STORMWATER IMPACT REPORT

FOR

Driveway Access

BLOCK 502.01, LOTS 47.02, 50.01, 51.01 & 52.01
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

Owner:
ROYAL SOMERSET INN, LLC
28 Ambrose Valley Lane
Piscataway, New Jersey 08854

Applicant:
COLOSSEO SOMERSET, INC.
244 Madison Ave., #2910
New York City, NY 10016

August 2022

Prepared By:

The Reynolds Group Inc.
575 ROUTE 28, SUITE 110
RARITAN, NEW JERSEY 08869

_____
Adonis Crispo, P.E.
N. J. License Number 44152

_____
F. Mitchel Ardman, P.E.
N. J. License Number 34317

TRG Project No. 22-005

TABLE OF CONTENTS

I. PROJECT SUMMARY

The applicant, Colosseo Somerset, Inc., proposes to construct a 24-ft wide access road across an unnamed tributary to the Raritan River. The proposed driveway access is located on existing Tax Lot 47.02, Block 502, Franklin Township, Somerset County. The existing property is a hotel site with paved driveways, parking, and a stormwater basin. Remainder of the hotel site (across the stream) property is undeveloped to date.

The current owner previously obtained Permits from the Department (NJDEP, Flood Hazard Area and Freshwater Wetlands) to construct a private connector road across this unnamed tributary to the Raritan River. The Permit also includes related site improvements for the hotel portion of the tract.

For the current site plan application, the scope of work is limited to the construction of approximately 470 ft of paved access road across the NJDEP regulated areas and modifications to the existing stormwater basin. The proposed stream crossing includes installations of a long-span arch culvert and relief box culverts. The existing onsite extended detention basin will be modified to comply with current stormwater quantity and water quality requirements. The proposed site improvements are located within Tax Lot 47.02, Block 502 only, and the net impervious coverage increase is approximately 0.33 Ac (14,224 sq. ft.).

GZA Geo Environmental Inc recently performed onsite geotechnical explorations to determine seasonal high-water table and field permeability rates. Based on findings by the Geotech, the onsite soils were reclassified as HSG 'D', see report in Appendix E.

The application also involves a major subdivision for the consolidation/subdivision of Tax Lots 47.02, 50.01, 51.01 and 52.01, Block 502.

II. GREEN INFRASTRUCTURE & STORMWATER ANALYSIS

GREEN INFRASTRUCTURE:

The stormwater design for the project incorporates Green Infrastructure (GI) BMP's. The existing extended detention basin will be modified and converted into a small scale bioretention system. The modified basin will continue to receive runoff from the existing hotel site and pavement runoff from the proposed private road across the unnamed east stream tributary. The GI bioretention basin is designed to meet stormwater quality and quantity requirements. The BMP includes an underdrain system due to poor soil permeability onsite, see geotechnical report in Appendix D.

The contributory drainage area to the proposed small-scale bioretention basin is 2.22 acres.

STORMWATER ANALYSIS:

A. STORMWATER QUANTITY

The proposed site improvements are located within Tax Lot 47.02, Block 502 only, as such, the stormwater design for this project is limited to this parcel. Tax Lot 47.02 is traversed by two unnamed tributaries (East and West) to the Raritan River. The limits of land disturbance associated with the proposed site improvements drain to the unnamed East tributary to the Raritan River. A large section of the site across the unnamed east and west tributaries will remain undeveloped for this project. The stormwater point of analysis for this project is taken along the northerly property line of the unnamed east tributary.

PRE-DEVELOPMENT CONDITIONS: The onsite drainage areas consist of the developed hotel site including an extended detention basin and the wooded areas that directly drain to the unnamed east tributary.

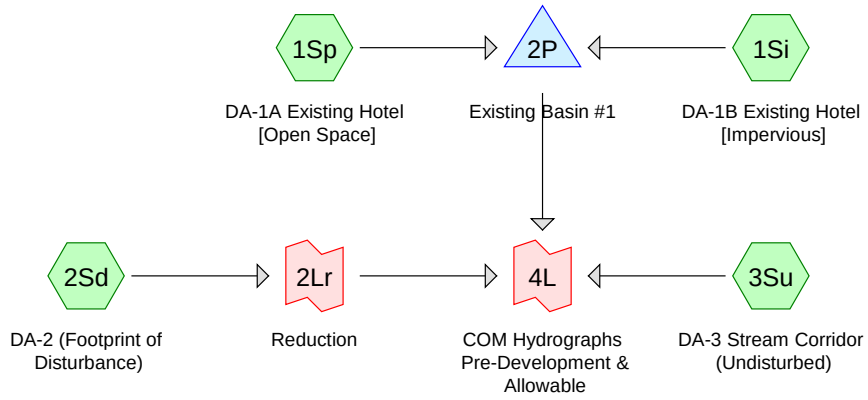
The allowable site peak flow rates are calculated by applying the 2-, 10- and 100-yr peak flow reduction factors for land disturbance associated with the proposed private road across the stream.

DRAINAGE DATA: PRE-DEVELOPMENT | ALLOWABLE FLOW

DA-1A Existing Hotel Site	34,271 SF – Open space including extended detention basin. CN 80 (Reclassified from HSG C to HSG D) Time of Concentration (Tc) 3.7 minutes
DA-1B Existing Hotel Site	63,475 SF - Building, pavement, sidewalks, and misc. paved areas CN 98 Time of Concentration (Tc) 1.9 minutes
DA-2 Footprint of Disturbance	20,201 SF – Woods, wetlands/regulated areas CN 77 (Reclassified from HSG C to HSG D) Time of Concentration (Tc) 12.9 minutes
DA-3 Stream Corridor	195,810 SF – Woods CN 70 Time of Concentration (Tc) 12.9 minutes

PRE-DEVELOPMENT AND ALLOWABLE FLOWS:

	Design Storm (CFS)		
	2-year	10-year	100-year
DA-1A, Ex. Hotel | O.S. {1Sp}	1.7	3.3	6.4
DA-1B, Ex. Hotel | Impv {1Si}	5.6	8.6	14.3
Existing Basin #1 {2P}			
Inflow	7.2	11.8	20.7
Outflow	1.2	2.4	17.2
Stage	*43.27'*	*44.25'*	*45.01'*
DA-2, Footprint of Dist. {2Sd}	0.6	1.3	2.6
Flow Reduction {2Lr}	(0.3)	(0.3)	(0.5)
DA-3 {3Su}	3.8	9.3	22.0
Pre-development Flow {4L} Combined Hydrographs	***5.4***	***12.9***	***37.0***
Allowable Flow {4L} Combined Hydrographs	**5.1**	**12.6**	**36.5**



PRE-DEVELOPMENT ROUTING DIAGRAM

POST-DEVELOPMENT CONDITIONS: The construction of the proposed private road for future access to developable land across the unnamed tributary to Raritan River will increase post-development site runoff. To control runoff from the site after development, the existing detention basin located behind the hotel building will be modified to meet stormwater quality and quantity requirements.

The alignment of the proposed driveway access will impact the footprint of the existing extended detention basin. As such, the existing facility will be modified and converted to a bioretention basin with underdrain system. The modified basin will also receive new impervious runoff from the proposed private road.

The design of the proposed bioretention basin is consistent with Township requirements for green infrastructure BMP. The modified bioretention basin is contained within the footprint of the existing basin. Reinforced concrete retaining walls are proposed within the basin perimeter to optimize storage volume for stormwater quantity compliance.

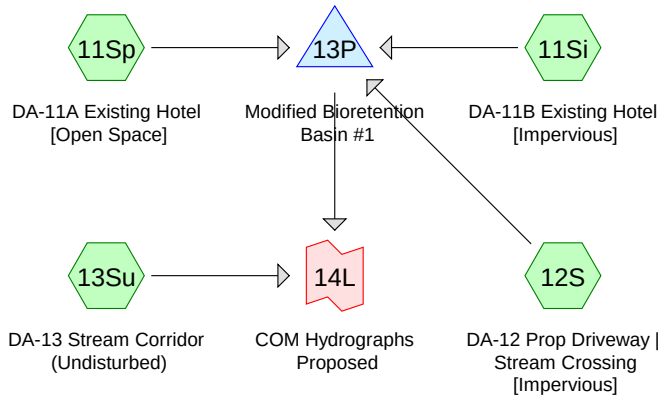
DRAINAGE DATA:	POST-DEVELOPMENT
DA-11A Existing Hotel Site	27,220 SF – Open space including modified bioretention basin CN 80 (Reclassified from HSG C to HSG D) Time of Concentration (Tc) 3.5 minutes
DA-11B Existing Hotel Site	61,808 SF - Building, pavement, sidewalks, and misc. paved areas CN 98 Time of Concentration (Tc) 1.7 minutes
DA-12 Prop. Driveway Access Stream Crossing	15,891 SF – Pavement and sidewalk CN 98 Time of Concentration (Tc) 3.6 minutes
DA-13 Stream Corridor	208,838 SF – Open Space & Woods CN 70 Time of Concentration (Tc) 12.9 minutes

POST-DEVELOPMENT FLOWS

Description	**Design Storm** (CFS)		
	2-year	10-year	100-year
DA-11A, Ex. Hotel {11Sp}	1.3	2.6	5.2
DA-11B, Ex. Hotel {11Si}	5.5	8.3	13.9
DA-12, Prop. Driveway {12S}	1.4	2.1	3.5
Bioretention Basin #1 {13P}			
Inflow	8.2	13.0	22.5
Outflow	1.2	2.8	15.7
Stage	*45.13'*	*45.97'*	*46.69'*
DA-13, Stream Corridor Undisturbed {13Su}	4.0	10.0	23.5
Post-development Flow {14L} Combined Hydrographs	**5.1**	**12.5**	**36.4**
Allowable Flow {4L} Combined Hydrographs	***5.1***	***12.6***	***36.5***

As shown above, proposed flow at the point of analysis is less than the allowable for each design storm, therefore, the project meets the stormwater quantity requirements.

The flood stages from the unnamed stream tributary to Raritan River will have tailwater effect on both existing extended detention and modified bioretention basins. The existing detention and proposed bioretention basin bottom elevations are 39.15 ft and 43.33 ft respectively. The approximate 100-yr flood elevation at existing outfall is approximately 43.68 from approved FHA delineation. Note that the peak flow from the stream lags with peak flow from the site; therefore, the modified basin has adequate storage.



POST-DEVELOPMENT ROUTING DIAGRAM

The modified bioretention basin is also designed to safely convey flow during an emergency event (blocked outlet structure for the 100-yr storm).

RESULTS FOR EMERGENCY STORM ANALYSIS

Description	Q_{inflow} (cfs)	$Q_{outflow}$ (cfs)	W.S.E. (ft)	Crest Elev (ft)	Top of Wall (ft)	Width (ft)	Vel (fps)	Allow. Vel (fps)
Bioretention Basin #1 {13P}	22.5	21.2	*47.17'*	46.75*	48.25	24.0	2.1	3.0

* Existing gabion lined emergency spillway to remain. Proposed 5-ft wide concrete toe/channelized slab to be installed at bottom of proposed concrete spillway, Elev. 45.50. The proposed drop spillway complies with the 2014 Standards for Soil Erosion and Sediment Control in NJ, Engineering Standards for Grade Stabilization Structure, drop is 1.25 ft < 3.0 ft.

The onsite soils for existing improved areas and extended detention basin footprint have been reclassified as HSG D per geotech's findings and recommendation. The remainder of proposed land disturbances for the driveway access and culvert(s) across the stream are in regulated areas. As such, HSG D curve number was used in the calculations within the limitst of disturbance.

The Time of Concentration (Tc) was calculated using the McCuen-Spiess maximum sheet flow limitation criterion in accordance with the National Engineering Handbook, Chapter 15, titled Time of Concentration, revised May 2010. The runoff parameters were computed using the methodologies outlined in the Natural Resource Conservation Service's Technical Release No. 55. The HydroCAD modeling software was used to compute the existing and developed runoff hydrographs utilizing local NOAA Atlas 14, Volume 2, Version 3 24-hr rainfall depths, Storm Curve 'C'. All input and the HydroCAD output data are provided in Appendix B.

B. STORMWATER QUALITY

In addition to providing adequate storage volume for the 2 through 100-year storm events, the modified stormwater facility is also designed to enhance the quality of runoff discharged from the site.

Adequate storage volume has been provided below the 8" orifice to infiltrate the entire water quality runoff volume through the soil bed and the underdrain will convey the treated runoff into the outlet structure. The 24" soil bed consists of loam or silt loam per USDA textural triangle to retain stormwater while still maintaining sufficient infiltration rate to provide 80% TSS removal rate. The underdrain system is designed to convey twice the soil bed infiltration rate. Therefore, the project meets the stormwater quality requirements. The WQ design storm data are summarized below:

Description	**Bioretention Basin #1**
Inflow	**5.8 cfs**
Peak Time	1.08 Hrs
Peak Stage	44.28'
Peak Volume	7,091 c.f.
Outflow	0
8" Orifice	Elev. 44.30'
Effective TSS Removal Rate	**80.0%**
Drain Time	W.Q. Design: 27.9 hours 100-yr Storm: 27.1 hours Total Drain Time: 55 hours @ Design Permeability Rate 0.5"/hr
Peak Underdrain Flow	0.10 cfs
4" Underdrain, (2) pipes|Orifice	2.02 cfs > 0.10 cfs

The underdrain system consists of a 10" clean stone layer (entire basin bottom) with rows of 4" perforated PVC pipes including (2) underdrain pipe tie-ins to the outlet structure. To determine underdrain pipe conveyance and drain time, a routing was performed through the bioretention system soil bed via infiltration and tie-in pipes as orifice.

See Appendix C for the HydroCAD Water Quality design storm output data and underdrain system conveyance calculations.

C. GROUNDWATER RECHARGE

GZA Geo Environmental Inc. performed subsurface explorations and in-situ infiltration testing onsite within the proposed area of disturbance (existing basin) and open space areas outside regulated buffer zones. The results of the geotech explorations and testing indicate that mapping units PenB, PenC and RehB within the project limits should be reclassified as HSG D. For more information, see the full Geotech report in Appendix E.

Based on the geotech's findings, negligible groundwater recharge is being provided under existing conditions and no structural stormwater measures to prevent the loss of groundwater recharge is required for this project.

IV. STORMWATER Pipe Design & Conduit Outlet Protection

The on-site storm sewer collection system has been designed to capture and convey the 25-year storm runoff. Critical pipe sections (downstream segment) between the rain gardens and bioretention basin and basin outlet pipe are designed to convey 100-year storm runoff. Pipe design output data (Hydraflow) show that the proposed inlets grates /manhole rim are above the 100-yr design storm hydraulic grade lines (HGL).

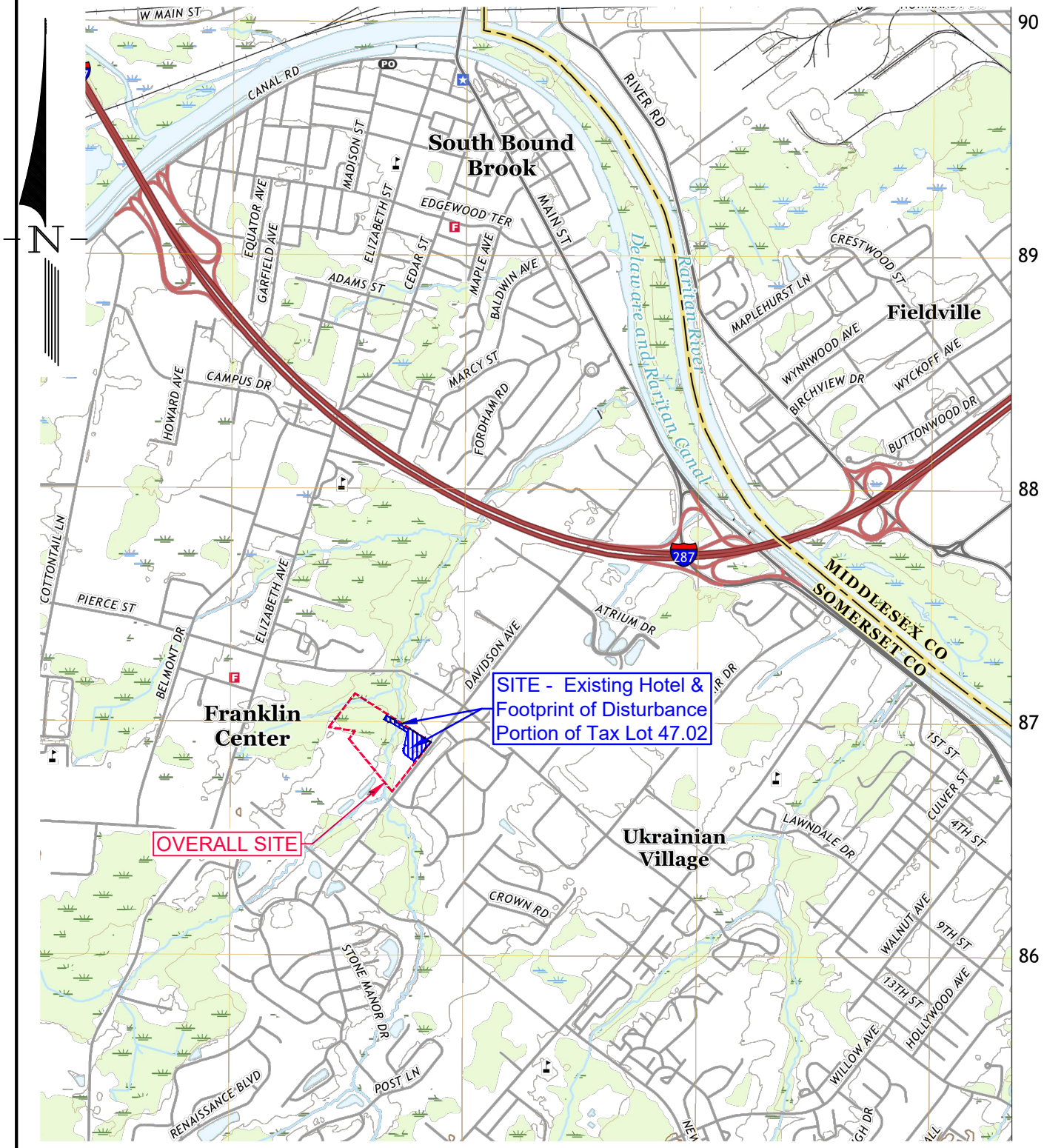
The design of the proposed stormwater management basins is in accordance with New Jersey Standards for Soil Erosion and Sediment Control. Conduit outlet protections (COP) will be installed at inflow pipes to the bioretention basin. The basin outfall pipe between existing storm manhole and flared end section including a scour hole will remain.

The design of the stormwater conveyance pipes complies with minimum and maximum pipe velocity parameters in the Stormwater Ordinance.

Supporting calculations for pipe conveyance and conduit outlet protections are located in Appendix D.

APPENDIX A

MAP FIGURES



BOUND BROOK QUADRANGLE, NJ
7.5-MINUTE SERIES, 2016

0 2,000 4,000
SCALE IN FEET

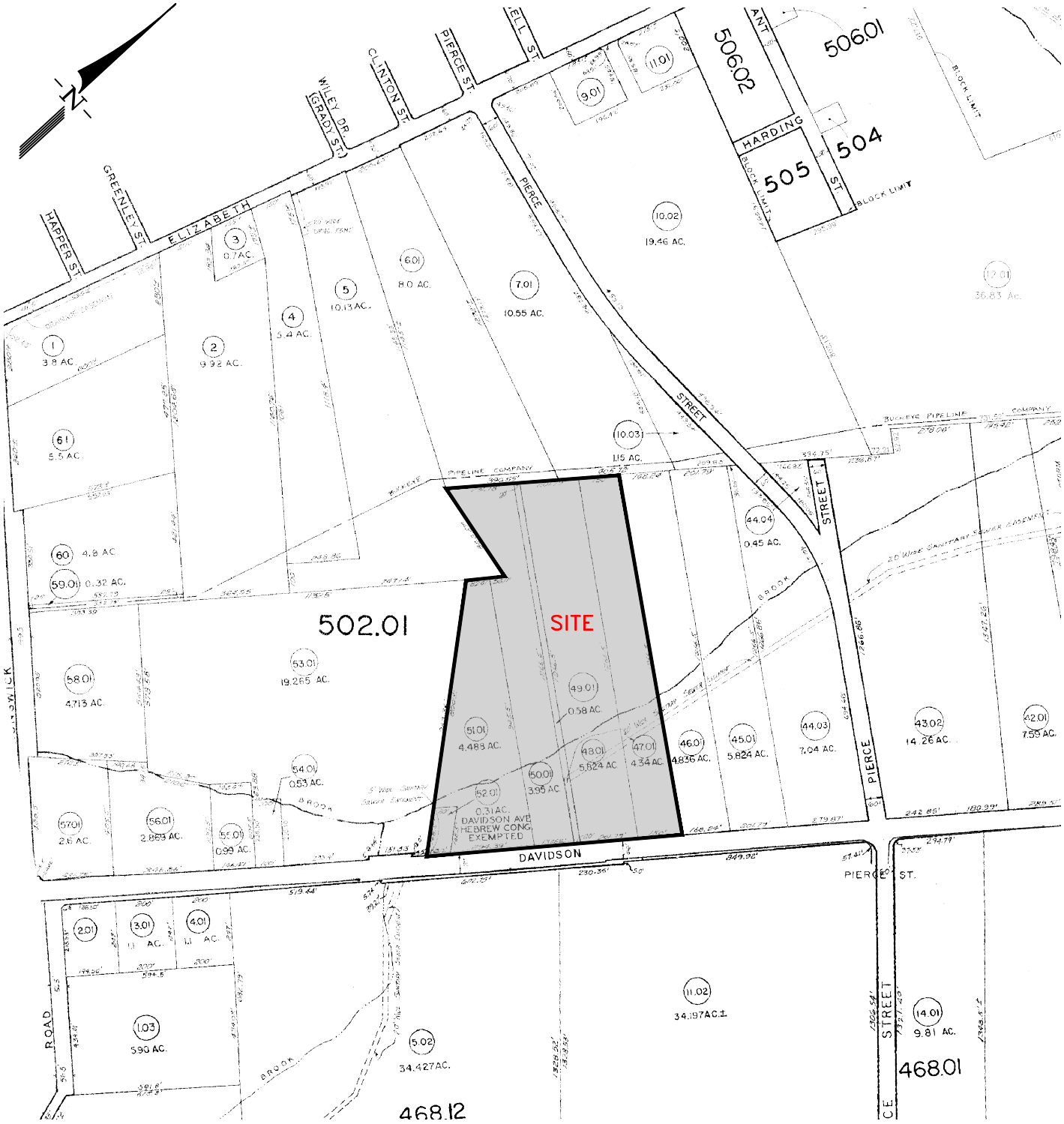
The Reynolds Group, Inc.
Engineers
Landscape Architects
Land Surveyors
Planners
575 Route 28, Suite 110
Raritan, N.J. 08869
Tele 908-722-1500
Fax 908-722-7035
F. Mitchel Ardman, P.E., P.P.
Jeffrey D. Reynolds, P.L.A.
State of New Jersey
Certificate of Authorization
Number 24GA27969200
21MH00004300

SCALE: 1"=2000'	TRG Job No.: 22-005	Date: JULY 2022

Project:
COLOSSEO - DAVIDSON AVE.
BLOCK 502.01, LOTS 47.02, 50.01, 51.01 & 52.01
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

Figure No.:
1

J:\ENGINEERING PROJECTS\2022\22-005 - COLOSSEO SOMERSET_CAD\DRAINAGE\22005 USGS.DWG-(7/6/22)



TAX MAP – FRANKLIN TOWNSHIP SHEET 89

The Reynolds Group Inc.

575 Route 28 Suite 110 Raritan, N.J. 08869 Tele 908–722–1500

Title: **TAX MAP**

Scale: NOT TO SCALE | TRG Job #: 22–005 | Date: JULY 2022

Project: **COLOSSEO – DAVIDSON AVE**
BLOCK 502.01, LOTS 47.02, 50.01, 51.01 & 52.01
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

Figure No.: 2

Soil Map—Somerset County, New Jersey
(Colosseo - Footprint of Disturbance)

Map Scale: 1:1,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

Figure 3

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PenB	Penn silt loam, 2 to 6 percent slopes	1.4	52.0%
PenC	Penn silt loam, 6 to 12 percent slopes	1.0	37.1%
RehB	Reaville silt loam, 2 to 6 percent slopes	0.1	2.4%
RorAt	Rowland silt loam, 0 to 2 percent slopes, frequently flooded	0.2	8.5%
Totals for Area of Interest		**2.7**	**100.0%**

APPENDIX B

CALCULATIONS FOR STORMWATER ANALYSIS

HydroCAD® Routing for Two, 10 and 100-yr storm events
Existing, Allowable and Proposed Conditions
Emergency Spillway Design

EXISTING CONDITIONS

NOAA Atlas 14, Volume 2, Version 3
Location name: Somerset, New Jersey, USA*
Latitude: 40.5317°, Longitude: -74.53°
Elevation: 60.82 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.332** (0.301-0.367)	**0.396** (0.358-0.437)	**0.469** (0.424-0.518)	**0.522** (0.471-0.576)	**0.587** (0.527-0.646)	**0.632** (0.565-0.696)	**0.678** (0.603-0.746)	**0.718** (0.636-0.792)	**0.768** (0.674-0.849)	**0.805** (0.702-0.893)
10-min	**0.531** (0.481-0.586)	**0.633** (0.573-0.699)	**0.751** (0.678-0.829)	**0.835** (0.753-0.921)	**0.935** (0.840-1.03)	**1.01** (0.900-1.11)	**1.08** (0.958-1.19)	**1.14** (1.01-1.25)	**1.22** (1.07-1.34)	**1.27** (1.11-1.41)
15-min	**0.663** (0.601-0.733)	**0.796** (0.721-0.878)	**0.950** (0.858-1.05)	**1.06** (0.953-1.17)	**1.19** (1.07-1.31)	**1.27** (1.14-1.40)	**1.36** (1.21-1.50)	**1.44** (1.27-1.58)	**1.53** (1.34-1.69)	**1.59** (1.39-1.76)
30-min	**0.909** (0.824-1.00)	**1.10** (0.995-1.21)	**1.35** (1.22-1.49)	**1.53** (1.38-1.69)	**1.76** (1.58-1.93)	**1.92** (1.72-2.11)	**2.08** (1.86-2.30)	**2.24** (1.98-2.47)	**2.43** (2.14-2.69)	**2.58** (2.25-2.86)
60-min	**1.13** (1.03-1.25)	**1.38** (1.25-1.52)	**1.73** (1.56-1.91)	**1.99** (1.80-2.20)	**2.34** (2.10-2.58)	**2.60** (2.33-2.86)	**2.87** (2.56-3.16)	**3.14** (2.78-3.46)	**3.49** (3.06-3.86)	**3.76** (3.28-4.17)
2-hr	**1.39** (1.25-1.54)	**1.69** (1.52-1.87)	**2.14** (1.93-2.38)	**2.50** (2.24-2.77)	**2.98** (2.66-3.30)	**3.38** (3.00-3.74)	**3.79** (3.34-4.20)	**4.22** (3.69-4.67)	**4.81** (4.17-5.35)	**5.29** (4.54-5.89)
3-hr	**1.54** (1.39-1.72)	**1.88** (1.70-2.10)	**2.38** (2.15-2.66)	**2.78** (2.50-3.10)	**3.33** (2.97-3.70)	**3.78** (3.35-4.19)	**4.24** (3.74-4.71)	**4.73** (4.13-5.25)	**5.40** (4.66-6.01)	**5.93** (5.08-6.62)
6-hr	**1.97** (1.78-2.21)	**2.40** (2.16-2.67)	**3.04** (2.73-3.38)	**3.56** (3.19-3.95)	**4.32** (3.82-4.77)	**4.94** (4.36-5.46)	**5.62** (4.90-6.20)	**6.34** (5.48-6.99)	**7.39** (6.29-8.16)	**8.25** (6.94-9.13)
12-hr	**2.40** (2.16-2.70)	**2.91** (2.61-3.27)	**3.71** (3.32-4.15)	**4.39** (3.91-4.90)	**5.39** (4.76-6.00)	**6.26** (5.49-6.95)	**7.21** (6.25-7.98)	**8.26** (7.07-9.16)	**9.81** (8.25-10.9)	**11.1** (9.22-12.4)
24-hr	**2.73** (2.53-2.96)	**3.30** (3.06-3.59)	**4.22** (3.91-4.59)	**5.02** (4.63-5.44)	**6.20** (5.68-6.71)	**7.23** (6.57-7.82)	**8.36** (7.54-9.06)	**9.63** (8.58-10.5)	**11.5** (10.1-12.5)	**13.1** (11.4-14.3)
2-day	**3.17** (2.90-3.48)	**3.83** (3.51-4.22)	**4.89** (4.47-5.37)	**5.77** (5.25-6.33)	**7.06** (6.39-7.74)	**8.15** (7.34-8.94)	**9.35** (8.34-10.3)	**10.6** (9.40-11.7)	**12.5** (10.9-13.9)	**14.1** (12.2-15.7)
3-day	**3.36** (3.08-3.69)	**4.06** (3.72-4.46)	**5.16** (4.72-5.66)	**6.07** (5.53-6.65)	**7.39** (6.70-8.09)	**8.50** (7.66-9.31)	**9.70** (8.68-10.6)	**11.0** (9.74-12.1)	**12.9** (11.2-14.2)	**14.4** (12.5-16.0)
4-day	**3.55** (3.26-3.89)	**4.29** (3.94-4.71)	**5.44** (4.98-5.95)	**6.37** (5.82-6.97)	**7.72** (7.02-8.44)	**8.84** (7.99-9.68)	**10.0** (9.01-11.0)	**11.3** (10.1-12.4)	**13.2** (11.6-14.5)	**14.7** (12.8-16.3)
7-day	**4.17** (3.86-4.53)	**5.00** (4.63-5.44)	**6.21** (5.74-6.75)	**7.21** (6.64-7.83)	**8.63** (7.91-9.38)	**9.82** (8.94-10.7)	**11.1** (10.0-12.1)	**12.4** (11.1-13.6)	**14.3** (12.7-15.7)	**15.9** (13.9-17.6)
10-day	**4.74** (4.41-5.12)	**5.66** (5.27-6.11)	**6.92** (6.43-7.47)	**7.95** (7.37-8.58)	**9.41** (8.68-10.2)	**10.6** (9.72-11.5)	**11.9** (10.8-12.8)	**13.2** (11.9-14.3)	**15.0** (13.4-16.4)	**16.5** (14.6-18.1)
20-day	**6.40** (6.02-6.80)	**7.59** (7.15-8.08)	**9.05** (8.52-9.64)	**10.2** (9.59-10.9)	**11.8** (11.0-12.5)	**13.0** (12.1-13.8)	**14.2** (13.2-15.2)	**15.4** (14.2-16.5)	**17.1** (15.6-18.4)	**18.4** (16.7-19.8)
30-day	**7.98** (7.56-8.42)	**9.42** (8.93-9.94)	**11.0** (10.4-11.6)	**12.2** (11.6-12.9)	**13.8** (13.0-14.6)	**15.0** (14.1-15.8)	**16.2** (15.2-17.1)	**17.3** (16.2-18.4)	**18.8** (17.4-20.0)	**19.9** (18.3-21.2)
45-day	**10.2** (9.66-10.7)	**11.9** (11.3-12.5)	**13.8** (13.1-14.5)	**15.1** (14.4-15.9)	**16.9** (16.0-17.8)	**18.2** (17.2-19.2)	**19.5** (18.4-20.5)	**20.7** (19.4-21.8)	**22.2** (20.8-23.5)	**23.3** (21.7-24.7)
60-day	**12.2** (11.6-12.7)	**14.3** (13.6-14.9)	**16.3** (15.5-17.1)	**17.8** (17.0-18.6)	**19.7** (18.7-20.6)	**21.1** (20.0-22.1)	**22.3** (21.2-23.4)	**23.5** (22.2-24.7)	**25.0** (23.5-26.3)	**26.0** (24.4-27.4)

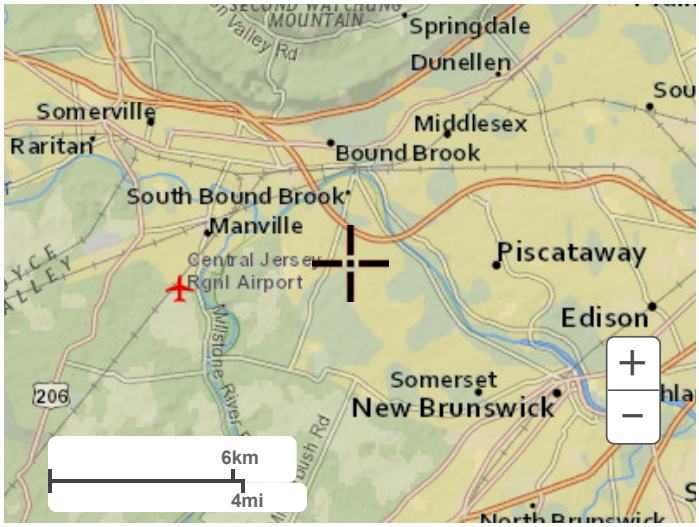
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

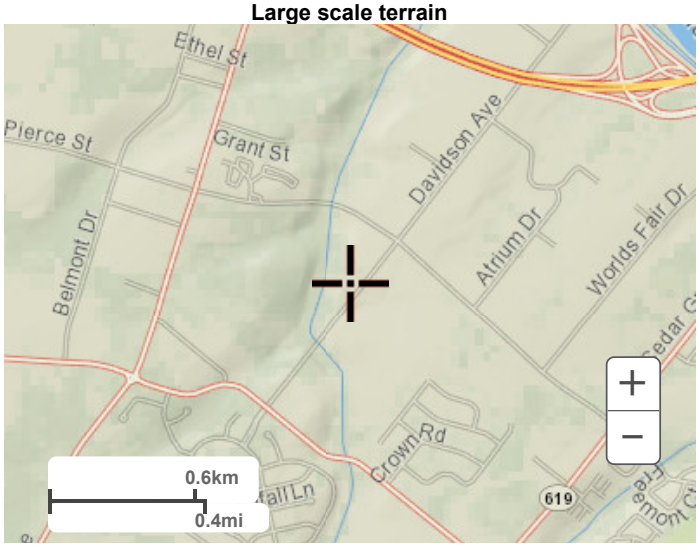
Please refer to NOAA Atlas 14 document for more information.

Back to Top

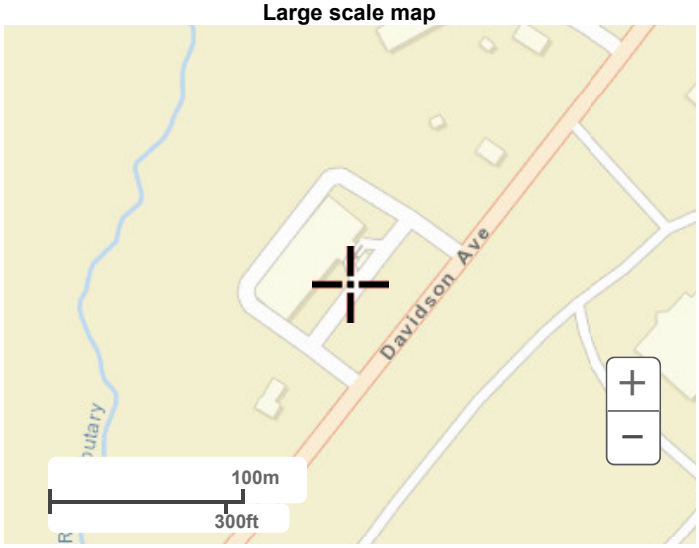
PF graphical



Large scale terrain



Large scale map



Large scale aerial

The Reynolds Group Inc.

Project: Driveway Access

Location: 315 Davidson Ave. - Fairfield Inn & Suites
Block 502.01, Lot 47.02
Franklin Twp, Somerset Co.
TRG 22-005

Existing
Basin #1

Existing Extended Detention Basin #1

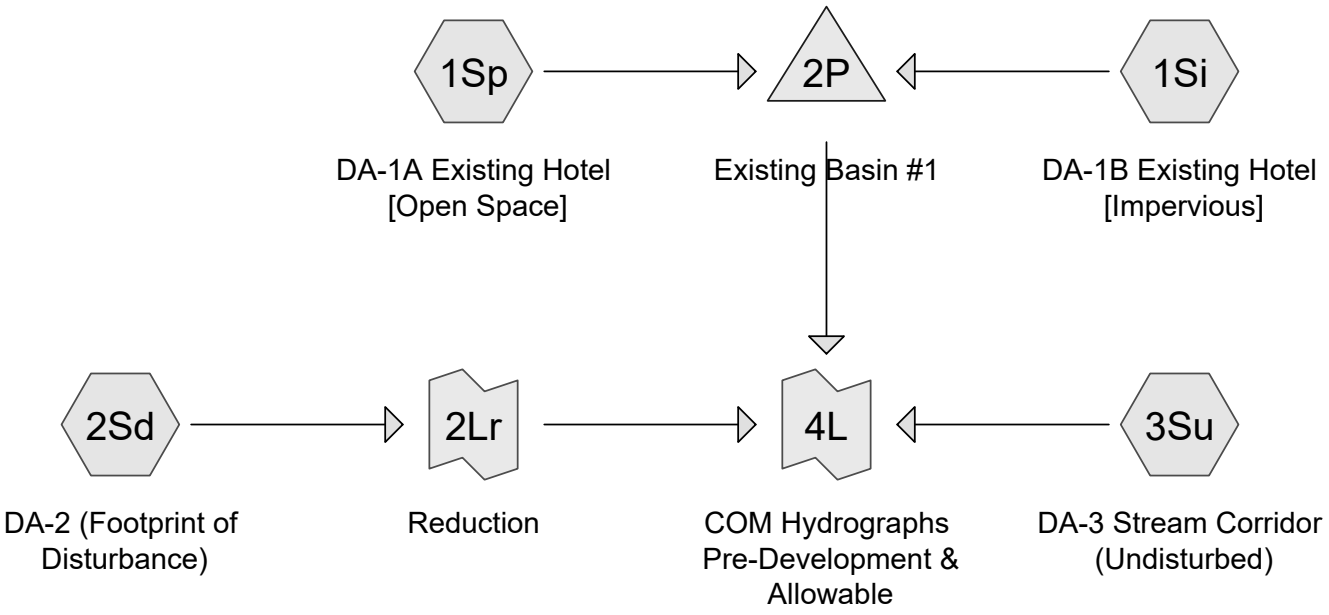
Elevation (feet)	Discharge (cfs)	Surface (sq-ft)	Cum. Storage (cubic-feet)	Cum. Storage (acre-feet)
39.15	0	0	0	0.000
40.00	0	81	34	0.001
41.00	0	1,422	786	0.018
42.00	0.21	3,320	3,157	0.072
43.00	0.88	4,360	6,997	0.161
44.00	2.01	5,463	11,908	0.273
45.00	16.88	6,972	18,036	0.414
45.50*	0.00	7,489	21,606	0.496
46.00	27.90	8,185	25,524	0.586

Existing Outlet Structure Data:

9" Fluidic Cone with 3.5" Outlet Elev. 39.15
0.5-ft Wide Weir: Elev. 42.35
Top Grate: Elev 44.52
**Emergency Spillway: Blocked Outlet Structure*
30-ft Wide Spillway: Elev 45.50

22-005 Pre Dev R0 MS
Prepared by The Reynolds Group, Inc.

TABLE OF CONTENTS



Subcat Reach Pond Link

Routing Diagram for 22-005 Pre Dev R0 MS
Prepared by The Reynolds Group, Inc.

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Si: DA-1B Existing Hotel Runoff Area=63,475 sf 100.00% Impervious Runoff Depth=3.07"
Flow Length=495' Tc=1.9 min CN=0/98 Runoff=5.60 cfs 0.372 af

Subcatchment 1Sp: DA-1A Existing Hotel Runoff Area=34,271 sf 0.00% Impervious Runoff Depth=1.48"
Flow Length=513' Tc=3.7 min CN=80/0 Runoff=1.68 cfs 0.097 af

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=1.28"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=0.60 cfs 0.050 af

Subcatchment 3Su: DA-3 Stream Corridor Runoff Area=195,810 sf 0.00% Impervious Runoff Depth=0.89"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=3.77 cfs 0.332 af

Pond 2P: Existing Basin #1 Peak Elev=43.27' Storage=8,211 cf Inflow=7.24 cfs 0.469 af
Outflow=1.17 cfs 0.469 af

Link 2Lr: Reduction Inflow=0.60 cfs 0.050 af
Primary=0.60 cfs 0.050 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=5.42 cfs 0.851 af
Primary=5.42 cfs 0.851 af

Total Runoff Area = 7.203 ac Runoff Volume = 0.851 af Average Runoff Depth = 1.42"
79.77% Pervious = 5.746 ac 20.23% Impervious = 1.457 ac

Summary for Subcatchment 1Si: DA-1B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

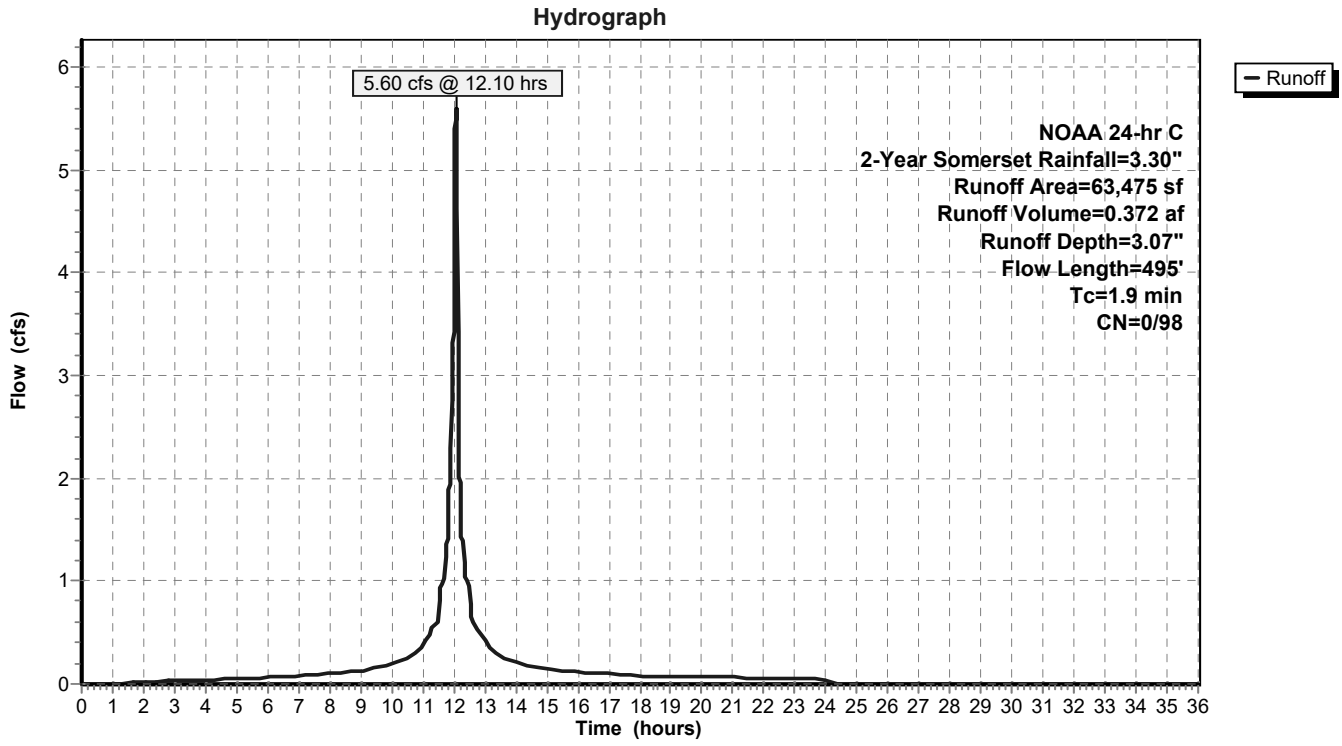
Runoff = 5.60 cfs @ 12.10 hrs, Volume= 0.372 af, Depth= 3.07"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Somerset Rainfall=3.30"

Area (sf)	CN	Description
63,475	98	Paved roads w/curbs & sewers, HSG D
63,475		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
1.9	495	Total			

Subcatchment 1Si: DA-1B Existing Hotel [Impervious]



Summary for Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

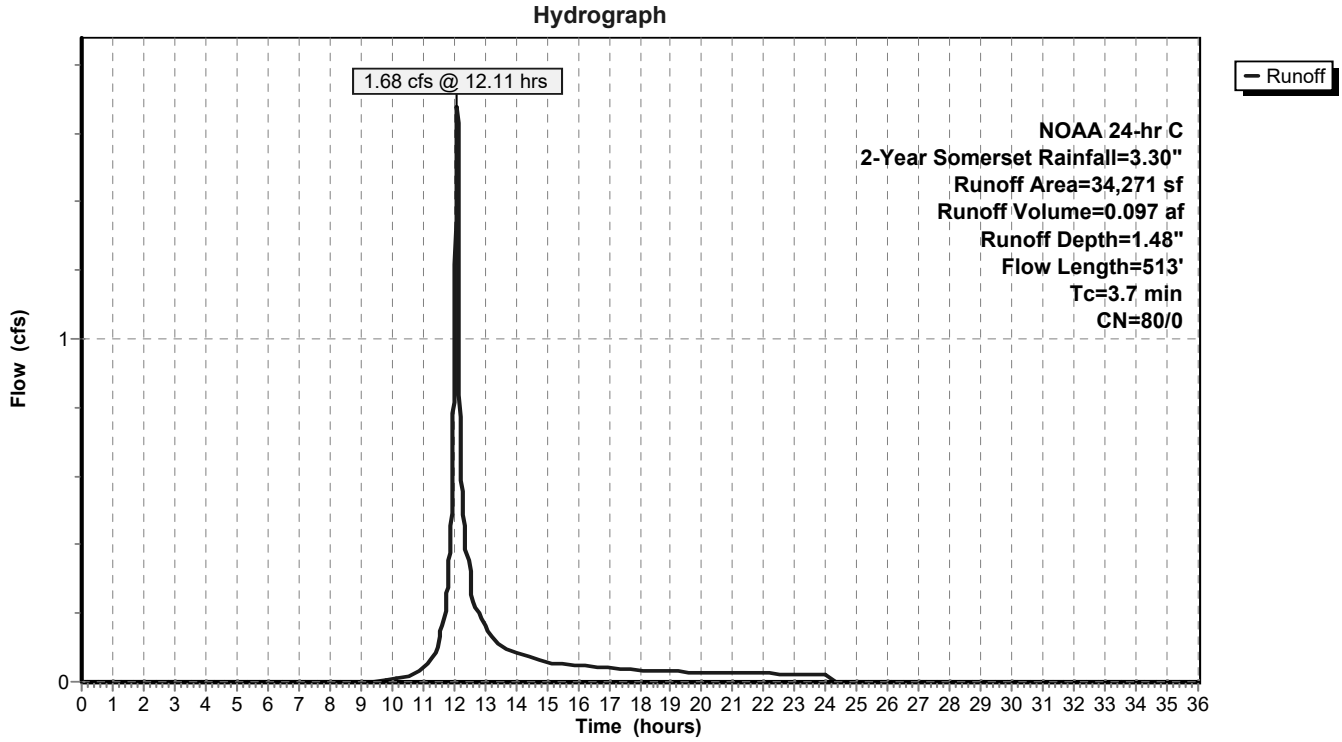
Runoff = 1.68 cfs @ 12.11 hrs, Volume= 0.097 af, Depth= 1.48"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Somerset Rainfall=3.30"

Area (sf)	CN	Description
34,271	80	>75% Grass cover, Good, HSG D
34,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
3.7	513	Total			

Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]



Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

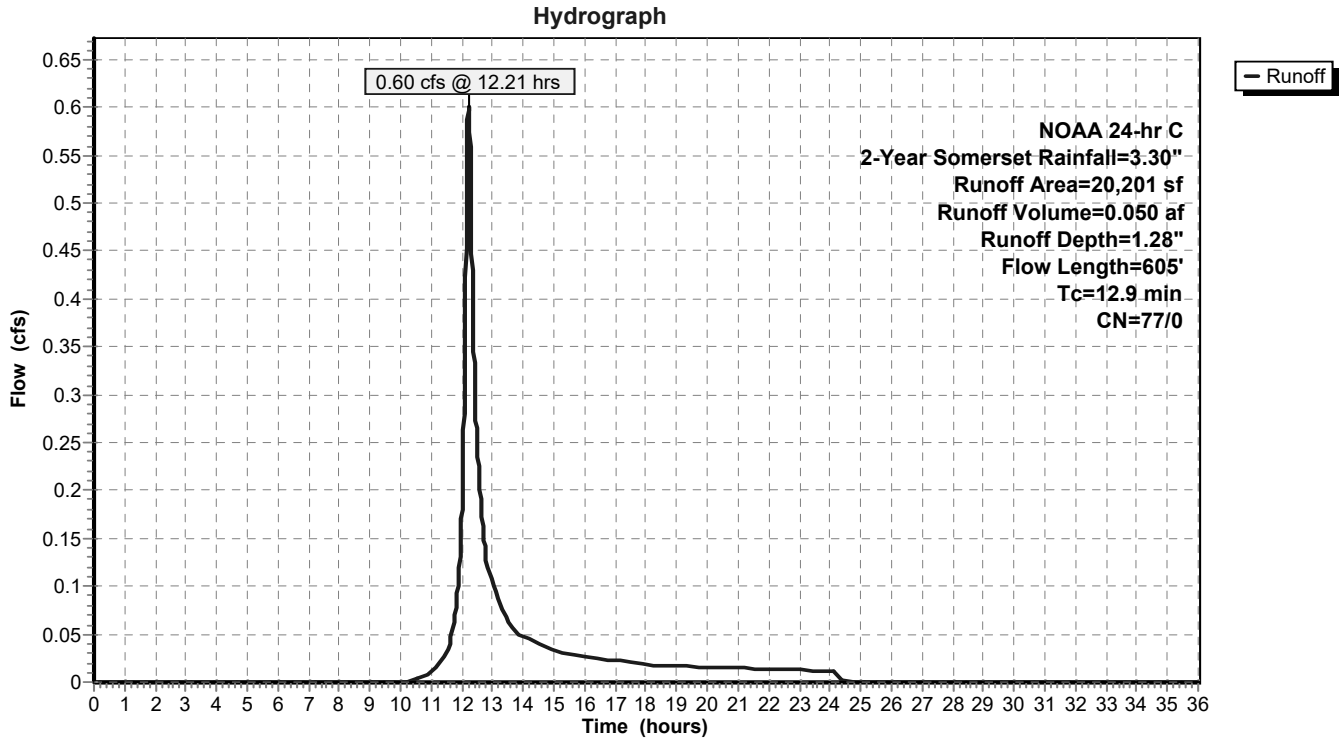
Runoff = 0.60 cfs @ 12.21 hrs, Volume= 0.050 af, Depth= 1.28"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Somerset Rainfall=3.30"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)



Summary for Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

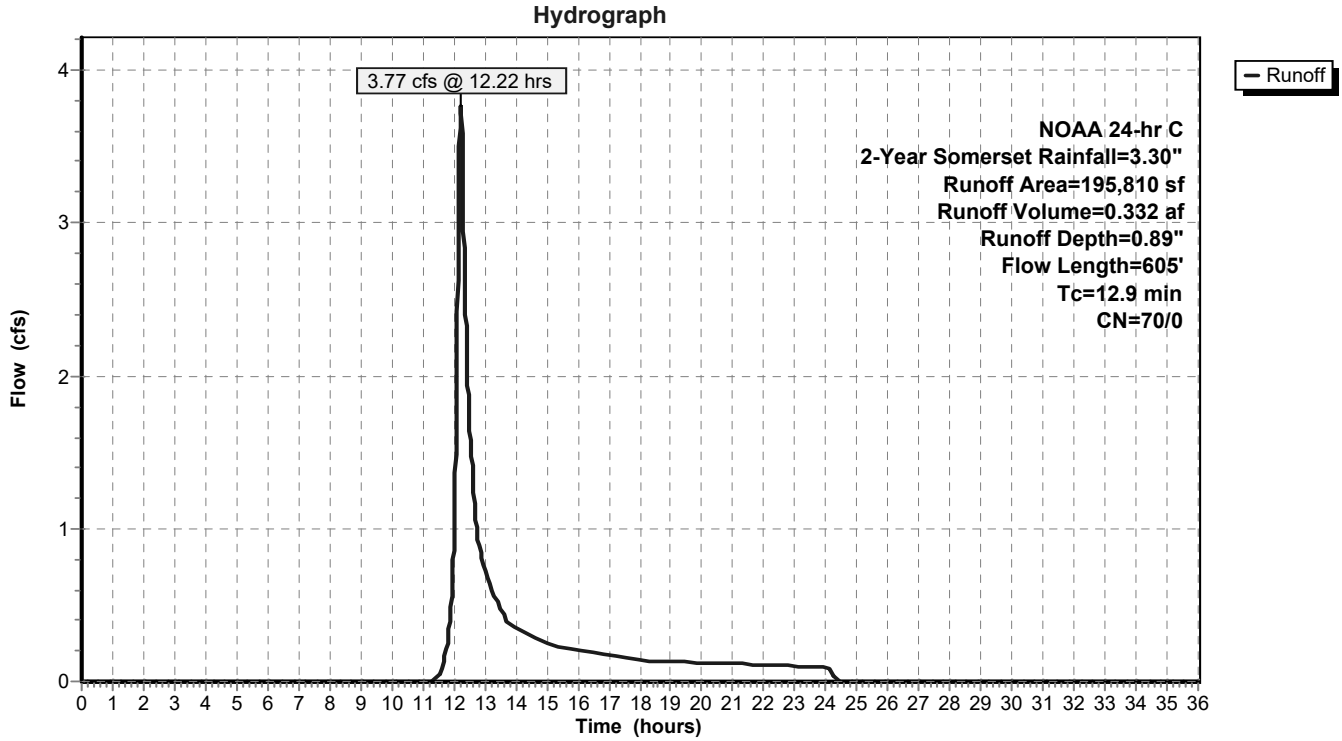
Runoff = 3.77 cfs @ 12.22 hrs, Volume= 0.332 af, Depth= 0.89"
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Somerset Rainfall=3.30"

Area (sf)	CN	Description
195,810	70	Woods, Good, HSG C
195,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)



Summary for Pond 2P: Existing Basin #1

Reference: As-built basin

Inflow Area = 2.244 ac, 64.94% Impervious, Inflow Depth = 2.51" for 2-Year Somerset event
Inflow = 7.24 cfs @ 12.10 hrs, Volume= 0.469 af
Outflow = 1.17 cfs @ 12.53 hrs, Volume= 0.469 af, Atten= 84%, Lag= 25.6 min
Primary = 1.17 cfs @ 12.53 hrs, Volume= 0.469 af
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 43.27' @ 12.53 hrs Surf.Area= 4,657 sf Storage= 8,211 cf

Plug-Flow detention time= 158.6 min calculated for 0.469 af (100% of inflow)
Center-of-Mass det. time= 158.6 min (930.1 - 771.5)

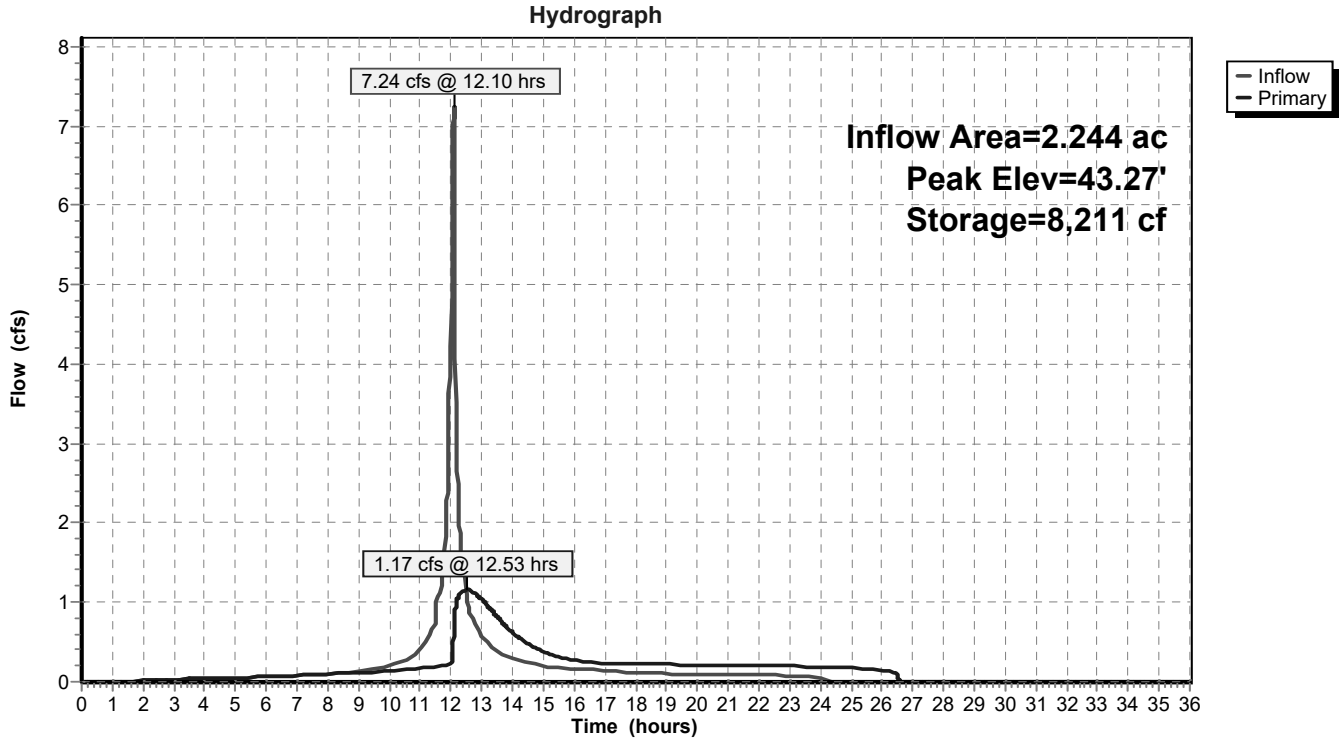
Volume	Invert	Avail.Storage	Storage Description
#1	39.15'	25,524 cf	**Existing Basin (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.15	0	0	0
40.00	81	34	34
41.00	1,422	752	786
42.00	3,320	2,371	3,157
43.00	4,360	3,840	6,997
44.00	5,463	4,912	11,908
45.00	6,792	6,128	18,036
46.00	8,185	7,489	25,524

Device	Routing	Invert	Outlet Devices
#1	Primary	39.15'	**9" Fluidic Cone with 3.5" outlet** Head (feet) 0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 6.50 Disch. (cfs) 0.000 0.060 0.090 0.110 0.120 0.140 0.150 0.170 0.180 0.190 0.200 0.210 0.220 0.230 0.230 0.240 0.250 0.260 0.270 0.320
#2	Primary	42.35'	**0.5' long Rectangular Weir** 2 End Contraction(s)
#3	Primary	44.52'	**48.0" x 48.0" Horiz. Grate X 0.75** C= 0.600 Limited to weir flow at low heads
#4	Primary	45.50'	**30.0' long x 10.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.17 cfs @ 12.53 hrs HW=43.27' (Free Discharge)
- **1=9" Fluidic Cone with 3.5" outlet** (Custom Controls 0.25 cfs)
- **2=Rectangular Weir** (Weir Controls 0.91 cfs @ 3.13 fps)
- **3=Grate** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 2P: Existing Basin #1

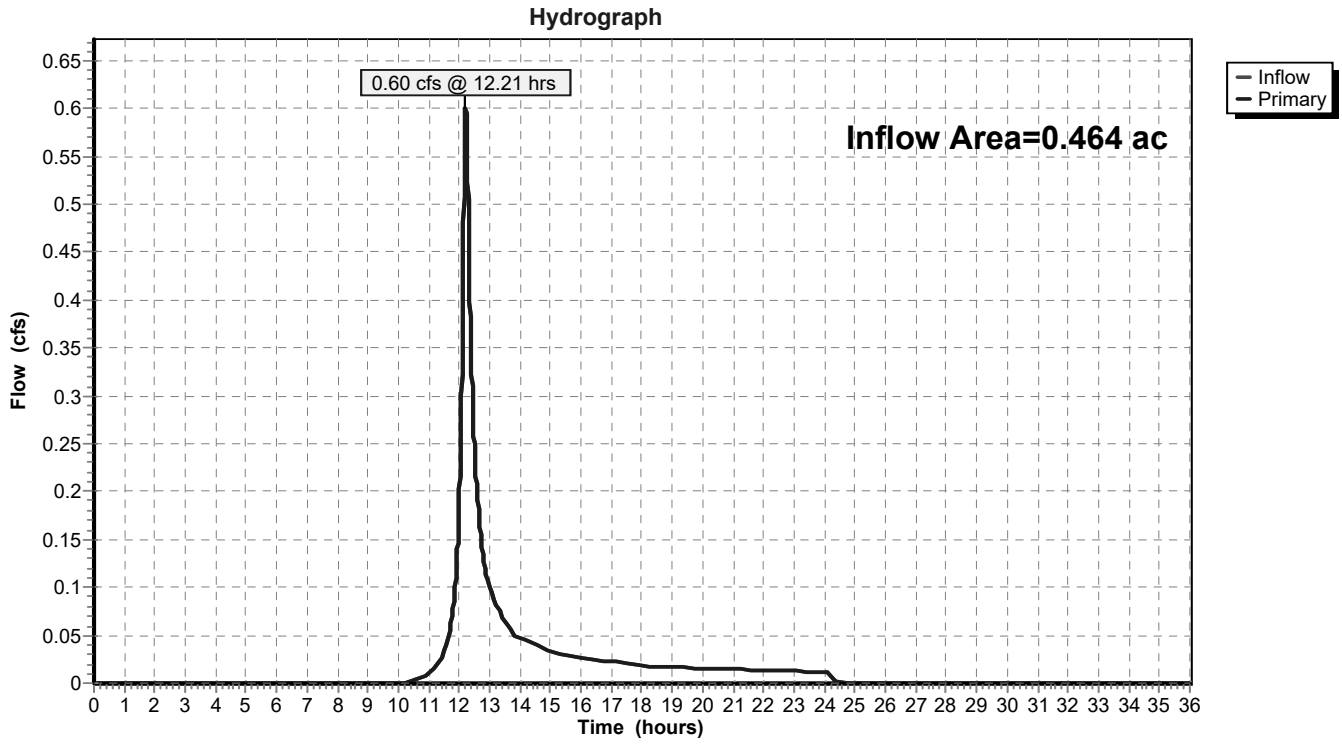


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 1.28" for 2-Year Somerset event
Inflow = 0.60 cfs @ 12.21 hrs, Volume= 0.050 af
Primary = 0.60 cfs @ 12.21 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction

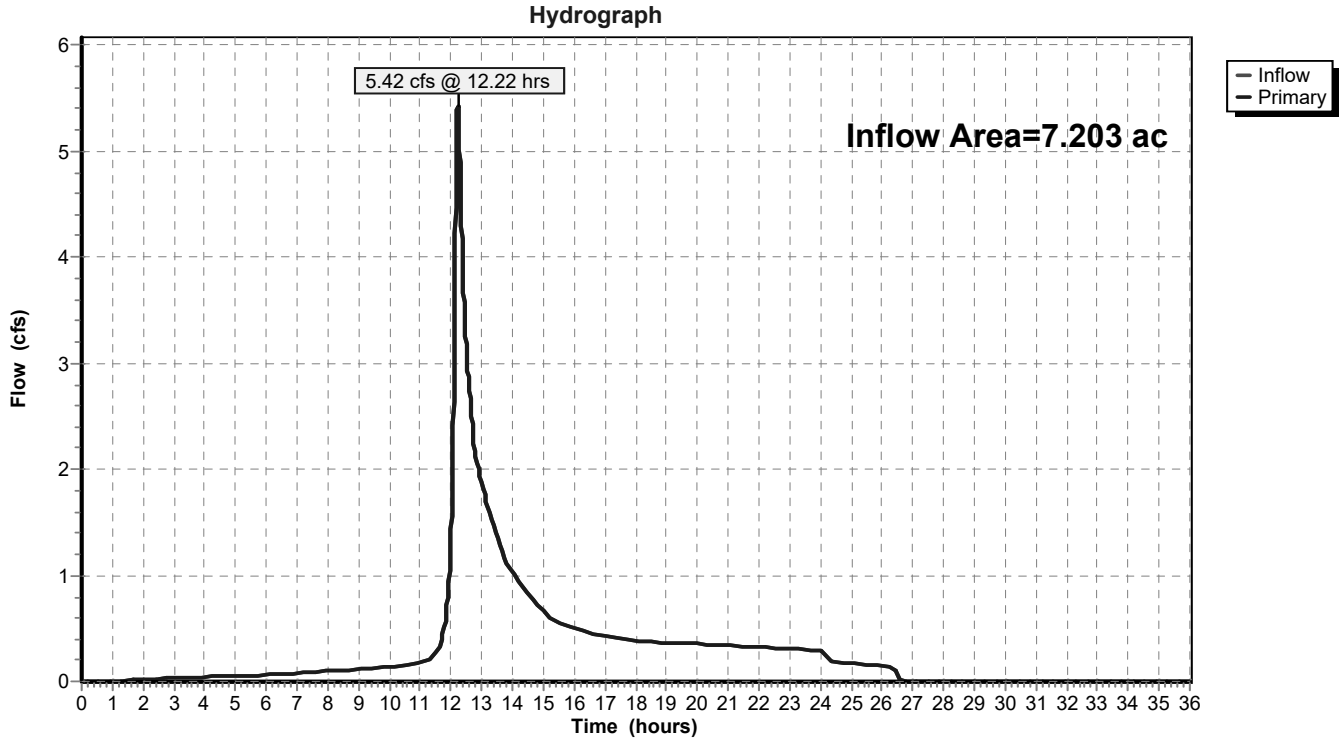


Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 1.42" for 2-Year Somerset event
Inflow = 5.42 cfs @ 12.22 hrs, Volume= 0.851 af
Primary = 5.42 cfs @ 12.22 hrs, Volume= 0.851 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Si: DA-1B Existing Hotel Runoff Area=63,475 sf 100.00% Impervious Runoff Depth=4.78"
Flow Length=495' Tc=1.9 min CN=0/98 Runoff=8.56 cfs 0.581 af

Subcatchment 1Sp: DA-1A Existing Hotel Runoff Area=34,271 sf 0.00% Impervious Runoff Depth=2.91"
Flow Length=513' Tc=3.7 min CN=80/0 Runoff=3.26 cfs 0.191 af

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=2.64"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=1.26 cfs 0.102 af

Subcatchment 3Su: DA-3 Stream Corridor Runoff Area=195,810 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=9.34 cfs 0.768 af

Pond 2P: Existing Basin #1 Peak Elev=44.25' Storage=13,314 cf Inflow=11.77 cfs 0.772 af
Outflow=2.43 cfs 0.772 af

Link 2Lr: Reduction Inflow=1.26 cfs 0.102 af
Primary=1.26 cfs 0.102 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=12.91 cfs 1.642 af
Primary=12.91 cfs 1.642 af

Total Runoff Area = 7.203 ac Runoff Volume = 1.642 af Average Runoff Depth = 2.74"
79.77% Pervious = 5.746 ac 20.23% Impervious = 1.457 ac

Summary for Subcatchment 1Si: DA-1B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

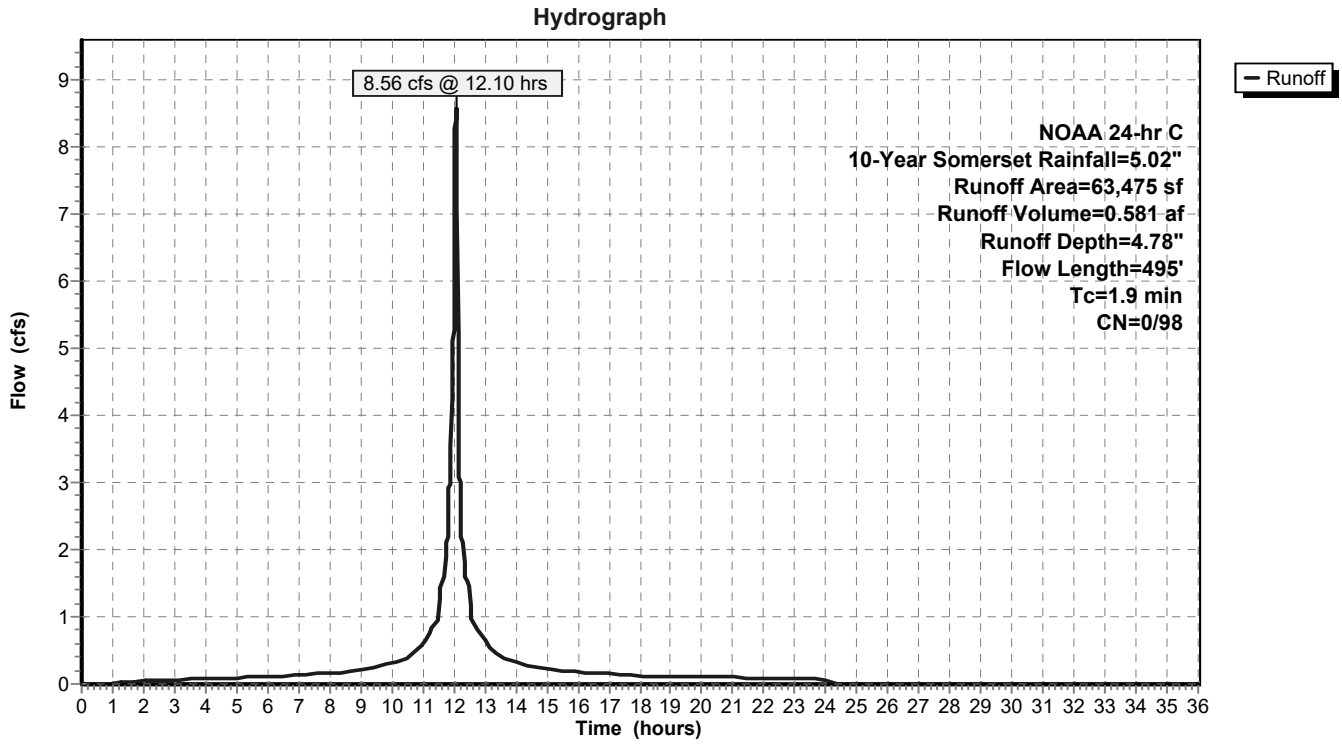
Runoff = 8.56 cfs @ 12.10 hrs, Volume= 0.581 af, Depth= 4.78"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Somerset Rainfall=5.02"

Area (sf)	CN	Description
63,475	98	Paved roads w/curbs & sewers, HSG D
63,475		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
1.9	495	Total			

Subcatchment 1Si: DA-1B Existing Hotel [Impervious]



Summary for Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

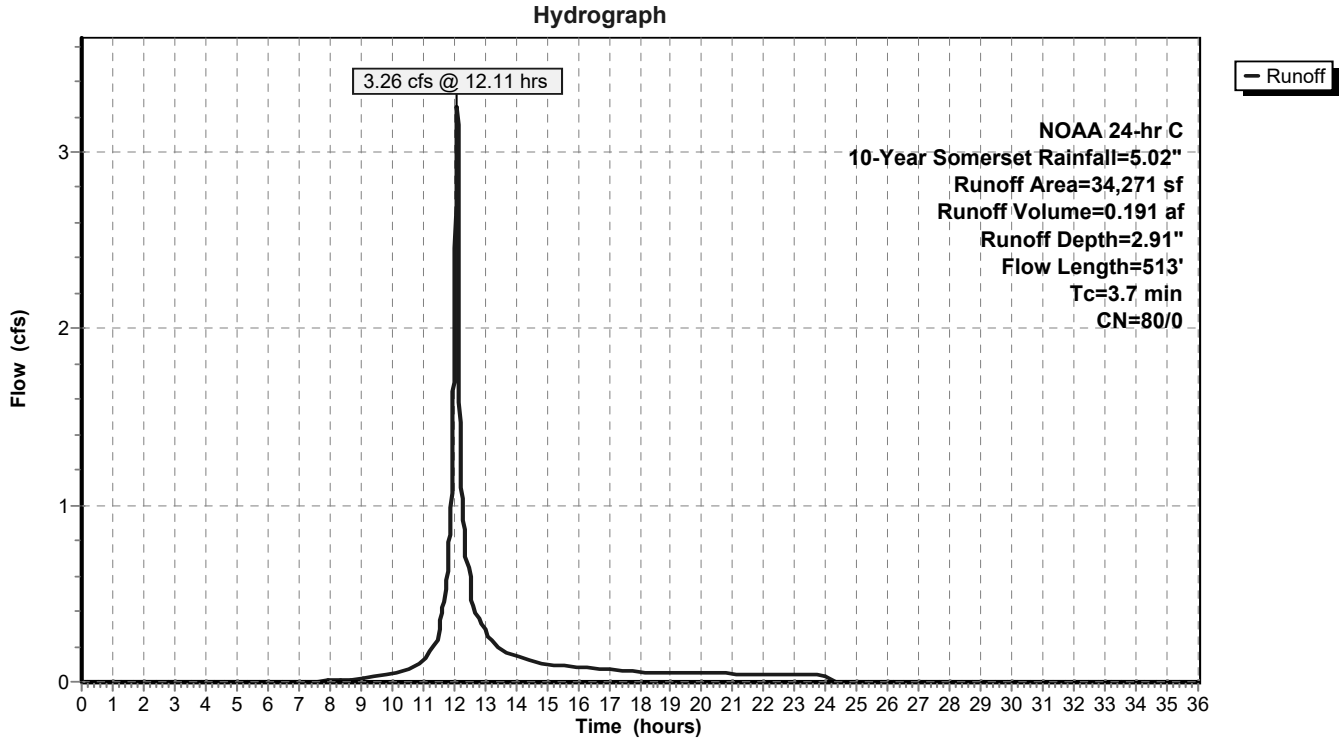
Runoff = 3.26 cfs @ 12.11 hrs, Volume= 0.191 af, Depth= 2.91"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Somerset Rainfall=5.02"

Area (sf)	CN	Description
34,271	80	>75% Grass cover, Good, HSG D
34,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
3.7	513	Total			

Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]



Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

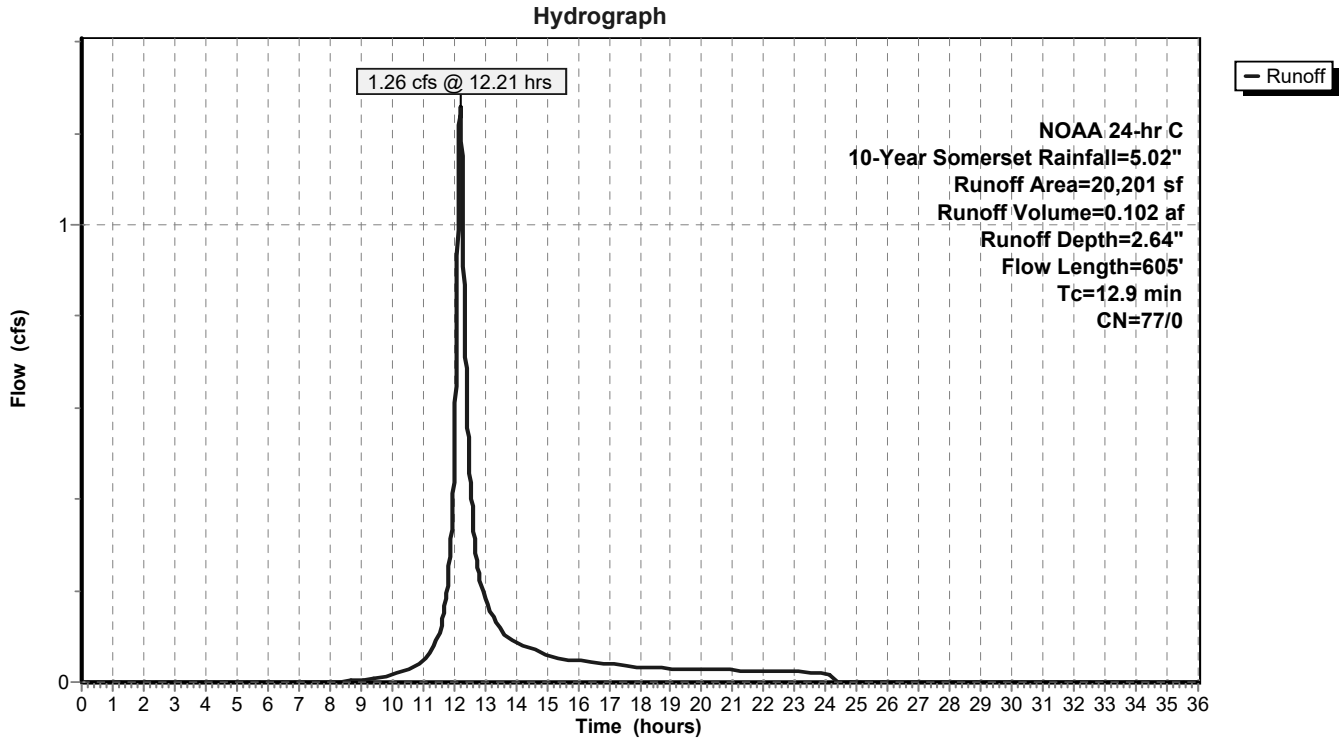
Runoff = 1.26 cfs @ 12.21 hrs, Volume= 0.102 af, Depth= 2.64"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Somerset Rainfall=5.02"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)



Summary for Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

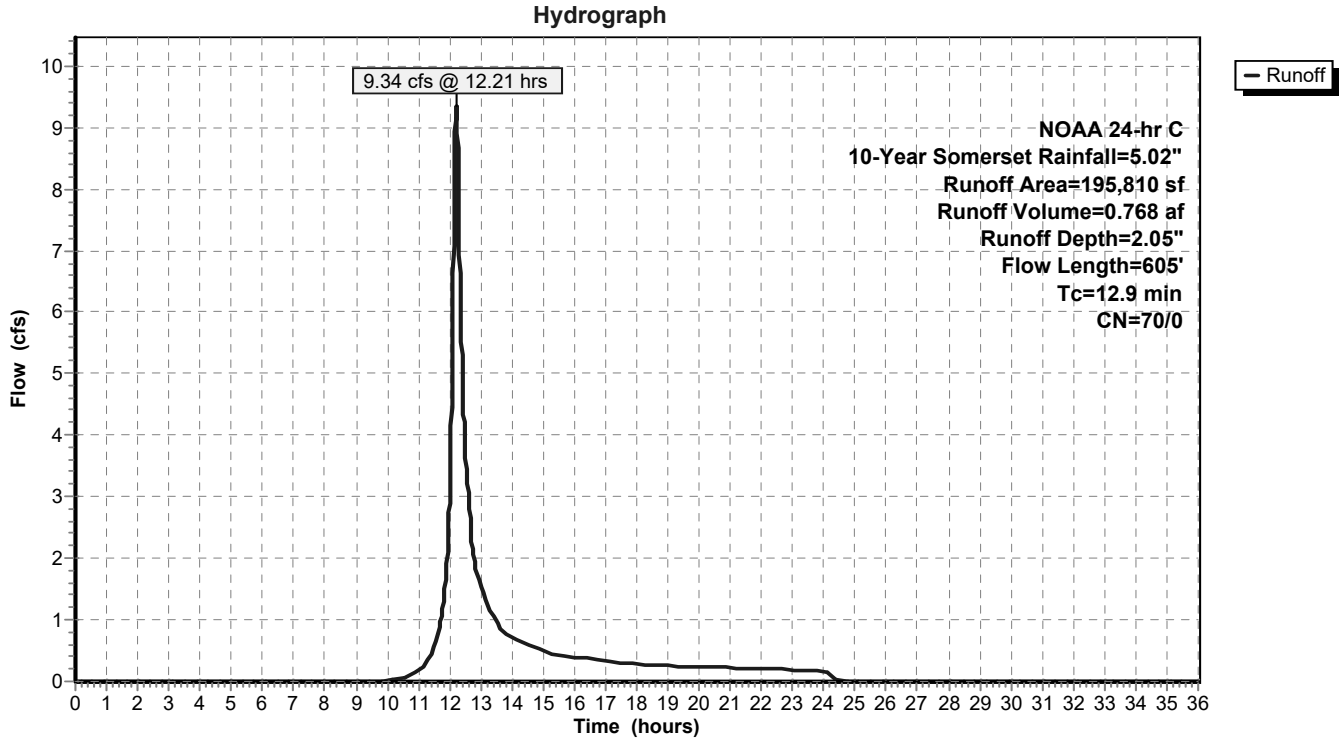
Runoff = 9.34 cfs @ 12.21 hrs, Volume= 0.768 af, Depth= 2.05"
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Somerset Rainfall=5.02"

Area (sf)	CN	Description
195,810	70	Woods, Good, HSG C
195,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)



Summary for Pond 2P: Existing Basin #1

Reference: As-built basin

Inflow Area = 2.244 ac, 64.94% Impervious, Inflow Depth = 4.13" for 10-Year Somerset event
Inflow = 11.77 cfs @ 12.10 hrs, Volume= 0.772 af
Outflow = 2.43 cfs @ 12.35 hrs, Volume= 0.772 af, Atten= 79%, Lag= 15.0 min
Primary = 2.43 cfs @ 12.35 hrs, Volume= 0.772 af
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 44.25' @ 12.35 hrs Surf.Area= 5,795 sf Storage= 13,314 cf

Plug-Flow detention time= 143.2 min calculated for 0.771 af (100% of inflow)
Center-of-Mass det. time= 143.2 min (907.4 - 764.2)

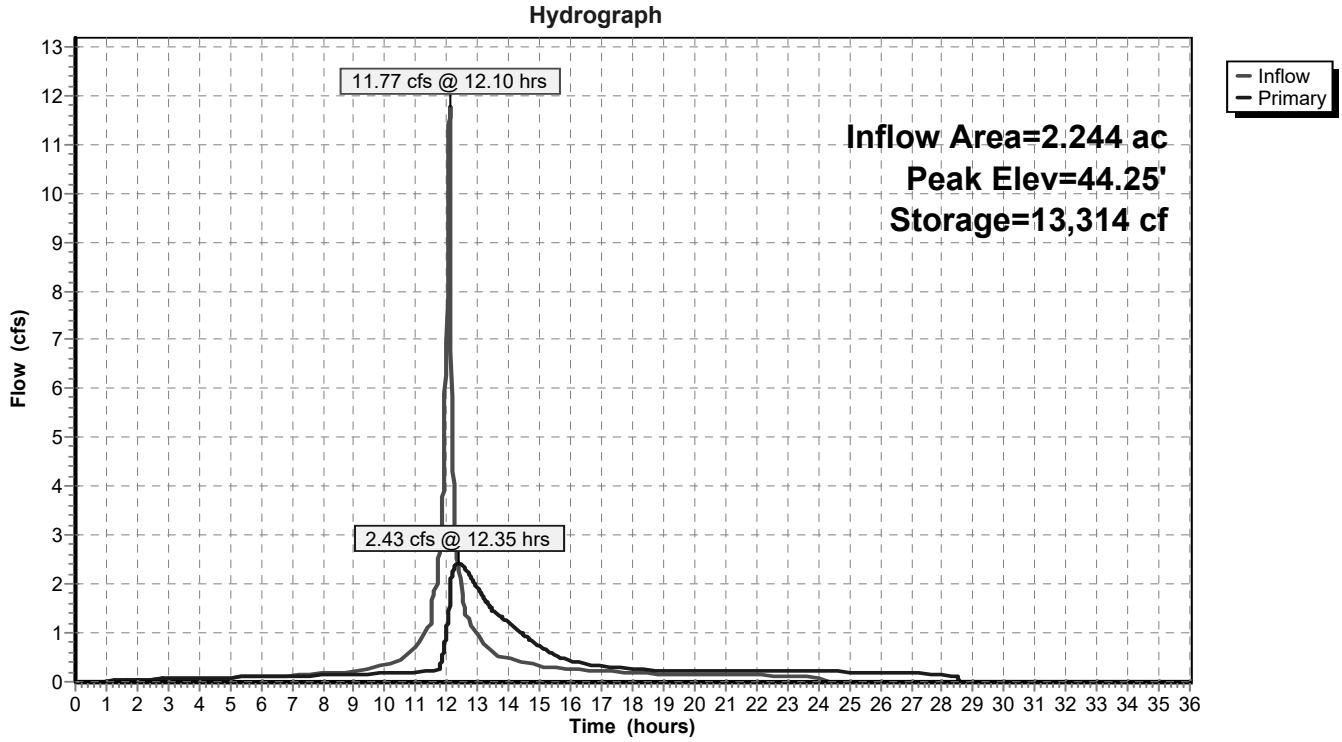
Volume	Invert	Avail.Storage	Storage Description
#1	39.15'	25,524 cf	**Existing Basin (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.15	0	0	0
40.00	81	34	34
41.00	1,422	752	786
42.00	3,320	2,371	3,157
43.00	4,360	3,840	6,997
44.00	5,463	4,912	11,908
45.00	6,792	6,128	18,036
46.00	8,185	7,489	25,524

Device	Routing	Invert	Outlet Devices
#1	Primary	39.15'	**9" Fluidic Cone with 3.5" outlet** Head (feet) 0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 6.50 Disch. (cfs) 0.000 0.060 0.090 0.110 0.120 0.140 0.150 0.170 0.180 0.190 0.200 0.210 0.220 0.230 0.230 0.240 0.250 0.260 0.270 0.320
#2	Primary	42.35'	**0.5' long Rectangular Weir** 2 End Contraction(s)
#3	Primary	44.52'	**48.0" x 48.0" Horiz. Grate X 0.75** C= 0.600 Limited to weir flow at low heads
#4	Primary	45.50'	**30.0' long x 10.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.43 cfs @ 12.35 hrs HW=44.25' (Free Discharge)
- **1=9" Fluidic Cone with 3.5" outlet** (Custom Controls 0.28 cfs)
- **2=Rectangular Weir** (Weir Controls 2.14 cfs @ 4.51 fps)
- **3=Grate** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 2P: Existing Basin #1

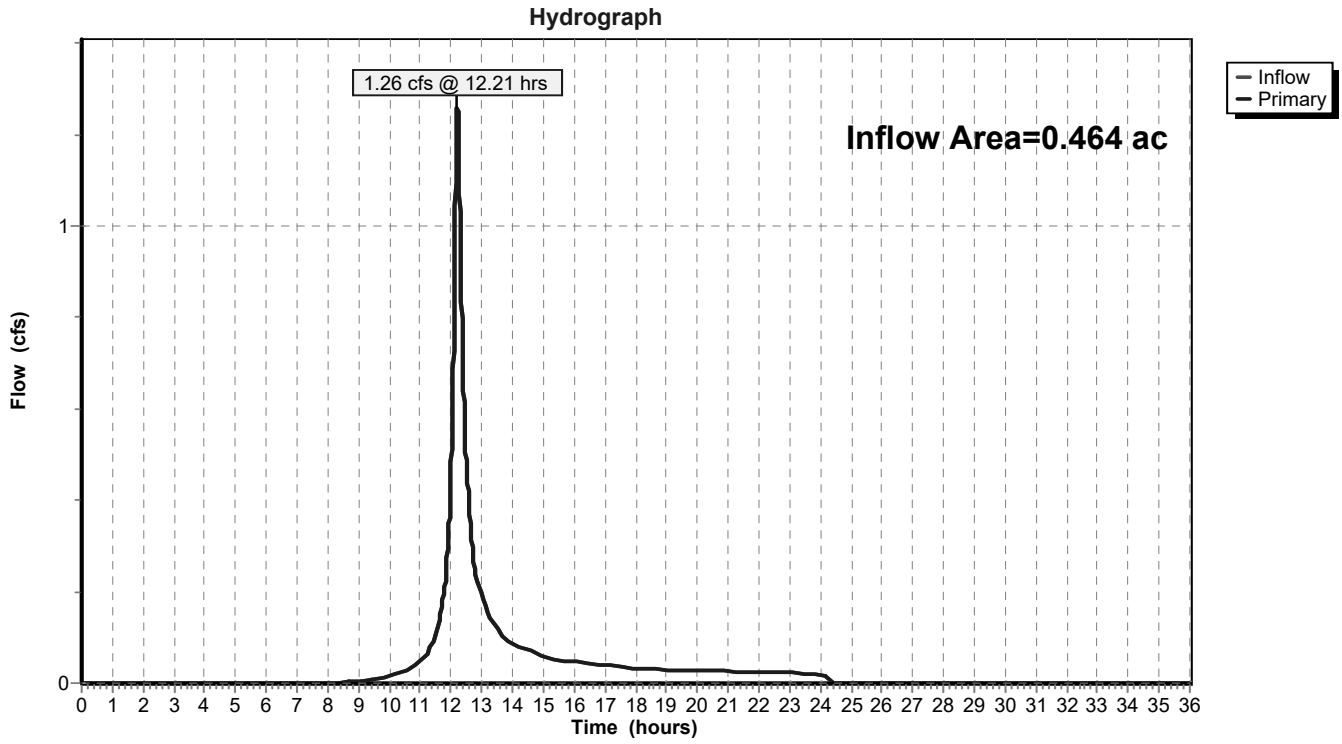


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 2.64" for 10-Year Somerset event
Inflow = 1.26 cfs @ 12.21 hrs, Volume= 0.102 af
Primary = 1.26 cfs @ 12.21 hrs, Volume= 0.102 af, Atten= 0%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction

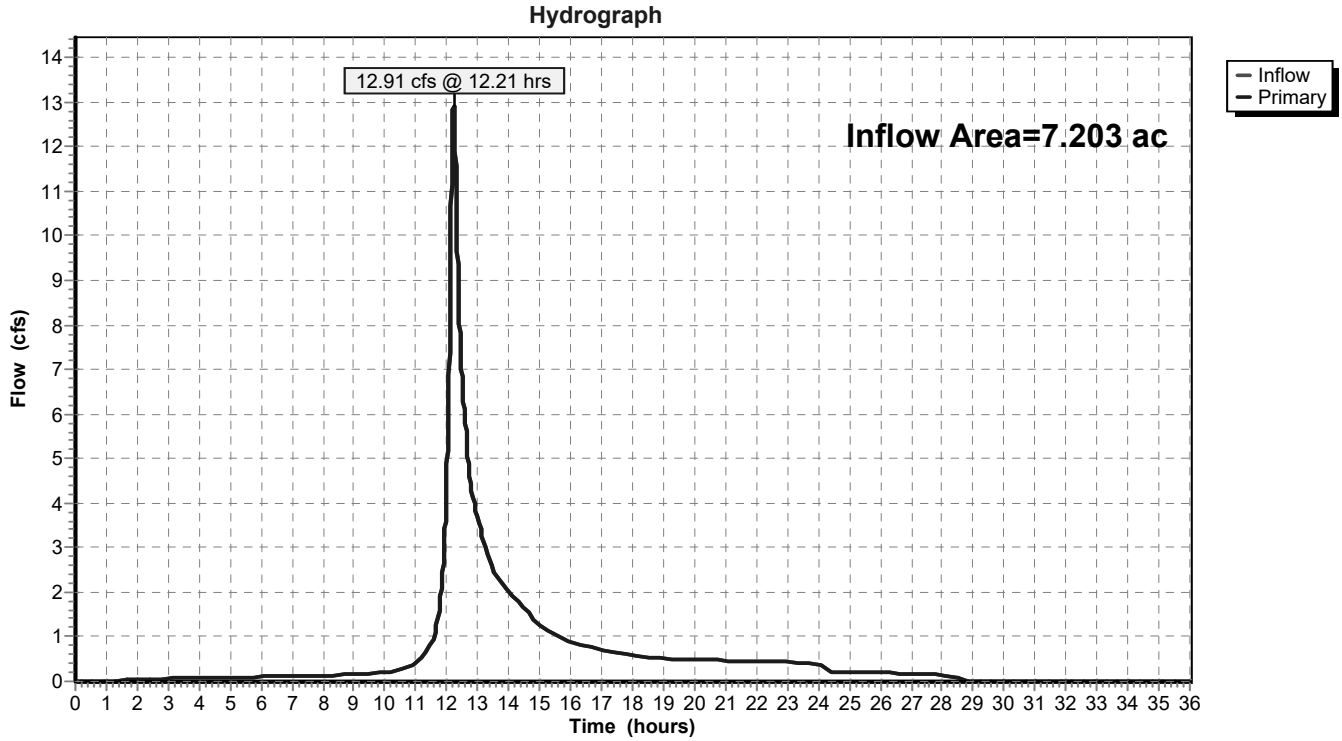


Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 2.74" for 10-Year Somerset event
Inflow = 12.91 cfs @ 12.21 hrs, Volume= 1.642 af
Primary = 12.91 cfs @ 12.21 hrs, Volume= 1.642 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Si: DA-1B Existing Hotel Runoff Area=63,475 sf 100.00% Impervious Runoff Depth=8.12"
Flow Length=495' Tc=1.9 min CN=0/98 Runoff=14.30 cfs 0.986 af

Subcatchment 1Sp: DA-1A Existing Hotel Runoff Area=34,271 sf 0.00% Impervious Runoff Depth=5.96"
Flow Length=513' Tc=3.7 min CN=80/0 Runoff=6.44 cfs 0.391 af

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=5.61"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=2.63 cfs 0.217 af

Subcatchment 3Su: DA-3 Stream Corridor Runoff Area=195,810 sf 0.00% Impervious Runoff Depth=4.78"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=22.00 cfs 1.789 af

Pond 2P: Existing Basin #1 Peak Elev=45.01' Storage=18,085 cf Inflow=20.67 cfs 1.377 af
Outflow=17.19 cfs 1.377 af

Link 2Lr: Reduction Inflow=2.63 cfs 0.217 af
Primary=2.63 cfs 0.217 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=36.96 cfs 3.382 af
Primary=36.96 cfs 3.382 af

Total Runoff Area = 7.203 ac Runoff Volume = 3.382 af Average Runoff Depth = 5.64"
79.77% Pervious = 5.746 ac 20.23% Impervious = 1.457 ac

Summary for Subcatchment 1Si: DA-1B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

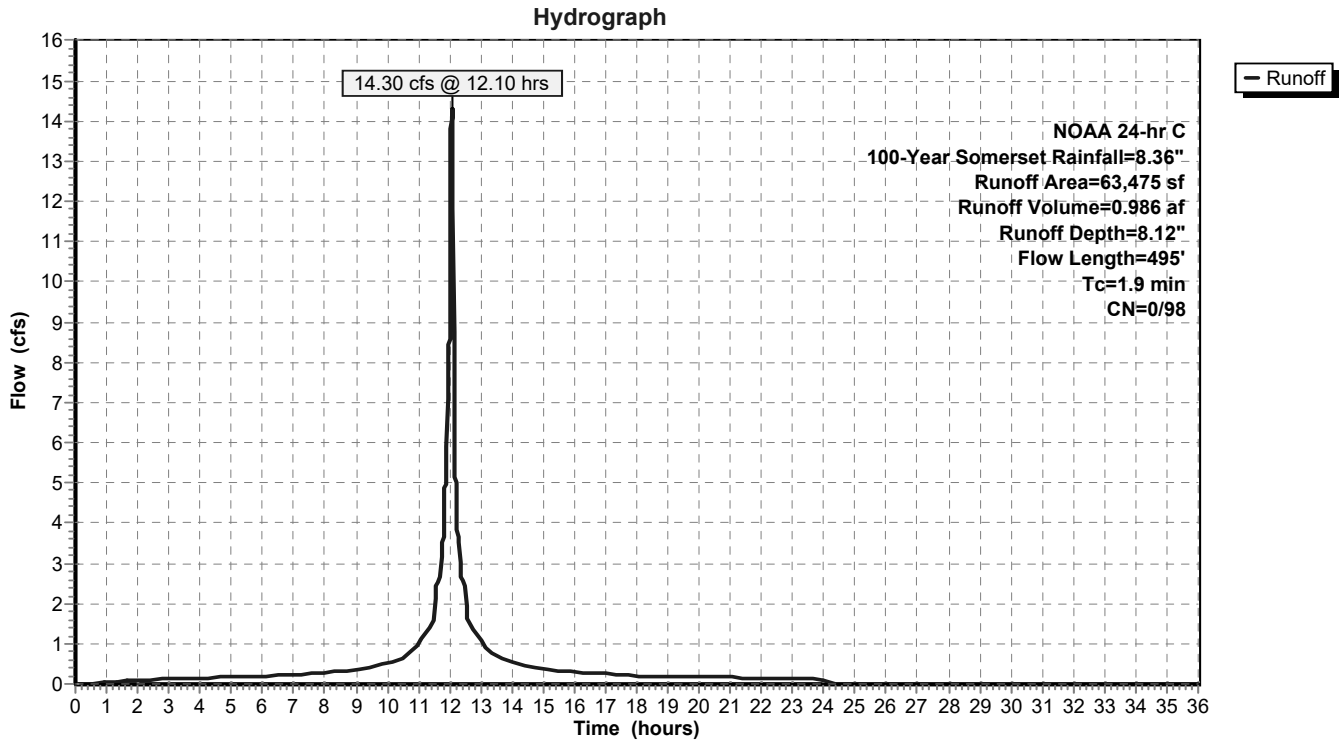
Runoff = 14.30 cfs @ 12.10 hrs, Volume= 0.986 af, Depth= 8.12"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Somerset Rainfall=8.36"

Area (sf)	CN	Description
63,475	98	Paved roads w/curbs & sewers, HSG D
63,475		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
1.9	495	Total			

Subcatchment 1Si: DA-1B Existing Hotel [Impervious]



Summary for Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

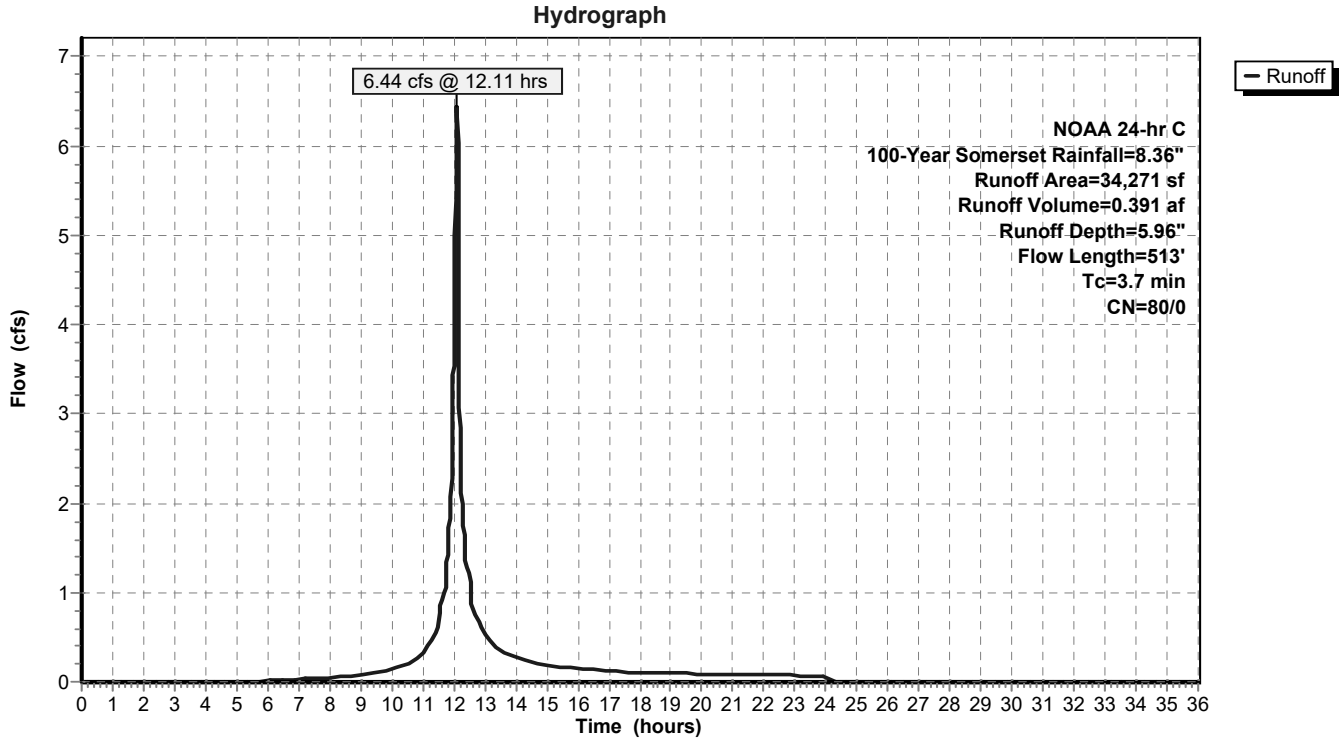
Runoff = 6.44 cfs @ 12.11 hrs, Volume= 0.391 af, Depth= 5.96"
Routed to Pond 2P : Existing Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Somerset Rainfall=8.36"

Area (sf)	CN	Description
34,271	80	>75% Grass cover, Good, HSG D
34,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	264	0.0400	10.53	12.92	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	75	0.0130	6.78	11.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
3.7	513	Total			

Subcatchment 1Sp: DA-1A Existing Hotel [Open Space]



Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

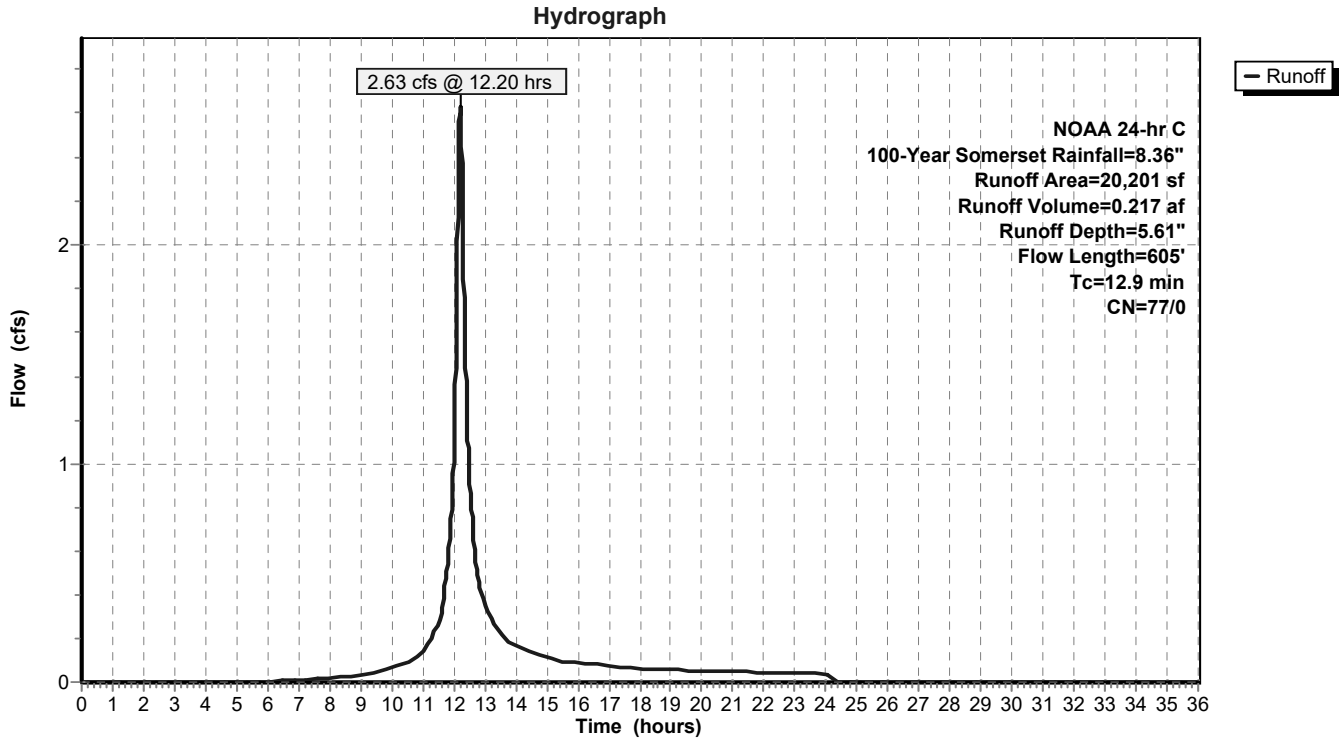
Runoff = 2.63 cfs @ 12.20 hrs, Volume= 0.217 af, Depth= 5.61"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Somerset Rainfall=8.36"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)



Summary for Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

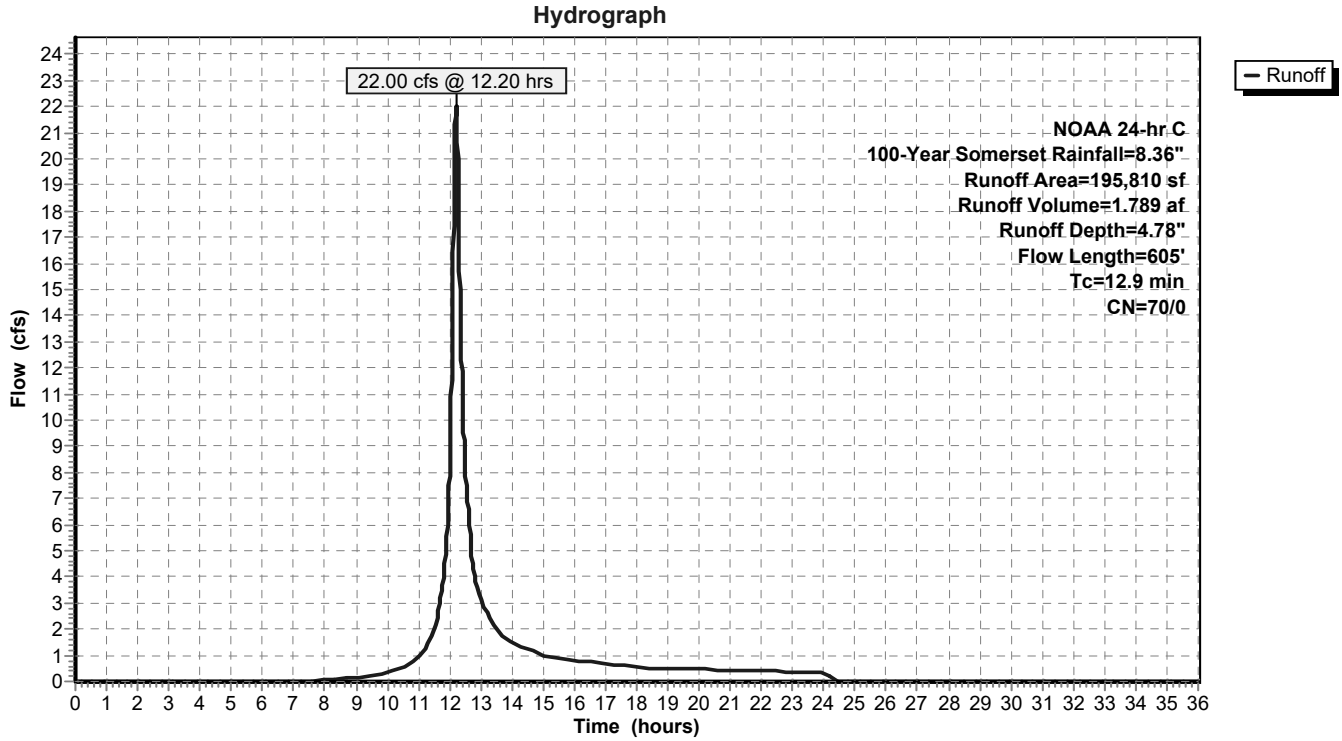
Runoff = 22.00 cfs @ 12.20 hrs, Volume= 1.789 af, Depth= 4.78"
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Somerset Rainfall=8.36"

Area (sf)	CN	Description
195,810	70	Woods, Good, HSG C
195,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 3Su: DA-3 Stream Corridor (Undisturbed)



Summary for Pond 2P: Existing Basin #1

Reference: As-built basin

Inflow Area = 2.244 ac, 64.94% Impervious, Inflow Depth = 7.36" for 100-Year Somerset event
Inflow = 20.67 cfs @ 12.10 hrs, Volume= 1.377 af
Outflow = 17.19 cfs @ 12.12 hrs, Volume= 1.377 af, Atten= 17%, Lag= 1.5 min
Primary = 17.19 cfs @ 12.12 hrs, Volume= 1.377 af
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 45.01' @ 12.12 hrs Surf.Area= 6,802 sf Storage= 18,085 cf

Plug-Flow detention time= 114.6 min calculated for 1.377 af (100% of inflow)
Center-of-Mass det. time= 114.7 min (870.4 - 755.7)

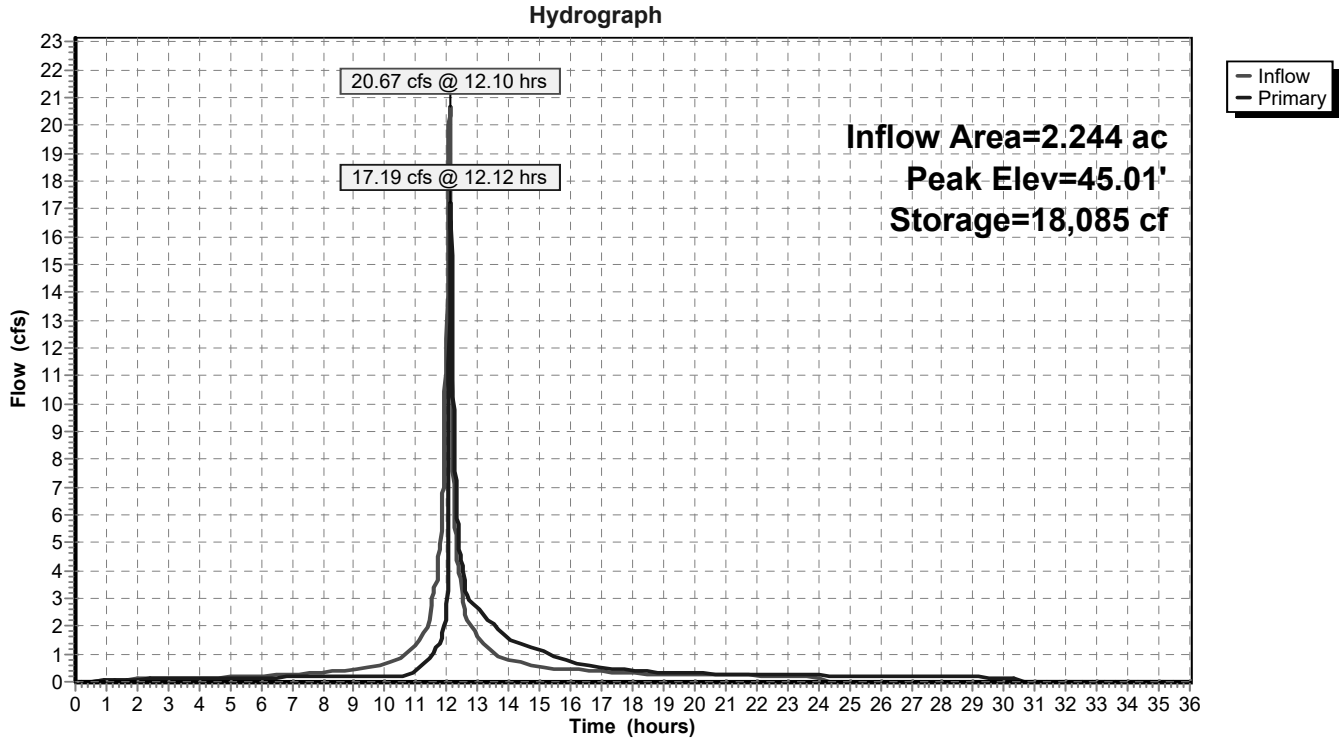
Volume	Invert	Avail.Storage	Storage Description
#1	39.15'	25,524 cf	**Existing Basin (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.15	0	0	0
40.00	81	34	34
41.00	1,422	752	786
42.00	3,320	2,371	3,157
43.00	4,360	3,840	6,997
44.00	5,463	4,912	11,908
45.00	6,792	6,128	18,036
46.00	8,185	7,489	25,524

Device	Routing	Invert	Outlet Devices
#1	Primary	39.15'	**9" Fluidic Cone with 3.5" outlet** Head (feet) 0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 6.50 Disch. (cfs) 0.000 0.060 0.090 0.110 0.120 0.140 0.150 0.170 0.180 0.190 0.200 0.210 0.220 0.230 0.230 0.240 0.250 0.260 0.270 0.320
#2	Primary	42.35'	**0.5' long Rectangular Weir** 2 End Contraction(s)
#3	Primary	44.52'	**48.0" x 48.0" Horiz. Grate X 0.75** C= 0.600 Limited to weir flow at low heads
#4	Primary	45.50'	**30.0' long x 10.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=17.12 cfs @ 12.12 hrs HW=45.01' (Free Discharge)
- **1=9" Fluidic Cone with 3.5" outlet** (Custom Controls 0.30 cfs)
- **2=Rectangular Weir** (Weir Controls 3.54 cfs @ 5.33 fps)
- **3=Grate** (Weir Controls 13.28 cfs @ 1.71 fps)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 2P: Existing Basin #1

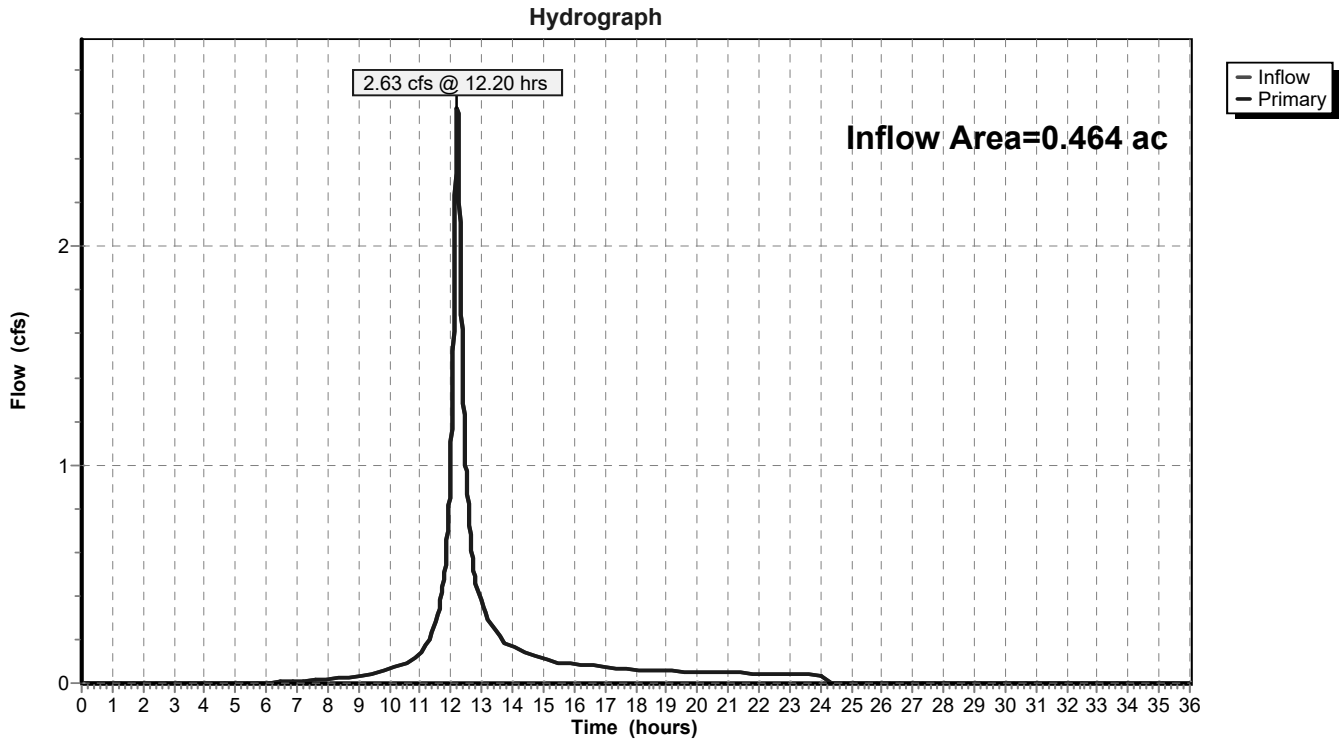


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 5.61" for 100-Year Somerset event
Inflow = 2.63 cfs @ 12.20 hrs, Volume= 0.217 af
Primary = 2.63 cfs @ 12.20 hrs, Volume= 0.217 af, Atten= 0%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction

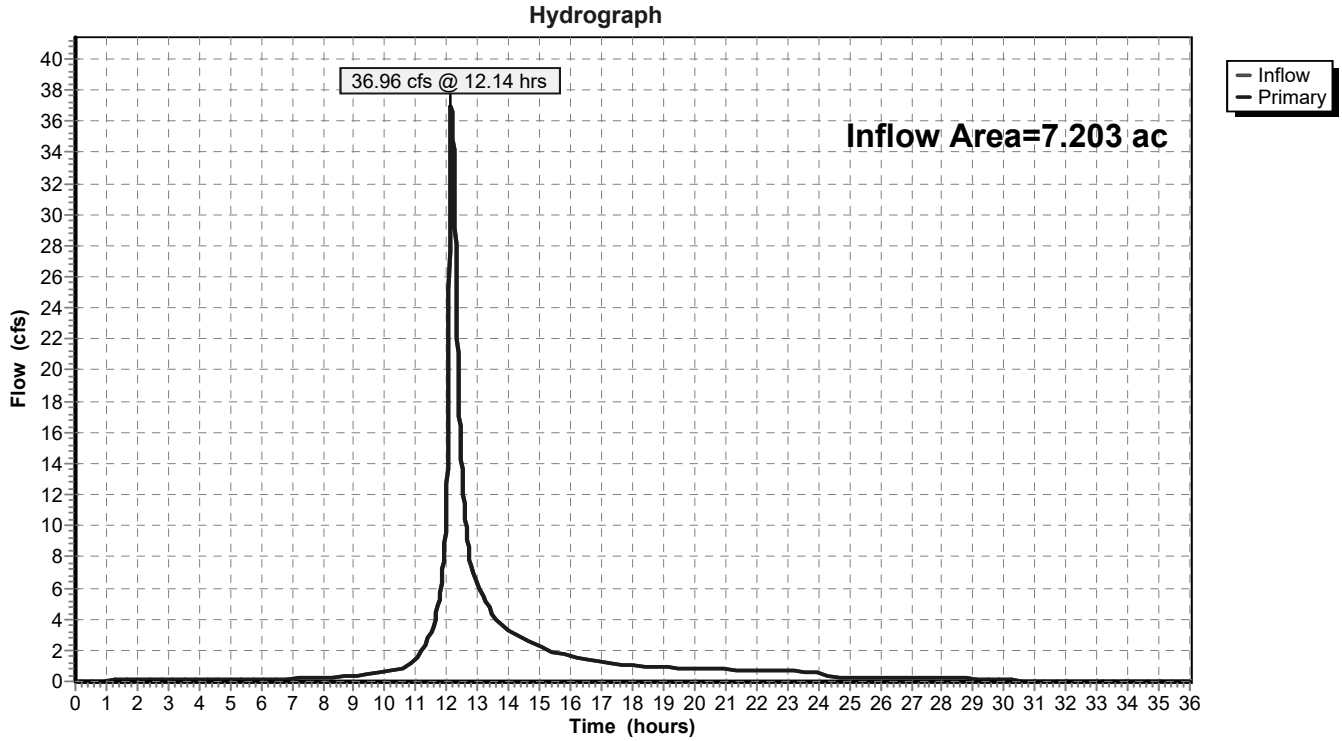


Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

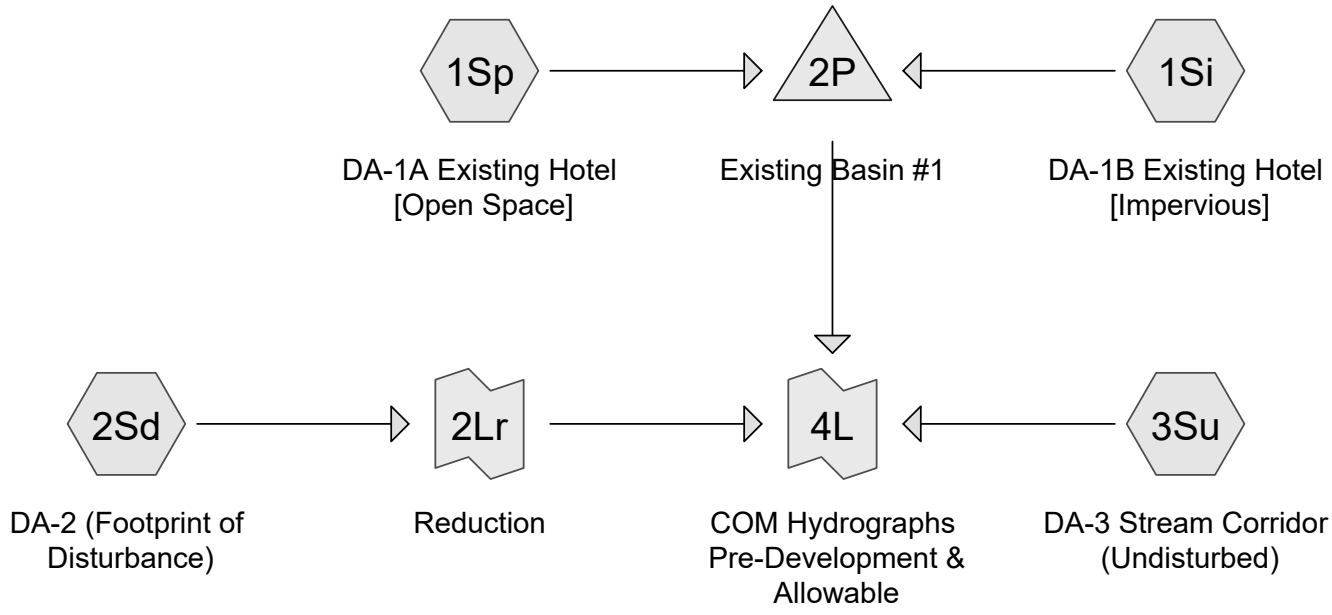
Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 5.64" for 100-Year Somerset event
Inflow = 36.96 cfs @ 12.14 hrs, Volume= 3.382 af
Primary = 36.96 cfs @ 12.14 hrs, Volume= 3.382 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



ALLOWABLE FLOWS



For DA-1A, DA-1B, DA-3 & Existing Basin #1, Refer to Existing Conditions Data

Subcat Reach Pond Link

Routing Diagram for 22-005 Pre Dev R0 MS
Prepared by The Reynolds Group, Inc.

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=1.28"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=0.60 cfs 0.050 af

Link 2Lr: Reduction x 0.50 Inflow=0.60 cfs 0.050 af
Primary=0.30 cfs 0.025 af Secondary=0.30 cfs 0.025 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=5.12 cfs 0.826 af
Primary=5.12 cfs 0.826 af

Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

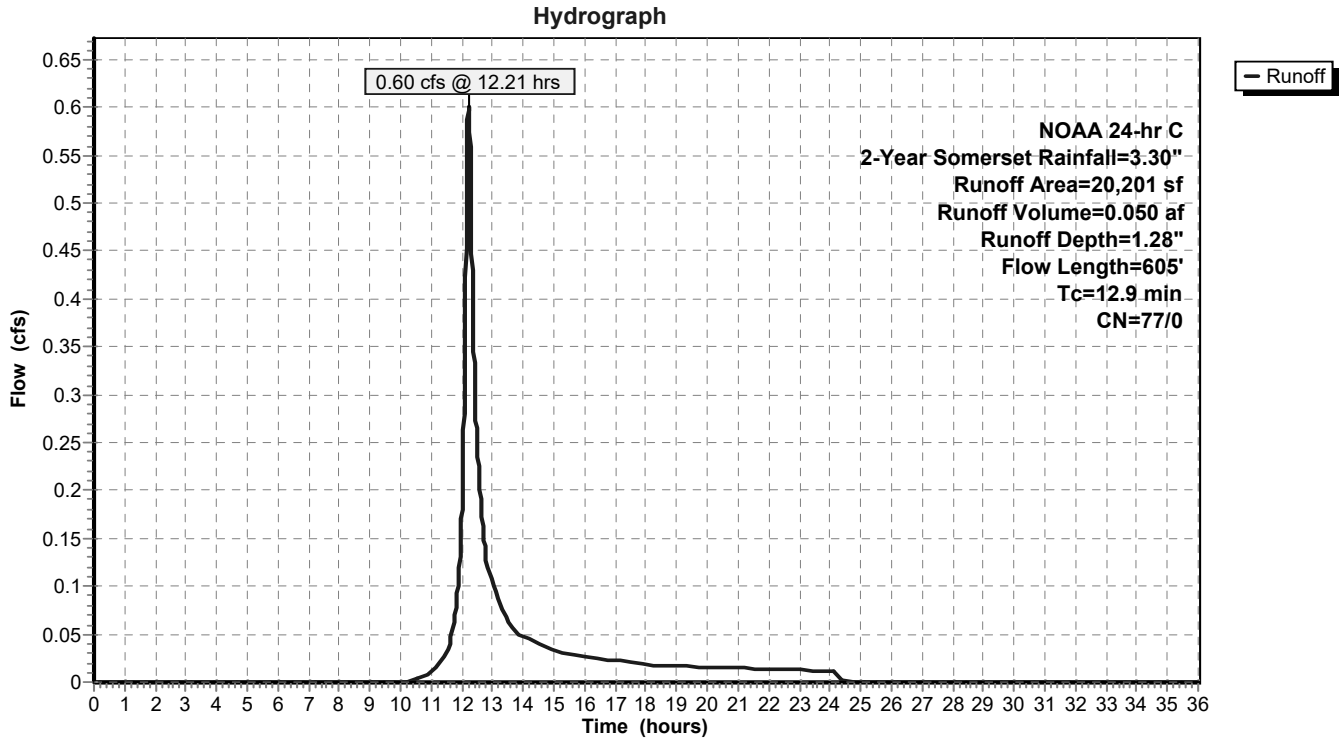
Runoff = 0.60 cfs @ 12.21 hrs, Volume= 0.050 af, Depth= 1.28"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Somerset Rainfall=3.30"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

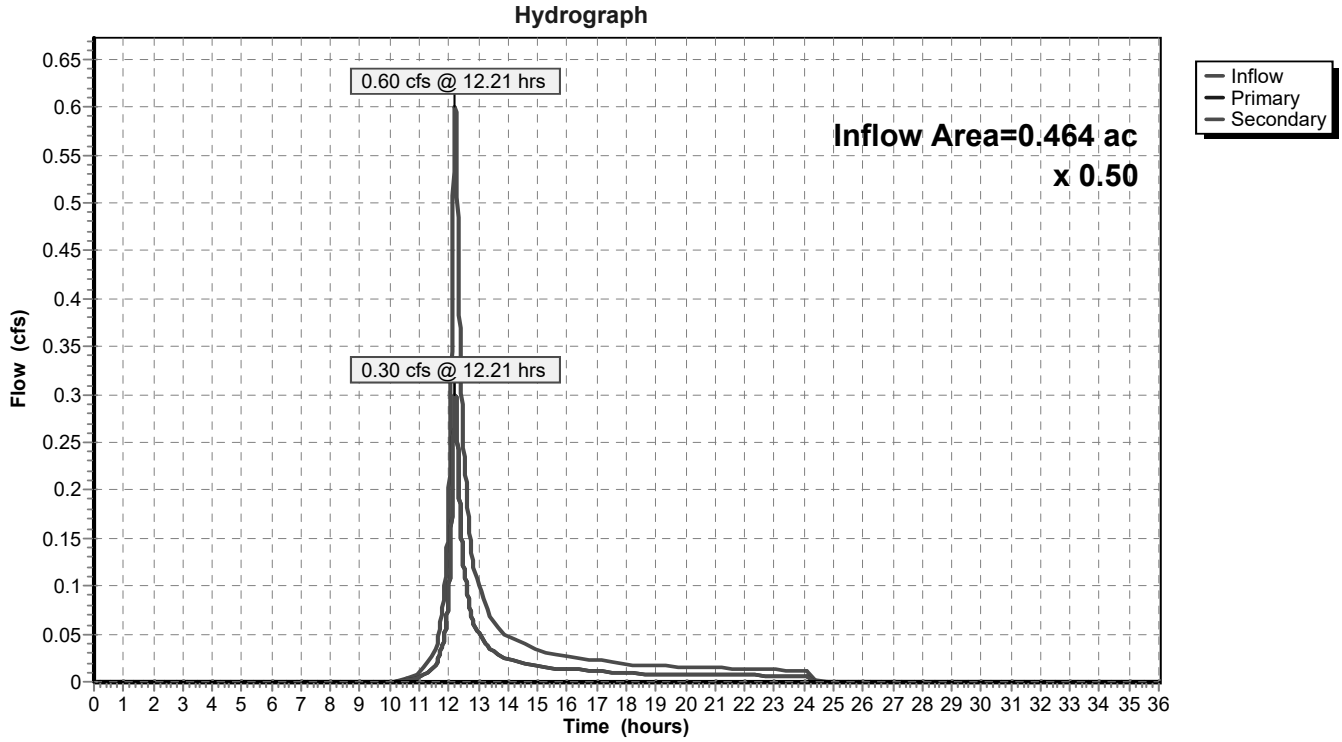


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 1.28" for 2-Year Somerset event
Inflow = 0.60 cfs @ 12.21 hrs, Volume= 0.050 af
Primary = 0.30 cfs @ 12.21 hrs, Volume= 0.025 af, Atten= 50%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable
Secondary = 0.30 cfs @ 12.21 hrs, Volume= 0.025 af

Primary outflow = Inflow x 0.50, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction



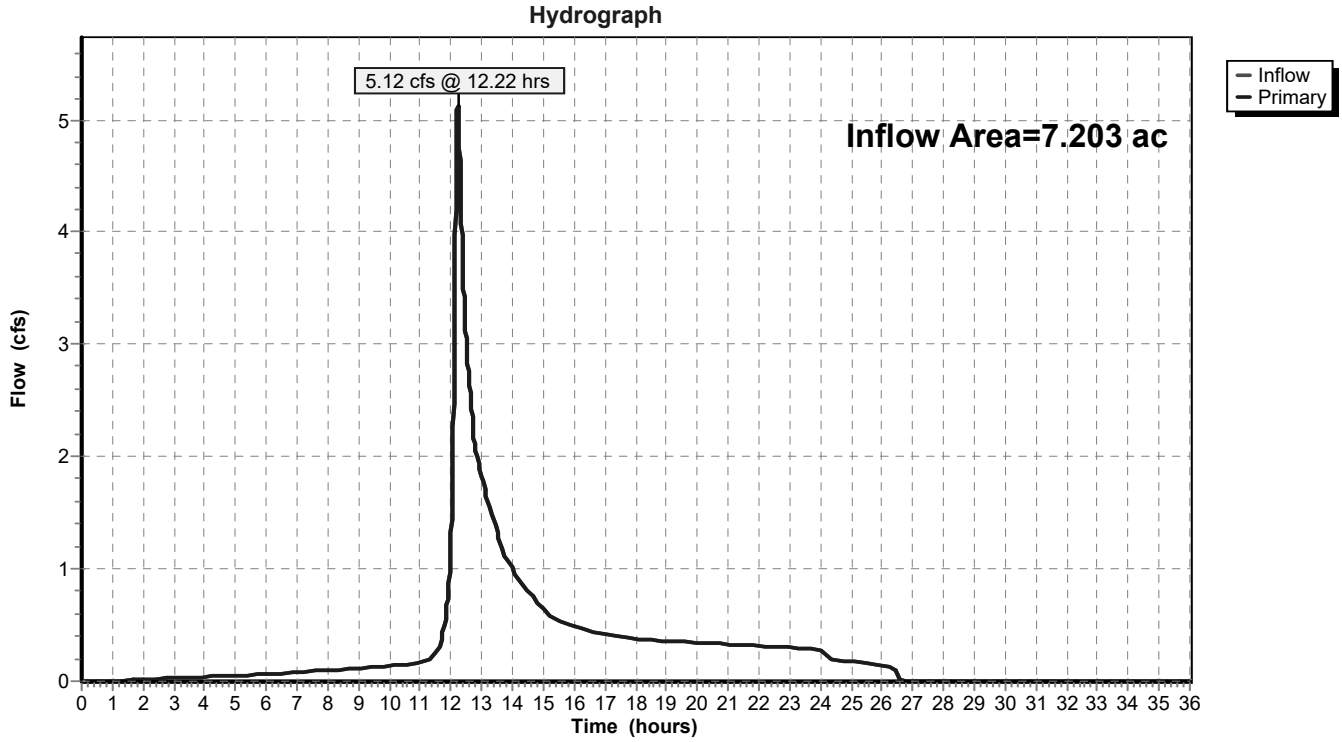
Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

For DA-1A, DA-1B, DA-3 & Existing Basin #1, Refer to Existing Conditions Data

Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 1.38" for 2-Year Somerset event
Inflow = 5.12 cfs @ 12.22 hrs, Volume= 0.826 af
Primary = 5.12 cfs @ 12.22 hrs, Volume= 0.826 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=2.64"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=1.26 cfs 0.102 af

Link 2Lr: Reduction x 0.75 Inflow=1.26 cfs 0.102 af
Primary=0.94 cfs 0.077 af Secondary=0.31 cfs 0.026 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=12.60 cfs 1.617 af
Primary=12.60 cfs 1.617 af

Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

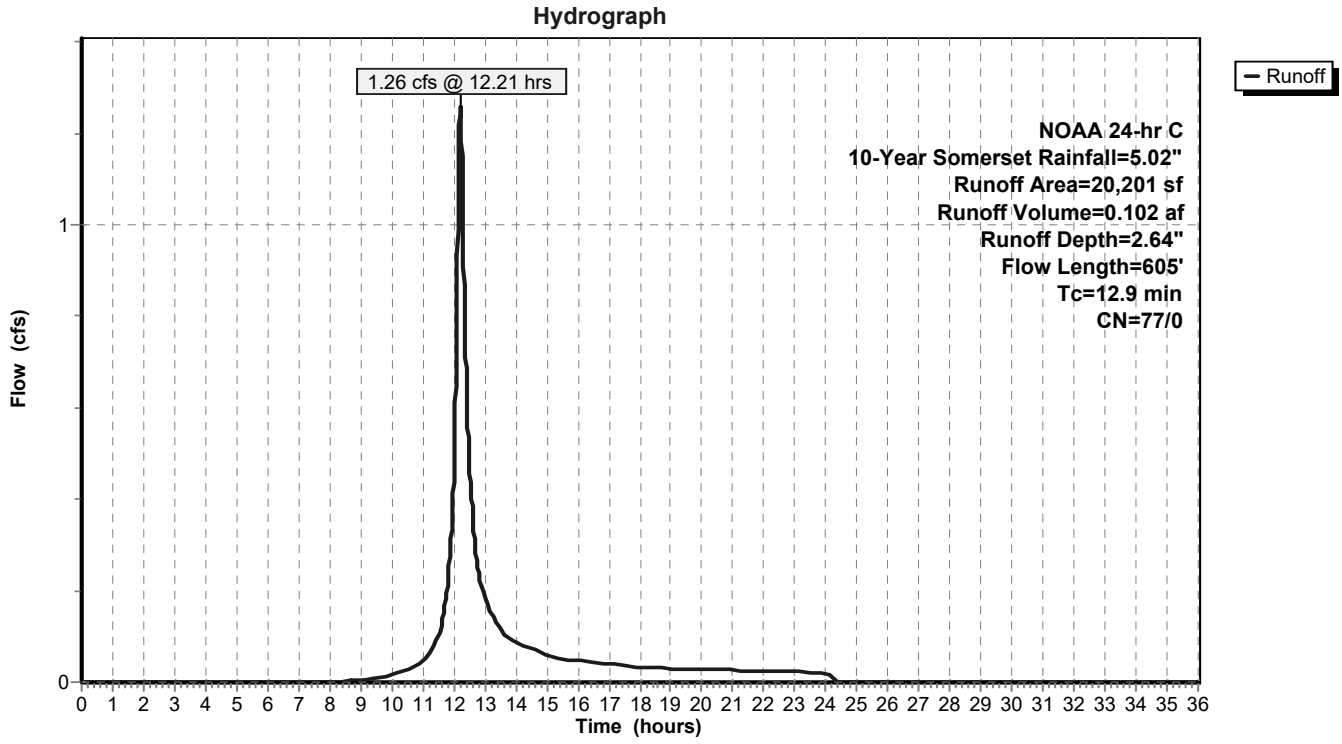
Runoff = 1.26 cfs @ 12.21 hrs, Volume= 0.102 af, Depth= 2.64"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Somerset Rainfall=5.02"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

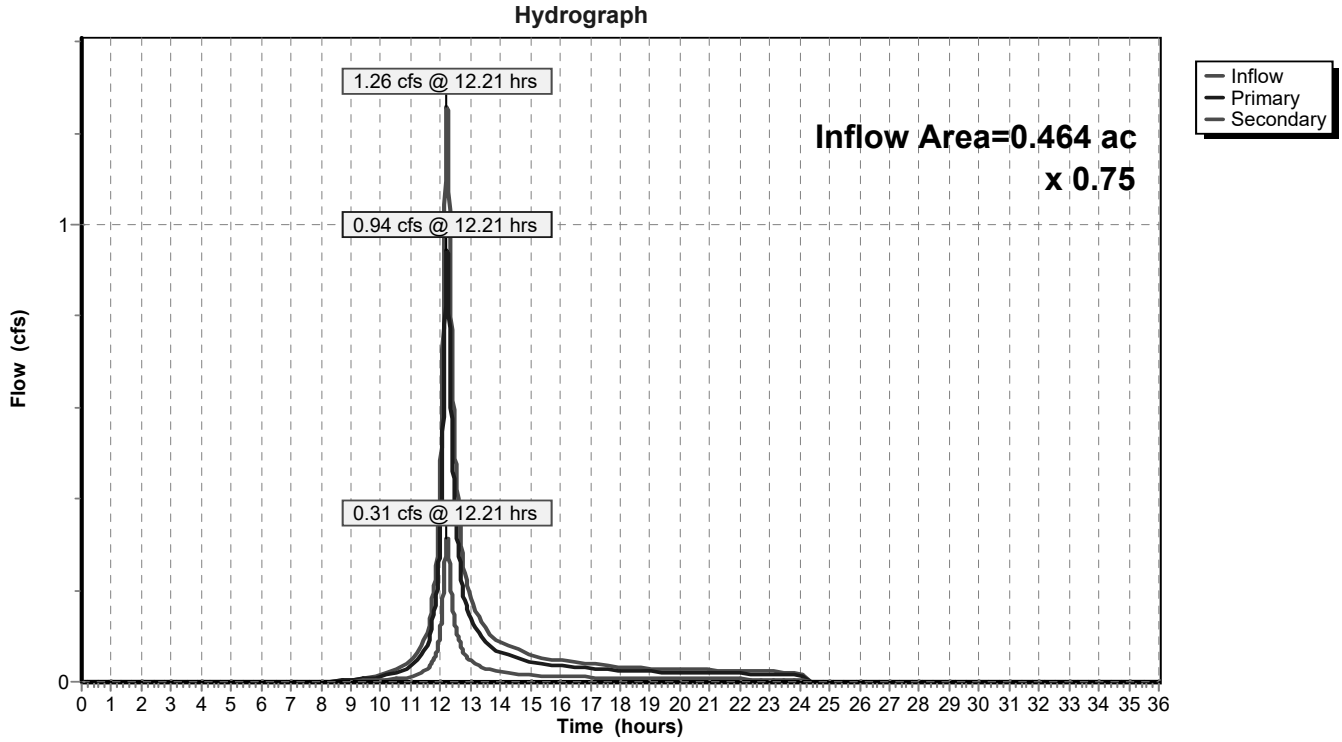


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 2.64" for 10-Year Somerset event
Inflow = 1.26 cfs @ 12.21 hrs, Volume= 0.102 af
Primary = 0.94 cfs @ 12.21 hrs, Volume= 0.077 af, Atten= 25%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable
Secondary = 0.31 cfs @ 12.21 hrs, Volume= 0.026 af

Primary outflow = Inflow x 0.75, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction



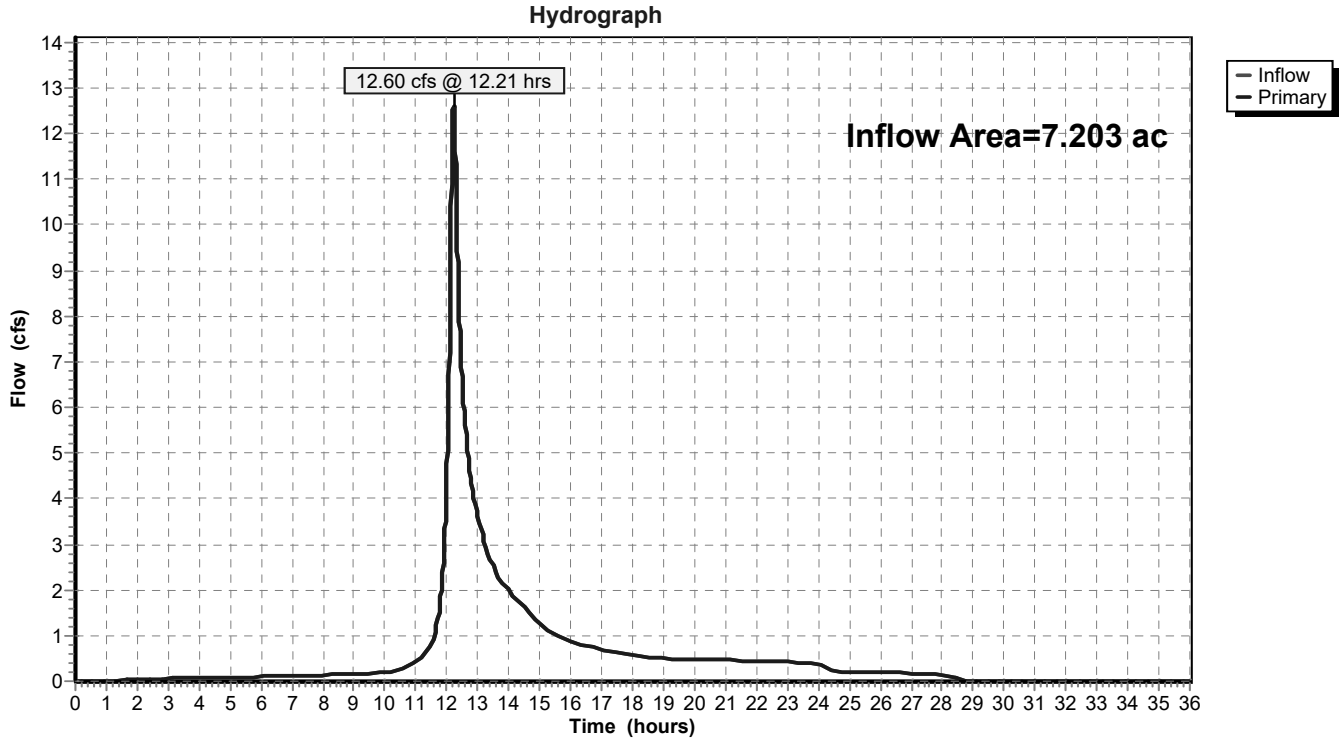
Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

For DA-1A, DA-1B, DA-3 & Existing Basin #1, Refer to Existing Conditions Data

Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 2.69" for 10-Year Somerset event
Inflow = 12.60 cfs @ 12.21 hrs, Volume= 1.617 af
Primary = 12.60 cfs @ 12.21 hrs, Volume= 1.617 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2Sd: DA-2 (Footprint of Runoff Area=20,201 sf 0.00% Impervious Runoff Depth=5.61"
Flow Length=605' Tc=12.9 min CN=77/0 Runoff=2.63 cfs 0.217 af

Link 2Lr: Reduction x 0.80 Inflow=2.63 cfs 0.217 af
Primary=2.11 cfs 0.173 af Secondary=0.53 cfs 0.043 af

Link 4L: COM Hydrographs Pre-Development & Allowable Inflow=36.51 cfs 3.339 af
Primary=36.51 cfs 3.339 af

Summary for Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

Existing Condition
[Apply flow reduction]

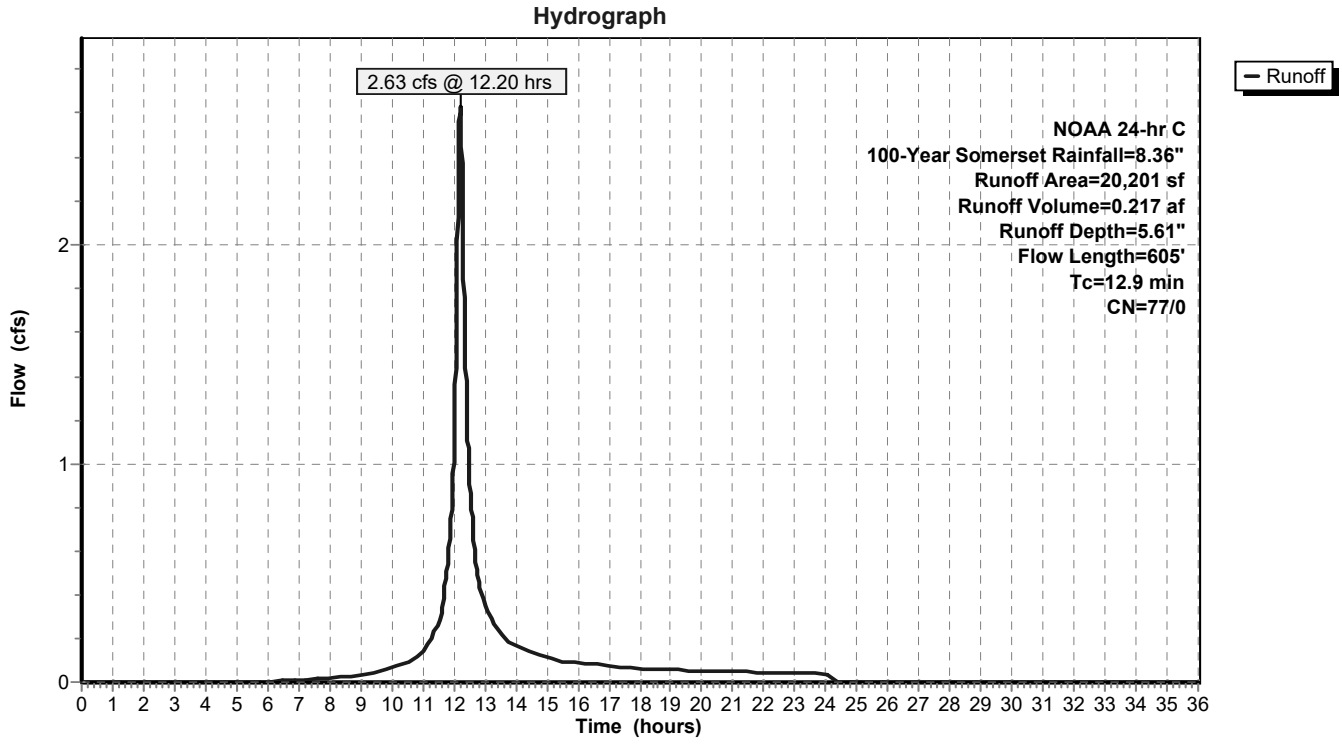
Runoff = 2.63 cfs @ 12.20 hrs, Volume= 0.217 af, Depth= 5.61"
Routed to Link 2Lr : Reduction

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Somerset Rainfall=8.36"

Area (sf)	CN	Description
20,201	77	Woods, Good, HSG D
20,201		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 2Sd: DA-2 (Footprint of Disturbance)

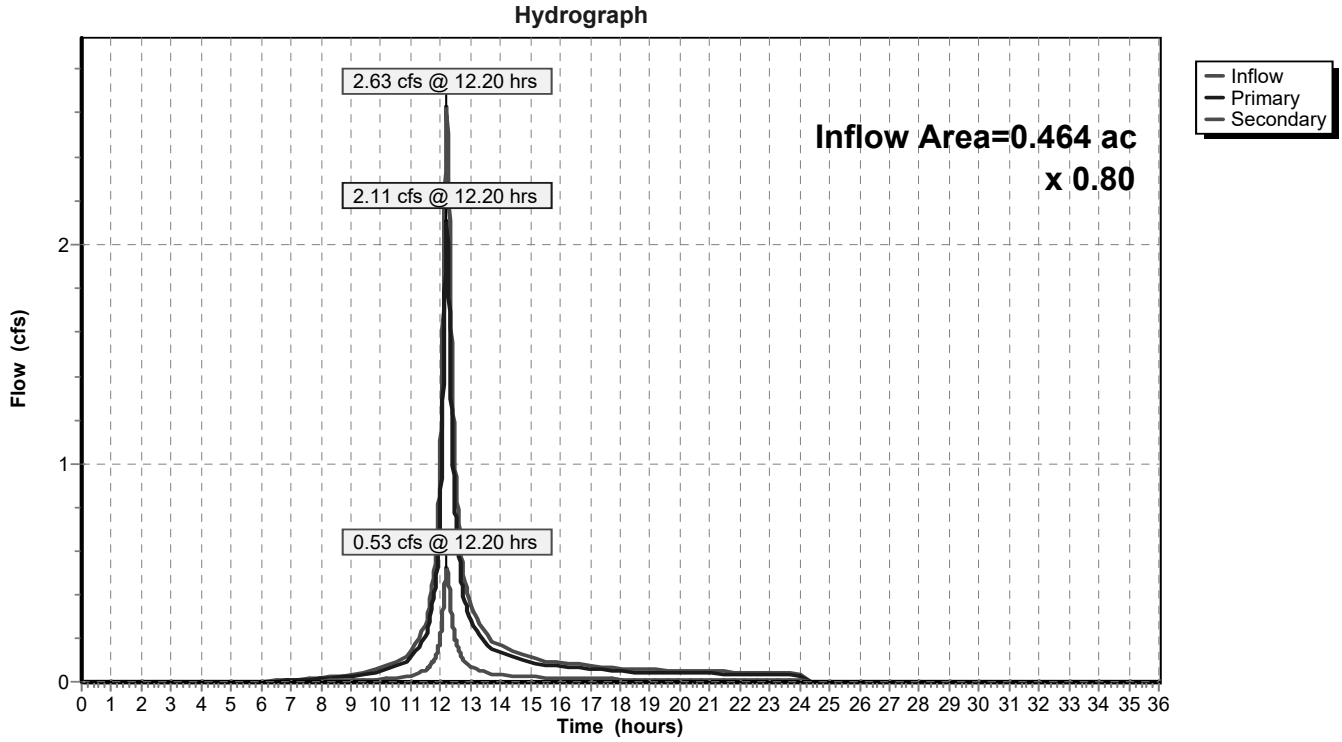


Summary for Link 2Lr: Reduction

Inflow Area = 0.464 ac, 0.00% Impervious, Inflow Depth = 5.61" for 100-Year Somerset event
Inflow = 2.63 cfs @ 12.20 hrs, Volume= 0.217 af
Primary = 2.11 cfs @ 12.20 hrs, Volume= 0.173 af, Atten= 20%, Lag= 0.0 min
Routed to Link 4L : COM Hydrographs Pre-Development & Allowable
Secondary = 0.53 cfs @ 12.20 hrs, Volume= 0.043 af

Primary outflow = Inflow x 0.80, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2Lr: Reduction



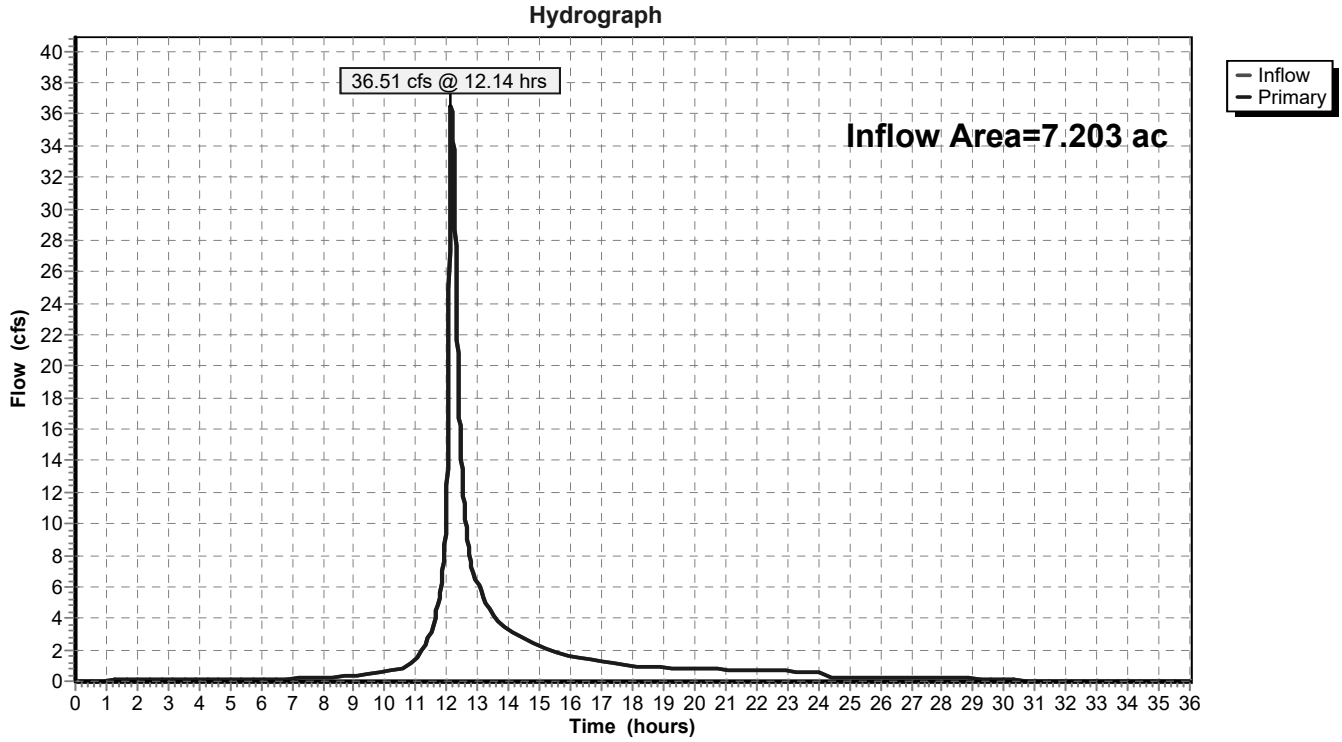
Summary for Link 4L: COM Hydrographs Pre-Development & Allowable

For DA-1A, DA-1B, DA-3 & Existing Basin #1, Refer to Existing Conditions Data

Inflow Area = 7.203 ac, 20.23% Impervious, Inflow Depth = 5.56" for 100-Year Somerset event
Inflow = 36.51 cfs @ 12.14 hrs, Volume= 3.339 af
Primary = 36.51 cfs @ 12.14 hrs, Volume= 3.339 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 4L: COM Hydrographs Pre-Development & Allowable



PROPOSED CONDITIONS

The Reynolds Group Inc.

Project: Driveway Access

Location: 315 Davidson Ave. - Fairfield Inn & Suites
Block 502.01, Lot 47.02
Franklin Twp, Somerset Co.
TRG 22-005

Modified
BioBasin #1

Small Scale Bioretention Basin #1

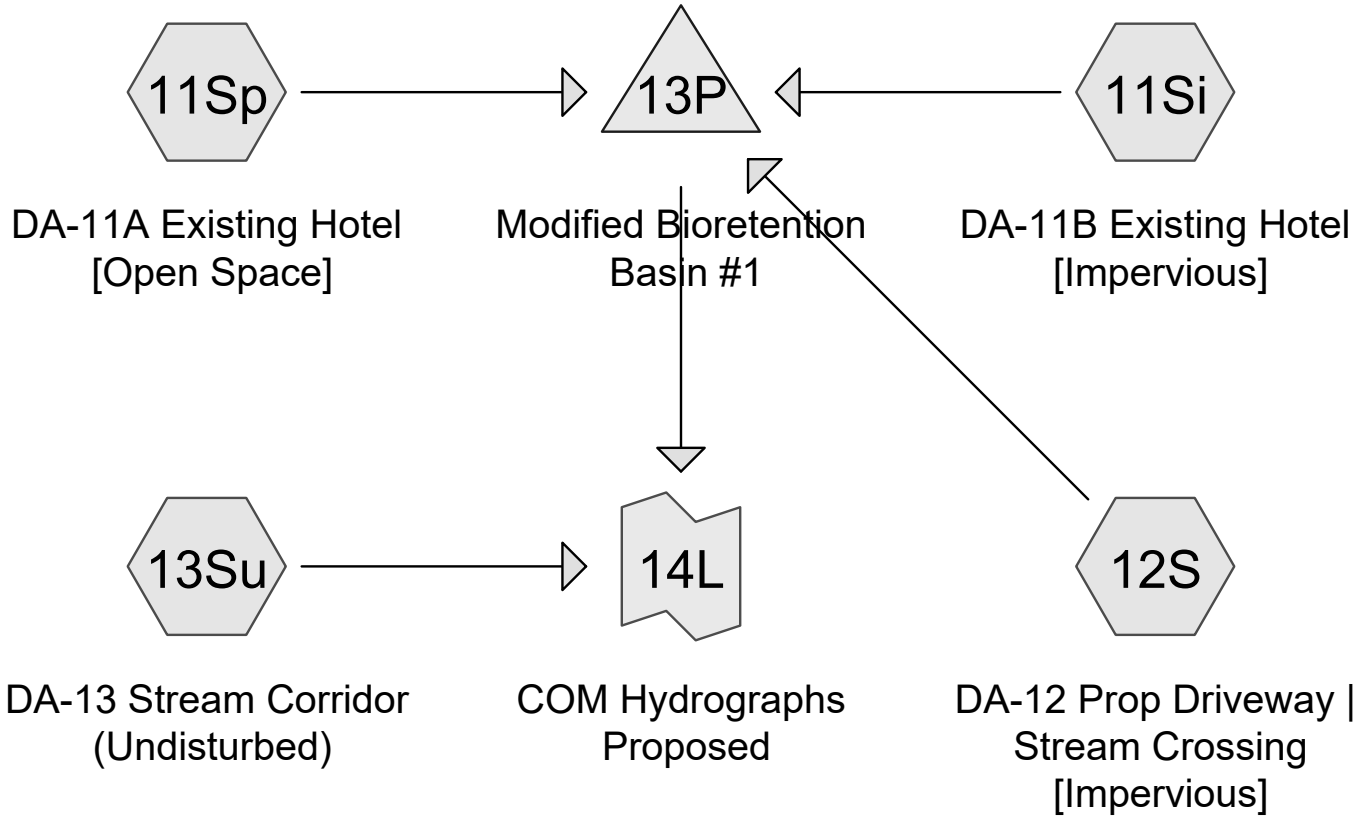
Elevation (feet)	Discharge (cfs)	Surface (sq-ft)	Cum. Storage (cubic-feet)	Cum. Storage (acre-feet)
43.33	0	7,422	0	0.000
44.00	0	7,465	4,987	0.114
44.30	0	7,485	7,230	0.166
45.00	1.02	7,530	12,485	0.287
46.00	2.97	7,595	20,047	0.460
46.50	11.22	7,628	23,853	0.548
46.75*	0.00	7,644	25,762	0.591
47.00	9.79	7,660	27,675	0.635
48.00	108.54	7,725	35,367	0.812
48.50	179.03	7,758	39,238	0.901

Outlet Structure Data:

8" Orifice Elev. 44.30
Front 3.5-ft Wide Weir: Elev. 46.00
Side 2.5-ft Wide Weir: Elev. 45.75
Top Grate: Elev 48.00
*Emergency Spillway: Blocked Outlet Structure
24-ft Wide Conc. Spillway: Elev 46.75

22-005 Post Dev R0 MS
Prepared by The Reynolds Group, Inc.

TABLE OF CONTENTS



Subcat Reach Pond Link

Routing Diagram for 22-005 Post Dev R0 MS
Prepared by The Reynolds Group, Inc.

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11Si: DA-11B Existing Hotel Runoff Area=61,808 sf 100.00% Impervious Runoff Depth=3.07"
Flow Length=415' Tc=1.7 min CN=0/98 Runoff=5.45 cfs 0.363 af

Subcatchment 11Sp: DA-11A Existing Hotel Runoff Area=27,220 sf 0.00% Impervious Runoff Depth=1.48"
Flow Length=433' Tc=3.5 min CN=80/0 Runoff=1.34 cfs 0.077 af

Subcatchment 12S: DA-12 Prop Driveway | Runoff Area=15,891 sf 100.00% Impervious Runoff Depth=3.07"
Flow Length=470' Tc=3.6 min CN=0/98 Runoff=1.37 cfs 0.093 af

Subcatchment 13Su: DA-13 Stream Corridor Runoff Area=208,838 sf 0.00% Impervious Runoff Depth=0.89"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=4.02 cfs 0.354 af

Pond 13P: Modified Bioretention Basin #1 Peak Elev=45.13' Storage=13,427 cf Inflow=8.14 cfs 0.533 af
Outflow=1.18 cfs 0.357 af

Link 14L: COM Hydrographs Proposed Inflow=5.08 cfs 0.711 af
Primary=5.08 cfs 0.711 af

Total Runoff Area = 7.203 ac Runoff Volume = 0.887 af Average Runoff Depth = 1.48"
75.24% Pervious = 5.419 ac 24.76% Impervious = 1.784 ac

Summary for Subcatchment 11Si: DA-11B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

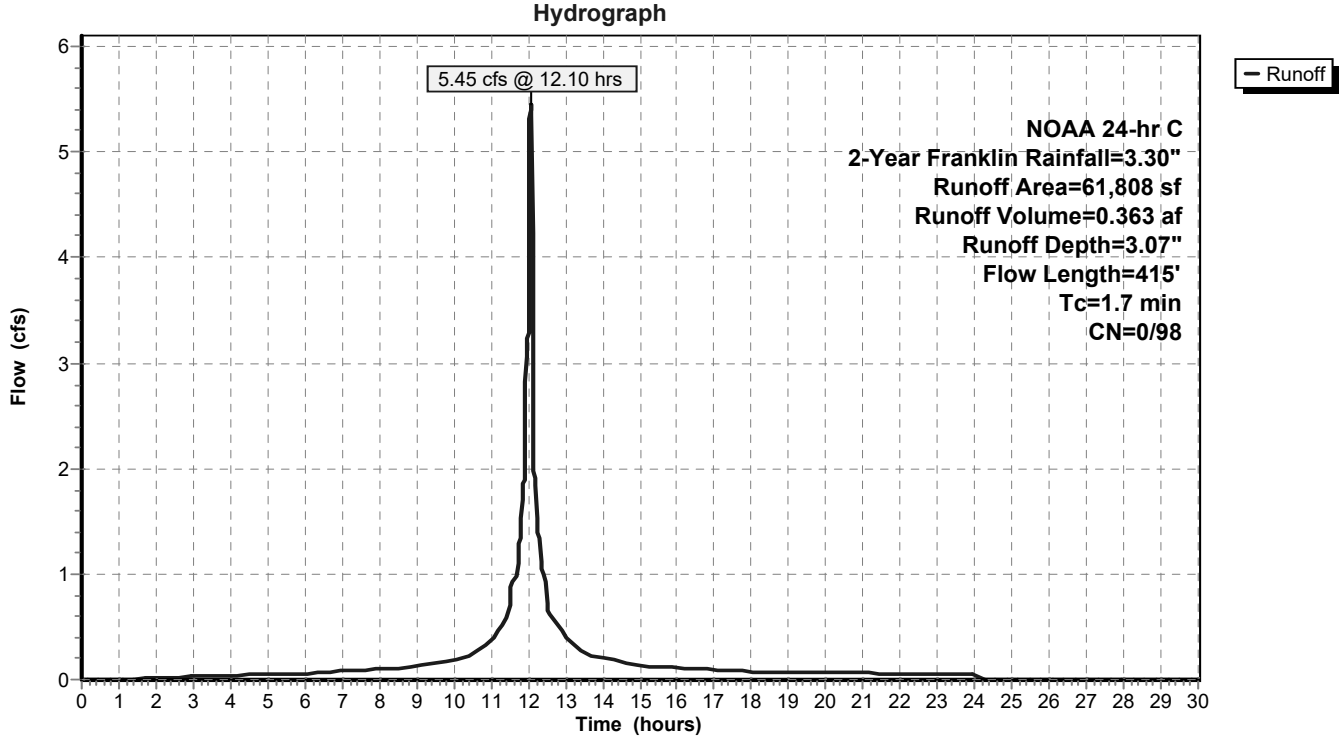
Runoff = 5.45 cfs @ 12.10 hrs, Volume= 0.363 af, Depth= 3.07"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Franklin Rainfall=3.30"

Area (sf)	CN	Description
61,808	98	Paved roads w/curbs & sewers, HSG D
61,808		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.7	415	Total			

Subcatchment 11Si: DA-11B Existing Hotel [Impervious]



Summary for Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

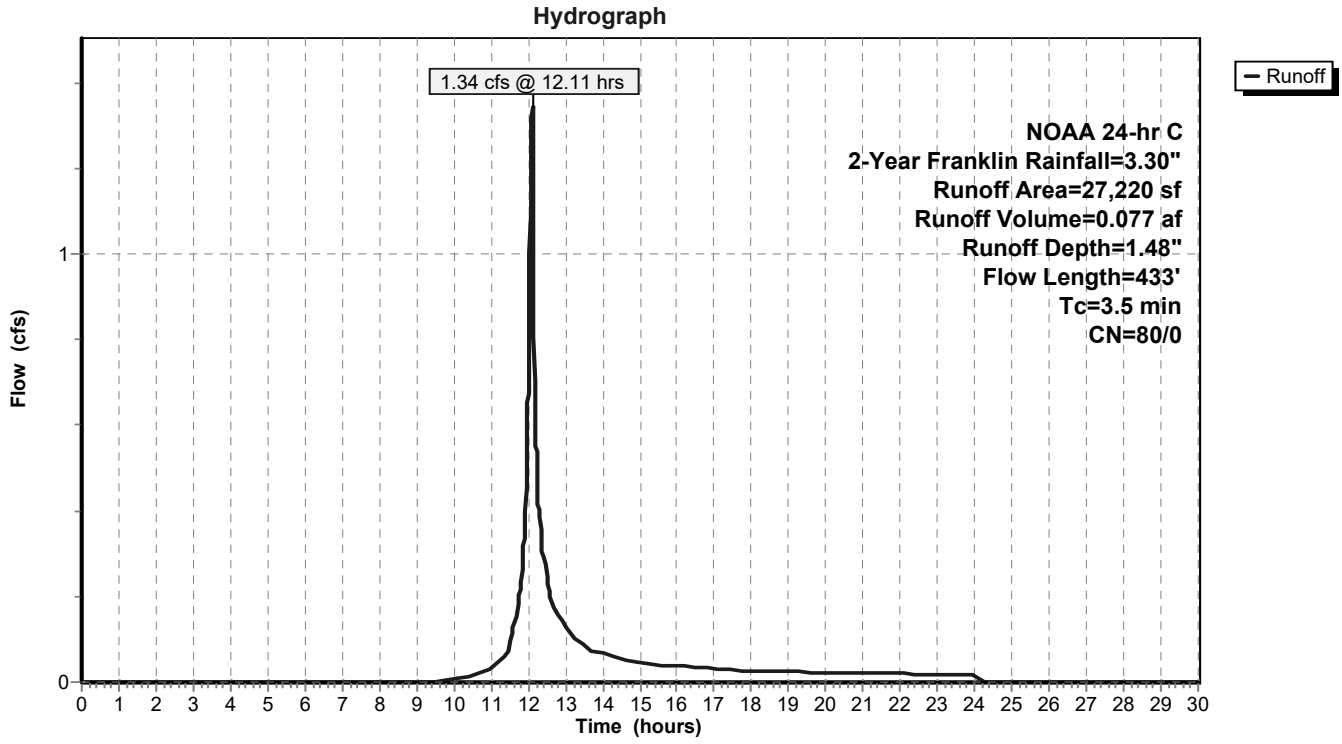
Runoff = 1.34 cfs @ 12.11 hrs, Volume= 0.077 af, Depth= 1.48"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Franklin Rainfall=3.30"

Area (sf)	CN	Description
27,220	80	>75% Grass cover, Good, HSG D
27,220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.5	433	Total			

Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]



Summary for Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]

From Comfort Inn SWR revised 8/01

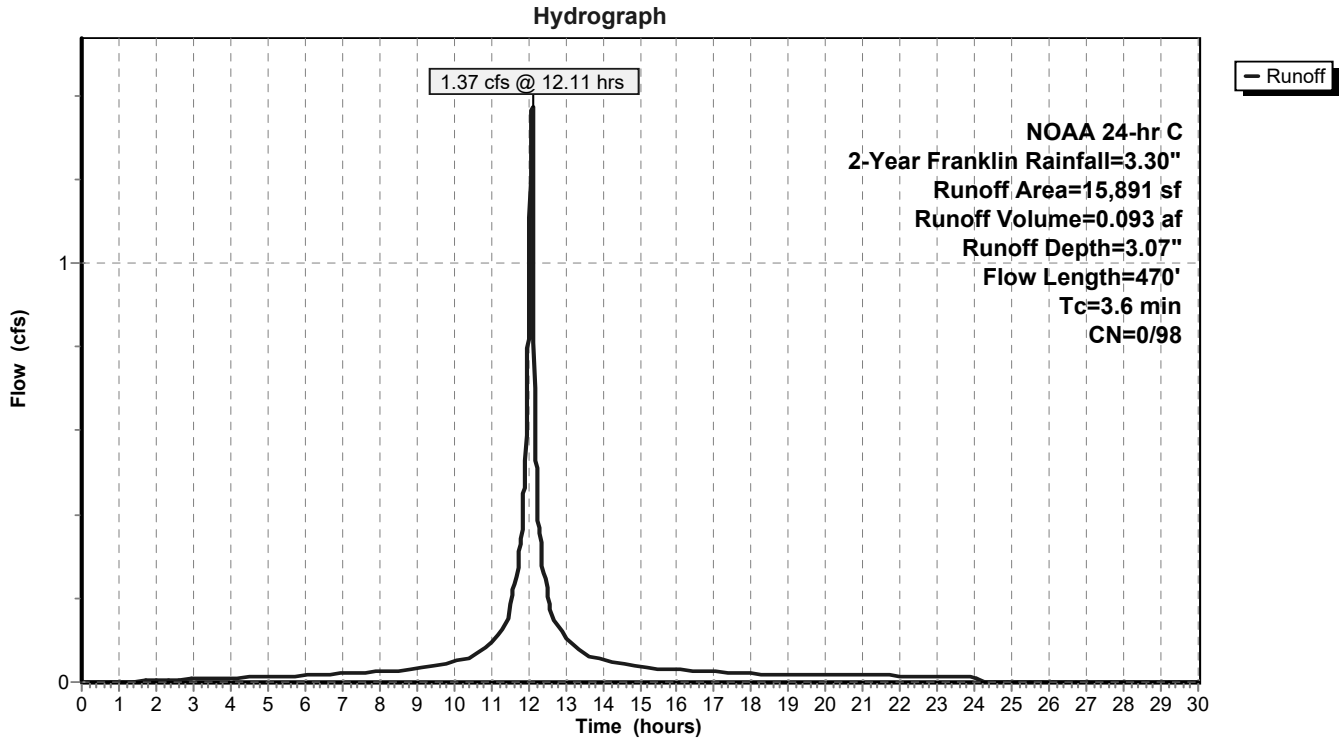
Runoff = 1.37 cfs @ 12.11 hrs, Volume= 0.093 af, Depth= 3.07"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Franklin Rainfall=3.30"

Area (sf)	CN	Description
15,891	98	Paved roads w/curbs & sewers, HSG D
15,891		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0900	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	90	0.0430	1.86		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
1.4	260	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	110	0.0240	8.15	10.01	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.6	470	Total			

Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]



Summary for Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

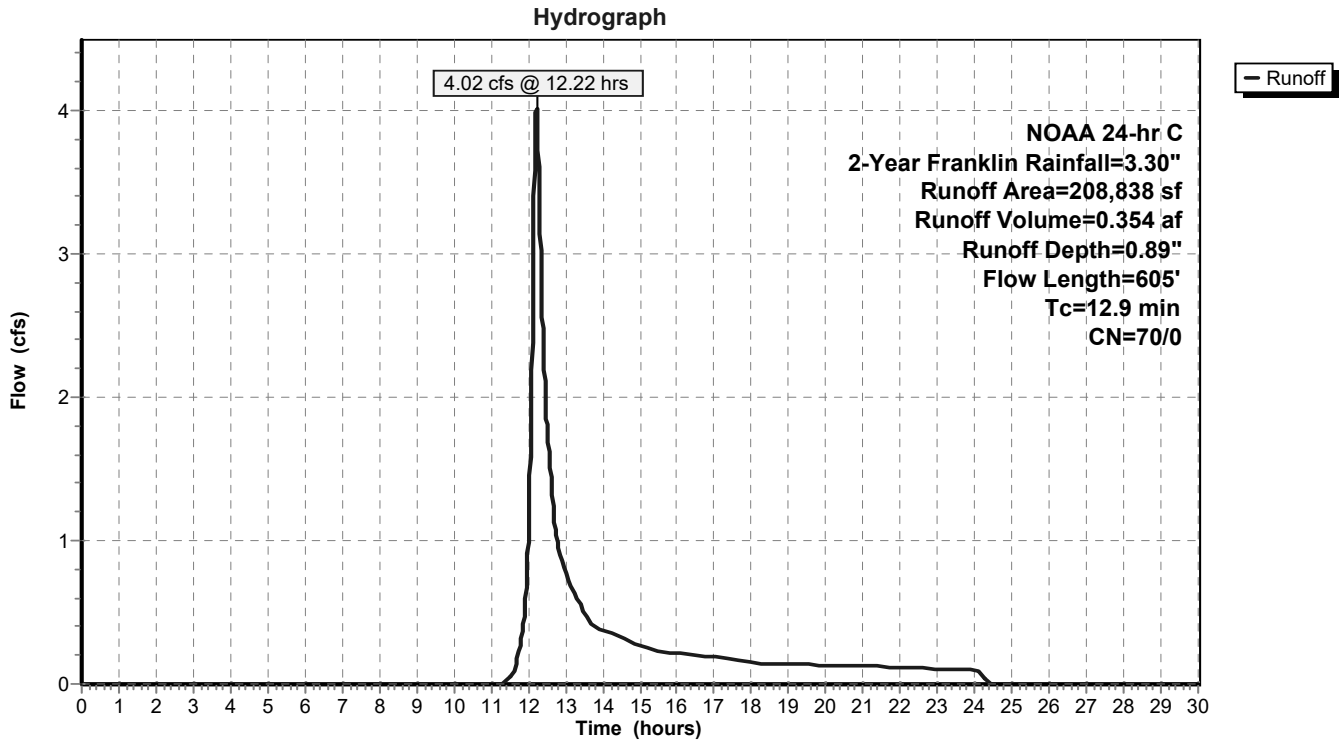
Runoff = 4.02 cfs @ 12.22 hrs, Volume= 0.354 af, Depth= 0.89"
Routed to Link 14L : COM Hydrographs Proposed

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Franklin Rainfall=3.30"

Area (sf)	CN	Description
204,785	70	Woods, Good, HSG C
4,053	74	>75% Grass cover, Good, HSG C
208,838	70	Weighted Average
208,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)



Summary for Pond 13P: Modified Bioretention Basin #1

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 2.66" for 2-Year Franklin event
Inflow = 8.14 cfs @ 12.10 hrs, Volume= 0.533 af
Outflow = 1.18 cfs @ 12.53 hrs, Volume= 0.357 af, Atten= 86%, Lag= 26.2 min
Primary = 1.18 cfs @ 12.53 hrs, Volume= 0.357 af
Routed to Link 14L : COM Hydrographs Proposed

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 45.13' @ 12.53 hrs Surf.Area= 7,538 sf Storage= 13,427 cf

Plug-Flow detention time= 282.9 min calculated for 0.357 af (67% of inflow)
Center-of-Mass det. time= 180.6 min (946.8 - 766.1)

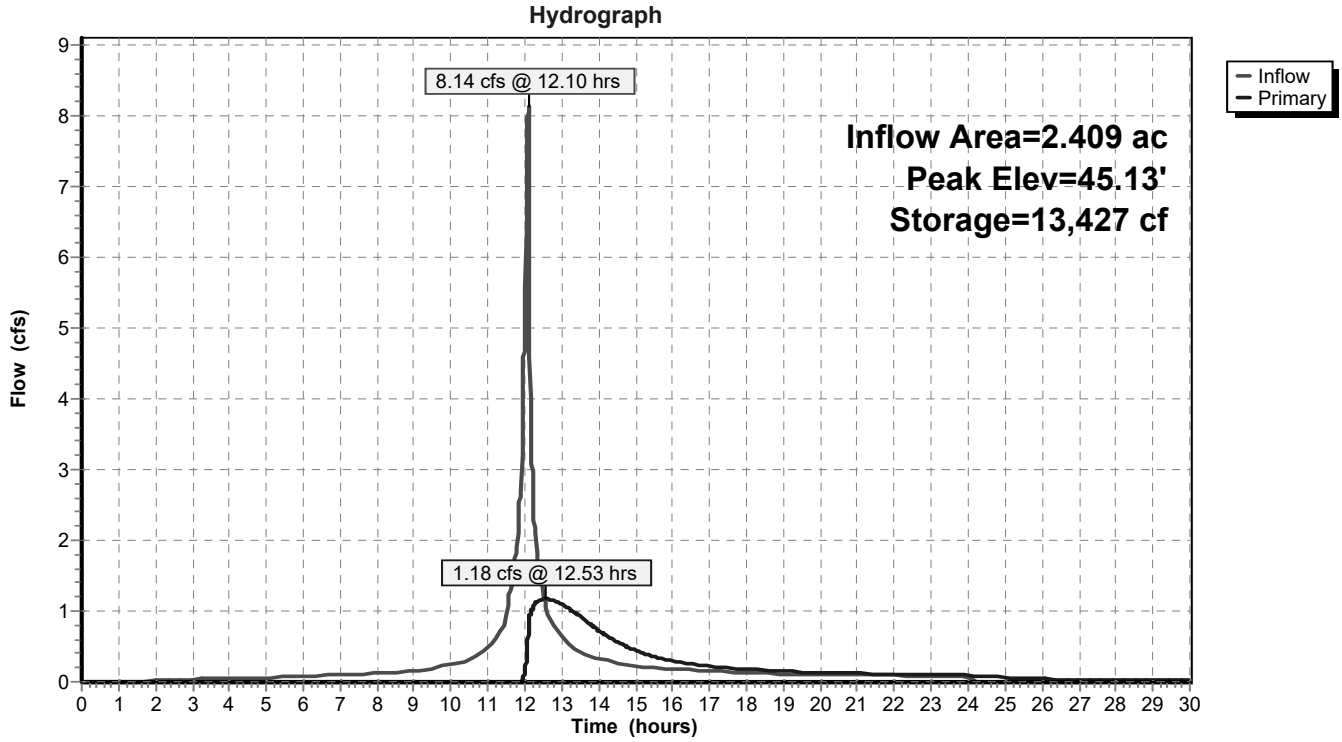
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)

Primary OutFlow Max=1.18 cfs @ 12.53 hrs HW=45.13' (Free Discharge)
- **1=Outfall** (Passes 1.18 cfs of 28.85 cfs potential flow)
  - **2=Orifice** (Orifice Controls 1.18 cfs @ 3.38 fps)
  - **3=Rectangular Weir** (Controls 0.00 cfs)
  - **4=Rectangular Weir** (Controls 0.00 cfs)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1

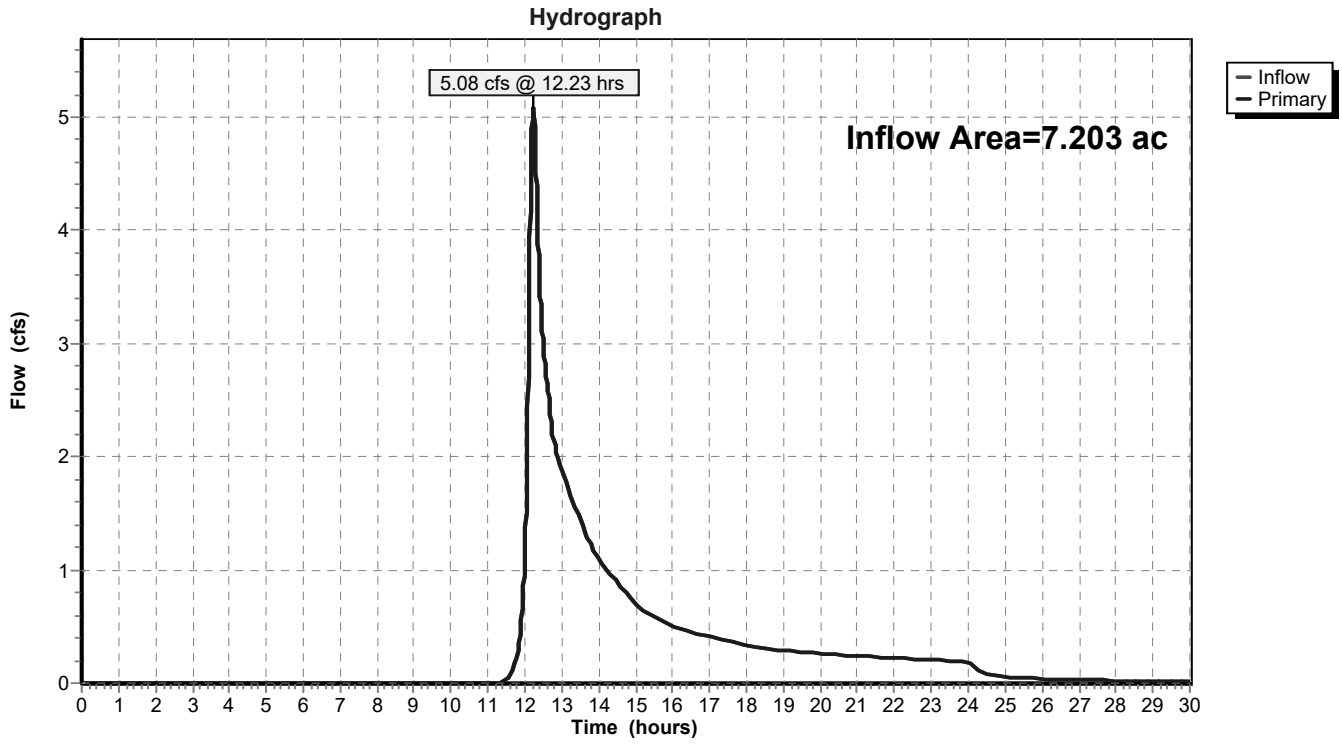


Summary for Link 14L: COM Hydrographs Proposed

Inflow Area = 7.203 ac, 24.76% Impervious, Inflow Depth > 1.18" for 2-Year Franklin event
Inflow = 5.08 cfs @ 12.23 hrs, Volume= 0.711 af
Primary = 5.08 cfs @ 12.23 hrs, Volume= 0.711 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node COM-1

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 14L: COM Hydrographs Proposed



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11Si: DA-11B Existing Hotel Runoff Area=61,808 sf 100.00% Impervious Runoff Depth=4.78"
Flow Length=415' Tc=1.7 min CN=0/98 Runoff=8.34 cfs 0.566 af

Subcatchment 11Sp: DA-11A Existing Hotel Runoff Area=27,220 sf 0.00% Impervious Runoff Depth=2.91"
Flow Length=433' Tc=3.5 min CN=80/0 Runoff=2.60 cfs 0.152 af

Subcatchment 12S: DA-12 Prop Driveway | Runoff Area=15,891 sf 100.00% Impervious Runoff Depth=4.78"
Flow Length=470' Tc=3.6 min CN=0/98 Runoff=2.10 cfs 0.145 af

Subcatchment 13Su: DA-13 Stream Corridor Runoff Area=208,838 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=9.97 cfs 0.819 af

Pond 13P: Modified Bioretention Basin #1 Peak Elev=45.97' Storage=19,824 cf Inflow=13.01 cfs 0.863 af
Outflow=2.78 cfs 0.685 af

Link 14L: COM Hydrographs Proposed Inflow=12.45 cfs 1.505 af
Primary=12.45 cfs 1.505 af

Total Runoff Area = 7.203 ac Runoff Volume = 1.682 af Average Runoff Depth = 2.80"
75.24% Pervious = 5.419 ac 24.76% Impervious = 1.784 ac

Summary for Subcatchment 11Si: DA-11B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

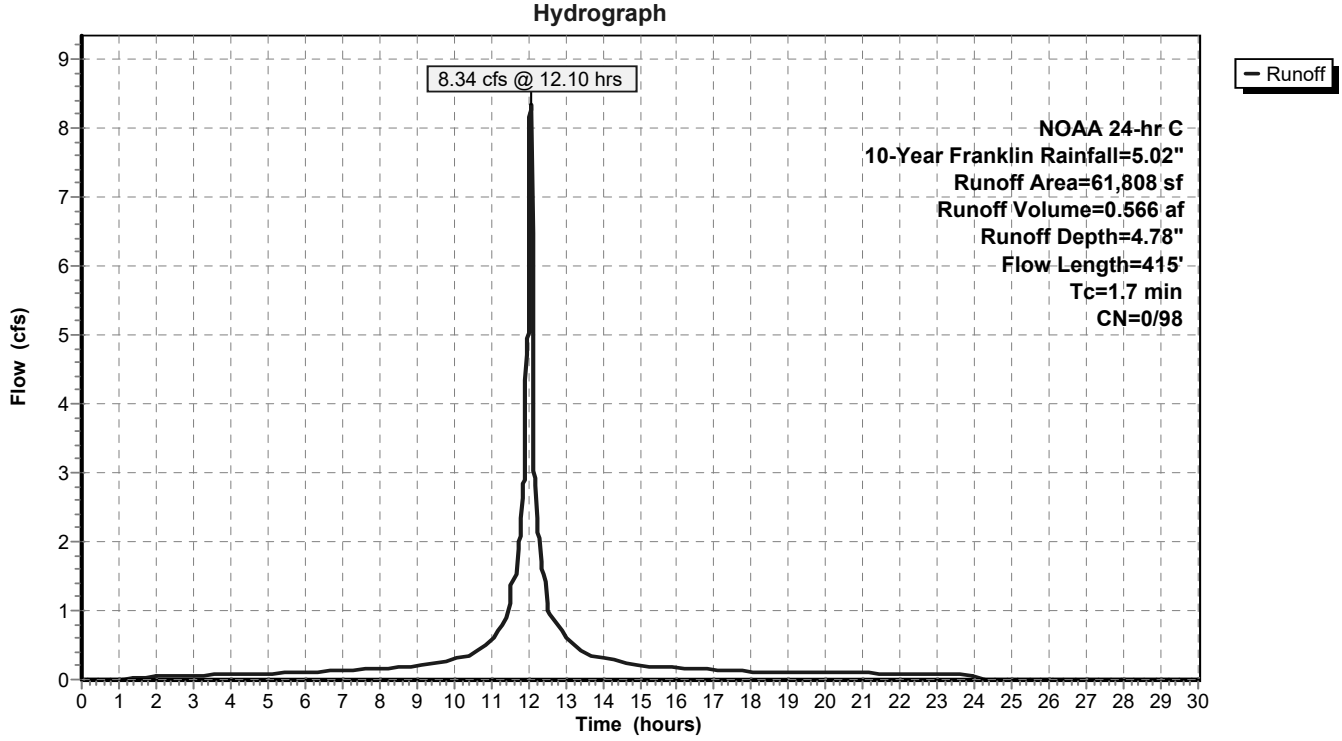
Runoff = 8.34 cfs @ 12.10 hrs, Volume= 0.566 af, Depth= 4.78"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Franklin Rainfall=5.02"

Area (sf)	CN	Description
61,808	98	Paved roads w/curbs & sewers, HSG D
61,808		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.7	415	Total			

Subcatchment 11Si: DA-11B Existing Hotel [Impervious]



Summary for Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

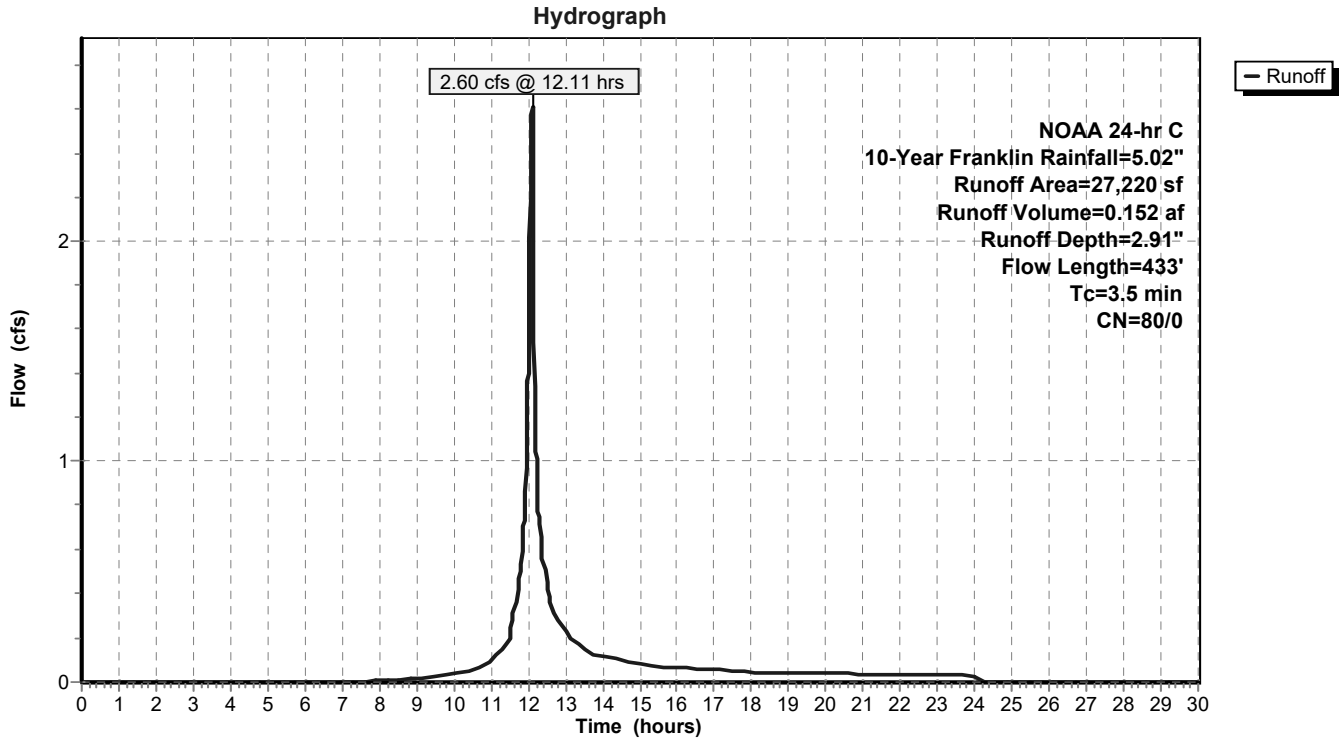
Runoff = 2.60 cfs @ 12.11 hrs, Volume= 0.152 af, Depth= 2.91"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Franklin Rainfall=5.02"

Area (sf)	CN	Description
27,220	80	>75% Grass cover, Good, HSG D
27,220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.5	433	Total			

Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]



Summary for Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]

From Comfort Inn SWR revised 8/01

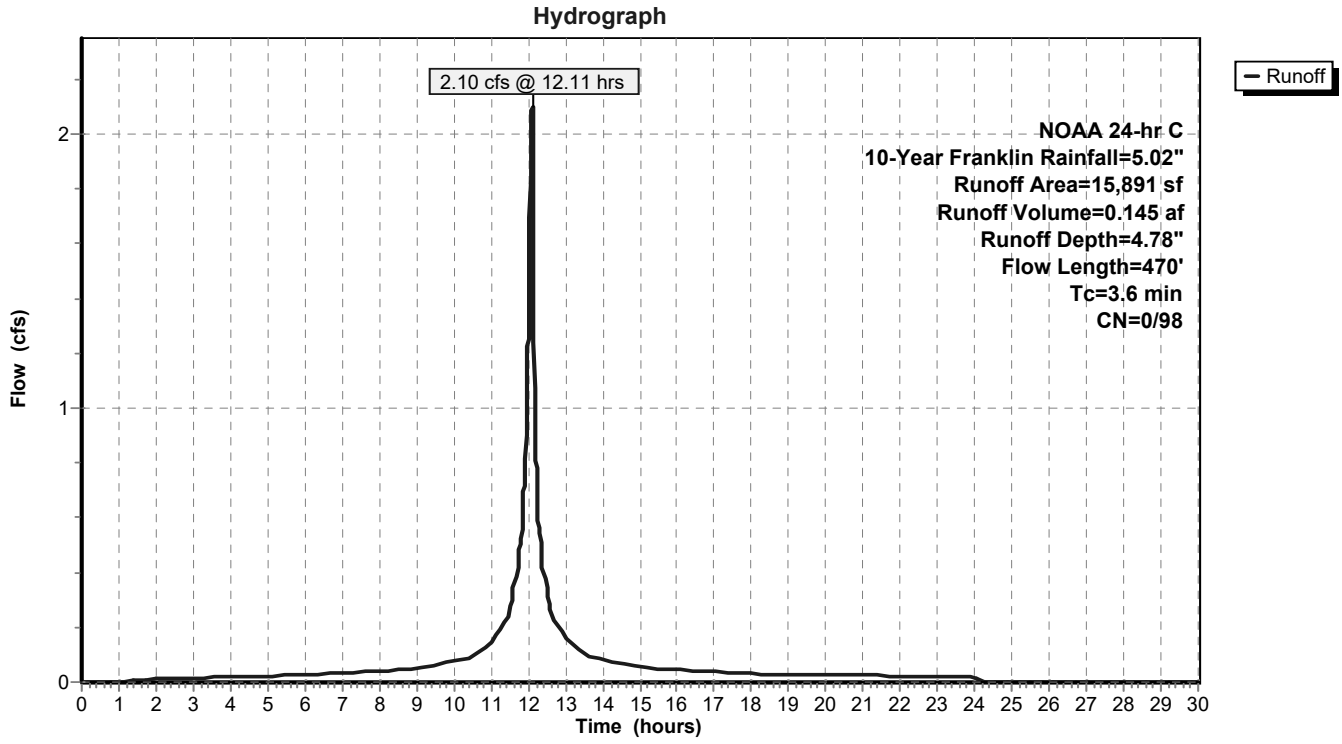
Runoff = 2.10 cfs @ 12.11 hrs, Volume= 0.145 af, Depth= 4.78"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Franklin Rainfall=5.02"

Area (sf)	CN	Description
15,891	98	Paved roads w/curbs & sewers, HSG D
15,891		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0900	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	90	0.0430	1.86		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
1.4	260	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	110	0.0240	8.15	10.01	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.6	470	Total			

Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]



Summary for Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

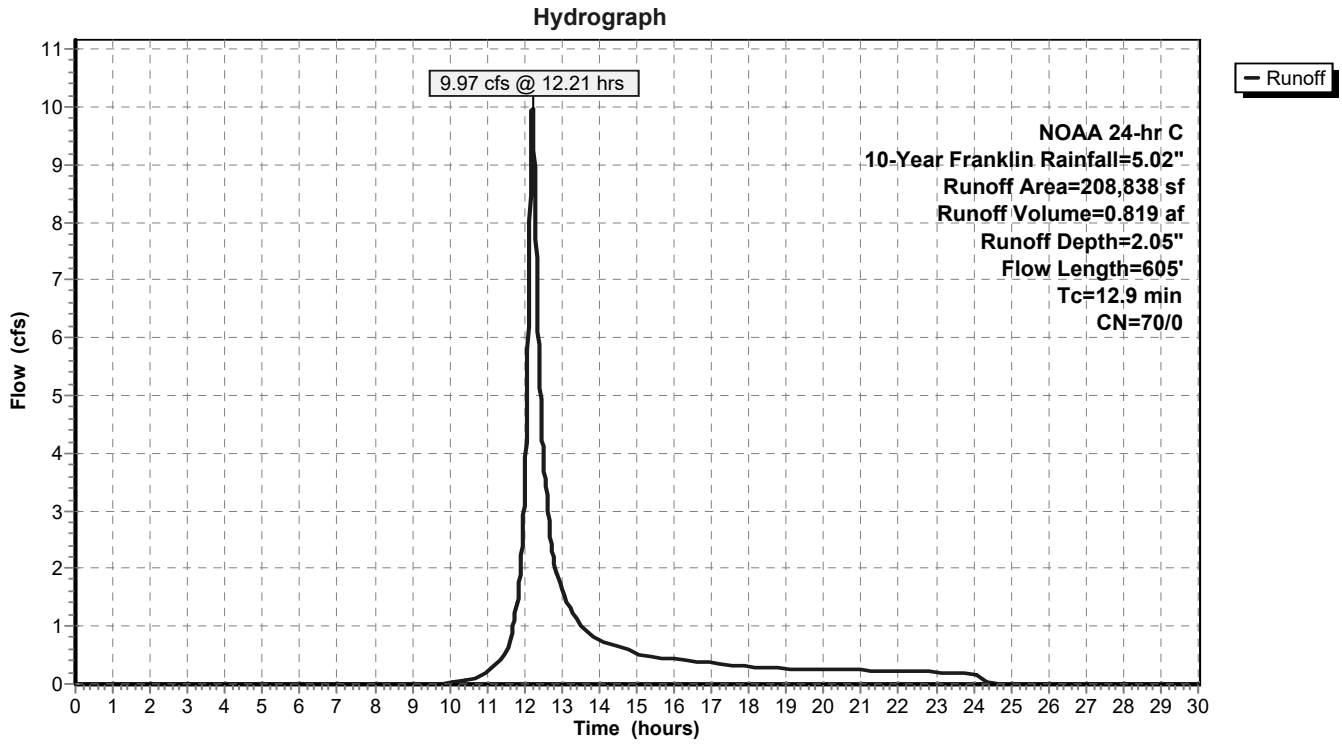
Runoff = 9.97 cfs @ 12.21 hrs, Volume= 0.819 af, Depth= 2.05"
Routed to Link 14L : COM Hydrographs Proposed

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Franklin Rainfall=5.02"

Area (sf)	CN	Description
204,785	70	Woods, Good, HSG C
4,053	74	>75% Grass cover, Good, HSG C
208,838	70	Weighted Average
208,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)



Summary for Pond 13P: Modified Bioretention Basin #1

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 4.30" for 10-Year Franklin event
Inflow = 13.01 cfs @ 12.10 hrs, Volume= 0.863 af
Outflow = 2.78 cfs @ 12.34 hrs, Volume= 0.685 af, Atten= 79%, Lag= 14.5 min
Primary = 2.78 cfs @ 12.34 hrs, Volume= 0.685 af
Routed to Link 14L : COM Hydrographs Proposed

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 45.97' @ 12.34 hrs Surf.Area= 7,593 sf Storage= 19,824 cf

Plug-Flow detention time= 237.1 min calculated for 0.685 af (79% of inflow)
Center-of-Mass det. time= 155.1 min (913.8 - 758.7)

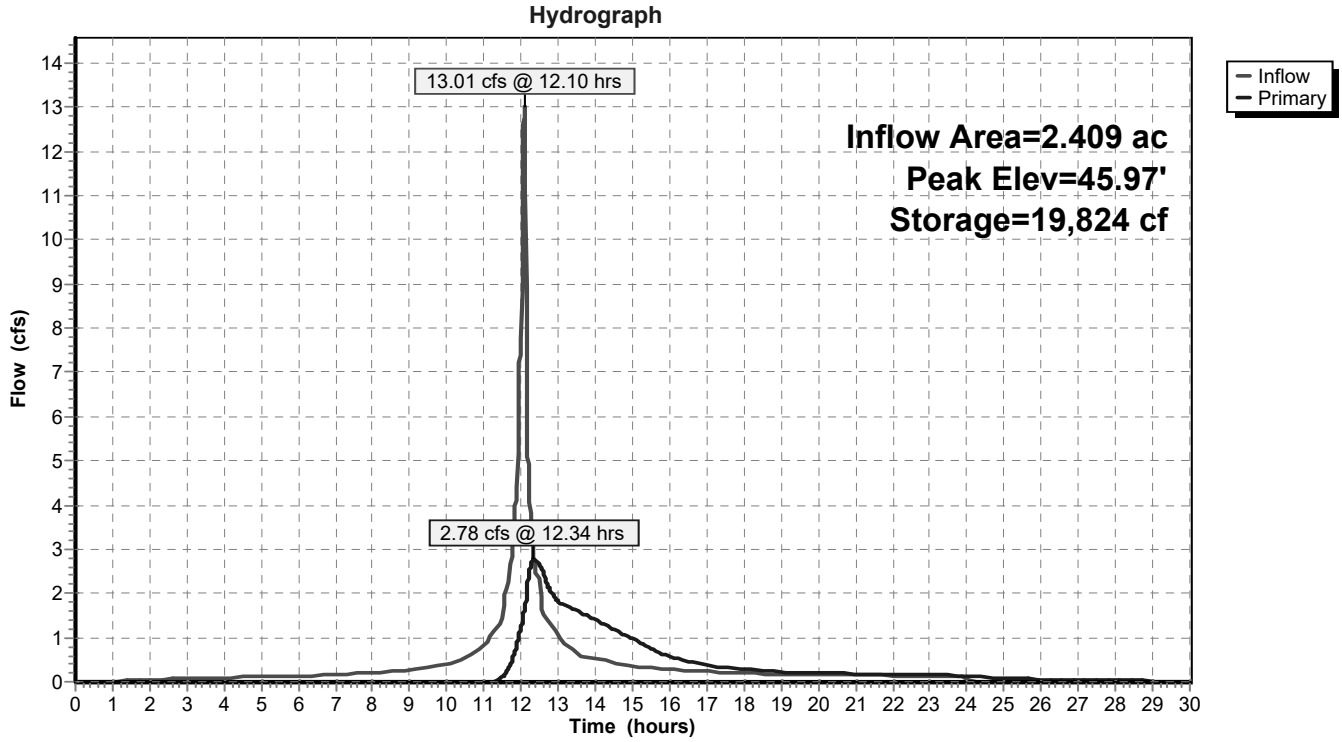
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)

Primary OutFlow Max=2.78 cfs @ 12.34 hrs HW=45.97' (Free Discharge)
- **1=Outfall** (Passes 2.78 cfs of 30.51 cfs potential flow)
  - **2=Orifice** (Orifice Controls 1.94 cfs @ 5.57 fps)
  - **3=Rectangular Weir** (Weir Controls 0.83 cfs @ 1.54 fps)
  - **4=Rectangular Weir** (Controls 0.00 cfs)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1

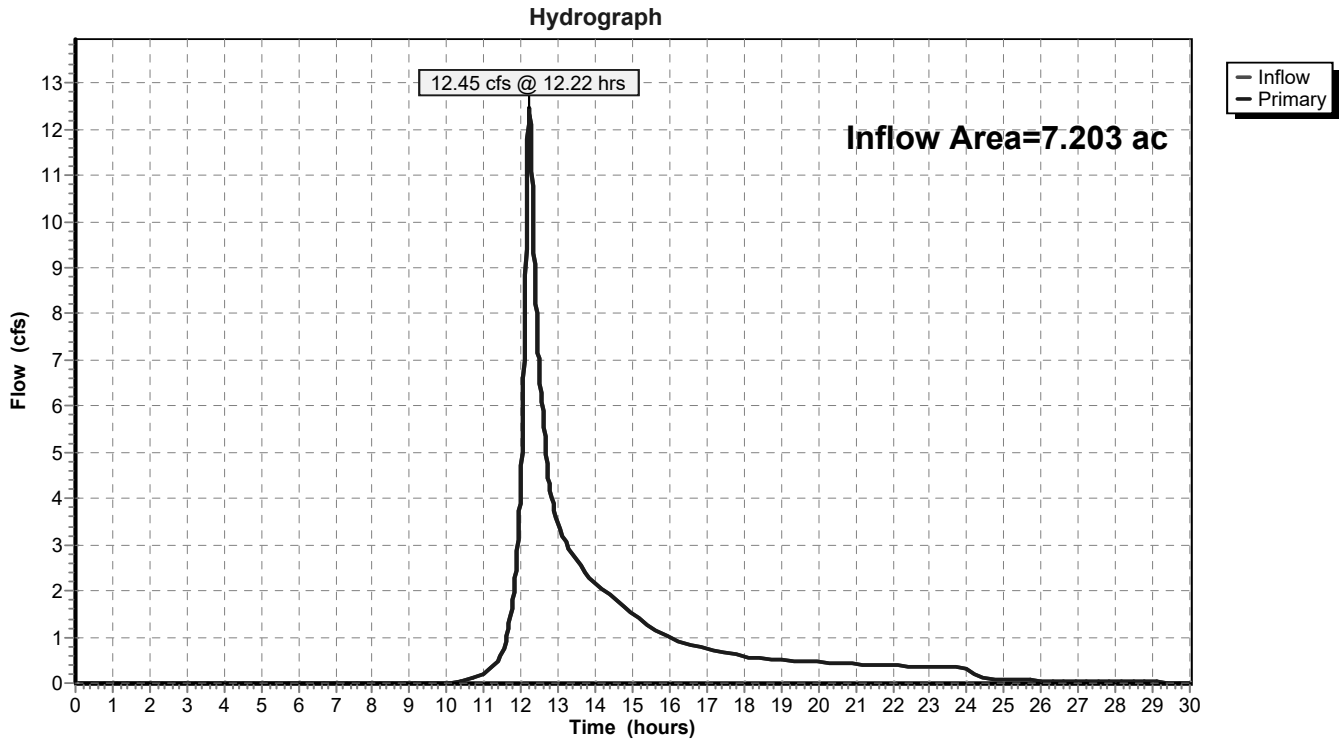


Summary for Link 14L: COM Hydrographs Proposed

Inflow Area = 7.203 ac, 24.76% Impervious, Inflow Depth > 2.51" for 10-Year Franklin event
Inflow = 12.45 cfs @ 12.22 hrs, Volume= 1.505 af
Primary = 12.45 cfs @ 12.22 hrs, Volume= 1.505 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node COM-1

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 14L: COM Hydrographs Proposed



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11Si: DA-11B Existing Hotel Runoff Area=61,808 sf 100.00% Impervious Runoff Depth=8.12"
Flow Length=415' Tc=1.7 min CN=0/98 Runoff=13.93 cfs 0.960 af

Subcatchment 11Sp: DA-11A Existing Hotel Runoff Area=27,220 sf 0.00% Impervious Runoff Depth=5.96"
Flow Length=433' Tc=3.5 min CN=80/0 Runoff=5.15 cfs 0.311 af

Subcatchment 12S: DA-12 Prop Driveway | Runoff Area=15,891 sf 100.00% Impervious Runoff Depth=8.12"
Flow Length=470' Tc=3.6 min CN=0/98 Runoff=3.51 cfs 0.247 af

Subcatchment 13Su: DA-13 Stream Corridor Runoff Area=208,838 sf 0.00% Impervious Runoff Depth=4.78"
Flow Length=605' Tc=12.9 min CN=70/0 Runoff=23.47 cfs 1.908 af

Pond 13P: Modified Bioretention Basin #1 Peak Elev=46.69' Storage=25,320 cf Inflow=22.53 cfs 1.518 af
Outflow=15.66 cfs 1.339 af

Link 14L: COM Hydrographs Proposed Inflow=36.37 cfs 3.247 af
Primary=36.37 cfs 3.247 af

Total Runoff Area = 7.203 ac Runoff Volume = 3.425 af Average Runoff Depth = 5.71"
75.24% Pervious = 5.419 ac 24.76% Impervious = 1.784 ac

Summary for Subcatchment 11Si: DA-11B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

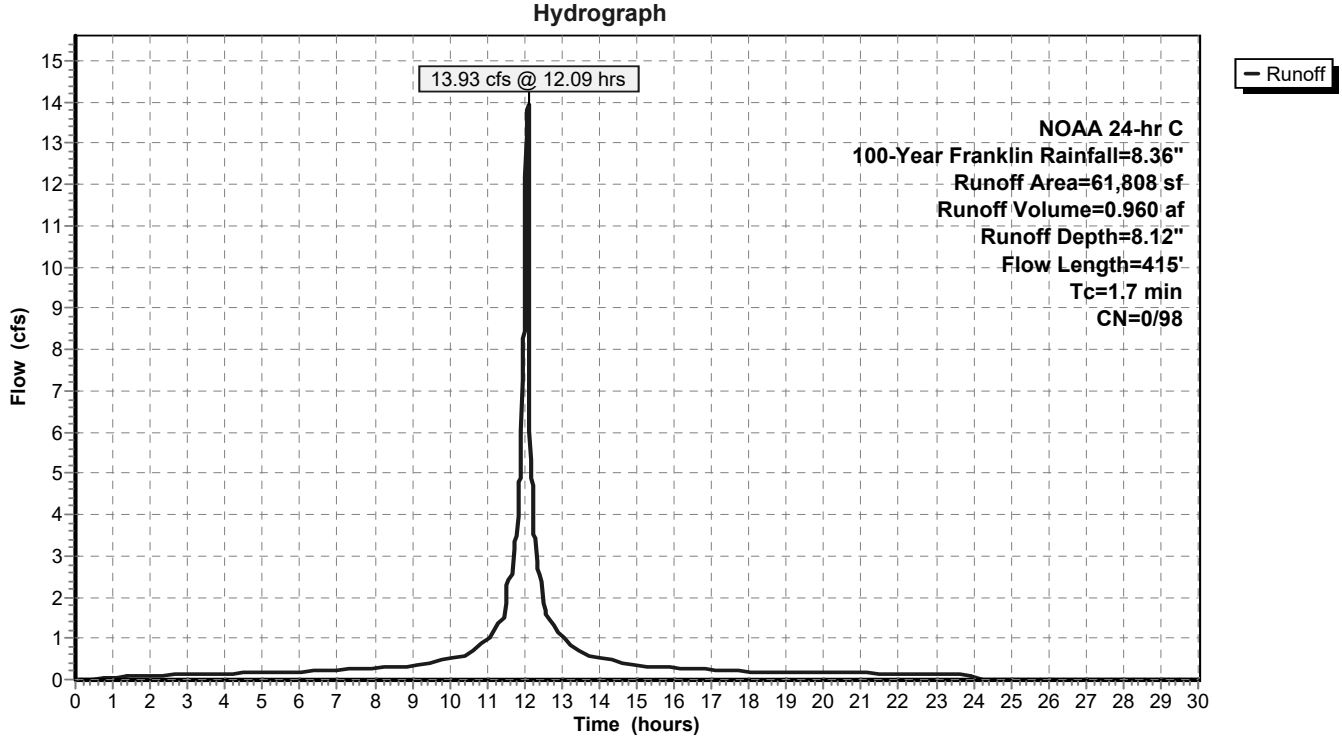
Runoff = 13.93 cfs @ 12.09 hrs, Volume= 0.960 af, Depth= 8.12"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
61,808	98	Paved roads w/curbs & sewers, HSG D
61,808		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.7	415	Total			

Subcatchment 11Si: DA-11B Existing Hotel [Impervious]



Summary for Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

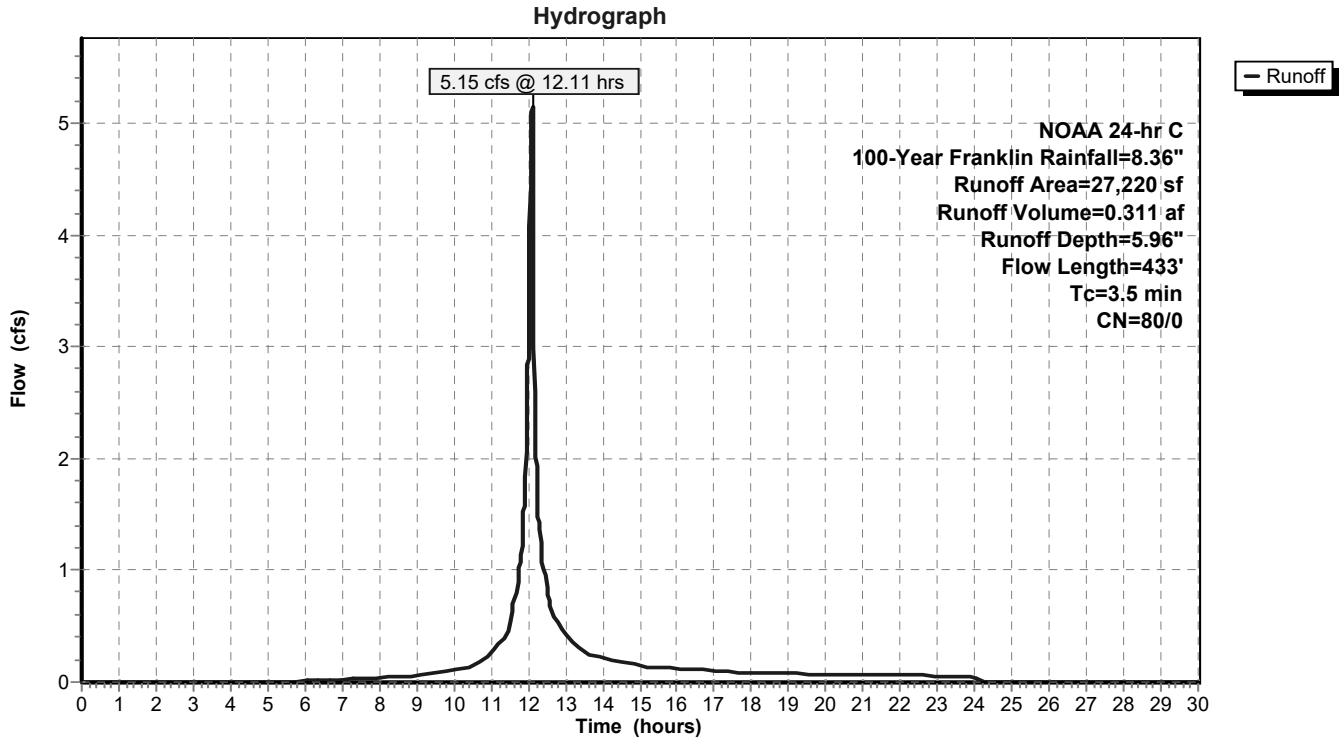
Runoff = 5.15 cfs @ 12.11 hrs, Volume= 0.311 af, Depth= 5.96"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
27,220	80	>75% Grass cover, Good, HSG D
27,220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.5	433	Total			

Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]



Summary for Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]

From Comfort Inn SWR revised 8/01

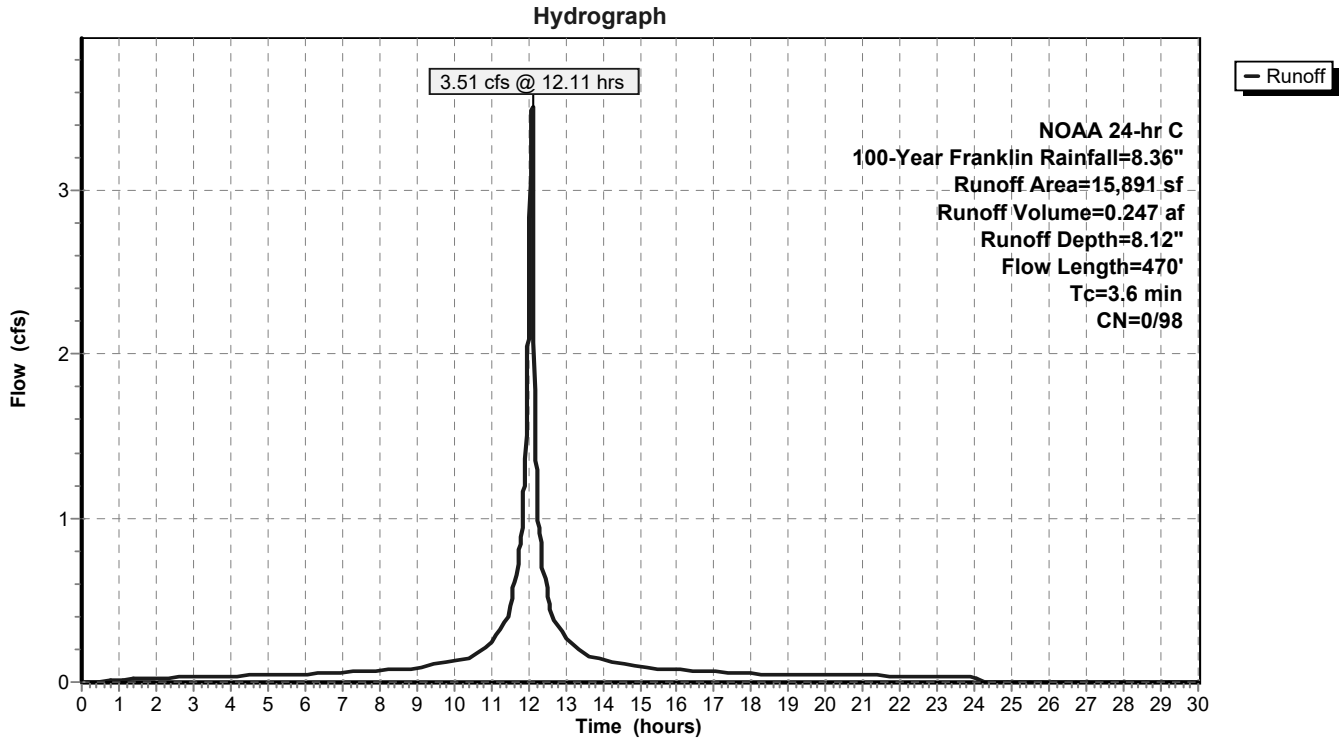
Runoff = 3.51 cfs @ 12.11 hrs, Volume= 0.247 af, Depth= 8.12"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
15,891	98	Paved roads w/curbs & sewers, HSG D
15,891		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0900	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	90	0.0430	1.86		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
1.4	260	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	110	0.0240	8.15	10.01	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.6	470	Total			

Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]



Summary for Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)

Wooded areas to remain (undisturbed)

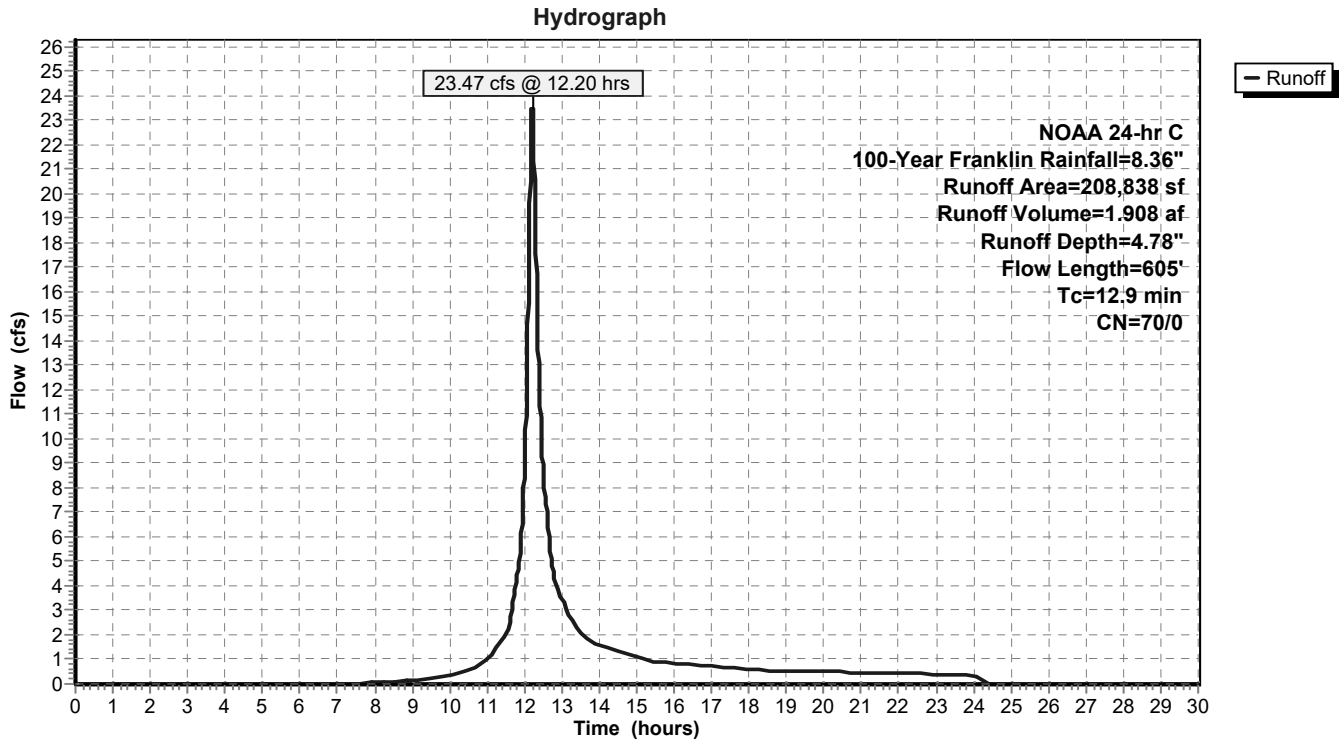
Runoff = 23.47 cfs @ 12.20 hrs, Volume= 1.908 af, Depth= 4.78"
Routed to Link 14L : COM Hydrographs Proposed

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
204,785	70	Woods, Good, HSG C
4,053	74	>75% Grass cover, Good, HSG C
208,838	70	Weighted Average
208,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	39	0.0230	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.30"
1.3	277	0.0470	3.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	119	0.1870	11.57	69.40	**Channel Flow, Swale** Area= 6.0 sf Perim= 12.0' r= 0.50' n= 0.035
2.0	170	0.0035	1.43	34.27	**Channel Flow, Main Channel (East Tributary)** Area= 24.0 sf Perim= 56.0' r= 0.43' n= 0.035
12.9	605	Total			

Subcatchment 13Su: DA-13 Stream Corridor (Undisturbed)



Summary for Pond 13P: Modified Bioretention Basin #1

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 7.56" for 100-Year Franklin event
Inflow = 22.53 cfs @ 12.10 hrs, Volume= 1.518 af
Outflow = 15.66 cfs @ 12.13 hrs, Volume= 1.339 af, Atten= 31%, Lag= 2.0 min
Primary = 15.66 cfs @ 12.13 hrs, Volume= 1.339 af
Routed to Link 14L : COM Hydrographs Proposed

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 46.69' @ 12.13 hrs Surf.Area= 7,640 sf Storage= 25,320 cf

Plug-Flow detention time= 175.4 min calculated for 1.339 af (88% of inflow)
Center-of-Mass det. time= 116.9 min (867.7 - 750.7)

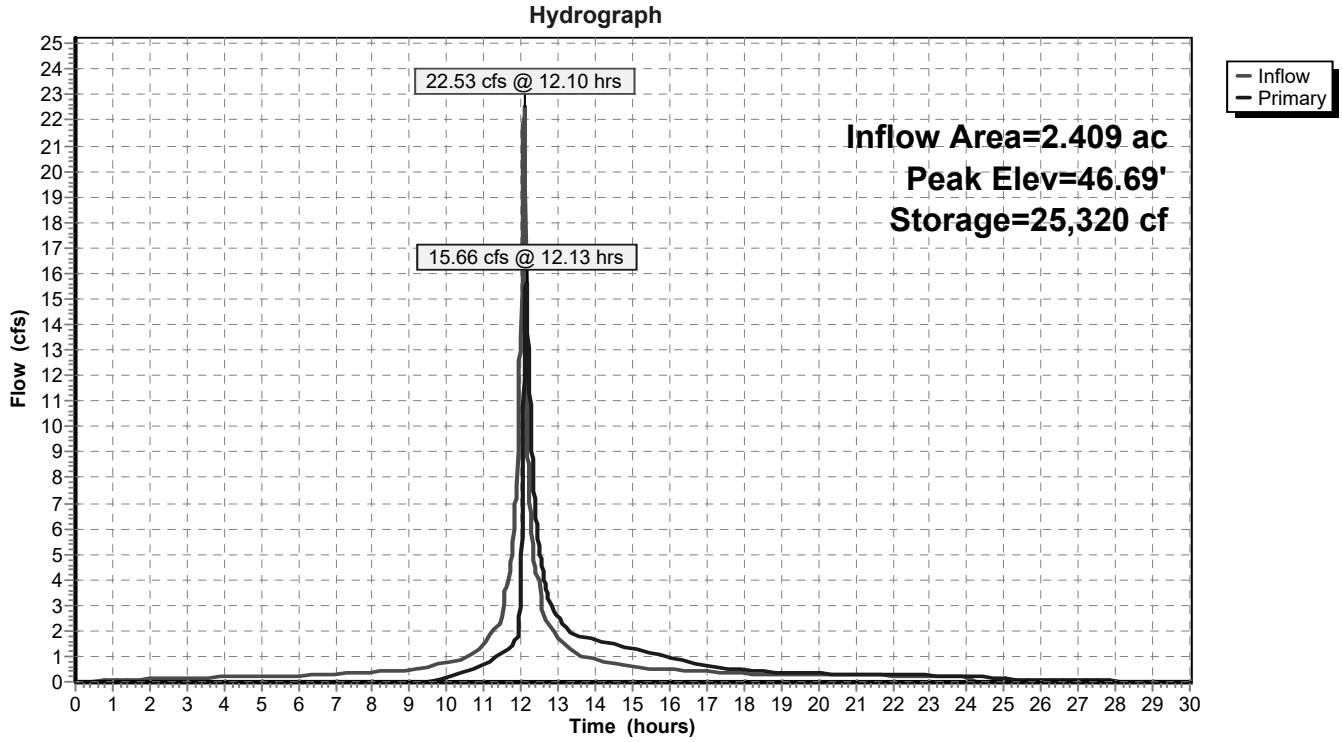
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)

Primary OutFlow Max=15.64 cfs @ 12.13 hrs HW=46.69' (Free Discharge)
- **1=Outfall** (Passes 15.64 cfs of 31.86 cfs potential flow)
  - **2=Orifice** (Orifice Controls 2.41 cfs @ 6.91 fps)
  - **3=Rectangular Weir** (Weir Controls 6.91 cfs @ 3.17 fps)
  - **4=Rectangular Weir** (Weir Controls 6.32 cfs @ 2.72 fps)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1

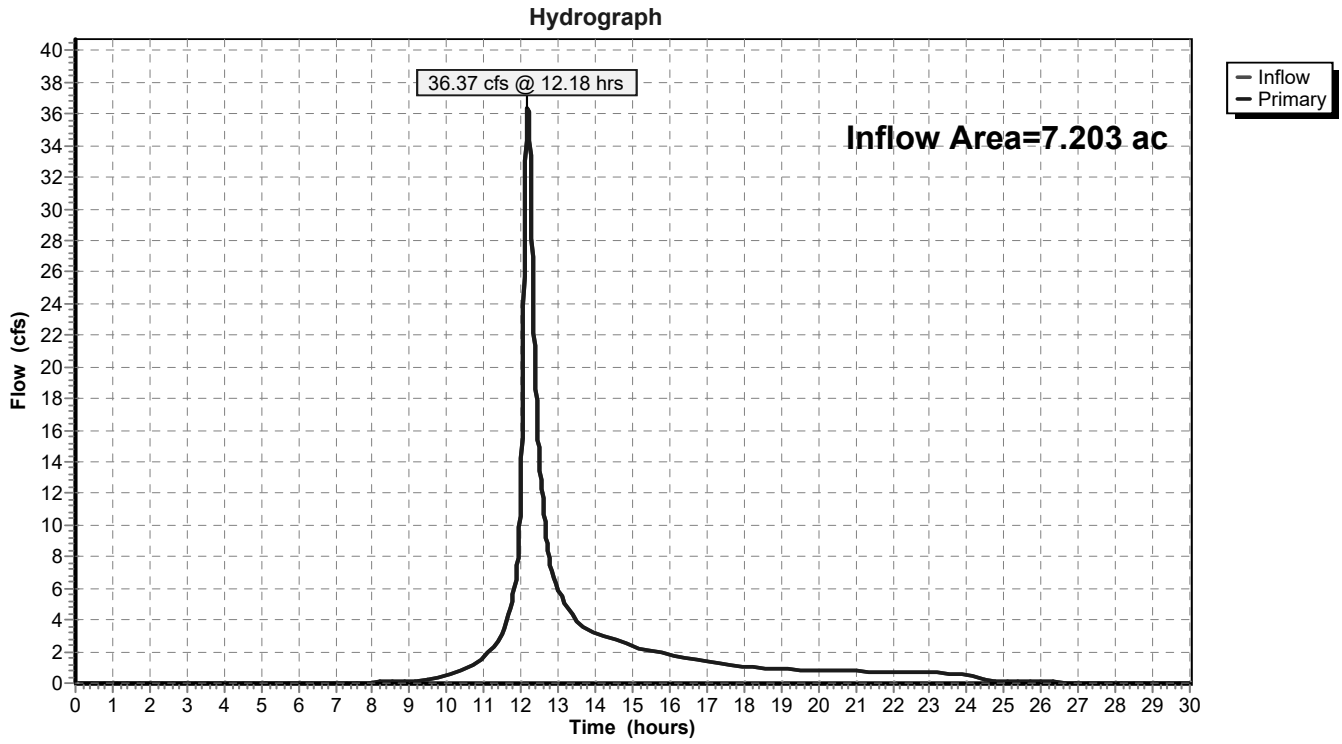


Summary for Link 14L: COM Hydrographs Proposed

Inflow Area = 7.203 ac, 24.76% Impervious, Inflow Depth > 5.41" for 100-Year Franklin event
Inflow = 36.37 cfs @ 12.18 hrs, Volume= 3.247 af
Primary = 36.37 cfs @ 12.18 hrs, Volume= 3.247 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node COM-1

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

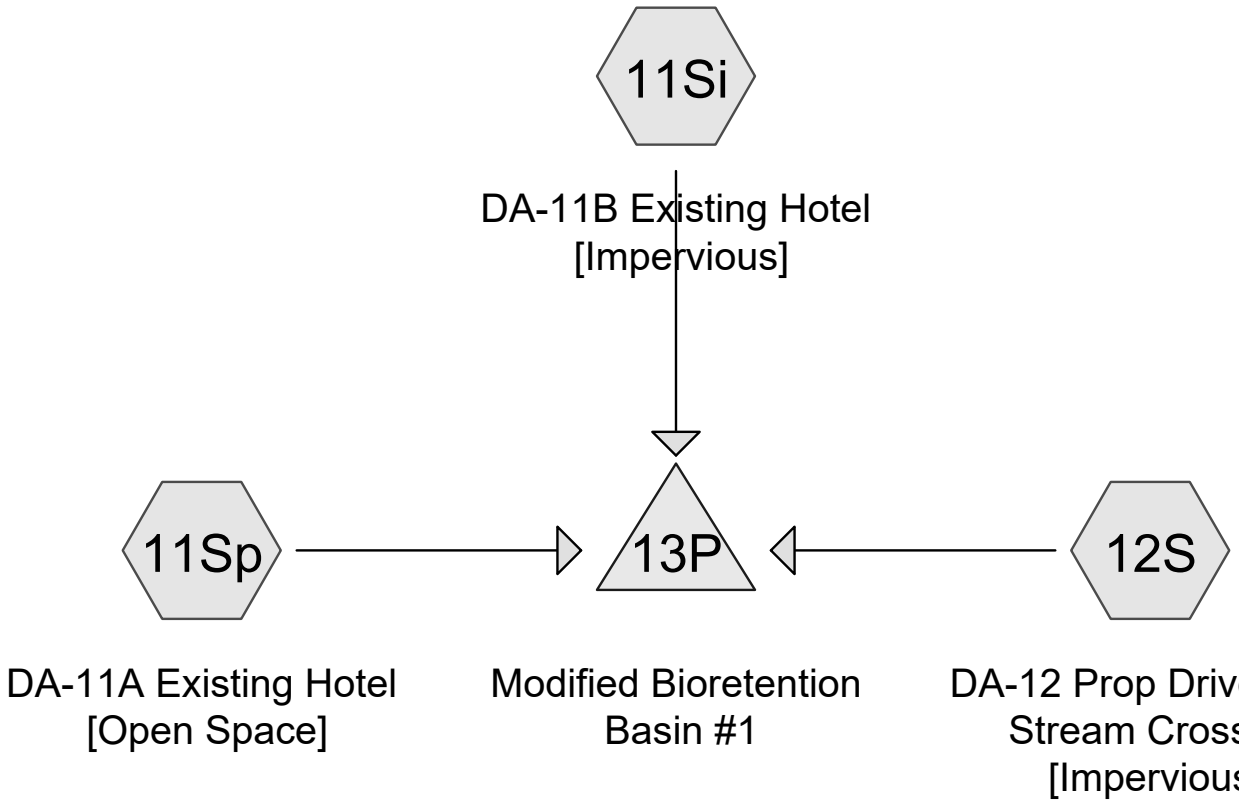
Link 14L: COM Hydrographs Proposed



EMERGENCY SPILLWAY

22-005 Spillway R0 MS
Prepared by The Reynolds Group, Inc.

TABLE OF CONTENTS



Subcat Reach Pond Link

Routing Diagram for 22-005 Spillway R0 MS
Prepared by The Reynolds Group, Inc.

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11Si: DA-11B Existing Hotel Runoff Area=61,808 sf 100.00% Impervious Runoff Depth=8.12"
Flow Length=415' Tc=1.7 min CN=0/98 Runoff=13.93 cfs 0.960 af

Subcatchment 11Sp: DA-11A Existing Hotel Runoff Area=27,220 sf 0.00% Impervious Runoff Depth=5.96"
Flow Length=433' Tc=3.5 min CN=80/0 Runoff=5.15 cfs 0.311 af

Subcatchment 12S: DA-12 Prop Driveway | Runoff Area=15,891 sf 100.00% Impervious Runoff Depth=8.12"
Flow Length=470' Tc=3.6 min CN=0/98 Runoff=3.51 cfs 0.247 af

Pond 13P: Modified Bioretention Basin #1 Peak Elev=47.17' Storage=28,965 cf Inflow=22.53 cfs 1.518 af
Outflow=21.18 cfs 0.926 af

Total Runoff Area = 2.409 ac Runoff Volume = 1.518 af Average Runoff Depth = 7.56"
25.94% Pervious = 0.625 ac 74.06% Impervious = 1.784 ac

Summary for Subcatchment 11Si: DA-11B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

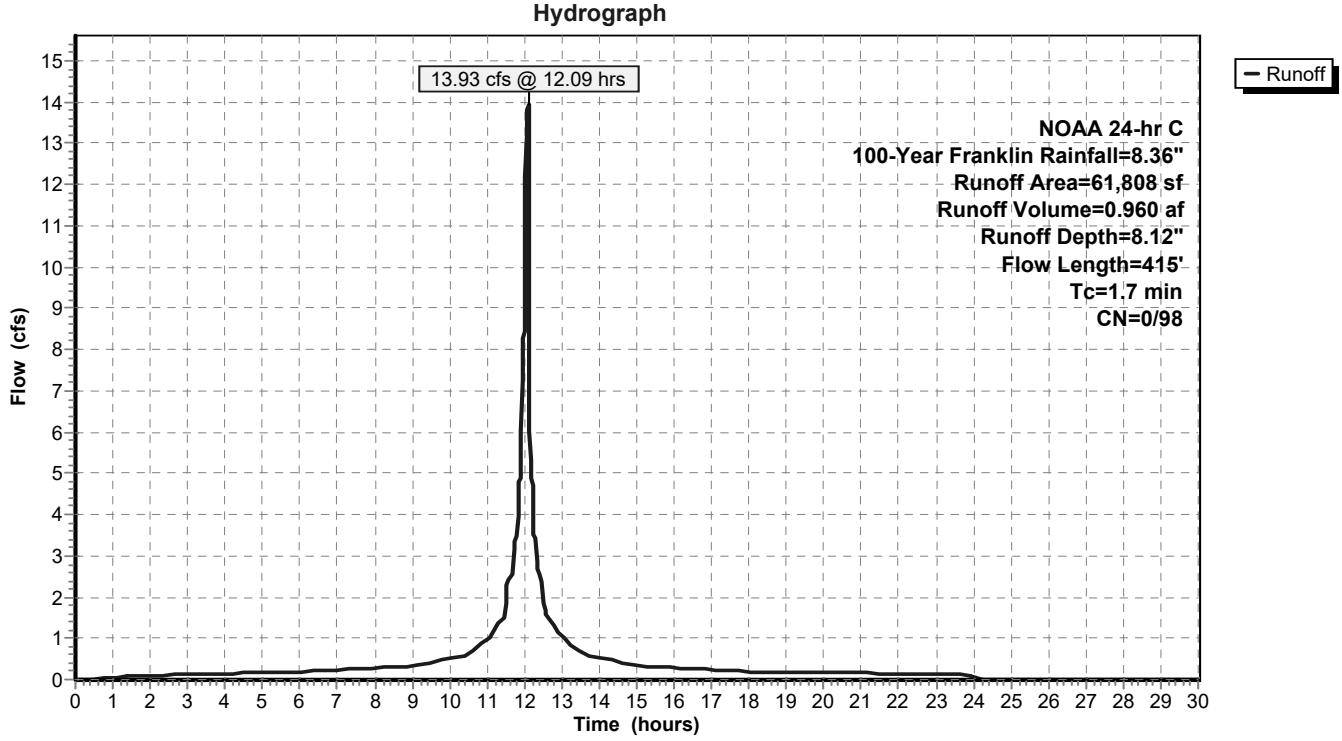
Runoff = 13.93 cfs @ 12.09 hrs, Volume= 0.960 af, Depth= 8.12"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
61,808	98	Paved roads w/curbs & sewers, HSG D
61,808		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.7	415	Total			

Subcatchment 11Si: DA-11B Existing Hotel [Impervious]



Summary for Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

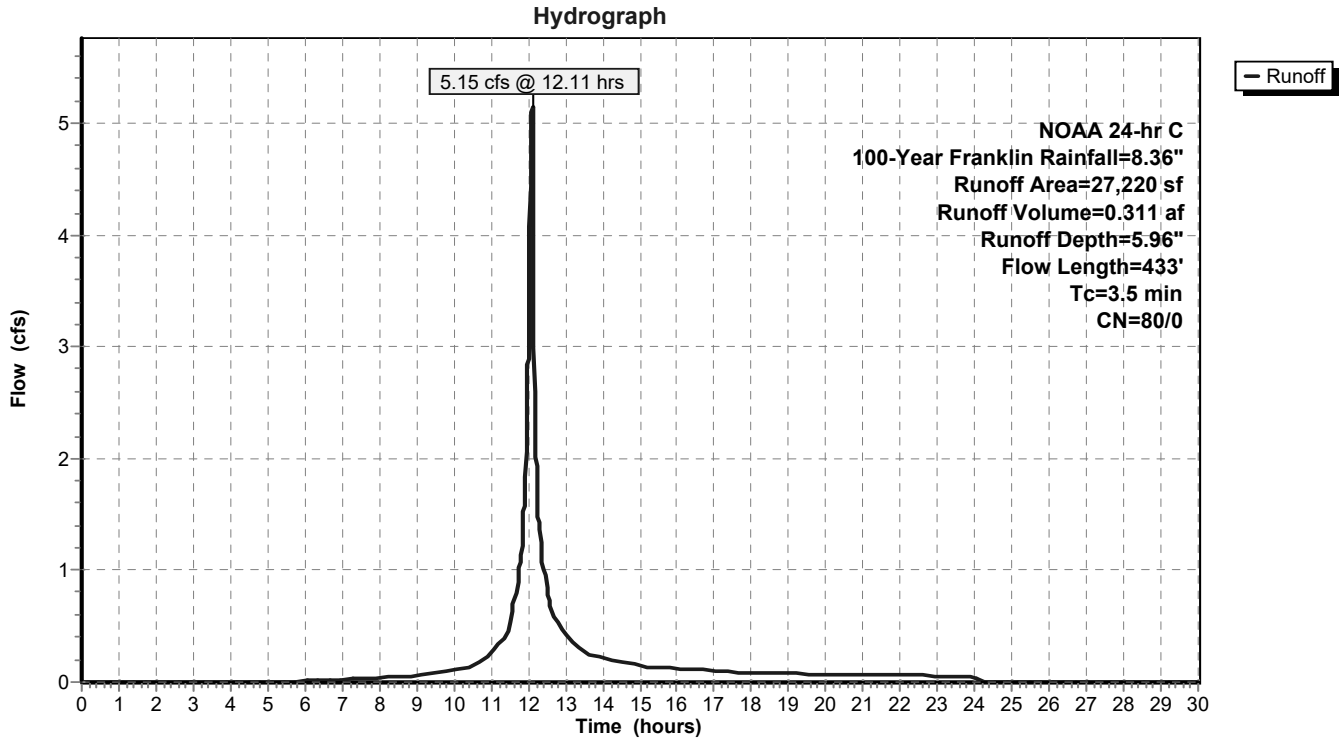
Runoff = 5.15 cfs @ 12.11 hrs, Volume= 0.311 af, Depth= 5.96"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
27,220	80	>75% Grass cover, Good, HSG D
27,220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.5	433	Total			

Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]



Summary for Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]

From Comfort Inn SWR revised 8/01

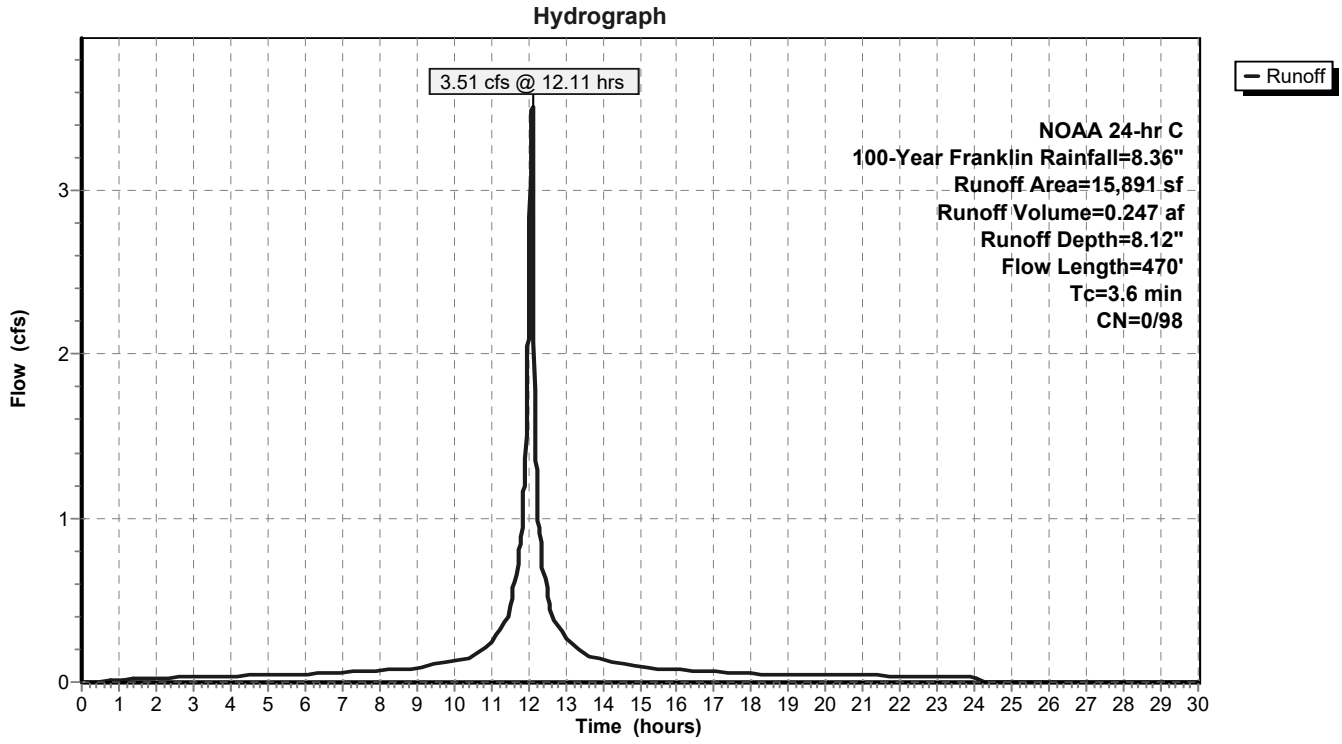
Runoff = 3.51 cfs @ 12.11 hrs, Volume= 0.247 af, Depth= 8.12"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 100-Year Franklin Rainfall=8.36"

Area (sf)	CN	Description
15,891	98	Paved roads w/curbs & sewers, HSG D
15,891		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0900	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	90	0.0430	1.86		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
1.4	260	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	110	0.0240	8.15	10.01	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.6	470	Total			

Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]



Summary for Pond 13P: Modified Bioretention Basin #1

Model | Condition: Blocked Outlet Structure

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 7.56" for 100-Year Franklin event
Inflow = 22.53 cfs @ 12.10 hrs, Volume= 1.518 af
Outflow = 21.18 cfs @ 12.11 hrs, Volume= 0.926 af, Atten= 6%, Lag= 0.9 min
Primary = 21.18 cfs @ 12.11 hrs, Volume= 0.926 af
Routed to nonexistent node 14L

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 47.17' @ 12.11 hrs Surf.Area= 7,671 sf Storage= 28,965 cf

Plug-Flow detention time= 220.8 min calculated for 0.926 af (61% of inflow)
Center-of-Mass det. time= 108.6 min (859.4 - 750.7)

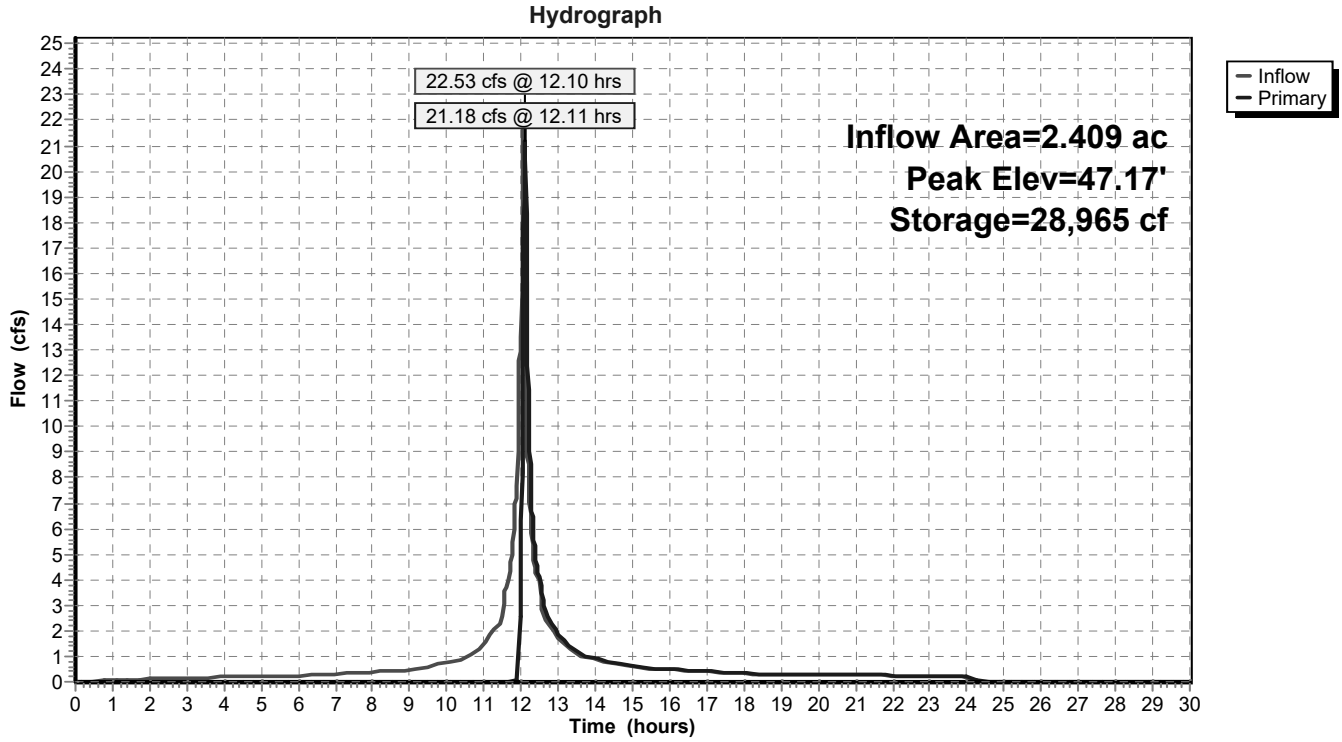
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall X 0.00** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice X 0.00** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir X 0.00** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir X 0.00** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)

Primary OutFlow Max=21.10 cfs @ 12.11 hrs HW=47.17' (Free Discharge)
- **1=Outfall** (Controls 0.00 cfs)
  - **2=Orifice** (Controls 0.00 cfs)
  - **3=Rectangular Weir** (Controls 0.00 cfs)
  - **4=Rectangular Weir** (Controls 0.00 cfs)
- **5=Emergency Concrete Spillway** (Weir Controls 21.10 cfs @ 2.11 fps)

Pond 13P: Modified Bioretention Basin #1



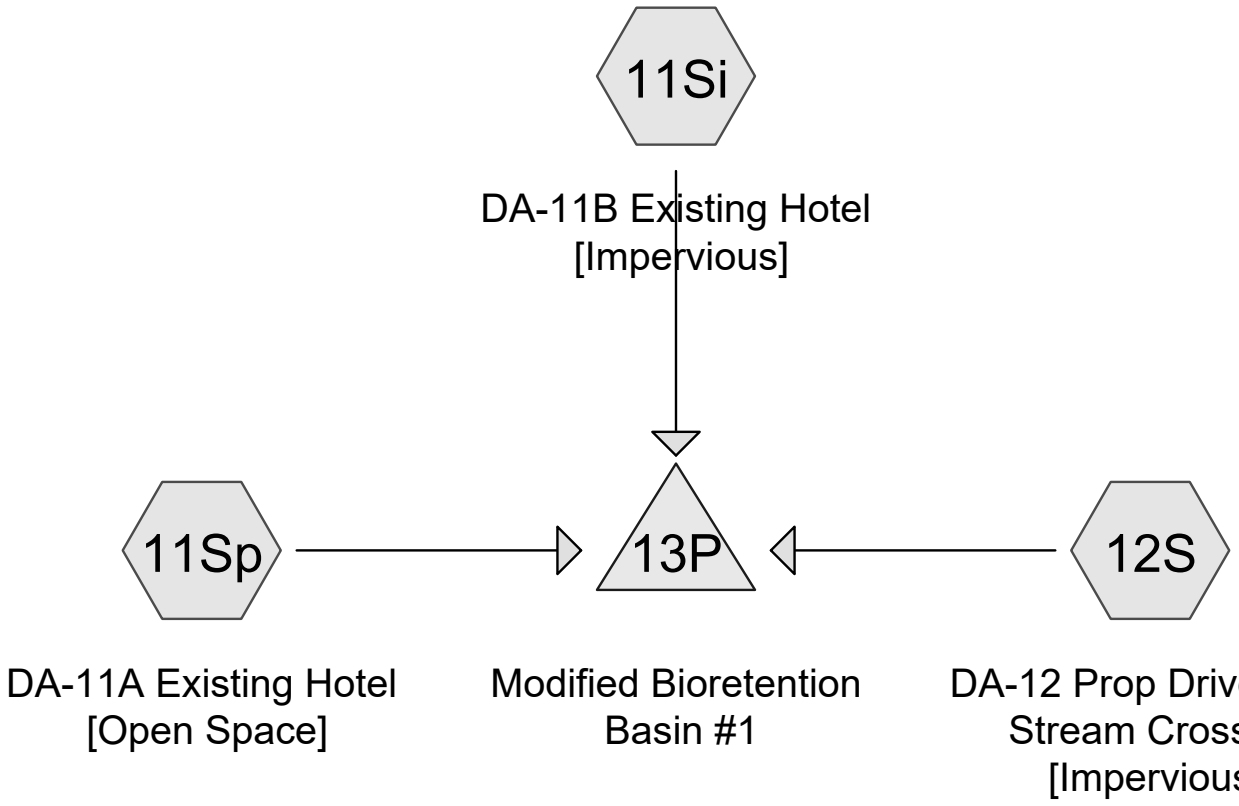
APPENDIX C

WATER QUALITY DESIGN

HydroCAD® Routing for W.Q. Design Storm
Underdrain System Drain Time and Pipe Capacity

22-005 WQ R0 MS
Prepared by The Reynolds Group, Inc.

TABLE OF CONTENTS



Subcat Reach Pond Link

Routing Diagram for 22-005 WQ R0 MS
Prepared by The Reynolds Group, Inc.

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11Si: DA-11B Existing Hotel Runoff Area=61,808 sf 100.00% Impervious Runoff Depth=1.03"
Flow Length=415' Tc=1.7 min CN=0/98 Runoff=4.37 cfs 0.122 af

Subcatchment 11Sp: DA-11A Existing Hotel Runoff Area=27,220 sf 0.00% Impervious Runoff Depth=0.17"
Flow Length=433' Tc=3.5 min CN=80/0 Runoff=0.37 cfs 0.009 af

Subcatchment 12S: DA-12 Prop Driveway | Runoff Area=15,891 sf 100.00% Impervious Runoff Depth=1.03"
Flow Length=470' Tc=3.6 min CN=0/98 Runoff=1.11 cfs 0.031 af

Pond 13P: Modified Bioretention Basin #1 Peak Elev=44.28' Storage=7,091 cf Inflow=5.78 cfs 0.163 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.409 ac Runoff Volume = 0.163 af Average Runoff Depth = 0.81"
25.94% Pervious = 0.625 ac 74.06% Impervious = 1.784 ac

Summary for Subcatchment 11Si: DA-11B Existing Hotel [Impervious]

From Comfort Inn SWR revised 8/01

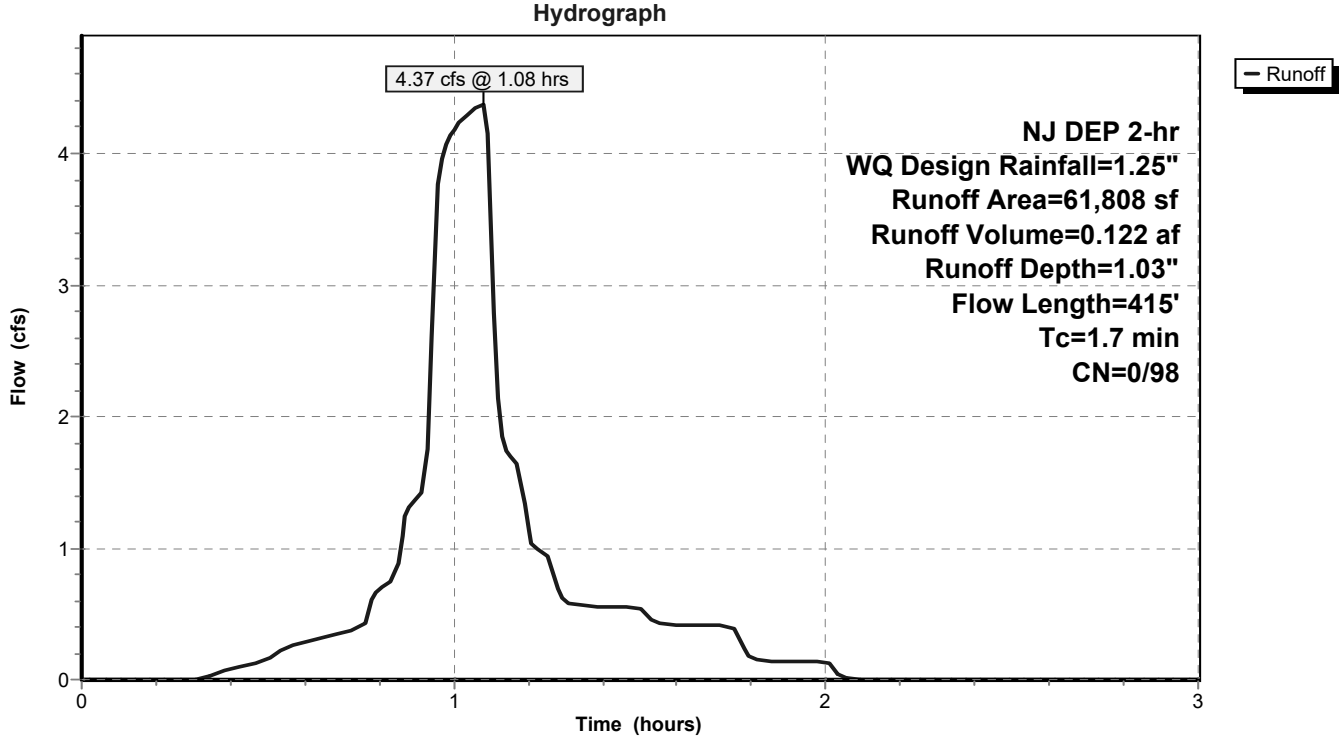
Runoff = 4.37 cfs @ 1.08 hrs, Volume= 0.122 af, Depth= 1.03"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ DEP 2-hr WQ Design Rainfall=1.25"

Area (sf)	CN	Description
61,808	98	Paved roads w/curbs & sewers, HSG D
61,808		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0270	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.2	56	0.0420	4.16		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.7	415	Total			

Subcatchment 11Si: DA-11B Existing Hotel [Impervious]



Summary for Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]

From Comfort Inn SWR revised 8/01

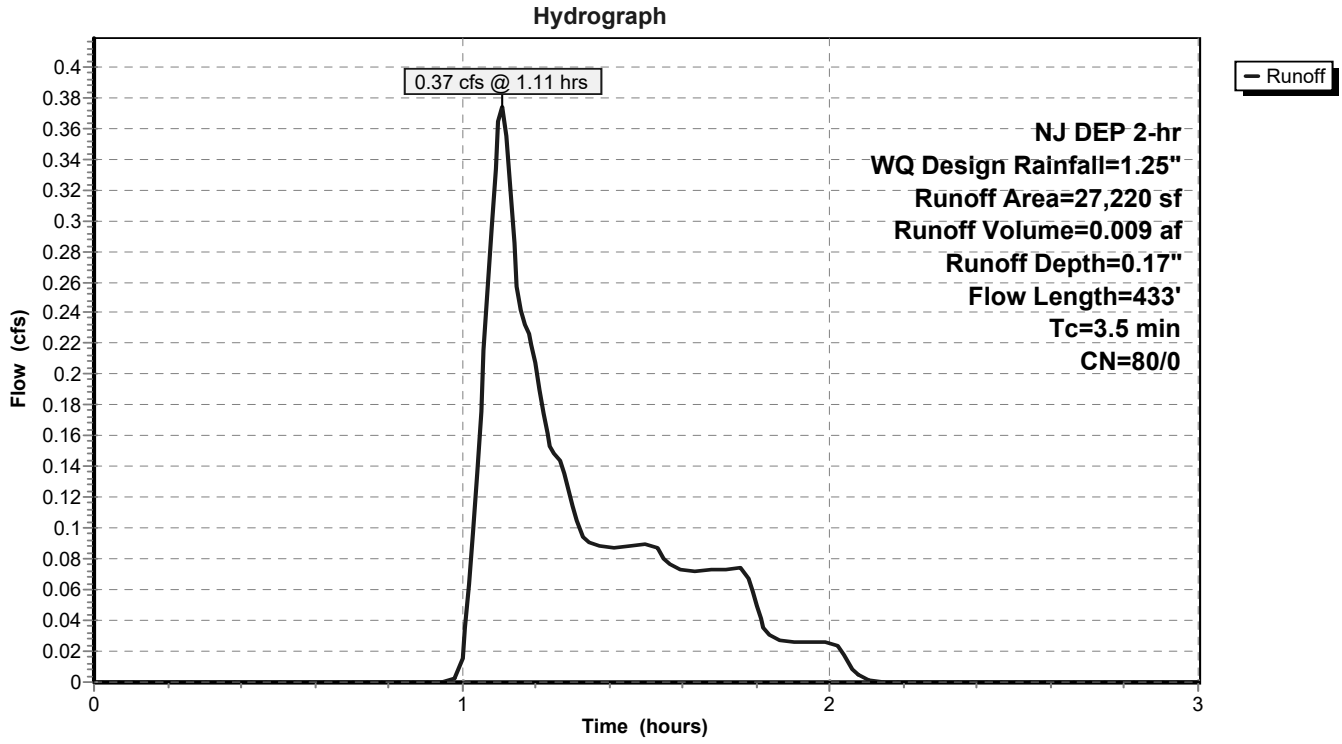
Runoff = 0.37 cfs @ 1.11 hrs, Volume= 0.009 af, Depth= 0.17"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ DEP 2-hr WQ Design Rainfall=1.25"

Area (sf)	CN	Description
27,220	80	>75% Grass cover, Good, HSG D
27,220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	16	0.0890	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.0	84	0.0240	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.3	74	0.0370	3.90		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	259	0.0360	9.99	12.26	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.5	433	Total			

Subcatchment 11Sp: DA-11A Existing Hotel [Open Space]



Summary for Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]

From Comfort Inn SWR revised 8/01

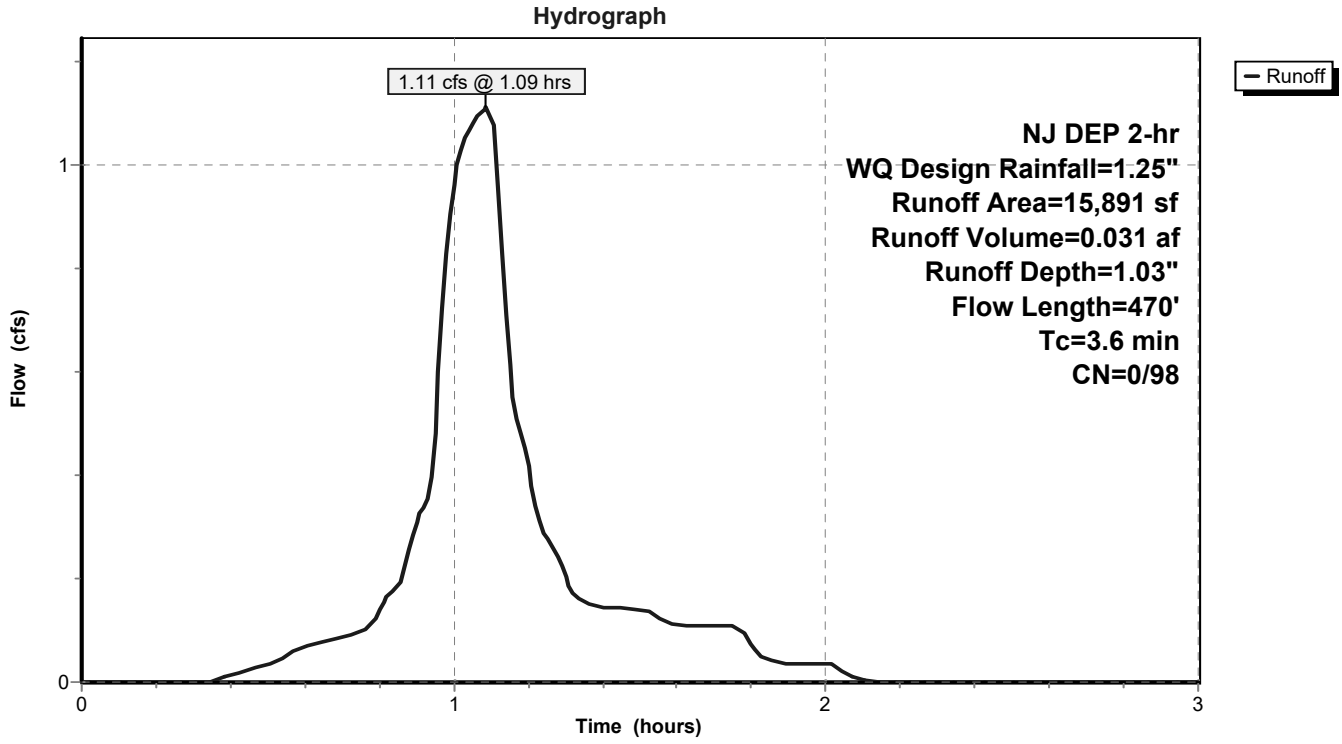
Runoff = 1.11 cfs @ 1.09 hrs, Volume= 0.031 af, Depth= 1.03"
Routed to Pond 13P : Modified Bioretention Basin #1

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ DEP 2-hr WQ Design Rainfall=1.25"

Area (sf)	CN	Description
15,891	98	Paved roads w/curbs & sewers, HSG D
15,891		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0900	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	90	0.0430	1.86		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
1.4	260	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	110	0.0240	8.15	10.01	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.6	470	Total			

Subcatchment 12S: DA-12 Prop Driveway | Stream Crossing [Impervious]



Summary for Pond 13P: Modified Bioretention Basin #1

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 0.81" for WQ Design event
Inflow = 5.78 cfs @ 1.08 hrs, Volume= 0.163 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node 14L

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 44.28' @ 2.21 hrs Surf.Area= 7,483 sf Storage= 7,091 cf

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

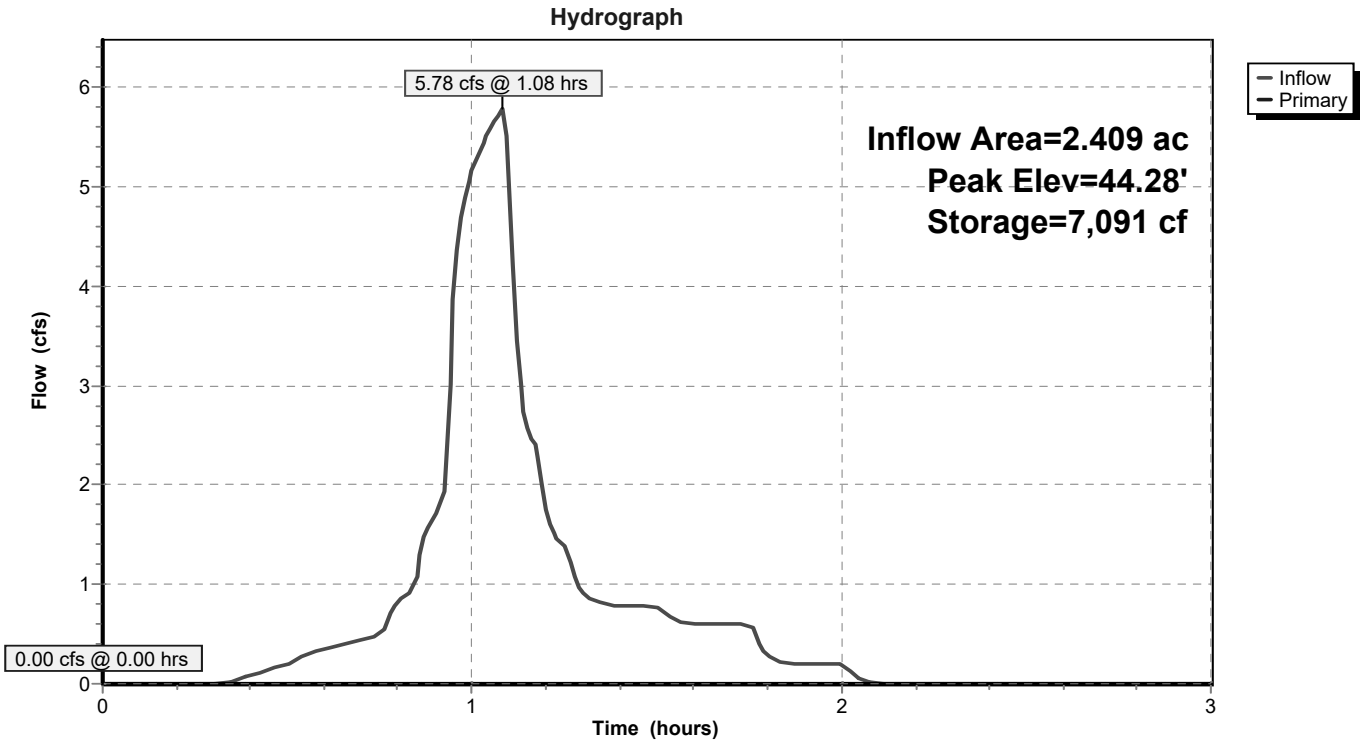
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=43.33' (Free Discharge)
- **1=Outfall** (Passes 0.00 cfs of 24.95 cfs potential flow)
  - **2=Orifice** (Controls 0.00 cfs)
  - **3=Rectangular Weir** (Controls 0.00 cfs)
  - **4=Rectangular Weir** (Controls 0.00 cfs)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1



Summary for Pond 13P: Modified Bioretention Basin #1

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 0.81" for WQ Design event
Inflow = 5.78 cfs @ 1.08 hrs, Volume= 0.163 af
Outflow = 0.10 cfs @ 2.03 hrs, Volume= 0.163 af, Atten= 98%, Lag= 56.7 min
Primary = 0.10 cfs @ 2.03 hrs, Volume= 0.163 af
Routed to nonexistent node 14L

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 44.22' @ 2.03 hrs Surf.Area= 7,479 sf Storage= 6,604 cf

Plug-Flow detention time= 598.2 min calculated for 0.163 af (100% of inflow)
Center-of-Mass det. time= 598.4 min (665.8 - 67.4)

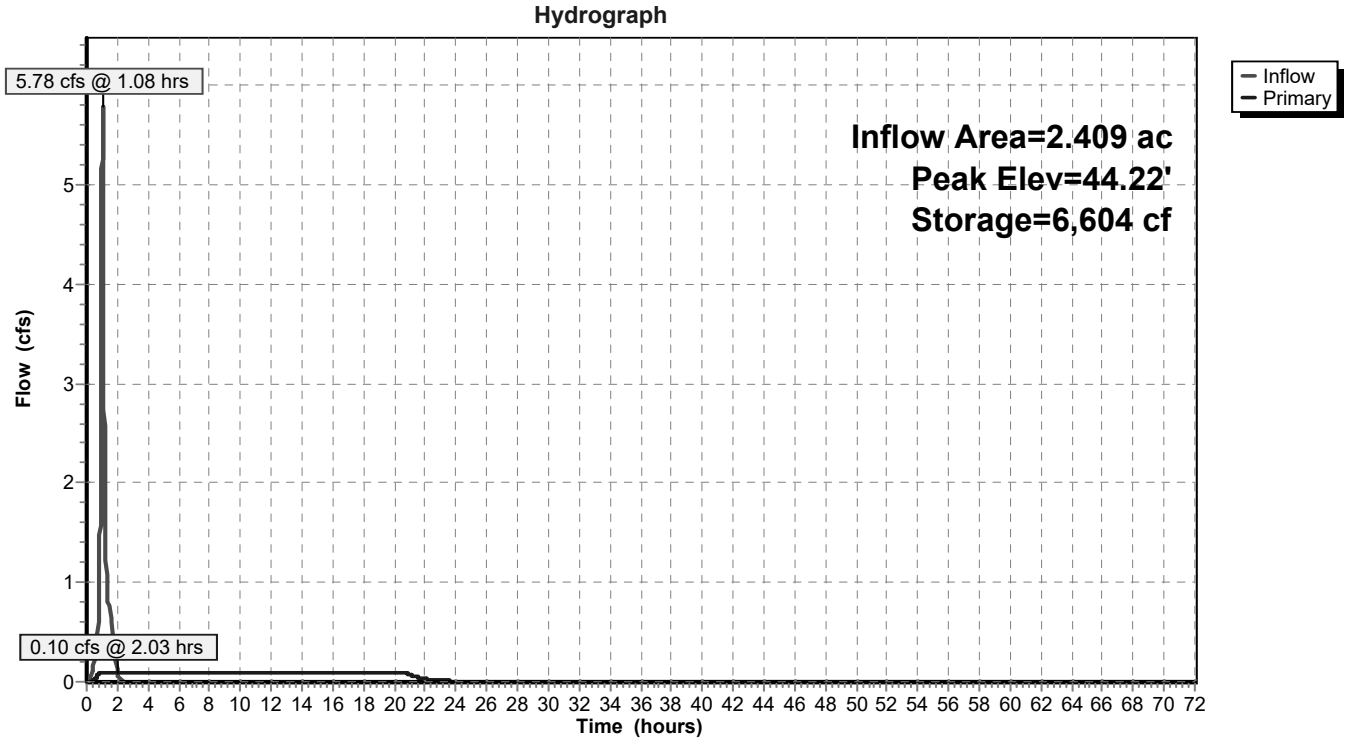
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)
#6	Device 1	38.25'	**4.0" Vert. Orifice - Underdrain X 2.00** C= 0.600 Limited to weir flow at low heads
#7	Device 6	43.33'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 37.00'

Primary OutFlow Max=0.10 cfs @ 2.03 hrs HW=44.22' (Free Discharge)
- **1=Outfall** (Passes 0.10 cfs of 26.95 cfs potential flow)
  - **2=Orifice** (Controls 0.00 cfs)
  - **3=Rectangular Weir** (Controls 0.00 cfs)
  - **4=Rectangular Weir** (Controls 0.00 cfs)
  - **6=Orifice - Underdrain** (Passes 0.10 cfs of 2.02 cfs potential flow)
    - **7=Exfiltration** (Controls 0.10 cfs)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1



Hydrograph for Pond 13P: Modified Bioretention Basin #1 (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
22.00	0.00	137	43.35	0.03
22.20	0.00	116	43.35	0.03
22.40	0.00	99	43.34	0.02
22.60	0.00	84	43.34	0.02
22.80	0.00	71	43.34	0.02
23.00	0.00	61	43.34	0.01
23.20	0.00	52	43.34	0.01
23.40	0.00	44	43.34	0.01
23.60	0.00	37	43.34	0.01
23.80	0.00	32	43.33	0.01
24.00	0.00	27	43.33	0.01
24.20	0.00	23	43.33	0.01
24.40	0.00	19	43.33	0.00
24.60	0.00	17	43.33	0.00
24.80	0.00	14	43.33	0.00
25.00	0.00	12	43.33	0.00
25.20	0.00	10	43.33	0.00
25.40	0.00	9	43.33	0.00
25.60	0.00	7	43.33	0.00
25.80	0.00	6	43.33	0.00
26.00	0.00	5	43.33	0.00
26.20	0.00	5	43.33	0.00
26.40	0.00	4	43.33	0.00
26.60	0.00	3	43.33	0.00
26.80	0.00	3	43.33	0.00
27.00	0.00	2	43.33	0.00
27.20	0.00	2	43.33	0.00
27.40	0.00	2	43.33	0.00
27.60	0.00	1	43.33	0.00
27.80	0.00	1	43.33	0.00
28.00	0.00	1	43.33	0.00
28.20	0.00	1	43.33	0.00
28.40	0.00	1	43.33	0.00
28.60	0.00	1	43.33	0.00
28.80	0.00	1	43.33	0.00
29.00	0.00	0	43.33	0.00
29.20	0.00	0	43.33	0.00
29.40	0.00	0	43.33	0.00
29.60	0.00	0	43.33	0.00
29.80	0.00	0	43.33	0.00
30.00	0.00	0	43.33	0.00
30.20	0.00	0	43.33	0.00
30.40	0.00	0	43.33	0.00
30.60	0.00	0	43.33	0.00
30.80	0.00	0	43.33	0.00
31.00	0.00	0	43.33	0.00
31.20	0.00	0	43.33	0.00
31.40	0.00	0	43.33	0.00
31.60	0.00	0	43.33	0.00
31.80	0.00	0	43.33	0.00
32.00	0.00	0	43.33	0.00
32.20	0.00	0	43.33	0.00
32.40	0.00	0	43.33	0.00
32.60	0.00	0	43.33	0.00
32.80	0.00	0	43.33	0.00

Basin is Empty @ HR 29.00
Water Quality Design:
Drain Time from Peak: 27.9 hours
100-yr Storm
Drain Time from Peak: 27.1 hours
Total Drain Time:
Approx. 55 hours

Summary for Pond 13P: Modified Bioretention Basin #1

Infiltration | Underdrain discharge was not included to calculate drain time, drawdown to 8" orifice @ elev. 44.30.

Inflow Area = 2.409 ac, 74.06% Impervious, Inflow Depth = 7.56" for 100-yr Somerset event
Inflow = 22.53 cfs @ 12.10 hrs, Volume= 1.518 af
Outflow = 15.66 cfs @ 12.13 hrs, Volume= 1.350 af, Atten= 31%, Lag= 2.0 min
Primary = 15.66 cfs @ 12.13 hrs, Volume= 1.350 af
Routed to nonexistent node 14L

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 46.69' @ 12.13 hrs Surf.Area= 7,640 sf Storage= 25,320 cf

Plug-Flow detention time= 184.1 min calculated for 1.350 af (89% of inflow)
Center-of-Mass det. time= 128.2 min (879.0 - 750.7)

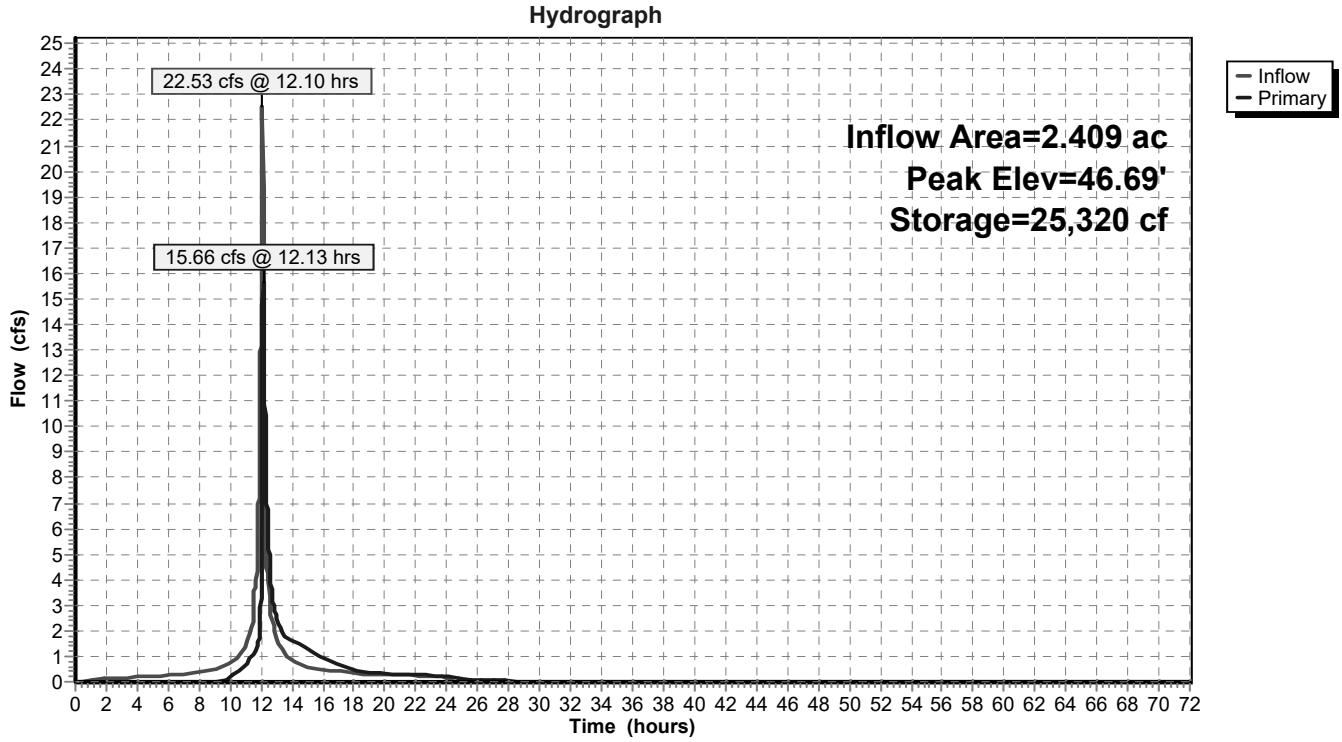
Volume	Invert	Avail.Storage	Storage Description
#1	43.33'	39,238 cf	**Modified Bioretention Basin (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.33	7,422	0	0
44.00	7,465	4,987	4,987
45.00	7,530	7,498	12,485
46.00	7,595	7,563	20,047
47.00	7,660	7,628	27,675
48.00	7,725	7,693	35,367
48.50	7,758	3,871	39,238

Device	Routing	Invert	Outlet Devices
#1	Primary	36.84'	**18.0" Round Outfall** L= 34.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 36.84' / 36.50' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	44.30'	**8.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.75'	**2.5' long Rectangular Weir** 2 End Contraction(s)
#4	Device 1	46.00'	**3.5' long Rectangular Weir** 2 End Contraction(s)
#5	Primary	46.75'	**24.0' long Emergency Concrete Spillway** 2 End Contraction(s)
#6	Device 1	38.25'	**4.0" Vert. Orifice - Underdrain X 0.00** C= 0.600 Limited to weir flow at low heads
#7	Device 6	43.33'	**0.500 in/hr Exfiltration X 0.00 over Surface area** Conductivity to Groundwater Elevation = 37.00'

Primary OutFlow Max=15.64 cfs @ 12.13 hrs HW=46.69' (Free Discharge)
- **1=Outfall** (Passes 15.64 cfs of 31.86 cfs potential flow)
  - **2=Orifice** (Orifice Controls 2.41 cfs @ 6.91 fps)
  - **3=Rectangular Weir** (Weir Controls 6.91 cfs @ 3.17 fps)
  - **4=Rectangular Weir** (Weir Controls 6.32 cfs @ 2.72 fps)
  - **6=Orifice - Underdrain** (Controls 0.00 cfs)
    - **7=Exfiltration** (Controls 0.00 cfs)
- **5=Emergency Concrete Spillway** (Controls 0.00 cfs)

Pond 13P: Modified Bioretention Basin #1



Hydrograph for Pond 13P: Modified Bioretention Basin #1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	43.33	0.00
0.20	0.00	0	43.33	0.00
0.40	0.00	0	43.33	0.00
0.60	0.02	4	43.33	0.00
0.80	0.04	24	43.33	0.00
1.00	0.06	58	43.34	0.00
1.20	0.07	106	43.34	0.00
1.40	0.09	163	43.35	0.00
1.60	0.10	231	43.36	0.00
1.80	0.11	307	43.37	0.00
2.00	0.12	390	43.38	0.00
2.20	0.13	479	43.39	0.00
2.40	0.14	575	43.41	0.00
2.60	0.14	676	43.42	0.00
2.80	0.15	783	43.44	0.00
3.00	0.16	894	43.45	0.00
3.20	0.16	1,010	43.47	0.00
3.40	0.17	1,130	43.48	0.00
3.60	0.17	1,254	43.50	0.00
3.80	0.18	1,382	43.52	0.00
4.00	0.18	1,513	43.53	0.00
4.20	0.19	1,648	43.55	0.00
4.40	0.19	1,787	43.57	0.00
4.60	0.20	1,928	43.59	0.00
4.80	0.20	2,073	43.61	0.00
5.00	0.21	2,222	43.63	0.00
5.20	0.21	2,374	43.65	0.00
5.40	0.22	2,531	43.67	0.00
5.60	0.23	2,691	43.69	0.00
5.80	0.23	2,856	43.71	0.00
6.00	0.24	3,025	43.74	0.00
6.20	0.25	3,201	43.76	0.00
6.40	0.27	3,388	43.79	0.00
6.60	0.28	3,585	43.81	0.00
6.80	0.29	3,793	43.84	0.00
7.00	0.31	4,012	43.87	0.00
7.20	0.33	4,242	43.90	0.00
7.40	0.34	4,483	43.93	0.00
7.60	0.36	4,735	43.97	0.00
7.80	0.37	4,998	44.00	0.00
8.00	0.39	5,273	44.04	0.00
8.20	0.41	5,559	44.08	0.00
8.40	0.42	5,857	44.12	0.00
8.60	0.44	6,167	44.16	0.00
8.80	0.45	6,488	44.20	0.00
9.00	0.47	6,822	44.25	0.00
9.20	0.52	7,182	44.29	0.00
9.40	0.58	7,580	44.35	0.01
9.60	0.64	8,003	44.40	0.04
9.80	0.69	8,438	44.46	0.09
10.00	0.75	8,870	44.52	0.16
10.20	0.81	9,288	44.57	0.24
10.40	0.86	9,686	44.63	0.33
10.60	1.00	10,077	44.68	0.43
10.80	1.21	10,532	44.74	0.55

Hydrograph for Pond 13P: Modified Bioretention Basin #1 (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	
11.00	1.43	11,047	44.81	0.69	
11.20	1.84	11,686	44.89	0.86	
11.40	2.25	12,500	45.00	1.02	
11.60	3.74	13,728	45.17	1.23	
11.80	5.48	15,931	45.46	1.53	
12.00	**13.32**	**20,984**	**46.12**	**4.35**	
12.20	**8.32**	**24,336**	**46.56**	**12.63**	← Peak Time @ HR 12.13
12.40	4.24	21,966	46.25	6.37	
12.60	2.61	20,838	46.10	4.11	
12.80	2.21	20,072	46.00	2.99	
13.00	1.79	19,508	45.93	2.53	
13.20	1.46	18,966	45.86	2.15	
13.40	1.23	18,476	45.79	1.89	
13.60	1.01	17,969	45.73	1.76	
13.80	0.94	17,423	45.65	1.70	
14.00	0.88	16,879	45.58	1.64	
14.20	0.83	16,336	45.51	1.57	
14.40	0.77	15,796	45.44	1.51	
14.60	0.71	15,262	45.37	1.44	
14.80	0.65	14,734	45.30	1.37	
15.00	0.59	14,215	45.23	1.30	
15.20	0.55	13,712	45.16	1.22	
15.40	0.54	13,248	45.10	1.15	
15.60	0.52	12,824	45.05	1.08	
15.80	0.50	12,439	44.99	1.01	
16.00	0.49	12,091	44.95	0.95	
16.20	0.47	11,777	44.91	0.88	
16.40	0.46	11,499	44.87	0.81	
16.60	0.44	11,257	44.84	0.75	
16.80	0.42	11,048	44.81	0.69	
17.00	0.41	10,865	44.78	0.64	
17.20	0.39	10,705	44.76	0.60	
17.40	0.38	10,563	44.74	0.56	
17.60	0.36	10,436	44.73	0.53	
17.80	0.35	10,321	44.71	0.50	
18.00	0.33	10,216	44.70	0.47	
18.20	0.32	10,120	44.69	0.44	
18.40	0.32	10,038	44.67	0.42	
18.60	0.31	9,967	44.67	0.40	
18.80	0.31	9,904	44.66	0.39	
19.00	0.30	9,850	44.65	0.37	
19.20	0.30	9,802	44.64	0.36	
19.40	0.30	9,759	44.64	0.35	
19.60	0.29	9,720	44.63	0.34	
19.80	0.29	9,686	44.63	0.33	
20.00	0.28	9,655	44.62	0.33	
20.20	0.28	9,625	44.62	0.32	
20.40	0.28	9,598	44.62	0.31	
20.60	0.27	9,572	44.61	0.31	
20.80	0.27	9,547	44.61	0.30	
21.00	0.26	9,524	44.61	0.30	
21.20	0.26	9,501	44.60	0.29	
21.40	0.26	9,479	44.60	0.29	
21.60	0.25	9,458	44.60	0.28	
21.80	0.25	9,437	44.59	0.28	

Hydrograph for Pond 13P: Modified Bioretention Basin #1 (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
22.00	0.24	9,417	44.59	0.27
22.20	0.24	9,398	44.59	0.27
22.40	0.24	9,378	44.59	0.26
22.60	0.23	9,359	44.58	0.26
22.80	0.23	9,340	44.58	0.25
23.00	0.23	9,321	44.58	0.25
23.20	0.22	9,303	44.58	0.25
23.40	0.22	9,284	44.57	0.24
23.60	0.21	9,266	44.57	0.24
23.80	0.21	9,248	44.57	0.23
24.00	0.25	9,241	44.57	0.23
24.20	0.00	9,115	44.55	0.21
24.40	0.00	8,976	44.53	0.18
24.60	0.00	8,855	44.52	0.16
24.80	0.00	8,749	44.50	0.14
25.00	0.00	8,654	44.49	0.12
25.20	0.00	8,570	44.48	0.11
25.40	0.00	8,496	44.47	0.10
25.60	0.00	8,429	44.46	0.09
25.80	0.00	8,368	44.45	0.08
26.00	0.00	8,312	44.44	0.07
26.20	0.00	8,261	44.44	0.07
26.40	0.00	8,214	44.43	0.06
26.60	0.00	8,172	44.43	0.06
26.80	0.00	8,133	44.42	0.05
27.00	0.00	8,097	44.42	0.05
27.20	0.00	8,064	44.41	0.04
27.40	0.00	8,033	44.41	0.04
27.60	0.00	8,004	44.40	0.04
27.80	0.00	7,977	44.40	0.04
28.00	0.00	7,951	44.40	0.03
28.20	0.00	7,927	44.39	0.03
28.40	0.00	7,904	44.39	0.03
28.60	0.00	7,882	44.39	0.03
28.80	0.00	7,862	44.38	0.03
29.00	0.00	7,842	44.38	0.03
29.20	0.00	7,824	44.38	0.02
29.40	0.00	7,807	44.38	0.02
29.60	0.00	7,791	44.38	0.02
29.80	0.00	7,776	44.37	0.02
30.00	0.00	7,762	44.37	0.02
30.20	0.00	7,749	44.37	0.02
30.40	0.00	7,736	44.37	0.02
30.60	0.00	7,724	44.37	0.02
30.80	0.00	7,713	44.36	0.02
31.00	0.00	7,702	44.36	0.01
31.20	0.00	7,692	44.36	0.01
31.40	0.00	7,682	44.36	0.01
31.60	0.00	7,672	44.36	0.01
31.80	0.00	7,663	44.36	0.01
32.00	0.00	7,653	44.36	0.01
32.20	0.00	7,644	44.36	0.01
32.40	0.00	7,636	44.35	0.01
32.60	0.00	7,627	44.35	0.01
32.80	0.00	7,619	44.35	0.01

Hydrograph for Pond 13P: Modified Bioretention Basin #1 (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
33.00	0.00	7,610	44.35	0.01
33.20	0.00	7,603	44.35	0.01
33.40	0.00	7,595	44.35	0.01
33.60	0.00	7,587	44.35	0.01
33.80	0.00	7,580	44.35	0.01
34.00	0.00	7,573	44.35	0.01
34.20	0.00	7,566	44.34	0.01
34.40	0.00	7,559	44.34	0.01
34.60	0.00	7,553	44.34	0.01
34.80	0.00	7,546	44.34	0.01
35.00	0.00	7,540	44.34	0.01
35.20	0.00	7,534	44.34	0.01
35.40	0.00	7,528	44.34	0.01
35.60	0.00	7,522	44.34	0.01
35.80	0.00	7,517	44.34	0.01
36.00	0.00	7,511	44.34	0.01
36.20	0.00	7,506	44.34	0.01
36.40	0.00	7,501	44.34	0.01
36.60	0.00	7,496	44.34	0.01
36.80	0.00	7,491	44.33	0.01
37.00	0.00	7,486	44.33	0.01
37.20	0.00	7,481	44.33	0.01
37.40	0.00	7,477	44.33	0.01
37.60	0.00	7,472	44.33	0.01
37.80	0.00	7,468	44.33	0.01
38.00	0.00	7,464	44.33	0.01
38.20	0.00	7,460	44.33	0.01
38.40	0.00	7,456	44.33	0.01
38.60	0.00	7,452	44.33	0.01
38.80	0.00	7,448	44.33	0.01
39.00	0.00	7,444	44.33	0.01
39.20	0.00	7,441	44.33	0.00
39.40	0.00	7,437	44.33	0.00
39.60	0.00	7,434	44.33	0.00
39.80	0.00	7,430	44.33	0.00
40.00	0.00	7,427	44.33	0.00
40.20	0.00	7,424	44.33	0.00
40.40	0.00	7,421	44.33	0.00
40.60	0.00	7,418	44.33	0.00
40.80	0.00	7,415	44.32	0.00
41.00	0.00	7,412	44.32	0.00
41.20	0.00	7,410	44.32	0.00
41.40	0.00	7,407	44.32	0.00
41.60	0.00	7,404	44.32	0.00
41.80	0.00	7,402	44.32	0.00
42.00	0.00	7,399	44.32	0.00
42.20	0.00	7,397	44.32	0.00
42.40	0.00	7,394	44.32	0.00
42.60	0.00	7,392	44.32	0.00
42.80	0.00	7,390	44.32	0.00
43.00	0.00	7,388	44.32	0.00
43.20	0.00	7,386	44.32	0.00
43.40	0.00	7,384	44.32	0.00
43.60	0.00	7,382	44.32	0.00
43.80	0.00	7,380	44.32	0.00

100-yr Storm Evacuated @ HR 39.2
Drain Time from Peak: 27.1 hours

APPENDIX D

STORM SEWER DESIGN & CONDUIT OUTLET PROTECTION (C.O.P.) DESIGN

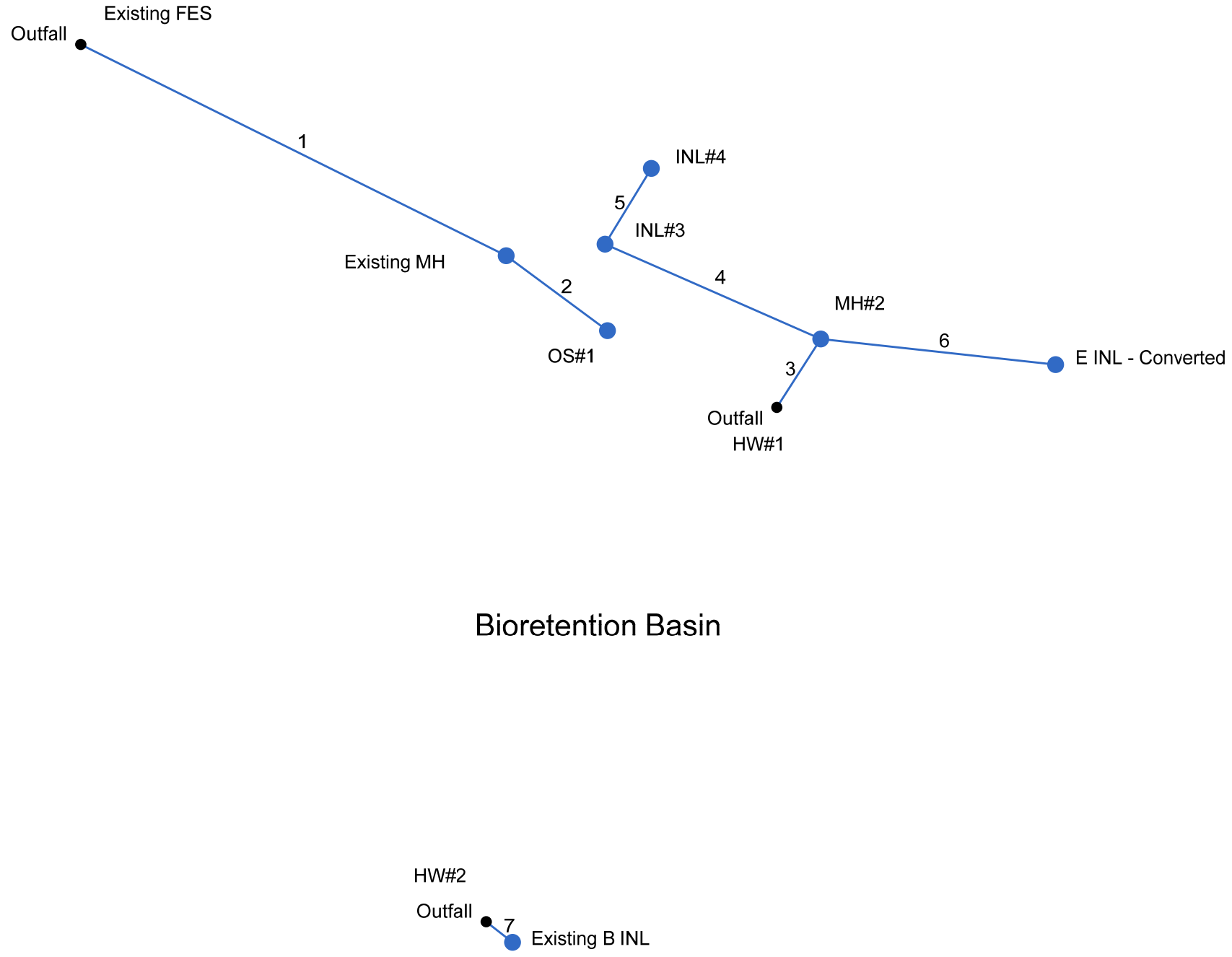
The Reynolds Group Inc.

INLET DRAINAGE AREA
COMPOSITE "C" CALCULATIONS

OPEN SPACE = 0.65; WOODS = 0.59 and IMPV. = 0.99

DESC	AREA *(SF)*	O.S. *(SF)*	WOODS *(SF)*	IMP. *(SF)*	"C"	AREA *(Ac.)*
MODIFIED BASIN #1						
B INL #4	7,181	571	0	6,610	***0.96***	**0.16**
B INL #3	10,004	723	0	9,281	***0.97***	**0.23**
Ex B INL	49,265	12,480	0	36,785	***0.90***	**1.13**
Ex E INL	29,996	4,973	0	25,023	***0.93***	**0.69**
Note: Runoff coefficients for HSG D were used.						

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 22005 Pipes R0.stm	Number of lines: 7	Date: 7/8/2022

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	128.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	6.77	10.50	4.60	18	1.00	34.79	36.07	36.29	37.08	36.29	45.47	EX MH - EX FES
2	1	34.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	6.77	10.50	5.84	18	1.00	36.50	36.84	37.38	37.85	45.47	48.00	OS#1 - EX MH
3	End	22.000	0.00	1.08	0.00	0.00	1.02	0.0	5.9	6.7	6.86	9.13	5.59	15	2.00	43.33	43.77	46.28	46.53	53.00	52.13	MH#2 - HW#1
4	3	63.500	0.23	0.39	0.97	0.22	0.38	5.0	5.5	6.9	2.59	9.13	2.11	15	2.00	44.39	45.66	47.02	47.12	52.13	51.00	INL#3 - MH#2
5	4	24.000	0.16	0.16	0.96	0.15	0.15	5.0	5.0	7.0	1.08	6.46	0.89	15	1.00	45.76	46.00	47.19	47.19	51.00	51.00	INL#4 - INL#3
6	3	63.608	0.69	0.69	0.93	0.64	0.64	5.0	5.0	7.0	4.51	9.12	3.68	15	2.00	43.88	45.15	47.02	47.33	52.13	53.00	EX E INL - MH#2
7	End	9.000	1.13	1.13	0.90	1.02	1.02	5.0	5.0	7.0	7.15	14.85	4.05	18	2.00	43.33	43.51	46.28	46.32	48.25	47.15	EX B INL - HW#2

Project File: 22005 Pipes R0.stm

Number of lines: 7

Run Date: 8/15/2022

NOTES:Intensity = 54.48 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	128.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	15.70	10.50	8.89	18	1.00	34.79	36.07	36.29	39.15	36.29	45.47	EX MH - EX FES
2	1	34.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	15.70	10.50	8.89	18	1.00	36.50	36.84	39.41	40.17	45.47	48.00	OS#1 - EX MH
3	End	22.000	0.00	1.08	0.00	0.00	1.02	0.0	5.8	7.8	7.98	9.13	6.50	15	2.00	43.33	43.77	46.69	47.03	53.00	52.13	MH#2 - HW#1
4	3	63.500	0.23	0.39	0.97	0.22	0.38	5.0	5.4	8.0	3.01	9.13	2.45	15	2.00	44.39	45.66	47.68	47.82	52.13	51.00	INL#3 - MH#2
5	4	24.000	0.16	0.16	0.96	0.15	0.15	5.0	5.0	8.1	1.25	6.46	1.02	15	1.00	45.76	46.00	47.91	47.92	51.00	51.00	INL#4 - INL#3
6	3	63.608	0.69	0.69	0.93	0.64	0.64	5.0	5.0	8.1	5.22	9.12	4.25	15	2.00	43.88	45.15	47.68	48.10	52.13	53.00	EX E INL - MH#2
7	End	9.000	1.13	1.13	0.90	1.02	1.02	5.0	5.0	8.1	8.27	14.85	4.68	18	2.00	43.33	43.51	46.69	46.75	48.25	47.15	EX B INL - HW#2

Note: The 18" RCP outfall will be under surcharge conditions as shown under lines 1 and 2 above. The outfall surcharge elevations will have no impact to the basin design since the proposed basin bottom @ elev. 43.33 is above the calculated HGL of 40.17. Also, the HydroCAD model accounted for the 18" outfall in the 100-yr basin routing.

Project File: 22005 Pipes R0.stm | Number of lines: 7 | Run Date: 8/16/2022

NOTES:Intensity = 46.51 / (Inlet time + 9.20) ^ 0.66; Return period =Yrs. 100 ; c = cir e = ellip b = box

NOAA Atlas 14, Volume 2, Version 3
Location name: Somerset, New Jersey, USA*
Latitude: 40.532°, Longitude: -74.5303°
Elevation: 51.44 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.98** (3.61-4.40)	**4.75** (4.30-5.24)	**5.63** (5.09-6.22)	**6.26** (5.65-6.91)	**7.04** (6.32-7.75)	**7.58** (6.78-8.35)	**8.14** (7.24-8.95)	**8.62** (7.63-9.50)	**9.22** (8.09-10.2)	**9.66** (8.42-10.7)
10-min	**3.19** (2.89-3.52)	**3.80** (3.44-4.19)	**4.51** (4.07-4.97)	**5.01** (4.52-5.53)	**5.61** (5.04-6.18)	**6.04** (5.40-6.65)	**6.46** (5.75-7.12)	**6.83** (6.05-7.53)	**7.29** (6.40-8.06)	**7.61** (6.64-8.44)
15-min	**2.65** (2.40-2.93)	**3.18** (2.88-3.51)	**3.80** (3.43-4.20)	**4.22** (3.81-4.66)	**4.74** (4.26-5.22)	**5.10** (4.56-5.61)	**5.44** (4.84-6.00)	**5.74** (5.08-6.34)	**6.12** (5.37-6.76)	**6.37** (5.55-7.06)
30-min	**1.82** (1.65-2.01)	**2.20** (1.99-2.43)	**2.70** (2.44-2.98)	**3.06** (2.76-3.38)	**3.51** (3.15-3.87)	**3.84** (3.43-4.23)	**4.17** (3.71-4.59)	**4.47** (3.96-4.93)	**4.87** (4.27-5.38)	**5.16** (4.50-5.71)
60-min	**1.13** (1.03-1.25)	**1.38** (1.25-1.52)	**1.73** (1.56-1.91)	**1.99** (1.80-2.20)	**2.34** (2.10-2.58)	**2.60** (2.33-2.86)	**2.87** (2.56-3.16)	**3.14** (2.78-3.46)	**3.49** (3.06-3.86)	**3.76** (3.28-4.17)
2-hr	**0.693** (0.623-0.770)	**0.844** (0.760-0.937)	**1.07** (0.964-1.19)	**1.25** (1.12-1.38)	**1.49** (1.33-1.65)	**1.69** (1.50-1.87)	**1.90** (1.67-2.10)	**2.11** (1.85-2.34)	**2.41** (2.08-2.68)	**2.64** (2.27-2.94)
3-hr	**0.513** (0.463-0.573)	**0.625** (0.564-0.698)	**0.794** (0.715-0.885)	**0.926** (0.832-1.03)	**1.11** (0.990-1.23)	**1.26** (1.12-1.40)	**1.41** (1.24-1.57)	**1.57** (1.38-1.75)	**1.80** (1.55-2.00)	**1.98** (1.69-2.20)
6-hr	**0.329** (0.297-0.368)	**0.400** (0.360-0.446)	**0.508** (0.456-0.564)	**0.595** (0.533-0.660)	**0.721** (0.639-0.797)	**0.826** (0.727-0.911)	**0.938** (0.819-1.03)	**1.06** (0.915-1.17)	**1.23** (1.05-1.36)	**1.38** (1.16-1.52)
12-hr	**0.199** (0.179-0.224)	**0.242** (0.217-0.271)	**0.308** (0.276-0.345)	**0.364** (0.325-0.407)	**0.448** (0.395-0.498)	**0.520** (0.456-0.577)	**0.598** (0.519-0.663)	**0.685** (0.587-0.760)	**0.814** (0.685-0.904)	**0.924** (0.765-1.03)
24-hr	**0.114** (0.105-0.124)	**0.138** (0.128-0.150)	**0.176** (0.163-0.191)	**0.209** (0.193-0.227)	**0.258** (0.237-0.280)	**0.301** (0.274-0.326)	**0.348** (0.314-0.377)	**0.401** (0.357-0.435)	**0.480** (0.421-0.523)	**0.548** (0.473-0.598)
2-day	**0.066** (0.060-0.073)	**0.080** (0.073-0.088)	**0.102** (0.093-0.112)	**0.120** (0.109-0.132)	**0.147** (0.133-0.161)	**0.170** (0.153-0.186)	**0.195** (0.174-0.214)	**0.222** (0.196-0.244)	**0.261** (0.227-0.289)	**0.295** (0.253-0.327)
3-day	**0.047** (0.043-0.051)	**0.056** (0.052-0.062)	**0.072** (0.066-0.079)	**0.084** (0.077-0.092)	**0.103** (0.093-0.112)	**0.118** (0.106-0.129)	**0.135** (0.121-0.148)	**0.153** (0.135-0.168)	**0.179** (0.156-0.197)	**0.201** (0.173-0.222)
4-day	**0.037** (0.034-0.041)	**0.045** (0.041-0.049)	**0.057** (0.052-0.062)	**0.066** (0.061-0.073)	**0.080** (0.073-0.088)	**0.092** (0.083-0.101)	**0.105** (0.094-0.115)	**0.118** (0.105-0.130)	**0.137** (0.121-0.152)	**0.153** (0.133-0.170)
7-day	**0.025** (0.023-0.027)	**0.030** (0.028-0.032)	**0.037** (0.034-0.040)	**0.043** (0.040-0.047)	**0.051** (0.047-0.056)	**0.058** (0.053-0.064)	**0.066** (0.060-0.072)	**0.074** (0.066-0.081)	**0.085** (0.075-0.094)	**0.095** (0.083-0.104)
10-day	**0.020** (0.018-0.021)	**0.024** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.039** (0.036-0.042)	**0.044** (0.041-0.048)	**0.049** (0.045-0.053)	**0.055** (0.050-0.060)	**0.063** (0.056-0.068)	**0.069** (0.061-0.075)
20-day	**0.013** (0.013-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.025** (0.023-0.026)	**0.027** (0.025-0.029)	**0.030** (0.027-0.032)	**0.032** (0.030-0.034)	**0.036** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.022** (0.021-0.024)	**0.024** (0.022-0.025)	**0.026** (0.024-0.028)	**0.028** (0.025-0.029)
45-day	**0.009** (0.009-0.010)	**0.011** (0.011-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.020-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.015)	**0.016** (0.015-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

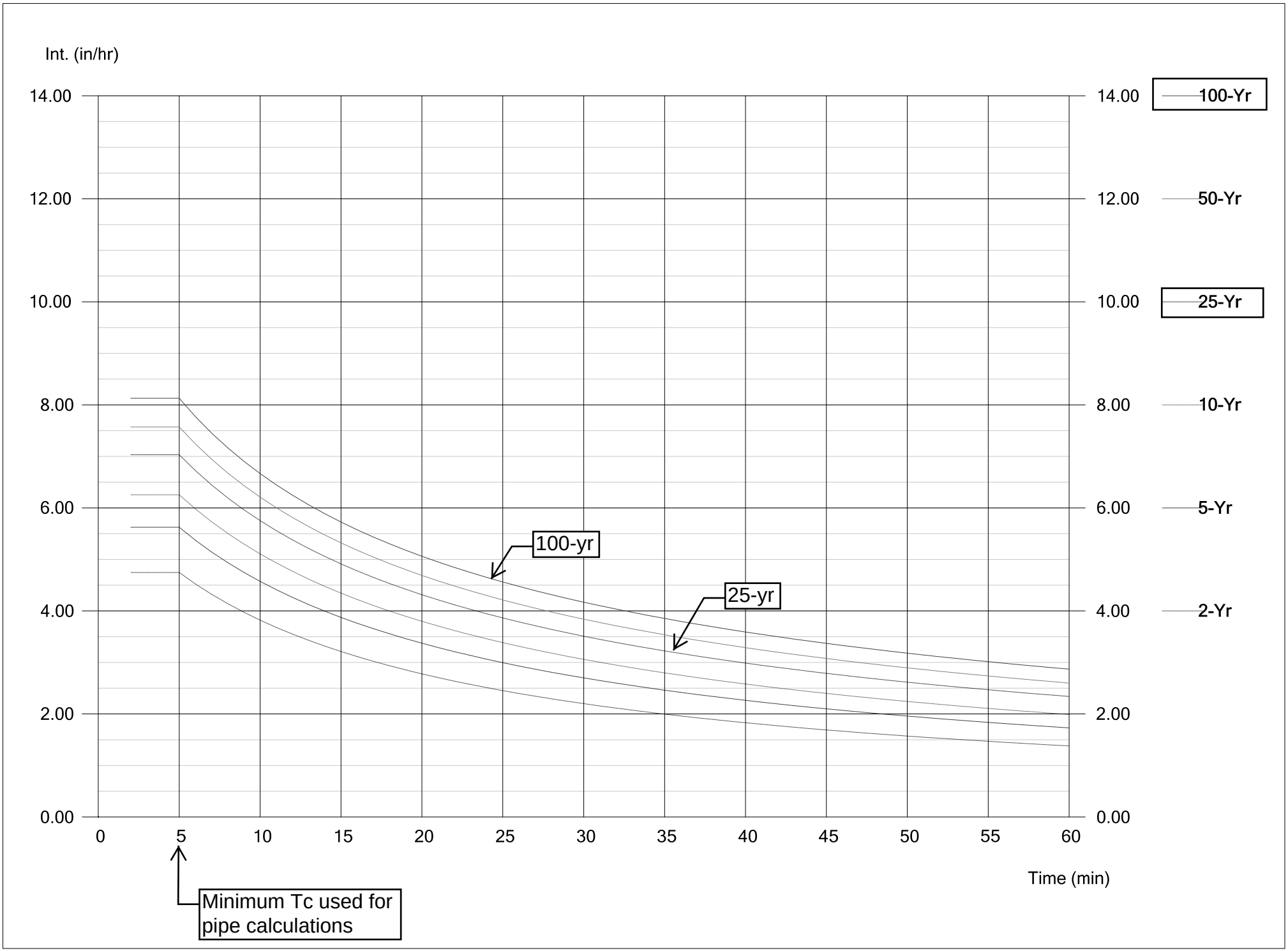
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

Storm Sewer IDF Curves

IDF file: 22-005 IDF Franklin.IDF



The Reynolds Group Inc.

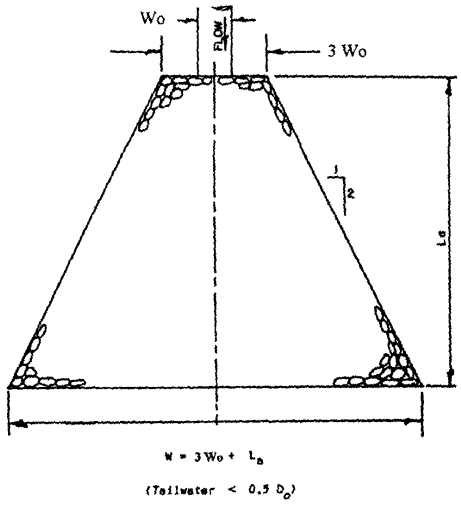
RIPRAP APRON DATA SHEET

PROJECT NAME: **Driveway Access** TRG #: 22-005

STORM FREQENCIES: **25-year** DATE: Aug-22

For Tailwater < 0.5D_o

OUTLET STRUCT.	YEAR STORM	Q (cfs)	VELOCITY-max (fps)	PIPE HEIGHT (in)	PIPE WIDTH (in)	TAILWATER (ft)	La (ft)	W (beg) (ft)	W (end) (ft)	d50 (in)



For tailwater elevation less than the elevation of the center of the pipe,

$W = 3\ W_o + L_a$

$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7Do$ TW < ½ D_o

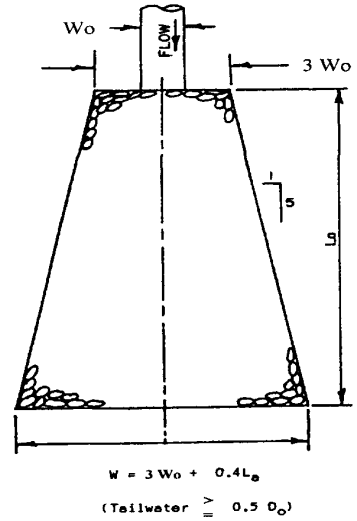
$d_{50} = \frac{0.02}{Tw} q^{1.33}$ where $q = \frac{Q}{Wo}$

TW = 0.2 D_o

For Tailwater >/= 0.5D_o

OUTLET STRUCT.	YEAR STORM	Q (cfs)	VELOCITY-max (fps)	PIPE HEIGHT (in)	PIPE WIDTH (in)	TAILWATER (ft)	La (ft)	W (beg) (ft)	W (end) (ft)	d50 (in)
HW #1	25	**6.90**	5.63	15	15	1.82	**14.8**	**3.8**	**9.7**	**1.3**
HW#2	25	**7.20**	4.14	18	18	1.82	**11.8**	**4.5**	**9.2**	**1.1**

Bioretention Basin 2-yr WSE @ 45.15; Basin Bottom Elev. 43.33; Tailwater = 1.82 ft



For tailwater elevation greater than or equal to the elevation of the center of the pipe,

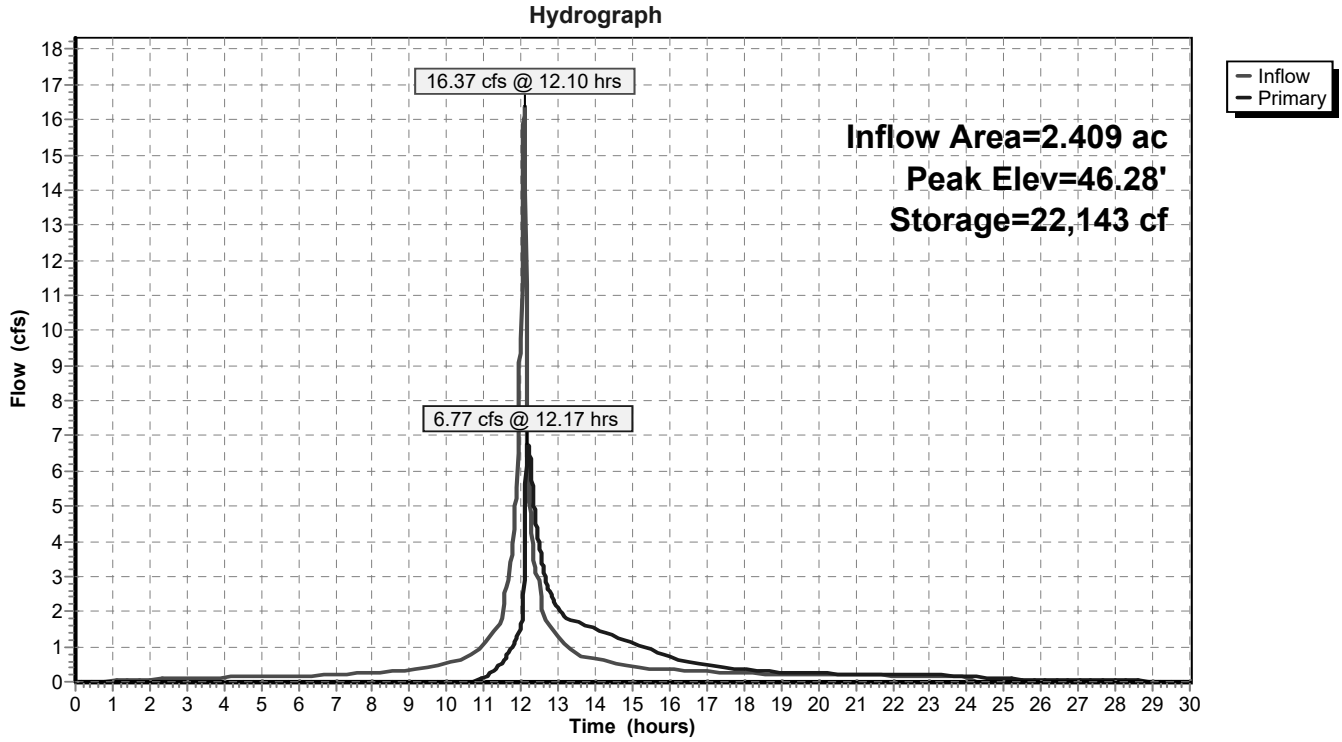
$W = 3\ W_o + 0.4\ L_a$

$L_a = 3\frac{q}{D_o^{1/2}}$ TW > ½ D_o

$d_{50} = \frac{0.02}{Tw} q^{1.33}$ where $q = \frac{Q}{Wo}$

TW = 0.2 D_o

Pond 13P: Modified Bioretention Basin #1



APPENDIX E

SUBSURFACE INVESTIGATION

GZA GEO ENVIRONMENTAL INC.

Proactive by Design

SUBSURFACE INVESTIGATION – PROPOSED STORMWATER FACILITIES

315 and 327 Davidson Avenue
Franklin Township, Somerset County, NJ

May 24, 2022
File No. 26.0092691.00

PREPARED FOR:
The Reynolds Group
575 Route 28, Suite 110
Raritan, New Jersey 08869

GZA GeoEnvironmental Inc.
117 Canal Road | South Bound Brook, NJ 08880
732-356-340

32 Offices Nationwide
www.gza.com

Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

117 Canal Road
South Bound Brook, NJ
T: 732.356.3400
www.gza.com

May 24, 2022
File No. 26.0092691.00

The Reynolds Group, Inc.
575 Route 28, Suite 110
Raritan, New Jersey 08869

Attention: Adonis Crispo, P.E.
Senior Project Engineer

Report
Subsurface Investigation
Proposed Stormwater Facilities
315 and 327 Davidson Avenue
Franklin Township, Somerset County, New Jersey

Introduction

This report presents the results of a subsurface investigation performed by GZA GeoEnvironmental, Inc. (GZA) for proposed modifications of stormwater facilities which may be completed to service the existing Marriot Fairfield Suites hotel building in Franklin Township, Somerset County, New Jersey. The subject site is identified as 315 and 327 Davidson Avenue which encompasses Block 502.01, Lots 47.02, 50.01, 51.01 and 52.01. The approximate location of the site is shown on the Site Location Map, Plate 1. This report was prepared in general accordance with our proposal dated April 14, 2022.

Proposed Construction

Based on information provided to us, we understand that the stormwater improvements would include a new stormwater/bio-retention basin to be constructed on the lot to the south of the hotel (325 Davidson Avenue) which currently contains a residence and a bioswale to be located to the north of the hotel which would include removal of some existing parking spaces. Modifications would also reportedly be performed to the existing stormwater basin located to the rear of the hotel and associated paved areas.

Purpose and Scope of Work

The purpose of our services was to:

1) explore the subsurface soil, rock and groundwater conditions via test pits at or as close as possible to the six locations identified to us;

2) collect tube samples of soil layers encountered above the rock from all proposed test pit locations for laboratory tube permeameter permeability testing, if appropriate;

3) perform basin flood field permeability tests where conditions allow to gauge the general infiltration/permeability characteristics of the underlying rock; and

4) prepare a brief summary report of our findings for use by the Reynolds Group in their evaluation of the stormwater improvements.

To accomplish these purposes, a subsurface exploration program consisting of the six supervised test pit excavations requested by the Reynolds Group was performed on May 3rd, 2022, just three days following the traditional NJDEP wet season. The test pits were advanced using a CAT 320E track-mounted excavator subcontracted by you and extended to depths ranging from approximately 4.3 feet to 8 feet beneath the existing surface grades where refusal to further excavation was encountered. Basin flood tests were performed in Test Pits 1, 2, 4, 5, and 6. A basin flood test could not be performed in Test Pit 3 due to observed groundwater seepage above the requested test depth. In addition, tube samples were obtained from the upper soils in the test pits to evaluate their permeability characteristics. The approximate locations of the test pits performed for this study are shown on the Plot Plan, Plate 2.

All field work was performed under the direct technical supervision of a geotechnical engineer from GZA. Our representative located the test pits in the field relative to existing surface features shown on the plan provided, maintained continuous logs of the test pits as the work proceeded, obtained samples of the encountered materials, conducted the basin flood tests, and obtained relatively undisturbed tube samples of the subsoils above bedrock for laboratory tube permeameter permeability testing.

Detailed descriptions of the subsurface conditions encountered in the test pits are presented on the Test Pits Logs, Plates 3A through 3F. The soil samples from the test pits were visually described in general accordance with the USDA Soil Textural Triangle shown on Plate 4.

All soil samples obtained from the test pits were brought to our office where they were further examined in our soil mechanics laboratory. Tube samples obtained from the test pits were subjected to laboratory tube permeameter permeability testing, the results of which are summarized later in this report.

The following discussions of our findings are subject to the Limitations attached as an Appendix to this report.

Findings

The test pits were performed in landscape areas around the hotel as requested by the Reynolds Group and encountered approximately 5 to 11 inches of topsoil at the surface. In Test Pits 1 through 5, the topsoil was typically underlain by residual soils consisting of sandy clay loam, clay loam, and clay soils and containing at least 20 to 30 percent gravel-sized shale fragments. These residual soils typically extended to depths of 2.4 to 5.5 feet below grade. In Test Pit 6 which was excavated within the existing stormwater basin, approximately 2.1 feet of shaley clay fill was encountered below the topsoil. The fill and residual soils were underlain by shale bedrock which extended to the completion depths of the explorations, about 4.3 to 8 feet below grade. In general, the shale was weathered near the surface and graded fractured and harder with depth and increasing fragment size. Refusal to further excavation was encountered in the shale bedrock with the equipment noted in all of the test pits.

Very slight groundwater seepage was encountered at a depth of 6 feet below grade in Test Pit 3. The excavation was left open to observe the groundwater level overnight as about 4 inches of water was observed in the excavation at the end of the initial day. The next morning approximately 22 inches of water was observed in the excavation. In addition, some localized perched/trapped groundwater seepage at the base of some surface fill and atop the rock was encountered in Test Pit 6 as the excavation was performed within an existing stormwater basin where the site's

stormwater is directed. Soil mottling was not observed in the test pits, therefore, the depth to seasonal high groundwater should be estimated based on the published mapped soil series or as shown on the test pit logs.

The test pits were initially dug to the surface of the weathered/fractured shale bedrock. The excavations were then extended to reach the test depths requested by Reynolds Group, where the basin flood tests were initiated, except for Test Pit 3 where groundwater seepage was observed above the requested test depth. At least 375 gallons of water was introduced into the excavations during the tests. None of the basin flood tests drained during the first test cycle. Once the basin flood testing was completed, the test pits were excavated deeper to refusal. Relatively undisturbed tube samples were also obtained from the test pits to obtain permeability information on the upper soils. The table below provides a summary of the permeability test results for the basin flood and laboratory tube permeameter permeability testing:

Test Pit No.	Depth of Permeability/ Infiltration Test (ft)	Type of Test Performed	Permeability/ Infiltration Test Result (in/hr)	USDA Visual Soil Description of Material Tested
1	1	Tube Permeameter	<0.06	Shaley Clay Loam
1	8	Basin Flood	Fail	Shale Bedrock
2	1	Tube Permeameter	<0.06	Shaley Clay Loam
2	5.5	Basin Flood	Fail	Shale Bedrock
3	1	Tube Permeameter	<0.06	Shaley Clay Loam
4	1	Tube Permeameter	<0.06	Shaley Sandy Clay Loam
4	6	Basin Flood	Fail	Shale Bedrock
5	1	Tube Permeameter	<0.06	Shaley Clay Loam
5	7	Basin Flood	Fail	Shale Bedrock
6	1	Tube Permeameter	<0.06	Fill - Shaley Clay
6	3	Basin Flood	Fail	Shale Bedrock

Chapter 12 of the NJDEP Stormwater BMP Manual indicates a design permeability of 0.5 inches per hour is to be used when a basin flood test passes. However, none of the basin flood tests in the rock drained within the initial 24-hour period indicating the limiting zone should be considered a massive rock substratum. In addition, none of the residual silty/clayey soils overlying the rock exhibited permeabilities greater than 0.5 inches per hour with the exception of the

surface fill within the existing basin. Based on the laboratory testing, Hydrologic Soil Group (HSG) "D" conditions can be considered for Test Pits 1 through 6. Based on the results of our study, it is our opinion that the tested locations are unfavorable for infiltration.

Please feel free to contact us if there are any questions regarding this report.

The following Plates and Appendix are attached and complete this report:

Plate 1 – Site Location Map
Plate 2 – Plot Plan
Plates 3A through 3F – Test Pit Logs
Plate 4 – USDA Textural Triangle
Appendix – Limitations

Respectfully submitted,

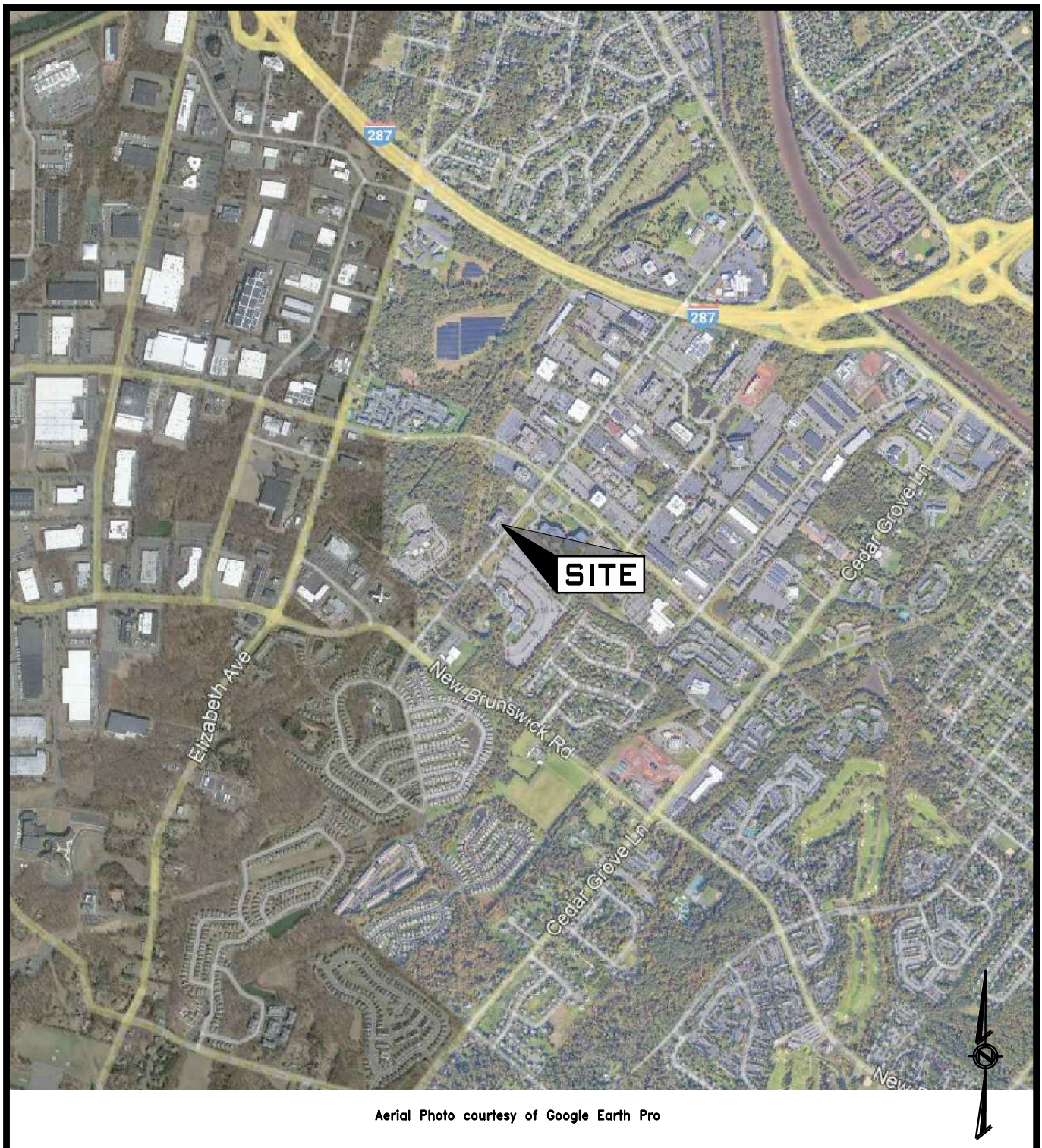
GZA GeoEnvironmental, Inc.,

Cory S. Karinja, P.E.
Project Manager

Mark R. Denno, P.E.
Principal

Robert E. Schwankert, P.E.
Consultant/Reviewer

CSK:MRD/ck
(1 copy submitted via email)



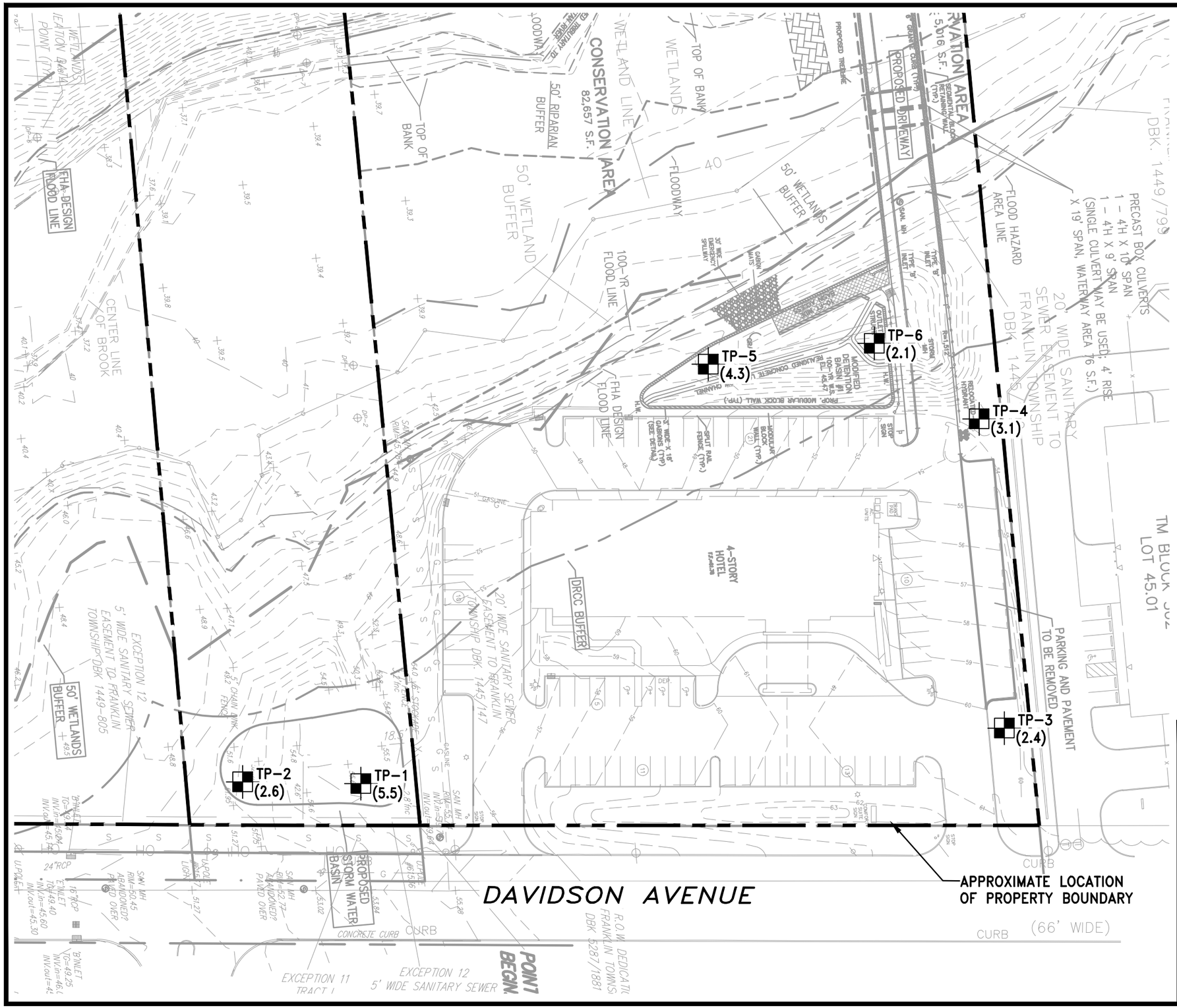
Aerial Photo courtesy of Google Earth Pro

GZA GeoEnvironmental, Inc.
Engineers and Scientists
Known for excellence. Built on trust.
www.gza.com

SITE LOCATION MAP

PROPOSED STORMWATER FACILITIES
FRANKLIN TOWNSHIP, NEW JERSEY
THE REYNOLDS GROUP

JOB NO.	FILE NO.	DR. BY	CHK. BY	DATE	SCALE	PLATE
26.0092691.00	–	VJD	CSK	5/17/22	1"=2,000'	1



KEY:

TP-1 — NUMBER AND APPROXIMATE LOCATION OF TEST PITS PERFORMED FOR THIS STUDY

(5.5) — APPROXIMATE DEPTH IN FEET TO THE SURFACE OF SHALE BEDROCK BELOW THE EXISTING GROUND SURFACE

NOTES:

1. This drawing is part of GZA GeoEnvironmental, Inc. Report No. 26.0092691.00 and should be read together with the report for complete evaluation.
2. General layout was obtained from a drawing prepared by The Reynolds Group, entitled "Concept Plan (Proposed Stream Crossing)" dated 4/6/22, scale 1"= 60'.

PLOT PLAN

PROPOSED STORMWATER FACILITIES
FRANKLIN TOWNSHIP, NEW JERSEY
THE REYNOLDS GROUP

GZA GeoEnvironmental, Inc.
Engineers and Scientists
Known for excellence. Built on trust.
www.gza.com

JOB NO.	FILE NO.			
26.0092691.00	-			
DR. BY	CHK. BY	DATE	SCALE	PLATE
VJD	CSK	5/17/22	1"= 60'	2

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-1
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 55.3
Final Test Pit Depth (ft.): 8
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator
Excavator Model: CAT 320E

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
5/3/22		NE	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1	S1, T1	1	0-10	Topsoil - Reddish brown (5YR, 4/4) sandy clay loam, 10% gravel, moderate medium crumb, moist, loose, clear smooth boundary, common medium roots	1		
2			10-66	Dark reddish brown (2.5YR, 3/4) shaley clay loam, 20% gravel, strong fine subangular blocky, moist, firm, clear smooth boundary, few fine roots	2		
3					3		
4					4		
5					5		
6			66-96	Dark reddish brown (2.5YR, 3/4) weathered/fractured shale, with 20% clay in joints, moist	6		
7					7		
8				- refusal @ 8'	8		
9				End of exploration at 8 feet. Groundwater seepage not encountered Estimated seasonal high water deeper than 8'			
10				Note: Failing basin flood test at requested test depth of 8'			
11							
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3A

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-2
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 52

Final Test Pit Depth (ft.): 8
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator

Excavator Model: CAT 320E

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
5/3/22		NE	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1	S1, T1	1	0-11	Topsoil - Dark reddish brown (5YR, 3/4) sandy clay, 10% gravel, weak medium crumb, moist, loose, clear smooth boundary, common fine roots	1		
2			11-31	Dark reddish brown (2.5YR, 3/4) shaley clay loam, 20% gravel, strong fine crumb, moist, firm, clear smooth boundary, few fine roots	2		
3				Dark reddish brown (2.5YR, 3/4) weathered/fractured shale, with 20% clay in joints, moist	3		
4					4		
5					5		
6			31-96		6		
7					7		
8				- refusal @ 8'	8		
9				End of exploration at 8 feet. Groundwater seepage not encountered Estimated seasonal high water deeper than 8'			
10				Note: Failing basin flood test at requested test depth of 5.5'			
11							
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3B

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-3
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 60.5

Final Test Pit Depth (ft.): 8
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator
Excavator Model: CAT 320E

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
5/3/22		6	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1	S1, T1	1	0-8	Dark reddish brown (5YR, 3/3) silty clay loam, 10% gravel, moderate medium crumb, moist, friable, clear smooth boundary, many medium roots	1		
2			8-29	Reddish brown (2.5YR, 4/4) shaley clay loam, 25% gravel, strong fine crumb, moit, firm, clear smooth boundary, few fine roots	2		
3			29-96	Dark reddish brown (10YR, 3/4) weathered/fractured shale, with 20% clay in joints, moist	3		
4					4		
5					5		
6					6		
7					7		
8				- refusal @ 8'	8		
9				End of exploration at 8 feet. Very slight groundwater seepage encountered @ 6' Approximately 4" of water in excavation at end of day on 5/10/2022 Approximately 22" of water in excavation at end of day on 5/11/2022 Estimated seasonal high water @ 6'			
10							
11				Note: Basin flood test could not be performed due to groundwater seepage			
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3C

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-4
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 53
Final Test Pit Depth (ft.): 6.5
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator
Excavator Model: CAT 320E

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
5/3/22		NE	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1			0-9	Topsoil - Dark brown (7.5YR, 3/4) silty clay, 15% gravel, moderate medium crumb, moist, friable, clear smooth boundary, many medium roots	1		
2			9-37	Dark reddish brown (2.5YR, 2.5/4) shaley sandy clay loam, 20% gravel, moderate medium subangular blocky, moist, friable, abrupt smooth boundary, few fine roots	2		
3					3		
4			37-78	Dark reddish brown (2.5YR, 3/4) weathered/fractured shale, with 20% silty clay in joints, moist	4		
5					5		
6				- refusal @ 6.5'	6		
7				End of exploration at 6.5 feet. Groundwater seepage not encountered Estimated seasonal high water deeper than 6.5'			
8							
9				Note: Failing basin flood test at requested test depth of 6'			
10							
11							
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3D

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-5
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 46

Final Test Pit Depth (ft.): 7
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator

Excavator Model: CAT 320E

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
5/3/22		NE	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1	S1, T1	1	0-8	Topsoil - Dark reddish brown (2.5YR, 3/3) silty clay loam, 10% gravel, moderate fine crumb, moist, friable, abrupt smooth boundary, many medium roots	1		
2			8-52	Reddish brown (2.5YR, 4/4) shaley clay, 35% gravel, 10% cobbles, strong fine crumb, moist, firm, clear smooth boundary, few fine roots	2		
3					3		
4					4		
5			52-84	Reddish brown (2.5Y, 4/4) weathered/fractured shale, with 20% clay in joints, moist	5		
6					6		
7				- refusal @ 7'	7		
8				End of exploration at 7 feet. Groundwater seepage not encountered Estimated seasonal high water deeper than 7'			
9							
10				Note: Failing basin flood test at requested test depth of 7'			
11							
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3E

TEST PIT LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

The Reynolds Group
Proposed Stormwater Facilities
Franklin Township, NJ

EXPLORATION NO.: TP-6
SHEET: 1 of 1
PROJECT NO: 26.0092691.00
REVIEWED BY: Cory Karinja

Logged By: Cody Lynes
Contractor: Colosseo Development Group Inc.
Operator: Robert

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 41
Final Test Pit Depth (ft.): 4.3
Date Start - Finish: 5/3/2022 - 5/11/2022

Type of Excavator: Tracked Excavator
Excavator Model: CAT 320E

Groundwater Depth (ft.)

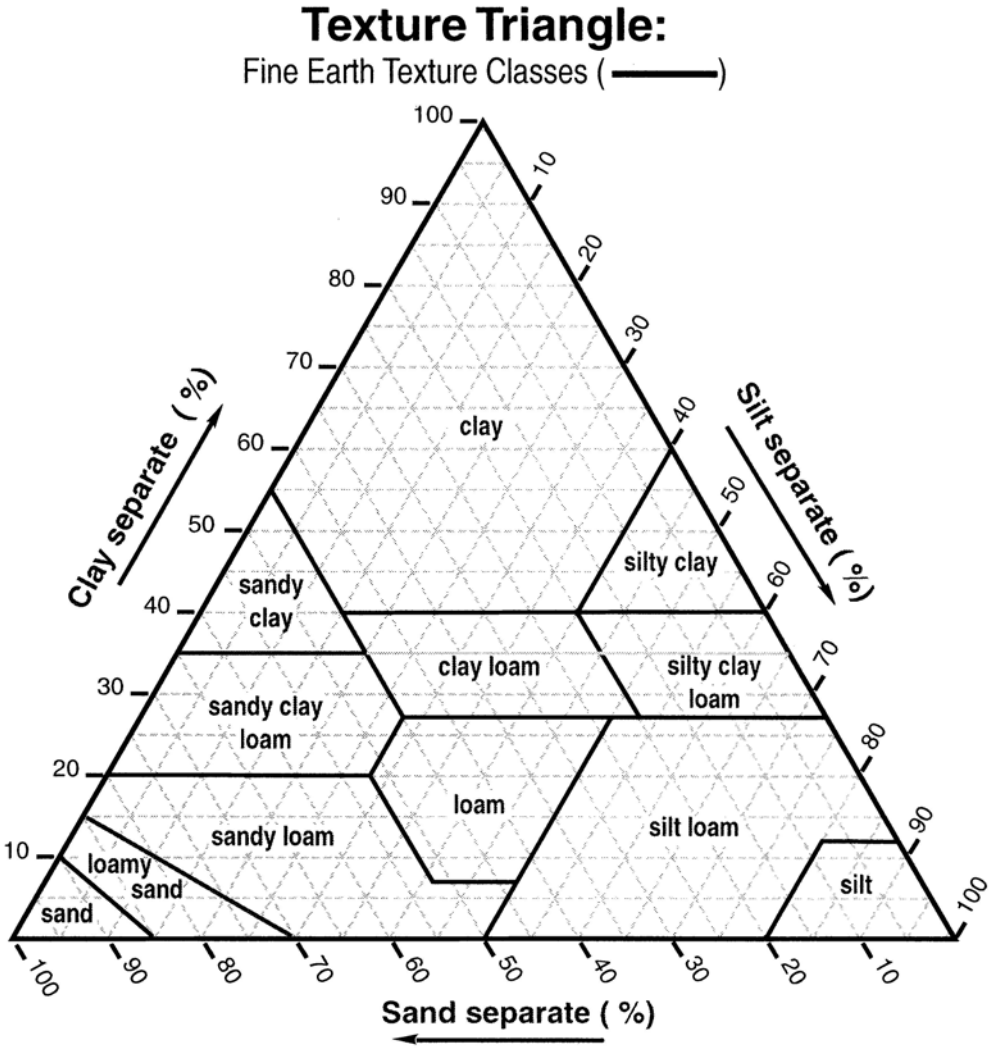
Date	Time	Water Depth	Stab.Time
5/3/22		2	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (in.)	Sample Description and Identification	Depth (ft)	Water Content (%)	Remark
1	S1, T1	1	0-5	Topsoil - Dark reddish brown (2.5YR, 3/4) silty clay, 10% gravel, moderate medium crumb, moist, friable, clear wavy boundary, many fine roots	1		
2			5-25	Fill - Dark reddish brown (5YR, 3/4) shaley clay, 20% gravel, moderate fine subangular blocky, moist, friable, abrupt smooth boundary	2		
3			25-52	Dark reddish brown (2.5YR, 3/4) weathered/fractured shale, with 20% clay in joints, moist	3		
4				- refusal @ 4.3'	4		
5				End of exploration at 4.3 feet. Very slight groundwater seepage encountered @ 2' . Trapped flow subsided in 1 hour Estimated seasonal high water @ 2'			
6				Note: Failing basin flood test at requested test depth of 3'			
7							
8							
9							
10							
11							
12							
13							
14							
15							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.: 3F



USDA SOIL CLASSIFICATION SYSTEM

APPENDIX

APPENDIX

Limitations

A. Subsurface Information

Locations: The locations of the explorations were approximately determined by tape measurement from existing site features. Elevations of the explorations were approximately determined by interpolation between contours shown on topographic plans provided to us. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used.

Interface of Strata: The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types, and the transitions may be gradual.

Field Logs/Final Logs: A field log was prepared for each exploration by a member of our staff. The field log contains factual information and interpretation of the soil conditions between samples. Our recommendations are based on the final logs as shown in this report and the information contained therein, and not on the field logs. The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and/or tests of the field samples.

Water Levels: Water level readings have been made in the explorations at times and under conditions stated on the individual logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater will occur due to variations in rainfall, temperature, and other factors.

Pollution/Contamination: Unless specifically indicated to the contrary in this report, the scope of our services was limited only to investigation and evaluation of the geotechnical engineering aspects of the site conditions, and did not include any consideration of potential site pollution or contamination resulting from the presence of chemicals, metals, radioactive elements, etc. This report offers no facts or opinions related to potential pollution/contamination of the site.

Environmental Considerations: Unless specifically indicated to the contrary in this report, this report does not address environmental considerations which may affect the site development, e.g., wetlands determinations, flora and fauna, wildlife, etc. The conclusions and recommendations of this report are not intended to supersede any environmental conditions which should be reflected in the site planning.

B. Applicability of Report

This report has been prepared in accordance with generally accepted soils and foundation engineering practices for the exclusive use of The Reynolds Group for specific application to the design of the proposed modifications of stormwater facilities. No other warranty, expressed or implied, is made.

This report may be referred to in the project specifications for general information purposes only, but should not be used as the technical specifications for the work, as it was prepared for design purposes exclusively.

C. Reinterpretation of Recommendations

Change in Location or Nature of Facilities: In the event that any changes in the nature, design or location of the facilities are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

Changed Conditions During Construction: The analyses and recommendations submitted in this report are based in part upon the data obtained from 6 widely-spaced test pit excavations performed for this study. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

Changes in State-of-the-Art: The conclusions and recommendations contained in this report are based upon the applicable standards of our profession at the time this report was prepared.

D. Use of Report by Prospective Bidders

This soil and foundation engineering report was prepared for the project by GZA GeoEnvironmental Inc. (GZA) for design purposes and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope was developed to address design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

E. Construction Observation

We recommend that GZA be retained to provide on-site soils engineering services during the earthwork construction and foundation phases of the work. This is to observe compliance with the design concepts and to allow changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.