

January 28, 2021

Town of Reading
Conservation Commission

**Re: Small Lane Extension, Reading
Drainage Design**

This drainage study was conducted for the proposed roadway extension of Small Lane to access two new house lots. The drainage study is limited to the roadway extension and not any construction on the future house lots. This report is intended to accompany Site Plans prepared by Sullivan Engineering Group, LLC dated Dec. 1, 2020.

Soil testing was conducted on-site on 11/5/2019 by John D. Sullivan III, P.E. Soil testing was conducted in four locations (testhole locations shown on the Site Plan). All testholes show highly suitable soils for groundwater recharge (coarse sand).

The proposed drainage system is proposing to utilize a low impact stormwater design which will involve some roadway curbing to channel stormwater runoff to open curb areas with a grass shoulder and crushed stone infiltration trench. The grass shoulder and crushed stone infiltration trench will exist on both sides of the proposed roadway extension. The proposed roadway will be 24 feet in width. There will be a 3 foot grass shoulder off the edge of pavement to provide pretreatment to the stormwater before entering the crushed stone infiltration trench. The infiltration trench will be trapezoidal shaped being 6 feet wide and 2 feet deep. The bottom of the infiltration trench will be 2 feet above the seasonal high groundwater table.

The HydroCAD report models the Predevelopment Condition vs. Postdevelopment Condition for the entire site area. The stormwater design reduces the peak rate of runoff and volume for the 2, 10, and 100 year storm event. The following is summary of the peak rate of runoff for various storm events:

<u>Storm Event</u>	Predevelopment (cfs)	Postdevelopment (cfs)
2 Year	0.00	0.00
10 Year	0.01	0.01
100 Year	0.62	0.38

HydroCAD calculations are attached which show that the infiltration fields are sized properly for the various storm events. The soil logs for this project are provided on the Existing Conditions Plan in the Civil set.

The Predevelopment and Postdevelopment drainage area plans are attached as well.

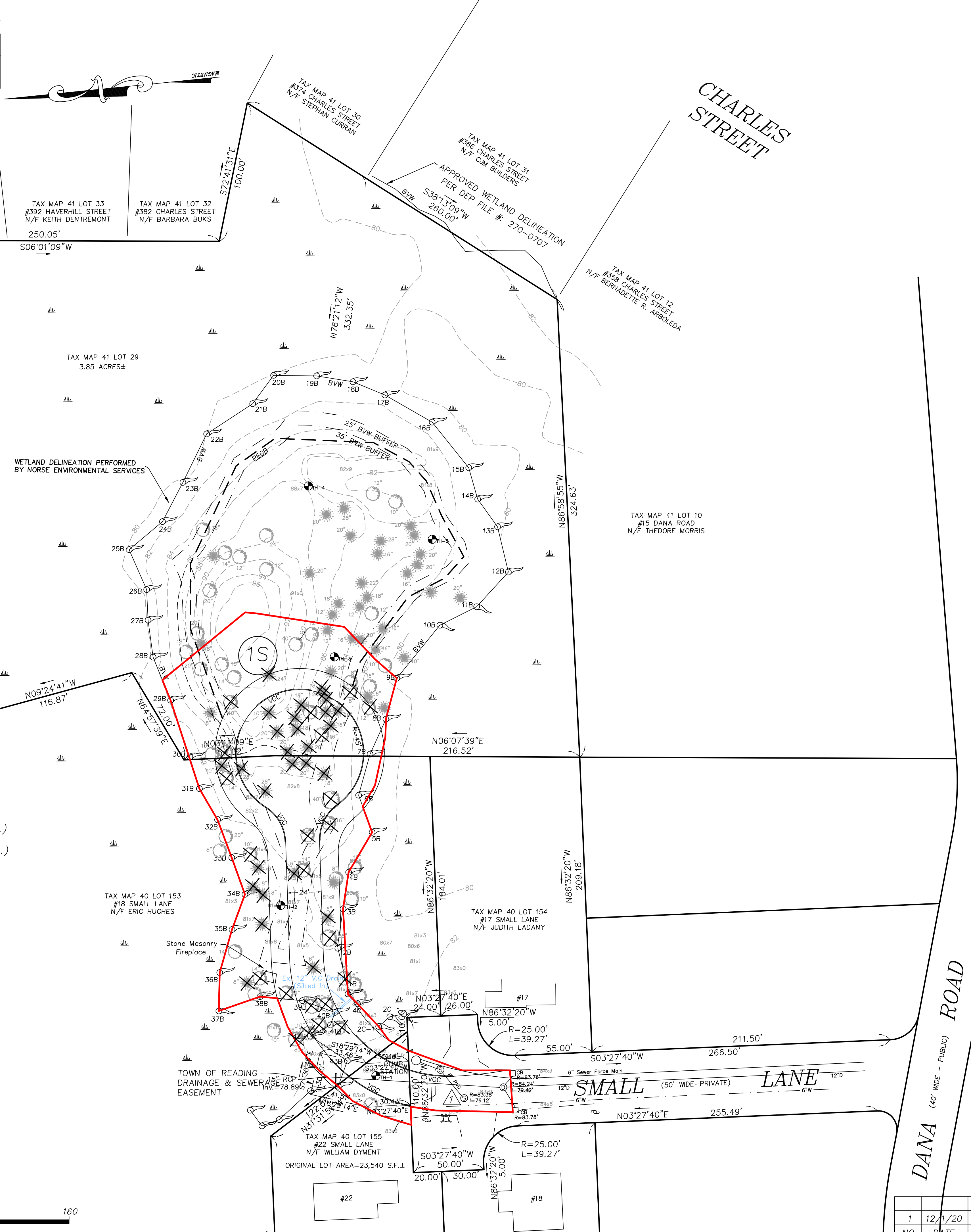
Very Truly Yours

John (Jack) D. Sullivan III, PE



TEMPORARY BENCHMARK CHART:

TBM #	DESCRIPTION	ELEV.
△	SEWER MANHOLE RIM	83.38'



SOILS INFORMATION:

TEST PIT WAS PERFORMED BY JOHN D. SULLIVAN III, P.E., C.S.E. ON 11/5/19

TEST PIT: TH-1
ELEV.=82.9'
MOTTLING @ 28" (ELEV=80.5')
0"-4" HORIZON A: SANDY LOAM 10 YR 3/3
4"-13" HORIZON Bw: LOAMY SAND 10 YR 6/B
13"-50" C-LAYER: LOAMY SAND 2.5 Y 5/4
WATER STANDING @ 43"

TEST PIT: TH-2
ELEV.=81.5'
MOTTLING @ 24" (ELEV=79.5')
0"-6" HORIZON A: SANDY LOAM 10 YR 3/3
6"-15" HORIZON Bw: LOAMY SAND 10 YR 6/B
15"-55" C-LAYER: M-C SAND 2.5 Y 5/4
WATER STANDING @ 28"

TEST PIT: TH-3
ELEV.=85.2'
MOTTLING @ 38" (ELEV=82.0')
0"-5" HORIZON A: SANDY LOAM 10 YR 3/3
5"-14" HORIZON Bw: LOAMY SAND 10 YR 6/B
14"-67" C-LAYER: M-C SAND 2.5 Y 5/4
WATER STANDING @ 48"

TEST PIT: TH-4
ELEV.=86.1'
MOTTLING @ NONE
0"-4" HORIZON A0: SANDY LOAM 10 YR 3/3
4"-15" HORIZON Bw: LOAMY SAND 10 YR 6/B
15"-80" C-LAYER: M-C SAND 2.5 Y 5/4
WATER STANDING @ 72" (ELEV=80.1')

TEST PIT: TH-5
ELEV.=84.3
MOTTLING @ NONE
0"-4" HORIZON A0: SANDY LOAM 10 YR 3/3
4"-13" HORIZON Bw: LOAMY SAND 10 YR 6/B
13"-68" C-LAYER: M-C SAND 2.5 Y 5/4
WATER STANDING @ 55" (ELEV=79.7')

FOR REGISTRY OF DEEDS USE ONLY
I DECLARE, TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION, AND BELIEF, THAT THIS PLAN WAS PREPARED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

PAUL FINOCCHIO, PLS DATE

READING COMMUNITY PLANNING & DEVELOPMENT COMMISSION

APPROVED _____, 20__

TREE REMOVAL INFORMATION:

A TOTAL OF 50 TREES (6" OR GREATER) TO BE REMOVED WITHIN ROADWAY AND GRADING AREAS.

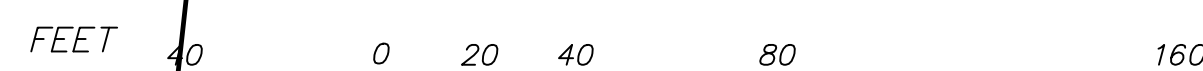
NOTES:

1. THE TOPOGRAPHY, SITE DETAIL & SURFACE IMPROVEMENTS DEPICTED HEREON WERE OBTAINED FROM A PARTIAL FIELD SURVEY CONDUCTED ON OCT. 1-3, 2019 BY SULLIVAN ENGINEERING GROUP, LLC.
2. THE LOCUS PROPERTY DEPICTED IS LOCATED IN ZONING DISTRICT S-20.
3. THE LOCATION OF ALL UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE AND ARE BASED UPON A PARTIAL FIELD SURVEY AND COMPILATION OF PLANS OF RECORD. THE DESIGN ENGINEER DOES NOT WARRANT NOR GUARANTEE THE LOCATION OF ALL UTILITIES DEPICTED OR NOT DEPICTED. THE CONTRACTOR, PRIOR TO COMMENCEMENT OF CONSTRUCTION, SHALL VERIFY THE LOCATION OF ALL UTILITIES AND CONTACT DIG SAFE AT 1-888-344-7233.
4. THIS PLAN DOES NOT SHOW ANY UNRECORDED OR UNWRITTEN EASEMENTS WHICH MAY EXIST. A REASONABLE AND DILIGENT ATTEMPT HAS BEEN MADE TO OBSERVE ANY APPARENT, VISIBLE USES OF THE LAND; HOWEVER, THIS DOES NOT CONSTITUTE A GUARANTEE THAT NO SUCH EASEMENTS EXIST.
5. THE ELEVATIONS DEPICTED HEREON WERE BASED UPON THE 1929 NGVD DATUM.
6. THE LOCUS PROPERTY IS NOT LOCATED WITHIN A FLOOD ZONE AS DEPICTED ON THE LATEST FLOOD INSURANCE RATE MAP.

LEGEND:

- 248 — TWO FOOT CONTOUR
- DECIDUOUS TREE (> 6" DIA.)
- EVERGREEN TREE (> 6" DIA.)
- ⊕ UTILITY POLE
- ⊙ SEWER MANHOLE
- S — SEWER MAIN
- W — COMPILED WATER MAIN
- CB □ CATCHBASIN
- D — DRAIN LINE
- BIT. BITUMINOUS
- CONC. CONCRETE
- EOP EDGE OF PAVEMENT
- TH ● TEST PIT
- 248.0 SPOT GRADE
- ✕ PROP. TREE REMOVAL

GRAPHIC SCALE
SCALE: 1"=40'

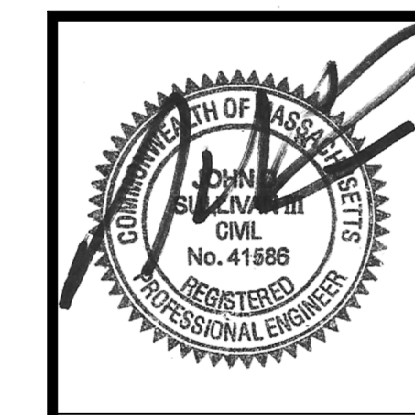


SMALL LANE EXTENSION

PREDEVELOPMENT DRAINAGE AREA
LOCATED IN
READING, MASSACHUSETTS
(MIDDLESEX COUNTY)

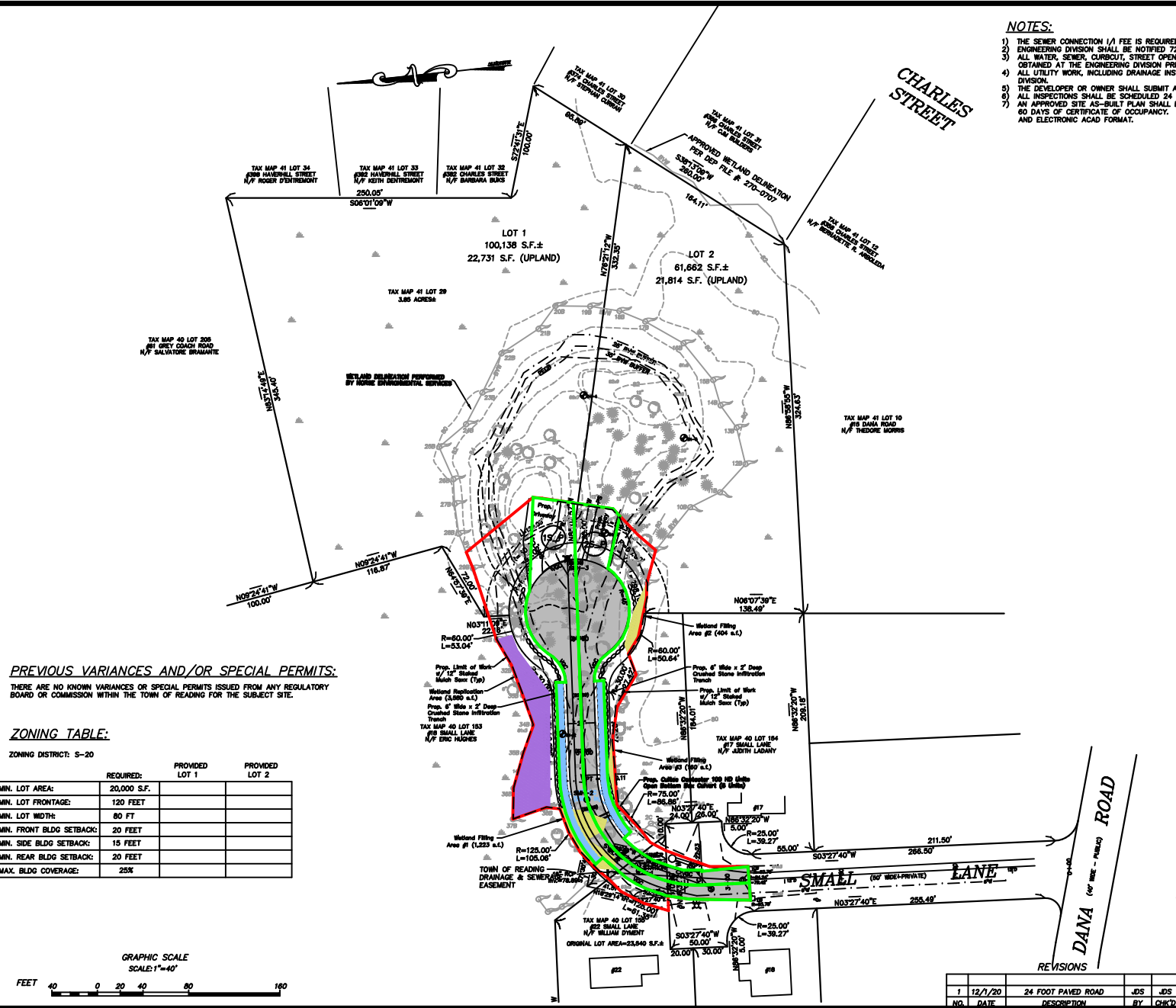
PREPARED FOR
DEL REY R.T.
SCALE: 1"= 40' DATE: JULY 27, 2020

PREPARED BY
SULLIVAN ENGINEERING GROUP, LLC
P.O. BOX 2004
WOBBURN, MA 01888
(781) 854-8644



REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D
1	12/1/20	TREE REMOVAL	JDS	JDS



- NOTES:**
- 1) THE SEWER CONNECTION 1/1 FEE IS REQUIRED FOR THE NEW HOUSES PRIOR TO OCCUPANCY.
 - 2) ENGINEERING DIVISION SHALL BE NOTIFIED 72 HOURS IN ADVANCE TO MARK OUT TOWN UTILITIES.
 - 3) ALL WATER, SEWER, CURB/CUT, STREET OPENING, & JACKIE'S LAW EXCAVATION PERMITS SHALL BE OBTAINED AT THE ENGINEERING DIVISION PRIOR TO ANY EXCAVATION.
 - 4) ALL UTILITY WORK, INCLUDING DRAINAGE INSTALLATION SHALL BE INSPECTED BY THE ENGINEERING DIVISION.
 - 5) THE DEVELOPER OR OWNER SHALL SUBMIT A CONSTRUCTION SCHEDULE OF PROPOSED WORK.
 - 6) ALL INSPECTIONS SHALL BE SCHEDULED 24 HOURS IN ADVANCE.
 - 7) AN APPROVED SITE AS-BUILT PLAN SHALL BE SUBMITTED TO THE ENGINEERING DIVISION WITHIN 60 DAYS OF CERTIFICATE OF OCCUPANCY. THE AS-BUILT SHALL BE PROVIDED ON PAPER COPY AND ELECTRONIC ACAD FORMAT.

FOR REGISTRY OF DEEDS USE ONLY
 I DECLARE, TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION AND BELIEF, THAT THIS PLAN WAS PREPARED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

PAUL FRODOCK, PLS _____ DATE _____
 READING COMMUNITY PLANNING & DEVELOPMENT COMMISSION

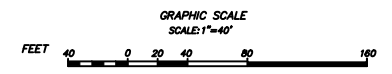
APPROVED _____ 20__

- LEGEND:**
- 248- TWO FOOT CONTOUR
 - DECIDUOUS TREE (> 6" DIA.)
 - EVERGREEN TREE (> 6" DIA.)
 - UTILITY POLE
 - ⊙ SEWER MANHOLE
 - S- SEWER MAIN
 - W- COMPILED WATER MAIN
 - CB □ CATCHBASIN
 - D- DRAIN LINE
 - BIT. BITUMINOUS
 - CONC. CONCRETE
 - EOP. EDGE OF PAVEMENT
 - TH ⊙ TEST PIT
 - (100)- PROP. CONTOUR

PREVIOUS VARIANCES AND/OR SPECIAL PERMITS:
 THERE ARE NO KNOWN VARIANCES OR SPECIAL PERMITS ISSUED FROM ANY REGULATORY BOARD OR COMMISSION WITHIN THE TOWN OF READING FOR THE SUBJECT SITE.

ZONING TABLE:

	REQUIRED:	PROVIDED LOT 1	PROVIDED LOT 2
MIN. LOT AREA:	20,000 S.F.		
MIN. LOT FRONTAGE:	120 FEET		
MIN. LOT WIDTH:	80 FT		
MIN. FRONT BLDG SETBACK:	20 FEET		
MIN. SIDE BLDG SETBACK:	15 FEET		
MIN. REAR BLDG SETBACK:	20 FEET		
MAX. BLDG COVERAGE:	25%		



SMALL LANE EXTENSION
POST DEVELOPMENT DRAINAGE
 LOCATED IN
READING, MASSACHUSETTS
 (MIDDLESEX COUNTY)

PREPARED FOR
 DEL REY R.T.

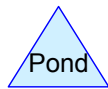
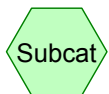
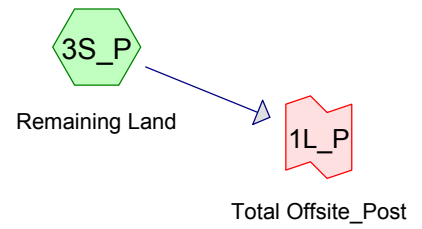
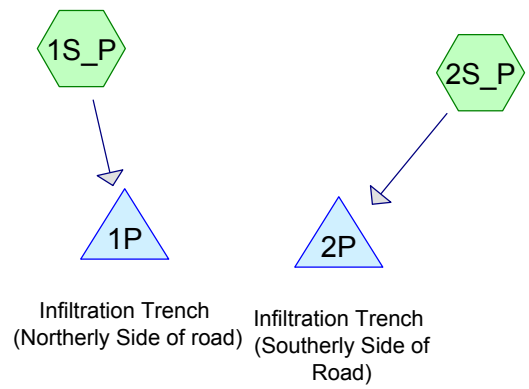
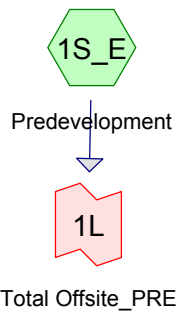
SCALE: 1"= 40' DATE: JULY 27, 2020

PREPARED BY
SULLIVAN ENGINEERING GROUP, LLC
 P.O. BOX 2004
 WOBURN, MA 01890
 (781) 864-8844



REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D
1	12/1/20	24 FOOT PAVED ROAD	JDS	JDS



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S_E: Predevelopment

Runoff Area=36,777 sf Runoff Depth=0.00"
Flow Length=279' Tc=12.2 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment 1S_P:

Runoff Area=10,809 sf Runoff Depth=1.17"
Flow Length=217' Tc=2.2 min CN=78 Runoff=0.40 cfs 0.024 af

Subcatchment 2S_P:

Runoff Area=9,958 sf Runoff Depth=1.36"
Flow Length=217' Tc=2.2 min CN=81 Runoff=0.43 cfs 0.026 af

Subcatchment 3S_P: Remaining Land

Runoff Area=16,010 sf Runoff Depth=0.00"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.000 af

Pond 1P: Infiltration Trench (Northerly Side of roa

Peak Elev=0.02' Storage=6 cf Inflow=0.40 cfs 0.024 af
Outflow=0.40 cfs 0.024 af

Pond 2P: Infiltration Trench (Southerly Side of Ro

Peak Elev=0.02' Storage=7 cf Inflow=0.43 cfs 0.026 af
Outflow=0.43 cfs 0.026 af

Link 1L: Total Offsite_PRE

Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link 1L_P: Total Offsite_Post

Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.689 ac Runoff Volume = 0.050 af Average Runoff Depth = 0.36"

Subcatchment 1S_E: Predevelopment

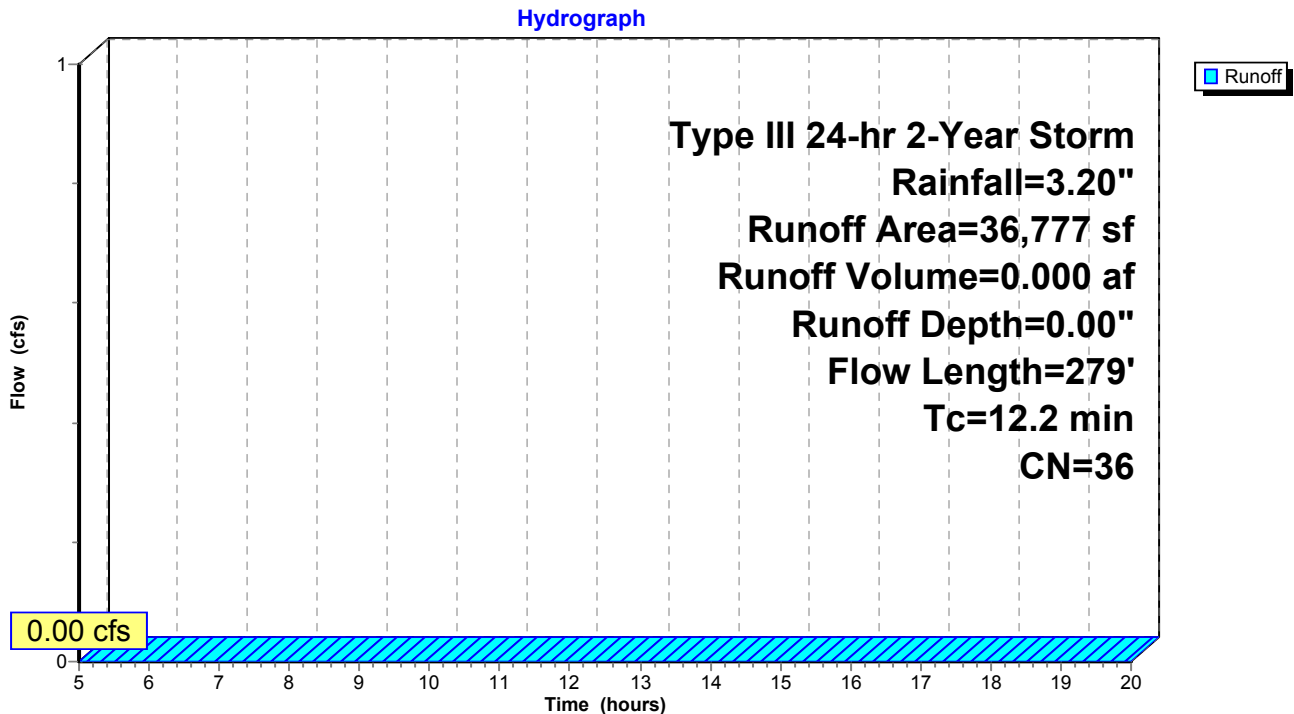
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
36,777	36	Woods, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.1		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	61	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.7	168	0.0230	0.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.2	279	Total			

Subcatchment 1S_E: Predevelopment



Subcatchment 1S_P:

Runoff = 0.40 cfs @ 12.04 hrs, Volume= 0.024 af, Depth= 1.17"

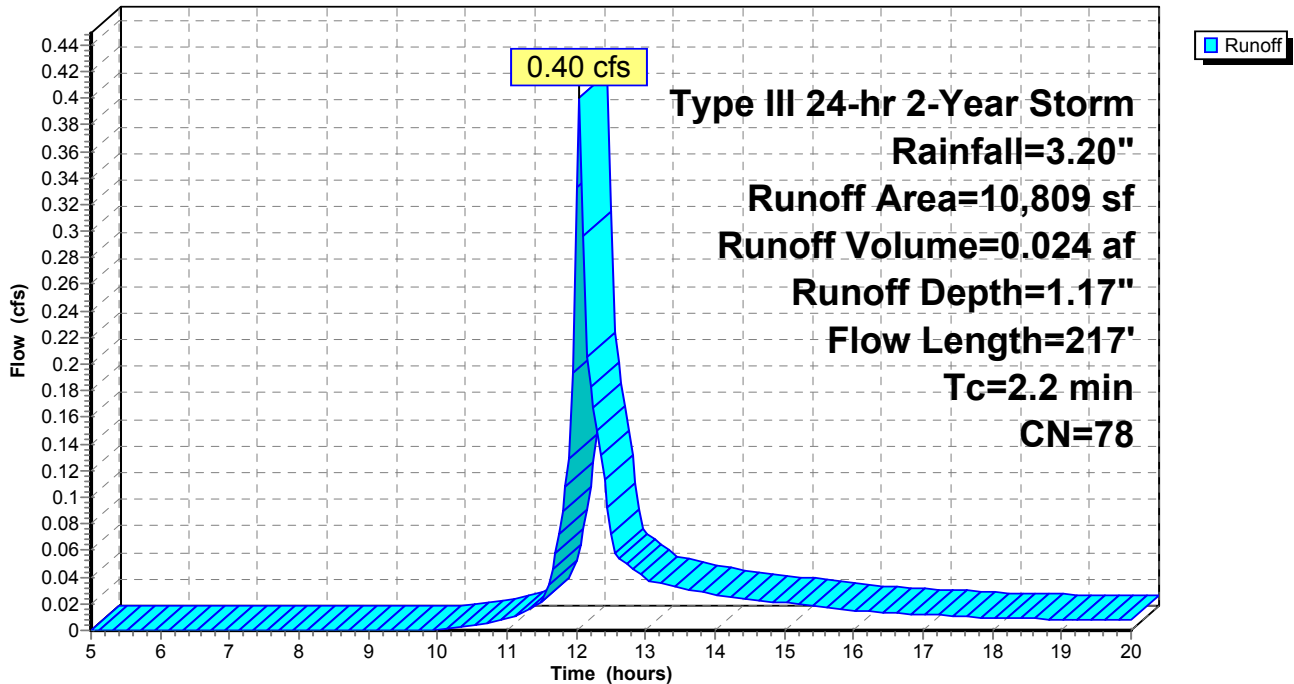
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
489	39	>75% Grass cover, Good, HSG A
3,096	36	Woods, Fair, HSG A
10,809	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 1S_P:

Hydrograph



Subcatchment 2S_P:

Runoff = 0.43 cfs @ 12.04 hrs, Volume= 0.026 af, Depth= 1.36"

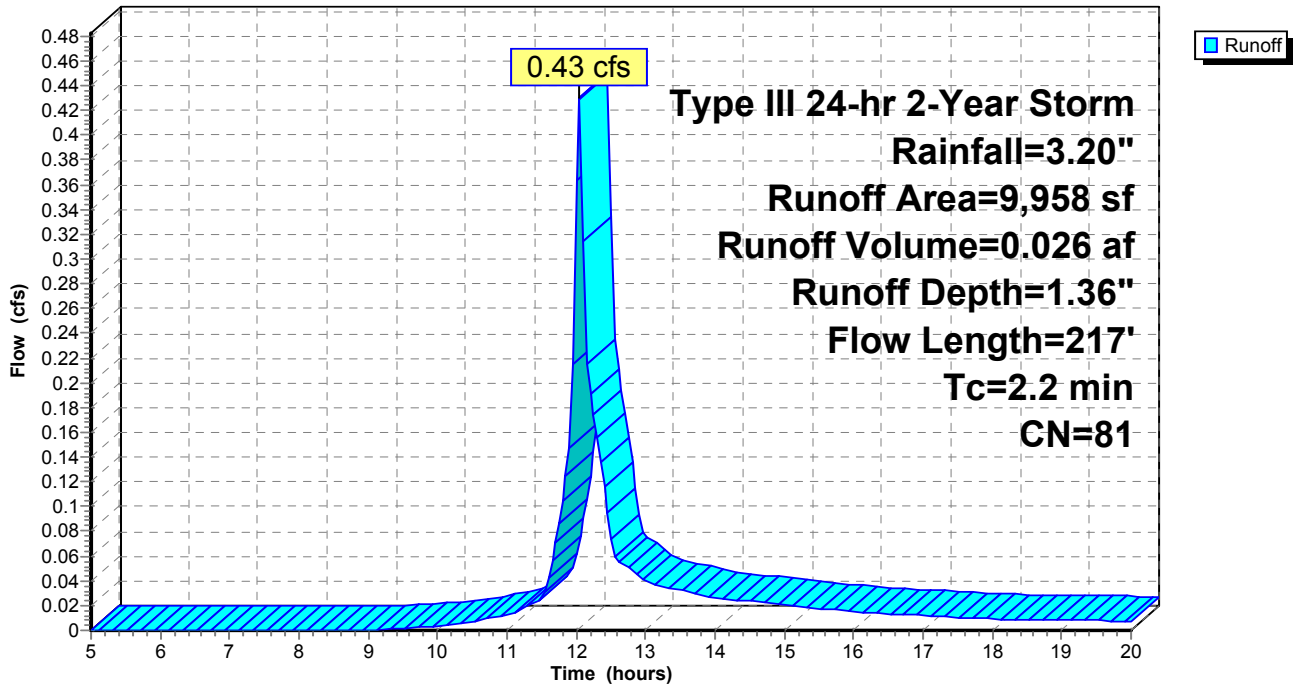
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
426	39	>75% Grass cover, Good, HSG A
2,308	36	Woods, Fair, HSG A
9,958	81	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 2S_P:

Hydrograph



Subcatchment 3S_P: Remaining Land

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

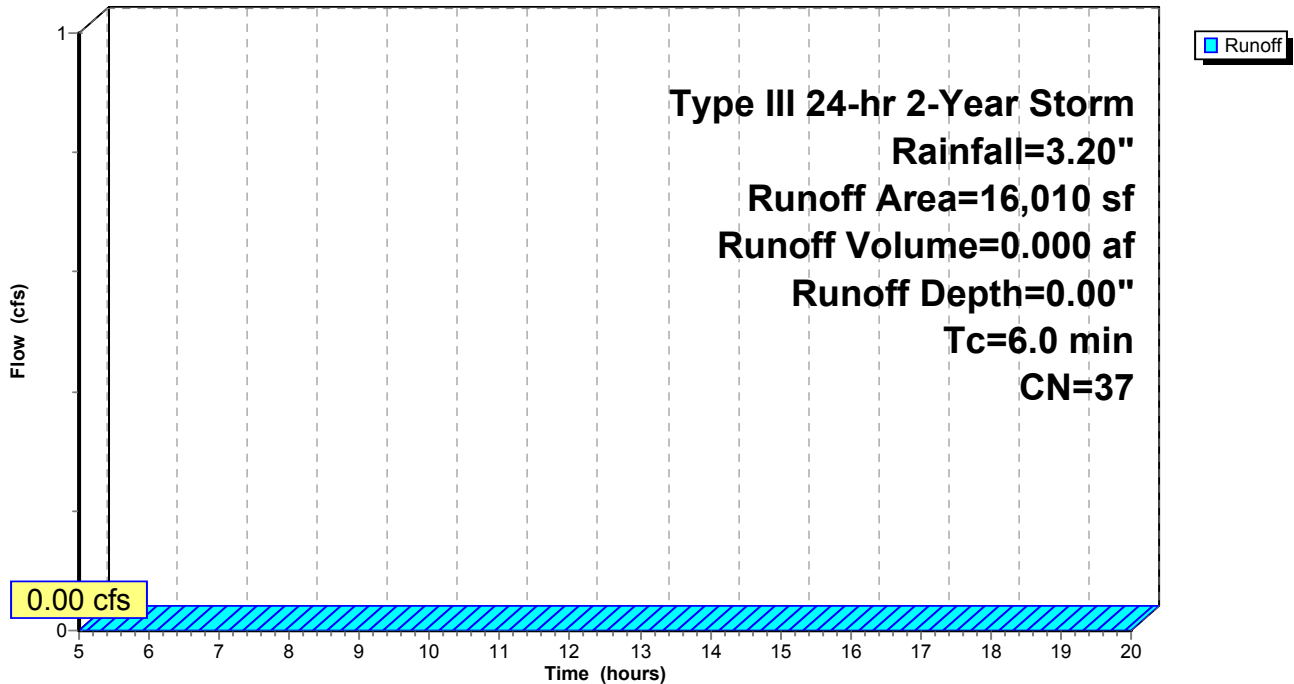
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
326	98	ret wall
15,684	36	Woods, Fair, HSG A
16,010	37	Weighted Average

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

Subcatchment 3S_P: Remaining Land

Hydrograph



Pond 1P: Infiltration Trench (Northerly Side of road)

Inflow Area = 0.248 ac, Inflow Depth = 1.17" for 2-Year Storm event
 Inflow = 0.40 cfs @ 12.04 hrs, Volume= 0.024 af
 Outflow = 0.40 cfs @ 12.05 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.3 min
 Discarded = 0.40 cfs @ 12.05 hrs, Volume= 0.024 af

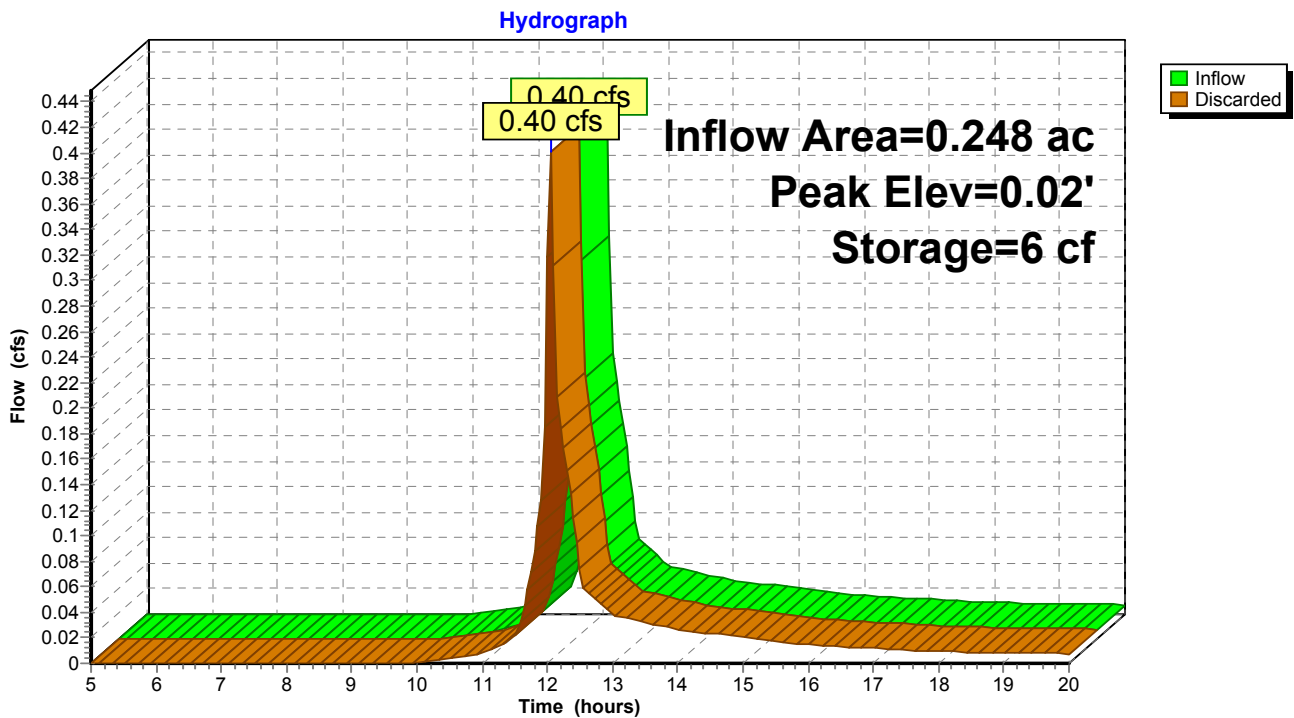
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.02' @ 12.05 hrs Surf.Area= 978 sf Storage= 6 cf
 Plug-Flow detention time= 0.3 min calculated for 0.024 af (100% of inflow)
 Center-of-Mass det. time= 0.2 min (805.9 - 805.7)

#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 12.05 hrs HW=0.02' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.68 cfs)

Pond 1P: Infiltration Trench (Northerly Side of road)



Pond 2P: Infiltration Trench (Southerly Side of Road)

Inflow Area = 0.229 ac, Inflow Depth = 1.36" for 2-Year Storm event
 Inflow = 0.43 cfs @ 12.04 hrs, Volume= 0.026 af
 Outflow = 0.43 cfs @ 12.05 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.3 min
 Discarded = 0.43 cfs @ 12.05 hrs, Volume= 0.026 af

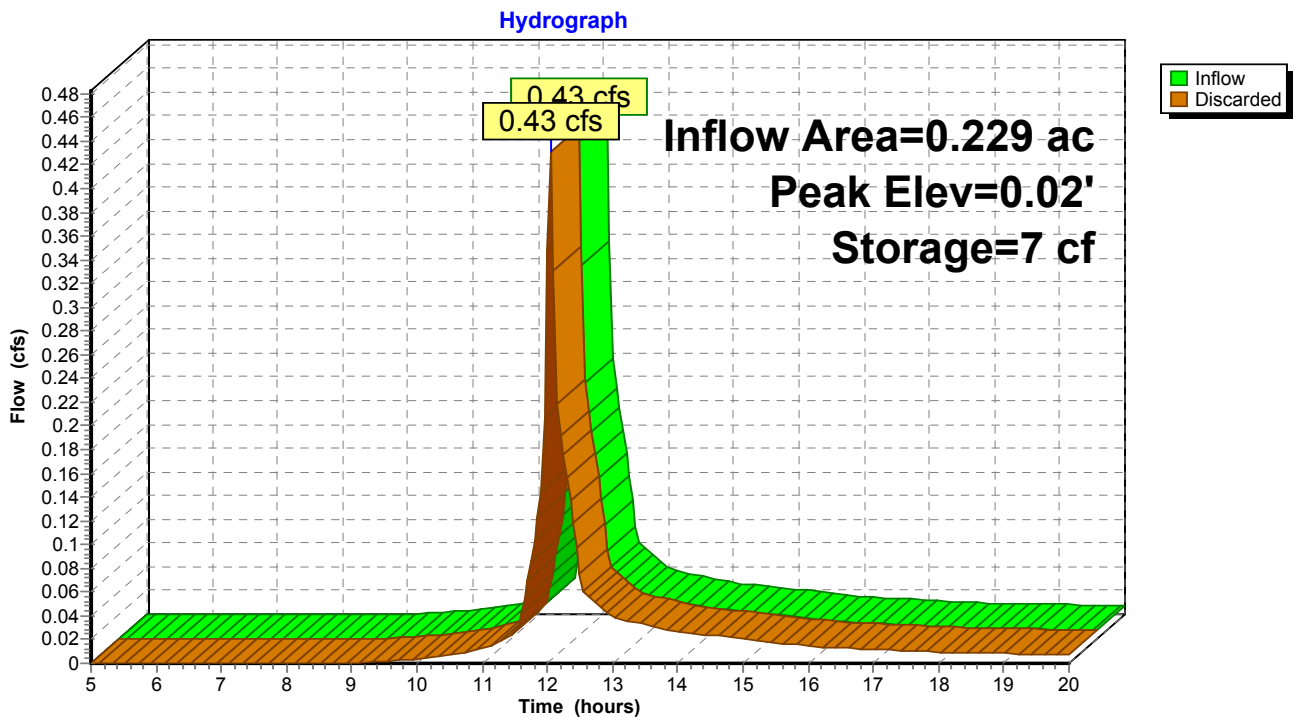
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.02' @ 12.05 hrs Surf.Area= 978 sf Storage= 7 cf
 Plug-Flow detention time= 0.3 min calculated for 0.026 af (100% of inflow)
 Center-of-Mass det. time= 0.2 min (798.4 - 798.2)

#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 12.05 hrs HW=0.02' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.68 cfs)

Pond 2P: Infiltration Trench (Southerly Side of Road)



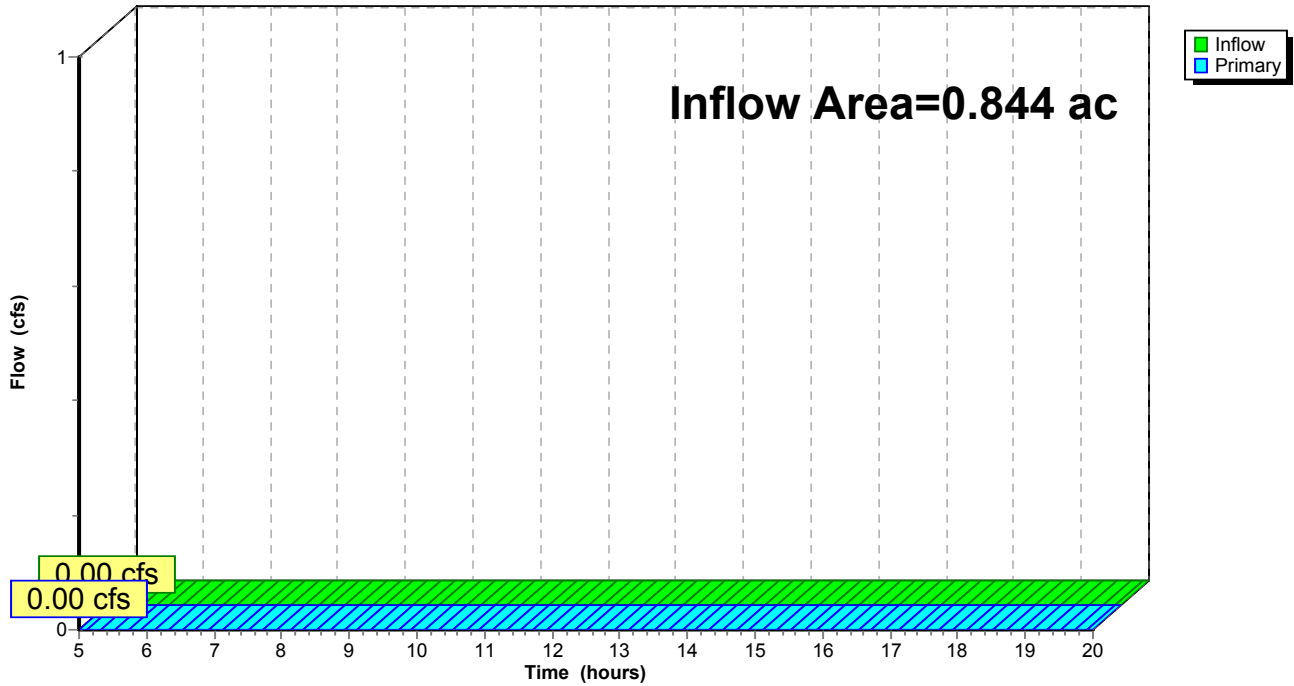
Link 1L: Total Offsite_PRE

Inflow Area = 0.844 ac, Inflow Depth = 0.00" for 2-Year Storm event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Total Offsite_PRE

Hydrograph



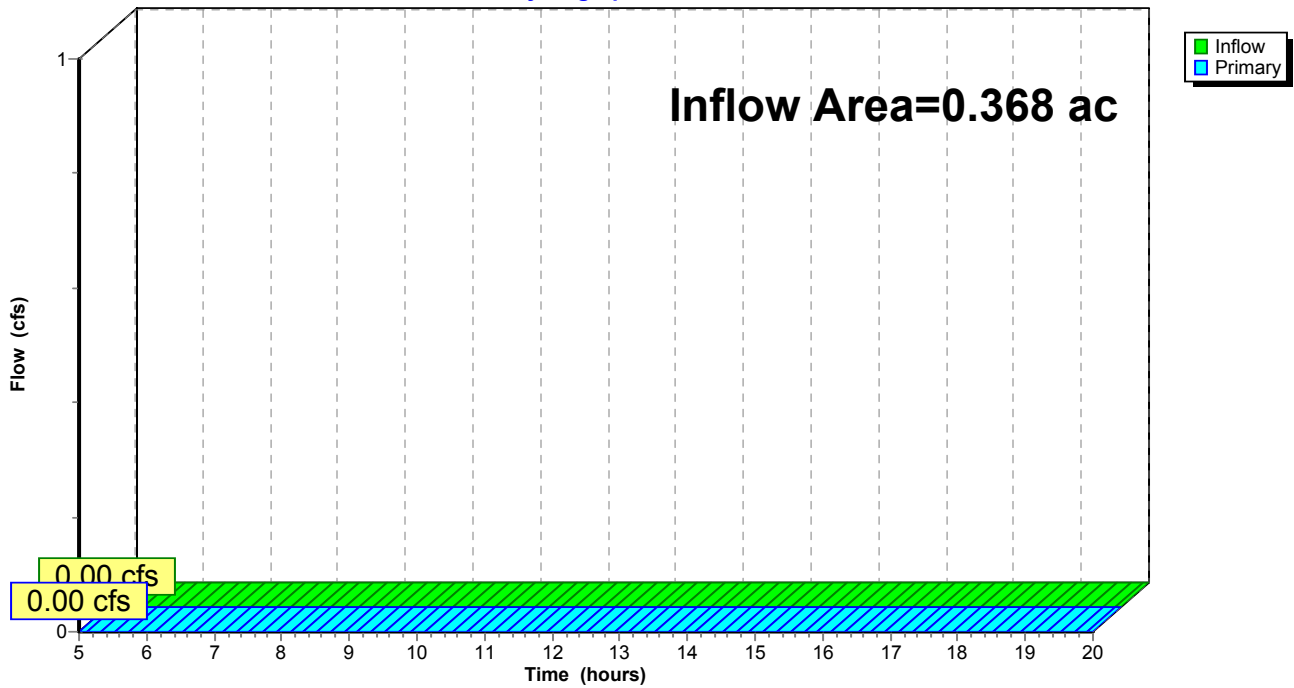
Link 1L_P: Total Offsite_Post

Inflow Area = 0.368 ac, Inflow Depth = 0.00" for 2-Year Storm event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L_P: Total Offsite_Post

Hydrograph



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S_E: Predevelopment

Runoff Area=36,777 sf Runoff Depth=0.07"
Flow Length=279' Tc=12.2 min CN=36 Runoff=0.01 cfs 0.005 af

Subcatchment 1S_P:

Runoff Area=10,809 sf Runoff Depth=2.45"
Flow Length=217' Tc=2.2 min CN=78 Runoff=0.84 cfs 0.051 af

Subcatchment 2S_P:

Runoff Area=9,958 sf Runoff Depth=2.71"
Flow Length=217' Tc=2.2 min CN=81 Runoff=0.85 cfs 0.052 af

Subcatchment 3S_P: Remaining Land

Runoff Area=16,010 sf Runoff Depth=0.09"
Tc=6.0 min CN=37 Runoff=0.01 cfs 0.003 af

Pond 1P: Infiltration Trench (Northerly Side of ro Peak Elev=0.10' Storage=38 cf Inflow=0.84 cfs 0.051 af
Outflow=0.68 cfs 0.051 af

Pond 2P: Infiltration Trench (Southerly Side of R Peak Elev=0.11' Storage=44 cf Inflow=0.85 cfs 0.052 af
Outflow=0.68 cfs 0.052 af

Link 1L: Total Offsite_PRE

Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Link 1L_P: Total Offsite_Post

Inflow=0.01 cfs 0.003 af
Primary=0.01 cfs 0.003 af

Total Runoff Area = 1.689 ac Runoff Volume = 0.110 af Average Runoff Depth = 0.78"

Subcatchment 1S_E: Predevelopment

Runoff = 0.01 cfs @ 15.08 hrs, Volume= 0.005 af, Depth= 0.07"

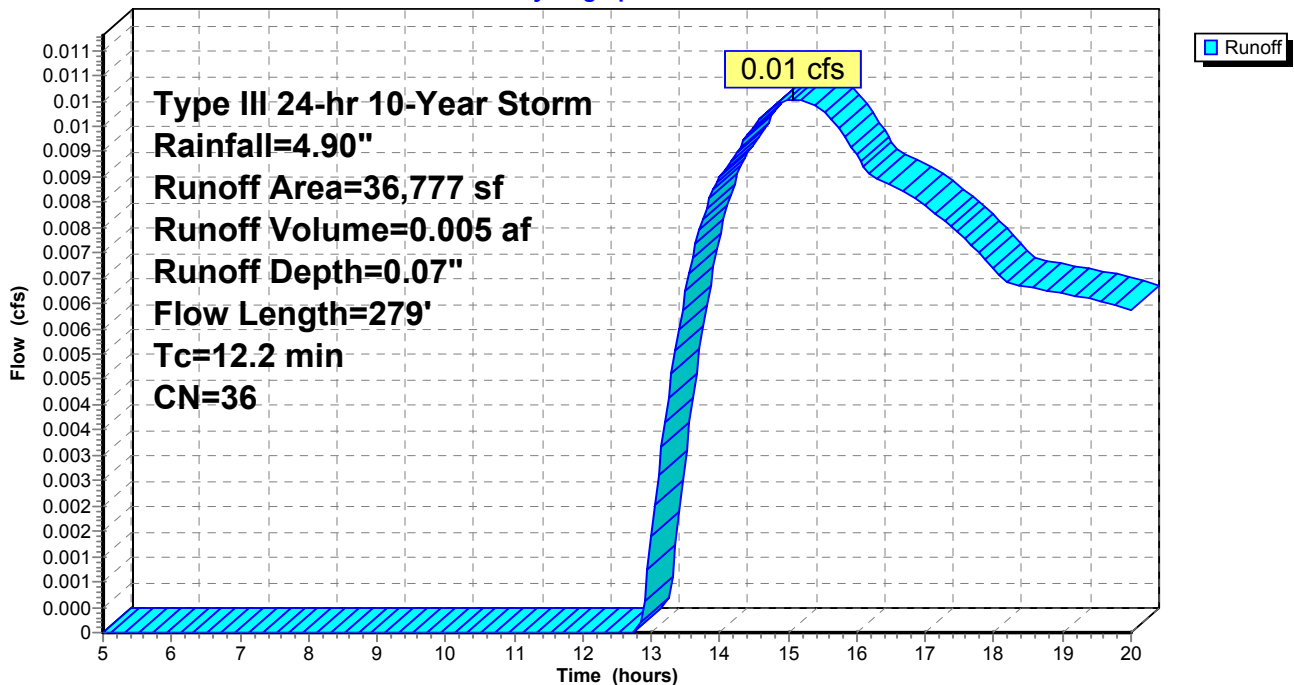
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
36,777	36	Woods, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.1		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	61	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.7	168	0.0230	0.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.2	279	Total			

Subcatchment 1S_E: Predevelopment

Hydrograph



Subcatchment 1S_P:

Runoff = 0.84 cfs @ 12.04 hrs, Volume= 0.051 af, Depth= 2.45"

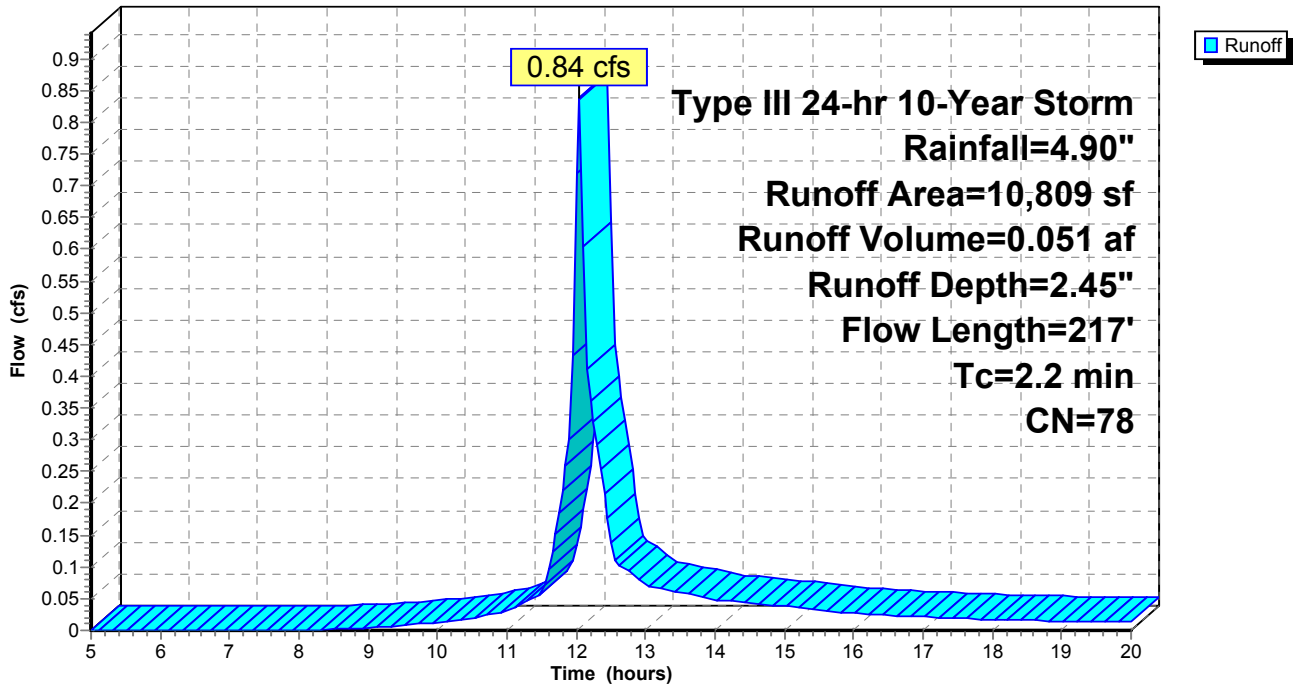
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
489	39	>75% Grass cover, Good, HSG A
3,096	36	Woods, Fair, HSG A
10,809	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 1S_P:

Hydrograph



Subcatchment 2S_P:

Runoff = 0.85 cfs @ 12.04 hrs, Volume= 0.052 af, Depth= 2.71"

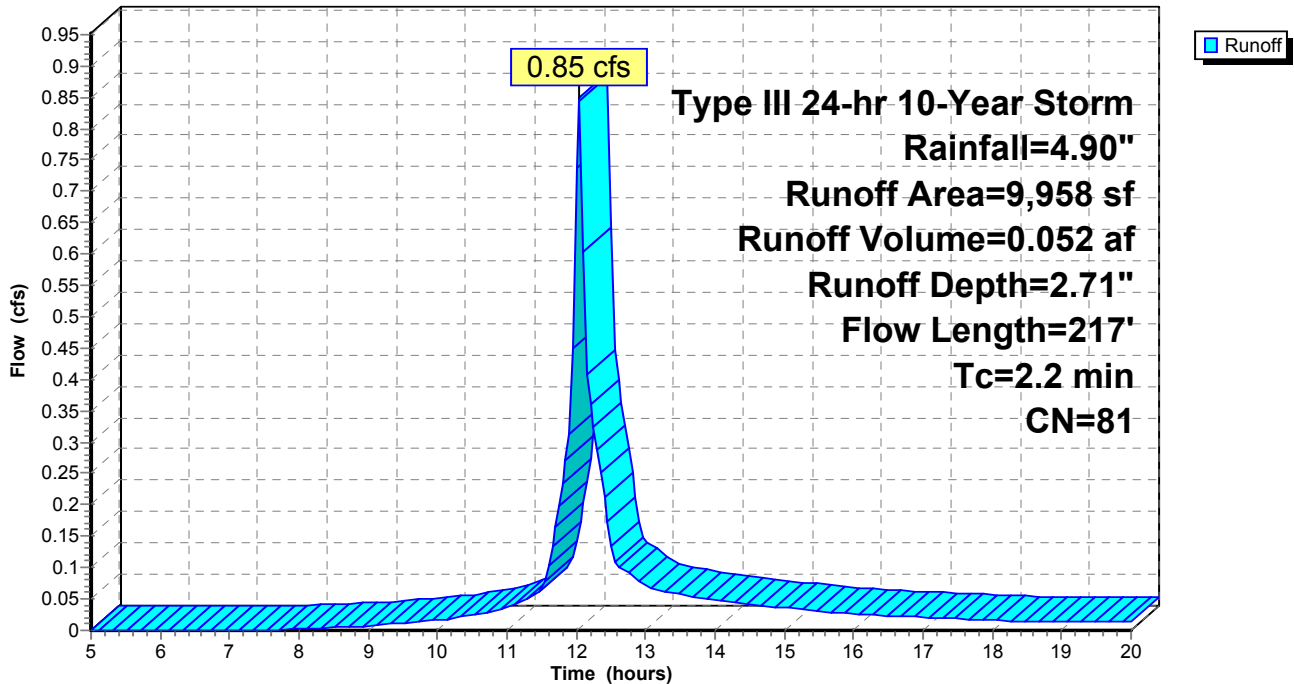
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
426	39	>75% Grass cover, Good, HSG A
2,308	36	Woods, Fair, HSG A
9,958	81	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 2S_P:

Hydrograph



Subcatchment 3S_P: Remaining Land

Runoff = 0.01 cfs @ 14.71 hrs, Volume= 0.003 af, Depth= 0.09"

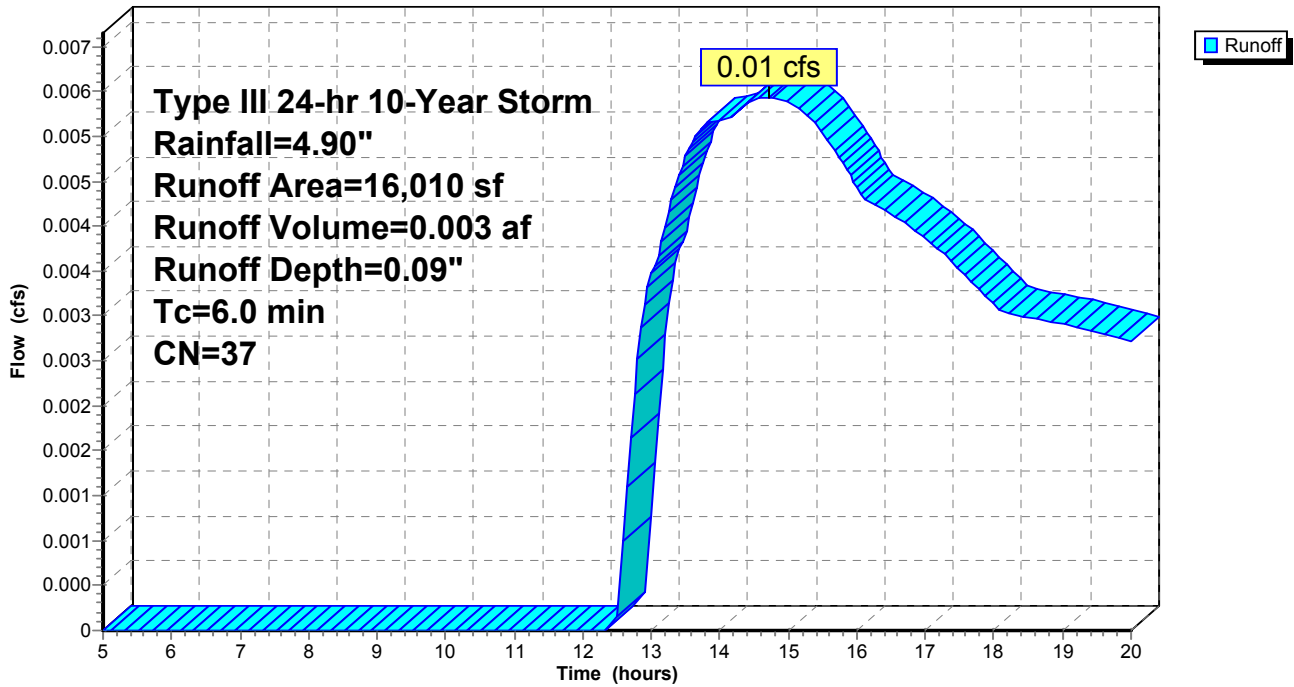
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
326	98	ret wall
15,684	36	Woods, Fair, HSG A
16,010	37	Weighted Average

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

Subcatchment 3S_P: Remaining Land

Hydrograph



Pond 1P: Infiltration Trench (Northerly Side of road)

Inflow Area = 0.248 ac, Inflow Depth = 2.45" for 10-Year Storm event
 Inflow = 0.84 cfs @ 12.04 hrs, Volume= 0.051 af
 Outflow = 0.68 cfs @ 12.00 hrs, Volume= 0.051 af, Atten= 19%, Lag= 0.0 min
 Discarded = 0.68 cfs @ 12.00 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.10' @ 12.09 hrs Surf.Area= 978 sf Storage= 38 cf
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= (not calculated)

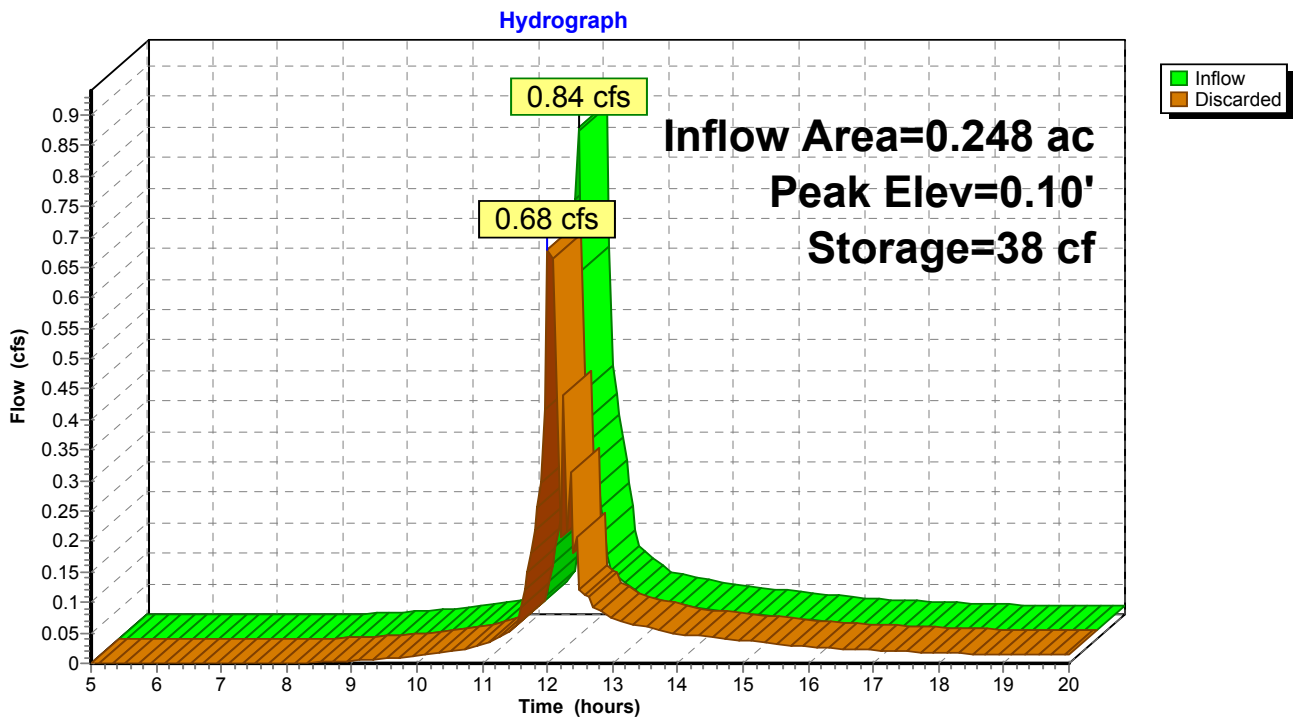
#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 12.00 hrs HW=0.03' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.68 cfs)

Pond 1P: Infiltration Trench (Northerly Side of road)



Pond 2P: Infiltration Trench (Southerly Side of Road)

Inflow Area = 0.229 ac, Inflow Depth = 2.71" for 10-Year Storm event
 Inflow = 0.85 cfs @ 12.04 hrs, Volume= 0.052 af
 Outflow = 0.68 cfs @ 12.00 hrs, Volume= 0.052 af, Atten= 20%, Lag= 0.0 min
 Discarded = 0.68 cfs @ 12.00 hrs, Volume= 0.052 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.11' @ 12.09 hrs Surf.Area= 978 sf Storage= 44 cf
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= (not calculated)

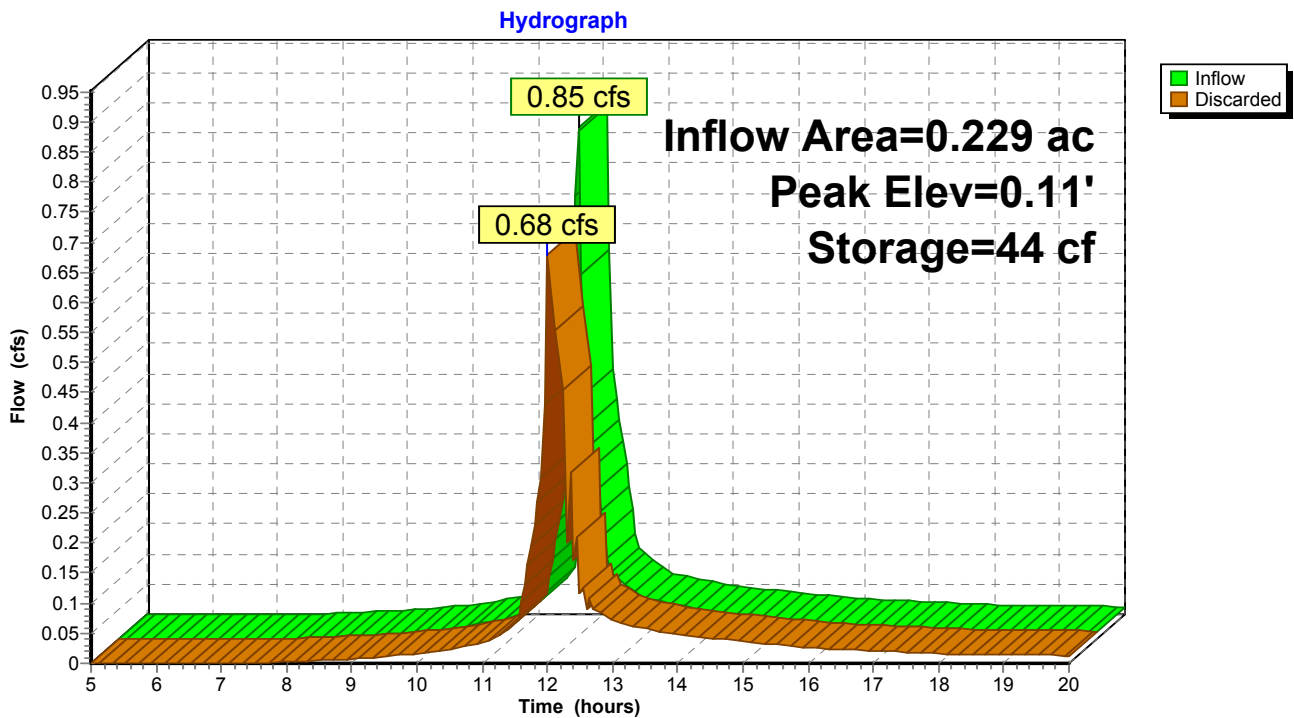
#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 12.00 hrs HW=0.03' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.68 cfs)

Pond 2P: Infiltration Trench (Southerly Side of Road)



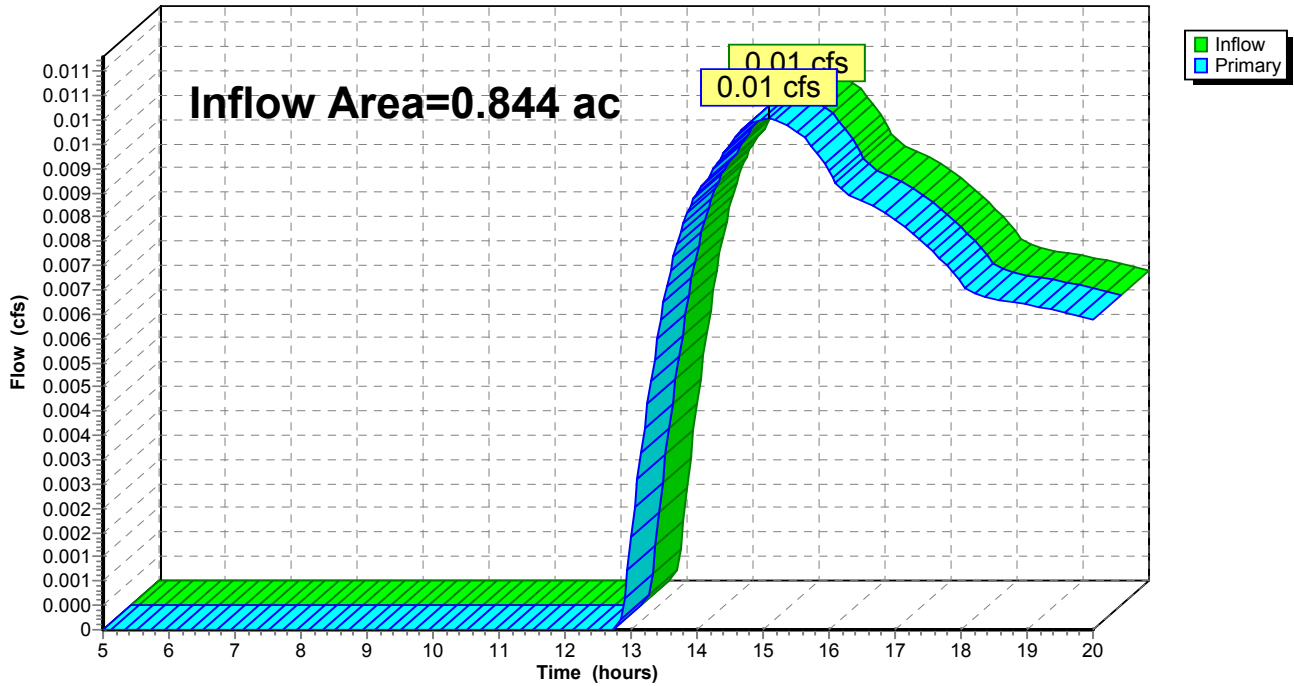
Link 1L: Total Offsite_PRE

Inflow Area = 0.844 ac, Inflow Depth = 0.07" for 10-Year Storm event
Inflow = 0.01 cfs @ 15.08 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 15.08 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Total Offsite_PRE

Hydrograph



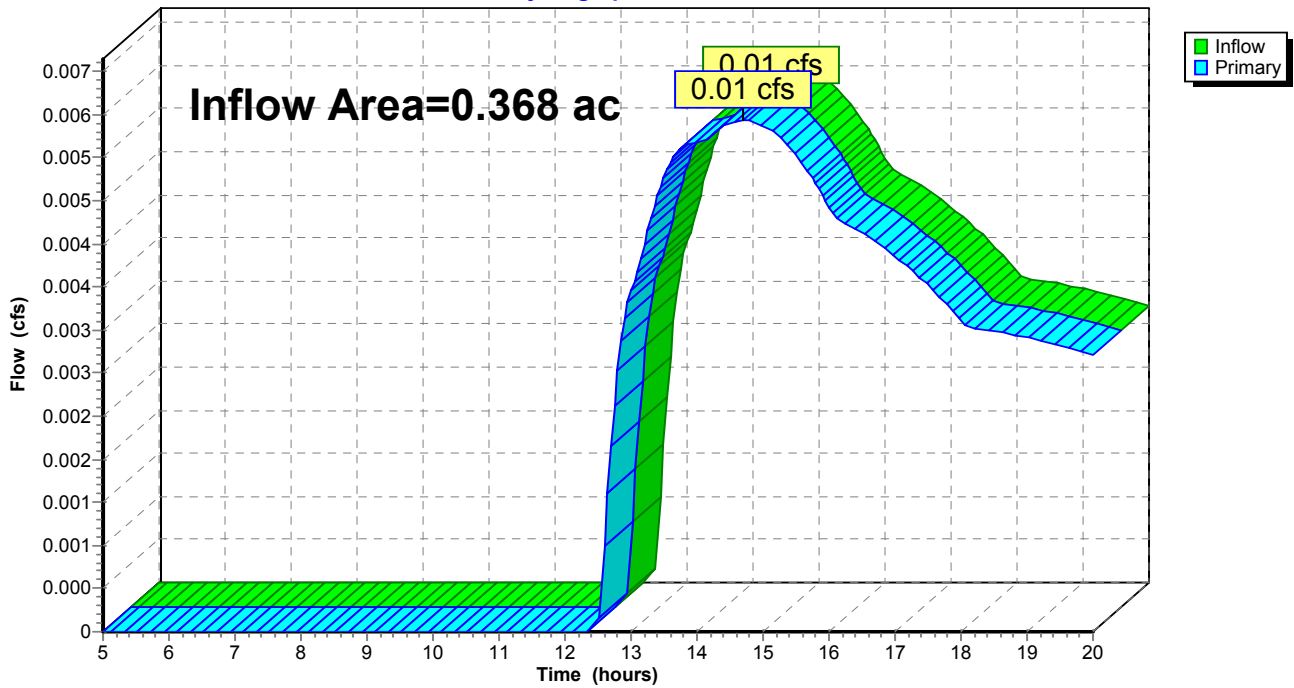
Link 1L_P: Total Offsite_Post

Inflow Area = 0.368 ac, Inflow Depth = 0.09" for 10-Year Storm event
Inflow = 0.01 cfs @ 14.71 hrs, Volume= 0.003 af
Primary = 0.01 cfs @ 14.71 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L_P: Total Offsite_Post

Hydrograph



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S_E: Predevelopment

Runoff Area=36,777 sf Runoff Depth=1.08"
Flow Length=279' Tc=12.2 min CN=36 Runoff=0.62 cfs 0.076 af

Subcatchment 1S_P:

Runoff Area=10,809 sf Runoff Depth=5.87"
Flow Length=217' Tc=2.2 min CN=78 Runoff=1.95 cfs 0.121 af

Subcatchment 2S_P:

Runoff Area=9,958 sf Runoff Depth=6.23"
Flow Length=217' Tc=2.2 min CN=81 Runoff=1.88 cfs 0.119 af

Subcatchment 3S_P: Remaining Land

Runoff Area=16,010 sf Runoff Depth=1.18"
Tc=6.0 min CN=37 Runoff=0.38 cfs 0.036 af

Pond 1P: Infiltration Trench (Northerly Side of rd)

Peak Elev=1.78' Storage=698 cf Inflow=1.95 cfs 0.121 af
Outflow=0.68 cfs 0.121 af

Pond 2P: Infiltration Trench (Southerly Side of R)

Peak Elev=1.64' Storage=640 cf Inflow=1.88 cfs 0.119 af
Outflow=0.68 cfs 0.119 af

Link 1L: Total Offsite_PRE

Inflow=0.62 cfs 0.076 af
Primary=0.62 cfs 0.076 af

Link 1L_P: Total Offsite_Post

Inflow=0.38 cfs 0.036 af
Primary=0.38 cfs 0.036 af

Total Runoff Area = 1.689 ac Runoff Volume = 0.352 af Average Runoff Depth = 2.50"

Subcatchment 1S_E: Predevelopment

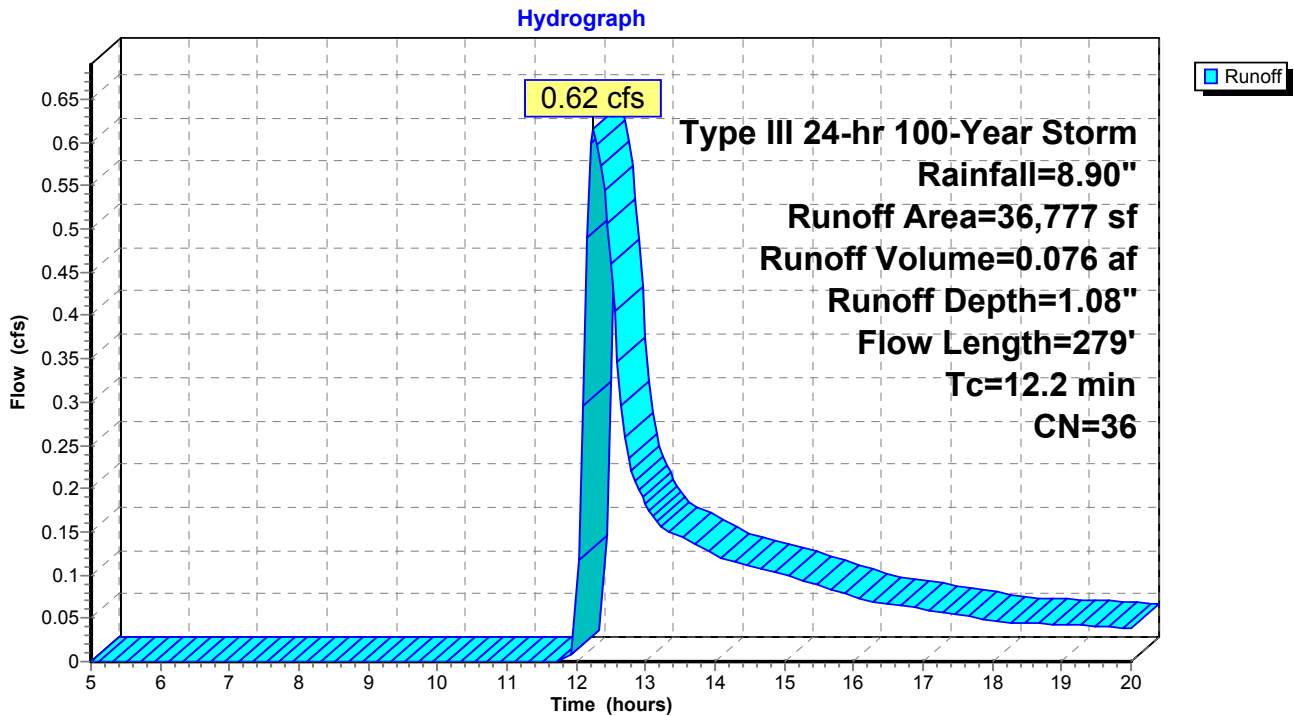
Runoff = 0.62 cfs @ 12.25 hrs, Volume= 0.076 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=8.90"

Area (sf)	CN	Description
36,777	36	Woods, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.1		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	61	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.7	168	0.0230	0.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.2	279	Total			

Subcatchment 1S_E: Predevelopment



Subcatchment 1S_P:

Runoff = 1.95 cfs @ 12.04 hrs, Volume= 0.121 af, Depth= 5.87"

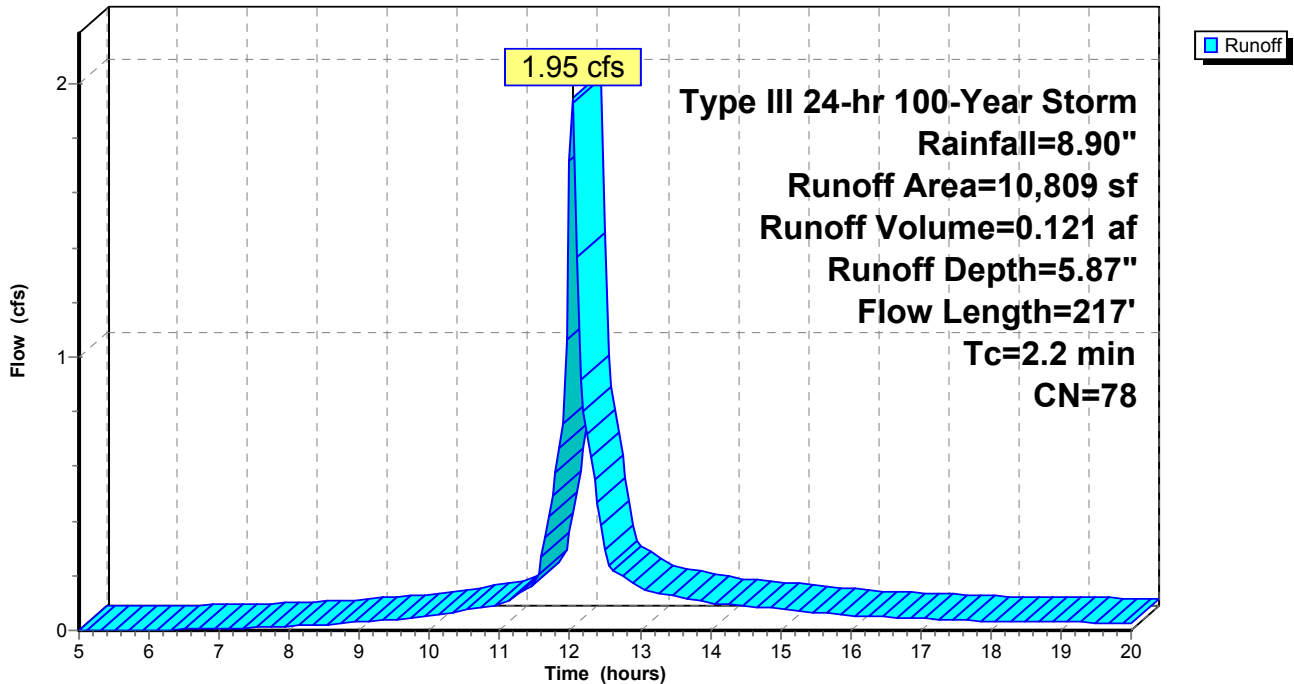
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Storm Rainfall=8.90"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
489	39	>75% Grass cover, Good, HSG A
3,096	36	Woods, Fair, HSG A
10,809	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 1S_P:

Hydrograph



Subcatchment 2S_P:

Runoff = 1.88 cfs @ 12.04 hrs, Volume= 0.119 af, Depth= 6.23"

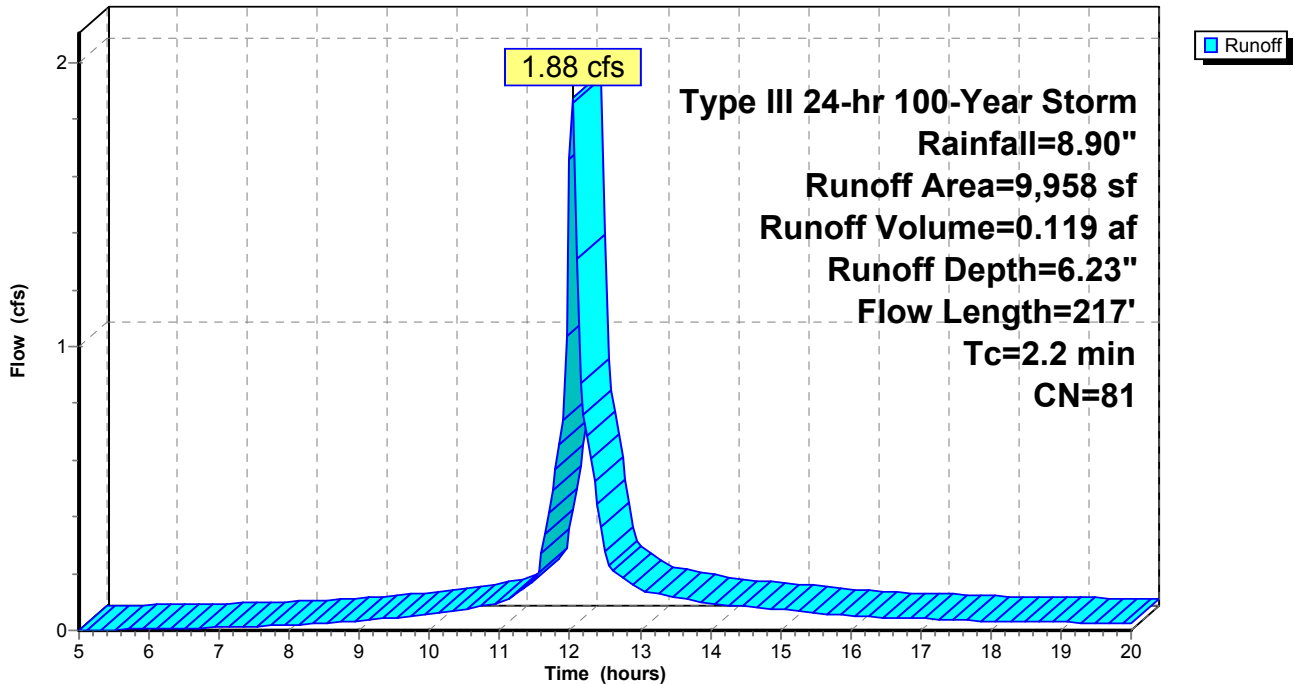
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Storm Rainfall=8.90"

Area (sf)	CN	Description
7,224	98	Pavement/Curb
426	39	>75% Grass cover, Good, HSG A
2,308	36	Woods, Fair, HSG A
9,958	81	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.9		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
1.3	167	0.0110	2.1		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.2	217	Total			

Subcatchment 2S_P:

Hydrograph



Subcatchment 3S_P: Remaining Land

Runoff = 0.38 cfs @ 12.12 hrs, Volume= 0.036 af, Depth= 1.18"

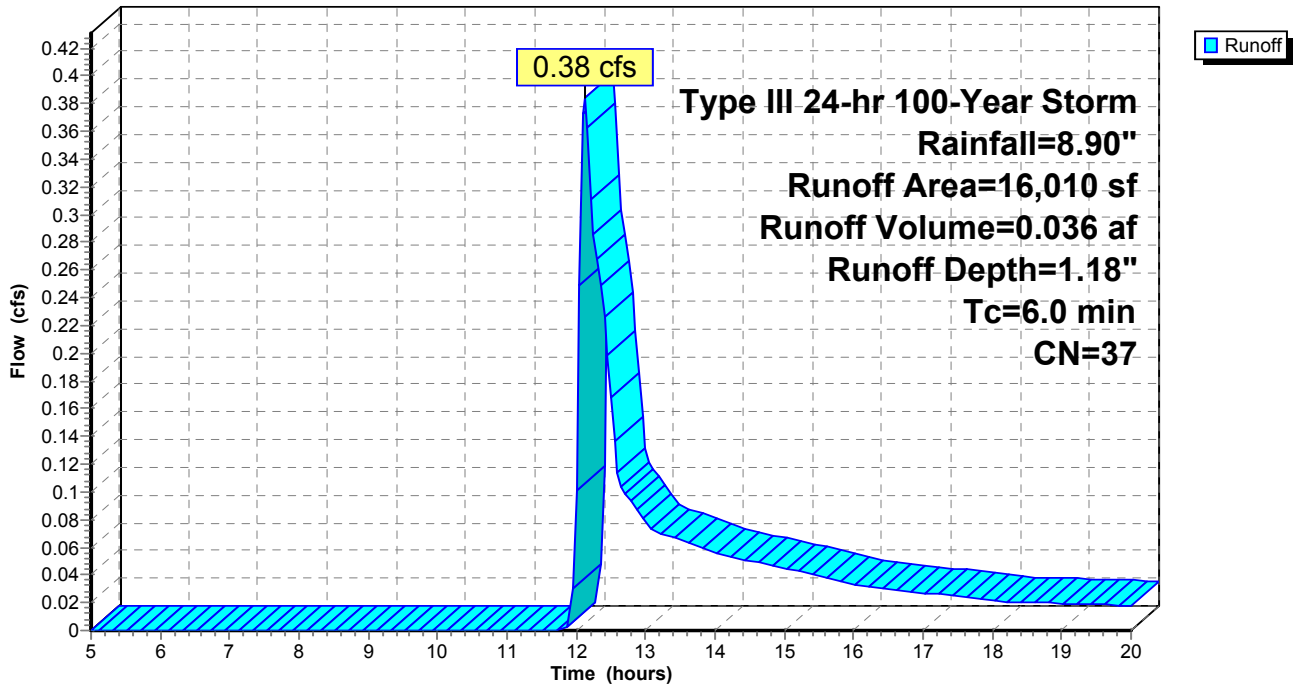
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Storm Rainfall=8.90"

Area (sf)	CN	Description
326	98	ret wall
15,684	36	Woods, Fair, HSG A
16,010	37	Weighted Average

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

Subcatchment 3S_P: Remaining Land

Hydrograph



Pond 1P: Infiltration Trench (Northerly Side of road)

Inflow Area = 0.248 ac, Inflow Depth = 5.87" for 100-Year Storm event
 Inflow = 1.95 cfs @ 12.04 hrs, Volume= 0.121 af
 Outflow = 0.68 cfs @ 11.90 hrs, Volume= 0.121 af, Atten= 65%, Lag= 0.0 min
 Discarded = 0.68 cfs @ 11.90 hrs, Volume= 0.121 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1.78' @ 12.27 hrs Surf.Area= 978 sf Storage= 698 cf
 Plug-Flow detention time= 4.7 min calculated for 0.121 af (100% of inflow)
 Center-of-Mass det. time= 4.7 min (773.2 - 768.5)

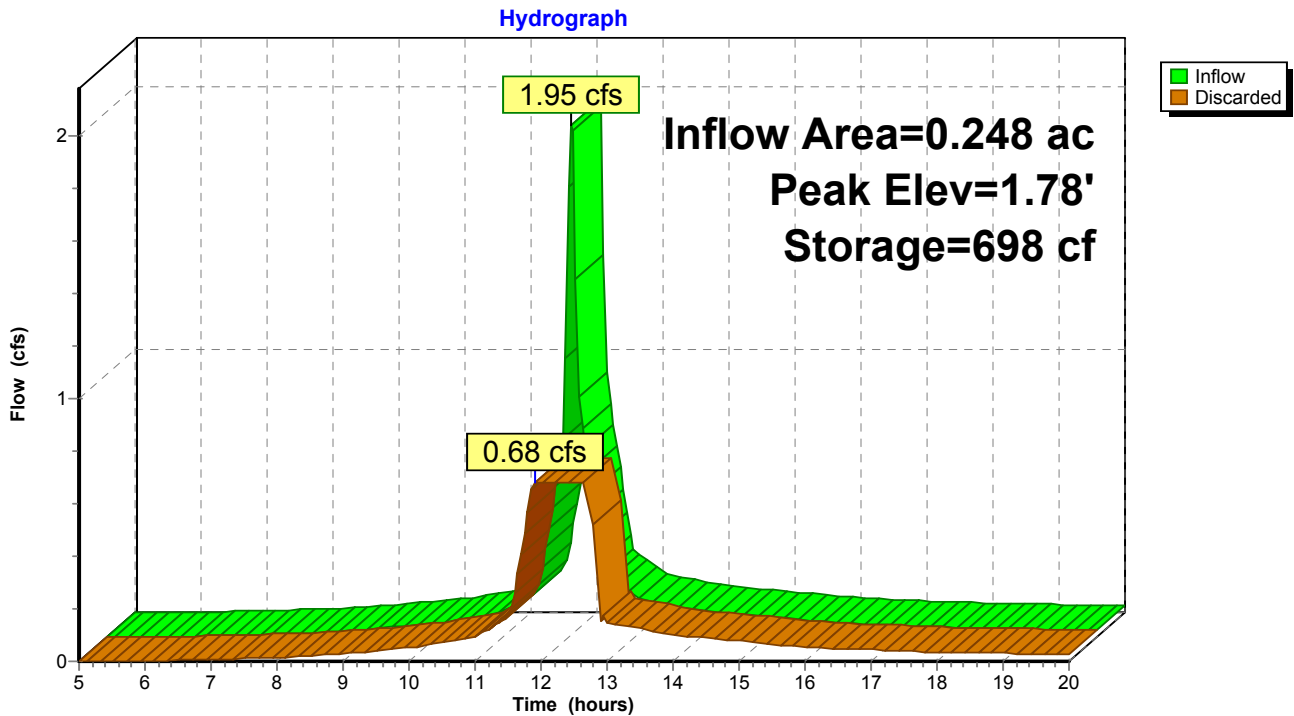
#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 11.90 hrs HW=0.05' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.68 cfs)

Pond 1P: Infiltration Trench (Northerly Side of road)



Pond 2P: Infiltration Trench (Southerly Side of Road)

Inflow Area = 0.229 ac, Inflow Depth = 6.23" for 100-Year Storm event
 Inflow = 1.88 cfs @ 12.04 hrs, Volume= 0.119 af
 Outflow = 0.68 cfs @ 11.90 hrs, Volume= 0.119 af, Atten= 64%, Lag= 0.0 min
 Discarded = 0.68 cfs @ 11.90 hrs, Volume= 0.119 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 1.64' @ 12.25 hrs Surf.Area= 978 sf Storage= 640 cf
 Plug-Flow detention time= 4.2 min calculated for 0.119 af (100% of inflow)
 Center-of-Mass det. time= 4.1 min (766.8 - 762.7)

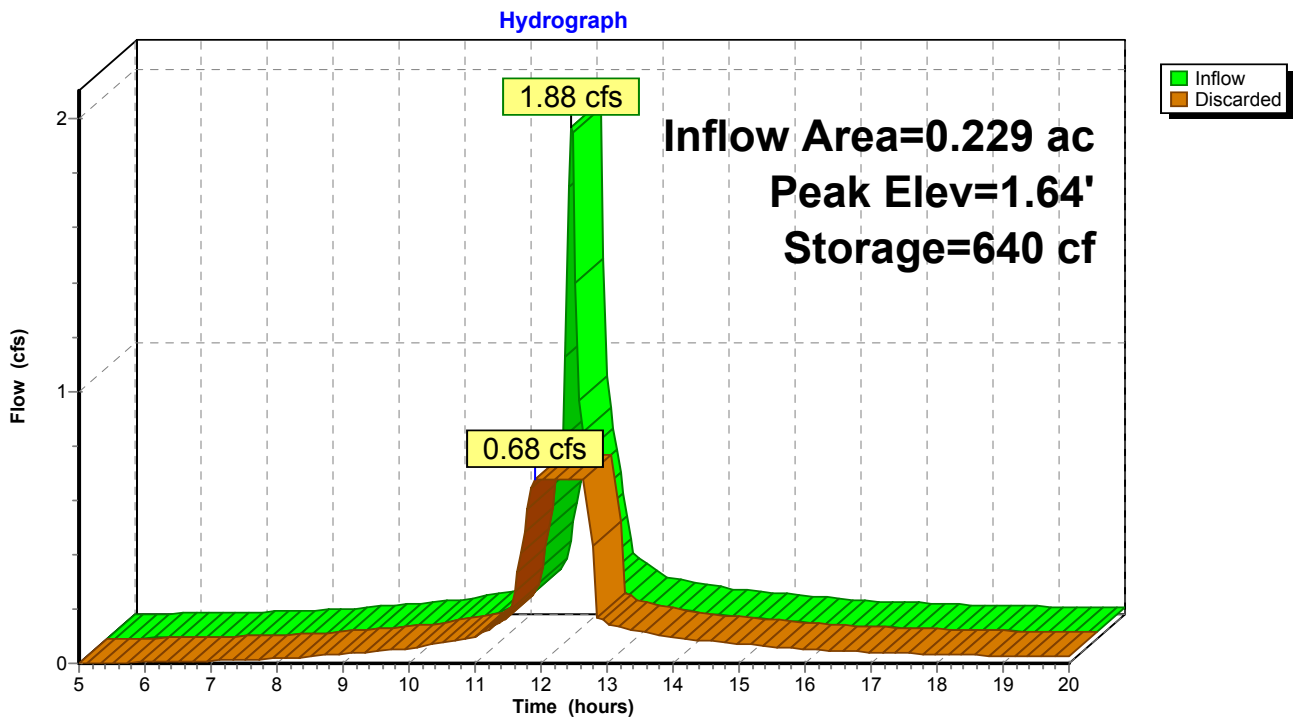
#	Invert	Avail.Storage	Storage Description
1	0.00'	1,045 cf	6.00'W x 163.00'L x 2.67'H Prismatic 2,611 cf Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.041600 fpm Exfiltration over entire Surface area

Discarded OutFlow Max=0.68 cfs @ 11.90 hrs HW=0.04' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.68 cfs)

Pond 2P: Infiltration Trench (Southerly Side of Road)

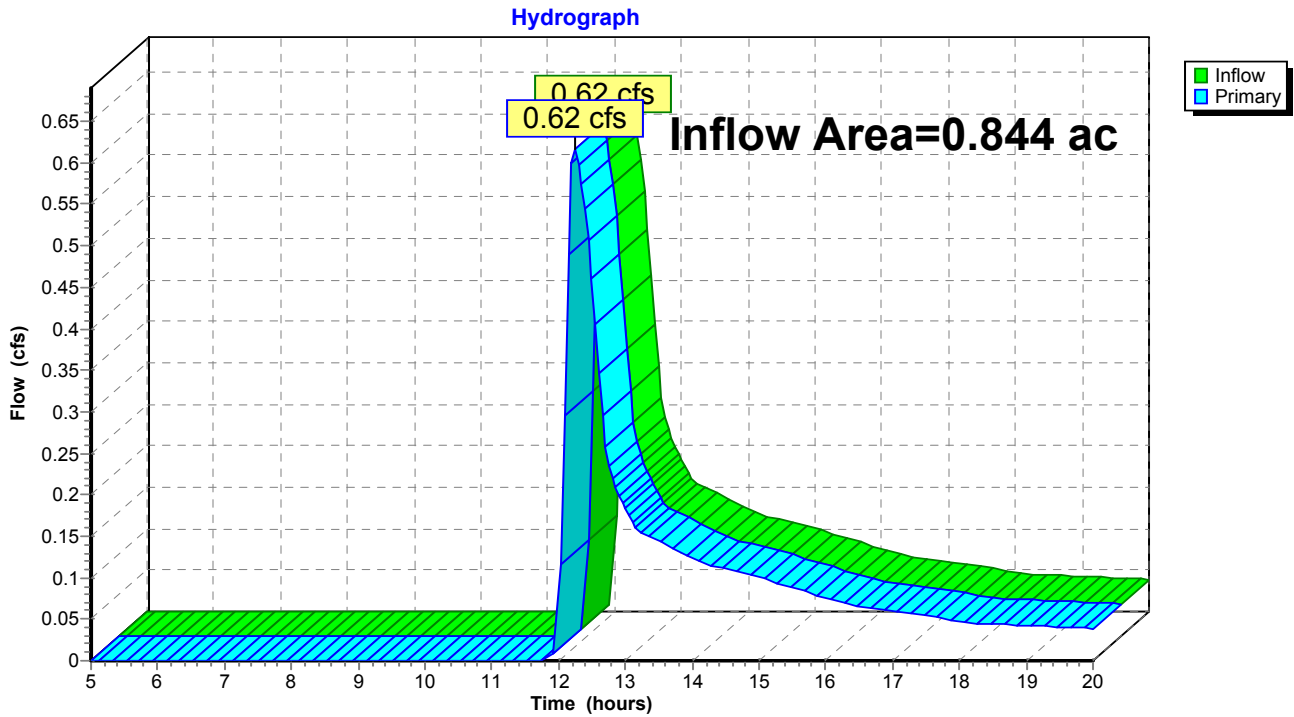


Link 1L: Total Offsite_PRE

Inflow Area = 0.844 ac, Inflow Depth = 1.08" for 100-Year Storm event
Inflow = 0.62 cfs @ 12.25 hrs, Volume= 0.076 af
Primary = 0.62 cfs @ 12.25 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Total Offsite_PRE



Link 1L_P: Total Offsite_Post

Inflow Area = 0.368 ac, Inflow Depth = 1.18" for 100-Year Storm event
Inflow = 0.38 cfs @ 12.12 hrs, Volume= 0.036 af
Primary = 0.38 cfs @ 12.12 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L_P: Total Offsite_Post

Hydrograph

