EXHIBIT F

Preliminary Stormwater Report

Riverlands Subdivision

Stormwater Drainage Report

Prepared For

Del Boca Vista LLC

Newberg, OR

Prepared By

DAVID EVANS
AND ASSOCIATES INC.

2100 SW River Parkway

Portland, OR 97201

Project Engineer:

Brady Berry, P.E.

February 26, 2019

TABLE OF CONTENTS

1 INTRODUCTION AND PURPOSE

The purpose of this report is to provide documentation for the stormwater management associated with the development of the Riverlands subdivision, located on the west side of River Street between 11th Street and 14th Street in Newberg, Oregon, in Yamhill County. This report will evaluate the proposed stormwater conveyance, water quality, and water quantity design.

The calculations and stormwater management methods contained in this report have been based on the current City of Newberg Public Works Design and Construction Standards 2015 stormwater standards.

2 PROJECT LOCATION AND DESCRIPTION

This project proposes the construction of a new roadway with associated sidewalks, landscaping, and stormwater facilities located on tax lot R3229 02500. The current property is mostly undeveloped with an existing single family dwelling with a few trees, outbuildings, and driveway.

3 EXISTING CONDITIONS

The total site area is approximately 1.64 acres with 0.12 acres of offsite work. There is approximately 0.2 acres of existing impervious area per EX001 in Appendix 1. Currently, there is no storm system or water quality facility on the property. The storm runoff from the site sheet flows to the west where it eventually discharges into Chehalem Creek and Willamette River.

The soil is composed of:

- 2300A – Aloha silt loam, 0 to 3 percent slopes, Hydrologic Soil Group C/D

The NRCS Web Soil Survey documentation regarding soil groups and site composition is available in Appendix 3.

4   DRAINAGE DESIGN/ANALYSIS

The proposed drainage analysis is based on the requirements of the City of Newberg Public Works Design and Construction Standards, dated August 2015.

The storm runoff values contained in this report were modeled with Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2016 by Autodesk, Inc. Hydrologic analysis is based upon the Santa Barbara Urban Hydrograph (SBUH) method. The following criteria were input to the model:

- 24-Hour rainfall depths:
  - o   2-yr: 2.5 inches
  - o   10-yr: 3.5 inches
  - o   25-yr: 4.0 inches

- Hydrologic Soil Group is C taken from the NRCS Soil Survey of Yamhill County.
- NRCS 24-Hr Type 1A Hydrograph
- The runoff curve number (CN) value for developed urban impervious areas is 98.
- The runoff curve number (CN) value for good condition grassland is 74.
- A minimum time of concentration of 5 minutes was used for all catchment areas within the project area.

5   CONVEYANCE DESIGN

The proposed storm pipe system is designed using manning's equation to have the capacity to convey the runoff from a 25-year return frequency storm event without roadway ponding, and to convey runoff from all impervious areas and some pervious areas on site with a minimum free flow velocity of 3.0 ft/s in all pipes.

Conveyance map EX003 is included in Appendix B. Calculations determining the pipe capacities and flow velocities of the proposed storm drain system for a 25-year storm event are also compiled in Appendix B.

6   WATER QUANTITY

The post-developed flow rates were determined by modeling the peak discharge released from the site at a common downstream point. The design assumes approximately 70% of each post-developed lot area will consist of impervious area based on keeping side and rear setbacks non-impervious. Table 1 below compares the peak pre-developed flow rates with the peak post-developed flow rates for the 2-yr, 10-yr, and 25-yr storm events. The resulting post-developed peak flows do not exceed the pre-developed peak flows for the listed storm events.

Table 1: Storm event peak flows in cubic-feet per second.

	2-year	10-year	25-year
Total Pre-developed	0.145	0.353	0.472
Total Post-developed	0.100	0.241	0.420

7 WATER QUALITY

The proposed ponds are designed to treat runoff from proposed impervious areas. See Appendix 1 for the post-developed basin maps EX002 and the water quality storm hydrographs. The same calculation methods used for water quantity analysis were also used for water quality. The water quality storm depth is 1 inch falling in 24 hours with an average storm return period of 96 hours per City of Newberg standards.

Runoff from Basins P1-P3 will be routed into Facility A, an extended dry basin, which has a bottom elevation of 165.00. The water quality volume required for the total contributing impervious areas is 1,632 ft³. The pond is designed to have a capacity of 6,658 ft³ and maximum ponding depth of 4' for a 25-year storm event. Discharge from Facility A will be controlled by two ditch inlets with rim elevations of 165.00 and 167.8 with a 0.625" orifice restricting flow from the lower inlet to the higher. Facility A will discharge into the proposed public storm drain system, connecting with the existing storm drain system within River Street. In the rare occurrence that the basin capacity is exceeded, overflow from Facility A will flow to the south into the adjacent railway, following existing drainage patterns.

Runoff from Basin P4 will be routed into Facility B, a stormwater planter, which has a standard depth of 8 in. and a length 26 ft. The water quality volume required for the total contributing impervious areas is 77 ft³. The pond is designed to have a treatment volume of 87 ft³. Facility B will discharge into the public storm drain system within River Street. In the occurrence that the pond capacity is exceeded for a greater storm event, BMP B will overflow into the street gutter.

8 CONCLUSION

The proposed development has appropriate stormwater facilities and a system that fulfills the required conveyance, water quality and water quantity based on City of Newberg standards.

9 REFERENCES

Public Works Design and Construction Standards, City of Newberg, dated August 2015

NRCS County Web Soil Survey accessed on line on November 9, 2018

10 APPENDICES

Appendix 1: Basin Maps
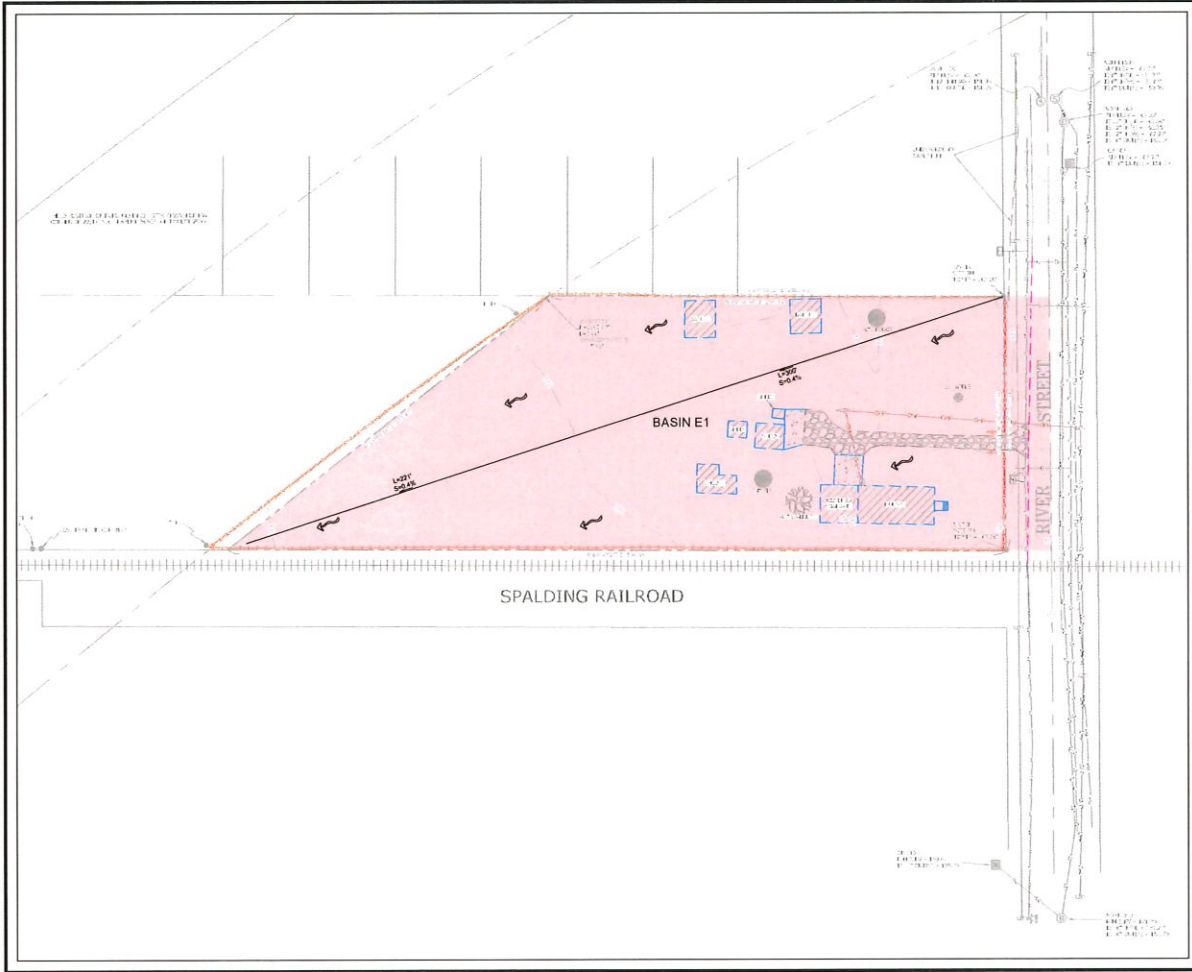
LEGEND

- ——— — ROW / PROPERTY LINE
- EXISTING CONTOUR
- BASIN E1
- FLOW DIRECTION ARROW

AREAS

BASIN	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
E1	0.20	1.44	1.64

BASIN E1

SPALDING RAILROAD

RIVER STREET

PROJECT
RIVERLANDS SUBDIVISION
DEL BOCA VISTA, LLC
NEWBERG, OREGON

SHEET TITLE
EXISTING BASIN MAP

PRELIMINARY

DATE	02/26/19
DESIGN	ATR
DRAWN	ATR

SHEET NO.
EX001

PROJECT NO. DBVC0000-0000

SCALE: 1" = 30'
0   15   30   60
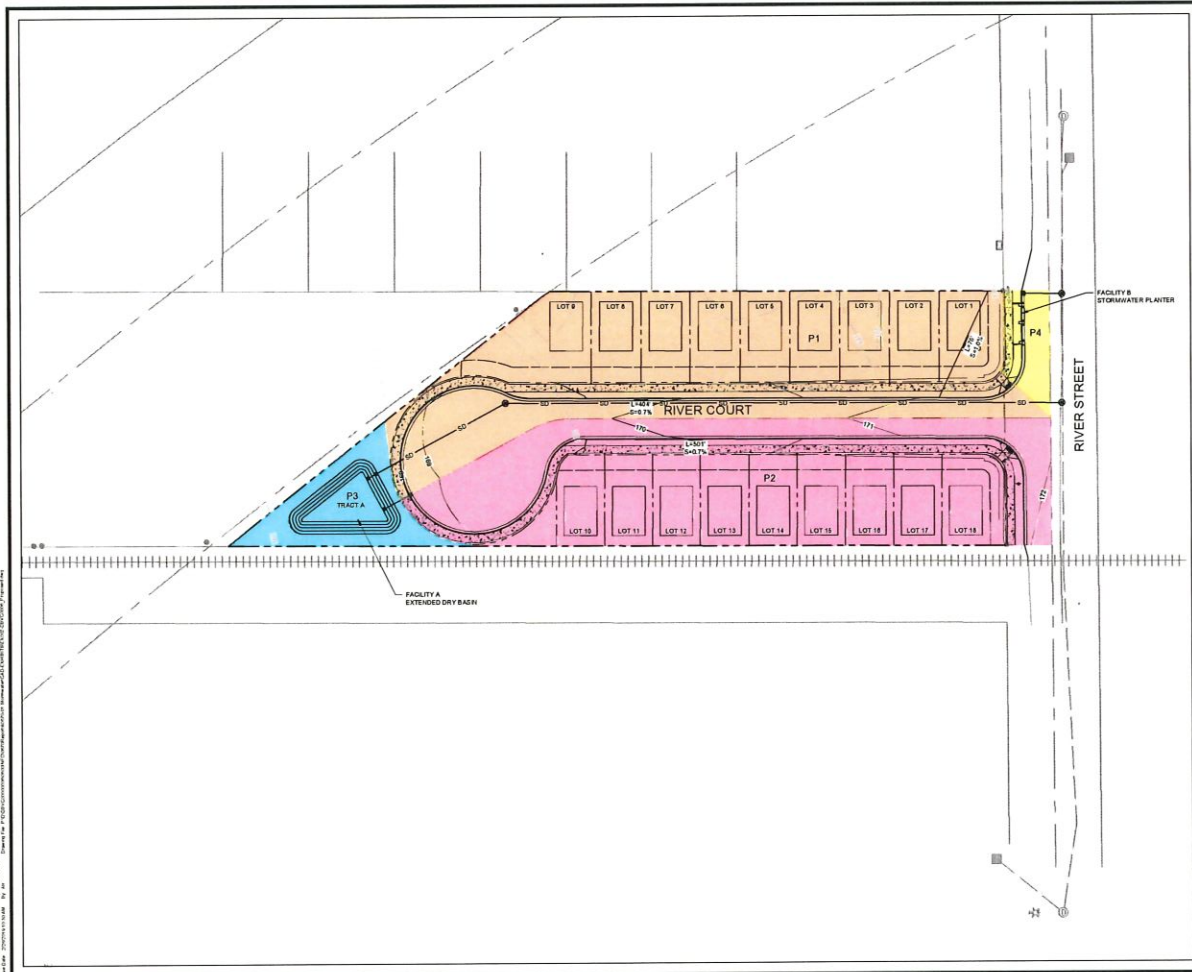
1. IT IS ASSUMED THAT ALL UNDEVELOPED LOTS WILL CONTRIBUTE 2,000 SF. THESE IMPERVIOUS AREAS ARE INCLUDED IN AREA AND TREATMENT REQUIREMENT CALCULATIONS.

DAVID EVANS AND ASSOCIATES INC.
2100 SW River Parkway
Portland Oregon 97201
Phone 503.223.6663

DESIGN STUDIO

LEGEND

— — — ROW / PROPERTY LINE
EASEMENT
PROPOSED CONTOUR
EXISTING CONTOUR
FLOW ARROW
BASIN P1
BASIN P2
BASIN P3
BASIN P4

PROPOSED BASIN AREAS

BASIN	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
P1	0.54	0.20	0.74
P2	0.59	0.15	0.74
P3	0.00	0.12	0.12
SUBTOTAL	1.13	0.47	1.60
P4	0.00	0.05	0.05
SUBTOTAL	0.00	0.05	0.05
TOTAL	1.13	0.52	1.64

FACILITY B
STORMWATER PLANTER

RIVER STREET

LOT 9 LOT 8 LOT 7 LOT 6 LOT 5 LOT 4 LOT 3 LOT 2 LOT 1

P1

P4

RIVER COURT

P3
TRACT A

P2

LOT 10 LOT 11 LOT 12 LOT 13 LOT 14 LOT 15 LOT 16 LOT 17 LOT 18

FACILITY A
EXTENDED DRY BASIN

PROJECT
RIVERLANDS SUBDIVISION
DEL BOCA VISTA, LLC
NEWBERG, OREGON

SHEET TITLE
PROPOSED BASIN MAP

PRELIMINARY

DATE 03/25/19
DESIGN ATR
DRAWN ATR

SHEET NO.
EX002

PROJECT NO DBVC0000-0006

0 15 30 60
SCALE: 1" = 30'

**DAVID EVANS
AND ASSOCIATES INC.**
2100 SW River Parkway
Portland Oregon 97201
Phone 503.223.6663

DESIGN STUDIO

LOT 9 | LOT 8 | LOT 7 | LOT 6 | LOT 5 | LOT 4 | LOT 3 | LOT 2 | LOT 1

RIVER COURT

FACILITY B
STORMWATER PLANTER

EXISTING 18" SD MAIN

RIVER STREET

TRACT A

FACILITY A
EXTENDED DRY BASIN

LOT 10 | LOT 11 | LOT 12 | LOT 13 | LOT 14 | LOT 15 | LOT 16 | LOT 17 | LOT 18

PROJECT
RIVERLANDS SUBDIVISION
DEL BOCA VISTA, LLC
NEWBERG, OREGON

SHEET TITLE
CONVEYANCE MAP

PRELIMINARY

DATE   02/25/19
DESIGN   ATR
DRAWN   ATR

SHEET NO.
EX003

0   15   30   60
SCALE: 1" = 30'

PROJECT NO   DBVC0000-0000

Appendix 2: Water Quality Calcs & Hydrographs

Hydrograph Report

Tuesday, 02 / 26 / 2019

Hyd. No. 4

FACILITY A - INFLOW

Hydrograph type	= Combine	Peak discharge	= 0.087 cfs
Storm frequency	= 1 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,632 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.600 ac
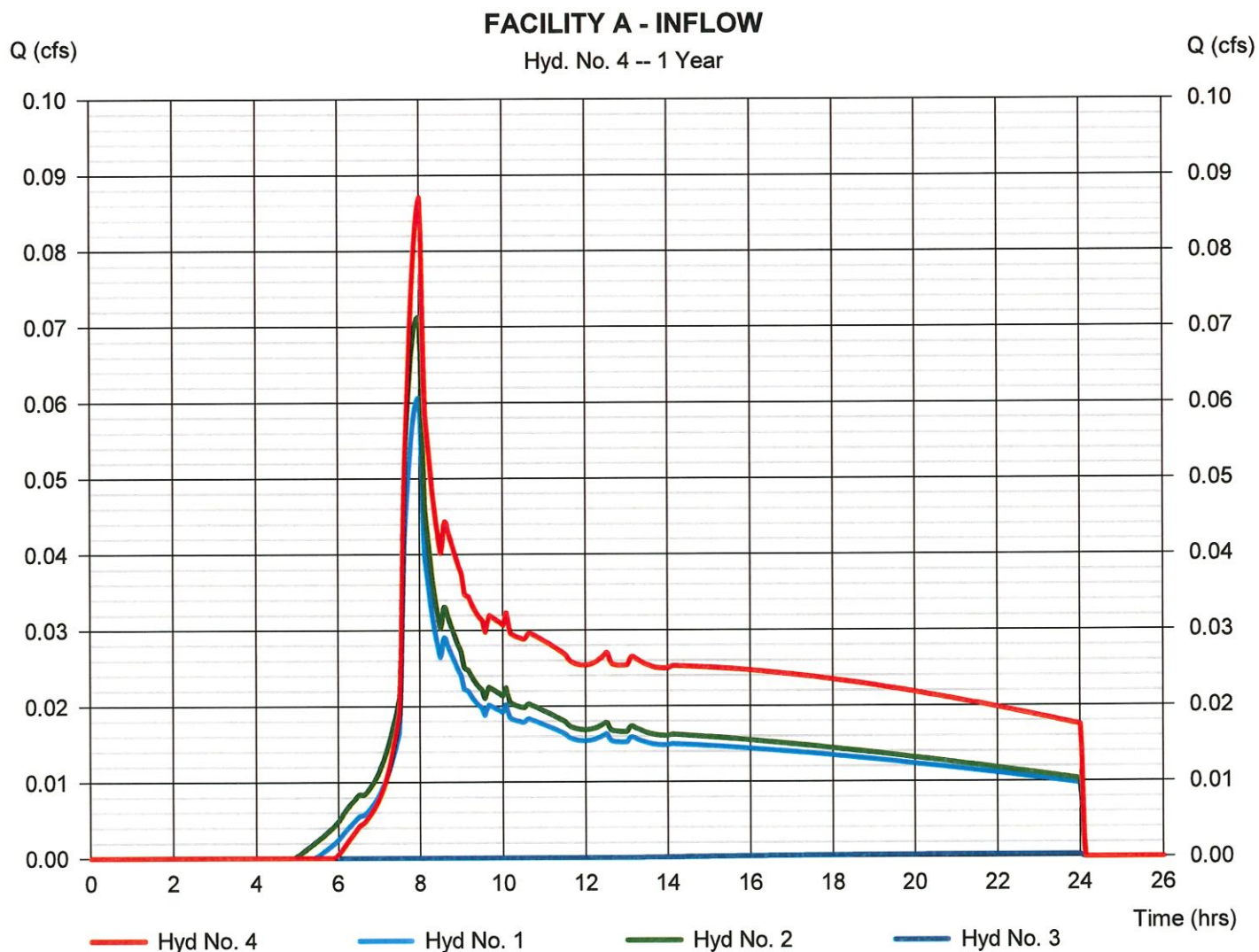
FACILITY A - INFLOW

Hyd. No. 4 -- 1 Year

Legend: Hyd No. 4, Hyd No. 1, Hyd No. 2, Hyd No. 3

Hydrograph Report

Tuesday, 02 / 26 / 2019

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 1 yrs	Time to peak	= 7.97 hrs
Time interval	= 2 min	Hyd. volume	= 77 cuft
Drainage area	= 0.050 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 98) + (0.010 x 74)] / 0.050

P4

Hyd. No. 6 -- 1 Year

— Hyd No. 6
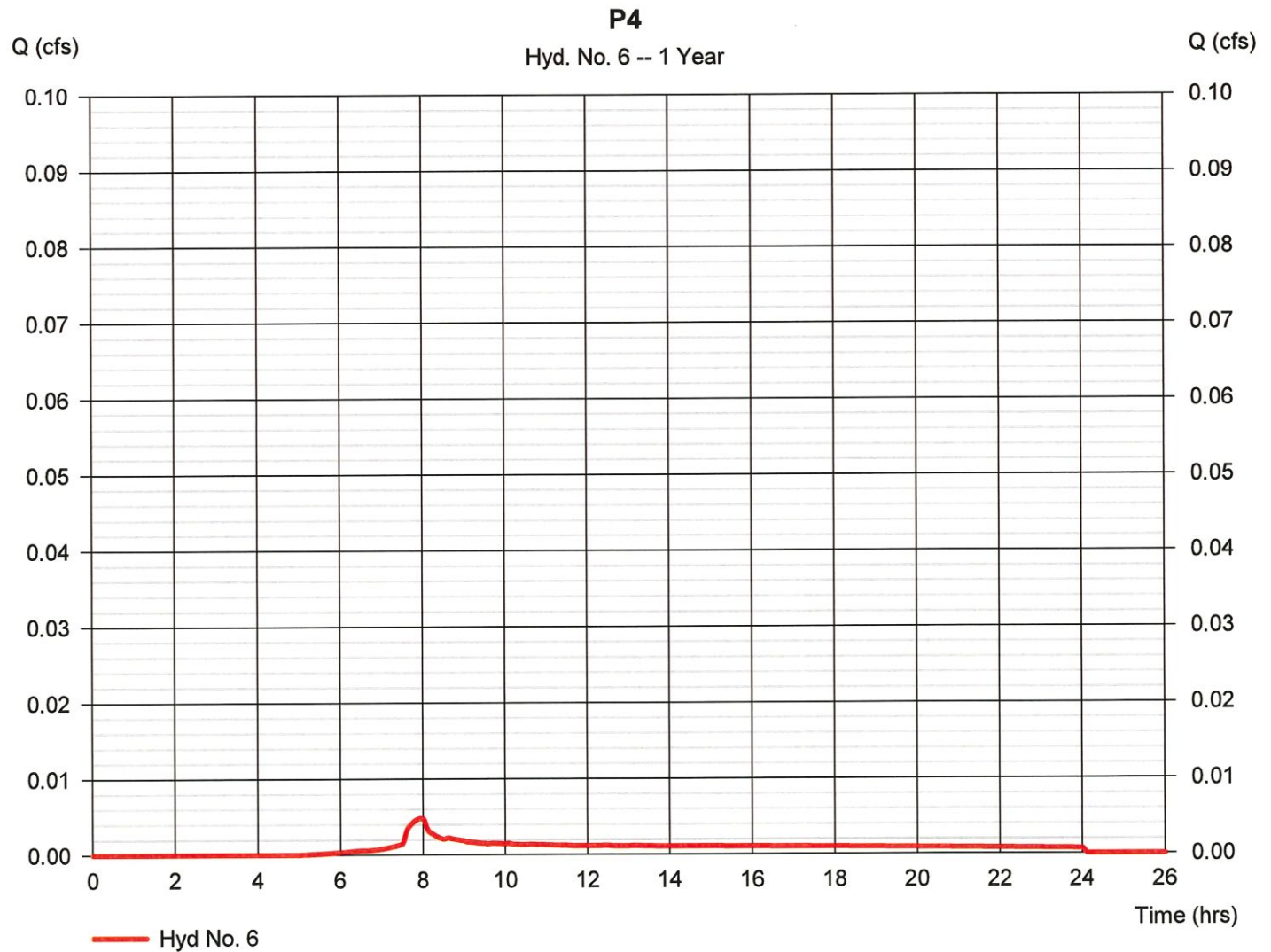
Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020
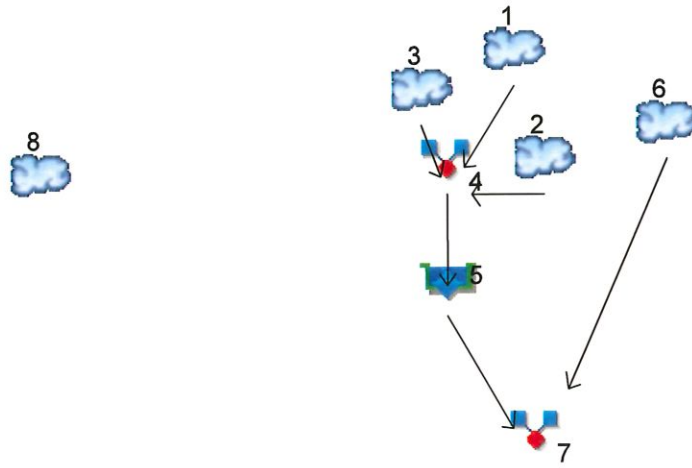
Legend

Hyd.	Origin	Description
1	SCS Runoff	P1
2	SCS Runoff	P2
3	SCS Runoff	P3
4	Combine	FACILITY A - INFLOW
5	Reservoir	FACILITY A - OUTFLOW
6	SCS Runoff	P4
7	Combine	Post-Construction Discharge
8	SCS Runoff	E1

Project: Post-Construction.gpw

Tuesday, 02 / 26 / 2019

Hydrograph Summary Report
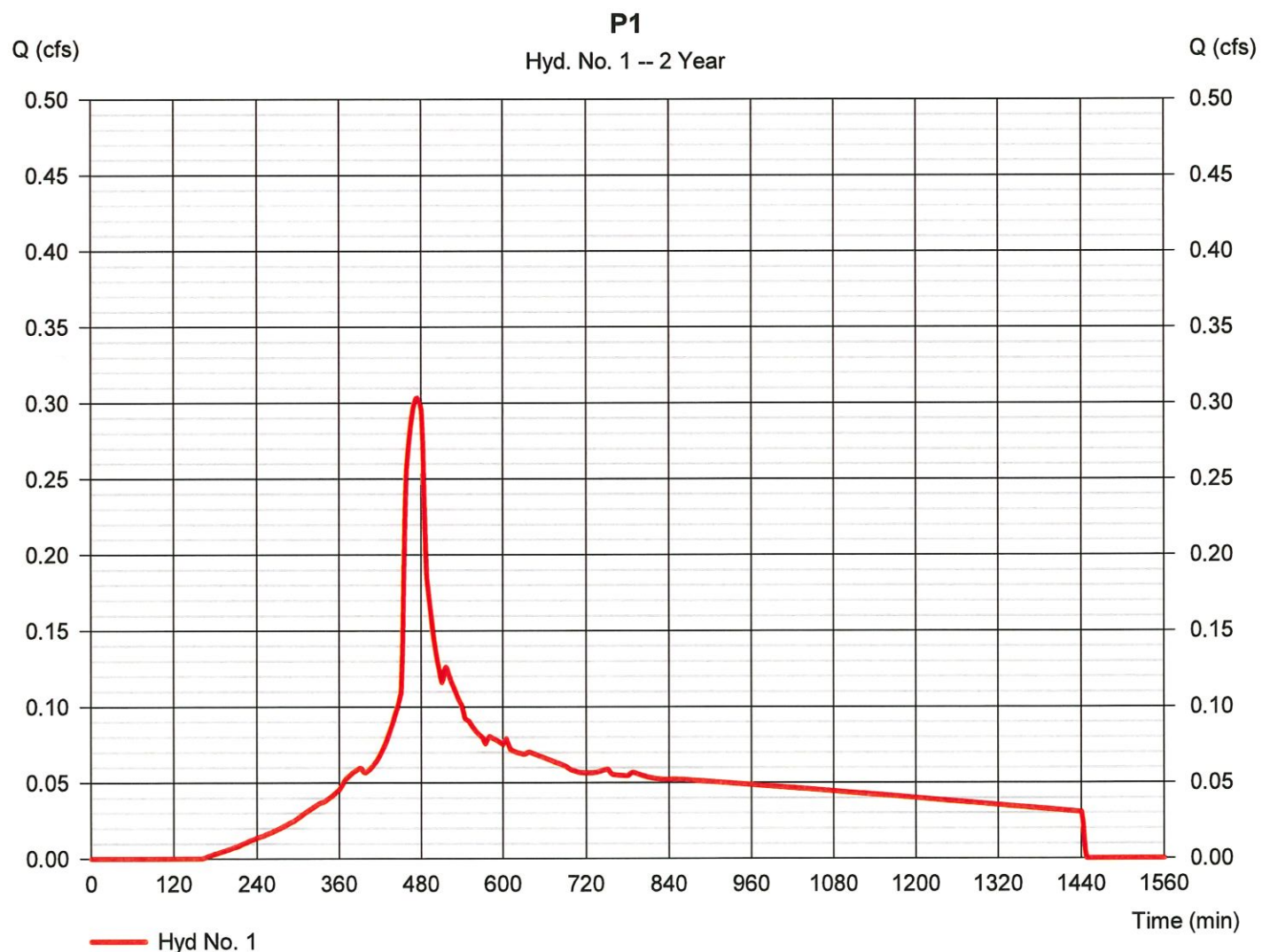Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.304	2	474	4,264	------	------	------	P1
2	SCS Runoff	0.322	2	474	4,481	------	------	------	P2
3	SCS Runoff	0.010	2	480	248	------	------	------	P3
4	Combine	0.542	2	476	7,909	1, 2, 3	------	------	FACILITY A - INFLOW
5	Reservoir	0.096	2	948	7,514	4	167.82	4,698	FACILITY A - OUTFLOW
6	SCS Runoff	0.022	2	474	303	------	------	------	P4
7	Combine	0.100	2	948	7,816	5, 6	------	------	Post-Construction Discharge
8	SCS Runoff	0.145	2	518	4,375	------	------	------	E1

Post-Construction.gpw	Return Period: 2 Year	Tuesday, 02 / 26 / 2019

Hydrograph Report

Hyd. No. 1

P1

Hydrograph type	= SCS Runoff		Peak discharge	= 0.304 cfs
Storm frequency	= 2 yrs		Time to peak	= 474 min
Time interval	= 2 min		Hyd. volume	= 4,264 cuft
Drainage area	= 0.740 ac		Curve number	= 92*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= User		Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.50 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.200 x 74)] / 0.740

P1

Hyd. No. 1 -- 2 Year

Hydrograph Report

Hyd. No. 2

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.322 cfs
Storm frequency	= 2 yrs	Time to peak	= 474 min
Time interval	= 2 min	Hyd. volume	= 4,481 cuft
Drainage area	= 0.740 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.590 x 98) + (0.150 x 74)] / 0.740

P2

Hyd. No. 2 -- 2 Year

Hyd No. 2

Hydrograph Report

Tuesday, 02 / 26 / 2019

Hyd. No. 3

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.010 cfs
Storm frequency	= 2 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 248 cuft
Drainage area	= 0.120 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (0.120 x 74)] / 0.120

P3
Hyd. No. 3 -- 2 Year

Hyd No. 3

Hydrograph Report

Hyd. No. 4

FACILITY A - INFLOW

Hydrograph type	= Combine	Peak discharge	= 0.542 cfs
Storm frequency	= 2 yrs	Time to peak	= 476 min
Time interval	= 2 min	Hyd. volume	= 7,909 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.600 ac
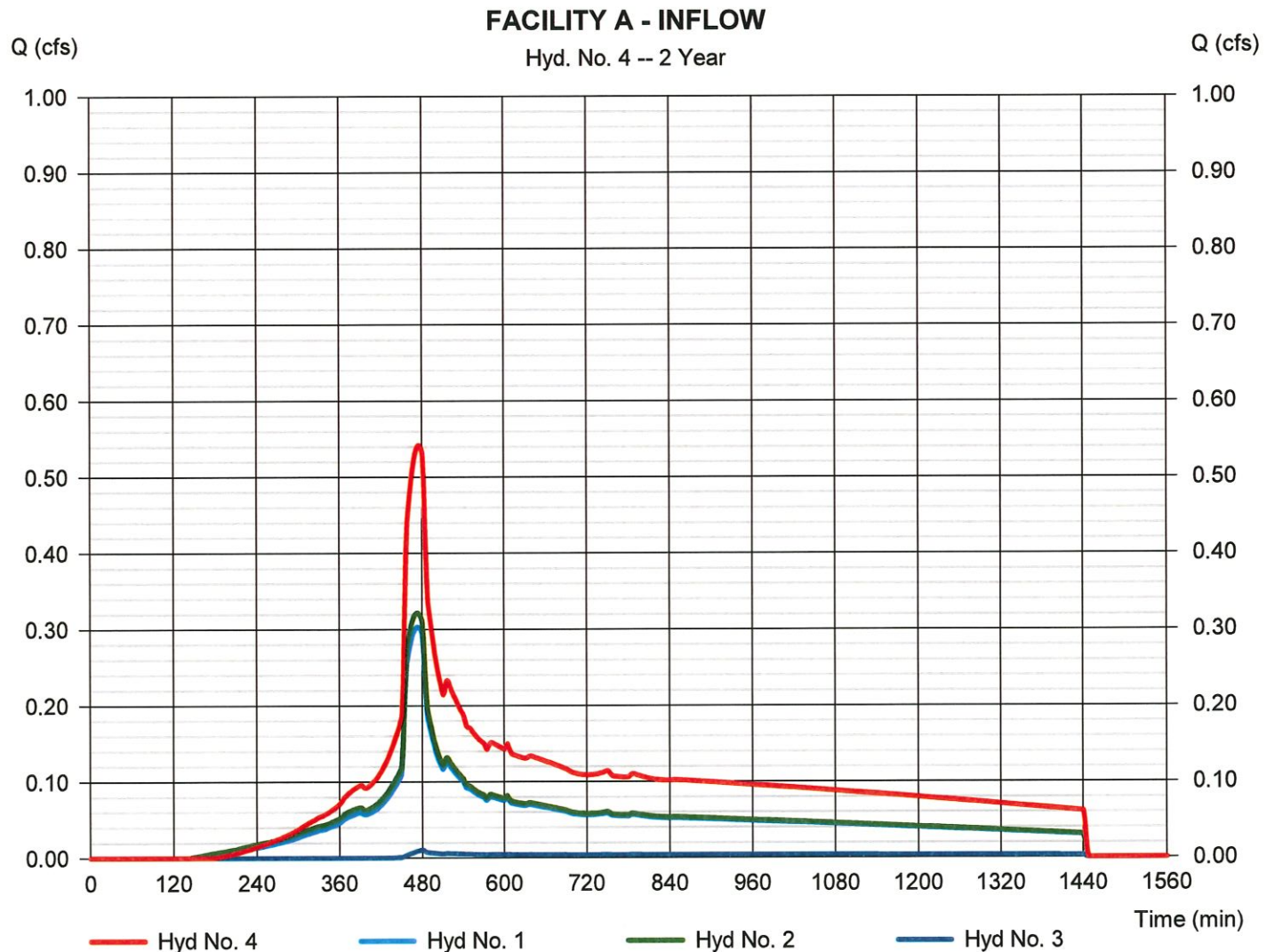
FACILITY A - INFLOW

Hyd. No. 4 -- 2 Year

Legend: Hyd No. 4, Hyd No. 1, Hyd No. 2, Hyd No. 3

Hydrograph Report

Hyd. No. 5

FACILITY A - OUTFLOW

Hydrograph type	= Reservoir	Peak discharge	= 0.096 cfs
Storm frequency	= 2 yrs	Time to peak	= 948 min
Time interval	= 2 min	Hyd. volume	= 7,514 cuft
Inflow hyd. No.	= 4 - FACILITY A - INFLOW	Max. Elevation	= 167.82 ft
Reservoir name	= BMP A	Max. Storage	= 4,698 cuft

Storage Indication method used.

FACILITY A - OUTFLOW

Hyd. No. 5 -- 2 Year

Q (cfs)

| Hyd No. 5 | Hyd No. 4 | Total storage used = 4,698 cuft |

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020   Tuesday, 02 / 26 / 2019
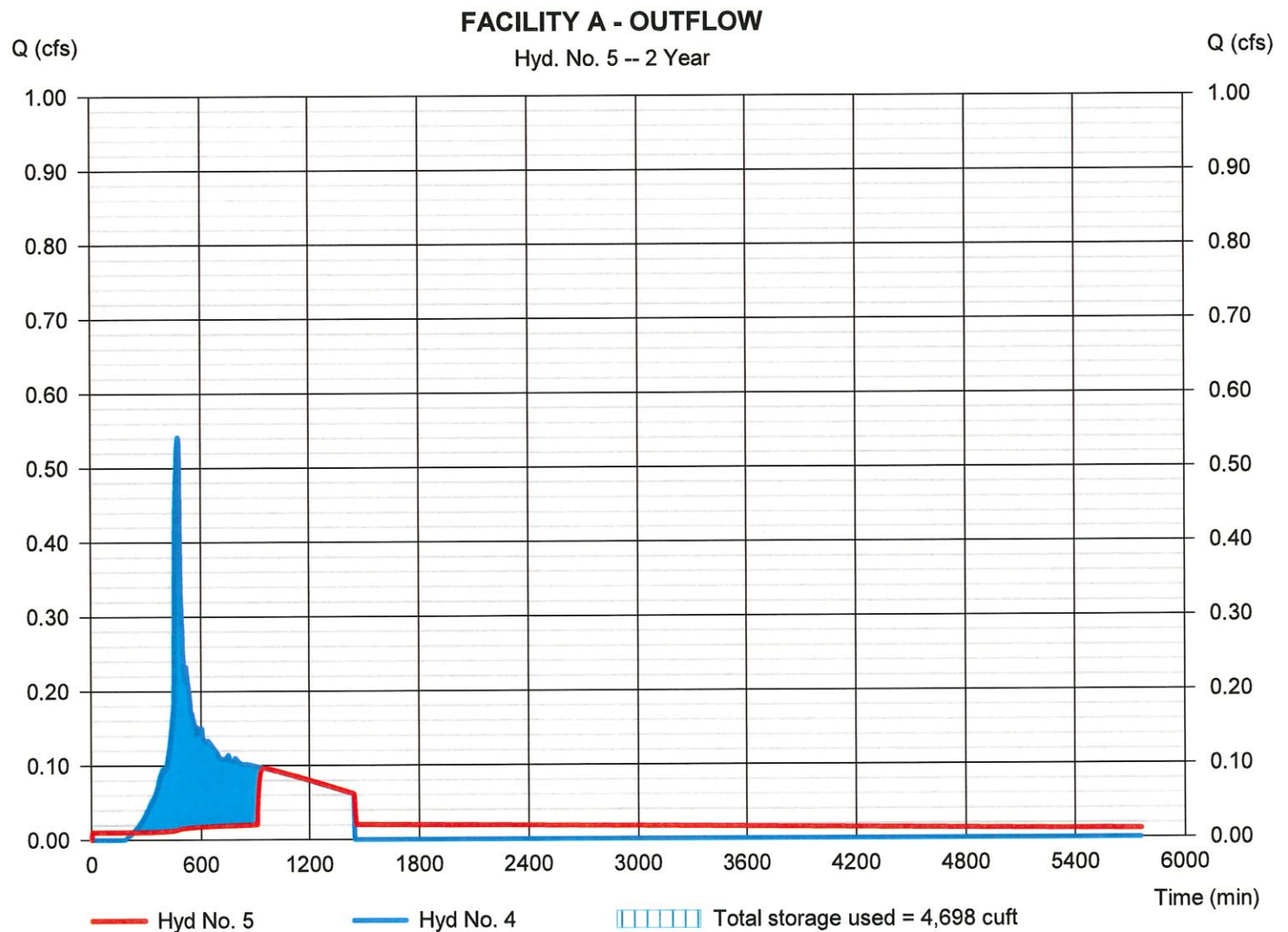
Pond No. 1 - BMP A
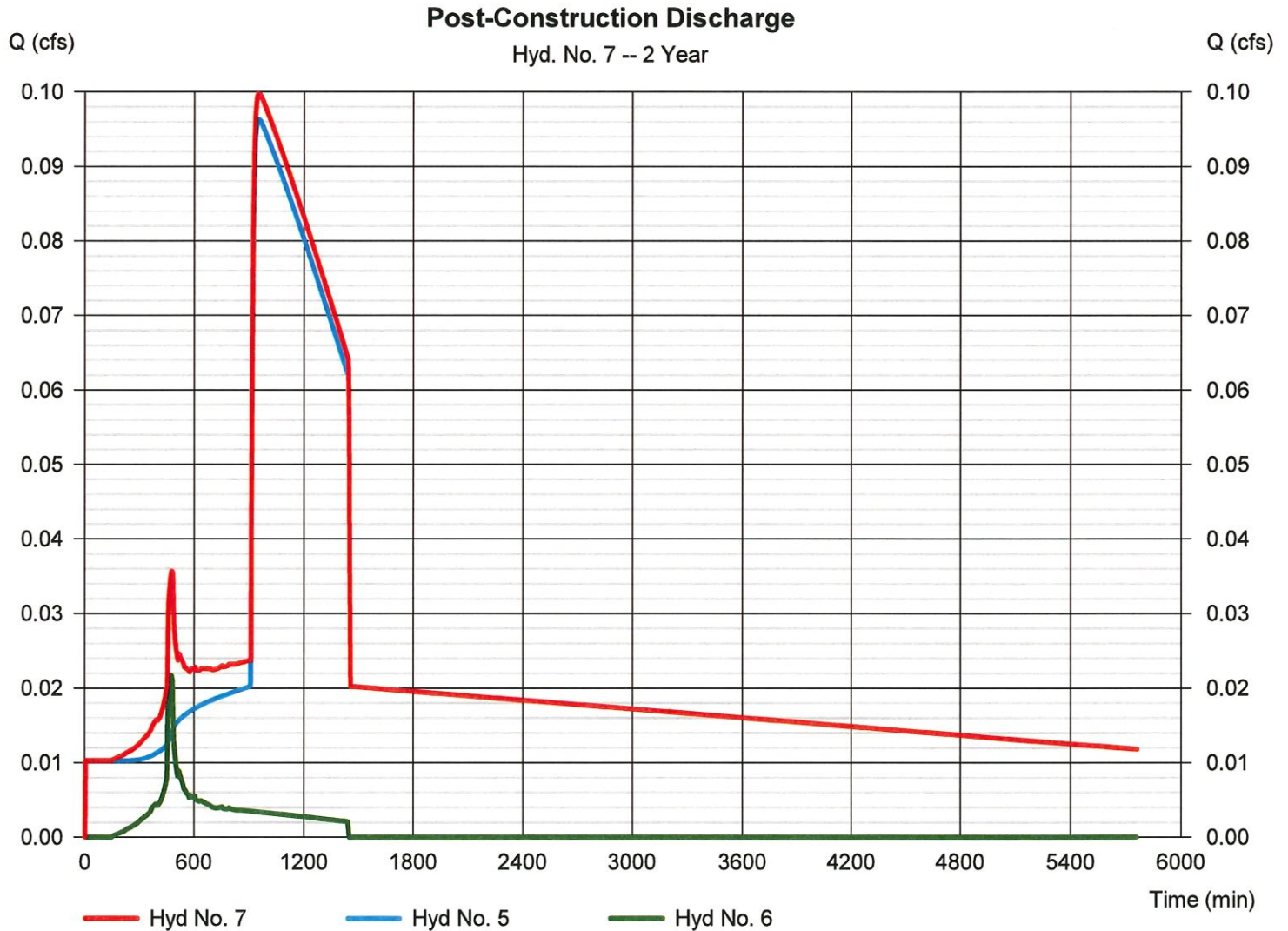
Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 165.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	165.00	979	0	0
4.00	169.00	2,350	6,658	6,658

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.63	0.00	0.00	0.00
Span (in)	= 0.63	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 164.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	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)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 167.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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 / Discharge

Hydrograph Report

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.022 cfs
Storm frequency	= 2 yrs	Time to peak	= 474 min
Time interval	= 2 min	Hyd. volume	= 303 cuft
Drainage area	= 0.050 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 98) + (0.010 x 74)] / 0.050

P4
Hyd. No. 6 -- 2 Year

Hyd No. 6

Hydrograph Report

Hyd. No. 7

Post-Construction Discharge

Hydrograph type	= Combine	Peak discharge	= 0.100 cfs
Storm frequency	= 2 yrs	Time to peak	= 948 min
Time interval	= 2 min	Hyd. volume	= 7,816 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.050 ac

Post-Construction Discharge

Hyd. No. 7 -- 2 Year

Q (cfs) ... Time (min)

Hyd No. 7   Hyd No. 5   Hyd No. 6

Hydrograph Report

Hyd. No. 8

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.145 cfs
Storm frequency	= 2 yrs	Time to peak	= 518 min
Time interval	= 2 min	Hyd. volume	= 4,375 cuft
Drainage area	= 1.640 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.40 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 74) + (0.200 x 98)] / 1.640

E1
Hyd. No. 8 -- 2 Year
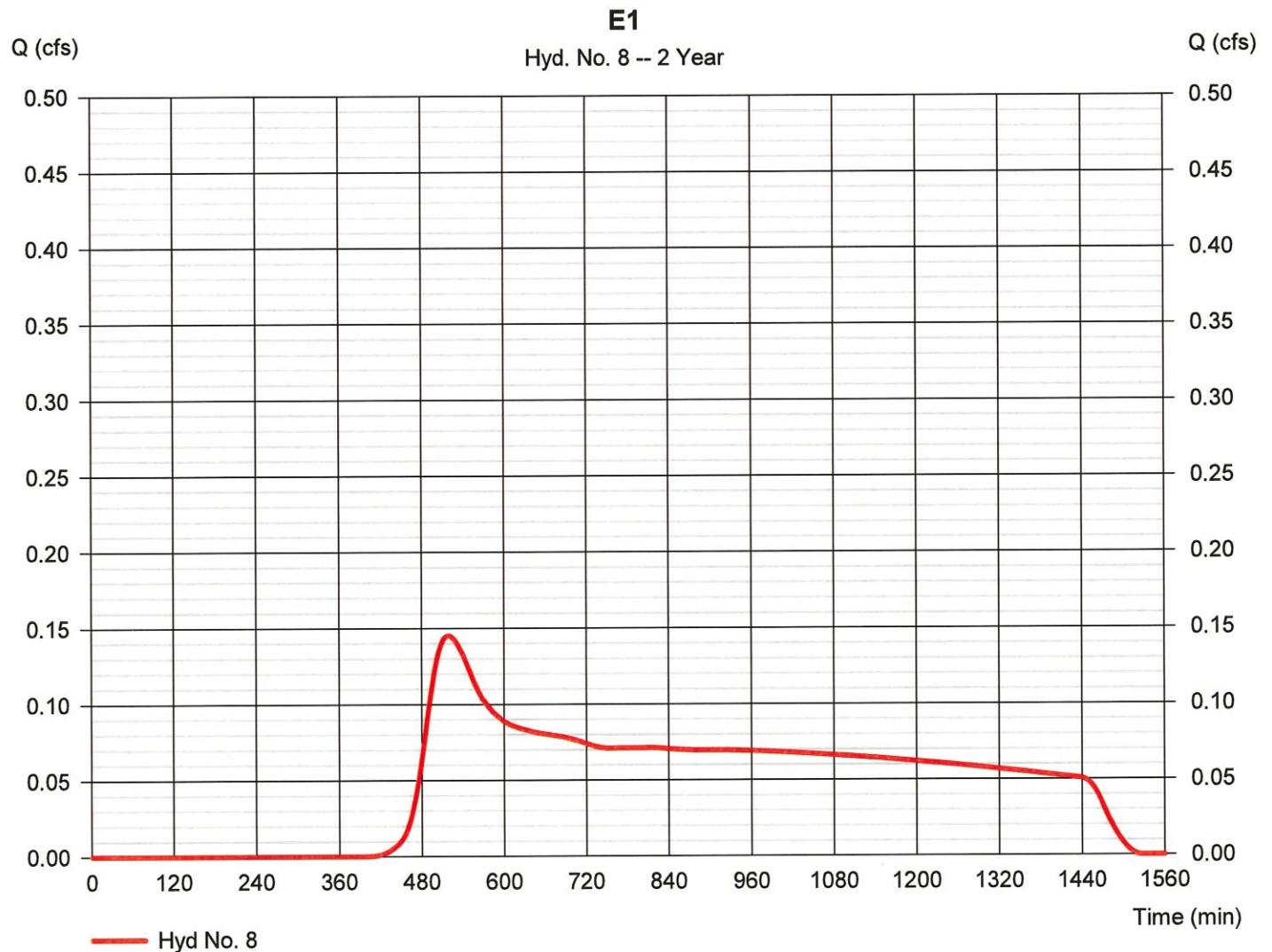
Hyd No. 8

Hydrograph Summary Report
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.480	2	472	6,640	------	------	------	P1
2	SCS Runoff	0.499	2	472	6,887	------	------	------	P2
3	SCS Runoff	0.028	2	480	506	------	------	------	P3
4	Combine	0.902	2	474	12,741	1, 2, 3	------	------	FACILITY A - INFLOW
5	Reservoir	0.233	2	588	12,309	4	167.86	4,764	FACILITY A - OUTFLOW
6	SCS Runoff	0.034	2	472	465	------	------	------	P4
7	Combine	0.241	2	588	12,775	5, 6	------	------	Post-Construction Discharge
8	SCS Runoff	0.353	2	512	8,453	------	------	------	E1

Post-Construction.gpw	Return Period: 10 Year	Tuesday, 02 / 26 / 2019

Hydrograph Report

Hyd. No. 1

P1

Hydrograph type	= SCS Runoff		Peak discharge	= 0.480 cfs
Storm frequency	= 10 yrs		Time to peak	= 472 min
Time interval	= 2 min		Hyd. volume	= 6,640 cuft
Drainage area	= 0.740 ac		Curve number	= 92*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= User		Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.200 x 74)] / 0.740

P1

Hyd. No. 1 -- 10 Year

Hyd No. 1

Hydrograph Report

Hyd. No. 2

P2
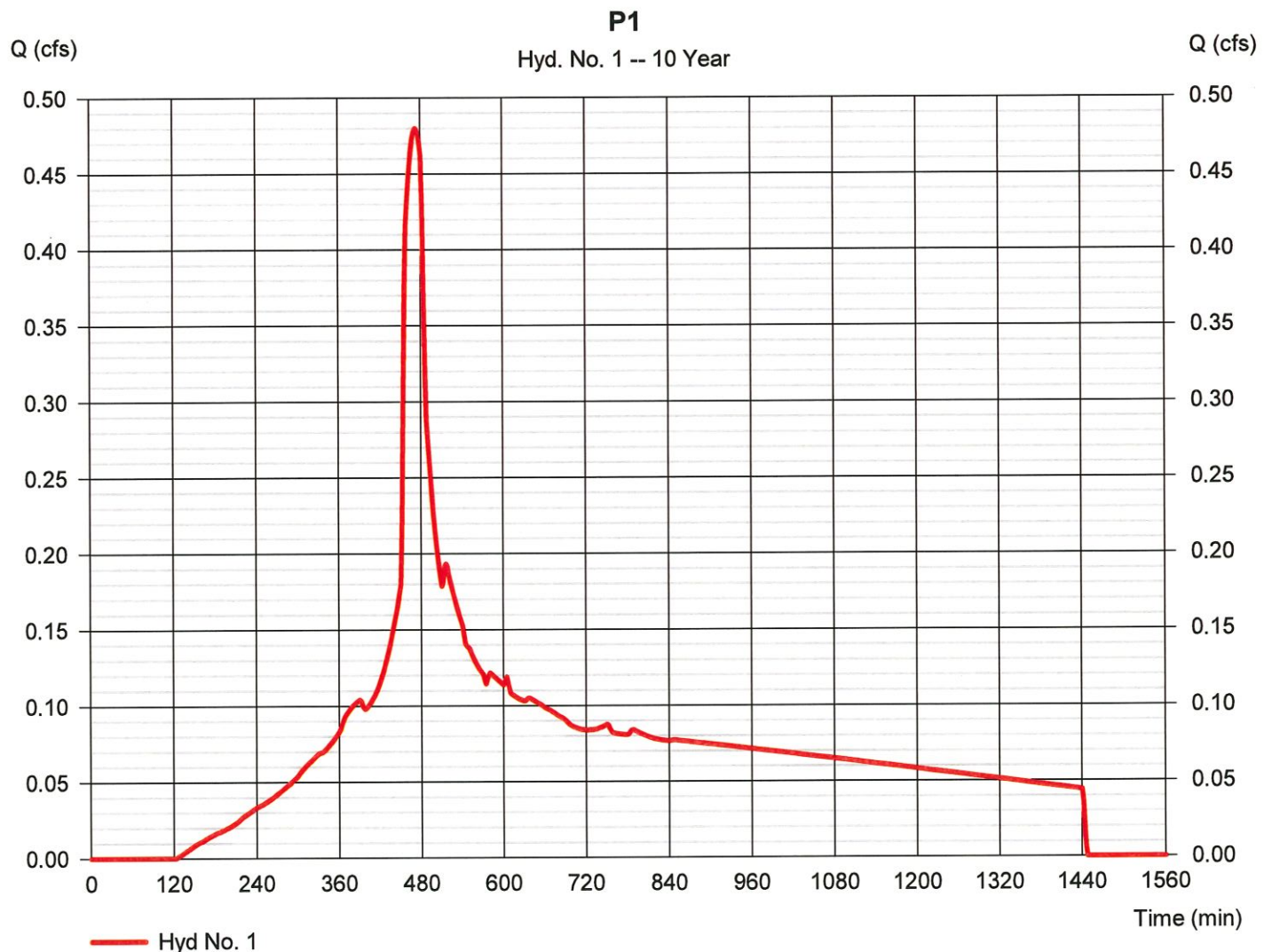
Hydrograph type	= SCS Runoff		Peak discharge	= 0.499 cfs
Storm frequency	= 10 yrs		Time to peak	= 472 min
Time interval	= 2 min		Hyd. volume	= 6,887 cuft
Drainage area	= 0.740 ac		Curve number	= 93*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= User		Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(0.590 x 98) + (0.150 x 74)] / 0.740

P2

Hyd. No. 2 -- 10 Year

Hydrograph Report

Hyd. No. 3

P3
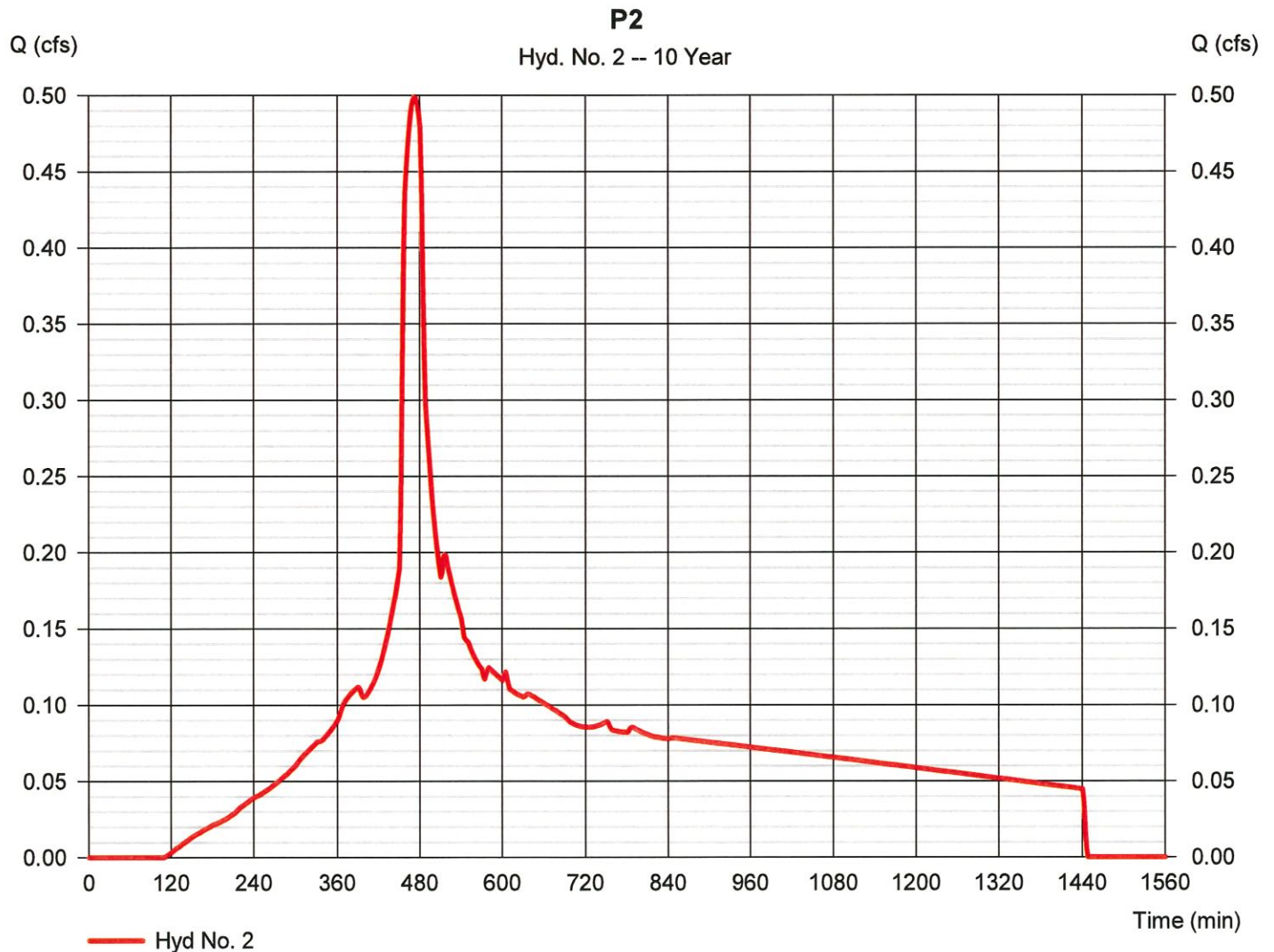
Hydrograph type	= SCS Runoff	Peak discharge	= 0.028 cfs
Storm frequency	= 10 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 506 cuft
Drainage area	= 0.120 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (0.120 x 74)] / 0.120

P3

Hyd. No. 3 -- 10 Year

Hyd No. 3

Hydrograph Report

Hyd. No. 4

FACILITY A - INFLOW

Hydrograph type	= Combine	Peak discharge	= 0.902 cfs
Storm frequency	= 10 yrs	Time to peak	= 474 min
Time interval	= 2 min	Hyd. volume	= 12,741 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.600 ac

FACILITY A - INFLOW
Hyd. No. 4 -- 10 Year

— Hyd No. 4   — Hyd No. 1   — Hyd No. 2   — Hyd No. 3

Hydrograph Report

Hyd. No. 5

FACILITY A - OUTFLOW

Hydrograph type	= Reservoir	Peak discharge	= 0.233 cfs
Storm frequency	= 10 yrs	Time to peak	= 588 min
Time interval	= 2 min	Hyd. volume	= 12,309 cuft
Inflow hyd. No.	= 4 - FACILITY A - INFLOW	Max. Elevation	= 167.86 ft
Reservoir name	= BMP A	Max. Storage	= 4,764 cuft

Storage Indication method used.
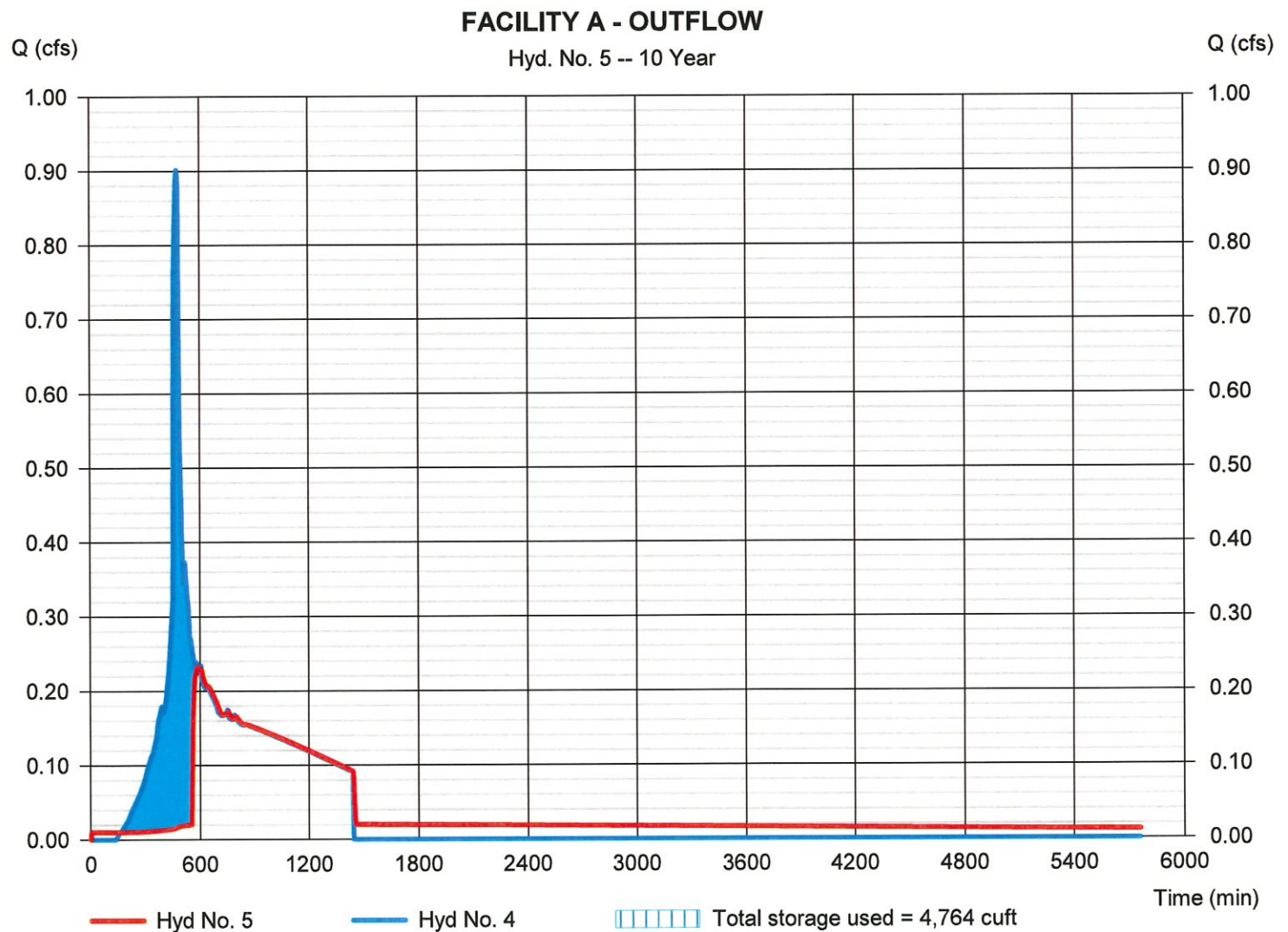
FACILITY A - OUTFLOW

Hyd. No. 5 -- 10 Year

Hyd No. 5   Hyd No. 4   Total storage used = 4,764 cuft

Hydrograph Report

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.034 cfs
Storm frequency	= 10 yrs	Time to peak	= 472 min
Time interval	= 2 min	Hyd. volume	= 465 cuft
Drainage area	= 0.050 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 98) + (0.010 x 74)] / 0.050

P4
Hyd. No. 6 -- 10 Year
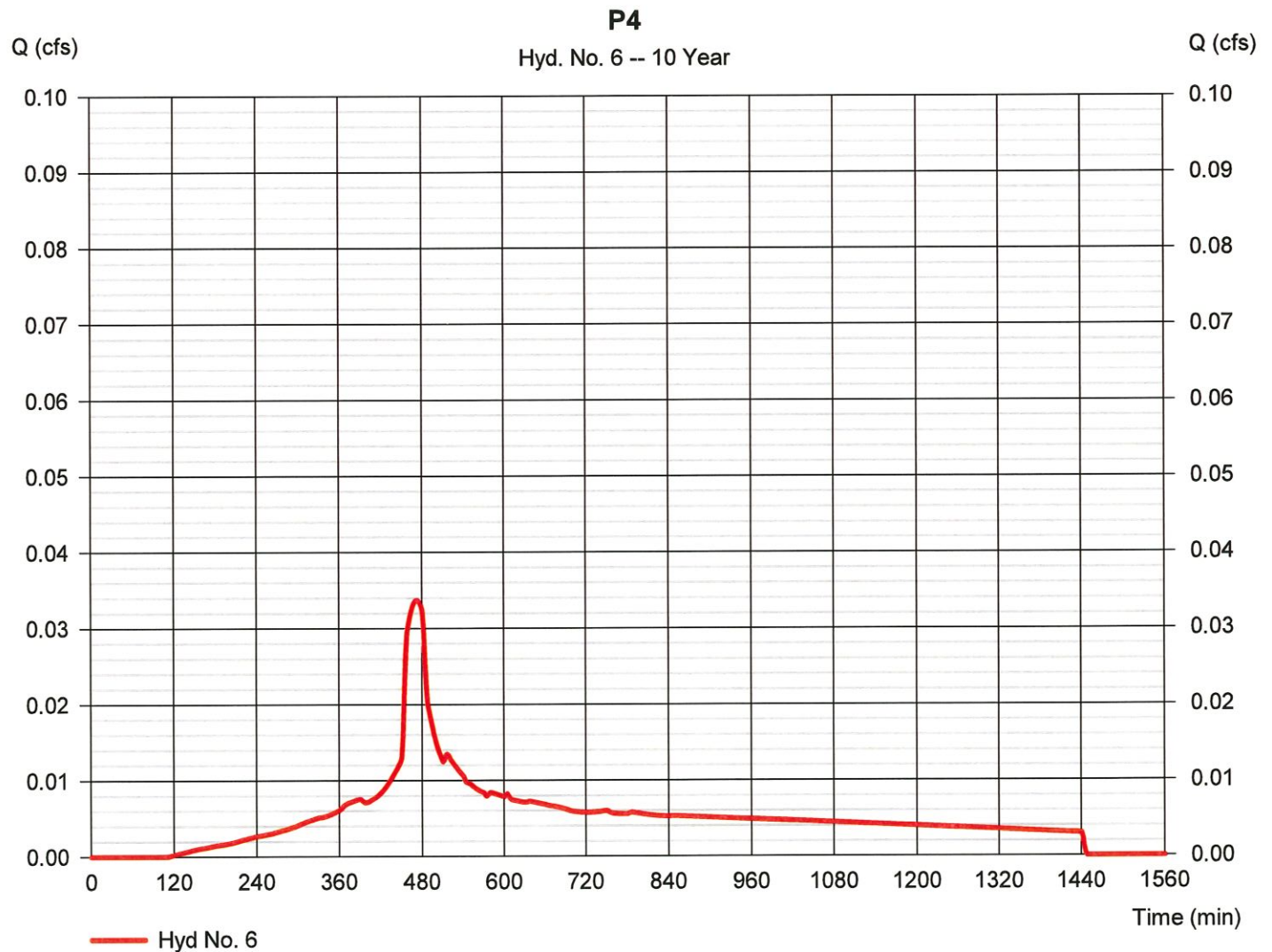
Hydrograph Report

Hyd. No. 7

Post-Construction Discharge

Hydrograph type	= Combine	Peak discharge	= 0.241 cfs
Storm frequency	= 10 yrs	Time to peak	= 588 min
Time interval	= 2 min	Hyd. volume	= 12,775 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.050 ac
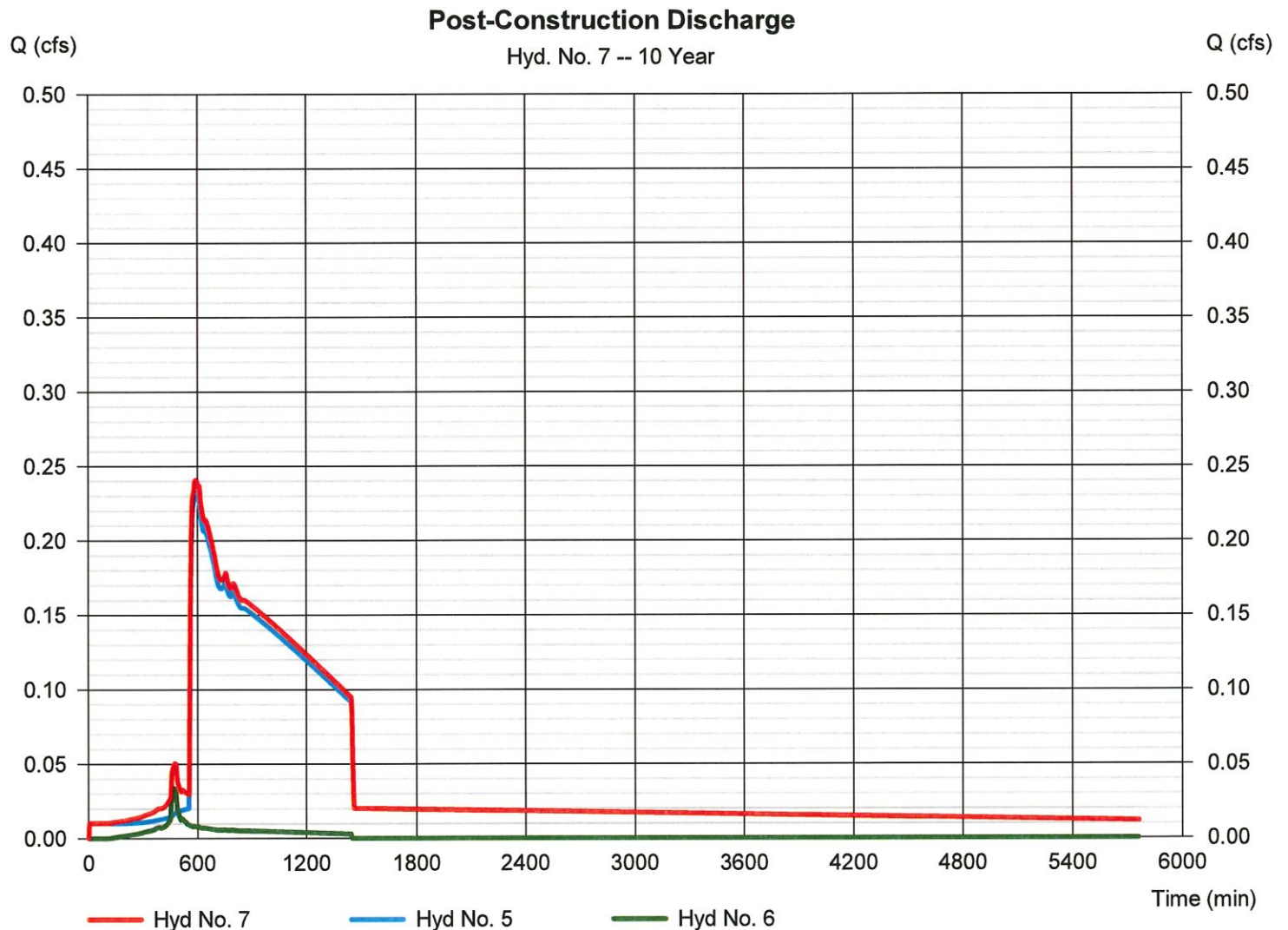
Post-Construction Discharge

Hyd. No. 7 -- 10 Year

Hyd No. 7   Hyd No. 5   Hyd No. 6

Hydrograph Report

Hyd. No. 8

E1

Hydrograph type	= SCS Runoff		Peak discharge	= 0.353 cfs
Storm frequency	= 10 yrs		Time to peak	= 512 min
Time interval	= 2 min		Hyd. volume	= 8,453 cuft
Drainage area	= 1.640 ac		Curve number	= 77*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= TR55		Time of conc. (Tc)	= 54.40 min
Total precip.	= 3.50 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 74) + (0.200 x 98)] / 1.640

E1

Hyd. No. 8 -- 10 Year
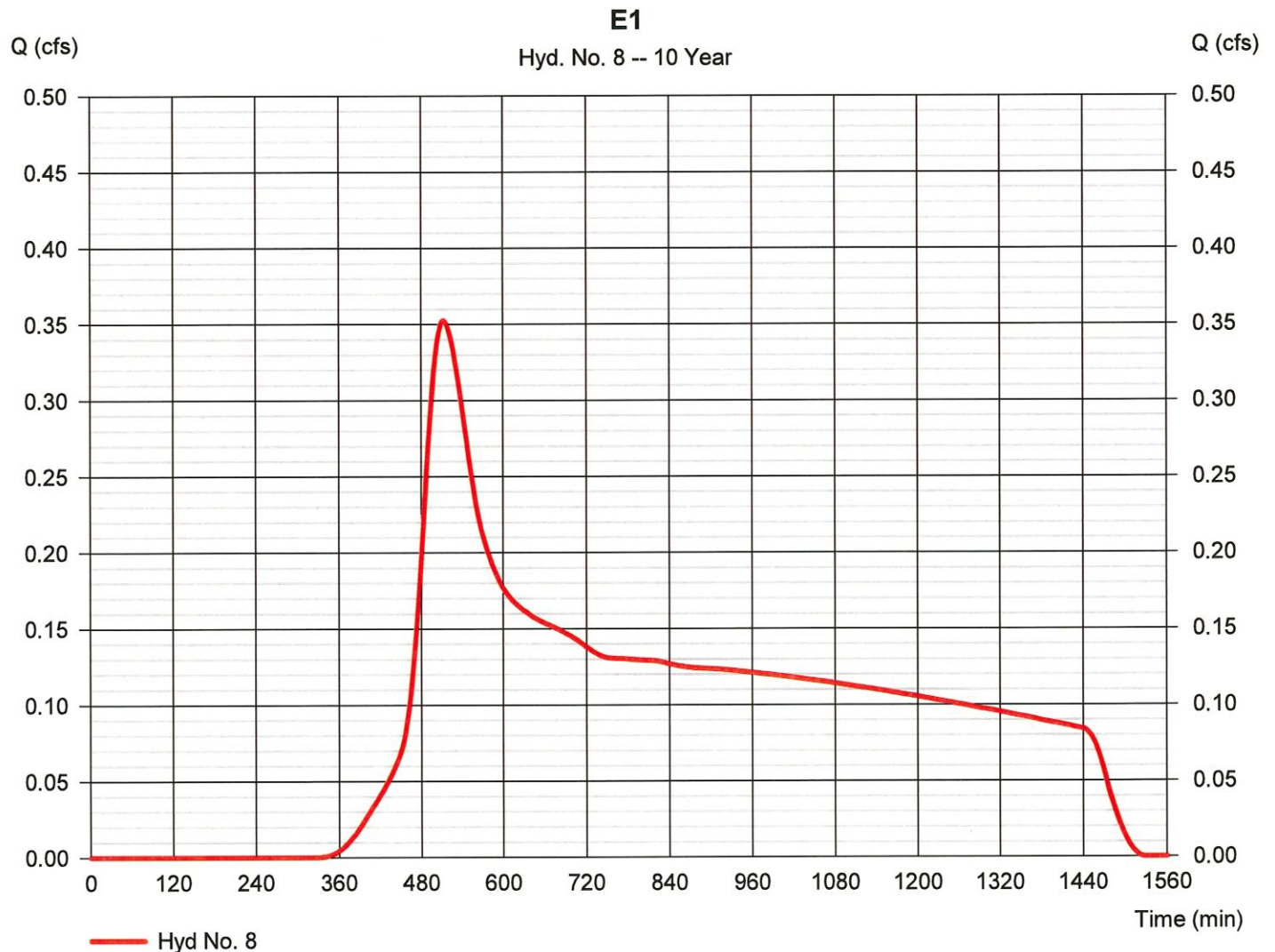
Hyd No. 8

Hydrograph Summary Report
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.569	2	472	7,851	------	-------	------	P1
2	SCS Runoff	0.588	2	472	8,109	------	-------	------	P2
3	SCS Runoff	0.039	2	478	652	------	-------	------	P3
4	Combine	1.086	2	474	15,237	1, 2, 3	-------	------	FACILITY A - INFLOW
5	Reservoir	0.405	2	526	14,795	4	167.91	4,848	FACILITY A - OUTFLOW
6	SCS Runoff	0.040	2	472	548	------	-------	------	P4
7	Combine	0.420	2	526	15,343	5, 6	-------	------	Post-Construction Discharge
8	SCS Runoff	0.472	2	510	10,708	------	-------	------	E1

Post-Construction.gpw	Return Period: 25 Year	Tuesday, 02 / 26 / 2019

Hydrograph Report

Hyd. No. 1

P1

Hydrograph type	= SCS Runoff		Peak discharge	= 0.569 cfs
Storm frequency	= 25 yrs		Time to peak	= 472 min
Time interval	= 2 min		Hyd. volume	= 7,851 cuft
Drainage area	= 0.740 ac		Curve number	= 92*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= User		Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.00 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.200 x 74)] / 0.740

P1

Hyd. No. 1 -- 25 Year

Hydrograph Report

Hyd. No. 2

P2
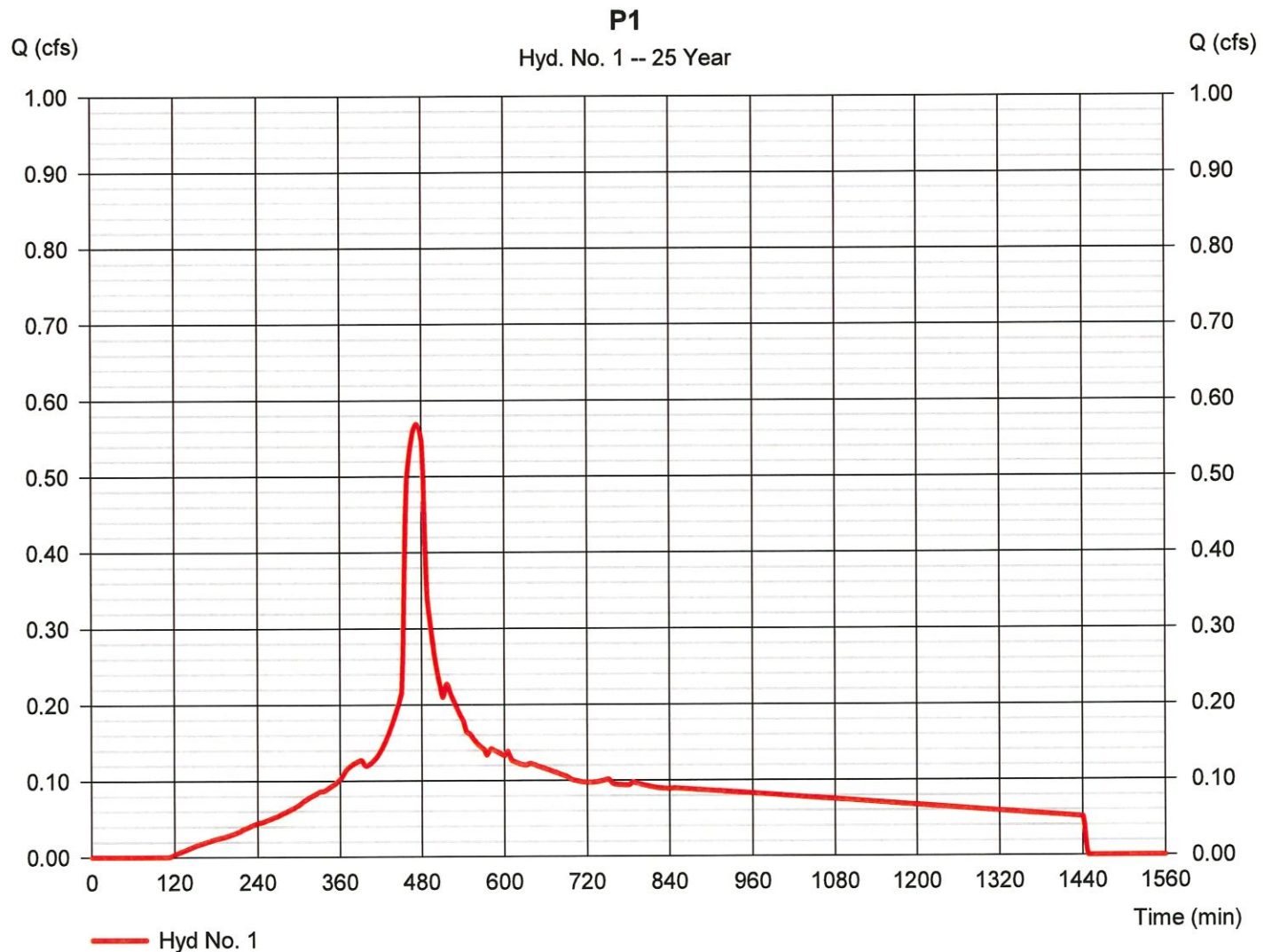
Hydrograph type	= SCS Runoff	Peak discharge	= 0.588 cfs
Storm frequency	= 25 yrs	Time to peak	= 472 min
Time interval	= 2 min	Hyd. volume	= 8,109 cuft
Drainage area	= 0.740 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.590 x 98) + (0.150 x 74)] / 0.740

P2

Hyd. No. 2 -- 25 Year

Hydrograph Report

Hyd. No. 3

P3
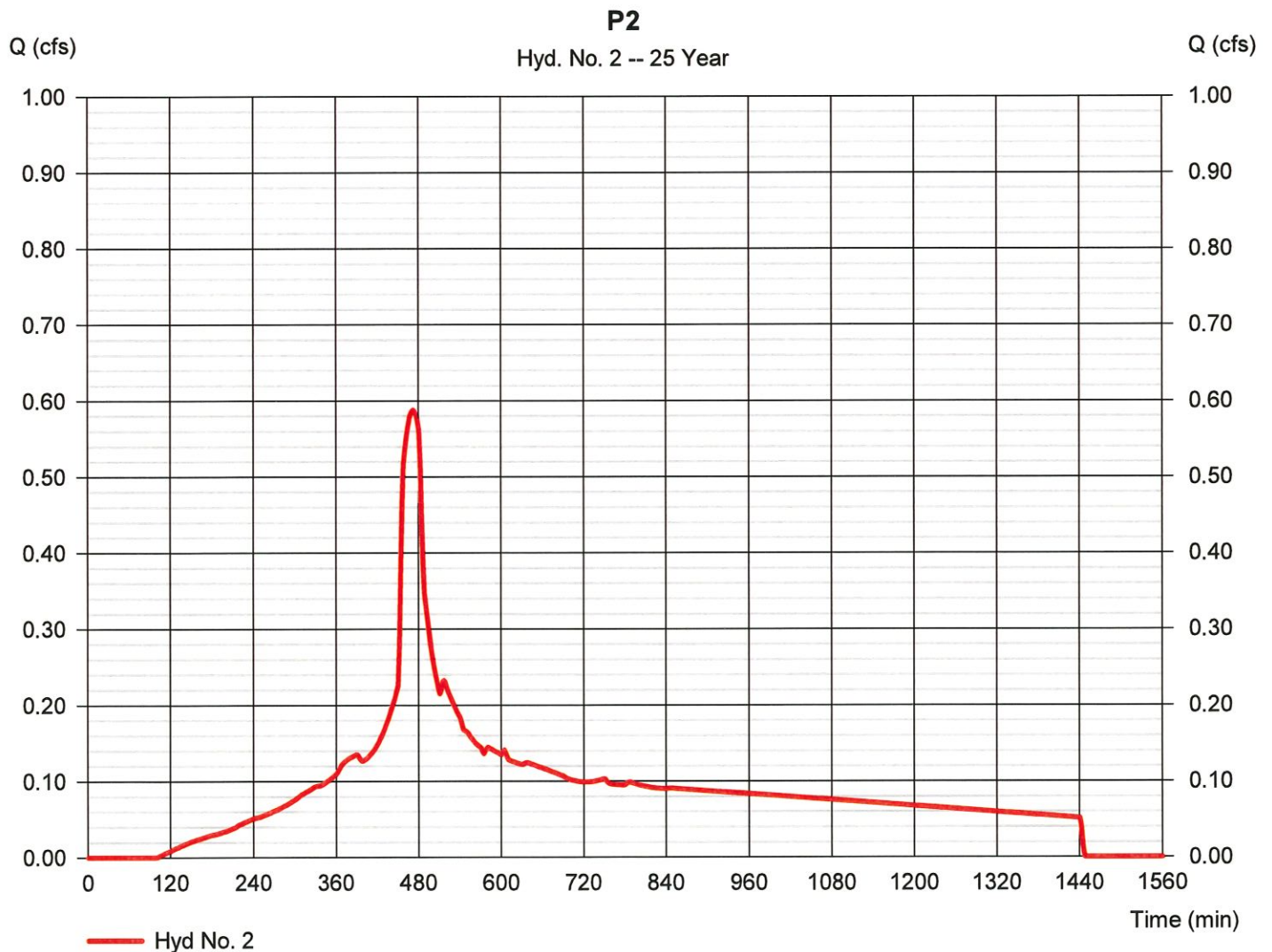
Hydrograph type	= SCS Runoff	Peak discharge	= 0.039 cfs
Storm frequency	= 25 yrs	Time to peak	= 478 min
Time interval	= 2 min	Hyd. volume	= 652 cuft
Drainage area	= 0.120 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (0.120 x 74)] / 0.120

P3
Hyd. No. 3 -- 25 Year
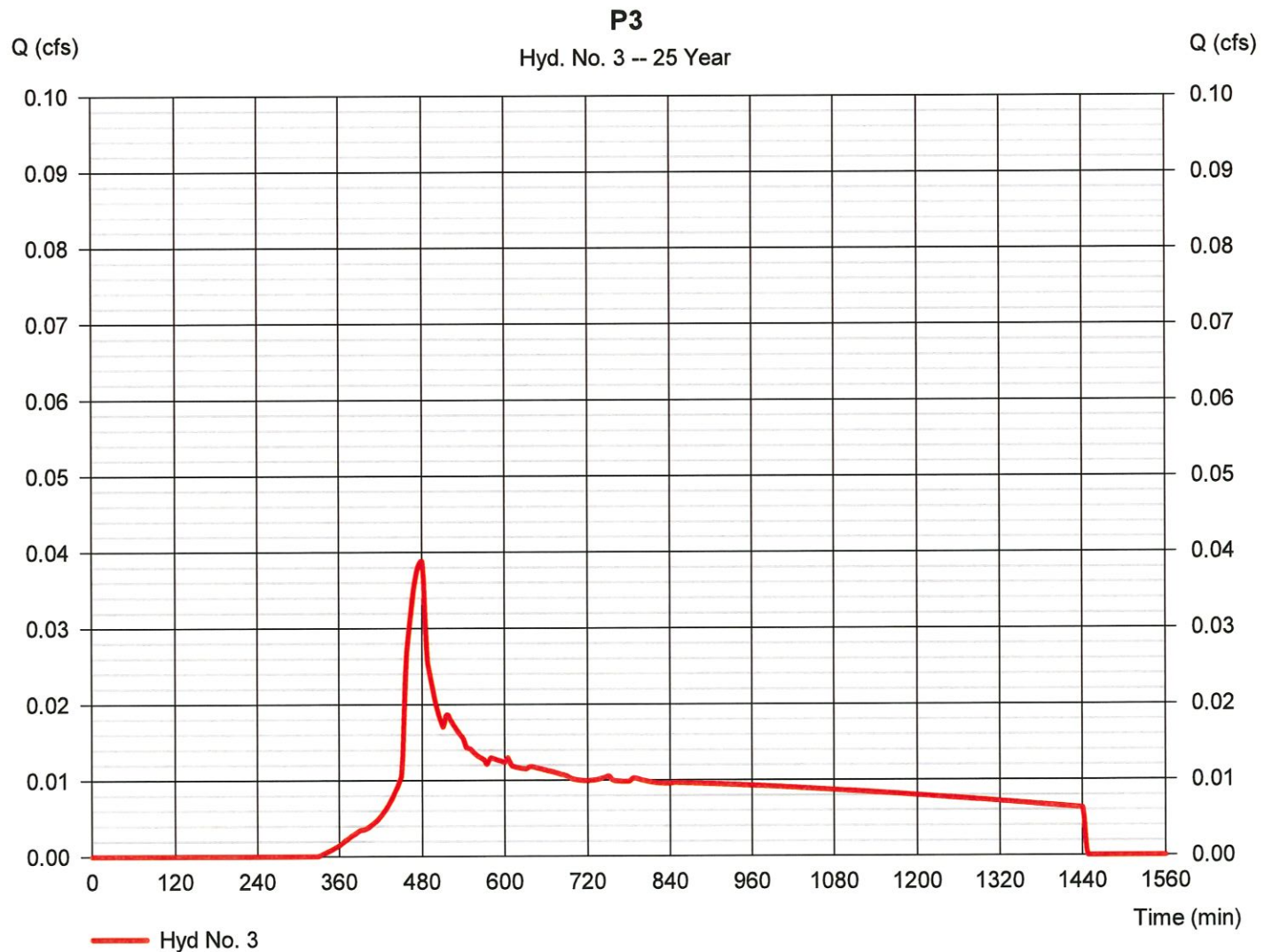
Hydrograph Report

Hyd. No. 4

FACILITY A - INFLOW

Hydrograph type	= Combine	Peak discharge	= 1.086 cfs
Storm frequency	= 25 yrs	Time to peak	= 474 min
Time interval	= 2 min	Hyd. volume	= 15,237 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.600 ac
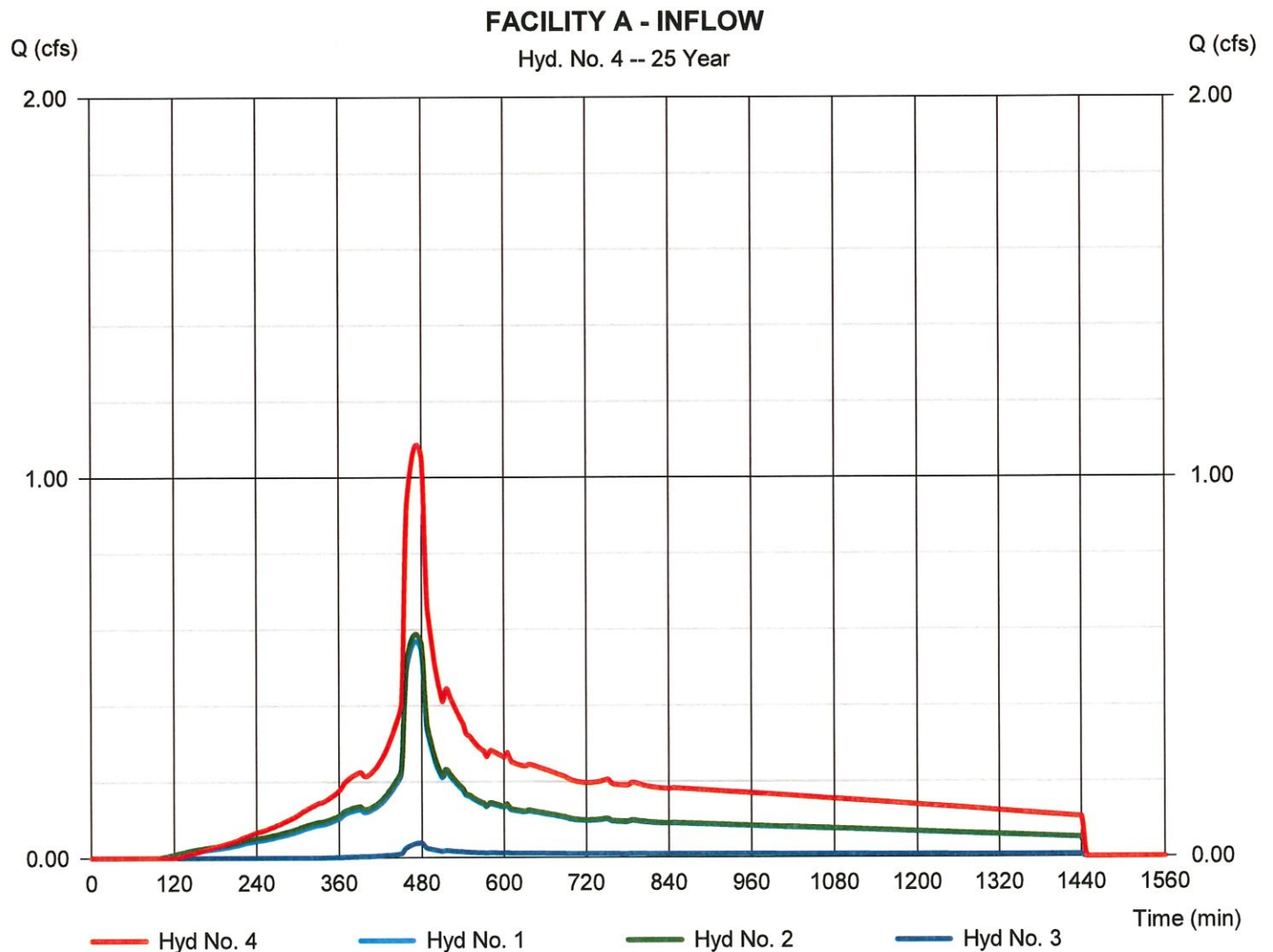
FACILITY A - INFLOW

Hyd. No. 4 -- 25 Year

Legend: Hyd No. 4 — Hyd No. 1 — Hyd No. 2 — Hyd No. 3

Hydrograph Report

Hyd. No. 5

FACILITY A - OUTFLOW

Hydrograph type	= Reservoir	Peak discharge	= 0.405 cfs
Storm frequency	= 25 yrs	Time to peak	= 526 min
Time interval	= 2 min	Hyd. volume	= 14,795 cuft
Inflow hyd. No.	= 4 - FACILITY A - INFLOW	Max. Elevation	= 167.91 ft
Reservoir name	= BMP A	Max. Storage	= 4,848 cuft

Storage Indication method used.
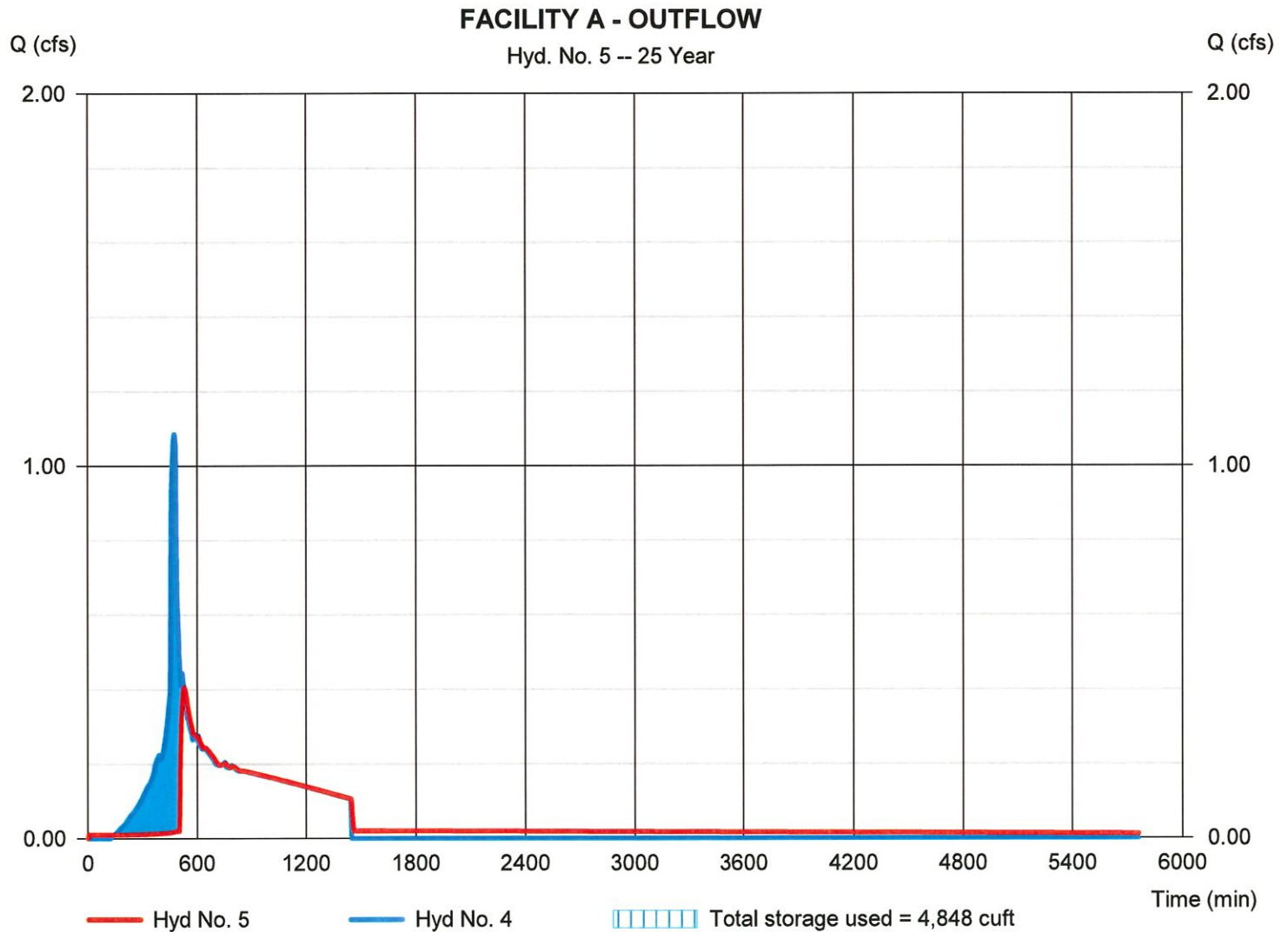
FACILITY A - OUTFLOW

Hyd. No. 5 -- 25 Year

Hyd No. 5 ——— Hyd No. 4 ——— Total storage used = 4,848 cuft

Hydrograph Report

Tuesday, 02 / 26 / 2019

Hyd. No. 6

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.040 cfs
Storm frequency	= 25 yrs	Time to peak	= 472 min
Time interval	= 2 min	Hyd. volume	= 548 cuft
Drainage area	= 0.050 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 98) + (0.010 x 74)] / 0.050

P4

Hyd. No. 6 -- 25 Year
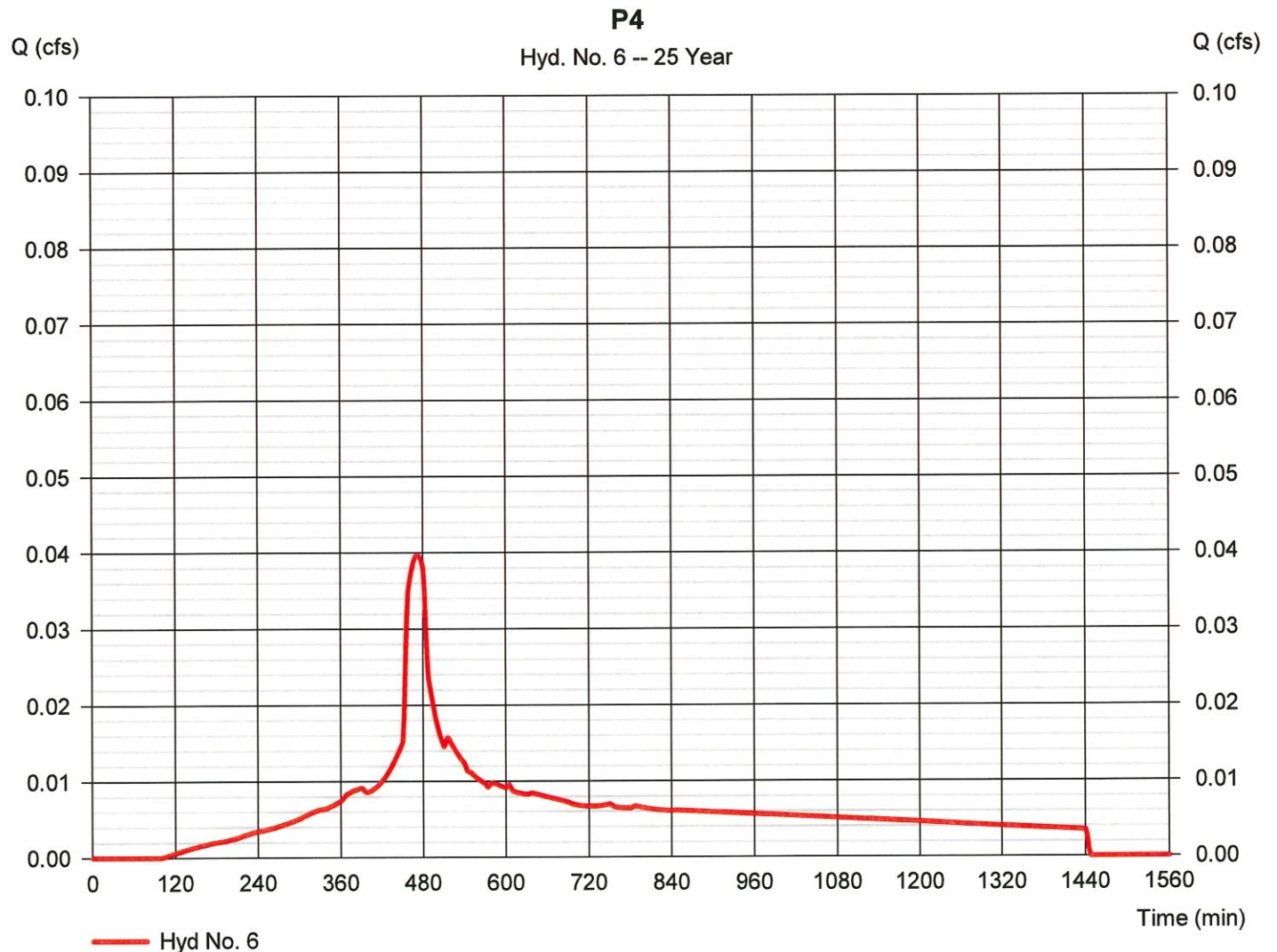
Hydrograph Report

Tuesday, 02 / 26 / 2019

Hyd. No. 7

Post-Construction Discharge

Hydrograph type	= Combine	Peak discharge	= 0.420 cfs
Storm frequency	= 25 yrs	Time to peak	= 526 min
Time interval	= 2 min	Hyd. volume	= 15,343 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.050 ac
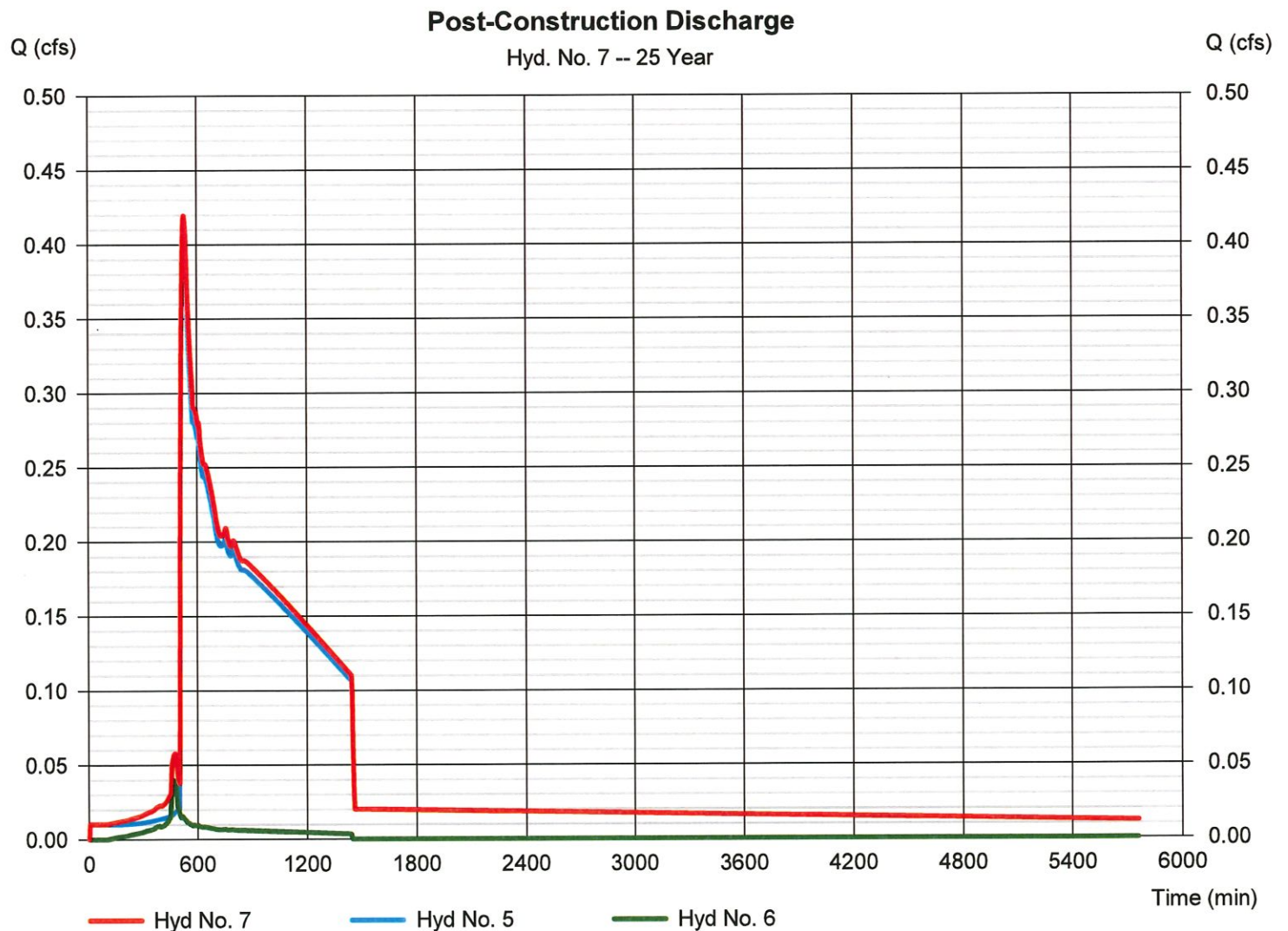
Post-Construction Discharge

Hyd. No. 7 -- 25 Year

Hyd No. 7   Hyd No. 5   Hyd No. 6

Hydrograph Report

Hyd. No. 8

E1

Hydrograph type	= SCS Runoff		Peak discharge	= 0.472 cfs
Storm frequency	= 25 yrs		Time to peak	= 510 min
Time interval	= 2 min		Hyd. volume	= 10,708 cuft
Drainage area	= 1.640 ac		Curve number	= 77*
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= TR55		Time of conc. (Tc)	= 54.40 min
Total precip.	= 4.00 in		Distribution	= Type IA
Storm duration	= 24 hrs		Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 74) + (0.200 x 98)] / 1.640

E1

Hyd. No. 8 -- 25 Year

Hyd No. 8
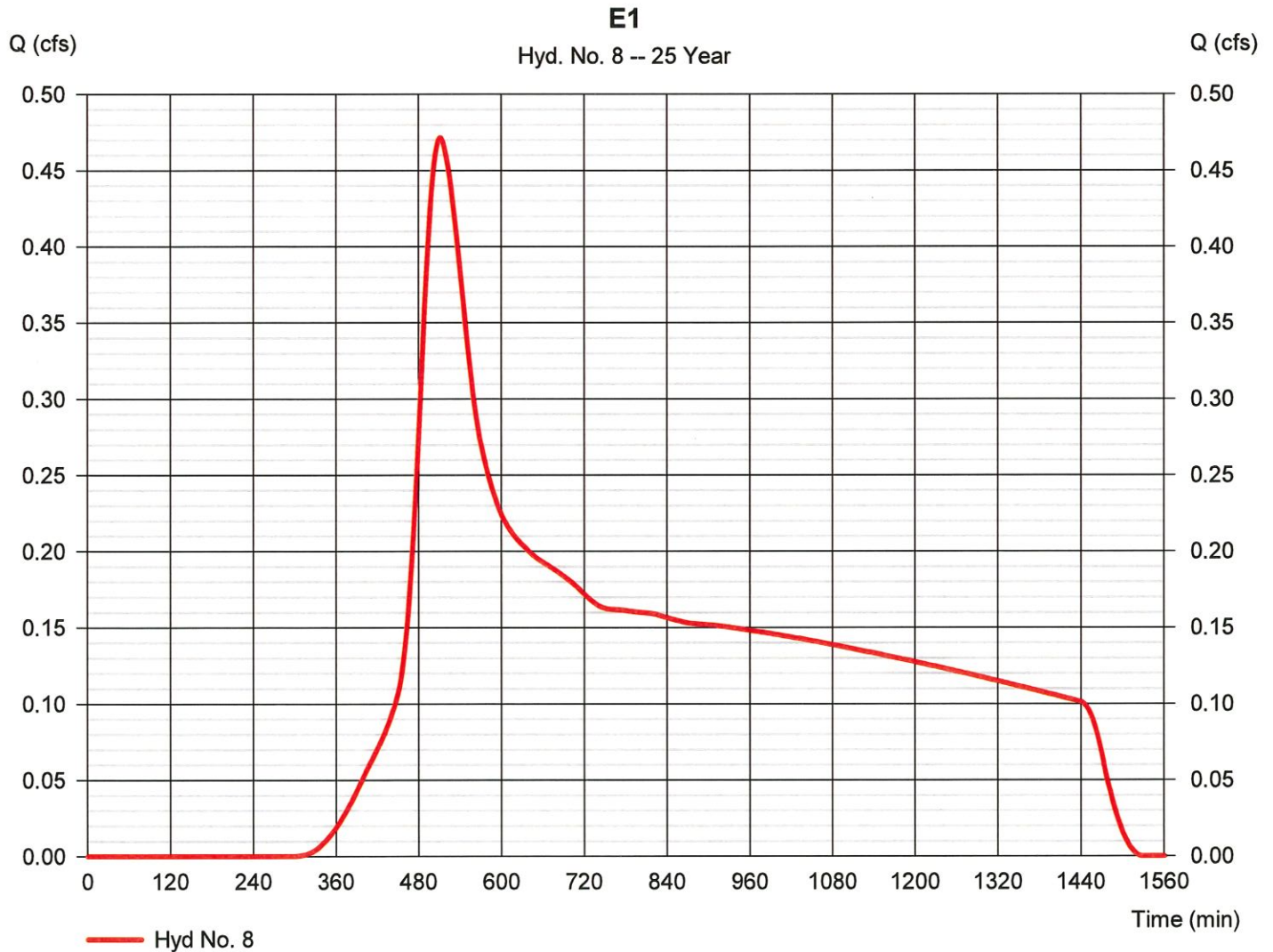
Appendix 3: Conveyance Calcs

Pipe Conveyance Calculations

<mark>MINIMUM PIPE SLOPES & CAPACITIES</mark>

Project: Riverland Subdivision
Client: Del Boca Vista, LLC
Job No.:   DBVC00000006
Design: A. Rappé   Check:
Date: 02/26/19   Rev:

Storm = SBUH Runoff (25-yr)
Distribution = NRCS 24-hr Type IA
Default 'n' = 0.013

Pipe Sizing (via Manning's equation, full flow)									Checks	
Pipe	Upstream Node	Downstream Node	Q1 NRCS TYPE 1A	Slope	Dia. (in)	n	Q2 Cap.	V		
									$Q_2 > Q_1$	V>=3
			(cfs)	%	(in)		(cfs)	(fps)		
SD01	CB01	DI01	1.086	0.44	12	0.013	2.36	3.01	OK	OK
SD02	OCS01	MH01	0.405	0.44	12	0.013	2.36	3.01	OK	OK
SD03	MH01	MH02	0.405	0.44	12	0.013	2.36	3.01	OK	OK
SD04	CB02	MH03	0.040	0.44	12	0.013	2.36	3.01	OK	OK

Appendix 4: Soil Properties

Hydrologic Soil Group—Yamhill County, Oregon
(Riverlands Subdivision)

2300A

Soil Map may not be valid at this scale.

Map Scale: 1:911 if printed on A landscape (11" x 8.5") sheet.

Meters
0   10   20   40   60

Feet
0   40   80   160   240

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

USDA   Natural Resources
       Conservation Service

Web Soil Survey
National Cooperative Soil Survey

11/8/2018
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MAP LEGEND

Area of Interest (AOI)
☐ Area of Interest (AOI)

Soils
Soil Rating Polygons
☐ A
☐ A/D
☐ B
☐ B/D
☐ C
☐ C/D
☐ D
☐ Not rated or not available

Soil Rating Lines
🖋 A
🖋 A/D
🖋 B
🖋 B/D
🖋 C
🖋 C/D
🖋 D
⚹ Not rated or not available

Soil Rating Points
■ A
■ A/D
■ B
■ B/D

■ C
■ C/D
■ D
☐ Not rated or not available

Water Features
〜 Streams and Canals

Transportation
+++ Rails
〜 Interstate Highways
〜 US Routes
〜 Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 6, Sep 18, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2015—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

USDA **Natural Resources**
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

11/8/2018
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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2300A	Aloha silt loam, 0 to 3 percent slopes	C/D	1.7	100.0%
Totals for Area of Interest			1.7	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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