Griffin
Engineering
Group, LLC

November 9, 2015

Mr. Gregory St. Louis, P.E., City Engineer
Beverly City Hall
191 Cabot Street
Beverly, MA 01915

Subject: Drainage Calculations for Jewett Road Extension

Dear Mr. St. Louis:

This letter summarizes drainage calculations prepared in support of the proposed Jewett Road extension and development of the single-family residential lot at 25 Jewett Road in Beverly, MA. The enclosed calculations show that neither an increase in rate nor volume of stormwater runoff will occur from the project site.

Pre-Development Conditions

The project site consists of the existing Jewett Road privately-maintained right-of-way and an approximately half-acre, undeveloped parcel located at 25 Jewett Road. Jewett Road is a 40-foot wide right-of-way extending from Lake Shore Avenue past the undeveloped parcel. Jewett Road is constructed from Lake Shore Avenue up to the project site; the last 200 feet (from the intersection with Newman Road) are privately maintained.

The subject parcel is undeveloped and consists of forested upland with moderately sloping terrain and a few ledge outcrops. The parcel is the last privately held, undeveloped lot along Jewett Road. Several parcels in the project area are owned by the City of Beverly and are designated as Open Space. The subject parcel is bounded to the south by the Jewett Road right-of-way. The remainder of the perimeter is bounded by the aforementioned Open Space parcels and one privately held parcel to the north (Assessors Map 32, Lot 111; See Enclosed Sheet D-1).

Post-Development Conditions

The proposed project involves extending the constructed portion of Jewett Road by approximately 75 feet to accommodate a hammerhead turn area. Approximately 140-feet of the existing Jewett Road privately maintained way is proposed to be widened to a minimum pavement width of 16 feet with a 2-foot wide grass shoulder. Associated with the roadway extension and improvements, a modest-sized single-family residence will be constructed with an associated driveway, utility service connections, and landscaping. A separately provided Site Plan shows the proposed development.

A catchbasin drainage structure is proposed to capture stormwater runoff from the proposed roadway extension. The catchbasin will discharge stormwater to a

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shallow detention area located in the northwesterly corner of the 25 Jewett Road parcel. Stormwater runoff from the majority of the proposed impervious surfaces (roadway extension, driveway, and building roof) will be dampened by the shallow detention area. A drywell infiltration device is also proposed to infiltrate stormwater from a portion of the proposed residence.

Drainage Calculations

Hydrologic modeling was conducted using the HydroCAD computer model. This model uses an approximation of Soil Conservation Service TR-20 methods to calculate runoff rates and volumes based on descriptions of land use, ground characteristics, and size.

The time of concentration (Tc) for each subcatchment was calculated in HydroCAD using a combination of sheet flow and shallow concentrated flow. Sheet flow uses roughness coefficients (Manning's *n*) and watercourse slope to calculate travel time of stormwater runoff for the subcatchment. The site was modeled using a maximum of 100-feet of sheet flow. The shallow concentrated flow method is used to determine the velocity factor along the flow path of the runoff and thereby a travel time. The time of concentration of each subcatchment is the combination of these travel times. A minimum time of concentration of 6 minutes was used for all subcatchments, for both existing and proposed conditions.

The project site drains by overland flow in three directions but ultimately converges downhill of the project site in the existing drainage ditch along Bonad Road. A description of the three drainage areas (subcatchments) is as follows:

> *Subcatchment 1:* Stormwater runoff from the existing developed portion of the privately maintained right-of-way flows downhill towards existing catchbasins in Jewett Road. The existing catchbasins discharge to the drainage ditch along Bonad Road.
>
> *Subcatchment 2:* Stormwater runoff from the proposed roadway extension area flows in a southwesterly direction around the residence at 22 Jewett Road and then downhill towards the backyards of #2 & #4 Bonad Road. An existing drainage pipe conveys runoff from the backyards to the drainage ditch along Bonad Road.
>
> *Subcatchment 3:* Stormwater runoff from the 25 Jewett Road parcel generally drains in a northerly direction towards a wetland area located adjacent to the MBTA railroad tracks and behind the residence at 21 Jewett Road. An existing drainage pipe connects the wetland area to the existing drainage ditch along Bonad Road.

Runoff from Subcatchment 2 combines with runoff from a portion of the uphill Open

Space parcel as it flows towards the residence at 22 Jewett Road. No changes to the drainage pattern of the uphill Open Space parcel are anticipated. The proposed work will divert stormwater runoff from the proposed roadway extension away from the 22 Jewett Road residence and to the shallow detention area on the 25 Jewett Road property. In other words, stormwater runoff to 22 Jewett Road will decrease as a result of this project.

The Existing Subcatchment Plan (Sheet D-1), Proposed Subcatchment Plan (Sheet D-2), and Drainage Calculations comparing the pre- and post-development peak runoff rates from the project area for the 2-, 10-, 25-, and 100-year, 24-hour storm events are enclosed. The results are summarized below in Table 1. Peak stormwater discharges from the project area are dampened by the proposed shallow detention area. We note that further dampening will occur downhill of the proposed shallow detention area due to an existing wetland area along the MBTA railroad tracks. The dampening effects of this wetland area was omitted from the calculations of peak discharge rates to conservatively estimate peak flow rates from the project site.

Table 1 : Comparison of Pre- and Post-Development Peak Flows from the Project Site (cfs)

Condition	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	0.72	1.47	1.99	2.66
Post-Development	0.67	1.45	1.94	2.59

The volume of stormwater runoff from the project site is also reduced during the 2-, 10-, 25-, and 100-year, 24-hour storm events, as shown in Table 2. The volume is reduced due to exfiltration through the bottom of the shallow detention pond and drywell. An exfiltration rate of 1.02 inches/hour (Rawls Rate) was used for calculation purposes to simulate the sandy loam topsoil and subsoil observed in on-site test pits. Test pits field data forms are enclosed; the test pits locations are shown on the separately provided Site Plan.

Table 2: Comparison of Pre- and Post-Development Runoff Volume from the Project Site (cf)

Condition	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	2,851	5,613	7,567	10,076
Post-Development	2,664	5,487	7,480	10,020

Summary

Our calculations demonstrate that the peak rate and volume of stormwater runoff from the project site will be decreased by the proposed stormwater management features. Addition dampening of peak runoff rates and volumes from the off-site wetland area is noted but was conservatively ignored in the calculations.

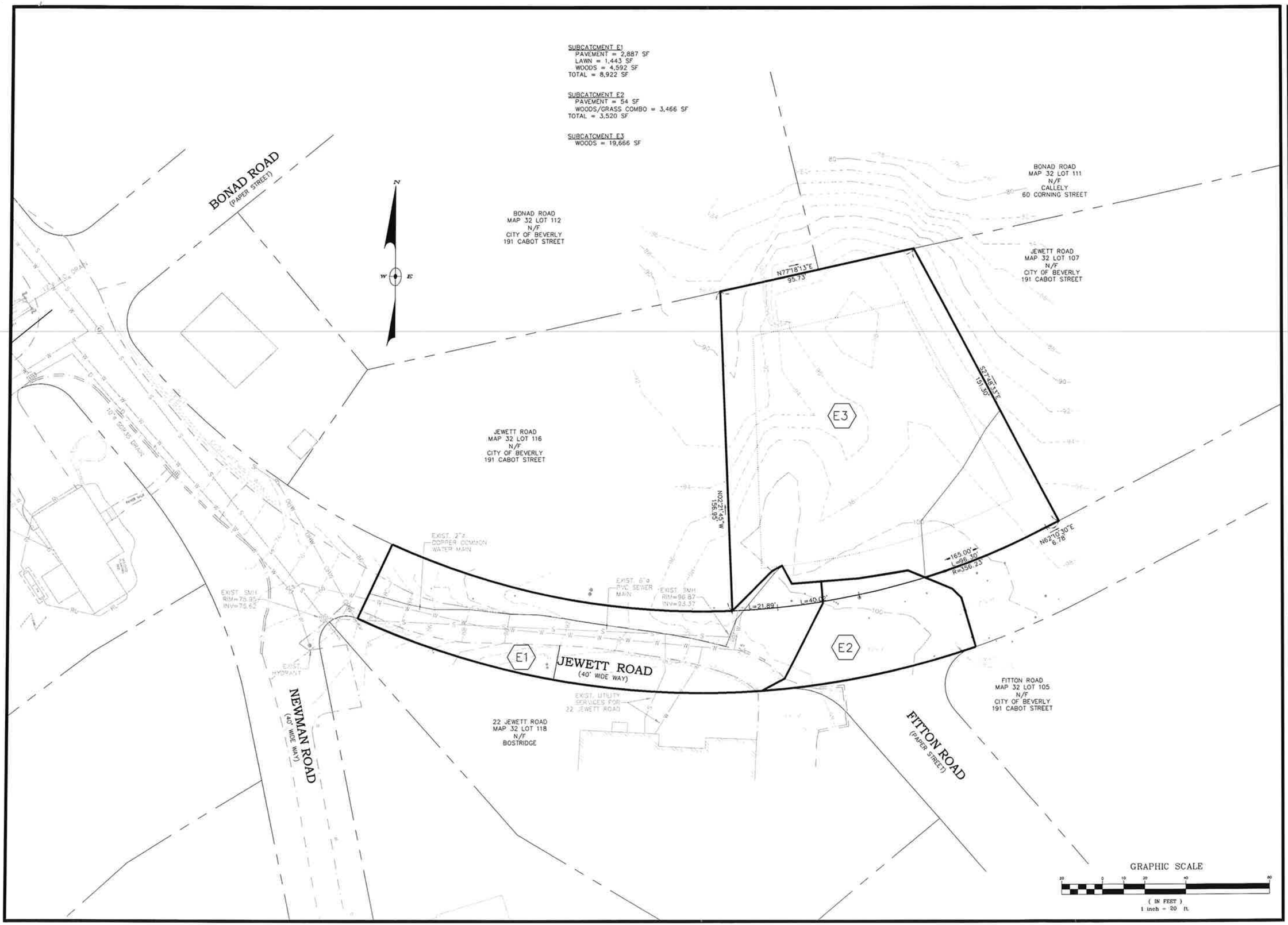
Should you have any questions or comments, or require additional information, please do not hesitate to contact the undersigned.

Very truly yours,
GRIFFIN ENGINEERING GROUP, LLC

Robert H. Griffin, P.E.

Enclosure: Subcatchment Plans (Sheets DR-1 & DR-2)
Drainage Calculations (2, 10, 25, 100-year storm events)
Soil Suitability Assessment Forms

Cc: A. Clausen, Planning Director
F. Byrne
T. Alexander, Esq.



No.	Date	Description

Revisions

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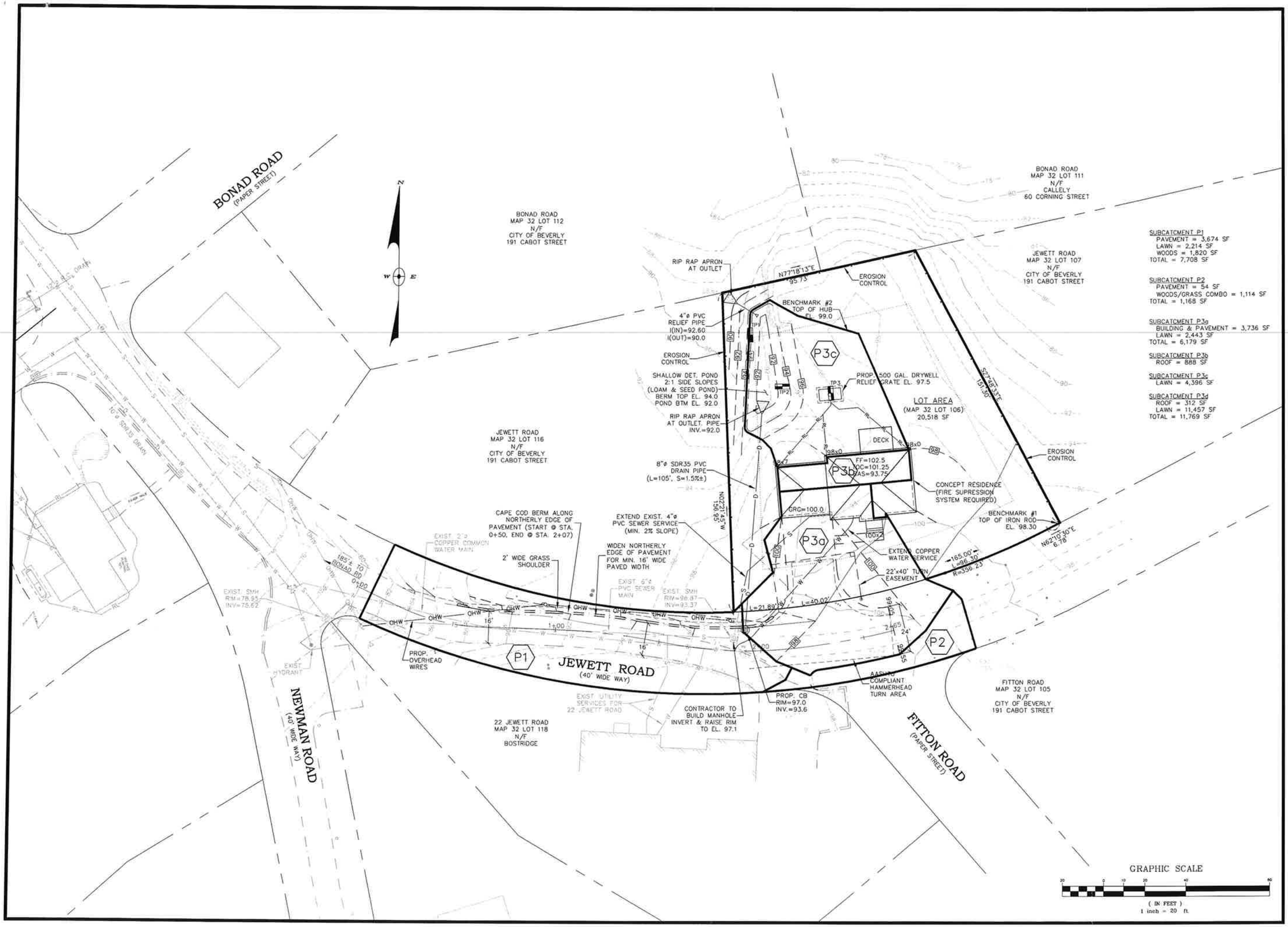
25 JEWETT ROAD
BEVERLY, MA

DEFINITIVE SUBDIVISION
JEWETT RD. EXTENSION
EXISTING
SUBCATCHMENT PLAN

Scale: 1"=20'
Job No.: TBD
File Name: p/p/b/by
Date: 11/9/15

D-1



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FRANCIS BYRNE
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25 JEWETT ROAD
BEVERLY, MA

DEFINITIVE SUBDIVISION
JEWETT RD. EXTENSION
PROPOSED
SUBCATCHMENT PLAN

Scale: 1"=20'
Job No.: TBD
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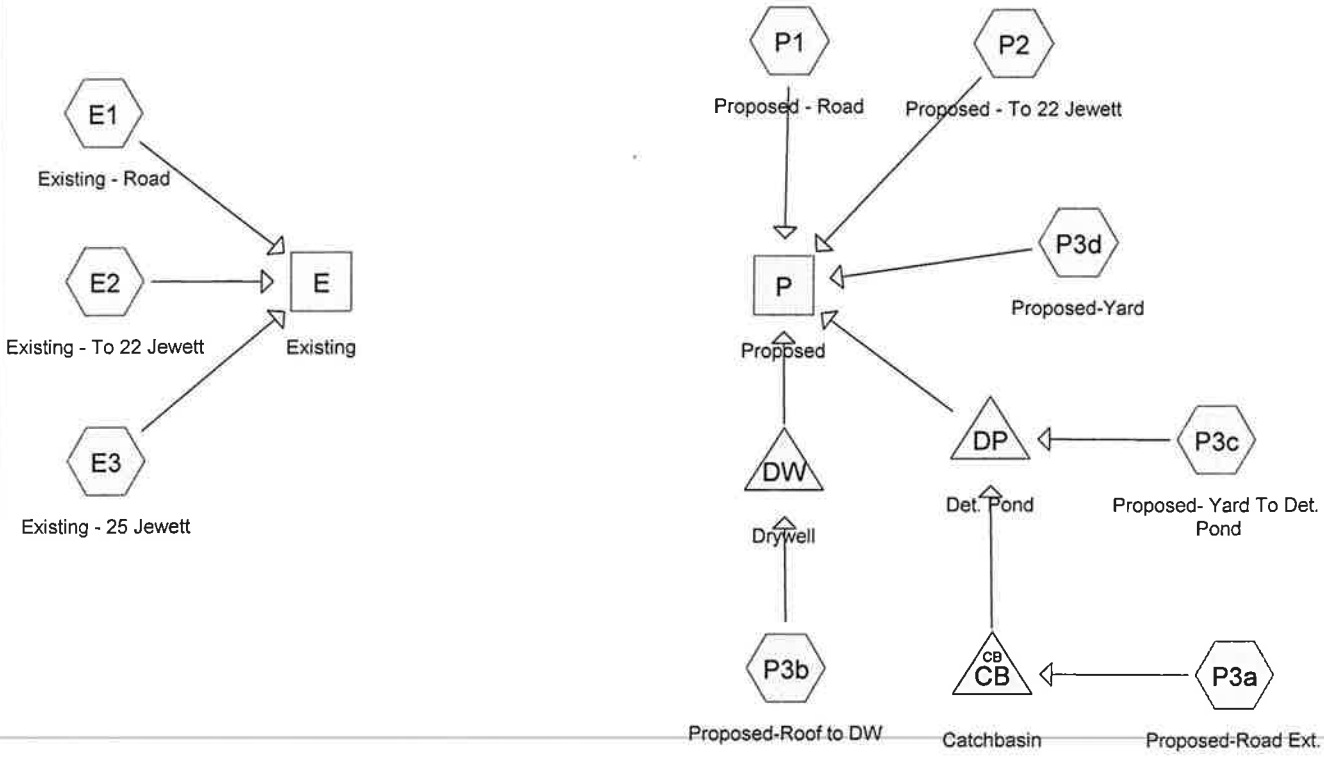
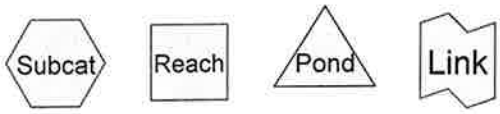
D-2





Routing Diagram for Byrne-Jewett
Prepared by Griffin Engineering Group, LLC, Printed 10/20/2015
HydroCAD® 10.00 s/n 01316 © 2013 HydroCAD Software Solutions LLC

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Existing - Road Runoff Area=8,922 sf 32.36% Impervious Runoff Depth>1.39"
Flow Length=223' Tc=7.9 min CN=81 Runoff=0.31 cfs 1,032 cf

Subcatchment E2: Existing - To 22 Jewett Runoff Area=3,520 sf 1.53% Impervious Runoff Depth>1.08"
Tc=6.0 min CN=76 Runoff=0.10 cfs 317 cf

Subcatchment E3: Existing - 25 Jewett Runoff Area=19,666 sf 0.00% Impervious Runoff Depth>0.92"
Flow Length=94' Slope=0.0690 '/' Tc=12.7 min CN=73 Runoff=0.36 cfs 1,502 cf

Subcatchment P1: Proposed - Road Runoff Area=7,708 sf 47.66% Impervious Runoff Depth>1.67"
Flow Length=190' Tc=6.0 min CN=85 Runoff=0.35 cfs 1,073 cf

Subcatchment P2: Proposed - To 22 Jewett Runoff Area=1,168 sf 4.62% Impervious Runoff Depth>1.03"
Tc=6.0 min CN=75 Runoff=0.03 cfs 100 cf

Subcatchment P3a: Proposed-Road Ext. Runoff Area=6,179 sf 60.46% Impervious Runoff Depth>1.99"
Flow Length=98' Tc=6.1 min CN=89 Runoff=0.33 cfs 1,024 cf

Subcatchment P3b: Proposed-Roof to DW Runoff Area=888 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.06 cfs 212 cf

Subcatchment P3c: Proposed- Yard To Det. Runoff Area=4,396 sf 0.00% Impervious Runoff Depth>0.97"
Tc=6.0 min CN=74 Runoff=0.11 cfs 356 cf

Subcatchment P3d: Proposed-Yard Runoff Area=11,769 sf 2.65% Impervious Runoff Depth>1.02"
Flow Length=81' Slope=0.0740 '/' Tc=7.3 min CN=75 Runoff=0.30 cfs 1,005 cf

Reach E: Existing Inflow=0.72 cfs 2,851 cf
Outflow=0.72 cfs 2,851 cf

Reach P: Proposed Inflow=0.67 cfs 2,664 cf
Outflow=0.67 cfs 2,664 cf

Pond CB: Catchbasin Peak Elev=93.93' Inflow=0.33 cfs 1,024 cf
8.0" Round Culvert n=0.013 L=105.0' S=0.0152 '/' Outflow=0.33 cfs 1,024 cf

Pond DP: Det. Pond Peak Elev=92.87' Storage=522 cf Inflow=0.44 cfs 1,379 cf
Discarded=0.01 cfs 615 cf Primary=0.11 cfs 486 cf Outflow=0.12 cfs 1,101 cf

Pond DW: Drywell Peak Elev=96.49' Storage=126 cf Inflow=0.06 cfs 212 cf
Discarded=0.00 cfs 105 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 105 cf

Summary for Subcatchment E1: Existing - Road

Runoff = 0.31 cfs @ 12.12 hrs, Volume= 1,032 cf, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	2,887	98	Paved Driveway
	1,443	74	>75% Grass cover, Good, HSG C
	4,592	73	Woods, Fair, HSG C
	8,922	81	Weighted Average
	6,035		67.64% Pervious Area
	2,887		32.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	48	0.0688	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	175	0.0914	6.14		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
7.9	223	Total			

Summary for Subcatchment E2: Existing - To 22 Jewett

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 317 cf, Depth> 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	3,466	76	Woods/grass comb., Fair, HSG C
	3,520	76	Weighted Average
	3,466		98.47% Pervious Area
	54		1.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment E3: Existing - 25 Jewett

Runoff = 0.36 cfs @ 12.19 hrs, Volume= 1,502 cf, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
19,666	73	Woods, Fair, HSG C
19,666		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	94	0.0690	0.12		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment P1: Proposed - Road

Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,073 cf, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	3,674	98	Paved Driveway
	2,214	74	>75% Grass cover, Good, HSG C
	1,820	73	Woods, Fair, HSG C
	7,708	85	Weighted Average
	4,034		52.34% Pervious Area
	3,674		47.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	12	0.1500	0.17		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
0.5	178	0.0899	6.09		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
4.3					**Direct Entry, Min. 6 minutes**
6.0	190	Total			

Summary for Subcatchment P2: Proposed - To 22 Jewett

Runoff = 0.03 cfs @ 12.10 hrs, Volume= 100 cf, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	1,114	74	>75% Grass cover, Good, HSG C
	1,168	75	Weighted Average
	1,114		95.38% Pervious Area
	54		4.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3a: Proposed-Road Ext.

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 1,024 cf, Depth> 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	3,736	98	Road Ext. & Front of Building
	2,443	74	>75% Grass cover, Good, HSG C
	6,179	89	Weighted Average
	2,443		39.54% Pervious Area
	3,736		60.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	41	0.0375	0.12		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"
0.6	57	0.0350	1.51		**Sheet Flow, Sheet Flow-Pavement** Smooth surfaces n= 0.011 P2= 3.10"
6.1	98	Total			

Summary for Subcatchment P3b: Proposed-Roof to DW

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 212 cf, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	888	98	Building
	888		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3c: Proposed- Yard To Det. Pond

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 356 cf, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
4,396	74	>75% Grass cover, Good, HSG C
4,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3d: Proposed-Yard

Runoff = 0.30 cfs @ 12.11 hrs, Volume= 1,005 cf, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	312	98	Building
	11,457	74	>75% Grass cover, Good, HSG C
	11,769	75	Weighted Average
	11,457		97.35% Pervious Area
	312		2.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	81	0.0740	0.19		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"

Summary for Reach E: Existing

Inflow Area = 32,108 sf, 9.16% Impervious, Inflow Depth > 1.07" for 2-yr event
Inflow = 0.72 cfs @ 12.14 hrs, Volume= 2,851 cf
Outflow = 0.72 cfs @ 12.14 hrs, Volume= 2,851 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Reach P: Proposed

Inflow Area = 32,108 sf, 26.98% Impervious, Inflow Depth > 1.00" for 2-yr event
Inflow = 0.67 cfs @ 12.10 hrs, Volume= 2,664 cf
Outflow = 0.67 cfs @ 12.10 hrs, Volume= 2,664 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB: Catchbasin

Inflow Area = 6,179 sf, 60.46% Impervious, Inflow Depth > 1.99" for 2-yr event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 1,024 cf
Outflow = 0.33 cfs @ 12.09 hrs, Volume= 1,024 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.33 cfs @ 12.09 hrs, Volume= 1,024 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 93.93' @ 12.09 hrs
Flood Elev= 97.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.60'	**8.0" Round Culvert** L= 105.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.60' / 92.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.33 cfs @ 12.09 hrs HW=93.92' TW=92.51' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.33 cfs @ 1.94 fps)

Summary for Pond DP: Det. Pond

Inflow Area =	10,575 sf,	35.33% Impervious,	Inflow Depth >	1.57"	for 2-yr event
Inflow =	0.44 cfs @	12.09 hrs, Volume=	1,379 cf		
Outflow =	0.12 cfs @	12.47 hrs, Volume=	1,101 cf,	Atten= 72%,	Lag= 22.7 min
Discarded =	0.01 cfs @	12.47 hrs, Volume=	615 cf		
Primary =	0.11 cfs @	12.47 hrs, Volume=	486 cf		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 92.87' @ 12.47 hrs Surf.Area= 586 sf Storage= 522 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 91.8 min (916.8 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,361 cf	**Custom Stage Data (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	327	0	0	327
94.00	921	1,198	1,198	945
94.25	10,000	1,163	2,361	10,024

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	**4.0" Round Culvert** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.60' / 90.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Primary	94.00'	**70.0' long x 4.5' 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) 2.36 2.52 2.70 2.68 2.67 2.67 2.65 2.66 2.66 2.67 2.70 2.70 2.72 2.75 2.81 2.93 3.10
#3	Discarded	92.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 12.47 hrs HW=92.87' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.11 cfs @ 12.47 hrs HW=92.87' TW=0.00' (Dynamic Tailwater)
├─**1=Culvert** (Inlet Controls 0.11 cfs @ 1.40 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond DW: Drywell

Inflow Area =	888 sf,	100.00% Impervious,	Inflow Depth >	2.87"	for 2-yr event
Inflow =	0.06 cfs @	12.08 hrs,	Volume=	212 cf	
Outflow =	0.00 cfs @	14.18 hrs,	Volume=	105 cf,	Atten= 97%, Lag= 125.8 min
Discarded =	0.00 cfs @	14.18 hrs,	Volume=	105 cf	
Primary =	0.00 cfs @	1.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 96.49' @ 16.11 hrs Surf.Area= 70 sf Storage= 126 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 127.0 min (883.5 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	52 cf	**6.67'W x 10.00'L x 3.50'H Prismatoid** 233 cf Overall - 102 cf Embedded = 131 cf x 40.0% Voids
#2	94.00'	87 cf	**4.67'W x 8.00'L x 2.33'H Prismatoid** Inside #1 102 cf Overall - 3.0" Wall Thickness = 87 cf
#3	96.33'	4 cf	**2.00'D x 1.17'H Vertical Cone/Cylinder**
#4	97.50'	1,250 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,393 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2	0	0
97.75	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	93.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**20.0" Horiz. Orifice/Grate** C= 0.600 in 20.0" Grate Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 14.18 hrs HW=96.33' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=93.50' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Existing - Road Runoff Area=8,922 sf 32.36% Impervious Runoff Depth>2.54"
Flow Length=223' Tc=7.9 min CN=81 Runoff=0.57 cfs 1,892 cf

Subcatchment E2: Existing - To 22 Jewett Runoff Area=3,520 sf 1.53% Impervious Runoff Depth>2.13"
Tc=6.0 min CN=76 Runoff=0.20 cfs 624 cf

Subcatchment E3: Existing - 25 Jewett Runoff Area=19,666 sf 0.00% Impervious Runoff Depth>1.89"
Flow Length=94' Slope=0.0690 '/' Tc=12.7 min CN=73 Runoff=0.79 cfs 3,098 cf

Subcatchment P1: Proposed - Road Runoff Area=7,708 sf 47.66% Impervious Runoff Depth>2.91"
Flow Length=190' Tc=6.0 min CN=85 Runoff=0.60 cfs 1,867 cf

Subcatchment P2: Proposed - To 22 Jewett Runoff Area=1,168 sf 4.62% Impervious Runoff Depth>2.05"
Tc=6.0 min CN=75 Runoff=0.06 cfs 199 cf

Subcatchment P3a: Proposed-Road Ext. Runoff Area=6,179 sf 60.46% Impervious Runoff Depth>3.29"
Flow Length=98' Tc=6.1 min CN=89 Runoff=0.53 cfs 1,695 cf

Subcatchment P3b: Proposed-Roof to DW Runoff Area=888 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.09 cfs 315 cf

Subcatchment P3c: Proposed- Yard To Det. Runoff Area=4,396 sf 0.00% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=74 Runoff=0.23 cfs 722 cf

Subcatchment P3d: Proposed-Yard Runoff Area=11,769 sf 2.65% Impervious Runoff Depth>2.05"
Flow Length=81' Slope=0.0740 '/' Tc=7.3 min CN=75 Runoff=0.62 cfs 2,008 cf

Reach E: Existing Inflow=1.47 cfs 5,613 cf
Outflow=1.47 cfs 5,613 cf

Reach P: Proposed Inflow=1.45 cfs 5,487 cf
Outflow=1.45 cfs 5,487 cf

Pond CB: Catchbasin Peak Elev=94.05' Inflow=0.53 cfs 1,695 cf
8.0" Round Culvert n=0.013 L=105.0' S=0.0152 '/' Outflow=0.53 cfs 1,695 cf

Pond DP: Det. Pond Peak Elev=93.37' Storage=823 cf Inflow=0.76 cfs 2,417 cf
Discarded=0.02 cfs 691 cf Primary=0.26 cfs 1,378 cf Outflow=0.28 cfs 2,069 cf

Pond DW: Drywell Peak Elev=97.51' Storage=145 cf Inflow=0.09 cfs 315 cf
Discarded=0.01 cfs 149 cf Primary=0.02 cfs 34 cf Outflow=0.03 cfs 184 cf

Summary for Subcatchment E1: Existing - Road

Runoff = 0.57 cfs @ 12.11 hrs, Volume= 1,892 cf, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	2,887	98	Paved Driveway
	1,443	74	>75% Grass cover, Good, HSG C
	4,592	73	Woods, Fair, HSG C
	8,922	81	Weighted Average
	6,035		67.64% Pervious Area
	2,887		32.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	48	0.0688	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	175	0.0914	6.14		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
7.9	223	Total			

Summary for Subcatchment E2: Existing - To 22 Jewett

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 624 cf, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	3,466	76	Woods/grass comb., Fair, HSG C
	3,520	76	Weighted Average
	3,466		98.47% Pervious Area
	54		1.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment E3: Existing - 25 Jewett

Runoff = 0.79 cfs @ 12.18 hrs, Volume= 3,098 cf, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
19,666	73	Woods, Fair, HSG C
19,666		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	94	0.0690	0.12		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment P1: Proposed - Road

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 1,867 cf, Depth> 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	3,674	98	Paved Driveway
	2,214	74	>75% Grass cover, Good, HSG C
	1,820	73	Woods, Fair, HSG C
	7,708	85	Weighted Average
	4,034		52.34% Pervious Area
	3,674		47.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	12	0.1500	0.17		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
0.5	178	0.0899	6.09		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
4.3					**Direct Entry, Min. 6 minutes**
6.0	190	Total			

Summary for Subcatchment P2: Proposed - To 22 Jewett

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 199 cf, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	1,114	74	>75% Grass cover, Good, HSG C
	1,168	75	Weighted Average
	1,114		95.38% Pervious Area
	54		4.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3a: Proposed-Road Ext.

Runoff = 0.53 cfs @ 12.09 hrs, Volume= 1,695 cf, Depth> 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	3,736	98	Road Ext. & Front of Building
	2,443	74	>75% Grass cover, Good, HSG C
	6,179	89	Weighted Average
	2,443		39.54% Pervious Area
	3,736		60.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	41	0.0375	0.12		**Sheet Flow, Sheet Flow-Grass**
					Grass: Dense n= 0.240 P2= 3.10"
0.6	57	0.0350	1.51		**Sheet Flow, Sheet Flow-Pavement**
					Smooth surfaces n= 0.011 P2= 3.10"
6.1	98	Total			

Summary for Subcatchment P3b: Proposed-Roof to DW

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 315 cf, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	888	98	Building
	888		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3c: Proposed- Yard To Det. Pond

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 722 cf, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
4,396	74	>75% Grass cover, Good, HSG C
4,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3d: Proposed-Yard

Runoff = 0.62 cfs @ 12.11 hrs, Volume= 2,008 cf, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	312	98	Building
	11,457	74	>75% Grass cover, Good, HSG C
	11,769	75	Weighted Average
	11,457		97.35% Pervious Area
	312		2.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	81	0.0740	0.19		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"

Summary for Reach E: Existing

Inflow Area = 32,108 sf, 9.16% Impervious, Inflow Depth > 2.10" for 10-yr event
Inflow = 1.47 cfs @ 12.14 hrs, Volume= 5,613 cf
Outflow = 1.47 cfs @ 12.14 hrs, Volume= 5,613 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Reach P: Proposed

Inflow Area = 32,108 sf, 26.98% Impervious, Inflow Depth > 2.05" for 10-yr event
Inflow = 1.45 cfs @ 12.10 hrs, Volume= 5,487 cf
Outflow = 1.45 cfs @ 12.10 hrs, Volume= 5,487 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB: Catchbasin

Inflow Area = 6,179 sf, 60.46% Impervious, Inflow Depth > 3.29" for 10-yr event
Inflow = 0.53 cfs @ 12.09 hrs, Volume= 1,695 cf
Outflow = 0.53 cfs @ 12.09 hrs, Volume= 1,695 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.53 cfs @ 12.09 hrs, Volume= 1,695 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 94.05' @ 12.10 hrs
Flood Elev= 97.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.60'	**8.0" Round Culvert** L= 105.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.60' / 92.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.53 cfs @ 12.09 hrs HW=94.05' TW=93.03' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.53 cfs @ 3.03 fps)

Summary for Pond DP: Det. Pond

Inflow Area =	10,575 sf,	35.33% Impervious,	Inflow Depth >	2.74"	for 10-yr event
Inflow =	0.76 cfs @	12.09 hrs,	Volume=	2,417 cf	
Outflow =	0.28 cfs @	12.37 hrs,	Volume=	2,069 cf,	Atten= 64%, Lag= 16.7 min
Discarded =	0.02 cfs @	12.37 hrs,	Volume=	691 cf	
Primary =	0.26 cfs @	12.37 hrs,	Volume=	1,378 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 93.37' @ 12.37 hrs Surf.Area= 735 sf Storage= 823 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 49.9 min (860.8 - 810.8)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,361 cf	**Custom Stage Data (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	327	0	0	327
94.00	921	1,198	1,198	945
94.25	10,000	1,163	2,361	10,024

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	**4.0" Round Culvert** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.60' / 90.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Primary	94.00'	**70.0' long x 4.5' 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) 2.36 2.52 2.70 2.68 2.67 2.67 2.65 2.66 2.66 2.67 2.70 2.70 2.72 2.75 2.81 2.93 3.10
#3	Discarded	92.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.37 hrs HW=93.37' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.26 cfs @ 12.37 hrs HW=93.37' TW=0.00' (Dynamic Tailwater)
├─**1=Culvert** (Inlet Controls 0.26 cfs @ 2.96 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond DW: Drywell

Inflow Area =	888 sf,	100.00% Impervious,	Inflow Depth >	4.26"	for 10-yr event
Inflow =	0.09 cfs @	12.08 hrs,	Volume=	315 cf	
Outflow =	0.03 cfs @	12.36 hrs,	Volume=	184 cf,	Atten= 66%, Lag= 16.4 min
Discarded =	0.01 cfs @	12.36 hrs,	Volume=	149 cf	
Primary =	0.02 cfs @	12.36 hrs,	Volume=	34 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 97.51' @ 12.36 hrs Surf.Area= 495 sf Storage= 145 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 78.5 min (827.7 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	52 cf	**6.67'W x 10.00'L x 3.50'H Prismatoid** 233 cf Overall - 102 cf Embedded = 131 cf x 40.0% Voids
#2	94.00'	87 cf	**4.67'W x 8.00'L x 2.33'H Prismatoid** Inside #1 102 cf Overall - 3.0" Wall Thickness = 87 cf
#3	96.33'	4 cf	**2.00'D x 1.17'H Vertical Cone/Cylinder**
#4	97.50'	1,250 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,393 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2	0	0
97.75	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	93.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**20.0" Horiz. Orifice/Grate** C= 0.600 in 20.0" Grate Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 12.36 hrs HW=97.51' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.02 cfs @ 12.36 hrs HW=97.51' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.34 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Existing - Road Runoff Area=8,922 sf 32.36% Impervious Runoff Depth>3.34"
Flow Length=223' Tc=7.9 min CN=81 Runoff=0.75 cfs 2,481 cf

Subcatchment E2: Existing - To 22 Jewett Runoff Area=3,520 sf 1.53% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=76 Runoff=0.27 cfs 840 cf

Subcatchment E3: Existing - 25 Jewett Runoff Area=19,666 sf 0.00% Impervious Runoff Depth>2.59"
Flow Length=94' Slope=0.0690 '/' Tc=12.7 min CN=73 Runoff=1.10 cfs 4,246 cf

Subcatchment P1: Proposed - Road Runoff Area=7,708 sf 47.66% Impervious Runoff Depth>3.74"
Flow Length=190' Tc=6.0 min CN=85 Runoff=0.77 cfs 2,400 cf

Subcatchment P2: Proposed - To 22 Jewett Runoff Area=1,168 sf 4.62% Impervious Runoff Depth>2.77"
Tc=6.0 min CN=75 Runoff=0.09 cfs 270 cf

Subcatchment P3a: Proposed-Road Ext. Runoff Area=6,179 sf 60.46% Impervious Runoff Depth>4.15"
Flow Length=98' Tc=6.1 min CN=89 Runoff=0.67 cfs 2,138 cf

Subcatchment P3b: Proposed-Roof to DW Runoff Area=888 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.11 cfs 382 cf

Subcatchment P3c: Proposed- Yard To Det. Runoff Area=4,396 sf 0.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=74 Runoff=0.32 cfs 983 cf

Subcatchment P3d: Proposed-Yard Runoff Area=11,769 sf 2.65% Impervious Runoff Depth>2.77"
Flow Length=81' Slope=0.0740 '/' Tc=7.3 min CN=75 Runoff=0.84 cfs 2,720 cf

Reach E: Existing Inflow=1.99 cfs 7,567 cf
Outflow=1.99 cfs 7,567 cf

Reach P: Proposed Inflow=1.94 cfs 7,480 cf
Outflow=1.94 cfs 7,480 cf

Pond CB: Catchbasin Peak Elev=94.16' Inflow=0.67 cfs 2,138 cf
8.0" Round Culvert n=0.013 L=105.0' S=0.0152 '/' Outflow=0.67 cfs 2,138 cf

Pond DP: Det. Pond Peak Elev=93.75' Storage=1,050 cf Inflow=0.98 cfs 3,121 cf
Discarded=0.02 cfs 735 cf Primary=0.33 cfs 2,019 cf Outflow=0.35 cfs 2,754 cf

Pond DW: Drywell Peak Elev=97.52' Storage=150 cf Inflow=0.11 cfs 382 cf
Discarded=0.02 cfs 174 cf Primary=0.04 cfs 72 cf Outflow=0.06 cfs 246 cf

Summary for Subcatchment E1: Existing - Road

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,481 cf, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	2,887	98	Paved Driveway
	1,443	74	>75% Grass cover, Good, HSG C
	4,592	73	Woods, Fair, HSG C
	8,922	81	Weighted Average
	6,035		67.64% Pervious Area
	2,887		32.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	48	0.0688	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	175	0.0914	6.14		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
7.9	223	Total			

Summary for Subcatchment E2: Existing - To 22 Jewett

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 840 cf, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	3,466	76	Woods/grass comb., Fair, HSG C
	3,520	76	Weighted Average
	3,466		98.47% Pervious Area
	54		1.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment E3: Existing - 25 Jewett

Runoff = 1.10 cfs @ 12.18 hrs, Volume= 4,246 cf, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
19,666	73	Woods, Fair, HSG C
19,666		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	94	0.0690	0.12		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment P1: Proposed - Road

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,400 cf, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	3,674	98	Paved Driveway
	2,214	74	>75% Grass cover, Good, HSG C
	1,820	73	Woods, Fair, HSG C
	7,708	85	Weighted Average
	4,034		52.34% Pervious Area
	3,674		47.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	12	0.1500	0.17		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
0.5	178	0.0899	6.09		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
4.3					**Direct Entry, Min. 6 minutes**
6.0	190	Total			

Summary for Subcatchment P2: Proposed - To 22 Jewett

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 270 cf, Depth> 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	1,114	74	>75% Grass cover, Good, HSG C
	1,168	75	Weighted Average
	1,114		95.38% Pervious Area
	54		4.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3a: Proposed-Road Ext.

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,138 cf, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	3,736	98	Road Ext. & Front of Building
	2,443	74	>75% Grass cover, Good, HSG C
	6,179	89	Weighted Average
	2,443		39.54% Pervious Area
	3,736		60.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	41	0.0375	0.12		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"
0.6	57	0.0350	1.51		**Sheet Flow, Sheet Flow-Pavement** Smooth surfaces n= 0.011 P2= 3.10"
6.1	98	Total			

Summary for Subcatchment P3b: Proposed-Roof to DW

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 382 cf, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	888	98	Building
	888		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3c: Proposed- Yard To Det. Pond

Runoff = 0.32 cfs @ 12.09 hrs, Volume= 983 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
4,396	74	>75% Grass cover, Good, HSG C
4,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3d: Proposed-Yard

Runoff = 0.84 cfs @ 12.11 hrs, Volume= 2,720 cf, Depth> 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	312	98	Building
	11,457	74	>75% Grass cover, Good, HSG C
	11,769	75	Weighted Average
	11,457		97.35% Pervious Area
	312		2.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	81	0.0740	0.19		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"

Summary for Reach E: Existing

Inflow Area = 32,108 sf, 9.16% Impervious, Inflow Depth > 2.83" for 25-yr event
Inflow = 1.99 cfs @ 12.14 hrs, Volume= 7,567 cf
Outflow = 1.99 cfs @ 12.14 hrs, Volume= 7,567 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Reach P: Proposed

Inflow Area = 32,108 sf, 26.98% Impervious, Inflow Depth > 2.80" for 25-yr event
Inflow = 1.94 cfs @ 12.10 hrs, Volume= 7,480 cf
Outflow = 1.94 cfs @ 12.10 hrs, Volume= 7,480 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB: Catchbasin

Inflow Area = 6,179 sf, 60.46% Impervious, Inflow Depth > 4.15" for 25-yr event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 2,138 cf
Outflow = 0.67 cfs @ 12.09 hrs, Volume= 2,138 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.67 cfs @ 12.09 hrs, Volume= 2,138 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 94.16' @ 12.11 hrs
Flood Elev= 97.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.60'	**8.0" Round Culvert** L= 105.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.60' / 92.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.66 cfs @ 12.09 hrs HW=94.15' TW=93.32' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.66 cfs @ 2.92 fps)

Summary for Pond DP: Det. Pond

Inflow Area =	10,575 sf,	35.33% Impervious,	Inflow Depth >	3.54"	for 25-yr event
Inflow =	0.98 cfs @	12.09 hrs,	Volume=	3,121 cf	
Outflow =	0.35 cfs @	12.37 hrs,	Volume=	2,754 cf,	Atten= 64%, Lag= 16.7 min
Discarded =	0.02 cfs @	12.37 hrs,	Volume=	735 cf	
Primary =	0.33 cfs @	12.37 hrs,	Volume=	2,019 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 93.75' @ 12.37 hrs Surf.Area= 848 sf Storage= 1,050 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 44.4 min (848.8 - 804.4)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,361 cf	**Custom Stage Data (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	327	0	0	327
94.00	921	1,198	1,198	945
94.25	10,000	1,163	2,361	10,024

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	**4.0" Round Culvert** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.60' / 90.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Primary	94.00'	**70.0' long x 4.5' 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) 2.36 2.52 2.70 2.68 2.67 2.67 2.65 2.66 2.66 2.67 2.70 2.70 2.72 2.75 2.81 2.93 3.10
#3	Discarded	92.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.37 hrs HW=93.75' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.33 cfs @ 12.37 hrs HW=93.75' TW=0.00' (Dynamic Tailwater)
├─**1=Culvert** (Inlet Controls 0.33 cfs @ 3.78 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond DW: Drywell

Inflow Area =	888 sf, 100.00% Impervious, Inflow Depth > 5.16" for 25-yr event				
Inflow =	0.11 cfs @	12.08 hrs,	Volume=	382 cf	
Outflow =	0.06 cfs @	12.19 hrs,	Volume=	246 cf,	Atten= 40%, Lag= 6.3 min
Discarded =	0.02 cfs @	12.19 hrs,	Volume=	174 cf	
Primary =	0.04 cfs @	12.19 hrs,	Volume=	72 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 97.52' @ 12.19 hrs Surf.Area= 830 sf Storage= 150 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 57.8 min (804.1 - 746.3)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	52 cf	**6.67'W x 10.00'L x 3.50'H Prismatoid** 233 cf Overall - 102 cf Embedded = 131 cf x 40.0% Voids
#2	94.00'	87 cf	**4.67'W x 8.00'L x 2.33'H Prismatoid** Inside #1 102 cf Overall - 3.0" Wall Thickness = 87 cf
#3	96.33'	4 cf	**2.00'D x 1.17'H Vertical Cone/Cylinder**
#4	97.50'	1,250 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,393 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2	0	0
97.75	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	93.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**20.0" Horiz. Orifice/Grate** C= 0.600 in 20.0" Grate Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.19 hrs HW=97.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 12.19 hrs HW=97.52' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Weir Controls 0.04 cfs @ 0.45 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Existing - Road Runoff Area=8,922 sf 32.36% Impervious Runoff Depth>4.34"
Flow Length=223' Tc=7.9 min CN=81 Runoff=0.97 cfs 3,224 cf

Subcatchment E2: Existing - To 22 Jewett Runoff Area=3,520 sf 1.53% Impervious Runoff Depth>3.81"
Tc=6.0 min CN=76 Runoff=0.36 cfs 1,118 cf

Subcatchment E3: Existing - 25 Jewett Runoff Area=19,666 sf 0.00% Impervious Runoff Depth>3.50"
Flow Length=94' Slope=0.0690 '/' Tc=12.7 min CN=73 Runoff=1.50 cfs 5,734 cf

Subcatchment P1: Proposed - Road Runoff Area=7,708 sf 47.66% Impervious Runoff Depth>4.77"
Flow Length=190' Tc=6.0 min CN=85 Runoff=0.97 cfs 3,065 cf

Subcatchment P2: Proposed - To 22 Jewett Runoff Area=1,168 sf 4.62% Impervious Runoff Depth>3.71"
Tc=6.0 min CN=75 Runoff=0.12 cfs 361 cf

Subcatchment P3a: Proposed-Road Ext. Runoff Area=6,179 sf 60.46% Impervious Runoff Depth>5.22"
Flow Length=98' Tc=6.1 min CN=89 Runoff=0.83 cfs 2,686 cf

Subcatchment P3b: Proposed-Roof to DW Runoff Area=888 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.13 cfs 463 cf

Subcatchment P3c: Proposed- Yard To Det. Runoff Area=4,396 sf 0.00% Impervious Runoff Depth>3.61"
Tc=6.0 min CN=74 Runoff=0.43 cfs 1,321 cf

Subcatchment P3d: Proposed-Yard Runoff Area=11,769 sf 2.65% Impervious Runoff Depth>3.71"
Flow Length=81' Slope=0.0740 '/' Tc=7.3 min CN=75 Runoff=1.12 cfs 3,636 cf

Reach E: Existing Inflow=2.66 cfs 10,076 cf
Outflow=2.66 cfs 10,076 cf

Reach P: Proposed Inflow=2.59 cfs 10,020 cf
Outflow=2.59 cfs 10,020 cf

Pond CB: Catchbasin Peak Elev=94.36' Inflow=0.83 cfs 2,686 cf
8.0" Round Culvert n=0.013 L=105.0' S=0.0152 '/' Outflow=0.83 cfs 2,686 cf

Pond DP: Det. Pond Peak Elev=94.01' Storage=1,252 cf Inflow=1.25 cfs 4,007 cf
Discarded=0.03 cfs 792 cf Primary=0.58 cfs 2,836 cf Outflow=0.61 cfs 3,628 cf

Pond DW: Drywell Peak Elev=97.53' Storage=159 cf Inflow=0.13 cfs 463 cf
Discarded=0.03 cfs 200 cf Primary=0.08 cfs 123 cf Outflow=0.11 cfs 323 cf

Summary for Subcatchment E1: Existing - Road

Runoff = 0.97 cfs @ 12.11 hrs, Volume= 3,224 cf, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	2,887	98	Paved Driveway
	1,443	74	>75% Grass cover, Good, HSG C
	4,592	73	Woods, Fair, HSG C
	8,922	81	Weighted Average
	6,035		67.64% Pervious Area
	2,887		32.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	48	0.0688	0.11		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	175	0.0914	6.14		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
7.9	223	Total			

Summary for Subcatchment E2: Existing - To 22 Jewett

Runoff = 0.36 cfs @ 12.09 hrs, Volume= 1,118 cf, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	3,466	76	Woods/grass comb., Fair, HSG C
	3,520	76	Weighted Average
	3,466		98.47% Pervious Area
	54		1.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment E3: Existing - 25 Jewett

Runoff = 1.50 cfs @ 12.18 hrs, Volume= 5,734 cf, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
19,666	73	Woods, Fair, HSG C
19,666		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	94	0.0690	0.12		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment P1: Proposed - Road

Runoff = 0.97 cfs @ 12.09 hrs, Volume= 3,065 cf, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	3,674	98	Paved Driveway
	2,214	74	>75% Grass cover, Good, HSG C
	1,820	73	Woods, Fair, HSG C
	7,708	85	Weighted Average
	4,034		52.34% Pervious Area
	3,674		47.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	12	0.1500	0.17		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.10"
0.5	178	0.0899	6.09		**Shallow Concentrated Flow, Gutterline** Paved Kv= 20.3 fps
4.3					**Direct Entry, Min. 6 minutes**
6.0	190	Total			

Summary for Subcatchment P2: Proposed - To 22 Jewett

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 361 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	54	98	Paved Driveway
	1,114	74	>75% Grass cover, Good, HSG C
	1,168	75	Weighted Average
	1,114		95.38% Pervious Area
	54		4.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3a: Proposed-Road Ext.

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 2,686 cf, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	3,736	98	Road Ext. & Front of Building
	2,443	74	>75% Grass cover, Good, HSG C
	6,179	89	Weighted Average
	2,443		39.54% Pervious Area
	3,736		60.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	41	0.0375	0.12		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"
0.6	57	0.0350	1.51		**Sheet Flow, Sheet Flow-Pavement** Smooth surfaces n= 0.011 P2= 3.10"
6.1	98	Total			

Summary for Subcatchment P3b: Proposed-Roof to DW

Runoff = 0.13 cfs @ 12.08 hrs, Volume= 463 cf, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	888	98	Building
	888		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3c: Proposed- Yard To Det. Pond

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,321 cf, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
4,396	74	>75% Grass cover, Good, HSG C
4,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. 6 Minutes**

Summary for Subcatchment P3d: Proposed-Yard

Runoff = 1.12 cfs @ 12.11 hrs, Volume= 3,636 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	312	98	Building
	11,457	74	>75% Grass cover, Good, HSG C
	11,769	75	Weighted Average
	11,457		97.35% Pervious Area
	312		2.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	81	0.0740	0.19		**Sheet Flow, Sheet Flow-Grass** Grass: Dense n= 0.240 P2= 3.10"

Summary for Reach E: Existing

Inflow Area = 32,108 sf, 9.16% Impervious, Inflow Depth > 3.77" for 100-yr event
Inflow = 2.66 cfs @ 12.14 hrs, Volume= 10,076 cf
Outflow = 2.66 cfs @ 12.14 hrs, Volume= 10,076 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Reach P: Proposed

Inflow Area = 32,108 sf, 26.98% Impervious, Inflow Depth > 3.74" for 100-yr event
Inflow = 2.59 cfs @ 12.10 hrs, Volume= 10,020 cf
Outflow = 2.59 cfs @ 12.10 hrs, Volume= 10,020 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB: Catchbasin

Inflow Area = 6,179 sf, 60.46% Impervious, Inflow Depth > 5.22" for 100-yr event
Inflow = 0.83 cfs @ 12.09 hrs, Volume= 2,686 cf
Outflow = 0.83 cfs @ 12.09 hrs, Volume= 2,686 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.83 cfs @ 12.09 hrs, Volume= 2,686 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 94.36' @ 12.12 hrs
Flood Elev= 97.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.60'	**8.0" Round Culvert** L= 105.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.60' / 92.00' S= 0.0152 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.83 cfs @ 12.09 hrs HW=94.32' TW=93.65' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.83 cfs @ 2.72 fps)

Summary for Pond DP: Det. Pond

Inflow Area =	10,575 sf,	35.33% Impervious,	Inflow Depth >	4.55"	for 100-yr event
Inflow =	1.25 cfs @	12.09 hrs,	Volume=	4,007 cf	
Outflow =	0.61 cfs @	12.24 hrs,	Volume=	3,628 cf,	Atten= 51%, Lag= 9.5 min
Discarded =	0.03 cfs @	12.24 hrs,	Volume=	792 cf	
Primary =	0.58 cfs @	12.24 hrs,	Volume=	2,836 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 94.01' @ 12.24 hrs Surf.Area= 1,347 sf Storage= 1,252 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 41.5 min (839.6 - 798.0)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,361 cf	**Custom Stage Data (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.00	327	0	0	327
94.00	921	1,198	1,198	945
94.25	10,000	1,163	2,361	10,024

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	**4.0" Round Culvert** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 92.60' / 90.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Primary	94.00'	**70.0' long x 4.5' 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) 2.36 2.52 2.70 2.68 2.67 2.67 2.65 2.66 2.66 2.67 2.70 2.70 2.72 2.75 2.81 2.93 3.10
#3	Discarded	92.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 12.24 hrs HW=94.01' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.58 cfs @ 12.24 hrs HW=94.01' TW=0.00' (Dynamic Tailwater)
├─**1=Culvert** (Inlet Controls 0.37 cfs @ 4.24 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.21 cfs @ 0.26 fps)

Summary for Pond DW: Drywell

Inflow Area =	888 sf,100.00% Impervious, Inflow Depth > 6.26" for 100-yr event				
Inflow =	0.13 cfs @	12.08 hrs,	Volume=	463 cf	
Outflow =	0.11 cfs @	12.14 hrs,	Volume=	323 cf,	Atten= 17%, Lag= 3.2 min
Discarded =	0.03 cfs @	12.14 hrs,	Volume=	200 cf	
Primary =	0.08 cfs @	12.14 hrs,	Volume=	123 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 97.53' @ 12.14 hrs Surf.Area= 1,186 sf Storage= 159 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 46.7 min (790.3 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	52 cf	**6.67'W x 10.00'L x 3.50'H Prismatoid** 233 cf Overall - 102 cf Embedded = 131 cf x 40.0% Voids
#2	94.00'	87 cf	**4.67'W x 8.00'L x 2.33'H Prismatoid** Inside #1 102 cf Overall - 3.0" Wall Thickness = 87 cf
#3	96.33'	4 cf	**2.00'D x 1.17'H Vertical Cone/Cylinder**
#4	97.50'	1,250 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,393 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2	0	0
97.75	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	93.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**20.0" Horiz. Orifice/Grate** C= 0.600 in 20.0" Grate Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.14 hrs HW=97.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.08 cfs @ 12.14 hrs HW=97.53' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Weir Controls 0.08 cfs @ 0.55 fps)

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MassDEP has provided this form for use by on-site professionals and local Boards of Health. Other forms may be used, but the information must be substantially the same as provided here. Before using this form, check with your local Board of Health to determine the form they use.

A. Facility Information

Frank Byrne
Owner Name

25 Jewett Road
Street Address

Map 32 Lot 106
Map/Lot #

Beverly
City

MA
State

01915
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Published Soil Survey Available? ☒ Yes ☐ No If yes: 1984 (Year Published) 1:15,840 (Publication Scale) CrD/CrC (Soil Map Unit)

   Chatfield Hollis Rock Outcrop (Soil Name) Shallow to Ledge (Soil Limitations)

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: MassGIS (Year Published) (Publication Scale) (Map Unit)

   Thick Till w/ Bedrock Outcrops (Geologic Material) Ground Moraine (Landform)

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☒ No

   Within the 500-year flood boundary? ☐ Yes ☒ No Within a velocity zone? ☐ Yes ☒ No

5. Wetland Area: National Wetland Inventory Map — None (Map Unit) Upland (Name)

   Wetlands Conservancy Program Map — None (Map Unit) Upland (Name)

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

B. Site Information (Continued)

6. Current Water Resource Conditions (USGS): Oct. 2015 (Month/Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

7. Other references reviewed: _____

C. On-Site Review (*minimum of two holes required at every proposed primary and reserved disposal area)*

Deep Observation Hole Number: TP1 | 10/27/15 (Date) | 9:00 AM (Time) | Sunny, 45° (Weather)

1. Location

Ground Elevation at Surface of Hole: 91.0 Location (identify on plan): See Plan

2. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Outcrops (Surface Stones) | 5% (Slope (%))

Mature Trees (Vegetation) | Ground Moraine (Landform) | Top (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Possible Wet Area	>100' feet
Property Line	12' feet	Drinking Water Well	>100' feet	Other	feet

4. Parent Material: Glacial Till Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ (Depth Weeping from Pit) _____ (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 40" (inches) 87.7' (elevation)

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (Continued)

Deep Observation Hole Number: TP1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10 YR 3/2	--	--	--	FSL	<2%	<2%	gr	fr	
6-22	Bw	10 YR 5/8	--	--	--	LS	2%	<2%	ma	fr	
22-44	C	10 YR 5/8	40"	5 YR 4/4	2%	LS	10%	2%	ma	fr	

Additional Notes:

1) Root to 40", Refusal at 44", No Water Observed, Large Boulder in Hole – Moved w/ Machine

2) C-Layer has pockets of gravelly material.

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (Continued)

Deep Observation Hole Number: TP2 | 10/27/15 (Date) | 9:30 AM (Time) | Sunny, 45° (Weather)

1. Location

Ground Elevation at Surface of Hole: 93.0 Location (identify on plan): See Plan

2. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Stone Walls (Surface Stones) | 5% (Slope (%))

Mature Trees (Vegetation) | Ground Moraine (Landform) | Top (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Possible Wet Area	>100' feet
Property Line	24' feet	Drinking Water Well	>100' feet	Other	feet

4. Parent Material: Glacial Till Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: >48" (inches) | 89.0' (elevation)

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (Continued)

Deep Observation Hole Number: TP2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-3	A	10 YR 3/2	--	--	--	FSL	<2%	<2%	gr	fr	
3-16	Bw	10 YR 5/8	--	--	--	LS	2%	<2%	ma	fr	
16-32	C1	10 YR 5/8	--	--	--	LS	10%	2%	ma	fr	
32-48	C2	10 YR 6/4	--	--	--	LS	10%	5%	ma	firm	See Note 1

Additional Notes:

1) Compact soil. Loose in Hand, Firm in Place.

2) Root to 43", No Refusal But Hardpan at Bottom of Hole, No Water, No Mottles

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (Continued)

Deep Observation Hole Number: TP3 | 10/27/15 (Date) | 10:00 AM (Time) | Sunny, 45° (Weather)

1. Location

Ground Elevation at Surface of Hole: 95.5 Location (identify on plan): See Plan

2. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Stone Walls (Surface Stones) | 5% (Slope (%))

Mature Trees (Vegetation) | Ground Moraine (Landform) | Top (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Possible Wet Area	>100' feet
Property Line	50' feet	Drinking Water Well	>100' feet	Other	feet

4. Parent Material: Glacial Till Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit | Depth Standing Water in Hole

Estimated Depth to High Groundwater: >72" inches | 89.5' elevation

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (Continued)

Deep Observation Hole Number: TP3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10 YR 3/2	--	--	--	FSL	<2%	<2%	gr	fr	
6-22	Bw	10 YR 5/8	--	--	--	LS	2%	<2%	ma	fr	
22-42	C1	10 YR 5/8	--	--	--	LS	10%	2%	ma	fr	
42-72	C2	10 YR 6/4	--	--	--	SL/LS	10%	2%	ma	fr	See Note 1

Additional Notes:

1) Pockets of Sand and pockets of gravel.

2) Root to 44", Refusal at 72", No Water, No Mottles

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	TP1	TP2	TP3
☐ Depth observed standing water in observation hole	A. inches	B. inches	
☐ Depth weeping from side of observation hole	A. inches	B. inches	
☒ Depth to soil redoximorphic features (mottles)	A. 40" inches	B. >48" inches	>72"
☐ Groundwater adjustment (USGS methodology)	A. inches	B. inches	

2. _____ Index Well Number _____ Reading Date _____ Index Well Level

_____ Adjustment Factor _____ Adjusted Groundwater Level

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? Upper boundary: _____ inches Lower boundary: _____ inches

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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.

Signature of Soil Evaluator	10/27/15 Date
Jesse Blanchette, PE (#12897) Typed or Printed Name of Soil Evaluator / License #	2008 Date of Soil Evaluator Exam
NA Name of Board of Health Witness	Board of Health

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 sheet for field diagrams: