have proven to be beneficial for drainage but is the Town of Groveland confident that as stewards of our land that future residents of the abutters will be satisfied with the decisions made on this project?
4) Can you define what the Proposed Tree Line on the plan represents? Will there be vegetative screening planted along most of the perimeter as shown in the plan?
5) I was not able to locate the drill holes along the stone wall. Can you help me understand where the property lines between 181R School Street and the abutters?

I am thanking you in advance for taking the time to read and answer my questions and concerns, preferably this evening but at a minimum to receive an email. I hope that the owner of the project can extent an increased effort in understanding the impact of this proposed project has on the residents of White Stone Village, thank you.

Joe Szczechowicz
1103 Alyssa Drive
Groveland, MA

Joe Szczechowicz, MCLP

President

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TOWN of
GROVELAND
MASSACHUSETTS

Let's Talk about HOUSING

Opportunities for Groveland

Public Workshop #1

TOWN HALL AT
183 MAIN
STREET

A 2 Hour Discussion

Housing Options + Section 3A Compliance

Thursday
November 21
6:30 pm - 8:30pm

Stay Connected through our Interactive Project Website

https://community.innesassocltd.com/groveland

For More Information: https://grovelandma.com/mbta-zoning-mgl-chapter-40a-section-3a/

APPROVED X-X-2024

BOARD: PLANNING BOARD
MEETING DATE: **October 29, 2024**
MEETING PLACE: Main Meeting Room and Zoom
TIME: 7:00 PM
MEMBERS PRESENT: D. McNulty, P. Millina, C. Goodwin, J. Naves,
MEMBERS ABSENT: B. Ligols, W.F. Sorenson Jr

Note: Minutes are not a transcript; see the recorded meeting for verbatim information.

PUBLIC HEARING
***CONTINUED* 181R SCHOOL STREET**:
A hearing in accordance with M.G.L. Chapter 41, Section 81T, the Town of Groveland Subdivision Rules and Regulations and Article 14 of the Groveland General Bylaws, to hear the application of Groveland Redevelopment LLC. c/o Louis Minicucci Jr, 231 Sutton St, Suite 1B, North Andover MA 01845, requesting approval of a six (6) lot Definitive Subdivision Plan labeled 181R School Street, Groveland, Massachusetts and associated Stormwater Management & Land Disturbance Permit. The site is located in the Residential 2 (R-2) Zoning District. The proposed subdivision is located at 181R School Street Groveland, MA 01834. (Assessors Map 34, Parcel 13).
McNulty: *Reads the above public notice.*
MOTION: Goodwin motions to open the public hearing. Millina seconds the motion. Voted all in favor, the motion passes unanimously.
McNulty: We have a request from the Morin Cameron Group for a continuance, they are still working on the plans, and they have not gotten back to TECs initial response to the site plan. I encourage everyone to read the TEC comments, because the next time the Morin Cameron Group comes in, they will have responses to some of the questions posed, both TEC and the Morin Cameron Group will be there next meeting.
MOTION: Goodwin motions to continue the hearing on 181R School Street to the next meeting November 19th at 7 pm. Millina seconds the motion. Voted all in favor, the motion passes unanimously.

SECTION 3A ZONING UPDATE
Update on where the consultant is with this project and announce Public Workshop on November 21st.
McNulty: The first public workshop is taking place on Thursday November 21st from 6:30 to 8:30 at Town Hall, there are some extra fliers here if anyone would like to take one.

TOWN PLANNER UPDATE
None.

MEETING MINUTES
Approval of October 15, 2024, meeting minutes.
Board missed this agenda item.

OTHER ITEMS NOT REASONABLE ANTICIPATED AT TIME OF POSTING

None.

NEXT MEETING: November 19, 2024

ADJOURNMENT

MOTION: Goodwin motions to adjourn the meeting at 7:12 pm. Millina seconds the motion. Voted all in favor, the motion passes unanimously.