HOUSTON CREEK FLOOD STUDY

FINAL REPORT

FOR

DCED FLOOD MITIGATION PROGRAM

LOWER GWYNEDD TOWNSHIP
MONTGOMERY COUNTY, PA

FILE NO. 21-02081

DATE: JULY 2023

Prepared For:

Lower Gwynedd Township
1130 N. Bethlehem Pike
Spring House, PA 19477
(215) 646-5302

Prepared By:

Gilmore & Associates, Inc.
Engineers ♦ Land Surveyors ♦ Planners ♦ GIS Consultants
65 E. Butler Avenue
New Britain, PA 18901
(215) 345-4330

This project was financed in part by a grant from the Commonwealth Financing Authority

TABLE OF CONTENTS

STUDY PREPARER INFORMATION

NAME OF PLAN PREPARER: James J. Hersh, P.E.

FORMAL EDUCATION:

Name of College or Technical Institute: Northeastern University
Curriculum or Program: Civil Engineering
Dates of Attendance: 2003 - 2008
Degree Received: Bachelor of Science in Civil Engineering

EMPLOYMENT HISTORY:

Current Employer: Gilmore & Associates, Inc.
Telephone: (215) 345-4330

STUDY NARRATIVE

1.0 PROJECT DESCRIPTION

In response to consistent flooding within Lower Gwynedd Township around the Houston Creek, tributary to the Wissahickon Creek, the Lower Gwynedd Board of Supervisors applied to, and were subsequently awarded funds from the Commonwealth Financing Authority – Flood Mitigation Program for a study of the subject area. The goal of the study being to identify potential projects which could be implemented to reduce the frequency and severity of flooding in the area.

The total study area is the 280-acre Houston Creek watershed, as identified on the aerial map contained in Appendix A. Also included within Appendix A is FEMA Flood Insurance Map 42091C0286G, which identifies the project area as containing Zone A (100-year floodplain with no Base Flood Elevations). Available existing HEC-RAS (Hydraulic Engineering Center – River Analysis System) data was received from FEMA and used as a base for the HEC-RAS calculations compiled as part of the project. An on-site survey was performed to supplement the data received from FEMA and generate accurate cross sections at various obstructions (bridges, culverts, dam, etc.) throughout the study section of the creek. The existing drainage area was estimated using a combination of available LiDAR (light imaging and ranging) contours, aerial photography, land development plans, and on-site investigations. Runoff calculations were completed utilizing the SCS (Soil Conservation Service) 24-hour Type II storm distribution with inputs from the NOAA (National Oceanic and Atmospheric Association) Point Precipitation Estimates for this location in Lower Gwynedd. The runoff analyses were completed for the 2-year and 100-year recurrence intervals.

The study is structured into three separate analyses: Conveyance Capacity at creek obstructions, Runoff Rate / Volume reduction, and investigation and evaluation of localized neighborhood flooding issues.

2.0 STUDY ANALYSES

2.1 CONVEYANCE CAPACITY ANALYSIS

The stream begins at headwaters just north of an existing dam on the Wissahickon School District property. From the outlet of the gabion dam, the creek flows south before crossing under Knight Road via a box culvert, then traversing the rear yards of residential properties along Brookside Avenue and Marion Avenue before crossing under Spring Garden Street via a box culvert and continuing under the parking lot for the Ambler Yards development. The creek continues in a combination of box culvert and triple 36" reinforced concrete pipes as it travels under Building #19 within the Ambler Yards development before entering an open channel and discharging under SEPTA tracks via a combination box culvert and elliptical corrugated metal pipe. From the dam to the SEPTA culvert, there are various obstructions within the creek that were analyzed using Mannings Equation for open channel flow. The purpose of the analysis was to determine

if any "pinch points" exist where capacity is substantially reduced due to inadequate capacity at an obstruction that doesn't match the upstream and downstream capacity in the stream channel. The following pages contain photographs of various obstructions within the creek along with their corresponding capacities as calculated utilizing Mannings Equation:

DAM ON SCHOOL DISTRICT PROPERTY

Knight Road Culvert - Upstream

Knight Road - Downstream

Box Culvert in Knight Road					
Open-Channel Flow Calculations - Rectangle					
Q =	Av				
=	(1.49/n)AR^(2/3)S^(1/2)				
n =	0.013	concrete or RCP			
d =	2.667	ft =	32	in (depth of rectangle)	
w =	8.000	ft =	96	in (width of rectangle)	
A =	21.33	ft^2 (Area of rectangle)			
P =	21.33	ft (Wetted Perimeter)			
R =	1.000	ft (Hydraulic Radius)			
S =	0.0565	=	5.65%		
	Length =	55	ft		
	Top Elev =	242.02			
	Bottom Elev =	238.91			
Q =	**581.43**	**cfs**			
v =	Q/A =	**27.25**	**ft/s**		

PED BRIDGE 450 MARION AVE.

4’ high x 10’ wide opening available for flow.

SLAB BRIDGE 448 MARION AVE.

Box Culvert Driveway Bridge

Open-Channel Flow Calculations - Rectangle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d =	4.333	ft =	52	in (depth of rectangle)
w =	11.000	ft =	132	in (width of rectangle)
A =	47.67	ft^2 (Area of rectangle)		
P =	30.67	ft (Wetted Perimeter)		
R =	1.554	ft (Hydraulic Radius)		
S =	0.0575	=	5.75%	
	Length =	12	ft	
	Top Elev =	236.55		
	Bottom Elev =	235.86		
Q =	**1,757.88**	**cfs**		
v =	Q/A =	**36.88**	**ft/s**	

DRIVEWAY BRIDGE 446 MARION AVE.

2 RCP Pipe Culvert Driveway Bridge

Open-Channel Flow Calculations - Full or 1/2 Full Circle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d = D =	3.667	ft =	44	in (depth of water = diameter of pipe)
A =	5.28	ft^2 (Area of pipe)		
P =	9.43	ft (Wetted Perimeter)		
R =	0.560	ft (Hydraulic Radius)		
S =	0.0567	=	5.67%	
Length =	12	ft		
Top Elev =	234.71			
Bottom Elev =	234.03			
Q =	**97.88**	**cfs**		
v =	Q/A =	**18.54**	**ft/s**	

Total Flow Capacity =	**195.8**	**cfs**

Spring Garden – Culvert (2) 68”x42” Elliptical Pipes transition to 8’x4’ Box Culvert

S

Second Stretch of Culvert in Spring Garden Street:
One 8'x4' RCP Box

Open-Channel Flow Calculations - Rectangle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d =	4.000	ft =	48	in (depth of rectangle)
w =	8.000	ft =	96	in (width of rectangle)
A =	32.00	ft^2 (Area of rectangle)		
P =	24.00	ft (Wetted Perimeter)		
R =	1.333	ft (Hydraulic Radius)		
S =	0.0227	=	2.27%	
	Length =	391	ft	
	Top Elev =	210.00		
	Bottom Elev =	201.13		
Q =	**669.20**	**cfs**		
v =	Q/A =	**20.91**	**ft/s**	

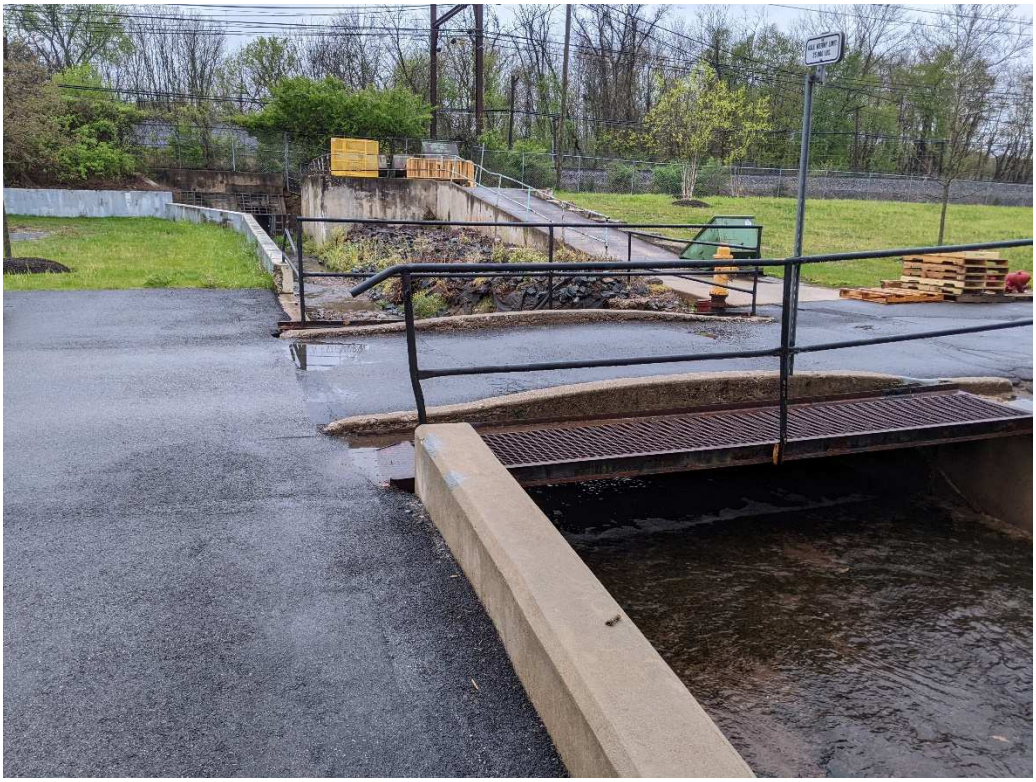
*Capacity reduced to 250 CFS if assume rock / silted bottom.

36” PIPES UNDER BUILDING 19 @ AMBLER YARDS

(3) 36" PIPES UNDER BUILDING #19

Open-Channel Flow Calculations - Full or 1/2 Full Circle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d = D =	3.000	ft =	36	in (depth of water = diameter of pipe)
A =	7.07	ft^2 (Area of pipe)		
P =	9.42	ft (Wetted Perimeter)		
R =	0.750	ft (Hydraulic Radius)		
S =	0.0152	=	1.52%	
Length =	165	ft		
Top Elev =	202.50			
Bottom Elev =	200.00			
Q =	**82.32**	**cfs**		
v =	Q/A =	**11.65**	**ft/s**	

Total Flow Capacity = 247 cfs



Looking from Building 19 toward SEPTA

SEPTA CULVERT @ AMBLER YARDS

SEPTA CULVERT - AMBLER YARDS

Open-Channel Flow Calculations - Full or 1/2 Full Circle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d = D =	5.500	ft =	66	in (depth of water = diameter of pipe)
A =	23.76	ft^2 (Area of pipe)		
P =	17.28	ft (Wetted Perimeter)		
R =	1.375	ft (Hydraulic Radius)		
S =	0.0100	=	1.00%	
Length =	100	ft		
Top Elev =	198.00			
Bottom Elev =	197.00			
Q =	336.71	cfs		
v =	Q/A =	14.17	ft/s	

Open-Channel Flow Calculations - Rectangle				
Q =	Av			
=	(1.49/n)AR^(2/3)S^(1/2)			
n =	0.013	concrete or RCP		
d =	5.167	ft =	62	in (depth of rectangle)
w =	4.000	ft =	48	in (width of rectangle)
A =	20.67	ft^2 (Area of rectangle)		
P =	18.33	ft (Wetted Perimeter)		
R =	1.127	ft (Hydraulic Radius)		
S =	0.0100	=	1.00%	
Length =	100	ft		
Top Elev =	198.00			
Bottom Elev =	197.00			
Q =	256.57	cfs		
v =	Q/A =	12.41	ft/s	

Total Flow = Q =	**593.28**	**cfs**

Based on the calculations, there are two identified "pinch points" where flow within the creek is being significantly impacted by culverts that do not have adequate capacity to convey flow. The first "pinch point" is a concrete bridge culvert that serves as the driveway to the rear of a dwelling located at 446 Marion Avenue. The subject culvert has the capacity to convey 195 cubic feet per second while the immediately upstream box culvert under Knight Road has capacity to convey 580 cubic feet per second. The drastic capacity reduction of at the driveway culvert causes overflows onto Brookside Avenue. Since this driveway culvert is situated on private property, outside of the Township's right-of-way, the recommendation is for the Township to work with the property owner to have the driveway bridge either removed or replaced with a box culvert that will have increased capacity.

The other identified "pinch point" is on the Ambler Yards property where creek transitions from a 4'x8' box culvert with 670 cubic feet per second of capacity to a configuration of three (3) 36" pipes with a total capacity of 247 cubic feet per second. The recommendation to Ambler Yards is to explore replacing the triple 36" pipes with a 12'W x 3'H box culvert that would have capacity to carry 700 cubic feet per second.

Lastly, the additional recommendation that comes out of the performed capacity analysis is related to the Township engaging PennDOT to discuss continued maintenance of the culvert that carries the stream under Spring Garden Street. This culvert is owned by PennDOT and at the time of investigation there was observed accumulated sediment in the bottom of the culvert. Accumulated sediment and debris have the potential to significantly reduce the carry capacity of the culvert so continuous maintenance is key to keeping the maximum capacity ahead of large rain events.

2.2 RATE / VOLUME REDUCTION ANALYSIS

In conjunction with the capacity analysis, runoff rate/volume calculations were conducted to identify existing flows to certain study points and then calculate the rate reductions that could be achieved by implementing stormwater facilities which would serve to reduce rate and volume of runoff to the creek.

For rate analysis, study points of Knight Road, Spring Garden Culvert, and SEPTA tracks culvert were utilized to demonstrate the potential rate reductions that can be achieved. Proposed Best Management Practice (BMP) locations were identified via desktop analysis, site walks, and evaluation of available land development plans. Existing stormwater BMPs within the study area are very limited and consist of a basin adjacent to the Wissahickon School District (WSD) administration building, an existing dam on the WSD property, and an underground basin that was installed on Ambler Yards property as part of a redevelopment in 2018. Existing & Proposed BMPs are delineated on the aerial exhibit plan included in Appendix B of this report.

Potential BMP locations were identified as the following:

Retrofit Existing Dam w/ Multi-Level Outlet Structure

The existing dam on the WSD property is constructed of concrete and gabion baskets with a singular outlet pipe located at the bottom of the dam. The outlet pipe is a 30"x48" elliptical pipe that doesn't provide much rate reduction in smaller storms. The potential exists to install a smaller orifice at the bottom of the dam to attenuate the smaller storms and then have a larger discharge at higher elevations to control against overflow in larger rain events. However, when evaluated and routed through the Hydroflow modeling software, this option proved unfeasible because while the flow rate was reduced in smaller storms (1-year to 5-year), it was increased in larger storms (10-year to 100-year). All runoff calculations and routings are included in Appendix C. Below table provides a pre/post rate comparison for the outlet structure reconfiguration:

MODIFY DAM OUTLET CONTROL STRUCTURE

PEAK FLOW SUMMARY (DAM OUTLET)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	101.3	122.5	143.6	155.3	188.8	303.9	452.9
Post-Development Flow (cfs)	58.7	75.1	133.8	161.0	267.2	389.1	545.2
Flow Reduction (%)	-42%	-39%	-7%	4%	42%	28%	20%

Enlarge Dam Impoundment & Modify Outlet Structure

To provide rate reductions in all storms, it was determined that increasing volume behind the dam was necessary in addition to modifying the outlet control structure. To achieve the additional capacity volume, a forest area would need to be cleared along with the excavation and removal of the earth. It's unclear at this time whether rock excavation would be required; however, due to the proximity to the creek bed, it is assumed that some rock would need to be removed to achieve the volume considered in the routing calculations. Rate reductions from this alternative are in the tale below and represent reductions across all analyzed storms:

MODIFY DAM OUTLET STRUCTURE / INCREASE IMPOUNDMENT AREA

PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	178.2	224.7	288.0	338.3	424.8	624.9	883.5
Post-Development Flow (cfs)	83.2	120.6	177.6	231.8	310.4	387.6	489.4
Flow Reduction (%)	-53%	-46%	-38%	-31%	-27%	-38%	-45%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	241.9	312.5	410.1	490.2	628.3	870.6	1188.9
Post-Development Flow (cfs)	144.7	206.2	299.8	387.9	509.0	636.1	772.1
Flow Reduction (%)	-40%	-34%	-27%	-21%	-19%	-27%	-35%

New Basin (Houston & Knight Road)

While available land for the implementation of new BMPs within the study area is limited, the corner of Houston & Knight Road was identified as a potential location for a new stormwater basin. This property is currently wooded and owned by the Wissahickon School District. Drainage from approximately 21 acres comprised of Houston Road and the WSD High School parking lot drain through this area before ultimately discharging to the creek just above the Knight Road culvert. By capturing and providing peak rate attenuation in this area the potential exists to provide the rate reductions as outlined in the table below:

NEW BASIN @ HOUSTON / KNIGHT (OPTION 3)

PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	182.2	234.9	308.2	365.3	444.9	546.2	779.6
Post-Development Flow (cfs)	151.6	191.1	244.1	284.2	338.8	437.5	638.0
Flow Reduction (%)	-17%	-19%	-21%	-22%	-24%	-20%	-18%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	245.0	321.7	431.5	518.5	643.3	798.7	1096.8
Post-Development Flow (cfs)	215.0	277.6	367.2	440.8	537.3	691.0	952.4
Flow Reduction (%)	-12%	-14%	-15%	-15%	-16%	-13%	-13%

Combined Flow Reduction (Houston/Knight Basin & Dam Enlargement)

The analysis was run to determine the maximum flow reduction that could be achieved in this part of the drainage basin by implementing both potential improvements:

NEW BASIN (HOUSTON / KNIGHT) + DAM ENGLARGEMENT/MODIFICATION

PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	182.2	234.9	308.2	365.3	444.9	546.2	779.6
Post-Development Flow (cfs)	61.7	90.4	137.2	173.1	238.1	287.9	357.5
Flow Reduction (%)	-66%	-62%	-55%	-53%	-46%	-47%	-54%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	245.0	321.7	431.5	518.5	643.3	798.7	1096.8
Post-Development Flow (cfs)	124.3	175.4	258.0	325.4	437.8	526.0	651.8
Flow Reduction (%)	-49%	-45%	-40%	-37%	-32%	-34%	-41%

2.3 HEC-RAS ANALYSIS

The Hydraulic Engineering Center – River Analysis System (HEC-RAS) was utilized to analyze the effects of recommended improvements on the floodplain elevation at various stream cross-sections throughout the study area. Included in the report are exhibits depicting the existing and proposed limits of the 2-year and 100-year floodplain based on the following combinations of recommended improvements:

Option A – Remove and/or Increase Capacity at 446 Marion Driveway Bridge

The 2-year flood depth is reduced by 9-23" at cross-sections 2172 and 2110, which are located immediately upstream of the subject driveway bridge. This depth of flow reduction correlates to a reduction in the overall width of the 2-year floodplain in this area and would serve to reduce the frequency of water overflowing the creek banks onto Brookside Avenue. 100-year flood depth reductions are approximately 2-3" because of the bridge removal; however, the overall width of the 100-year floodplain is only nominally affected by this improvement.

Option B – New Stormwater Basin @ Houston / Knight Road

The 2-year flood depth is reduced throughout the entire study area by depths in the range of 3-10" because of the reduced rates that can be achieved through the implementation of this project. Additionally, the 100-year floodplain is reduced throughout the study area by depths between 2-4". Again, the overall width of the 100-year floodplain is impacted only minimally from this improvement.

Option C – Enlarge Dam Impoundment & Modify Outlet Control Structure

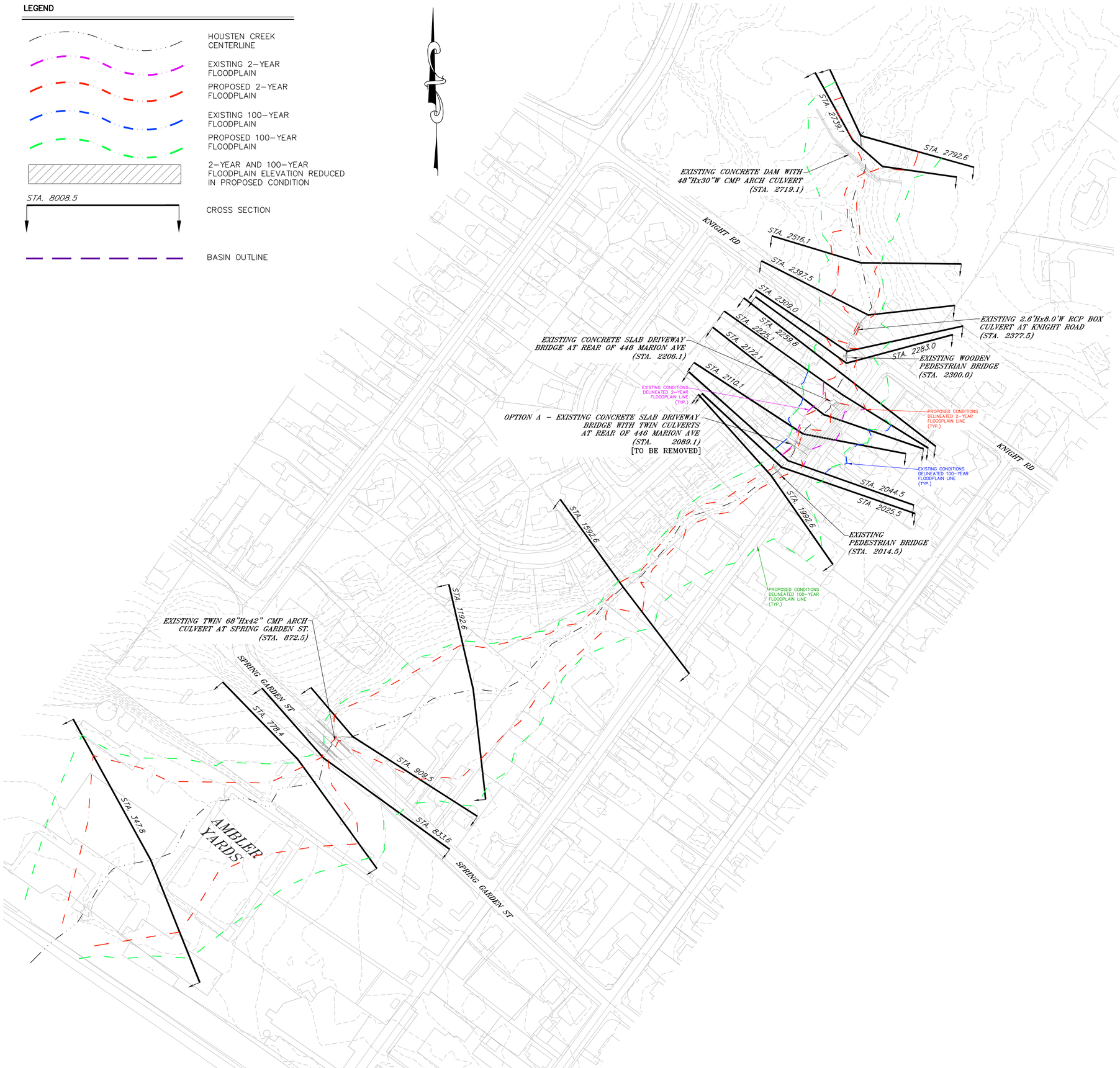
The 2-year flow depth is reduced in the range of 3-20" throughout the study area and the 100-year flow depth is reduced in the range of 3-10". While this improvement represents the most improvement in 100-year flow depth of Options A, B, and C, the width reduction of the 100-year floodplain does not serve to remove buildings from the limits of the calculated floodplain.

Option D – Combination of A, B & C.

The 2-year flow depth is reduced in the range of 3-34" throughout the study area and the 100-year flow depth is reduced in the range of 4-18". This iteration of the HEC-RAS analysis represents the greatest reduction in flow depth for the 2-year and 100-year storms. While the 100-year floodplain is not reduced to a point where dwellings would be removed from the floodplain limits, there are several areas along Brookside Avenue where the width of flow from the 100-year event is reduced by up to 35-feet.

Option E – Combination of A & B

The 2-year flow depth is reduced between 3-25" throughout the study area and the 100-year flow depth is reduced between 3-7". This iteration was run to show the potential improvement of Options A & B should they be implemented prior to the larger undertaking that is an expansion of the existing dam.



2-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS - OPTION A

Cross-Section	Existing Conditions 2-Yr W.S.E. (ft)	Proposed Conditions 2-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	258.85	258.85	0.00
2739.1	258.85	258.85	0.00
2516.1	245.88	245.88	0.00
2397.5	244.38	244.38	0.00
2309.0	242.12	242.12	0.00
2283.0	240.51	240.51	0.00
2259.8	240.07	240.07	0.00
2225.1	240.25	240.25	0.00
2172.1	238.56	237.81	-0.75
2110.1	237.66	235.77	-1.89
2044.5	235.04	235.04	0.00
2025.5	234.79	234.79	0.00
1992.6	233.77	233.77	0.00
1592.6	228.25	228.25	0.00
1192.6	220.04	220.04	0.00
909.5	217.75	217.75	0.00
833.6	215.09	215.09	0.00
778.4	214.65	214.65	0.00
347.8	205.56	205.56	0.00

100-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS - OPTION A

Cross-Section	Existing Conditions 100-Yr W.S.E. (ft)	Proposed Conditions 100-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	260.54	260.54	0.00
2739.1	260.54	260.54	0.00
2516.1	246.90	246.90	0.00
2397.5	245.51	245.51	0.00
2309.0	243.77	243.77	0.00
2283.0	242.37	242.37	0.00
2259.8	241.78	241.78	0.00
2225.1	242.15	242.15	0.00
2172.1	239.89	239.69	-0.20
2110.1	239.00	238.78	-0.22
2044.5	237.09	237.09	0.00
2025.5	237.21	237.21	0.00
1992.6	235.90	235.90	0.00
1592.6	229.63	229.63	0.00
1192.6	221.17	221.17	0.00
909.5	221.02	221.02	0.00
833.6	216.47	216.47	0.00
778.4	215.48	215.48	0.00
347.8	206.40	206.40	0.00

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

REV.	DESCRIPTION	DATE	BY

EXHIBIT

LOWER GWYNEDD TOWNSHIP - HOUSTEN CREEK FLOODPLAIN STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

OPTION A - REMOVE DRIVEWAY BRIDGE AT STA. 2089.1

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081
OWNERS INFO: --

MUNICIPAL FILE No.: --
TAX MAP PARCEL No.: --
TOTAL AREA: --
TOTAL LOTS: --
DATE: 03/17/23
SCALE: 1"=80'
DRAWN BY: BH
CHECKED BY: DPB
SHEET NO.: 1 OF 4

LEGEND

HOUSTEN CREEK CENTERLINE

EXISTING 2-YEAR FLOODPLAIN

PROPOSED 2-YEAR FLOODPLAIN

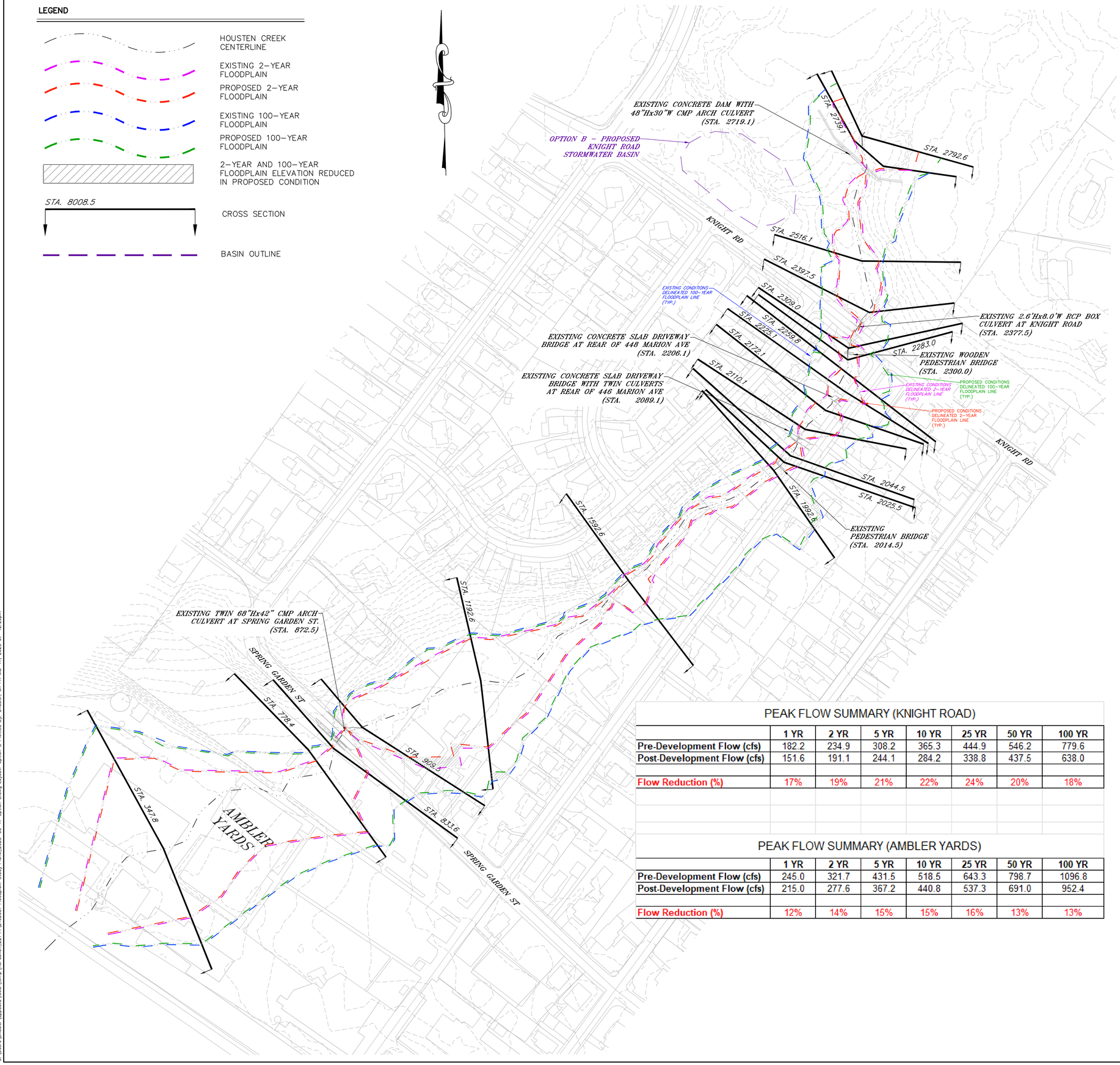
EXISTING 100-YEAR FLOODPLAIN

PROPOSED 100-YEAR FLOODPLAIN

2-YEAR AND 100-YEAR FLOODPLAIN ELEVATION REDUCED IN PROPOSED CONDITION

STA. 8008.5 — CROSS SECTION

BASIN OUTLINE



PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	182.2	234.9	308.2	365.3	444.9	546.2	779.6
Post-Development Flow (cfs)	151.6	191.1	244.1	284.2	338.8	437.5	638.0
Flow Reduction (%)	17%	19%	21%	22%	24%	20%	18%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	245.0	321.7	431.5	518.5	643.3	798.7	1096.8
Post-Development Flow (cfs)	215.0	277.6	367.2	440.8	537.3	691.0	952.4
Flow Reduction (%)	12%	14%	15%	15%	16%	13%	13%

2-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION B

Cross-Section	Existing Conditions 2-Yr W.S.E. (ft)	Proposed Conditions 2-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	258.85	258.85	0.00
2739.1	258.85	258.85	0.00
2516.1	245.88	245.78	-0.10
2397.5	244.38	243.86	-0.52
2309.0	242.12	241.70	-0.42
2283.0	240.51	240.33	-0.18
2259.8	240.07	239.77	-0.30
2225.1	240.25	239.92	-0.33
2172.1	238.56	238.41	-0.15
2110.1	237.66	237.54	-0.12
2044.5	235.04	234.77	-0.27
2025.5	234.79	234.55	-0.24
1992.6	233.77	233.60	-0.17
1592.6	228.25	228.08	-0.17
1192.6	220.04	219.93	-0.11
909.5	217.75	216.89	-0.86
833.6	215.09	214.98	-0.11
778.4	214.65	214.58	-0.07
347.8	205.56	205.49	-0.07

100-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION B

Cross-Section	Existing Conditions 100-Yr W.S.E. (ft)	Proposed Conditions 100-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	260.54	260.54	0.00
2739.1	260.54	260.54	0.00
2516.1	246.90	246.67	-0.23
2397.5	245.51	245.30	-0.21
2309.0	243.77	243.57	-0.20
2283.0	242.37	242.13	-0.24
2259.8	241.78	241.43	-0.35
2225.1	242.15	242.00	-0.15
2172.1	239.89	239.71	-0.18
2110.1	239.00	238.83	-0.17
2044.5	237.09	237.03	-0.06
2025.5	237.21	237.09	-0.12
1992.6	235.90	235.57	-0.33
1592.6	229.63	229.51	-0.12
1192.6	221.17	220.83	-0.34
909.5	221.02	220.75	-0.27
833.6	216.47	216.26	-0.21
778.4	215.48	215.35	-0.13
347.8	206.40	206.29	-0.11

80 0 80 160
SCALE IN FEET
1"=80'

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

REV.	DESCRIPTION	DATE	BY

EXHIBIT

LOWER GWYNEDD TOWNSHIP – HOUSTEN CREEK FLOODPLAIN STUDY

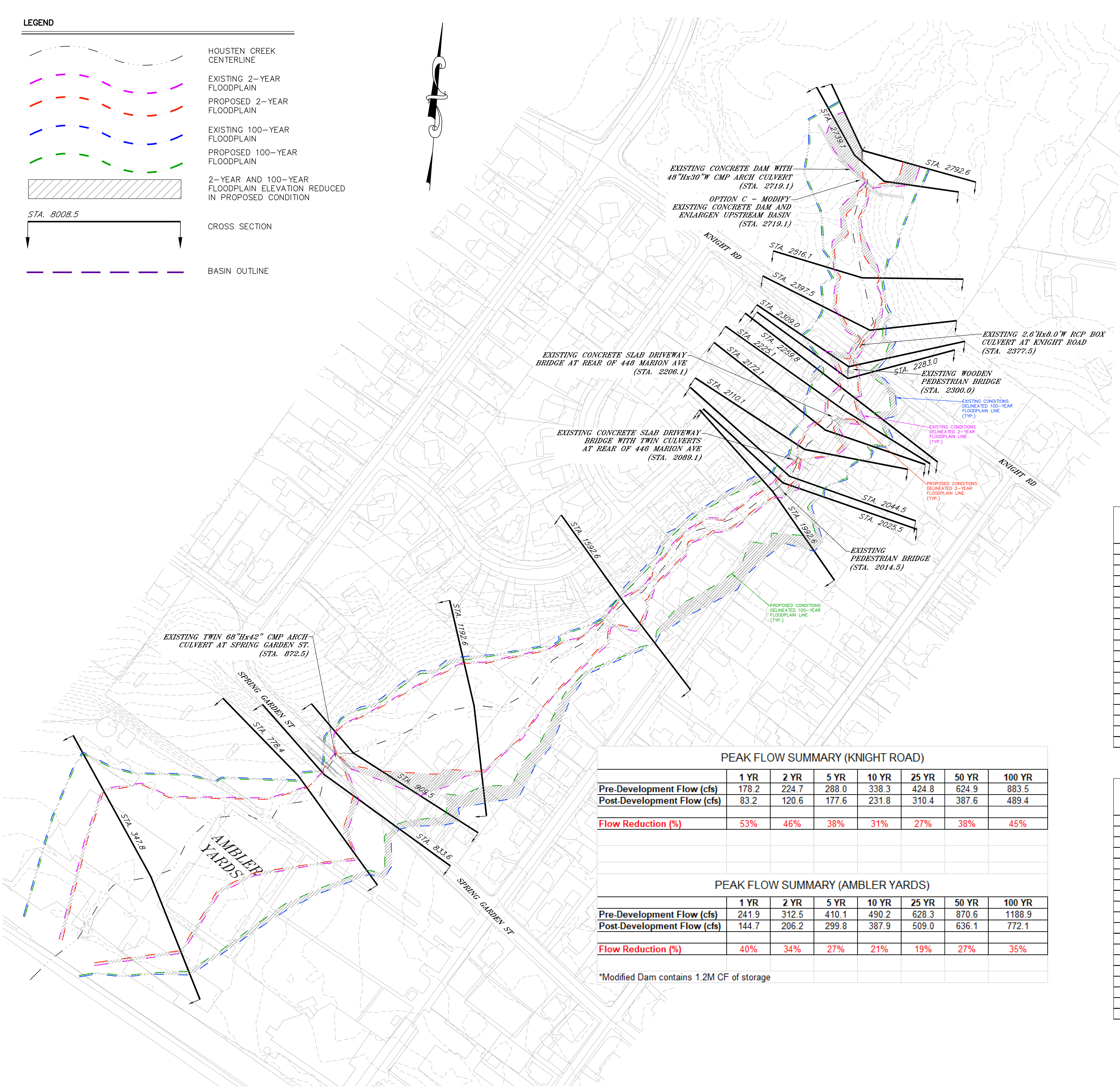
LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

OPTION B – HOUSTEN/KNIGHT ROAD BASIN

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081
OWNERS INFO: – –
MUNICIPAL FILE No.: – –
TAX MAP PARCEL No.: – –
TOTAL AREA: – –
TOTAL LOTS: – –
DATE: 03/17/23
SCALE: 1"=80'
DRAWN BY: BH
CHECKED BY: DPB
SHEET NO.: 2 OF 4

C:\Users\bhodler\appdata\local\temp\AcPublish_22744\2102081 Floodplain Study Plans_2023-03-17 Option B.dwg Layout: Option B Plotted By: bhodler, on Fri Mar 17, 2023 at 12:26pm



PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	178.2	224.7	288.0	338.3	424.8	624.9	883.5
Post-Development Flow (cfs)	83.2	120.6	177.6	231.8	310.4	387.6	489.4
Flow Reduction (%)	53%	46%	38%	31%	27%	38%	45%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	241.9	312.5	410.1	490.2	628.3	870.6	1188.9
Post-Development Flow (cfs)	144.7	206.2	299.8	387.9	509.0	636.1	772.1
Flow Reduction (%)	40%	34%	27%	21%	19%	27%	35%

*Modified Dam contains 1.2M CF of storage

2–YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION C

Cross-Section	Existing Conditions 2-Yr W.S.E. (ft)	Proposed Conditions 2-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	258.85	250.62	-8.23
2739.1	258.85	249.93	-8.92
2516.1	245.88	245.61	-0.27
2397.5	244.38	242.98	-1.40
2309.0	242.12	241.21	-0.91
2283.0	240.51	240.07	-0.44
2259.8	240.07	239.34	-0.73
2225.1	240.25	239.45	-0.80
2172.1	238.56	238.15	-0.41
2110.1	237.66	237.49	-0.17
2044.5	235.04	234.40	-0.64
2025.5	234.79	234.20	-0.59
1992.6	233.77	233.33	-0.44
1592.6	228.25	227.84	-0.41
1192.6	220.04	219.81	-0.23
909.5	217.75	216.02	-1.73
833.6	215.09	214.83	-0.26
778.4	214.65	214.49	-0.16
347.8	205.56	205.40	-0.16

100–YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION C

Cross-Section	Existing Conditions 100-Yr W.S.E. (ft)	Proposed Conditions 100-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	260.54	259.89	-0.65
2739.1	260.54	259.89	-0.65
2516.1	246.90	246.44	-0.46
2397.5	245.51	245.12	-0.39
2309.0	243.77	243.36	-0.41
2283.0	242.37	241.83	-0.54
2259.8	241.78	241.24	-0.54
2225.1	242.15	241.83	-0.32
2172.1	239.89	239.51	-0.38
2110.1	239.00	238.62	-0.38
2044.5	237.09	236.95	-0.14
2025.5	237.21	236.96	-0.25
1992.6	235.90	235.01	-0.89
1592.6	229.63	229.62	-0.01
1192.6	221.17	220.42	-0.75
909.5	221.02	220.42	-0.60
833.6	216.47	216.02	-0.45
778.4	215.48	215.21	-0.27
347.8	206.40	206.14	-0.26

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

REV. | DESCRIPTION | DATE | BY

EXHIBIT

LOWER GWYNEDD TOWNSHIP – HOUSTEN CREEK FLOODPLAIN STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

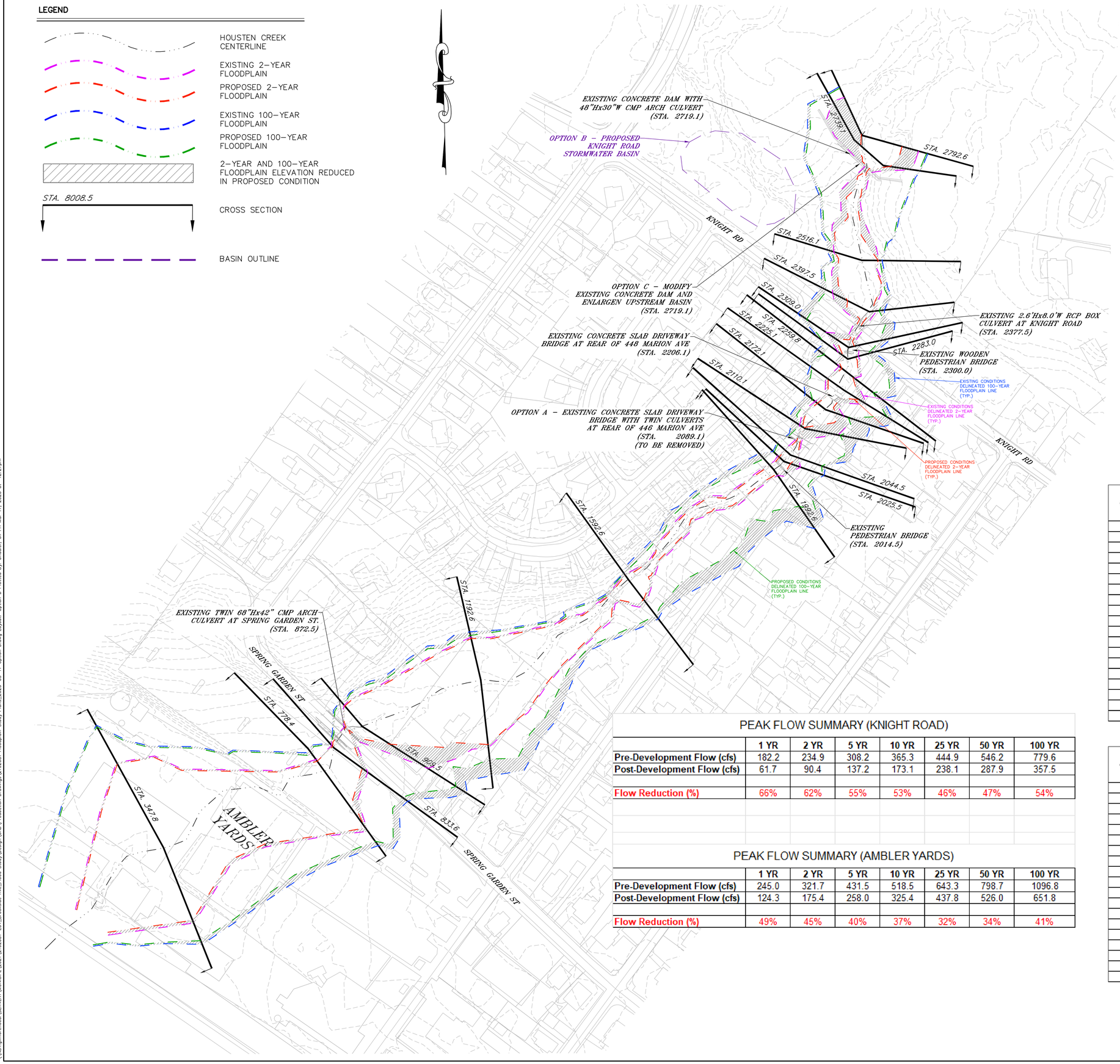
OPTION C – MODIFY EXISTING DAM/ENLARGE BASIN AT STA. 2719.1

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081
OWNERS INFO: --
MUNICIPAL FILE No.: --
TAX MAP PARCEL No.: --
TOTAL AREA: -- | TOTAL LOTS: --
DATE: 03/17/23 | SCALE: 1"=80'
DRAWN BY: BH | CHECKED BY: DPB

LEGEND

- HOUSTEN CREEK CENTERLINE
- EXISTING 2-YEAR FLOODPLAIN
- PROPOSED 2-YEAR FLOODPLAIN
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED 100-YEAR FLOODPLAIN
- 2-YEAR AND 100-YEAR FLOODPLAIN ELEVATION REDUCED IN PROPOSED CONDITION
- STA. 8008.5 — CROSS SECTION
- BASIN OUTLINE



PEAK FLOW SUMMARY (KNIGHT ROAD)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	182.2	234.9	308.2	365.3	444.9	546.2	779.6
Post-Development Flow (cfs)	61.7	90.4	137.2	173.1	238.1	287.9	357.5
Flow Reduction (%)	66%	62%	55%	53%	46%	47%	54%

PEAK FLOW SUMMARY (AMBLER YARDS)

	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
Pre-Development Flow (cfs)	245.0	321.7	431.5	518.5	643.3	798.7	1096.8
Post-Development Flow (cfs)	124.3	175.4	258.0	325.4	437.8	526.0	651.8
Flow Reduction (%)	49%	45%	40%	37%	32%	34%	41%

2-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION D

Cross-Section	Existing Conditions 2-Yr W.S.E. (ft)	Proposed Conditions 2-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	258.85	250.62	-8.23
2739.1	258.85	249.93	-8.92
2516.1	245.88	245.47	-0.41
2397.5	244.38	242.01	-2.37
2309.0	242.12	240.83	-1.29
2283.0	240.51	239.87	-0.64
2259.8	240.07	239.00	-1.07
2225.1	240.25	239.07	-1.18
2172.1	238.56	237.22	-1.34
2110.1	237.66	234.79	-2.87
2044.5	235.04	234.11	-0.93
2025.5	234.79	233.92	-0.87
1992.6	233.77	233.15	-0.62
1592.6	228.25	227.62	-0.63
1192.6	220.04	219.72	-0.32
909.5	217.75	215.48	-2.27
833.6	215.09	214.71	-0.38
778.4	214.65	214.42	-0.23
347.8	205.56	205.32	-0.24

100-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION D

Cross-Section	Existing Conditions 100-Yr W.S.E. (ft)	Proposed Conditions 100-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	260.54	259.89	-0.65
2739.1	260.54	259.89	-0.65
2516.1	246.90	246.16	-0.74
2397.5	245.51	244.85	-0.66
2309.0	243.77	243.14	-0.63
2283.0	242.37	241.51	-0.86
2259.8	241.78	241.27	-0.51
2225.1	242.15	241.64	-0.51
2172.1	239.89	238.79	-1.10
2110.1	239.00	237.50	-1.50
2044.5	237.09	236.69	-0.40
2025.5	237.21	236.64	-0.57
1992.6	235.90	234.68	-1.22
1592.6	229.63	229.28	-0.35
1192.6	221.17	220.31	-0.86
909.5	221.02	220.08	-0.94
833.6	216.47	215.77	-0.70
778.4	215.48	215.06	-0.42
347.8	206.40	205.98	-0.42

80 0 80 160
SCALE IN 1"=80' FEET

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

REV.	DESCRIPTION	DATE	BY

EXHIBIT

LOWER GWYNEDD TOWNSHIP – HOUSTEN CREEK FLOODPLAIN STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

OPTION D – OPTION A, B, & C COMBINED

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081
OWNERS INFO: --
MUNICIPAL FILE No.: --
TAX MAP PARCEL No.: --
TOTAL AREA: --
TOTAL LOTS: --
DATE: 03/17/23
SCALE: 1"=80'
DRAWN BY: BH
CHECKED BY: DPB
SHEET NO.: 4 OF 4

LEGEND

HOUSTEN CREEK CENTERLINE

EXISTING 2-YEAR FLOODPLAIN

PROPOSED 2-YEAR FLOODPLAIN

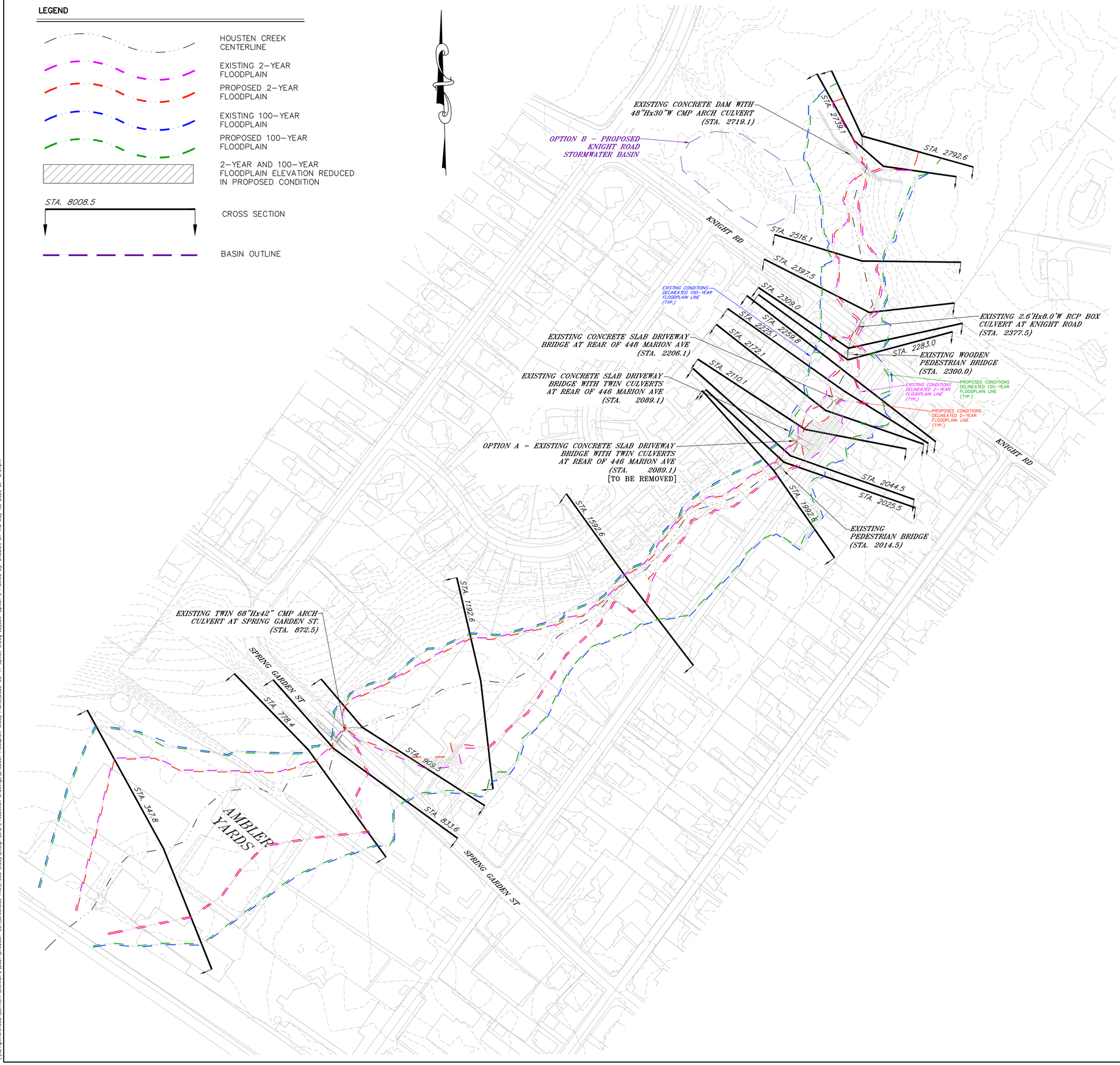
EXISTING 100-YEAR FLOODPLAIN

PROPOSED 100-YEAR FLOODPLAIN

2-YEAR AND 100-YEAR FLOODPLAIN ELEVATION REDUCED IN PROPOSED CONDITION

STA. 8008.5 — CROSS SECTION

BASIN OUTLINE



2-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION E

Cross-Section	Existing Conditions 2-Yr W.S.E. (ft)	Proposed Conditions 2-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	258.85	258.85	0.00
2739.1	258.85	258.85	0.00
2516.1	245.88	245.78	-0.10
2397.5	244.38	243.86	-0.52
2309.0	242.12	241.70	-0.42
2283.0	240.51	240.33	-0.18
2259.8	240.07	239.77	-0.30
2225.1	240.25	239.92	-0.33
2172.1	238.56	237.65	-0.91
2110.1	237.66	235.49	-2.17
2044.5	235.04	234.77	-0.27
2025.5	234.79	234.55	-0.24
1992.6	233.77	233.60	-0.17
1592.6	228.25	228.08	-0.17
1192.6	220.04	219.93	-0.11
909.5	217.75	216.89	-0.86
833.6	215.09	214.98	-0.11
778.4	214.65	214.58	-0.07
347.8	205.56	205.49	-0.07

100-YEAR FLOODPLAIN WATER SURFACE ELEVATIONS – OPTION E

Cross-Section	Existing Conditions 100-Yr W.S.E. (ft)	Proposed Conditions 100-Yr W.S.E. (ft)	Elevation Change from Existing to Proposed Conditions (ft)
2792.6	260.54	260.54	0.00
2739.1	260.54	260.54	0.00
2516.1	246.90	246.67	-0.23
2397.5	245.51	245.30	-0.21
2309.0	243.77	243.57	-0.20
2283.0	242.37	242.13	-0.24
2259.8	241.78	241.43	-0.35
2225.1	242.15	242.00	-0.15
2172.1	239.89	239.44	-0.45
2110.1	239.00	238.37	-0.63
2044.5	237.09	237.03	-0.06
2025.5	237.21	237.09	-0.12
1992.6	235.90	235.57	-0.33
1592.6	229.63	229.51	-0.12
1192.6	221.17	220.83	-0.34
909.5	221.02	220.75	-0.27
833.6	216.47	216.26	-0.21
778.4	215.48	215.35	-0.13
347.8	206.40	206.29	-0.11

80 0 80 160
SCALE IN 1"=80' FEET

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

REV.	DESCRIPTION	DATE	BY

EXHIBIT

LOWER GWYNEDD TOWNSHIP – HOUSTEN CREEK FLOODPLAIN STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

OPTION E – OPTION A & B COMBINED

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081

OWNERS INFO: --

MUNICIPAL FILE No.: --

TAX MAP PARCEL No.: --

TOTAL AREA: --

TOTAL LOTS: --

DATE: 03/17/23

SCALE: 1"=80'

DRAWN BY: BH

CHECKED BY: DPB

SHEET NO.: 5 OF 5

2.4 LOCALIZED NEIGHBORHOOD FLOODING

In June 2022 the Township Engineer toured the neighborhood of Brookside Avenue, Francis Avenue, and Knight Road to talk with residents about the stormwater issues they have been experiencing to gain a deeper understanding of the drainage area. From those site meetings came the understanding that the stormwater issues are not solely related to flooding in the creek, but additional problems exist throughout the area primarily related to inadequate or undersized existing stormwater infrastructure.

In response to information from residents along Brookside Avenue and Francis Avenue confirming stormwater overtopping curbs in heavy rain events, the Township commissioned Sewer Specialty Services to conduct TV inspection and cleaning of the storm pipes within this area to evaluate the condition as well as determine if any blockages existed that could be contributing the experienced drainage issues. The results of the inspections were that the pipes are in good condition and no blockages were observed.

From site observations and desktop evaluation of the available LiDAR contours, it appears that stormwater is flowing down Francis Avenue from Knight Road where the general topography of the area suggested that historically the gutter flow had continued down Knight towards the Creek. In recent years there have been a few watermain breaks that resulted in the need to excavate and repave portions of the roads in this neighborhood. One of those such breaks was at the intersection of Knight Road and Francis Avenue. It is possible that when the intersection was repaved after the water main was repaired, the crown & gutter line were affected enough to direct stormwater down Francis rather than continuing along Knight as would have been the case historically. A recommendation of the study will be to gather detailed survey information of that intersection to determine if regrading can help alleviate some of the stormwater problems experienced by residents on Francis Avenue and the rear yards of residents on Brookside Avenue. An additional recommendation is to evaluate the potential for additional stormwater infrastructure (inlets, pipes, curbs) within the neighborhood to reduce the frequency and severity of road gutter and yard flooding.

3.0 RECOMMENDATIONS

The below list of recommendations is a summary of the items that were identified as improvements through the various analyses completed in the study. The "Priority Level" is intended to assist the Township is determining how to utilize funds as they become available. Engineer's Opinion of Probable Cost for improvements can be found in Appendix D.

- Explore potential for replacement of private driveway bridge (serves 446 Marion) to increase flow capacity. This is a private driveway on private property. Installation of box culvert in place of the existing structure would significantly increase capacity at this location. (Priority Level 1)

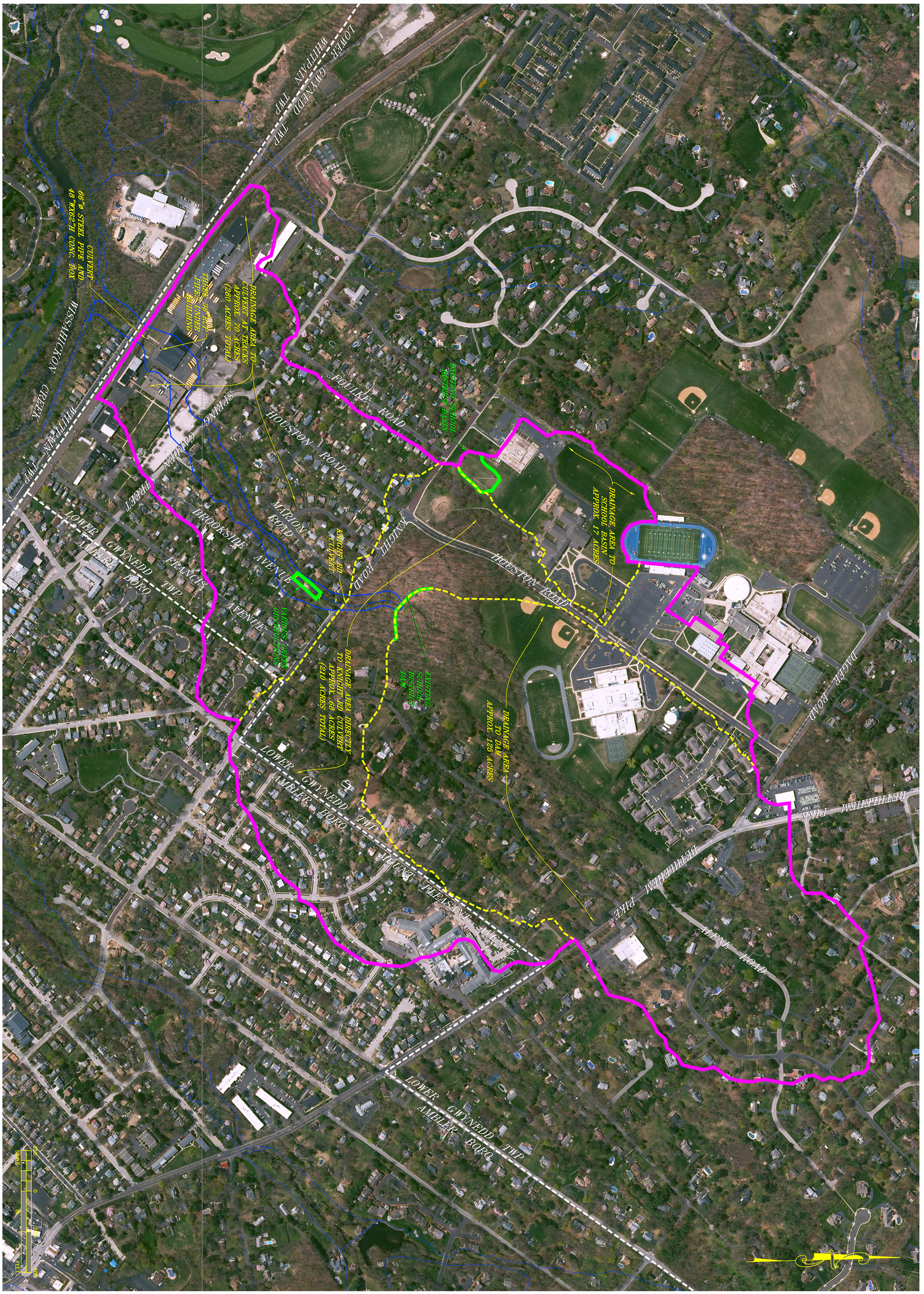
- Explore roadway drainage improvements (inlets, pipes, re-grading intersections, etc.) within areas of Knight, Francis, Brookside to alleviate street / yard flooding. Evaluate and potentially re-contour Knight/Francis Intersection. (Priority Level 1)

- Explore partnership with Wissahickon School District for construction of new basin at corner of Houston & Knight Road and retrofit of existing basin near admin building. These improvements have rate / volume reduction and water quality potential making them eligible for many grants. (Priority Level 2)

- Explore partnership with Wissahickon School District for expansion of existing dam or development of additional stormwater detention, volume reduction, or water quality BMPs elsewhere on WSD campus. (Priority Level 3)

- Engage PennDOT regarding ongoing maintenance of Spring Garden Street culvert (Priority Level 3)

APPENDIX A – AERIAL MAP & FEMA FLOOD MAP



EXHIBIT

BROOKSIDE AVE. FLOOD STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

BROOKSIDE AVE. FLOOD STUDY PLAN – EXISTING

REV.	DESCRIPTION	DATE	BY

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
CORPORATE HEADQUARTERS
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

NOT APPROVED FOR CONSTRUCTION

SHEET NO.: 1 OF 2

DRAWN BY: JAH
CHECKED BY: JAH

DATE: 11/22/2022
SCALE: 1"=250'

TOTAL AREA: 205 AC.±
TOTAL LOTS: TBD

MUNICIPAL FILE No.: N/A

TAX MAP PARCEL No.: MULTIPLE

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021-02081

OWNERS INFO: LOWER GWYNEDD TOWNSHIP
1130 N. BETHLEHEM PIKE
SPRING HOUSE, PA 19477
(215) 646-5302

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

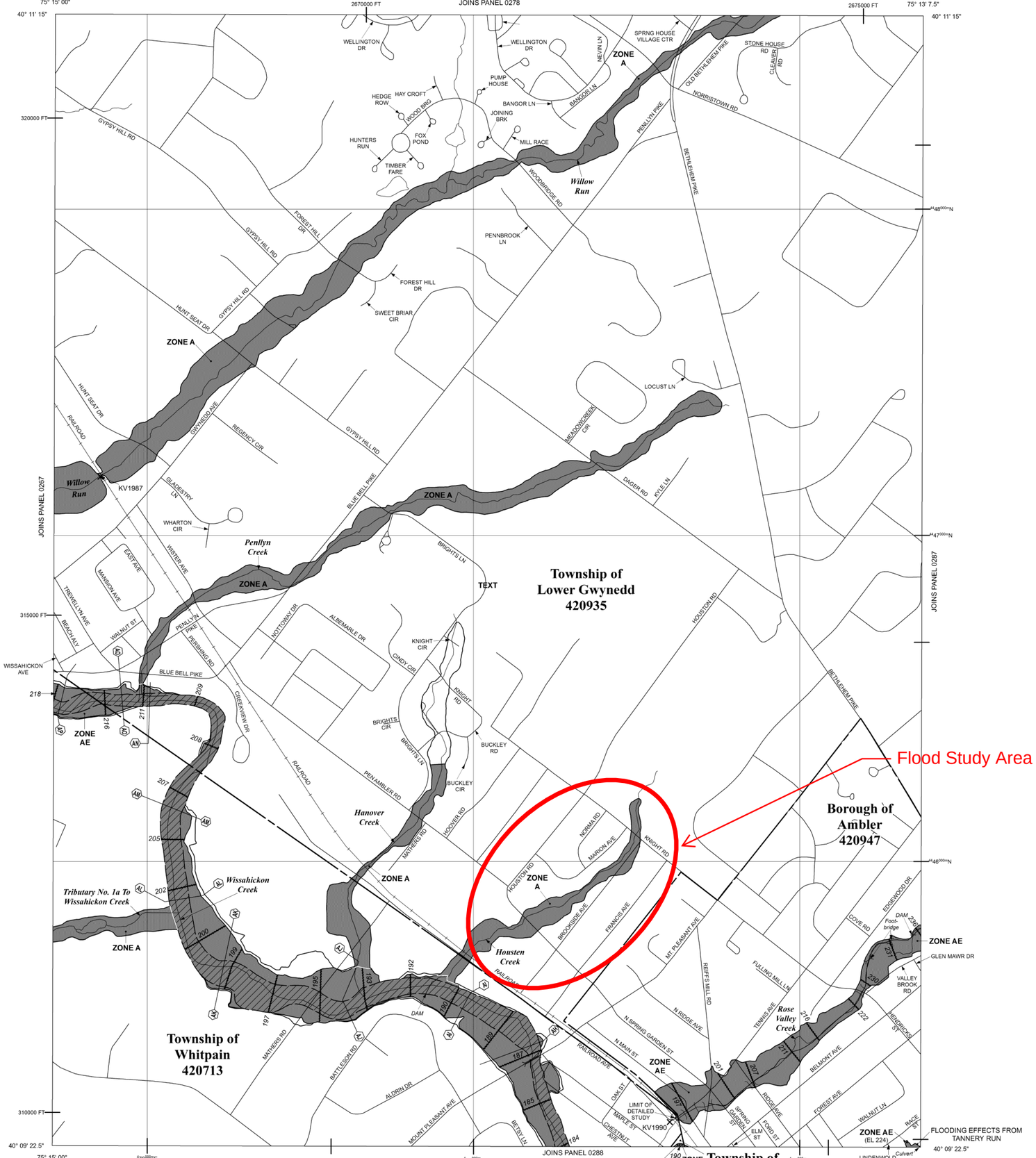
If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

BASE MAP SOURCE: Road centerlines were obtained in digital spatial data format from the Delaware Valley Regional Planning Commission. County and township/borough boundaries were downloaded from the Pennsylvania Spatial Data Access website. 2002 and 2005 digital orthophotographs were provided by the Delaware Valley Regional Planning Commission. Streamlines were digitized based on the orthophotos. Adjustments were made to specific base map features to align them to 1"=200' scale orthophotos.



The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAS)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

	Bridge
	Culvert
A A	Cross section line
23 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276 000 M	1000-meter Universal Transverse Mercator grid values, zone 18
600000 FT	5000-foot grid ticks: Pennsylvania State Plane (South) coordinate system (FIPSZONE 3702), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

DECEMBER 19, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
MARCH 2, 1998 APRIL 21, 1999 AUGUST 9, 1999 OCTOBER 19, 2001
MARCH 2, 2016 - to add, change and delete Special Flood Hazard Areas; to reflect updated topographic information; to change, add Base Flood Elevations; and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0286G

FIRM
FLOOD INSURANCE RATE MAP

MONTGOMERY COUNTY, PENNSYLVANIA
(ALL JURISDICTIONS)

PANEL 286 OF 451
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

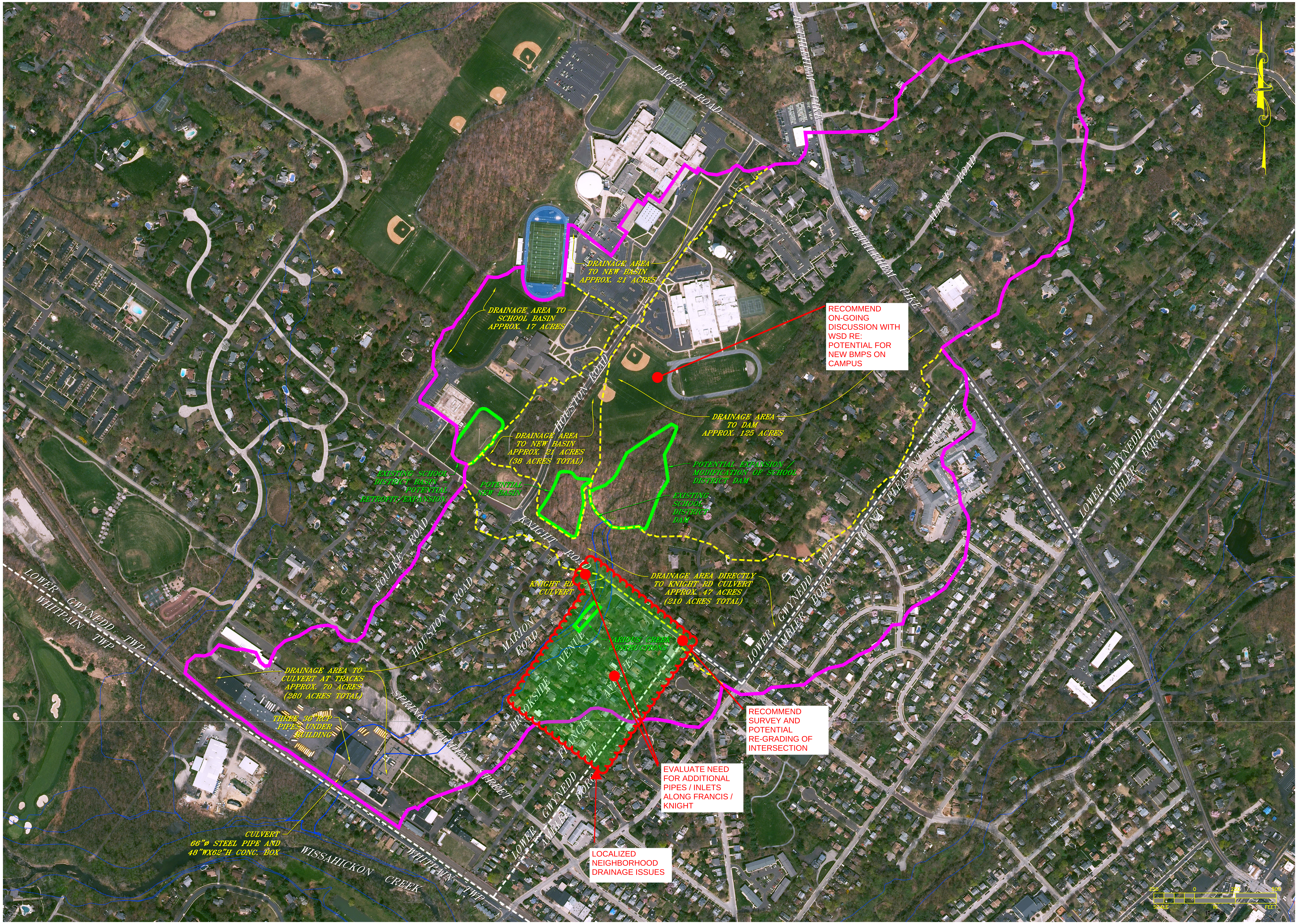
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AMBLER, BOR OF	420947	0286	G
LOWER GWYNEDD, TWP OF	420953	0286	G
UPPER DUBLIN, TWP OF	420708	0286	G
WHITPAIN, TWP OF	420713	0286	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
42091C0286G
MAP REVISED

APPENDIX B – PROPOSED IMPROVEMENT AERIAL MAP


RECOMMEND ON-GOING DISCUSSION WITH WSD RE: POTENTIAL FOR NEW BMPS ON CAMPUS
DRAINAGE AREA TO NEW BASIN APPROX. 21 ACRES
DRAINAGE AREA TO SCHOOL BASIN APPROX. 17 ACRES
DRAINAGE AREA TO NEW BASIN APPROX. 21 ACRES (38 ACRES TOTAL)
DRAINAGE AREA TO DAM APPROX. 125 ACRES
EXISTING SCHOOL DISTRICT BASIN POTENTIAL RETROFIT/EXPANSION
POTENTIAL NEW BASIN
POTENTIAL EXPANSION / MODIFICATION OF SCHOOL DISTRICT DAM
EXISTING SCHOOL DISTRICT DAM
DRAINAGE AREA DIRECTLY TO KNIGHT RD CULVERT APPROX. 47 ACRES (210 ACRES TOTAL)
KNIGHT RD CULVERT
DRAINAGE AREA TO CULVERT AT TRACKS APPROX. 70 ACRES (280 ACRES TOTAL)
THREE 36" RCP PIPES UNDER BUILDING
CULVERT 66"⌀ STEEL PIPE AND 48"WX62"H CONC. BOX
RECOMMEND SURVEY AND POTENTIAL RE-GRADING OF INTERSECTION
EVALUATE NEED FOR ADDITIONAL PIPES / INLETS ALONG FRANCIS / KNIGHT
LOCALIZED NEIGHBORHOOD DRAINAGE ISSUES
DAGER ROAD
HOUSTON ROAD
KNIGHT ROAD
FOULKE ROAD
MARION ROAD
BROOKSIDE AVENUE
SPRING GARDEN STREET
BETHLEHEM PIKE
LOWER GWYNEDD TWP
WHITPAIN TWP
AMBLER BORO
WISSAHICKON CREEK

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
CORPORATE HEADQUARTERS
65 EAST BUTLER AVENUE, SUITE 100, NEW BRITAIN, PA 18901 • (215) 345-4330 • www.gilmore-assoc.com

NOT APPROVED FOR CONSTRUCTION

REV.	DESCRIPTION	DATE	BY

EXHIBIT

BROOKSIDE AVE. FLOOD STUDY

LOWER GWYNEDD TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

BROOKSIDE AVE. FLOOD STUDY PLAN – PROPOSED

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

PROJECT No.: 2021–02081

OWNERS INFO:
LOWER GWYNEDD TOWNSHIP
1130 N. BETHLEHEM PIKE
SPRING HOUSE, PA 19477
(215) 646–5302

MUNICIPAL FILE No.: N/A

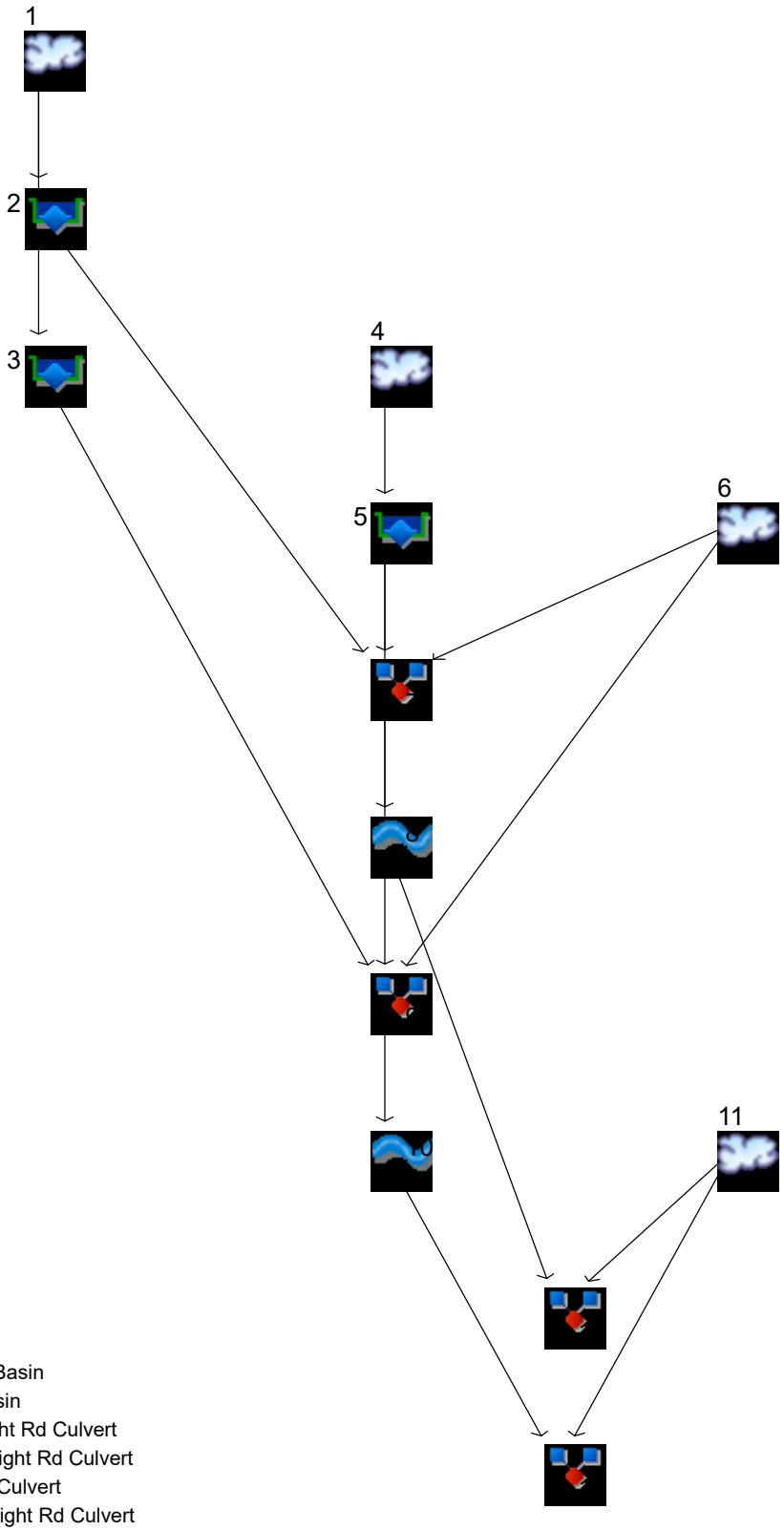
TAX MAP PARCEL No.: MULTIPLE

TOTAL AREA: 205 AC.	TOTAL LOTS: TBD
DATE: 11/22/2022	SCALE: 1"=250'
DRAWN BY: BMS	CHECKED BY: JJH

SHEET NO.: 2 OF 2

APPENDIX C – RUNOFF CALCULATIONS & HYDROGRAPHS

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA to Dam
2	Reservoir	EX Dam
3	Reservoir	PR Dam
4	SCS Runoff	DA to School Basin
5	Reservoir	EX School Basin
6	SCS Runoff	EX DA to Knight Rd Culvert
7	Combine	Total EX to Knight Rd Culvert
8	Reach	EX Knight Rd Culvert
9	Combine	Total PR to Knight Rd Culvert
10	Reach	PR Knight Rd Culvert
11	SCS Runoff	DA to Culvert at Tracks
12	Combine	Total EX to Culvert at Tracks
13	Combine	Total PR to Culvert at Tracks

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	125.75	180.90	-------	269.70	348.18	462.79	561.52	668.28	DA to Dam
2	Reservoir	1	101.31	122.45	-------	143.57	155.32	188.75	303.95	452.95	EX Dam
3	Reservoir	1	18.03	28.27	-------	43.57	62.56	85.01	143.09	173.73	PR Dam
4	SCS Runoff	-------	16.46	23.17	-------	33.84	43.17	56.70	68.29	80.79	DA to School Basin
5	Reservoir	4	8.431	11.97	-------	18.44	24.40	33.06	46.22	62.91	EX School Basin
6	SCS Runoff	-------	82.53	114.92	-------	165.88	210.08	273.90	328.43	387.07	EX DA to Knight Rd Culvert
7	Combine	2, 5, 6	182.16	234.98	-------	308.22	365.25	444.90	546.15	779.64	Total EX to Knight Rd Culvert
8	Reach	7	185.01	238.11	-------	311.00	368.57	445.40	556.53	803.93	EX Knight Rd Culvert
9	Combine	3, 5, 6,	92.47	134.25	-------	201.22	254.17	344.24	415.63	504.36	Total PR to Knight Rd Culvert
10	Reach	9	92.80	135.04	-------	201.72	254.20	344.56	416.20	509.12	PR Knight Rd Culvert
11	SCS Runoff	-------	64.98	89.60	-------	128.23	161.67	209.86	250.96	295.14	DA to Culvert at Tracks
12	Combine	8, 11	244.99	321.68	-------	431.54	518.45	643.34	798.74	1096.75	Total EX to Culvert at Tracks
13	Combine	10, 11,	153.62	219.02	-------	322.26	406.73	542.85	653.57	799.96	Total PR to Culvert at Tracks

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	125.75	2	728	451,492	----	------	------	DA to Dam
2	Reservoir	101.31	2	734	451,435	1	252.64	25,632	EX Dam
3	Reservoir	18.03	2	770	421,572	1	253.04	199,938	PR Dam
4	SCS Runoff	16.46	2	732	67,620	----	------	------	DA to School Basin
5	Reservoir	8.431	2	750	67,612	4	272.07	20,387	EX School Basin
6	SCS Runoff	82.53	2	728	290,476	----	------	------	EX DA to Knight Rd Culvert
7	Combine	182.16	2	728	809,523	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	185.01	2	730	809,488	7	------	------	EX Knight Rd Culvert
9	Combine	92.47	2	728	779,659	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	92.80	2	730	779,530	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	64.98	2	736	299,359	----	------	------	DA to Culvert at Tracks
12	Combine	244.99	2	730	1,108,848	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	153.62	2	732	1,078,890	10, 11,	------	------	Total PR to Culvert at Tracks

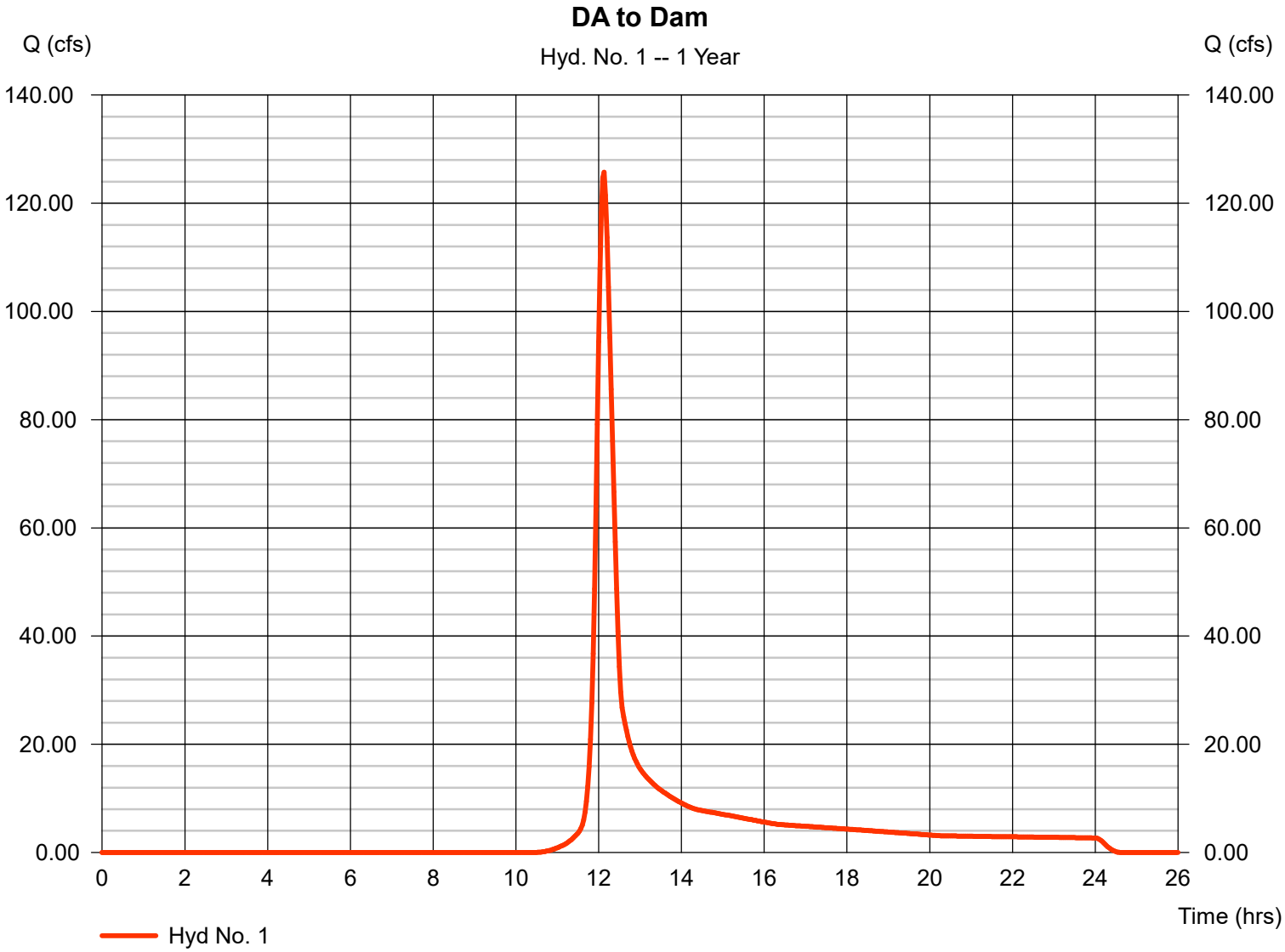
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	125.75 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	451,492 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

DA to Dam

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	160.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.25		0.00		0.00		
Land slope (%)	=	5.00		0.00		0.00		
Travel Time (min)	**=**	**9.81**	**+**	**0.00**	**+**	**0.00**	**=**	**9.81**
Shallow Concentrated Flow								
Flow length (ft)	=	150.00		675.00		0.00		
Watercourse slope (%)	=	4.70		3.30		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	3.50		3.69		0.00		
Travel Time (min)	**=**	**0.71**	**+**	**3.05**	**+**	**0.00**	**=**	**3.76**
Channel Flow								
X sectional flow area (sqft)	=	3.14		30.00		0.00		
Wetted perimeter (ft)	=	6.28		22.60		0.00		
Channel slope (%)	=	2.00		2.00		0.00		
Manning's n-value	=	0.015		0.050		0.015		
Velocity (ft/s)	=	8.83		5.10		0.00		
Flow length (ft)	=	650.0		2470.0		0.0		
Travel Time (min)	**=**	**1.23**	**+**	**8.08**	**+**	**0.00**	**=**	**9.31**

Total Travel Time, Tc ..... 22.90 min

Hydrograph Report

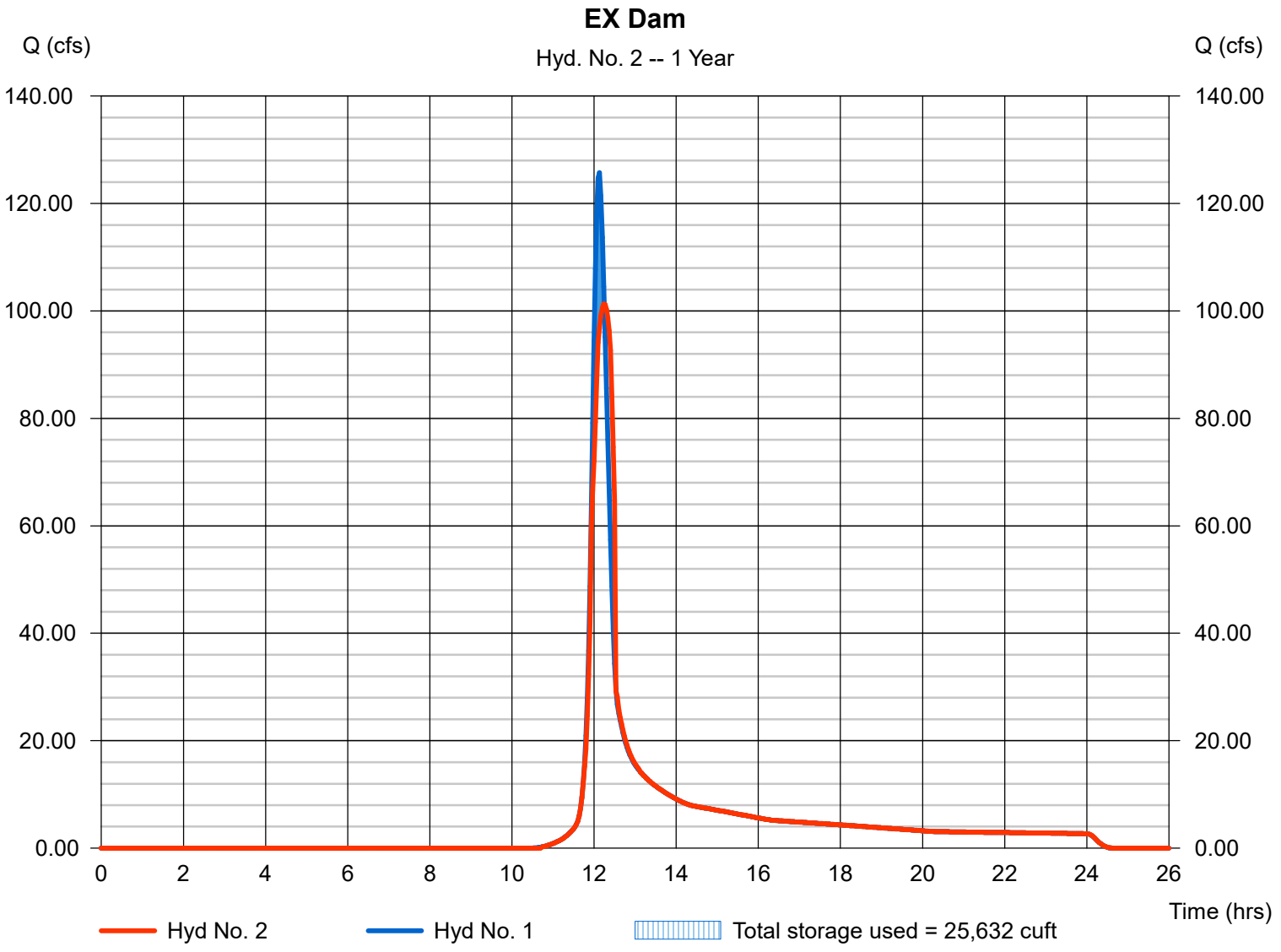
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	101.31 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	451,435 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	252.64 ft
Reservoir name	=	EX Dam	Max. Storage	=	25,632 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Pond No. 1 - EX Dam

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 246.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	246.00	01	0	0
2.00	248.00	143	144	144
4.00	250.00	2,390	2,533	2,677
6.00	252.00	10,496	12,886	15,563
8.00	254.00	21,604	32,100	47,663
10.00	256.00	32,612	54,216	101,879
12.00	258.00	60,893	93,505	195,384
14.00	260.00	104,424	165,317	360,701
16.00	262.00	155,295	259,719	620,420

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 246.95	0.00	0.00	0.00
Length (ft)	= 9.00	0.00	0.00	0.00
Slope (%)	= 5.20	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 72.00	175.00	0.00	0.00
Crest El. (ft)	= 260.00	261.00	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	3.33
Weir Type	= Broad	Broad	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	246.00	0.00	---	---	---	0.00	0.00	---	---	---	---	0.000
2.00	144	248.00	14.65 ic	---	---	---	0.00	0.00	---	---	---	---	14.65
4.00	2,677	250.00	64.60 ic	---	---	---	0.00	0.00	---	---	---	---	64.60
6.00	15,563	252.00	93.86 ic	---	---	---	0.00	0.00	---	---	---	---	93.86
8.00	47,663	254.00	115.96 ic	---	---	---	0.00	0.00	---	---	---	---	115.96
10.00	101,879	256.00	134.48 ic	---	---	---	0.00	0.00	---	---	---	---	134.48
12.00	195,384	258.00	150.73 ic	---	---	---	0.00	0.00	---	---	---	---	150.73
14.00	360,701	260.00	165.40 ic	---	---	---	0.00	0.00	---	---	---	---	165.40
16.00	620,420	262.00	178.87 ic	---	---	---	529.48	455.00	---	---	---	---	1163.35

Hydrograph Report

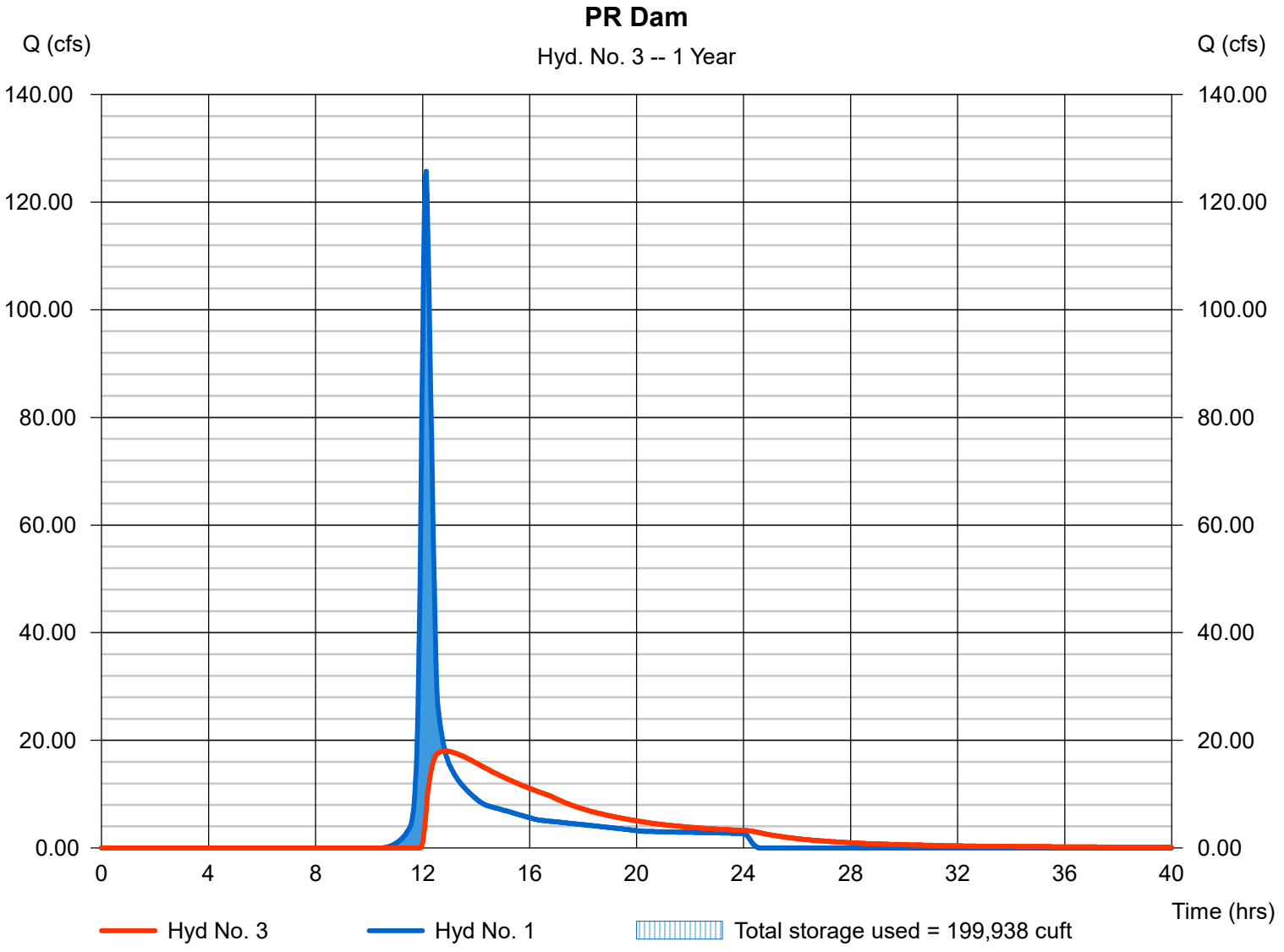
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	18.03 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.83 hrs
Time interval	=	2 min	Hyd. volume	=	421,572 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	253.04 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	199,938 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Pond No. 2 - PR Dam - OCS and Grading

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 246.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	246.00	01	0	0
2.00	248.00	259	260	260
4.00	250.00	29,372	29,631	29,891
6.00	252.00	61,915	91,287	121,178
8.00	254.00	89,847	151,762	272,940
10.00	256.00	119,368	209,215	482,155
12.00	258.00	143,508	262,876	745,031
14.00	260.00	161,138	304,647	1,049,677
16.00	262.00	176,750	337,888	1,387,565

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	48.00	12.00	0.00
Span (in)	= 48.00	12.00	48.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 246.95	250.00	255.00	0.00
Length (ft)	= 9.00	0.00	0.00	0.00
Slope (%)	= 5.20	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 24.00	72.00	175.00	0.00
Crest El. (ft)	= 258.00	260.00	261.00	0.00
Weir Coeff.	= 3.33	2.60	2.60	3.33
Weir Type	= Rect	Broad	Broad	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	246.00	0.00	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.000
2.00	260	248.00	0.00	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.000
4.00	29,891	250.00	0.00	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.000
6.00	121,178	252.00	9.63 ic	9.63 ic	0.00	---	0.00	0.00	0.00	---	---	---	9.630
8.00	272,940	254.00	27.24 ic	27.24 ic	0.00	---	0.00	0.00	0.00	---	---	---	27.24
10.00	482,155	256.00	52.14 oc	38.52 ic	13.62 ic	---	0.00	0.00	0.00	---	---	---	52.14
12.00	745,031	258.00	77.63 ic	47.18 ic	30.45 ic	---	0.00	0.00	0.00	---	---	---	77.63
14.00	1,049,677	260.00	162.62 ic	12.08 ic	12.08 ic	---	138.46 s	0.00	0.00	---	---	---	162.62
16.00	1,387,565	262.00	178.33 ic	5.53 ic	5.53 ic	---	167.22 s	529.48	455.00	---	---	---	1162.76

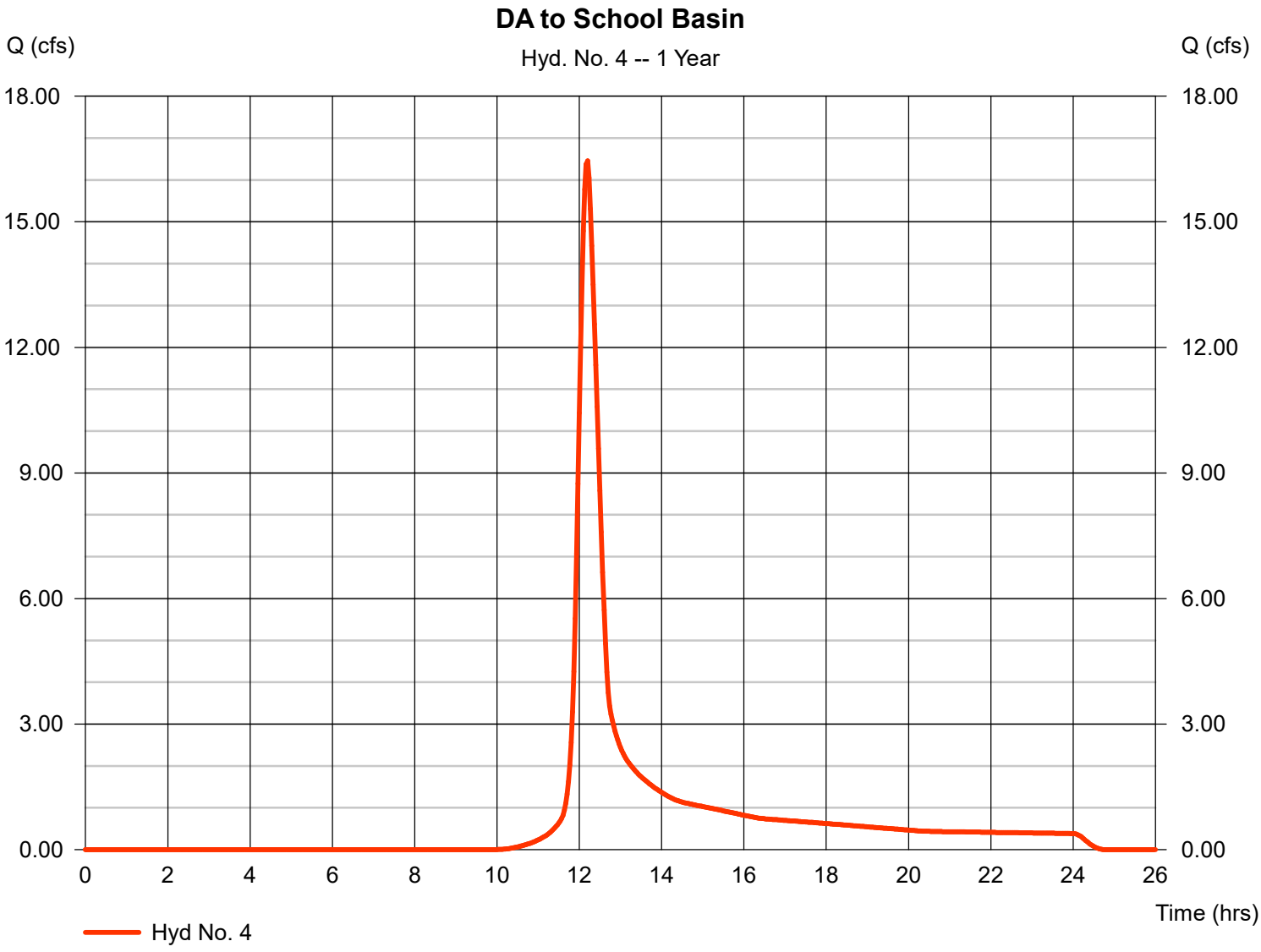
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.46 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	67,620 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 4

DA to School Basin

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	300.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.25		0.00		0.00		
Land slope (%)	=	2.00		0.00		0.00		
Travel Time (min)	**=**	**23.41**	**+**	**0.00**	**+**	**0.00**	**=**	**23.41**
Shallow Concentrated Flow								
Flow length (ft)	=	265.00		60.00		160.00		
Watercourse slope (%)	=	2.30		16.70		1.90		
Surface description	=	Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=	2.45		6.59		2.80		
Travel Time (min)	**=**	**1.80**	**+**	**0.15**	**+**	**0.95**	**=**	**2.91**
Channel Flow								
X sectional flow area (sqft)	=	0.20		1.23		0.00		
Wetted perimeter (ft)	=	1.57		3.93		0.00		
Channel slope (%)	=	1.00		2.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	2.50		6.45		0.00		
Flow length (ft)	=	285.0		115.0		0.0		
Travel Time (min)	**=**	**1.90**	**+**	**0.30**	**+**	**0.00**	**=**	**2.20**

Total Travel Time, Tc ..... 28.50 min

Hydrograph Report

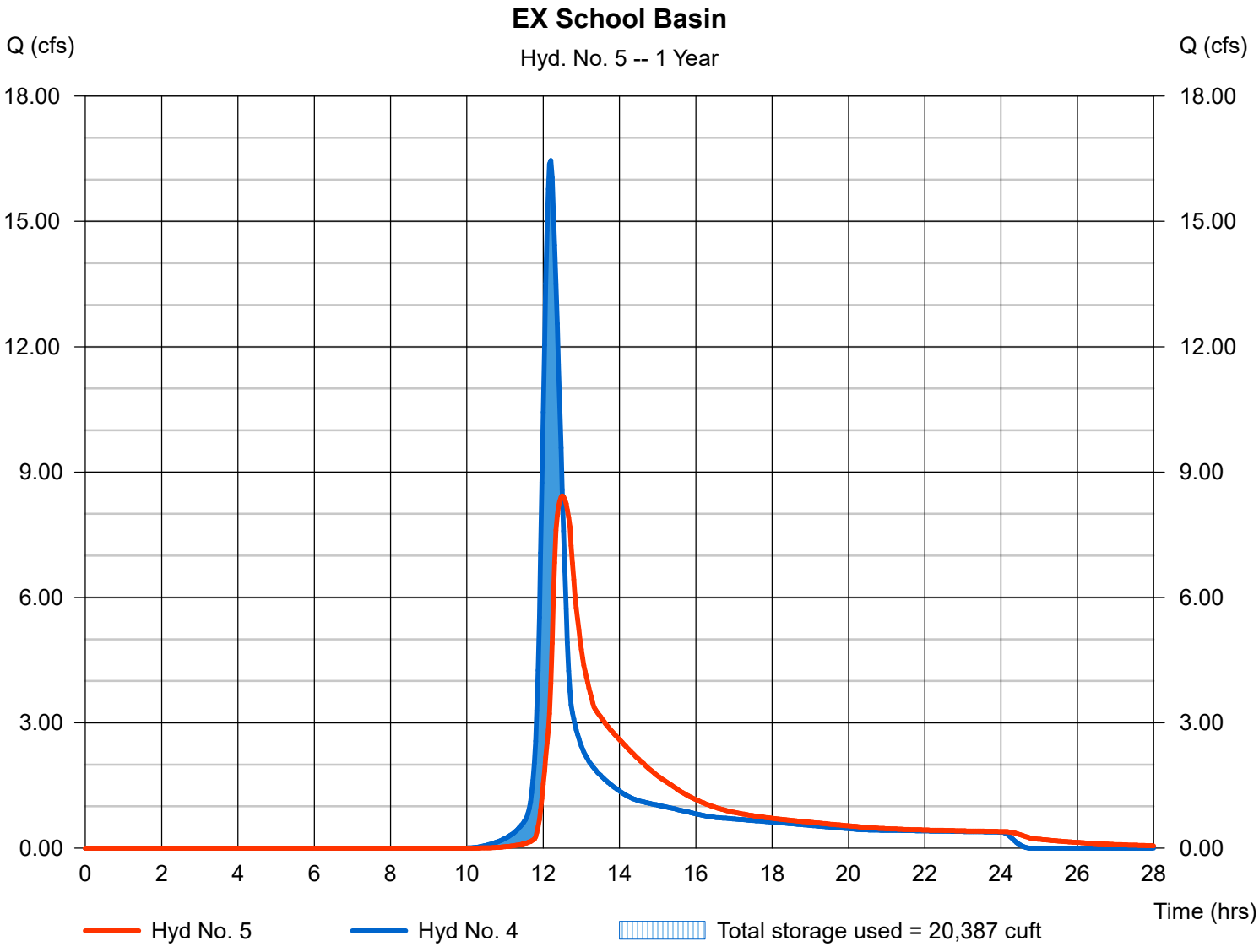
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	8.431 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	67,612 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	272.07 ft
Reservoir name	=	EX School Basin	Max. Storage	=	20,387 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - EX School Basin

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 270.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	270.00	441	0	0
2.00	272.00	18,356	18,797	18,797
4.00	274.00	28,936	47,292	66,089
5.00	275.00	37,052	32,994	99,083

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	6.00	24.00	0.00
Span (in)	= 36.00	6.00	26.00	0.00
No. Barrels	= 1	4	1	0
Invert El. (ft)	= 270.00	270.00	271.33	0.00
Length (ft)	= 330.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	25.00	0.00	0.00
Crest El. (ft)	= 273.75	274.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	270.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	18,797	272.00	7.75 ic	3.70 ic	4.05 ic	---	0.00	0.00	---	---	---	---	7.748
4.00	66,089	274.00	35.83 ic	4.48 ic	24.69 ic	---	6.66	0.00	---	---	---	---	35.83
5.00	99,083	275.00	53.53 oc	1.70 ic	9.38 ic	---	42.45 s	83.25	---	---	---	---	136.77

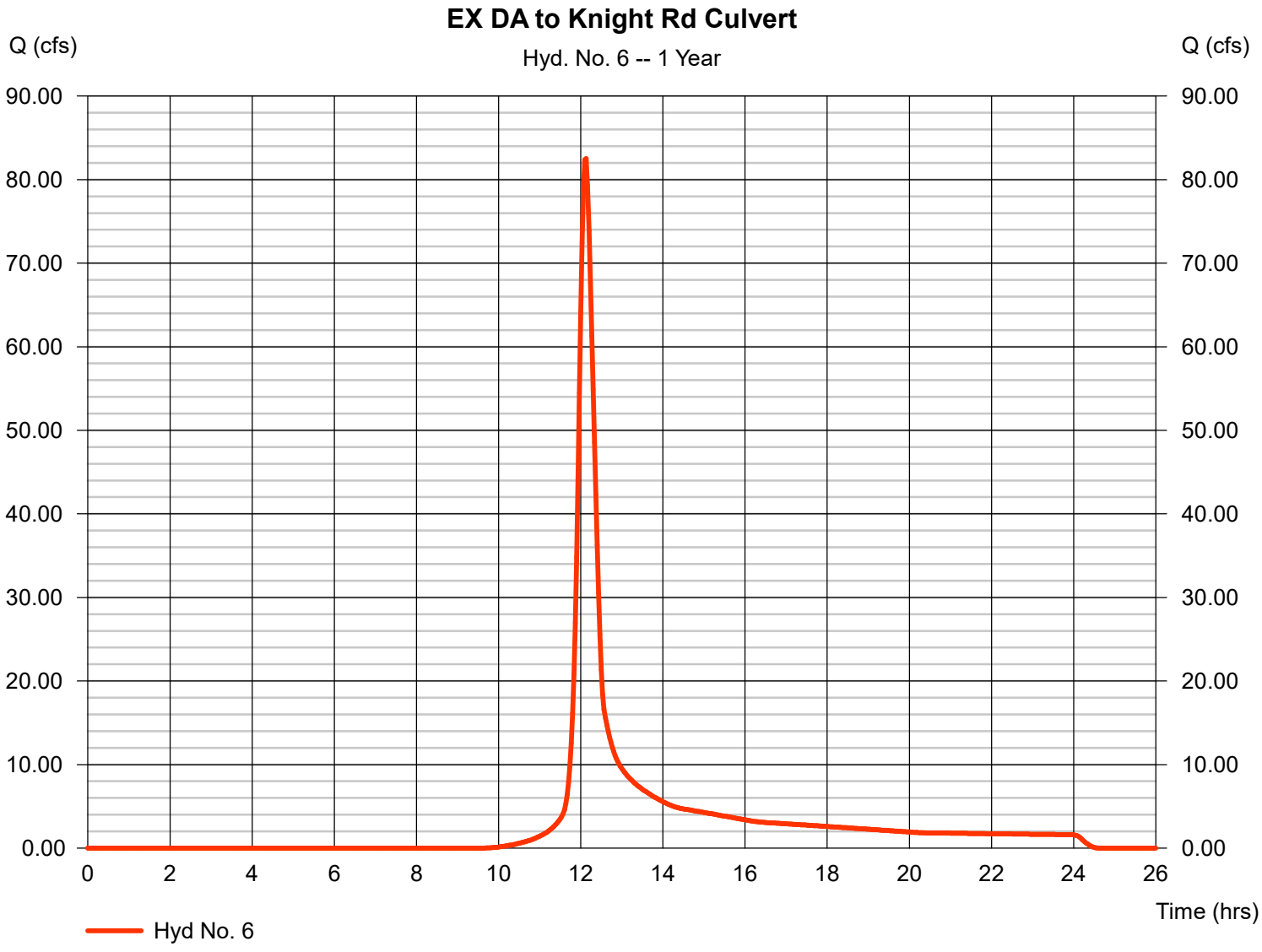
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	82.53 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	290,476 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 6

EX DA to Knight Rd Culvert

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 255.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		3.25		0.00		
Land slope (%)	= 2.70		0.00		0.00		
Travel Time (min)	**= 18.23**	**+**	**0.00**	**+**	**0.00**	**=**	**18.23**
Shallow Concentrated Flow							
Flow length (ft)	= 30.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.49		0.00		0.00		
Travel Time (min)	**= 0.20**	**+**	**0.00**	**+**	**0.00**	**=**	**0.20**
Channel Flow							
X sectional flow area (sqft)	= 1.77		3.14		7.07		
Wetted perimeter (ft)	= 4.71		6.28		9.42		
Channel slope (%)	= 1.70		1.50		1.90		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 6.72		7.65		11.30		
Flow length (ft)	= 600.0		875.0		1025.0		
Travel Time (min)	**= 1.49**	**+**	**1.91**	**+**	**1.51**	**=**	**4.91**

Total Travel Time, Tc ..... 23.30 min

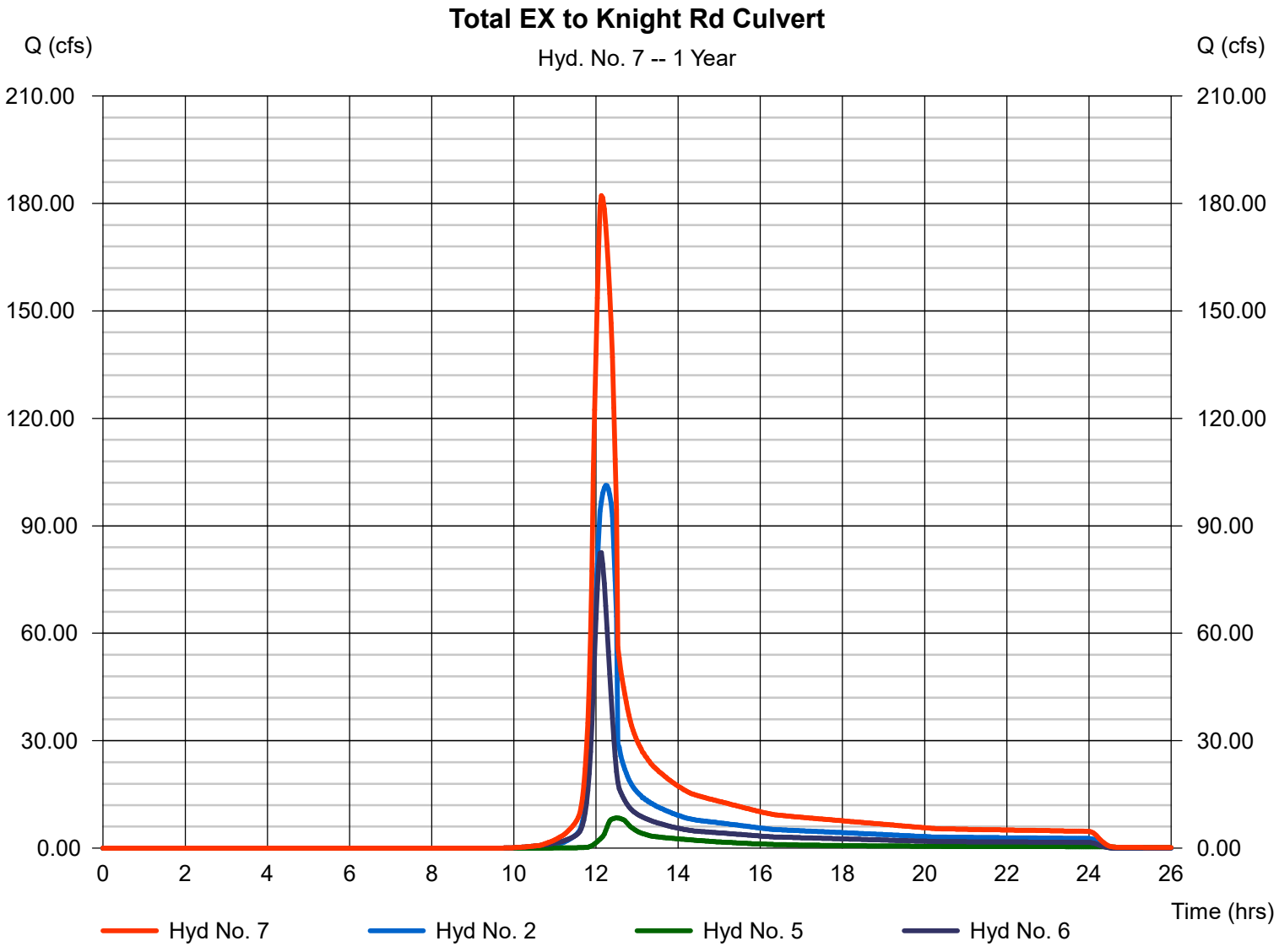
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 182.16 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 809,523 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

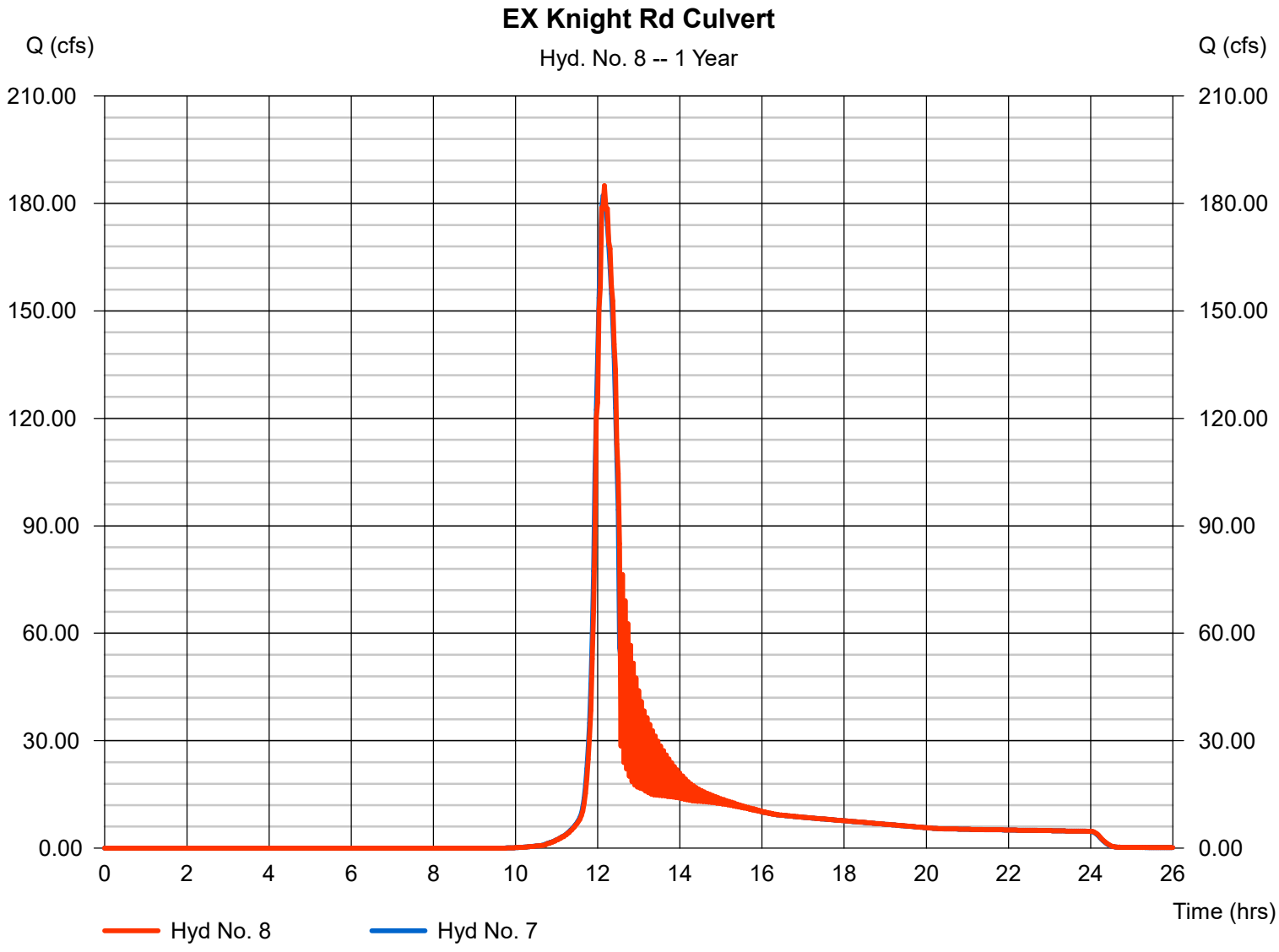
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	185.01 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	809,488 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	22.02 ft/s	Routing coeff.	=	1.9479

Modified Att-Kin routing method used.



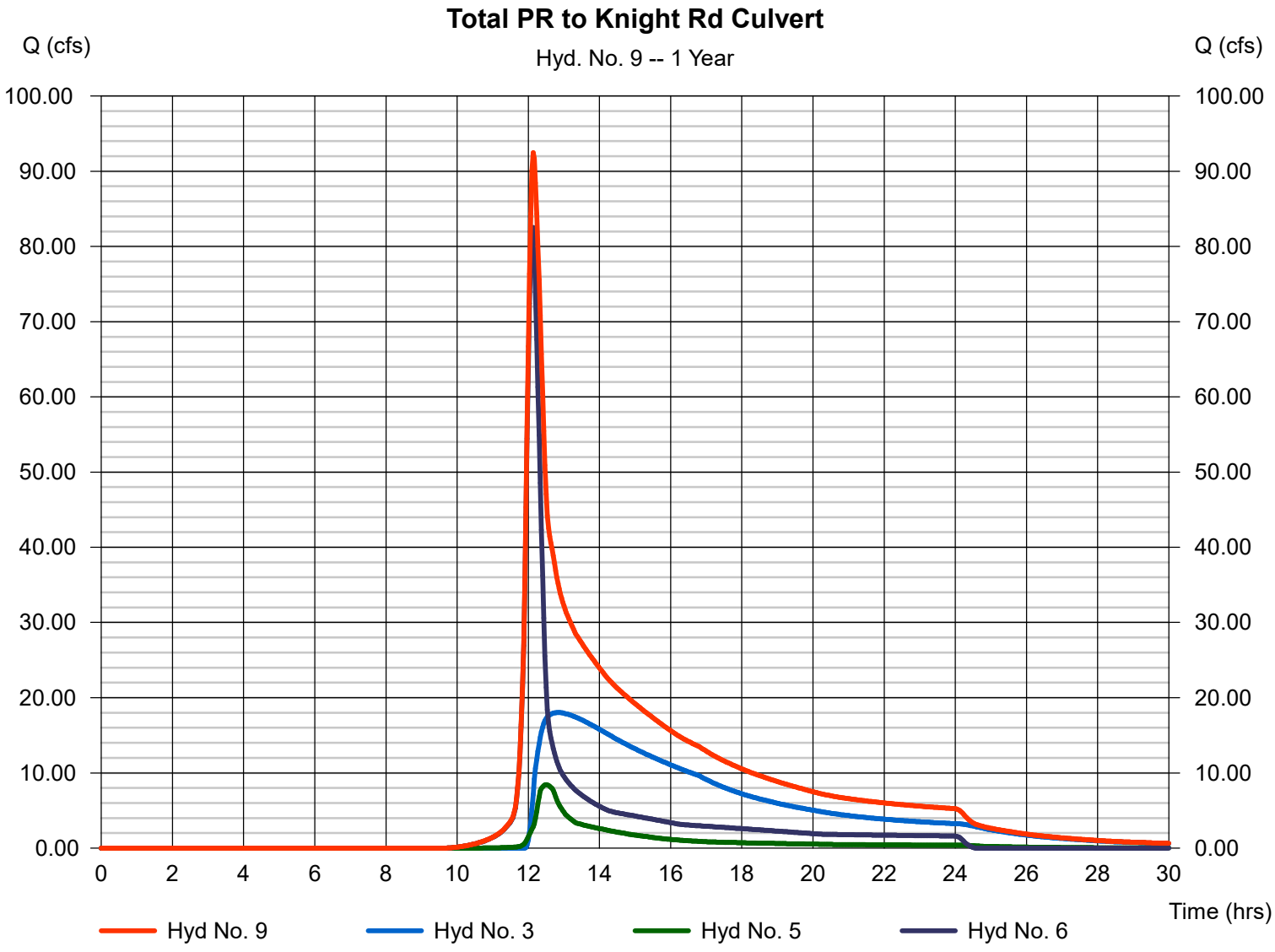
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 92.47 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 779,659 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

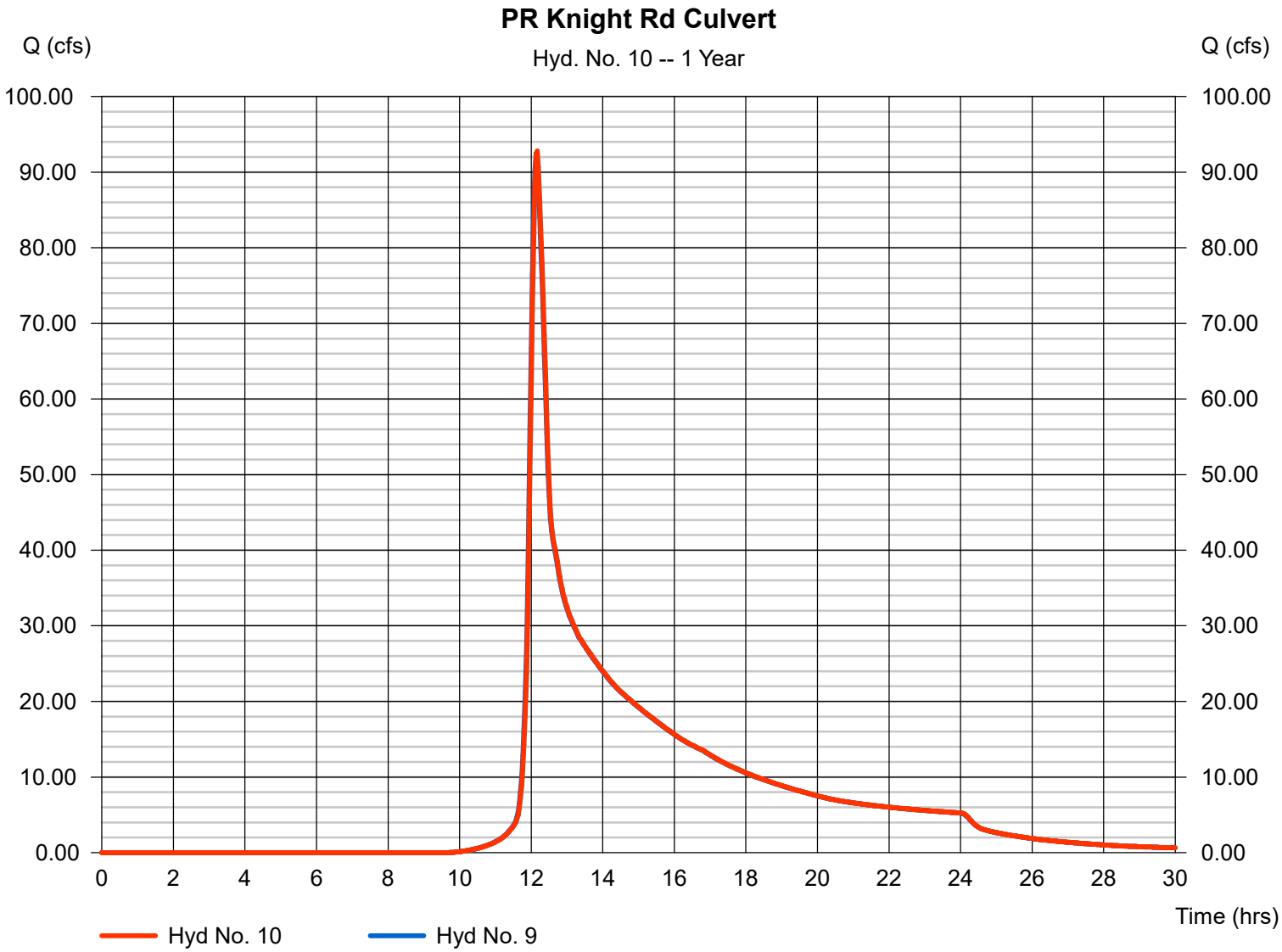
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	92.80 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	779,530 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	17.28 ft/s	Routing coeff.	=	1.9341

Modified Att-Kin routing method used.



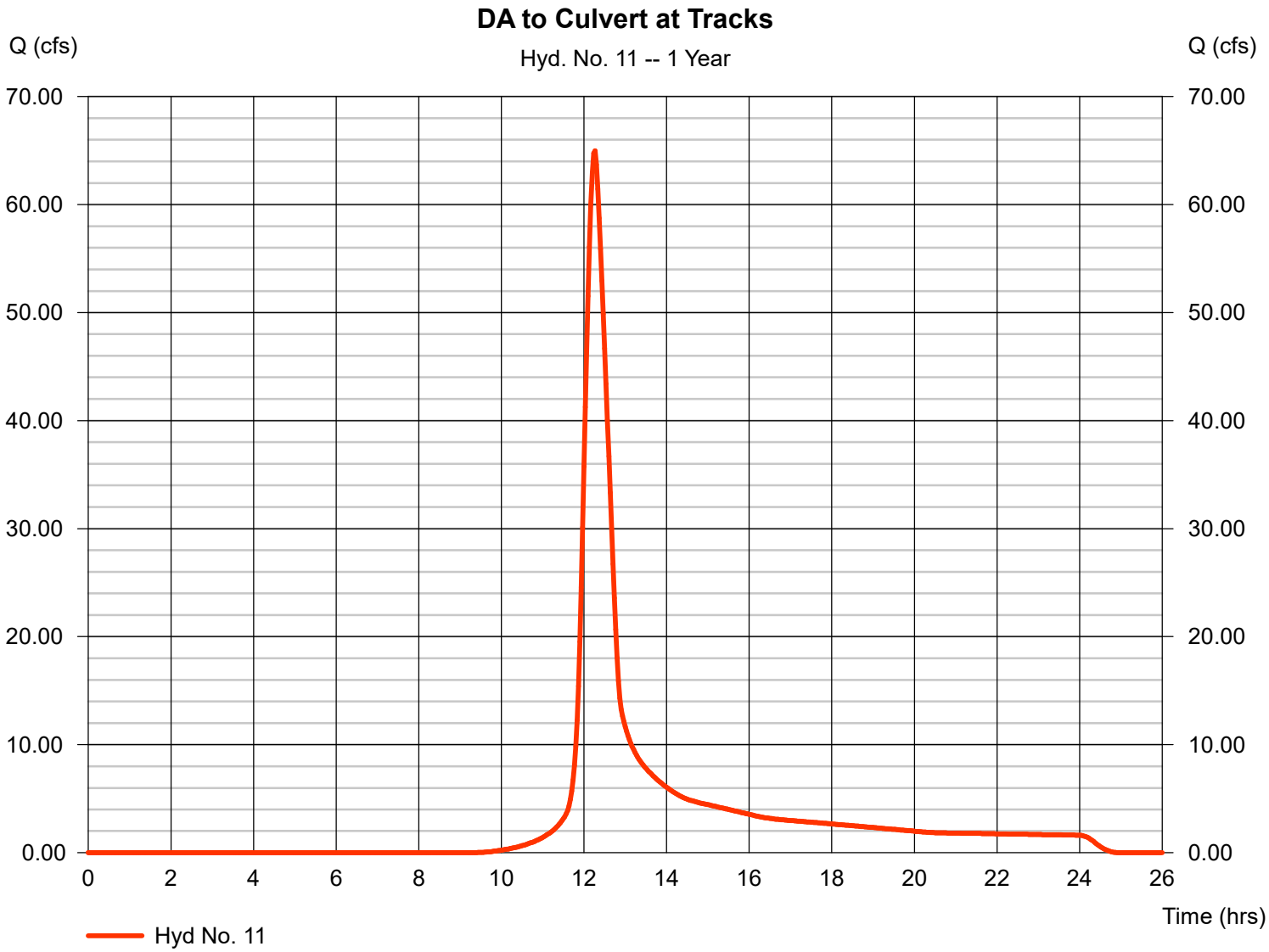
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	64.98 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	299,359 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 11

DA to Culvert at Tracks

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	300.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.25		0.00		0.00		
Land slope (%)	=	1.70		0.00		0.00		
Travel Time (min)	**=**	**24.99**	**+**	**0.00**	**+**	**0.00**	**=**	**24.99**
Shallow Concentrated Flow								
Flow length (ft)	=	740.00		560.00		0.00		
Watercourse slope (%)	=	1.00		6.60		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.61		5.22		0.00		
Travel Time (min)	**=**	**7.64**	**+**	**1.79**	**+**	**0.00**	**=**	**9.43**
Channel Flow								
X sectional flow area (sqft)	=	3.14		21.21		0.00		
Wetted perimeter (ft)	=	6.28		28.27		0.00		
Channel slope (%)	=	3.30		2.80		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	11.34		13.71		0.00		
Flow length (ft)	=	60.0		650.0		0.0		
Travel Time (min)	**=**	**0.09**	**+**	**0.79**	**+**	**0.00**	**=**	**0.88**

Total Travel Time, Tc ..... 35.30 min

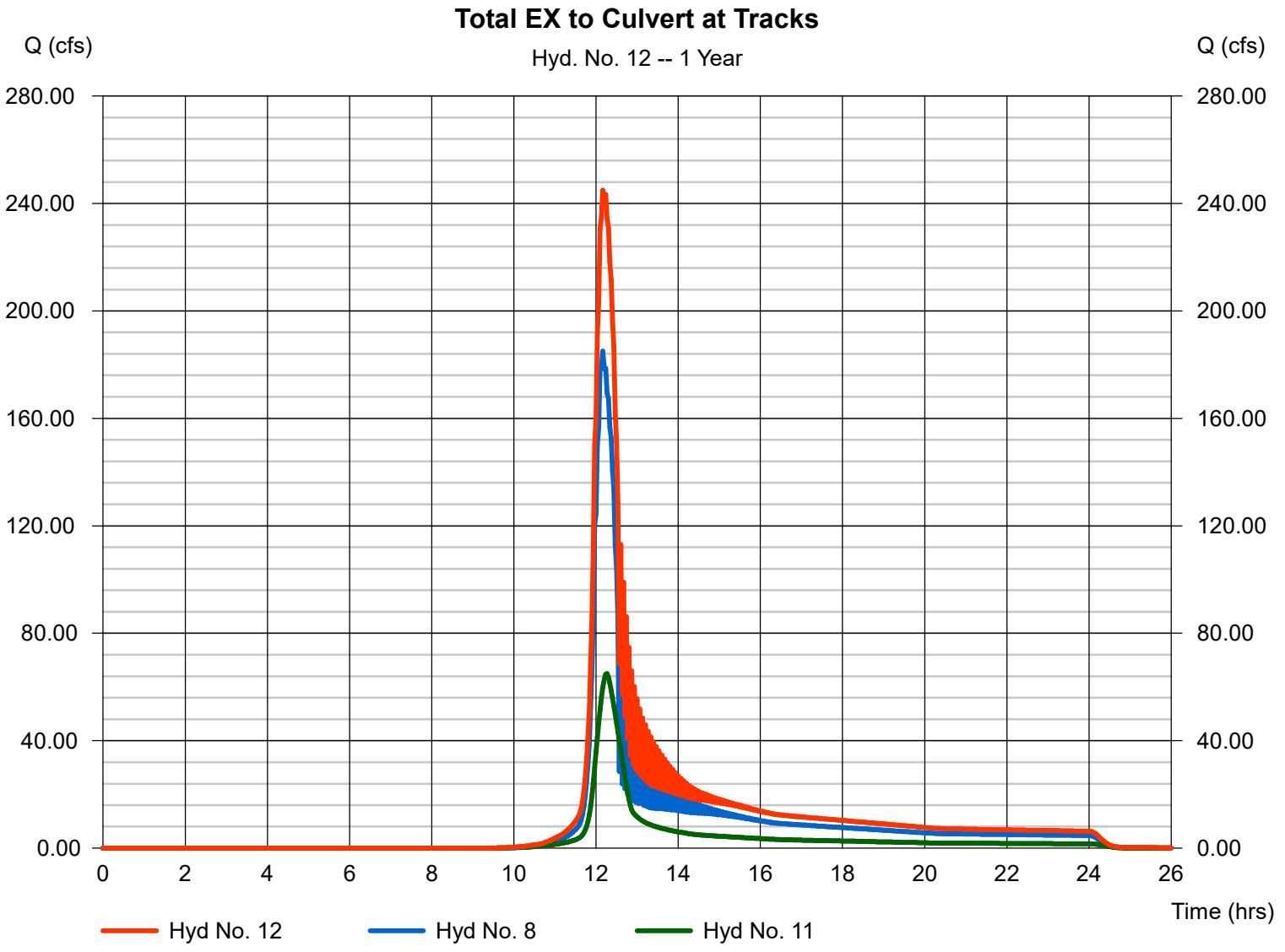
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 244.99 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,108,848 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



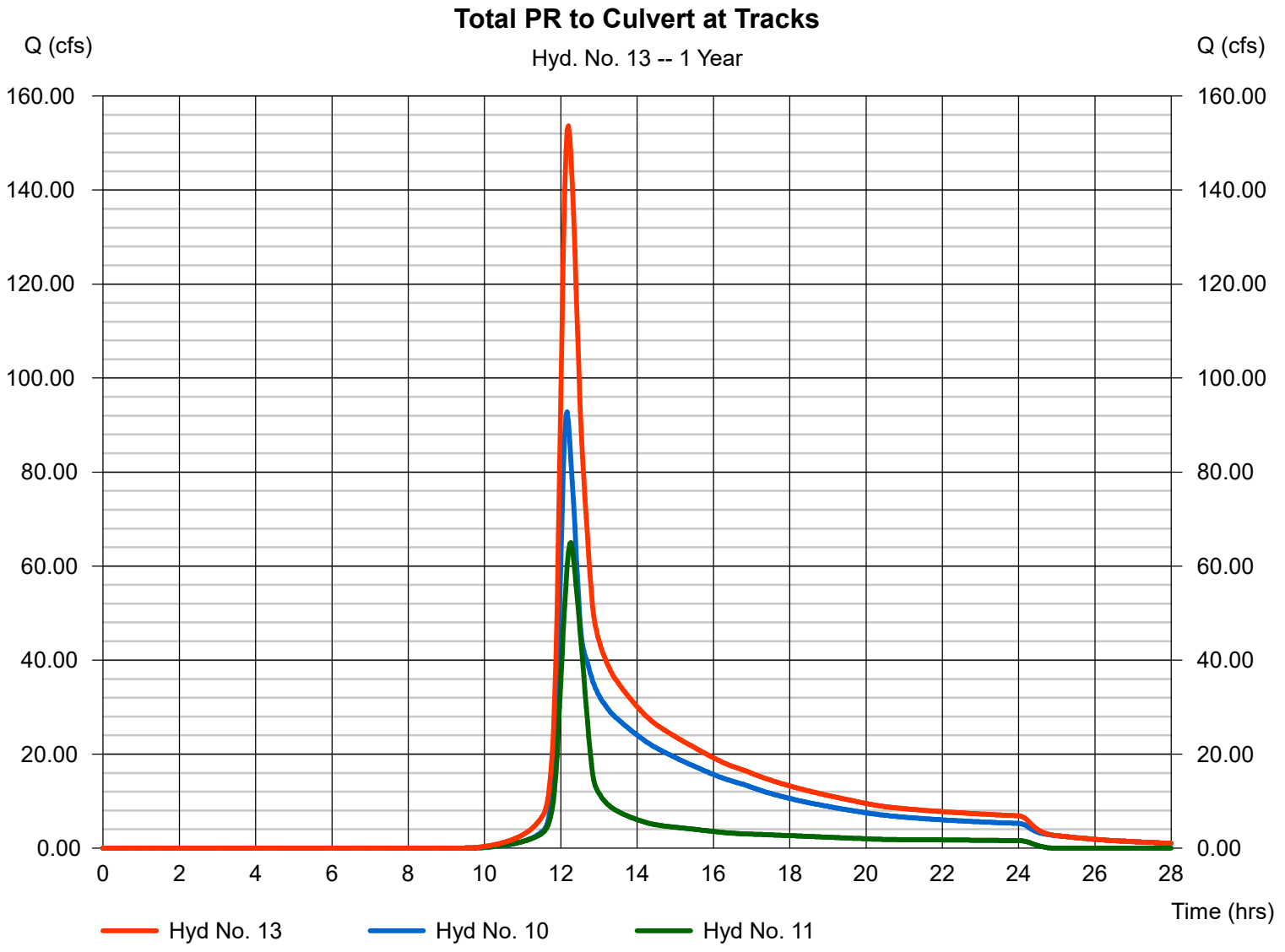
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 153.62 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,078,890 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	180.90	2	728	636,994	----	------	------	DA to Dam
2	Reservoir	122.45	2	738	636,936	1	254.67	65,759	EX Dam
3	Reservoir	28.27	2	764	607,073	1	254.16	289,158	PR Dam
4	SCS Runoff	23.17	2	732	93,799	----	------	------	DA to School Basin
5	Reservoir	11.97	2	750	93,791	4	272.39	28,057	EX School Basin
6	SCS Runoff	114.92	2	726	399,659	----	------	------	EX DA to Knight Rd Culvert
7	Combine	234.98	2	730	1,130,385	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	238.11	2	730	1,130,352	7	------	------	EX Knight Rd Culvert
9	Combine	134.25	2	728	1,100,521	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	135.04	2	730	1,100,394	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	89.60	2	736	408,597	----	------	------	DA to Culvert at Tracks
12	Combine	321.68	2	730	1,538,951	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	219.02	2	732	1,508,991	10, 11,	------	------	Total PR to Culvert at Tracks

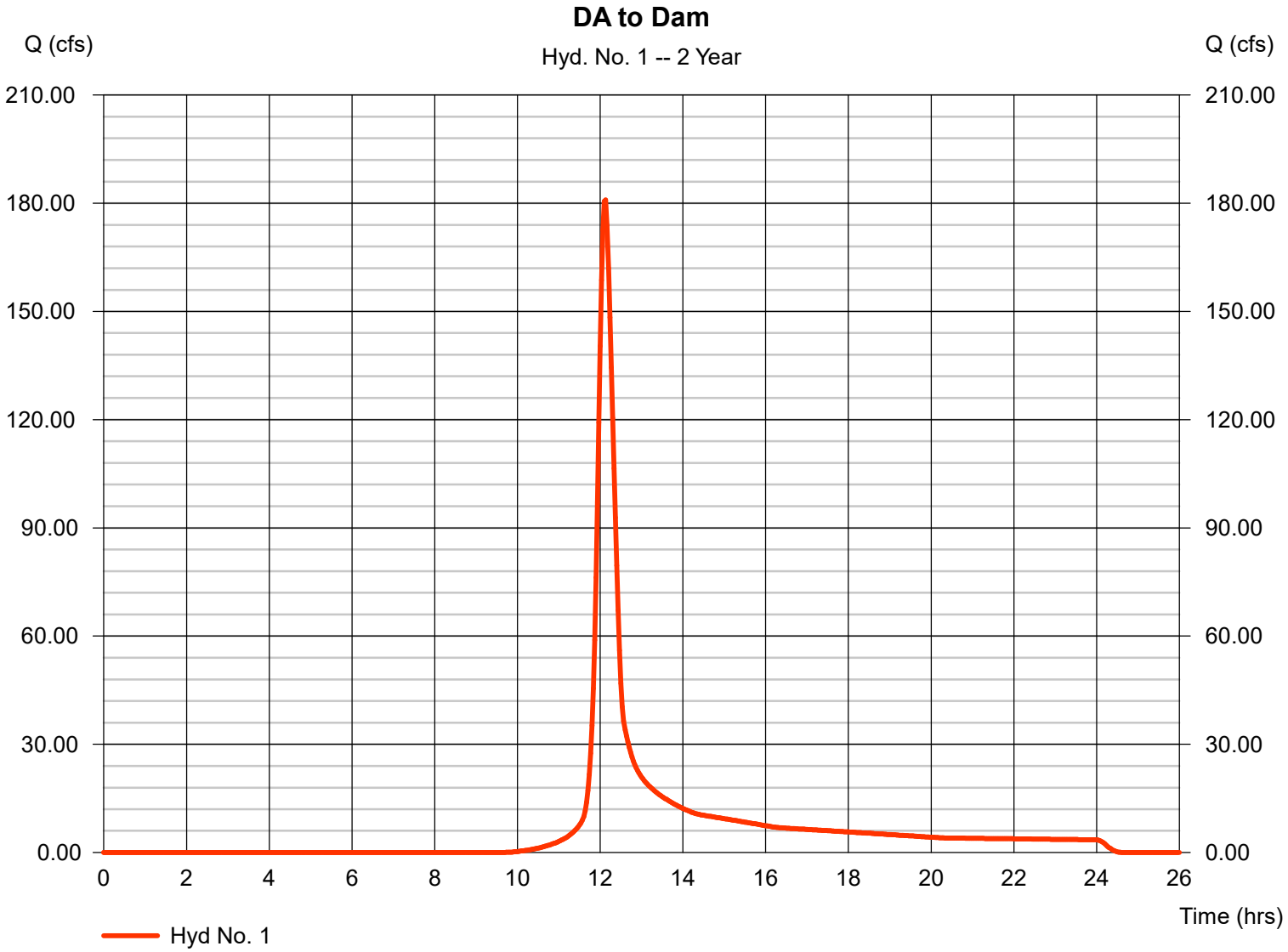
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	180.90 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	636,994 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

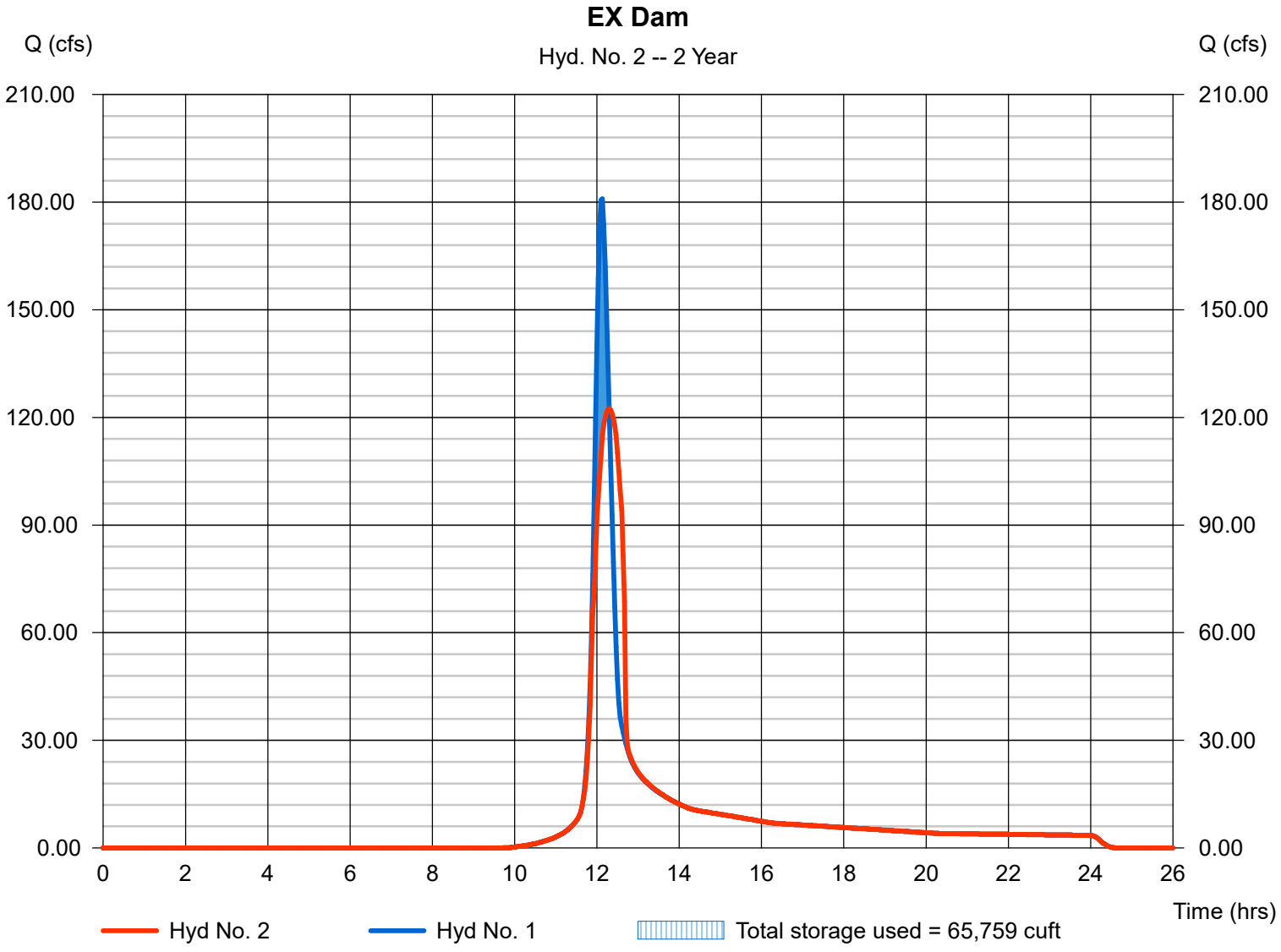
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	122.45 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	636,936 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	254.67 ft
Reservoir name	=	EX Dam	Max. Storage	=	65,759 cuft

Storage Indication method used.



Hydrograph Report

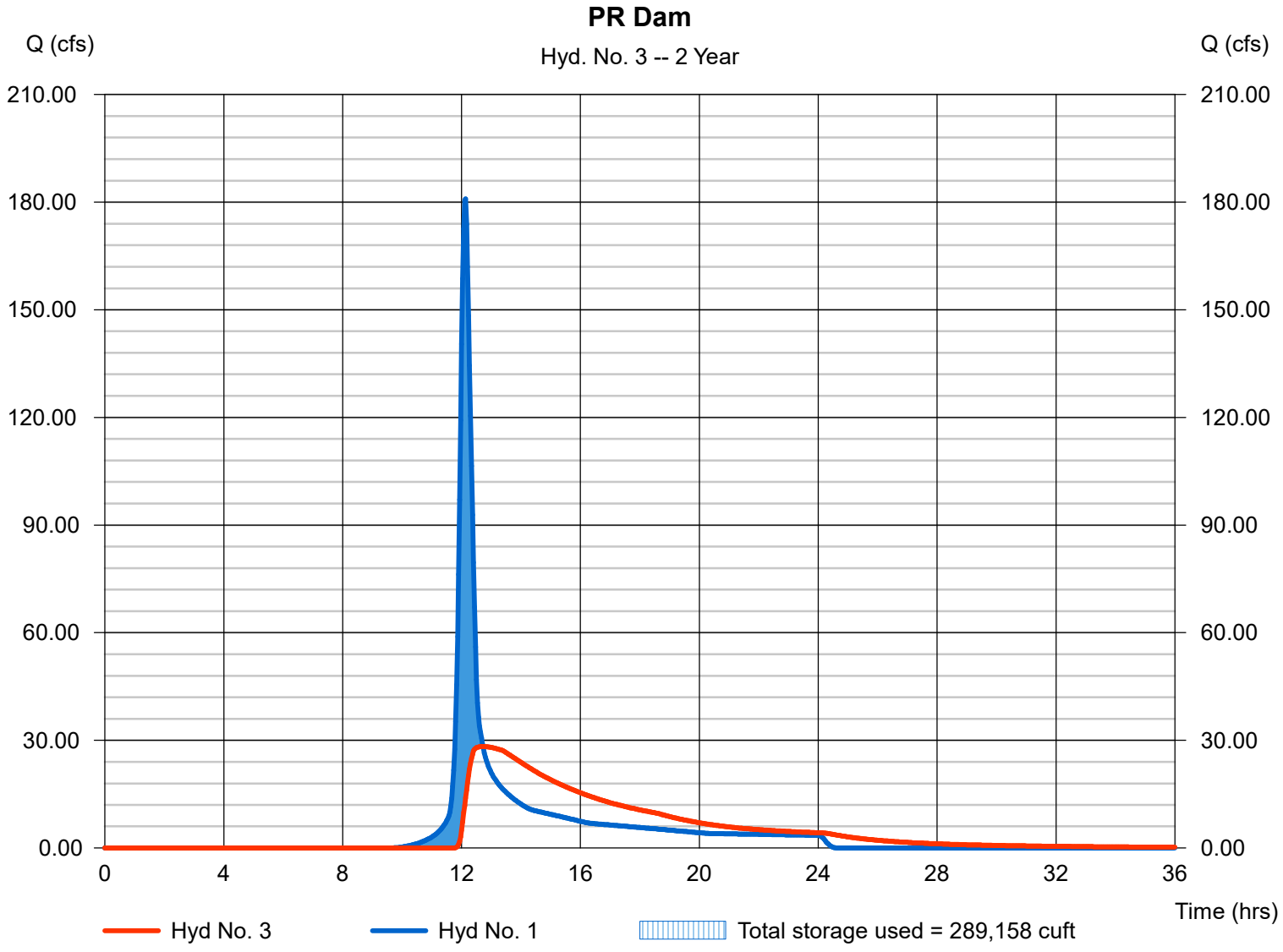
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	28.27 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.73 hrs
Time interval	=	2 min	Hyd. volume	=	607,073 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	254.16 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	289,158 cuft

Storage Indication method used.



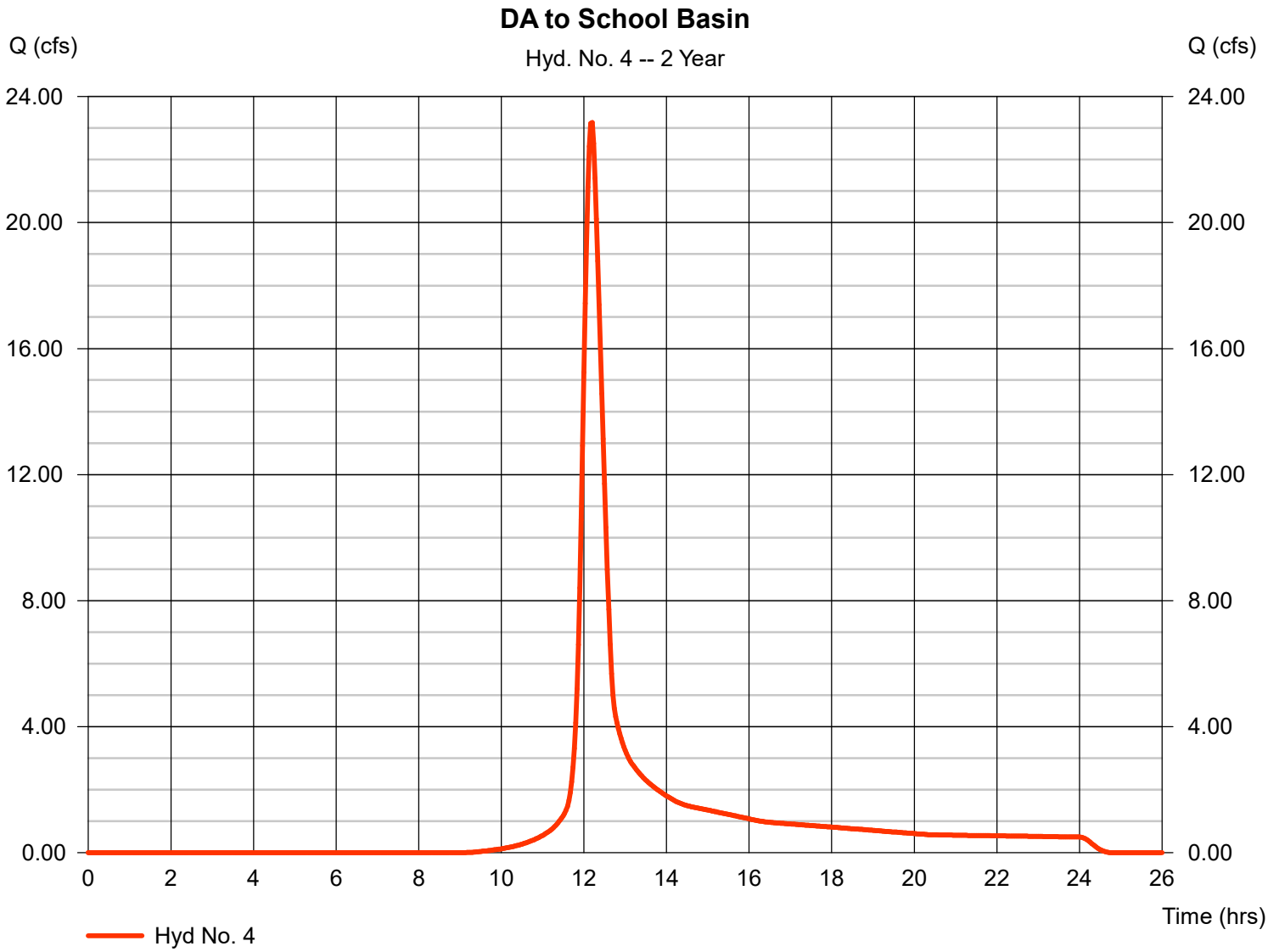
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.17 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	93,799 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

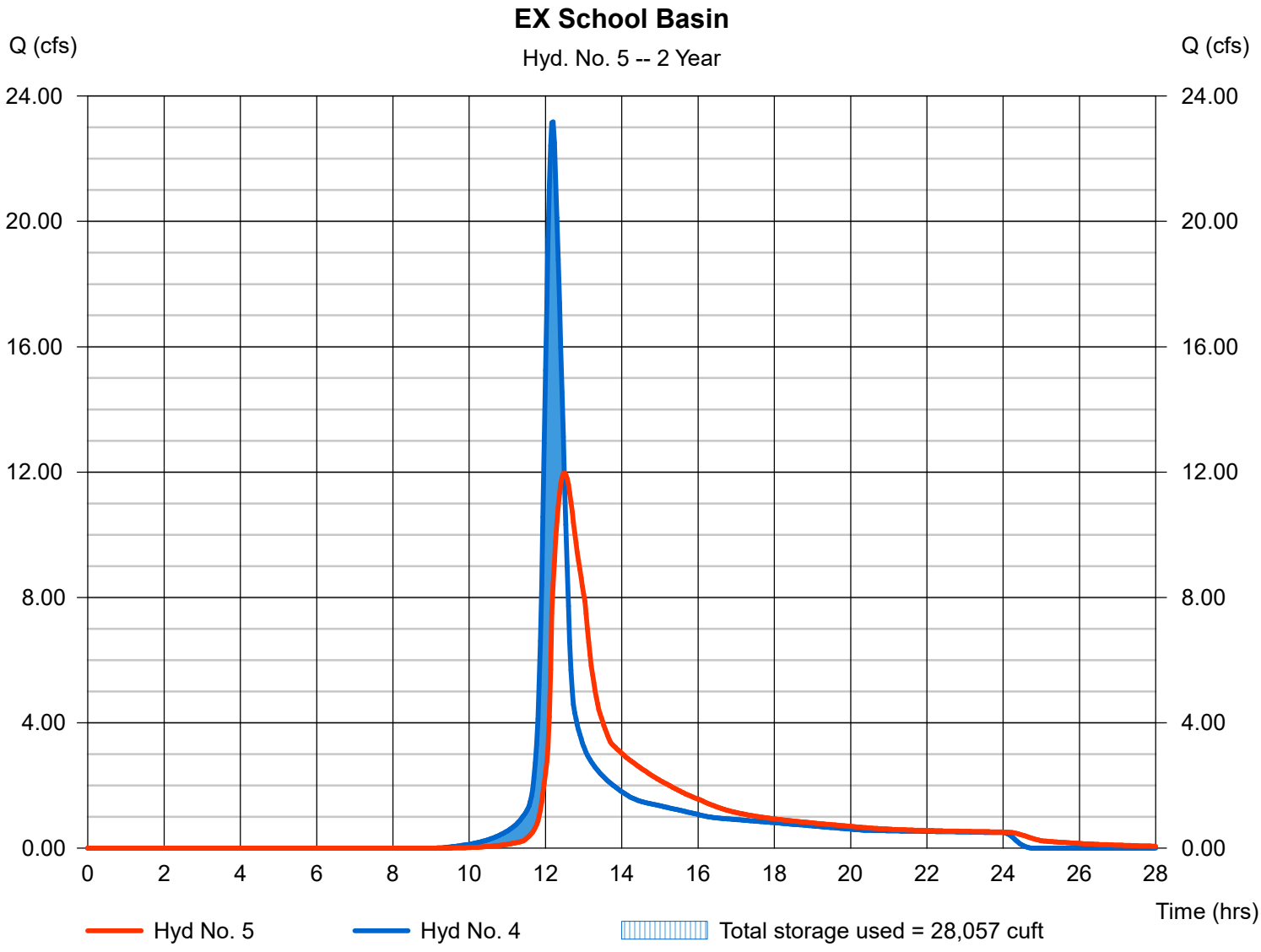
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	11.97 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	93,791 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	272.39 ft
Reservoir name	=	EX School Basin	Max. Storage	=	28,057 cuft

Storage Indication method used.



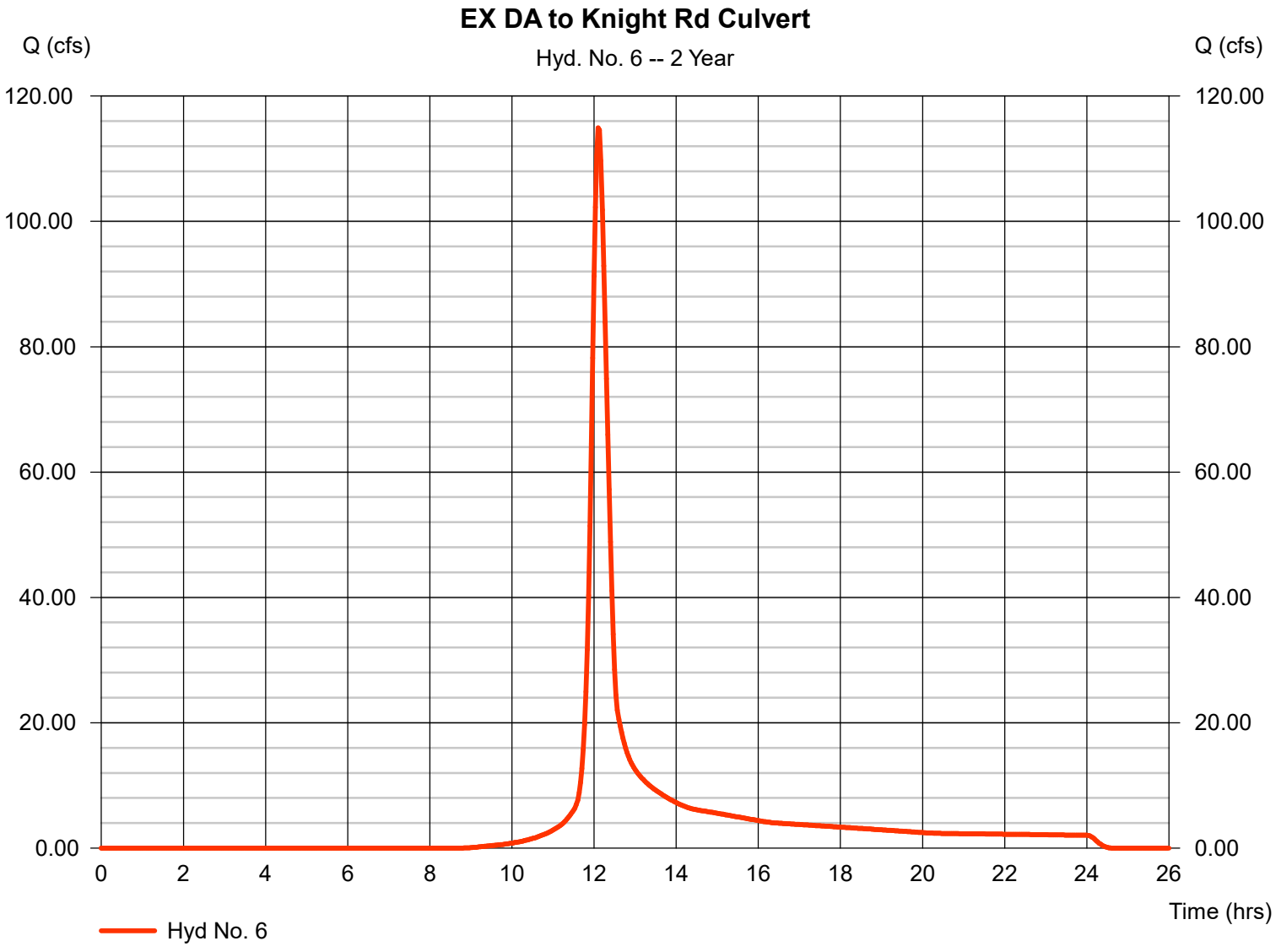
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	114.92 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	399,659 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



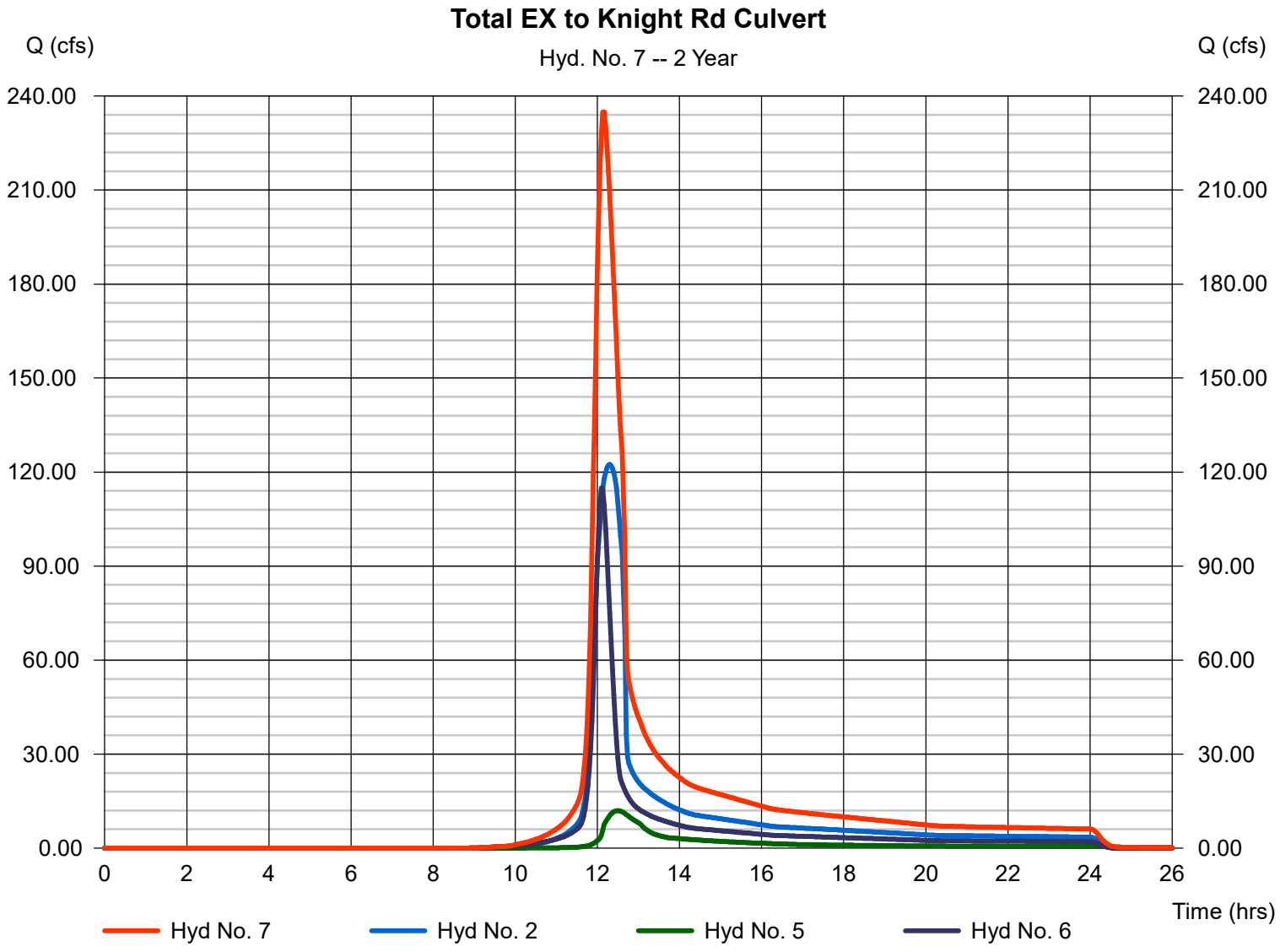
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 234.98 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,130,385 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

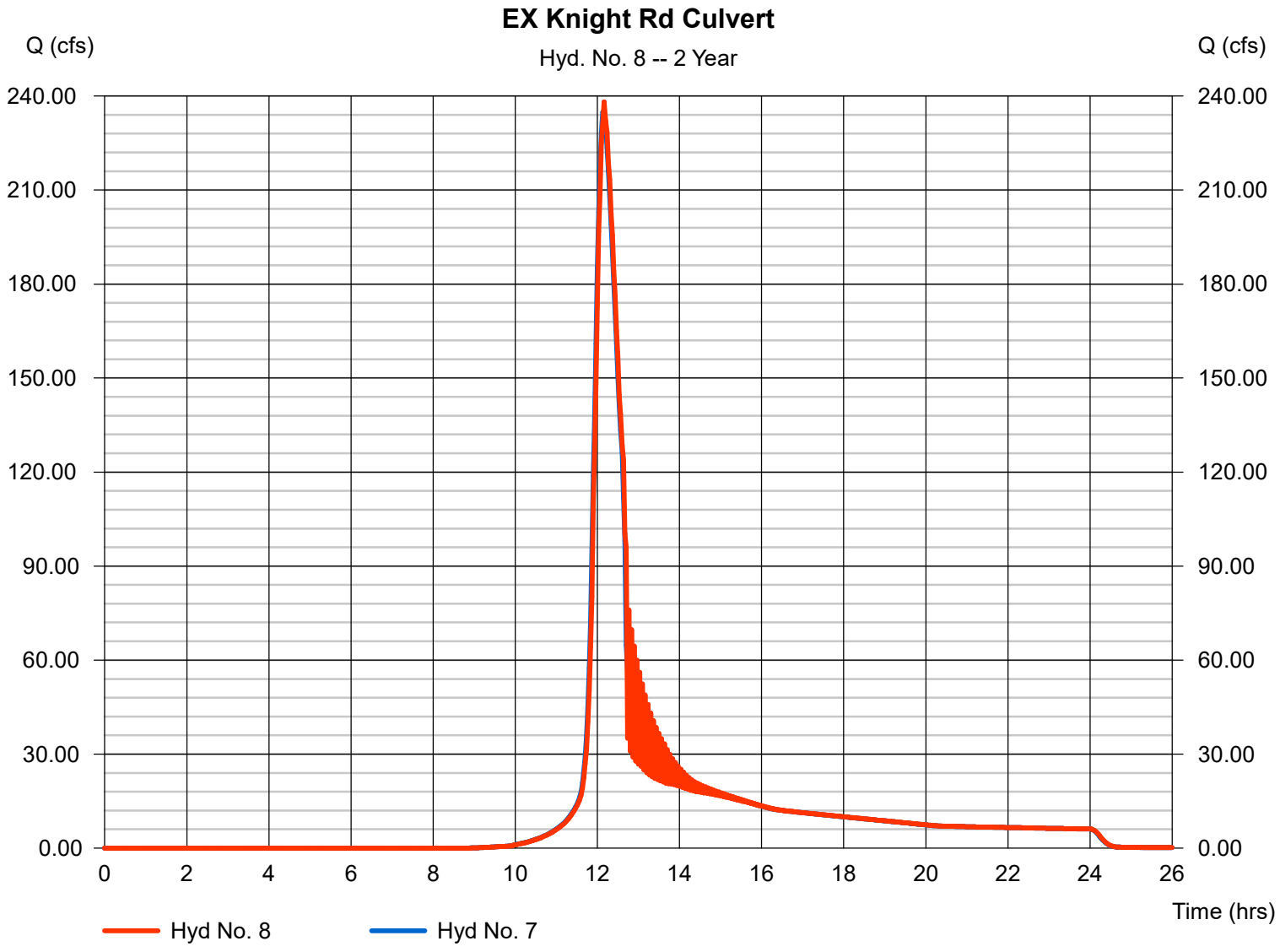
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	238.11 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,130,352 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	24.11 ft/s	Routing coeff.	=	1.9523

Modified Att-Kin routing method used.



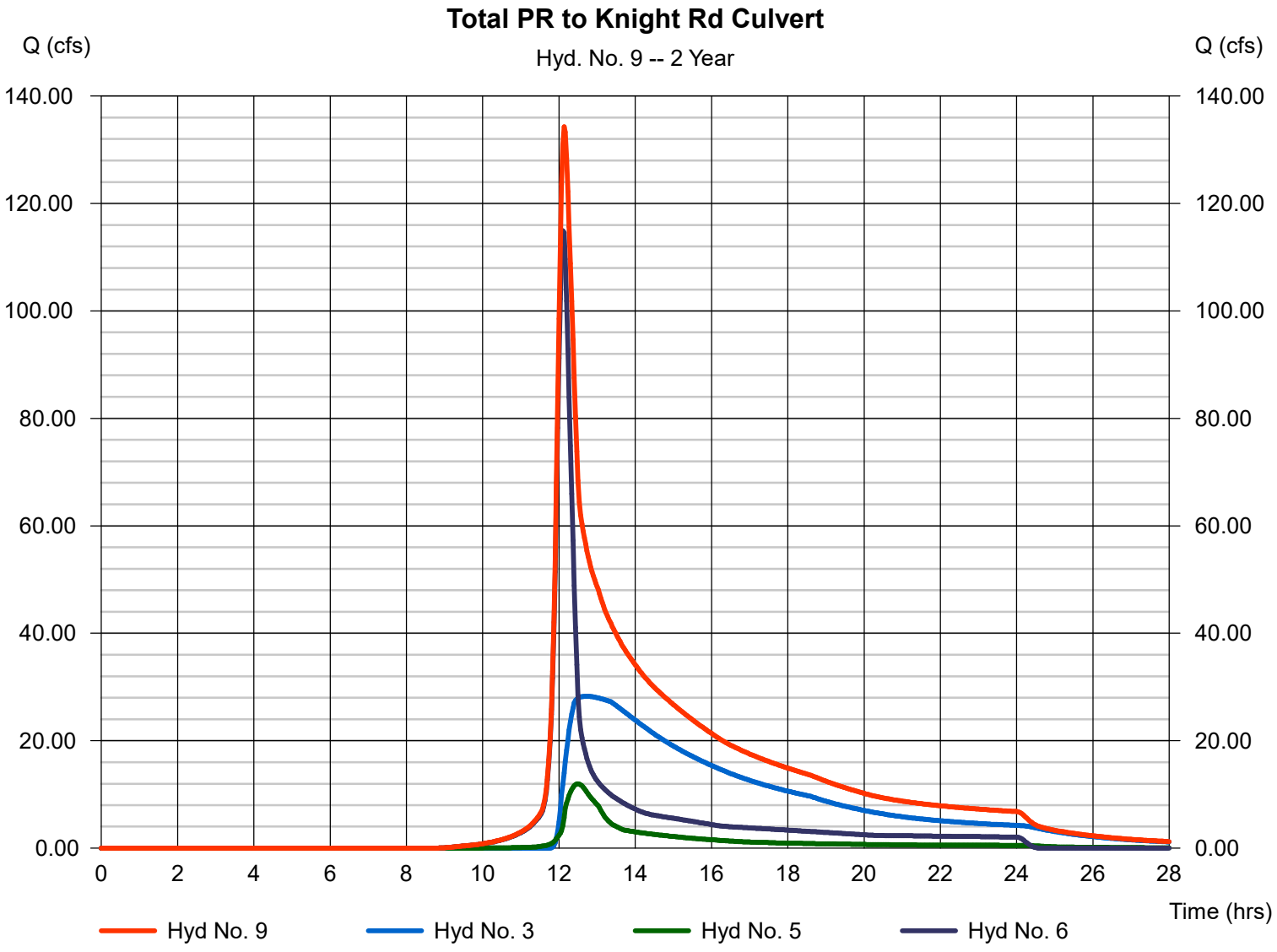
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 134.25 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,100,521 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

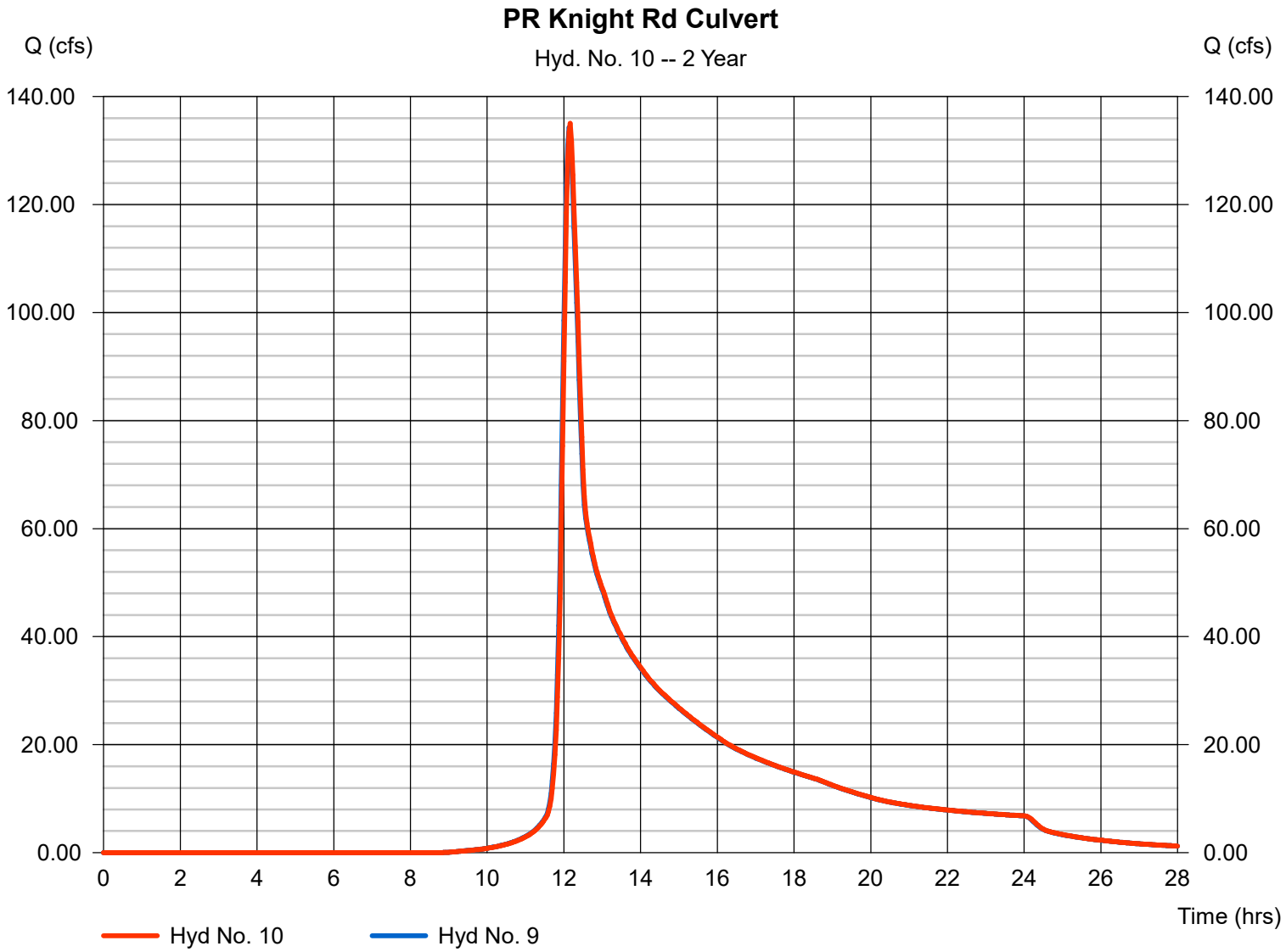
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	135.04 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,100,394 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	19.74 ft/s	Routing coeff.	=	1.9420

Modified Att-Kin routing method used.



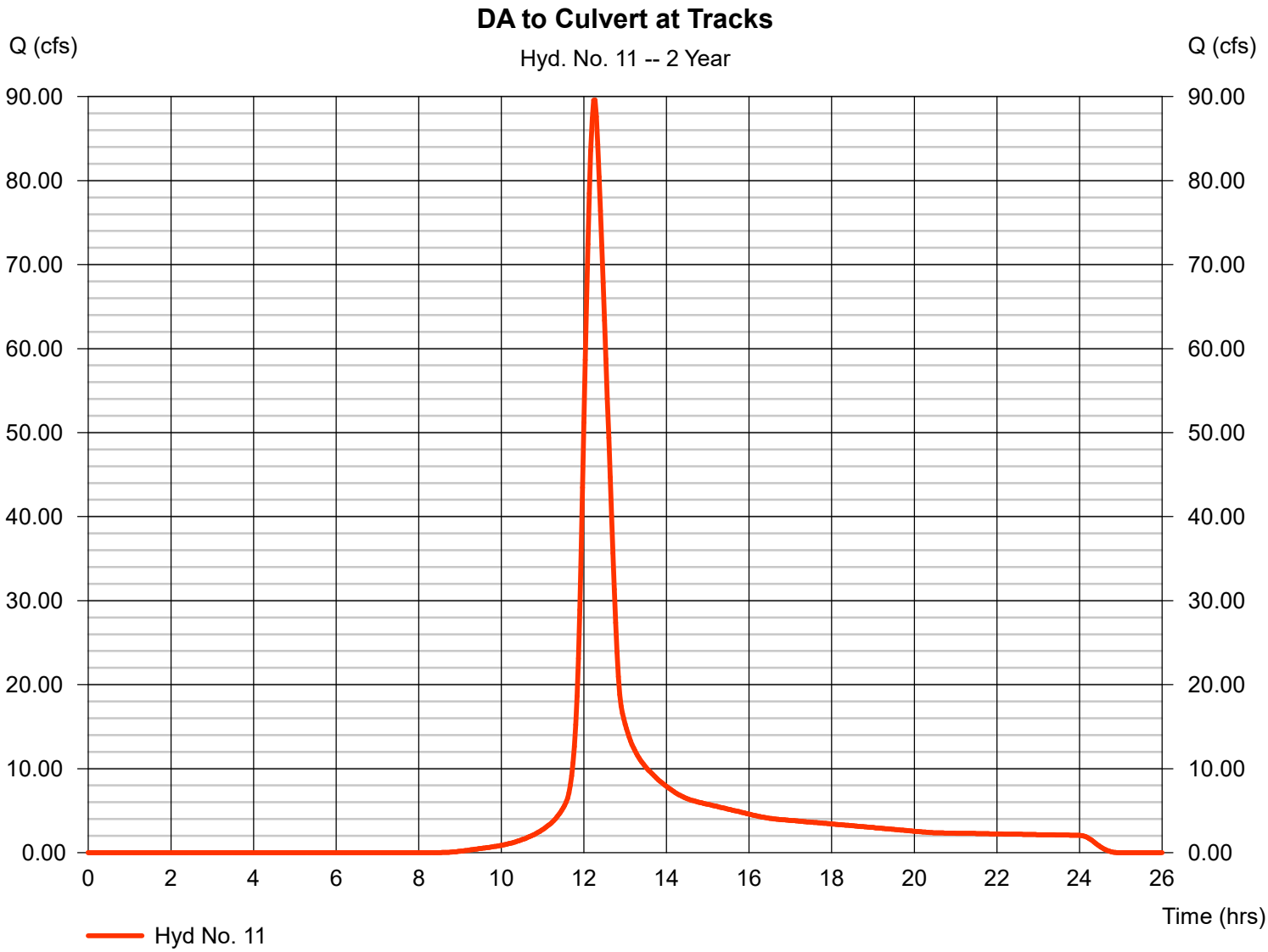
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	89.60 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	408,597 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



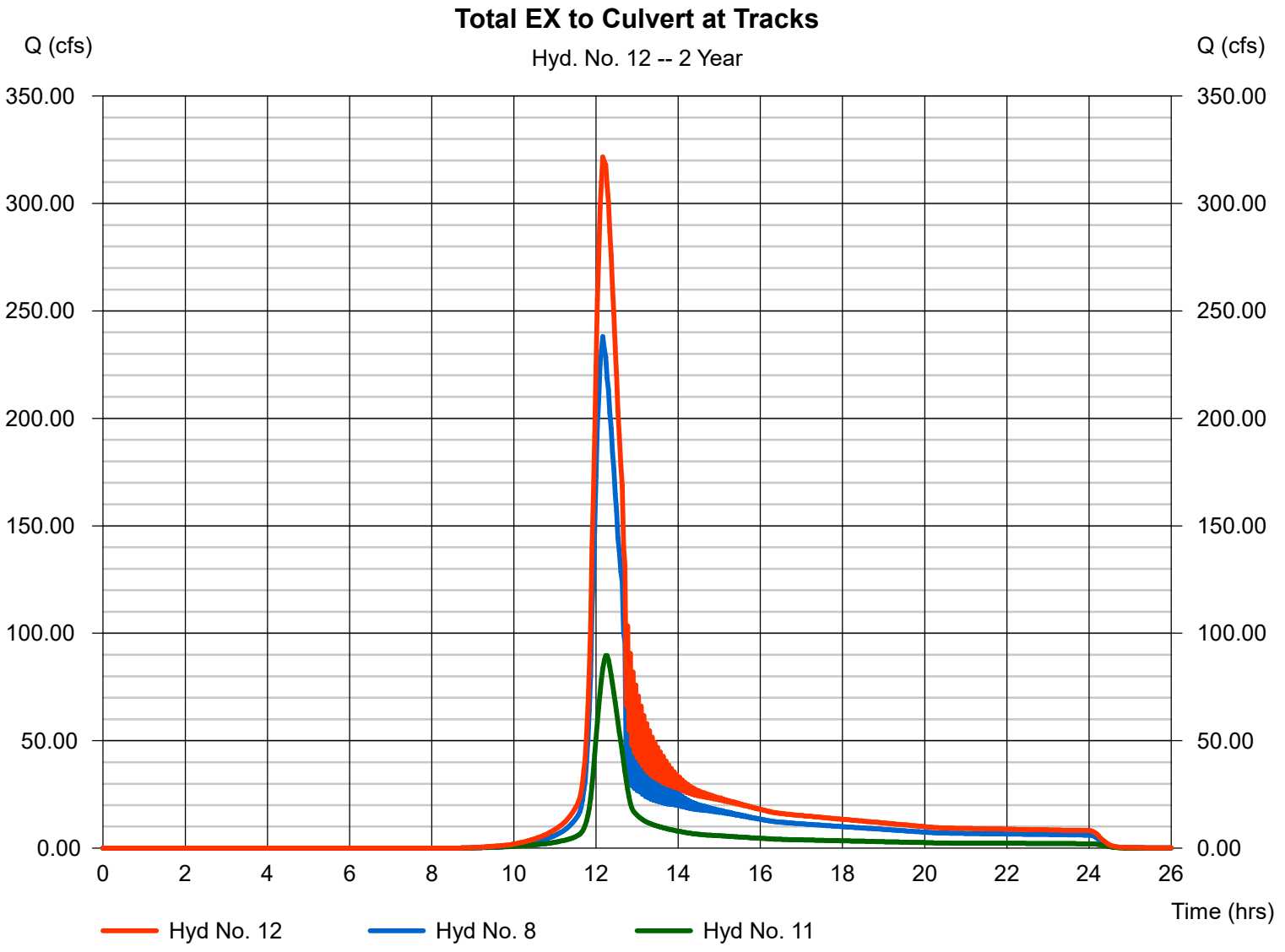
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 321.68 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,538,951 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



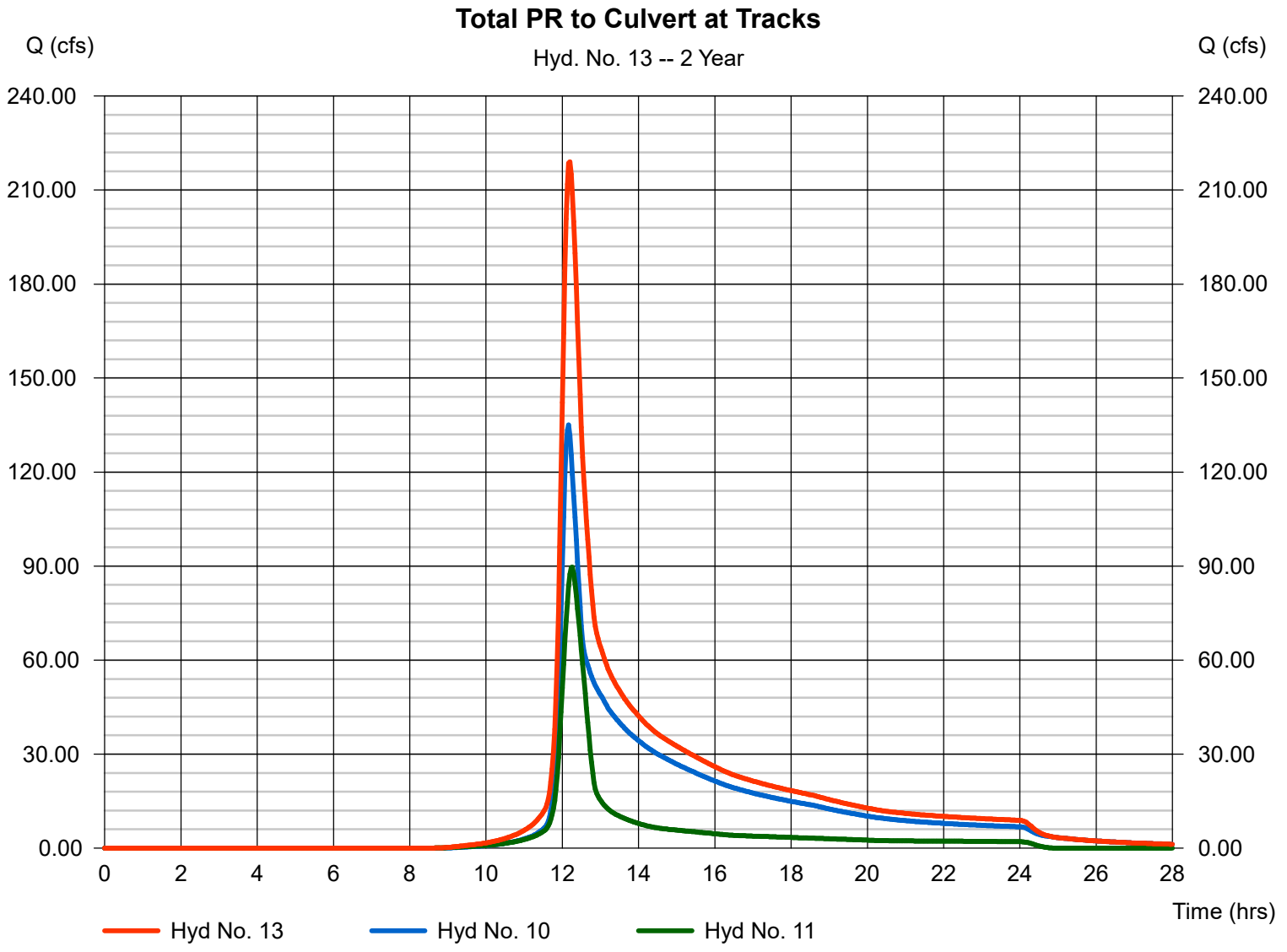
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 219.02 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,508,991 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	269.70	2	726	936,440	----	------	------	DA to Dam
2	Reservoir	143.57	2	742	936,383	1	257.10	152,900	EX Dam
3	Reservoir	43.57	2	760	906,519	1	255.63	443,611	PR Dam
4	SCS Runoff	33.84	2	730	135,585	----	------	------	DA to School Basin
5	Reservoir	18.44	2	748	135,577	4	272.89	39,715	EX School Basin
6	SCS Runoff	165.88	2	726	572,985	----	------	------	EX DA to Knight Rd Culvert
7	Combine	308.22	2	728	1,644,944	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	311.00	2	730	1,644,911	7	------	------	EX Knight Rd Culvert
9	Combine	201.22	2	728	1,615,079	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	201.72	2	730	1,614,954	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	128.23	2	734	581,100	----	------	------	DA to Culvert at Tracks
12	Combine	431.54	2	730	2,226,012	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	322.26	2	730	2,196,052	10, 11,	------	------	Total PR to Culvert at Tracks

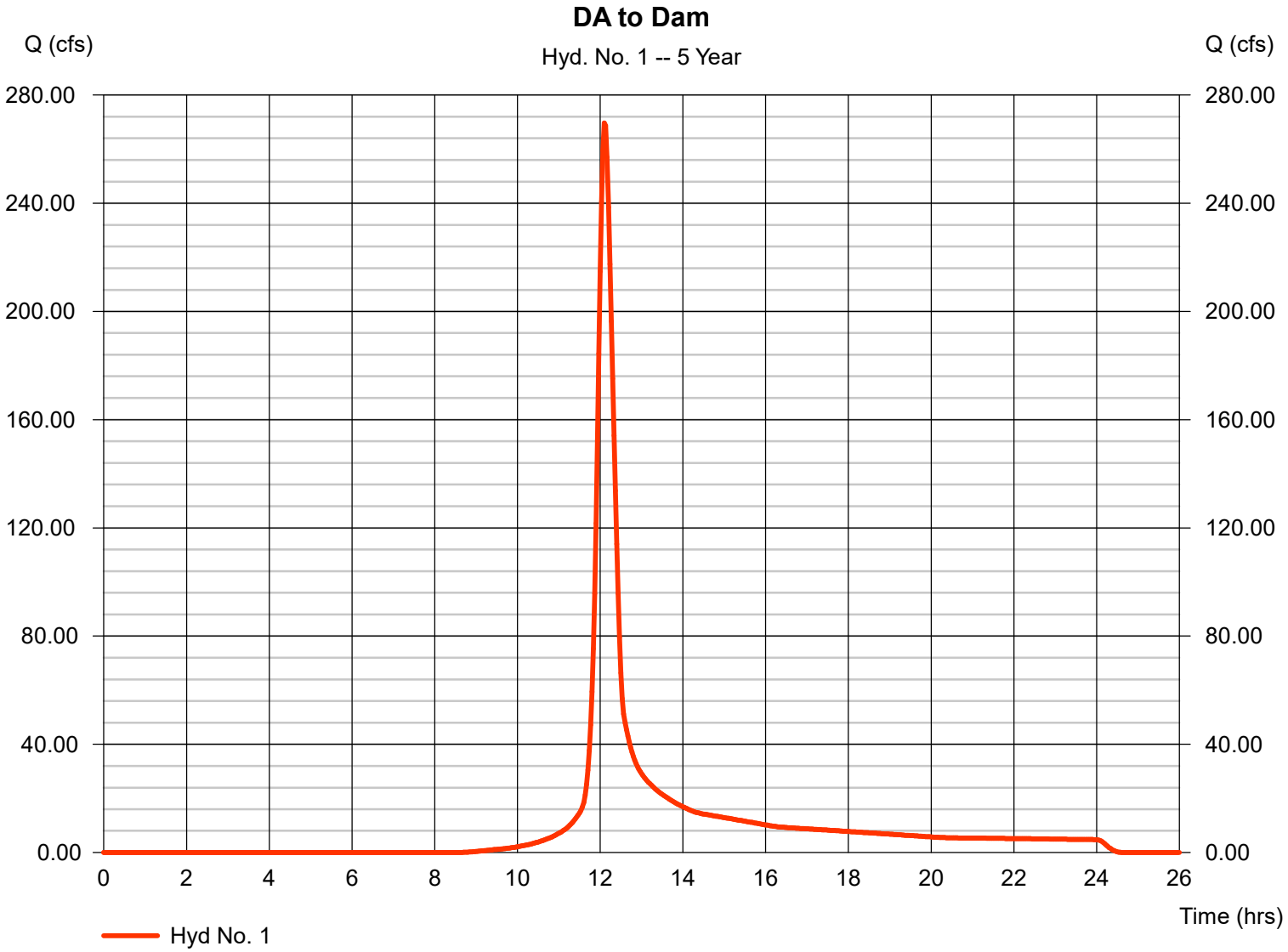
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	269.70 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	936,440 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

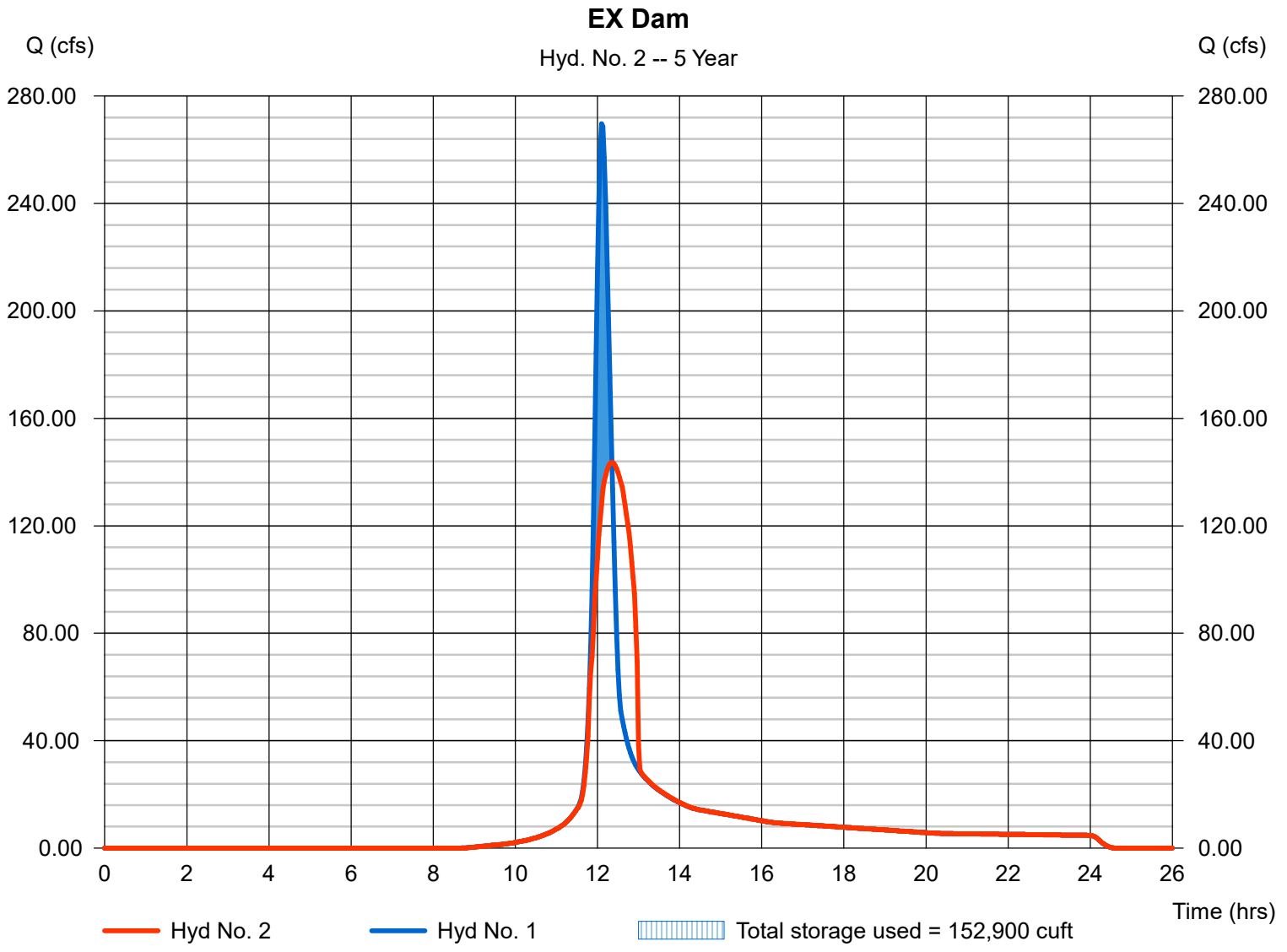
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	143.57 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.37 hrs
Time interval	=	2 min	Hyd. volume	=	936,383 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	257.10 ft
Reservoir name	=	EX Dam	Max. Storage	=	152,900 cuft

Storage Indication method used.



Hydrograph Report

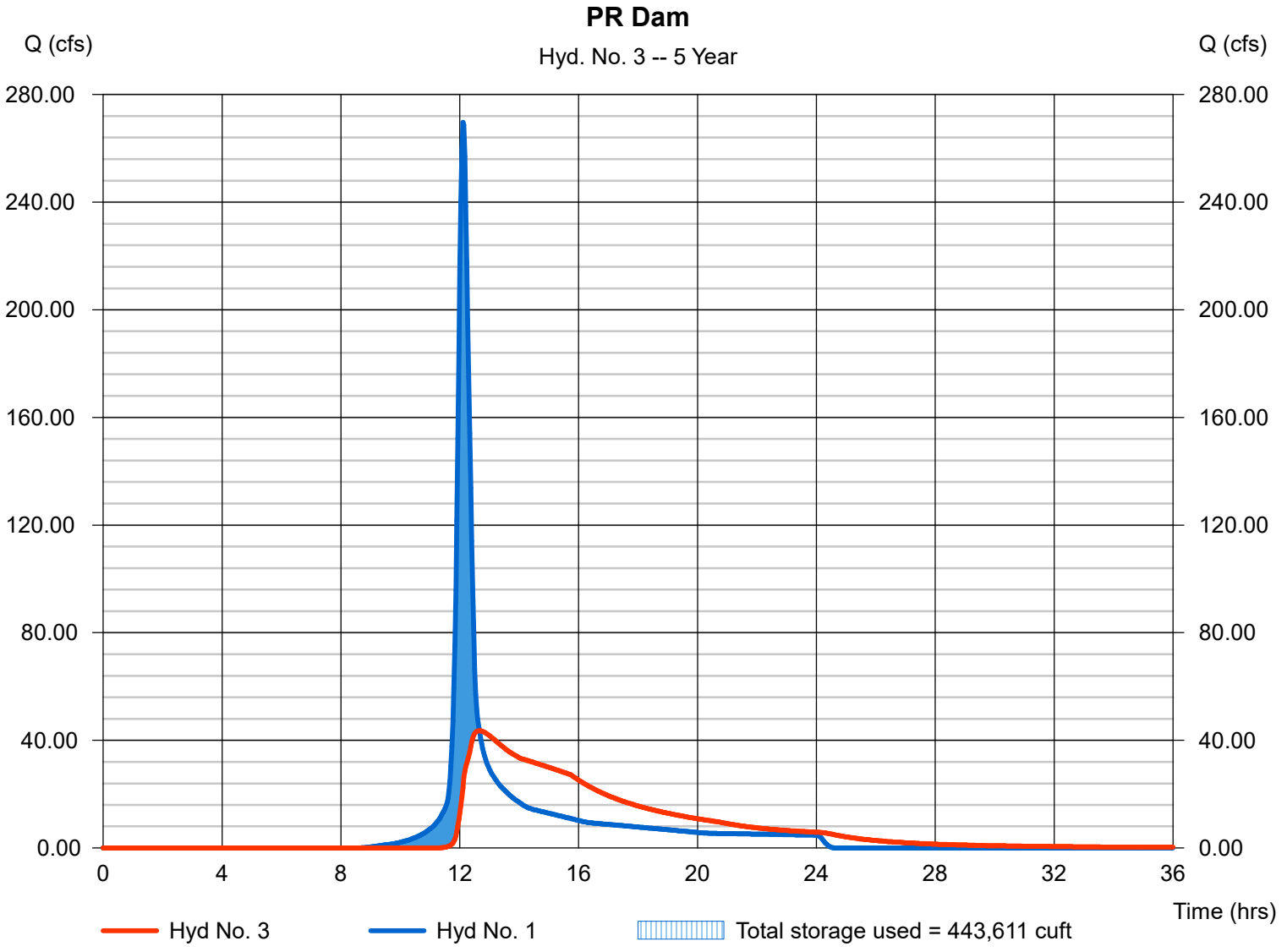
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	43.57 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.67 hrs
Time interval	=	2 min	Hyd. volume	=	906,519 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	255.63 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	443,611 cuft

Storage Indication method used.



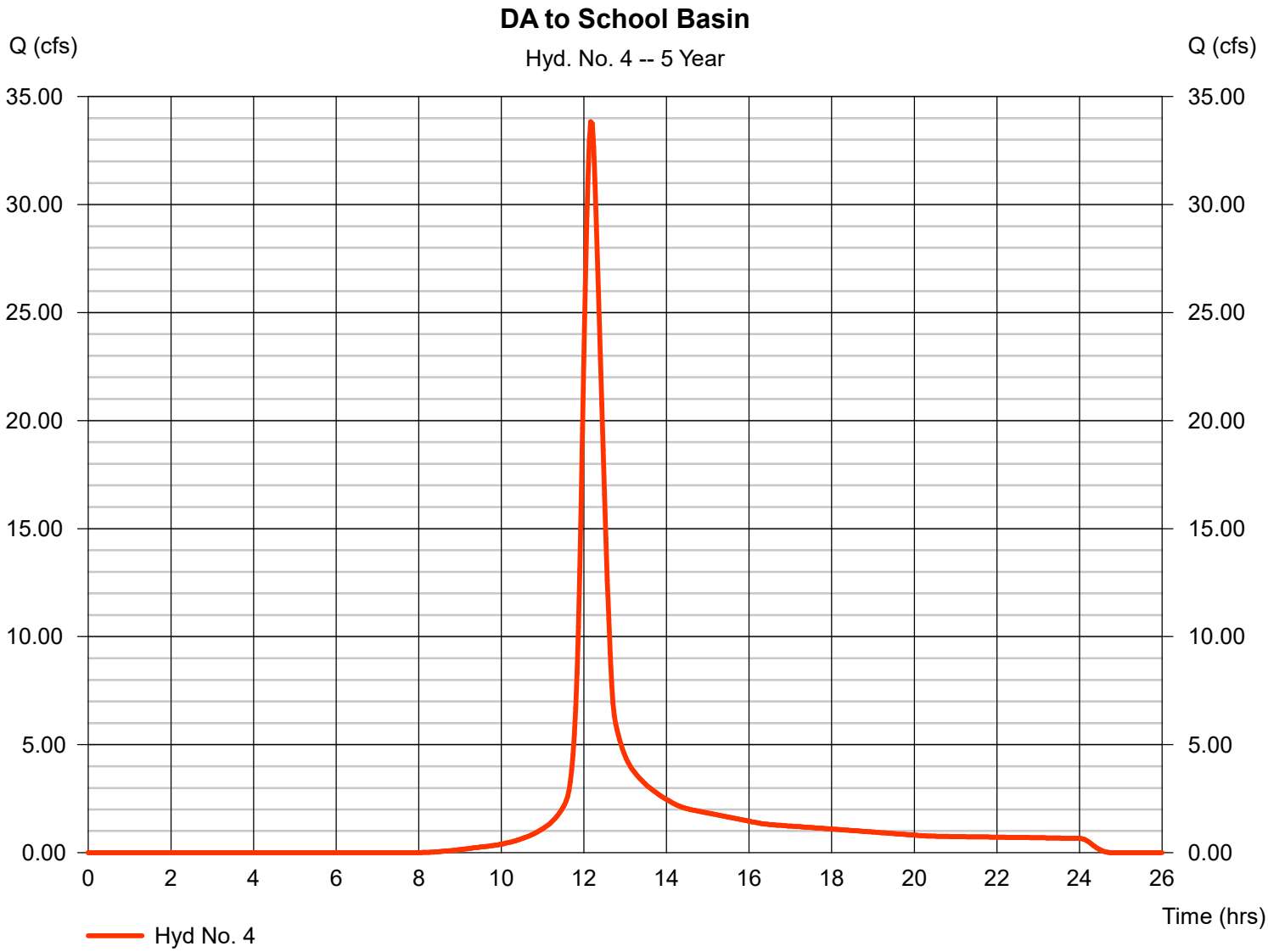
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.84 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	135,585 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

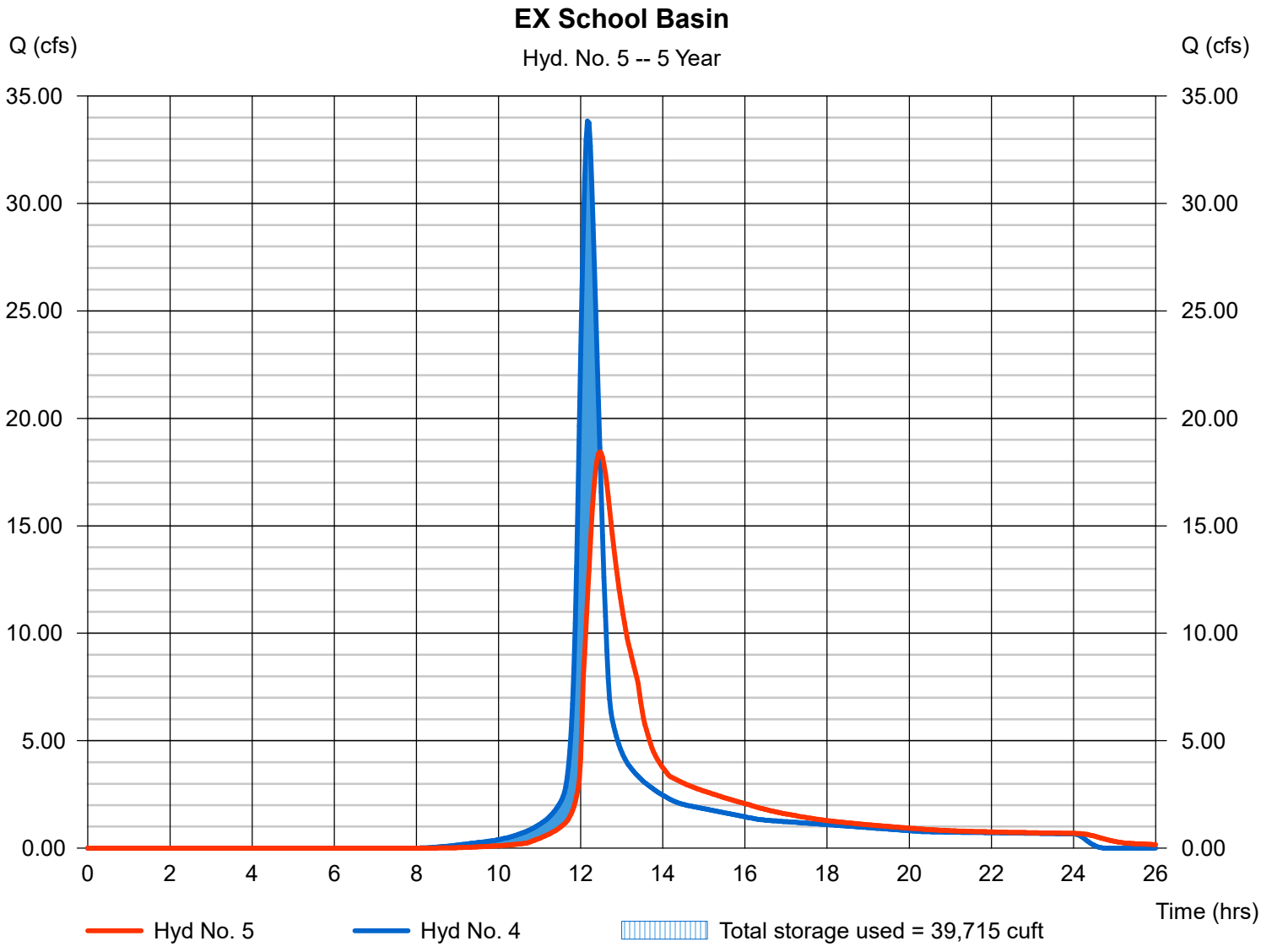
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	18.44 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	135,577 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	272.89 ft
Reservoir name	=	EX School Basin	Max. Storage	=	39,715 cuft

Storage Indication method used.



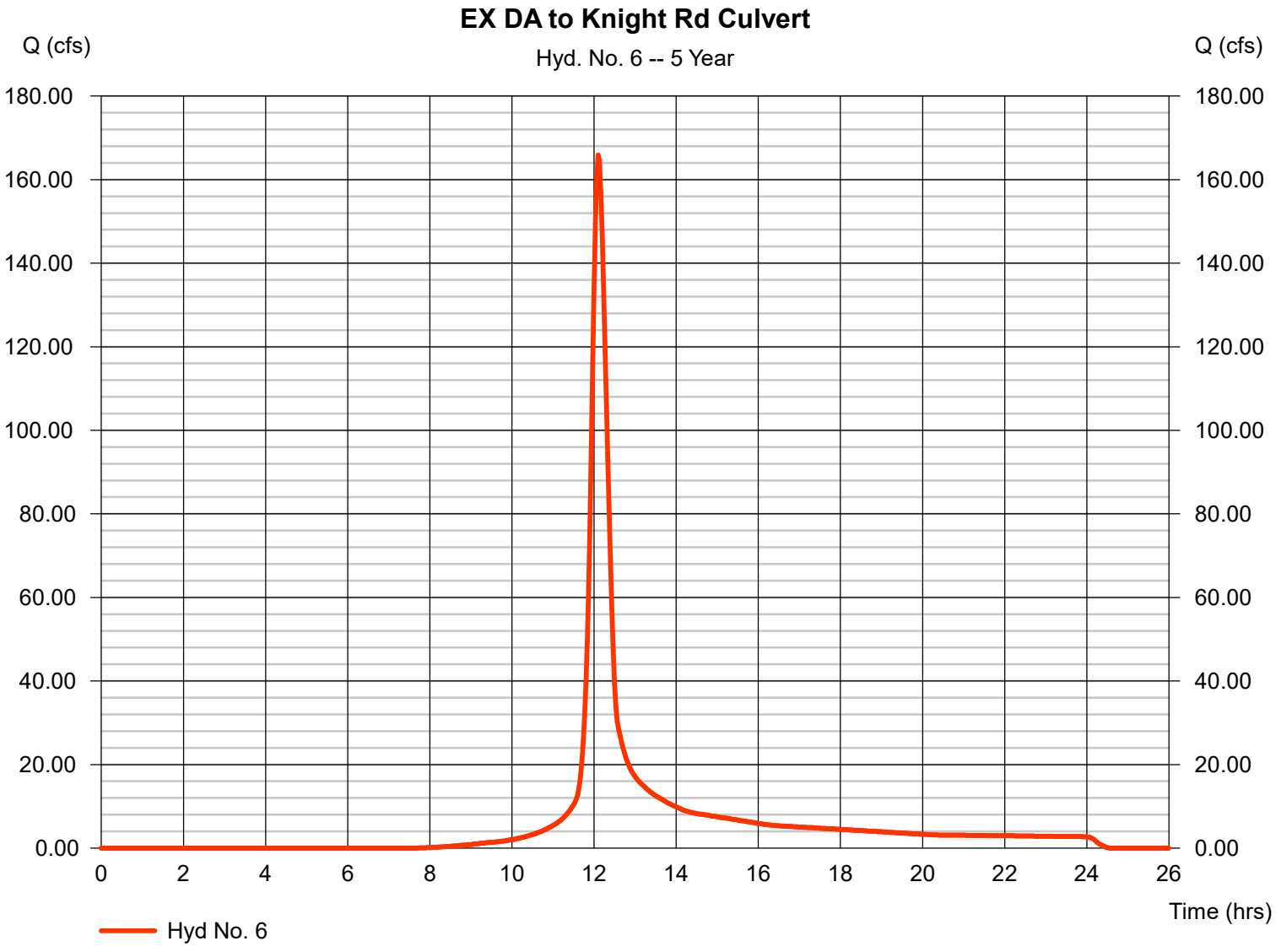
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	165.88 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	572,985 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



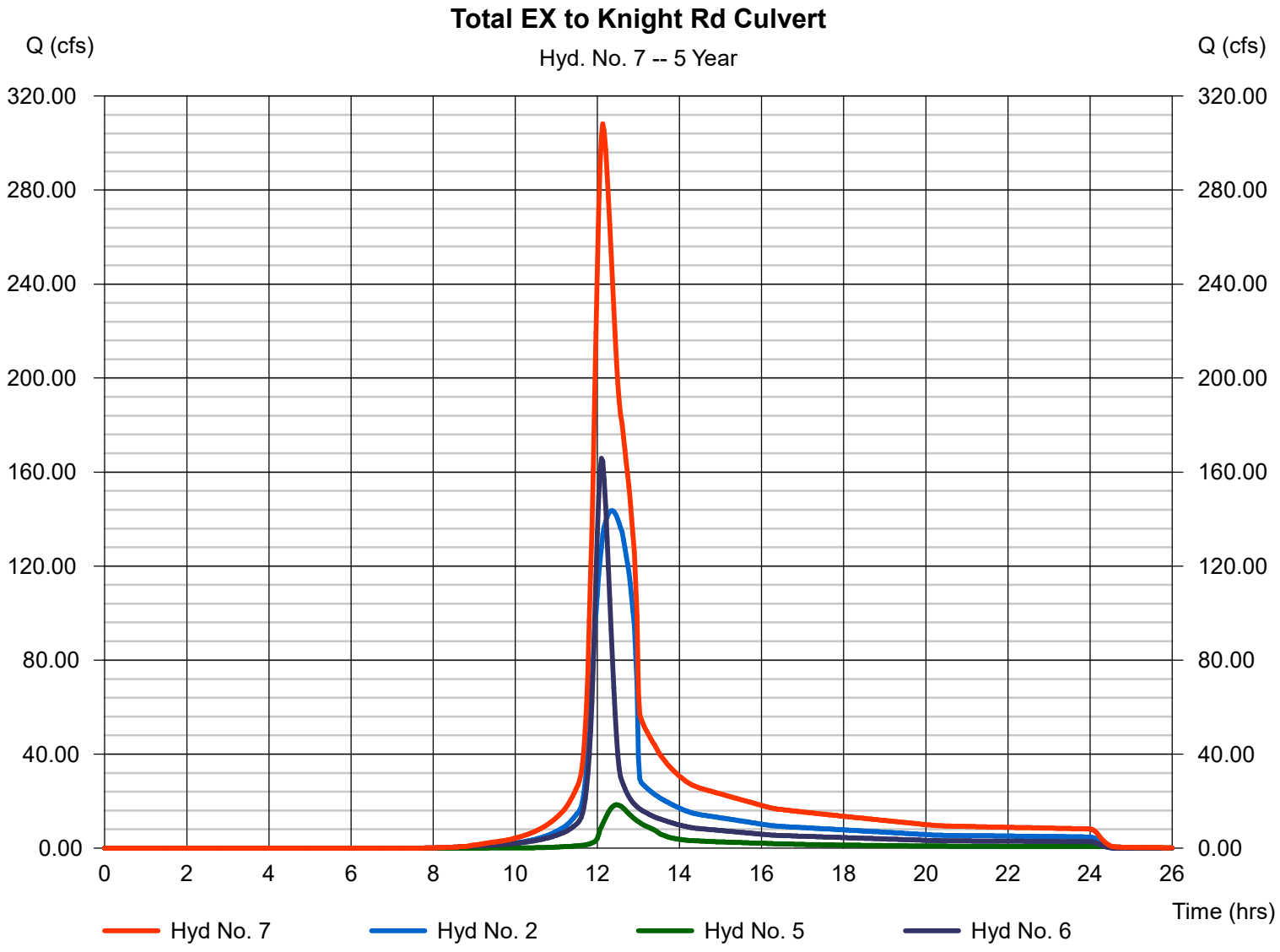
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 308.22 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,644,944 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

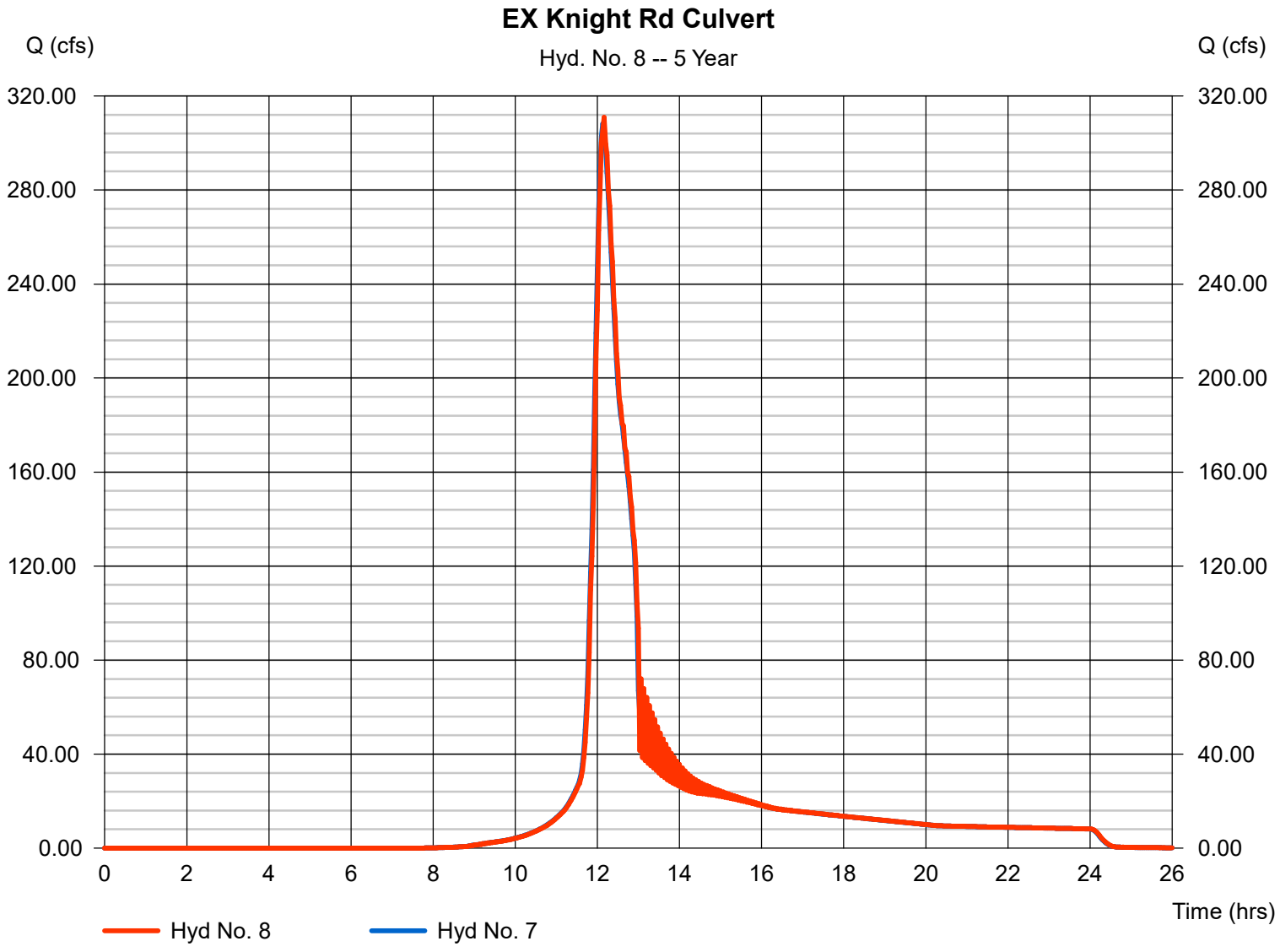
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	311.00 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,644,911 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	26.57 ft/s	Routing coeff.	=	1.9566

Modified Att-Kin routing method used.



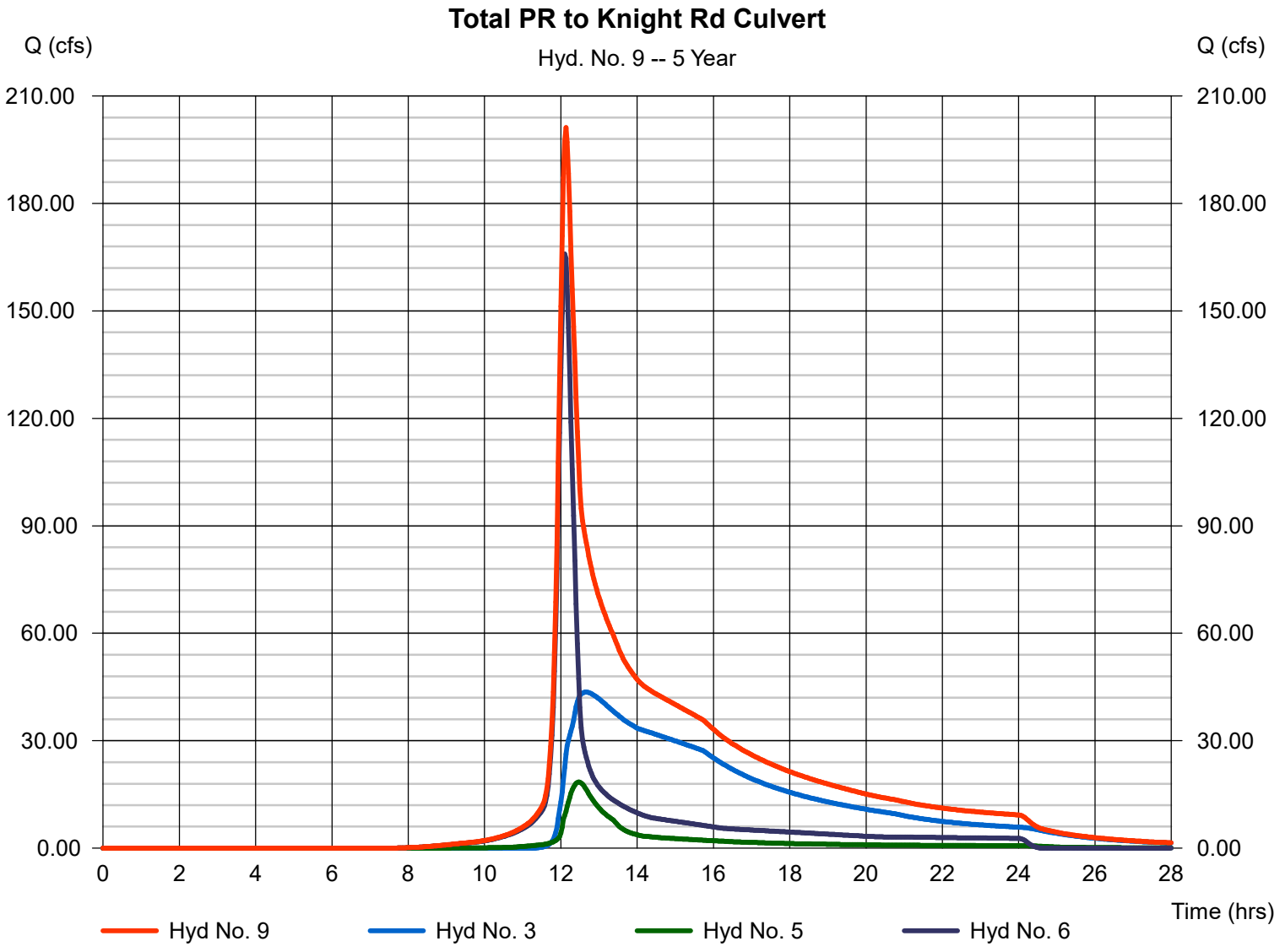
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 201.22 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,615,079 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

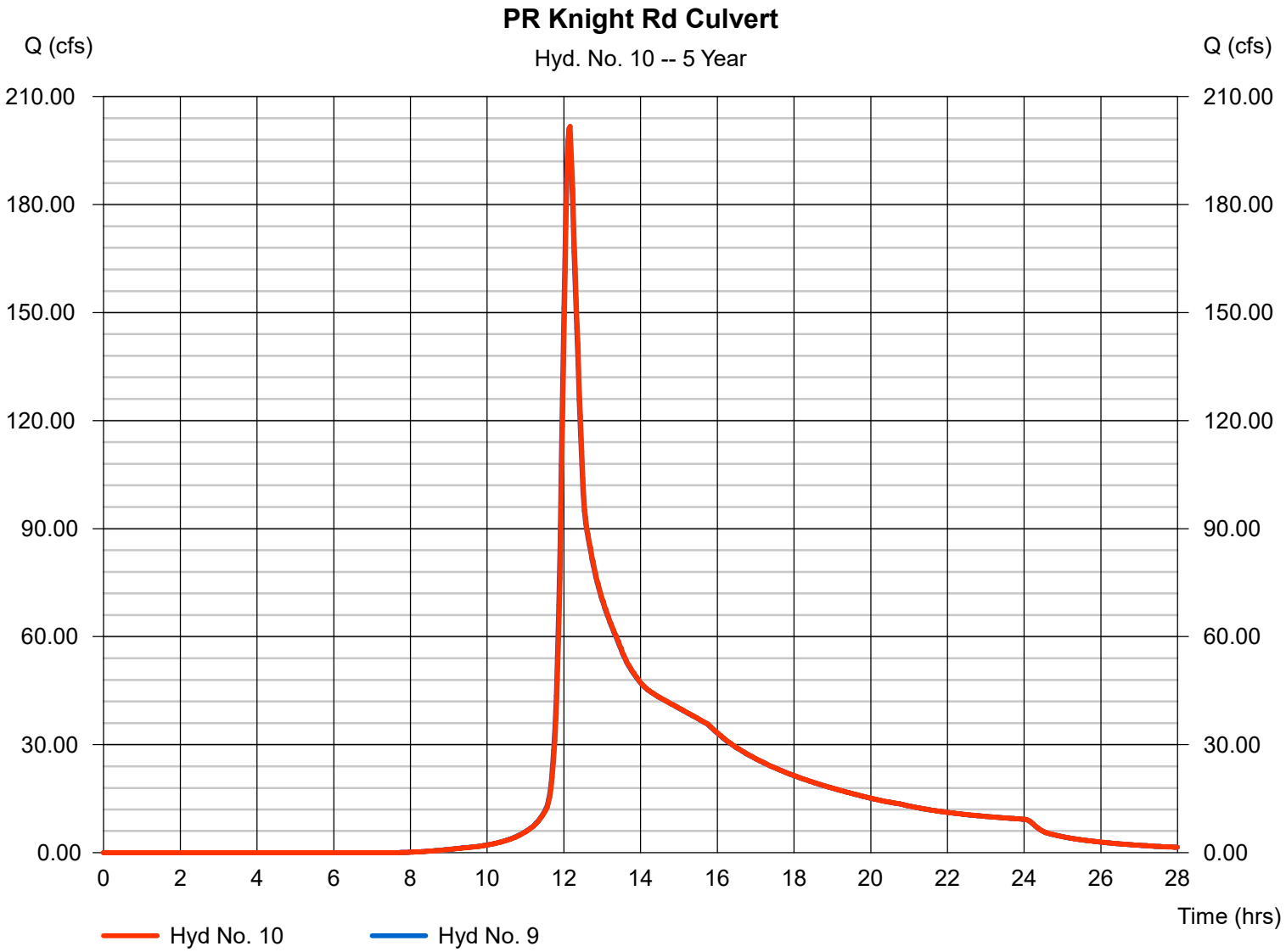
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	201.72 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,614,954 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	22.81 ft/s	Routing coeff.	=	1.9496

Modified Att-Kin routing method used.



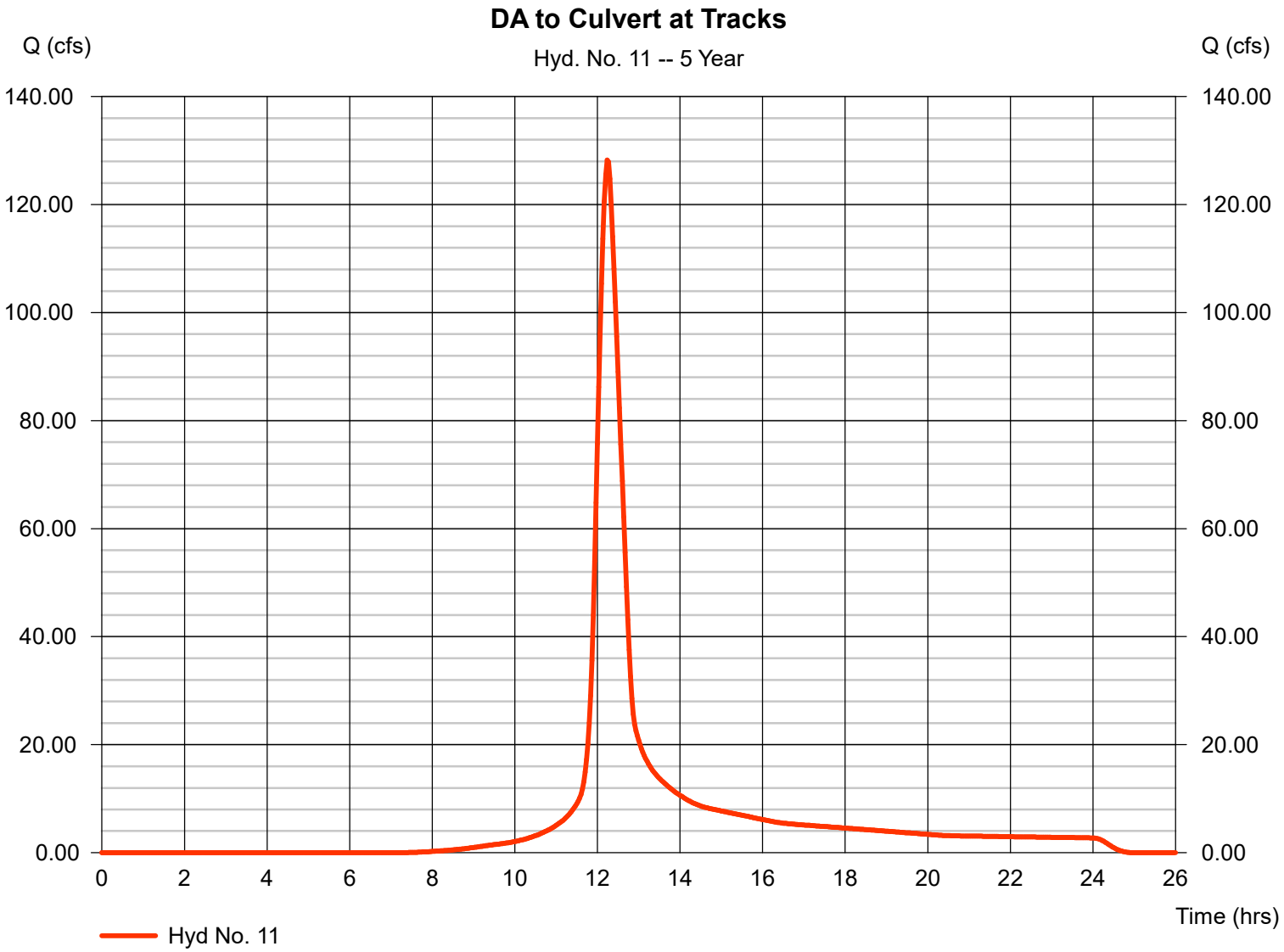
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	128.23 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	581,100 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



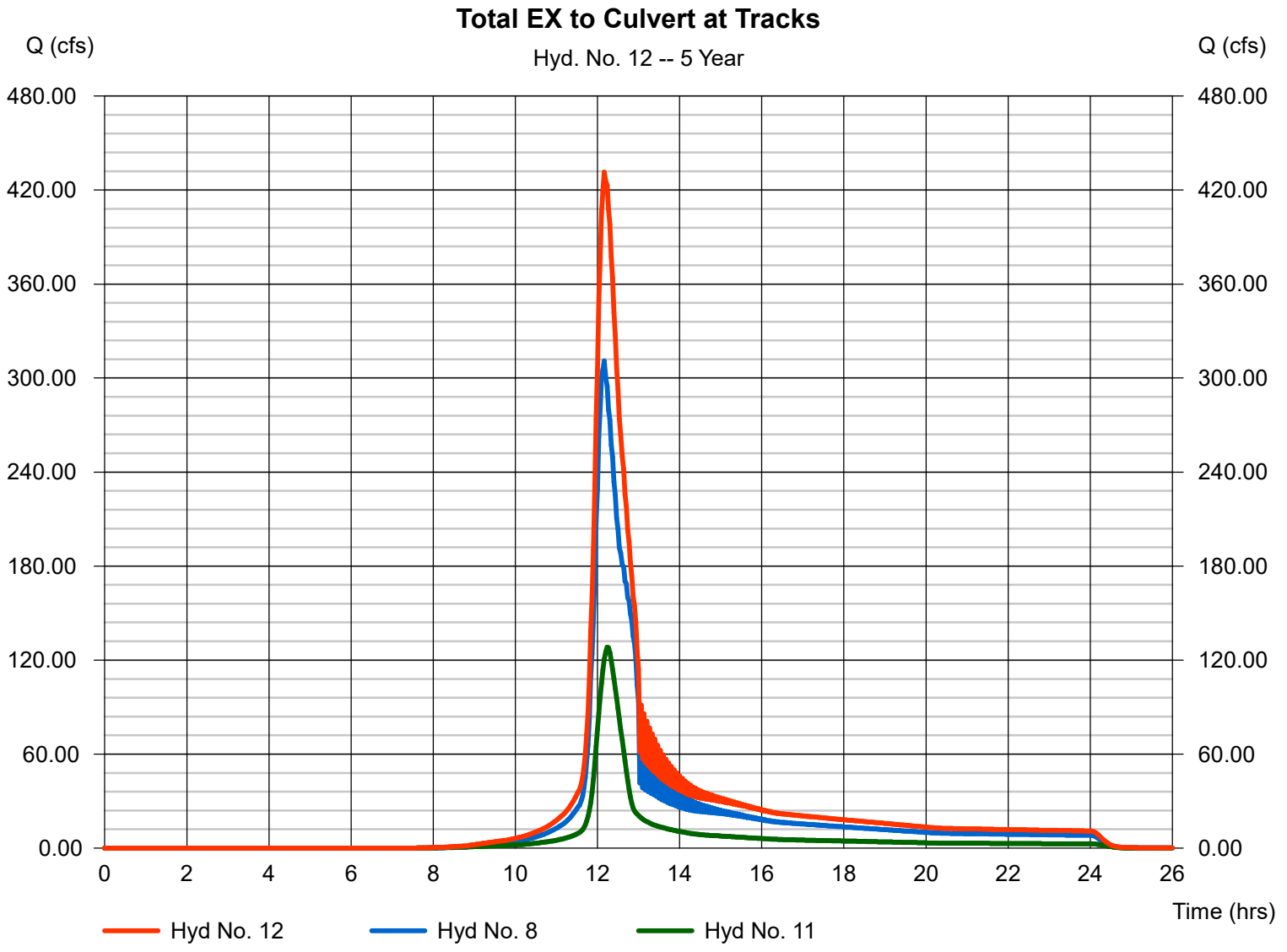
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 431.54 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,226,012 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



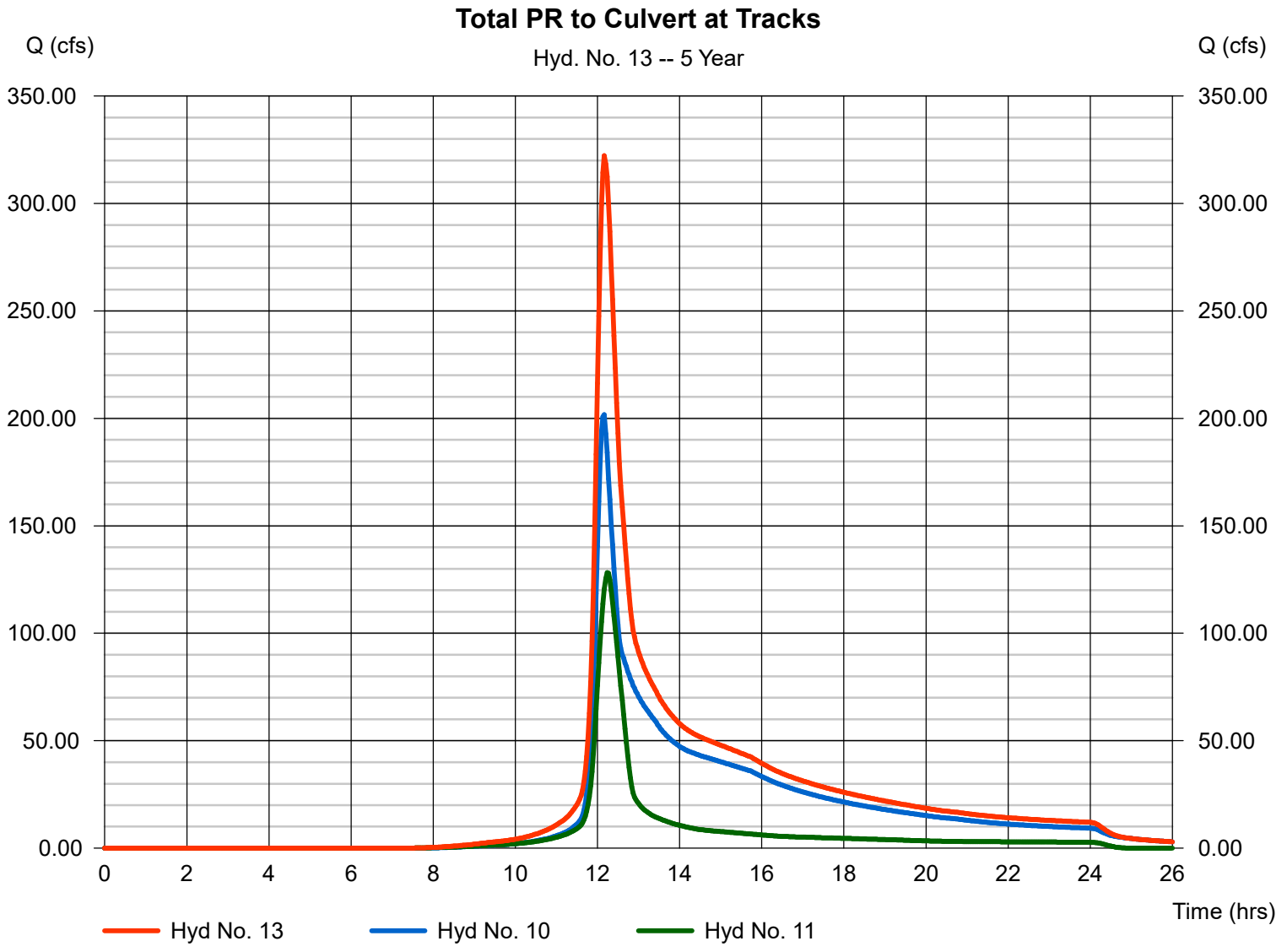
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 322.26 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,196,052 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	348.18	2	726	1,203,285	----	------	------	DA to Dam
2	Reservoir	155.32	2	744	1,203,227	1	258.61	245,448	EX Dam
3	Reservoir	62.56	2	754	1,173,364	1	256.68	571,479	PR Dam
4	SCS Runoff	43.17	2	730	172,509	----	------	------	DA to School Basin
5	Reservoir	24.40	2	748	172,501	4	273.29	49,337	EX School Basin
6	SCS Runoff	210.08	2	726	725,522	----	------	------	EX DA to Knight Rd Culvert
7	Combine	365.25	2	728	2,101,253	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	368.57	2	728	2,101,216	7	------	------	EX Knight Rd Culvert
9	Combine	254.17	2	728	2,071,385	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	254.20	2	728	2,071,259	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	161.67	2	734	732,316	----	------	------	DA to Culvert at Tracks
12	Combine	518.45	2	732	2,833,535	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	406.73	2	730	2,803,575	10, 11,	------	------	Total PR to Culvert at Tracks

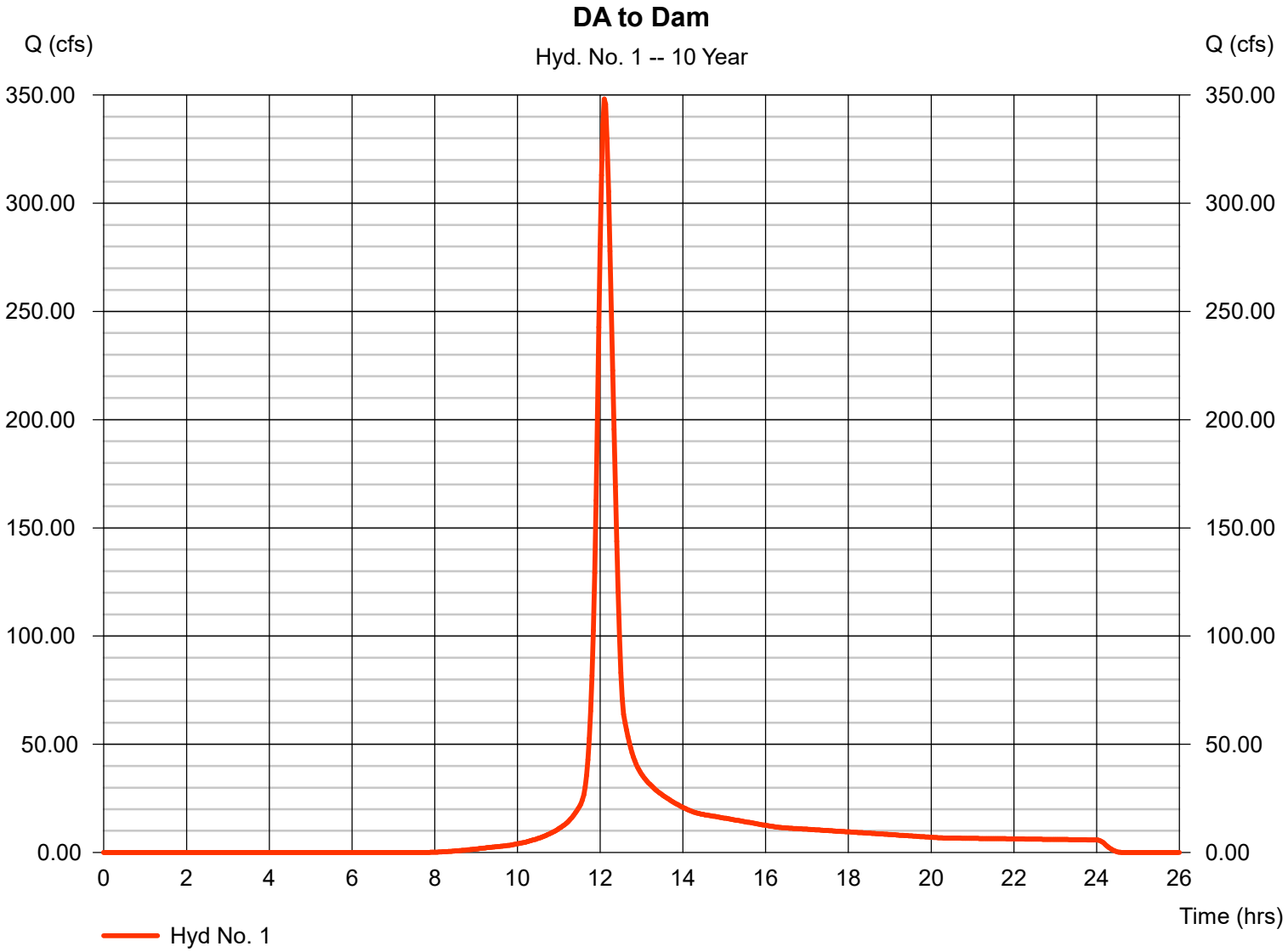
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	348.18 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,203,285 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

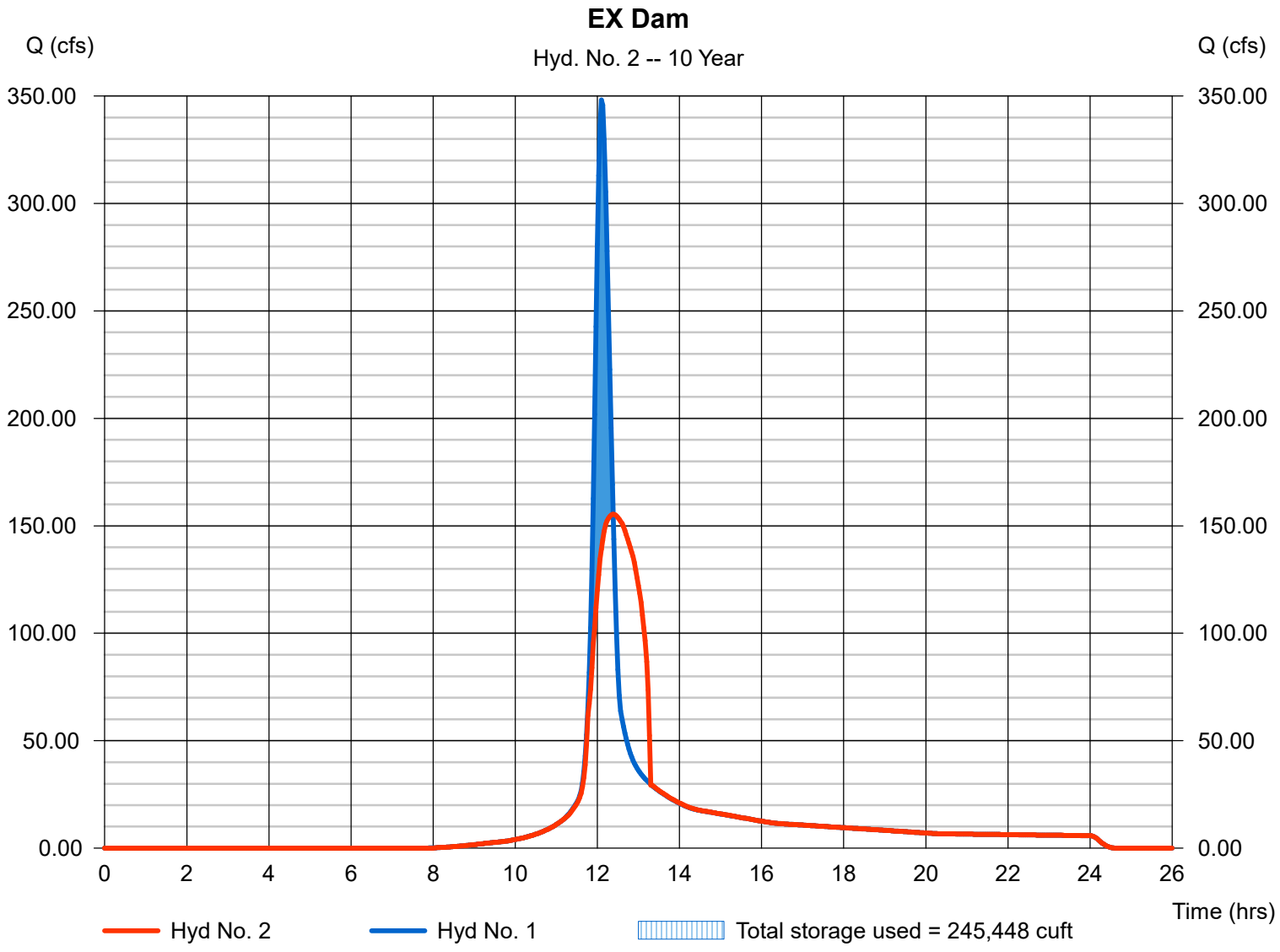
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	155.32 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	1,203,227 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	258.61 ft
Reservoir name	=	EX Dam	Max. Storage	=	245,448 cuft

Storage Indication method used.



Hydrograph Report

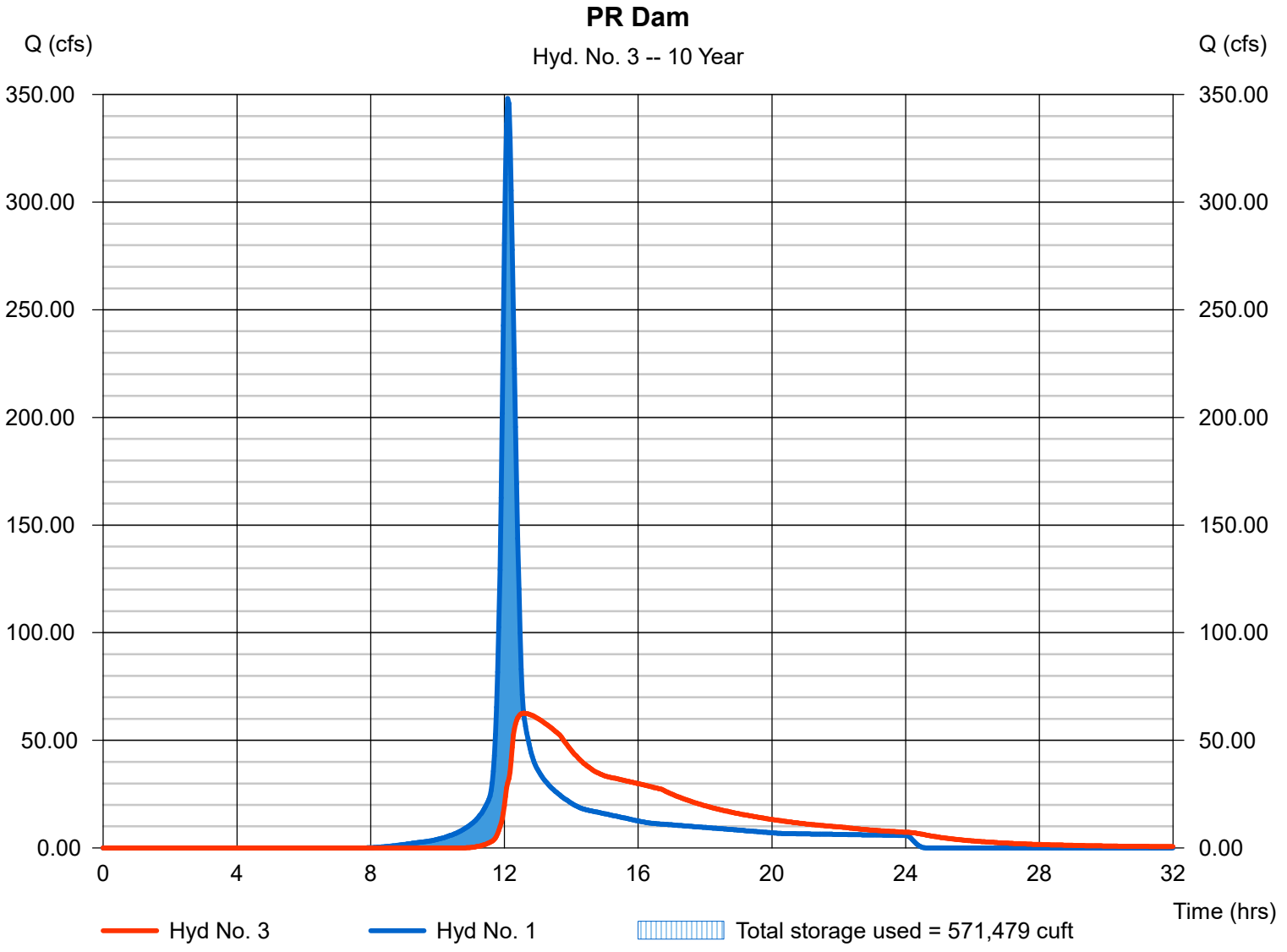
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	62.56 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.57 hrs
Time interval	=	2 min	Hyd. volume	=	1,173,364 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	256.68 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	571,479 cuft

Storage Indication method used.



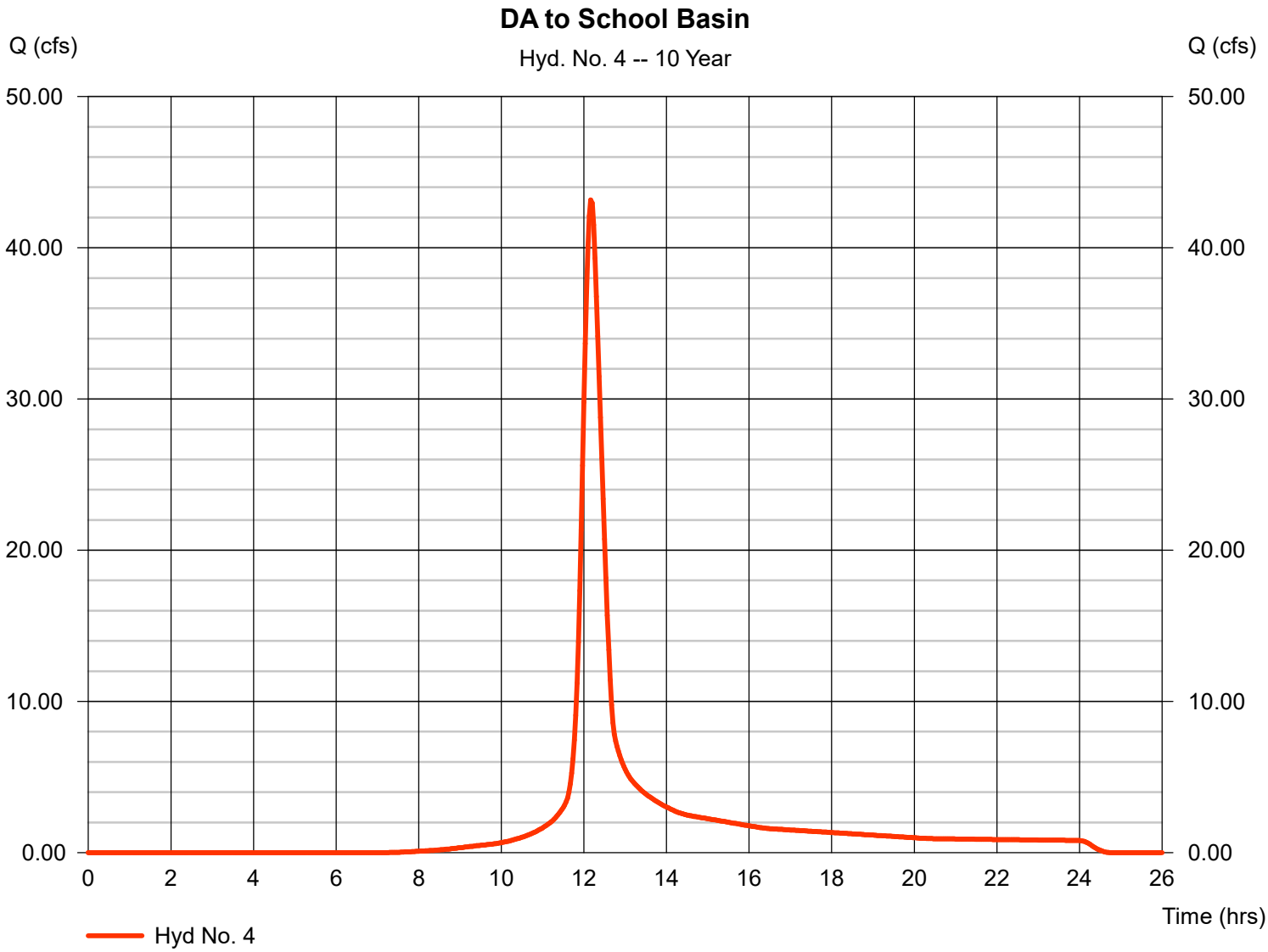
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.17 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	172,509 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

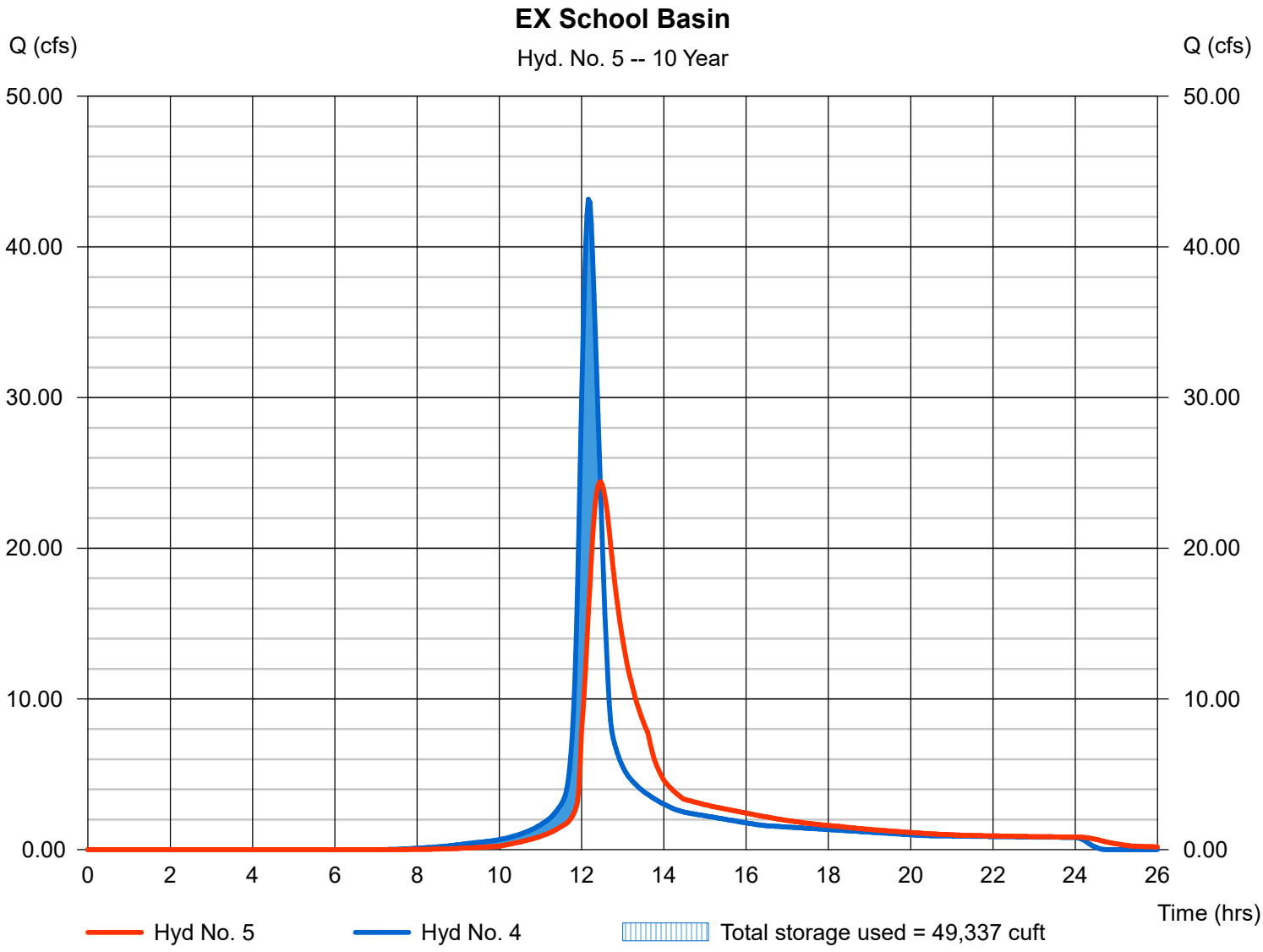
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	24.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	172,501 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	273.29 ft
Reservoir name	=	EX School Basin	Max. Storage	=	49,337 cuft

Storage Indication method used.



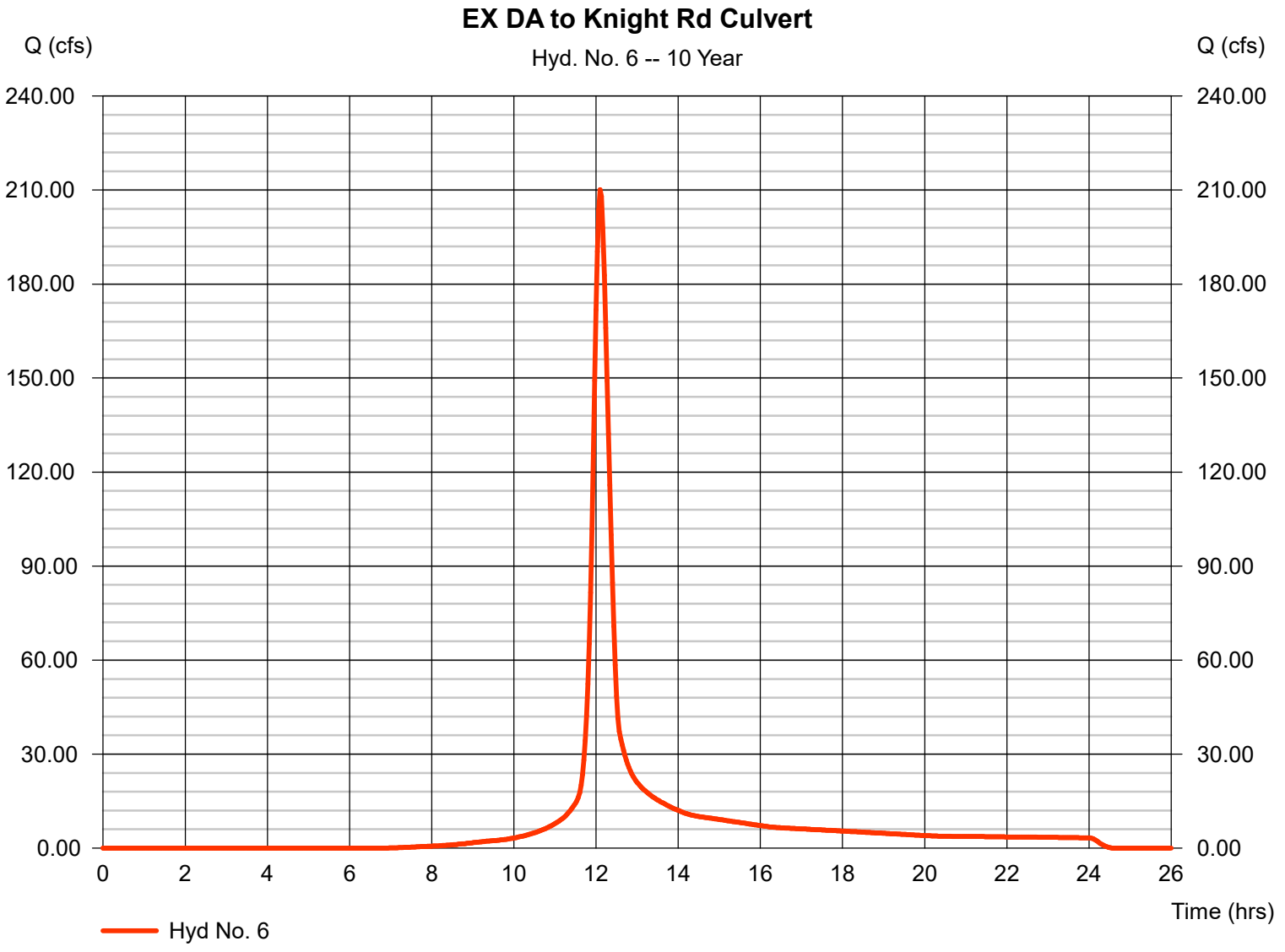
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	210.08 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	725,522 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



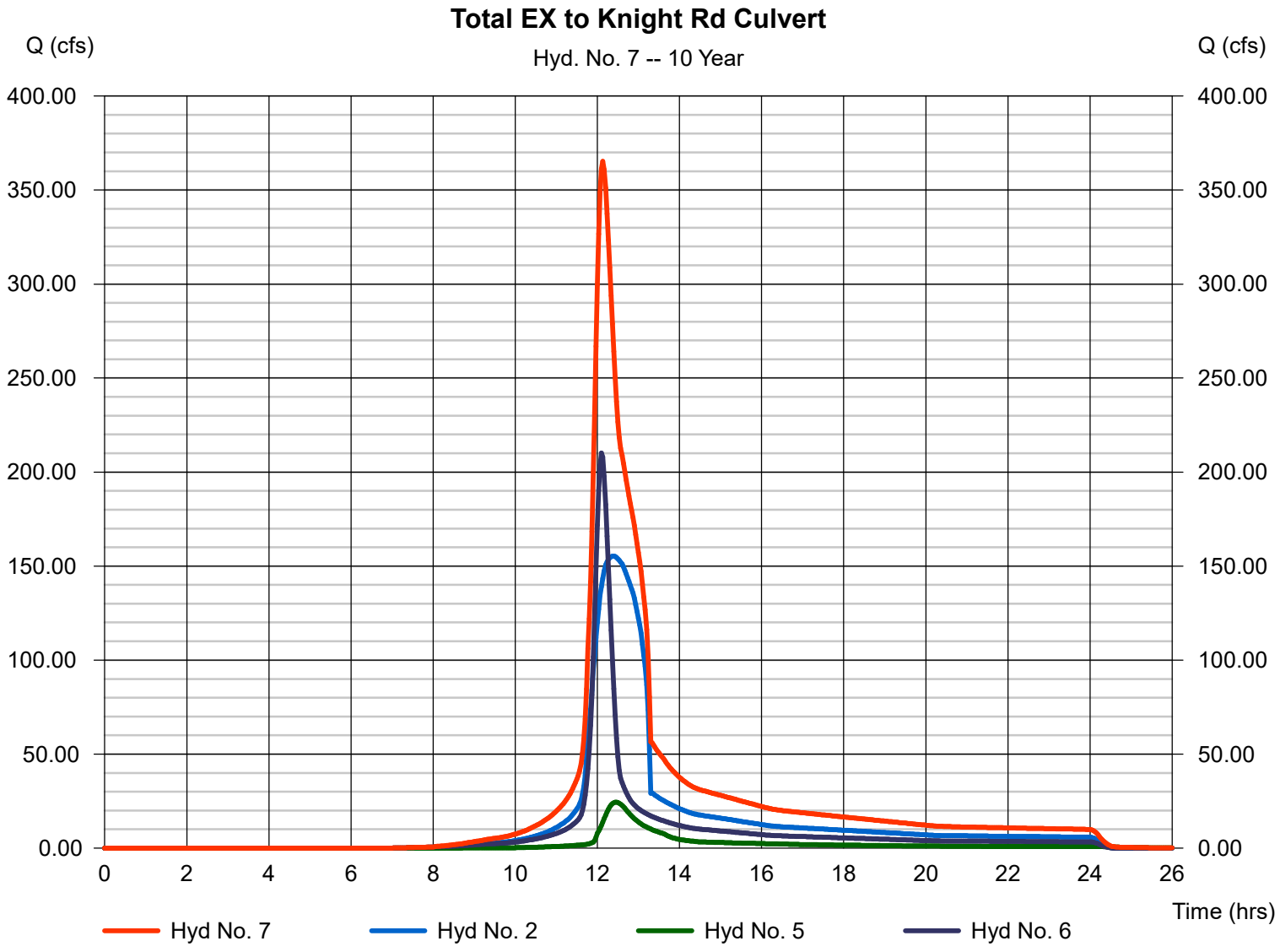
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 365.25 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,101,253 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

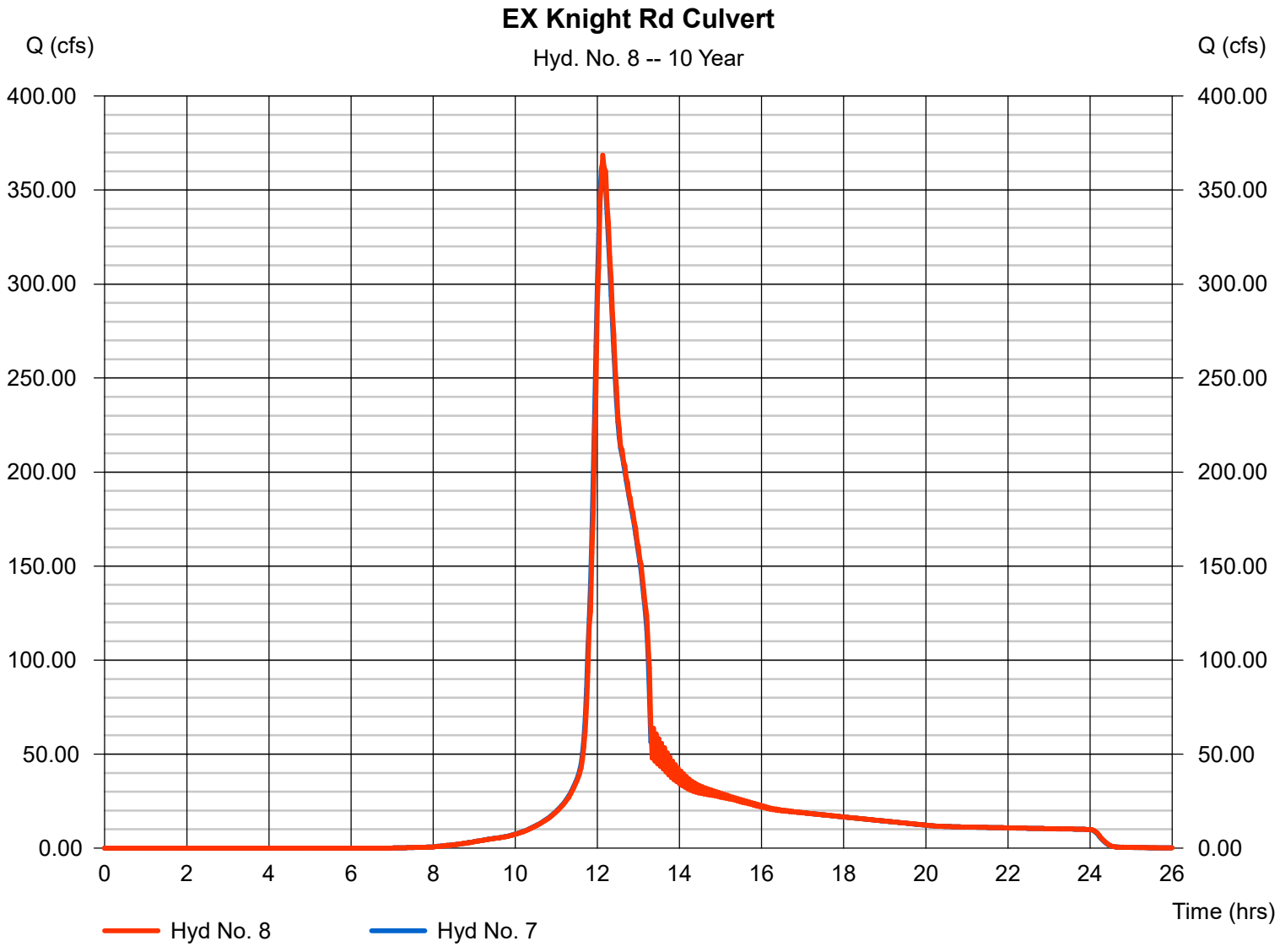
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	368.57 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,101,216 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	28.23 ft/s	Routing coeff.	=	1.9591

Modified Att-Kin routing method used.



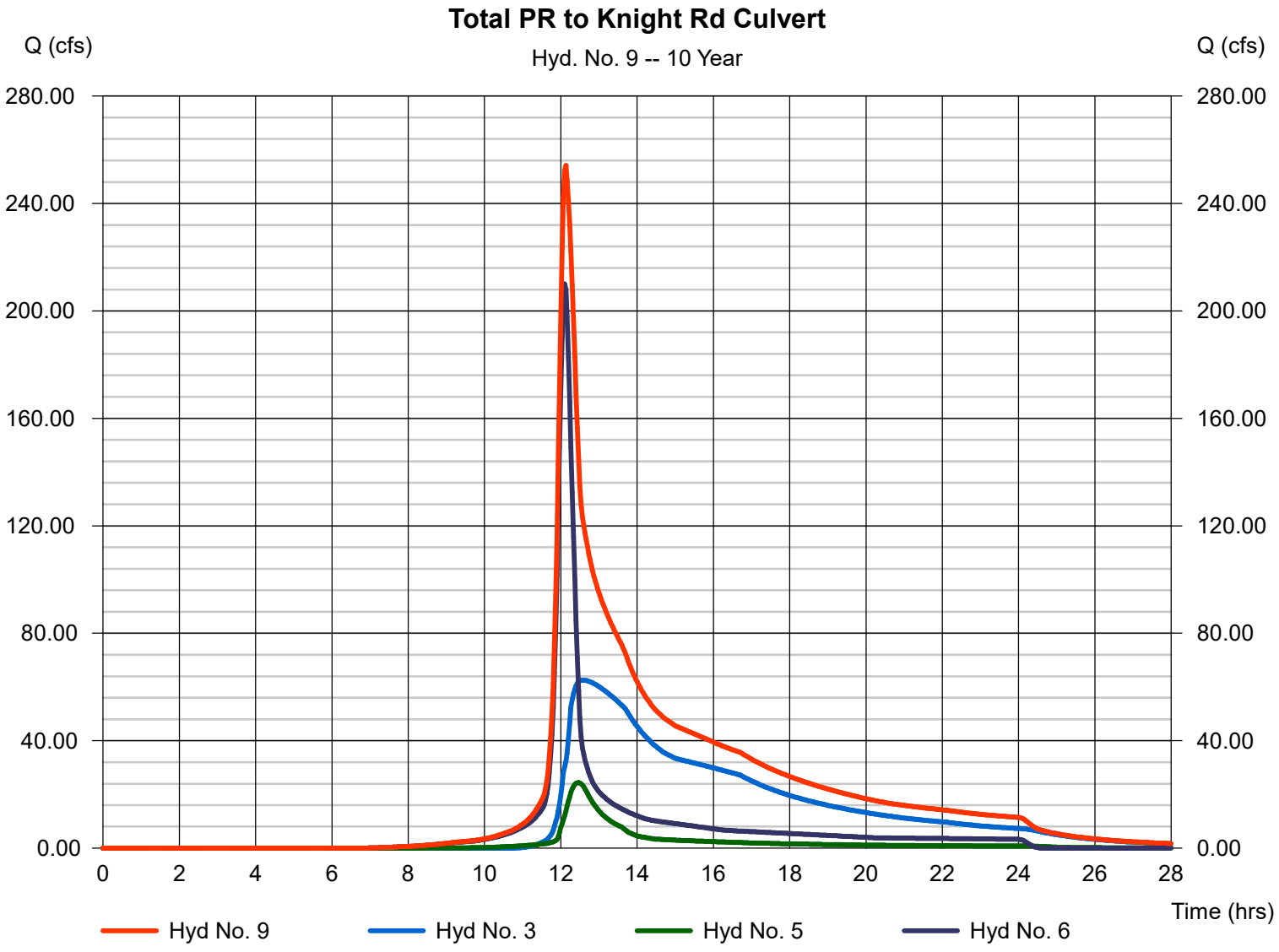
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 254.17 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,071,385 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

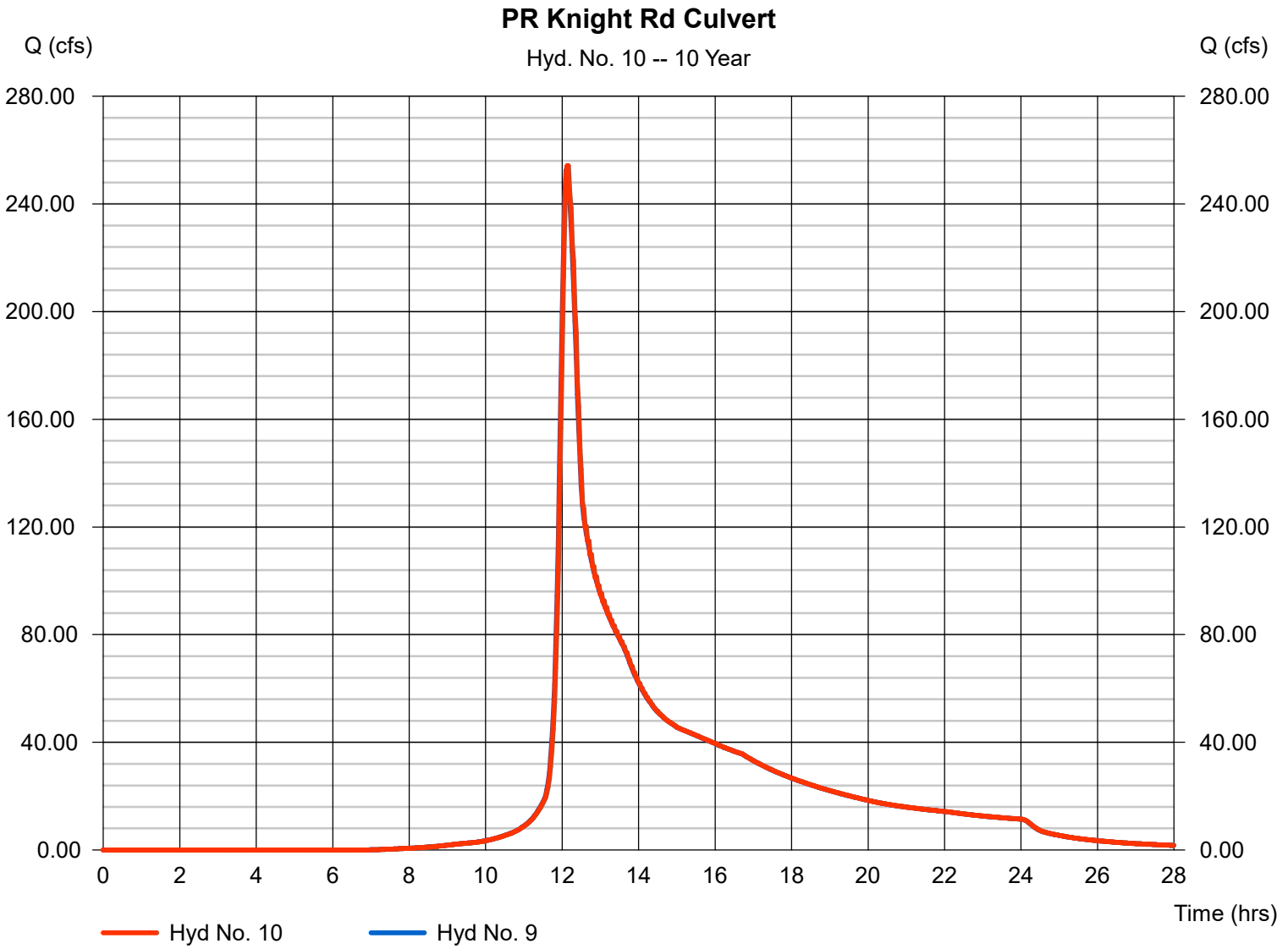
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	254.20 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,071,259 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	24.80 ft/s	Routing coeff.	=	1.9536

Modified Att-Kin routing method used.



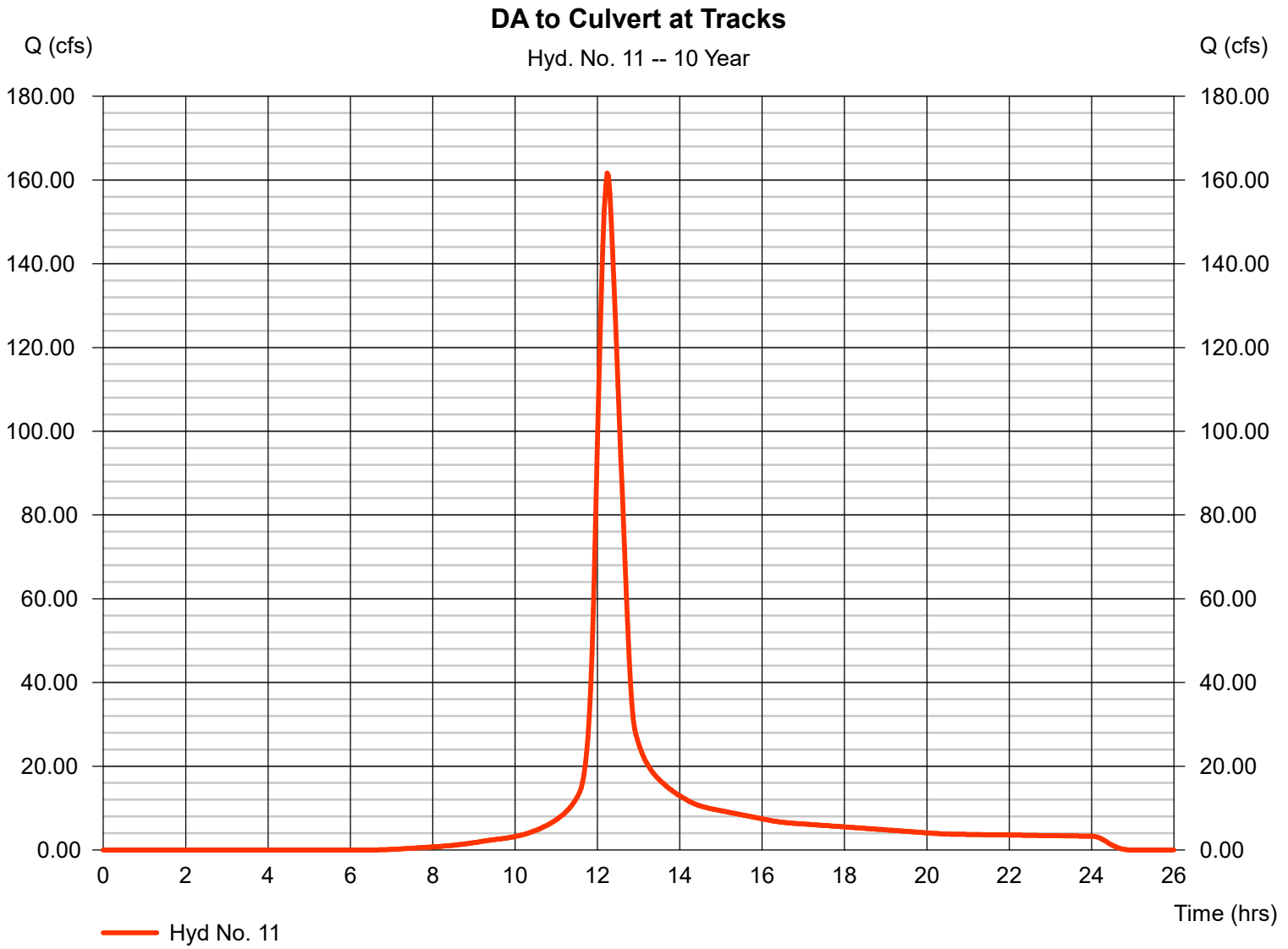
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	161.67 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	732,316 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



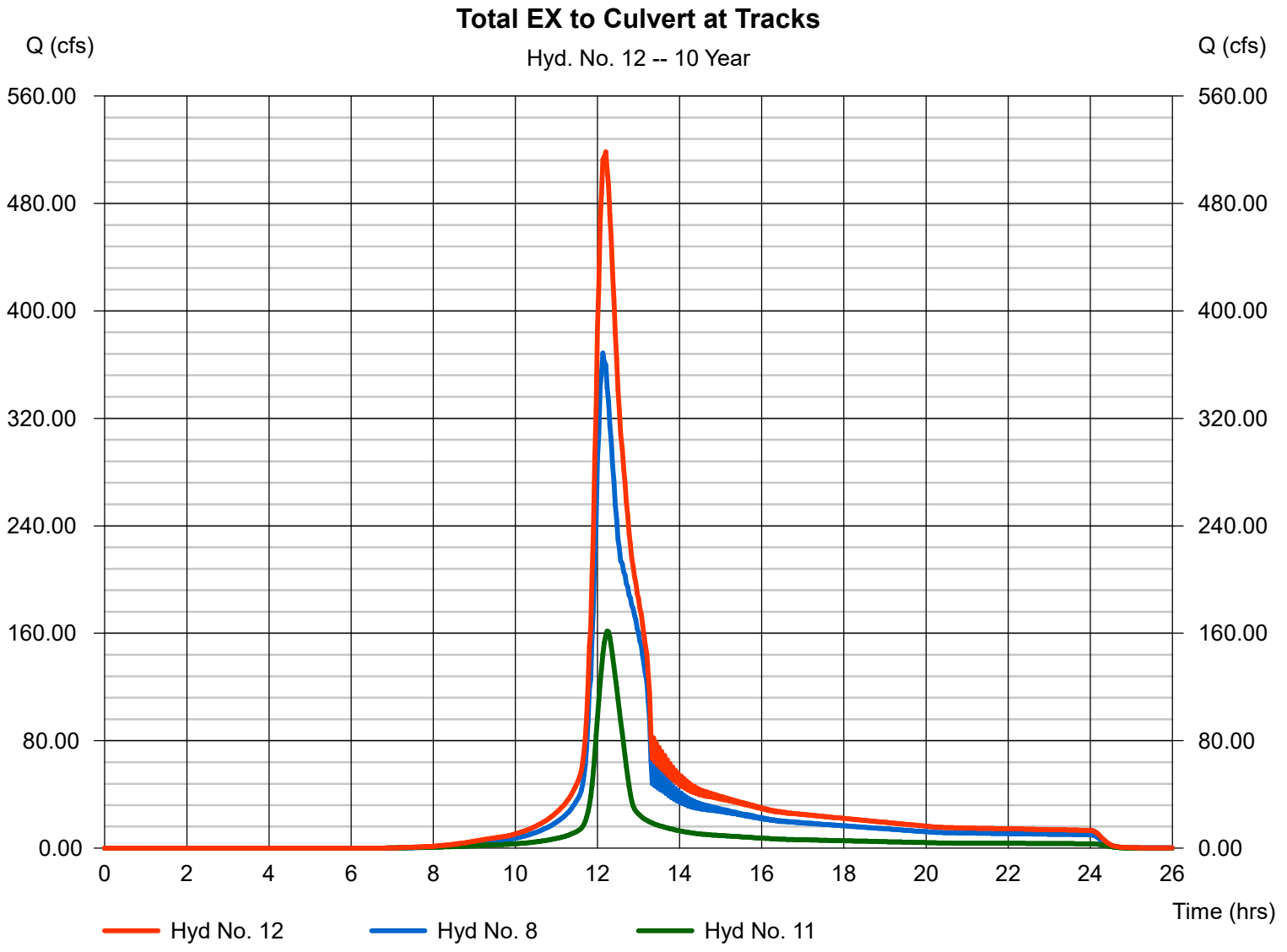
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 518.45 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 2,833,535 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



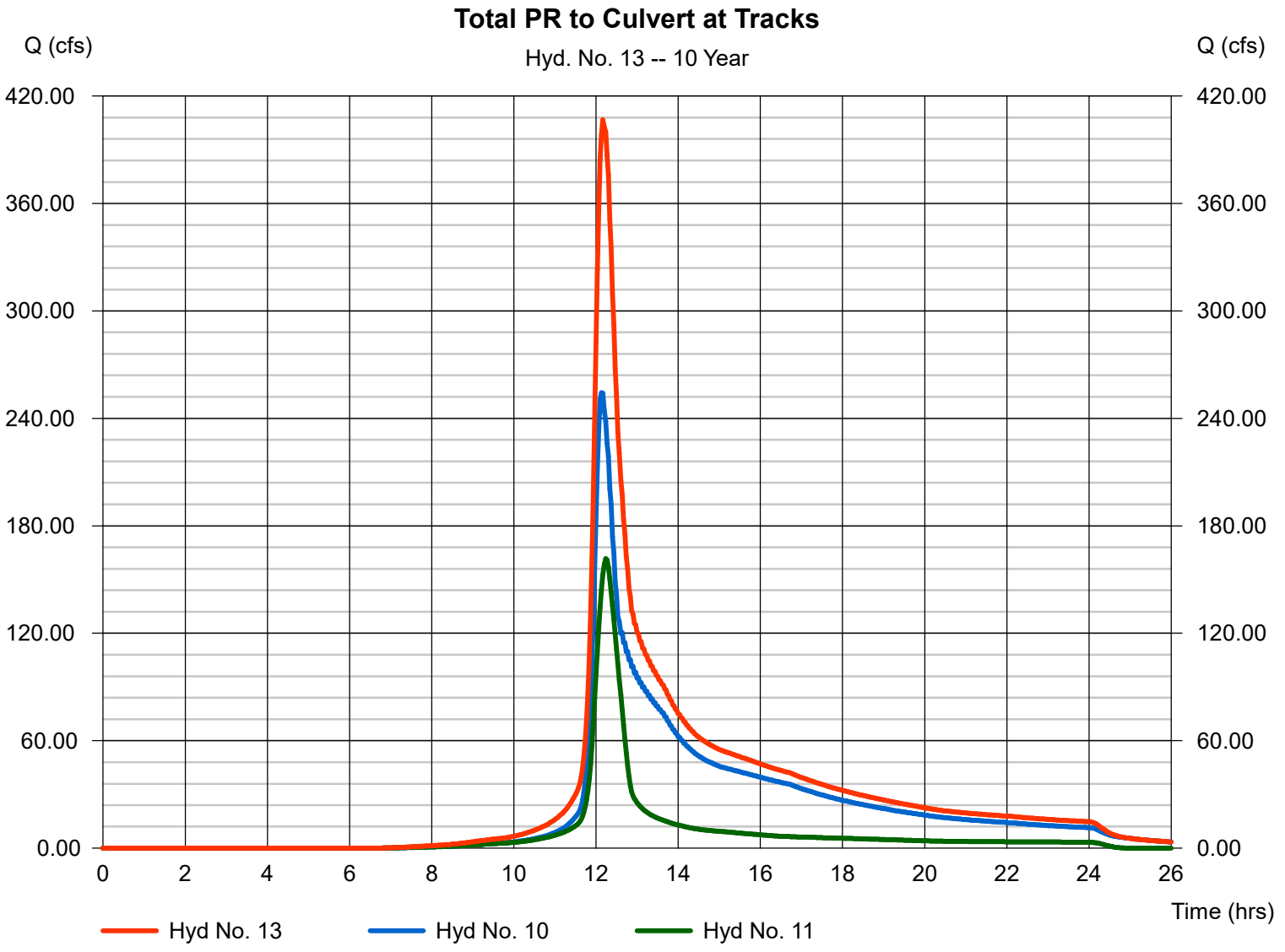
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 406.73 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,803,575 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	462.79	2	726	1,598,249	----	------	------	DA to Dam
2	Reservoir	188.75	2	744	1,598,191	1	260.23	390,897	EX Dam
3	Reservoir	85.01	2	754	1,568,328	1	258.16	769,690	PR Dam
4	SCS Runoff	56.70	2	730	226,814	----	------	------	DA to School Basin
5	Reservoir	33.06	2	746	226,806	4	273.90	63,633	EX School Basin
6	SCS Runoff	273.90	2	726	949,184	----	------	------	EX DA to Knight Rd Culvert
7	Combine	444.90	2	728	2,774,184	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	445.40	2	728	2,774,151	7	------	------	EX Knight Rd Culvert
9	Combine	344.24	2	728	2,744,325	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	344.56	2	728	2,744,193	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	209.86	2	734	953,392	----	------	------	DA to Culvert at Tracks
12	Combine	643.34	2	730	3,727,539	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	542.85	2	730	3,697,583	10, 11,	------	------	Total PR to Culvert at Tracks

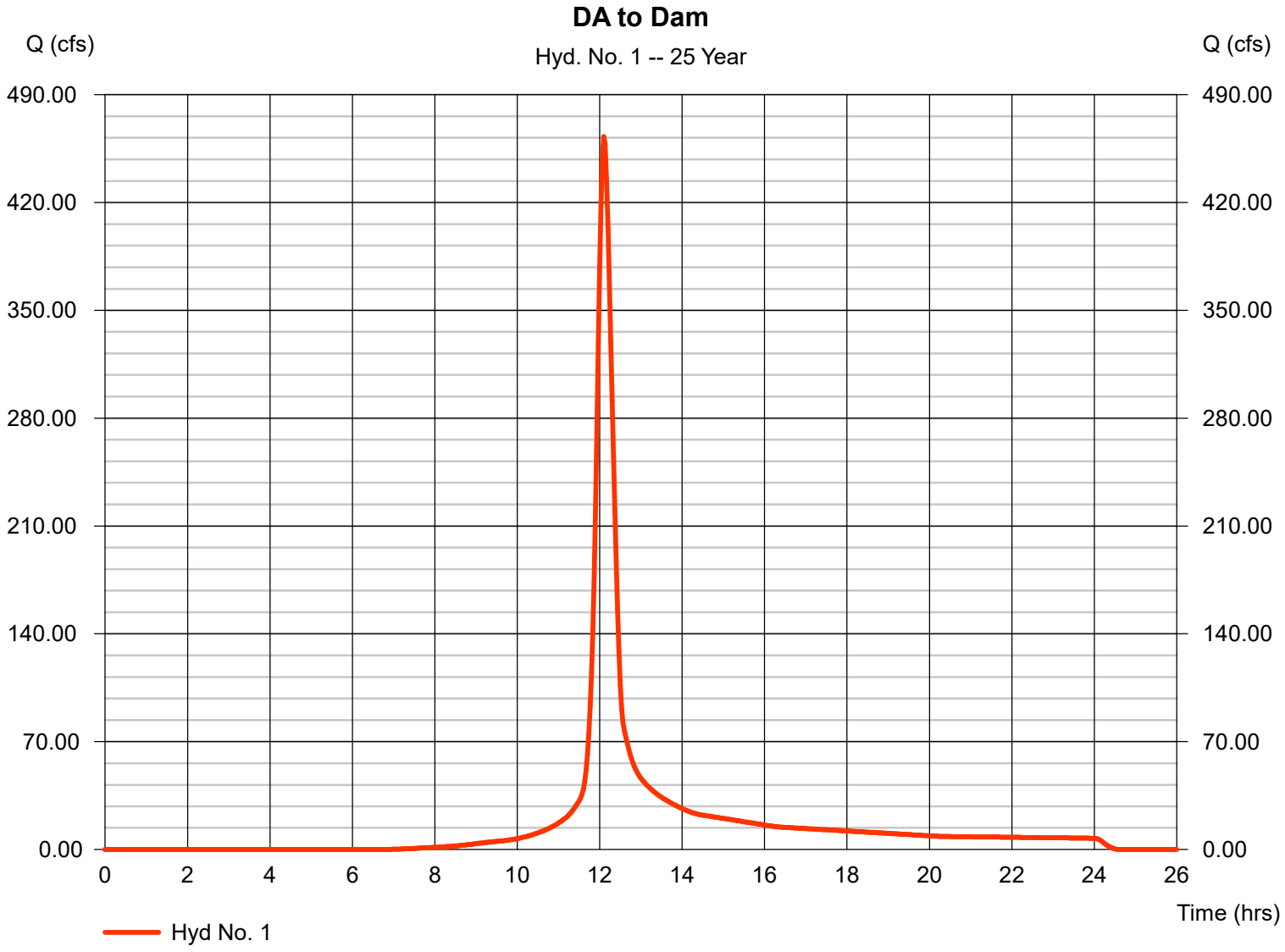
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	462.79 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,598,249 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

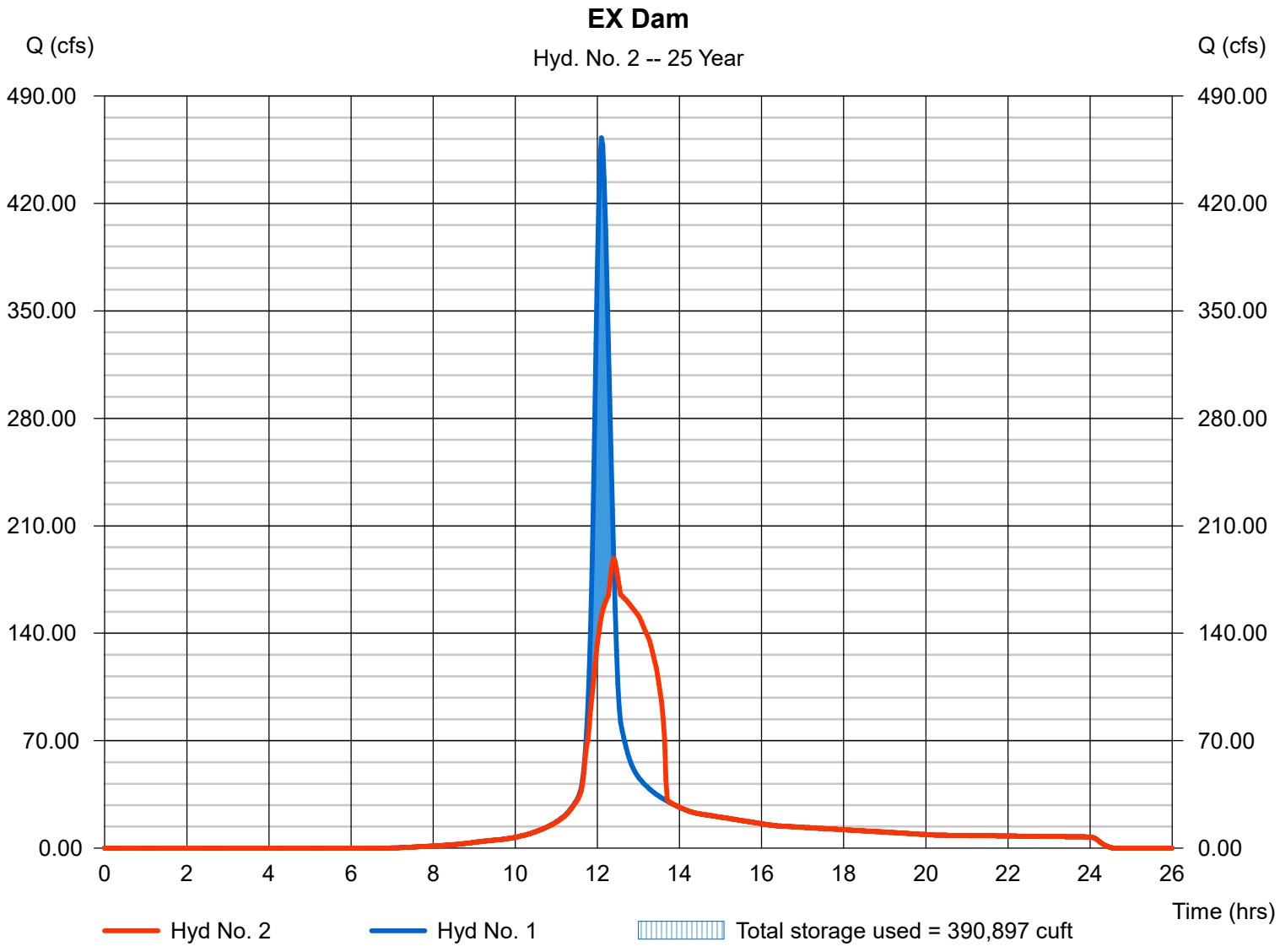
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	188.75 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	1,598,191 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	260.23 ft
Reservoir name	=	EX Dam	Max. Storage	=	390,897 cuft

Storage Indication method used.



Hydrograph Report

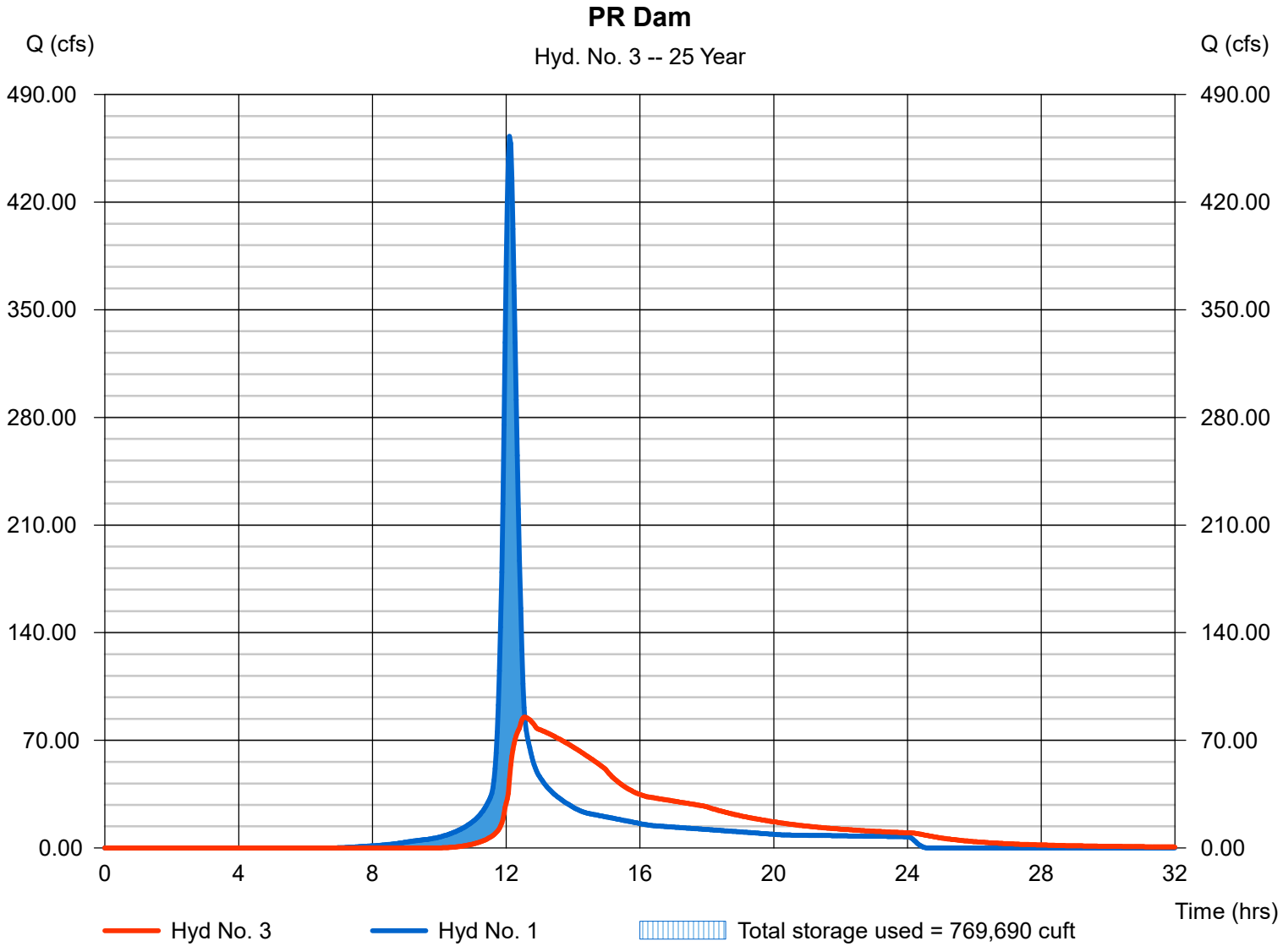
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	85.01 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.57 hrs
Time interval	=	2 min	Hyd. volume	=	1,568,328 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	258.16 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	769,690 cuft

Storage Indication method used.



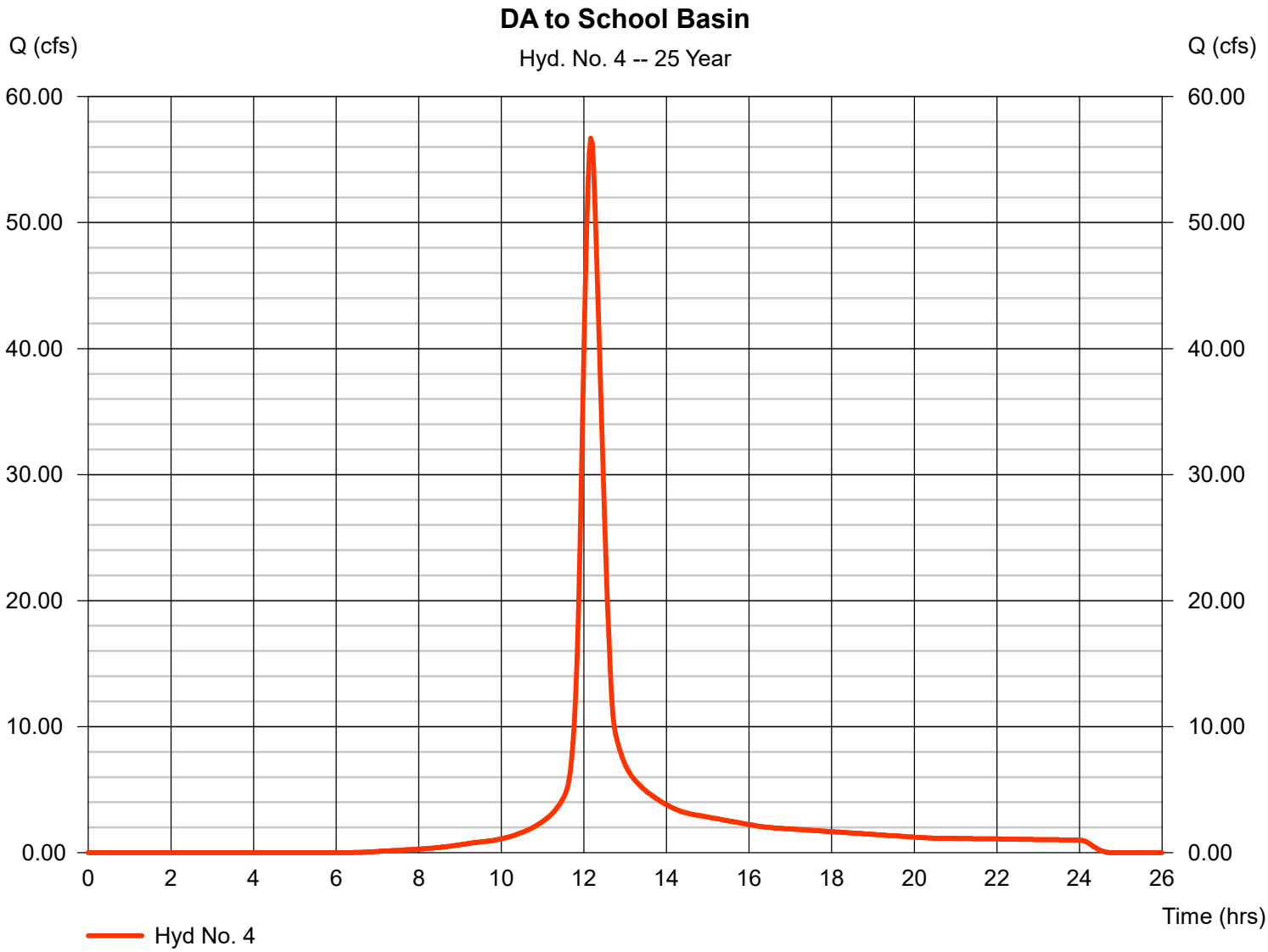
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	226,814 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

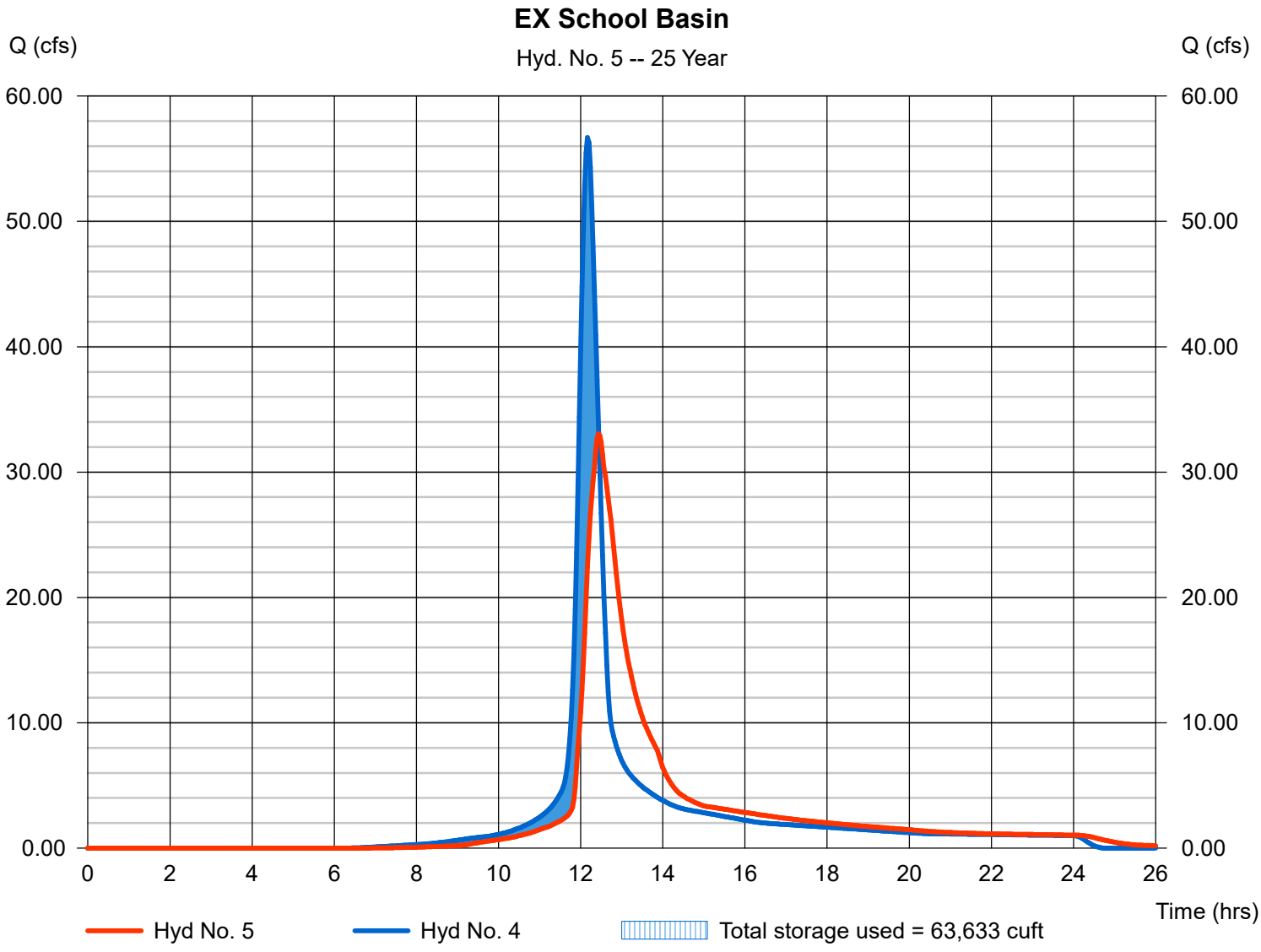
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	33.06 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.43 hrs
Time interval	=	2 min	Hyd. volume	=	226,806 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	273.90 ft
Reservoir name	=	EX School Basin	Max. Storage	=	63,633 cuft

Storage Indication method used.



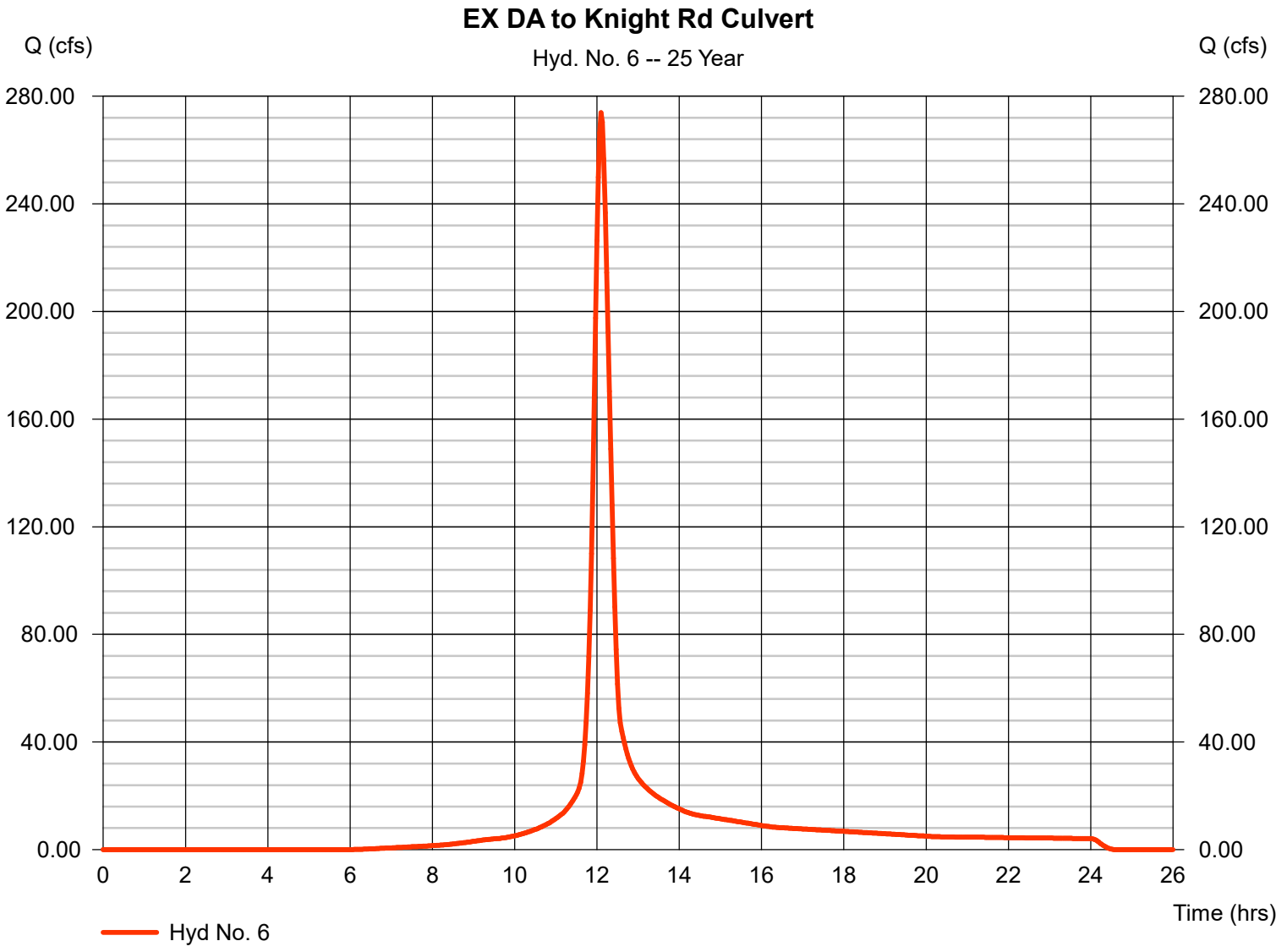
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	273.90 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	949,184 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



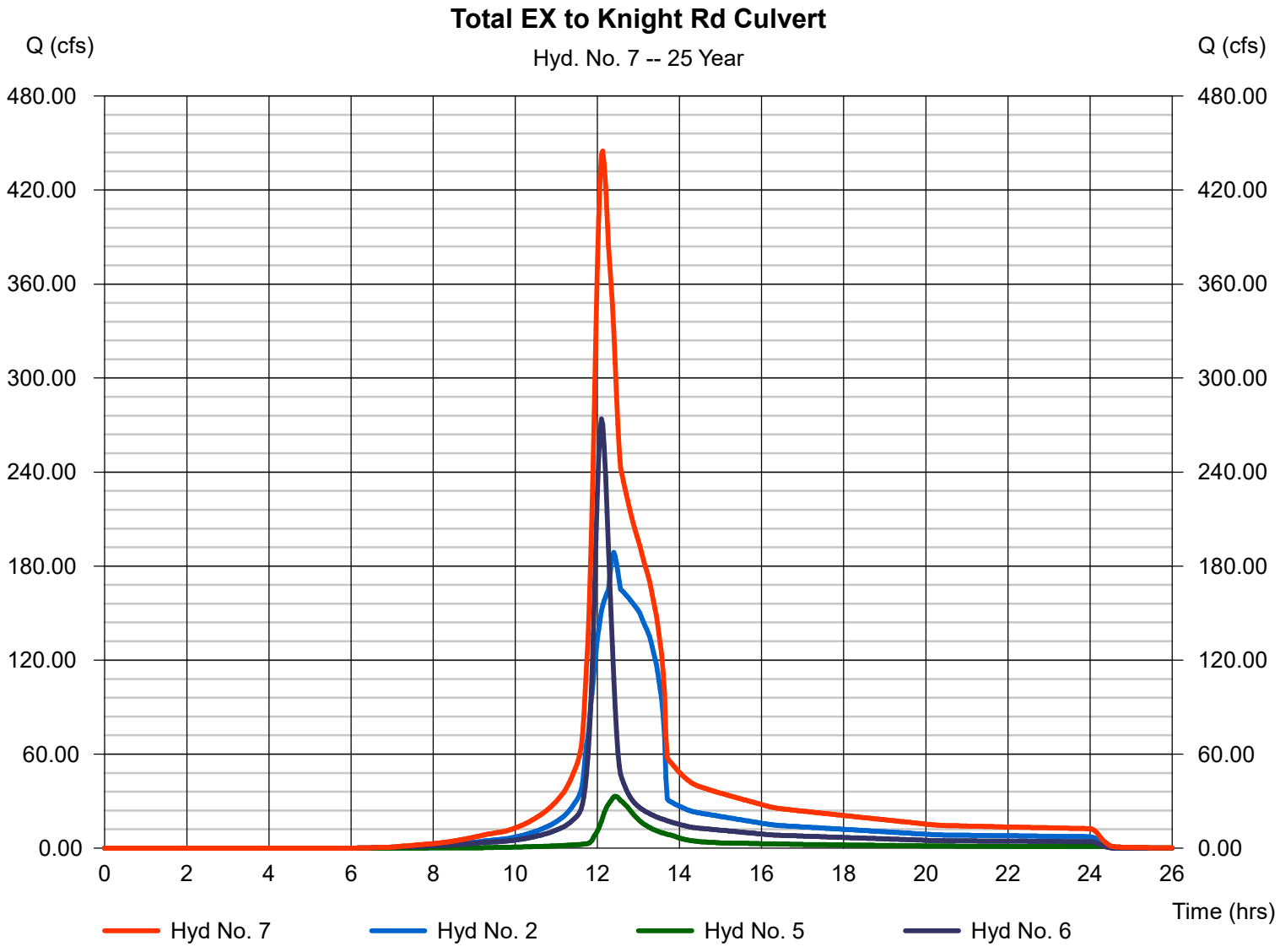
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 444.90 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,774,184 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

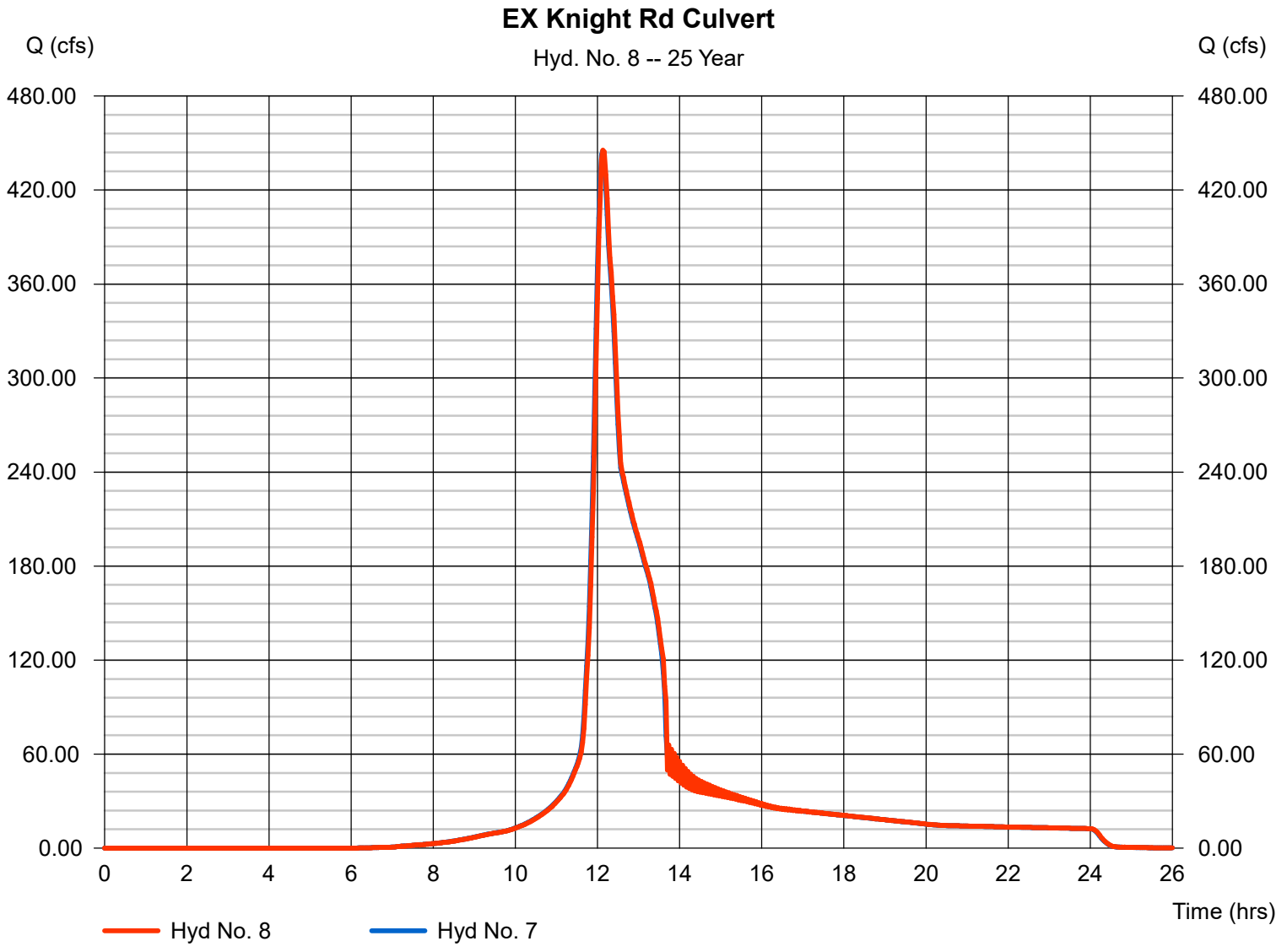
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	445.40 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,774,151 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	30.29 ft/s	Routing coeff.	=	1.9618

Modified Att-Kin routing method used.



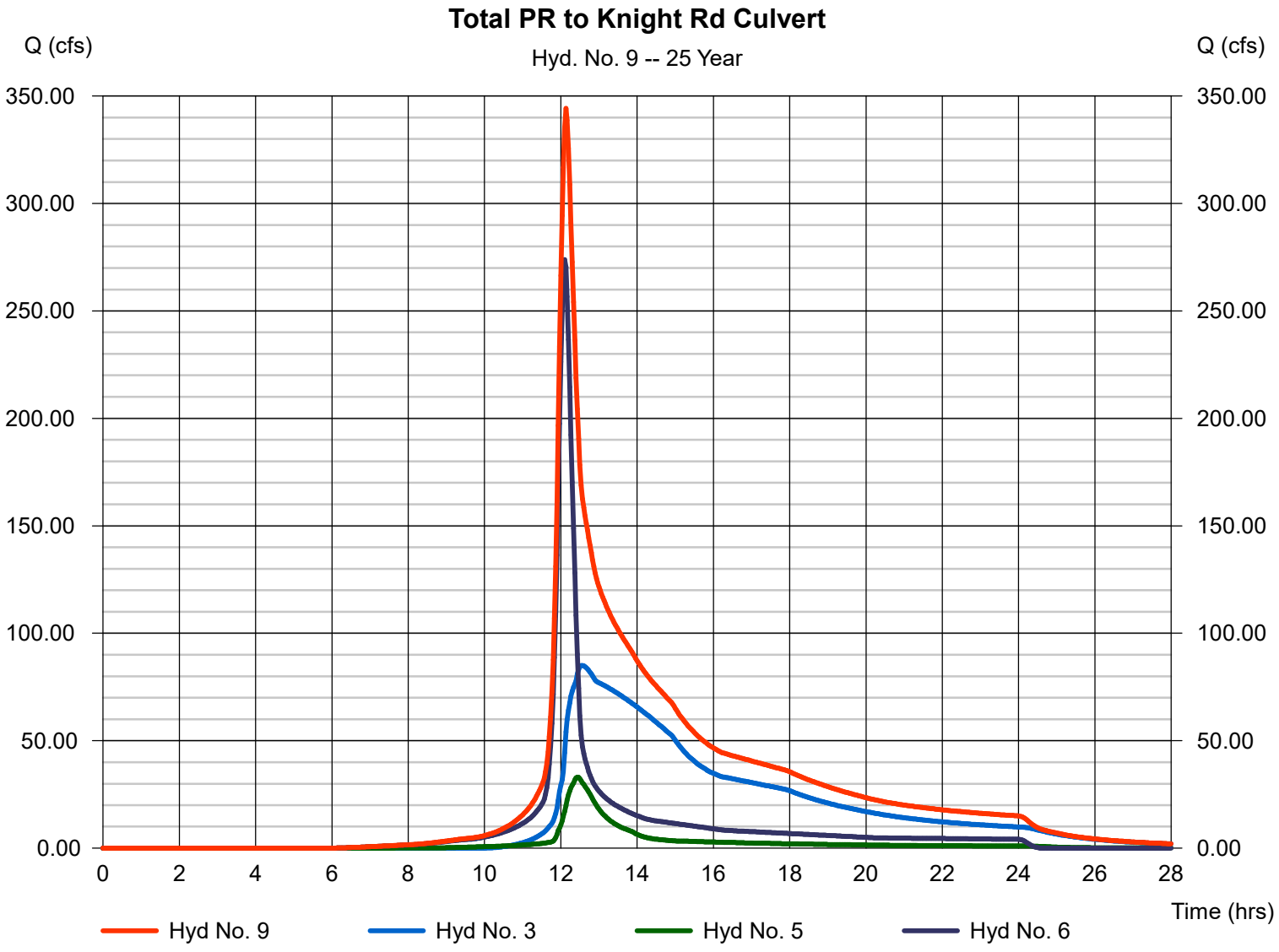
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 344.24 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,744,325 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

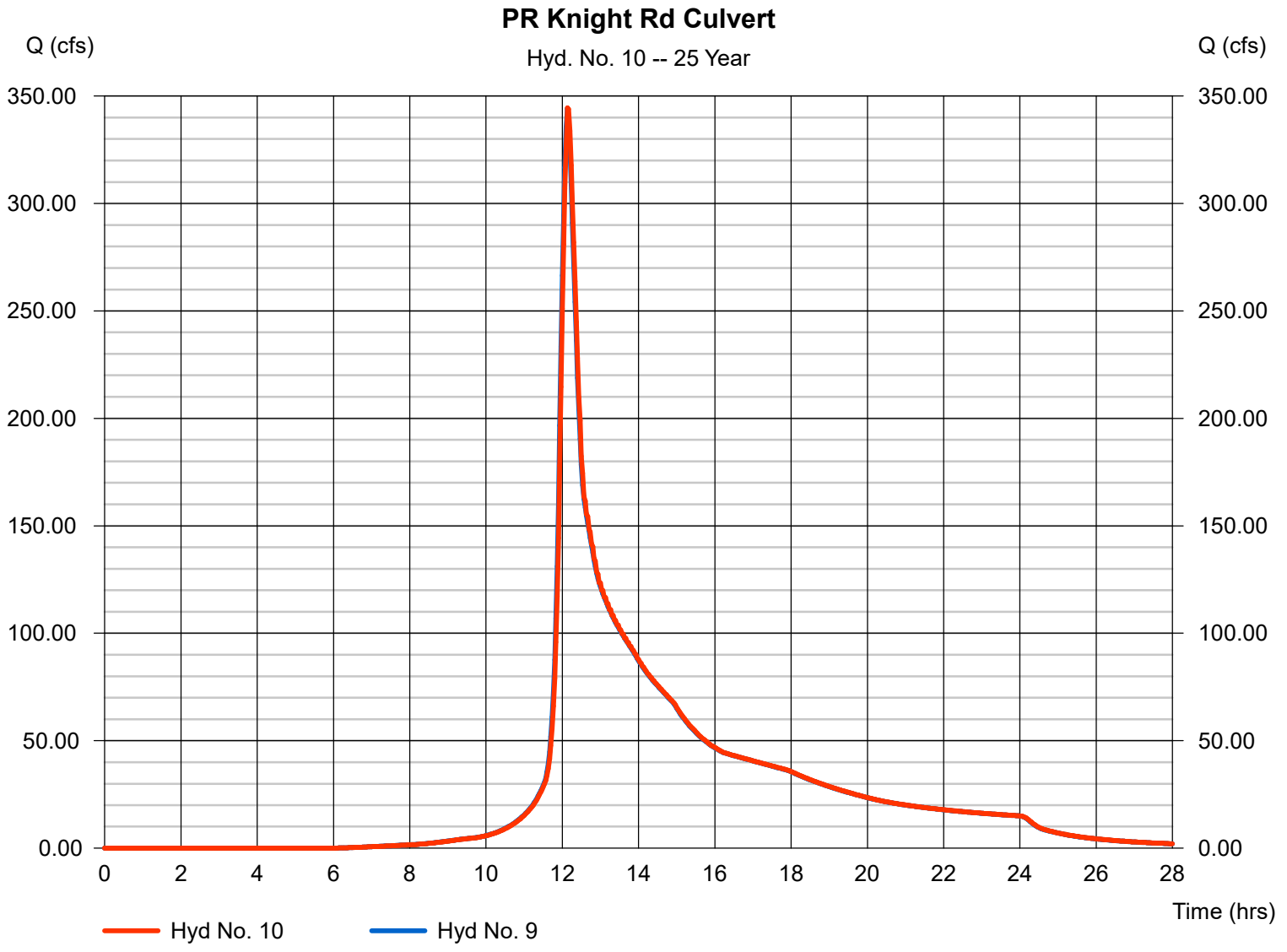
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	344.56 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,744,193 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	27.64 ft/s	Routing coeff.	=	1.9582

Modified Att-Kin routing method used.



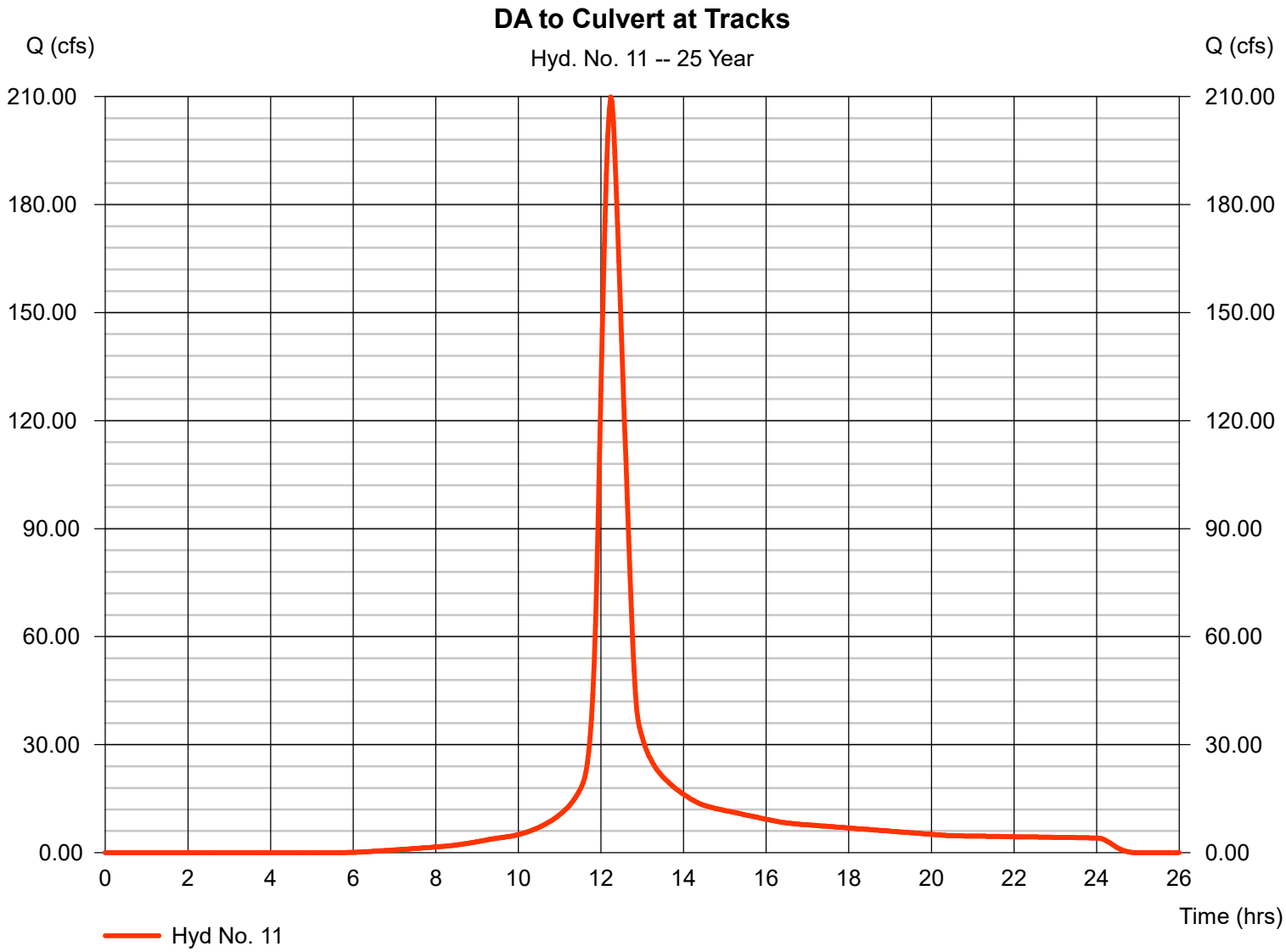
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	209.86 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	953,392 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

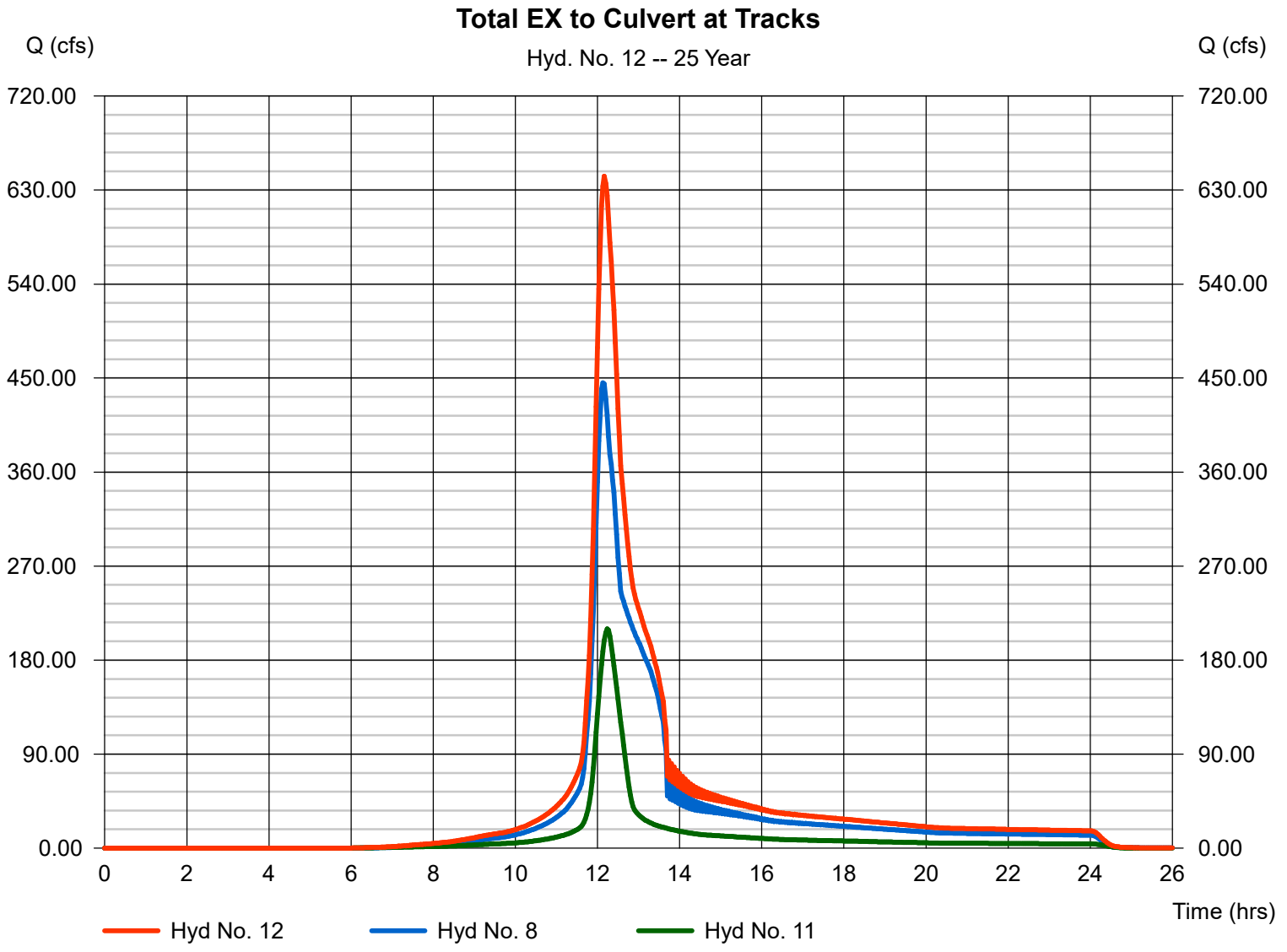


Hydrograph Report

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 643.34 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,727,539 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



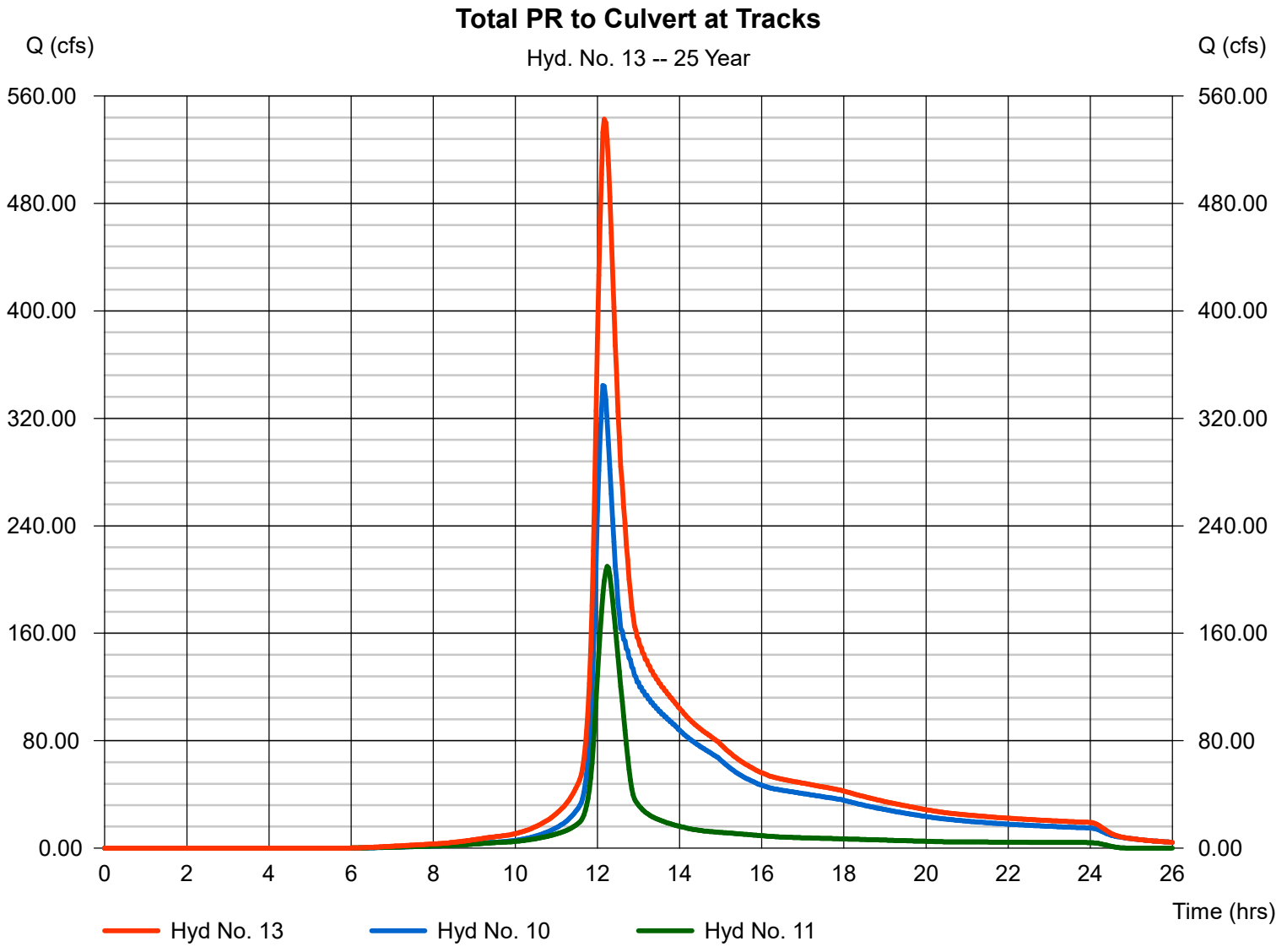
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 542.85 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,697,583 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	561.52	2	726	1,943,202	----	------	------	DA to Dam
2	Reservoir	303.95	2	740	1,943,144	1	260.80	464,090	EX Dam
3	Reservoir	143.09	2	748	1,913,282	1	259.07	907,972	PR Dam
4	SCS Runoff	68.29	2	730	274,011	----	------	------	DA to School Basin
5	Reservoir	46.22	2	744	274,003	4	274.19	72,104	EX School Basin
6	SCS Runoff	328.43	2	726	1,143,120	----	------	------	EX DA to Knight Rd Culvert
7	Combine	546.15	2	736	3,360,269	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	556.53	2	738	3,360,231	7	------	------	EX Knight Rd Culvert
9	Combine	415.63	2	728	3,330,410	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	416.20	2	728	3,330,279	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	250.96	2	734	1,144,656	----	------	------	DA to Culvert at Tracks
12	Combine	798.74	2	738	4,504,890	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	653.57	2	730	4,474,937	10, 11,	------	------	Total PR to Culvert at Tracks

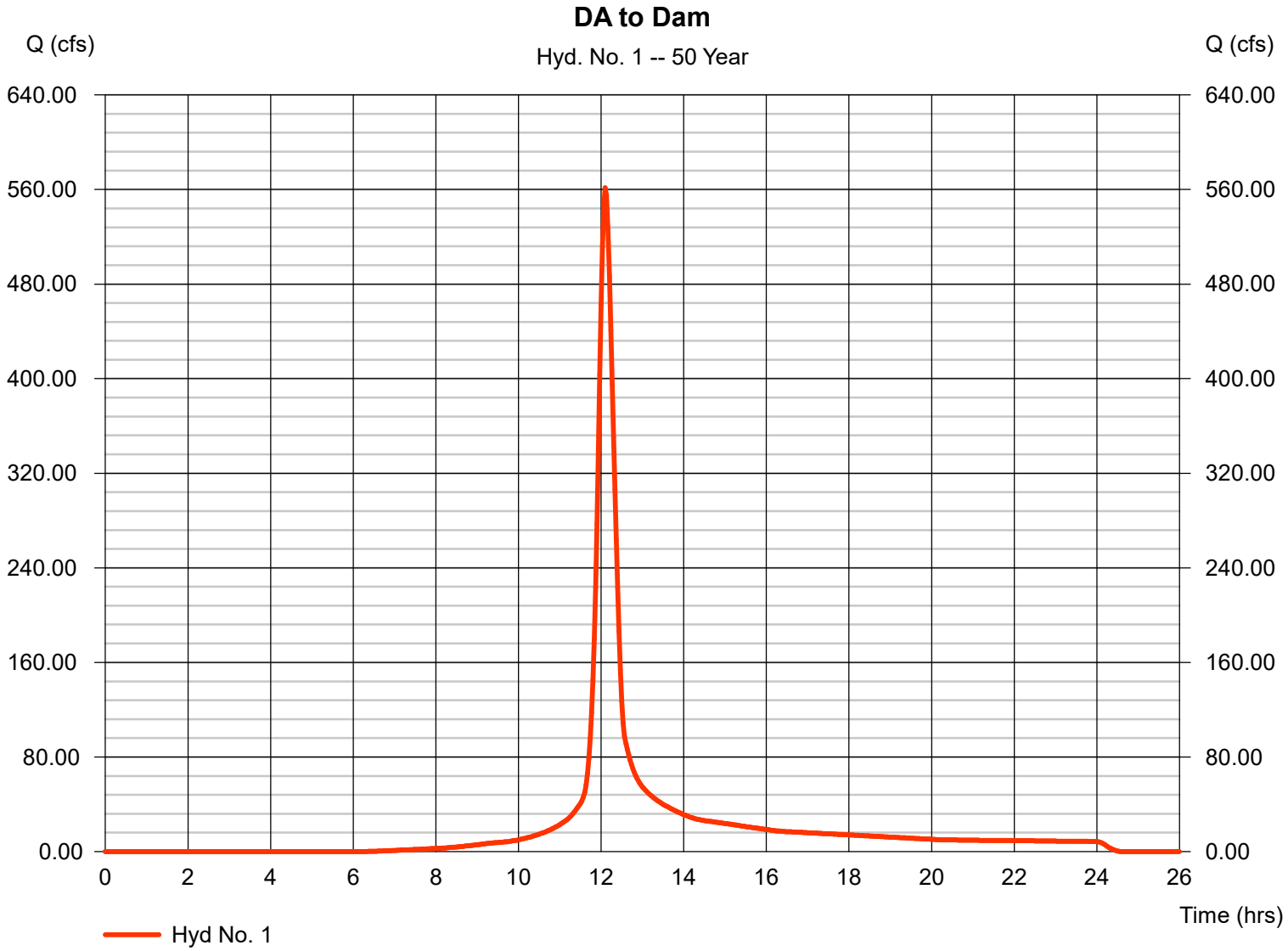
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	561.52 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,943,202 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

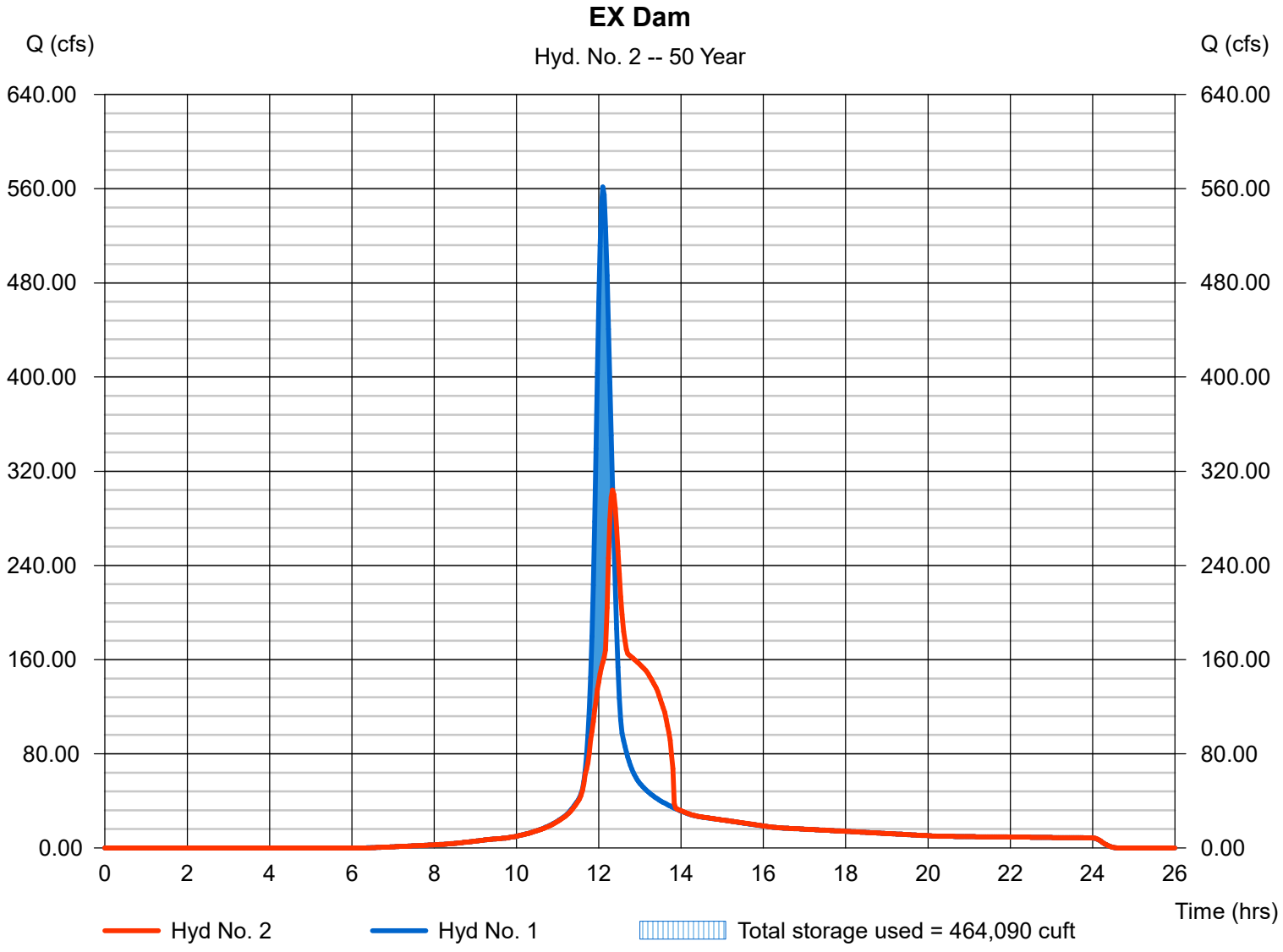
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	303.95 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	1,943,144 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	260.80 ft
Reservoir name	=	EX Dam	Max. Storage	=	464,090 cuft

Storage Indication method used.



Hydrograph Report

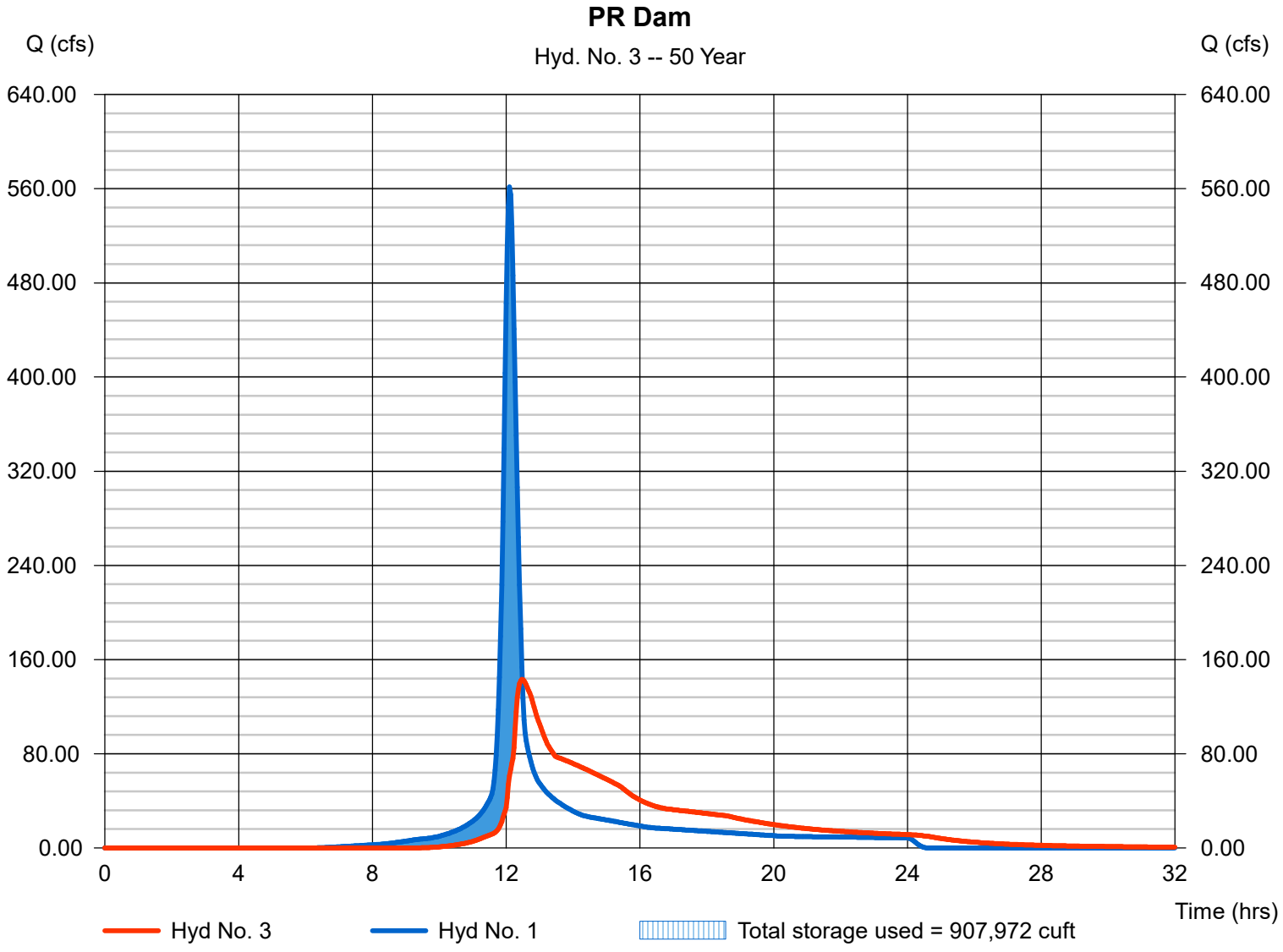
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	143.09 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	1,913,282 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	259.07 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	907,972 cuft

Storage Indication method used.



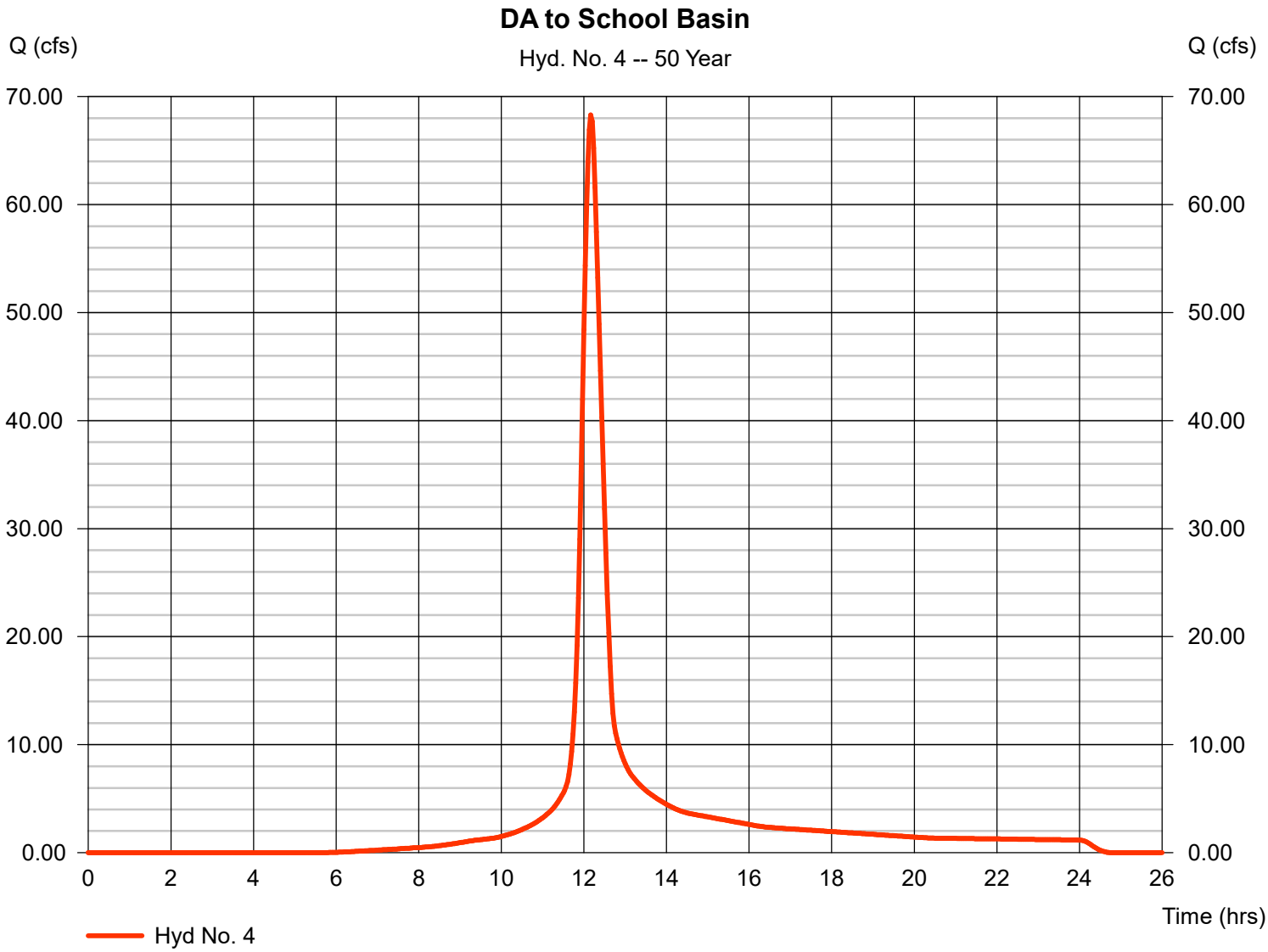
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	68.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	274,011 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

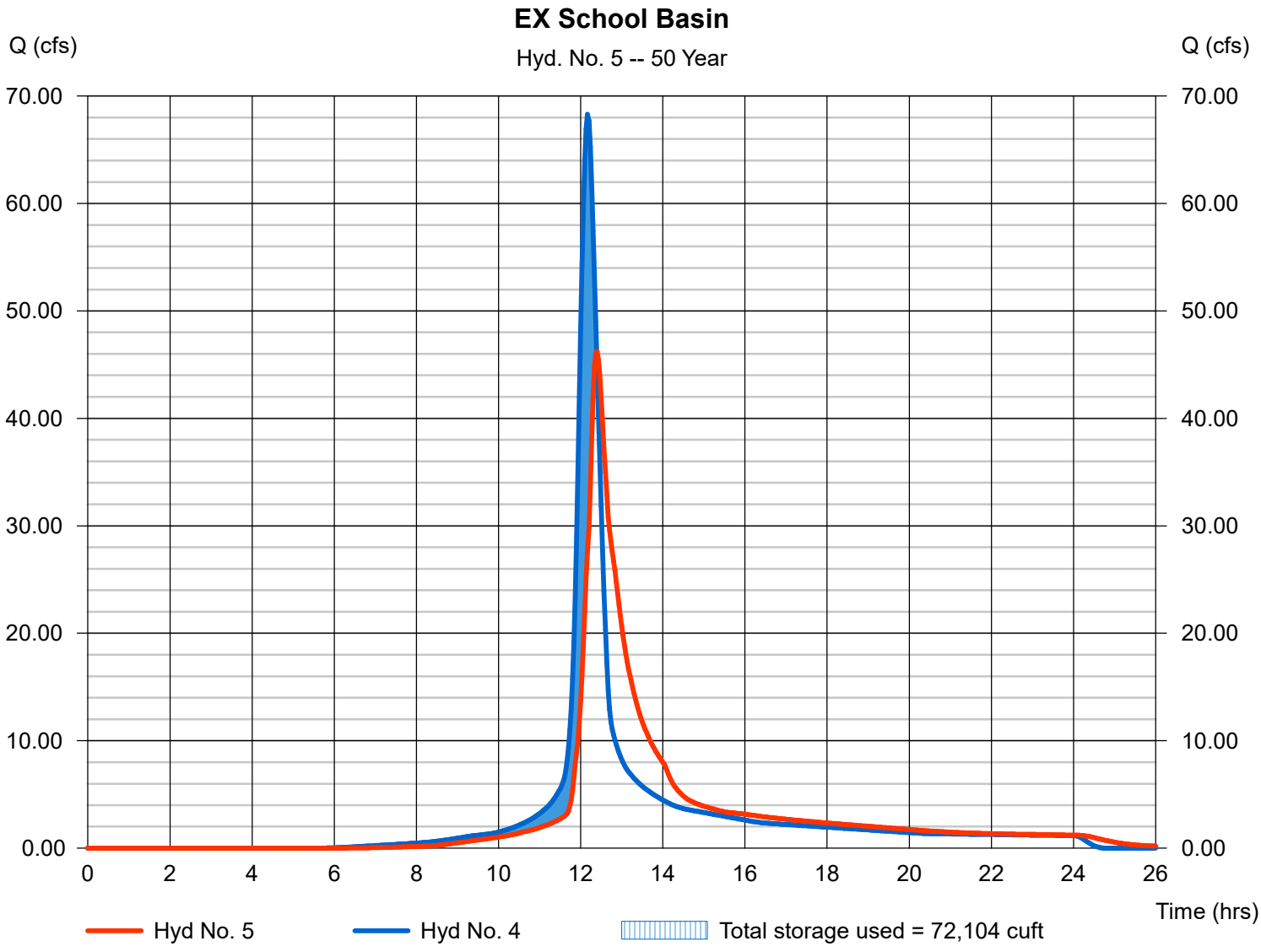
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	46.22 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	274,003 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	274.19 ft
Reservoir name	=	EX School Basin	Max. Storage	=	72,104 cuft

Storage Indication method used.



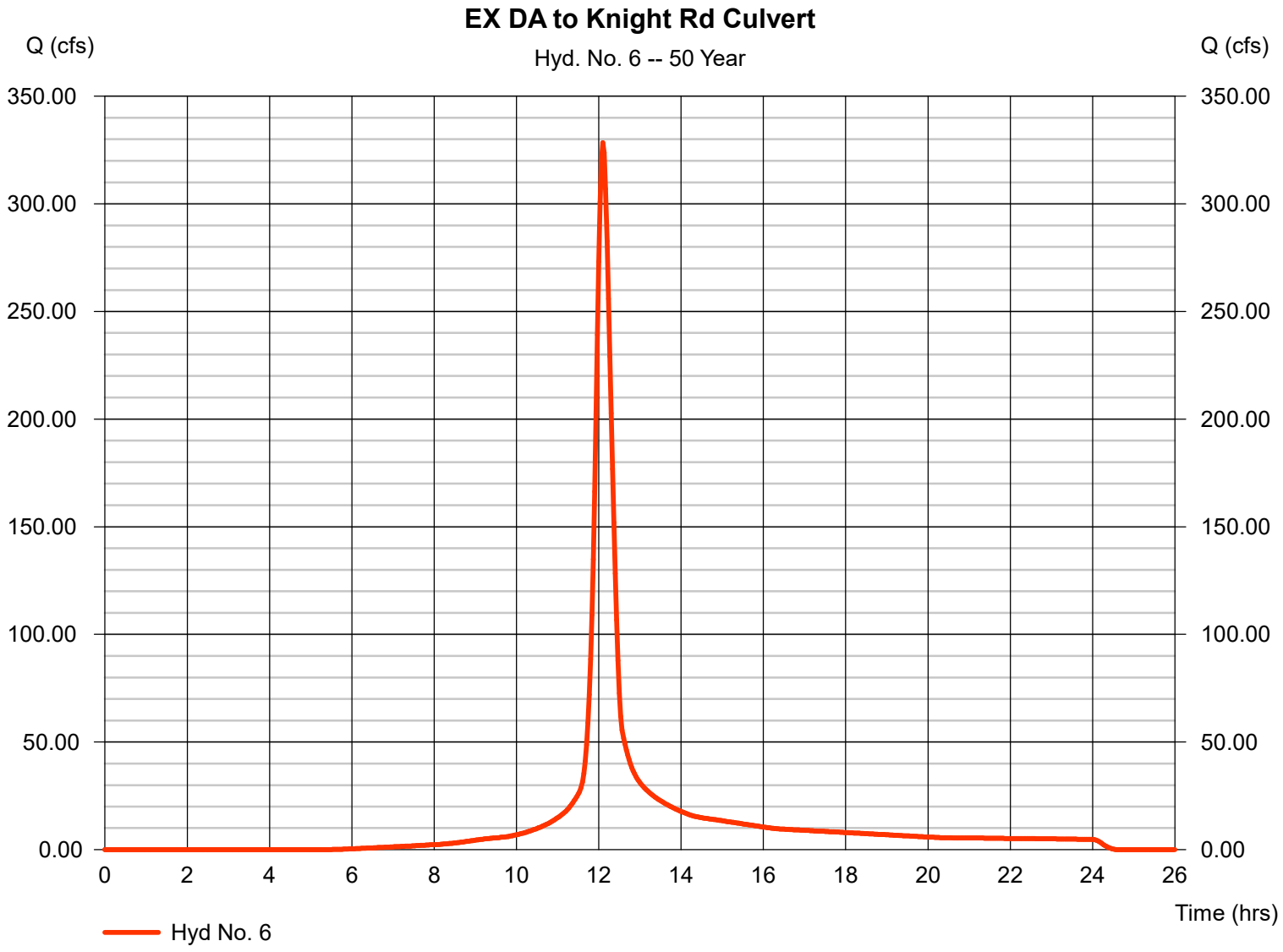
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	328.43 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,143,120 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



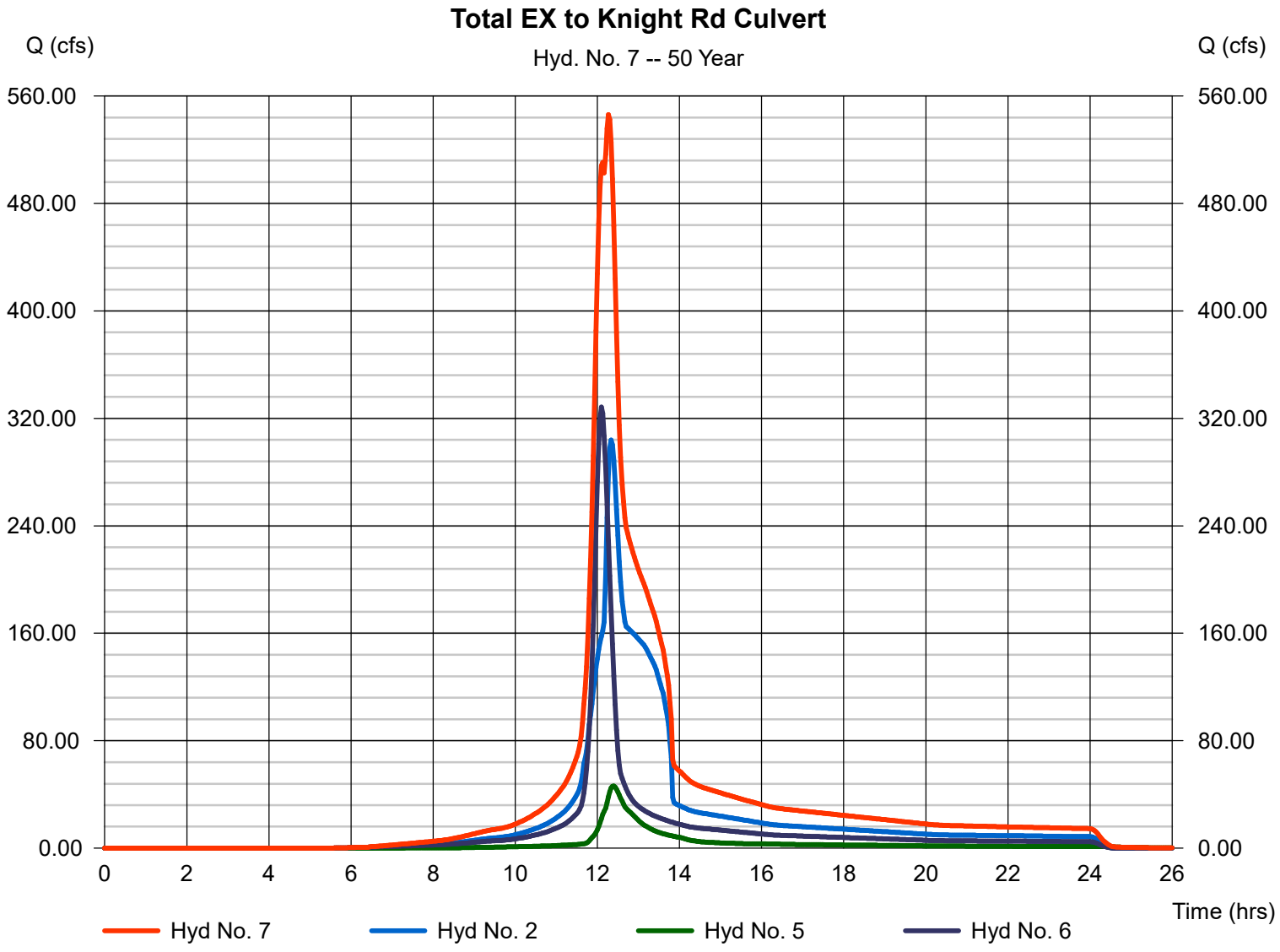
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 546.15 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 3,360,269 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

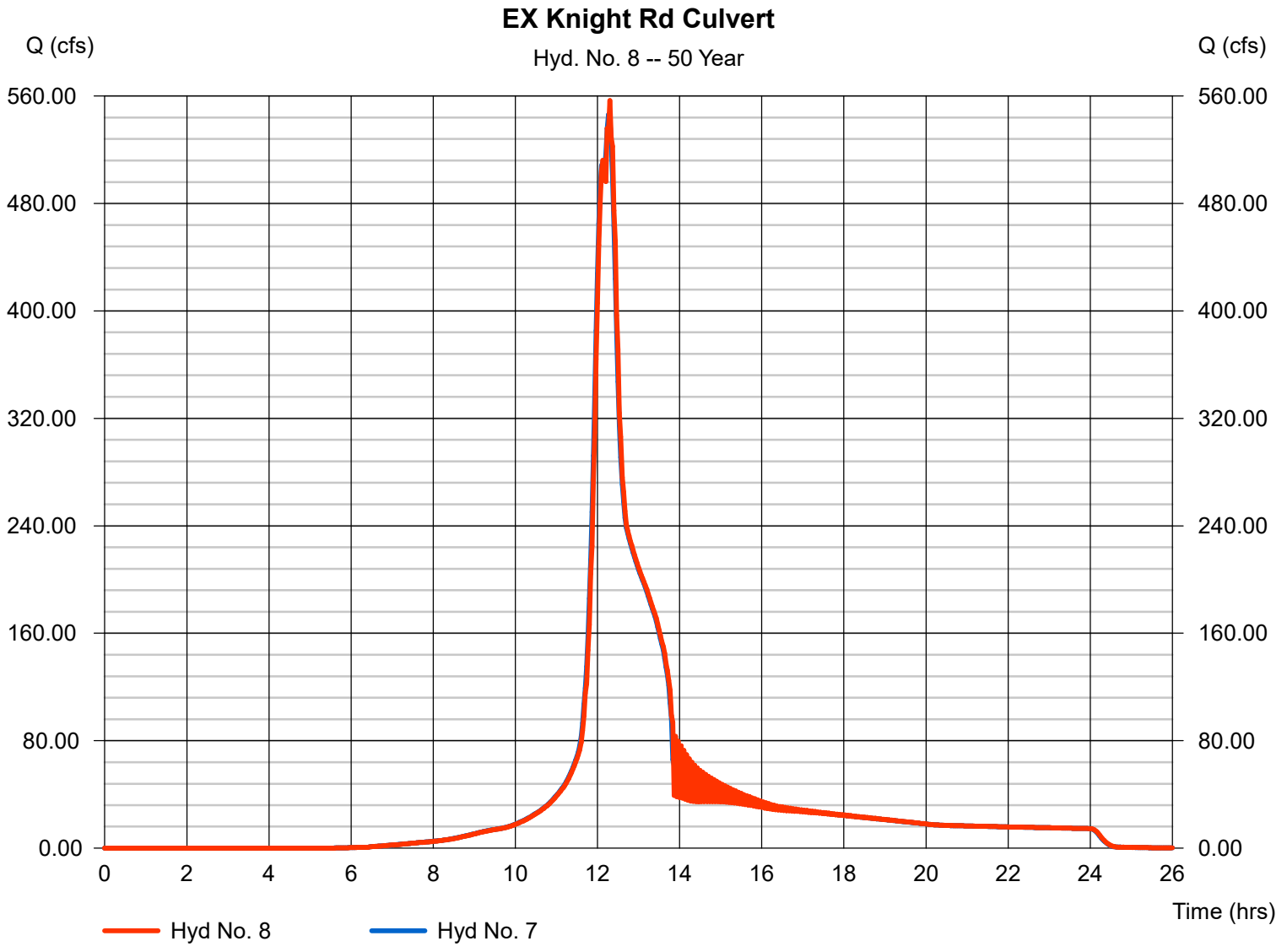
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	556.53 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	3,360,231 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	32.59 ft/s	Routing coeff.	=	1.9645

Modified Att-Kin routing method used.



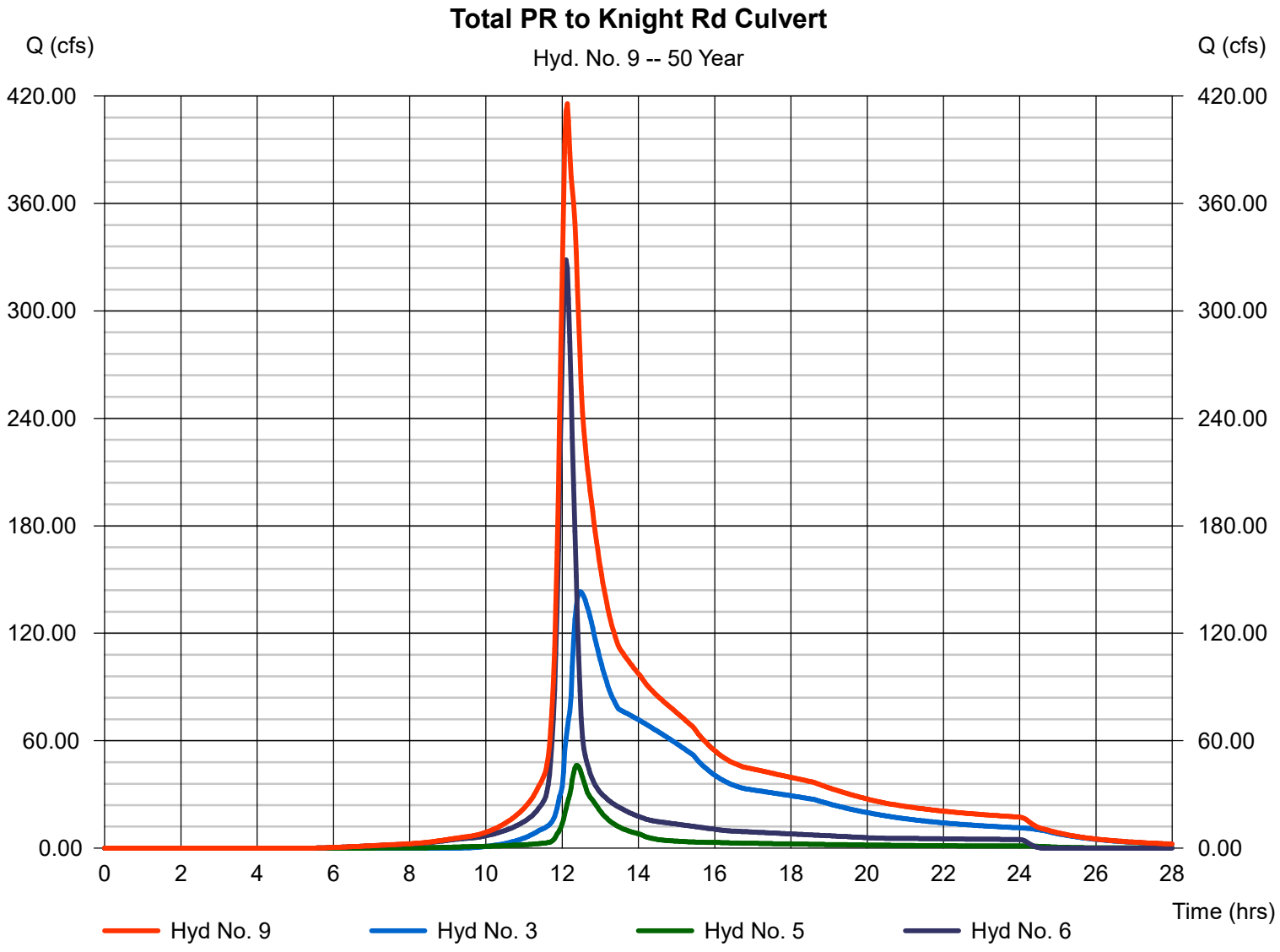
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 415.63 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 3,330,410 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

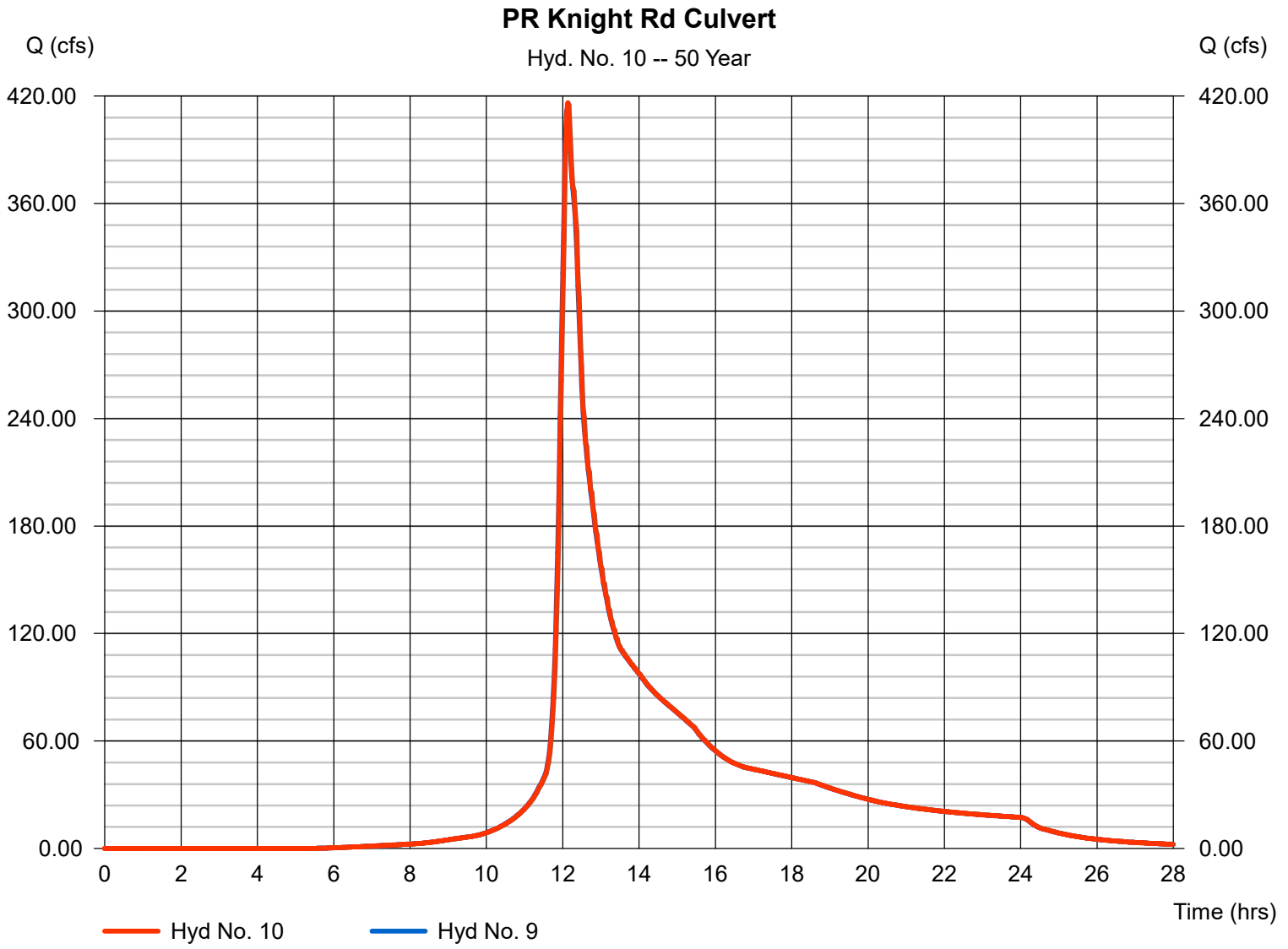
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	416.20 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	3,330,279 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	29.56 ft/s	Routing coeff.	=	1.9609

Modified Att-Kin routing method used.



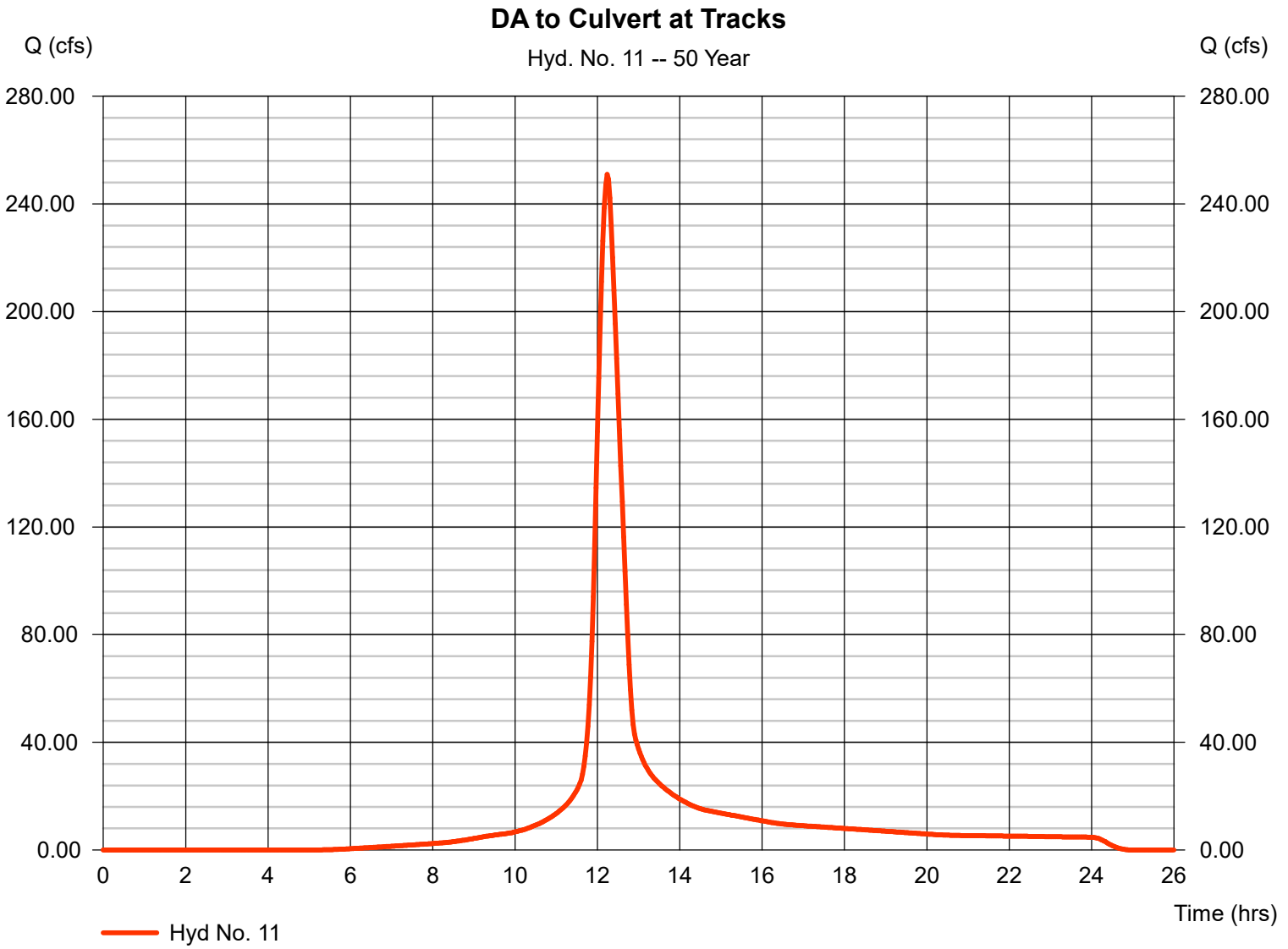
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	250.96 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	1,144,656 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



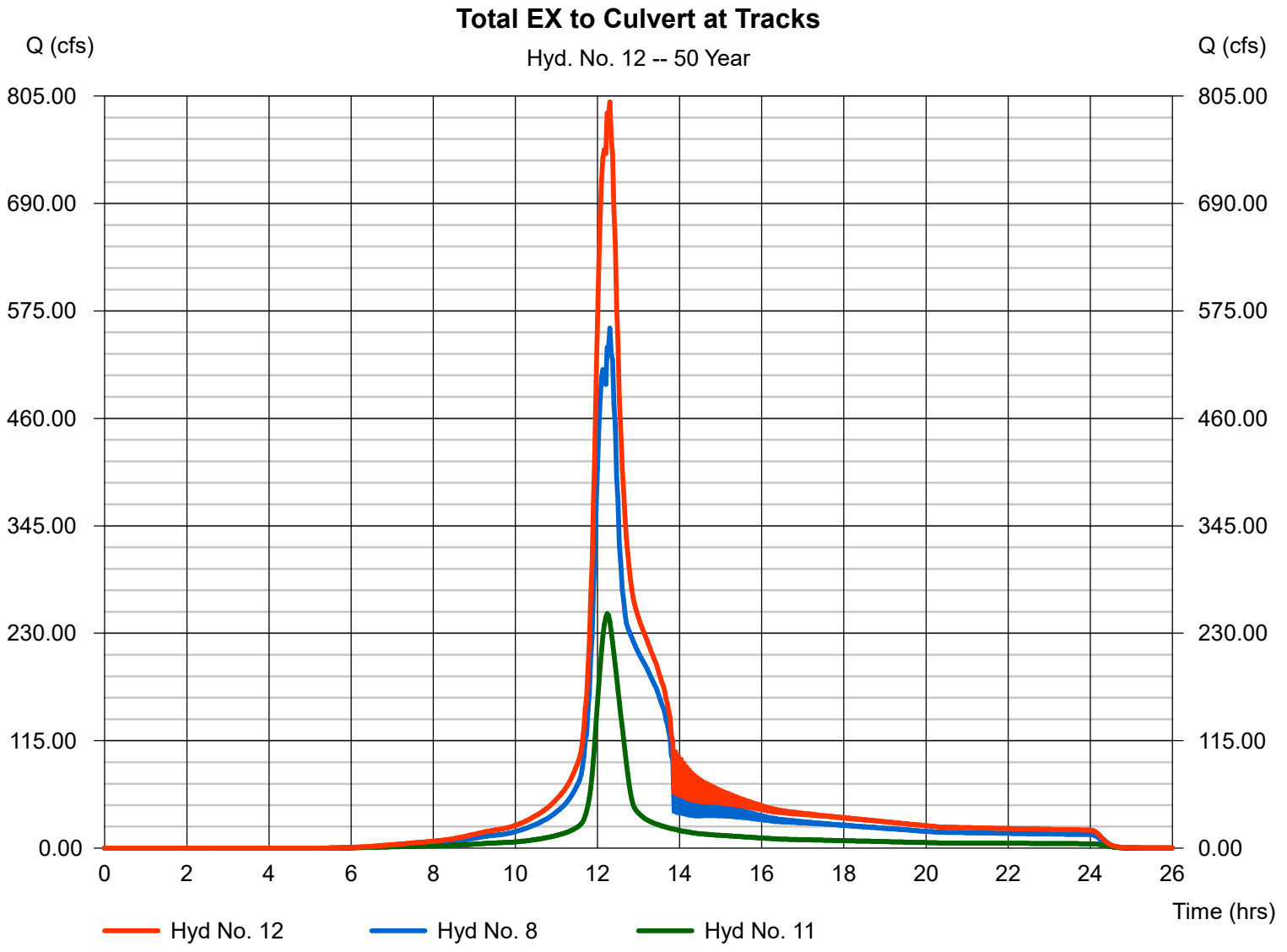
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 798.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 4,504,890 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



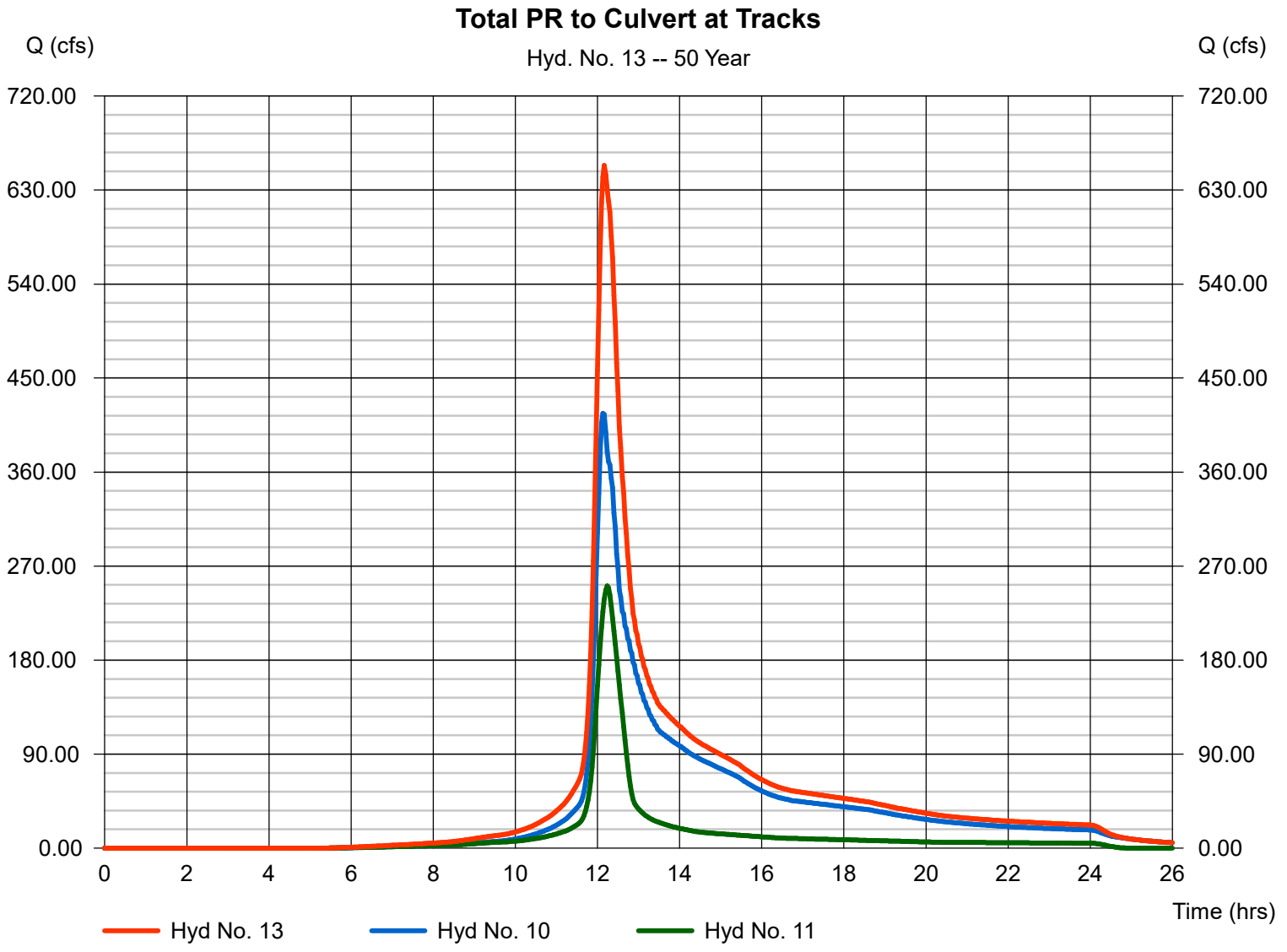
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 653.57 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 4,474,937 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	668.28	2	726	2,320,737	----	------	------	DA to Dam
2	Reservoir	452.95	2	736	2,320,678	1	261.19	514,607	EX Dam
3	Reservoir	173.73	2	748	2,290,824	1	260.12	1,069,778	PR Dam
4	SCS Runoff	80.79	2	730	325,492	----	------	------	DA to School Basin
5	Reservoir	62.91	2	740	325,484	4	274.36	78,068	EX School Basin
6	SCS Runoff	387.07	2	726	1,354,321	----	------	------	EX DA to Knight Rd Culvert
7	Combine	779.64	2	736	4,000,486	2, 5, 6	------	------	Total EX to Knight Rd Culvert
8	Reach	803.93	2	736	4,000,450	7	------	------	EX Knight Rd Culvert
9	Combine	504.36	2	732	3,970,628	3, 5, 6,	------	------	Total PR to Knight Rd Culvert
10	Reach	509.12	2	732	3,970,496	9	------	------	PR Knight Rd Culvert
11	SCS Runoff	295.14	2	734	1,352,631	----	------	------	DA to Culvert at Tracks
12	Combine	1096.75	2	736	5,353,085	8, 11	------	------	Total EX to Culvert at Tracks
13	Combine	799.96	2	732	5,323,131	10, 11,	------	------	Total PR to Culvert at Tracks

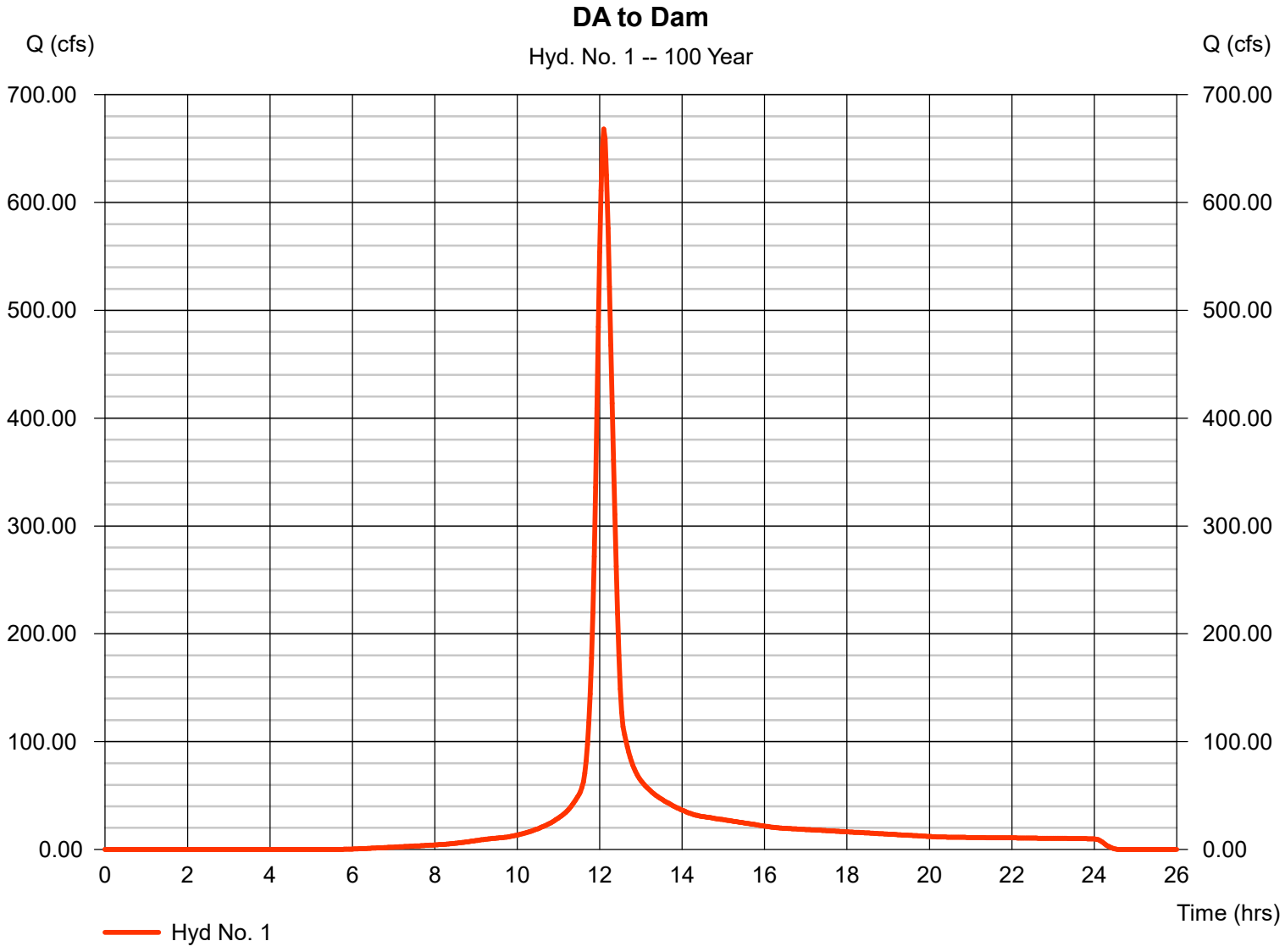
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	668.28 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	2,320,737 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

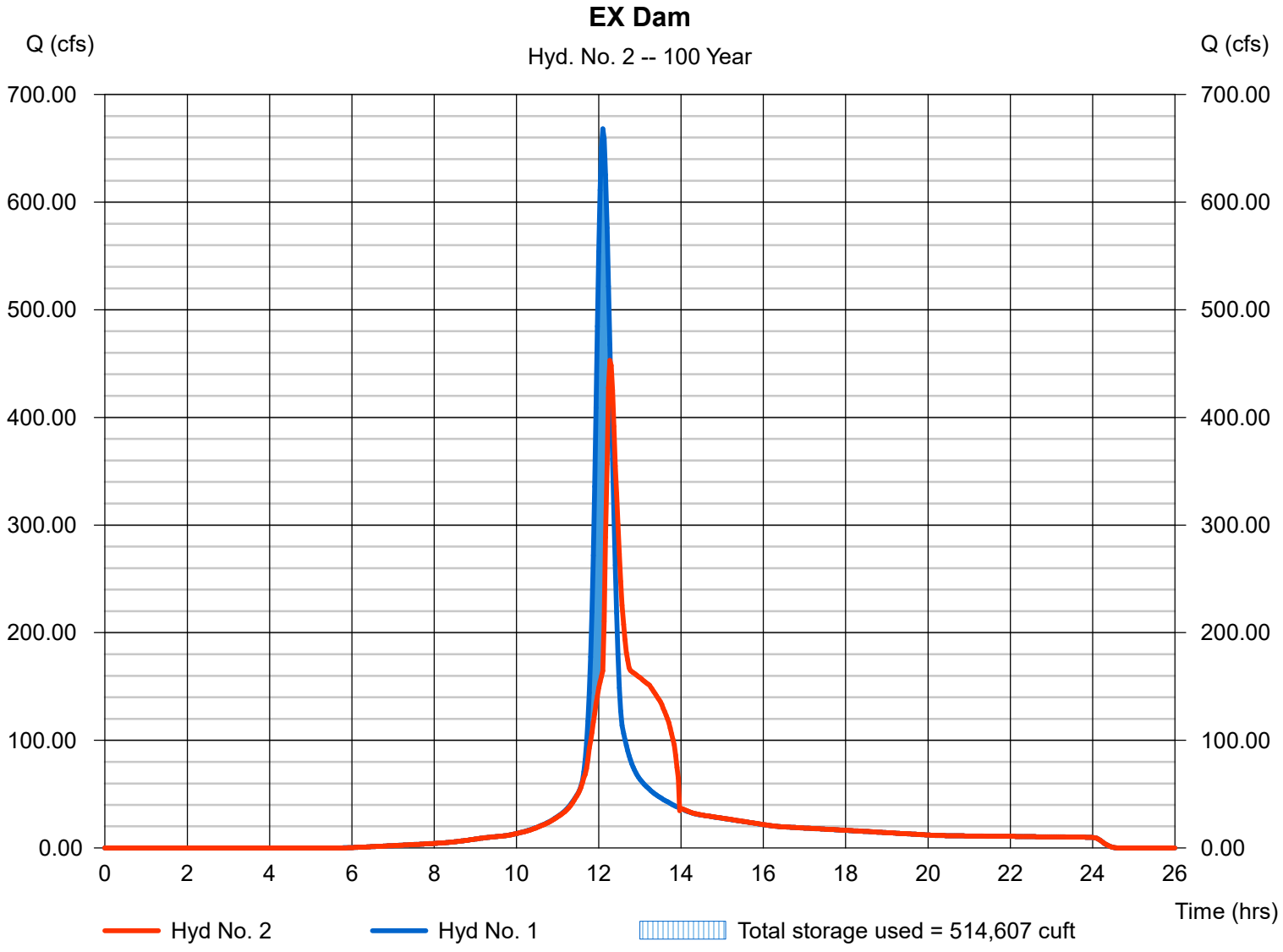
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	452.95 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	2,320,678 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	261.19 ft
Reservoir name	=	EX Dam	Max. Storage	=	514,607 cuft

Storage Indication method used.



Hydrograph Report

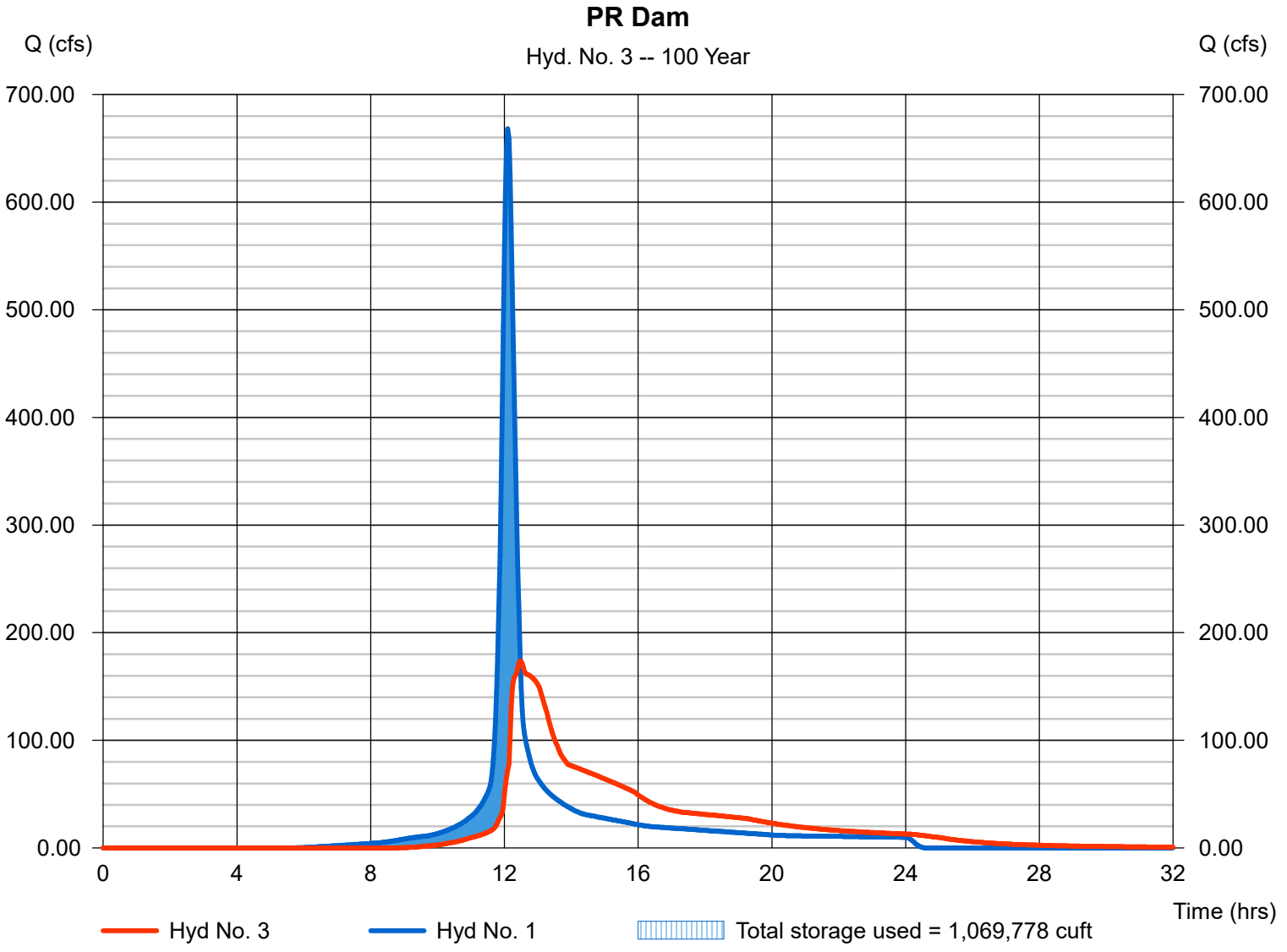
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 3

PR Dam

Hydrograph type	=	Reservoir	Peak discharge	=	173.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	2,290,824 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	260.12 ft
Reservoir name	=	PR Dam - OCS and Grading	Max. Storage	=	1,069,778 cuft

Storage Indication method used.

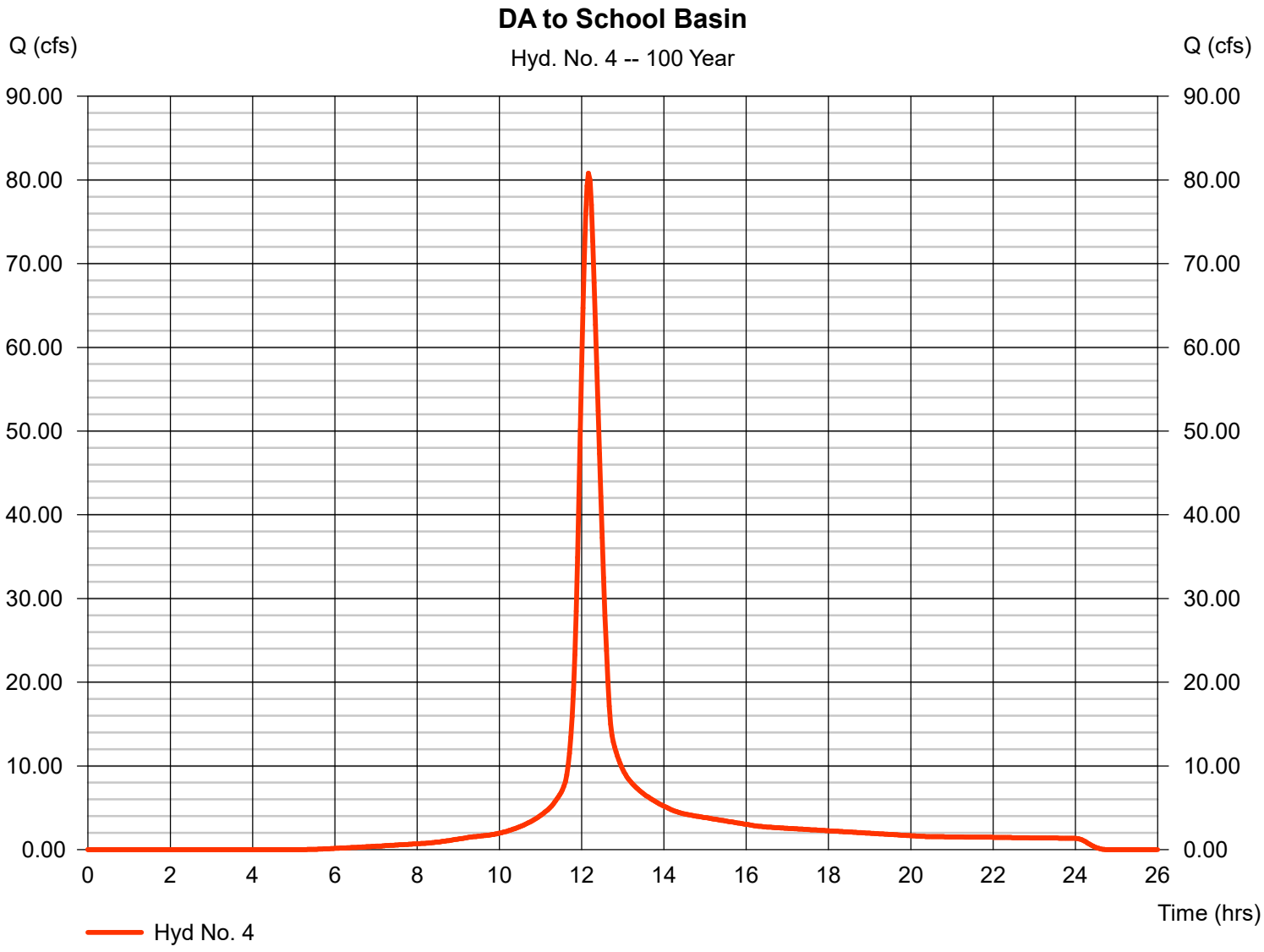


Hydrograph Report

Hyd. No. 4

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	80.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	325,492 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

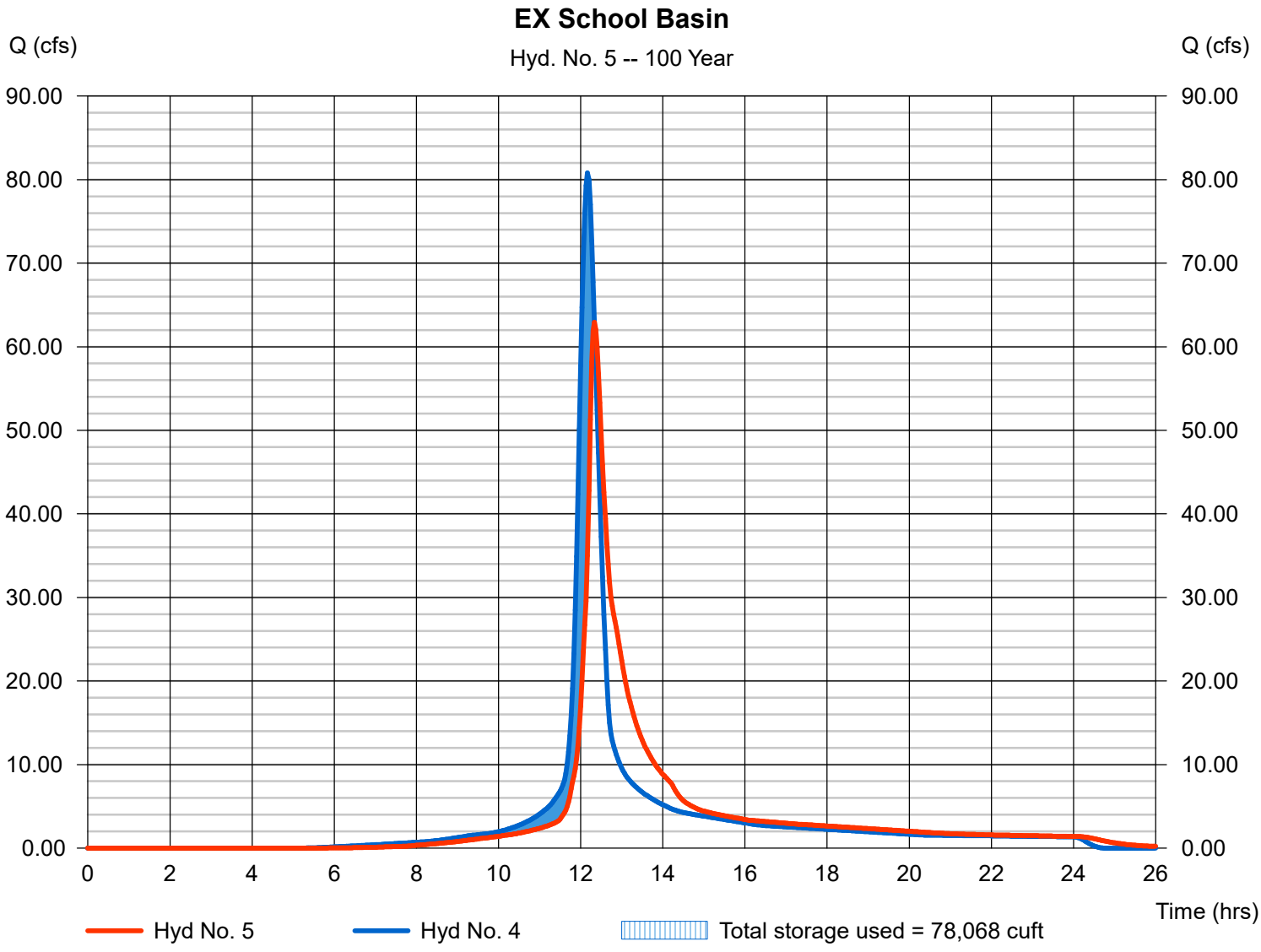
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 5

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	62.91 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	325,484 cuft
Inflow hyd. No.	=	4 - DA to School Basin	Max. Elevation	=	274.36 ft
Reservoir name	=	EX School Basin	Max. Storage	=	78,068 cuft

Storage Indication method used.



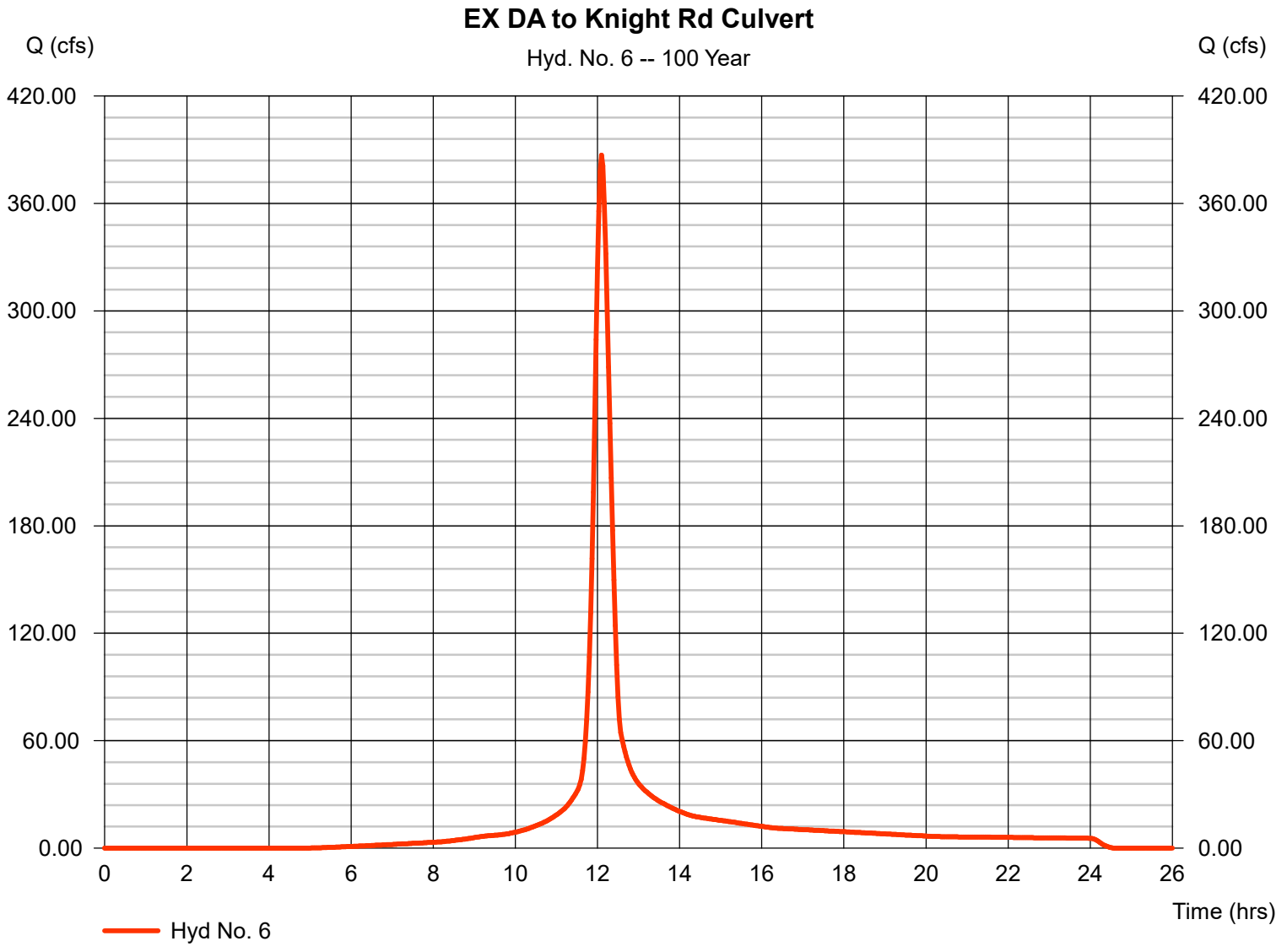
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 6

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	387.07 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,354,321 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



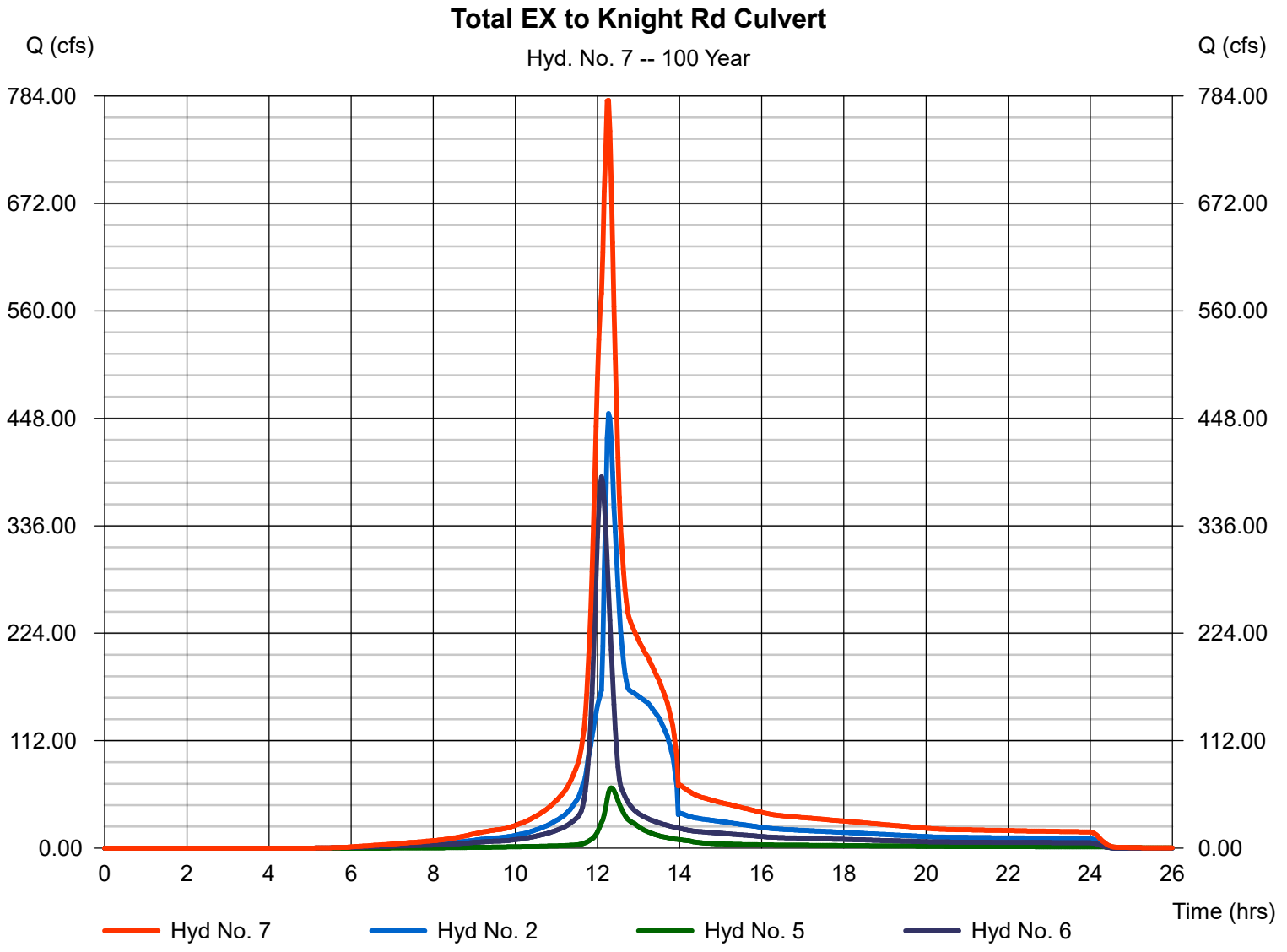
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 7

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 779.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 4,000,486 cuft
Inflow hyds.	= 2, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

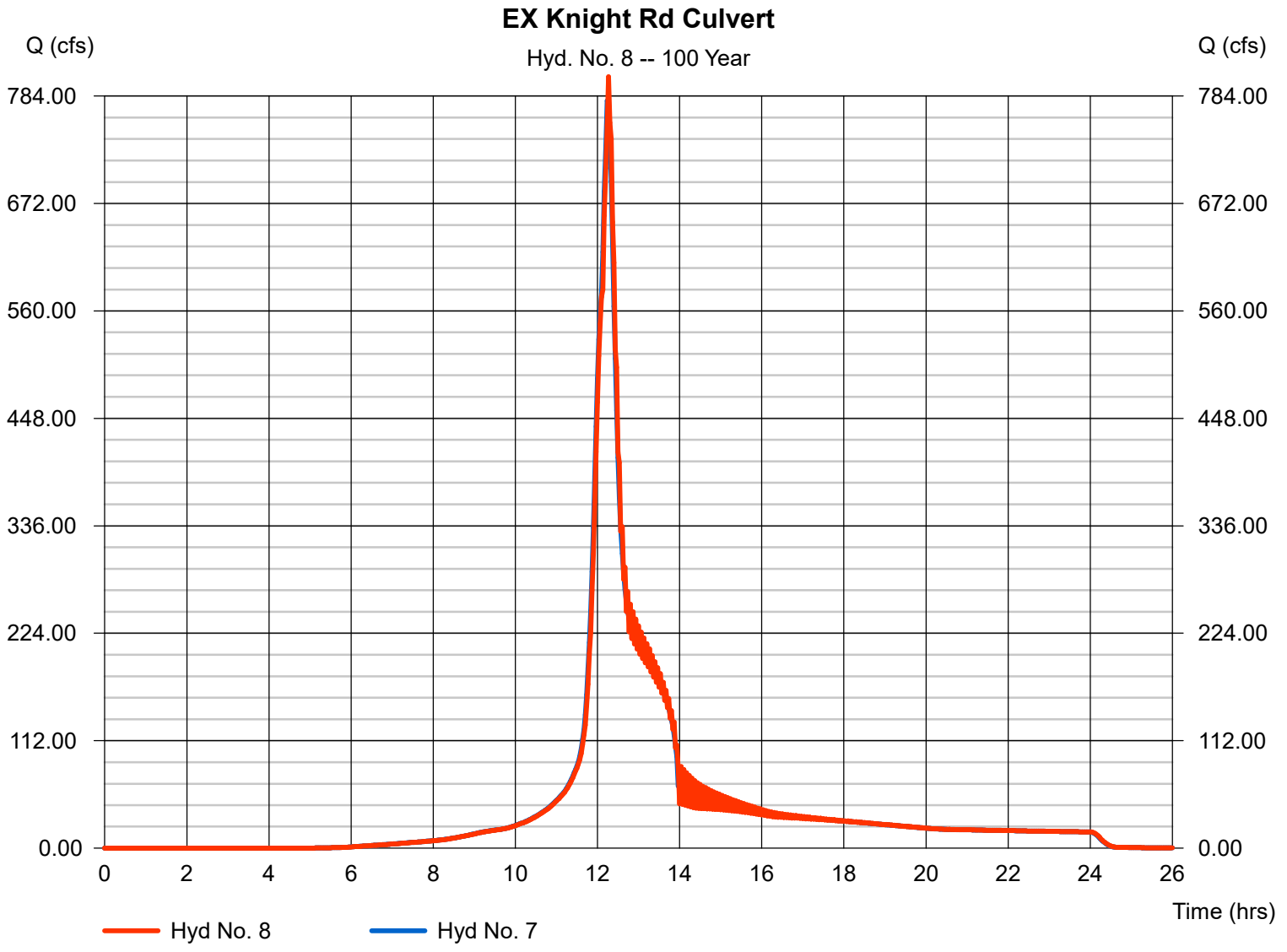
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 8

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	803.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	4,000,450 cuft
Inflow hyd. No.	=	7 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	37.01 ft/s	Routing coeff.	=	1.9687

Modified Att-Kin routing method used.



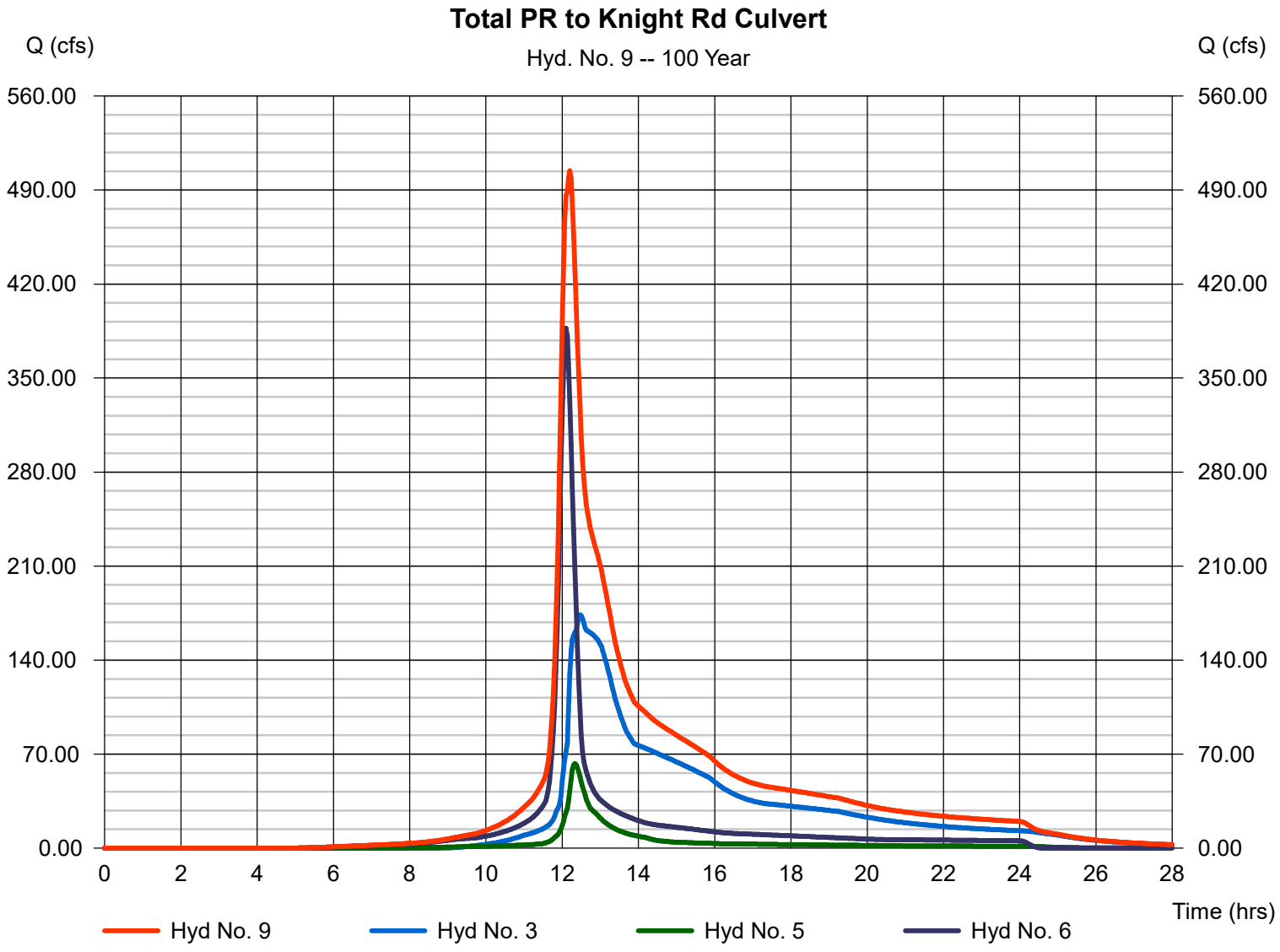
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 9

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 504.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 3,970,628 cuft
Inflow hyds.	= 3, 5, 6	Contrib. drain. area	= 68.530 ac



Hydrograph Report

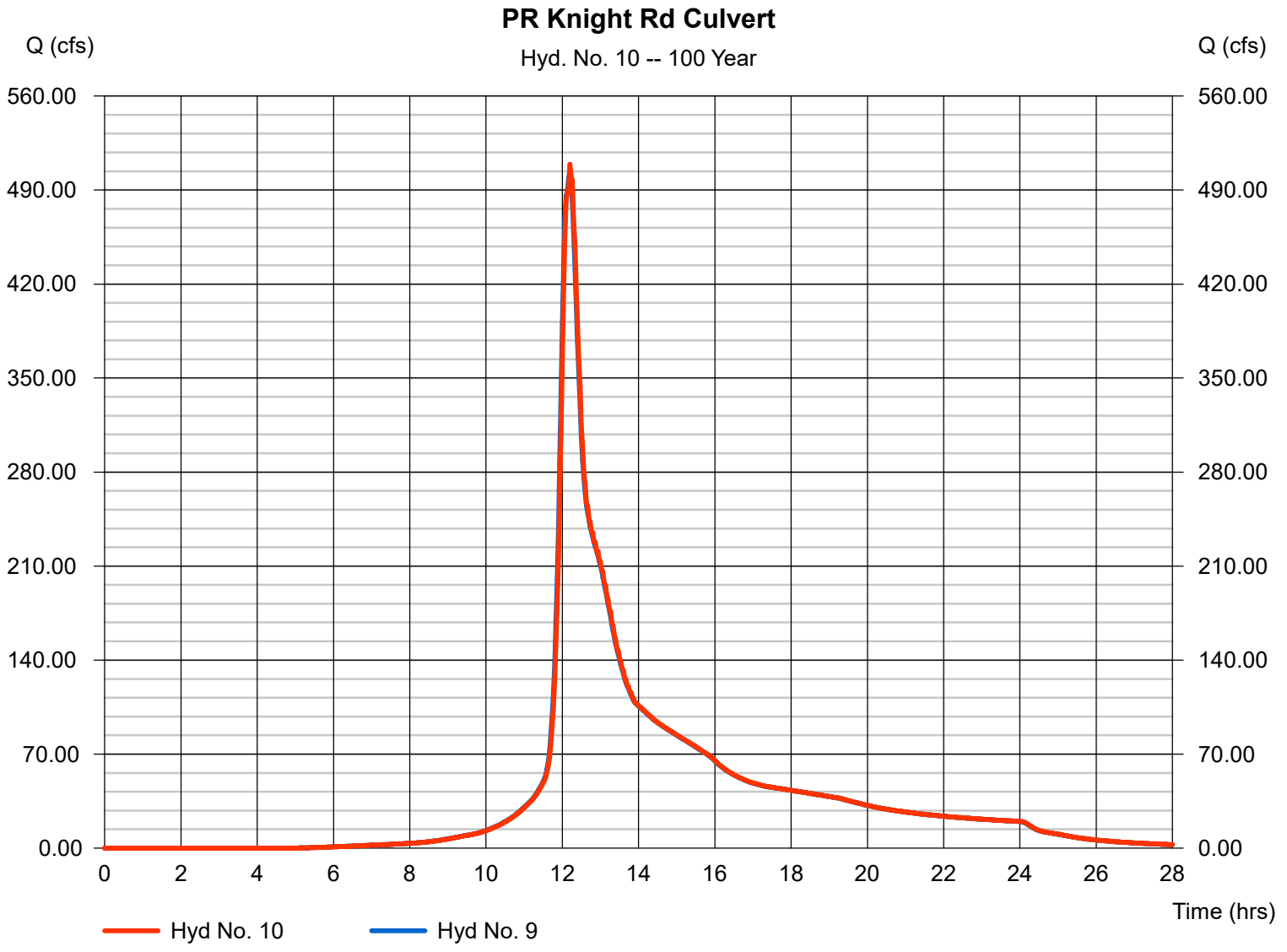
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 10

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	509.12 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	3,970,496 cuft
Inflow hyd. No.	=	9 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	31.68 ft/s	Routing coeff.	=	1.9635

Modified Att-Kin routing method used.



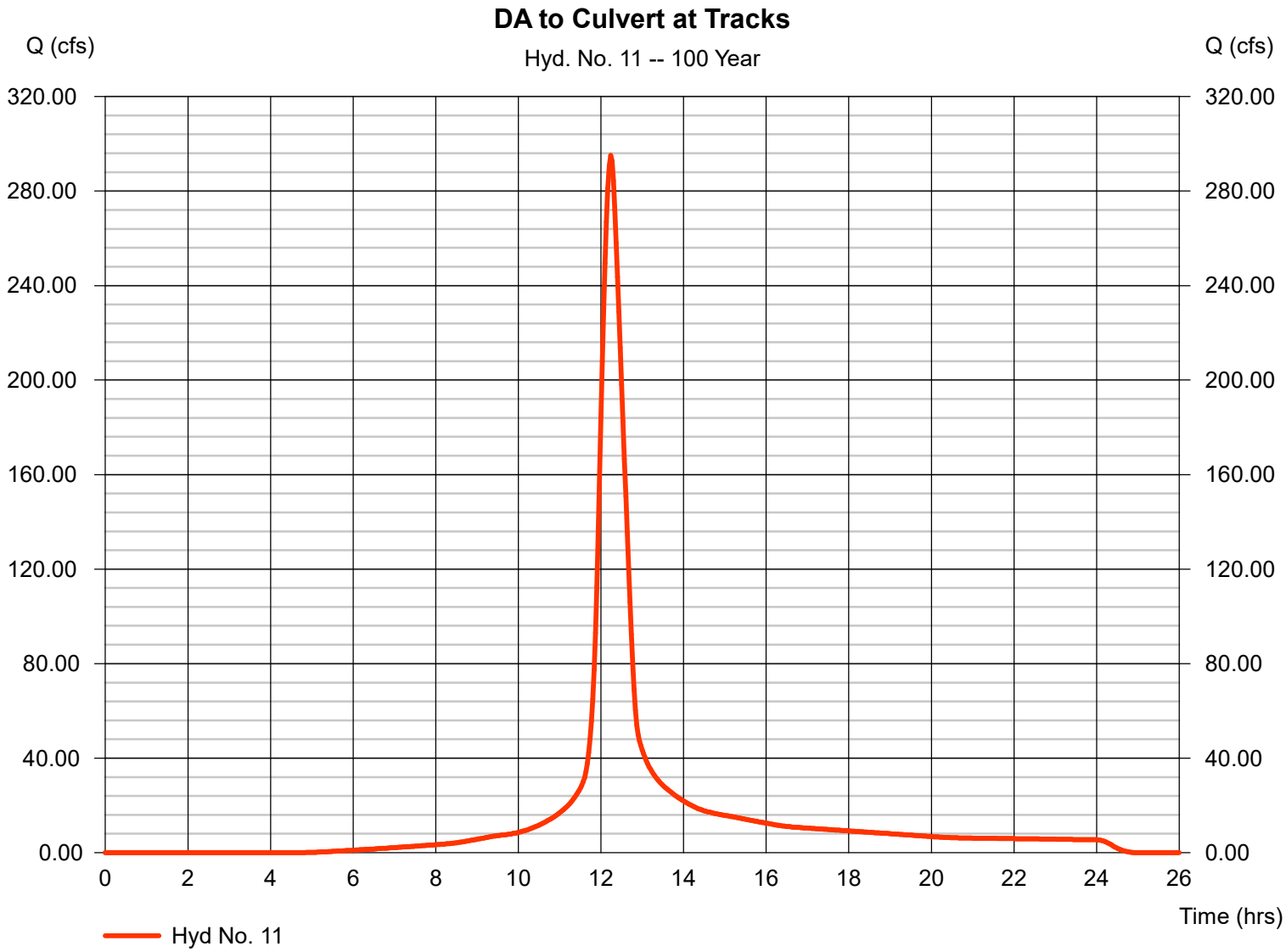
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Mar 13, 2023

Hyd. No. 11

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	295.14 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	1,352,631 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



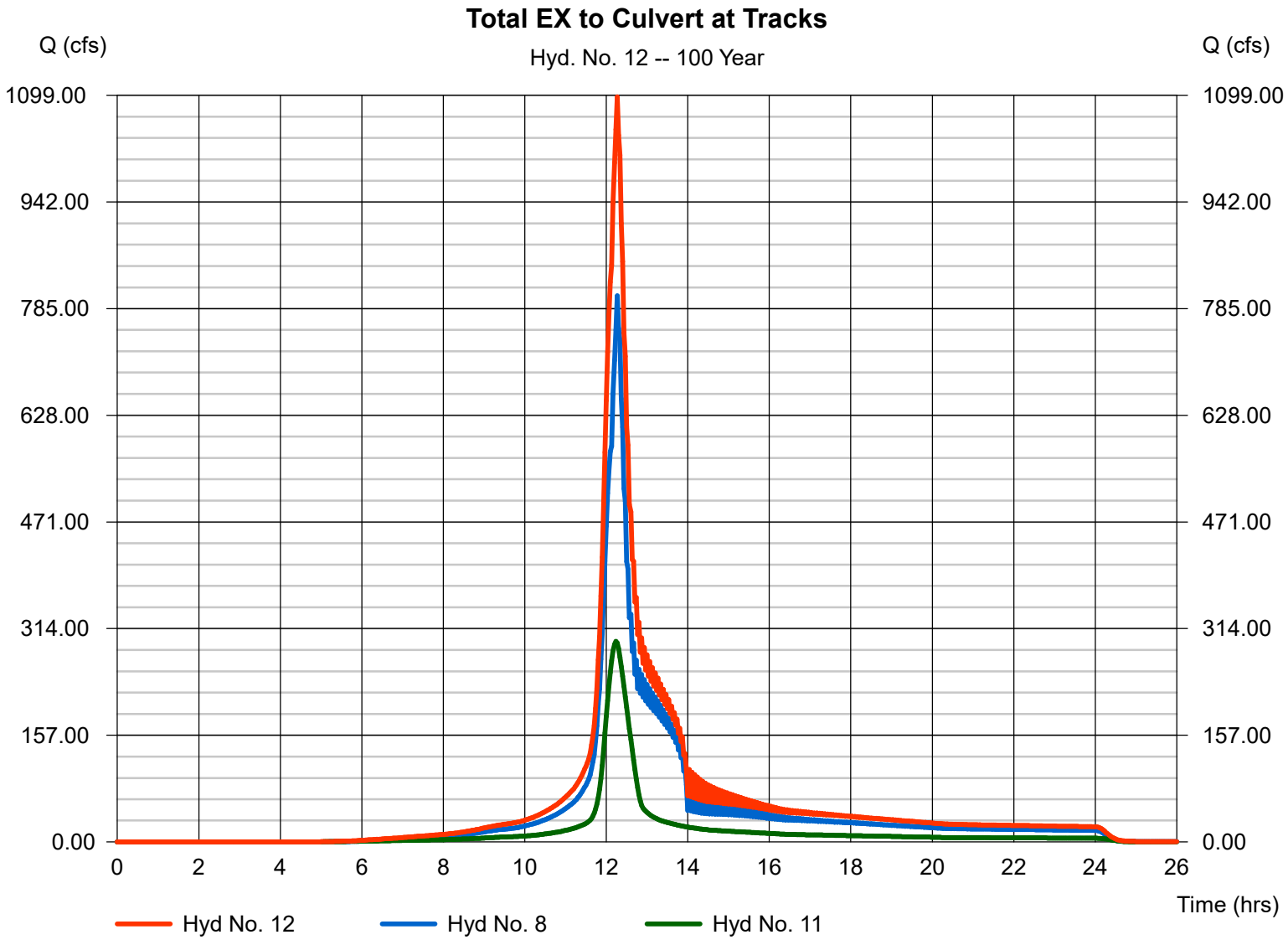
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 12

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 1096.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 5,353,085 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 68.990 ac



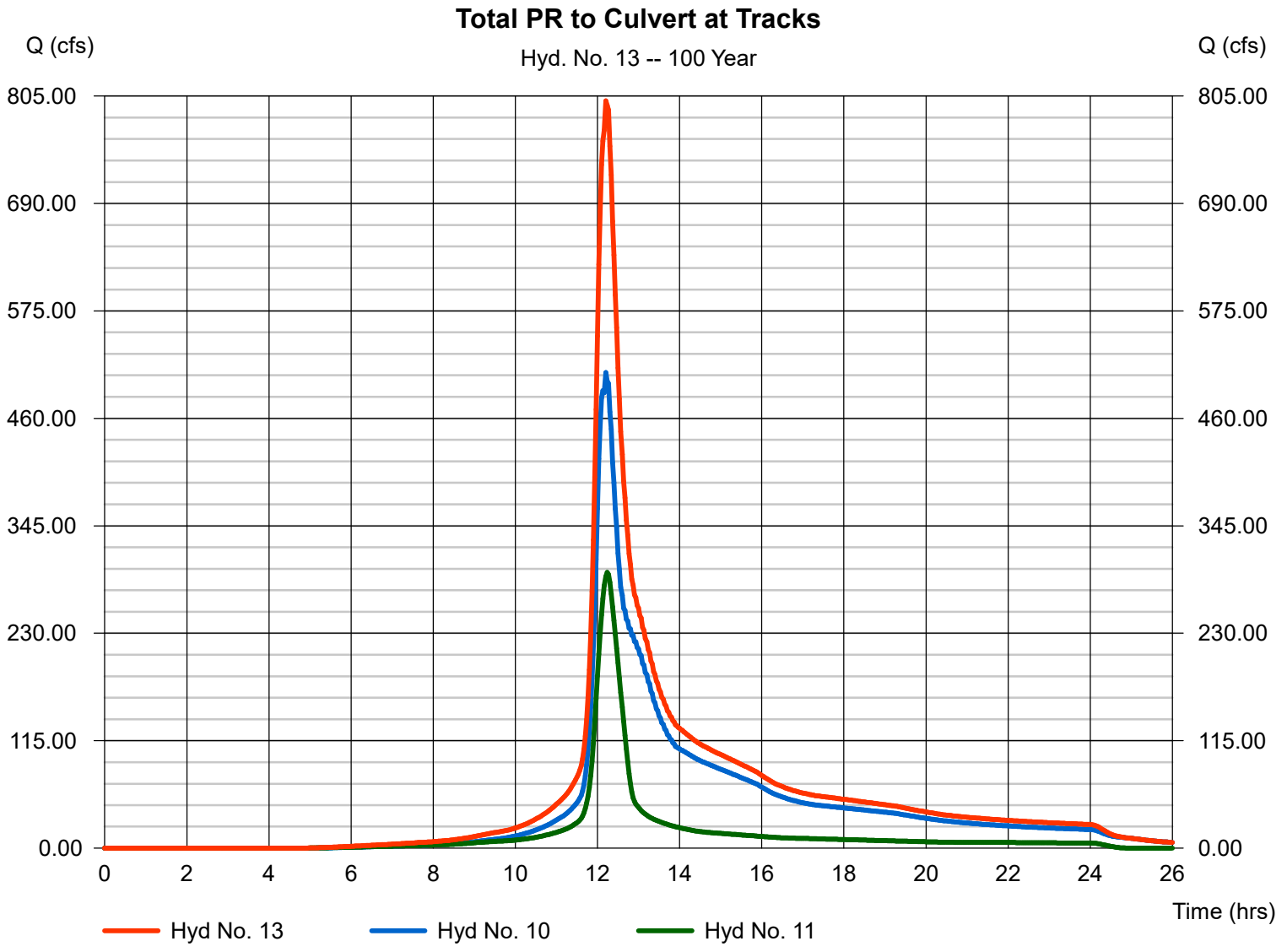
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 Monday, Mar 13, 2023

Hyd. No. 13

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 799.96 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 5,323,131 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 68.990 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	37.0466	9.8000	0.9093	--------
2	16.9729	3.2000	0.6105	--------
3	0.0000	0.0000	0.0000	--------
5	25.3184	5.4000	0.6606	--------
10	54.7383	10.8000	0.8016	--------
25	92.8341	14.6000	0.8787	--------
50	41.8042	8.4000	0.6573	--------
100	116.5471	18.3000	0.8393	--------

File name: NOAA IDF Lower Gwynedd.IDF

Intensity = B / (Tc + D)^E

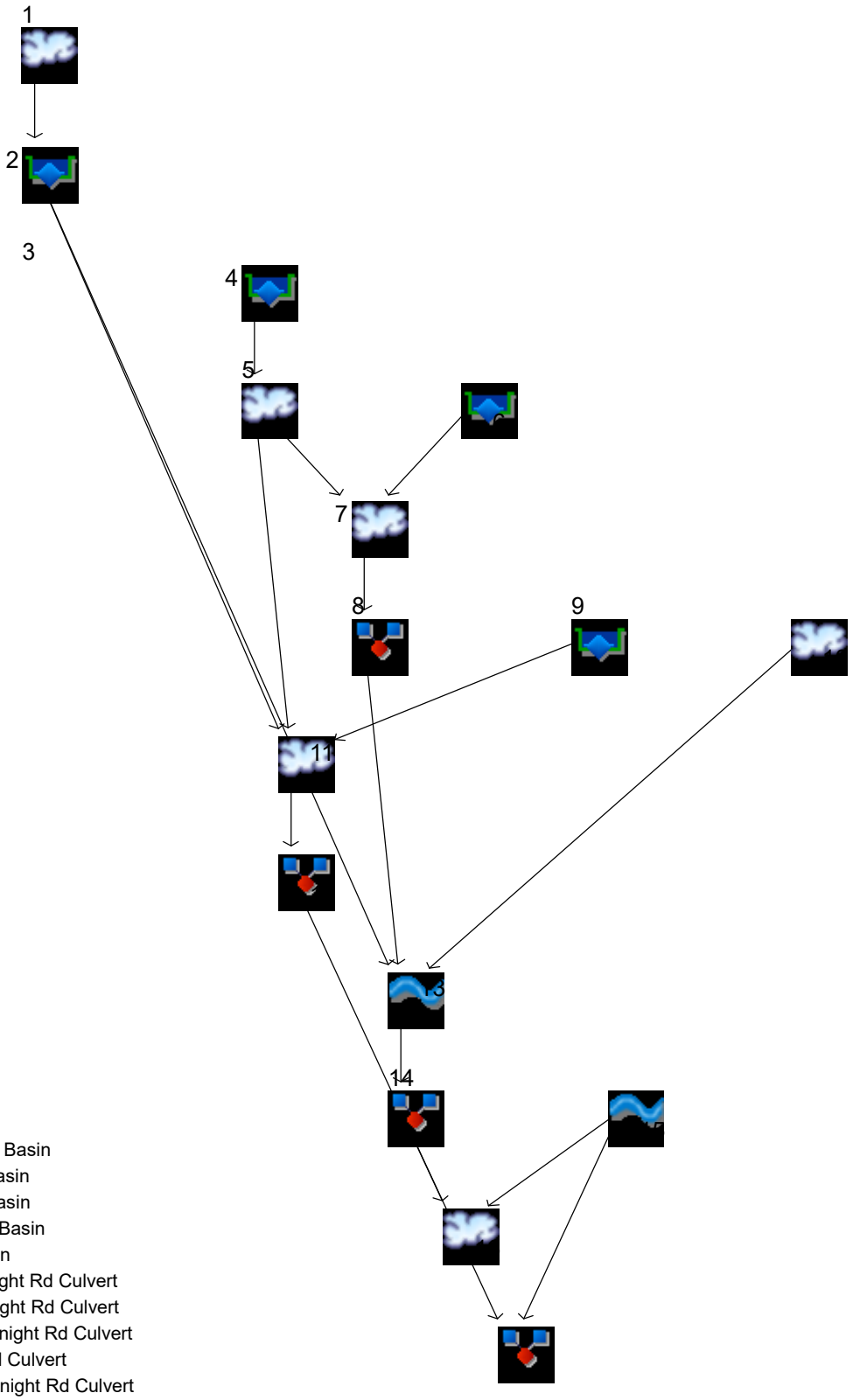
Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.20	2.45	2.00	1.69	1.47	1.30	1.17	1.06	0.97	0.90	0.83	0.78
2	4.70	3.51	2.89	2.49	2.21	2.00	1.84	1.70	1.59	1.50	1.42	1.35
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.39	4.16	3.45	2.99	2.65	2.40	2.20	2.04	1.90	1.79	1.69	1.60
10	5.99	4.81	4.04	3.51	3.11	2.80	2.55	2.35	2.18	2.03	1.91	1.80
25	6.80	5.57	4.73	4.12	3.66	3.30	3.01	2.76	2.56	2.38	2.23	2.10
50	7.59	6.16	5.26	4.63	4.16	3.80	3.51	3.26	3.06	2.88	2.73	2.60
100	8.30	7.05	6.15	5.47	4.93	4.50	4.14	3.84	3.59	3.36	3.17	3.00

Tc = time in minutes. Values may exceed 60.

Precip. file name: NOAA Precipitation Lower Gwynedd.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.70	3.25	0.00	4.07	4.76	5.74	6.57	7.46
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA to Dam
2	Reservoir	EX Dam
3	SCS Runoff	DA to School Basin
4	Reservoir	EX School Basin
5	SCS Runoff	DA to New Basin
6	Combine	Total to New Basin
7	Reservoir	PR New Basin
8	SCS Runoff	EX DA to Knight Rd Culvert
9	SCS Runoff	PR DA to Knight Rd Culvert
10	Combine	Total EX to Knight Rd Culvert
11	Reach	EX Knight Rd Culvert
12	Combine	Total PR to Knight Rd Culvert
13	Reach	PR Knight Rd Culvert
14	SCS Runoff	DA to Culvert at Tracks
15	Combine	Total EX to Culvert at Tracks
16	Combine	Total PR to Culvert at Tracks

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	125.75	180.90	-------	269.70	348.18	462.79	561.52	668.28	DA to Dam
2	Reservoir	1	101.31	122.45	-------	143.57	155.32	188.75	303.95	452.95	EX Dam
3	SCS Runoff	-------	16.46	23.17	-------	33.84	43.17	56.70	68.29	80.79	DA to School Basin
4	Reservoir	3	8.431	11.97	-------	18.44	24.40	33.06	46.22	62.91	EX School Basin
5	SCS Runoff	-------	26.95	37.18	-------	53.10	66.84	86.61	103.47	121.57	DA to New Basin
6	Combine	4, 5	29.78	42.87	-------	62.94	79.96	105.18	126.96	149.16	Total to New Basin
7	Reservoir	6	1.422	1.718	-------	2.084	2.348	2.670	7.414	20.67	PR New Basin
8	SCS Runoff	-------	82.53	114.92	-------	165.88	210.08	273.90	328.43	387.07	EX DA to Knight Rd Culvert
9	SCS Runoff	-------	53.82	75.67	-------	110.43	140.73	184.64	222.25	262.76	PR DA to Knight Rd Culvert
10	Combine	2, 4, 8,	182.16	234.98	-------	308.22	365.25	444.90	546.15	779.64	Total EX to Knight Rd Culvert
11	Reach	10	185.01	238.11	-------	311.00	368.57	445.40	556.53	803.93	EX Knight Rd Culvert
12	Combine	2, 7, 9,	151.55	191.14	-------	244.14	284.21	338.77	437.54	637.99	Total PR to Knight Rd Culvert
13	Reach	12	154.19	194.00	-------	246.66	287.67	339.16	448.83	659.54	PR Knight Rd Culvert
14	SCS Runoff	-------	64.98	89.60	-------	128.23	161.67	209.86	250.96	295.14	DA to Culvert at Tracks
15	Combine	11, 14	244.99	321.68	-------	431.54	518.45	643.34	798.74	1096.75	Total EX to Culvert at Tracks
16	Combine	13, 14,	215.00	277.57	-------	367.20	440.81	537.31	691.03	952.36	Total PR to Culvert at Tracks

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

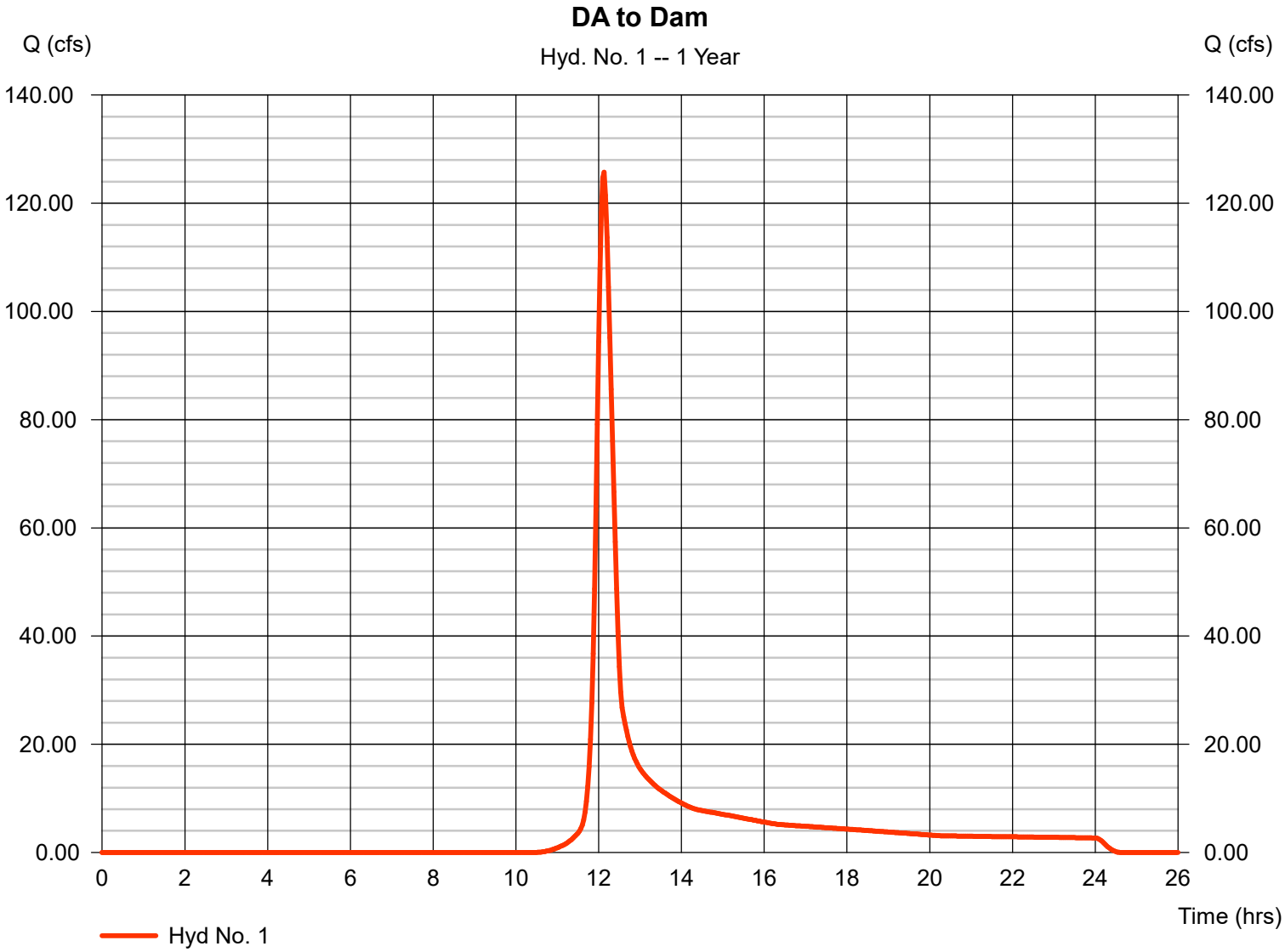
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	125.75	2	728	451,492	----	------	------	DA to Dam
2	Reservoir	101.31	2	734	451,435	1	252.64	25,632	EX Dam
3	SCS Runoff	16.46	2	732	67,620	----	------	------	DA to School Basin
4	Reservoir	8.431	2	750	67,612	3	272.07	20,387	EX School Basin
5	SCS Runoff	26.95	2	726	94,441	----	------	------	DA to New Basin
6	Combine	29.78	2	728	162,053	4, 5	------	------	Total to New Basin
7	Reservoir	1.422	2	1114	160,630	6	252.69	106,791	PR New Basin
8	SCS Runoff	82.53	2	728	290,476	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	53.82	2	728	190,450	----	------	------	PR DA to Knight Rd Culvert
10	Combine	182.16	2	728	809,523	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	185.01	2	730	809,488	10	------	------	EX Knight Rd Culvert
12	Combine	151.55	2	730	802,515	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	154.19	2	730	802,514	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	64.98	2	736	299,359	----	------	------	DA to Culvert at Tracks
15	Combine	244.99	2	730	1,108,848	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	215.00	2	734	1,101,873	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	125.75 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	451,492 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

DA to Dam

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 160.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		0.00		0.00		
Land slope (%)	= 5.00		0.00		0.00		
Travel Time (min)	**= 9.81**	**+**	**0.00**	**+**	**0.00**	**=**	**9.81**
Shallow Concentrated Flow							
Flow length (ft)	= 150.00		675.00		0.00		
Watercourse slope (%)	= 4.70		3.30		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 3.50		3.69		0.00		
Travel Time (min)	**= 0.71**	**+**	**3.05**	**+**	**0.00**	**=**	**3.76**
Channel Flow							
X sectional flow area (sqft)	= 3.14		30.00		0.00		
Wetted perimeter (ft)	= 6.28		22.60		0.00		
Channel slope (%)	= 2.00		2.00		0.00		
Manning's n-value	= 0.015		0.050		0.015		
Velocity (ft/s)	= 8.83		5.10		0.00		
Flow length (ft)	= 650.0		2470.0		0.0		
Travel Time (min)	**= 1.23**	**+**	**8.08**	**+**	**0.00**	**=**	**9.31**

Total Travel Time, Tc ..... 22.90 min

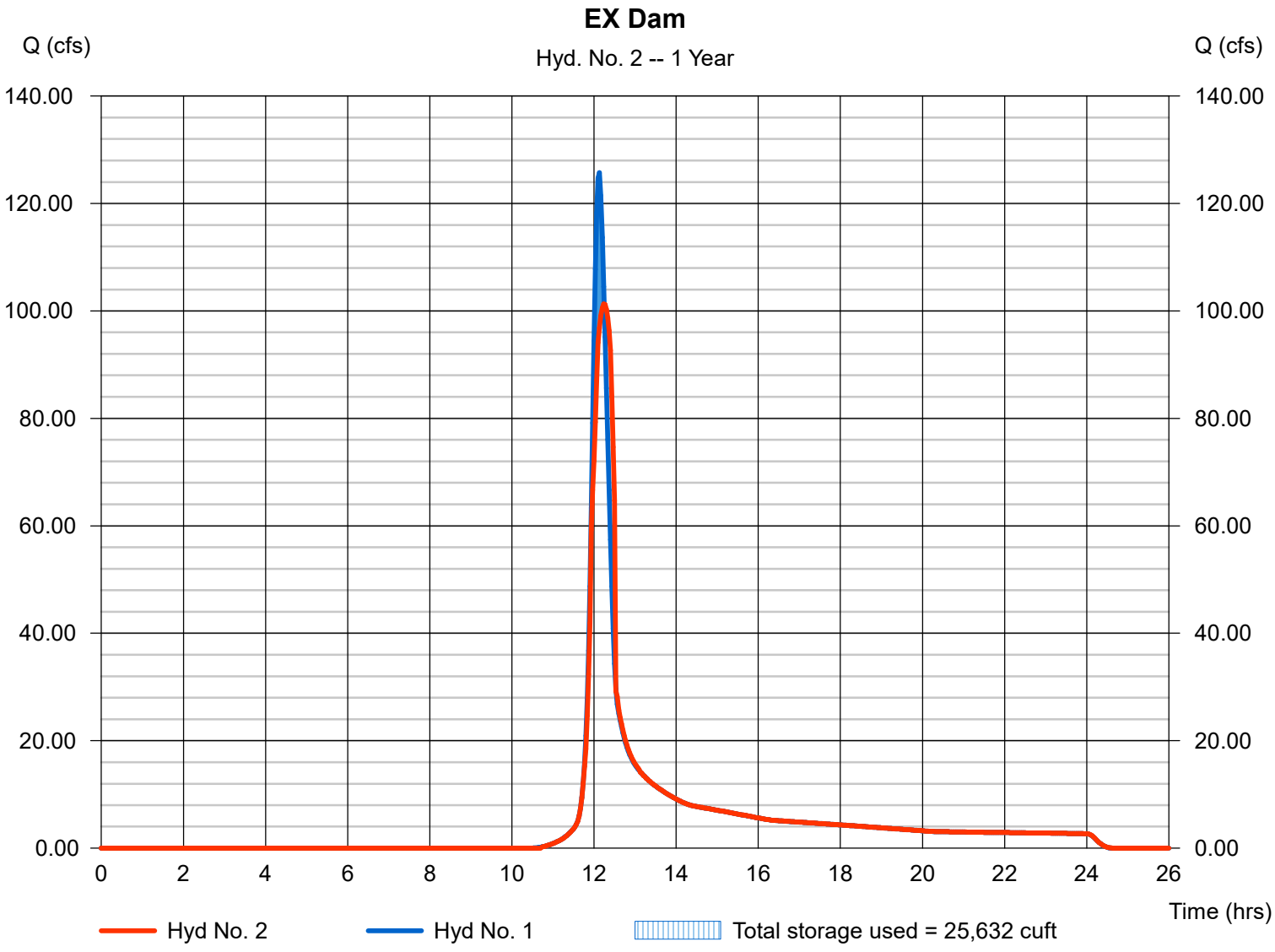
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	101.31 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	451,435 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	252.64 ft
Reservoir name	=	EX Dam	Max. Storage	=	25,632 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - EX Dam

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 246.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	246.00	01	0	0
2.00	248.00	143	144	144
4.00	250.00	2,390	2,533	2,677
6.00	252.00	10,496	12,886	15,563
8.00	254.00	21,604	32,100	47,663
10.00	256.00	32,612	54,216	101,879
12.00	258.00	60,893	93,505	195,384
14.00	260.00	104,424	165,317	360,701
16.00	262.00	155,295	259,719	620,420

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 246.95	0.00	0.00	0.00
Length (ft)	= 9.00	0.00	0.00	0.00
Slope (%)	= 5.20	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 72.00	175.00	0.00	0.00
Crest El. (ft)	= 260.00	261.00	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	3.33
Weir Type	= Broad	Broad	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

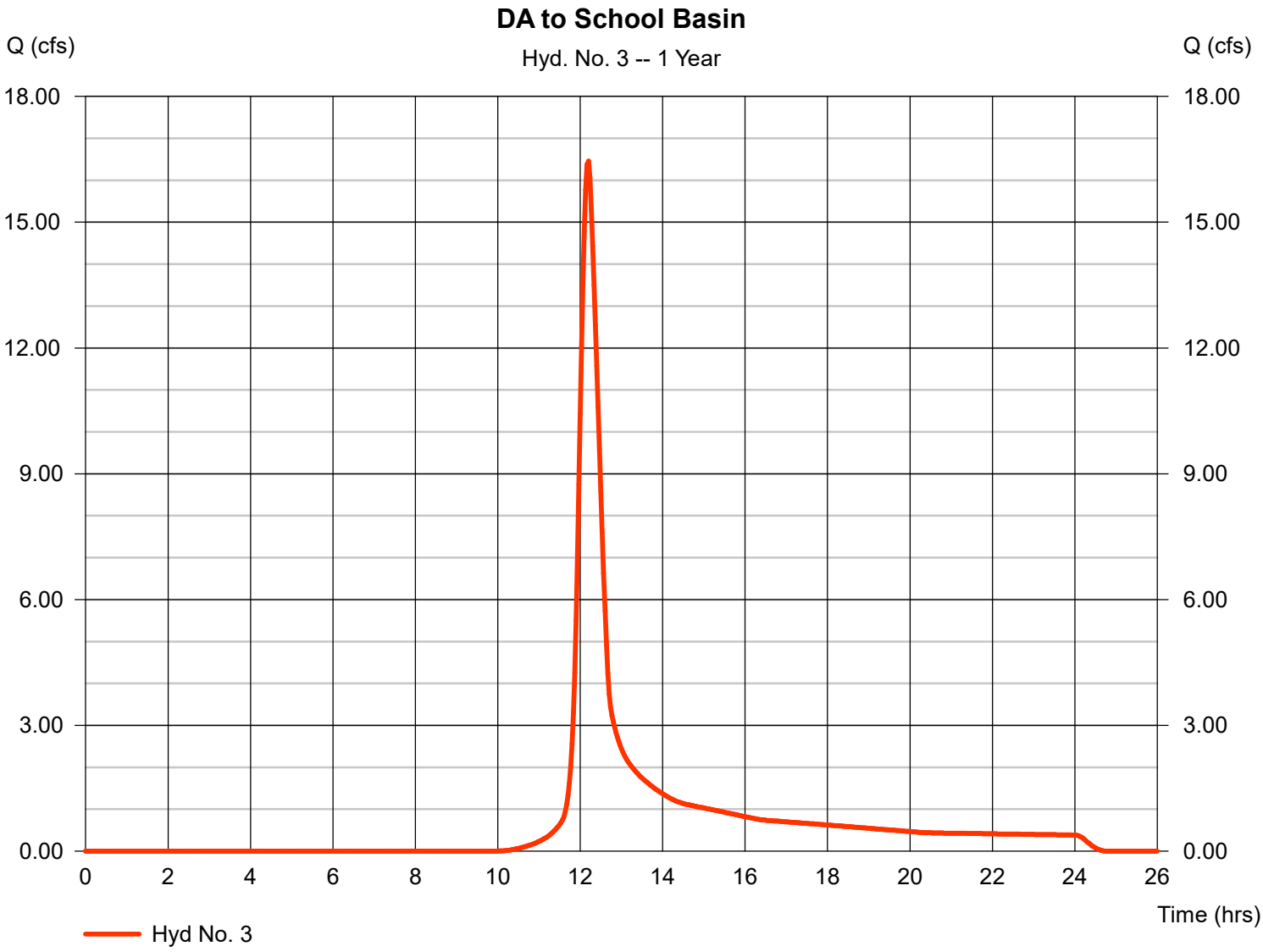
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	246.00	0.00	---	---	---	0.00	0.00	---	---	---	---	0.000
2.00	144	248.00	14.65 ic	---	---	---	0.00	0.00	---	---	---	---	14.65
4.00	2,677	250.00	64.60 ic	---	---	---	0.00	0.00	---	---	---	---	64.60
6.00	15,563	252.00	93.86 ic	---	---	---	0.00	0.00	---	---	---	---	93.86
8.00	47,663	254.00	115.96 ic	---	---	---	0.00	0.00	---	---	---	---	115.96
10.00	101,879	256.00	134.48 ic	---	---	---	0.00	0.00	---	---	---	---	134.48
12.00	195,384	258.00	150.73 ic	---	---	---	0.00	0.00	---	---	---	---	150.73
14.00	360,701	260.00	165.40 ic	---	---	---	0.00	0.00	---	---	---	---	165.40
16.00	620,420	262.00	178.87 ic	---	---	---	529.48	455.00	---	---	---	---	1163.35

Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.46 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	67,620 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

DA to School Basin

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 23.41**	**+**	**0.00**	**+**	**0.00**	**=**	**23.41**
Shallow Concentrated Flow							
Flow length (ft)	= 265.00		60.00		160.00		
Watercourse slope (%)	= 2.30		16.70		1.90		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	= 2.45		6.59		2.80		
Travel Time (min)	**= 1.80**	**+**	**0.15**	**+**	**0.95**	**=**	**2.91**
Channel Flow							
X sectional flow area (sqft)	= 0.20		1.23		0.00		
Wetted perimeter (ft)	= 1.57		3.93		0.00		
Channel slope (%)	= 1.00		2.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 2.50		6.45		0.00		
Flow length (ft)	= 285.0		115.0		0.0		
Travel Time (min)	**= 1.90**	**+**	**0.30**	**+**	**0.00**	**=**	**2.20**

Total Travel Time, Tc ..... 28.50 min

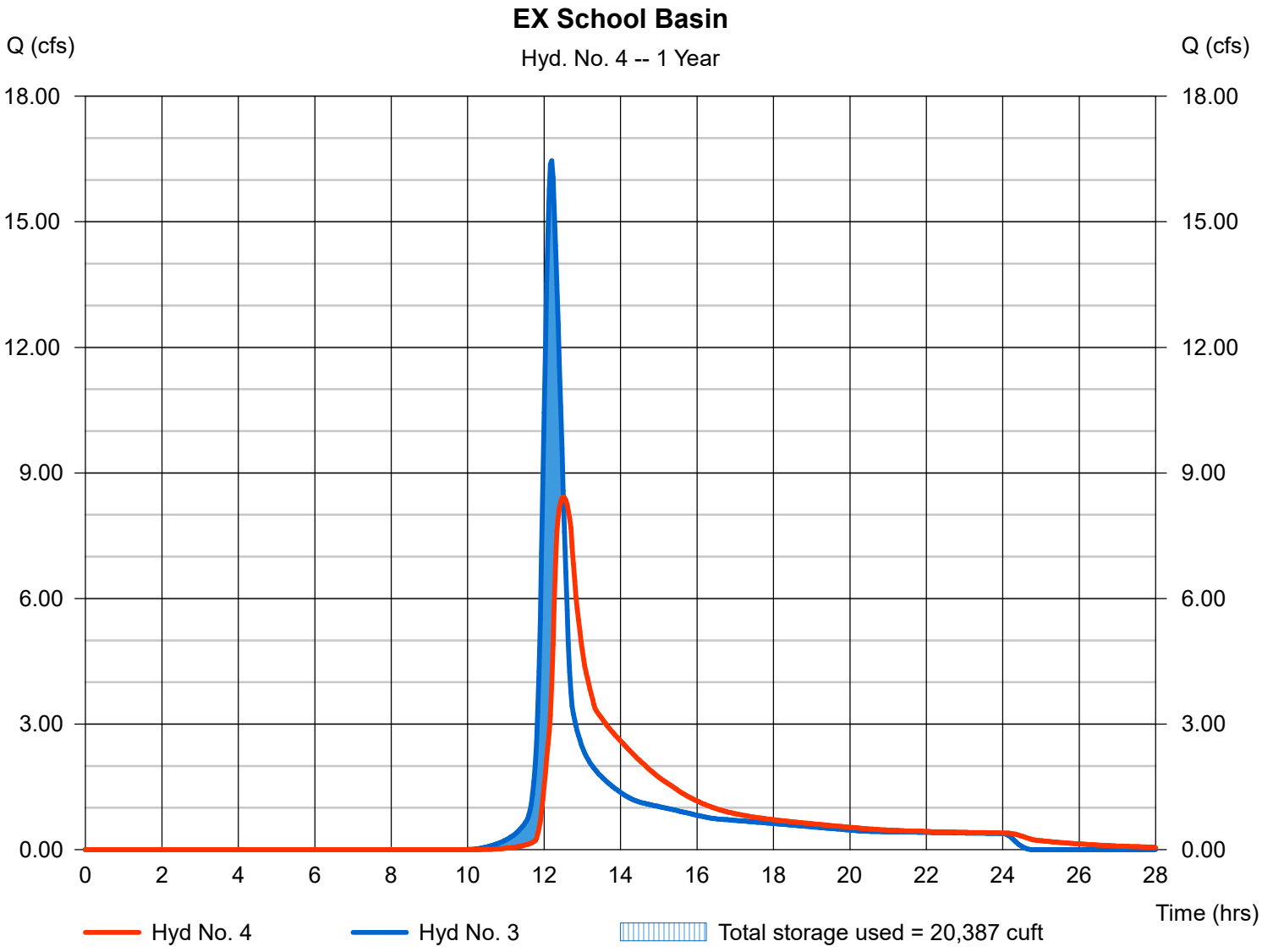
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	8.431 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	67,612 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	272.07 ft
Reservoir name	=	EX School Basin	Max. Storage	=	20,387 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - EX School Basin

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 270.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	270.00	441	0	0
2.00	272.00	18,356	18,797	18,797
4.00	274.00	28,936	47,292	66,089
5.00	275.00	37,052	32,994	99,083

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	6.00	24.00	0.00
Span (in)	= 36.00	6.00	26.00	0.00
No. Barrels	= 1	4	1	0
Invert El. (ft)	= 270.00	270.00	271.33	0.00
Length (ft)	= 330.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	25.00	0.00	0.00
Crest El. (ft)	= 273.75	274.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

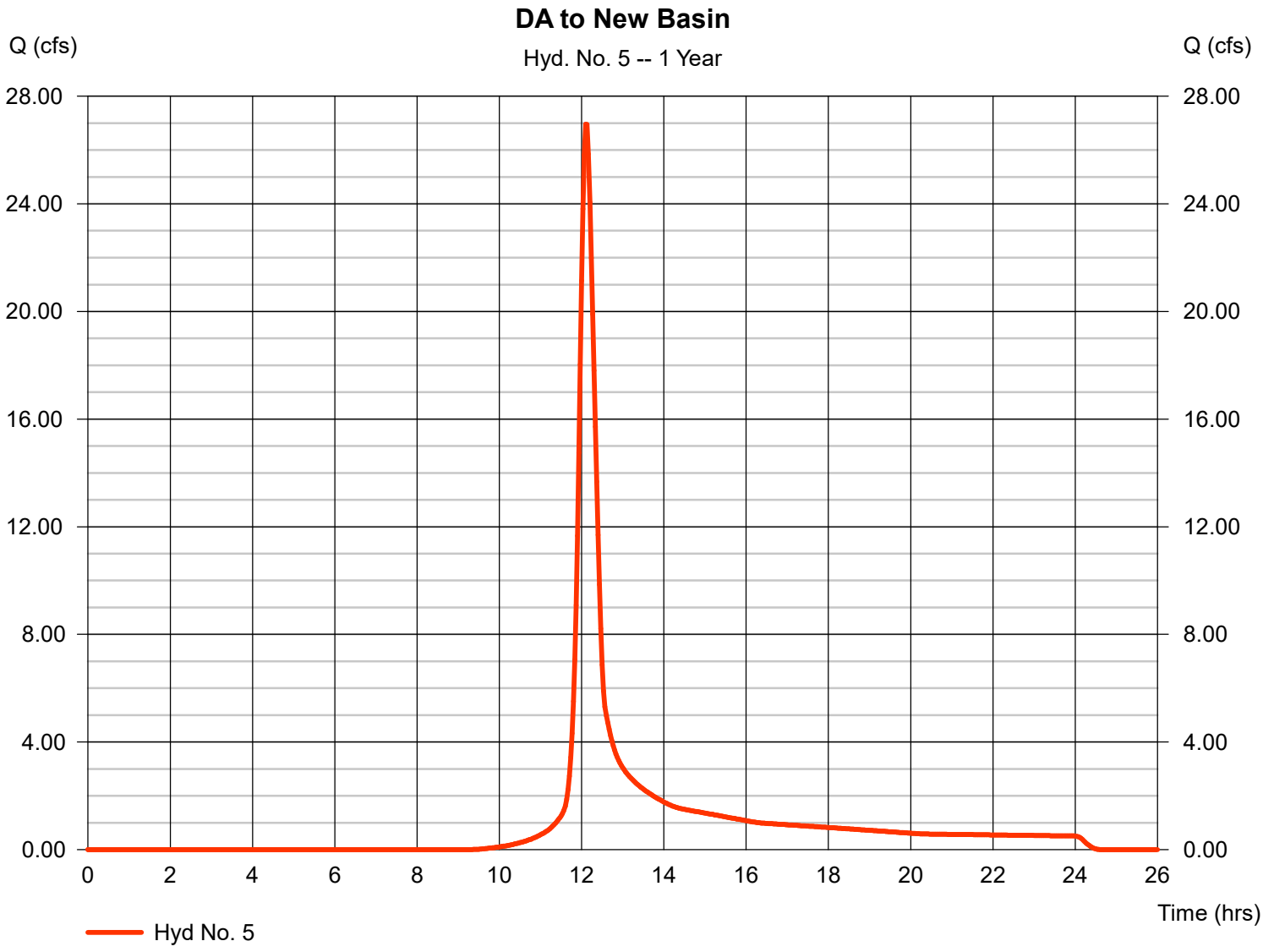
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	270.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	18,797	272.00	7.75 ic	3.70 ic	4.05 ic	---	0.00	0.00	---	---	---	---	7.748
4.00	66,089	274.00	35.83 ic	4.48 ic	24.69 ic	---	6.66	0.00	---	---	---	---	35.83
5.00	99,083	275.00	53.53 oc	1.70 ic	9.38 ic	---	42.45 s	83.25	---	---	---	---	136.77

Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	26.95 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	94,441 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 5

DA to New Basin

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 110.0		110.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		3.25		0.00		
Land slope (%)	= 1.80		0.50		0.00		
Travel Time (min)	**= 10.94**	**+**	**2.26**	**+**	**0.00**	**=**	**13.20**
Shallow Concentrated Flow							
Flow length (ft)	= 740.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.49		0.00		0.00		
Travel Time (min)	**= 4.95**	**+**	**0.00**	**+**	**0.00**	**=**	**4.95**
Channel Flow							
X sectional flow area (sqft)	= 1.77		7.07		60.00		
Wetted perimeter (ft)	= 4.71		9.42		35.60		
Channel slope (%)	= 2.30		3.30		2.00		
Manning's n-value	= 0.015		0.015		0.050		
Velocity (ft/s)	= 7.82		14.89		5.98		
Flow length (ft)	= 310.0		965.0		100.0		
Travel Time (min)	**= 0.66**	**+**	**1.08**	**+**	**0.28**	**=**	**2.02**

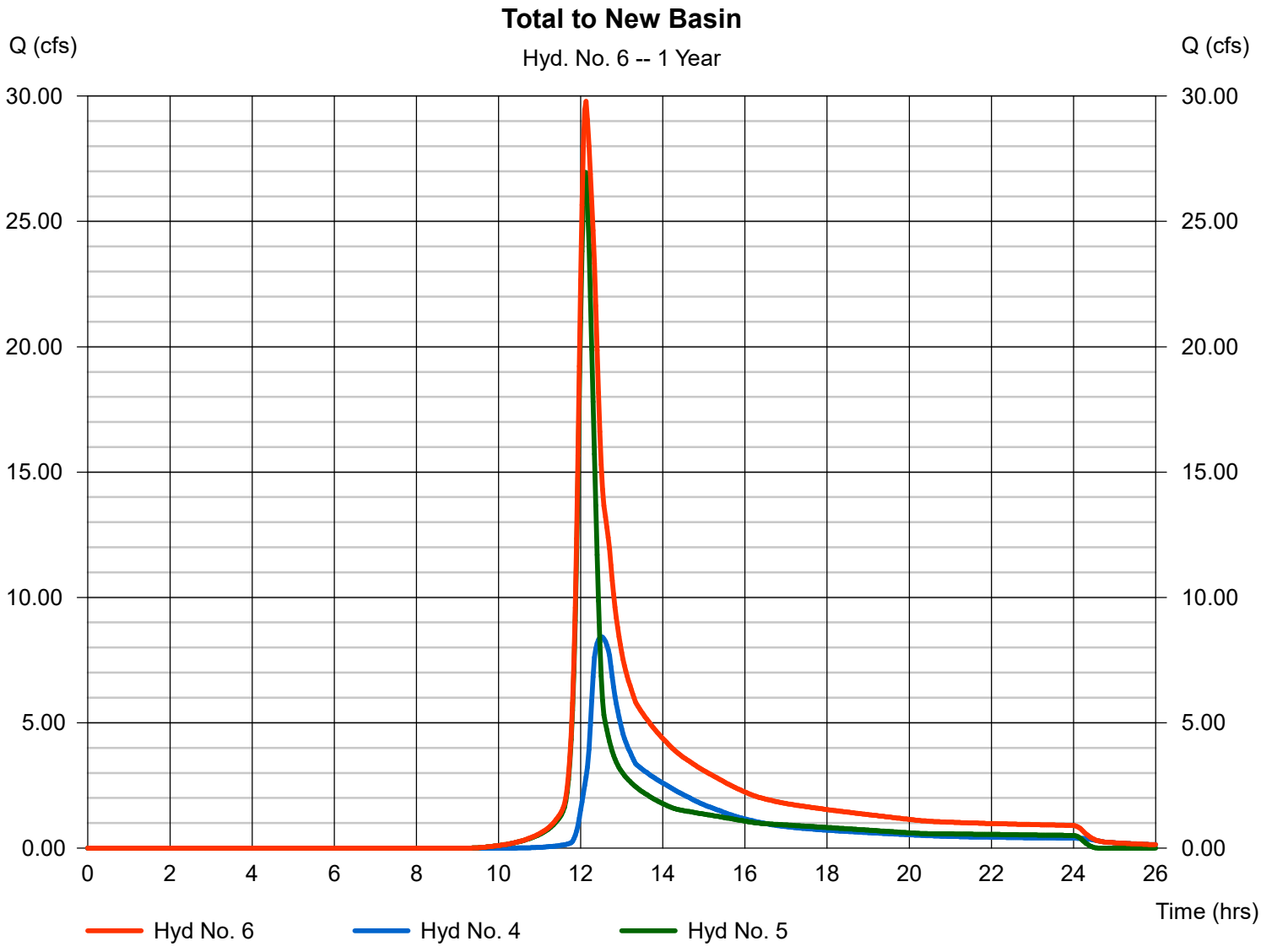
Total Travel Time, Tc ..... 20.20 min

Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 29.78 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 162,053 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



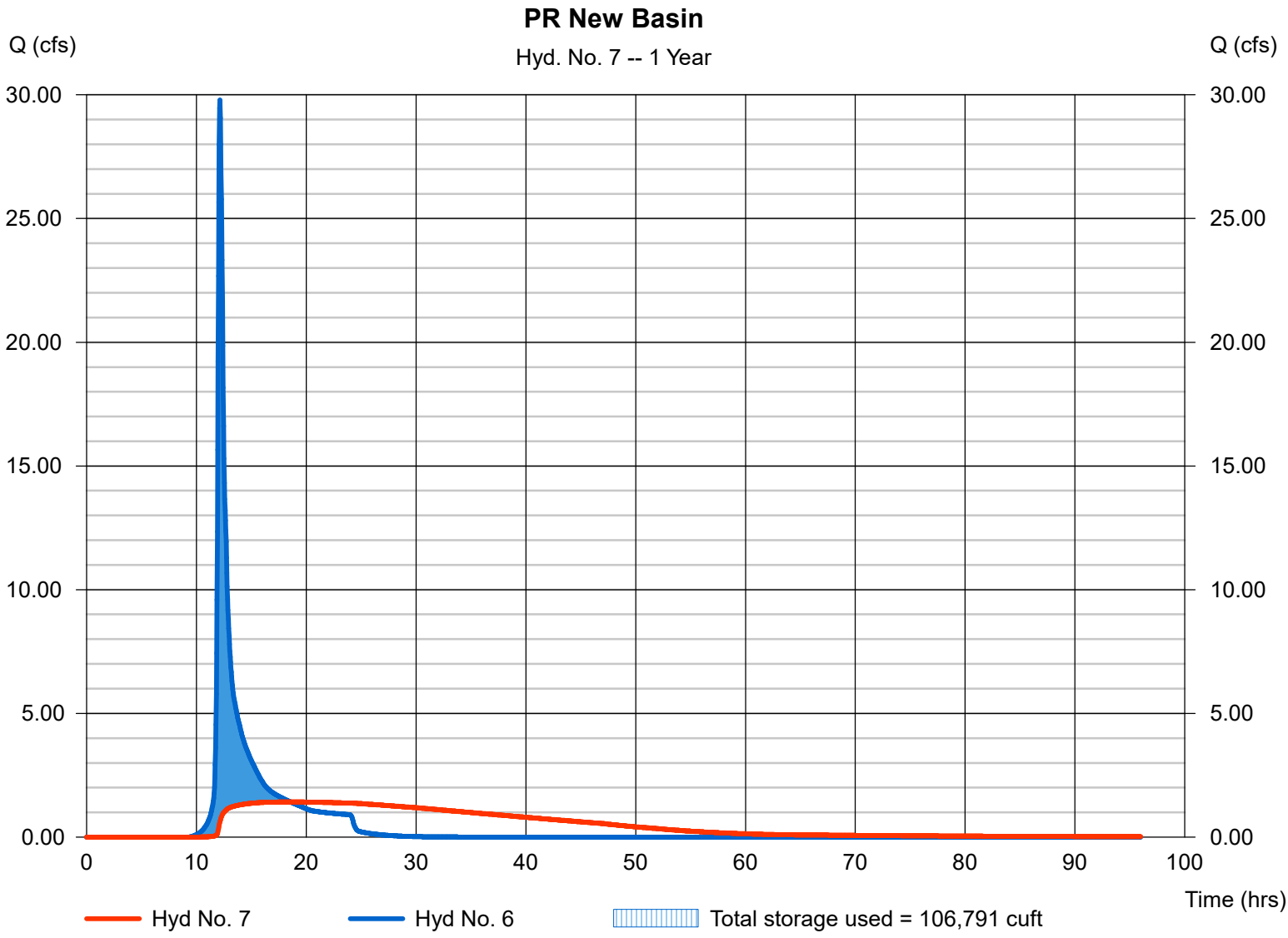
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	1.422 cfs
Storm frequency	=	1 yrs	Time to peak	=	18.57 hrs
Time interval	=	2 min	Hyd. volume	=	160,630 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	252.69 ft
Reservoir name	=	PR New Basin	Max. Storage	=	106,791 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - PR New Basin

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 250.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	250.00	35,786	0	0
2.00	252.00	40,829	76,615	76,615
4.00	254.00	46,204	87,033	163,648
6.00	256.00	51,945	98,149	261,797
8.00	258.00	58,059	110,004	371,801
10.00	260.00	64,562	122,621	494,422
12.00	262.00	72,730	137,292	631,714

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	6.00	Inactive	0.00
Span (in)	= 36.00	6.00	36.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 250.00	250.00	252.00	0.00
Length (ft)	= 90.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	100.00	0.00	0.00
Crest El. (ft)	= 259.00	260.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

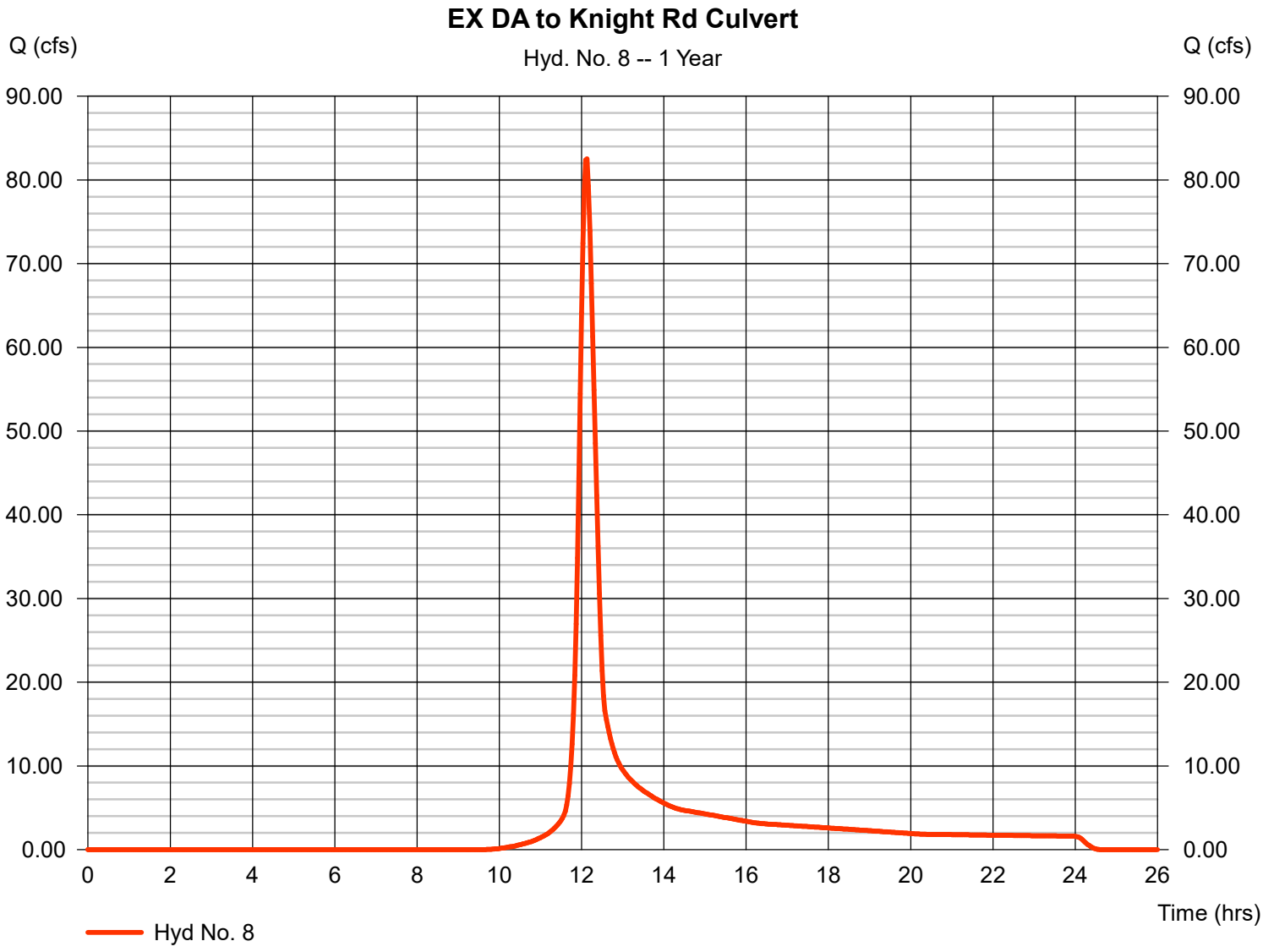
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	250.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	76,615	252.00	1.22 ic	1.20 ic	0.00	---	0.00	0.00	---	---	---	---	1.199
4.00	163,648	254.00	1.77 ic	1.77 ic	0.00	---	0.00	0.00	---	---	---	---	1.774
6.00	261,797	256.00	2.30 ic	2.21 ic	0.00	---	0.00	0.00	---	---	---	---	2.208
8.00	371,801	258.00	2.61 ic	2.57 ic	0.00	---	0.00	0.00	---	---	---	---	2.575
10.00	494,422	260.00	55.48 oc	2.20 ic	0.00	---	53.28	0.00	---	---	---	---	55.48
12.00	631,714	262.00	109.32 ic	0.40 ic	0.00	---	108.92 s	941.87	---	---	---	---	1051.19

Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	82.53 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	290,476 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 8

EX DA to Knight Rd Culvert

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 255.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		3.25		0.00		
Land slope (%)	= 2.70		0.00		0.00		
Travel Time (min)	**= 18.23**	**+**	**0.00**	**+**	**0.00**	**=**	**18.23**
Shallow Concentrated Flow							
Flow length (ft)	= 30.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.49		0.00		0.00		
Travel Time (min)	**= 0.20**	**+**	**0.00**	**+**	**0.00**	**=**	**0.20**
Channel Flow							
X sectional flow area (sqft)	= 1.77		3.14		7.07		
Wetted perimeter (ft)	= 4.71		6.28		9.42		
Channel slope (%)	= 1.70		1.50		1.90		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 6.72		7.65		11.30		
Flow length (ft)	= 600.0		875.0		1025.0		
Travel Time (min)	**= 1.49**	**+**	**1.91**	**+**	**1.51**	**=**	**4.91**

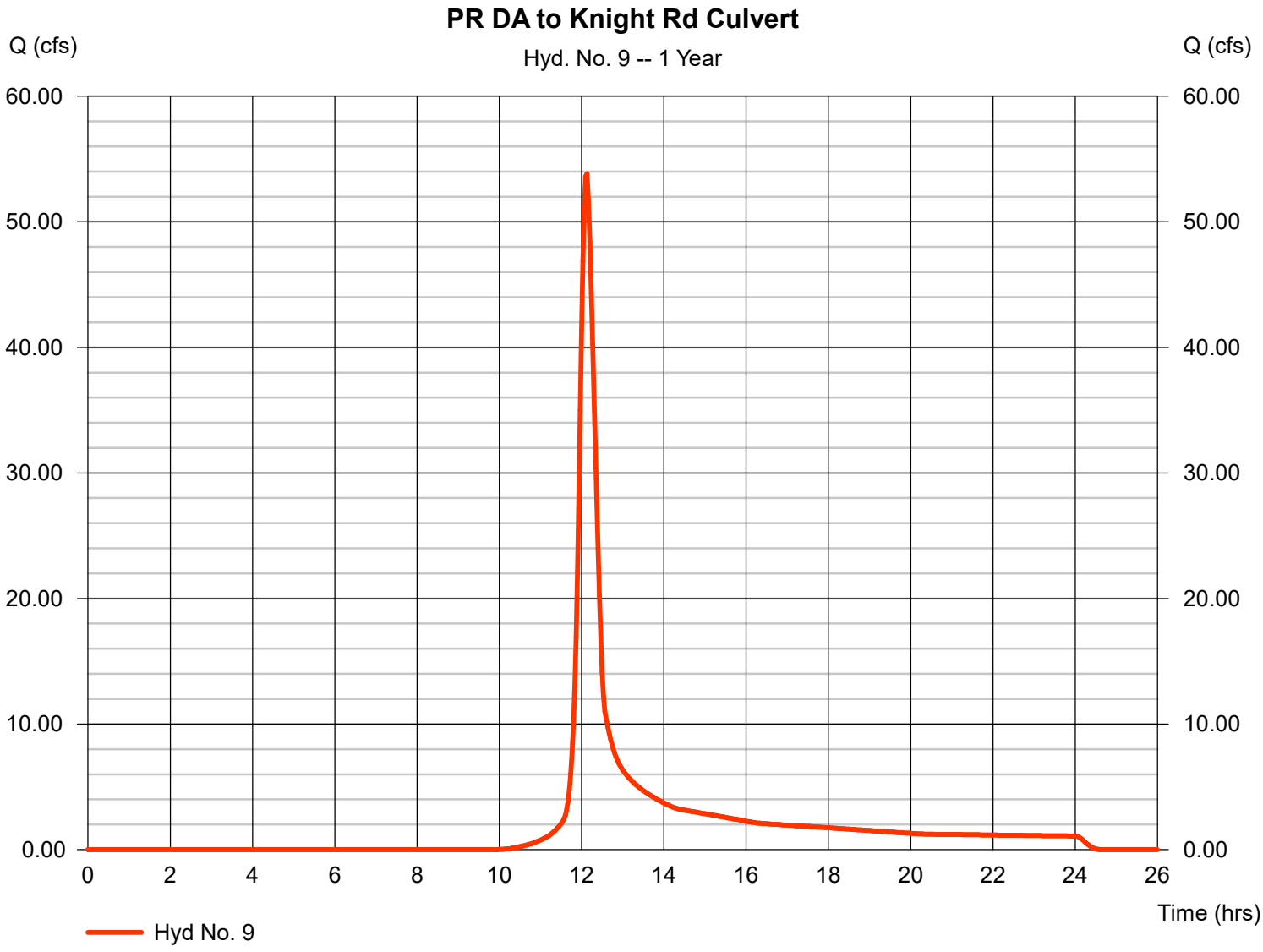
Total Travel Time, Tc ..... 23.30 min

Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.82 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	190,450 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 9

PR DA to Knight Rd Culvert

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 255.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.25		3.25		0.00		
Land slope (%)	= 2.70		0.00		0.00		
Travel Time (min)	**= 18.23**	**+**	**0.00**	**+**	**0.00**	**=**	**18.23**
Shallow Concentrated Flow							
Flow length (ft)	= 30.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.49		0.00		0.00		
Travel Time (min)	**= 0.20**	**+**	**0.00**	**+**	**0.00**	**=**	**0.20**
Channel Flow							
X sectional flow area (sqft)	= 1.77		3.14		7.07		
Wetted perimeter (ft)	= 4.71		6.28		9.42		
Channel slope (%)	= 1.70		1.50		1.90		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 6.72		7.65		11.30		
Flow length (ft)	= 600.0		875.0		1025.0		
Travel Time (min)	**= 1.49**	**+**	**1.91**	**+**	**1.51**	**=**	**4.91**

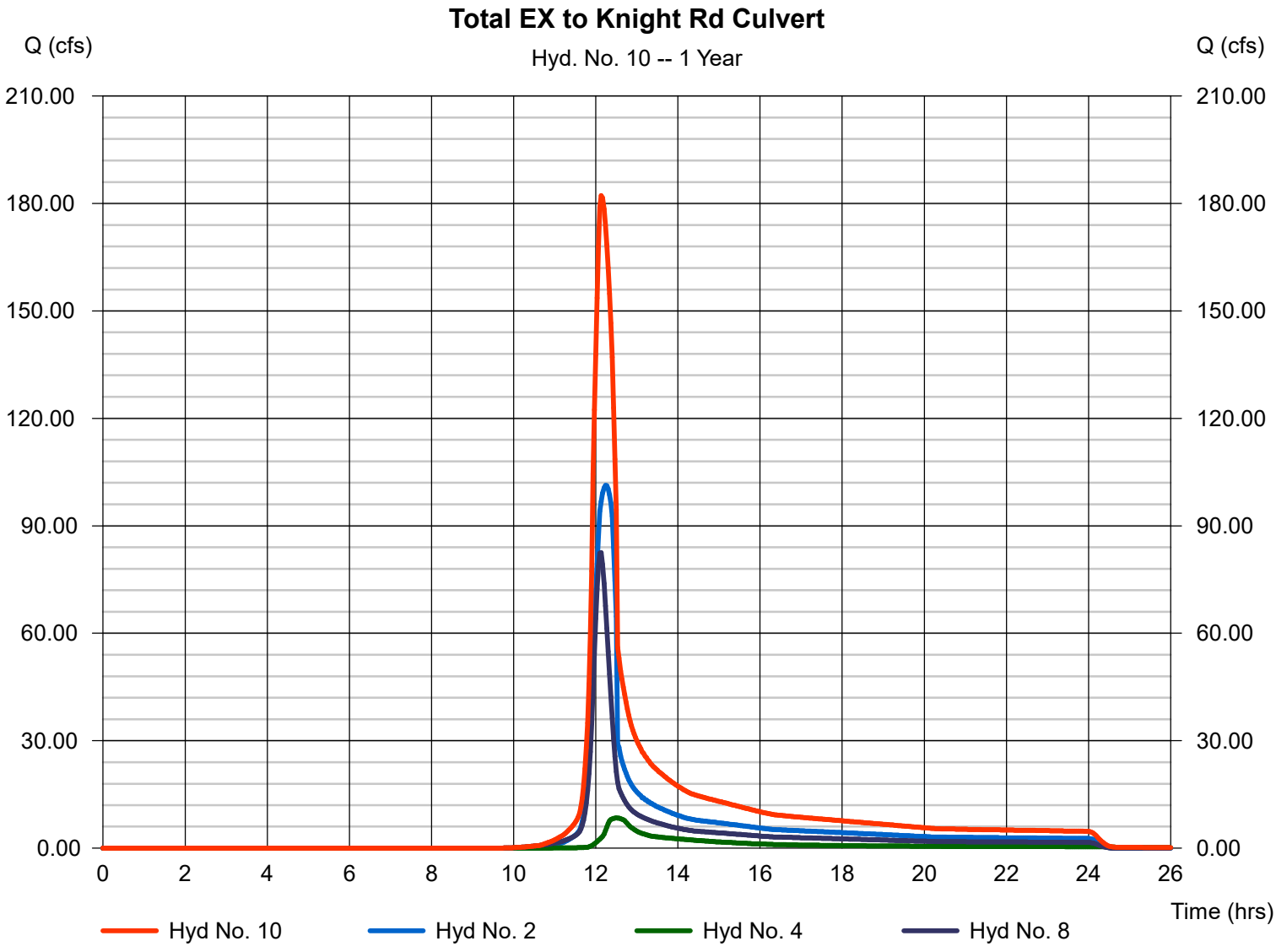
Total Travel Time, Tc ..... 23.30 min

Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 182.16 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 809,523 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



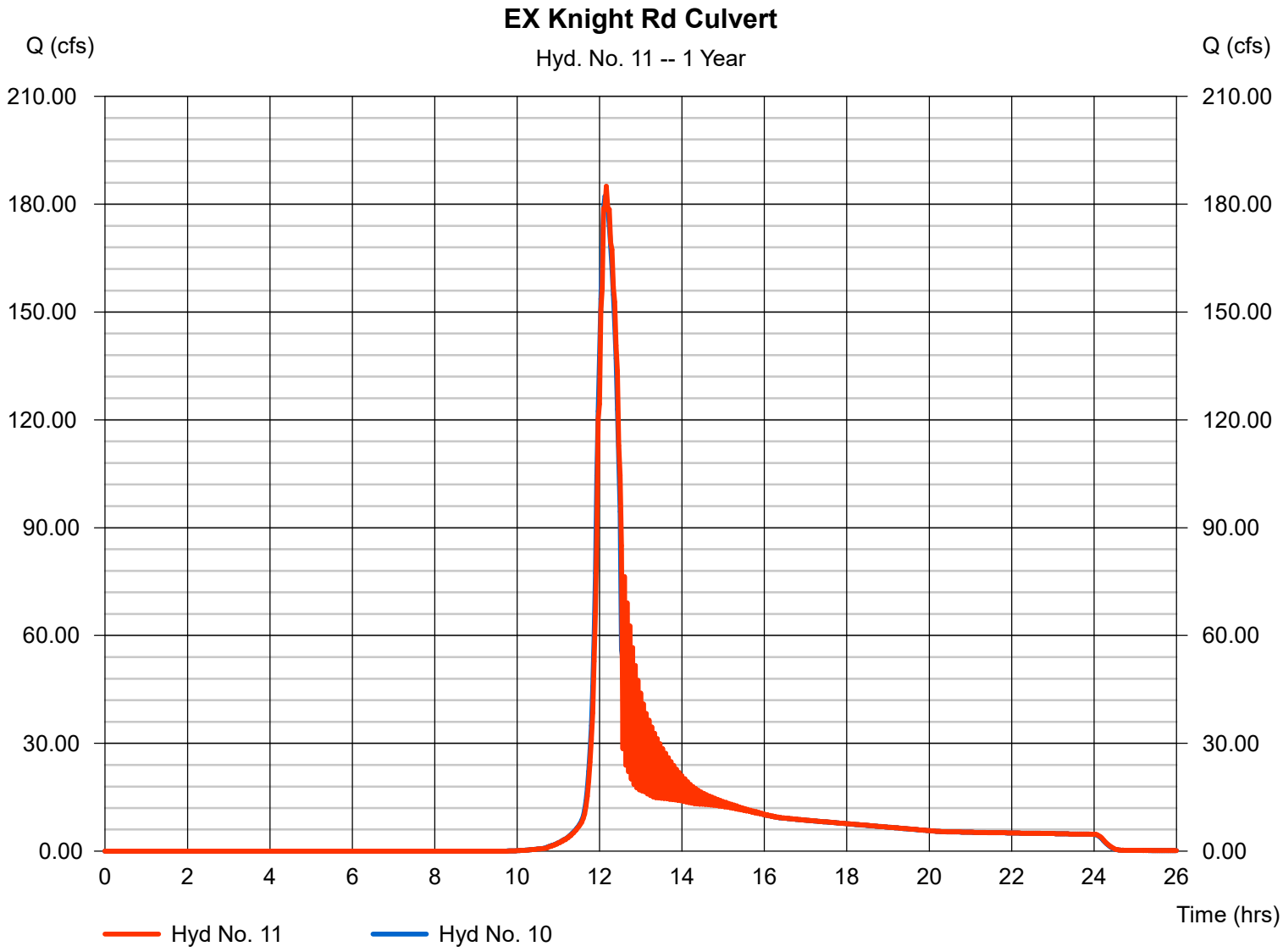
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	185.01 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	809,488 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	22.02 ft/s	Routing coeff.	=	1.9479

Modified Att-Kin routing method used.

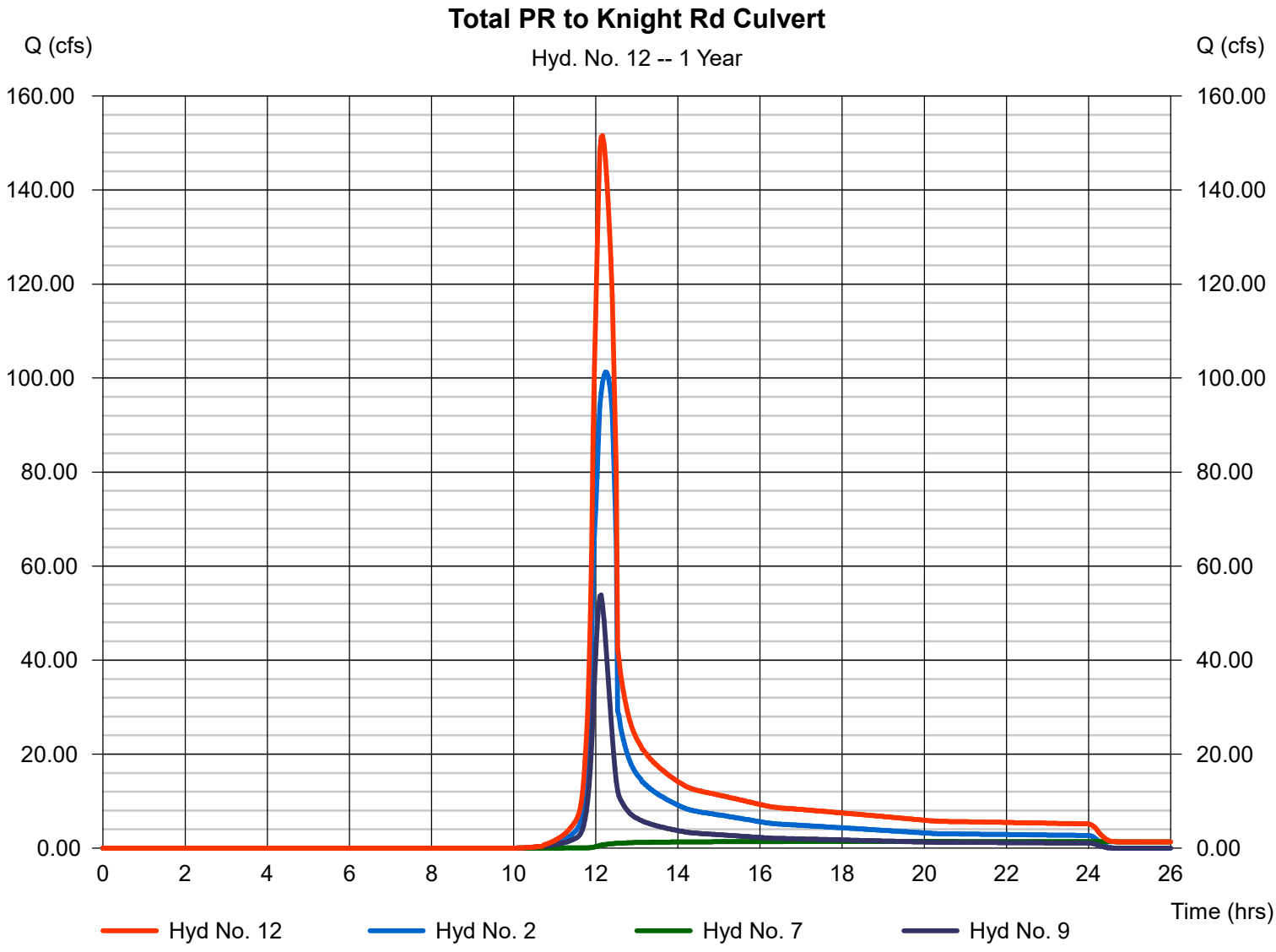


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 151.55 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 802,515 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



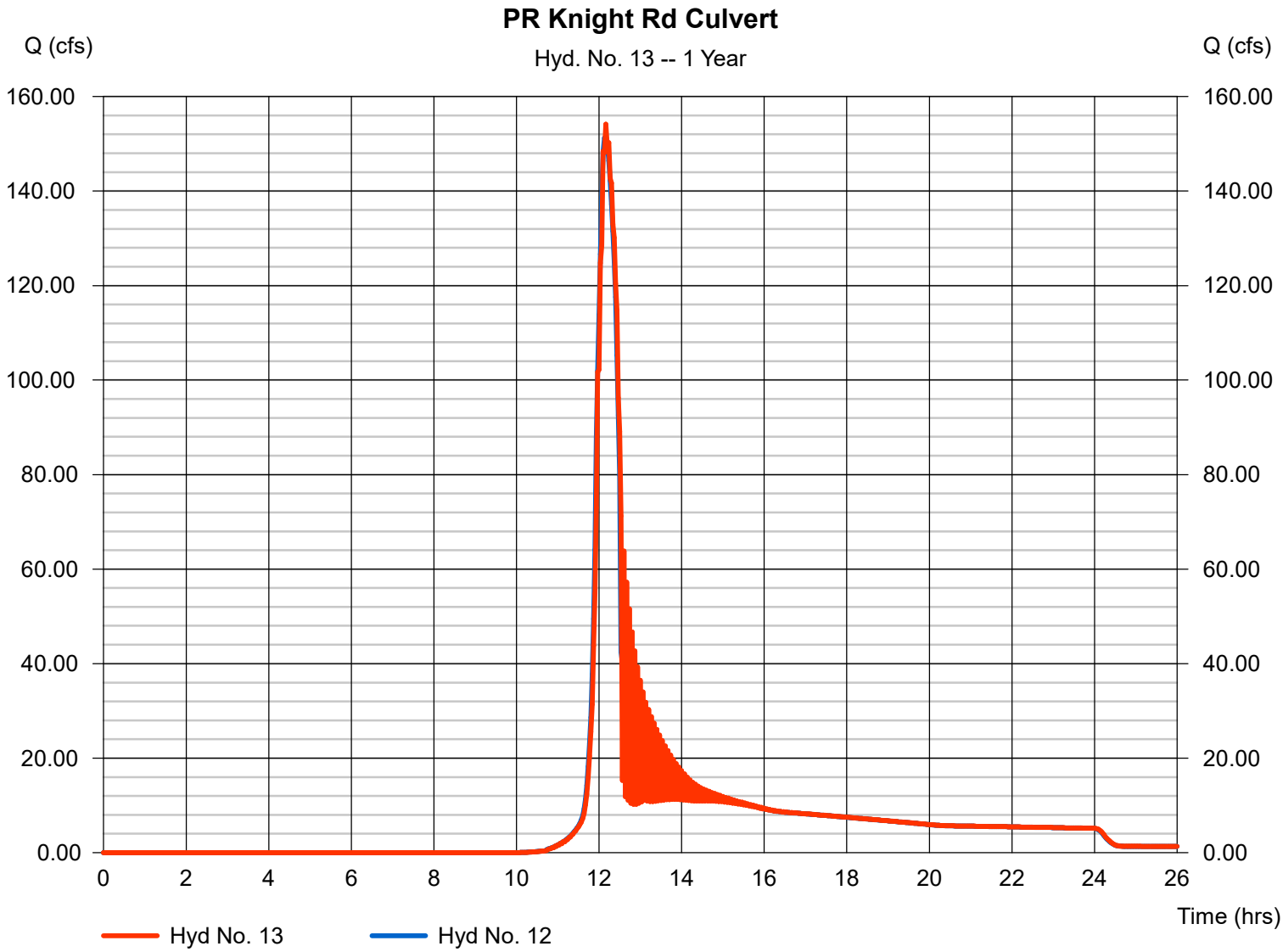
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	154.19 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	802,514 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	20.62 ft/s	Routing coeff.	=	1.9444

Modified Att-Kin routing method used.

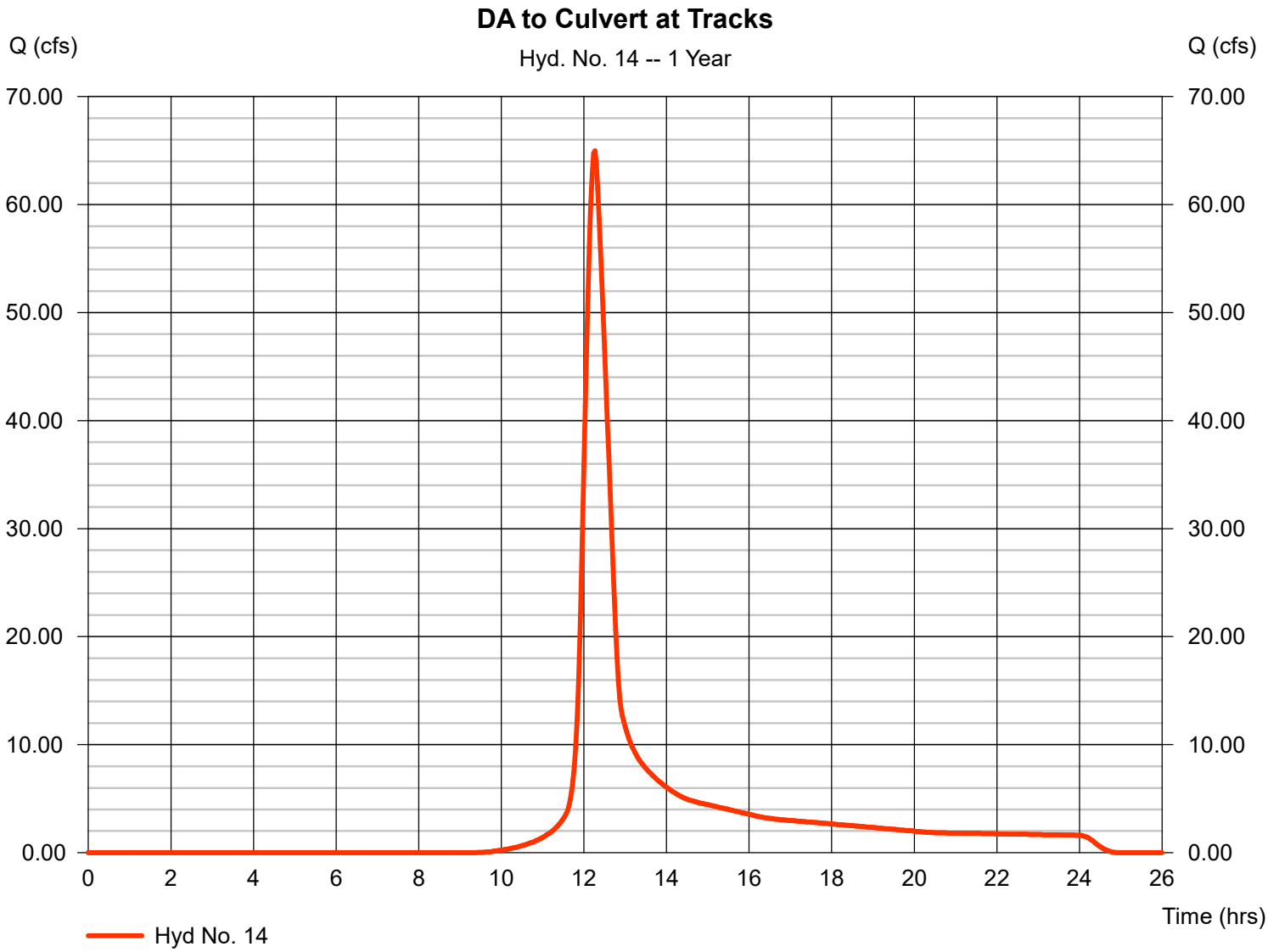


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	64.98 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	299,359 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 14

DA to Culvert at Tracks

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 300.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.25	0.00	0.00	
Land slope (%)	= 1.70	0.00	0.00	
Travel Time (min)	**= 24.99**	**+ 0.00**	**+ 0.00**	**= 24.99**
Shallow Concentrated Flow				
Flow length (ft)	= 740.00	560.00	0.00	
Watercourse slope (%)	= 1.00	6.60	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	5.22	0.00	
Travel Time (min)	**= 7.64**	**+ 1.79**	**+ 0.00**	**= 9.43**
Channel Flow				
X sectional flow area (sqft)	= 3.14	21.21	0.00	
Wetted perimeter (ft)	= 6.28	28.27	0.00	
Channel slope (%)	= 3.30	2.80	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 11.34	13.71	0.00	
Flow length (ft)	= 60.0	650.0	0.0	
Travel Time (min)	**= 0.09**	**+ 0.79**	**+ 0.00**	**= 0.88**

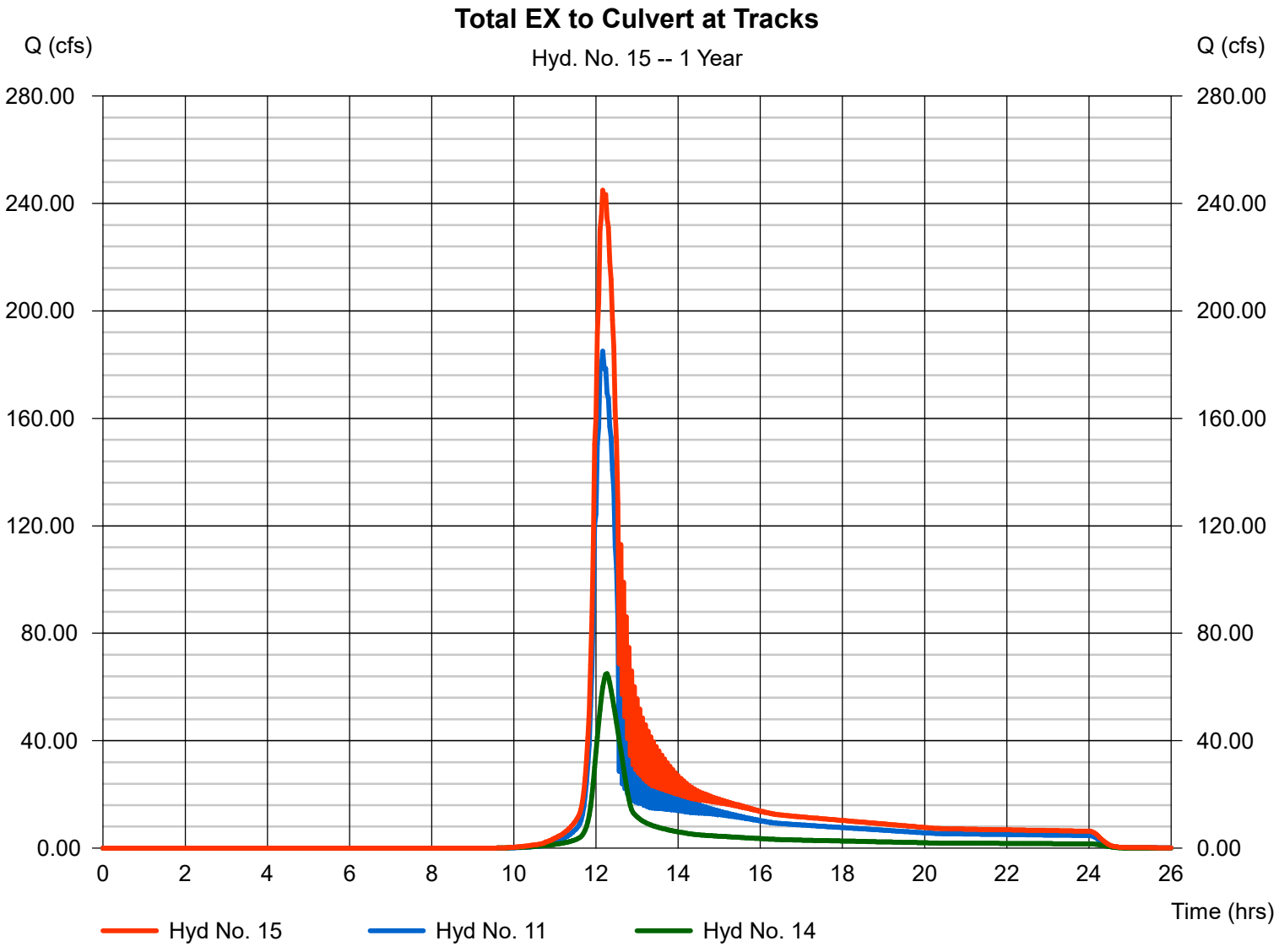
Total Travel Time, Tc ..... 35.30 min

Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 244.99 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,108,848 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

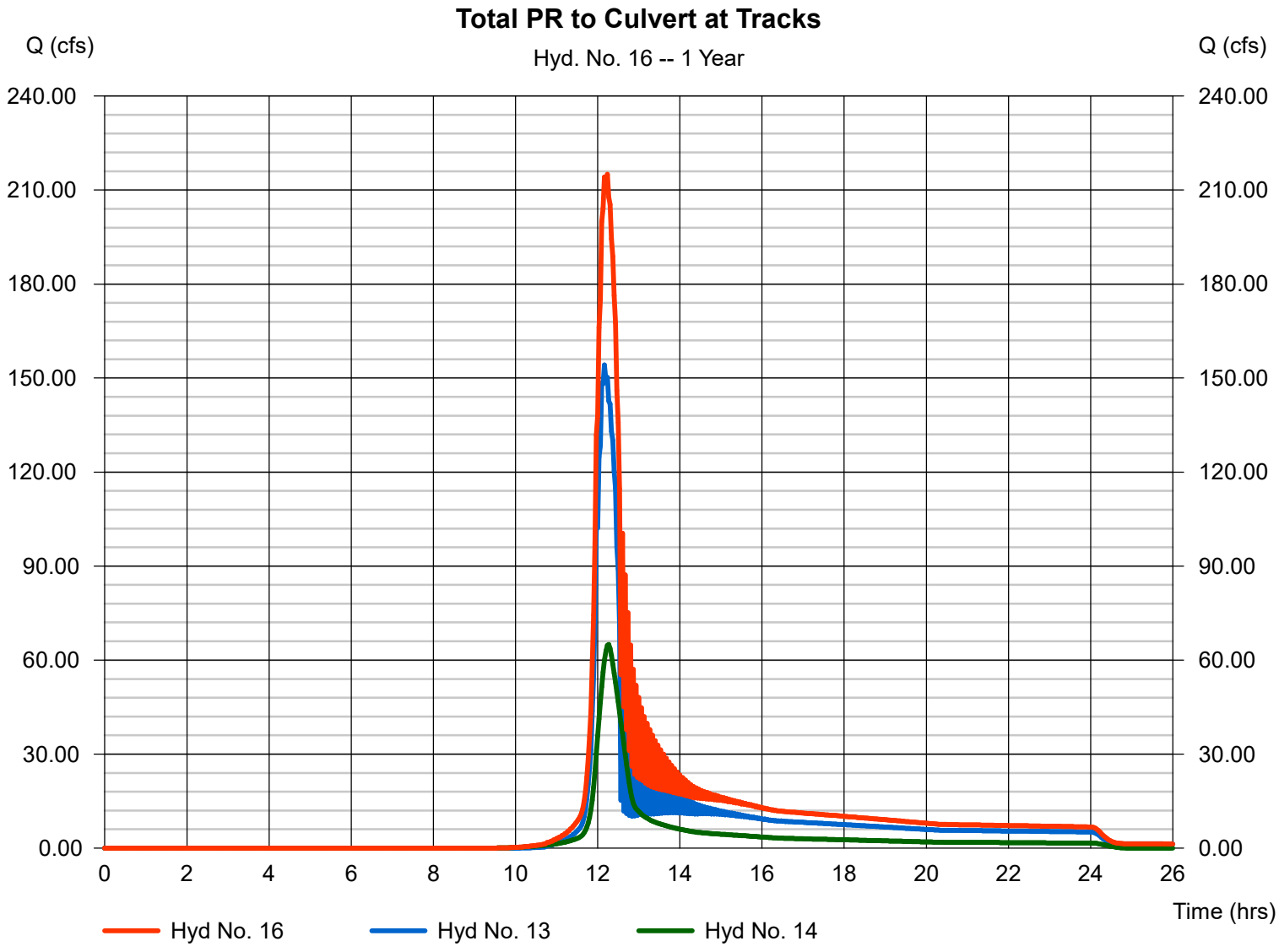


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 215.00 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 1,101,873 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

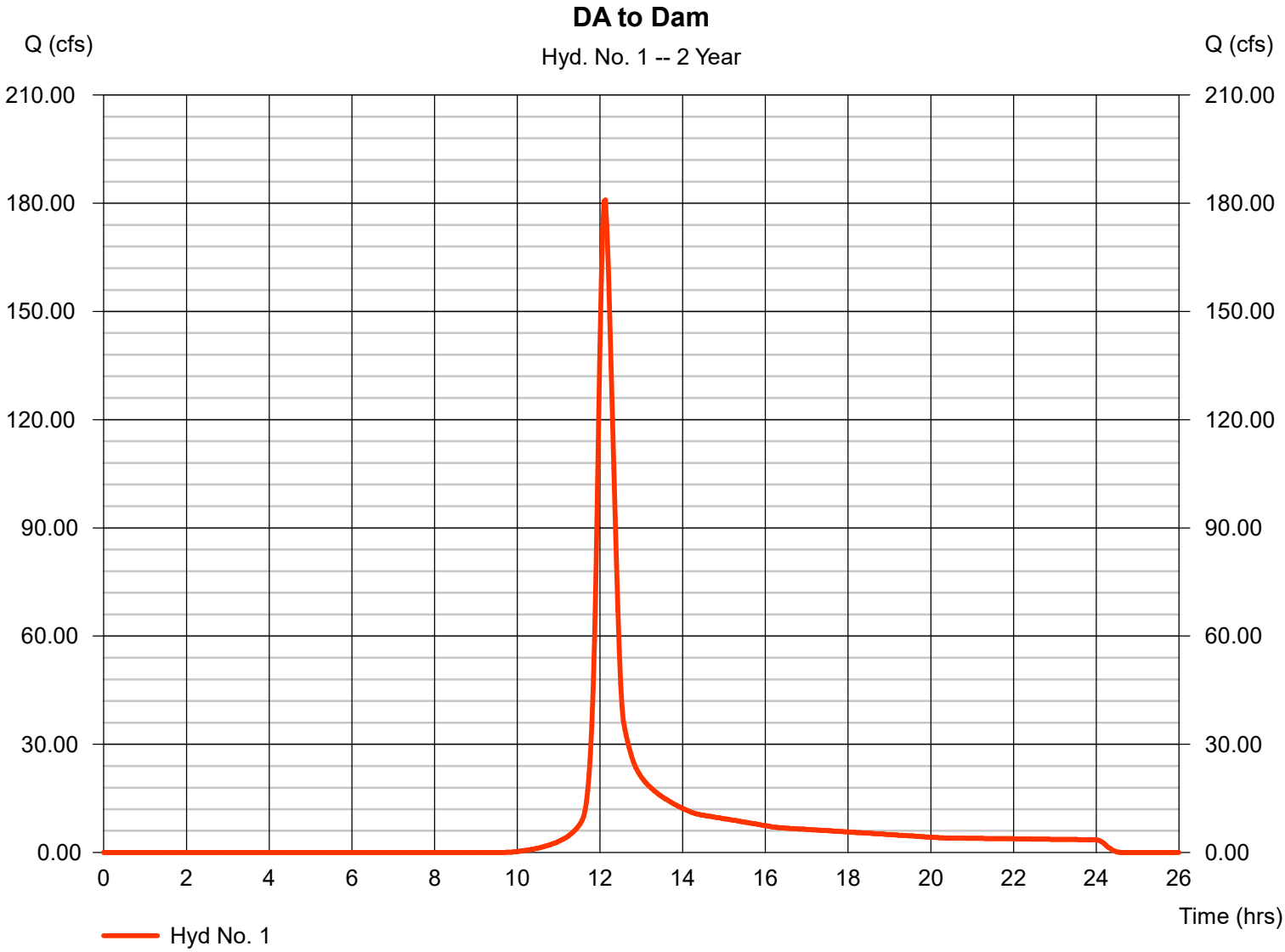
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	180.90	2	728	636,994	----	------	------	DA to Dam
2	Reservoir	122.45	2	738	636,936	1	254.67	65,759	EX Dam
3	SCS Runoff	23.17	2	732	93,799	----	------	------	DA to School Basin
4	Reservoir	11.97	2	750	93,791	3	272.39	28,057	EX School Basin
5	SCS Runoff	37.18	2	726	128,904	----	------	------	DA to New Basin
6	Combine	42.87	2	730	222,695	4, 5	------	------	Total to New Basin
7	Reservoir	1.718	2	1142	220,519	6	253.78	153,972	PR New Basin
8	SCS Runoff	114.92	2	726	399,659	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	75.67	2	726	264,184	----	------	------	PR DA to Knight Rd Culvert
10	Combine	234.98	2	730	1,130,385	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	238.11	2	730	1,130,352	10	------	------	EX Knight Rd Culvert
12	Combine	191.14	2	730	1,121,638	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	194.00	2	730	1,121,638	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	89.60	2	736	408,597	----	------	------	DA to Culvert at Tracks
15	Combine	321.68	2	730	1,538,951	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	277.57	2	730	1,530,236	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	180.90 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	636,994 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



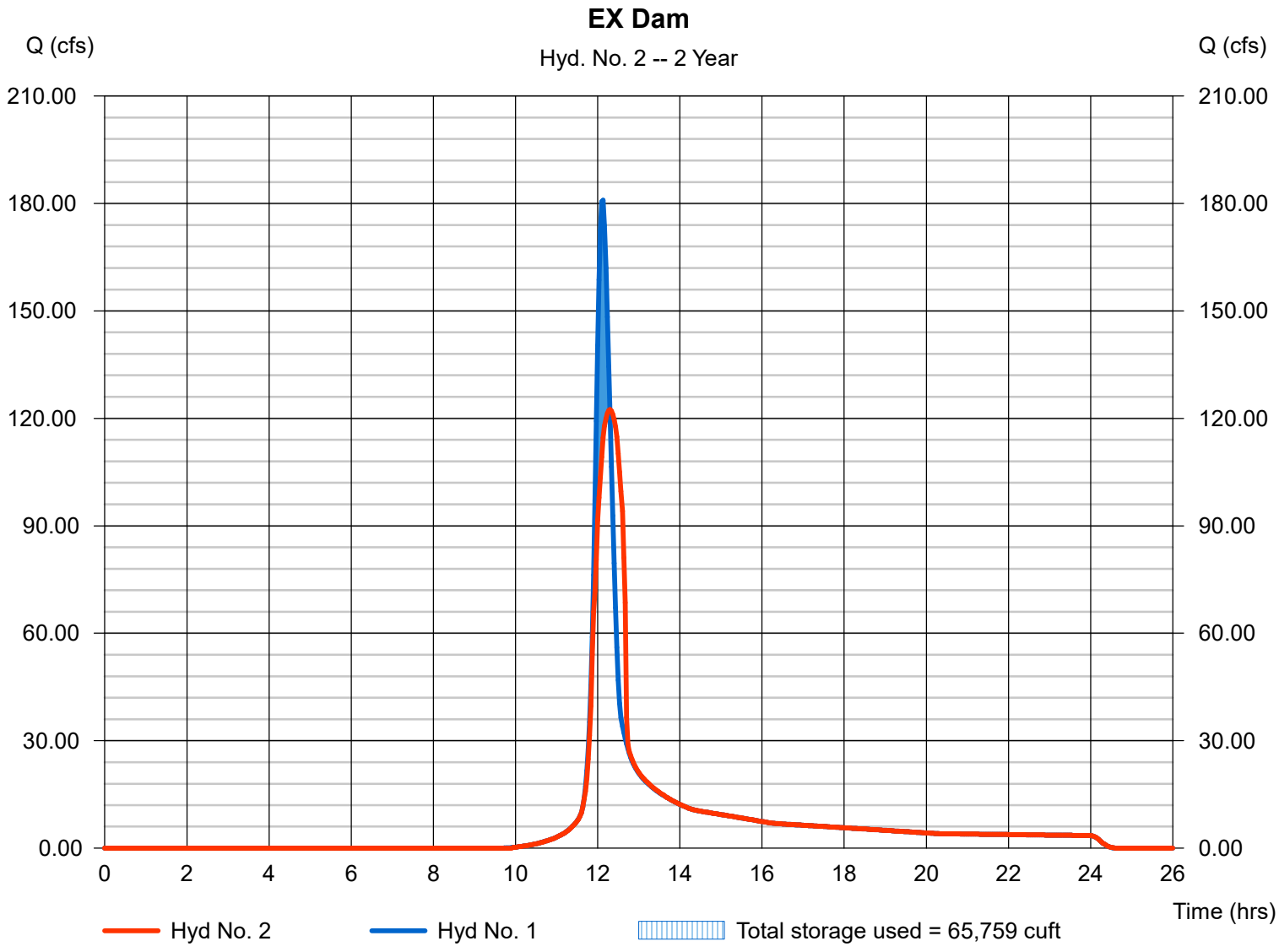
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	122.45 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	636,936 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	254.67 ft
Reservoir name	=	EX Dam	Max. Storage	=	65,759 cuft

Storage Indication method used.

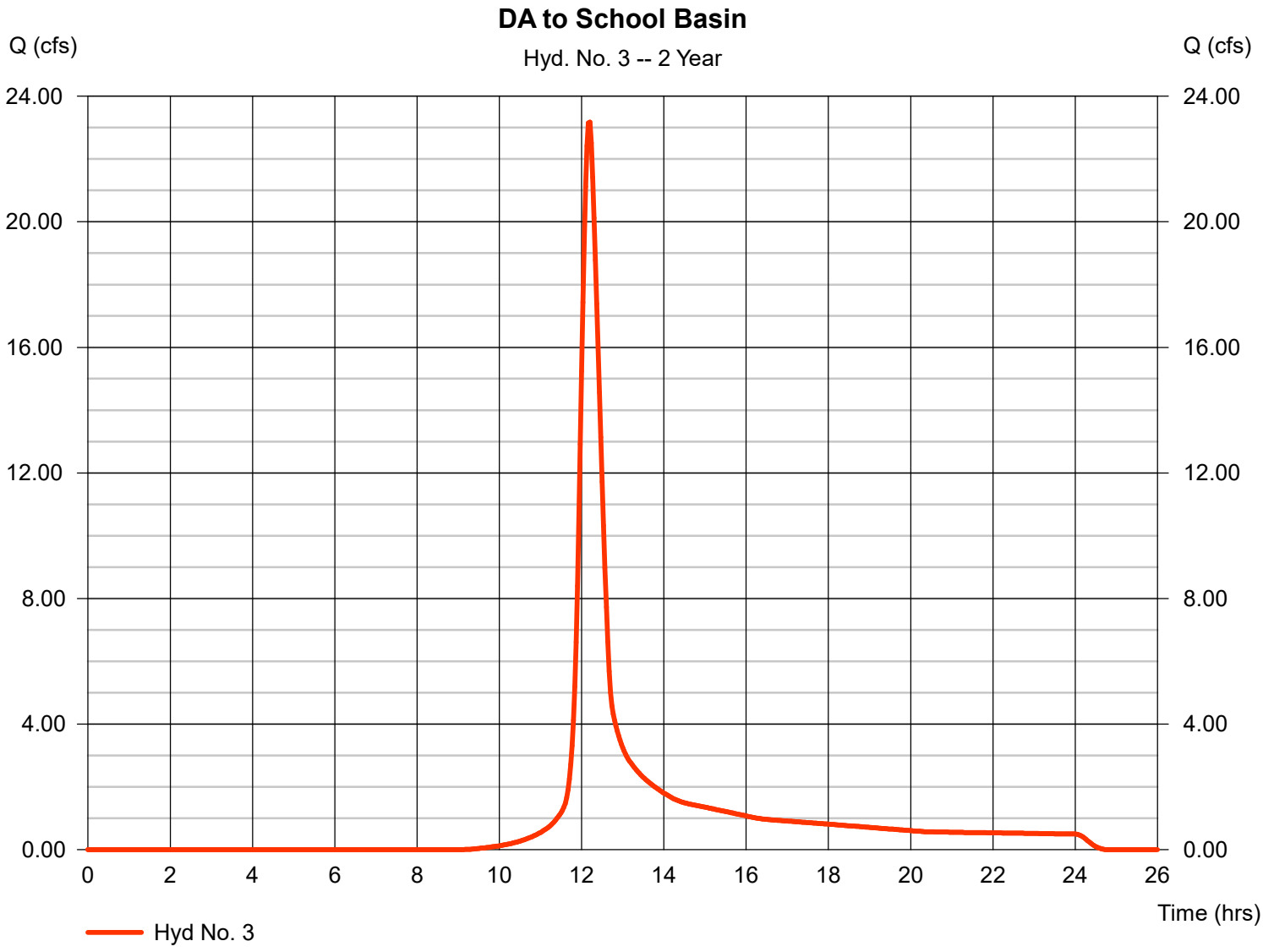


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.17 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	93,799 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



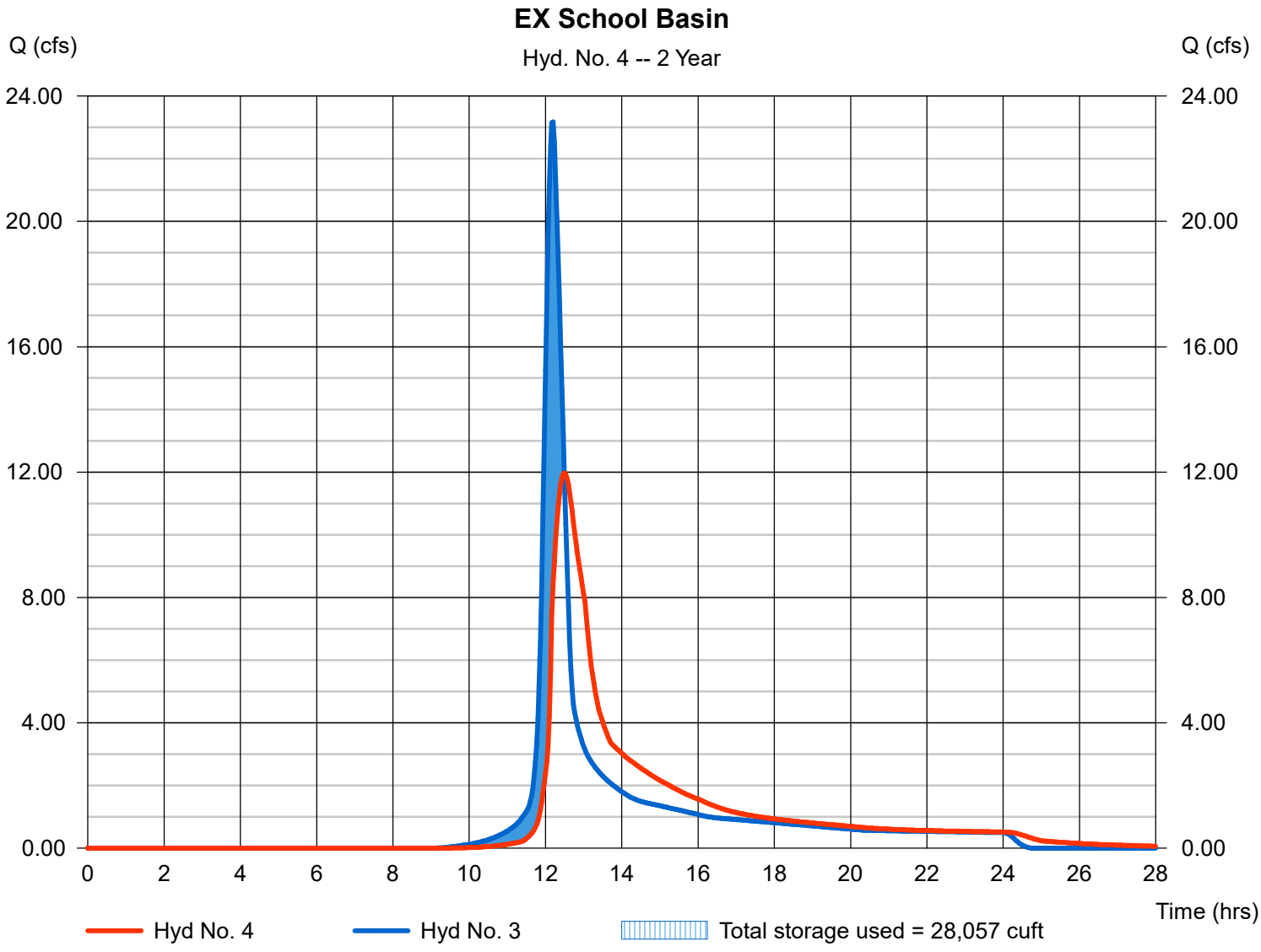
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	11.97 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	93,791 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	272.39 ft
Reservoir name	=	EX School Basin	Max. Storage	=	28,057 cuft

Storage Indication method used.

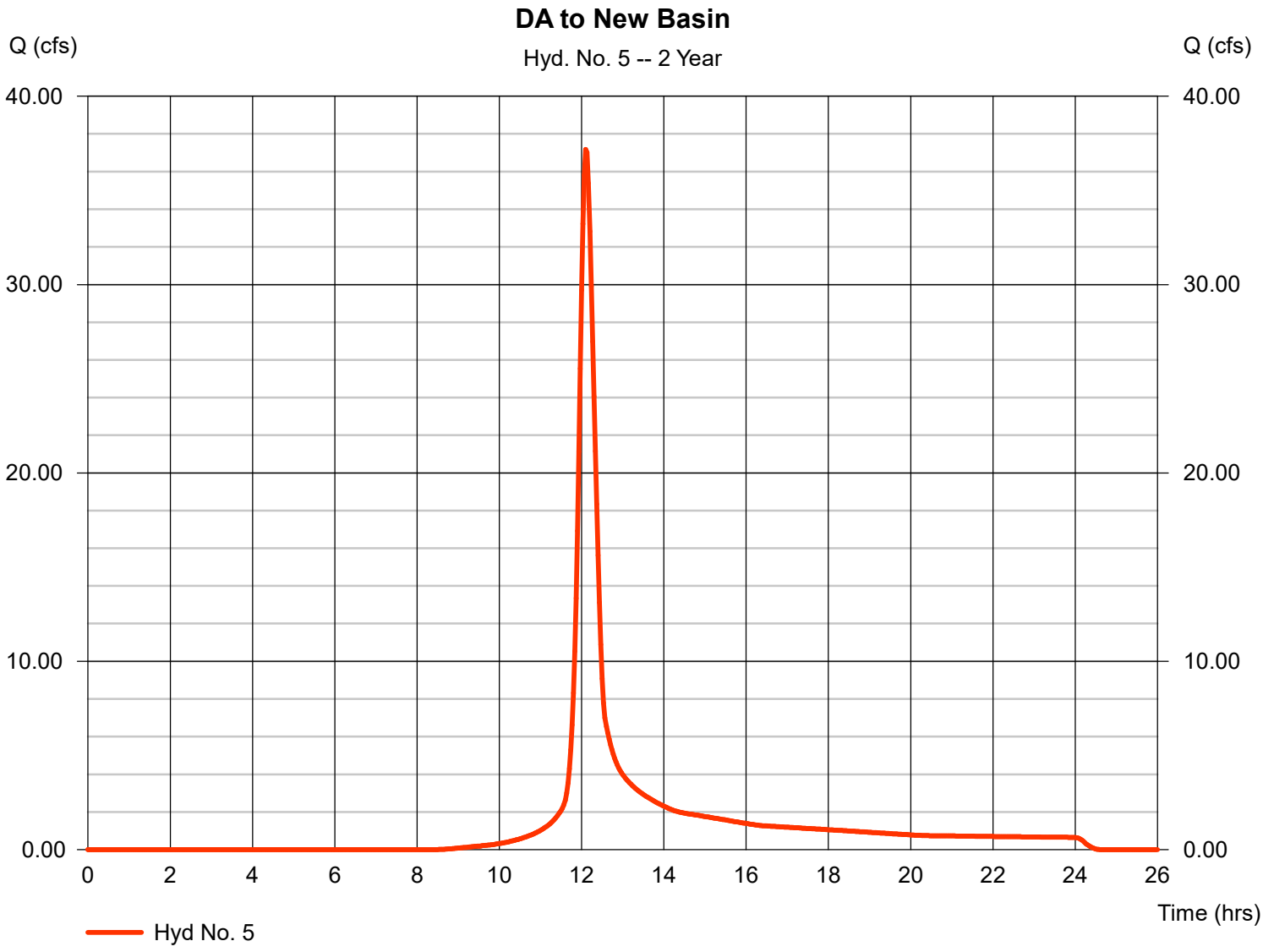


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.18 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	128,904 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

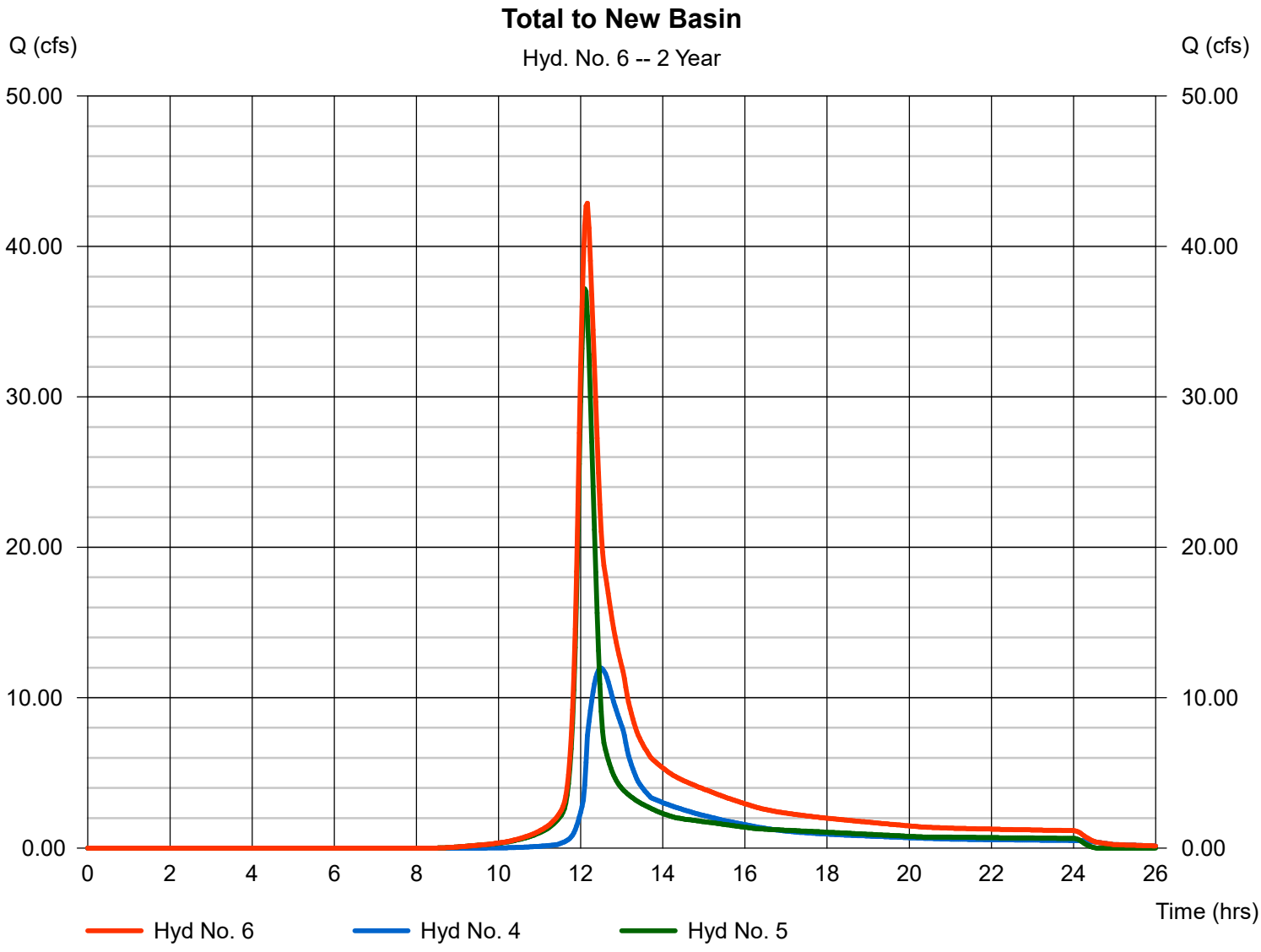


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 42.87 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 222,695 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



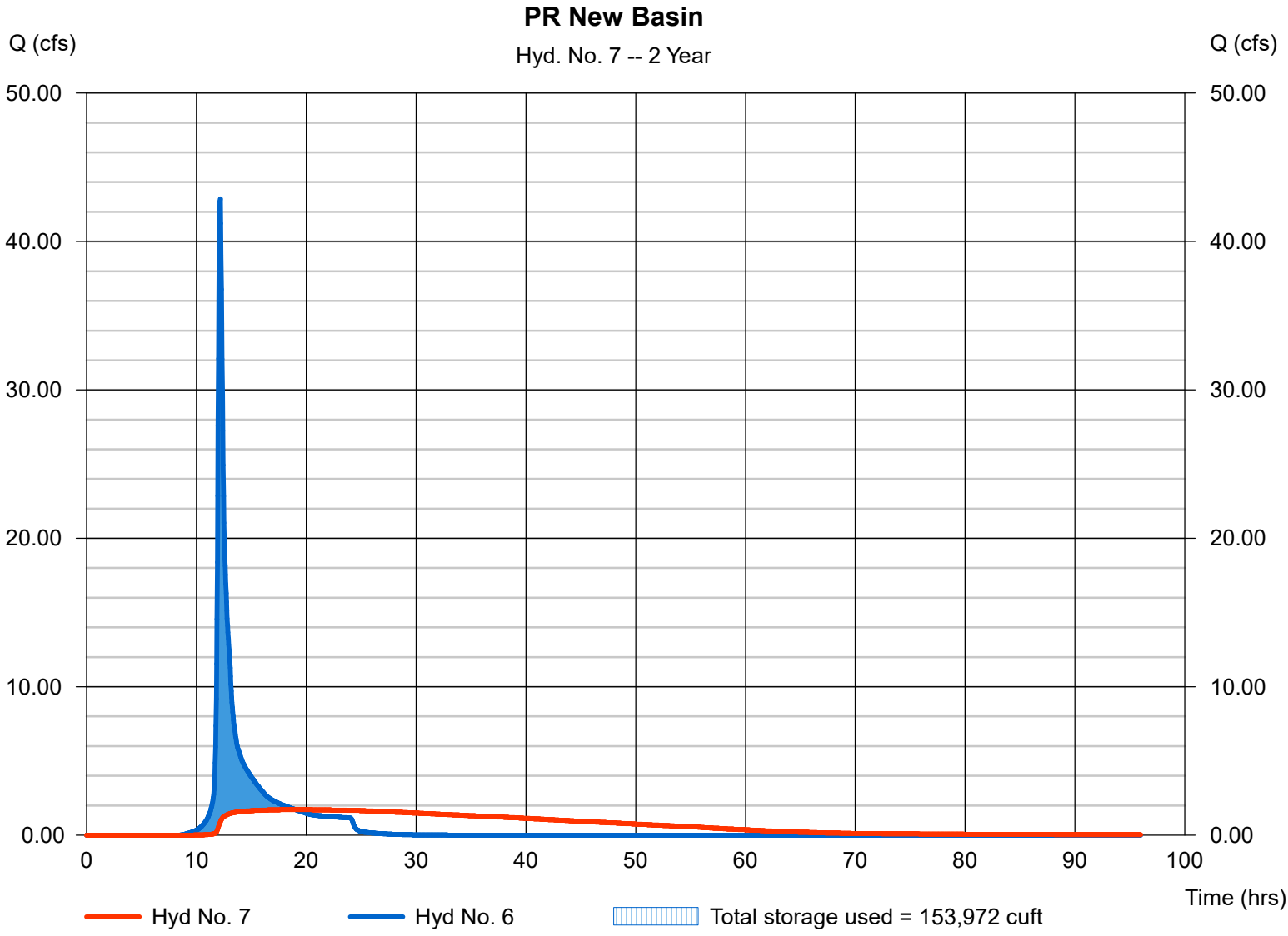
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	1.718 cfs
Storm frequency	=	2 yrs	Time to peak	=	19.03 hrs
Time interval	=	2 min	Hyd. volume	=	220,519 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	253.78 ft
Reservoir name	=	PR New Basin	Max. Storage	=	153,972 cuft

Storage Indication method used.

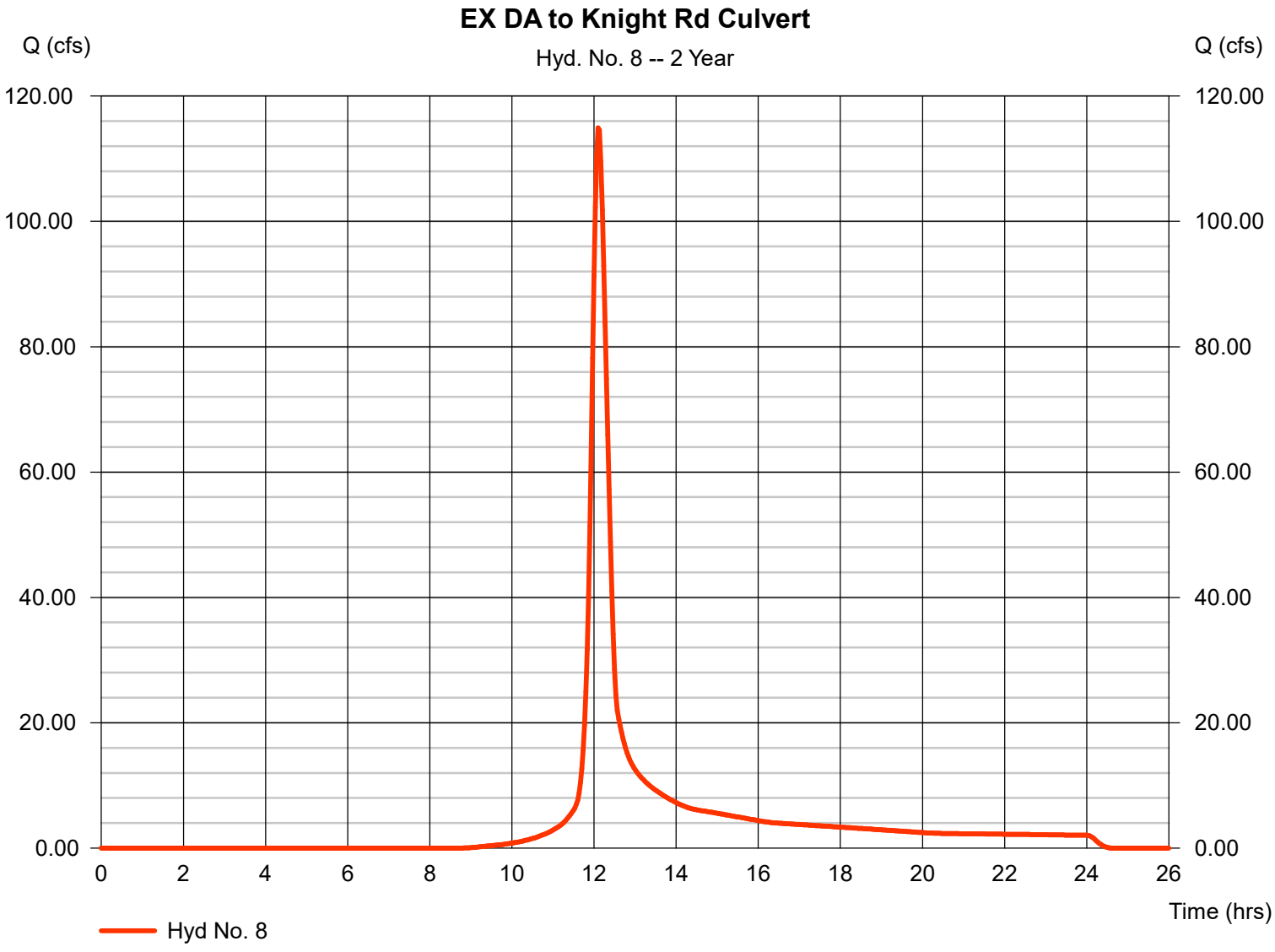


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	114.92 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	399,659 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

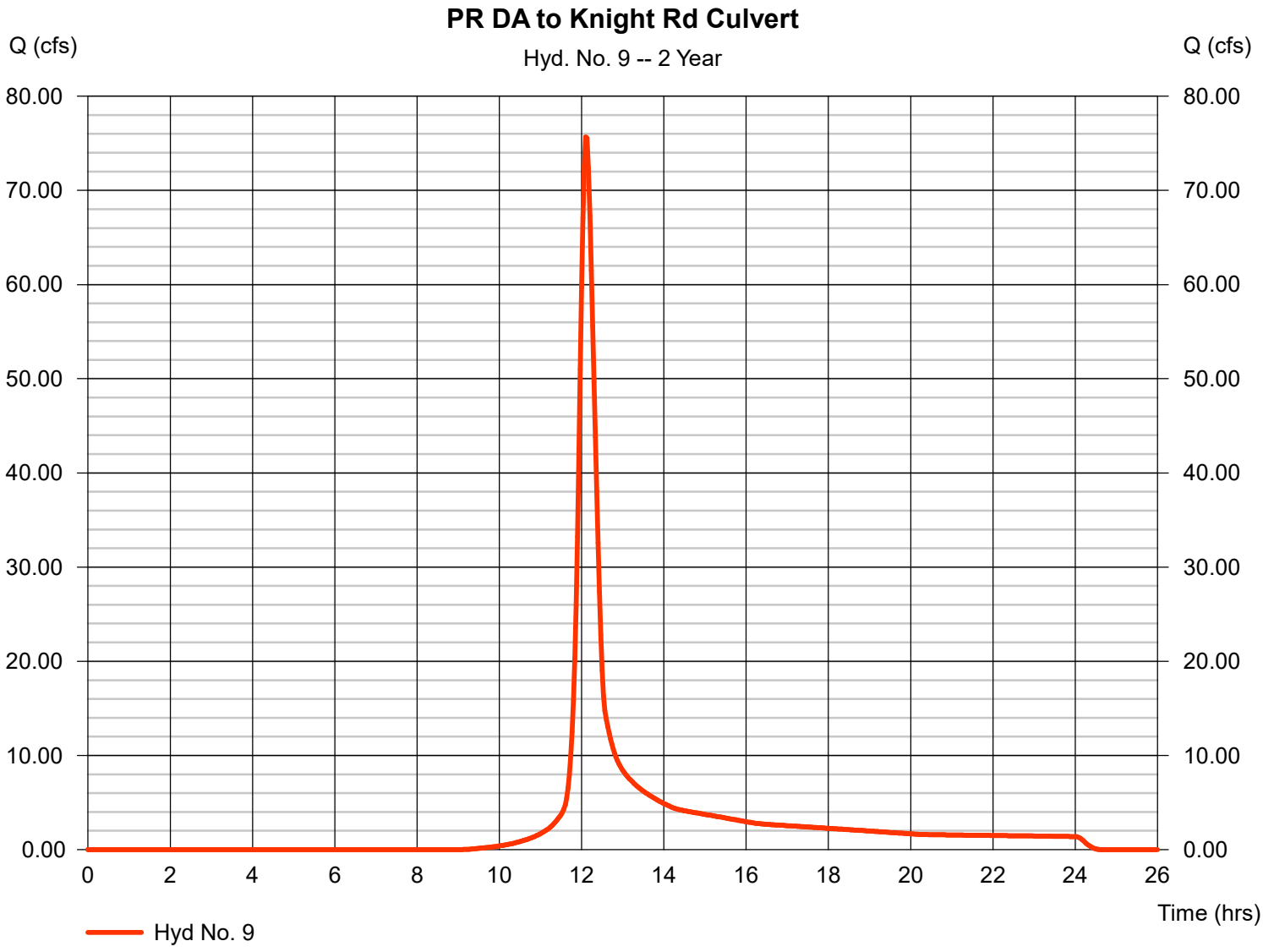


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	75.67 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	264,184 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

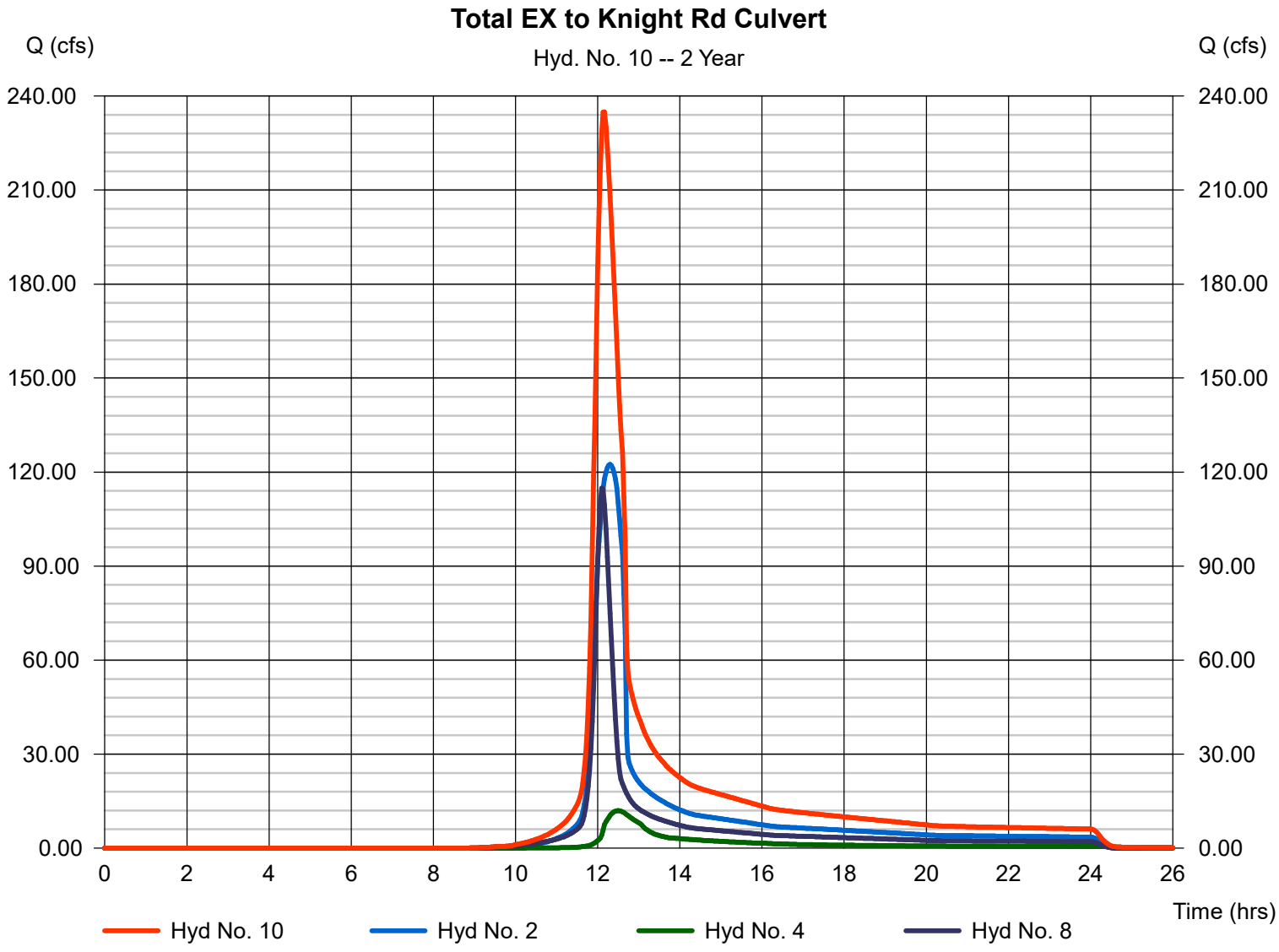


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 234.98 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,130,385 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



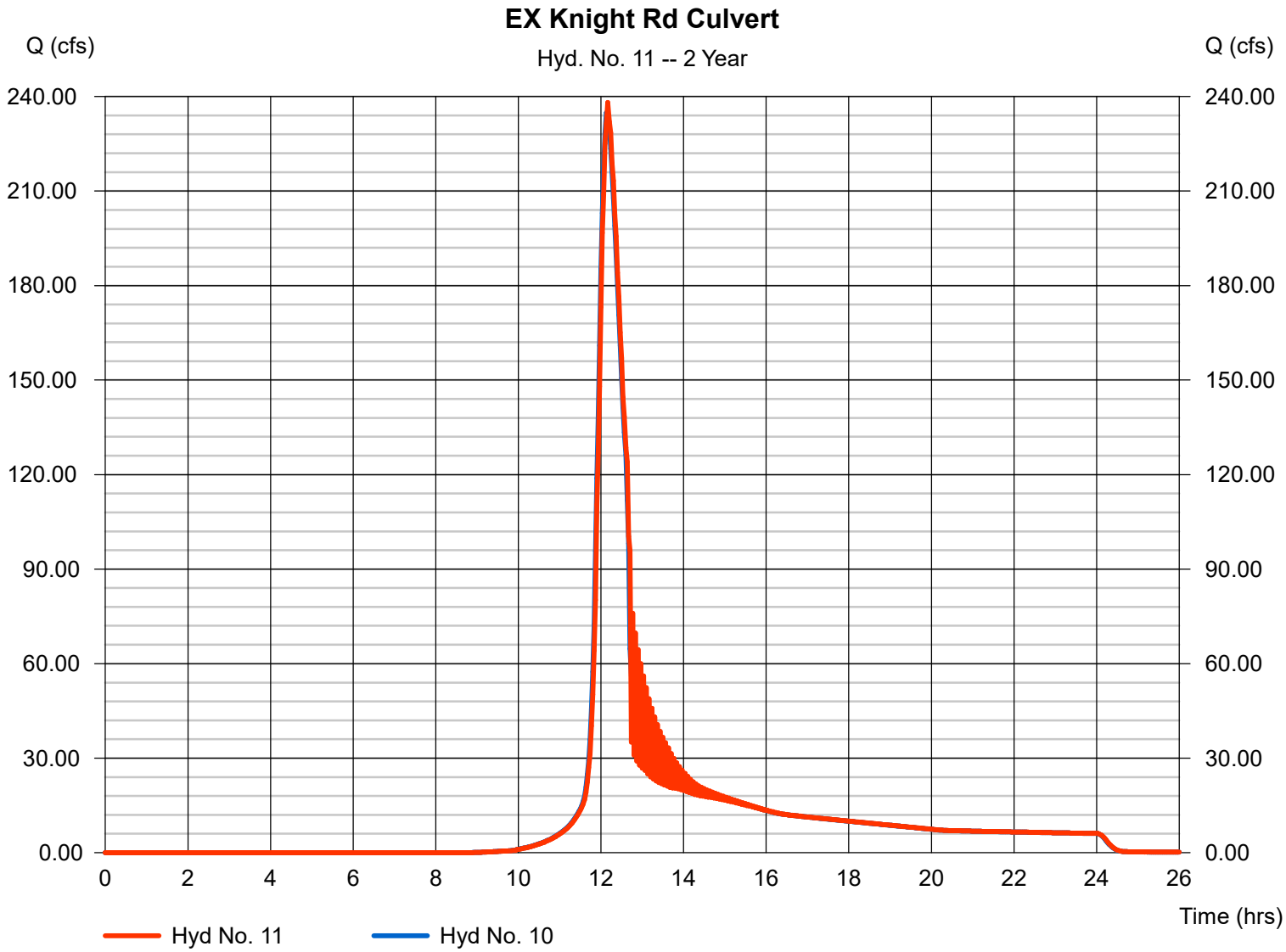
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	238.11 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,130,352 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	24.11 ft/s	Routing coeff.	=	1.9523

Modified Att-Kin routing method used.

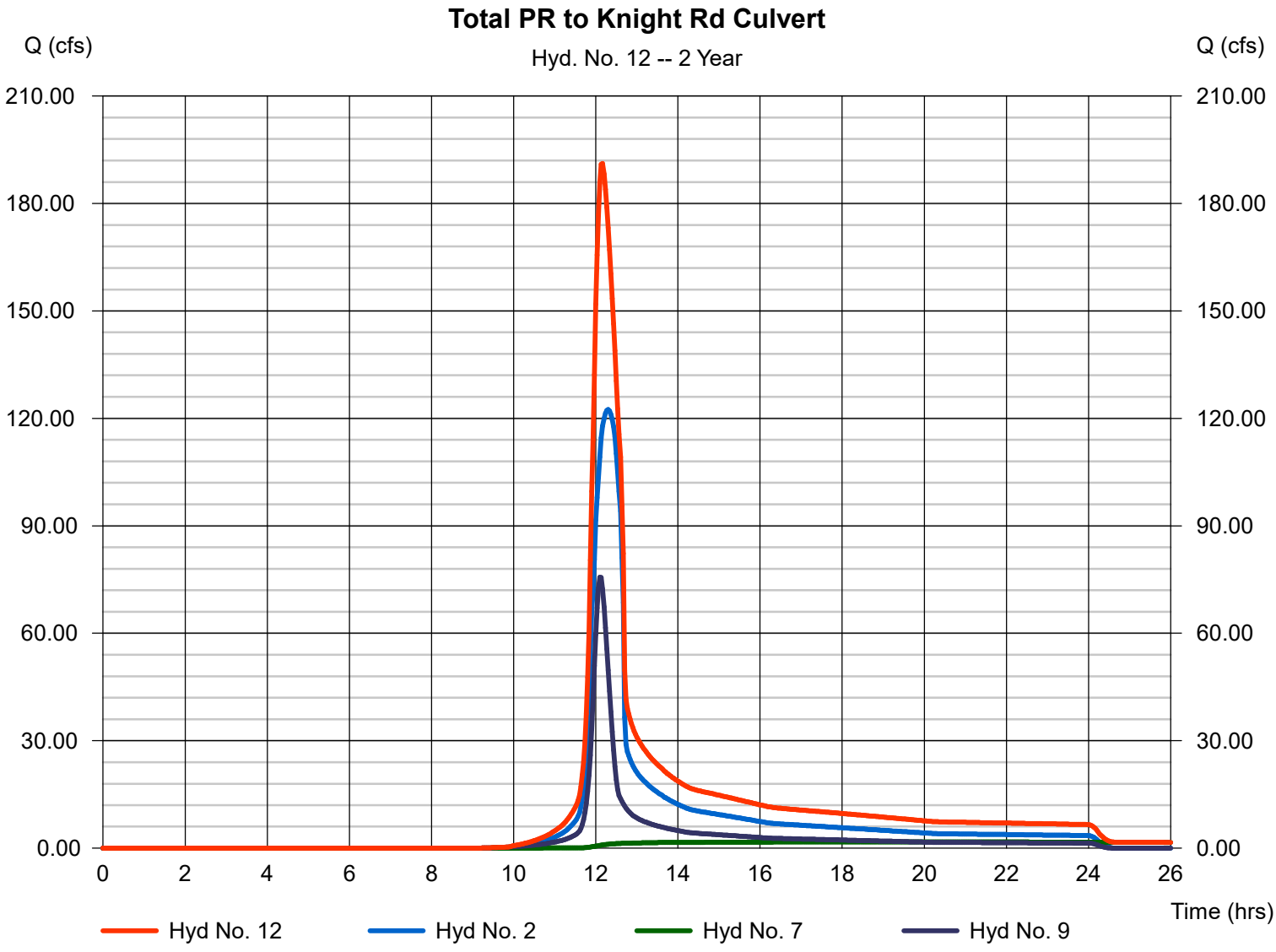


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 191.14 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,121,638 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



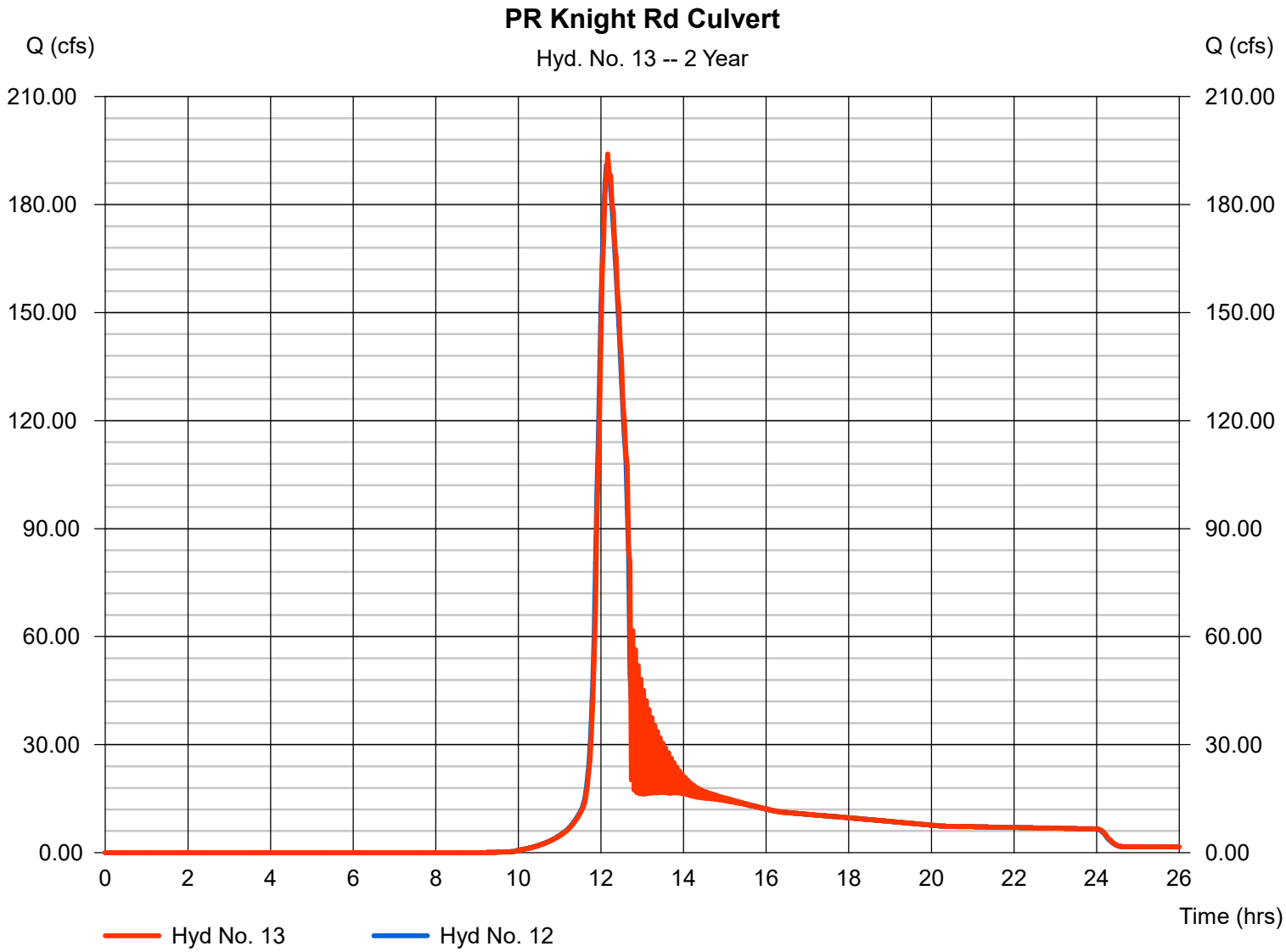
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	194.00 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,121,638 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	22.40 ft/s	Routing coeff.	=	1.9487

Modified Att-Kin routing method used.

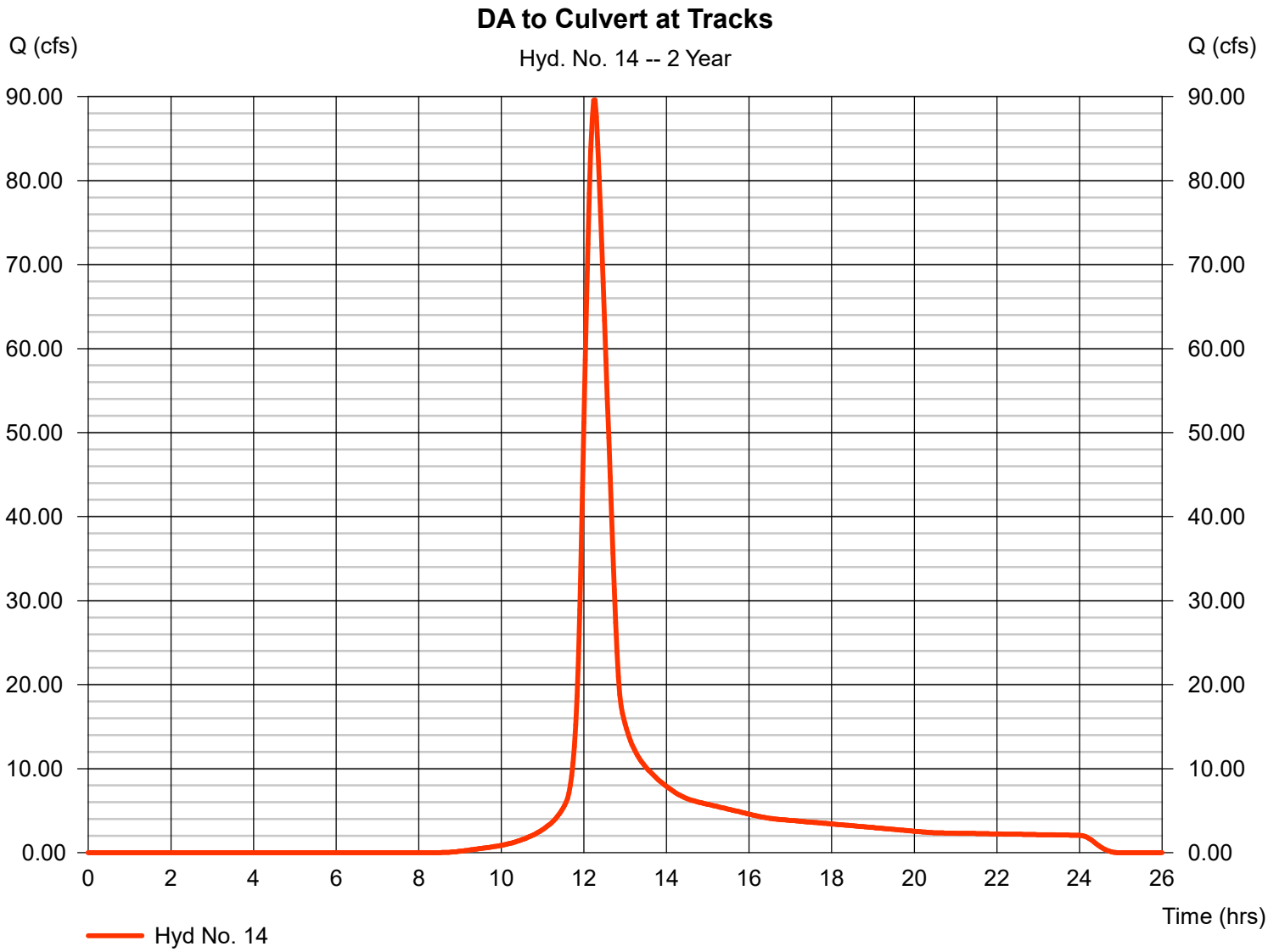


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	89.60 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	408,597 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	3.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

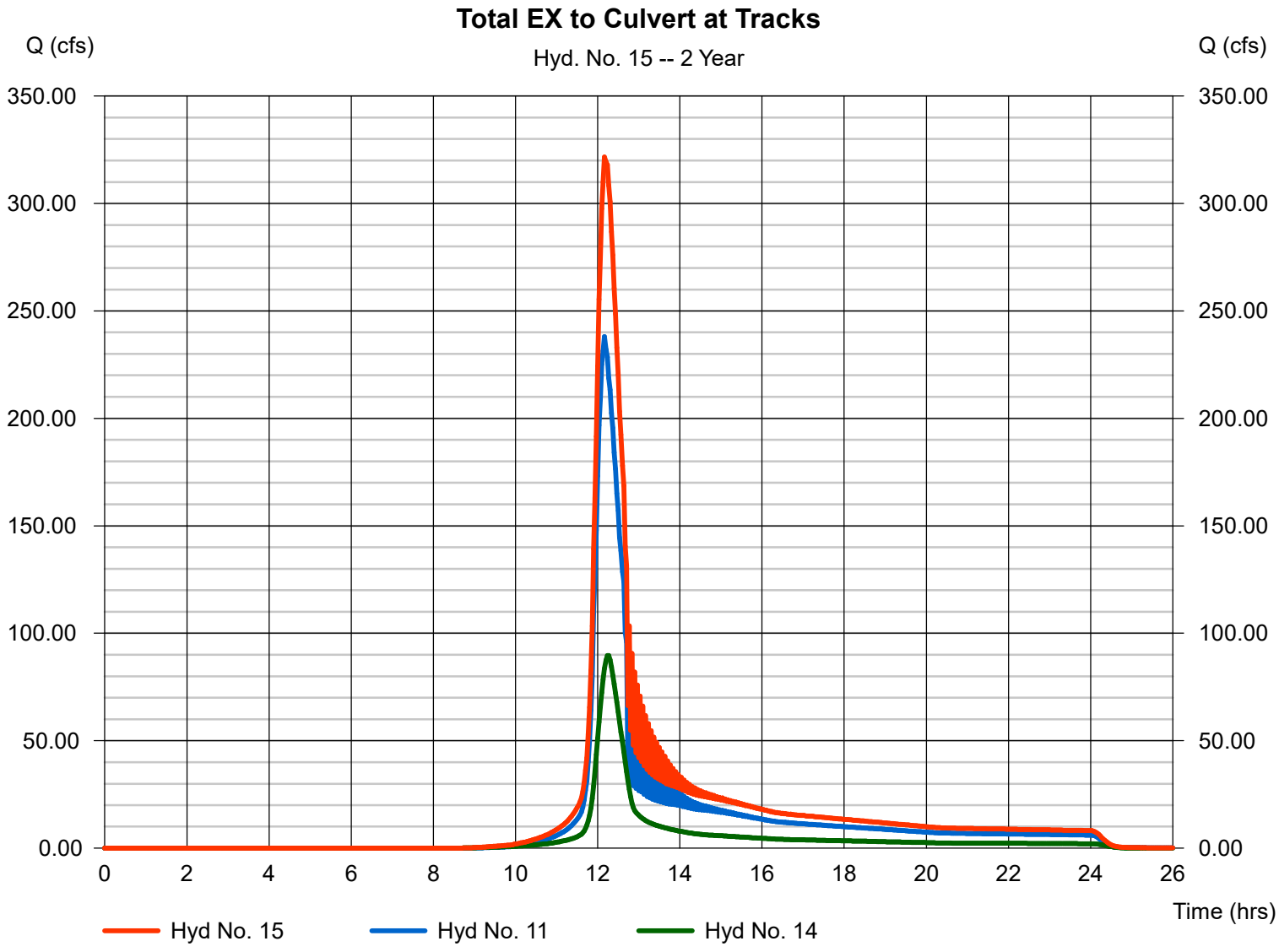


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 321.68 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,538,951 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

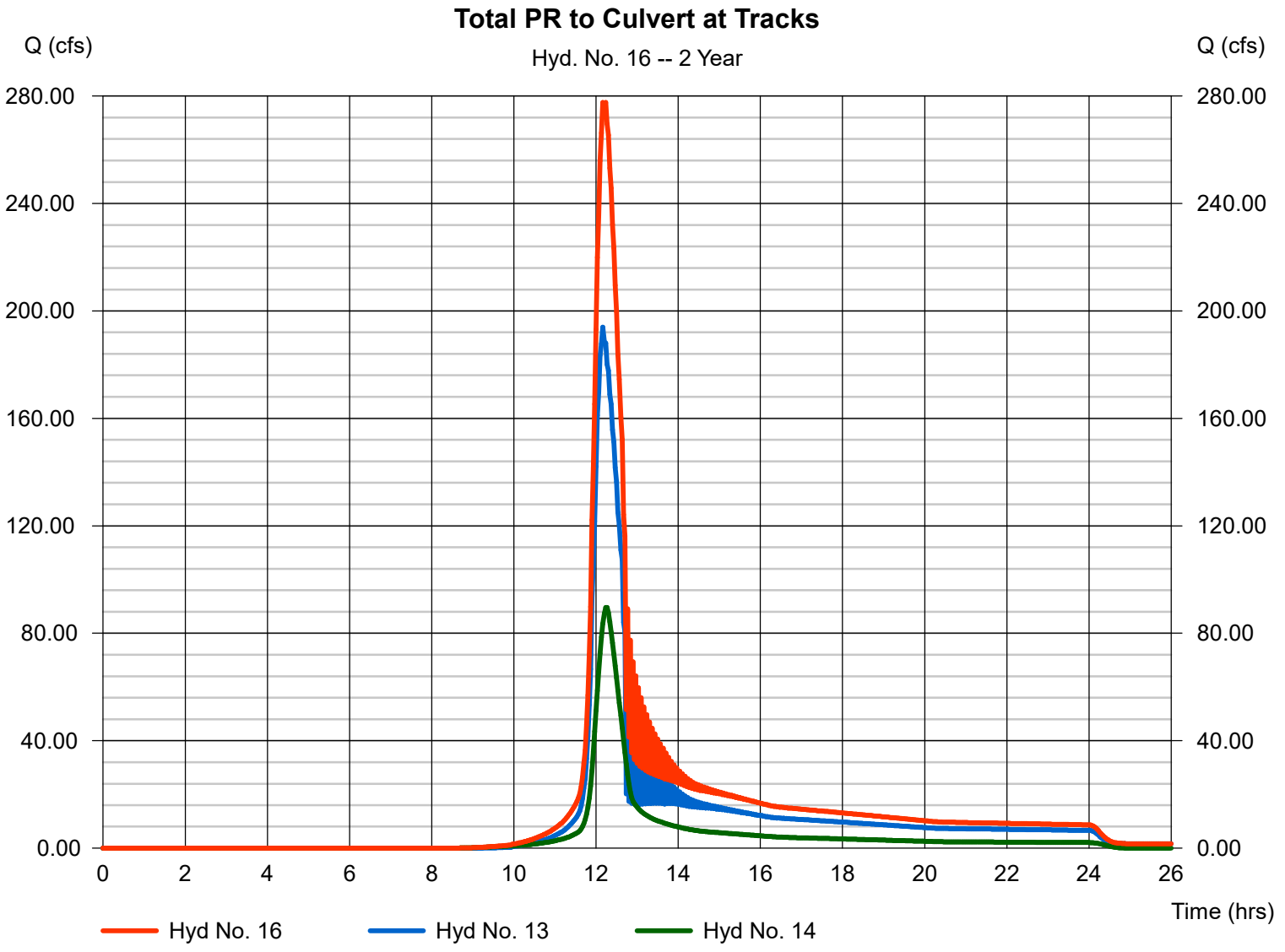


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 277.57 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,530,236 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

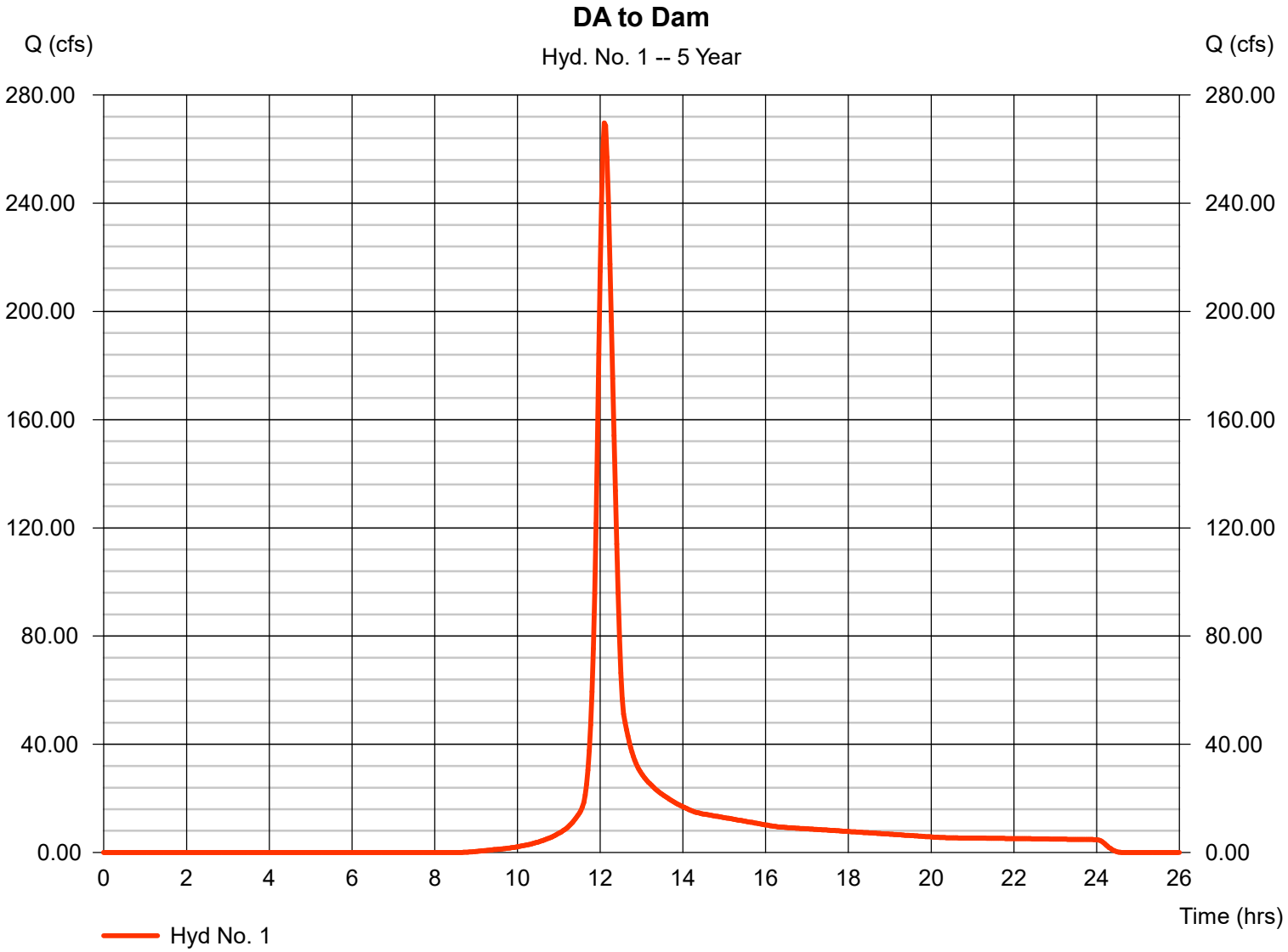
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	269.70	2	726	936,440	----	------	------	DA to Dam
2	Reservoir	143.57	2	742	936,383	1	257.10	152,900	EX Dam
3	SCS Runoff	33.84	2	730	135,585	----	------	------	DA to School Basin
4	Reservoir	18.44	2	748	135,577	3	272.89	39,715	EX School Basin
5	SCS Runoff	53.10	2	726	183,324	----	------	------	DA to New Basin
6	Combine	62.94	2	728	318,902	4, 5	------	------	Total to New Basin
7	Reservoir	2.084	2	1180	315,020	6	255.39	231,689	PR New Basin
8	SCS Runoff	165.88	2	726	572,985	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	110.43	2	726	381,875	----	------	------	PR DA to Knight Rd Culvert
10	Combine	308.22	2	728	1,644,944	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	311.00	2	730	1,644,911	10	------	------	EX Knight Rd Culvert
12	Combine	244.14	2	728	1,633,272	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	246.66	2	730	1,633,274	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	128.23	2	734	581,100	----	------	------	DA to Culvert at Tracks
15	Combine	431.54	2	730	2,226,012	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	367.20	2	730	2,214,371	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	269.70 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	936,440 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



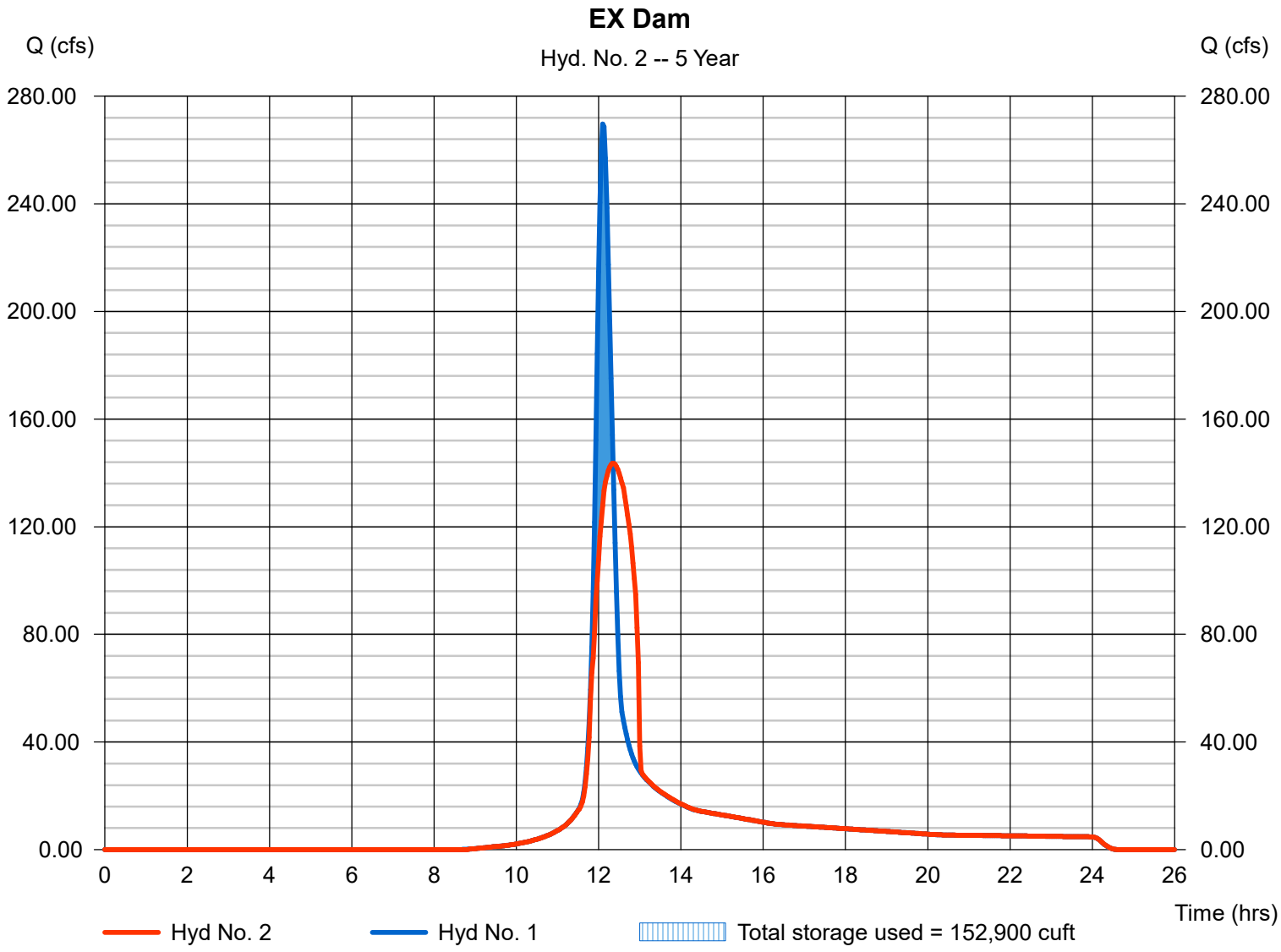
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	143.57 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.37 hrs
Time interval	=	2 min	Hyd. volume	=	936,383 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	257.10 ft
Reservoir name	=	EX Dam	Max. Storage	=	152,900 cuft

Storage Indication method used.

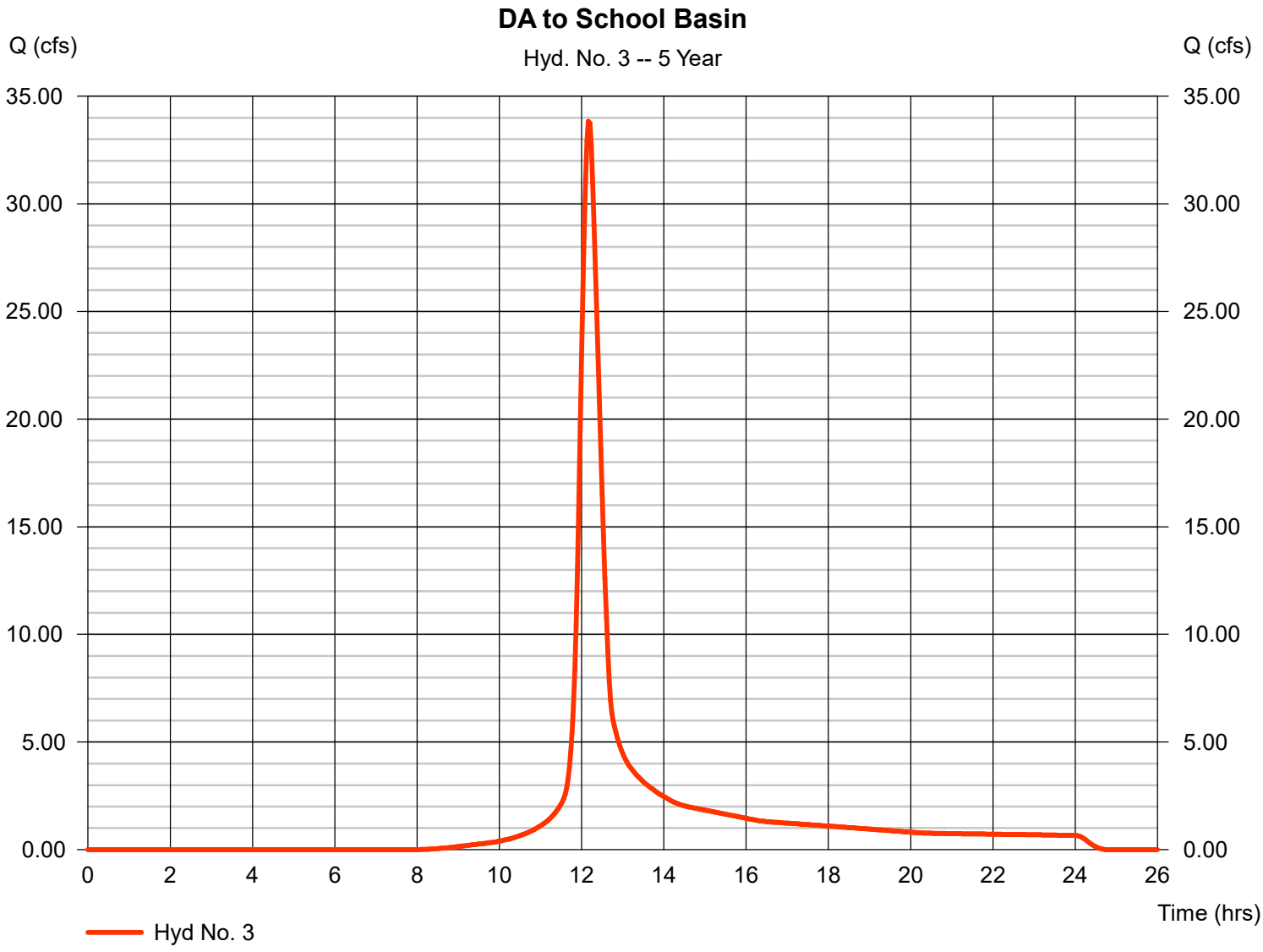


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.84 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	135,585 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



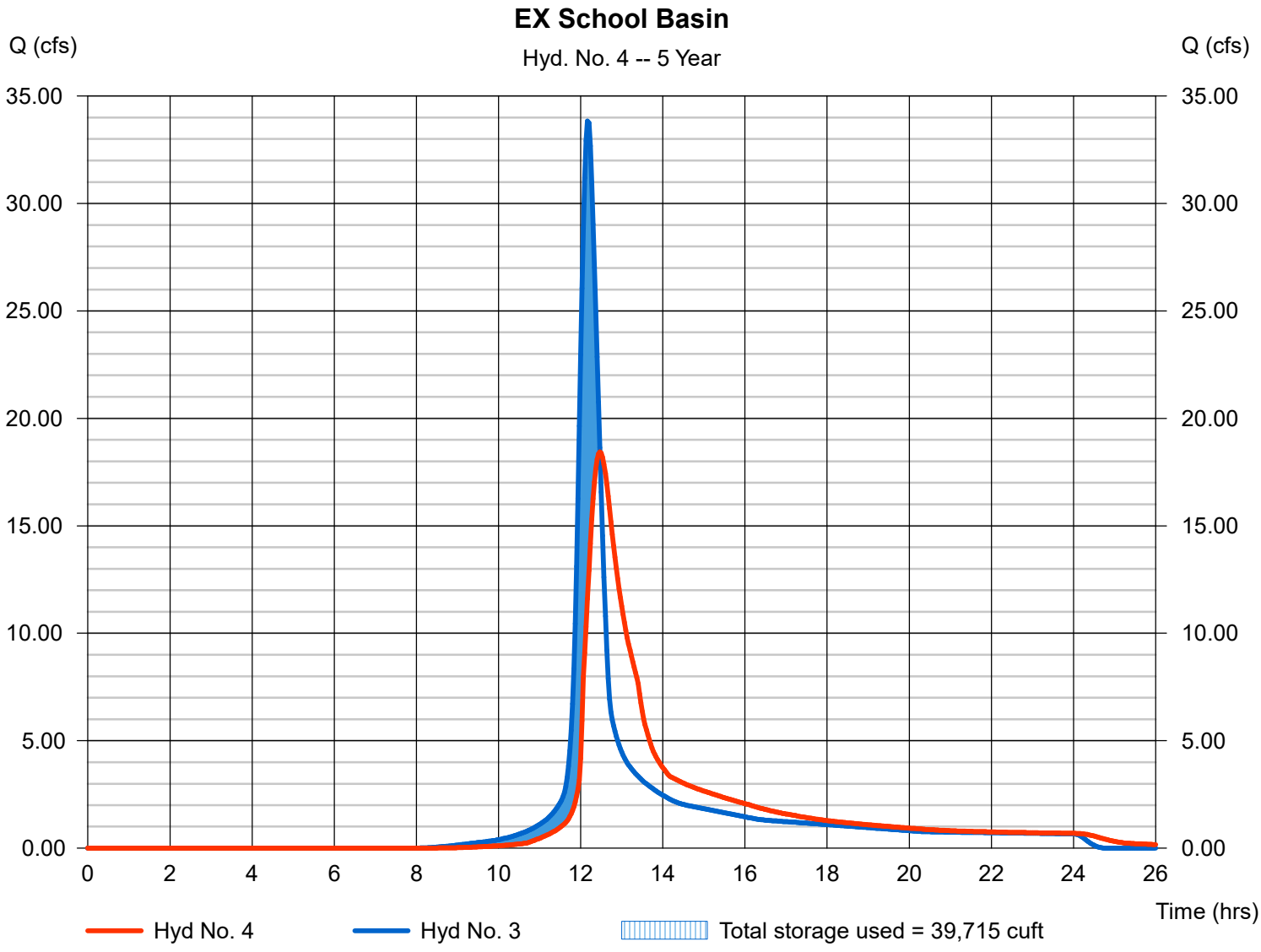
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	18.44 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	135,577 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	272.89 ft
Reservoir name	=	EX School Basin	Max. Storage	=	39,715 cuft

Storage Indication method used.

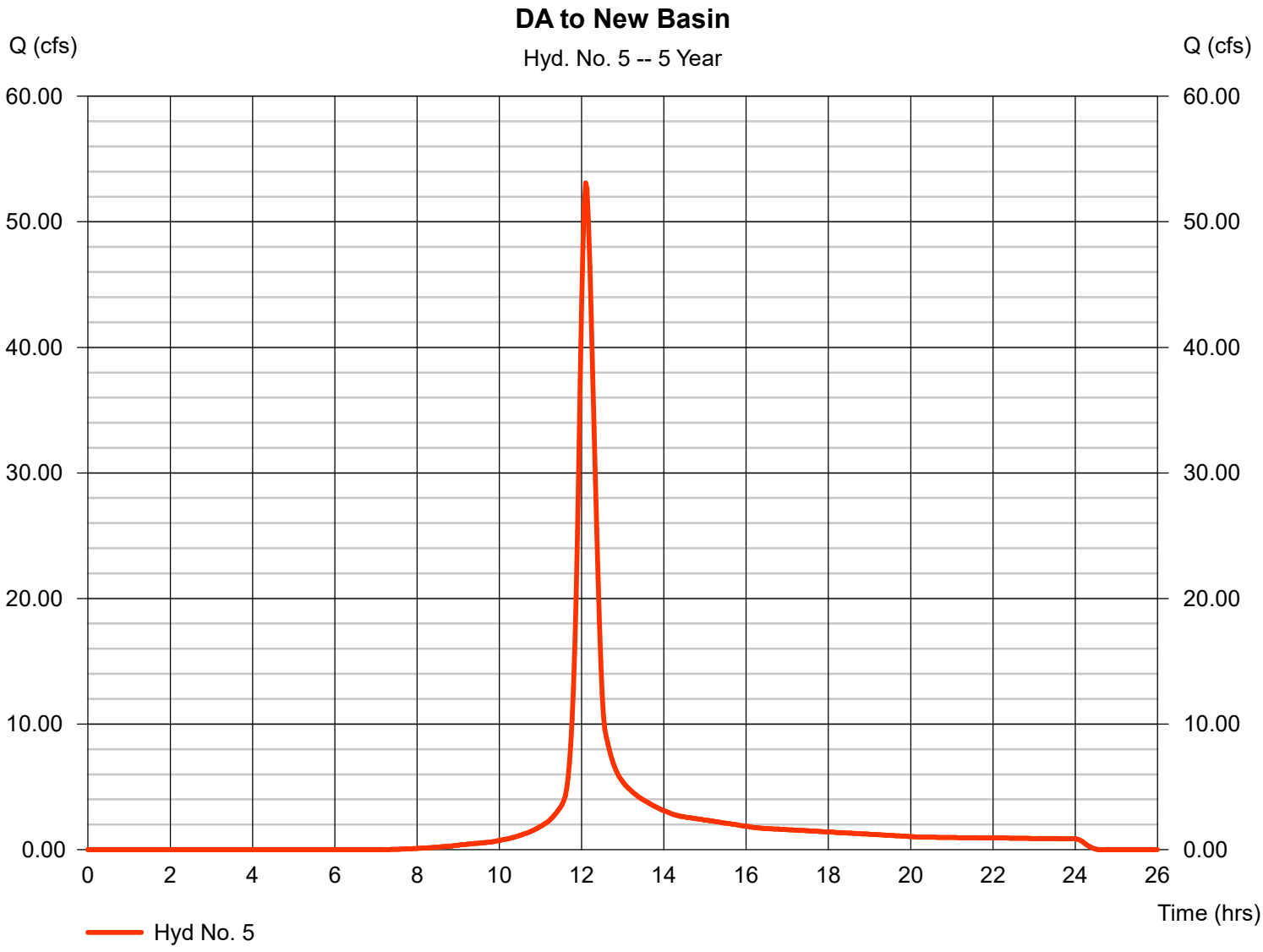


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.10 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	183,324 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

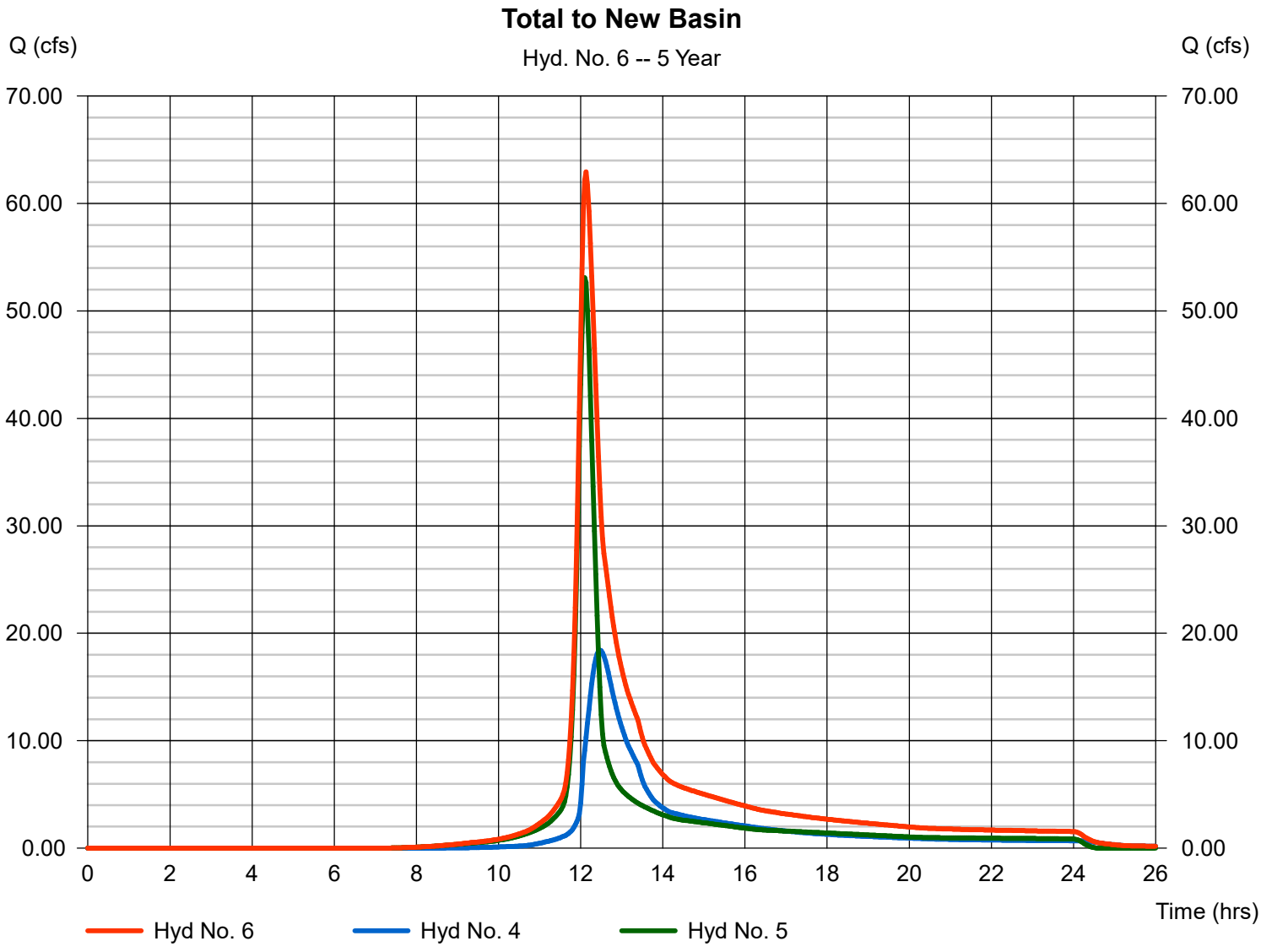


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 62.94 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 318,902 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



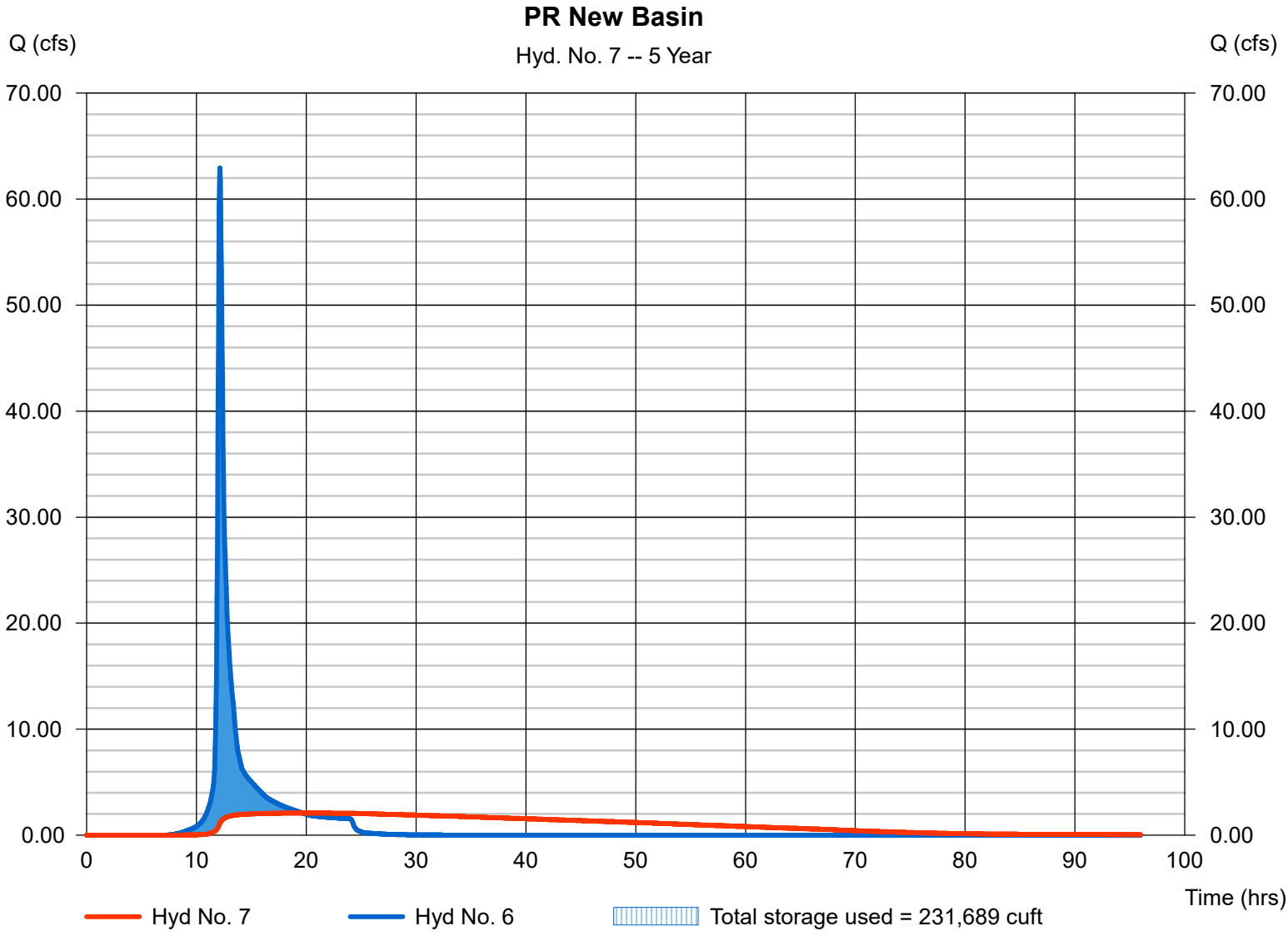
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	2.084 cfs
Storm frequency	=	5 yrs	Time to peak	=	19.67 hrs
Time interval	=	2 min	Hyd. volume	=	315,020 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	255.39 ft
Reservoir name	=	PR New Basin	Max. Storage	=	231,689 cuft

Storage Indication method used.

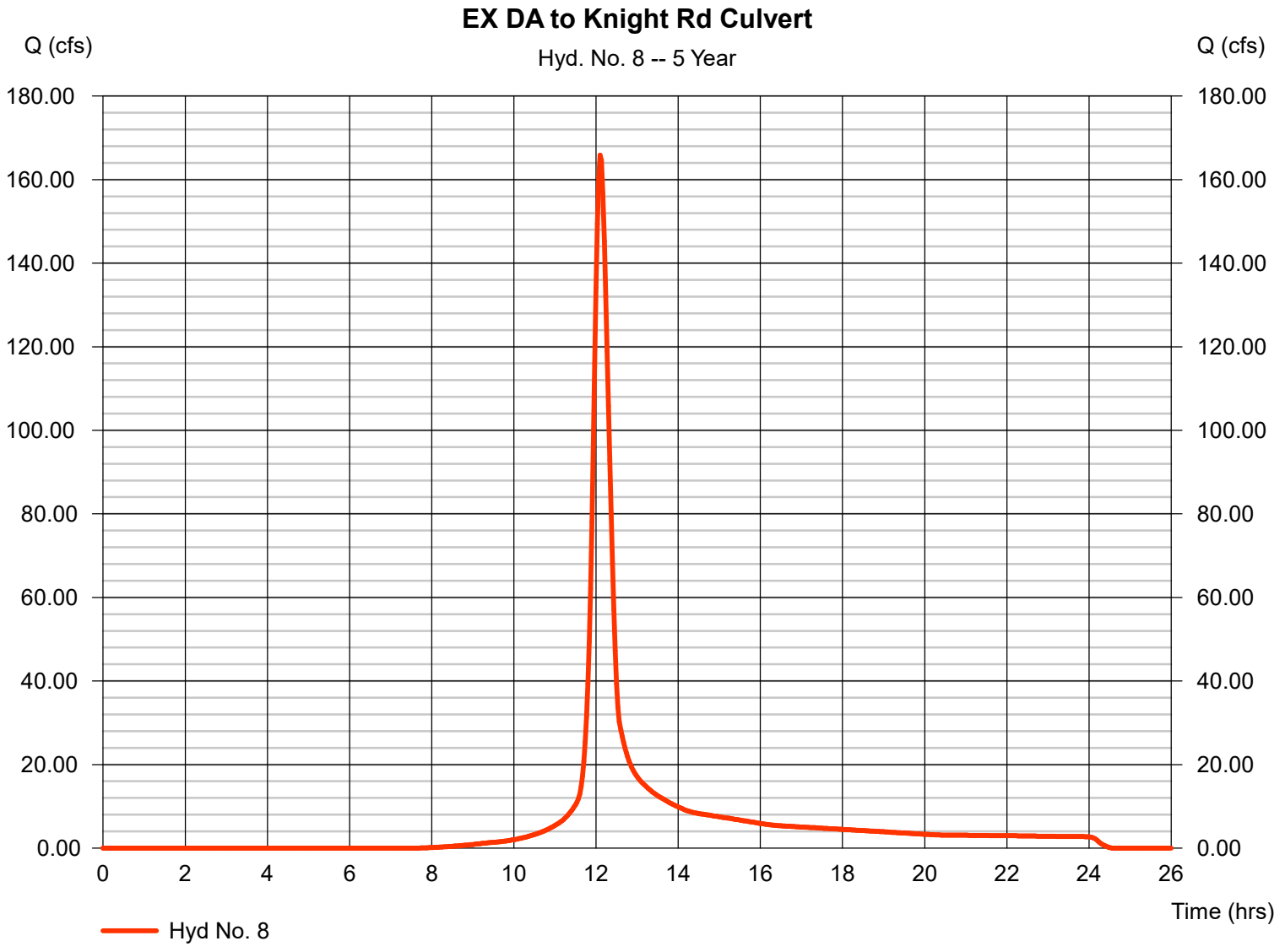


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	165.88 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	572,985 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

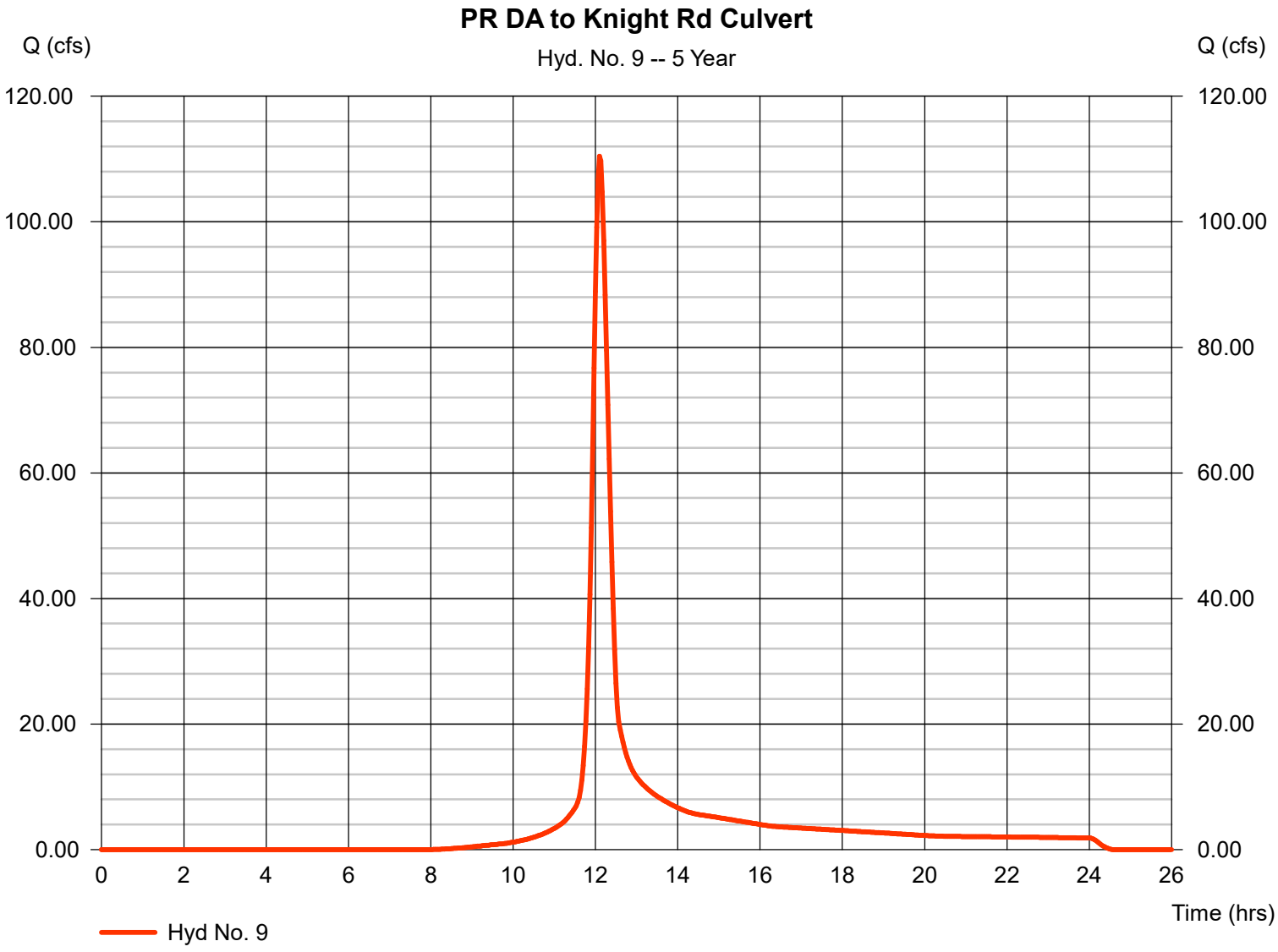


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	110.43 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	381,875 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

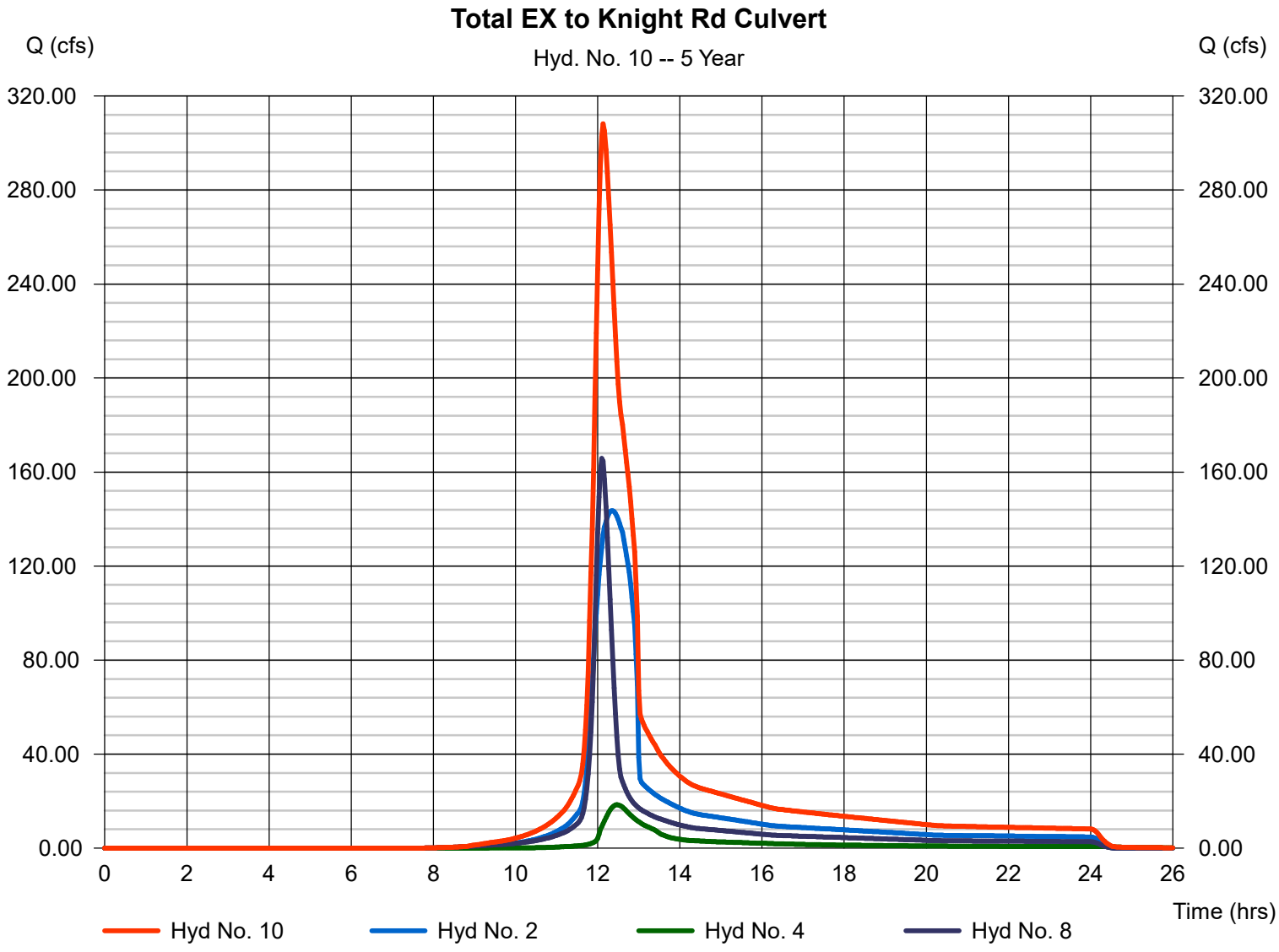


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 308.22 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,644,944 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



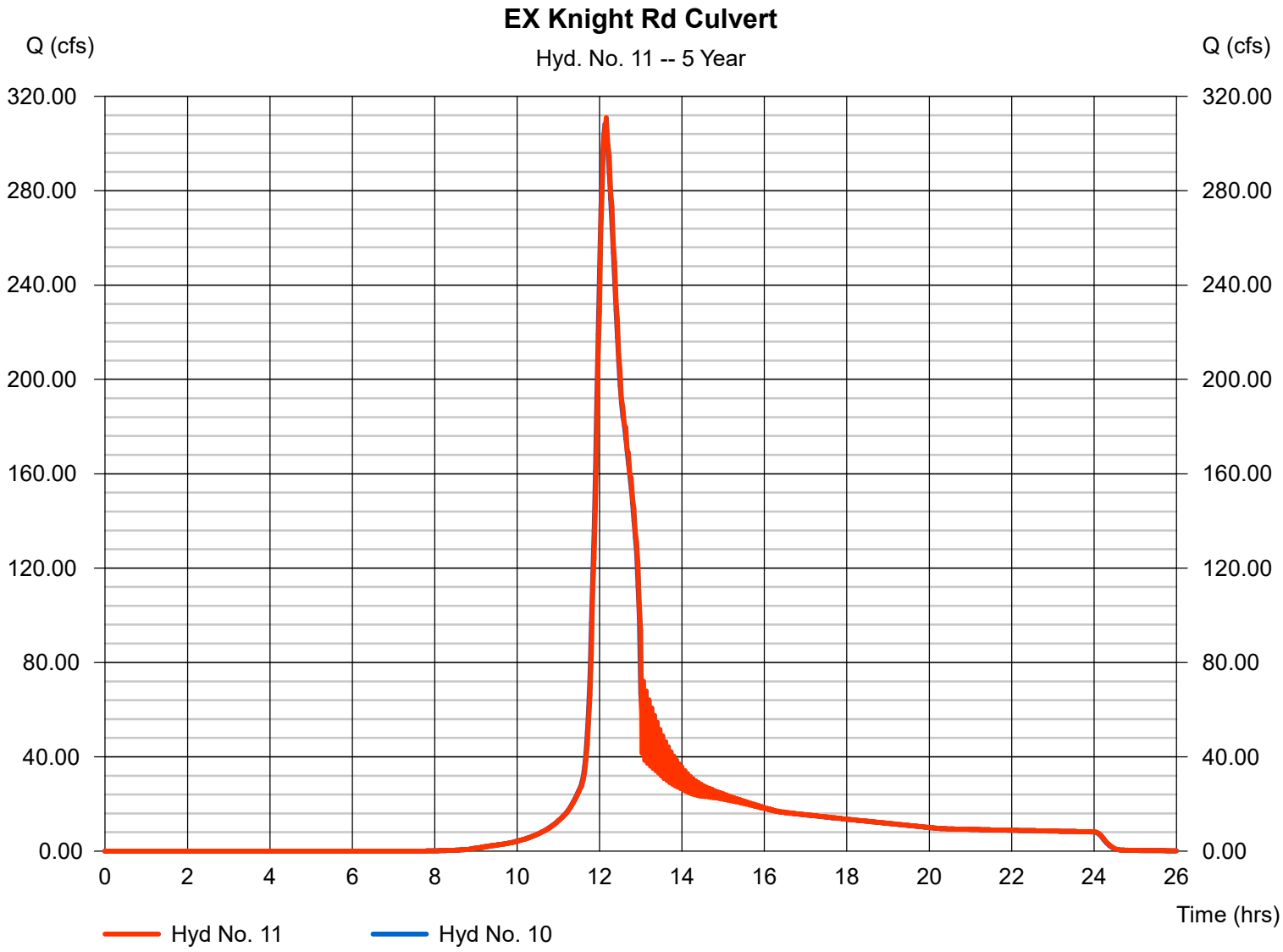
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	311.00 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,644,911 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	26.57 ft/s	Routing coeff.	=	1.9566

Modified Att-Kin routing method used.

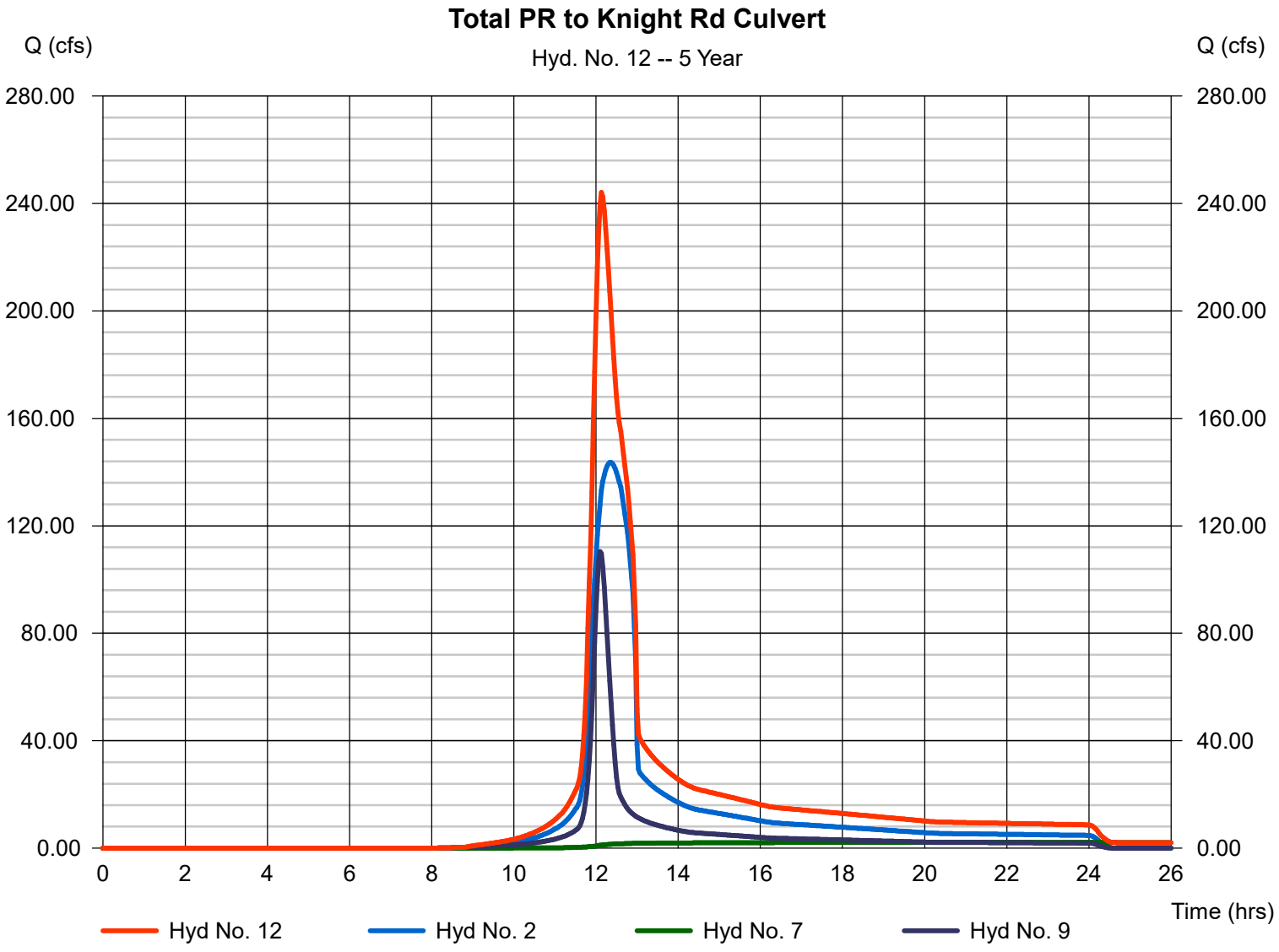


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 244.14 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 1,633,272 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



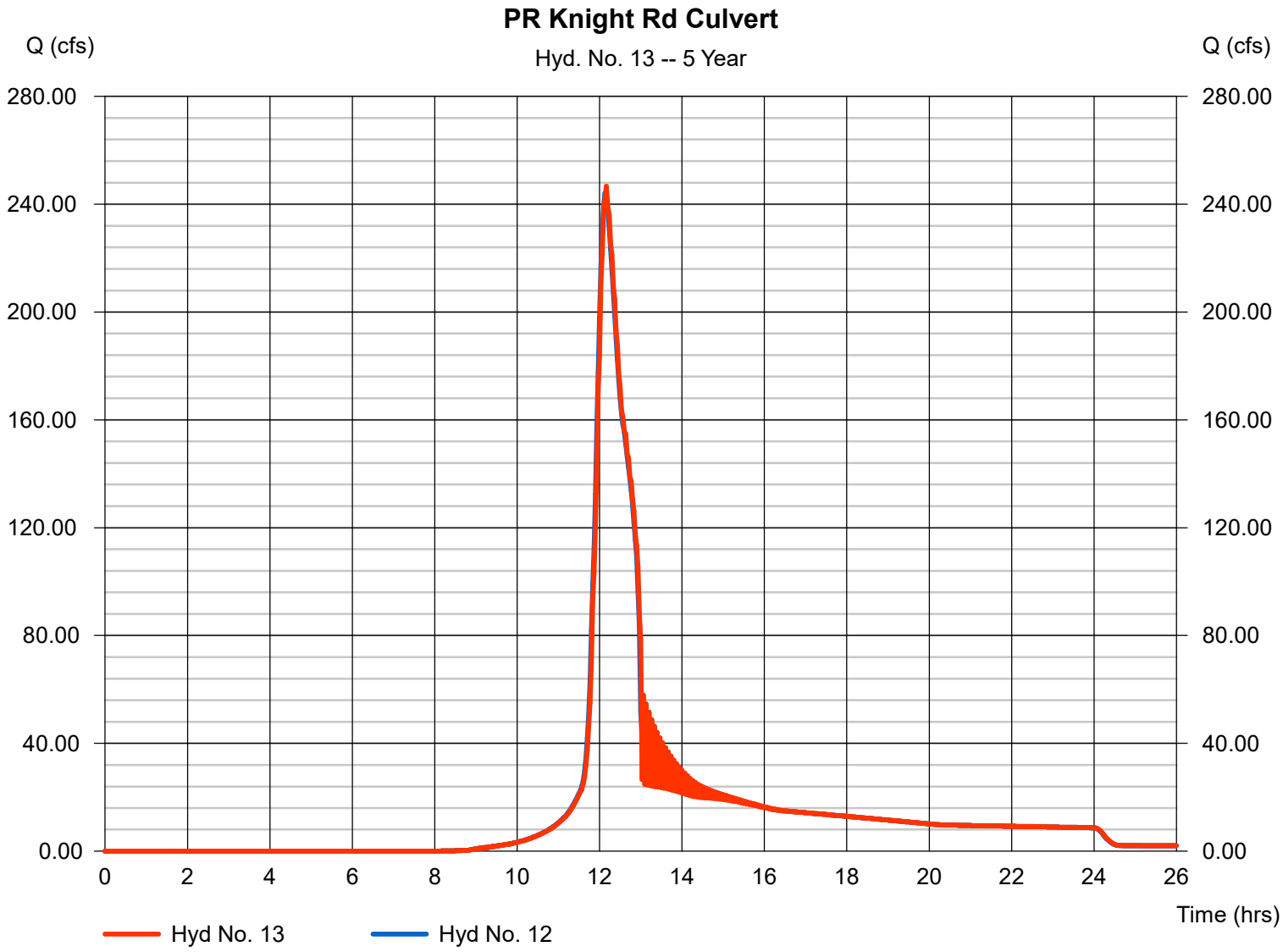
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	246.66 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,633,274 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	24.45 ft/s	Routing coeff.	=	1.9529

Modified Att-Kin routing method used.

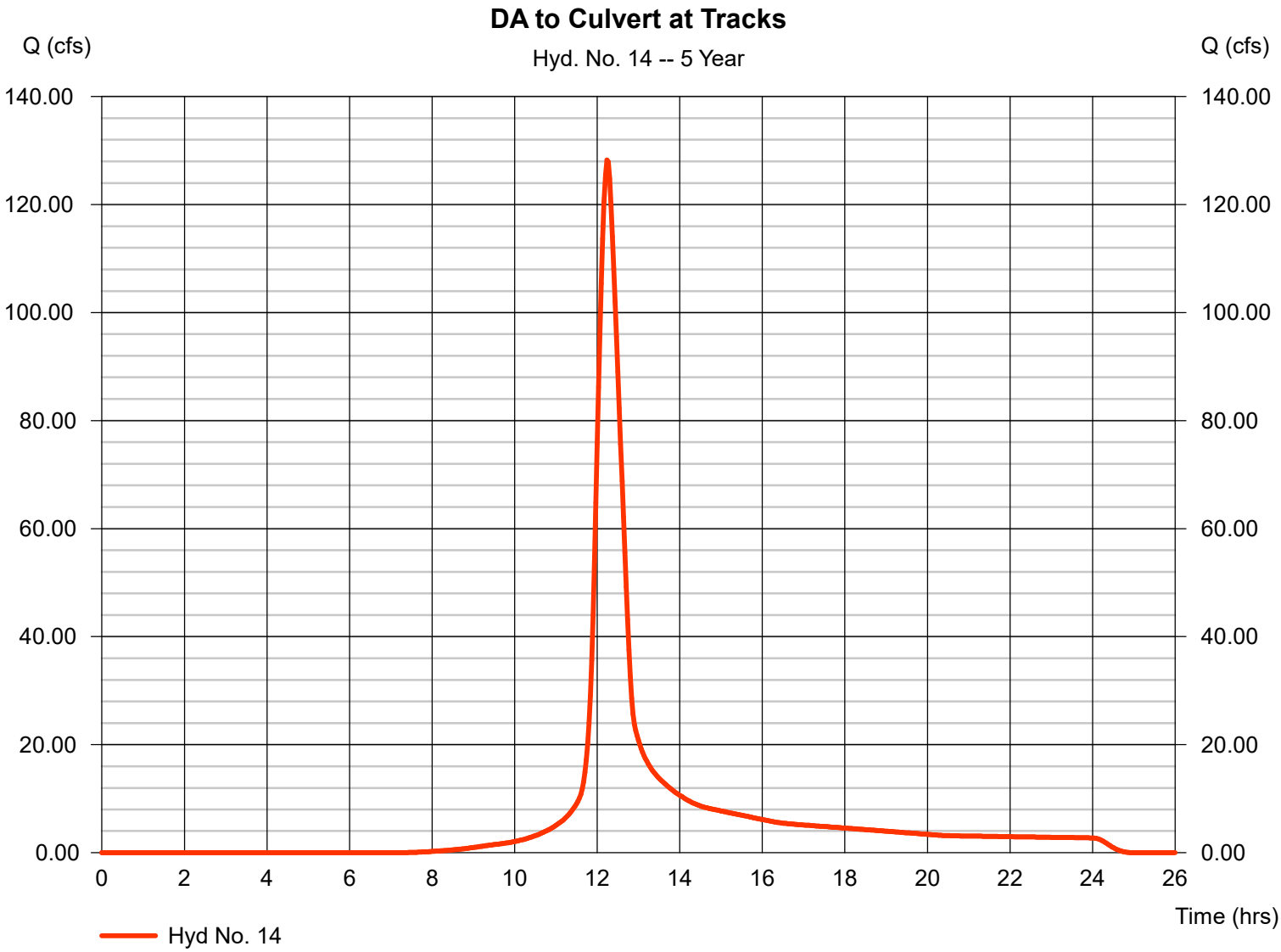


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	128.23 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	581,100 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	4.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

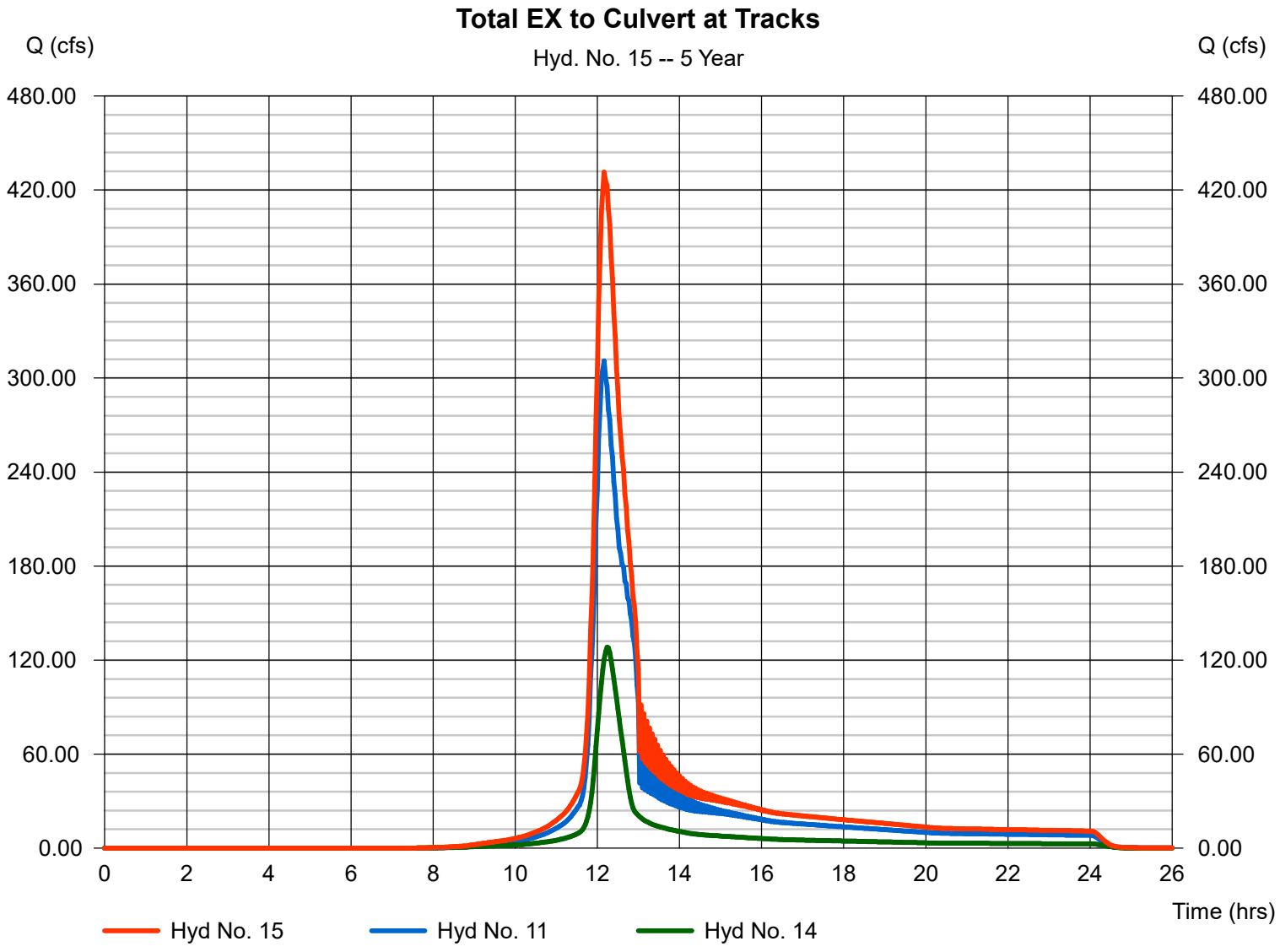


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 431.54 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,226,012 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

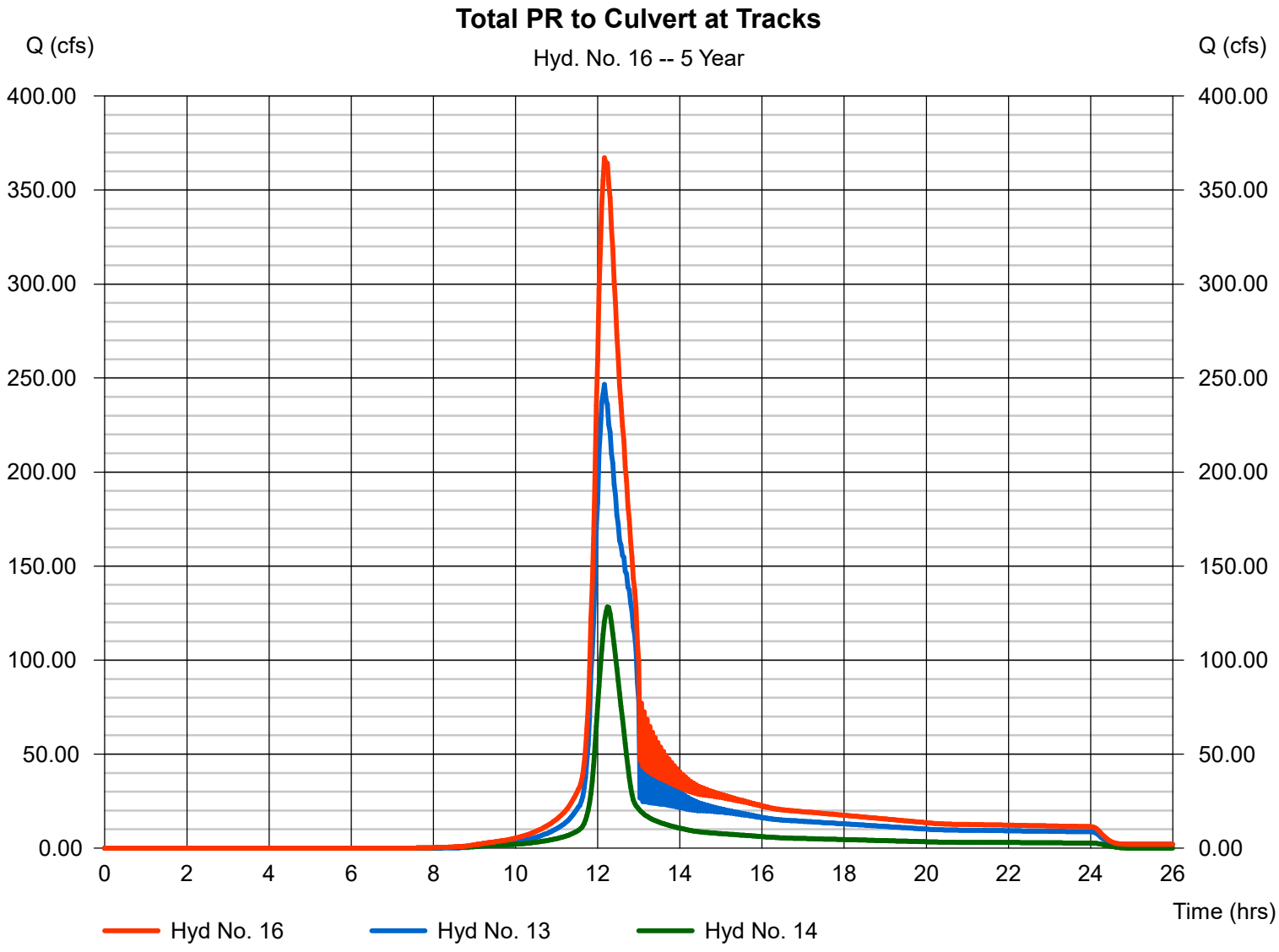


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 367.20 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,214,371 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

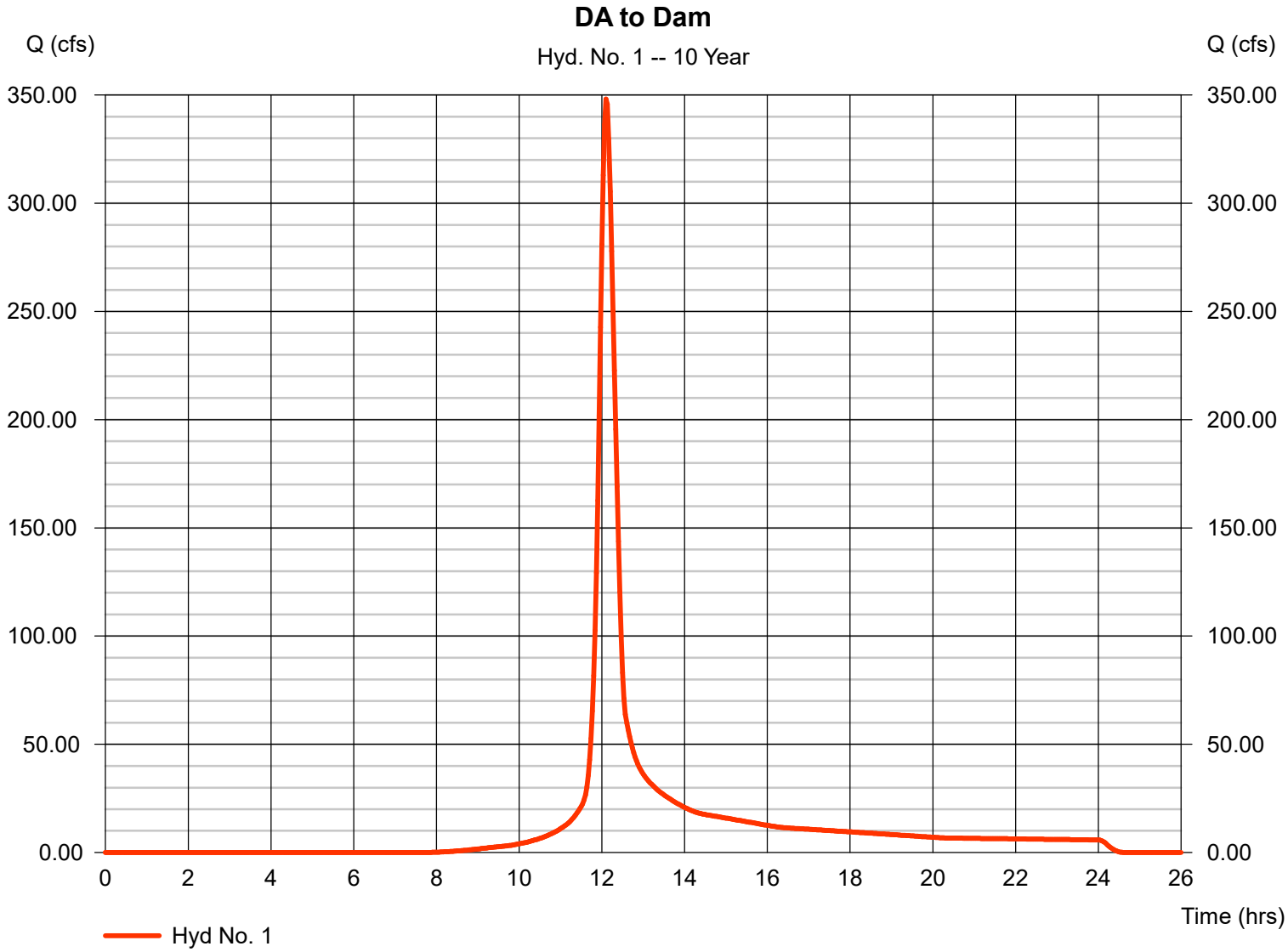
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	348.18	2	726	1,203,285	----	------	------	DA to Dam
2	Reservoir	155.32	2	744	1,203,227	1	258.61	245,448	EX Dam
3	SCS Runoff	43.17	2	730	172,509	----	------	------	DA to School Basin
4	Reservoir	24.40	2	748	172,501	3	273.29	49,337	EX School Basin
5	SCS Runoff	66.84	2	726	231,030	----	------	------	DA to New Basin
6	Combine	79.96	2	728	403,530	4, 5	------	------	Total to New Basin
7	Reservoir	2.348	2	1206	397,452	6	256.73	301,846	PR New Basin
8	SCS Runoff	210.08	2	726	725,522	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	140.73	2	726	485,870	----	------	------	PR DA to Knight Rd Culvert
10	Combine	365.25	2	728	2,101,253	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	368.57	2	728	2,101,216	10	------	------	EX Knight Rd Culvert
12	Combine	284.21	2	728	2,086,549	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	287.67	2	728	2,086,544	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	161.67	2	734	732,316	----	------	------	DA to Culvert at Tracks
15	Combine	518.45	2	732	2,833,535	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	440.81	2	732	2,818,860	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	348.18 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,203,285 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



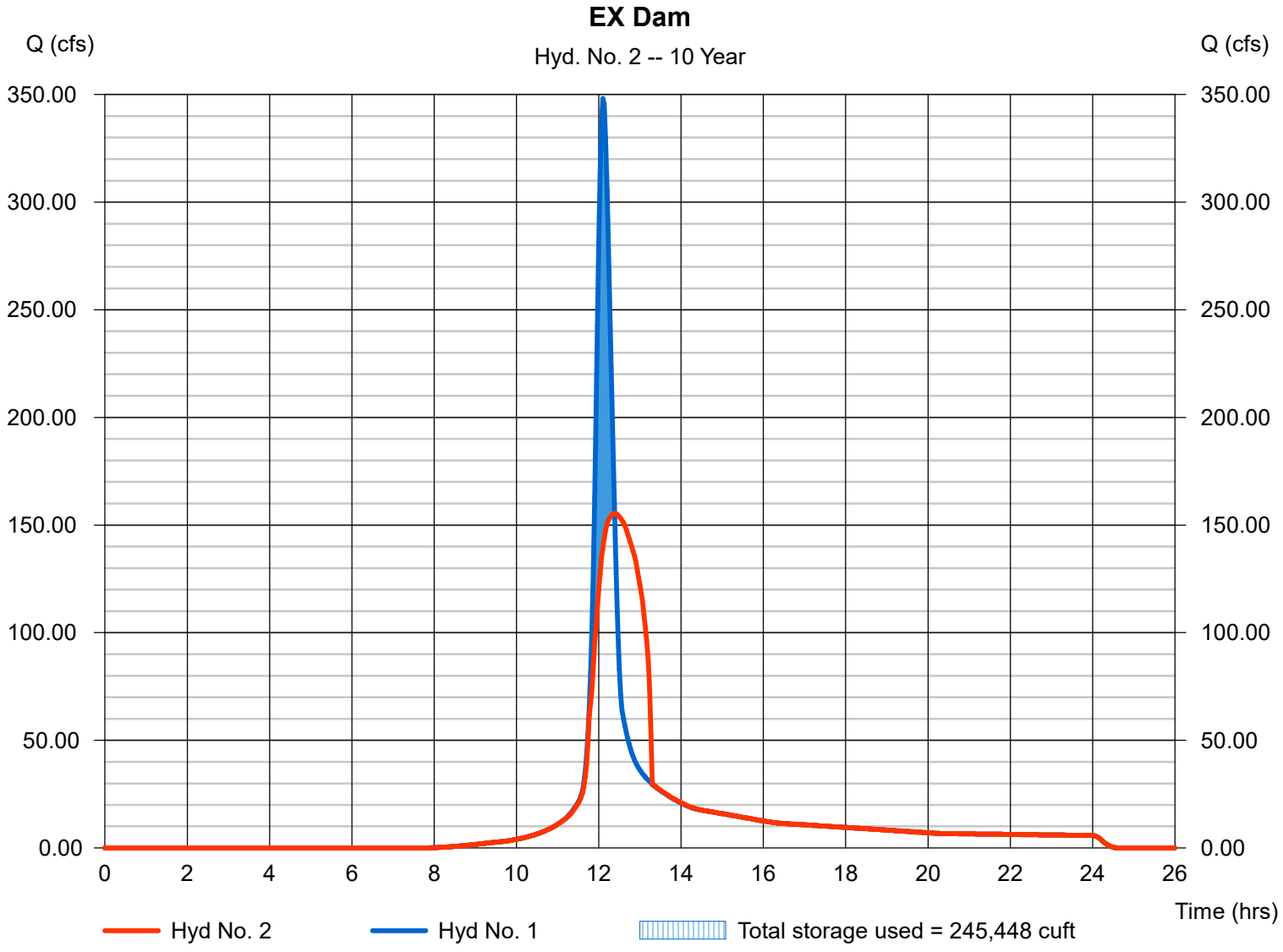
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	155.32 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	1,203,227 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	258.61 ft
Reservoir name	=	EX Dam	Max. Storage	=	245,448 cuft

Storage Indication method used.

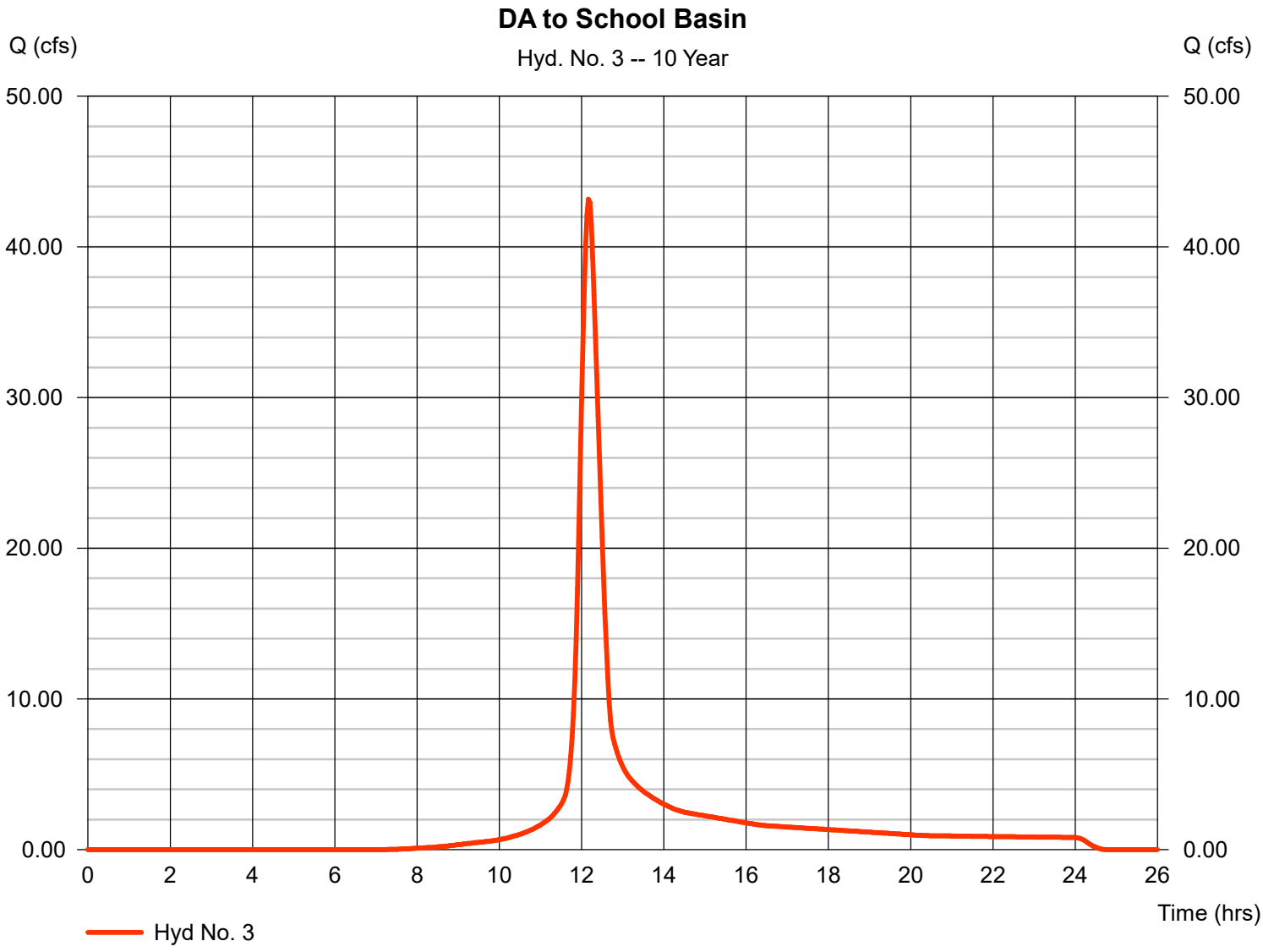


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.17 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	172,509 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



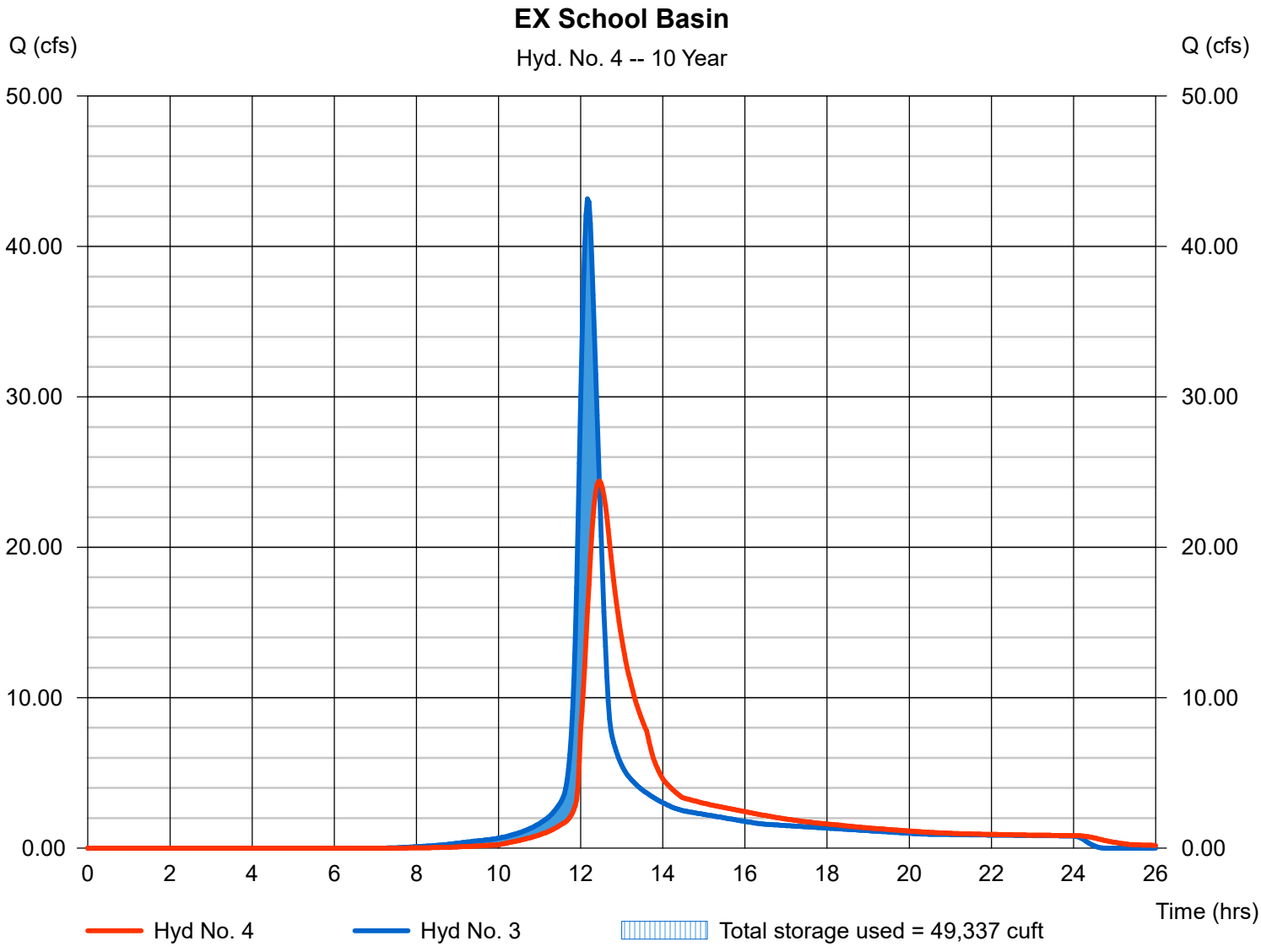
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	24.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	172,501 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	273.29 ft
Reservoir name	=	EX School Basin	Max. Storage	=	49,337 cuft

Storage Indication method used.

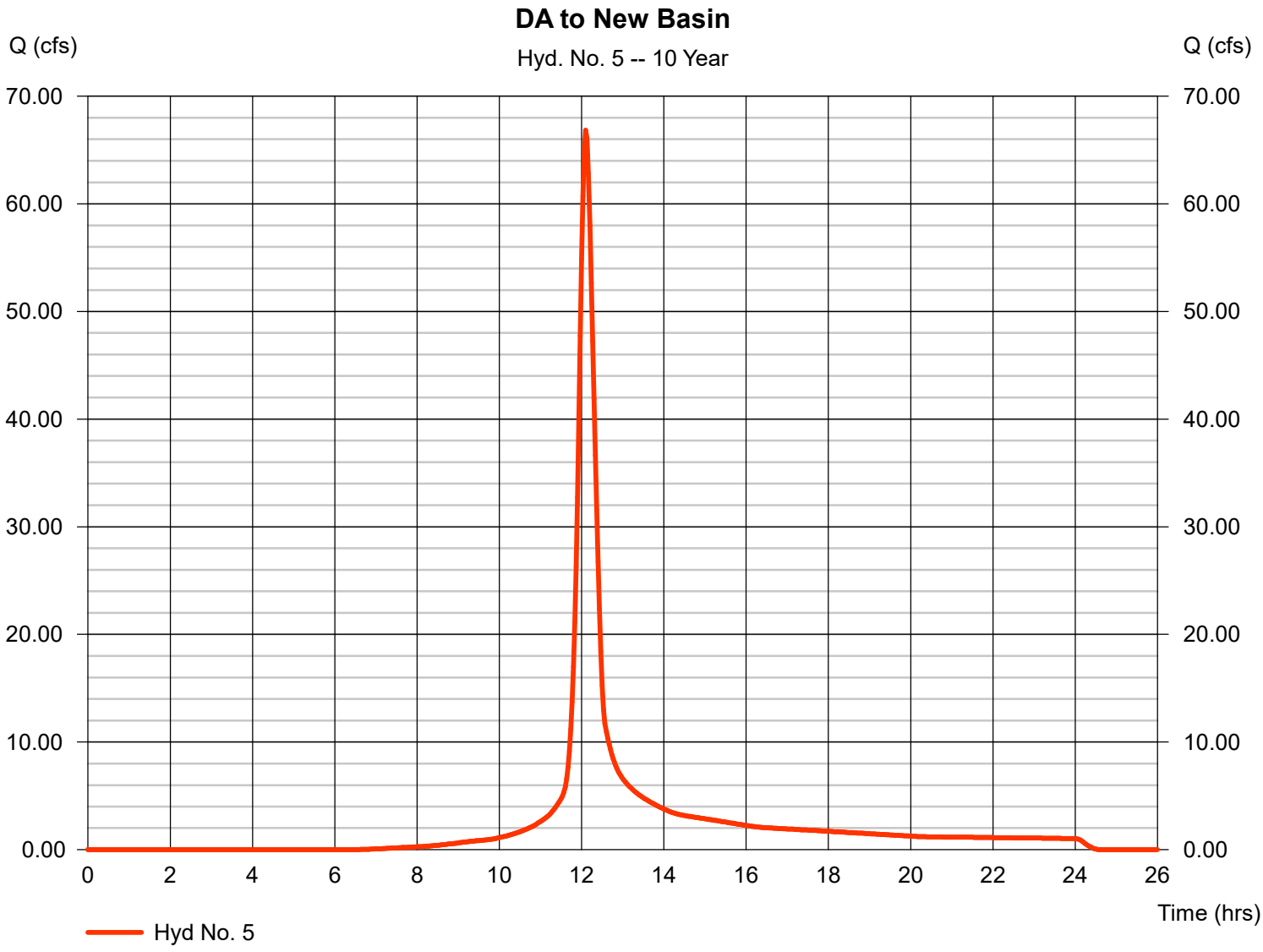


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	66.84 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	231,030 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

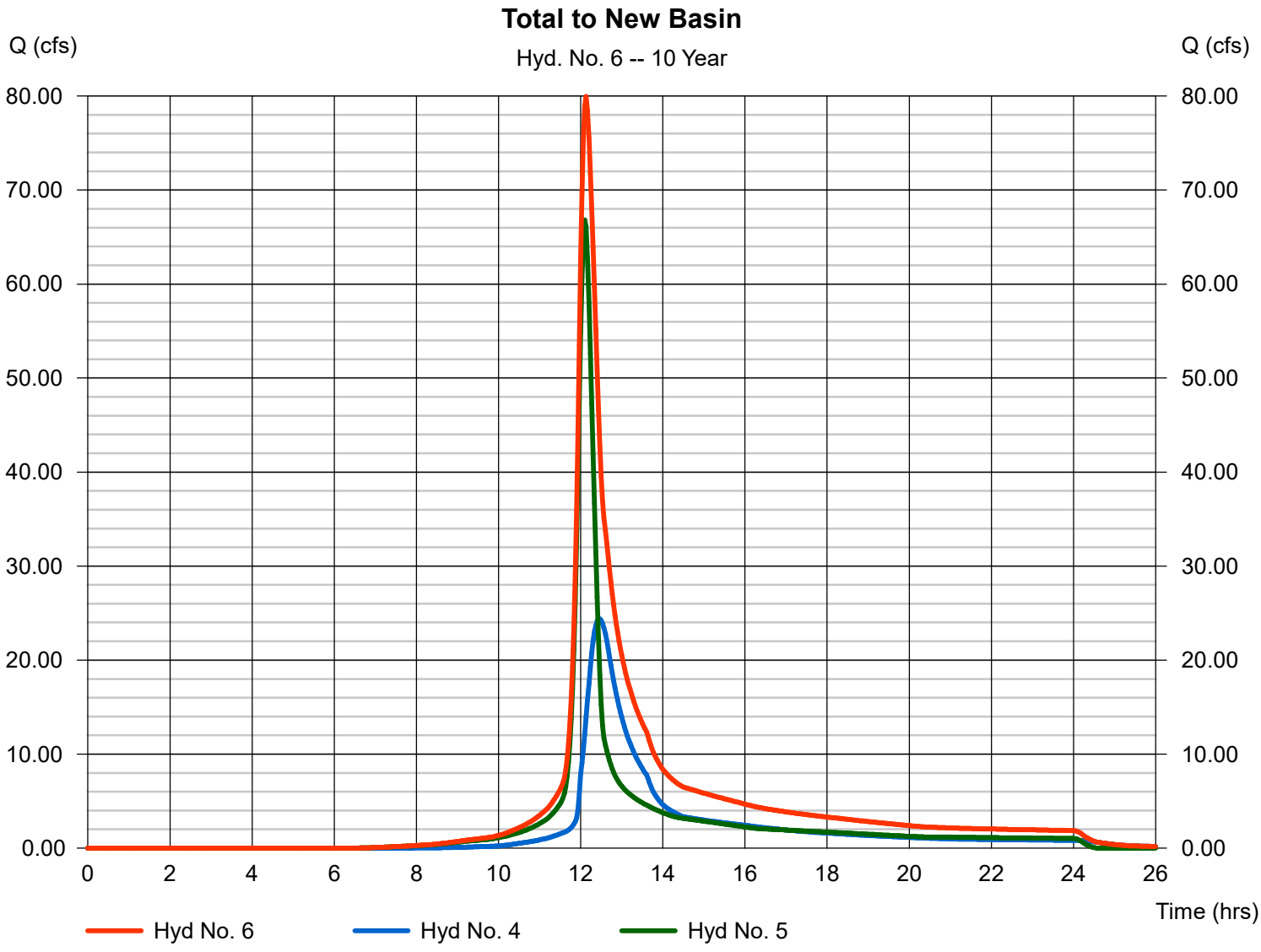


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 79.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 403,530 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



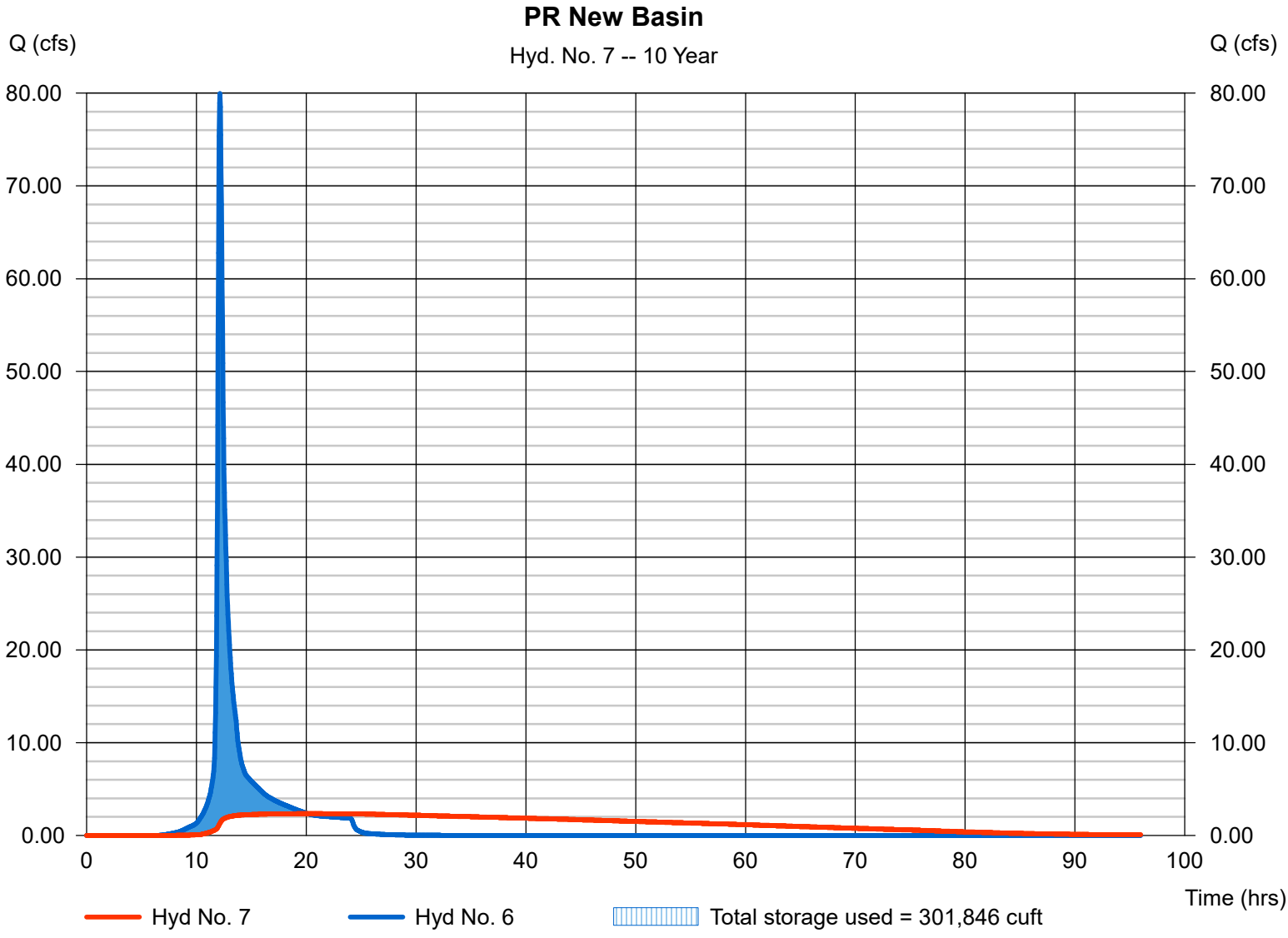
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	2.348 cfs
Storm frequency	=	10 yrs	Time to peak	=	20.10 hrs
Time interval	=	2 min	Hyd. volume	=	397,452 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	256.73 ft
Reservoir name	=	PR New Basin	Max. Storage	=	301,846 cuft

Storage Indication method used.

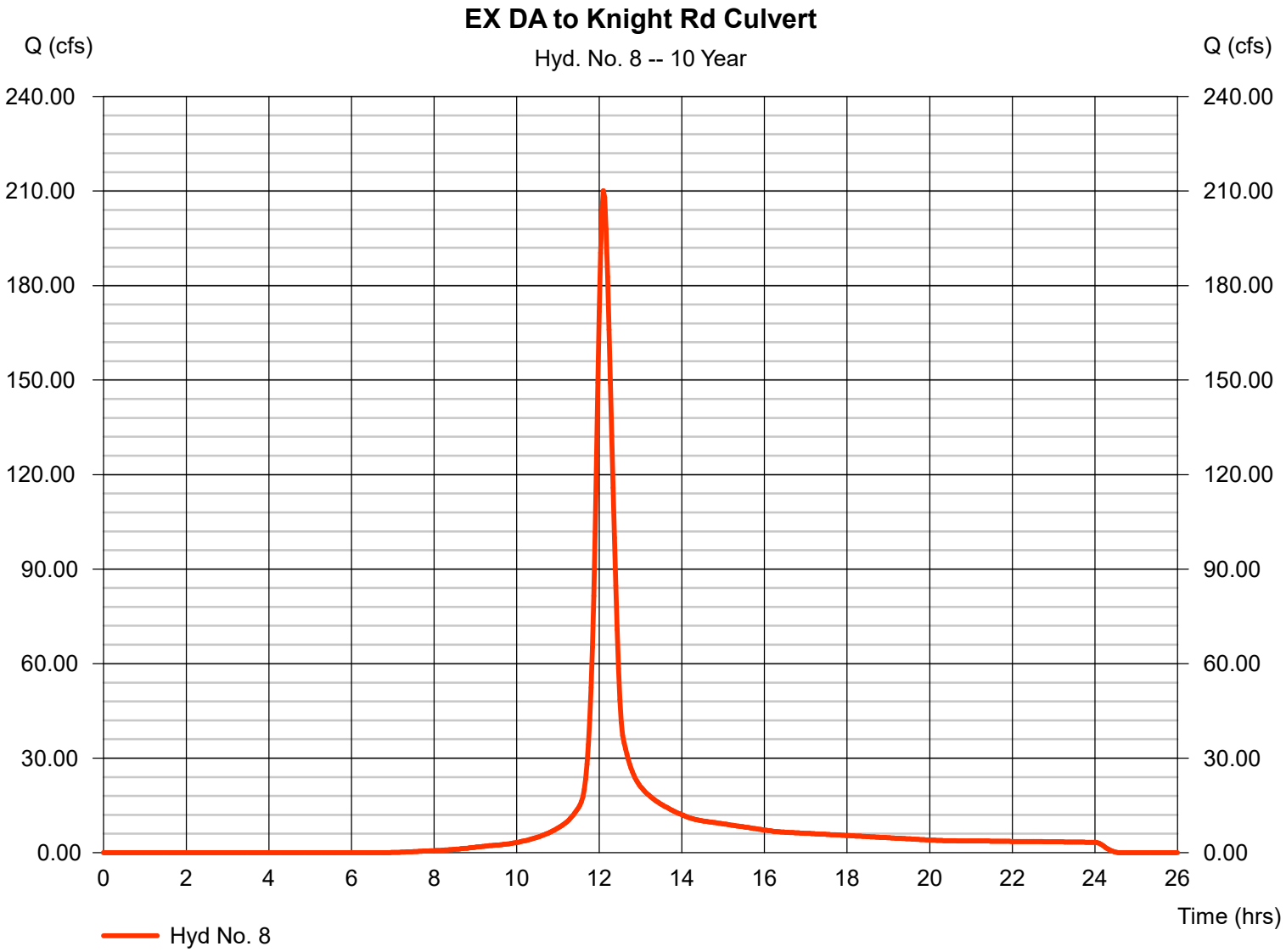


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	210.08 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	725,522 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

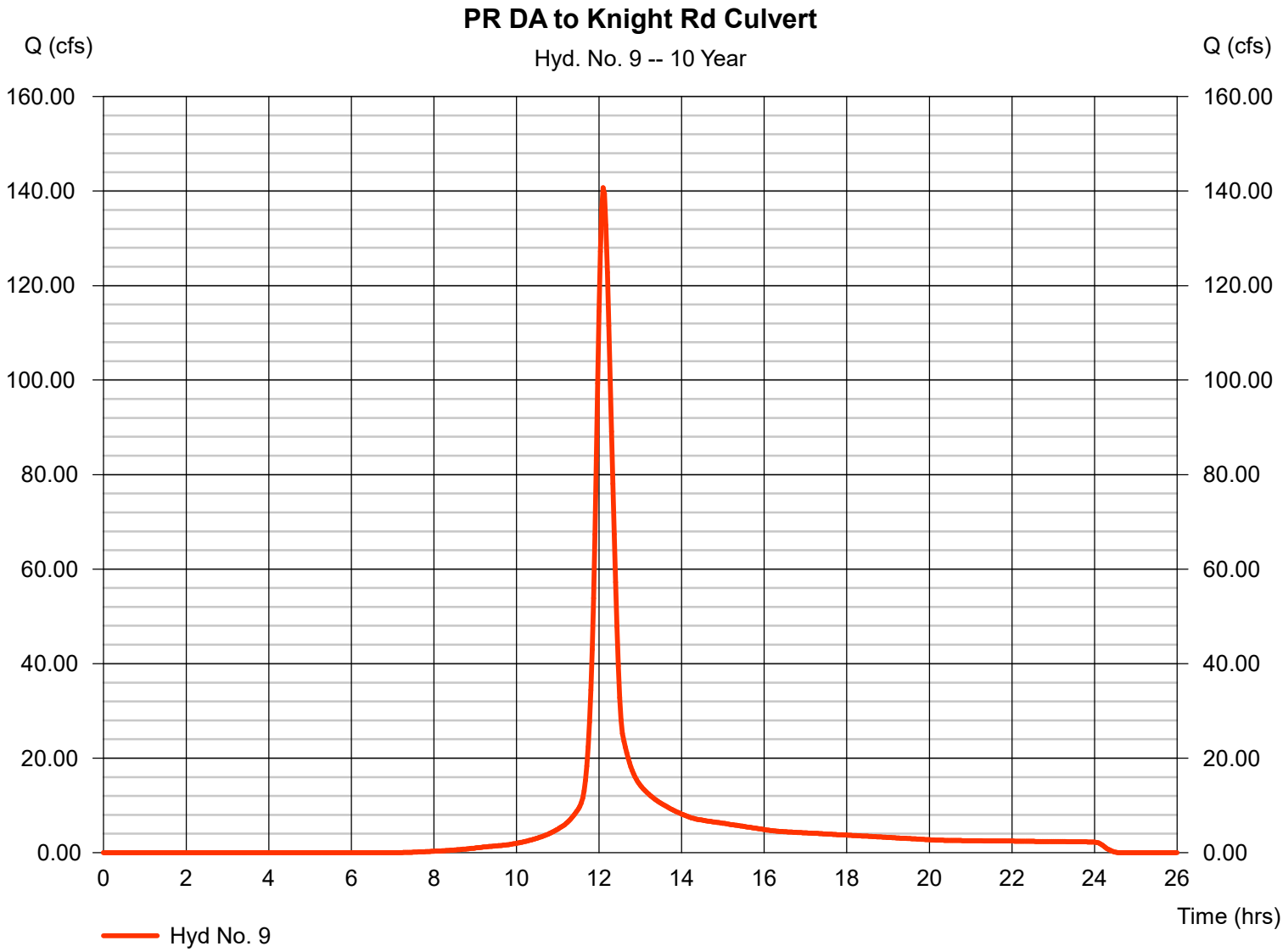


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	140.73 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	485,870 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

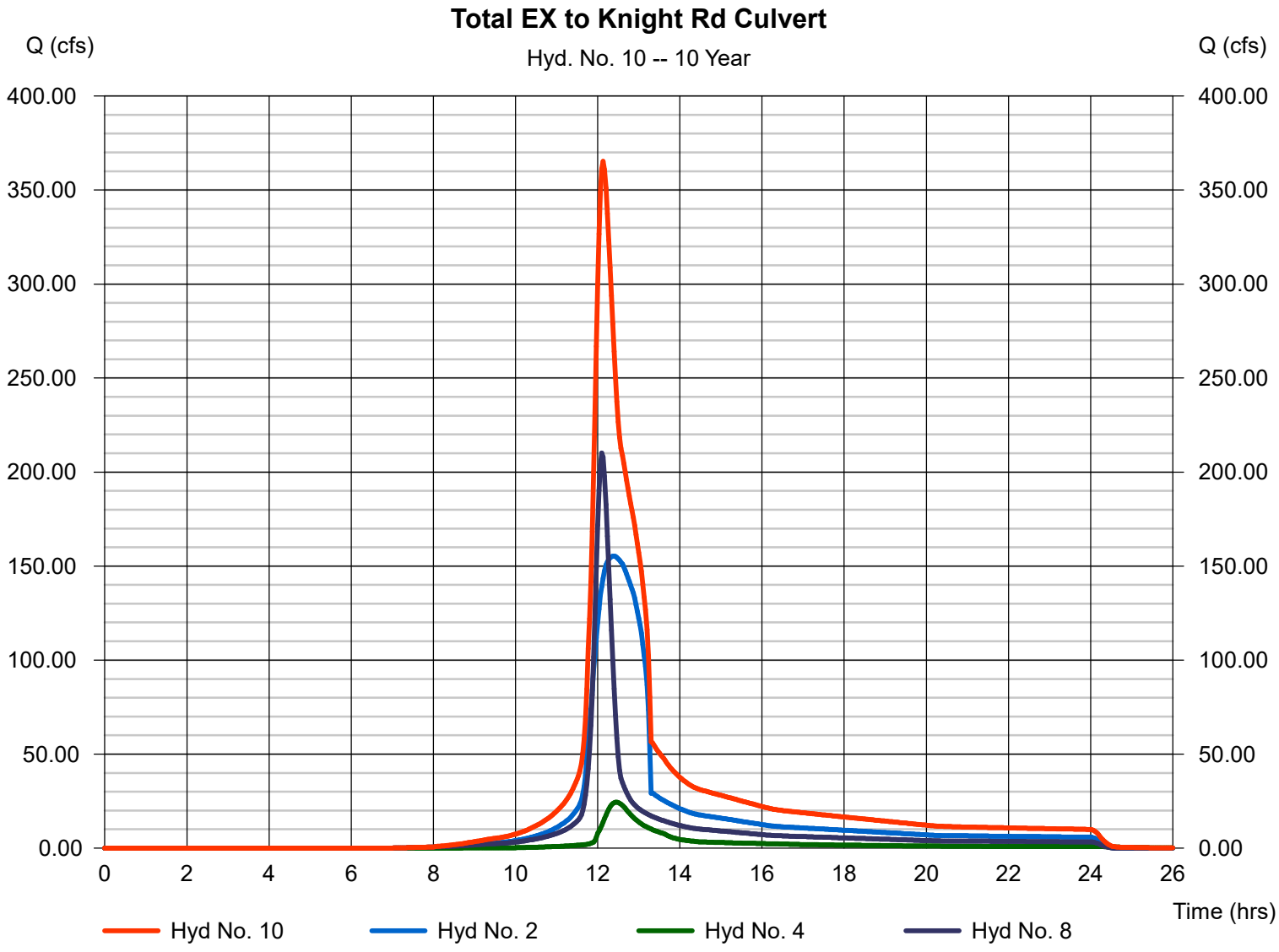


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 365.25 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,101,253 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



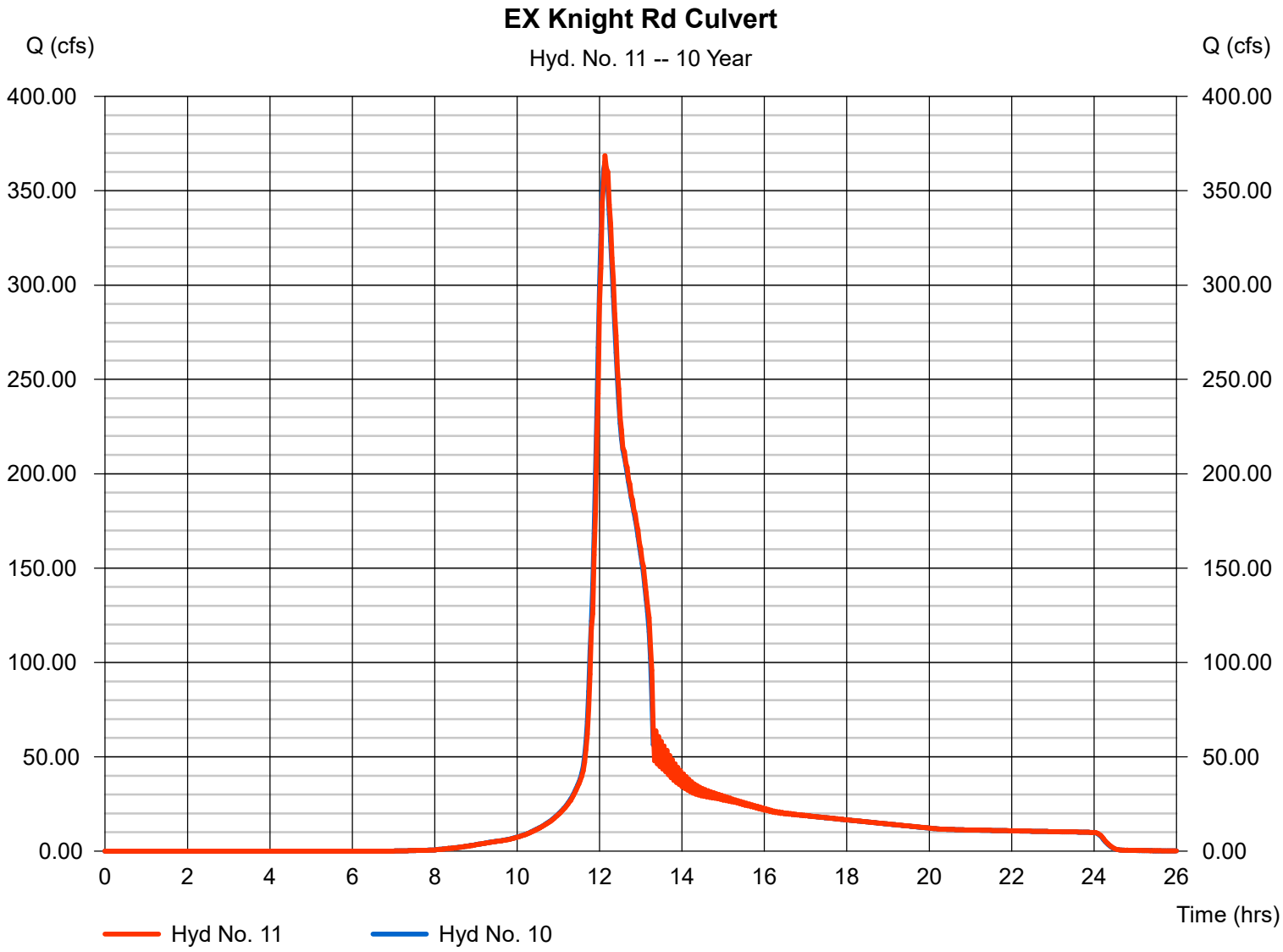
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	368.57 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,101,216 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	28.23 ft/s	Routing coeff.	=	1.9591

Modified Att-Kin routing method used.

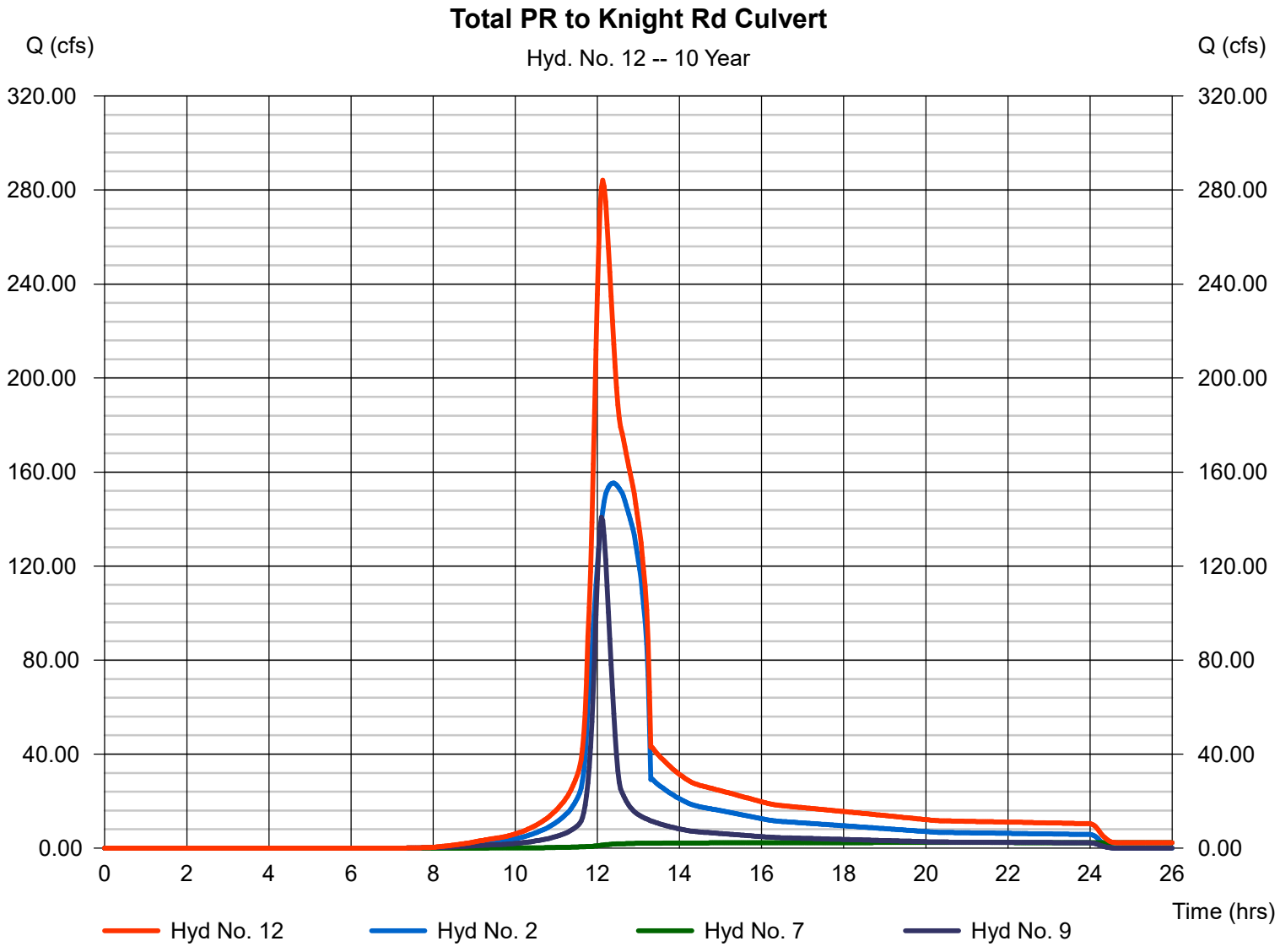


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 284.21 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,086,549 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



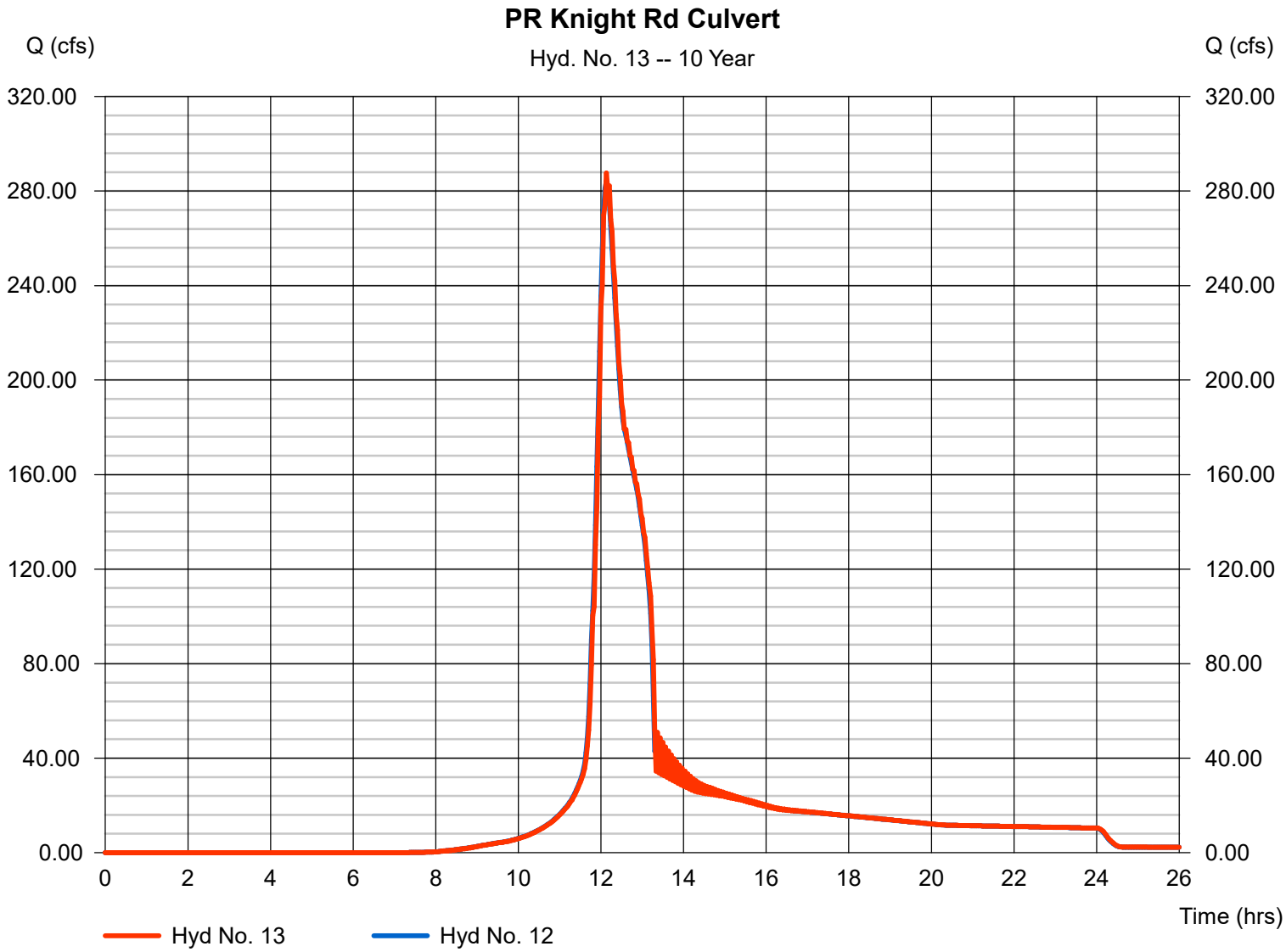
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	287.67 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,086,544 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	25.81 ft/s	Routing coeff.	=	1.9554

Modified Att-Kin routing method used.

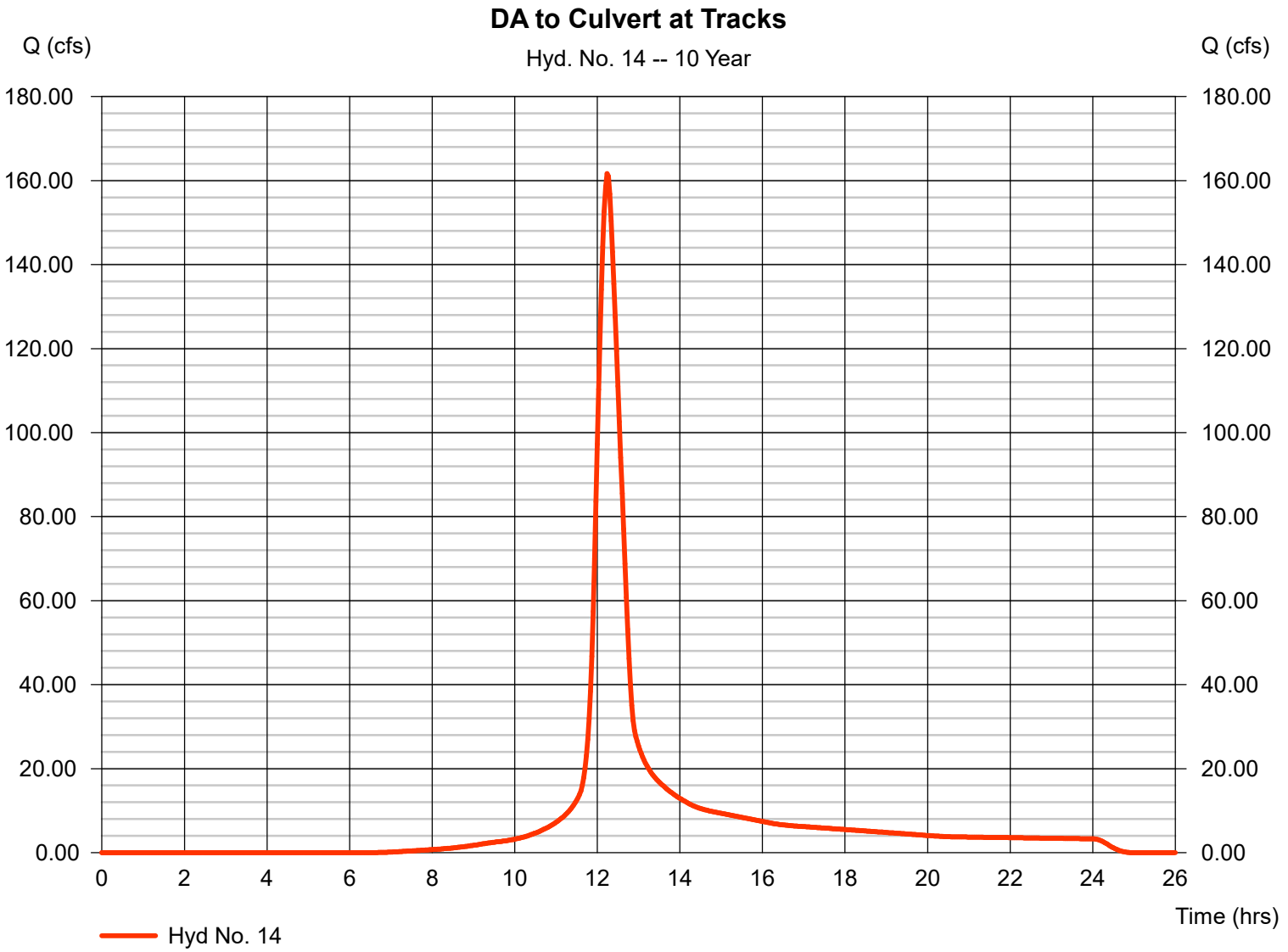


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	161.67 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	732,316 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	4.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

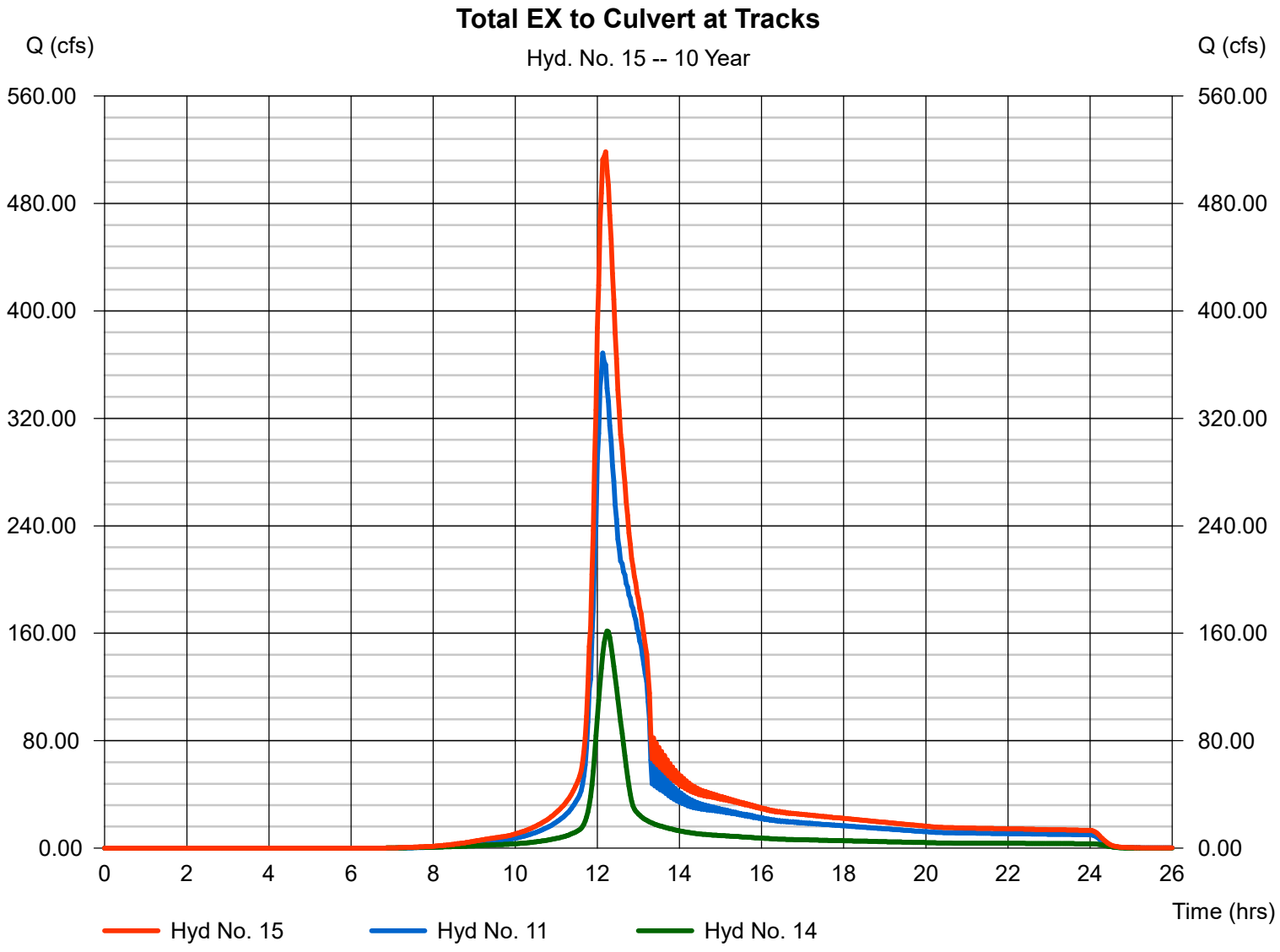


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 518.45 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 2,833,535 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

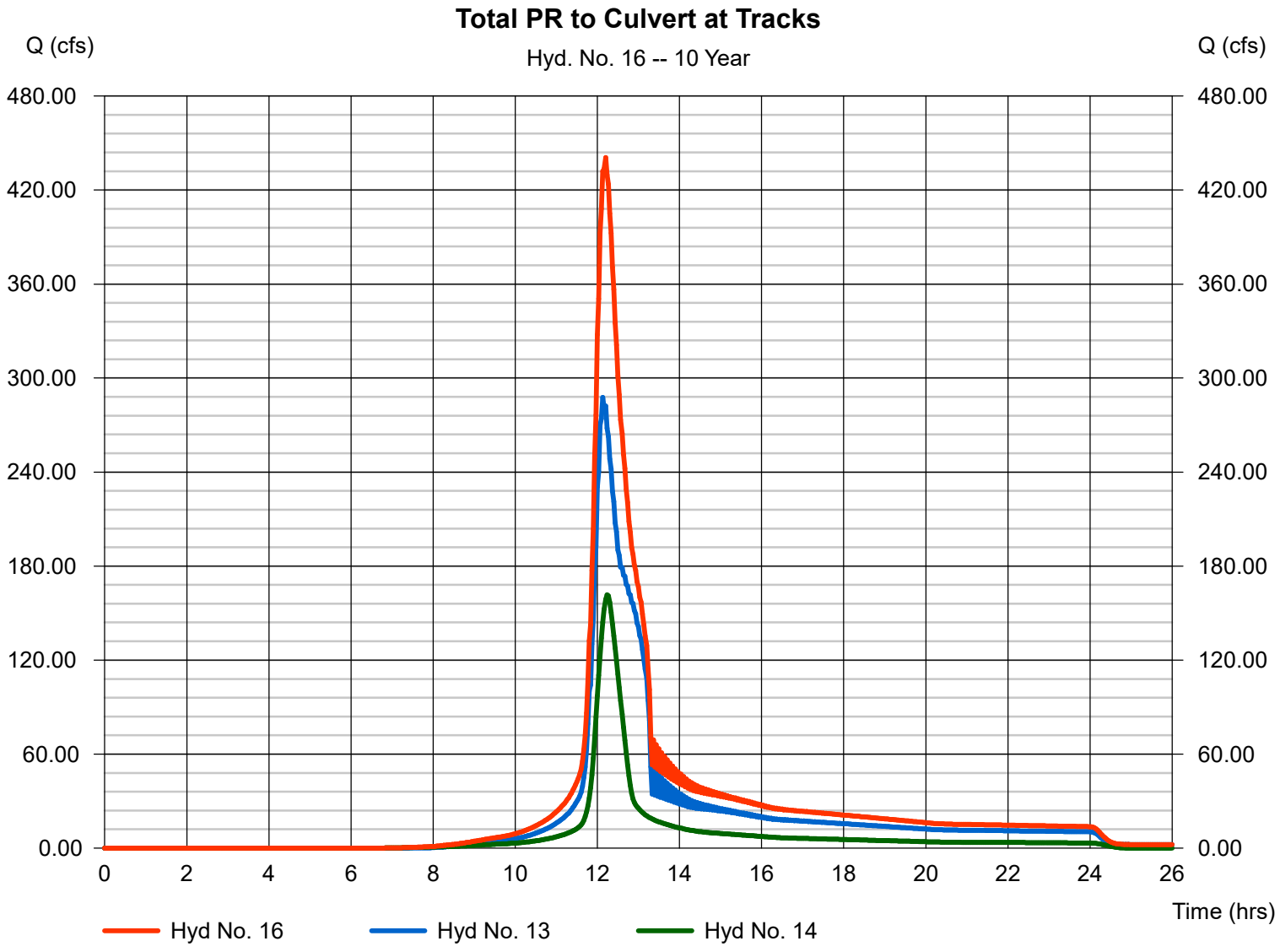


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 440.81 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 2,818,860 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

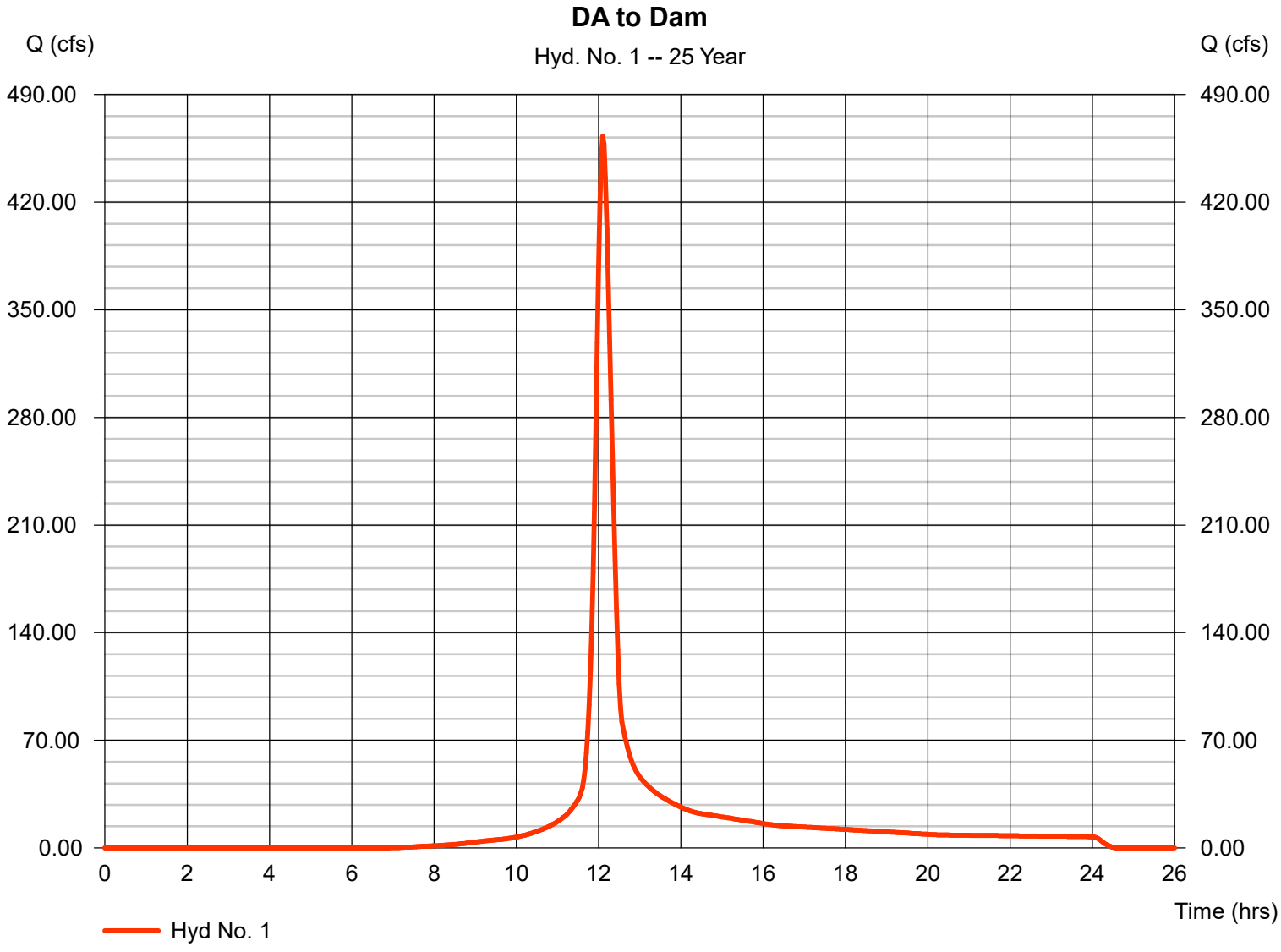
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	462.79	2	726	1,598,249	----	------	------	DA to Dam
2	Reservoir	188.75	2	744	1,598,191	1	260.23	390,897	EX Dam
3	SCS Runoff	56.70	2	730	226,814	----	------	------	DA to School Basin
4	Reservoir	33.06	2	746	226,806	3	273.90	63,633	EX School Basin
5	SCS Runoff	86.61	2	726	300,774	----	------	------	DA to New Basin
6	Combine	105.18	2	728	527,579	4, 5	------	------	Total to New Basin
7	Reservoir	2.670	2	1266	515,557	6	258.58	407,051	PR New Basin
8	SCS Runoff	273.90	2	726	949,184	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	184.64	2	726	638,819	----	------	------	PR DA to Knight Rd Culvert
10	Combine	444.90	2	728	2,774,184	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	445.40	2	728	2,774,151	10	------	------	EX Knight Rd Culvert
12	Combine	338.77	2	728	2,752,567	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	339.16	2	728	2,752,552	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	209.86	2	734	953,392	----	------	------	DA to Culvert at Tracks
15	Combine	643.34	2	730	3,727,539	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	537.31	2	730	3,705,946	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	462.79 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,598,249 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



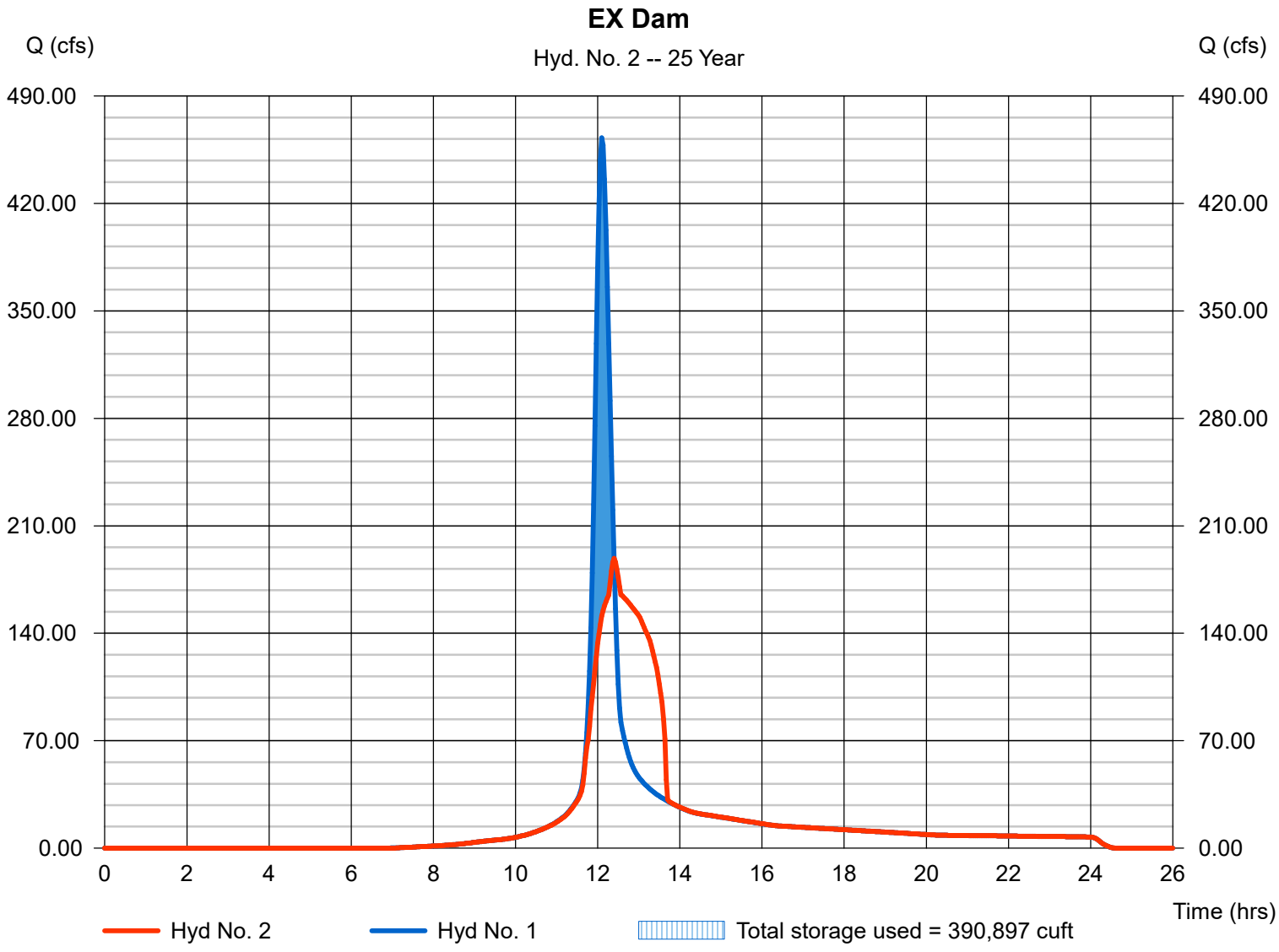
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	188.75 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	1,598,191 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	260.23 ft
Reservoir name	=	EX Dam	Max. Storage	=	390,897 cuft

Storage Indication method used.

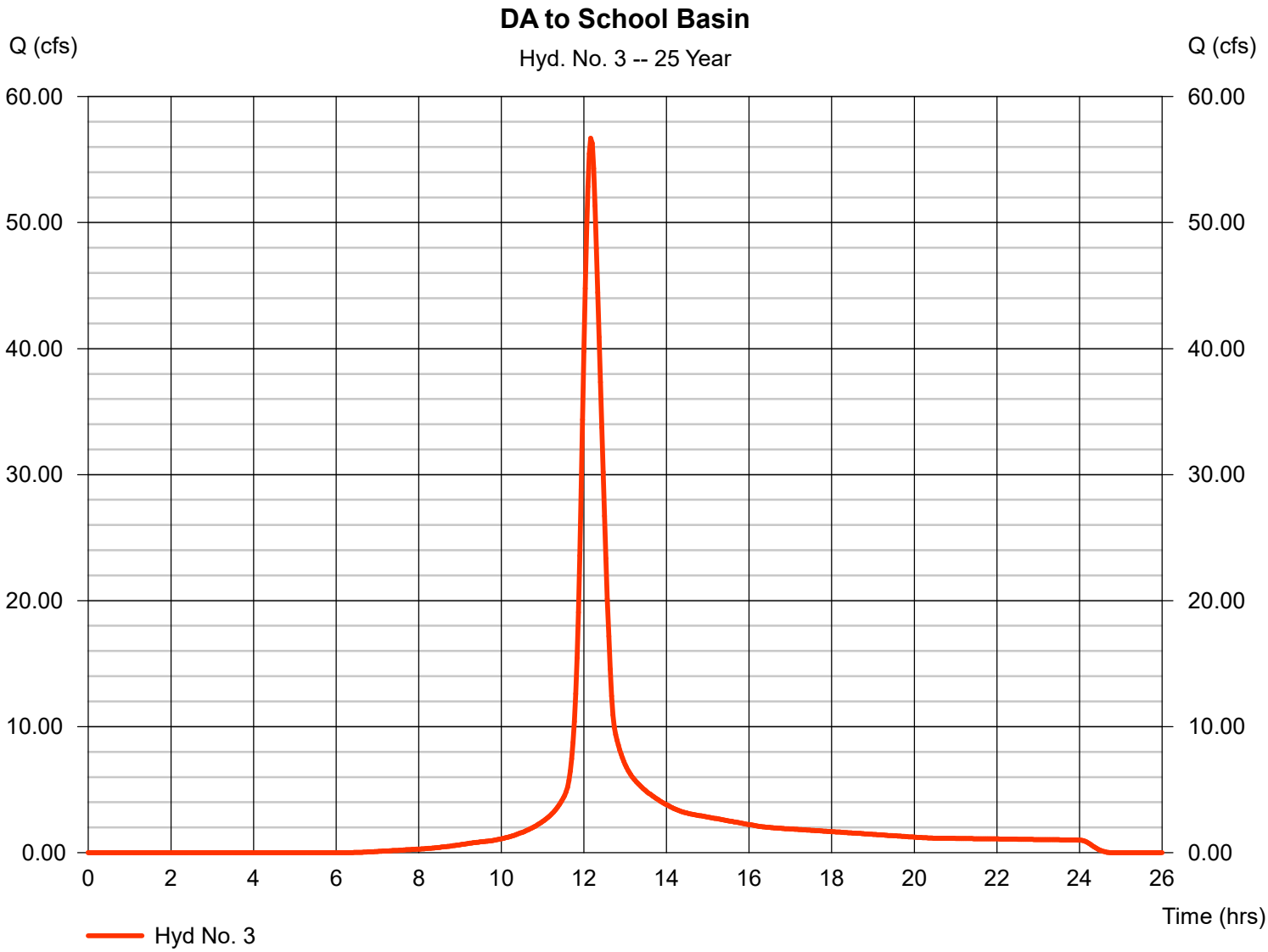


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	226,814 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



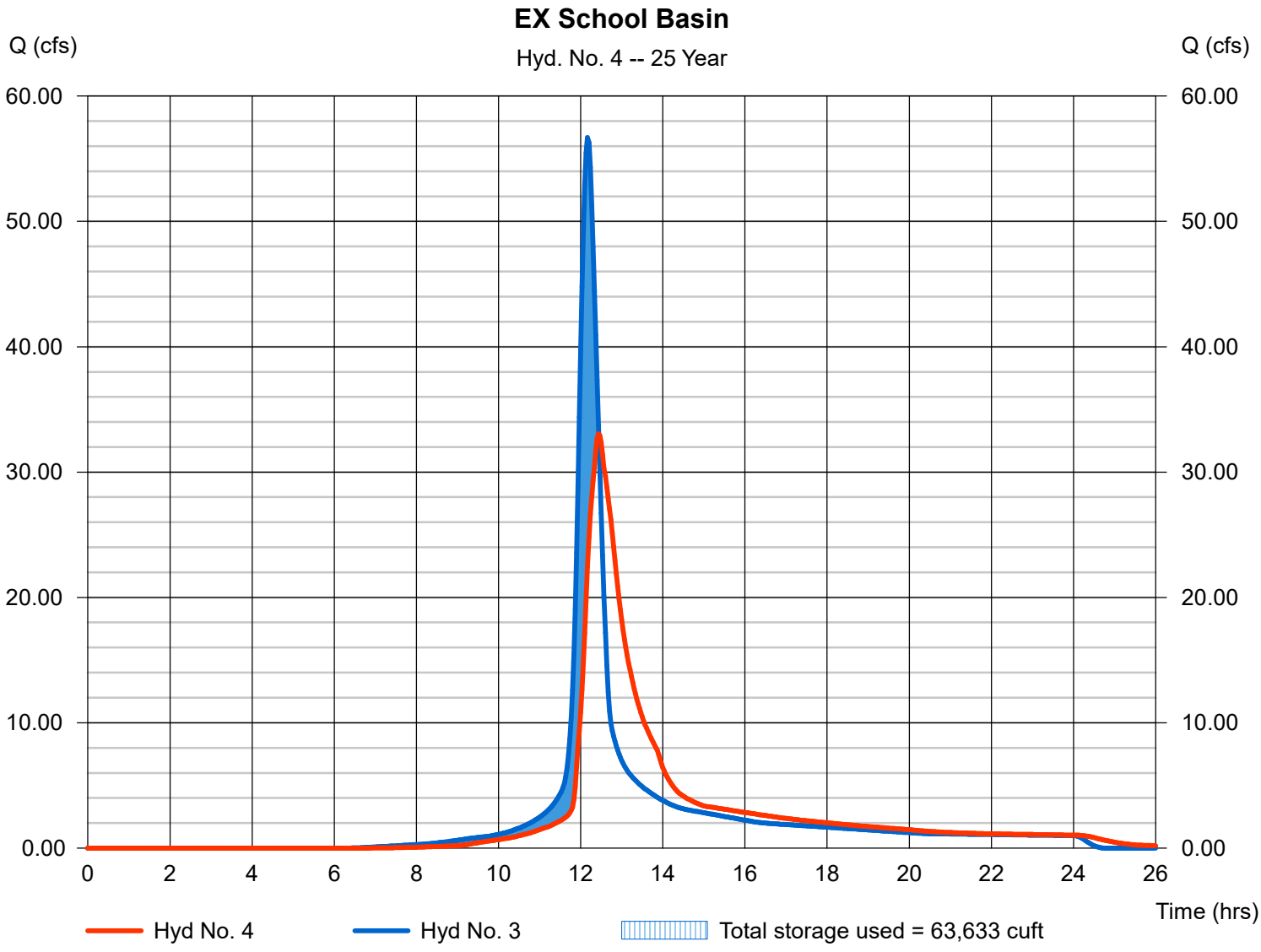
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	33.06 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.43 hrs
Time interval	=	2 min	Hyd. volume	=	226,806 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	273.90 ft
Reservoir name	=	EX School Basin	Max. Storage	=	63,633 cuft

Storage Indication method used.

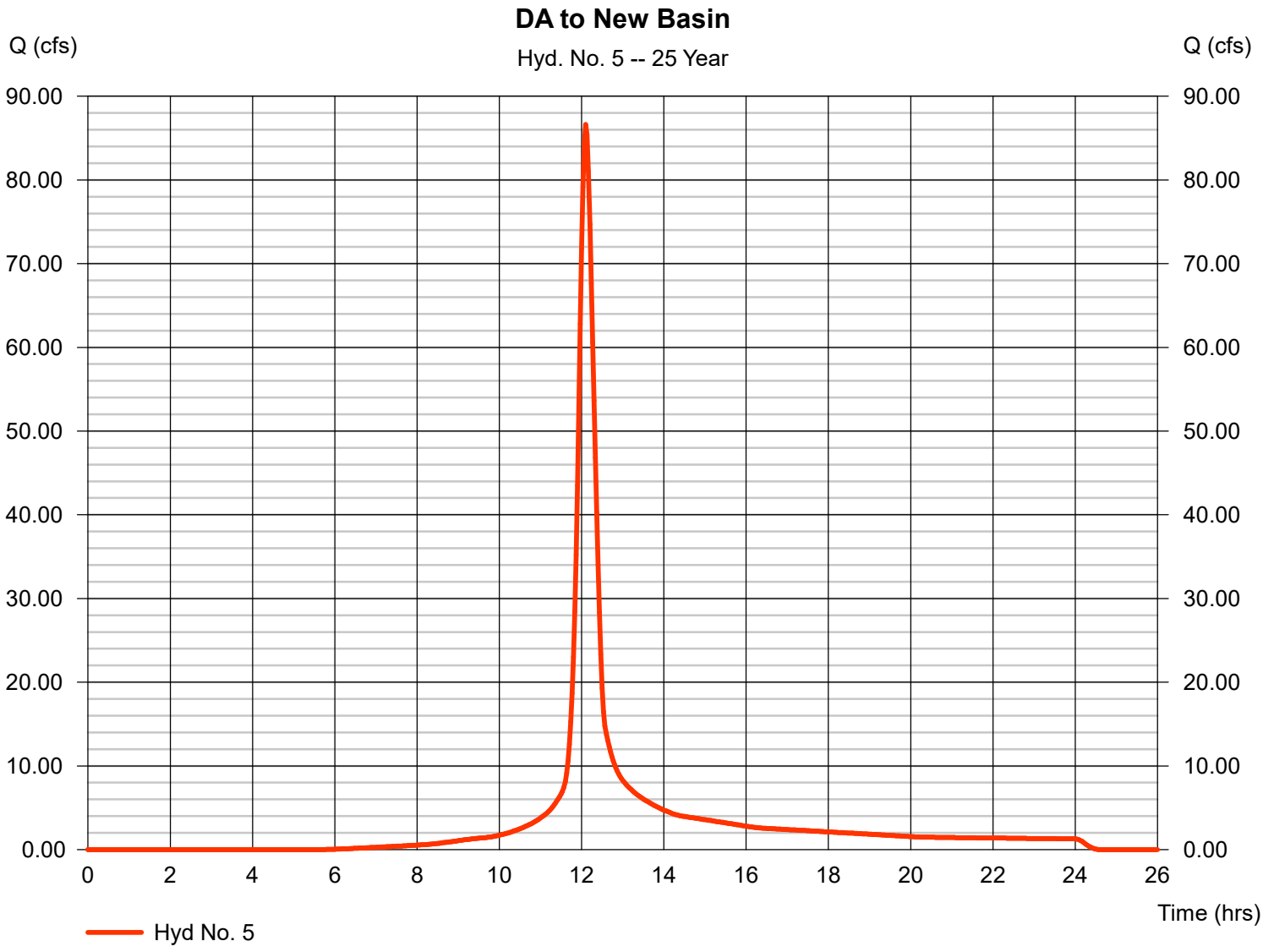


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	86.61 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	300,774 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

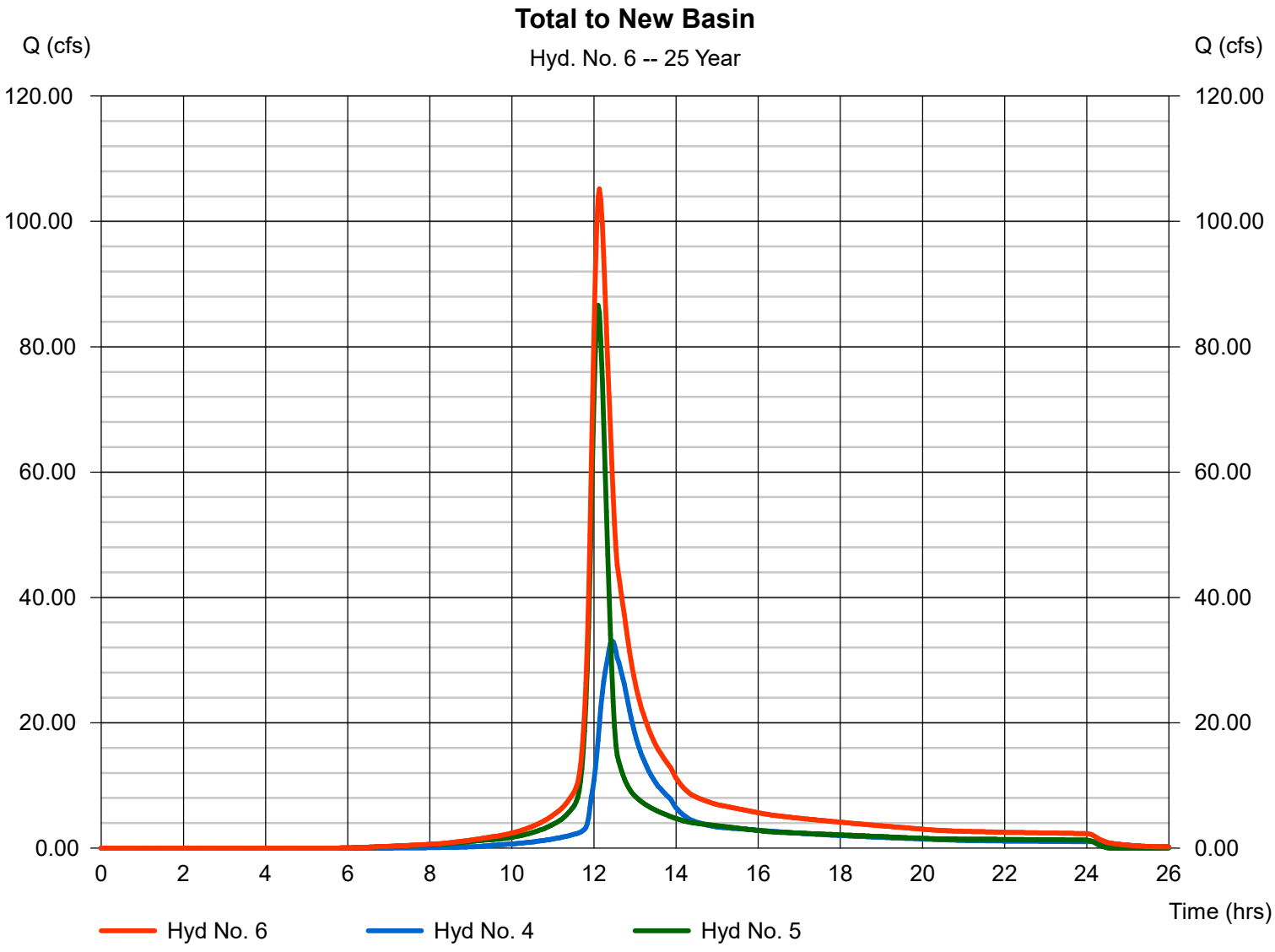


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 105.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 527,579 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



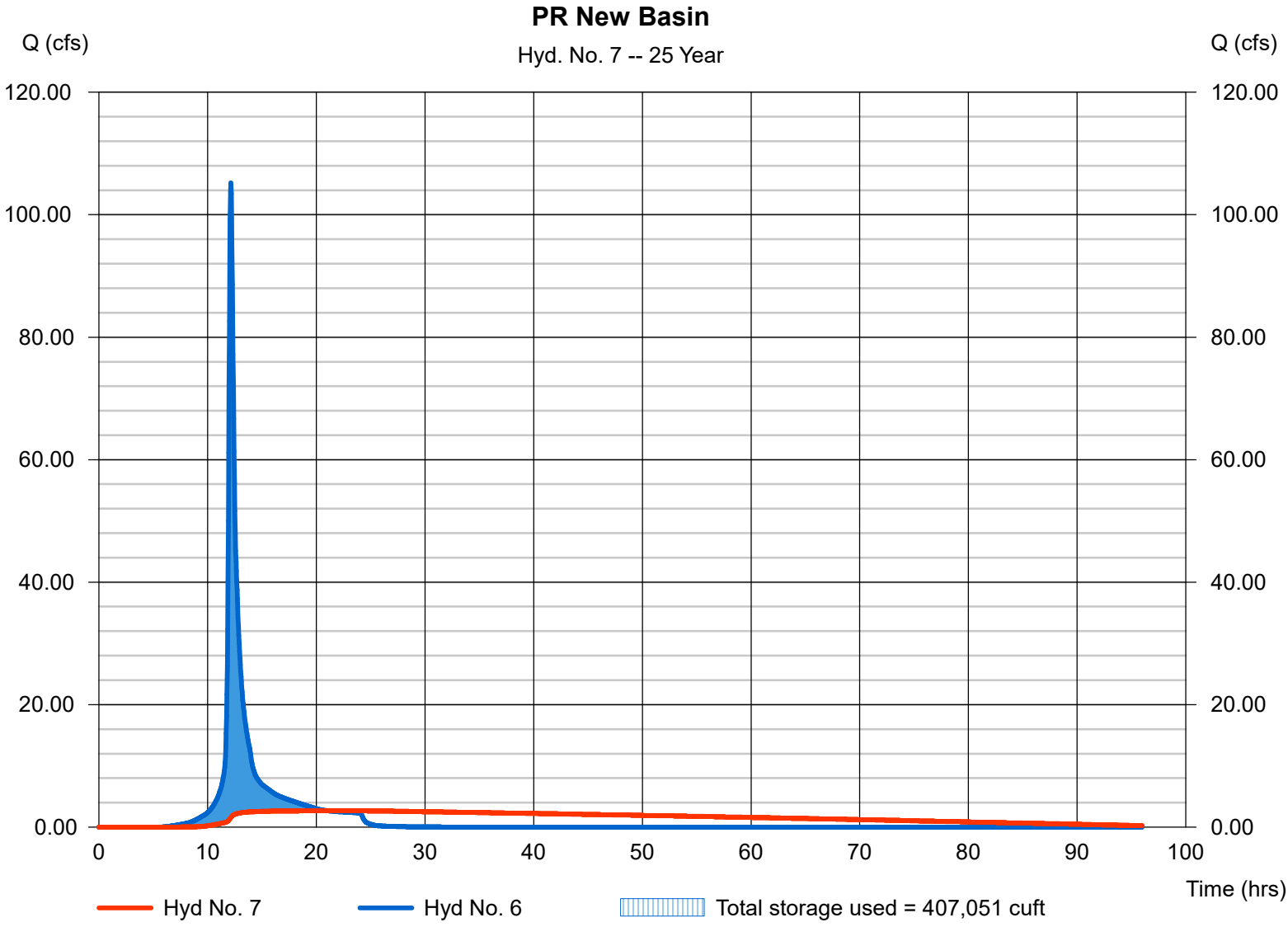
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	2.670 cfs
Storm frequency	=	25 yrs	Time to peak	=	21.10 hrs
Time interval	=	2 min	Hyd. volume	=	515,557 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	258.58 ft
Reservoir name	=	PR New Basin	Max. Storage	=	407,051 cuft

Storage Indication method used.

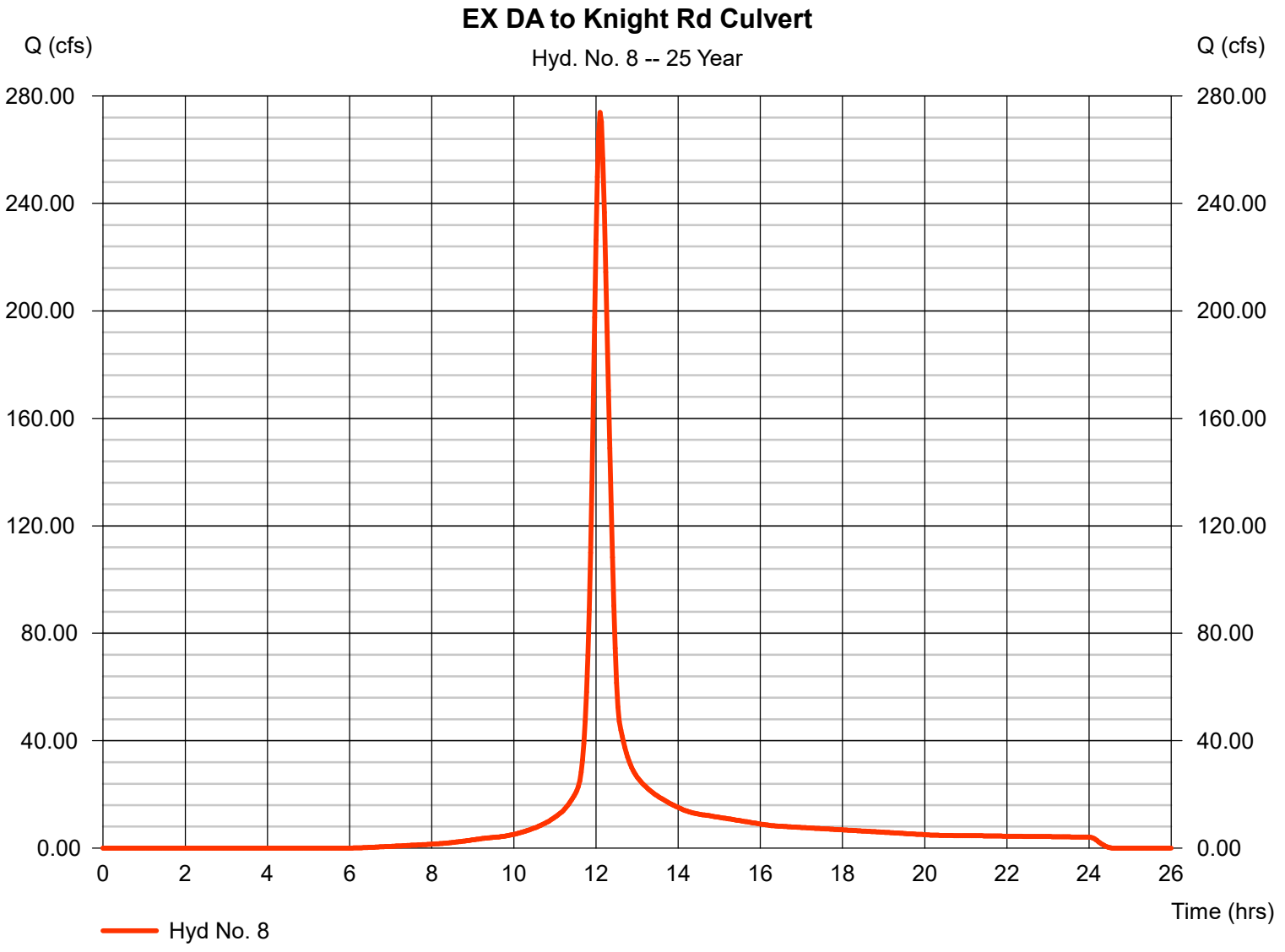


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	273.90 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	949,184 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

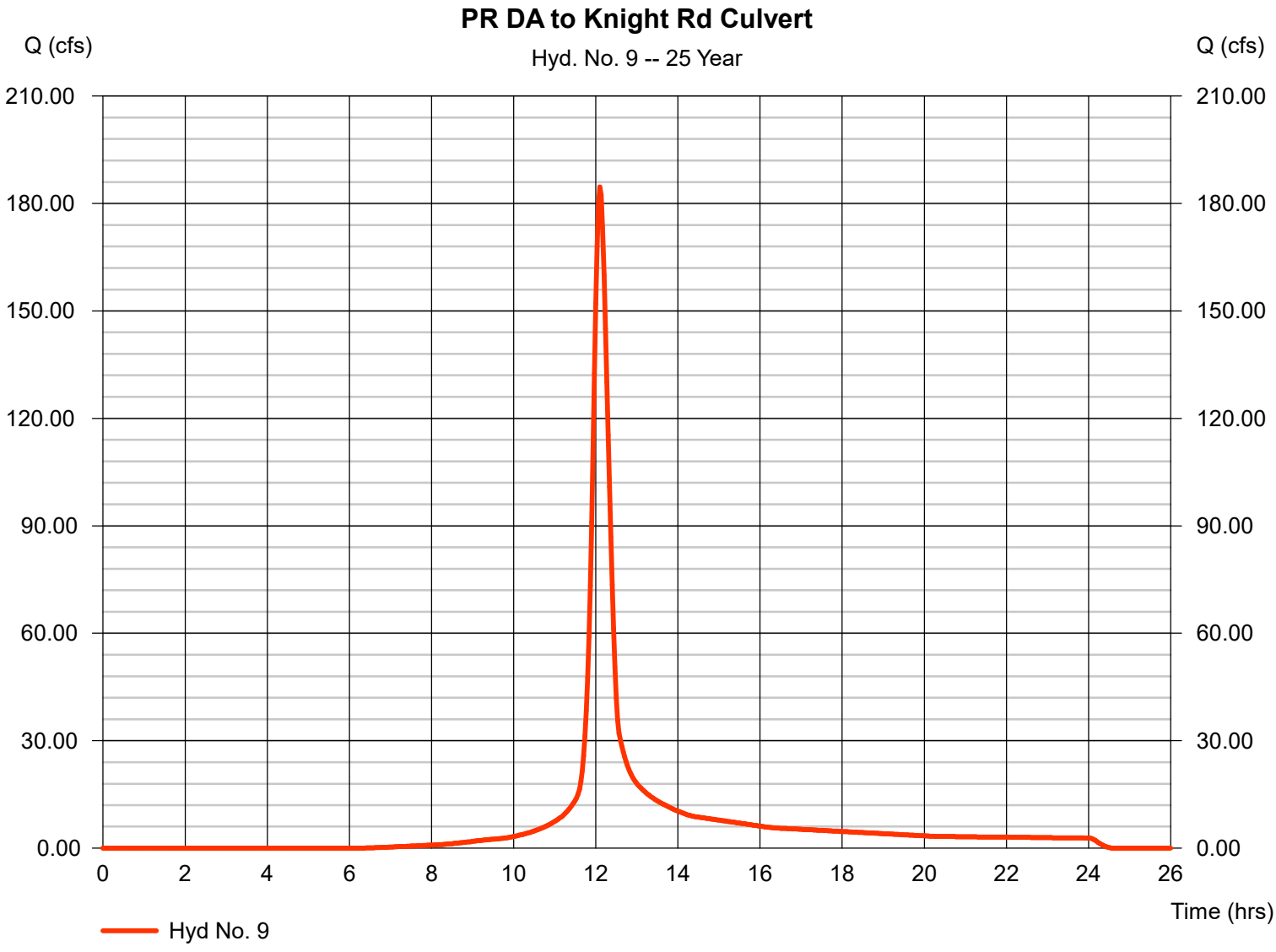


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	184.64 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	638,819 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

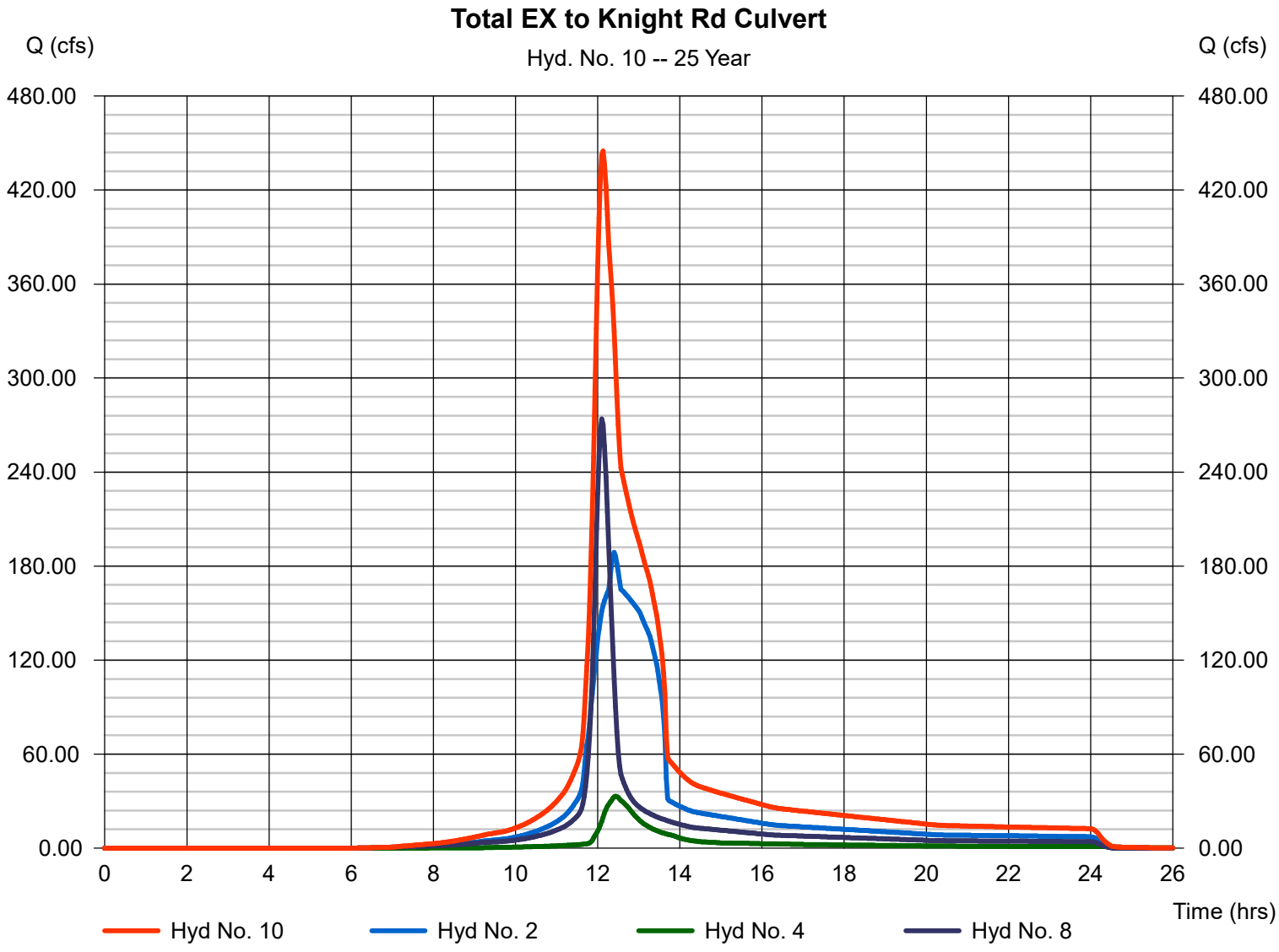


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 444.90 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,774,184 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



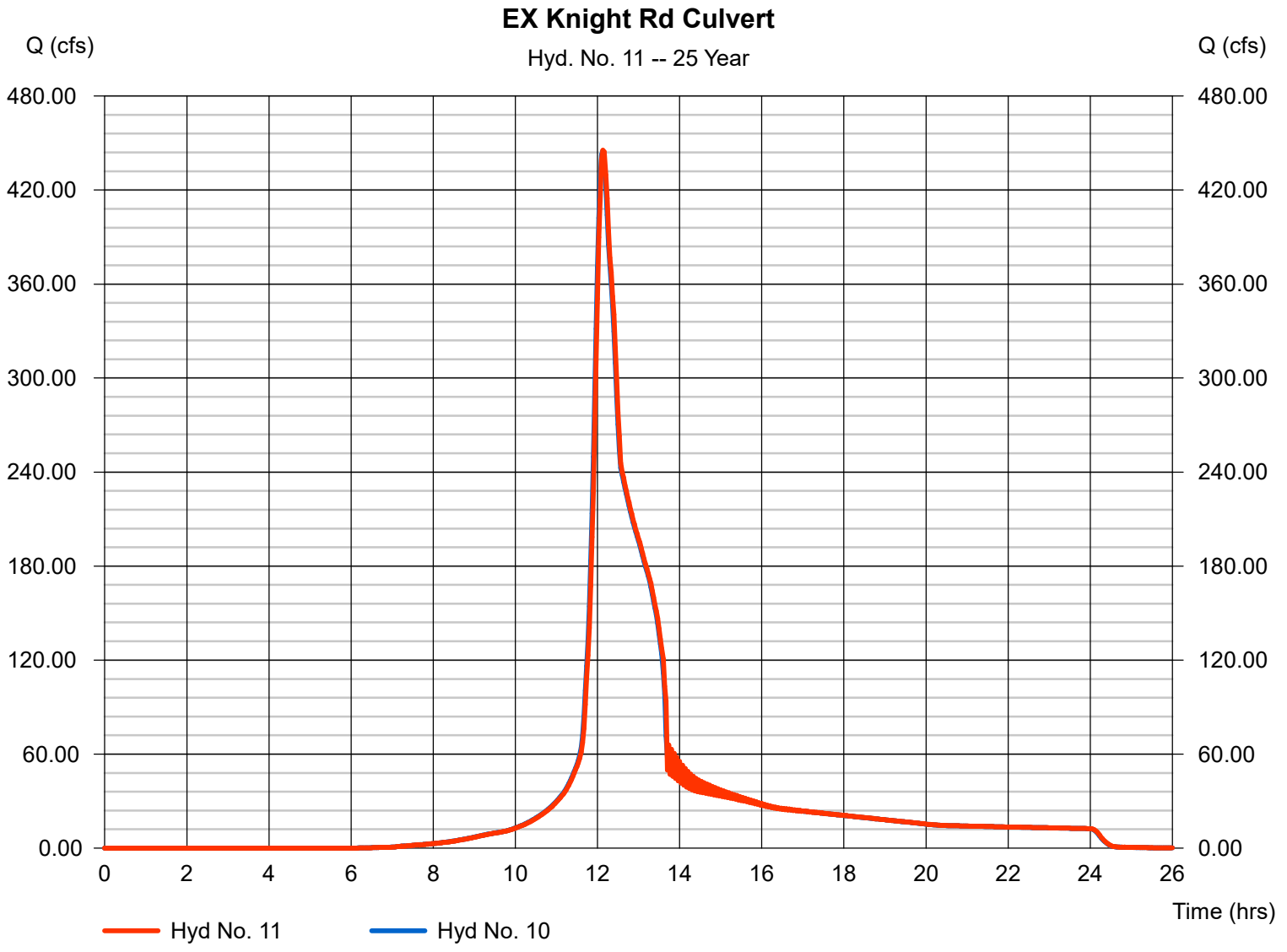
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	445.40 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,774,151 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	30.29 ft/s	Routing coeff.	=	1.9618

Modified Att-Kin routing method used.

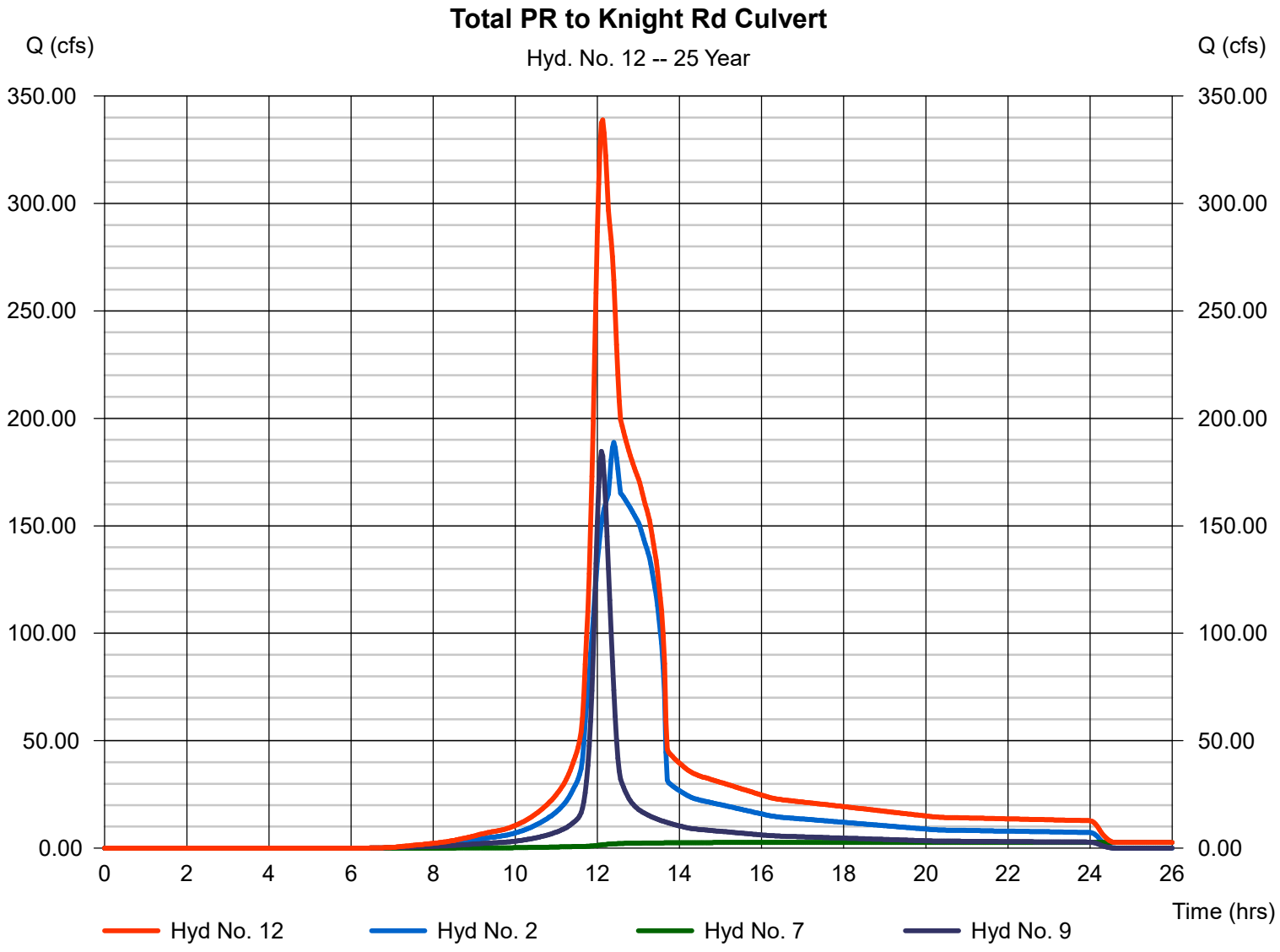


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 338.77 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,752,567 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



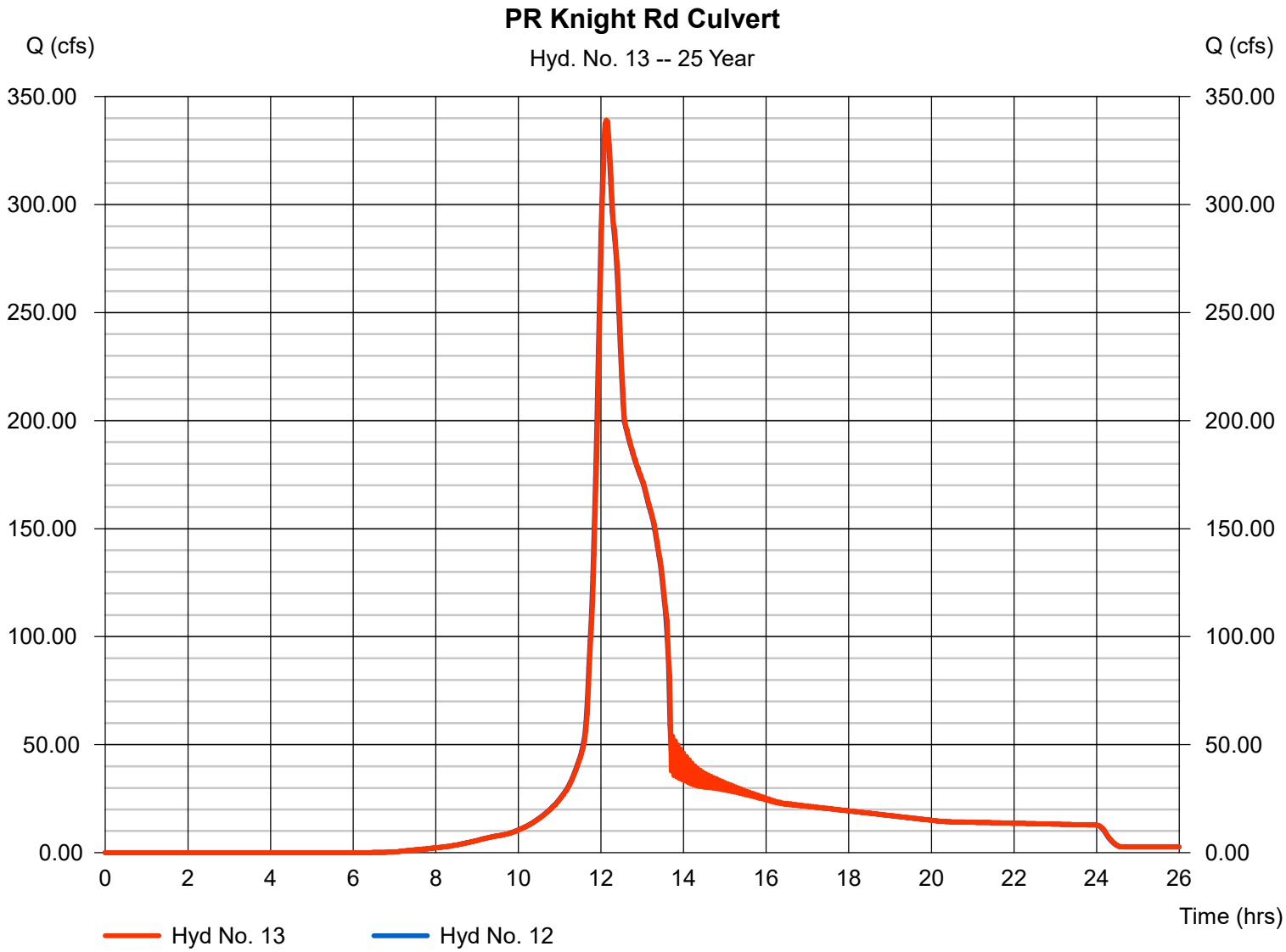
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	339.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	2,752,552 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	27.48 ft/s	Routing coeff.	=	1.9580

Modified Att-Kin routing method used.

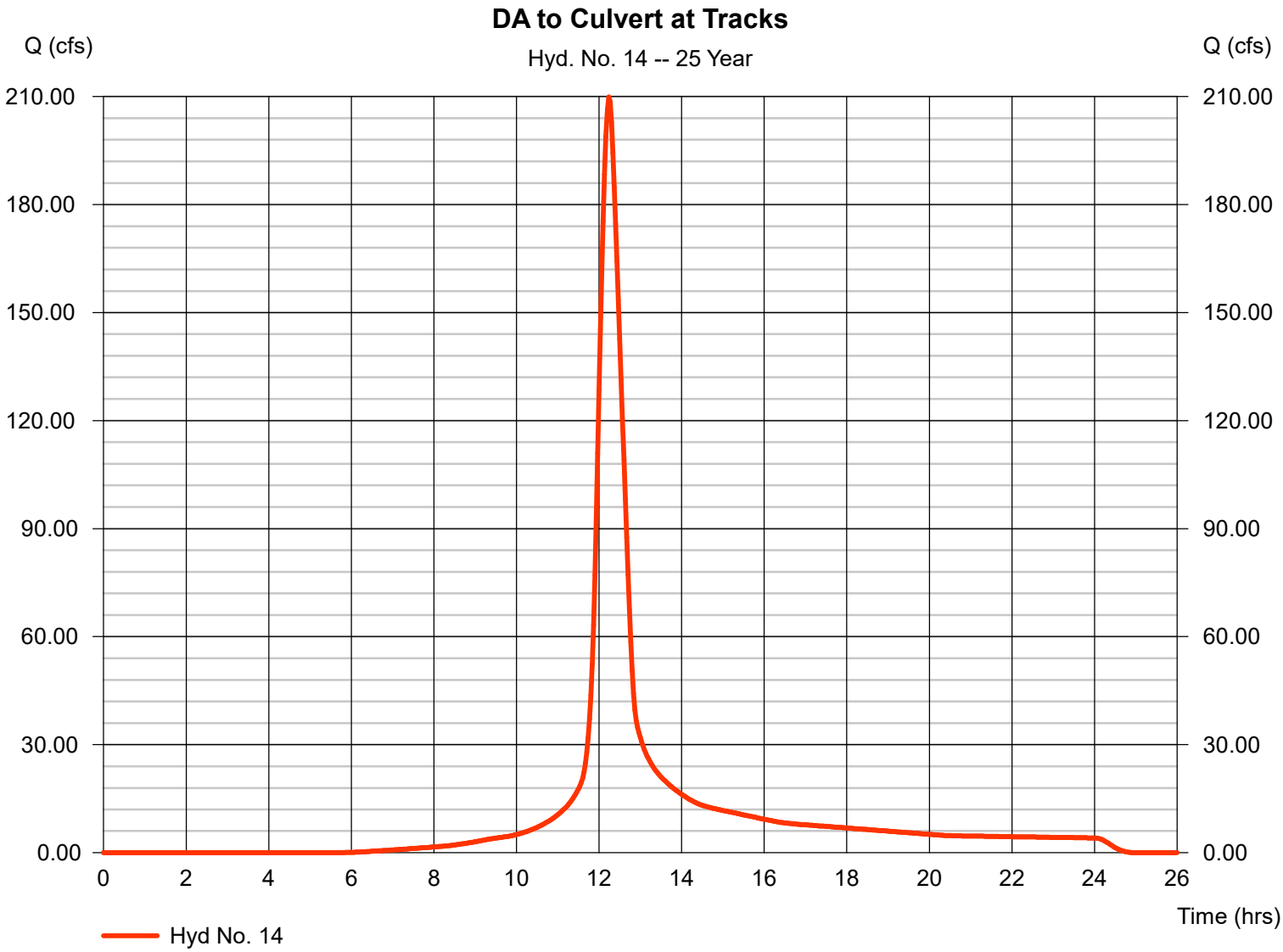


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	209.86 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	953,392 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	5.74 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

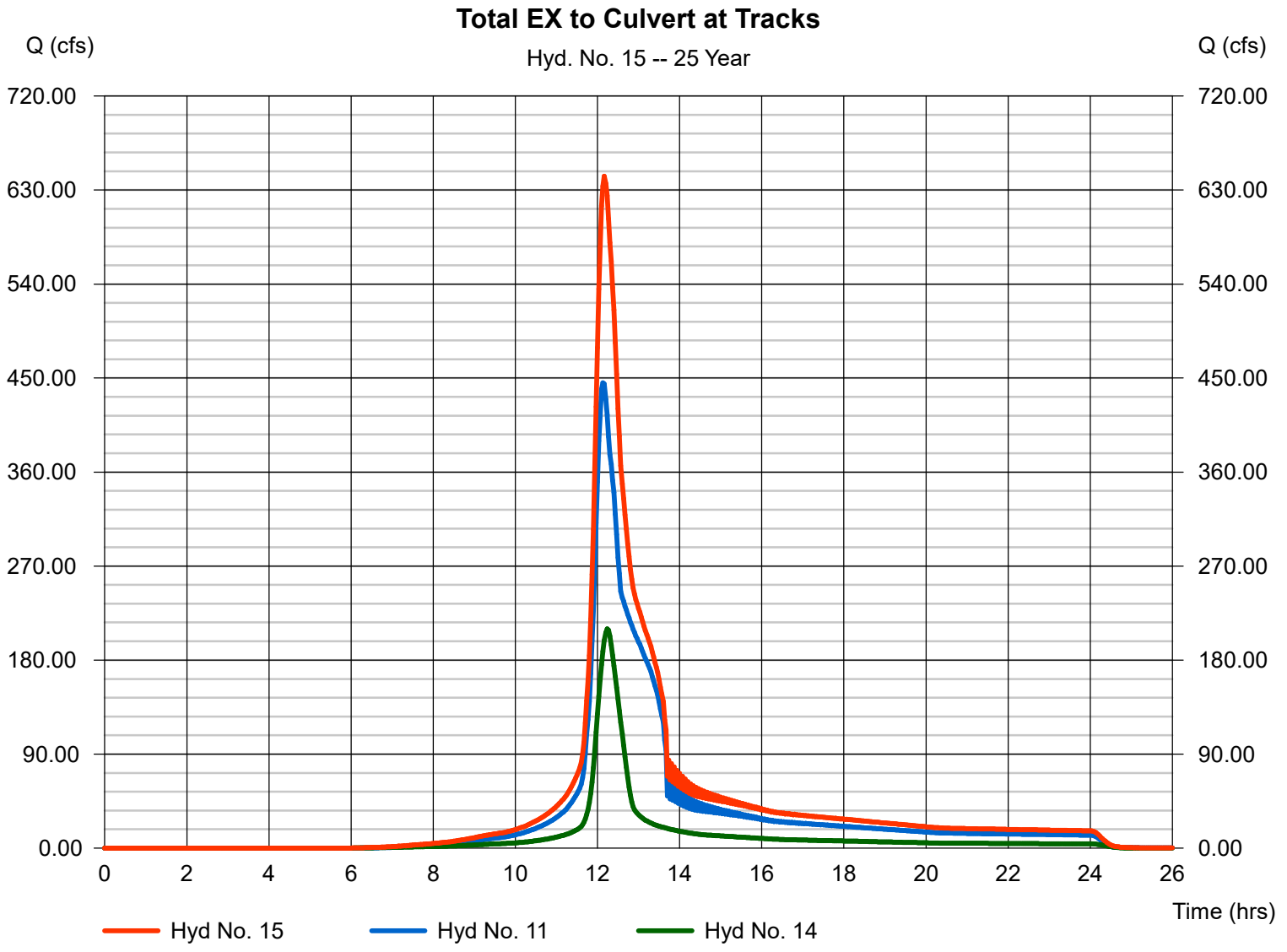


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 643.34 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,727,539 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

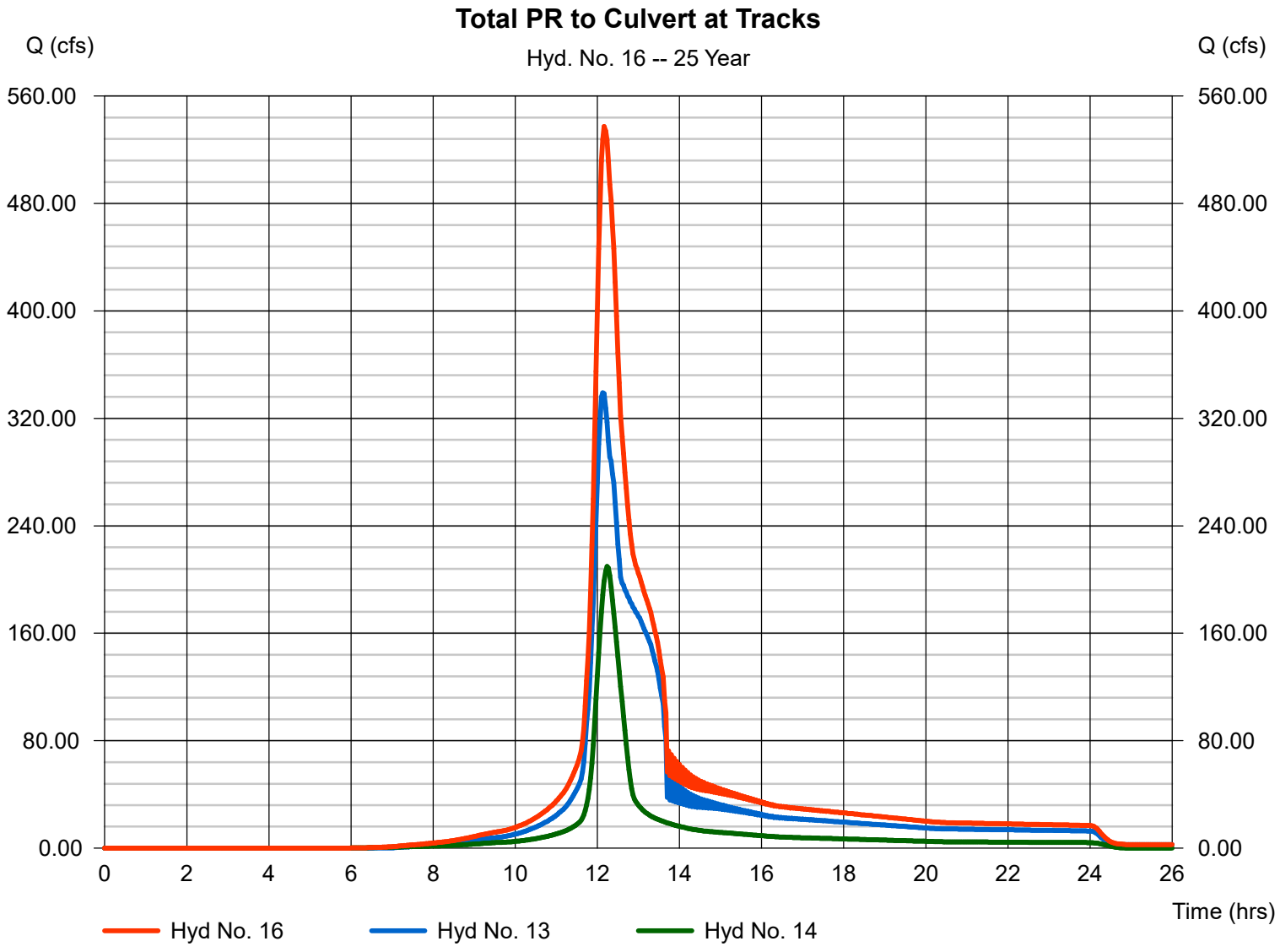


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 537.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 3,705,946 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

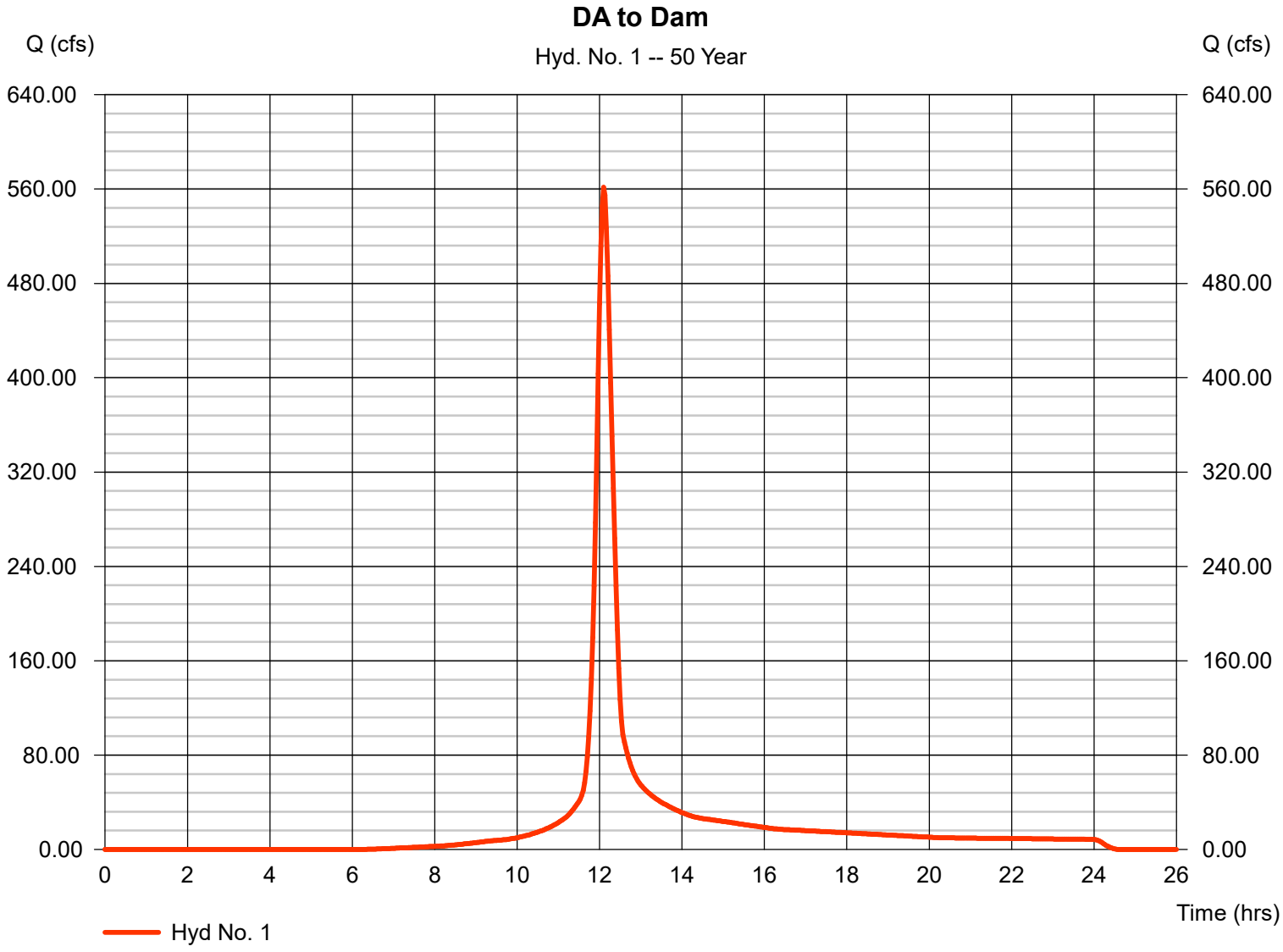
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	561.52	2	726	1,943,202	----	------	------	DA to Dam
2	Reservoir	303.95	2	740	1,943,144	1	260.80	464,090	EX Dam
3	SCS Runoff	68.29	2	730	274,011	----	------	------	DA to School Basin
4	Reservoir	46.22	2	744	274,003	3	274.19	72,104	EX School Basin
5	SCS Runoff	103.47	2	726	361,114	----	------	------	DA to New Basin
6	Combine	126.96	2	728	635,117	4, 5	------	------	Total to New Basin
7	Reservoir	7.414	2	920	619,931	6	259.20	445,227	PR New Basin
8	SCS Runoff	328.43	2	726	1,143,120	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	222.25	2	726	771,748	----	------	------	PR DA to Knight Rd Culvert
10	Combine	546.15	2	736	3,360,269	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	556.53	2	738	3,360,231	10	------	------	EX Knight Rd Culvert
12	Combine	437.54	2	738	3,334,822	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	448.83	2	738	3,334,803	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	250.96	2	734	1,144,656	----	------	------	DA to Culvert at Tracks
15	Combine	798.74	2	738	4,504,890	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	691.03	2	738	4,479,459	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	561.52 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,943,202 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



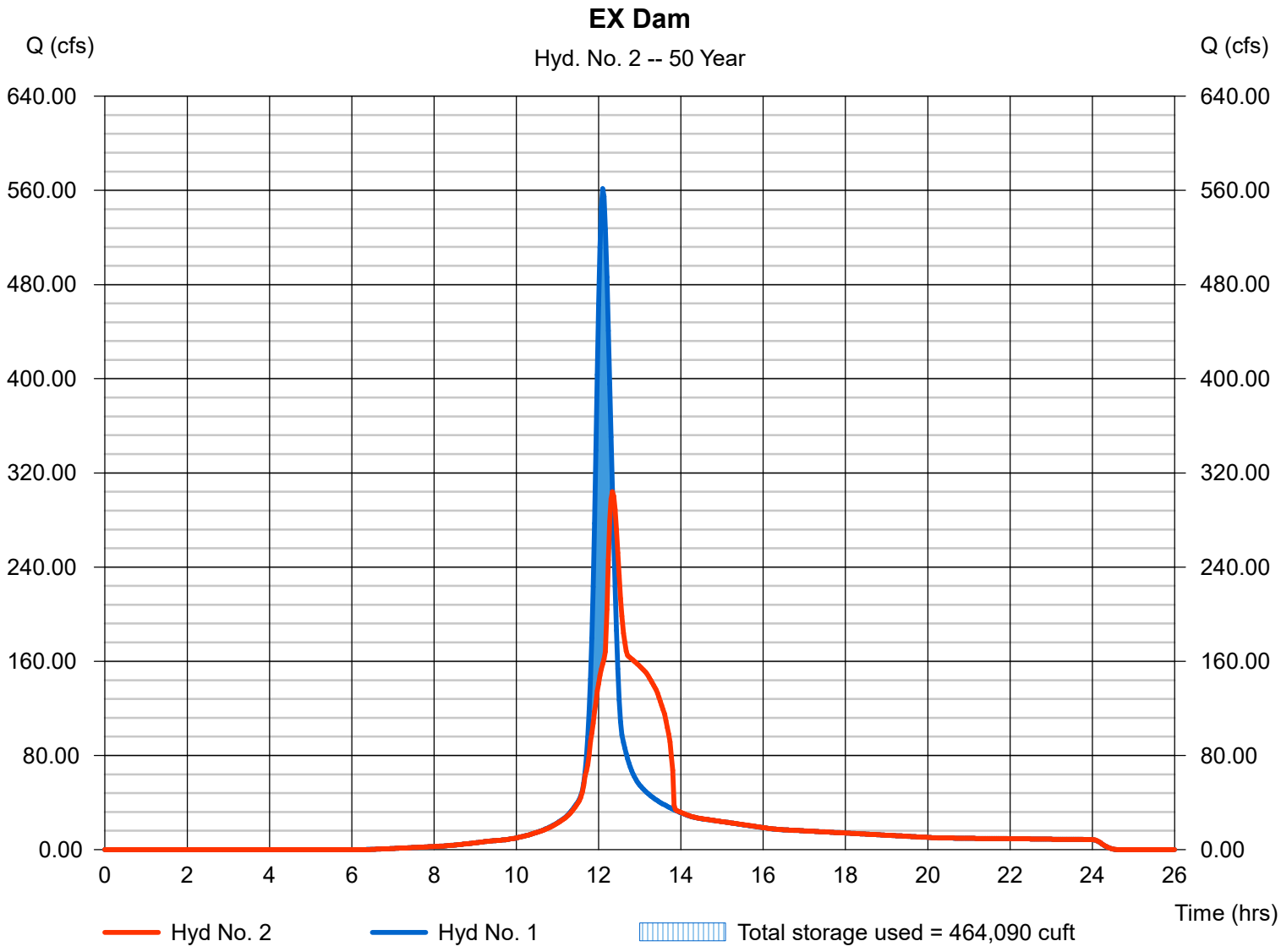
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	303.95 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	1,943,144 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	260.80 ft
Reservoir name	=	EX Dam	Max. Storage	=	464,090 cuft

Storage Indication method used.

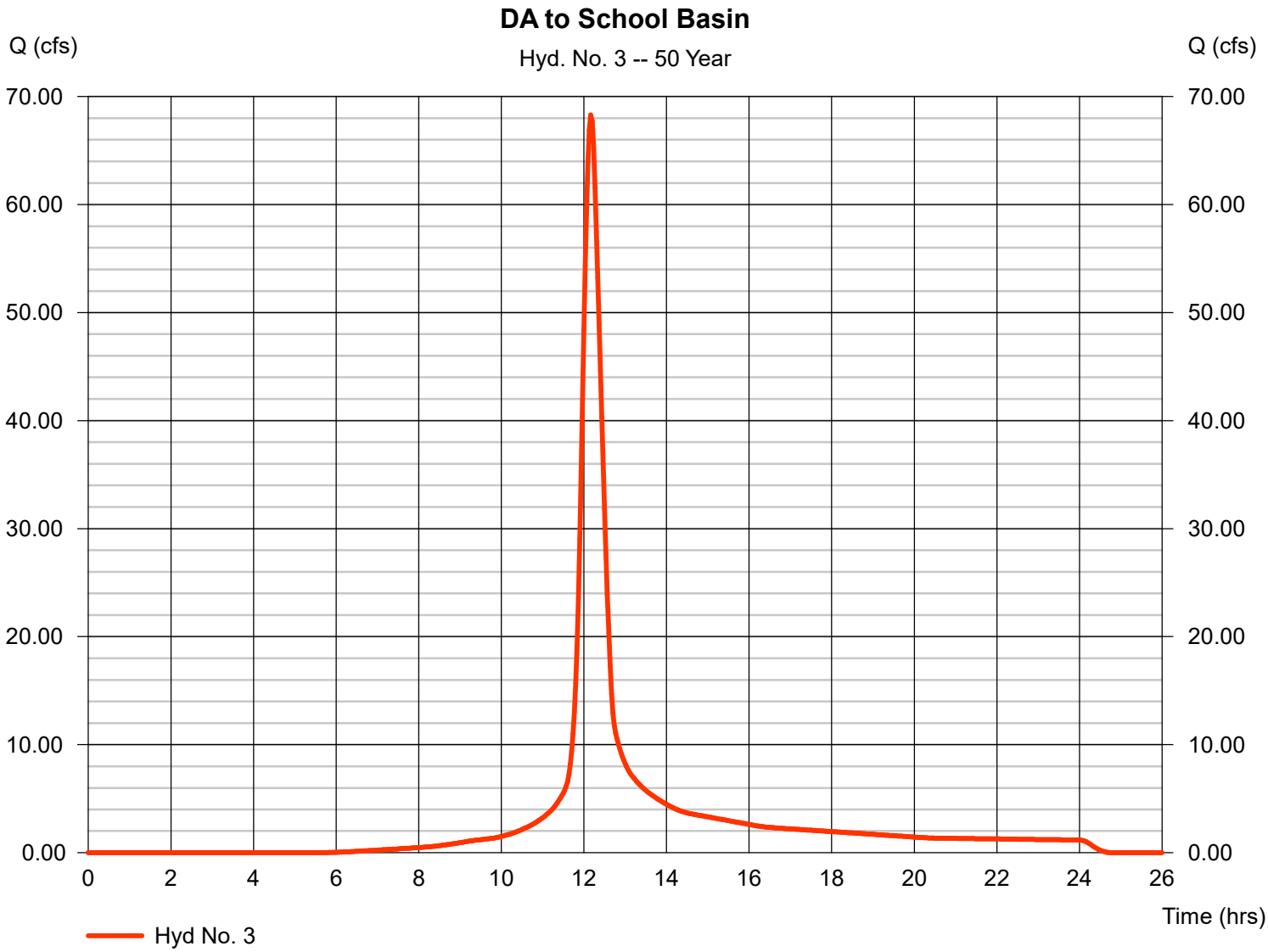


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	68.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	274,011 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



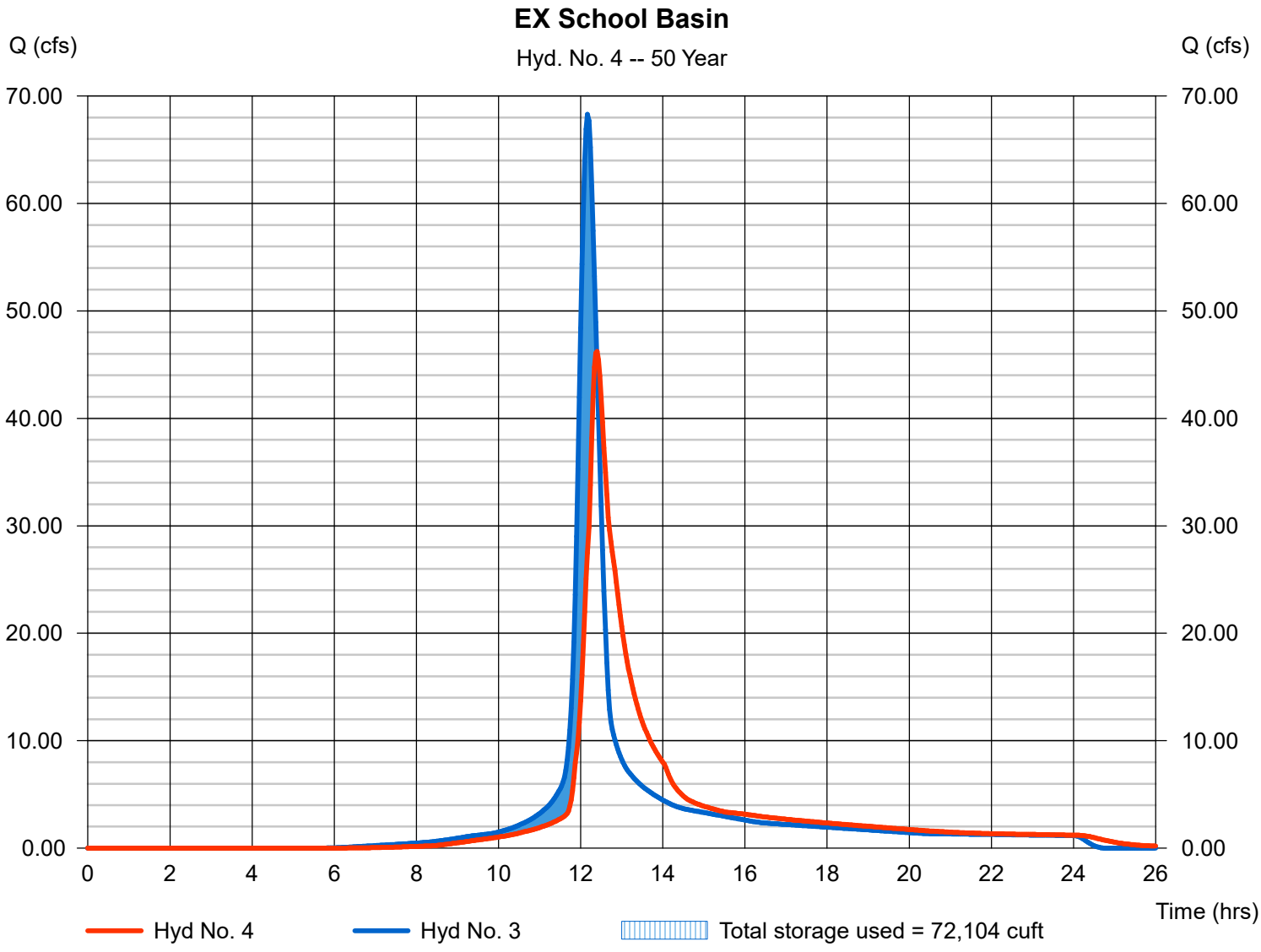
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	46.22 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	274,003 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	274.19 ft
Reservoir name	=	EX School Basin	Max. Storage	=	72,104 cuft

Storage Indication method used.

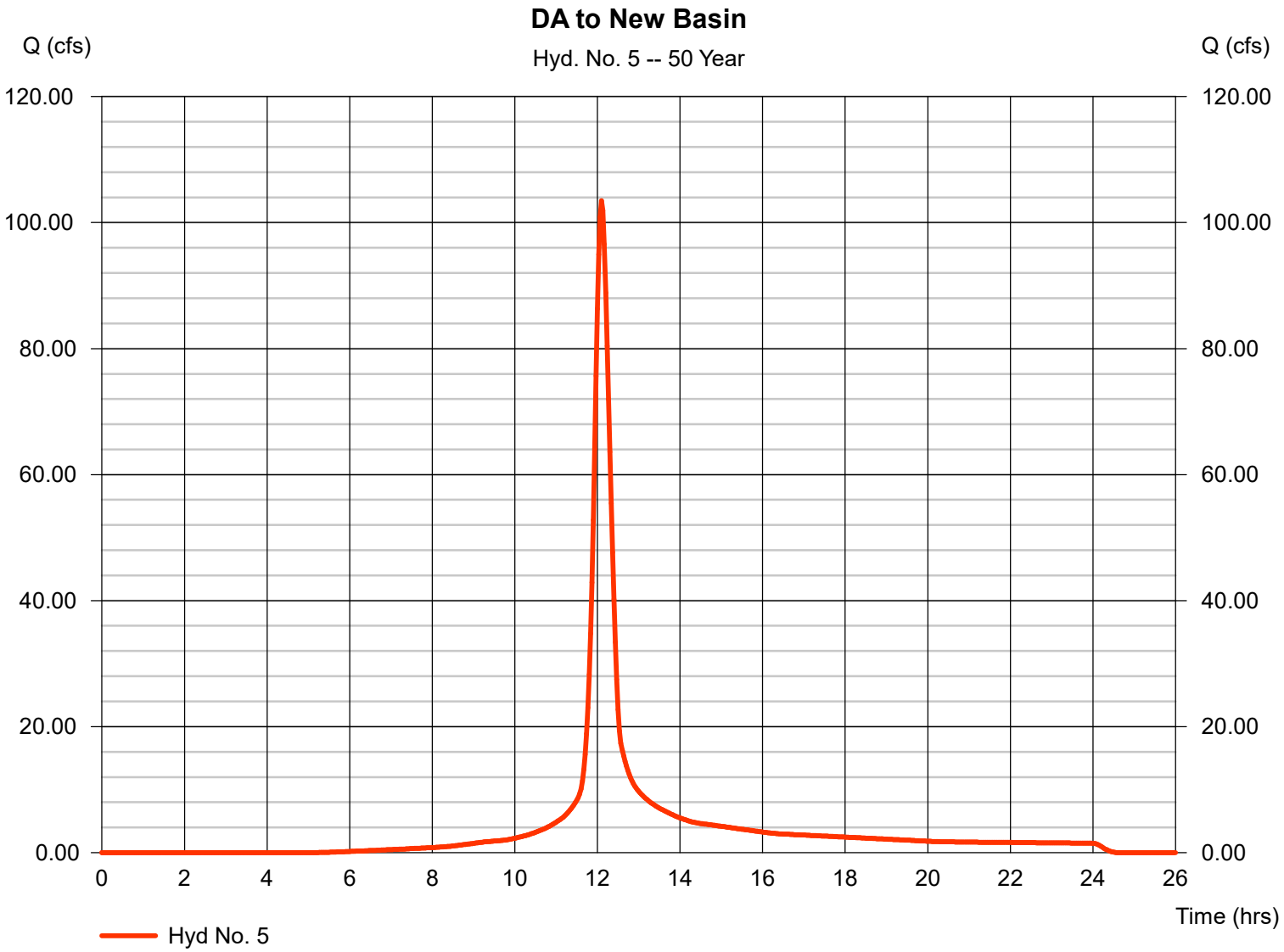


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	103.47 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	361,114 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

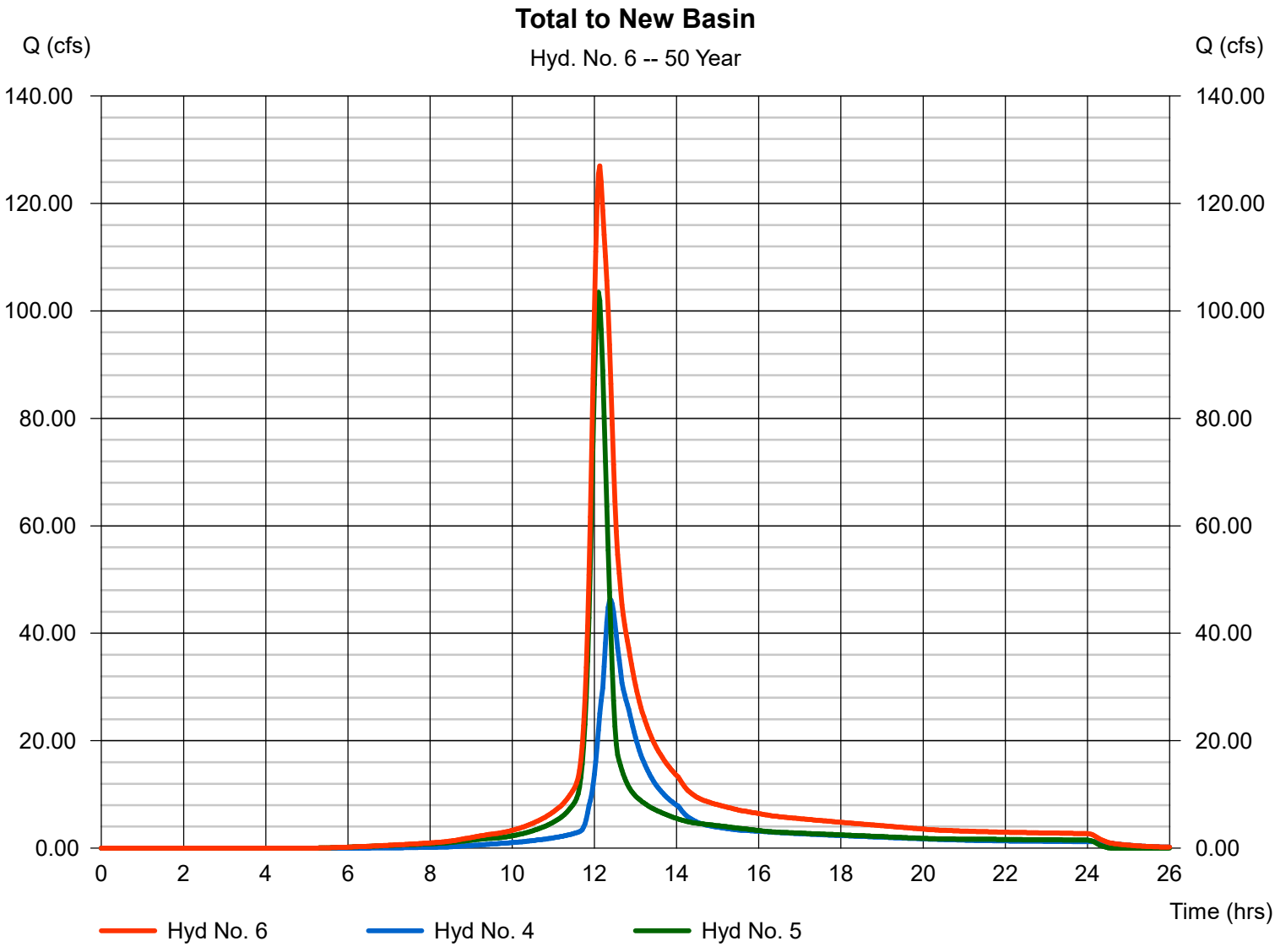


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 126.96 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 635,117 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



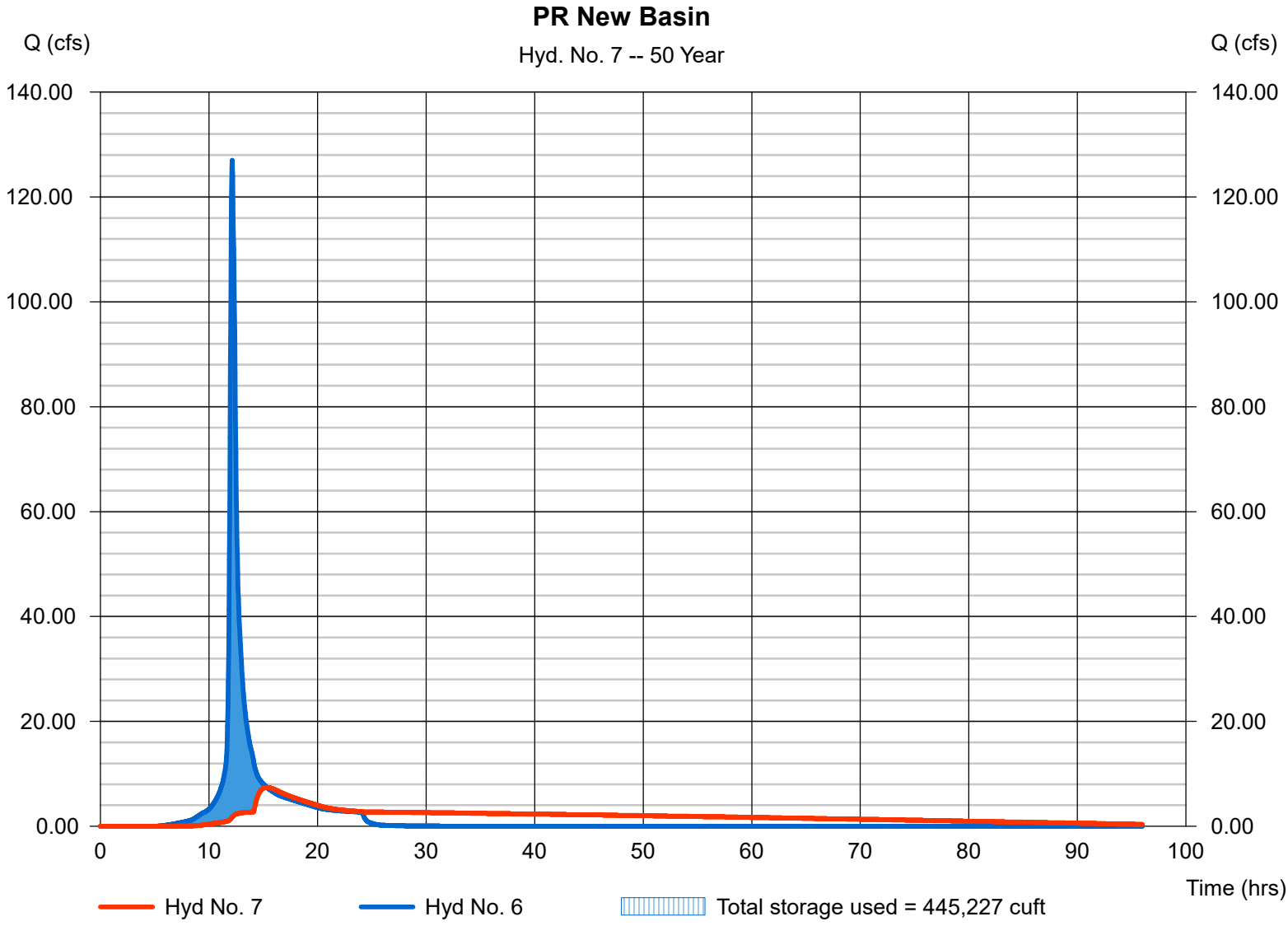
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	7.414 cfs
Storm frequency	=	50 yrs	Time to peak	=	15.33 hrs
Time interval	=	2 min	Hyd. volume	=	619,931 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	259.20 ft
Reservoir name	=	PR New Basin	Max. Storage	=	445,227 cuft

Storage Indication method used.

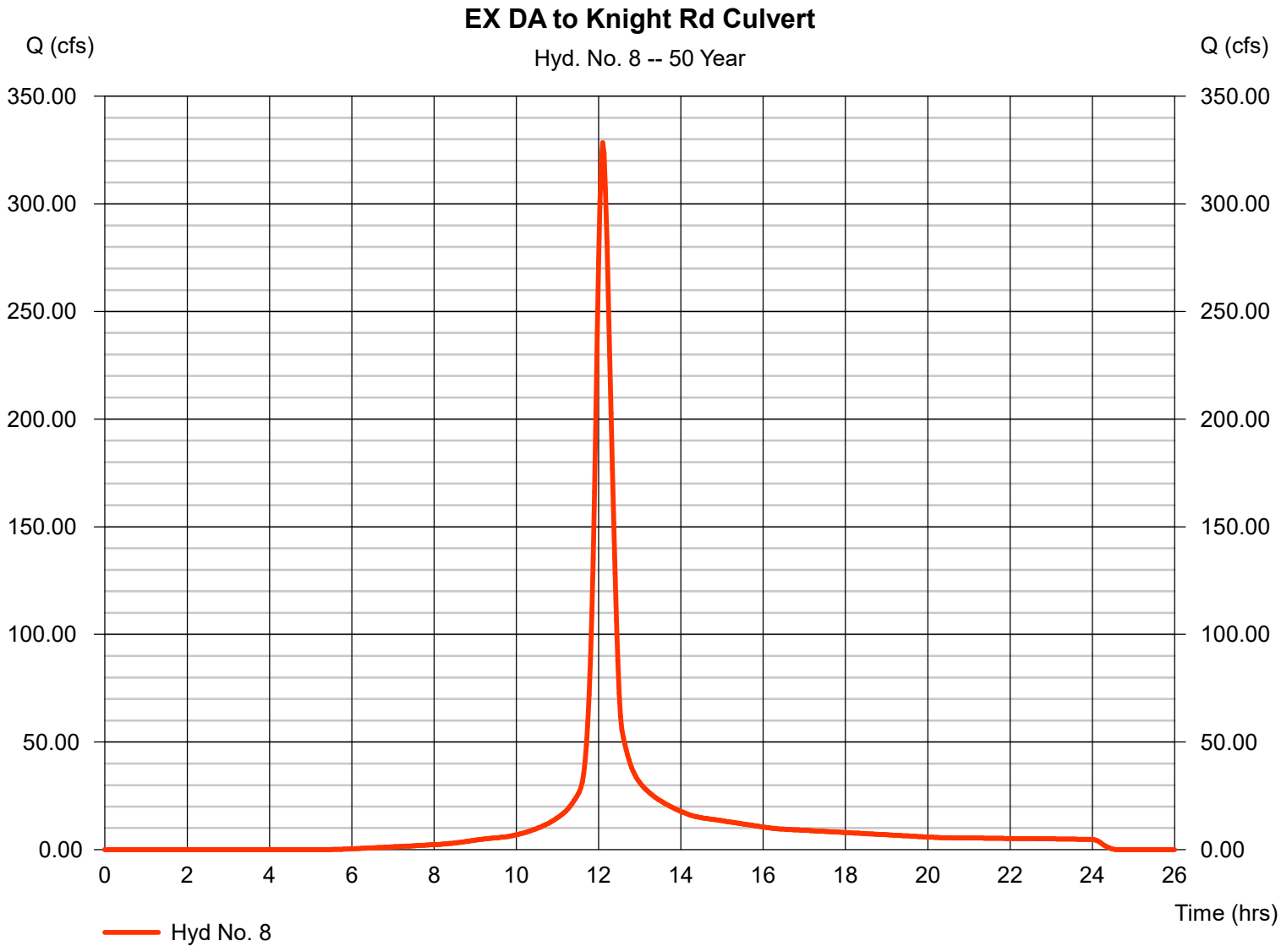


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	328.43 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,143,120 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

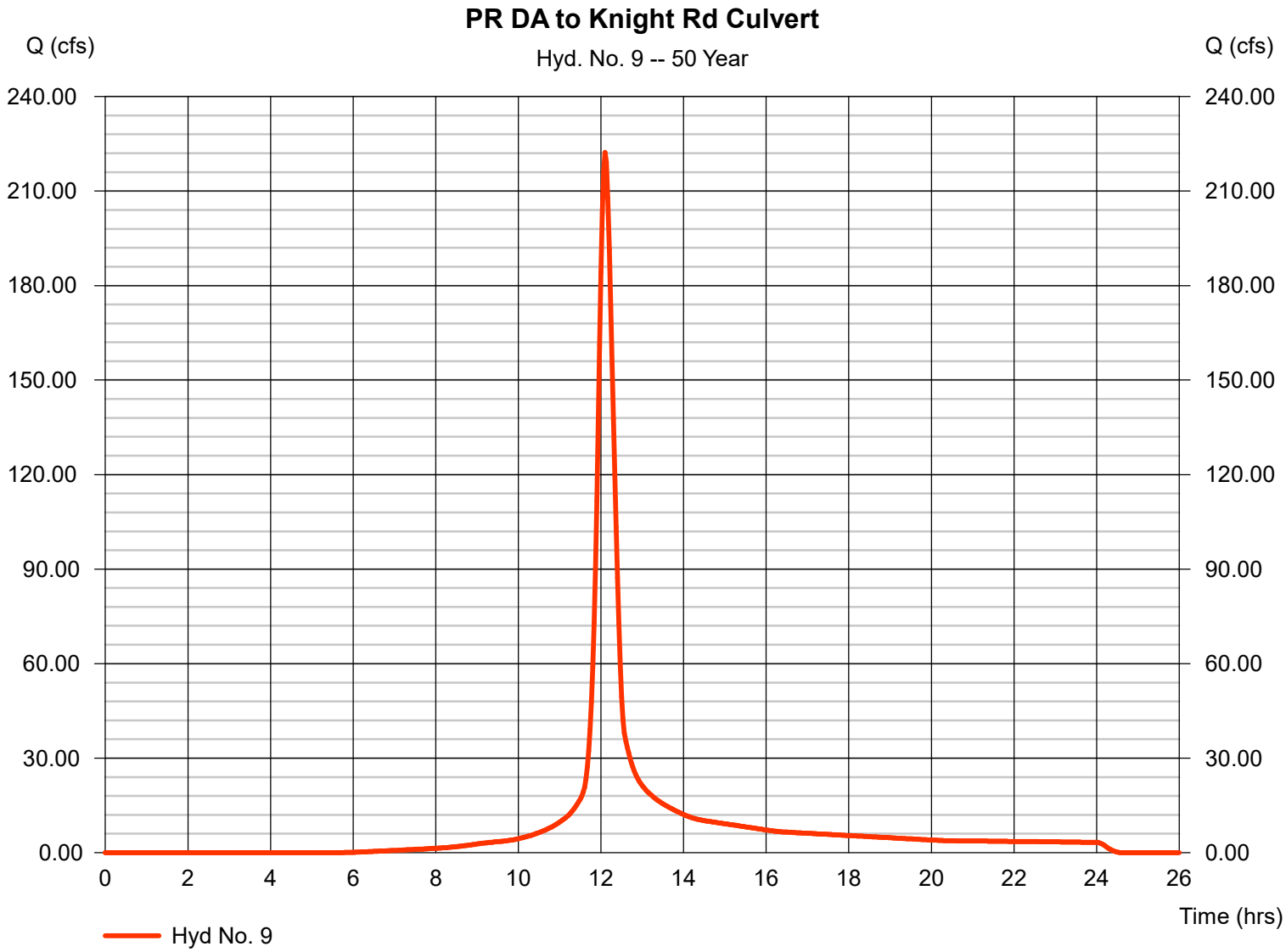


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	222.25 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	771,748 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

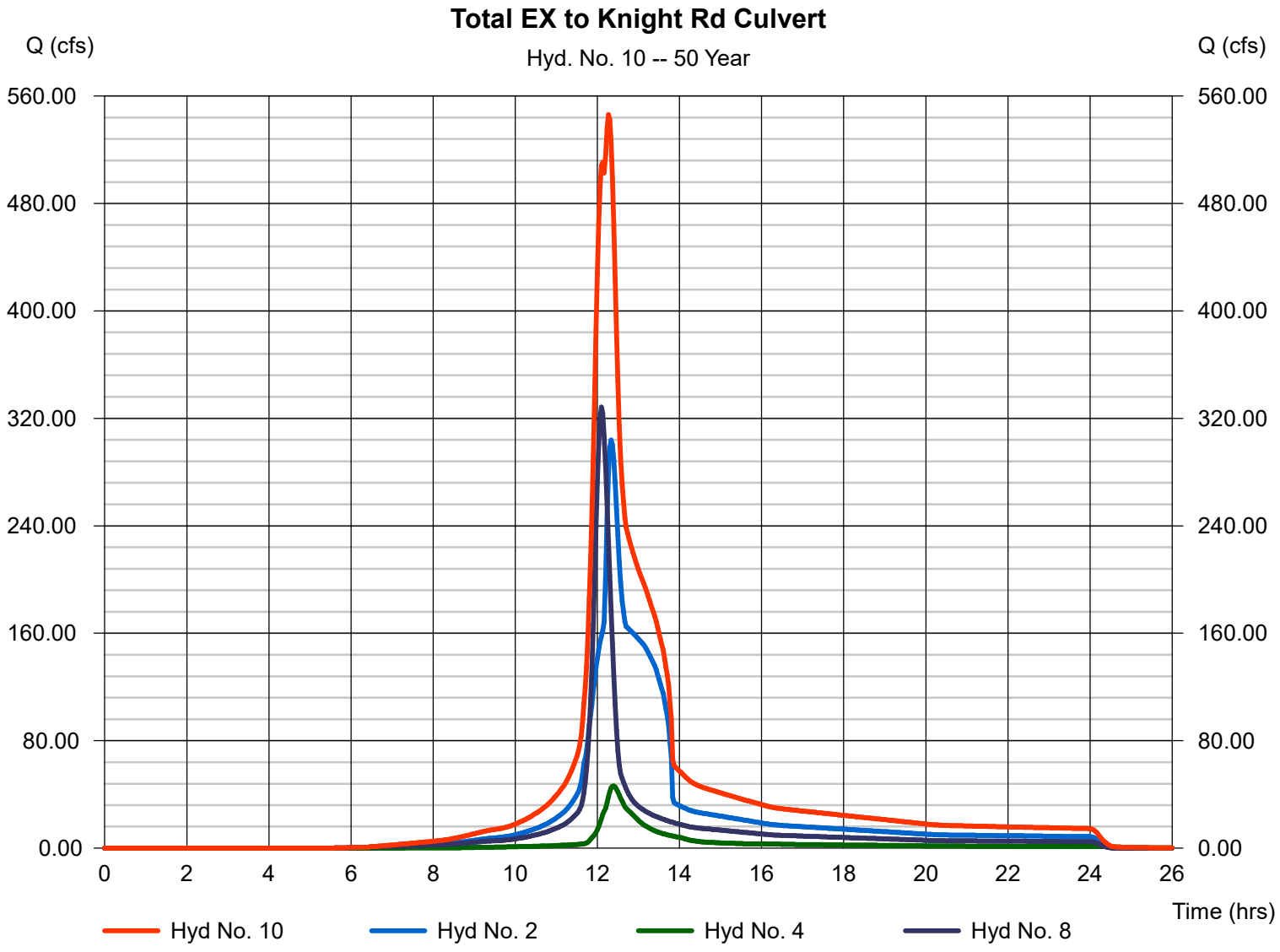


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 546.15 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 3,360,269 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



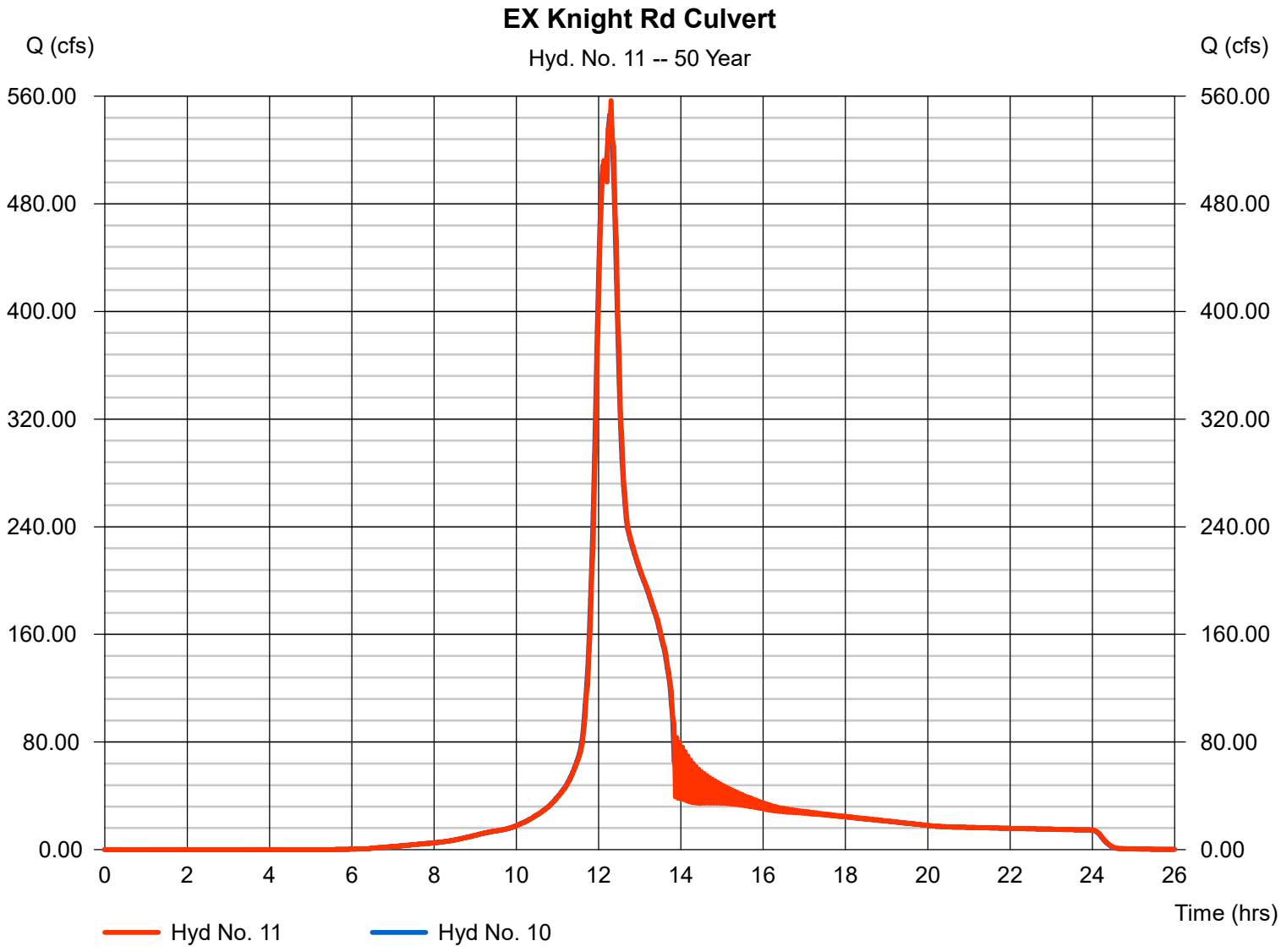
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	556.53 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	3,360,231 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	32.59 ft/s	Routing coeff.	=	1.9645

Modified Att-Kin routing method used.

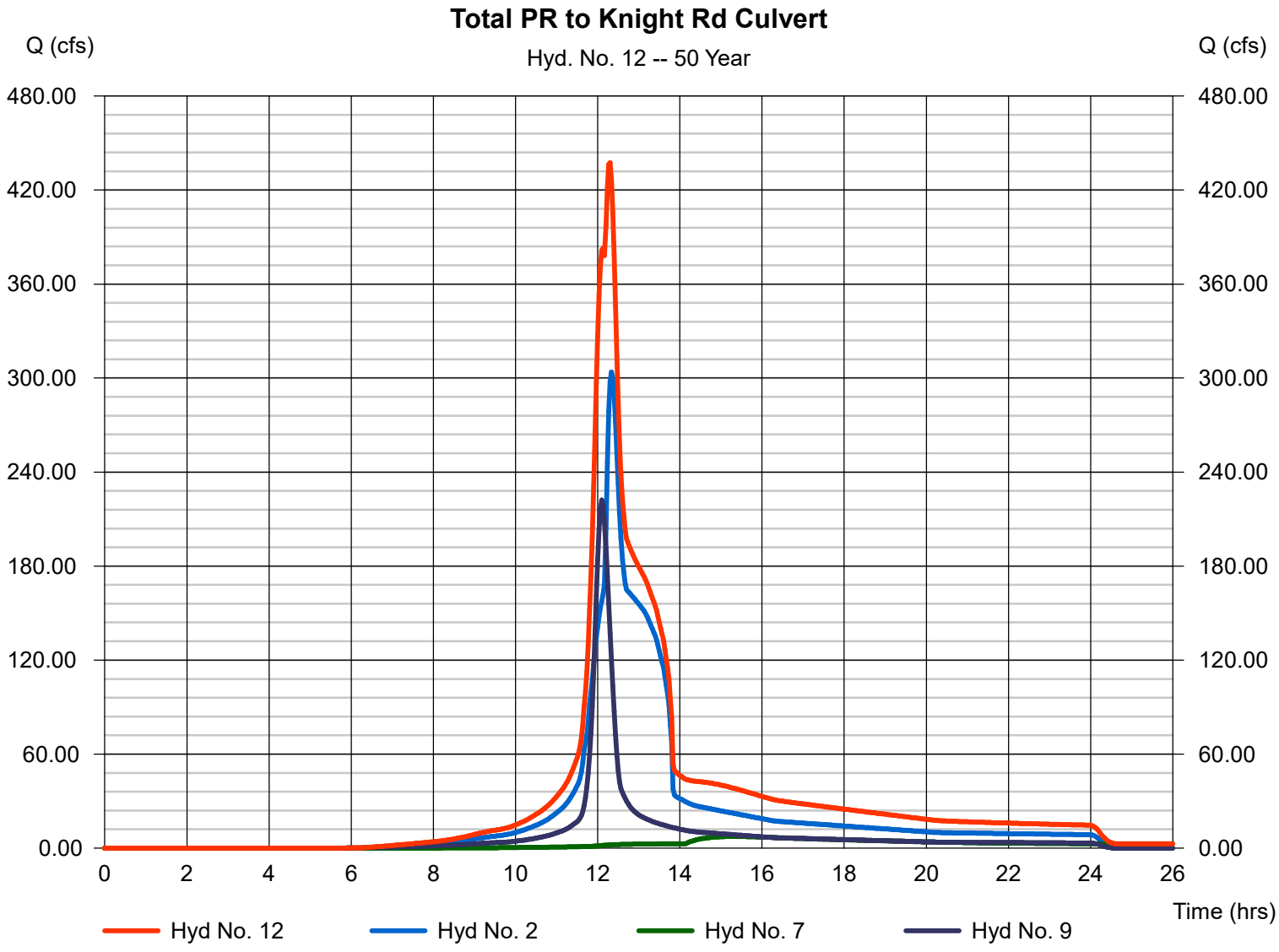


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 437.54 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 3,334,822 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



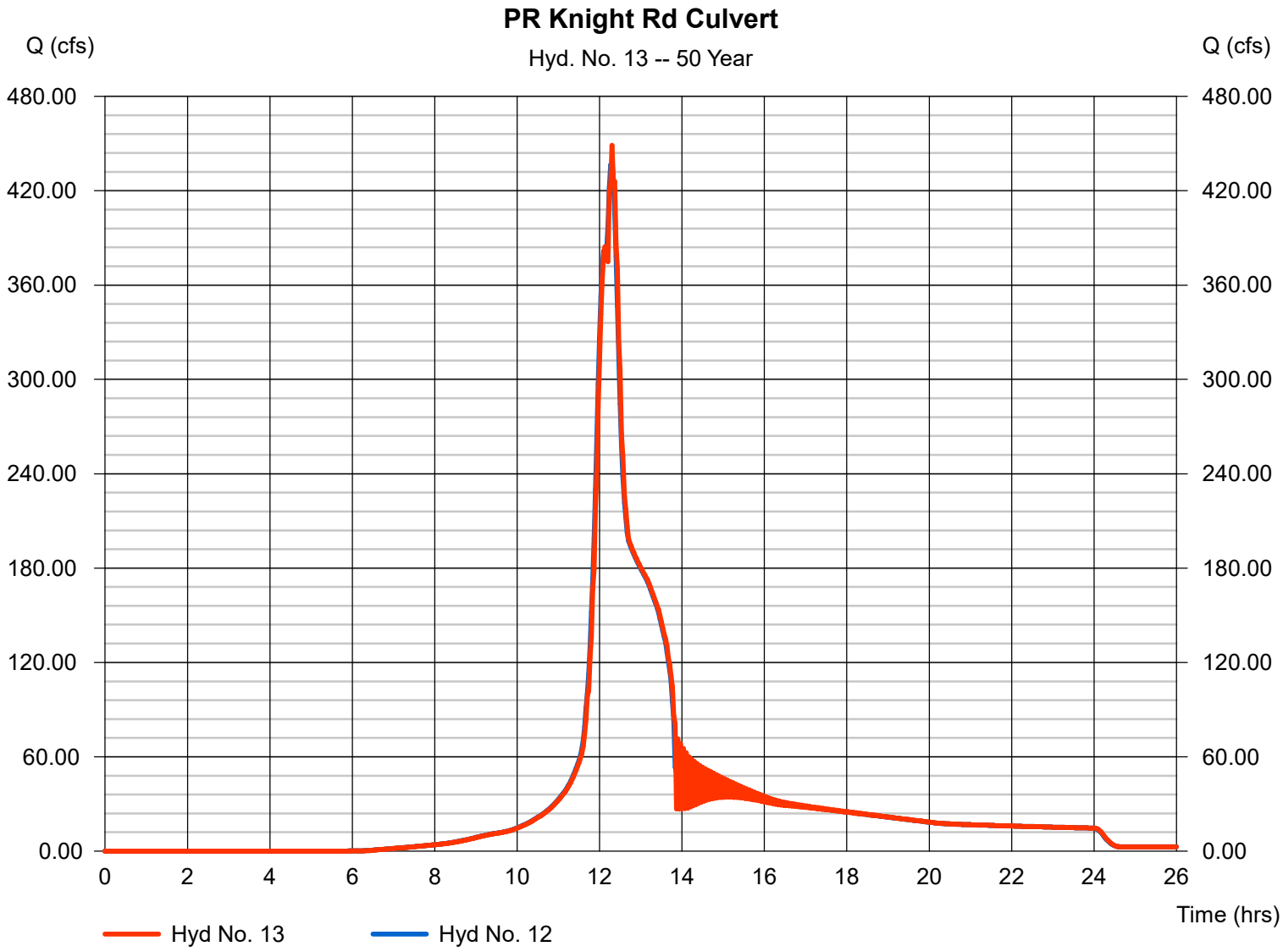
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	448.83 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	3,334,803 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	30.11 ft/s	Routing coeff.	=	1.9616

Modified Att-Kin routing method used.

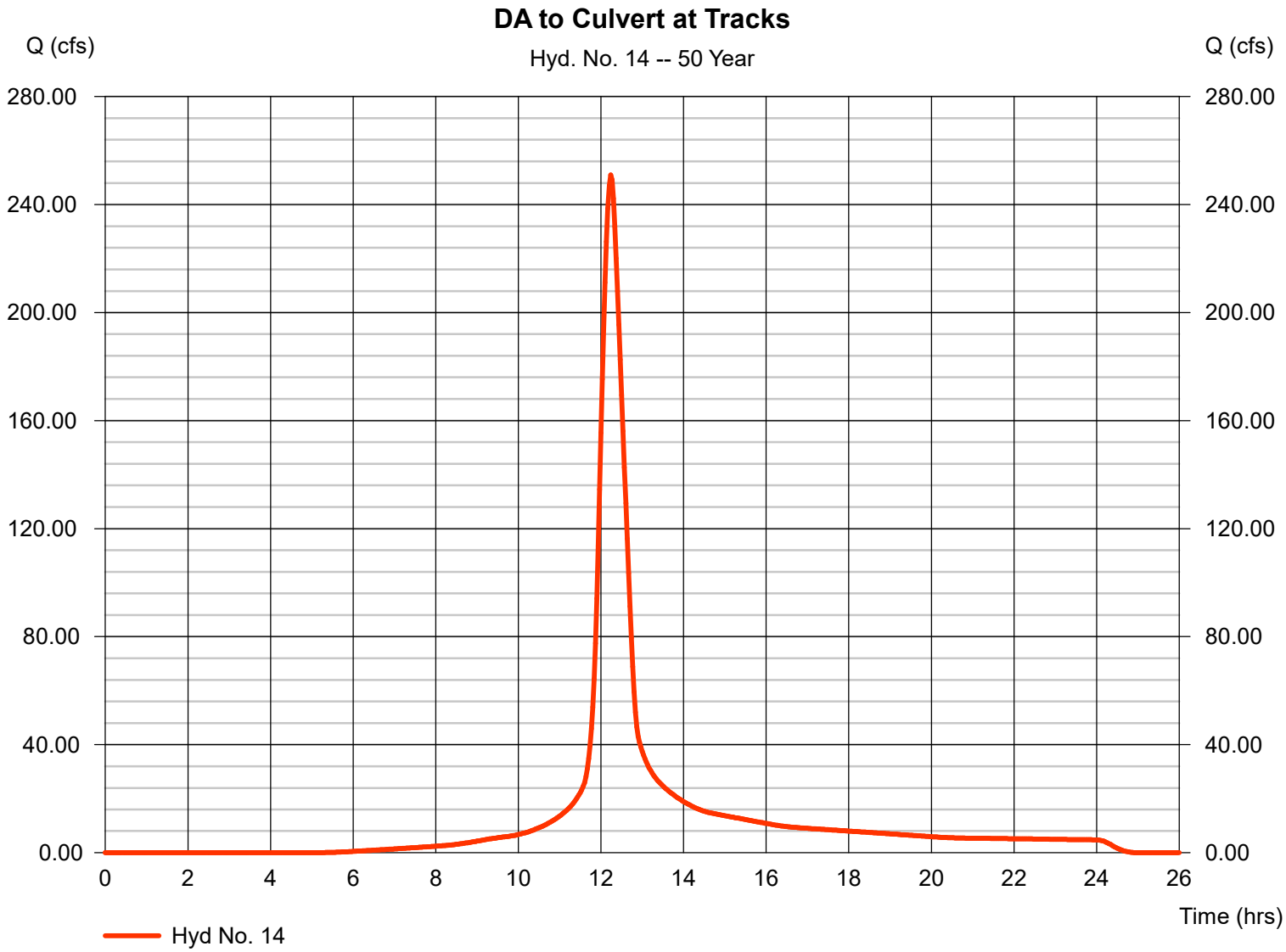


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	250.96 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	1,144,656 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	6.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

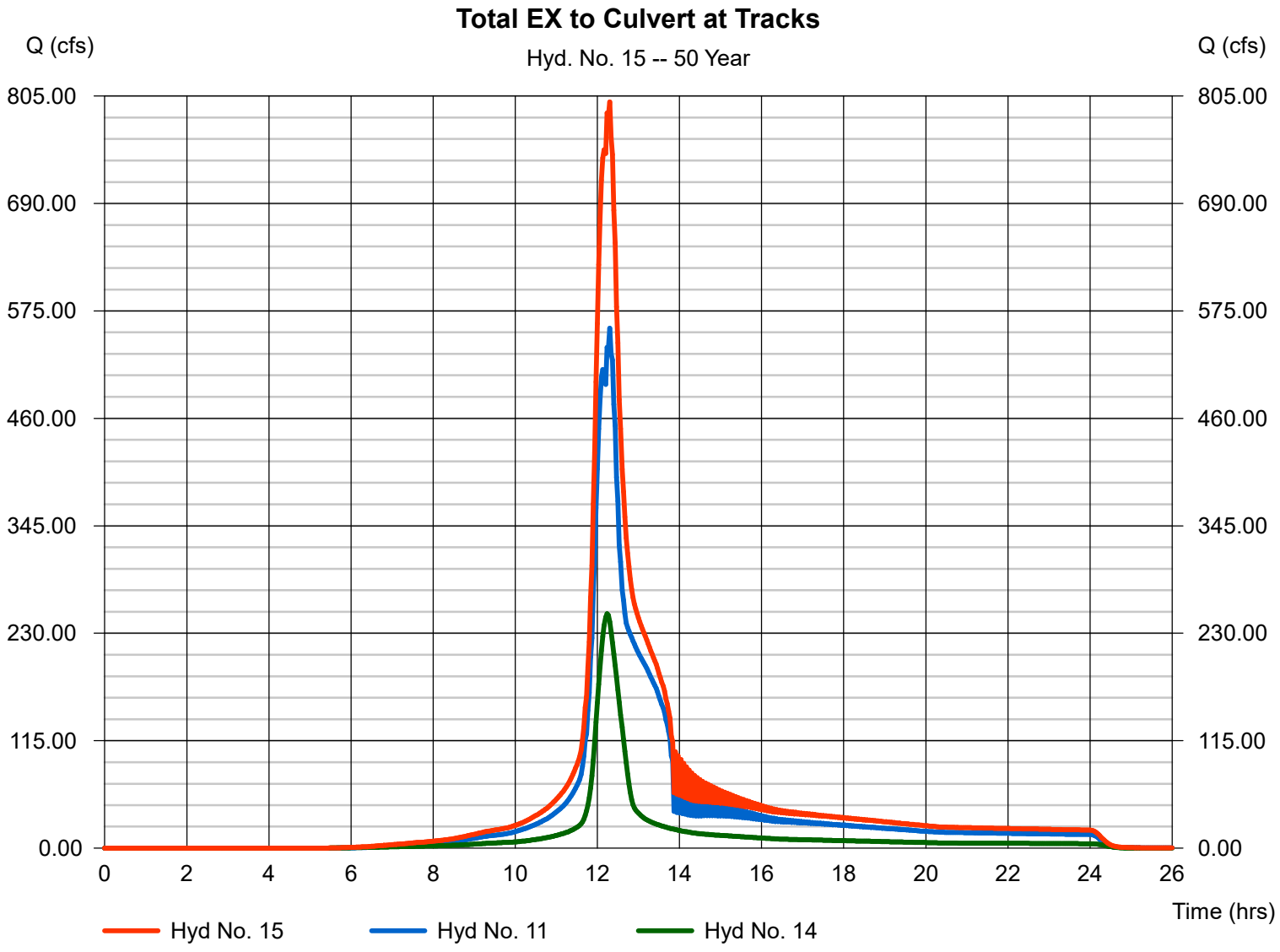


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 798.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 4,504,890 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

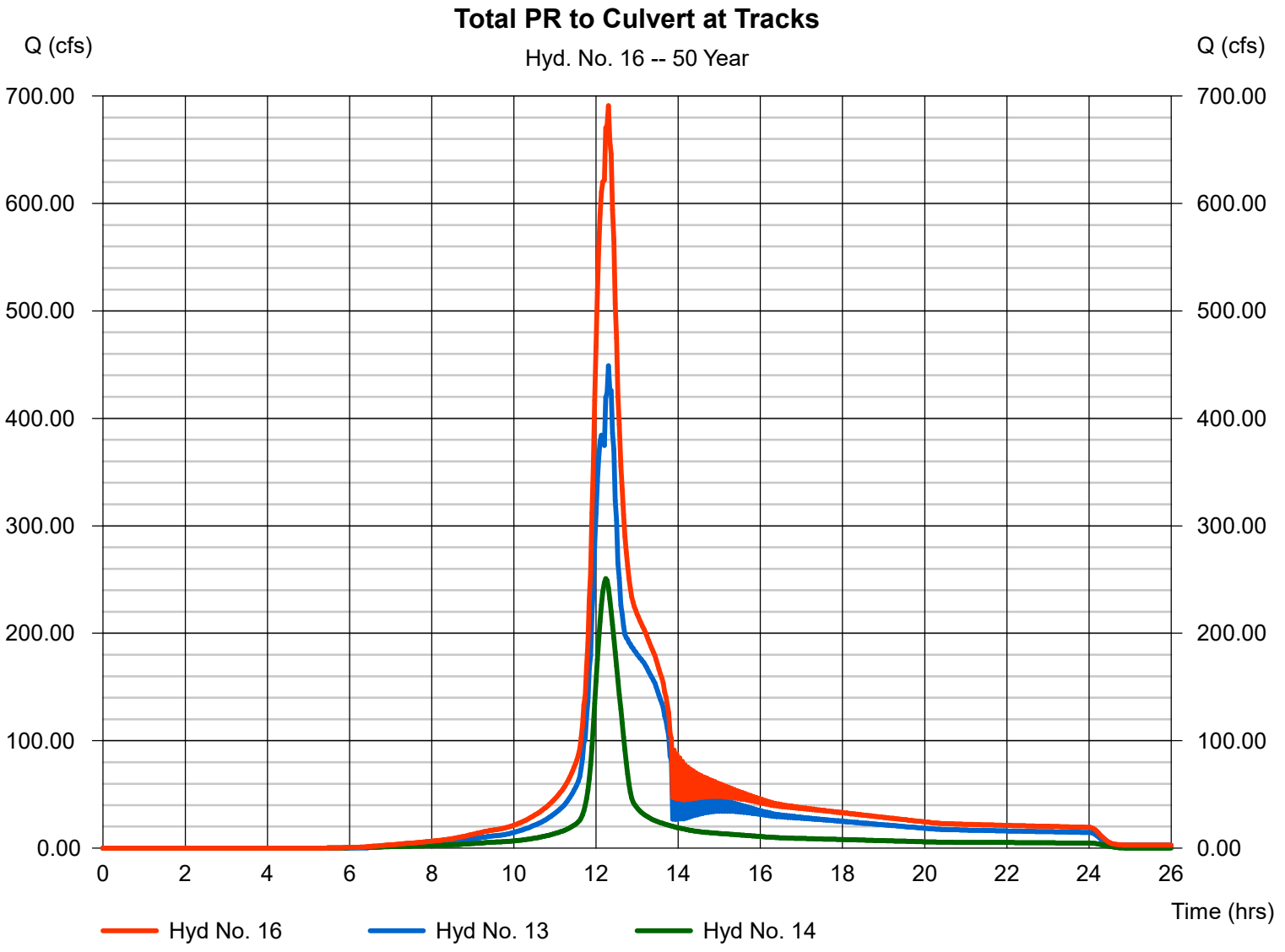


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 691.03 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 4,479,459 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

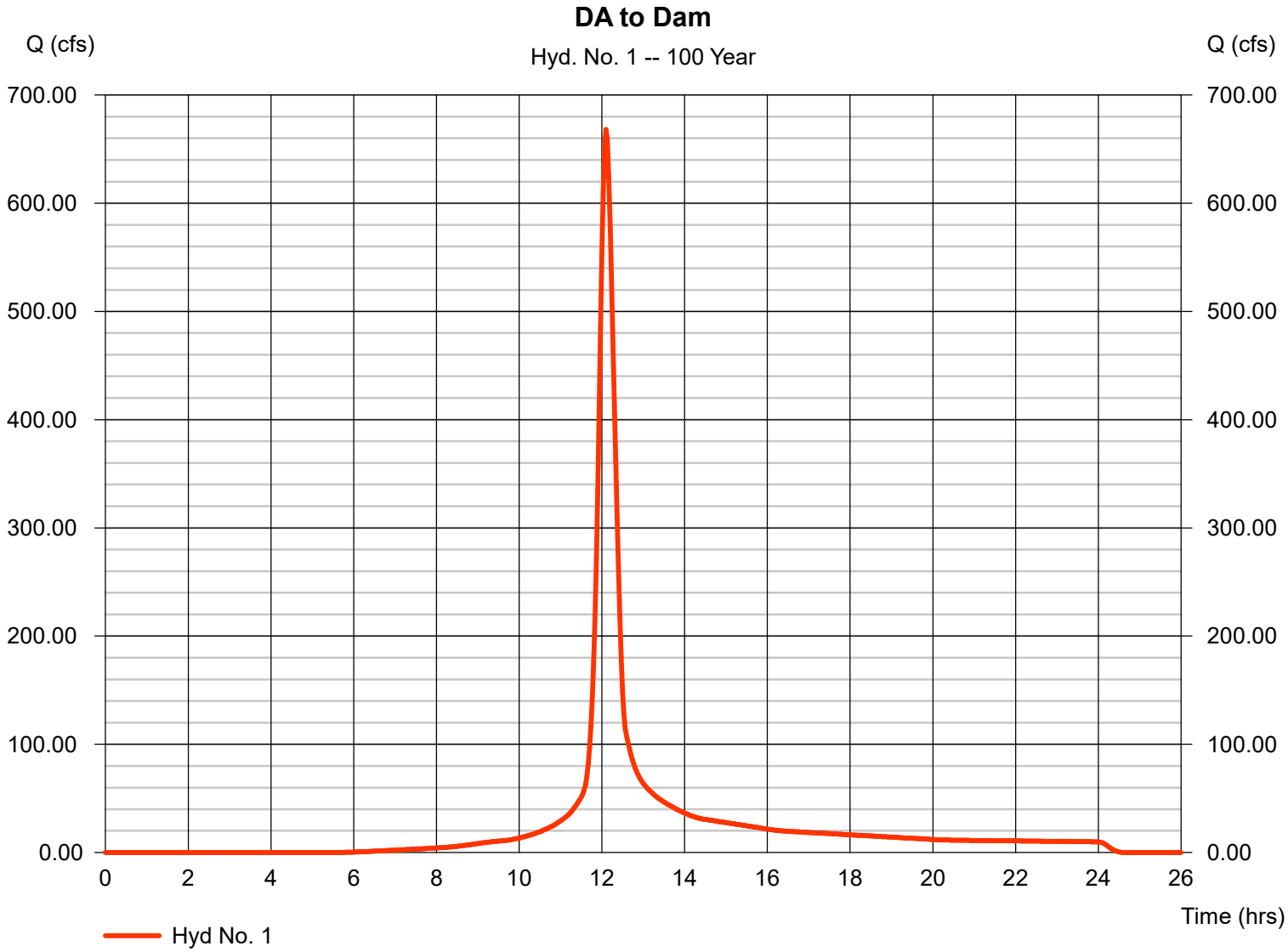
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	668.28	2	726	2,320,737	----	------	------	DA to Dam
2	Reservoir	452.95	2	736	2,320,678	1	261.19	514,607	EX Dam
3	SCS Runoff	80.79	2	730	325,492	----	------	------	DA to School Basin
4	Reservoir	62.91	2	740	325,484	3	274.36	78,068	EX School Basin
5	SCS Runoff	121.57	2	726	426,726	----	------	------	DA to New Basin
6	Combine	149.16	2	728	752,209	4, 5	------	------	Total to New Basin
7	Reservoir	20.67	2	812	736,819	6	259.48	462,694	PR New Basin
8	SCS Runoff	387.07	2	726	1,354,321	----	------	------	EX DA to Knight Rd Culvert
9	SCS Runoff	262.76	2	726	916,743	----	------	------	PR DA to Knight Rd Culvert
10	Combine	779.64	2	736	4,000,486	2, 4, 8,	------	------	Total EX to Knight Rd Culvert
11	Reach	803.93	2	736	4,000,450	10	------	------	EX Knight Rd Culvert
12	Combine	637.99	2	736	3,974,245	2, 7, 9,	------	------	Total PR to Knight Rd Culvert
13	Reach	659.54	2	736	3,974,221	12	------	------	PR Knight Rd Culvert
14	SCS Runoff	295.14	2	734	1,352,631	----	------	------	DA to Culvert at Tracks
15	Combine	1096.75	2	736	5,353,085	11, 14	------	------	Total EX to Culvert at Tracks
16	Combine	952.36	2	736	5,326,852	13, 14,	------	------	Total PR to Culvert at Tracks

Hydrograph Report

Hyd. No. 1

DA to Dam

Hydrograph type	=	SCS Runoff	Peak discharge	=	668.28 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	2,320,737 cuft
Drainage area	=	125.440 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	22.90 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



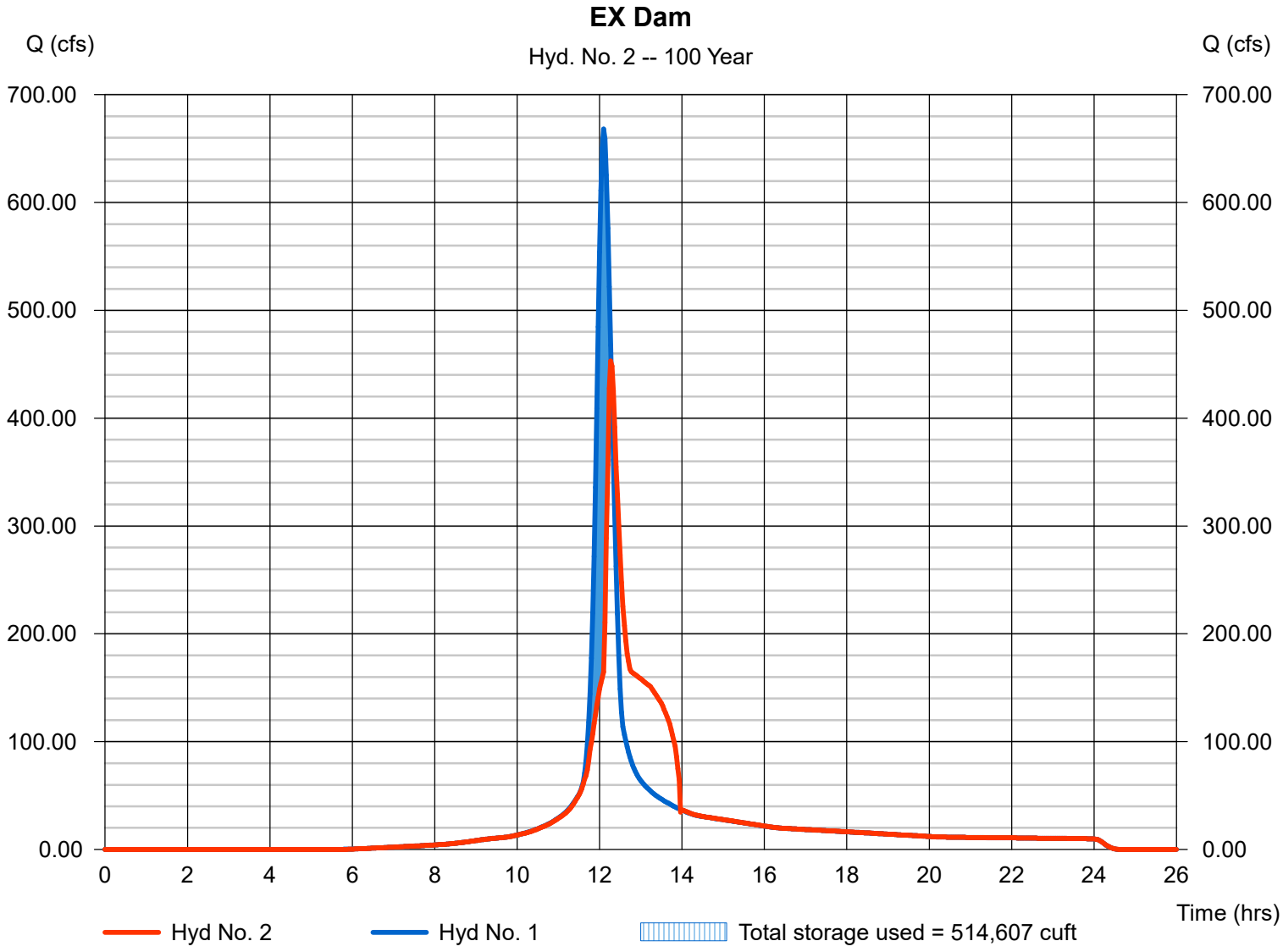
Hydrograph Report

Hyd. No. 2

EX Dam

Hydrograph type	=	Reservoir	Peak discharge	=	452.95 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	2,320,678 cuft
Inflow hyd. No.	=	1 - DA to Dam	Max. Elevation	=	261.19 ft
Reservoir name	=	EX Dam	Max. Storage	=	514,607 cuft

Storage Indication method used.

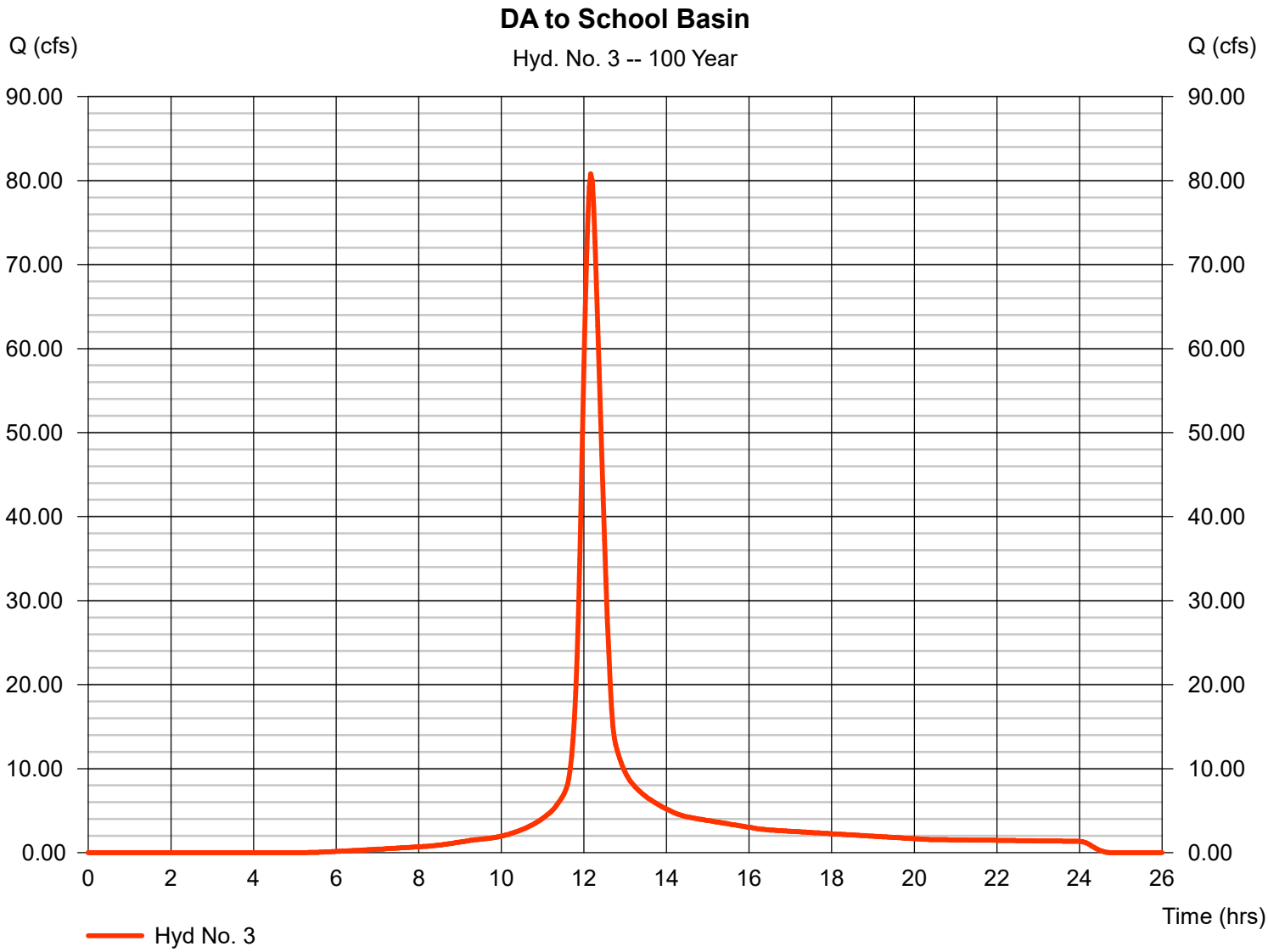


Hydrograph Report

Hyd. No. 3

DA to School Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	80.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	325,492 cuft
Drainage area	=	17.130 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.50 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



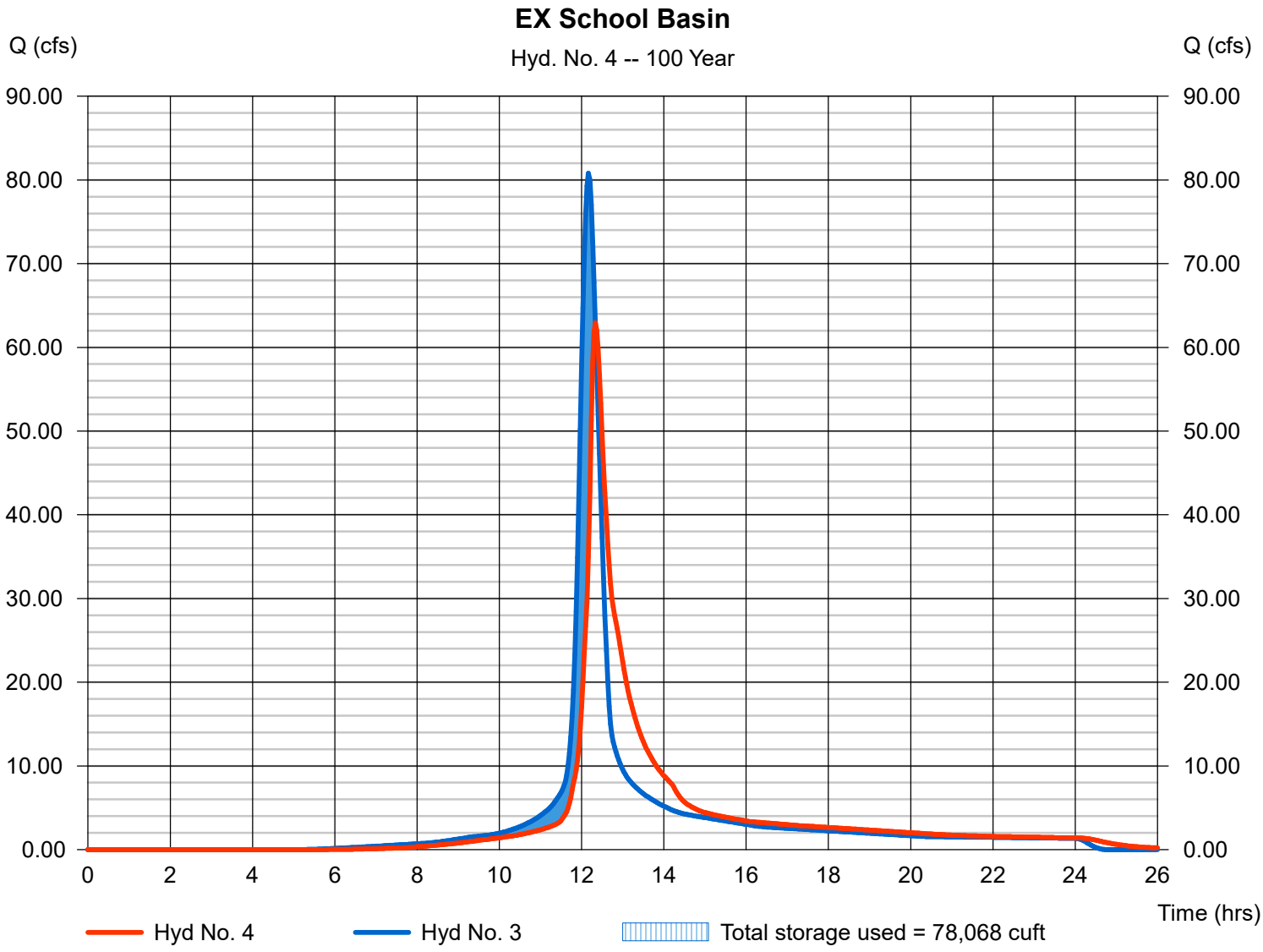
Hydrograph Report

Hyd. No. 4

EX School Basin

Hydrograph type	=	Reservoir	Peak discharge	=	62.91 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	325,484 cuft
Inflow hyd. No.	=	3 - DA to School Basin	Max. Elevation	=	274.36 ft
Reservoir name	=	EX School Basin	Max. Storage	=	78,068 cuft

Storage Indication method used.

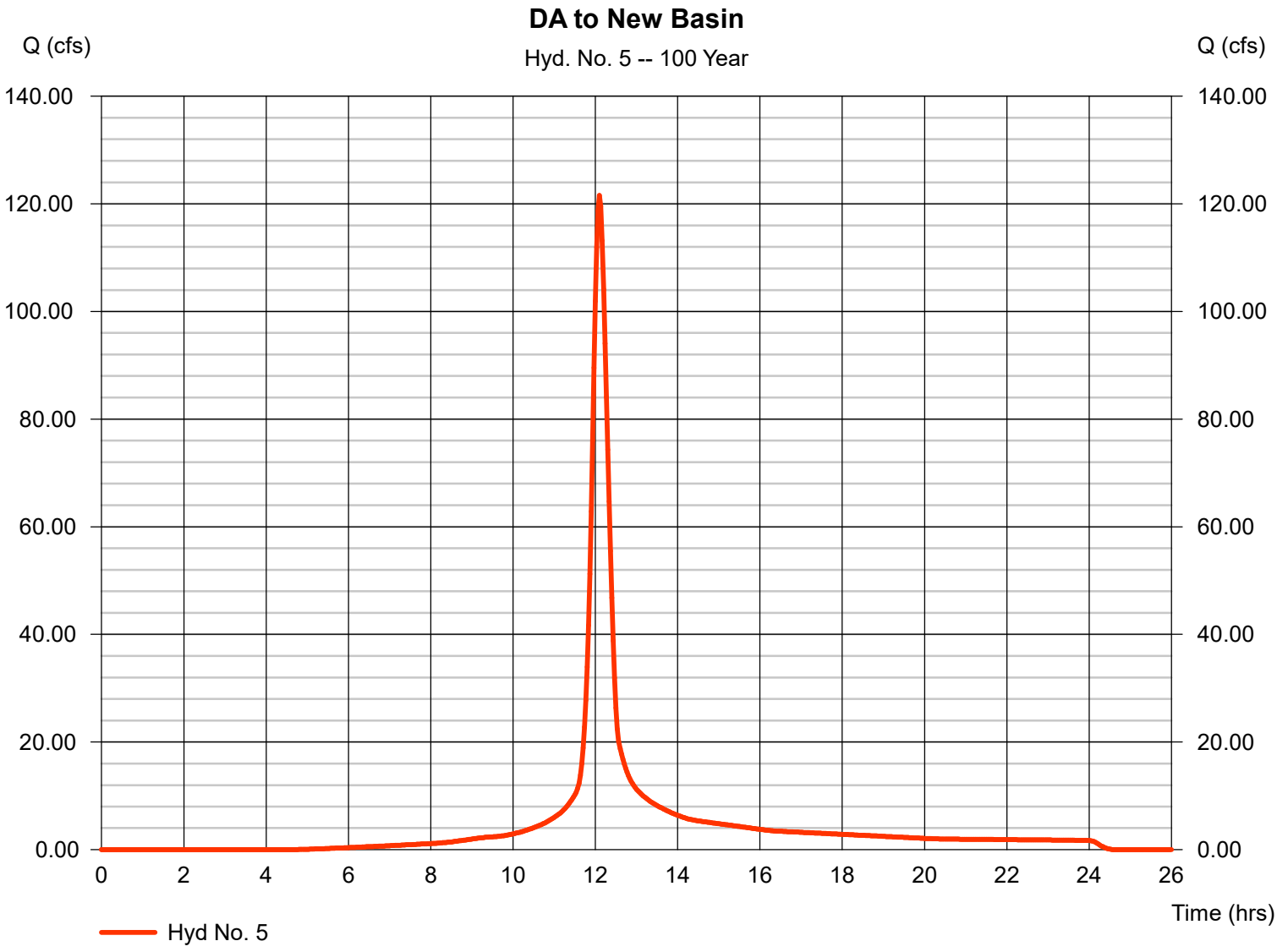


Hydrograph Report

Hyd. No. 5

DA to New Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	121.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	426,726 cuft
Drainage area	=	21.140 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.20 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

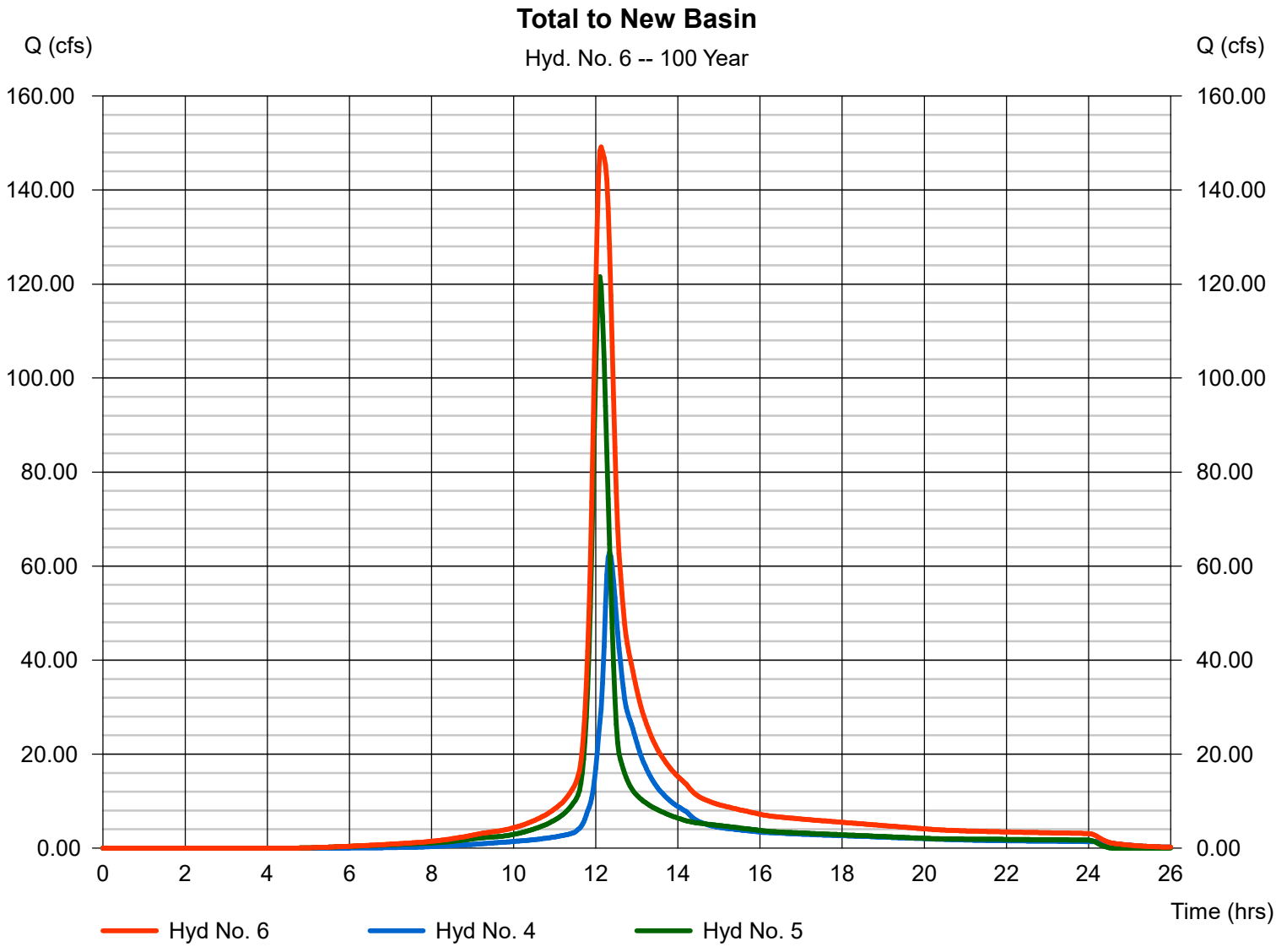


Hydrograph Report

Hyd. No. 6

Total to New Basin

Hydrograph type	= Combine	Peak discharge	= 149.16 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 752,209 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 21.140 ac



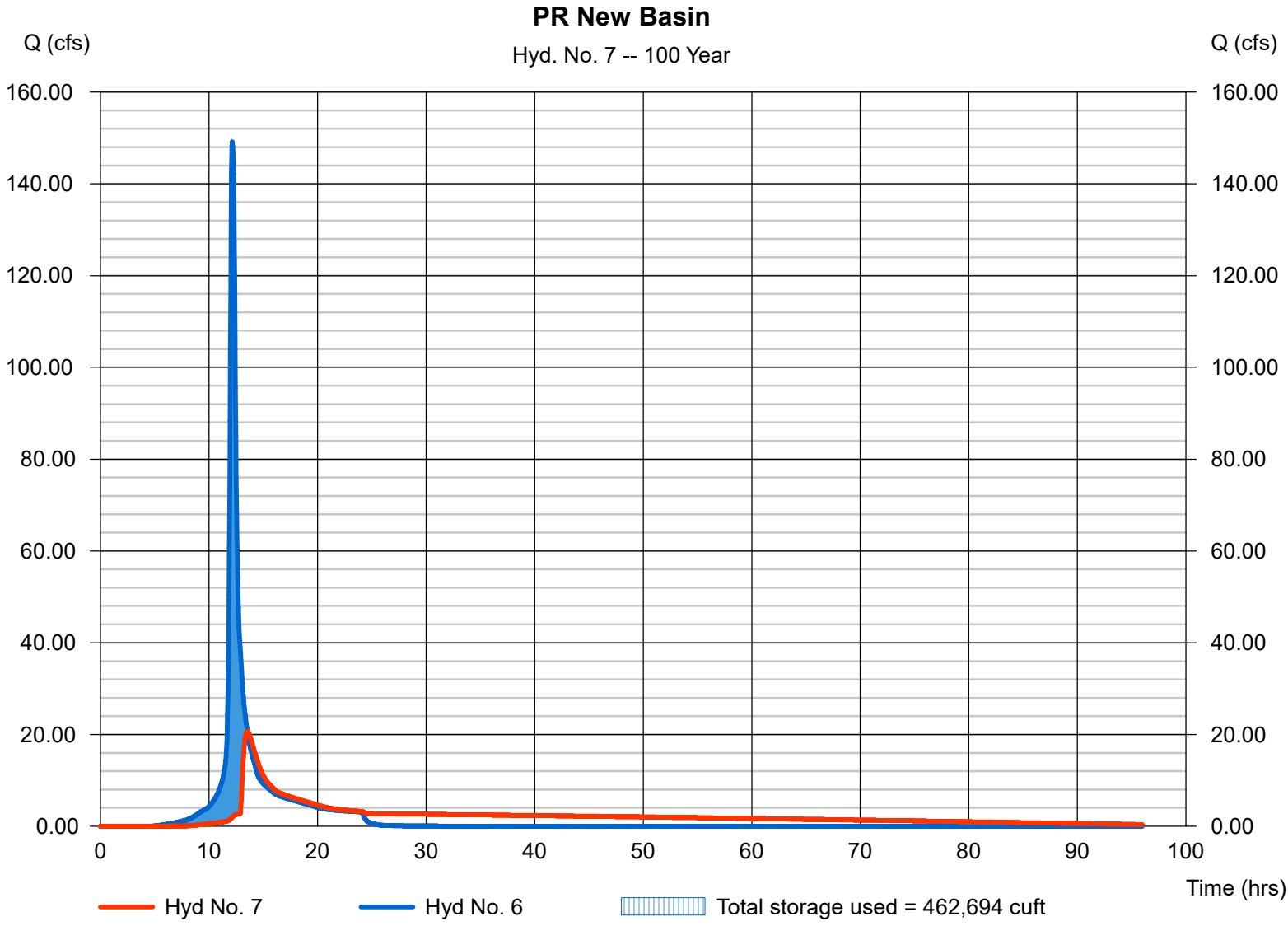
Hydrograph Report

Hyd. No. 7

PR New Basin

Hydrograph type	=	Reservoir	Peak discharge	=	20.67 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.53 hrs
Time interval	=	2 min	Hyd. volume	=	736,819 cuft
Inflow hyd. No.	=	6 - Total to New Basin	Max. Elevation	=	259.48 ft
Reservoir name	=	PR New Basin	Max. Storage	=	462,694 cuft

Storage Indication method used.

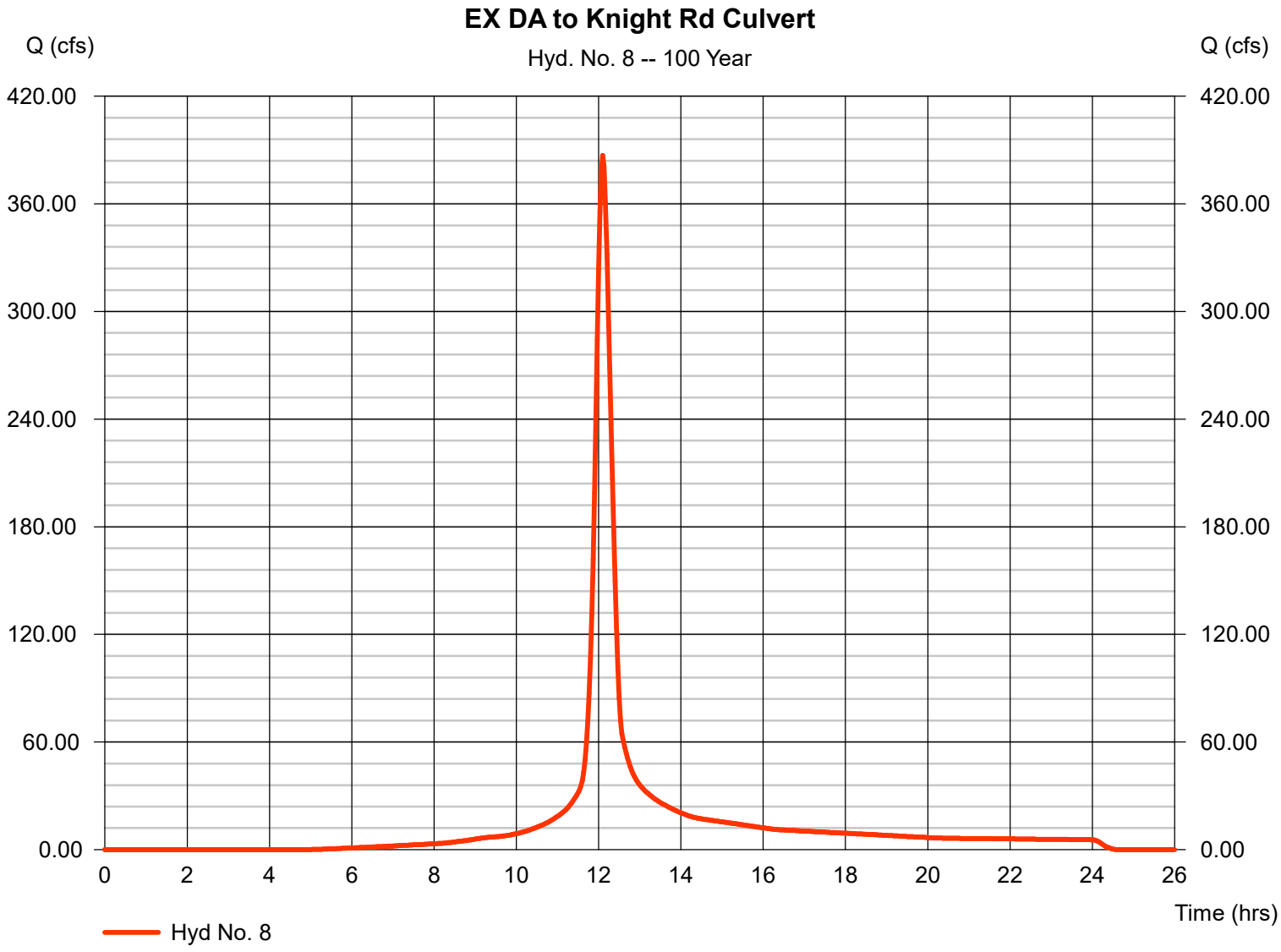


Hydrograph Report

Hyd. No. 8

EX DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	387.07 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	1,354,321 cuft
Drainage area	=	68.530 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

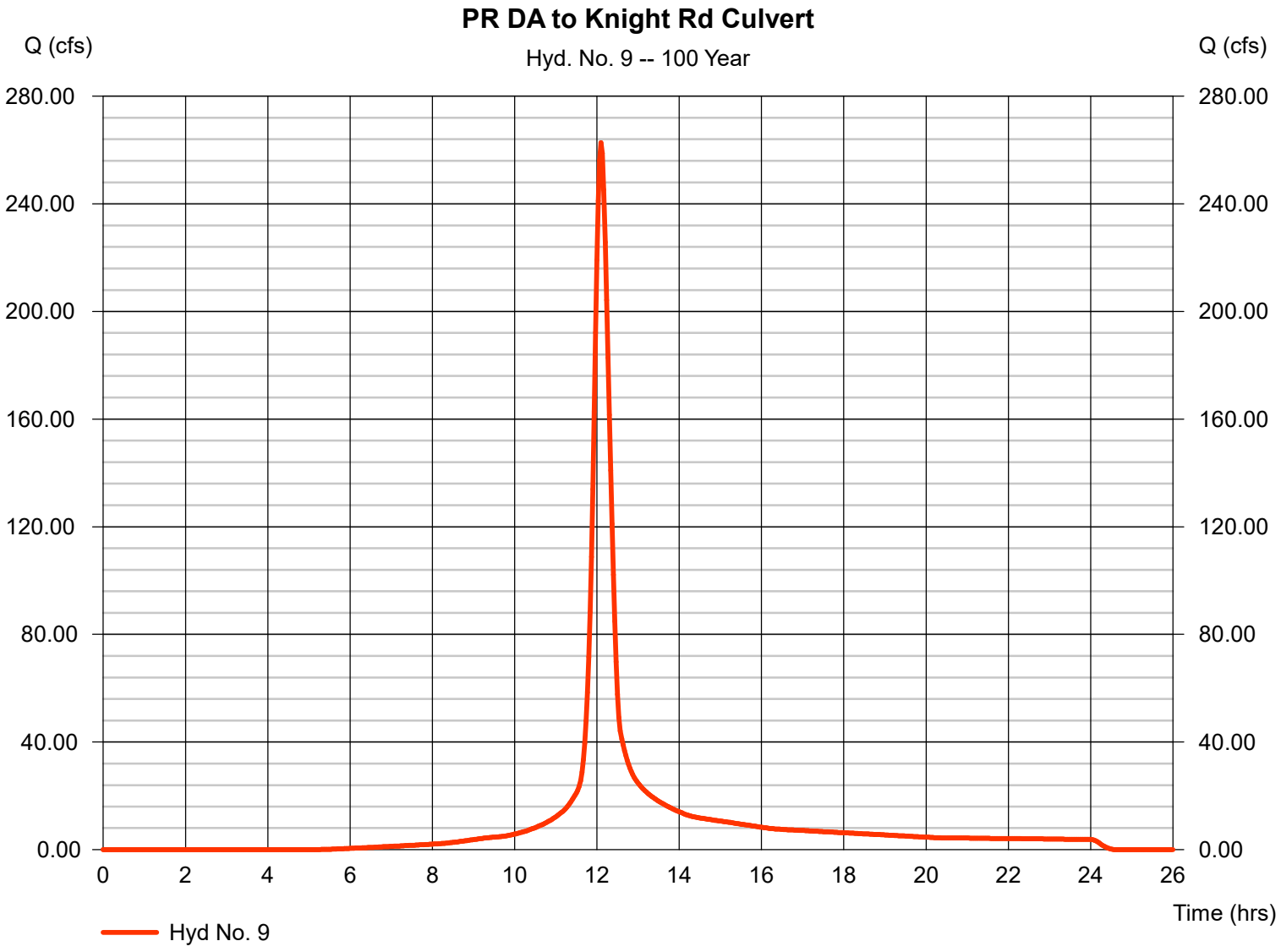


Hydrograph Report

Hyd. No. 9

PR DA to Knight Rd Culvert

Hydrograph type	=	SCS Runoff	Peak discharge	=	262.76 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	916,743 cuft
Drainage area	=	47.400 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

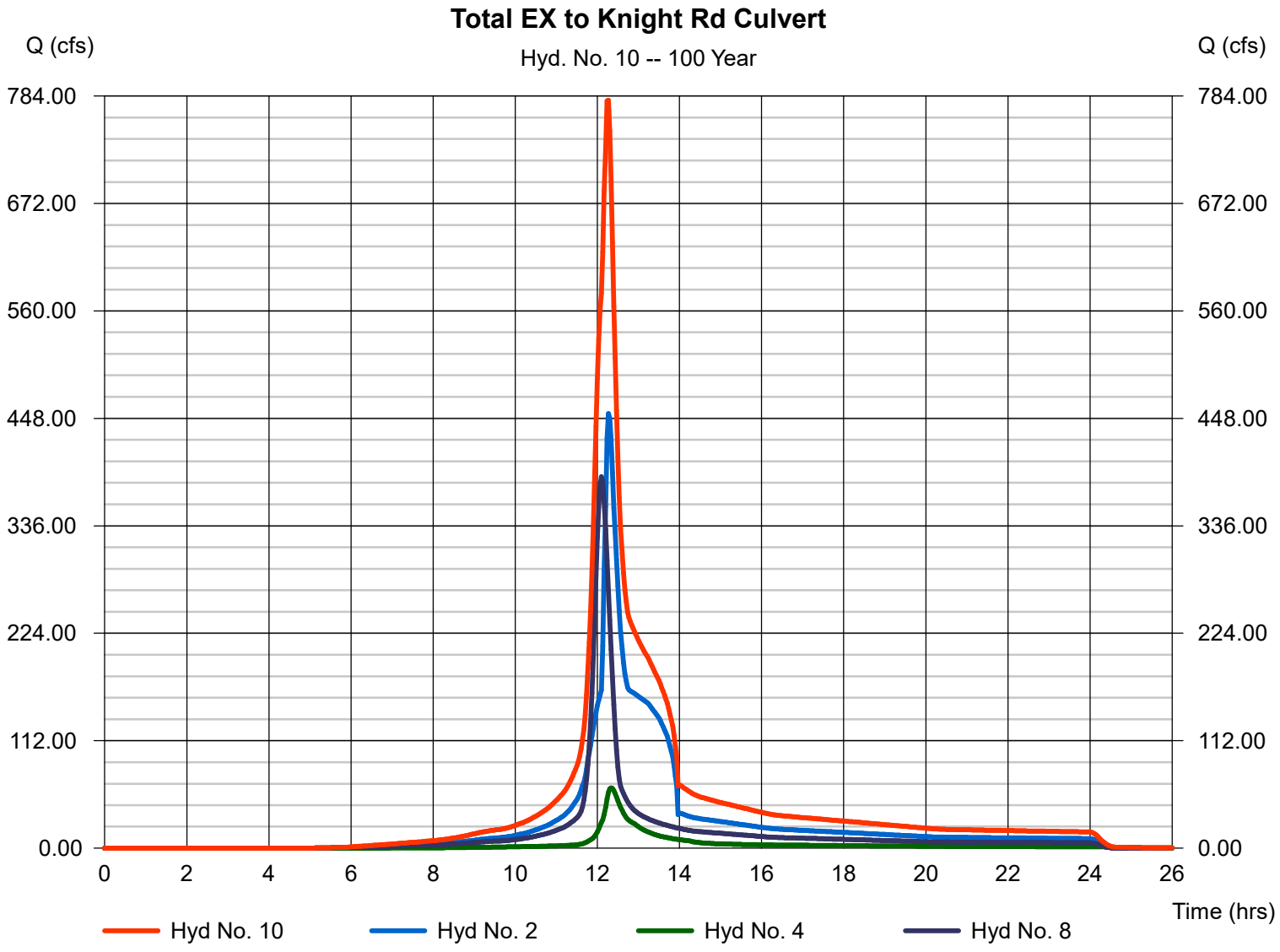


Hydrograph Report

Hyd. No. 10

Total EX to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 779.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 4,000,486 cuft
Inflow hyds.	= 2, 4, 8	Contrib. drain. area	= 68.530 ac



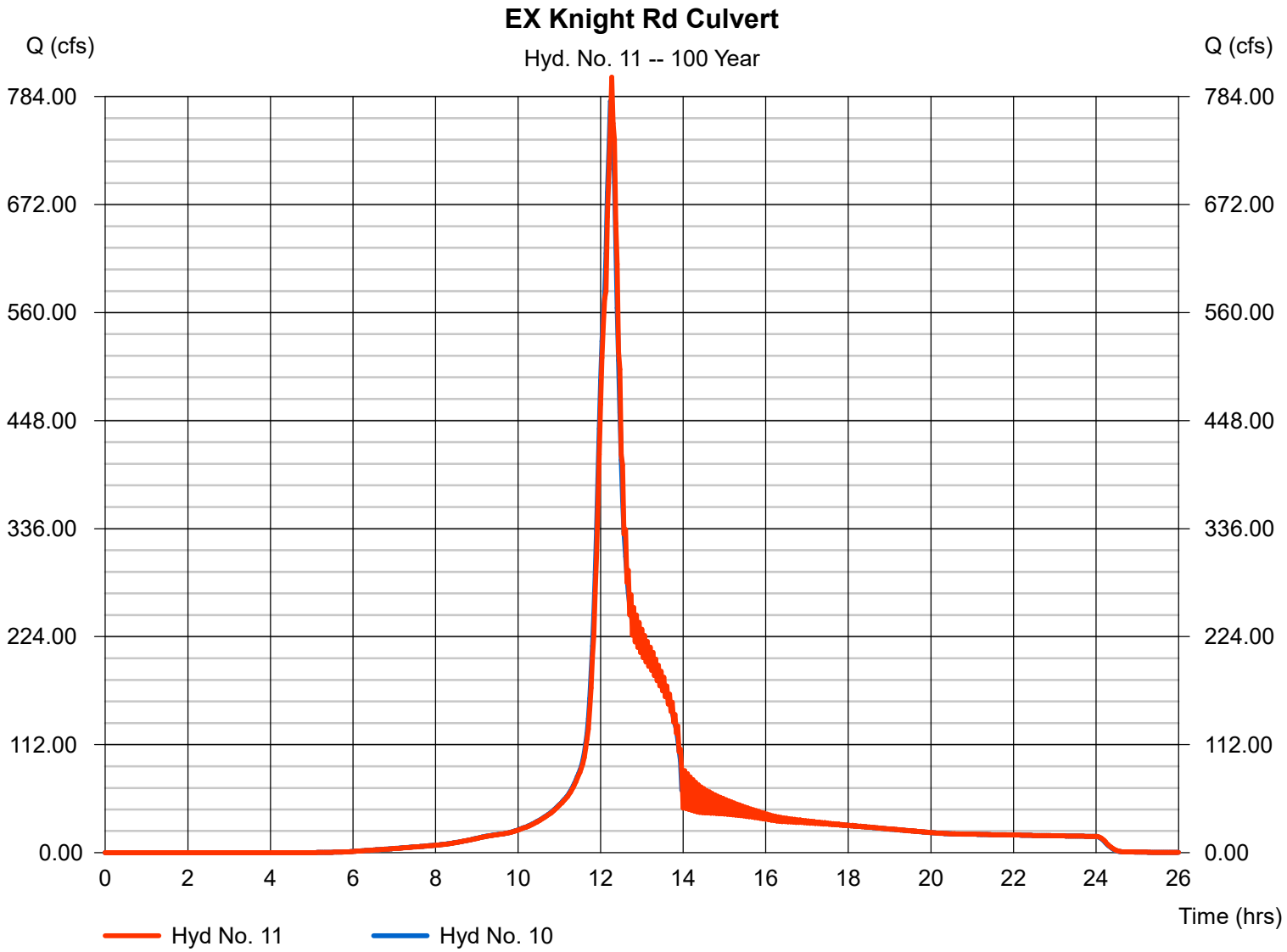
Hydrograph Report

Hyd. No. 11

EX Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	803.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	4,000,450 cuft
Inflow hyd. No.	=	10 - Total EX to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	37.01 ft/s	Routing coeff.	=	1.9687

Modified Att-Kin routing method used.

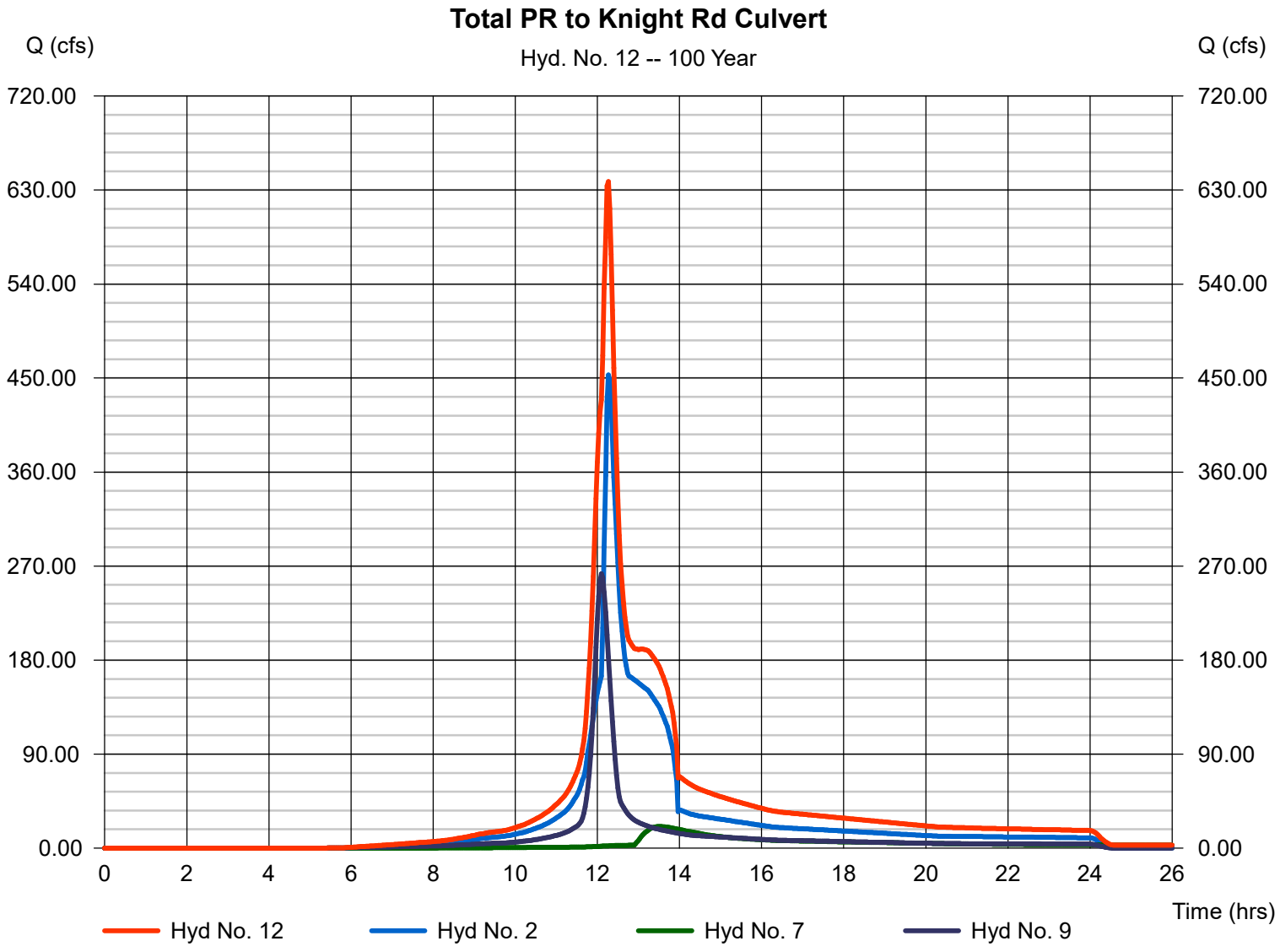


Hydrograph Report

Hyd. No. 12

Total PR to Knight Rd Culvert

Hydrograph type	= Combine	Peak discharge	= 637.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 3,974,245 cuft
Inflow hyds.	= 2, 7, 9	Contrib. drain. area	= 47.400 ac



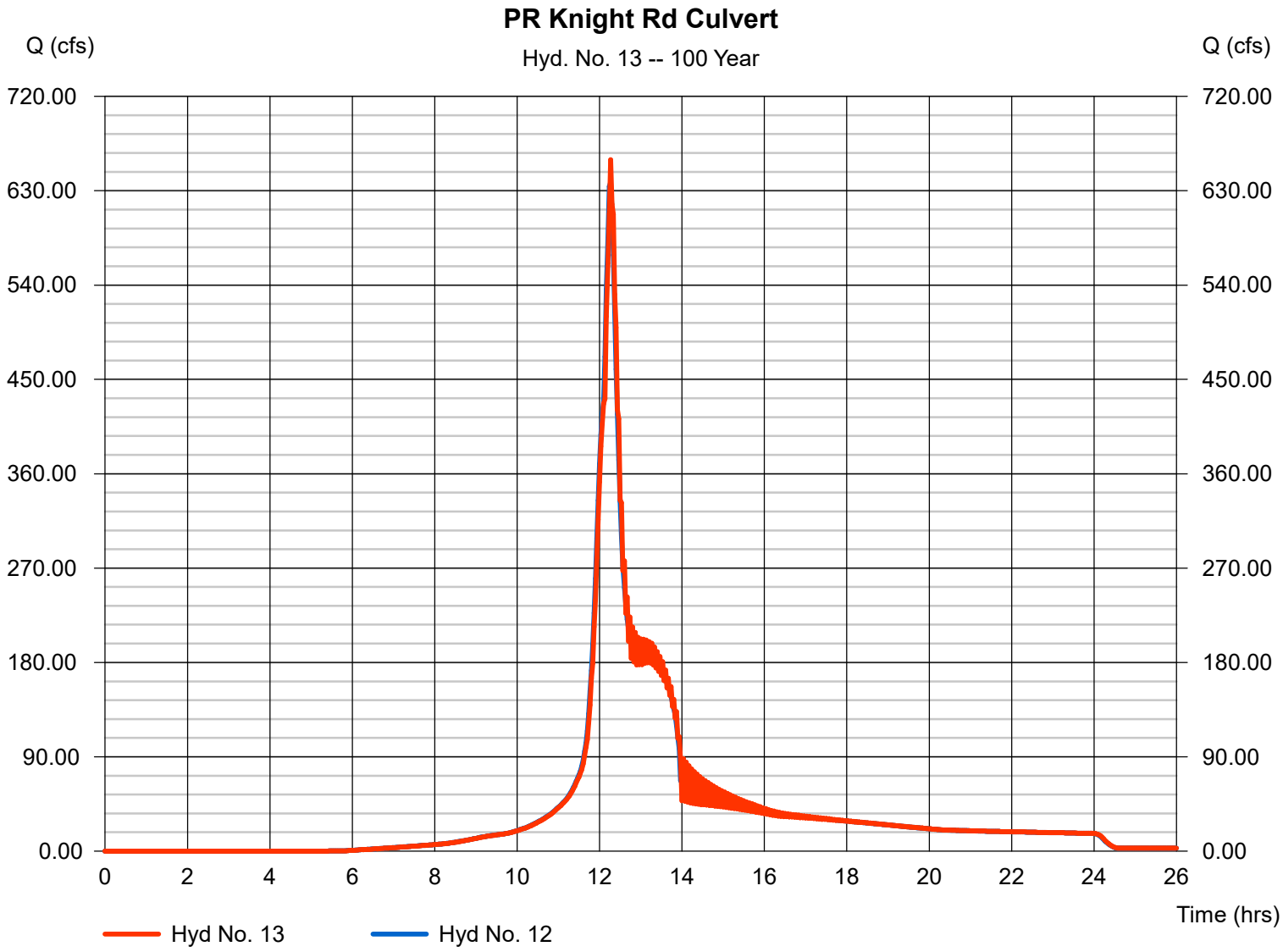
Hydrograph Report

Hyd. No. 13

PR Knight Rd Culvert

Hydrograph type	=	Reach	Peak discharge	=	659.54 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	3,974,221 cuft
Inflow hyd. No.	=	12 - Total PR to Knight Rd Culvert	Section type	=	Rectangular
Reach length	=	55.0 ft	Channel slope	=	5.7 %
Manning's n	=	0.013	Bottom width	=	8.0 ft
Side slope	=	0.0:1	Max. depth	=	2.7 ft
Rating curve x	=	6.806	Rating curve m	=	1.556
Ave. velocity	=	34.45 ft/s	Routing coeff.	=	1.9664

Modified Att-Kin routing method used.

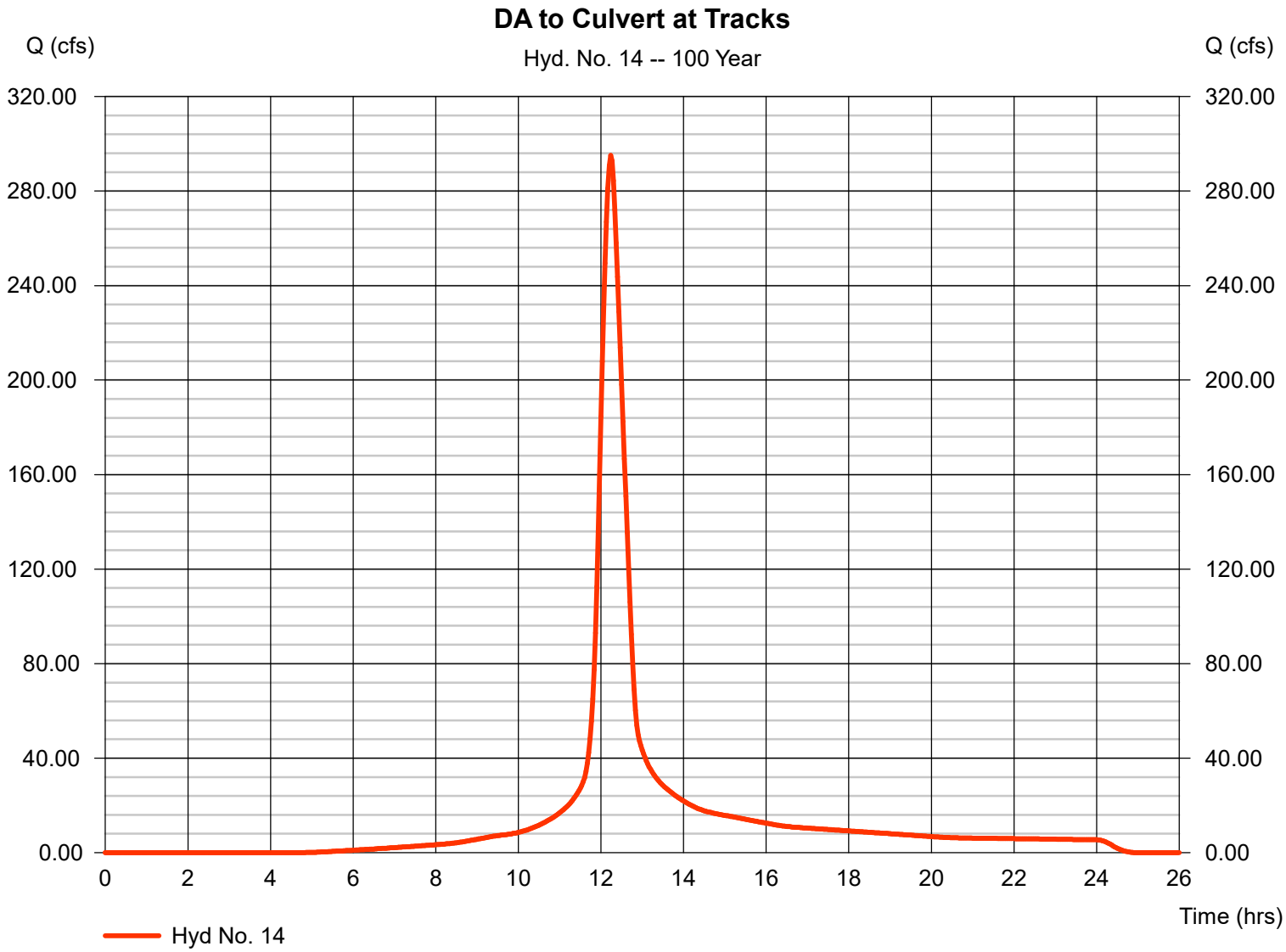


Hydrograph Report

Hyd. No. 14

DA to Culvert at Tracks

Hydrograph type	=	SCS Runoff	Peak discharge	=	295.14 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	1,352,631 cuft
Drainage area	=	68.990 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	35.30 min
Total precip.	=	7.46 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

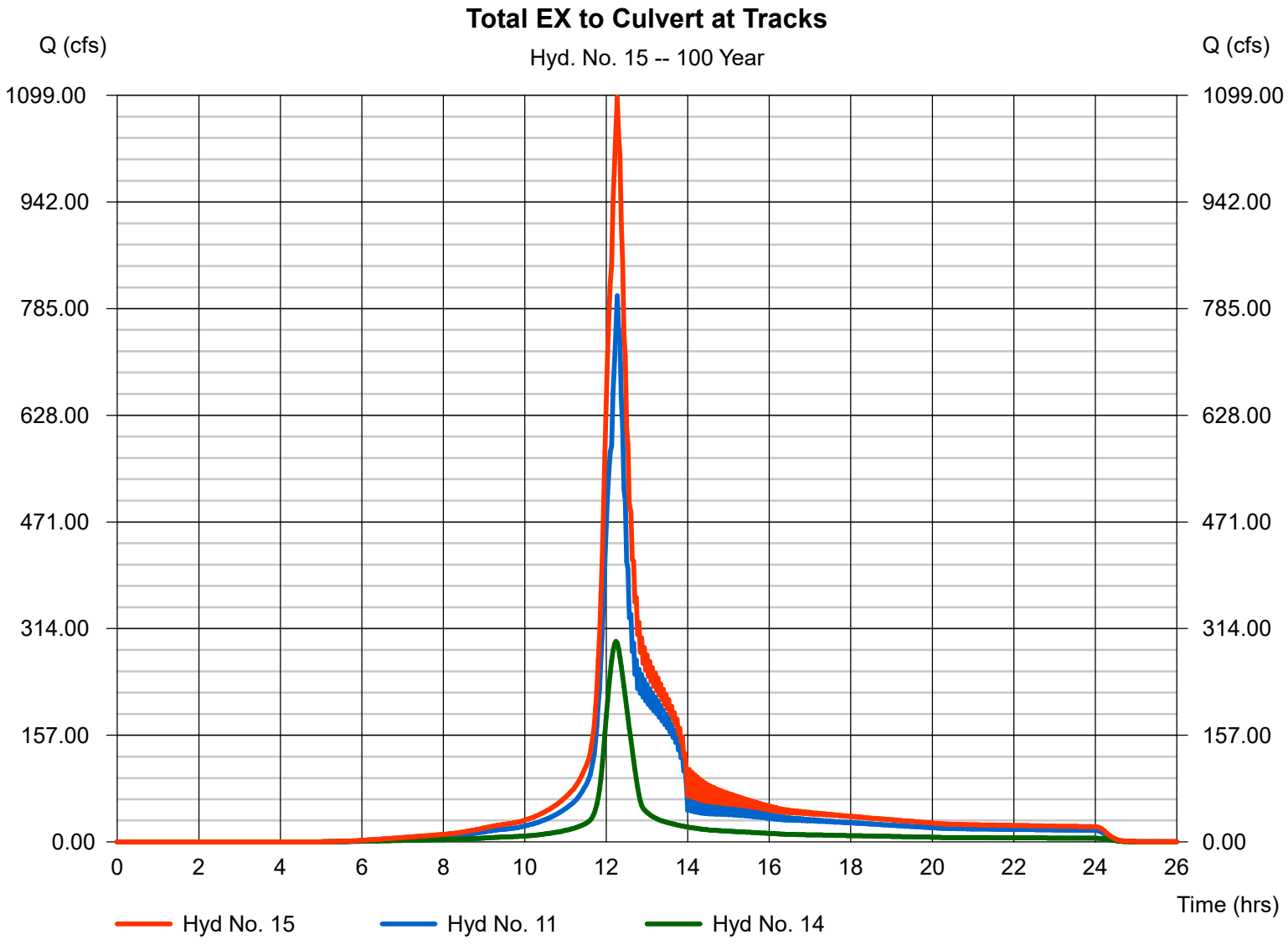


Hydrograph Report

Hyd. No. 15

Total EX to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 1096.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 5,353,085 cuft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 68.990 ac

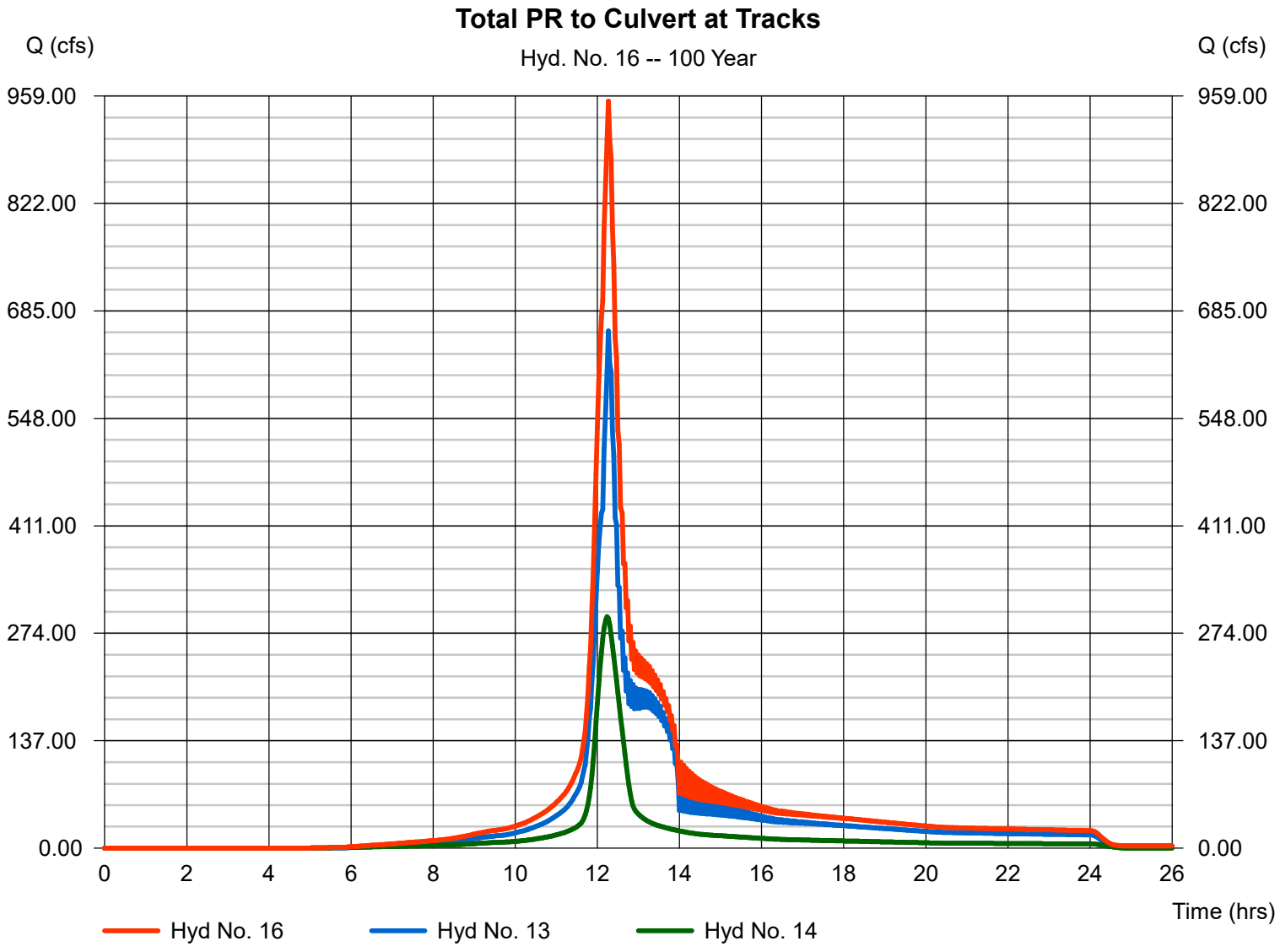


Hydrograph Report

Hyd. No. 16

Total PR to Culvert at Tracks

Hydrograph type	= Combine	Peak discharge	= 952.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 5,326,852 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 68.990 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	37.0466	9.8000	0.9093	--------
2	16.9729	3.2000	0.6105	--------
3	0.0000	0.0000	0.0000	--------
5	25.3184	5.4000	0.6606	--------
10	54.7383	10.8000	0.8016	--------
25	92.8341	14.6000	0.8787	--------
50	41.8042	8.4000	0.6573	--------
100	116.5471	18.3000	0.8393	--------

File name: NOAA IDF Lower Gwynedd.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.20	2.45	2.00	1.69	1.47	1.30	1.17	1.06	0.97	0.90	0.83	0.78
2	4.70	3.51	2.89	2.49	2.21	2.00	1.84	1.70	1.59	1.50	1.42	1.35
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.39	4.16	3.45	2.99	2.65	2.40	2.20	2.04	1.90	1.79	1.69	1.60
10	5.99	4.81	4.04	3.51	3.11	2.80	2.55	2.35	2.18	2.03	1.91	1.80
25	6.80	5.57	4.73	4.12	3.66	3.30	3.01	2.76	2.56	2.38	2.23	2.10
50	7.59	6.16	5.26	4.63	4.16	3.80	3.51	3.26	3.06	2.88	2.73	2.60
100	8.30	7.05	6.15	5.47	4.93	4.50	4.14	3.84	3.59	3.36	3.17	3.00

Tc = time in minutes. Values may exceed 60.

Precip. file name: NOAA Precipitation Lower Gwynedd.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.70	3.25	0.00	4.07	4.76	5.74	6.57	7.46
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00

APPENDIX D – OPINION OF PROBABLE COSTS

Estimated costs are for budgetary purposes only as preliminary design has not been completed for any of the projects contemplated as part of this study. Costs subject to change based on actual project scope, timing of implementation, and required state and local permitting.

GILMORE & ASSOCIATES, INC.
OPINION OF PROBABLE COST SUMMARY

PROJECT NAME: Brookside Avenue Flood Study (Houston / Knight Basin)
LOCATION: Lower Gwynedd Township
DATE: 5/19/2023

Engineers Opinion of Probable Cost

Item	Construction Items	TOTAL
1	Clearing	$ 40,000.00
2	E&S Controls & Maintenance	$ 30,000.00
3	Rough / Bulk Excavation	$ 125,000.00
4	Soil Export	$ 150,000.00
5	Outlet Control Structure & Pipe	$ 15,000.00
6	Amended Soils	$ 50,000.00
7	4" Perforated Underdrain	$ 20,000.00
8	Landscaping	$ 45,000.00
9	Seeding & Matting	$ 15,000.00

Construction Sub-Total	**$ 490,000.00**
Contingency (10%)	**$ 49,000.00**
Design / Permitting / Bid Administration	**$ 98,000.00**
Total Project Budget Estimate	**$ 637,000.00**

GILMORE & ASSOCIATES, INC.
OPINION OF PROBABLE COST SUMMARY

PROJECT NAME: School District Administration Building (Existing Basin Retrofit)
LOCATION: Lower Gwynedd Township
DATE: 5/19/2023

Engineers Opinion of Probable Cost

Item	Construction Items	TOTAL
1	E&S Controls & Maintenance	$ 10,000.00
2	Demo & Remove Concrete Channels	$ 5,000.00
3	Amended Soils	$ 30,000.00
4	Landscaping	$ 25,000.00
5	Rip Rap Aprons	$ 3,500.00
6	Infiltration Trench	$ 35,000.00

Construction Sub-Total	**$ 108,500.00**
Contingency (10%)	**$ 10,850.00**
Design / Permitting / Bid Administration	**$ 21,700.00**
Total Project Budget Estimate	**$ 141,050.00**

GILMORE & ASSOCIATES, INC.
OPINION OF PROBABLE COST SUMMARY

PROJECT NAME: Dam Englargment / Modifications
LOCATION: Lower Gwynedd Township
DATE: 5/19/2023

Engineers Opinion of Probable Cost

Item	Construction Items	TOTAL
1	E&S Controls & Maintenance	$ 40,000.00
2	Clearing (4 Acres)	$ 100,000.00
3	Bulk Excavation	$ 250,000.00
4	Soil Export	$ 300,000.00
5	Outlet Structure Modifications	$ 50,000.00
6	Landscape Restoration (3" trees at 25' spacing = 280 total)	$ 190,000.00

Construction Sub-Total	**$ 930,000.00**
Contingency (10%)	**$ 93,000.00**
Design / Permitting / Bid Administration	**$ 186,000.00**
Total Project Budget Estimate	**$ 1,209,000.00**

GILMORE & ASSOCIATES, INC.
OPINION OF PROBABLE COST SUMMARY

PROJECT NAME: Driveway Culvert Replacement (446 Marion)
LOCATION: Lower Gwynedd Township
DATE: 5/19/2023

Engineers Opinion of Probable Cost

Item	Construction Items	TOTAL
1	Demo & Removal of Existing Driveway Bridge	$ 5,000.00
2	3'X5' Box Culvert w/ Wing Walls (12 LF)	$ 80,000.00
3	Installation	$ 25,000.00
4	E&S Controls	$ 2,500.00
5	Rip Rap	$ 500.00
6	Paving	$ 1,500.00

Construction Sub-Total	**$ 114,500.00**
Contingency (10%)	**$ 11,450.00**
Design / Permitting / Bid Administration	**$ 5,000.00**
Total Project Budget Estimate	**$ 130,950.00**

*Prices above assume public bid and all work done by contrator. Scope could be completed by Township Public Works Department with savings related to labor costs.