Stormwater Management & Erosion Control Plan

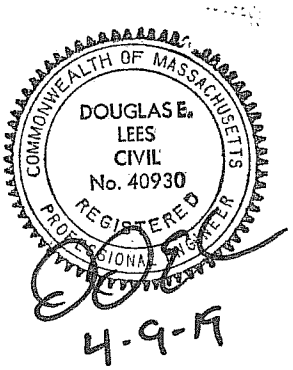
Reedy Meadow Estates
Groton, Massachusetts

Assessor's Map 220
Parcels 59 & 60

Prepared on:
March 15, 2019

Revised on:
April 9, 2019

Prepared for:
Reedy Meadow, LLC
LEES Job No. 27503



Prepared by:
Land Engineering
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130 Middlesex Road
Tyngsboro, MA 01879

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Figure #4 – Rainfall/Intensity/Duration/Frequency Curve
Drainage System Computational Worksheet
Proposed Conditions Drainage Plan

This project was first presented to the Town in or around 2002 and approved in 2006. The record Stormwater Analysis, by others, contains the soils evaluation forms for many test pits throughout the site that were witnessed by a representative from the original engineering company and the Nashoba Associated Board of Health. The test pits in Pepperell were also witnessed by a representative of the original engineering company along with an agent for the Pepperell Board of Health. The test pits show the soils on site to be loose sand/sandy gravel material with a deep seasonal high water table (eshwt).

The approved plans call for each set of catch basins to tie into a water quality inlet before discharging to a subsurface infiltration pond consisting of Stormtech SC-740 plastic chambers in a bed of stone. There are no overflow relief pipes on any of the infiltration systems.

The review engineer for the Town told the Planning Board that Nitsch Engineering's field reports from 2016 show no evidence of groundwater when the systems were installed.

In October or November of 2018; after the stormwater systems, the homes and the roadway were installed, it was noticed that the rain was ponding at the catch basins and in the road at the end of Olivia Way. Upon further investigation, it was determined that something had caused a change in the water table and that the infiltration systems at the end of Olivia Way, systems 8 and 9, were no longer functioning as designed. Since the ponds were not originally designed with an overflow, the water ponded in the roadway at the catch basins.

The applicant is proposing a two pronged approach to address the situation. The first objective is to provide an overflow for the two infiltration ponds, #8 and #9. The grades around pond #8 are higher than the pond and do not provide an obvious means for installing an overflow, while the grades west of pond #9 drop off towards the Town owned property, allowing for an overflow to be installed for this pond as shown on the new plans. To provide an overflow for pond #8, a six inch HDPE pipe was installed connecting catch basin # 20 with catch basin #22, essentially tying the two infiltration ponds together.

The overflow pipe from pond #9 will flow to a new stormwater pond located on the open space parcel owned by the Town of Groton, Parcel H. Once constructed, this system will provide a path for excess runoff, above what the existing infiltration ponds can handle, to pass through the system and flow to the proposed pond on Parcel H, keeping the water from ponding on the existing roadway.

To provide redundancy to the solution, the plans also provide for an overland path for excess runoff to be captured in a proposed 15" pipe and piped to a forebay for pretreatment prior to being directed to the new pond on Parcel H mentioned above. To accomplish this, a portion of the roadway will be regraded and super elevated to direct runoff that is not captured in the existing catch basins to the proposed culvert at the proposed headwall.

The new plans also include a six inch perimeter drain along the back of #10 Oliva Way to help divert groundwater from their basement along with a 40 mil impervious barrier to offer additional protection to this home.

Calculation Methodology

The enclosed stormwater peak-rate runoff calculations were performed utilizing the stormwater modeling software HydroCAD. HydroCAD utilizes SCS TR-20 methodology. Culvert flow calculations contained in the Closed Drainage Computation Worksheet in the appendix were performed using the Rational Method.

Stormwater Runoff Peak-Rate Analysis Table

Peak Runoff (CFS)

Return Interval	*2-Yr*	*10-Yr*	*25-Yr*	*100-Yr*
Discharge from new pond	0	0.1	0.3	2.3

Land Engineering & Environmental Services, Inc.
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TYNGSBORO, MA 01879
TELEPHONE (978) 649-4642 / FAX (978) 649-0981

JOB 215-03
SHEET NO. _____ OF _____
CALCULATED BY 3-15-19 DATE _____
CHECKED BY _____ DATE _____
SCALE Revised 4-9-19

WATER QUALITY VOLUME (WQV.)

TOTAL PAVEMENT TO CB #19, 20, 21 & 22 = 26,700 SF

TOTAL PAVEMENT TO PROP. CULVERT IF CB'S BYPASSED
= 26,700 + 5,100
= 31,800 SF

FOREBAY WQV = 31,800 SF × $\frac{0.1"}{12"/1'}$ = 265 CF

POND WQV = 31,800 SF × $\frac{0.5"}{12"/1'}$ = 1325 CF

FOREBAY

ELEV.	AREA	VOL	ΣVOL.
202.5			
		50 CF	
203.0	200	550 CF	50 CF
			600 CF ← 325 CF @ elev 203.5
204	900		> 265 CF

POND

ELEV.	AREA	VOL	ΣVOL.
203	4780 SF		
		7500 CF	
			← 5250 CF @ elev 203.7
204	10,220 SF		7500 CF
		5400 CF	> 1325
204.5	11,380 SF		12,900 CF

(Total Volume exist. ponds #8 + #9 = 9,518 CF ±)

TSS Removal Calculation Worksheet

Location: Olivia Way

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Wet Pond w/ Forebay	80%	1.00*	0.80	0.20

Total TSS Removal = 80%

Project: Reedy Meadow

Prepared By: DEL

Date: 4-5-19

* Equals remaining load from previous BMP (E) which enters the BMP

Operation and Maintenance Plan
Olivia Way – Groton Massachusetts

Person Responsible for Operation and Maintenance is the Reedy Meadow Estates Trust

1. The landscaped and lawn areas shall be regularly maintained and tributary sources of sediment quickly stabilized and landscaped surfaces restored.

2. The shared driveway, 'Olivia Way', shall be inspected monthly and any debris or rubbish shall be picked up disposed of properly.

3. Catch basins should be inspected four times per year and cleaned whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin or 24" maximum. Catch basin hoods should be inspected for proper function and repaired as needed. Inlet grates shall be kept free of debris and inspected for damage, any damage shall be repaired in a timely manner.

4. Inspection and Maintenance of the water quality units:

    a. Inspect and check condition of the unit at least twice a year, once in the spring and once in the fall.
    b. Ascertain that the unit is functioning properly (no blockages or obstructions).
    c. Check for oil or gas. Remove any oil or gas separately by using a small portable pump.
    d. Measure amount of solid materials that have accumulated in the sump (Unit should be cleaned when the sediment depth is eight inches).
    e. Pump down unit (at least once a year) and thoroughly inspect chamber.

5. Inspection and Maintenance of Infiltration Systems shall be biannual.

    a. The subsurface infiltration systems are in the water table and will therefore have standing water at certain times of the year. Standing water should not exceed two feet, at which time excess water should drain through the 12" overflow to the wet pond on Parcel H. If standing water exceeds two feet, check the outlet of the overflow pipe for obstructions.

6. Inspection and Maintenance of wet basin and forebay

    a. Inspect wet basin at least one per year,
    b. Inspect the outlet for signs of clogging or excess outflow,

c. Check the banks and berm for signs of erosion, including channeling. Any erosion should be repaired by hand and stabilized.
d. Check the pond for the presence of invasive species. Any invasive species should be removed by hand.
e. Inspect sediment forebay at least twice per year and remove any accumulated sediment and any debris or trash collected therein,

7. Drainage pipe outlets shall be inspected twice a year for scour and sediment. If scour has occurred the rip-rap shall be replaced. Any sediment should be removed and disposed of properly.

Use attached inspection form when performing inspections

Stormwater Site Inspection Report
Olivia Way – Groton, MA

General Information			
Project Name			
Location	Olivia Way, Groton, MA		
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			

Type of Inspection:
❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event

Weather Information

Has there been a major storm event since the last inspection? ❑Yes ❑No
If yes, provide:
Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):

Weather at time of this inspection?
❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds
❑ Other: Temperature:

Have any discharges occurred since the last inspection? ❑Yes ❑No
If yes, describe:

Are there any discharges at the time of inspection? ❑Yes ❑No
If yes, describe:

Inspection Items

	Stormwater BMP & Site Features	Inspection Frequency	Maintenance Required?	Corrective Action Needed and Notes
1	Landscaped & lawn areas shall be regularly maintained and inspected for washout & remove trash	Monthly	❑Yes ❑No	
2	Olivia Way roadway - Inspect for rubbish, debris or sediment buildup. Inspect curbing for damage.	Monthly	❑Yes ❑No	

	Stormwater BMP & Site Features	Inspection Frequency	Maintenance Required?	Corrective Action Needed and Notes
3	Catch Basins–Inspect for depth of deposits & proper function of hoods	Quarterly	❑Yes ❑No	
	Catch Basin #17		❑Yes ❑No	
	Catch Basin #18		❑Yes ❑No	
	Catch Basin #19		❑Yes ❑No	
	Catch Basin #20		❑Yes ❑No	
	Catch Basin #21		❑Yes ❑No	
	Catch Basin #22		❑Yes ❑No	
4	Water Quality Units - Inspect for deposits and/or floatables and oils	Biannually	❑Yes ❑No	
	Water Quality Unit #7		❑Yes ❑No	
	Water Quality Unit #8		❑Yes ❑No	
	Water Quality Unit #9		❑Yes ❑No	
5	Surface & Subsurface Infiltration Systems – Inspect for sediment, debris or standing water	Biannually	❑Yes ❑No	
	Infiltration System #7		❑Yes ❑No	
	Infiltration System #8		❑Yes ❑No	
	Infiltration System #9		❑Yes ❑No	
6	Forebay	Biannually		

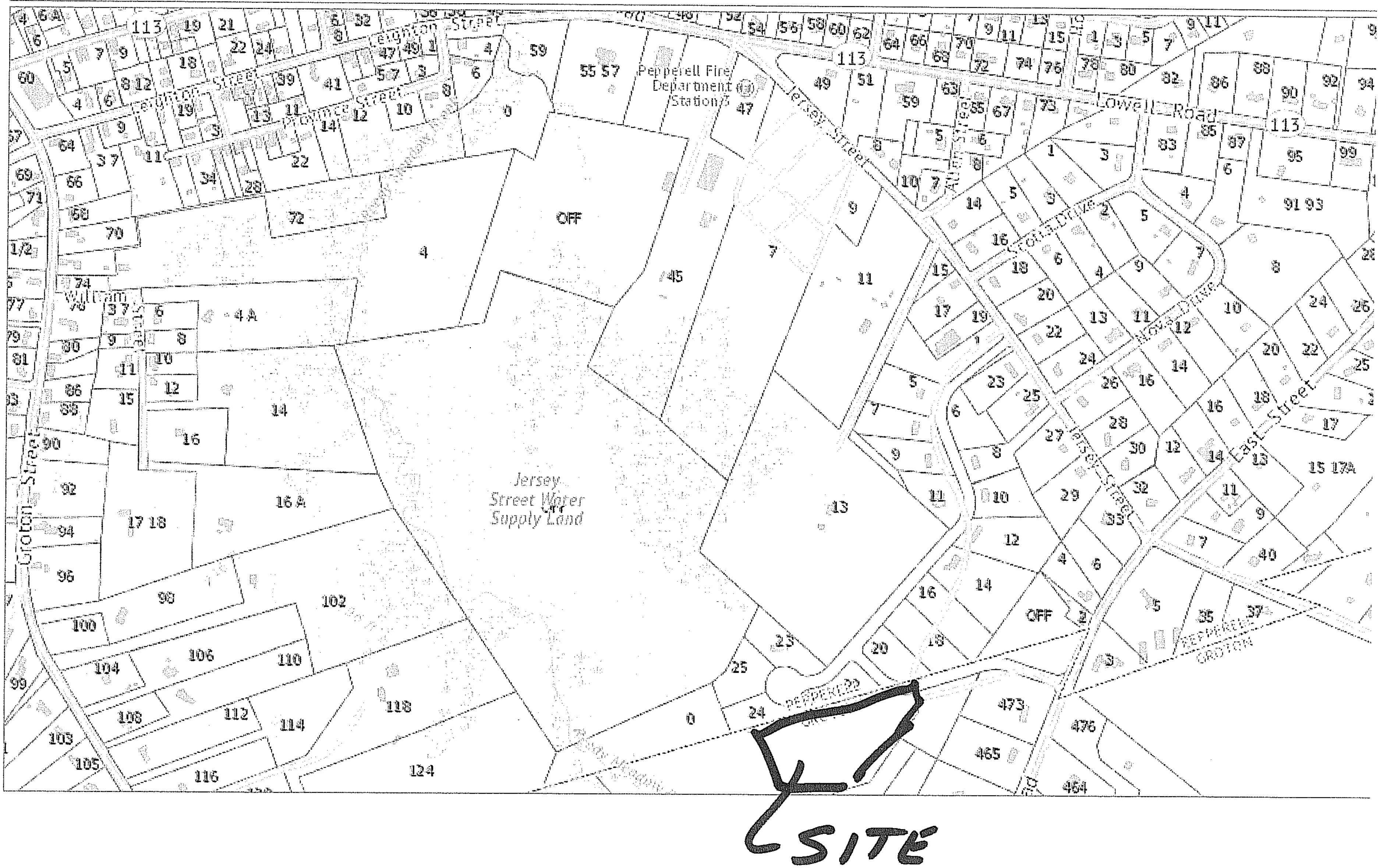
	Stormwater BMP & Site Features	Inspection Frequency	Maintenance Required?	Corrective Action Needed and Notes
	Wet Pond	Annually	❑Yes ❑No	
7	Flared end outlet- Inspect for erosion or blockage	Biannually	❑Yes ❑No	
	Other		Weekly	❑Yes ❑No

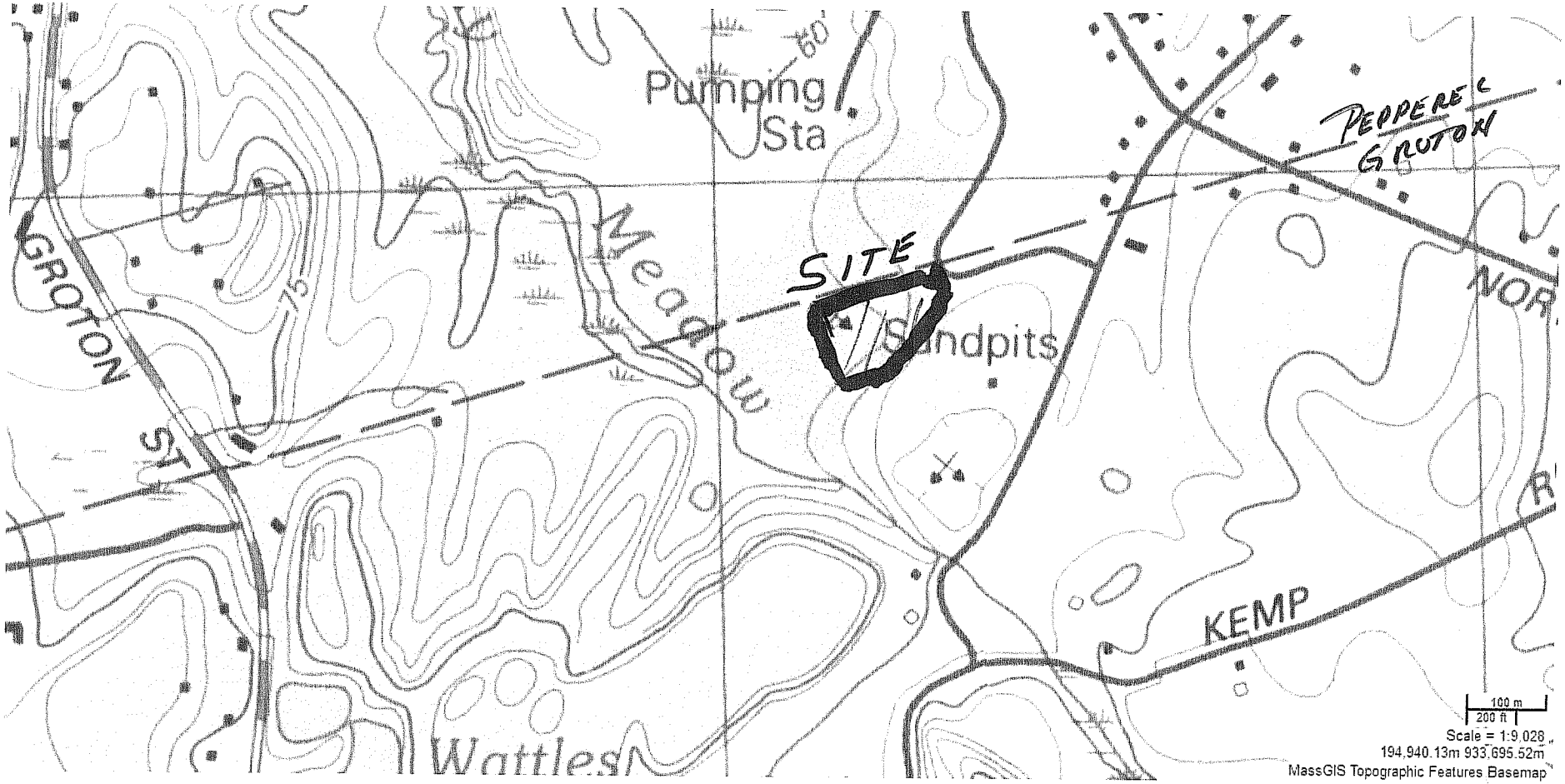
Non-Compliance

Describe any incidents of non-compliance not described above:

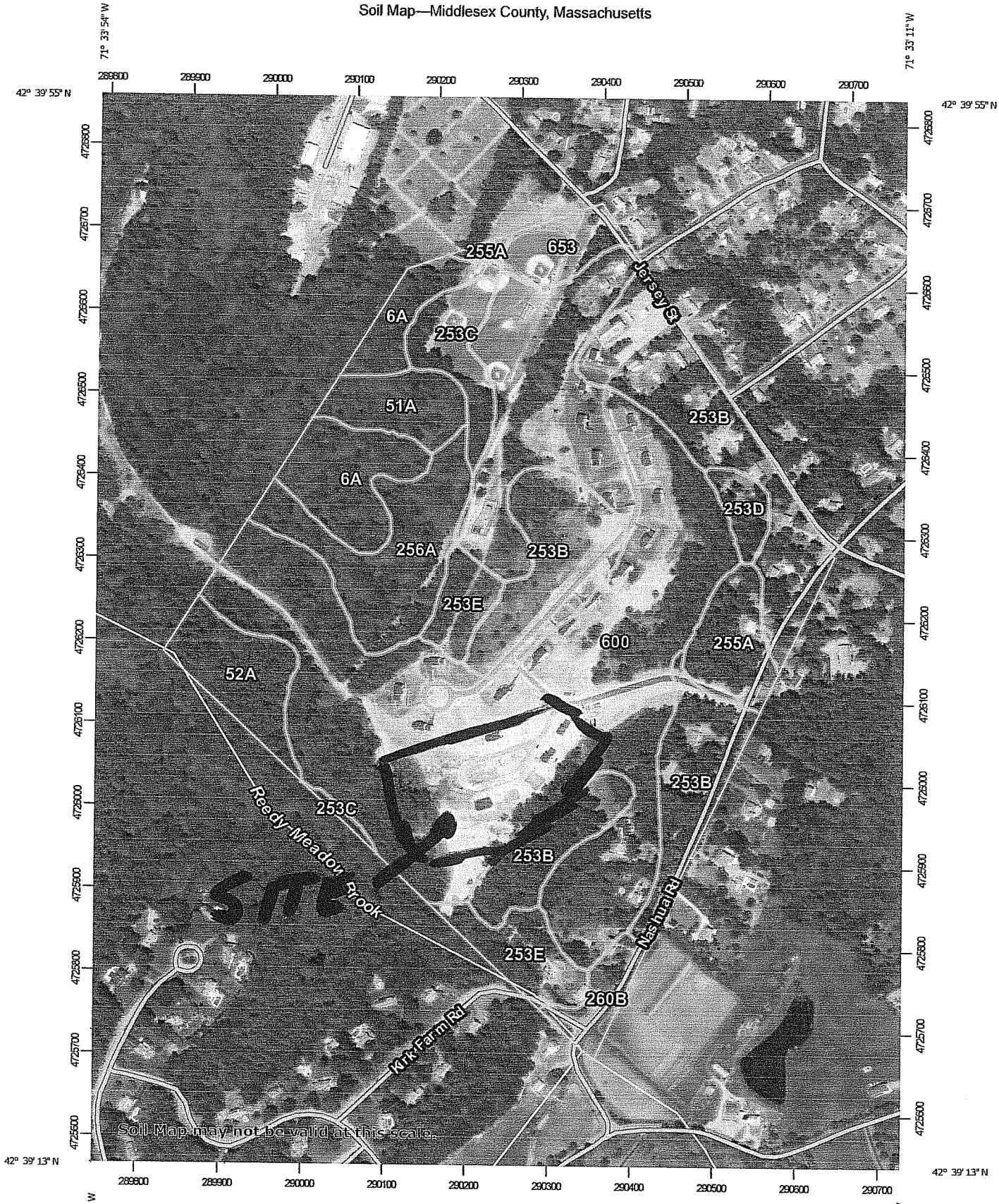
Inspectors Signature:_____

Locus Map


Lowell Road
113
Jersey Street
Leighton Street
Province Street
Groton Street
William Street
Allen Street
Nova Drive
Stone Drive
East Street
Pepperell Fire Department Station 3
Jersey Street Water Supply Land
Pepperell Rd
PEPPERELL
GROTON
OFF
SITE


Pumping Sta
60
PEPPERELL
GROTON
SITE
Meadow
Sandpits
GROTON
ST
NOR
KEMP
100 m
200 ft
Scale = 1:9,028
194,940.13m 933,695.52m
MassGIS Topographic Features Basemap

USGS MAP



Map Scale: 1:6,300 if printed on A portrait (8.5" x 11") sheet.

N

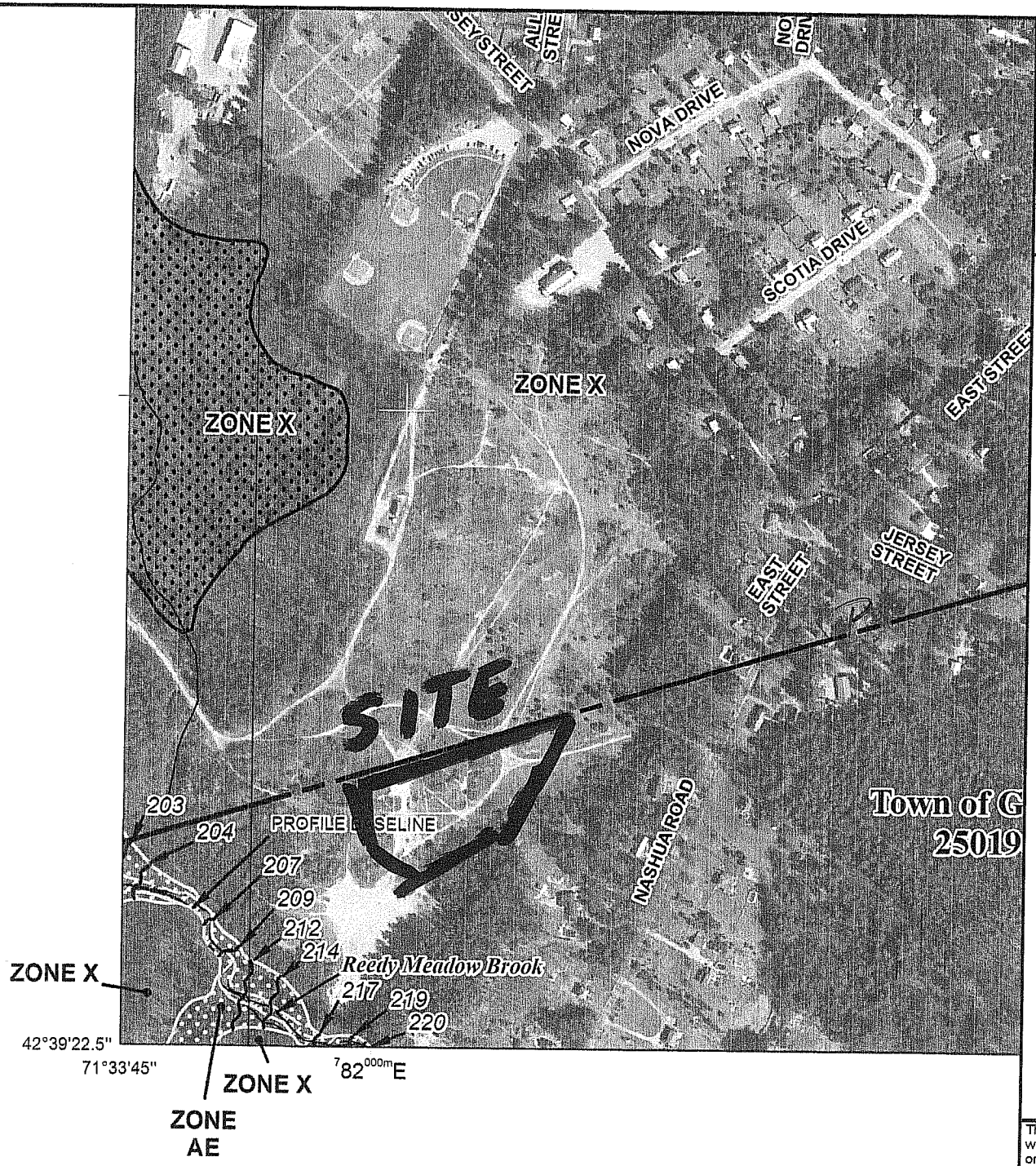
Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	6.8	5.9%
51A	Swansea muck, 0 to 1 percent slopes	3.1	2.6%
52A	Freetown muck, 0 to 1 percent slopes	4.0	3.4%
253B	Hinckley loamy sand, 3 to 8 percent slopes	23.5	20.4%
253C	Hinckley loamy sand, 8 to 15 percent slopes	3.3	2.9%
253D	Hinckley loamy sand, 15 to 25 percent slopes	1.3	1.1%
253E	Hinckley loamy sand, 25 to 35 percent slopes	4.8	4.1%
255A	Windsor loamy sand, 0 to 3 percent slopes	3.6	3.1%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	7.2	6.2%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	1.8	1.6%
600	Pits, gravel	53.9	46.7%
653	Udorthents, sandy	2.3	2.0%
Totals for Area of Interest		**115.3**	**100.0%**



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0091E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 91 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DUNSTABLE, TOWN OF	250191	0091	E
GROTON, TOWN OF	250194	0091	E
PEPPERELL, TOWN OF	250210	0091	E

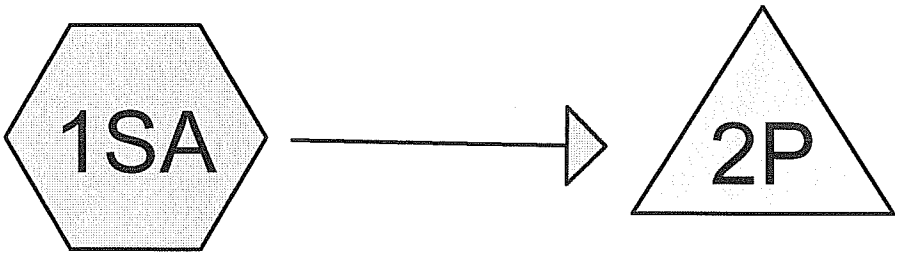
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25017C0091E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

Proposed Conditions



To Pond

new pond

Subcat Reach Pond Link

Routing Diagram for 27503-Olivia.3.15.19
Prepared by Land Engineering & Environmental Services, Inc., Printed 4/9/2019
HydroCAD® 10.00-24 s/n 02454 © 2018 HydroCAD Software Solutions LLC

2-Year Storm Event

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1SA: To Pond Runoff Area=211,200 sf 23.30% Impervious Runoff Depth>0.04"
Flow Length=730' Tc=24.3 min CN=47 Runoff=0.0 cfs 714 cf

Pond 2P: new pond Peak Elev=203.14' Storage=712 cf Inflow=0.0 cfs 714 cf
Outflow=0.0 cfs 0 cf

Total Runoff Area = 211,200 sf Runoff Volume = 714 cf Average Runoff Depth = 0.04"
76.70% Pervious = 162,000 sf 23.30% Impervious = 49,200 sf

Summary for Subcatchment 1SA: To Pond

Runoff = 0.0 cfs @ 15.29 hrs, Volume= 714 cf, Depth> 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	60,000	30	Woods, Good, HSG A
	26,700	98	Paved roads w/curbs & sewers, HSG A
	10,500	98	Roofs, HSG A
	68,000	30	Brush, Good, HSG A
	34,000	39	>75% Grass cover, Good, HSG A
*	12,000	98	Pond Surface
	211,200	47	Weighted Average
	162,000		76.70% Pervious Area
	49,200		23.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
2.7	160	0.0380	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	120	0.5800	7.62		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.8	400	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.3	730	Total			

Summary for Pond 2P: new pond

Inflow Area = 211,200 sf, 23.30% Impervious, Inflow Depth > 0.04" for 2-Year event
Inflow = 0.0 cfs @ 15.29 hrs, Volume= 714 cf
Outflow = 0.0 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 203.14' @ 20.00 hrs Surf.Area= 5,531 sf Storage= 712 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	203.00'	12,900 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
203.00	4,780	0	0
204.00	10,220	7,500	7,500
204.50	11,380	5,400	12,900

Device	Routing	Invert	Outlet Devices
#1	Primary	203.70'	**8.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=203.00' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

10-Year Storm Event

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1SA: To Pond Runoff Area=211,200 sf 23.30% Impervious Runoff Depth>0.31"
Flow Length=730' Tc=24.3 min CN=47 Runoff=0.6 cfs 5,451 cf

Pond 2P: new pond Peak Elev=203.72' Storage=4,871 cf Inflow=0.6 cfs 5,451 cf
Outflow=0.1 cfs 584 cf

Total Runoff Area = 211,200 sf Runoff Volume = 5,451 cf Average Runoff Depth = 0.31"
76.70% Pervious = 162,000 sf 23.30% Impervious = 49,200 sf

Summary for Subcatchment 1SA: To Pond

Runoff = 0.6 cfs @ 12.59 hrs, Volume= 5,451 cf, Depth> 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	60,000	30	Woods, Good, HSG A
	26,700	98	Paved roads w/curbs & sewers, HSG A
	10,500	98	Roofs, HSG A
	68,000	30	Brush, Good, HSG A
	34,000	39	>75% Grass cover, Good, HSG A
*	12,000	98	Pond Surface
	211,200	47	Weighted Average
	162,000		76.70% Pervious Area
	49,200		23.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
2.7	160	0.0380	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	120	0.5800	7.62		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.8	400	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.3	730	Total			

Summary for Pond 2P: new pond

Inflow Area = 211,200 sf, 23.30% Impervious, Inflow Depth > 0.31" for 10-Year event
Inflow = 0.6 cfs @ 12.59 hrs, Volume= 5,451 cf
Outflow = 0.1 cfs @ 19.37 hrs, Volume= 584 cf, Atten= 86%, Lag= 406.6 min
Primary = 0.1 cfs @ 19.37 hrs, Volume= 584 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 203.72' @ 19.37 hrs Surf.Area= 8,709 sf Storage= 4,871 cf

Plug-Flow detention time= 397.0 min calculated for 582 cf (11% of inflow)
Center-of-Mass det. time= 248.4 min (1,144.4 - 895.9)

Volume	Invert	Avail.Storage	Storage Description
#1	203.00'	12,900 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
203.00	4,780	0	0
204.00	10,220	7,500	7,500
204.50	11,380	5,400	12,900

Device	Routing	Invert	Outlet Devices
#1	Primary	203.70'	**8.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.1 cfs @ 19.37 hrs HW=203.72' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.1 cfs @ 0.49 fps)

25-Year Storm Event

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1SA: To Pond Runoff Area=211,200 sf 23.30% Impervious Runoff Depth>0.52"
Flow Length=730' Tc=24.3 min CN=47 Runoff=1.3 cfs 9,160 cf

Pond 2P: new pond Peak Elev=203.75' Storage=5,124 cf Inflow=1.3 cfs 9,160 cf
Outflow=0.3 cfs 4,242 cf

Total Runoff Area = 211,200 sf Runoff Volume = 9,160 cf Average Runoff Depth = 0.52"
76.70% Pervious = 162,000 sf 23.30% Impervious = 49,200 sf

Summary for Subcatchment 1SA: To Pond

Runoff = 1.3 cfs @ 12.51 hrs, Volume= 9,160 cf, Depth> 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

	Area (sf)	CN	Description
	60,000	30	Woods, Good, HSG A
	26,700	98	Paved roads w/curbs & sewers, HSG A
	10,500	98	Roofs, HSG A
	68,000	30	Brush, Good, HSG A
	34,000	39	>75% Grass cover, Good, HSG A
*	12,000	98	Pond Surface
	211,200	47	Weighted Average
	162,000		76.70% Pervious Area
	49,200		23.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
2.7	160	0.0380	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	120	0.5800	7.62		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.8	400	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.3	730	Total			

Summary for Pond 2P: new pond

Inflow Area = 211,200 sf, 23.30% Impervious, Inflow Depth > 0.52" for 25-Year event
Inflow = 1.3 cfs @ 12.51 hrs, Volume= 9,160 cf
Outflow = 0.3 cfs @ 15.04 hrs, Volume= 4,242 cf, Atten= 76%, Lag= 151.7 min
Primary = 0.3 cfs @ 15.04 hrs, Volume= 4,242 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 203.75' @ 15.04 hrs Surf.Area= 8,866 sf Storage= 5,124 cf

Plug-Flow detention time= 230.5 min calculated for 4,228 cf (46% of inflow)
Center-of-Mass det. time= 122.5 min (1,000.3 - 877.8)

Volume	Invert	Avail.Storage	Storage Description
#1	203.00'	12,900 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
203.00	4,780	0	0
204.00	10,220	7,500	7,500
204.50	11,380	5,400	12,900

Device	Routing	Invert	Outlet Devices
#1	Primary	203.70'	**8.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.3 cfs @ 15.04 hrs HW=203.75' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.3 cfs @ 0.75 fps)

100-Year Storm Event

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1SA: To Pond Runoff Area=211,200 sf 23.30% Impervious Runoff Depth>1.24"
Flow Length=730' Tc=24.3 min CN=47 Runoff=4.0 cfs 21,829 cf

Pond 2P: new pond Peak Elev=203.89' Storage=6,414 cf Inflow=4.0 cfs 21,829 cf
Outflow=2.3 cfs 16,784 cf

Total Runoff Area = 211,200 sf Runoff Volume = 21,829 cf Average Runoff Depth = 1.24"
76.70% Pervious = 162,000 sf 23.30% Impervious = 49,200 sf

Summary for Subcatchment 1SA: To Pond

Runoff = 4.0 cfs @ 12.41 hrs, Volume= 21,829 cf, Depth> 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
	60,000	30	Woods, Good, HSG A
	26,700	98	Paved roads w/curbs & sewers, HSG A
	10,500	98	Roofs, HSG A
	68,000	30	Brush, Good, HSG A
	34,000	39	>75% Grass cover, Good, HSG A
*	12,000	98	Pond Surface
	211,200	47	Weighted Average
	162,000		76.70% Pervious Area
	49,200		23.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
2.7	160	0.0380	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	120	0.5800	7.62		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.8	400	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.3	730	Total			

Summary for Pond 2P: new pond

Inflow Area = 211,200 sf, 23.30% Impervious, Inflow Depth > 1.24" for 100-yr event
Inflow = 4.0 cfs @ 12.41 hrs, Volume= 21,829 cf
Outflow = 2.3 cfs @ 12.79 hrs, Volume= 16,784 cf, Atten= 44%, Lag= 22.8 min
Primary = 2.3 cfs @ 12.79 hrs, Volume= 16,784 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 203.89' @ 12.79 hrs Surf.Area= 9,625 sf Storage= 6,414 cf

Plug-Flow detention time= 101.6 min calculated for 16,728 cf (77% of inflow)
Center-of-Mass det. time= 42.6 min (895.6 - 853.0)

Volume	Invert	Avail.Storage	Storage Description
#1	203.00'	12,900 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
203.00	4,780	0	0
204.00	10,220	7,500	7,500
204.50	11,380	5,400	12,900

Device	Routing	Invert	Outlet Devices
#1	Primary	203.70'	**8.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

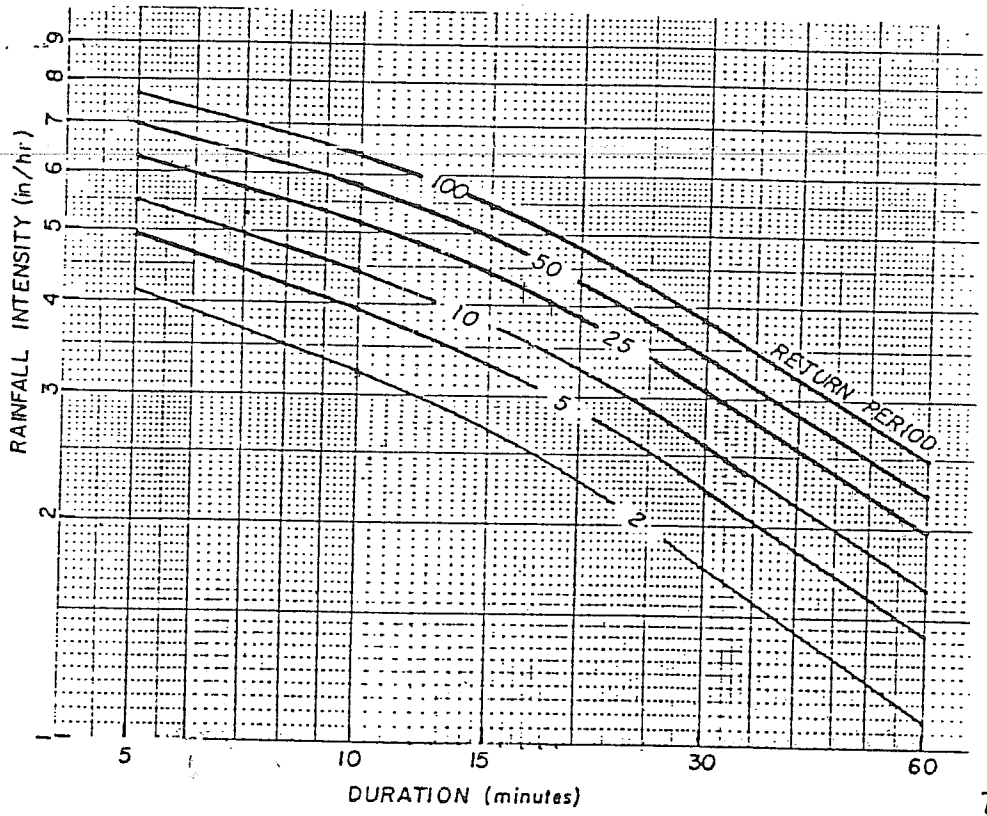
Primary OutFlow Max=2.3 cfs @ 12.79 hrs HW=203.89' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 2.3 cfs @ 1.49 fps)

Appendix

FIGURE #4

RAINFALL/INTENSITY/DURATION/FREQUENCY CURVE

GREATER BOSTON, MASS.



5	6.2
6	6.0
7	5.7
8	5.5
9	5.3
10	5.2
11	5.0
12	4.8
13	4.7
14	4.5
15	4.4
16	4.3
17	4.2
18	4.0
19	3.9
20	3.9
21	3.7
22	3.7
23	3.6
24	3.5
25	3.4

Land Engineering
& Environmental Services, LLC
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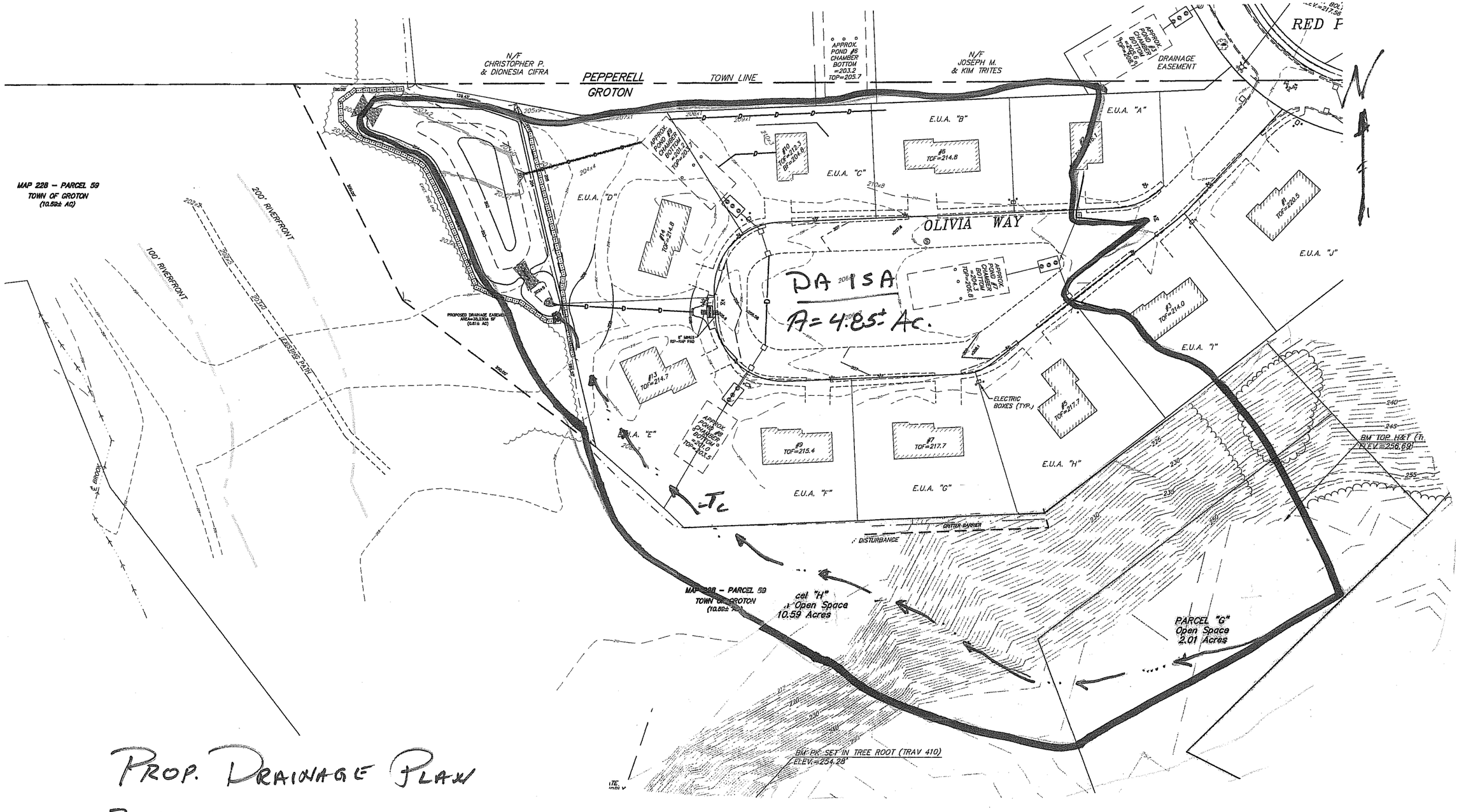
DRAINAGE SYSTEM COMPUTATIONAL WORKSHEET

PROJECT: Reedy Meadow
DATE: 3-15-19
COMPUTED BY: N
SHEET 1 OF 1

PIPE INLET		PIPE OUTLET		EARTH			PAVEMENT					FREQ		THROUGH REACH					
FROM	INV.	TO	INV	AREA ACRES	C	CA	AREA ACRES	C	CA	TOTAL CA	T(c) MINS	i	Q C.F.S.	PIPE SIZE N= 12	Q(full) C.F.S.	SLOPE FEET/FOOT	V(full) FT/SEC	L FT	V FT/SEC
Headwall		Forebay		4.0	.2	0.8	0.85	.9	.77	1.57	17.6	4.1	6.4	15"	10.6	0.02	8.9	115'	8.5



PROP. DRAINAGE PLAN

3-15-19 275-03

1"=80'