City of Madison, WI

Stormwater Report

Casey's Madison
3603 Cross Hill Drive
Madison, WI 53718

Prepared For:
Casey's Retail Company
One Convenience Blvd., P.O. Box 3001
Ankeny, IA. 50021
James Skloda
Phone: (515) 965-6100

Prepared By:
Patrick Bennett
Core States Group
6500 Chippewa St., Suite 200
St. Louis, MO 63109
(314) 843-4320

This work was prepared by me
or under my supervision.

April 16, 2018

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CITY OF MADISON, WI

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April 2018

Project No.: CGS.24147

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04/17/18

April 16, 2018

PROJECT NARRATIVE

Project Description

The project consists of a 4,406 sf proposed gas station and convenience store at 3603 Cross Hill Dr. on a 1.811-acre lot. The current site is vacant of structures and has been graded for a pad ready site.

The hydrologic analysis was completed with Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2016 Version: 11 by Autodesk, Inc. and is compiled into Appendix A along with the pond report. The City of Madison storm depths and rainfall distributions were used in the analysis.

Proposed Condition

The existing site is raised from the intersection and generally slopes from south to north. The overall grading of the site will be maintained close to the current existing grades. We are utilizing trench drains across both proposed entrances to capture as much of the site water as possible. The paved and roof areas are all directed into a dry detention pond at the northeast corner of the lot. The discharge of the pond is through a storm sewer to be constructed by the adjacent developer that extends approximately 400' east of the property and is in an existing easement. A few small unpaved areas along the perimeter will flow offsite without entering the onsite storm sewers. A summary of the drainage areas can be found on sheet C14 and hydrologic calculations can be found in Appendix A. The storm sewer pipes were modeled with Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 and are shown in Appendix B.

Water Quality

The site is proposed to be treated using two Up-Flo filters by Hydro International and provided by Advanced Drainage Systems. There will be an 11 filter unit and a 4 filter unit proposed to treat the paved areas of the lot. The results of the analysis is a TSS removal of 80.47%. These were modeled in WinSLAMM Version 10.3.4 and the results are summarized in Appendix C.

Floodplain

The subject parcel is located in Flood Zone X as determined by FEMA Flood Insurance Rate Map Panel 55025C0268H, effective date September 17202014. A FIRMette of FEMA flood map is provided as Exhibit 1.

Conclusion

This project is designed to comply with City of Madison drainage standards and will have no adverse impact to roadways or abutting properties.

ENGINEER'S CERTIFICATION

THIS IS TO CERTIFY THAT THE ENCLOSED ENGINEERING CALCULATIONS WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION.

Patrick T. Bennett, P.E.
Core States Group, Inc.
6500 Chippewa Street, Suite 200
St. Louis, MO 63109

DATE: 04/17/18

EXHIBIT 1
FEMA FIRMette Map

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0268H

FIRM

FLOOD INSURANCE RATE MAP

DANE COUNTY, WISCONSIN AND INCORPORATED AREAS

PANEL 268 OF 850

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DANE COUNTY	550077	0268	H
MADISON, CITY OF	550083	0268	H

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
55025C0268H

MAP REVISED
SEPTEMBER 17, 2014

Federal Emergency Management Agency

APPENDIX A

Hydraflow Hydrographs Report

April 16, 2018

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Monday, 04 / 16 / 2018

Pond No. 1 - Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 984.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	984.50	3,740	0	0
3.50	988.00	7,739	19,667	19,667

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 5.16	0.00	0.00	0.00
Span (in)	= 5.16	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 984.50	0.00	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 0.10	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 986.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
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	984.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.50	19,667	988.00	1.27 ic	---	---	---	29.42	---	---	---	---	---	30.68

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 — Monday, 04 / 16 / 2018

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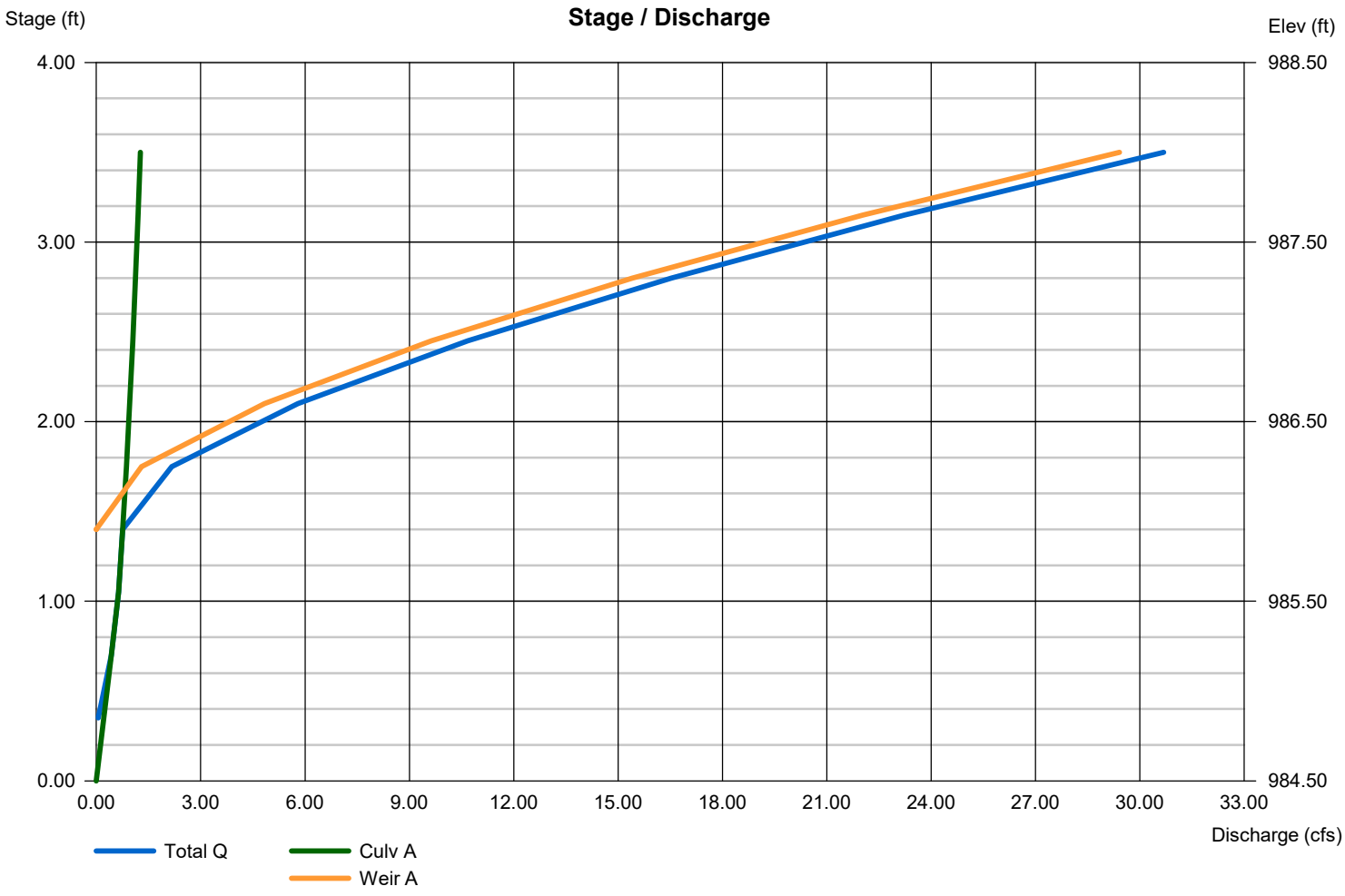
TW Elev. (ft)	= 0.00			

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



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Monday, 04 / 16 / 2018

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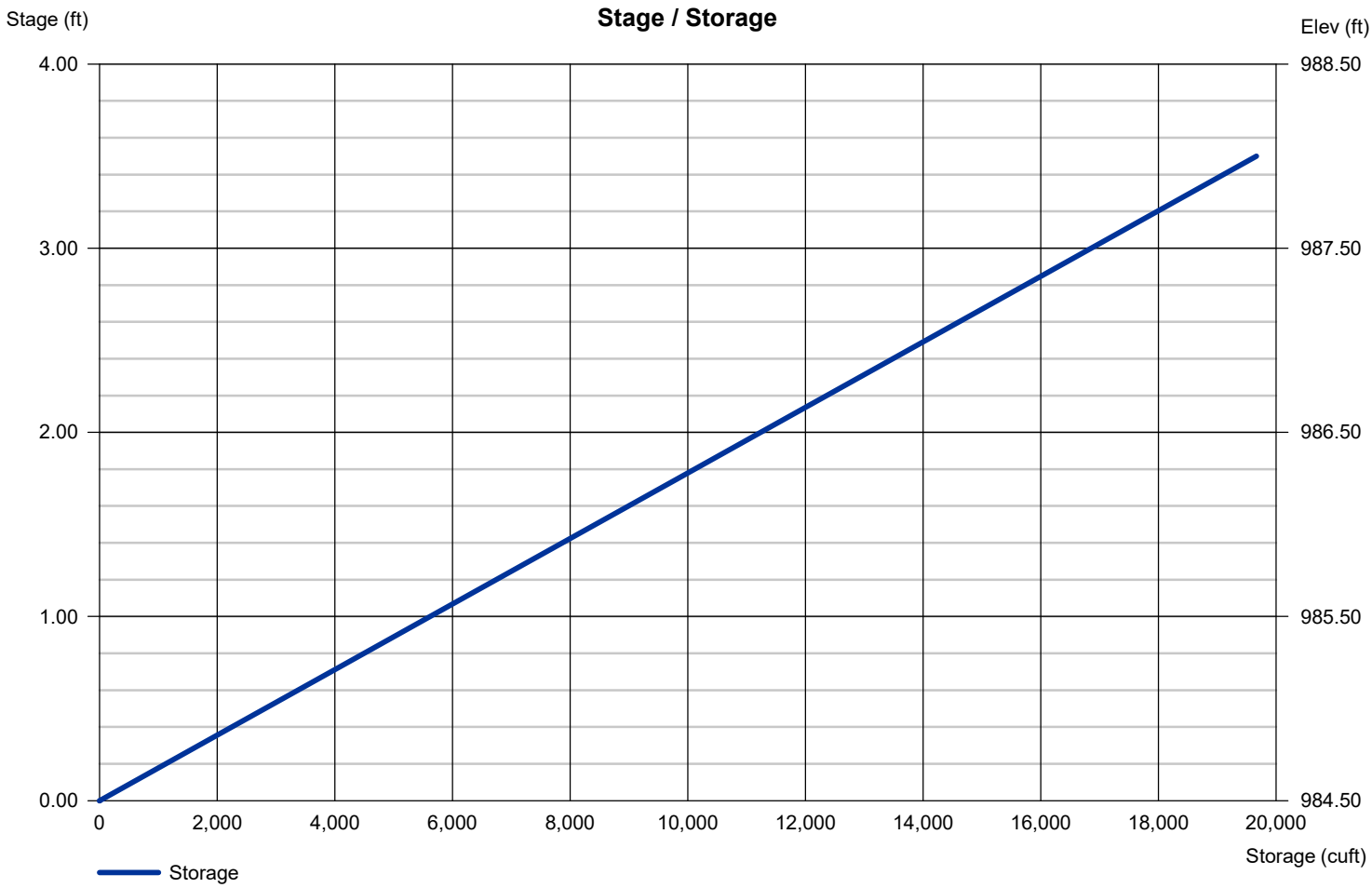
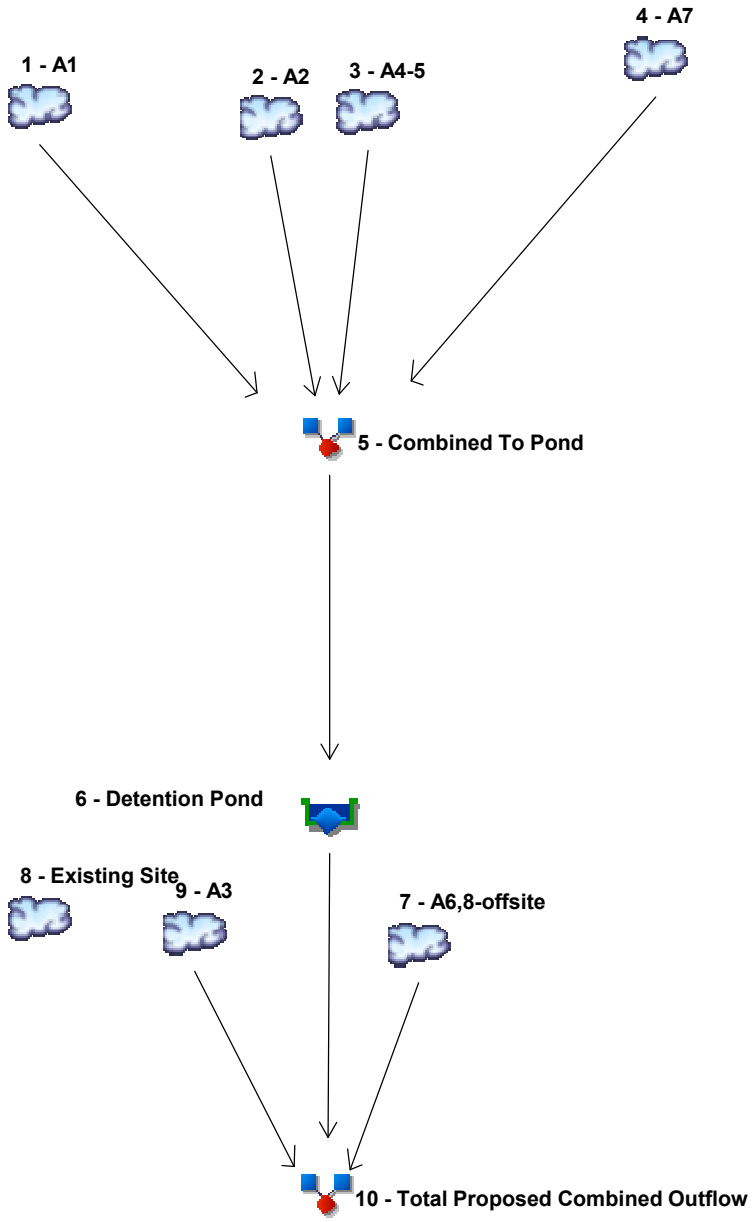


Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	A1
2	SCS Runoff	A2
3	SCS Runoff	A4-5
4	SCS Runoff	A7
5	Combine	Combined To Pond
6	Reservoir	Detention Pond
7	SCS Runoff	A6,8-offsite
8	SCS Runoff	Existing Site
9	SCS Runoff	A3
10	Combine	Total Proposed Combined Outflow

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	------	1.243	1.424	-------	-------	2.068	-------	-------	3.385	A1
2	SCS Runoff	------	0.677	0.775	-------	-------	1.126	-------	-------	1.843	A2
3	SCS Runoff	------	0.445	0.510	-------	-------	0.741	-------	-------	1.213	A4-5
4	SCS Runoff	------	0.151	0.228	-------	-------	0.549	-------	-------	1.339	A7
5	Combine	1, 2, 3, 4	2.516	2.937	-------	-------	4.484	-------	-------	7.779	Combined To Pond
6	Reservoir	5	0.524	0.603	-------	-------	1.038	-------	-------	4.608	Detention Pond
7	SCS Runoff	------	0.100	0.151	-------	-------	0.363	-------	-------	0.885	A6,8-offsite
8	SCS Runoff	------	0.734	1.056	-------	-------	2.421	-------	-------	5.713	Existing Site
9	SCS Runoff	------	0.236	0.270	-------	-------	0.392	-------	-------	0.642	A3
10	Combine	6, 7, 9	0.733	0.867	-------	-------	1.389	-------	-------	5.443	Total Proposed Combined Outflow

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

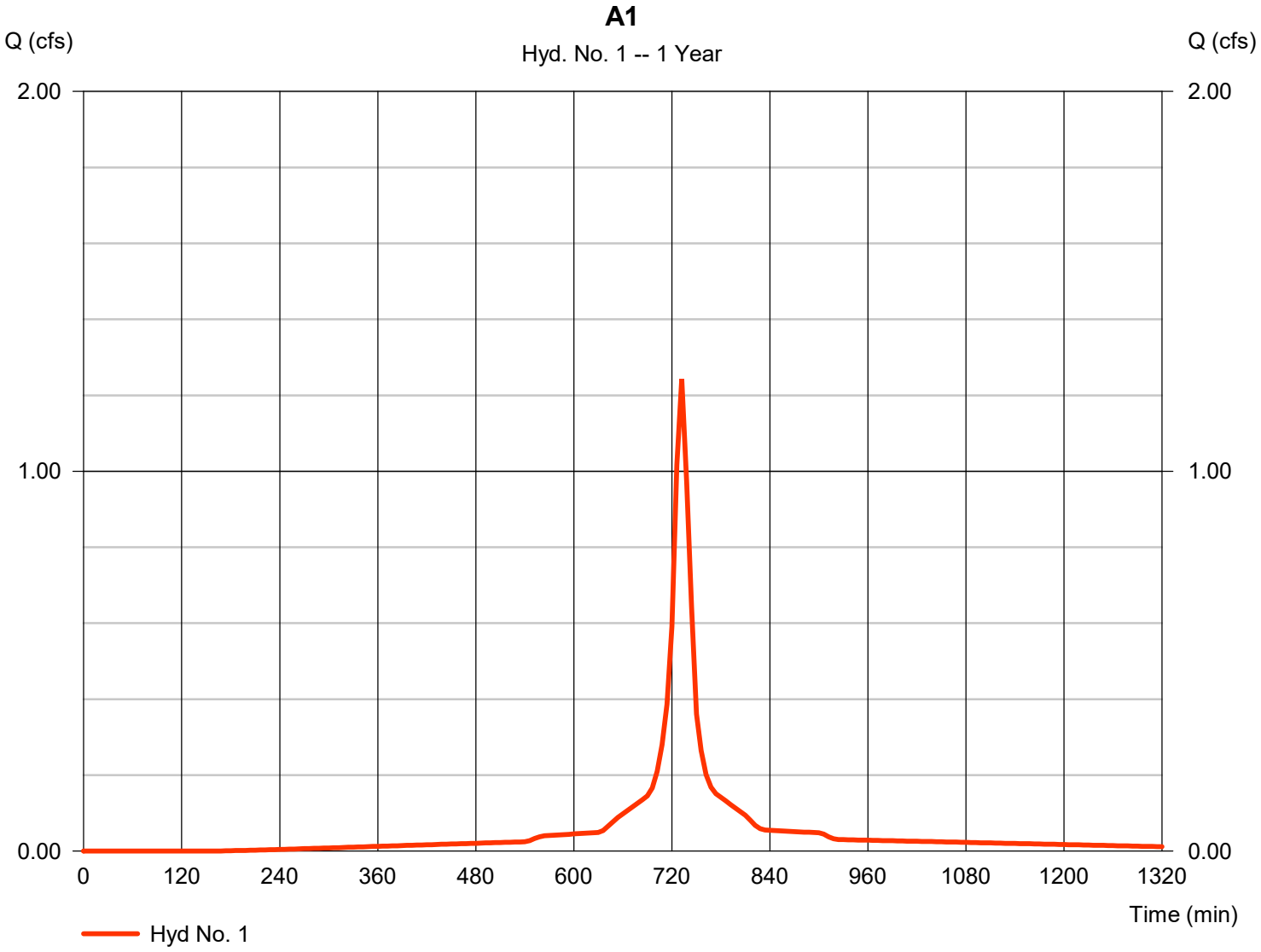
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.243	6	732	4,424	------	------	------	A1
2	SCS Runoff	0.677	6	732	2,408	------	------	------	A2
3	SCS Runoff	0.445	6	732	1,585	------	------	------	A4-5
4	SCS Runoff	0.151	6	732	605	------	------	------	A7
5	Combine	2.516	6	732	9,022	1, 2, 3, 4	------	------	Combined To Pond
6	Reservoir	0.524	6	756	8,985	5	985.35	4,793	Detention Pond
7	SCS Runoff	0.100	6	732	400	------	------	------	A6,8-offsite
8	SCS Runoff	0.734	6	744	3,693	------	------	------	Existing Site
9	SCS Runoff	0.236	6	732	839	------	------	------	A3
10	Combine	0.733	6	738	10,224	6, 7, 9	------	------	Total Proposed Combined Outflow

Hydrograph Report

Hyd. No. 1

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.243 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	4,424 cuft
Drainage area	=	0.575 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

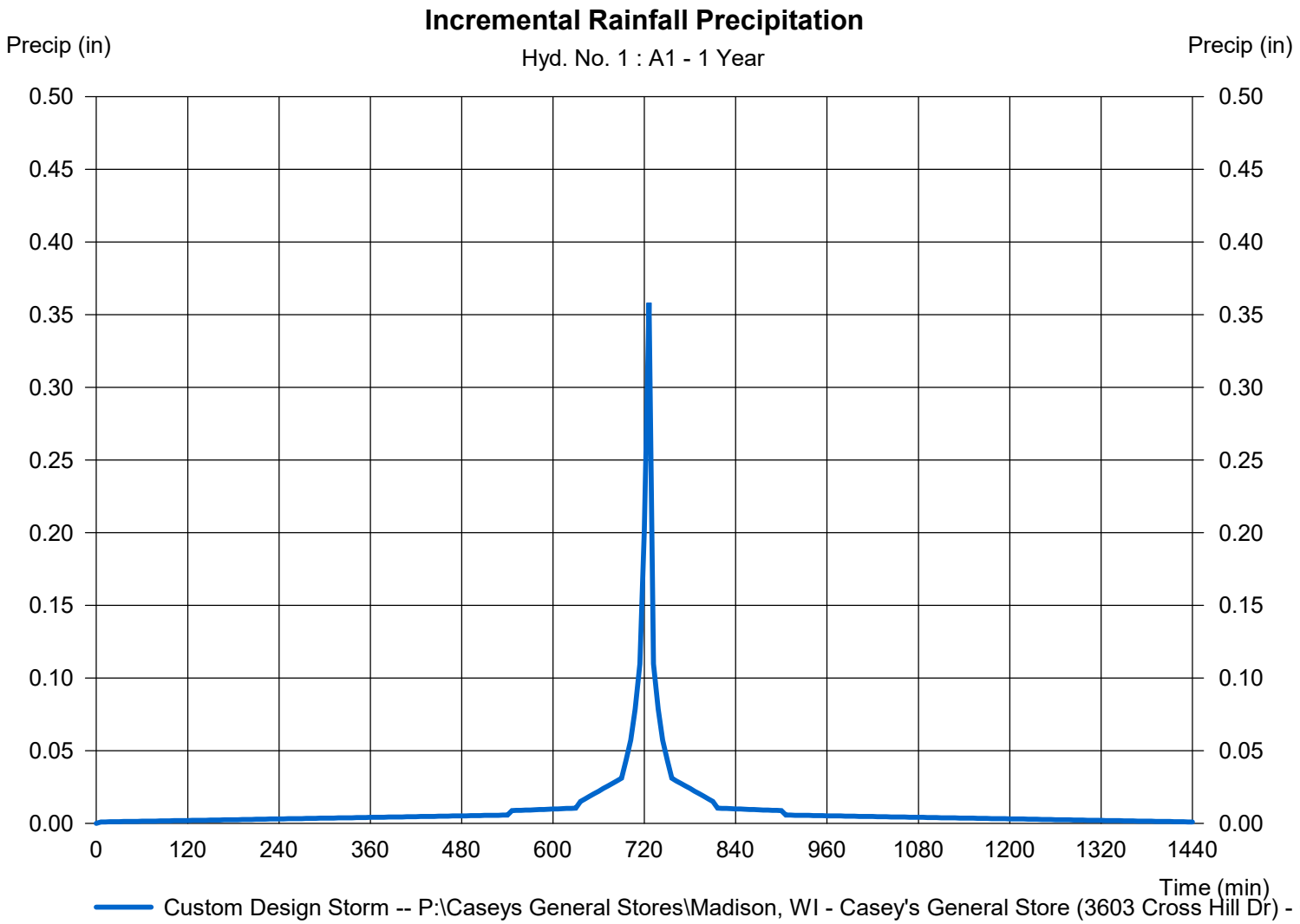


Precipitation Report

Hyd. No. 1

A1

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

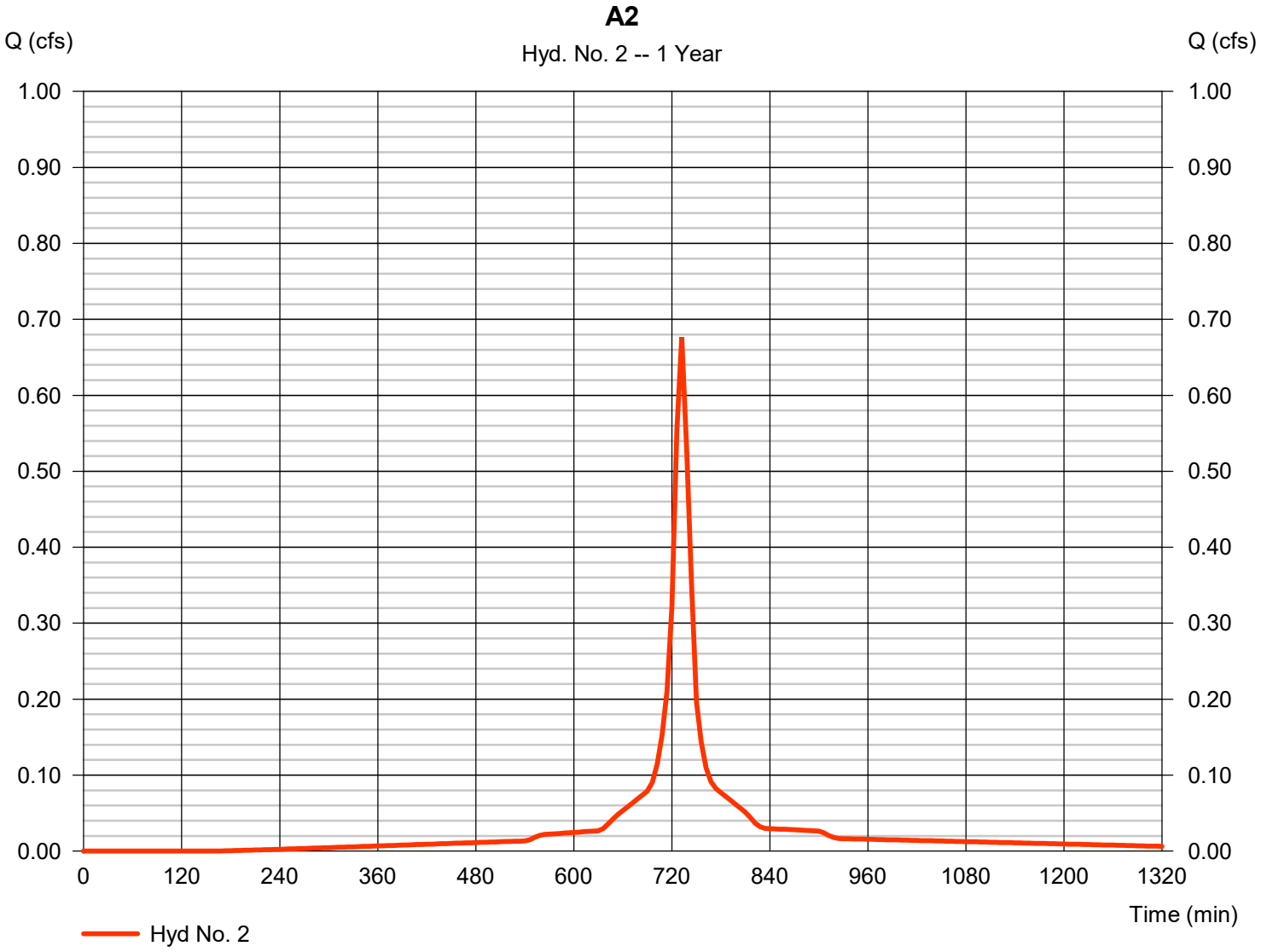


Hydrograph Report

Hyd. No. 2

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.677 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,408 cuft
Drainage area	=	0.313 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

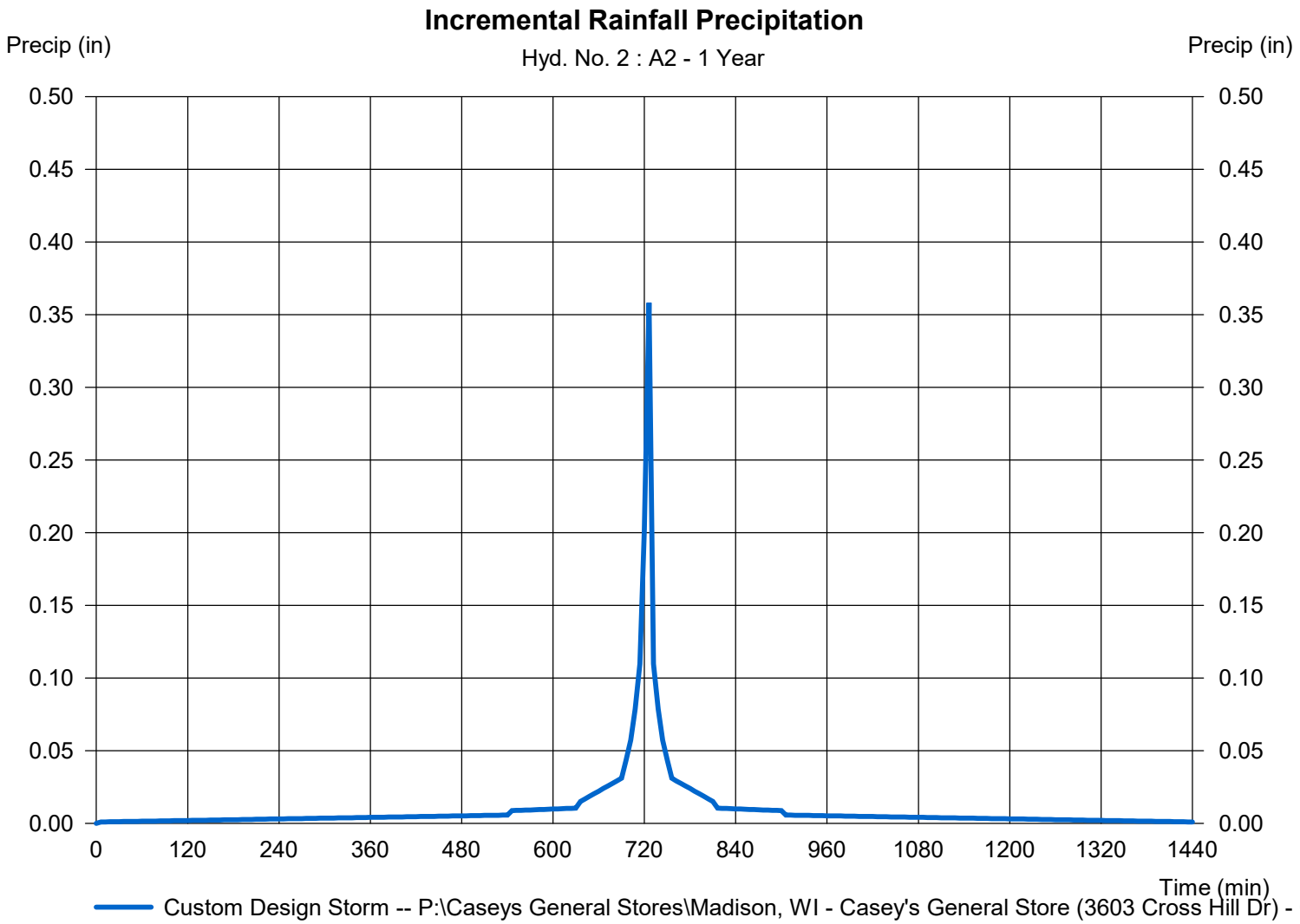


Precipitation Report

Hyd. No. 2

A2

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

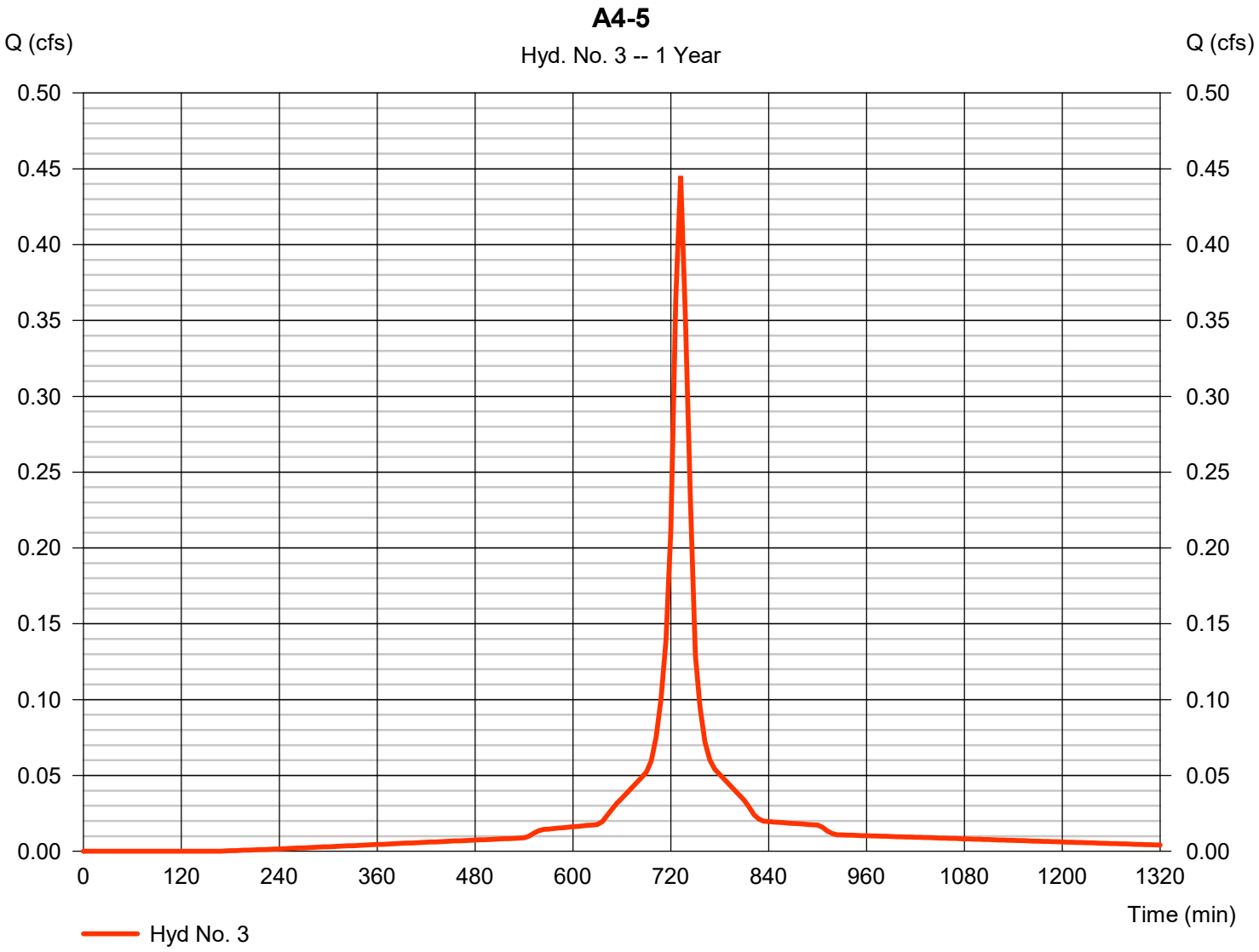


Hydrograph Report

Hyd. No. 3

A4-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.445 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,585 cuft
Drainage area	=	0.206 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

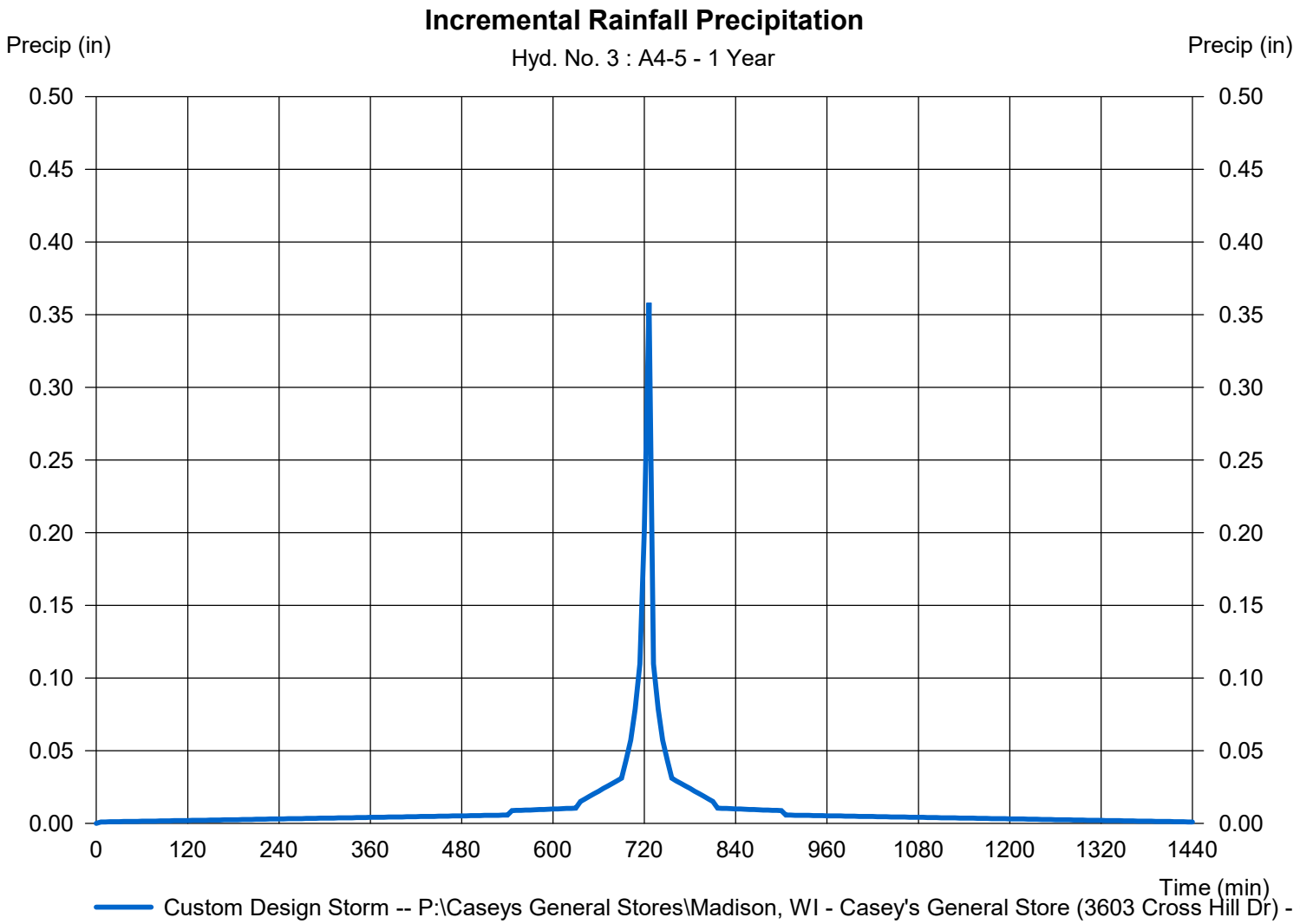


Precipitation Report

Hyd. No. 3

A4-5

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

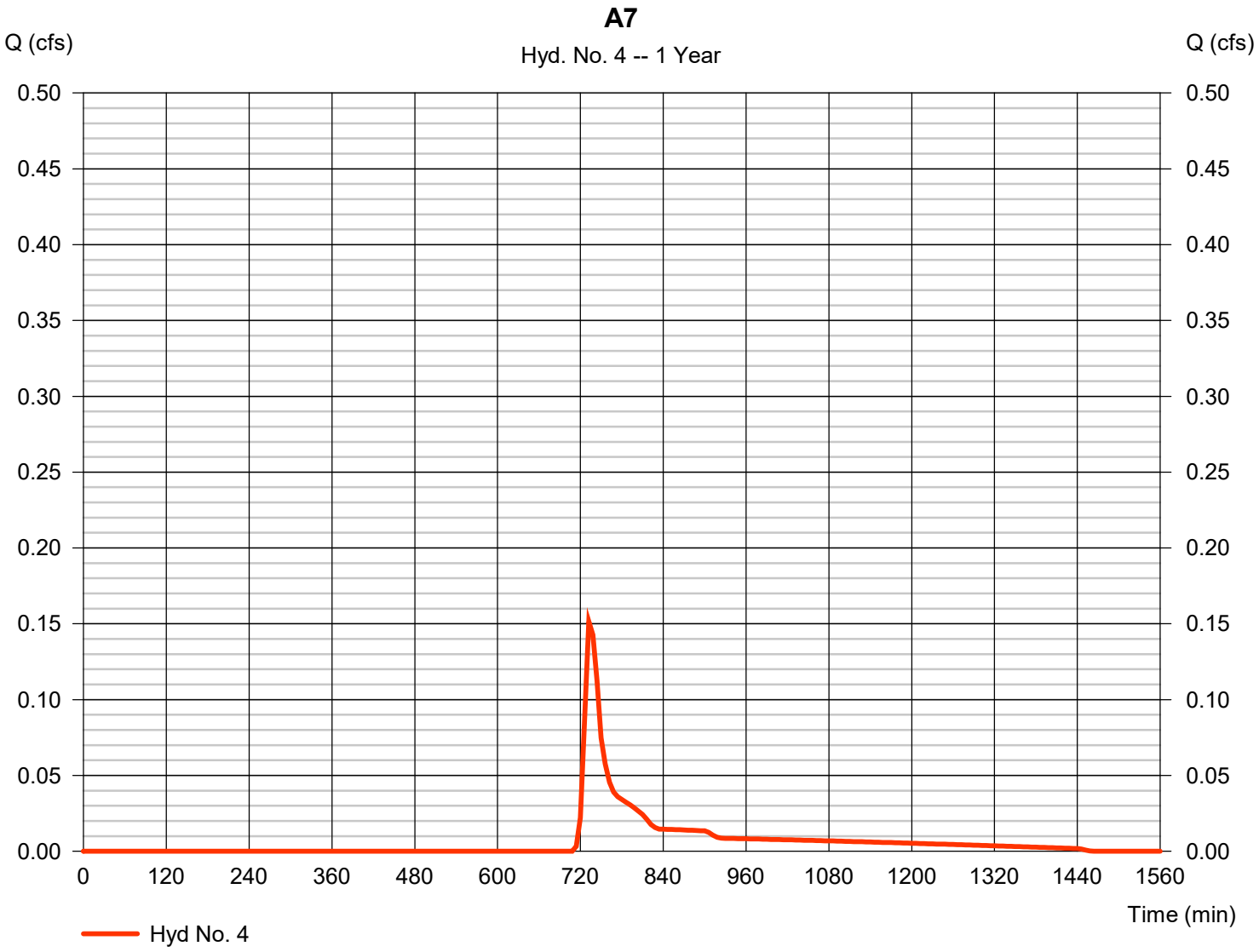


Hydrograph Report

Hyd. No. 4

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.151 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	605 cuft
Drainage area	=	0.366 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	483

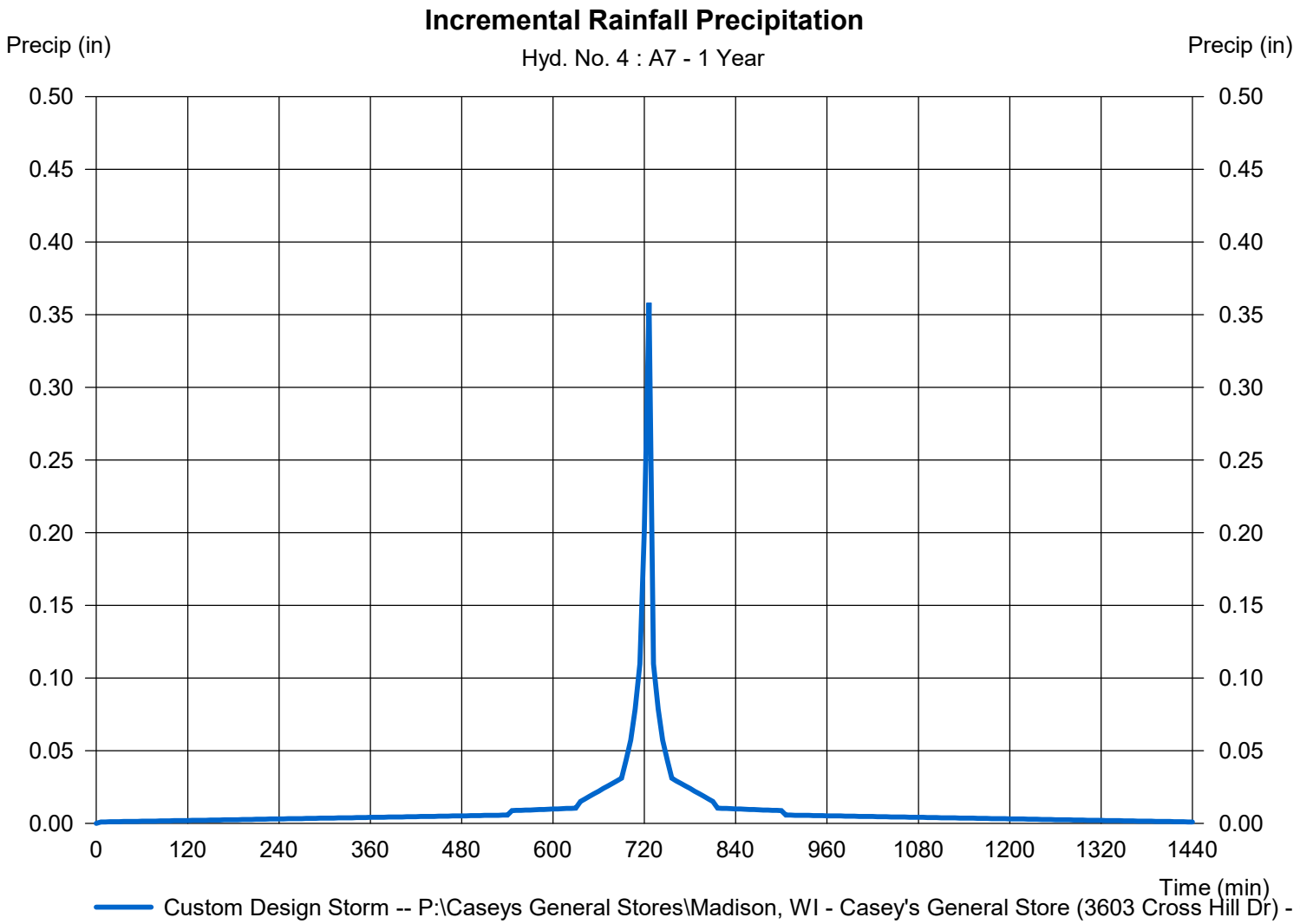


Precipitation Report

Hyd. No. 4

A7

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

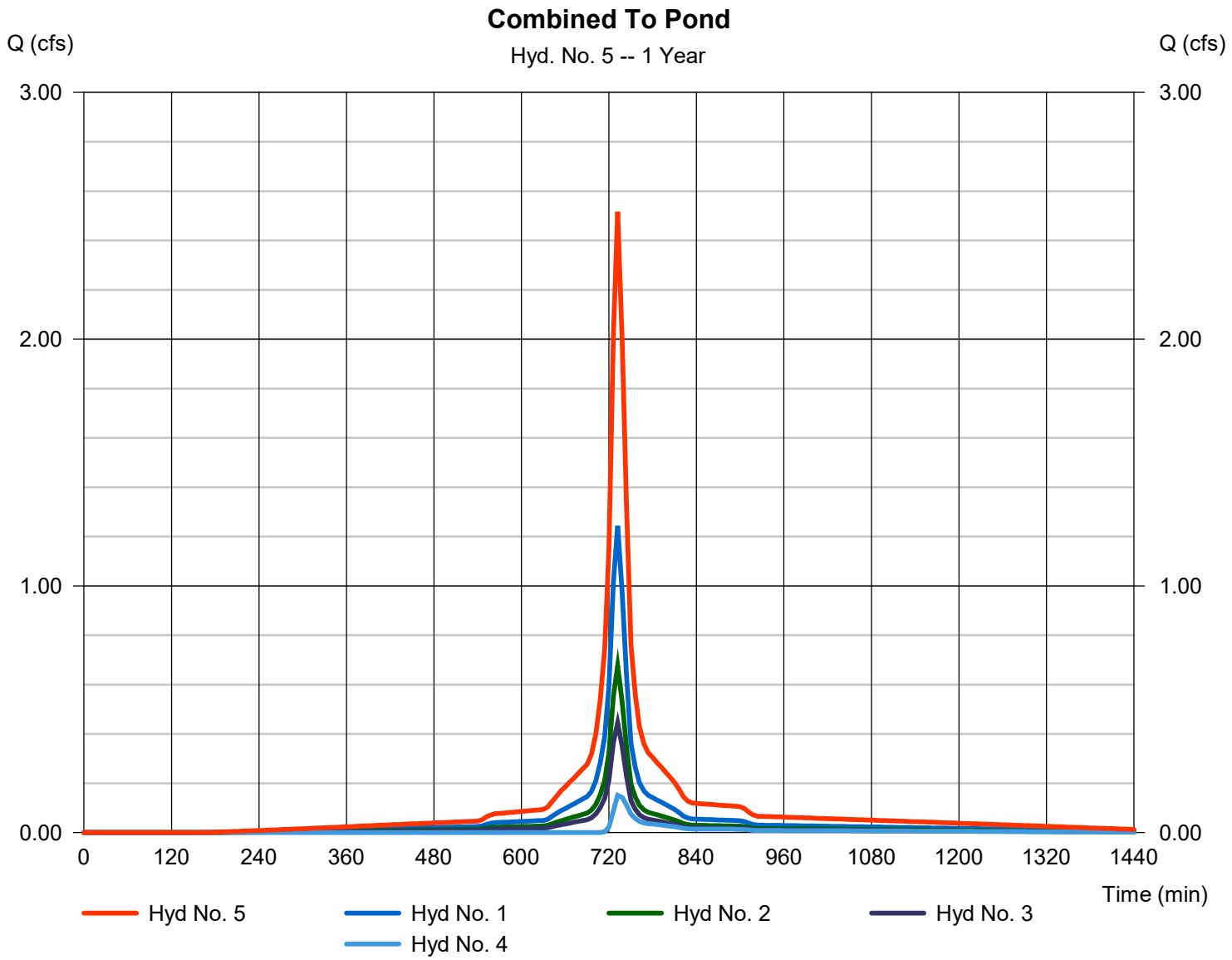


Hydrograph Report

Hyd. No. 5

Combined To Pond

Hydrograph type	=	Combine	Peak discharge	=	2.516 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	9,022 cuft
Inflow hyds.	=	1, 2, 3, 4	Contrib. drain. area	=	1.460 ac



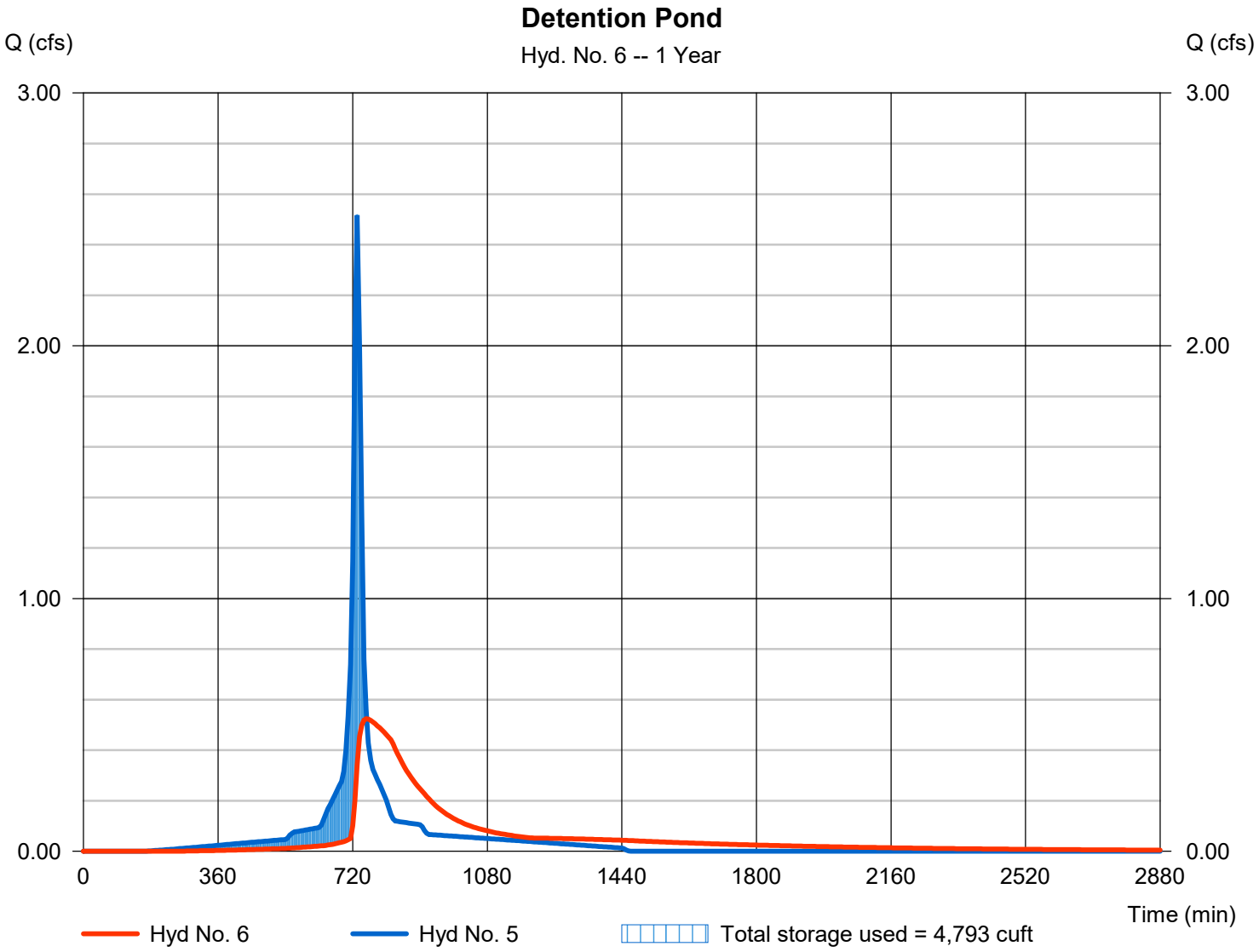
Hydrograph Report

Hyd. No. 6

Detention Pond

Hydrograph type	=	Reservoir	Peak discharge	=	0.524 cfs
Storm frequency	=	1 yrs	Time to peak	=	756 min
Time interval	=	6 min	Hyd. volume	=	8,985 cuft
Inflow hyd. No.	=	5 - Combined To Pond	Max. Elevation	=	985.35 ft
Reservoir name	=	Detention	Max. Storage	=	4,793 cuft

Storage Indication method used.

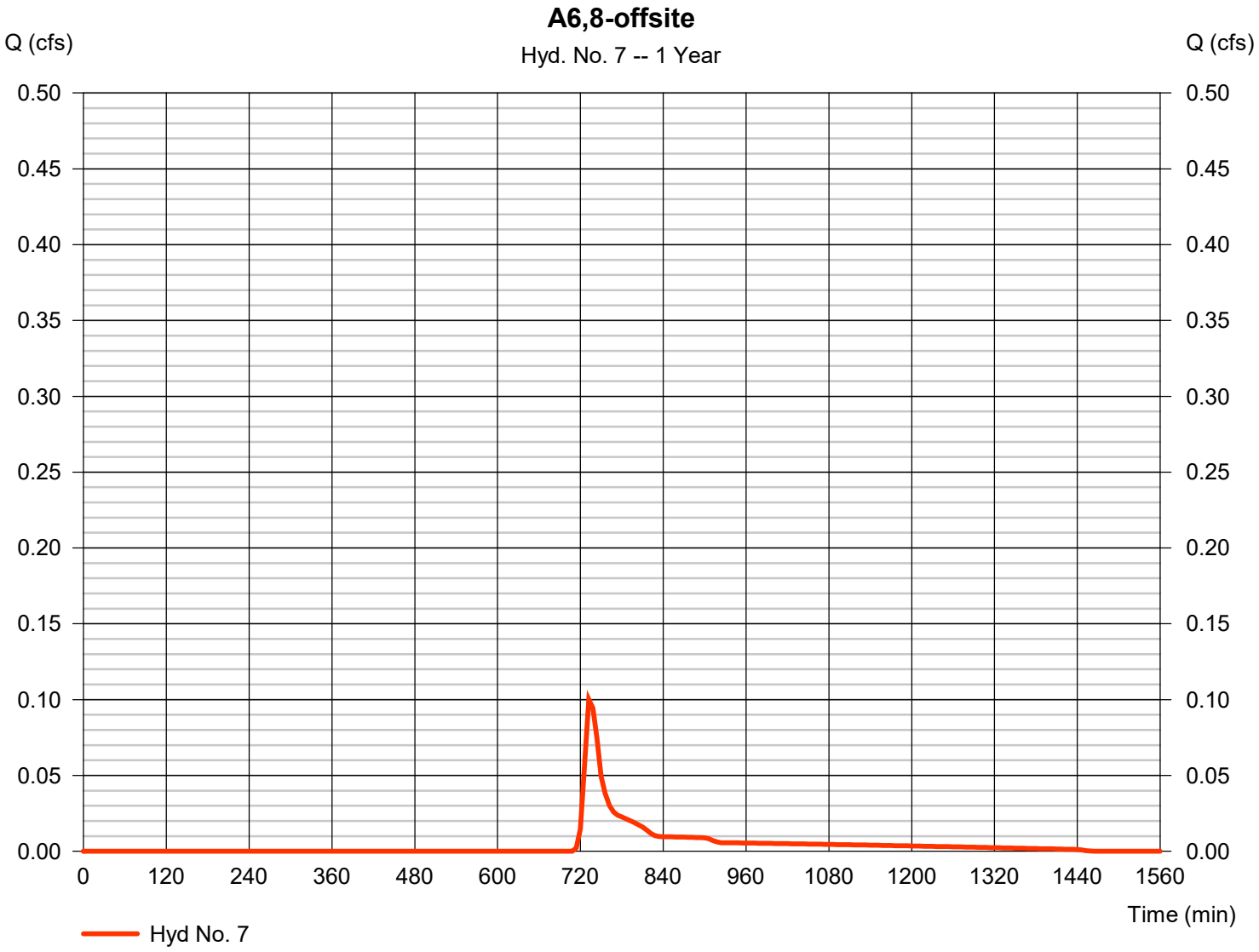


Hydrograph Report

Hyd. No. 7

A6,8-offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.100 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	400 cuft
Drainage area	=	0.242 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

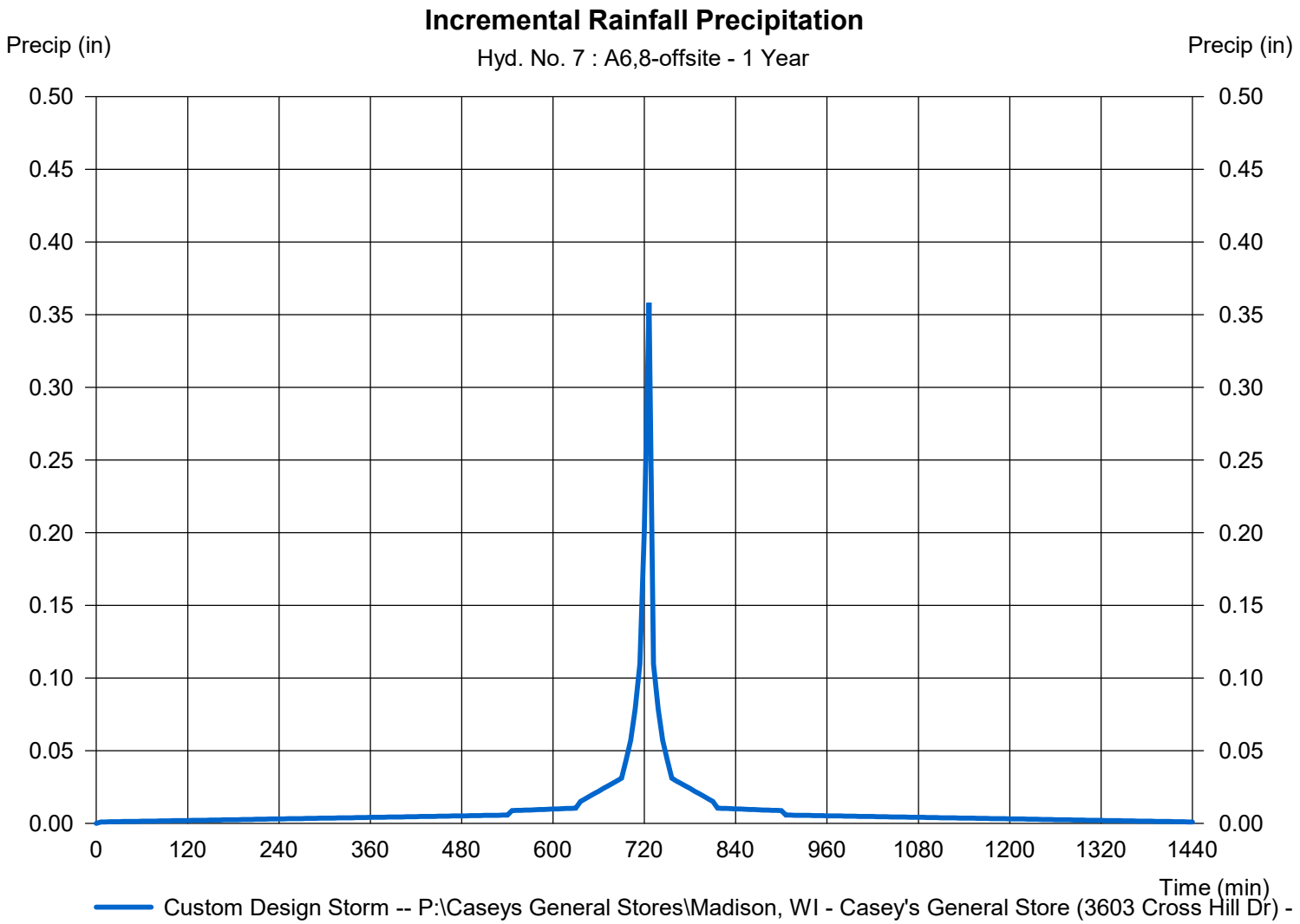


Precipitation Report

Hyd. No. 7

A6,8-offsite

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		



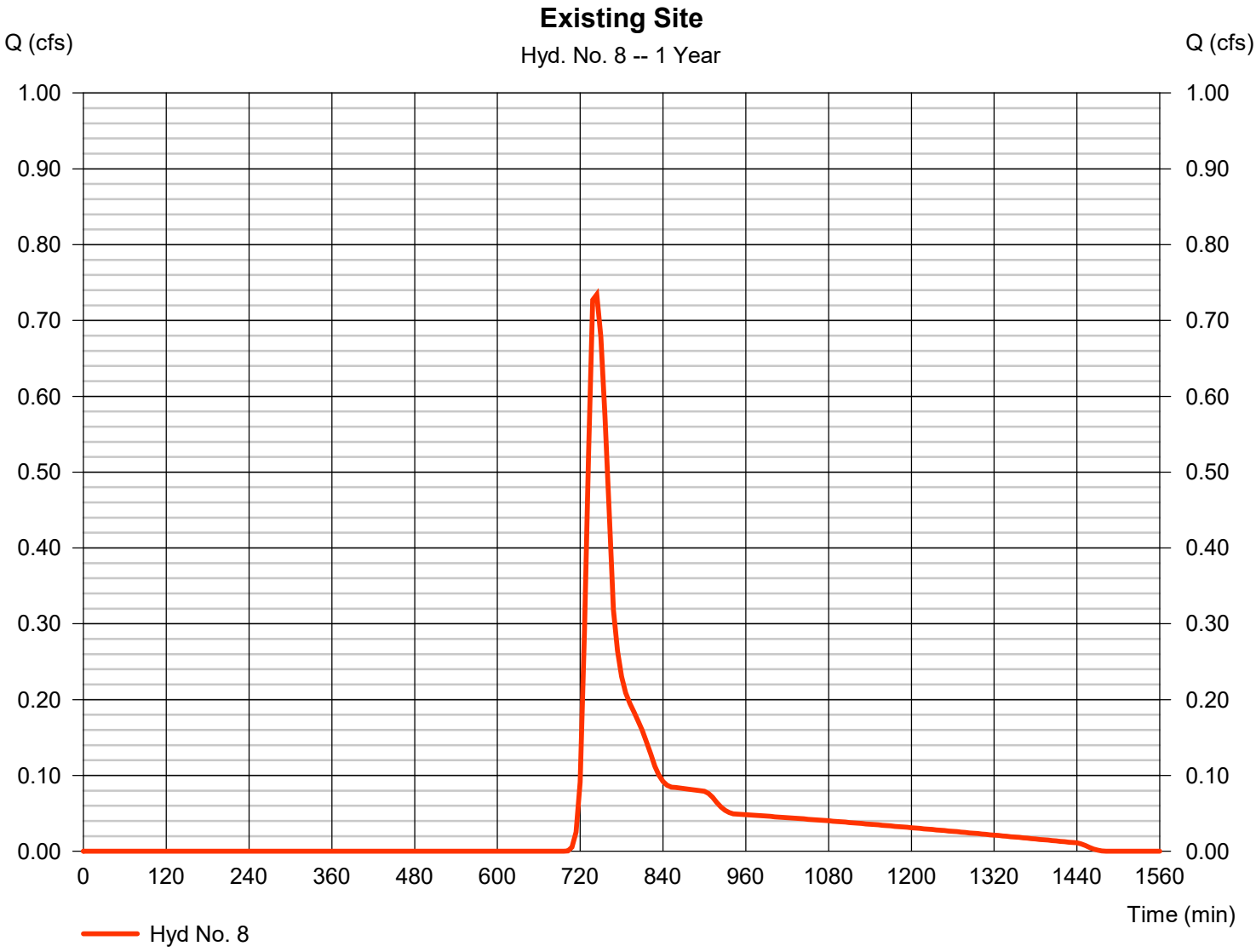
Hydrograph Report

Hyd. No. 8

Existing Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.734 cfs
Storm frequency	=	1 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	3,693 cuft
Drainage area	=	1.810 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.10 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

* Composite (Area/CN) = [(1.300 x 71) + (0.511 x 78)] / 1.810

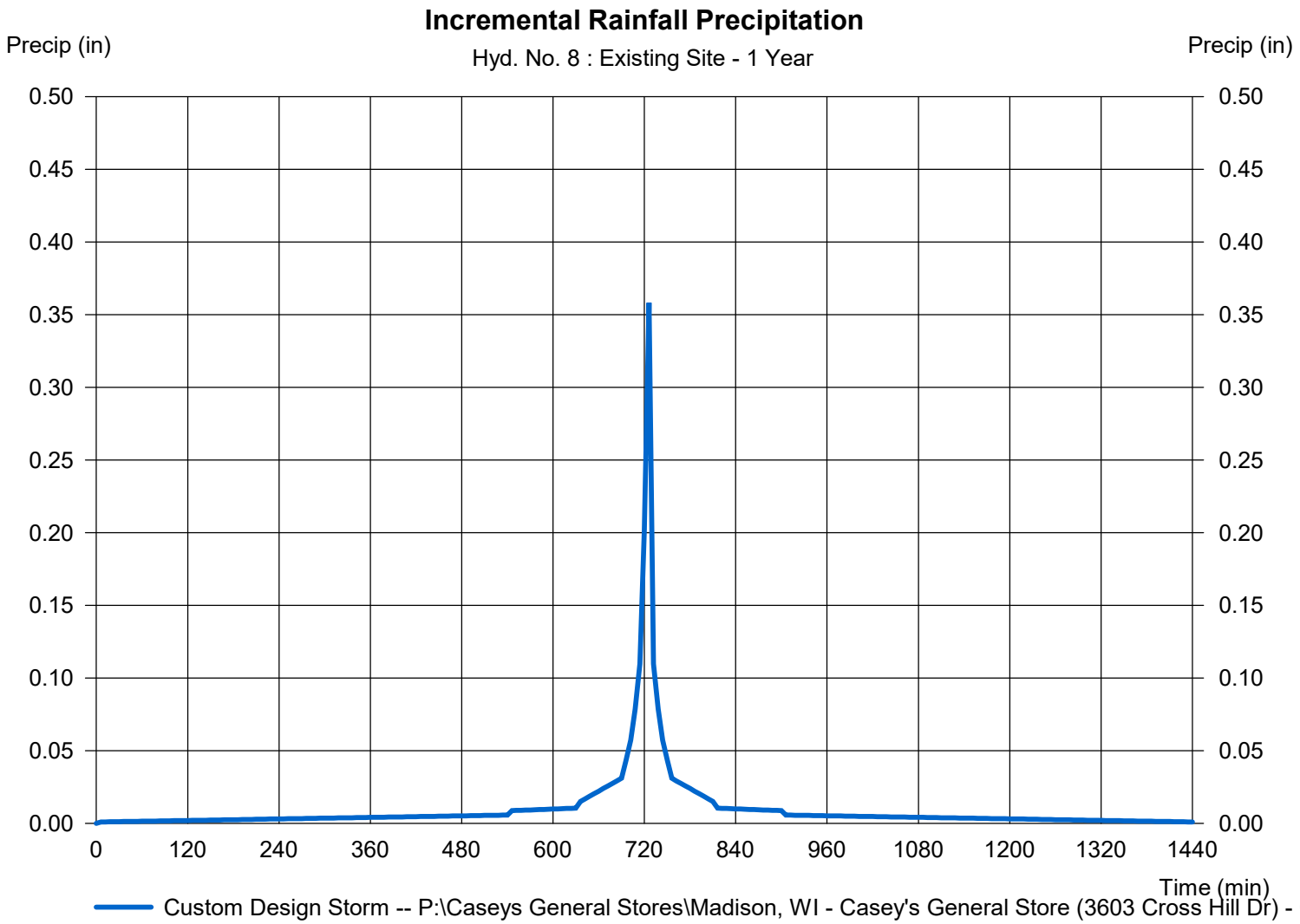


Precipitation Report

Hyd. No. 8

Existing Site

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

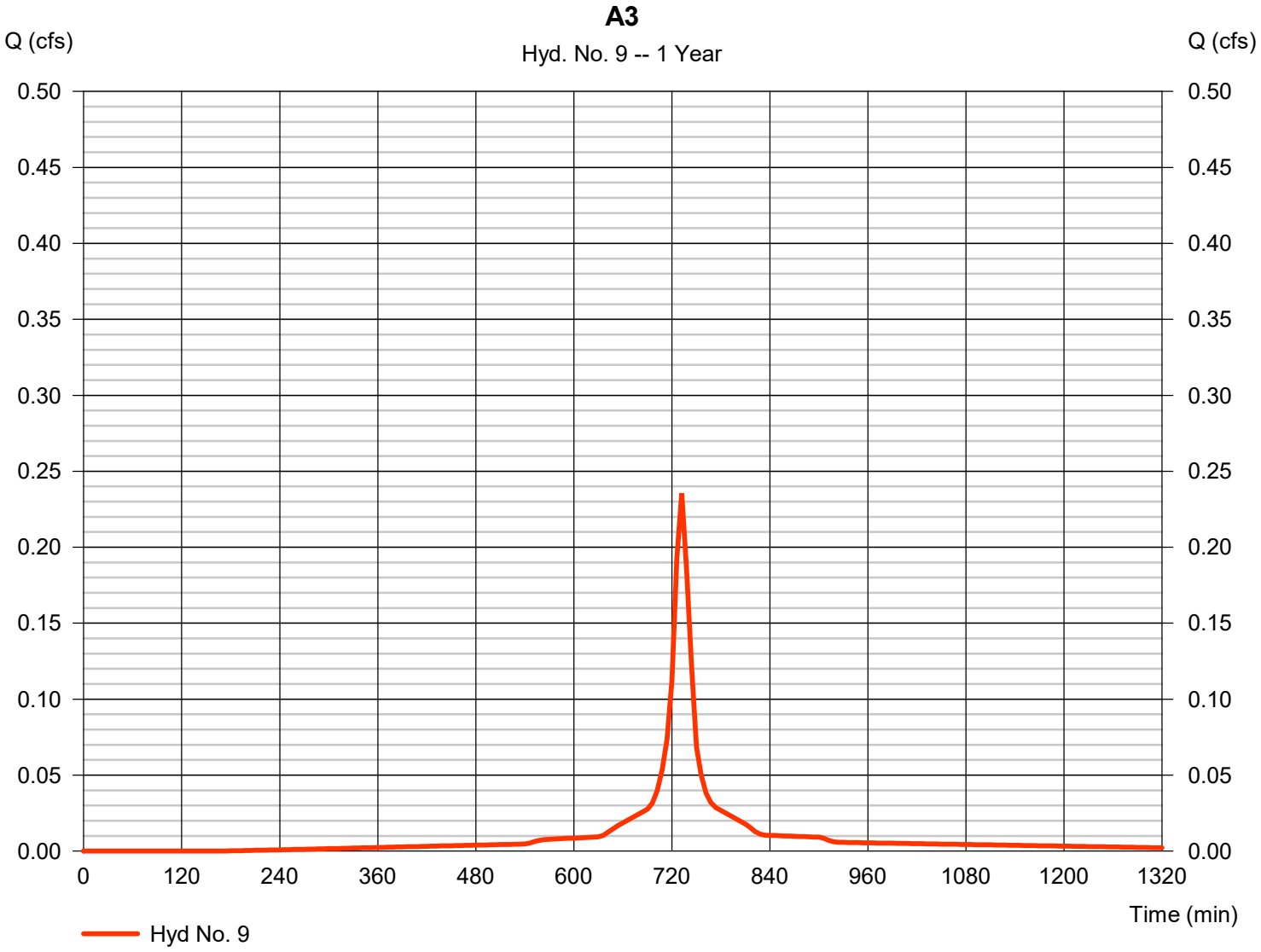


Hydrograph Report

Hyd. No. 9

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.236 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	839 cuft
Drainage area	=	0.109 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.49 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

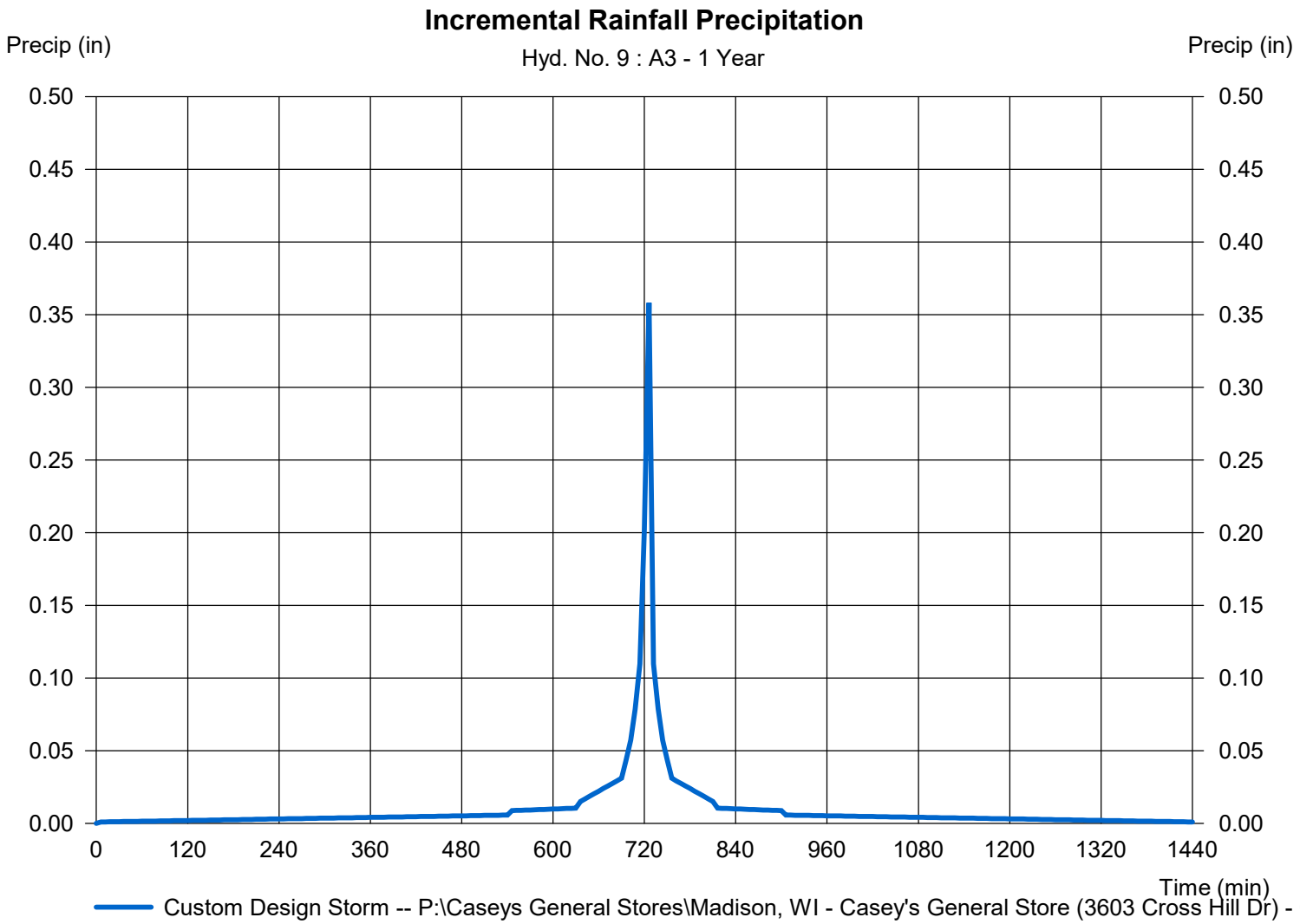


Precipitation Report

Hyd. No. 9

A3

Storm Frequency	= 1 yrs	Time interval	= 6 min
Total precip.	= 2.4900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

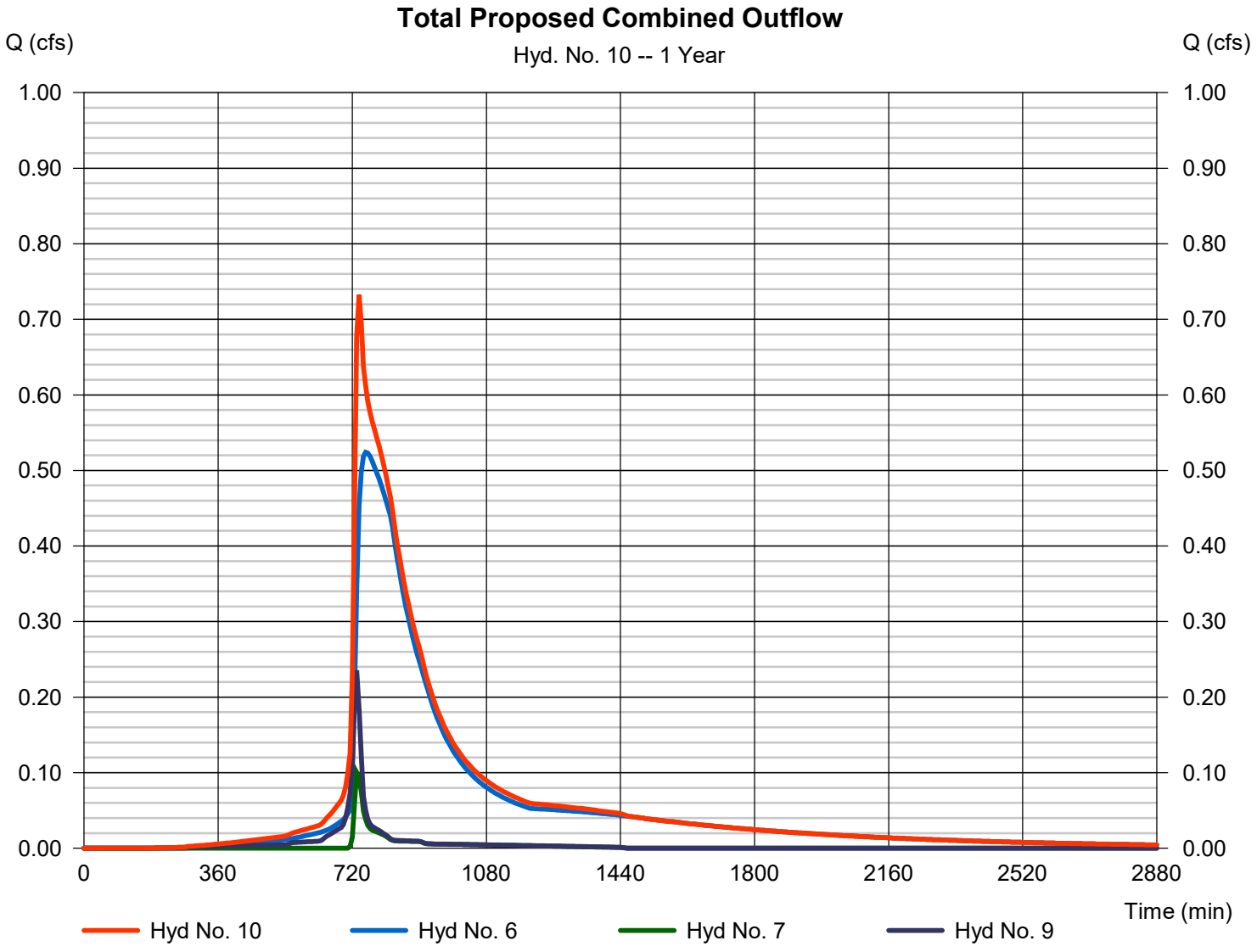


Hydrograph Report

Hyd. No. 10

Total Proposed Combined Outflow

Hydrograph type	= Combine	Peak discharge	= 0.733 cfs
Storm frequency	= 1 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 10,224 cuft
Inflow hyds.	= 6, 7, 9	Contrib. drain. area	= 0.351 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

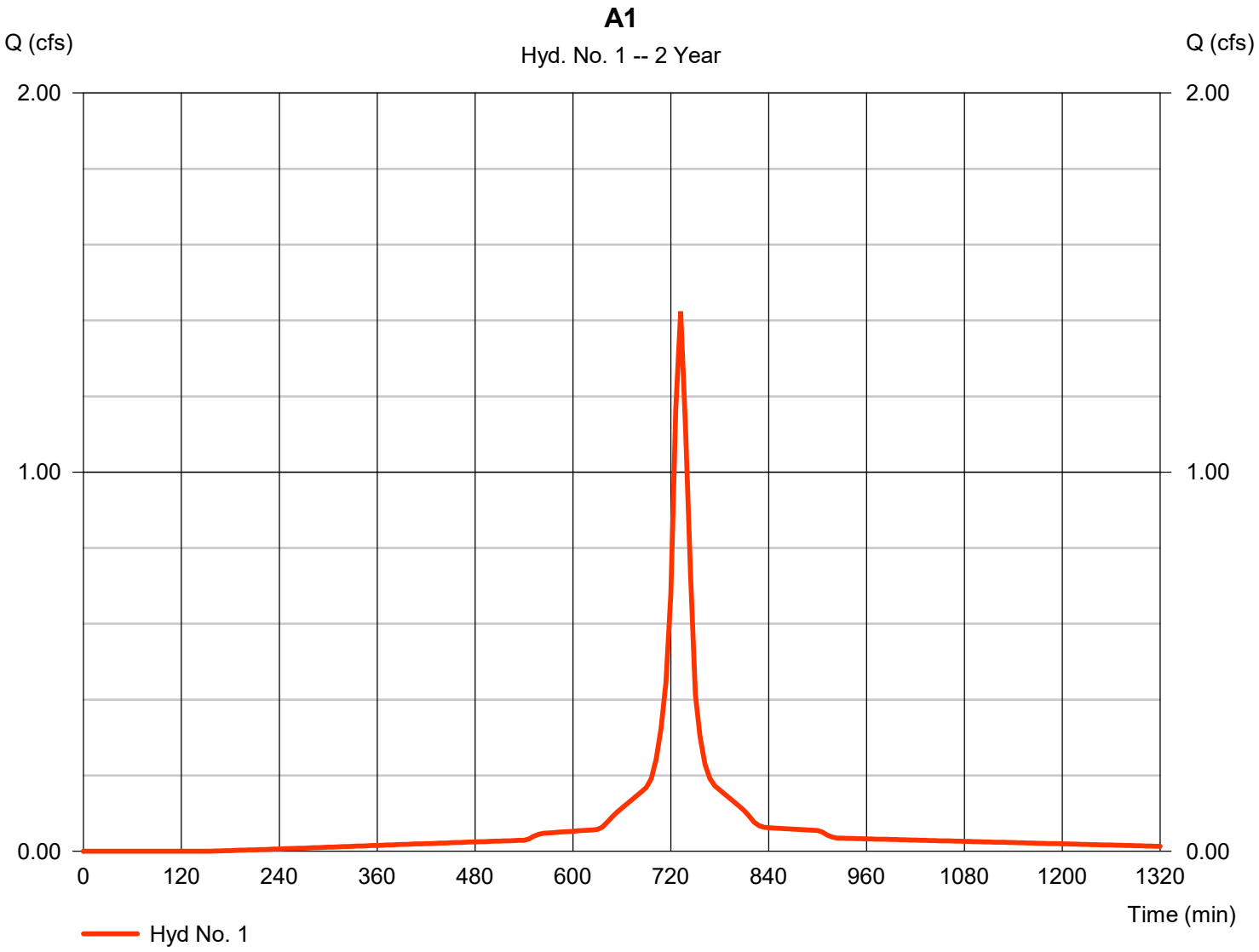
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.424	6	732	5,105	------	------	------	A1
2	SCS Runoff	0.775	6	732	2,779	------	------	------	A2
3	SCS Runoff	0.510	6	732	1,829	------	------	------	A4-5
4	SCS Runoff	0.228	6	732	835	------	------	------	A7
5	Combine	2.937	6	732	10,548	1, 2, 3, 4	------	------	Combined To Pond
6	Reservoir	0.603	6	756	10,510	5	985.49	5,552	Detention Pond
7	SCS Runoff	0.151	6	732	552	------	------	------	A6,8-offsite
8	SCS Runoff	1.056	6	738	4,998	------	------	------	Existing Site
9	SCS Runoff	0.270	6	732	968	------	------	------	A3
10	Combine	0.867	6	738	12,030	6, 7, 9	------	------	Total Proposed Combined Outflow

Hydrograph Report

Hyd. No. 1

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.424 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	5,105 cuft
Drainage area	=	0.575 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtq	=	488

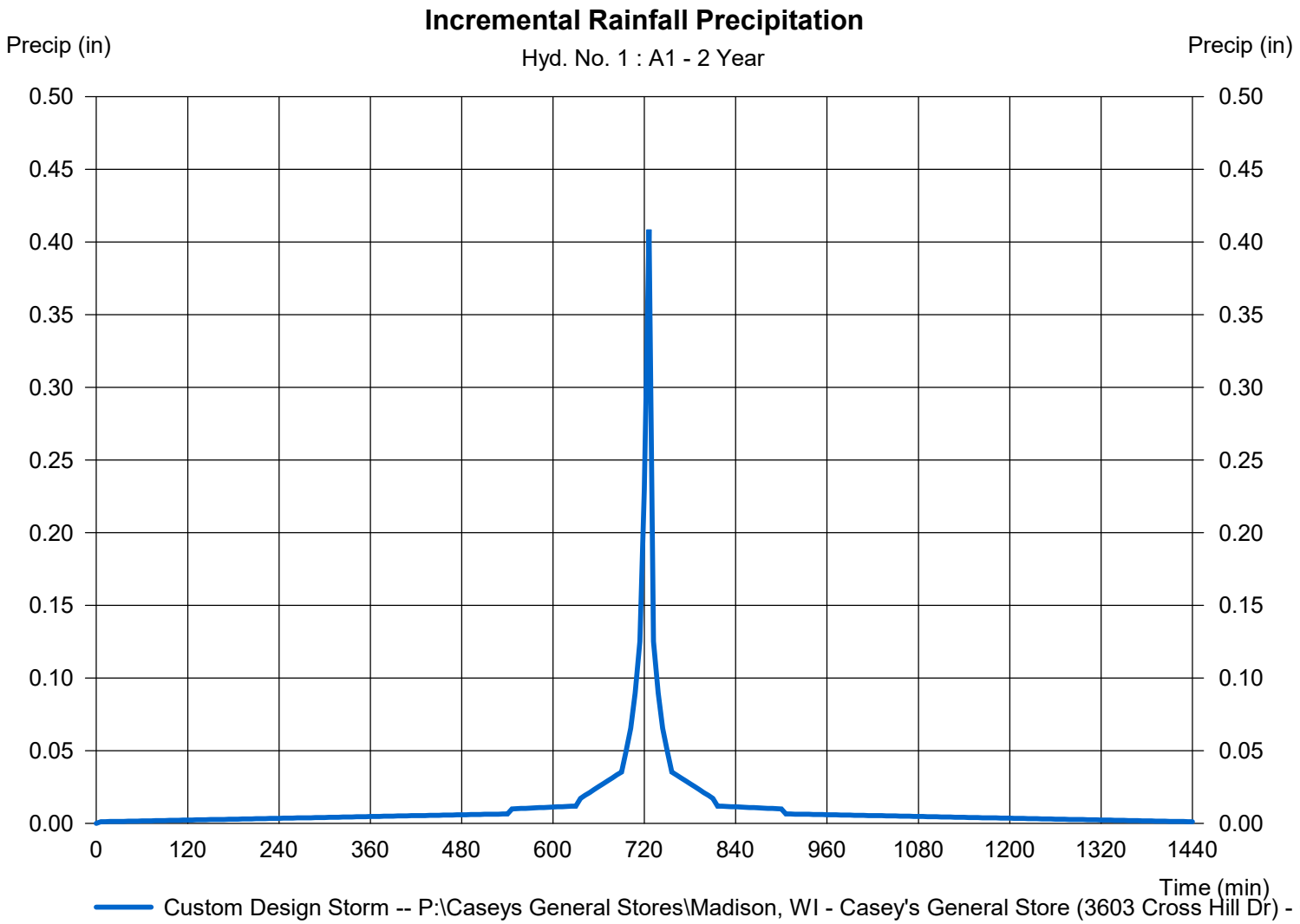


Precipitation Report

Hyd. No. 1

A1

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

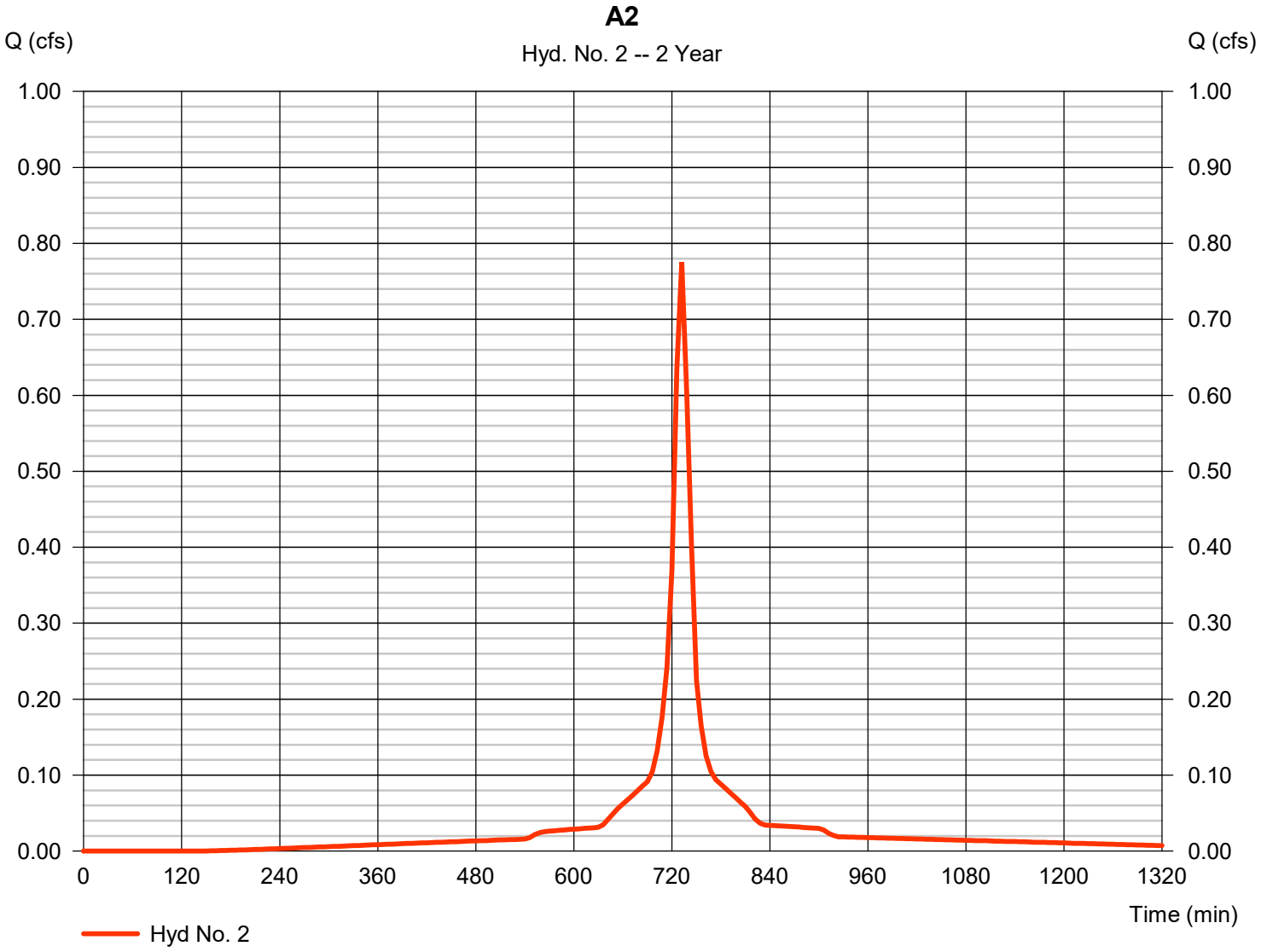


Hydrograph Report

Hyd. No. 2

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.775 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,779 cuft
Drainage area	=	0.313 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

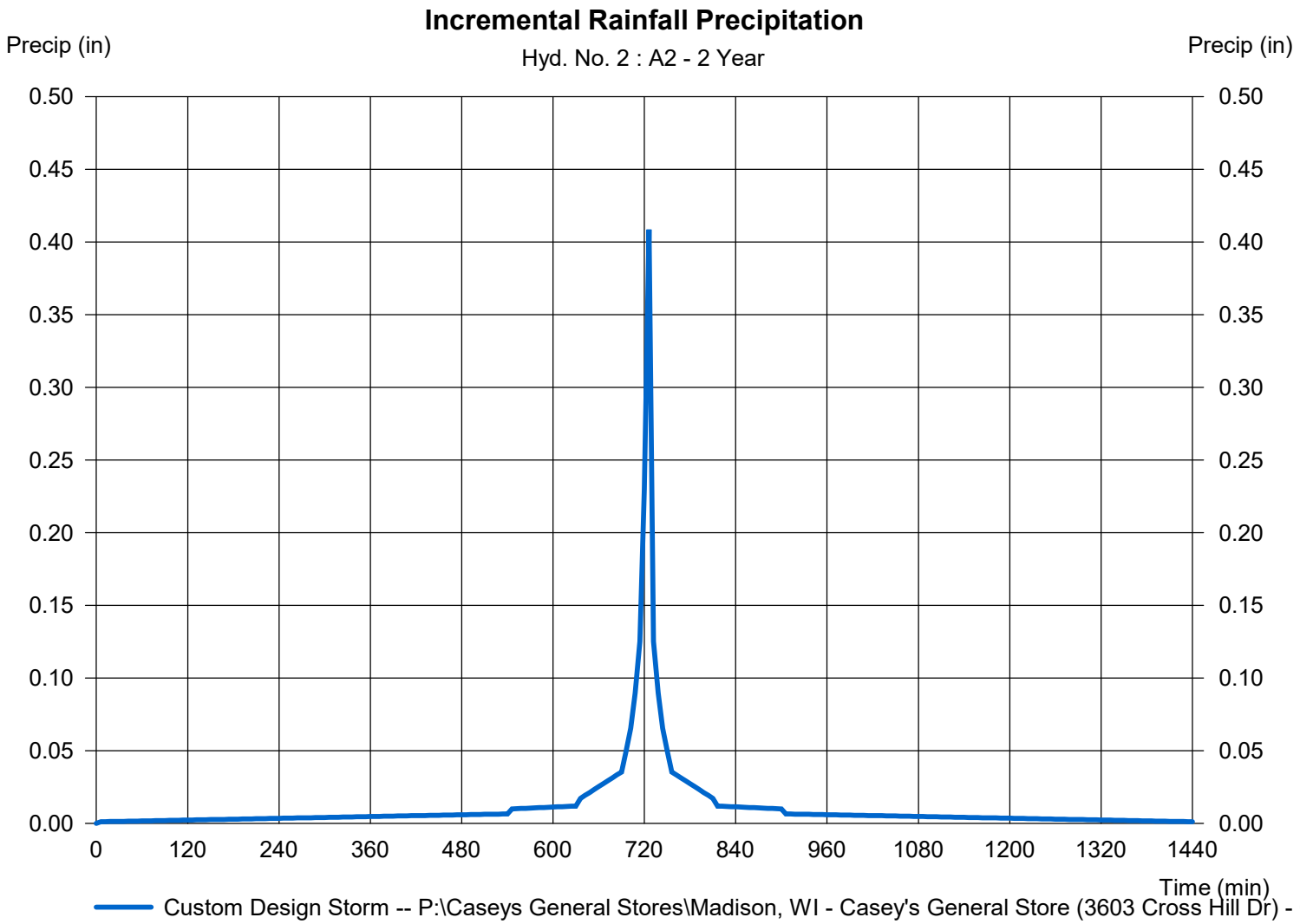


Precipitation Report

Hyd. No. 2

A2

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

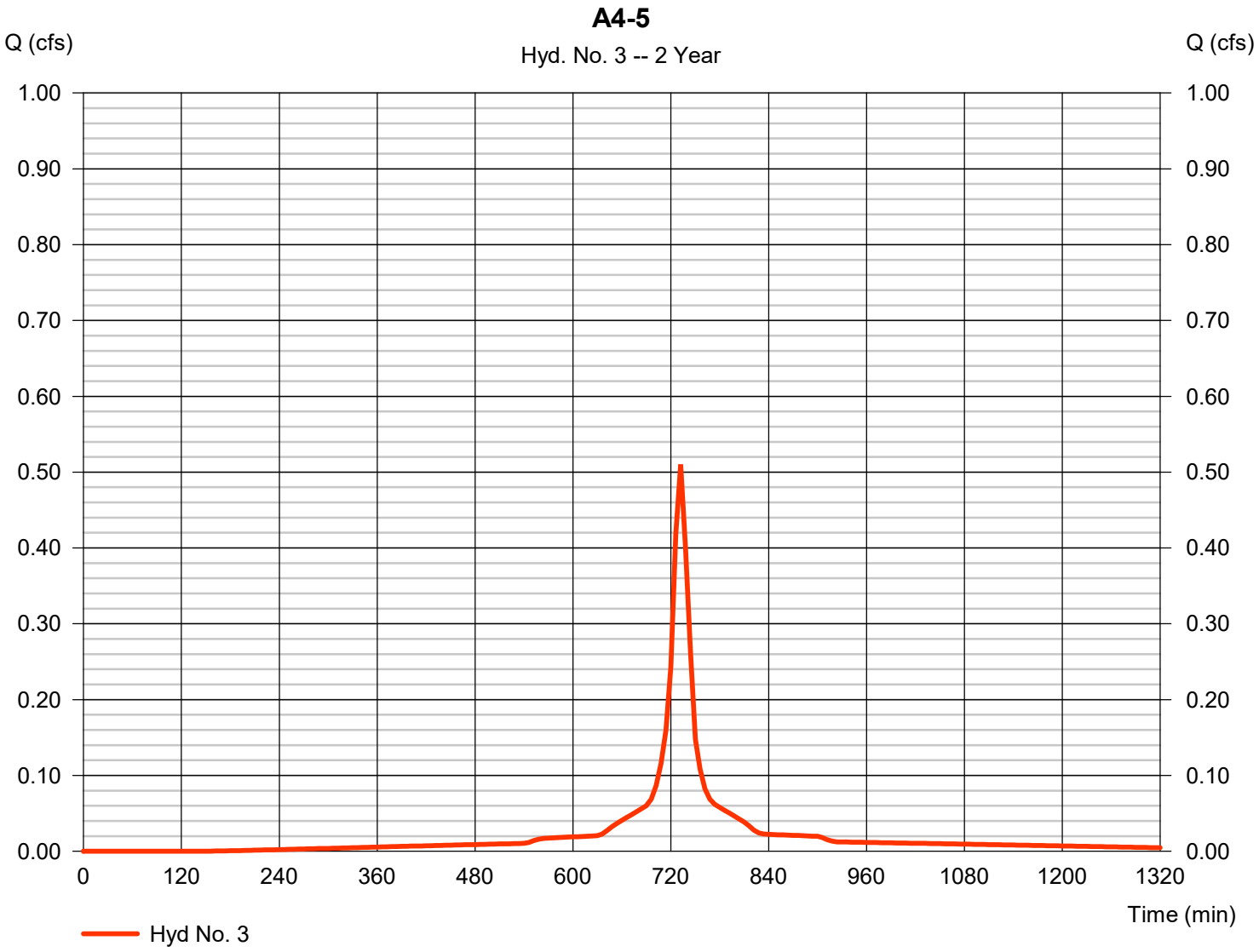


Hydrograph Report

Hyd. No. 3

A4-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.510 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,829 cuft
Drainage area	=	0.206 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtq	=	488

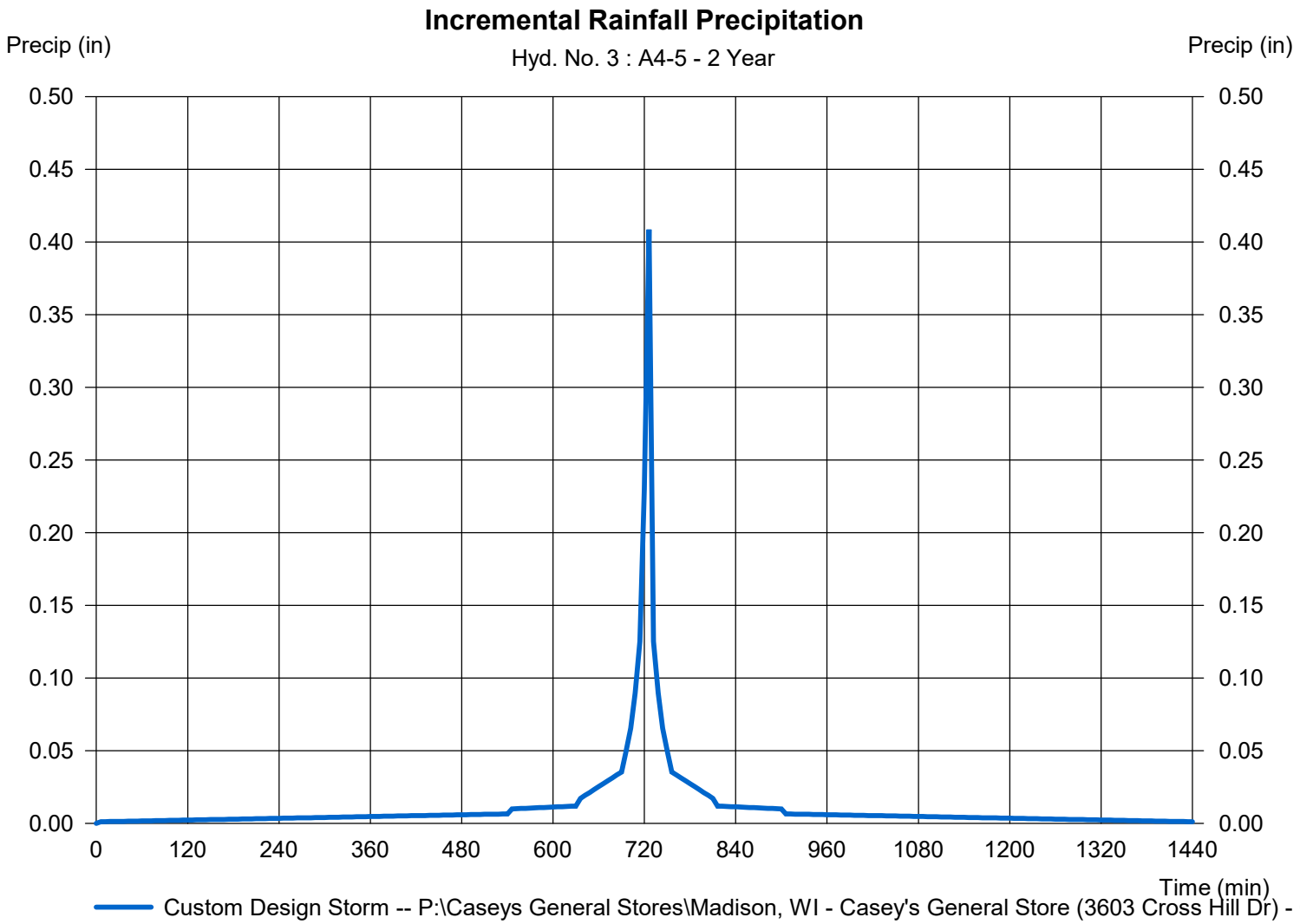


Precipitation Report

Hyd. No. 3

A4-5

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

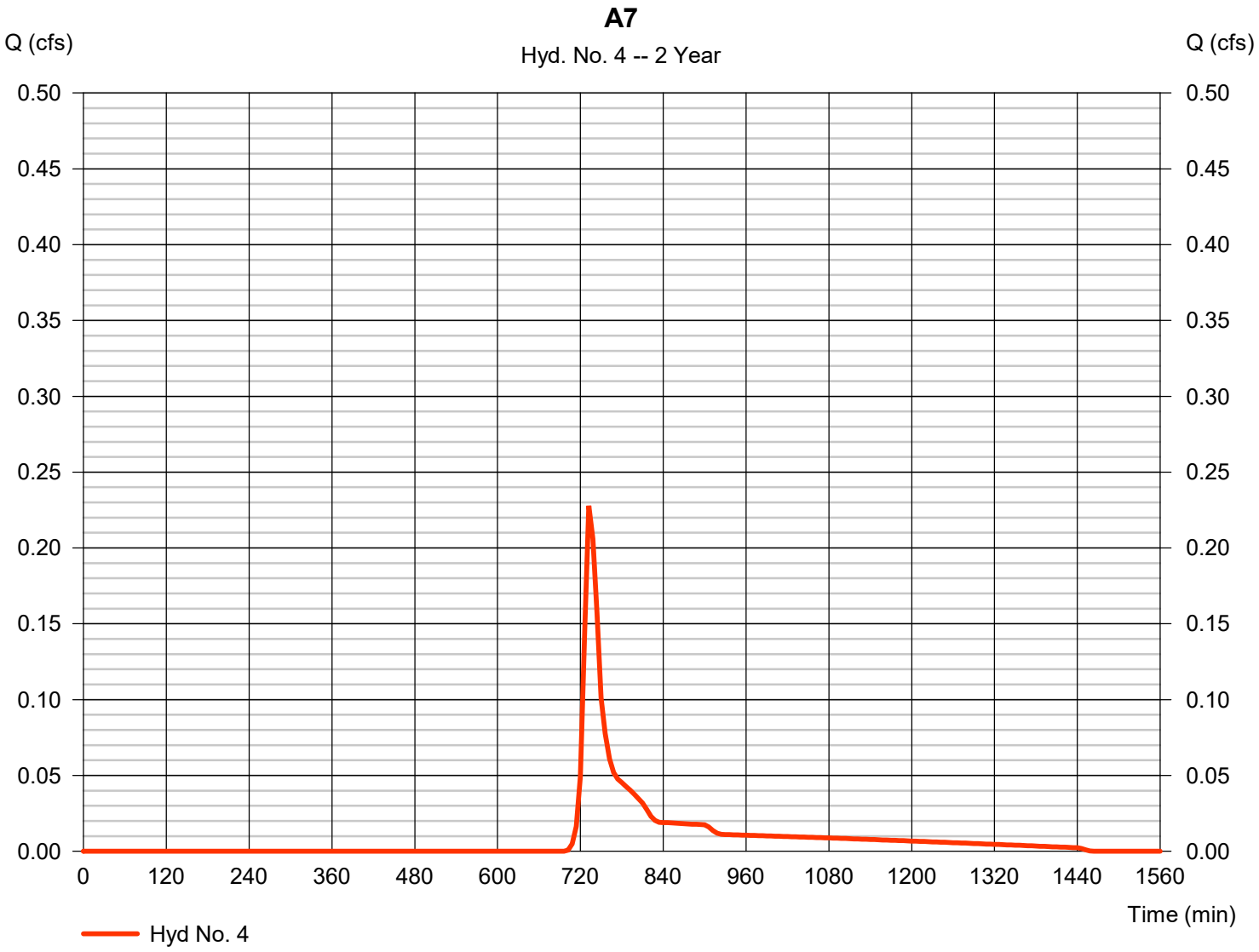


Hydrograph Report

Hyd. No. 4

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.228 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	835 cuft
Drainage area	=	0.366 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

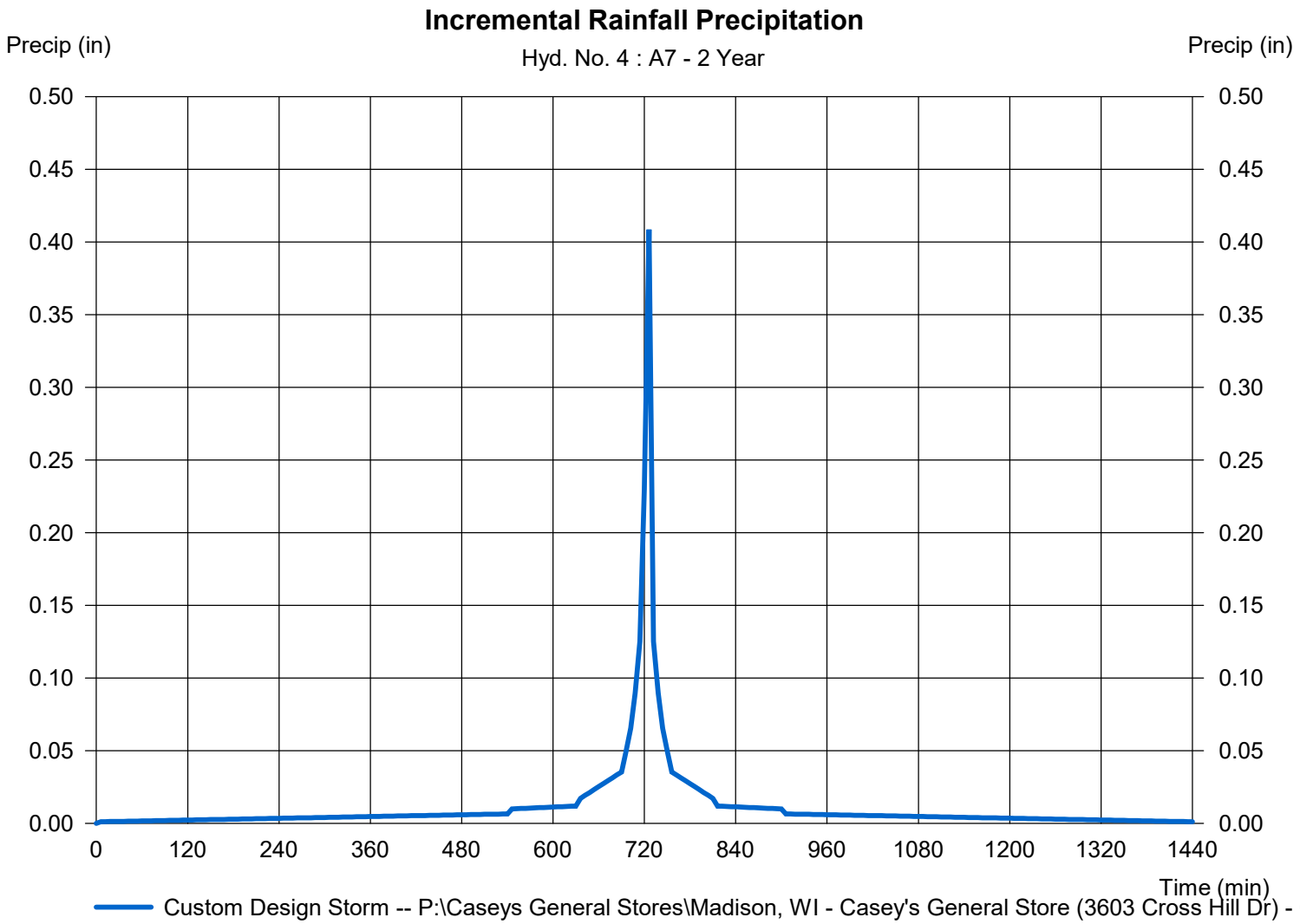


Precipitation Report

Hyd. No. 4

A7

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

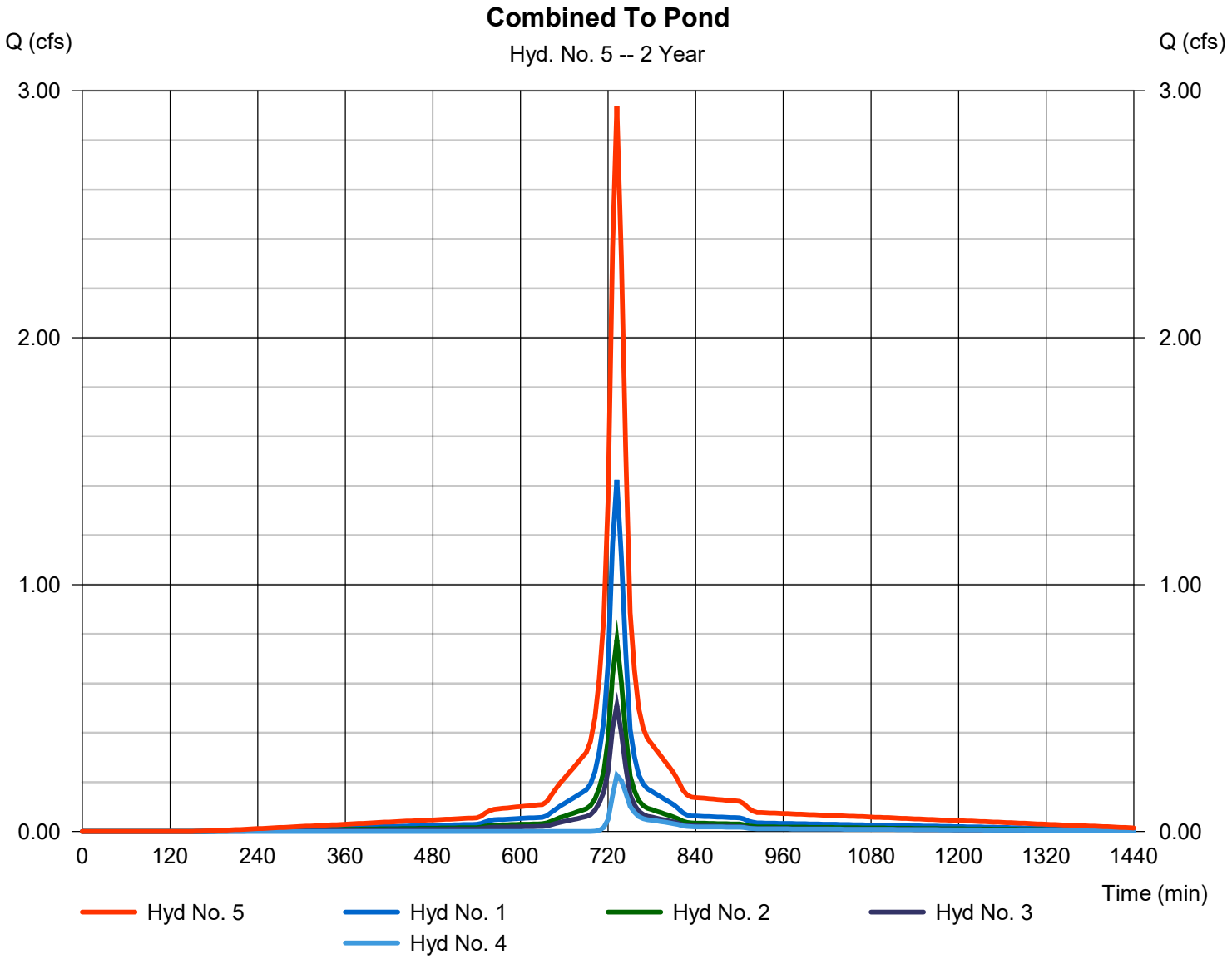


Hydrograph Report

Hyd. No. 5

Combined To Pond

Hydrograph type	=	Combine	Peak discharge	=	2.937 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	10,548 cuft
Inflow hyds.	=	1, 2, 3, 4	Contrib. drain. area	=	1.460 ac



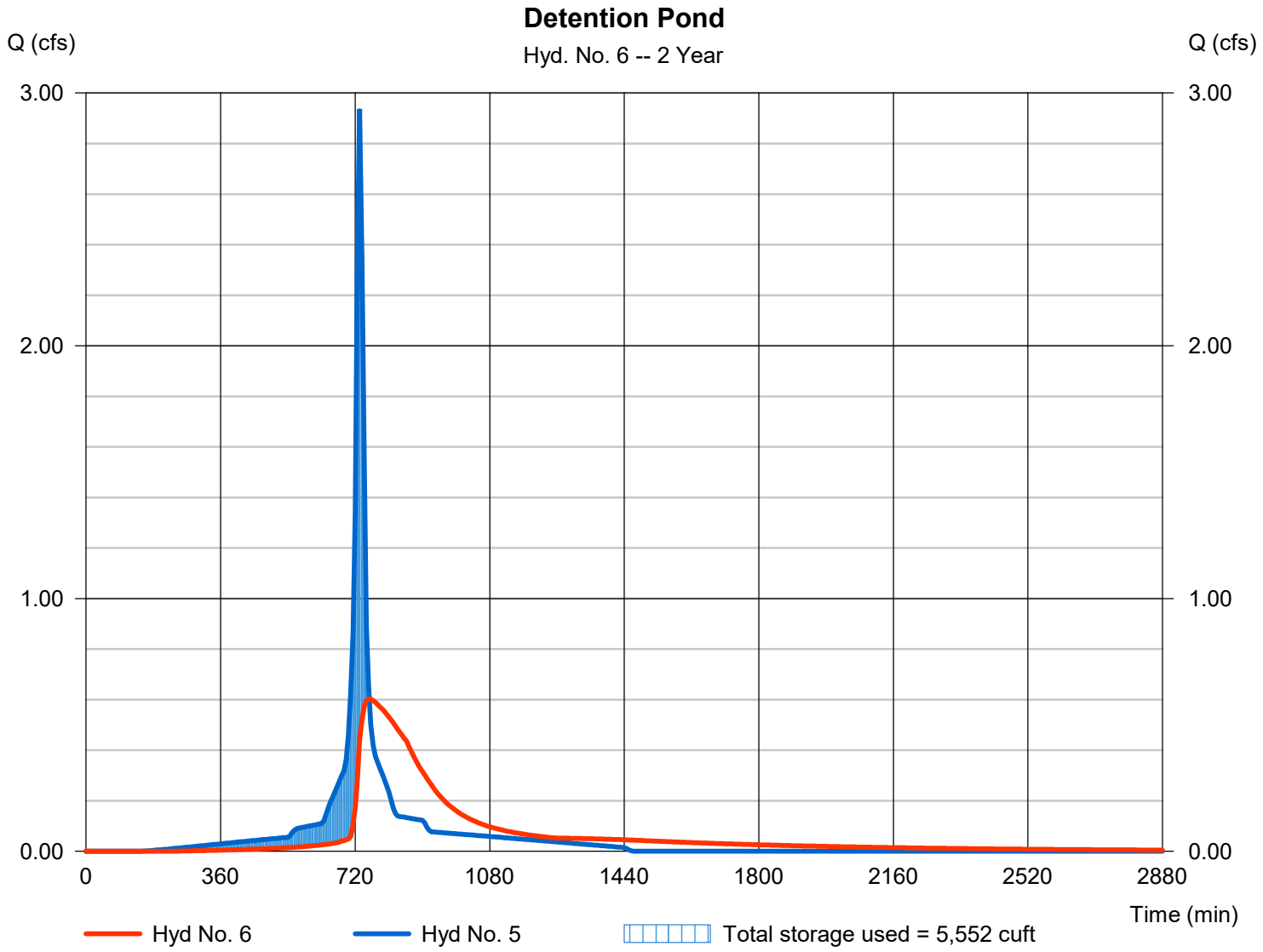
Hydrograph Report

Hyd. No. 6

Detention Pond

Hydrograph type	=	Reservoir	Peak discharge	=	0.603 cfs
Storm frequency	=	2 yrs	Time to peak	=	756 min
Time interval	=	6 min	Hyd. volume	=	10,510 cuft
Inflow hyd. No.	=	5 - Combined To Pond	Max. Elevation	=	985.49 ft
Reservoir name	=	Detention	Max. Storage	=	5,552 cuft

Storage Indication method used.

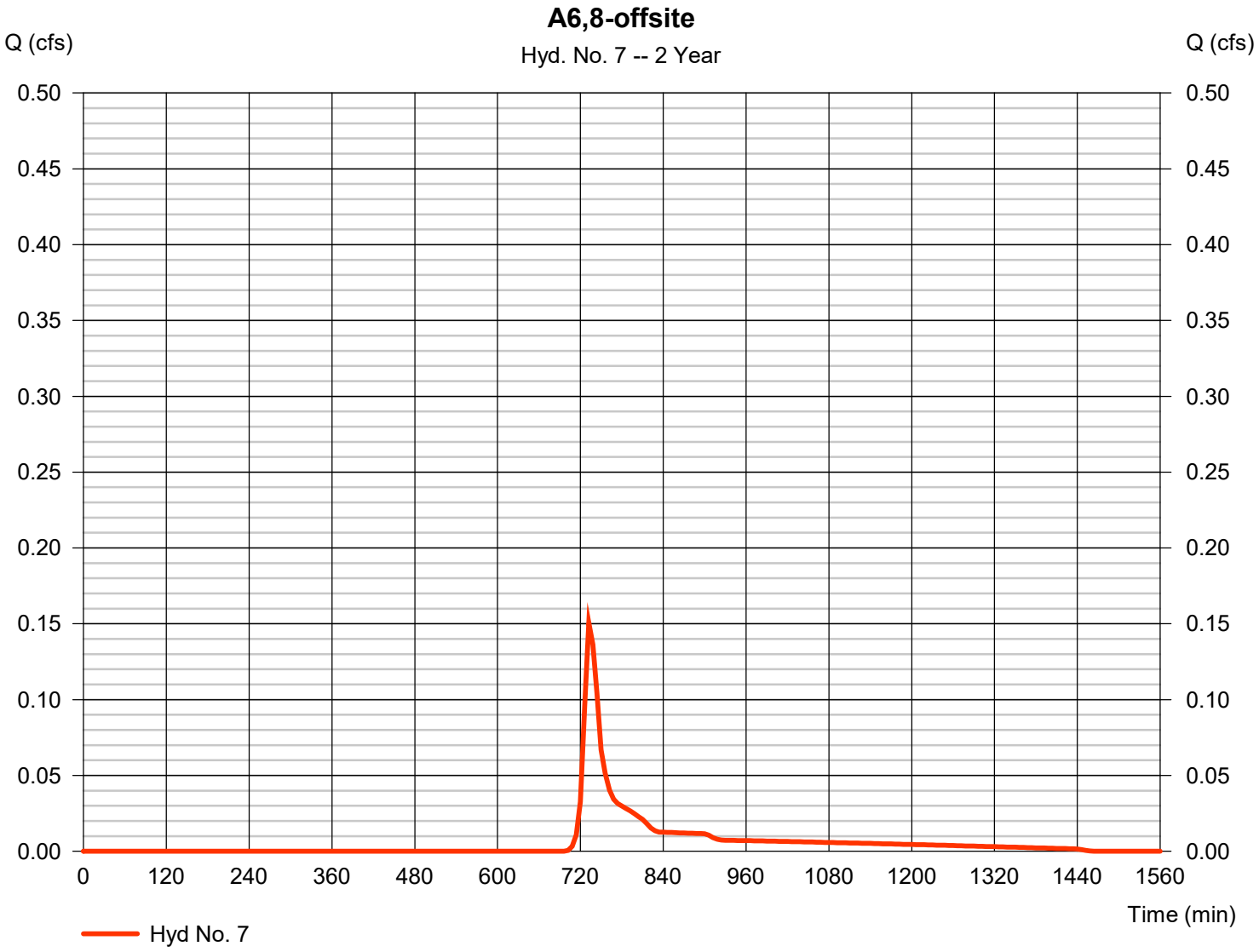


Hydrograph Report

Hyd. No. 7

A6,8-offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.151 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	552 cuft
Drainage area	=	0.242 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtn	=	488

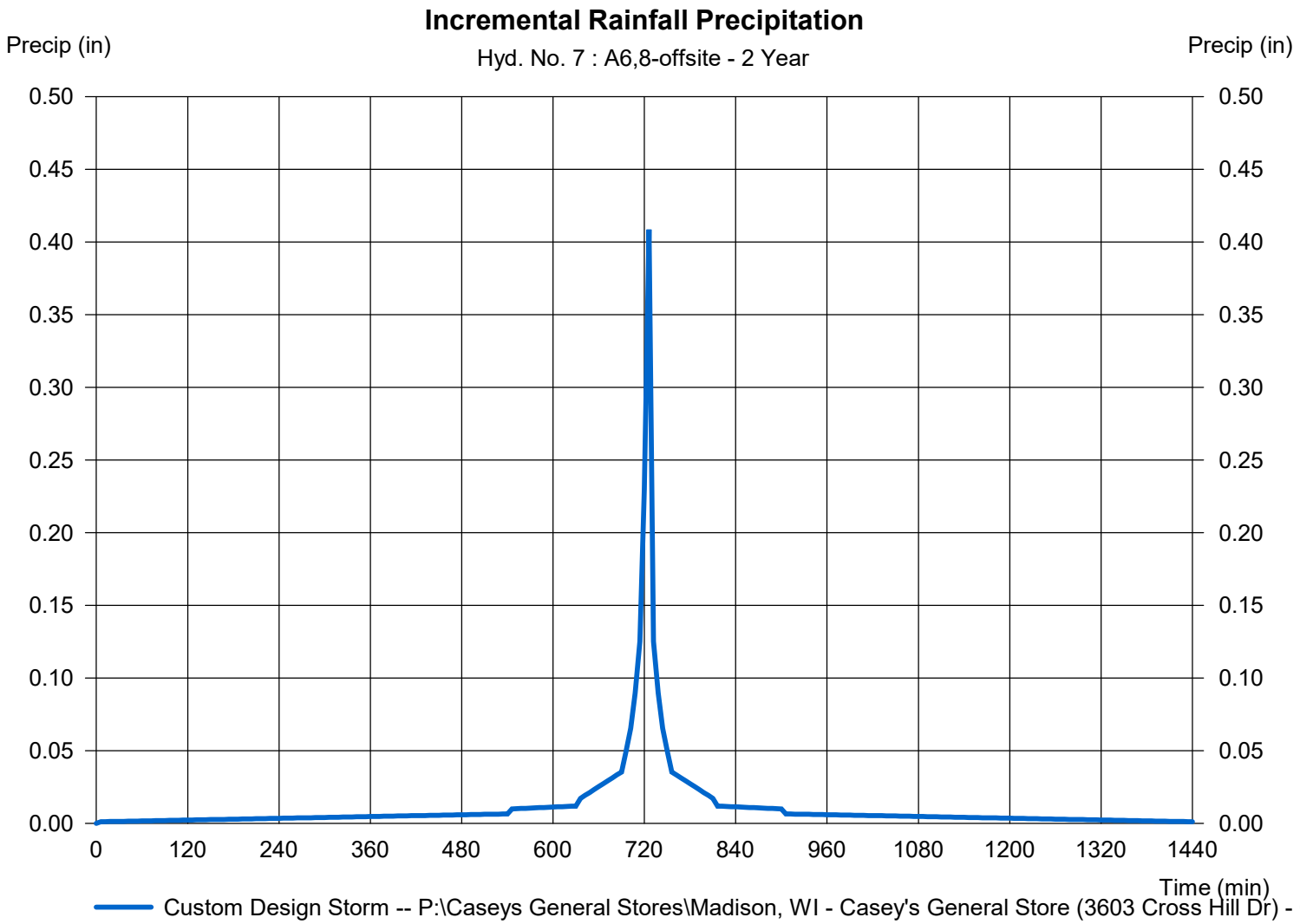


Precipitation Report

Hyd. No. 7

A6,8-offsite

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		



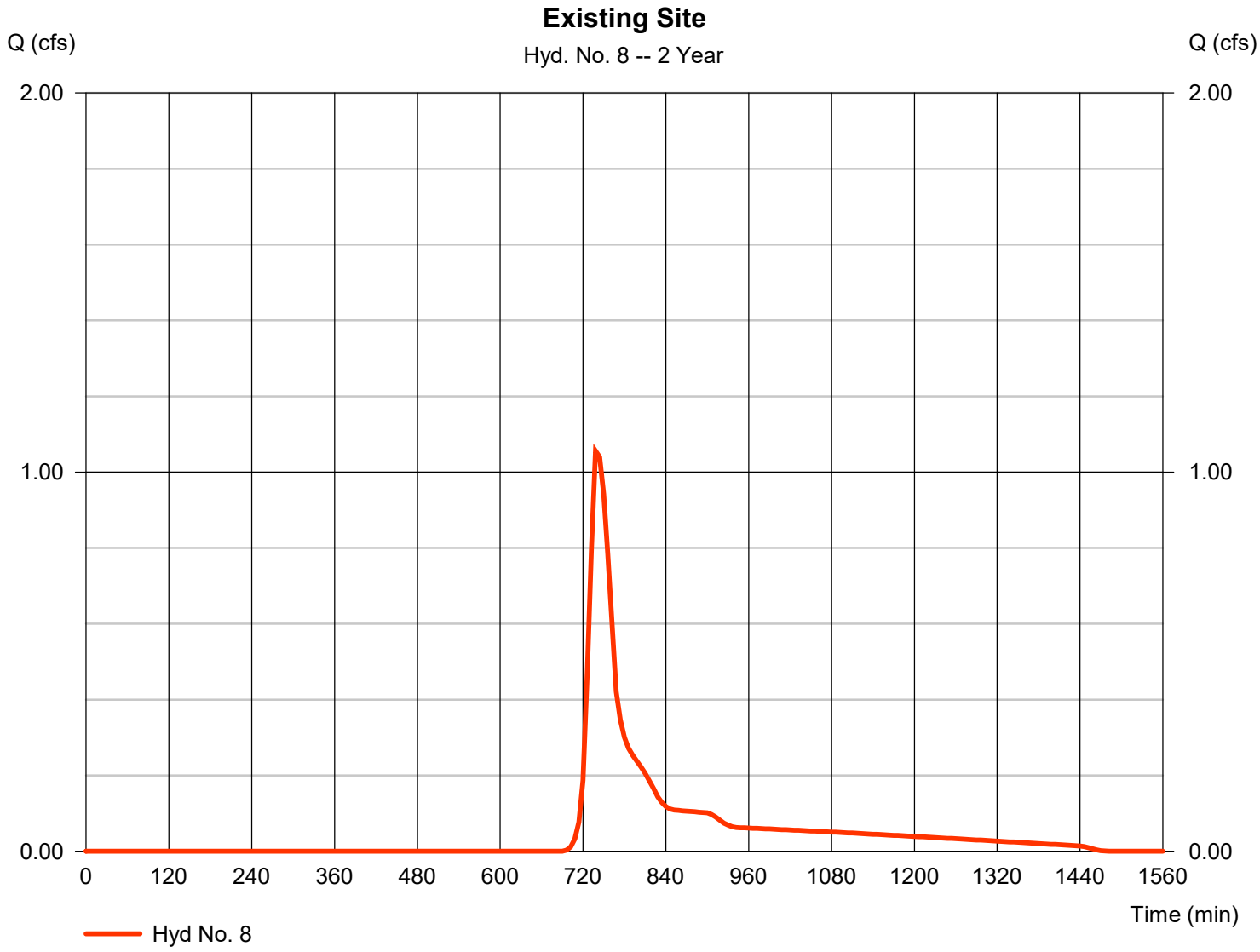
Hydrograph Report

Hyd. No. 8

Existing Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.056 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	4,998 cuft
Drainage area	=	1.810 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.10 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frq.	=	2 yrs

* Composite (Area/CN) = [(1.300 x 71) + (0.511 x 78)] / 1.810

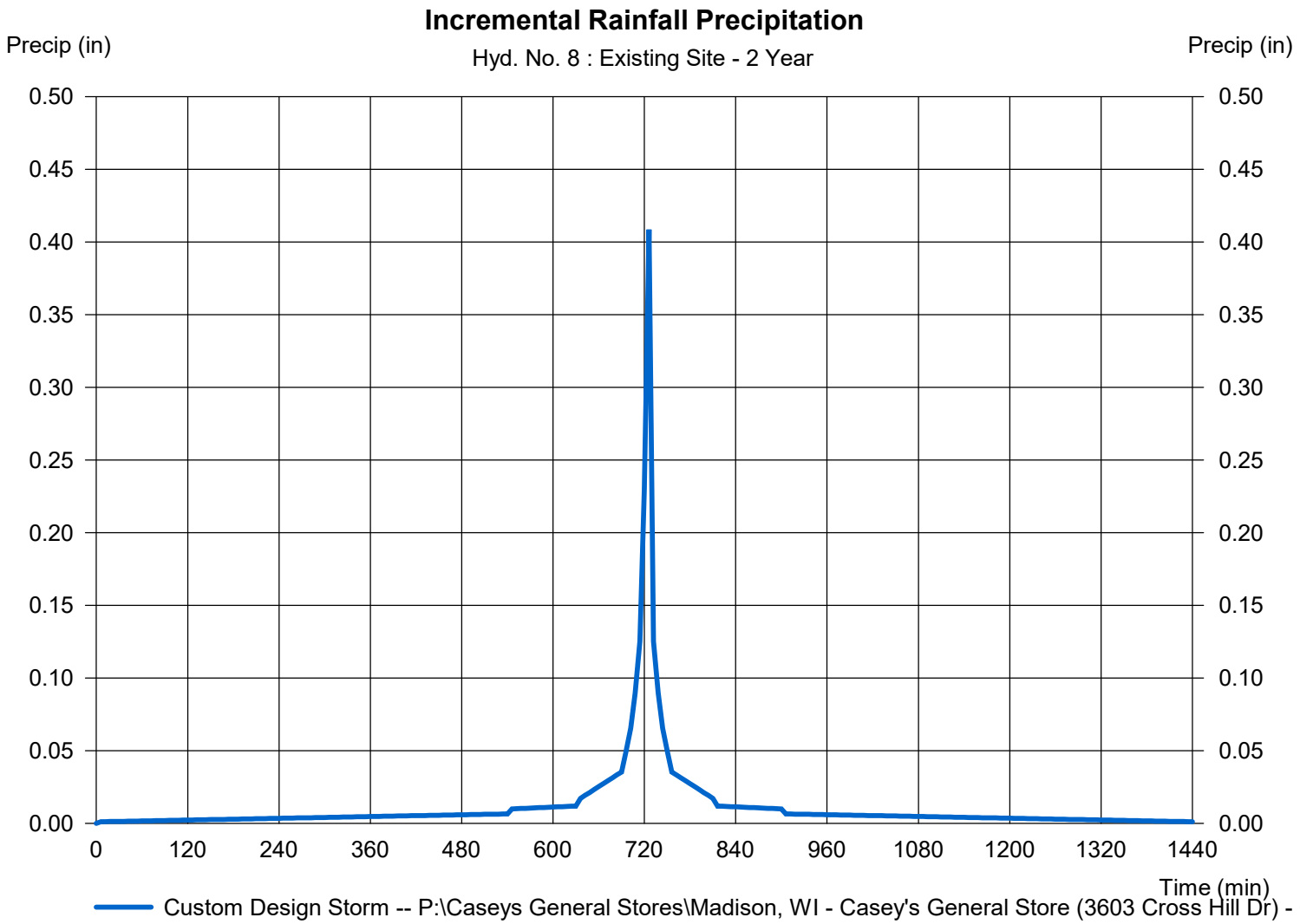


Precipitation Report

Hyd. No. 8

Existing Site

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

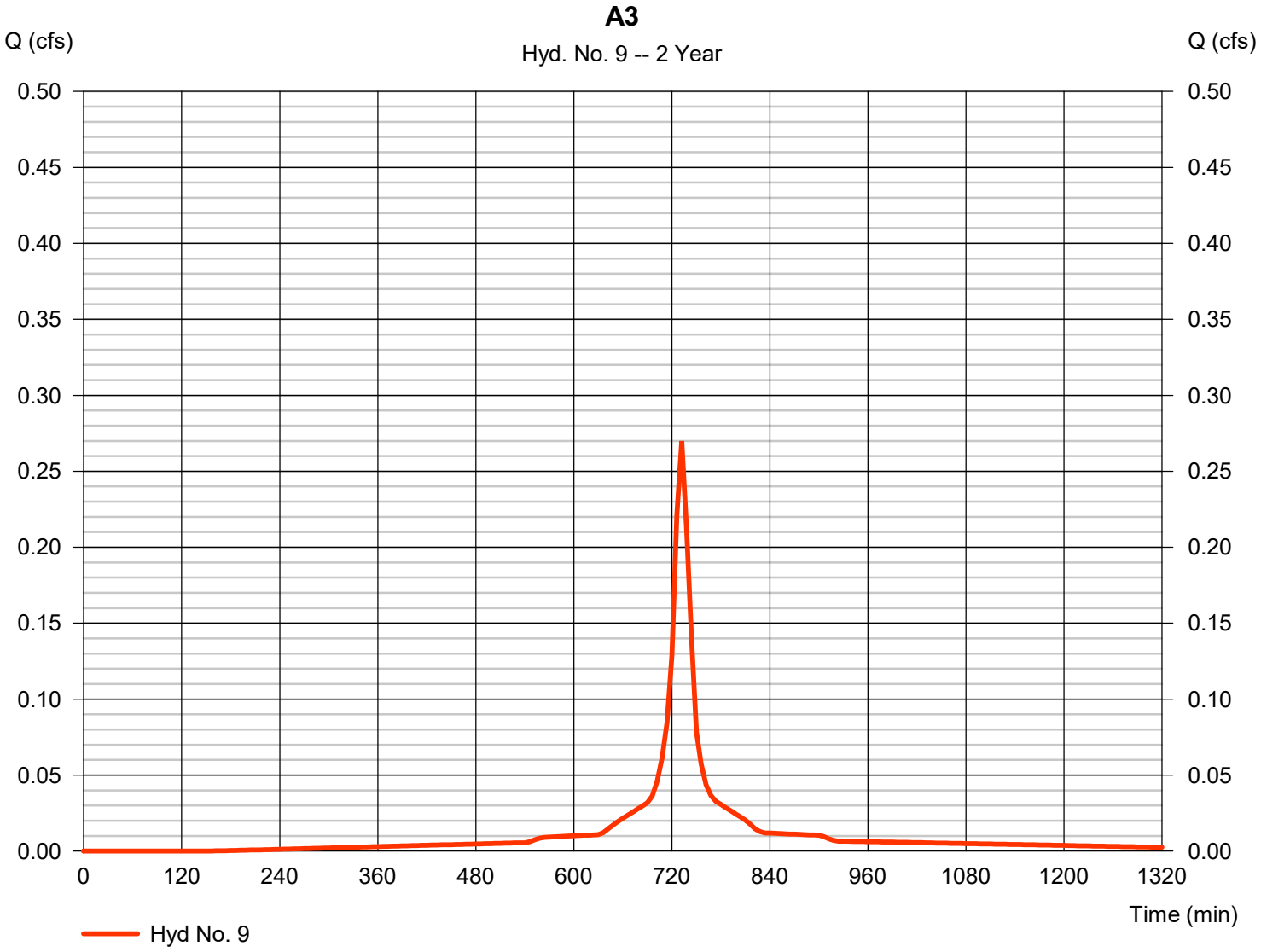


Hydrograph Report

Hyd. No. 9

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.270 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	968 cuft
Drainage area	=	0.109 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.84 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

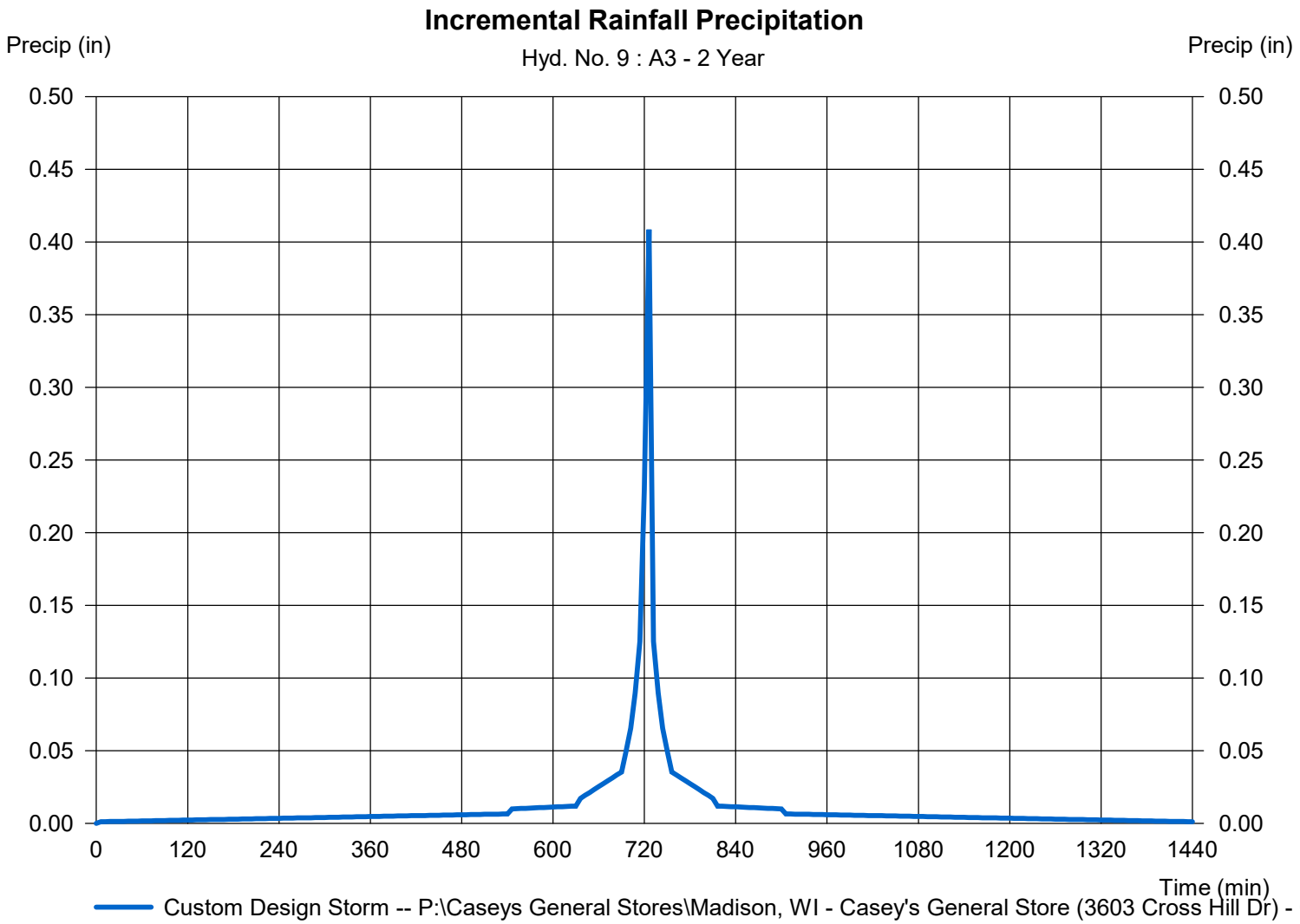


Precipitation Report

Hyd. No. 9

A3

Storm Frequency	= 2 yrs	Time interval	= 6 min
Total precip.	= 2.8400 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

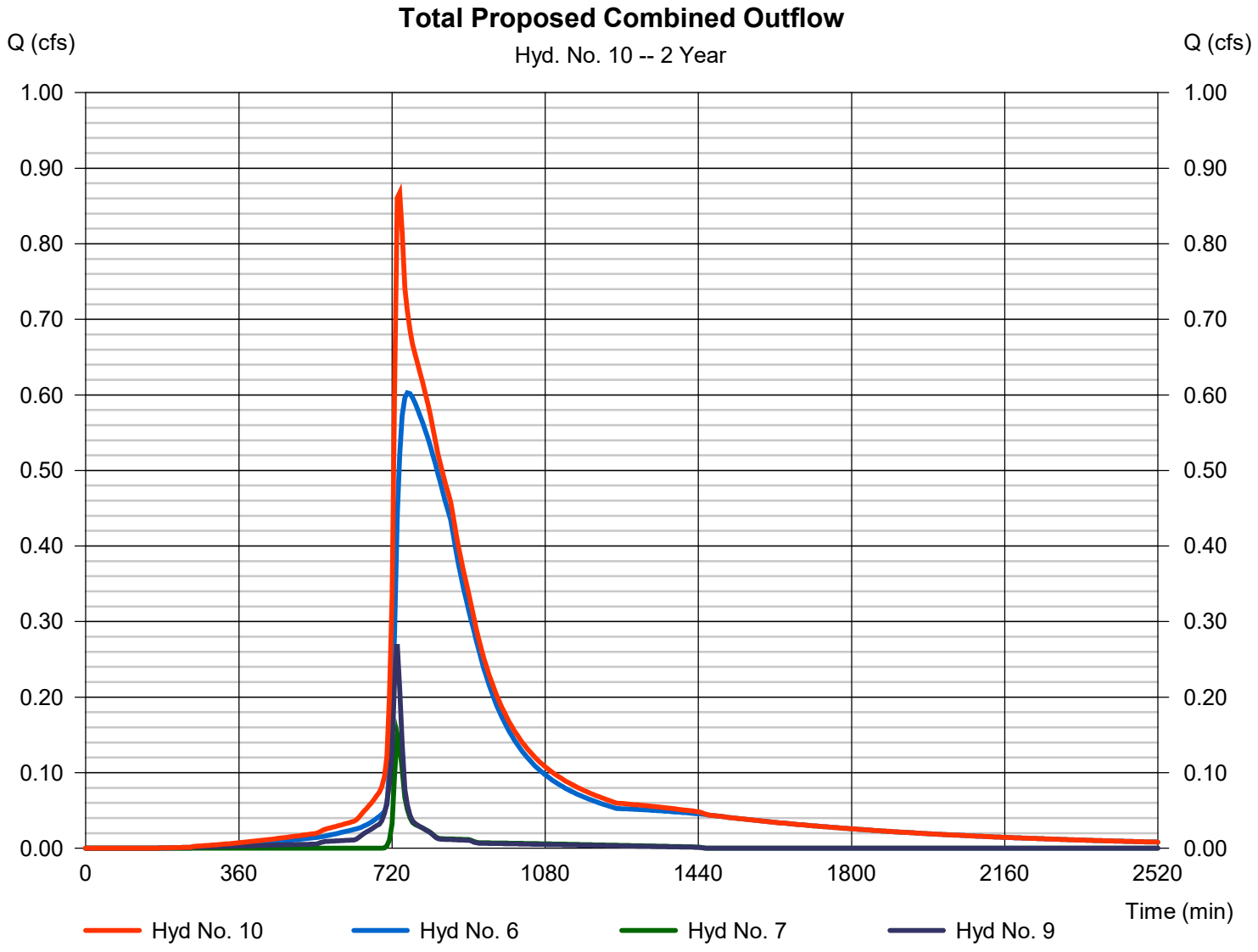


Hydrograph Report

Hyd. No. 10

Total Proposed Combined Outflow

Hydrograph type	= Combine	Peak discharge	= 0.867 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 12,030 cuft
Inflow hyds.	= 6, 7, 9	Contrib. drain. area	= 0.351 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

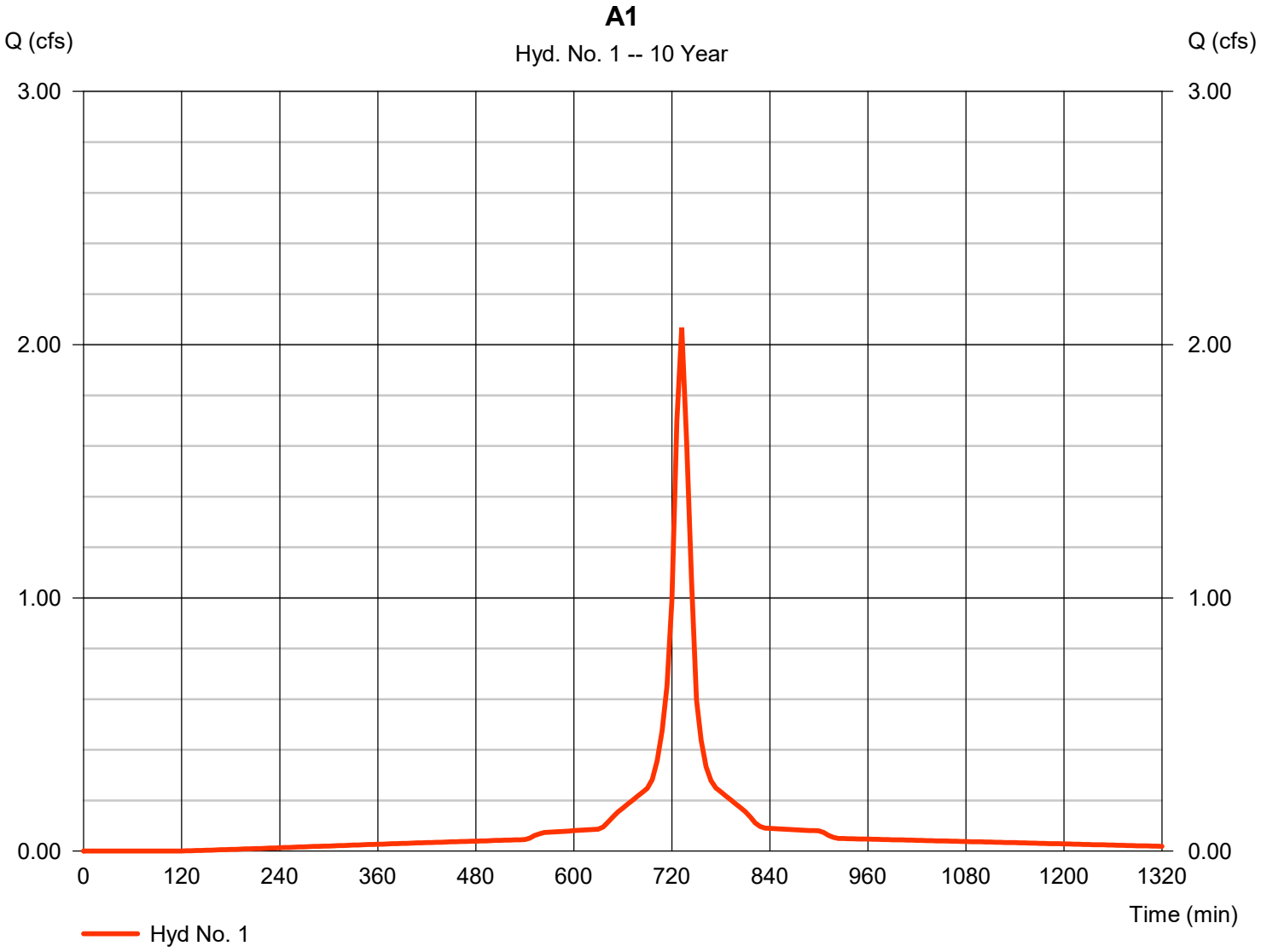
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.068	6	732	7,543	------	------	------	A1
2	SCS Runoff	1.126	6	732	4,106	------	------	------	A2
3	SCS Runoff	0.741	6	732	2,702	------	------	------	A4-5
4	SCS Runoff	0.549	6	732	1,814	------	------	------	A7
5	Combine	4.484	6	732	16,165	1, 2, 3, 4	------	------	Combined To Pond
6	Reservoir	1.038	6	756	16,128	5	985.97	8,254	Detention Pond
7	SCS Runoff	0.363	6	732	1,199	------	------	------	A6,8-offsite
8	SCS Runoff	2.421	6	738	10,462	------	------	------	Existing Site
9	SCS Runoff	0.392	6	732	1,430	------	------	------	A3
10	Combine	1.389	6	732	18,757	6, 7, 9	------	------	Total Proposed Combined Outflow

Hydrograph Report

Hyd. No. 1

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.068 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	7,543 cuft
Drainage area	=	0.575 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frq.	=	10 yrs

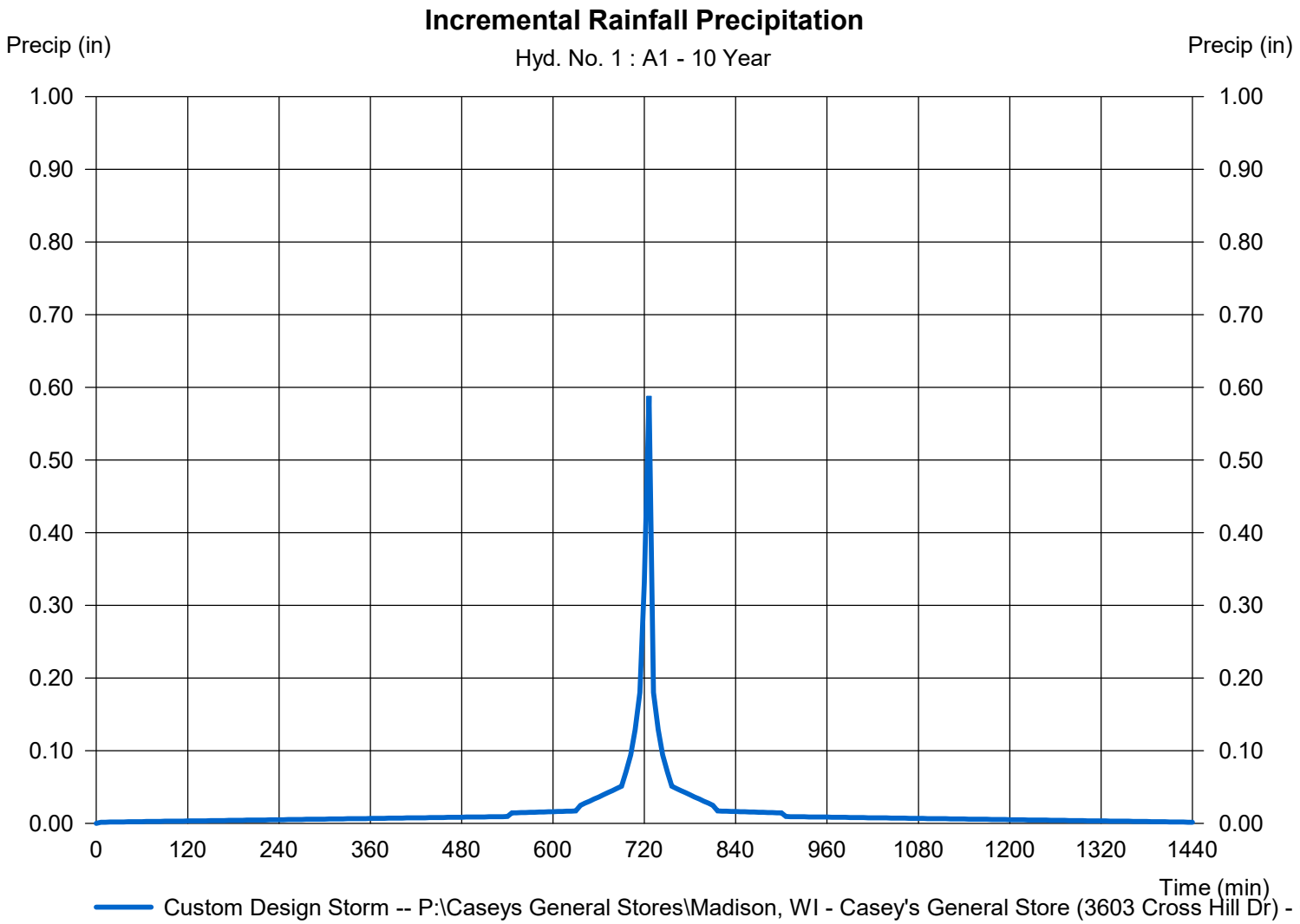


Precipitation Report

Hyd. No. 1

A1

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

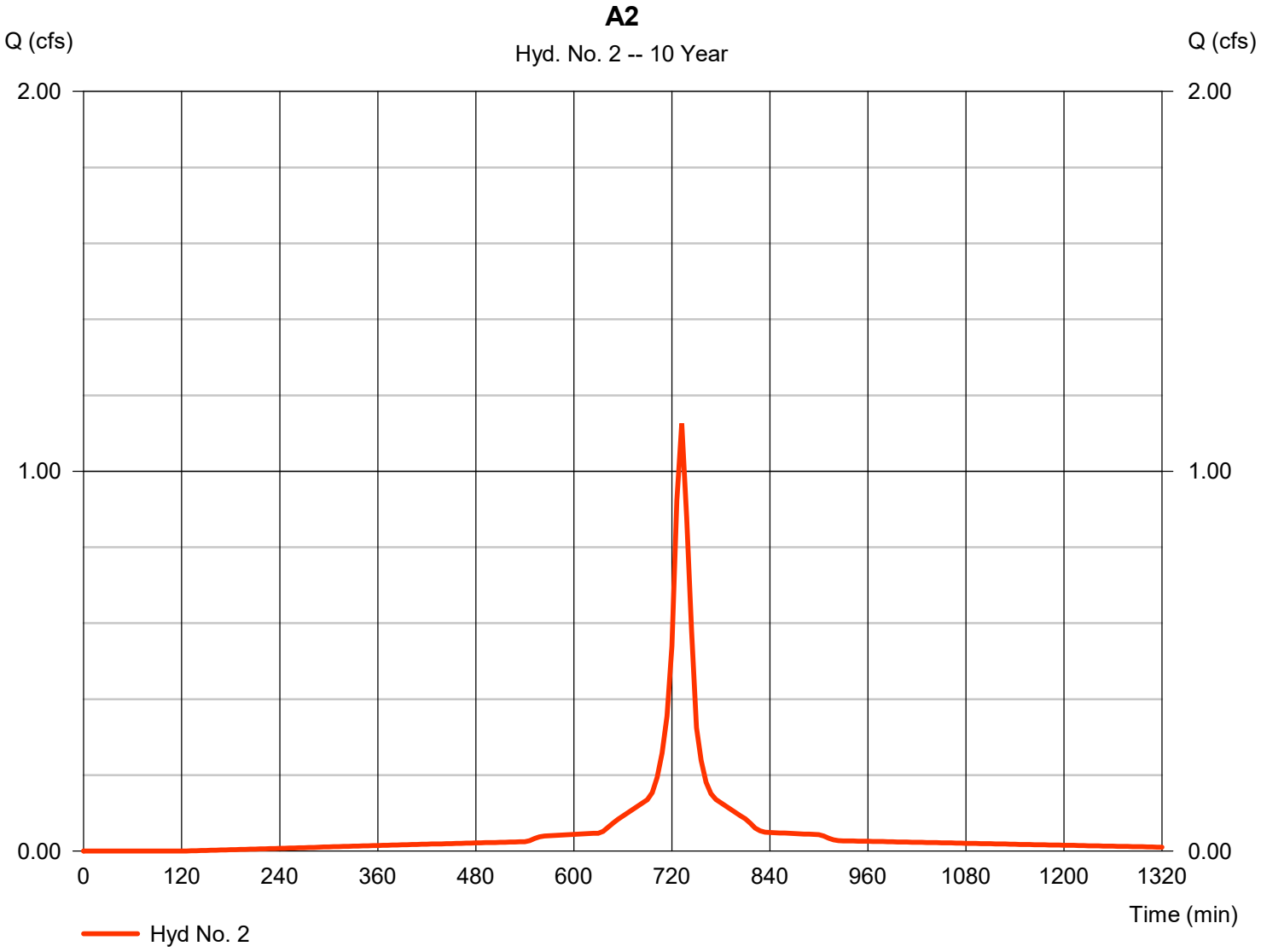


Hydrograph Report

Hyd. No. 2

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.126 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	4,106 cuft
Drainage area	=	0.313 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

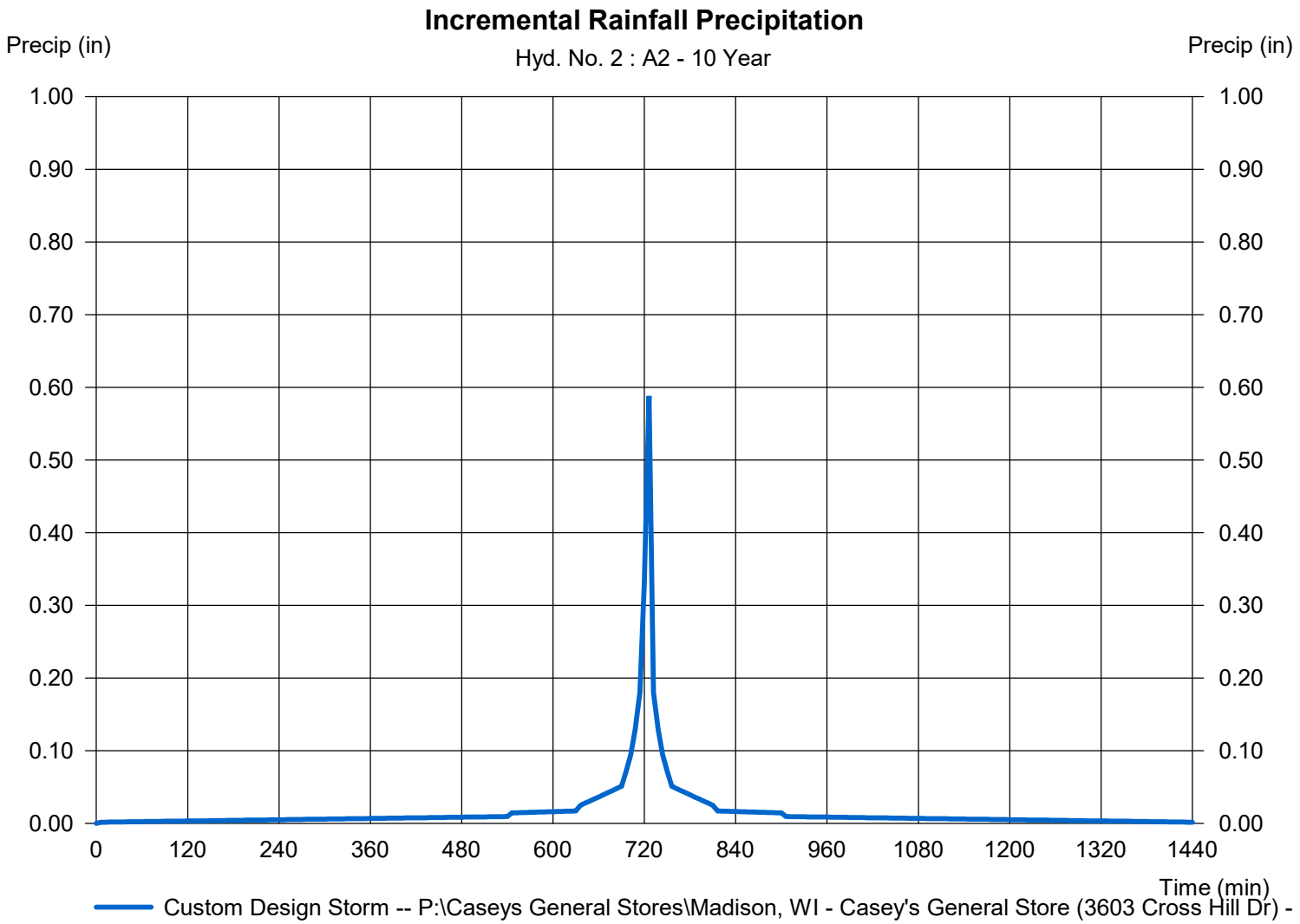


Precipitation Report

Hyd. No. 2

A2

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

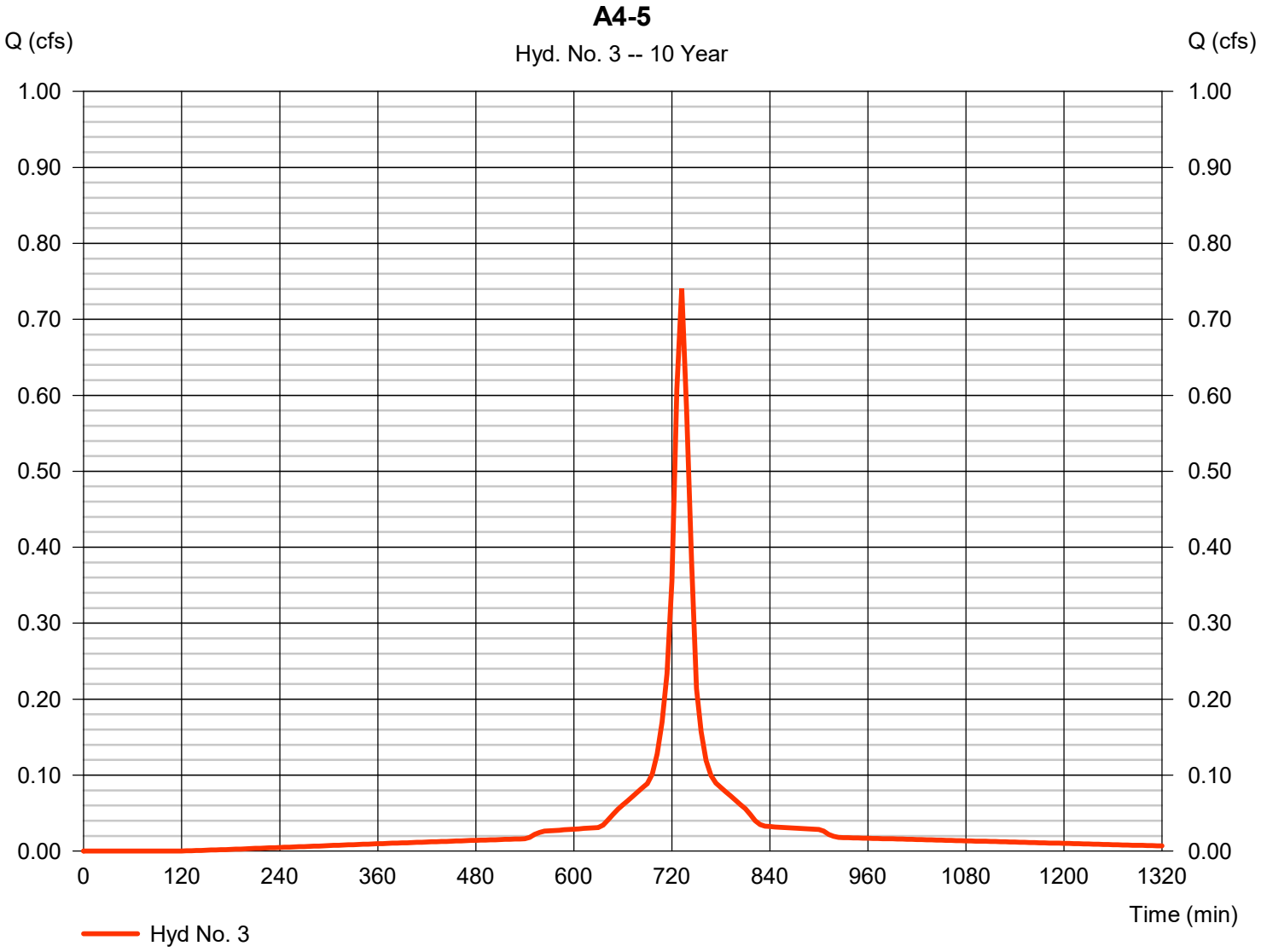


Hydrograph Report

Hyd. No. 3

A4-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.741 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,702 cuft
Drainage area	=	0.206 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	48

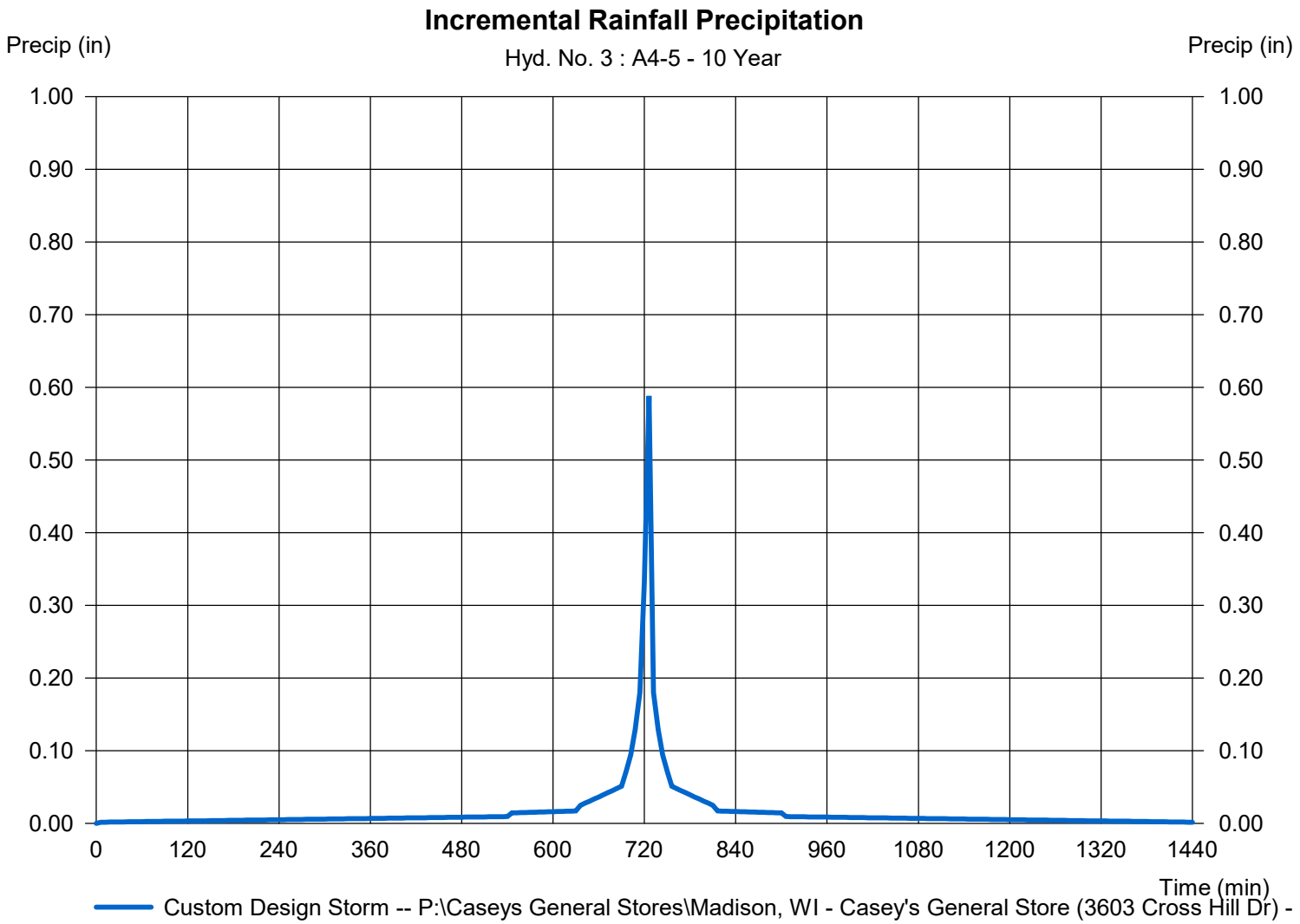


Precipitation Report

Hyd. No. 3

A4-5

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

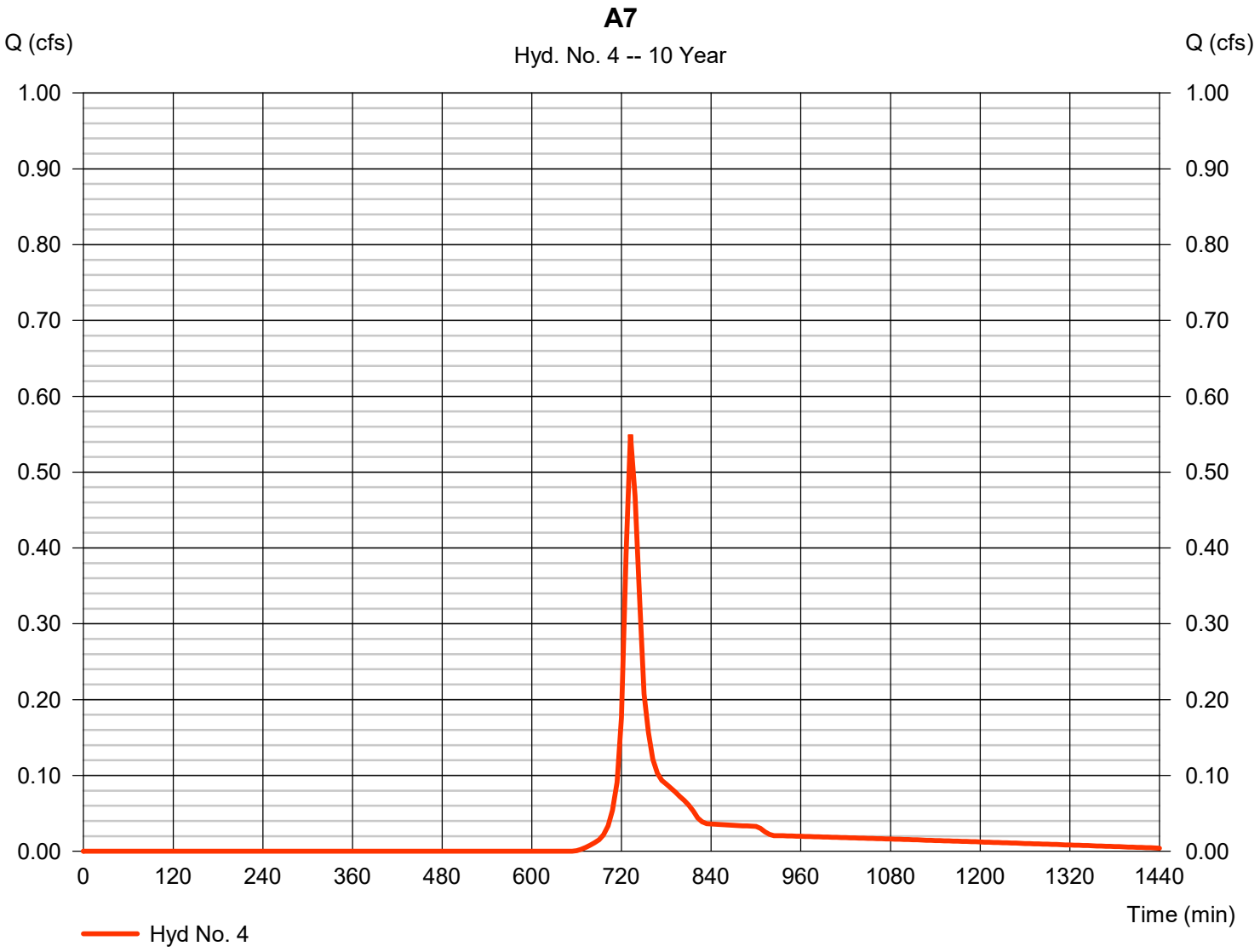


Hydrograph Report

Hyd. No. 4

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.549 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,814 cuft
Drainage area	=	0.366 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frequency	=	10 yrs

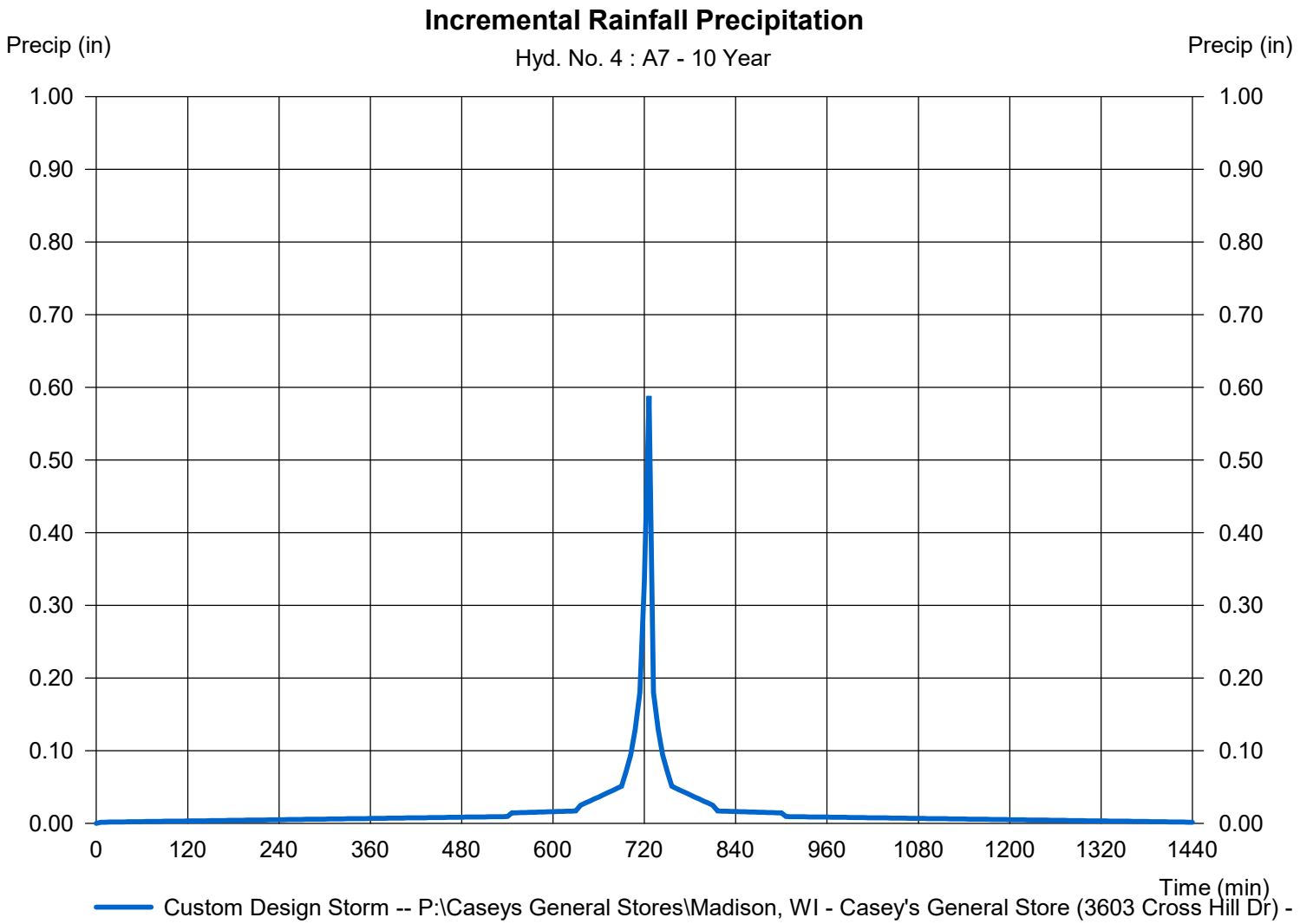


Precipitation Report

Hyd. No. 4

A7

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

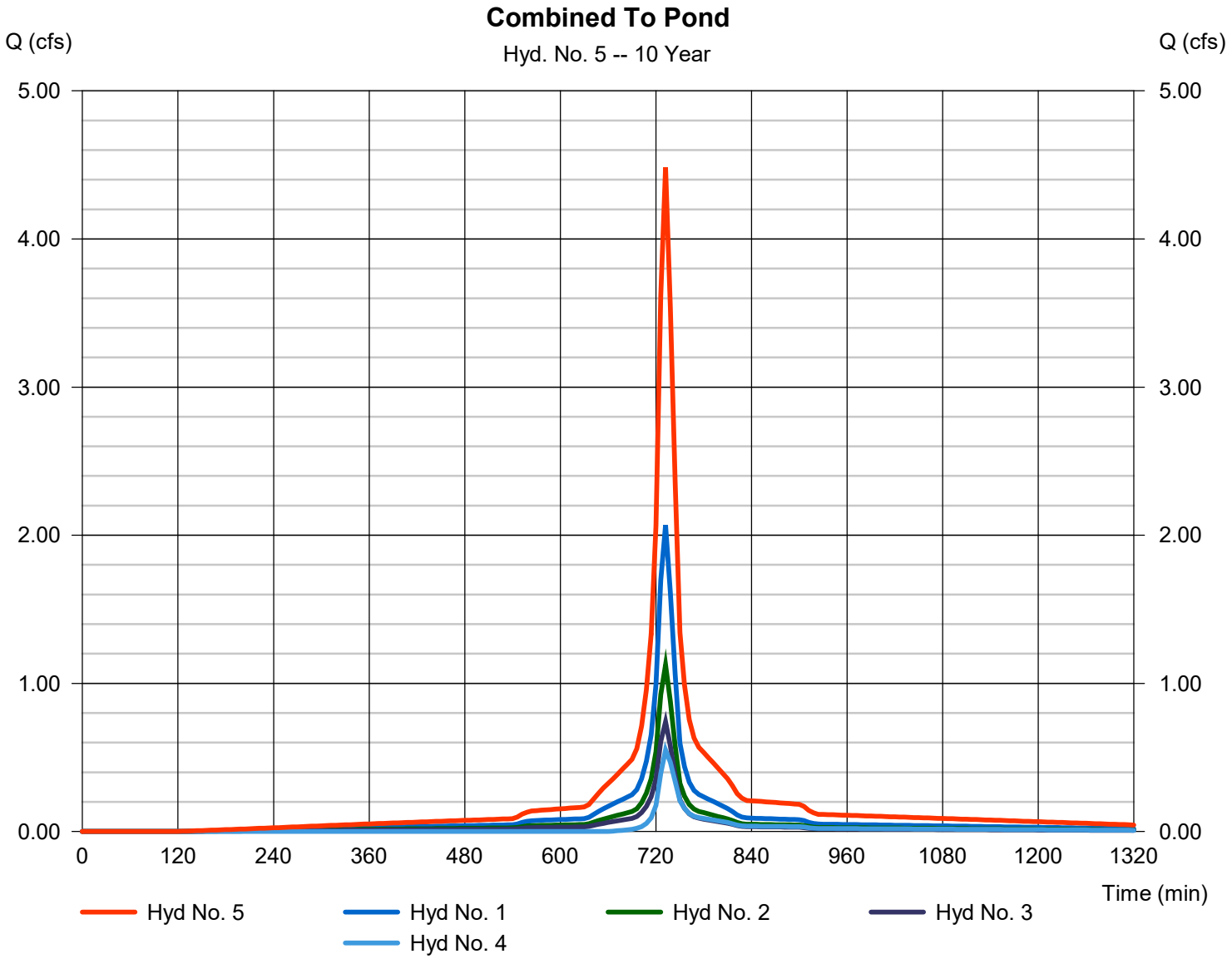


Hydrograph Report

Hyd. No. 5

Combined To Pond

Hydrograph type	= Combine	Peak discharge	= 4.484 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 16,165 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 1.460 ac



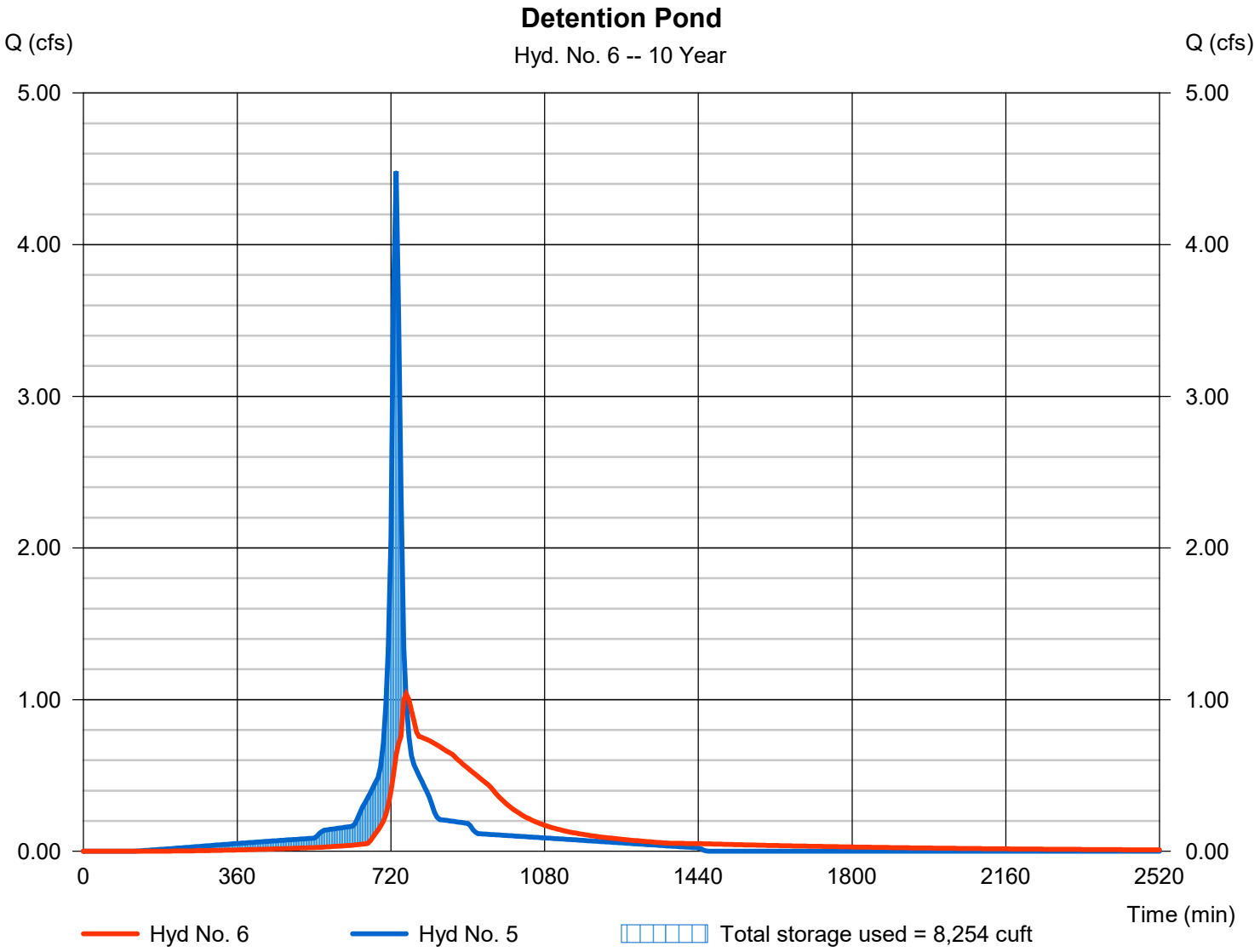
Hydrograph Report

Hyd. No. 6

Detention Pond

Hydrograph type	=	Reservoir	Peak discharge	=	1.038 cfs
Storm frequency	=	10 yrs	Time to peak	=	756 min
Time interval	=	6 min	Hyd. volume	=	16,128 cuft
Inflow hyd. No.	=	5 - Combined To Pond	Max. Elevation	=	985.97 ft
Reservoir name	=	Detention	Max. Storage	=	8,254 cuft

Storage Indication method used.

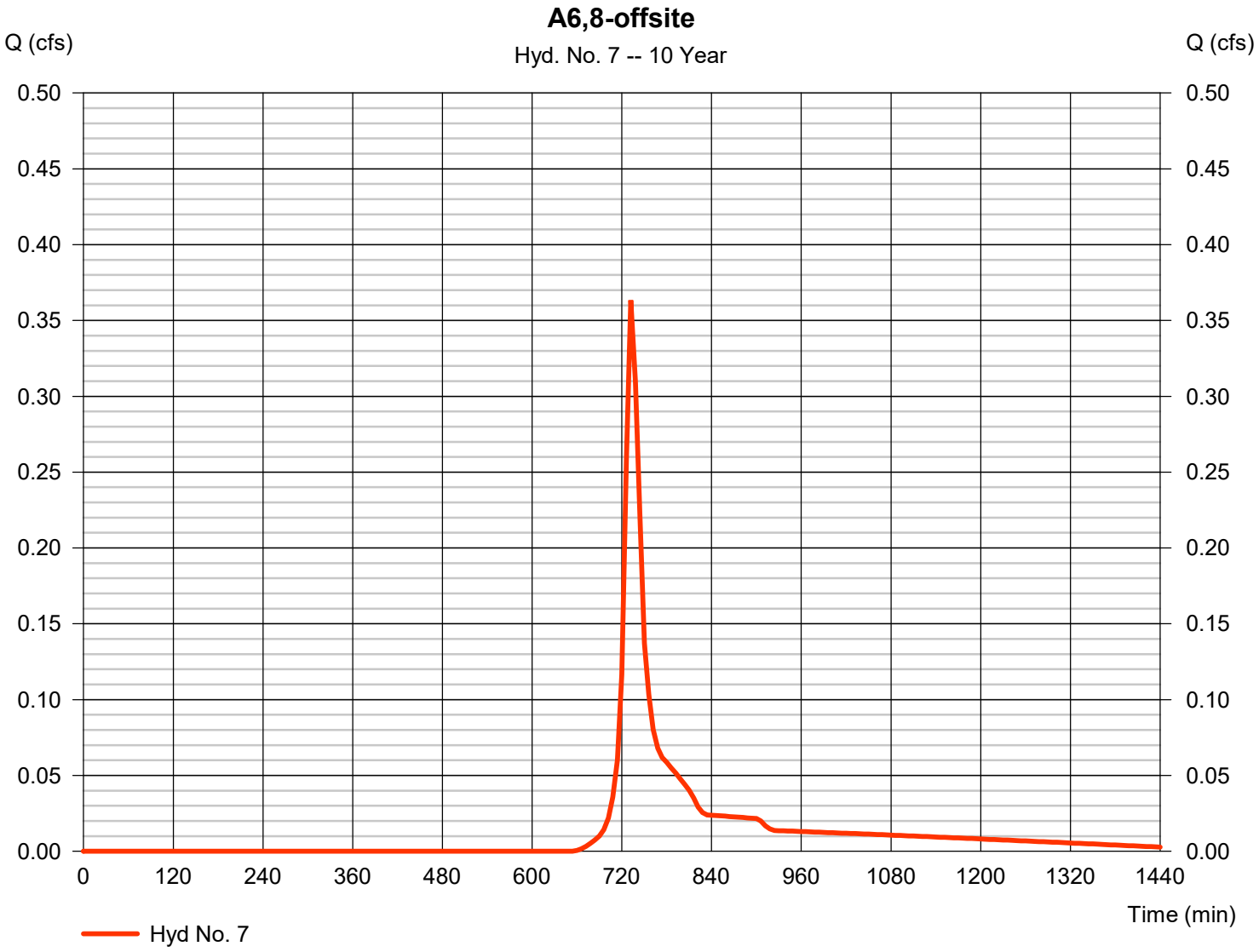


Hydrograph Report

Hyd. No. 7

A6,8-offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.363 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,199 cuft
Drainage area	=	0.242 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtn	=	483

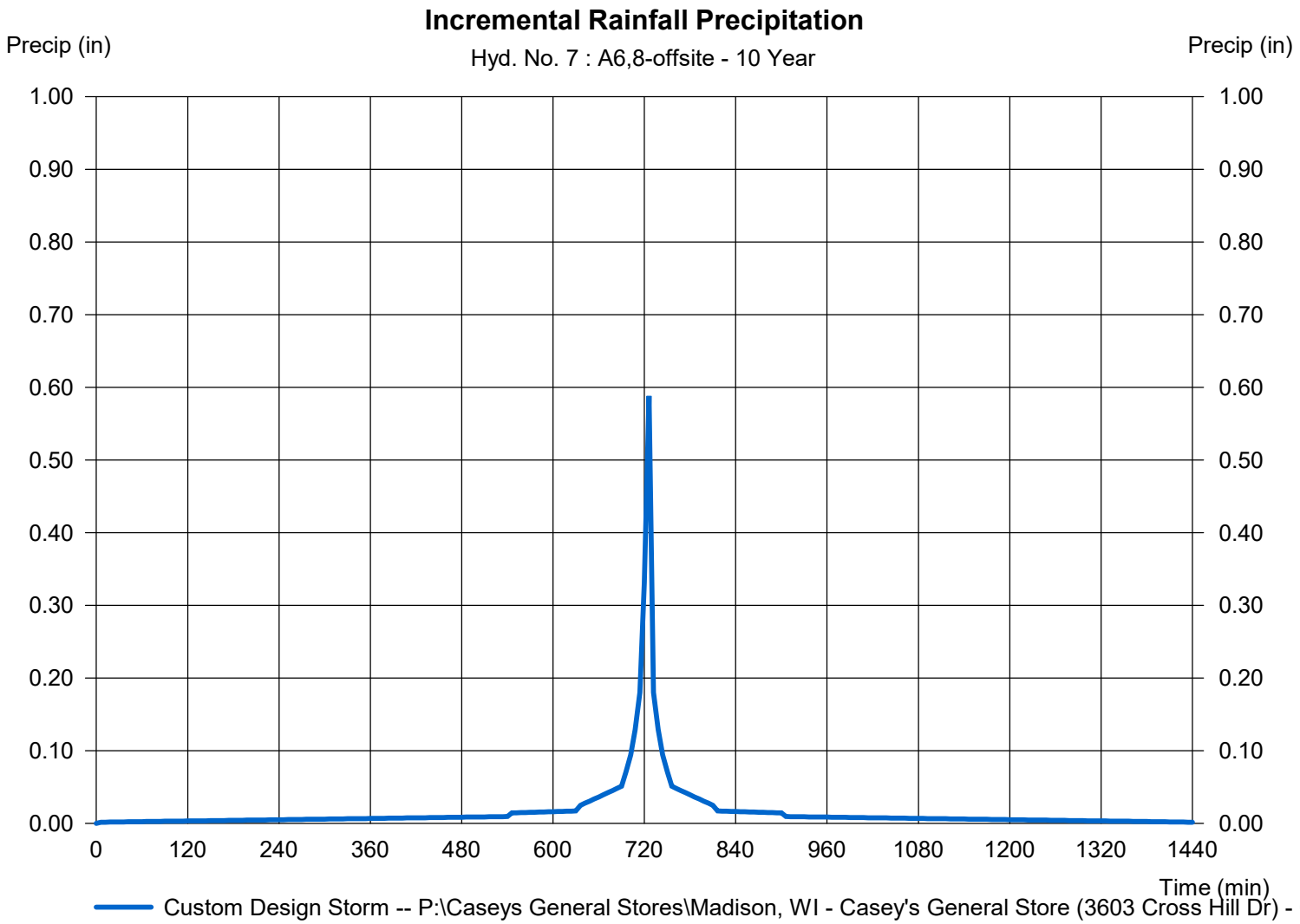


Precipitation Report

Hyd. No. 7

A6,8-offsite

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		



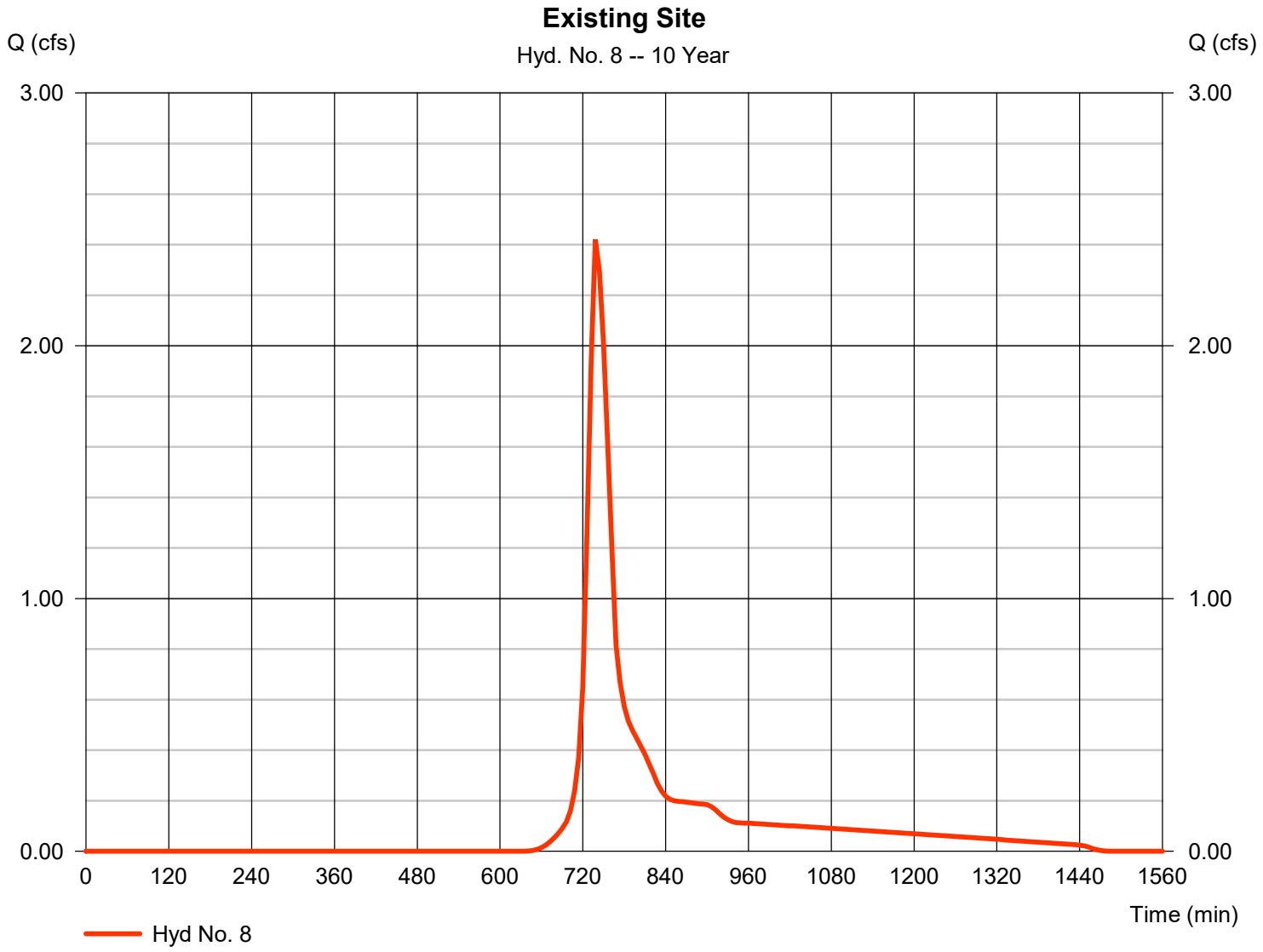
Hydrograph Report

Hyd. No. 8

Existing Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.421 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	10,462 cuft
Drainage area	=	1.810 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.10 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frequency	=	10 yrs

* Composite (Area/CN) = [(1.300 x 71) + (0.511 x 78)] / 1.810

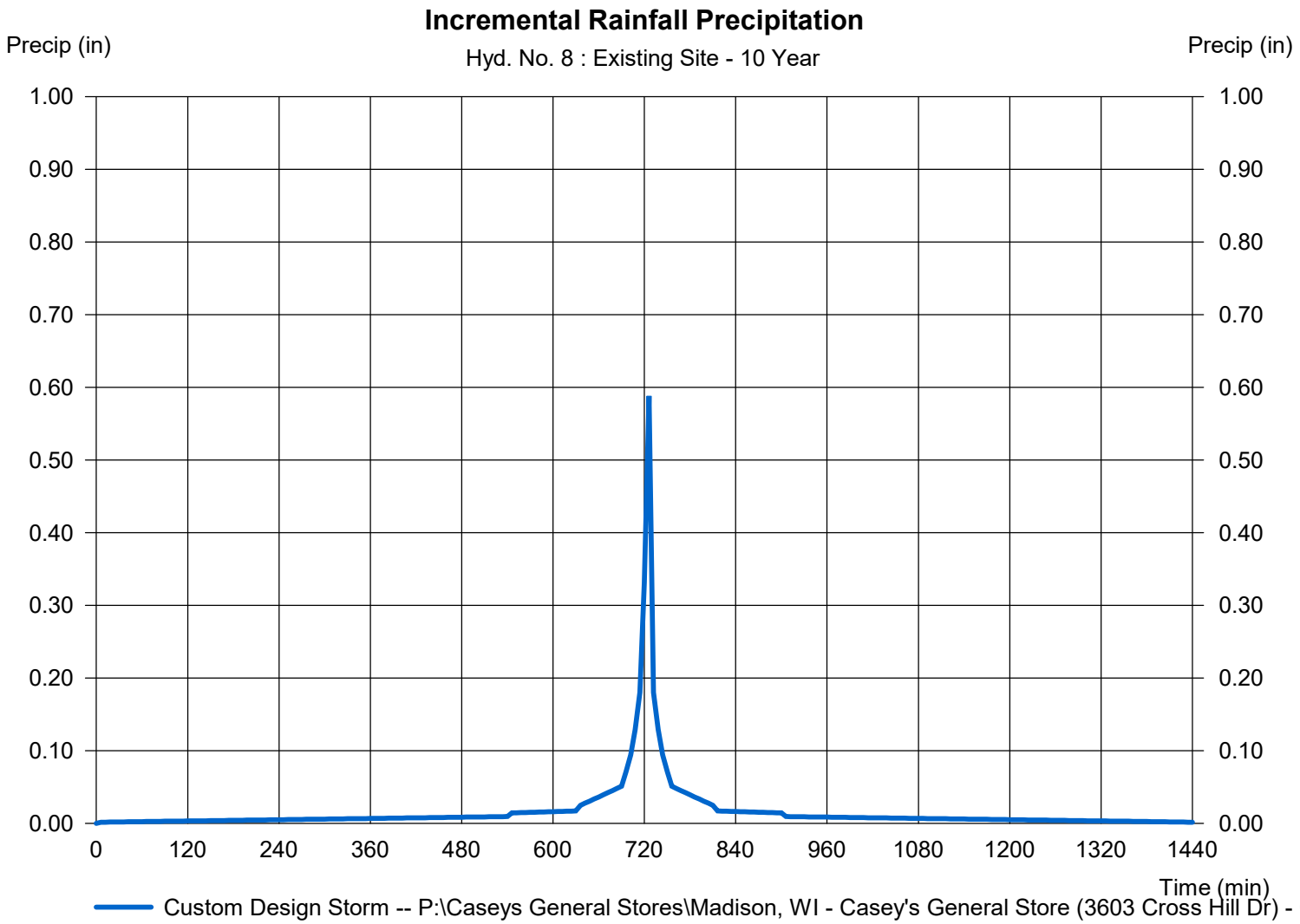


Precipitation Report

Hyd. No. 8

Existing Site

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

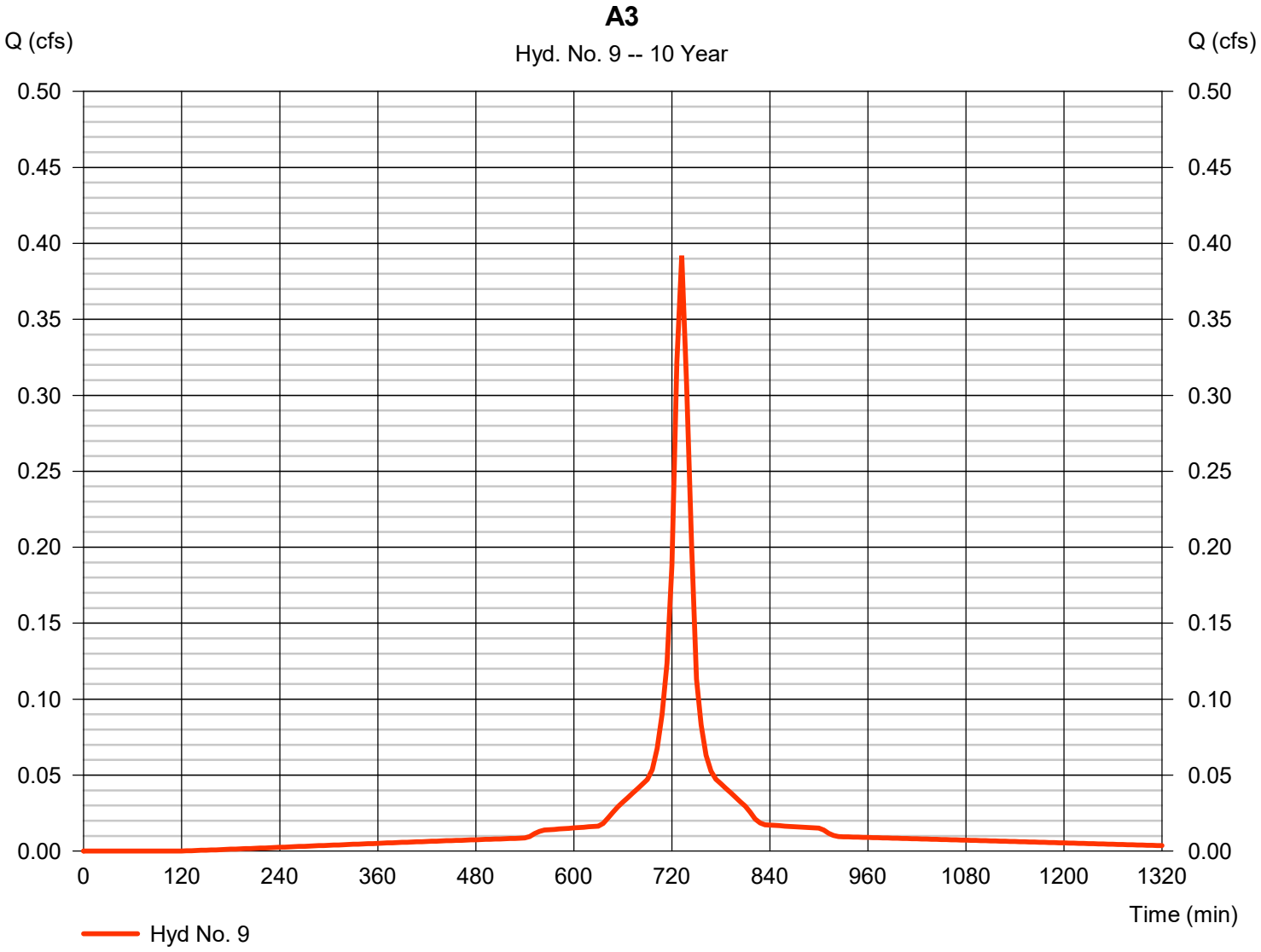


Hydrograph Report

Hyd. No. 9

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.392 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,430 cuft
Drainage area	=	0.109 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.09 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

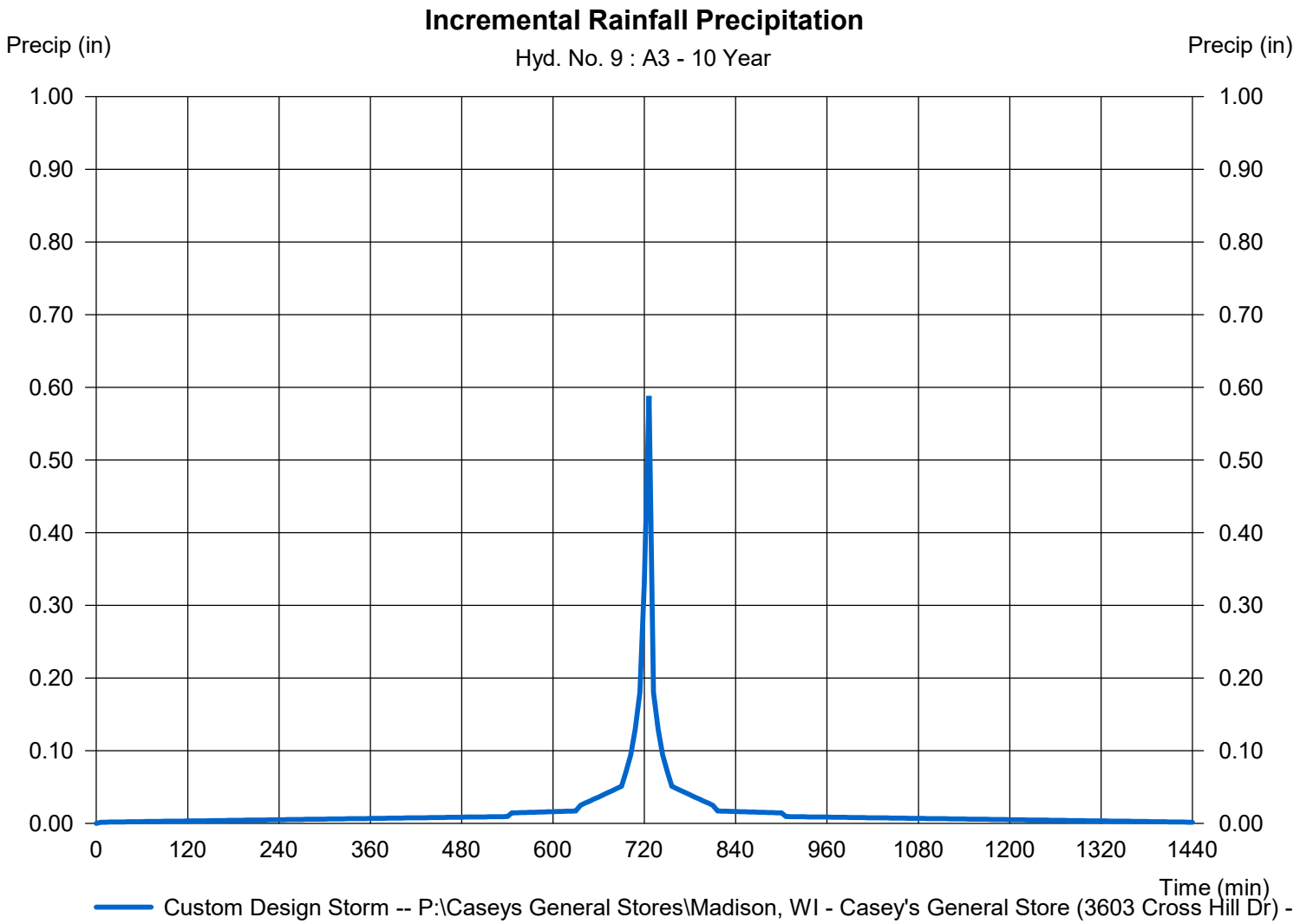


Precipitation Report

Hyd. No. 9

A3

Storm Frequency	= 10 yrs	Time interval	= 6 min
Total precip.	= 4.0900 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

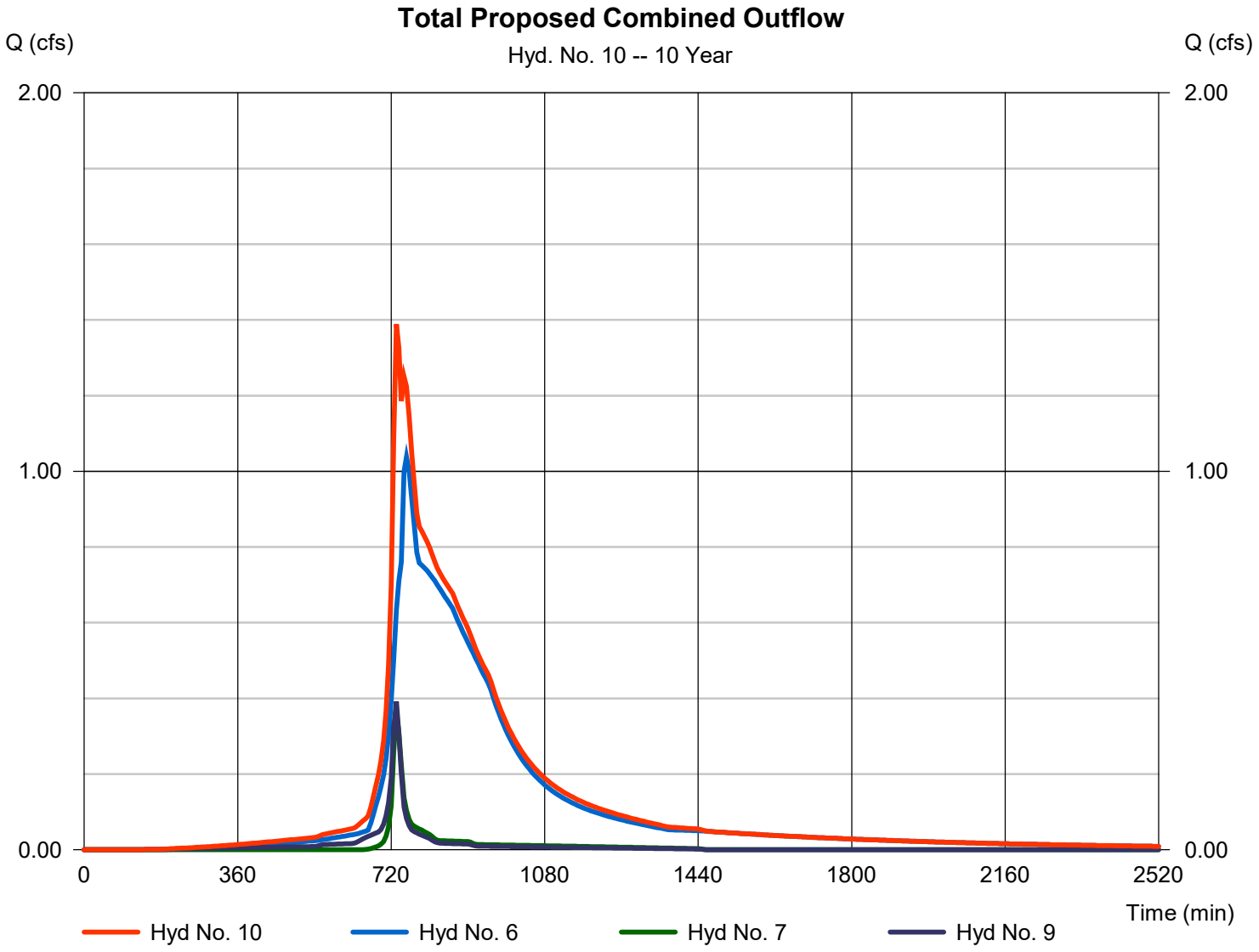


Hydrograph Report

Hyd. No. 10

Total Proposed Combined Outflow

Hydrograph type	= Combine	Peak discharge	= 1.389 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 18,757 cuft
Inflow hyds.	= 6, 7, 9	Contrib. drain. area	= 0.351 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

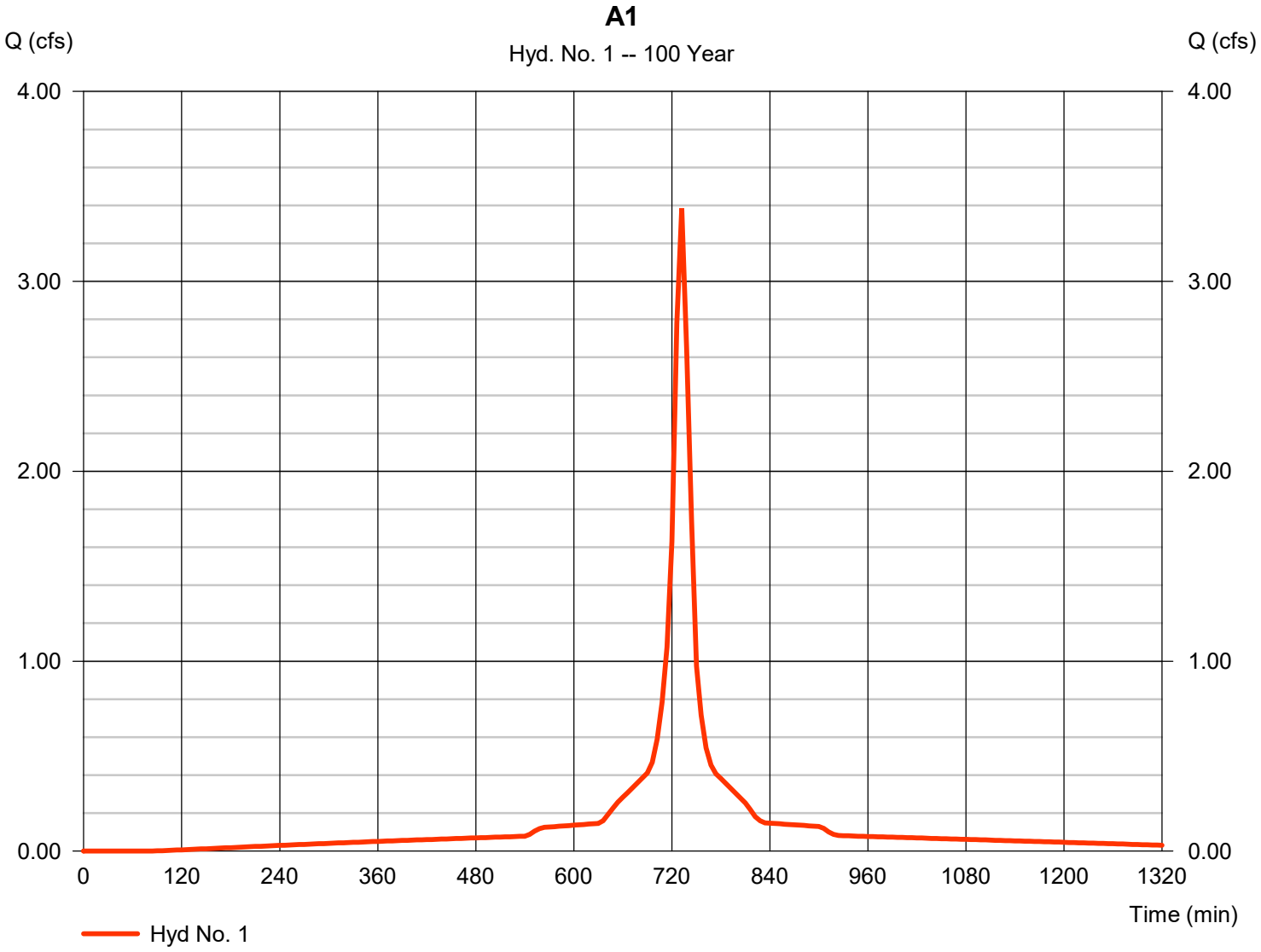
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.385	6	732	12,565	------	------	------	A1
2	SCS Runoff	1.843	6	732	6,840	------	------	------	A2
3	SCS Runoff	1.213	6	732	4,502	------	------	------	A4-5
4	SCS Runoff	1.339	6	732	4,283	------	------	------	A7
5	Combine	7.779	6	732	28,190	1, 2, 3, 4	------	------	Combined To Pond
6	Reservoir	4.608	6	744	28,152	5	986.50	11,158	Detention Pond
7	SCS Runoff	0.885	6	732	2,832	------	------	------	A6,8-offsite
8	SCS Runoff	5.713	6	738	23,941	------	------	------	Existing Site
9	SCS Runoff	0.642	6	732	2,382	------	------	------	A3
10	Combine	5.443	6	744	33,366	6, 7, 9	------	------	Total Proposed Combined Outflow

Hydrograph Report

Hyd. No. 1

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.385 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	12,565 cuft
Drainage area	=	0.575 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	100

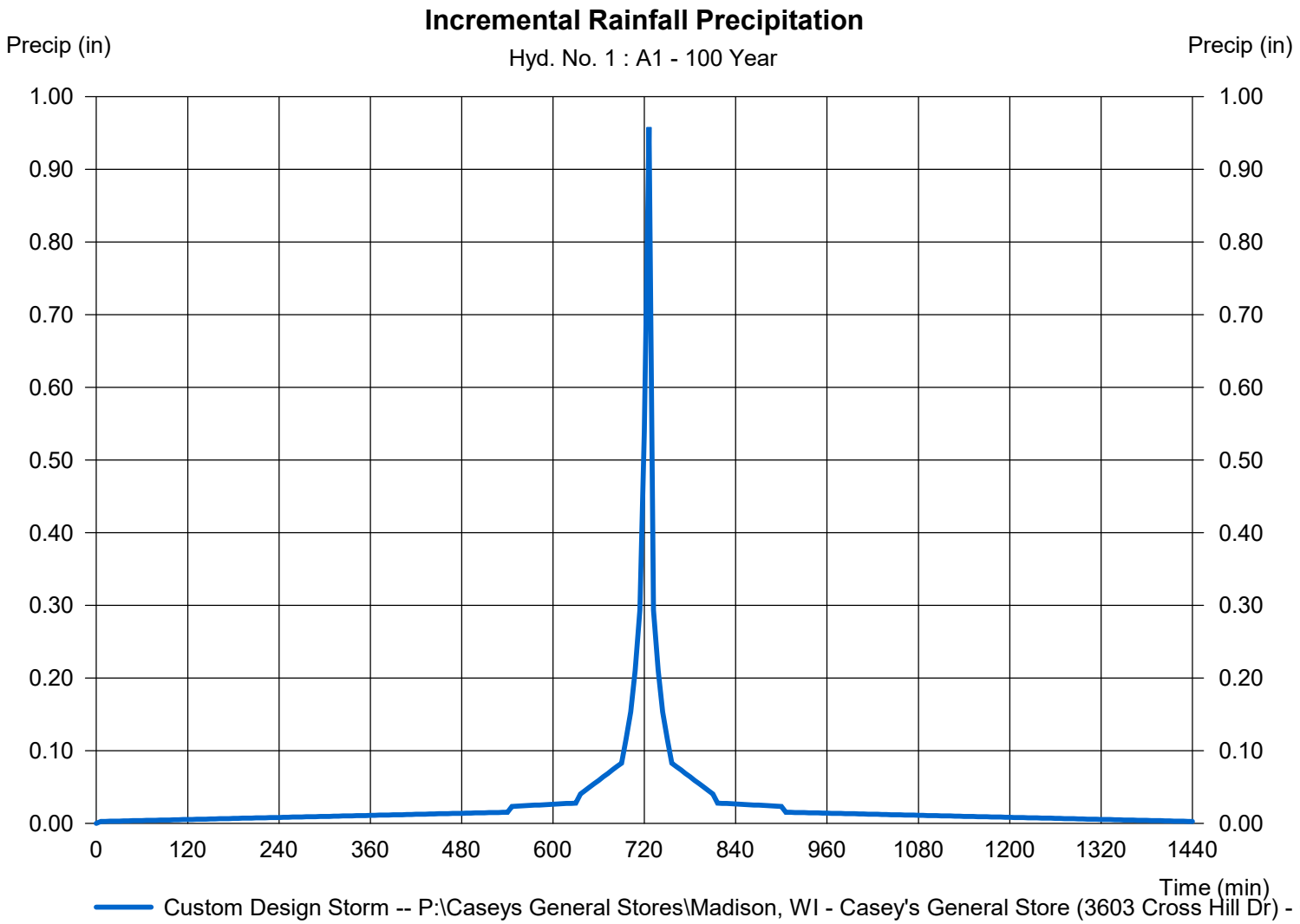


Precipitation Report

Hyd. No. 1

A1

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

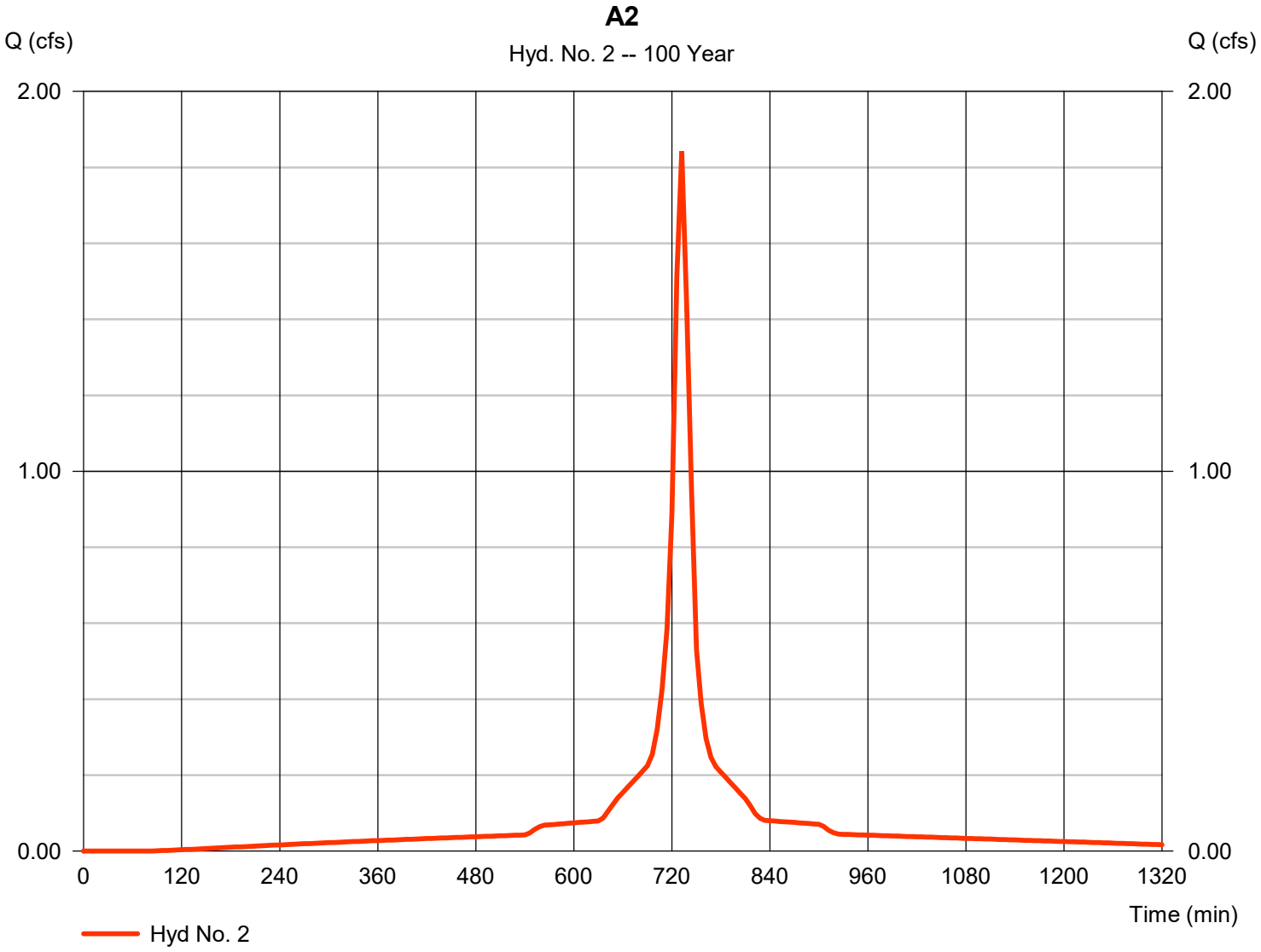


Hydrograph Report

Hyd. No. 2

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.843 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	6,840 cuft
Drainage area	=	0.313 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	100

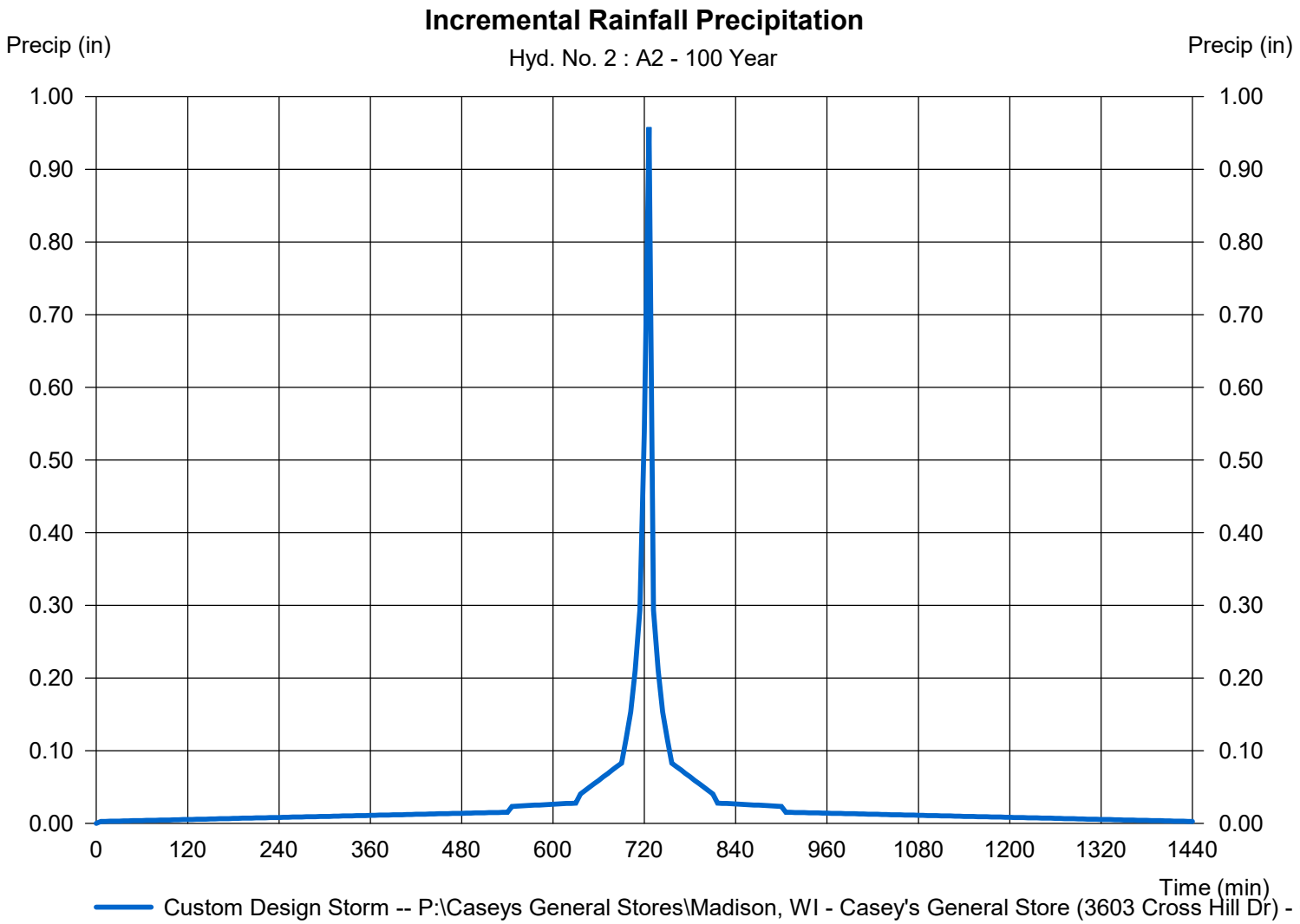


Precipitation Report

Hyd. No. 2

A2

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

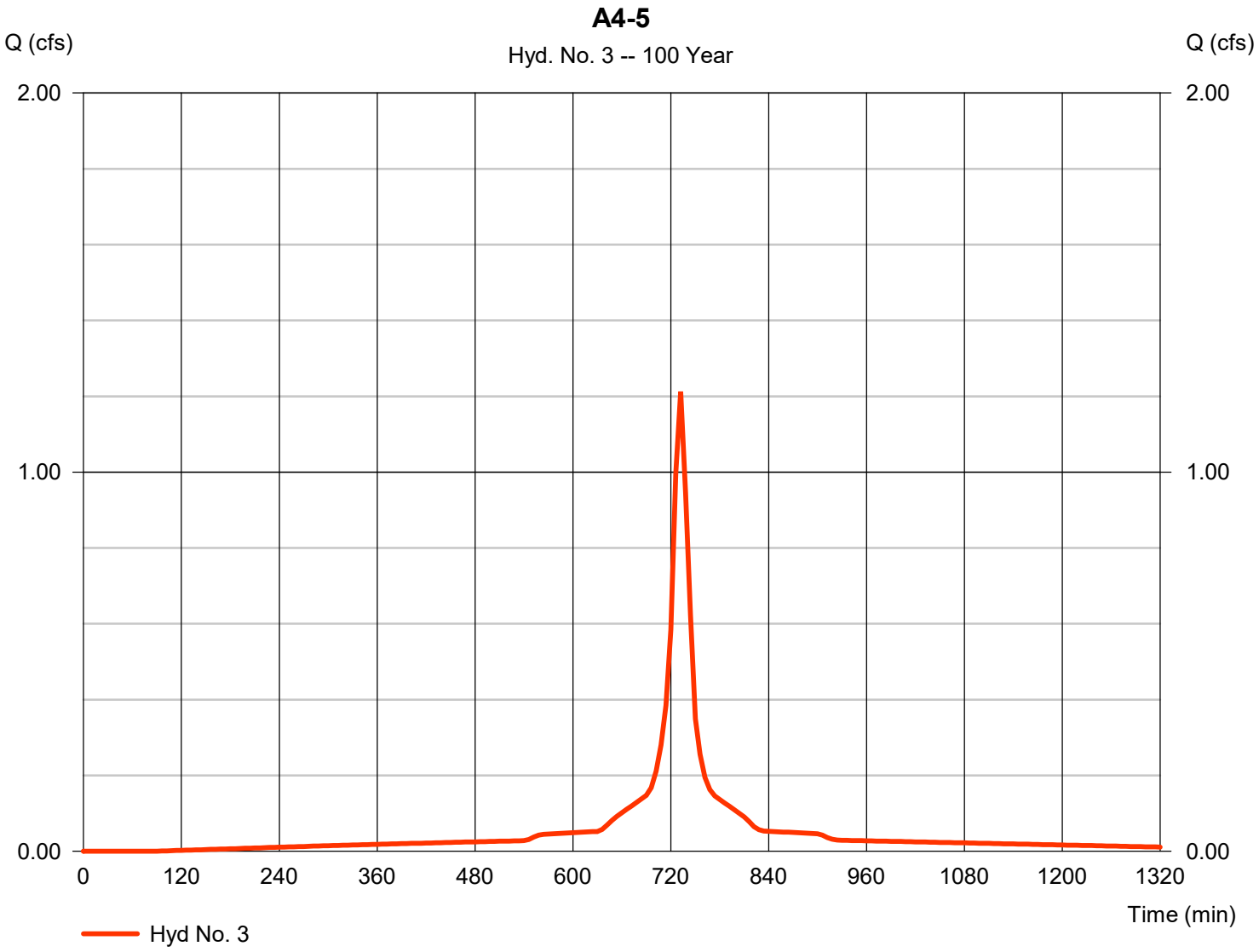


Hydrograph Report

Hyd. No. 3

A4-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.213 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	4,502 cuft
Drainage area	=	0.206 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtq	=	488

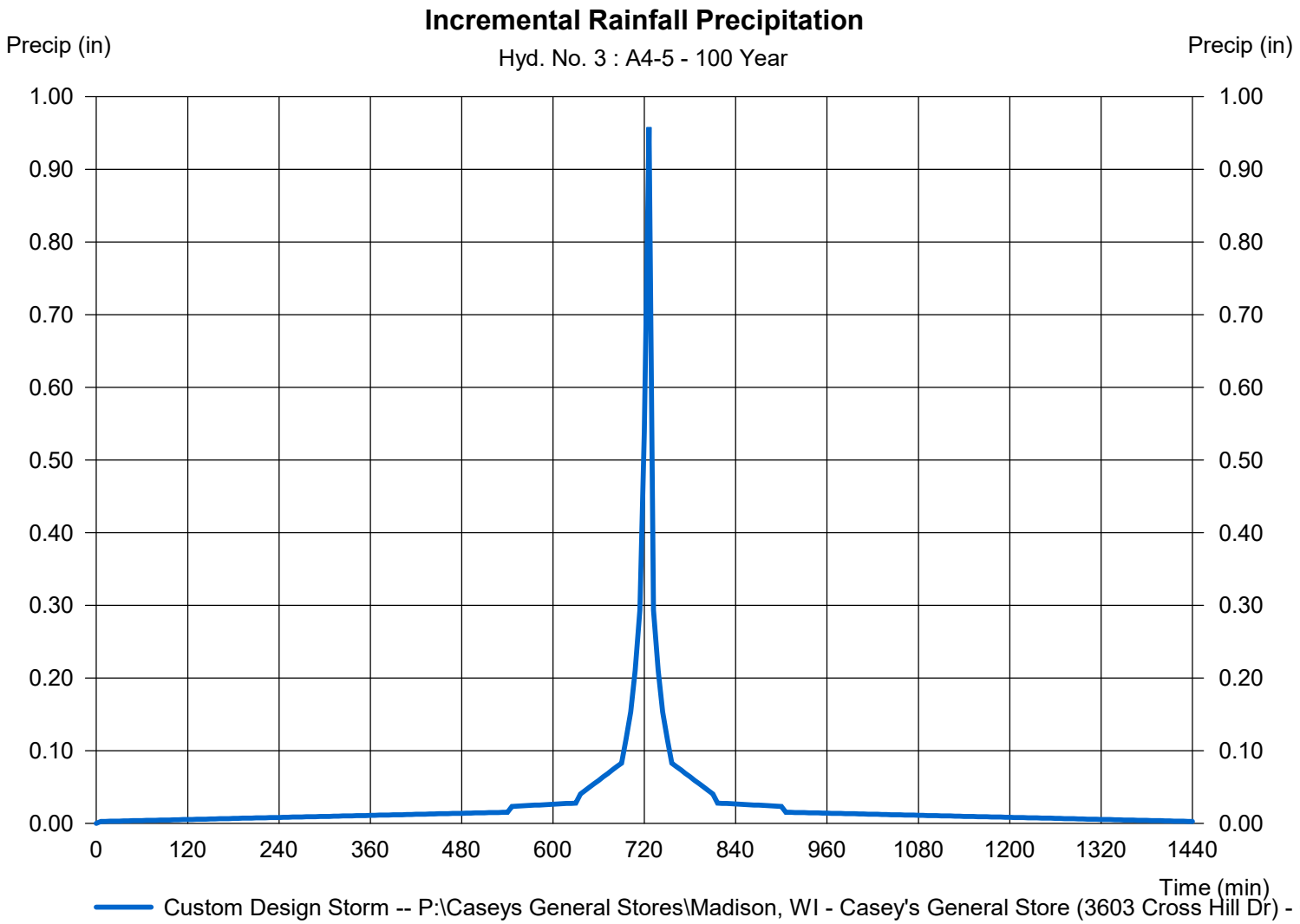


Precipitation Report

Hyd. No. 3

A4-5

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

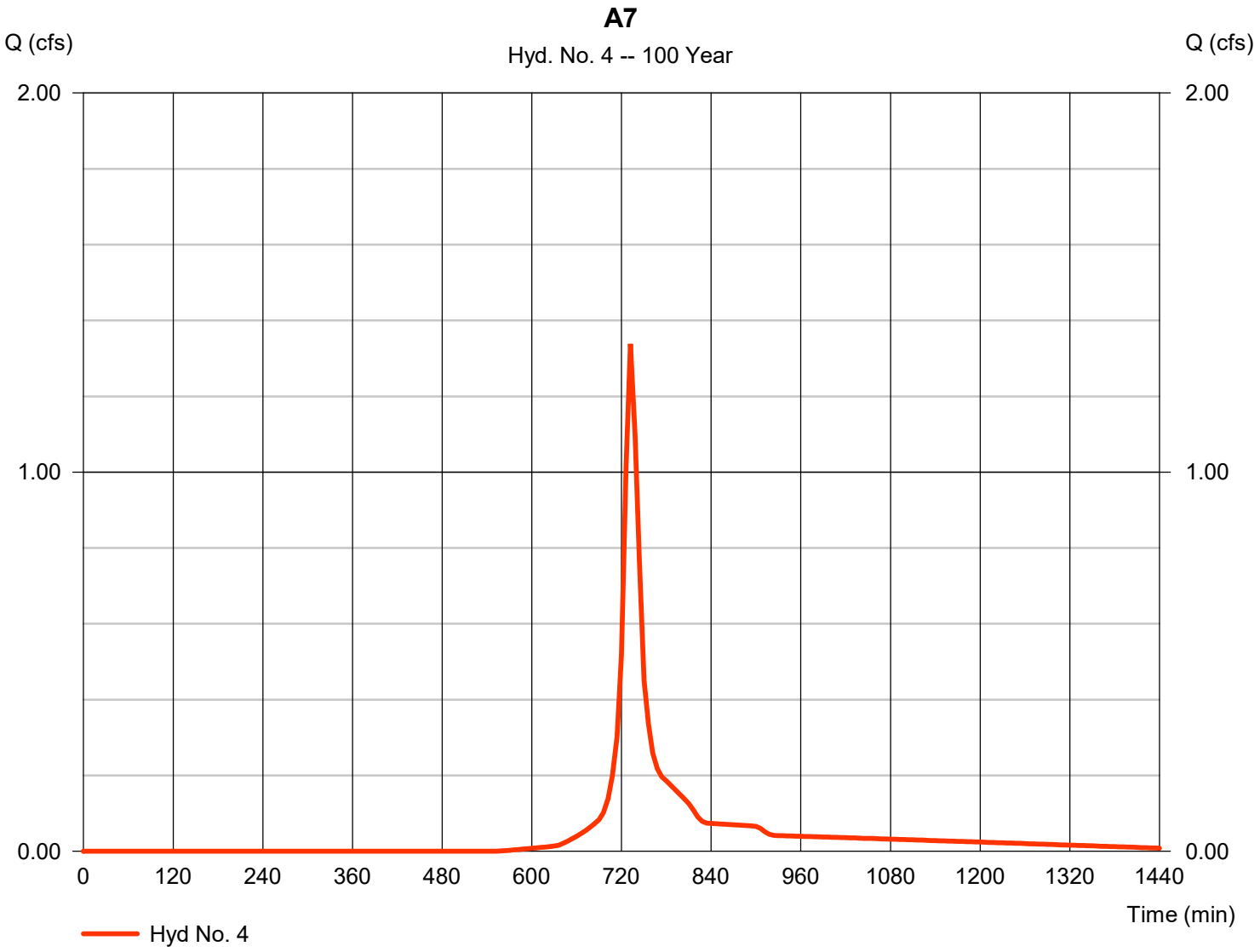


Hydrograph Report

Hyd. No. 4

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.339 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	4,283 cuft
Drainage area	=	0.366 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

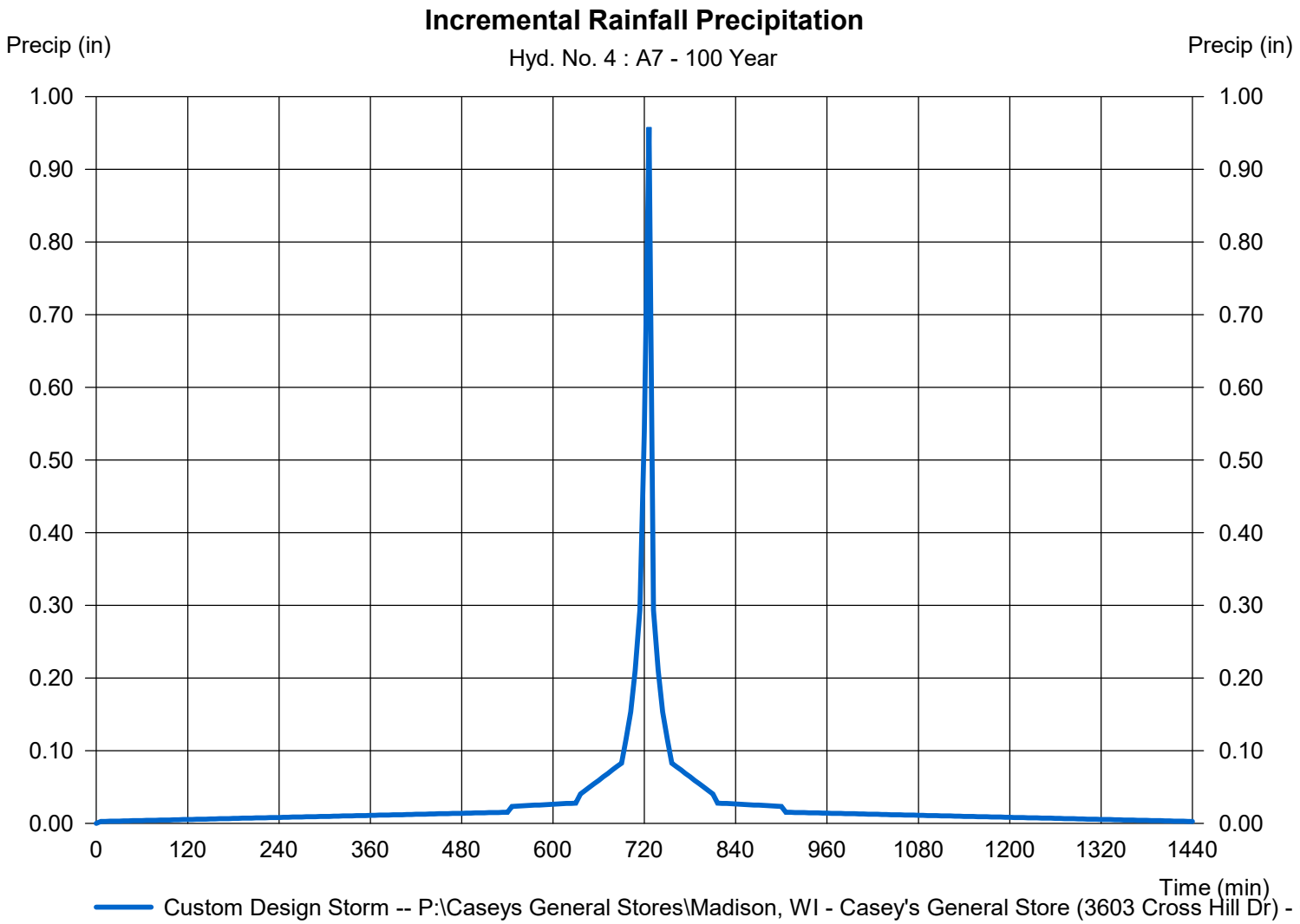


Precipitation Report

Hyd. No. 4

A7

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

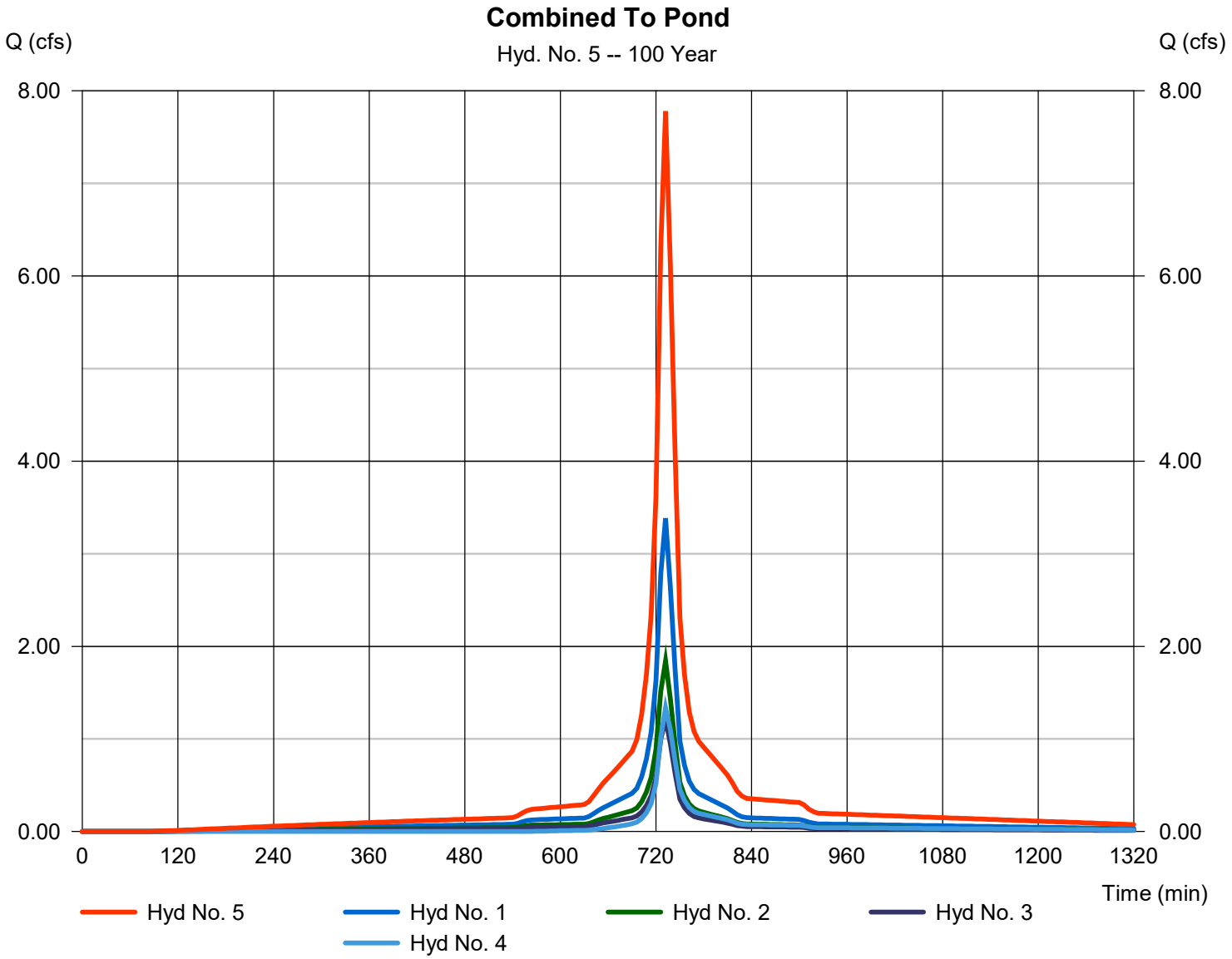


Hydrograph Report

Hyd. No. 5

Combined To Pond

Hydrograph type	= Combine	Peak discharge	= 7.779 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 28,190 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 1.460 ac



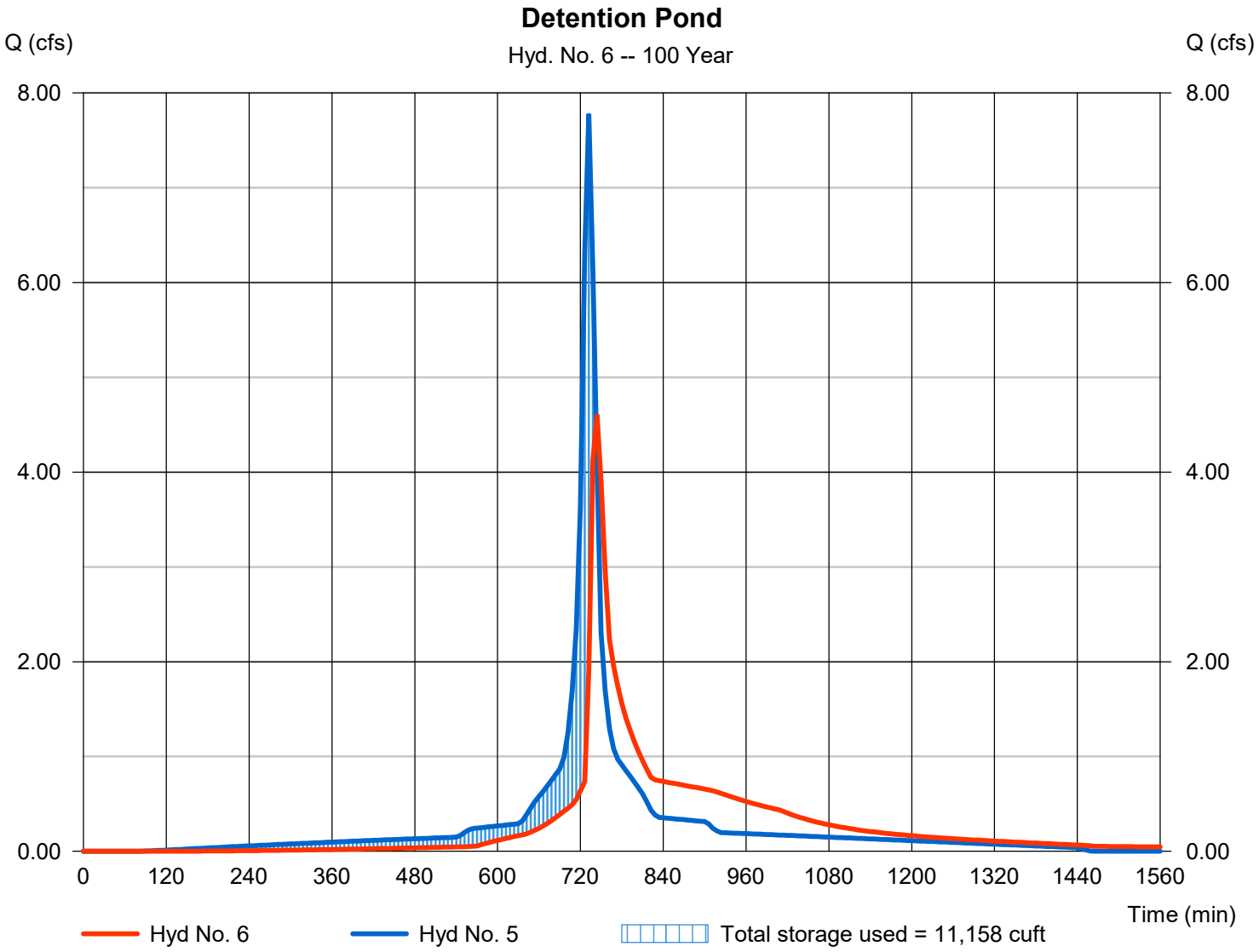
Hydrograph Report

Hyd. No. 6

Detention Pond

Hydrograph type	=	Reservoir	Peak discharge	=	4.608 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	28,152 cuft
Inflow hyd. No.	=	5 - Combined To Pond	Max. Elevation	=	986.50 ft
Reservoir name	=	Detention	Max. Storage	=	11,158 cuft

Storage Indication method used.

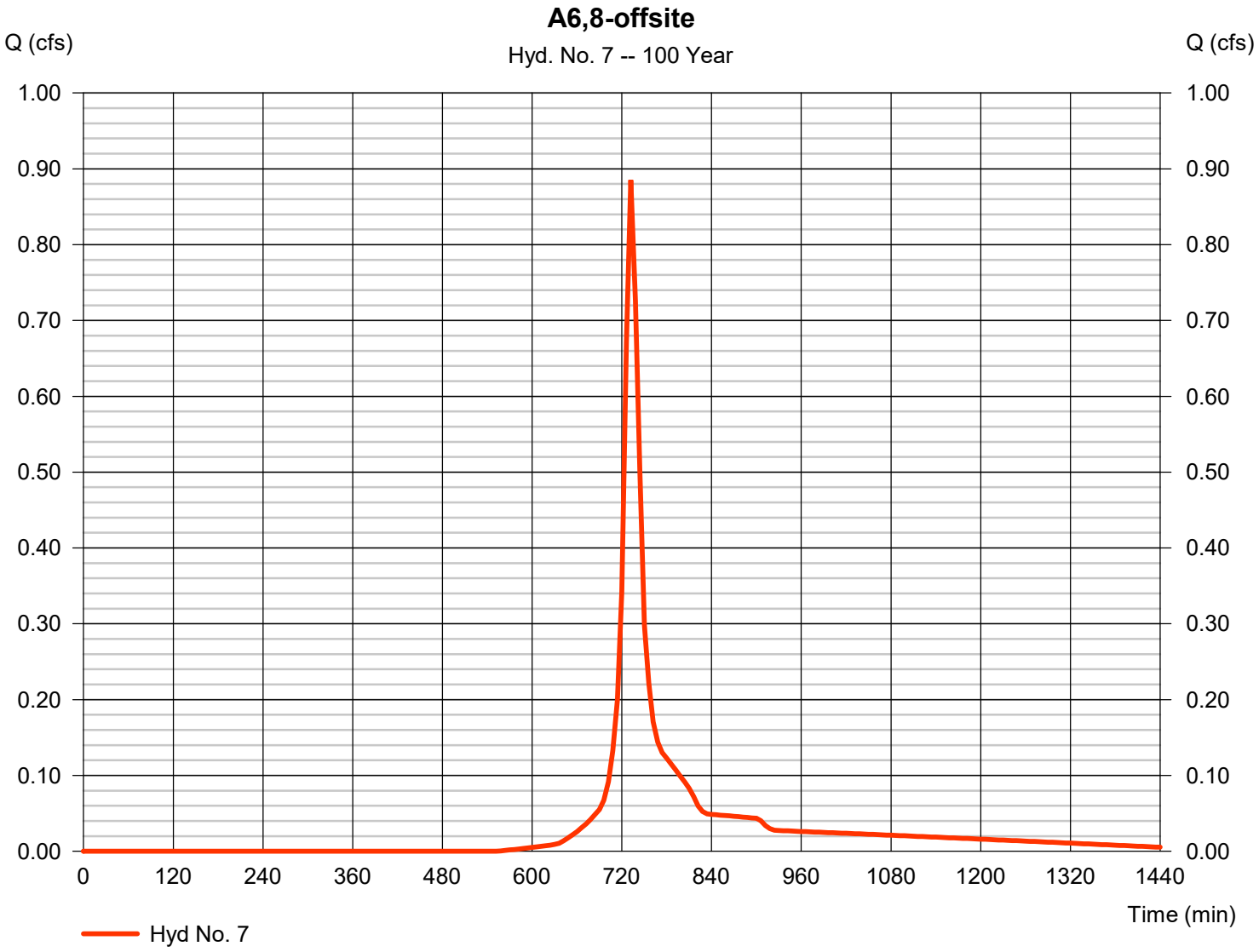


Hydrograph Report

Hyd. No. 7

A6,8-offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.885 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,832 cuft
Drainage area	=	0.242 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frtq	=	488

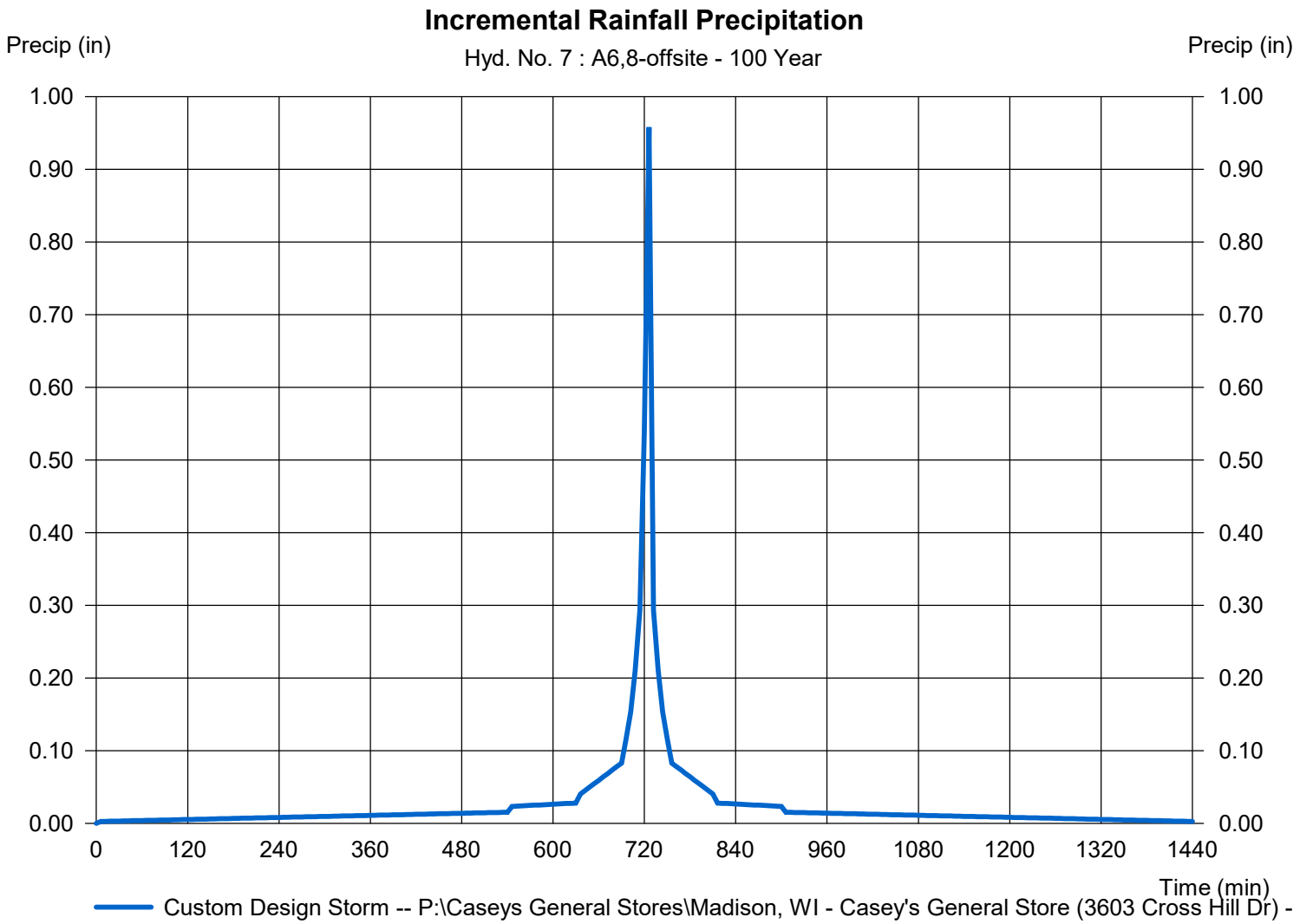


Precipitation Report

Hyd. No. 7

A6,8-offsite

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		



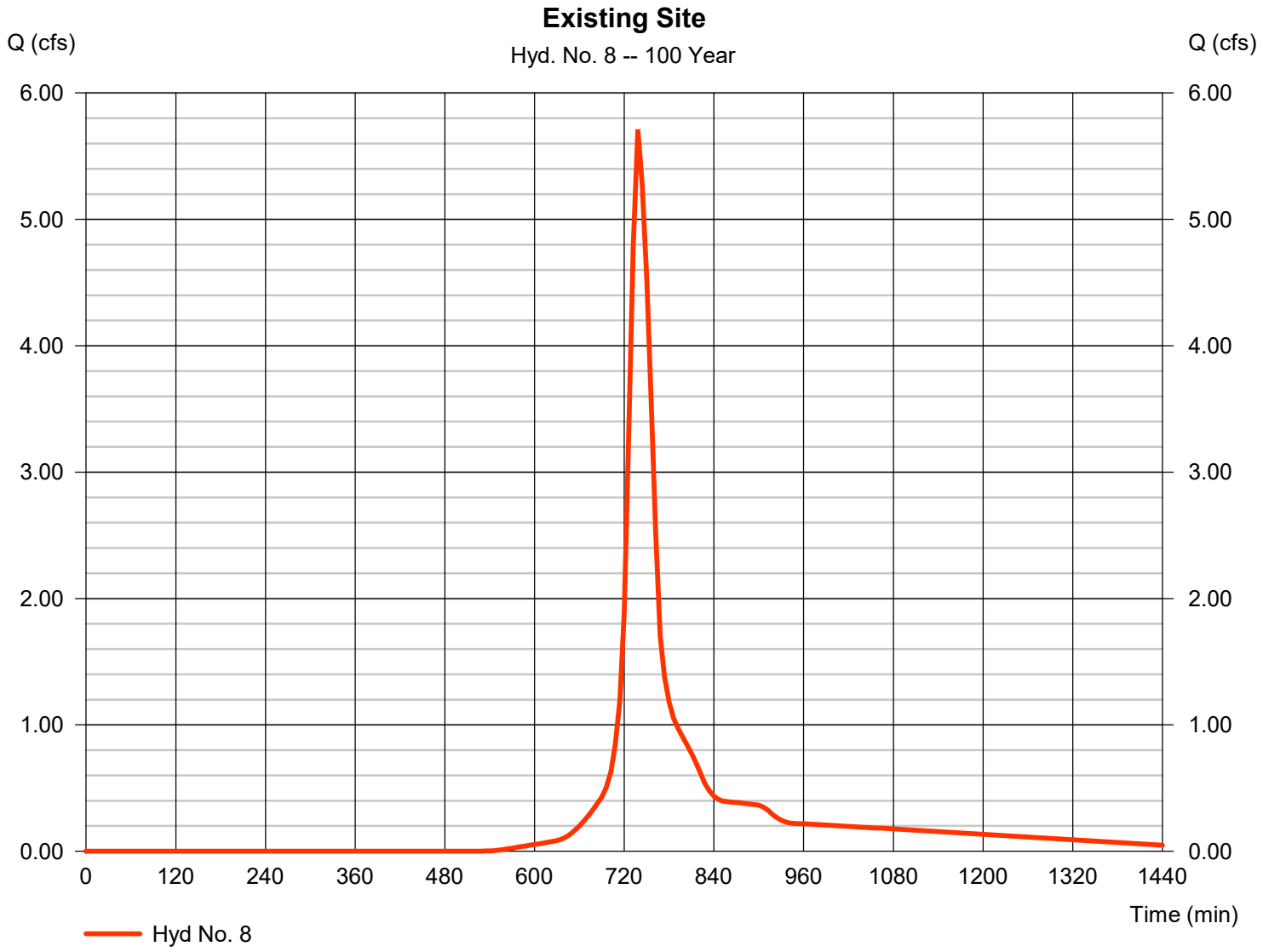
Hydrograph Report

Hyd. No. 8

Existing Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.713 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	23,941 cuft
Drainage area	=	1.810 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.10 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frq.	=	100 yrs

* Composite (Area/CN) = [(1.300 x 71) + (0.511 x 78)] / 1.810

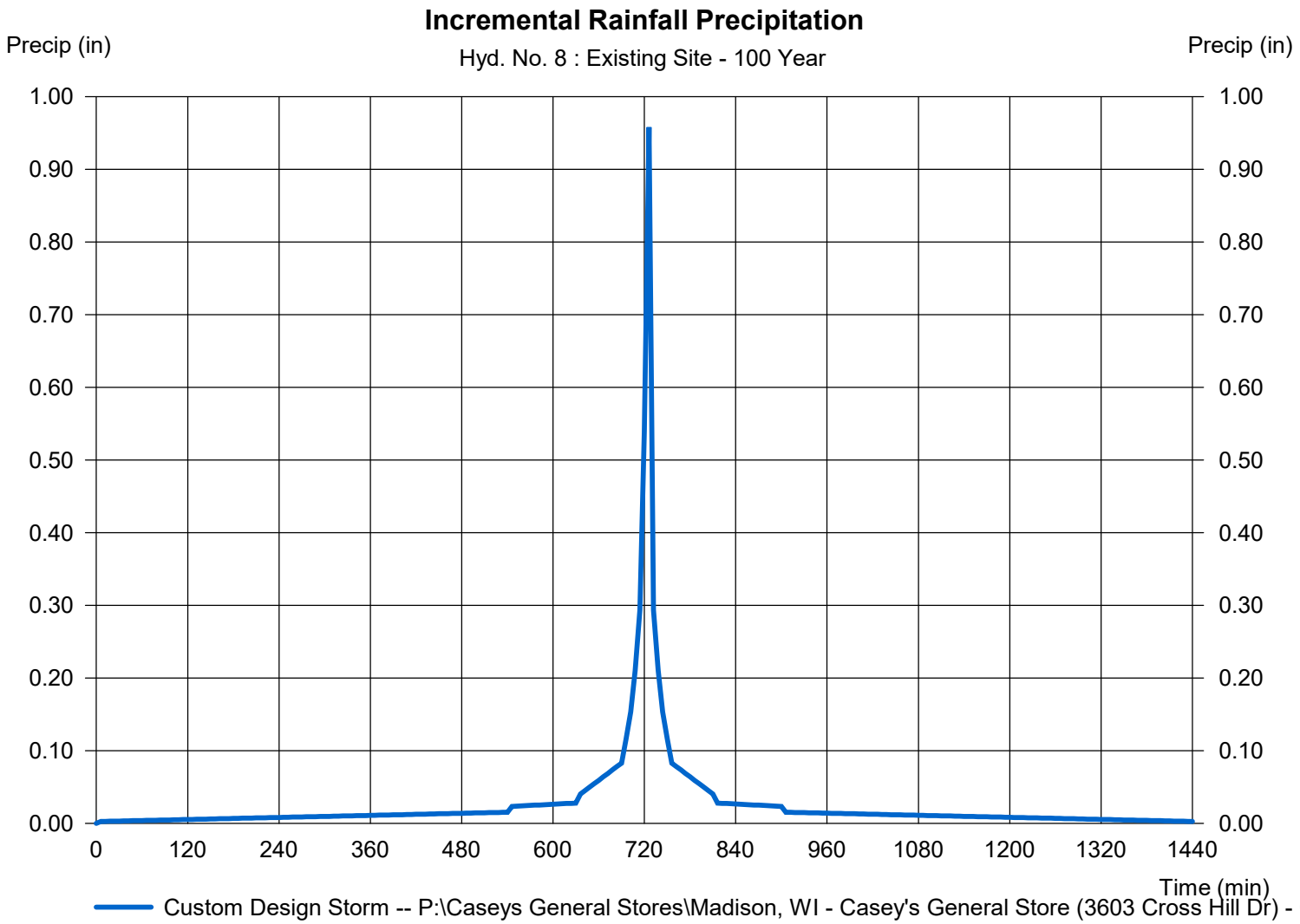


Precipitation Report

Hyd. No. 8

Existing Site

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

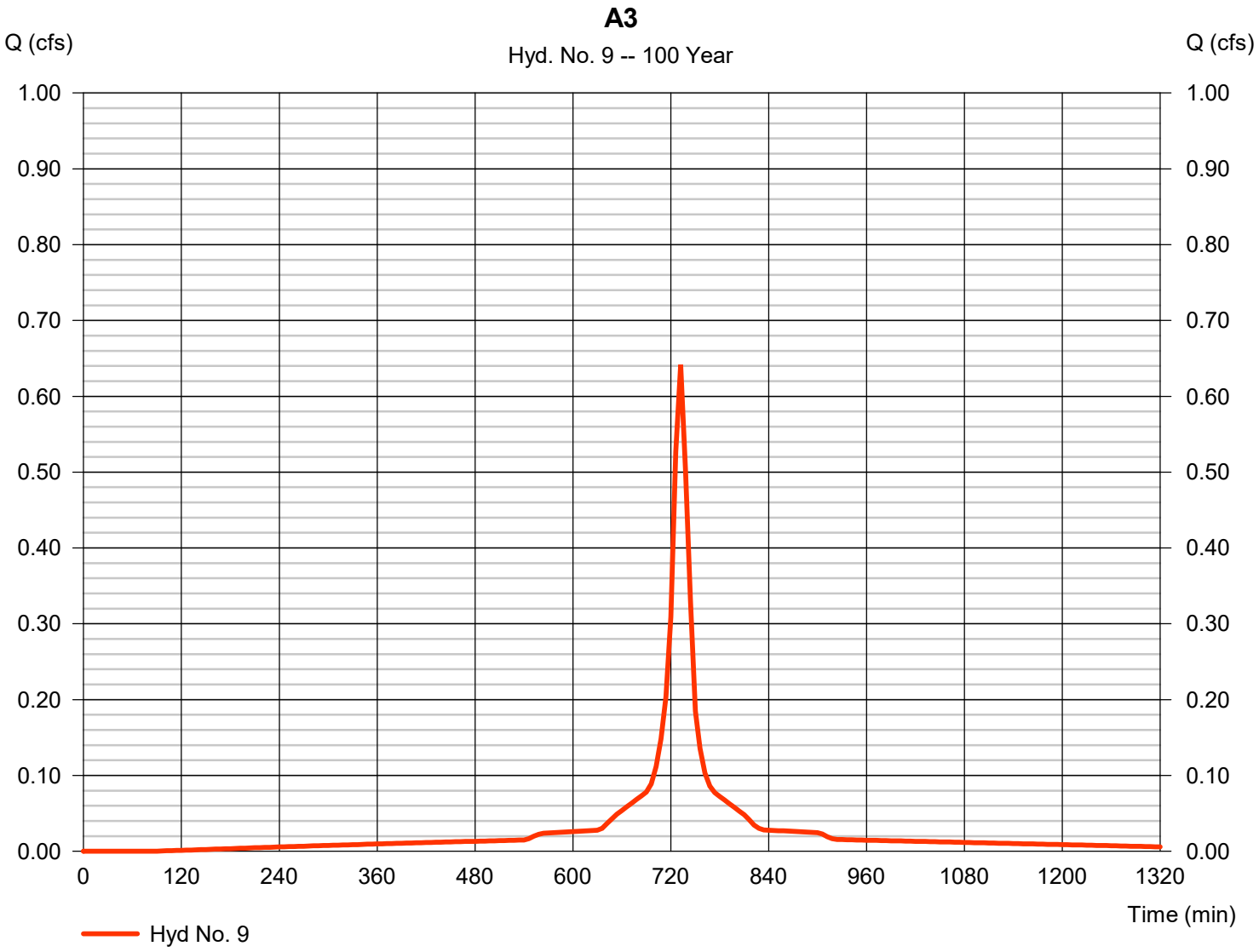


Hydrograph Report

Hyd. No. 9

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.642 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,382 cuft
Drainage area	=	0.109 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.66 in	Distribution	=	Custom
Storm duration	=	P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hill	Storm Frwy	=	488

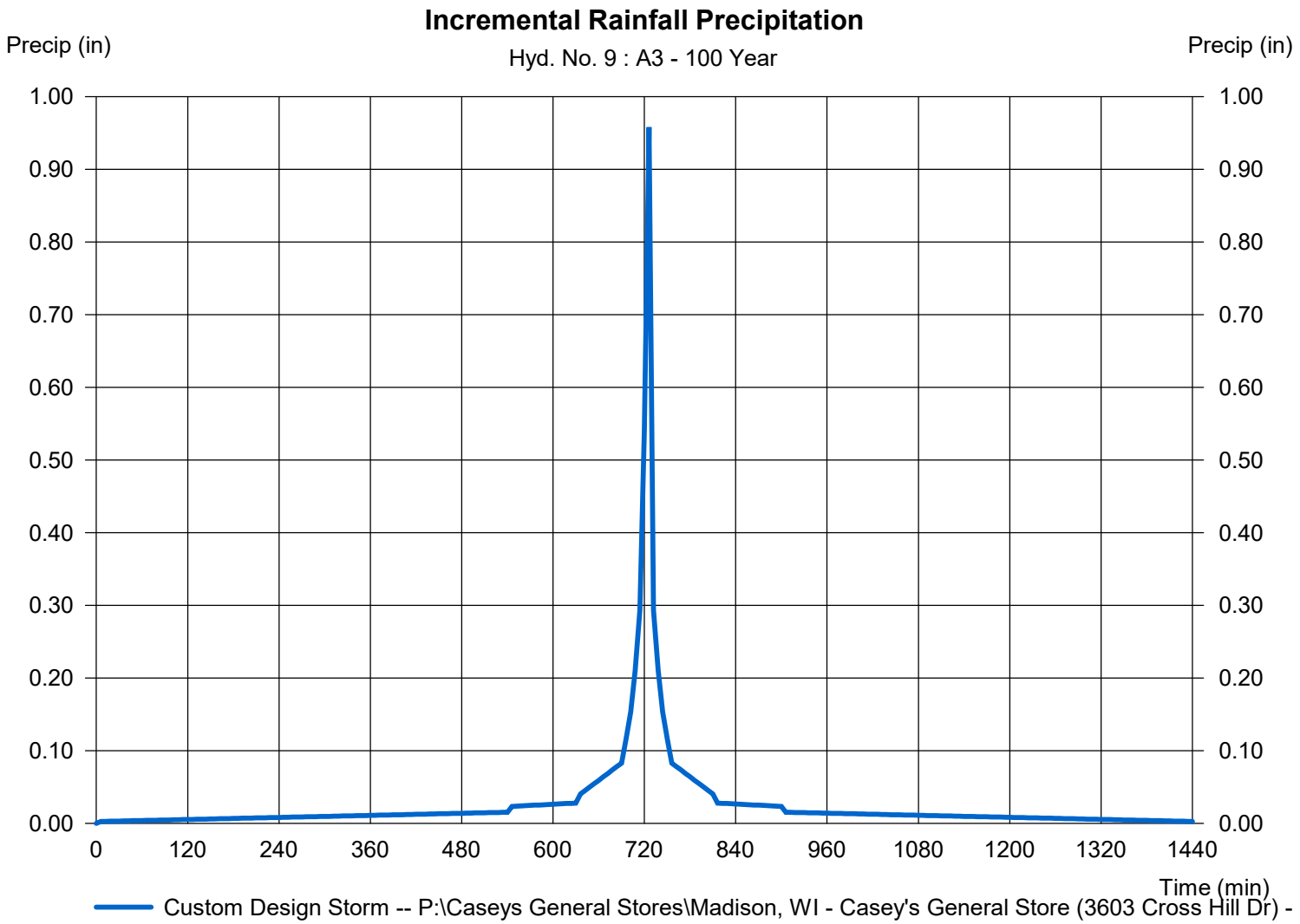


Precipitation Report

Hyd. No. 9

A3

Storm Frequency	= 100 yrs	Time interval	= 6 min
Total precip.	= 6.6600 in	Distribution	= Custom
Storm duration	= P:\Caseys General Stores\Madison, WI - Casey's General Store (3603 Cross Hi		

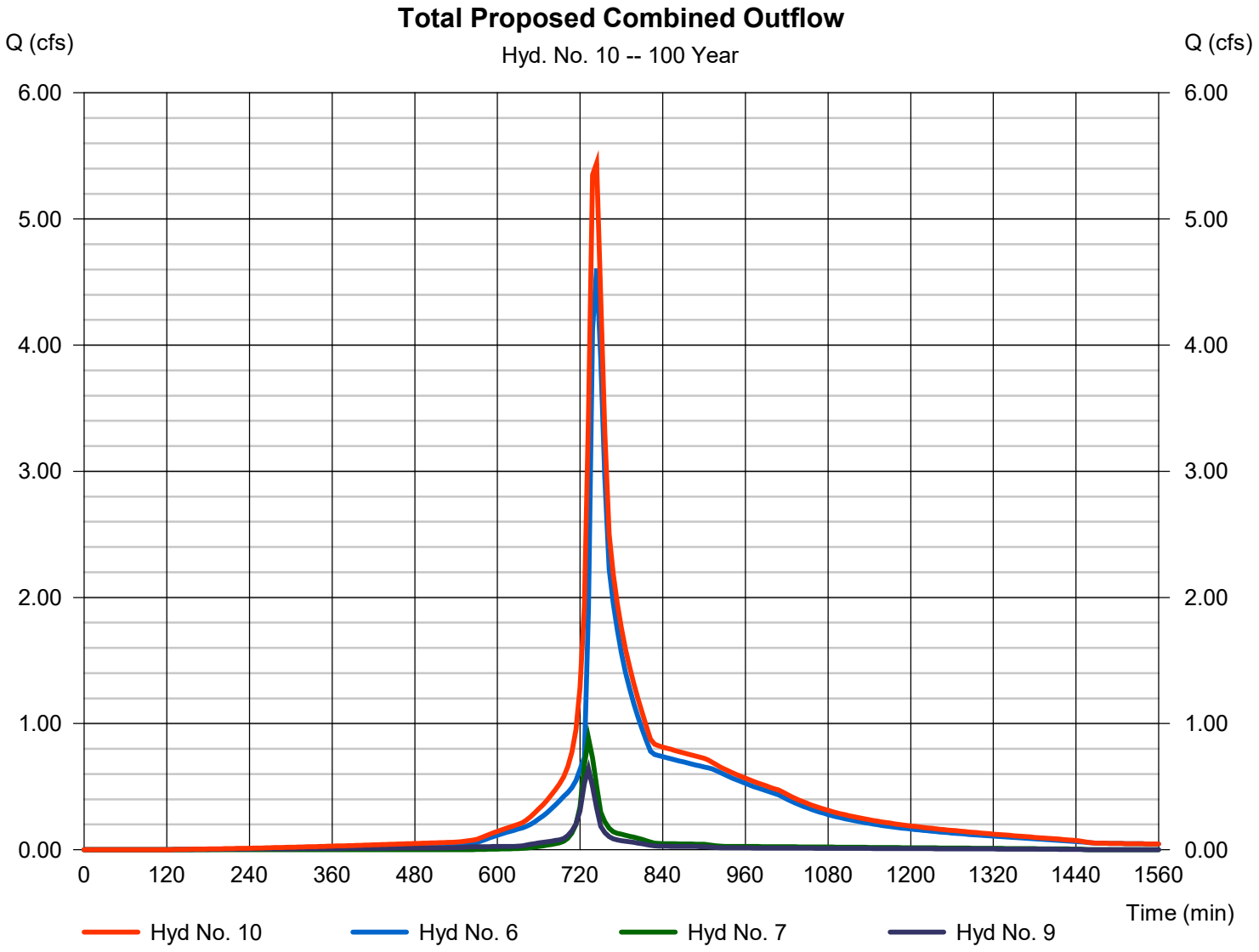


Hydrograph Report

Hyd. No. 10

Total Proposed Combined Outflow

Hydrograph type	= Combine	Peak discharge	= 5.443 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 33,366 cuft
Inflow hyds.	= 6, 7, 9	Contrib. drain. area	= 0.351 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	71.8477	13.3000	0.8718	--------
3	0.0000	0.0000	0.0000	--------
5	75.7517	14.2000	0.8271	--------
10	86.7192	15.3000	0.8244	--------
25	103.3028	16.6000	0.8227	--------
50	116.5747	17.3000	0.8234	--------
100	124.5731	17.6000	0.8144	--------

File name: SampleFHA.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	5.70	4.62	3.90	3.38	2.99	2.69	2.45	2.24	2.08	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	6.58	5.43	4.65	4.08	3.64	3.30	3.02	2.79	2.59	2.42	2.28	2.15
10	7.25	6.05	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	4.81	4.38	4.03	3.73	3.48	3.26	3.08	2.91
50	9.05	7.66	6.67	5.92	5.34	4.87	4.48	4.16	3.88	3.64	3.43	3.25
100	9.83	8.35	7.30	6.49	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.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	2.49	2.84	0.00	3.30	4.09	5.77	6.80	6.66
SCS 6-Hr	1.00	1.80	0.00	0.00	0.00	0.00	0.00	4.00
Huff-1st	1.00	1.55	0.00	2.75	0.00	5.38	6.50	8.00
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	2.49	2.84	0.00	2.80	4.09	3.34	6.00	6.66

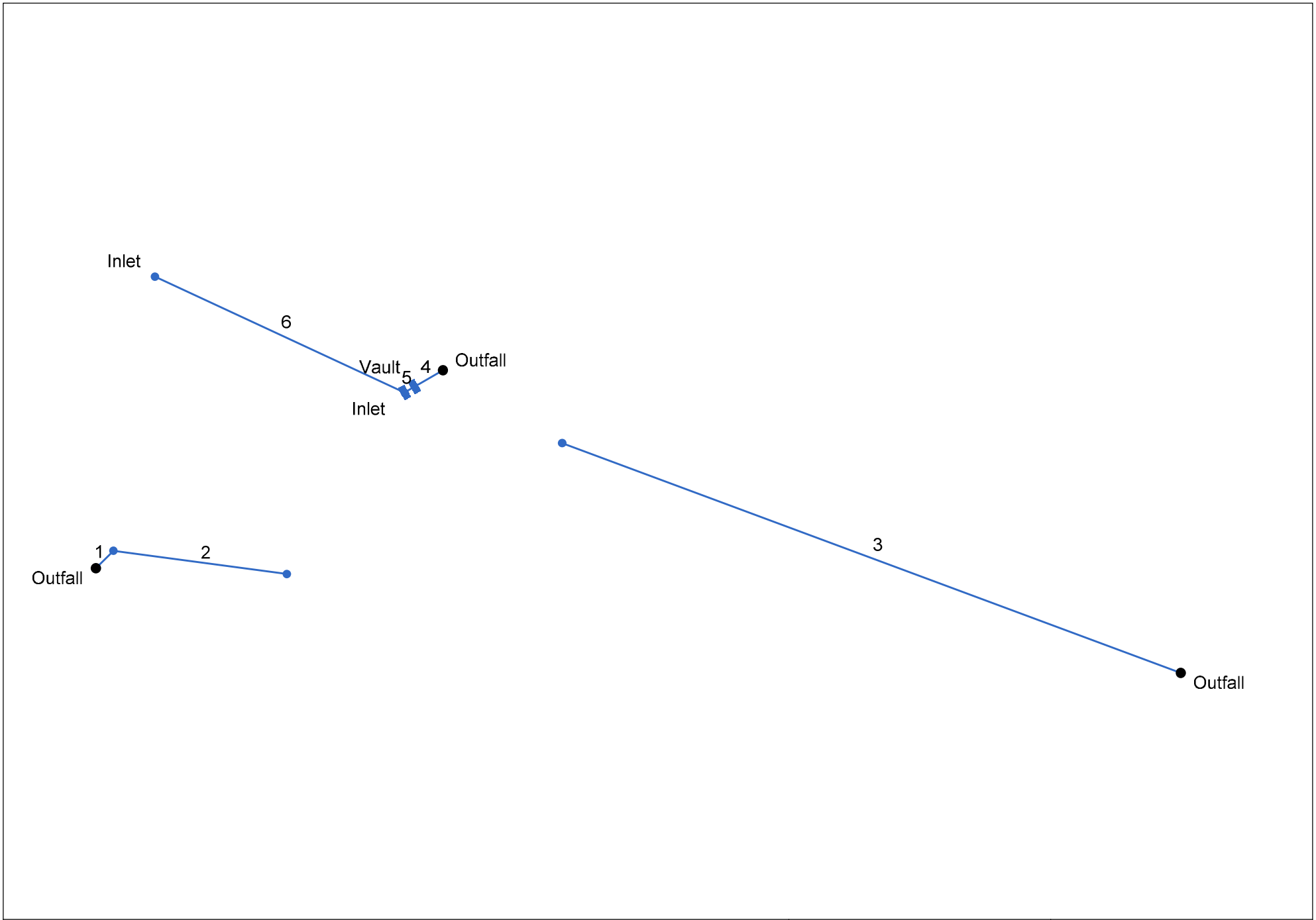
Hydraflow Table of Contents

APPENDIX B

Hydraflow Storm Sewers

April 16, 2018

Casey's Madison, WI Storm



Project File: CGS-24147-STORM-new.stm	Number of lines: 6	Date: 4/13/2018

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	15.00	-45.00	MH	3.39	0.00	0.98	10.0	979.86	2.60	980.25	12	Cir	0.012	0.83	985.00	
2	1	106.00	52.66	DrGrt	1.84	0.00	0.98	10.0	981.17	2.31	983.62	12	Cir	0.011	1.00	988.62	
3	End	400.00	-159.54	DrGrt	4.75	0.00	0.00	0.0	982.80	0.30	984.00	18	Cir	0.012	1.00	988.00	
4	End	20.00	150.00	MH	0.00	0.00	0.00	0.0	984.75	0.35	984.82	18	Cir	0.012	0.15	989.00	
5	4	7.00	0.00	DrGrt	3.39	0.00	0.00	0.0	985.02	0.57	985.06	18	Cir	0.012	1.27	988.74	
6	5	166.70	55.00	DrGrt	1.84	0.00	0.00	0.0	985.06	0.35	985.65	15	Cir	0.012	1.00	988.80	

Casey's Madison, WI Storm | Number of lines: 6 | Date: 4/13/2018

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1		Manhole	985.00	Cir	4.00	4.00	12	Cir	980.25	12	Cir	981.17
2		DropGrate	988.62	Cir	4.00	4.00	12	Cir	983.62			
3		DropGrate	988.00	Cir	4.00	4.00	18	Cir	984.00			
4	Vault	Manhole	989.00	Rect	4.00	8.00	18	Cir	984.82	18	Cir	985.02
5	Inlet	DropGrate	988.74	Rect	4.00	8.00	18	Cir	985.06	15	Cir	985.06
6	Inlet	DropGrate	988.80	Cir	4.00	4.00	15	Cir	985.65			

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		5.23	12	Cir	15.00	979.86	980.25	2.601	980.86	981.18	n/a	981.18 j	End	Manhole
2		1.84	12	Cir	106.00	981.17	983.62	2.311	981.54	984.20	n/a	984.20	1	DropGrate
3		4.75	18	Cir	400.00	982.80	984.00	0.300	983.78	984.98	0.23	985.21	End	DropGrate
4		5.23	18	Cir	20.00	984.75	984.82	0.350	986.50*	986.54*	0.02	986.56	End	Manhole
5		5.23	18	Cir	7.00	985.02	985.06	0.571	986.56*	986.58*	0.17	986.75	4	DropGrate
6		1.84	15	Cir	166.70	985.06	985.65	0.354	986.75	986.86	0.04	986.89	5	DropGrate

Casey's Madison, WI Storm | Number of lines: 6 | Run Date: 4/13/2018

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	15.00	0.00	0.00	0.98	0.00	0.00	10.0	10.8	0.0	5.23	6.22	6.77	12	2.60	979.86	980.25	980.86	981.18	982.27	985.00	
2	1	106.00	0.00	0.00	0.98	0.00	0.00	10.0	10.0	0.0	1.84	6.40	5.48	12	2.31	981.17	983.62	981.54	984.20	985.00	988.62	
3	End	400.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.75	6.23	3.88	18	0.30	982.80	984.00	983.78	984.98	984.40	988.00	
4	End	20.00	0.00	0.00	0.00	0.00	0.00	0.0	1.9	0.0	5.23	6.73	2.96	18	0.35	984.75	984.82	986.50	986.54	988.00	989.00	
5	4	7.00	0.00	0.00	0.00	0.00	0.00	0.0	1.9	0.0	5.23	8.60	2.96	18	0.57	985.02	985.06	986.56	986.58	989.00	988.74	
6	5	166.70	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.84	4.16	1.51	15	0.35	985.06	985.65	986.75	986.86	988.74	988.80	

Casey's Madison, WI Storm | Number of lines: 6 | Run Date: 4/13/2018

NOTES:Known Qs only ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

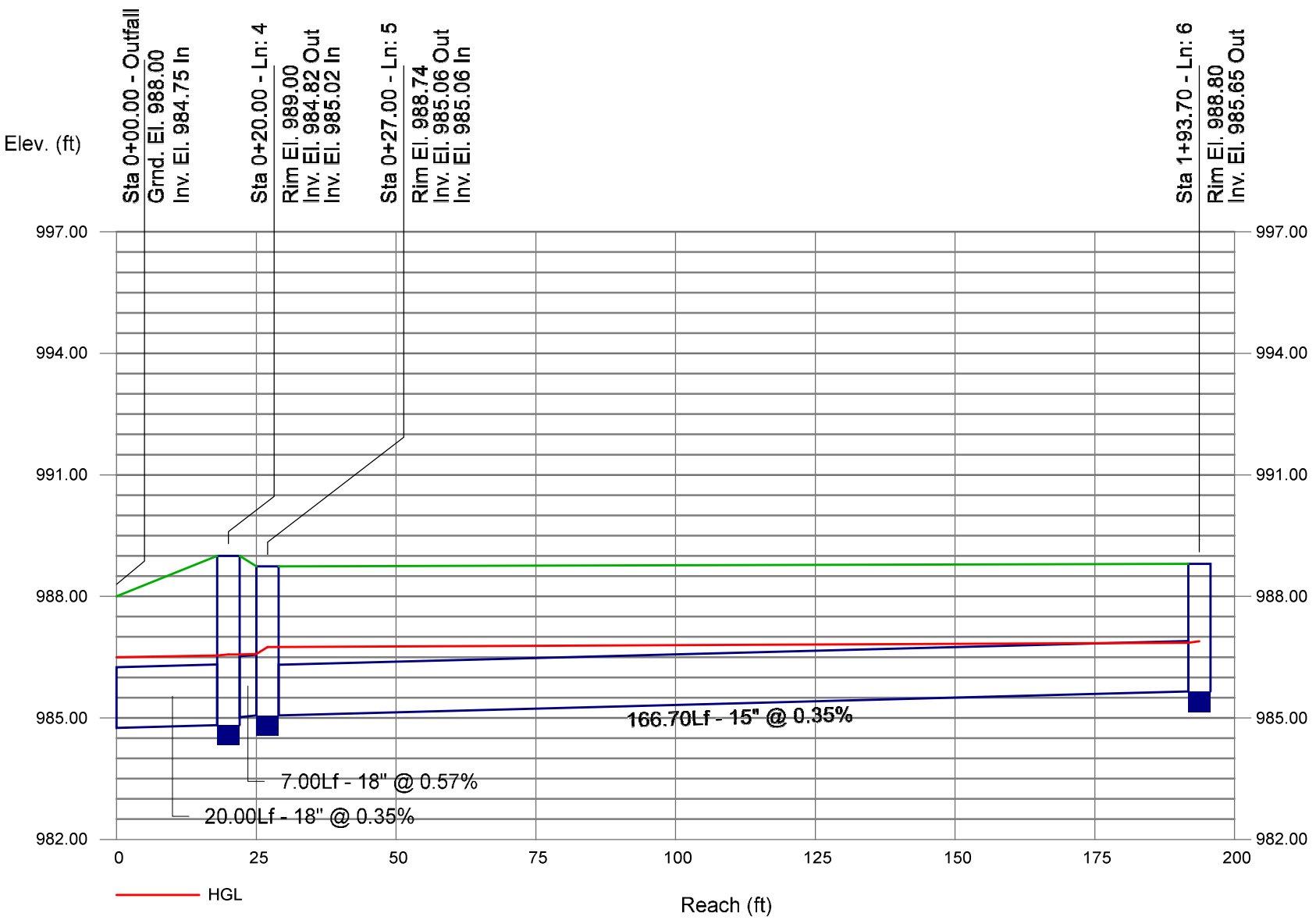
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	12	5.23	979.86	980.86	1.00	0.76	6.66	0.69	981.55	1.838	15.00	980.25	981.18 j	0.93**	0.76	6.88	0.74	981.91	1.591	1.715	n/a	0.83	n/a
2	12	1.84	981.17	981.54	0.37*	0.26	7.04	0.24	981.78	0.000	106.00	983.62	984.20	0.58**	0.47	3.92	0.24	984.44	0.000	0.000	n/a	1.00	n/a
3	18	4.75	982.80	983.78	0.98	1.22	3.88	0.23	984.01	0.300	400.00	984.00	984.98	0.98	1.22	3.89	0.23	985.21	0.301	0.300	1.202	1.00	0.23
4	18	5.23	984.75	986.50	1.50	1.77	2.96	0.14	986.64	0.211	20.00	984.82	986.54	1.50	1.77	2.96	0.14	986.68	0.211	0.211	0.042	0.15	0.02
5	18	5.23	985.02	986.56	1.50	1.77	2.96	0.14	986.70	0.211	7.00	985.06	986.58	1.50	1.77	2.96	0.14	986.71	0.211	0.211	0.015	1.27	0.17
6	15	1.84	985.06	986.75	1.25	1.23	1.50	0.03	986.79	0.069	166.70	985.65	986.86	1.21	1.21	1.52	0.04	986.89	0.061	0.065	0.108	1.00	0.04

Casey's Madison, WI Storm | Number of lines: 6 | Run Date: 4/13/2018

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

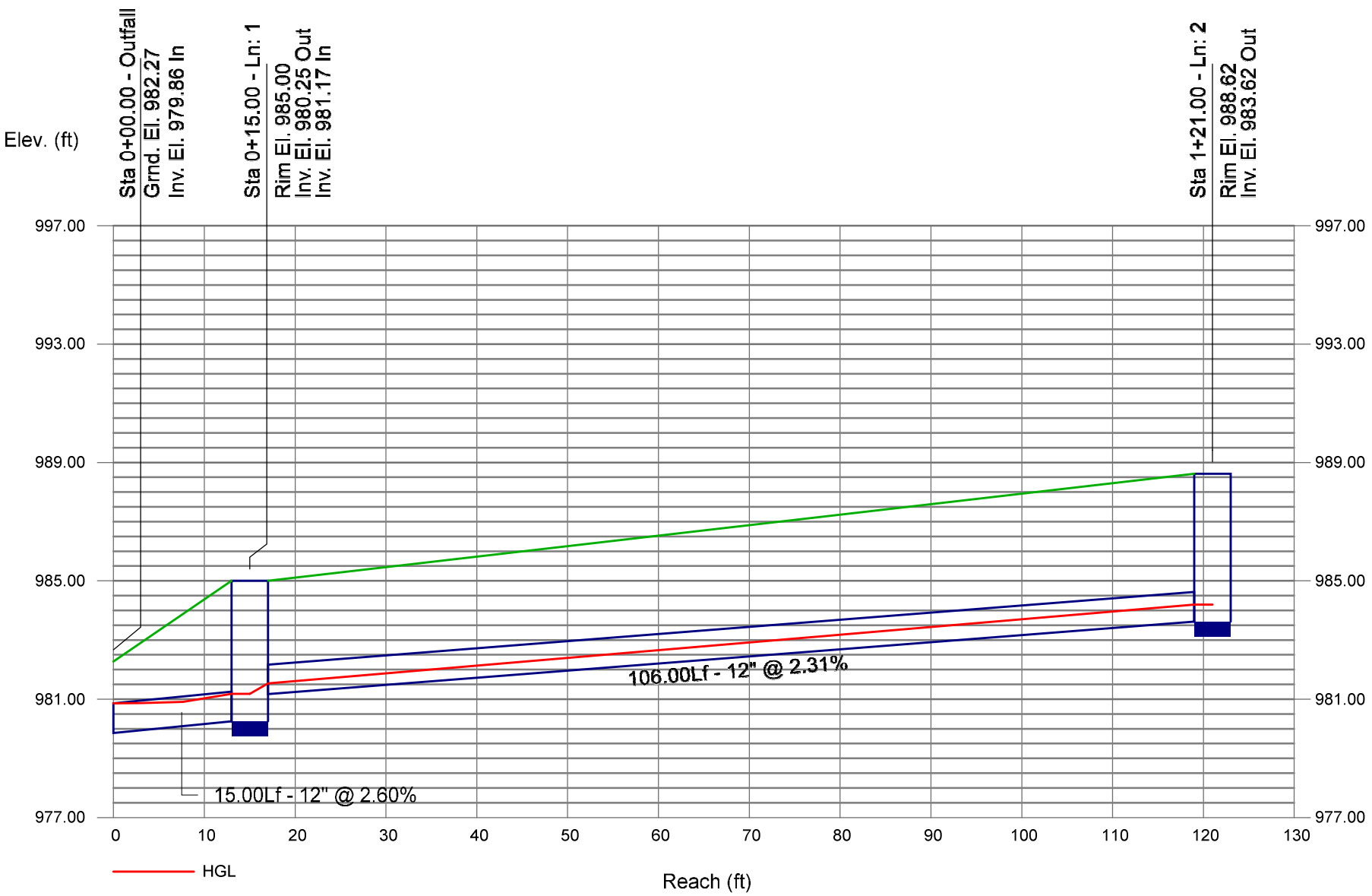
Storm Sewer Profile

Proj. file: CGS-24147-STORM-new.stm



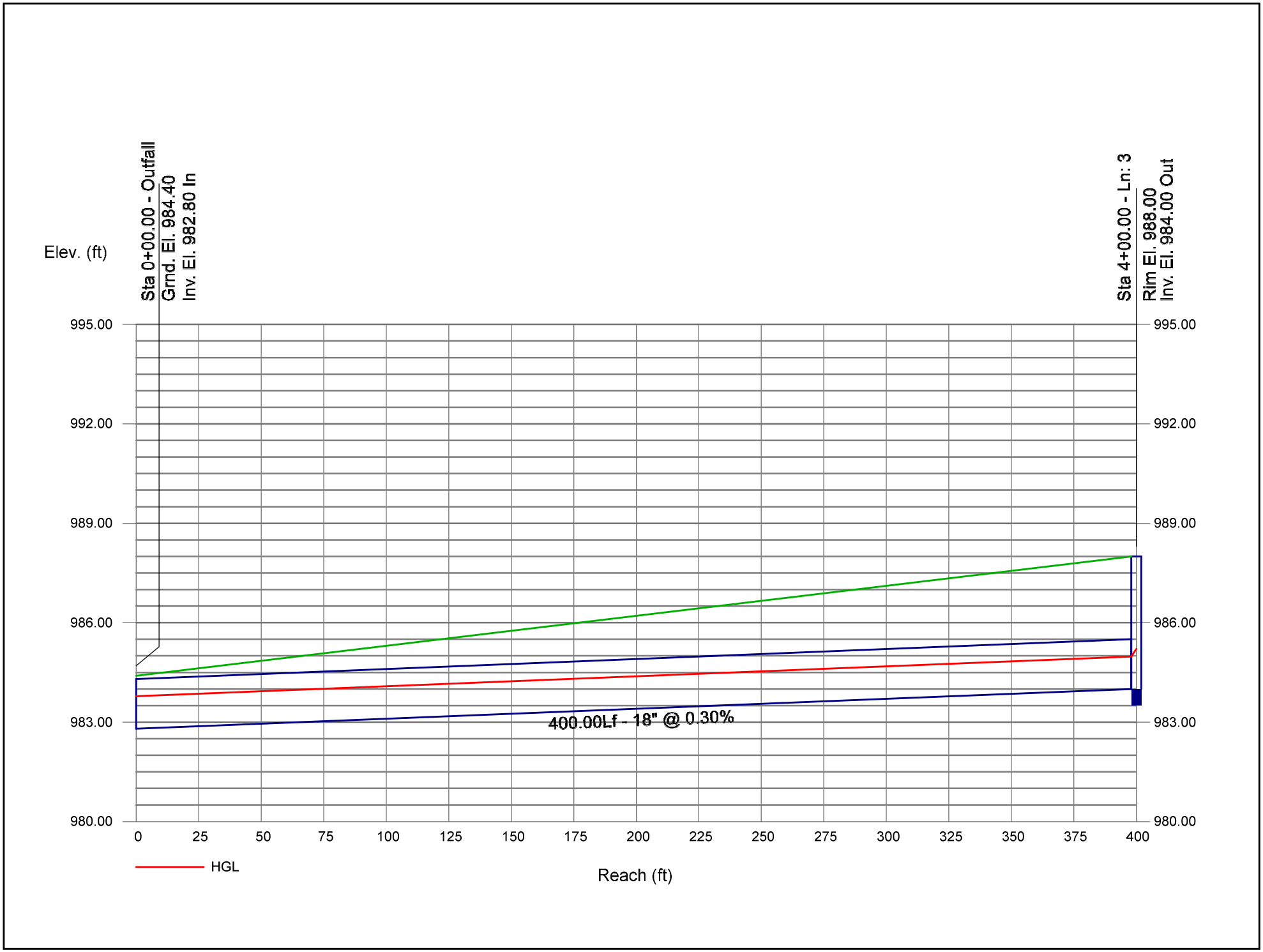
Storm Sewer Profile

Proj. file: CGS-24147-STORM-new.stm



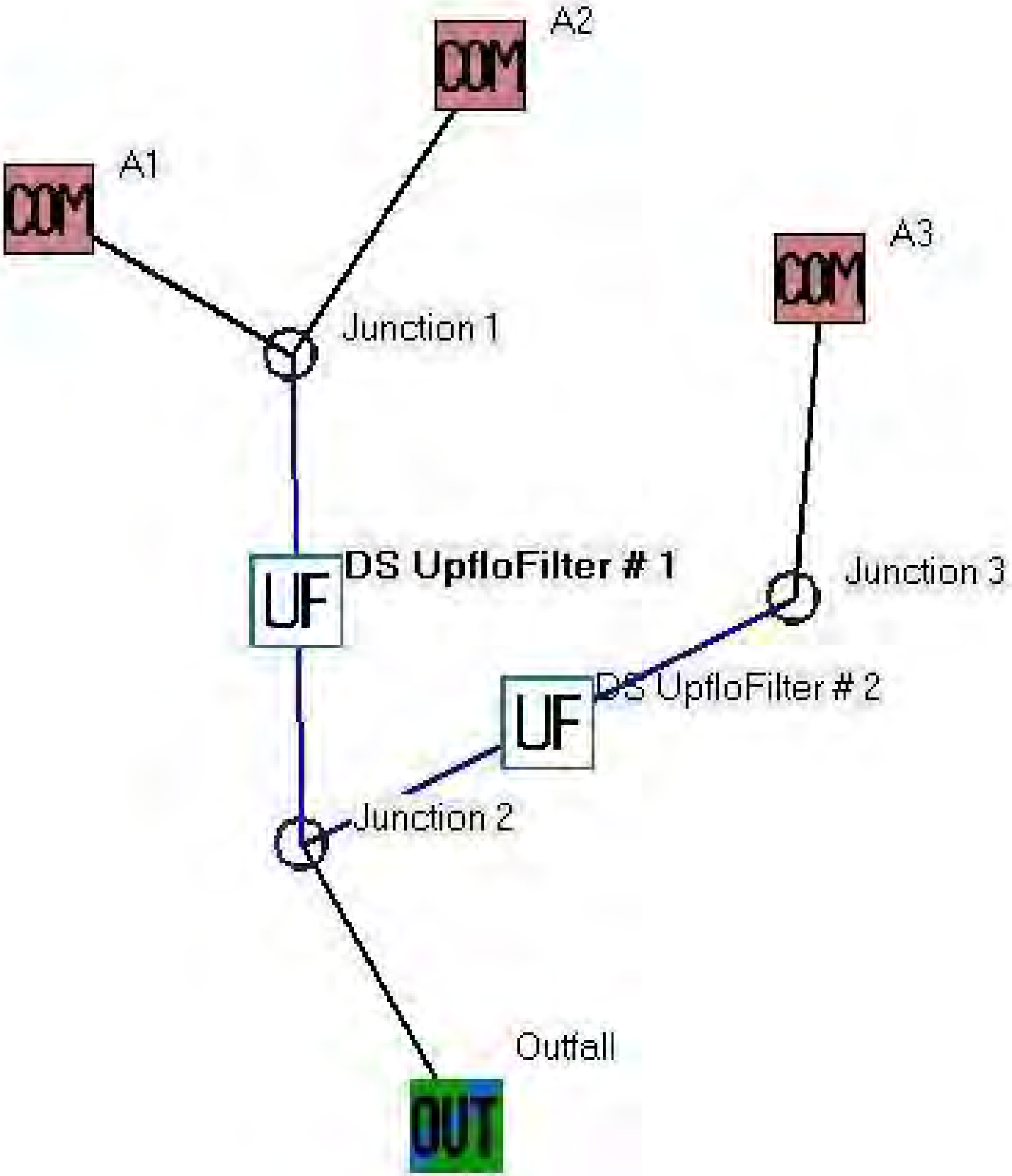
Storm Sewer Profile

Proj. file: CGS-24147-STORM-new.stm



APPENDIX C

WinSLAMM Output


A2
A1
A3
Junction 1
DS UpfloFilter # 1
Junction 3
DS UpfloFilter # 2
Junction 2
Outfall

Data file name: C:\Users\cfairbanks\OneDrive - Core States Group\Desktop\2018-03-29 2\Casey's Madison.mdb
WinSLAMM Version 10.3.4
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Madison WI 1981.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
Seed for random number generator: -42
Study period starting date: 01/01/81 Study period ending date: 12/31/81
Start of Winter Season: 12/02 End of Winter Season: 03/12
Date: 04-09-2018 Time: 15:28:31
Site information:

LU# 1 - Commercial: A1 Total area (ac): 0.575
  13 - Paved Parking 1: 0.575 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Commercial: A 2 Total area (ac): 0.313
  13 - Paved Parking 1: 0.313 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Commercial: A3 Total area (ac): 0.137
  13 - Paved Parking 1: 0.137 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Upflo Filter CP# 1 (DS) - DS UpfloFilter # 1
Media Type: CPZ

```
         Fraction of Area Served by Upflo Filters (0-1):  1.0
         Height from Outlet Invert to Structure Top (ft):  4.0
         Sump Depth (ft):  2.00
         Sump Cleaning/Filter Replacement is not considered during the model run
         Solve for Given Conditions
         Number of filters:  11
         Upflo Filter particle size distribution file name:  Not needed - calculated
by program


      Control Practice 2:  Upflo Filter CP# 2 (DS) - DS UpfloFilter # 2
         Media Type:  CPZ
         Fraction of Area Served by Upflo Filters (0-1):  1.0
         Height from Outlet Invert to Structure Top (ft):  5.0
         Sump Depth (ft):  2.00
         Sump Cleaning/Filter Replacement is not considered during the model run
         Solve for Given Conditions
         Number of filters:  4
         Upflo Filter particle size distribution file name:  Not needed - calculated
by program
```

SLAMM for Windows Version 10.3.4

Data file name: C:\Users\cfairbanks\OneDrive - Core States Group\Desktop\2018-03-29 2\Casey's Madison.mdb
Data file description:
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Madison WI 1981.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Start of Winter Season: 12/02 End of Winter Season: 03/12
Model Run Start Date: 01/01/81 Model Run End Date: 12/31/81
Date of run: 04-09-2018 Time of run: 15:33:26
Total Area Modeled (acres): 1.025
Years in Model Run: 1.00

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	77803	-	130.0	631.4	-
Outfall Total with Controls:	78003	-0.26%	25.33	123.3	80.47%
Annualized Total After Outfall Controls:	78218			123.7	