

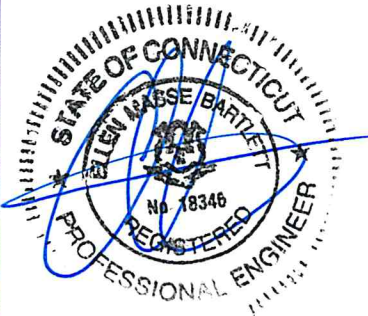
# **DRAINAGE CALCULATIONS, HYDRAULICS & HYDROLOGY REPORT**

**PROPOSED WAREHOUSES  
69 FITCH HILL ROAD  
UNCASVILLE, CT**

**APRIL 2023**

Revised May 25, 2023

Revised July 31, 2023



**GREEN SITE DESIGN**

**69 FITCH HILL ROAD  
MONTVILLE, CT**

The site was previously developed as a gravel excavation site, with areas of previous excavation, stockpiles, and cleared land. The site is proposed to be developed with three new warehouse buildings. Building 1 will be for A&B Excavation. Buildings 2 and 3 will be rental space. Green Site Design is providing the design and calculations for the stabilization of the site.

**PROPOSED HYDRAULICS**

There will be two main on-site drainage areas for the proposed development. Please see the attached plans entitled Drainage Plan – Drainage Map.

Drainage area 1 will handle runoff from the Building 1 area, A&B Excavation, and northern halves of Buildings 2&3. The runoff from these areas will flow to the wetlands, after flowing thru Stormwater basin 1, resulting in a decrease in peak flows to the wetlands system.

Drainage area 2 will handle runoff from the southern halves of Buildings 2&3 and their associated areas. The runoff from these areas will flow to the wetlands, after flowing thru Stormwater Basin 2, resulting in a decrease in peak flows to the existing wetlands system.

The soils on the site are extremely well drained gravel and sand. Numerous test holes were done on the site, and showed the soils and groundwater levels to be very consistent. The rainwater during most storm events will infiltrate into the ground with little runoff.

Both the existing and the proposed conditions for the development site have been analyzed for the 2-year, 10-year, 25-year, and 100-year design storms using the TR-55

SCS modelling program. The following is the summary table for the 2-year, 10-year, 25-year, and 100-year design storms showing first the existing conditions and proposed conditions, after passing thru the proposed stormwater basins. The calculations show that there will be a decrease in runoff leaving the site. The following are the results of the computer model.

#### **Drainage Area 1**

	<u>2-year</u>	<u>10-year</u>	<u>25-year</u>	<u>100-year</u>
Existing	0.796 cfs	5.542 cfs	9.625 cfs	16.96 cfs
Proposed	0.000 cfs	0.244 cfs	1.101 cfs	6.702 cfs

#### **Drainage Area 2**

	<u>2-year</u>	<u>10-year</u>	<u>25-year</u>	<u>100-year</u>
Existing	0.883 cfs	5.427 cfs	9.411 cfs	16.46 cfs
Proposed	0.000 cfs	0.000 cfs	2.244 cfs	16.39 cfs

### **CT GUIDELINES FOR SOIL EROSION & SEDIMENTATION CONTROL**

The 2002 CT Guidelines for Soil Erosion & Sedimentation Control applies to the construction phase of the project. A detailed erosion and sediment control plan has been provided in the site development plans. The proposed Stormwater Basins have been designed to function as sedimentation traps during stabilization, and then as stormwater basins to provide permanent water quality treatment, prior to entering the existing off-site drainage systems, for the life of the facility.

#### **Drainage Area 1, Temporary Sediment Trap 1**

The first calculation required by the Guidelines is for the sediment storage volume (SSV). The sediment storage volume is the calculation for one year of predicted

sediment load. The calculations for a Temporary Sediment Trap show that the sediment storage volume required is 20,622 CF:

$$SSV = A(134\text{CY/Acre})$$

$$A = 5.7 \text{ ACRES}$$

$$SSV = 763.8\text{CY} = \underline{20,622 \text{ CF}}$$

The second calculation required by the Guidelines is for wet storage volume (WSV). The wet storage volume is the volume in the basin that is located below the riprap for the level spreader outlet of the basin (elevation 38.5). The volume of the wet storage is required to be half of the required SSV. The required wet storage volume is  $20,622 \text{ CF}/2 = \underline{10,311 \text{ CF}}$ . The required dry storage volume, located above the bottom of the riprap of the level spreader outlet of the basin (elevation 38.5), is 10,311 CF.

The total storage volume required is the dry storage volume plus the wet storage volume, which is a total of 20,622 CF.

The combined volume required for the Sedimentation Basin as follows:

10,311 CF of Wet Storage Volume	29,079 CF Provided
10,311 CF of Dry Storage Volume	22,523 CF Provided
20,622 CF of Total Volume Required	51,602 CF Total Provided

## **Drainage Area 2 Temporary Sediment Trap 2**

The first calculation required by the Guidelines is for the sediment storage volume (SSV). The sediment storage volume is the calculation for one year of predicted sediment load. The calculations for a Temporary Sediment Trap show that the sediment storage volume required is 20,984 CF:

$$SSV = A(134CY/Acre)$$

$$A = 5.8 \text{ ACRES}$$

$$SSV = 777.2 \text{ CY} = \underline{20,984 \text{ CF}}$$

The second calculation required by the Guidelines is for wet storage volume (WSV). The wet storage volume is the volume in the basin that is located below the riprap for the level spreader outlet of the basin (elevation 38.5). The volume of the wet storage is required to be half of the required SSV. The required wet storage volume is  $20,984 \text{ CF} / 2 = \underline{10,492 \text{ CF}}$ . The required dry storage volume, located above the bottom of the riprap of the level spreader outlet of the basin (elevation 38.5), is 10,492 CF.

The total storage volume required is the dry storage volume plus the wet storage volume, which is a total of 20,984 CF.

The combined volume required for the Sedimentation Basin as follows:

10,492 CF of Wet Storage Volume	14,620 CF Provided
10,492 CF of Dry Storage Volume	11,575 CF Provided
20,984 CF of Total Volume Required	26,195 CF Total Provided

## **CONNECTICUT STORMWATER QUALITY MANUAL**

The Stormwater Management System, consisting of two and Water Quality Basins, have been designed to function as permanent water quality treatment for the life of the facility. The Connecticut 2004 Stormwater Quality Manual (Manual) applies to the post construction phase, for the operation of the facility.



### **Drainage Area 1, Water Quality Basin 1**

The Stormwater Management System meets the criteria of the Connecticut Stormwater Quality Manual for a Water Quality Basin. The calculations show that a Water Quality Volume (WQV) of 6,621 CF is required:

$$WQV = (1'')(R)(A)/12$$

$$A = 5.7 \text{ Acres}$$

$$R = 0.05 + 0.009(I)$$

$$I = 1.8 \text{ Acres} / 5.7 \text{ Acres} = 0.32 \quad (32\%)$$

$$R = 0.338$$

$$WQV = 0.160 \text{ Ac-Ft} = \underline{6,994 \text{ CF required}}$$

**51,602 CF Provided in the Water Quality Basin and Forebay**

**As the calculations show that there will be no stormwater leaving the proposed stormwater management system (water quality basin), up to and including the 2 year storm event, the anticipated pollutant removal rate is 100%.**

### **Drainage Area 2, Water Quality Basin 2**

The Stormwater Management System meets the criteria of the Connecticut Stormwater Quality Manual for a Water Quality Basin. The calculations show that a Water Quality Volume (WQV) of 6,142 CF is required:

$$WQV = (1'')(R)(A)/12$$

$$A = 5.8 \text{ Acres}$$

$$R = 0.05 + 0.009(I)$$

$$I = 1.4 \text{ Acres} / 5.8 \text{ Acres} = 0.24 \quad (24\%)$$

$$R = 0.266$$

$$WQV = 0.1286 \text{ Ac-Ft} = \underline{5,600 \text{ CF required}}$$

**26,195 CF Provided in the Water Quality Basin**

**As the calculations show that there will be no stormwater leaving the proposed stormwater management system (water quality basin), up to and including the 2 year storm event, the anticipated pollutant removal rate is 99-100%.**

**The University of New Hampshire's Stormwater Center in Durham New Hampshire indicates that typical Phosphorus load export rate from this type of development (commercial/industrial) will be 1.78 lbs/acre/year. For Nitrogen that value will be 15 lbs/acre/year.**

**([https://www.unh.edu/unhsc/sites/default/files/media/ms4\\_permit\\_nomographs\\_sheet\\_final\\_2020.pdf](https://www.unh.edu/unhsc/sites/default/files/media/ms4_permit_nomographs_sheet_final_2020.pdf)) The University of New Hampshire's research reveals that efficiency removal for typical pollutants of concern such as TSS, N, P, and zinc is directly tied to the volume of stormwater that is held and infiltrated. The research reveals that if a 2 inch depth of runoff from a site's impervious surface is held and infiltrated by a given BMP, the reduction in these pollutants is 99-100%. On this site, Stormwater basin #1 will contain up to and including the 2 year storm event and Stormwater basin #2 will contain up to and including the 10 year storm event. Thus, CLA believes that pollutant removal rates for pollutants of concern will be greater than 99% and there will be no increase in releases of pollutants to the wetlands system.**

## **BUILDING ADDITION**

**Due to the size of disturbance for the building addition, 0.9 acres, a temporary sediment trap is not required. The General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities states that "For points of discharge from disturbed sites with a total contributing drainage area of between two to five acres, a temporary sediment trap or temporary sediment basin shall be designed and installed in accordance with the Guidelines.**

Due to the size of disturbance for the building addition, under one acre, providing Water Quality Volume does not apply. Section 7.2 Criteria Applicability, of the Stormwater Water Quality Manual, states that “The design criteria presented in this chapter are generally applicable to the following types of development and redevelopment projects, including phased developments:

- Any development resulting in the disturbance of greater than or equal to one acre of land.”



# Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.796	1	737	6,399	-----	-----	-----	Existing Conditions - Areas 1
2	SCS Runoff	3.594	1	724	13,150	-----	-----	-----	Proposed Conditions - Area 1
3	Reservoir	0.000	1	n/a	0	2	38.34	13,150	Forebay 1
4	Reservoir	0.000	1	n/a	0	3	36.00	0.000	Stormwater Basin 1
5	SCS Runoff	0.883	2	730	6,305	-----	-----	-----	Existing Conditions - Area 2
6	SCS Runoff	2.719	2	724	10,492	-----	-----	-----	Proposed Conditions - Area 2
7	Reservoir	0.633	2	752	7,294	6	38.56	3,310	Forebay 2
8	Reservoir	0.000	2	846	0	7	36.21	860	Stormwater Basin 2
A&B Excavation TR55.gpw					Return Period: 2 Year			Tuesday, Aug 1, 2023	

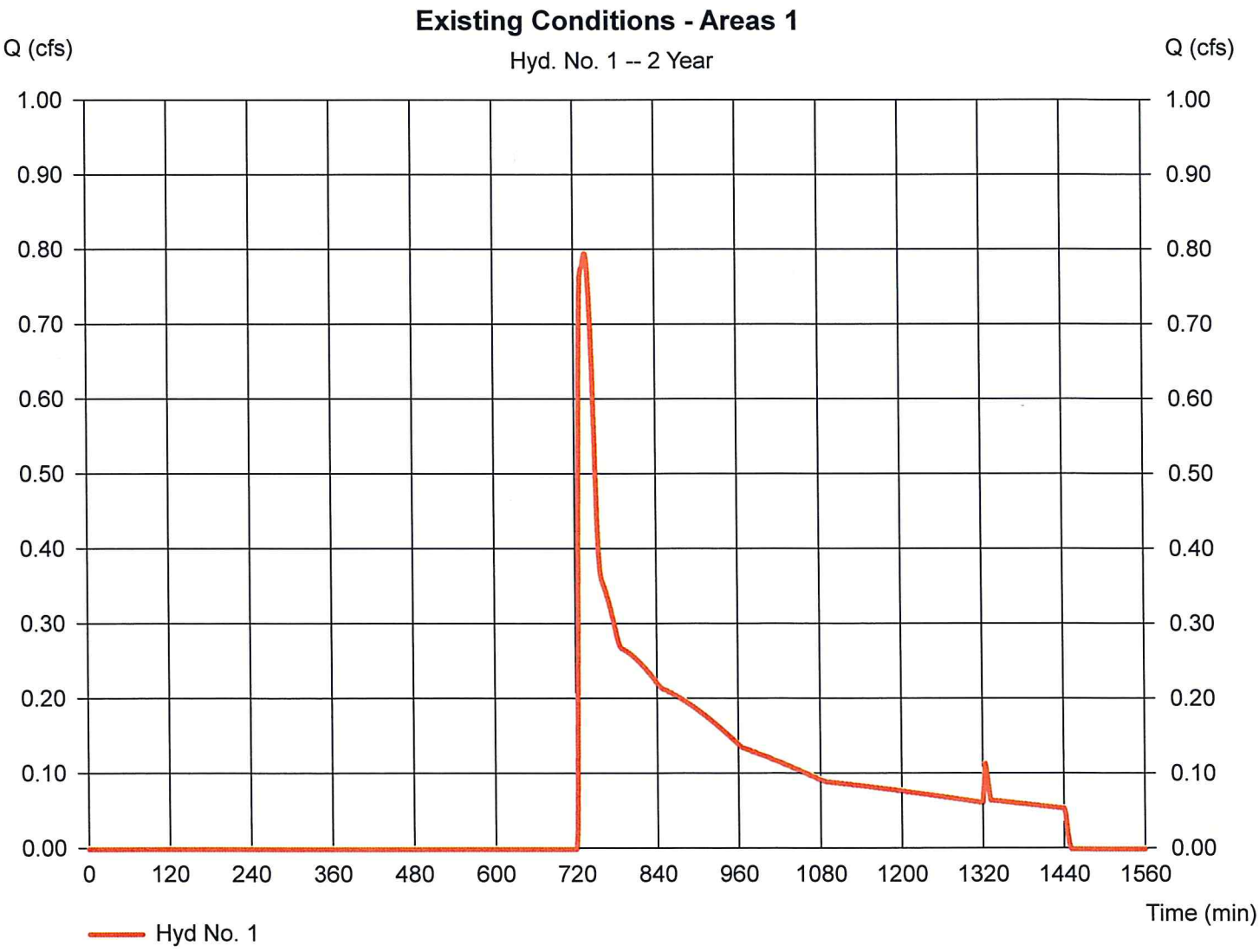
# Hydrograph Report

## Hyd. No. 1

### Existing Conditions - Areas 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.796 cfs
Storm frequency	=	2 yrs	Time to peak	=	737 min
Time interval	=	1 min	Hyd. volume	=	6,399 cuft
Drainage area	=	5.700 ac	Curve number	=	55*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	3.36 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

\* Composite (Area/CN) = [(5.300 x 55)] / 5.700



# Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

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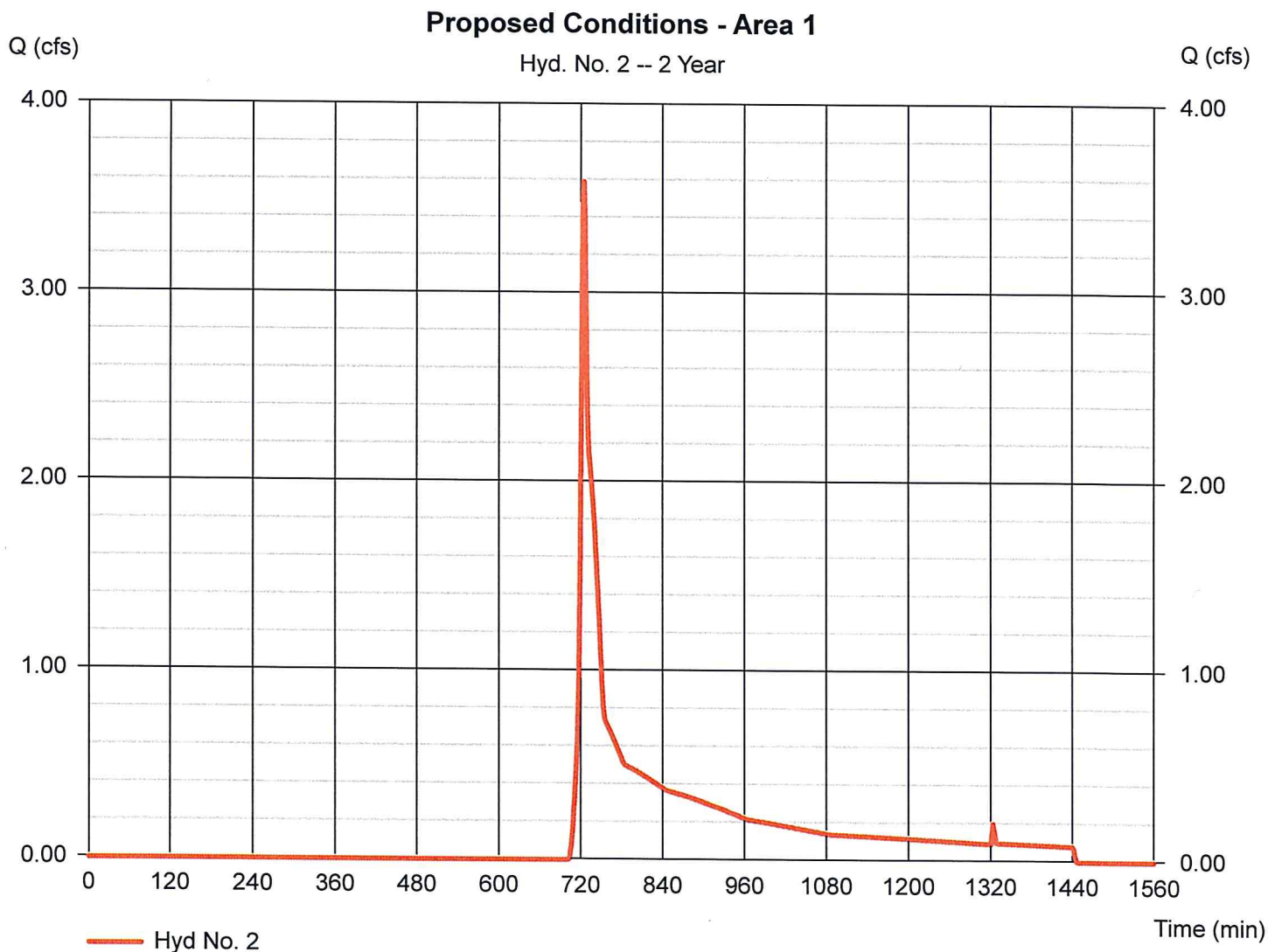
## Hyd. No. 2

### Proposed Conditions - Area 1

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 5.700 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 3.36 in  
Storm duration = 24 hrs

Peak discharge = 3.594 cfs  
Time to peak = 724 min  
Hyd. volume = 13,150 cuft  
Curve number = 64\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 4.50 min  
Distribution = Type III  
Shape factor = 484

\* Composite (Area/CN) =  $[(1.900 \times 83) + (3.800 \times 55)] / 5.700$



# Hydrograph Report

4

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

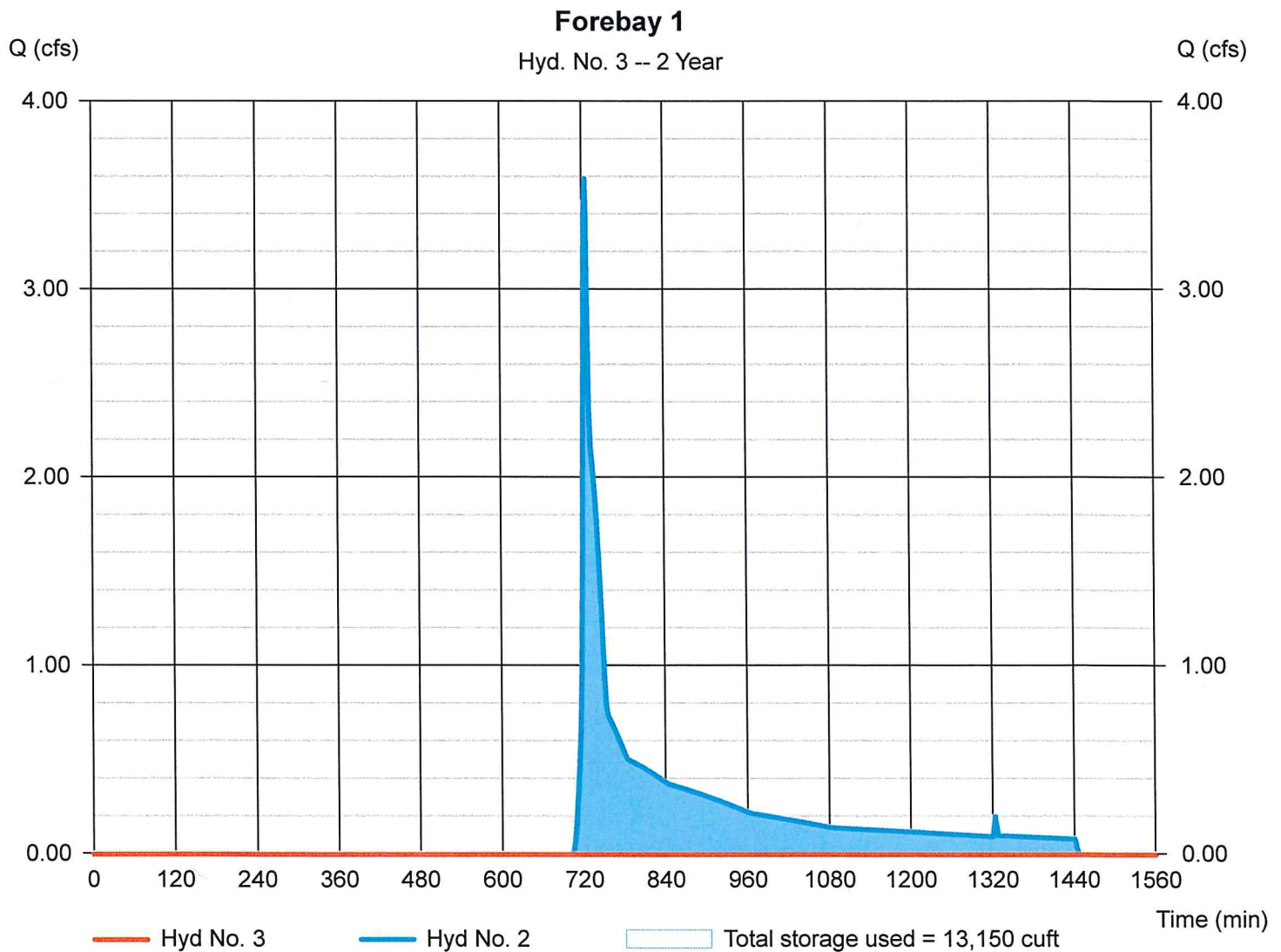
## Hyd. No. 3

### Forebay 1

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Time interval = 1 min  
Inflow hyd. No. = 2 - Proposed Conditions - Area 1  
Reservoir name = Forebay #1

Peak discharge = 0.000 cfs  
Time to peak = n/a  
Hyd. volume = 0 cuft  
Max. Elevation = 38.34 ft  
Max. Storage = 13,150 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

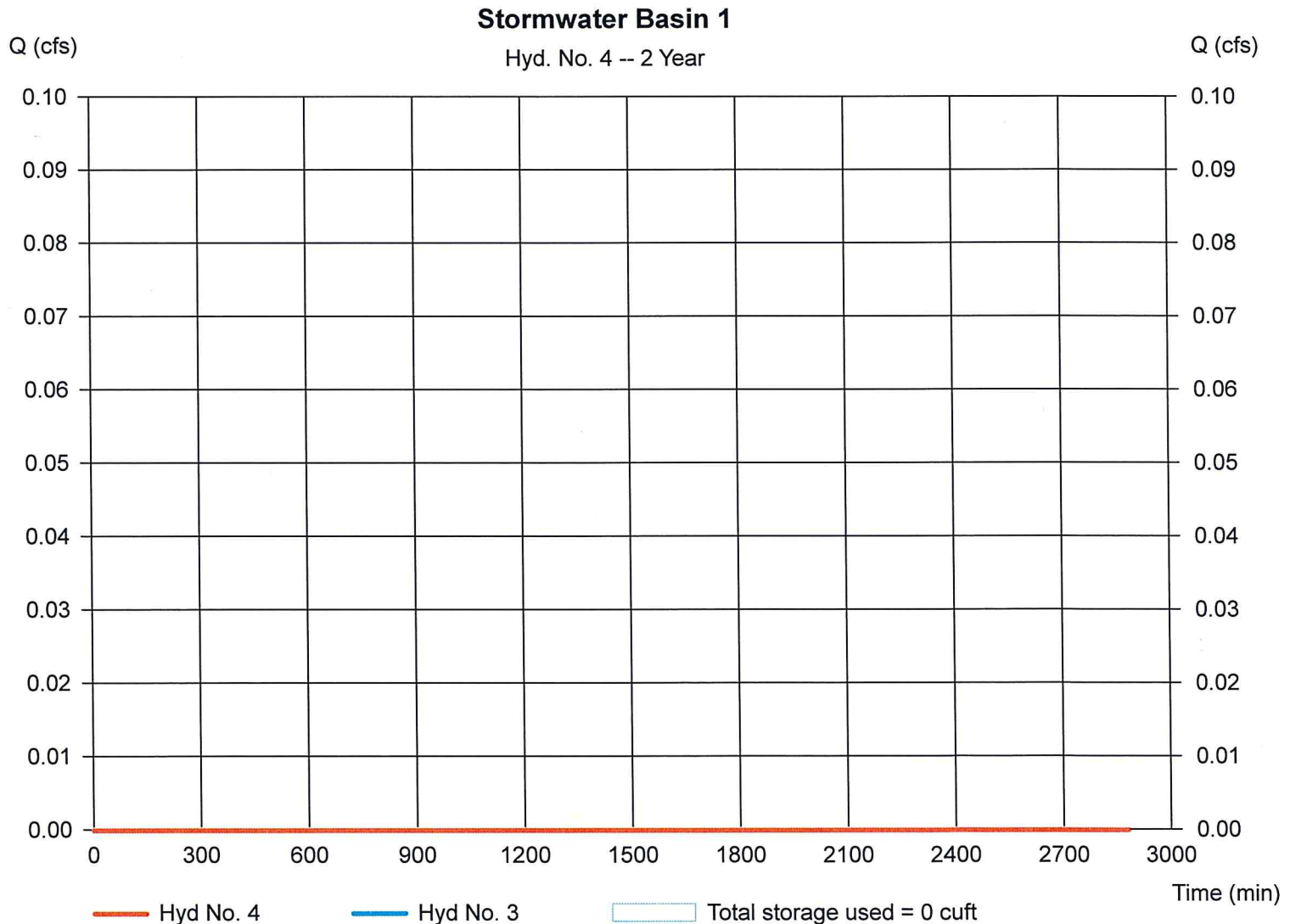
Tuesday, Aug 1, 2023

## Hyd. No. 4

### Stormwater Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Forebay 1	Max. Elevation	= 36.00 ft
Reservoir name	= Stormwater Basin 1	Max. Storage	= 0 cuft

Storage Indication method used.





# Hydrograph Report

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Tuesday, Aug 1, 2023

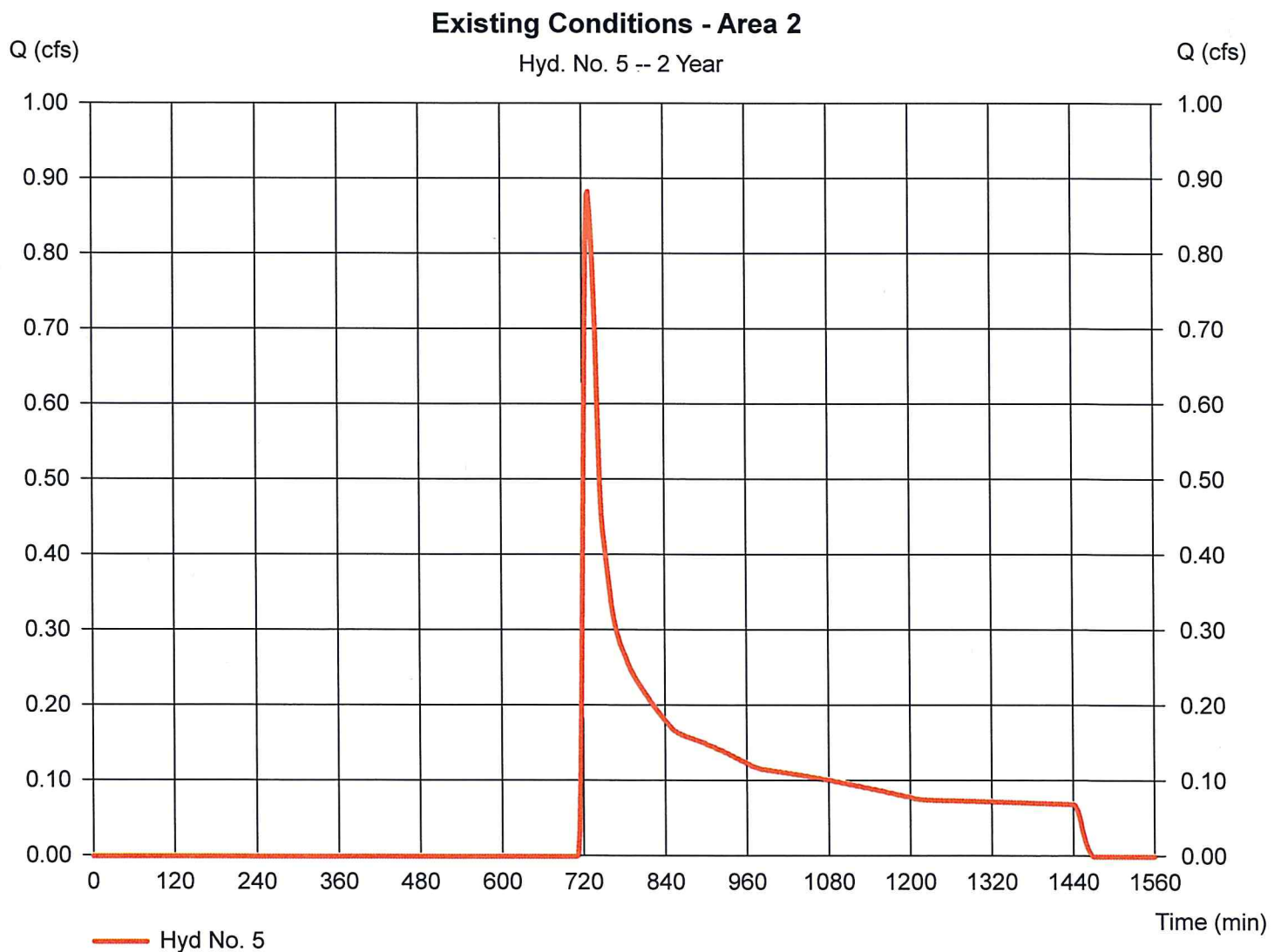
## Hyd. No. 5

### Existing Conditions - Area 2

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 2 min  
Drainage area = 5.800 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 3.36 in  
Storm duration = 24 hrs

Peak discharge = 0.883 cfs  
Time to peak = 730 min  
Hyd. volume = 6,305 cuft  
Curve number = 55\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 16.90 min  
Distribution = Type II  
Shape factor = 484

\* Composite (Area/CN) = [(4.700 x 55)] / 5.800



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

## Hyd. No. 6

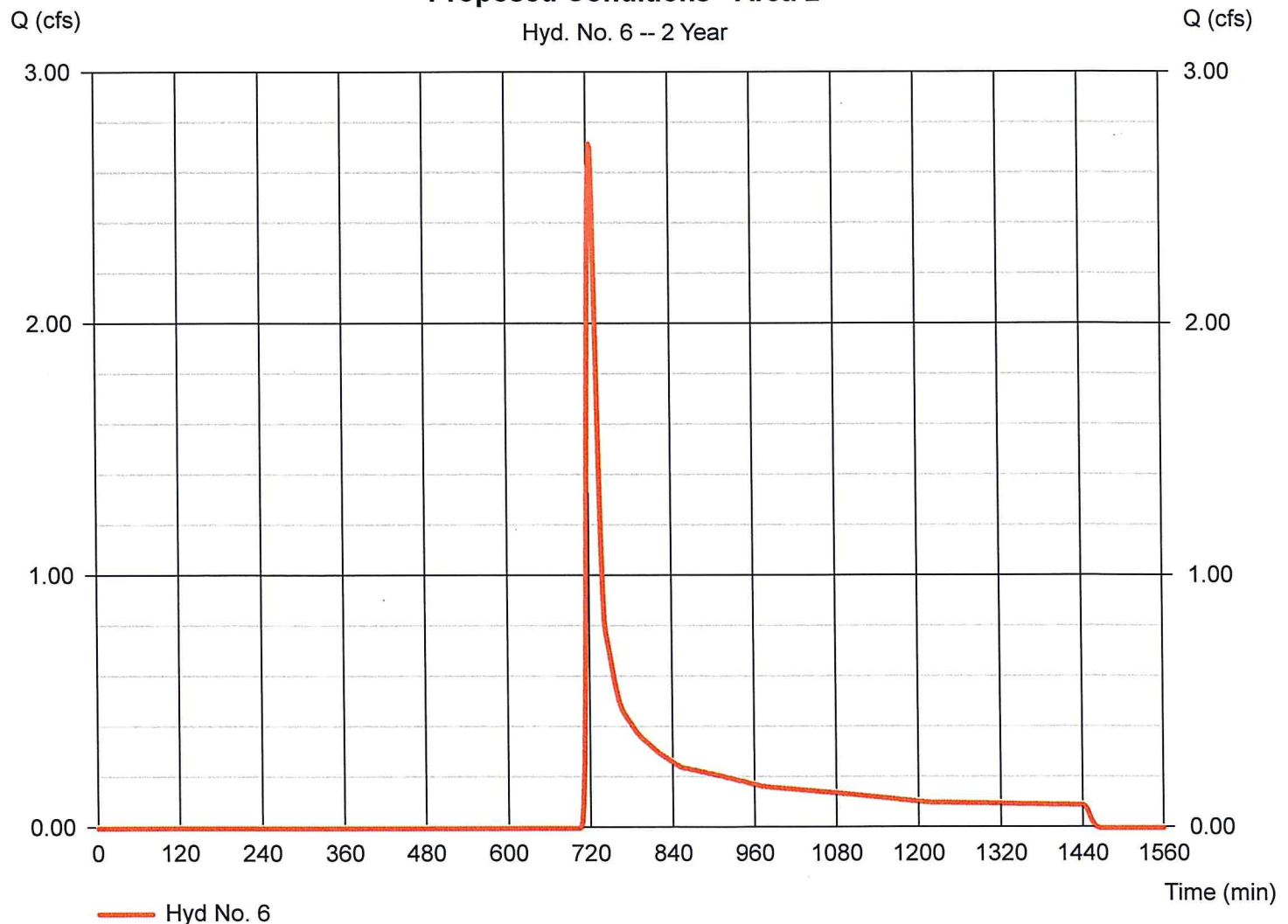
### Proposed Conditions - Area 2

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 5.800 ac  
 Basin Slope = 0.0 %  
 Tc method = TR55  
 Total precip. = 3.36 in  
 Storm duration = 24 hrs

Peak discharge = 2.719 cfs  
 Time to peak = 724 min  
 Hyd. volume = 10,492 cuft  
 Curve number = 61\*  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 16.50 min  
 Distribution = Type II  
 Shape factor = 484

\* Composite (Area/CN) =  $[(1.200 \times 83) + (4.600 \times 55)] / 5.800$

### Proposed Conditions - Area 2



# Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

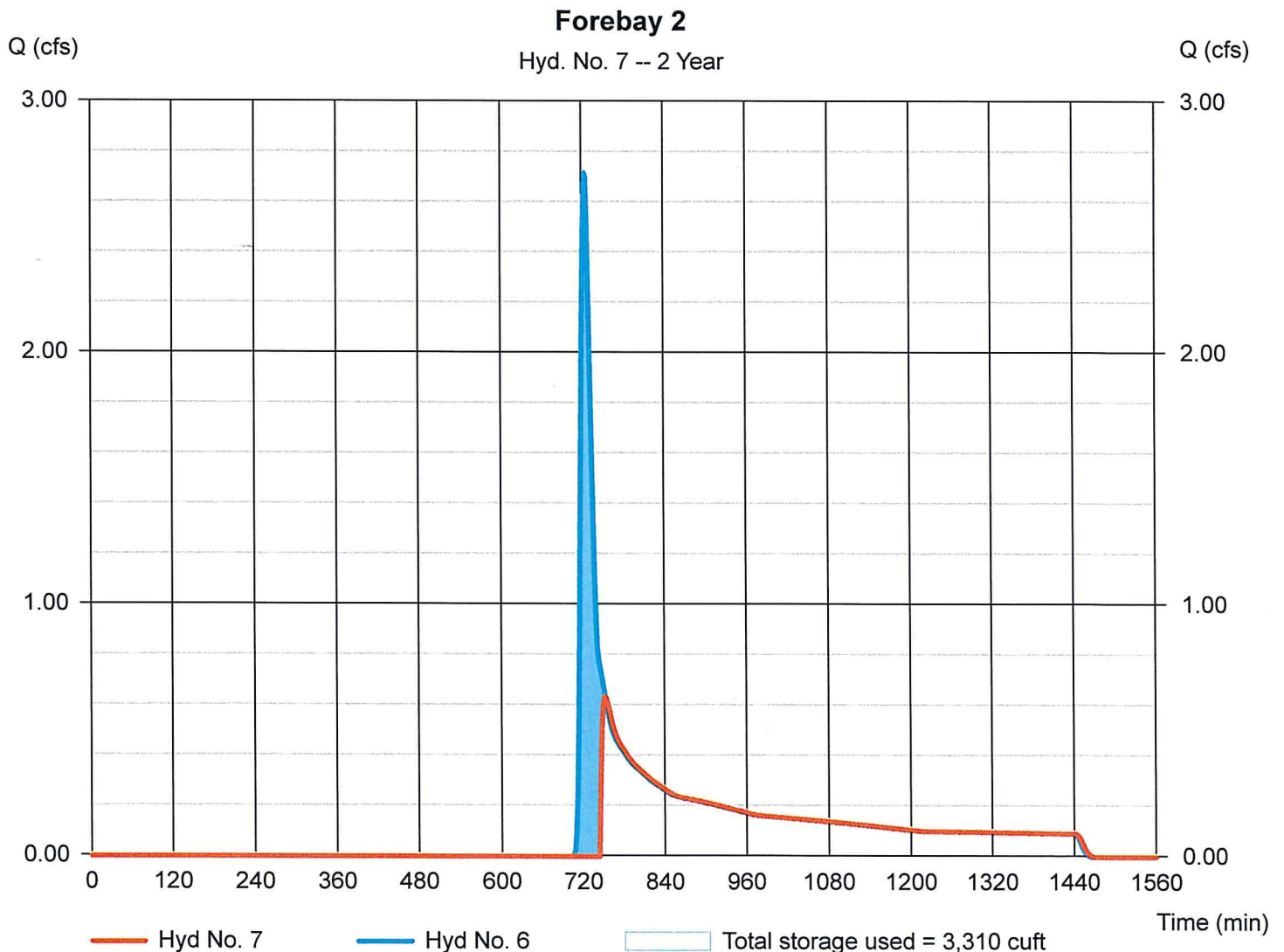
## Hyd. No. 7

### Forebay 2

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Time interval = 2 min  
Inflow hyd. No. = 6 - Proposed Conditions - Area 2  
Reservoir name = Forebay #2

Peak discharge = 0.633 cfs  
Time to peak = 752 min  
Hyd. volume = 7,294 cuft  
Max. Elevation = 38.56 ft  
Max. Storage = 3,310 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

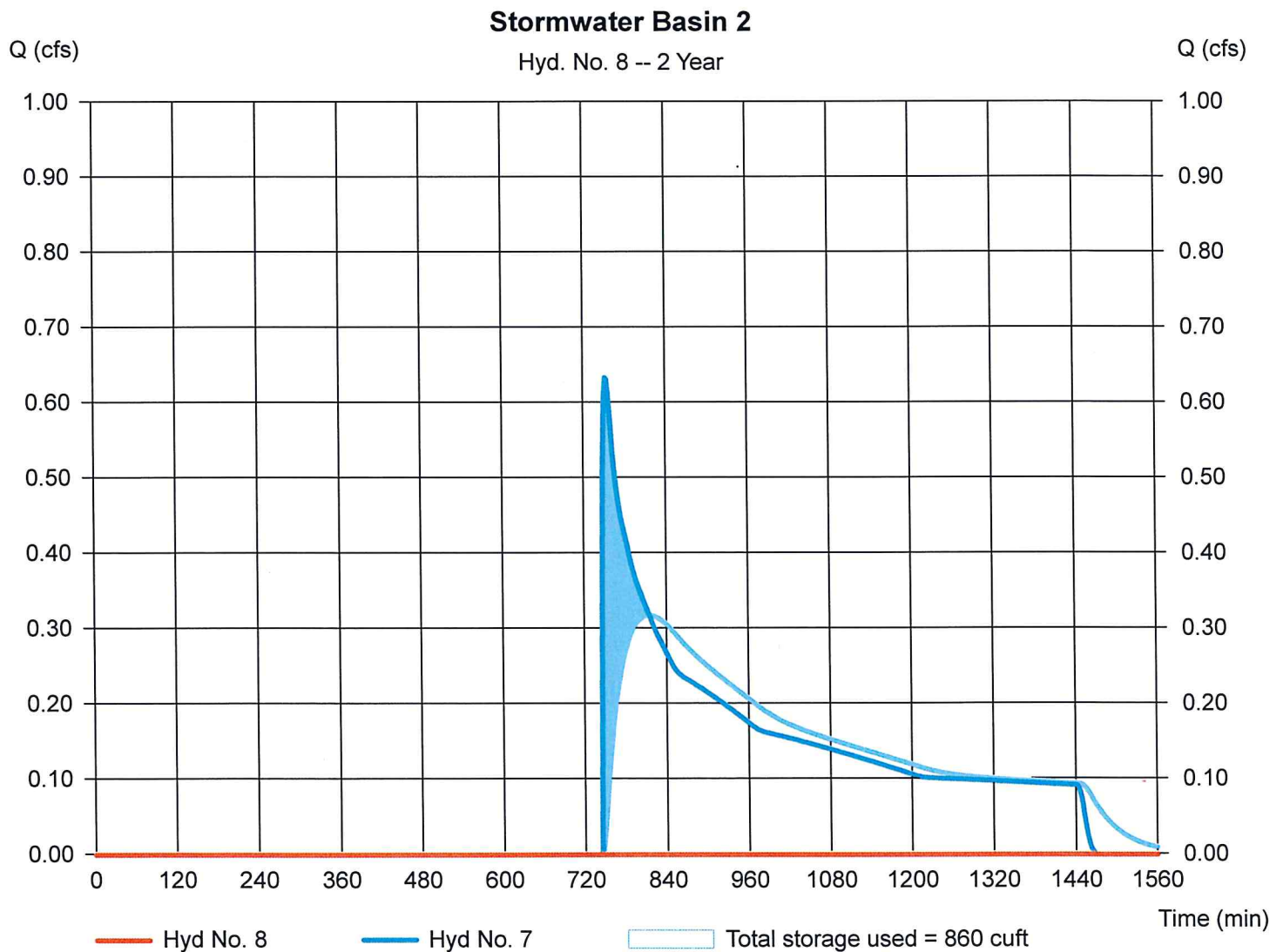
## Hyd. No. 8

### Stormwater Basin 2

Hydrograph type = Reservoir  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Inflow hyd. No. = 7 - Forebay 2  
 Reservoir name = Stormwater Basin 2

Peak discharge = 0.000 cfs  
 Time to peak = 846 min  
 Hyd. volume = 0 cuft  
 Max. Elevation = 36.21 ft  
 Max. Storage = 860 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	3.010	1	726	13,683	-----	-----	-----	Existing Conditions - Areas 1
2	SCS Runoff	7.318	1	724	23,336	-----	-----	-----	Proposed Conditions - Area 1
3	Reservoir	0.530	1	880	9,109	2	38.55	14,574	Forebay 1
4	Reservoir	0.000	1	n/a	0	3	37.61	9,109	Stormwater Basin 1
5	SCS Runoff	3.009	2	728	13,499	-----	-----	-----	Existing Conditions - Area 2
6	SCS Runoff	6.141	2	724	19,572	-----	-----	-----	Proposed Conditions - Area 2
7	Reservoir	5.477	2	728	16,374	6	38.81	3,759	Forebay 2
8	Reservoir	0.000	2	816	0	7	36.77	3,190	Stormwater Basin 2
A&B Excavation TR55.gpw					Return Period: 5 Year			Tuesday, Aug 1, 2023	



# Hydrograph Report

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## Hyd. No. 1

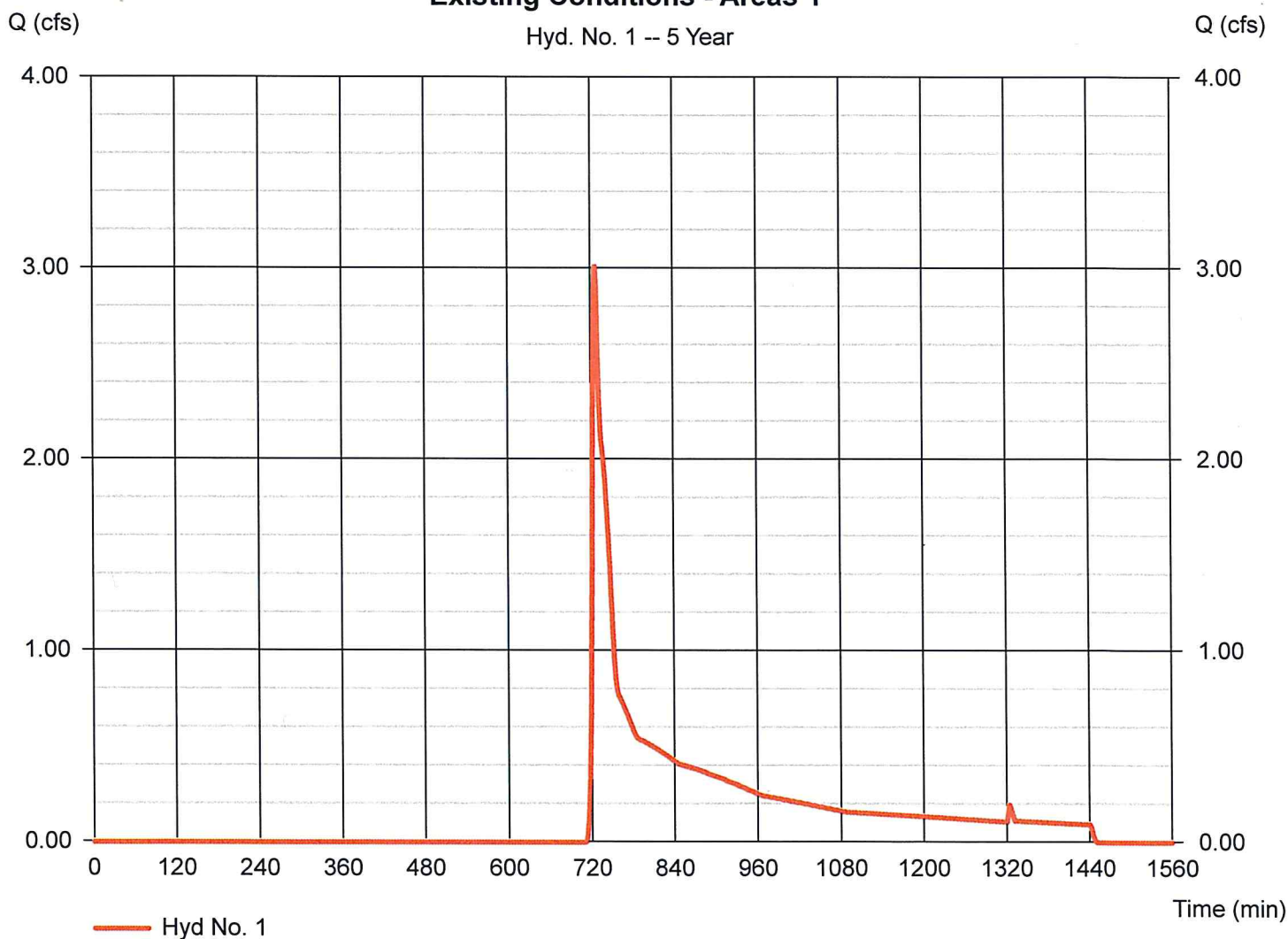
### Existing Conditions - Areas 1

Hydrograph type = SCS Runoff  
Storm frequency = 5 yrs  
Time interval = 1 min  
Drainage area = 5.700 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 4.27 in  
Storm duration = 24 hrs

Peak discharge = 3.010 cfs  
Time to peak = 726 min  
Hyd. volume = 13,683 cuft  
Curve number = 55\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 5.30 min  
Distribution = Type III  
Shape factor = 484

\* Composite (Area/CN) = [(5.300 x 55)] / 5.700

### Existing Conditions - Areas 1



# Hydrograph Report

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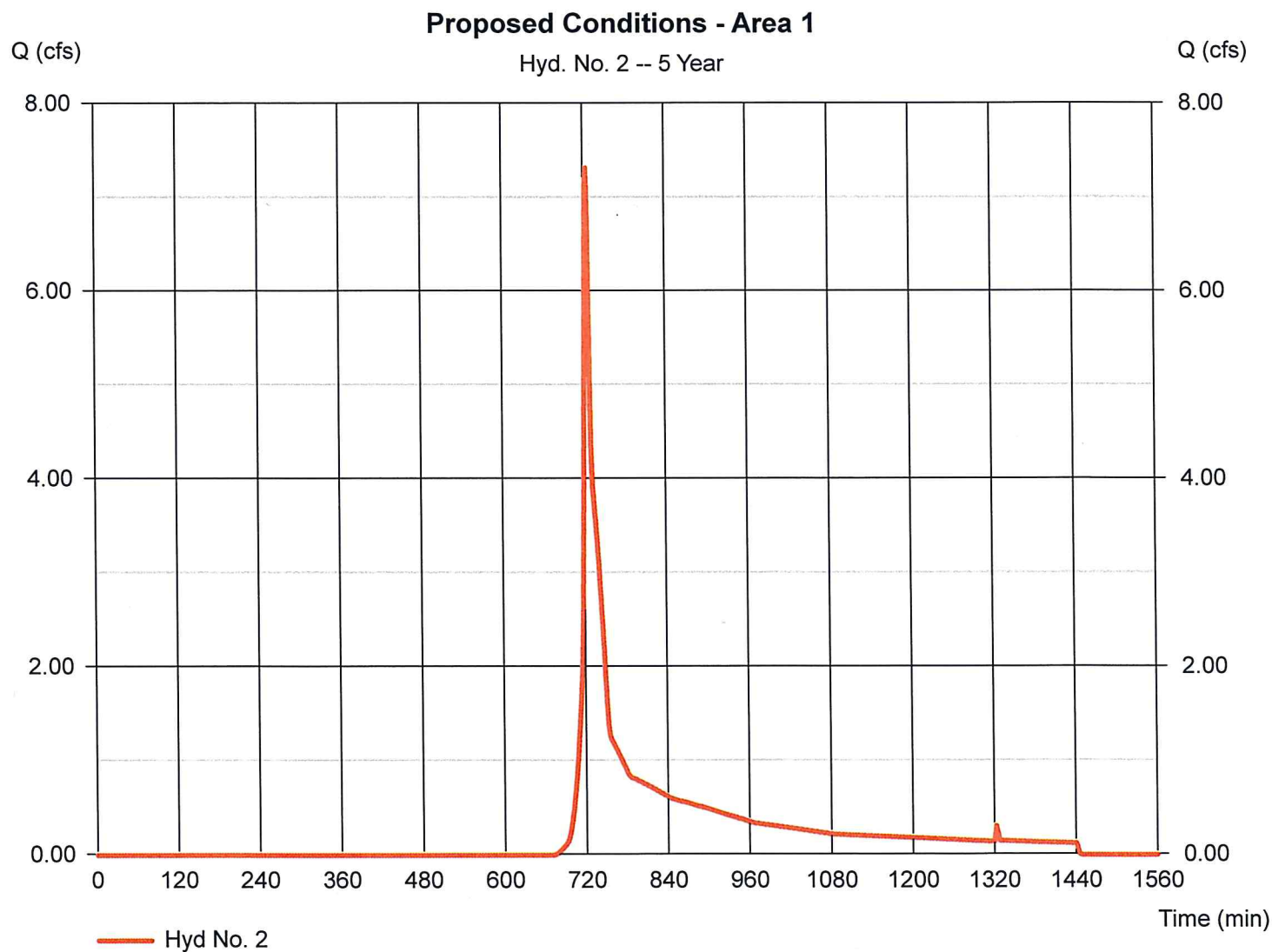
## Hyd. No. 2

### Proposed Conditions - Area 1

Hydrograph type = SCS Runoff  
Storm frequency = 5 yrs  
Time interval = 1 min  
Drainage area = 5.700 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 4.27 in  
Storm duration = 24 hrs

Peak discharge = 7.318 cfs  
Time to peak = 724 min  
Hyd. volume = 23,336 cuft  
Curve number = 64\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 4.50 min  
Distribution = Type III  
Shape factor = 484

\* Composite (Area/CN) =  $[(1.900 \times 83) + (3.800 \times 55)] / 5.700$



# Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

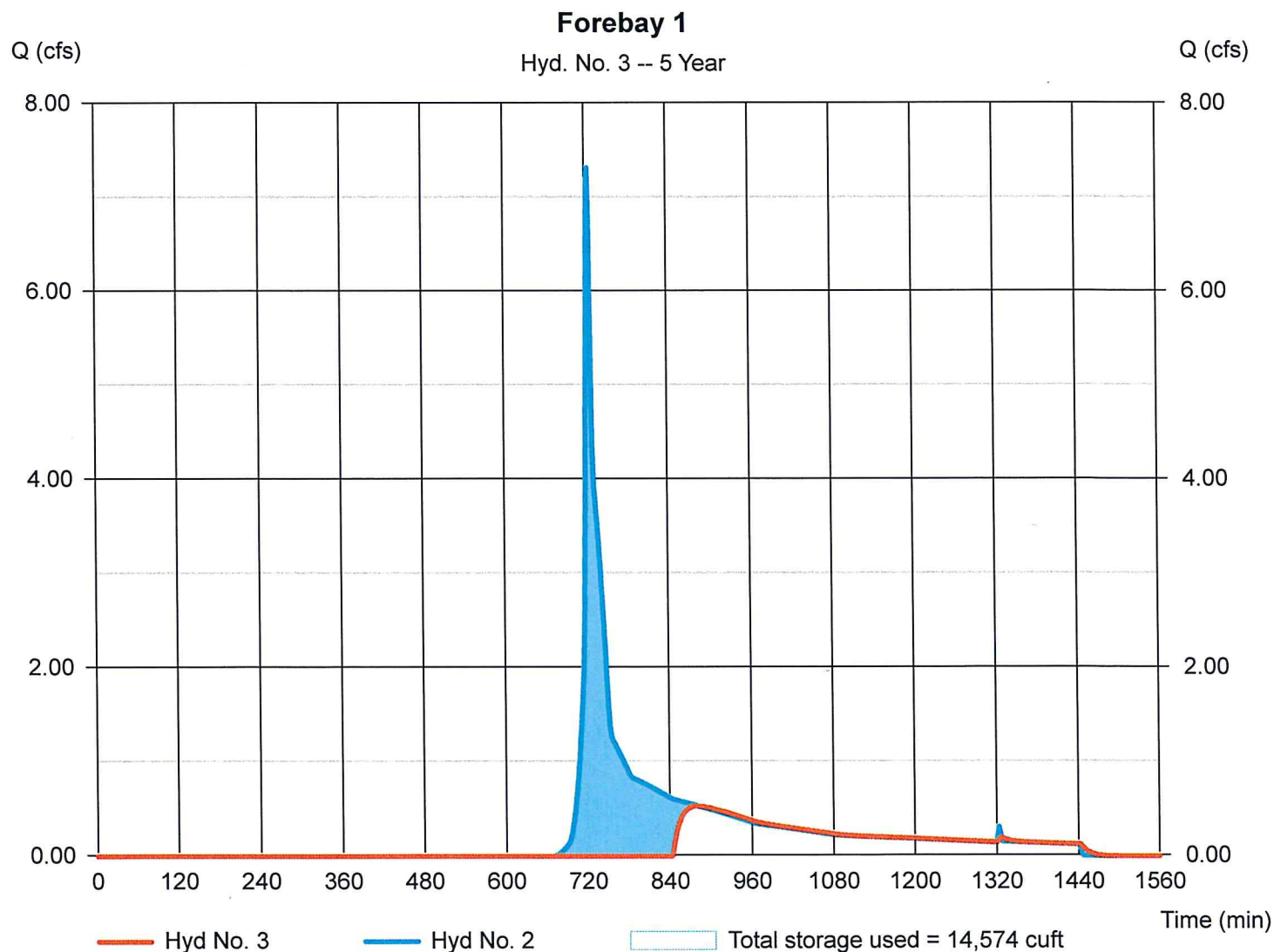
## Hyd. No. 3

Forebay 1

Hydrograph type = Reservoir  
Storm frequency = 5 yrs  
Time interval = 1 min  
Inflow hyd. No. = 2 - Proposed Conditions - Area 1  
Reservoir name = Forebay #1

Peak discharge = 0.530 cfs  
Time to peak = 880 min  
Hyd. volume = 9,109 cuft  
Max. Elevation = 38.55 ft  
Max. Storage = 14,574 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

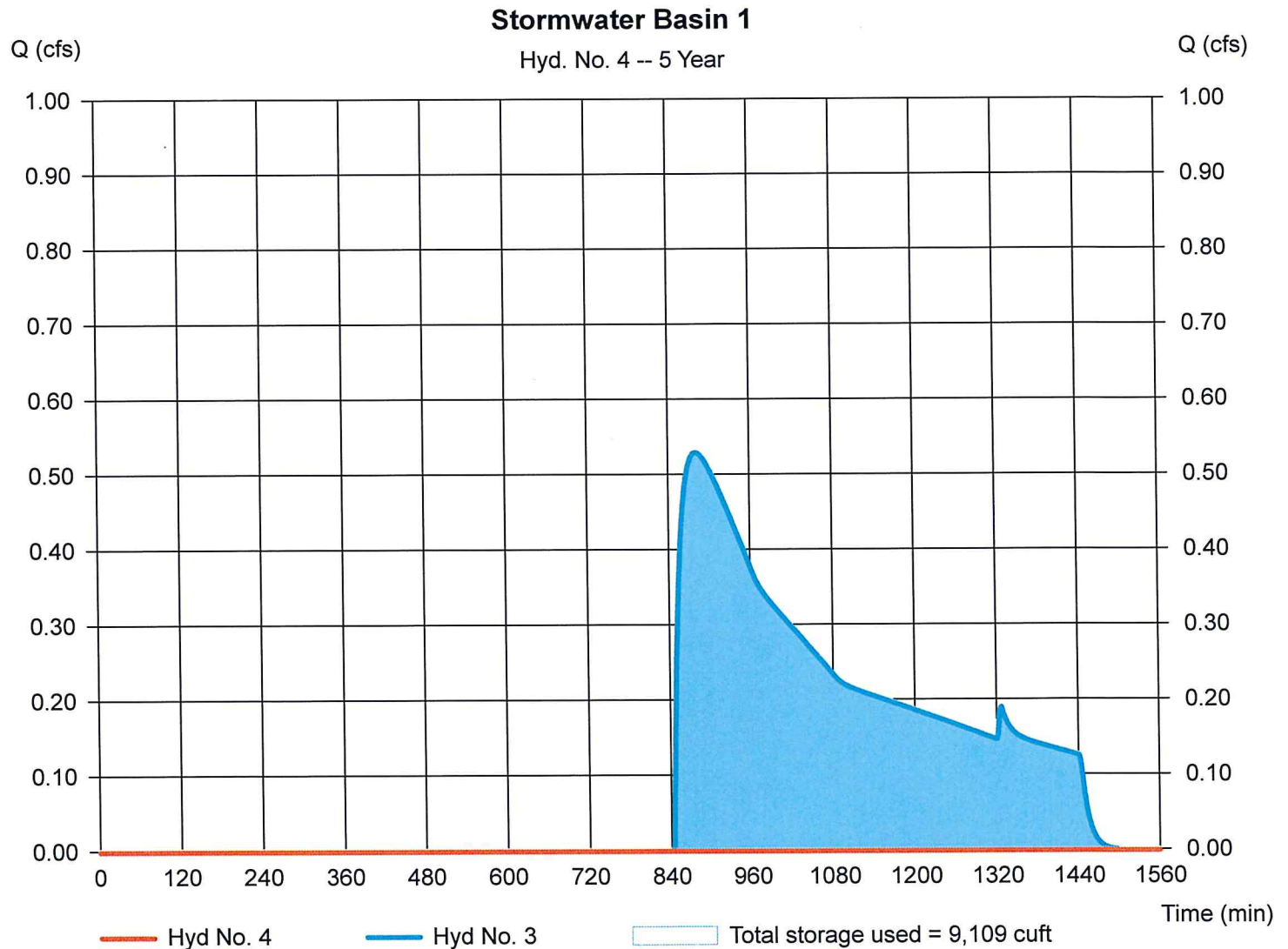
## Hyd. No. 4

### Stormwater Basin 1

Hydrograph type = Reservoir  
 Storm frequency = 5 yrs  
 Time interval = 1 min  
 Inflow hyd. No. = 3 - Forebay 1  
 Reservoir name = Stormwater Basin 1

Peak discharge = 0.000 cfs  
 Time to peak = n/a  
 Hyd. volume = 0 cuft  
 Max. Elevation = 37.61 ft  
 Max. Storage = 9,109 cuft

Storage Indication method used.



# Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

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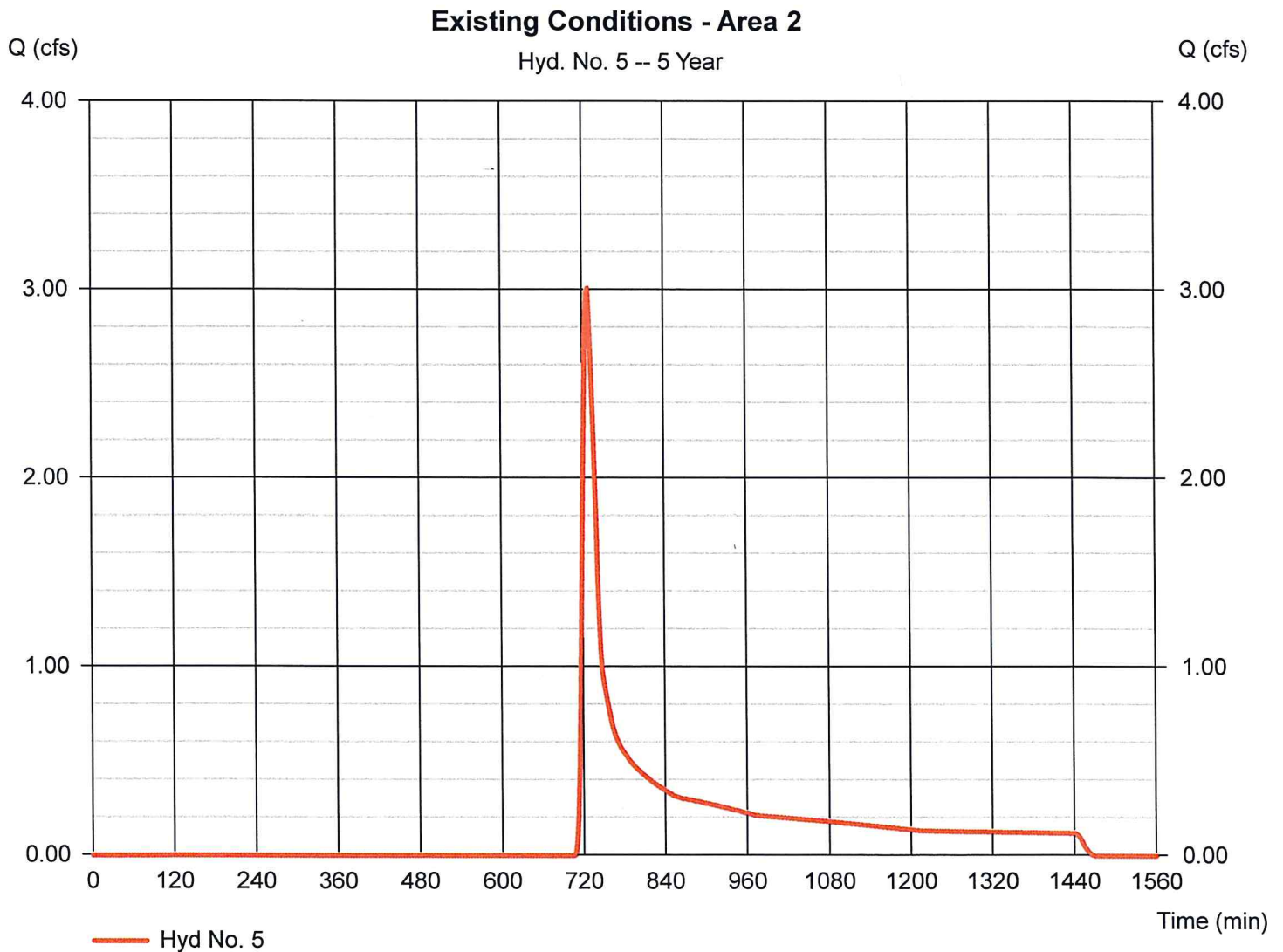
## Hyd. No. 5

### Existing Conditions - Area 2

Hydrograph type = SCS Runoff  
Storm frequency = 5 yrs  
Time interval = 2 min  
Drainage area = 5.800 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 4.27 in  
Storm duration = 24 hrs

Peak discharge = 3.009 cfs  
Time to peak = 728 min  
Hyd. volume = 13,499 cuft  
Curve number = 55\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 16.90 min  
Distribution = Type II  
Shape factor = 484

\* Composite (Area/CN) = [(4.700 x 55)] / 5.800





# Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

## Hyd. No. 6

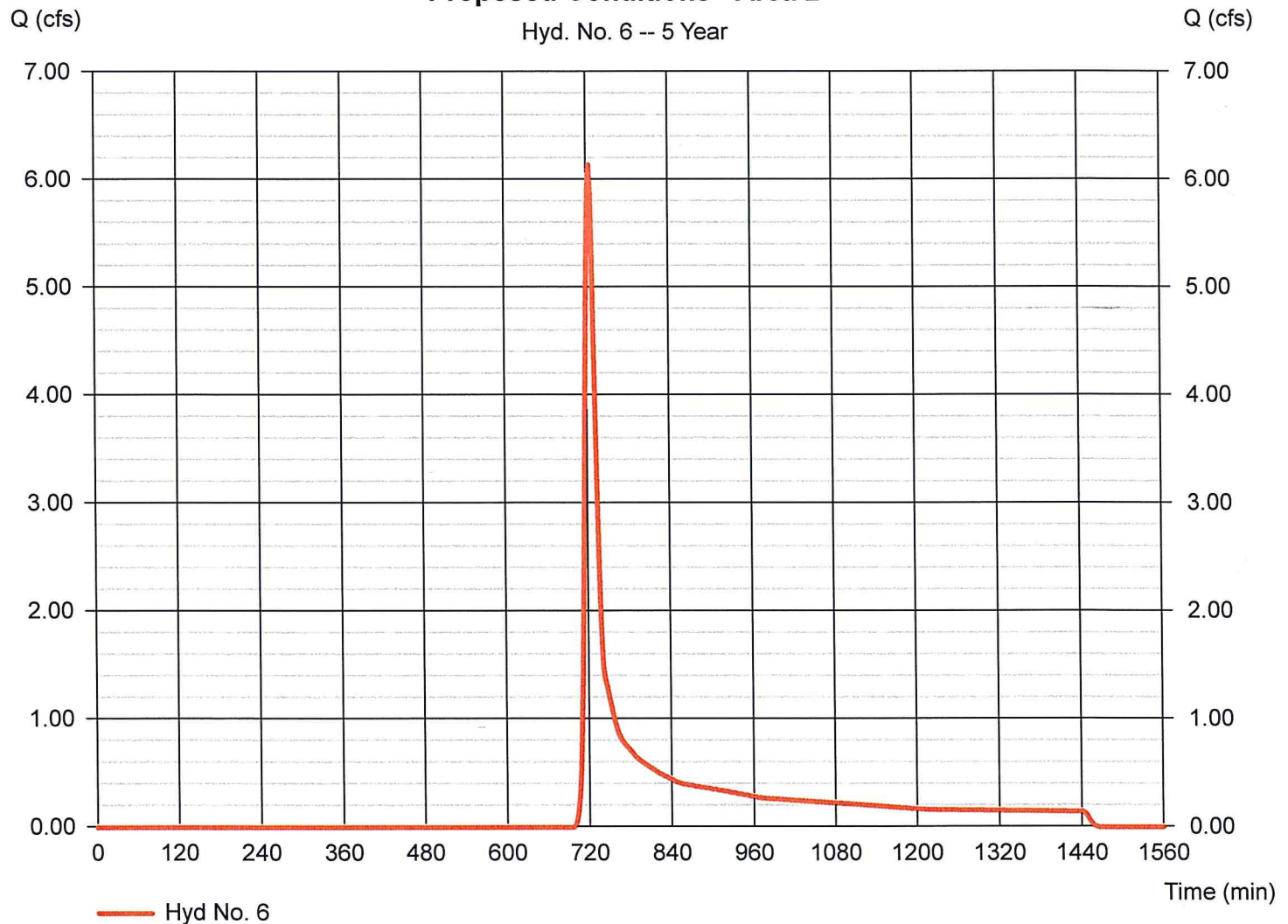
### Proposed Conditions - Area 2

Hydrograph type = SCS Runoff  
Storm frequency = 5 yrs  
Time interval = 2 min  
Drainage area = 5.800 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 4.27 in  
Storm duration = 24 hrs

Peak discharge = 6.141 cfs  
Time to peak = 724 min  
Hyd. volume = 19,572 cuft  
Curve number = 61\*  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 16.50 min  
Distribution = Type II  
Shape factor = 484

\* Composite (Area/CN) = [(1.200 x 83) + (4.600 x 55)] / 5.800

### Proposed Conditions - Area 2



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Aug 1, 2023

## Hyd. No. 7

### Forebay 2

Hydrograph type = Reservoir  
 Storm frequency = 5 yrs  
 Time interval = 2 min  
 Inflow hyd. No. = 6 - Proposed Conditions - Area 2  
 Reservoir name = Forebay #2

Peak discharge = 5.477 cfs  
 Time to peak = 728 min  
 Hyd. volume = 16,374 cuft  
 Max. Elevation = 38.81 ft  
 Max. Storage = 3,759 cuft

Storage Indication method used.

