Appendix K Stormwater Public Improvement Plan

Stormwater Public Improvement Plan

for

IPC Phase II
San Joaquin County, CA

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1 INTRODUCTION

This report defines the storm water system for the proposed second phase of the International Park of Commerce (IPC Phase II). The project's hydrology as well as the criteria used in sizing the various storm water facilities are defined below. The IPC Phase II project is in unincorporated San Joaquin County, CA. This project includes the development of approximately 280 acres of undeveloped farmland into a logistics center. The proposed project consists of five warehouse buildings along with the infrastructure tailored to support these buildings. The site features stormwater infrastructure including four detention basins to detain stormwater from a 100-year 24-hour storm event.

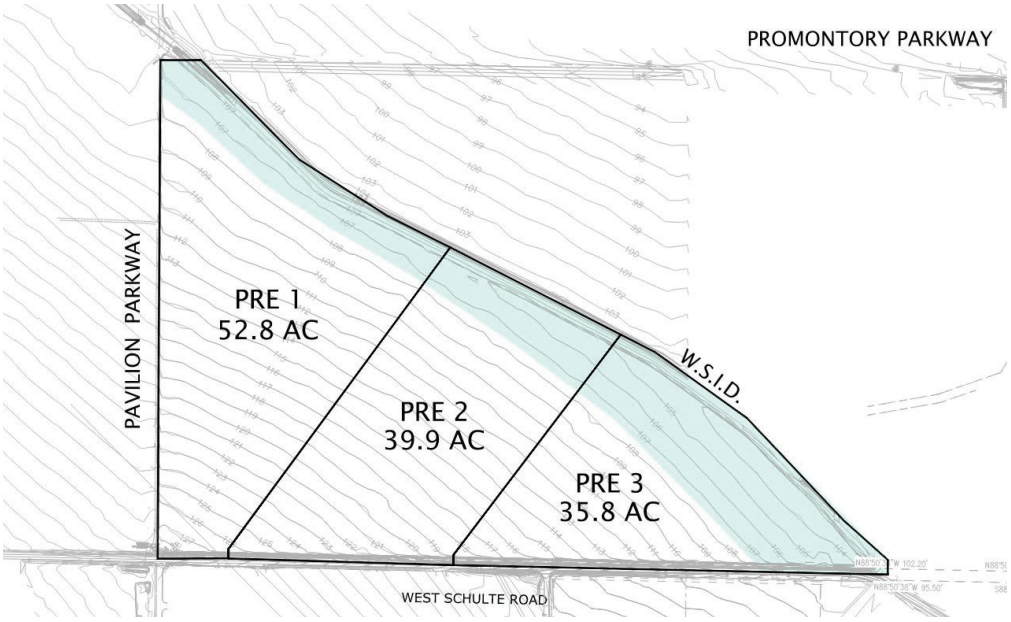
FIGURE 1: VICINITY MAP

2 EXISTING CONDITIONS

The project site is presently utilized as agricultural land dedicated to support almond orchards. The land slopes at approximately 1% to the northeast. There is no existing storm drain infrastructure on the project site. There is an existing West Side Irrigation District (WSID) canal bisecting the northern portion of the site which is utilized for regional irrigation.

The preconstruction area of 128.5 acres was split into three drainage areas as shown in Figure 2. Each area has a curve number of 81 for row crops and an average time of concentration of 50 minutes. The WSID canal creates a berm on the site, in turn creating a ponding area along the canal. The areas indicated as PRE1 and PRE2 in the calculations will be conveyed in this ponding area indicated as a swale. This swale has a Manning's n value of 0.05 for cultivated crops per Hec Ras manning's n values. See section 4 of this report for calculation parameter information.

FIGURE 2: PRE-CONSTRUCTION DRAINAGE AREAS



The pre-construction hydrology calculations are included in Appendix A and the resultant flows and volumes are tabulated in Table 1.

TABLE 1: PRE-CONSTRUCTION DRAINAGE (100-YEAR, 24-HOUR STORM)

DMA	Drainage Area (ac)	Time of Concentration (min)	CN	Runoff (cfs)	Volume (af)
PRE 1	52.8	53.6	81	20.9	5.8
PRE 2	39.9	57.9	81	15.11	4.4
PRE 3	35.8	42.6	81	16.24	3.9

The stormwater eventually will overtop the canal bank and drain into the WSID. The following table summarizes the resultant pre-construction flows into the WSID.

TABLE 2: PRE-CONSTRUCTION DRAINAGE INTO WSID (100-YEAR, 24-HOUR STORM)

Inflow (cfs)	Inflow Volume (af)	Outflow (cfs)	Outflow Volume (af)
32.11	14.1	7.4	3.351

3 PROPOSED CONDITIONS

The proposed project will consist of the construction of five warehouse buildings with infrastructure designed to support the buildings, such as wet and dry utilities and road improvements. The project will be divided into three phases. The first phase will include undergrounding the existing West Side Irrigation District canal via two 42" storm drains. The second phase will include the construction of buildings 1, 2 and 3 as well as detention basins 1, 2, 3 and 4. The third phase will include the construction

of buildings 4 and 5 which are located south of Schulte Road. See Figure 3, identifying the location of buildings and onsite detention basins.

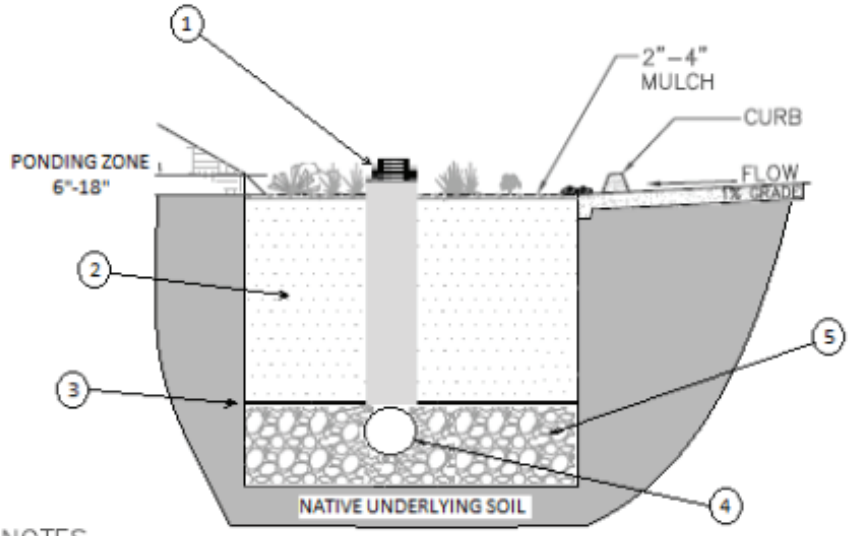
FIGURE 3: IPC PHASE II SITE PLAN

Stormwater improvements will include two types of basins, water quality basins and stormwater detention basins. Stormwater runoff from the site development will drain to water quality basins for stormwater treatment prior to draining to the stormwater detention basins. Water Quality basins will be designed per the Multi-Agency Post-Construction Stormwater Standards Manual for San Joaquin County. The water quality basins will be located adjacent to parking areas on each building site to promote treatment and infiltration during small storm events (less than 1 inch of rainfall) prior to discharge into the collection system and stormwater detention basins. See Figure 4 for the standard stormwater quality basin section. Currently, stormwater quality basins are shown on the site plan as

they are the preferred treatment measure. Other approved stormwater treatment measures may be considered during the design development and if so, will be designed per the Multi-Agency Post-Construction Stormwater Standards Manual for San Joaquin County.

Stormwater detention basins are designed to detain a 100-year 24-hour storm, methods for sizing the detention basins are discussed in later sections.

FIGURE 4: SAMPLE BIORETENTION FACILITY SECTION



NOTES

1. OVERFLOW DEVICE: VERTICAL RISER OR EQUIVALENT
2. 1.5' PLANTING MEDIA; 3' PREFERRED. PLANTING MEDIA SPECIFICATIONS PER BIORETENTION TECHNICAL SPECIFICATIONS
3. 2-4" CALTRANS CLASS 2 PERMEABLE MATERIAL (PLANTING MEDIA/GRAVEL LAYER SEPARATION ZONE)
4. PERFORATED 6" MIN PVC SDR 26 OR C900
5. 1' MIN 1"-2.5" DIAMETER STONE

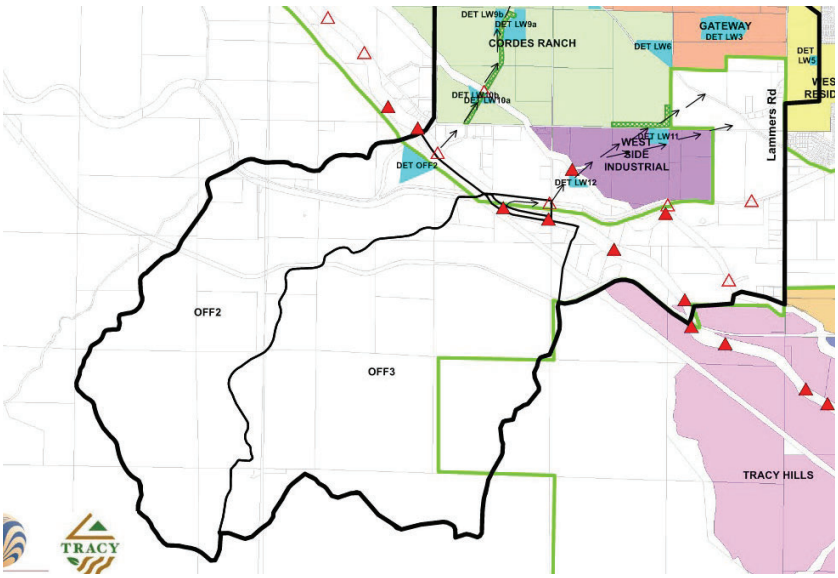
3.1 OFFSITE FLOWS

Offsite flows are negligible for the southern part of the site as there is minimal stormwater run-on. As indicated in the 2012 City of Tracy Storm Drain Master Plan, see Figure 5 below, offsite runoff from the south does not flow onto the project. This water is collected at the Union Pacific Railroad embankment and is directed north via two 36" culverts located to the east of the site.

FIGURE 5: CITY OF TRACY 2012 STORMWATER MASTER PLAN FOCUS AREA

For the northern part of the development, there are offsite stormwater flows originating from the western hillside. The 2012 City of Tracy Stormwater Master Plan refers to this drainage area as "OFF3". This flow currently sheet flows across the property and excess offsite runoff is intercepted by the WSID upper Main canal. Refer to Figure 6 below for the drainage path as shown in the 2012 City of Tracy Stormwater Master Plan Figure 5-7.

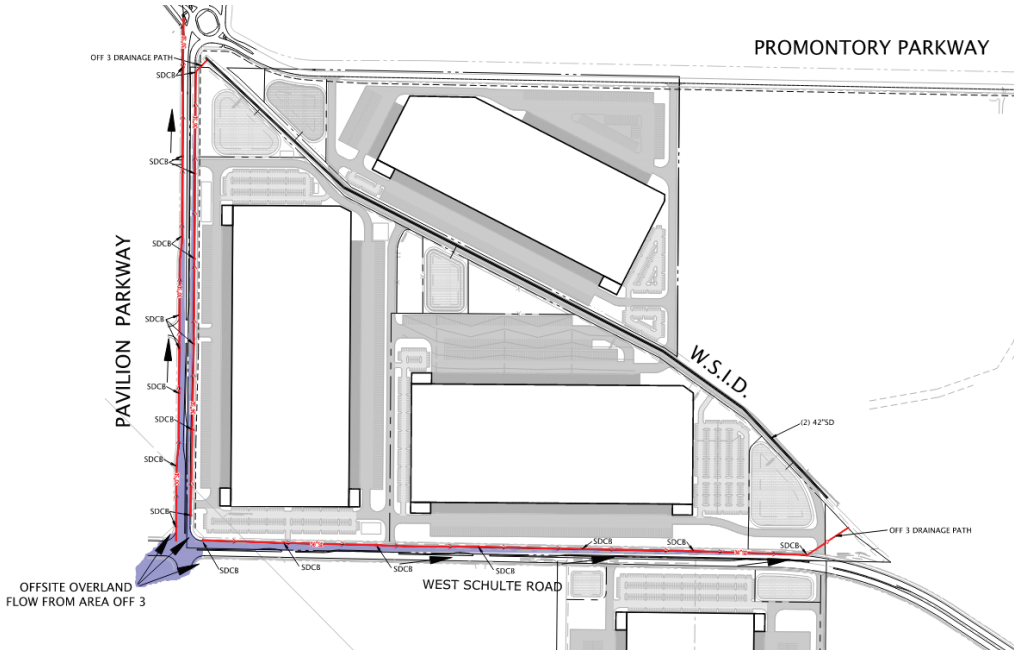
FIGURE 6: CITY OF TRACY 2012 STORMWATER MASTER PLAN OFF 3 DRAINAGE (FIGURE 5-7)



In the post-construction condition, the OFF 3 drainage flow ponds south of West Schulte Road and the excess stormwater crosses the road and splits into three conveyances: west side of Pavilion Parkway,

east side of Pavilion Parkway and the north side of W Schulte Road. See Appendix B for offsite flow routing and shown below in Figure 7.

FIGURE 7: OFFSITE FLOW ROUTING



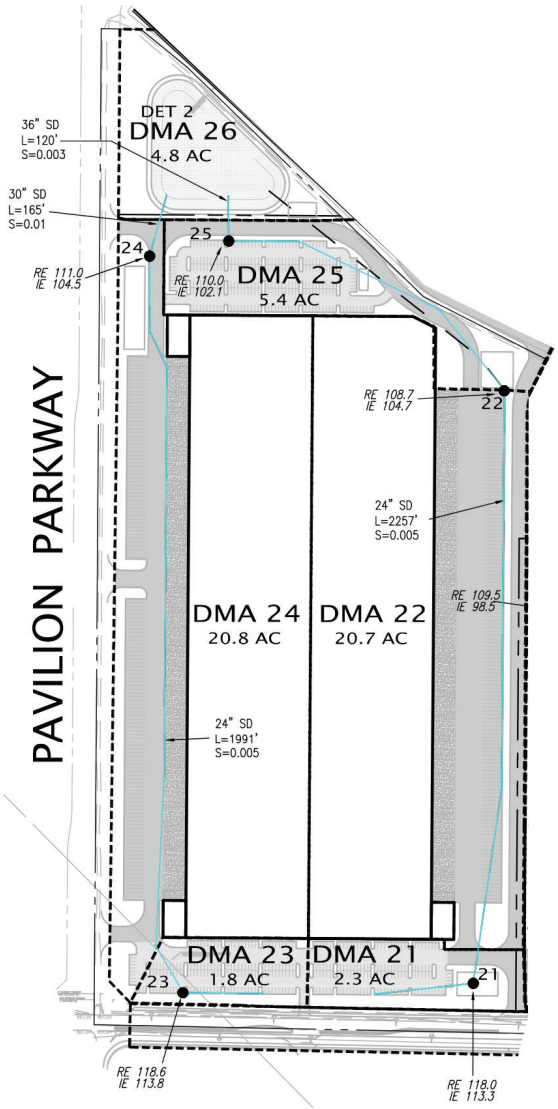
Overland flows that run along the west side of Pavillion Parkway will continue to drain to the north and towards the existing LW6 drainage basin, which is constructed larger than the sizing requirements per the City of Tracy 2012 Master Plan, and therefore can accommodate the additional OFF3 runoff. The rest of the OFF3 stormwater that drains to the east side of Pavillion and along West Schulte Road will continue into the WSID at the northwest corner of site and at southeast corner of site by pipes and an inlet system designed to intercept flows.

This combined flow conveyance exceeds any assumed excess OFF 3 drainage flows that are contemplated in the 2012 City of Tracy Stormwater Master Plan.

4 HYDRAULIC MODELING

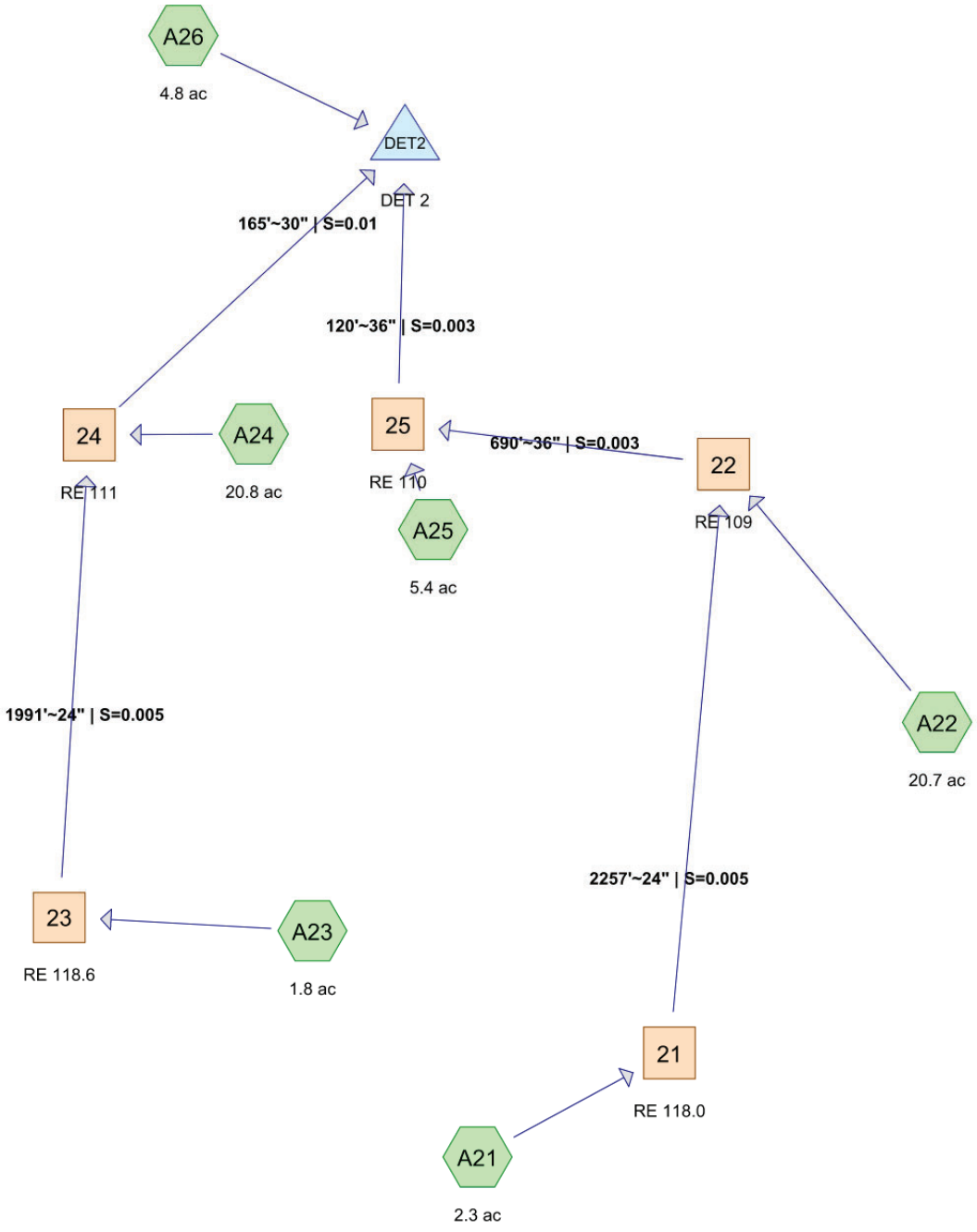
Hydraulic calculations were based on the San Joaquin County Improvement Standards performed using the HydroCAD modeling software. This modeling software is used to show the site based on the conditions shown on the hydrology map. As shown in Figure 8 for an example, the hydrology map shows the drainage management areas (DMAs), pipes connecting the DMAs to the detention ponds, and the detention ponds onsite. Each element on the hydrology map is individually numbered to correlate stormwater infrastructure between the Hydrology map and HydroCAD. Refer to the site hydrology map in Appendix B.

FIGURE 8: SAMPLE HYDROLOGY MAP FOR DETENTION BASIN 2



For the sizing of the detention ponds, each detention pond is analyzed independently in HydroCAD. The DMAs are the subcatchment areas in HydroCAD. Pipes are the reaches in HydroCAD, with the start of the pipe acting as the node in HydroCAD. The detention ponds are represented by ponds in HydroCAD. The routing diagram, see Figure 9 for an example, schematically shows these elements from the hydrology map in the HydroCAD model. More information on the design parameters for subcatchments, reaches, and ponds is discussed in the following sections. HydroCAD reports from the 100-year 24-hour storm for each detention basin are included in Appendix C, D, E, and F.

FIGURE 9: SAMPLE ROUTING DIAGRAM FOR DETENTION BASIN 2



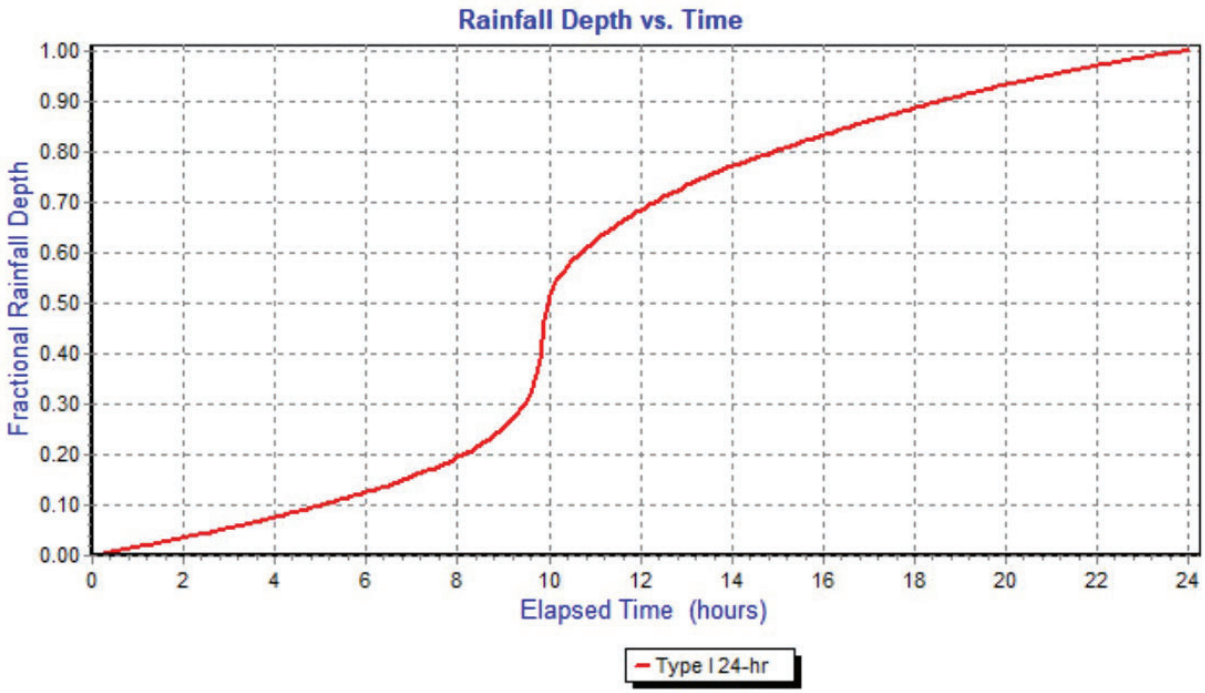
4.1 SUBCATCHMENTS

Subcatchments represent the individual drainage management areas where rainfall is directed to stormwater elements. Design parameters are consistent throughout all subcatchments. The basis of design for rainfall, soil types, and curve numbers are discussed in the following sections.

4.1.1 RAINFALL DISTRIBUTION AND DEPTH

A design 24-hour storm will not have a constant rate of rainfall throughout the length of the storm. To account for the variable rate of rainfall throughout a storm, a rainfall distribution is required. This analysis uses the SCS Type 1 24-hour rainfall distribution. Figure 10 shows this distribution as the cumulative depth of rainfall over time. Rainfall depth and distribution are identical for all subcatchments.

FIGURE 10: SCS TYPE I 24-HR RAINFALL DISTRIBUTION



A 10-year 24-hour storm will have a rainfall depth of 1.89" and a 100-year 24-hour storm will have a rainfall depth of 3.00". This data is from the NOAA Atlas 14 – National Weather Service Precipitation Frequency Data Server.

4.1.2 HYDRAULIC SOIL GROUP

Hydraulic soils groups are estimates of the runoff potential of soils. Soils are classed by the rate of water infiltration when thoroughly wet. Group A soils are characterized by having a high infiltration rate, while Group D soils have very low infiltration rates. The Natural Resources Conservation Service Web Soil Survey provides the site hydraulic soil group. Capay clay and stomar clay loam soils are identified onsite, both soils are in the hydrologic soil group C. Group C soils are characterized by low infiltration rates.

All subcatchments use a hydrologic group C. As detention basins are fully impervious as the water surface does not infiltrate. This is classified as "other" soil group. The cumulative areas of each detention basin using Hydrologic group C soils are shown on page 3 and 4 of each calculation appendix.

4.1.3 CURVE NUMBERS

Curve numbers are empirical parameters used to predict the direct runoff from rainfall. Hydrologic soil groups assume the soil has no ground cover. The process of determining runoff from rainfall using hydrologic soil groups and ground cover is detailed in the NRCS publication, "*Urban Hydrology for Small Watersheds*". The standard curve numbers identified by the NRCS can be applied to various ground covers and soil types can be used to identify the actual infiltration that will occur.

The site has hydrologic soil group C soils. With this information a Curve number of 91 is used for all industrial areas. Since detention basins are fully impervious with no infiltration, a curve number of 100 is used.

4.1.4 TIME OF CONCENTRATION

Time of concentration is the length of time rain takes to navigate through a watershed. Time of concentration determined from methodology described in 2012 City of Tracy Master Plan.

The time of concentration is a minimum of 10 minutes but is otherwise determined by the watershed lag method which includes the hydraulic length, the distance between the furthest location in the area to the point of catchment, and the average land slope. For all developed areas on this site, we are using 10 minutes as the time of concentration as a conservative value for these preliminary calculations. For basins, as rainfall will immediately reach the stormwater facility, a time of concentration of 0 minutes is used. For pre-construction conditions, the lag method was used to determine the time of concentration. Time of concentration is an average of 50 minutes for each drainage area in the pre-construction condition.

4.2 REACHES

Reaches are pipes modeled in HydroCAD software. HydroCAD dynamically calculates the flow rate of water in reaches with the Mannings equation. The Mannings equation is an empirical equation that is used to calculate pipe velocity and flow rates as a function of the slope of the pipe and the amount of roughness of a pipe. As pipes are not perfectly smooth the Mannings number is used as a roughness coefficient along with the amount of water in contact with the pipe walls to account for pipe losses. The Mannings number used for the project is identified in the following section. Each calculation appendix identifies all inputs to each reach conveying to a detention basin on page 5.

4.2.1 MANNINGS NUMBER

The Mannings number changes based on the pipe material depending on the roughness of the pipe. Smoother pipes will have a lower Mannings number than a corrugated pipe.

All pipes on site are Concrete pipe with a Mannings roughness coefficient of 0.013. The preconstruction swale as mentioned in section 2 has a Manning's n value of 0.05 for cultivated crops per Hec Ras manning's n values.

4.3 BASINS

Basins are used to model detention basins in HydroCAD. Basins are modeled with elevations and volumes that the basin can contain as well as the outflows that each basin is capable of. The design of detention basins is discussed in the following section. The following tables provide a summary of the calculations for the reaches and basins also shown in Appendix C, D, E, and F.

TABLE 3: SITE DRAINAGE AREAS

DETENTION BASIN 1					
DMA	Runoff Area (ac)	Tc (min)	CN	Runoff (cfs)	Volume (af)
11	4.9	10	91	7.62	0.846
12	28	10	91	43.53	4.833
13	9.9	10	91	15.39	1.709
14	4.2	10	91	6.53	0.725
15	2.2	0	100	5.23	0.55
DETENTION BASIN 2					
DMA	Runoff Area (ac)	Tc (min)	CN	Runoff (cfs)	Volume (af)
21	2.3	10	91	3.58	0.397
22	20.7	10	91	32.18	3.573
23	1.8	10	91	2.8	0.311
24	20.8	10	91	32.34	3.59
25	5.4	10	91	8.4	0.932
26	4.8	0	100	11.42	1.2
DETENTION BASIN 3					
DMA	Runoff Area (ac)	Tc (min)	CN	Runoff (cfs)	Volume (af)
31	15	10	91	23.32	2.589
32	7.3	10	91	11.35	1.26
33	13.2	10	91	20.52	2.278
34	8.4	10	91	13.06	1.45
35	3	0	100	7.14	0.75
DETENTION BASIN 4					
DMA	Runoff Area (ac)	Tc (min)	CN	Runoff (cfs)	Volume (af)
41	16.2	10	91	25.19	2.796
42	17.9	10	91	27.83	3.09
43	16.3	10	91	25.34	2.813
44	17.4	10	91	27.05	3.003
45	17.8	10	91	27.67	3.072
46	18.8	10	91	29.23	3.245
47					
51	9	10	91	13.99	1.553
52	10.4	10	91	16.17	1.795
53	4	10	91	6.22	0.69
55	3.4	0	100	8.09	0.85

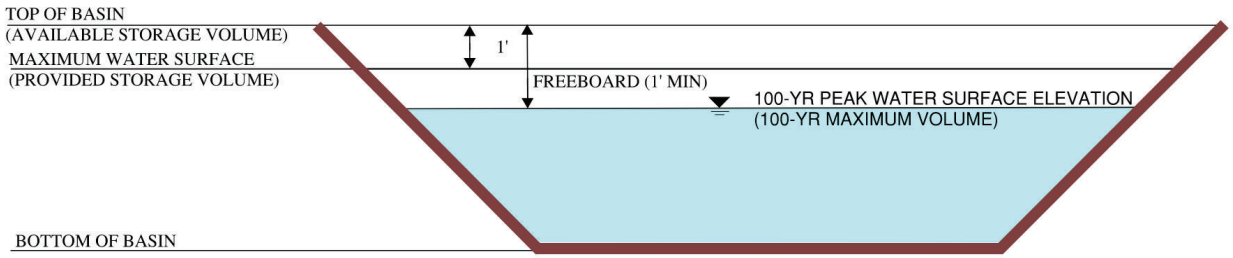
TABLE 4: SITE REACHES

DETENTION BASIN 1						
REACHES	Pipe Size (in)	n	Length (ft)	Slope (ft/ft)	Max Velocity (fps)	Downstream Reach
11	24	0.013	505	0.0059	5.34	12
12	36	0.013	95	0.0053	7.8	DET1
13	24	0.013	860	0.0041	5.24	14
14	36	0.013	263	0.0019	4.43	DET1
15						
DETENTION BASIN 2						
REACHES	Size (in)	n	Length (ft)	Slope (ft/ft)	Max Velocity (fps)	Downstream Reach
21	24	0.013	2257	0.0051	3.83	22
22	36	0.013	690	0.003	5.87	25
23	24	0.013	1991	0.0047	3.49	24
24	30	0.013	165	0.0121	10.04	DET2
25	36	0.013	120	0.0033	6.21	DET2
26						
DETENTION BASIN 3						
REACHES	Size (in)	n	Length (ft)	Slope (ft/ft)	Max Velocity (fps)	Downstream Reach
31	30	0.013	905	0.003	5.25	32
32	36	0.013	285	0.0026	5.49	DET3
33	30	0.013	1115	0.0037	5.6	34
34	36	0.013	134	0.0037	6.29	DET3
35						
DETENTION BASIN 4						
REACHES	Size (in)	n	Length (ft)	Slope (ft/ft)	Max Velocity (fps)	Downstream Reach
41	30	0.013	1050	0.0067	7.44	42
42	36	0.013	2400	0.0073	8.94	47
43	30	0.013	1240	0.005	6.6	44
44	42	0.013	1430	0.003	6.38	46
45	30	0.013	1240	0.005	6.69	46
46	42	0.013	125	0.0072	10.12	47
47	48	0.013	80	0.0075	11.28	51
51	48	0.013	180	0.0128	14.53	DET4
52	24	0.013	460	0.01	7.82	DET4
53						
55						

5 DETENTION BASIN DESIGN

Onsite detention basins are designed to detain a 100-year 24-hr design storm with a 4:1 side slope. To avoid overtopping the basins during a storm event, a freeboard is considered. A freeboard is the distance between the top of basin to the design storm water surface elevation. A minimum of 1 foot of freeboard is provided in each basin. The maximum water surface in the basin is the elevation 1 foot below the top of the basin. The provided volume is the volume at this elevation. See Figure 11 for the typical section showing these relationships. Table 5 identifies physical properties of each basin, including elevations, areas, and volumes. Note groundwater is not a concern for this site or basin design as it is at least 40 feet below existing grade.

FIGURE 11: TYPICAL DETENTION BASIN SECTION



Each detention basin will outflow to the WSID channel (the proposed duel 42" pipes). Basins 1 and 2 have gravity outflows and use an orifice, while basins 3 and 4 use a pump to discharge water detained in the basin. See Table 5 for information on the design of the basins.

TABLE 5: DETENTION BASIN DESIGN

	Elevation			Surface Area (ac)		Volume (acre-feet)			
Basin	Bottom of Basin	Top of Basin	Maximum Water surface	Bottom of Basin	Top of Basin	Available Storage	Provided Storage	Type of Outlet	Max Flow Outlet (cfs)
1	97.5'	106'	105'	0.8	1.4	9.1	7.9	Gravity	2.5
2	100'	108'	107'	1.2	2.0	12.6	10.7	Gravity	2.5
3	87'	100'	99'	0.5	1.6	12.9	11.5	Pump	2.0
4	96'	108'	107'	1.2	2.4	21.4	19.0	Pump	5.0

5.1 PRE-CONSTRUCTION VS POST-CONSTRUCTION

As discussed in section 2 of this report, the peak flow drainage into the canal for the preconstruction condition is 7.4 cfs. The post construction condition will drain 12 cfs into the canal, which is an additional 4.6 cfs of flow. Prologis and BBID (the owner/operator of the WSID canal) will have a stormwater discharge agreement for the post-construction flows into the WSID canal.

The total pre-construction storage for the offsite stormwater flows in the 100-year, 24-hour event would pond approximately 14 af before draining into the WSID. In the post-construction condition, 14 af of offsite stormwater volume will be redirected into the onsite detention basins, which will be designed to accommodate this additional volume.

6 100-YEAR 24-HOUR STORM RESULTS

The 100-year 24-hour storm was modeled using HydroCAD. Peak Inflow, outflow, water surface elevation, and maximum volume from the HydroCAD calculations are provided in Table 6. All basins are adequately sized as the freeboard provided is greater than the 1' minimum. HydroCAD Reports for each basin are provided in appendixes C, D, E and F.

TABLE 6: 100-YEAR 24-HOUR DESIGN STORM RESULTS

Basin	Peak Inflow (cfs)	Water Surface Elevation	Freeboard	Maximum Volume (acre feet)
1	69.4	104.6'	1.4'	7.5
2	73.6	105.9'	2.1'	10.0
3	62.5	94.3'	5.7'	7.0
4	158.3	107.0'	1.1'	18.9

7 PROBABLE COST

Probable costs for IPC Phase II drainage infrastructure are shown in Table 7.

TABLE 7: PROBABLE COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
DETENTION BASIN 1				
EXCAVATION	7.5	AF	$ 32,000	$ 240,000
12" SD OUTLET	1	LS	$ 15,000	$ 15,000
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
DETENTION BASIN 2				
EXCAVATION	8.8	AF	$ 32,000	$ 281,600
12" SD OUTLET	1	LS	$ 15,000	$ 15,000
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
DETENTION BASIN 3				
EXCAVATION	7	AF	$ 32,000	$ 224,000
PUMP AND SD OUTLET	1	LS	$ 400,000	$ 400,000
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
DETENTION BASIN 4				
EXCAVATION	18.9	AF	$ 32,000	$ 604,800
48" SD INLET	300	LF	$ 760	$ 228,000
PUMP AND SD OUTLET	1	LS	$ 400,000	$ 400,000
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
WSID DISCHARGE AGREEMENT	1	EA	$ 1,000,000	$ 1,000,000
SUBTOTAL				**$ 4,208,400**
25% CONTINGENCY				$ 1,052,100
TOTAL				**$ 5,260,500**

8 REFERENCES

City of Tracy, "Citywide Storm Drainage Master Plan", November 2012.

City of Tracy, "Supplement No. 3 to Citywide Storm Drainage Master Plan Lammers and Mountain House Watersheds", October 2019.

National Oceanic and Atmospheric Administration, "Precipitation Frequency Data Server (PFDS)", April 2017.

Natural Resources Conservation Service, "Web Soil Survey", July 2019.

City of Lathrop,. et al. "Multi-Agency Post-Construction Stormwater Standards Manual", June 2015.

Appendices

Appendix A

IPC Phase II Pre-construction Hydrology

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REVISIONS

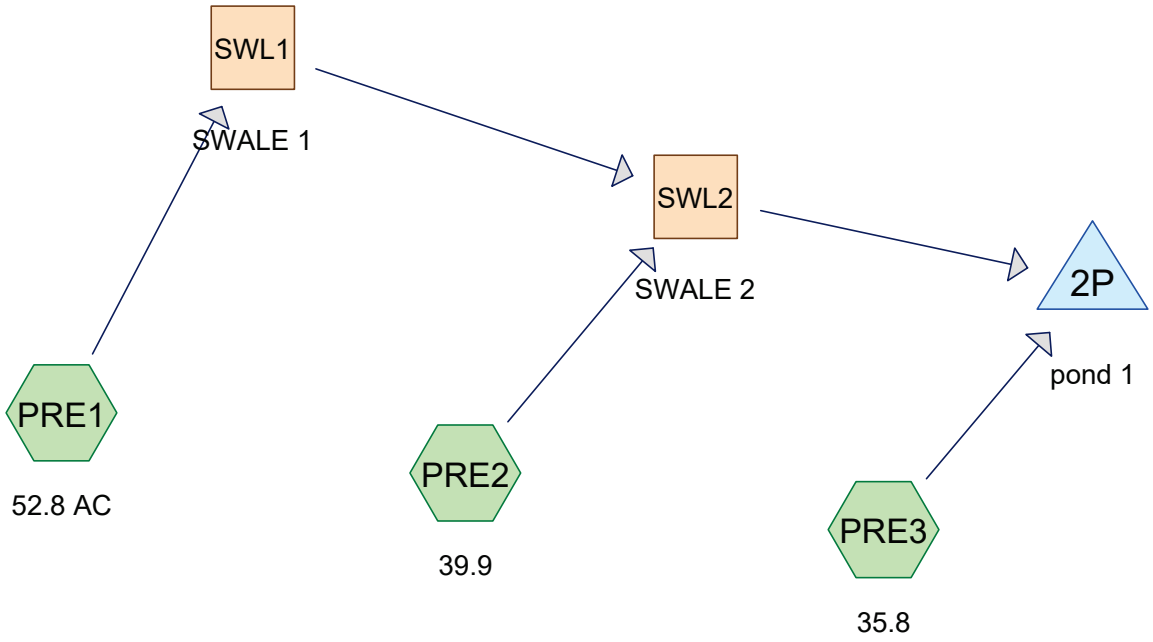
SYMBOL	DATE	DESCRIPTION	APPROVED

DESIGNED BY: C.I.P.
DRAWN BY: R.S.
CHECKED BY: M.B.
SCALE: AS SHOWN

TENTATIVE SUBDIVISION MAP OF INTERNATIONAL PARK OF COMMERCE PHASE II
HYDRO - PRECONDITION

SHEET HYD OF 22 SHEETS

Z:\2023\A23500\DWG\EXHIBITS\HYDROLOGY EXHIBIT\IPC II - HYDRO - PRECONDITION.dwg 12-23-24 04:51:11 PM rsolb



Subcat Reach Pond Link

Routing Diagram for Precondition Detention Basins - 100 year
Prepared by Kier & Wright, Printed 12/23/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
128.500	81	Row crops, C + CR, Good, HSG C (PRE1, PRE2, PRE3)
128.500	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
128.500	HSG C	PRE1, PRE2, PRE3
0.000	HSG D	
0.000	Other	
128.500		**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	128.500	0.000	0.000	128.500	Row crops, C + CR, Good	PRE1, PRE2, PRE3
0.000	**0.000**	**128.500**	**0.000**	**0.000**	**128.500**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRE1: 52.8 AC Runoff Area=52.800 ac 0.00% Impervious Runoff Depth=1.31"
Flow Length=2,000' Slope=0.0100 '/' Tc=53.6 min CN=81 Runoff=20.90 cfs 5.779 af

Subcatchment PRE2: 39.9 Runoff Area=39.900 ac 0.00% Impervious Runoff Depth=1.31"
Flow Length=2,200' Slope=0.0100 '/' Tc=57.9 min CN=81 Runoff=15.11 cfs 4.367 af

Subcatchment PRE3: 35.8 Runoff Area=35.800 ac 0.00% Impervious Runoff Depth=1.31"
Flow Length=1,500' Slope=0.0100 '/' Tc=42.6 min CN=81 Runoff=16.24 cfs 3.919 af

Reach SWL1: SWALE 1 Avg. Flow Depth=0.51' Max Vel=0.68 fps Inflow=20.90 cfs 5.779 af
n=0.050 L=900.0' S=0.0022 '/' Capacity=16.84 cfs Outflow=17.78 cfs 5.774 af

Reach SWL2: SWALE 2 Avg. Flow Depth=0.62' Max Vel=0.65 fps Inflow=27.95 cfs 10.141 af
n=0.050 L=600.0' S=0.0017 '/' Capacity=17.50 cfs Outflow=26.68 cfs 10.132 af

Pond 2P: pond 1 Peak Elev=107.20' Storage=10.722 af Inflow=32.11 cfs 14.051 af
Outflow=7.40 cfs 3.351 af

Total Runoff Area = 128.500 ac Runoff Volume = 14.065 af Average Runoff Depth = 1.31"
100.00% Pervious = 128.500 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment PRE1: 52.8 AC

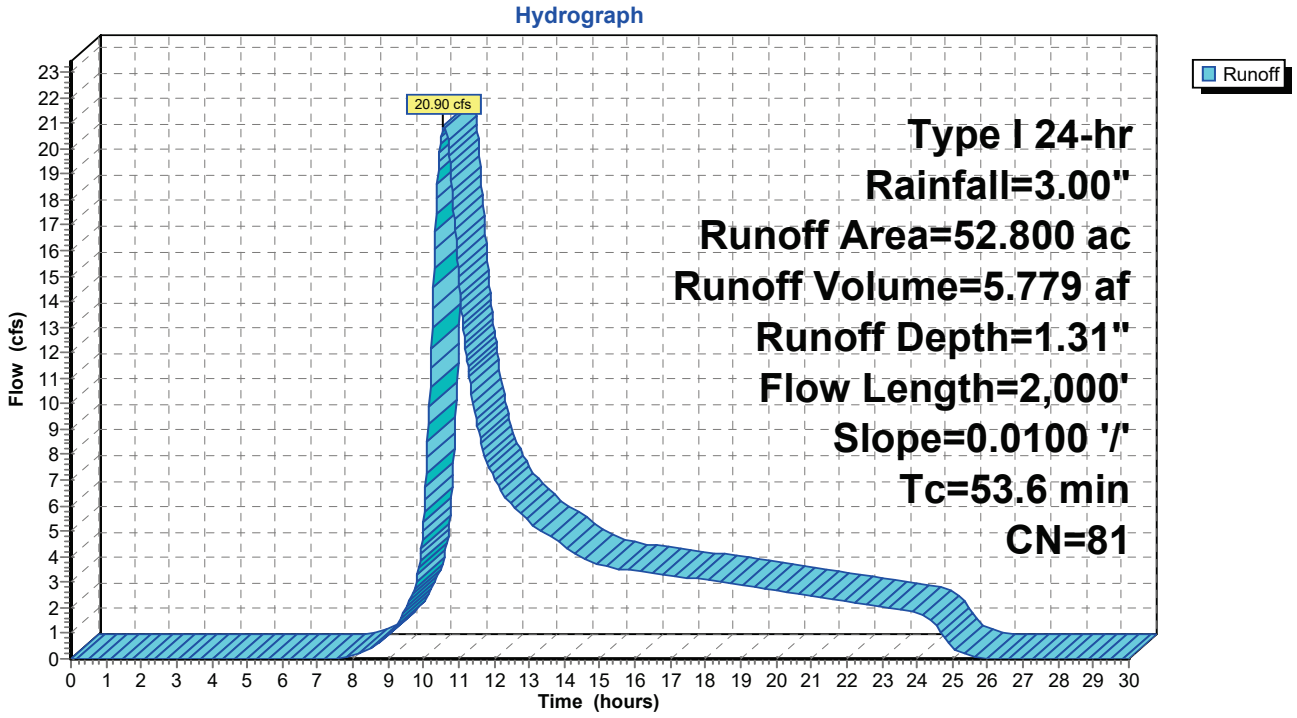
Runoff = 20.90 cfs @ 10.58 hrs, Volume= 5.779 af, Depth= 1.31"
Routed to Reach SWL1 : SWALE 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
52.800	81	Row crops, C + CR, Good, HSG C
52.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
53.6	2,000	0.0100	0.62		**Lag/CN Method,**

Subcatchment PRE1: 52.8 AC



Summary for Subcatchment PRE2: 39.9

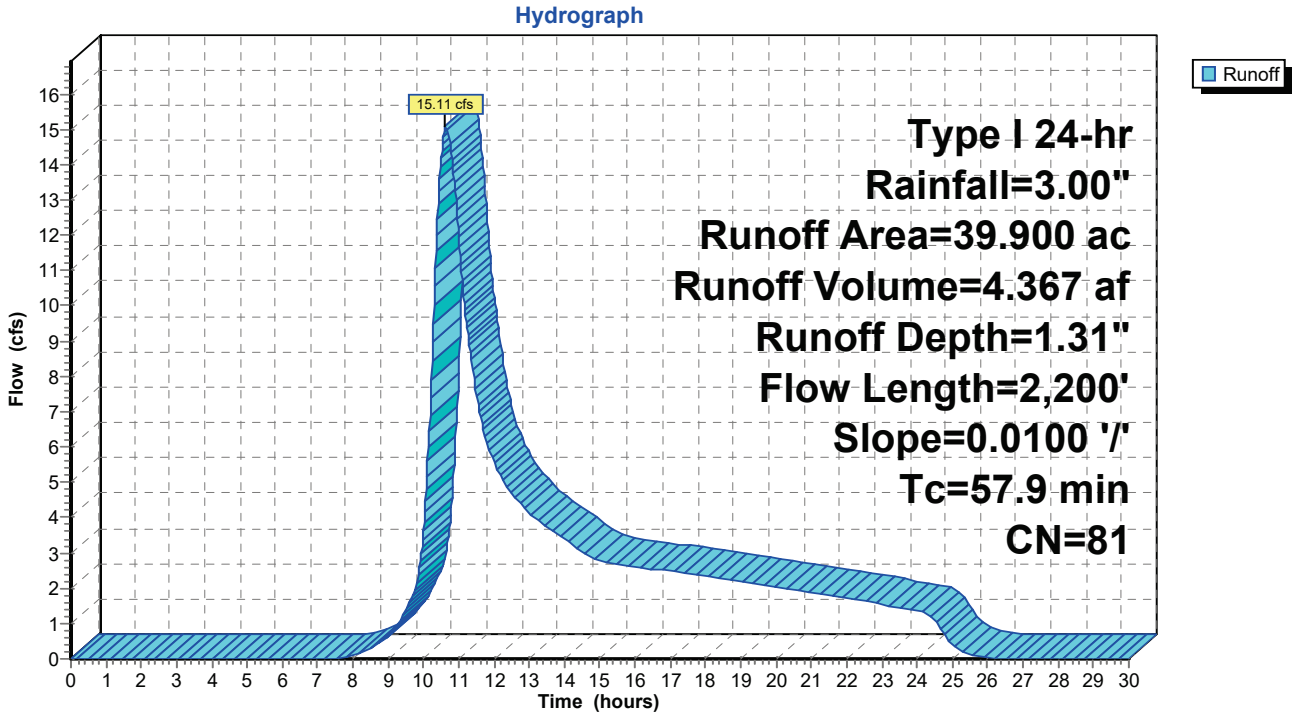
Runoff = 15.11 cfs @ 10.63 hrs, Volume= 4.367 af, Depth= 1.31"
Routed to Reach SWL2 : SWALE 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
39.900	81	Row crops, C + CR, Good, HSG C
39.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.9	2,200	0.0100	0.63		**Lag/CN Method,**

Subcatchment PRE2: 39.9



Summary for Subcatchment PRE3: 35.8

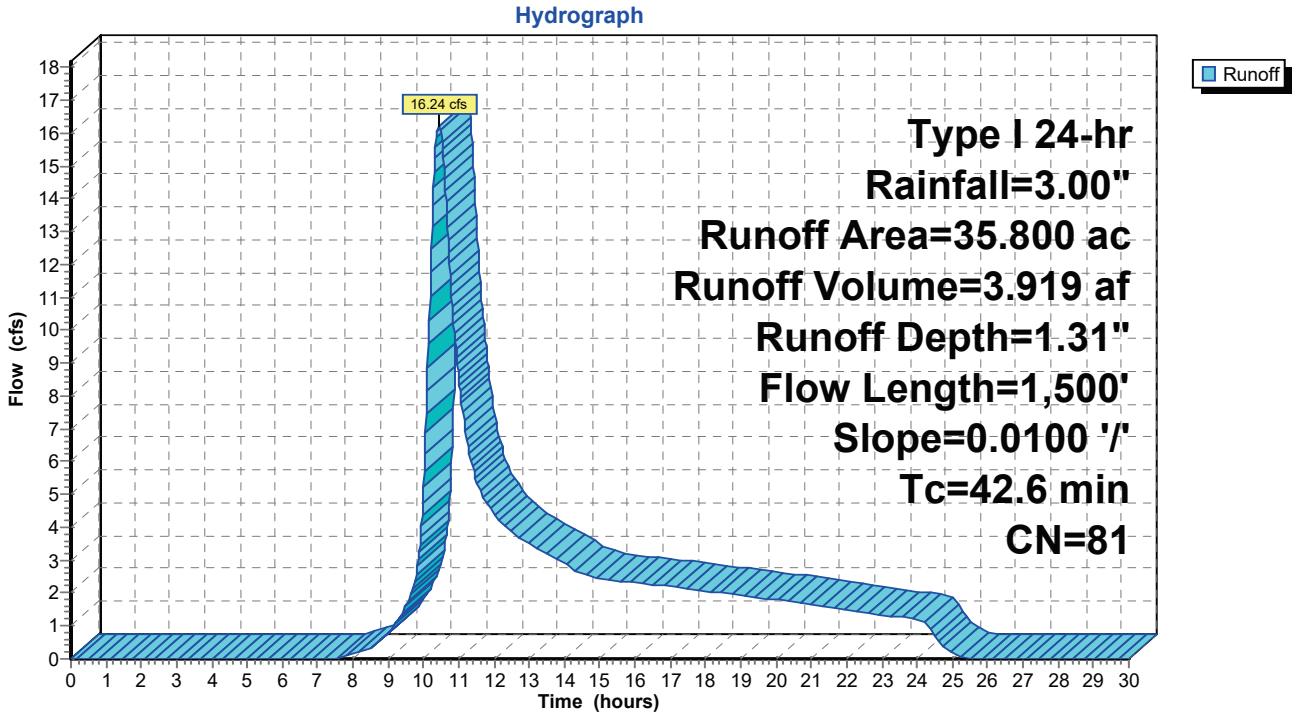
Runoff = 16.24 cfs @ 10.44 hrs, Volume= 3.919 af, Depth= 1.31"
Routed to Pond 2P : pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
35.800	81	Row crops, C + CR, Good, HSG C
35.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.6	1,500	0.0100	0.59		**Lag/CN Method,**

Subcatchment PRE3: 35.8



Summary for Reach SWL1: SWALE 1

[91] Warning: Storage range exceeded by 0.01'
[55] Hint: Peak inflow is 124% of Manning's capacity

Inflow Area = 52.800 ac, 0.00% Impervious, Inflow Depth = 1.31"
Inflow = 20.90 cfs @ 10.58 hrs, Volume= 5.779 af
Outflow = 17.78 cfs @ 11.22 hrs, Volume= 5.774 af, Atten= 15%, Lag= 38.4 min
Routed to Reach SWL2 : SWALE 2

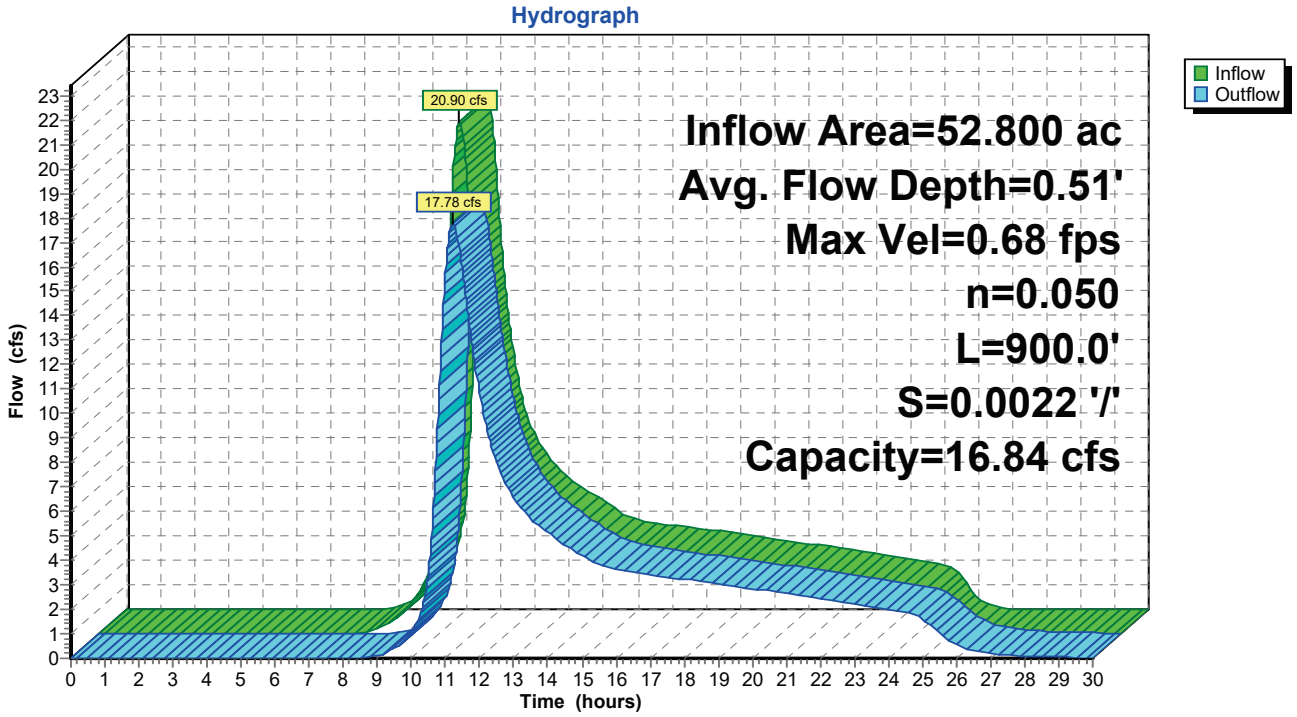
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.68 fps, Min. Travel Time= 21.9 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 44.7 min

Peak Storage= 23,374 cf @ 10.85 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 75.97'
Bank-Full Depth= 0.50' Flow Area= 25.0 sf, Capacity= 16.84 cfs

75.00' x 0.50' deep Parabolic Channel, n= 0.050
Length= 900.0' Slope= 0.0022 '/'
Inlet Invert= 107.00', Outlet Invert= 105.00'

‡

Reach SWL1: SWALE 1



Summary for Reach SWL2: SWALE 2

[91] Warning: Storage range exceeded by 0.12'
[55] Hint: Peak inflow is 160% of Manning's capacity
[62] Hint: Exceeded Reach SWL1 OUTLET depth by 0.18' @ 11.52 hrs
[64] Warning: Exceeded Reach SWL1 outlet bank by 0.12' @ 11.28 hrs

Inflow Area = 92.700 ac, 0.00% Impervious, Inflow Depth > 1.31"
Inflow = 27.95 cfs @ 11.09 hrs, Volume= 10.141 af
Outflow = 26.68 cfs @ 11.53 hrs, Volume= 10.132 af, Atten= 5%, Lag= 26.8 min
Routed to Pond 2P : pond 1

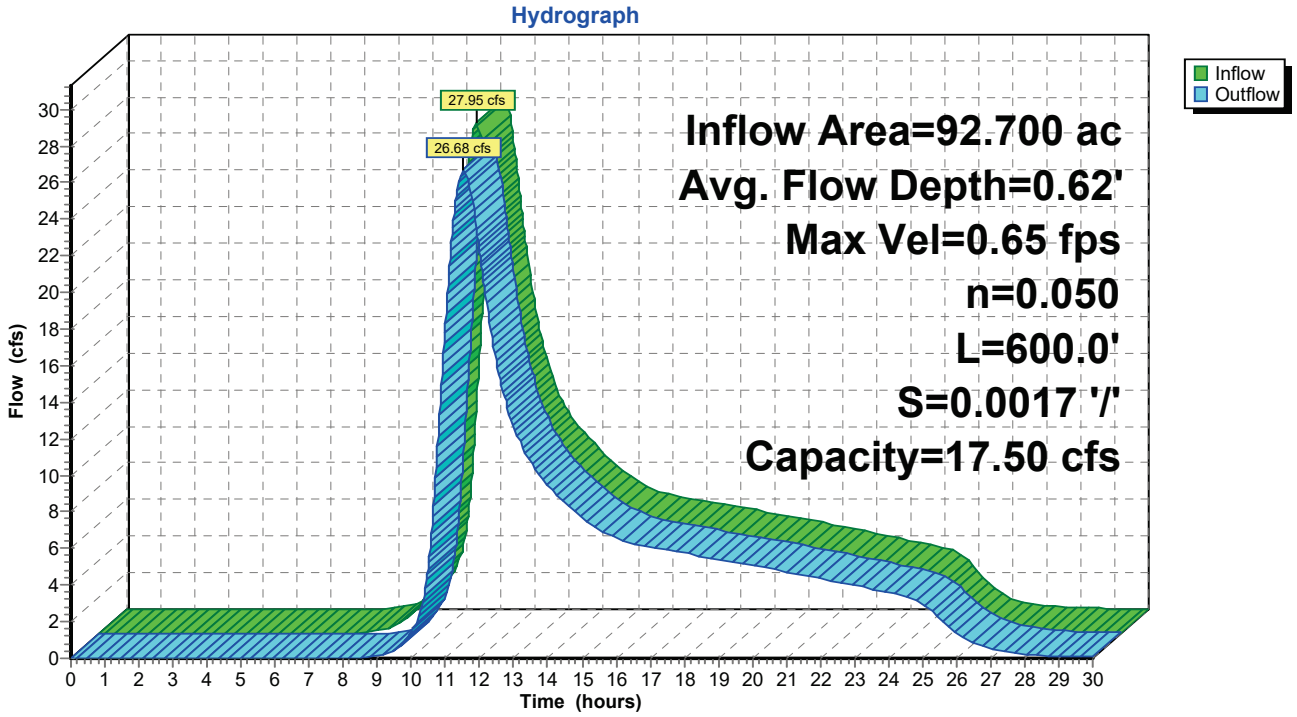
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.65 fps, Min. Travel Time= 15.3 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 29.0 min

Peak Storage= 24,565 cf @ 11.28 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 100.37'
Bank-Full Depth= 0.50' Flow Area= 30.0 sf, Capacity= 17.50 cfs

90.00' x 0.50' deep Parabolic Channel, n= 0.050
Length= 600.0' Slope= 0.0017 '/'
Inlet Invert= 105.00', Outlet Invert= 104.00'

‡

Reach SWL2: SWALE 2



Summary for Pond 2P: pond 1

[63] Warning: Exceeded Reach SWL2 INLET depth by 2.16' @ 29.98 hrs
[64] Warning: Exceeded Reach SWL2 outlet bank by 2.70' @ 18.91 hrs

Inflow Area = 128.500 ac, 0.00% Impervious, Inflow Depth > 1.31"
Inflow = 32.11 cfs @ 11.48 hrs, Volume= 14.051 af
Outflow = 7.40 cfs @ 18.91 hrs, Volume= 3.351 af, Atten= 77%, Lag= 445.9 min
Primary = 7.40 cfs @ 18.91 hrs, Volume= 3.351 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 107.20' @ 18.91 hrs Storage= 10.722 af

Plug-Flow detention time= 668.6 min calculated for 3.351 af (24% of inflow)
Center-of-Mass det. time= 400.8 min (1,318.5 - 917.8)

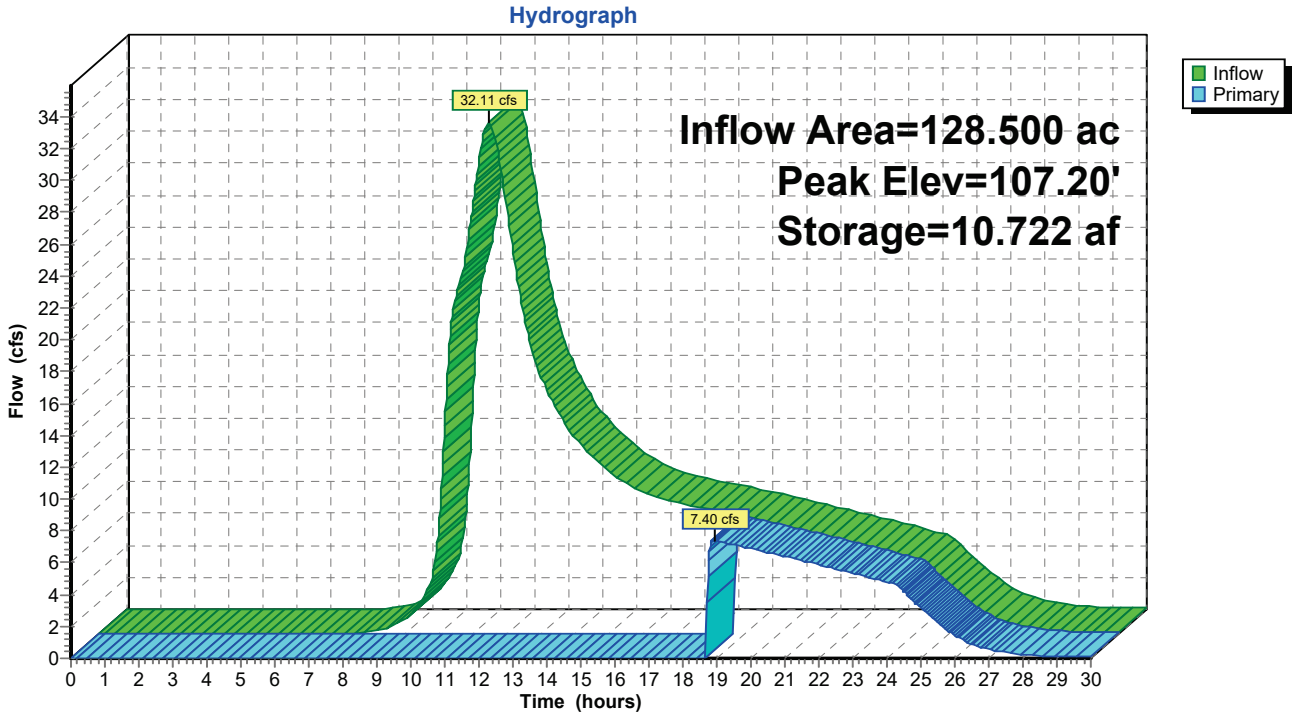
Volume	Invert	Avail.Storage	Storage Description
#1	104.00'	12.500 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
104.00	0.000
105.00	3.400
106.00	5.500
107.00	9.500
107.50	12.500

Device	Routing	Invert	Outlet Devices
#1	Primary	107.20'	**Asymmetrical Weir, C= 3.27** Offset (feet) 0.00 5.00 4,390.00 4,400.00 Height (feet) 0.25 0.00 0.00 0.25

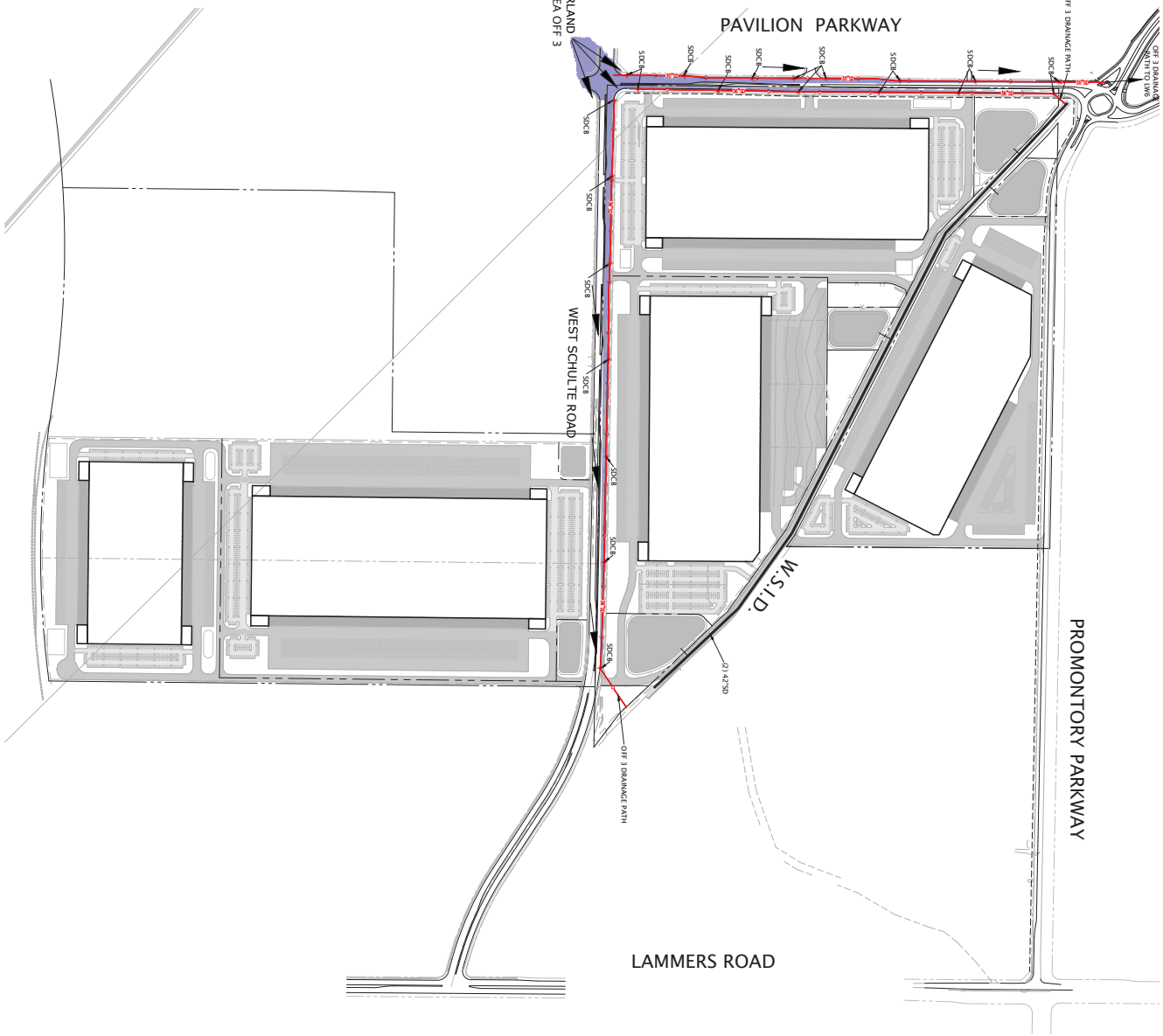
Primary OutFlow Max=3.16 cfs @ 18.91 hrs HW=107.20' (Free Discharge)
↑**1=Asymmetrical Weir** (Weir Controls 3.16 cfs @ 0.20 fps)

Pond 2P: pond 1



Appendix B

IPC Phase II Hydrology Maps



LEGEND

SDCB — STORM DRAIN CATCH BASIN

OFF 3 DRAINAGE PATH — STORM DRAIN CONVEYING OFFSITE FLOWS

NOTE:
DRAINAGE PATH SHOWN IS FOR THE OFFSITE FLOWS ORIGINATING FROM AREA 'OFF 3' WHICH IS THE WESTERN HILLSIDE AS DESCRIBED IN THE CITY OF TRACY 2012 STORMWATER MASTER PLAN.

TENTATIVE SUBDIVISION MAP
OF
INTERNATIONAL PARK OF COMMERCE
PHASE II
OFFSITE FLOW ROUTING

SHEET HYD 1 OF 2 SHEETS

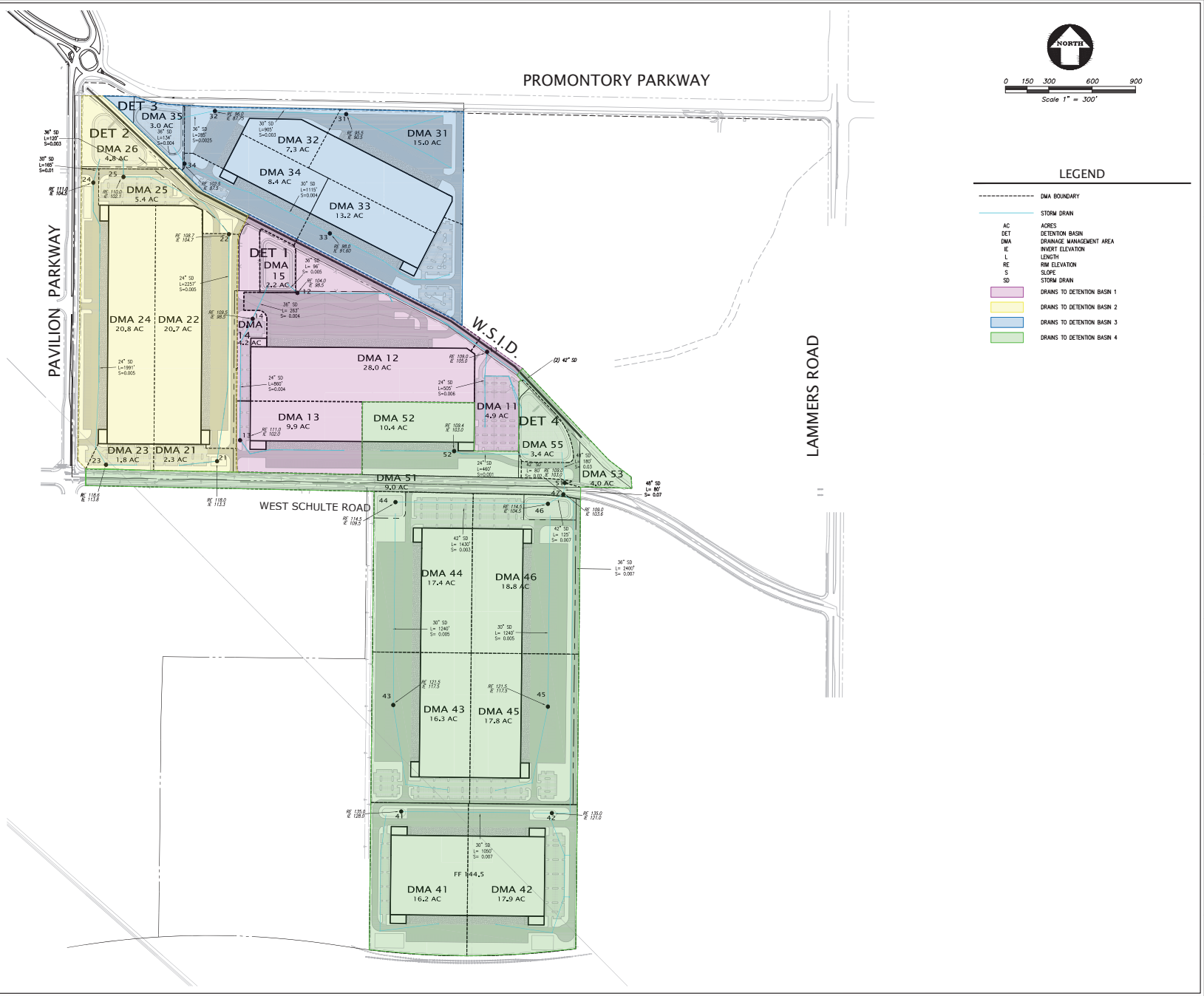
DESIGNED BY: C.I.P.
DRAWN BY: R.S.
CHECKED BY: M.B.
SCALE: AS SHOWN

REVISIONS

SYMBOL	DATE	DESCRIPTION	APPROVED

KIER+WRIGHT
2850 Collier Canyon Road
Livermore, California 94551
Phone (925) 245-8788
www.kierwright.com

REGISTERED PROFESSIONAL ENGINEER — No. 74814 — CIVIL — STATE OF CALIFORNIA



REGISTERED PROFESSIONAL ENGINEER
MICHAEL T. BASSETTI
No. 71814
CIVIL
STATE OF CALIFORNIA

KIER+WRIGHT
2850 Collier Canyon Road
Livermore, California 94551
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www.kierwright.com

SYMBOL	DATE	REVISIONS	APPROVED

DESIGNED BY: C.L.P.
DRAWN BY: R.S.
CHECKED BY: M.B.
SCALE: AS SHOWN

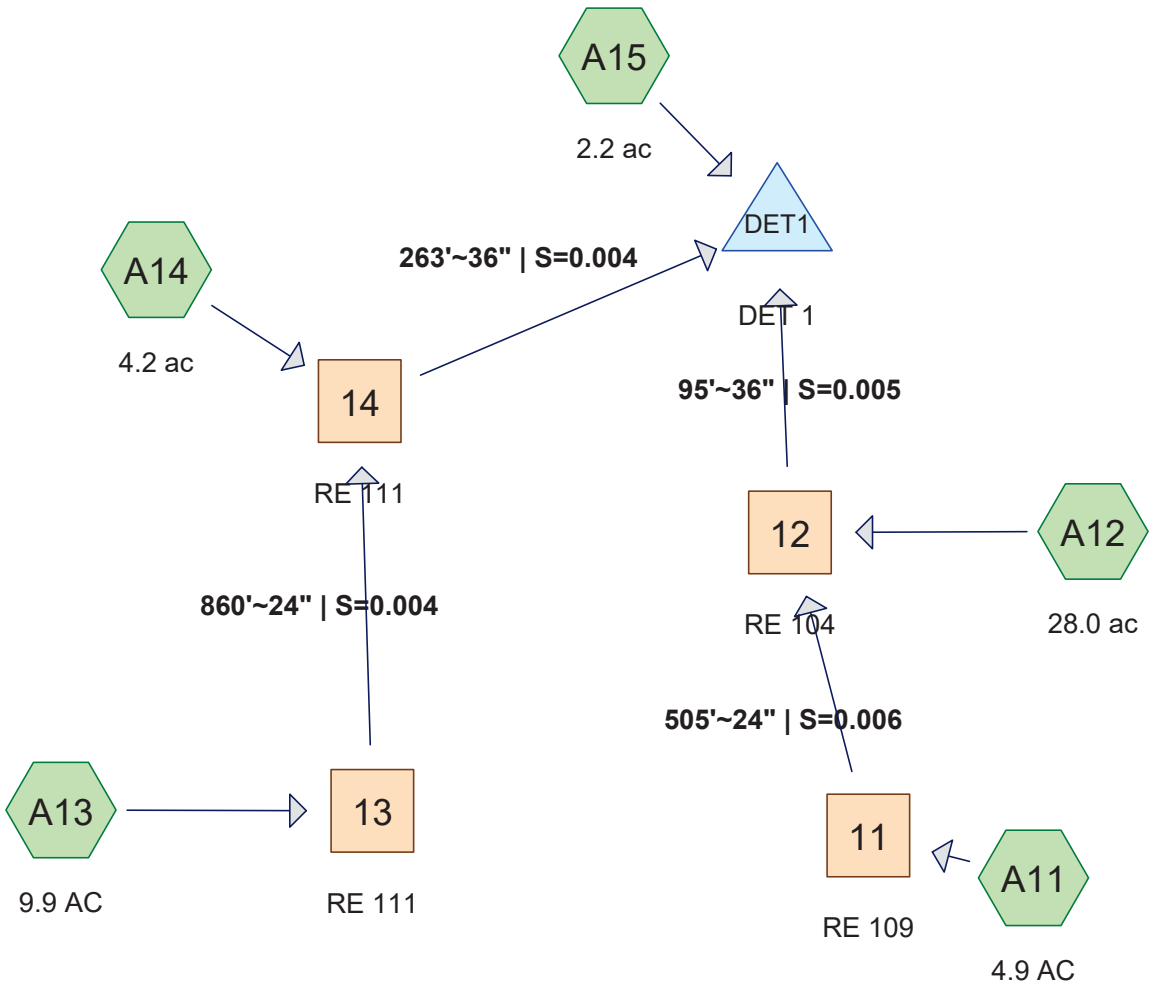
TENTATIVE SUBDIVISION MAP
OF
INTERNATIONAL PARK OF COMMERCE
PHASE II
HYDROMAP

SHEET
HYD
OF 22 SHEETS

Z:\2023\23250\DWG\CIVIL\IPC II - HYDRO.dwg 12-19-24 09:33:21 AM ks

Appendix C

Detention Basin 1 100-Year 24-hour Storm Event Calculations



Subcat Reach Pond Link

Routing Diagram for Detention Basin 1 - 100 year
Prepared by Kier and Wright, Printed 8/24/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.200	100	BASIN (A15)
47.000	91	Urban industrial, 72% imp, HSG C (A11, A12, A13, A14)
49.200	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
47.000	HSG C	A11, A12, A13, A14
0.000	HSG D	
2.200	Other	A15
49.200		**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	0.000	0.000	2.200	2.200	BASIN	A15
0.000	0.000	47.000	0.000	0.000	47.000	Urban industrial, 72% imp	A11, A12, A13, A14
0.000	**0.000**	**47.000**	**0.000**	**2.200**	**49.200**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	11	108.00	105.00	505.0	0.0059	0.013	0.0	24.0	0.0
2	12	98.50	98.00	95.0	0.0053	0.013	0.0	36.0	0.0
3	13	102.00	98.50	860.0	0.0041	0.013	0.0	24.0	0.0
4	14	98.50	98.00	263.0	0.0019	0.013	0.0	36.0	0.0

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A11: 4.9 AC Runoff Area=4.900 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=7.62 cfs 0.846 af

Subcatchment A12: 28.0 ac Runoff Area=28.000 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=43.53 cfs 4.833 af

Subcatchment A13: 9.9 AC Runoff Area=9.900 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=15.39 cfs 1.709 af

Subcatchment A14: 4.2 ac Runoff Area=4.200 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=6.53 cfs 0.725 af

Subcatchment A15: 2.2 ac Runoff Area=2.200 ac 100.00% Impervious Runoff Depth=3.00"
Tc=0.0 min CN=100 Runoff=5.23 cfs 0.550 af

Reach 11: RE 109 Avg. Flow Depth=0.92' Max Vel=5.34 fps Inflow=7.62 cfs 0.846 af
24.0" Round Pipe n=0.013 L=505.0' S=0.0059 '/' Capacity=17.44 cfs Outflow=7.49 cfs 0.846 af

Reach 12: RE 104 Avg. Flow Depth=2.60' Max Vel=7.80 fps Inflow=50.56 cfs 5.679 af
36.0" Round Pipe n=0.013 L=95.0' S=0.0053 '/' Capacity=48.39 cfs Outflow=50.40 cfs 5.679 af

Reach 13: RE 111 Avg. Flow Depth=1.66' Max Vel=5.24 fps Inflow=15.39 cfs 1.709 af
24.0" Round Pipe n=0.013 L=860.0' S=0.0041 '/' Capacity=14.43 cfs Outflow=14.56 cfs 1.709 af

Reach 14: RE 111 Avg. Flow Depth=1.82' Max Vel=4.43 fps Inflow=20.04 cfs 2.434 af
36.0" Round Pipe n=0.013 L=263.0' S=0.0019 '/' Capacity=29.08 cfs Outflow=19.91 cfs 2.434 af

Pond DET1: DET 1 Peak Elev=104.58' Storage=7.468 af Inflow=69.42 cfs 8.662 af
Outflow=1.18 cfs 1.735 af

Total Runoff Area = 49.200 ac Runoff Volume = 8.662 af Average Runoff Depth = 2.11"
26.75% Pervious = 13.160 ac 73.25% Impervious = 36.040 ac

Summary for Subcatchment A11: 4.9 AC

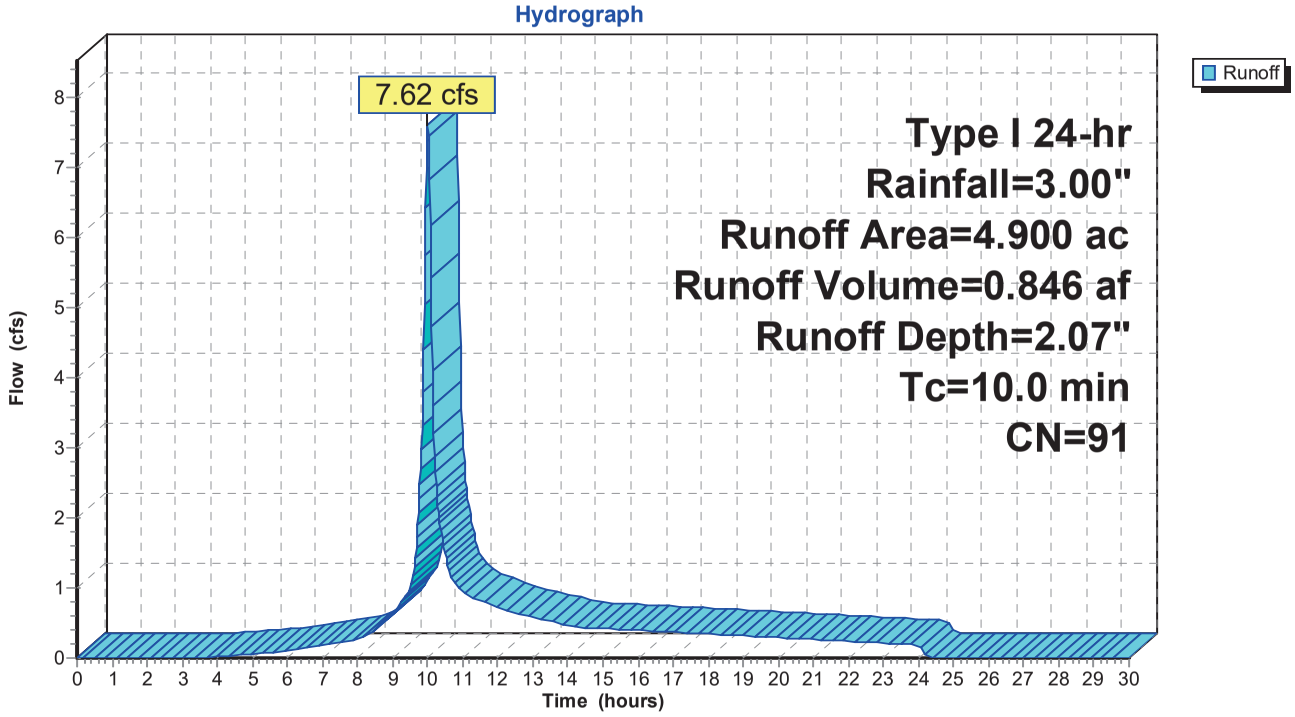
Runoff = 7.62 cfs @ 10.01 hrs, Volume= 0.846 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
4.900	91	Urban industrial, 72% imp, HSG C
1.372		28.00% Pervious Area
3.528		72.00% Impervious Area

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

Subcatchment A11: 4.9 AC



Summary for Subcatchment A12: 28.0 ac

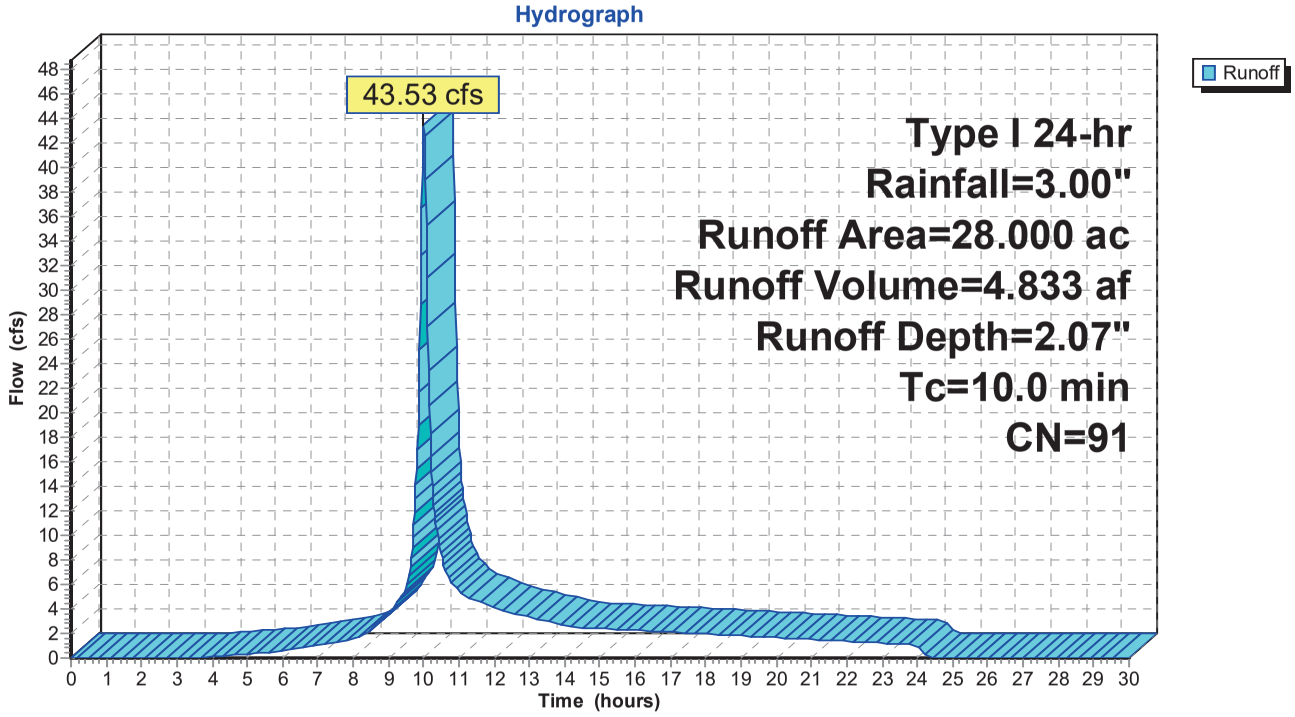
Runoff = 43.53 cfs @ 10.01 hrs, Volume= 4.833 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
28.000	91	Urban industrial, 72% imp, HSG C
7.840		28.00% Pervious Area
20.160		72.00% Impervious Area

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

Subcatchment A12: 28.0 ac



Summary for Subcatchment A13: 9.9 AC

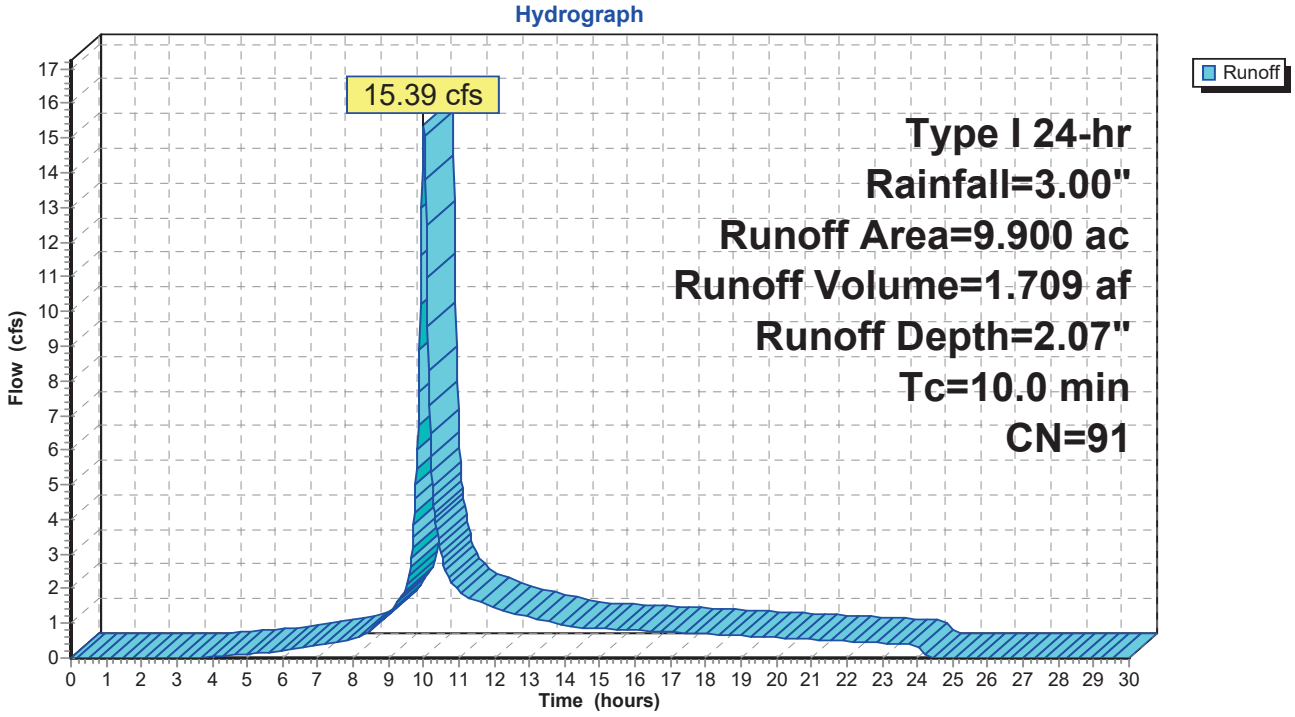
Runoff = 15.39 cfs @ 10.01 hrs, Volume= 1.709 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
9.900	91	Urban industrial, 72% imp, HSG C
2.772		28.00% Pervious Area
7.128		72.00% Impervious Area

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

Subcatchment A13: 9.9 AC



Summary for Subcatchment A14: 4.2 ac

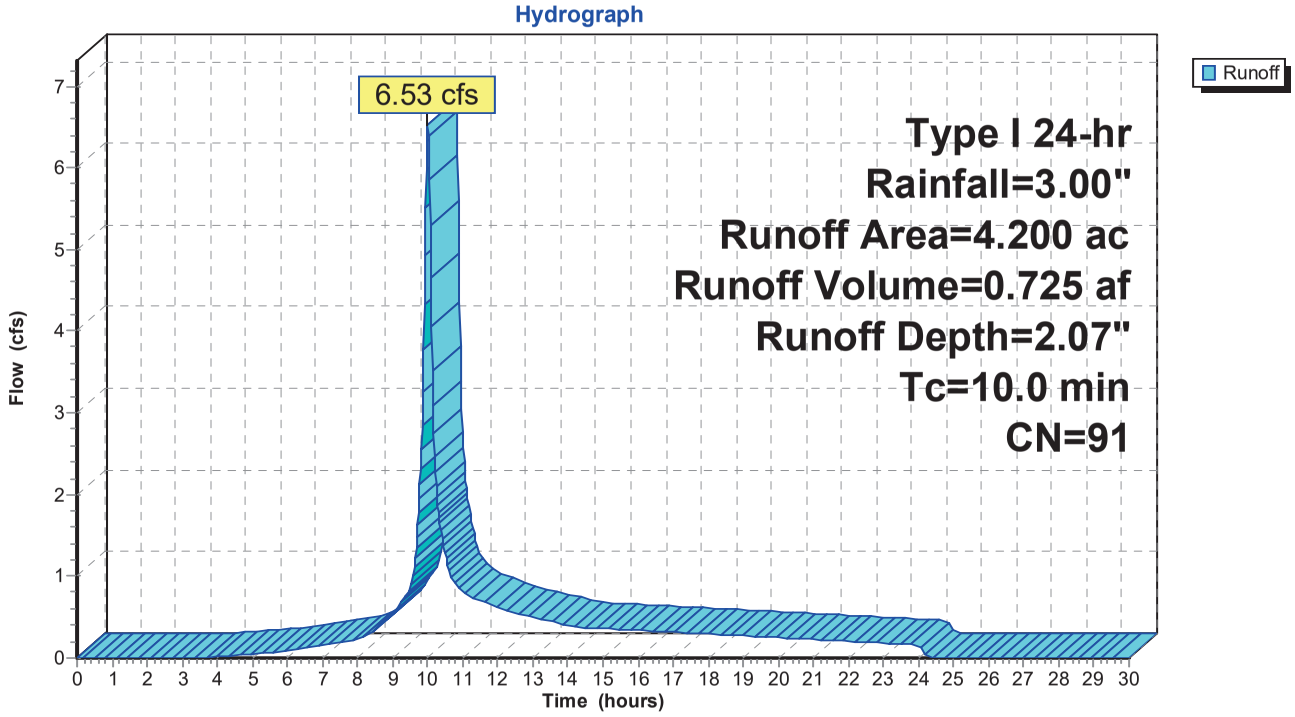
Runoff = 6.53 cfs @ 10.01 hrs, Volume= 0.725 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
4.200	91	Urban industrial, 72% imp, HSG C
1.176		28.00% Pervious Area
3.024		72.00% Impervious Area

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

Subcatchment A14: 4.2 ac



Summary for Subcatchment A15: 2.2 ac

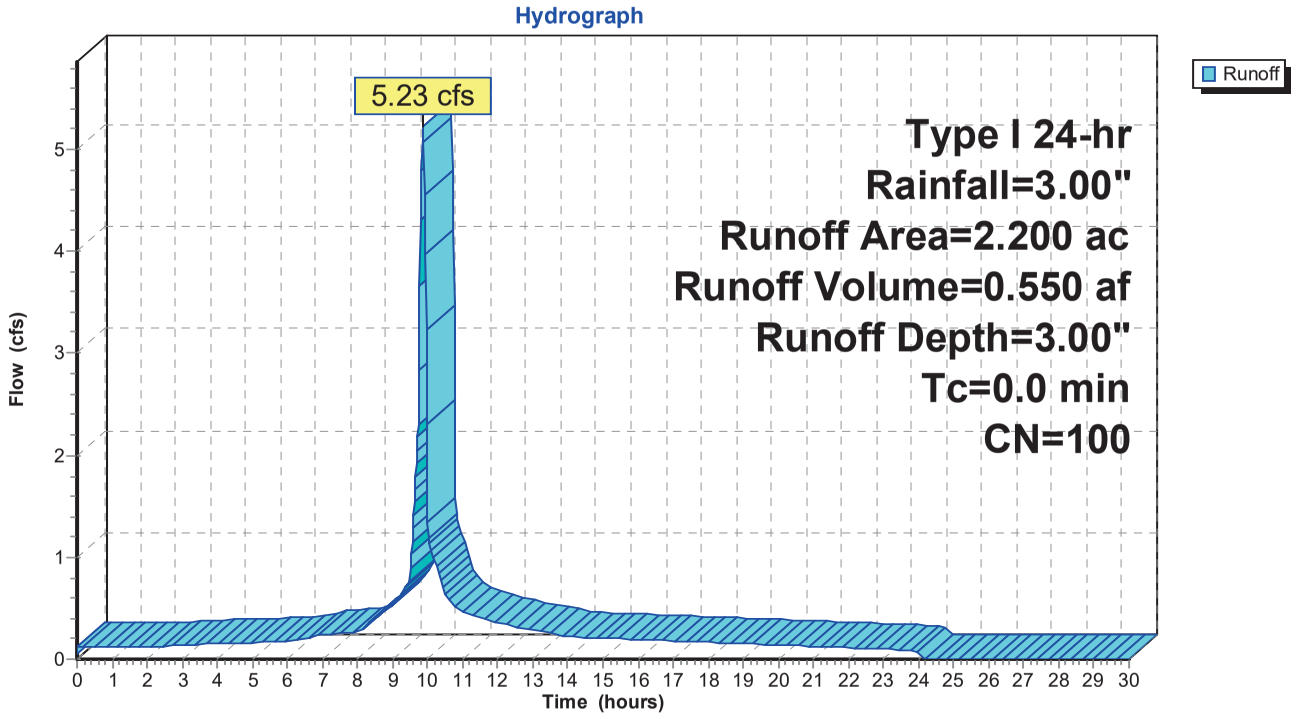
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 5.23 cfs @ 9.86 hrs, Volume= 0.550 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

	Area (ac)	CN	Description
*	2.200	100	BASIN
	2.200		100.00% Impervious Area

Subcatchment A15: 2.2 ac



Summary for Reach 11: RE 109

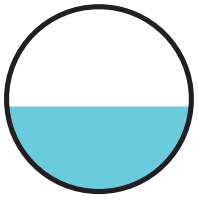
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 4.900 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 7.62 cfs @ 10.01 hrs, Volume= 0.846 af
Outflow = 7.49 cfs @ 10.05 hrs, Volume= 0.846 af, Atten= 2%, Lag= 2.7 min

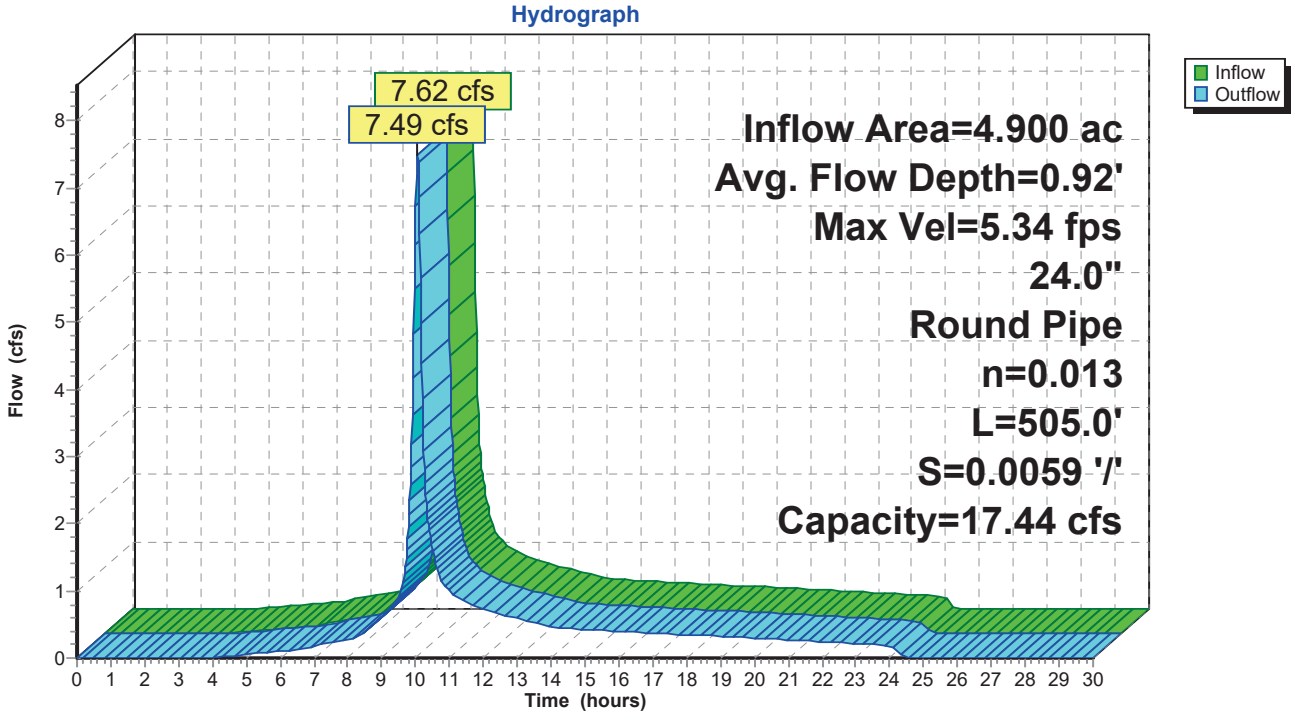
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.34 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.08 fps, Avg. Travel Time= 4.0 min

Peak Storage= 710 cf @ 10.03 hrs
Average Depth at Peak Storage= 0.92' , Surface Width= 1.99'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 17.44 cfs

24.0" Round Pipe
n= 0.013
Length= 505.0' Slope= 0.0059 '/'
Inlet Invert= 108.00', Outlet Invert= 105.00'



Reach 11: RE 109



Summary for Reach 12: RE 104

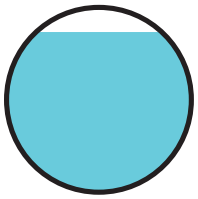
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 104% of Manning's capacity

Inflow Area = 32.900 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 50.56 cfs @ 10.01 hrs, Volume= 5.679 af
Outflow = 50.40 cfs @ 10.02 hrs, Volume= 5.679 af, Atten= 0%, Lag= 0.4 min

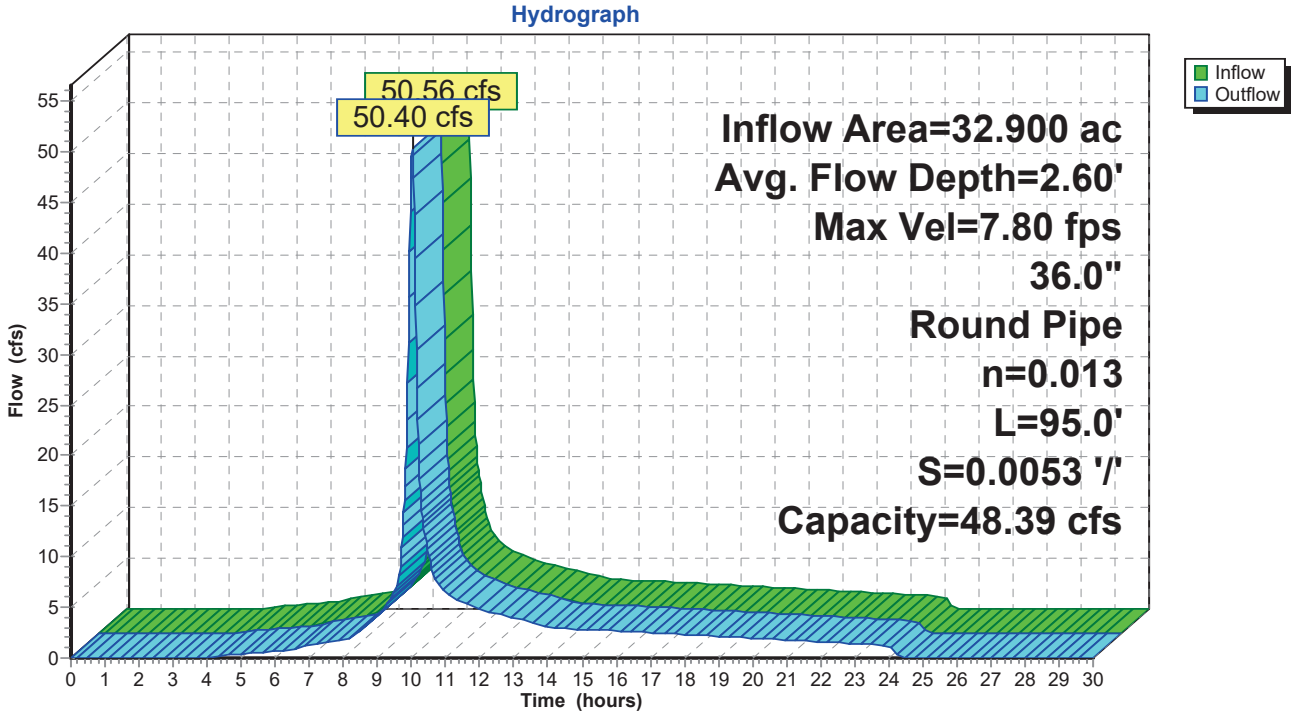
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.80 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 0.5 min

Peak Storage= 618 cf @ 10.02 hrs
Average Depth at Peak Storage= 2.60' , Surface Width= 2.04'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 48.39 cfs

36.0" Round Pipe
n= 0.013
Length= 95.0' Slope= 0.0053 '/'
Inlet Invert= 98.50', Outlet Invert= 98.00'



Reach 12: RE 104



Summary for Reach 13: RE 111

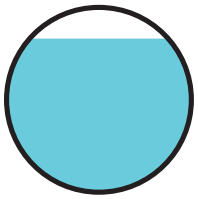
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 107% of Manning's capacity

Inflow Area = 9.900 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 15.39 cfs @ 10.01 hrs, Volume= 1.709 af
Outflow = 14.56 cfs @ 10.09 hrs, Volume= 1.709 af, Atten= 5%, Lag= 4.9 min

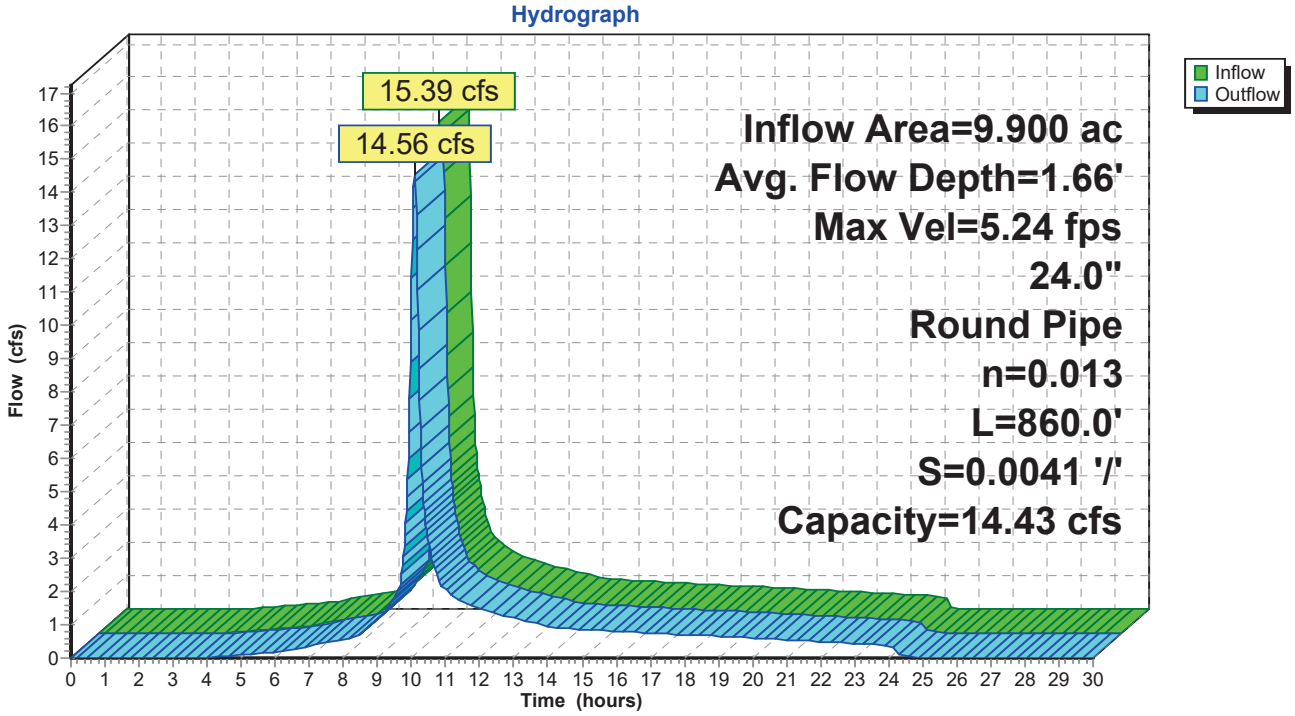
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.24 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 6.8 min

Peak Storage= 2,399 cf @ 10.04 hrs
Average Depth at Peak Storage= 1.66' , Surface Width= 1.50'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 14.43 cfs

24.0" Round Pipe
n= 0.013
Length= 860.0' Slope= 0.0041 '/'
Inlet Invert= 102.00', Outlet Invert= 98.50'



Reach 13: RE 111



Summary for Reach 14: RE 111

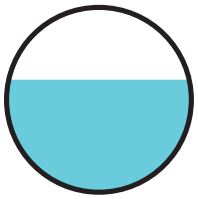
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 13 OUTLET depth by 0.43' @ 10.16 hrs

Inflow Area = 14.100 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 20.04 cfs @ 10.06 hrs, Volume= 2.434 af
Outflow = 19.91 cfs @ 10.09 hrs, Volume= 2.434 af, Atten= 1%, Lag= 1.8 min

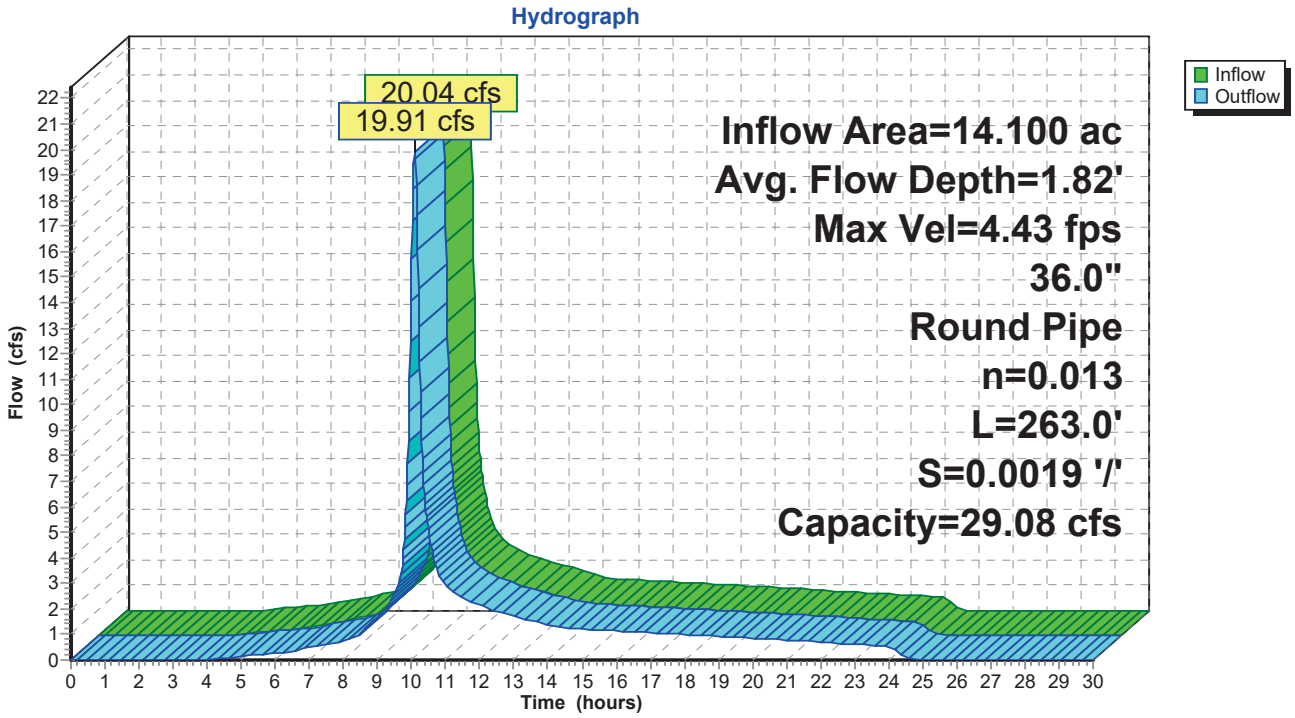
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.43 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.69 fps, Avg. Travel Time= 2.6 min

Peak Storage= 1,183 cf @ 10.07 hrs
Average Depth at Peak Storage= 1.82' , Surface Width= 2.93'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 29.08 cfs

36.0" Round Pipe
n= 0.013
Length= 263.0' Slope= 0.0019 '/'
Inlet Invert= 98.50', Outlet Invert= 98.00'



Reach 14: RE 111



Summary for Pond DET1: DET 1

[63] Warning: Exceeded Reach 12 INLET depth by 6.03' @ 24.70 hrs
[63] Warning: Exceeded Reach 14 INLET depth by 5.98' @ 24.86 hrs

Inflow Area = 49.200 ac, 73.25% Impervious, Inflow Depth = 2.11"
Inflow = 69.42 cfs @ 10.04 hrs, Volume= 8.662 af
Outflow = 1.18 cfs @ 24.15 hrs, Volume= 1.735 af, Atten= 98%, Lag= 846.8 min
Primary = 1.18 cfs @ 24.15 hrs, Volume= 1.735 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 104.58' @ 24.15 hrs Storage= 7.468 af

Plug-Flow detention time= 733.6 min calculated for 1.734 af (20% of inflow)
Center-of-Mass det. time= 472.2 min (1,240.6 - 768.4)

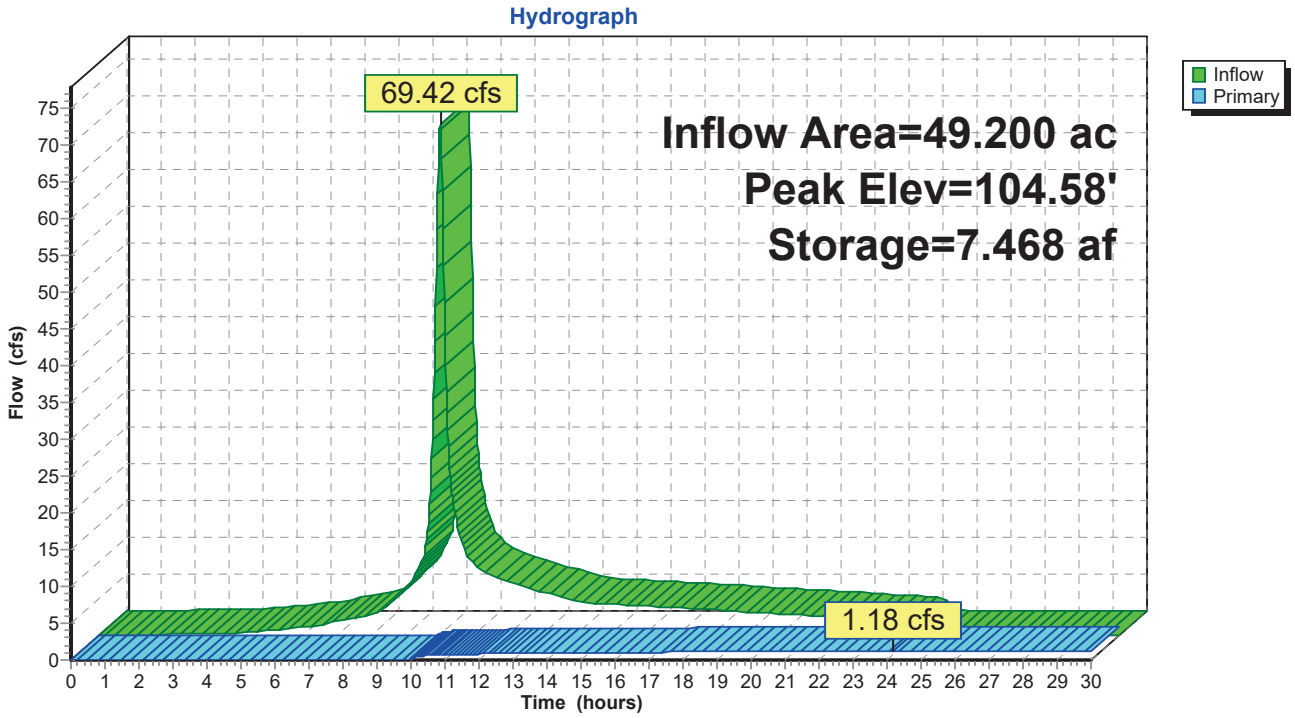
Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	9.140 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
97.50	0.000
105.00	7.910
106.00	9.140

Device	Routing	Invert	Outlet Devices
#1	Primary	99.50'	**4.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

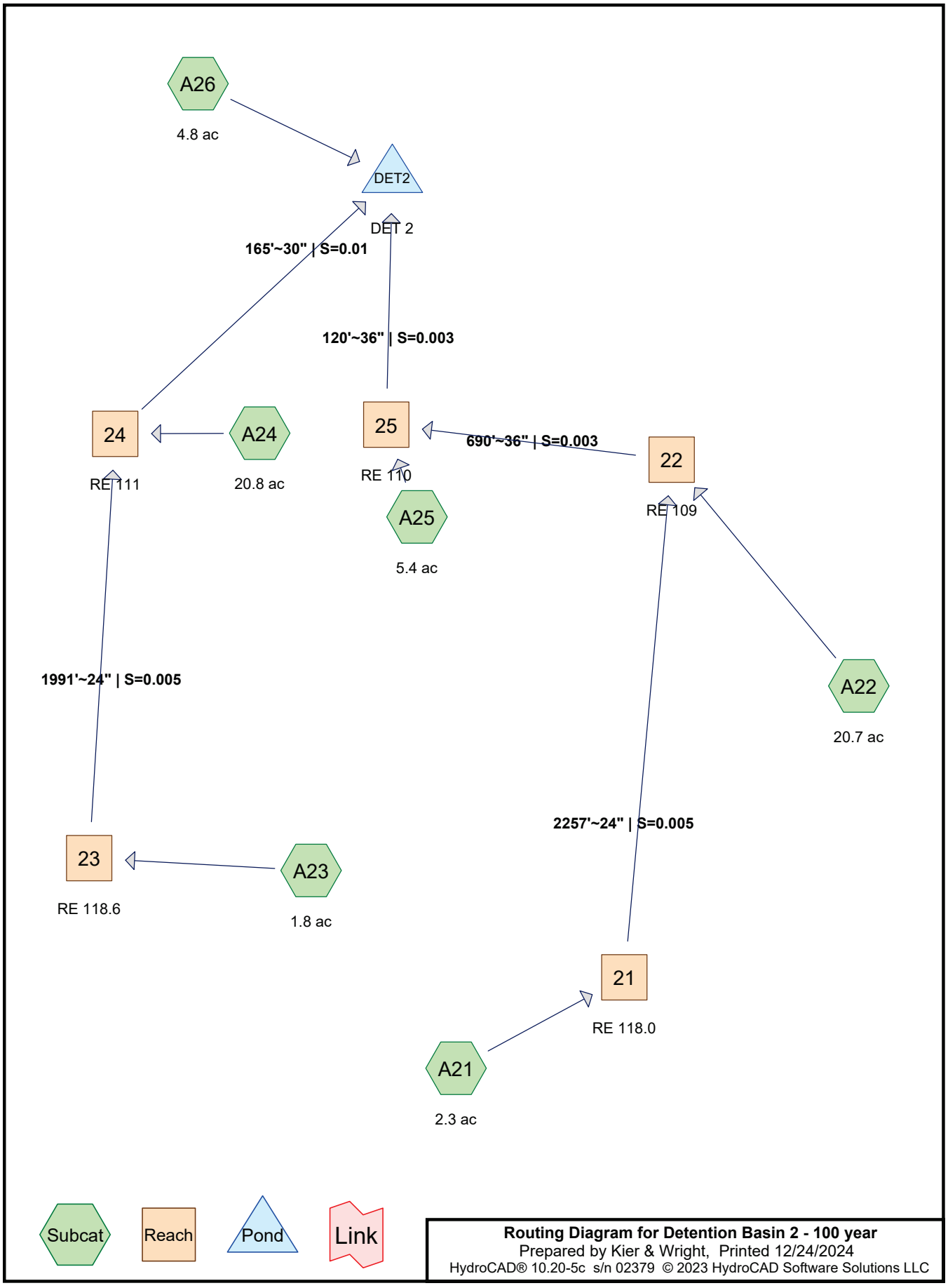
Primary OutFlow Max=1.18 cfs @ 24.15 hrs HW=104.58' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 1.18 cfs @ 10.65 fps)

Pond DET1: DET 1



Appendix D

Detention Basin 2 100-Year 24-hour Storm Event Calculations



Routing Diagram for Detention Basin 2 - 100 year
Prepared by Kier & Wright, Printed 12/24/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.800	100	BASIN (A26)
51.000	91	Urban industrial, 72% imp, HSG C (A21, A22, A23, A24, A25)
55.800	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
51.000	HSG C	A21, A22, A23, A24, A25
0.000	HSG D	
4.800	Other	A26
55.800		**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	0.000	0.000	4.800	4.800	BASIN	A26
0.000	0.000	51.000	0.000	0.000	51.000	Urban industrial, 72% imp	A21, A22, A23, A24, A25
0.000	**0.000**	**51.000**	**0.000**	**4.800**	**55.800**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	21	113.30	101.90	2,257.0	0.0051	0.013	0.0	24.0	0.0	
2	22	104.70	102.60	690.0	0.0030	0.013	0.0	36.0	0.0	
3	23	113.80	104.50	1,991.0	0.0047	0.013	0.0	24.0	0.0	
4	24	104.50	102.50	165.0	0.0121	0.013	0.0	30.0	0.0	
5	25	102.10	101.70	120.0	0.0033	0.013	0.0	36.0	0.0	

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA21: 2.3 ac Runoff Area=2.300 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=3.58 cfs 0.397 af

SubcatchmentA22: 20.7 ac Runoff Area=20.700 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=32.18 cfs 3.573 af

SubcatchmentA23: 1.8 ac Runoff Area=1.800 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=2.80 cfs 0.311 af

SubcatchmentA24: 20.8 ac Runoff Area=20.800 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=32.34 cfs 3.590 af

SubcatchmentA25: 5.4 ac Runoff Area=5.400 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=8.40 cfs 0.932 af

SubcatchmentA26: 4.8 ac Runoff Area=4.800 ac 100.00% Impervious Runoff Depth=3.00"
Tc=0.0 min CN=100 Runoff=11.42 cfs 1.200 af

Reach 21: RE 118.0 Avg. Flow Depth=0.56' Max Vel=3.83 fps Inflow=3.58 cfs 0.397 af
24.0" Round Pipe n=0.013 L=2,257.0' S=0.0051 '/' Capacity=16.08 cfs Outflow=2.78 cfs 0.397 af

Reach 22: RE 109 Avg. Flow Depth=2.18' Max Vel=5.87 fps Inflow=33.11 cfs 3.970 af
36.0" Round Pipe n=0.013 L=690.0' S=0.0030 '/' Capacity=36.80 cfs Outflow=32.18 cfs 3.970 af

Reach 23: RE 118.6 Avg. Flow Depth=0.51' Max Vel=3.49 fps Inflow=2.80 cfs 0.311 af
24.0" Round Pipe n=0.013 L=1,991.0' S=0.0047 '/' Capacity=15.46 cfs Outflow=2.20 cfs 0.311 af

Reach 24: RE 111 Avg. Flow Depth=1.59' Max Vel=10.04 fps Inflow=33.08 cfs 3.901 af
30.0" Round Pipe n=0.013 L=165.0' S=0.0121 '/' Capacity=45.16 cfs Outflow=32.98 cfs 3.901 af

Reach 25: RE 110 Avg. Flow Depth=2.54' Max Vel=6.21 fps Inflow=39.67 cfs 4.902 af
36.0" Round Pipe n=0.013 L=120.0' S=0.0033 '/' Capacity=38.51 cfs Outflow=39.51 cfs 4.902 af

Pond DET2: DET 2 Peak Elev=105.91' Storage=9.046 af Inflow=73.59 cfs 10.003 af
Outflow=1.08 cfs 1.443 af

Total Runoff Area = 55.800 ac Runoff Volume = 10.003 af Average Runoff Depth = 2.15"
25.59% Pervious = 14.280 ac 74.41% Impervious = 41.520 ac

Summary for Subcatchment A21: 2.3 ac

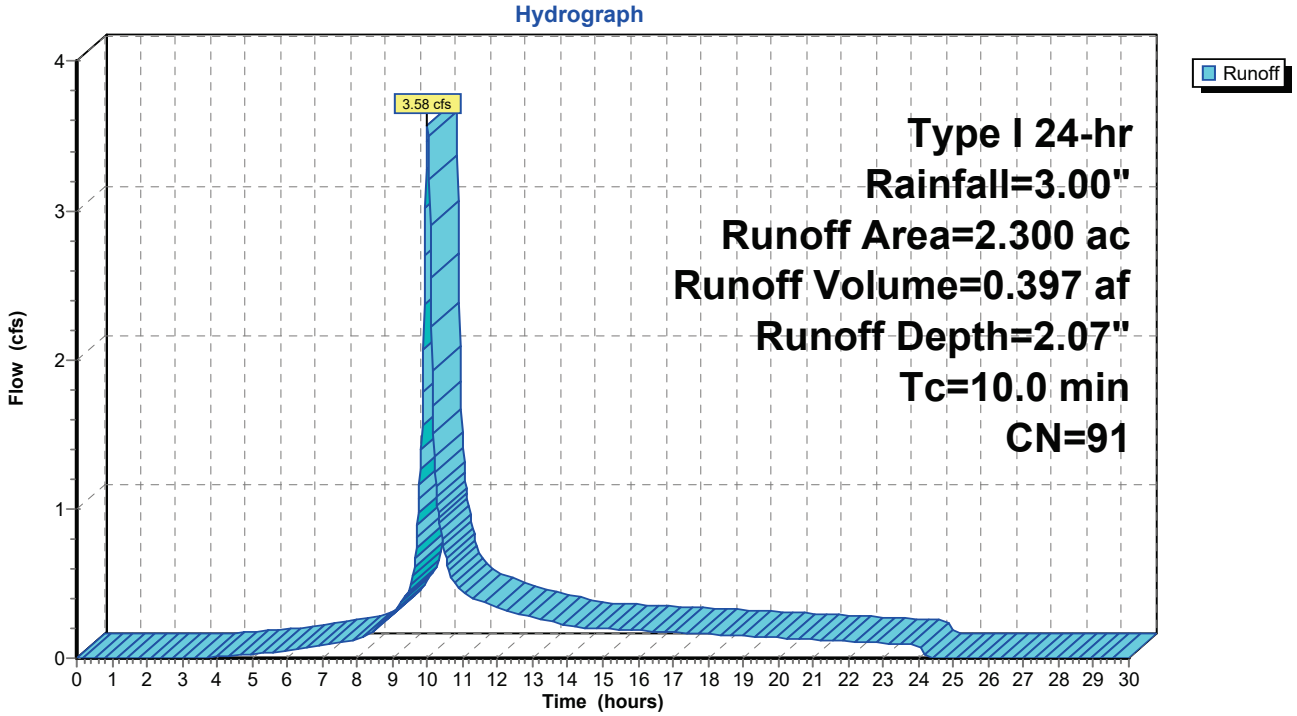
Runoff = 3.58 cfs @ 10.01 hrs, Volume= 0.397 af, Depth= 2.07"
Routed to Reach 21 : RE 118.0

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
2.300	91	Urban industrial, 72% imp, HSG C
0.644		28.00% Pervious Area
1.656		72.00% Impervious Area

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

Subcatchment A21: 2.3 ac



Summary for Subcatchment A22: 20.7 ac

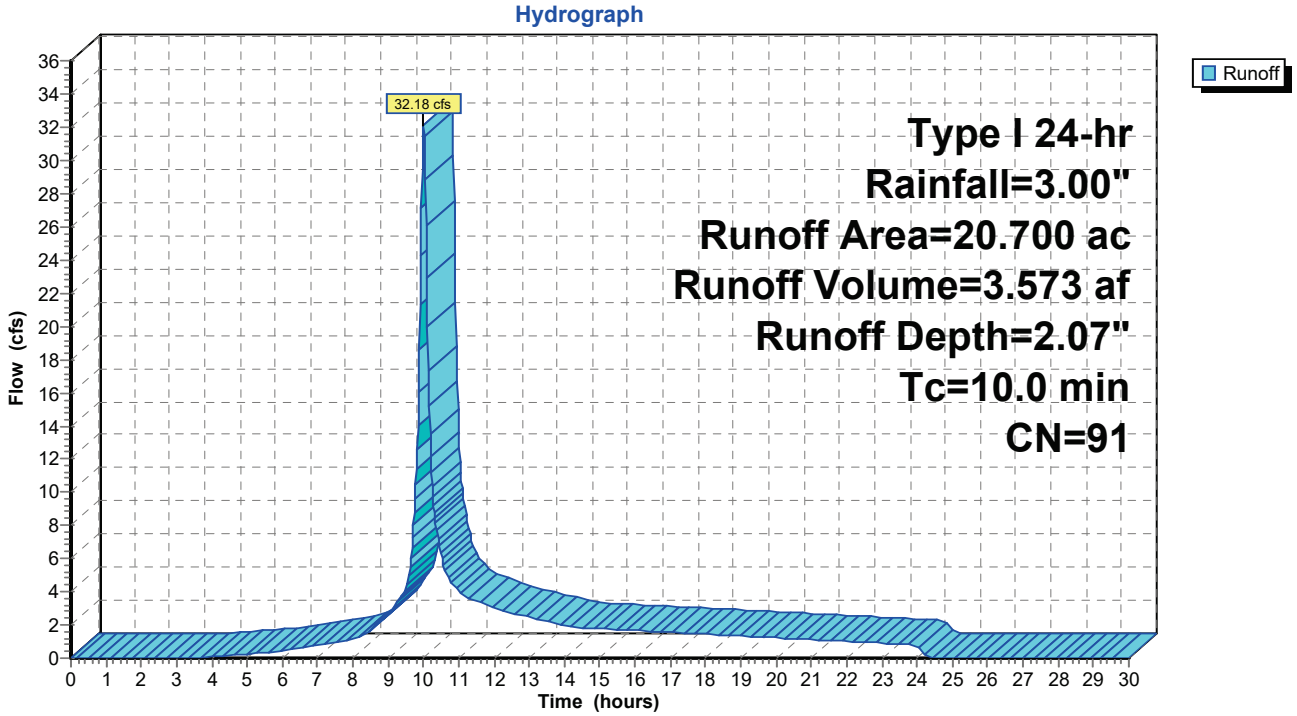
Runoff = 32.18 cfs @ 10.01 hrs, Volume= 3.573 af, Depth= 2.07"
Routed to Reach 22 : RE 109

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
20.700	91	Urban industrial, 72% imp, HSG C
5.796		28.00% Pervious Area
14.904		72.00% Impervious Area

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

Subcatchment A22: 20.7 ac



Summary for Subcatchment A23: 1.8 ac

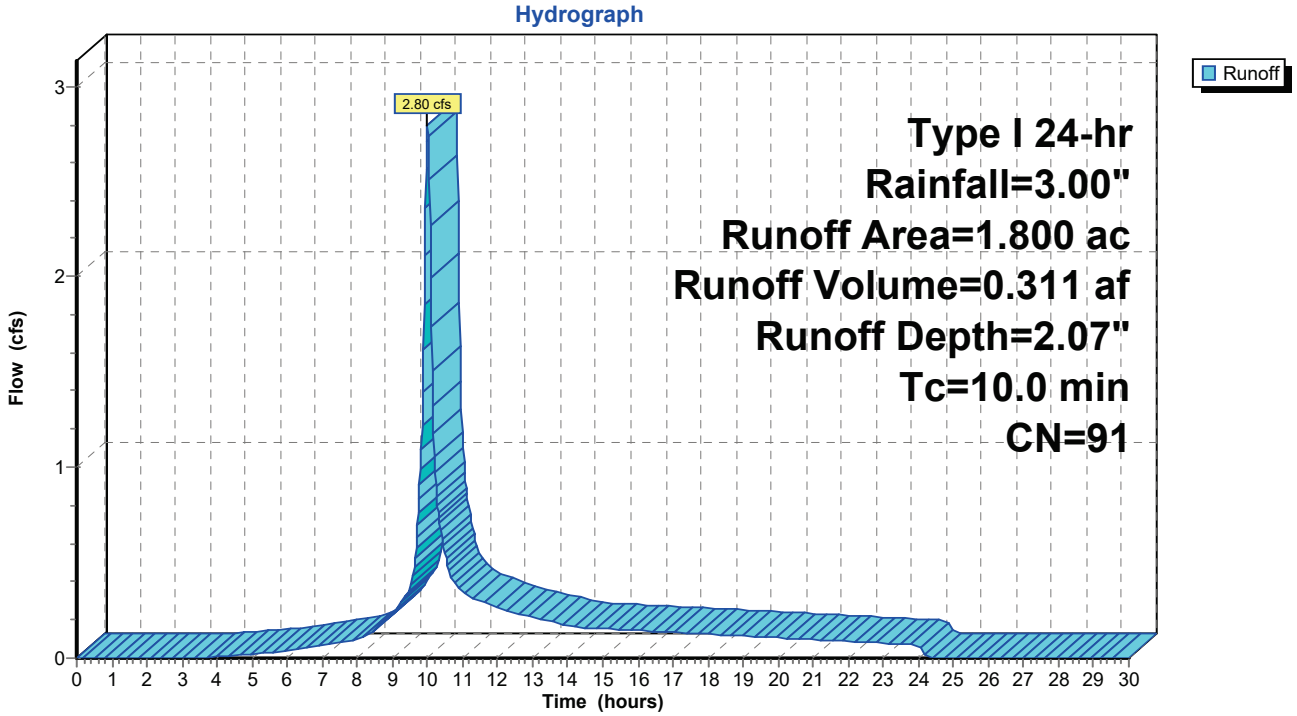
Runoff = 2.80 cfs @ 10.01 hrs, Volume= 0.311 af, Depth= 2.07"
Routed to Reach 23 : RE 118.6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
1.800	91	Urban industrial, 72% imp, HSG C
0.504		28.00% Pervious Area
1.296		72.00% Impervious Area

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

Subcatchment A23: 1.8 ac



Summary for Subcatchment A24: 20.8 ac

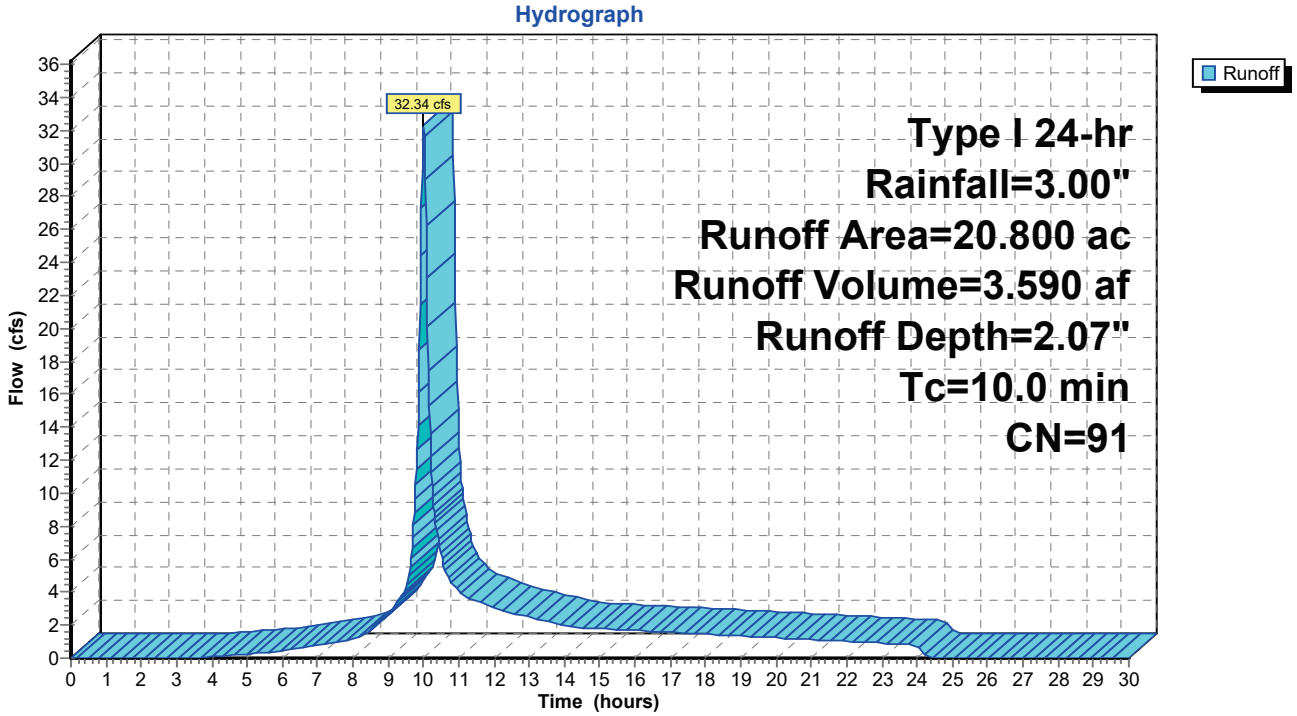
Runoff = 32.34 cfs @ 10.01 hrs, Volume= 3.590 af, Depth= 2.07"
Routed to Reach 24 : RE 111

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
20.800	91	Urban industrial, 72% imp, HSG C
5.824		28.00% Pervious Area
14.976		72.00% Impervious Area

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

Subcatchment A24: 20.8 ac



Summary for Subcatchment A25: 5.4 ac

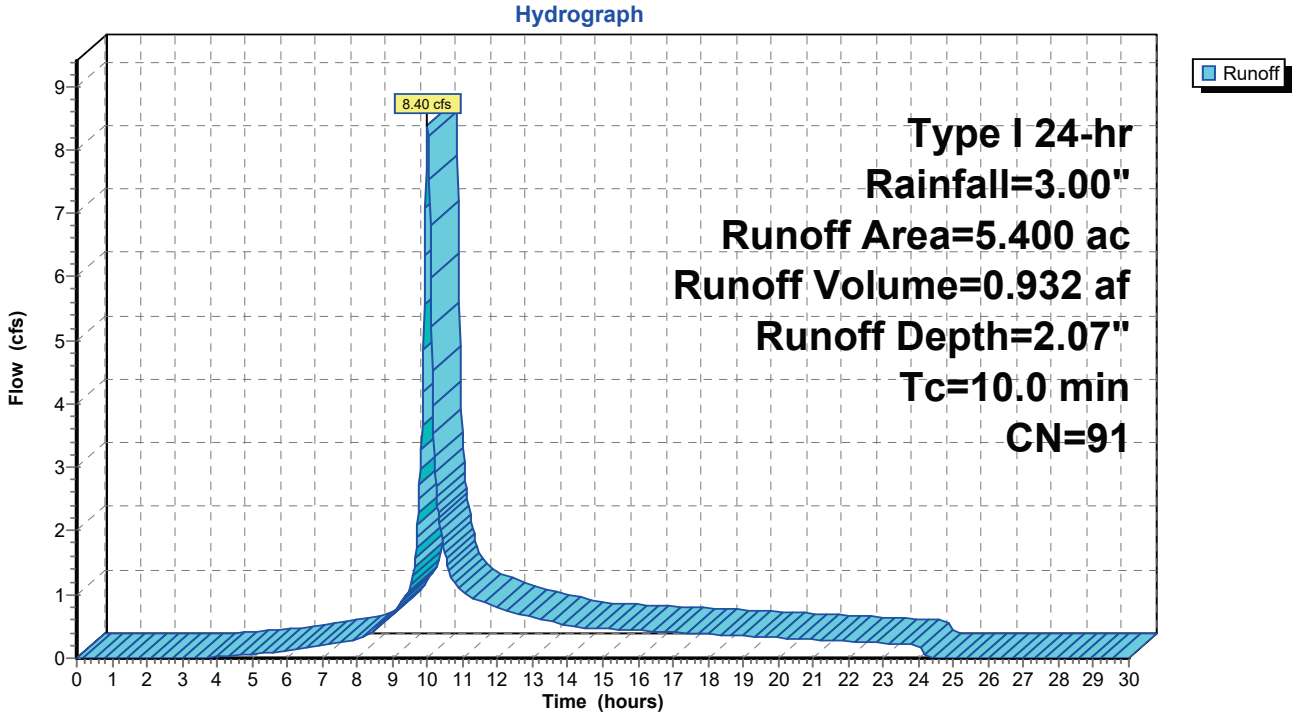
Runoff = 8.40 cfs @ 10.01 hrs, Volume= 0.932 af, Depth= 2.07"
Routed to Reach 25 : RE 110

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
5.400	91	Urban industrial, 72% imp, HSG C
1.512		28.00% Pervious Area
3.888		72.00% Impervious Area

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

Subcatchment A25: 5.4 ac



Summary for Subcatchment A26: 4.8 ac

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

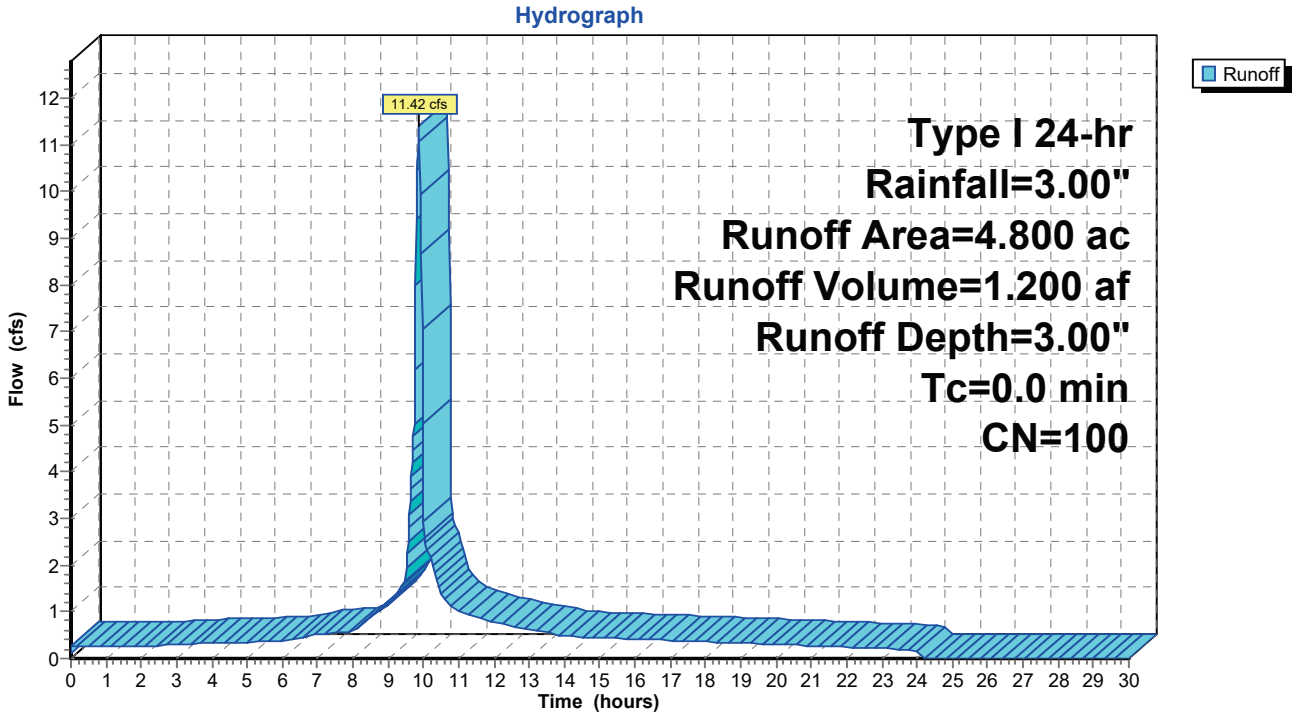
Runoff = 11.42 cfs @ 9.86 hrs, Volume= 1.200 af, Depth= 3.00"
Routed to Pond DET2 : DET 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

	Area (ac)	CN	Description
*	4.800	100	BASIN
	4.800		100.00% Impervious Area

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

Subcatchment A26: 4.8 ac



Summary for Reach 21: RE 118.0

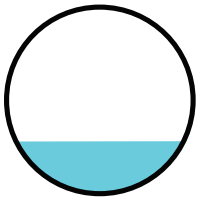
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 2.300 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 3.58 cfs @ 10.01 hrs, Volume= 0.397 af
Outflow = 2.78 cfs @ 10.25 hrs, Volume= 0.397 af, Atten= 22%, Lag= 14.5 min
Routed to Reach 22 : RE 109

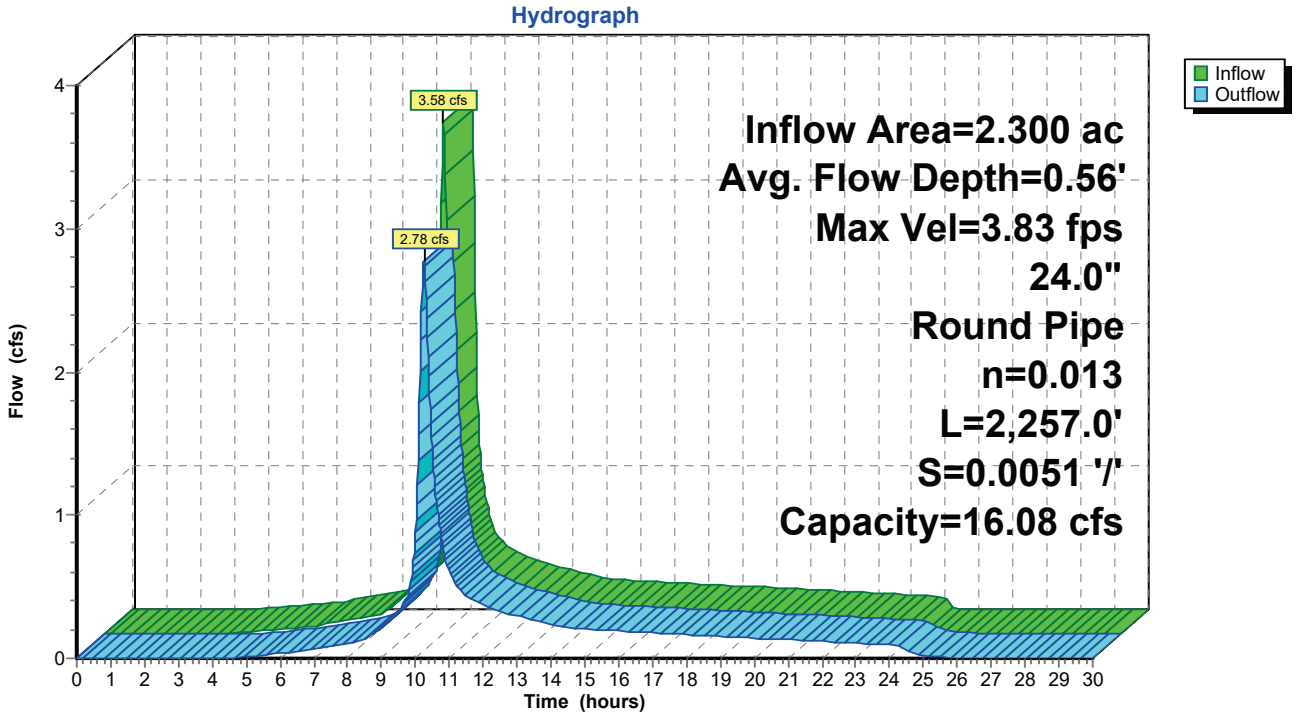
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.83 fps, Min. Travel Time= 9.8 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 26.7 min

Peak Storage= 1,638 cf @ 10.09 hrs
Average Depth at Peak Storage= 0.56' , Surface Width= 1.80'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.08 cfs

24.0" Round Pipe
n= 0.013
Length= 2,257.0' Slope= 0.0051 '/'
Inlet Invert= 113.30', Outlet Invert= 101.90'



Reach 21: RE 118.0



Summary for Reach 22: RE 109

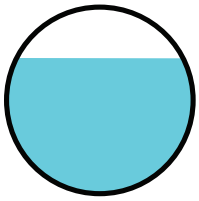
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 21 OUTLET depth by 4.44' @ 10.02 hrs

Inflow Area = 23.000 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 33.11 cfs @ 10.01 hrs, Volume= 3.970 af
Outflow = 32.18 cfs @ 10.07 hrs, Volume= 3.970 af, Atten= 3%, Lag= 3.5 min
Routed to Reach 25 : RE 110

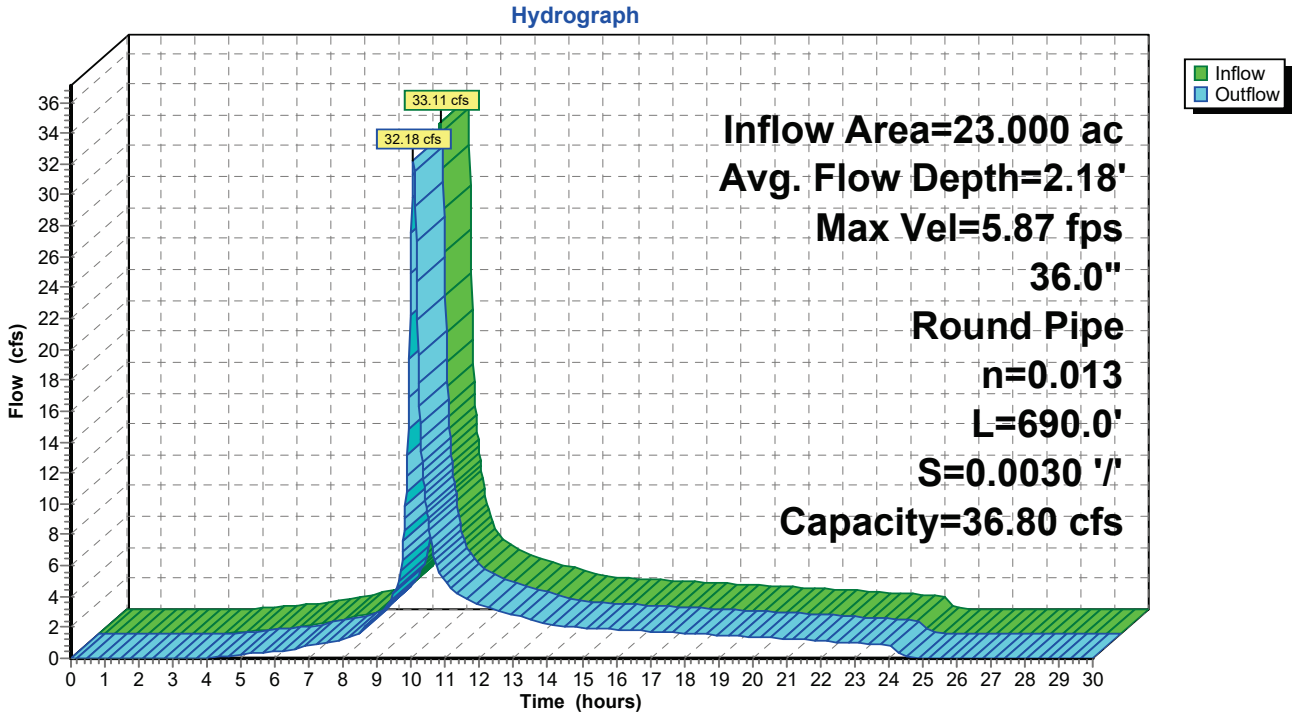
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.87 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 5.3 min

Peak Storage= 3,794 cf @ 10.04 hrs
Average Depth at Peak Storage= 2.18' , Surface Width= 2.68'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 36.80 cfs

36.0" Round Pipe
n= 0.013
Length= 690.0' Slope= 0.0030 '/'
Inlet Invert= 104.70', Outlet Invert= 102.60'



Reach 22: RE 109



Summary for Reach 23: RE 118.6

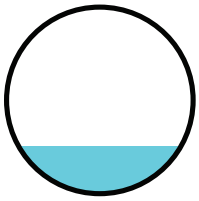
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.800 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 2.80 cfs @ 10.01 hrs, Volume= 0.311 af
Outflow = 2.20 cfs @ 10.24 hrs, Volume= 0.311 af, Atten= 21%, Lag= 14.2 min
Routed to Reach 24 : RE 111

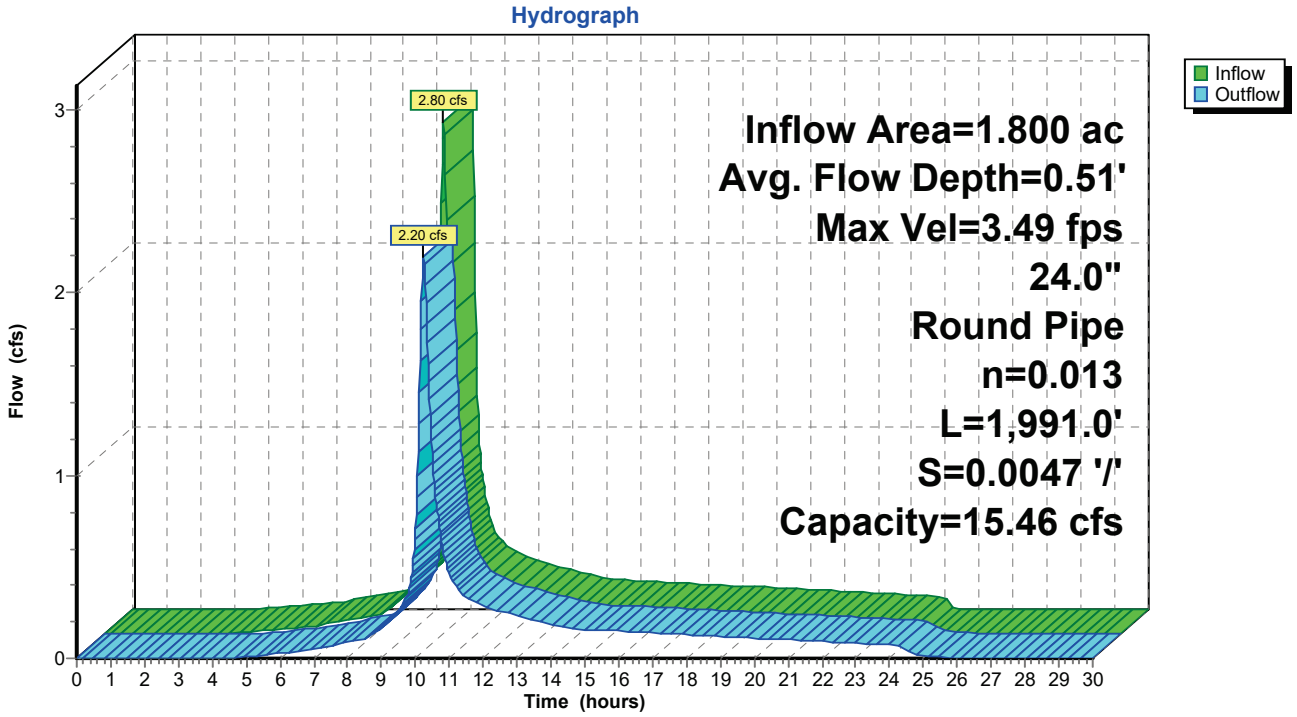
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 9.5 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 26.0 min

Peak Storage= 1,255 cf @ 10.09 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 1.74'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 15.46 cfs

24.0" Round Pipe
n= 0.013
Length= 1,991.0' Slope= 0.0047 '/'
Inlet Invert= 113.80', Outlet Invert= 104.50'



Reach 23: RE 118.6



Summary for Reach 24: RE 111

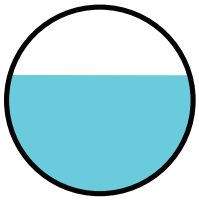
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 23 OUTLET depth by 1.12' @ 10.00 hrs

Inflow Area = 22.600 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 33.08 cfs @ 10.01 hrs, Volume= 3.901 af
Outflow = 32.98 cfs @ 10.02 hrs, Volume= 3.901 af, Atten= 0%, Lag= 0.5 min
Routed to Pond DET2 : DET 2

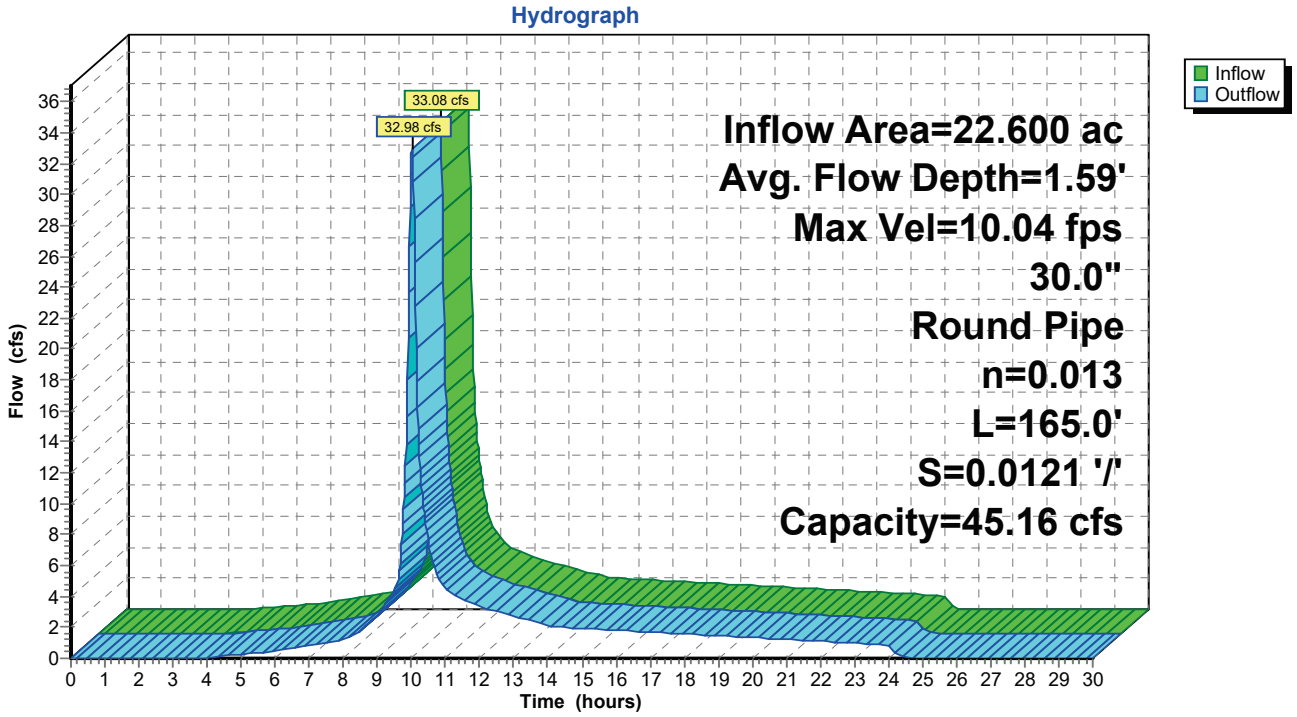
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 10.04 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.57 fps, Avg. Travel Time= 0.8 min

Peak Storage= 543 cf @ 10.01 hrs
Average Depth at Peak Storage= 1.59' , Surface Width= 2.41'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 45.16 cfs

30.0" Round Pipe
n= 0.013
Length= 165.0' Slope= 0.0121 '/'
Inlet Invert= 104.50', Outlet Invert= 102.50'



Reach 24: RE 111



Summary for Reach 25: RE 110

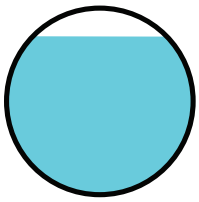
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 103% of Manning's capacity
[61] Hint: Exceeded Reach 22 outlet invert by 2.04' @ 10.06 hrs

Inflow Area = 28.400 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 39.67 cfs @ 10.05 hrs, Volume= 4.902 af
Outflow = 39.51 cfs @ 10.07 hrs, Volume= 4.902 af, Atten= 0%, Lag= 0.7 min
Routed to Pond DET2 : DET 2

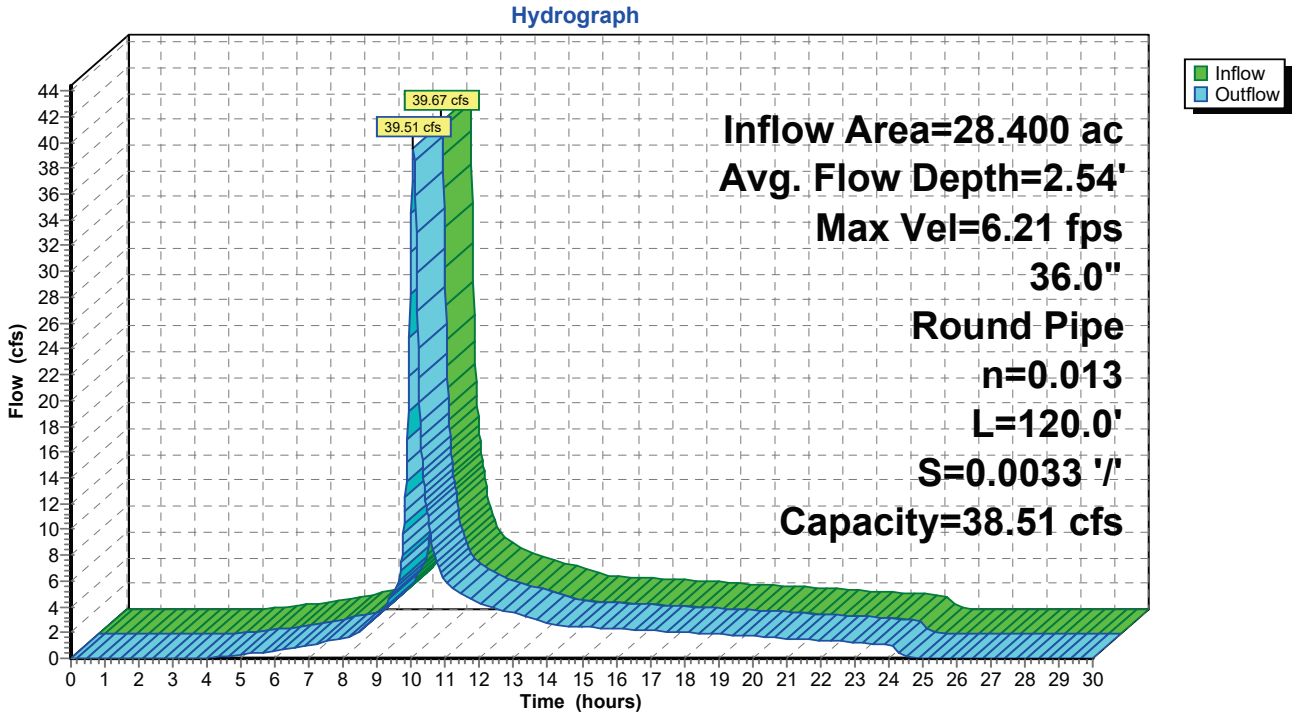
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.21 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 0.8 min

Peak Storage= 767 cf @ 10.06 hrs
Average Depth at Peak Storage= 2.54' , Surface Width= 2.15'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 38.51 cfs

36.0" Round Pipe
n= 0.013
Length= 120.0' Slope= 0.0033 '/'
Inlet Invert= 102.10', Outlet Invert= 101.70'



Reach 25: RE 110



Summary for Pond DET2: DET 2

[63] Warning: Exceeded Reach 24 INLET depth by 1.35' @ 24.74 hrs
[63] Warning: Exceeded Reach 25 INLET depth by 3.71' @ 25.00 hrs

Inflow Area = 55.800 ac, 74.41% Impervious, Inflow Depth = 2.15"
Inflow = 73.59 cfs @ 10.04 hrs, Volume= 10.003 af
Outflow = 1.08 cfs @ 24.19 hrs, Volume= 1.443 af, Atten= 99%, Lag= 848.9 min
Primary = 1.08 cfs @ 24.19 hrs, Volume= 1.443 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 105.91' @ 24.19 hrs Storage= 9.046 af

Plug-Flow detention time= 829.2 min calculated for 1.442 af (14% of inflow)
Center-of-Mass det. time= 522.6 min (1,286.7 - 764.1)

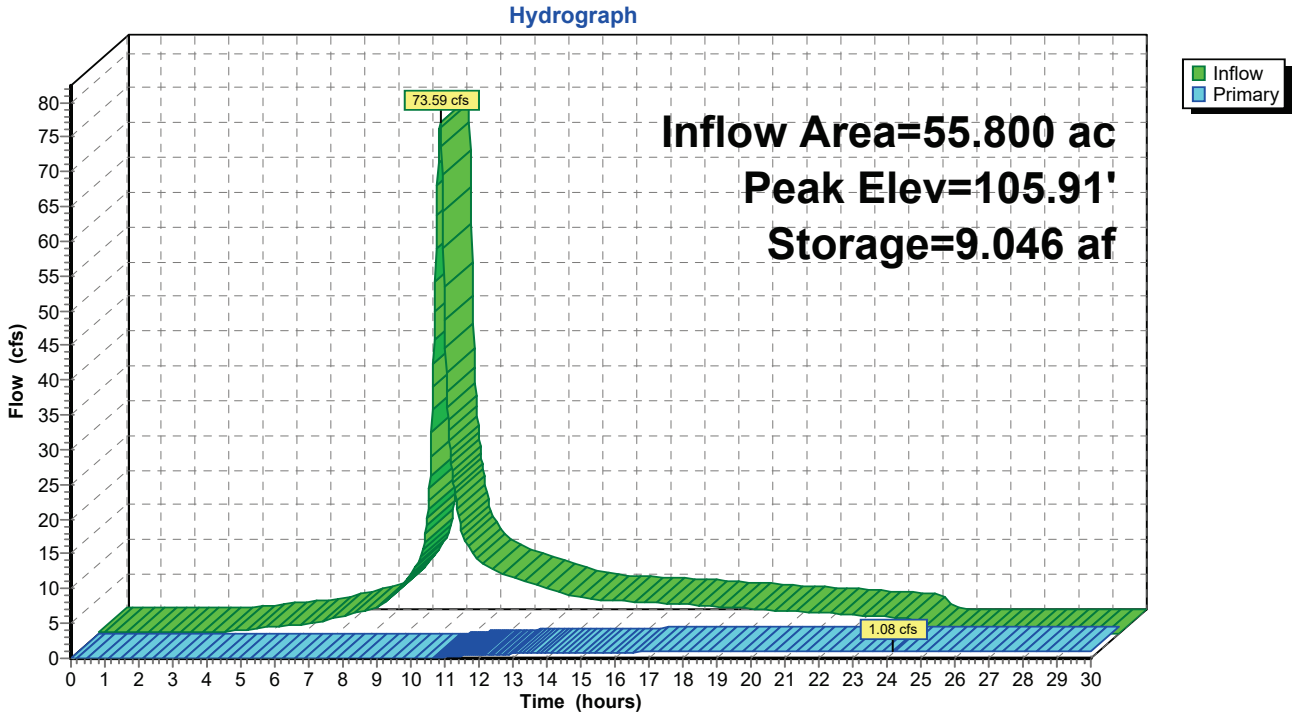
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	12.630 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
100.00	0.000
107.00	10.710
108.00	12.630

Device	Routing	Invert	Outlet Devices
#1	Primary	103.00'	**5.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

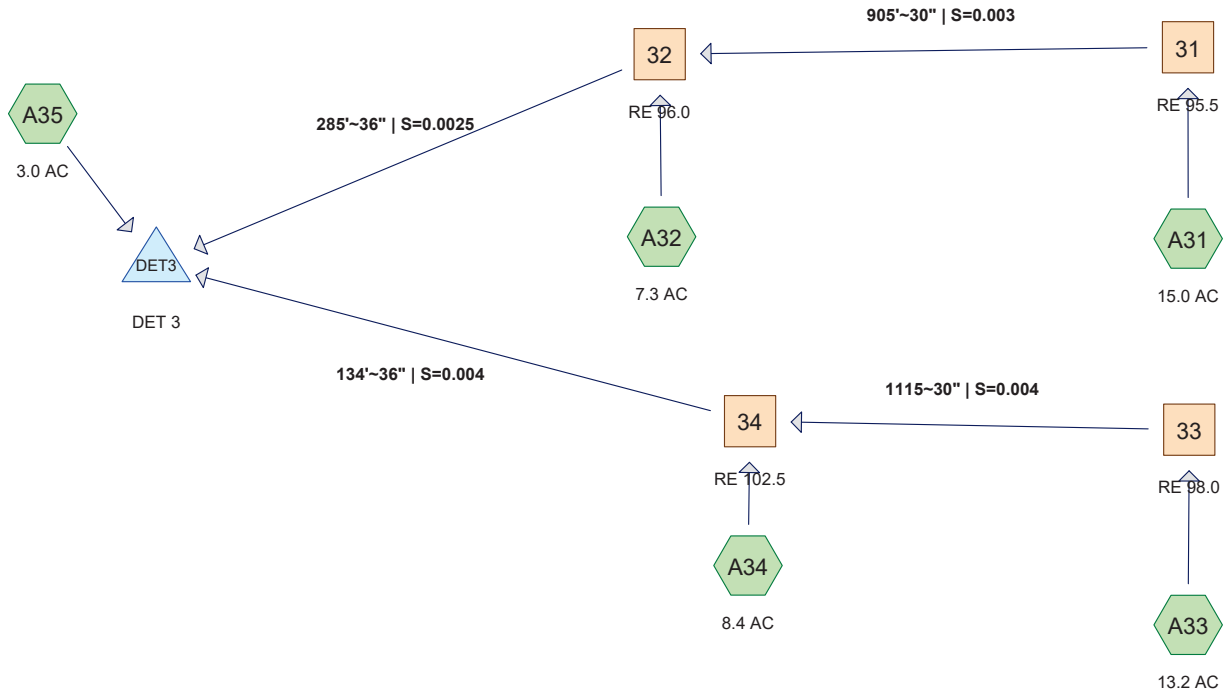
Primary OutFlow Max=1.08 cfs @ 24.19 hrs HW=105.91' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 1.08 cfs @ 7.92 fps)

Pond DET2: DET 2



Appendix E

Detention Basin 3 100-Year 24-hour Storm Event Calculations



Subcat Reach Pond Link

Routing Diagram for Detention Basin 3 - 100 year
Prepared by Kier and Wright, Printed 8/24/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.000	100	BASIN (A35)
43.900	91	Urban industrial, 72% imp, HSG C (A31, A32, A33, A34)
46.900	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
43.900	HSG C	A31, A32, A33, A34
0.000	HSG D	
3.000	Other	A35
46.900		**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	0.000	0.000	3.000	3.000	BASIN	A35
0.000	0.000	43.900	0.000	0.000	43.900	Urban industrial, 72% imp	A31, A32, A33, A34
0.000	**0.000**	**43.900**	**0.000**	**3.000**	**46.900**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	31	90.50	87.75	905.0	0.0030	0.013	0.0	30.0	0.0
2	32	87.75	87.00	285.0	0.0026	0.013	0.0	36.0	0.0
3	33	91.60	87.50	1,115.0	0.0037	0.013	0.0	30.0	0.0
4	34	87.50	87.00	134.0	0.0037	0.013	0.0	36.0	0.0

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A31: 15.0 AC Runoff Area=15.000 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=23.32 cfs 2.589 af

Subcatchment A32: 7.3 AC Runoff Area=7.300 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=11.35 cfs 1.260 af

Subcatchment A33: 13.2 AC Runoff Area=13.200 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=20.52 cfs 2.278 af

Subcatchment A34: 8.4 AC Runoff Area=8.400 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=13.06 cfs 1.450 af

Subcatchment A35: 3.0 AC Runoff Area=3.000 ac 100.00% Impervious Runoff Depth=3.00"
Tc=0.0 min CN=100 Runoff=7.14 cfs 0.750 af

Reach 31: RE 95.5 Avg. Flow Depth=2.00' Max Vel=5.25 fps Inflow=23.32 cfs 2.589 af
30.0" Round Pipe n=0.013 L=905.0' S=0.0030 '/' Capacity=22.61 cfs Outflow=22.03 cfs 2.589 af

Reach 32: RE 96.0 Avg. Flow Depth=2.26' Max Vel=5.49 fps Inflow=31.48 cfs 3.849 af
36.0" Round Pipe n=0.013 L=285.0' S=0.0026 '/' Capacity=34.22 cfs Outflow=31.26 cfs 3.849 af

Reach 33: RE 98.0 Avg. Flow Depth=1.66' Max Vel=5.60 fps Inflow=20.52 cfs 2.278 af
30.0" Round Pipe n=0.013 L=1,115.0' S=0.0037 '/' Capacity=24.87 cfs Outflow=19.28 cfs 2.278 af

Reach 34: RE 102.5 Avg. Flow Depth=1.91' Max Vel=6.29 fps Inflow=29.87 cfs 3.728 af
36.0" Round Pipe n=0.013 L=134.0' S=0.0037 '/' Capacity=40.74 cfs Outflow=29.78 cfs 3.728 af

Pond DET3: DET 3 Peak Elev=94.30' Storage=7.000 af Inflow=62.45 cfs 8.327 af
Outflow=1.11 cfs 1.844 af

Total Runoff Area = 46.900 ac Runoff Volume = 8.327 af Average Runoff Depth = 2.13"
26.21% Pervious = 12.292 ac 73.79% Impervious = 34.608 ac

Summary for Subcatchment A31: 15.0 AC

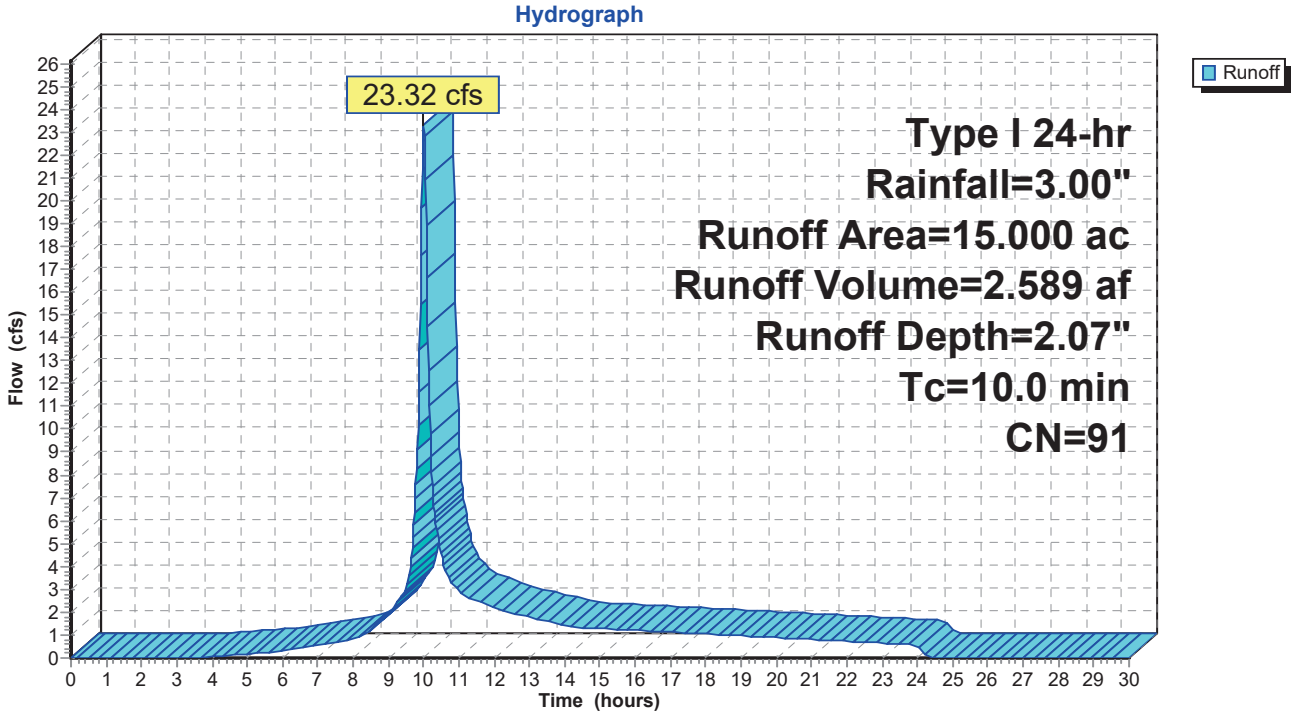
Runoff = 23.32 cfs @ 10.01 hrs, Volume= 2.589 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
15.000	91	Urban industrial, 72% imp, HSG C
4.200		28.00% Pervious Area
10.800		72.00% Impervious Area

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

Subcatchment A31: 15.0 AC



Summary for Subcatchment A32: 7.3 AC

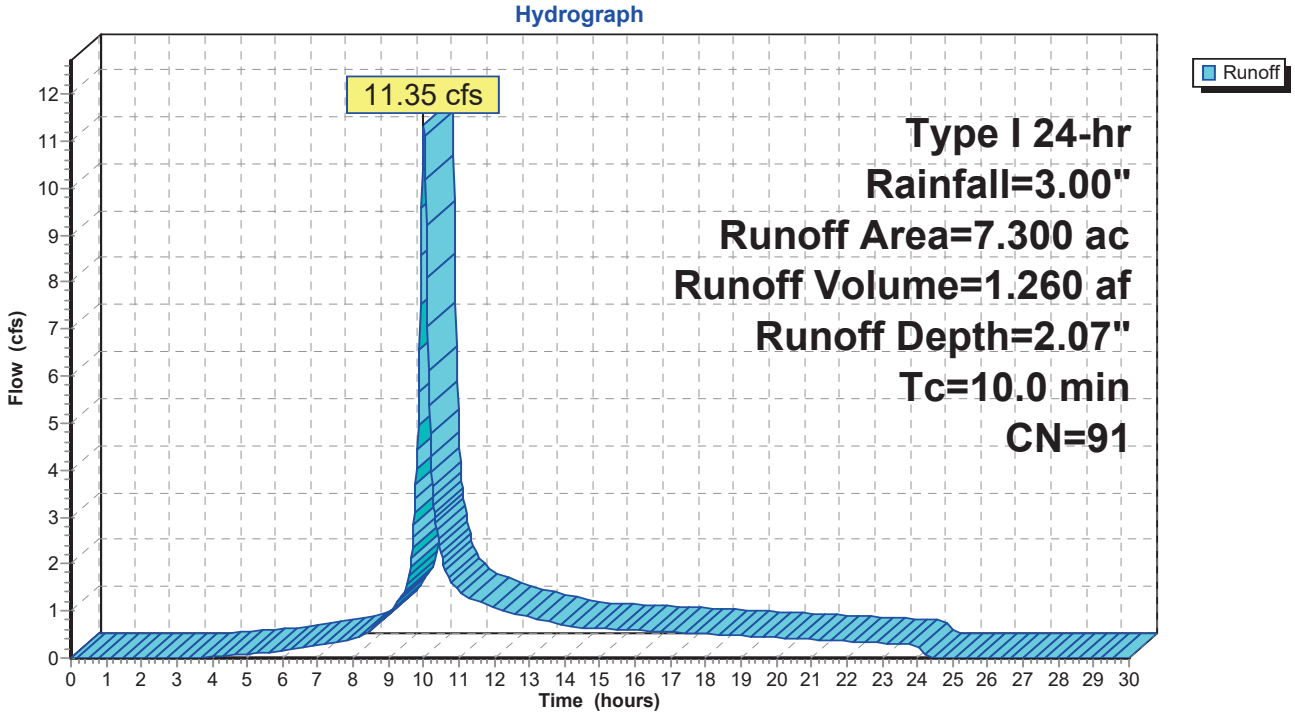
Runoff = 11.35 cfs @ 10.01 hrs, Volume= 1.260 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
7.300	91	Urban industrial, 72% imp, HSG C
2.044		28.00% Pervious Area
5.256		72.00% Impervious Area

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

Subcatchment A32: 7.3 AC



Summary for Subcatchment A33: 13.2 AC

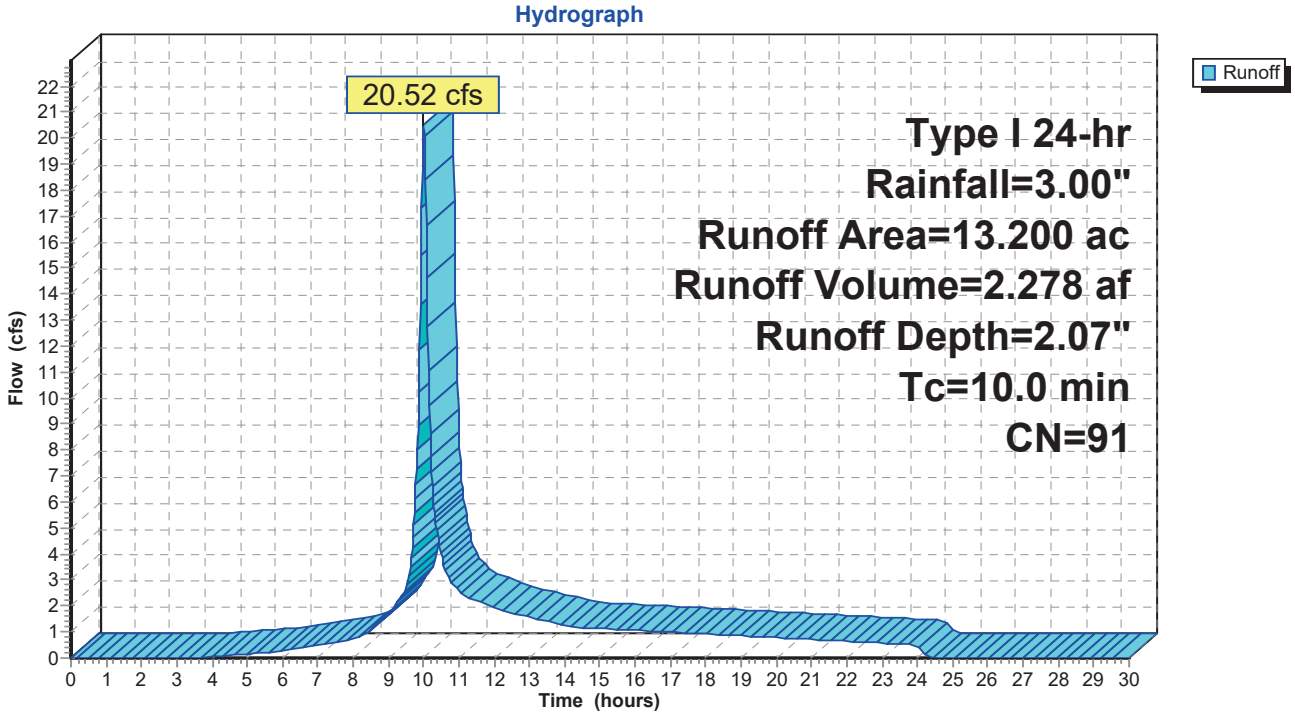
Runoff = 20.52 cfs @ 10.01 hrs, Volume= 2.278 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
13.200	91	Urban industrial, 72% imp, HSG C
3.696		28.00% Pervious Area
9.504		72.00% Impervious Area

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

Subcatchment A33: 13.2 AC



Summary for Subcatchment A34: 8.4 AC

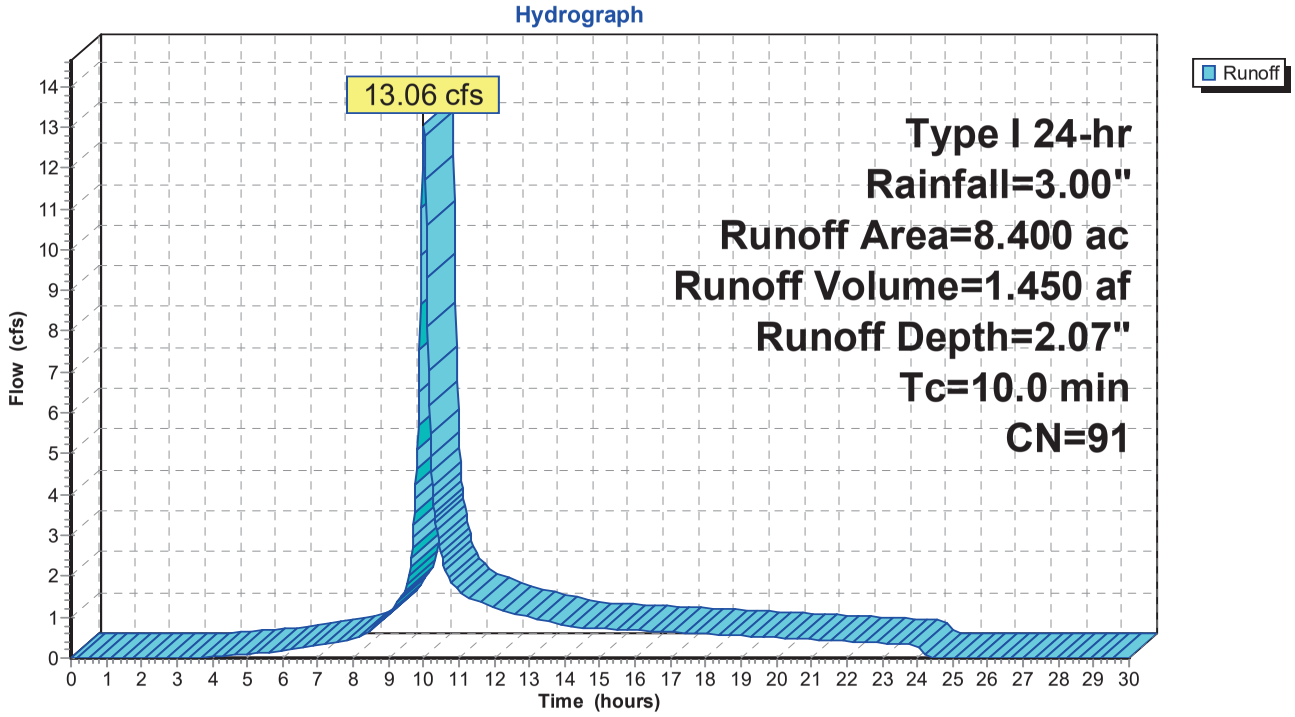
Runoff = 13.06 cfs @ 10.01 hrs, Volume= 1.450 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
8.400	91	Urban industrial, 72% imp, HSG C
2.352		28.00% Pervious Area
6.048		72.00% Impervious Area

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

Subcatchment A34: 8.4 AC



Summary for Subcatchment A35: 3.0 AC

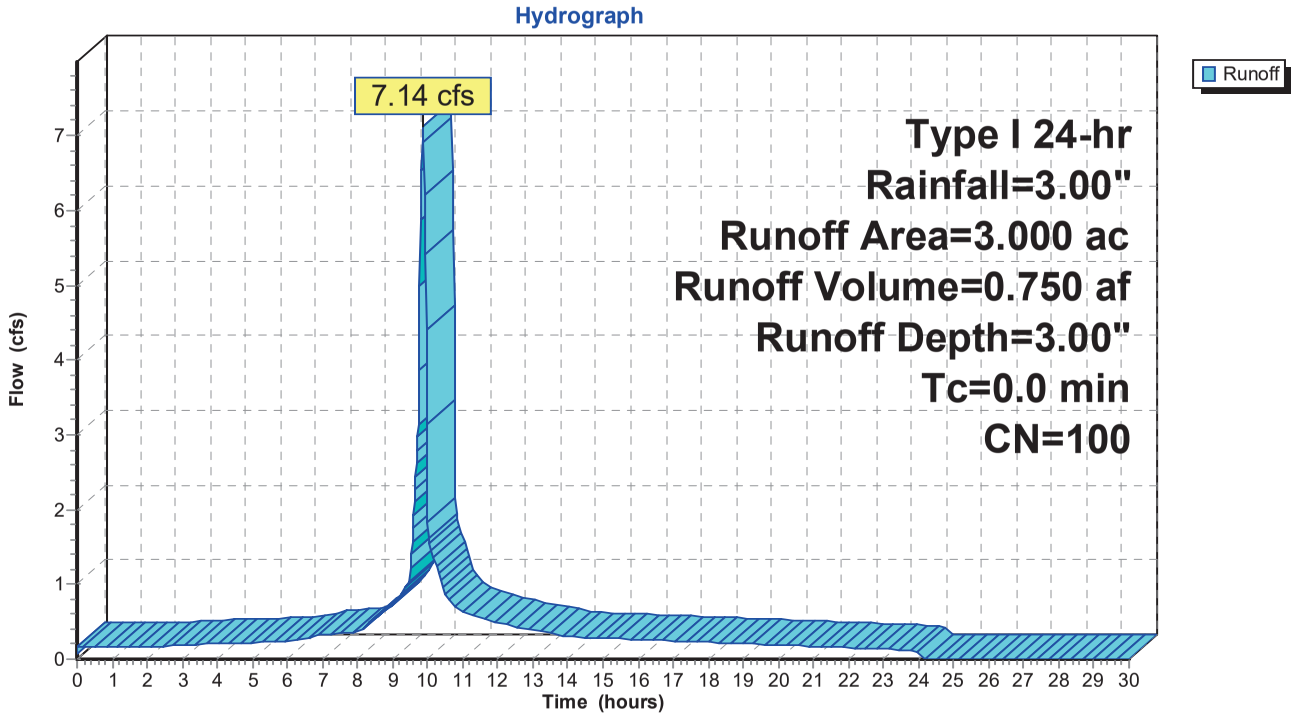
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 7.14 cfs @ 9.86 hrs, Volume= 0.750 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

	Area (ac)	CN	Description
*	3.000	100	BASIN
	3.000		100.00% Impervious Area

Subcatchment A35: 3.0 AC



Summary for Reach 31: RE 95.5

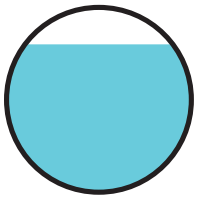
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 103% of Manning's capacity

Inflow Area = 15.000 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 23.32 cfs @ 10.01 hrs, Volume= 2.589 af
Outflow = 22.03 cfs @ 10.09 hrs, Volume= 2.589 af, Atten= 6%, Lag= 5.0 min

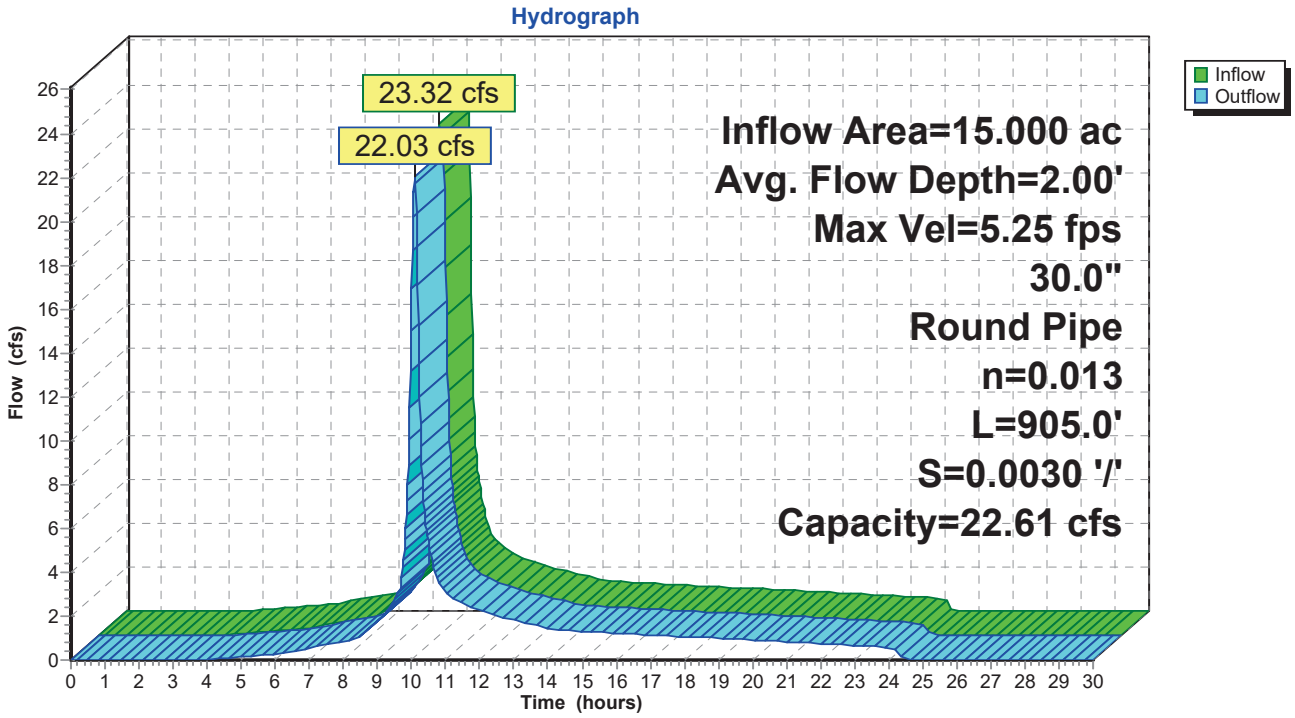
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.25 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 7.3 min

Peak Storage= 3,809 cf @ 10.04 hrs
Average Depth at Peak Storage= 2.00' , Surface Width= 2.00'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 22.61 cfs

30.0" Round Pipe
n= 0.013
Length= 905.0' Slope= 0.0030 '/'
Inlet Invert= 90.50', Outlet Invert= 87.75'



Reach 31: RE 95.5



Summary for Reach 32: RE 96.0

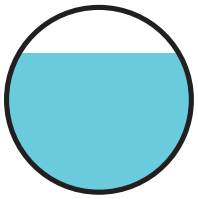
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 31 OUTLET depth by 0.48' @ 10.16 hrs

Inflow Area = 22.300 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 31.48 cfs @ 10.06 hrs, Volume= 3.849 af
Outflow = 31.26 cfs @ 10.09 hrs, Volume= 3.849 af, Atten= 1%, Lag= 1.6 min

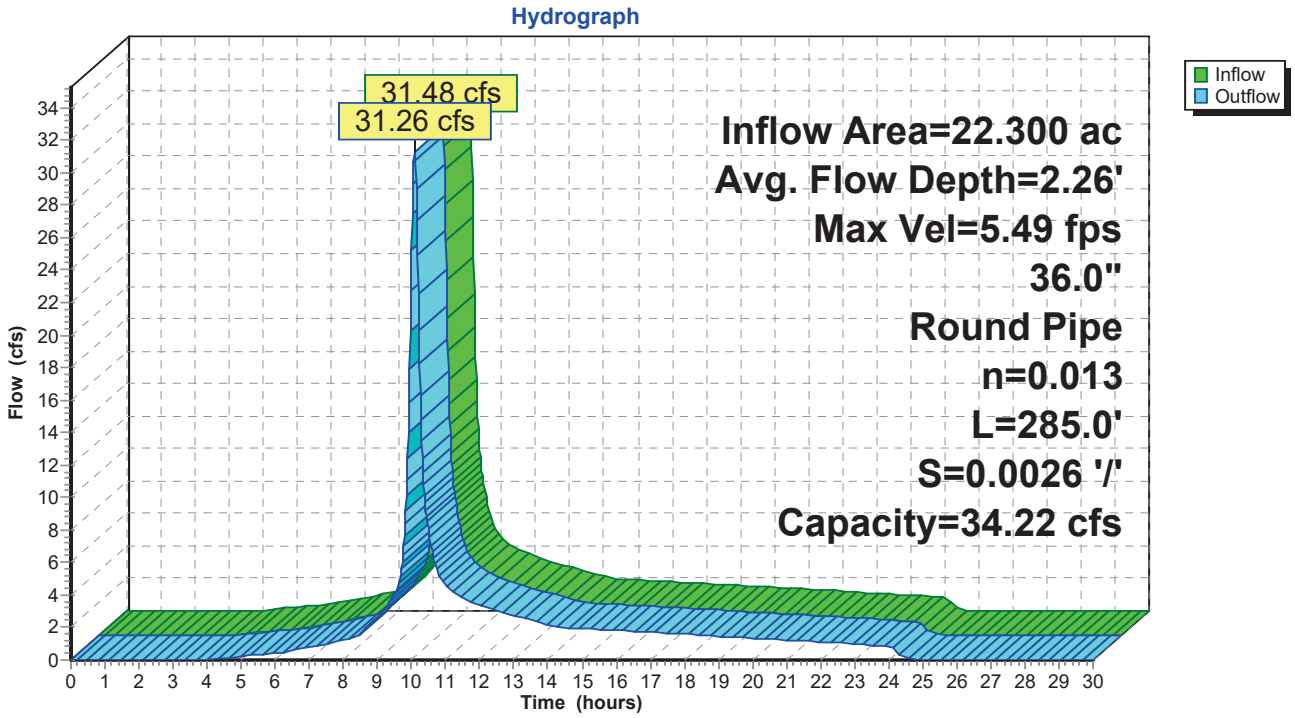
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.49 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.14 fps, Avg. Travel Time= 2.2 min

Peak Storage= 1,627 cf @ 10.07 hrs
Average Depth at Peak Storage= 2.26' , Surface Width= 2.59'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 34.22 cfs

36.0" Round Pipe
n= 0.013
Length= 285.0' Slope= 0.0026 '/'
Inlet Invert= 87.75', Outlet Invert= 87.00'



Reach 32: RE 96.0



Summary for Reach 33: RE 98.0

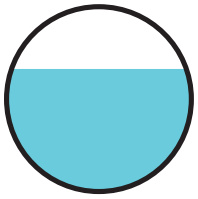
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 13.200 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 20.52 cfs @ 10.01 hrs, Volume= 2.278 af
Outflow = 19.28 cfs @ 10.10 hrs, Volume= 2.278 af, Atten= 6%, Lag= 5.6 min

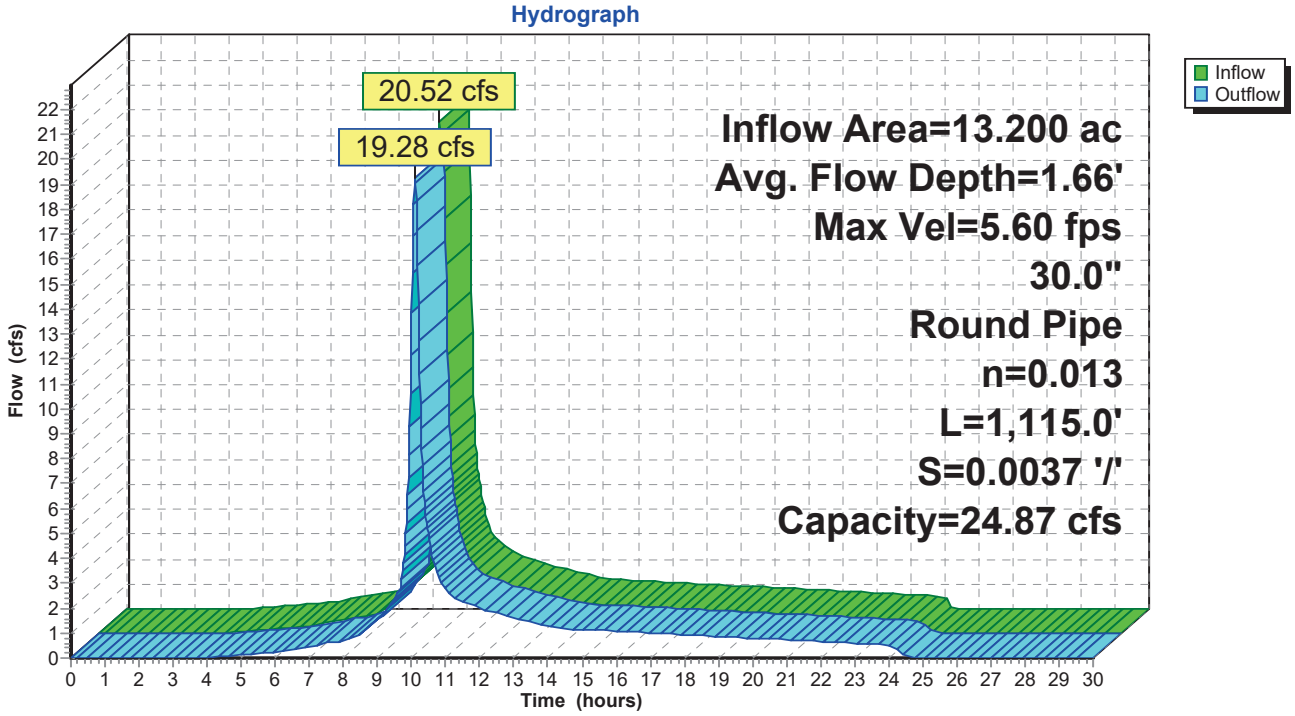
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.60 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 8.8 min

Peak Storage= 3,849 cf @ 10.05 hrs
Average Depth at Peak Storage= 1.66' , Surface Width= 2.36'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 24.87 cfs

30.0" Round Pipe
n= 0.013
Length= 1,115.0' Slope= 0.0037 '/'
Inlet Invert= 91.60', Outlet Invert= 87.50'



Reach 33: RE 98.0



Summary for Reach 34: RE 102.5

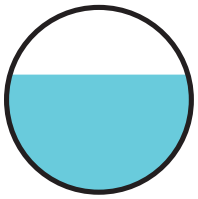
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 33 OUTLET depth by 0.36' @ 10.16 hrs

Inflow Area = 21.600 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 29.87 cfs @ 10.06 hrs, Volume= 3.728 af
Outflow = 29.78 cfs @ 10.07 hrs, Volume= 3.728 af, Atten= 0%, Lag= 0.6 min

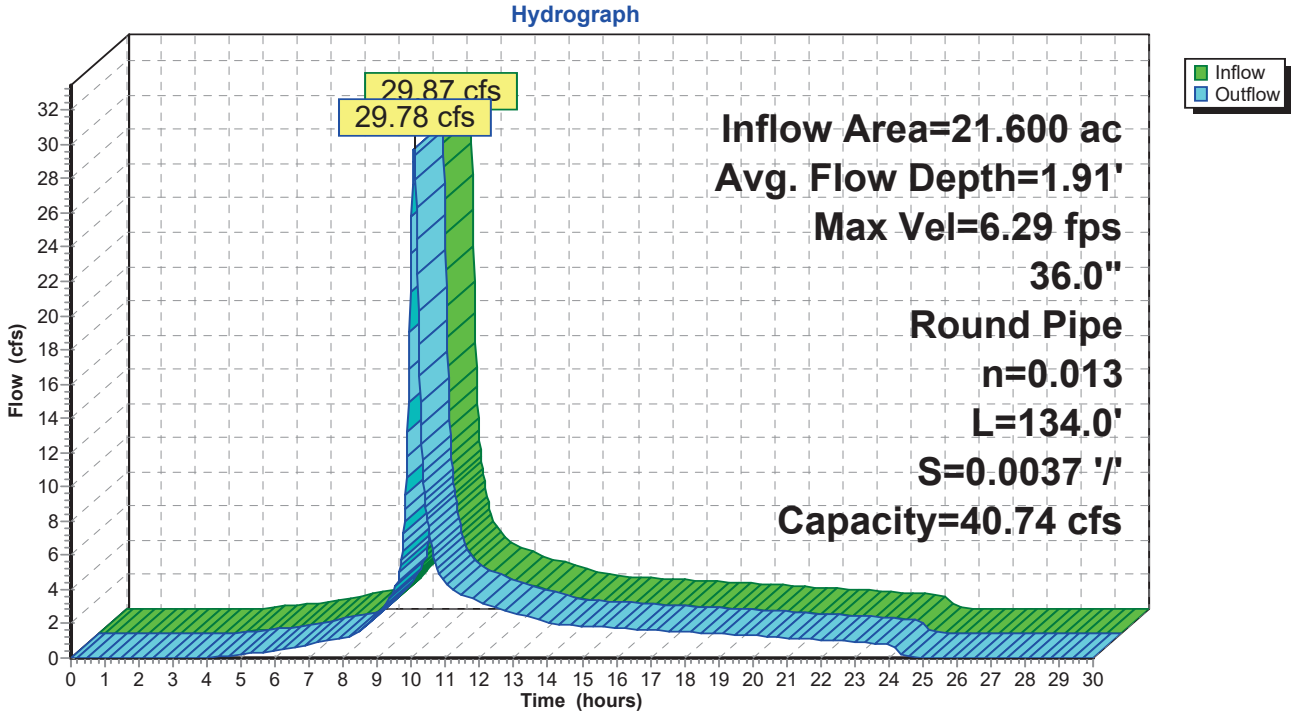
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.29 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 0.9 min

Peak Storage= 635 cf @ 10.07 hrs
Average Depth at Peak Storage= 1.91' , Surface Width= 2.89'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 40.74 cfs

36.0" Round Pipe
n= 0.013
Length= 134.0' Slope= 0.0037 '/'
Inlet Invert= 87.50', Outlet Invert= 87.00'



Reach 34: RE 102.5



Summary for Pond DET3: DET 3

[63] Warning: Exceeded Reach 32 INLET depth by 6.45' @ 24.90 hrs
[63] Warning: Exceeded Reach 34 INLET depth by 6.71' @ 24.88 hrs

Inflow Area = 46.900 ac, 73.79% Impervious, Inflow Depth = 2.13"
Inflow = 62.45 cfs @ 10.08 hrs, Volume= 8.327 af
Outflow = 1.11 cfs @ 10.00 hrs, Volume= 1.844 af, Atten= 98%, Lag= 0.0 min
Primary = 1.11 cfs @ 10.00 hrs, Volume= 1.844 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 94.30' @ 24.21 hrs Storage= 7.000 af

Plug-Flow detention time= 688.0 min calculated for 1.844 af (22% of inflow)
Center-of-Mass det. time= 430.5 min (1,199.6 - 769.1)

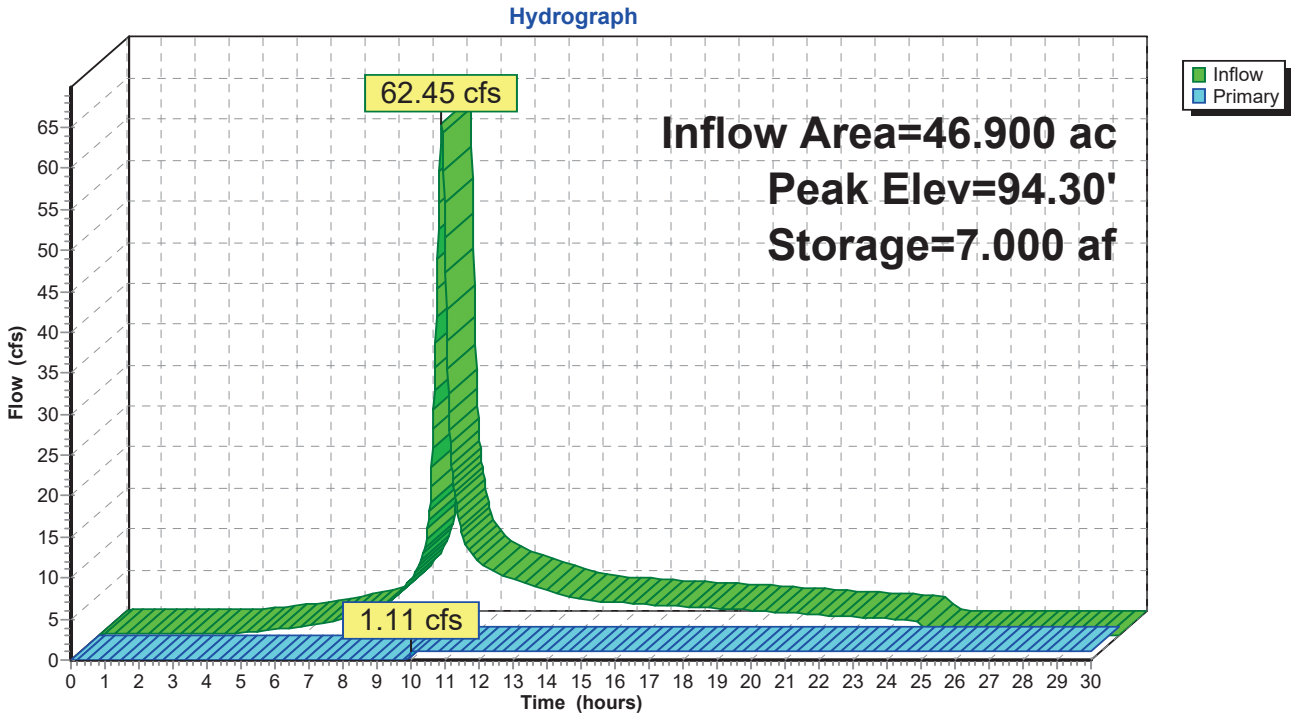
Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	12.930 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
99.00	11.500
100.00	12.930

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**Pump** Discharges@0.00' Flow (gpm)= 500.0 Head (feet)= 3.00

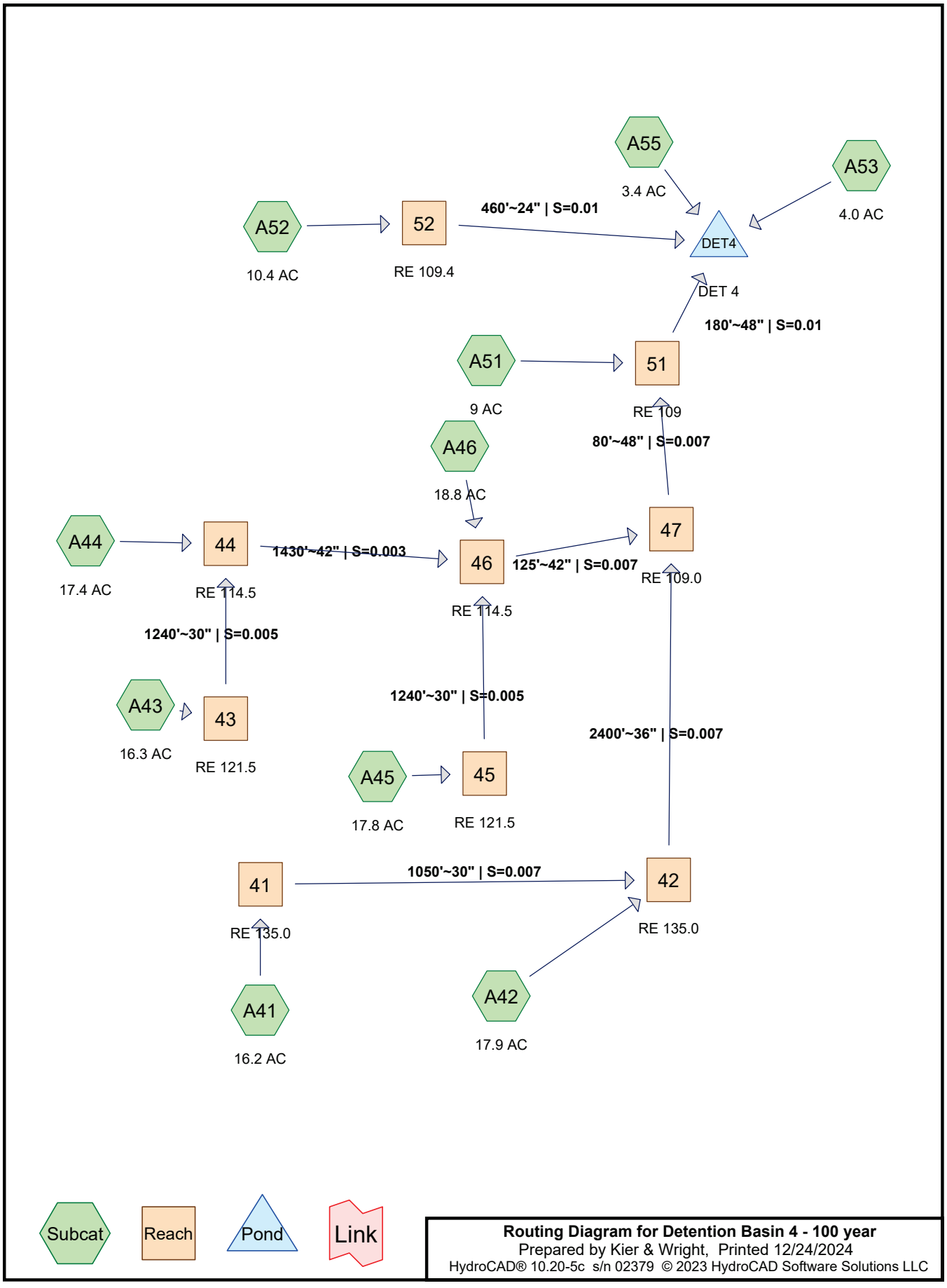
Primary OutFlow Max=1.11 cfs @ 10.00 hrs HW=89.14' (Free Discharge)
↑—**1=Pump** (Pump Controls 1.11 cfs)

Pond DET3: DET 3



Appendix F

Detention Basin 4 100-Year 24-hour Storm Event Calculations



Routing Diagram for Detention Basin 4 - 100 year
Prepared by Kier & Wright, Printed 12/24/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
127.800	91	Urban industrial, 72% imp, HSG C (A41, A42, A43, A44, A45, A46, A51, A52, A53)
3.400	100	basin (A55)
131.200	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
127.800	HSG C	A41, A42, A43, A44, A45, A46, A51, A52, A53
0.000	HSG D	
3.400	Other	A55
131.200		**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	127.800	0.000	0.000	127.800	Urban industrial, 72% imp	A41, A42, A43, A44, A45, A46, A51, A52, A53
0.000	0.000	0.000	0.000	3.400	3.400	basin	A55
0.000	**0.000**	**127.800**	**0.000**	**3.400**	**131.200**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	41	128.00	121.00	1,050.0	0.0067	0.013	0.0	30.0	0.0	
2	42	121.00	103.60	2,400.0	0.0073	0.013	0.0	36.0	0.0	
3	43	117.50	111.30	1,240.0	0.0050	0.013	0.0	30.0	0.0	
4	44	108.50	104.20	1,430.0	0.0030	0.013	0.0	42.0	0.0	
5	45	117.50	111.30	1,240.0	0.0050	0.013	0.0	30.0	0.0	
6	46	104.50	103.60	125.0	0.0072	0.013	0.0	42.0	0.0	
7	47	103.90	103.30	80.0	0.0075	0.013	0.0	48.0	0.0	
8	51	100.00	97.70	180.0	0.0128	0.013	0.0	48.0	0.0	
9	52	103.00	98.40	460.0	0.0100	0.013	0.0	24.0	0.0	

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA41: 16.2 AC Runoff Area=16.200 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=25.19 cfs 2.796 af

SubcatchmentA42: 17.9 AC Runoff Area=17.900 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=27.83 cfs 3.090 af

SubcatchmentA43: 16.3 AC Runoff Area=16.300 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=25.34 cfs 2.813 af

SubcatchmentA44: 17.4 AC Runoff Area=17.400 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=27.05 cfs 3.003 af

SubcatchmentA45: 17.8 AC Runoff Area=17.800 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=27.67 cfs 3.072 af

SubcatchmentA46: 18.8 AC Runoff Area=18.800 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=29.23 cfs 3.245 af

SubcatchmentA51: 9 AC Runoff Area=9.000 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=13.99 cfs 1.553 af

SubcatchmentA52: 10.4 AC Runoff Area=10.400 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=16.17 cfs 1.795 af

SubcatchmentA53: 4.0 AC Runoff Area=4.000 ac 72.00% Impervious Runoff Depth=2.07"
Tc=10.0 min CN=91 Runoff=6.22 cfs 0.690 af

SubcatchmentA55: 3.4 AC Runoff Area=3.400 ac 100.00% Impervious Runoff Depth=3.00"
Tc=0.0 min CN=100 Runoff=8.09 cfs 0.850 af

Reach 41: RE 135.0 Avg. Flow Depth=1.58' Max Vel=7.44 fps Inflow=25.19 cfs 2.796 af
30.0" Round Pipe n=0.013 L=1,050.0' S=0.0067 '/' Capacity=33.49 cfs Outflow=24.36 cfs 2.796 af

Reach 42: RE 135.0 Avg. Flow Depth=2.04' Max Vel=8.94 fps Inflow=49.99 cfs 5.886 af
36.0" Round Pipe n=0.013 L=2,400.0' S=0.0073 '/' Capacity=56.79 cfs Outflow=45.73 cfs 5.886 af

Reach 43: RE 121.5 Avg. Flow Depth=1.73' Max Vel=6.60 fps Inflow=25.34 cfs 2.813 af
30.0" Round Pipe n=0.013 L=1,240.0' S=0.0050 '/' Capacity=29.00 cfs Outflow=23.90 cfs 2.813 af

Reach 44: RE 114.5 Avg. Flow Depth=2.39' Max Vel=6.38 fps Inflow=47.42 cfs 5.817 af
42.0" Round Pipe n=0.013 L=1,430.0' S=0.0030 '/' Capacity=55.17 cfs Outflow=44.56 cfs 5.817 af

Reach 45: RE 121.5 Avg. Flow Depth=1.86' Max Vel=6.69 fps Inflow=27.67 cfs 3.072 af
30.0" Round Pipe n=0.013 L=1,240.0' S=0.0050 '/' Capacity=29.00 cfs Outflow=26.06 cfs 3.072 af

Reach 46: RE 114.5 Avg. Flow Depth=3.01' Max Vel=10.12 fps Inflow=88.71 cfs 12.134 af
42.0" Round Pipe n=0.013 L=125.0' S=0.0072 '/' Capacity=85.37 cfs Outflow=88.59 cfs 12.134 af

Reach 47: RE 109.0 Avg. Flow Depth=3.53' Max Vel=11.28 fps Inflow=131.35 cfs 18.019 af
48.0" Round Pipe n=0.013 L=80.0' S=0.0075 '/' Capacity=124.40 cfs Outflow=131.23 cfs 18.019 af

Reach 51: RE 109 Avg. Flow Depth=2.86' Max Vel=14.53 fps Inflow=139.72 cfs 19.573 af
48.0" Round Pipe n=0.013 L=180.0' S=0.0128 '/' Capacity=162.37 cfs Outflow=139.56 cfs 19.573 af

Reach 52: RE 109.4 Avg. Flow Depth=1.25' Max Vel=7.82 fps Inflow=16.17 cfs 1.795 af
24.0" Round Pipe n=0.013 L=460.0' S=0.0100 '/' Capacity=22.62 cfs Outflow=16.03 cfs 1.795 af

Pond DET4: DET 4 Peak Elev=106.95' Storage=18.914 af Inflow=158.06 cfs 22.908 af
Outflow=3.34 cfs 5.519 af

Total Runoff Area = 131.200 ac Runoff Volume = 22.908 af Average Runoff Depth = 2.10"
27.27% Pervious = 35.784 ac 72.73% Impervious = 95.416 ac

Summary for Subcatchment A41: 16.2 AC

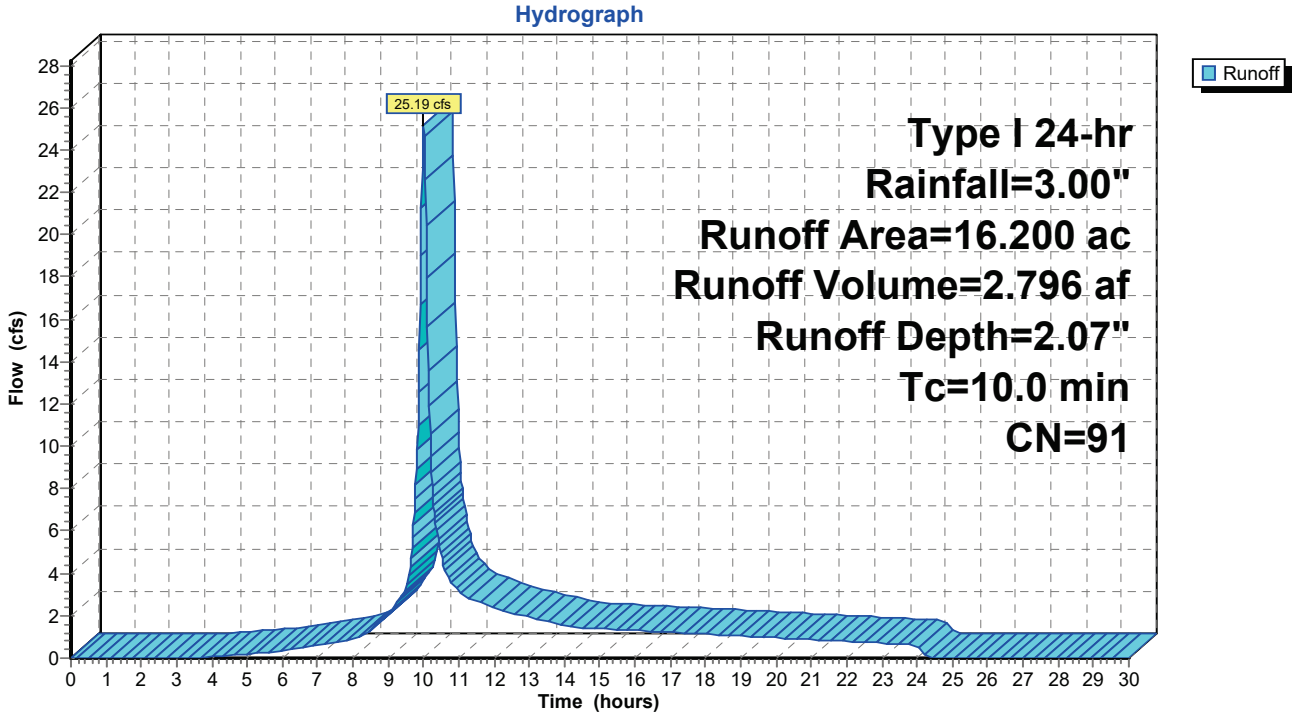
Runoff = 25.19 cfs @ 10.01 hrs, Volume= 2.796 af, Depth= 2.07"
Routed to Reach 41 : RE 135.0

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
16.200	91	Urban industrial, 72% imp, HSG C
4.536		28.00% Pervious Area
11.664		72.00% Impervious Area

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

Subcatchment A41: 16.2 AC



Summary for Subcatchment A42: 17.9 AC

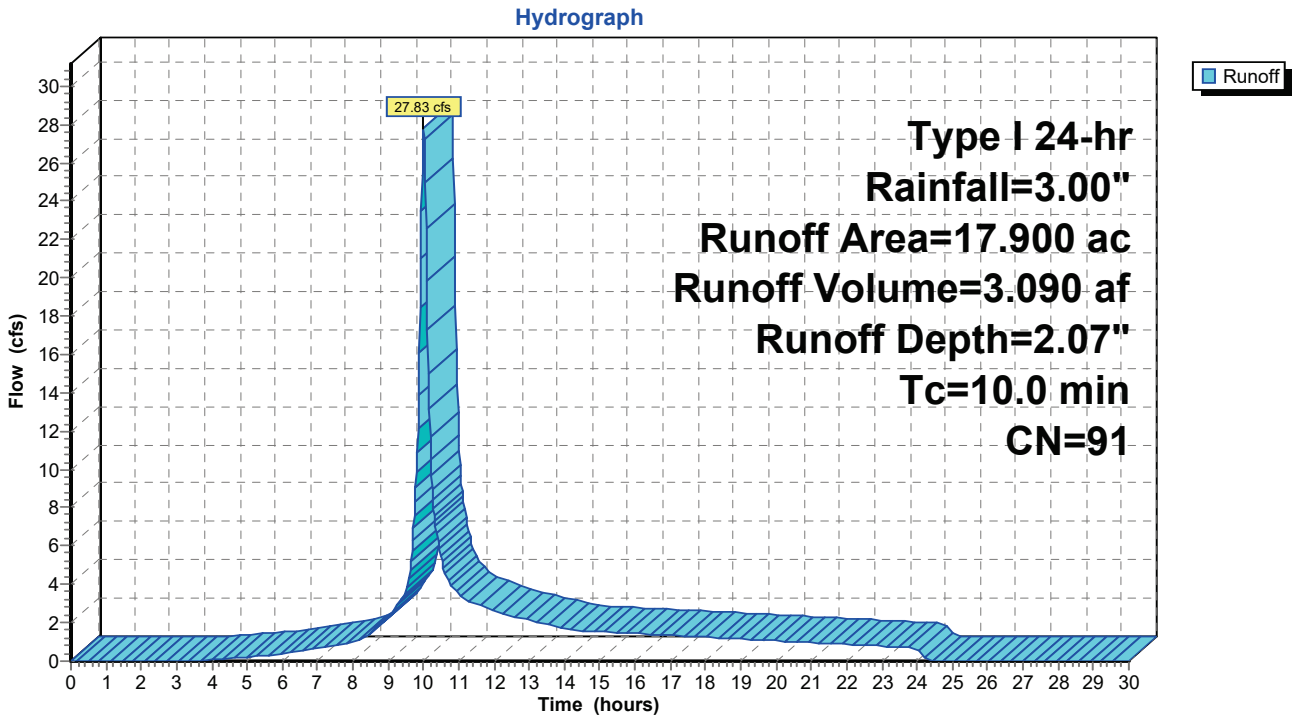
Runoff = 27.83 cfs @ 10.01 hrs, Volume= 3.090 af, Depth= 2.07"
Routed to Reach 42 : RE 135.0

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
17.900	91	Urban industrial, 72% imp, HSG C
5.012		28.00% Pervious Area
12.888		72.00% Impervious Area

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

Subcatchment A42: 17.9 AC



Summary for Subcatchment A43: 16.3 AC

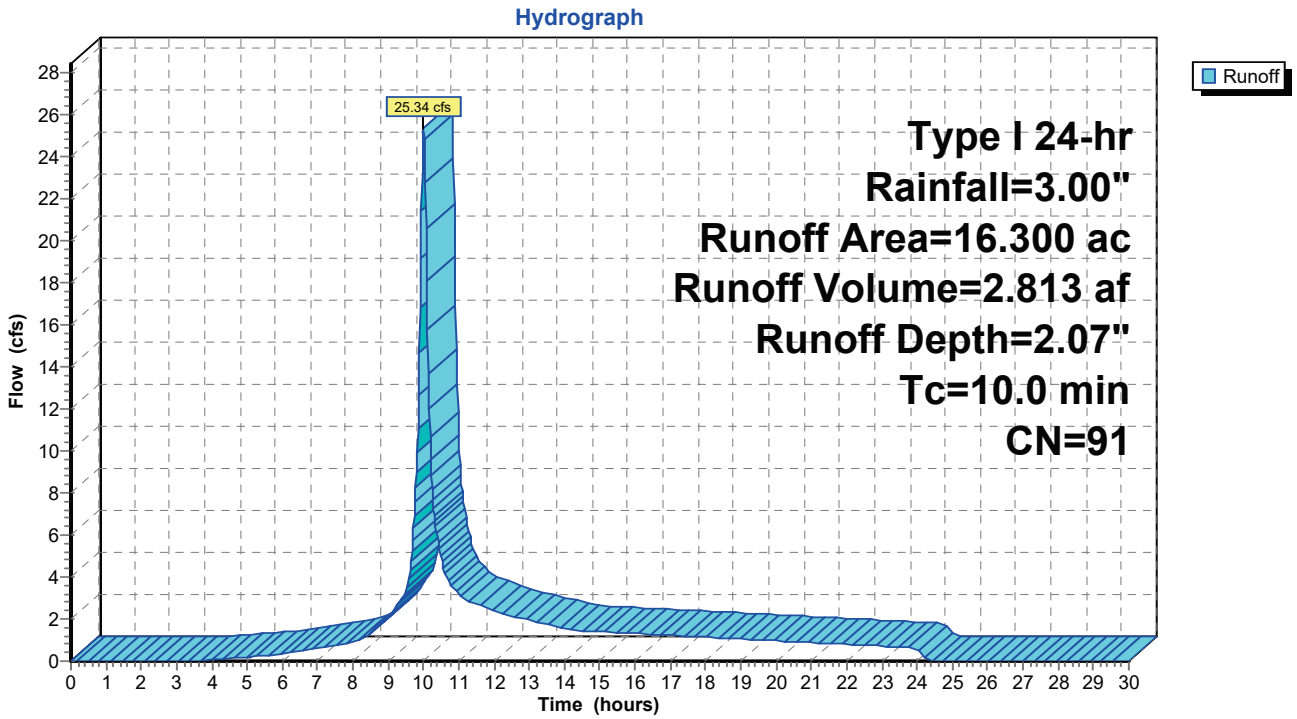
Runoff = 25.34 cfs @ 10.01 hrs, Volume= 2.813 af, Depth= 2.07"
Routed to Reach 43 : RE 121.5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
16.300	91	Urban industrial, 72% imp, HSG C
4.564		28.00% Pervious Area
11.736		72.00% Impervious Area

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

Subcatchment A43: 16.3 AC



Summary for Subcatchment A44: 17.4 AC

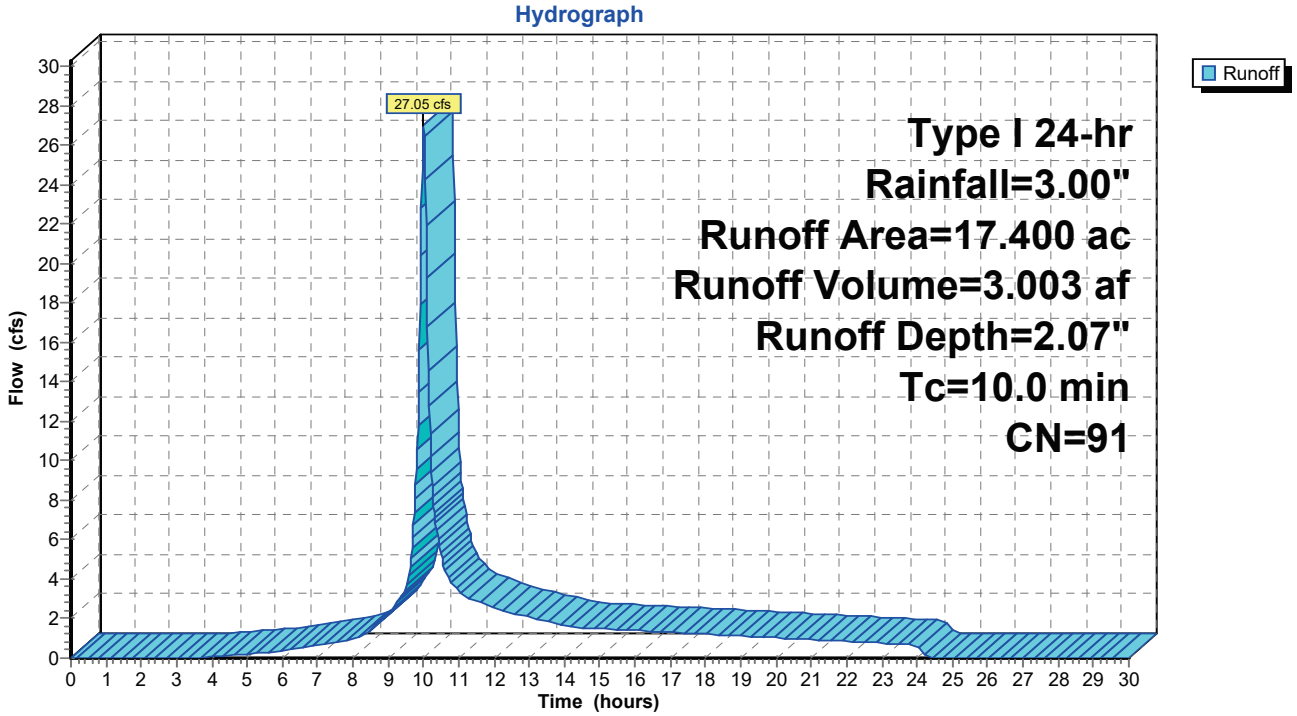
Runoff = 27.05 cfs @ 10.01 hrs, Volume= 3.003 af, Depth= 2.07"
Routed to Reach 44 : RE 114.5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
17.400	91	Urban industrial, 72% imp, HSG C
4.872		28.00% Pervious Area
12.528		72.00% Impervious Area

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

Subcatchment A44: 17.4 AC



Summary for Subcatchment A45: 17.8 AC

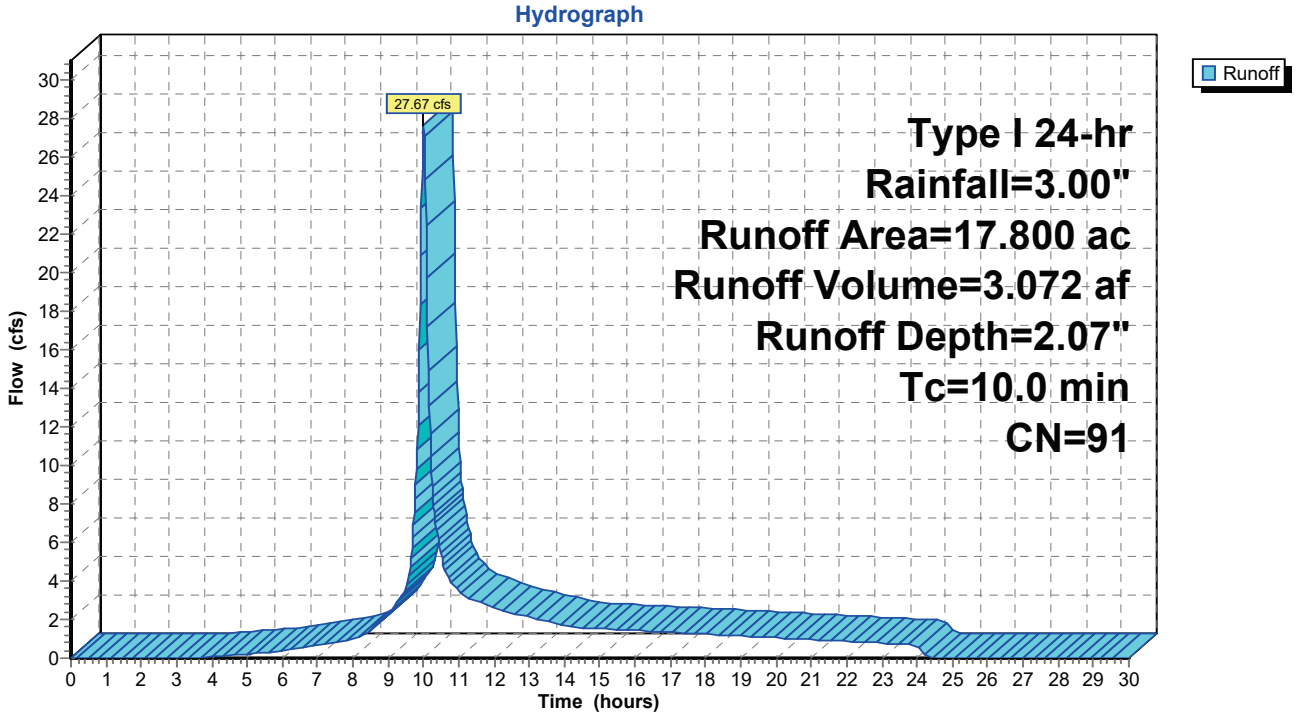
Runoff = 27.67 cfs @ 10.01 hrs, Volume= 3.072 af, Depth= 2.07"
Routed to Reach 45 : RE 121.5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
17.800	91	Urban industrial, 72% imp, HSG C
4.984		28.00% Pervious Area
12.816		72.00% Impervious Area

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

Subcatchment A45: 17.8 AC



Summary for Subcatchment A46: 18.8 AC

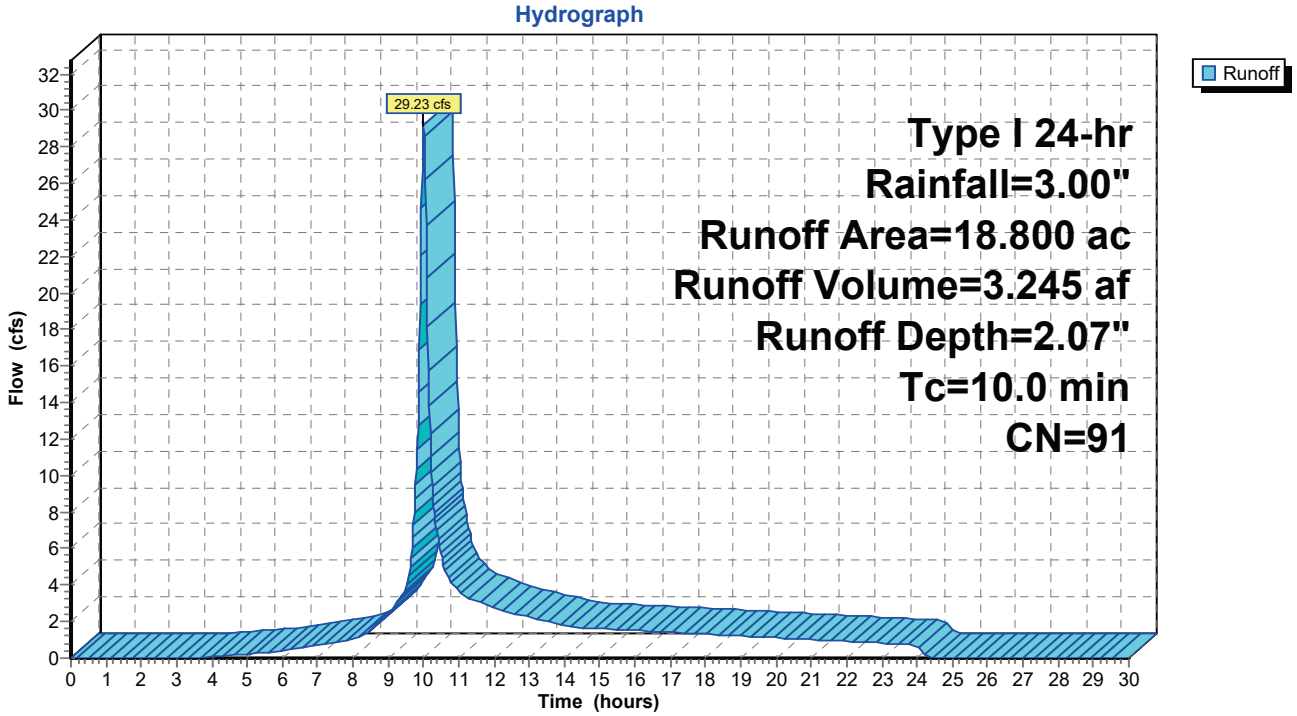
Runoff = 29.23 cfs @ 10.01 hrs, Volume= 3.245 af, Depth= 2.07"
Routed to Reach 46 : RE 114.5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
18.800	91	Urban industrial, 72% imp, HSG C
5.264		28.00% Pervious Area
13.536		72.00% Impervious Area

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

Subcatchment A46: 18.8 AC



Summary for Subcatchment A51: 9 AC

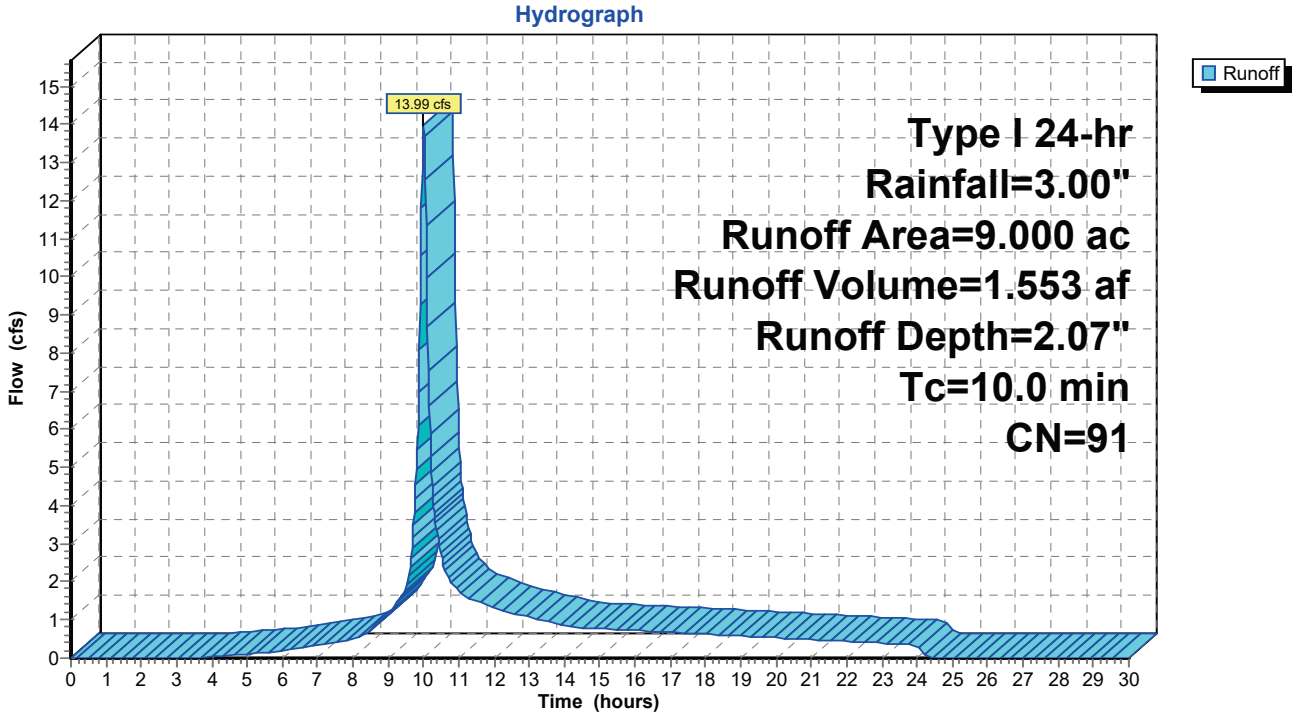
Runoff = 13.99 cfs @ 10.01 hrs, Volume= 1.553 af, Depth= 2.07"
Routed to Reach 51 : RE 109

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
9.000	91	Urban industrial, 72% imp, HSG C
2.520		28.00% Pervious Area
6.480		72.00% Impervious Area

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

Subcatchment A51: 9 AC



Summary for Subcatchment A52: 10.4 AC

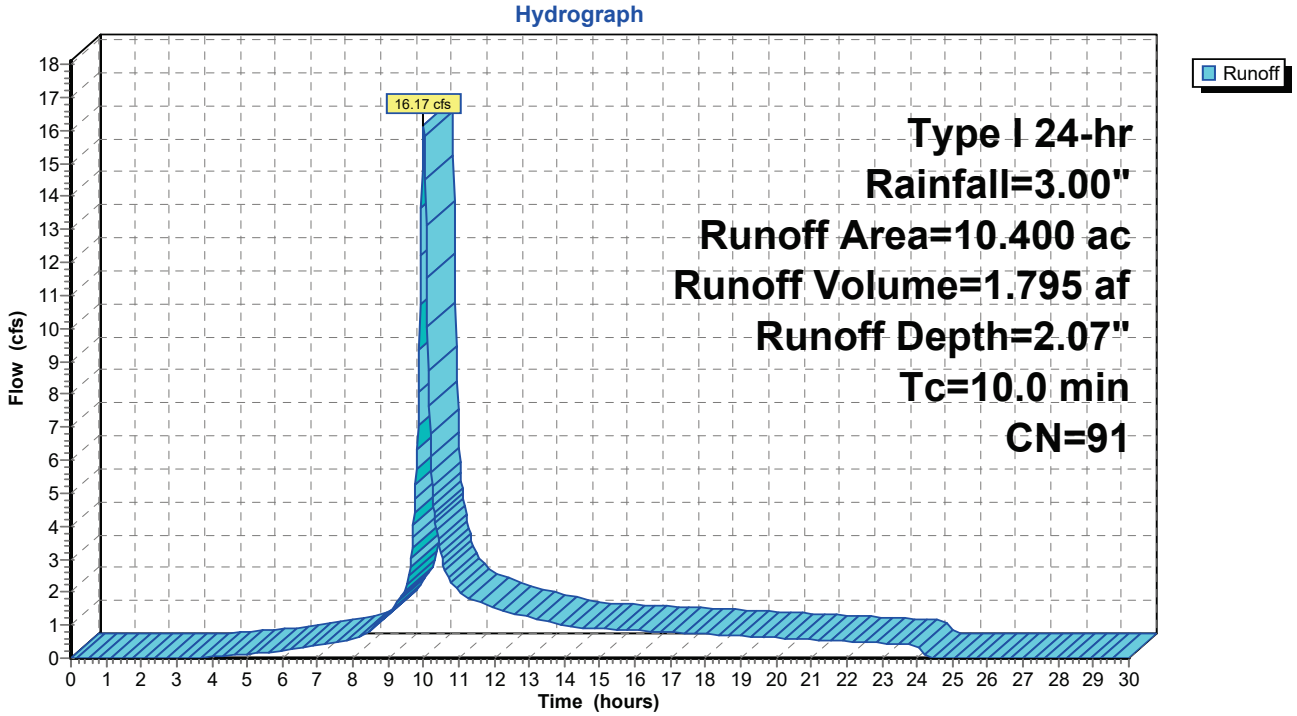
Runoff = 16.17 cfs @ 10.01 hrs, Volume= 1.795 af, Depth= 2.07"
Routed to Reach 52 : RE 109.4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
10.400	91	Urban industrial, 72% imp, HSG C
2.912		28.00% Pervious Area
7.488		72.00% Impervious Area

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

Subcatchment A52: 10.4 AC



Summary for Subcatchment A53: 4.0 AC

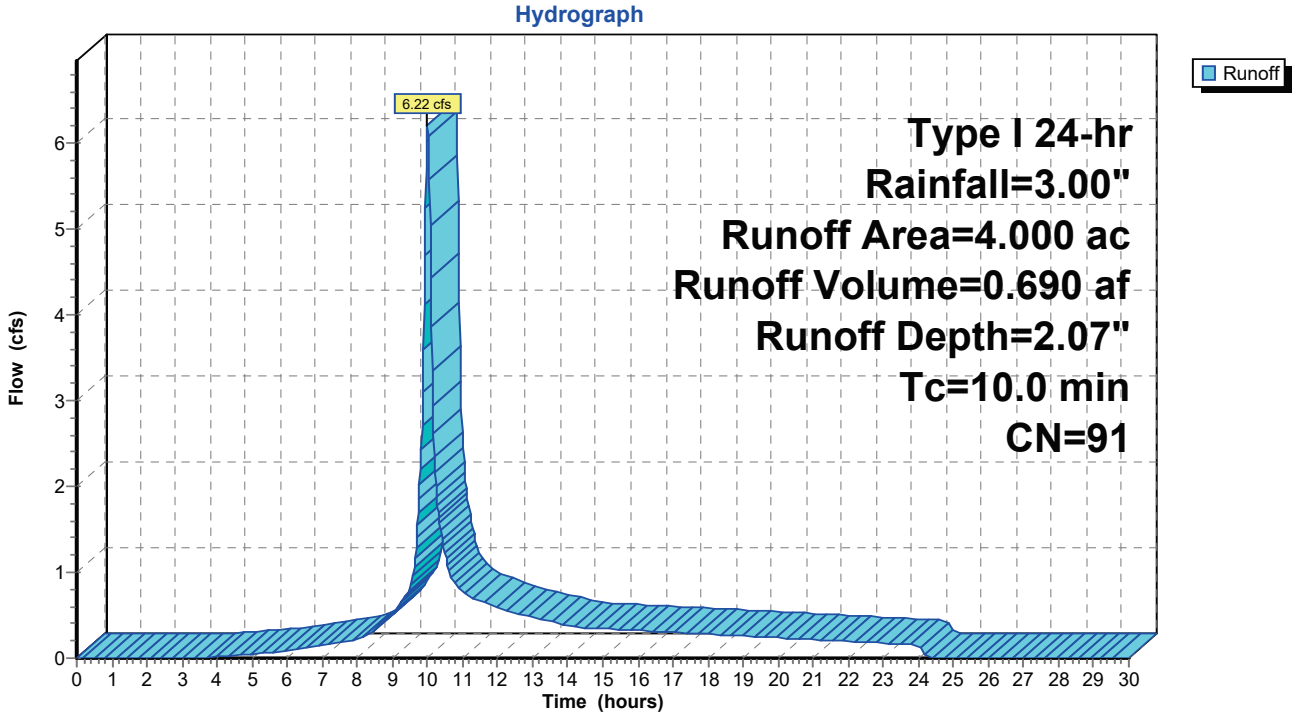
Runoff = 6.22 cfs @ 10.01 hrs, Volume= 0.690 af, Depth= 2.07"
Routed to Pond DET4 : DET 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

Area (ac)	CN	Description
4.000	91	Urban industrial, 72% imp, HSG C
1.120		28.00% Pervious Area
2.880		72.00% Impervious Area

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

Subcatchment A53: 4.0 AC



Summary for Subcatchment A55: 3.4 AC

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

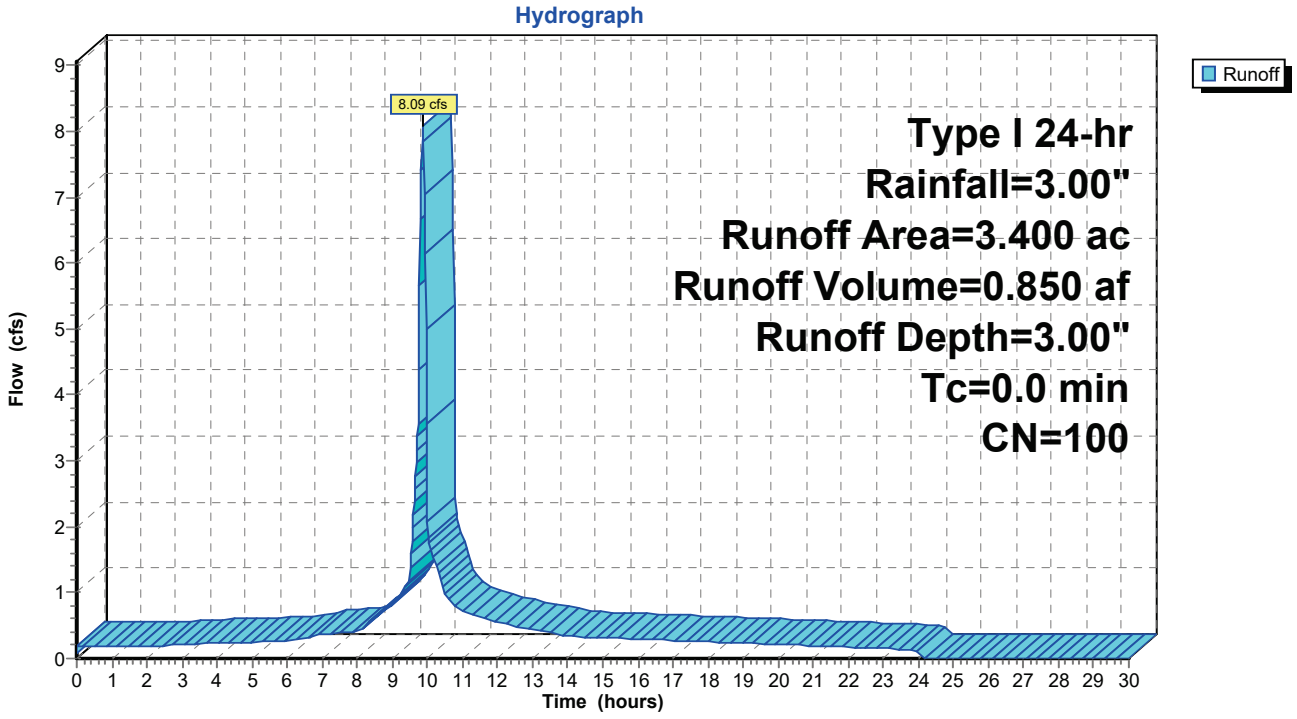
Runoff = 8.09 cfs @ 9.86 hrs, Volume= 0.850 af, Depth= 3.00"
Routed to Pond DET4 : DET 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type I 24-hr Rainfall=3.00"

	Area (ac)	CN	Description
*	3.400	100	basin
	3.400		100.00% Impervious Area

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

Subcatchment A55: 3.4 AC



Summary for Reach 41: RE 135.0

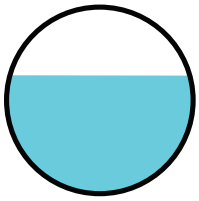
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 16.200 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 25.19 cfs @ 10.01 hrs, Volume= 2.796 af
Outflow = 24.36 cfs @ 10.08 hrs, Volume= 2.796 af, Atten= 3%, Lag= 4.1 min
Routed to Reach 42 : RE 135.0

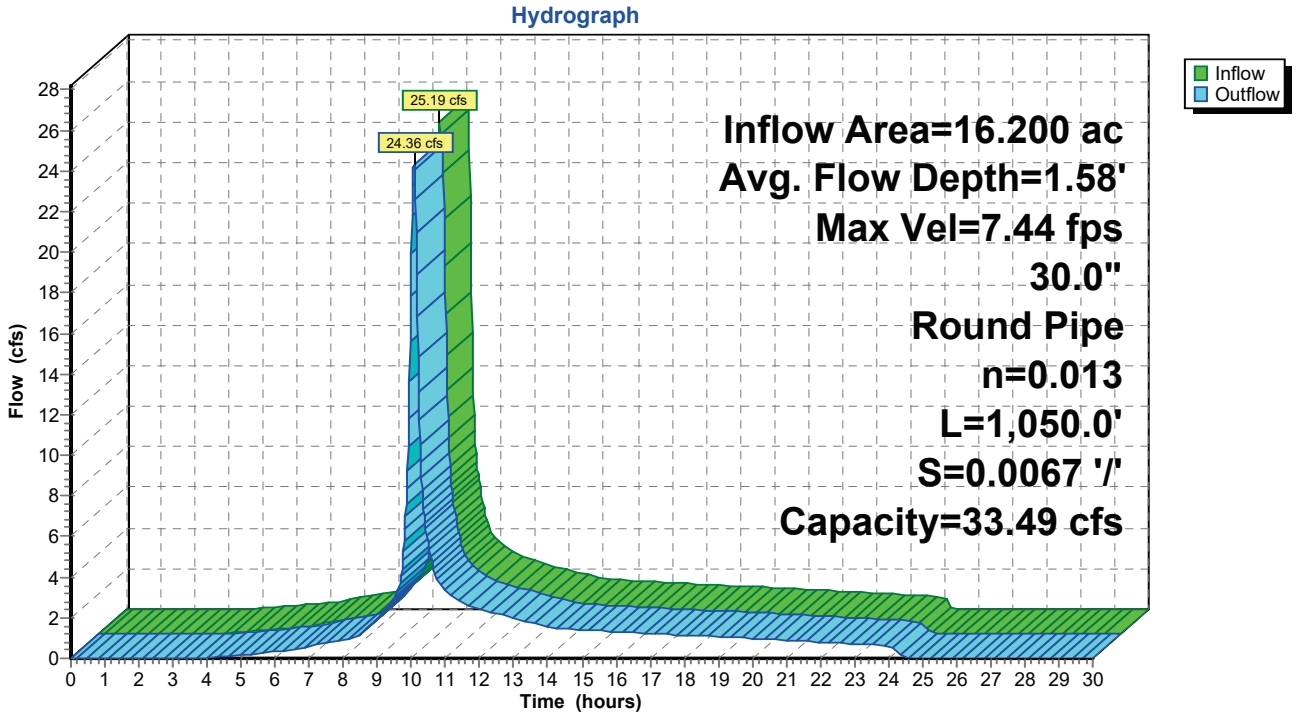
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.44 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 6.1 min

Peak Storage= 3,439 cf @ 10.04 hrs
Average Depth at Peak Storage= 1.58' , Surface Width= 2.41'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 33.49 cfs

30.0" Round Pipe
n= 0.013
Length= 1,050.0' Slope= 0.0067 '/'
Inlet Invert= 128.00', Outlet Invert= 121.00'



Reach 41: RE 135.0



Summary for Reach 42: RE 135.0

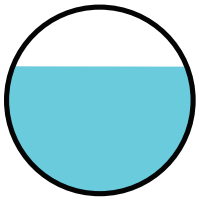
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 41 OUTLET depth by 0.69' @ 10.16 hrs

Inflow Area = 34.100 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 49.99 cfs @ 10.04 hrs, Volume= 5.886 af
Outflow = 45.73 cfs @ 10.16 hrs, Volume= 5.886 af, Atten= 9%, Lag= 7.5 min
Routed to Reach 47 : RE 109.0

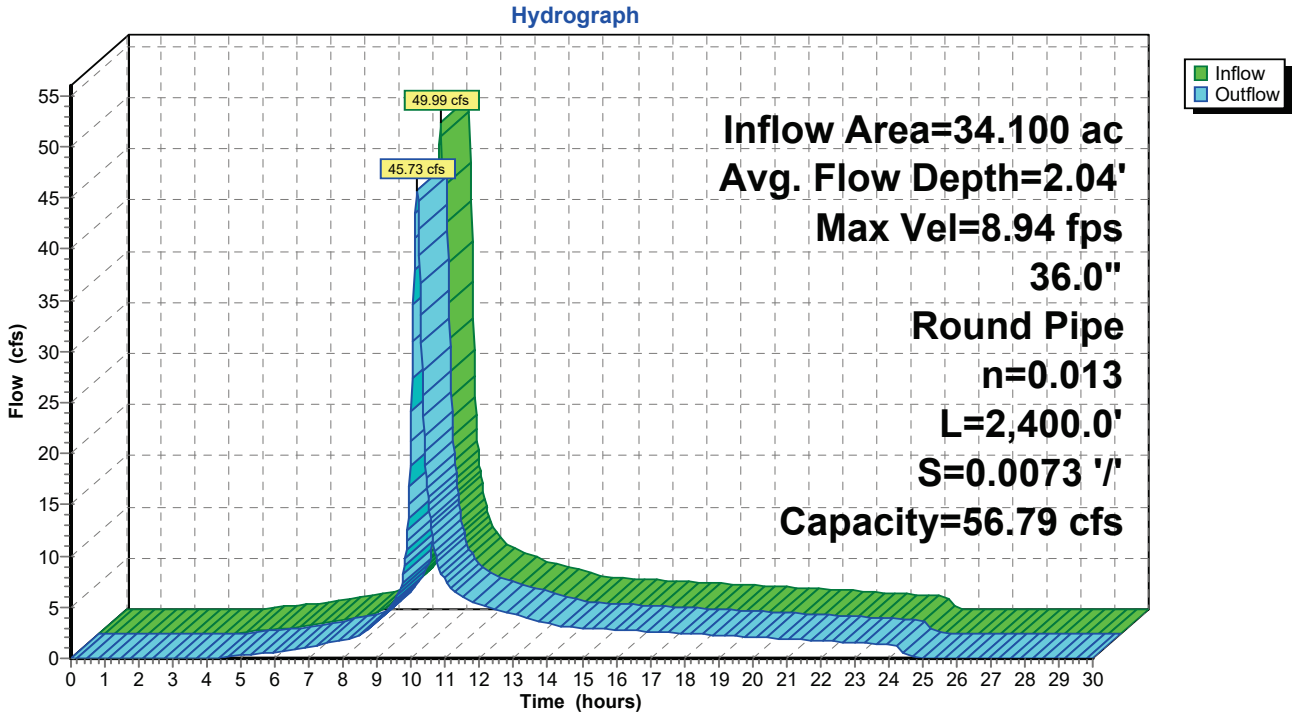
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.94 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 3.29 fps, Avg. Travel Time= 12.1 min

Peak Storage= 12,302 cf @ 10.09 hrs
Average Depth at Peak Storage= 2.04' , Surface Width= 2.80'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 56.79 cfs

36.0" Round Pipe
n= 0.013
Length= 2,400.0' Slope= 0.0073 '/'
Inlet Invert= 121.00', Outlet Invert= 103.60'



Reach 42: RE 135.0



Summary for Reach 43: RE 121.5

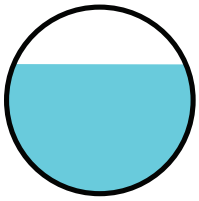
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 16.300 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 25.34 cfs @ 10.01 hrs, Volume= 2.813 af
Outflow = 23.90 cfs @ 10.10 hrs, Volume= 2.813 af, Atten= 6%, Lag= 5.3 min
Routed to Reach 44 : RE 114.5

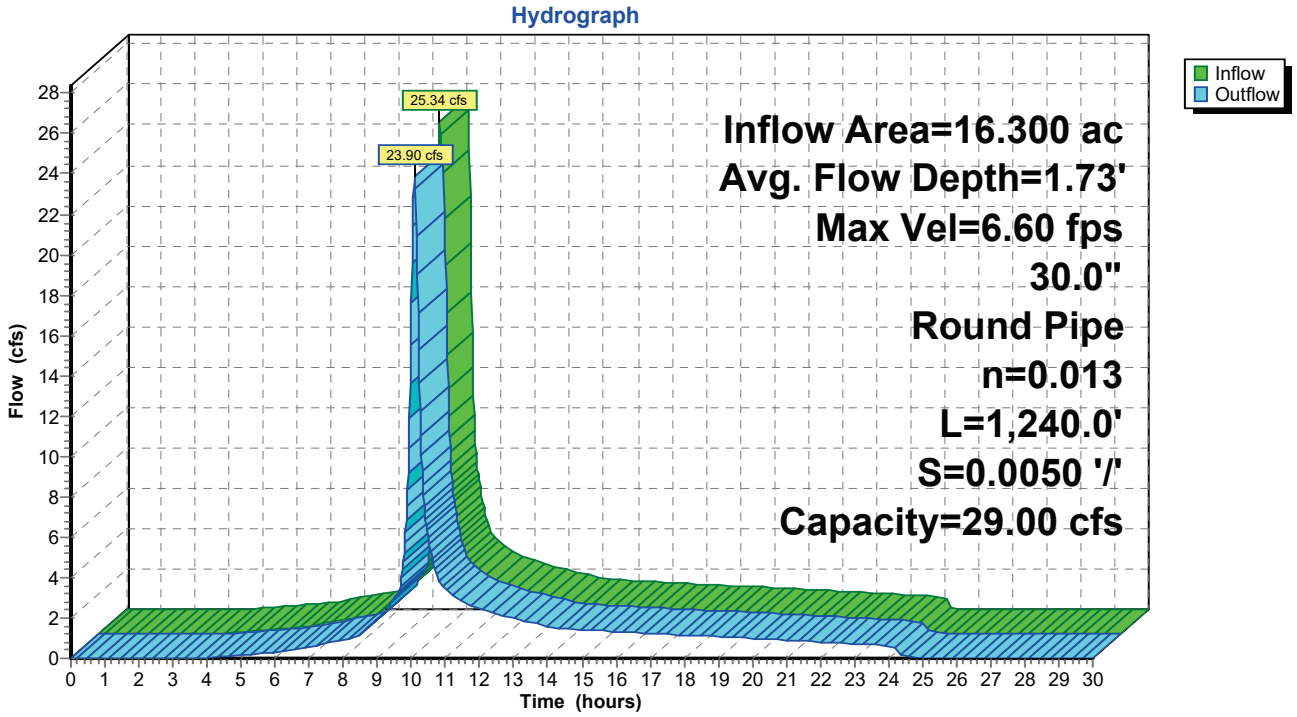
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.60 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 2.50 fps, Avg. Travel Time= 8.3 min

Peak Storage= 4,503 cf @ 10.04 hrs
Average Depth at Peak Storage= 1.73' , Surface Width= 2.31'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 29.00 cfs

30.0" Round Pipe
n= 0.013
Length= 1,240.0' Slope= 0.0050 '/'
Inlet Invert= 117.50', Outlet Invert= 111.30'



Reach 43: RE 121.5



Summary for Reach 44: RE 114.5

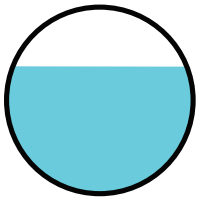
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 33.700 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 47.42 cfs @ 10.04 hrs, Volume= 5.817 af
Outflow = 44.56 cfs @ 10.15 hrs, Volume= 5.817 af, Atten= 6%, Lag= 6.4 min
Routed to Reach 46 : RE 114.5

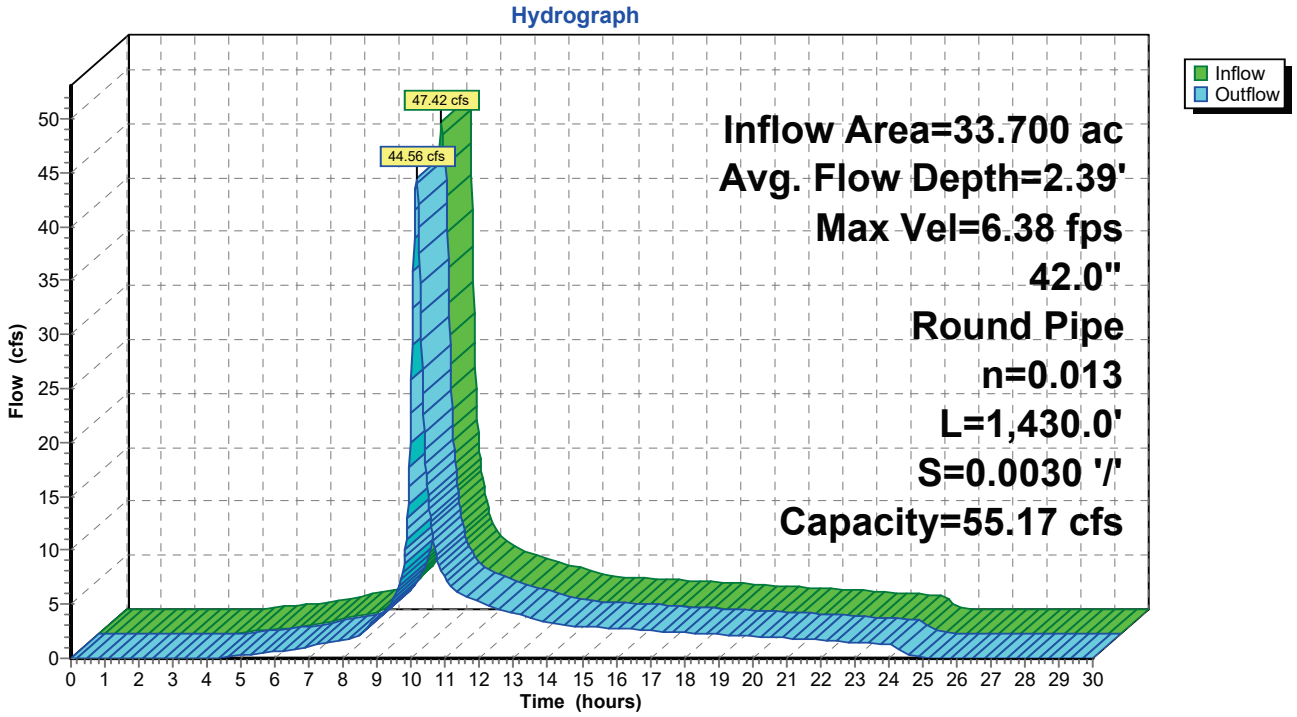
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.38 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 10.1 min

Peak Storage= 9,994 cf @ 10.09 hrs
Average Depth at Peak Storage= 2.39' , Surface Width= 3.26'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 55.17 cfs

42.0" Round Pipe
n= 0.013
Length= 1,430.0' Slope= 0.0030 '/'
Inlet Invert= 108.50', Outlet Invert= 104.20'



Reach 44: RE 114.5



Summary for Reach 45: RE 121.5

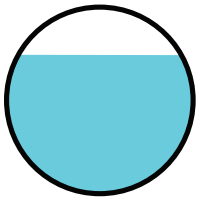
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 17.800 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 27.67 cfs @ 10.01 hrs, Volume= 3.072 af
Outflow = 26.06 cfs @ 10.10 hrs, Volume= 3.072 af, Atten= 6%, Lag= 5.3 min
Routed to Reach 46 : RE 114.5

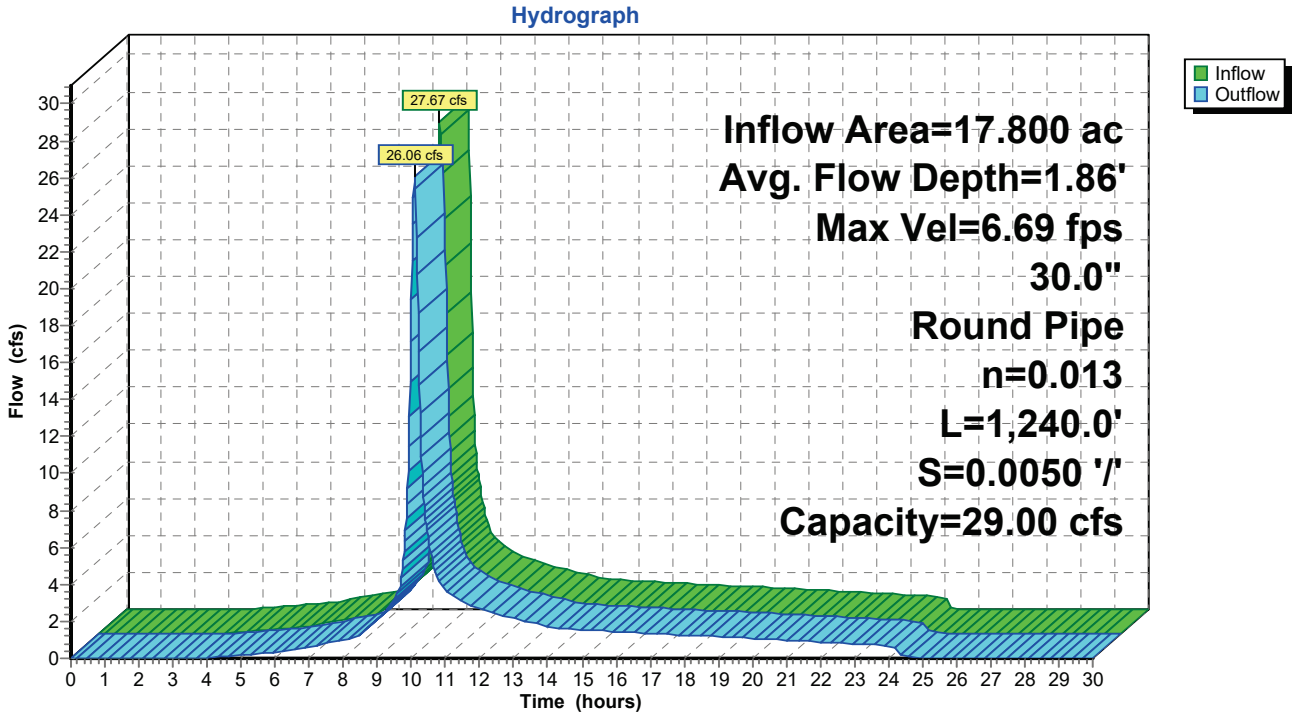
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.69 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 2.57 fps, Avg. Travel Time= 8.1 min

Peak Storage= 4,848 cf @ 10.05 hrs
Average Depth at Peak Storage= 1.86' , Surface Width= 2.19'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 29.00 cfs

30.0" Round Pipe
n= 0.013
Length= 1,240.0' Slope= 0.0050 '/'
Inlet Invert= 117.50', Outlet Invert= 111.30'



Reach 45: RE 121.5



Summary for Reach 46: RE 114.5

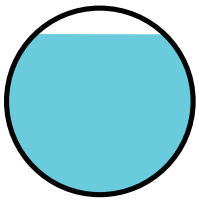
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 104% of Manning's capacity
[62] Hint: Exceeded Reach 44 OUTLET depth by 0.93' @ 10.10 hrs

Inflow Area = 70.300 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 88.71 cfs @ 10.09 hrs, Volume= 12.134 af
Outflow = 88.59 cfs @ 10.10 hrs, Volume= 12.134 af, Atten= 0%, Lag= 0.5 min
Routed to Reach 47 : RE 109.0

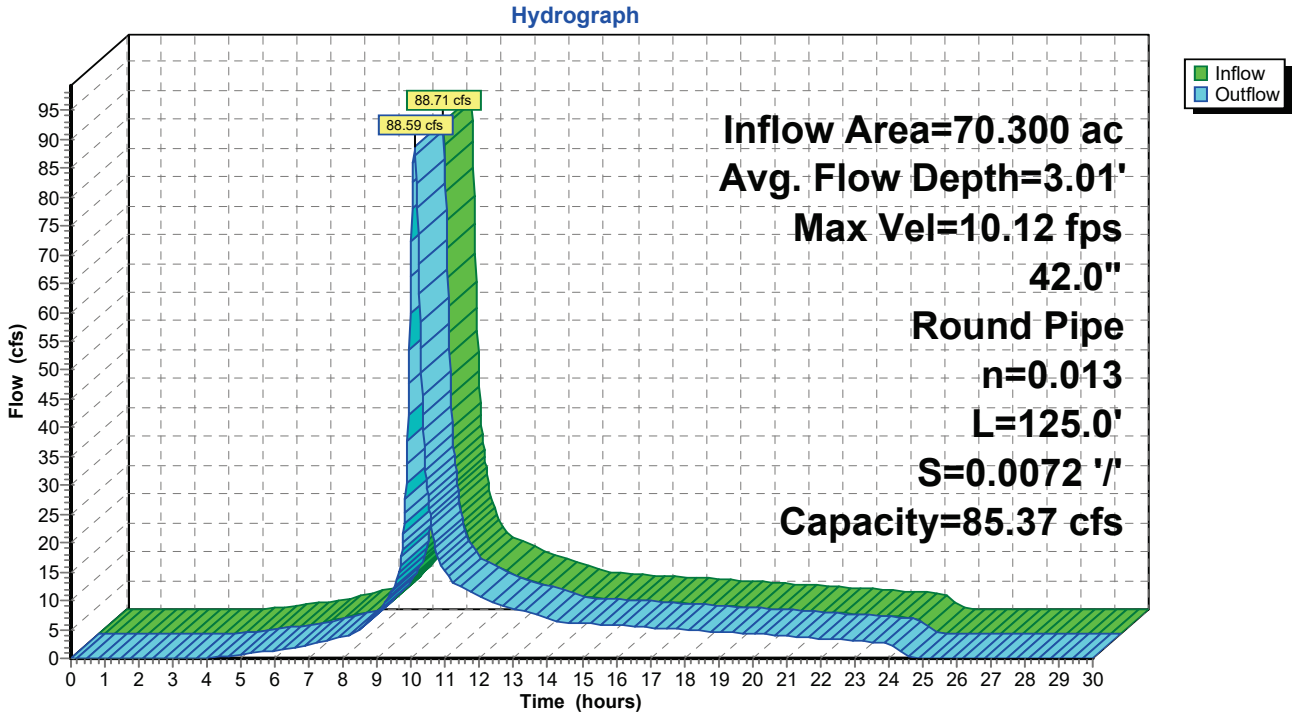
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 10.12 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.97 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,100 cf @ 10.09 hrs
Average Depth at Peak Storage= 3.01' , Surface Width= 2.43'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 85.37 cfs

42.0" Round Pipe
n= 0.013
Length= 125.0' Slope= 0.0072 '/'
Inlet Invert= 104.50', Outlet Invert= 103.60'



Reach 46: RE 114.5



Summary for Reach 47: RE 109.0

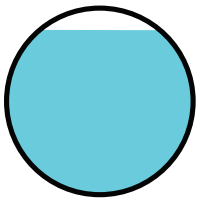
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 106% of Manning's capacity
[62] Hint: Exceeded Reach 42 OUTLET depth by 1.87' @ 10.14 hrs
[63] Warning: Exceeded Reach 46 INLET depth by 0.07' @ 10.16 hrs

Inflow Area = 104.400 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 131.35 cfs @ 10.12 hrs, Volume= 18.019 af
Outflow = 131.23 cfs @ 10.13 hrs, Volume= 18.019 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 51 : RE 109

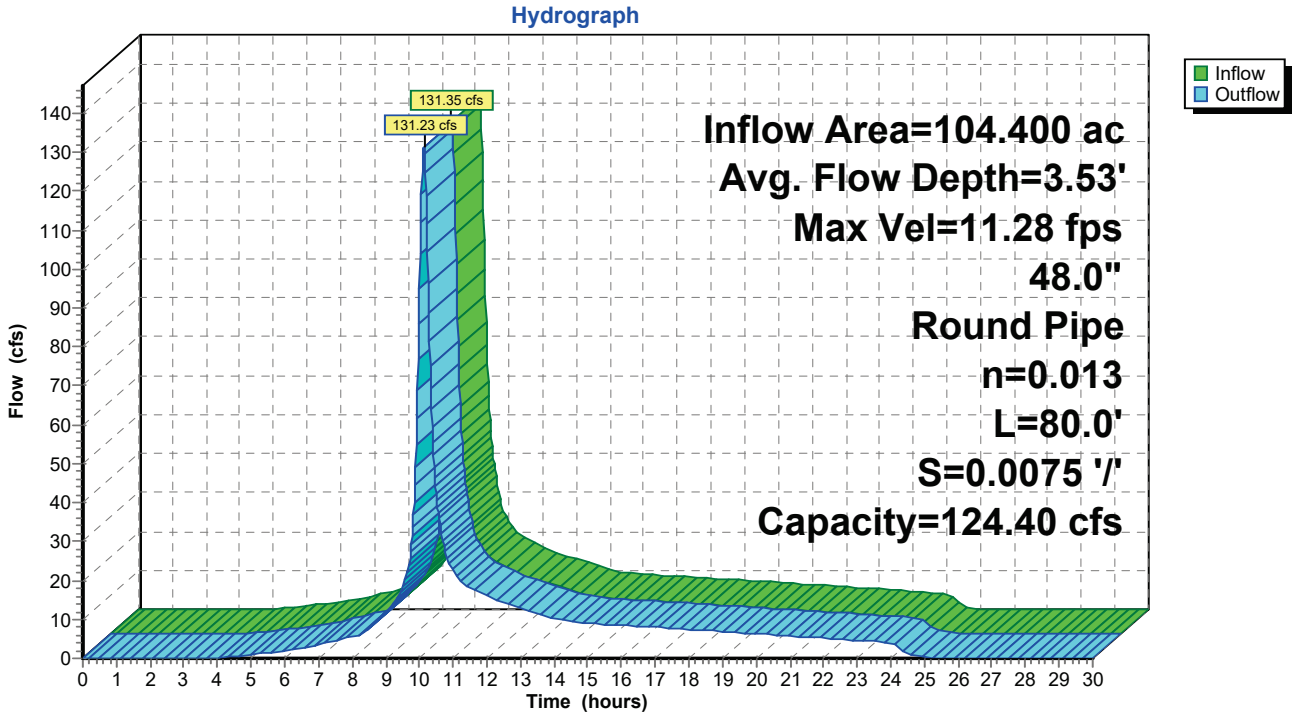
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 11.28 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.46 fps, Avg. Travel Time= 0.3 min

Peak Storage= 939 cf @ 10.13 hrs
Average Depth at Peak Storage= 3.53' , Surface Width= 2.58'
Bank-Full Depth= 4.00' Flow Area= 12.6 sf, Capacity= 124.40 cfs

48.0" Round Pipe
n= 0.013
Length= 80.0' Slope= 0.0075 '/'
Inlet Invert= 103.90', Outlet Invert= 103.30'



Reach 47: RE 109.0



Summary for Reach 51: RE 109

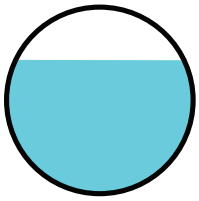
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 113.400 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 139.72 cfs @ 10.12 hrs, Volume= 19.573 af
Outflow = 139.56 cfs @ 10.12 hrs, Volume= 19.573 af, Atten= 0%, Lag= 0.4 min
Routed to Pond DET4 : DET 4

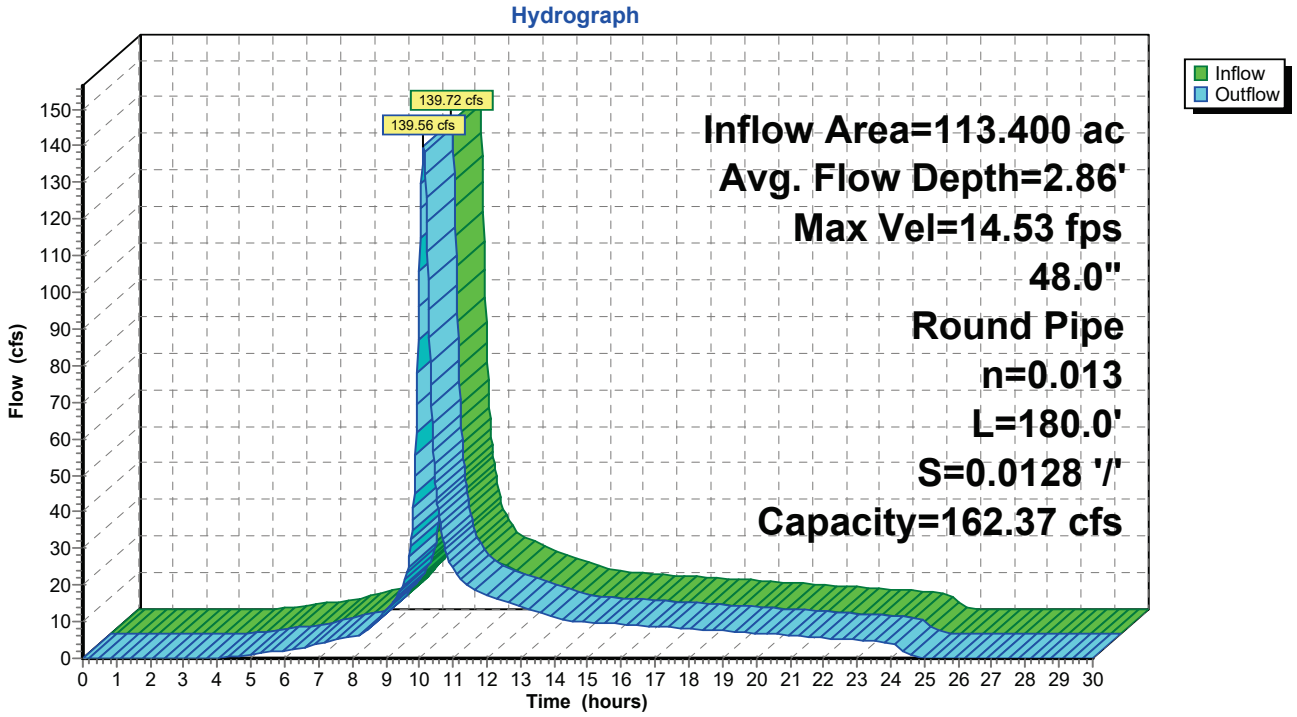
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 14.53 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.53 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,730 cf @ 10.12 hrs
Average Depth at Peak Storage= 2.86' , Surface Width= 3.61'
Bank-Full Depth= 4.00' Flow Area= 12.6 sf, Capacity= 162.37 cfs

48.0" Round Pipe
n= 0.013
Length= 180.0' Slope= 0.0128 '/'
Inlet Invert= 100.00', Outlet Invert= 97.70'



Reach 51: RE 109



Summary for Reach 52: RE 109.4

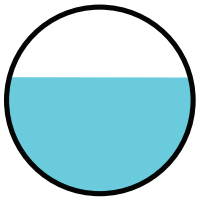
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 10.400 ac, 72.00% Impervious, Inflow Depth = 2.07"
Inflow = 16.17 cfs @ 10.01 hrs, Volume= 1.795 af
Outflow = 16.03 cfs @ 10.04 hrs, Volume= 1.795 af, Atten= 1%, Lag= 1.7 min
Routed to Pond DET4 : DET 4

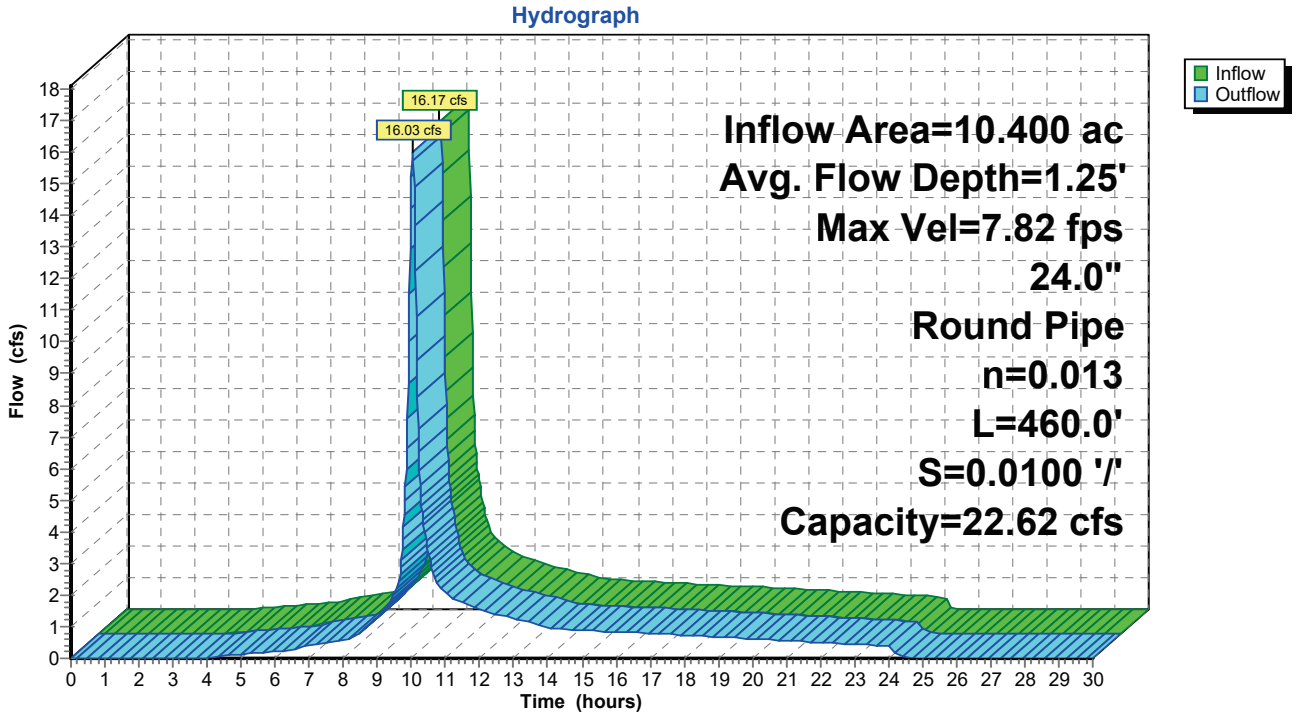
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.82 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 3.17 fps, Avg. Travel Time= 2.4 min

Peak Storage= 946 cf @ 10.02 hrs
Average Depth at Peak Storage= 1.25' , Surface Width= 1.94'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 22.62 cfs

24.0" Round Pipe
n= 0.013
Length= 460.0' Slope= 0.0100 '/'
Inlet Invert= 103.00', Outlet Invert= 98.40'



Reach 52: RE 109.4



Summary for Pond DET4: DET 4

[63] Warning: Exceeded Reach 51 INLET depth by 6.77' @ 24.96 hrs
[63] Warning: Exceeded Reach 52 INLET depth by 3.91' @ 24.50 hrs

Inflow Area = 131.200 ac, 72.73% Impervious, Inflow Depth = 2.10"
Inflow = 158.06 cfs @ 10.10 hrs, Volume= 22.908 af
Outflow = 3.34 cfs @ 10.04 hrs, Volume= 5.519 af, Atten= 98%, Lag= 0.0 min
Primary = 3.34 cfs @ 10.04 hrs, Volume= 5.519 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 106.95' @ 24.22 hrs Storage= 18.914 af

Plug-Flow detention time= 666.8 min calculated for 5.515 af (24% of inflow)
Center-of-Mass det. time= 422.8 min (1,201.2 - 778.4)

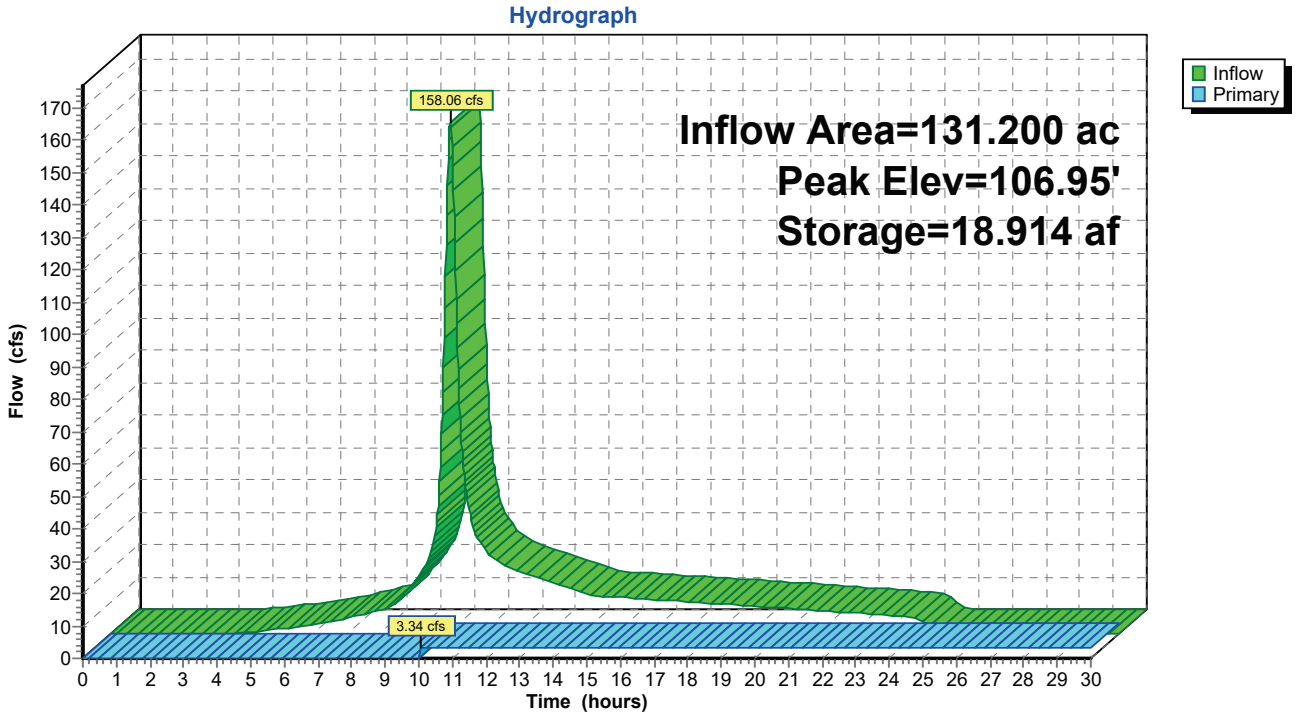
Volume	Invert	Avail.Storage	Storage Description
#1	96.00'	21.400 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
96.00	0.000
107.00	19.000
108.00	21.400

Device	Routing	Invert	Outlet Devices
#1	Primary	99.00'	**Pump** Discharges@0.00' Flow (gpm)= 1,500.0 Head (feet)= 4.00

Primary OutFlow Max=3.34 cfs @ 10.04 hrs HW=99.14' (Free Discharge)
↑—**1=Pump** (Pump Controls 3.34 cfs)

Pond DET4: DET 4



Stormwater Public Improvement Plan
Retention Basin Alternative

for

IPC Phase II
San Joaquin County, CA

May 19, 2025

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1 INTRODUCTION

This memo covers an alternate stormwater basin design for the proposed second phase of the International Park of Commerce (IPC Phase II). The project's hydrology as well as the criteria used in sizing the various storm water facilities were defined in Stormwater Public Improvement Plan. The site alternate design features stormwater infrastructure including four retention basins to retain stormwater from consecutive 10-year 48 hour storms.

FIGURE 1: VICINITY MAP

2 PROPOSED ALTERNATE: RETENTION BASIN

To provide flexibility in site design, retention basins may be implemented for stormwater infiltration and treatment. These basins will be designed to fully capture and contain two consecutive 10-year, 48-hour storm events without any offsite discharge. In addition to containing the consecutive storms the basins are sized to contain the 100 year 10 day storm within the basin while accounting for infiltration and freeboard storage. Preliminary sizing for the proposed retention basins is presented in Table 1. The retention basin will be designed per San Joaquin County Standards (Reference #1) such as 4:1 side slopes and 10 day draw down.

The retention basins will be located in the same areas identified as the detention basins in Figure 2 and Figure 3. By incorporating retention basins, the project will meet both hydromodification and stormwater treatment requirements, as all stormwater will be retained and infiltrated onsite rather than discharged.

TABLE 1: RETENTION BASIN SIZING

IPC II
RETENTION BASIN SIZING CALCULATIONS FOR 2 X 10 YEAR - 48 HR STORM

	Area Type					Total Area		Run Off Volume (10 year-48hr x 2)		Required Storage (10 year-48hr x 2)*	Basin Size Provided (Not Inlcuding Freeboard Volume)
	Pond (Basin) S.F. 1.00 x 0.156'	Pavement S.F. 0.95 x 0.156'	Roof S.F. 0.80 x 0.156'	Gravel S.F. 0.75 x 0.156'	Landscape S.F. 0.20 x 0.156'	S.F.	Acres	C.F.	A.F.	A.F.	A.F.
BASIN 1	58,640	825,030	768,530	12,160	408,670	2,073,030	47.59	241,503	5.54	11.09	**11.50**
BASIN 2	81,800	840,780	1,090,535	14,300	342,465	2,369,880	54.40	285,821	6.56	13.12	**14.00**
BASIN 3	65,570	842,460	818,090	13,250	399,130	2,138,500	49.09	251,182	5.77	11.53	**12.00**
BASIN 4	101,300	2,444,175	2,100,720	161,900	906,977	5,715,072	131.20	687,439	15.78	31.56	**31.60**

IPC II
RETENTION BASIN CALCULATION FOR 100 YEAR - 10 DAY STORM

	Freeboard Storage (A.F)	Percolation Rate**	Bottom Of Basin (SF)	Volume Percolated over 10 Day Drawdown Time (A.F)	Required Run Off Volume (100 year 10 Day)		Basin Size Provided (Including Freeboard Volume)	Available Storage (100 year)***
		in/hr			C.F.	A.F.	A.F.	A.F.
BASIN 1	1.85	0.51	68,489.00	16.04	879,738	20.20	13.35	**28.98**
BASIN 2	2.31	3.65	86,384.00	144.77	957,223	21.97	16.31	**160.20**
BASIN 3	2.16	3.65	79,999.00	134.07	899,085	20.64	14.16	**147.76**
BASIN 4	3.60	0.51	139,401.00	32.64	2,393,599	54.95	35.20	**67.80**

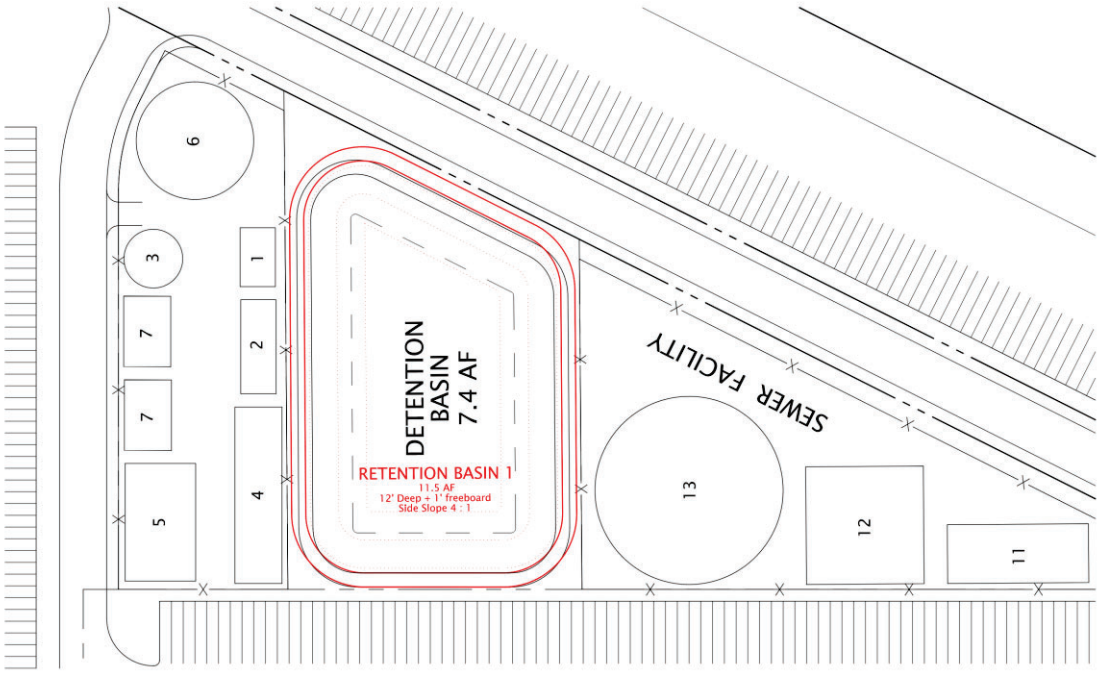
[1] This required storage is for a 48 hr 10-year event x 2
County Standards D-3 Urban 48-Hr Storm (Zone 3) 1.87" (0.156')
100 year 10 day storm 5.01" Per NOAA
** Does not inlcude Infiltration and includes 1' freeboard above maximum water elevation*
*** Infiltration Rate- Raw Infiltration Rate with safety factor of 2*
**** Includes Volume Infiltrated and No Available Freeboard*

FIGURE 2: IPC PHASE II SITE PLAN

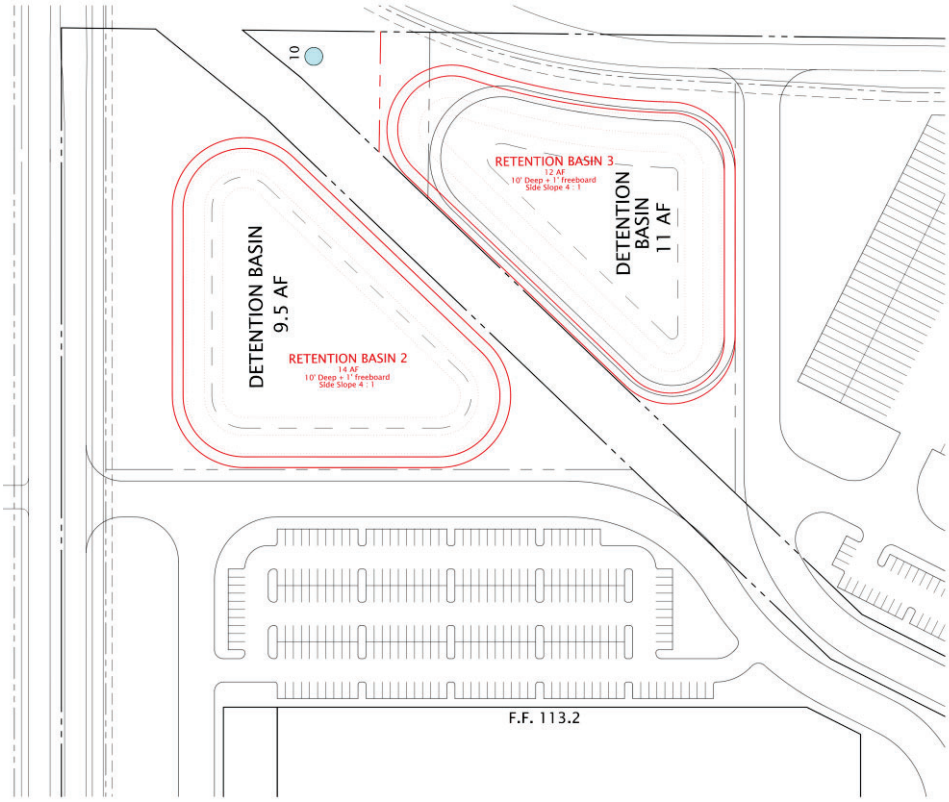
Note: The detention basin locations shown would serve as retention basins if this alternative is selected

FIGURE 3: RETENTION BASIN ENLARGED LAYOUT

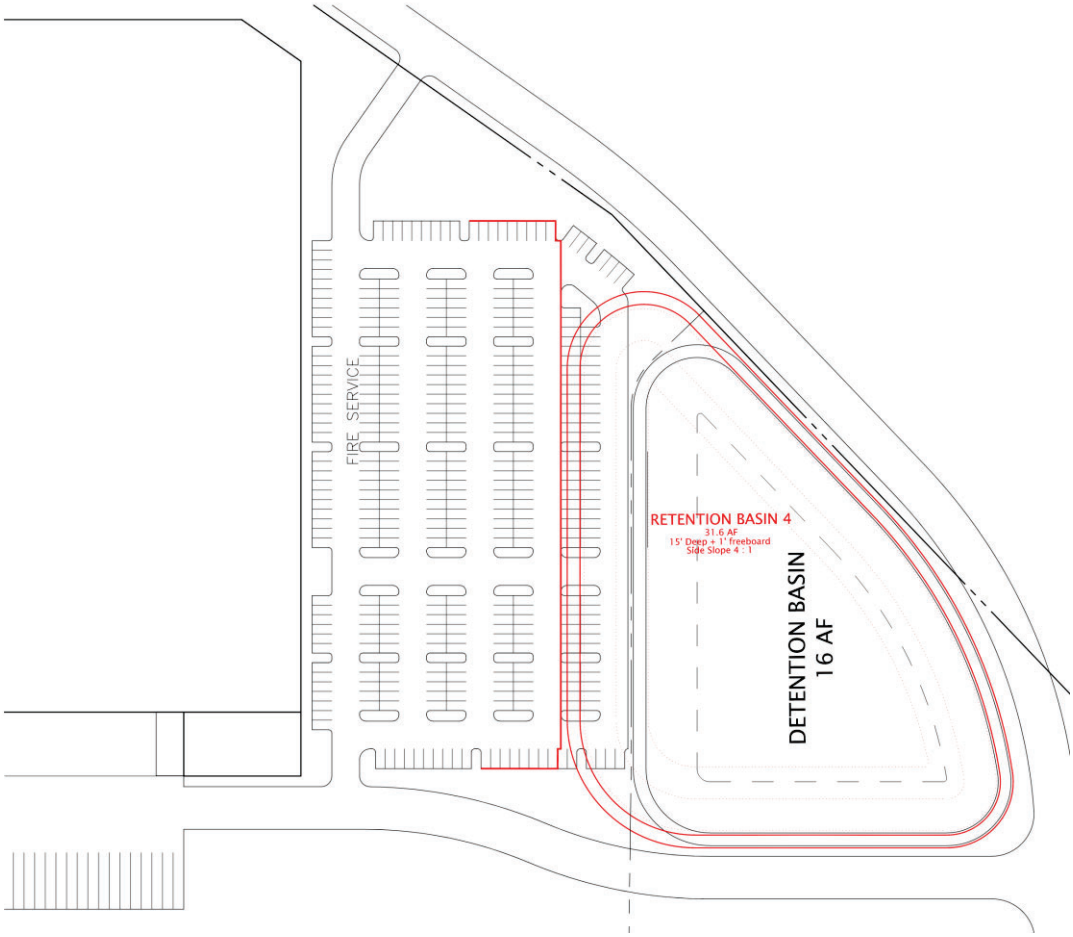
Basin 1:



Basin 2 & 3:


10
RETENTION BASIN 3
12 AF
10' Deep + 1' freeboard
Side Slope 4 : 1
DETENTION BASIN
11 AF
DETENTION BASIN
9.5 AF
RETENTION BASIN 2
14 AF
10' Deep + 1' freeboard
Side Slope 4 : 1
F.F. 113.2

Basin 4:


FIRE SERVICE
RETENTION BASIN 4
31.6 AF
15' Deep + 1' freeboard
Side Slope 4 : 1
DETENTION BASIN
16 AF

3 PROBABLE COST

Probable costs for IPC Phase II Retention Basin Alternative infrastructure are shown in Table 2.

TABLE 2: PROBABLE COSTS RETENTION BASIN

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
RETENTION BASIN 1				
EXCAVATION	11.09	AF	$ 32,000	$ 354,880
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
RETENTION BASIN 2				
EXCAVATION	13.12	AF	$ 32,000	$ 419,840
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
RETENTION BASIN 3				
EXCAVATION	11.53	AF	$ 32,000	$ 368,960
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
RETENTION BASIN 4				
EXCAVATION	31.56	AF	$ 32,000	$ 1,009,920
ACCESS ROAD, HYDROSEED, FENCING	1	LS	$ 200,000	$ 200,000
SUBTOTAL				**$ 2,953,600**
25% CONTINGENCY				$ 738,400
TOTAL				**$ 3,692,000**

4 REFERENCES

County of San Joaquin, "Improvement Standards", November 2014