



General Dynamics Electric Boat
Eastern Point Road – Lot B
Groton, Connecticut
July 5, 2019

Stormwater Management Narrative

General Dynamics Electric Boat (EB) proposes to add 74 parking spaces and associated drive aisles to parking lot “B” on the former Building 35 “Colonel Ledyard” school. The 0.94 acre site is bounded by residential properties to the north, Forest Street to the south and Chicago Avenue to the east. A site location map is presented as Figure 1.

Existing Conditions

The project area is relatively flat consisting of bituminous pavement and grass and gravel in the foot print of the former school.

Currently stormwater runoff generated by the project area drains to northwest towards a catch basin located in the existing Lot B parking area. From there, stormwater is conveyed west, ultimately discharging to the Thames River. Based on site investigations and available existing mapping, stormwater runoff collected by existing drainage structures is conveyed towards the Thames River.

The Lot B parking project area is not within a flood plain. A portion of relevant FEMA Flood Insurance Rate Map (Panel Number 09011C0504J, Map Revised: 8/5/2013) is presented as Figure 2.

Proposed Conditions

Proposed improvements to the lot include 0.81 acres of bituminous concrete pavement, of which 0.27 acres is new pavement. Additional site improvements include existing parking lot reconstruction, and landscaping.

The project area proposed drainage will mimic existing conditions, draining northwest towards the existing storm drainage structures that ultimately discharge runoff into the Thames River. Stormwater runoff generated by the parking area will drain to either of two proposed catch basins located in the northwest area of the parking lot. The two catch basins will drain to an infiltration chamber stormwater management system to store runoff on-site and abate discharge to equal or reduced peak flow rate and volume when compared to existing conditions. This is consistent with the CT-DEEP guidelines for stormwater discharge.

A summary of pre- and post-development impervious area is provided in Table 1. Due to the addition of the infiltrator system, the existing stormwater management system will be able to convey any increase in flows from the additional impervious area.

Table 1 – Existing vs. Proposed Impervious Area within Project Limits

	Existing Conditions	Proposed Conditions
Total Area	0.94	0.94
Impervious Area (AC)	0.54	0.81
Impervious Coverage (%)	57.4%	85.7%

Summary

It is our opinion that the Electric Boat existing stormwater management system has the capacity to convey stormwater runoff generated by the Lot B parking area site due to the addition of the infiltrator system. Stormwater runoff generated by the Lot B parking addition will be conveyed to the site's existing stormwater management system.

The design meets City of Groton Section 7.7C regulations of reducing pollutants, encouraging groundwater recharge, and reducing the peak flow generated by the site for the 2-, 10-, 25-, and 100-year design storm. The design also meets the Connecticut General Permit of the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities.

Figures

1 FEMA National Flood Hazard Layer FIRMette

Appendices

A Watershed Analysis

Figures

FEMA National Flood Hazard Layer FIRMette

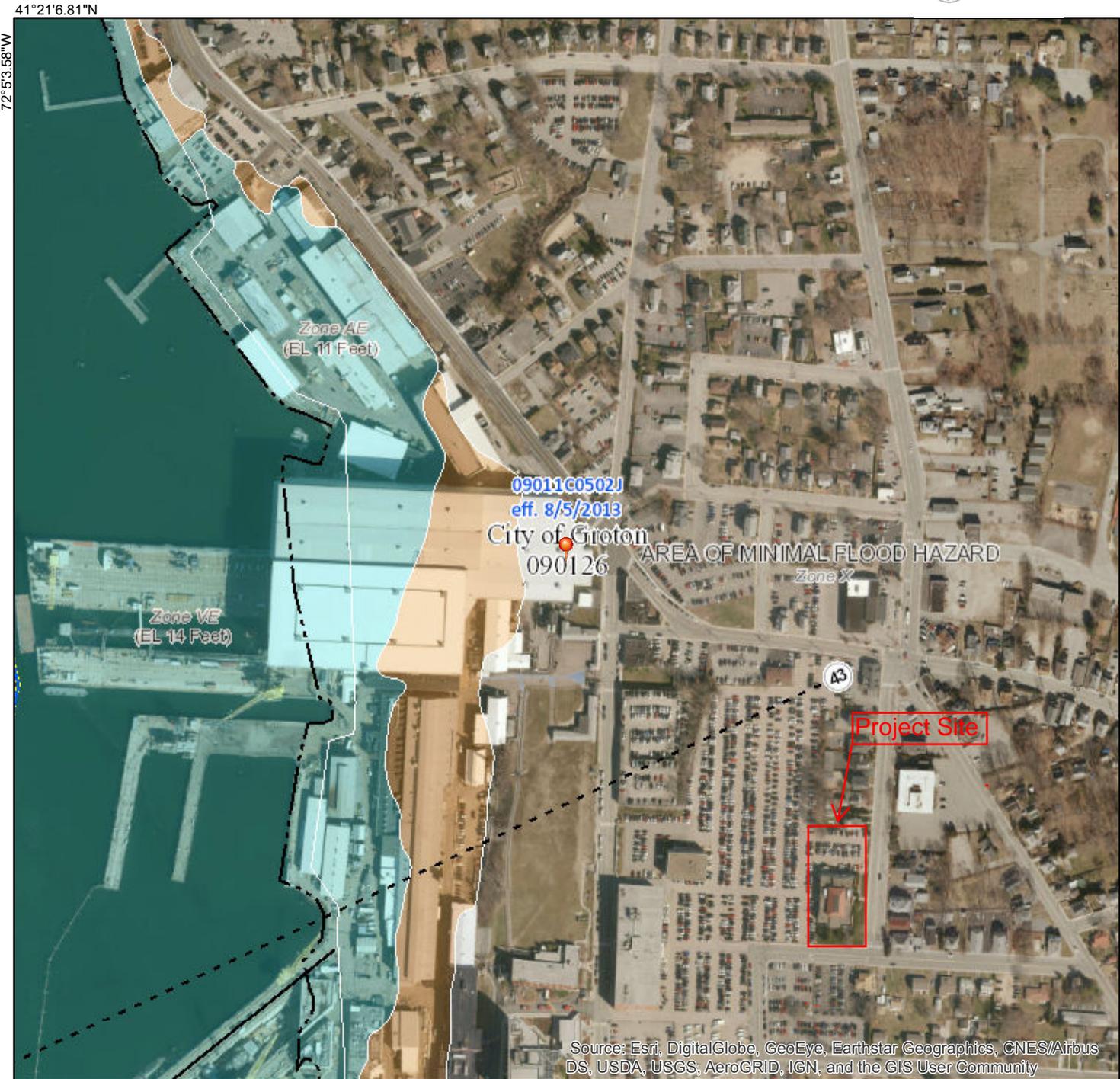
National Flood Hazard Layer FIRMMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth
		Regulatory Floodway Zone AE, AO, AH, VE, AR
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation 17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

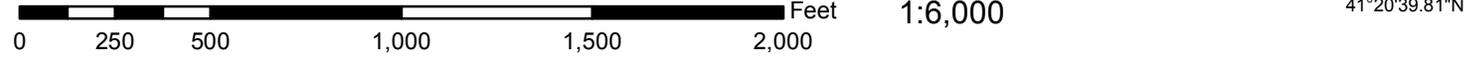


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **6/4/2018 at 10:23:25 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



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Appendix A

Watershed Analysis

2 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
(1L)	2.79	2.60	-0.19	-7%

10 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
(1L)	4.38	4.38	0.00	0%

25 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
(1L)	5.59	4.34	-1.25	-22%

100 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
(1L)	7.95	7.88	-0.07	-1%



Existing



Proposed



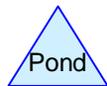
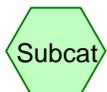
Underground Detention Proposed



Existing



Proposed



Routing Diagram for 1997570.A12

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1997570.A12Prepared by {enter your company name here}
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Page 2**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.673	84	50-75% Grass cover, Fair, HSG D (1S, 2S, 2SA)
1.209	98	Paved parking, HSG D (1S, 2S, 2SA)
1.882	93	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.882	HSG D	1S, 2S, 2SA
0.000	Other	
1.882		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.673	0.000	0.673	50-75% Grass cover, Fair	1S, 2S, 2SA
0.000	0.000	0.000	1.209	0.000	1.209	Paved parking	1S, 2S, 2SA
0.000	0.000	0.000	1.882	0.000	1.882	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	85.00	83.50	44.0	0.0341	0.011	18.0	0.0	0.0

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Summary for Subcatchment 1S: Existing

Runoff = 2.79 cfs @ 12.12 hrs, Volume= 0.181 af, Depth= 2.31"

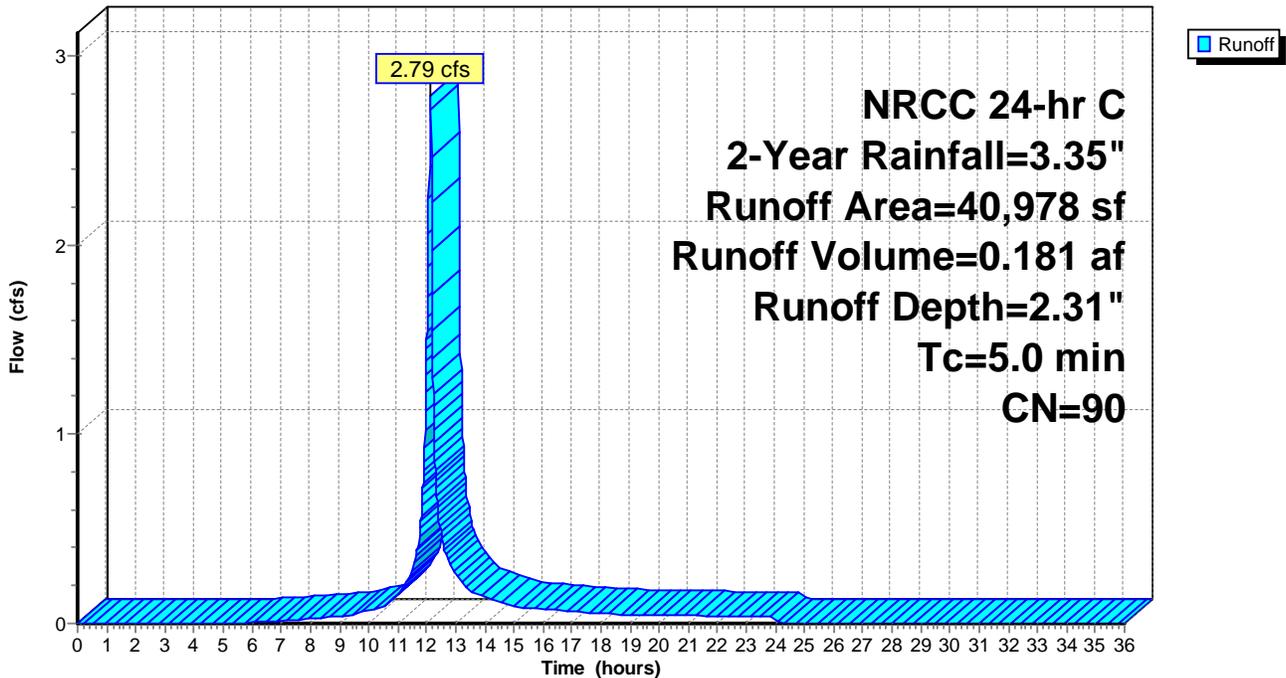
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
23,469	84	50-75% Grass cover, Fair, HSG D
17,509	98	Paved parking, HSG D
40,978	90	Weighted Average
23,469		57.27% Pervious Area
17,509		42.73% Impervious Area

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

Subcatchment 1S: Existing

Hydrograph



Summary for Subcatchment 2S: Proposed

Runoff = 3.06 cfs @ 12.12 hrs, Volume= 0.214 af, Depth= 2.90"

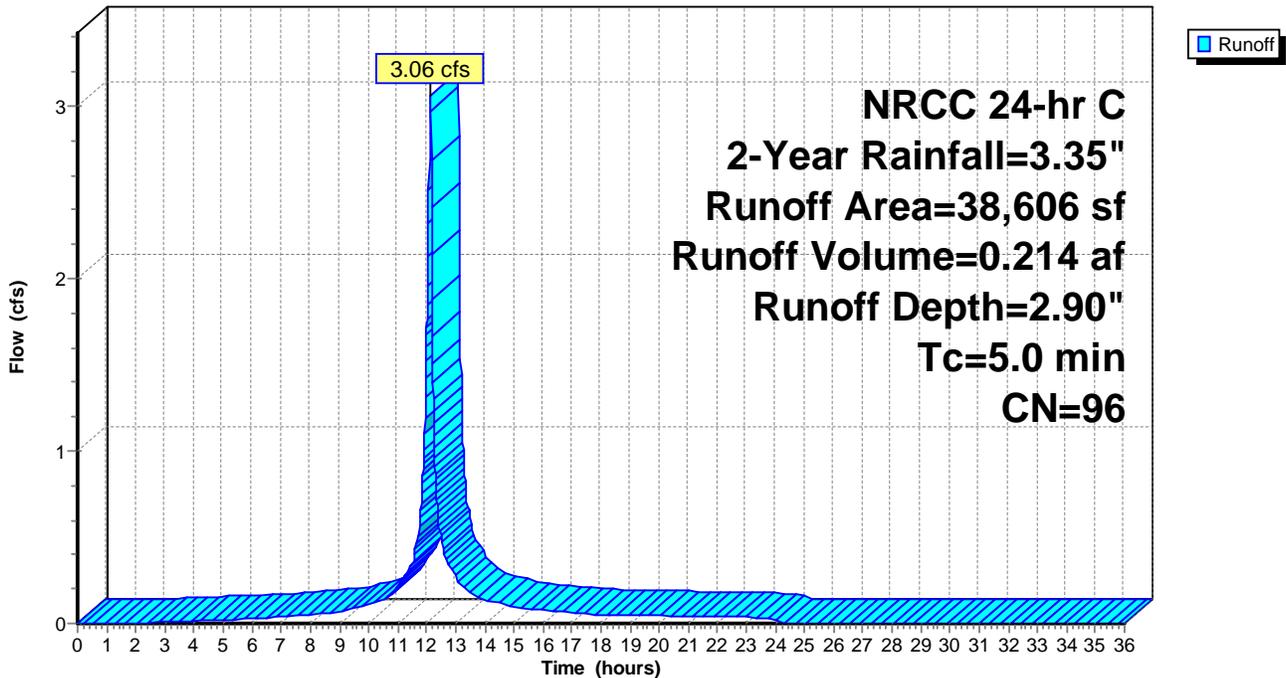
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
5,837	84	50-75% Grass cover, Fair, HSG D
32,769	98	Paved parking, HSG D
38,606	96	Weighted Average
5,837		15.12% Pervious Area
32,769		84.88% Impervious Area

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

Subcatchment 2S: Proposed

Hydrograph



Summary for Subcatchment 2SA: Proposed

Runoff = 0.20 cfs @ 12.12 hrs, Volume= 0.014 af, Depth= 3.12"

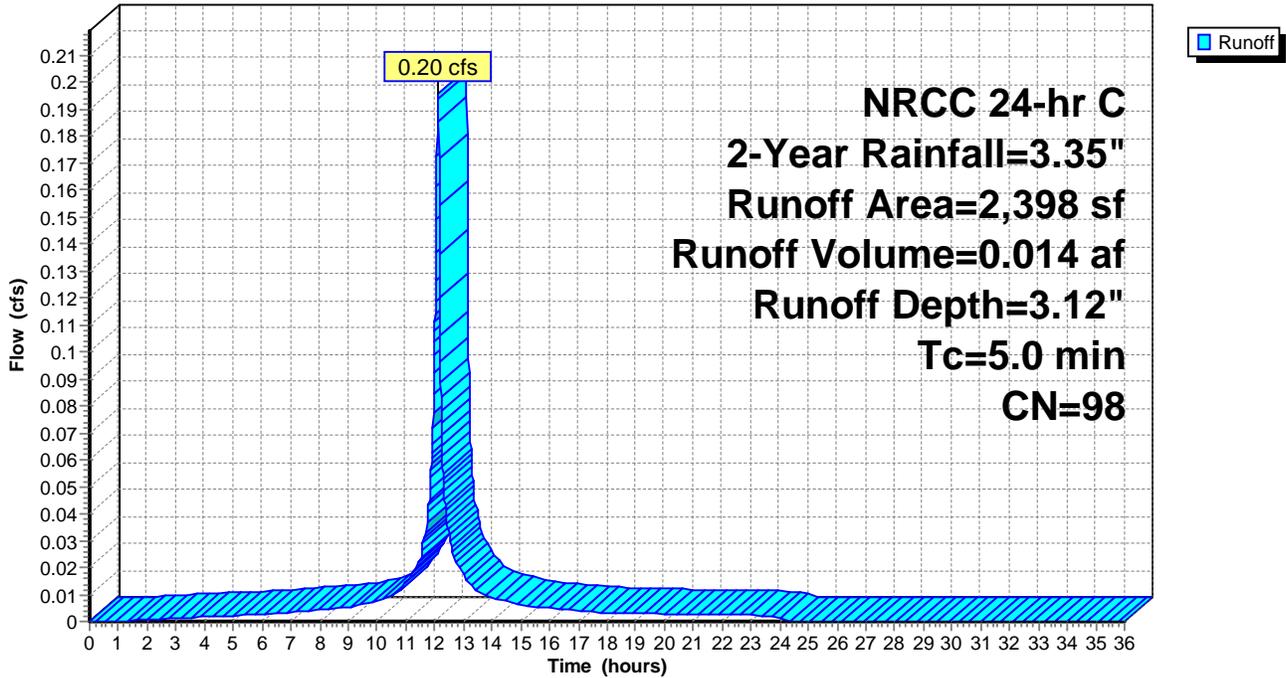
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
20	84	50-75% Grass cover, Fair, HSG D
2,378	98	Paved parking, HSG D
2,398	98	Weighted Average
20		0.83% Pervious Area
2,378		99.17% Impervious Area

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

Subcatchment 2SA: Proposed

Hydrograph



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Summary for Pond 2P: Underground Detention

Inflow Area = 0.886 ac, 84.88% Impervious, Inflow Depth = 2.90" for 2-Year event
Inflow = 3.06 cfs @ 12.12 hrs, Volume= 0.214 af
Outflow = 2.44 cfs @ 12.16 hrs, Volume= 0.214 af, Atten= 20%, Lag= 2.3 min
Primary = 2.44 cfs @ 12.16 hrs, Volume= 0.214 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 85.91' @ 12.16 hrs Surf.Area= 0.035 ac Storage= 0.015 af

Plug-Flow detention time= 4.6 min calculated for 0.214 af (100% of inflow)
Center-of-Mass det. time= 4.6 min (780.1 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	85.10'	0.025 af	22.50'W x 67.28'L x 2.33'H Field A 0.081 af Overall - 0.018 af Embedded = 0.063 af x 40.0% Voids
#2A	85.60'	0.018 af	ADS_StormTech SC-310 +Cap x 54 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		0.043 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	18.0" Round Culvert L= 44.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 83.50' S= 0.0341 ' /' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	86.93'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 1	85.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=2.44 cfs @ 12.16 hrs HW=85.91' (Free Discharge)

- ↑ **1=Culvert** (Passes 2.44 cfs of 3.65 cfs potential flow)
- ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 2.44 cfs @ 3.25 fps)

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Watershed Analysis

NRCC 24-hr C 2-Year Rainfall=3.35"

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Pond 2P: Underground Detention - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 18.0" Side Stone x 2 = 22.50' Base Width

6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

54 Chambers x 14.7 cf = 796.1 cf Chamber Storage

3,532.2 cf Field - 796.1 cf Chambers = 2,736.1 cf Stone x 40.0% Voids = 1,094.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,890.5 cf = 0.043 af

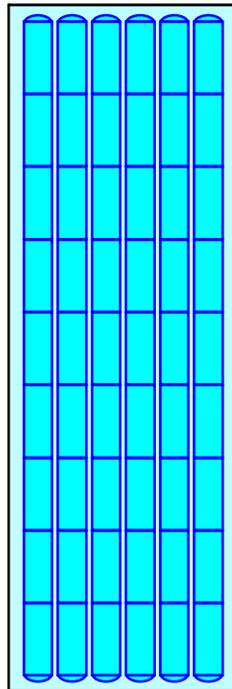
Overall Storage Efficiency = 53.5%

Overall System Size = 67.28' x 22.50' x 2.33'

54 Chambers

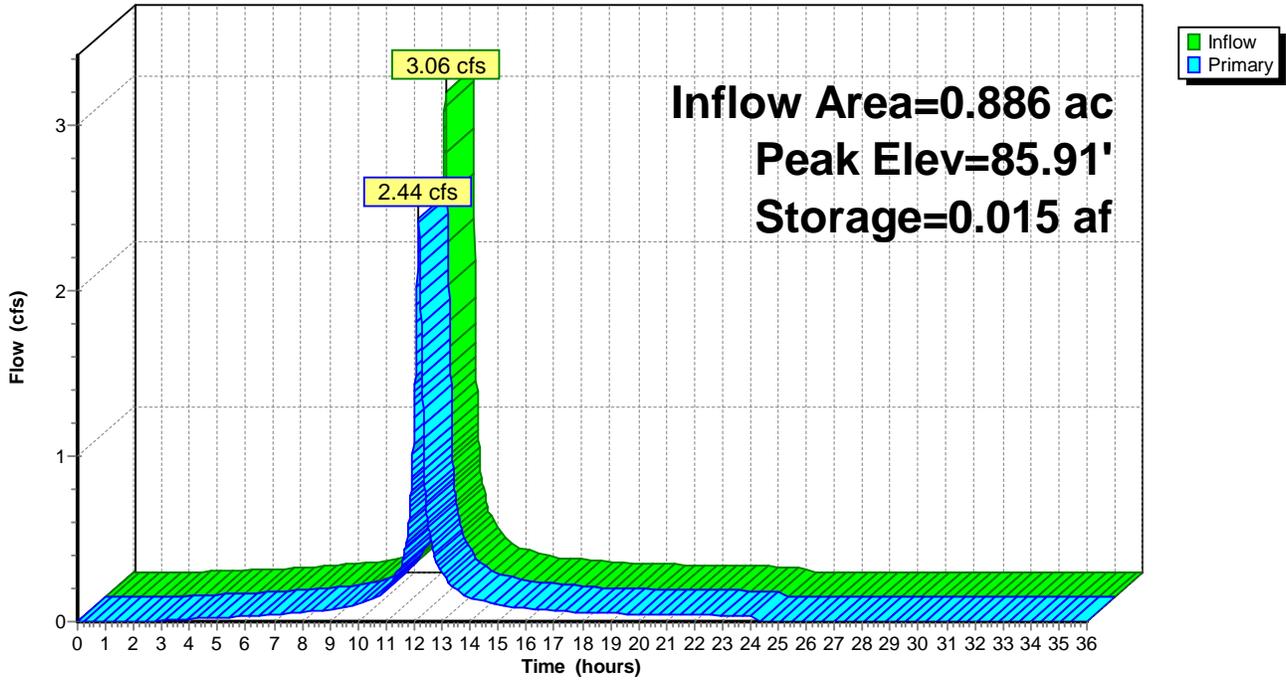
130.8 cy Field

101.3 cy Stone



Pond 2P: Underground Detention

Hydrograph



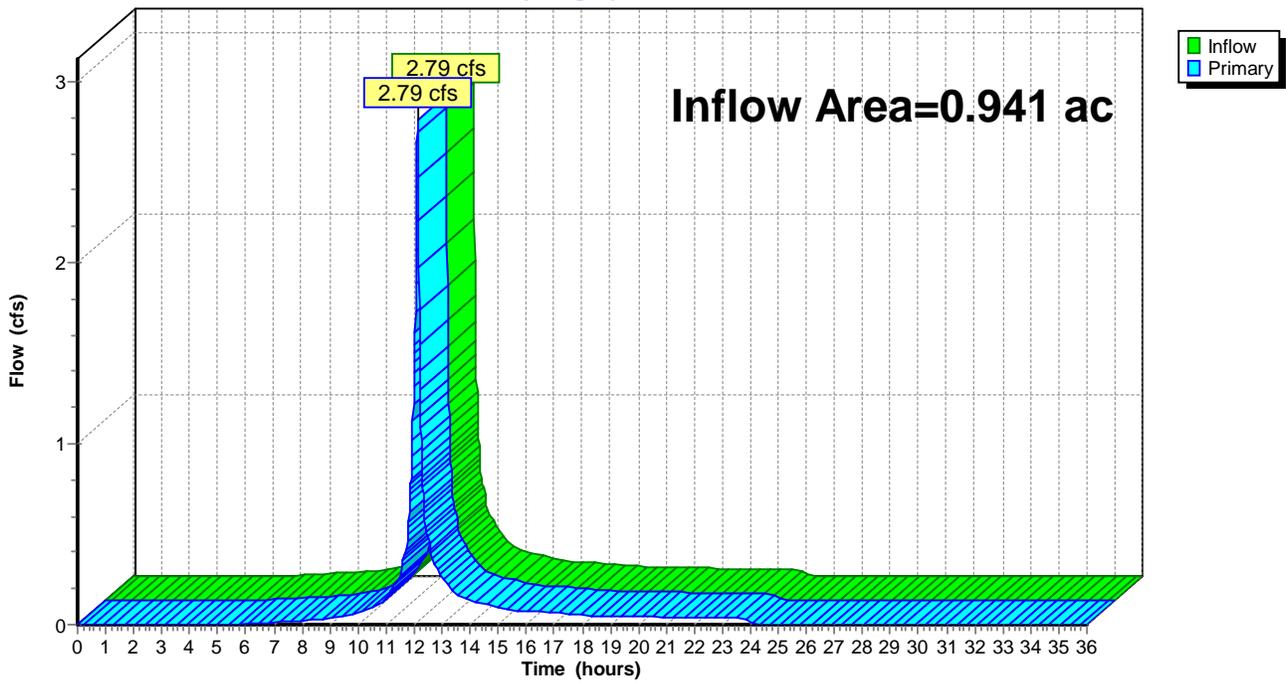
Summary for Link 1L: Existing

Inflow Area = 0.941 ac, 42.73% Impervious, Inflow Depth = 2.31" for 2-Year event
Inflow = 2.79 cfs @ 12.12 hrs, Volume= 0.181 af
Primary = 2.79 cfs @ 12.12 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Existing

Hydrograph



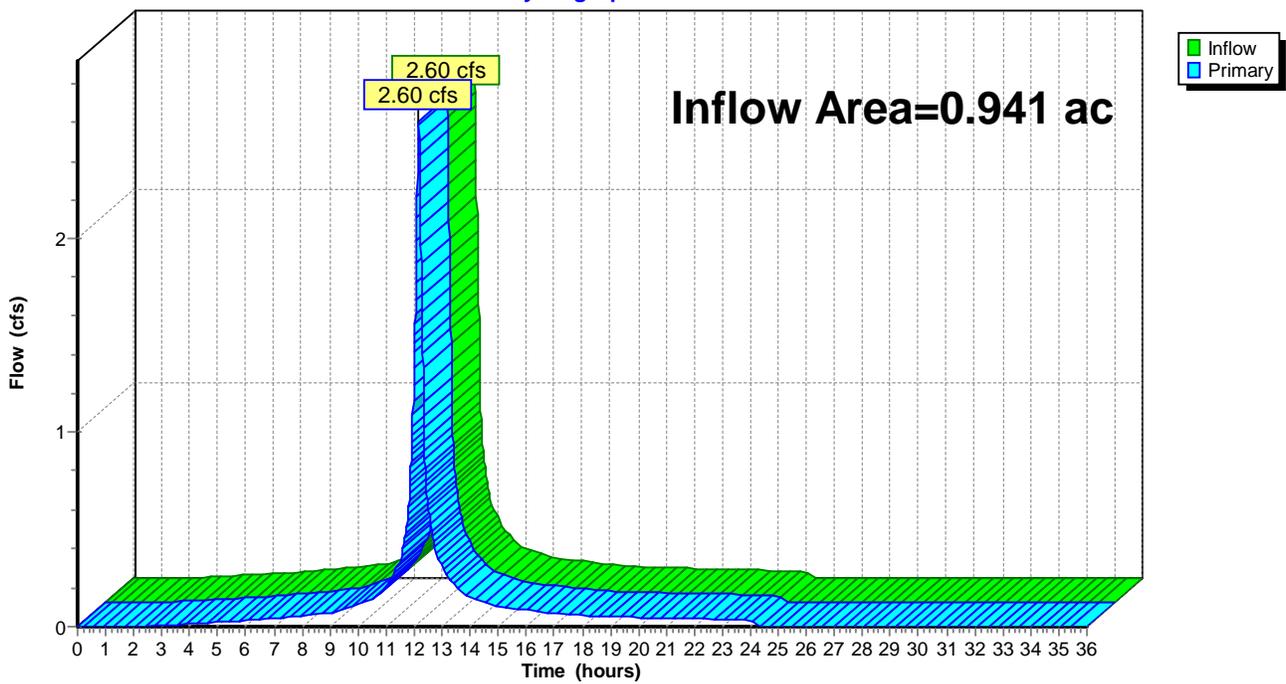
Summary for Link 2L: Proposed

Inflow Area = 0.941 ac, 85.72% Impervious, Inflow Depth = 2.91" for 2-Year event
Inflow = 2.60 cfs @ 12.15 hrs, Volume= 0.228 af
Primary = 2.60 cfs @ 12.15 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Proposed

Hydrograph



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Summary for Subcatchment 1S: Existing

Runoff = 4.38 cfs @ 12.12 hrs, Volume= 0.293 af, Depth= 3.73"

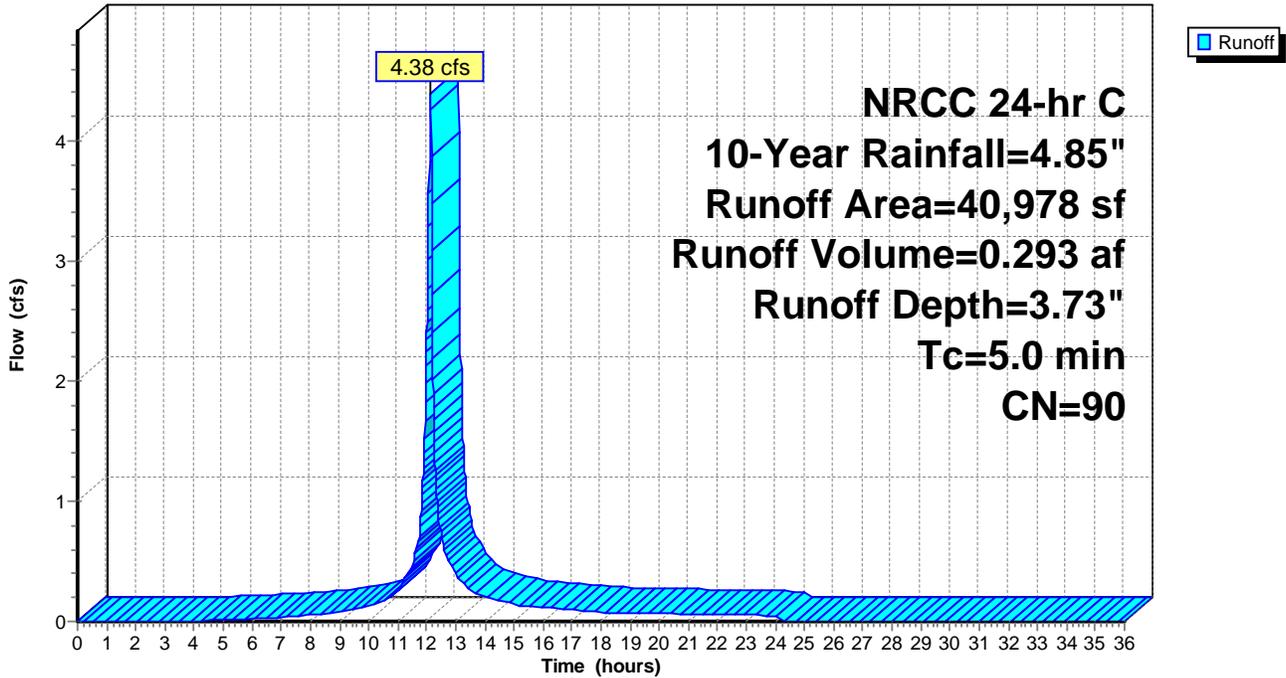
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 10-Year Rainfall=4.85"

Area (sf)	CN	Description
23,469	84	50-75% Grass cover, Fair, HSG D
17,509	98	Paved parking, HSG D
40,978	90	Weighted Average
23,469		57.27% Pervious Area
17,509		42.73% Impervious Area

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

Subcatchment 1S: Existing

Hydrograph



Summary for Subcatchment 2S: Proposed

Runoff = 4.51 cfs @ 12.12 hrs, Volume= 0.324 af, Depth= 4.38"

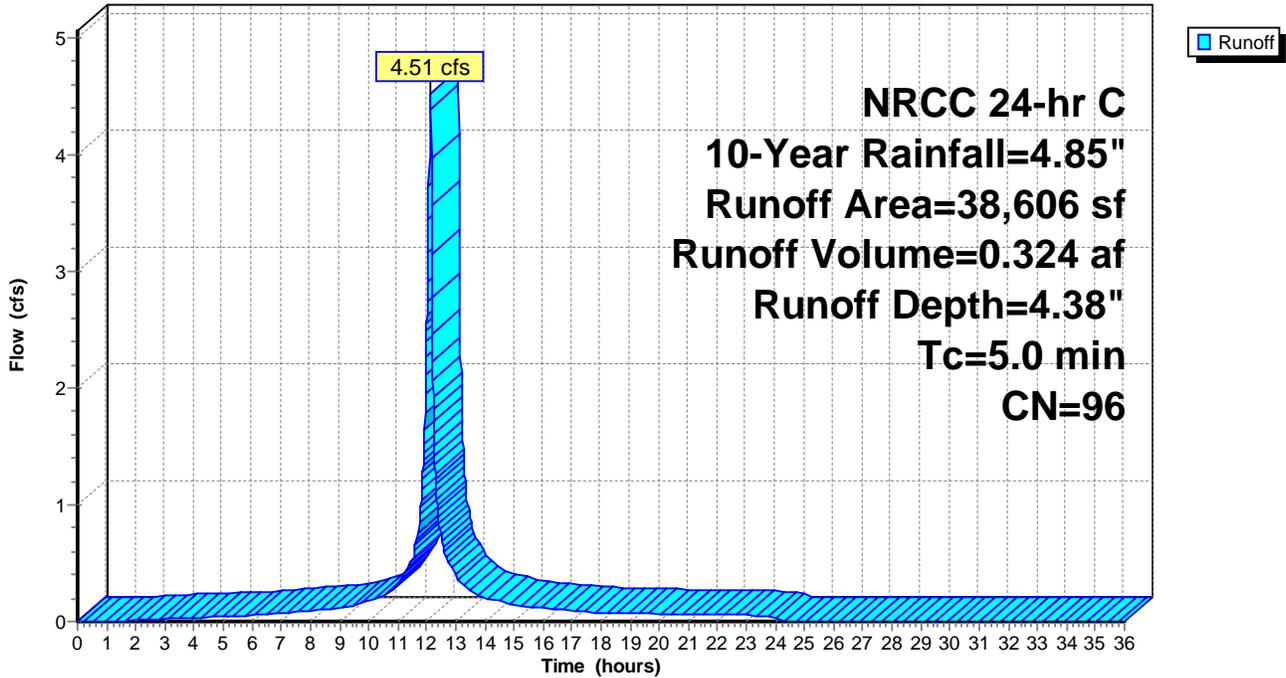
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 10-Year Rainfall=4.85"

Area (sf)	CN	Description
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38,606	96	Weighted Average
5,837		15.12% Pervious Area
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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment 2S: Proposed

Hydrograph



Summary for Subcatchment 2SA: Proposed

Runoff = 0.28 cfs @ 12.12 hrs, Volume= 0.021 af, Depth= 4.61"

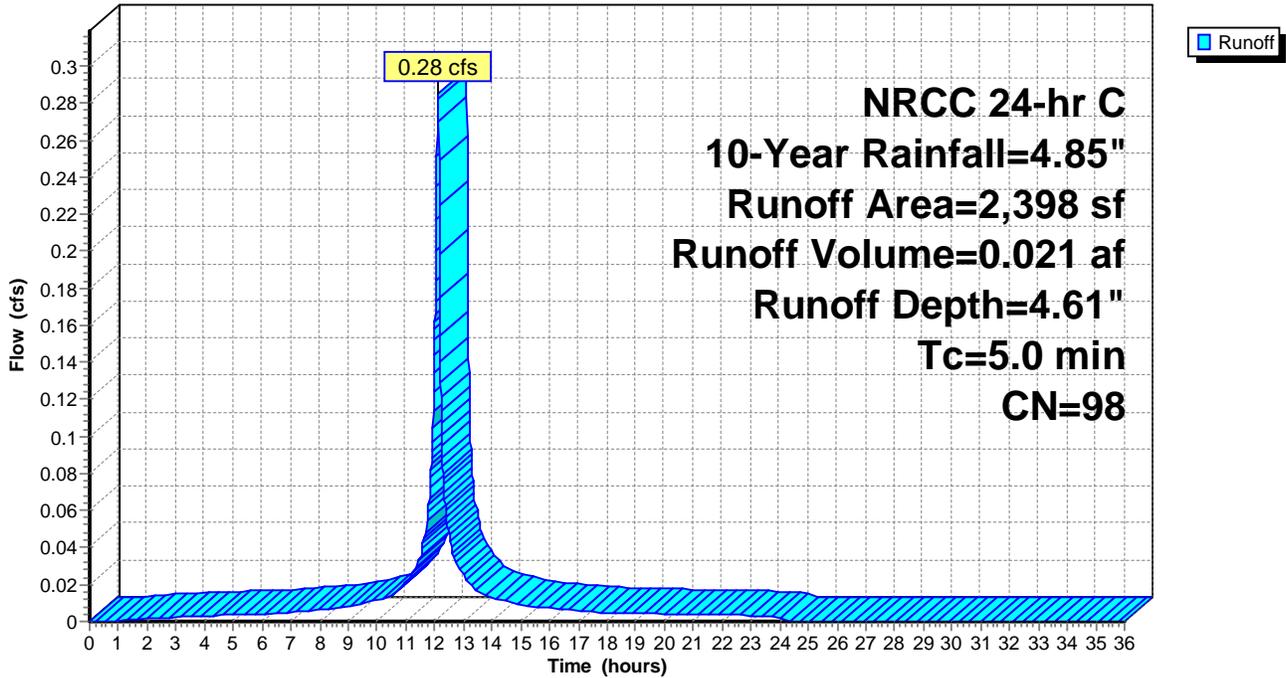
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 10-Year Rainfall=4.85"

Area (sf)	CN	Description
20	84	50-75% Grass cover, Fair, HSG D
2,378	98	Paved parking, HSG D
2,398	98	Weighted Average
20		0.83% Pervious Area
2,378		99.17% Impervious Area

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

Subcatchment 2SA: Proposed

Hydrograph



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Summary for Pond 2P: Underground Detention

Inflow Area = 0.886 ac, 84.88% Impervious, Inflow Depth = 4.38" for 10-Year event
Inflow = 4.51 cfs @ 12.12 hrs, Volume= 0.324 af
Outflow = 3.36 cfs @ 12.16 hrs, Volume= 0.324 af, Atten= 26%, Lag= 2.7 min
Primary = 3.36 cfs @ 12.16 hrs, Volume= 0.324 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 86.29' @ 12.16 hrs Surf.Area= 0.035 ac Storage= 0.024 af

Plug-Flow detention time= 4.8 min calculated for 0.324 af (100% of inflow)
Center-of-Mass det. time= 4.8 min (769.7 - 764.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	85.10'	0.025 af	22.50'W x 67.28'L x 2.33'H Field A 0.081 af Overall - 0.018 af Embedded = 0.063 af x 40.0% Voids
#2A	85.60'	0.018 af	ADS_StormTech SC-310 +Cap x 54 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		0.043 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	18.0" Round Culvert L= 44.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 83.50' S= 0.0341 ' /' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	86.93'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 1	85.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=3.36 cfs @ 12.16 hrs HW=86.29' (Free Discharge)

- ↑ **1=Culvert** (Passes 3.36 cfs of 6.24 cfs potential flow)
- ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 3.36 cfs @ 4.27 fps)

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Watershed Analysis

NRCC 24-hr C 10-Year Rainfall=4.85"

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Pond 2P: Underground Detention - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 18.0" Side Stone x 2 = 22.50' Base Width

6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

54 Chambers x 14.7 cf = 796.1 cf Chamber Storage

3,532.2 cf Field - 796.1 cf Chambers = 2,736.1 cf Stone x 40.0% Voids = 1,094.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,890.5 cf = 0.043 af

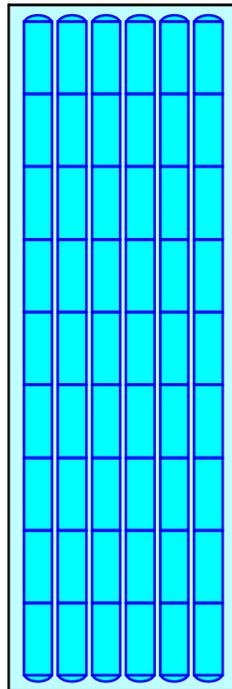
Overall Storage Efficiency = 53.5%

Overall System Size = 67.28' x 22.50' x 2.33'

54 Chambers

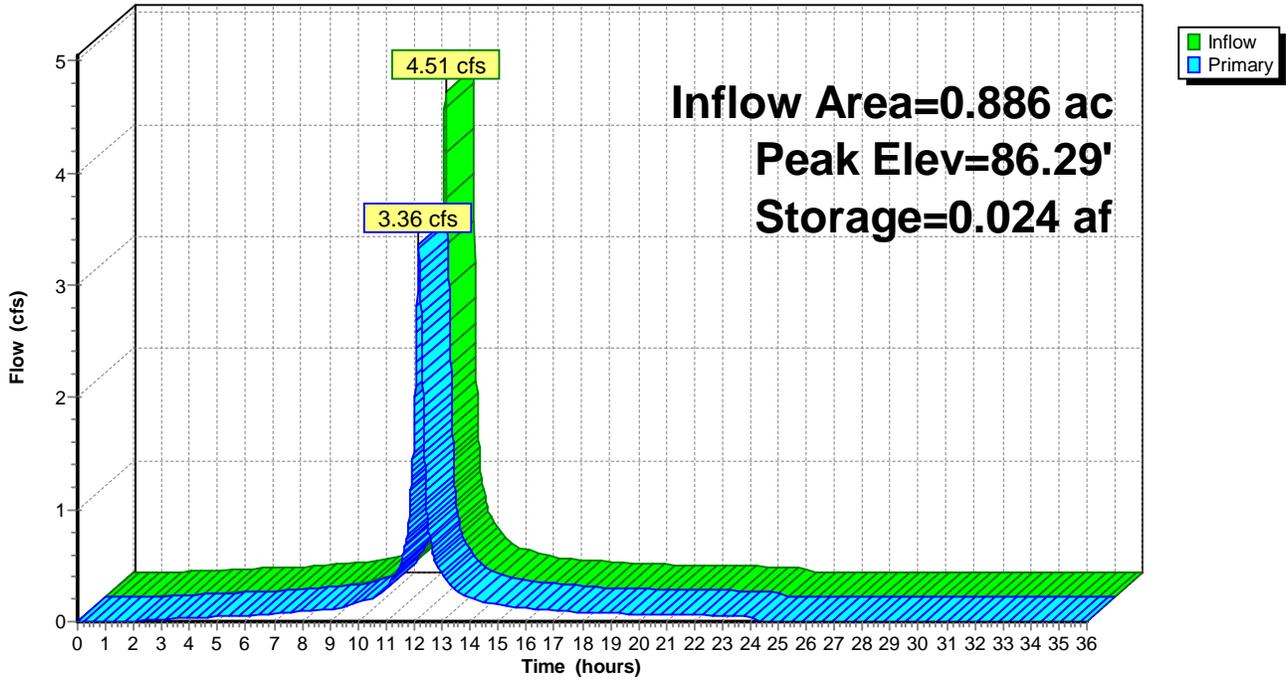
130.8 cy Field

101.3 cy Stone



Pond 2P: Underground Detention

Hydrograph



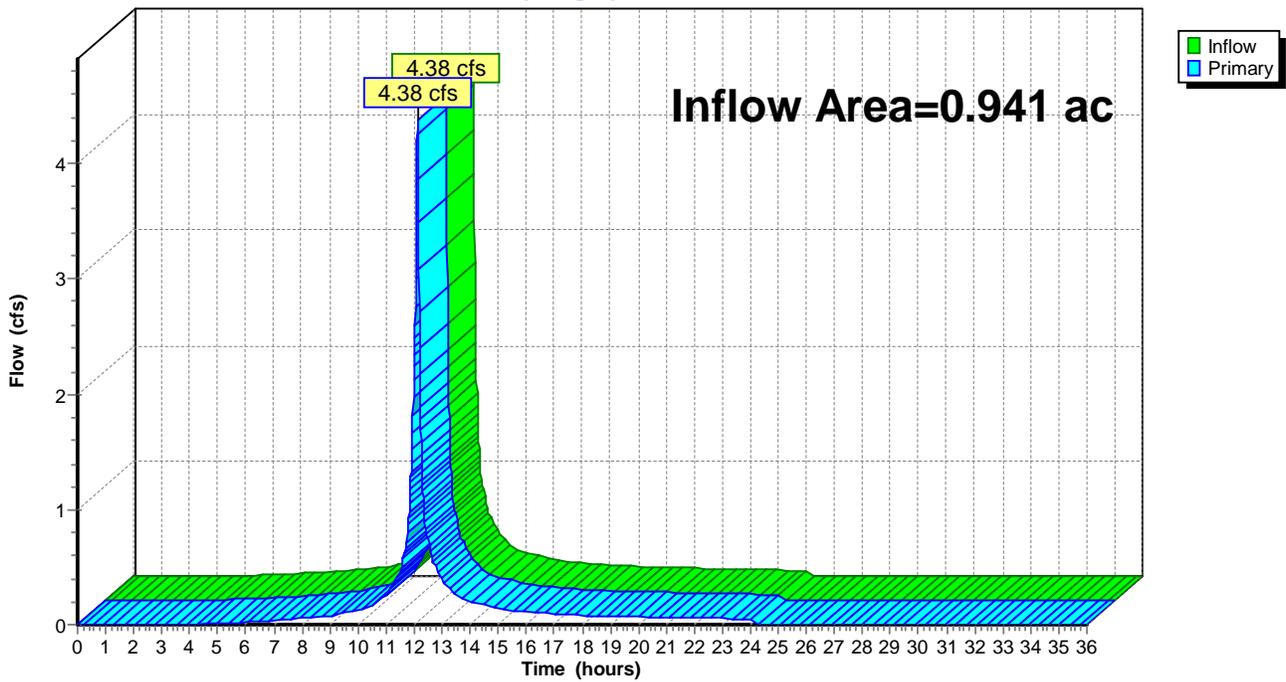
Summary for Link 1L: Existing

Inflow Area = 0.941 ac, 42.73% Impervious, Inflow Depth = 3.73" for 10-Year event
Inflow = 4.38 cfs @ 12.12 hrs, Volume= 0.293 af
Primary = 4.38 cfs @ 12.12 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Existing

Hydrograph



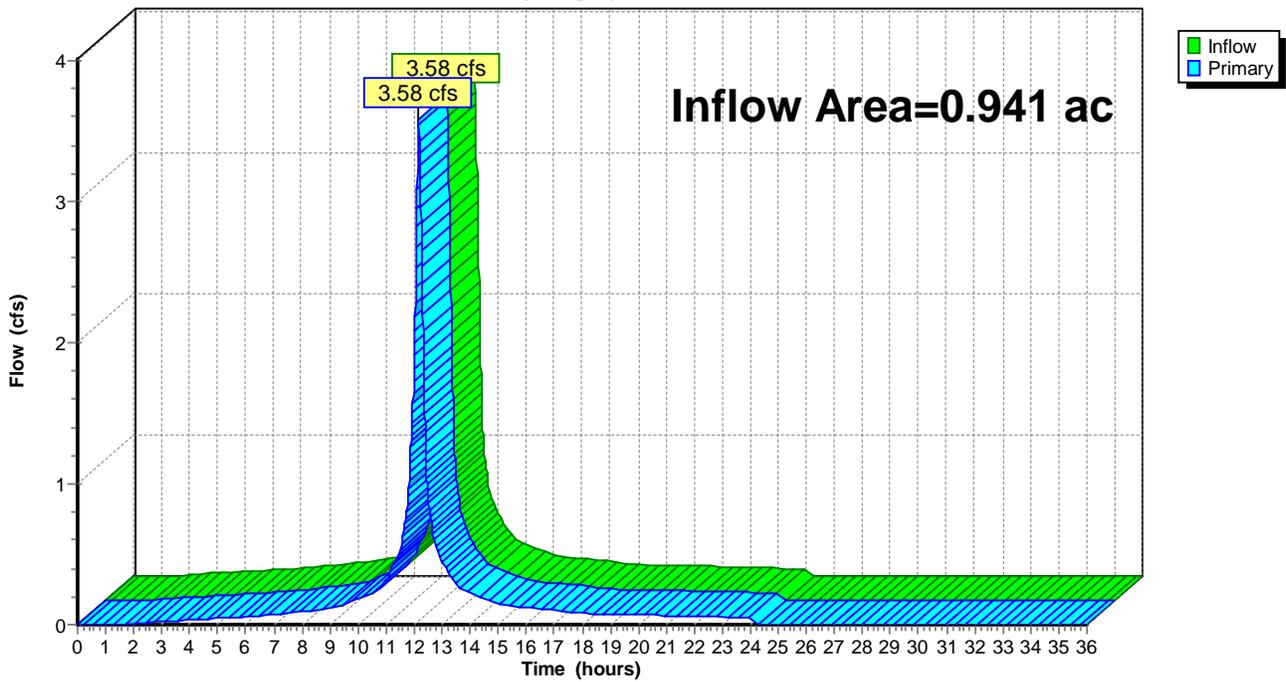
Summary for Link 2L: Proposed

Inflow Area = 0.941 ac, 85.72% Impervious, Inflow Depth = 4.40" for 10-Year event
Inflow = 3.58 cfs @ 12.16 hrs, Volume= 0.345 af
Primary = 3.58 cfs @ 12.16 hrs, Volume= 0.345 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Proposed

Hydrograph



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Summary for Subcatchment 1S: Existing

Runoff = 5.59 cfs @ 12.12 hrs, Volume= 0.379 af, Depth= 4.84"

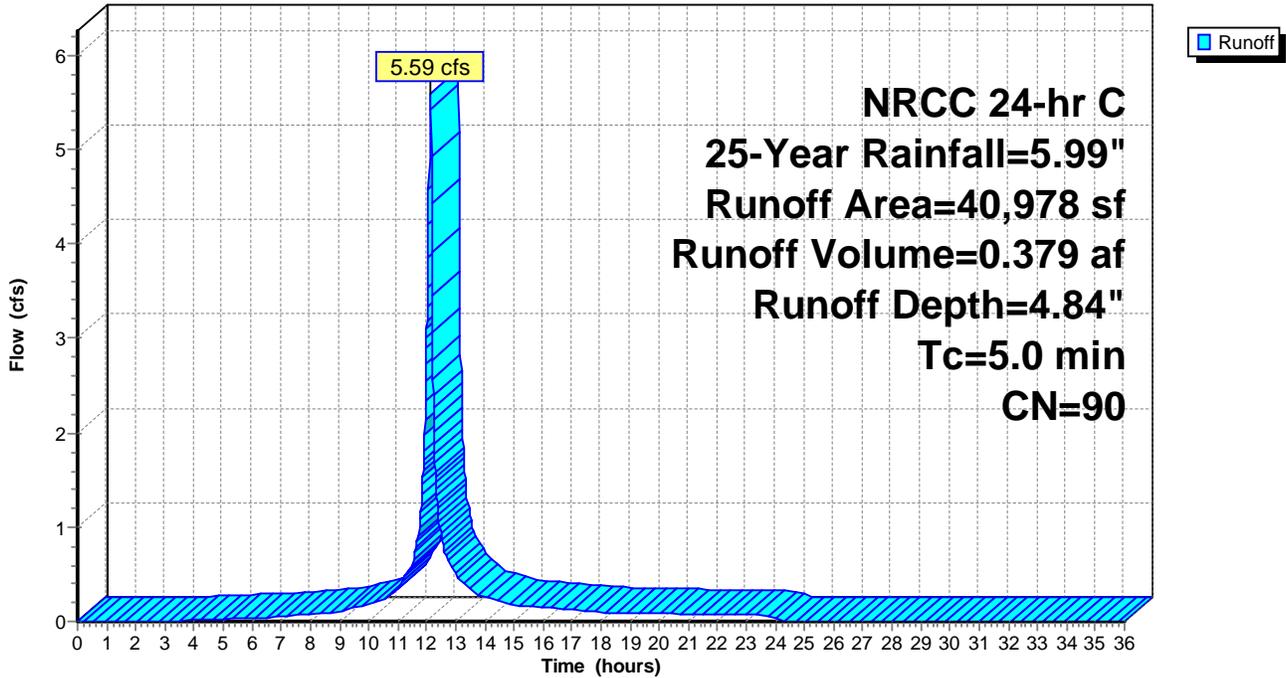
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 25-Year Rainfall=5.99"

Area (sf)	CN	Description
23,469	84	50-75% Grass cover, Fair, HSG D
17,509	98	Paved parking, HSG D
40,978	90	Weighted Average
23,469		57.27% Pervious Area
17,509		42.73% Impervious Area

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

Subcatchment 1S: Existing

Hydrograph



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Summary for Subcatchment 2S: Proposed

Runoff = 5.61 cfs @ 12.12 hrs, Volume= 0.407 af, Depth= 5.52"

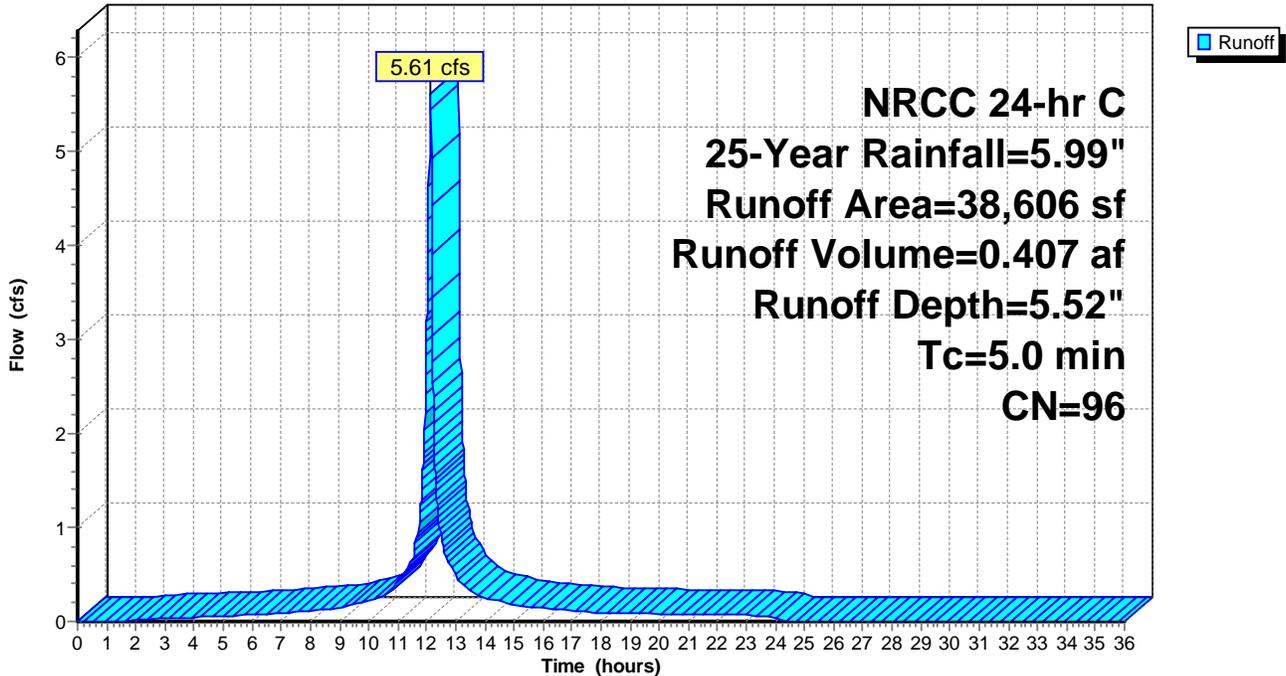
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 25-Year Rainfall=5.99"

Area (sf)	CN	Description
5,837	84	50-75% Grass cover, Fair, HSG D
32,769	98	Paved parking, HSG D
38,606	96	Weighted Average
5,837		15.12% Pervious Area
32,769		84.88% Impervious Area

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

Subcatchment 2S: Proposed

Hydrograph



Summary for Subcatchment 2SA: Proposed

Runoff = 0.35 cfs @ 12.12 hrs, Volume= 0.026 af, Depth= 5.75"

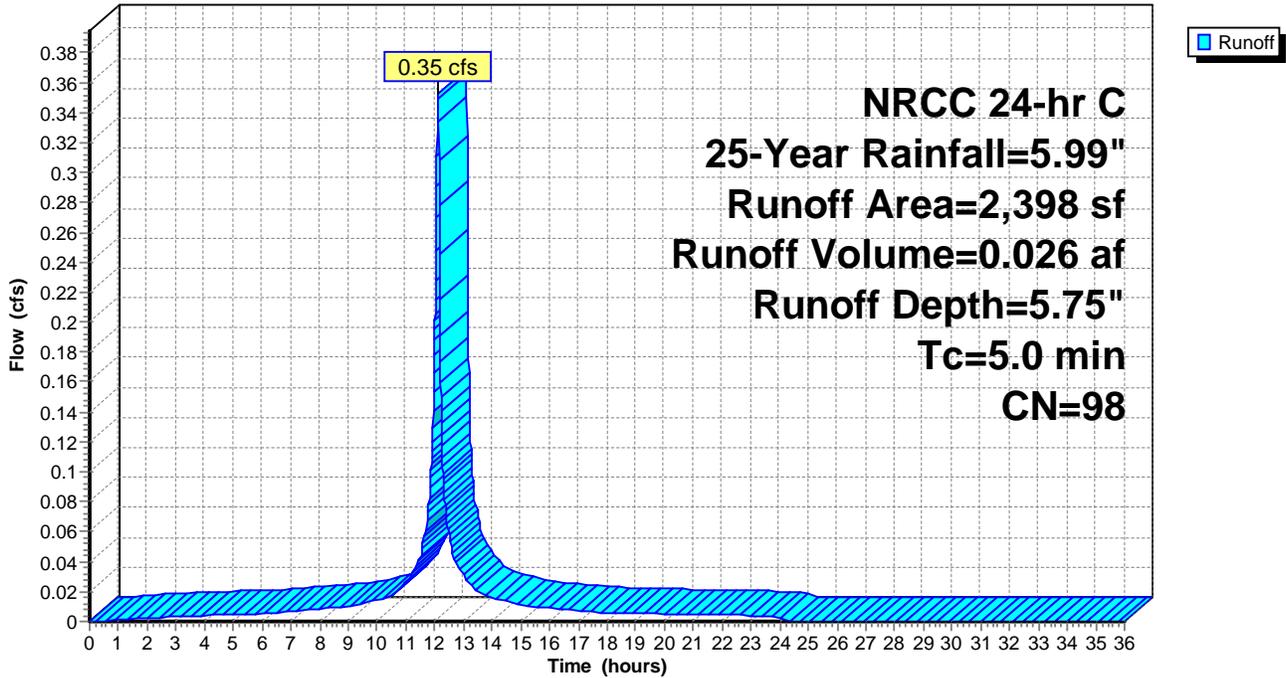
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 25-Year Rainfall=5.99"

Area (sf)	CN	Description
20	84	50-75% Grass cover, Fair, HSG D
2,378	98	Paved parking, HSG D
2,398	98	Weighted Average
20		0.83% Pervious Area
2,378		99.17% Impervious Area

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

Subcatchment 2SA: Proposed

Hydrograph



Summary for Pond 2P: Underground Detention

Inflow Area = 0.886 ac, 84.88% Impervious, Inflow Depth = 5.52" for 25-Year event
 Inflow = 5.61 cfs @ 12.12 hrs, Volume= 0.407 af
 Outflow = 4.07 cfs @ 12.17 hrs, Volume= 0.407 af, Atten= 27%, Lag= 2.8 min
 Primary = 4.07 cfs @ 12.17 hrs, Volume= 0.407 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 86.66' @ 12.17 hrs Surf.Area= 0.035 ac Storage= 0.032 af

Plug-Flow detention time= 5.0 min calculated for 0.407 af (100% of inflow)
 Center-of-Mass det. time= 5.0 min (764.5 - 759.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	85.10'	0.025 af	22.50'W x 67.28'L x 2.33'H Field A 0.081 af Overall - 0.018 af Embedded = 0.063 af x 40.0% Voids
#2A	85.60'	0.018 af	ADS_StormTech SC-310 +Cap x 54 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		0.043 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	18.0" Round Culvert L= 44.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 83.50' S= 0.0341 ' /' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	86.93'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 1	85.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=4.06 cfs @ 12.17 hrs HW=86.66' (Free Discharge)

- ↑ **1=Culvert** (Passes 4.06 cfs of 8.10 cfs potential flow)
- ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 4.06 cfs @ 5.18 fps)

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Watershed Analysis

NRCC 24-hr C 25-Year Rainfall=5.99"

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Pond 2P: Underground Detention - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 18.0" Side Stone x 2 = 22.50' Base Width

6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

54 Chambers x 14.7 cf = 796.1 cf Chamber Storage

3,532.2 cf Field - 796.1 cf Chambers = 2,736.1 cf Stone x 40.0% Voids = 1,094.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,890.5 cf = 0.043 af

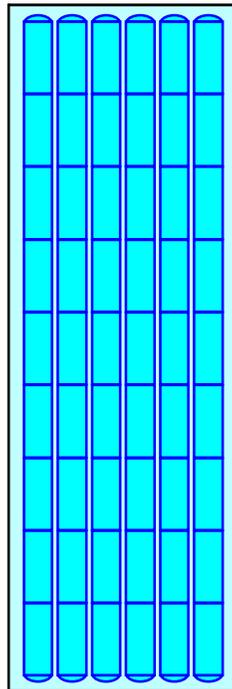
Overall Storage Efficiency = 53.5%

Overall System Size = 67.28' x 22.50' x 2.33'

54 Chambers

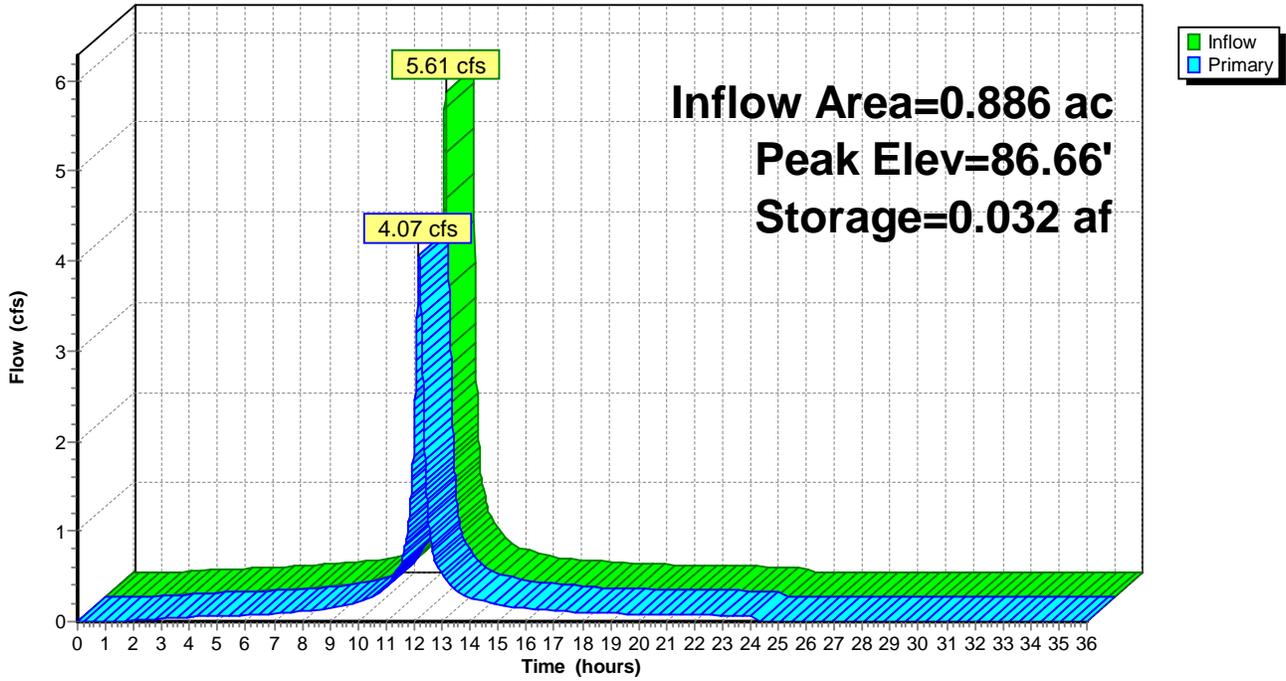
130.8 cy Field

101.3 cy Stone



Pond 2P: Underground Detention

Hydrograph



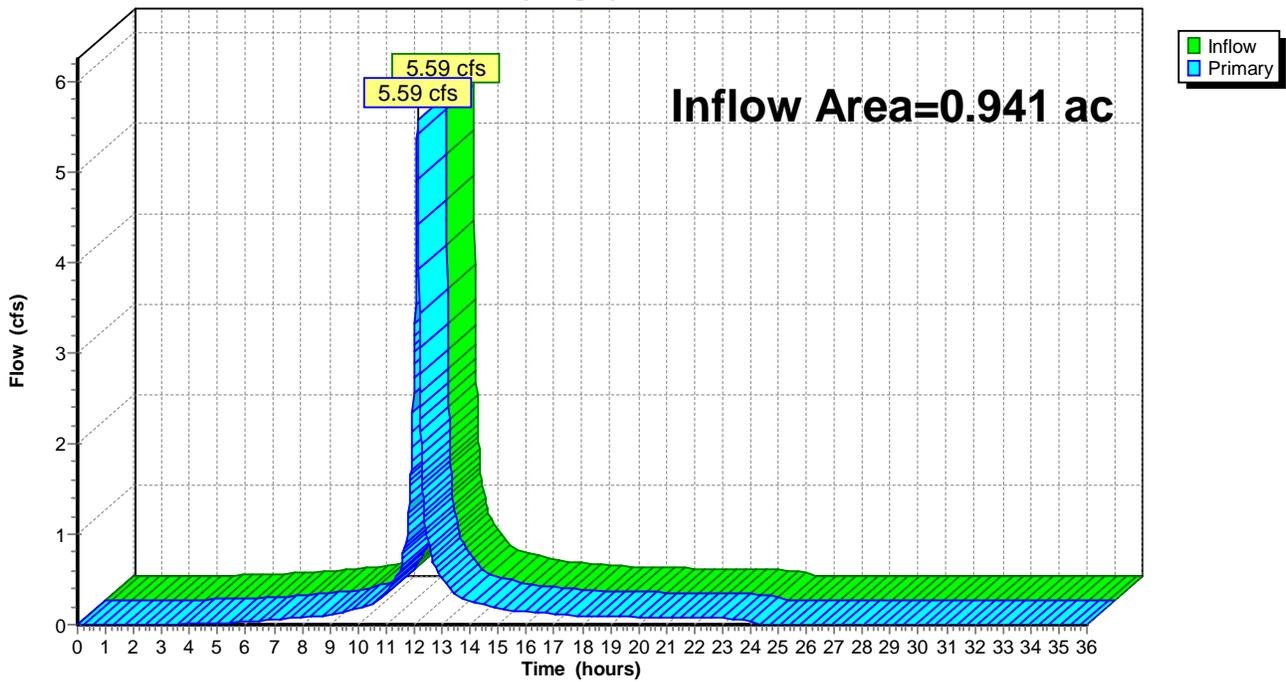
Summary for Link 1L: Existing

Inflow Area = 0.941 ac, 42.73% Impervious, Inflow Depth = 4.84" for 25-Year event
Inflow = 5.59 cfs @ 12.12 hrs, Volume= 0.379 af
Primary = 5.59 cfs @ 12.12 hrs, Volume= 0.379 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Existing

Hydrograph



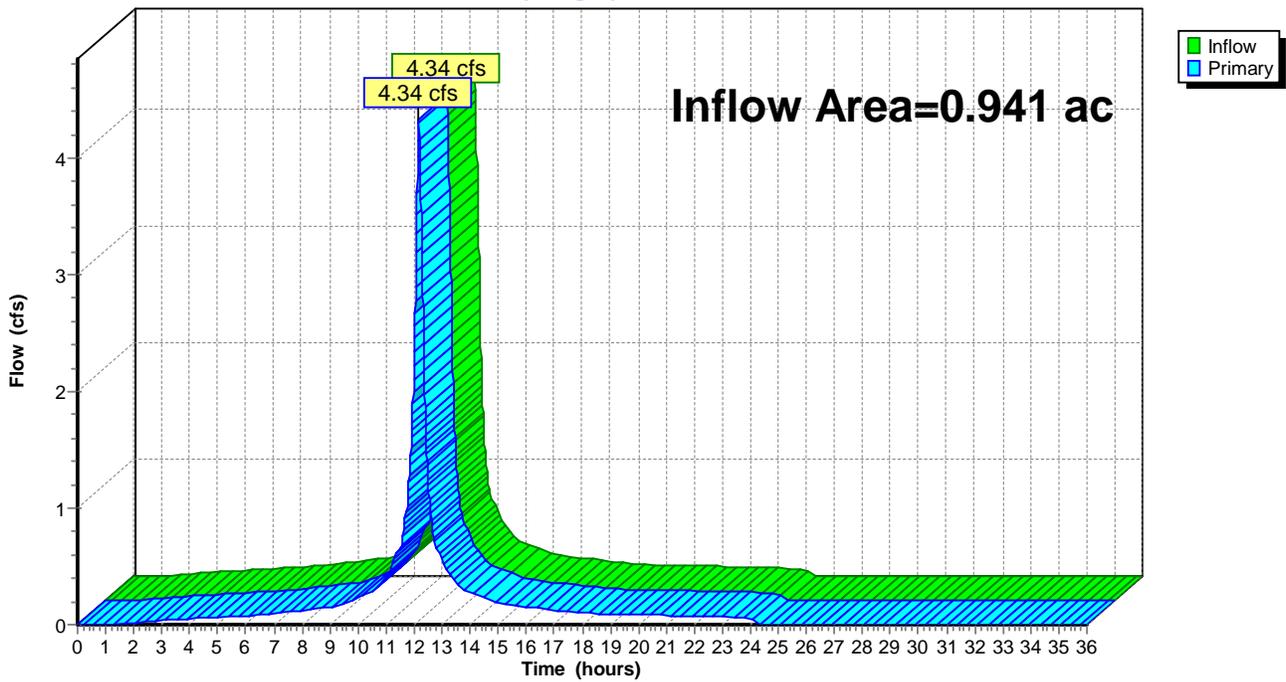
Summary for Link 2L: Proposed

Inflow Area = 0.941 ac, 85.72% Impervious, Inflow Depth = 5.53" for 25-Year event
Inflow = 4.34 cfs @ 12.16 hrs, Volume= 0.434 af
Primary = 4.34 cfs @ 12.16 hrs, Volume= 0.434 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Proposed

Hydrograph



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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=40,978 sf 42.73% Impervious Runoff Depth=7.05"
Tc=5.0 min CN=90 Runoff=7.95 cfs 0.553 af

Subcatchment 2S: Proposed Runoff Area=38,606 sf 84.88% Impervious Runoff Depth=7.77"
Tc=5.0 min CN=96 Runoff=7.78 cfs 0.574 af

Subcatchment 2SA: Proposed Runoff Area=2,398 sf 99.17% Impervious Runoff Depth=8.01"
Tc=5.0 min CN=98 Runoff=0.49 cfs 0.037 af

Pond 2P: Underground Detention Peak Elev=87.24' Storage=0.041 af Inflow=7.78 cfs 0.574 af
Outflow=7.42 cfs 0.574 af

Link 1L: Existing Inflow=7.95 cfs 0.553 af
Primary=7.95 cfs 0.553 af

Link 2L: Proposed Inflow=7.88 cfs 0.611 af
Primary=7.88 cfs 0.611 af

Total Runoff Area = 1.882 ac Runoff Volume = 1.163 af Average Runoff Depth = 7.42"
35.77% Pervious = 0.673 ac 64.23% Impervious = 1.209 ac

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Summary for Subcatchment 1S: Existing

Runoff = 7.95 cfs @ 12.12 hrs, Volume= 0.553 af, Depth= 7.05"

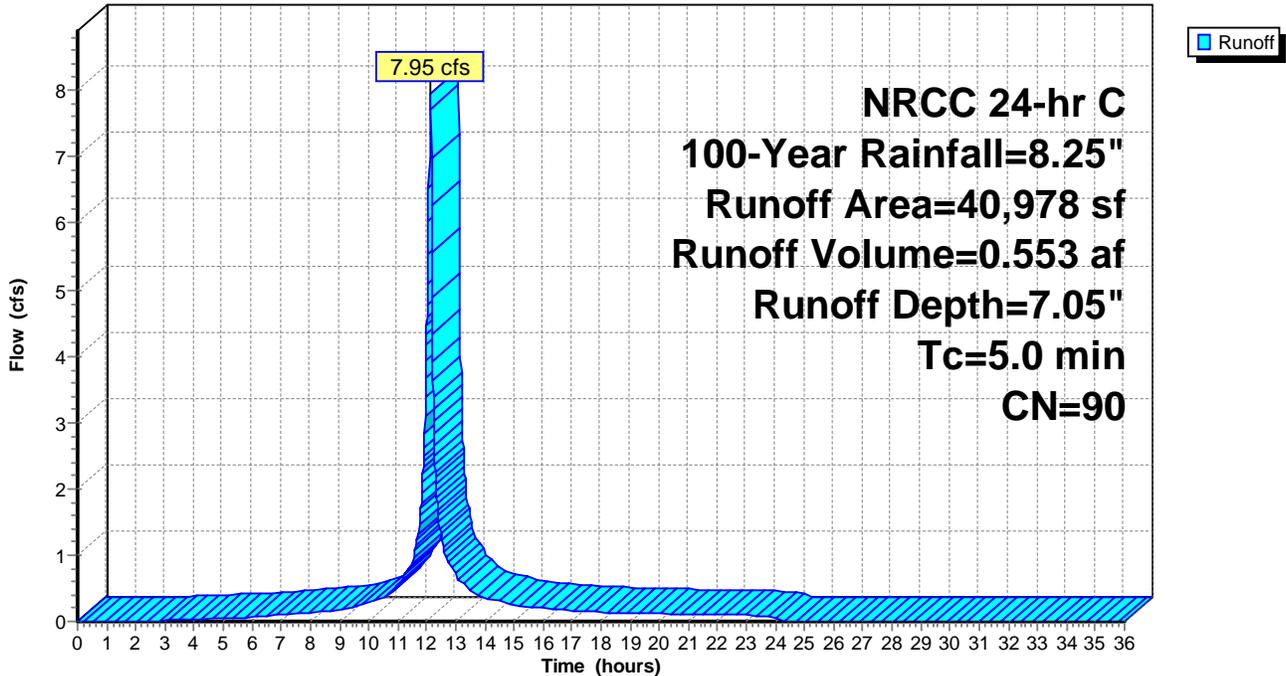
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.25"

Area (sf)	CN	Description
23,469	84	50-75% Grass cover, Fair, HSG D
17,509	98	Paved parking, HSG D
40,978	90	Weighted Average
23,469		57.27% Pervious Area
17,509		42.73% Impervious Area

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

Subcatchment 1S: Existing

Hydrograph



Summary for Subcatchment 2S: Proposed

Runoff = 7.78 cfs @ 12.12 hrs, Volume= 0.574 af, Depth= 7.77"

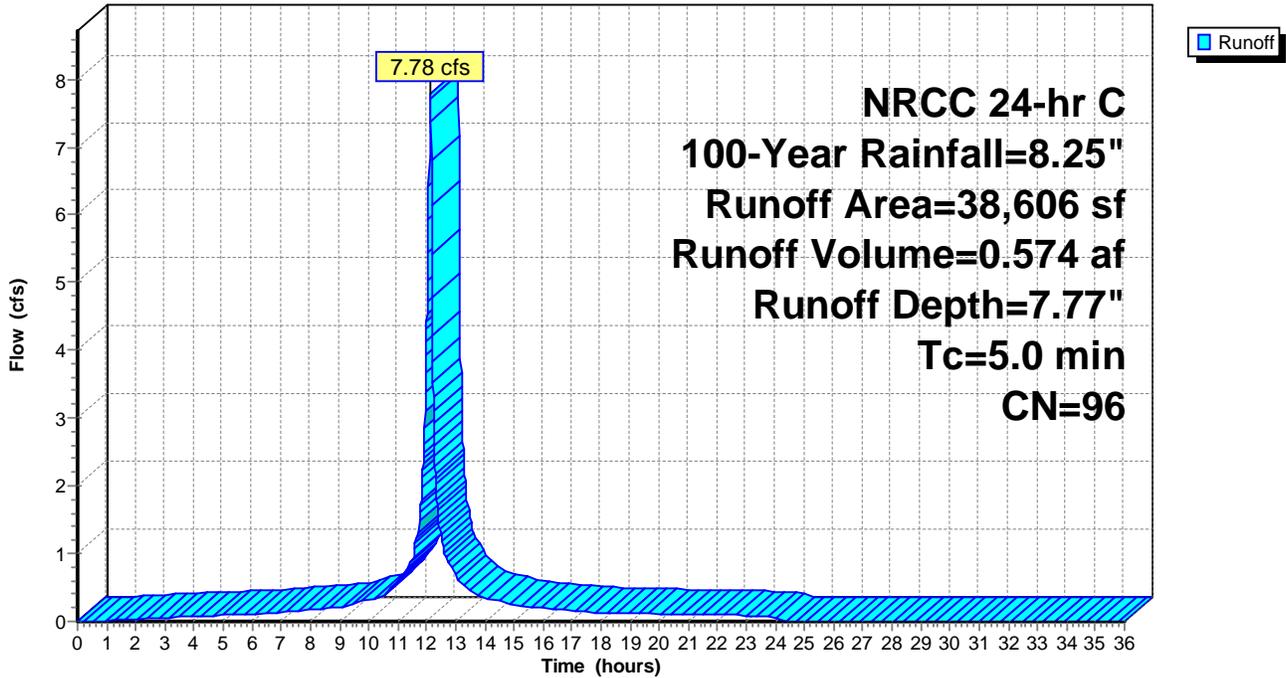
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 100-Year Rainfall=8.25"

Area (sf)	CN	Description
5,837	84	50-75% Grass cover, Fair, HSG D
32,769	98	Paved parking, HSG D
38,606	96	Weighted Average
5,837		15.12% Pervious Area
32,769		84.88% Impervious Area

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

Subcatchment 2S: Proposed

Hydrograph



Summary for Subcatchment 2SA: Proposed

Runoff = 0.49 cfs @ 12.12 hrs, Volume= 0.037 af, Depth= 8.01"

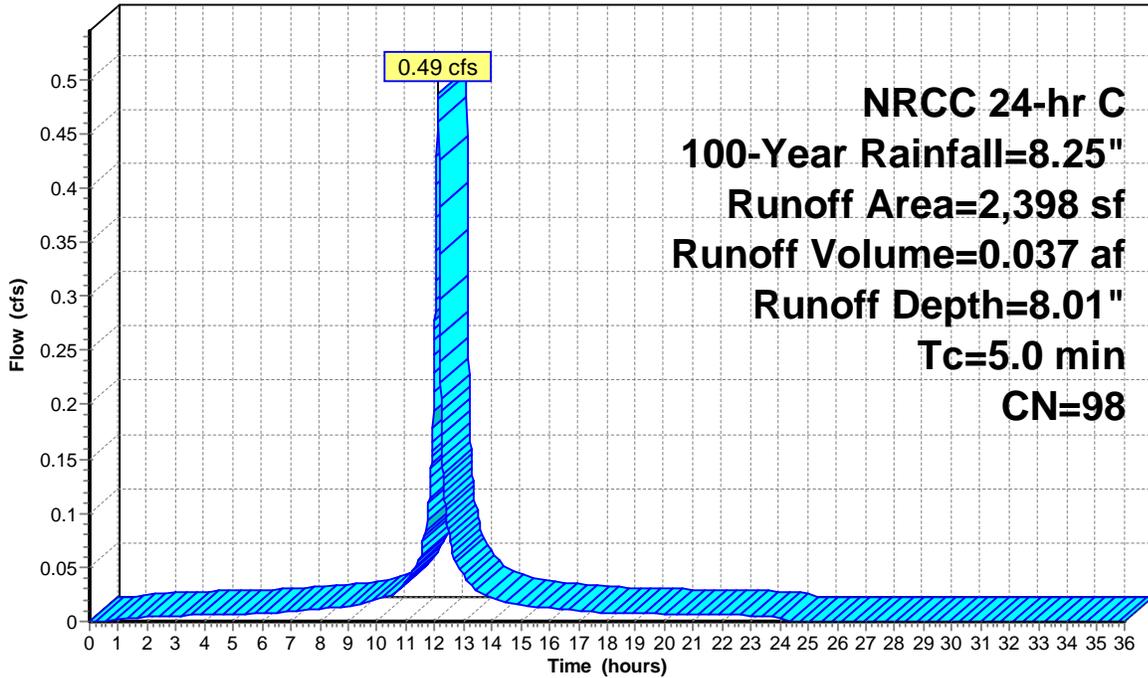
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NRCC 24-hr C 100-Year Rainfall=8.25"

Area (sf)	CN	Description
20	84	50-75% Grass cover, Fair, HSG D
2,378	98	Paved parking, HSG D
2,398	98	Weighted Average
20		0.83% Pervious Area
2,378		99.17% Impervious Area

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

Subcatchment 2SA: Proposed

Hydrograph



Runoff

**NRCC 24-hr C
 100-Year Rainfall=8.25"
 Runoff Area=2,398 sf
 Runoff Volume=0.037 af
 Runoff Depth=8.01"
 Tc=5.0 min
 CN=98**

Summary for Pond 2P: Underground Detention

Inflow Area = 0.886 ac, 84.88% Impervious, Inflow Depth = 7.77" for 100-Year event
 Inflow = 7.78 cfs @ 12.12 hrs, Volume= 0.574 af
 Outflow = 7.42 cfs @ 12.14 hrs, Volume= 0.574 af, Atten= 5%, Lag= 1.2 min
 Primary = 7.42 cfs @ 12.14 hrs, Volume= 0.574 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 87.24' @ 12.14 hrs Surf.Area= 0.035 ac Storage= 0.041 af

Plug-Flow detention time= 5.1 min calculated for 0.574 af (100% of inflow)
 Center-of-Mass det. time= 5.1 min (757.5 - 752.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	85.10'	0.025 af	22.50'W x 67.28'L x 2.33'H Field A 0.081 af Overall - 0.018 af Embedded = 0.063 af x 40.0% Voids
#2A	85.60'	0.018 af	ADS_StormTech SC-310 +Cap x 54 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		0.043 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	18.0" Round Culvert L= 44.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 83.50' S= 0.0341 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf
#2	Device 1	86.93'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 1	85.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=7.41 cfs @ 12.14 hrs HW=87.24' (Free Discharge)

- ↑ **1=Culvert** (Passes 7.41 cfs of 10.37 cfs potential flow)
- ↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 2.43 cfs @ 1.59 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 4.98 cfs @ 6.35 fps)

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Watershed Analysis

NRCC 24-hr C 100-Year Rainfall=8.25"

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Pond 2P: Underground Detention - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 18.0" Side Stone x 2 = 22.50' Base Width

6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

54 Chambers x 14.7 cf = 796.1 cf Chamber Storage

3,532.2 cf Field - 796.1 cf Chambers = 2,736.1 cf Stone x 40.0% Voids = 1,094.5 cf Stone Storage

Chamber Storage + Stone Storage = 1,890.5 cf = 0.043 af

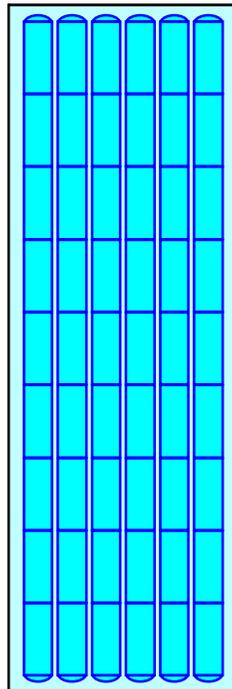
Overall Storage Efficiency = 53.5%

Overall System Size = 67.28' x 22.50' x 2.33'

54 Chambers

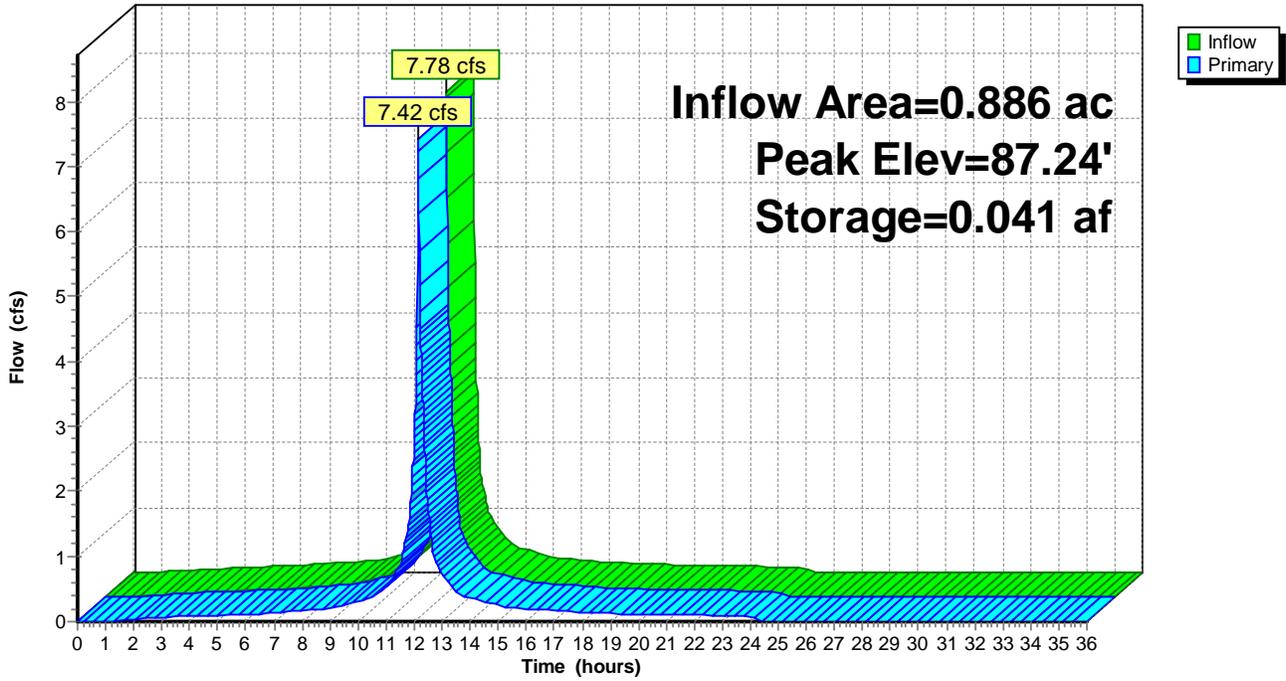
130.8 cy Field

101.3 cy Stone



Pond 2P: Underground Detention

Hydrograph



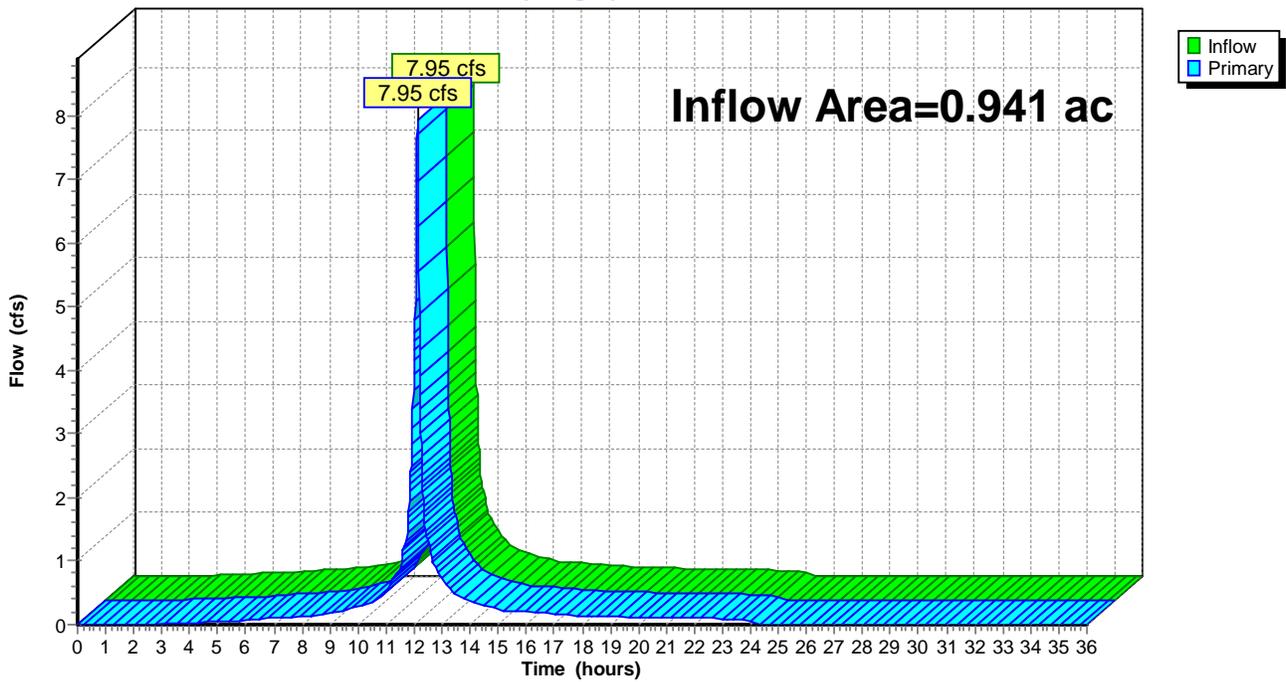
Summary for Link 1L: Existing

Inflow Area = 0.941 ac, 42.73% Impervious, Inflow Depth = 7.05" for 100-Year event
Inflow = 7.95 cfs @ 12.12 hrs, Volume= 0.553 af
Primary = 7.95 cfs @ 12.12 hrs, Volume= 0.553 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Existing

Hydrograph



Summary for Link 2L: Proposed

Inflow Area = 0.941 ac, 85.72% Impervious, Inflow Depth = 7.78" for 100-Year event
Inflow = 7.88 cfs @ 12.14 hrs, Volume= 0.611 af
Primary = 7.88 cfs @ 12.14 hrs, Volume= 0.611 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Proposed

Hydrograph

