MEGSON, HEAGLE & FRIEND

CIVIL ENGINEERS & LAND SURVEYORS, LLC
81 RANKIN ROAD
GLASTONBURY, CONNECTICUT 06033
PHONE (860) 659-0587
FAX (860) 657-4429

HYDROLOGY AND HYDRAULICS ENGINEERING REPORT

CENTRAL ROCK GYM

259 & 233 EASTERN BOULEVARD, GLASTONBURY, CT

MAY, 2020

Prepared By:

Mark W. Friend, PE
Soil Scientist, LEED AP

TABLE OF CONTENTS

I.	**INTRODUCTION**	
	Summary	**1**
	Methodology	**1**
	Conclusions	**2**
II.	**STORMWATER RUNOFF**	
	Pre -Development Runoff	**3**
	Post Development Runoff	**3**
	Increases Due to Development	**3**
	Inflow to SWMB	**3**
III.	**STORMWATER DETENTION**	
	Allowable flows from SWMB	**3**
	Proposed flows from SWMB	**3**
IV.	**REQUIRED WATER QUALITY VOLUME**	**4**

APPENDICES

APPENDIX A – HydroCAD Report

APPENDIX B - SWMB Volumes

APPENDIX C - Drainage Area Maps

I. INTRODUCTION

Summary:

In general, the project is a proposed 55 space parking lot on #233 Eastern Boulevard intended to expand the existing parking lot on #259 Eastern Boulevard. It is proposed to be drained via sheet flow to the north and into a stormwater management basin (SWMB). This basin will treat the water quality volume and dissipate the water into a coarse aggregate layer of bedding material. Increases in peak flows from the 2 to 100 years storms will also be mitigated. The basin will be drained by an underdrain system and discharged to the adjacent wetland.

Methodology:

The stormwater models for mitigation of peak runoffs were developed using the SCS TR-20 method in HydroCad drainage software. NRCC 24-hr curves were loaded into the program for use in the calculations. These curves were taken from the latest data available from the Precipitation Frequency Data Server which are based on NOAA Atlas 14. Runoff hydrographs were generated for the pre and post developed conditions. These hydrographs compute the peak flows as well as the total runoff volumes.

The proposed SWMB was modeled to demonstrate the discharge from the pond. The various hydrographs are included in the appendix. The results demonstrate peak flows will be detained for the 2, 10, 25, 50 and 100 year return frequency storms.

Water Quality Volume was computed using the equations in the 2004 Connecticut Stormwater Quality Manual. The calculation is included below.

Conclusions:

- The Curve Number (CN) increased from 69 to 71 from pre to post construction conditions.
- The time of concentration is 3.0 minutes for both pre and post conditions.
- No adverse impacts from development will be created for downstream areas. All pre development drainage patterns will be maintained. Peak flows will be detained to mitigate any impacts for the 2, 10, 25, 50 and 100 year return frequency storm.
- The SWMB will reduce peak flows below pre construction conditions for all storms from 1 year to 100 year frequency.
- The Water Quality Volumes from the project will be collected and infiltrated within the SWMB proposed.
- The proposed Stormwater Management Plan exceeds the goals of the 2004 Connecticut Stormwater Quality Manual.

II. STORMWATER RUNOFF

The following calculations illustrate the amount of peak runoffs generated from the site for both pre-development and post-development conditions. These calculations were generated using the SCS TR-20 and the hydrographs created using HydroCad Hydrographs.

Supporting Calculations:

Pre- Development peak runoff to PT "A"
$Q_2 = 1.53$ cfs
$Q_{10} = 4.28$ cfs
$Q_{25} = 6.22$ cfs
$Q_{50} = 7.79$ cfs
$Q_{100} = 9.40$ cfs

Post-Development peak runoff to PT "A"
$Q_2 = 1.78$ cfs
$Q_{10} = 4.64$ cfs
$Q_{25} = 6.63$ cfs
$Q_{50} = 8.23$ cfs
$Q_{100} = 9.86$ cfs

Increases due to development
$Q_2 = 1.78 - 1.53 = 0.25$ cfs
$Q_{10} = 4.64 - 4.28 = 0.36$ cfs
$Q_{25} = 6.63 - 6.22 = 0.41$ cfs
$Q_{50} = 8.23 - 7.79 = 0.44$ cfs
$Q_{100} = 9.86 - 9.40 = 0.46$ cfs

Inflow to SWMB
$Q_2 = 1.47$ cfs
$Q_{10} = 3.18$ cfs
$Q_{25} = 4.31$ cfs
$Q_{50} = 5.21$ cfs
$Q_{100} = 6.10$ cfs

III. STORMWATER DETENTION

Allowable Discharge from SWMB
$Q_2 = 1.47 - 0.25 = 1.22$ cfs
$Q_{10} = 3.18 - 0.36 = 2.82$ cfs
$Q_{25} = 4.31 - 0.41 = 3.90$ cfs
$Q_{50} = 5.21 - 0.44 = 4.77$ cfs
$Q_{100} = 6.10 - 0.46 = 5.64$ cfs

Proposed flows from Proposed SWMB:
2 yr Storm: 0.65 < 1.22 cfs
10 yr Storm: 0.85 < 2.82 cfs
25 yr Storm: 1.00 < 3.90 cfs
50 yr Storm: 1.13 cfs < 4.77 cfs
100 yr Storm: 1.25 < 5.64 cfs

*All post development release rates are less than the allowable release rates.

IV. REQUIRED WATER QUALITY VOLUME

$WQV = \frac{(1")(R)(A)}{12}$ Where

$R = 0.05 + 0.009(I)$ $0.05 + 0.009(55) = 0.545$

$I = \%\ \text{Impervious} = \frac{38{,}333\ \text{S.F.}}{70{,}132\ \text{S.F.}} = 55\%$

A = area of the catchment = 1.61

$WQV = \frac{(1")(0.545)(1.61)}{12} = 0.073$ AC-FT = **3,185 CF**

WQV provided – 3,828 CF > 3,185 CF

APPENDIX A
HYDROCAD REPORT

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	NRCC 24-hr	C	Default	24.00	1	3.07	2
2	10-yr	NRCC 24-hr	C	Default	24.00	1	4.87	2
3	25-yr	NRCC 24-hr	C	Default	24.00	1	5.99	2
4	50-yr	NRCC 24-hr	C	Default	24.00	1	6.86	2
5	100-yr	NRCC 24-hr	C	Default	24.00	1	7.73	2

Summary for Subcatchment 1S: Pre Development Runoff to Pt "A"

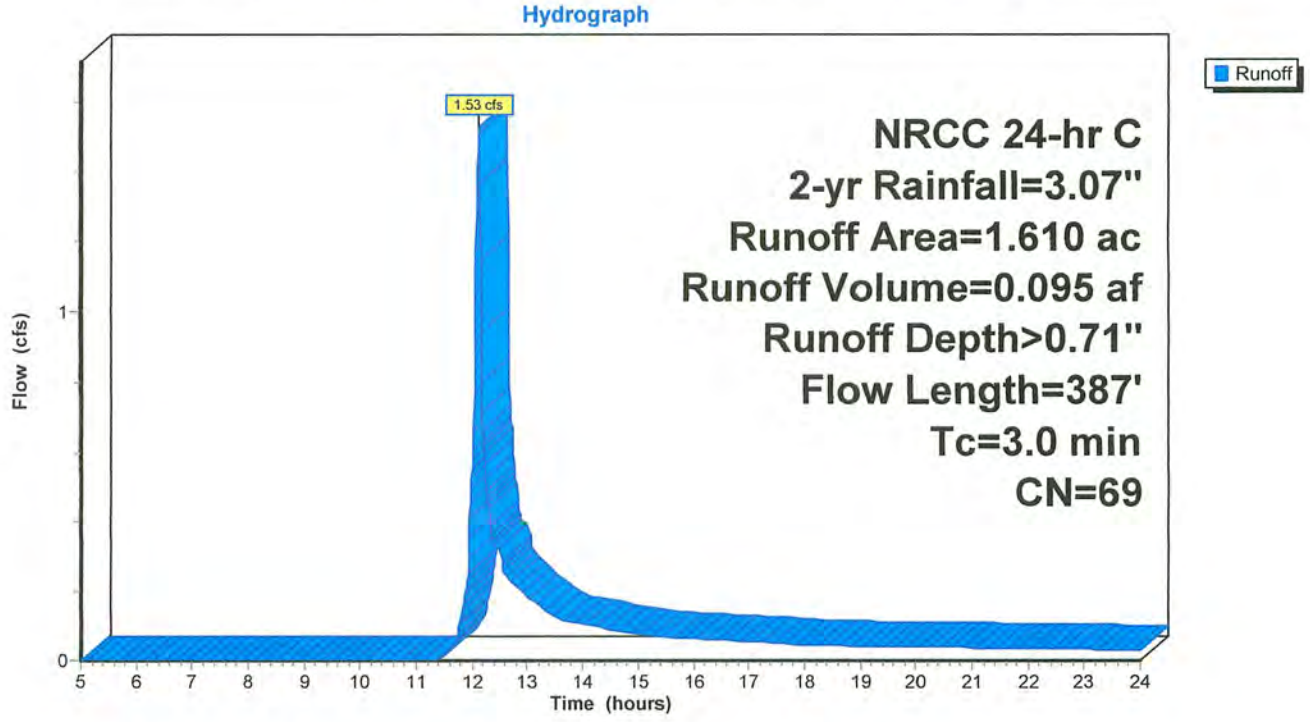
Runoff = 1.53 cfs @ 12.11 hrs, Volume= 0.095 af, Depth> 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-yr Rainfall=3.07"

Area (ac)	CN	Description
0.730	68	<50% Grass cover, Poor, HSG A
0.480	48	Brush, Poor, HSG A
0.400	98	Paved parking, HSG A
1.610	69	Weighted Average
1.210		75.16% Pervious Area
0.400		24.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 1S: Pre Development Runoff to Pt "A"



Summary for Subcatchment 2S: Post Development Runoff to Pt "A"

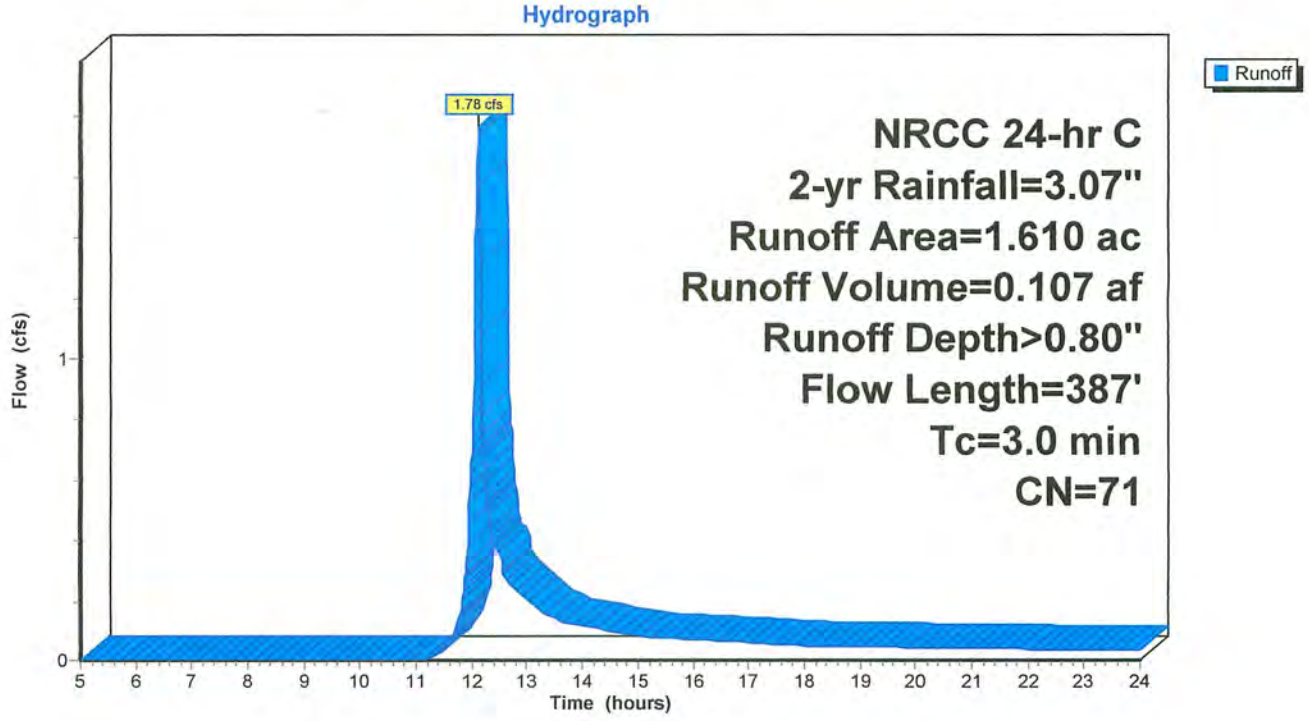
Runoff = 1.78 cfs @ 12.11 hrs, Volume= 0.107 af, Depth> 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-yr Rainfall=3.07"

Area (ac)	CN	Description
0.880	98	Paved parking, HSG A
0.730	39	>75% Grass cover, Good, HSG A
1.610	71	Weighted Average
0.730		45.34% Pervious Area
0.880		54.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 2S: Post Development Runoff to Pt "A"



Summary for Subcatchment 3S: Post Development Runoff to SWMB

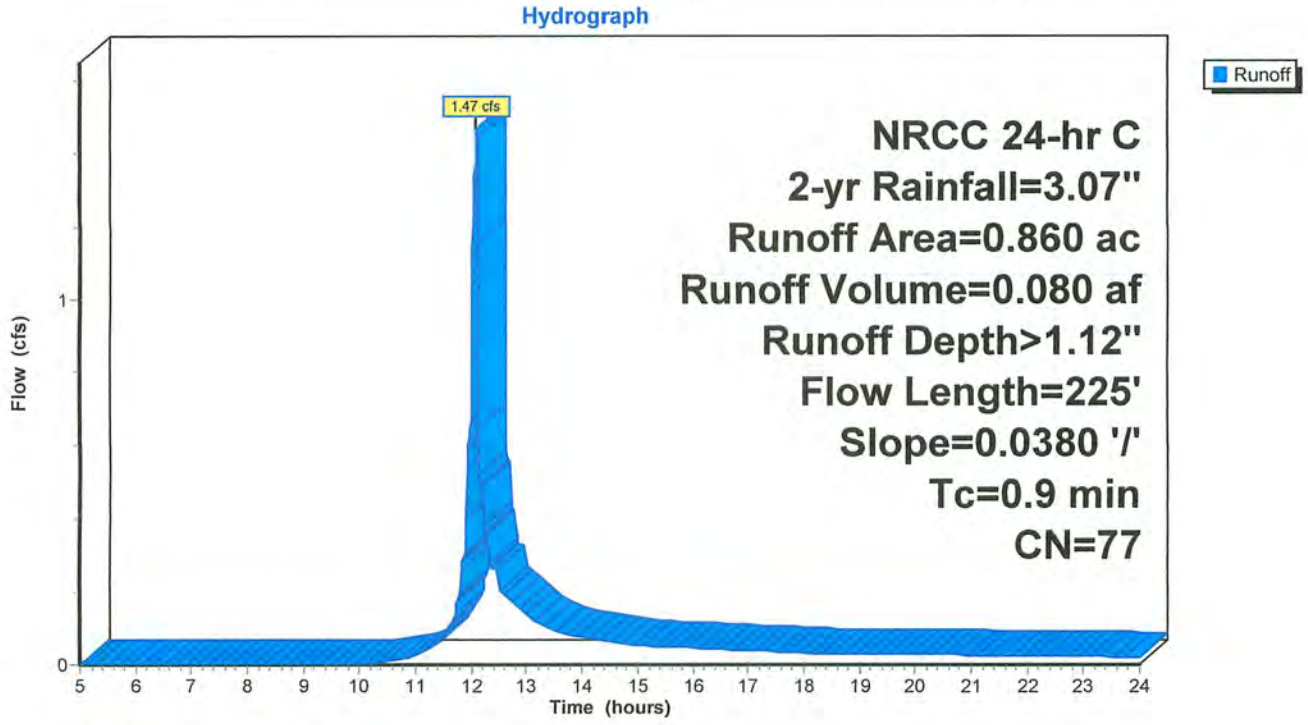
Runoff = 1.47 cfs @ 12.10 hrs, Volume= 0.080 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-yr Rainfall=3.07"

Area (ac)	CN	Description
0.560	98	Paved parking, HSG A
0.300	39	>75% Grass cover, Good, HSG A
0.860	77	Weighted Average
0.300		34.88% Pervious Area
0.560		65.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 3S: Post Development Runoff to SWMB



Summary for Pond 4P: SWMB

Inflow Area = 0.860 ac, 65.12% Impervious, Inflow Depth > 1.12" for 2-yr event
Inflow = 1.47 cfs @ 12.10 hrs, Volume= 0.080 af
Outflow = 0.65 cfs @ 12.12 hrs, Volume= 0.080 af, Atten= 56%, Lag= 1.6 min
Primary = 0.65 cfs @ 12.12 hrs, Volume= 0.080 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 114.19' @ 12.12 hrs Surf.Area= 1,578 sf Storage= 298 cf

Plug-Flow detention time= 1.9 min calculated for 0.080 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (864.0 - 862.2)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	3,824 cf	**Custom Stage Data (Irregular)** Listed below

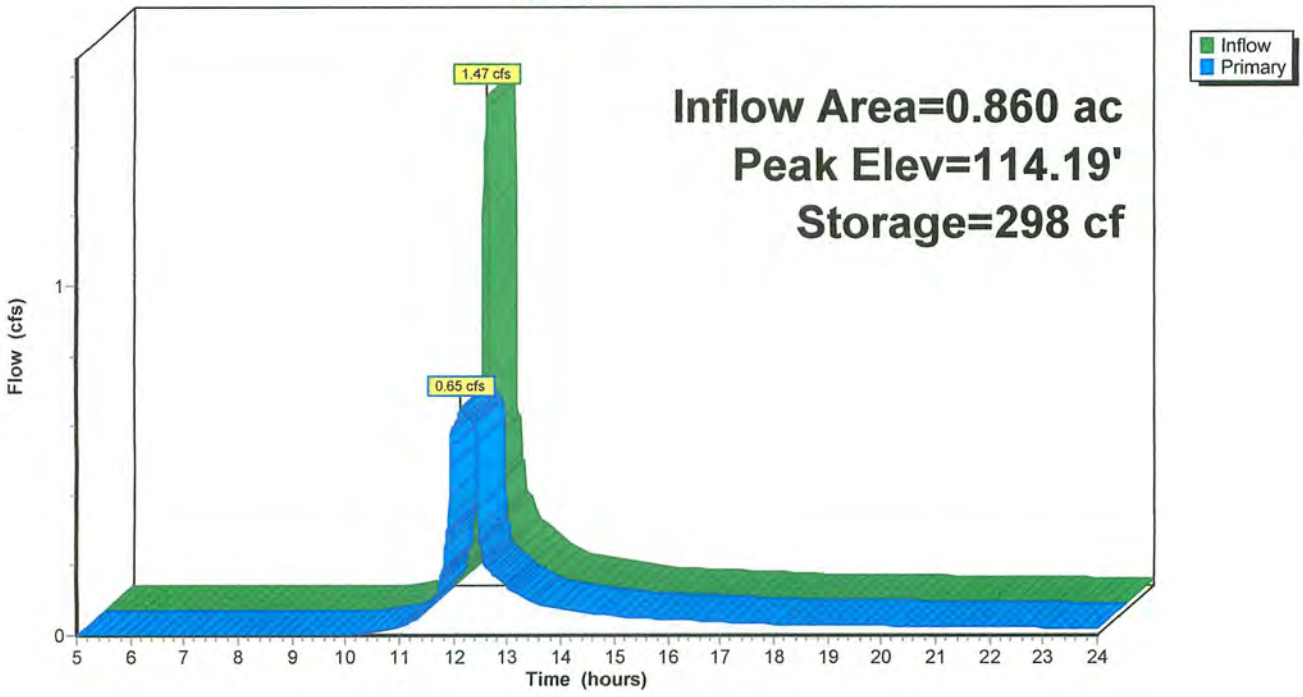
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	1,500	155.0	0	0	1,500
114.50	1,710	164.0	802	802	1,742
115.00	1,910	173.0	905	1,706	1,998
115.50	2,120	182.0	1,007	2,714	2,267
116.00	2,325	190.0	1,111	3,824	2,521

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**17.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 110.00' Phase-In= 0.02'

Primary OutFlow Max=0.65 cfs @ 12.12 hrs HW=114.19' (Free Discharge)
↑**1=Exfiltration** (Controls 0.65 cfs)

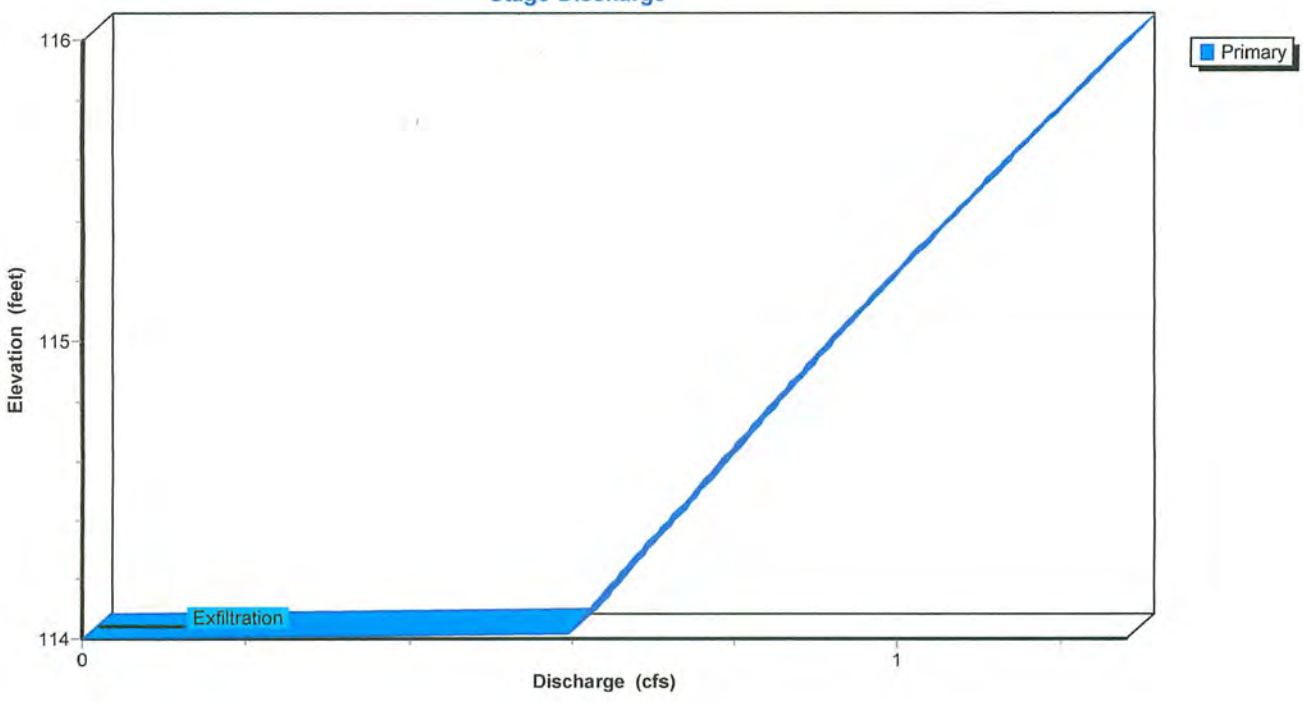
Pond 4P: SWMB

Hydrograph

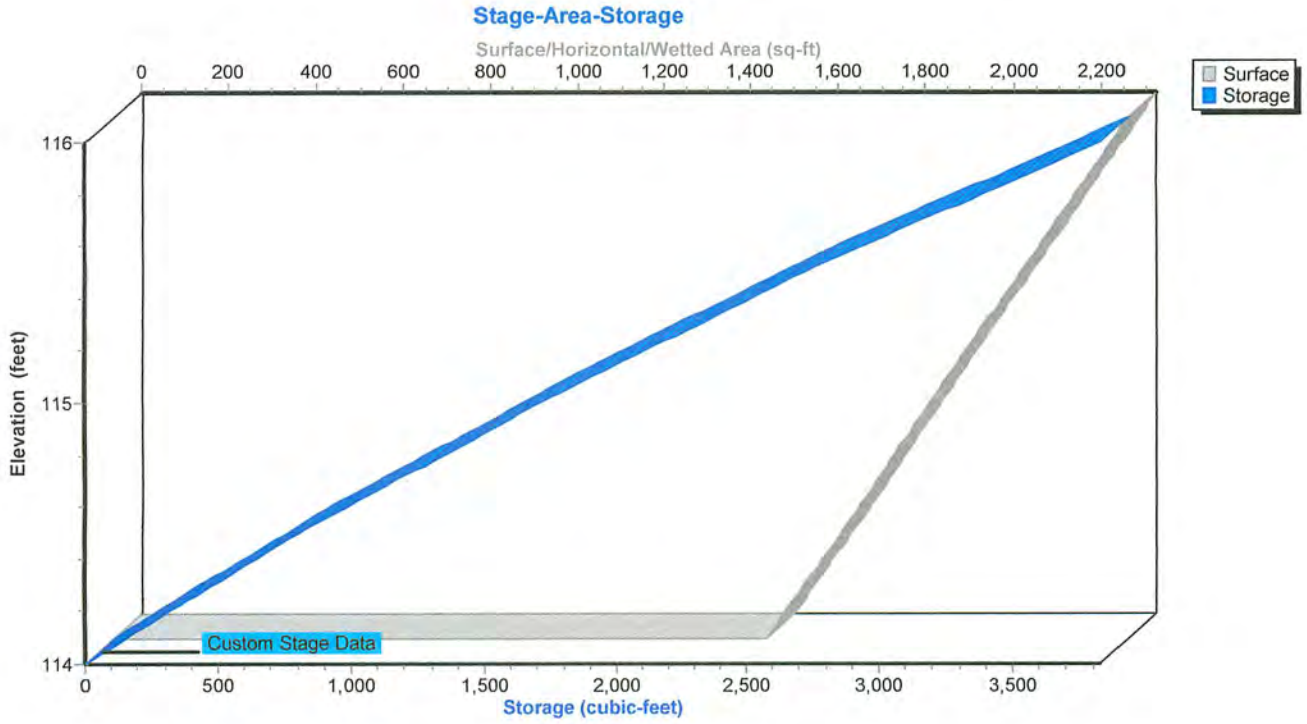


Pond 4P: SWMB

Stage-Discharge



Pond 4P: SWMB


Stage-Area-Storage
Surface/Horizontal/Wetted Area (sq-ft)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
Surface
Storage
116
115
114
Elevation (feet)
Custom Stage Data
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Storage (cubic-feet)

Summary for Subcatchment 1S: Pre Development Runoff to Pt "A"

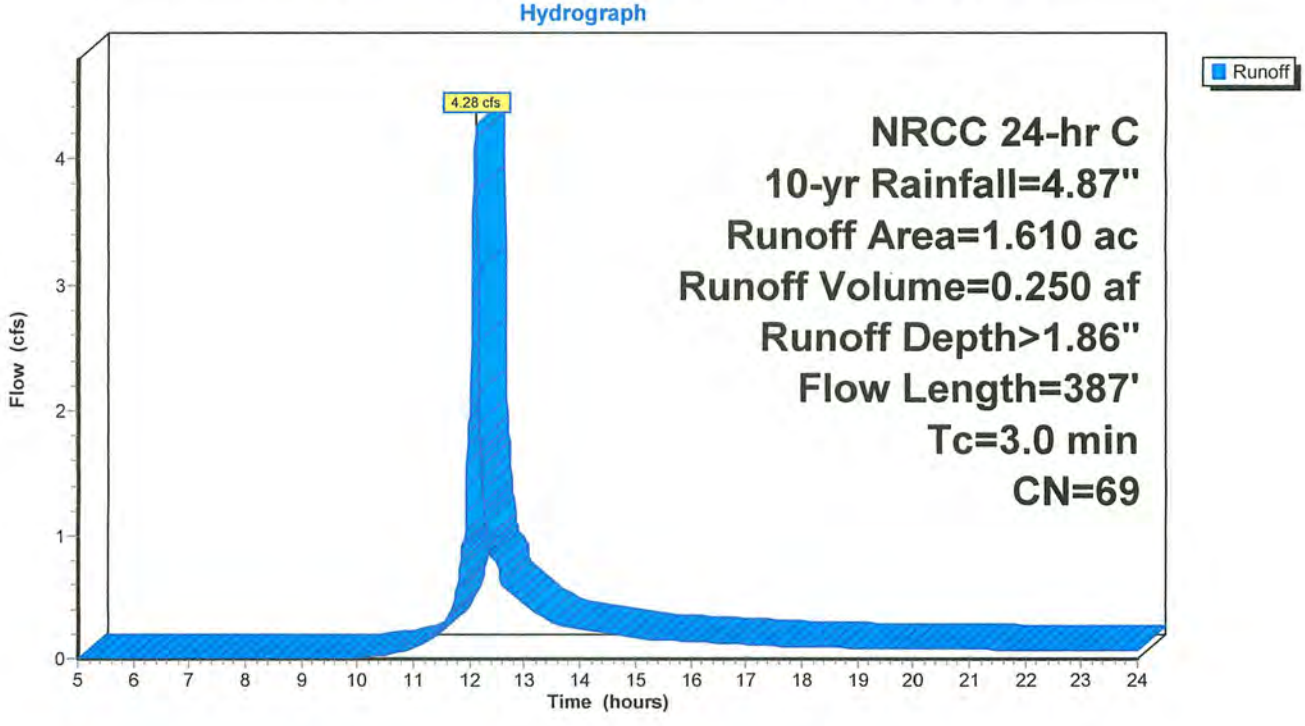
Runoff = 4.28 cfs @ 12.11 hrs, Volume= 0.250 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-yr Rainfall=4.87"

Area (ac)	CN	Description
0.730	68	<50% Grass cover, Poor, HSG A
0.480	48	Brush, Poor, HSG A
0.400	98	Paved parking, HSG A
1.610	69	Weighted Average
1.210		75.16% Pervious Area
0.400		24.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 1S: Pre Development Runoff to Pt "A"



Summary for Subcatchment 2S: Post Development Runoff to Pt "A"

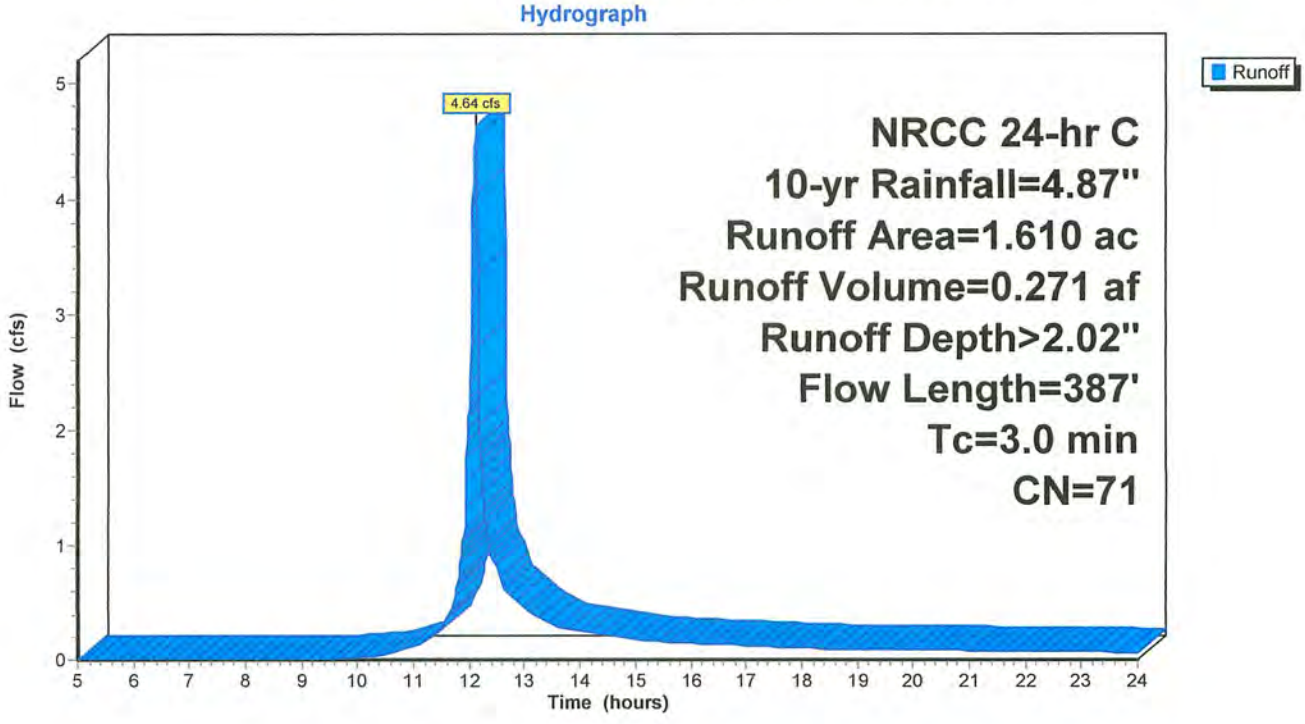
Runoff = 4.64 cfs @ 12.11 hrs, Volume= 0.271 af, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-yr Rainfall=4.87"

Area (ac)	CN	Description
0.880	98	Paved parking, HSG A
0.730	39	>75% Grass cover, Good, HSG A
1.610	71	Weighted Average
0.730		45.34% Pervious Area
0.880		54.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 2S: Post Development Runoff to Pt "A"



Summary for Subcatchment 3S: Post Development Runoff to SWMB

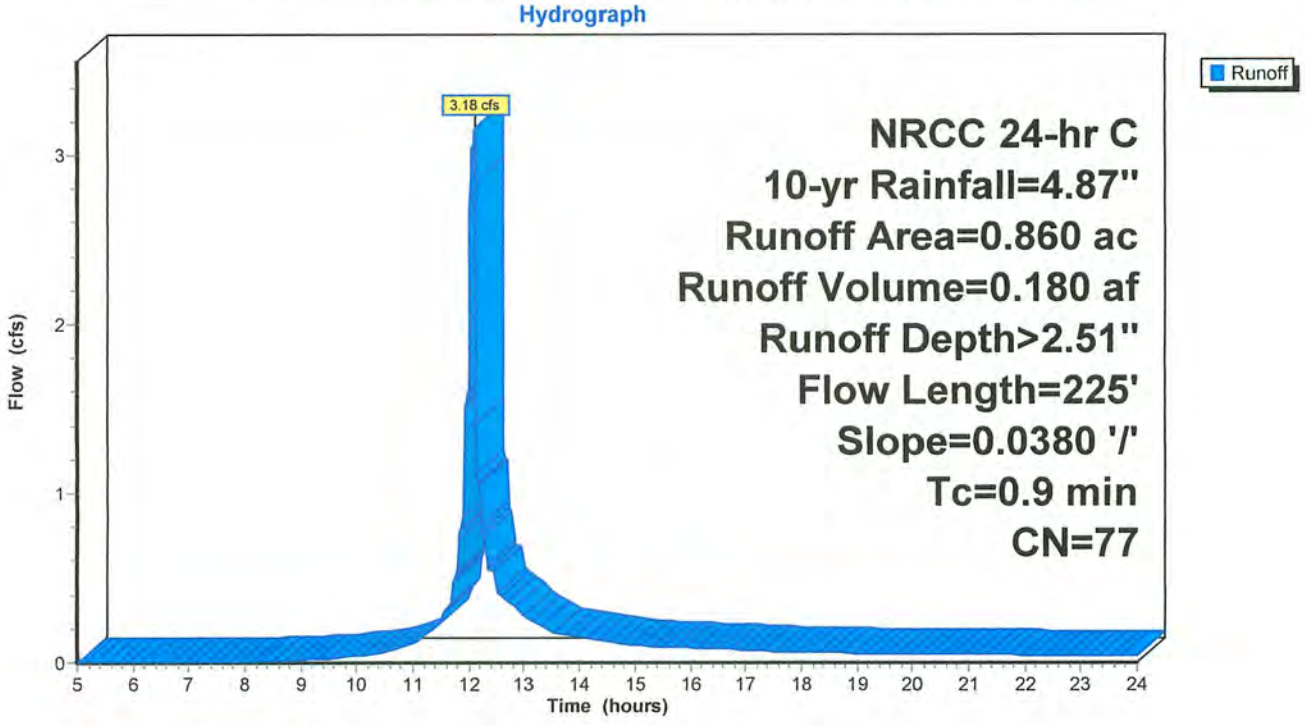
Runoff = 3.18 cfs @ 12.10 hrs, Volume= 0.180 af, Depth> 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-yr Rainfall=4.87"

Area (ac)	CN	Description
0.560	98	Paved parking, HSG A
0.300	39	>75% Grass cover, Good, HSG A
0.860	77	Weighted Average
0.300		34.88% Pervious Area
0.560		65.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 3S: Post Development Runoff to SWMB



Summary for Pond 4P: SWMB

Inflow Area = 0.860 ac, 65.12% Impervious, Inflow Depth > 2.51" for 10-yr event
Inflow = 3.18 cfs @ 12.10 hrs, Volume= 0.180 af
Outflow = 0.85 cfs @ 12.22 hrs, Volume= 0.180 af, Atten= 73%, Lag= 7.2 min
Primary = 0.85 cfs @ 12.22 hrs, Volume= 0.180 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 114.79' @ 12.22 hrs Surf.Area= 1,828 sf Storage= 1,334 cf

Plug-Flow detention time= 8.5 min calculated for 0.180 af (100% of inflow)
Center-of-Mass det. time= 8.3 min (844.5 - 836.1)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	3,824 cf	**Custom Stage Data (Irregular)** Listed below

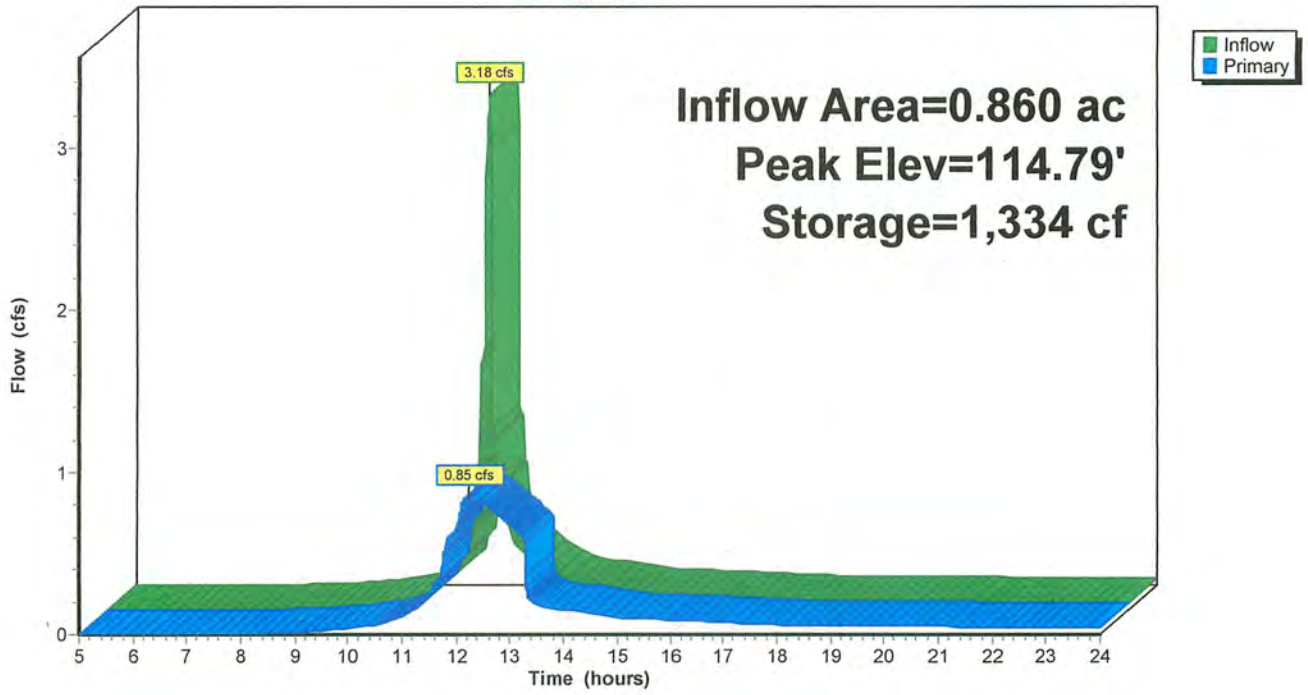
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	1,500	155.0	0	0	1,500
114.50	1,710	164.0	802	802	1,742
115.00	1,910	173.0	905	1,706	1,998
115.50	2,120	182.0	1,007	2,714	2,267
116.00	2,325	190.0	1,111	3,824	2,521

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**17.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 110.00' Phase-In= 0.02'

Primary OutFlow Max=0.85 cfs @ 12.22 hrs HW=114.79' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.85 cfs)

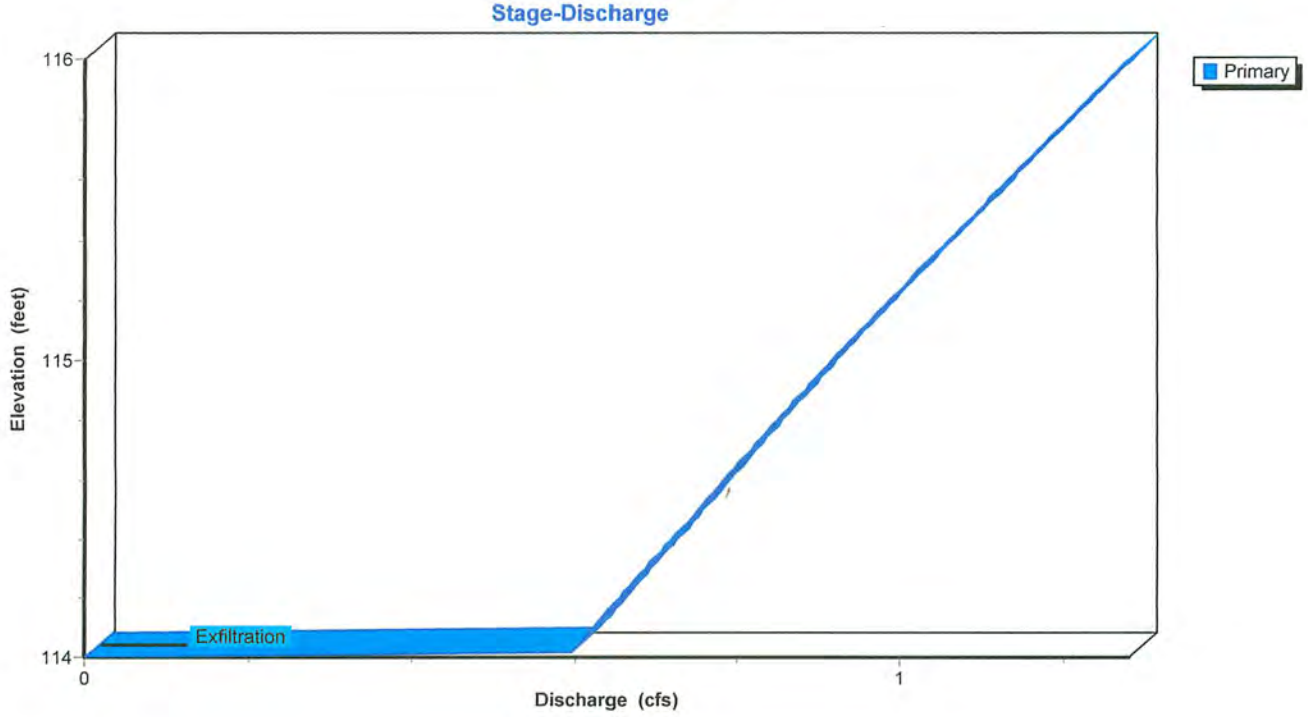
Pond 4P: SWMB

Hydrograph

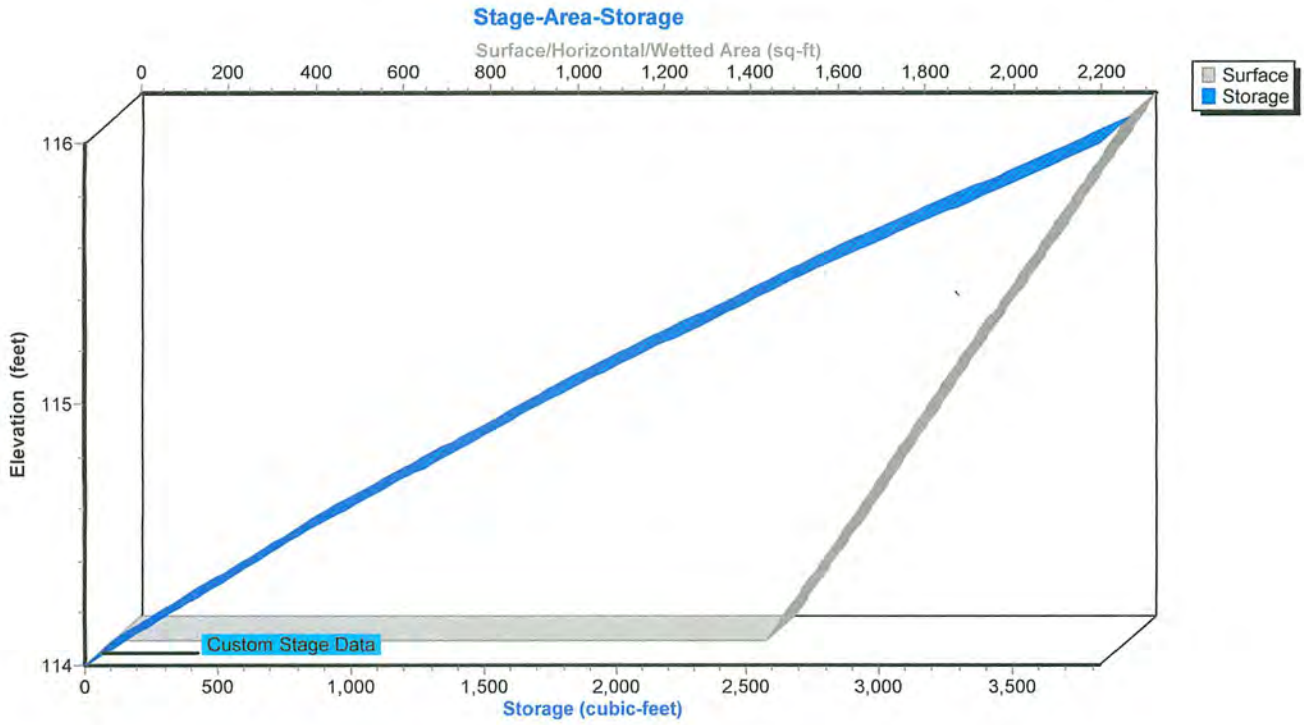


Pond 4P: SWMB

Stage-Discharge



Pond 4P: SWMB


Stage-Area-Storage
Surface/Horizontal/Wetted Area (sq-ft)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
Surface
Storage
116
115
114
Elevation (feet)
Custom Stage Data
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Storage (cubic-feet)

Summary for Subcatchment 1S: Pre Development Runoff to Pt "A"

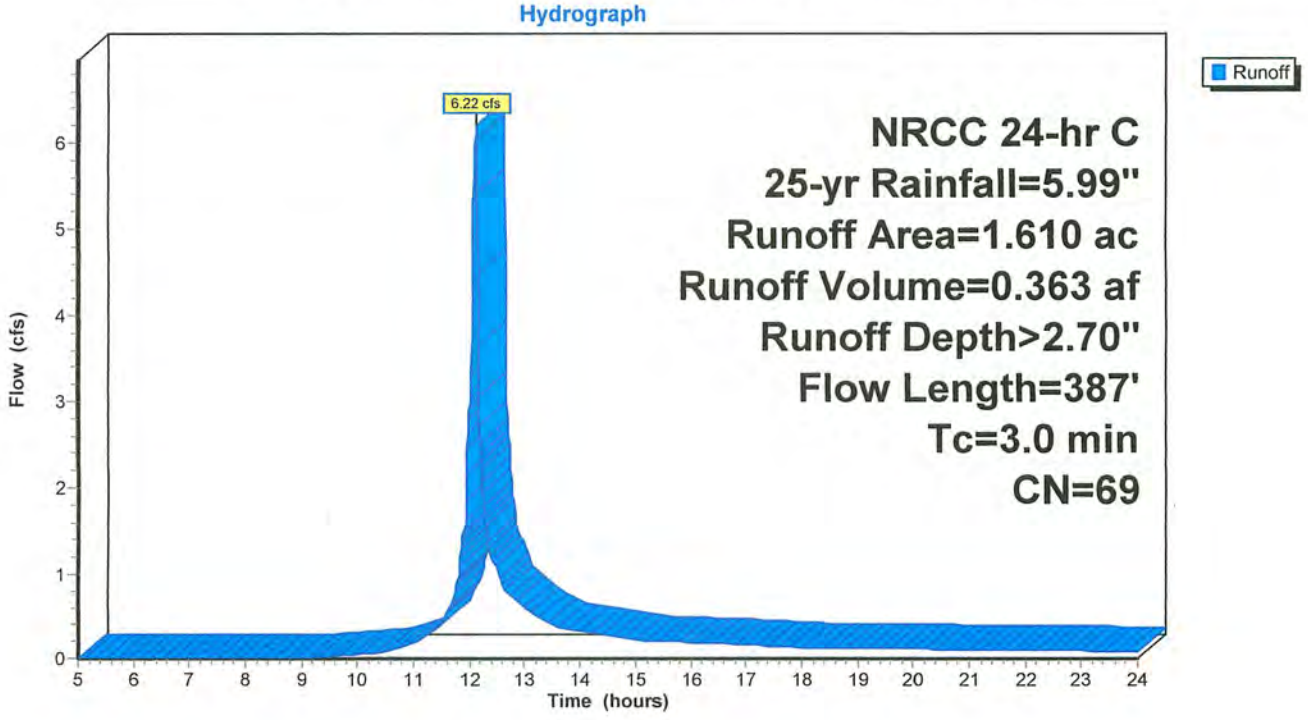
Runoff = 6.22 cfs @ 12.11 hrs, Volume= 0.363 af, Depth> 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-yr Rainfall=5.99"

Area (ac)	CN	Description
0.730	68	<50% Grass cover, Poor, HSG A
0.480	48	Brush, Poor, HSG A
0.400	98	Paved parking, HSG A
1.610	69	Weighted Average
1.210		75.16% Pervious Area
0.400		24.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 1S: Pre Development Runoff to Pt "A"



Summary for Subcatchment 2S: Post Development Runoff to Pt "A"

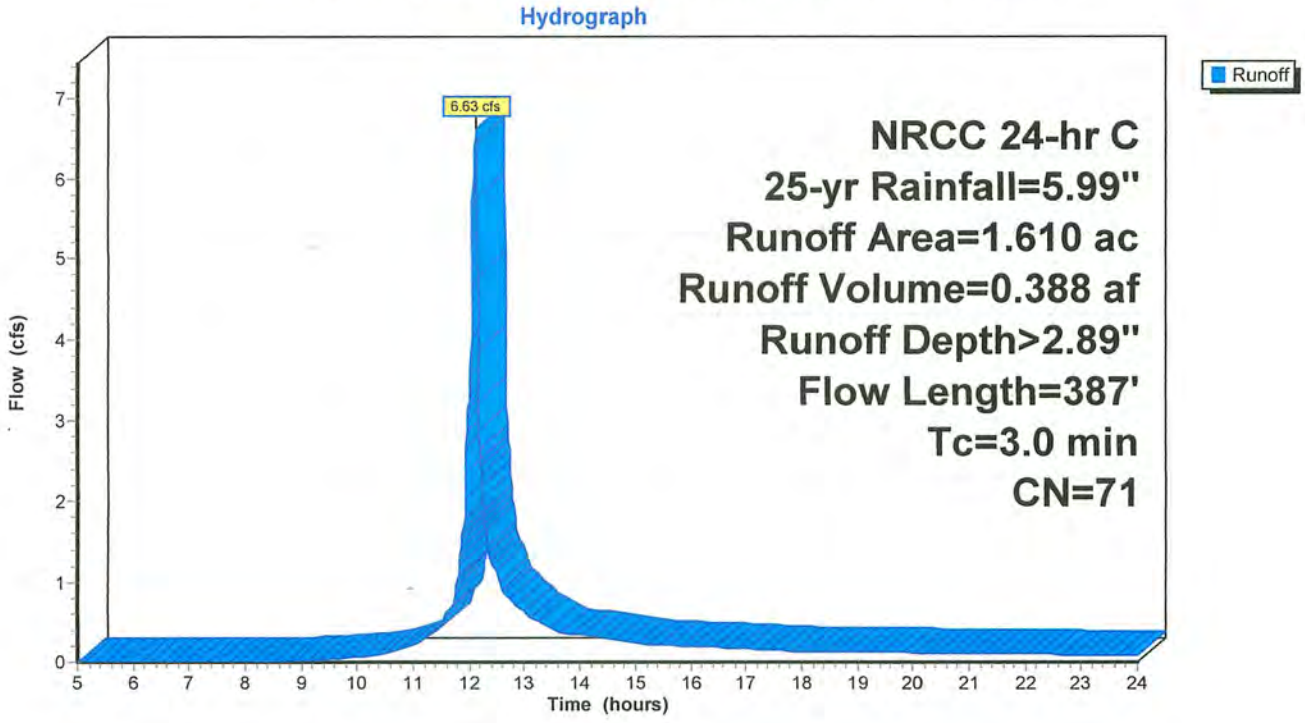
Runoff = 6.63 cfs @ 12.11 hrs, Volume= 0.388 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-yr Rainfall=5.99"

Area (ac)	CN	Description
0.880	98	Paved parking, HSG A
0.730	39	>75% Grass cover, Good, HSG A
1.610	71	Weighted Average
0.730		45.34% Pervious Area
0.880		54.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 2S: Post Development Runoff to Pt "A"



Summary for Subcatchment 3S: Post Development Runoff to SWMB

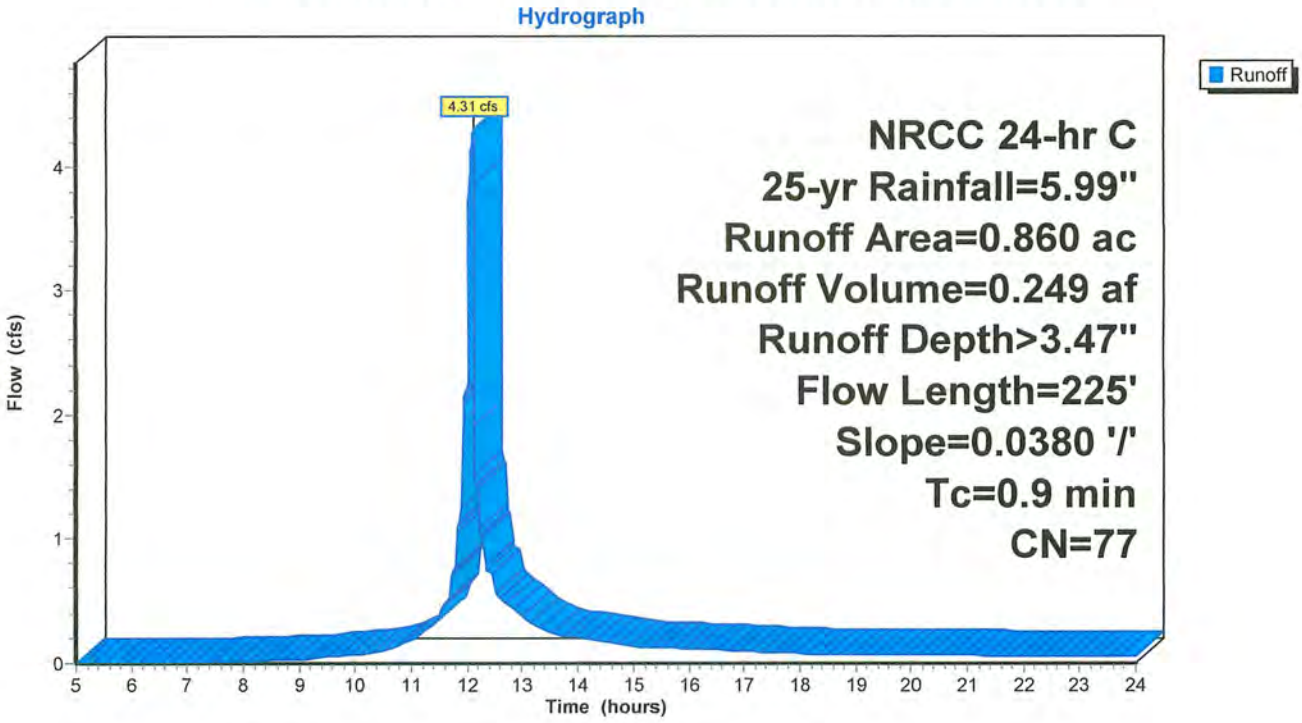
Runoff = 4.31 cfs @ 12.10 hrs, Volume= 0.249 af, Depth> 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-yr Rainfall=5.99"

Area (ac)	CN	Description
0.560	98	Paved parking, HSG A
0.300	39	>75% Grass cover, Good, HSG A
0.860	77	Weighted Average
0.300		34.88% Pervious Area
0.560		65.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 3S: Post Development Runoff to SWMB



Summary for Pond 4P: SWMB

Inflow Area = 0.860 ac, 65.12% Impervious, Inflow Depth > 3.47" for 25-yr event
Inflow = 4.31 cfs @ 12.10 hrs, Volume= 0.249 af
Outflow = 1.00 cfs @ 12.30 hrs, Volume= 0.249 af, Atten= 77%, Lag= 12.1 min
Primary = 1.00 cfs @ 12.30 hrs, Volume= 0.249 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.23' @ 12.30 hrs Surf.Area= 2,008 sf Storage= 2,176 cf

Plug-Flow detention time= 13.2 min calculated for 0.249 af (100% of inflow)
Center-of-Mass det. time= 13.0 min (839.0 - 825.9)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	3,824 cf	**Custom Stage Data (Irregular)** Listed below

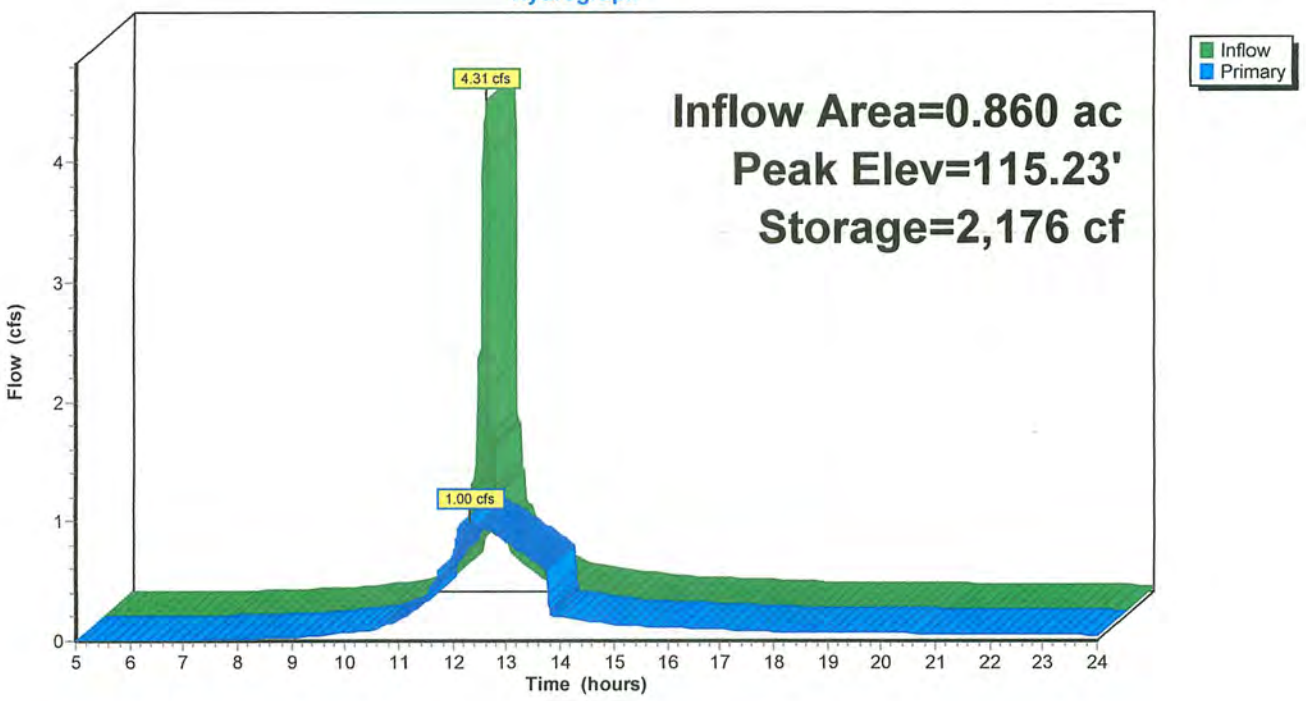
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	1,500	155.0	0	0	1,500
114.50	1,710	164.0	802	802	1,742
115.00	1,910	173.0	905	1,706	1,998
115.50	2,120	182.0	1,007	2,714	2,267
116.00	2,325	190.0	1,111	3,824	2,521

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**17.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 110.00' Phase-In= 0.02'

Primary OutFlow Max=1.00 cfs @ 12.30 hrs HW=115.23' (Free Discharge)
↑—**1=Exfiltration** (Controls 1.00 cfs)

Pond 4P: SWMB

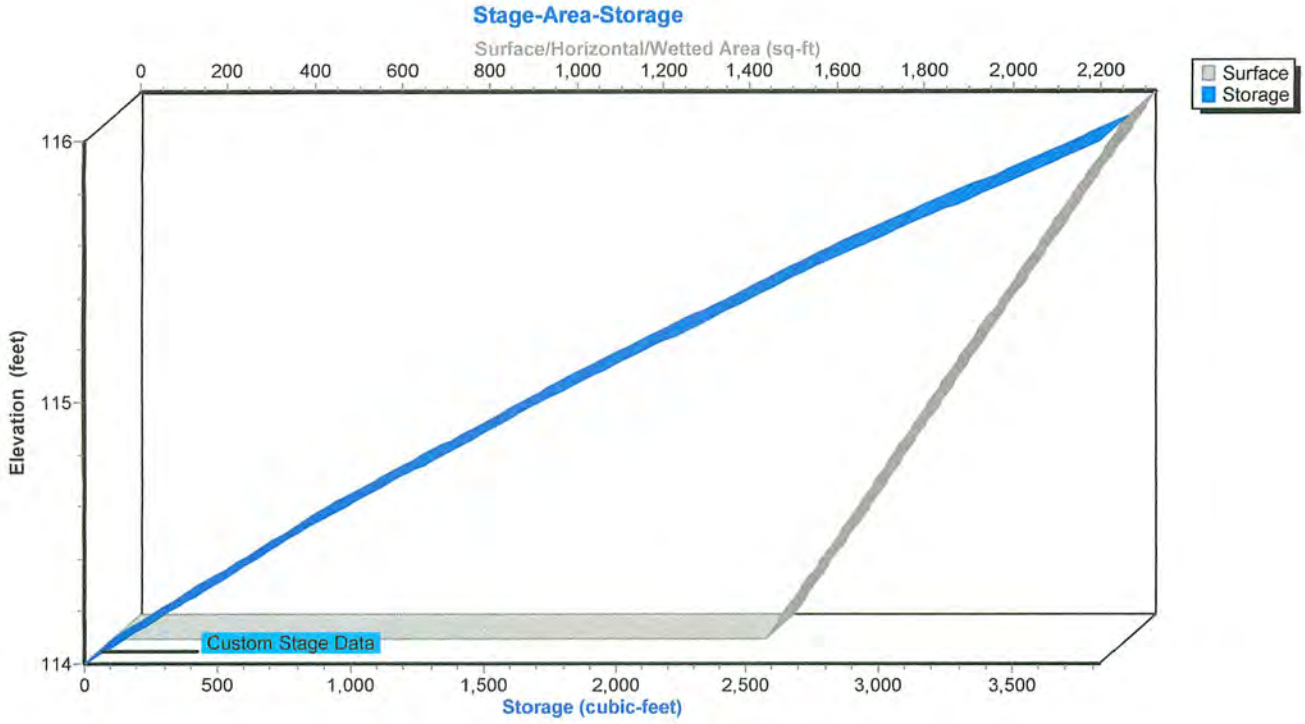
Hydrograph



Pond 4P: SWMB

Stage-Discharge

Pond 4P: SWMB


Stage-Area-Storage
Surface/Horizontal/Wetted Area (sq-ft)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
Surface
Storage
116
115
114
Elevation (feet)
Custom Stage Data
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Storage (cubic-feet)

Summary for Subcatchment 1S: Pre Development Runoff to Pt "A"

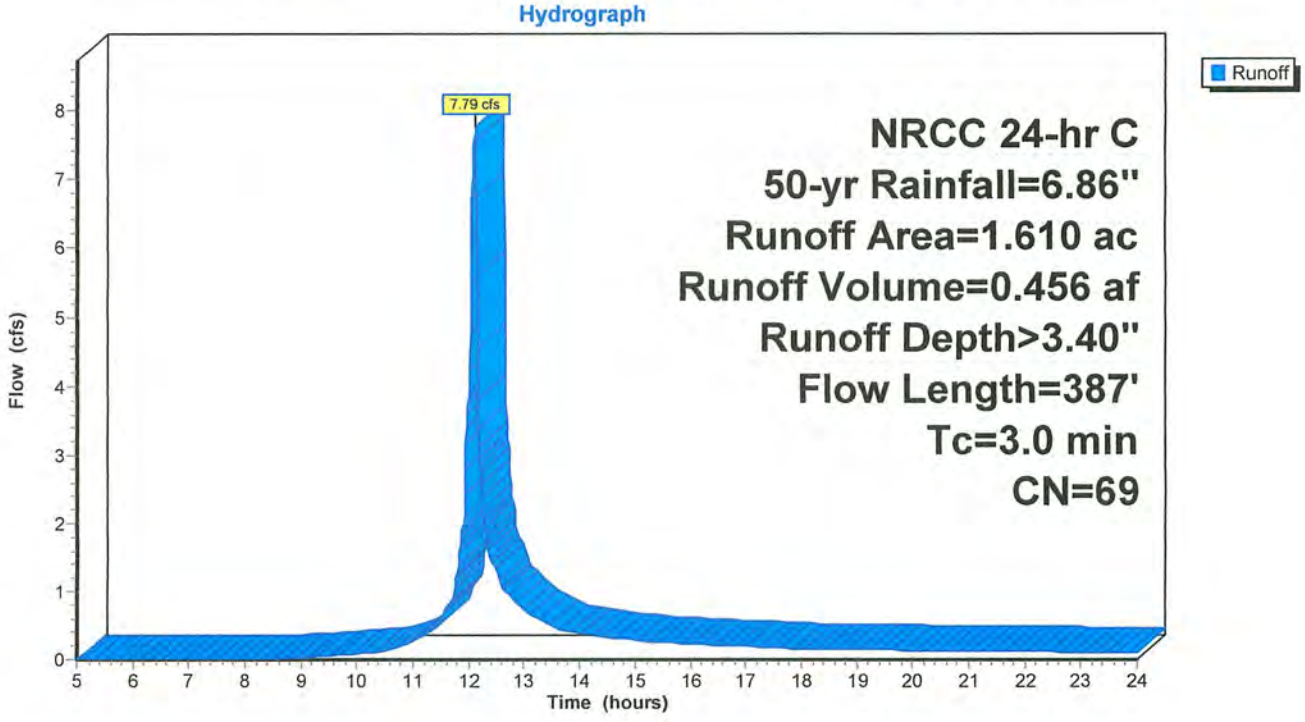
Runoff = 7.79 cfs @ 12.11 hrs, Volume= 0.456 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 50-yr Rainfall=6.86"

Area (ac)	CN	Description
0.730	68	<50% Grass cover, Poor, HSG A
0.480	48	Brush, Poor, HSG A
0.400	98	Paved parking, HSG A
1.610	69	Weighted Average
1.210		75.16% Pervious Area
0.400		24.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 1S: Pre Development Runoff to Pt "A"



Summary for Subcatchment 2S: Post Development Runoff to Pt "A"

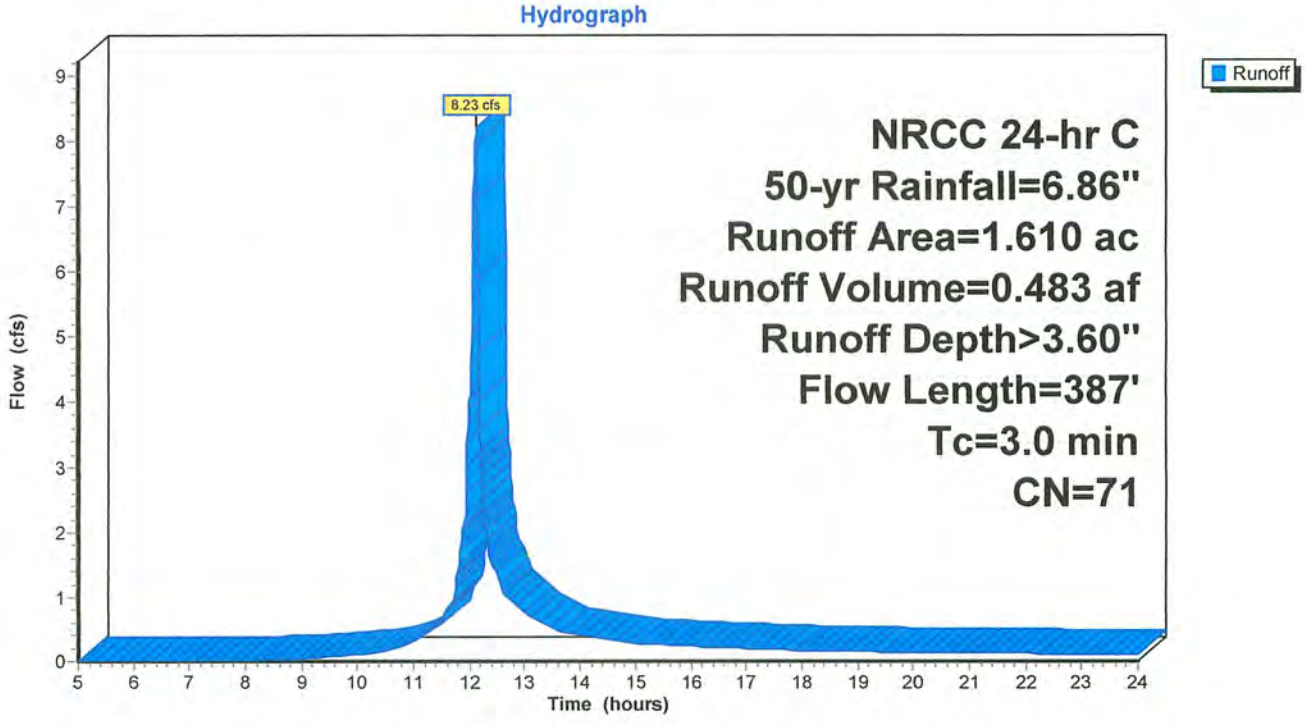
Runoff = 8.23 cfs @ 12.11 hrs, Volume= 0.483 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 50-yr Rainfall=6.86"

Area (ac)	CN	Description
0.880	98	Paved parking, HSG A
0.730	39	>75% Grass cover, Good, HSG A
1.610	71	Weighted Average
0.730		45.34% Pervious Area
0.880		54.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 2S: Post Development Runoff to Pt "A"



Summary for Subcatchment 3S: Post Development Runoff to SWMB

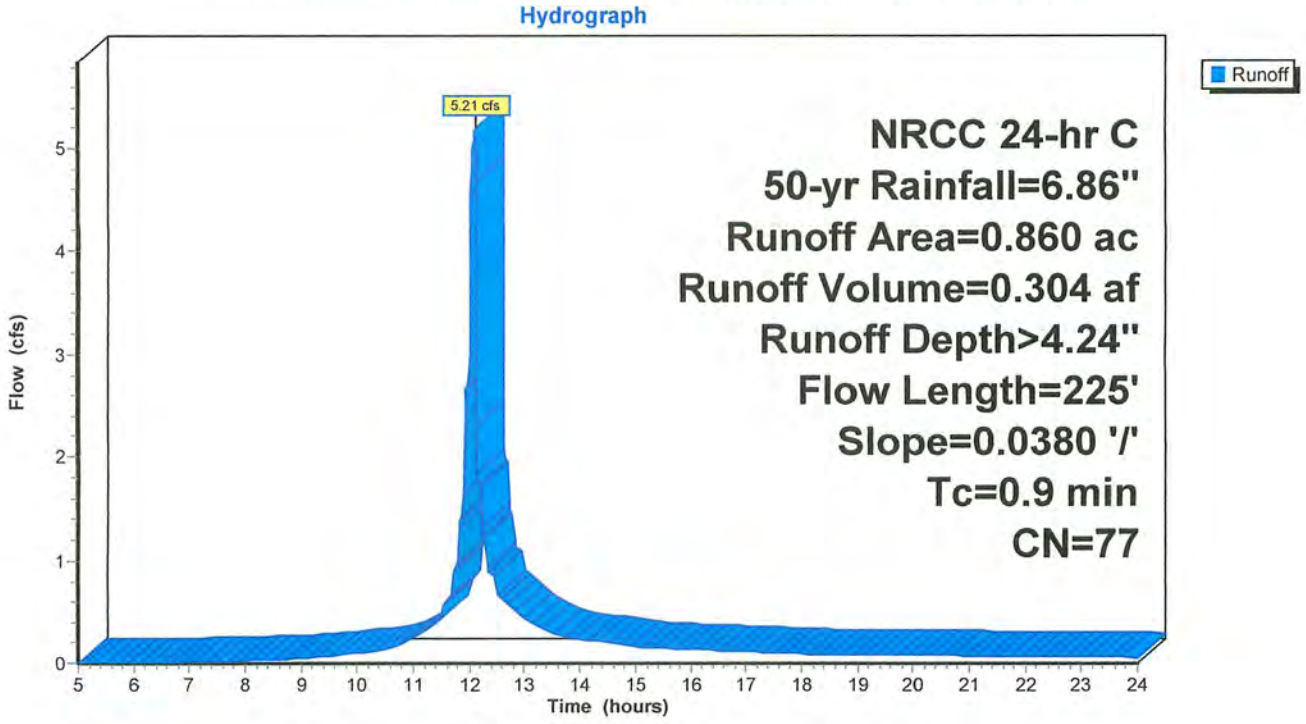
Runoff = 5.21 cfs @ 12.10 hrs, Volume= 0.304 af, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 50-yr Rainfall=6.86"

Area (ac)	CN	Description
0.560	98	Paved parking, HSG A
0.300	39	>75% Grass cover, Good, HSG A
0.860	77	Weighted Average
0.300		34.88% Pervious Area
0.560		65.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 3S: Post Development Runoff to SWMB



Summary for Pond 4P: SWMB

Inflow Area = 0.860 ac, 65.12% Impervious, Inflow Depth > 4.24" for 50-yr event
Inflow = 5.21 cfs @ 12.10 hrs, Volume= 0.304 af
Outflow = 1.13 cfs @ 12.31 hrs, Volume= 0.304 af, Atten= 78%, Lag= 12.5 min
Primary = 1.13 cfs @ 12.31 hrs, Volume= 0.304 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.58' @ 12.31 hrs Surf.Area= 2,154 sf Storage= 2,898 cf

Plug-Flow detention time= 16.6 min calculated for 0.304 af (100% of inflow)
Center-of-Mass det. time= 16.4 min (836.0 - 819.6)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	3,824 cf	**Custom Stage Data (Irregular)** Listed below

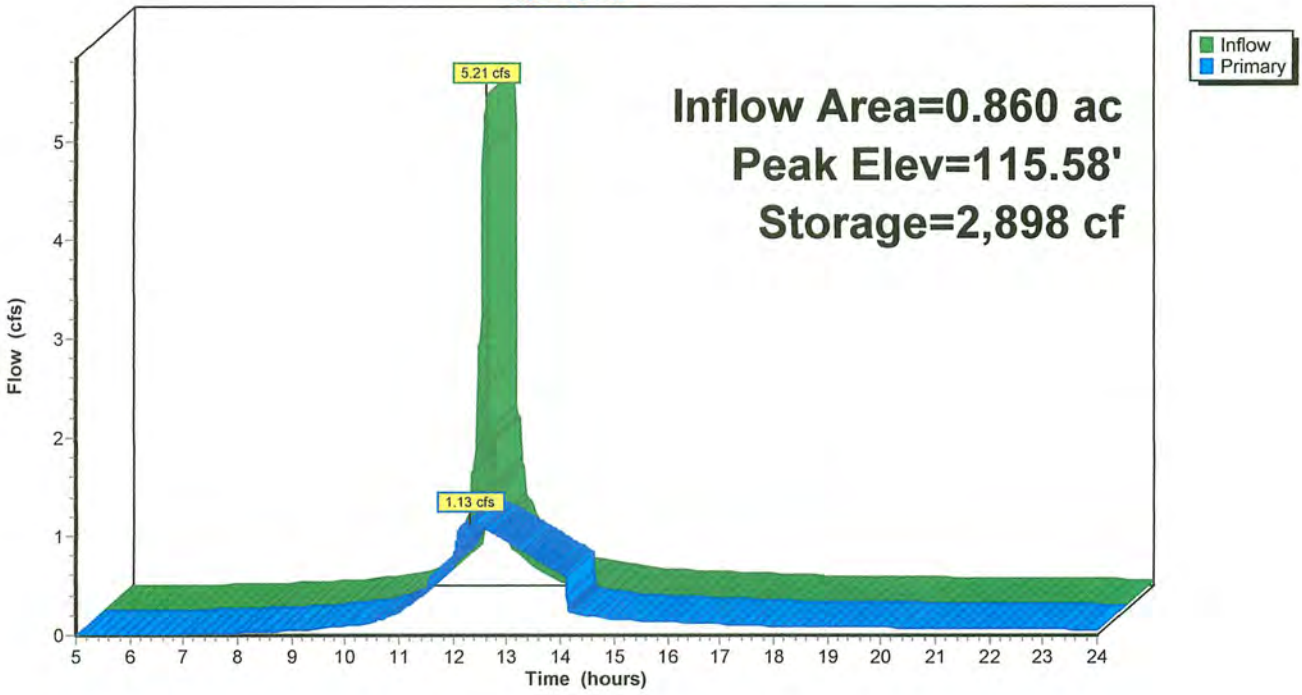
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	1,500	155.0	0	0	1,500
114.50	1,710	164.0	802	802	1,742
115.00	1,910	173.0	905	1,706	1,998
115.50	2,120	182.0	1,007	2,714	2,267
116.00	2,325	190.0	1,111	3,824	2,521

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**17.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 110.00' Phase-In= 0.02'

Primary OutFlow Max=1.13 cfs @ 12.31 hrs HW=115.58' (Free Discharge)
↑—**1=Exfiltration** (Controls 1.13 cfs)

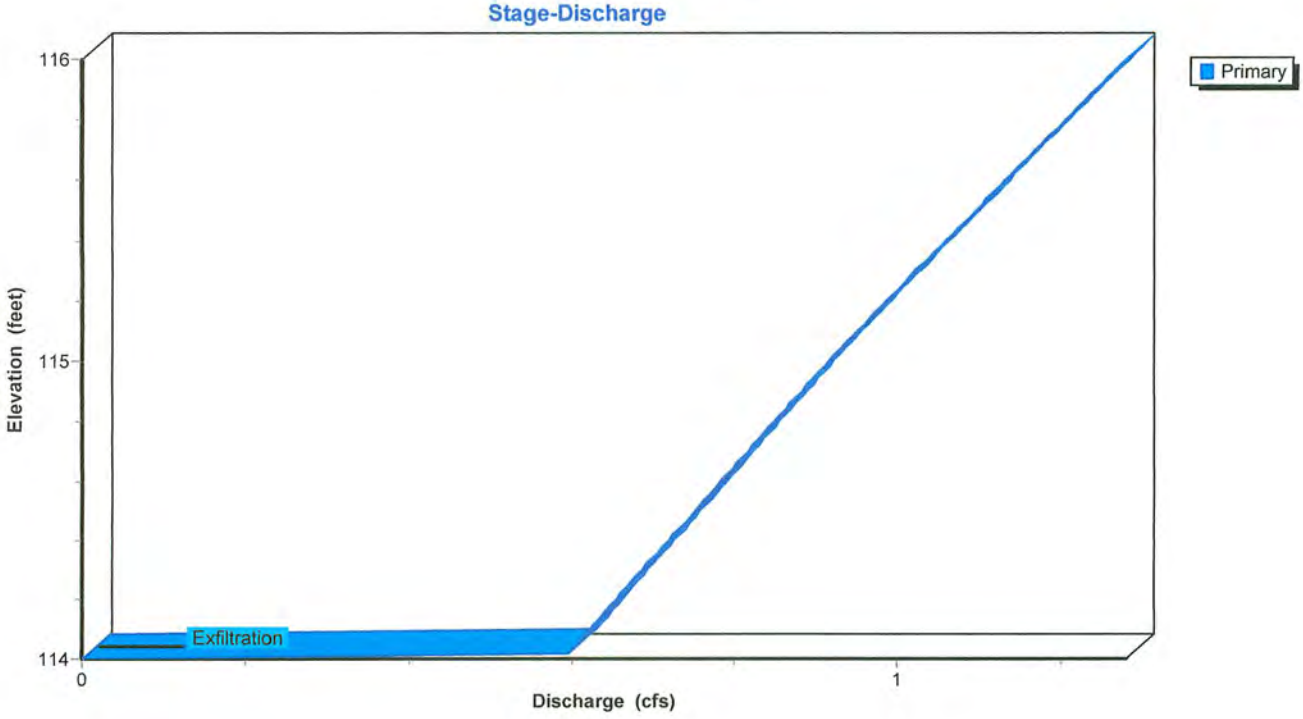
Pond 4P: SWMB

Hydrograph

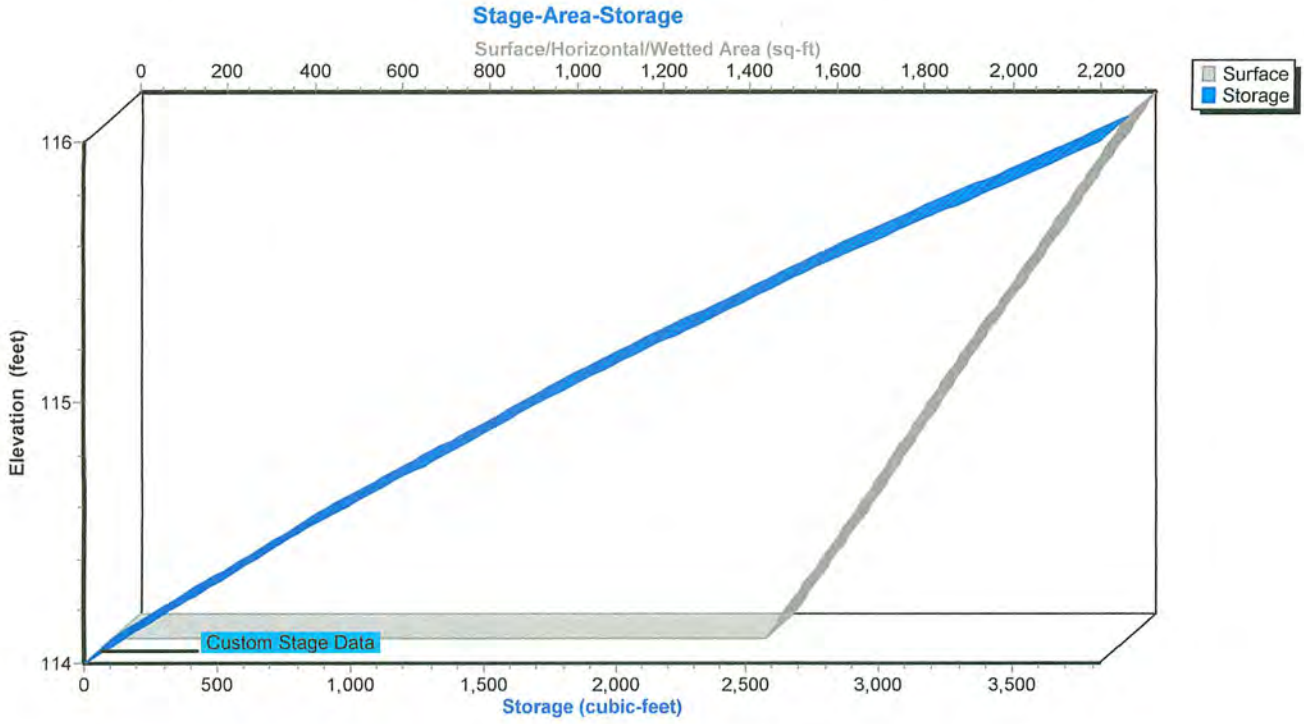


Pond 4P: SWMB

Stage-Discharge



Pond 4P: SWMB


Stage-Area-Storage
Surface/Horizontal/Wetted Area (sq-ft)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
Surface
Storage
116
115
114
Elevation (feet)
Custom Stage Data
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Storage (cubic-feet)

Summary for Subcatchment 1S: Pre Development Runoff to Pt "A"

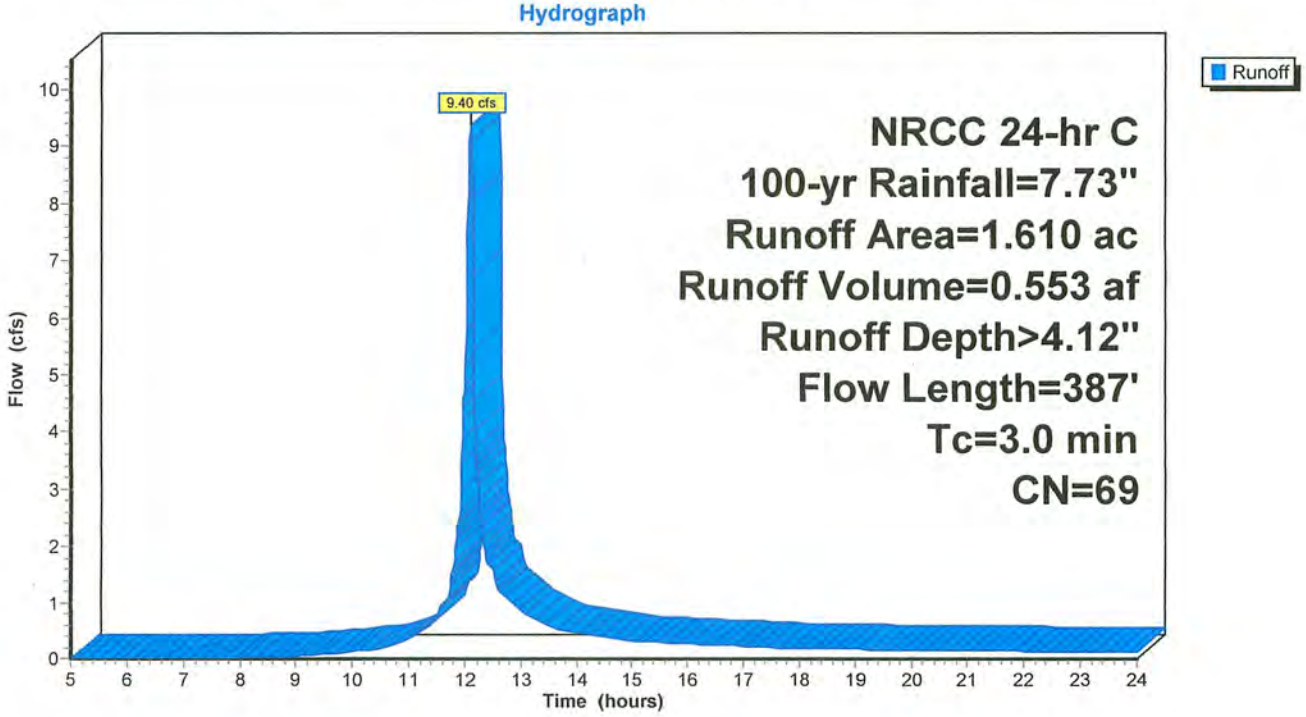
Runoff = 9.40 cfs @ 12.11 hrs, Volume= 0.553 af, Depth> 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-yr Rainfall=7.73"

Area (ac)	CN	Description
0.730	68	<50% Grass cover, Poor, HSG A
0.480	48	Brush, Poor, HSG A
0.400	98	Paved parking, HSG A
1.610	69	Weighted Average
1.210		75.16% Pervious Area
0.400		24.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 1S: Pre Development Runoff to Pt "A"



Summary for Subcatchment 2S: Post Development Runoff to Pt "A"

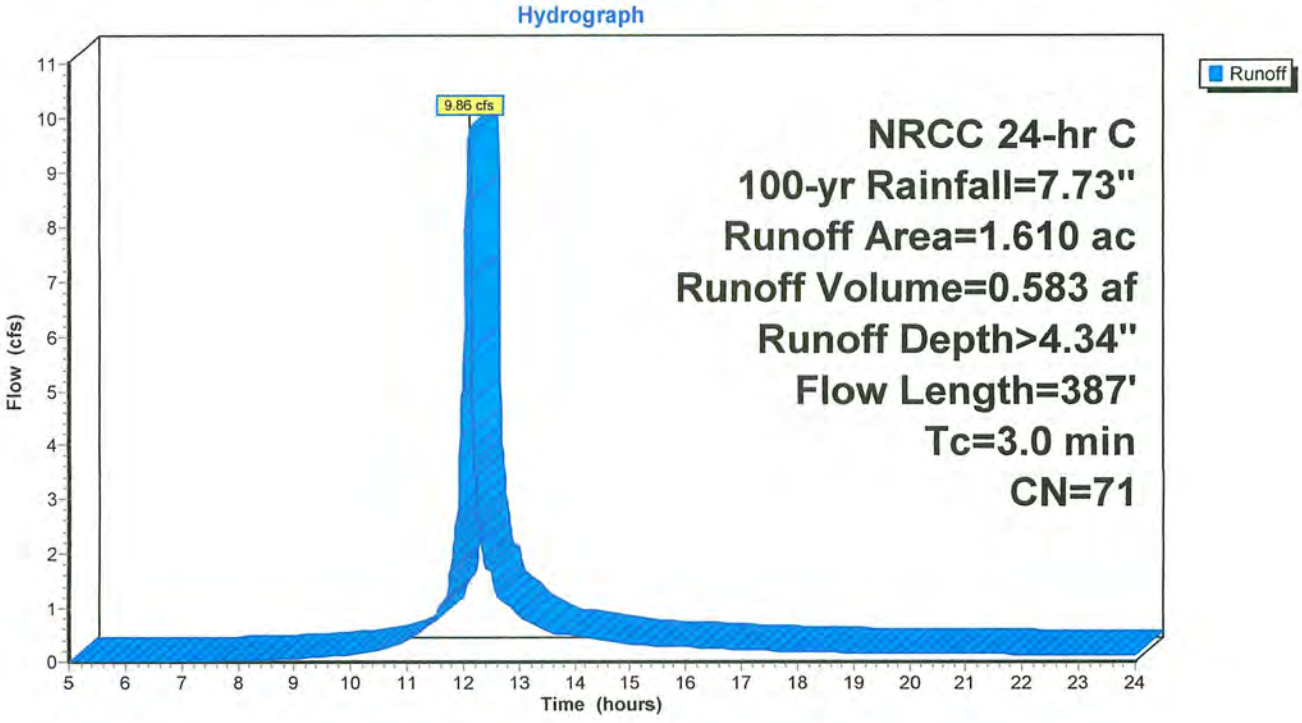
Runoff = 9.86 cfs @ 12.11 hrs, Volume= 0.583 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-yr Rainfall=7.73"

Area (ac)	CN	Description
0.880	98	Paved parking, HSG A
0.730	39	>75% Grass cover, Good, HSG A
1.610	71	Weighted Average
0.730		45.34% Pervious Area
0.880		54.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	240	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	147	0.0550	1.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	387	Total			

Subcatchment 2S: Post Development Runoff to Pt "A"



Summary for Subcatchment 3S: Post Development Runoff to SWMB

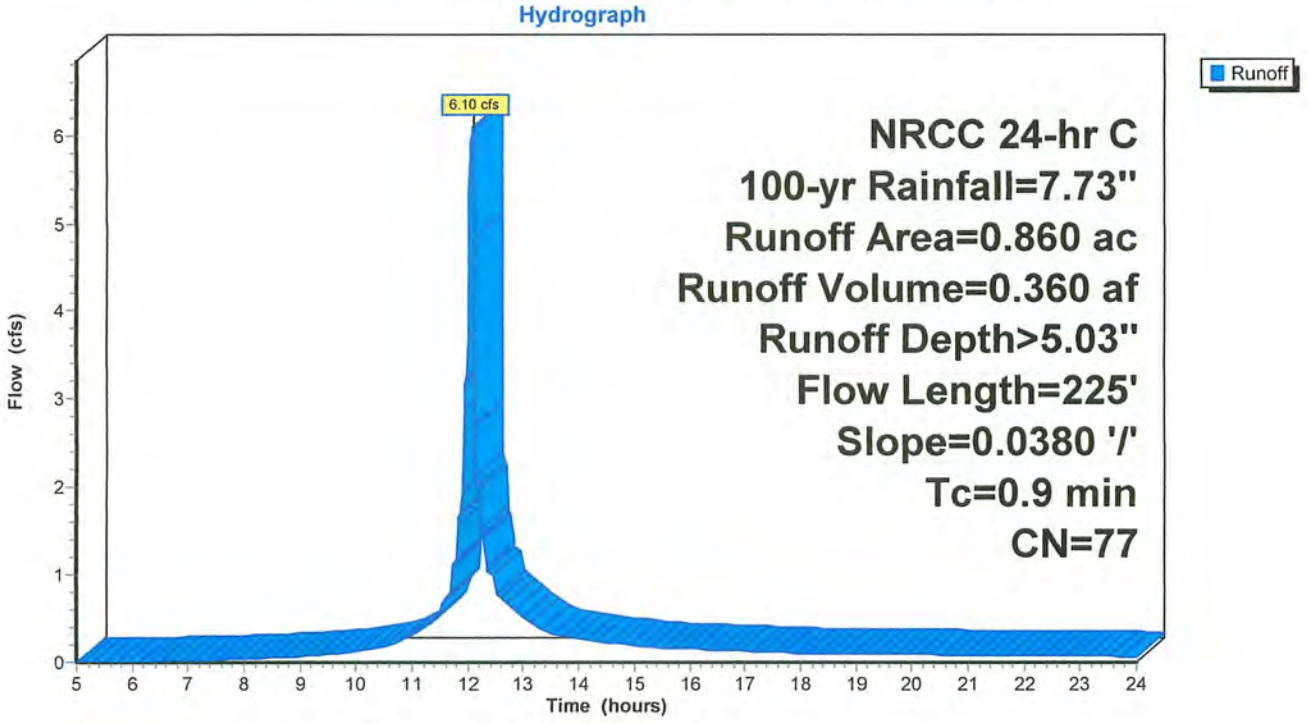
Runoff = 6.10 cfs @ 12.10 hrs, Volume= 0.360 af, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-yr Rainfall=7.73"

Area (ac)	CN	Description
0.560	98	Paved parking, HSG A
0.300	39	>75% Grass cover, Good, HSG A
0.860	77	Weighted Average
0.300		34.88% Pervious Area
0.560		65.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	225	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 3S: Post Development Runoff to SWMB



Summary for Pond 4P: SWMB

Inflow Area = 0.860 ac, 65.12% Impervious, Inflow Depth > 5.03" for 100-yr event
Inflow = 6.10 cfs @ 12.10 hrs, Volume= 0.360 af
Outflow = 1.25 cfs @ 12.31 hrs, Volume= 0.360 af, Atten= 79%, Lag= 12.7 min
Primary = 1.25 cfs @ 12.31 hrs, Volume= 0.360 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.93' @ 12.31 hrs Surf.Area= 2,298 sf Storage= 3,676 cf

Plug-Flow detention time= 19.9 min calculated for 0.360 af (100% of inflow)
Center-of-Mass det. time= 19.8 min (834.0 - 814.2)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	3,824 cf	**Custom Stage Data (Irregular)** Listed below

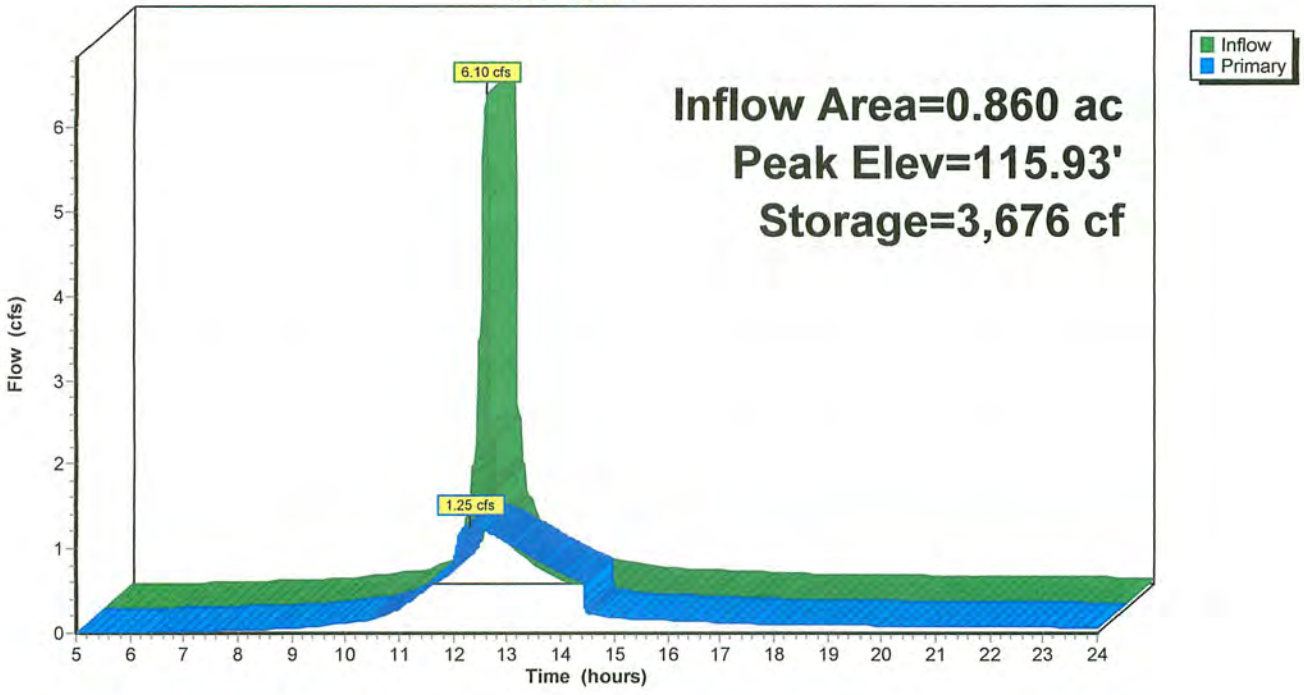
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	1,500	155.0	0	0	1,500
114.50	1,710	164.0	802	802	1,742
115.00	1,910	173.0	905	1,706	1,998
115.50	2,120	182.0	1,007	2,714	2,267
116.00	2,325	190.0	1,111	3,824	2,521

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**17.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 110.00' Phase-In= 0.02'

Primary OutFlow Max=1.25 cfs @ 12.31 hrs HW=115.93' (Free Discharge)
↑**1=Exfiltration** (Controls 1.25 cfs)

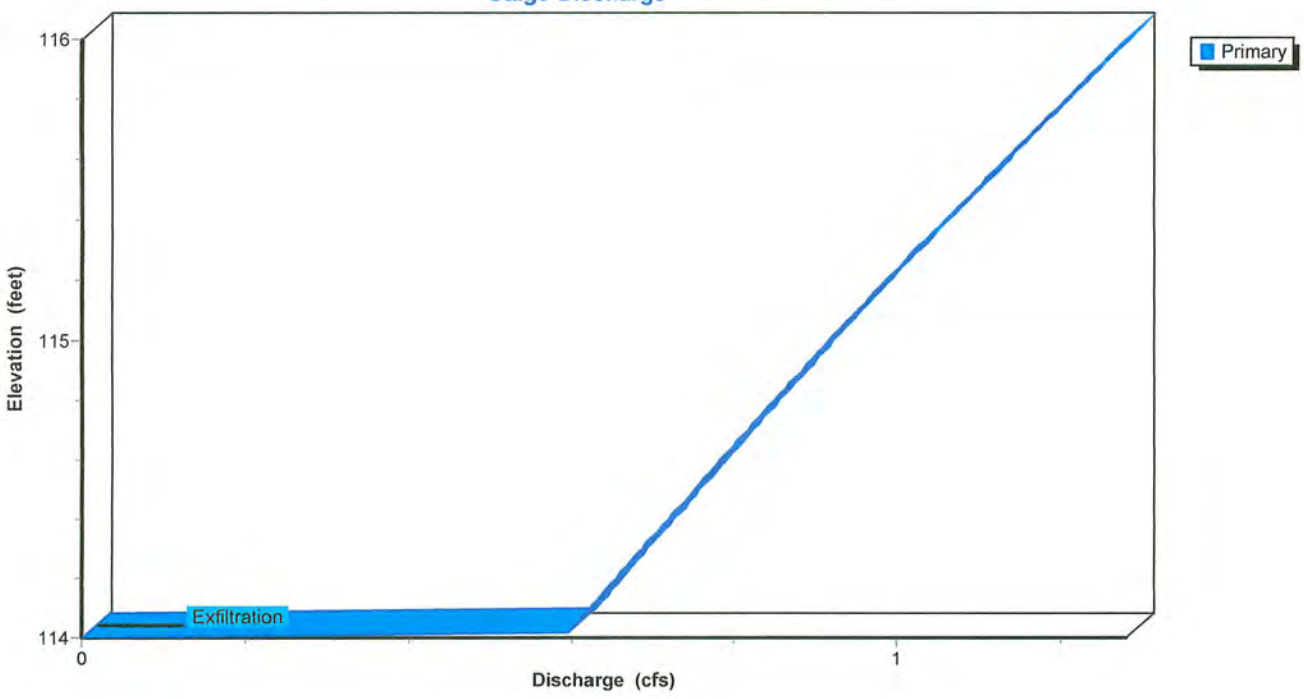
Pond 4P: SWMB

Hydrograph



Pond 4P: SWMB

Stage-Discharge



Pond 4P: SWMB

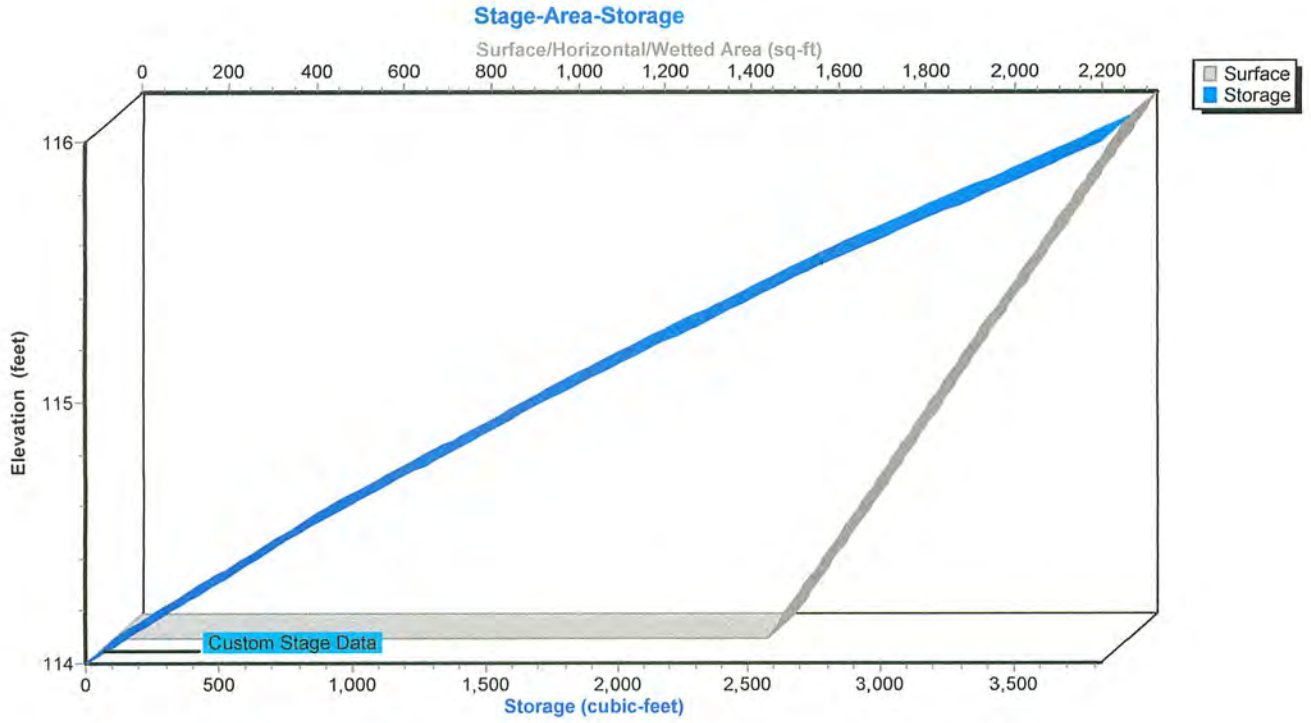

Stage-Area-Storage
Surface/Horizontal/Wetted Area (sq-ft)
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
Surface
Storage
116
115
114
Elevation (feet)
Custom Stage Data
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Storage (cubic-feet)

TABLE OF CONTENTS

Project Reports
1 Rainfall Events Listing (selected events)

2-yr Event
2 Subcat 1S: Pre Development Runoff to Pt "A"
3 Subcat 2S: Post Development Runoff to Pt "A"
4 Subcat 3S: Post Development Runoff to SWMB
5 Pond 4P: SWMB

10-yr Event
8 Subcat 1S: Pre Development Runoff to Pt "A"
9 Subcat 2S: Post Development Runoff to Pt "A"
10 Subcat 3S: Post Development Runoff to SWMB
11 Pond 4P: SWMB

25-yr Event
14 Subcat 1S: Pre Development Runoff to Pt "A"
15 Subcat 2S: Post Development Runoff to Pt "A"
16 Subcat 3S: Post Development Runoff to SWMB
17 Pond 4P: SWMB

50-yr Event
20 Subcat 1S: Pre Development Runoff to Pt "A"
21 Subcat 2S: Post Development Runoff to Pt "A"
22 Subcat 3S: Post Development Runoff to SWMB
23 Pond 4P: SWMB

100-yr Event
26 Subcat 1S: Pre Development Runoff to Pt "A"
27 Subcat 2S: Post Development Runoff to Pt "A"
28 Subcat 3S: Post Development Runoff to SWMB
29 Pond 4P: SWMB

APPENDIX B
STORMWATER MANAGEMENT BASIN VOLUMES

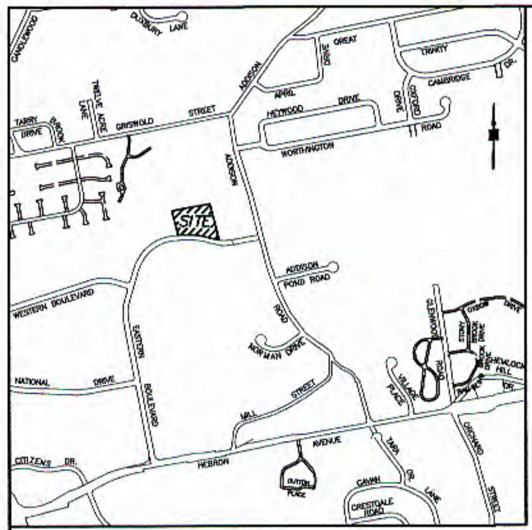
Volume of Pond

MEGSON, HEAGLE & FRIEND
Civil Engineers & Land Surveyors, LLC
81 Rankin Road
Glastonbury, Connecticut 06033
Phone (860) 659-0587
Fax (860) 657-4429

Job: 85-19 Central Rock Gym
Sheet No: 1 Of: 1
Calculated By: MWF Date: 05/22/20
Checked By: Date:
Scale:

Elevation Stage	Area (ft^2)	Area Last Section (ft^2)	Average Area (ft^2)	Section Volume (CF)	Total Volume (CF)
114.0	1500	0	0	0	0
114.5	1710	1500	1605	803	803
115.0	1910	1710	1810	905	1708
115.5	2120	1910	2015	1007	2715
116.0	2325	2120	2226	1113	3828

APPENDIX C
DRAINAGE AREA MAPS



SITE LOCATION MAP

SCALE: 1"=1,000'

WATER QUALITY VOLUME

$$WQV = \frac{(1")(R)(A)}{12} \quad \text{WHERE}$$

$R = 0.05 + 0.009(I) \qquad 0.05 + 0.009(62) = 0.608$

$I = \%\ IMPERVIOUS = \frac{19{,}232\ S.F.}{31{,}100\ S.F.} = 62\%$

$A = AREA = 1.04\ AC.$

$$WQV = \frac{(1")(0.608)(0.71\ AC)}{12} = 0.036\ AC\text{-}FT$$

$= 1{,}568\ CF$

VOLUME PROPOSED = 4150 CF

LEGEND

- EXIST. IRON PIN
- PROP. IRON PIN
- PROP. CONTOUR (264)
- EXIST. CONTOUR MINOR (264)
- EXIST. CONTOUR MAJOR (264)
- STAKED HAY BALES/SILT FENCE
- WETLAND FLAGS (WF 3)
- EXISTING LIMIT OF CLEARING
- PROPOSED LIMIT OF CLEARING
- EXISTING EDGE OF PAVEMENT
- EXIST. 6" BITUMINOUS CURB
- PROP. BITUMINOUS CURB (BCLC)
- PROP. SPOT ELEVATIONS (53.80)
- EXISTING TREES
- PROPOSED LIGHT POLE TYP.
- PROPOSED PARKING LOT
- EROSION CONTROL MAT
- LEAKY BERM
- CONSERVATION EASEMENT

ZONING INFORMATION

ZONE: PLANNED EMPLOYMENT
AREA = 45,376 S.F.

IMPERVIOUS COVERAGE	=19,232 S.F.	42.4%
OPEN SPACE	=26,144 S.F.	57.6%
	45,376 S.F.	100.0%

HORIZONTAL DATUM REFERS TO NAD83
VERTICAL DATUM REFERS TO NGVD88

NOTE: CONTOURS TAKEN FROM ACTUAL FIELD SURVEY AND TOWN OF GLASTONBURY AERIAL TOPO MAPS

REFERENCE IS MADE TO MAPS TITLED:

"TOWN OF GLASTONBURY PROPOSED RIGHT OF WAY #233, #247,#259 AND #273 EASTERN BOULEVARD GLASTONBURY, CONNECTICUT SCALE 1"=40' DATE 2-7-2000 REV. 7-17-2000

THE SURVEY STATEMENTS BELOW ONLY REFER TO 233 EASTERN BOULEVARD. ALL OTHER INFORMATION DEPICTED TAKEN FROM TOWN OF GLASTONBURY RESOURCE INFORMATION.

THIS MAP IS NOT VALID IF MODIFIED IN ANY WAY AND/OR DOES NOT BEAR THE EMBOSSED SEAL OF THE UNDERSIGNED.

NO ZONING VIOLATIONS
TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON. THIS SURVEY WAS PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTION 20-300b-1 THROUGH 20-300b-20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF LAND SURVEYORS, INC., ON SEPTEMBER 26, 1996.
TYPE OF SURVEY: ZONING LOCATION SURVEY
BOUNDARY DETERMINATION CATEGORY: DEPENDENT RESURVEY
CLASS OF ACCURACY: A-2, T-2

JOHN L. HEAGLE L.S. # 9396

I HAVE REVIEWED THE WETLAND BOUNDARIES AS SHOWN ON THIS PLAN AND AM OF THE OPINION THAT THEY REPRESENT THE SOIL BOUNDARIES MARKED BY ME IN THE FIELD.

MARK W. FRIEND
SOIL SCIENTIST

DRAINAGE AREA TO RAINGARDEN

THIS MAP IS NOT VALID IF MODIFIED IN ANY WAY AND/OR DOES NOT BEAR THE EMBOSSED SEAL OF THE UNDERSIGNED.

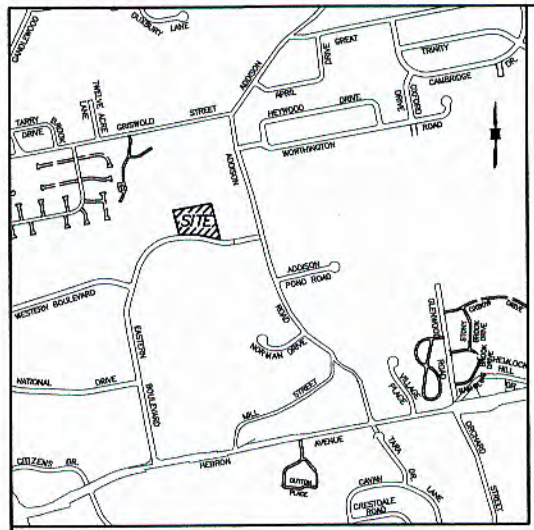
I HEREBY DECLARE TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS PLAN IS SUBSTANTIALLY CORRECT.

MARK W. FRIEND P.E. #15818

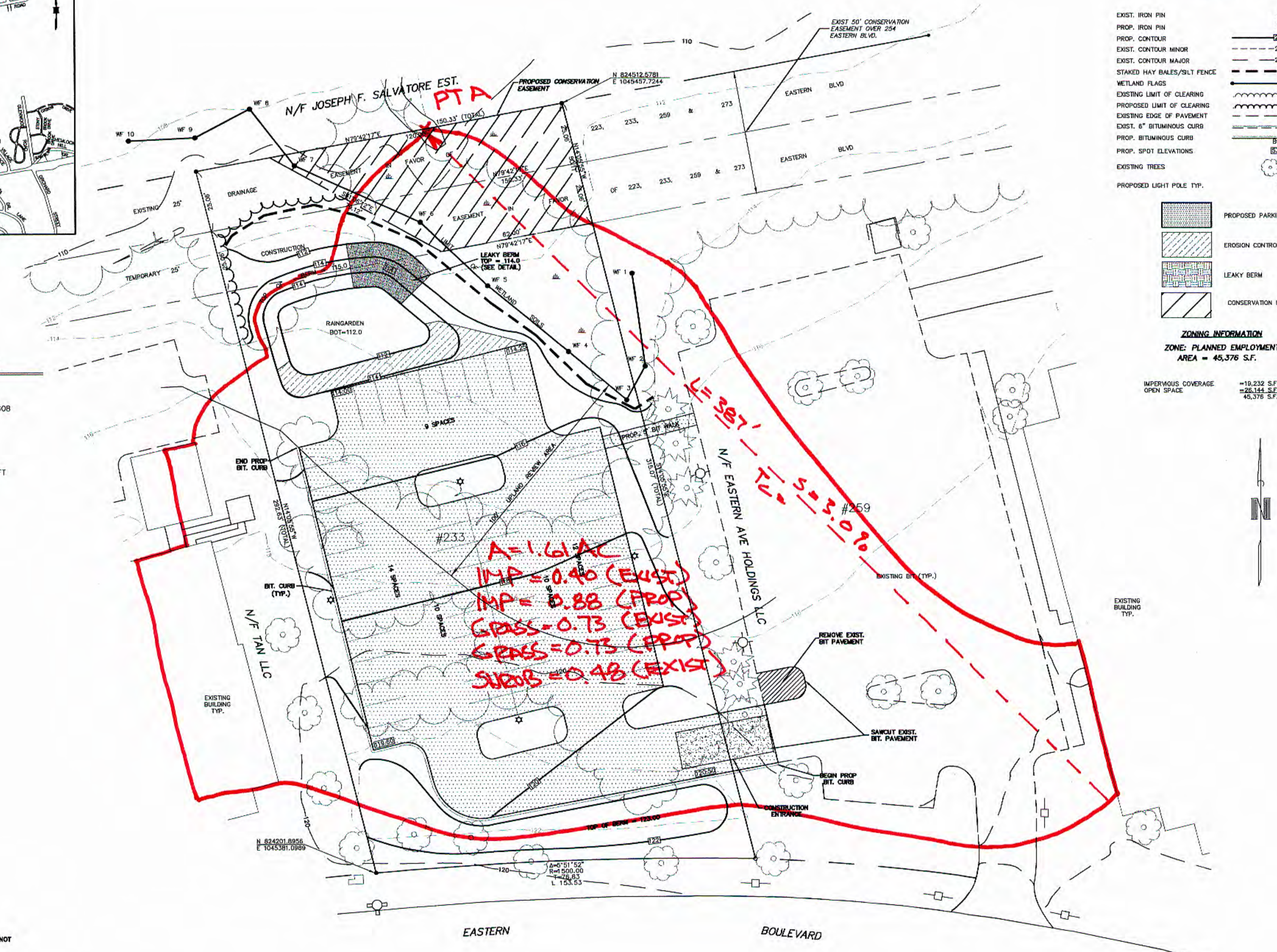
MEGSON, HEAGLE & FRIEND
CIVIL ENGINEERS & LAND SURVEYORS, LLC
81 RANKIN ROAD
GLASTONBURY, CONN. 06033
PHONE (860)-659-0587

SITE PLAN/EROSION & SEDIMENTATION CONTROL PLAN
#259 & #233 EASTERN BOULEVARD
PREPARED FOR
CENTRAL ROCK GYM
GLASTONBURY, CONN.

CK. BY:	MWF
DRW. BY:	PEJ
DATE:	2-20-20
SCALE:	1"=20'
SHEET	1 OF 2
MAP NO.	85-19-1SP



SITE LOCATION MAP
SCALE: 1"=1,000'



WATER QUALITY VOLUME

$$WQV = \frac{(1")(R)(A)}{12} \quad \text{WHERE}$$

R = 0.05+ 0.009(I)   0.05+ 0.009(62) =0.608

$$I = \%\ \text{IMPERVIOUS} = \frac{19{,}232\ \text{S.F.}}{31{,}100\ \text{S.F.}} = 62\%$$

A = AREA = 1.04 AC.

$$WQV = \frac{(1")(0.608)(0.71\ AC)}{12} = 0.036\ \text{AC-FT}$$

= 1,568 CF

VOLUME PROPOSED = 4150 CF

LEGEND

- EXIST. IRON PIN
- PROP. IRON PIN
- PROP. CONTOUR (264)
- EXIST. CONTOUR MINOR (264)
- EXIST. CONTOUR MAJOR (264)
- STAKED HAY BALES/SILT FENCE
- WETLAND FLAGS (WF 3)
- EXISTING LIMIT OF CLEARING
- PROPOSED LIMIT OF CLEARING
- EXISTING EDGE OF PAVEMENT
- EXIST. 6" BITUMINOUS CURB
- PROP. BITUMINOUS CURB (BCLC)
- PROP. SPOT ELEVATIONS (53.60)
- EXISTING TREES
- PROPOSED LIGHT POLE TYP.
- PROPOSED PARKING LOT
- EROSION CONTROL MAT
- LEAKY BERM
- CONSERVATION EASEMENT

ZONING INFORMATION

ZONE: PLANNED EMPLOYMENT
AREA = 45,376 S.F.

IMPERVIOUS COVERAGE	=19,232 S.F.	42.4%
OPEN SPACE	=26,144 S.F.	57.6%
	45,376 S.F.	100.0%

HORIZONTAL DATUM REFERS TO NAD83
VERTICAL DATUM REFERS TO NGVD88

NOTE: CONTOURS TAKEN FROM ACTUAL FIELD SURVEY AND TOWN OF GLASTONBURY AERIAL TOPO MAPS

REFERENCE IS MADE TO MAPS TITLED:

"TOWN OF GLASTONBURY PROPOSED RIGHT OF WAY #233, #247,#259 AND #273 EASTERN BOULEVARD GLASTONBURY, CONNECTICUT SCALE 1"=40' DATE 2-7-2000 REV. 7-17-2000

THE SURVEY STATEMENTS BELOW ONLY REFER TO 233 EASTERN BOULEVARD. ALL OTHER INFORMATION DEPICTED TAKEN FROM TOWN OF GLASTONBURY RESOURCE INFORMATION.

THIS MAP IS NOT VALID IF MODIFIED IN ANY WAY AND/OR DOES NOT BEAR THE EMBOSSED SEAL OF THE UNDERSIGNED.

NO ZONING VIOLATIONS
TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON. THIS SURVEY WAS PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTION 20-300b-1 THROUGH 20-300b-20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF LAND SURVEYORS, INC., ON SEPTEMBER 26, 1996.
TYPE OF SURVEY: ZONING LOCATION SURVEY
BOUNDARY DETERMINATION CATEGORY: DEPENDENT RESURVEY
CLASS OF ACCURACY: A-2, T-2

JOHN L. HEAGLE   L.S. # 9396

I HAVE REVIEWED THE WETLAND BOUNDARIES AS SHOWN ON THIS PLAN AND AM OF THE OPINION THAT THEY REPRESENT THE SOIL BOUNDARIES MARKED BY ME IN THE FIELD.

MARK W. FRIEND
SOIL SCIENTIST

THIS MAP IS NOT VALID IF MODIFIED IN ANY WAY AND/OR DOES NOT BEAR THE EMBOSSED SEAL OF THE UNDERSIGNED.

I HEREBY DECLARE TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS PLAN IS SUBSTANTIALLY CORRECT.

MARK W. FRIEND   P.E. #15818

MEGSON, HEAGLE & FRIEND
CIVIL ENGINEERS & LAND SURVEYORS, LLC
81 RANKIN ROAD
GLASTONBURY, CONN. 06033
PHONE (860)-659-0587

DRAINAGE AREA MAP

SITE PLAN/EROSION & SEDIMENTATION CONTROL PLAN
#259 & #233 EASTERN BOULEVARD
PREPARED FOR
CENTRAL ROCK GYM
GLASTONBURY, CONN.

CK. BY:	MWF
DRW. BY:	PEJ
DATE:	2-20-20
SCALE:	1"=20'
SHEET	1 OF 2
MAP NO.	85-19-1SP