LEE'S SUMMIT
MISSOURI

DESIGN & CONSTRUCTION MANUAL
DESIGN CRITERIA MODIFICATION REQUEST

PROJECT NAME: Cobey Creek 2nd Plat

ADDRESS: Intersection of Cobey Creek Drive and Hwy-150

PERMIT NUMBER: PL2022092

OWNER'S NAME: Clayton Properties Group DBA Summit Homes KC

TO: Deputy Director of Public Works / City Engineer

In accordance with the City of Lee's Summit's Design and Construction Manual (DCM), I wish to apply for a modification to one or more provisions of the code as I feel that the spirit and intent of the DCM is observed and the public health, welfare and safety are assured. The following articulates my request for your review and action. (NOTE: Cite specific code sections, justification and all appropriate supporting documents.)

Seeking relief from Section 5608.4(C)(1) for the "peripheral drainage issue" that is inherent in most residential subdivisions due to grading changes during construction to lessen the drainage area in a particular portion of the project, and hence the peak runoff from those particular areas when compared to the pre-developed condition.

SUBMITTED BY:
NAME: Garrett Cates - Anderson Engineering Inc.
ADDRESS: 941 W 141st Ter., Suite A
CITY, STATE, ZIP: Kansas City, MO 64145
Email: gcates@ae-inc.com

( ) OWNER (X) OWNER'S AGENT
PHONE #: (913) 284-9362
SIGNATURE: Garrett R Cates

KENT MONTER, P.E.
DEVELOPMENT ENGINEERING MANAGER ( ) APPROVAL ( ) DENIAL
SIGNATURE: _____ DATE: _____

JEFF THORN, P.E.
WATER UTILITIES ASSITANT DIRECTOR OF ENGINEERING SERVICES ( ) APPROVED ( ) DENIAL
SIGNATURE: _____ DATE: _____

GEORGE M. BINGER III, P.E.
DEPUTY DIRECTOR OF PUBLIC WORKS/CITY ENGINEER ( ) APPROVED ( ) DENIAL
SIGNATURE: _____ DATE: _____

COMMENTS: _____

A COPY MUST BE ATTACHED TO THE APPROVED PLANS ON THE JOB SITE

ANDERSON ENGINEERING
EMPLOYEE OWNED

AndersonEngineeringInc.com
941 W 141st Terrace Suite A
Kansas City, MO 64145
816-777-0400

August 26, 2022

Deputy Director of Public Works/City Engineer
Public Works
220 SE Green Street
Lee's Summit, Missouri 64063

Re: Cobey Creek - Peripheral Drainage Waiver Request

Cobey Creek is a multi-phase mixed-use development that is made up of primarily single-family and two-family residential homes. The development was started by JCM Development, LLC in 2018, and hired HG Consultants to complete the Preliminary Development Plan, Master Drainage Study, and 1st Plat design drawings. Due to a change in ownership to Summit Homes KC following the completion of Phase 1 of the development, Anderson Engineering Inc. has been hired to develop the remaining design and construction documents necessary to complete the project. Discussed in the Master Drainage Plan that was completed and approved with the 1st Plat (Phase 1), is the inherent drainage issue referred to as "fringe drainage" or "peripheral drainage". This issue is a result of grading changes during construction to lessen the drainage area in a particular portion of the project, and hence, the peak runoff from those particular areas when compared to the pre-development condition. Due to the challenges meeting Section 5608.4(C)(1) of the City of Lee's Summit Design and Construction Manual, the developer is seeking a waiver relief to allow these peripheral drainage areas that cannot feasibly be captured by the provided wet and dry detention basins, and therefore allow them to be released to adjacent properties at flow rates that are still significantly less than the pre-developed condition. The following paragraphs summarize the results of a micro drainage analysis that was conducted to assess the pre-deevelopment, intermediate, and post-development drainage areas depicted in **Exhibit A** (pre-construction), **Exhibit B** (after phase 2 is completed) and **Exhibit C** (fully developed site), located in **Appendix A**.

There are two peripheral drainage areas located within the Cobey Creek development, which are referred to as the "North" and "South" peripheral drainage areas in this analysis. The composite curve numbers for each of these areas are set to increase due to an increase in impervious area. Even with this increase in composite curve numbers however, the overall runoff is being reduced because of a decrease in total area from pre-phase 2 construction to a fully developed site. The North peripheral drainage area is reducing in size from

14.7 acres pre-construction, to 3.74 acres after phase 2, and 2.51 acres once the site is fully developed. The South peripheral drainage area is reducing in size from 1.75 acres pre-construction to 1.12 acres once phase 2 is complete as well as once fully developed. Therefore, the total contributing drainage area is reducing by a total of 12.7 acres, or approximately 86%. This decrease in area is more than enough to account for the increase in the composite curve number, which ultimately results to a net decrease in runoff for the peripheral drainage areas.

To model the total runoff for the peripheral drainage areas, Hydraflow Hydragraphs software extension for AutoDesk Civil 3d was utilized. Using the SCS TR-55 method and a Type-ll 24-hour rainfall distribution, hydrographs for a 2-year, 10-year, and 100-year stormwater event were analyzed. **Table 1** and **Table 2** summarize the peak flow values from the Hydraflow model and can be further analyzed in the attached stormwater model output included in **Appendix B**. The analysis confirms that the stormwater runoff for each of the peripheral drainage areas decreases in the intermediate and fully-developed condition, due to the decrease in contributing drainage area.

Table 1: Pre vs Post North Runoff Summary					
	Pre	**Inter**	**Post**	**Percent Reduction Inter**	**Percent Reduction Post**
2-yr	28.5	8.48	7.69	70.2	73.0
10-yr	60.68	17.52	14.26	71.1	76.5
100-yr	125.76	35.62	26.57	71.7	78.9

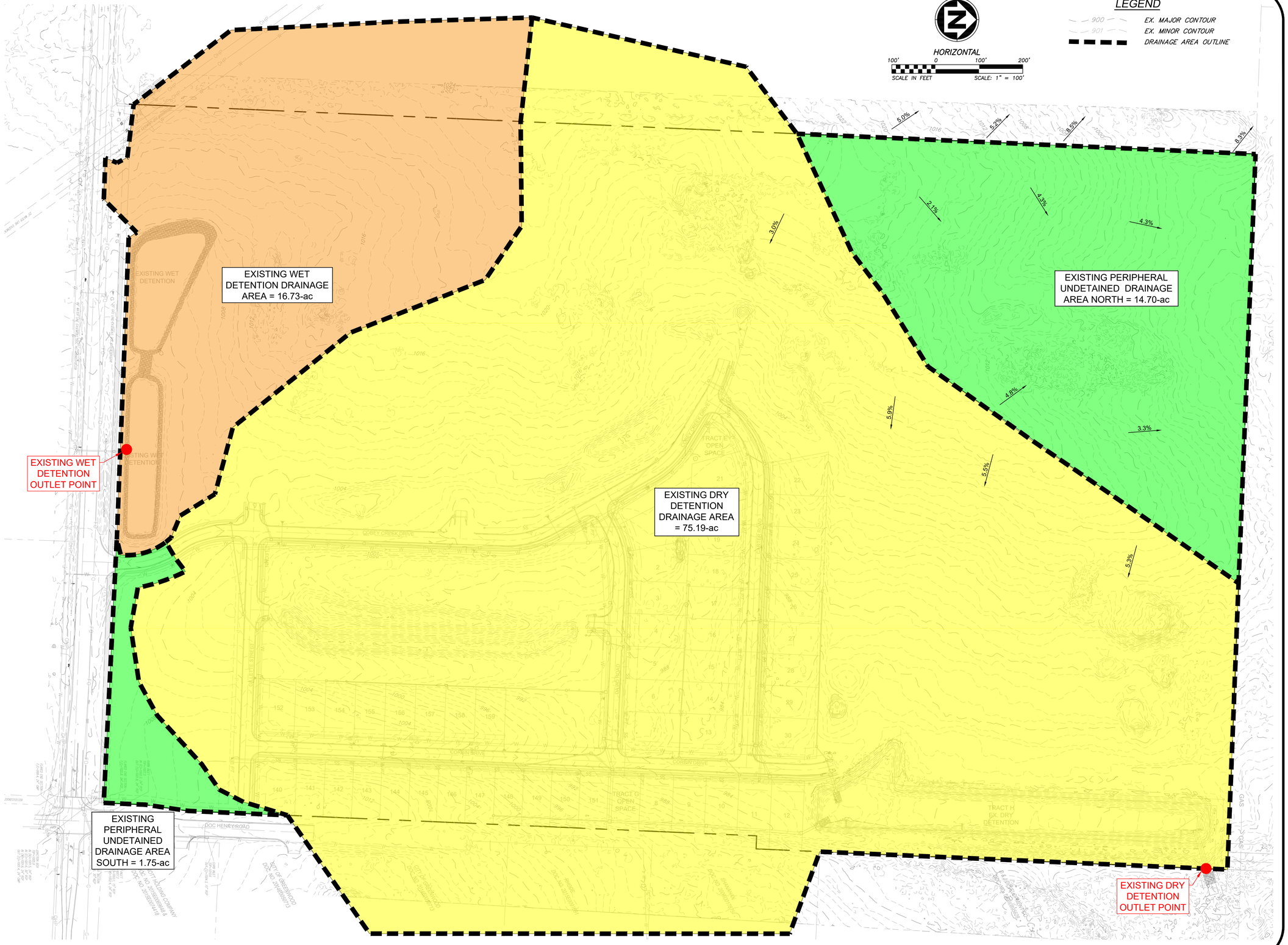
Table 2: Pre vs Post South Runoff Summary				
	Pre	**Inter**	**Post**	**Percent Reduction**
2-yr	3.10	2.78	2.78	10.3
10-yr	6.52	5.57	5.57	14.6
100-yr	13.35	11.03	11.03	17.4

Due to the decrease in runoff to the adjacent properties within the peripheral drainage areas identified in this analysis, no downstream impacts are anticipated once phase 2 is completed as well as once the site is fully developed, and a waiver to the comprehensive control measures defined under Section 5608.4(C)(1) is requested for the Cobey Creek Development.

Anderson Engineering, Inc.

Garrett Cates, P.E.
GCates@ae-inc.com

APPENDIX A



Aug 26, 2022 – 11:01am Plotted By: gcote G:\Shared drives\KC10 – Land Development\Projects\2021\21KC10060 Cobey Creek Residential\01 CIVIL\03–DWG\Sheet\Exhibits\2022.07.26 – DRAINAGE MAP.dwg Layout: EXISTING MASTER DRAINAGE PLAN

ANDERSON ENGINEERING
EMPLOYEE OWNED
ENGINEERS • SURVEYORS • LABORATORIES • DRILLING
941 W 141ST TERR, STE A • KANSAS CITY, MO 64145 • PHONE (816) 777-4400
A LICENSED MISSOURI ENGINEERING & SURVEYING CORPORATION – LC 62

DRAWING INFO.
DRAWN BY: GC
CHECK BY: PJ
LICENSE NO. PE-2021025089
DATE: 08/26/2022
ISSUED FOR: FOR REVIEW
JOB NUMBER: 21KC10060

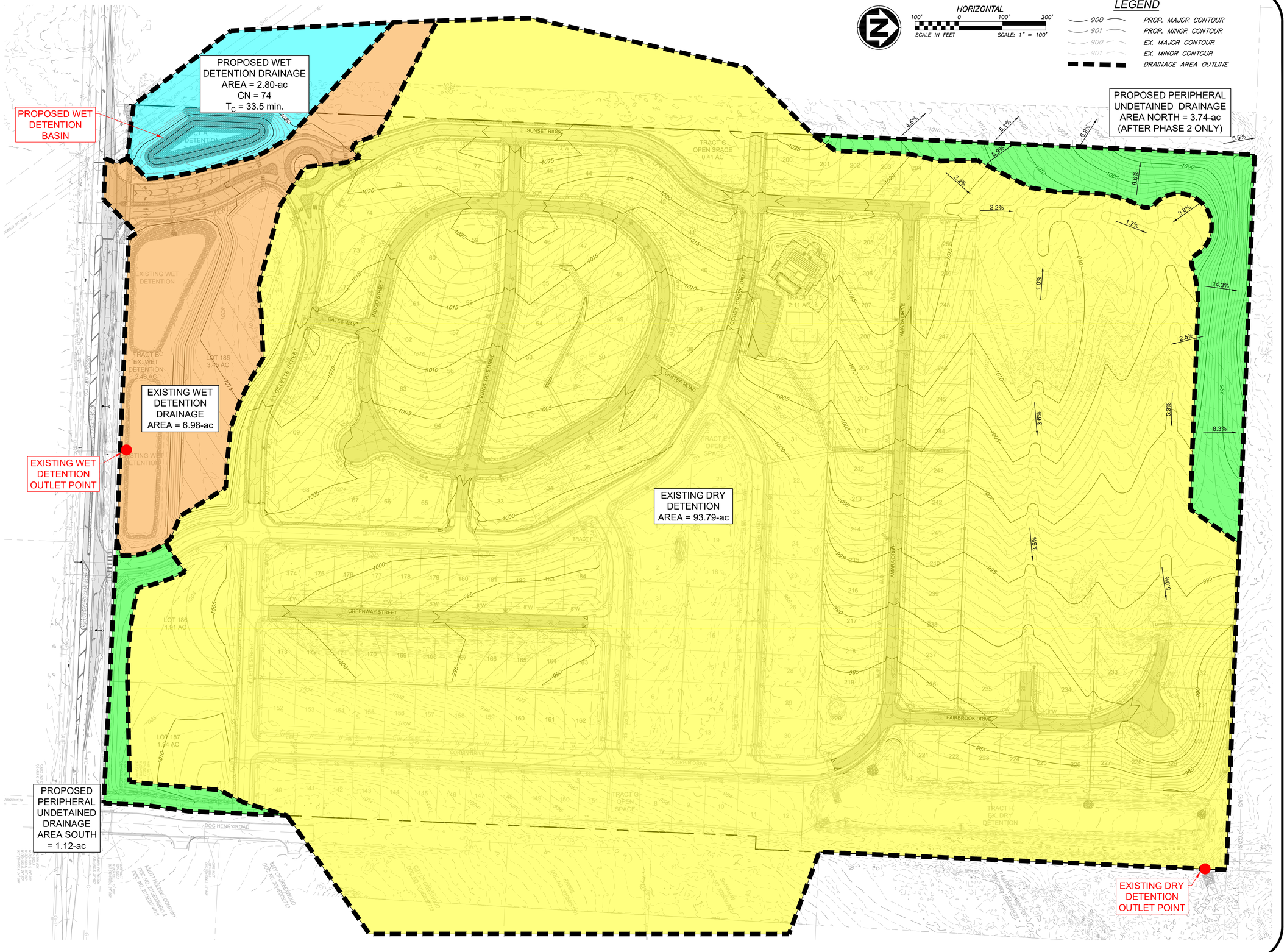
REVISIONS
NO. | DESCRIPTION | DATE | BY

CLAYTON PROPERTIES GROUP
COBEY CREEK - 2ND PLAT - STREET, STORM, & EROSION

EXISTING DRAINAGE AREAS (BEFORE PHASE 2)

S29, T47N, R31W
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

SHEET NUMBER
EXHIBIT A



ANDERSON ENGINEERING
EMPLOYEE OWNED
ENGINEERS • SURVEYORS • LABORATORIES • DRILLING
941 W 141ST TERR, STE A • KANSAS CITY, MO 64145 • PHONE (816) 777-4400
A LICENSED MISSOURI ENGINEERING & SURVEYING CORPORATION – LC 62

DRAWING INFO.

DRAWN BY:	GC
CHECK BY:	PJ
LICENSE NO.	PE-2021025089
DATE:	08/26/2022
ISSUED FOR:	FOR REVIEW
JOB NUMBER:	21KC10060

REVISIONS

NO.	DESCRIPTION	BY	DATE

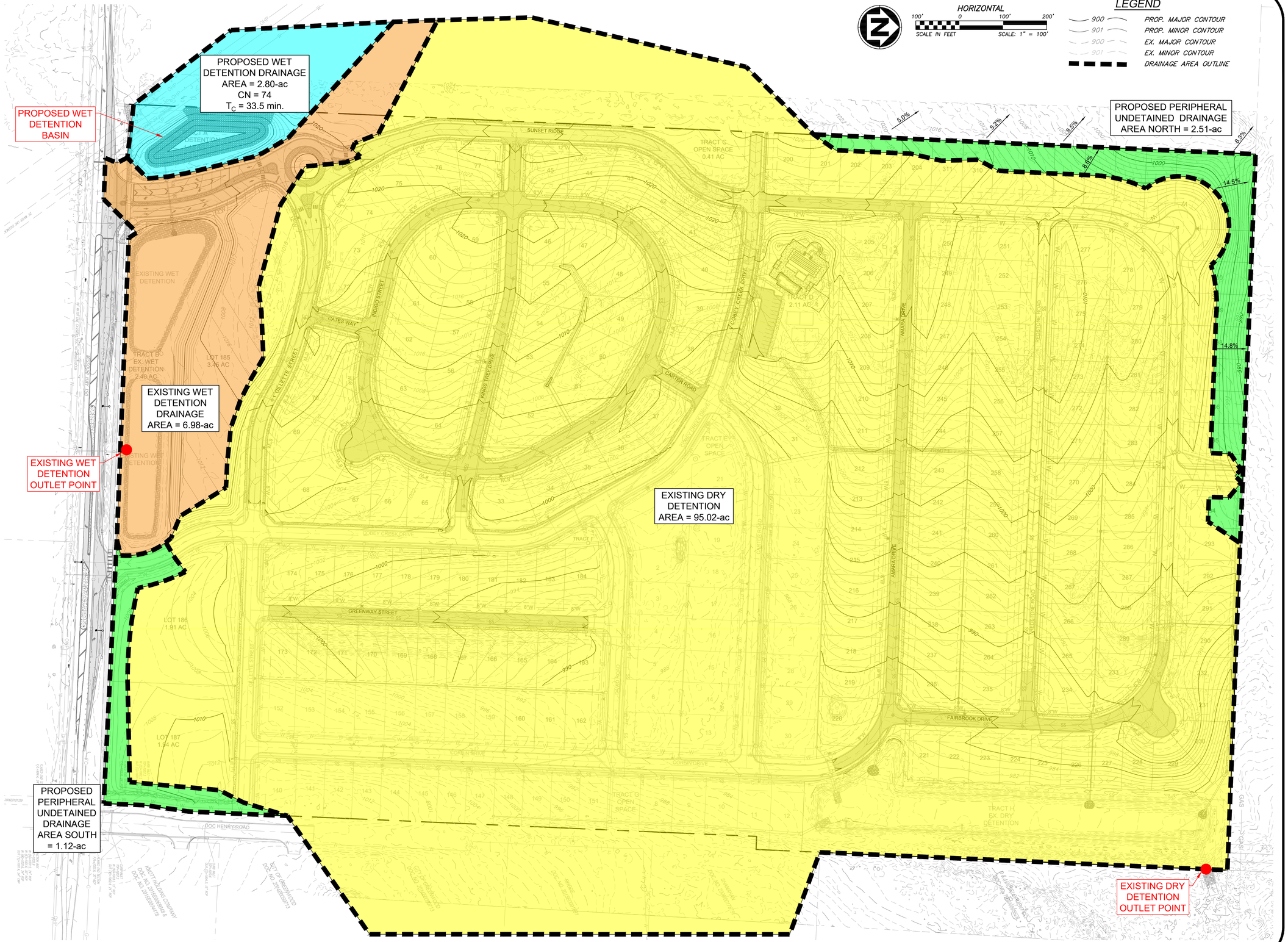
CLAYTON PROPERTIES GROUP
COBEY CREEK - 2ND PLAT - STREET, STORM, & EROSION

PROPOSED DRAINAGE AREAS (AFTER PHASE 2)

S29, T47N, R31W
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

SHEET NUMBER
EXHIBIT B

Aug 26, 2022 – 10:48am Plotted By: gcate G:\Shared drives\KC10 – Land Development\Projects\2021\21KC10060 Cobey Creek Residential\01 CIVIL\03–DWG\Sheet\Exhibits\2022.08.26 – DRAINAGE MAP (Intermediate Condition).dwg Layout: PROPOSED MASTER DRAINAGE PLAN



ANDERSON ENGINEERING
EMPLOYEE OWNED
ENGINEERS • SURVEYORS • LABORATORIES • DRILLING
941 W 141ST TERR, STE A • KANSAS CITY, MO 64145 • PHONE (816) 777-4400
A LICENSED MISSOURI ENGINEERING & SURVEYING CORPORATION – LC 62

DRAWING INFO.

DRAWN BY:	GC
CHECK BY:	PJ
LICENSE NO.	PE-2021025089
DATE:	08/26/2022
ISSUED FOR:	FOR REVIEW
JOB NUMBER:	21KC10060

NO.	DESCRIPTION	DATE	BY

REVISIONS

CLAYTON PROPERTIES GROUP
COBEY CREEK - 2ND PLAT - STREET, STORM, & EROSION

PROPOSED DRAINAGE AREAS (FULLY DEVELOPED CONDITION)

S29, T47N, R31W
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

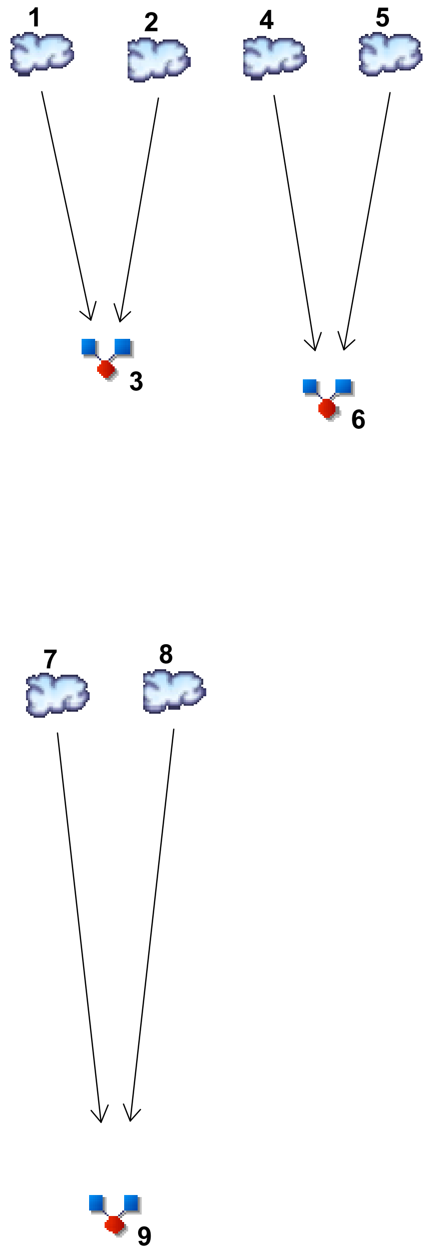
SHEET NUMBER
EXHIBIT C

Aug 26, 2022 – 10:51am Plotted By: gcote G:\Shared drives\KC10 – Land Development\Projects\2021\21KC10060 Cobey Creek Residential\01 CIVIL\03–DWG\Sheet\Exhibits\2022.07.26 – DRAINAGE MAP.dwg Layout: PROPOSED MASTER DRAINAGE PLAN

APPENDIX B

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Legend

Hyd.	Origin	Description
1	SCS Runoff	Exisitng Peripheral Drainage Area North
2	SCS Runoff	Existing Peripheral Drainage Area South
3	Combine	Total Existing Peripheral Drainage Area
4	SCS Runoff	Proposed North Drainage Area
5	SCS Runoff	Proposed South drainage Area
6	Combine	Total Proposed Peripheral Drainage Area
7	SCS Runoff	Intermediate South drainage Area
8	SCS Runoff	Intermediate Drainage Area North
9	Combine	Intermediate Peripheral Area

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	------	19.79	28.50	-------	-------	60.68	-------	-------	125.76	Exisitng Peripheral Drainage Area No
2	SCS Runoff	------	2.163	3.095	-------	-------	6.523	-------	-------	13.35	Existing Peripheral Drainage Area So
3	Combine	1, 2	21.94	31.60	-------	-------	66.88	-------	-------	138.62	Total Existing Peripheral Drainage Ar
4	SCS Runoff	------	5.770	7.694	-------	-------	14.26	-------	-------	26.57	Proposed North Drainage Area
5	SCS Runoff	------	2.008	2.781	-------	-------	5.571	-------	-------	11.03	Proposed South drainage Area
6	Combine	4, 5	7.771	10.46	-------	-------	19.83	-------	-------	37.60	Total Proposed Peripheral Drainage
7	SCS Runoff	------	2.008	2.781	-------	-------	5.571	-------	-------	11.03	Intermediate South drainage Area
8	SCS Runoff	------	5.993	8.477	-------	-------	17.52	-------	-------	35.62	Intermediate Drainage Area North
9	Combine	7, 8	8.001	11.26	-------	-------	23.09	-------	-------	46.65	Intermediate Peripheral Area

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	28.50	2	722	75,151	------	------	------	Exisitng Peripheral Drainage Area No
2	SCS Runoff	3.095	2	722	8,861	------	------	------	Existing Peripheral Drainage Area So
3	Combine	31.60	2	722	84,012	1, 2	------	------	Total Existing Peripheral Drainage Ar
4	SCS Runoff	7.694	2	718	17,605	------	------	------	Proposed North Drainage Area
5	SCS Runoff	2.781	2	720	6,365	------	------	------	Proposed South drainage Area
6	Combine	10.46	2	718	23,970	4, 5	------	------	Total Proposed Peripheral Drainage
7	SCS Runoff	2.781	2	720	6,365	------	------	------	Intermediate South drainage Area
8	SCS Runoff	8.477	2	720	19,423	------	------	------	Intermediate Drainage Area North
9	Combine	11.26	2	720	25,788	7, 8	------	------	Intermediate Peripheral Area

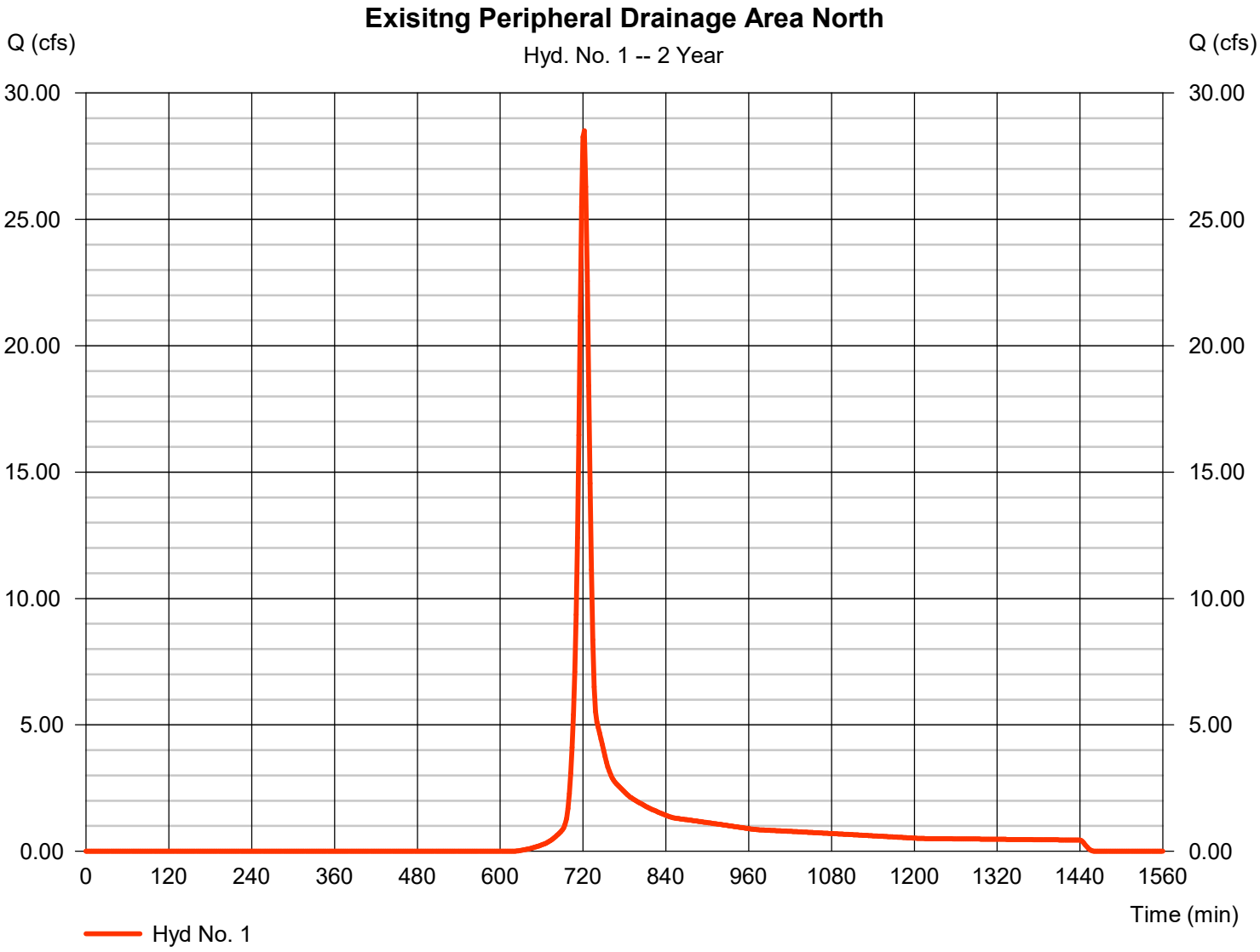
Hydrograph Report

Hyd. No. 1

Exisitng Peripheral Drainage Area North

Hydrograph type	= SCS Runoff	Peak discharge	= 28.50 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 75,151 cuft
Drainage area	= 14.700 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.70 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.700 x 74)] / 14.700



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No. 1

Exisitng Peripheral Drainage Area North

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 1.20		0.00		0.00		
Travel Time (min)	**= 6.44**	**+**	**0.00**	**+**	**0.00**	**=**	**6.44**
Shallow Concentrated Flow							
Flow length (ft)	= 340.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.79		0.00		0.00		
Travel Time (min)	**= 2.03**	**+**	**0.00**	**+**	**0.00**	**=**	**2.03**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 15.00		0.00		0.00		
Channel slope (%)	= 3.00		0.00		0.00		
Manning's n-value	= 0.050		0.015		0.015		
Velocity (ft/s)	=5.39						
			0.00				
					0.00		
Flow length (ft)	({0})730.0		0.0		0.0		
Travel Time (min)	**= 2.26**	**+**	**0.00**	**+**	**0.00**	**=**	**2.26**

Total Travel Time, Tc ..... 10.70 min

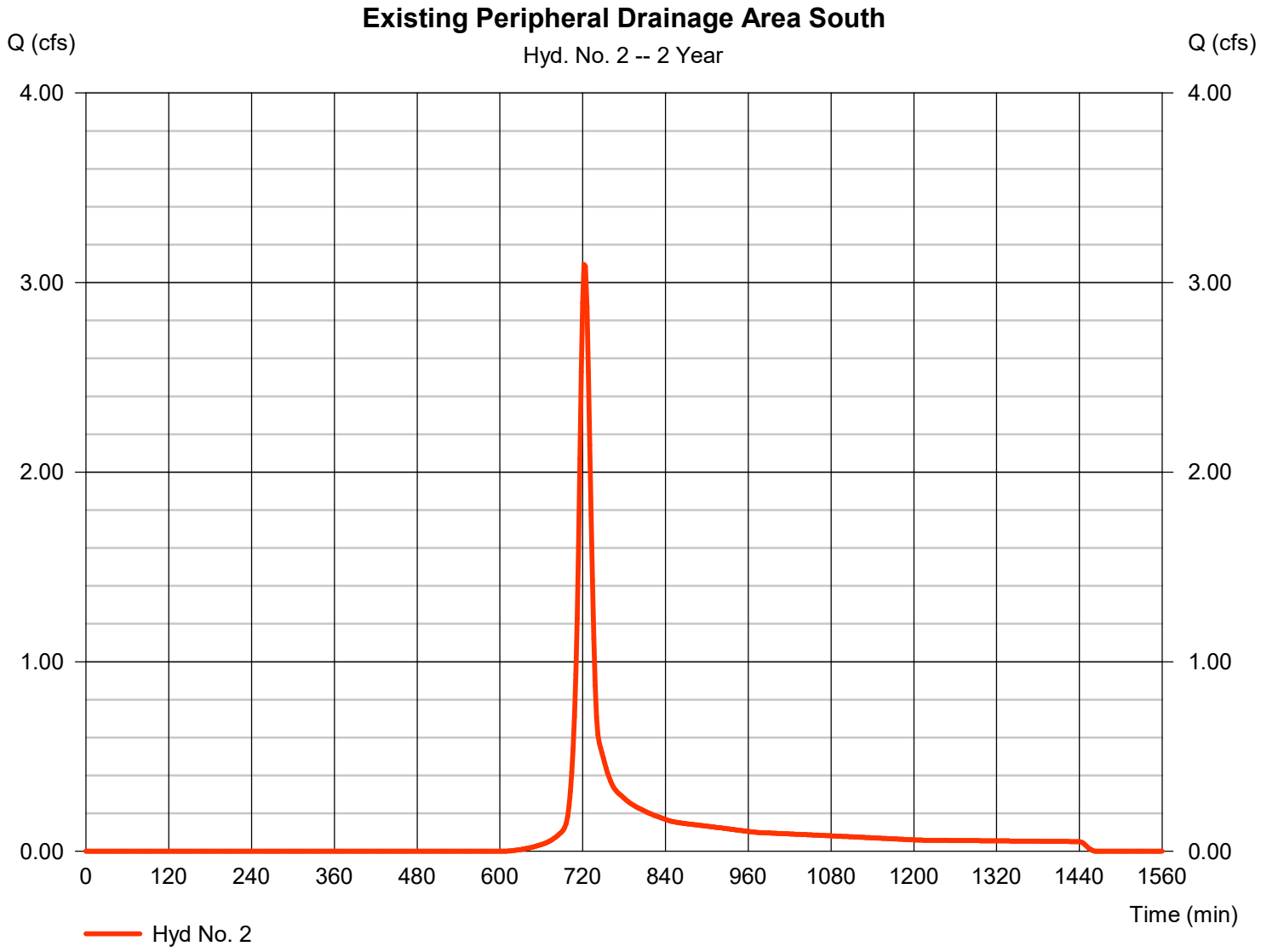
Hydrograph Report

Hyd. No. 2

Existing Peripheral Drainage Area South

Hydrograph type	= SCS Runoff	Peak discharge	= 3.095 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 8,861 cuft
Drainage area	= 1.750 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.20 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.087 x 99) + (1.660 x 74)] / 1.750



TR55 Tc Worksheet

Hyd. No. 2

Existing Peripheral Drainage Area South

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 14.18**	**+**	**0.00**	**+**	**0.00**	**=**	**14.18**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.050		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

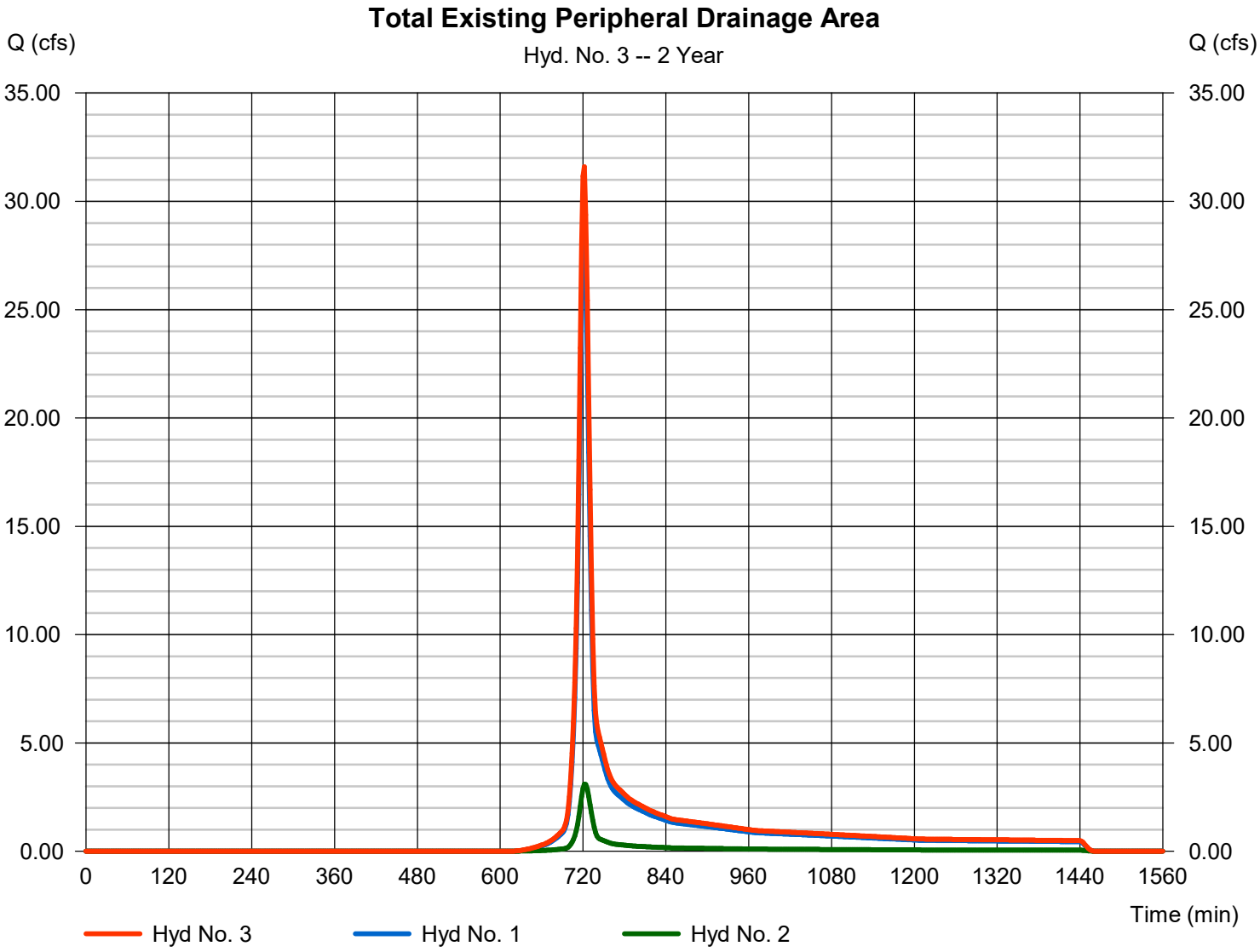
Total Travel Time, Tc ..... 14.20 min

Hydrograph Report

Hyd. No. 3

Total Existing Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 31.60 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 84,012 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 16.450 ac



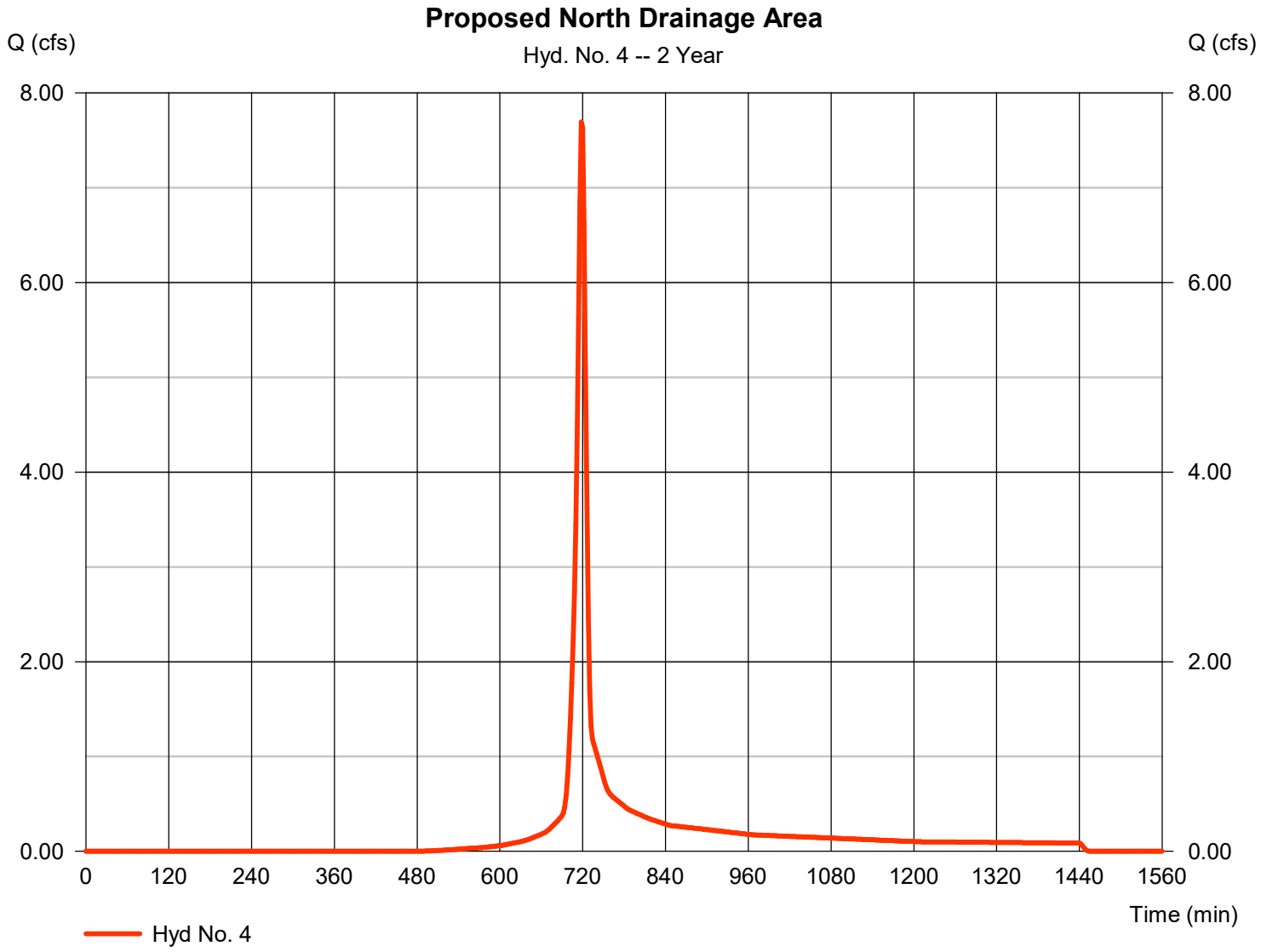
Hydrograph Report

Hyd. No. 4

Proposed North Drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.694 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	17,605 cuft
Drainage area	=	2.510 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.70 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.510 x 82)] / 2.510



TR55 Tc Worksheet

Hyd. No. 4

Proposed North Drainage Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 1.20		0.00		0.00		
Travel Time (min)	**= 6.44**	**+**	**0.00**	**+**	**0.00**	**=**	**6.44**
Shallow Concentrated Flow							
Flow length (ft)	= 100.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.79		0.00		0.00		
Travel Time (min)	**= 0.60**	**+**	**0.00**	**+**	**0.00**	**=**	**0.60**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 15.00		0.00		0.00		
Channel slope (%)	= 3.00		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=8.98						
			0.00				
					0.00		
Flow length (ft)	({0})1460.0		0.0		0.0		
Travel Time (min)	**= 2.71**	**+**	**0.00**	**+**	**0.00**	**=**	**2.71**

Total Travel Time, Tc ..... 9.70 min

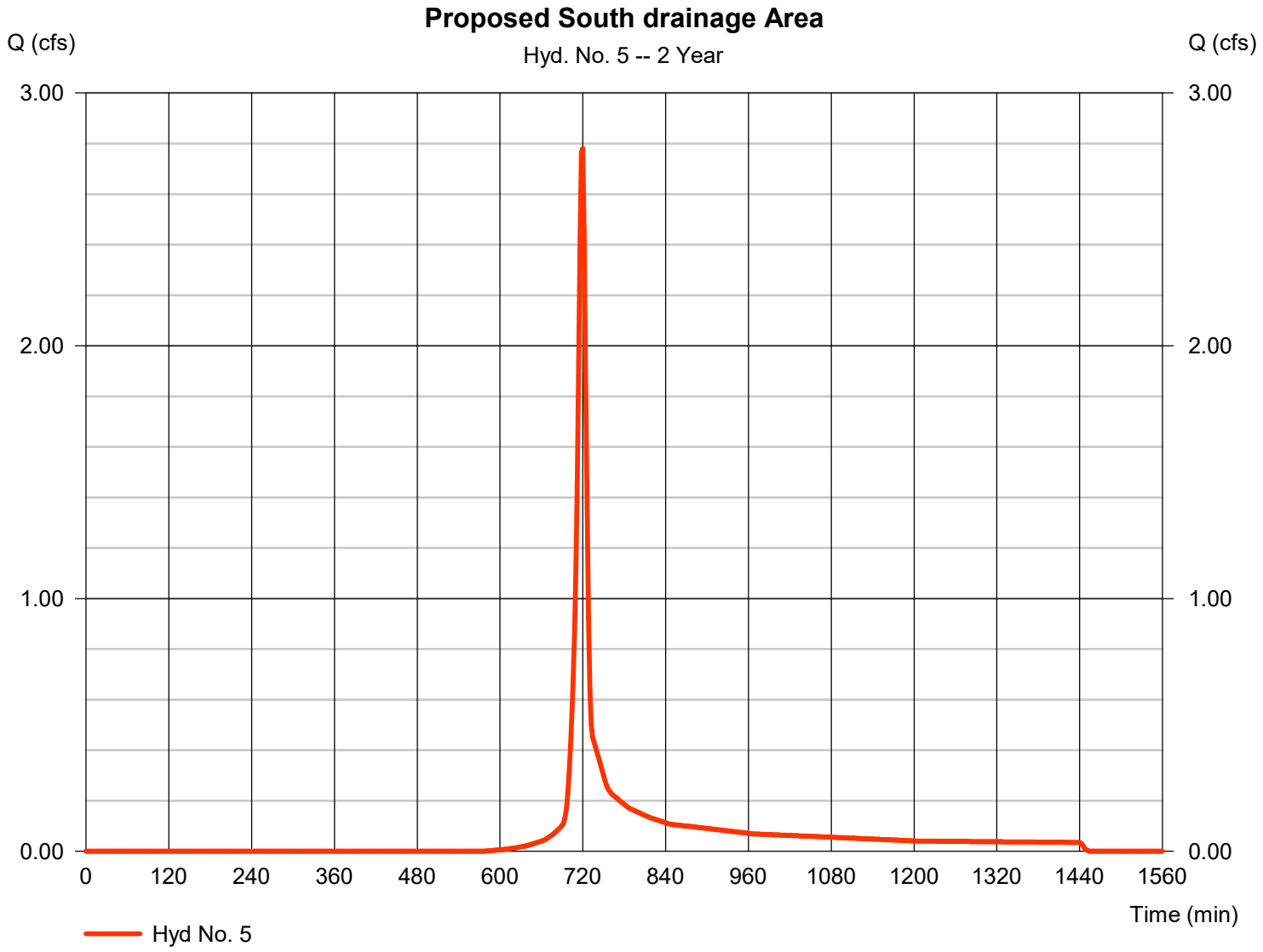
Hydrograph Report

Hyd. No. 5

Proposed South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.781 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,365 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120



TR55 Tc Worksheet

Hyd. No. 5

Proposed South drainage Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 80.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 8.57**	**+**	**0.00**	**+**	**0.00**	**=**	**8.57**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.013		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

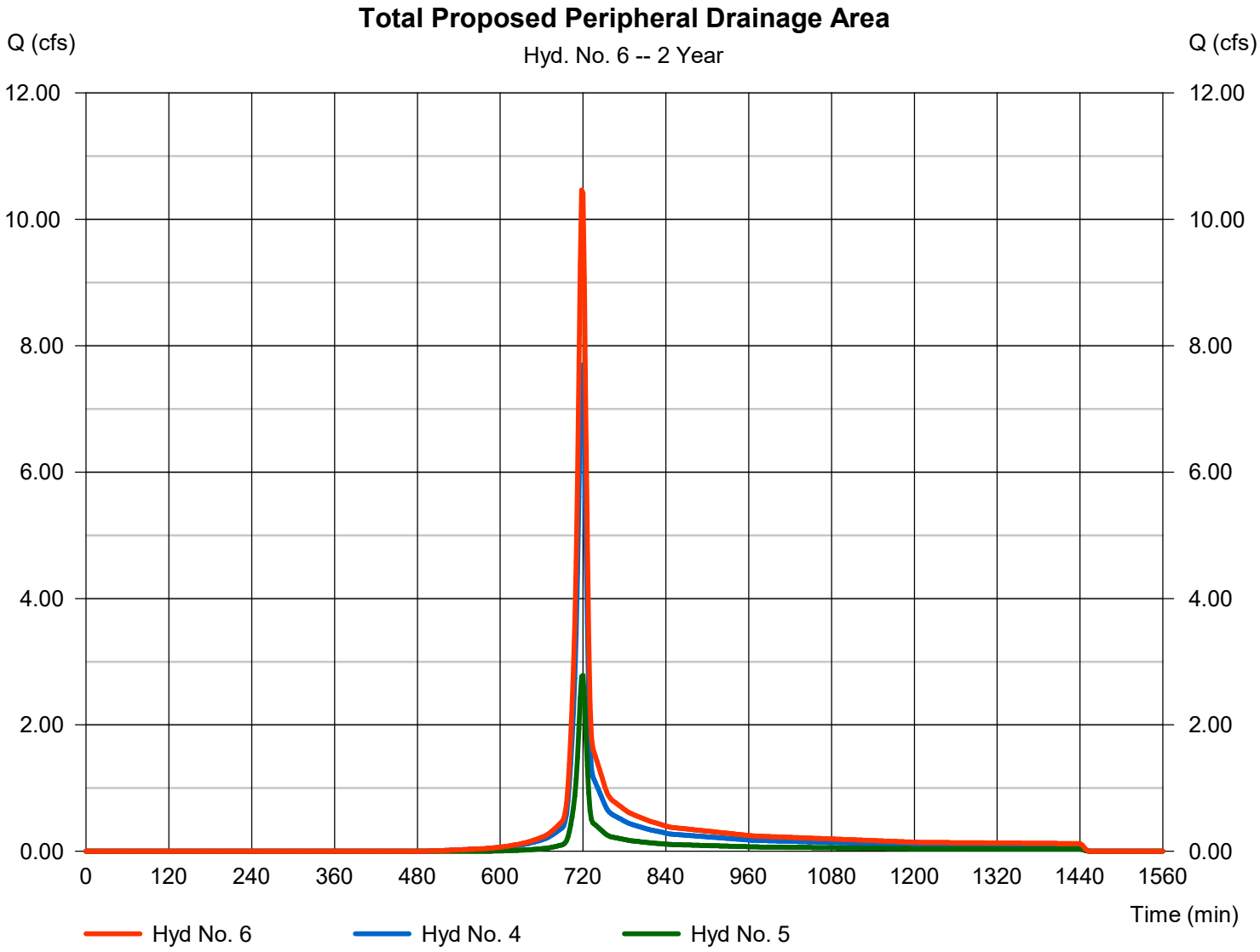
Total Travel Time, Tc ..... 8.60 min

Hydrograph Report

Hyd. No. 6

Total Proposed Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 10.46 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,970 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.630 ac



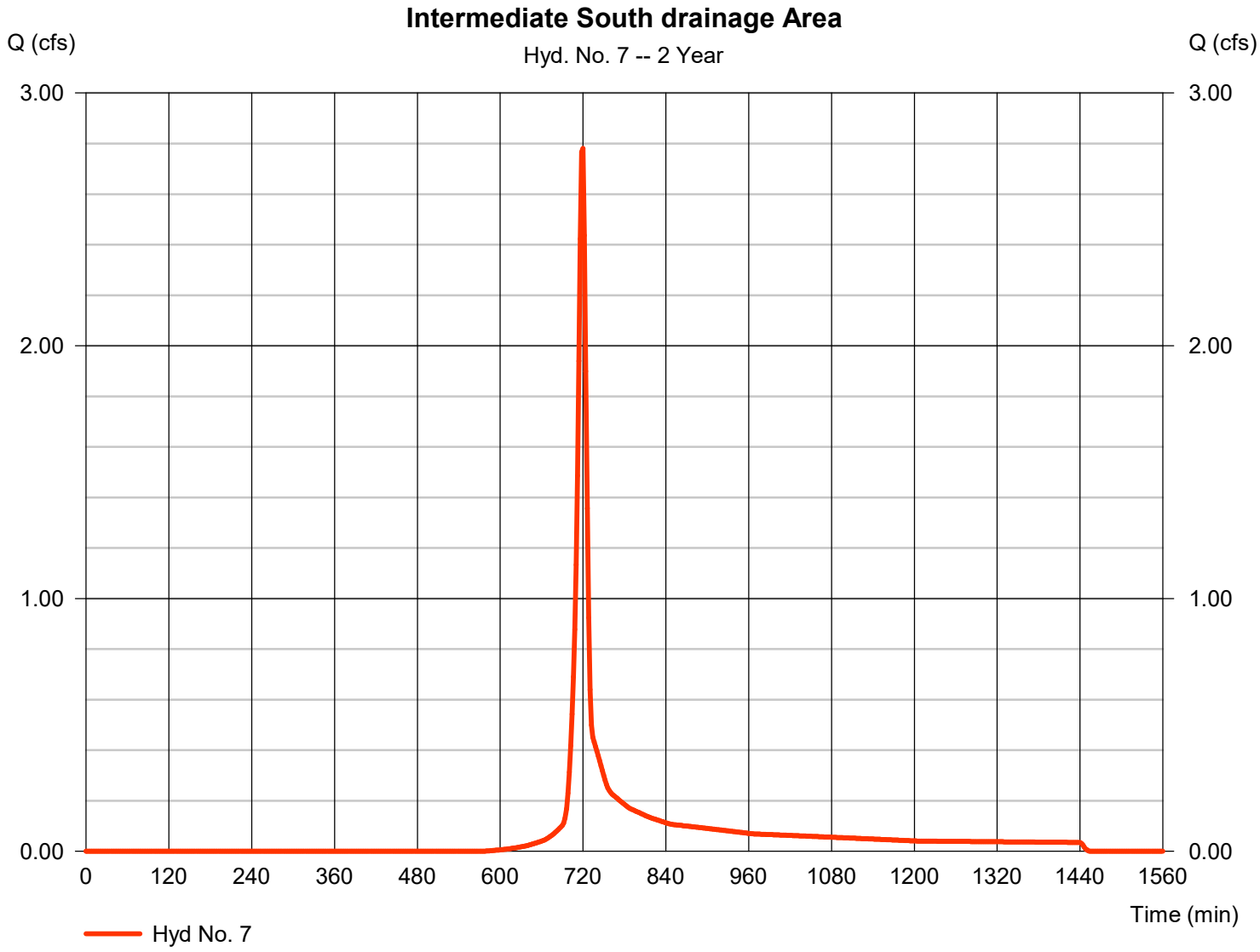
Hydrograph Report

Hyd. No. 7

Intermediate South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.781 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,365 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120



TR55 Tc Worksheet

Hyd. No. 7

Intermediate South drainage Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 80.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 8.57**	**+**	**0.00**	**+**	**0.00**	**=**	**8.57**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.013		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.60 min

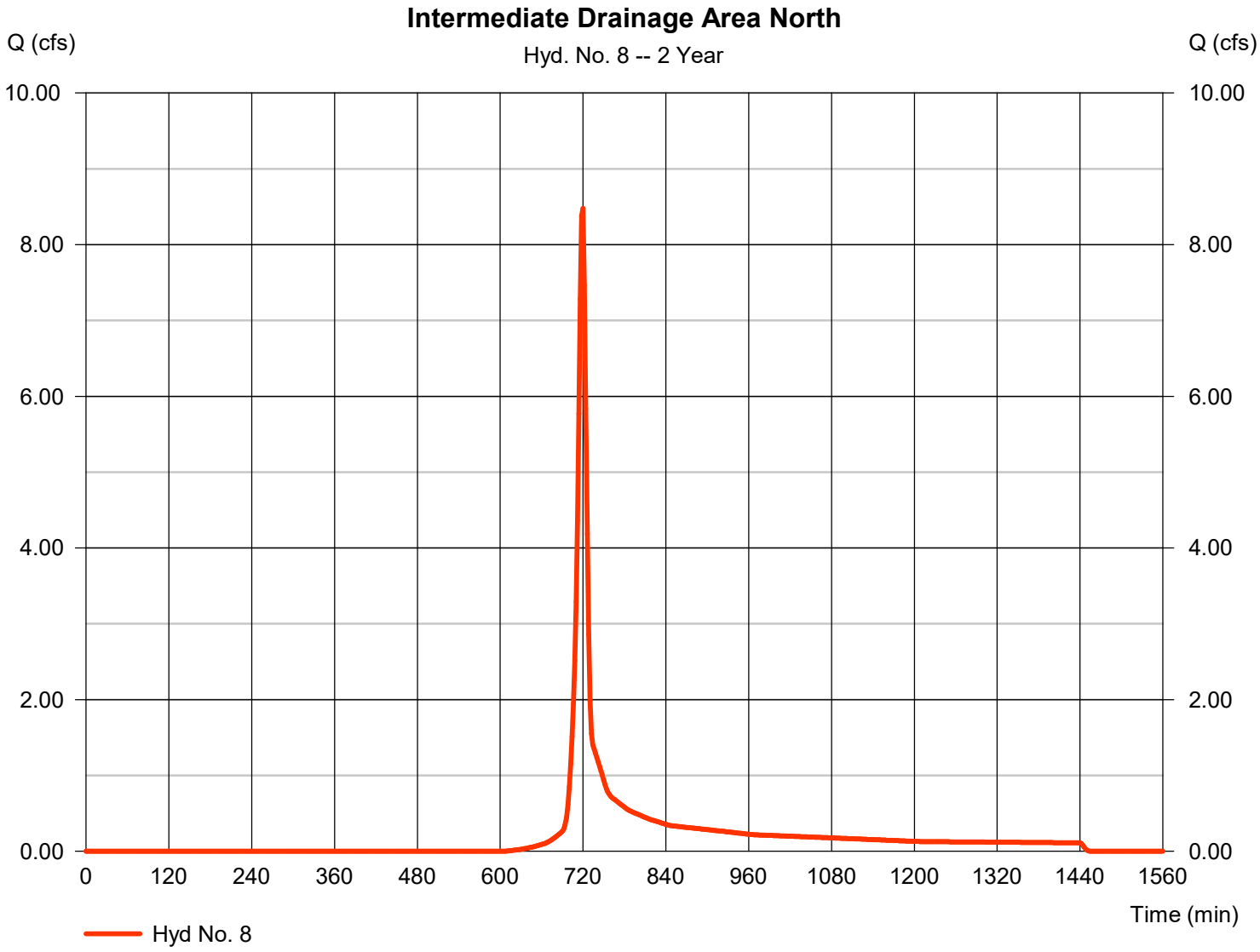
Hydrograph Report

Hyd. No. 8

Intermediate Drainage Area North

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.477 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	19,423 cuft
Drainage area	=	3.740 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.80 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 82) + (2.310 x 74)] / 3.740



TR55 Tc Worksheet

Hyd. No. 8

Intermediate Drainage Area North

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 170.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.68		0.00		0.00		
Land slope (%)	= 4.90		0.00		0.00		
Travel Time (min)	**= 9.76**	**+**	**0.00**	**+**	**0.00**	**=**	**9.76**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

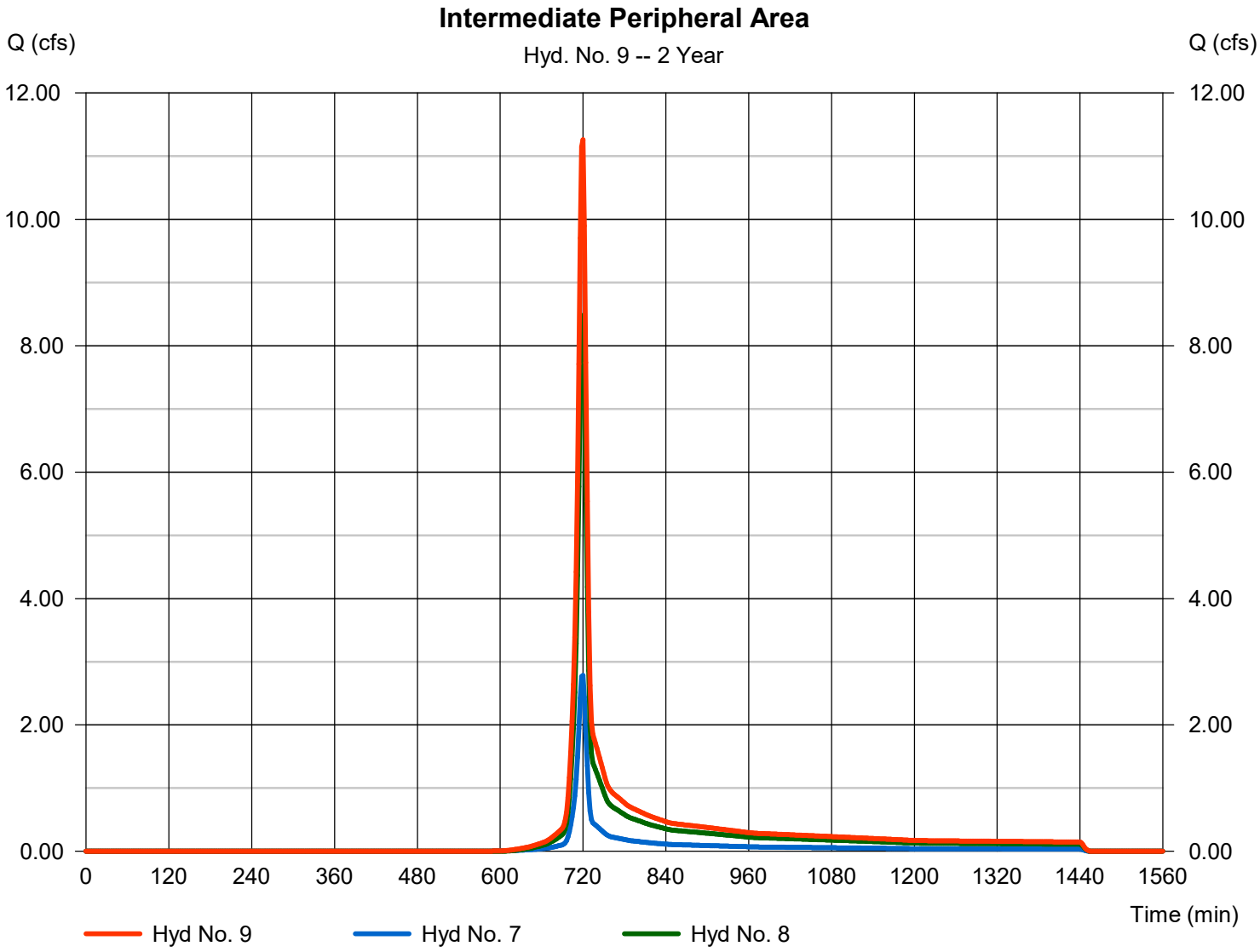
Total Travel Time, Tc ..... 9.80 min

Hydrograph Report

Hyd. No. 9

Intermediate Peripheral Area

Hydrograph type	= Combine	Peak discharge	= 11.26 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 25,788 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 4.860 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	60.68	2	720	157,369	------	------	------	Exisitng Peripheral Drainage Area No
2	SCS Runoff	6.523	2	722	18,287	------	------	------	Existing Peripheral Drainage Area So
3	Combine	66.88	2	720	175,656	1, 2	------	------	Total Existing Peripheral Drainage Ar
4	SCS Runoff	14.26	2	718	33,074	------	------	------	Proposed North Drainage Area
5	SCS Runoff	5.571	2	718	12,770	------	------	------	Proposed South drainage Area
6	Combine	19.83	2	718	45,844	4, 5	------	------	Total Proposed Peripheral Drainage
7	SCS Runoff	5.571	2	718	12,770	------	------	------	Intermediate South drainage Area
8	SCS Runoff	17.52	2	718	40,083	------	------	------	Intermediate Drainage Area North
9	Combine	23.09	2	718	52,853	7, 8	------	------	Intermediate Peripheral Area

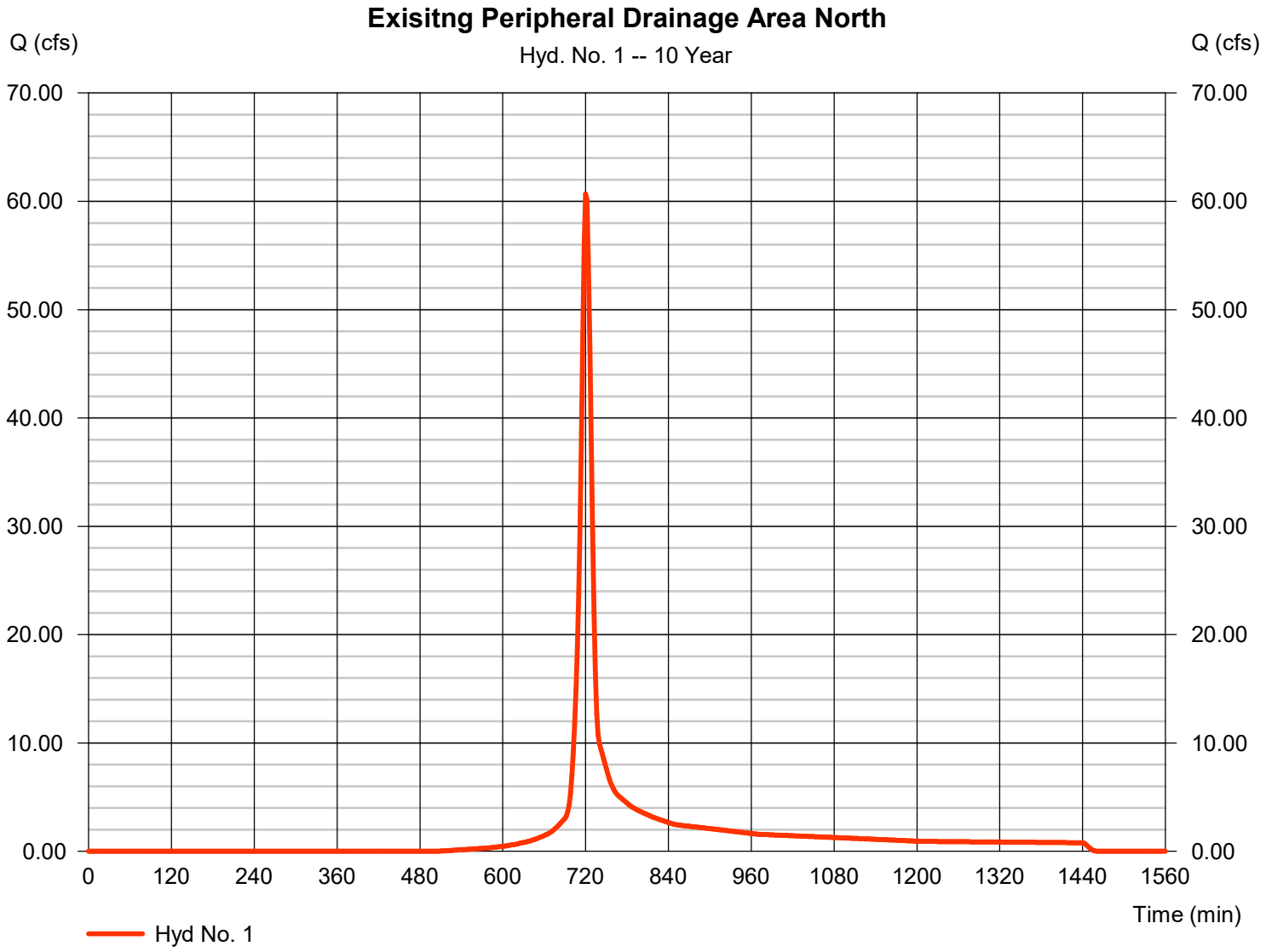
Hydrograph Report

Hyd. No. 1

Exisitng Peripheral Drainage Area North

Hydrograph type	=	SCS Runoff	Peak discharge	=	60.68 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	157,369 cuft
Drainage area	=	14.700 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.70 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(14.700 x 74)] / 14.700



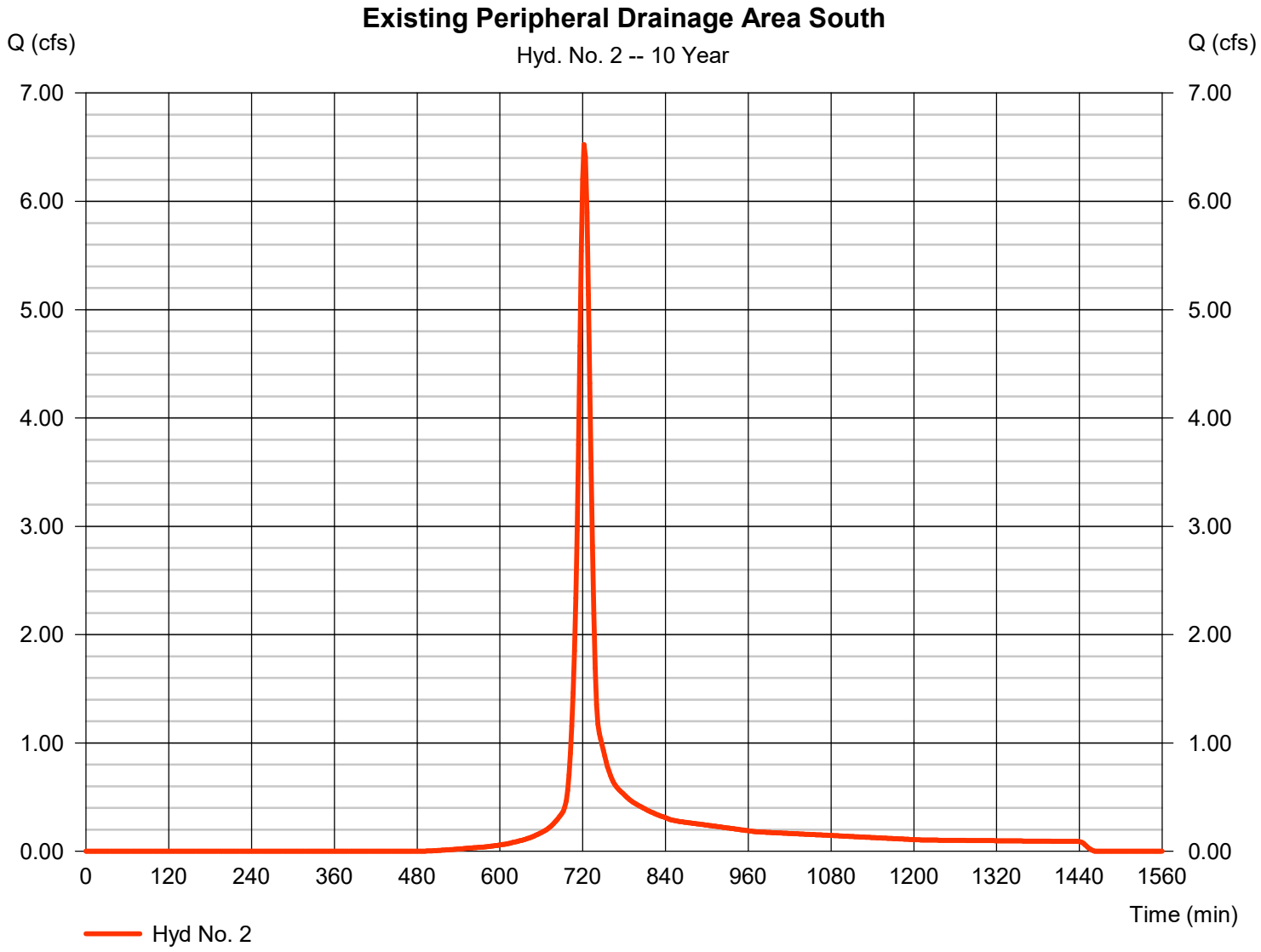
Hydrograph Report

Hyd. No. 2

Existing Peripheral Drainage Area South

Hydrograph type	= SCS Runoff	Peak discharge	= 6.523 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 18,287 cuft
Drainage area	= 1.750 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.20 min
Total precip.	= 5.61 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.087 x 99) + (1.660 x 74)] / 1.750

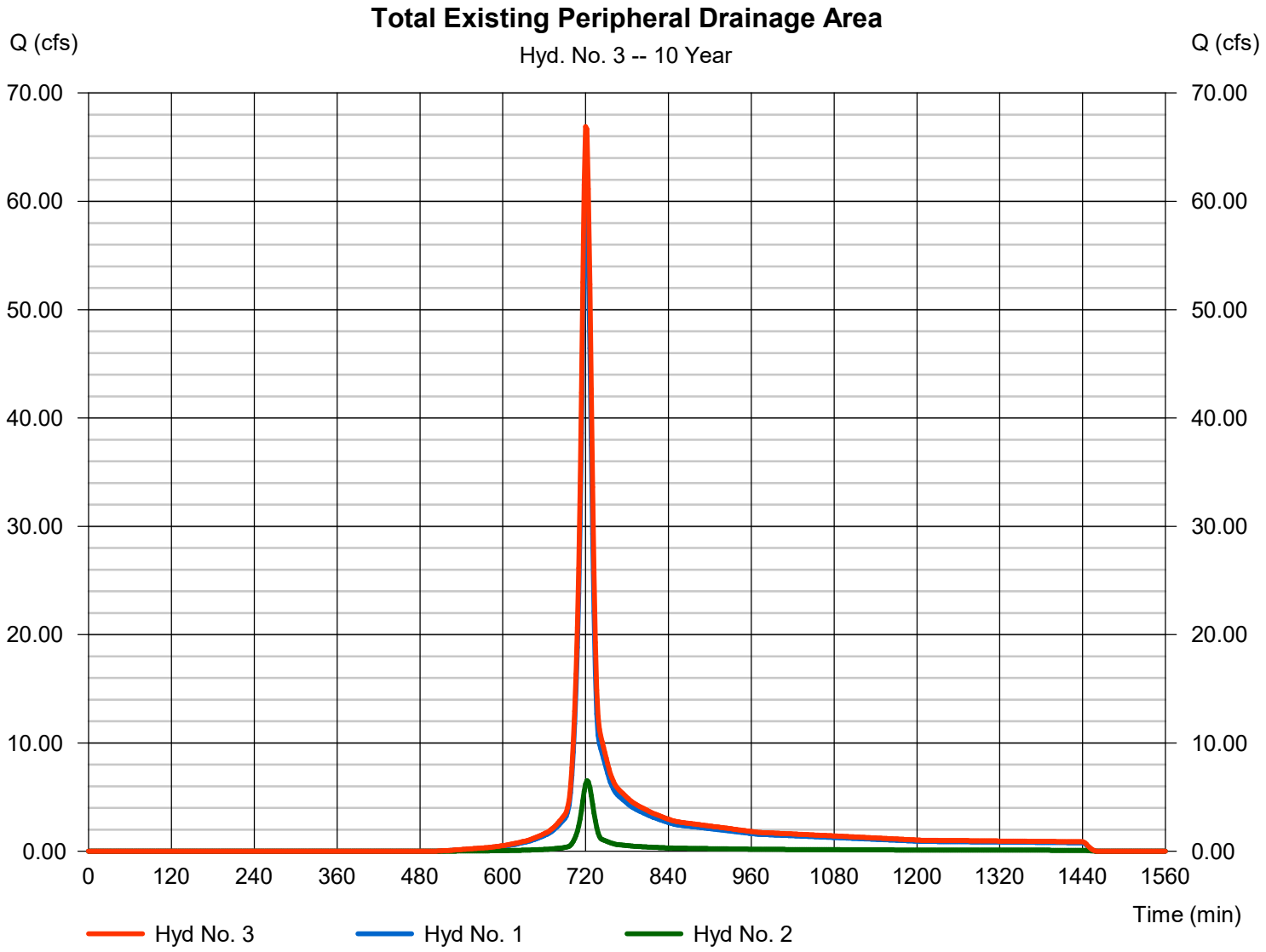


Hydrograph Report

Hyd. No. 3

Total Existing Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 66.88 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 175,656 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 16.450 ac



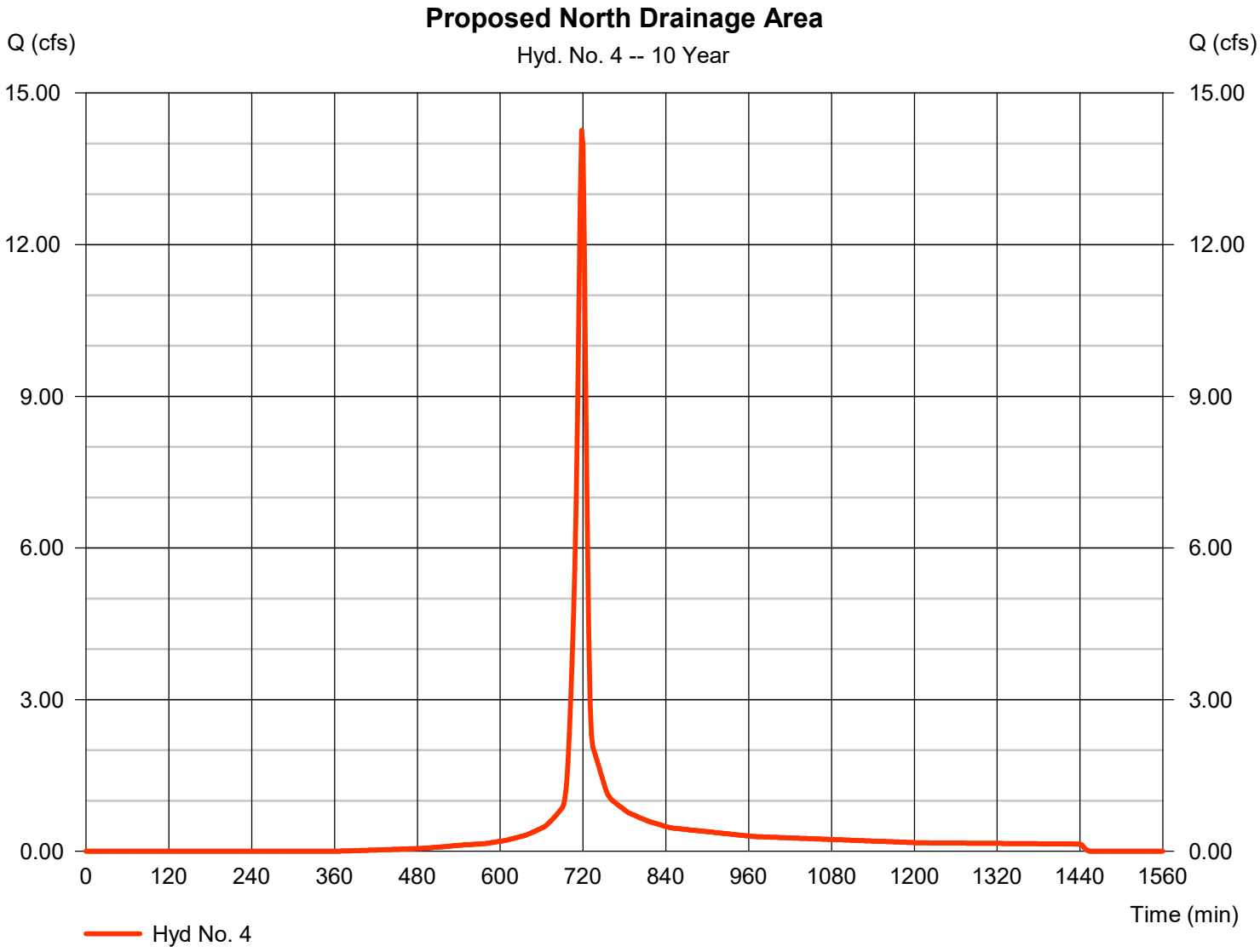
Hydrograph Report

Hyd. No. 4

Proposed North Drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	33,074 cuft
Drainage area	=	2.510 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.70 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.510 x 82)] / 2.510



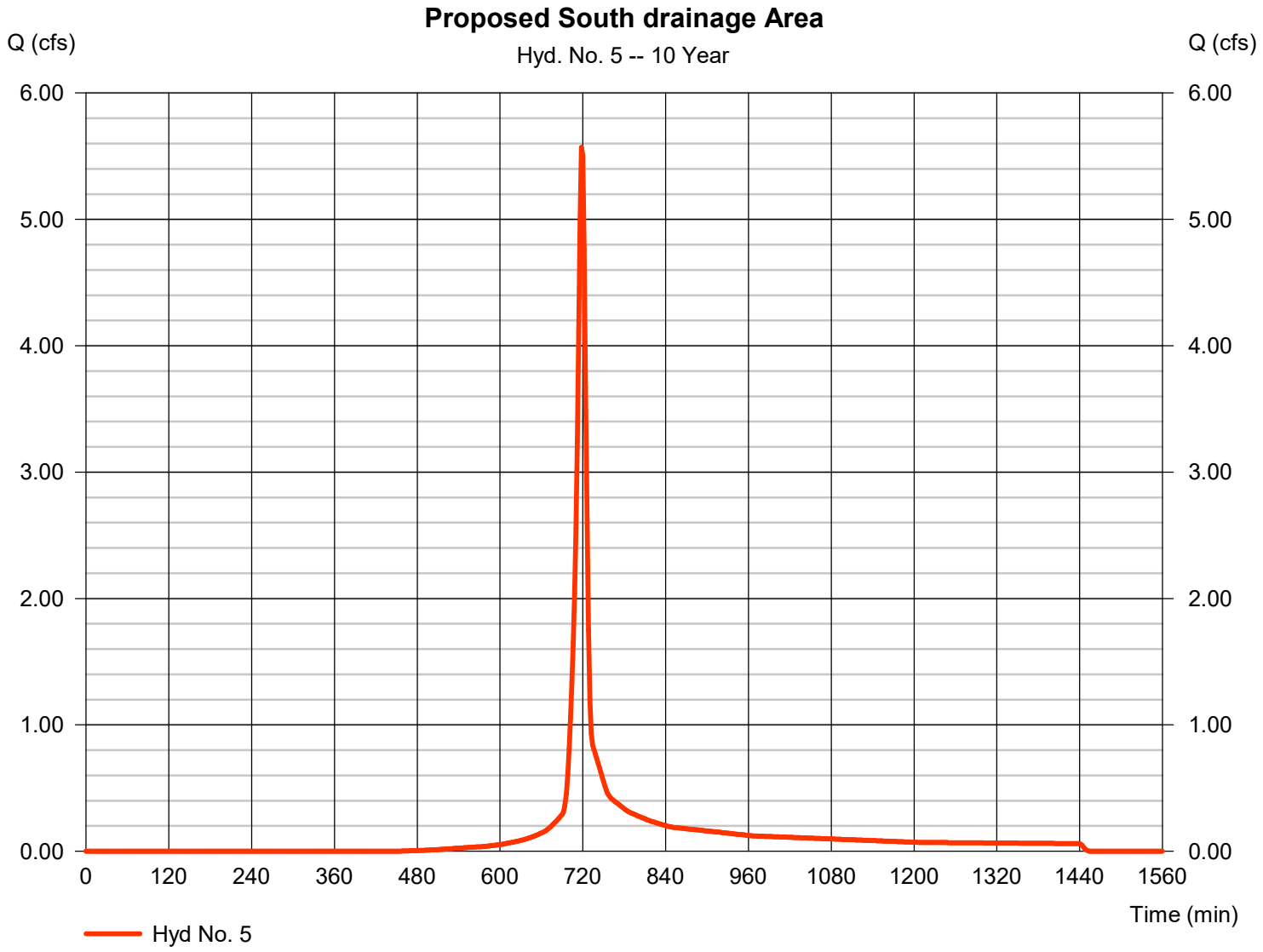
Hydrograph Report

Hyd. No. 5

Proposed South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.571 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,770 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120

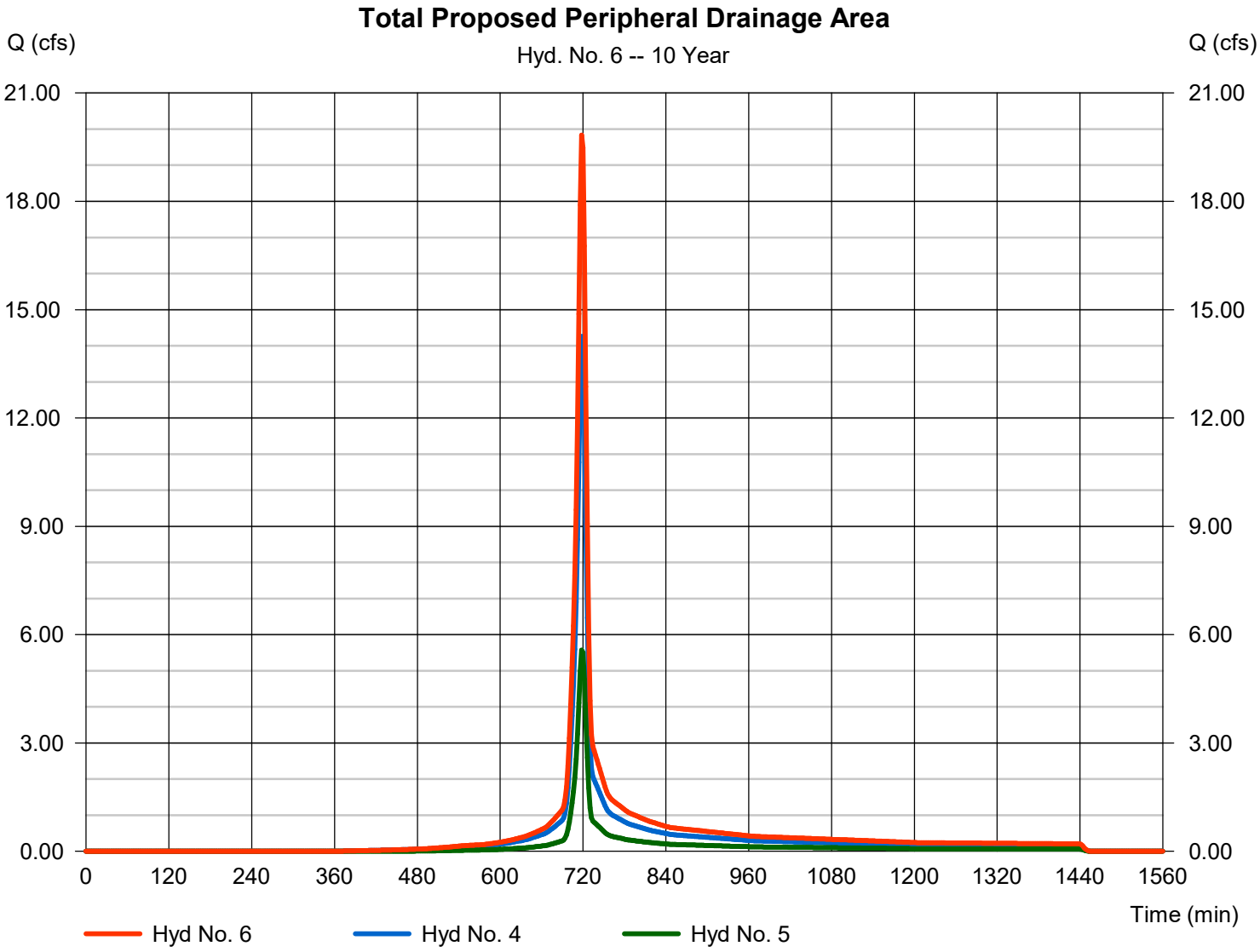


Hydrograph Report

Hyd. No. 6

Total Proposed Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 19.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 45,844 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.630 ac



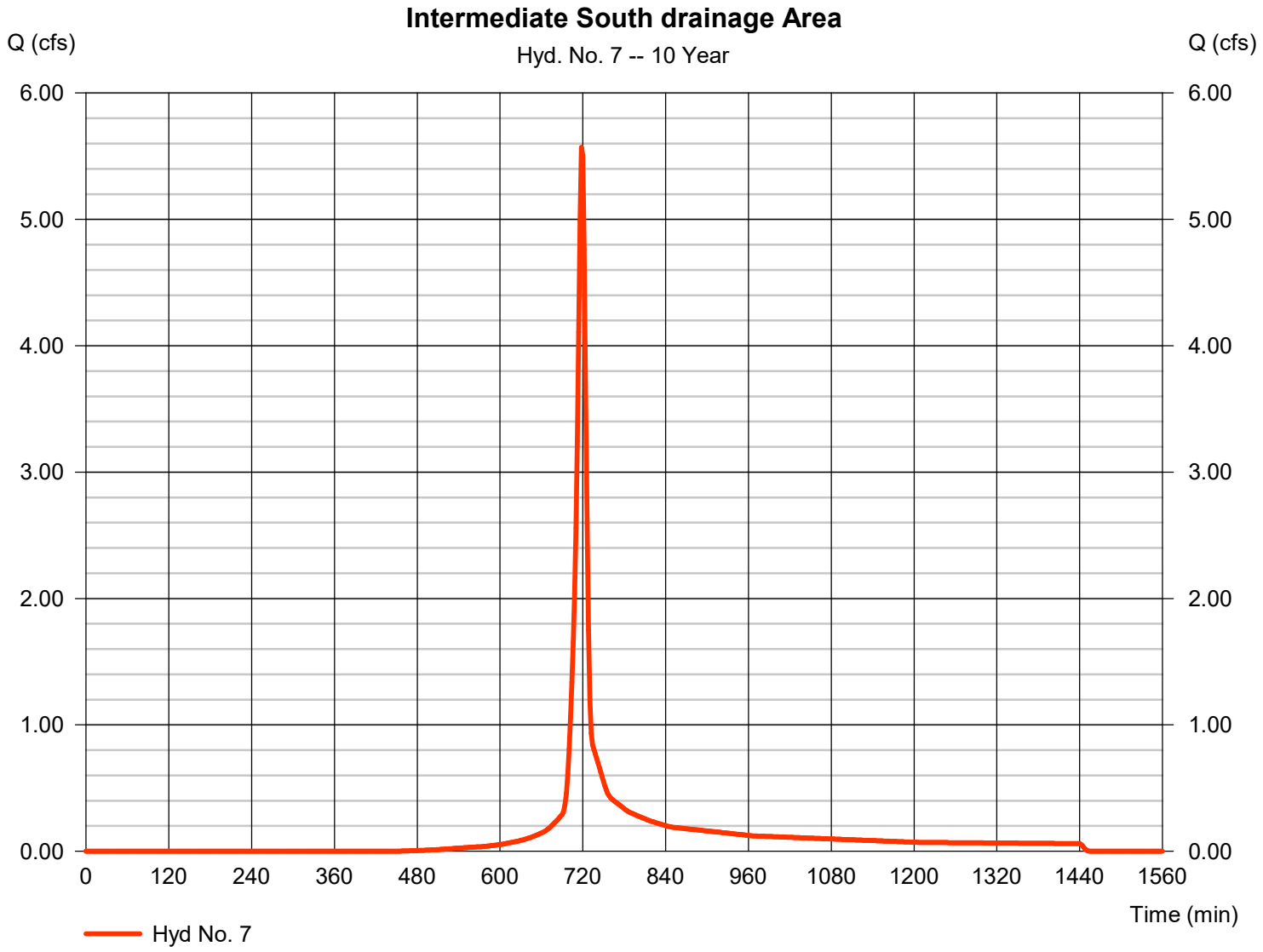
Hydrograph Report

Hyd. No. 7

Intermediate South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.571 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,770 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120



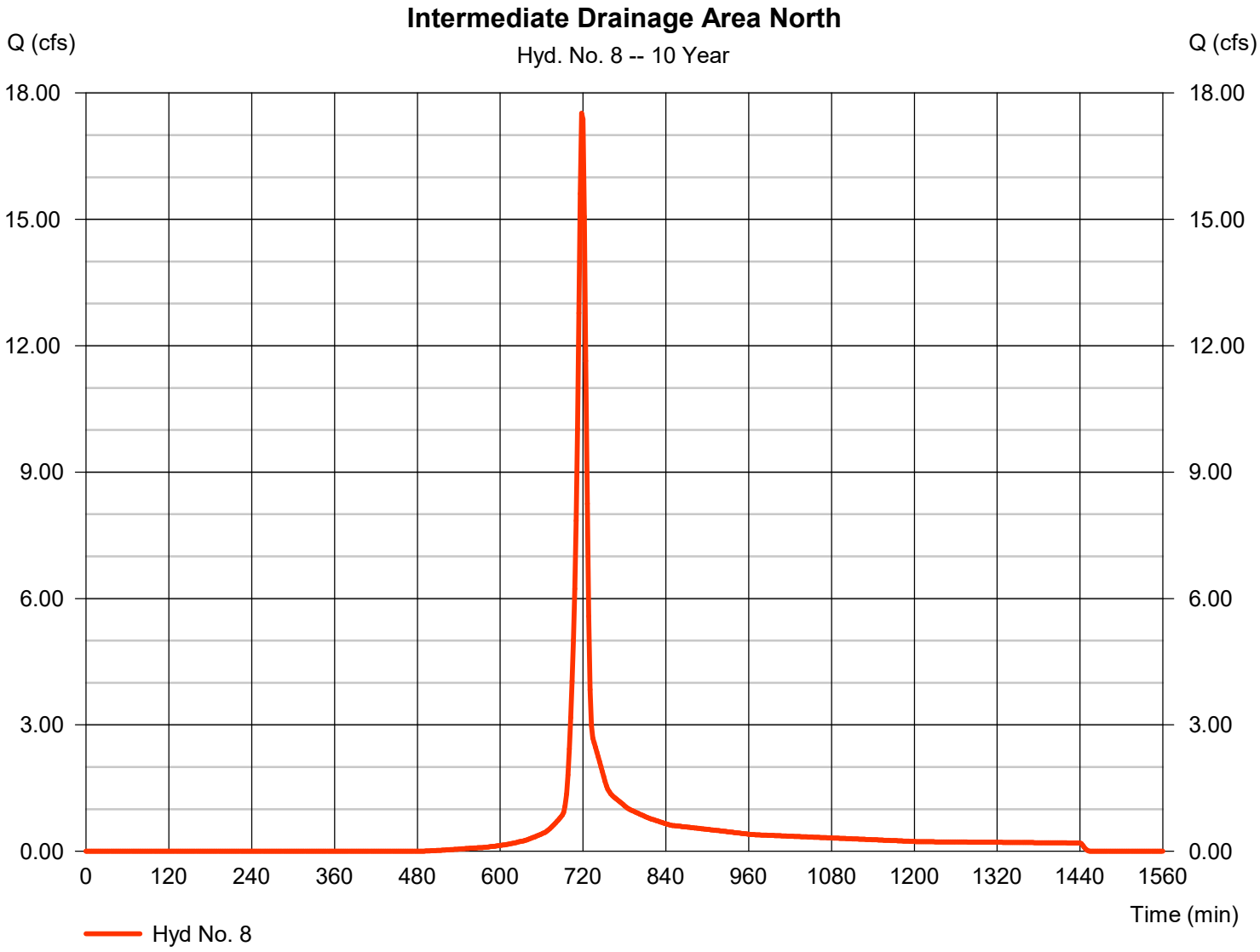
Hydrograph Report

Hyd. No. 8

Intermediate Drainage Area North

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.52 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	40,083 cuft
Drainage area	=	3.740 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.80 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 82) + (2.310 x 74)] / 3.740

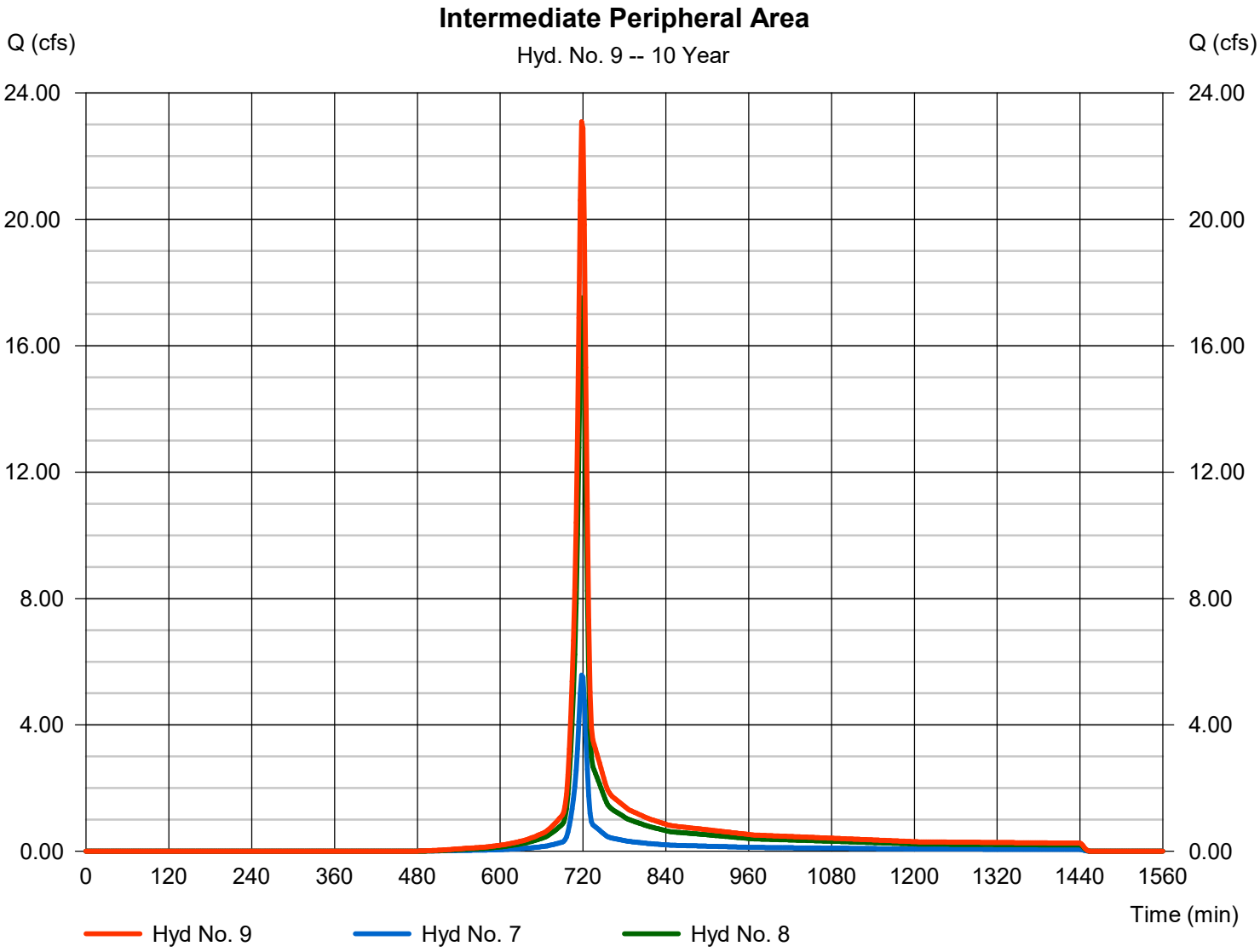


Hydrograph Report

Hyd. No. 9

Intermediate Peripheral Area

Hydrograph type	= Combine	Peak discharge	= 23.09 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 52,853 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 4.860 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	125.76	2	720	329,300	------	------	------	Exisitng Peripheral Drainage Area No
2	SCS Runoff	13.35	2	722	37,835	------	------	------	Existing Peripheral Drainage Area So
3	Combine	138.62	2	720	367,135	1, 2	------	------	Total Existing Peripheral Drainage Ar
4	SCS Runoff	26.57	2	718	63,568	------	------	------	Proposed North Drainage Area
5	SCS Runoff	11.03	2	718	25,847	------	------	------	Proposed South drainage Area
6	Combine	37.60	2	718	89,415	4, 5	------	------	Total Proposed Peripheral Drainage
7	SCS Runoff	11.03	2	718	25,847	------	------	------	Intermediate South drainage Area
8	SCS Runoff	35.62	2	718	82,933	------	------	------	Intermediate Drainage Area North
9	Combine	46.65	2	718	108,780	7, 8	------	------	Intermediate Peripheral Area

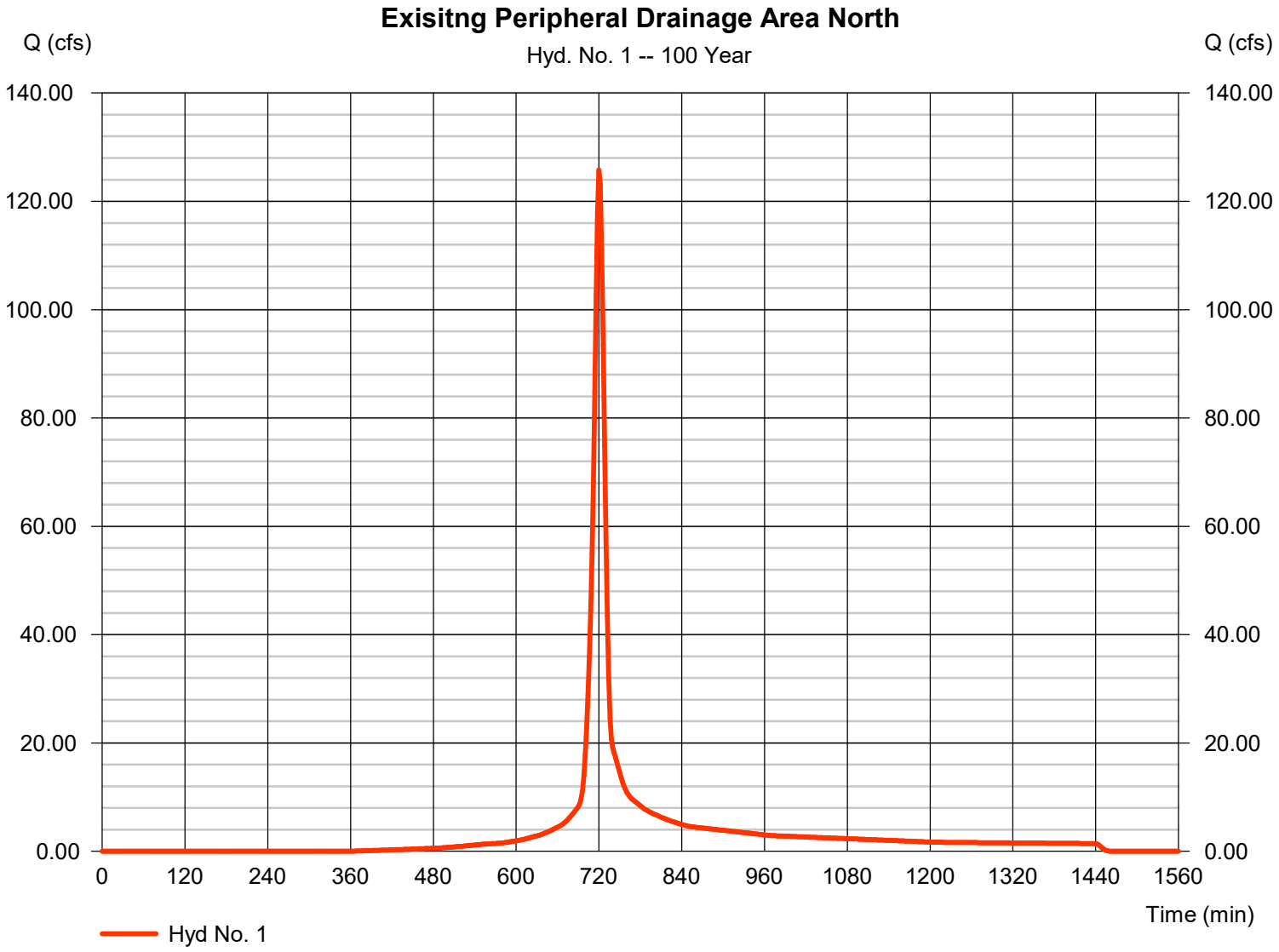
Hydrograph Report

Hyd. No. 1

Exisitng Peripheral Drainage Area North

Hydrograph type	= SCS Runoff	Peak discharge	= 125.76 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 329,300 cuft
Drainage area	= 14.700 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.70 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.700 x 74)] / 14.700



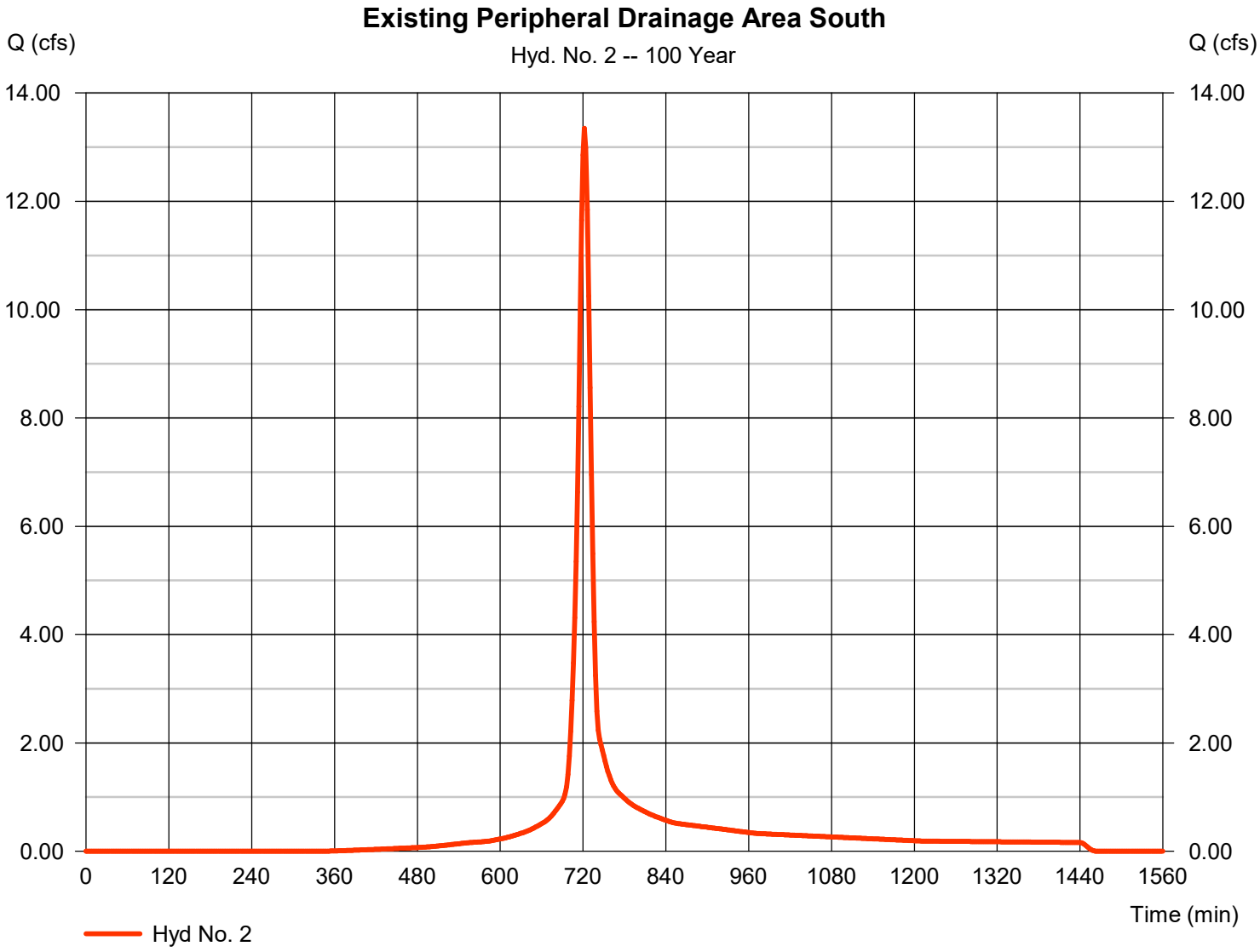
Hydrograph Report

Hyd. No. 2

Existing Peripheral Drainage Area South

Hydrograph type	= SCS Runoff	Peak discharge	= 13.35 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 37,835 cuft
Drainage area	= 1.750 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.20 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.087 x 99) + (1.660 x 74)] / 1.750

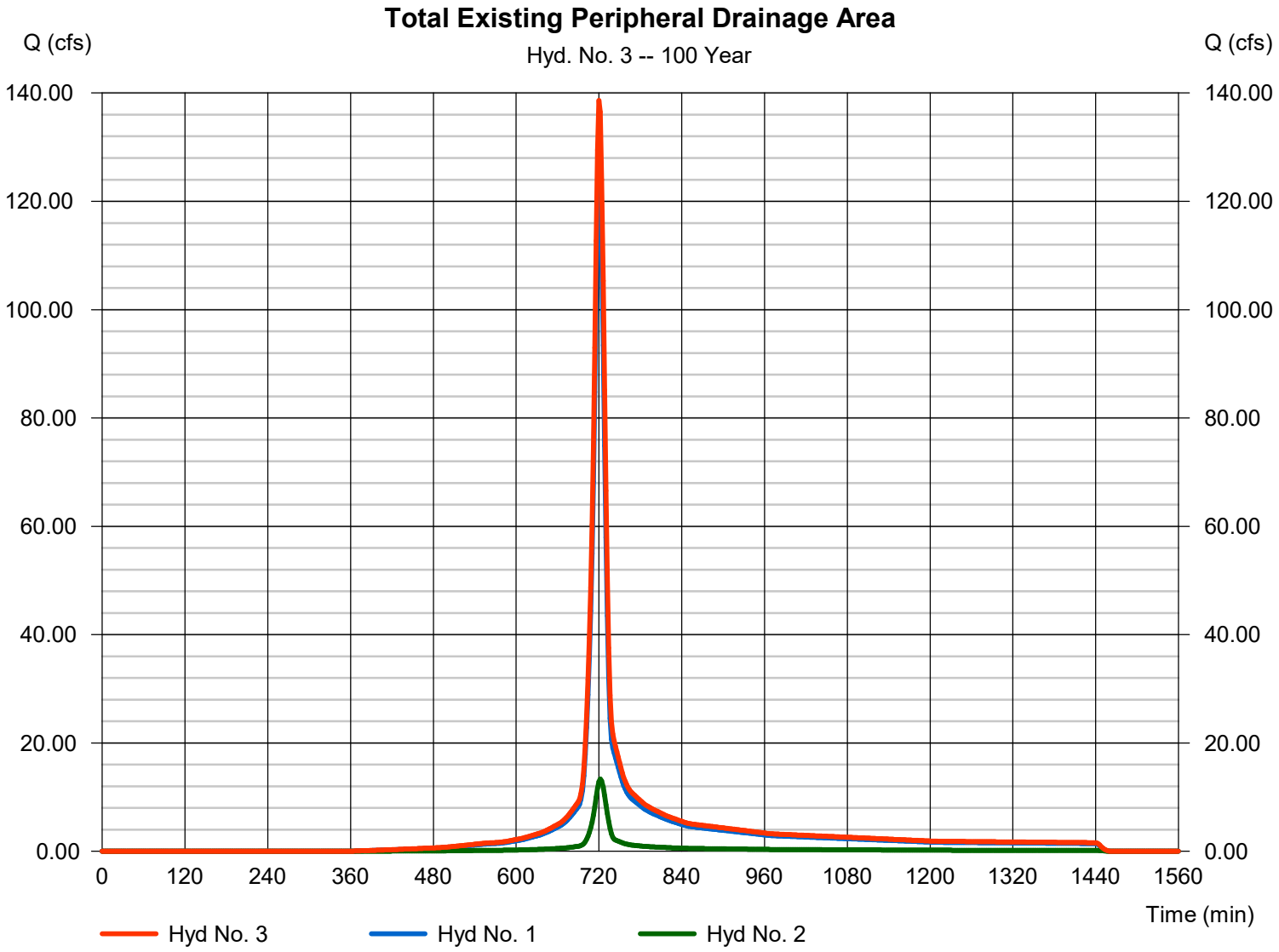


Hydrograph Report

Hyd. No. 3

Total Existing Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 138.62 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 367,135 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 16.450 ac



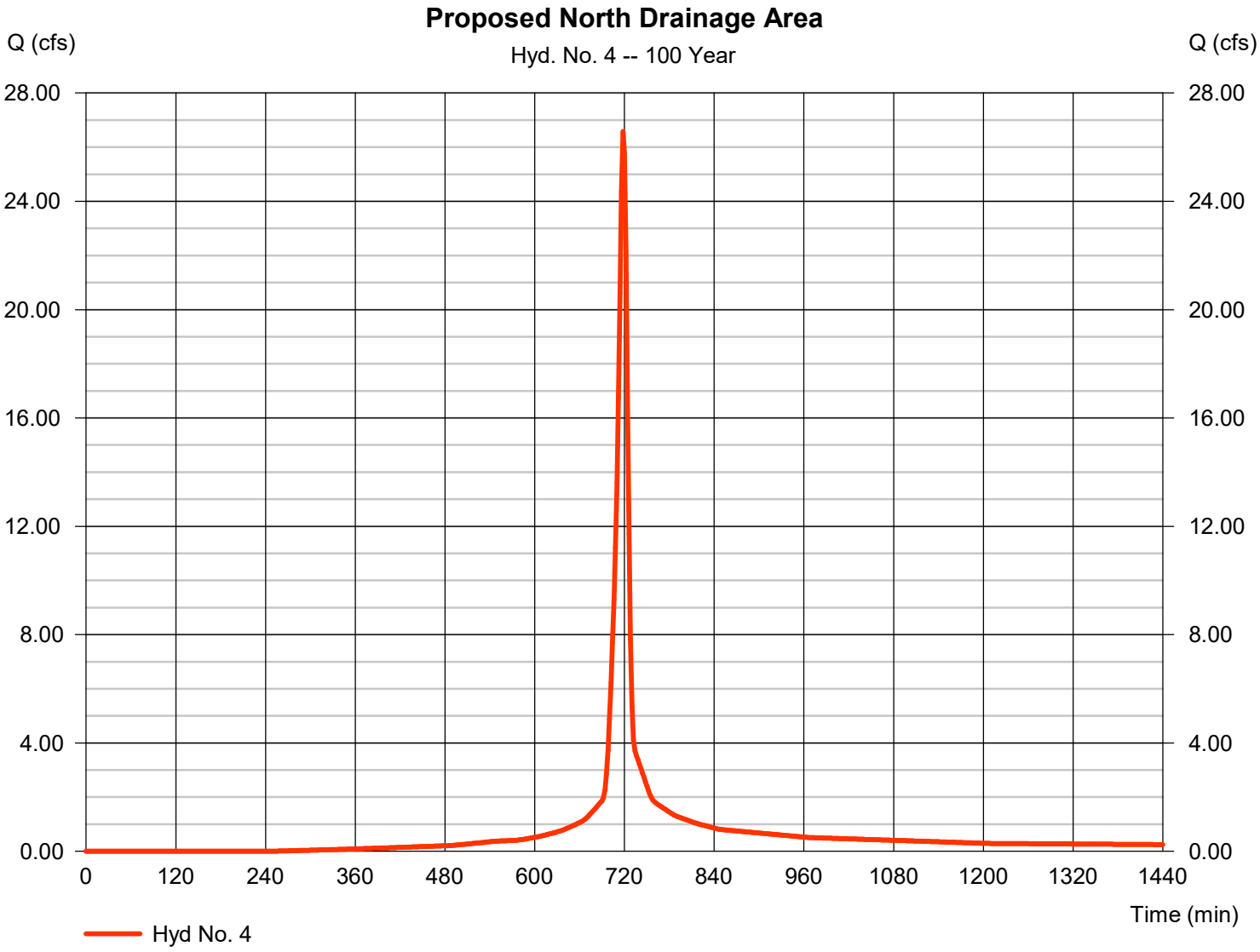
Hydrograph Report

Hyd. No. 4

Proposed North Drainage Area

Hydrograph type	= SCS Runoff	Peak discharge	= 26.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 63,568 cuft
Drainage area	= 2.510 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.510 x 82)] / 2.510



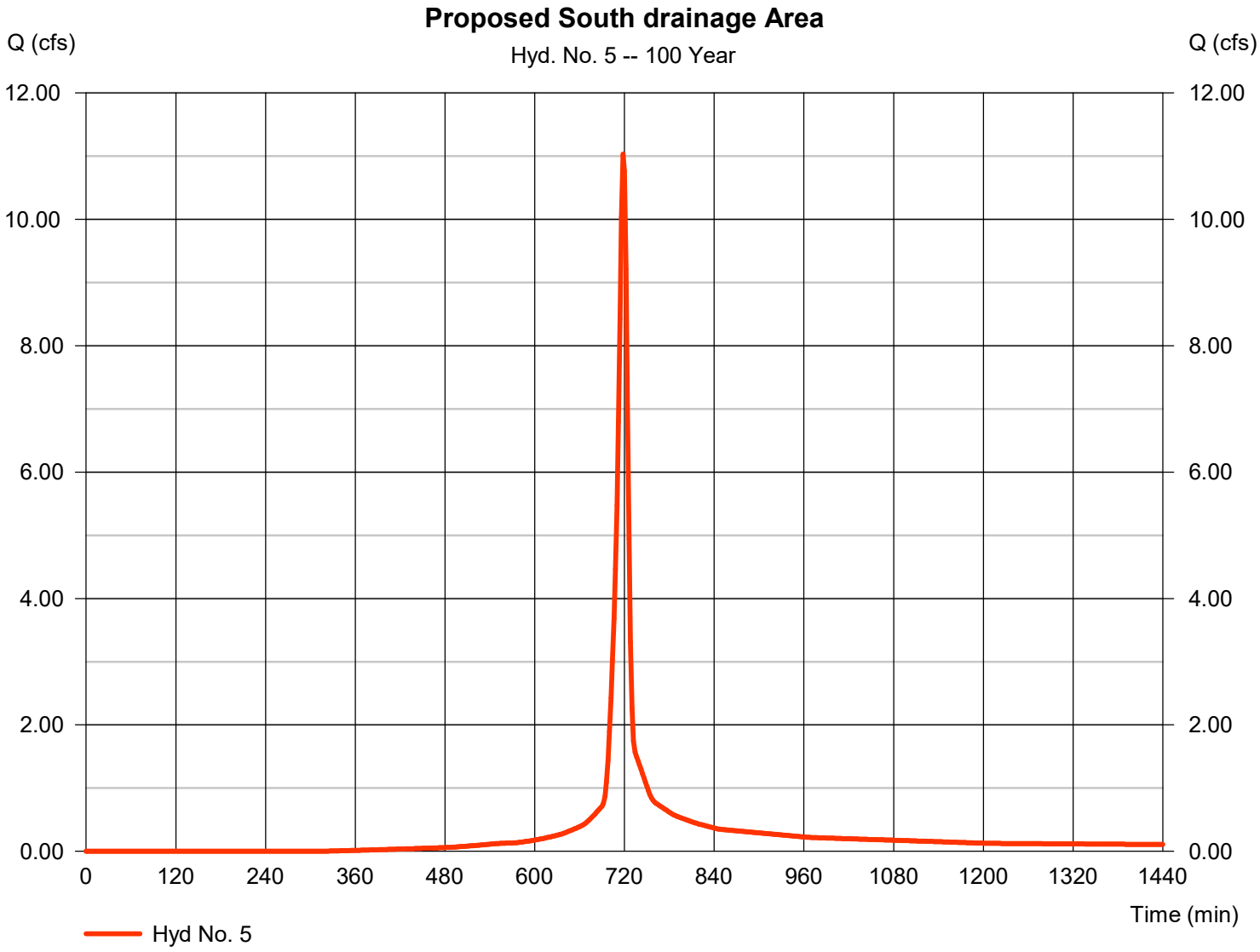
Hydrograph Report

Hyd. No. 5

Proposed South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.03 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	25,847 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	9.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120

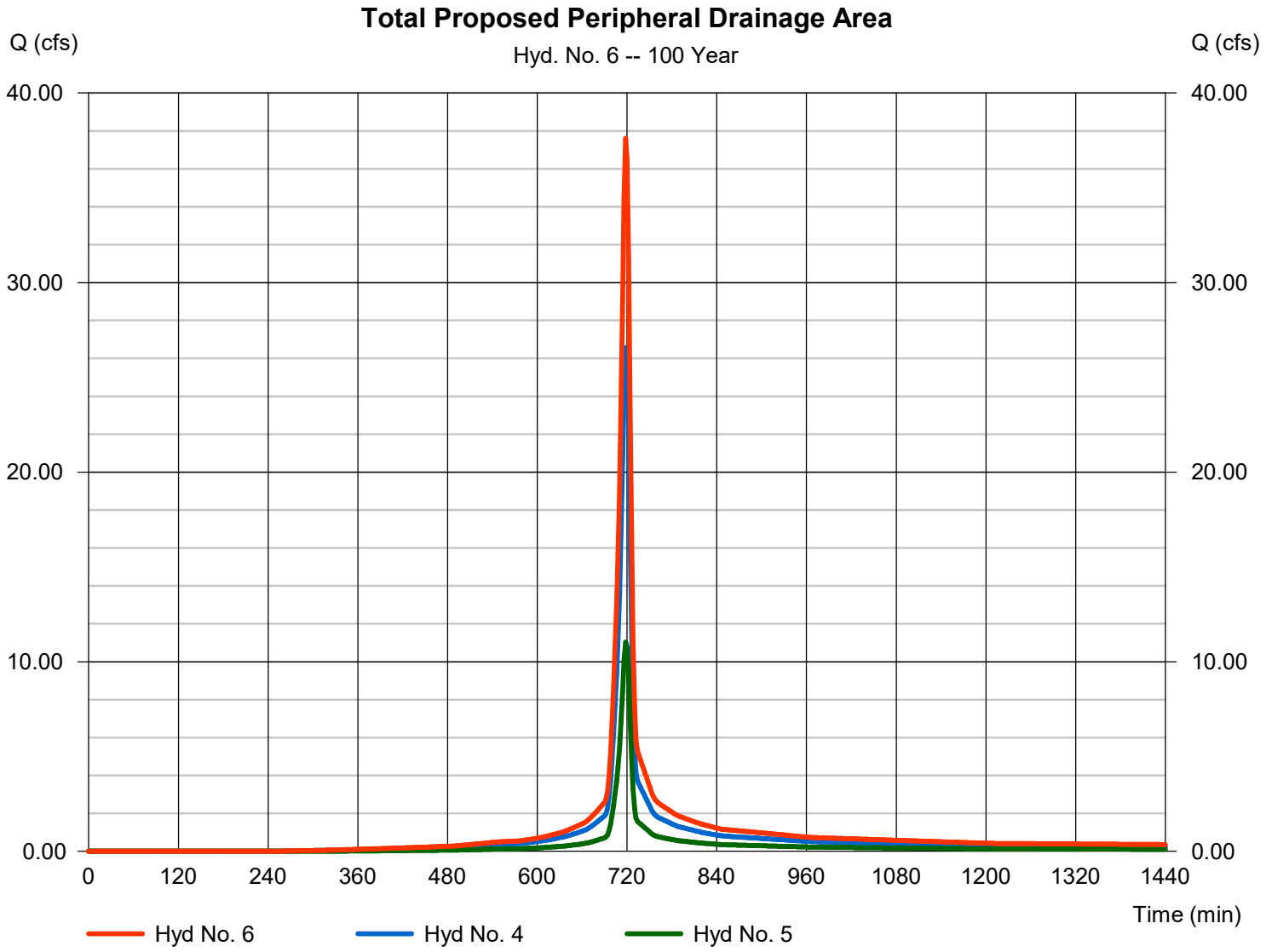


Hydrograph Report

Hyd. No. 6

Total Proposed Peripheral Drainage Area

Hydrograph type	= Combine	Peak discharge	= 37.60 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 89,415 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.630 ac



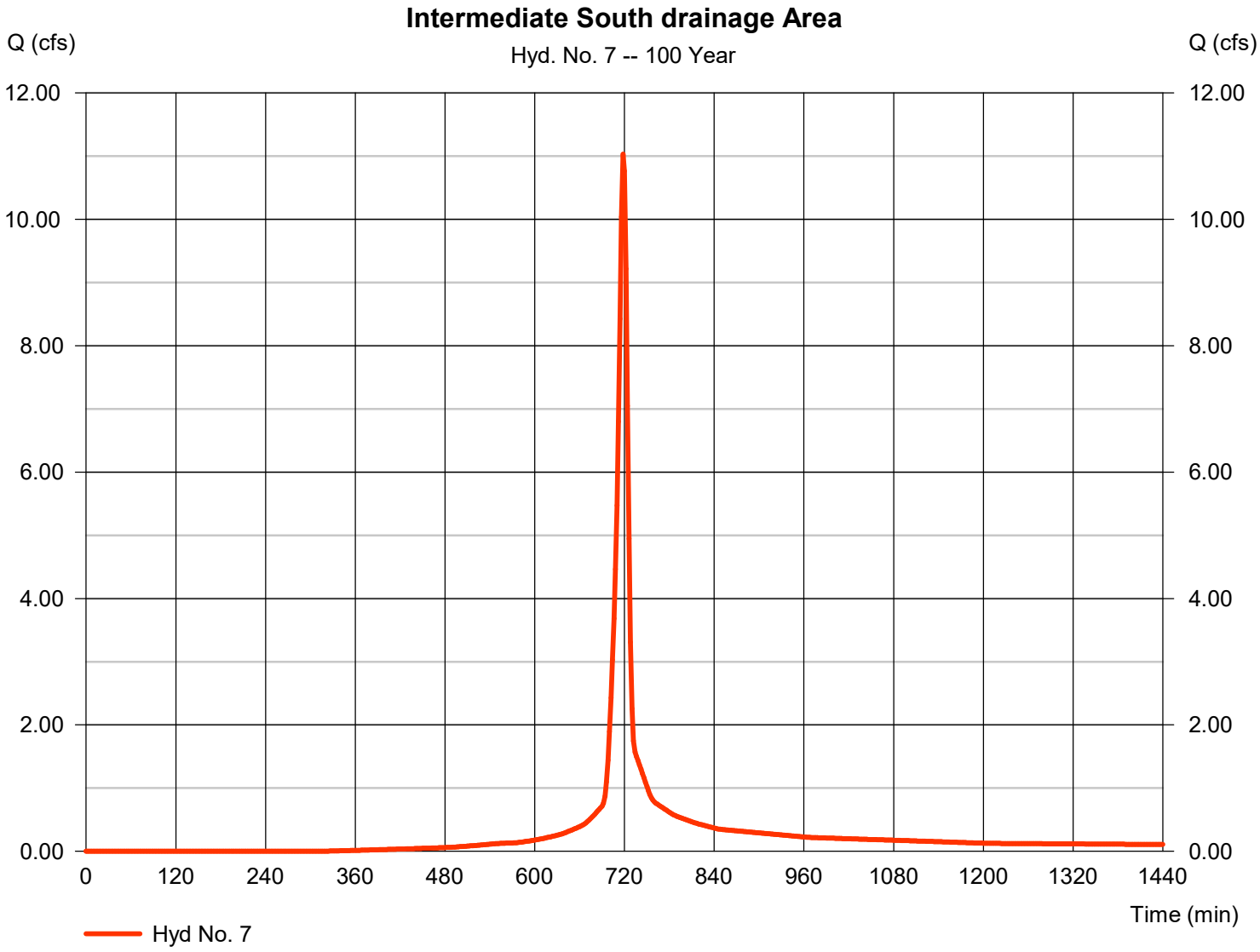
Hydrograph Report

Hyd. No. 7

Intermediate South drainage Area

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.03 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	25,847 cuft
Drainage area	=	1.120 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.60 min
Total precip.	=	9.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 99) + (0.980 x 74)] / 1.120



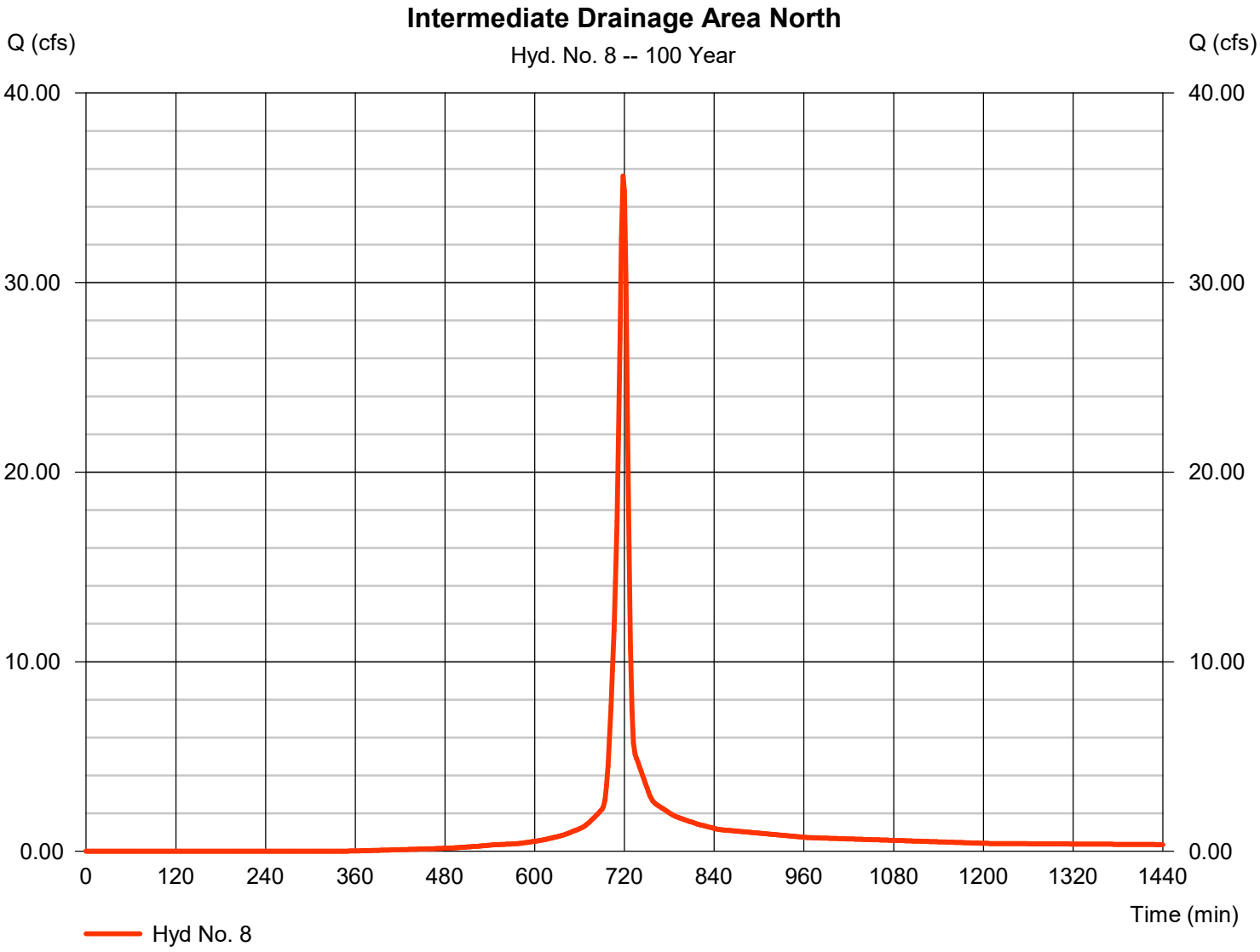
Hydrograph Report

Hyd. No. 8

Intermediate Drainage Area North

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.62 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	82,933 cuft
Drainage area	=	3.740 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.80 min
Total precip.	=	9.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 82) + (2.310 x 74)] / 3.740

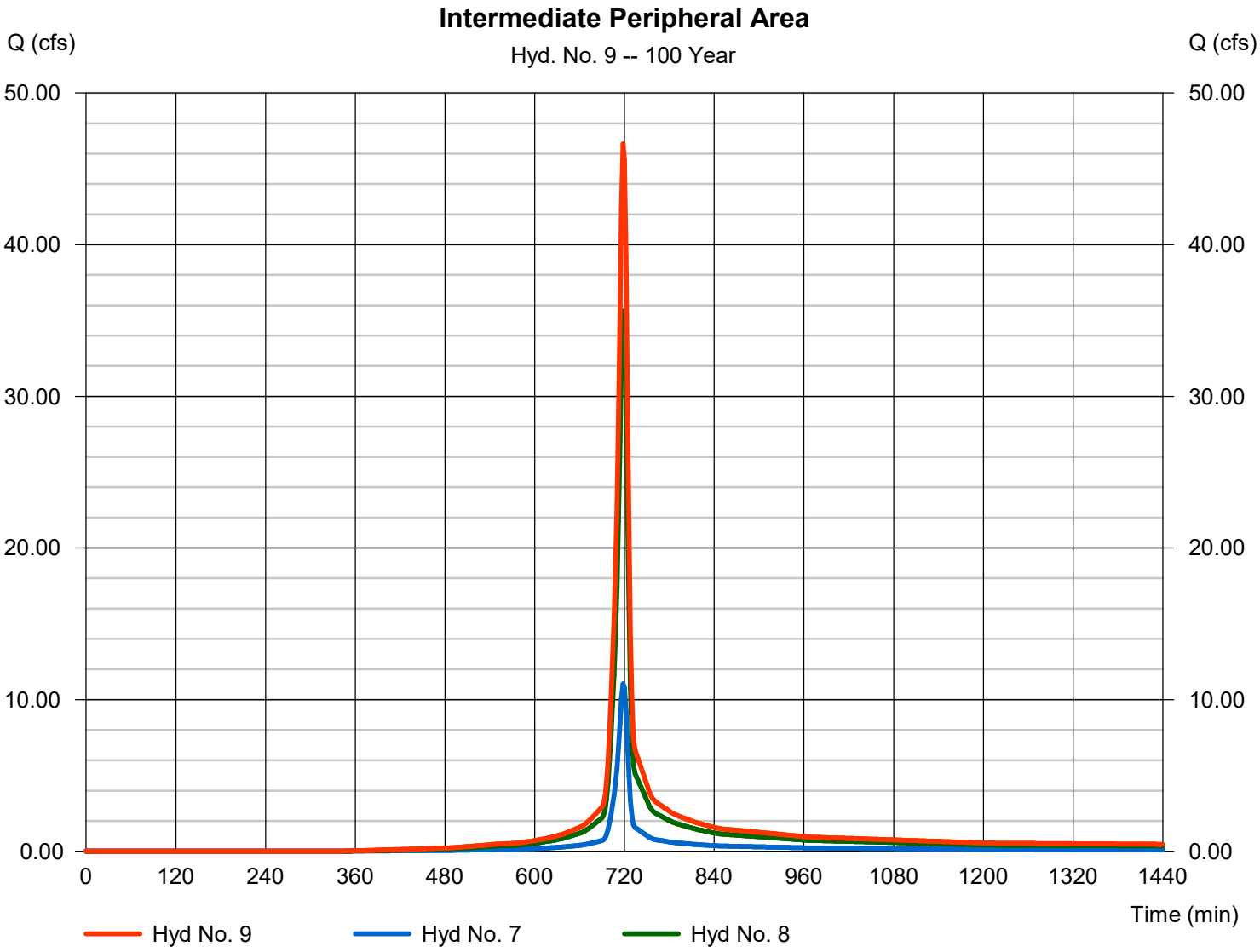


Hydrograph Report

Hyd. No. 9

Intermediate Peripheral Area

Hydrograph type	= Combine	Peak discharge	= 46.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 108,780 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 4.860 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: Springfield_IDF.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
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	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

0 Cobey Creek Residential\01 CIVIL\02-R&D\Drainage\SW DETENTION BASIN\COBEY CREEK RAINFALL DATA.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	3.09	3.68	0.00	0.00	5.61	0.00	0.00	9.17
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	0.00	0.00	0.00	0.00	0.00	0.00

Hydraflow Table of Contents

Contents continued