DEL BOCA
VISTA
A LIMITED LIABILITY COMPANY

EXHIBIT E

Stormwater Report

Riverrun 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.

June 28, 2018

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1 INTRODUCTION AND PURPOSE

The purpose of this report is to provide documentation for the stormwater management associated with the development of the Riverrun subdivision, located at the terminus of E Weatherly Way and E Waterfront Street, Newberg, Oregon, in Yamhill County. It 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 new roadways with associated sidewalks, landscaping, and stormwater facilities located on tax lots R3230 00400, 00403, and 00500. The current property is mostly undeveloped with hazelnut trees and a few existing buildings and driveways.

3 EXISTING CONDITIONS

The total site area is approximately 15.21 acres with 0.49 acres of existing impervious area per EX001 & EX002 in Appendix 1. Currently, there is no storm system or water quality facility on the property. The storm runoff from the northern portion of the site sheet flows into Chehalem Creek to the north, and the storm runoff from the southern portion of the site sheet flows into roadway ditches to the north and south that eventually discharge into Chehalem Creek and Willamette River.

The soil is composed of:

- 2009A – Newberg silt loam, 0 to 3 percent slopes
- 2040A – Chehalis silt loam, 0 to 3 percent slopes
- 2300A – Aloha silt loam, 0 to 3 percent slopes
- 2310D – Woodburn silt loam, 12 to 20 percent slopes
- 2310F Woodburn silt loam, 20 to 55 percent slopes

Yamhill County 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:
  - 2-yr: 2.5 inches
  - 10-yr: 3.5 inches
  - 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 PIPE SIZING & STORM HYDROGRAPH DESIGN

The proposed storm pipe system is designed to have the capacity to convey the runoff from a 25-year return frequency storm event without roadway ponding. The storm system was designed to convey runoff from all impervious areas and some pervious areas on site. A minimum pipe slope of 0.5% will be maintained throughout the system with the intent that a minimum free flow velocity of 3.0 ft/s will be maintained in all pipes.

6 WATER QUANTITY

Table 1 below displays the peak runoffs for each storm event. The northern and southern sections of the project site were analyzed separately. The post-developed flow rates were determined by combining all uncontrolled sheet flow and captured runoff discharged from the proposed ponds. The design assumes that each undeveloped lot less than 4,000 SF will consist of 1,700 SF of post-developed impervious area per building footprints as shown in Appendix 1, and each undeveloped lot greater than or equal to 4,000 SF will consist of 2,877 SF of post-developed impervious area per City of Newberg standards in addition to proposed impervious areas. Uncontrolled sheet flow will not be altered from the pre-developed sheet flow. Therefore, post-developed flows to neighboring sites will be decreased and no negative impacts are expected.

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

	2-year	10-year	25-year
Northern Site (Pond A):			
Total Pre-developed	0.90	2.48	3.39
Total Post-developed	0.76	1.83	3.27
Southern Site (Pond B & C):			
Total Pre-developed	0.43	1.19	1.63
Total Post-developed	0.41	0.64	1.33

7 WATER QUALITY

The proposed ponds are designed to treat runoff from proposed impervious areas. See Appendix 1 for the post-developed basin maps (EX003 & EX004) and water quality sizing calculations. Undeveloped lots greater than 4,000 ft^2 are assumed to consist of 2,877 ft^2 post-developed impervious area for calculations per City of Newberg stormwater standards. Lots less than 4,000 ft^2 are assumed to consist of 1,700 ft^2 post-developed impervious area for calculations per building footprints for these lots as shown in Appendix 1.

Runoff from Basins 1-9 will be routed into Pond A, which has a bottom elevation of 137.90. The water quality volume required for the total contributing impervious areas is 20,936 ft^3. The pond is designed to have a treatment volume of 22,871 ft^3 and maximum ponding depth of 4' for a 25-year storm event. Pond A will discharge into Chehalem Creek, north of the property. In the occurrence that the pond capacity is exceeded for a greater storm event, overflow from Pond A will flow to the north around Lot 15 and into Chehalem Creek. Runoff from impervious areas on Lots 56-58, 90, and the access road to Lots 56-58 will not be collected and treated. Instead, Pond A has been designed to over treat the rest of the collected runoff to make up for the impervious area runoff that won't be treated.

Runoff from Basins 10-12 & 14-15 will be routed into Pond B, which has a bottom elevation of 156.00. The water quality volume required for the total contributing impervious areas is 5,142 ft^3. The pond is designed to have a treatment volume of 5,705 ft^3 and maximum ponding depth of 4' for a 25-year storm event. Runoff treated by Pond B will eventually discharge into Chehalem Creek, north of the property. In the occurrence that the pond capacity is exceeded for a greater storm event, overflow from Pond B will flow into the new public storm drain to the south along E Waterfront Street, where it will eventually discharge into Chehalem Creek.

Runoff from Basins 13 & 16-20 will be routed into Pond C, which has a bottom elevation of 155.80. The water quality volume required for the total contributing impervious areas is 6,081 ft^3. The pond is designed to have a treatment volume of 7,811 ft^3 and maximum ponding depth of 4' for a 25-year storm event. Runoff treated by Pond C will eventually discharge into Chehalem Creek, north of the property. In the occurrence that the pond capacity is exceeded for a greater storm event, overflow from Pond C will flow into the new public storm drain to the south along E Waterfront Street, where it will eventually discharge into Chehalem Creek.

8 CONCLUSION

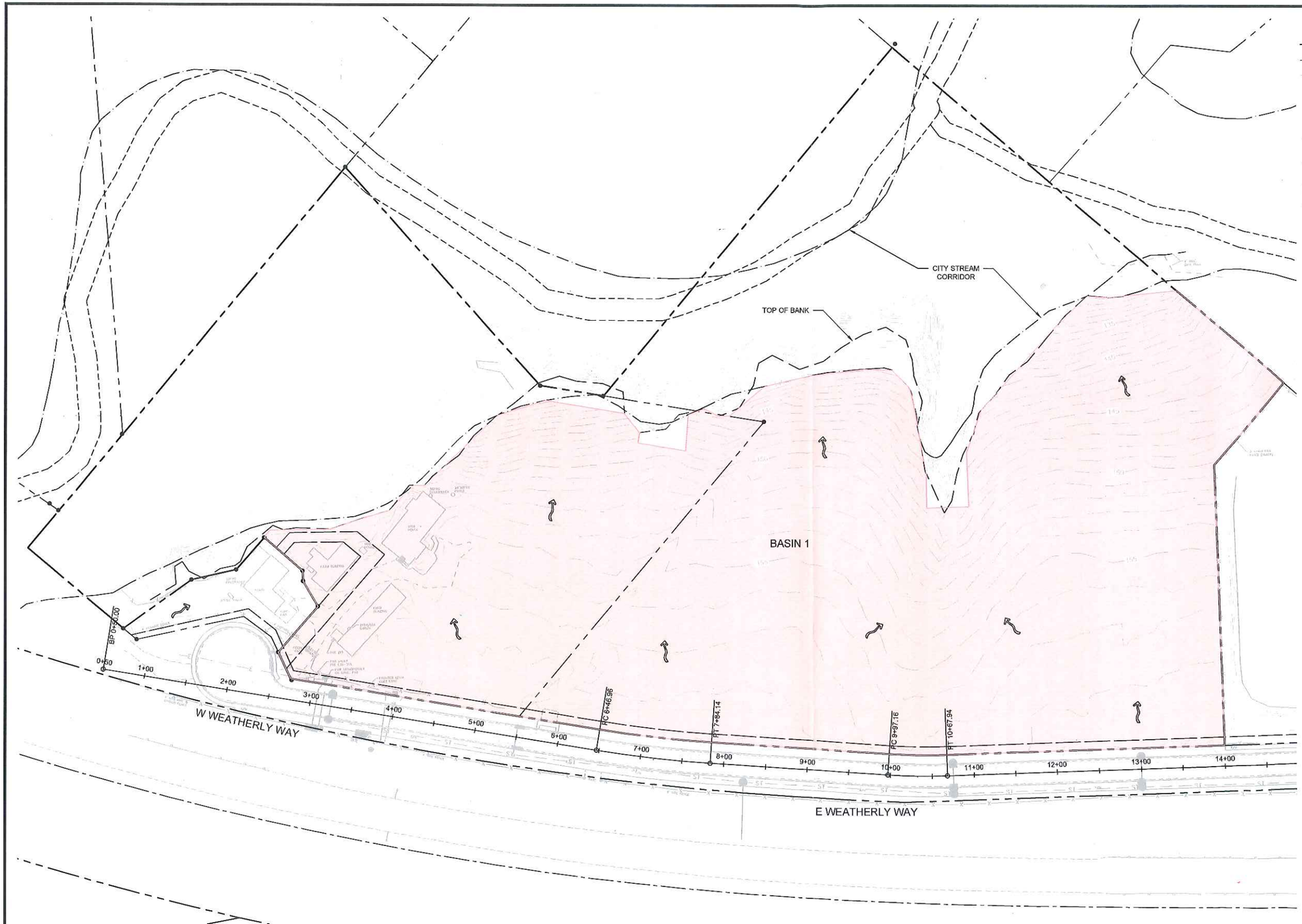
The proposed development has appropriate stormwater facilities and a system that fulfills the required conveyance, water quality and water quantity based on City of Newberg standards.

9 REFERENCES

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

Yamhill County Web Soil Survey accessed on line on April 16, 2018

Appendix 1: Basin Maps, WQ Calcs, & Hydrographs



AREAS			
	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 1	0.33	9.74	10.07

0 30 60 120
SCALE: 1" = 60'
* NOTE: IF PLOTTED ON 11x17, SCALE IS 1"=120'

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

DESIGN STUDIO
Inspired Livable Places

PROJECT
RIVERRUN (A SUBDIVISION)
RIVERRUN SUBDIVISION LLC
NEWBERG, OREGON

SHEET TITLE
EXISTING BASIN MAP
(PHASE 1)

NO.	DATE	REVISION	BY
1			

30% CD'S

PRELIMINARY

DATE: 04/16/18
DESIGN: NJRU
DRAWN: NJRU

SHEET NO.
EX001

PROJECT NO. DBVX0000-0002

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By: ( )
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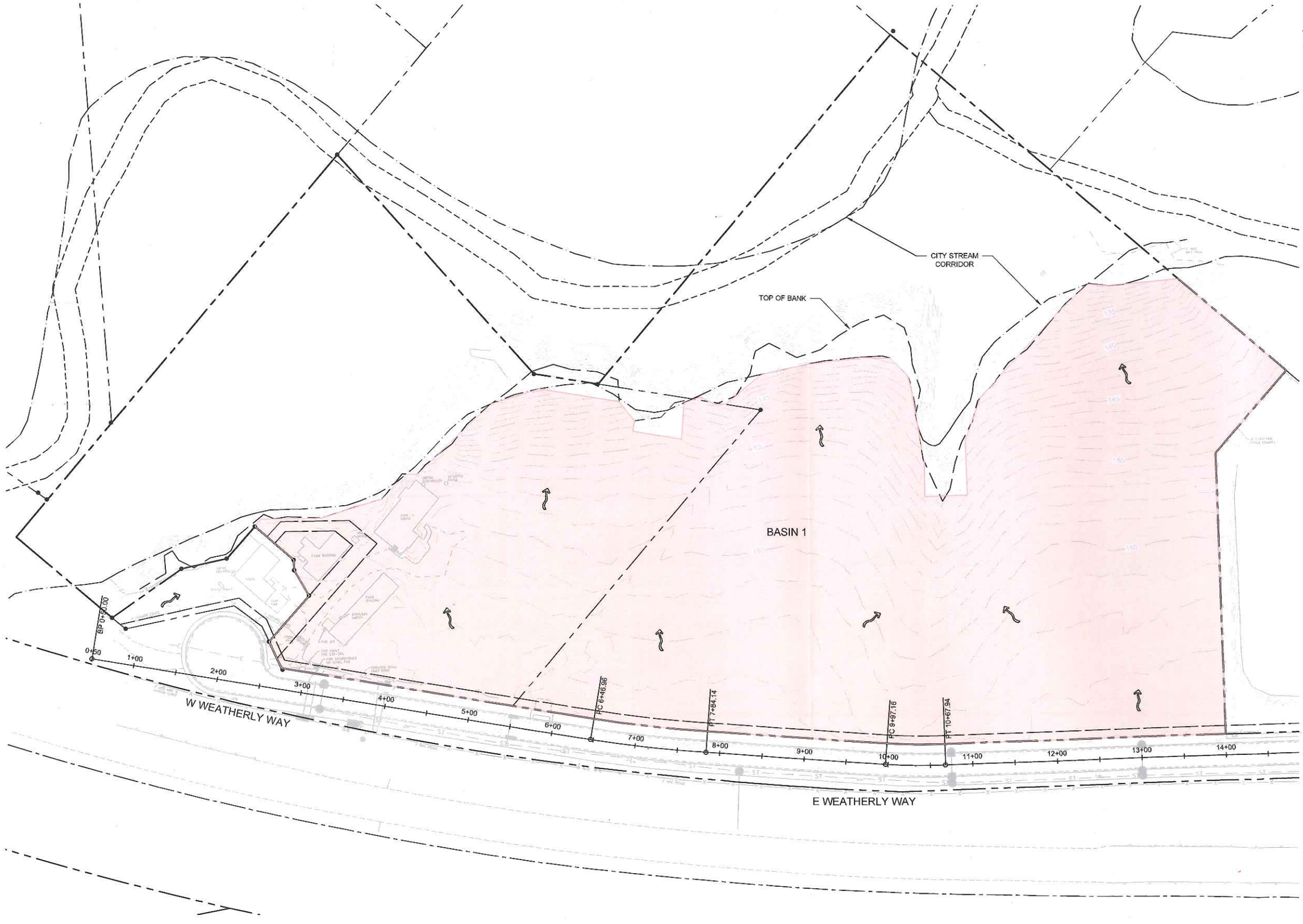

AREAS			
	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 1	0.33	9.74	10.07

0 30 60 120
SCALE: 1" = 60'
* NOTE: IF PLOTTED ON 11x17, SCALE IS 1"=120'

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PROJECT
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RIVERRUN SUBDIVISION LLC
NEWBERG, OREGON

SHEET TITLE
EXISTING BASIN MAP
(PHASE 1)

NO.	DATE	REVISION	BY
1			

30% CD'S

PRELIMINARY

DATE: 04/16/18
DESIGN: NJRU
DRAWN: NJRU

SHEET NO.
EX001

PROJECT NO. DBVX0000-0002

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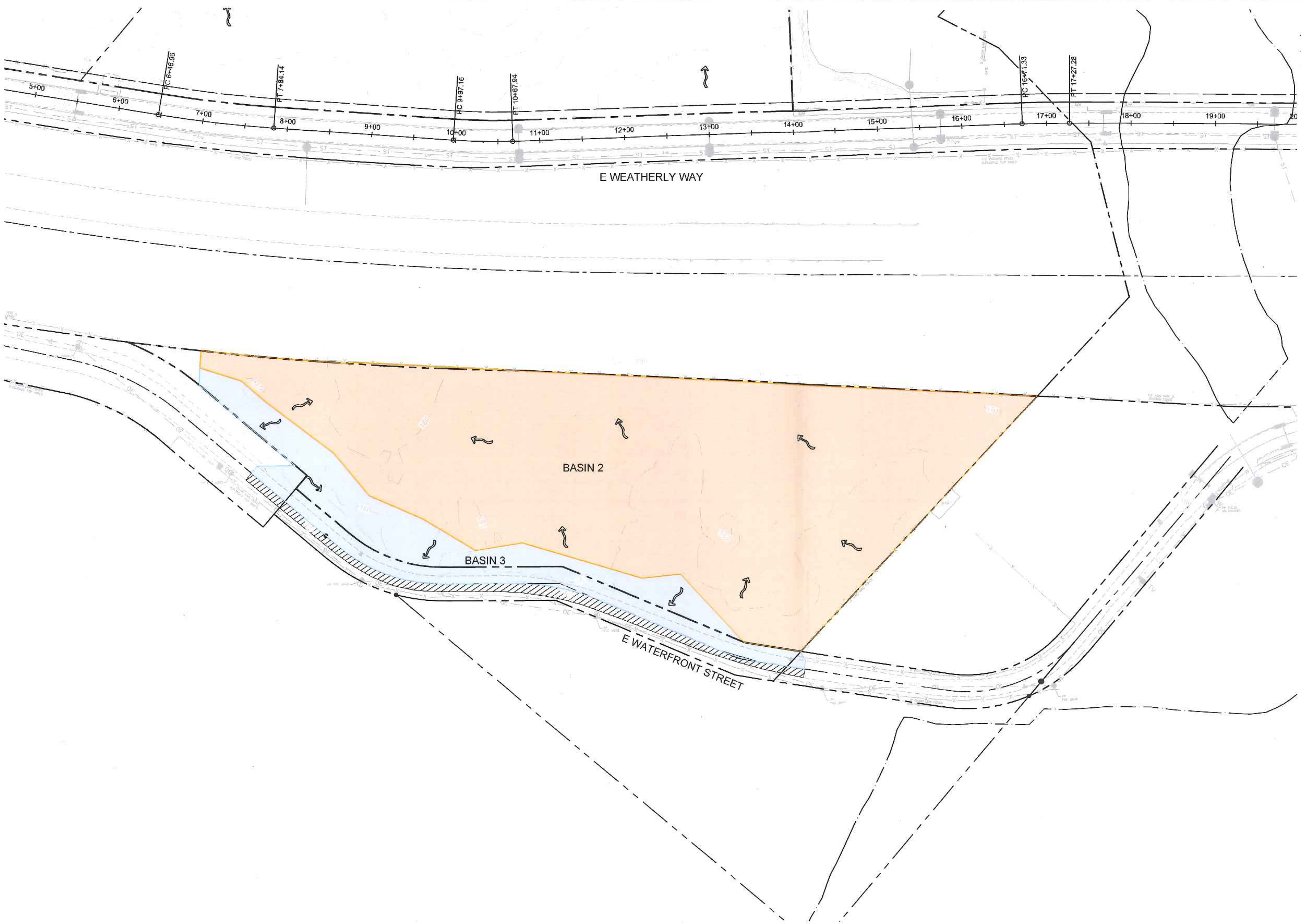

LEGEND

- ROW / PROPERTY LINE
- EASEMENT
- EXISTING CONTOUR
- BASIN 2
- BASIN 3

AREAS			
	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 2	0.00	4.06	4.06
BASIN 3	0.16	0.92	1.08
TOTAL	0.16	4.98	5.14

0 30 60 120

SCALE: 1" = 60'

* NOTE: IF PLOTTED ON 11x17, SCALE IS 1"=120'

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DESIGN STUDIO
Inspired Livable Places

PROJECT

RIVERRUN (A SUBDIVISION)
RIVERRUN SUBDIVISION LLC
NEWBERG, OREGON

SHEET TITLE

EXISTING BASIN MAP (PHASE 2)

BY

REVISION

NO. DATE

30% CD'S

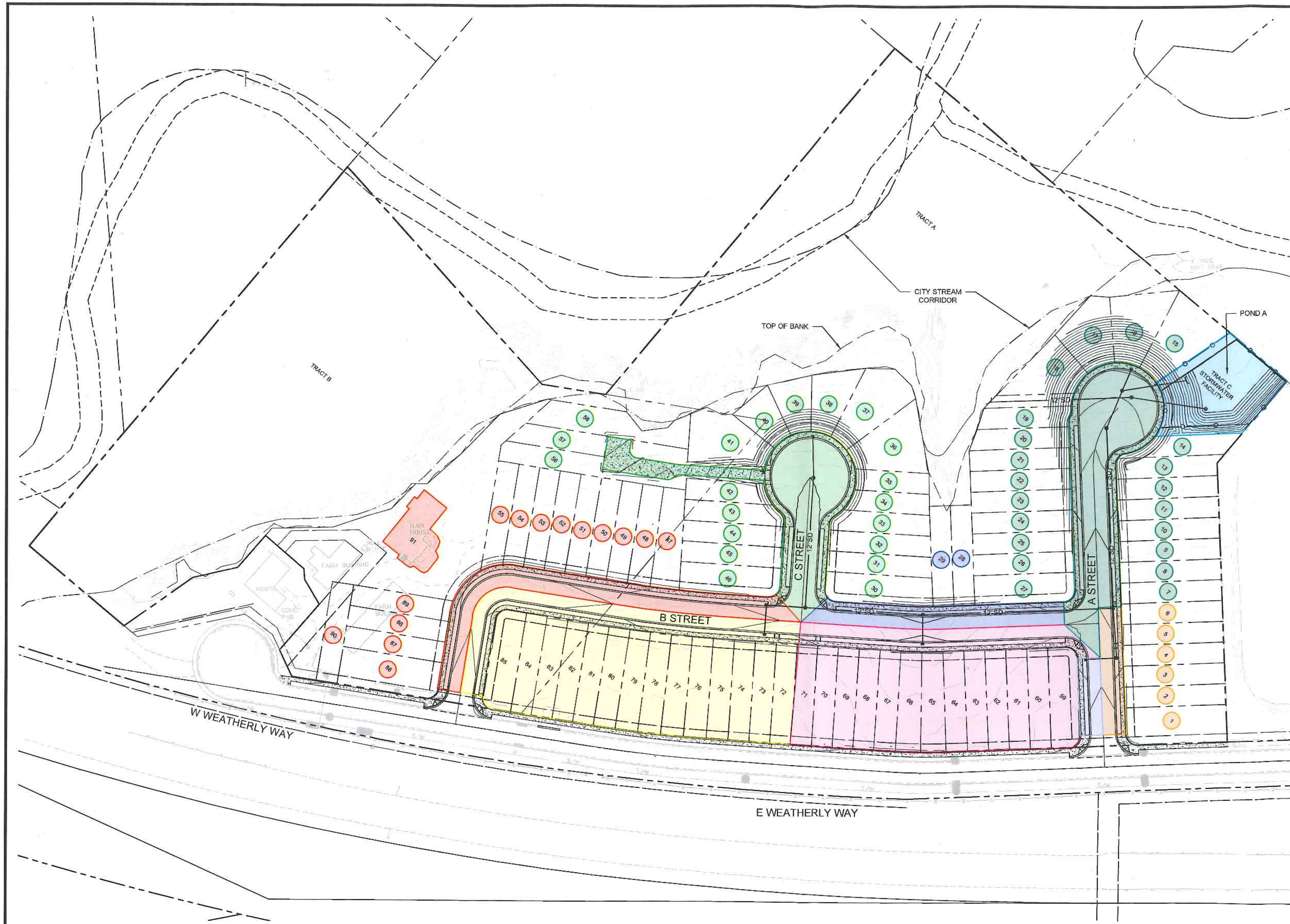
PRELIMINARY

DATE: 04/16/18
DESIGN: NJRU
DRAWN: NJRU

SHEET NO.

EX002

PROJECT NO. DBVX0000-0002



GENERAL NOTES

1. IT IS ASSUMED THAT ALL UNDEVELOPED LOTS LESS THAN 4,000 SF WILL CONTRIBUTE 1,700 SF OF FUTURE IMPERVIOUS AREA AND ALL UNDEVELOPED LOTS GREATER THAN OR EQUAL TO 4,000 SF WILL CONTRIBUTE 2,877 SF OF FUTURE IMPERVIOUS AREA. THESE IMPERVIOUS AREAS ARE INCLUDED IN AREA AND TREATMENT REQUIREMENT CALCULATIONS.

LEGEND

- ROW / PROPERTY LINE
- EASEMENT
- PROPOSED CONTOUR
- EXISTING CONTOUR
- BASIN 1
- BASIN 2
- BASIN 3
- BASIN 4
- BASIN 5
- BASIN 6
- BASIN 7
- BASIN 8
- BASIN 9

BASIN AREAS TREATED BY POND A

	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 1	0.92	0.07	0.99
BASIN 2	0.81	0.50	1.31
BASIN 3	1.33	0.03	1.36
BASIN 4	0.23	0.04	0.27
BASIN 5	0.71	0.44	1.15
BASIN 6	0.05	0.01	0.06
BASIN 7	0.34	0.02	0.36
BASIN 8	1.40	0.06	1.46
BASIN 9	0.00	0.28	0.28
TOTAL	5.79	1.45	7.24

0 30 60 120
SCALE: 1" = 60'
* NOTE: IF PLOTTED ON 11x17, SCALE IS 1"=120'

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

DESIGN STUDIO

PROJECT: RIVERRUN (A SUBDIVISION)

BY: RIVERRUN SUBDIVISION LLC, NEWBERG, OREGON

SHEET TITLE: PROPOSED BASIN MAP (PHASE 1)

NO. DATE REVISION

30% CD'S

PRELIMINARY

DATE: 04/16/18
DESIGN: NJRU
DRAWN: NJRU

SHEET NO. EX003

PROJECT NO. DBVX0000-0002

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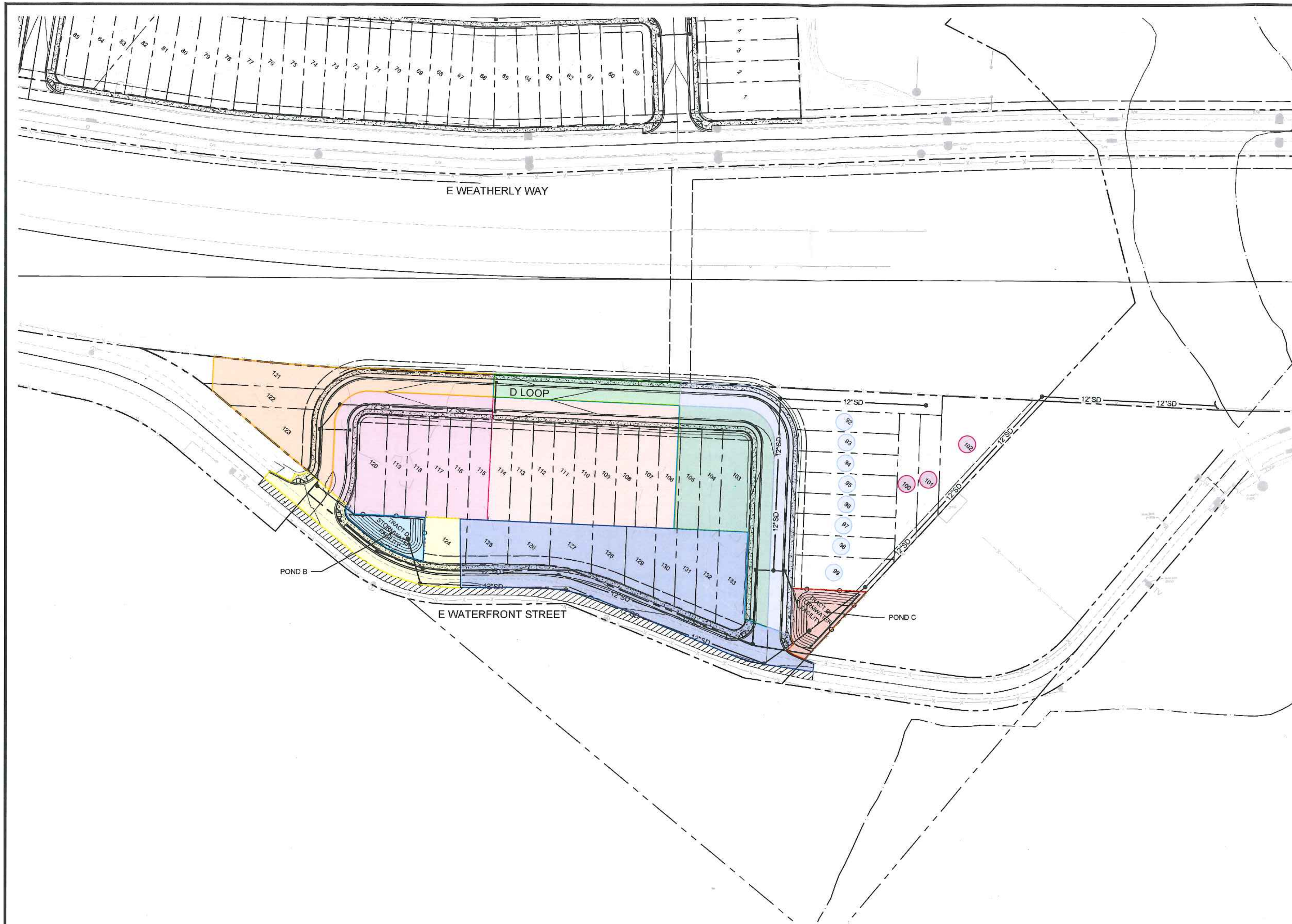

GENERAL NOTES

1. IT IS ASSUMED THAT ALL UNDEVELOPED LOTS LESS THAN 4,000 SF WILL CONTRIBUTE 1,700 SF OF FUTURE IMPERVIOUS AREA AND ALL UNDEVELOPED LOTS GREATER THAN OR EQUAL TO 4,000 SF WILL CONTRIBUTE 2,877 SF OF FUTURE IMPERVIOUS AREA. THESE IMPERVIOUS AREAS ARE INCLUDED IN AREA AND TREATMENT REQUIREMENT CALCULATIONS.

LEGEND

- ROW / PROPERTY LINE
- EASEMENT
- PROPOSED CONTOUR
- EXISTING CONTOUR
- BASIN 10
- BASIN 11
- BASIN 12
- BASIN 13
- BASIN 14
- BASIN 15
- BASIN 16
- BASIN 17
- BASIN 18
- BASIN 19
- BASIN 20

BASIN AREAS TREATED BY POND B

	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 10	0.29	0.15	0.44
BASIN 11	0.40	0.22	0.62
BASIN 12	0.00	0.08	0.08
BASIN 14	0.11	0.03	0.14
BASIN 15	0.46	0.29	0.75
TOTAL	1.26	0.77	2.03

BASIN AREAS TREATED BY POND C

	IMPERVIOUS (AC)	PERVIOUS (AC)	TOTAL (AC)
BASIN 13	0.20	0.04	0.24
BASIN 16	0.62	0.24	0.86
BASIN 17	0.53	0.05	0.58
BASIN 18	0.31	0.14	0.45
BASIN 19	0.17	0.00	0.17
BASIN 20	0.00	0.10	0.10
TOTAL	1.83	0.57	2.40

0 30 60 120

SCALE: 1" = 60'

* NOTE: IF PLOTTED ON 11x17, SCALE IS 1"=120'

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DESIGN STUDIO
Inspired Livable Places

PROJECT
RIVERRUN (A SUBDIVISION)
RIVERRUN SUBDIVISION LLC
NEWBERG, OREGON

SHEET TITLE
PROPOSED BASIN MAP (PHASE 2)

NO. DATE REVISION BY

30% CD'S

PRELIMINARY

DATE: 04/16/18
DESIGN: NJRU
DRAWN: NJRU

SHEET NO.
EX004

PROJECT NO. DBVX0000-0002

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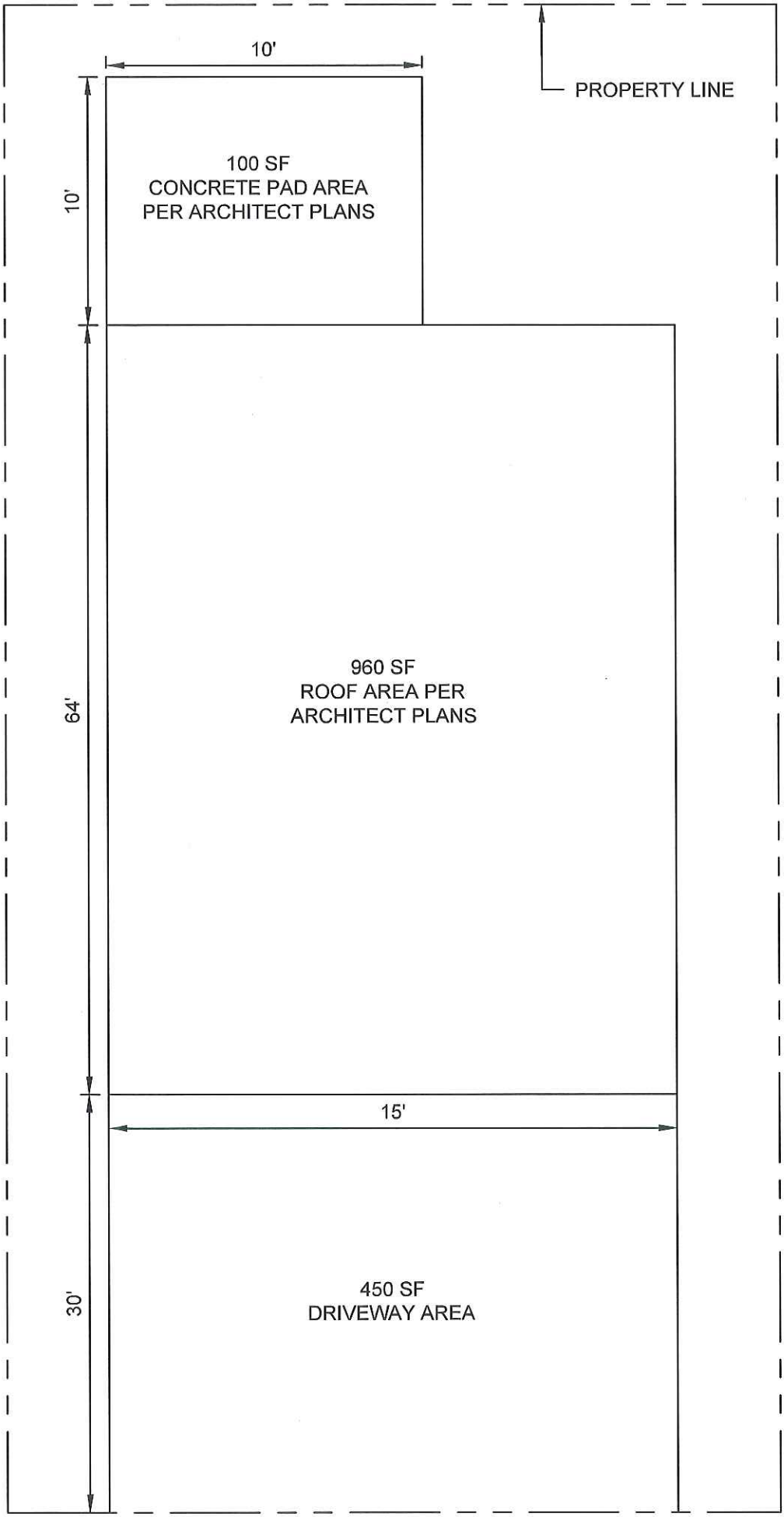


IMPERVIOUS AREA ESTIMATE FOR PROPOSED LOTS < 4,000 SF

DRIVEWAY	450 SF
ROOF AREA	960 SF
CONCRETE PAD	100 SF
TOTAL	1,510 SF

ASSUME 1,700 SF
IMPERVIOUS AREA
FOR LOTS < 4,000 SF

DRAWING IS NOT TO SCALE

Worksheet for Water Quality Facilities

Pond A:

Runoff from Basins 1-9 will be treated by a Pond A. It is assumed that each undeveloped lot < 4,000 SF will consist of 1,700 SF post-developed impervious area and undeveloped lots ≥ 4,000 SF will consist of 2,877 SF post-developed impervious area:

$$\textbf{Basins Total Impervious Area} = (15 \text{ lots})\left(2{,}877\frac{\text{ft}^2}{\text{lot}}\right) + (76 \text{ lots})\left(1{,}700\frac{\text{ft}^2}{\text{lot}}\right) + 78{,}871 \text{ ft}^2$$
$$= 251{,}226 \text{ ft}^2$$

$$\textbf{Pond A Water Quality Volume (WQV)} = \frac{(1 \text{ in})(\text{Area ft}^2)}{12 \text{ in/ft}} = \frac{(1 \text{ in})(251{,}226 \text{ ft}^2)}{12 \text{ in/ft}} = 20{,}936 \text{ ft}^3$$

Pond B:

Runoff from Basins 10-12 & 14-15 will be treated by a Pond B. It is assumed that each undeveloped lot < 4,000 SF will consist of 1,700 SF post-developed impervious area and undeveloped lots ≥ 4,000 SF will consist of 2,877 SF post-developed impervious area:

$$\textbf{Basins Total Impervious Area} = (3 \text{ lots})\left(2{,}877\frac{\text{ft}^2}{\text{lot}}\right) + (18 \text{ lots})\left(1{,}700\frac{\text{ft}^2}{\text{lot}}\right) + 22{,}474 \text{ ft}^2$$
$$= 61{,}705 \text{ ft}^2$$

$$\textbf{Pond B Water Quality Volume (WQV)} = \frac{(1 \text{ in})(\text{Area ft}^2)}{12 \text{ in/ft}} = \frac{(1 \text{ in})(61{,}705 \text{ ft}^2)}{12 \text{ in/ft}} = 5{,}142 \text{ ft}^3$$

Pond C:

Runoff from Basins 13 & 16-20 will be treated by a Pond C. It is assumed that each undeveloped lot < 4,000 SF will consist of 1,700 SF post-developed impervious area and undeveloped lots ≥ 4,000 SF will consist of 2,877 SF post-developed impervious area:

$$\textbf{Basins Total Impervious Area} = (4 \text{ lots})\left(2{,}877\frac{\text{ft}^2}{\text{lot}}\right) + (17 \text{ lots})\left(1{,}700\frac{\text{ft}^2}{\text{lot}}\right) + 32{,}563 \text{ ft}^2$$
$$= 72{,}971 \text{ ft}^2$$

$$\textbf{Pond C Water Quality Volume (WQV)} = \frac{(1 \text{ in})(\text{Area ft}^2)}{12 \text{ in/ft}} = \frac{(1 \text{ in})(72{,}971 \text{ ft}^2)}{12 \text{ in/ft}} = 6{,}081 \text{ ft}^3$$

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Thursday, 06 / 28 / 2018

Hyd. No. 1

Pre-developed - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.903 cfs
Storm frequency	= 2 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 23,780 cuft
Drainage area	= 10.070 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.330 x 98) + (9.740 x 74)] / 10.070

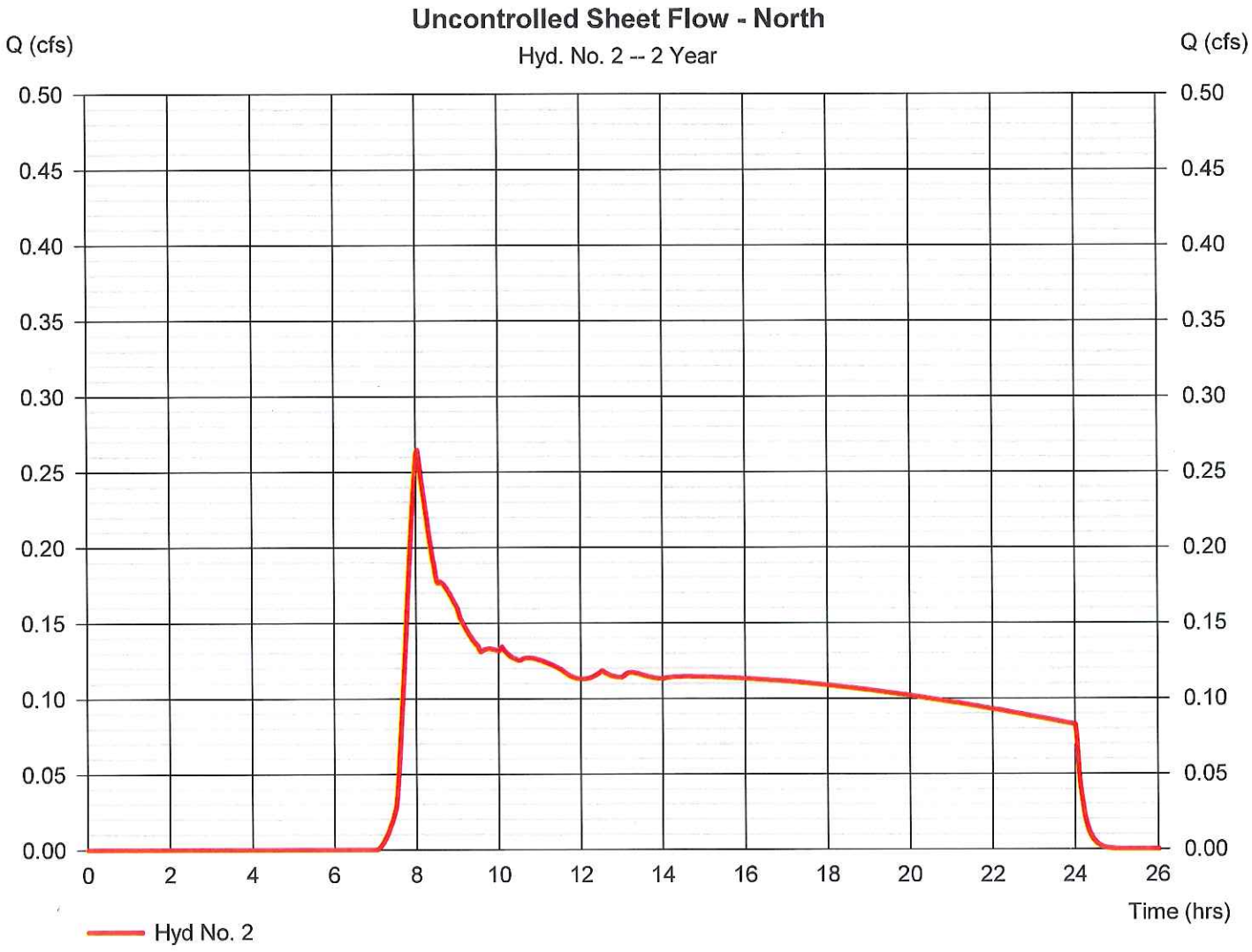
Hydrograph Report

Hyd. No. 2

Uncontrolled Sheet Flow - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.264 cfs
Storm frequency	= 2 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 6,966 cuft
Drainage area	= 2.950 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.120 x 98) + (2.830 x 74)] / 2.950



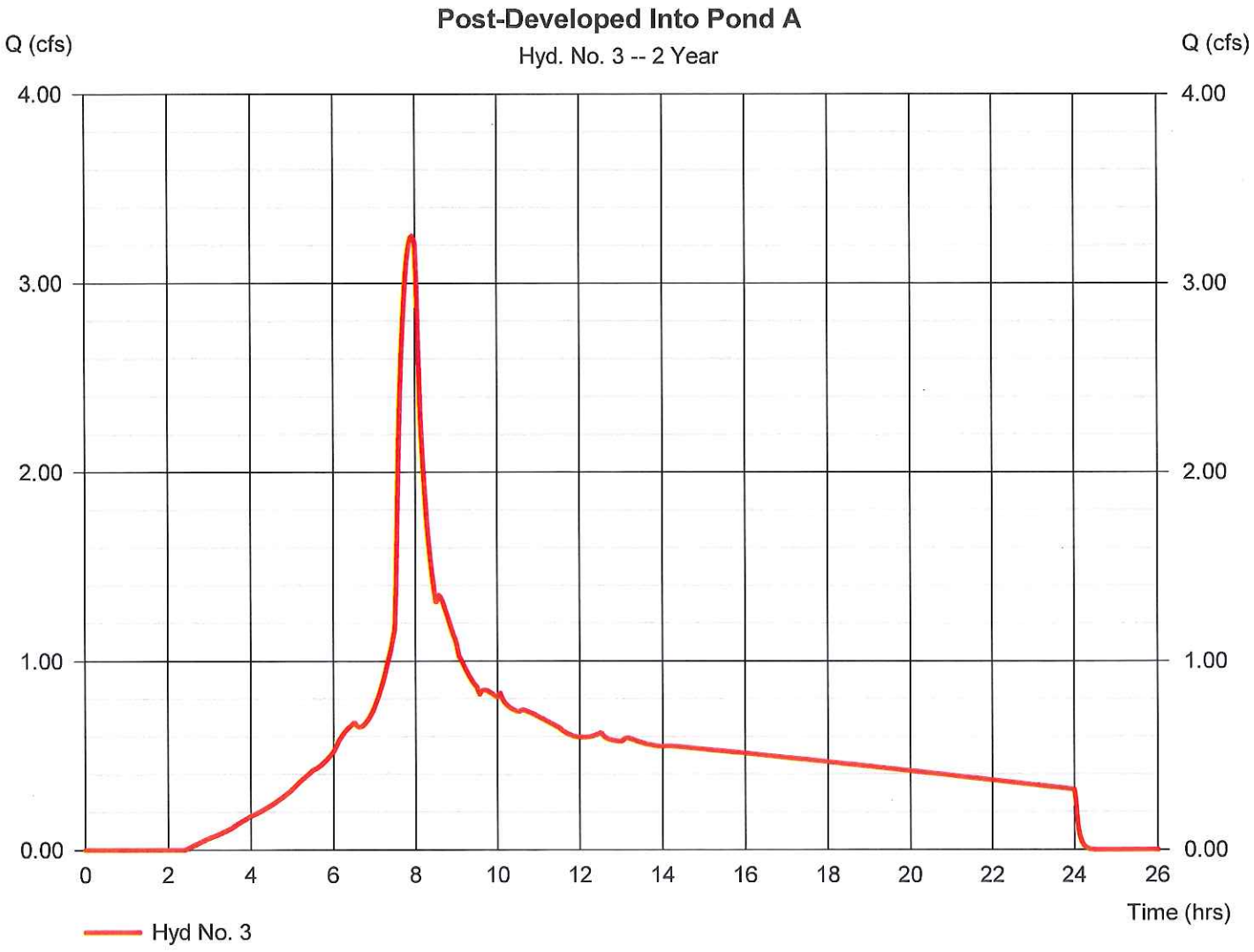
Hydrograph Report

Hyd. No. 3

Post-Developed Into Pond A

Hydrograph type	= SBUH Runoff	Peak discharge	= 3.250 cfs
Storm frequency	= 2 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 45,990 cuft
Drainage area	= 7.120 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	= n/a

* Composite (Area/CN) = [(5.670 x 98) + (1.450 x 74)] / 7.120



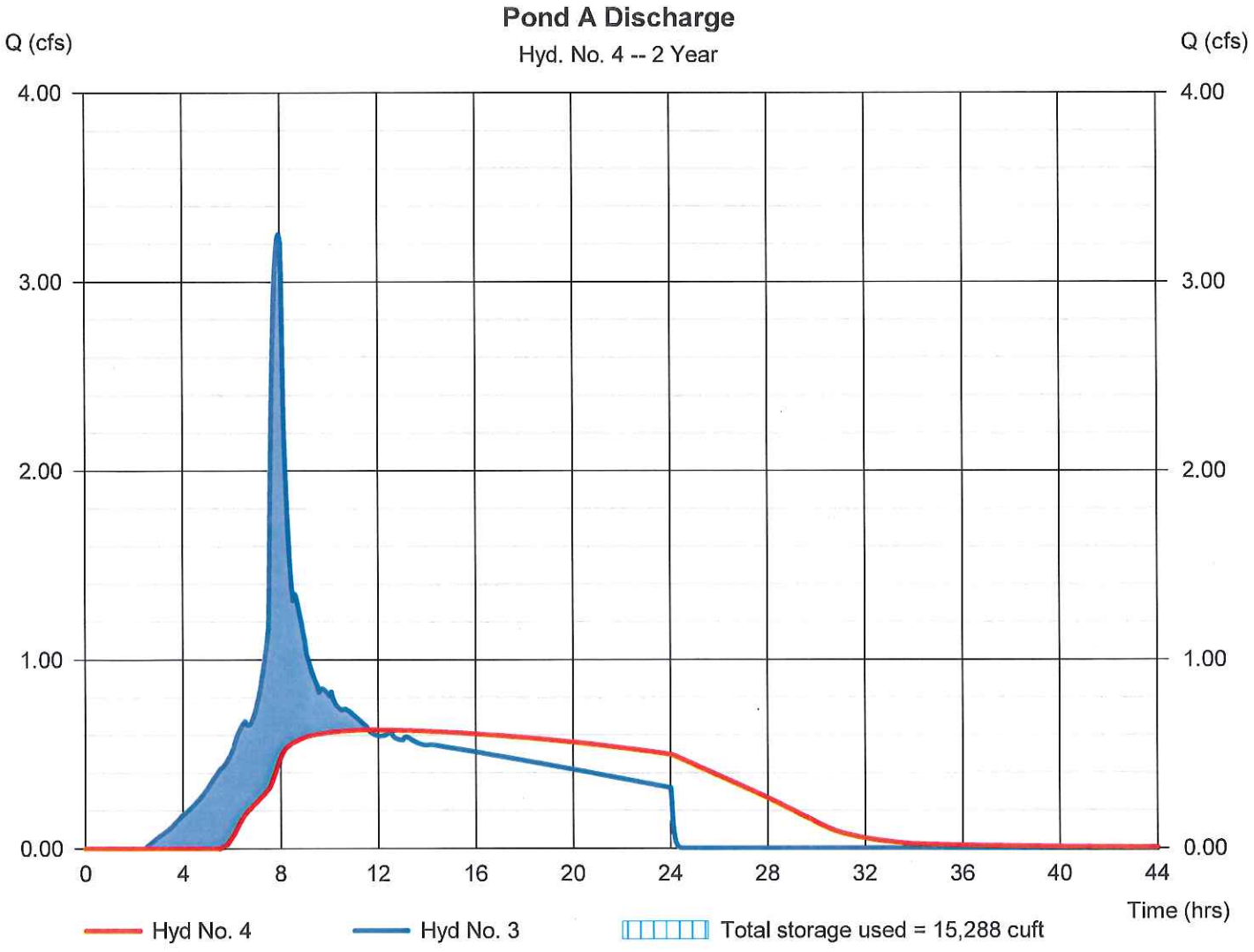
Hydrograph Report

Hyd. No. 4

Pond A Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.630 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.60 hrs
Time interval	= 2 min	Hyd. volume	= 43,977 cuft
Inflow hyd. No.	= 3 - Post-Developed Into Pond A	Max. Elevation	= 140.71 ft
Reservoir name	= POND A	Max. Storage	= 15,288 cuft

Storage Indication method used.

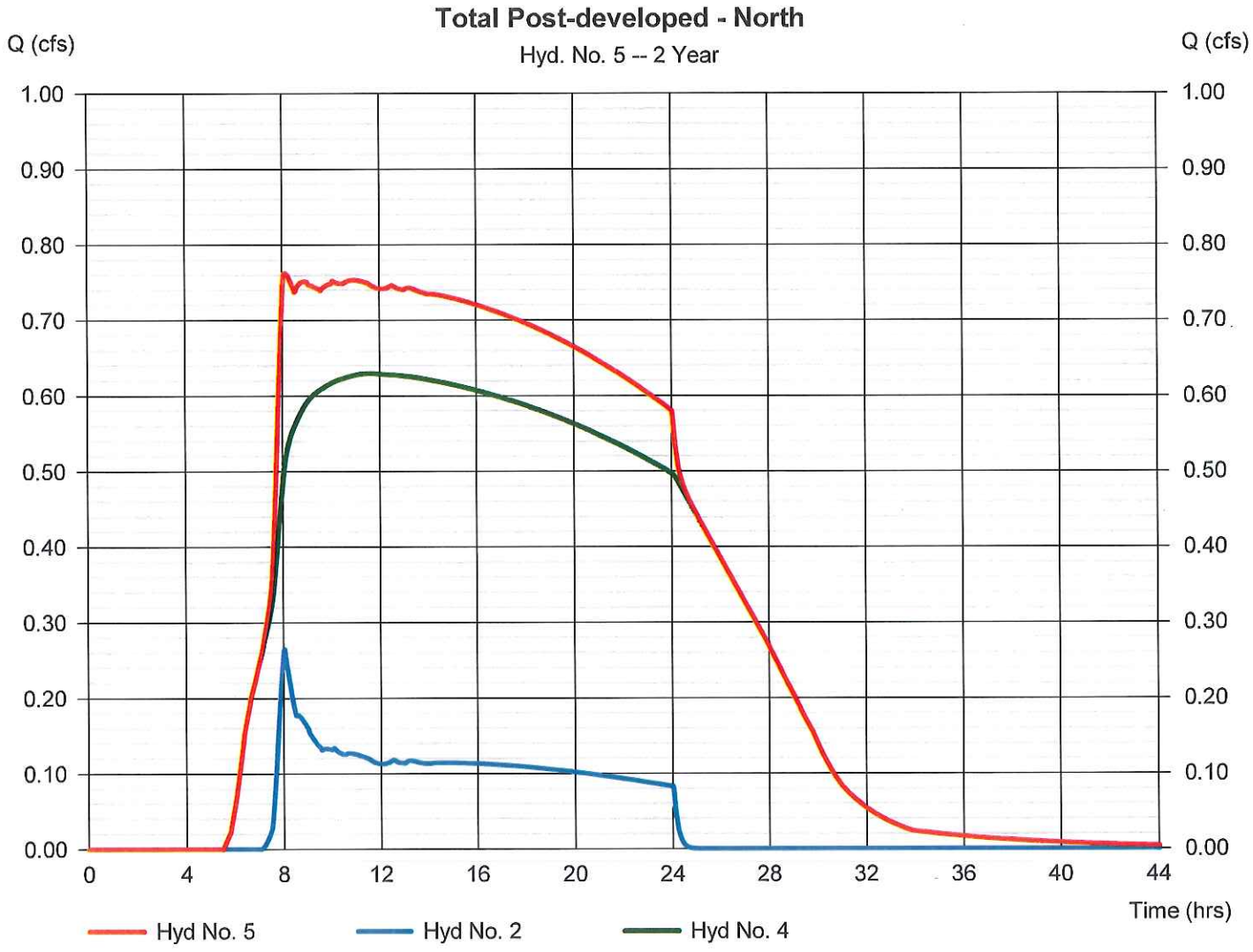


Hydrograph Report

Hyd. No. 5

Total Post-developed - North

Hydrograph type	= Combine	Peak discharge	= 0.762 cfs
Storm frequency	= 2 yrs	Time to peak	= 8.10 hrs
Time interval	= 2 min	Hyd. volume	= 50,943 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 2.950 ac



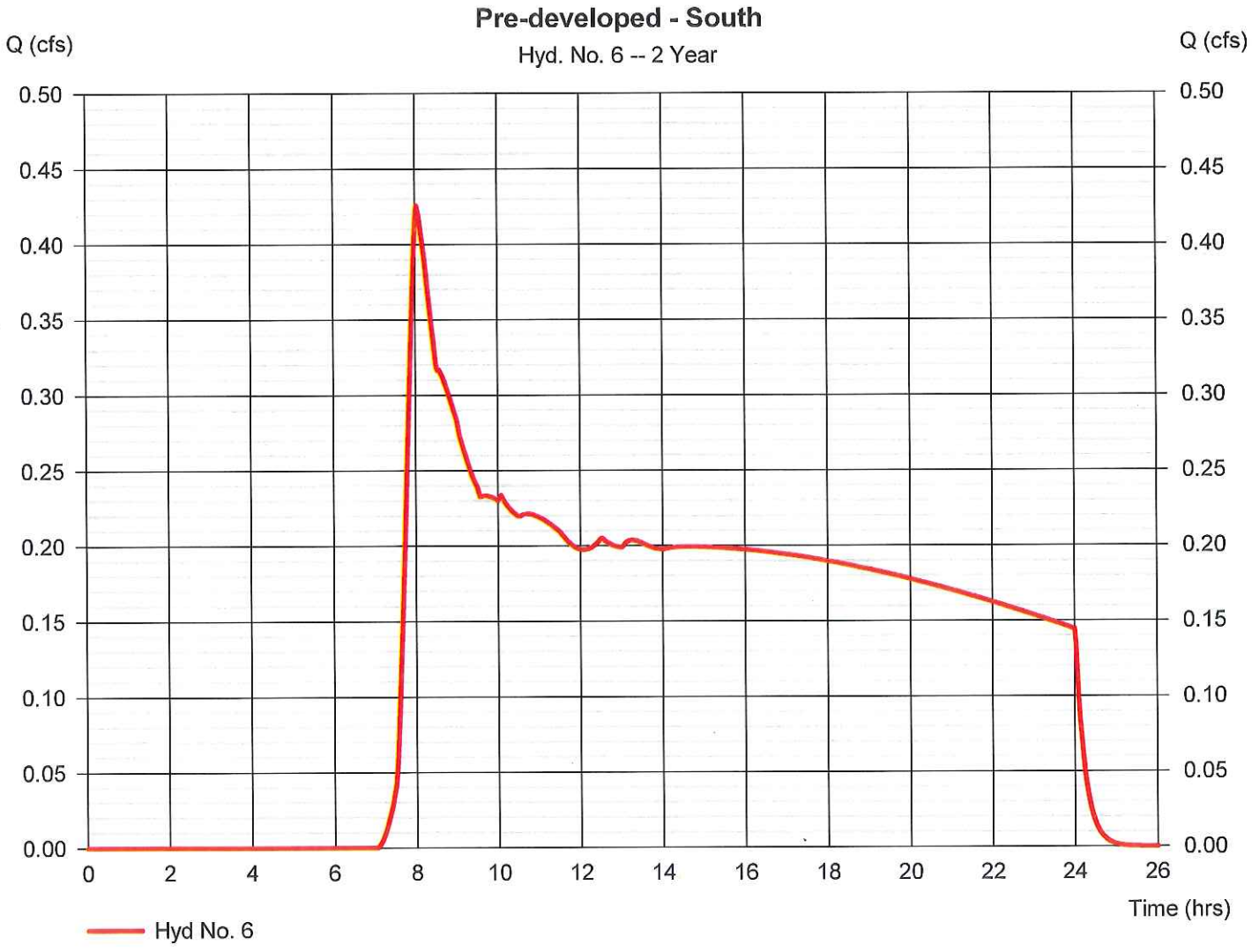
Hydrograph Report

Hyd. No. 6

Pre-developed - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.426 cfs
Storm frequency	= 2 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 12,138 cuft
Drainage area	= 5.140 ac	Curve number	= 75*
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.20 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.160 x 98) + (4.980 x 74)] / 5.140

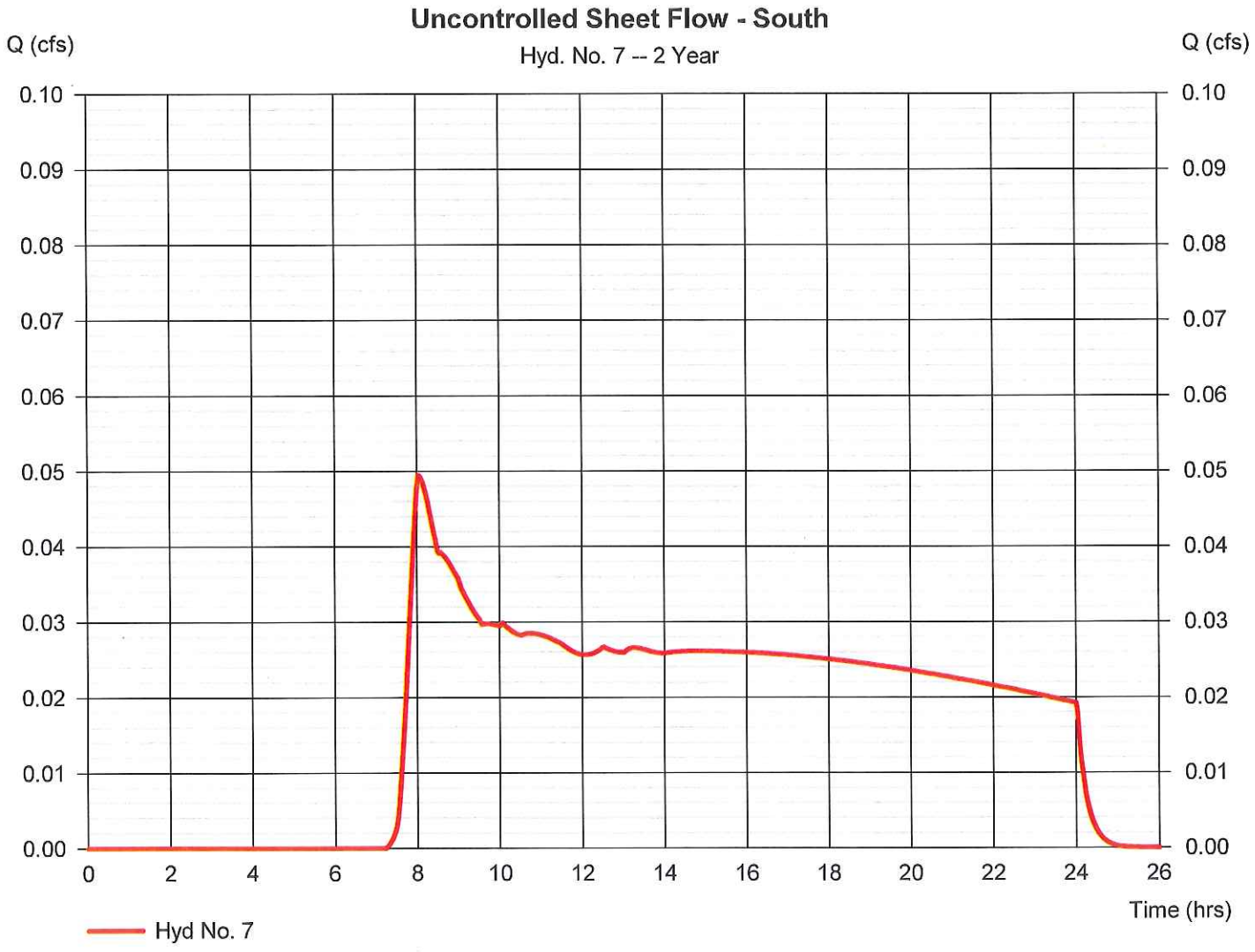


Hydrograph Report

Hyd. No. 7

Uncontrolled Sheet Flow - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.049 cfs
Storm frequency	= 2 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 1,568 cuft
Drainage area	= 0.710 ac	Curve number	= 74
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.60 min
Total precip.	= 2.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a



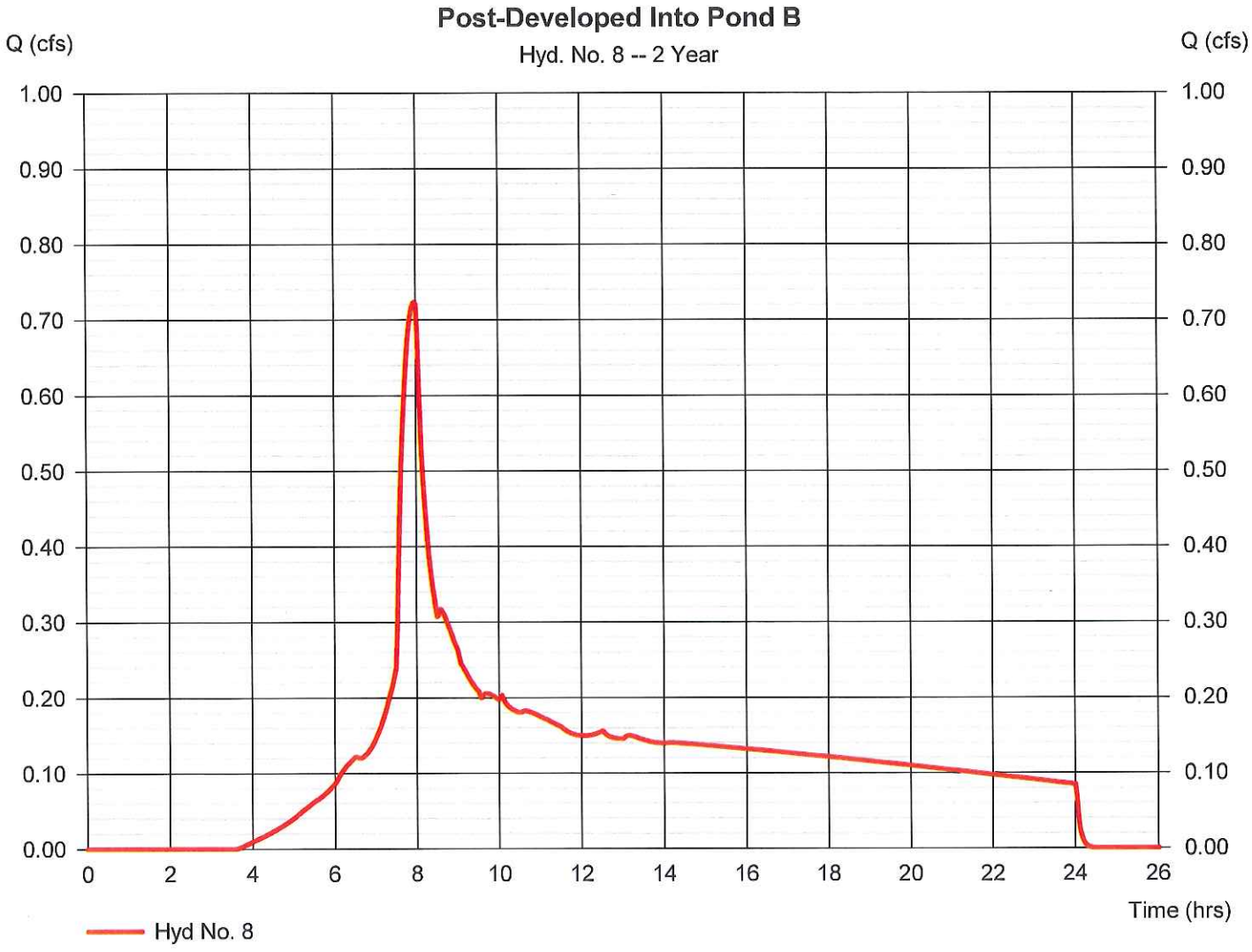
Hydrograph Report

Hyd. No. 8

Post-Developed Into Pond B

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.724 cfs
Storm frequency	= 2 yrs	Time to peak	= 7.97 hrs
Time interval	= 2 min	Hyd. volume	= 10,720 cuft
Drainage area	= 2.030 ac	Curve number	= 89*
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	= n/a

* Composite (Area/CN) = [(1.260 x 98) + (0.770 x 74)] / 2.030



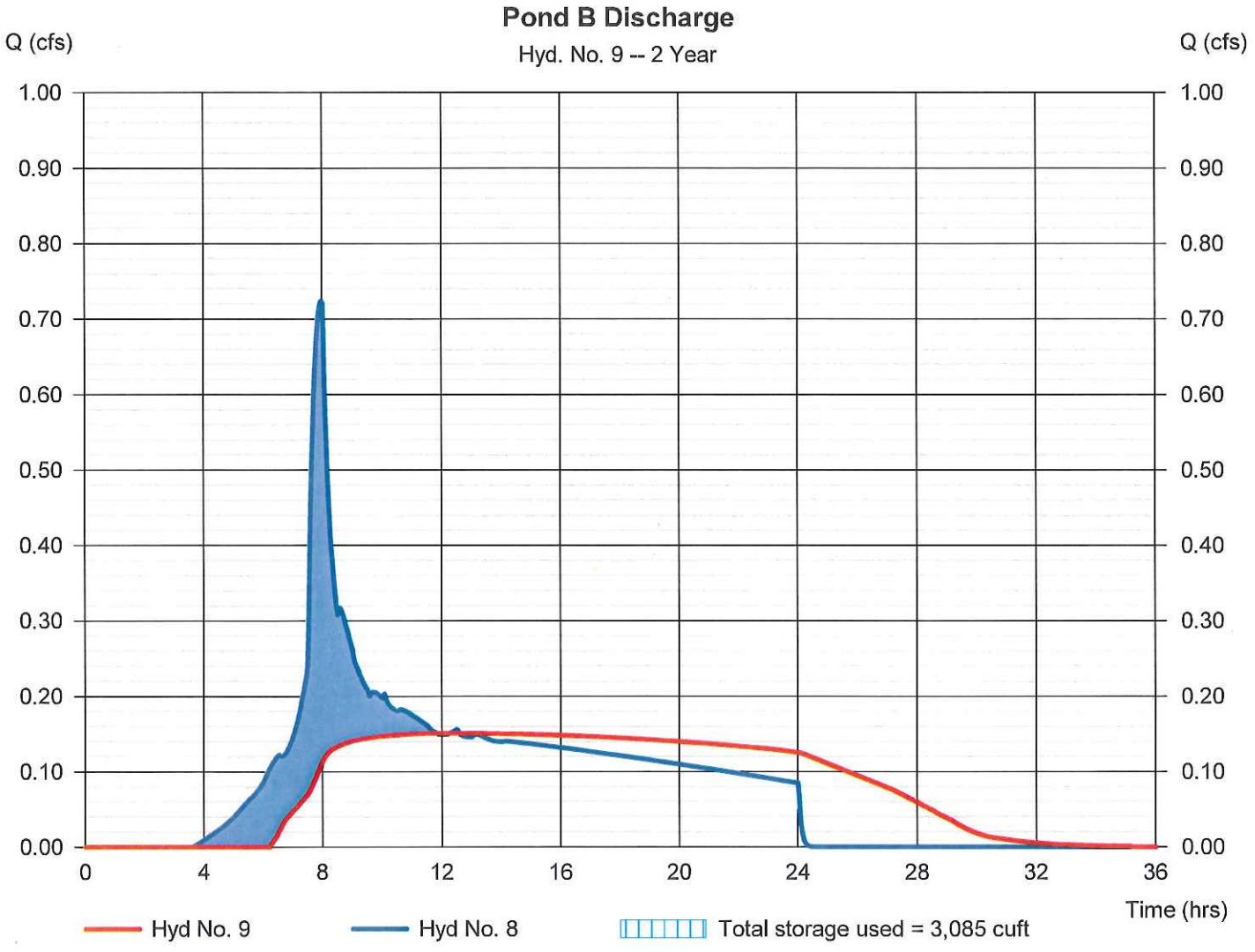
Hydrograph Report

Hyd. No. 9

Pond B Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.151 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 10,327 cuft
Inflow hyd. No.	= 8 - Post-Developed Into Pond B	Max. Elevation	= 158.55 ft
Reservoir name	= POND B	Max. Storage	= 3,085 cuft

Storage Indication method used.



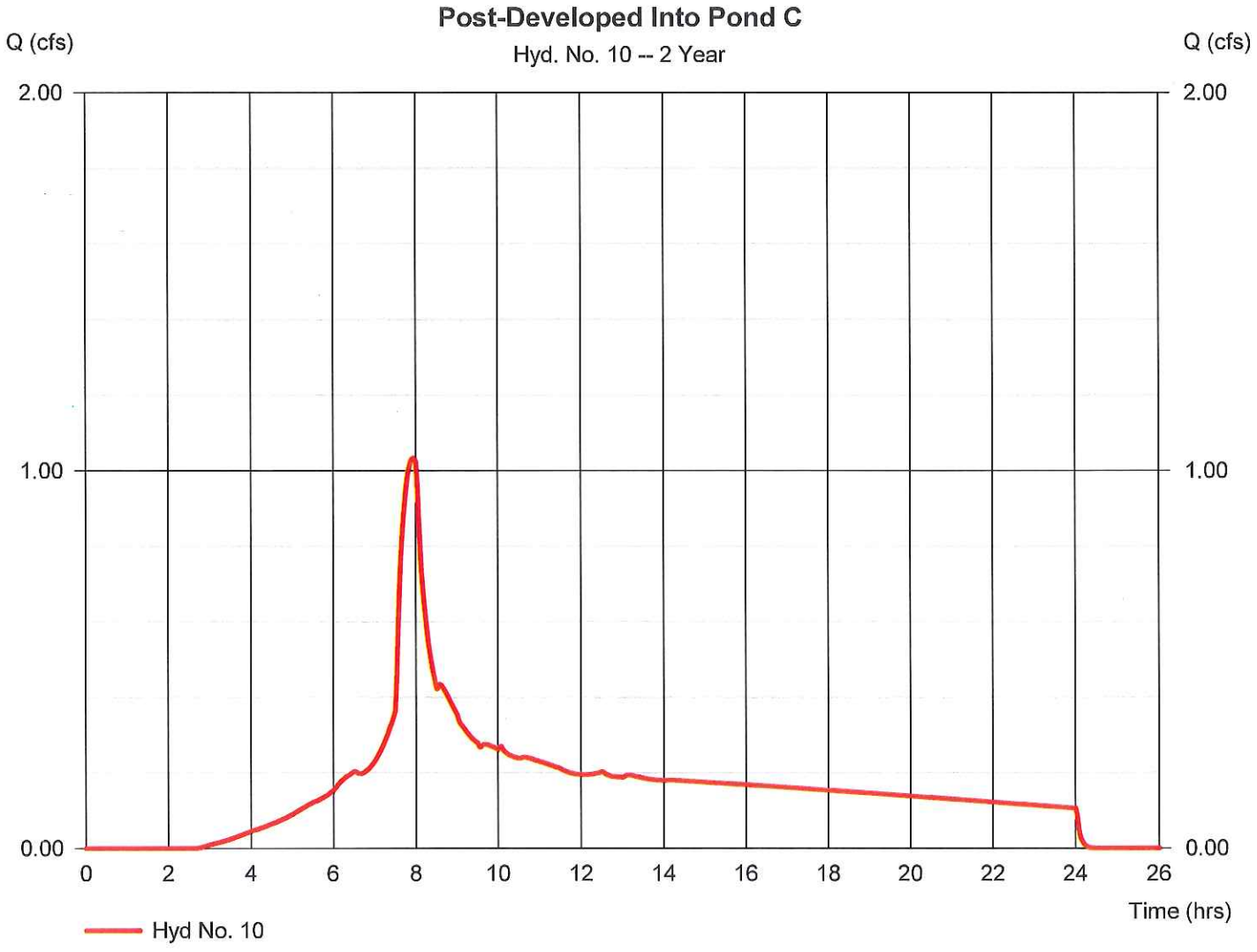
Hydrograph Report

Hyd. No. 10

Post-Developed Into Pond C

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.034 cfs
Storm frequency	= 2 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 14,751 cuft
Drainage area	= 2.400 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	= n/a

* Composite (Area/CN) = [(1.830 x 98) + (0.570 x 74)] / 2.400



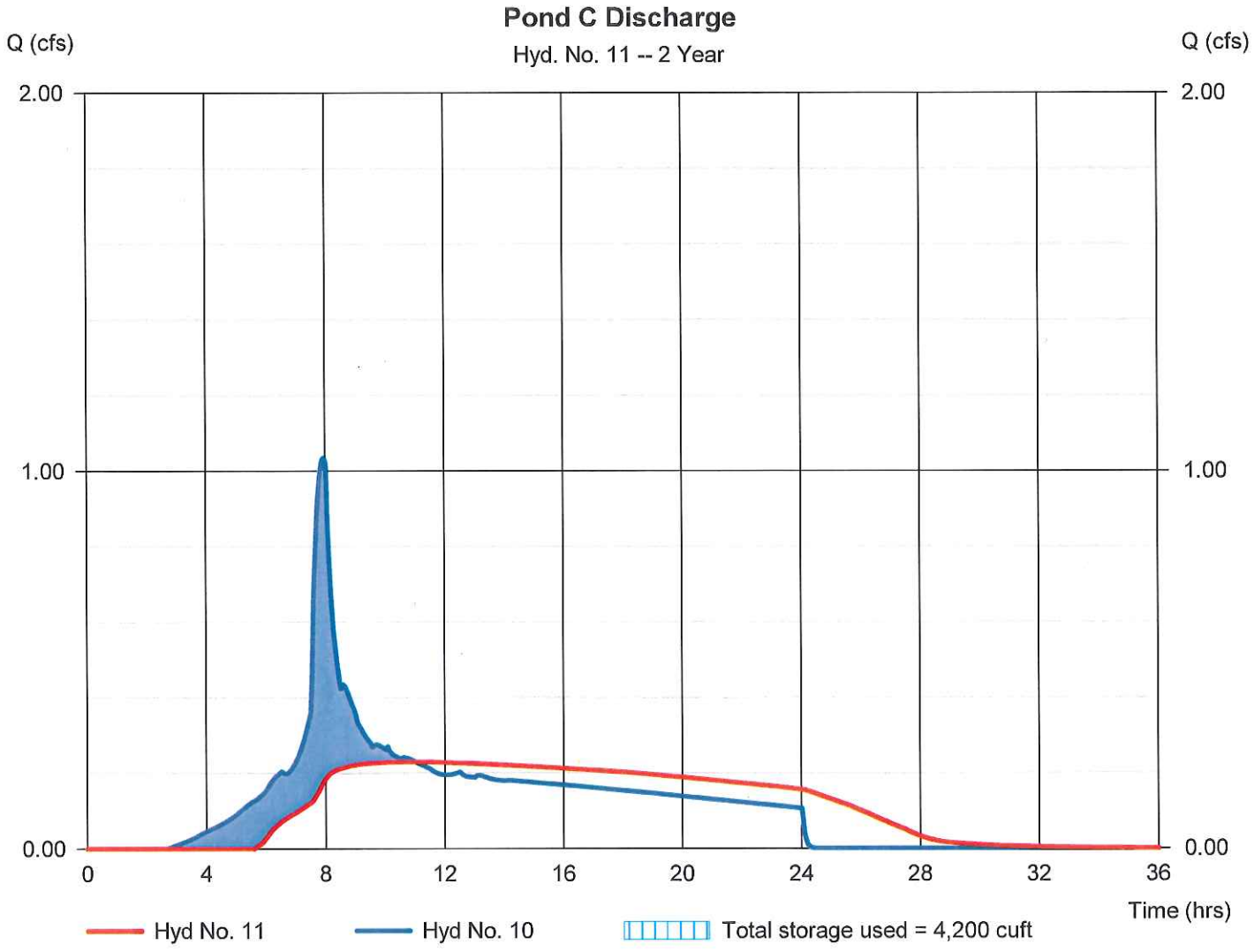
Hydrograph Report

Hyd. No. 11

Pond C Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.230 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.00 hrs
Time interval	= 2 min	Hyd. volume	= 14,169 cuft
Inflow hyd. No.	= 10 - Post-Developed Into Pond C	Max. Elevation	= 158.28 ft
Reservoir name	= POND C	Max. Storage	= 4,200 cuft

Storage Indication method used.

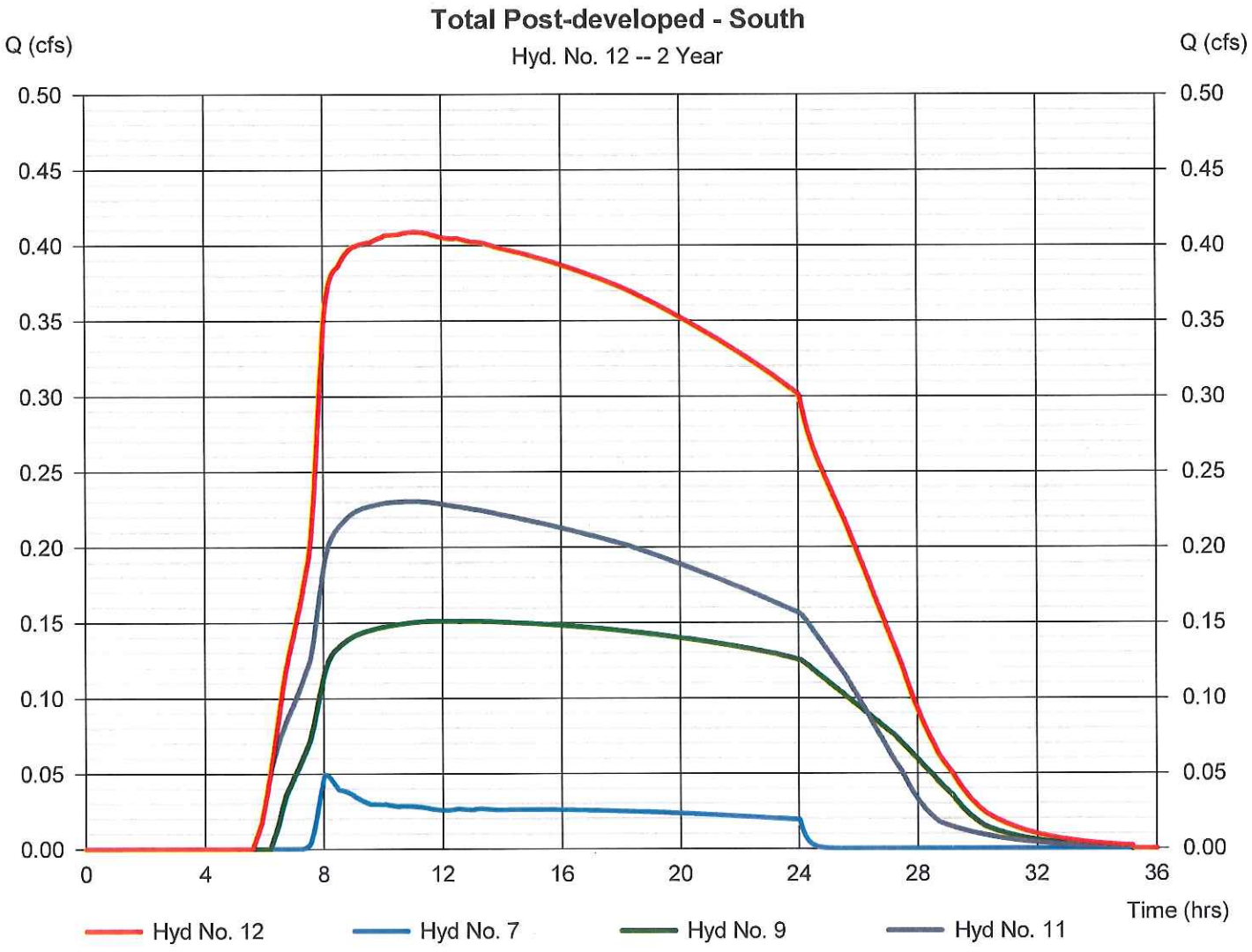


Hydrograph Report

Hyd. No. 12

Total Post-developed - South

Hydrograph type	= Combine	Peak discharge	= 0.409 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.03 hrs
Time interval	= 2 min	Hyd. volume	= 26,064 cuft
Inflow hyds.	= 7, 9, 11	Contrib. drain. area	= 0.710 ac



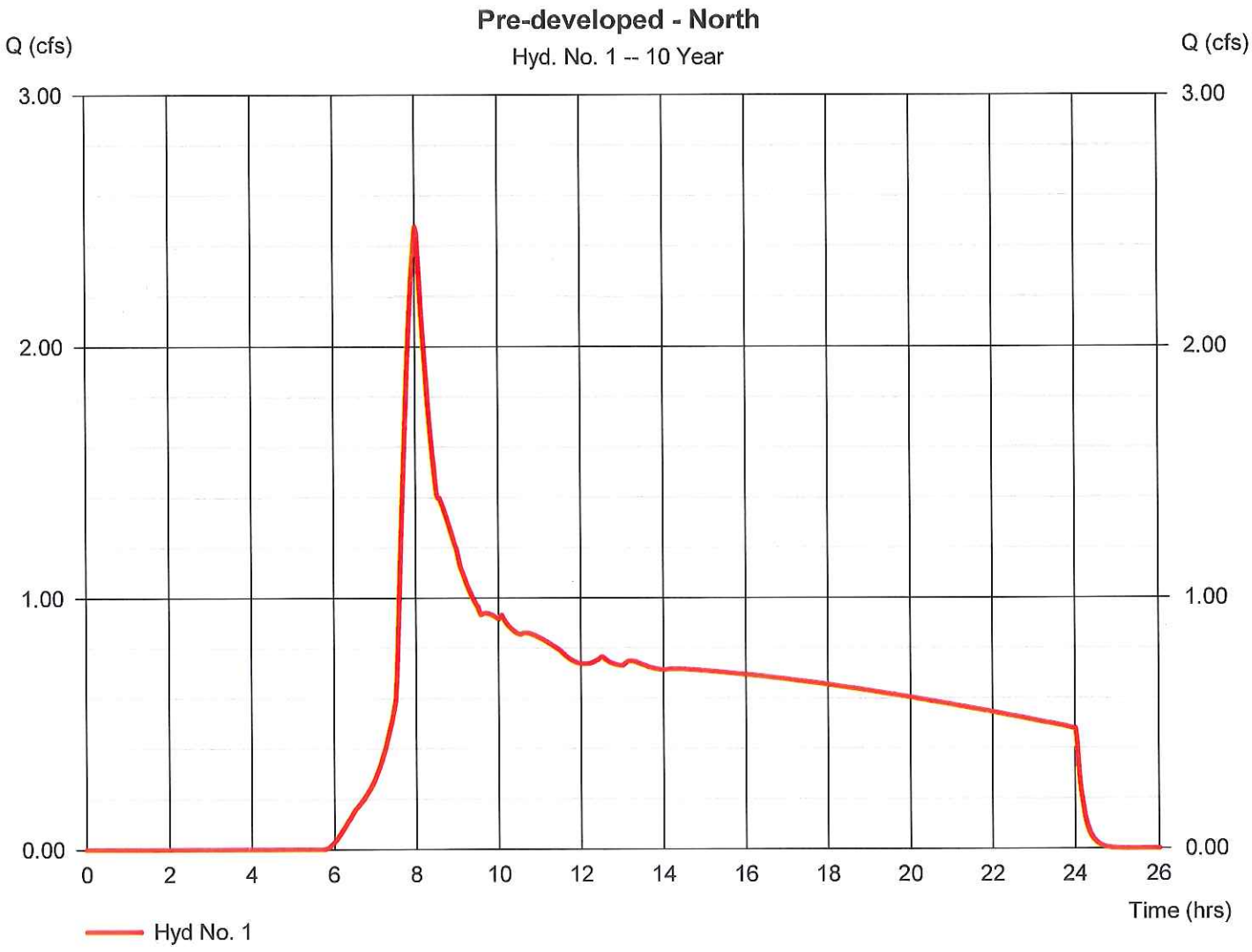
Hydrograph Report

Hyd. No. 1

Pre-developed - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 2.475 cfs
Storm frequency	= 10 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 47,586 cuft
Drainage area	= 10.070 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.330 x 98) + (9.740 x 74)] / 10.070



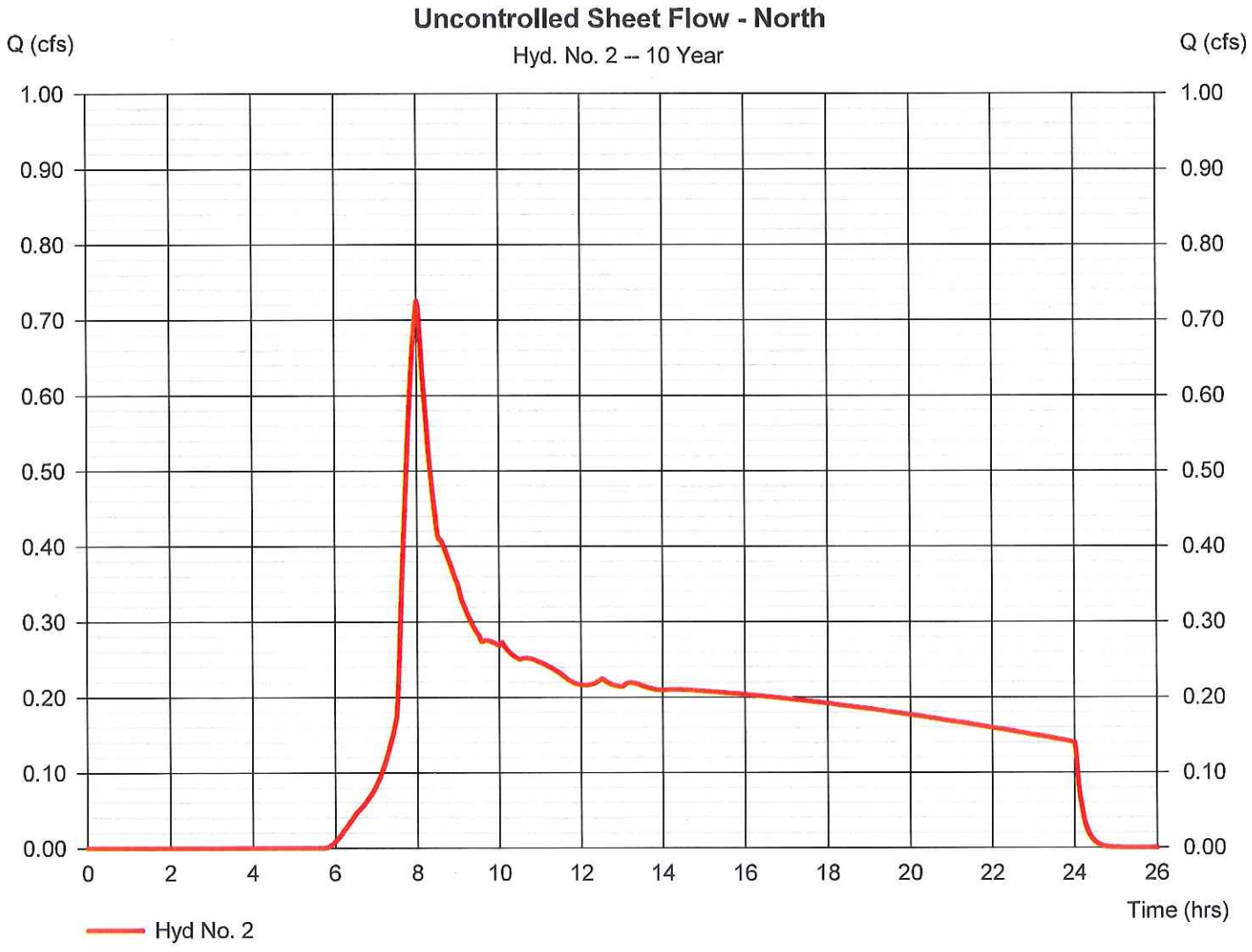
Hydrograph Report

Hyd. No. 2

Uncontrolled Sheet Flow - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.725 cfs
Storm frequency	= 10 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 13,940 cuft
Drainage area	= 2.950 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.120 x 98) + (2.830 x 74)] / 2.950



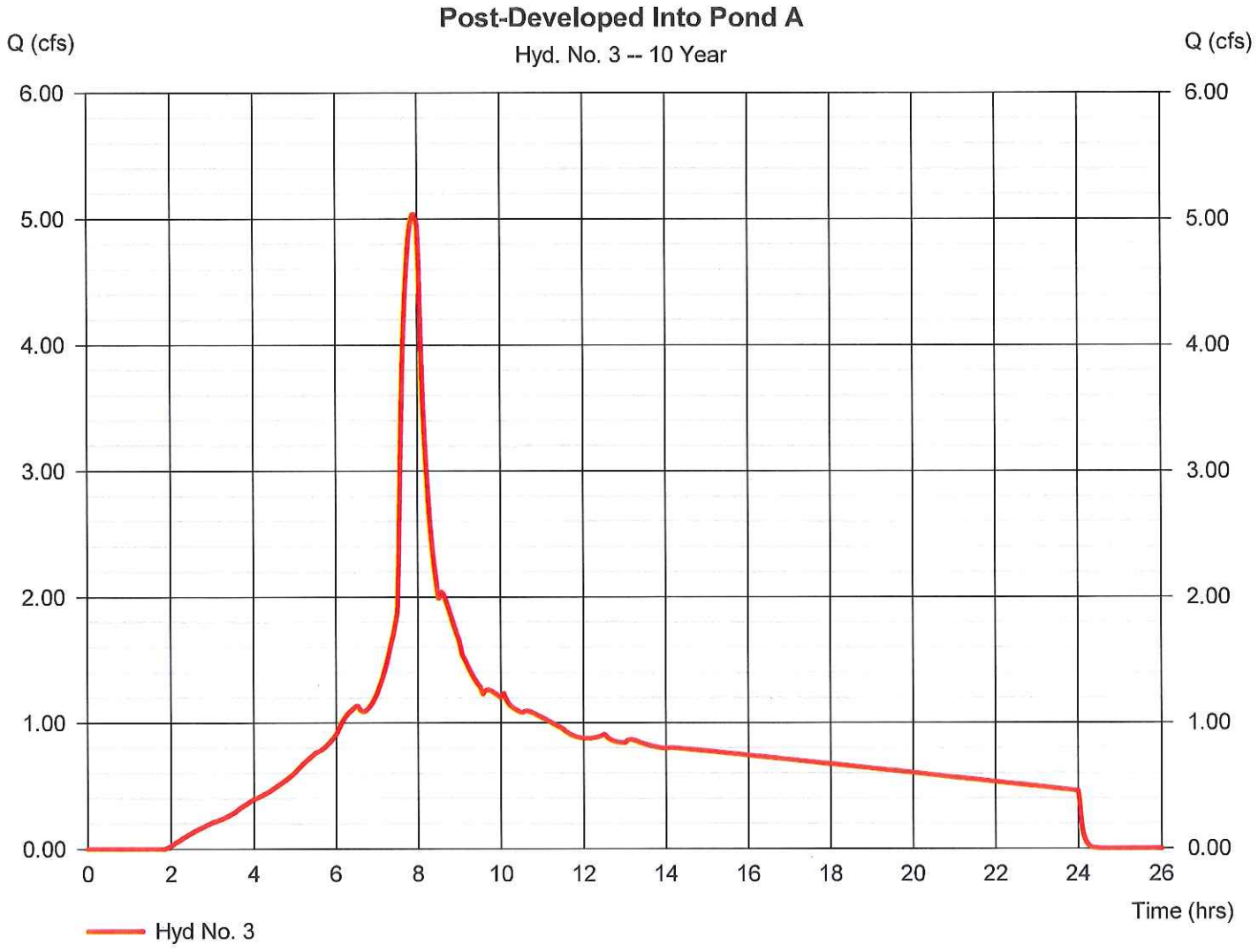
Hydrograph Report

Hyd. No. 3

Post-Developed Into Pond A

Hydrograph type	= SBUH Runoff	Peak discharge	= 5.038 cfs
Storm frequency	= 10 yrs	Time to peak	= 7.90 hrs
Time interval	= 2 min	Hyd. volume	= 70,685 cuft
Drainage area	= 7.120 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	= n/a

* Composite (Area/CN) = [(5.670 x 98) + (1.450 x 74)] / 7.120



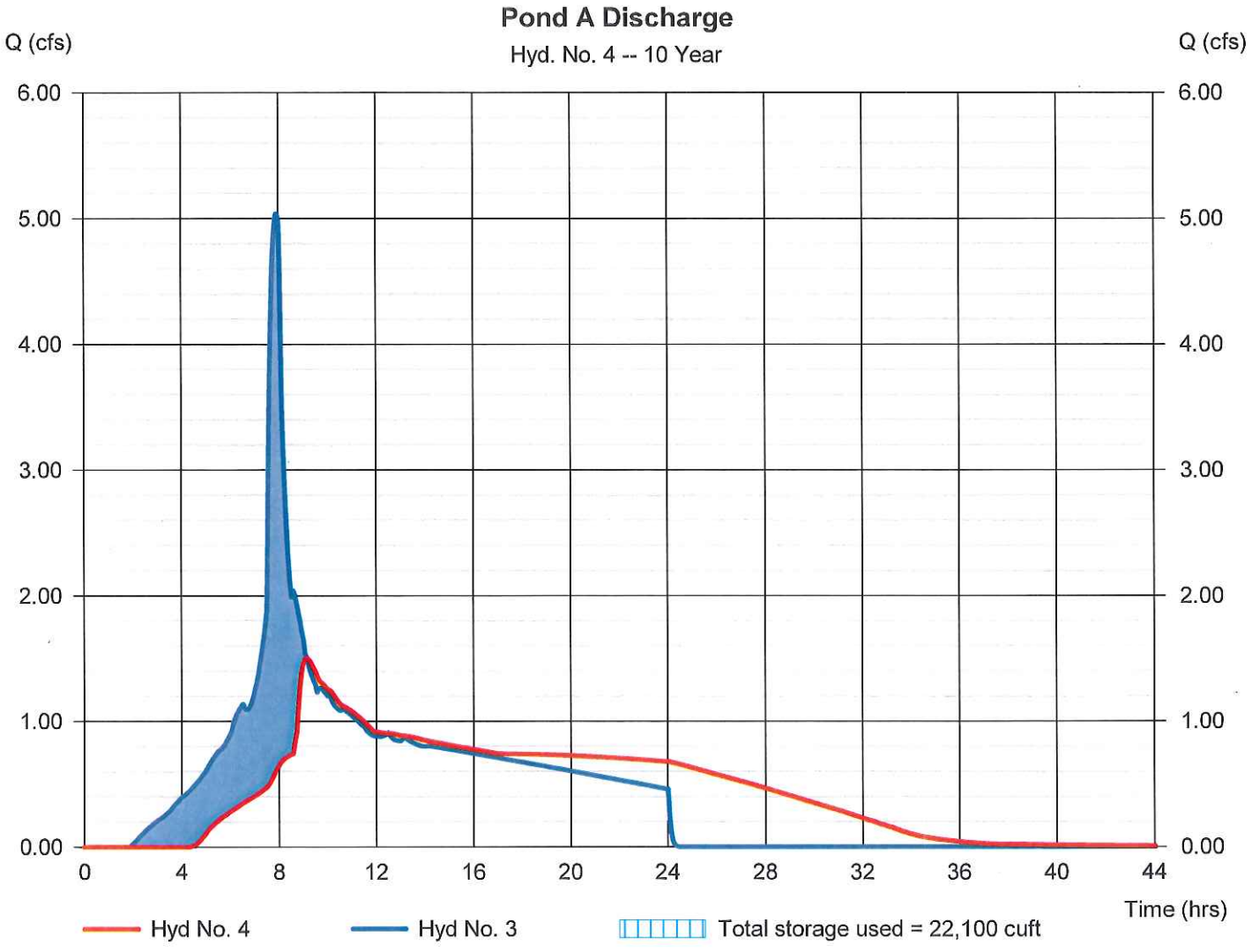
Hydrograph Report

Hyd. No. 4

Pond A Discharge

Hydrograph type	= Reservoir	Peak discharge	= 1.501 cfs
Storm frequency	= 10 yrs	Time to peak	= 9.13 hrs
Time interval	= 2 min	Hyd. volume	= 68,672 cuft
Inflow hyd. No.	= 3 - Post-Developed Into Pond A	Max. Elevation	= 141.78 ft
Reservoir name	= POND A	Max. Storage	= 22,100 cuft

Storage Indication method used.

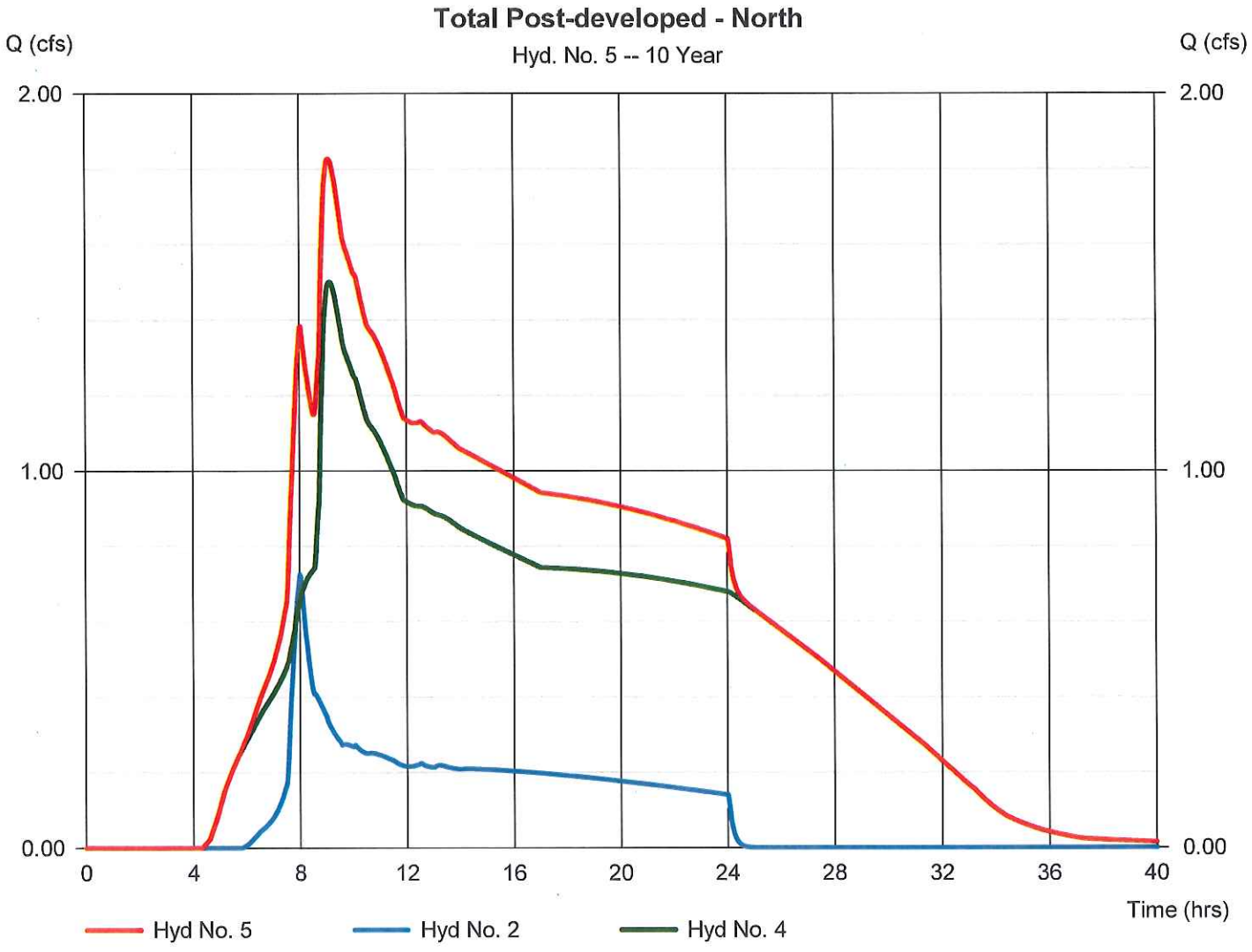


Hydrograph Report

Hyd. No. 5

Total Post-developed - North

Hydrograph type	= Combine	Peak discharge	= 1.827 cfs
Storm frequency	= 10 yrs	Time to peak	= 9.07 hrs
Time interval	= 2 min	Hyd. volume	= 82,612 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 2.950 ac



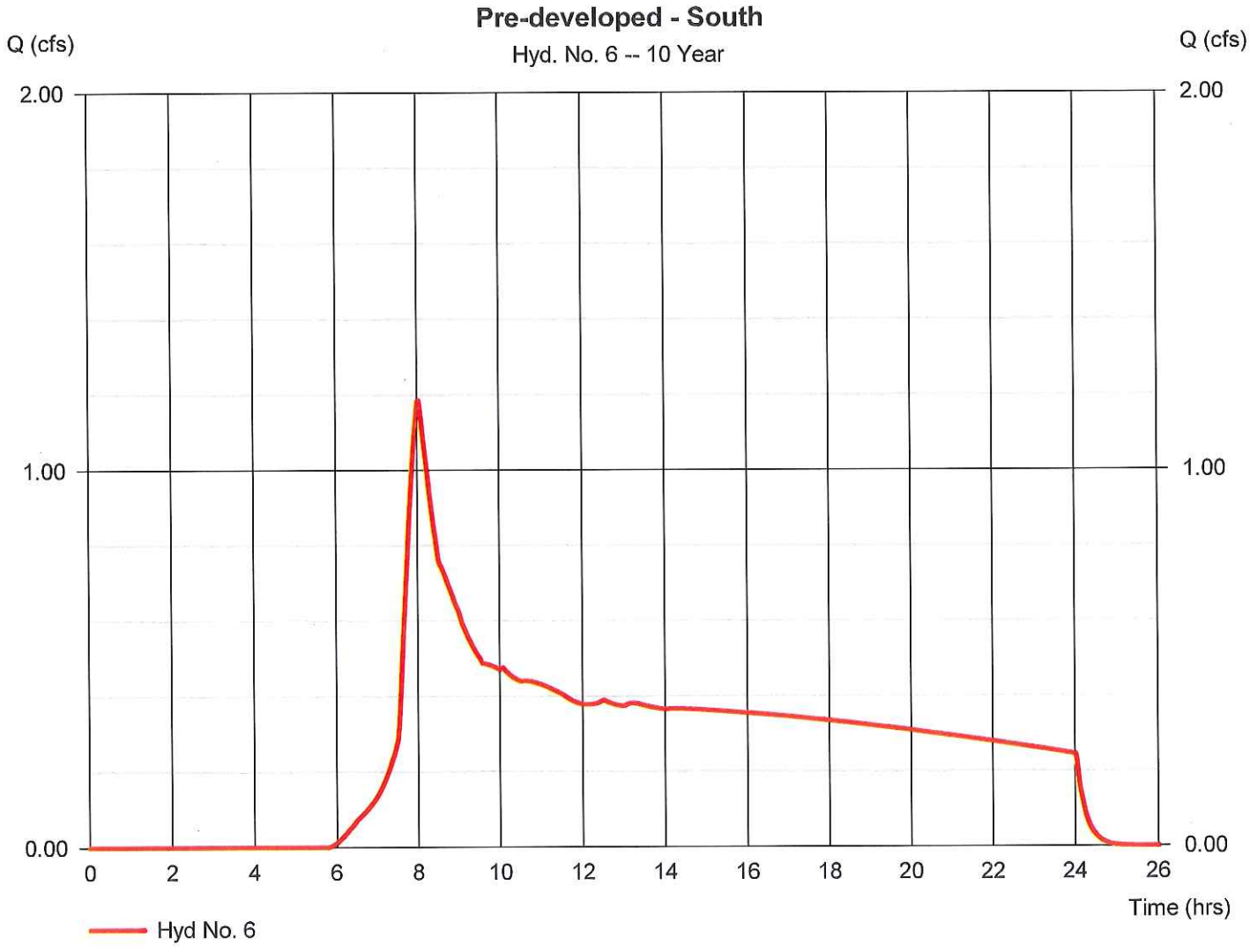
Hydrograph Report

Hyd. No. 6

Pre-developed - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.185 cfs
Storm frequency	= 10 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 24,289 cuft
Drainage area	= 5.140 ac	Curve number	= 75*
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.20 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.160 x 98) + (4.980 x 74)] / 5.140

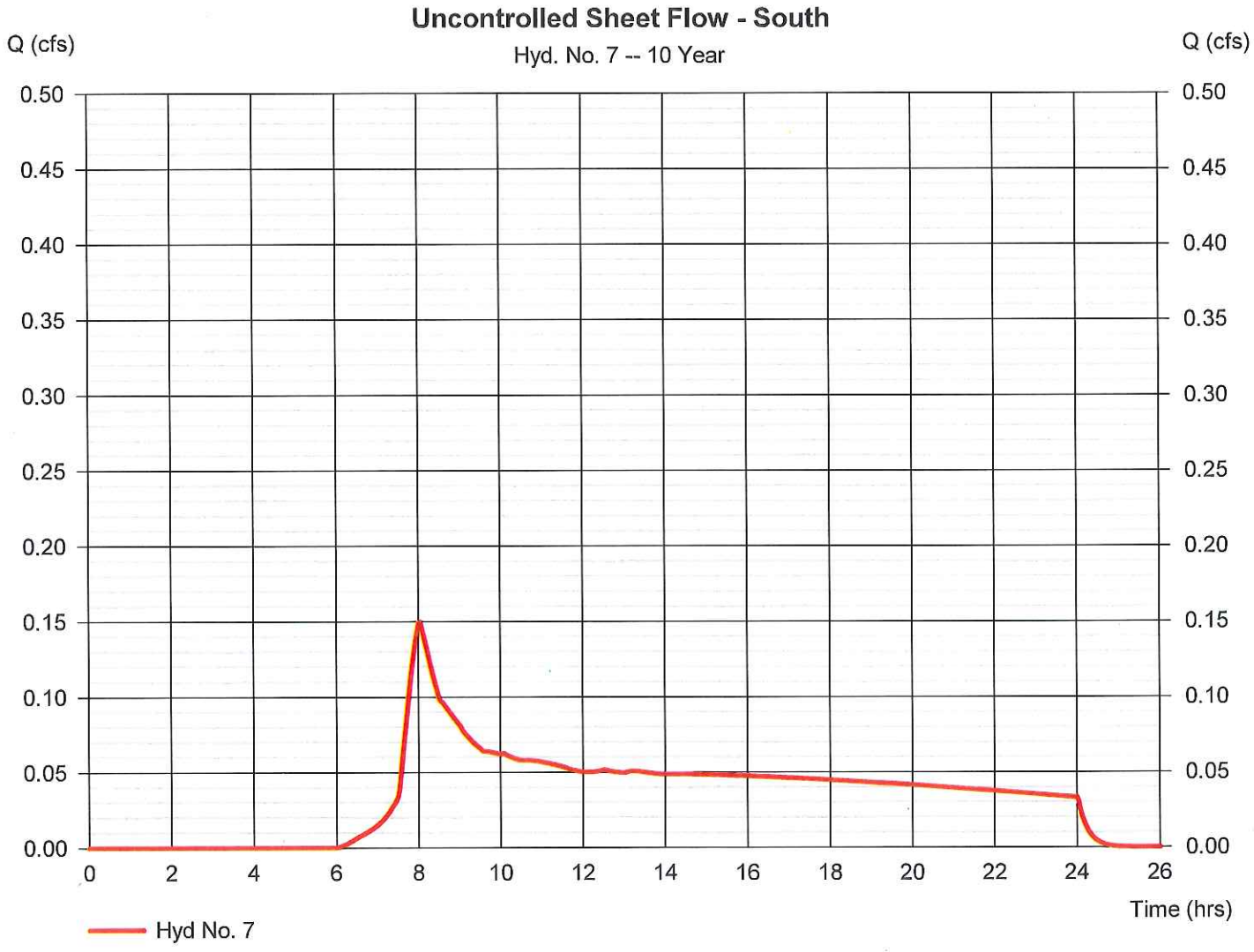


Hydrograph Report

Hyd. No. 7

Uncontrolled Sheet Flow - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.150 cfs
Storm frequency	= 10 yrs	Time to peak	= 8.03 hrs
Time interval	= 2 min	Hyd. volume	= 3,196 cuft
Drainage area	= 0.710 ac	Curve number	= 74
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.60 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a



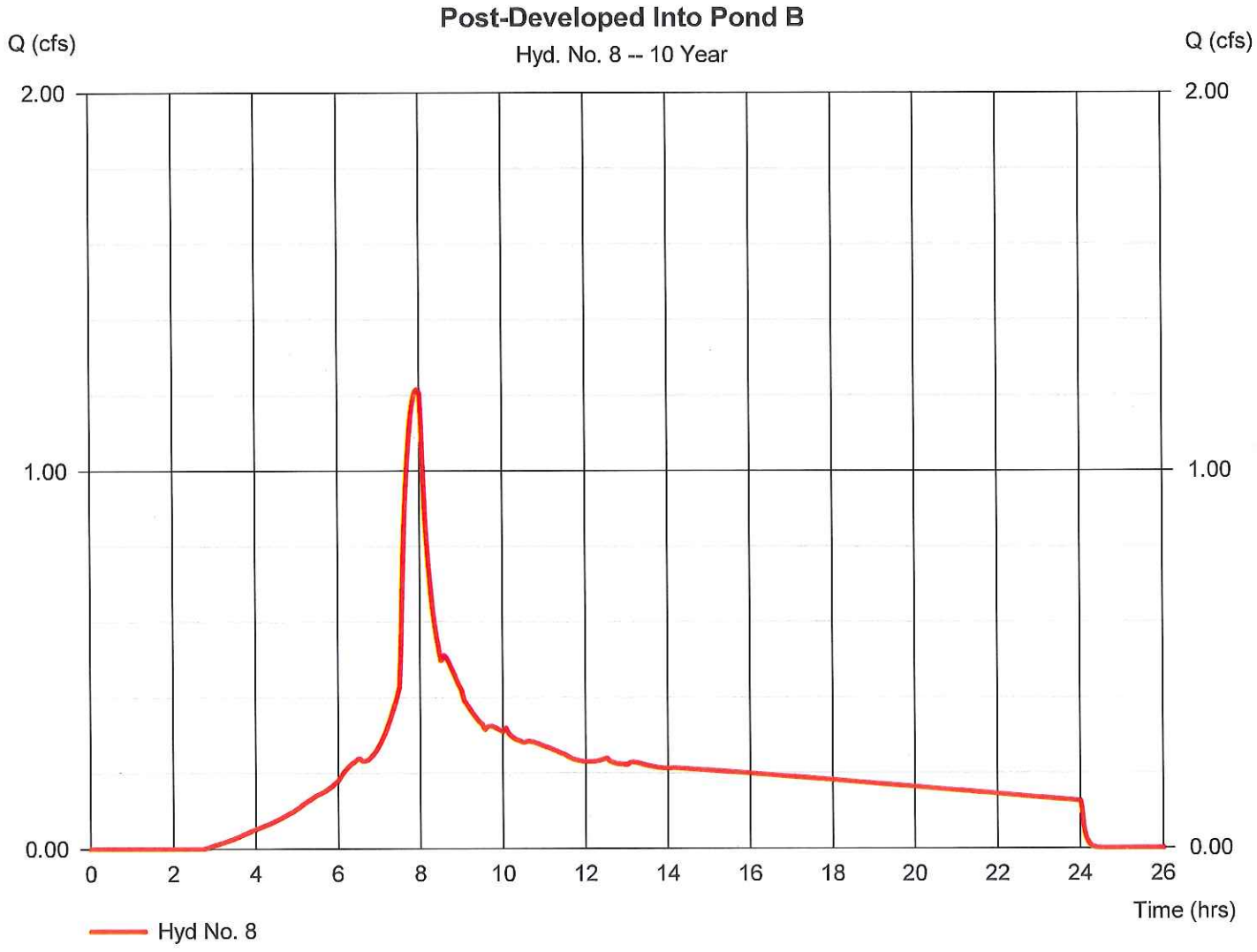
Hydrograph Report

Hyd. No. 8

Post-Developed Into Pond B

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.216 cfs
Storm frequency	= 10 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 17,370 cuft
Drainage area	= 2.030 ac	Curve number	= 89*
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	= n/a

* Composite (Area/CN) = [(1.260 x 98) + (0.770 x 74)] / 2.030



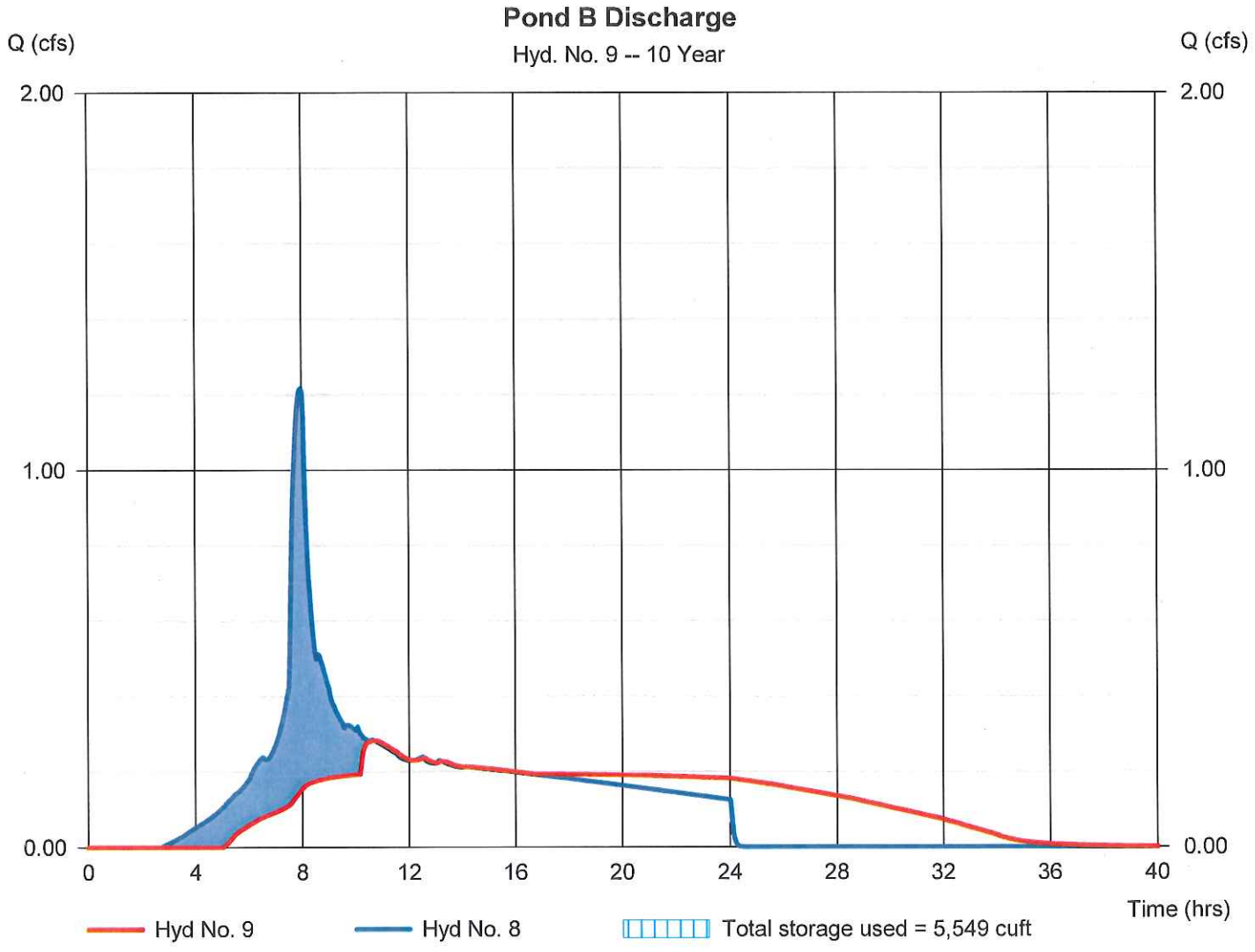
Hydrograph Report

Hyd. No. 9

Pond B Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.283 cfs
Storm frequency	= 10 yrs	Time to peak	= 10.70 hrs
Time interval	= 2 min	Hyd. volume	= 16,977 cuft
Inflow hyd. No.	= 8 - Post-Developed Into Pond B	Max. Elevation	= 159.92 ft
Reservoir name	= POND B	Max. Storage	= 5,549 cuft

Storage Indication method used.



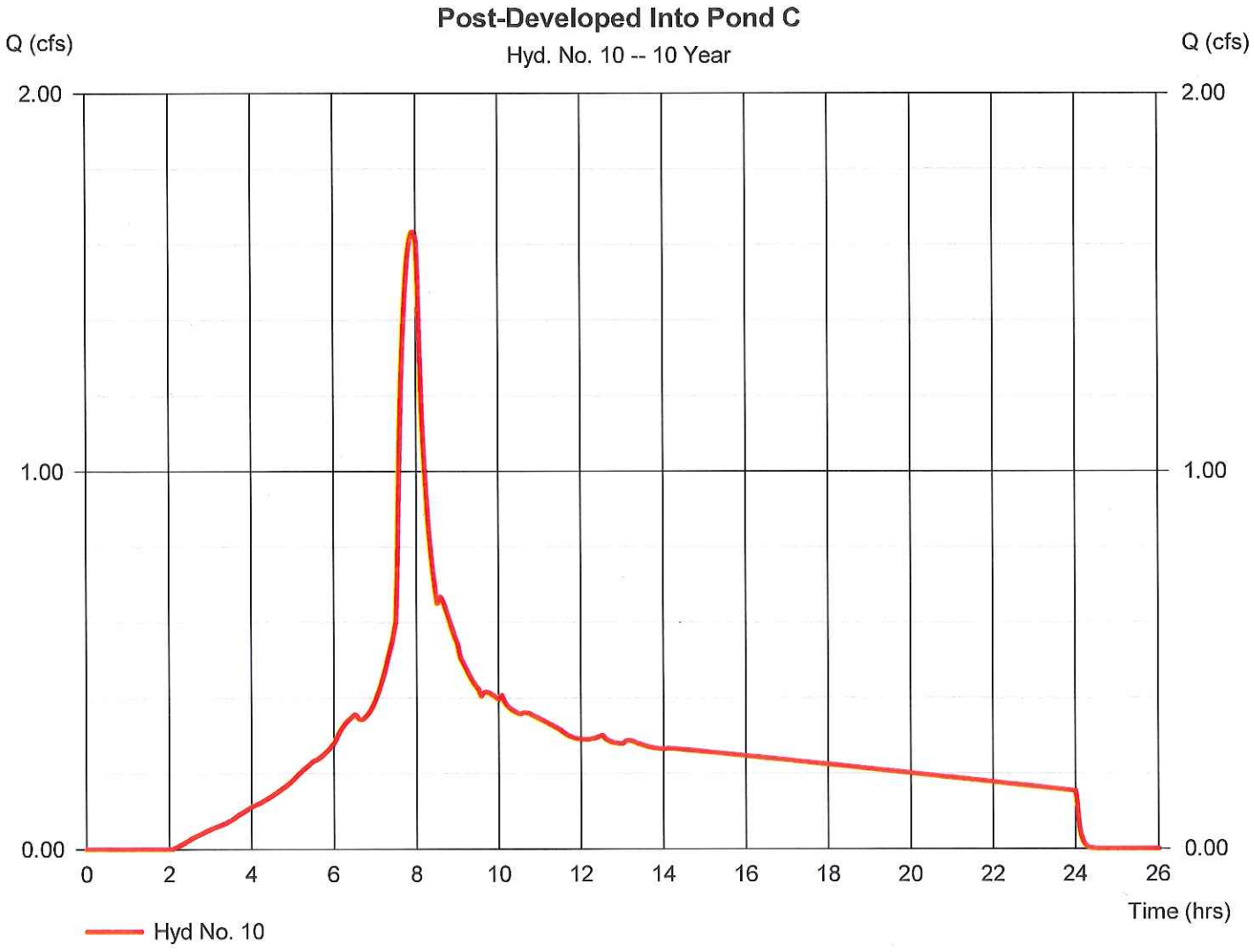
Hydrograph Report

Hyd. No. 10

Post-Developed Into Pond C

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.633 cfs
Storm frequency	= 10 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 22,971 cuft
Drainage area	= 2.400 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	= n/a

* Composite (Area/CN) = [(1.830 x 98) + (0.570 x 74)] / 2.400



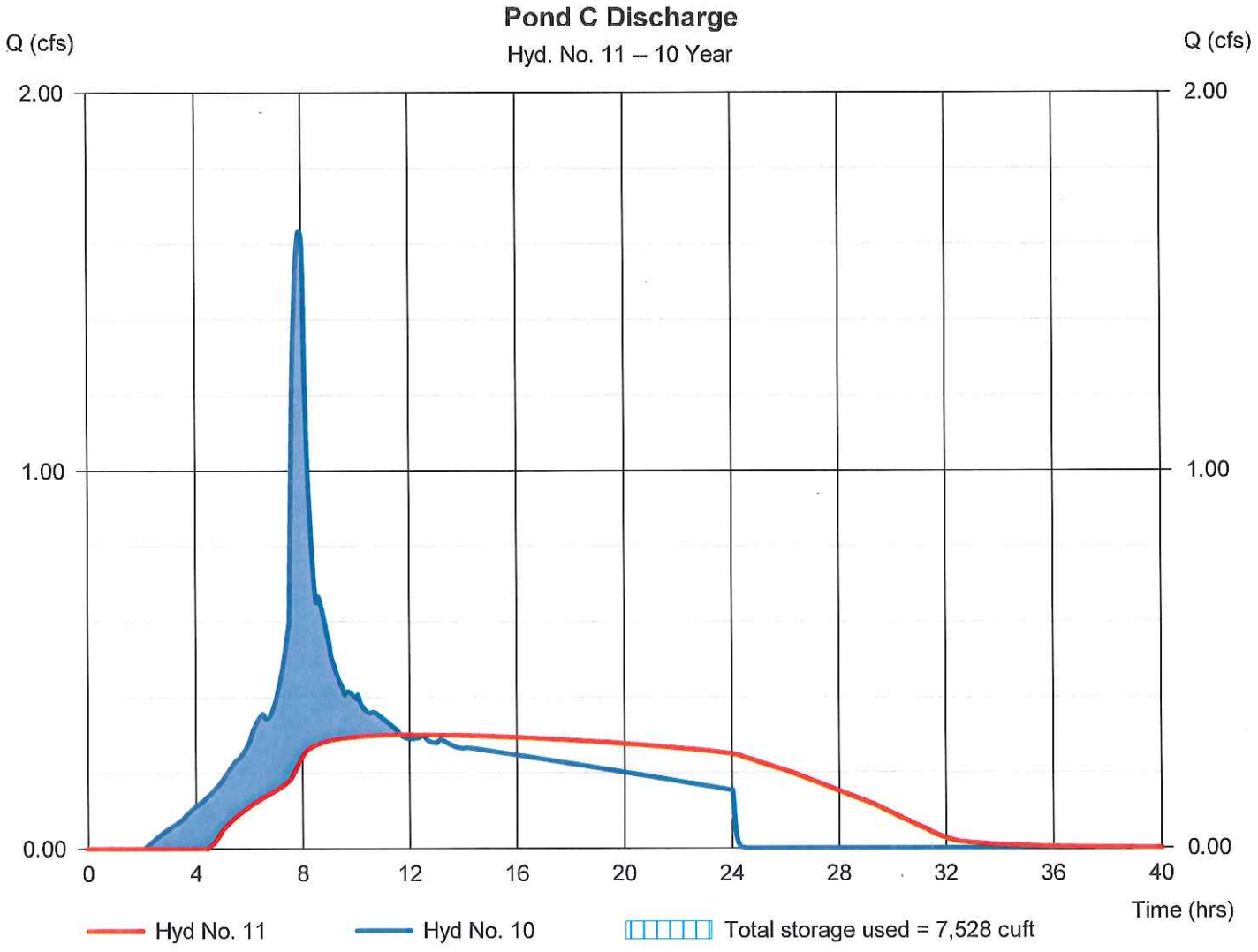
Hydrograph Report

Hyd. No. 11

Pond C Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.302 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.67 hrs
Time interval	= 2 min	Hyd. volume	= 22,390 cuft
Inflow hyd. No.	= 10 - Post-Developed Into Pond C	Max. Elevation	= 159.69 ft
Reservoir name	= POND C	Max. Storage	= 7,528 cuft

Storage Indication method used.

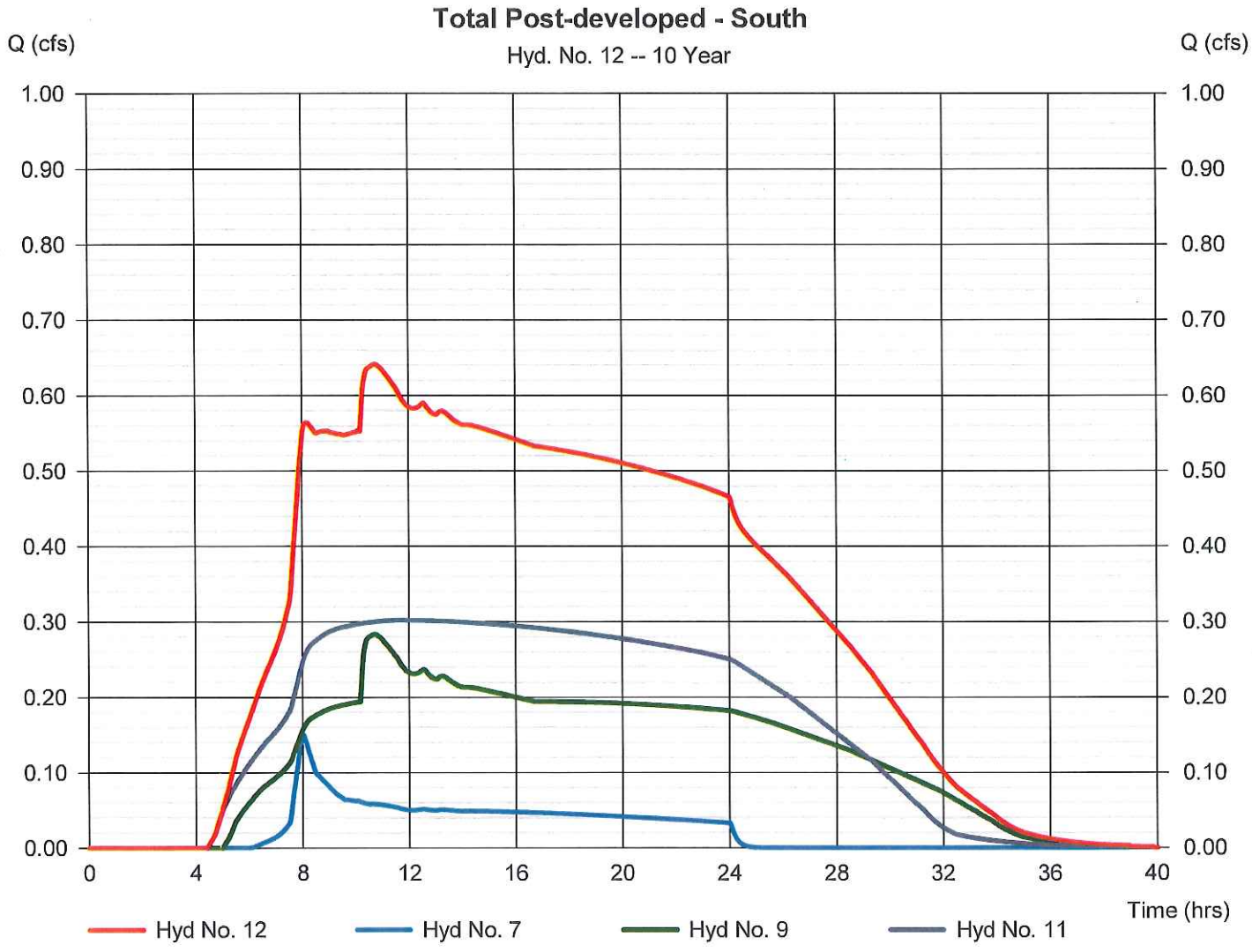


Hydrograph Report

Hyd. No. 12

Total Post-developed - South

Hydrograph type	= Combine	Peak discharge	= 0.641 cfs
Storm frequency	= 10 yrs	Time to peak	= 10.70 hrs
Time interval	= 2 min	Hyd. volume	= 42,563 cuft
Inflow hyds.	= 7, 9, 11	Contrib. drain. area	= 0.710 ac



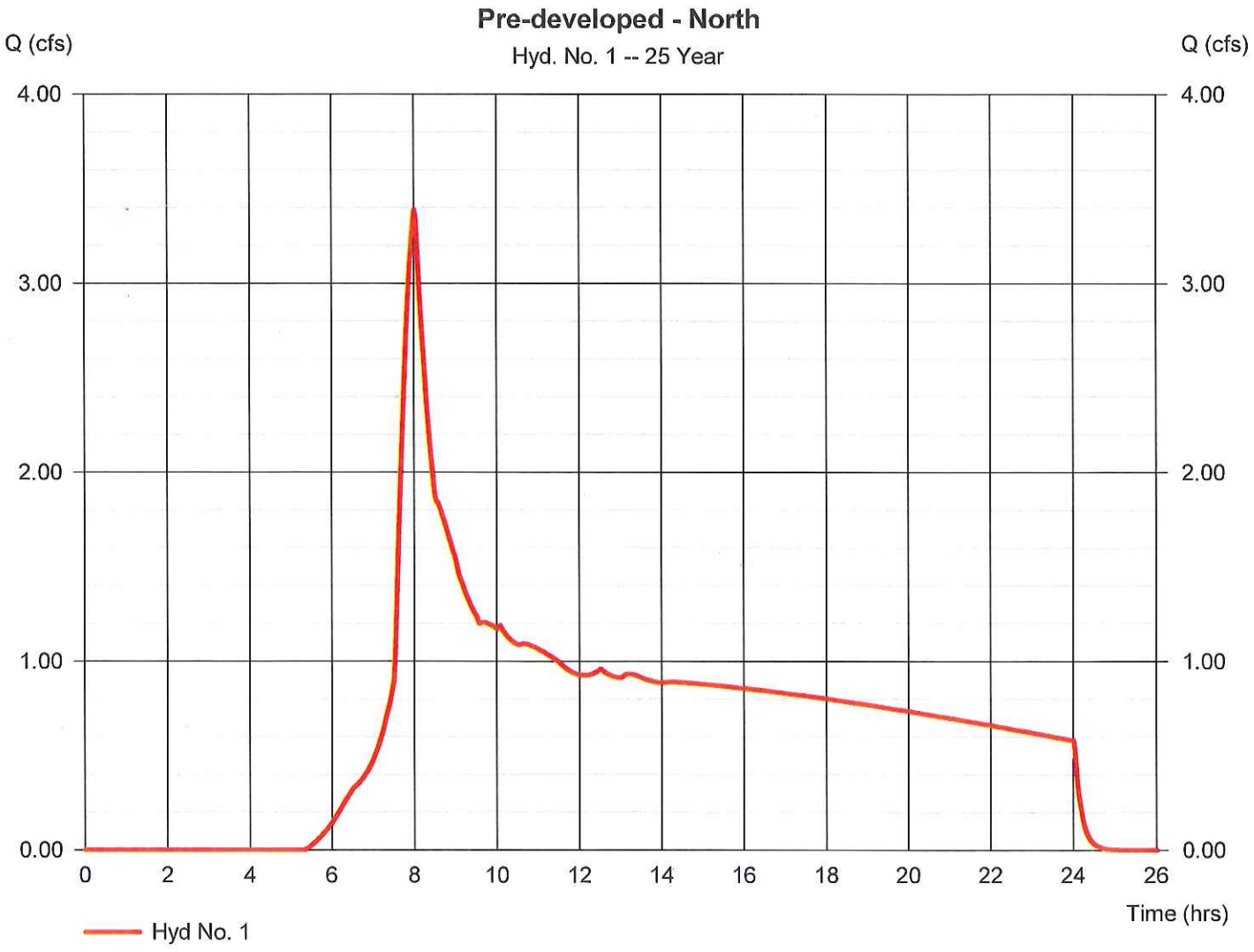
Hydrograph Report

Hyd. No. 1

Pre-developed - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 3.388 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 60,924 cuft
Drainage area	= 10.070 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.330 x 98) + (9.740 x 74)] / 10.070



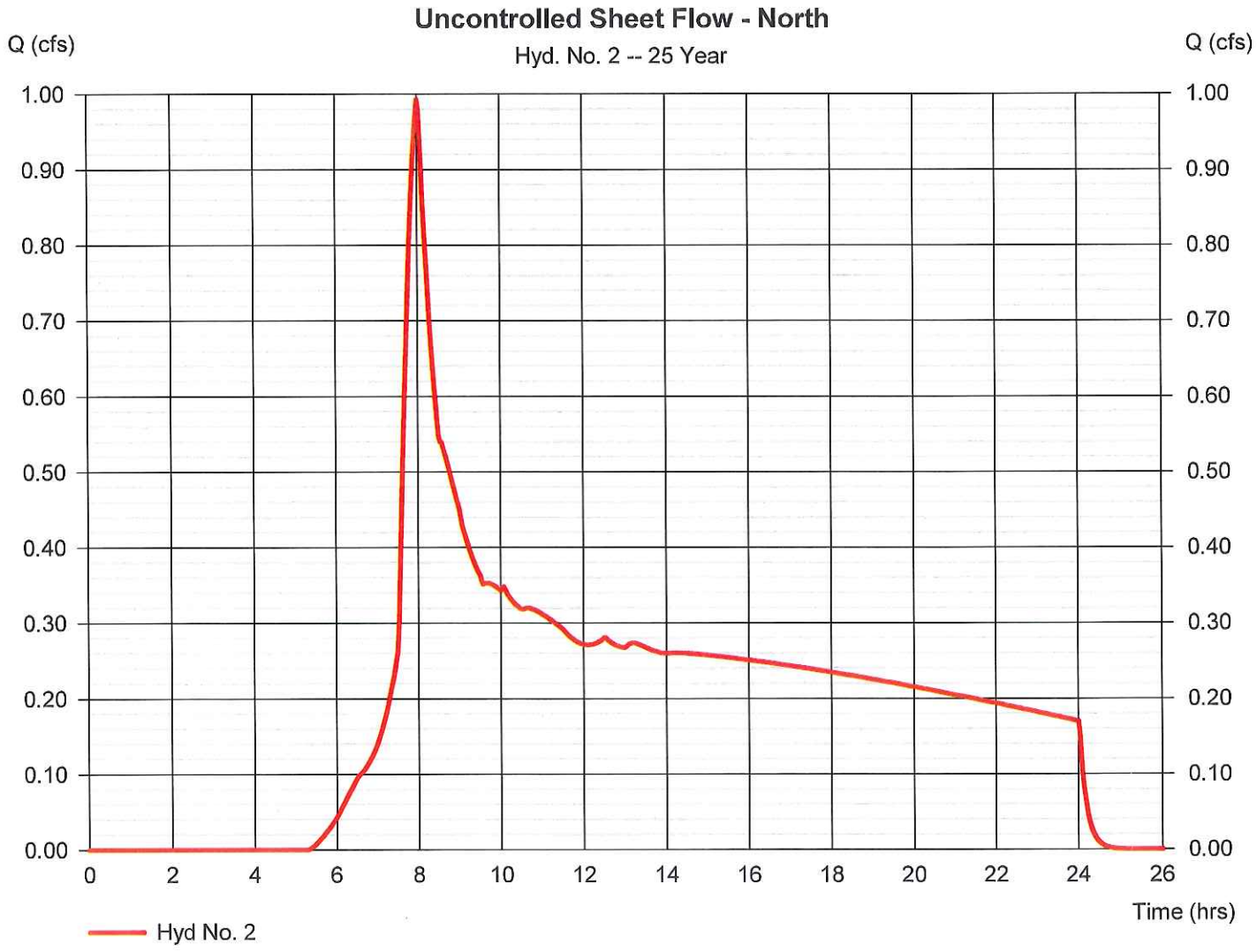
Hydrograph Report

Hyd. No. 2

Uncontrolled Sheet Flow - North

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.993 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 17,847 cuft
Drainage area	= 2.950 ac	Curve number	= 75*
Basin Slope	= 5.0 %	Hydraulic length	= 540 ft
Tc method	= LAG	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.120 x 98) + (2.830 x 74)] / 2.950



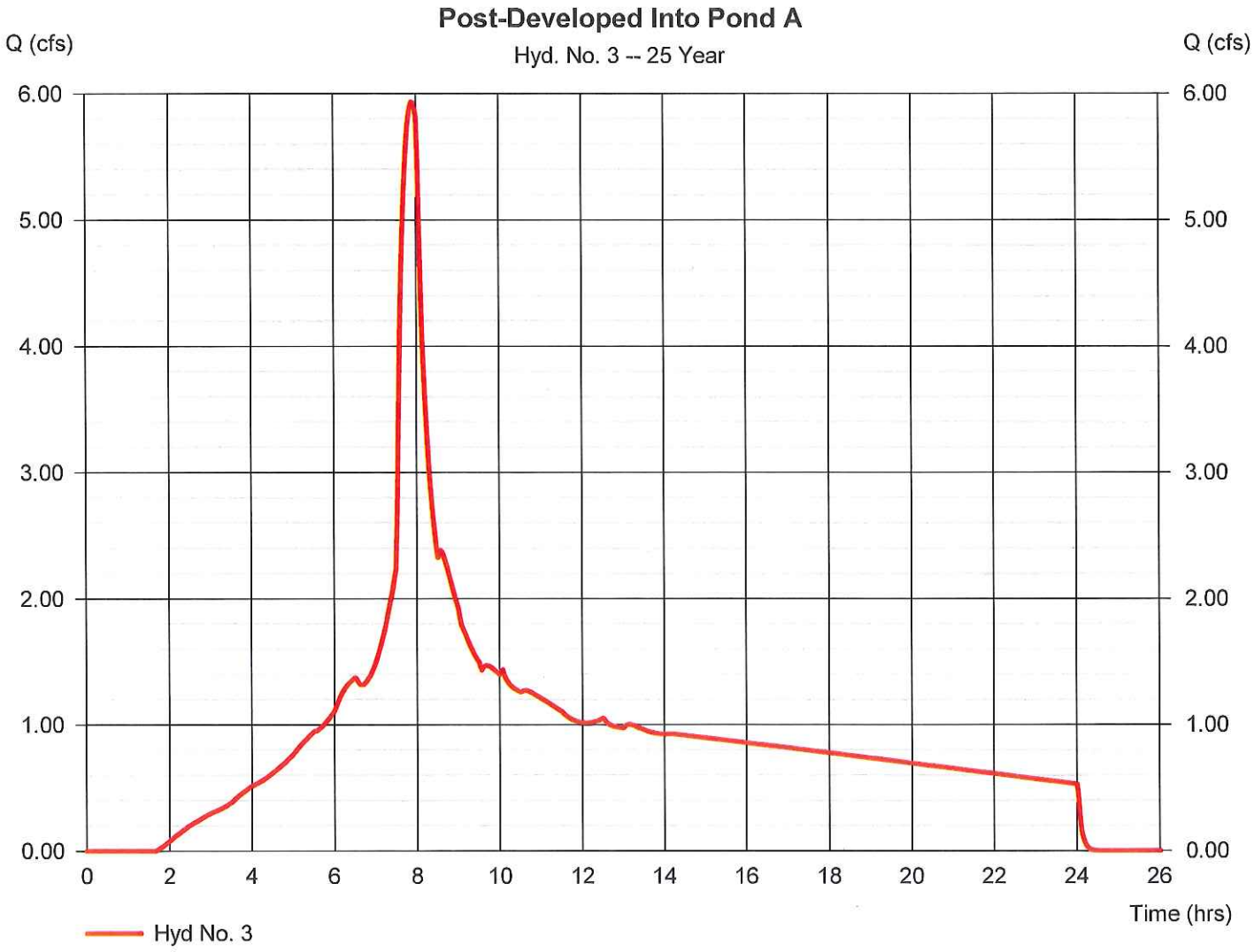
Hydrograph Report

Hyd. No. 3

Post-Developed Into Pond A

Hydrograph type	= SBUH Runoff	Peak discharge	= 5.935 cfs
Storm frequency	= 25 yrs	Time to peak	= 7.90 hrs
Time interval	= 2 min	Hyd. volume	= 83,220 cuft
Drainage area	= 7.120 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	= n/a

* Composite (Area/CN) = [(5.670 x 98) + (1.450 x 74)] / 7.120



Hydrograph Report

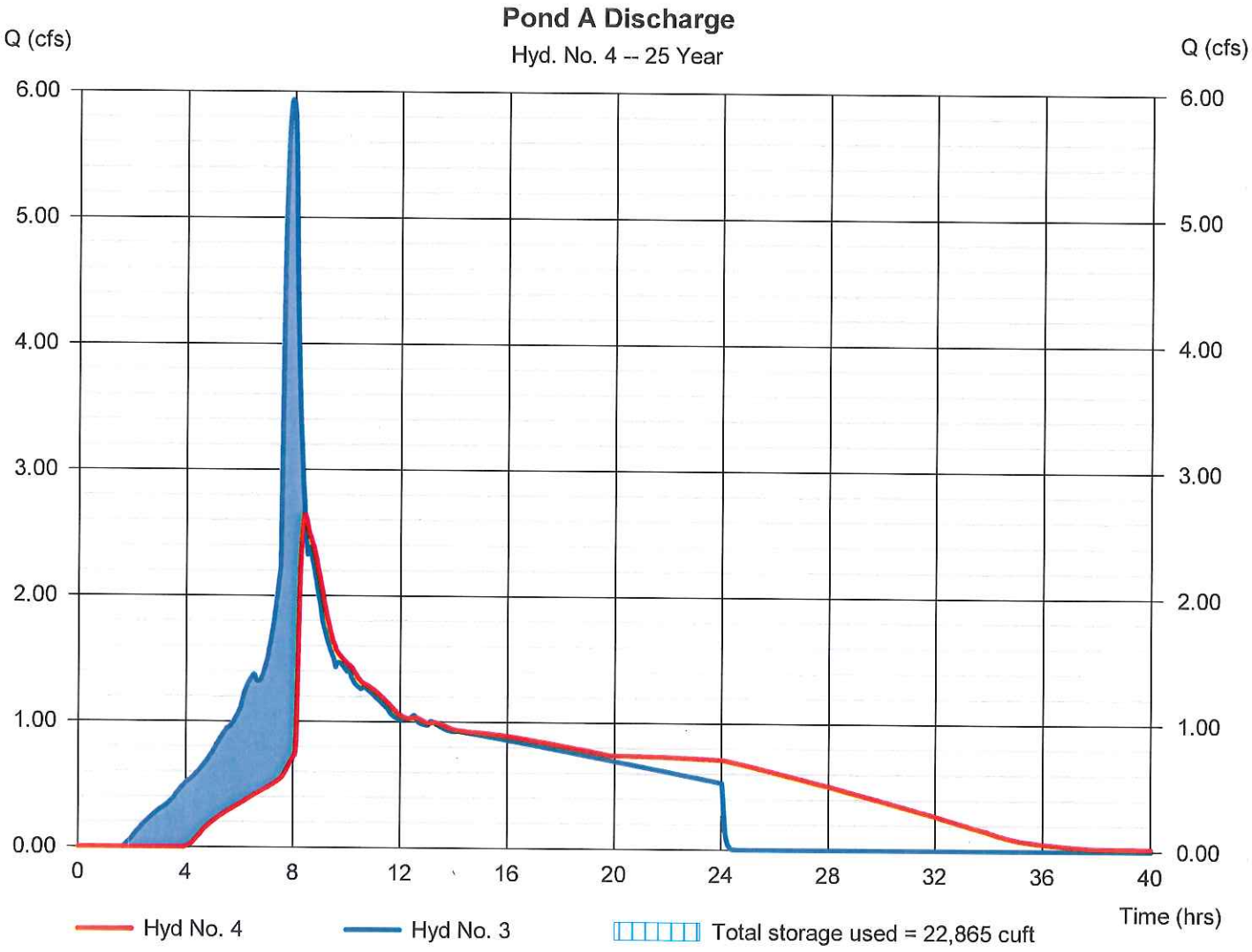
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Thursday, 06 / 28 / 2018

Hyd. No. 4

Pond A Discharge

Hydrograph type	= Reservoir	Peak discharge	= 2.642 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.40 hrs
Time interval	= 2 min	Hyd. volume	= 81,207 cuft
Inflow hyd. No.	= 3 - Post-Developed Into Pond A	Max. Elevation	= 141.90 ft
Reservoir name	= POND A	Max. Storage	= 22,865 cuft

Storage Indication method used.

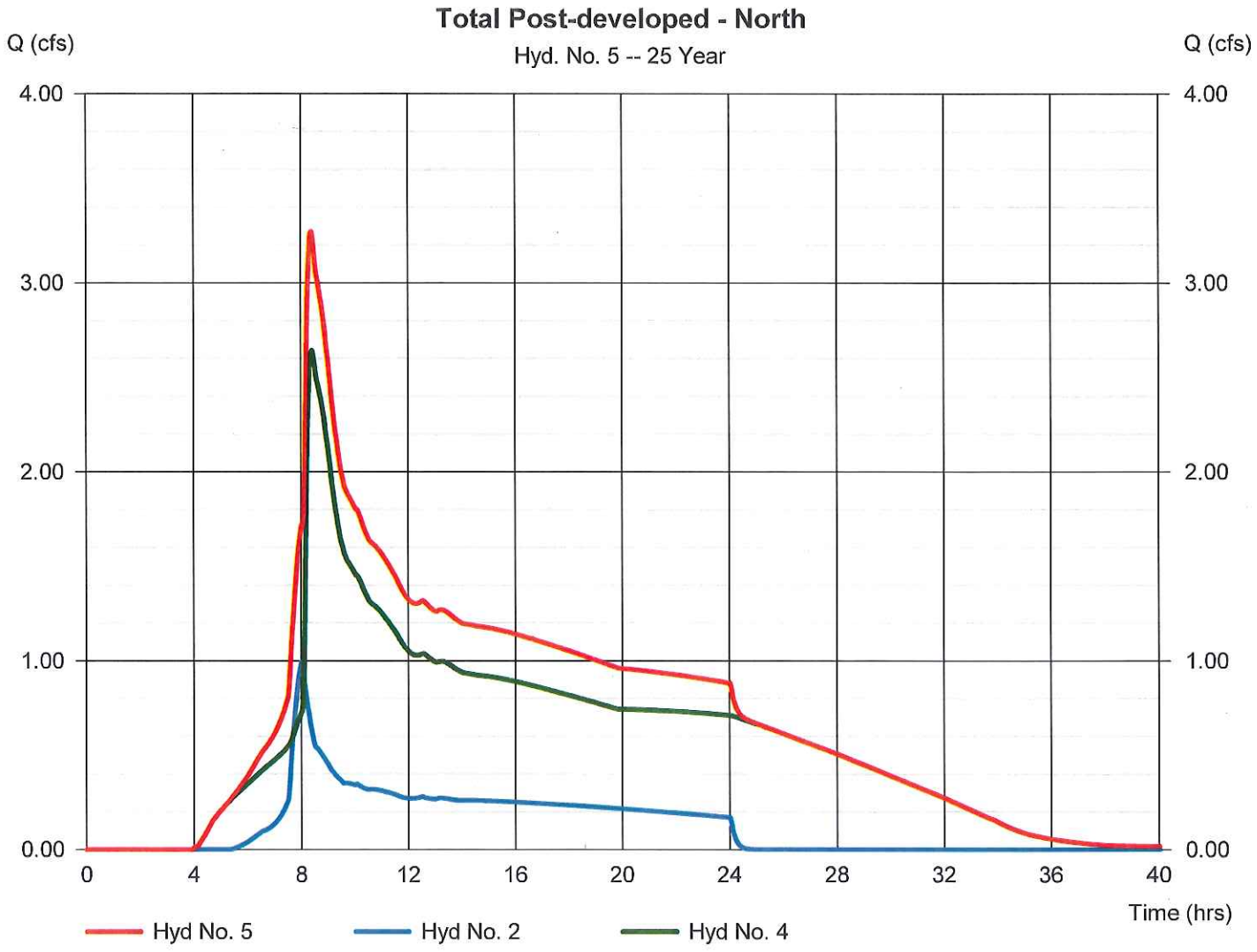


Hydrograph Report

Hyd. No. 5

Total Post-developed - North

Hydrograph type	= Combine	Peak discharge	= 3.270 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.37 hrs
Time interval	= 2 min	Hyd. volume	= 99,054 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 2.950 ac



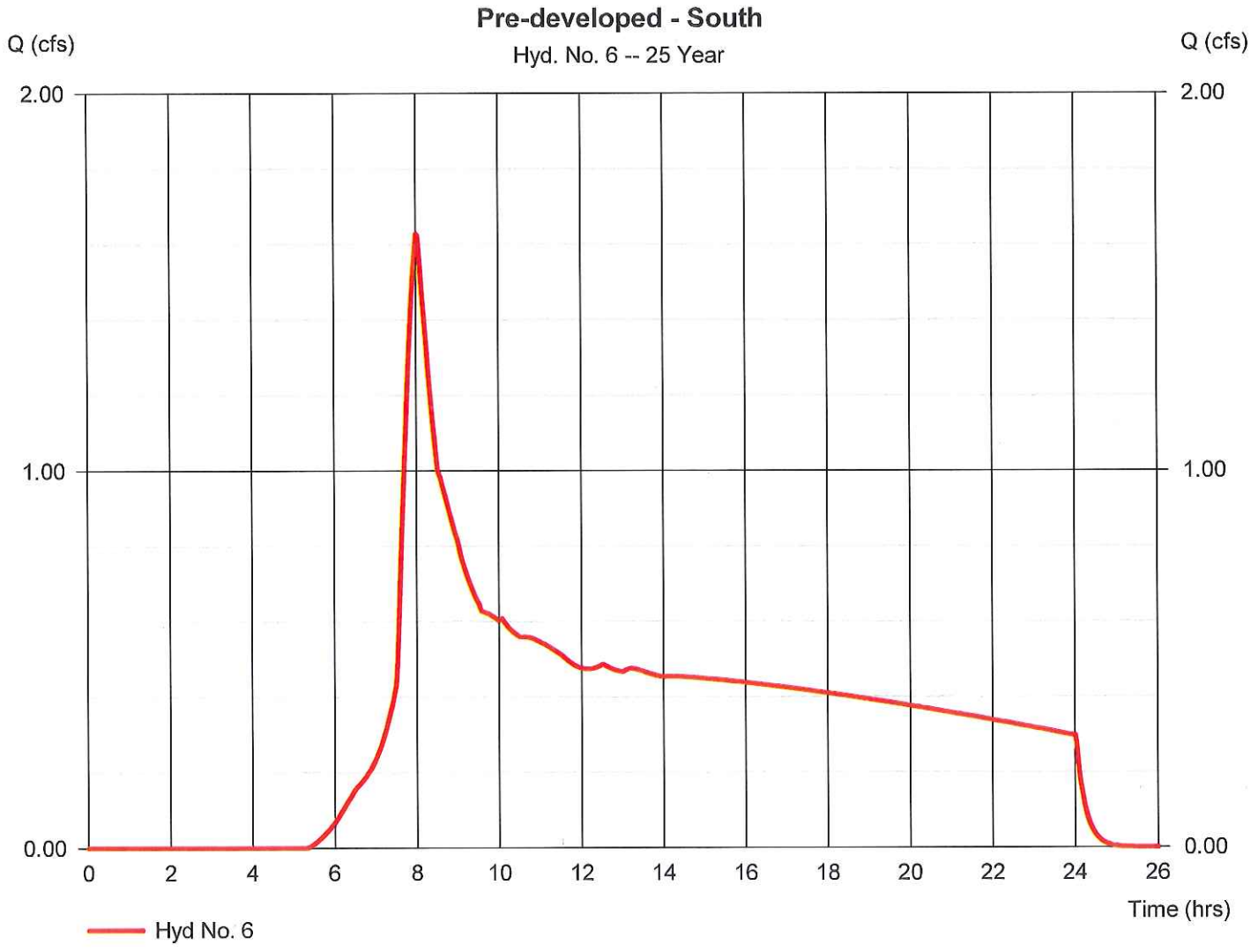
Hydrograph Report

Hyd. No. 6

Pre-developed - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.628 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 31,097 cuft
Drainage area	= 5.140 ac	Curve number	= 75*
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.20 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(0.160 x 98) + (4.980 x 74)] / 5.140

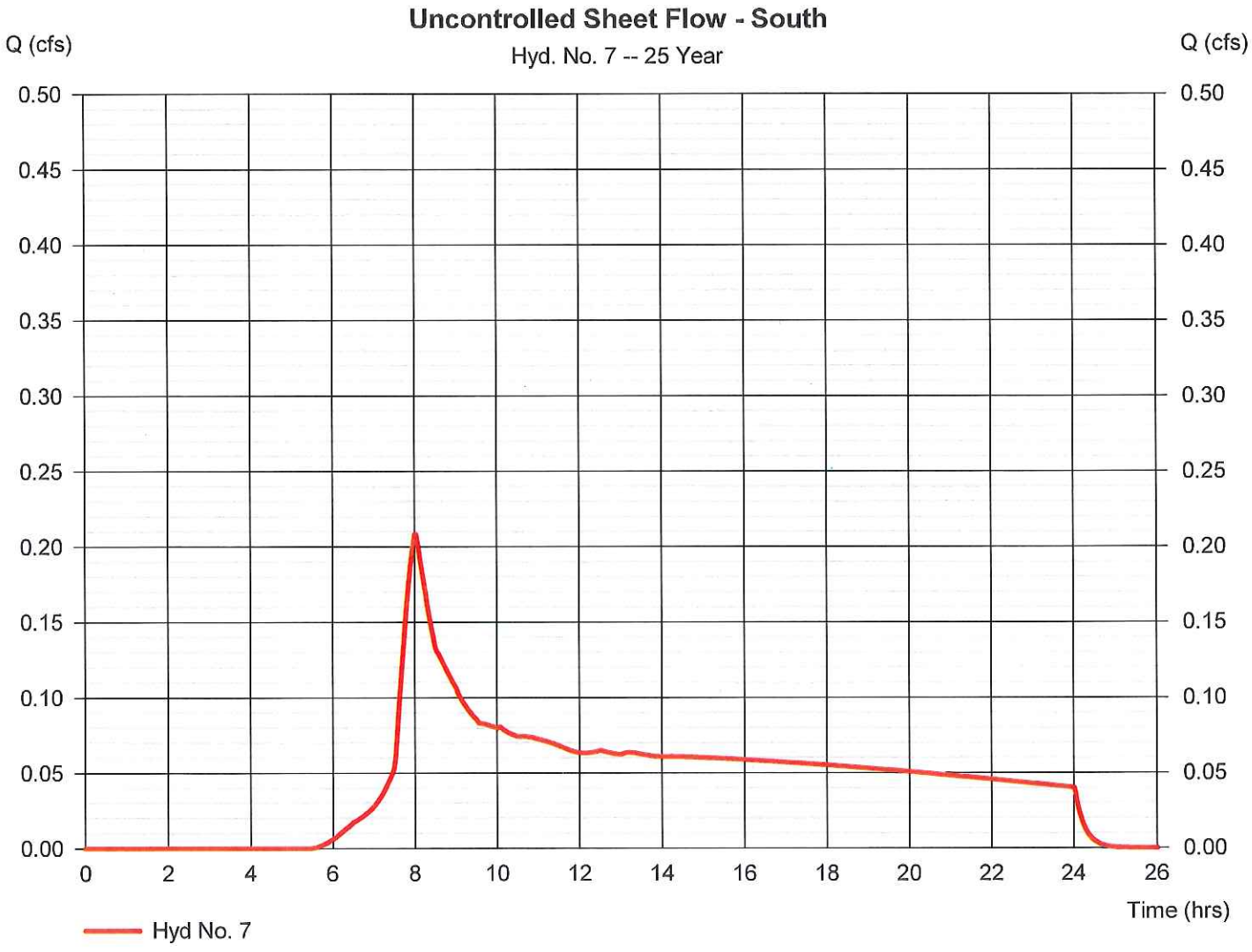


Hydrograph Report

Hyd. No. 7

Uncontrolled Sheet Flow - South

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.208 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,114 cuft
Drainage area	= 0.710 ac	Curve number	= 74
Basin Slope	= 0.5 %	Hydraulic length	= 180 ft
Tc method	= LAG	Time of conc. (Tc)	= 13.60 min
Total precip.	= 4.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a



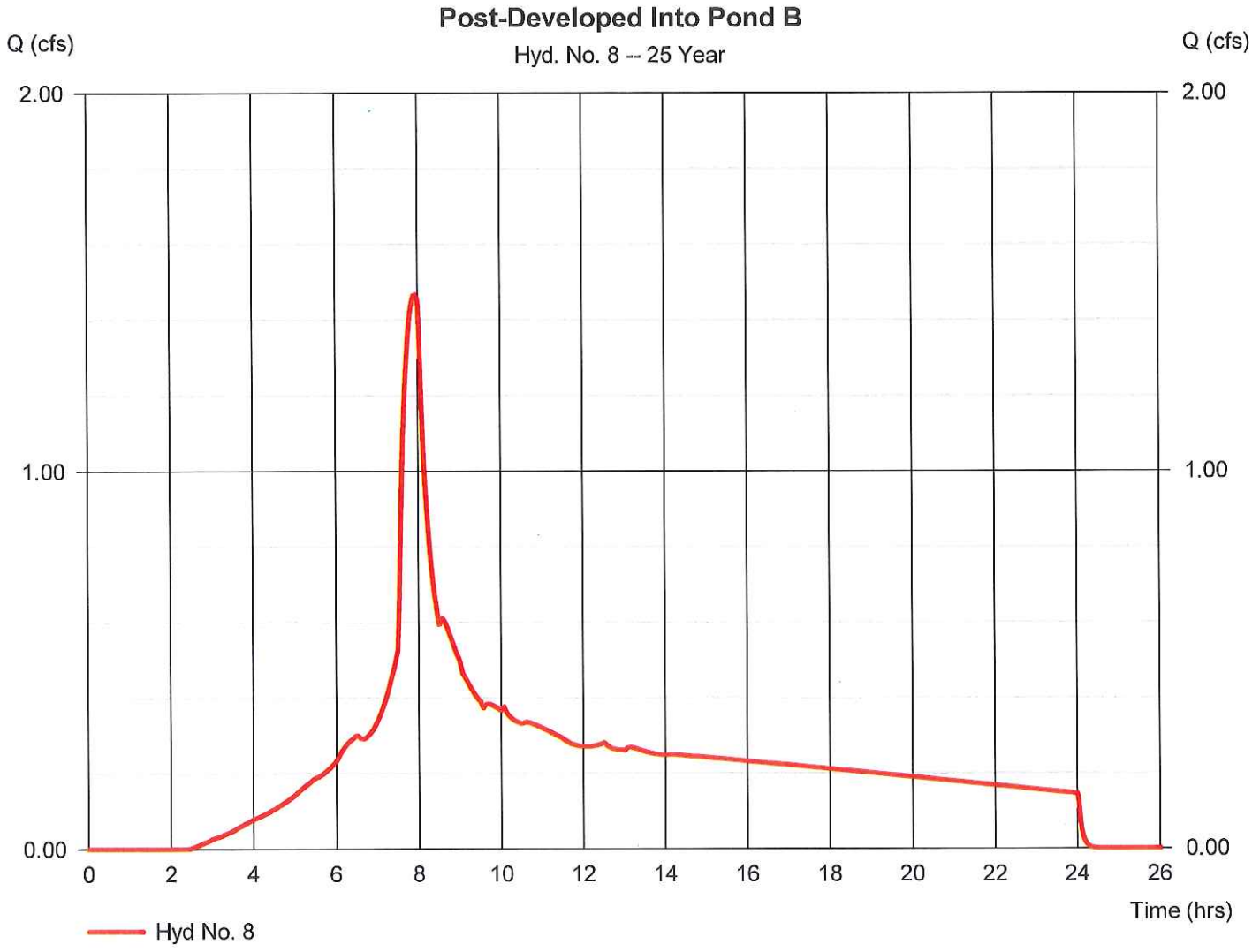
Hydrograph Report

Hyd. No. 8

Post-Developed Into Pond B

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.468 cfs
Storm frequency	= 25 yrs	Time to peak	= 7.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,803 cuft
Drainage area	= 2.030 ac	Curve number	= 89*
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	= n/a

* Composite (Area/CN) = [(1.260 x 98) + (0.770 x 74)] / 2.030



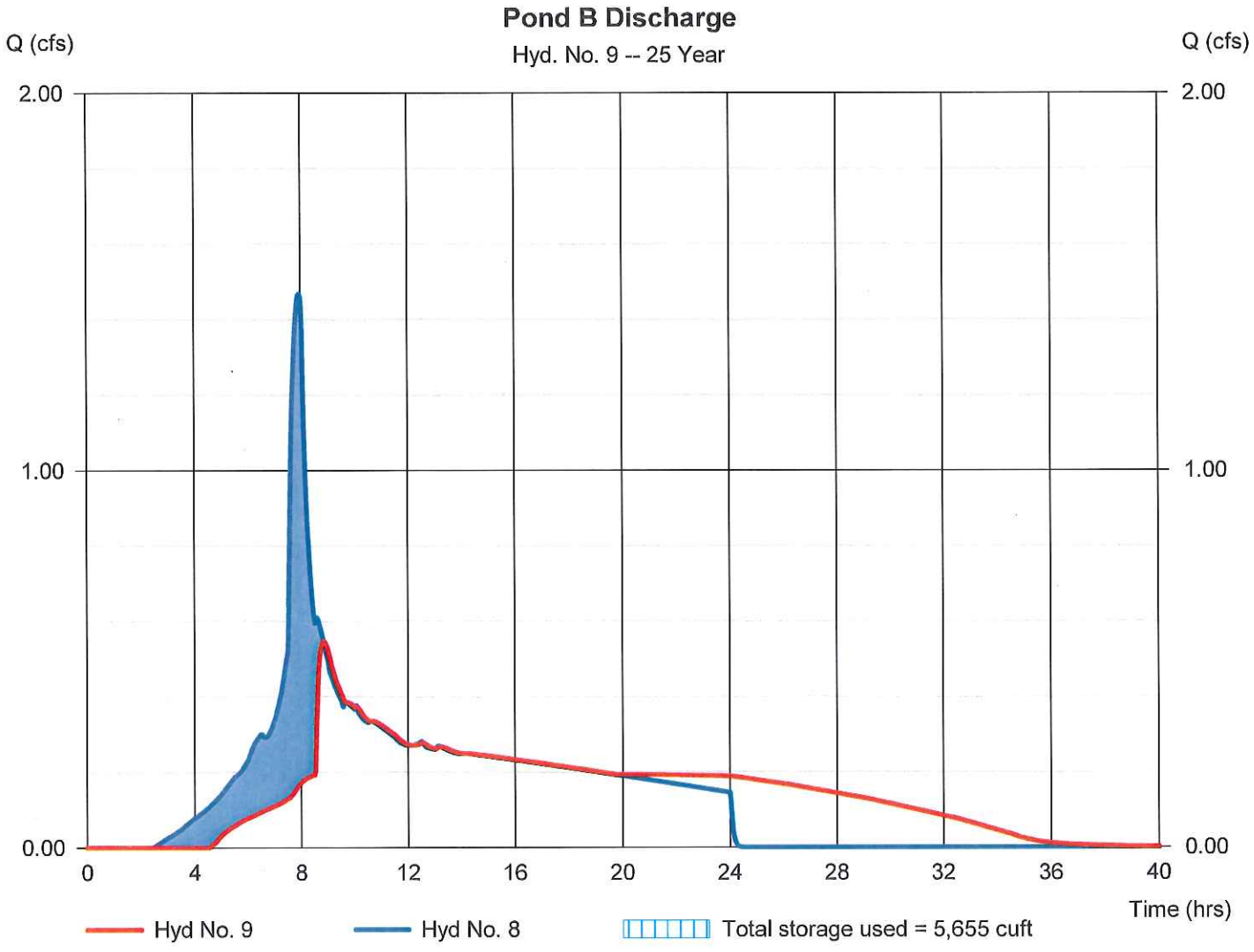
Hydrograph Report

Hyd. No. 9

Pond B Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.547 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.83 hrs
Time interval	= 2 min	Hyd. volume	= 20,410 cuft
Inflow hyd. No.	= 8 - Post-Developed Into Pond B	Max. Elevation	= 159.97 ft
Reservoir name	= POND B	Max. Storage	= 5,655 cuft

Storage Indication method used.



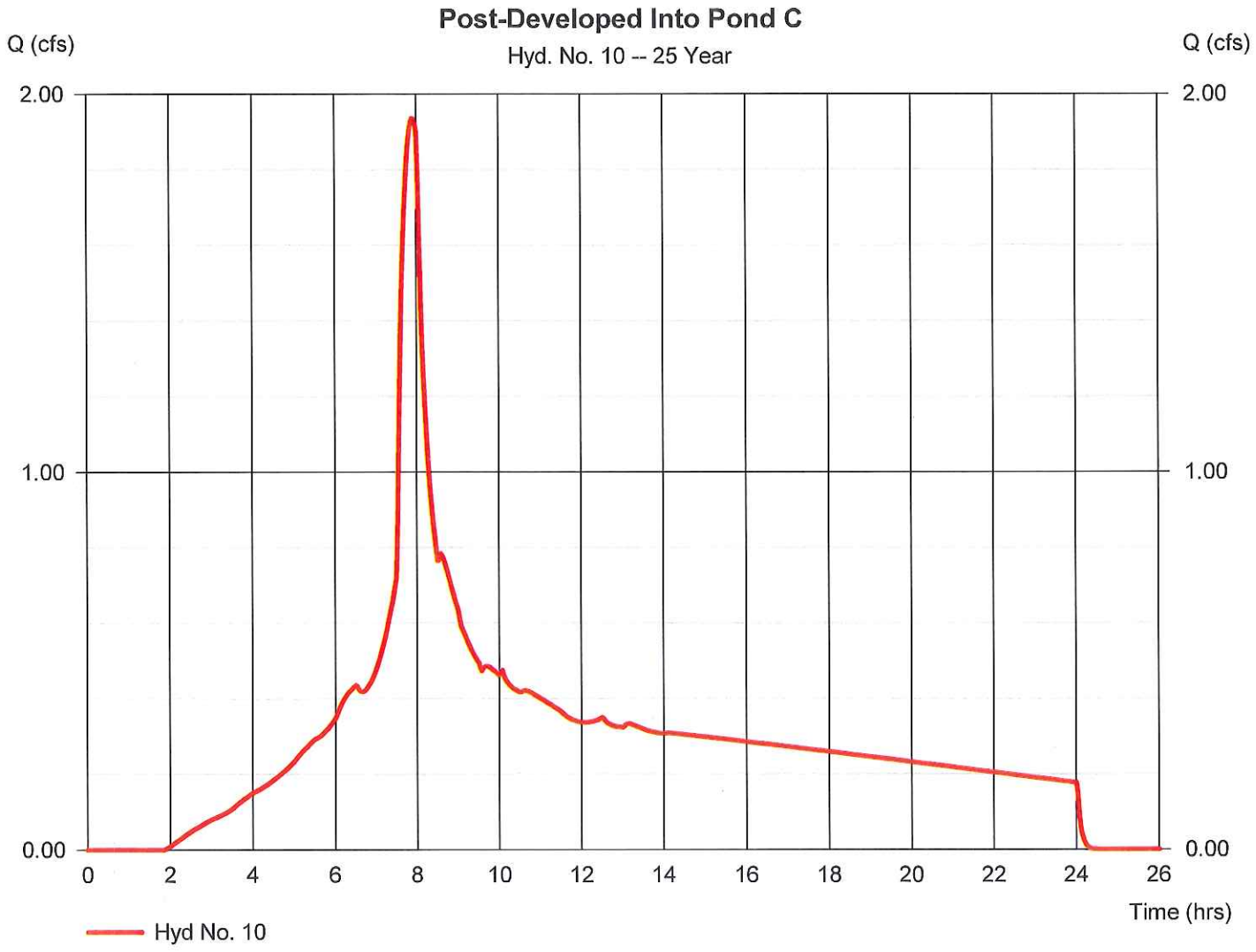
Hydrograph Report

Hyd. No. 10

Post-Developed Into Pond C

Hydrograph type	= SBUH Runoff	Peak discharge	= 1.936 cfs
Storm frequency	= 25 yrs	Time to peak	= 7.90 hrs
Time interval	= 2 min	Hyd. volume	= 27,160 cuft
Drainage area	= 2.400 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	= n/a

* Composite (Area/CN) = [(1.830 x 98) + (0.570 x 74)] / 2.400



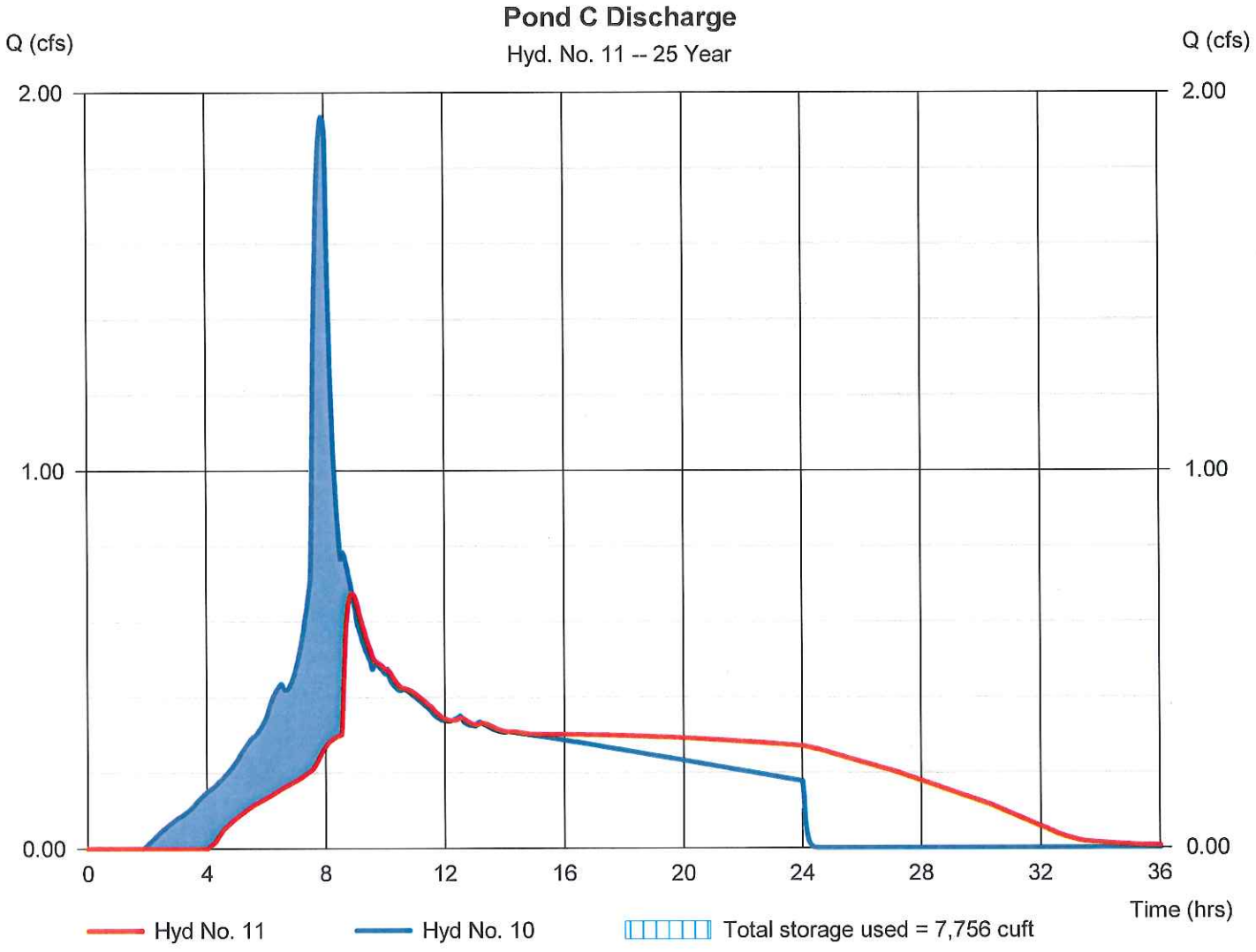
Hydrograph Report

Hyd. No. 11

Pond C Discharge

Hydrograph type	= Reservoir	Peak discharge	= 0.675 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.90 hrs
Time interval	= 2 min	Hyd. volume	= 26,579 cuft
Inflow hyd. No.	= 10 - Post-Developed Into Pond C	Max. Elevation	= 159.78 ft
Reservoir name	= POND C	Max. Storage	= 7,756 cuft

Storage Indication method used.

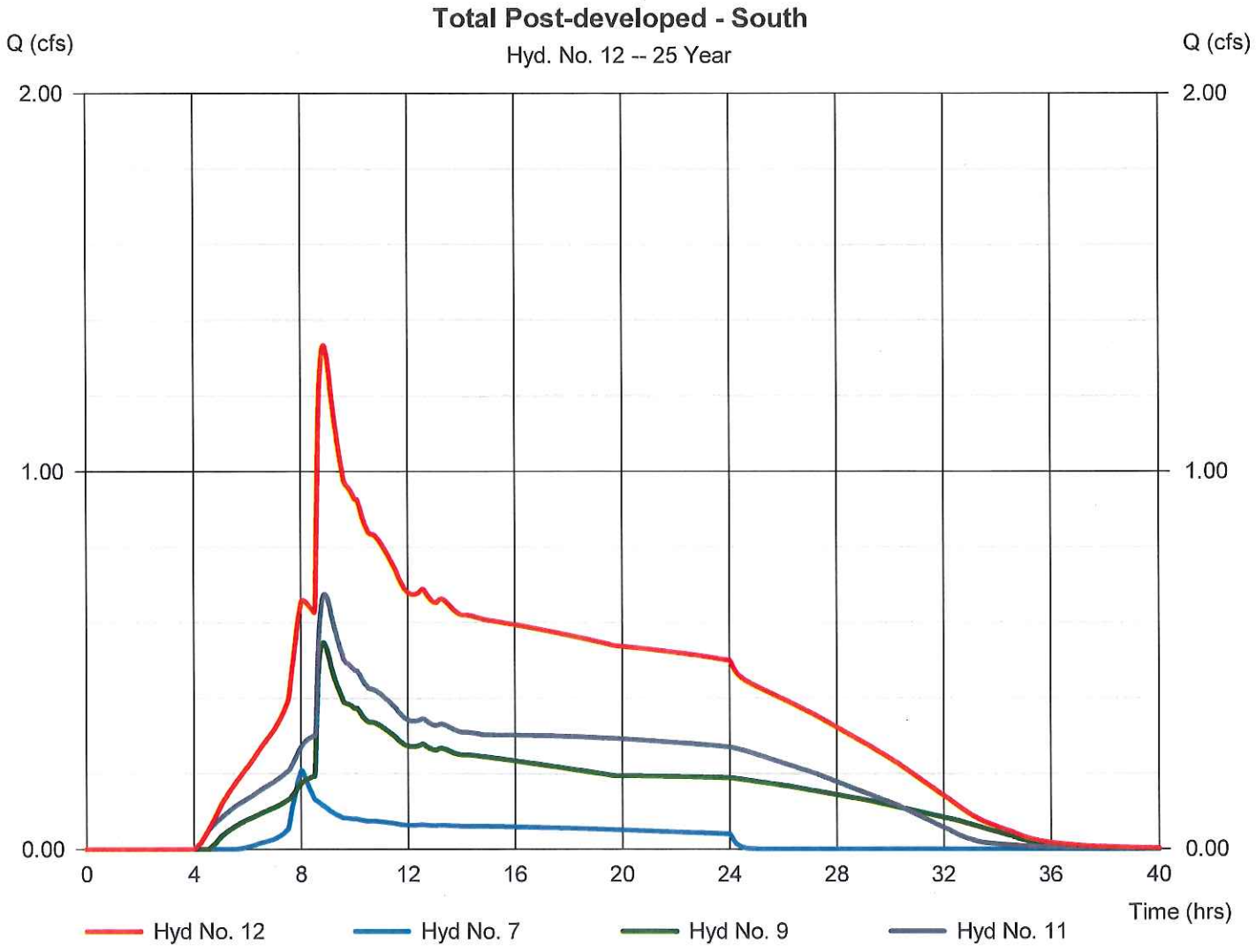


Hydrograph Report

Hyd. No. 12

Total Post-developed - South

Hydrograph type	= Combine	Peak discharge	= 1.333 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.87 hrs
Time interval	= 2 min	Hyd. volume	= 51,103 cuft
Inflow hyds.	= 7, 9, 11	Contrib. drain. area	= 0.710 ac



Pond Report

Pond No. 1 - POND A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 137.90 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	137.90	4,747	0	0
1.00	138.90	5,219	4,981	4,981
2.00	139.90	5,708	5,461	10,442
3.00	140.90	6,213	5,958	16,400
4.00	141.90	6,734	6,471	22,871
5.00	142.90	7,273	7,001	29,872

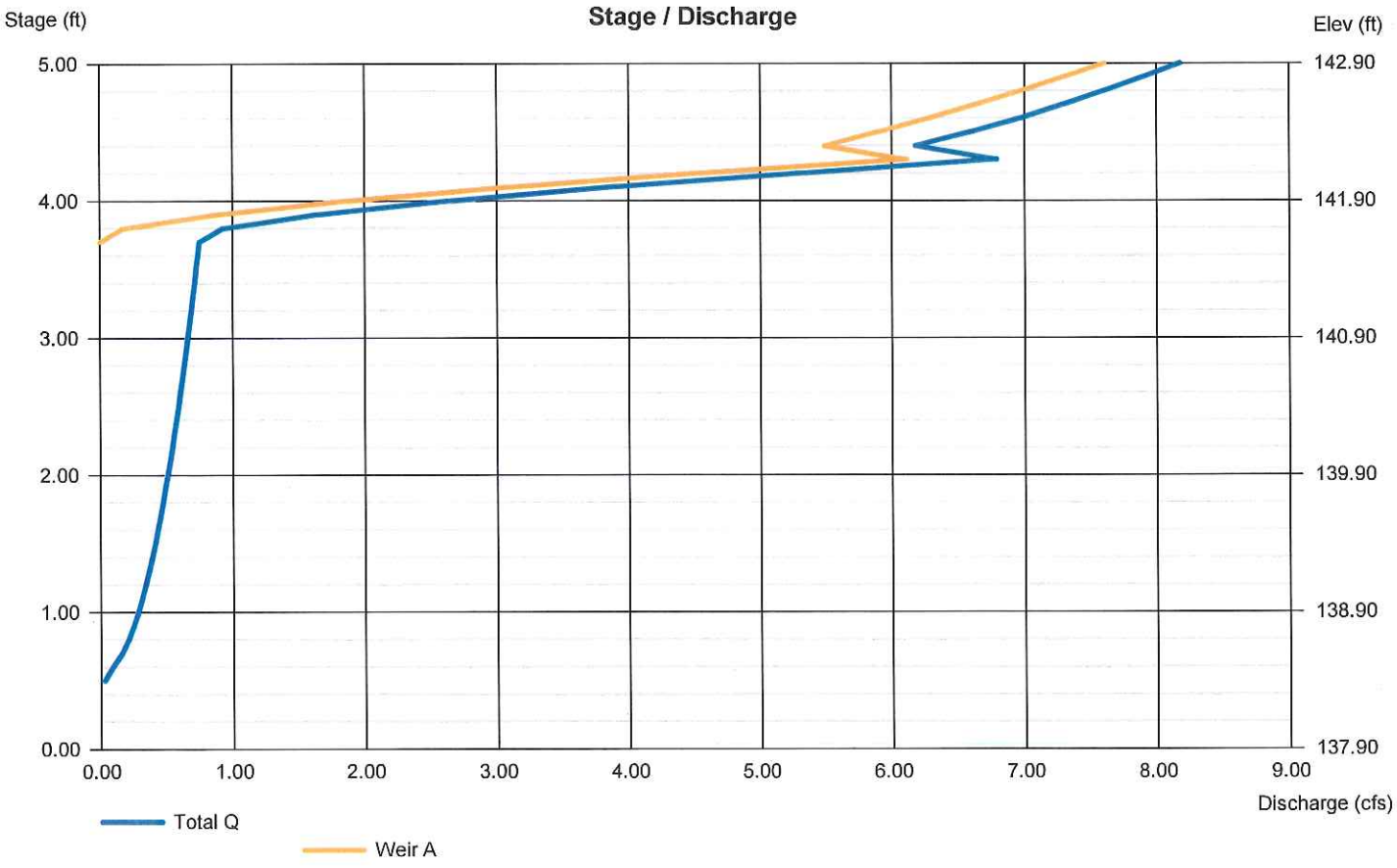
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	4.00	Inactive	Inactive
Span (in)	= 12.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 135.90	138.30	0.00	0.00
Length (ft)	= 10.00	0.00	0.00	0.00
Slope (%)	= 1.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.50	Inactive	Inactive	Inactive
Crest El. (ft)	= 141.65	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond Report

Pond No. 2 - POND B

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 156.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	156.00	834	0	0
1.00	157.00	1,104	966	966
2.00	158.00	1,406	1,252	2,218
3.00	159.00	1,739	1,569	3,787
4.00	160.00	2,103	1,918	5,705
5.00	161.00	2,570	2,332	8,037

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	2.00	Inactive	Inactive
Span (in)	= 12.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 154.00	156.40	0.00	0.00
Length (ft)	= 10.00	0.00	0.00	0.00
Slope (%)	= 1.00	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	Yes	No	No

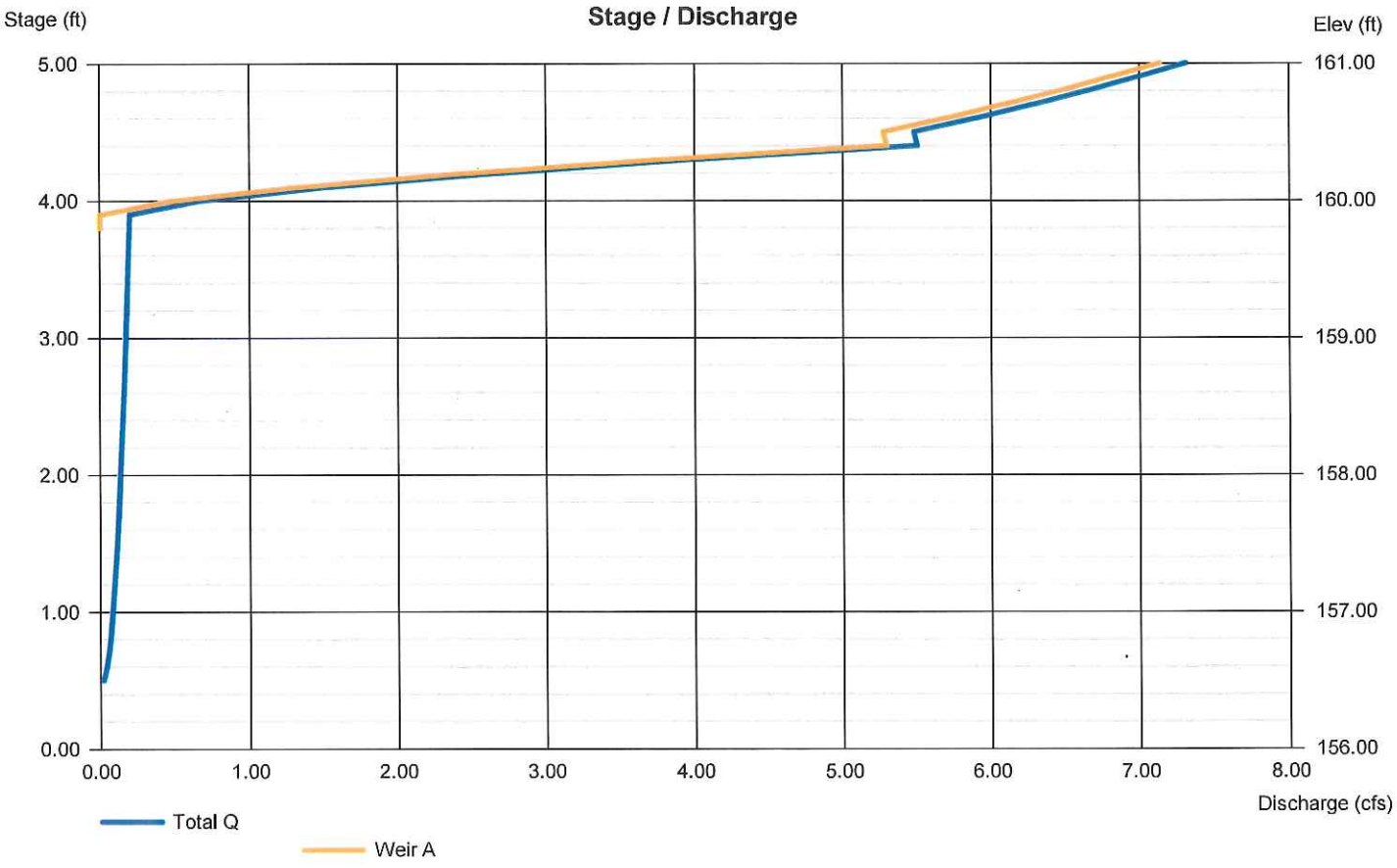
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.50	Inactive	Inactive	Inactive
Crest El. (ft)	= 159.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



Pond Report

Pond No. 3 - POND C

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 155.80 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	155.80	1,279	0	0
1.00	156.80	1,592	1,433	1,433
2.00	157.80	1,934	1,760	3,193
3.00	158.80	2,305	2,117	5,309
4.00	159.80	2,705	2,502	7,811
5.00	160.80	3,135	2,917	10,728

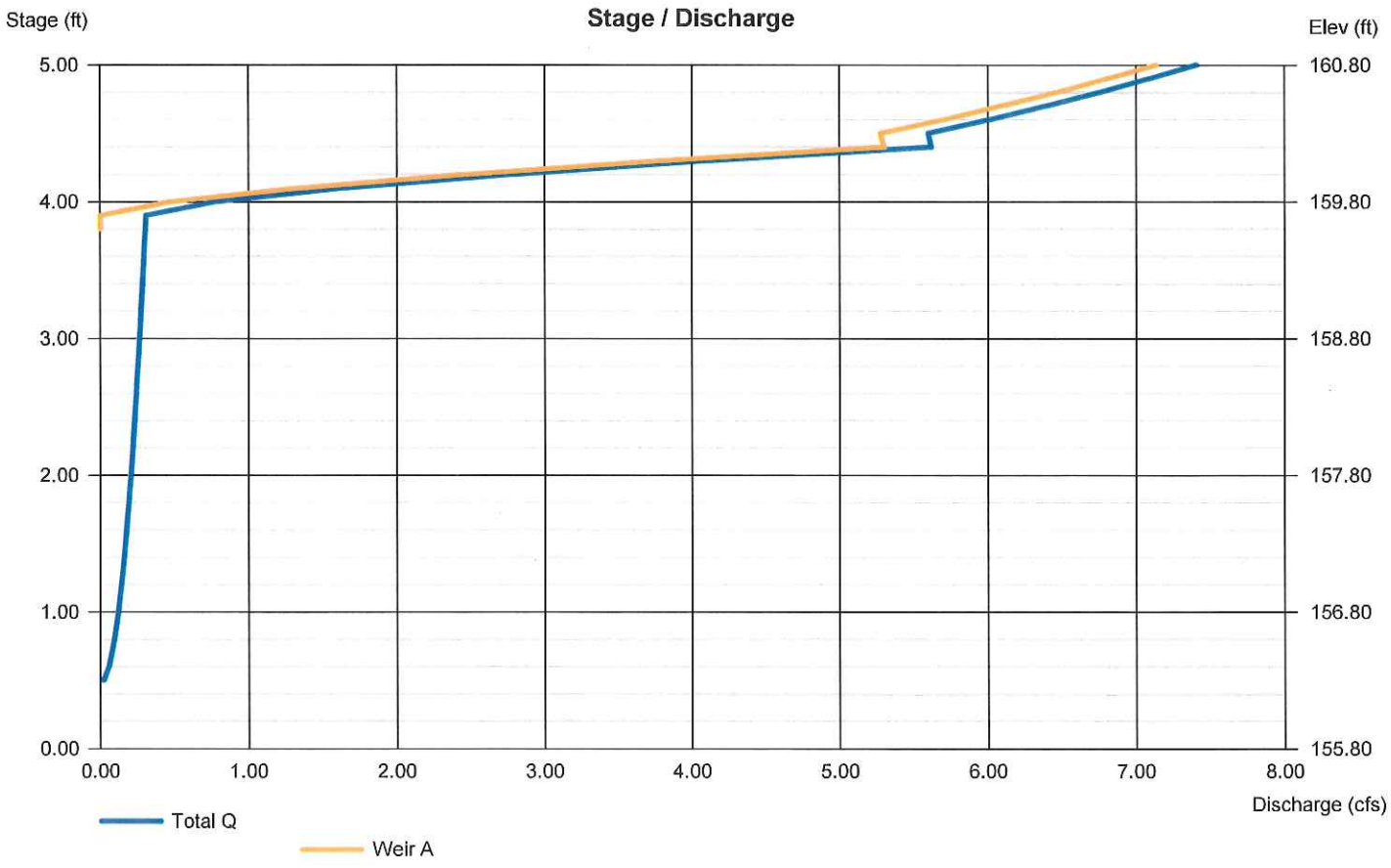
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	2.50	Inactive	Inactive
Span (in)	= 12.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 153.80	156.20	0.00	0.00
Length (ft)	= 10.00	0.00	0.00	0.00
Slope (%)	= 1.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.50	Inactive	Inactive	Inactive
Crest El. (ft)	= 159.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond Report

Pond No. 3 - POND C

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 155.80 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	155.80	1,279	0	0
1.00	156.80	1,592	1,433	1,433
2.00	157.80	1,934	1,760	3,193
3.00	158.80	2,305	2,117	5,309
4.00	159.80	2,705	2,502	7,811
5.00	160.80	3,135	2,917	10,728

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.00	Inactive	Inactive	Inactive
Span (in)	= 3.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 156.13	0.00	0.00	0.00
Length (ft)	= 1.00	0.00	0.00	0.00
Slope (%)	= 1.00	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

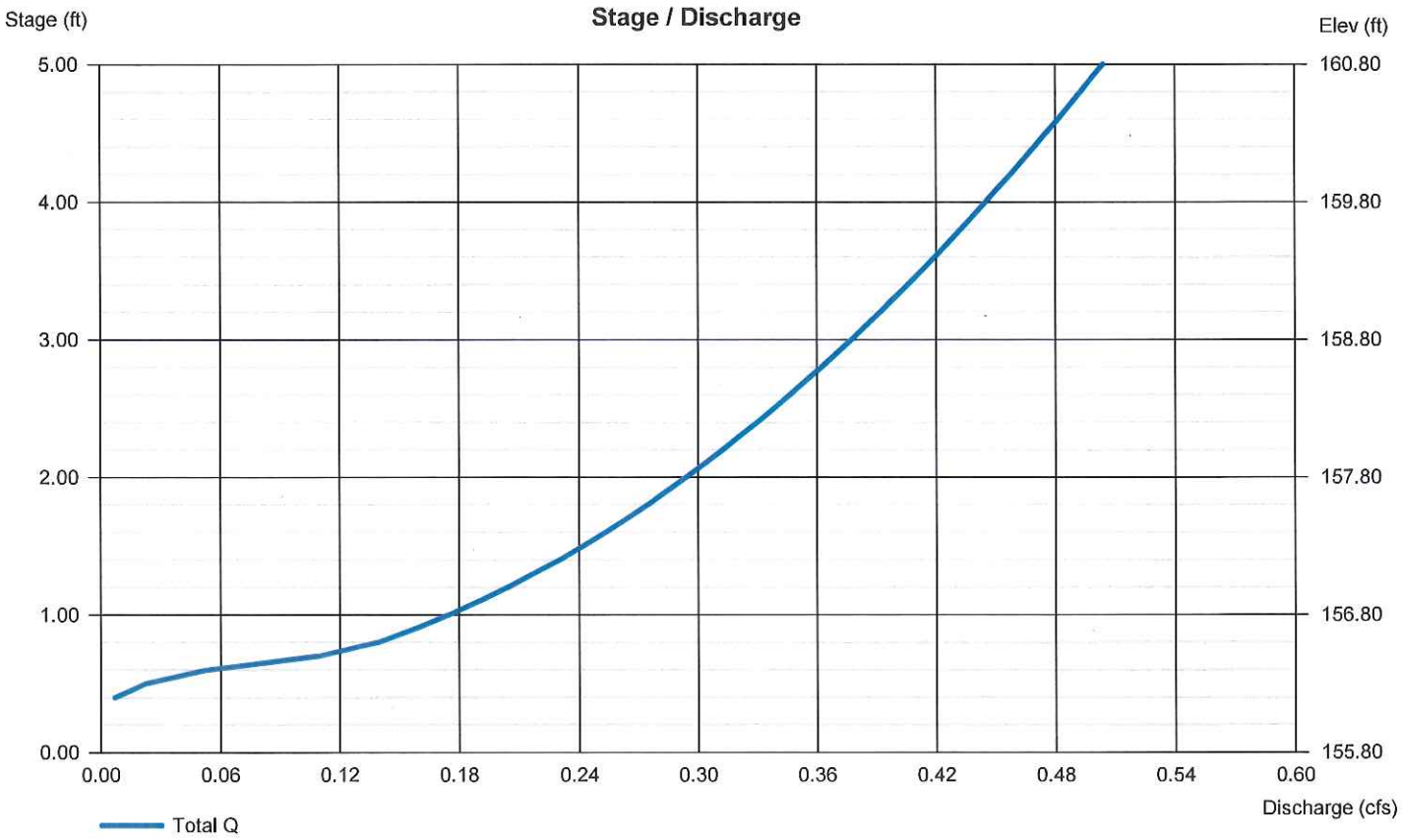
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	Inactive	Inactive	Inactive
Crest El. (ft)	= 159.80	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 Wet area)

TW Elev. (ft) = 0.00

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



Appendix 2: Conveyance

Appendix 3: Soil Properties

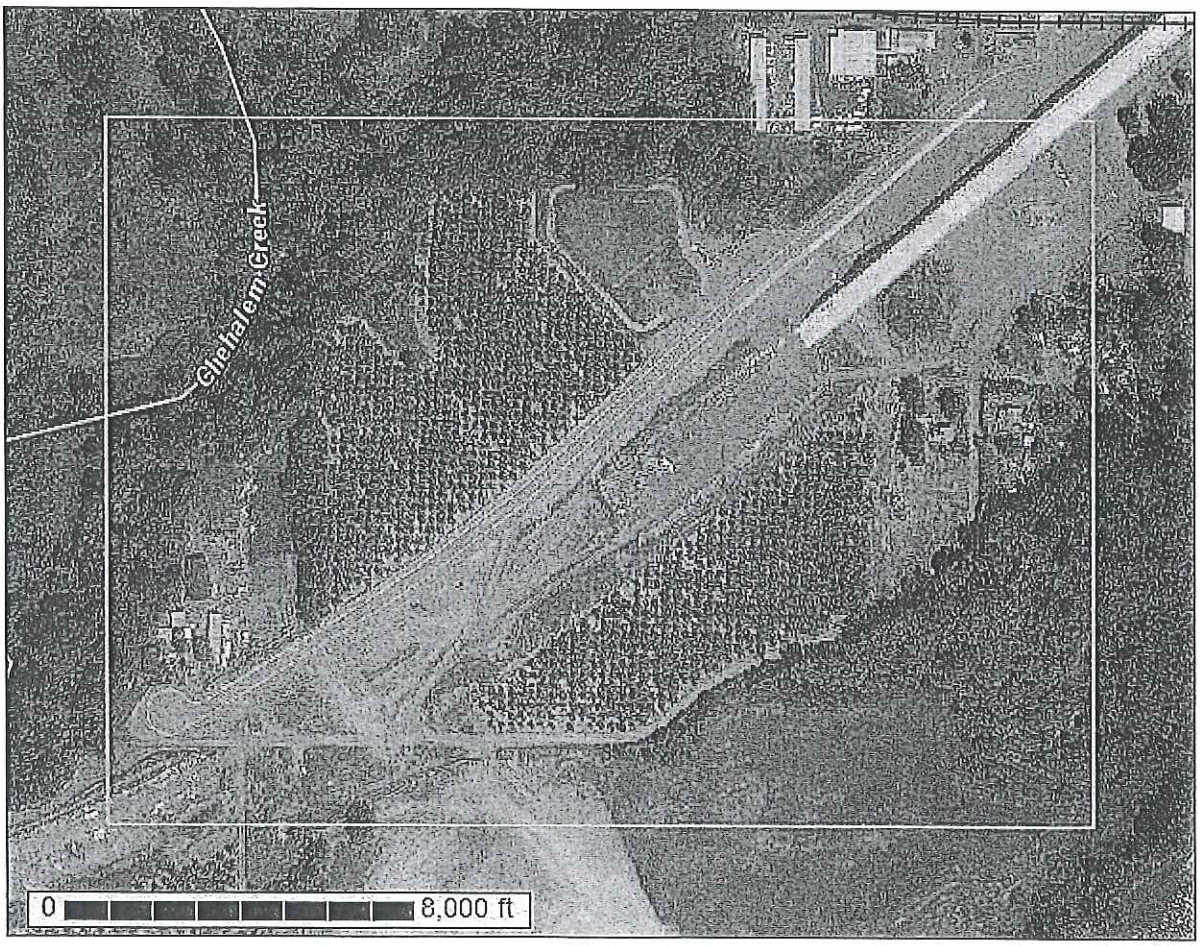
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

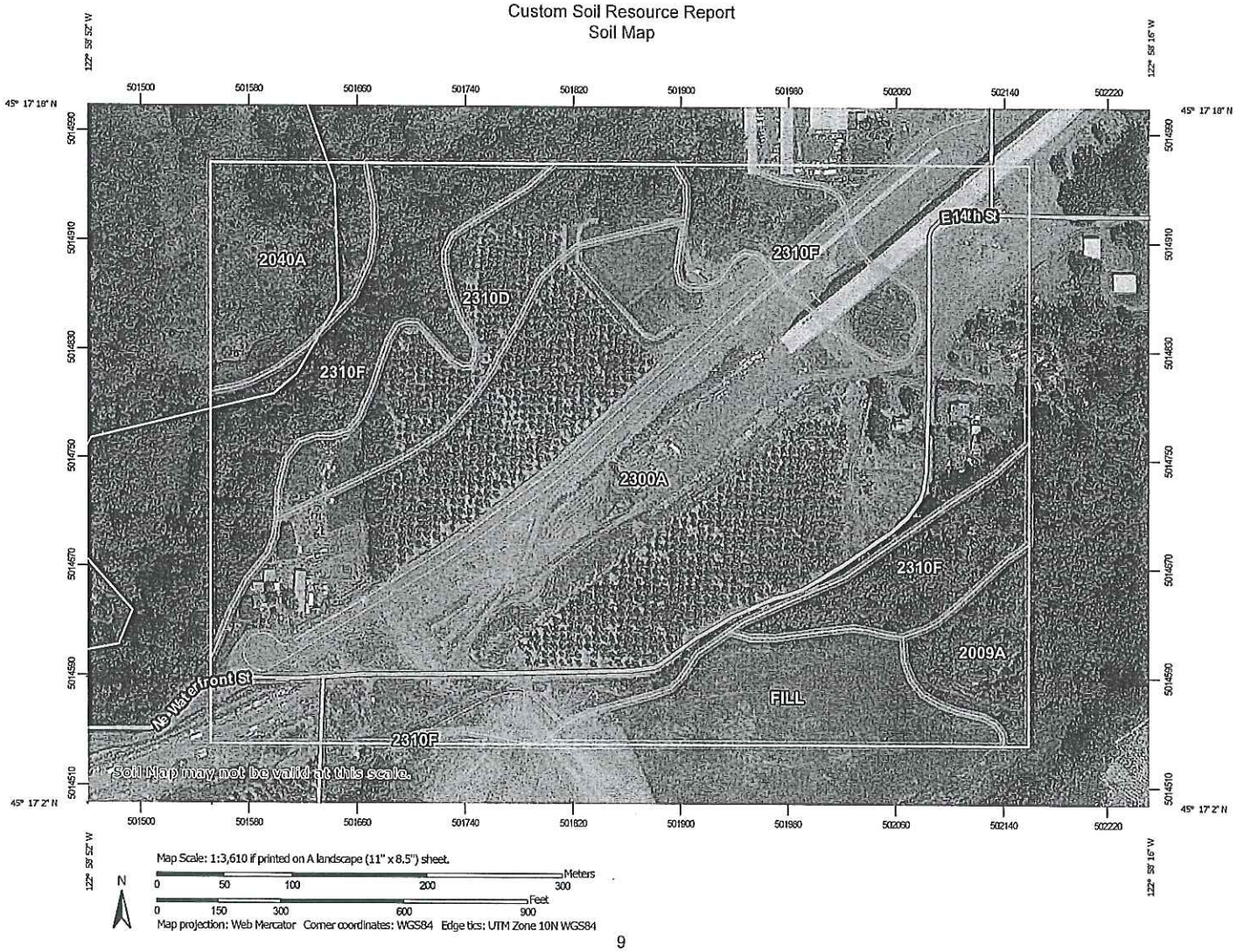
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yamhill County, Oregon



February 5, 2018

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 5, Sep 19, 2017

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2009A	Newberg silt loam, 0 to 3 percent slopes	2.0	3.1%
2040A	Chehalis silt loam, 0 to 3 percent slopes	4.0	6.3%
2300A	Aloha silt loam, 0 to 3 percent slopes	36.4	56.7%
2310D	Woodburn silt loam, 12 to 20 percent slopes	5.1	8.0%
2310F	Woodburn silt loam, 20 to 55 percent slopes	12.1	18.8%
FILL	Fill land	4.6	7.1%
Totals for Area of Interest		**64.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yamhill County, Oregon

2009A—Newberg silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2dgl8
Elevation: 100 to 170 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Newberg and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newberg

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Loamy and sandy alluvium derived from igneous rock

Typical profile

A - 0 to 12 inches: silt loam
AC - 12 to 18 inches: fine sandy loam
C1 - 18 to 30 inches: coarse sandy loam
C2 - 30 to 60 inches: stratified fine sand to fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Pilchuck

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Convex
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Chehalis

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, concave
Hydric soil rating: No

Mcbee

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Camas

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Wapato

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

2040A—Chehalis silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2lkh8
Elevation: 70 to 220 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, concave
Parent material: Silty and loamy alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
A - 7 to 24 inches: silty clay loam
Bw - 24 to 44 inches: silty clay loam
C - 44 to 60 inches: stratified fine sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Mcbee

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Newberg

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Wapato

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

2300A—Aloha silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1j8b0
Elevation: 100 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy glaciolacustrine deposits

Typical profile

Ap - 0 to 8 inches: silt loam
BA - 8 to 15 inches: silt loam
Bt - 15 to 22 inches: silt loam
Bw1 - 22 to 31 inches: silt loam
Bw2 - 31 to 46 inches: silt loam
Bw3 - 46 to 60 inches: silt loam
C - 60 to 65 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 8 to 15 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Willamette

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

2310D—Woodburn silt loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 1j8b6
Elevation: 100 to 380 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear

Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)
Hydric soil rating: No

Minor Components

Amity

Percent of map unit: 4 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Dayton

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310F—Woodburn silt loam, 20 to 55 percent slopes

Map Unit Setting

National map unit symbol: 1j8b7
Elevation: 100 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodburn and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 20 to 55 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

FILL—Fill land

Map Unit Composition

Fill land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fill Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf