STORM WATER MANAGEMENT ANALYSIS

for

48 Kettle Creek Road
Weston, Connecticut

April 2, 2024

Prepared for:
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Job #1097

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APPENDICES

1.0 PROJECT DESCRIPTION

The proposed project includes the construction of a dwelling, driveway, covered porch, deck walkways and steps located at 48 Kettle Creek Road in Weston, Connecticut. The existing dwelling will be demolished. The storm water runoff from the proposed dwelling, a portion of the driveway and lawn area will be collected, detained, and treated on-site with the use of an underground detention system.

2.0 SOIL ANALYSIS

The subject parcel was researched and tested for storm water infiltration suitability. According to the Soil Survey of Fairfield County the parcel is underlain with Charlton-Chatfield complex (73C), hydrologic soil group "B". Paxton and Montauk fine sandy loams (84B), hydrologic soil group "C". The soils were confirmed with excavated test pits. The results of the on-site testing are located on the Site Development Plan.

3.0 METHODOLOGY & ANALYSIS

Watershed

This study was prepared using the Soil Conservation Service (SCS) methodology. This method outlines procedures for calculating peak rates of runoff resulting from precipitation events and procedures for developing runoff hydrographs. The calculations use the unit hydrograph method as described by Technical Release 55 (TR-55). The rates of runoff for the pre-development and post-development conditions were compared to determine any change as a result of the improvements.

Composite values for area, curve number (CN) and time of concentration (Tc) were calculated for each the pre-development and post-development condition. The curve numbers were calculated using the following values:

Cover Description	Hyd. Condition	CN
Lawn Area: grassland	Fair "C"	79
Proposed Lawn: grassland	Good "C"	74
Impervious: dwelling, driveway, deck etc.	-	98

The value calculated for the pre-development condition was as follows:

Description	Area	CN	Tc
Pre-Development	**1.26 acres**	**81**	**26.3 min.**
[Existing Lawn: grassland	1.14 acres	79]	
[Impervious: house, driveway, etc.	0.12 acres	98]	

The post-development condition was modeled as two sub-watersheds, one which will be detained, and the other that will flow overland off-site. Pond Inflow, the detained sub-watershed, consists of runoff from the proposed dwelling, a portion of the driveway and lawn area. It will be collected and treated by the underground Cultec galleys. Undetained Area consists of runoff from the deck, patio, walkways, a portion of the driveway, and vegetated land that will be allowed to flow offsite naturally as it does today. Values used for the post-development condition were as follows:

Description	Area	CN	Tc
Undetained Area	**1.04 acres**	**76**	**26.3 min.**
[Proposed Lawn: grassland	0.95 acres	74]	
[Impervious: driveway, deck, etc.	0.09 acres	98]	
Pond Inflow	**0.22 acres**	**87**	**6.0 min.**
[Proposed Lawn: grassland	0.10 acres	74]	
[Impervious: dwelling driveway, etc.	0.12 acres	98]	

In accordance with the policies of the Town of Weston, systems shall be designed to accommodate Type III cumulative rainfall distribution. 24-hour rainfall depths for the 2-year, 10-year, and 25-year, 50-year storms shall be considered. Rainfall depths were obtained through NOAA's precipitation frequency data server, the results of which are included in Appendix C. The obtained rainfall values are as follows:

- A 2-year, 24-hour storm consisting of 3.52 inches of rainfall;
- A 10-year, 24-hour storm consisting of 5.41 inches of rainfall;
- A 25-year, 24-hour storm consisting of 6.58 inches of rainfall;
- A 50-year, 24-hour storm consisting of 7.45 inches of rainfall;

The design storm used for this study is the 24-hour SCS Type III cumulative rainfall distribution. Precipitation frequency estimates for the site were taken from NOAA Atlas 14, Volume 10 and are included in this report under appendix B. All the watersheds were analyzed by the computer program *Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2019*; the results of which are located in Appendix B. For convenience and to conserve resources, the drainage calculations included in the appendices of this report were limited to the 50-year storm event.

Detention System

Runoff from the driveway will be collected by the trench drain and will be directed into the underground detention system. Runoff from the roof will be collected and directed to the underground detention system. Due to the size of the system, it is not expected that excess stormwater will overflow the underground detention system up to the 50-year storm event. The system has been designed to contain and infiltrate the 50-year runoff volume and keep the proposed development's runoff flow rates below that of the calculated pre-development rates.

The proposed detention system was routed with the use of the computer program *Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2019*; the results of which are located in Appendix B. Infiltration rates were used as part of the design; however, the values used were half the measured rates for a factor of safety.

Results

The calculated storm water peak flows are as follows:

CONDITIONFLOW	2-YEAR FLOW	10-YEAR FLOW	25-YEAR FLOW	50-YEAR FLOW
PREDEVELOPMENT	1.502 CFS	2.923 CFS	3.838 CFS	4.522 CFS
Undetained Area	0.972 CFS	2.073 CFS	2.799 CFS	3.355 CFS
Pond Inflow	0.493 CFS	0.867 CFS	1.098 CFS	1.269 CFS
Pond Route	0.000 CFS	0.118 CFS	0.543 CFS	1.172 CFS
FINAL COMBINED	0.972 CFS	2.073 CFS	3.211 CFS	3.795 CFS

In order to accurately analyze the post-development condition, the Pre-Development hydrograph is compared to a combined hydrograph consisting of the undetained area hydrograph and the final combined hydrographs that result from detention pond outflows.

CONDITION	2-YEAR FLOW	10-YEAR FLOW	25-YEAR FLOW	50-YEAR FLOW
PREDEVELOPMENT	1.502 CFS	2.923 CFS	3.838 CFS	4.522 CFS
FINAL COMBINED	0.972 CFS	2.073 CFS	3.211 CFS	3.795 CFS
PROPOSED CHANGE	-0.530 CFS	-0.850 CFS	-0.627 CFS	-0.727 CFS

The proposed change shows that the storm water flow rates are expected to be reduced as a result of the development and proposed system.

4.0 STORM WATER QUALITY ANALYSIS

The majority of storm water introduced to the system will be roof runoff where the observance of any oils, grease or particulates is remote. Since the driveway is small and its use is primarily limited to residential vehicles, the anticipated levels of sediment and oils should be negligible.

The system was planned in accordance with design considerations found in the 2004 Connecticut Stormwater Quality Manual. As stated in the manual they should be enabled to infiltrate the full Water Quality Volume (WQV). The underground detention system was designed to handle 151.8% of the WQV of the entire site. Calculations for the system are located in Appendix B.

The homeowner will be responsible for the implementation of an annual maintenance program which should include driveway sweeping, gutter and trench drain cleaning and pipe maintenance. Proper fertilizer and pesticide management and household pet waste management should be observed.

5.0 CONCLUSION

The proposed storm water collection system has been designed to adequately convey the required storm event without any adverse impacts or increase in overall storm water flow and while maintaining adequate water quality.

6.0 REFERENCES

1. *Urban Hydrology for Small Watersheds*, Technical Release No. 55, USDA Soil Conservation Service Publication, June 1986.

2. Rainfall Frequency Values for Connecticut with 24-Hour Storm Duration, United States Department of Commerce and Weather Bureau, T.P. 40, May 1961.

3. *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*, The Connecticut Council on Soil and Water Conservation.

4. Debo, Thomas N. and Reese, Andrew J., *Municipal Stormwater Management*, Second Edition, Boca Raton, Lewis Publishers, 2003

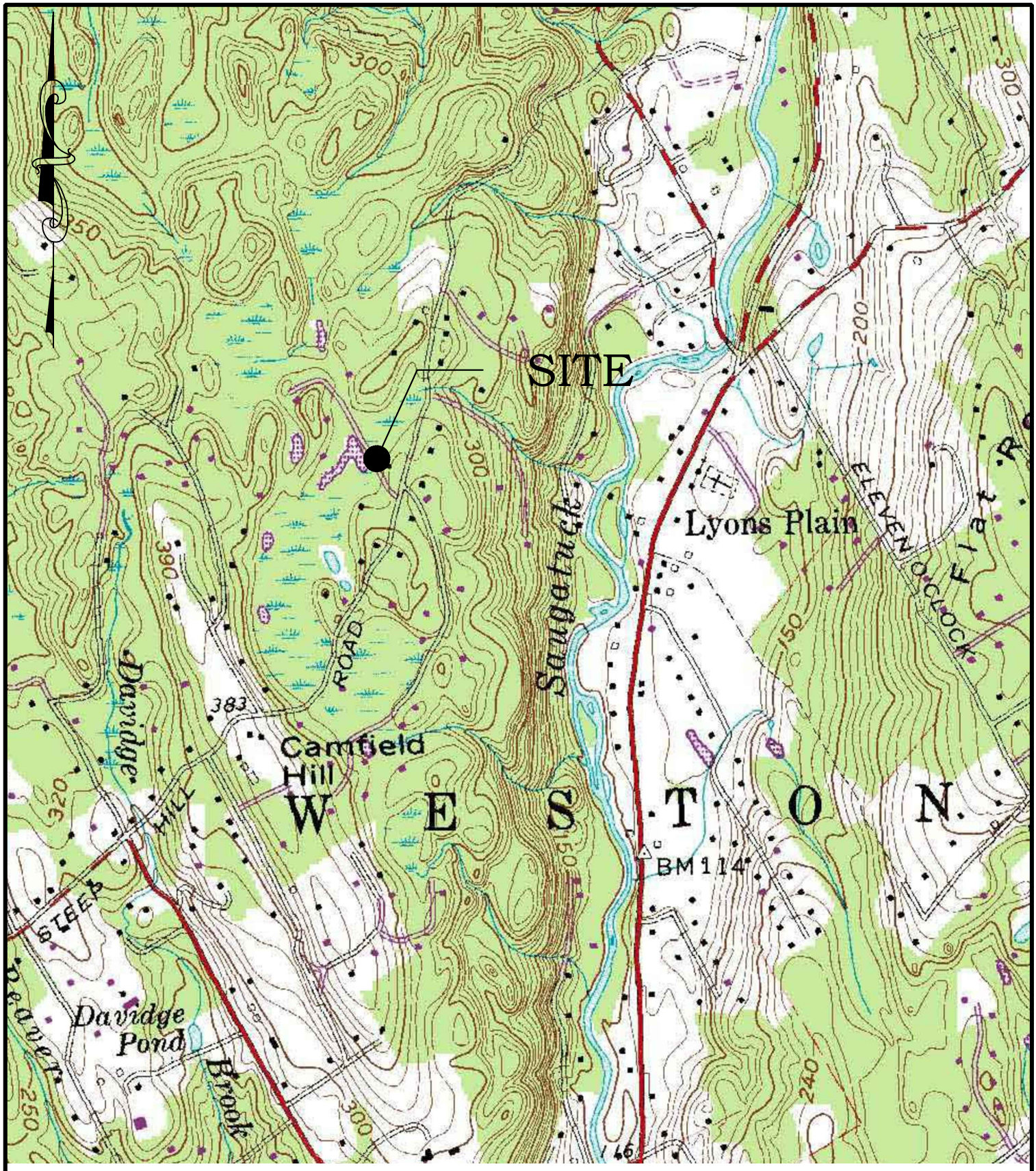
5. *2004 Connecticut Stormwater Quality Manual*, Connecticut Department of Environmental Protection.

6. *Web Soil Survey*. 8/1/2006. National Resources Conservation Service <http://websoilsurvey.nrcs.usda.gov/app/>

APPENDIX A

Figures

CONTENTS:



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ENGINEERING

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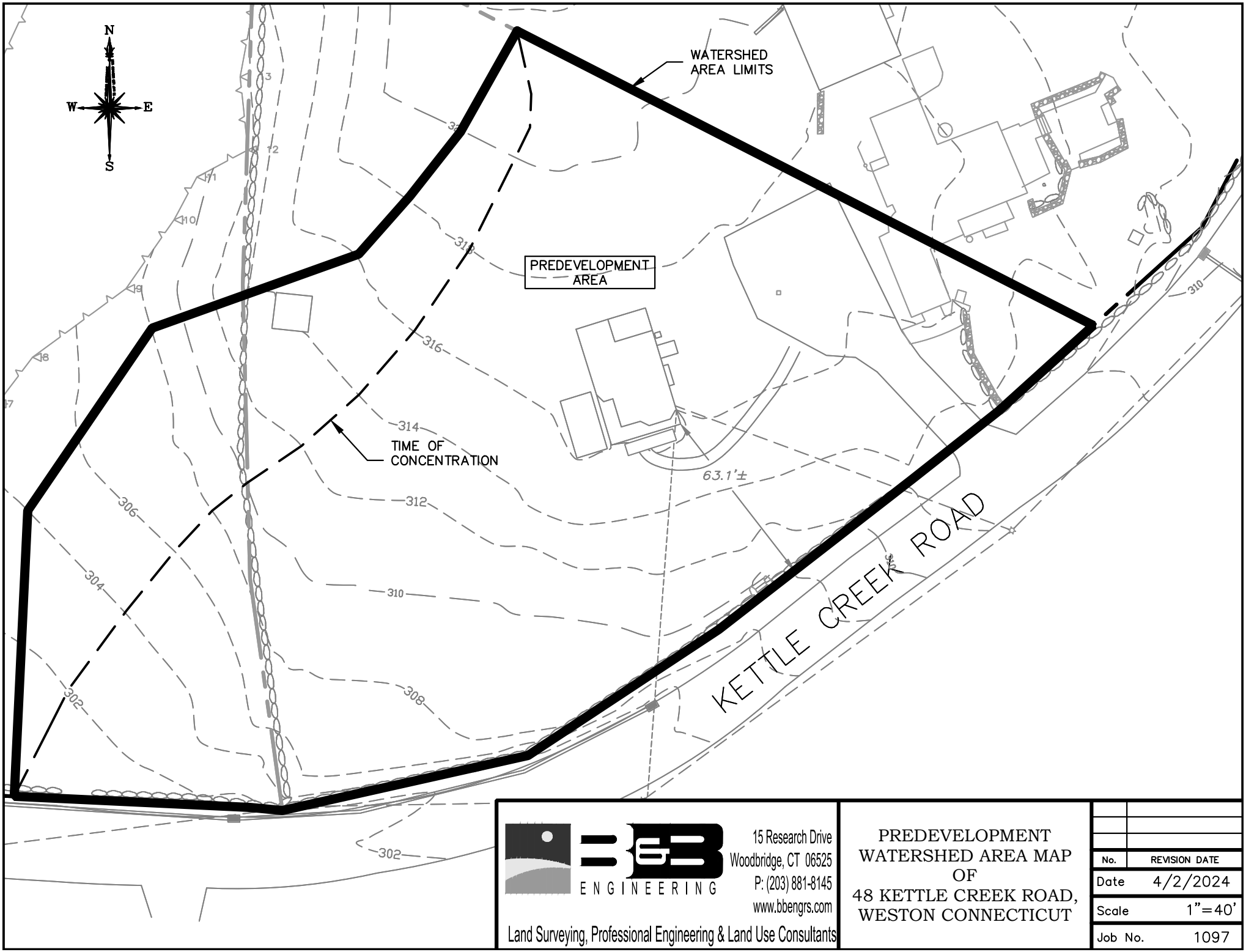
Drawing Title

USGS LOCATION MAP

OF

48 KETTLE CREEK ROAD
WESTON, CT

No.	REVISION DATE
Date	4/2/2024
Scale	1"=1000'
Job No.	1097



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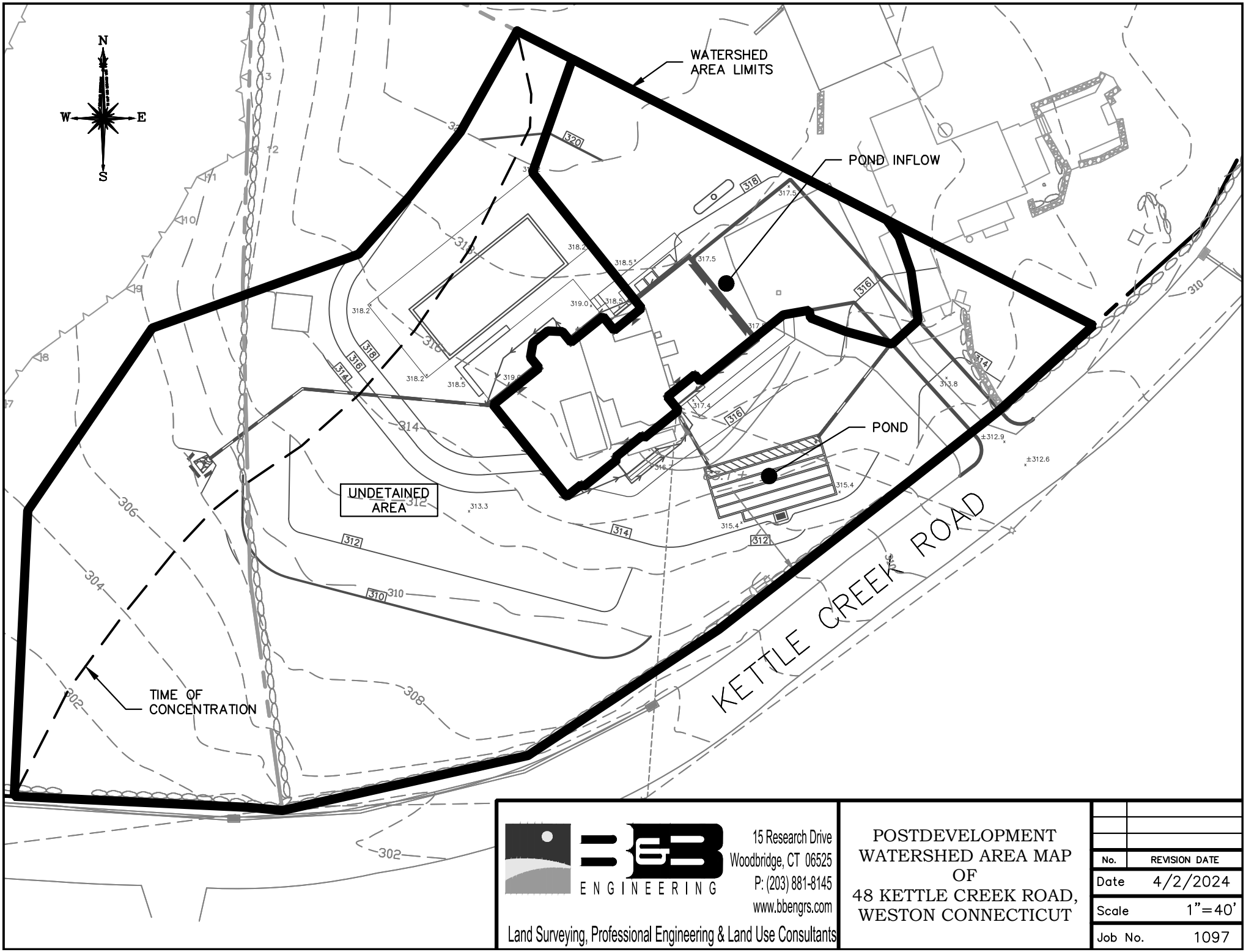
PREDEVELOPMENT
WATERSHED AREA MAP
OF
48 KETTLE CREEK ROAD,
WESTON CONNECTICUT

No.	REVISION DATE
Date	4/2/2024
Scale	1"=40'
Job No.	1097



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POSTDEVELOPMENT WATERSHED AREA MAP OF 48 KETTLE CREEK ROAD, WESTON CONNECTICUT

No.	REVISION DATE
Date	4/2/2024
Scale	1"=40'
Job No.	1097

APPENDIX B

Data & Calculations

CONTENTS:

Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	1.502	-------	-------	2.923	3.838	4.522	-------	PREDEVELPOMENT
3	SCS Runoff	------	-------	0.972	-------	-------	2.073	2.799	3.355	-------	Undetained
5	SCS Runoff	------	-------	0.493	-------	-------	0.867	1.098	1.269	-------	Pond Inflow
6	Reservoir	5	-------	0.000	-------	-------	0.118	0.543	1.172	-------	Pond Route
8	Combine	3, 6,	-------	0.972	-------	-------	2.073	3.211	3.795	-------	FINAL COMBINED

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.522	3	738	23,899	------	------	------	PREDEVELPOMENT
3	SCS Runoff	3.355	3	738	17,593	------	------	------	Undetained
5	SCS Runoff	1.269	3	726	4,429	------	------	------	Pond Inflow
6	Reservoir	1.172	3	729	813	5	314.84	1,093	Pond Route
8	Combine	3.795	3	735	18,406	3, 6,	------	------	FINAL COMBINED

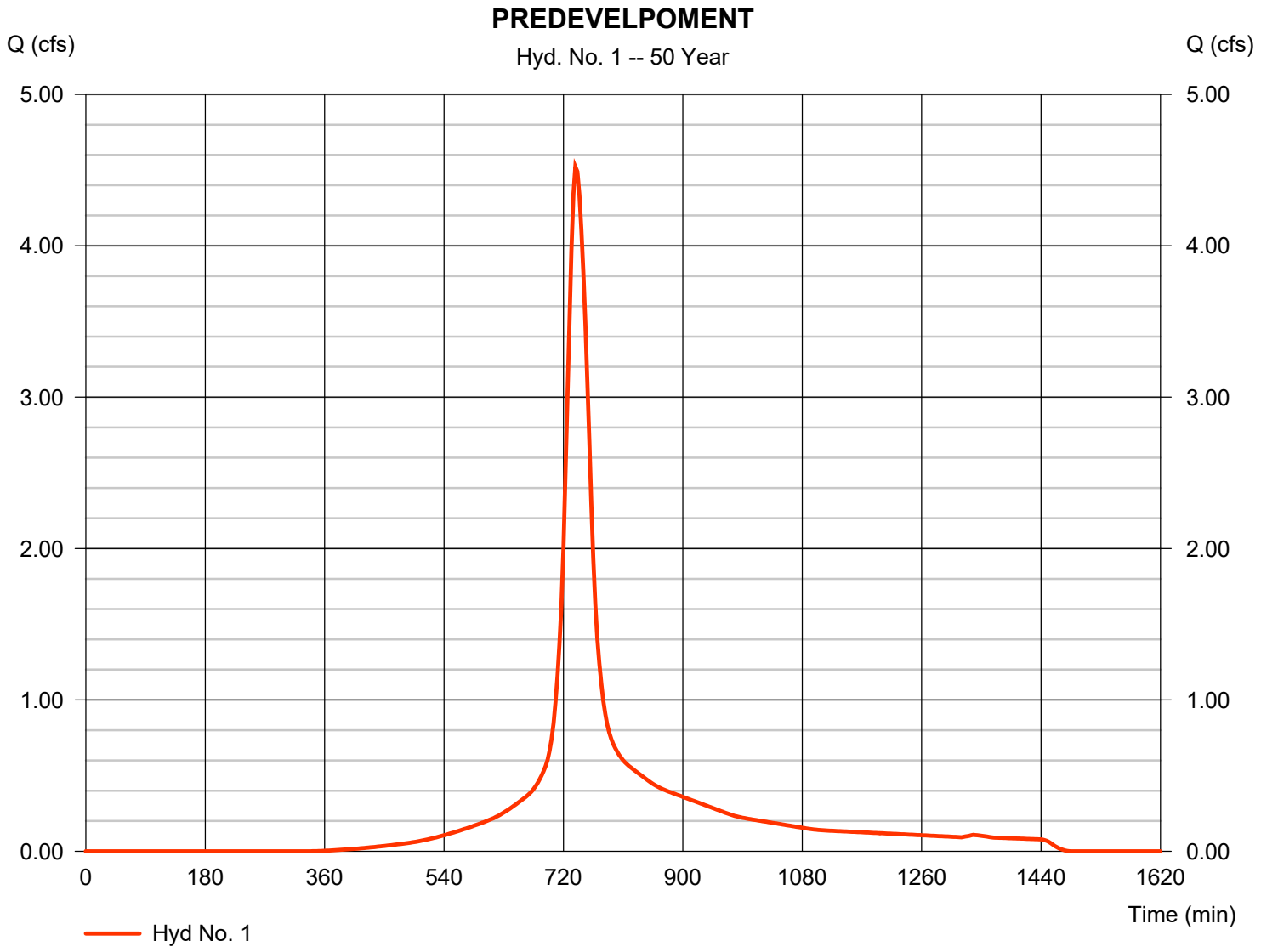
Hydrograph Report

Hyd. No. 1

PREDEVELPOMENT

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.522 cfs
Storm frequency	=	50 yrs	Time to peak	=	738 min
Time interval	=	3 min	Hyd. volume	=	23,899 cuft
Drainage area	=	1.260 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.30 min
Total precip.	=	7.45 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.140 x 79) + (0.120 x 98)] / 1.260



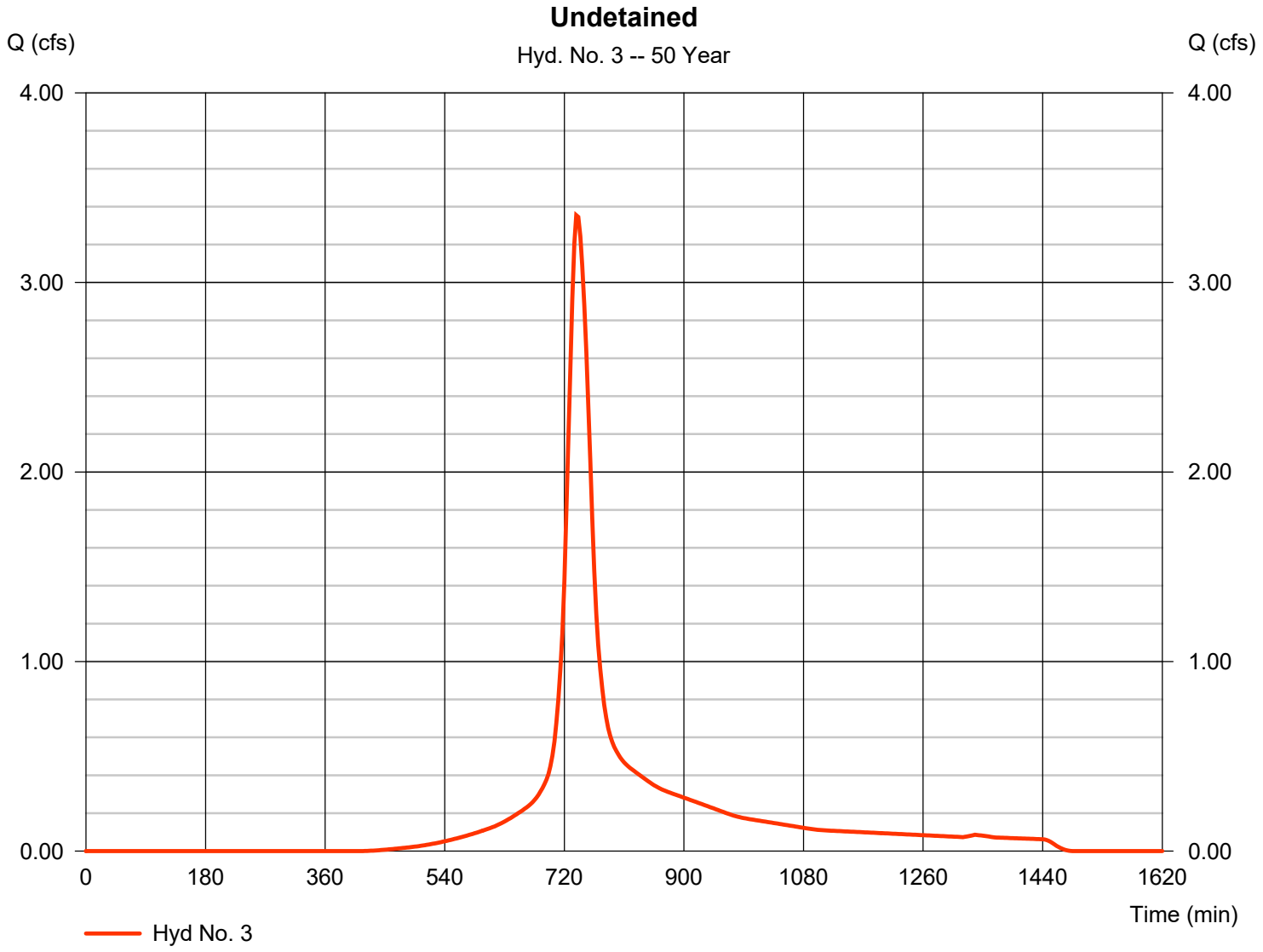
Hydrograph Report

Hyd. No. 3

Undetained

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.355 cfs
Storm frequency	=	50 yrs	Time to peak	=	738 min
Time interval	=	3 min	Hyd. volume	=	17,593 cuft
Drainage area	=	1.040 ac	Curve number	=	76*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.30 min
Total precip.	=	7.45 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.950 x 74) + (0.090 x 98)] / 1.040



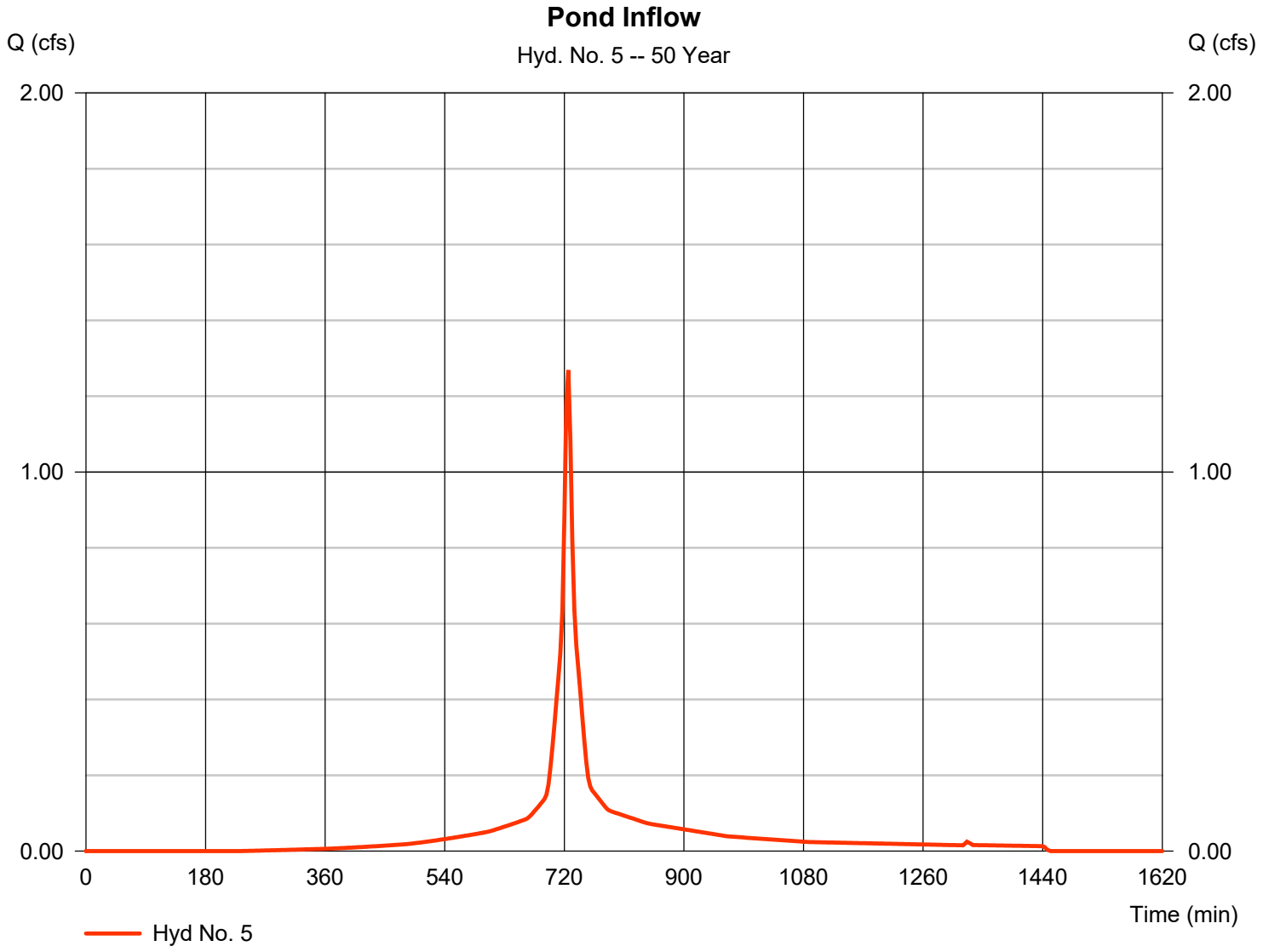
Hydrograph Report

Hyd. No. 5

Pond Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.269 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	3 min	Hyd. volume	=	4,429 cuft
Drainage area	=	0.220 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.45 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 74) + (0.120 x 98)] / 0.220



Hydrograph Report

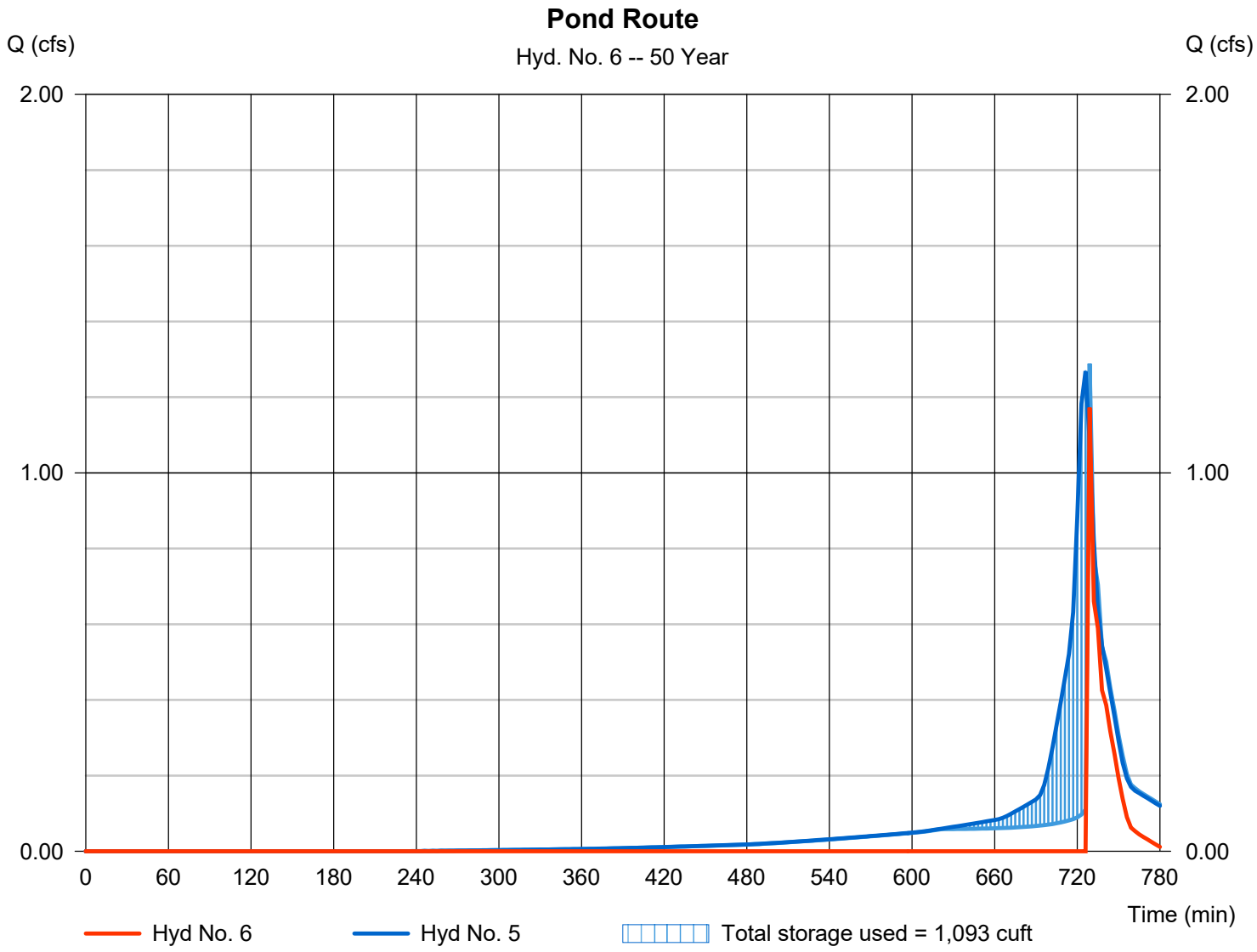
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Monday, 04 / 15 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	1.172 cfs
Storm frequency	=	50 yrs	Time to peak	=	729 min
Time interval	=	3 min	Hyd. volume	=	813 cuft
Inflow hyd. No.	=	5 - Pond Inflow	Max. Elevation	=	314.84 ft
Reservoir name	=	Pond (Cultec 100HD)	Max. Storage	=	1,093 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - Pond (Cultec 100HD)

Pond Data

UG Chambers -Invert elev. = 313.30 ft, Rise x Span = 1.04 x 3.00 ft, Barrel Len = 232.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 312.80 ft, Width = 4.00 ft, Height = 2.04 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	312.80	n/a	0	0
0.20	313.00	n/a	76	76
0.41	313.21	n/a	76	151
0.61	313.41	n/a	122	274
0.82	313.62	n/a	159	433
1.02	313.82	n/a	154	586
1.22	314.02	n/a	144	730
1.43	314.23	n/a	127	857
1.63	314.43	n/a	90	947
1.84	314.64	n/a	76	1,023
2.04	314.84	n/a	76	1,099

Culvert / Orifice Structures

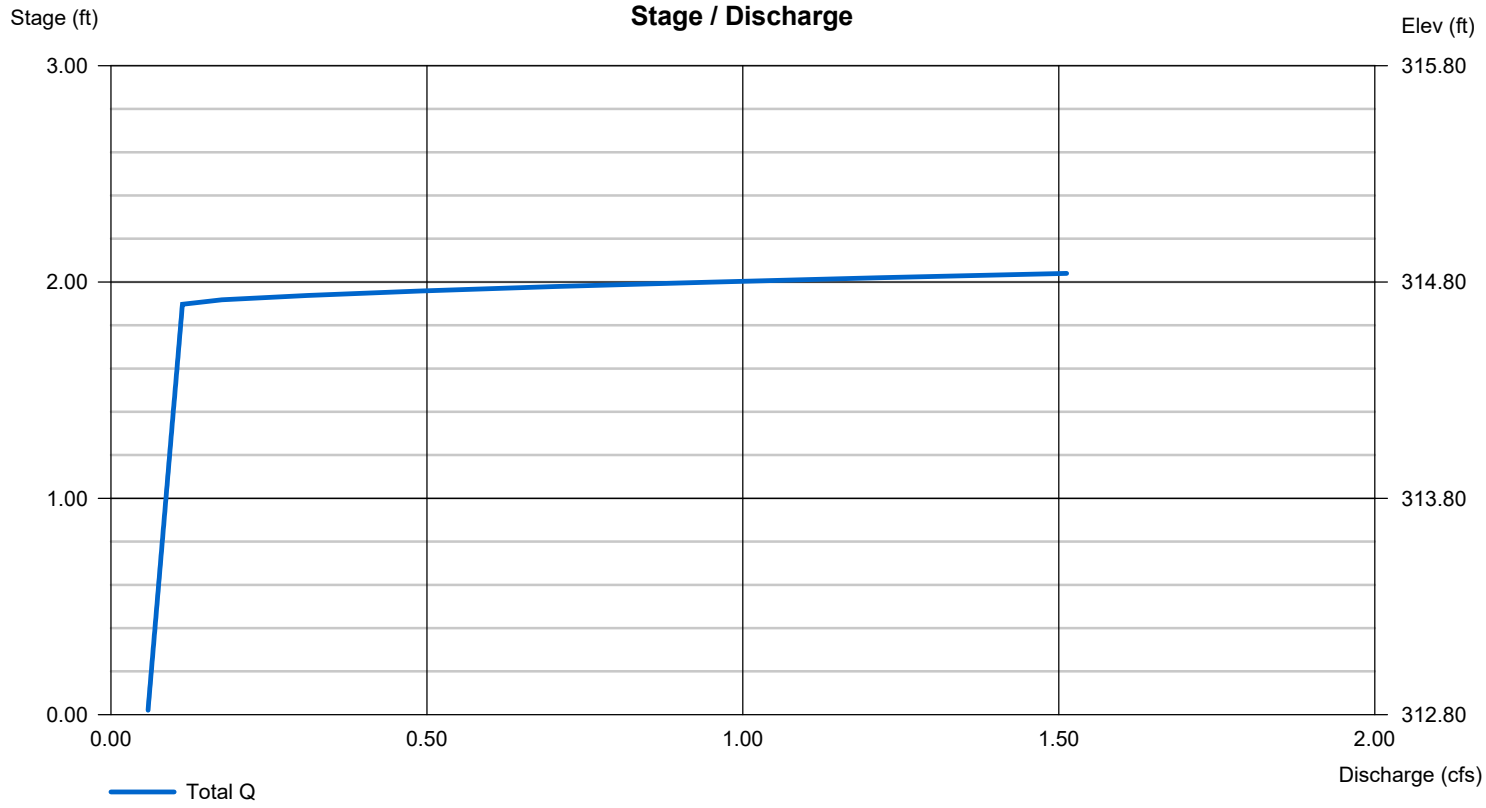
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 314.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.700 (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).

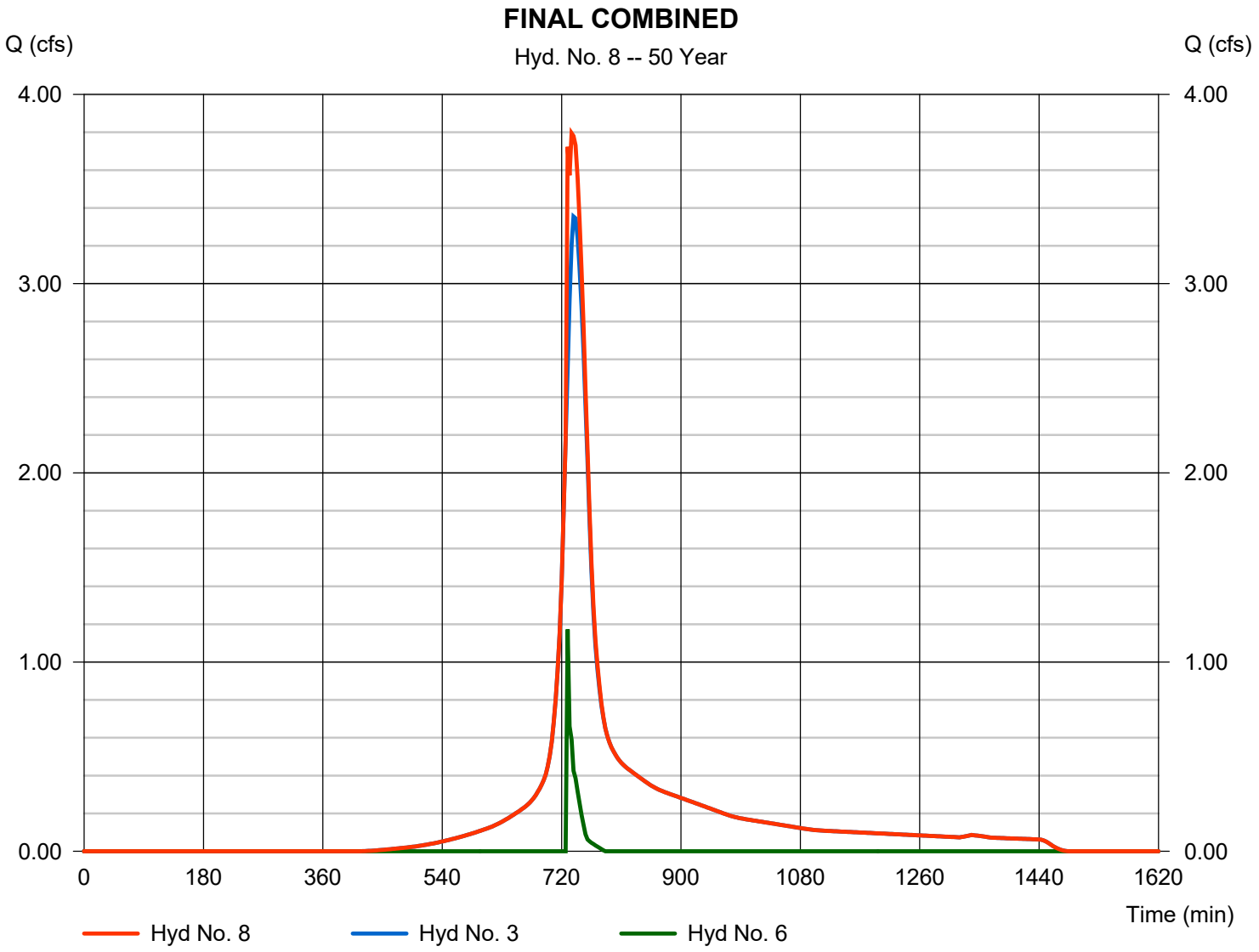


Hydrograph Report

Hyd. No. 8

FINAL COMBINED

Hydrograph type	=	Combine	Peak discharge	=	3.795 cfs
Storm frequency	=	50 yrs	Time to peak	=	735 min
Time interval	=	3 min	Hyd. volume	=	18,406 cuft
Inflow hyds.	=	3, 6	Contrib. drain. area	=	1.040 ac



STORM WATER QUALITY CALCULATIONS

Underground Detention System

as defined by "2004 Connecticut Stormwater Quality Manual"

Watershed:

Determine "Water Quality Volume" (WQV)

I = percent impervious cover = **100.0 %**

$$WQV = \frac{1" (R)(A)}{12}$$

R = volumetric runoff coefficient = 0.05 + 0.009(I)

= 0.05 + 0.009 (100.0) = **0.950**

$$= \frac{1" (0.95) \quad (0.21)}{12}$$

A = site area in acres = **0.21**

= 0.017 Acre-Feet

= 724 CF **Volume of designed basin = 1099 CF**

PER THE MANUAL, THE INFILTRATION SUTRUCTURES SHOULD BE DESIGNED TO MAINTAIN AT LEAST THE WATER QUALITY VOLUME (WQV)

AS DESIGNED, THE DETENTION SYSTEM HAS A TOTAL CAPACITY OF **1099 CF,** which EQUATES TO **151.8%** OF THE WQV.

THEREFORE, THE SYSTEMS COMPLY WITH THE REQUIREMENTS OF THE 2004 CONNECTICUT STORMWATER QUALITY MANUAL FOR UNDERGROUND INFILTRATION SYSTEMS.

E N G I N E E R I N G

APPENDIX C

Precipitation Data (NOAA)

NOAA Atlas 14, Volume 10, Version 3
Location name: Weston, Connecticut, USA*
Latitude: 41.1969°, Longitude: -73.3675°
Elevation: 321 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.365** (0.282-0.466)	**0.425** (0.328-0.543)	**0.523** (0.403-0.670)	**0.604** (0.462-0.778)	**0.716** (0.531-0.952)	**0.801** (0.581-1.08)	**0.888** (0.625-1.23)	**0.981** (0.660-1.39)	**1.11** (0.718-1.62)	**1.21** (0.766-1.80)
10-min	**0.517** (0.400-0.661)	**0.602** (0.465-0.770)	**0.741** (0.570-0.950)	**0.856** (0.655-1.10)	**1.01** (0.752-1.35)	**1.14** (0.824-1.53)	**1.26** (0.886-1.75)	**1.39** (0.935-1.97)	**1.57** (1.02-2.29)	**1.71** (1.08-2.54)
15-min	**0.609** (0.470-0.777)	**0.709** (0.547-0.906)	**0.872** (0.671-1.12)	**1.01** (0.771-1.30)	**1.19** (0.884-1.59)	**1.34** (0.969-1.80)	**1.48** (1.04-2.06)	**1.64** (1.10-2.32)	**1.85** (1.20-2.70)	**2.02** (1.28-3.00)
30-min	**0.847** (0.654-1.08)	**0.986** (0.761-1.26)	**1.21** (0.933-1.55)	**1.40** (1.07-1.80)	**1.66** (1.23-2.20)	**1.86** (1.35-2.50)	**2.06** (1.44-2.85)	**2.26** (1.52-3.22)	**2.54** (1.65-3.71)	**2.75** (1.74-4.08)
60-min	**1.08** (0.838-1.38)	**1.26** (0.975-1.61)	**1.55** (1.20-1.99)	**1.80** (1.37-2.31)	**2.13** (1.57-2.82)	**2.38** (1.72-3.21)	**2.64** (1.85-3.64)	**2.90** (1.95-4.11)	**3.23** (2.10-4.71)	**3.48** (2.20-5.17)
2-hr	**1.39** (1.08-1.76)	**1.64** (1.28-2.08)	**2.05** (1.59-2.61)	**2.39** (1.84-3.06)	**2.86** (2.13-3.78)	**3.22** (2.35-4.32)	**3.58** (2.53-4.94)	**3.97** (2.68-5.60)	**4.51** (2.93-6.54)	**4.93** (3.13-7.28)
3-hr	**1.60** (1.25-2.02)	**1.90** (1.48-2.40)	**2.39** (1.86-3.03)	**2.80** (2.16-3.57)	**3.36** (2.52-4.43)	**3.79** (2.78-5.08)	**4.23** (3.01-5.83)	**4.71** (3.19-6.62)	**5.40** (3.51-7.80)	**5.94** (3.78-8.74)
6-hr	**2.01** (1.58-2.52)	**2.41** (1.89-3.02)	**3.06** (2.39-3.85)	**3.59** (2.79-4.55)	**4.33** (3.26-5.69)	**4.89** (3.61-6.53)	**5.48** (3.93-7.54)	**6.14** (4.17-8.58)	**7.10** (4.64-10.2)	**7.89** (5.03-11.5)
12-hr	**2.48** (1.96-3.09)	**2.98** (2.35-3.72)	**3.80** (2.99-4.76)	**4.49** (3.51-5.64)	**5.43** (4.12-7.08)	**6.13** (4.56-8.15)	**6.88** (4.97-9.44)	**7.74** (5.27-10.7)	**9.00** (5.90-12.8)	**10.1** (6.43-14.6)
24-hr	**2.90** (2.30-3.59)	**3.52** (2.80-4.37)	**4.55** (3.61-5.66)	**5.41** (4.26-6.75)	**6.58** (5.02-8.55)	**7.45** (5.58-9.86)	**8.39** (6.11-11.5)	**9.50** (6.50-13.1)	**11.2** (7.34-15.8)	**12.6** (8.08-18.1)
2-day	**3.23** (2.58-3.97)	**4.00** (3.20-4.92)	**5.26** (4.19-6.49)	**6.30** (5.00-7.82)	**7.74** (5.95-10.0)	**8.81** (6.64-11.6)	**9.96** (7.33-13.6)	**11.4** (7.81-15.6)	**13.6** (8.96-19.1)	**15.5** (9.97-22.2)
3-day	**3.49** (2.81-4.28)	**4.34** (3.48-5.32)	**5.72** (4.58-7.04)	**6.88** (5.47-8.49)	**8.46** (6.53-10.9)	**9.62** (7.29-12.7)	**10.9** (8.05-14.9)	**12.5** (8.57-17.0)	**14.9** (9.85-20.9)	**17.0** (11.0-24.3)
4-day	**3.75** (3.02-4.58)	**4.64** (3.74-5.68)	**6.11** (4.90-7.49)	**7.32** (5.84-9.02)	**9.00** (6.96-11.6)	**10.2** (7.76-13.4)	**11.6** (8.56-15.7)	**13.2** (9.11-18.0)	**15.8** (10.4-22.1)	**18.0** (11.6-25.6)
7-day	**4.49** (3.64-5.46)	**5.47** (4.43-6.66)	**7.07** (5.70-8.62)	**8.40** (6.73-10.3)	**10.2** (7.93-13.0)	**11.6** (8.80-15.0)	**13.0** (9.64-17.5)	**14.8** (10.2-20.0)	**17.4** (11.6-24.2)	**19.7** (12.7-27.8)
10-day	**5.22** (4.24-6.32)	**6.25** (5.08-7.58)	**7.94** (6.42-9.64)	**9.34** (7.51-11.4)	**11.3** (8.75-14.3)	**12.7** (9.66-16.4)	**14.2** (10.5-19.0)	**16.0** (11.1-21.6)	**18.6** (12.4-25.8)	**20.8** (13.5-29.3)
20-day	**7.40** (6.06-8.90)	**8.55** (6.99-10.3)	**10.4** (8.50-12.6)	**12.0** (9.71-14.5)	**14.1** (11.0-17.7)	**15.8** (12.0-20.1)	**17.5** (12.8-22.8)	**19.3** (13.4-25.8)	**21.8** (14.6-30.0)	**23.8** (15.5-33.3)
30-day	**9.20** (7.56-11.0)	**10.4** (8.56-12.5)	**12.5** (10.2-15.0)	**14.1** (11.5-17.1)	**16.4** (12.9-20.5)	**18.2** (13.9-23.0)	**20.0** (14.7-25.9)	**21.8** (15.3-29.1)	**24.3** (16.3-33.3)	**26.2** (17.1-36.5)
45-day	**11.4** (9.41-13.6)	**12.7** (10.5-15.2)	**14.9** (12.3-17.9)	**16.7** (13.7-20.1)	**19.2** (15.1-23.8)	**21.2** (16.2-26.5)	**23.1** (16.9-29.6)	**25.0** (17.5-33.0)	**27.4** (18.4-37.3)	**29.1** (19.0-40.4)
60-day	**13.2** (11.0-15.7)	**14.7** (12.1-17.4)	**17.0** (14.0-20.2)	**18.9** (15.4-22.6)	**21.5** (16.9-26.5)	**23.6** (18.1-29.4)	**25.6** (18.8-32.7)	**27.5** (19.4-36.3)	**29.9** (20.2-40.6)	**31.6** (20.7-43.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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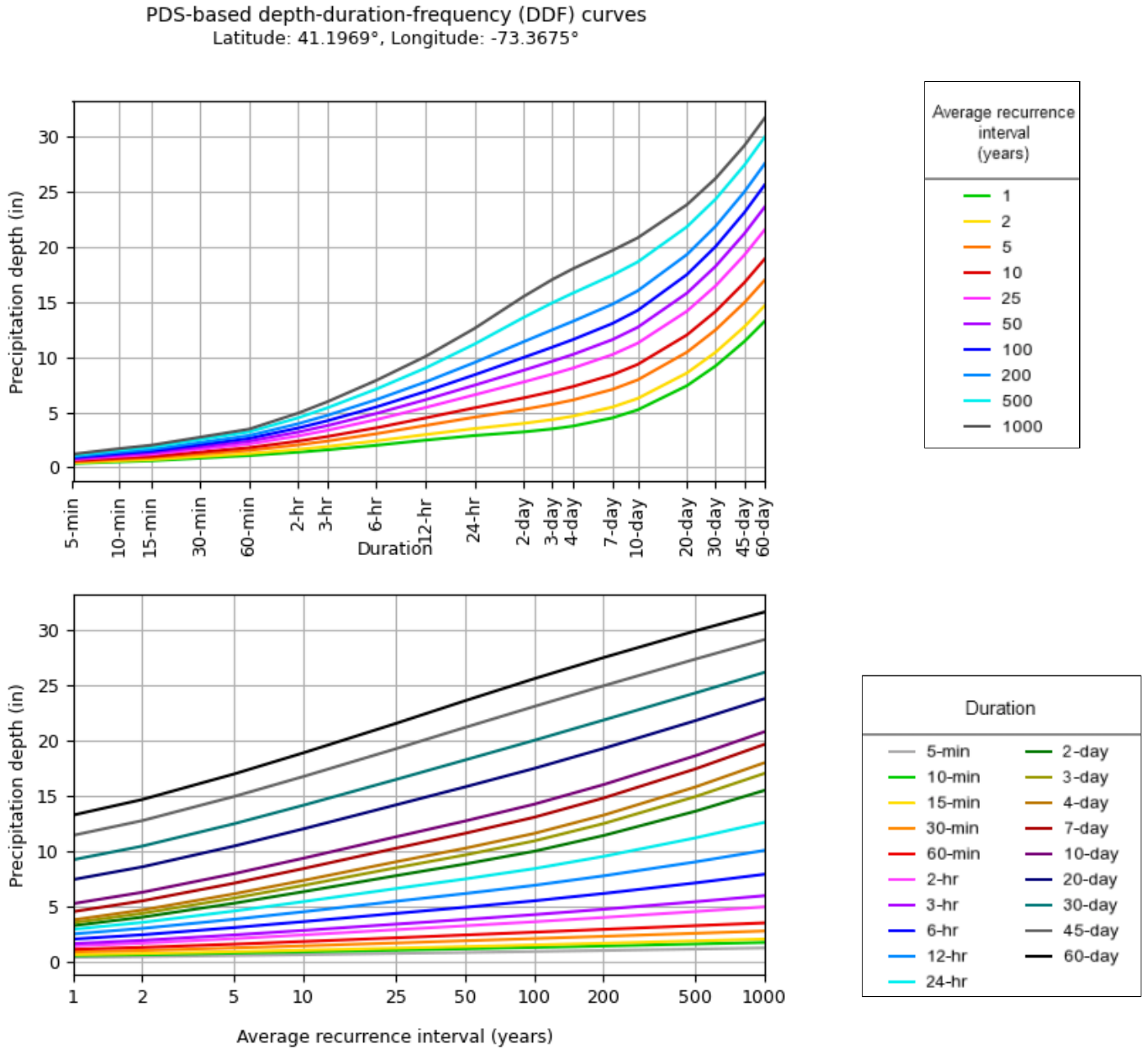
PF graphical



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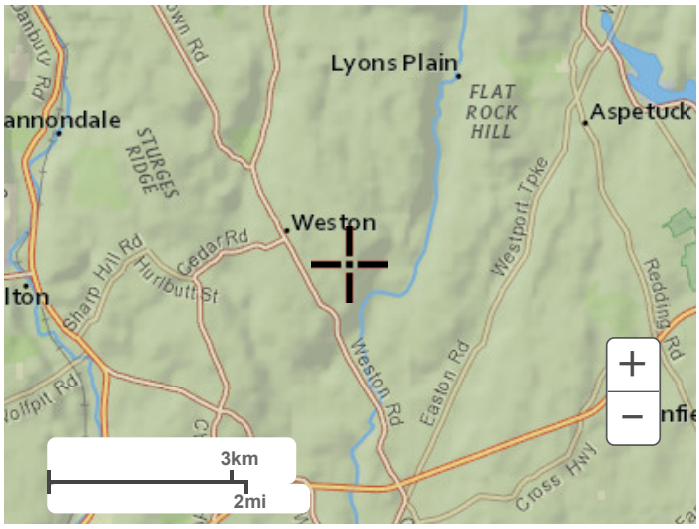
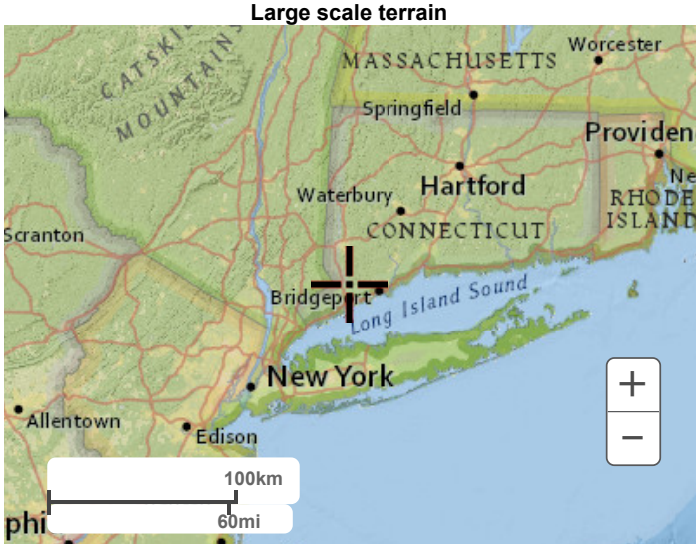
Maps & aerials

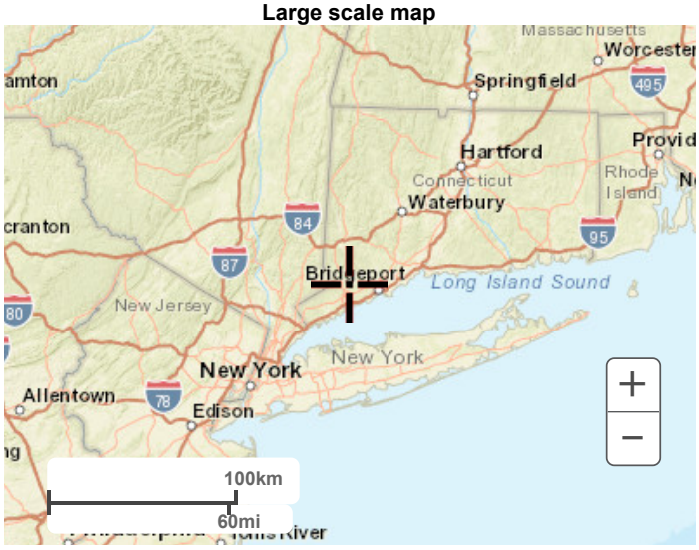
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial