

STORMWATER MANAGEMENT REPORT

THE ELEFThERIA

No. 241 South Allen Street

**CITY OF ALBANY
ALBANY COUNTY, N.Y.**

Applicant:
241 South Allen St. Housing, LLC

Prepared by:



HERSHBERG & HERSHBERG

CONSULTING ENGINEERS

18 Locust Street

Albany, N.Y. 12203-2908

(518) 459-3096 – Phone

(518) 459-5683 – Fax

hhershberg@aol.com

June 10, 2014

Revised July 11, 2014

INTRODUCTION

Hershberg & Hershberg, Consulting Engineers and Land Surveyors, were retained by the applicant, 241 South Allen St. Housing, LLC , to provide land planning and site/civil engineering services in connection with the construction of 48 units of apartments at No. 241 South Allen Street. Site plan approval will be required from the Planning Board which includes the review of storm drainage. This storm water management report provides details for the consideration of the proposed drainage system. This system is proposed to conform to the intent of the *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarsfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District.*

DESCRIPTION OF INTENDED SITE DEVELOPMENT AND USE

This parcel is located within the R-3A (multi-family low density zoning district). The applicant proposes to construct two (2) apartment building each three (3) stories in height and each containing twenty-four (24) units of apartments. Included is parking in the basement level for thirty (30) cars in each building. Also provided are twenty four (24) surface parking spaces, an access drive, a dumpster enclosure, landscaping walks and the on-site storm water management facilities which consist of large diameter pipe storage galleries. The off-site mitigation will also rely on large diameter pipe storage with a potential of utilizing ground water recharge from this system if infiltration level permits.

DESCRIPTION OF EXISTING DRAINAGE SYSTEM:

Currently all stormwater which falls on the project site at 241 South Allen Street is retained in a bowl at the base of a slope. It is retained there and with very minimal recharge to the groundwater possible due to subsurface soil conditions. Through the effects of transpiration and evaporation, the drainage pool in this site eventually is eliminated although a portion does remain as an isolated wetland not subject to United States Army Corps of Engineers jurisdiction. The off-site mitigation area at the intersection of Winnie Street and Cliff Street drains to four catch basins which are connected to a manhole on a 42" sub trunk combined sewer. Drainage from this intersections for intense storms is limited by pipe capacity of the 42" sub trunk combined sewer such that ponding occurs and the intersection drains after pipe capacity becomes available.

PROPOSED DRAINAGE

This project will result in an increase in the impervious area as computed under *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarsfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District* since the buildings and parking areas will occupy areas which must be modeled as green space. The *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarsfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District* includes the following statement:

All actions covered by these regulations must provide for the detention of storm water in such a manner that the peak flow discharge of storm water from the improved area is limited to

the peak flow discharge from this area in its pre- development state.

This has always been interpreted that the hydrologic model is constructed for the site in its completely undeveloped state and then the discharge is set to control the discharge for that developed area to the pre-developed computed discharge regardless the drainage reach to which that discharge was tributary. The Pre-Tributary Area Maps and Post Tributary Area Maps are attached in Appendix 2.

The stormwater model of this area in its totally undeveloped condition is attached as Appendix 3 and this shows a pre-developed discharge of 7.56 CFS. The stormwater model in the developed condition is attached as Appendix 3. In order to correct for the unusual condition, the discharge to the 48" combined sub trunk sewer on the north side of North Allen Street is held to 1.85 CFS which is less than 25% of the computed Pre-Developed discharge of 7.56 CFS. This is 1.2% of the flowing full capacity of the 48" sewer (154 CFS, with grade of 1.15% and $n = 0.013$).

In order to verify the impact of the 100 year storm on the site, the HydroCAD Post-model was run for the 100 year storm. During a 100 year storm a small shallow pond will be created on the parking lot to the rear of the northern proposed building. This would result in a pond with a peak elevation of 207.19. The maximum depth would be 0.69 feet. This would cause minor flooding in 6 parking spaces and would be 0.31 feet below the lowest garage floor grade. The discharge to the 48" combined sub trunk sewer on the north side of North Allen Street is held to 2.10 CFS which is 1.36% of the flowing full capacity of the 48" sewer (154 CFS, with grade of 1.15% and $n = 0.013$). The storage system is protected by a flap valve at

the discharge point into the 48" combined sub trunk sewer which will be surcharged during a period immediately following the storm.

In order to bring this site into strict compliance with comply with *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarsfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District*, the Applicant proposes to intercept drainage from 2 catch basins on the west side of the intersection of Winnie Street and Cliff Street which are directly tributary to a 42" combined sub trunk sewer which connects to the manhole over the 48" combined sub trunk sewer at North Allen Street. In order to constrain the flows so that no greater amount is tributary to the combined sub trunk sewer for the 10 year storm, the Applicant proposes to connect the 2 catch basins to a 72" diameter manhole and two lengths of 48" pipe extending 22 feet along Winnie Street North of the intersection and extending 22 feet along Cliff Street west of the intersection. The storage in this will be discharged through a 3.4" orifice. This controls the outfall from a 10 year storm to 0.72 CFS as compared to the existing outflow to the 42" combined sub trunk sewer 3.21 CFS. Thereby the reduction in flow is 2.49 CFS which exceeds the 10 year outflow from the project area of 1.85 CFS and actually exceeds the outflow from the project area for the 100 year storm of 2.10 CFS. The table below demonstrates how this design meets the requirements of *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarsfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District*.

Drainage Location	Pre-Development 10 Year Outflow (CFS)	Post-Development 10 Year Outflow (CFS)
241 South Allen Street	0.00	1.85
Winnie & Cliff Streets	3.21	0.72
NET FLOW IMPACTS	3.21	2.57

10 Year Storm Flow Comparison

In order to utilize “Green Infrastructure” methods to the maximum extent possible, the Applicant has commissioned infiltration tests which conform to Appendix D of The New York State Stormwater Management Design Manual at intersection. If any infiltration in excess of 0.5 inches per hour is discovered at the grades of the proposed piping, the 48” pipe will be changed to perforated pipe and an envelope of recharge stone will be placed around the pipe. This will allow the discharge to be at least partially recharged to the groundwater and would reduce the post development flow from this intersection.

FLOOD PLAIN

The entire site lies within Zone C (Area of Minimal Flooding) Flood Insurance Rate Map dated April 15, 1980.

SEDIMENTATION AND EROSION CONTROL DURING CONSTRUCTION

- ✓ Install sedimentation fence or other approved method to protect all areas downstream from the construction area where required.
- ✓ Utilize proposed curb cuts from Morris Street and Dana Avenue as the stabilized construction entrances.

- ✓ The existing pavement must be kept swept clean to avoid tracking materials onto any streets.
- ✓ Maintain this area clean of debris.
- ✓ Any construction materials, chemicals or construction debris must be stored in sealed receptacles, trailers or buildings. Any storage piles of materials meant for installation (i.e., sand, etc.) must be surrounded by sedimentation fence. The list of anticipated materials stored on site during construction is provided below and must be updated if any additional materials are utilized:
 - Building Materials
 - Concrete Structures
 - Pipes
 - Pipe Solvents
- ✓ Construct Buildings
- ✓ Install pavement subgrade and topsoil in required areas.
- ✓ Any chemical spills must be contained immediately on site and reported to NYSDEC.
- ✓ Oil and grease spills from equipment shall be treated immediately.
- ✓ Install new pipe connections and storage galleries.
- ✓ Complete pavements and topsoiled areas.
- ✓ Complete buildings.
- ✓ Remove all sedimentation controls.

MAINTENANCE OF STORMWATER MANAGEMENT FACILITIES

The maintenance of the storm water storage system and the connection to the sewer will be the responsibility of the Owner. A draft of a maintenance agreement is contained in Appendix 5.

CONCLUSION:

The drainage from the roof of the proposed buildings, green areas and the pavement areas will be stored in a subsurface pipe storage galleries. In addition off-site mitigation is proposed at the intersection of Cliff Street and Winnie Street. Utilizing the flow from the project site with the off-site mitigation, this system conforms to the intent of the *Interim Regulations for the issuance of building permits within the Beaver Creek Sewer District, Klarfeld Sanitary Sewer District and the Krum Kill Sanitary Sewer District*. If a storm that exceeds the 10 year storm occurs, storm water will accumulate on the surface of the parking lot or within the intersection of Cliff Street and Winnie Street, a condition that exists under existing conditions. It is the engineer's conclusion that this project can be completed with no adverse impact on any drainage facilities or watercourses



Prepared by:

A handwritten signature in black ink, appearing to read "D. Hershberg", written over a horizontal line.

HERSHBERG & HERSHBERG

Daniel R. Hershberg, P.E. & L.S.

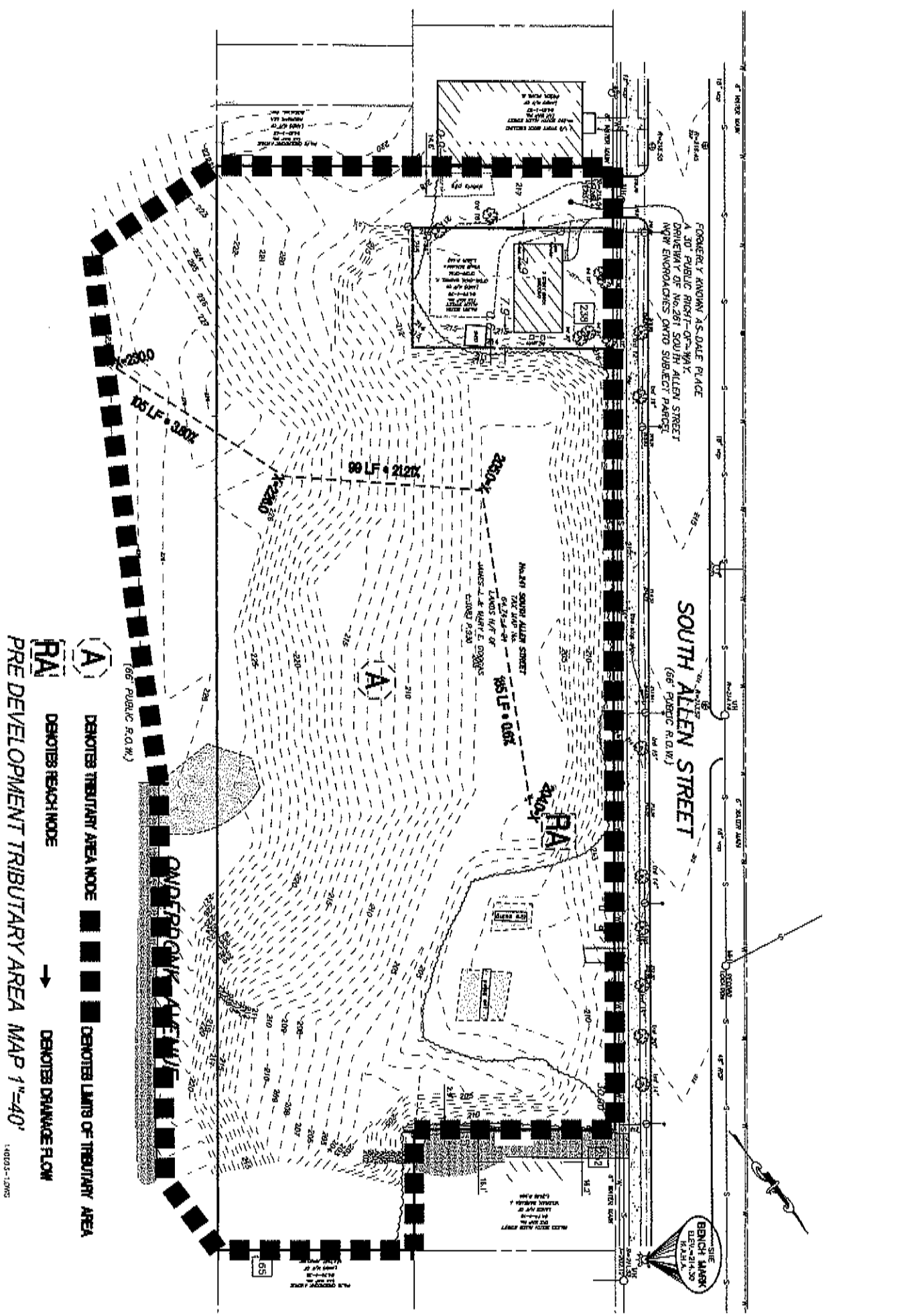
file/docs/swppp/SWMR20130302REV71114.doc

Appendix 1

VICINITY MAP

Appendix 2

PRE & POST TRIBUTARY AREA MAPS



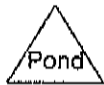
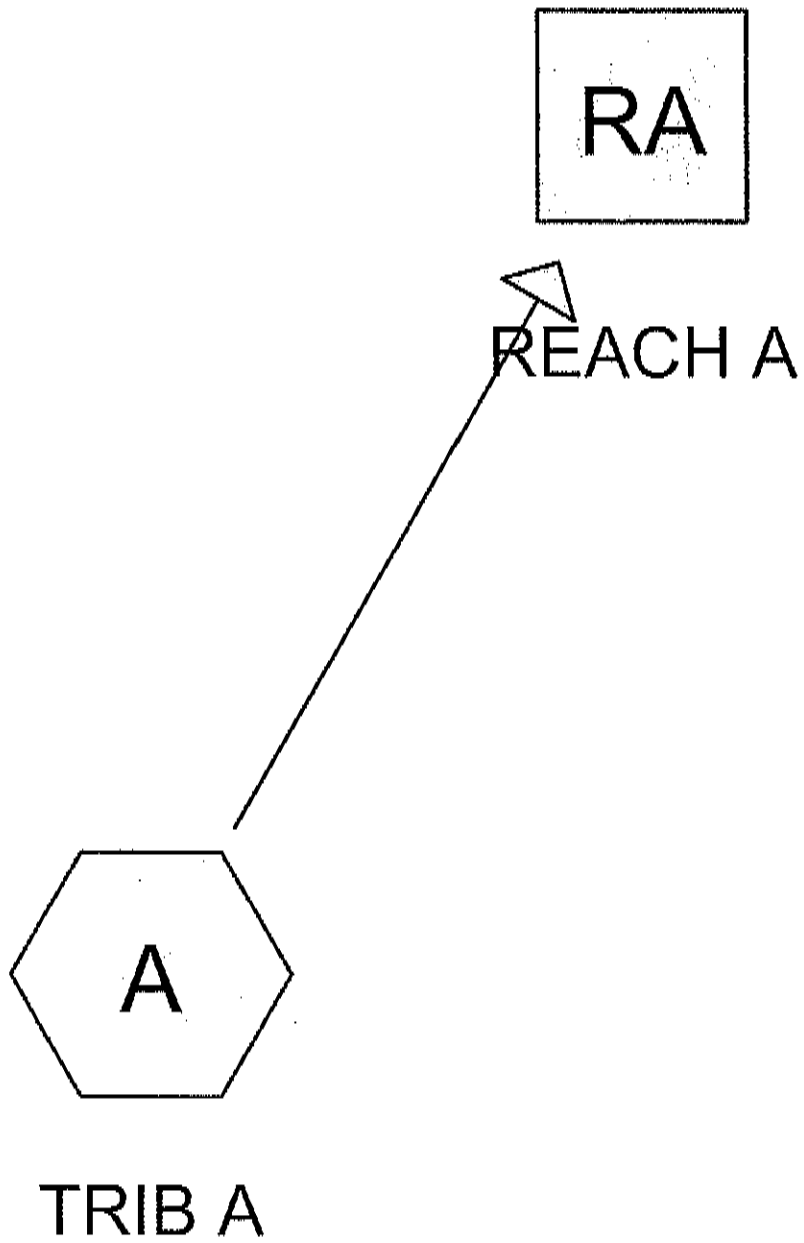
(A) DENOTES TRIBUTARY AREA NODE
RA DENOTES RESEARCH NODE
→ DENOTES DRAINAGE FLOW
■ DENOTES LIMITS OF TRIBUTARY AREA

PRE DEVELOPMENT TRIBUTARY AREA MAP 1"=40'

1-10103-1-10MS

Appendix 3

**241 SOUTH ALLEN STREET
2012 HYDROCAD® COMPUTATIONS
PRE AND POST DEVELOPMENT**



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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.762	79	50-75% Grass cover, Fair, HSG C (A)
2.762	79	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.762	HSG C	A
0.000	HSG D	
0.000	Other	
2.762		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	2.762	0.000	0.000	2.762	50-75% Grass cover, Fair	A
0.000	0.000	2.762	0.000	0.000	2.762	TOTAL AREA	

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Type II 24-hr 1 year Rainfall=2.20"

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Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment A: TRIB A

Runoff Area=120,315 sf 0.00% Impervious Runoff Depth=0.64"

Flow Length=369' Tc=15.1 min CN=79 Runoff=2.08 cfs 0.148 af

Reach RA: REACH A

Inflow=2.08 cfs 0.148 af

Outflow=2.08 cfs 0.148 af

Total Runoff Area = 2.762 ac Runoff Volume = 0.148 af Average Runoff Depth = 0.64"

100.00% Pervious = 2.762 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: TRIB A

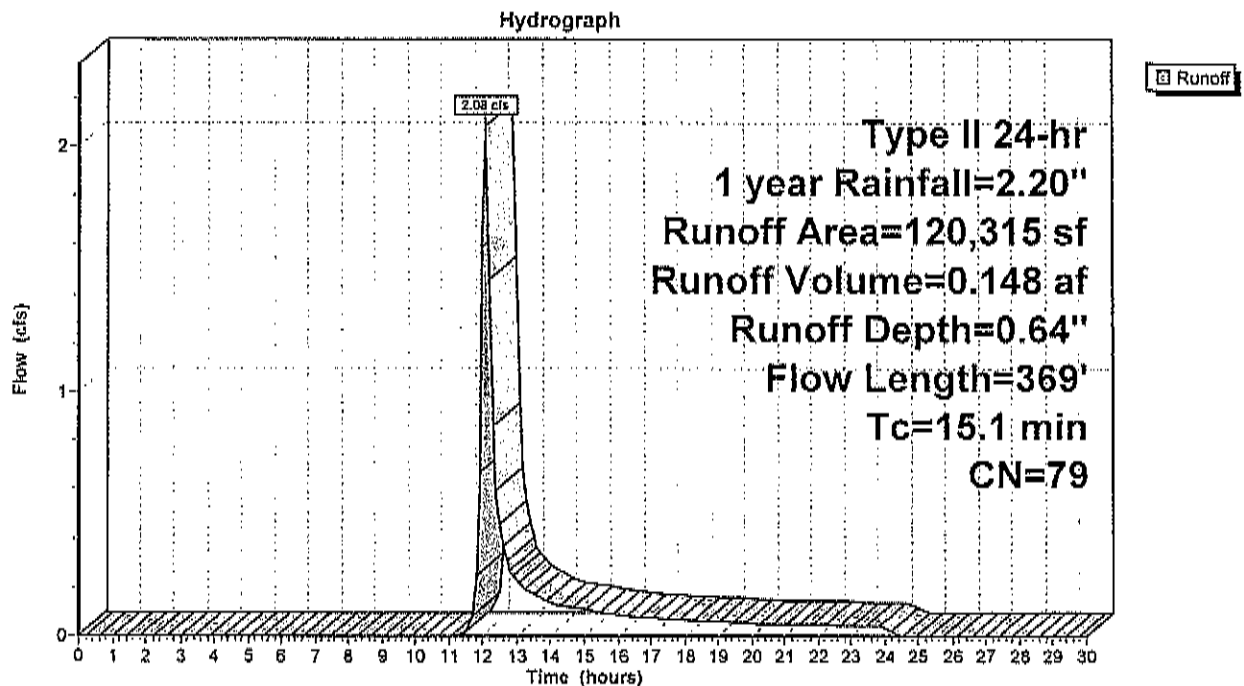
Runoff = 2.08 cfs @ 12.09 hrs, Volume= 0.148 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 1 year Rainfall=2.20"

Area (sf)	CN	Description
120,315	79	50-75% Grass cover, Fair, HSG C
120,315		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	105	0.0380	0.14		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.2	99	0.2121	7.41		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
2.2	165	0.0060	1.25		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
15.1	369	Total			

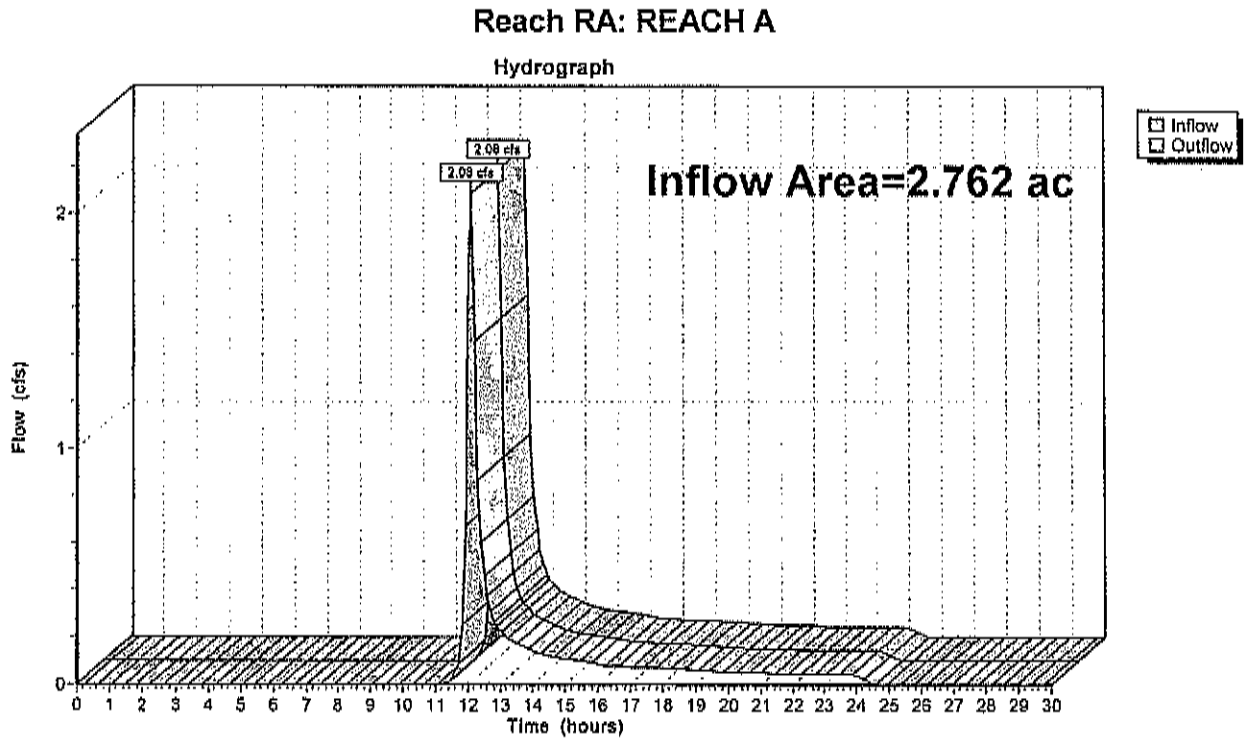
Subcatchment A: TRIB A



Summary for Reach RA: REACH A

Inflow Area = 2.762 ac, 0.00% Impervious, Inflow Depth = 0.64" for 1 year event
Inflow = 2.08 cfs @ 12.09 hrs, Volume= 0.148 af
Outflow = 2.08 cfs @ 12.09 hrs, Volume= 0.148 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs



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Type II 24-hr 10 year Rainfall=4.30"

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Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment A: TRIB A

Runoff Area=120,315 sf 0.00% Impervious Runoff Depth=2.21"
Flow Length=369' Tc=15.1 min CN=79 Runoff=7.56 cfs 0.509 af

Reach RA: REACH A

Inflow=7.56 cfs 0.509 af
Outflow=7.56 cfs 0.509 af

Total Runoff Area = 2.762 ac Runoff Volume = 0.509 af Average Runoff Depth = 2.21"
100.00% Pervious = 2.762 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: TRIB A

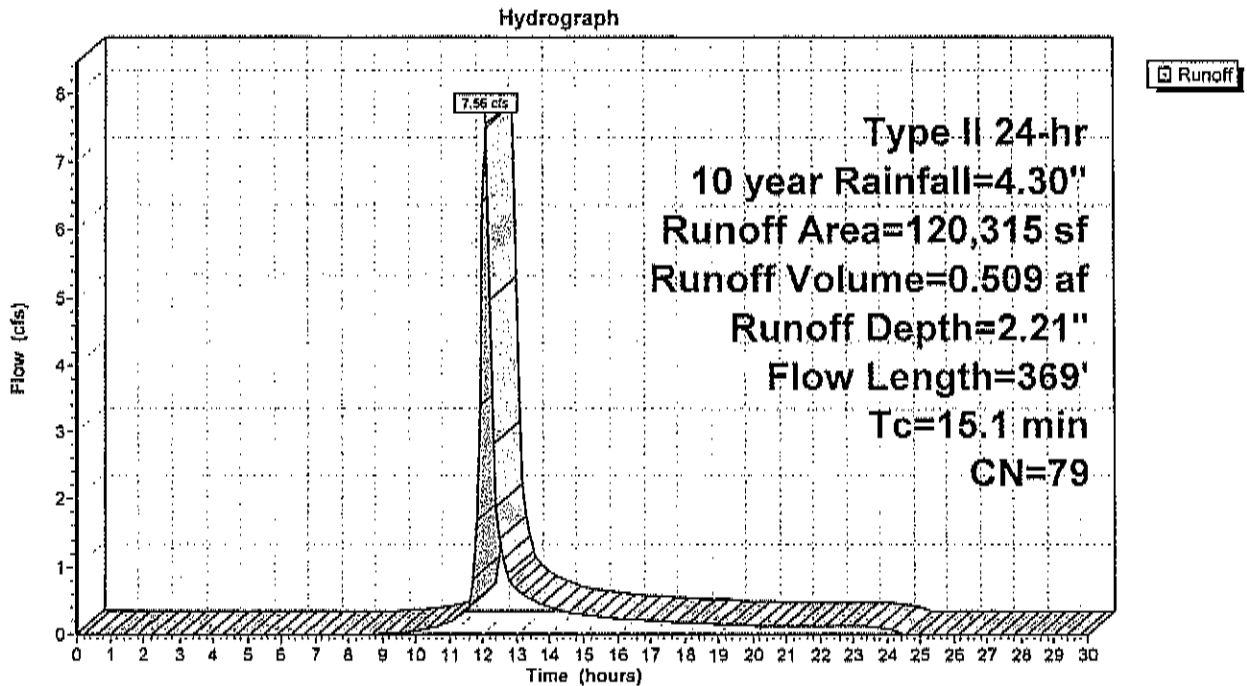
Runoff = 7.56 cfs @ 12.08 hrs, Volume= 0.509 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
120,315	79	50-75% Grass cover, Fair, HSG C
120,315		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	105	0.0380	0.14		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.2	99	0.2121	7.41		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
2.2	165	0.0060	1.25		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
15.1	369	Total			

Subcatchment A: TRIB A



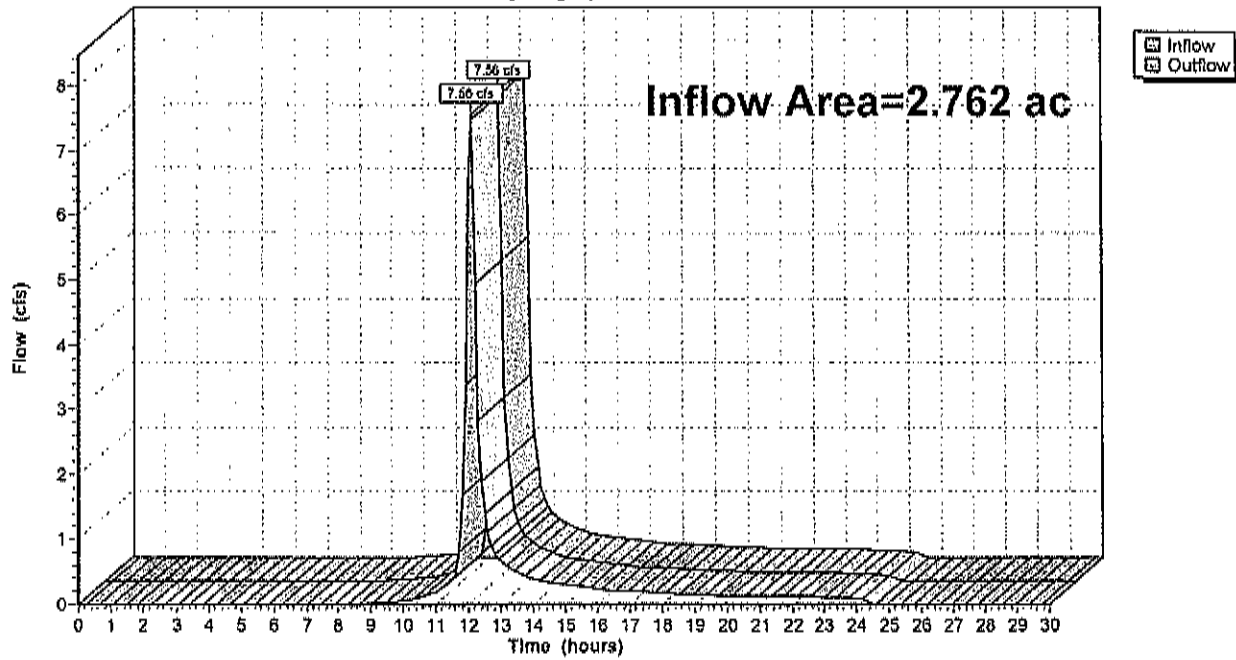
Summary for Reach RA: REACH A

Inflow Area = 2.762 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10 year event
Inflow = 7.56 cfs @ 12.08 hrs, Volume= 0.509 af
Outflow = 7.56 cfs @ 12.08 hrs, Volume= 0.509 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs

Reach RA: REACH A

Hydrograph



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PRE
Type II 24-hr 100 year Rainfall=6.00"

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Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment A: TRIB A

Runoff Area=120,315 sf 0.00% Impervious Runoff Depth=3.68"
Flow Length=369' Tc=15.1 min CN=79 Runoff=12.51 cfs 0.847 af

Reach RA: REACH A

Inflow=12.51 cfs 0.847 af
Outflow=12.51 cfs 0.847 af

Total Runoff Area = 2.762 ac Runoff Volume = 0.847 af Average Runoff Depth = 3.68"
100.00% Pervious = 2.762 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: TRIB A

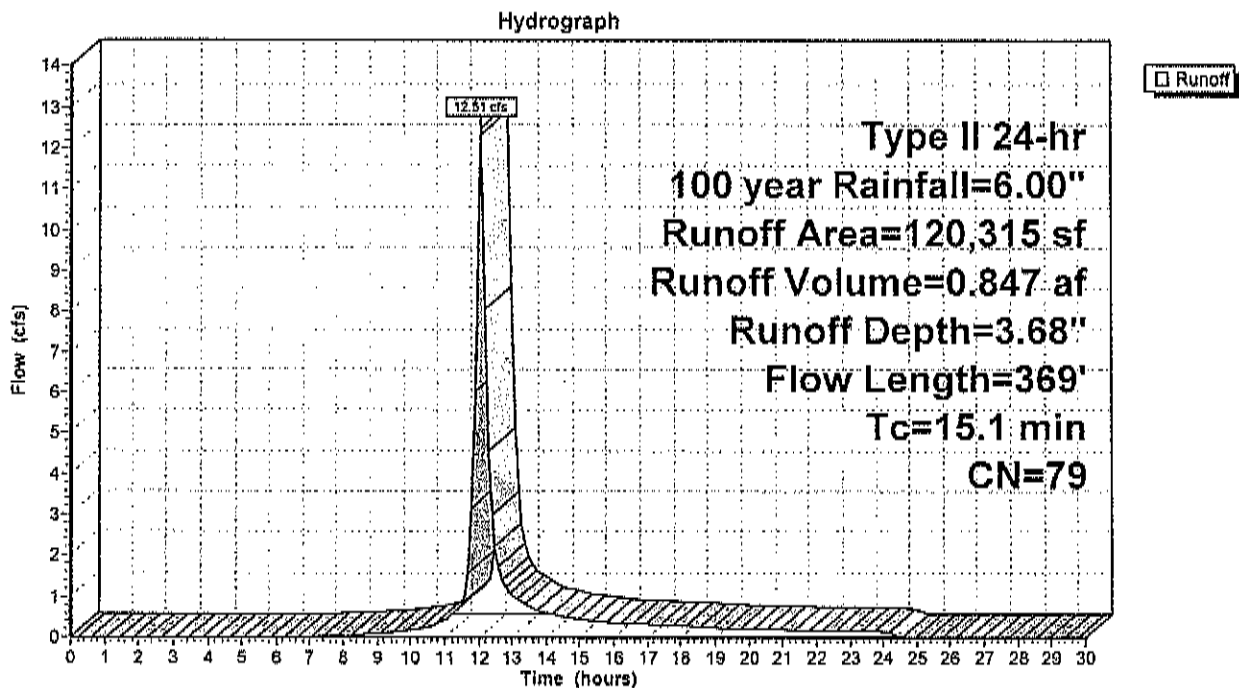
Runoff = 12.51 cfs @ 12.08 hrs, Volume= 0.847 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type II 24-hr 100 year Rainfall=6.00"

Area (sf)	CN	Description
120,315	79	50-75% Grass cover, Fair, HSG C
120,315		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	105	0.0380	0.14		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.2	99	0.2121	7.41		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
2.2	165	0.0060	1.25		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
15.1	369	Total			

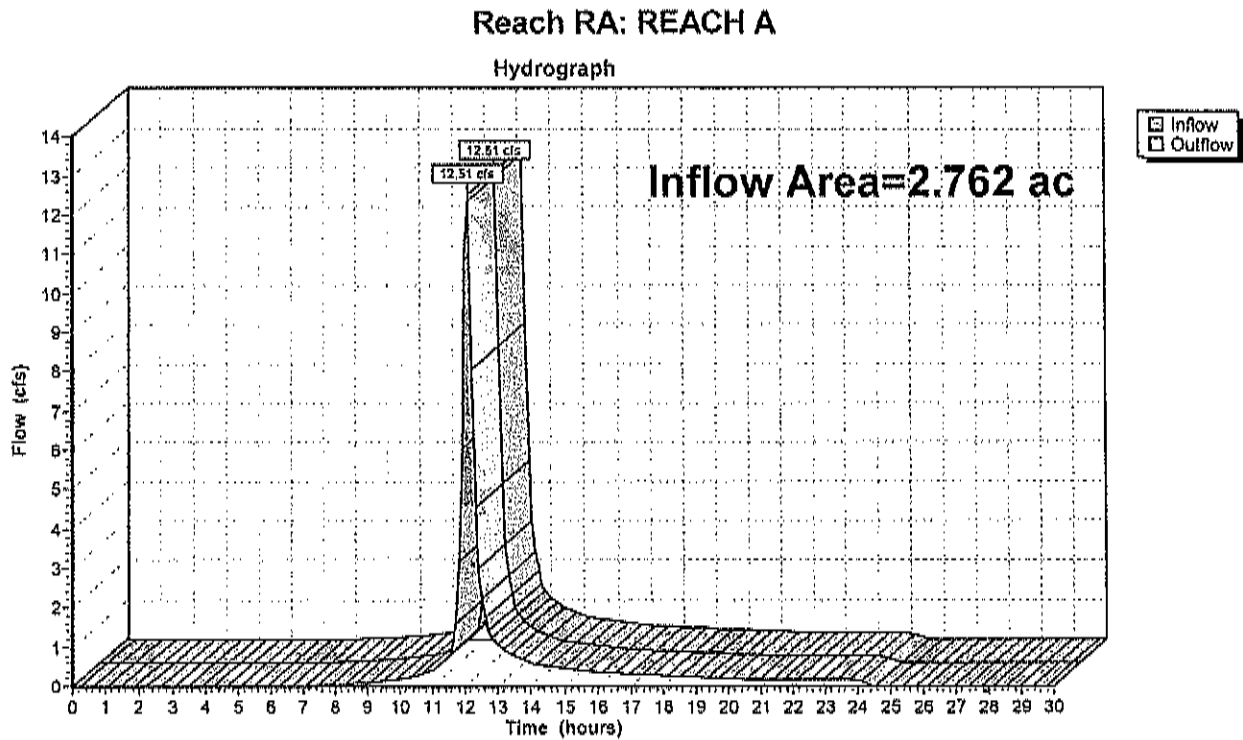
Subcatchment A: TRIB A

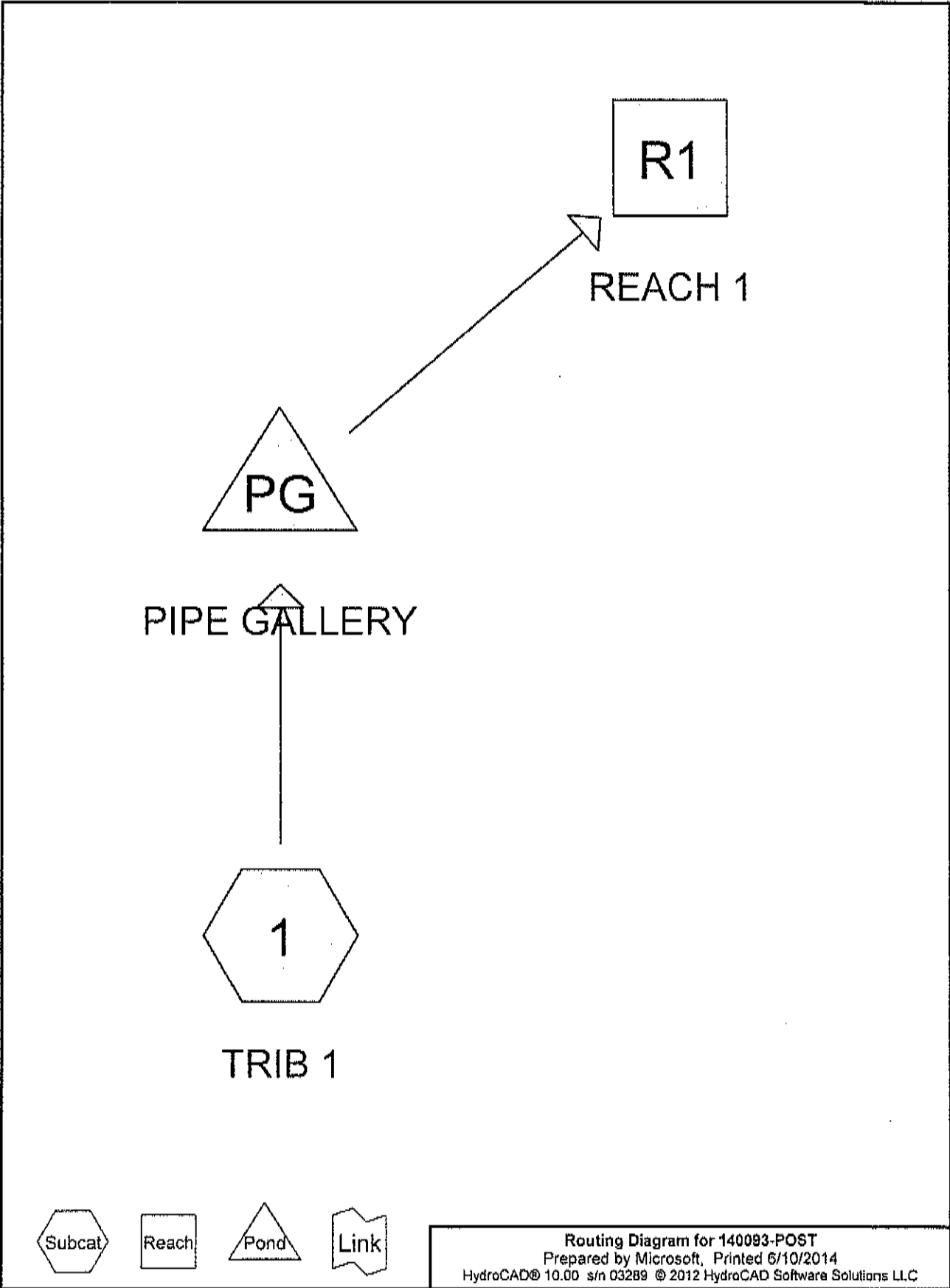


Summary for Reach RA: REACH A

Inflow Area = 2.762 ac, 0.00% Impervious, Inflow Depth = 3.68" for 100 year event
Inflow = 12.51 cfs @ 12.08 hrs, Volume= 0.847 af
Outflow = 12.51 cfs @ 12.08 hrs, Volume= 0.847 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs





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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.759	79	50-75% Grass cover, Fair, HSG C (1)
0.500	98	Building, HSG C (1)
0.503	98	Paved parking, HSG C (1)
2.762	86	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.762	HSG C	1
0.000	HSG D	
0.000	Other	
2.762		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	1.759	0.000	0.000	1.759	50-75% Grass cover, Fair	1
0.000	0.000	0.500	0.000	0.000	0.500	Building	1
0.000	0.000	0.503	0.000	0.000	0.503	Paved parking	1
0.000	0.000	2.762	0.000	0.000	2.762	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	1	0.00	0.00	91.0	0.0040	0.013	42.0	0.0	0.0
2	1	0.00	0.00	110.0	0.0040	0.013	48.0	0.0	0.0
3	1	0.00	0.00	113.0	0.0159	0.013	48.0	0.0	0.0

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Type II 24-hr 1 year Rainfall=2.20"

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Page 6

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1: TRIB 1

Runoff Area=120,315 sf 36.32% Impervious Runoff Depth=1.00"
Flow Length=451' Tc=7.6 min CN=86 Runoff=4.40 cfs 0.231 af

Reach R1: REACH 1

Inflow=1.09 cfs 0.226 af
Outflow=1.09 cfs 0.226 af

Pond PG: PIPE GALLERY

Peak Elev=203.58' Storage=3,331 cf Inflow=4.40 cfs 0.231 af
Primary=1.09 cfs 0.226 af Secondary=0.00 cfs 0.000 af Outflow=1.09 cfs 0.226 af

Total Runoff Area = 2.762 ac Runoff Volume = 0.231 af Average Runoff Depth = 1.00"
63.68% Pervious = 1.759 ac 36.32% Impervious = 1.003 ac

Summary for Subcatchment 1: TRIB 1

Runoff = 4.40 cfs @ 11.99 hrs, Volume= 0.231 af, Depth= 1.00"

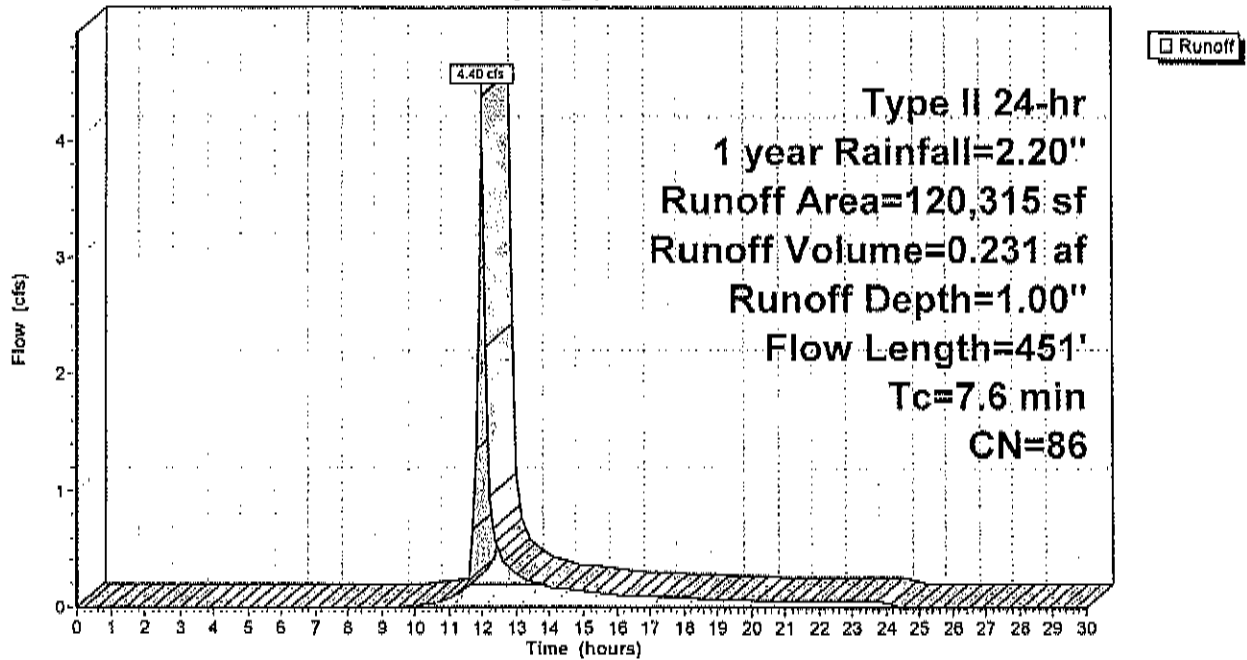
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (sf)	CN	Description
76,613	79	50-75% Grass cover, Fair, HSG C
21,907	98	Paved parking, HSG C
* 21,795	98	Building, HSG C
120,315	86	Weighted Average
76,613		63.68% Pervious Area
43,702		36.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	48	0.0416	0.12		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.1	40	0.3250	9.18		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
0.3	49	0.0255	3.24		Shallow Concentrated Flow, Asphalt Paved Kv= 20.3 fps
0.2	91	0.0040	6.61	63.63	Pipe Channel, 42 HDPE 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013 Corrugated PE, smooth interior
0.3	110	0.0040	7.23	90.85	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
0.1	113	0.0159	14.41	181.13	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
7.6	451	Total			

Subcatchment 1: TRIB 1

Hydrograph



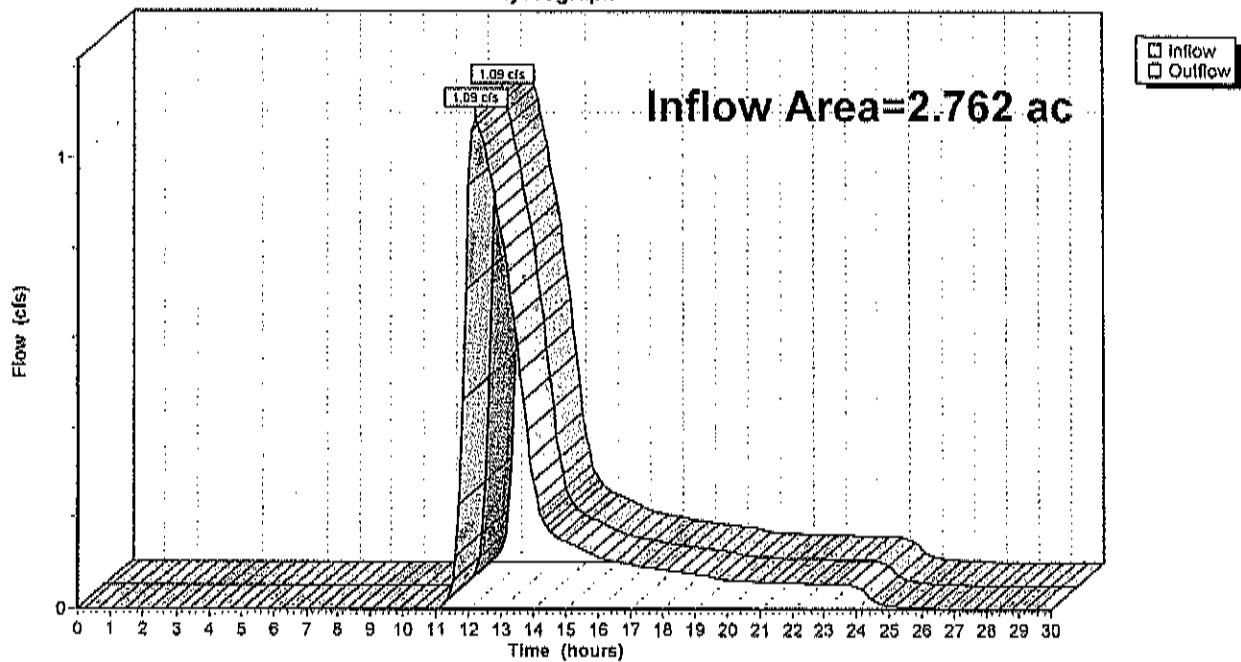
Summary for Reach R1: REACH 1

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth > 0.98" for 1 year event
Inflow = 1.09 cfs @ 12.22 hrs, Volume= 0.226 af
Outflow = 1.09 cfs @ 12.22 hrs, Volume= 0.226 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs

Reach R1: REACH 1

Hydrograph



Summary for Pond PG: PIPE GALLERY

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth = 1.00" for 1 year event
 Inflow = 4.40 cfs @ 11.99 hrs, Volume= 0.231 af
 Outflow = 1.09 cfs @ 12.22 hrs, Volume= 0.226 af, Atten= 75%, Lag= 13.5 min
 Primary = 1.09 cfs @ 12.22 hrs, Volume= 0.226 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Peak Elev= 203.58' @ 12.22 hrs Surf.Area= 3,196 sf Storage= 3,331 cf

Plug-Flow detention time= 49.2 min calculated for 0.225 af (97% of inflow)
 Center-of-Mass det. time= 36.2 min (874.4 - 838.2)

Volume	Invert	Avail.Storage	Storage Description
#1	201.48'	7,125 cf	48.0" D x 567.0'L 48" HDPE Pipe Storage S= 0.0040 '/'
#2	201.50'	3,771 cf	42.0" D x 392.0'L 42" HDPE Pipe Storage S= 0.0040 '/'
#3	201.41'	430 cf	CB#2 (Prismatic) Listed below (Recalc)
#4	201.37'	431 cf	CB#3 (Prismatic) Listed below (Recalc)
#5	201.48'	289 cf	CB#5 (Prismatic) Listed below (Recalc)
#6	201.45'	240 cf	CB#6 (Prismatic) Listed below (Recalc)
#7	201.49'	175 cf	CB#7 (Prismatic) Listed below (Recalc)
#8	206.50'	2,663 cf	PARKING AREA (Prismatic) Listed below (Recalc)
		15,124 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.41	50	0	0
210.00	50	430	430

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.37	50	0	0
210.00	50	431	431

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.48	50	0	0
207.25	50	289	289

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.45	50	0	0
206.25	50	240	240

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.49	50	0	0
205.00	50	175	175

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Type II 24-hr 1 year Rainfall=2.20"

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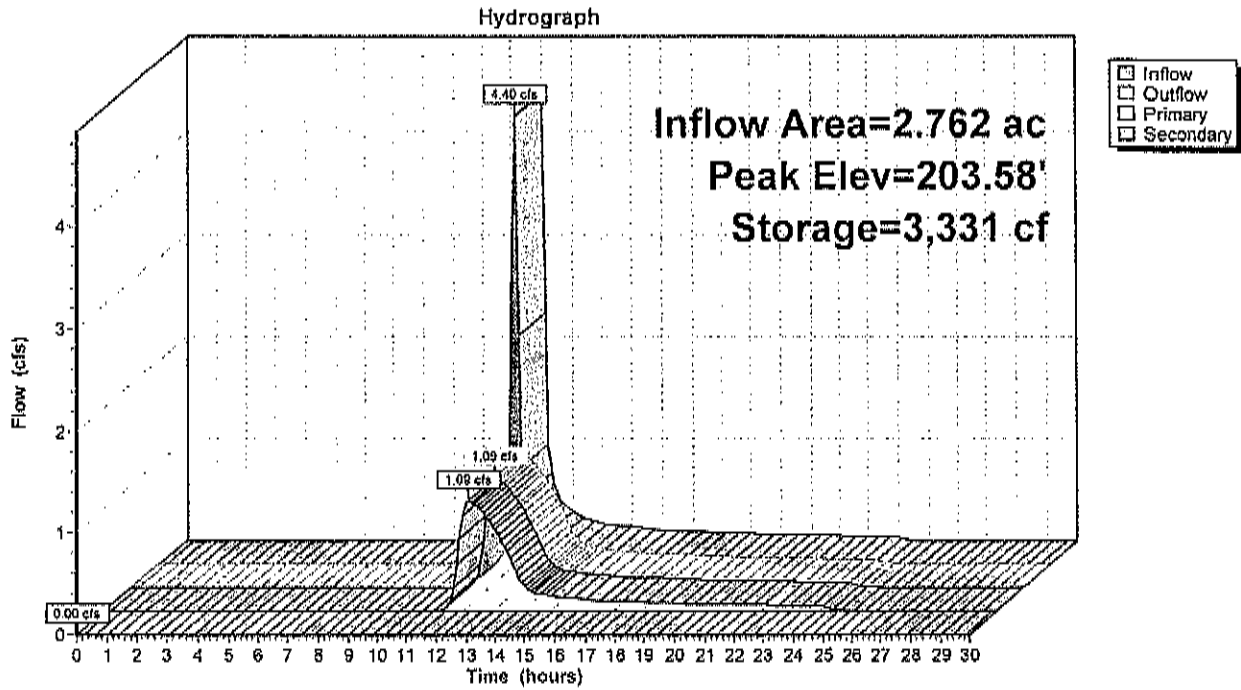
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.50	0	0	0
207.00	3,448	862	862
207.40	5,556	1,801	2,663

Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	6.0" Vert. 6" Orifice C= 0.600
#2	Secondary	206.50'	30.0" Horiz. CB#7 30" Grate X 0.80 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.09 cfs @ 12.22 hrs HW=203.58' (Free Discharge)
 ↳1=6" Orifice (Orifice Controls 1.09 cfs @ 5.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=201.37' (Free Discharge)
 ↳2=CB#7 30" Grate (Controls 0.00 cfs)

Pond PG: PIPE GALLERY



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Type II 24-hr 10 year Rainfall=4.30"

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Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1: TRIB 1

Runoff Area=120,315 sf 36.32% Impervious Runoff Depth=2.82"
Flow Length=451' Tc=7.6 min CN=86 Runoff=12.05 cfs 0.649 af

Reach R1: REACH 1

Inflow=1.85 cfs 0.644 af
Outflow=1.85 cfs 0.644 af

Pond PG: PIPE GALLERY

Peak Elev=206.06' Storage=11,069 cf Inflow=12.05 cfs 0.649 af
Primary=1.85 cfs 0.644 af Secondary=0.00 cfs 0.000 af Outflow=1.85 cfs 0.644 af

Total Runoff Area = 2.762 ac Runoff Volume = 0.649 af Average Runoff Depth = 2.82"
63.68% Pervious = 1.759 ac 36.32% Impervious = 1.003 ac

Summary for Subcatchment 1: TRIB 1

Runoff = 12.05 cfs @ 11.99 hrs, Volume= 0.649 af, Depth= 2.82"

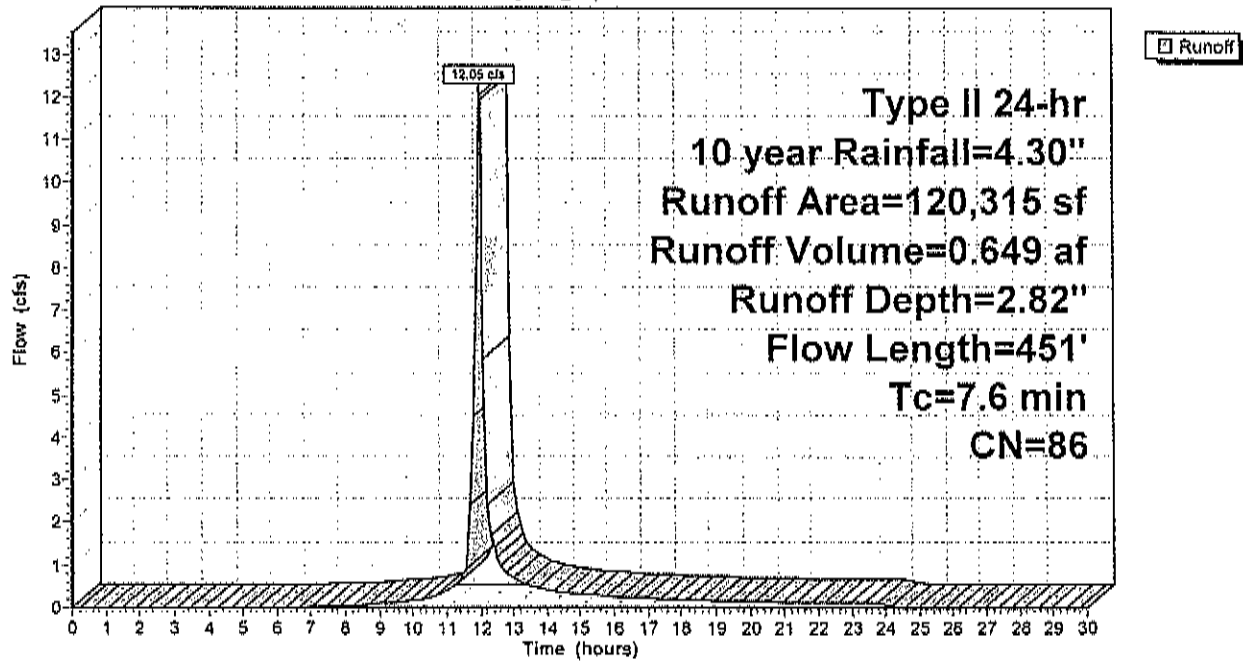
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
76,613	79	50-75% Grass cover, Fair, HSG C
21,907	98	Paved parking, HSG C
* 21,795	98	Building, HSG C
120,315	86	Weighted Average
76,613		63.68% Pervious Area
43,702		36.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	48	0.0416	0.12		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.1	40	0.3250	9.18		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
0.3	49	0.0255	3.24		Shallow Concentrated Flow, Asphalt Paved Kv= 20.3 fps
0.2	91	0.0040	6.61	63.63	Pipe Channel, 42 HDPE 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013 Corrugated PE, smooth interior
0.3	110	0.0040	7.23	90.85	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
0.1	113	0.0159	14.41	181.13	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
7.6	451	Total			

Subcatchment 1: TRIB 1

Hydrograph



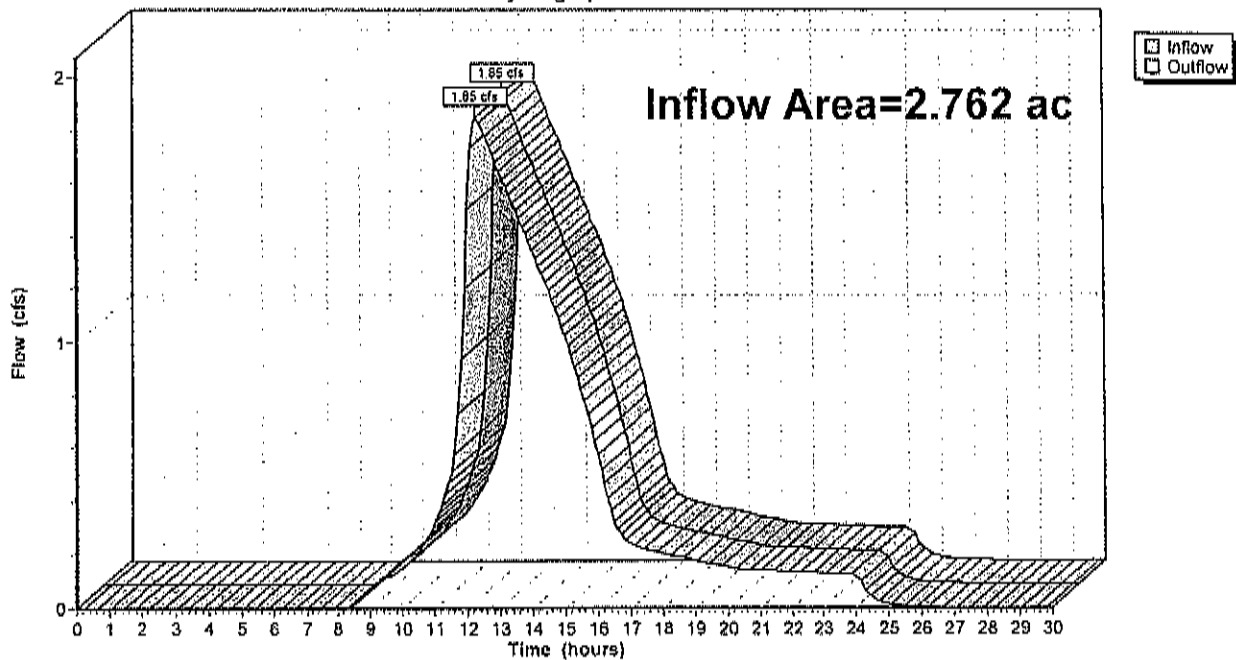
Summary for Reach R1: REACH 1

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth = 2.80" for 10 year event
Inflow = 1.85 cfs @ 12.30 hrs, Volume= 0.644 af
Outflow = 1.85 cfs @ 12.30 hrs, Volume= 0.644 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs

Reach R1: REACH 1

Hydrograph



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 Type II 24-hr 10 year Rainfall=4.30"
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Summary for Pond PG: PIPE GALLERY

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth = 2.82" for 10 year event
 Inflow = 12.05 cfs @ 11.99 hrs, Volume= 0.649 af
 Outflow = 1.85 cfs @ 12.30 hrs, Volume= 0.644 af, Atten= 85%, Lag= 18.6 min
 Primary = 1.85 cfs @ 12.30 hrs, Volume= 0.644 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Peak Elev= 206.06' @ 12.30 hrs Surf.Area= 1,720 sf Storage= 11,069 cf

Plug-Flow detention time= 65.0 min calculated for 0.641 af (99% of inflow)
 Center-of-Mass det. time= 60.2 min (868.9 - 808.7)

Volume	Invert	Avail.Storage	Storage Description
#1	201.48'	7,125 cf	48.0" D x 567.0'L 48" HDPE Pipe Storage S= 0.0040 '/
#2	201.50'	3,771 cf	42.0" D x 392.0'L 42" HDPE Pipe Storage S= 0.0040 '/
#3	201.41'	430 cf	CB#2 (Prismatic) Listed below (Recalc)
#4	201.37'	431 cf	CB#3 (Prismatic) Listed below (Recalc)
#5	201.48'	289 cf	CB#5 (Prismatic) Listed below (Recalc)
#6	201.45'	240 cf	CB#6 (Prismatic) Listed below (Recalc)
#7	201.49'	175 cf	CB#7 (Prismatic) Listed below (Recalc)
#8	206.50'	2,663 cf	PARKING AREA (Prismatic) Listed below (Recalc)
		15,124 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.41	50	0	0
210.00	50	430	430

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.37	50	0	0
210.00	50	431	431

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.48	50	0	0
207.25	50	289	289

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.45	50	0	0
206.25	50	240	240

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.49	50	0	0
205.00	50	175	175

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Type II 24-hr 10 year Rainfall=4.30"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.50	0	0	0
207.00	3,448	862	862
207.40	5,556	1,801	2,663

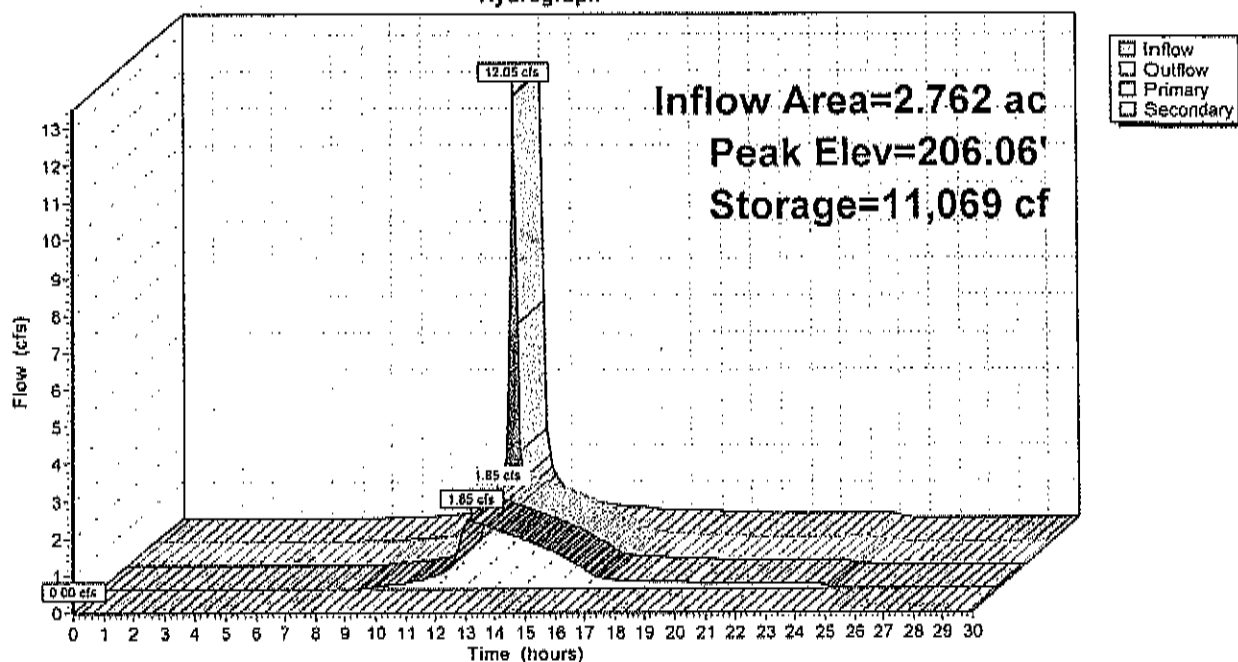
Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	6.0" Vert. 6" Orifice C= 0.600
#2	Secondary	206.50'	30.0" Horiz. CB#7 30" Grate X 0.80 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.85 cfs @ 12.30 hrs HW=206.06' (Free Discharge)
 ↳ 1=6" Orifice (Orifice Controls 1.85 cfs @ 9.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=201.37' (Free Discharge)
 ↳ 2=CB#7 30" Grate (Controls 0.00 cfs)

Pond PG: PIPE GALLERY

Hydrograph



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Type II 24-hr 100 year Rainfall=6.00"

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Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1: TRIB 1

Runoff Area=120,315 sf 36.32% Impervious Runoff Depth=4.41"
Flow Length=451' Tc=7.6 min CN=86 Runoff=18.42 cfs 1.015 af

Reach R1: REACH 1

Inflow=13.62 cfs 1.010 af
Outflow=13.62 cfs 1.010 af

Pond PG: PIPE GALLERY

Peak Elev=207.18' Storage=13,683 cf Inflow=18.42 cfs 1.015 af
Primary=2.10 cfs 0.850 af Secondary=11.52 cfs 0.159 af Outflow=13.62 cfs 1.010 af

Total Runoff Area = 2.762 ac Runoff Volume = 1.015 af Average Runoff Depth = 4.41"
63.68% Pervious = 1.759 ac 36.32% Impervious = 1.003 ac

Summary for Subcatchment 1: TRIB 1

Runoff = 18.42 cfs @ 11.98 hrs, Volume= 1.015 af, Depth= 4.41"

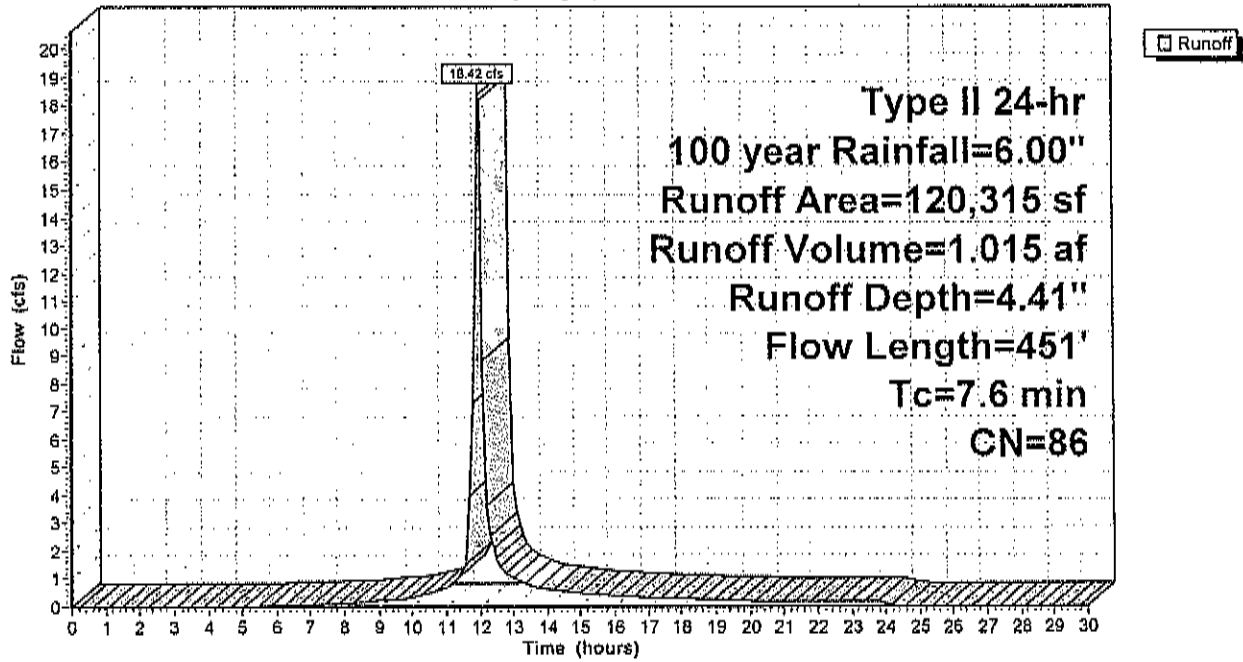
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 100 year Rainfall=6.00"

Area (sf)	CN	Description
76,613	79	50-75% Grass cover, Fair, HSG C
21,907	98	Paved parking, HSG C
* 21,795	98	Building, HSG C
120,315	86	Weighted Average
76,613		63.68% Pervious Area
43,702		36.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	48	0.0416	0.12		Sheet Flow, GRASS Grass: Dense n= 0.240 P2= 2.60"
0.1	40	0.3250	9.18		Shallow Concentrated Flow, GRASS Unpaved Kv= 16.1 fps
0.3	49	0.0255	3.24		Shallow Concentrated Flow, Asphalt Paved Kv= 20.3 fps
0.2	91	0.0040	6.61	63.63	Pipe Channel, 42 HDPE 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013 Corrugated PE, smooth interior
0.3	110	0.0040	7.23	90.85	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
0.1	113	0.0159	14.41	181.13	Pipe Channel, 48 HDPE 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013 Corrugated PE, smooth interior
7.6	451	Total			

Subcatchment 1: TRIB 1

Hydrograph



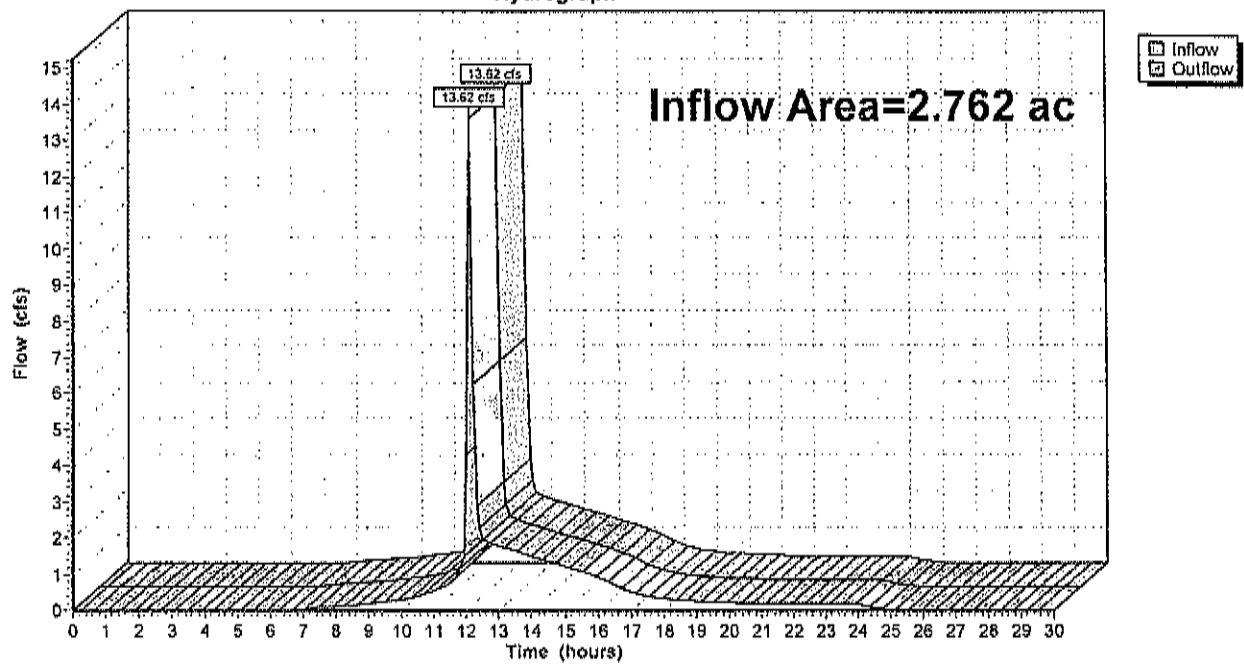
Summary for Reach R1: REACH 1

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth = 4.39" for 100 year event
Inflow = 13.62 cfs @ 12.11 hrs, Volume= 1.010 af
Outflow = 13.62 cfs @ 12.11 hrs, Volume= 1.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs

Reach R1: REACH 1

Hydrograph



Summary for Pond PG: PIPE GALLERY

Inflow Area = 2.762 ac, 36.32% Impervious, Inflow Depth = 4.41" for 100 year event
 Inflow = 18.42 cfs @ 11.98 hrs, Volume= 1.015 af
 Outflow = 13.62 cfs @ 12.11 hrs, Volume= 1.010 af, Atten= 26%, Lag= 7.4 min
 Primary = 2.10 cfs @ 12.11 hrs, Volume= 0.850 af
 Secondary = 11.52 cfs @ 12.11 hrs, Volume= 0.159 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Peak Elev= 207.18' @ 12.11 hrs Surf.Area= 4,922 sf Storage= 13,683 cf

Plug-Flow detention time= 54.9 min calculated for 1.006 af (99% of inflow)
 Center-of-Mass det. time= 51.7 min (847.8 - 796.0)

Volume	Invert	Avail.Storage	Storage Description
#1	201.48'	7,125 cf	48.0" D x 567.0'L 48" HDPE Pipe Storage S= 0.0040 'f
#2	201.50'	3,771 cf	42.0" D x 392.0'L 42" HDPE Pipe Storage S= 0.0040 'f
#3	201.41'	430 cf	CB#2 (Prismatic) Listed below (Recalc)
#4	201.37'	431 cf	CB#3 (Prismatic) Listed below (Recalc)
#5	201.48'	289 cf	CB#5 (Prismatic) Listed below (Recalc)
#6	201.45'	240 cf	CB#6 (Prismatic) Listed below (Recalc)
#7	201.49'	175 cf	CB#7 (Prismatic) Listed below (Recalc)
#8	206.50'	2,663 cf	PARKING AREA (Prismatic) Listed below (Recalc)
		15,124 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.41	50	0	0
210.00	50	430	430

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.37	50	0	0
210.00	50	431	431

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.48	50	0	0
207.25	50	289	289

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.45	50	0	0
206.25	50	240	240

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
201.49	50	0	0
205.00	50	175	175

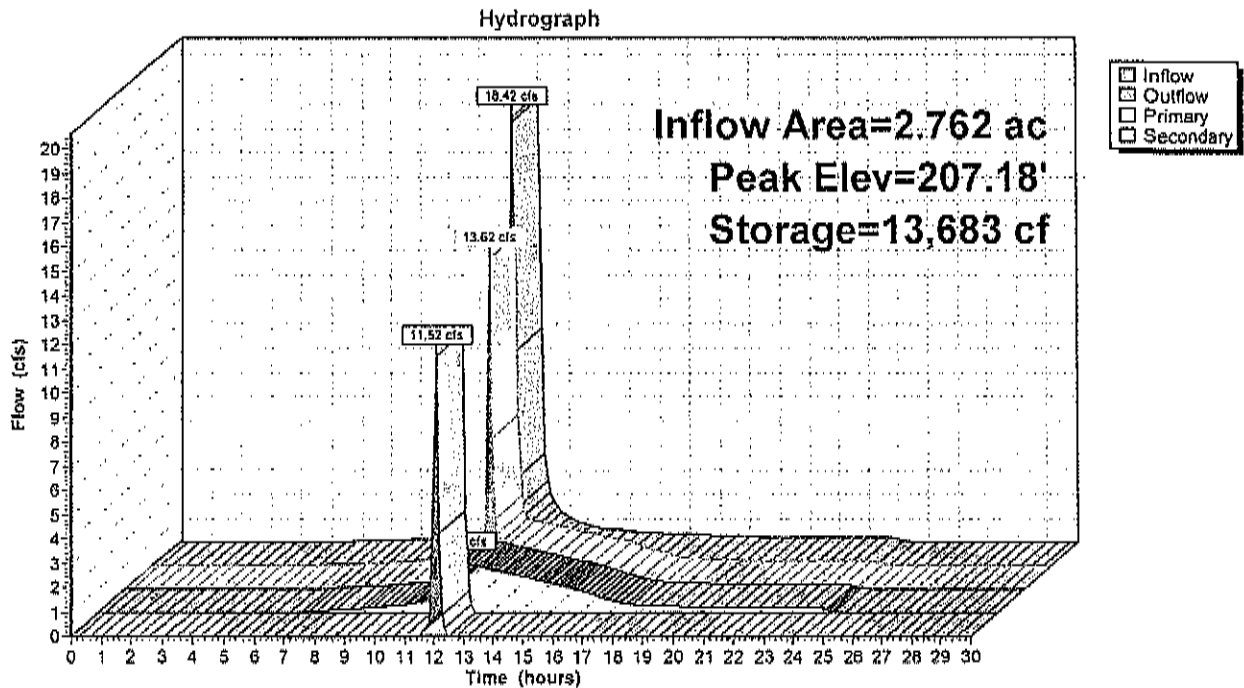
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.50	0	0	0
207.00	3,448	862	862
207.40	5,556	1,801	2,663

Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	6.0" Vert. 6" Orifice C= 0.600
#2	Secondary	206.50'	30.0" Horiz. CB#7 30" Grate X 0.80 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.09 cfs @ 12.11 hrs HW=207.15' (Free Discharge)
 ↑1=6" Orifice (Orifice Controls 2.09 cfs @ 10.66 fps)

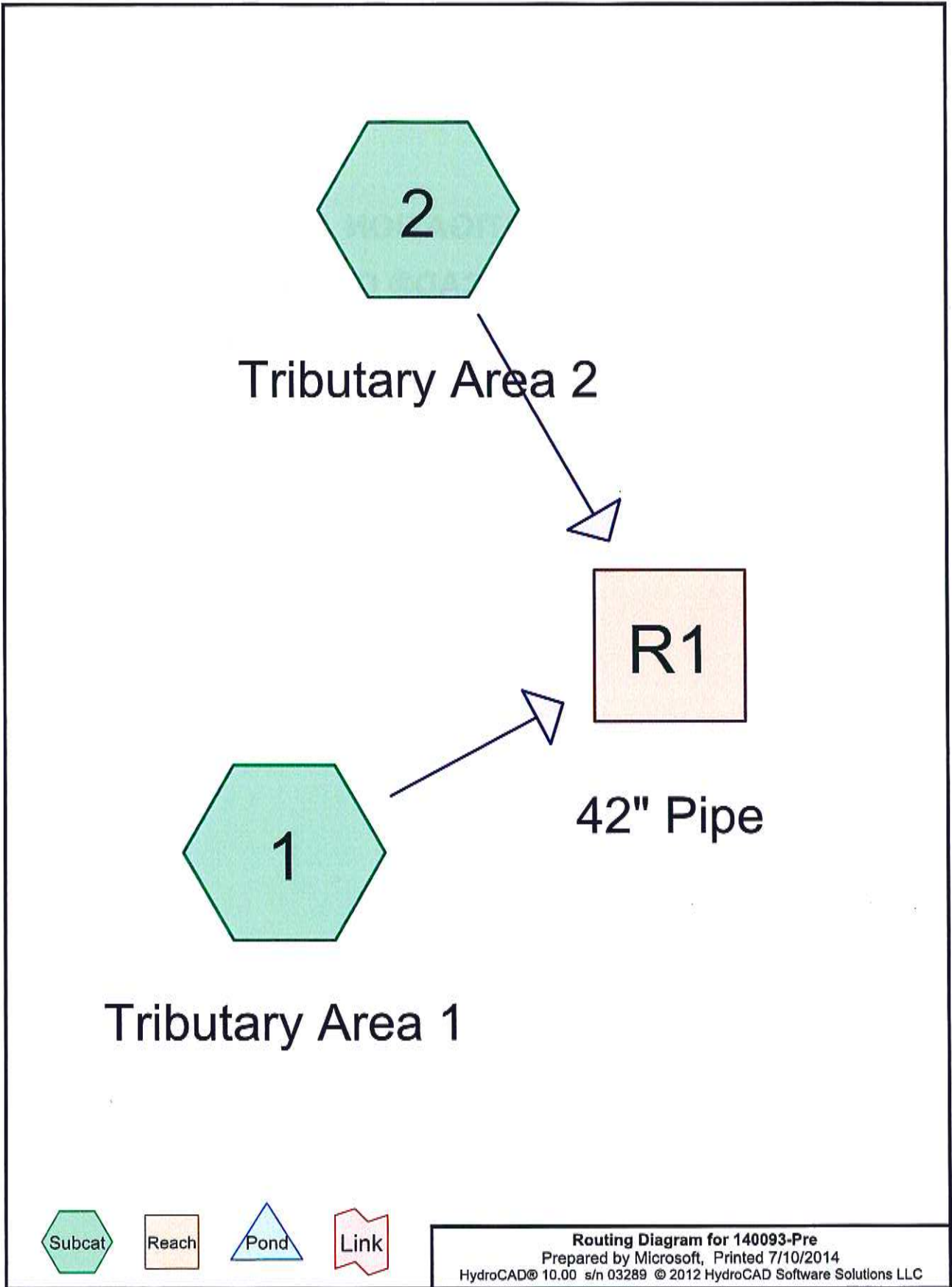
Secondary OutFlow Max=11.00 cfs @ 12.11 hrs HW=207.16' (Free Discharge)
 ↑2=CB#7 30" Grate (Weir Controls 11.00 cfs @ 2.12 fps)

Pond PG: PIPE GALLERY



Appendix 4

OFFSITE MITIGATION AREA PLAN & 2012 HYDROCAD® COMPUTATIONS PRE AND POST DEVELOPMENT



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.317	74	>75% Grass cover, Good, HSG C (1, 2)
0.136	98	Buildings-Driveways (1, 2)
0.263	98	Road (1, 2)
0.716	87	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.317	HSG C	1, 2
0.000	HSG D	
0.399	Other	1, 2
0.716		TOTAL AREA

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	0.317	0.000	0.000	0.317	>75% Grass cover, Good	1, 2
0.000	0.000	0.000	0.000	0.136	0.136	Buildings-Driveways	1, 2
0.000	0.000	0.000	0.000	0.263	0.263	Road	1, 2
0.000	0.000	0.317	0.000	0.399	0.716	TOTAL AREA	

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	R1	201.32	200.60	75.0	0.0096	0.015	42.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1: Tributary Area 1 Runoff Area=17,724 sf 55.48% Impervious Runoff Depth=2.91"
Flow Length=380' Tc=4.9 min CN=87 Runoff=1.82 cfs 0.099 af

Subcatchment 2: Tributary Area 2 Runoff Area=13,471 sf 56.12% Impervious Runoff Depth=2.91"
Flow Length=250' Tc=4.4 min CN=87 Runoff=1.37 cfs 0.075 af

Reach R1: 42" Pipe Avg. Flow Depth=0.47' Max Vel=4.16 fps Inflow=3.14 cfs 0.174 af
42.0" Round Pipe n=0.015 L=75.0' S=0.0096 '/' Capacity=85.43 cfs Outflow=3.21 cfs 0.174 af

Total Runoff Area = 0.716 ac Runoff Volume = 0.174 af Average Runoff Depth = 2.91"
44.24% Pervious = 0.317 ac 55.76% Impervious = 0.399 ac

Summary for Subcatchment 1: Tributary Area 1

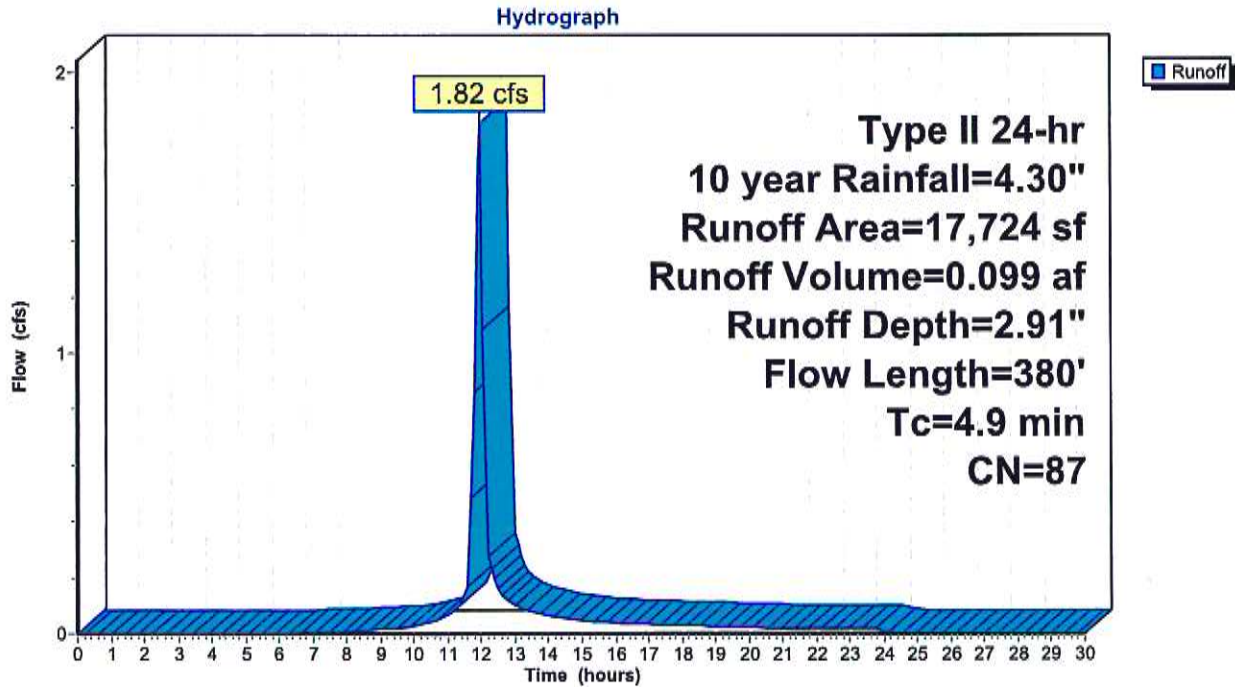
Runoff = 1.82 cfs @ 11.95 hrs, Volume= 0.099 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
* 6,451	98	Road
* 3,382	98	Buildings-Driveways
7,891	74	>75% Grass cover, Good, HSG C
17,724	87	Weighted Average
7,891		44.52% Pervious Area
9,833		55.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0200	0.12		Sheet Flow, Grass Grass: Short n= 0.150 P2= 2.60"
1.3	355	0.0468	4.39		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
4.9	380	Total			

Subcatchment 1: Tributary Area 1



Summary for Subcatchment 2: Tributary Area 2

Runoff = 1.37 cfs @ 11.94 hrs, Volume= 0.075 af, Depth= 2.91"

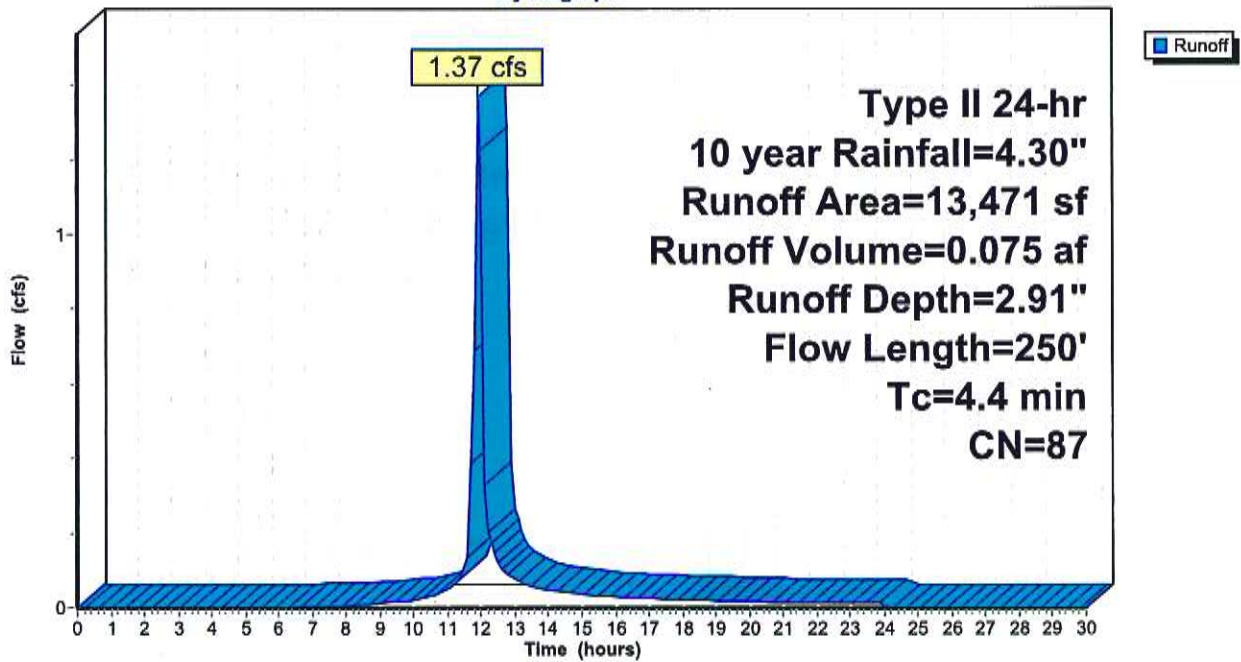
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
* 5,026	98	Road
* 2,534	98	Buildings-Driveways
5,911	74	>75% Grass cover, Good, HSG C
13,471	87	Weighted Average
5,911		43.88% Pervious Area
7,560		56.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0200	0.12		Sheet Flow, Pavement Grass: Short n= 0.150 P2= 2.60"
0.8	225	0.0539	4.71		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
4.4	250	Total			

Subcatchment 2: Tributary Area 2

Hydrograph



Summary for Reach R1: 42" Pipe

Inflow Area = 0.716 ac, 55.76% Impervious, Inflow Depth = 2.91" for 10 year event
 Inflow = 3.14 cfs @ 11.94 hrs, Volume= 0.174 af
 Outflow = 3.21 cfs @ 11.95 hrs, Volume= 0.174 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Max. Velocity= 4.16 fps, Min. Travel Time= 0.3 min
 Avg. Velocity = 1.29 fps, Avg. Travel Time= 1.0 min

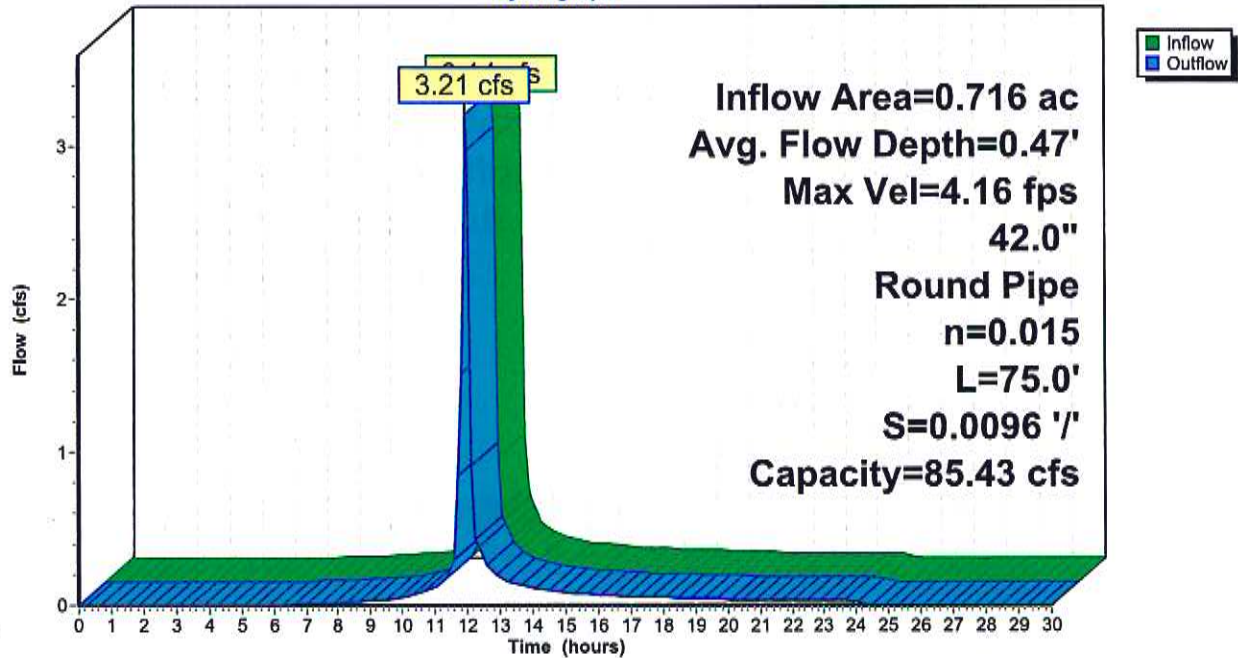
Peak Storage= 57 cf @ 11.95 hrs
 Average Depth at Peak Storage= 0.47'
 Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 85.43 cfs

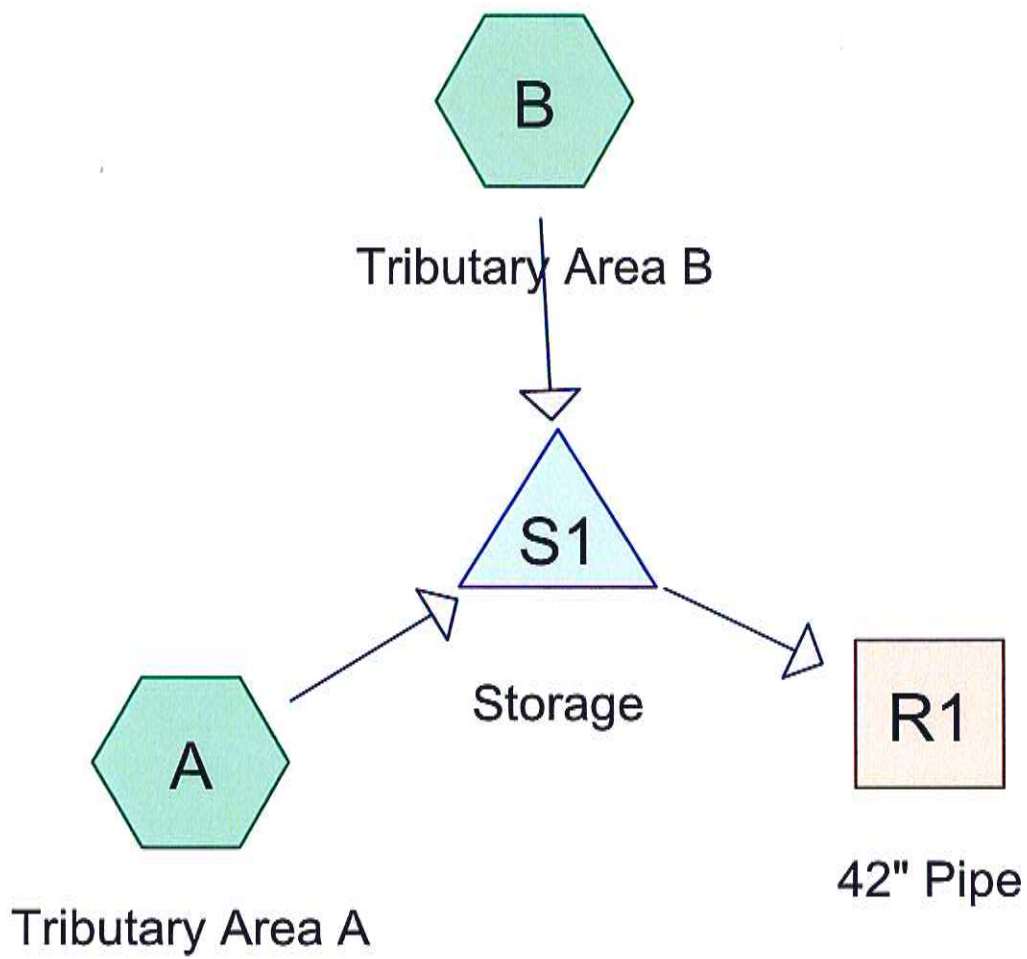
42.0" Round Pipe
 n= 0.015 Brickwork
 Length= 75.0' Slope= 0.0096 '/
 Inlet Invert= 201.32', Outlet Invert= 200.60'



Reach R1: 42" Pipe

Hydrograph





Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.317	74	>75% Grass cover, Good, HSG C (A, B)
0.136	98	Buildings-Driveways (A, B)
0.263	98	Road (A, B)
0.716	87	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.317	HSG C	A, B
0.000	HSG D	
0.399	Other	A, B
0.716		TOTAL AREA

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Page 4

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	0.317	0.000	0.000	0.317	>75% Grass cover, Good	A, B
0.000	0.000	0.000	0.000	0.136	0.136	Buildings-Driveways	A, B
0.000	0.000	0.000	0.000	0.263	0.263	Road	A, B
0.000	0.000	0.317	0.000	0.399	0.716	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	R1	201.32	200.57	75.0	0.0100	0.015	42.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment A: Tributary Area A Runoff Area=17,724 sf 55.48% Impervious Runoff Depth=2.91"
Flow Length=380' Slope=0.0468 '/' Tc=2.6 min CN=87 Runoff=1.99 cfs 0.099 af

Subcatchment B: Tributary Area B Runoff Area=13,471 sf 56.12% Impervious Runoff Depth=2.91"
Flow Length=257' Slope=0.0539 '/' Tc=1.9 min CN=87 Runoff=1.57 cfs 0.075 af

Reach R1: 42" Pipe Avg. Flow Depth=0.22' Max Vel=2.75 fps Inflow=0.70 cfs 0.134 af
42.0" Round Pipe n=0.015 L=75.0' S=0.0100 '/' Capacity=87.20 cfs Outflow=0.72 cfs 0.134 af

Pond S1: Storage Peak Elev=212.94' Storage=697 cf Inflow=3.56 cfs 0.174 af
Discarded=3.18 cfs 0.040 af Primary=0.70 cfs 0.134 af Outflow=3.88 cfs 0.174 af

Total Runoff Area = 0.716 ac Runoff Volume = 0.174 af Average Runoff Depth = 2.91"
44.24% Pervious = 0.317 ac 55.76% Impervious = 0.399 ac

Summary for Subcatchment A: Tributary Area A

Runoff = 1.99 cfs @ 11.90 hrs, Volume= 0.099 af, Depth= 2.91"

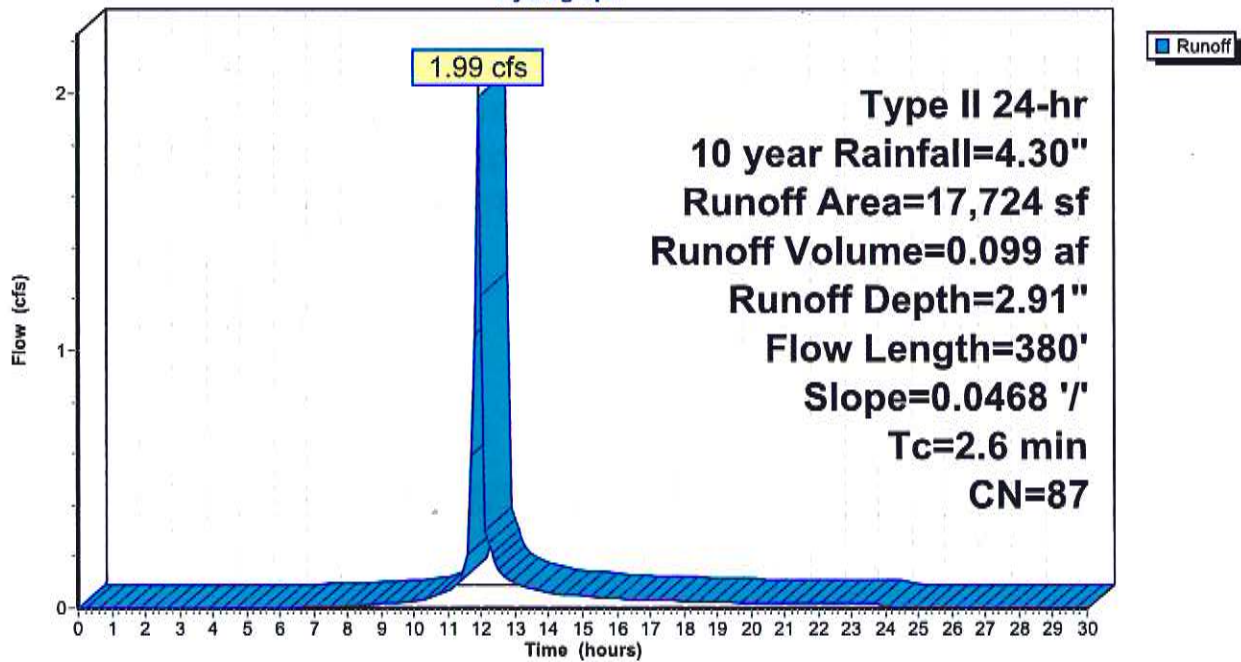
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
* 6,451	98	Road
* 3,382	98	Buildings-Driveways
7,891	74	>75% Grass cover, Good, HSG C
17,724	87	Weighted Average
7,891		44.52% Pervious Area
9,833		55.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	300	0.0468	2.17		Sheet Flow, Pavement Smooth surfaces n= 0.011 P2= 2.60"
0.3	80	0.0468	4.39		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
2.6	380	Total			

Subcatchment A: Tributary Area A

Hydrograph



Summary for Subcatchment B: Tributary Area B

Runoff = 1.57 cfs @ 11.90 hrs, Volume= 0.075 af, Depth= 2.91"

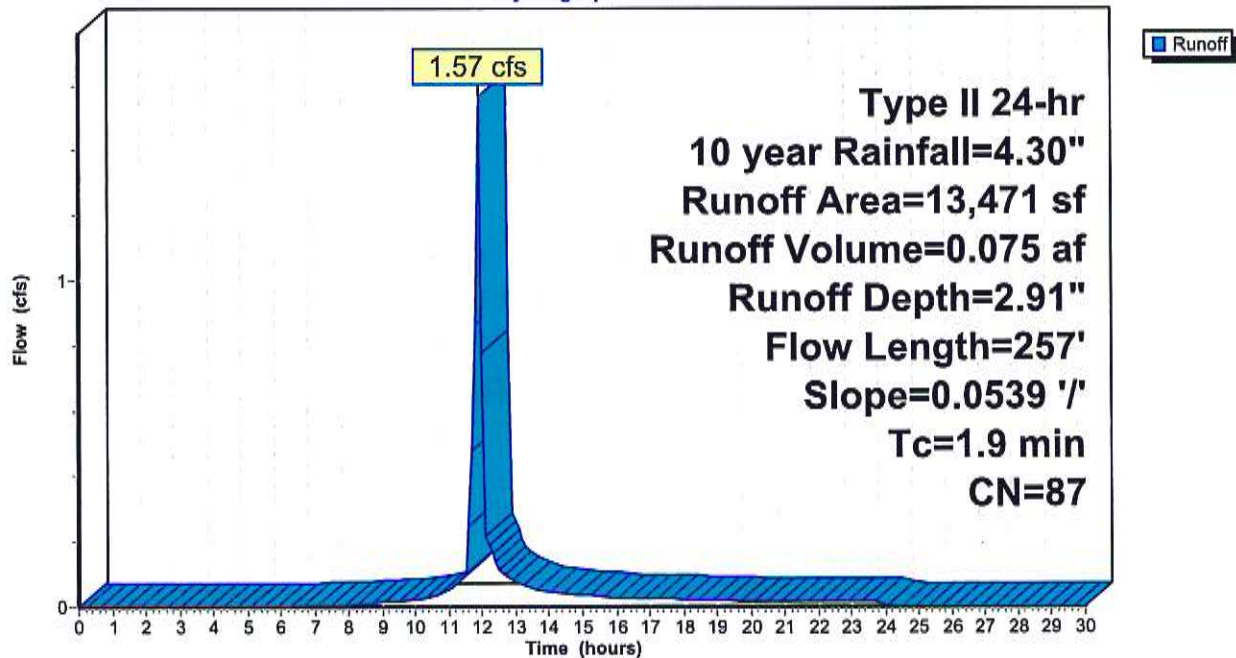
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type II 24-hr 10 year Rainfall=4.30"

Area (sf)	CN	Description
* 5,026	98	Road
* 2,534	98	Buildings-Driveways
5,911	74	>75% Grass cover, Good, HSG C
13,471	87	Weighted Average
5,911		43.88% Pervious Area
7,560		56.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	257	0.0539	2.23		Sheet Flow, Pavement Smooth surfaces n= 0.011 P2= 2.60"

Subcatchment B: Tributary Area B

Hydrograph



Summary for Reach R1: 42" Pipe

Inflow Area = 0.716 ac, 55.76% Impervious, Inflow Depth = 2.24" for 10 year event
 Inflow = 0.70 cfs @ 11.90 hrs, Volume= 0.134 af
 Outflow = 0.72 cfs @ 11.91 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Max. Velocity= 2.75 fps, Min. Travel Time= 0.5 min
 Avg. Velocity = 1.30 fps, Avg. Travel Time= 1.0 min

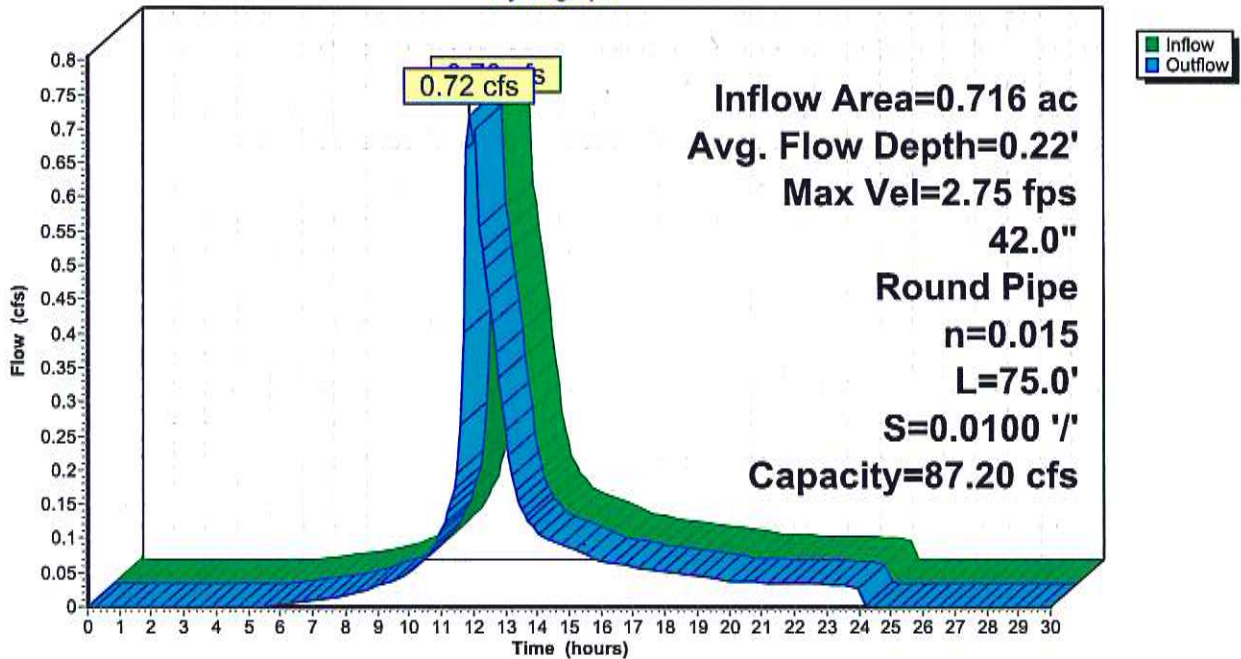
Peak Storage= 20 cf @ 11.91 hrs
 Average Depth at Peak Storage= 0.22'
 Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 87.20 cfs

42.0" Round Pipe
 n= 0.015 Brickwork
 Length= 75.0' Slope= 0.0100 '/'
 Inlet Invert= 201.32', Outlet Invert= 200.57'



Reach R1: 42" Pipe

Hydrograph



Summary for Pond S1: Storage

Inflow Area = 0.716 ac, 55.76% Impervious, Inflow Depth = 2.91" for 10 year event
 Inflow = 3.56 cfs @ 11.90 hrs, Volume= 0.174 af
 Outflow = 3.88 cfs @ 11.91 hrs, Volume= 0.174 af, Atten= 0%, Lag= 0.7 min
 Discarded = 3.18 cfs @ 11.91 hrs, Volume= 0.040 af
 Primary = 0.70 cfs @ 11.90 hrs, Volume= 0.134 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Peak Elev= 212.94' @ 11.92 hrs Surf.Area= 1,181 sf Storage= 697 cf

Plug-Flow detention time= 5.4 min calculated for 0.173 af (100% of inflow)
 Center-of-Mass det. time= 5.4 min (805.8 - 800.4)

Volume	Invert	Avail.Storage	Storage Description
#1	207.45'	553 cf	48.0" D x 44.0'L Pipe Storage
#2	212.70'	218 cf	Ponding (Prismatic) Listed below (Recalc)
		771 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
212.70	4	0	0
213.00	1,451	218	218

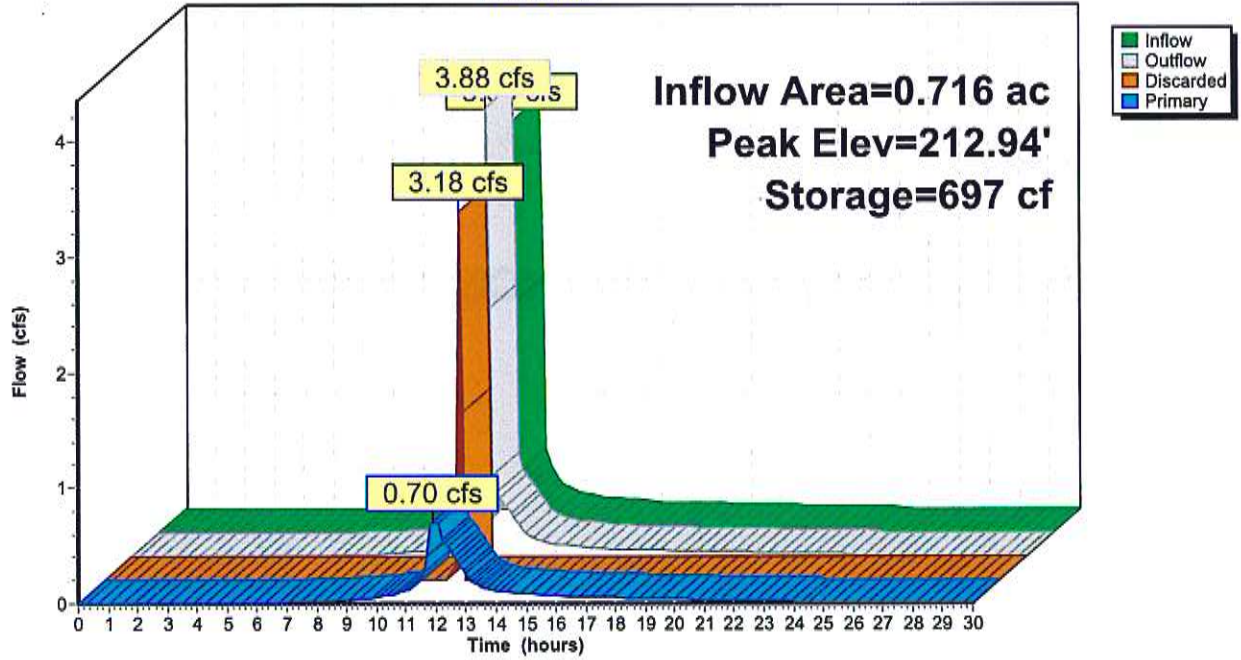
Device	Routing	Invert	Outlet Devices
#1	Primary	207.45'	3.4" Vert. Orifice C= 0.600
#2	Discarded	212.74'	32.0" x 32.0" Horiz. Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=2.89 cfs @ 11.91 hrs HW=212.93' (Free Discharge)
 ↑**2=Grate** (Weir Controls 2.89 cfs @ 1.43 fps)

Primary OutFlow Max=0.70 cfs @ 11.90 hrs HW=212.94' (Free Discharge)
 ↑**1=Orifice** (Orifice Controls 0.70 cfs @ 11.14 fps)

Pond S1: Storage

Hydrograph



Appendix 5

PROPOSED MAINTENANCE AGREEMENT

STORMWATER MANAGEMENT SYSTEM MAINTENANCE AGREEMENT
THE ELEFThERIA

THIS AGREEMENT is made and entered into on the [] day of [] 2014 by and between

241 South Allen St. Housing, LLC with an address of 43 New Scotland Avenue, Albany, NY 12208 hereinafter referred to as "the Facility Owner", and

City of Albany, a municipal corporation with an address of Eagle Street, Albany, NY 12207, hereinafter referred to as "the City".

WITNESSETH;

WHEREAS, **241 South Allen St. Housing, LLC** is the Owner of the subject parcel of land situated in the City of Albany, County of Albany and State of New York, and

WHEREAS, the City and the Facility Owner desire that the Stormwater Management System be built in accordance with the approved project documents and thereafter be maintained, cleaned, repaired, replaced and continued in perpetuity in order to ensure optimum performance of the components:

WHEREAS, the Facility Owner has determined that the proposed project requires a permit to allow sewer connection.

WHEREAS, the City has requested this legally binding and enforceable maintenance agreement from the Facility Owner.

WHEREAS, the Facility Owner is representing the following design documents, with their City approved revisions, as containing all necessary information to construct, operate and maintain the stormwater management system for the lifetime of the facility.

- a. Plan set submitted to the City of Albany representing a stormwater management system including stormwater collection, conveyance and storage using structures designed and specified by **Hershberg & Hershberg, Consulting Engineers**, sealed by **Daniel R. Hershberg, P.E. & L.S.**, as the Engineer of Record. The plan sheets showing features associated with the stormwater management system are listed below.

Sheet #	Date	Drawing Title
C-3	4/29/14 Rev. 6/3/14	Site Plan
C-4	4/29/14 Rev. 6/3/14	Utilities Plan
C-5	4/29/14 Rev. 6/3/14	Erosion & Sedimentation Plan
C-7	4/29/14 Rev. 6/3/14	Details

- b. **"STORM WATER MANAGEMENT REPORT (SWMR) THE ELEFThERIA** prepared by **Hershberg & Hershberg, Consulting Engineers, 18 Locust Street, Albany, NY 12203**, dated June 10, 2014 amended July 11, 2014

IN CONSIDERATION thereof, the party's agree as follows:

1. The Facility Owner shall maintain construction phase erosion and sediment controls to protect the stormwater management system until the site is stable.
2. It is anticipated that an amount of sediment will make its way into the closed pipe system and storm water storage structure.
3. The Facility Owner shall be responsible for maintaining the storage facility in a manner to prevent silt from becoming tributary to the City's combined sewer system.
4. Operation and Maintenance, including inspection and cleaning of the full stormwater drainage system, shall be the responsibility of the Facility Owner.
5. The Facility Owner shall have the stormwater system thoroughly cleaned, flushed and inspected prior to final acceptance from the Contractor.
6. In the event the Facility Owner fails to maintain the system in a manner to prevent silt from becoming tributary to the City's combined sewer system, the City may order the system cleaned and bill the Facility Owner the full cost of this work.
7. The Facility Owner shall disclose this agreement to any successor or assignees in interest; and
8. This agreement is binding upon the Facility Owner and any successor or assignees in interest; hereof.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed by their duly authorized officers as of the day and year first above written.

City of Albany, New York

241 South Allen St. Housing, LLC

By: _____
_____, Mayor

City of Albany

By: _____

Date: _____

Date: _____

STATE OF NEW YORK)
) SS.:
COUNTY OF ALBANY)

On the ____ day of _____, 2014 before me personally came, known to me, _____ who, being by me duly sworn, did depose and say that he/she is the _____ of 241 South Allen St. Housing, LLC, that he/she is personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledgement to me that he/she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual, and the Corporation upon whose behalf the individual acted, executed the instrument.

Notary Public – State of New York

STATE OF NEW YORK)
) SS.:
COUNTY OF ALBANY)

On the ____ day of _____, 2014 before me personally came Kathy M. Sheehan known to me, who, being by me duly sworn, did depose and say that she is the Mayor of the City of Albany, New York, described in and which executed the foregoing instrument; that she knows the seal of said City; that the seal affixed to said instrument is the seal of said City, and that she affixed the seal and signed said instrument by authority in her vested.

Notary Public – State of New York

Appendix 5

Maintenance Plan

This plan contains directions on the maintenance of drainage facilities, storm water quantity control facilities for

**THE ELEFThERIA
CITY OF ALBANY
ALBANY COUNTY, N.Y.**

This plan defines the maintenance of storm water management system after construction.

This maintenance manual also contains a maintenance and inspection form for use by the Facility Owner.

Facility Owner (Responsible Party):
241 South Allen St. Housing, LLC

The facility owner will be responsible to provide capital funding for this facility. The source will be from infrastructure funds set aside for construction. On an annual basis the responsible party will budget funds to fund the annual operating and maintenance costs. The facility owner must maintain all drainage facilities and stormwater quantity control facilities in accordance with approved plans and with this maintenance plan. Complete inspection form and retain on file.

The elements of this System which require inspection include:

Vegetation cover within the tributary area. The inspection shall verify that on lawns or other seeded areas that vegetation covers a minimum of 90% of the exposed ground. Other areas such as mulch beds or landscaped areas shall be inspected to verify that proper mulching is in place.

Concrete structures. Inspection shall verify that structures and their metal frames & grates or metal covers are in good condition. The storage structure shall be opened to verify that weir plates are in place and that the structure is clean.

Monthly inspection shall determine whether the following benchmarks are reached in which case appropriate action shall be taken.

Debris cleanup – Remove and dispose of all debris encountered on roadway, near catch basins or in area adjacent to public right-of-way.

Oil & Grease – Any visible oil and grease shall be treated with proper materials to capture residue. Remove any materials from the site. If possible, determine cause of accumulation of oil & grease and address these.

Condition of vegetation – The seeded lawns should be maintained in accordance with good cultural practices. Mow and remove clippings if required. Dead or diseased plant material shall be replaced.

Annual inspection shall determine whether the following benchmarks are reached in which case appropriate action shall be taken:

Storage Pipe gallery - Sediment cleaned out of the storage pipe gallery when accumulates to a depth of more than three inches.

Structures and pipes – Inspect condition of all concrete structures for spalling or cracking. Repair or replace as required. Examine metal grates. Repair or replace as required. Examine pipe galleries for any damage.

Outfall – Inspect condition of the outfall pipe and flap valve. Repair as required.

**SWMP
Operation, Maintenance
and Management Inspection Checklist (Complete in 3 Pages)**

Project: THE ELEFThERIA
 Location: No. 241 South Allen
 City of Albany, Albany County, NY
 Site Status: _____
 Date: _____
 Time: _____
 Inspector: _____

MAINTENANCE ITEM	SATISFACTORY(S)/ UNSATISFACTORY(U)	COMMENTS
------------------	---------------------------------------	----------

1. Debris Cleanout (Monthly or after any significant storm event) <hr/> Contributing areas clean of debris <input type="checkbox"/> (S) <input type="checkbox"/> (U) <hr/> Inlet and outlets clear of debris <input type="checkbox"/> (S) <input type="checkbox"/> (U)

2. Oil and Grease (Monthly) <hr/> Inspect water for evidence of oil & grease <input type="checkbox"/> (S) <input type="checkbox"/> (U) <hr/> Activities in drainage area minimize oil and grease entry <input type="checkbox"/> (S) <input type="checkbox"/> (U)

3. Vegetation & Insects Control (Monthly) <hr/> Contributing drainage area stabilized <input type="checkbox"/> (S) <input type="checkbox"/> (U) <hr/> No evidence of erosion <input type="checkbox"/> (S) <input type="checkbox"/> (U) <hr/> Area mowed and clipping removed <input type="checkbox"/> (S) <input type="checkbox"/> (U)
--

MAINTENANCE ITEM	SATISFACTORY(S)/ UNSATISFACTORY(U)	COMMENTS
------------------	---------------------------------------	----------

4. Sediment Deposition (Annual)

Depth of sediments in pipe storage gallery more than 3"

(Schedule cleaning) (S) (U)

Water standing in storage pipes above outlet

(Schedule pipe repair) (S) (U)

5. Structural Components (Annual)

No evidence of structural deterioration (S) (U)

Any grates are in good condition (S) (U)

No evidence of spalling or cracking of structural parts (S) (U)

6. Outlet/ (Annual)

Good condition, no need for repairs (S) (U)

7. Overall Function of Facility (Annual)

Vegetation condition OK

No replacement required (S) (U)

Evidence of flow bypassing facility (S) (U)

No noticeable odors outside of facility (S) (U)

Comments:

Actions to be Taken:

Map Pocket No. 1

Sheet C-3
Site Plan

Map Pocket No. 2

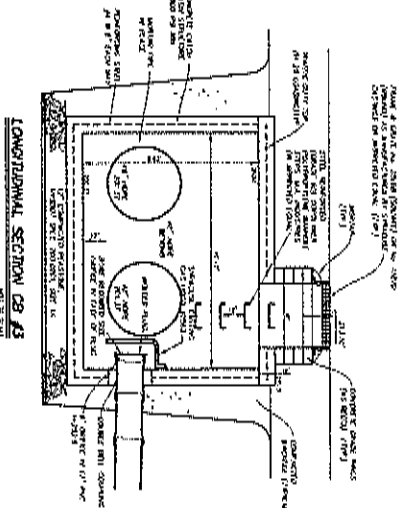
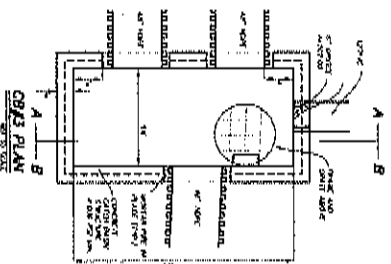
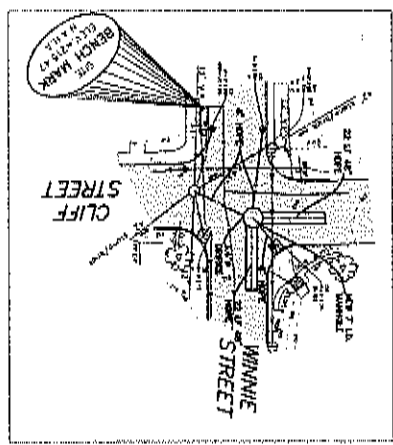
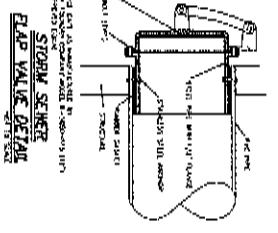
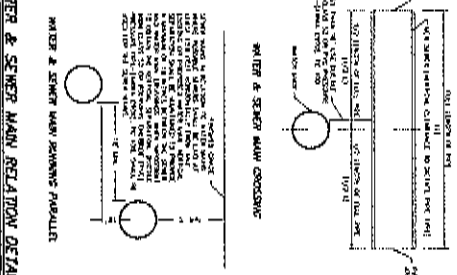
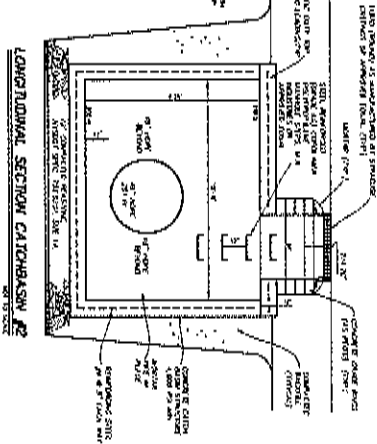
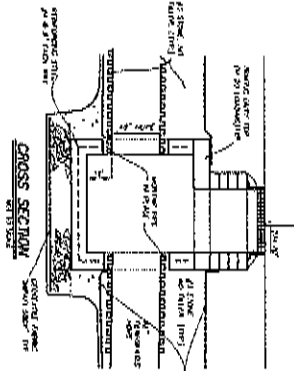
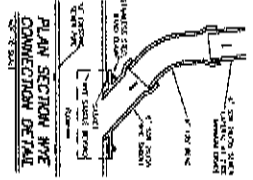
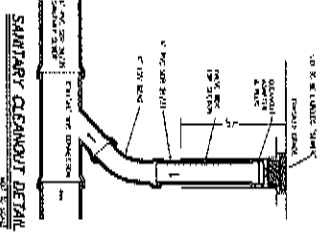
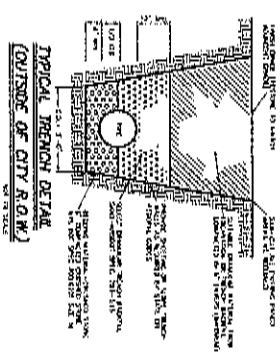
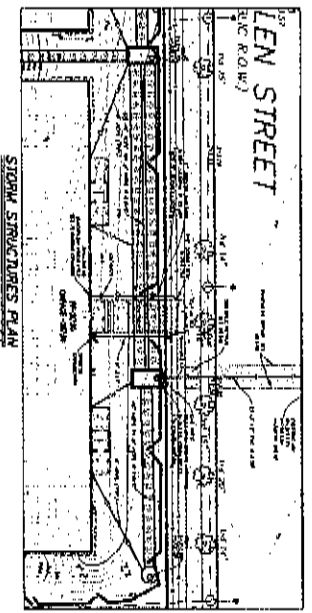
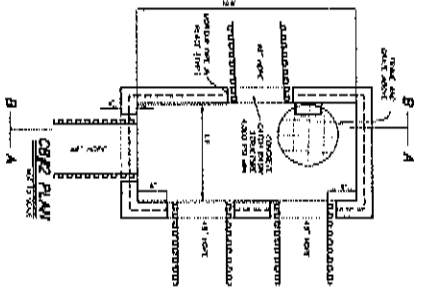
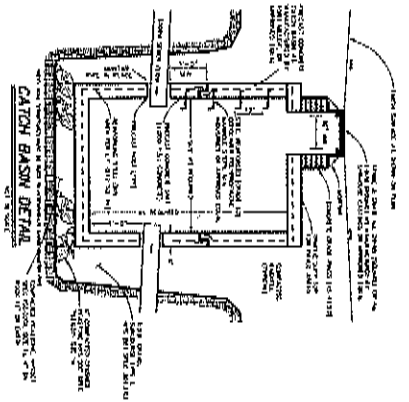
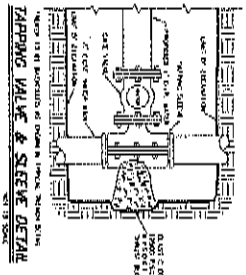
SHEET C-4
Utilities Plan

Map Pocket No. 3

SHEET C-5
Erosion & Sediment Control Plan

Map Pocket No. 4

SHEET C-7
Details



FOR MUNICIPAL APPROVAL ONLY - NOT INTENDED FOR CONSTRUCTION

DETAILS
THE ELEFHERIA
241 SOUTH ALLEN STREET
ALBANY, NEW YORK

REVISIONS	DATE	REMARKS



HERSBERG & HERSBERG
Consulting Engineers
and Land Surveyors
100 West 12th Street
Albany, New York 12240

