PRELIMINARY DRAINAGE REPORT
COFFIN BUTTE LANDFILL

CORVALLIS, OREGON

Prepared For:

REPUBLIC SERVICES

28972 Coffin Butte Road
Corvallis, Oregon 97330

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

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CEC Project 322-142

JANUARY 2025

UPDATED MARCH 2025

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1.0 INTRODUCTION

The purpose of this drainage report is to provide the analysis for the proposed Coffin Butte Landfill expansion project located at 28972 Coffin Butte Road, Corvallis, OR 97330. The proposed project will be an expansion of the landfill to the south side of Coffin Butte Road. This will be referred to in this report as the Proposed Development Area. For the design, the SCS method within Civil 3D's HydraFlow Hydrographs was used to calculate onsite and offsite flows. For onsite stormwater management, a combination detention and wet pond facility was designed using the Corvallis stormwater design standards. The outflow of all onsite stormwater is conveyed by way of a graded swale to a double barrel 12-inch reinforced concrete pipe (RCP) culvert crossing to the north side of Coffin Butte Road and ultimately discharging into an existing detention facility. For offsite stormwater, a retention basin was designed to capture stormwater runoff before entering the proposed development site from the south and a v-ditch was designed to capture stormwater runoff from the south side of Coffin Butte Road along the frontage of the site.

2.0 EXISTING DRAINAGE CONDITIONS

The existing expansion area generally drains from southwest to northeast towards a drainage ditch on the south side of Coffin Butte Road. To the north of Coffin Butte Road is another existing drainage channel conveying flows for the existing landfill area.

3.0 PROPOSED DRAINAGE CONDITIONS

3.1 STORMWATER DRAINAGE ANALYSIS

3.1.1 General

Per the design standards outlined in the Corvallis Stormwater Standard 2015 Edition, the drainage control systems for the Coffin Butte Landfill expansion have been designed to accommodate the anticipated volume of precipitation and resulting run-off generated from the peak 25-year, 24-hour rainfall event. Additionally, per the same stand document, A detention system designed to pass the 100-year, 24-hr storm event was included in the design to ensure the site can sustain a storm event that exceeds the design standard. The stormwater hydrology was calculated using the SCS method within Civil 3D's HydraFlow. It was then used to determine the 25-year, 24-hour stormwater discharge based on intensities for a 5-minute time of concentration. A 5-minute time of concentration was used to provide a conservative estimate for design flows. Pond routing was performed to attenuate the peak flows of 25-year, 24-hour storm event.

3.1.2 Rainfall Distribution

Rainfall distribution is represented as one of the four regional time-distribution types, which define the portion of rainfall that falls at any time within the 24-hour storm event type. Shown in **Figure**

1, all western Oregon, including the Proposed Development Area is located within the Soil Conversation Service (SCS) Type IA rainfall distribution zone. Thus, the Type IA rainfall distribution was used for the drainage analysis.

3.1.3 Rainfall Amount

The rainfall amounts used in the hydrologic analysis of the Proposed Development Area were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 2 rainfall frequency maps. The peak 2-year, 5-year, 10-year, and 25-year, 100-year, 24-hour storm events were determined to be 3.1, 3.8, 4.4, 5.1and 6.4 inches, respectively. The corresponding rainfall frequency maps are shown in **Figures 2, 3, 4, 5 and 6**.

3.2 PEAK RUN-OFF DETERMINATION

The SCS Unit Hydrograph method was used within Civil 3D's HydraFlow to compute the onsite peak discharges for the 2-year, 24-hour, and 25-year, 24-hour storm events, assuming a 5-minute time of concentration. A runoff curve number (CN) of 84 was used for the proposed development area, which is representative of a hydrologic soil type D material with grass covering 50-75% of the area. A runoff curve number (CN) of 98 was used for Coffin Butte Road, which is representative of asphaltic pavement.

Refer to **Appendix A** for Hydrologic Calculations.

3.3 ONSITE HYDRAULICS AND DRAINAGE INFRASTRUCTURE

Onsite Drainage for the site will be captured by graded swales and conveyed to proposed catch basins. The proposed catch basins direct flows to a combined detention and wet pond facility. The design 25-year, 24-hour storm event was estimated to generate a total site peak discharge of approximately 52.80 cubic feet/second (cfs). Per the Corvallis Stormwater Standard 2015 Edition, the detained stormwater collected onsite must have a controlled discharge. The use of an 8-inch HDPE storm pipe with a 6-inch orifice restrictor plate at the outlet of the combined detention / wet pond facility was designed to limit the outlet flow to 2.52 cfs to minimize inflow from the proposed expansion area to the existing detention pond located north of Coffin Butte Road. The outlet flow is designed to outfall to a proposed 1-foot-deep swale conveying the combined detention / wet pond facility flow and the flow from the south side of Coffin Butte Road through a double barrel 12-inch reinforced concrete pipe. The flow is then directed north of Coffin Butte Road and is conveyed to an existing detention facility located on the southeast corner of the Coffin Butte Landfill.

Refer to **Appendix B** for Hydraulic Calculations.

3.4 STORMWATER MANAGEMENT

3.4.1 Onsite

Runoff for the proposed development was calculated based on drainage areas defined by existing and proposed topography, Refer to **Figure 7** for the Drainage Area Map. Runoff from drainage area 1, calculated as 7.67 cfs for the 2-yr storm event and 17.28 cfs for the 25-year storm event, flows across existing topography from the southeast to the northwest to a historic outfall at an elevation of 280.00 ft. Runoff from drainage area 5, calculated as 3.40 cfs for the 2-year event and 7.66 cfs for the 25-year event, flows from south to north from Tampico Ridge to a proposed catch basin which directs the flow to the east to the historic flow path. Runoff from drainage areas 2, 4, and 6 combine in a proposed detention / wet pond located in the northeast corner of the proposed development. The combined detention / wet pond was designed according to the Corvallis, Oregon Stormwater Design Standards 2015 Edition. The manual outlines the design criteria and process for both a wet pond and a detention facility. When combined, the detention facility can be stacked above the wet pond to reduce loss of development area. Both criteria are required when designing a combined system. When conflicting requirements are encountered the stricter requirements are utilized for design. Wet ponds using this design criteria are expected to meet a treatment goal of 70 percent TSS removal. For wet pond analysis, the required wet pond volume ($V_b = fV_r$) is used to determine the overall dimensions of the storage facility. To calculate the wet pond volume a minimum volume factor (f) of 3 is applied to the final required volume found for the site as per Corvallis Stormwater Design Standards 2015 Edition. Based on the 100-yr, 24-hr storm event, the rainfall from the mean annual storm (R) is as 6.4 inches per National Oceanic and Atmospheric Administration (NOAA) Atlas 2 rainfall frequency maps, see **Figure 6**. Finally, the runoff from the mean annual storm (V_r) is calculated based on the soil type for the developed site. There are four soil types that are considered for this method of analysis that correspond to soil types associated with SCS hydrological soil group classifications, impervious (hard, non-penetrable surfaces), till grass (post-development grass or landscaped area and onsite forested land on Type C or D soils), till forest (permanent onsite forest and shrub cover located on type C or D soils), and outwash (soil that infiltrates well and produces small amounts of runoff, type A and B soils). For the proposed site type D soil was used with the assumption of the till grass option (A_{tg}), landscaped areas and post-development grass. The overall area for the development is approximately 68.95 acres or 3,003,462 sf. The runoff from the mean annual storm is calculated using the following formula:

$$V_r = \left(0.9Ai + 0.25A_{tg} + 0.10A_{tf} + 0.01A_o\right) \times R$$

Where:

$V_r = Volume\ of\ runoff\ from\ mean\ annual\ storm\ (cf)$
$A_i = Area\ of\ impervious\ surface\ (sf)$
$A_{tg} = Area\ of\ till\ soil\ covered\ with\ grass\ (sf)$
$A_{tf} = Area\ of\ soil\ covered\ with\ forest\ (sf)$
$A_o = Area\ of\ outwash\ soil\ covered\ with\ grass\ or\ forest\ (sf)$
$R = Rainfall\ from\ mean\ annual\ storm\ (ft)$

$$V_r = (0 + 0.25(3{,}003{,}462\ \ sf) + 0 + 0) \times \left(\frac{6.4}{12} ft\right) \approx 40{,}046\ cf$$

Therefore, the wet pond volume is calculated as follows:

$$V_b = fV_r$$

$$V_b = 3 \times 40{,}046\ cf \approx 120{,}138\ cf$$

To determine the dimensions of the wet pond the first wet pool cell must have the capacity to hold 25% to 35% of the wet pond volume. Refer to **Figure 8** for a typical plan view of a combined detention / wet pond design and **Figure 9** for typical cross sections of a combined detention / wet pond. For the proposed wet pond 35% of the required volume was used for design.

$$0.35 \times 120{,}138\ cf \approx 42{,}048\ cf$$

The overall wet pond dimensions were designed to be approximately 275 ft x 165 ft measured at the highest elevation, with a berm separating the primary and secondary cells. The primary cell dimensions are approximately 90 ft x 165 ft with a maximum depth (not including the sediment storage depth) of 8 ft, giving an approximate volume of 66,000 cf. The proposed wet pond design exceeds required capacity.

Refer to **Appendix A** for Stage Storage Report.

3.4.2 Offsite

The proposed development is designed to capture offsite runoff from Tampico Ridge to the south and runoff from the south side of Coffin Butte Road. Runoff for drainage area 3, as seen in **Figure 7**, calculated as 9.84 cfs for the 2-year event and 22.17 cfs for the 25-year event, is captured by a proposed retention basin located south of the top of excavation grades of the proposed development. The provided volume for the south basin, 764,196 cf exceeds the required storage volume of 313,151 cf. All runoff from DA-3 will be captured before entering the proposed development. An emergency overflow pipe with an inlet invert at the top of the proposed basin, 348.00 ft, was designed to convey any excess runoff captured from storm events that exceed design

considerations, with a maximum outflow 0f 0.65 cfs, through DA-4 in a roadside v-ditch. Any excess flow will be directed toward the detention / wet pond. Runoff from DA-O1, the south side of Coffin Butte Road along the frontage of the site, calculated as 1.41 cfs for the 2-year event and 2.36 cfs for the 25-year event, and DA-O2, calculated as 0.65 cfs for the 2-year event and 1.47 cfs for the 25-year event are captured in a roadside ditch and conveyed to a culvert passing beneath the entrance to the proposed development, then combining with the outlet flow from the detention / wet pond.

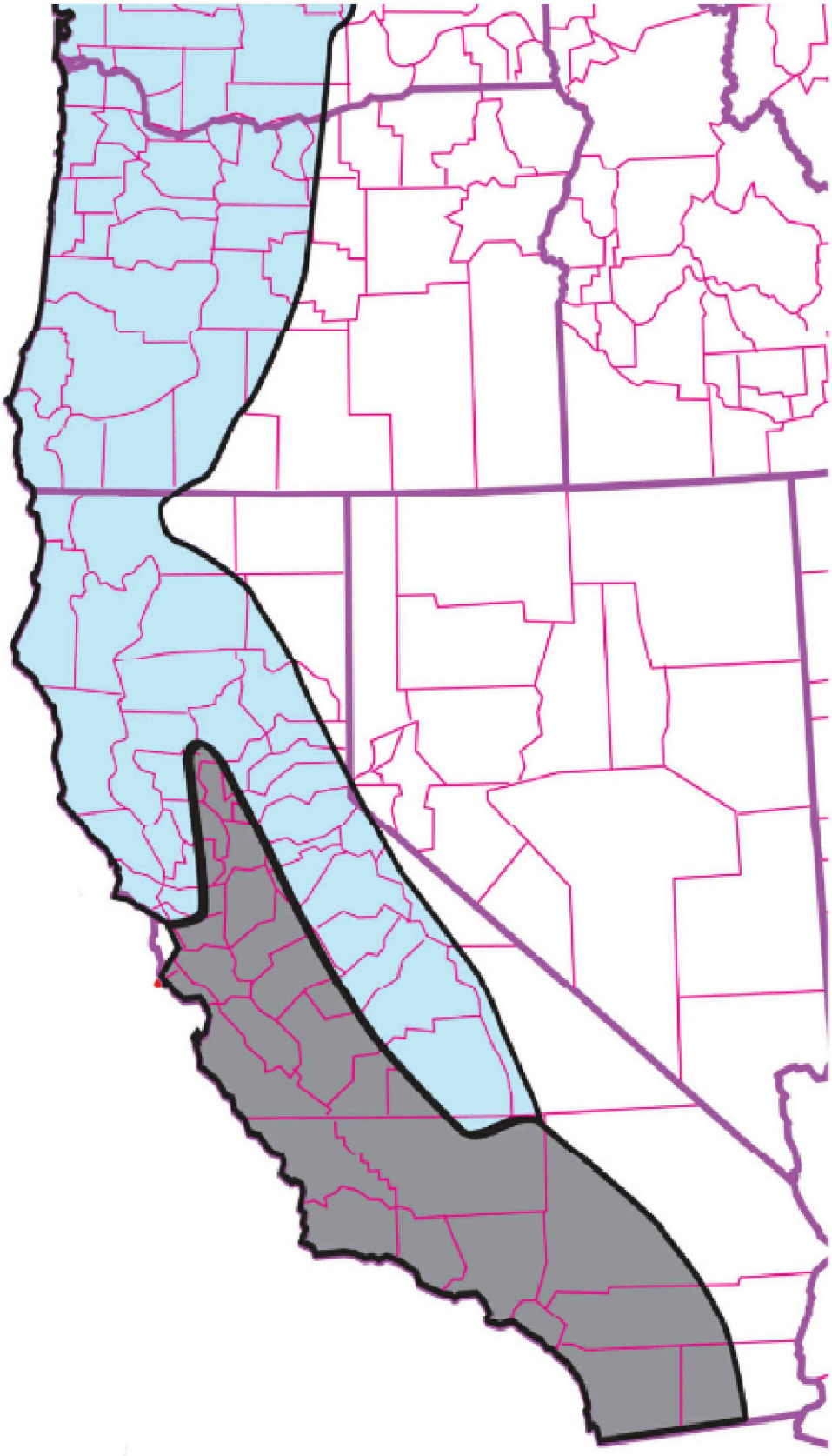
4.0 CONCLUSION

- The Coffin Butte Landfill expansion project will adhere to Corvallis stormwater design standards for Storm Drainage Facilities.
- When the Coffin Butte Landfill expansion area reaches final grades, the detention / wet pond facility will exceed the required stormwater storage capacity.
- The volume of the south basin retention pond exceeds the required volume of offsite flows from the south.
- An attenuated flow of 6.35 cfs will be added to the existing drainage channel north of Coffin Butte Road ultimately discharging into the existing detention pond.

5.0 REFERENCES

- 2015 Stormwater Design Standards, Corvallis, Oregon.
- National Oceanic and Atmospheric Administration (NOAA) Atlas 2.

APPENDIX A
HYDROLOGIC CALCULATIONS



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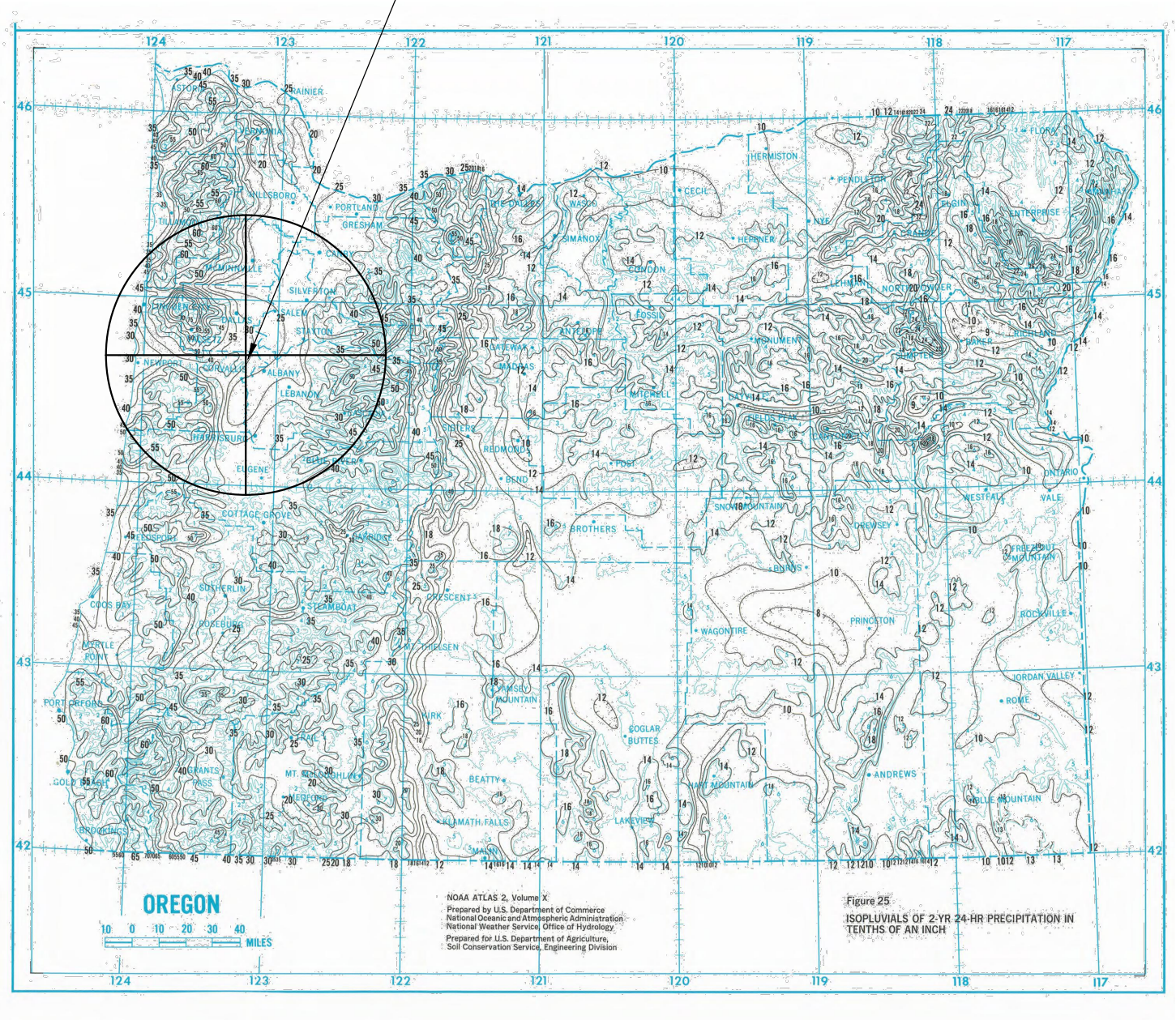
REPUBLIC SERVICES
COFFIN BUTTE LANDFILL
28972 COFFIN BUTTE ROAD
CORVALLIS, OR 97330

CONDITIONAL USE PERMIT APPLICATION
SCS RAINFALL DISTRIBUTION

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	1
DATE:	JANUARY 2025	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		



2–YEAR 24–HOUR STORM = 3.10 IN

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CONDITIONAL USE PERMIT APPLICATION
2-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	2
DATE:	JANUARY 2025	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

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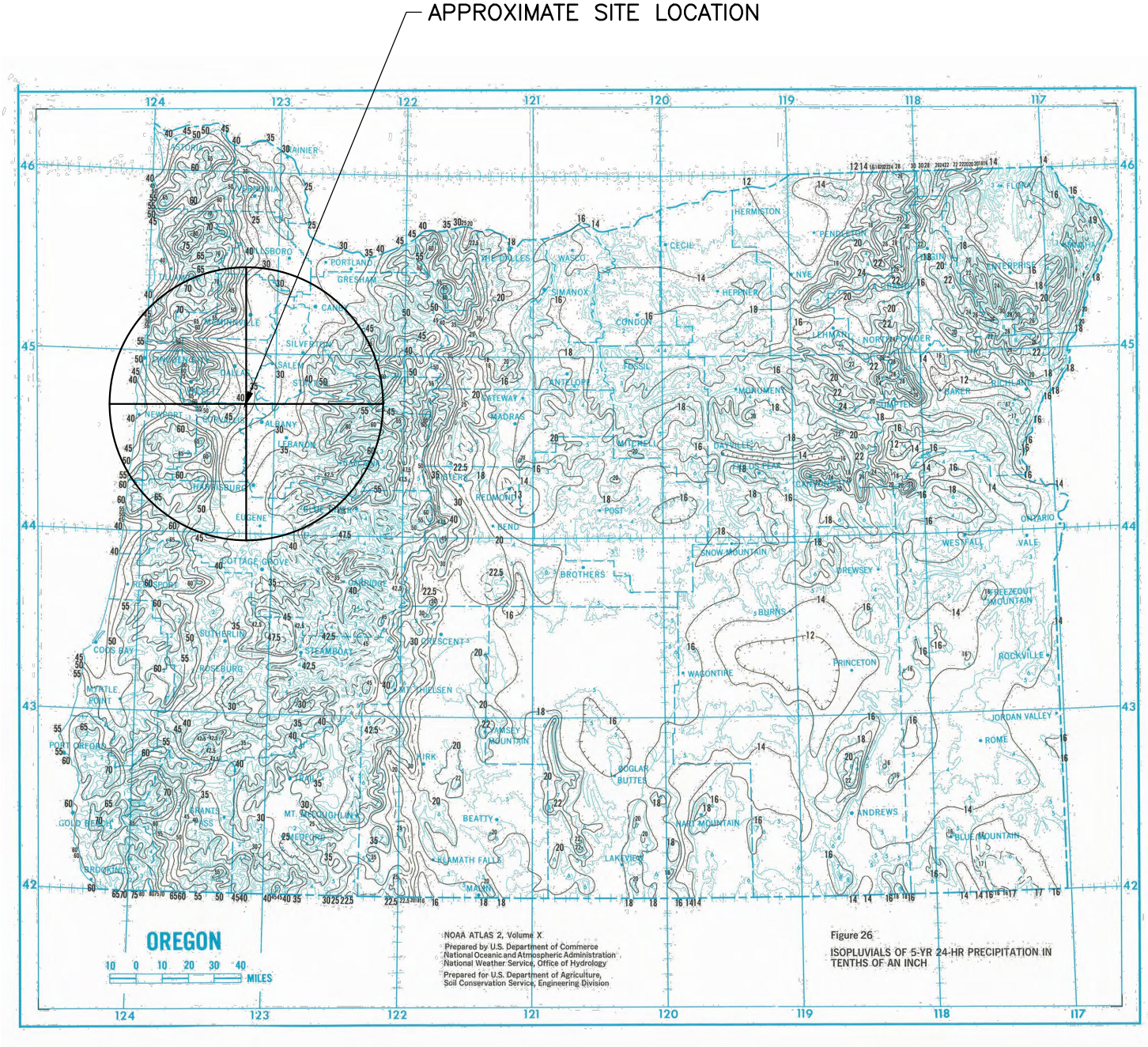

5–YEAR 24–HOUR STORM = 3.80 IN

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5-YR 24-HR RAINFALL DISTRIBUTION MAP

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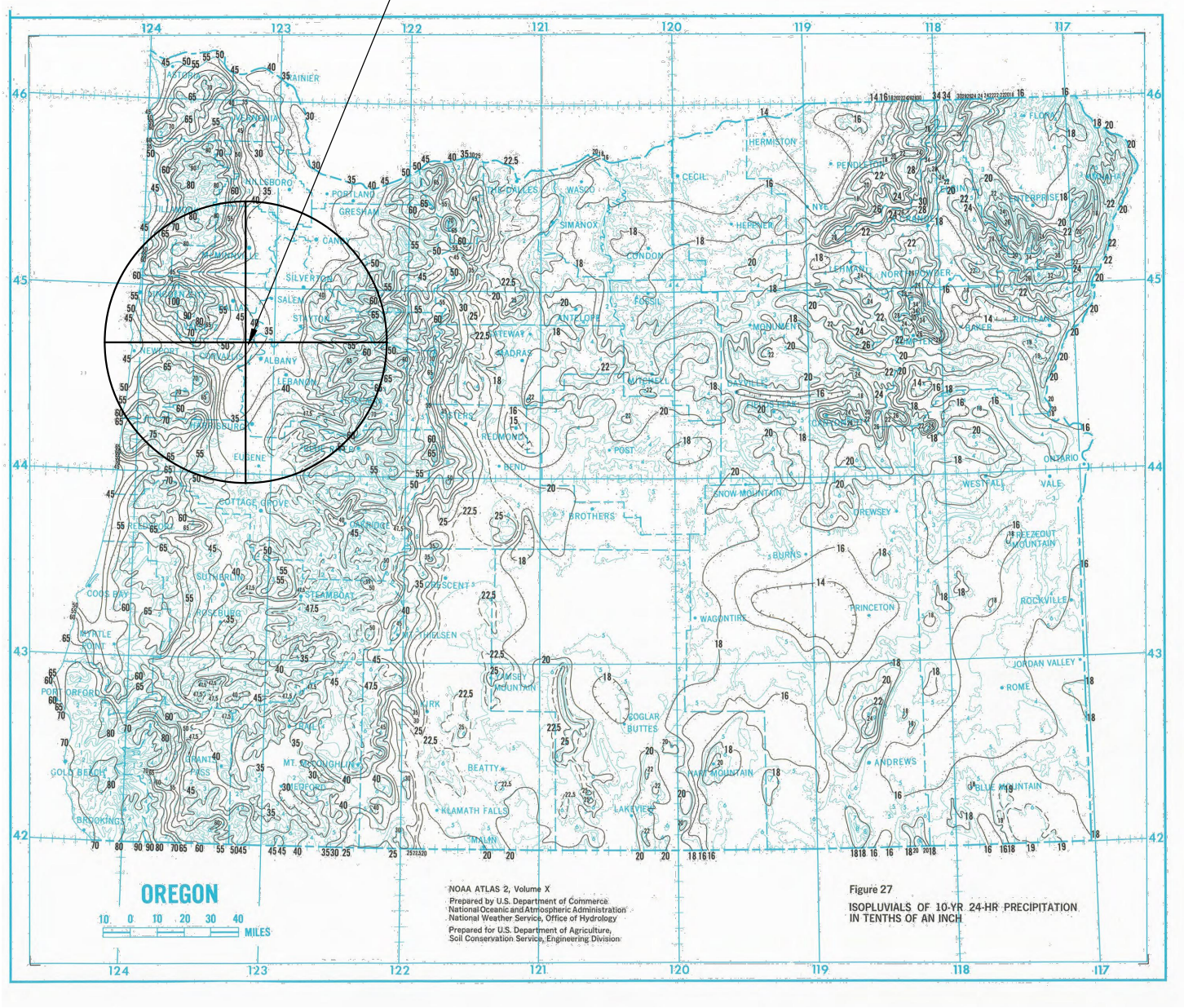

10–YEAR 24–HOUR STORM = 4.40 IN

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CONDITIONAL USE PERMIT APPLICATION
10-YR 24-HR RAINFALL DISTRIBUTION MAP

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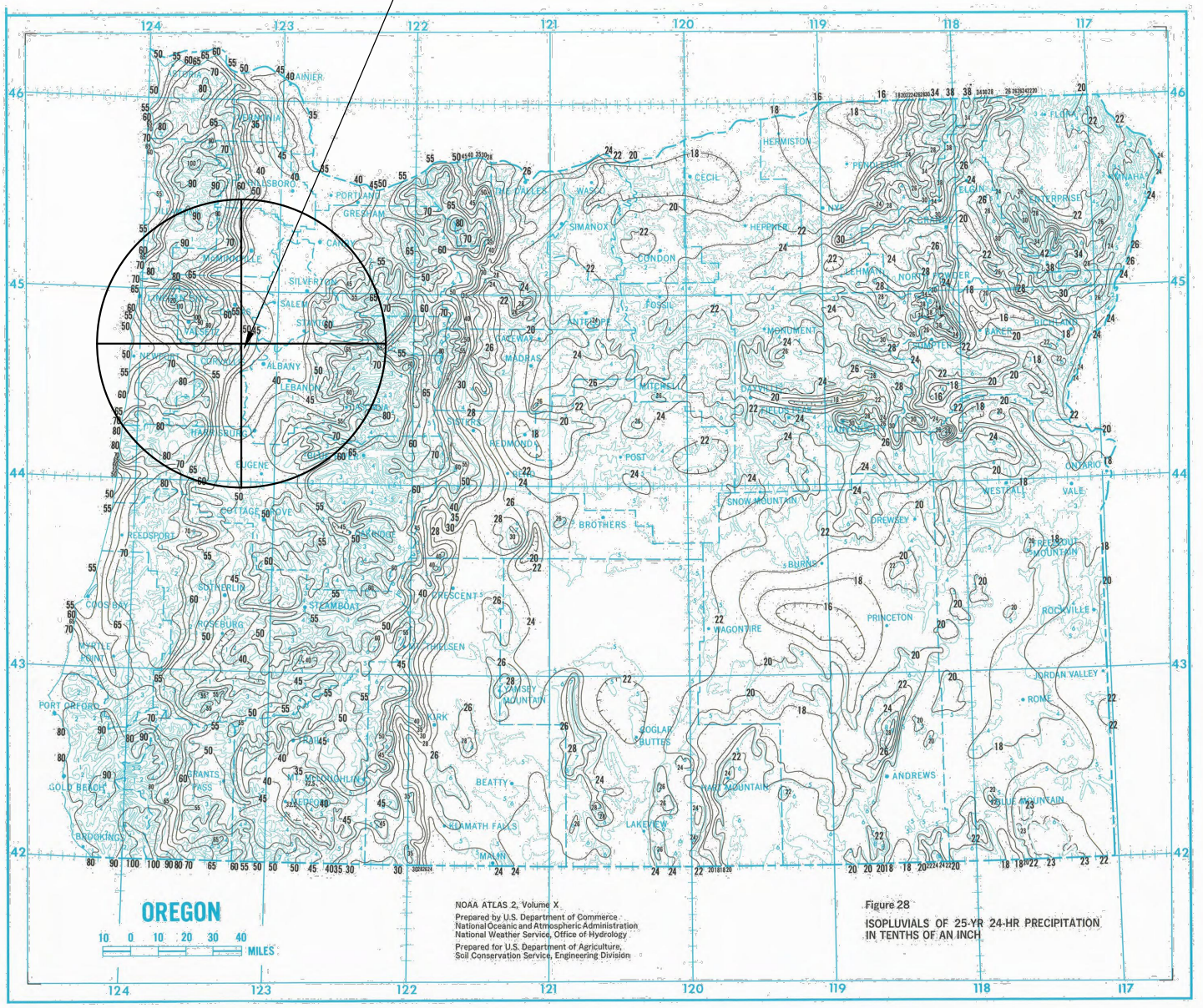

25–YEAR 24–HOUR STORM = 5.10 IN

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CONDITIONAL USE PERMIT APPLICATION
25-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	5
DATE:	JANUARY 2025	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

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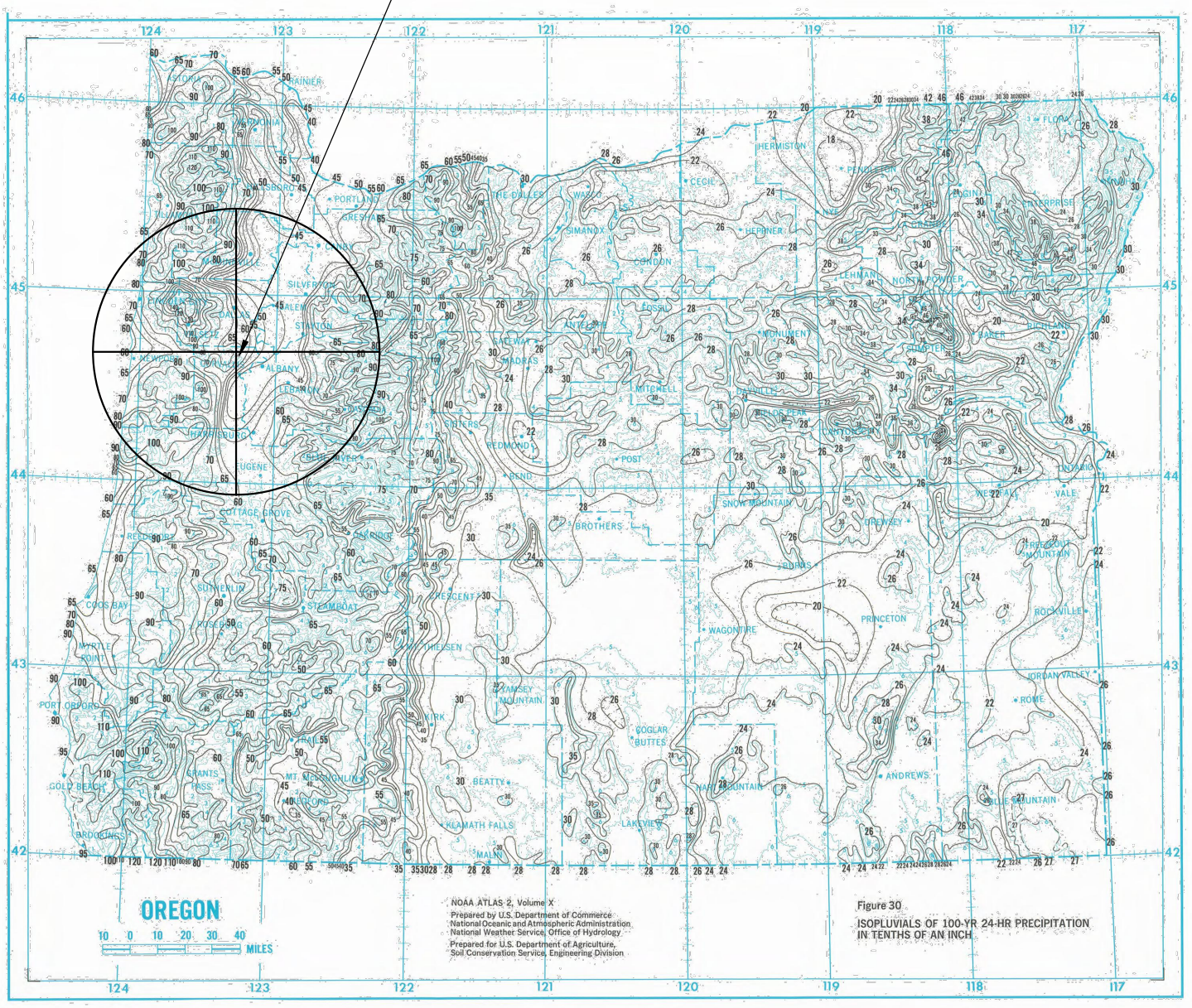
APPROXIMATE SITE LOCATION



100–YEAR 24–HOUR STORM = 6.40 IN

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CONDITIONAL USE PERMIT APPLICATION
25-YR 24-HR RAINFALL DISTRIBUTION MAP

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DATE:	JANUARY 2025	DWG SCALE:	N.T.S.	PROJECT NO:	322-142	6

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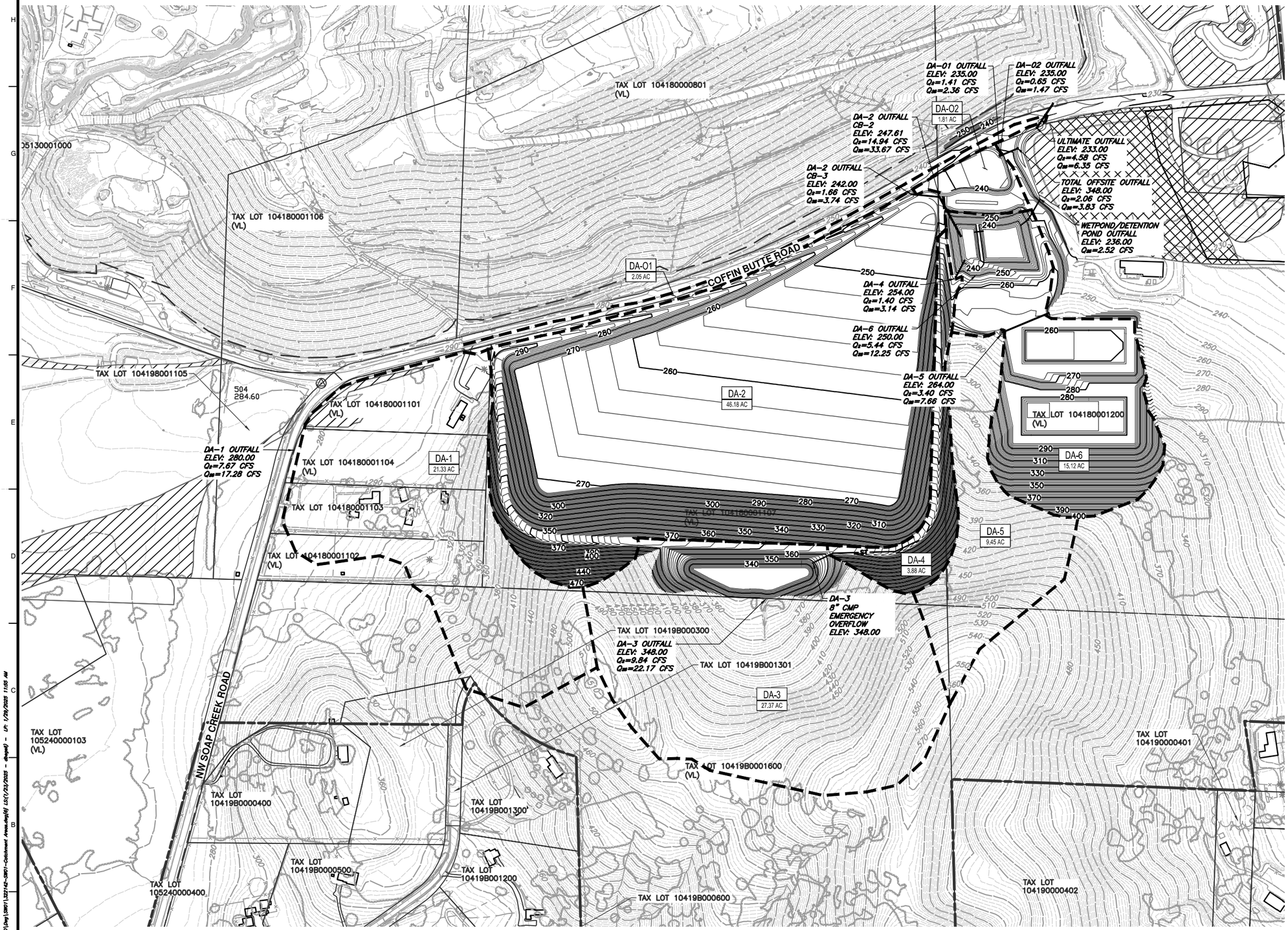

LEGEND

- PROPERTY BOUNDARY
- EXISTING LANDFILL BOUNDARY
- TAX LOT BOUNDARY
- ZONING BOUNDARY
- WETLAND MITIGATION BOUNDARY
- 300 EXISTING 10-FT CONTOUR
- EXISTING 2-FT CONTOUR
- EXISTING PALUSTRINE FORESTED WETLAND
- EXISTING PALUSTRINE EMERGENT WETLAND
- 250 PROPOSED 10-FT CONTOUR
- 254 PROPOSD 2-FT CONTOUR
- DRAINAGE AREA BOUNDARY
- DA-# / #.## DRAINAGE AREA BOUNDARY

NORTH

SCALE IN FEET
0 200 400

REFERENCE

AERIAL PHOTOGRAPH, TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY AND GRID BY COOPER AERIAL SURVEYS COMPANY; DATE OF PHOTOGRAPHY: OCTOBER 07, 2021.

REGISTERED PROFESSIONAL ENGINEER
92360PE
OREGON
JULY 13, 2017
JEFF A. SHEPHERD
EXPIRES: 06/30/2026

SUBMITTAL RECORD

NO	DATE	DESCRIPTION

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VALLEY LANDFILLS, INC.
COFFIN BUTTE LANDFILL
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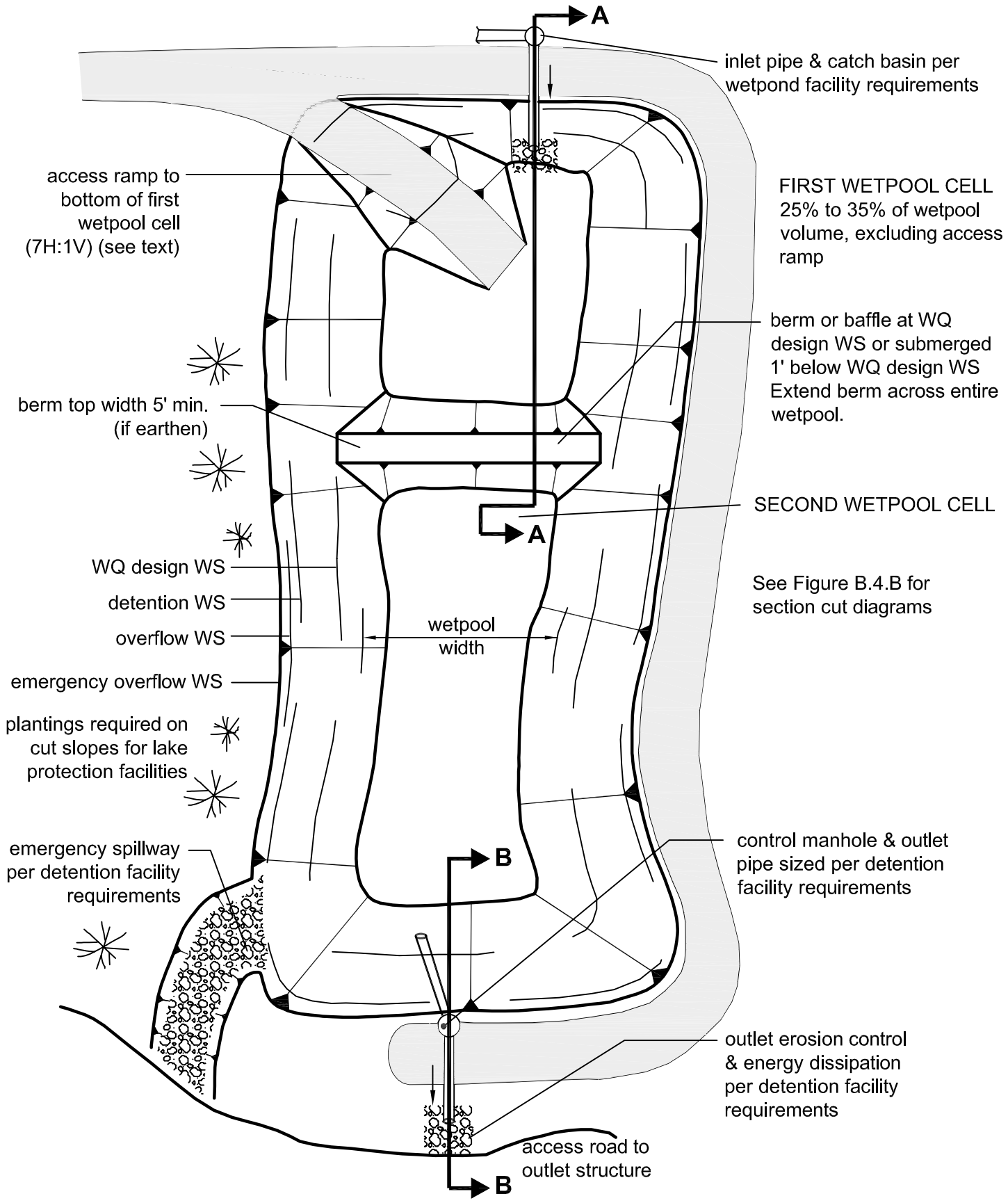
DRAINAGE AREA MAP

DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO:	322-142
APPROVED BY:	JAS
DRAWN BY:	JS
CHECKED BY:	JAS

FIGURE NO.: 6
SHEET OF

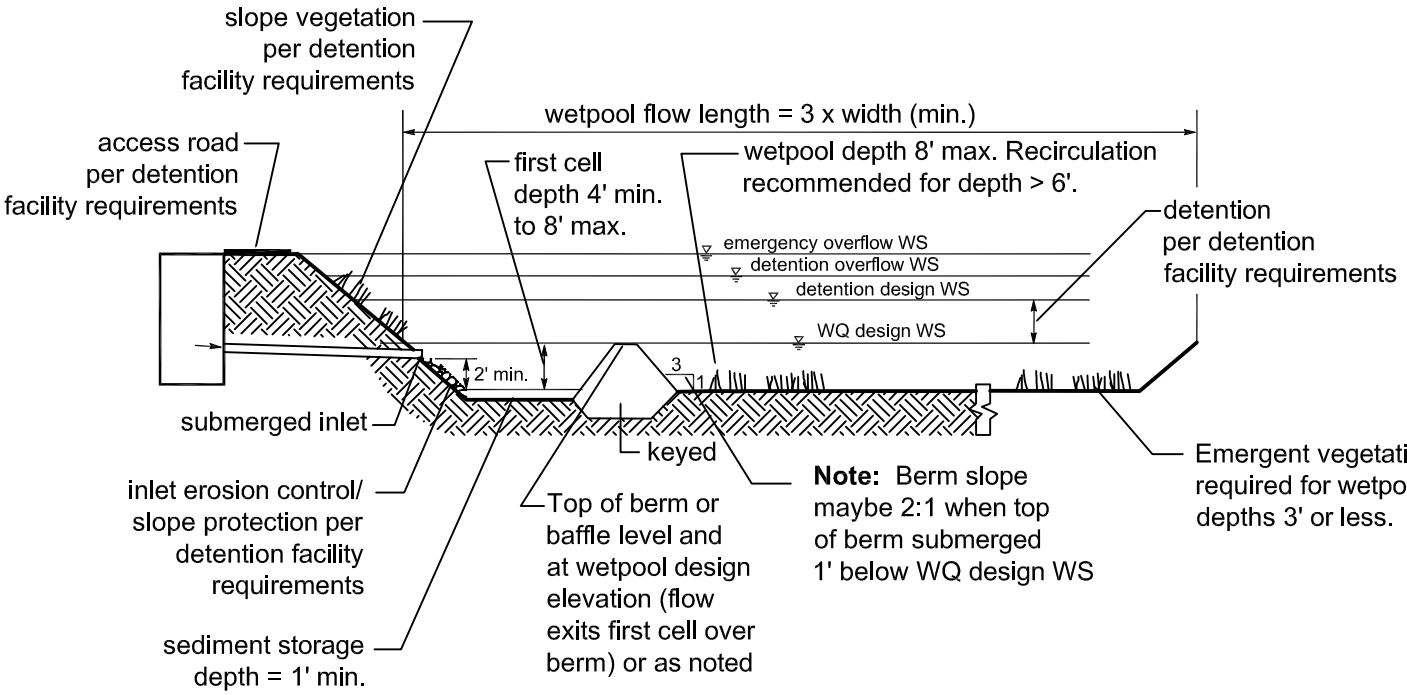
P:\300-000\322-142\-2400\Dwg\SHT01\322142-SHT01-Catchment Areas.dwg[6] LS(1/29/2025 - 4pm) - LP: 1/29/2025 11:55 AM

FIGURE 8. COMBINED DETENTION AND WETPOND

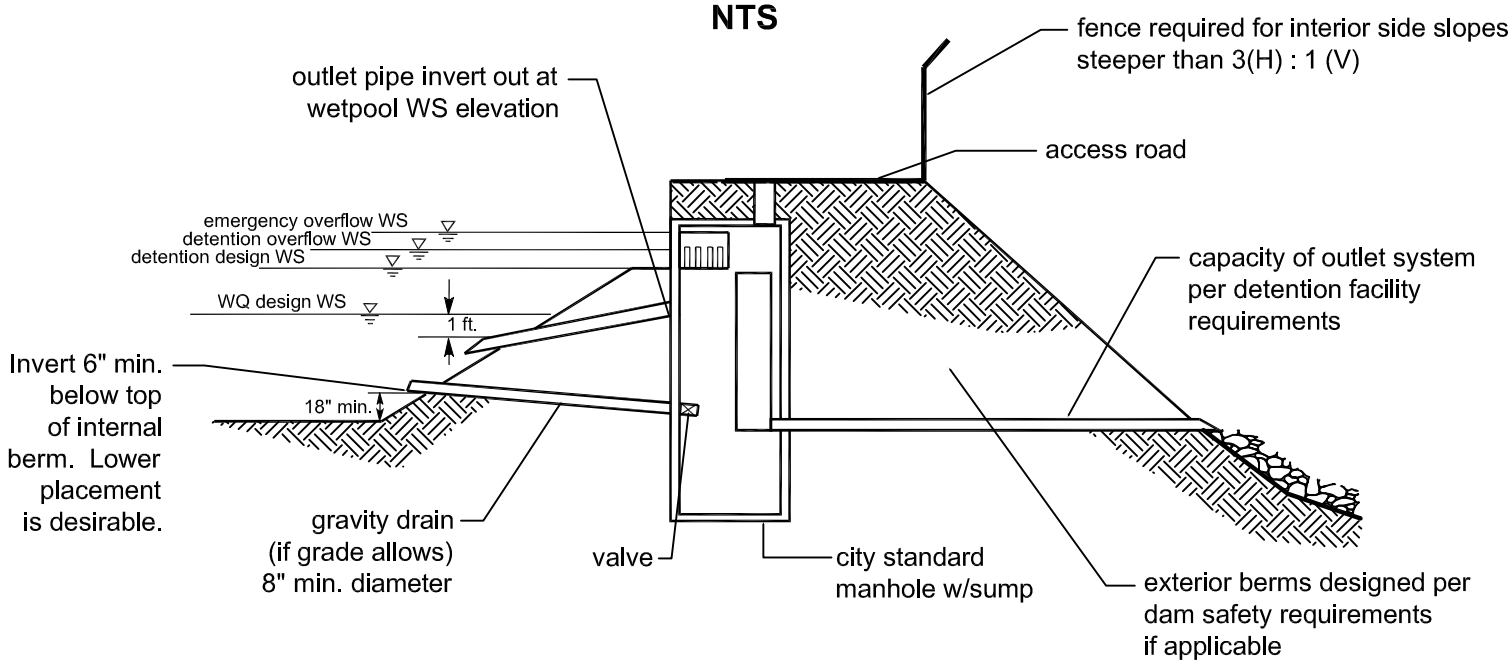


PLAN VIEW
NTS

FIGURE 9. COMBINED DETENTION AND WETPOND SECTIONS



SECTION A-A
NTS



SECTION B-B
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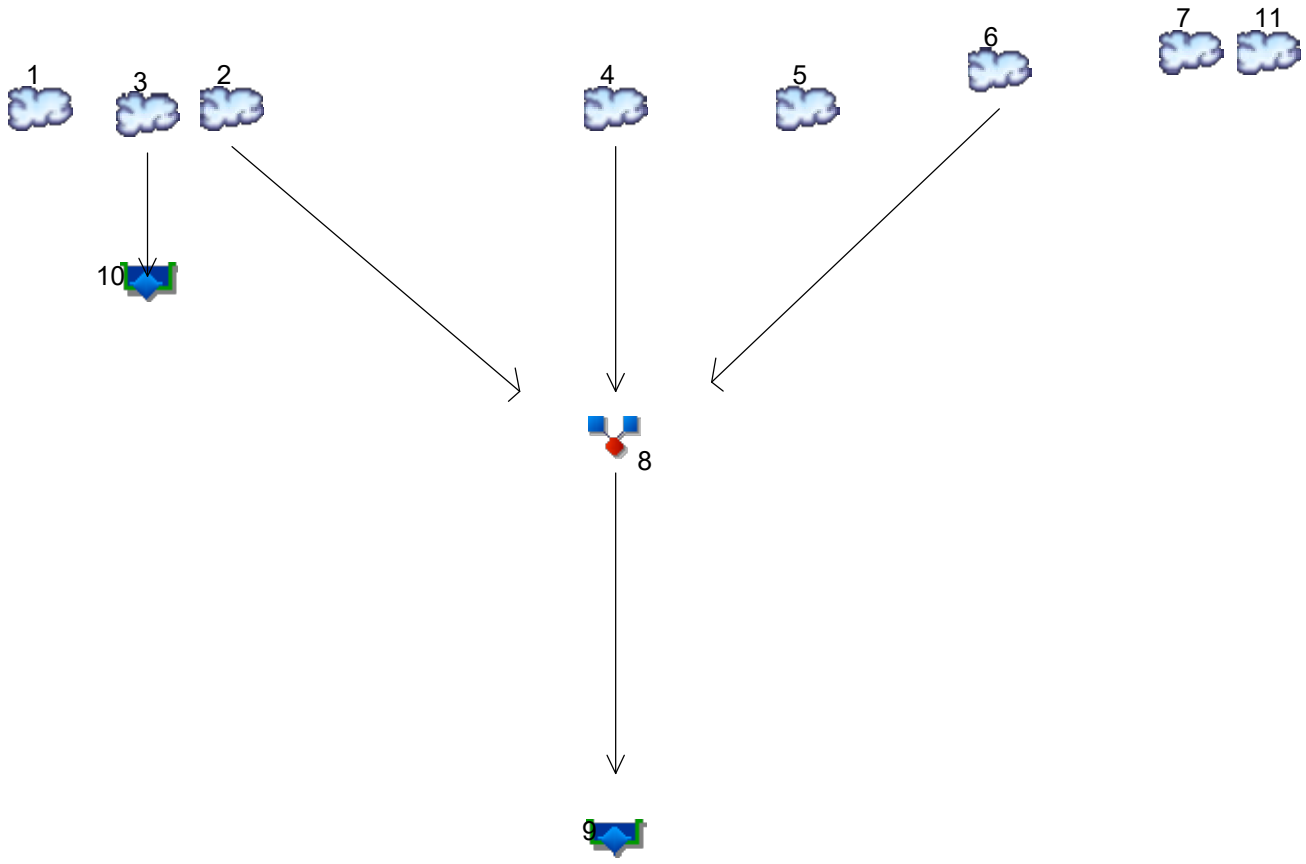
APPENDIX B
HYDRAULIC CALCULATIONS

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA-1
2	SCS Runoff	DA-2
3	SCS Runoff	DA-3
4	SCS Runoff	DA-4
5	SCS Runoff	DA-5
6	SCS Runoff	DA-6
7	SCS Runoff	DA-O1
8	Combine	North Pond Routing
9	Reservoir	Wet Pond / Detention P
10	Reservoir	South Basin
11	SCS Runoff	DA-O2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	7.668	2	476	116,065	------	------	------	DA-1
2	SCS Runoff	16.60	2	476	251,284	------	------	------	DA-2
3	SCS Runoff	9.840	2	476	148,931	------	------	------	DA-3
4	SCS Runoff	1.395	2	476	21,113	------	------	------	DA-4
5	SCS Runoff	3.397	2	476	51,421	------	------	------	DA-5
6	SCS Runoff	5.436	2	476	82,274	------	------	------	DA-6
7	SCS Runoff	1.412	2	470	20,007	------	------	------	DA-O1
8	Combine	23.43	2	476	354,671	2, 4, 6,	------	------	North Pond Routing
9	Reservoir	1.230	2	1444	147,353	8	242.85	322,800	Wet Pond / Detention P
10	Reservoir	0.000	2	n/a	0	3	336.24	148,931	South Basin
11	SCS Runoff	0.651	2	476	9,849	------	------	------	DA-O2

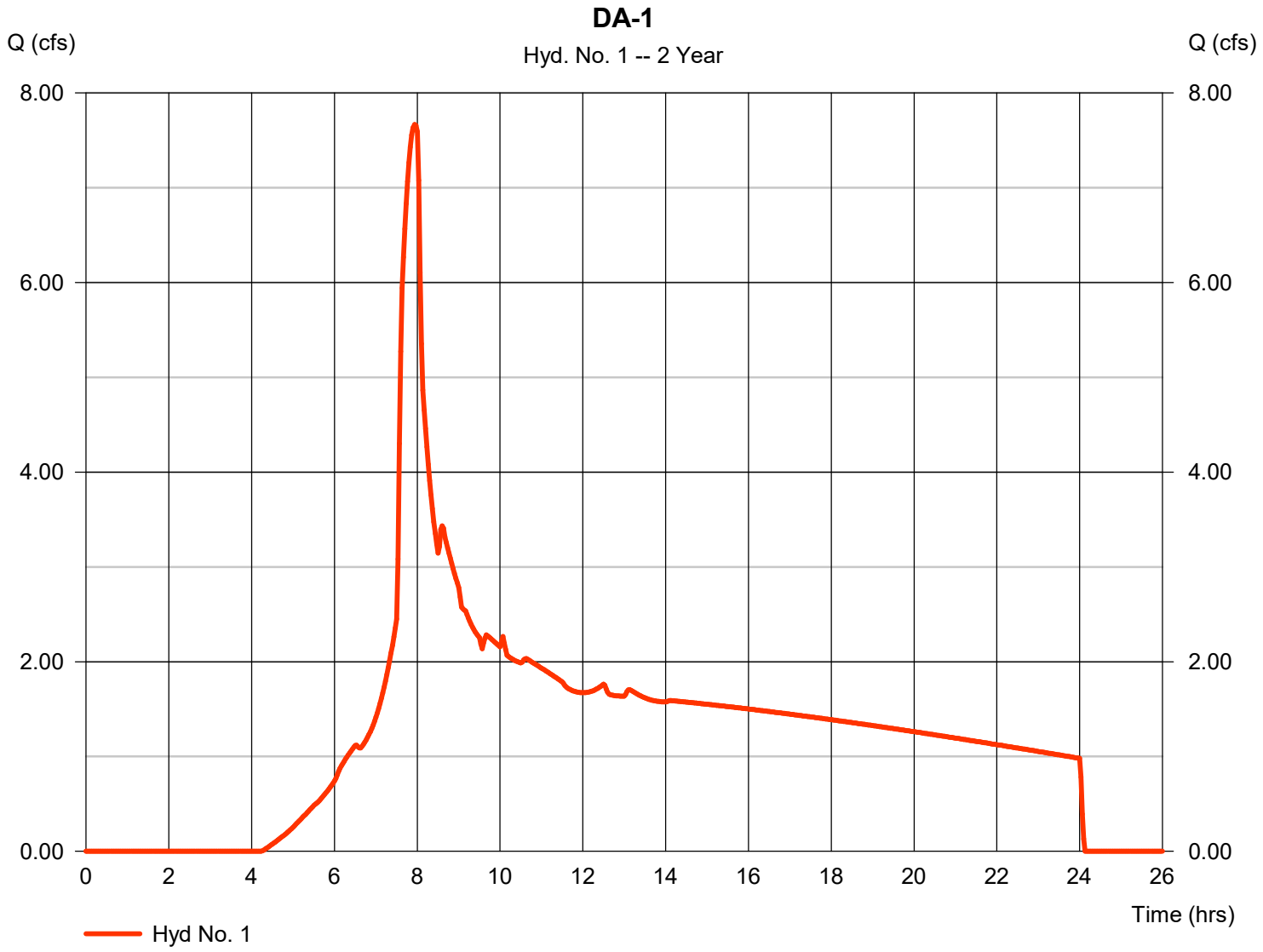
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 1

DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.668 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	116,065 cuft
Drainage area	=	21.330 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



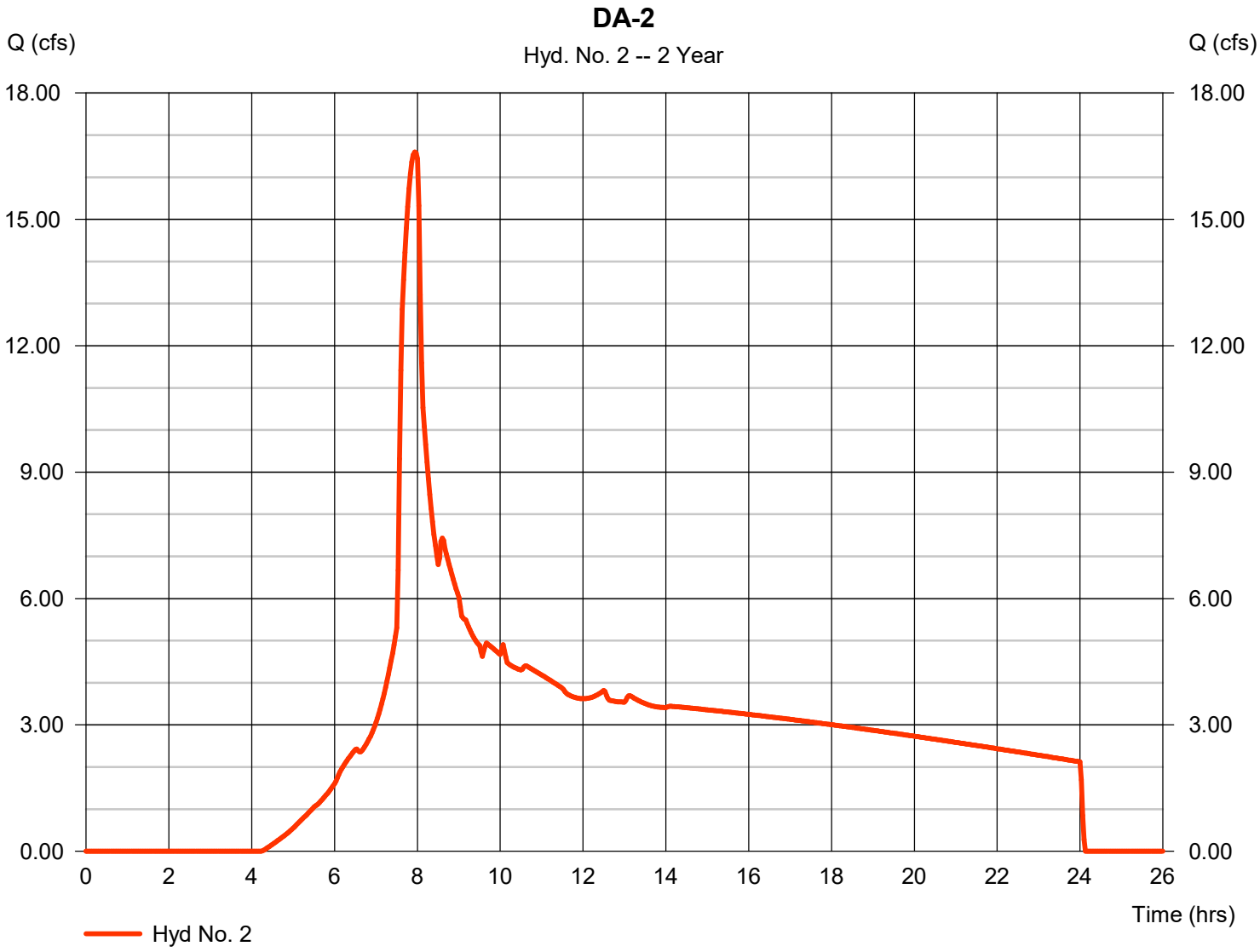
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 2

DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.60 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	251,284 cuft
Drainage area	=	46.180 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



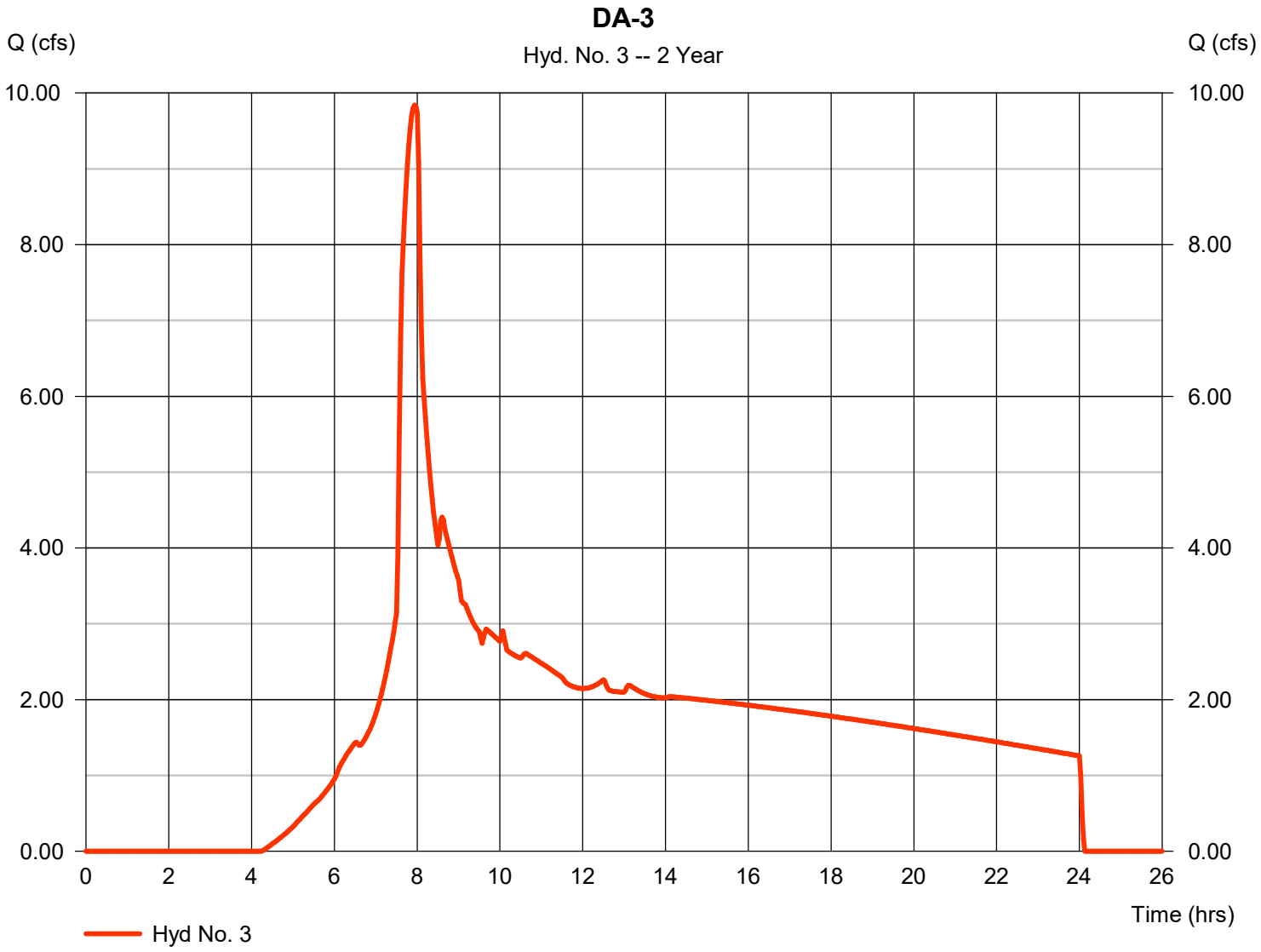
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 3

DA-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.840 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	148,931 cuft
Drainage area	=	27.370 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



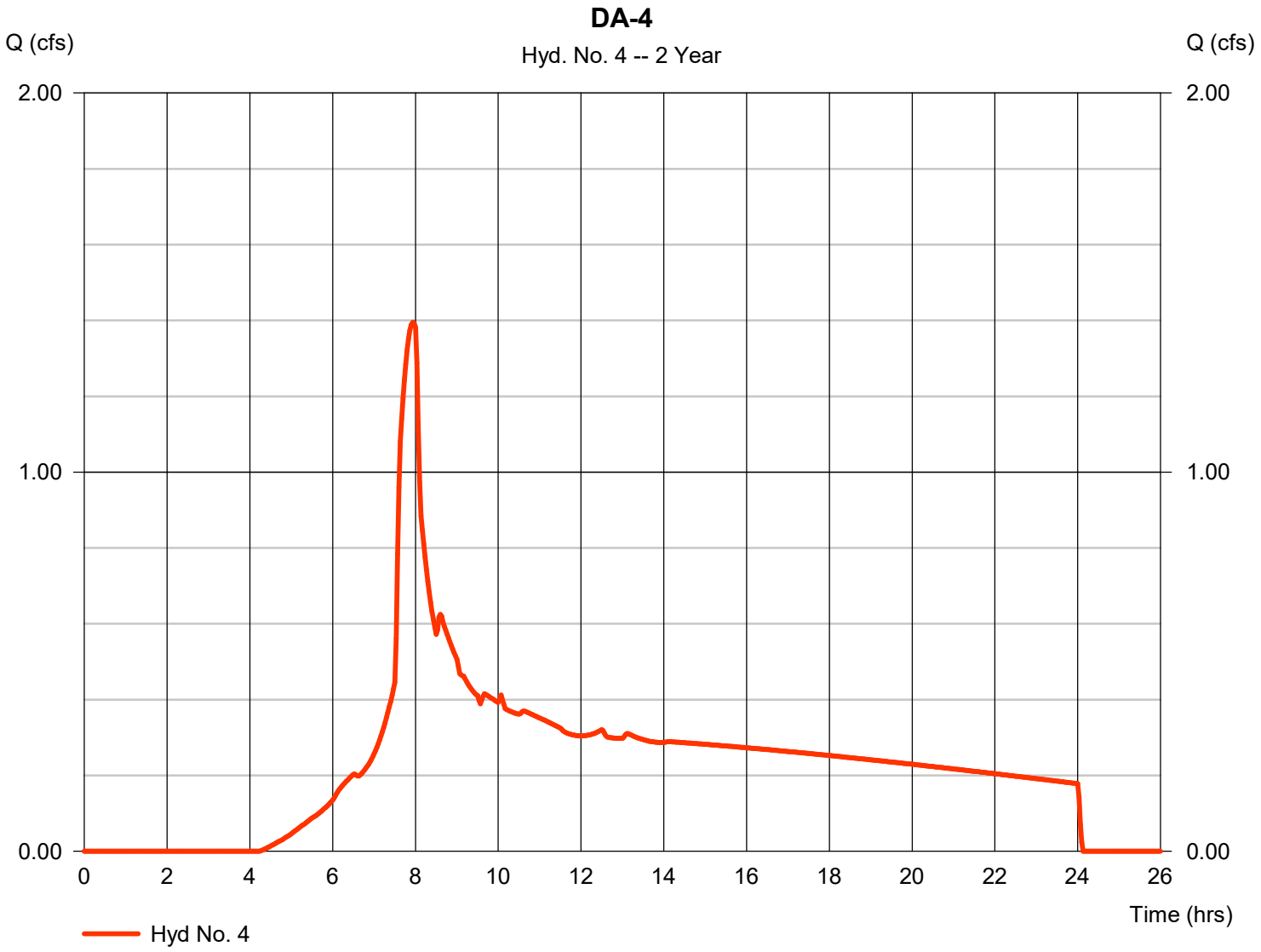
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 4

DA-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.395 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	21,113 cuft
Drainage area	=	3.880 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



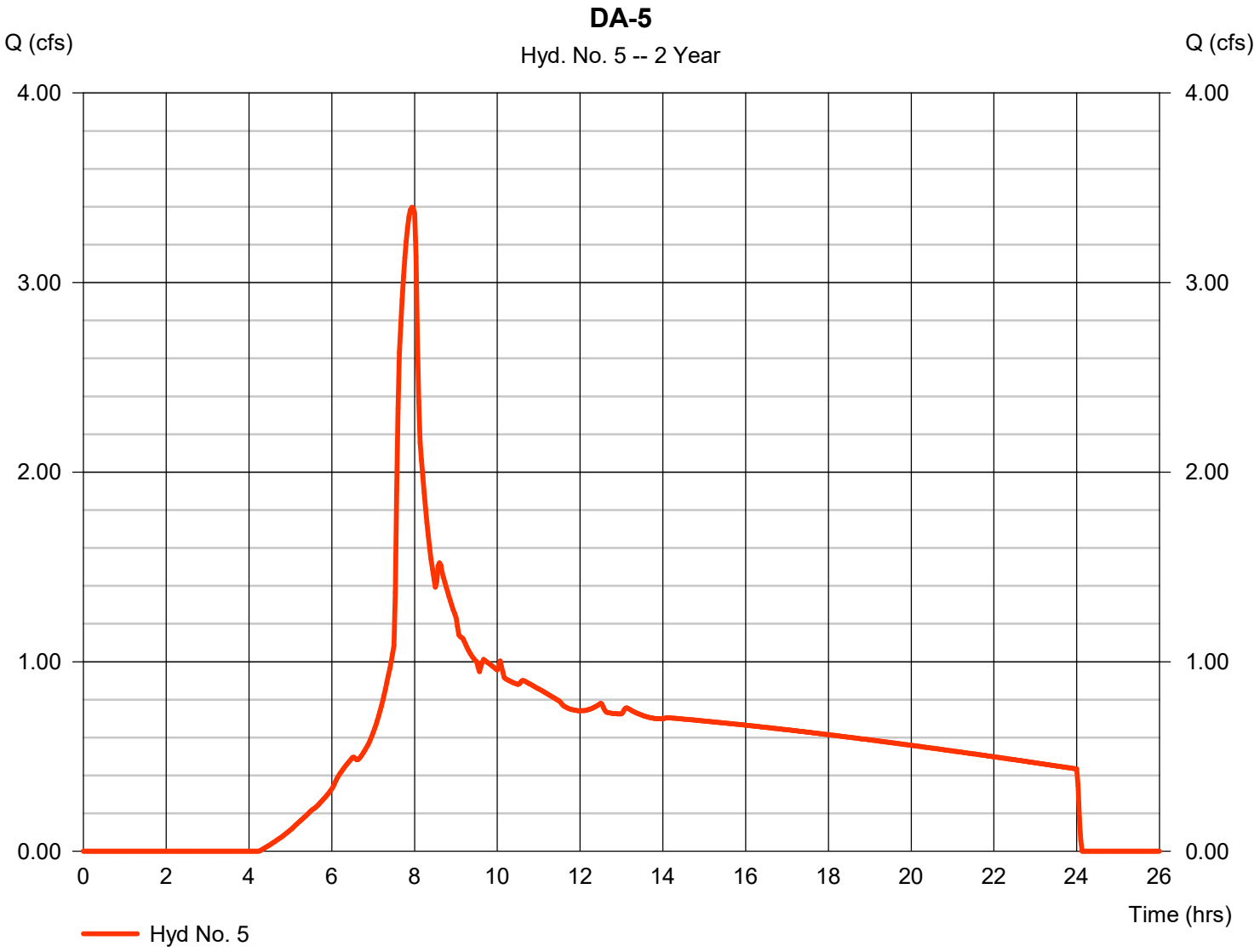
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 5

DA-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.397 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	51,421 cuft
Drainage area	=	9.450 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



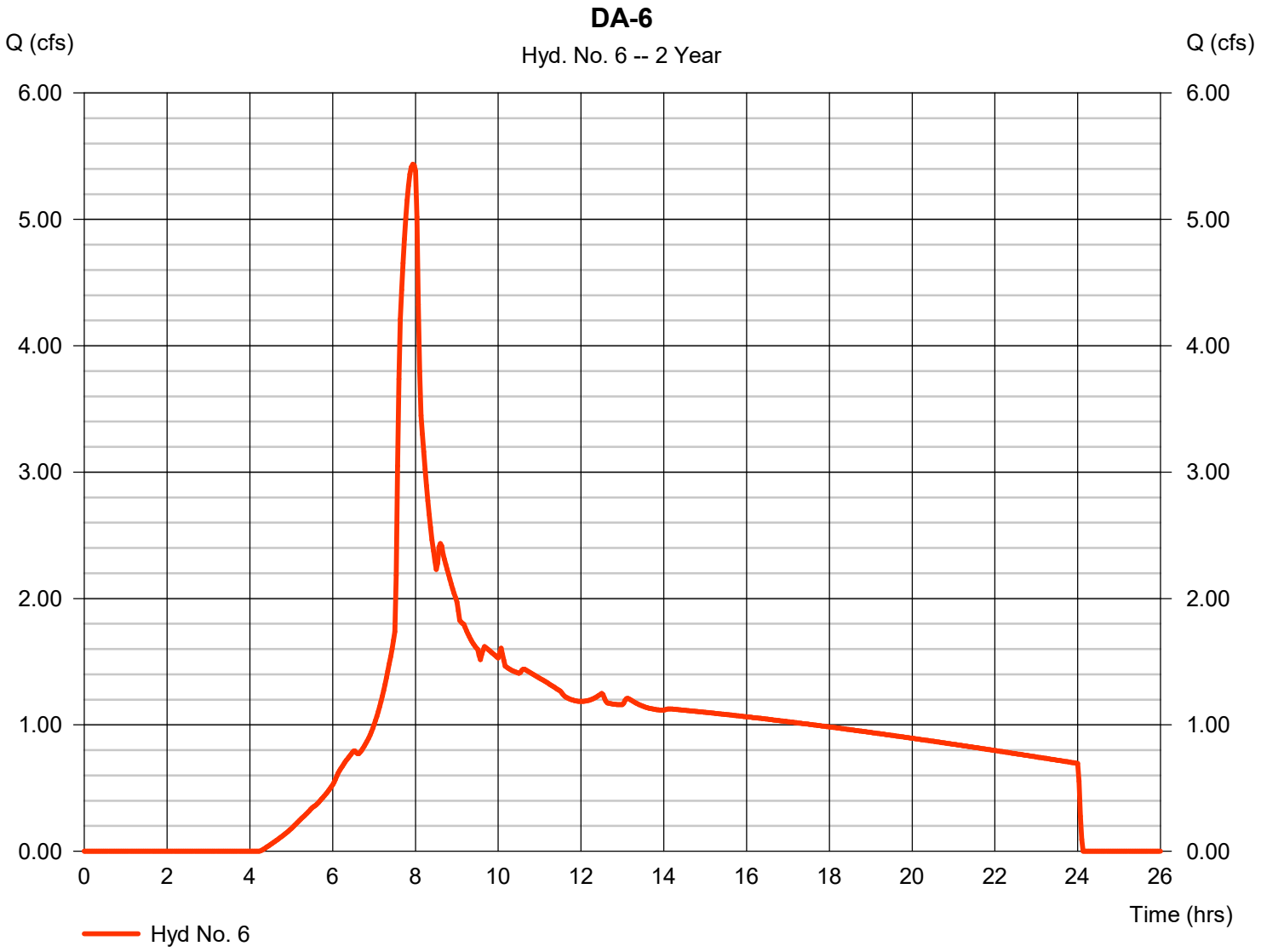
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 6

DA-6

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.436 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	82,274 cuft
Drainage area	=	15.120 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

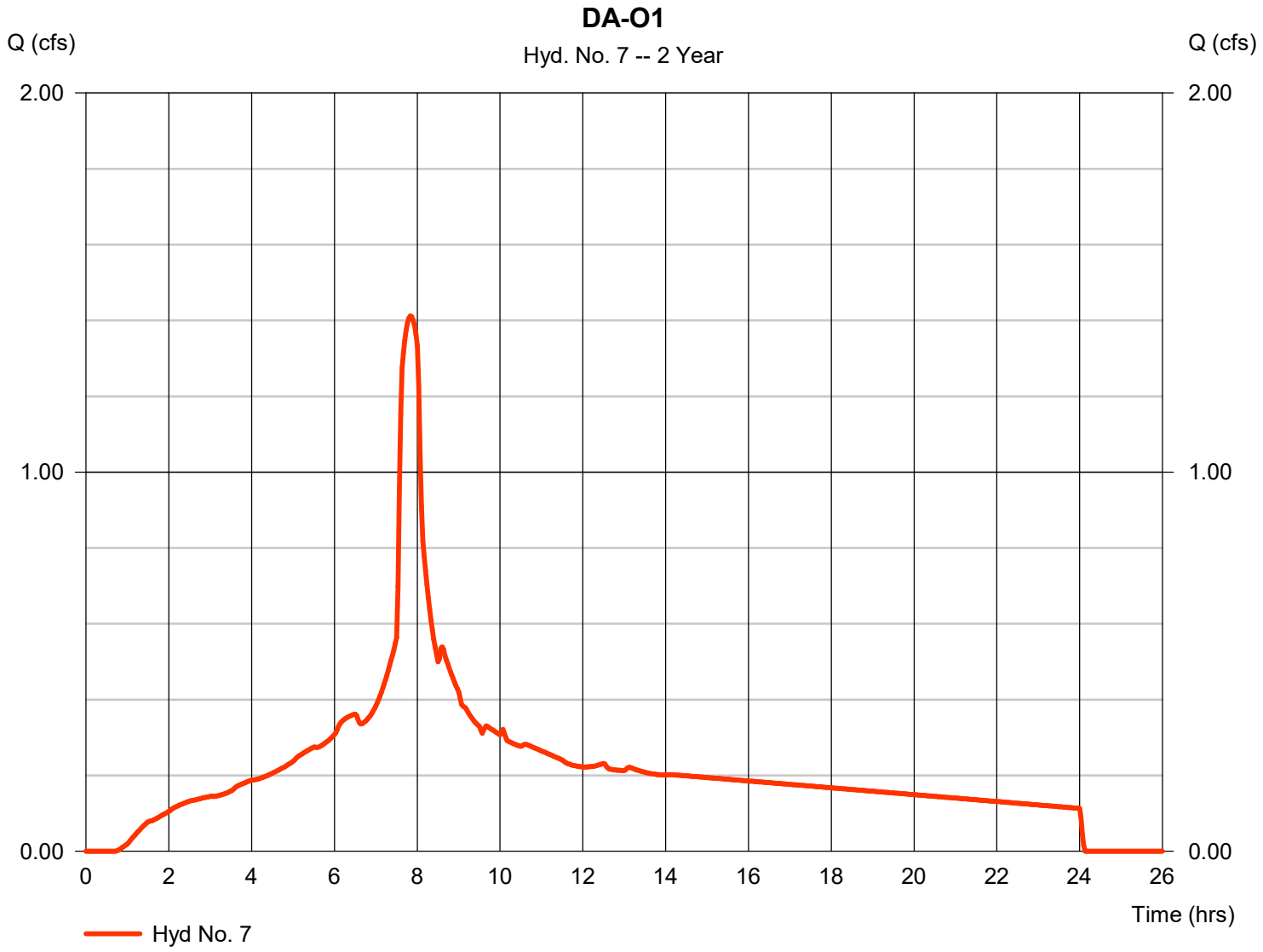
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 7

DA-O1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.412 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.83 hrs
Time interval	=	2 min	Hyd. volume	=	20,007 cuft
Drainage area	=	2.050 ac	Curve number	=	98*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.820 x 84) + (2.050 x 98)] / 2.050



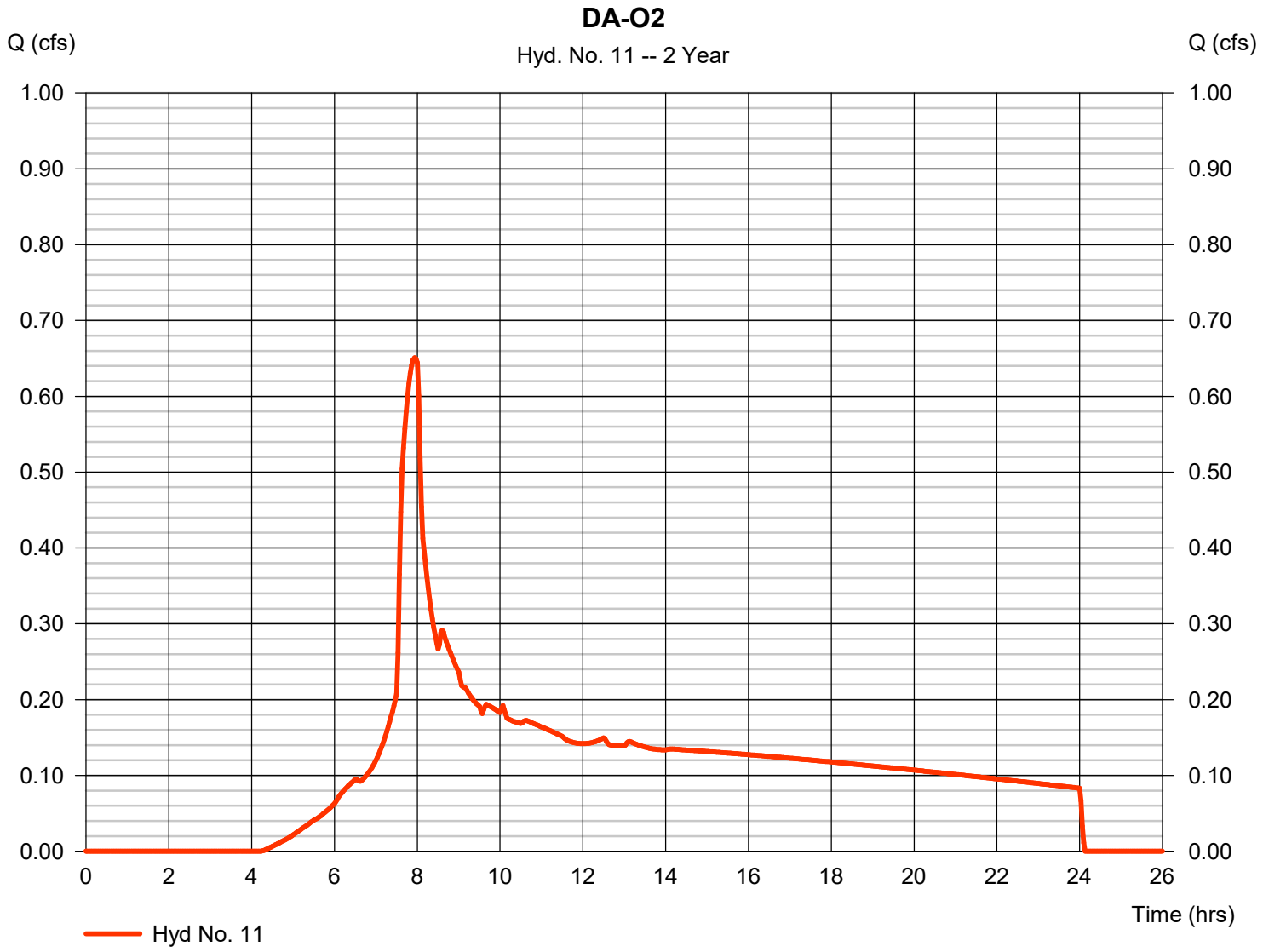
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 11

DA-O2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.651 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	9,849 cuft
Drainage area	=	1.810 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



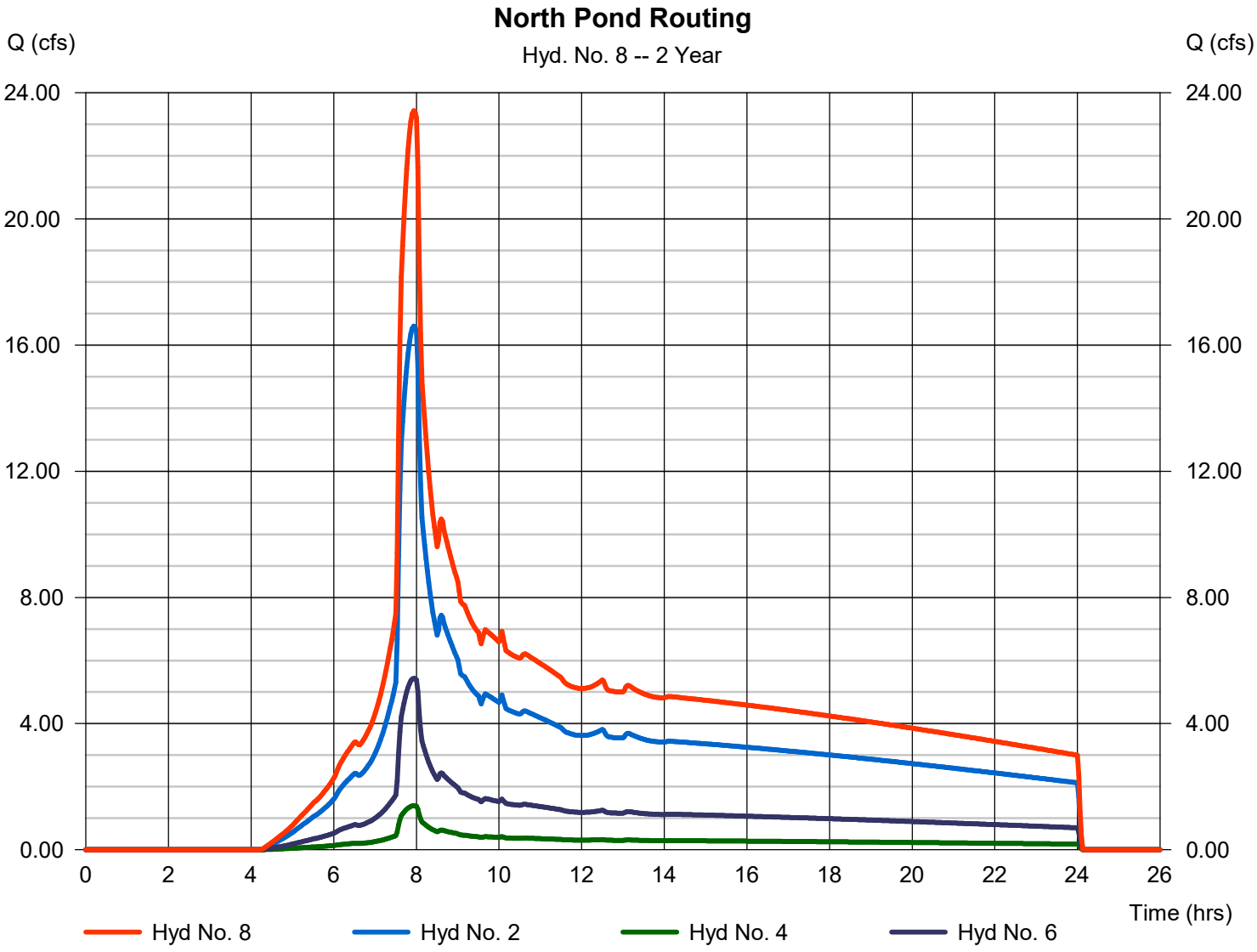
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 8

North Pond Routing

Hydrograph type	=	Combine	Peak discharge	=	23.43 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	354,671 cuft
Inflow hyds.	=	2, 4, 6	Contrib. drain. area	=	65.180 ac



Hydrograph Report

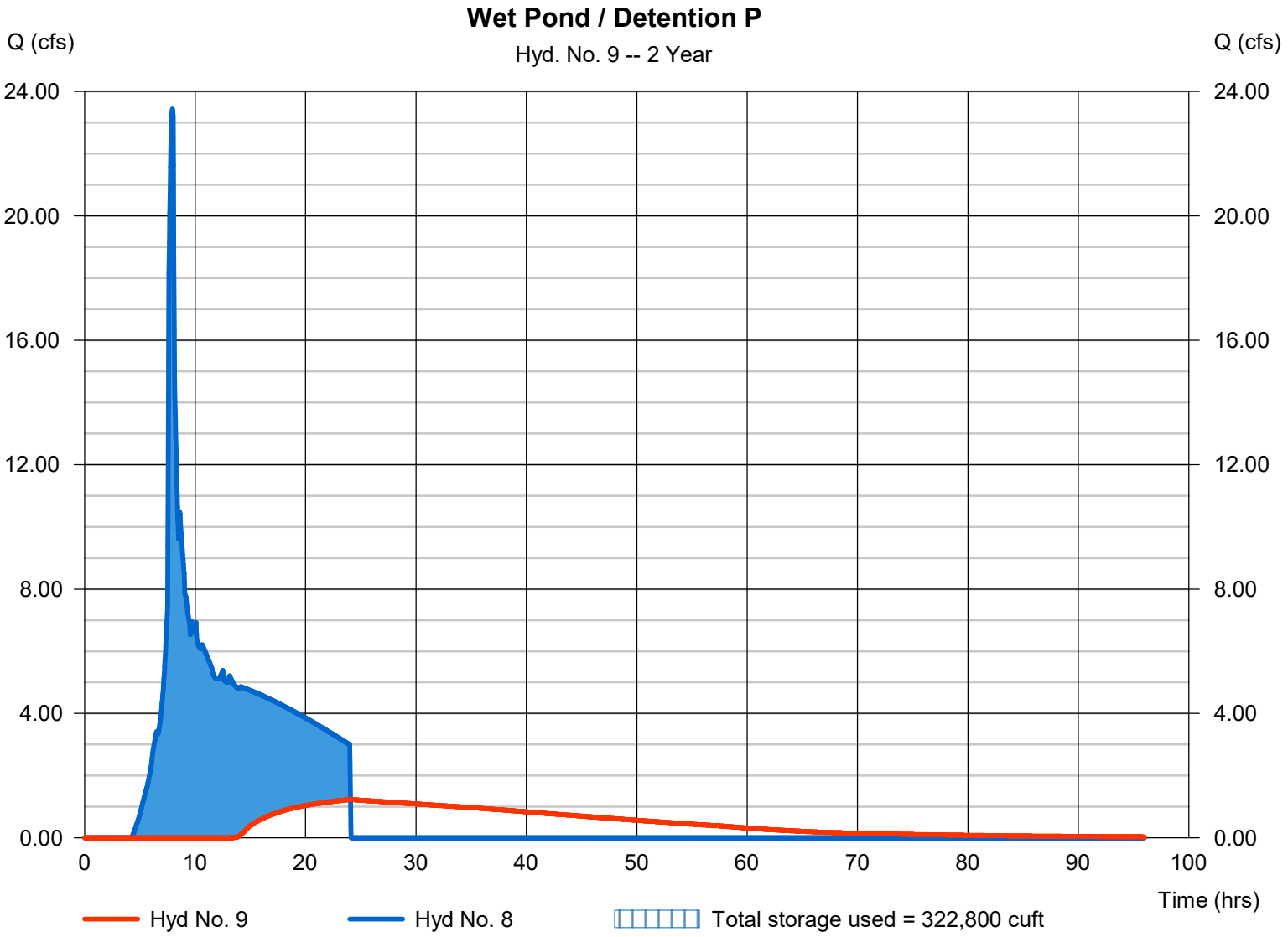
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 9

Wet Pond / Detention P

Hydrograph type	= Reservoir	Peak discharge	= 1.230 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.07 hrs
Time interval	= 2 min	Hyd. volume	= 147,353 cuft
Inflow hyd. No.	= 8 - North Pond Routing	Max. Elevation	= 242.85 ft
Reservoir name	= Wet Pond / Detention Pond	Max. Storage	= 322,800 cuft

Storage Indication method used.



Hydrograph Report

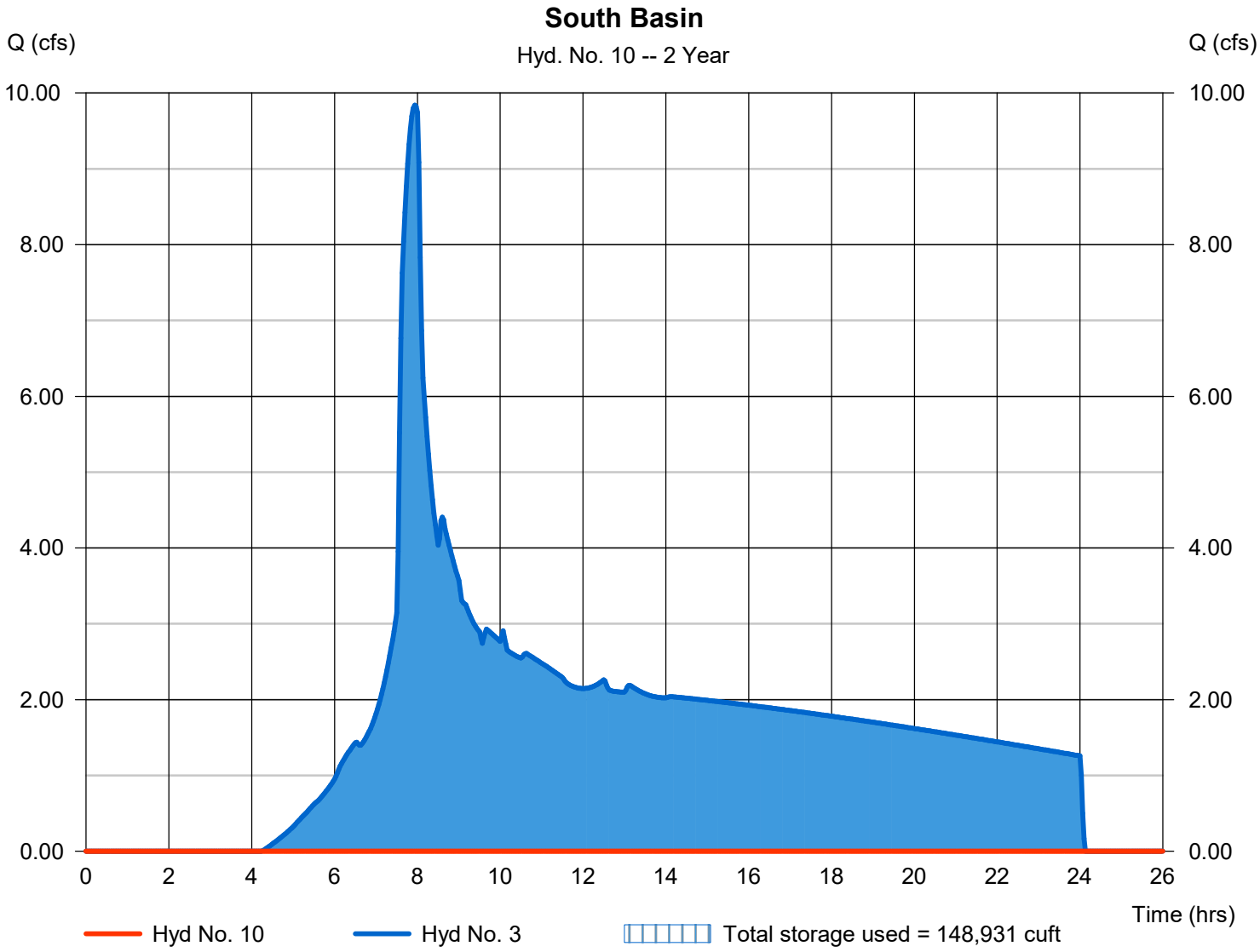
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 10

South Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - DA-3	Max. Elevation	= 336.24 ft
Reservoir name	= South Basin	Max. Storage	= 148,931 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	17.28	2	474	244,045	------	------	------	DA-1
2	SCS Runoff	37.41	2	474	528,364	------	------	------	DA-2
3	SCS Runoff	22.17	2	474	313,151	------	------	------	DA-3
4	SCS Runoff	3.143	2	474	44,393	------	------	------	DA-4
5	SCS Runoff	7.655	2	474	108,121	------	------	------	DA-5
6	SCS Runoff	12.25	2	474	172,994	------	------	------	DA-6
7	SCS Runoff	2.356	2	470	33,926	------	------	------	DA-O1
8	Combine	52.80	2	474	745,749	2, 4, 6,	------	------	North Pond Routing
9	Reservoir	2.275	2	1444	498,694	8	248.25	643,196	Wet Pond / Detention P
10	Reservoir	0.000	2	n/a	0	3	340.03	313,150	South Basin
11	SCS Runoff	1.466	2	474	20,709	------	------	------	DA-O2

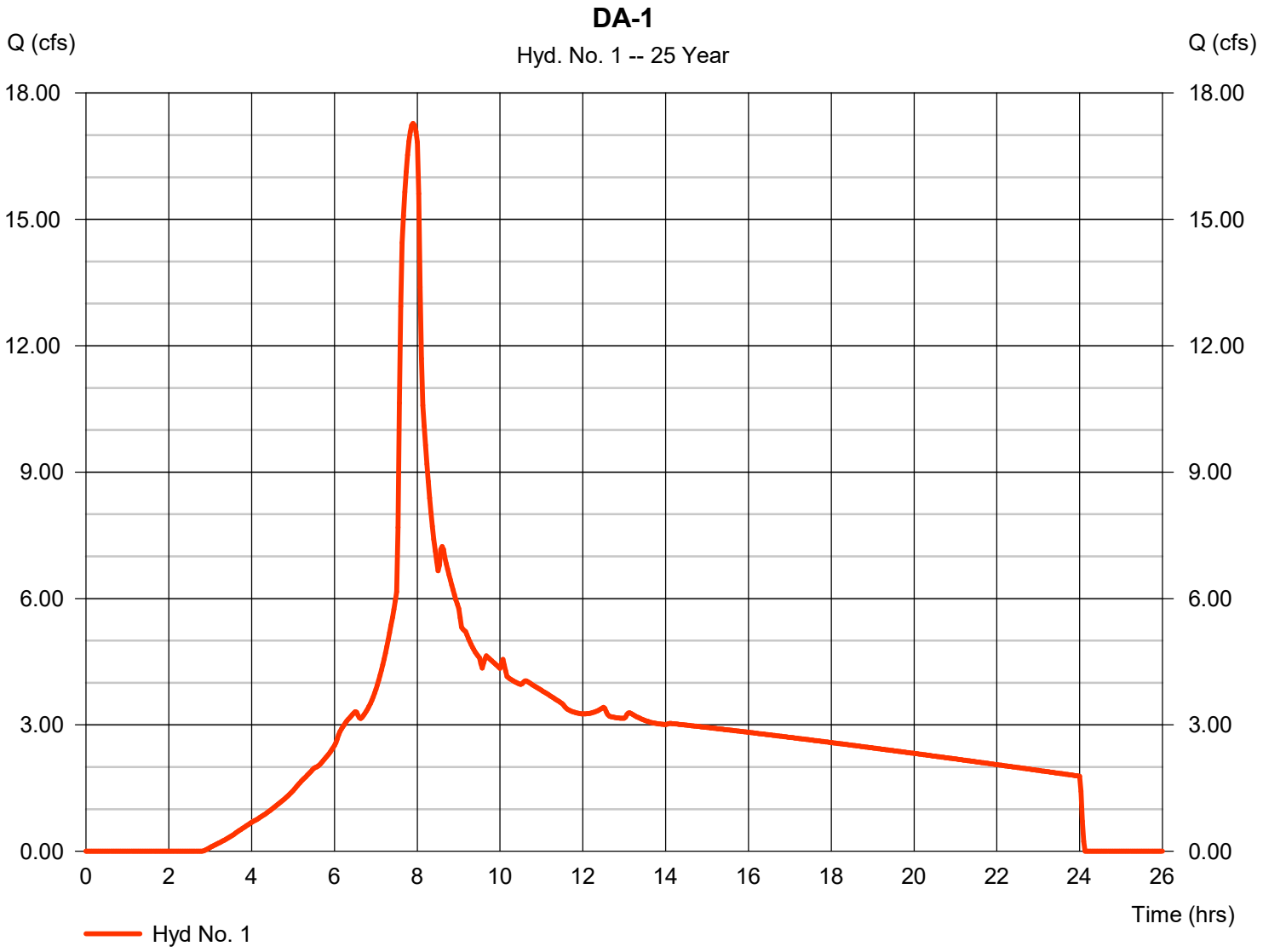
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 1

DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.28 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	244,045 cuft
Drainage area	=	21.330 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



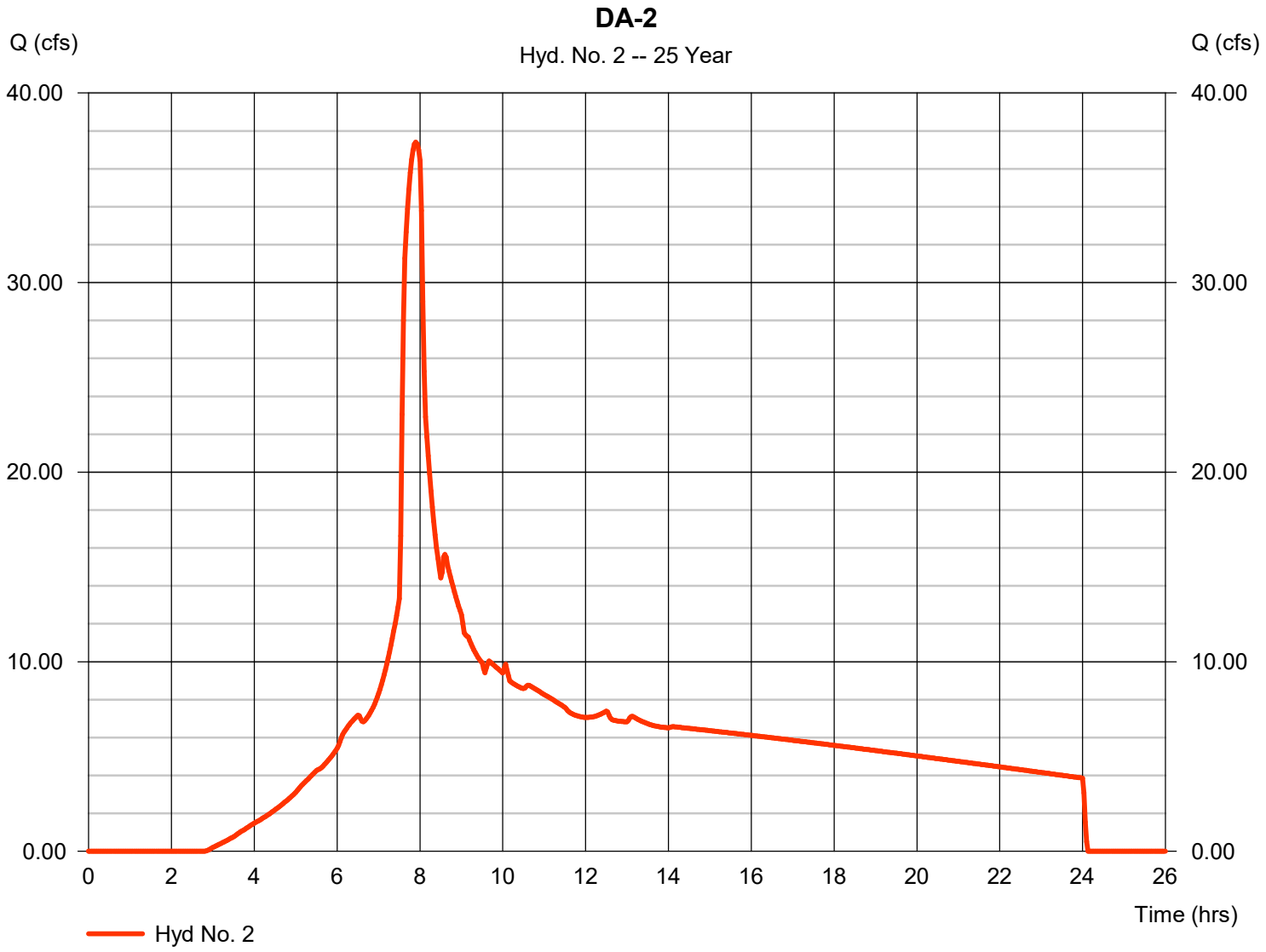
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 2

DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.41 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	528,364 cuft
Drainage area	=	46.180 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



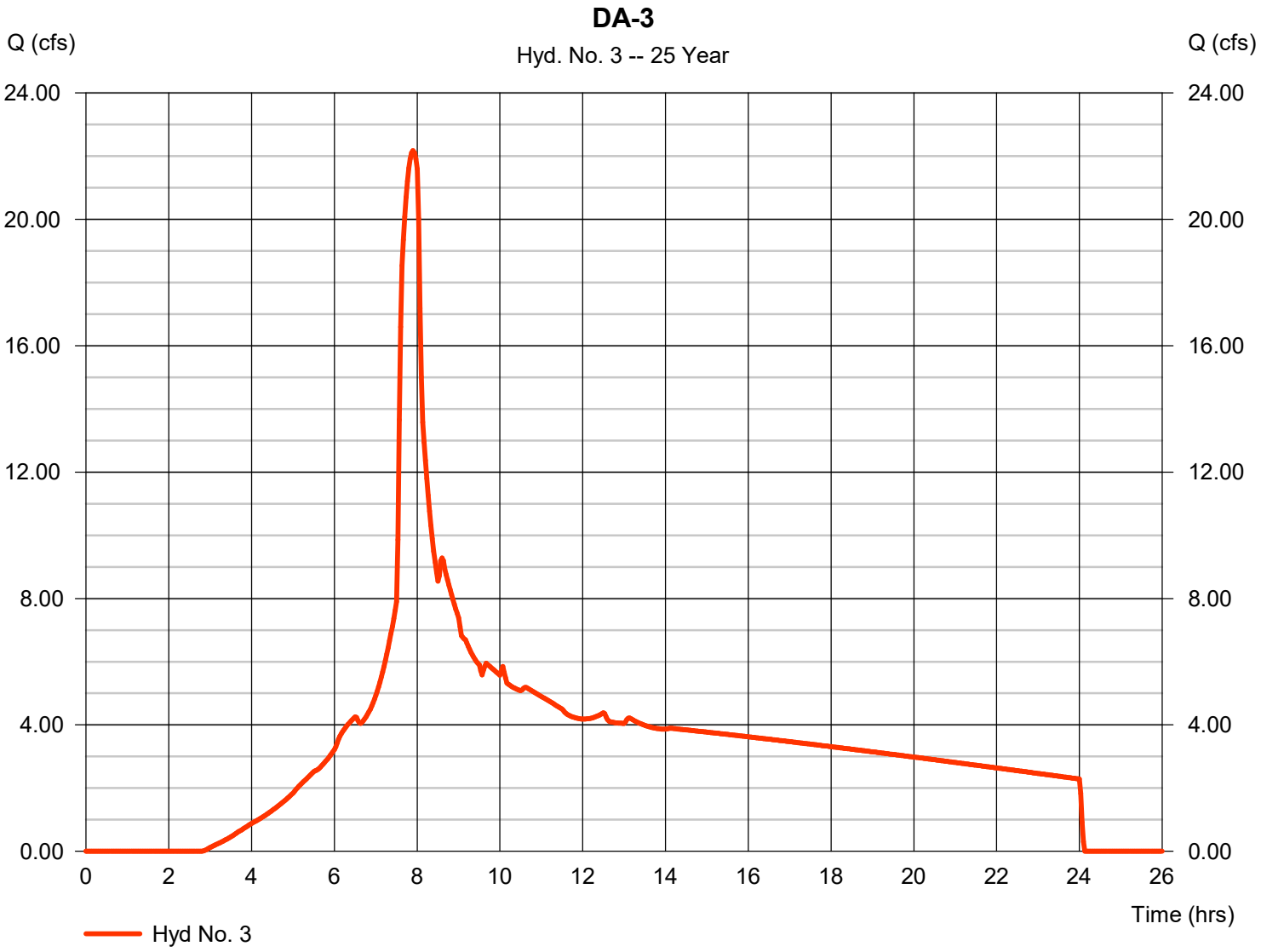
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 3

DA-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.17 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	313,151 cuft
Drainage area	=	27.370 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



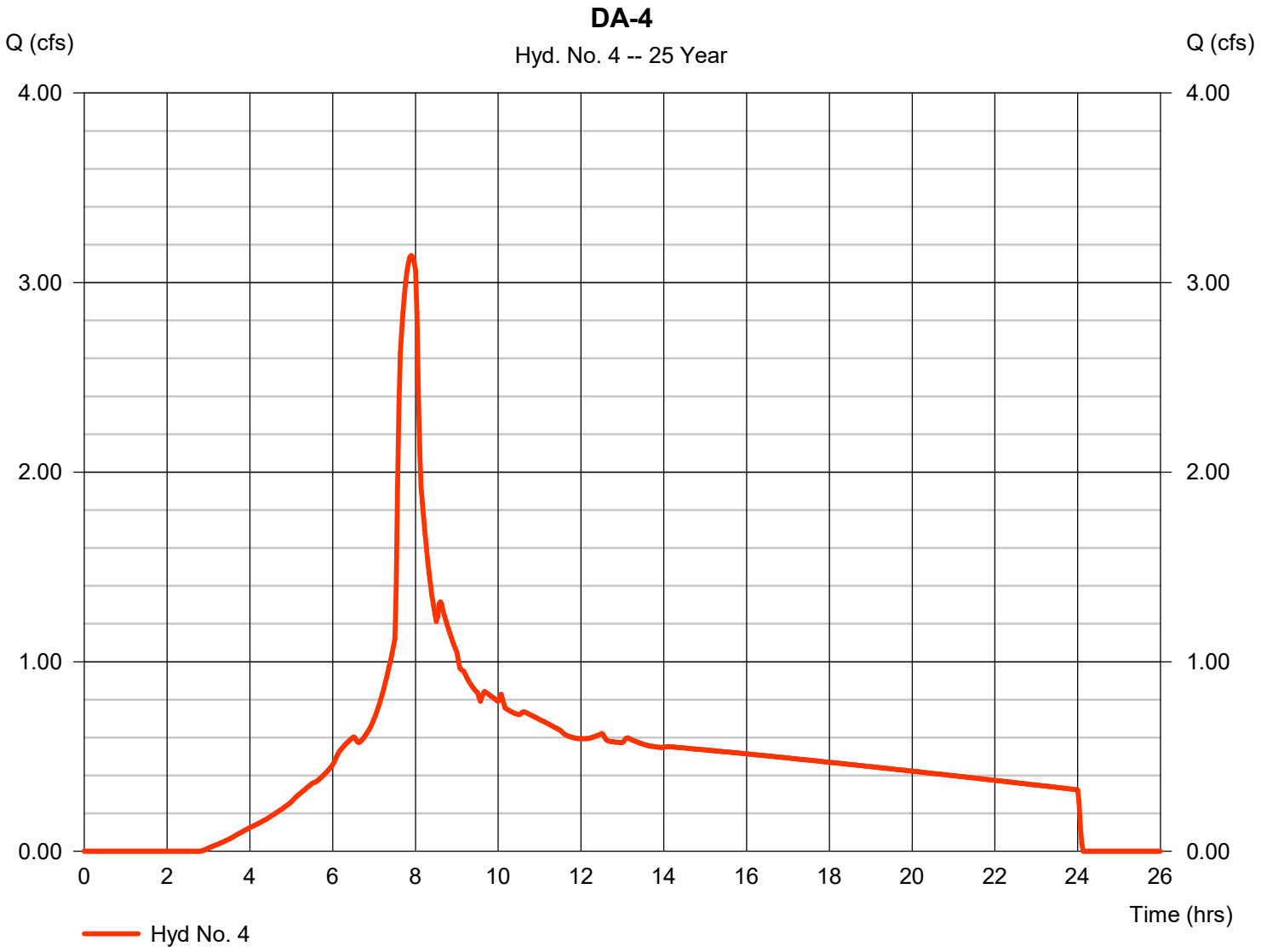
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 4

DA-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.143 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	44,393 cuft
Drainage area	=	3.880 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



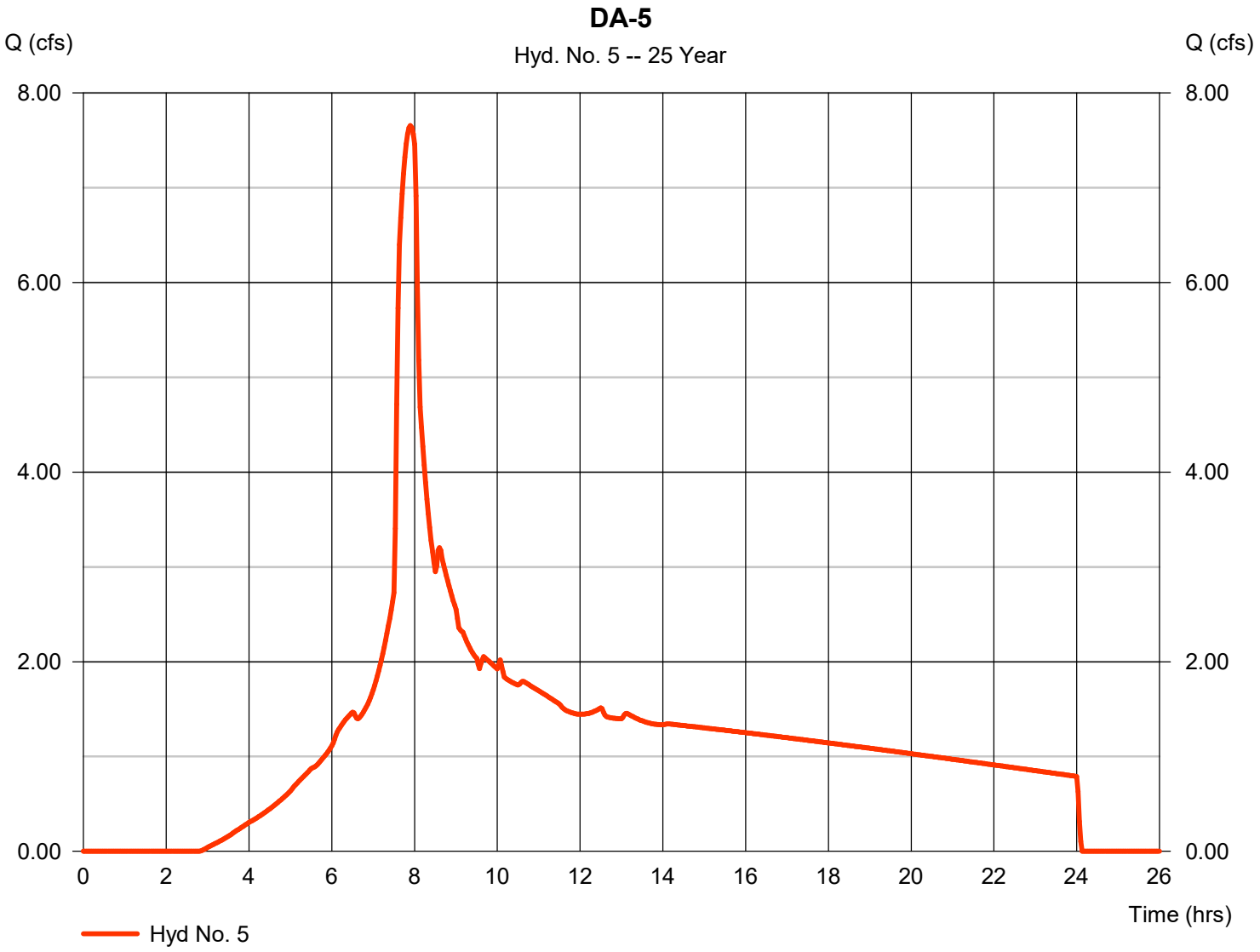
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 5

DA-5

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.655 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	108,121 cuft
Drainage area	=	9.450 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



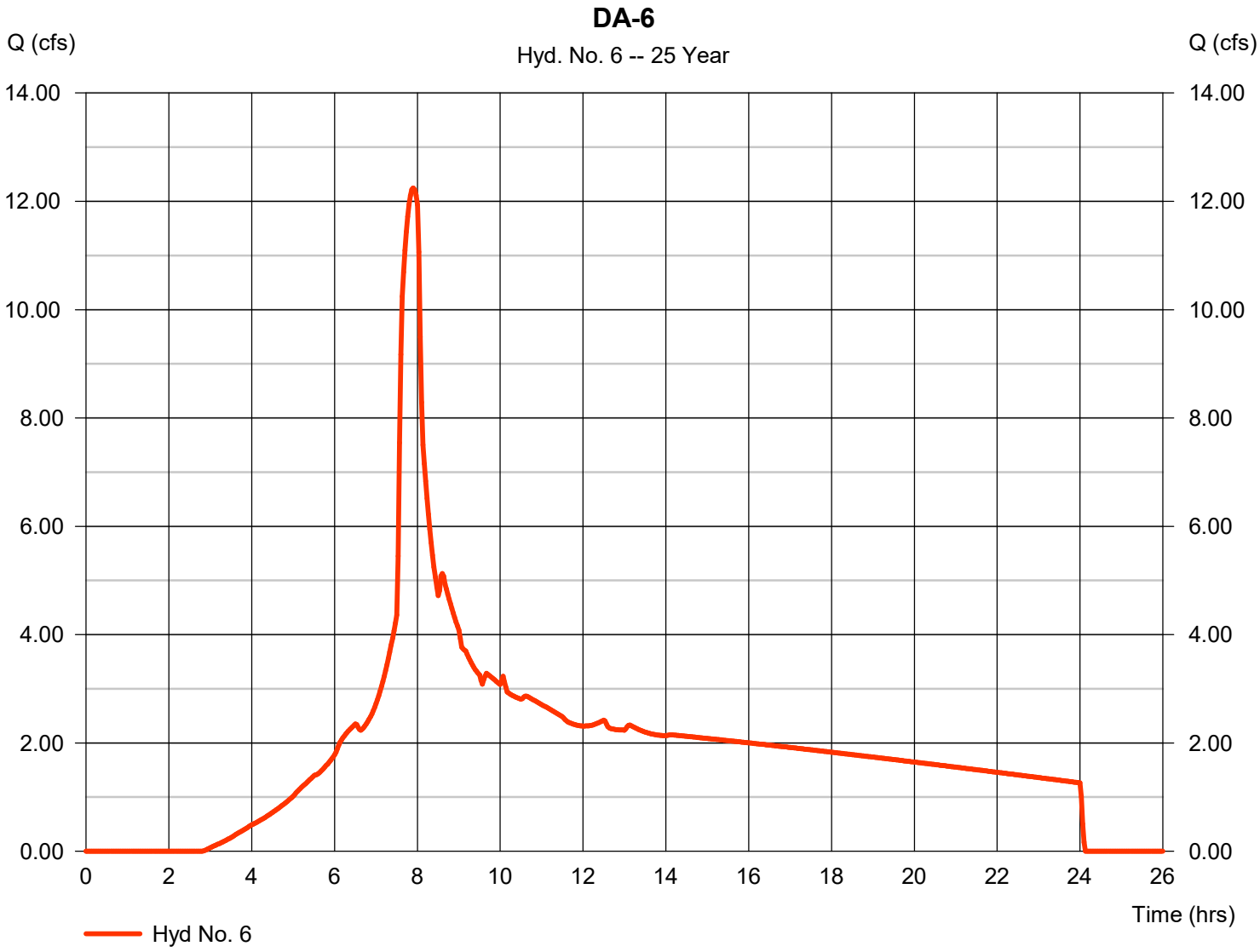
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 6

DA-6

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.25 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	172,994 cuft
Drainage area	=	15.120 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

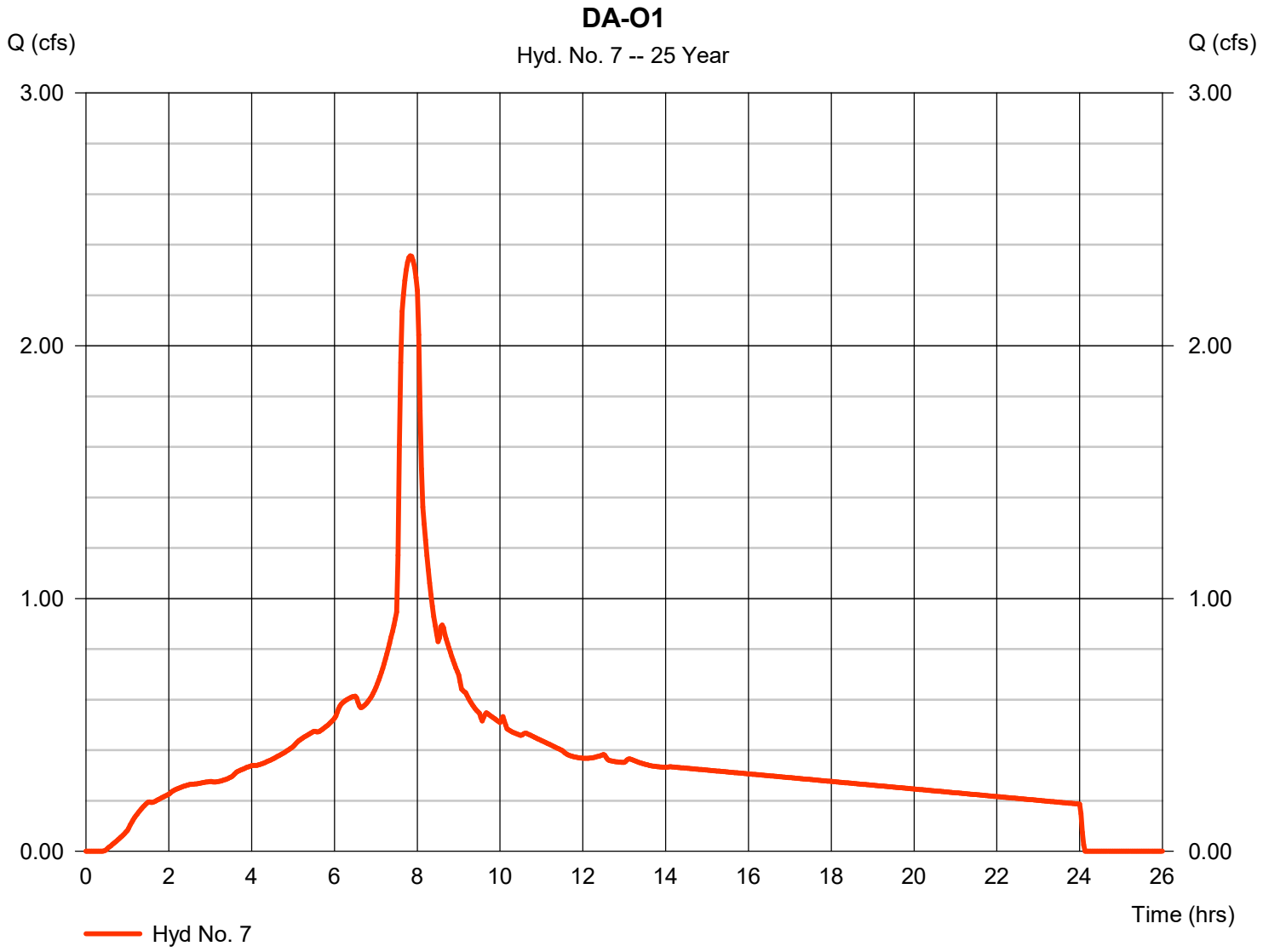
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 7

DA-O1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.356 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.83 hrs
Time interval	=	2 min	Hyd. volume	=	33,926 cuft
Drainage area	=	2.050 ac	Curve number	=	98*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.820 x 84) + (2.050 x 98)] / 2.050



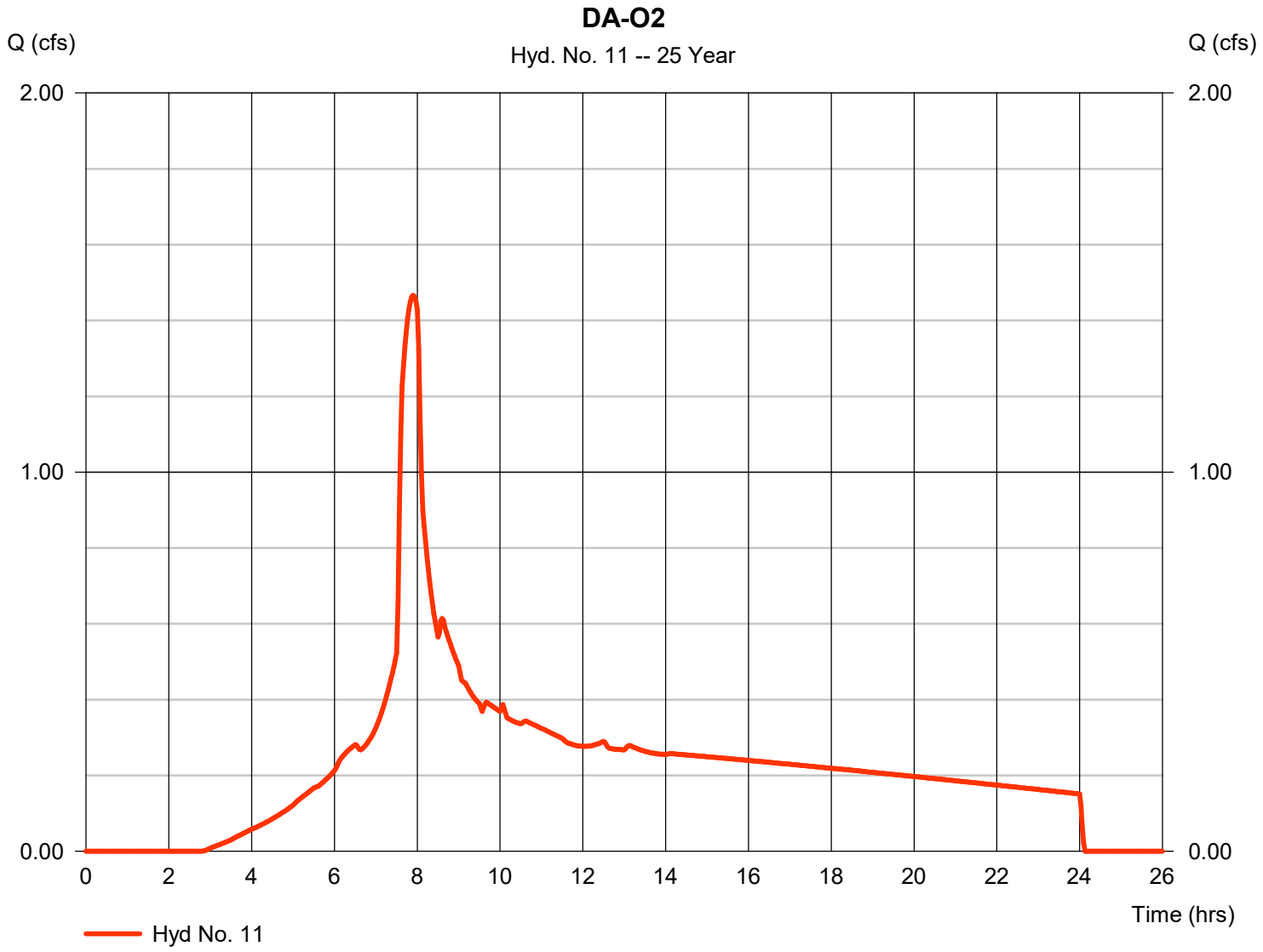
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 11

DA-O2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.466 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	20,709 cuft
Drainage area	=	1.810 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



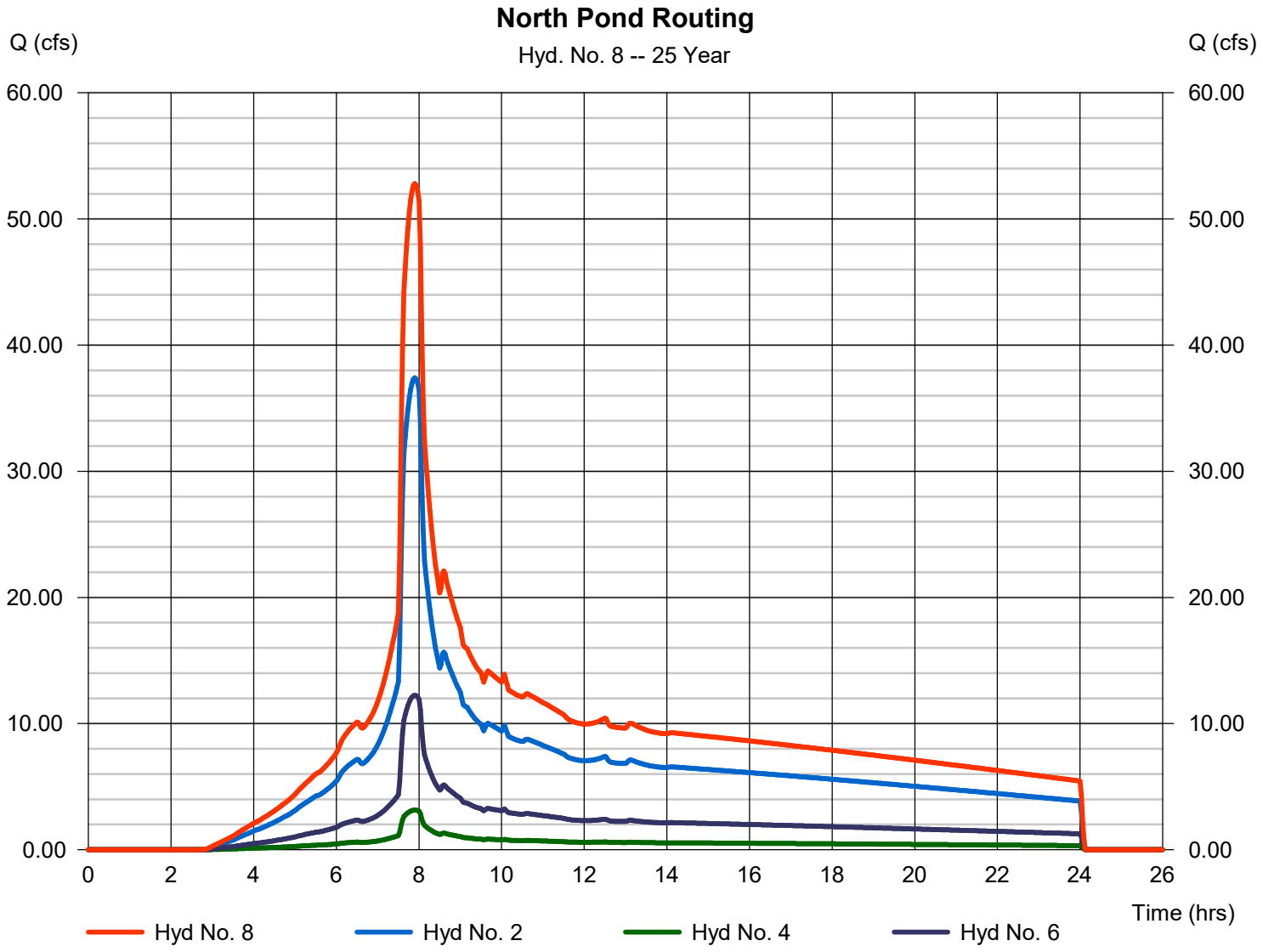
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 8

North Pond Routing

Hydrograph type	=	Combine	Peak discharge	=	52.80 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	745,749 cuft
Inflow hyds.	=	2, 4, 6	Contrib. drain. area	=	65.180 ac



Hydrograph Report

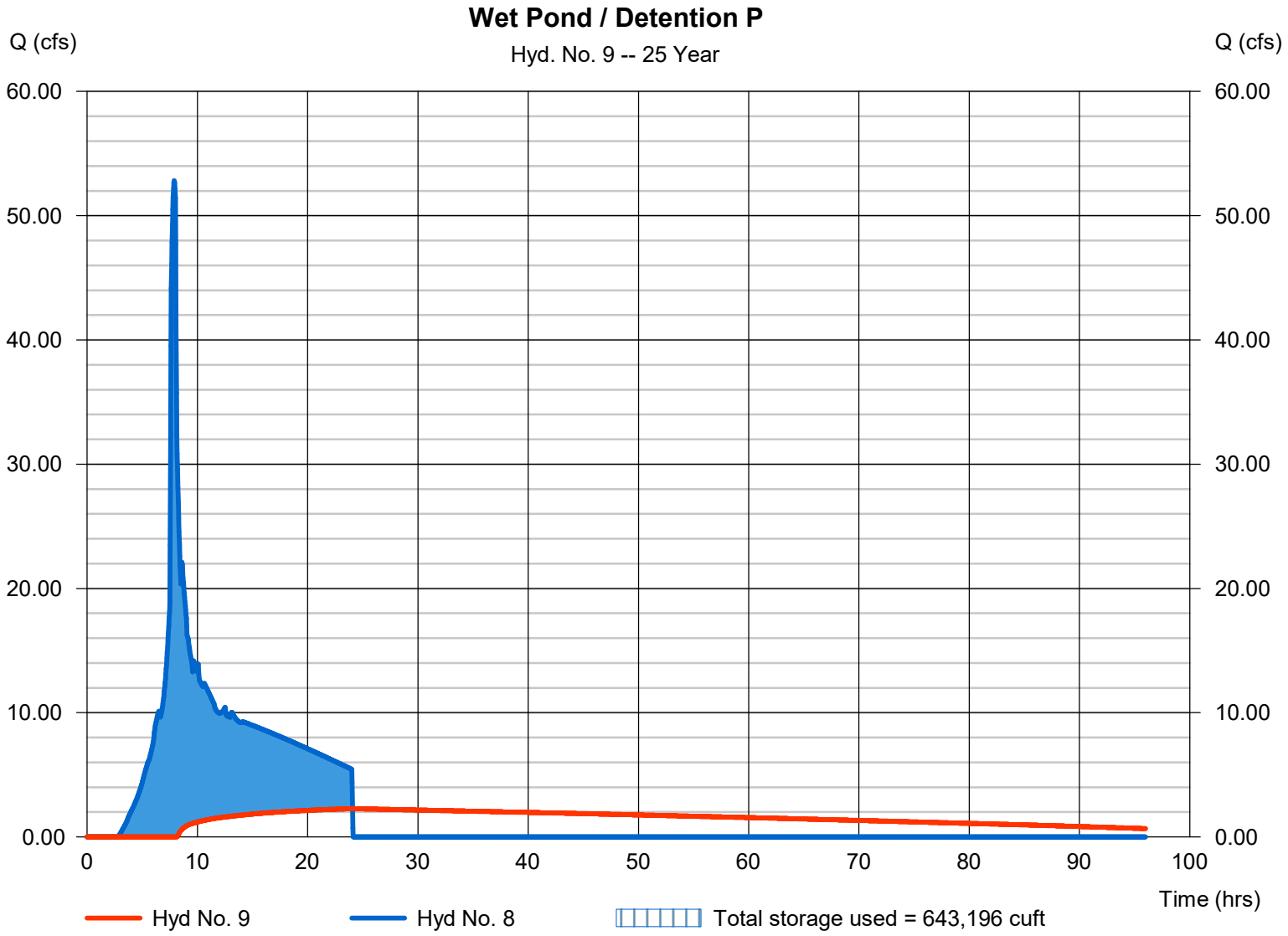
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 9

Wet Pond / Detention P

Hydrograph type	=	Reservoir	Peak discharge	=	2.275 cfs
Storm frequency	=	25 yrs	Time to peak	=	24.07 hrs
Time interval	=	2 min	Hyd. volume	=	498,694 cuft
Inflow hyd. No.	=	8 - North Pond Routing	Max. Elevation	=	248.25 ft
Reservoir name	=	Wet Pond / Detention Pond	Max. Storage	=	643,196 cuft

Storage Indication method used.



Hydrograph Report

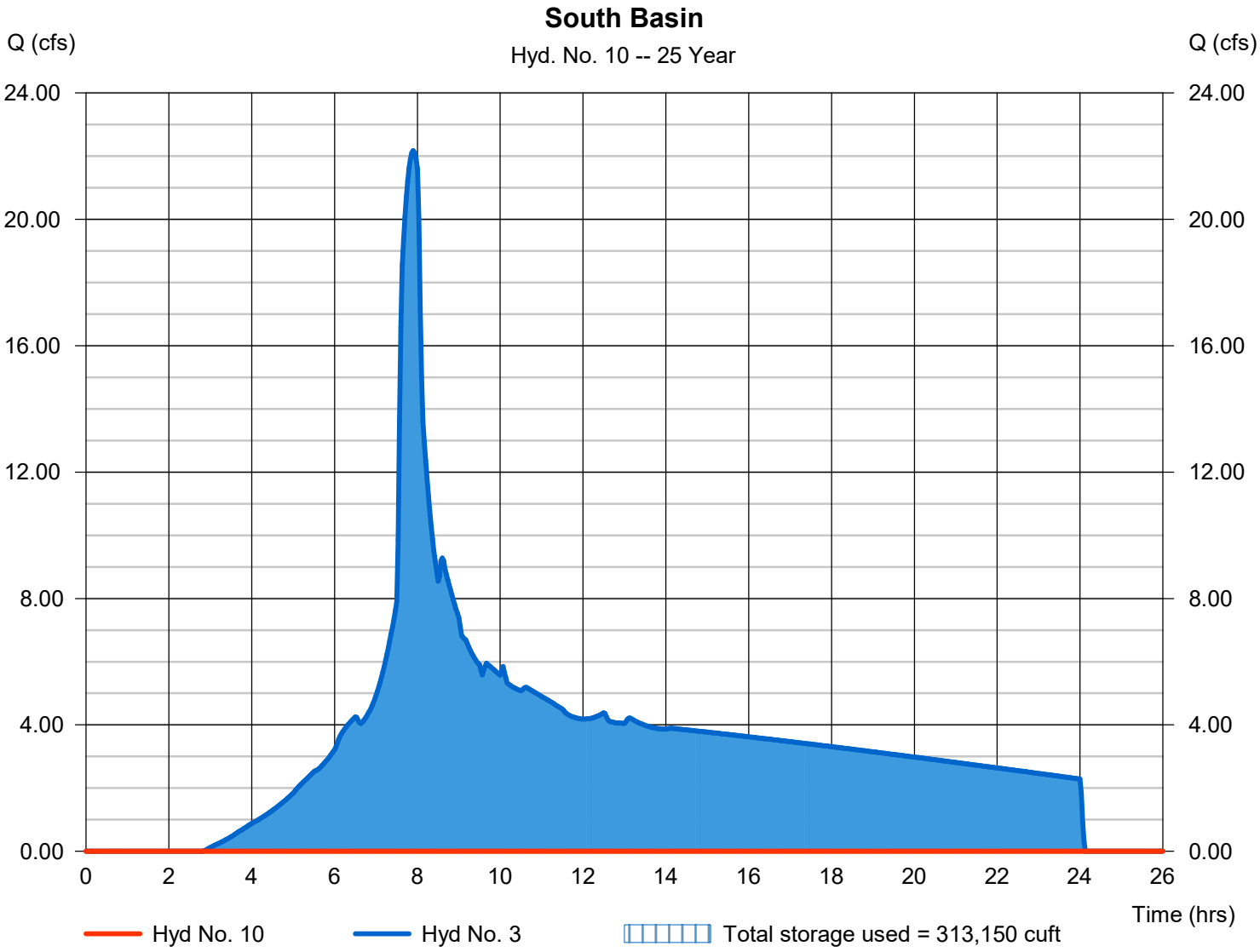
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Hyd. No. 10

South Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - DA-3	Max. Elevation	= 340.03 ft
Reservoir name	= South Basin	Max. Storage	= 313,150 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Pond No. 1 - Wet Pond / Detention Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 234.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	234.00	22,907	0	0
2.00	236.00	28,323	51,129	51,129
4.00	238.00	34,399	62,617	113,747
6.00	240.00	41,042	75,336	189,082
8.00	242.00	48,702	89,626	278,708
10.00	244.00	54,688	103,322	382,030
12.00	246.00	60,811	115,433	497,463
14.00	248.00	67,458	128,199	625,662
16.00	250.00	74,547	141,932	767,594

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	6.00	Inactive	Inactive
Span (in)	= 8.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 240.29	240.29	0.00	0.00
Length (ft)	= 40.00	0.00	0.00	0.00
Slope (%)	= 2.52	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)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	234.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
2.00	51,129	236.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
4.00	113,747	238.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
6.00	189,082	240.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
8.00	278,708	242.00	0.97 ic	0.97 ic	---	---	---	---	---	---	---	---	0.967
10.00	382,030	244.00	1.51 ic	1.51 ic	---	---	---	---	---	---	---	---	1.514
12.00	497,463	246.00	1.91 ic	1.91 ic	---	---	---	---	---	---	---	---	1.910
14.00	625,662	248.00	2.24 ic	2.24 ic	---	---	---	---	---	---	---	---	2.238
16.00	767,594	250.00	2.52 oc	2.52 ic	---	---	---	---	---	---	---	---	2.521

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 01 / 22 / 2025

Pond No. 2 - South Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 332.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	332.00	30,689	0	0
2.00	334.00	34,743	65,384	65,384
4.00	336.00	38,897	73,594	138,977
6.00	338.00	43,152	82,004	220,981
8.00	340.00	47,508	90,616	311,597
10.00	342.00	51,964	99,428	411,025
12.00	344.00	56,521	108,442	519,467
14.00	346.00	61,178	117,656	637,124
16.00	348.00	65,936	127,072	764,196

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	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	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	332.00	---	---	---	---	---	---	---	---	---	---	0.000
2.00	65,384	334.00	---	---	---	---	---	---	---	---	---	---	0.000
4.00	138,977	336.00	---	---	---	---	---	---	---	---	---	---	0.000
6.00	220,981	338.00	---	---	---	---	---	---	---	---	---	---	0.000
8.00	311,597	340.00	---	---	---	---	---	---	---	---	---	---	0.000
10.00	411,025	342.00	---	---	---	---	---	---	---	---	---	---	0.000
12.00	519,467	344.00	---	---	---	---	---	---	---	---	---	---	0.000
14.00	637,124	346.00	---	---	---	---	---	---	---	---	---	---	0.000
16.00	764,196	348.00	---	---	---	---	---	---	---	---	---	---	0.000

APPENDIX B
HYDRAULIC CALCULATIONS

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

15" HDPE (DA-2)

Invert Elev Dn (ft)	=	238.41
Pipe Length (ft)	=	116.00
Slope (%)	=	0.20
Invert Elev Up (ft)	=	238.64
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

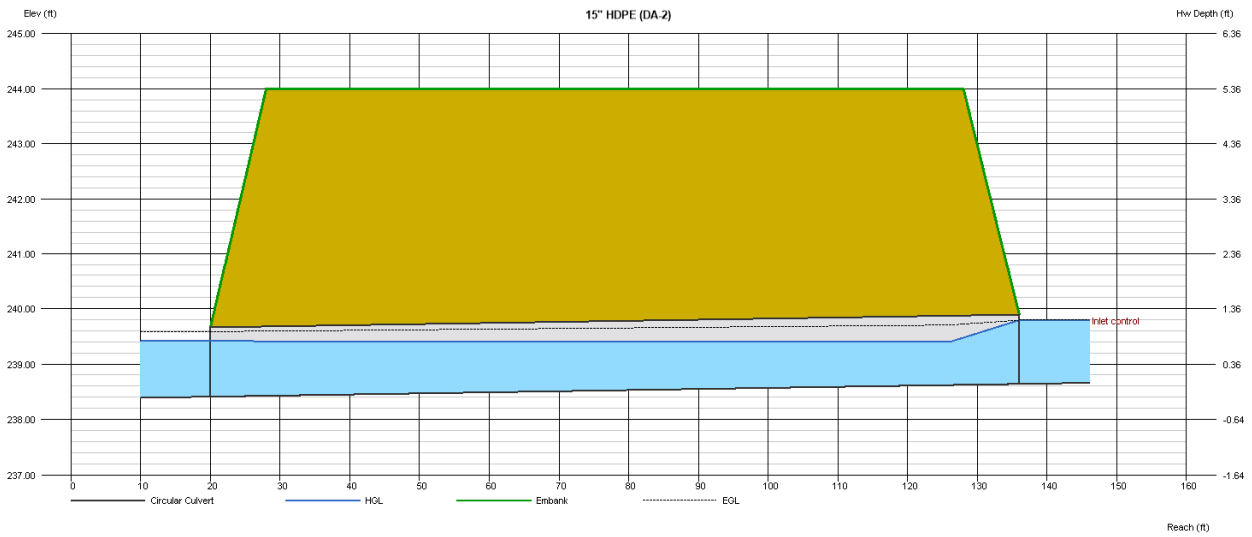
Top Elevation (ft)	=	244.00
Top Width (ft)	=	100.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	3.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.50
Qpipe (cfs)	=	3.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.32
Veloc Up (ft/s)	=	4.52
HGL Dn (ft)	=	239.41
HGL Up (ft)	=	239.39
Hw Elev (ft)	=	239.79
Hw/D (ft)	=	0.92
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

36" HDPE (DA-2)

Invert Elev Dn (ft)	=	236.00
Pipe Length (ft)	=	183.00
Slope (%)	=	0.36
Invert Elev Up (ft)	=	236.66
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

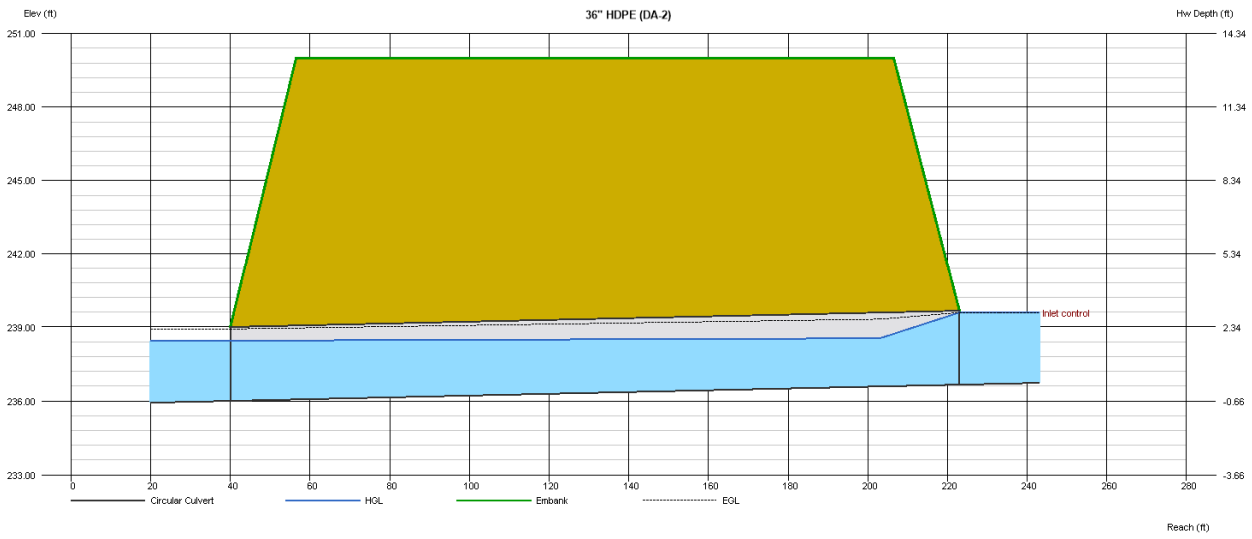
Top Elevation (ft)	=	250.00
Top Width (ft)	=	150.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	34.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	34.00
Qpipe (cfs)	=	34.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.51
Veloc Up (ft/s)	=	7.24
HGL Dn (ft)	=	238.45
HGL Up (ft)	=	238.55
Hw Elev (ft)	=	239.59
Hw/D (ft)	=	0.98
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

12" HDPE (DA-4)

Invert Elev Dn (ft)	=	236.00
Pipe Length (ft)	=	76.00
Slope (%)	=	6.75
Invert Elev Up (ft)	=	241.13
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

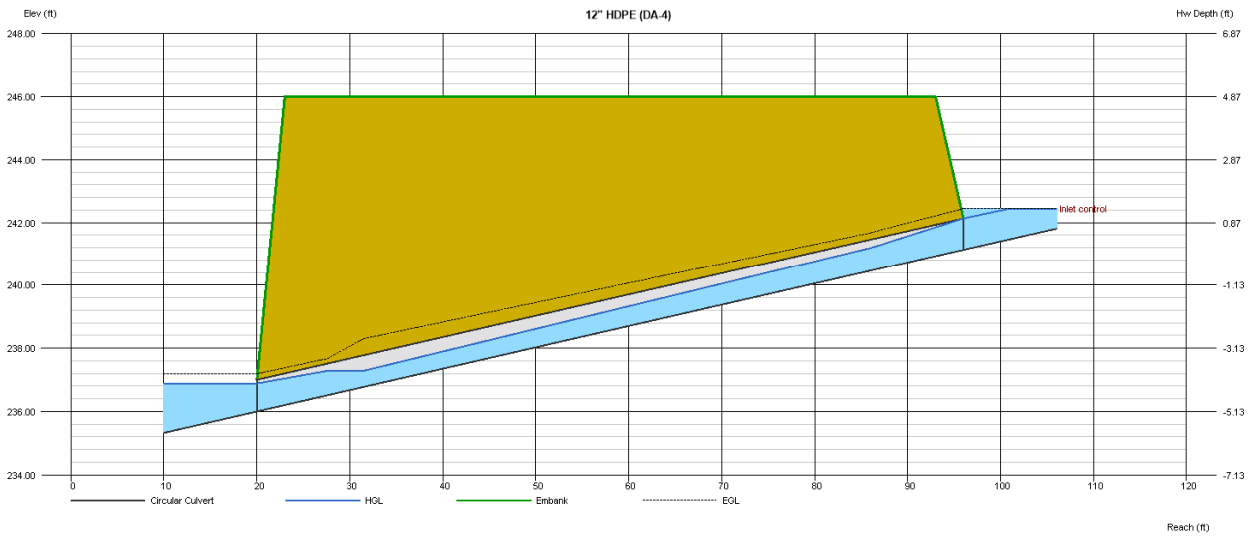
Top Elevation (ft)	=	246.00
Top Width (ft)	=	70.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	3.25
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.25
Qpipe (cfs)	=	3.25
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.42
Veloc Up (ft/s)	=	5.00
HGL Dn (ft)	=	236.89
HGL Up (ft)	=	241.90
Hw Elev (ft)	=	242.45
Hw/D (ft)	=	1.32
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

18" HDPE (DA-5)

Invert Elev Dn (ft)	=	259.16
Pipe Length (ft)	=	203.00
Slope (%)	=	0.60
Invert Elev Up (ft)	=	260.38
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

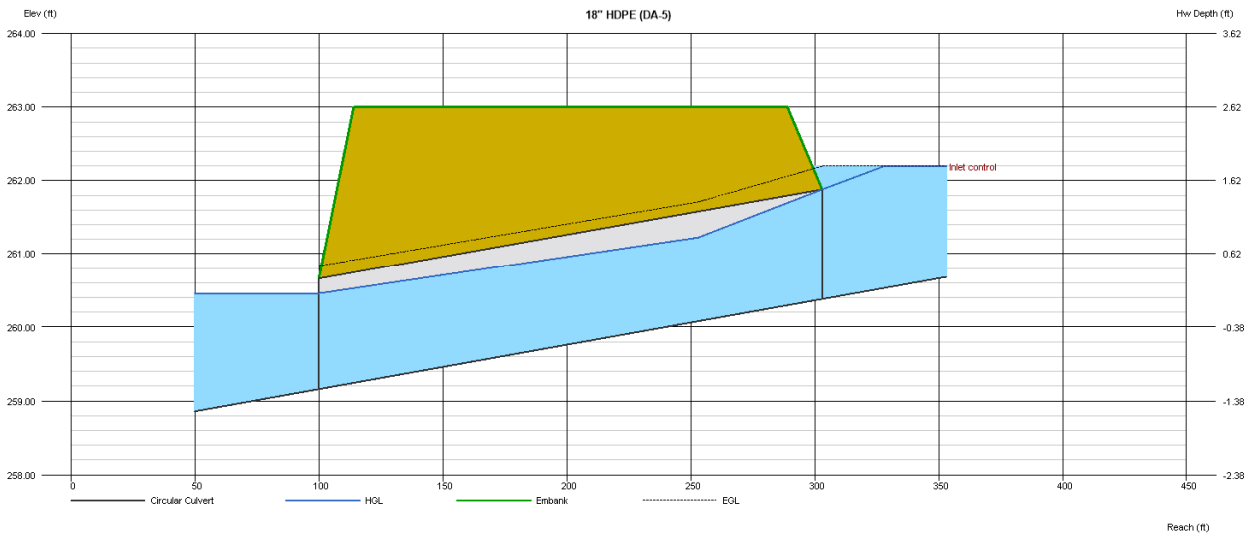
Top Elevation (ft)	=	263.00
Top Width (ft)	=	175.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	8.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	8.00
Qpipe (cfs)	=	8.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.92
Veloc Up (ft/s)	=	5.79
HGL Dn (ft)	=	260.46
HGL Up (ft)	=	261.47
Hw Elev (ft)	=	262.20
Hw/D (ft)	=	1.21
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

12" CMP (Entrance Culvert)

Invert Elev Dn (ft)	=	237.17
Pipe Length (ft)	=	77.00
Slope (%)	=	1.29
Invert Elev Up (ft)	=	238.16
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

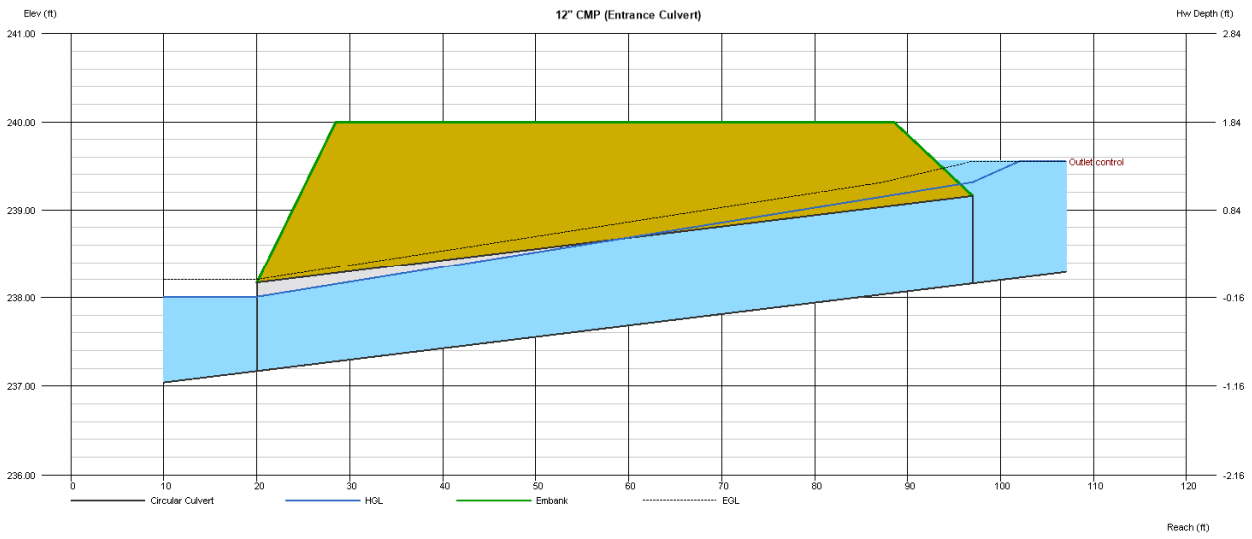
Top Elevation (ft)	=	240.00
Top Width (ft)	=	60.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	2.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.50
Qpipe (cfs)	=	2.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.56
Veloc Up (ft/s)	=	3.18
HGL Dn (ft)	=	238.01
HGL Up (ft)	=	239.32
Hw Elev (ft)	=	239.55
Hw/D (ft)	=	1.39
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jan 23 2025

2-Barrel 12" RCP (Coffin Butte Road Culvert)

Invert Elev Dn (ft)	=	232.25
Pipe Length (ft)	=	119.00
Slope (%)	=	0.63
Invert Elev Up (ft)	=	233.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	2
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

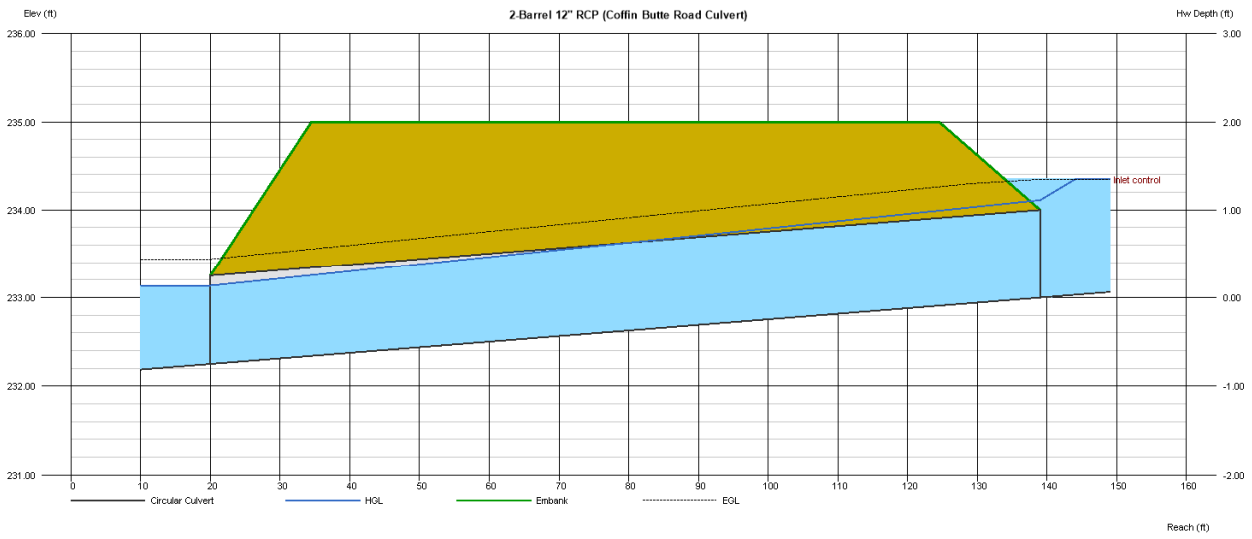
Top Elevation (ft)	=	235.00
Top Width (ft)	=	90.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	6.50
Qpipe (cfs)	=	6.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.42
Veloc Up (ft/s)	=	4.14
HGL Dn (ft)	=	233.14
HGL Up (ft)	=	234.11
Hw Elev (ft)	=	234.35
Hw/D (ft)	=	1.35
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

8" CMP (Emergency Overflow Pipe)

Invert Elev Dn (ft)	=	343.41
Pipe Length (ft)	=	452.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	347.93
Rise (in)	=	8.0
Shape	=	Circular
Span (in)	=	8.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

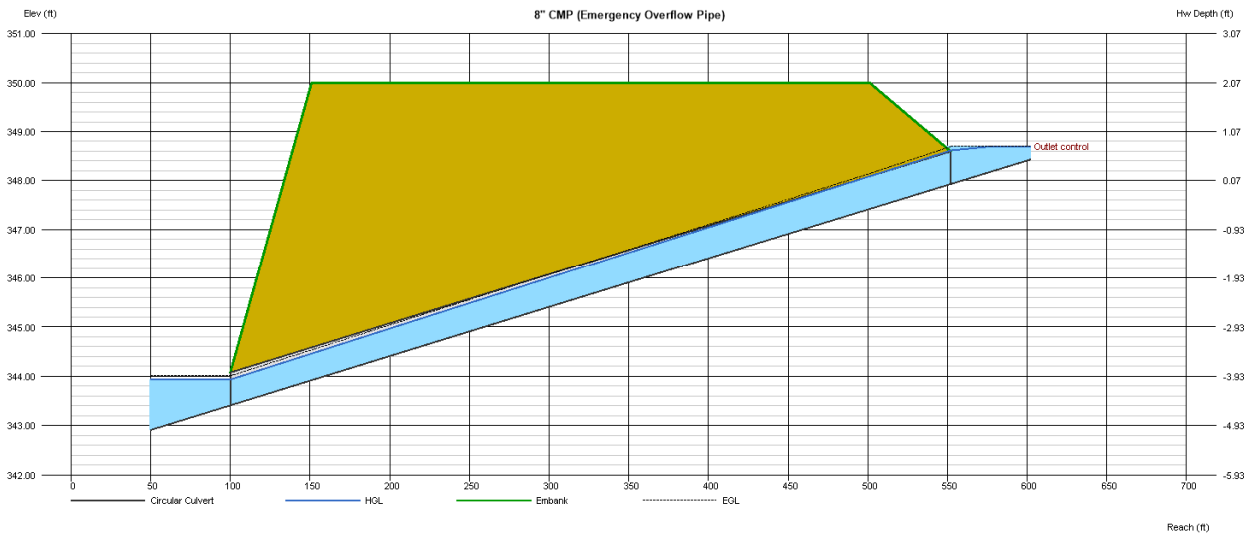
Top Elevation (ft)	=	350.00
Top Width (ft)	=	350.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	0.70
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	0.65
Qpipe (cfs)	=	0.65
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.21
Veloc Up (ft/s)	=	1.86
HGL Dn (ft)	=	343.93
HGL Up (ft)	=	348.62
Hw Elev (ft)	=	348.70
Hw/D (ft)	=	1.15
Flow Regime	=	Outlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 22 2025

Outflow Trapezoidal Ditch 2:1 Sideslope

Trapezoidal

Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 233.00
Slope (%)	= 0.97
N-Value	= 0.020

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 14.70
Area (sqft)	= 3.00
Velocity (ft/s)	= 4.90
Wetted Perim (ft)	= 5.47
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 5.00
EGL (ft)	= 1.37