STORMWATER MANAGEMENT
DESIGN CALCULATIONS

Proposed Commercial Site Plan

51 Alder Street
Assessors Lot 63-001-0001

Prepared for

Philip Anza
119 Milford Street
Medway, MA 02053

March 30, 2016

Table of Contents

SUMMARY

This analysis was prepared to demonstrate Compliance with the Massachusetts Stormwater Management Regulations and Section 204-3(3) of the Town of Medway Site Plan Rules and Regulations. The proposed project consist of constructing a 3,250 sf commercial building and a 7,774± sf paved parking lot.

The attenuation of storm water flows have been achieved by routing runoff from the proposed development to a subsurface sediment forebay and subsurface chamber infiltration system. Surface water currently runs overland to the Northerly boundary toward the abutting property and Southeasterly towards Alder Street. The analysis demonstrates that peak flows for the development are not increased due to the proposed site construction.

This analysis is divided into the following sections:

Section I	Overall Site Analysis
Section II	Compliance with Massachusetts Storm water Management Regulations
Section III	Operation And Maintenance Plan

The calculations have been performed for the 2, 10, 25, and 100-year 24 hour storm event, using the Autodesk Hydraflow Hydrographs extension for AutoCad Civil 3D 2015 computer program. This computer program is based upon the Soils Conservation Service (SCS) TR-20 and TR-55 computer models and uses the SCS Curvilinear Unit rainfall distribution.

SUMMARY OF STORMWATER FLOWS (Infiltration)

Design Storm	Existing Conditions (hyd 1)	Proposed Conditions (hyd 9-Infiltration)	Pond Elevation
Subcat-1			
2-Year	0	0.151-0.151 = 0	260.46
10-Year	0.002	0.156-0.156 = 0	260.80
25-Year	0.027	0.190-0.163=0.027	261.02
100-Year	0.249	0.356-0.166=0.190	261.50

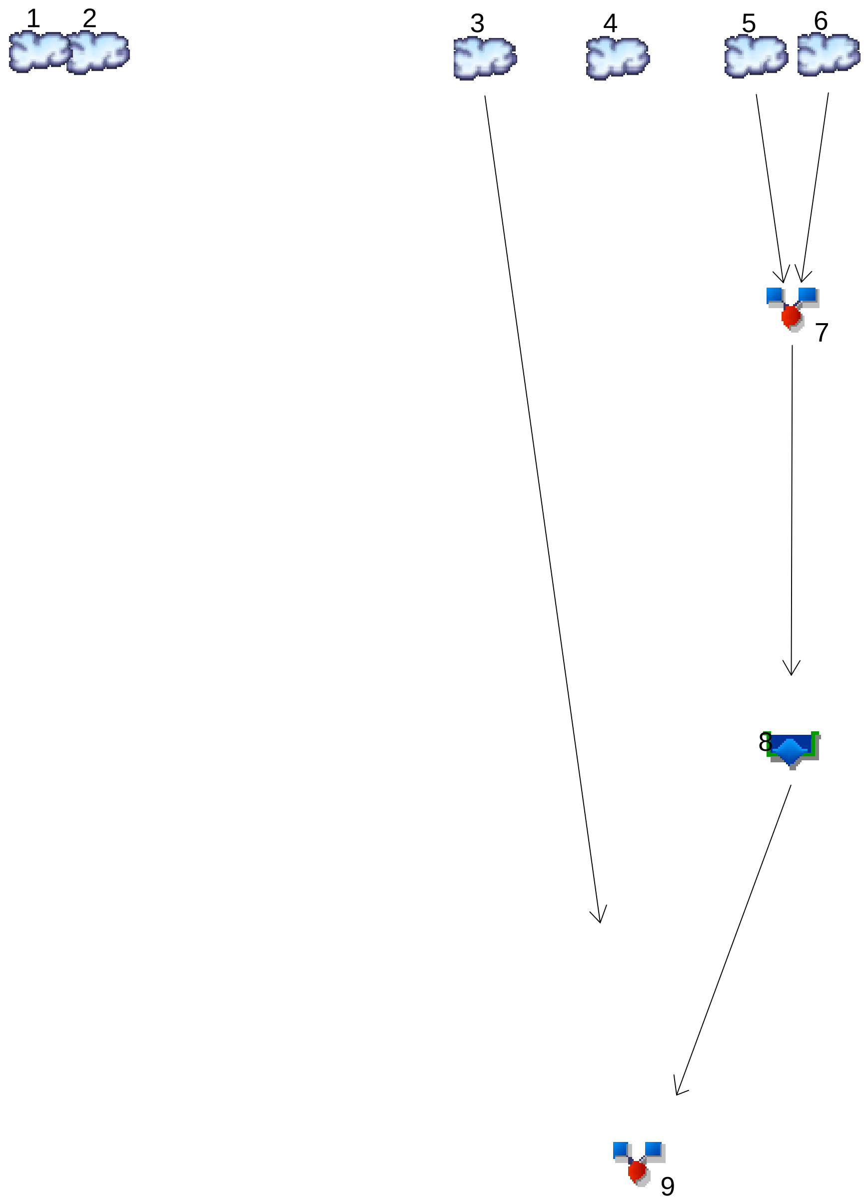
Design Storm	Existing Conditions (hyd 2)	Proposed Conditions (hyd 4)
Subcat-2		
2-Year	0.069	0.067
10-Year	0.314	0.284
25-Year	0.527	0.471
100-Year	0.849	0.751

Hyd 1 – Existing flow towards the wetlands compare to Hyd 9
Hyd 2 – Existing flow towards Alder Street compare to Hyd 4

Section I
Overall Site Analysis

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area 1
2	SCS Runoff	Area 2
3	SCS Runoff	Area 3 POST
4	SCS Runoff	Area 4 POST (Compare 2)
5	SCS Runoff	Area 5 POST - Parking (Compare 1)
6	SCS Runoff	Area 6 POST - Roof (Compare 1)
7	Combine	Add 5 + 6
8	Reservoir	Route UC
9	Combine	Add Pond +Area 3

Project: Stormwater.gpw

Wednesday, 03 / 30 / 2016

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	0.000	2	n/a	0	------	------	------	Area 1
2	SCS Runoff	0.069	2	724	247	------	------	------	Area 2
3	SCS Runoff	0.000	2	n/a	0	------	------	------	Area 3 POST
4	SCS Runoff	0.067	2	724	230	------	------	------	Area 4 POST (Compare 2)
5	SCS Runoff	0.407	2	724	1,343	------	------	------	Area 5 POST - Parking (Compare 1)
6	SCS Runoff	0.163	2	724	537	------	------	------	Area 6 POST - Roof (Compare 1)
7	Combine	0.569	2	724	1,880	5, 6	------	------	Add 5 + 6
8	Reservoir	0.151	2	744	1,879	7	260.46	399	Route UC
9	Combine	0.151	2	744	1,879	3, 8	------	------	Add Pond +Area 3

Hydrograph Report

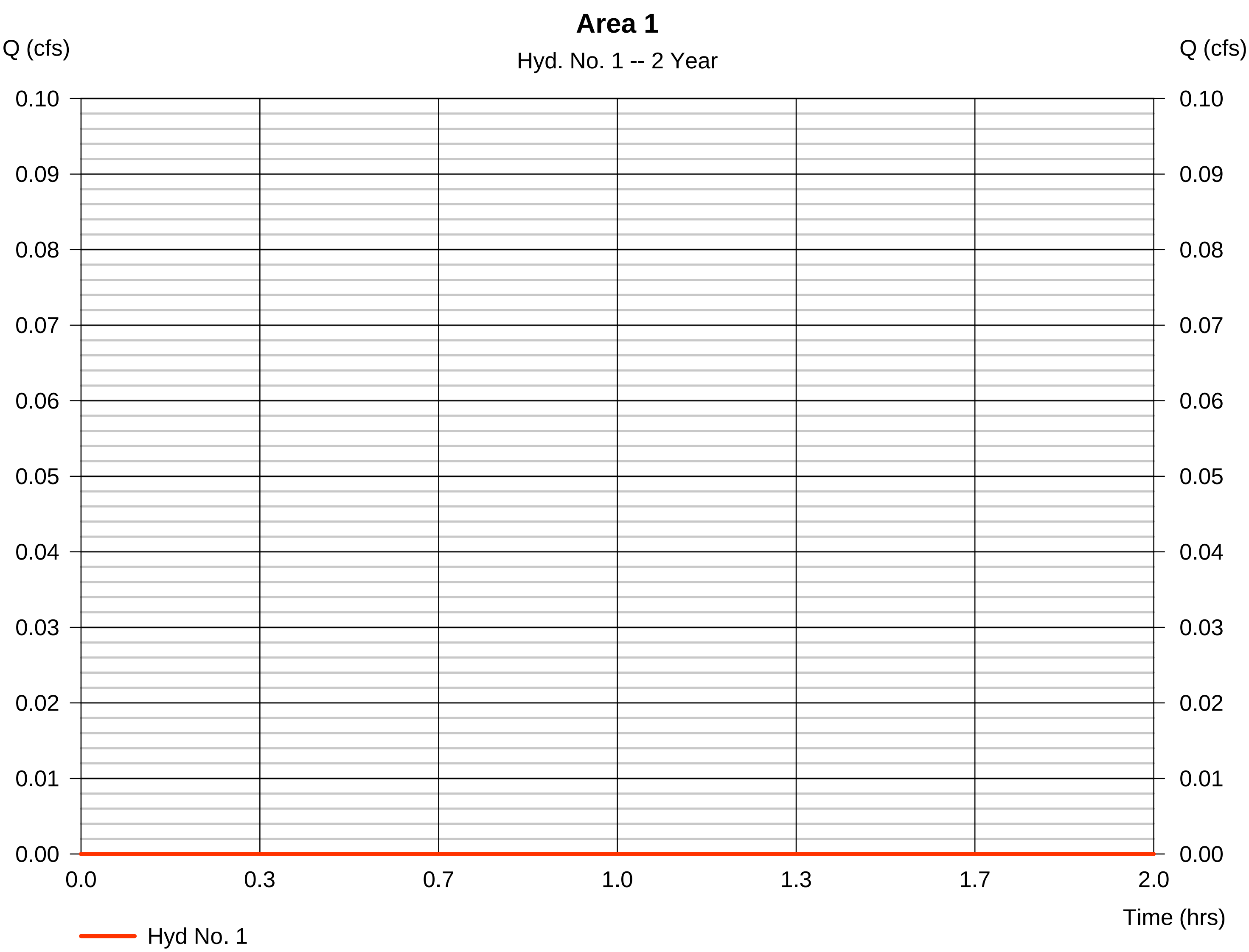
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 1

Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.530 ac	Curve number	= 36*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.60 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.530 x 36)] / 0.530



TR55 Tc Worksheet

Hyd. No. 1

Area 1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	50.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	2.20		0.00		0.00		
Land slope (%)	=	7.80		0.00		0.00		
Travel Time (min)	**=**	**5.74**	**+**	**0.00**	**+**	**0.00**	**=**	**5.74**
Shallow Concentrated Flow								
Flow length (ft)	=	148.40		0.00		0.00		
Watercourse slope (%)	=	3.20		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	2.89		0.00		0.00		
Travel Time (min)	**=**	**0.86**	**+**	**0.00**	**+**	**0.00**	**=**	**0.86**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)		({0})0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 6.60 min

Hydrograph Report

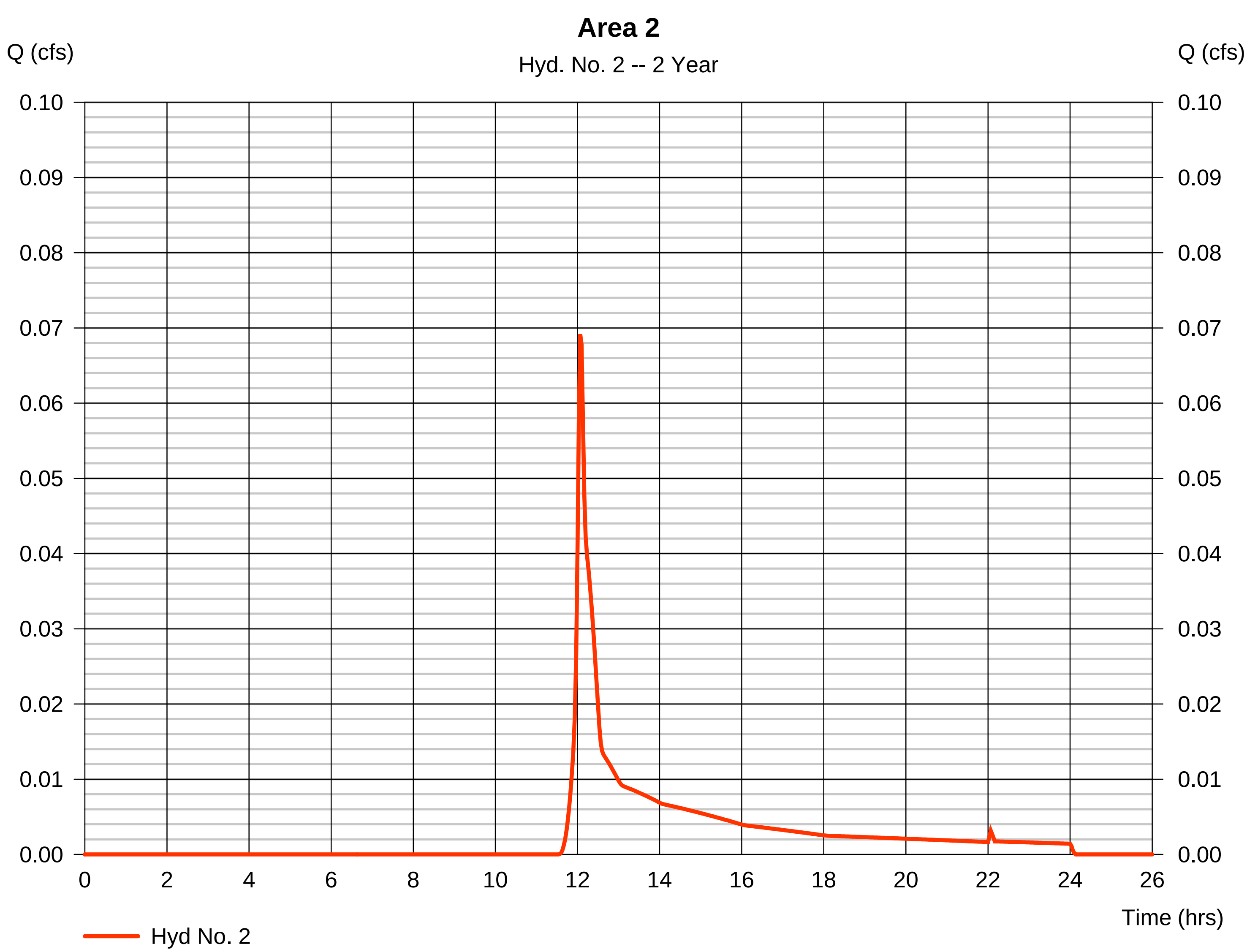
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Wednesday, 03 / 30 / 2016

Hyd. No. 2

Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.069 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 247 cuft
Drainage area	= 0.150 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 4.30 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 49) + (0.080 x 98)] / 0.150



Hydrograph Report

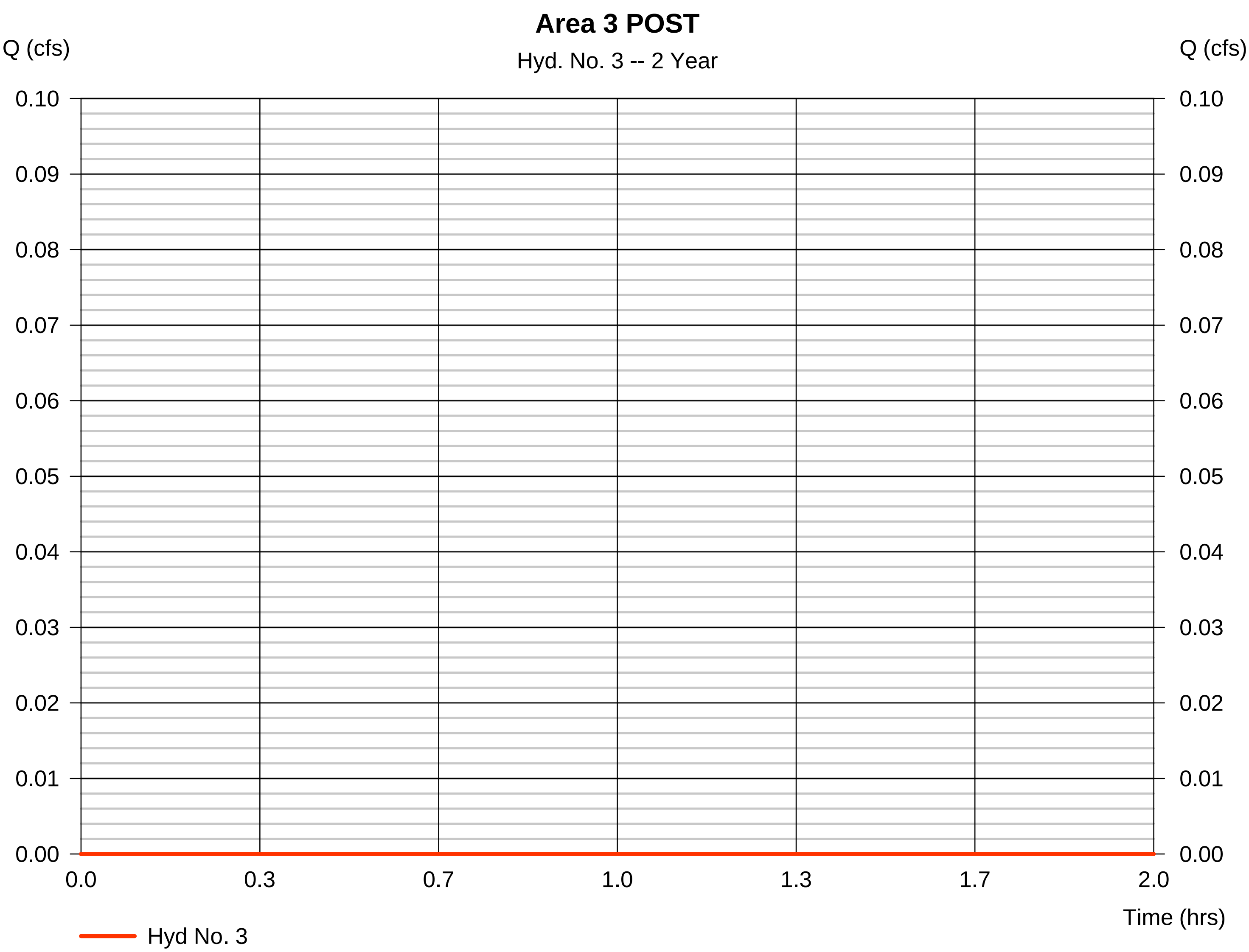
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 3

Area 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.290 ac	Curve number	= 38*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.246 x 36) + (0.040 x 49)] / 0.290



TR55 Tc Worksheet

Hyd. No. 3

Area 3 POST

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	50.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	2.20		0.00		0.00		
Land slope (%)	=	4.60		0.00		0.00		
Travel Time (min)	**=**	**7.08**	**+**	**0.00**	**+**	**0.00**	**=**	**7.08**
Shallow Concentrated Flow								
Flow length (ft)	=	173.00		0.00		0.00		
Watercourse slope (%)	=	2.89		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.74			0.00		0.00		
Travel Time (min)	**=**	**1.05**	**+**	**0.00**	**+**	**0.00**	**=**	**1.05**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=0.00							
				0.00				
						0.00		
Flow length (ft)	({0})0.0			0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... **8.10 min**

Hydrograph Report

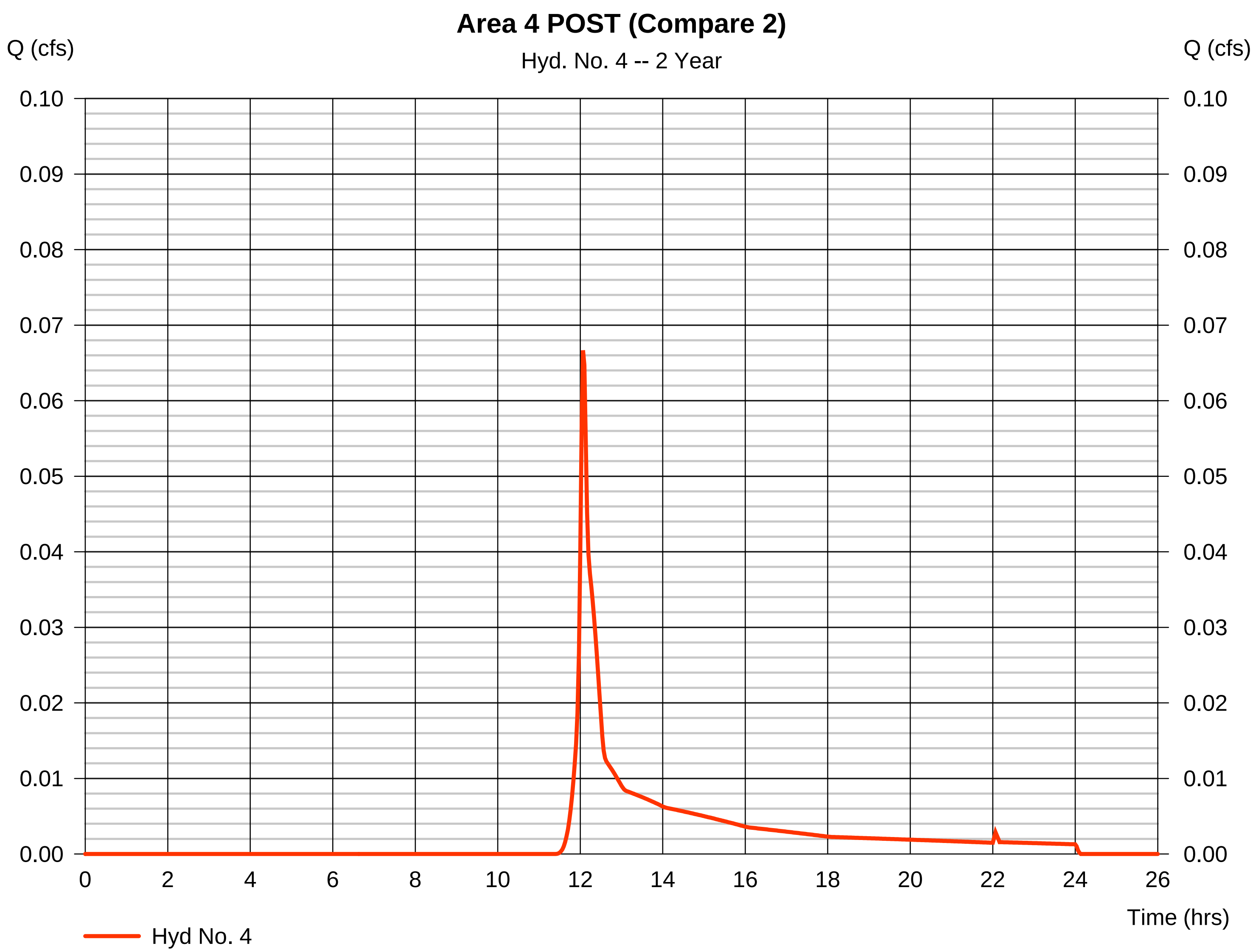
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 4

Area 4 POST (Compare 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.067 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 230 cuft
Drainage area	= 0.130 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.30 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.074 x 98) + (0.058 x 49)] / 0.130



TR55 Tc Worksheet

Hyd. No. 4

Area 4 POST (Compare 2)

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	22.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	2.20		0.00		0.00		
Land slope (%)	=	6.30		0.00		0.00		
Travel Time (min)	**=**	**3.24**	**+**	**0.00**	**+**	**0.00**	**=**	**3.24**
Shallow Concentrated Flow								
Flow length (ft)	=	174.00		0.00		0.00		
Watercourse slope (%)	=	1.89		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=2.79			0.00		0.00		
Travel Time (min)	**=**	**1.04**	**+**	**0.00**	**+**	**0.00**	**=**	**1.04**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=0.00			0.00		0.00		
Flow length (ft)	({0})0.0			0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 4.30 min

Hydrograph Report

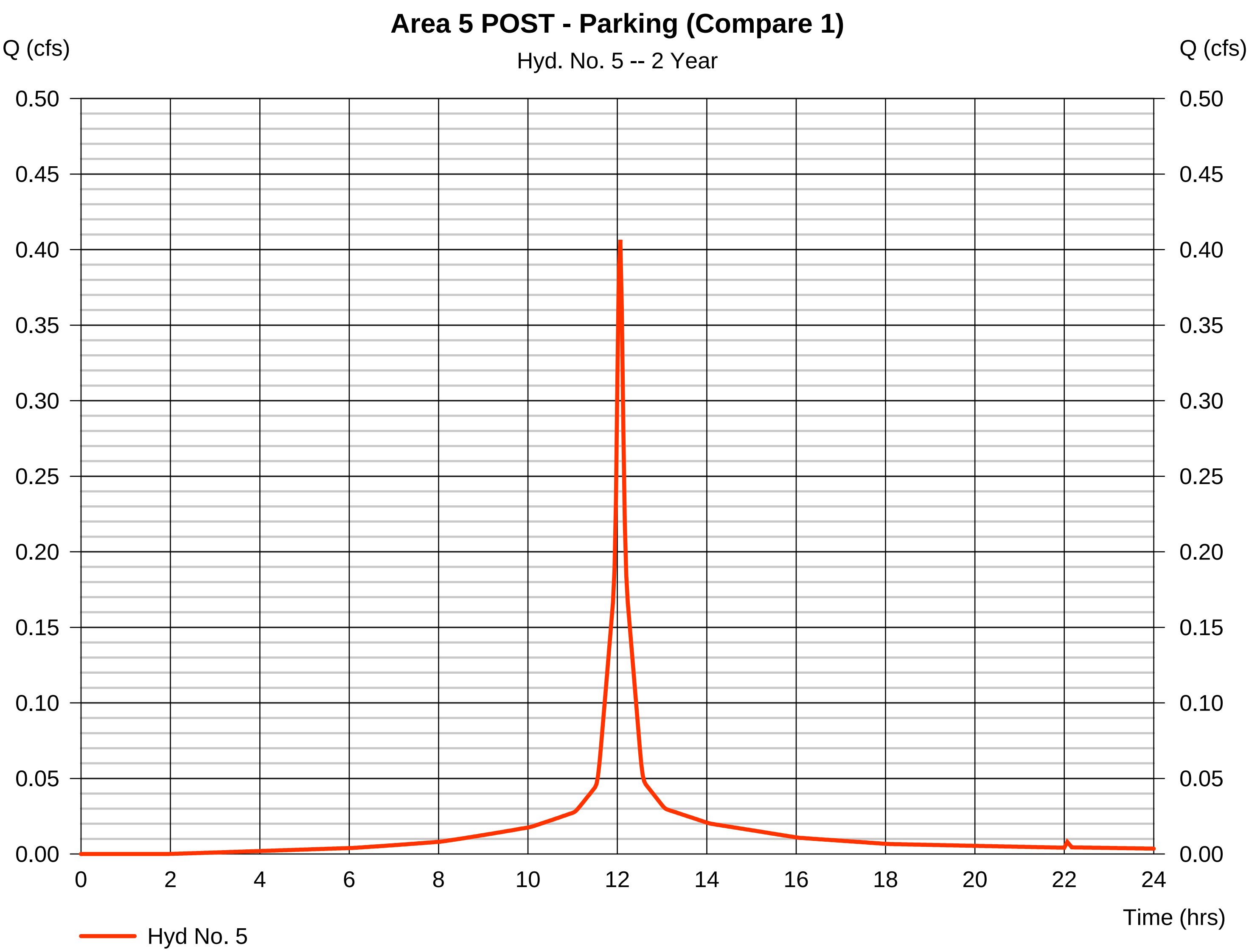
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 5

Area 5 POST - Parking (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.407 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,343 cuft
Drainage area	= 0.200 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98)] / 0.200



Hydrograph Report

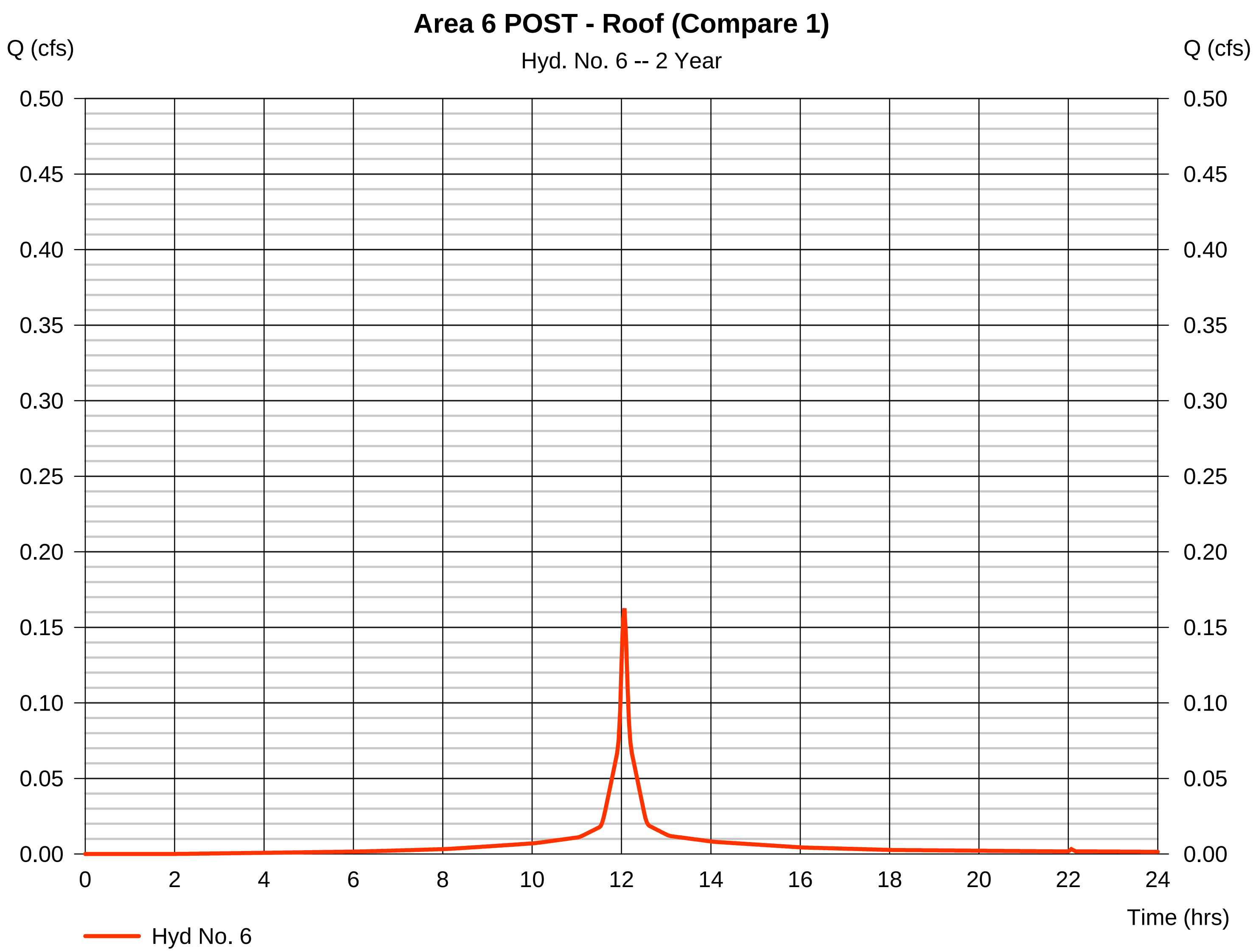
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 6

Area 6 POST - Roof (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.163 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 537 cuft
Drainage area	= 0.080 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.075 x 98)] / 0.080



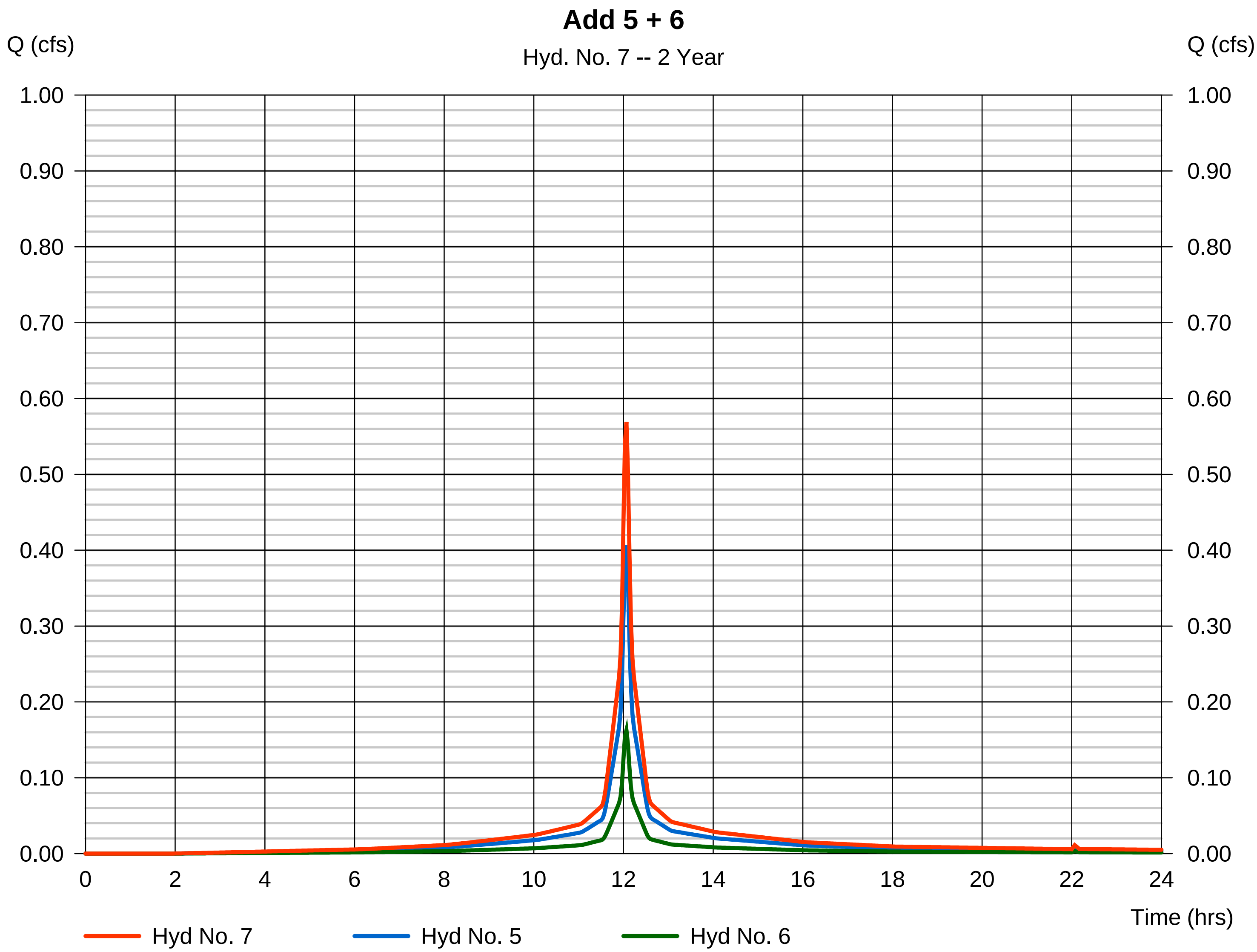
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 7

Add 5 + 6

Hydrograph type	= Combine	Peak discharge	= 0.569 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,880 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.280 ac



Hydrograph Report

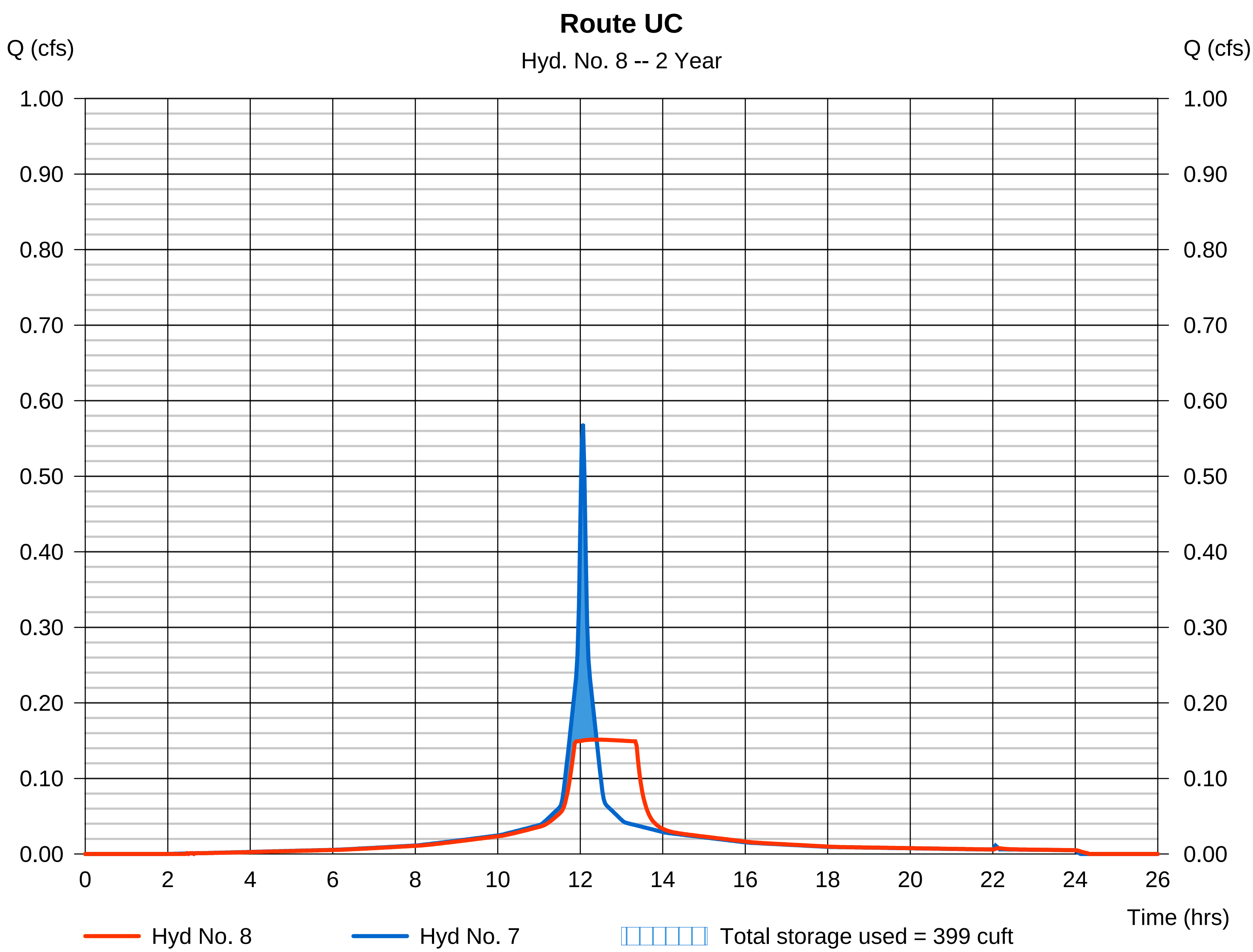
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 8

Route UC

Hydrograph type	= Reservoir	Peak discharge	= 0.151 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,879 cuft
Inflow hyd. No.	= 7 - Add 5 + 6	Max. Elevation	= 260.46 ft
Reservoir name	= UC Sys	Max. Storage	= 399 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Pond No. 1 - UC Sys

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	260.20	n/a	0	0
0.10	260.30	n/a	87	87
0.50	260.70	n/a	781	868
1.00	261.20	n/a	1,382	2,250
1.50	261.70	n/a	800	3,050
2.00	262.20	n/a	500	3,550

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 2.00	0.00	0.00	0.00
Span (in)	= 2.00	2.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 261.40	0.00	0.00	0.00
Length (ft)	= 130.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

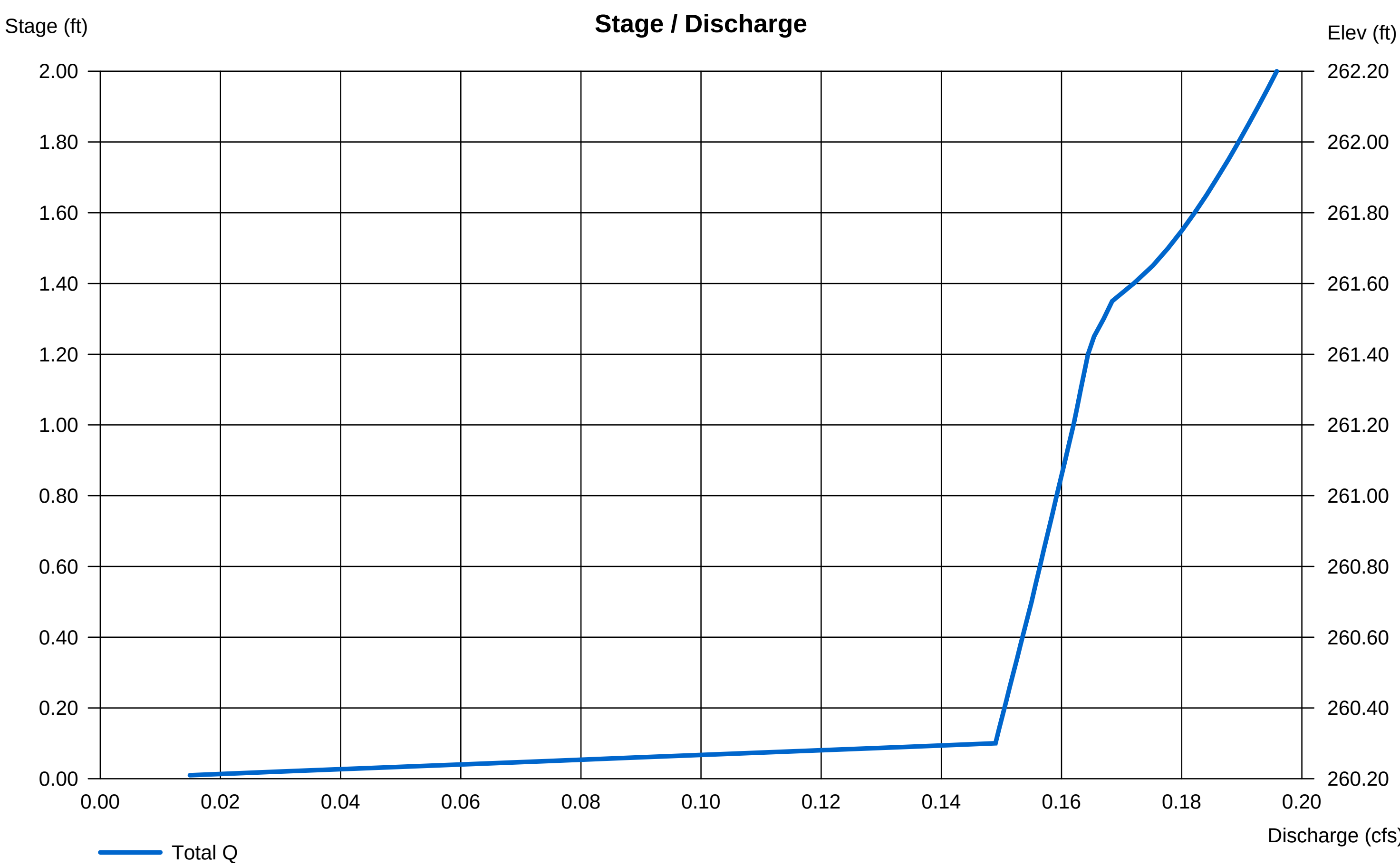
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 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).



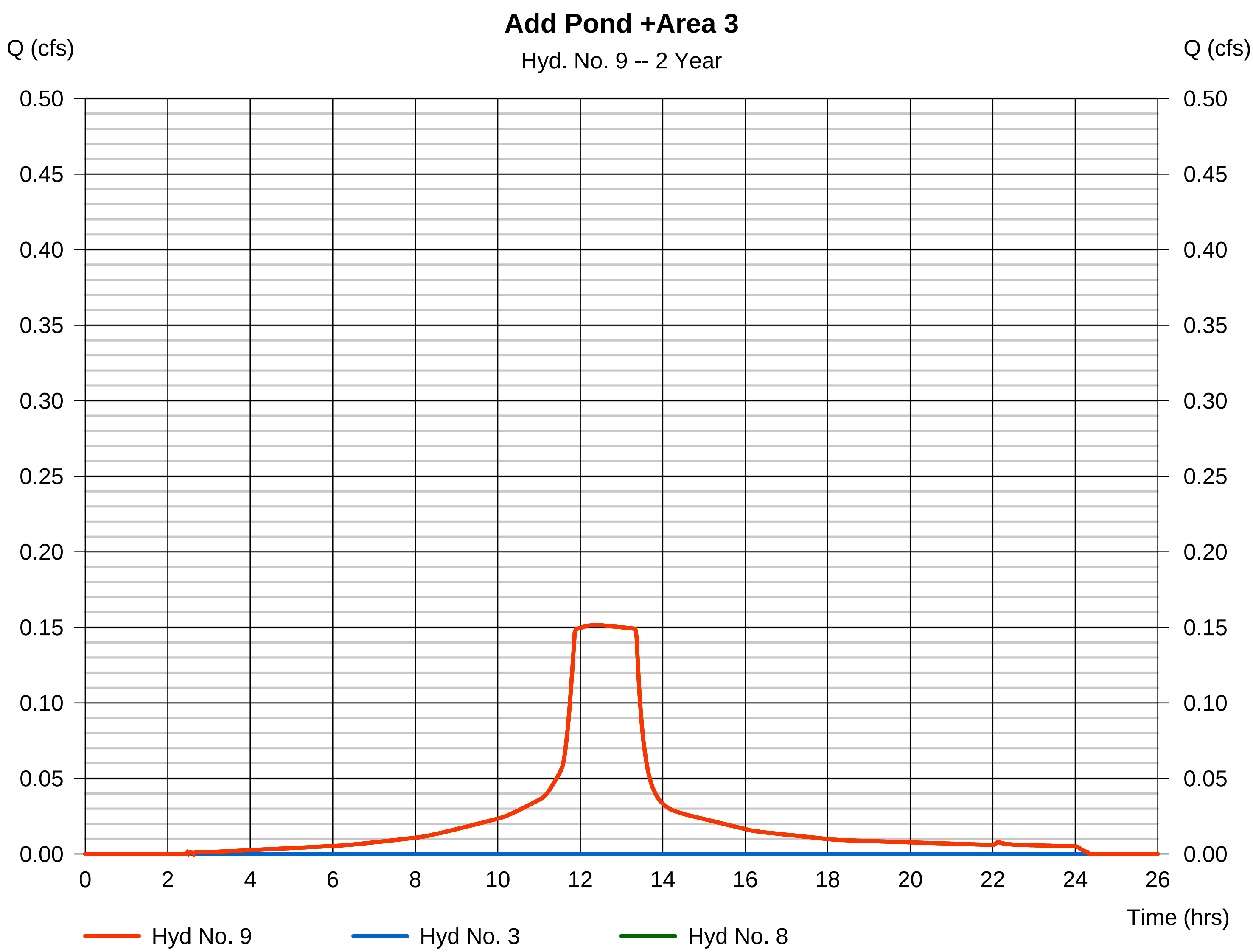
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 9

Add Pond +Area 3

Hydrograph type	= Combine	Peak discharge	= 0.151 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,879 cuft
Inflow hyds.	= 3, 8	Contrib. drain. area	= 0.290 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	0.002	2	1326	50	------	------	------	Area 1
2	SCS Runoff	0.314	2	724	948	------	------	------	Area 2
3	SCS Runoff	0.002	2	924	59	------	------	------	Area 3 POST
4	SCS Runoff	0.284	2	724	855	------	------	------	Area 4 POST (Compare 2)
5	SCS Runoff	0.800	2	724	2,732	------	------	------	Area 5 POST - Parking (Compare 1)
6	SCS Runoff	0.320	2	724	1,093	------	------	------	Area 6 POST - Roof (Compare 1)
7	Combine	1.120	2	724	3,825	5, 6	------	------	Add 5 + 6
8	Reservoir	0.156	2	752	3,825	7	260.80	1,143	Route UC
9	Combine	0.156	2	752	3,884	3, 8	------	------	Add Pond +Area 3

Hydrograph Report

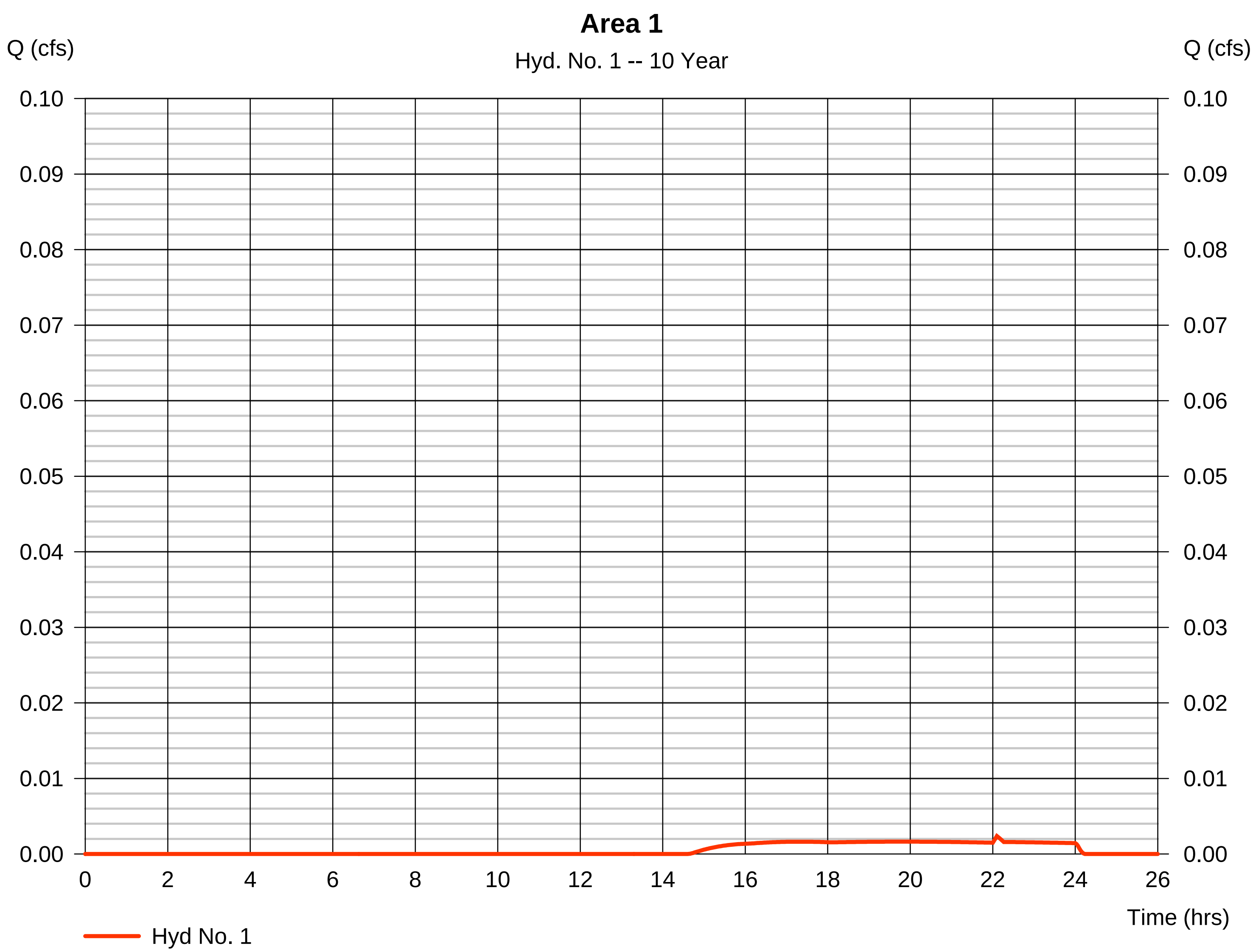
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 1

Area 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.002 cfs
Storm frequency	=	10 yrs	Time to peak	=	22.10 hrs
Time interval	=	2 min	Hyd. volume	=	50 cuft
Drainage area	=	0.530 ac	Curve number	=	36*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.60 min
Total precip.	=	4.25 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.530 x 36)] / 0.530



Hydrograph Report

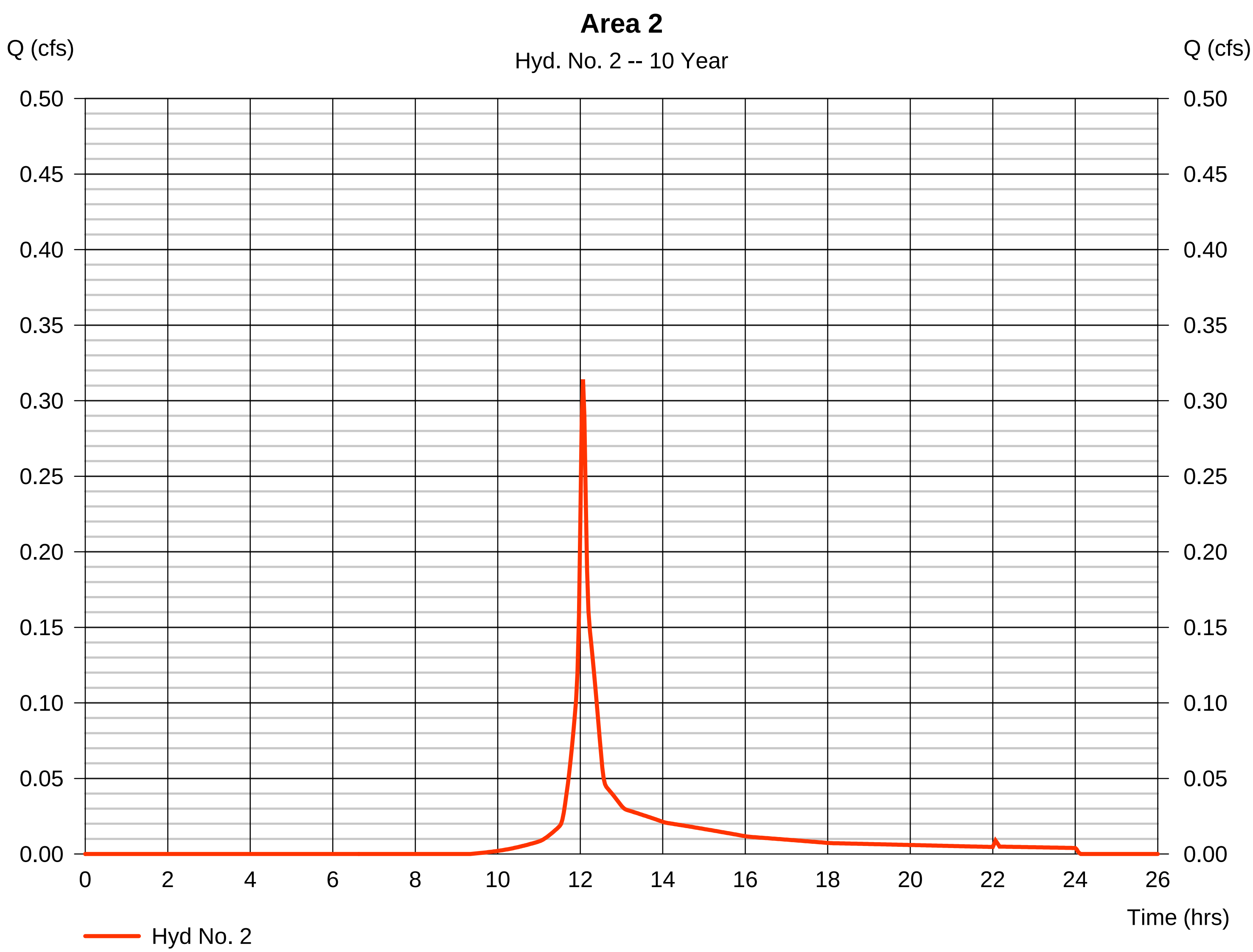
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 2

Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.314 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 948 cuft
Drainage area	= 0.150 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 4.30 min
Total precip.	= 4.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 49) + (0.080 x 98)] / 0.150



Hydrograph Report

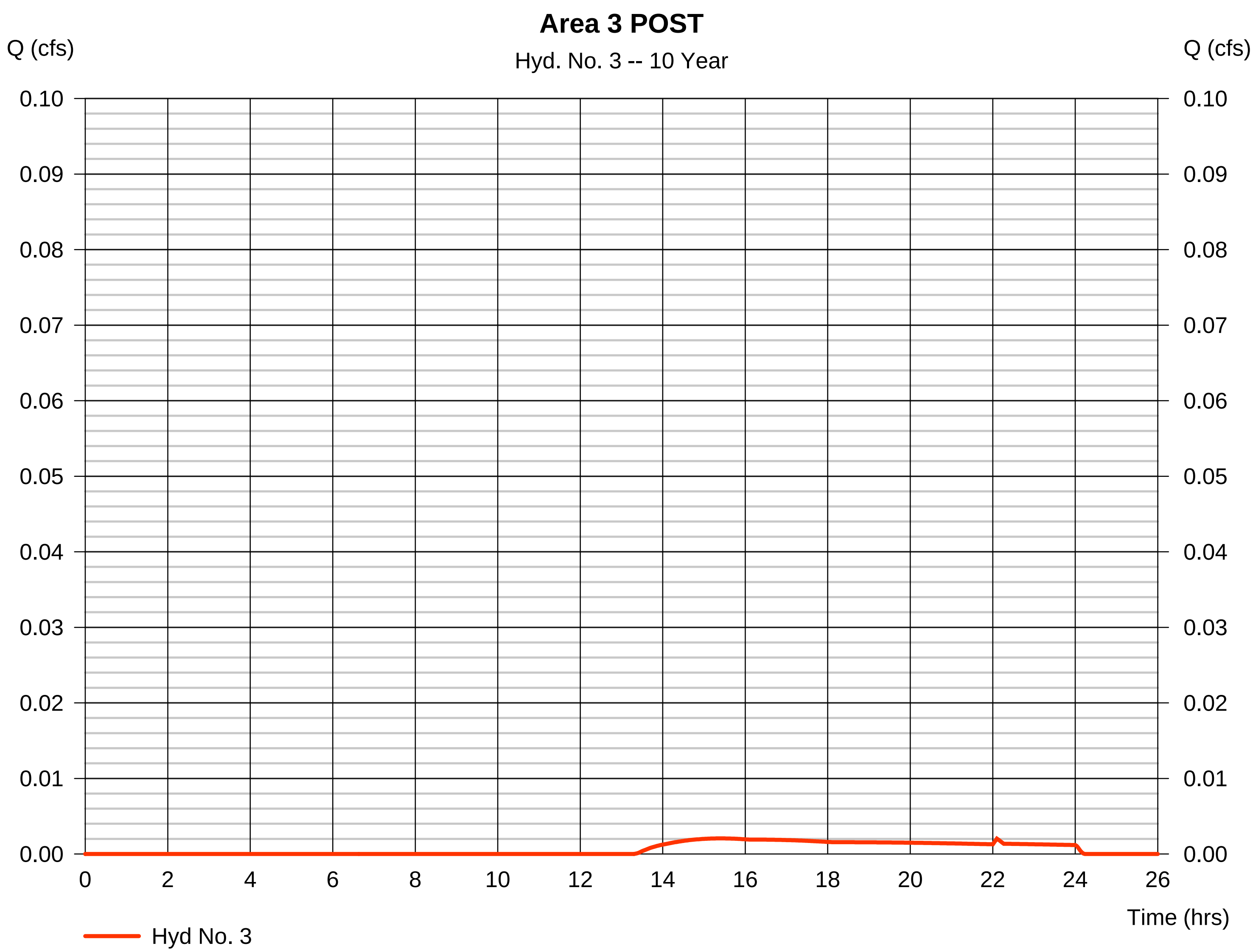
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 3

Area 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.002 cfs
Storm frequency	= 10 yrs	Time to peak	= 15.40 hrs
Time interval	= 2 min	Hyd. volume	= 59 cuft
Drainage area	= 0.290 ac	Curve number	= 38*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 4.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.246 x 36) + (0.040 x 49)] / 0.290



Hydrograph Report

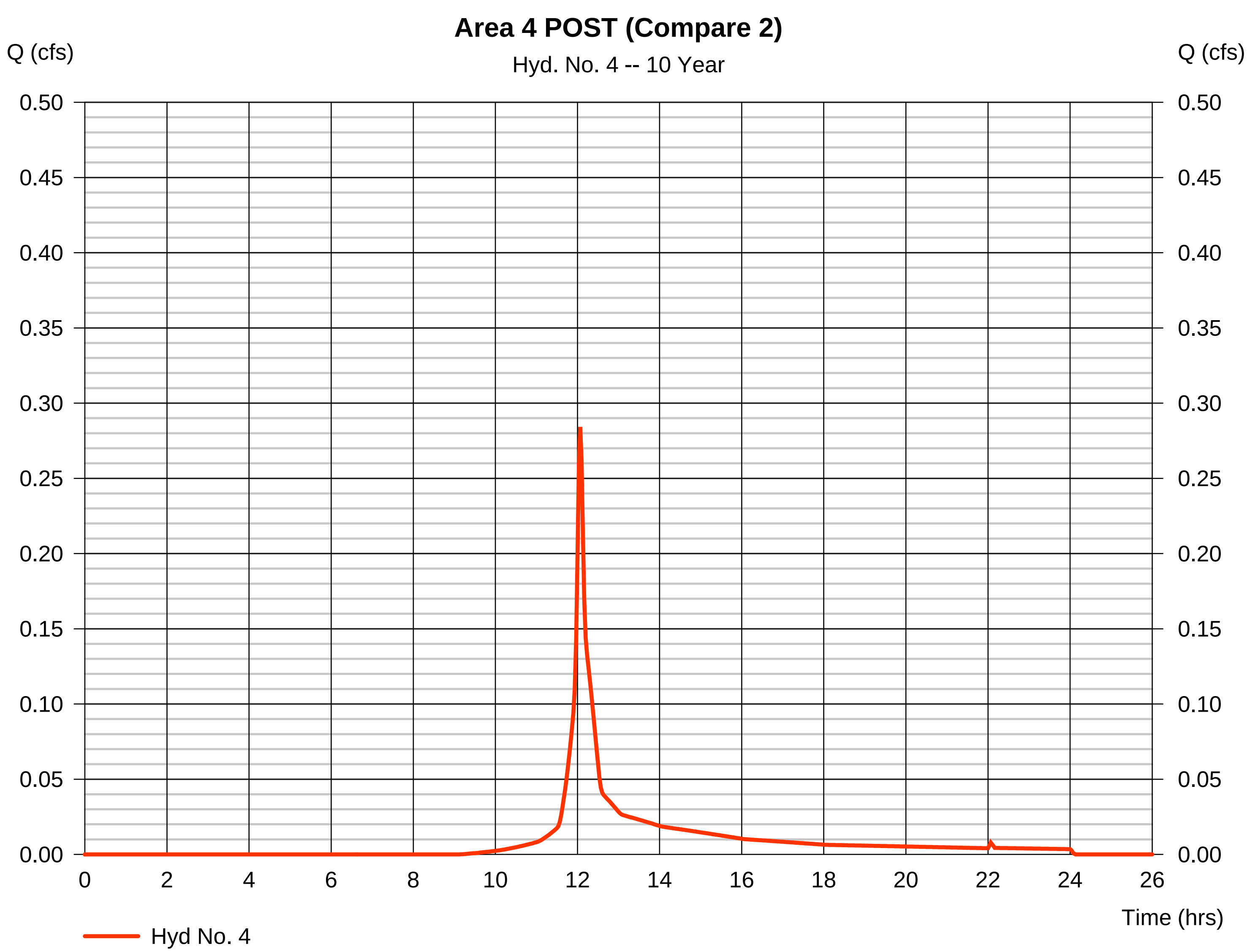
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 4

Area 4 POST (Compare 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.284 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 855 cuft
Drainage area	= 0.130 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.30 min
Total precip.	= 4.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.074 x 98) + (0.058 x 49)] / 0.130



Hydrograph Report

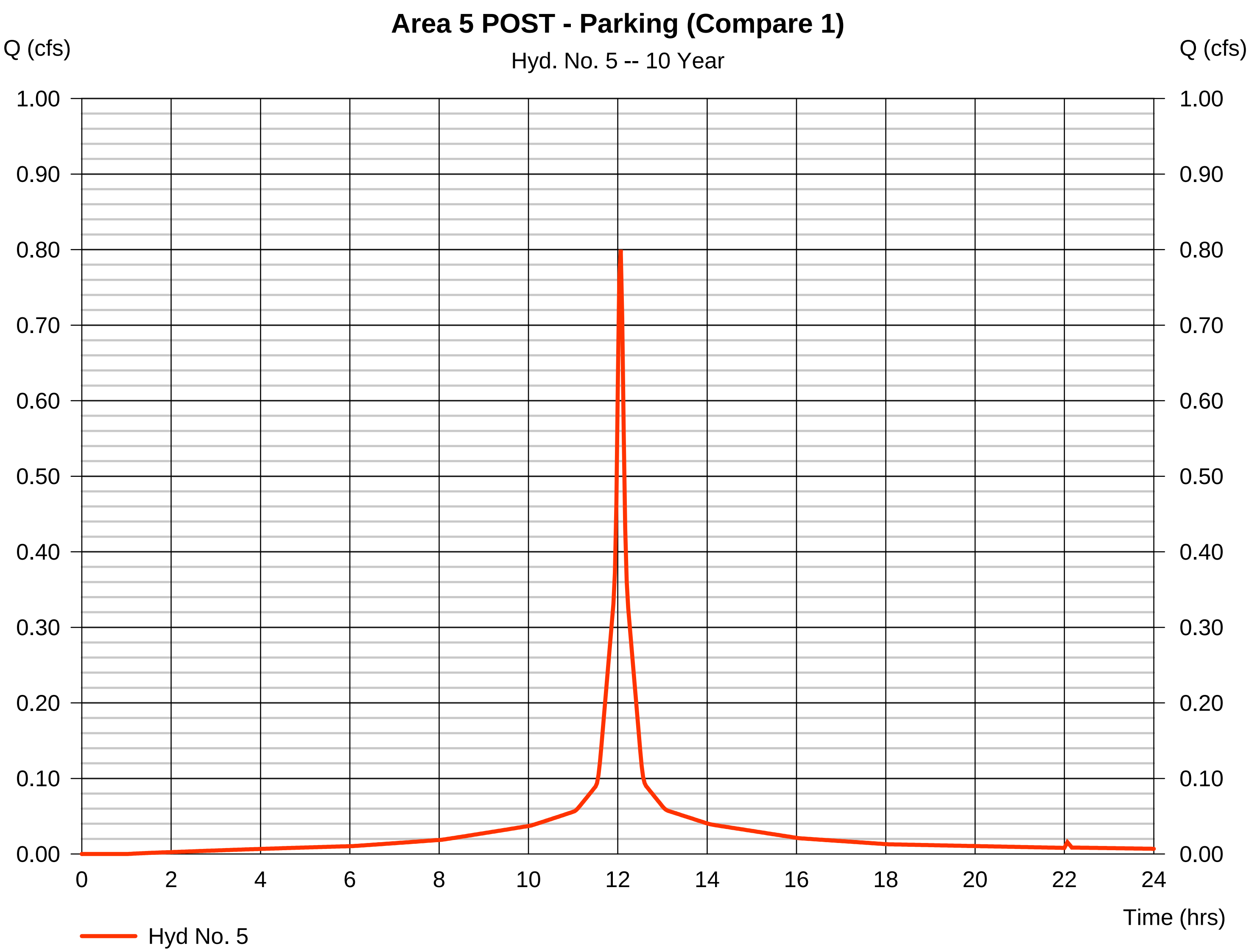
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 5

Area 5 POST - Parking (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.800 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,732 cuft
Drainage area	= 0.200 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98)] / 0.200



Hydrograph Report

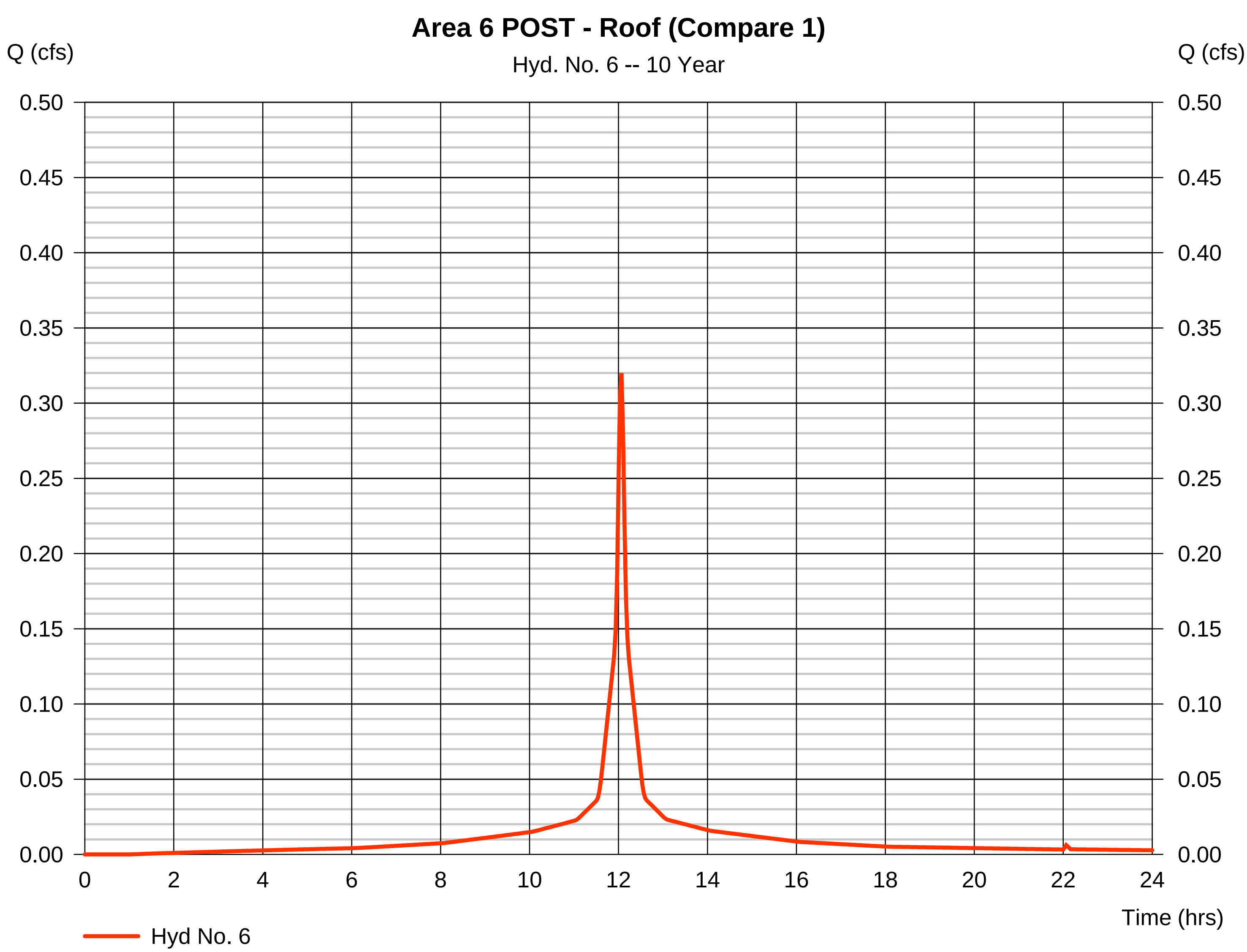
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 6

Area 6 POST - Roof (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.320 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,093 cuft
Drainage area	= 0.080 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.075 x 98)] / 0.080



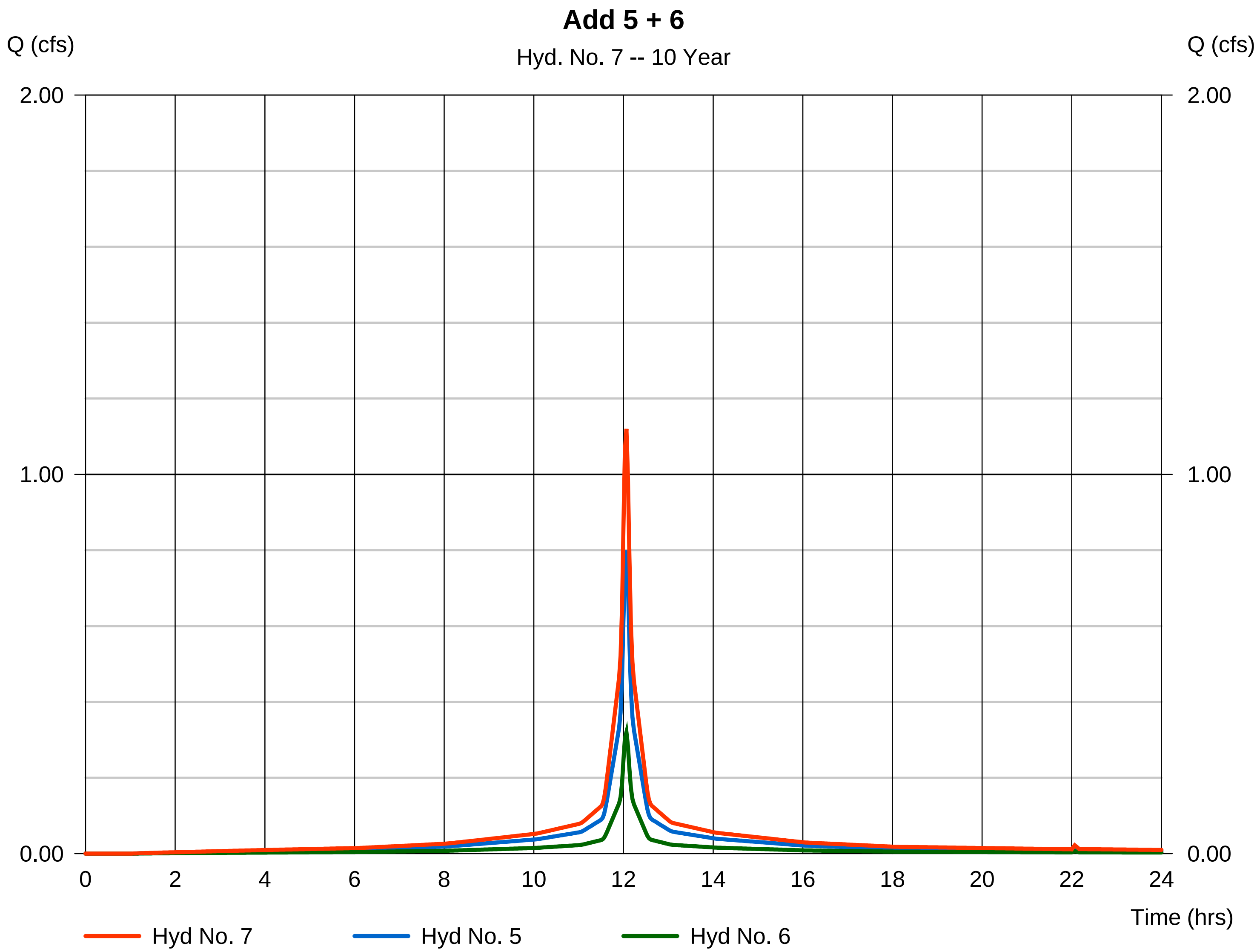
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 7

Add 5 + 6

Hydrograph type	= Combine	Peak discharge	= 1.120 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 3,825 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.280 ac



Hydrograph Report

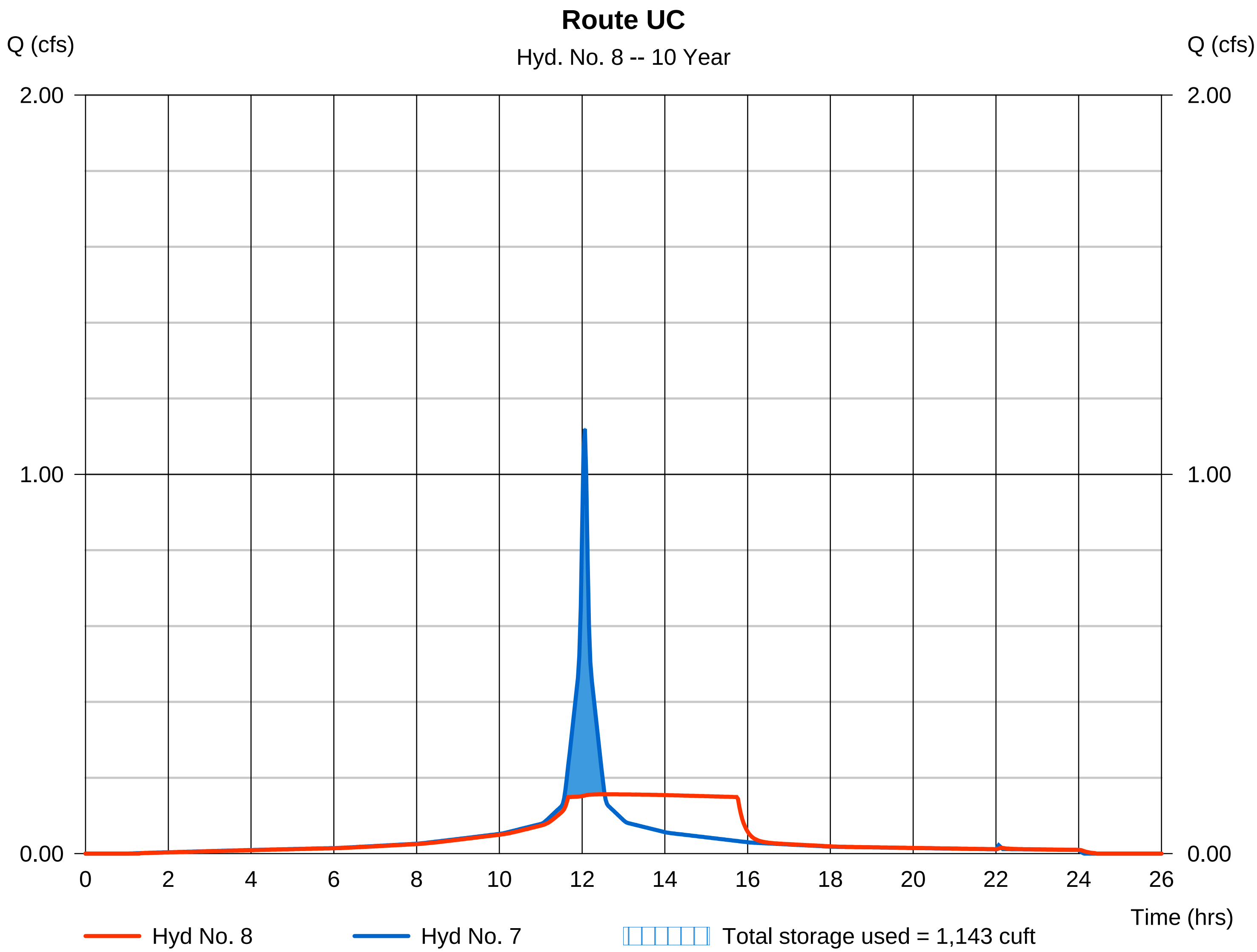
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 8

Route UC

Hydrograph type	= Reservoir	Peak discharge	= 0.156 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 3,825 cuft
Inflow hyd. No.	= 7 - Add 5 + 6	Max. Elevation	= 260.80 ft
Reservoir name	= UC Sys	Max. Storage	= 1,143 cuft

Storage Indication method used.



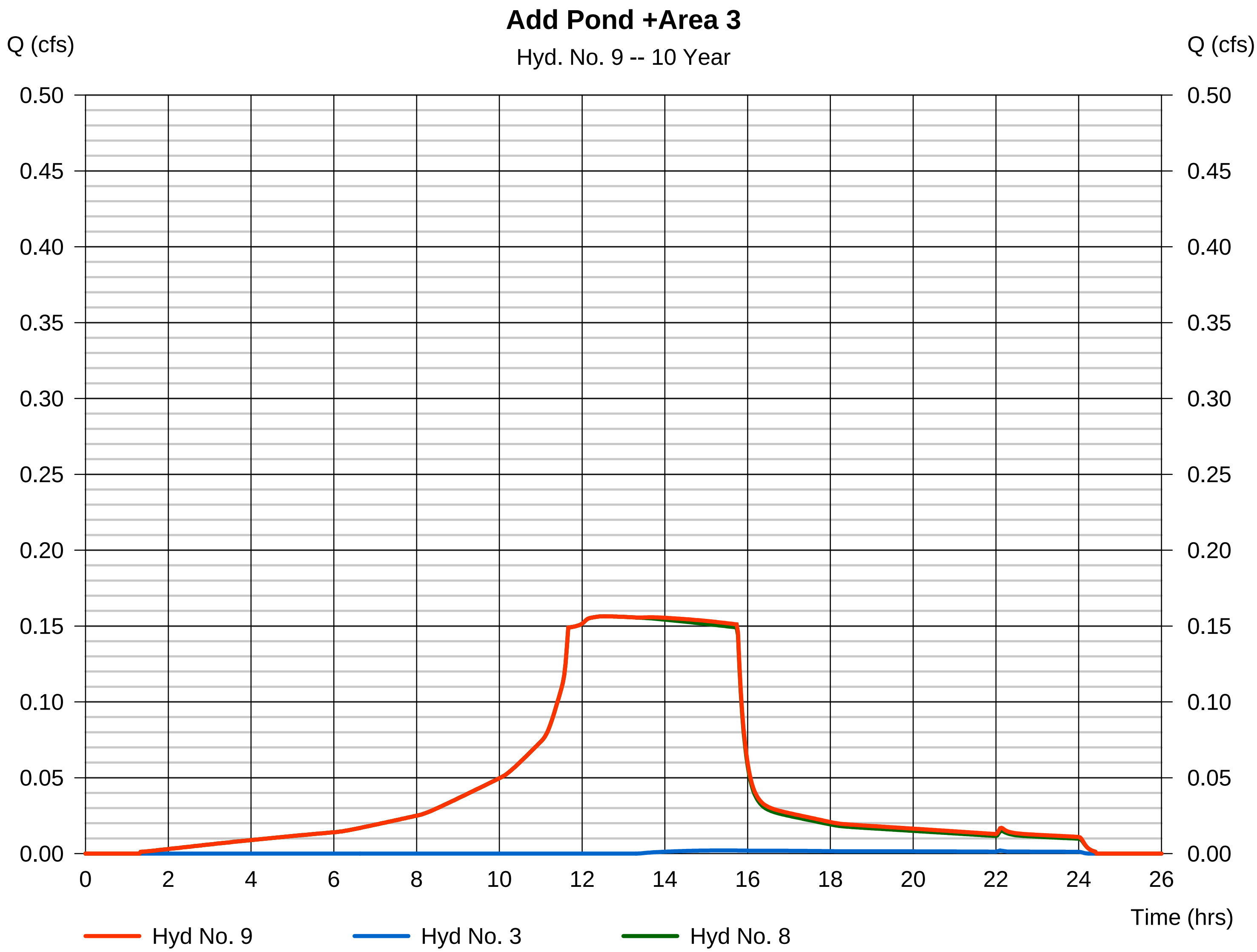
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 9

Add Pond +Area 3

Hydrograph type	= Combine	Peak discharge	= 0.156 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 3,884 cuft
Inflow hyds.	= 3, 8	Contrib. drain. area	= 0.290 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	0.027	2	748	472	------	------	------	Area 1
2	SCS Runoff	0.527	2	724	1,576	------	------	------	Area 2
3	SCS Runoff	0.031	2	744	351	------	------	------	Area 3 POST
4	SCS Runoff	0.471	2	724	1,408	------	------	------	Area 4 POST (Compare 2)
5	SCS Runoff	1.090	2	724	3,765	------	------	------	Area 5 POST - Parking (Compare 1)
6	SCS Runoff	0.436	2	724	1,506	------	------	------	Area 6 POST - Roof (Compare 1)
7	Combine	1.525	2	724	5,271	5, 6	------	------	Add 5 + 6
8	Reservoir	0.159	2	764	5,271	7	261.02	1,752	Route UC
9	Combine	0.190	2	744	5,622	3, 8	------	------	Add Pond +Area 3

Hydrograph Report

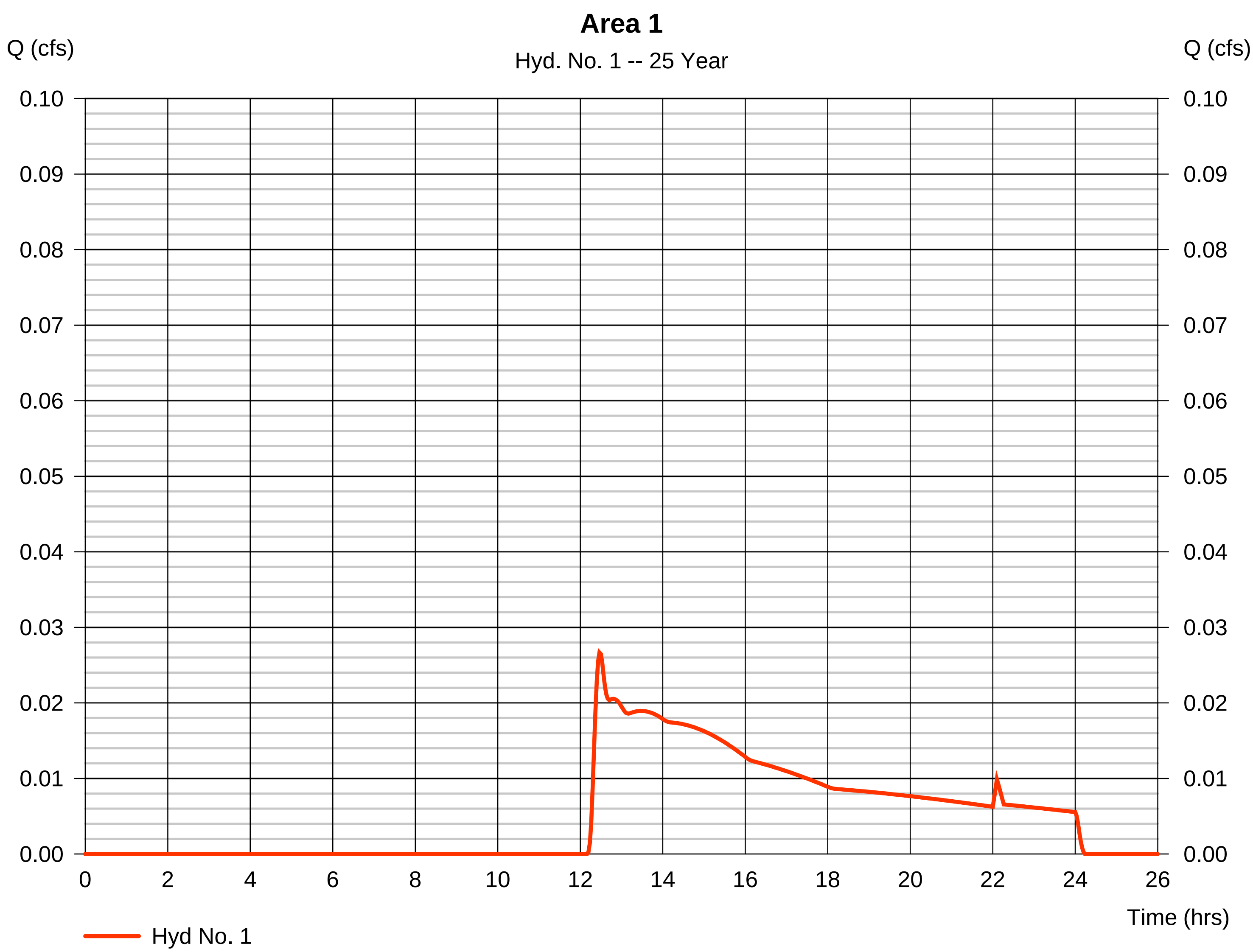
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 1

Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.027 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 472 cuft
Drainage area	= 0.530 ac	Curve number	= 36*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.60 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.530 x 36)] / 0.530



Hydrograph Report

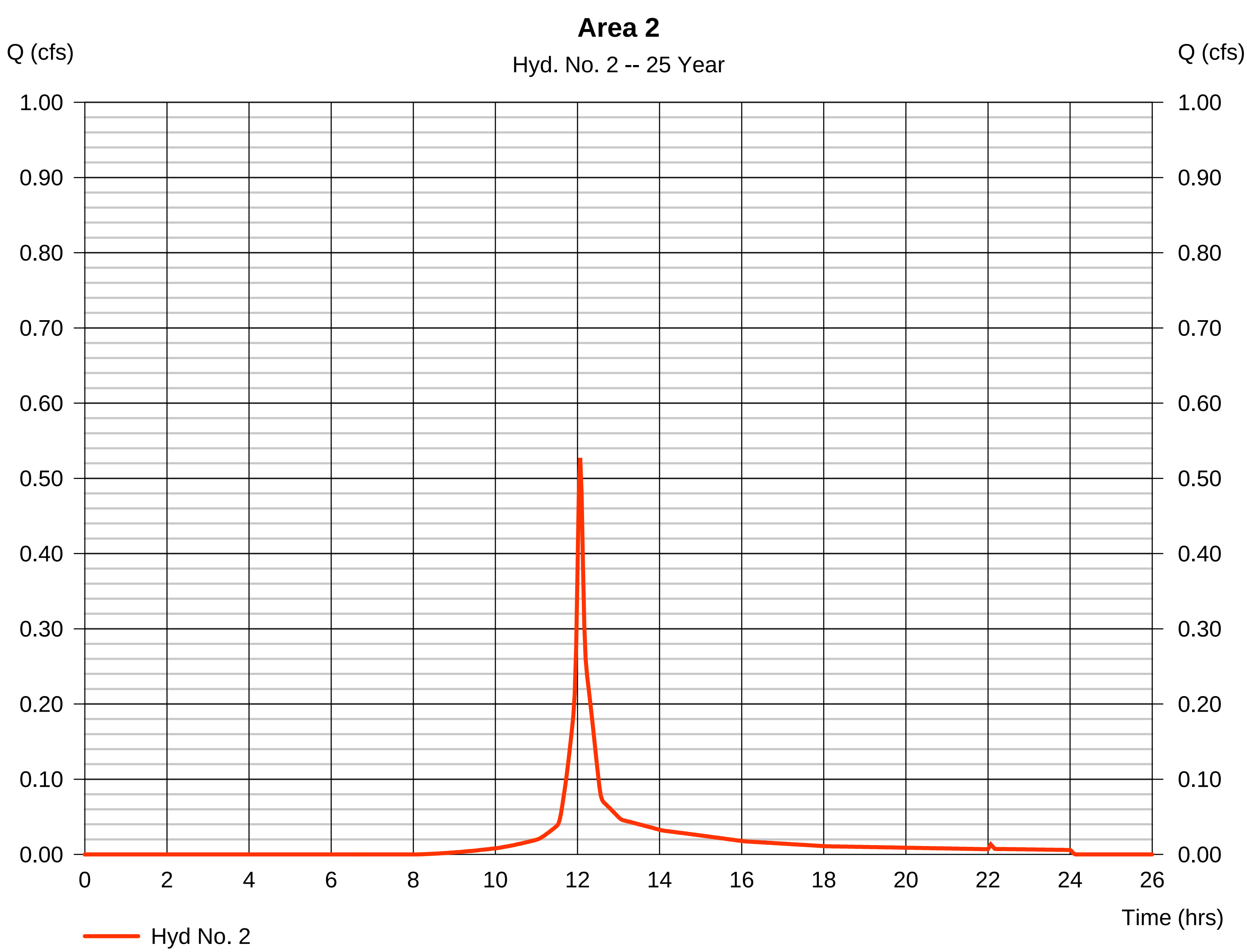
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 2

Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.527 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,576 cuft
Drainage area	= 0.150 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 4.30 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 49) + (0.080 x 98)] / 0.150



Hydrograph Report

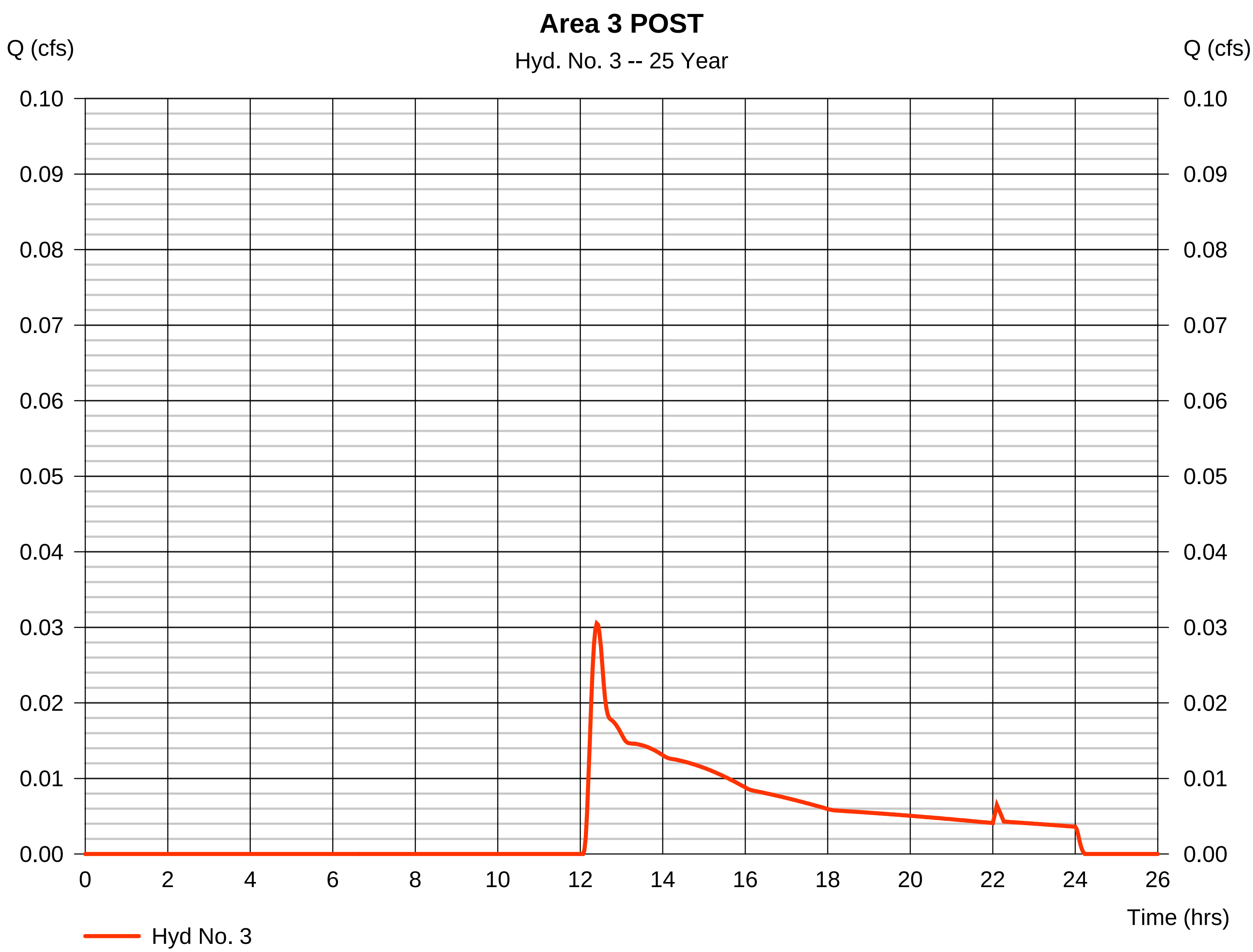
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 3

Area 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.031 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 351 cuft
Drainage area	= 0.290 ac	Curve number	= 38*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.246 x 36) + (0.040 x 49)] / 0.290



Hydrograph Report

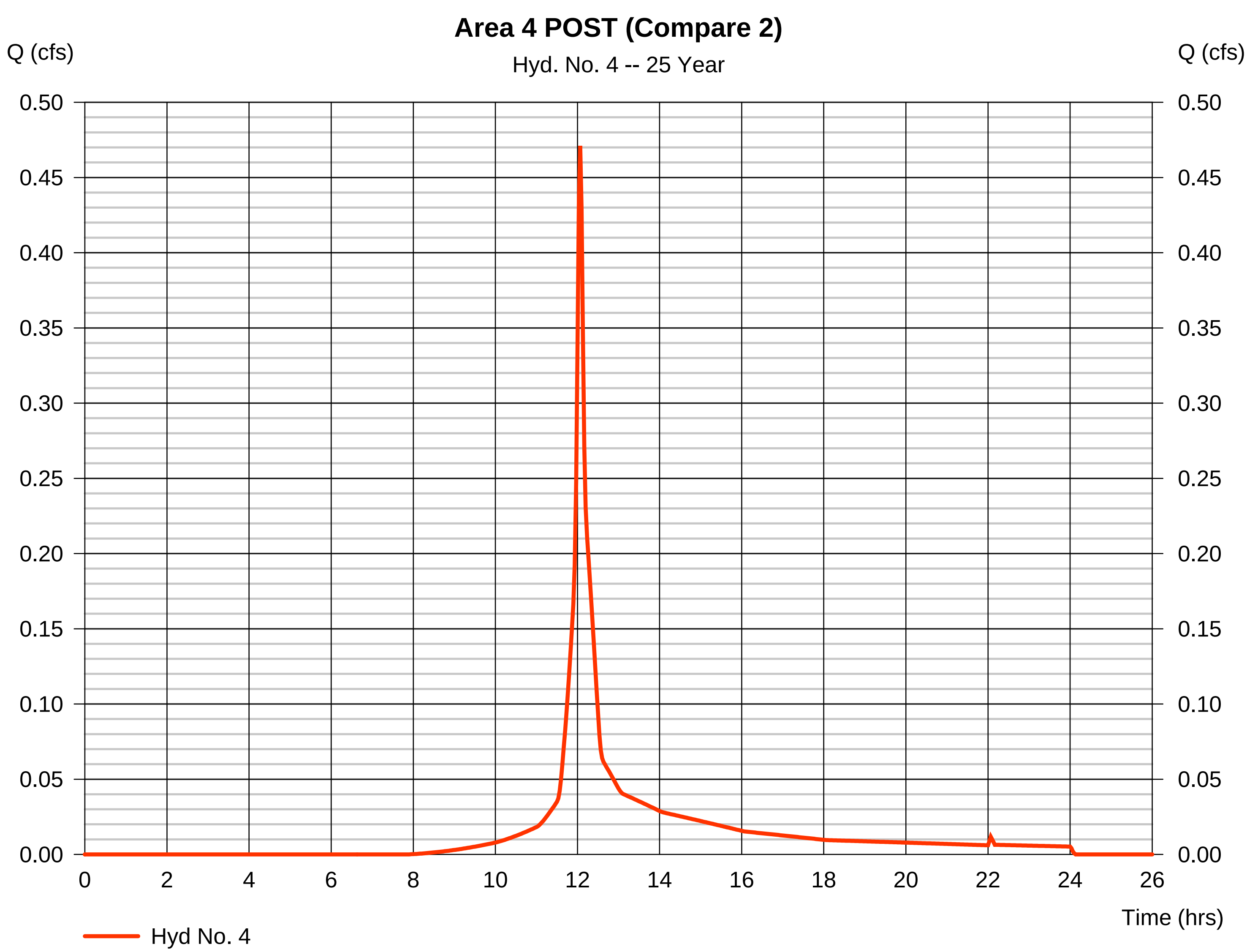
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 4

Area 4 POST (Compare 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.471 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,408 cuft
Drainage area	= 0.130 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.30 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.074 x 98) + (0.058 x 49)] / 0.130



Hydrograph Report

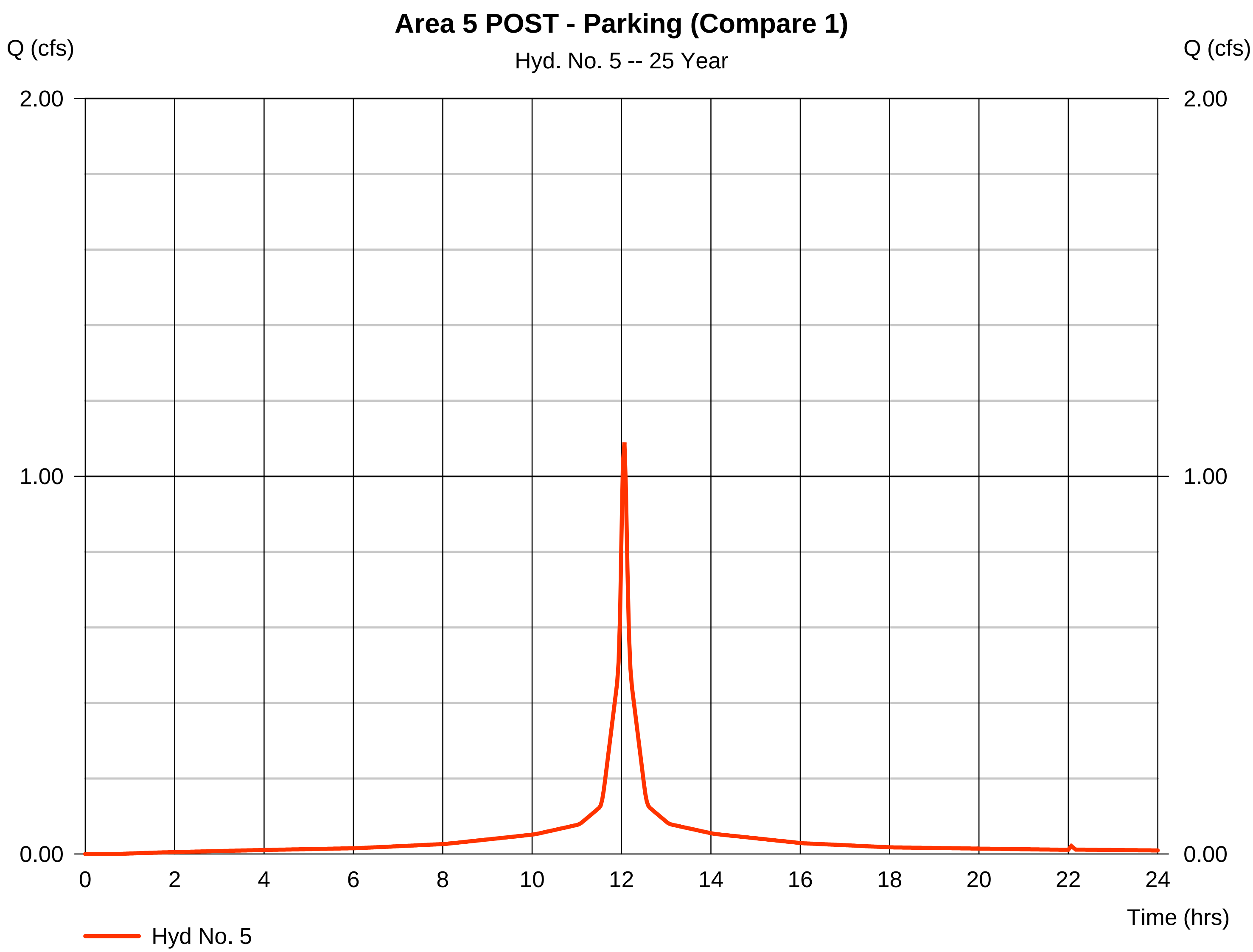
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 5

Area 5 POST - Parking (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.090 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 3,765 cuft
Drainage area	= 0.200 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98)] / 0.200



Hydrograph Report

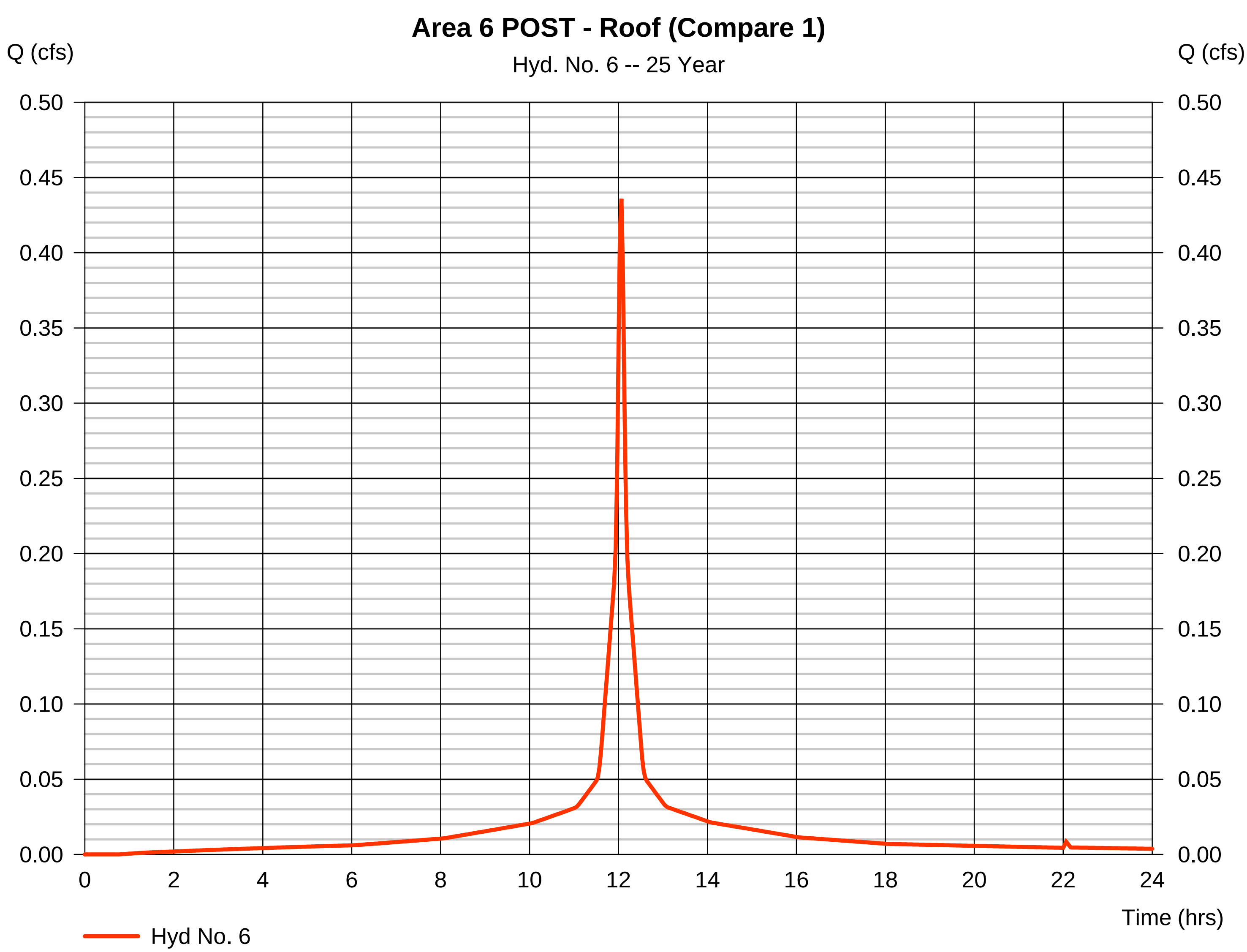
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 6

Area 6 POST - Roof (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.436 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,506 cuft
Drainage area	= 0.080 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.77 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.075 x 98)] / 0.080



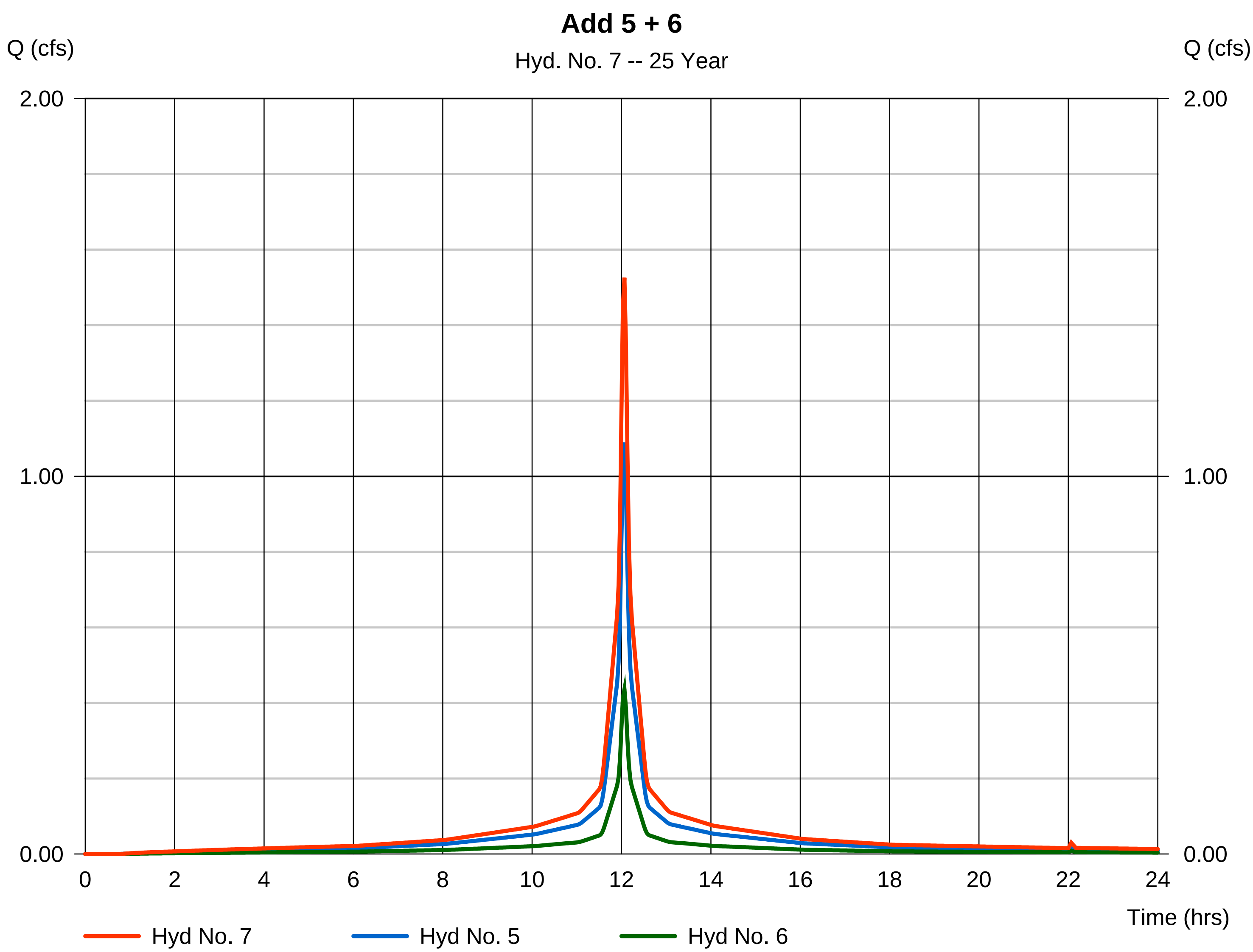
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 7

Add 5 + 6

Hydrograph type	= Combine	Peak discharge	= 1.525 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 5,271 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.280 ac



Hydrograph Report

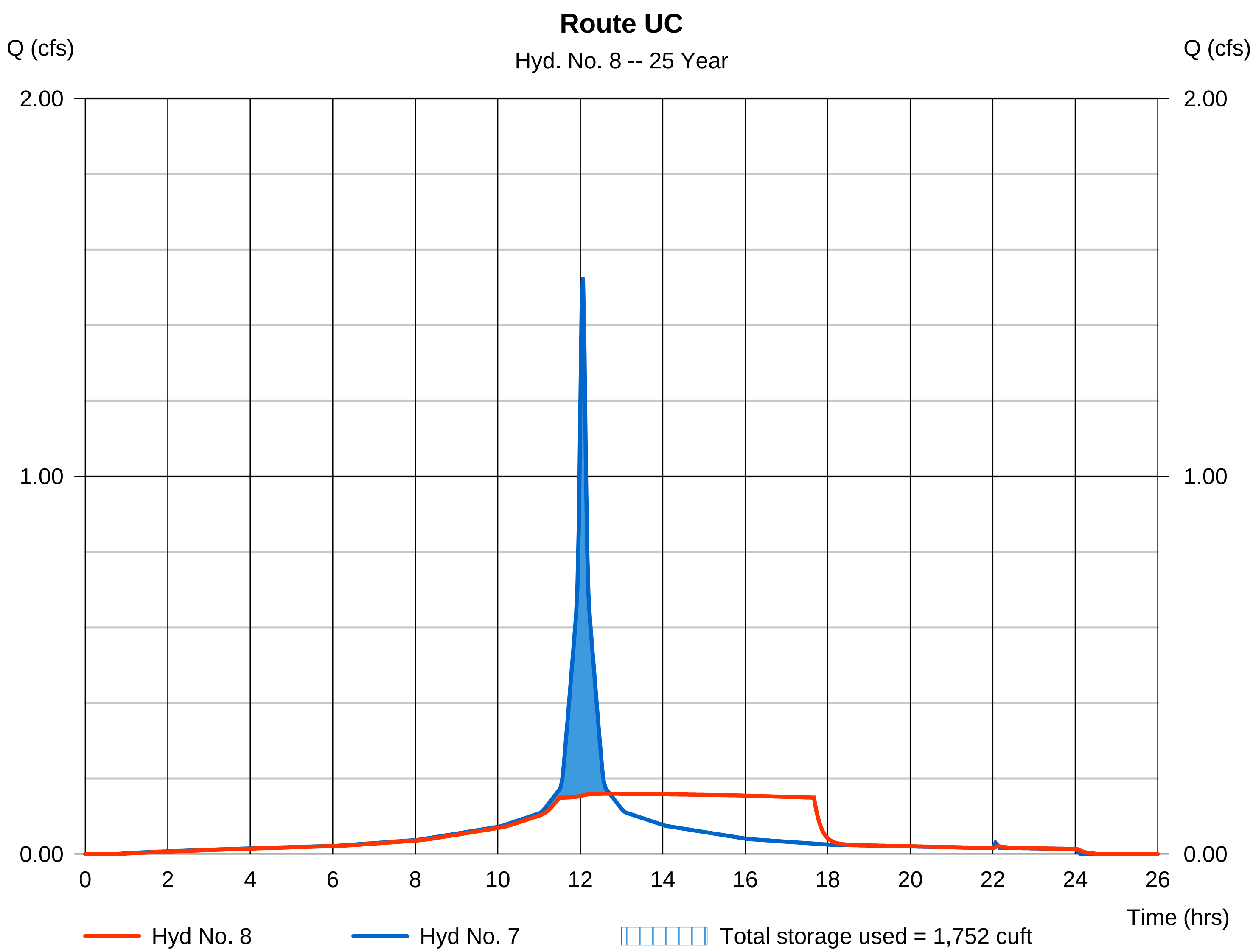
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Wednesday, 03 / 30 / 2016

Hyd. No. 8

Route UC

Hydrograph type	= Reservoir	Peak discharge	= 0.159 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.73 hrs
Time interval	= 2 min	Hyd. volume	= 5,271 cuft
Inflow hyd. No.	= 7 - Add 5 + 6	Max. Elevation	= 261.02 ft
Reservoir name	= UC Sys	Max. Storage	= 1,752 cuft

Storage Indication method used.



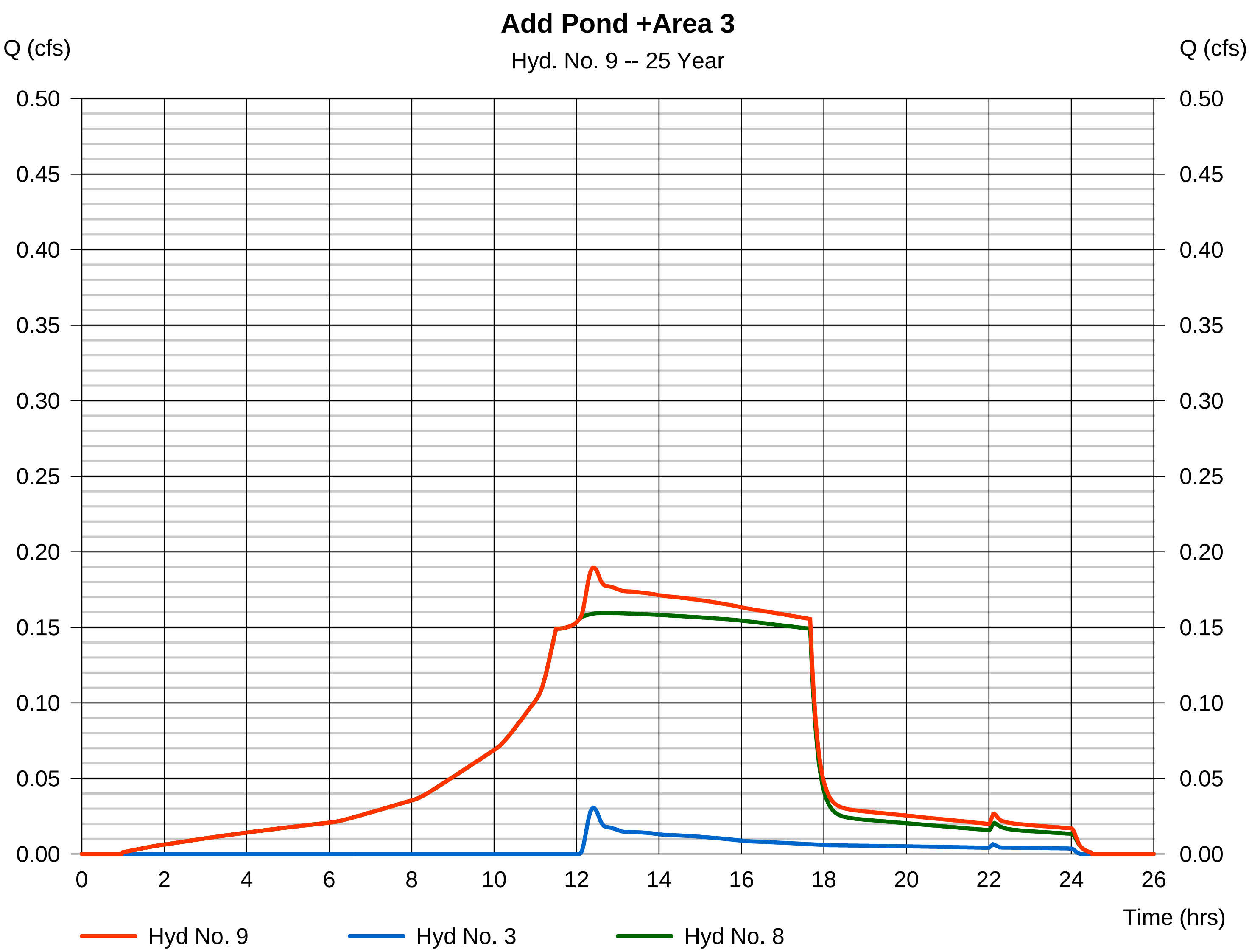
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 9

Add Pond +Area 3

Hydrograph type	= Combine	Peak discharge	= 0.190 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 5,622 cuft
Inflow hyds.	= 3, 8	Contrib. drain. area	= 0.290 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	0.249	2	732	1,675	------	------	------	Area 1
2	SCS Runoff	0.849	2	724	2,551	------	------	------	Area 2
3	SCS Runoff	0.196	2	730	1,101	------	------	------	Area 3 POST
4	SCS Runoff	0.751	2	724	2,262	------	------	------	Area 4 POST (Compare 2)
5	SCS Runoff	1.504	2	724	5,248	------	------	------	Area 5 POST - Parking (Compare 1)
6	SCS Runoff	0.602	2	724	2,099	------	------	------	Area 6 POST - Roof (Compare 1)
7	Combine	2.106	2	724	7,347	5, 6	------	------	Add 5 + 6
8	Reservoir	0.167	2	780	7,346	7	261.50	2,726	Route UC
9	Combine	0.356	2	730	8,447	3, 8	------	------	Add Pond +Area 3

Stormwater.gpw	Return Period: 100 Year	Wednesday, 03 / 30 / 2016

Hydrograph Report

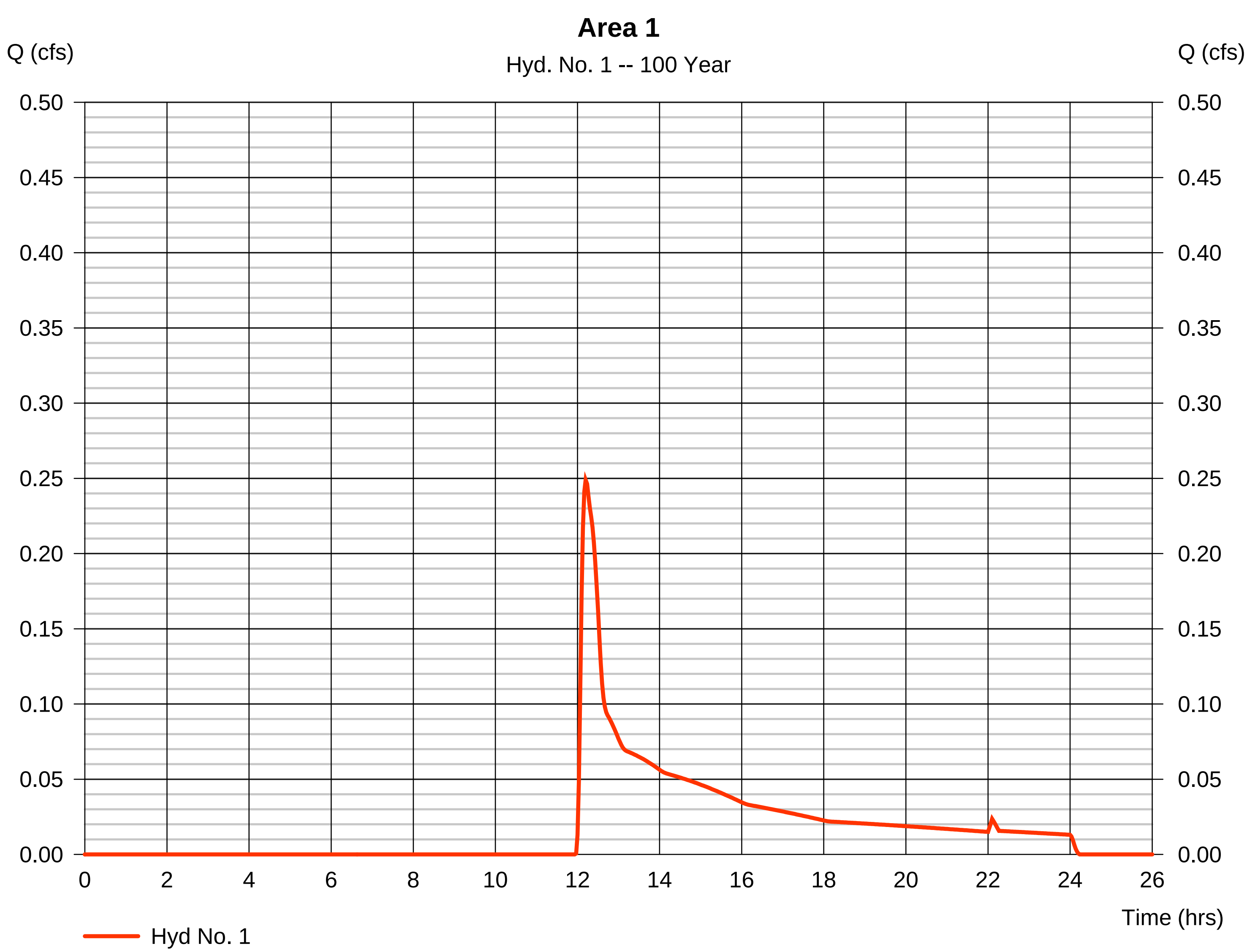
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 1

Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.249 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,675 cuft
Drainage area	= 0.530 ac	Curve number	= 36*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.60 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.530 x 36)] / 0.530



Hydrograph Report

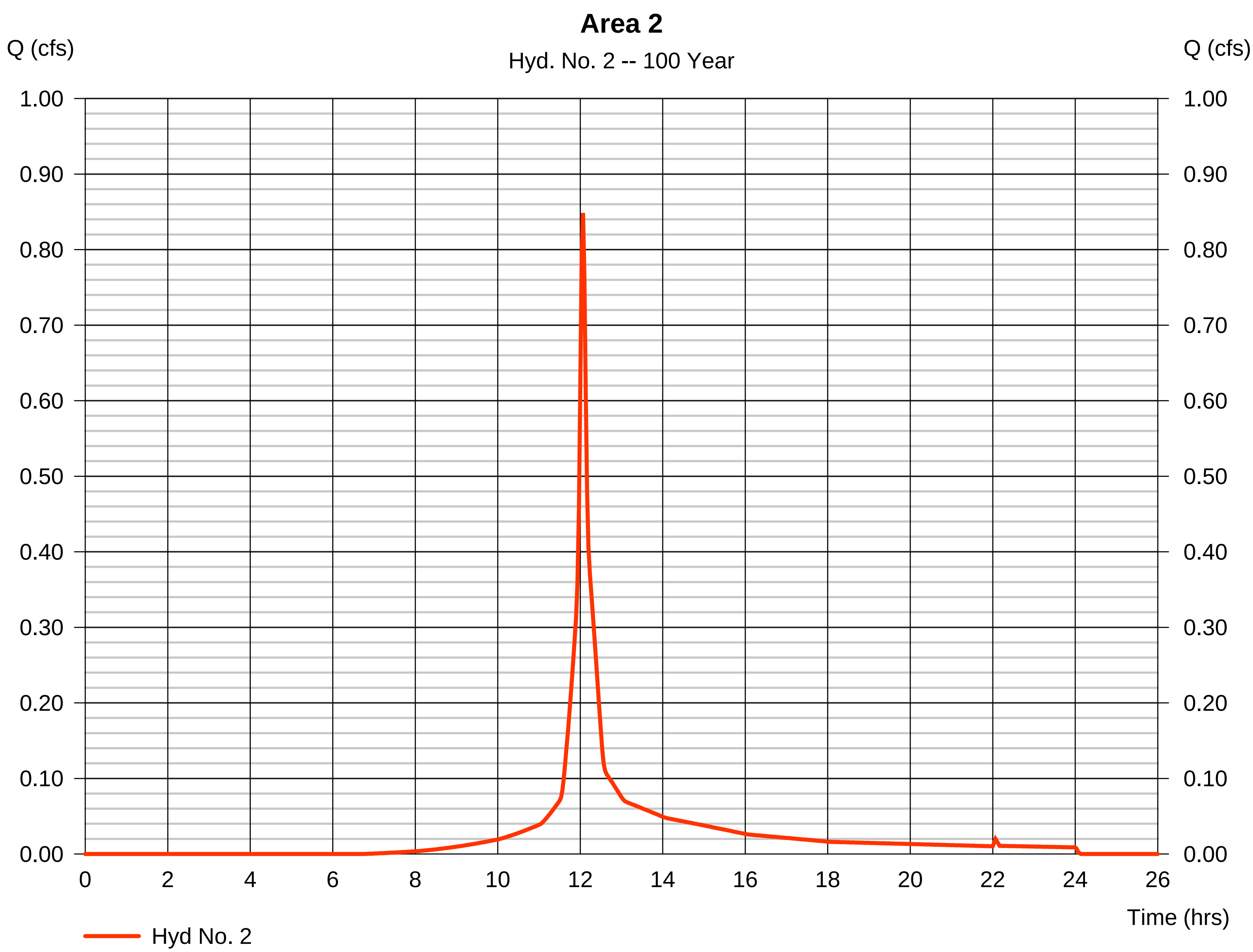
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 2

Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.849 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,551 cuft
Drainage area	= 0.150 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 4.30 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 49) + (0.080 x 98)] / 0.150



Hydrograph Report

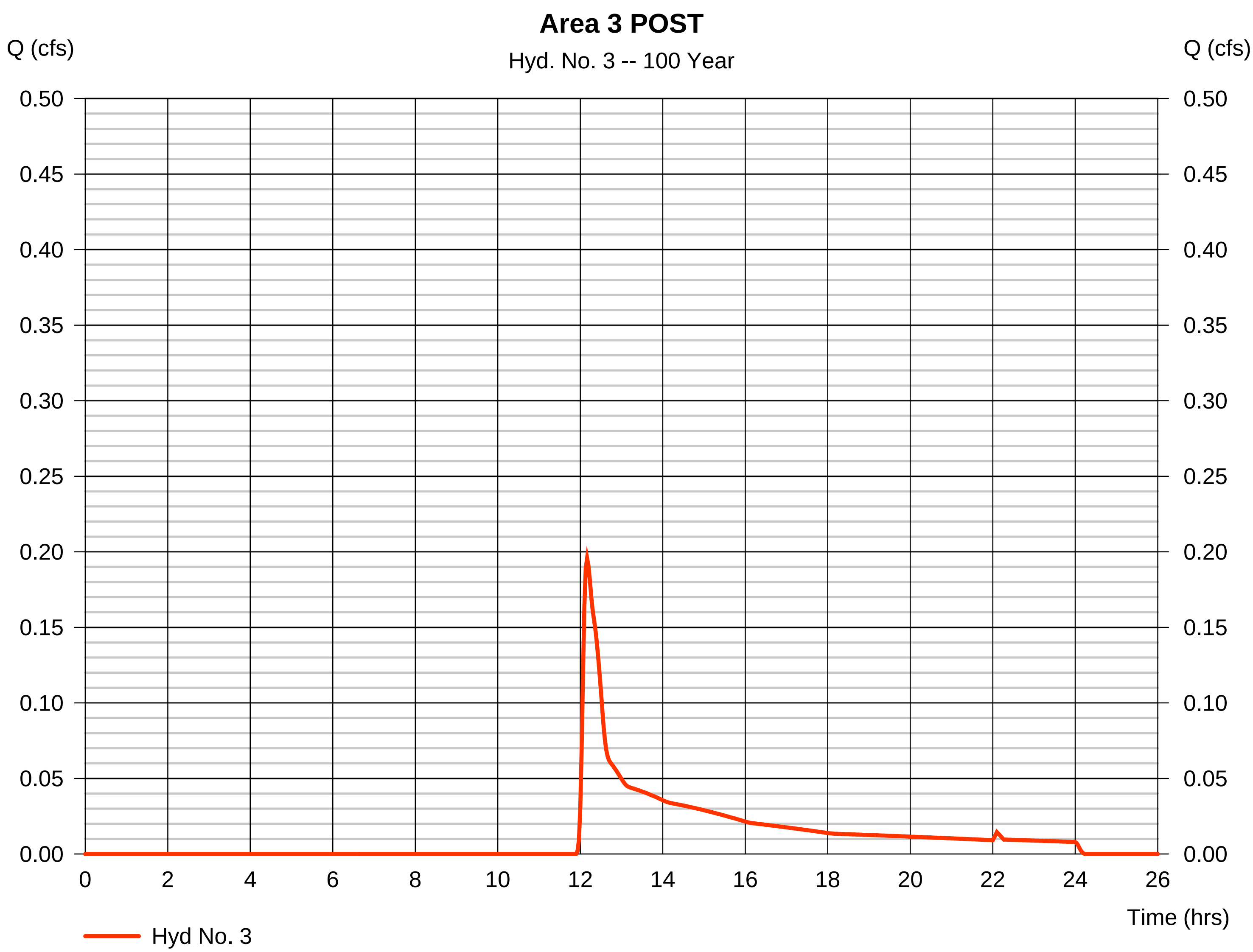
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Wednesday, 03 / 30 / 2016

Hyd. No. 3

Area 3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.196 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,101 cuft
Drainage area	= 0.290 ac	Curve number	= 38*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.246 x 36) + (0.040 x 49)] / 0.290



Hydrograph Report

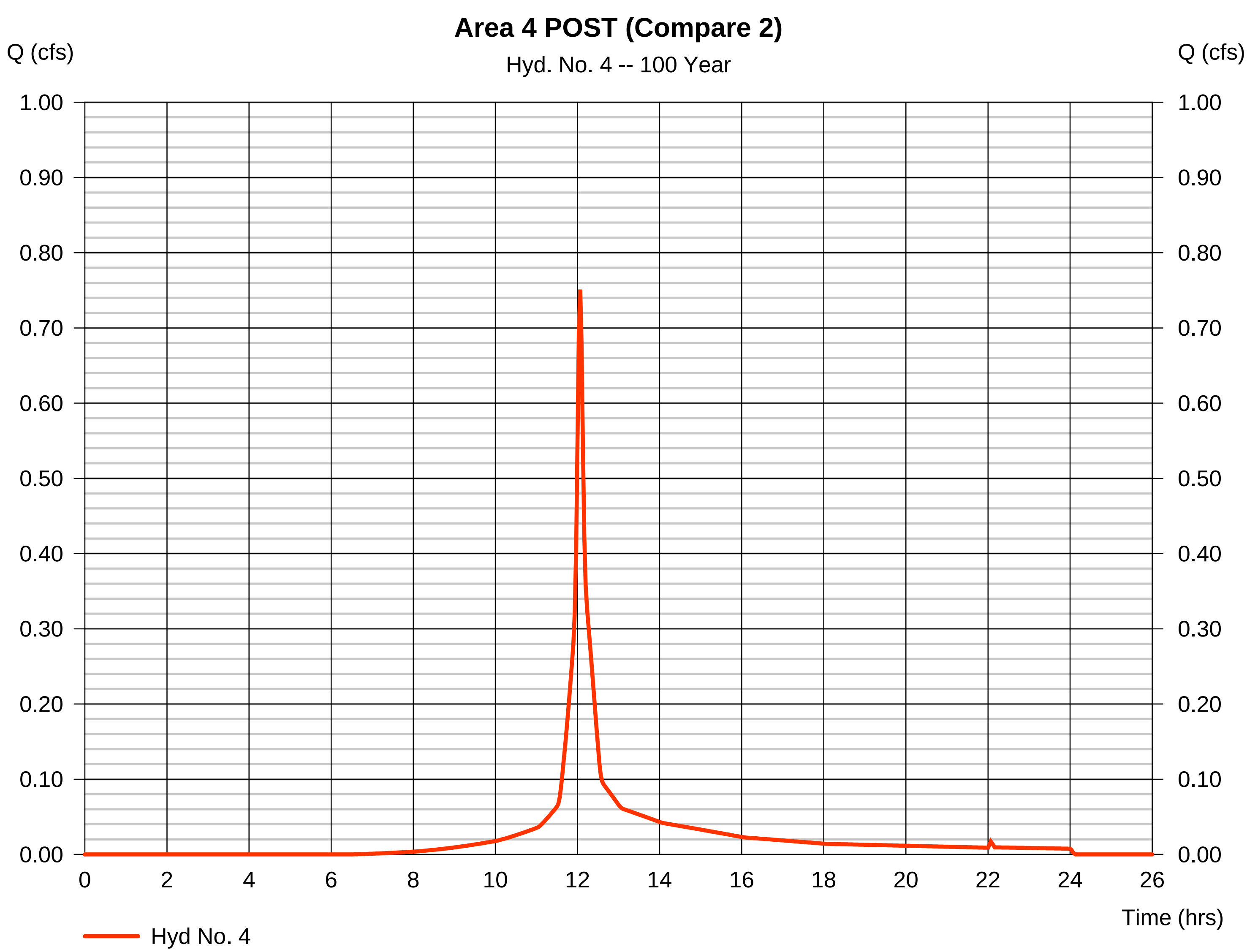
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 4

Area 4 POST (Compare 2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.751 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,262 cuft
Drainage area	= 0.130 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.30 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.074 x 98) + (0.058 x 49)] / 0.130



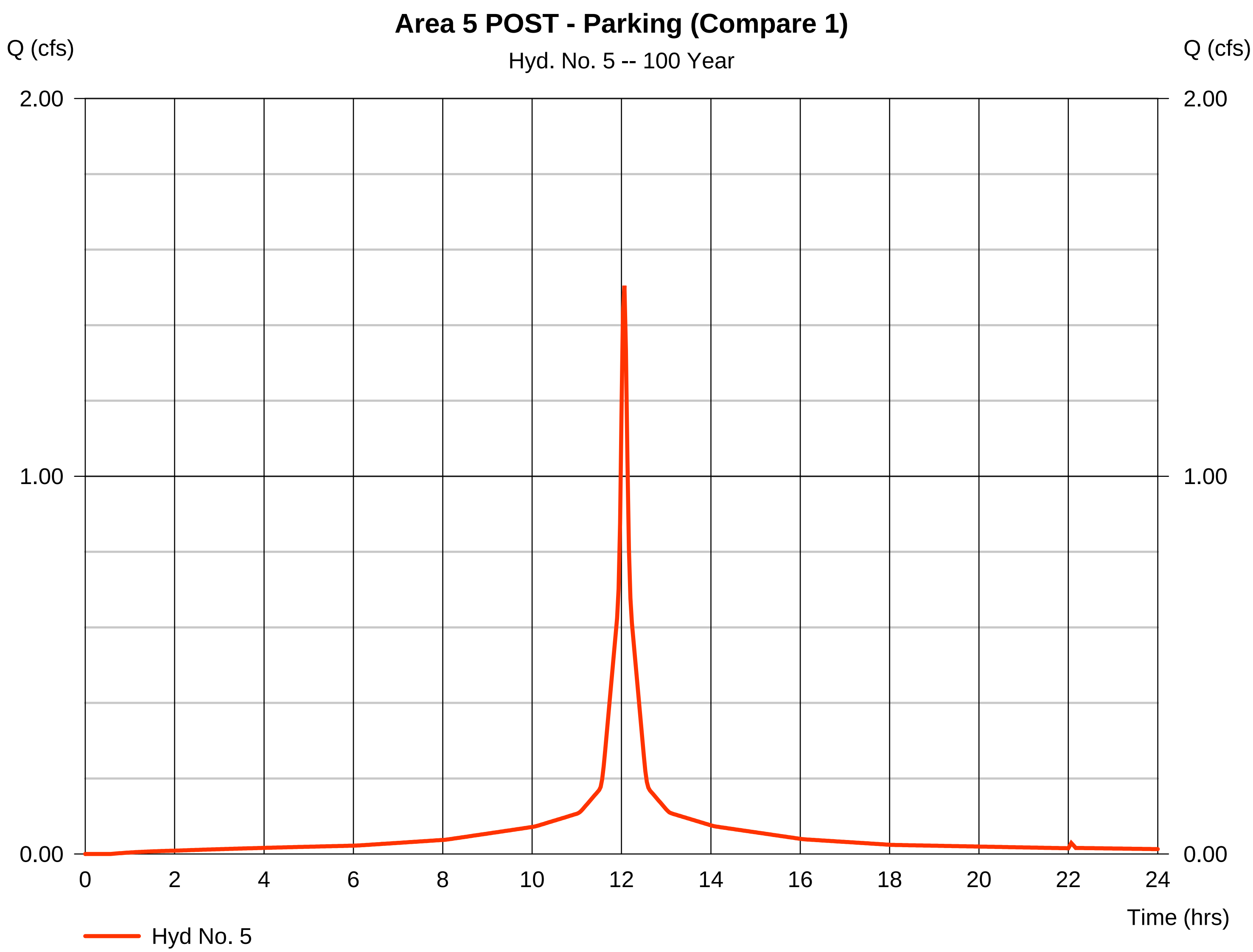
Hydrograph Report

Hyd. No. 5

Area 5 POST - Parking (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 1.504 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 5,248 cuft
Drainage area	= 0.200 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98)] / 0.200



Hydrograph Report

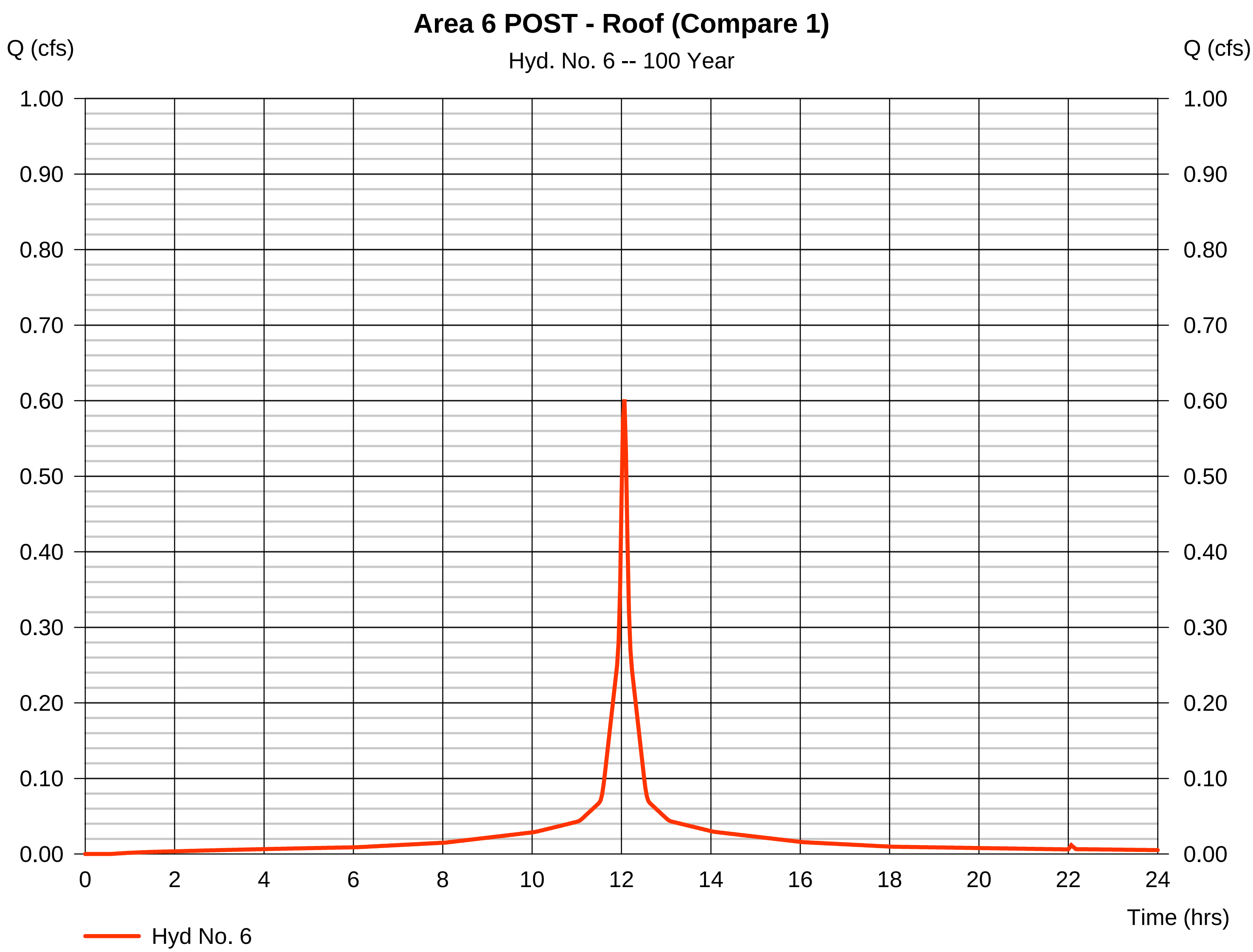
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Wednesday, 03 / 30 / 2016

Hyd. No. 6

Area 6 POST - Roof (Compare 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.602 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2,099 cuft
Drainage area	= 0.080 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.95 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.075 x 98)] / 0.080



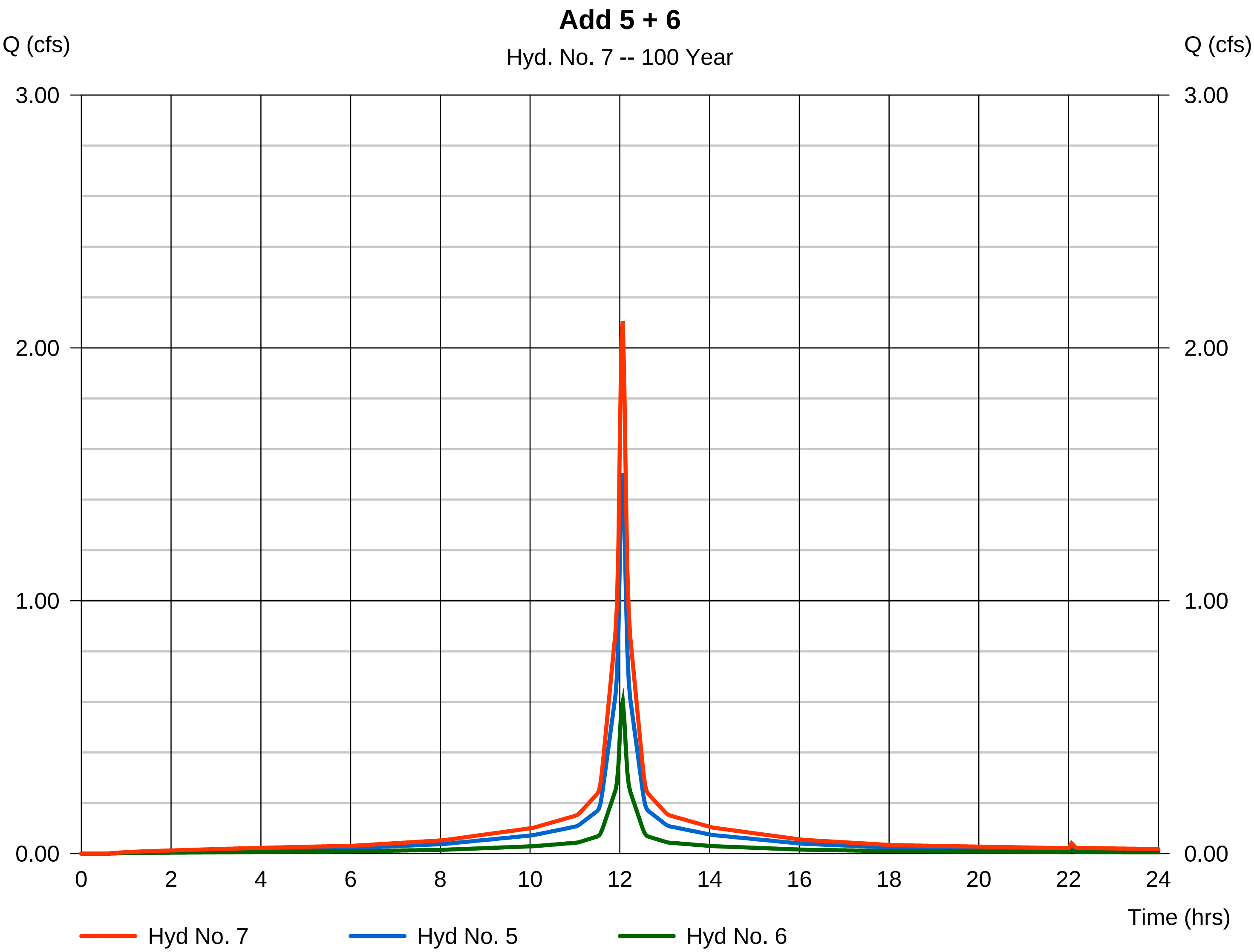
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 7

Add 5 + 6

Hydrograph type	= Combine	Peak discharge	= 2.106 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 7,347 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.280 ac



Hydrograph Report

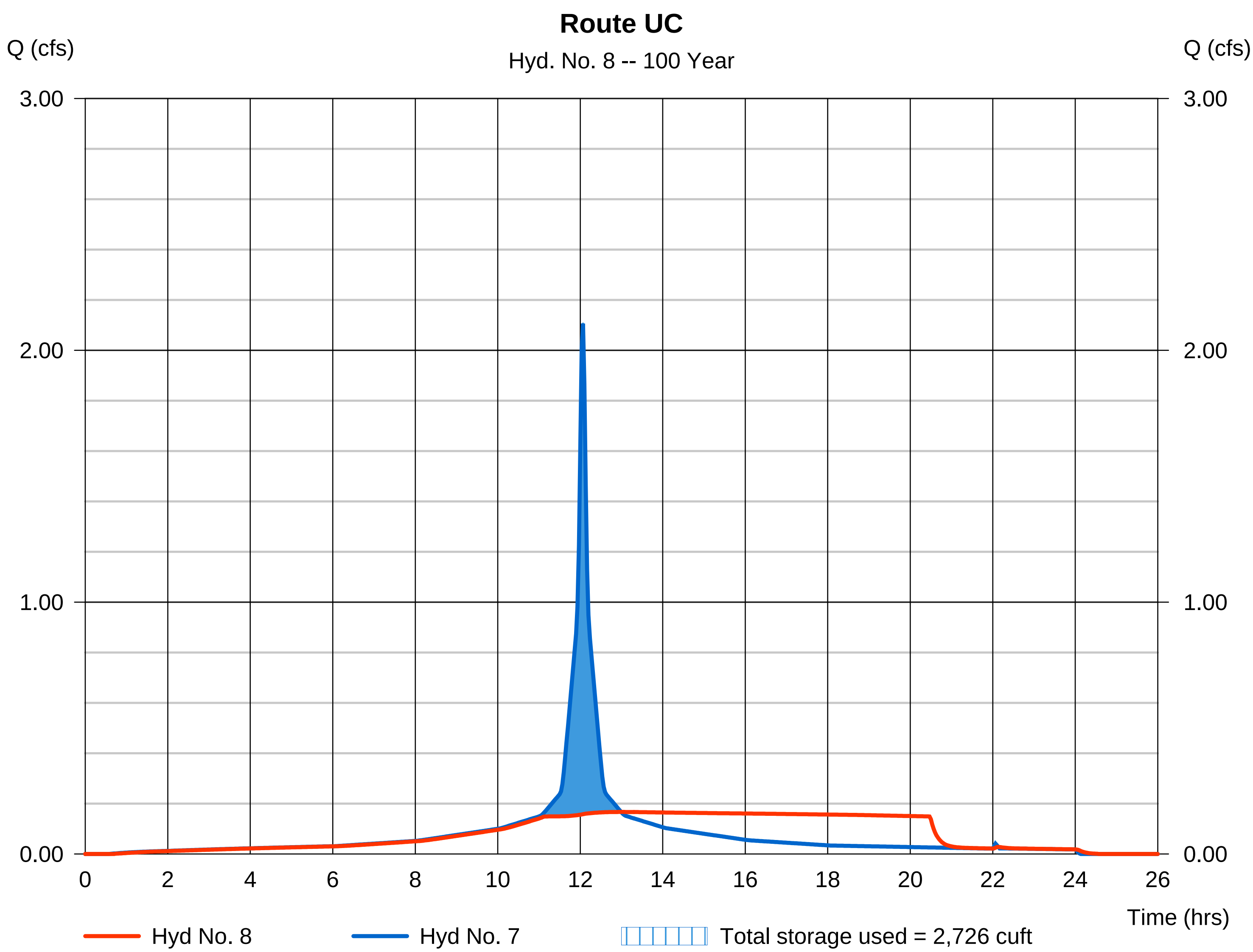
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 8

Route UC

Hydrograph type	= Reservoir	Peak discharge	= 0.167 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.00 hrs
Time interval	= 2 min	Hyd. volume	= 7,346 cuft
Inflow hyd. No.	= 7 - Add 5 + 6	Max. Elevation	= 261.50 ft
Reservoir name	= UC Sys	Max. Storage	= 2,726 cuft

Storage Indication method used.



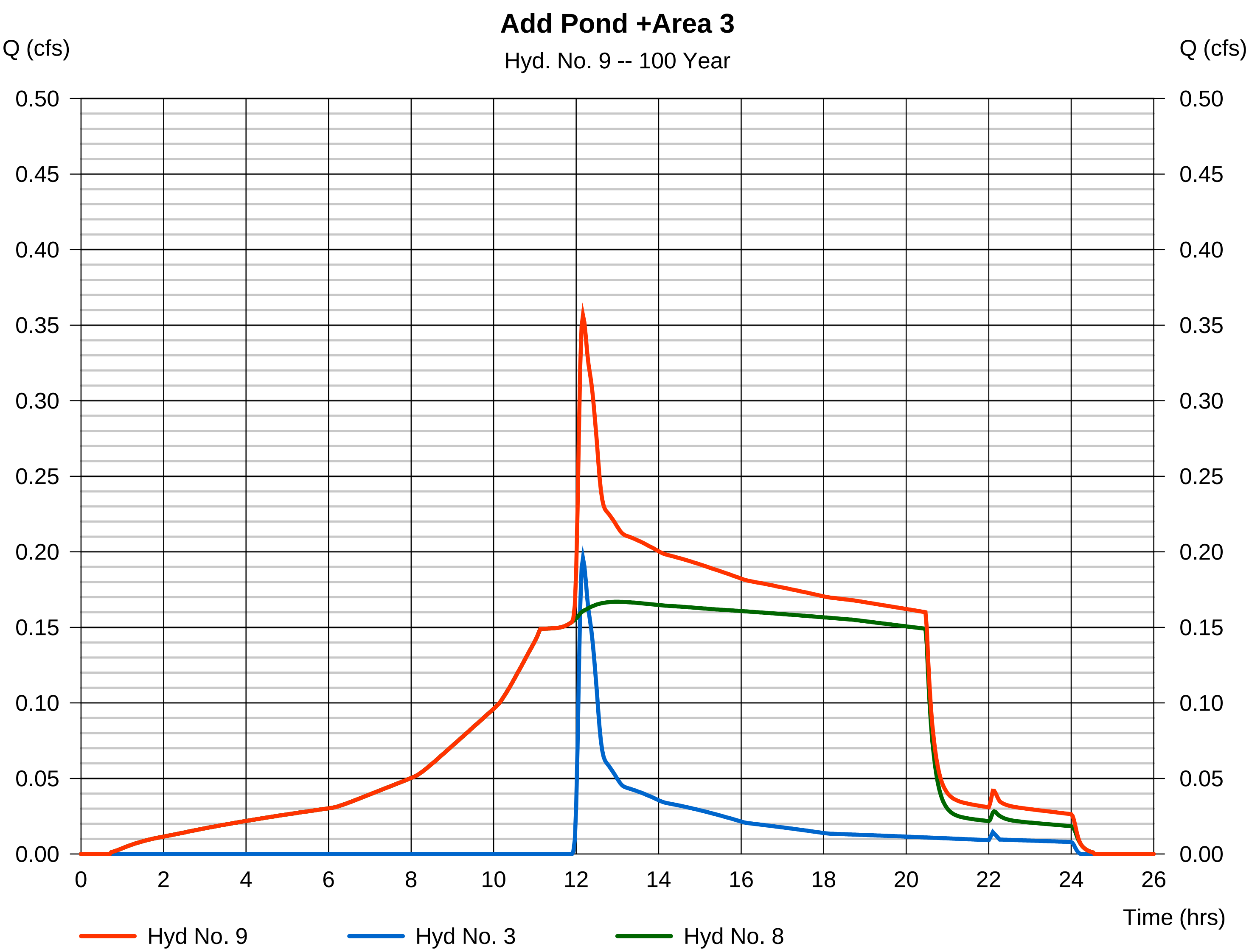
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Wednesday, 03 / 30 / 2016

Hyd. No. 9

Add Pond +Area 3

Hydrograph type	= Combine	Peak discharge	= 0.356 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 8,447 cuft
Inflow hyds.	= 3, 8	Contrib. drain. area	= 0.290 ac



Hydraflow Table of Contents

Section II
Stormwater Management

- **STANDARD #1 No New Stormwater Conveyances**
  The proposed project proposes no new stormwater conveyances that discharge untreated stormwater off-site or cause down gradient erosion.

- **STANDARD #2 Post Development Peak Discharge**
  The overall site analysis demonstrates that the stormwater management system has been designed so that the post-development peak discharge rates do not exceed the pre-development discharge rate for the 2yr, 10yr, 25yr, & 100yr 24 hr storm events.

- **STANDARD #3 RECHARGE TO GROUNDWATER**

Based on soil textual analysis, the soils were determined to consist of Hydrologic Soils Group "Type A".

Required Recharge Volume Calculation

Impervious Area = 11,939 SF
Target Depth Factor (F) = 0.60"

Rv = F x impervious area = 0.60"x 11,939 SF x 1'/12"= 597 CF

<u>Sizing Storage Volume</u>

Using the "static method", the proposed infiltration device must provide sufficient storage capacity to hold the Required Recharge Volume without taking any infiltration into account. Storage Volume calculated using the average end area shown below

Storage Capacity Provided = 2,739 CF > Required Recharge Volume = 597 CF
(Subsurface Chamber System below Outlet El.261.40)

Drawdown Within 72 Hours

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

W*here:*
Rv = Storage Volume
K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3). For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.
Bottom Area = Bottom Area of Recharge Structure

$$\text{Time} = \frac{2{,}739\text{ CF}}{(2.41")(1'/12")(2{,}491.6\text{ SF})} = 5.47\ \text{hour} < 72\ \text{hours}$$

Bottom area =2,491 SF at elev.=260.20

♦ STANDARD #4 WATER QUALITY

WATER QUALITY TREATMENT VOLUME

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} * 43,560 square feet/acre)

V_{WQ} = *Required Water Quality Volume* (in cubic feet)
D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour or greater; **½-inch for discharges near or to other areas**.
A_{IMP} = Impervious Area (in acres)

The site is not located within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL. Site soils with infiltration rate is greater than 2.4 inches/hour so a Water Quality Depth of 1-inch is required.

V_{WQ} = (1 inch/12 inches/foot) * (11,939 square feet) = 995 CF
(Subsurface Chamber System below Outlet El.261.40) = 2,739 CF

- **TSS REMOVAL** (see TSS Removal Work Sheet)

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

TSS Removal Calculation Worksheet

Location: 51 Alder Street, Medway

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Sediment Forebay	**0.25**	**0.75**	**0.19**	**0.56**
Subsurface Infiltration Structure	**0.80**	**0.56**	**0.45**	**0.11**
	0.00	**0.11**	**0.00**	**0.11**
	0.00	**0.11**	**0.00**	**0.11**

Total TSS Removal = 89%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:
Prepared By: **Richard Grady**
Date: **30-Mar-16**

*Equals remaining load from previous BMP (E) which enters the BMP

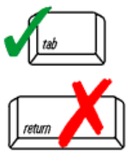
Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

---

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of “country drainage” versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Chamber System

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☒ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

- **STANDARD #5 Land Uses With Higher Potential Pollutant Loads**
  Commercial Building use is a land use with higher potential pollutant load per 310 cmr Section 22.20C(2)(i) motor vehicle repair operations. All repair operations are conducted within the proposed building. Floor drains and a M.D.C. trap are proposed.

- **STANDARD #6 Critical Areas**
  The site is not located within a critical area. Pre-treatment is provided through the use of catch basin and sediment forebay prior to infiltration and 80% TSS removal has been achieved.

- **STANDARD #7 Redevelopment**
  The site is not a redevelopment.

- **STANDARD #8 Erosion & Sediment Control Plan**
  Erosion and sediment controls are detailed within the site plan.

- **STANDARD #9 Operation & Maintenance Plan**
  See O&M plan attached hereto.

- **STANDARD #10 Illicit Discharge Statement**
  There are no illicit discharges on the site. *"All illicit discharges to the stormwater management system are prohibited."*

Section III

Operation & Maintenance

OPERATION AND MAINTENANCE PLAN

PROPOSED DRAINAGE SYSTEM – DURING CONSTRUCTION

#51 Alder Street
Medway, Massachusetts

Owner:

Philip Anza
119 Milford Street
Medway, MA 02053
Contact: Philip Anza 508-561-6499

Party Responsible for Operation and Maintenance:

Philip Anza
119 Milford Street
Medway, MA 02053
Contact: Philip Anza 508-561-6499

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the property owner to include its successor and/or assigns, as the same may appear on record with the appropriate register of deeds.

During Construction:

Construction activities shall follow the Construction Sequence shown on the approved plan. During periods of active construction the stormwater management system shall be inspected on a weekly basis and within 24 hours of a storm event of greater than ½". Maintenance tasks shall be performed monthly or after significant rainfall events of 1" of rain or greater. During construction, silt-laden runoff shall be prevented from entering the drainage system and off-site properties. Temporary swales shall be constructed as needed during construction to direct runoff to sediment traps. Infiltration systems shall not be placed in service until after the installation of base course pavement and vegetative stabilization of the areas contributing to the systems.

During dewatering operations, all water pumped from the dewatering shall be directed to a "dirt bag" pumped sediment removal system (or approved equal) as manufactured by ACF Environmental. The unit shall be placed on a crushed stone blanket. Disposal of such "dirt bag" shall occur when the device is full and can no longer effectively filter sediment or allow water to pass at a reasonable flow rate. Disposal of this unit shall be the responsibility of the contractor and shall be as directed by the owner in accordance with applicable local, state, and federal guidelines and regulations.

Stabilized construction entrances shall be placed at the entrances and shall consist of 1½“ to 2” stone and be constructed as shown on the approved plans.

All erosion and sedimentation control measures shall be in place prior to the commencement of any site work or earthwork operations, shall be maintained during construction, and shall remain in place until all site work is complete and ground cover is established.

Heavy equipment shall not be used on bottom of the drainage system

All exposed soils not to be paved shall be stabilized as soon as practical. Seed mixes shall only be applied during appropriate periods as recommended by the seed supplier, typically May 1 to October 15. Any exposed soils that cannot be stabilized by vegetation during these dates shall be stabilized with hay bales, hay mulch, check dams, jute netting or other acceptable means.

Once each structure is in place, it should be maintained in accordance with the procedures described in the post-construction Operations and Maintenance Plan.

During dry periods where dust is created by construction activities the following control measures should be implemented.

- Sprinkling – The contractor may sprinkle the ground along haul roads and traffic areas until moist.
- Vegetative cover – Areas that are not expected to be disturbed regularly may be stabilized with vegetative cover.
- Mulch – Mulching can be used as a quick and effective means of dust control in recently disturbed areas.
- Spray on chemical soil treatments may be utilized. Application rates shall conform to manufacturers recommendations.

Inspections

The Owner shall be responsible to secure the services of a Professional Engineer to perform inspections as required. Inspections during periods of active construction shall be weekly and within 24 hours of a storm event of greater than ½ “. The Professional Engineer shall perform inspections to insure that the approved plan is being followed with particular attention to the Zoning Board Approval and the Construction Sequencing. The Engineer shall be responsible for inspecting the roadway construction and the construction of the stormwater management system. The Engineer shall prepare and submit to the Planning Board, the Inspection Schedule and Evaluation Checklist (see attached) and, if necessary, request the required maintenance and/or repair of the necessary items. This form shall be stamped by the Engineer and the Owner shall be notified that specific changes and/or repairs are necessary.

For additional information, refer to <u>Performance, Standards and Guidelines for Stormwater Management in Massachusetts,</u> published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: 51 Alder Street, Medway   Latest Revision: 3/30/16

Stormwater Control Manager: _____   **Stamp**

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Silt fence & swales and silt traps	After every major storm event							
Dewatering Operations	Daily-during actual dewatering							
Temporary Construction Entrance	Daily or as needed.							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

PROPOSED DRAINAGE SYSTEM – POST CONSTRUCTION

Proposed Commercial Site
51 Alder Street
Medway, Massachusetts

Owner:

Philip Anza
119 Milford Street
Medway, MA 02053
Contact: Philip Anza 508-561-6499

Party Responsible for Operation and Maintenance:

Post construction the owner will be the party responsible for operation and maintenance of the drainage system. When the property is conveyed, the new owner will be the party responsible for operation and maintenance.

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the owner.

Schedule for Inspection and Maintenance:

<u>Sediment Forebay</u>
Sediment forebays should be inspected four times per year during construction and after every major storm. After construction is complete forebays should be inspected twice per year. Accumulated sediment should be removed at least once per year. Removal of sediment and hydrocarbons should be completed by a vacuum truck. Disposal of accumulated sediment and hydrocarbons must be in accordance with applicable local, state and federal guidelines and regulations.

<u>Infiltration System(s)</u>
The Infiltration System should be inspected at least once per year to ensure that the subsurface system is operating as intended. If accumulated sediment is observed within the galley it should be removed from the galley as necessary.

Estimated Annual Budget

The estimated annual budget for performance of the above is $700-$1200.

Subsurface Structures

Responsibility for maintenance: Owner

After construction, the subsurface structures shall be inspected for proper function and stabilization after every major storm event until the lot is completely developed and stabilized. Inspect each subsurface structure at least twice per year or if lack of performance is observed and perform necessary corrective measures to maintain infiltration capacity; as required by the Stormwater Management Policy.

Snow Removal and De-icing

Snow removal will be the responsibility of the Owner. Snow will be plowed from roadways and driveways and shoveled or removed with a snow blower from walkways. Snow will be stored along parking lot and walkways. If additional stockpiling area is needed, excess snow will be removed from the site with proper off-site disposal.

Inspections

Yearly inspections of the stormwater management system shall be performed and an Inspection Schedule and Evaluation Checklist shall be maintained by the Owner and made available to regulatory officials if requested. Copies of the receipts for cleaning of the systems shall also be maintained.

The Owner shall be responsible to secure the services of a Licensed Engineer on an on-going basis. The inspector shall review the project with respect to the following:

- Proper installation and performance of the Stormwater Management System.
- Review of the controls to determine any damaged or ineffective controls.
- Corrective actions.

The Engineer shall prepare, stamp and submit, to the Owner, a report documenting the findings and should request the required maintenance or repair for the pollution prevention controls when the inspector finds that it is necessary for the control to be effective (see attached Inspection Schedule and Evaluation Checklist). The inspector shall notify the Owner to make the changes.

For additional information, refer to Performance, Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: 51 Alder Street, Medway Latest Revision: 3/30/16

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Deterioration Characteristics
Sediment Forebay	twice per year							
Subsurface Chamber System	twice per year							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

Commonwealth of Massachusetts

MEDWAY, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed by: Richard Grady, P.E.
GRADY CONSULTING, L.L.C.
71 Evergreen Street, Suite 1
Kingston, MA 02364
Phone: (781) 585-2300 Fax: (781) 585-2378

Date: 2-18-16

Witnessed by: N/A

Location Address or Lot #
51 ALDER STREET
ASSESSORS PARCEL 63-001-0001

*Owner's Name
*Address &
*Telephone #

New Construction — Repair — DRAINAGE DESIGN

Office Review

Published Soil Survey Available: No ✓ Yes___

Year Published: ________ Publication Scale: ________ Soil Map Unit: ________

Drainage Class: ________ Soil Limitations: ________

Surficial Geology Report Available: No ✓ Yes ___

Year Published: ________ Publication Scale: ________

Geologic Material (Map Unit): ________

Landform: ________

Flood Insurance Rate Map:

Above 500 year flood boundary: **No** ____ **Yes** ✓

Within 500 year flood boundary **No** ✓ **Yes** ____

Within 100 year flood boundary **No** ✓ **Yes** ____

Wetland Area:

National Wetland Inventory Map (map unit): DELINEATED ON SITE

Wetlands Conservancy Program Map (map unit): ________

Current Water Resource Conditions (USGS): **Month:** * FEBRUARY

Range: **Above Normal** ✓ **Normal** ______ **Below Normal** _____

Other References Reviewed: * USGS REAL TIME DATA - NNW 27 NORFOLK MA

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

N/A - DRAINAGE DESIGN

If not, what is the depth of naturally occurring pervious material?

Certification

I certify that on May 7, 1996 (date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature: RG Date: 2-18-16

TITLE 5 ON-SITE REVIEW

Deep Hole # 1 **Date** 2-18-16 **Time** 9:30 **Weather** 32° SUNNY
Location(identify on Site Plan) 51 ALDER STREET MEDWAY
Land Use INDUSTRIAL PARK **Slope(%)** 2-3 **Surface Stones** FEW
Vegetation WOODS **Landform** ____

Distances from: Open Water Body N/A ft. Possible Wet Area 75 ± ft. Drinking Water Well N/A ft.

Drainageway N/A ft. Propertyline 10 ± ft Other ____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency,%Gravel
0"-24"	FILL	LOAMY SAND			
24"-30"	A	SANDY LOAM	10YR 3/2		
30"-60"	B	LOAMY SAND	10YR 6/4		
60"-126"	C	LOAMY SAND	2.5Y 6/1		<5% GRAVEL FRIABLE FEW LARGE STONES

Parent Material (geologic) ____ **Depth to Bedrock** ____
Depth to Groundwater: **Standing Water in Hole:** 126" **Weeping from Pit Face** 96"
Estimated Seasonal High Groundwater 96"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ___ **inches** ___ **Depth to soil mottles:** ___ **inches**
✓ **Depth to weeping from side of observation hole:** 96 **inches** ___ **Groundwater adjustment** ___ **ft**
Index Well # ___ **Reading Date** ___ **Index well level** ___ **Adj.factor** ___ **Adj.Groundwater level** ___

PERCOLATION TEST

Date ____ **Time** ____

Observation Hole #			**Time at 9"**		
Depth of Perc			**Time at 6"**		
Start Presoak			**Time (9"-6")**		
End Presoak			**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** ___ **Site Failed** ___ **Additional Testing Needed:**

Performed By RICK GRADY **Certification #** ____

Witnessed By N/A

Comments: EXCAVATOR: HERB BROKKERT

DRAINAGE INFILTRATION RATE USE LOAMY SAND = 2.41 IN/HR

TITLE 5 ON-SITE REVIEW

Deep Hole # 2 **Date** 2-18-16 **Time** 10:00 **Weather** 35° SUNNY
Location(identify on Site Plan) 51 ALDER STREET MEDWAY
Land Use INDUSTRIAL PARK **Slope(%)** 2-3 **Surface Stones** FEW
Vegetation WOODS **Landform** ____

Distances from: Open Water Body N/A ft. Possible Wet Area 75± ft. Drinking Water Well N/A ft.

Drainageway N/A ft. Propertyline 20± ft Other ____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency,%Gravel
0"-12"	A	SANDY LOAM	10YR3/2		
12"-32"	B	LOAMY SAND	10YR6/4		
32"-132"	C	LOAMY SAND	2.5Y7/1		<5% GRAVEL FRIABLE FEW LARGE STONES

Parent Material (geologic) ____ **Depth to Bedrock** ____
Depth to Groundwater: **Standing Water in Hole:** NONE **Weeping from Pit Face** 108"
Estimated Seasonal High Groundwater 72"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ____ **inches** ✓ **Depth to soil mottles:** 72 **inches**
___ **Depth to weeping from side of observation hole:** ____ **inches** ____ **Groundwater adjustment** ____ **ft**
Index Well # ____ **Reading Date** ____ **Index well level** ____ **Adj.factor** ____ **Adj.Groundwater level** ____

PERCOLATION TEST

Date ____ **Time** ____

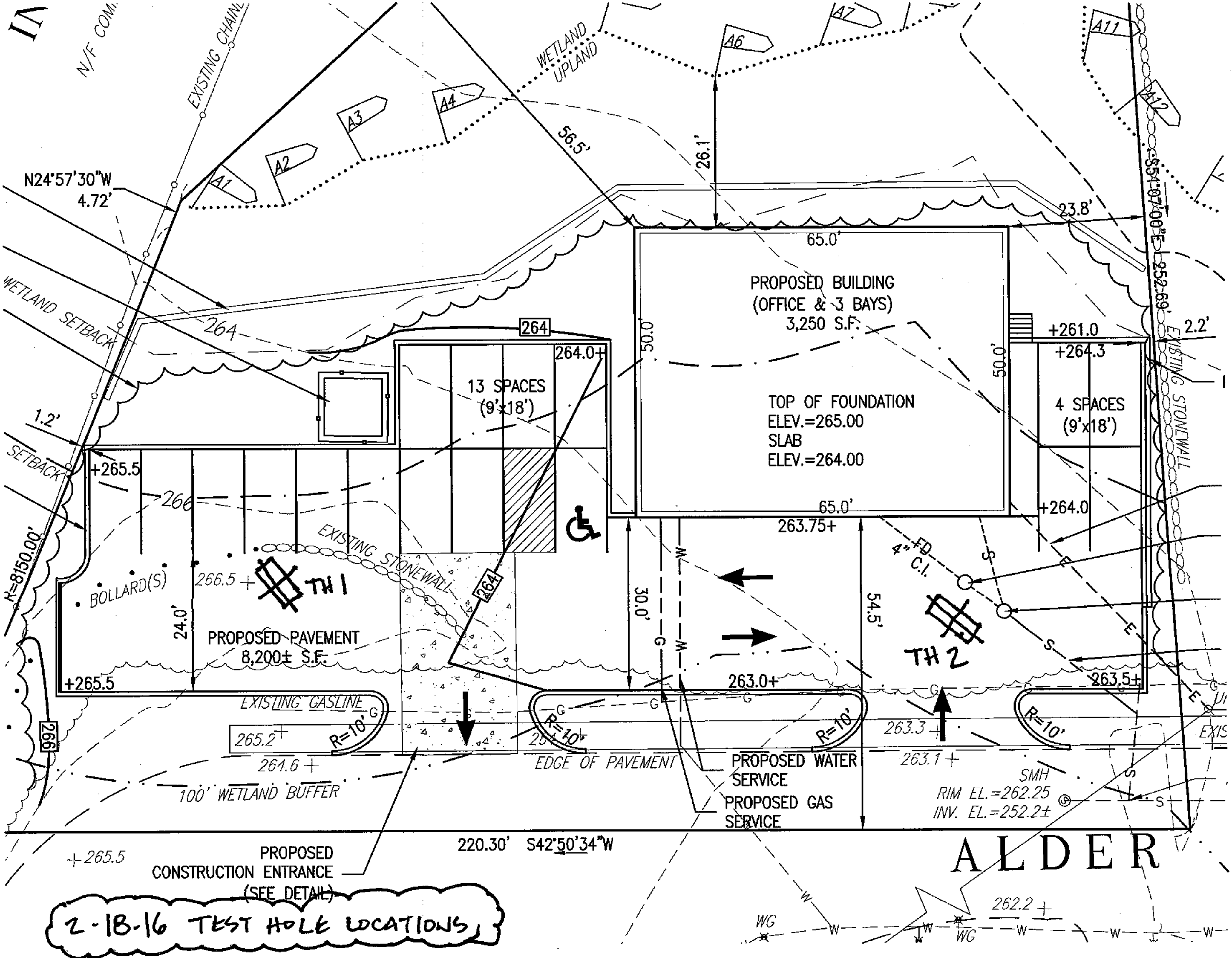
Observation Hole #			**Time at 9"**		
Depth of Perc			**Time at 6"**		
Start Presoak			**Time (9"-6")**		
End Presoak			**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** ____ **Site Failed** ____ **Additional Testing Needed:**

Performed By RICK GRADY **Certification #** ____

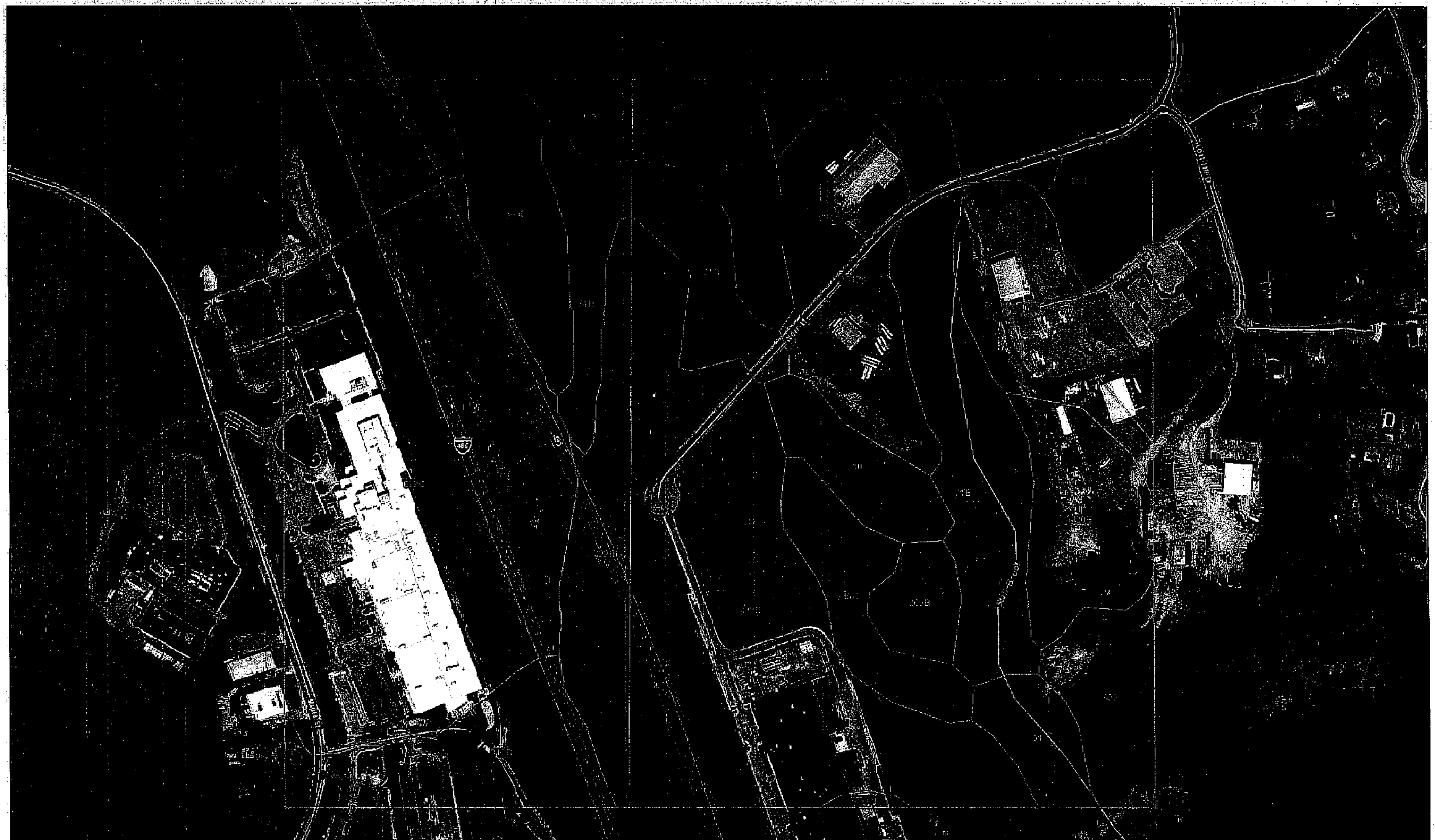
Witnessed By N/A

Comments: EXCAVATOR: HERB BROCKERT


PROPOSED BUILDING
(OFFICE & 3 BAYS)
3,250 S.F.
TOP OF FOUNDATION
ELEV.=265.00
SLAB
ELEV.=264.00
65.0'
50.0'
263.75+
13 SPACES
(9'x18')
4 SPACES
(9'x18')
+261.0
+264.3
+264.0
264.0+
264
266
+265.5
266.5 +
TH 1
TH 2
PROPOSED PAVEMENT
8,200± S.F.
BOLLARD(S)
24.0'
30.0'
54.5'
56.5'
26.1'
23.8'
2.2'
1.2'
4" C.I.
FD
EXISTING STONEWALL
EXISTING GASLINE
EDGE OF PAVEMENT
100' WETLAND BUFFER
WETLAND SETBACK
SETBACK
WETLAND
UPLAND
EXISTING CHAIN
N/F COM
N24°57'30"W
4.72'
S51°07'00"E 252.69'
R=8150.00'
R=10'
263.0+
263.5+
263.3 +
263.1 +
265.2
264.6 +
+265.5
262.2 +
PROPOSED WATER
SERVICE
PROPOSED GAS
SERVICE
SMH
RIM EL.=262.25
INV. EL.=252.2±
220.30' S42°50'34"W
ALDER
PROPOSED
CONSTRUCTION ENTRANCE
(SEE DETAIL)
2-18-16 TEST HOLE LOCATIONS
A1
A2
A3
A4
A6
A7
A11
A12
WG

Soil Map

Scale (not to scale)



Norfolk and Suffolk Counties, Massachusetts

422B—Canton fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: vkpz
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Ice-contact slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over loose sandy and gravelly ablation till

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 18 inches: fine sandy loam
H3 - 18 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Minor Components

Merrimac

Percent of map unit: 5 percent

Montauk

Percent of map unit: 5 percent

Charlton

Percent of map unit: 5 percent

Scituate

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 11, Sep 28, 2015

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 8, Sep 28, 2015

Oil/Grit Separators

Description: Oil/grit separators are underground storage tanks with three chambers designed to remove heavy particulates, floating debris and hydrocarbons from stormwater.

Stormwater enters the first chamber where heavy sediments and solids drop out. The flow moves into the second chamber where oils and greases are removed and further settling of suspended solids takes place. Oil and grease are stored in this second chamber for future removal. After moving into the third outlet chamber, the clarified stormwater runoff is then discharged to a pipe and another BMP. There are other separators that may be used for spill control.

Advantages/Benefits:

- Located underground so limited lot size not a deterrent in urban areas with small lots
- Can be used for retrofits
- Can be installed in any soil or terrain.
- Public safety risks are low.

Disadvantages/Limitations:

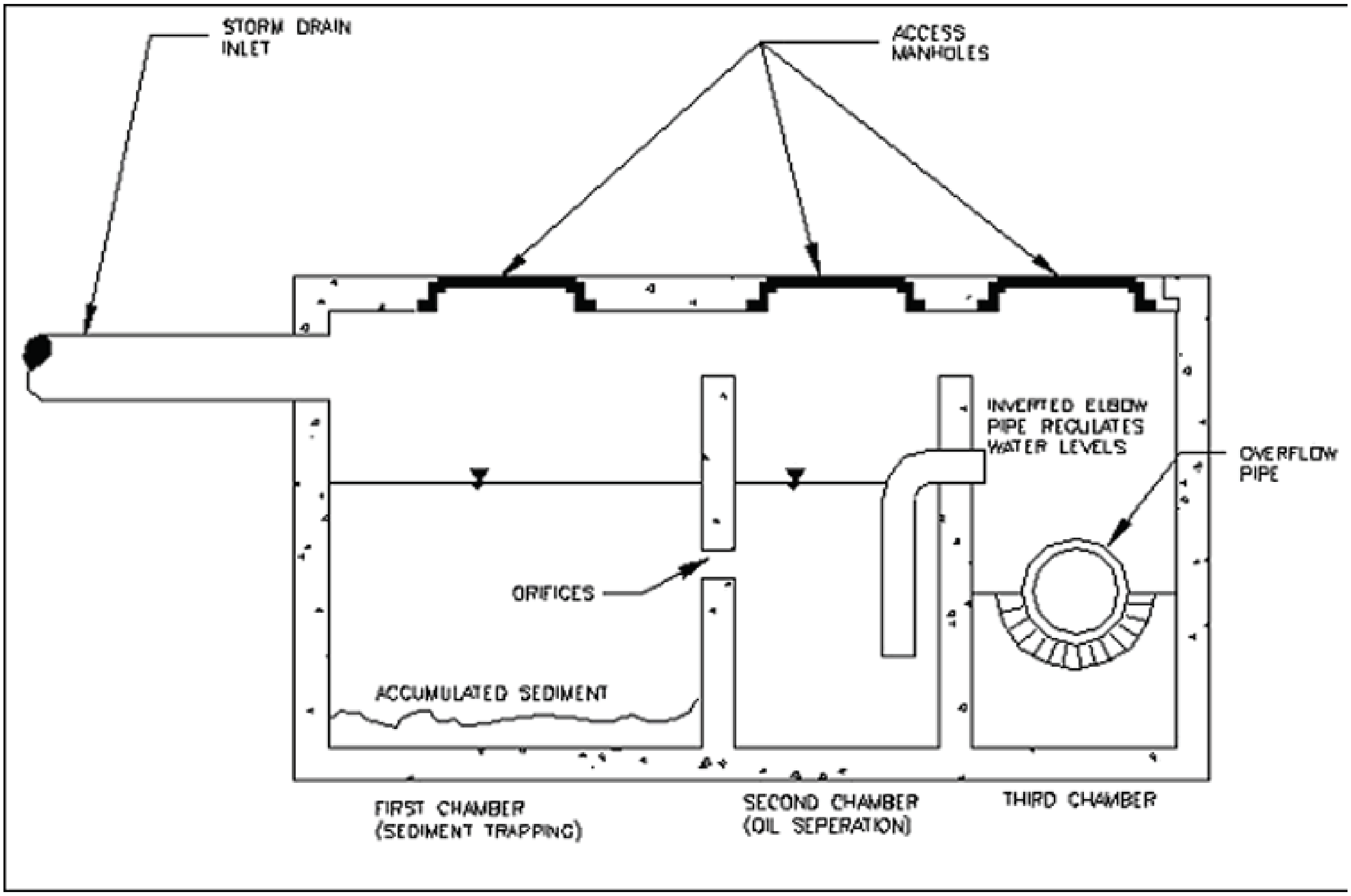
- Limited pollutant removal; cannot effectively remove soluble pollutants, fine particles, or bacteria
- Can become a source of pollutants due to resuspension of sediment unless properly maintained
- Susceptible to flushing during large storms
- Limited to relatively small contributing drainage areas
- Requires proper disposal of trapped sediments and oils
- May be expensive to construct and maintain
- Entrapment hazard for amphibians and other small animals

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 25% for oil grit separator, only when placed off-line and only when used for pretreatment
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides no groundwater recharge
4 - TSS Removal	25% TSS removal credit when used for pretreatment and placed off-line.
5 - Higher Pollutant Loading	MassDEP requires a pretreatment BMP, such as an oil/grit separator that is capable of removing oil and grease, for land uses with higher potential pollutant loads where there is a risk of petroleum spills such as: high intensity use parking lots, gas stations, fleet storage areas, vehicle and/or equipment maintenance and service areas.
6 - Discharges near or to Critical Areas	May be a pretreatment BMP when combined with other practices. May serve as a spill control device.
7 - Redevelopment	Highly suitable.



MassHighway 2004

Maintenance

Activity	Frequency
Inspect units	After every major storm but at least monthly
Clean units	Twice a year

Oil/Grit Separators

Applicability

Oil grit separators must be used to manage runoff from land uses with higher potential pollutant loads where there is a risk that the stormwater is contaminated with oil or grease. These uses include the following:

- High-Intensity-Use Parking Lots
- Gas Fueling Stations
- Vehicles (including boats, buses, cars, and trucks) and Equipment Service and Maintenance Areas
- Fleet Storage Areas

Design Considerations

- Dovetail design practices, source controls and pollution prevention measures with separator design.
- Place separators before all other structural stormwater treatment practices (except for structures associated with source control/ pollution prevention such as drip pans and structural treatment practices such as deep sump catch basins that double as inlets).
- Limit the contributing drainage area to the oil/grit separator to one acre or less of impervious cover.
- Use oil grit separators only in off-line configurations to treat the required water quality volume.
- Provide pool storage in the first chamber to accommodate the required water quality volume or 400 cubic feet per acre of impervious surface. Confirm that the oil/grit separator is designed to treat the required water quality volume.
- Make the permanent pool at least 4 feet deep.
- Design the device to pass the 2-year 24-hour storm without interference and provide a bypass for larger storms to prevent resuspension of solids.
- Make oil/grit separator units watertight to prevent possible groundwater contamination.
- Use a trash rack or screen to cover the discharge outlet and orifices between chambers.
- Provide each chamber with manholes and access stepladders to facilitate maintenance and allow cleaning without confined space entry.
- Seal potential mosquito entry points.
- Install any pump mechanism downstream of the separator to prevent oil emulsification.
- Locate an inverted elbow pipe between the second and third chambers and with the bottom of the elbow pipe at least 3 feet below the second chamber's permanent pool.
- Provide appropriate removal covers that allow access for observation and maintenance.
- Where the structure is located below the seasonal high groundwater table, design the structure to prevent flotation.
- For gas stations, automobile maintenance and service areas, and other areas where large volumes of petroleum and oil are handled, consider adding coalescing plates to increase the effectiveness of the device and reduce the size of the units. A series of coalescing plates constructed of oil-attracting materials such as polypropylene typically spaced one inch apart attracts small droplets of oil, which begin to concentrate until they are large enough to float to the surface.

Maintenance

Sediments and associated pollutants and trash are removed only when inlets or sumps are cleaned out, so regular maintenance is essential. Most studies have linked the failure of oil grit separators to the lack of regular maintenance. The more frequent the cleaning, the less likely sediments will be resuspended and subsequently discharged. In addition, frequent cleaning also makes more volume available for future storms and enhances overall performance. Cleaning includes removal of accumulated oil and grease and sediment using a vacuum truck or other ordinary catch basin cleaning device. In areas of high sediment loading, inspect and clean inlets after every major storm. At a minimum, inspect oil grit separators monthly, and clean them out at least twice per year. Polluted water or sediments removed from an oil grit separator should be disposed of in accordance with all applicable local, state and federal laws and regulations including M.G.L.c. 21C and 310 CMR 30.00.

References:

American Petroleum Institute, 2002, Management of Water Discharges: Design and Operations of Oil-Water Separators, 1st Edition, Revision 90, American Petroleum Institute.

Arizona Department of Environmental Quality, 1996, BADCT Guidance Document for Pretreatment with Oil/ Water Separators, OFR 96-15, http://www.azdeq.gov/environ/water/permits/download/owsbadct.pdf

Beychok, Milton, Wikipedia, API Oil-Water Separator, http://en.wikipedia.org/wiki/API_oil-water_separator

Center for Watershed Protection, Performance of Oil-Grit Separators in Removing Pollutants at Small Sites, Technical Note #101 from Watershed Protection Techniques. 2(3): 539-542

Houston, City of, Harris County, Harris County Flood Control District, 2001, Storm Water Quality Management Guidance Manual, Section 4.4.2, p. 4-84 to 4-89, http://www.cleanwaterclearchoice.org/downloads/professional/guidance_manual_full.pdf

Idaho Department of Environmental Quality, 2005, Storm Water Best Management Practices Catalog, Oil/ Water Separator, BMP 18, pp. 91 to 95, http://www.deq.idaho.gov/water/data_reports/storm_water/catalog/sec_4/bmps/18.pdf

Massachusetts Highway Department, 2004, Storm Water Handbook for Highways and Bridges, p.

Minton, Gary. 2002, Stormwater Treatment, RPA Associates, Seattle, WA, p. 120

New Zealand Water Environment Research Foundation, 2004, On-Site Stormwater Management Guideline, Section 5.10, pp. 23 to 24, http://www.nzwwa.org.nz/Section%205.pdf

Schueler, T.R., 1987, Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, Metropolitan Washington Council of Governments, Washington, DC.

U.S. EPA, 1999, Storm Water Technology Fact Sheet, Water Quality Inlets,
EPA 832-F-99-029, http://www.epa.gov/owm/mtb/wtrqlty.pdf

Subsurface Structures

Description: Subsurface structures are underground systems that capture runoff, and gradually infiltrate it into the groundwater through rock and gravel. There are a number of underground infiltration systems that can be installed to enhance groundwater recharge. The most common types include pre-cast concrete or plastic pits, chambers (manufactured pipes), perforated pipes, and galleys.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	Provides groundwater recharge
4 - TSS Removal	80%
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. Land uses with the potential to generate runoff with high concentrations of oil and grease require an oil grit separator or equivalent prior to discharge to the infiltration structure. Infiltration must be done in accordance with 314 CMR 5.00.
6 - Discharges near or to Critical Areas	Highly recommended
7 - Redevelopment	Suitable with pretreatment

Advantages/Benefits:
- Provides groundwater recharge
- Reduces downstream flooding
- Preserves the natural water balance of the site
- Can remove other pollutants besides TSS
- Can be installed on properties with limited space
- Useful in stormwater retrofit applications

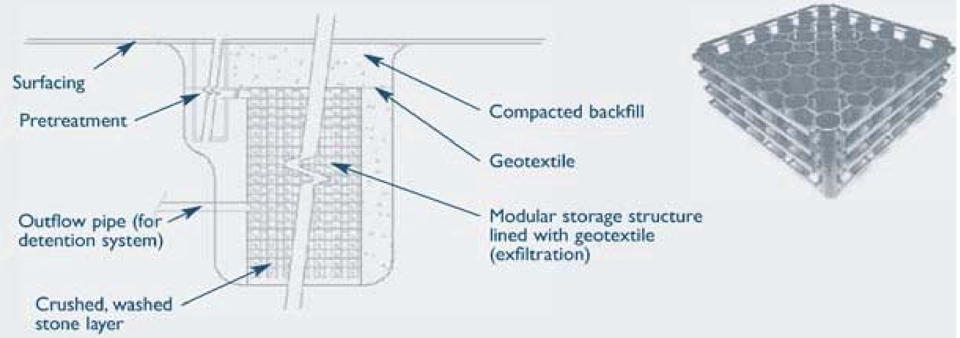
Disadvantages/Limitations:
- Limited data on field performance
- Susceptible to clogging by sediment
- Potential for mosquito breeding due to standing water if system fails

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80%
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data

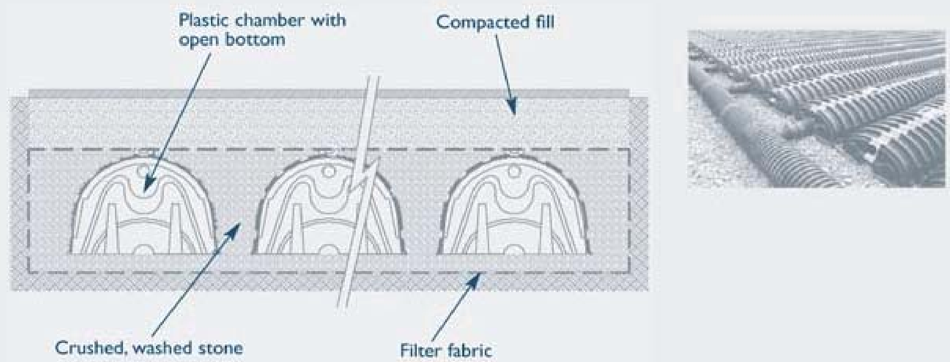
Subsurface Structures

Modular Underground Infiltration System



Elevation

Underground Plastic Chamber System



adapted from the CT State Stormwater Manual

Elevation

There are different types of subsurface structures:

Infiltration Pit: A pre-cast concrete or plastic barrel with uniform perforations. The bottom of the pit should be closed with the lowest row of perforations at least 6 inches above the bottom, to serve as a sump. Infiltration pits typically include an observation well. The pits may be placed linearly, so that as the infiltrative surfaces in the first pit clog, the overflow moves to the second pit for exfiltration. Place an outlet near the top of the infiltration pit to accommodate emergency overflows. MassDEP provides recharge credit for storage below the emergency outflow invert. To make an infiltration pit, excavate the pit, wrap fabric around the barrel, place stone in the bottom of the pit, place the barrel in the pit, and then backfill stone around the barrel. Take a boring or dig an observation trench at the site of each proposed pit.

Chambers: These are typically manufactured pipes containing open bottoms and sometimes perforations. The chambers are placed atop a stone bed. Take the same number of borings or observation pits as for infiltration trenches. Do not confuse these systems with underground detention systems (UDS) that use similar chambers. UDS are designed to attenuate peak rates of runoff--not to recharge groundwater.

Perforated Pipes: In this system, pipes containing perforations are placed in a leaching bed, similar to a Title 5 soil absorption system (SAS). The pipes dose the leaching bed. Take the same number of borings or observation pits as for infiltration trenches. Perforated pipes by themselves do not constitute a stormwater recharge system and receive no credit pursuant to Stormwater Standard No. 3. Do not confuse recharge systems that use perforated pipes with perforated pipes installed to lower the water table or divert groundwater flows.

Galleys: Similar to infiltration pits. Some designs consist of concrete perforated rectangular vaults. Others are modular systems usually placed under parking lots. When the galley design consists of a single rectangular perforated vault, conduct one boring or observation trench per galley. When the galleys consist of interlocking modular units, take the same number of borings or observation pits as for infiltration trenches. Do not confuse these galleys with vaults storing water for purposes of underground detention, which do not contain perforations.

Applicability

Subsurface structures are constructed to store stormwater temporarily and let it percolate into the underlying soil. These structures are used for small drainage areas (typically less than 2 acres). They are feasible only where the soil is adequately permeable and the maximum water table and/or bedrock elevation is sufficiently low. They can be used to control the quantity as well as quality of stormwater runoff, if properly designed and constructed. The structures serve as storage chambers for captured stormwater, while the soil matrix provides treatment.

Without adequate pretreatment, subsurface structures are not suitable for stormwater runoff from land uses or activities with the potential for high sediment or pollutant loads. Structural pretreatment BMPs for these systems include, but are not limited to, deep sump catch basins, proprietary separators, and oil/grit separators. They are suitable alternatives to traditional infiltration trenches and basins for space-limited sites. These systems can be installed beneath parking lots and other developed areas provided the systems can be accessed for routine maintenance.

Subsurface systems are highly prone to clogging. Pretreatment is always required unless the runoff is strictly from residential rooftops.

Effectiveness

Performance of subsurface systems varies by manufacturer and system design. Although there are limited field performance data, pollutant removal efficiency is expected to be similar to those of infiltration trenches and basins (i.e., up to 80% of TSS removal). MassDEP awards a TSS removal credit of 80% for systems designed in accordance with the specifications in this handbook.

Planning Considerations

Subsurface structures are excellent groundwater recharge alternatives where space is limited. Because infiltration systems discharge runoff to groundwater, they are inappropriate for use in areas with potentially higher pollutant loads (such as gas stations), unless adequate pretreatment is provided. In that event, oil grit separators, sand filters or equivalent BMPs must be used to remove sediment, floatables and grease prior to discharge to the subsurface structure.

Design

Unlike infiltration basins, widely accepted design standards and procedures for designing subsurface structures are not available. Generally, a subsurface structure is designed to store a "capture volume" of runoff for a specified period of "storage time." The definition of capture volume differs depending on the purpose of the subsurface structure and the stormwater management program being used. Subsurface structures should infiltrate good quality runoff only. Pretreatment prior to infiltration is essential.
The composition, configuration and layout of subsurface structures varies considerably depending on the manufacturer. Follow the design criteria specified by vendors or system manufacturers.
Install subsurface structures in areas that are easily accessible for routine and non-routine maintenance.

As with infiltration trenches and basins, install subsurface structures only in soils having suitable infiltration capacities as determined through field testing. Determine the infiltrative capacity of the underlying native soil through the soil evaluation set forth in Volume 3. Never use a standard septic system percolation test to determine soil permeability because this test tends to greatly overestimate the infiltration capacity of soils.

Subsurface structures are typically designed to function off-line. Place a flow bypass structure upgradient of the infiltration structure to convey high flows around the structure during large storms.

Design the subsurface structure so that it drains within 72 hours after the storm event and completely dewaters between storms. Use a minimum draining time of 6 hours to ensure adequate pollutant removal. Design all ports to be mosquito-proof, i.e., to inhibit or reduce the number of mosquitoes able to breed within the BMP.

The minimum acceptable field infiltration rate is 0.17 inches per hour. Subsurface structures must be sized in accordance with the procedures set forth in Volume 3. Manufactured structures must also be sized in accordance with the manufacturers' specifications. Design the system to totally exfiltrate within 72 hours.

Design the subsurface structure for live and dead loads appropriate for their location. Provide measures to dissipate inlet flow velocities and prevent channeling of the stone media. Generally, design the system so that inflow velocities are less than 2 feet per second (fps).
All of these devices must have an appropriate number of observation wells, to monitor the water surface elevation within the well, and to serve as a sampling port.

Each of these different types of structures, with the exception of perforated pipes in leaching fields similar to Title 5 systems, must have entry ports to allow worker access for maintenance, in accordance with OSHA requirements.

Construction

Stabilize the site prior to installing the subsurface structure. Do not allow runoff from any disturbed areas on the site to flow to the structure. Rope off the area where the subsurface structures are to be placed. Accomplish any required excavation with equipment placed just outside of this area. If the size of the area intended for exfiltration is too large to accommodate this approach, use trucks with low-pressure tires to minimize compaction. Do not allow any other vehicles within the area to be excavated. Keep the area above and immediately surrounding the subsurface structure roped off to all construction vehicles until the final top surface is installed (either paving or landscaping). This prevents additional compaction. When installing the final top surface, work from the edges to minimize compaction of the underlying soils.

Before installing the top surface, implement erosion and sediment controls to prevent sheet flow or wind blown sediment from entering the leach field. This includes, but is not limited to, minimizing land disturbances at any one time, placing stockpiles away from the area intended for infiltration, stabilizing any stockpiles through use of vegetation or tarps, and placing sediment fences around the perimeter of the infiltration field.

Provide an access port, man-way, and observation well to enable inspection of water levels within the system. Make the observation well pipe visible at grade (i.e., not buried).

Maintenance

Because subsurface structures are installed underground, they are extremely difficult to maintain. Inspect inlets at least twice a year. Remove any debris that might clog the system. Include mosquito controls in the Operation and Maintenance Plan.

Adapted from:
Connecticut Department of Environmental Conservation. Connecticut Stormwater Quality Manual. 2004.
MassHighway. Storm Water Handbook for Highways and Bridges. May 2004.

Deep Sump Catch Basin

Description: Deep sump catch basins, also known as oil and grease or hooded catch basins, are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases.

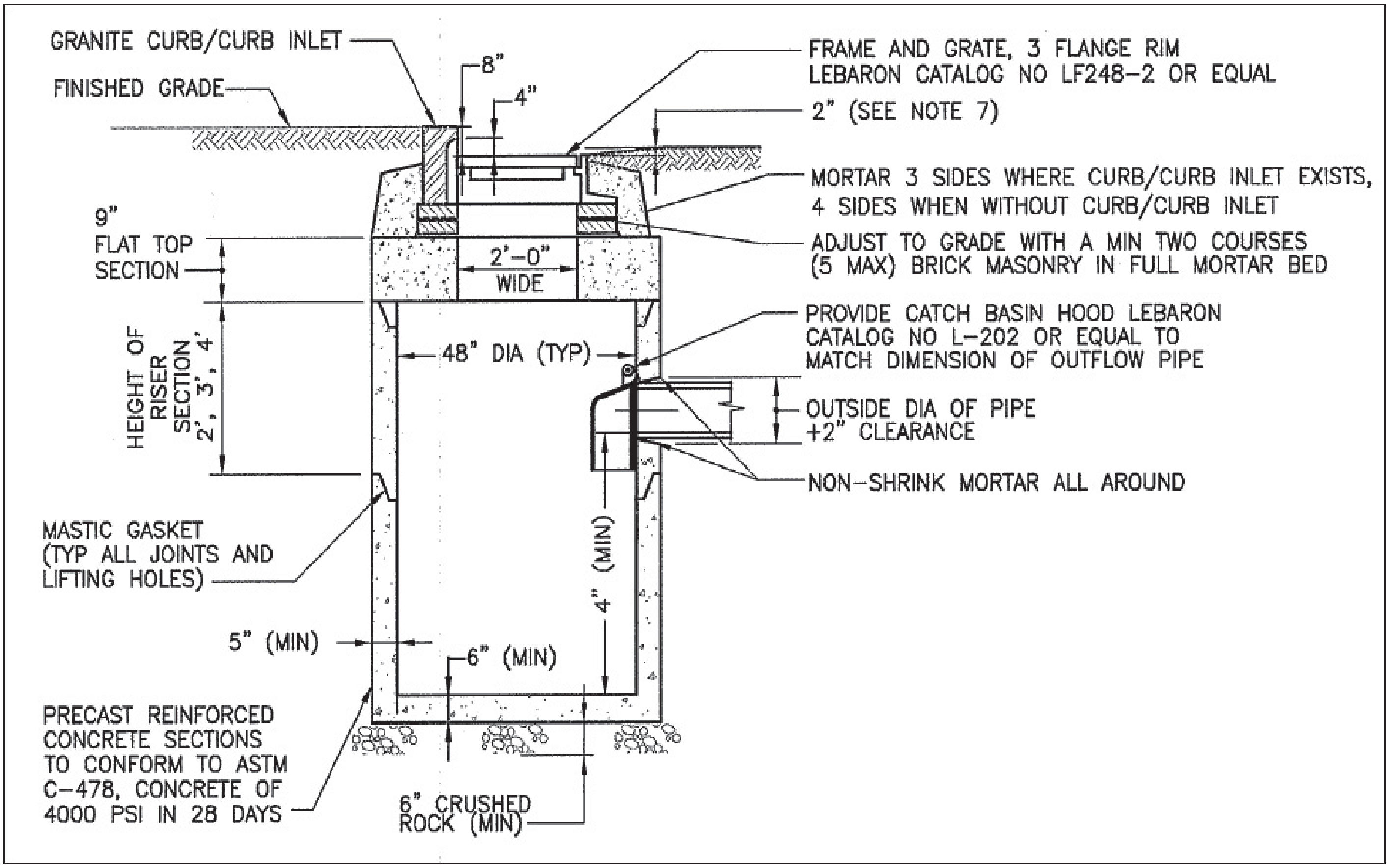
Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides no groundwater recharge
4 - TSS Removal	25% TSS removal credit when used for pretreatment. Because of their limited effectiveness and storage capacity, deep sump catch basins receive credit for removing TSS only if they are used for pretreatment and designed as off-line systems.
5 - Higher Pollutant Loading	Recommended as pretreatment BMP. Although provides some spill control capability, a deep sump catch basin may not be used in place of an oil grit separator or sand filter for land uses that have the potential to generate runoff with high concentrations of oil and grease such as: high-intensity-use parking lots, gas stations, fleet storage areas, vehicle and/or equipment maintenance and service areas.
6 - Discharges near or to Critical Areas	May be used as pretreatment BMP. not an adequate spill control device for discharges near or to critical areas.
7 - Redevelopment	Highly suitable.

Advantages/Benefits:
- Located underground, so limited lot size is not a deterrent.
- Compatible with subsurface storm drain systems.
- Can be used for retrofitting small urban lots where larger BMPs are not feasible.
- Provide pretreatment of runoff before it is delivered to other BMPs.
- Easily accessed for maintenance.
- Longevity is high with proper maintenance.

Disadvantages/Limitations:
- Limited pollutant removal.
- Expensive to install and maintain, resulting in high cost per unit area treated.
- No ability to control volume of stormwater
- Frequent maintenance is essential
- Requires proper disposal of trapped sediment and oil and grease
- Entrapment hazard for amphibians and other small animals

Pollutant Removal Efficiencies
- Total Suspended Solids (TSS) - 25% (for regulatory purposes)
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data



adapted from the University of New Hampshire

Maintenance

Activity	Frequency
Inspect units	Four times per year
Clean units	Four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Special Features

All deep sump catch basins must include hoods. For MassHighway projects, consult the Stormwater Handbook for Highways and Bridges for hood requirements.

LID Alternative

Reduce Impervious Surface
Disconnect rooftop and non-rooftop runoff
Vegetated Filter Strip

Deep Sump Catch Basin

Suitable Applications

- Pretreatment
- Residential subdivisions
- Office
- Retail

Design Considerations

- The contributing drainage area to any deep sump catch basin should not exceed ¼ acre of impervious cover.
- Design and construct deep sump catch basins as off-line systems.
- Size the drainage area so that the flow rate does not exceed the capacity of the inlet grate.
- Divert excess flows to another BMP intended to meet the water quantity requirements (peak rate attenuation) or to a storm drain system. An off-line design enhances pollutant removal efficiency, because it prevents the resuspension of sediments in large storms.

Make the sump depth (distance from the bottom of the outlet pipe to the bottom of the basin) at least four feet times the diameter of the outlet pipe and more if the contributing drainage area has a high sediment load. The minimum sump depth is 4 feet. Double catch basins, those with 2 inlet grates, may require deeper sumps. Install the invert of the outlet pipe at least 4 feet from the bottom of the catch basin grate.

The inlet grate serves to prevent larger debris from entering the sump. To be effective, the grate must have a separation between the grates of one square inch or less. The inlet openings must not allow flows greater than 3 cfs to enter the deep sump catch basin. If the inlet grate is designed with a curb cut, the grate must reach the back of the curb cut to prevent bypassing. The inlet grate must be constructed of a durable material and fit tightly into the frame so it won't be dislodged by automobile traffic. The inlet grate must not be welded to the frame so that sediments may be easily removed. To facilitate maintenance, the inlet grate must be placed along the road shoulder or curb line rather than a traffic lane.

Note that within parking garages, the State Plumbing Code regulates inlet grates and other stormwater management controls. Inlet grates inside parking garages are currently required to have much smaller openings than those described herein.

To receive the 25% removal credit, hoods must be used in deep sump catch basins. Hoods also help contain oil spills. MassHighway may install catch basins without hoods provided they are designed, constructed, operated, and maintained in accordance with the Mass Highway Stormwater Handbook.

Install the weep hole above the outlet pipe. Never install the weep hole in the bottom of the catch basin barrel.

Site Constraints

A proponent may not be able to install a deep sump catch basin because of:

- Depth to bedrock;
- High groundwater;
- Presence of utilities; or
- Other site conditions that limit depth of excavation because of stability.

Maintenance

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise the catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www. Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.