DUTTON ASSOCIATES, LLC

DRAINAGE COMPUTATIONS
CASELLA SUBDIVISION

KNOLLWOOD DRIVE
GLASTONBURY, CT

PREPARED BY
DUTTON ASSOCIATES, LLC
OCTOBER 1, 2020

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TABLE OF CONTENTS

SUMMARY

The Casella Subdivision proposal is a 3-lot subdivision of an 11.7-acre parcel located southeasterly of the Knollwood Drive cul-de-sac. The subdivision contains two rear lots and 1 frontage lot. All lots will be accessed by a common driveway from Knollwood Drive. Additionally, a previously approved rear lot (owned by the applicant but not a part of this application) will also be accessed by the common drive.

Topography of the site is moderately steep with approximately 41,200 s.f. (0.95 acres) of the site with slopes over 20%. The steep slope areas are scattered throughout the site. The site also contains some ledge outcrops and many large boulders. Soils on the site are predominantly Charlton and Hollis series (hydrologic soil groups B & D). Vegetation on the site consists of a mixed hardwood forest with scattered pines. Surface water runoff generally flows from the northeast to the southwest. A wetland area exists which was delineated by Cynthia Rabinowitz and field surveyed by Dutton Associates.

Storm water runoff generally flows from the northeast to the southwest and ultimately to a wetland area east, southeast of the site, then water flows southerly through the wetland area to Hebron Avenue, and easterly along the northerly gutter of Hebron Avenue to a catch basin inlet by building #2390, thence southerly through a pipe system to a discharge locates at a wetland area just easterly of Sturgeon River Road.

A subsurface drainage system has been designed to collect runoff from the common driveway. The flows are directed to a detention pond located at the southwesterly corner of the site. The storm drain system was designed for the 10-year storm using the rational method. The gutter flow analysis, pipe design, and headwater analysis were conducted per the Connecticut DOT Drainage manual.

Proposed storm flows from the site are directed to a detention pond located along the southerly end of the site. Hydrology computations were conducted using the TR-55 Method with routing computations run using the Hydraflow Hydrographs program. The detention pond was sized to mitigate for any increase in flow for the 2-year through the 100-year storms. Additionally, a small diversion of an upper portion of one of the watersheds is proposed to mitigate of the increase in the volume of stormwater due to the development. The volume mitigation is proposed due the storm flows running through private property to the southeast vis a small intermittent watercourse and a concern for long term erosion of the channel.

The detention pond will also be used to treat the water quality volume (WQV) from the site. The detention pond has been designed to contain the entire water quality volume below the first outlet flow structure. The WQV will be collected using an underdrain system located at the bottom of the detention pond with the outflow from the underdrain regulated by an orifice sized to drain the WQV over a 40-hour period.

Below is a summary of the pre and post development flows and volumes from the site.

STORM FLOW SUMMARY

STORM	EXIST. "A"	EXIST. "B"	TOTAL EXIST.	PROP. "A"	PROP. "B"	TOTAL PROP.	Δ
YEAR	CFS	CFS	CFS	CFS	CFS	CFS	CFS
2	1.4	1.7	3.0	1.3	1.4	2.5	-0.5
10	4.1	6.8	10.4	3.7	5.7	9.2	-1.2
25	6.1	10.8	16.2	5.5	9.6	14.8	-1.4
50	7.5	14.0	20.8	6.9	12.8	19.4	-1.4
100	9.2	17.8	26.0	8.4	16.7	24.8	-1.2

VOLUME SUMMARY

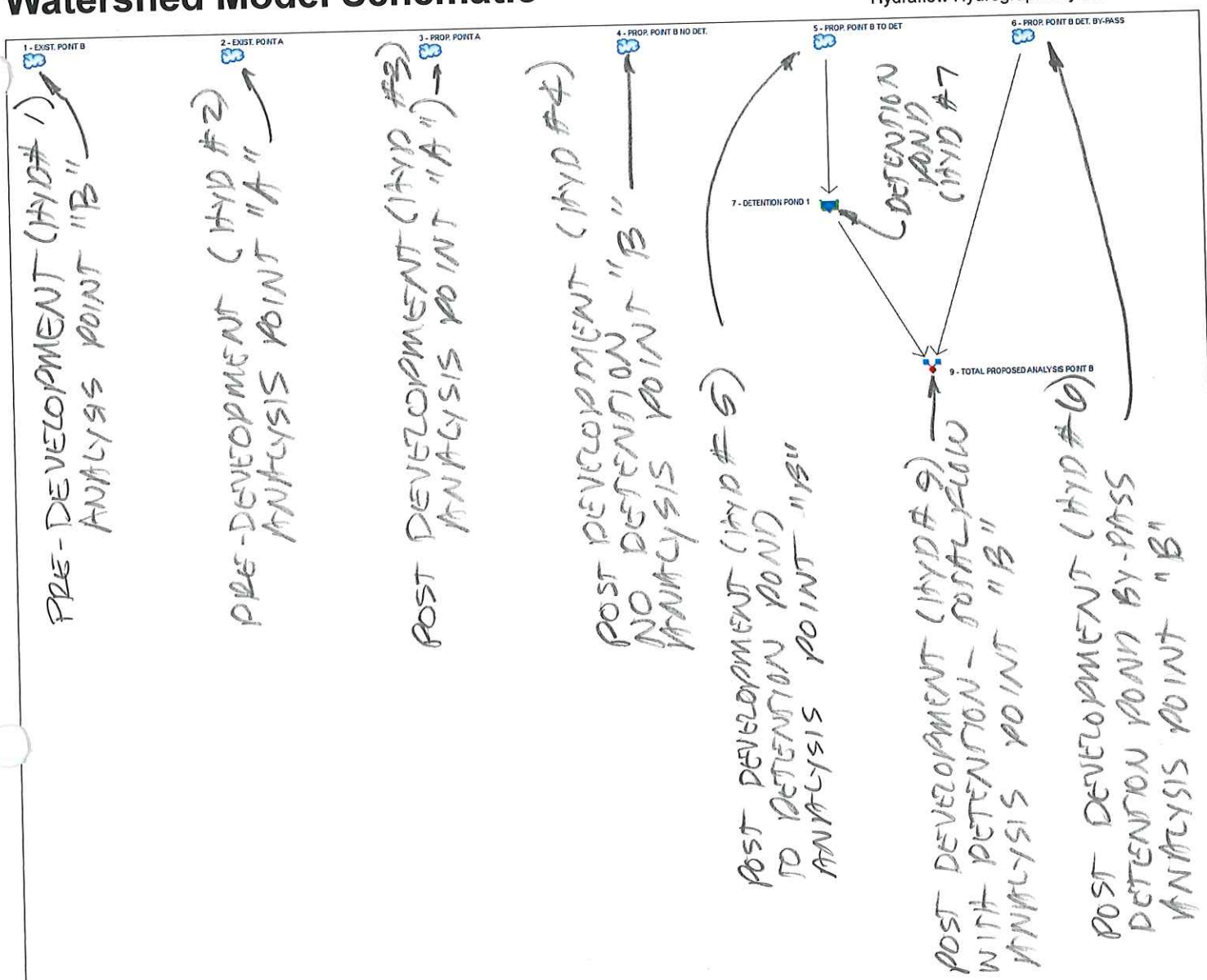
STORM	EXIST. "A"	EXIST. "B"	TOTAL EXIST.	PROP. "A"	PROP. "B"	TOTAL PROP.	Δ
YEAR	CUFT	CUFT	CUFT	CUFT	CUFT	CUFT	CUFT
2	11,160	20,731	31,890	10,861	21,486	32,246	+356
10	28,739	63,980	92,719	27,968	63,011	90,979	-1,740
25	41,429	97,256	138,685	40,318	94,658	134,976	-3,709
50	51,382	124,040	175,422	50,004	120,053	170,057	-5,365
100	62,695	155,006	217,701	61,014	149,360	210,373	-7,328

CONCLUSION

Based on the analysis conducted, the proposed Casella Development will not have an adverse impact on downstream properties.

Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.1



Legend

Hyd.	Origin	Description
1	SCS Runoff	EXIST. POINT B
2	SCS Runoff	EXIST. POINT A
3	SCS Runoff	PROP. POINT A
4	SCS Runoff	PROP. POINT B NO DET.
5	SCS Runoff	PROP. POINT B TO DET
6	SCS Runoff	PROP. POINT B DET. BY-PASS
7	Reservoir	DETENTION POND 1
9	Combine	TOTAL PROPOSED ANALYSIS POINT B

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	4 30	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	4 30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

PREPARED BY	DATE PREPARED	**DUTTON ASSOCIATES, LLC**	JOB NUMBER	PAGE NUMBER
		67 EASTERN BOULEVARD		6
CHECKED BY	DATE CHECKED	GLASTONBURY, CONNECTICUT 06033	CLIENT NAME	TOTAL PAGES
		TEL: (860)-633-9401 FAX: (860)-633-8851		
		EMAIL: JIMD@DUTTONASSOCIATESLLC.COM		

EXISTING - ANALYSIS POINT A

TOTAL AREA = 177637 SF

TOTAL AREA B = 95,553 SF

TOTAL AREA D = 82,084 SF

(HYDROGRAPH #2)

B WOODS = 34,885 + 15851 = 50,736 SF = 1.16 AC
GRASS = 30,971 SF = 0.71 AC
PAVED = 276 + 6089 + 4938 + 543 = 13,846 SF = 0.32 AC

D WOODS = 180879 SF = 1.86 AC
GRASS = 1205 SF = 0.03 AC
PAVED = 0

TC

150' C 14.7% WOODS, MANN. = 0.10
590' C 20% UNPAVED
68' C 1% PAVED

TR55 Tc Worksheet

Hyd. No. 2

EXIST. POINT A

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.15	0.00	0.00	
Travel Time (min)	**= 28.42**	**+ 0.00**	**+ 0.00**	**= 28.42**
Shallow Concentrated Flow				
Flow length (ft)	= 590.00	68.00	0.00	
Watercourse slope (%)	= 0.20	0.01	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 0.72	0.20	0.00	
Travel Time (min)	**= 13.63**	**+ 5.58**	**+ 0.00**	**= 19.20**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Total Travel Time, Tc				**47.62 min**

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EXISTING - ANALYSIS POINT B

TOTAL AREA = 539,230 (HYDROGRAPH #1)

TOTAL AREA D = 163,955

TOTAL B = 375,275

B WOODS = 10,975 + 304,085 SF = 315,060 SF = 7.23 AC
GRASS = 21,652 + 26,397 = 48,049 = 1.10 AC
PAVED = 1198 SF = 0.03 AC

D WOODS = 148,663 + 22,300 SF = 170,963 SF = 3.92 AC
GRASS = 0
PAVED = 0

TC

150' @ 14.6% WOODS, MANNING = 0.10
660' @ 20.0% UNPAVED
682' @ 4.4% UNPAVED

TR55 Tc Worksheet

Hyd. No. 1

EXIST. POINT B

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.19	0.00	0.00	
Travel Time (min)	**= 25.65**	**+ 0.00**	**+ 0.00**	**= 25.65**
Shallow Concentrated Flow				
Flow length (ft)	= 660.00	682.00	0.00	
Watercourse slope (%)	= 0.20	0.04	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 0.72	0.34	0.00	
Travel Time (min)	**= 15.24**	**+ 33.59**	**+ 0.00**	**= 48.83**
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	= 0.050	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 74.48 min

EXISTING

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.1

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	-------	-------	1.722	-------	-------	6.801	10.82	14.04	17.75	EXIST. POINT B
2	SCS Runoff	-------	-------	1.441	-------	-------	4.124	6.050	7.550	9.240	EXIST. POINT A
3	SCS Runoff	-------	-------	1.306	-------	-------	3.745	5.494	6.859	8.397	PROP. POINT A
4	SCS Runoff	-------	-------	1.895	-------	-------	7.088	11.12	14.34	18.05	PROP. POINT B NO DET.
5	SCS Runoff	-------	-------	1.451	-------	-------	3.762	5.376	6.616	8.002	PROP. POINT B TO DET
6	SCS Runoff	-------	-------	0.977	-------	-------	4.342	7.113	9.363	11.97	PROP. POINT B DET. BY-PASS
7	Reservoir	5	-------	0.552	-------	-------	1.839	3.125	4.184	5.457	DETENTION POND 1
9	Combine	6, 7,	-------	1.512	-------	-------	6.092	10.15	13.46	17.37	TOTAL PROPOSED ANALYSIS PO

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

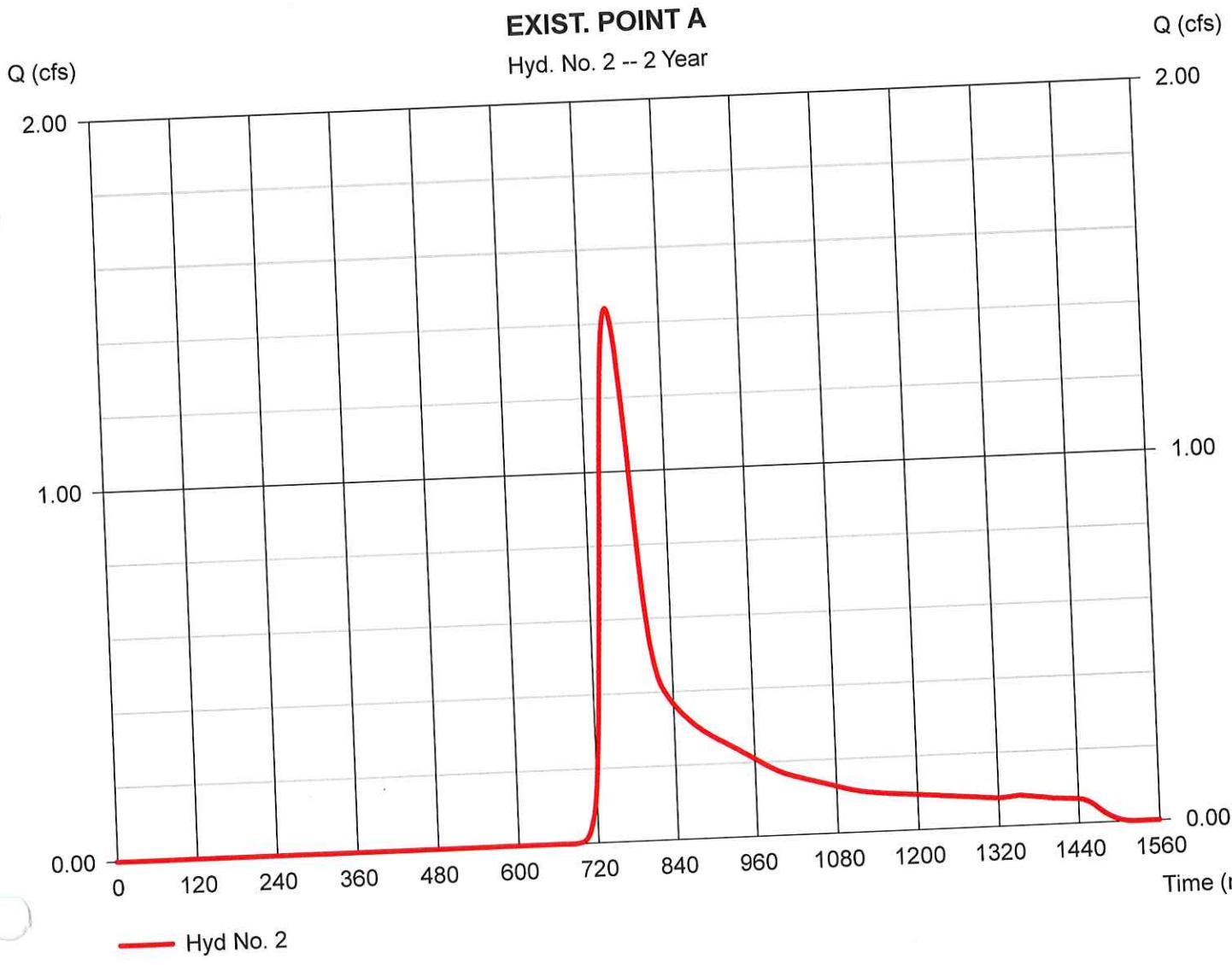
Saturday, Jan 4, 2020

Hyd. No. 2

EXIST. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.441 cfs
Storm frequency	= 2 yrs	Time to peak	= 760 min
Time interval	= 2 min	Hyd. volume	= 11,160 cuft
Drainage area	= 4.080 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.60 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.160 x 55) + (0.710 x 61) + (0.320 x 98) + (1.860 x 77) + (0.030 x 80)] / 4.080



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

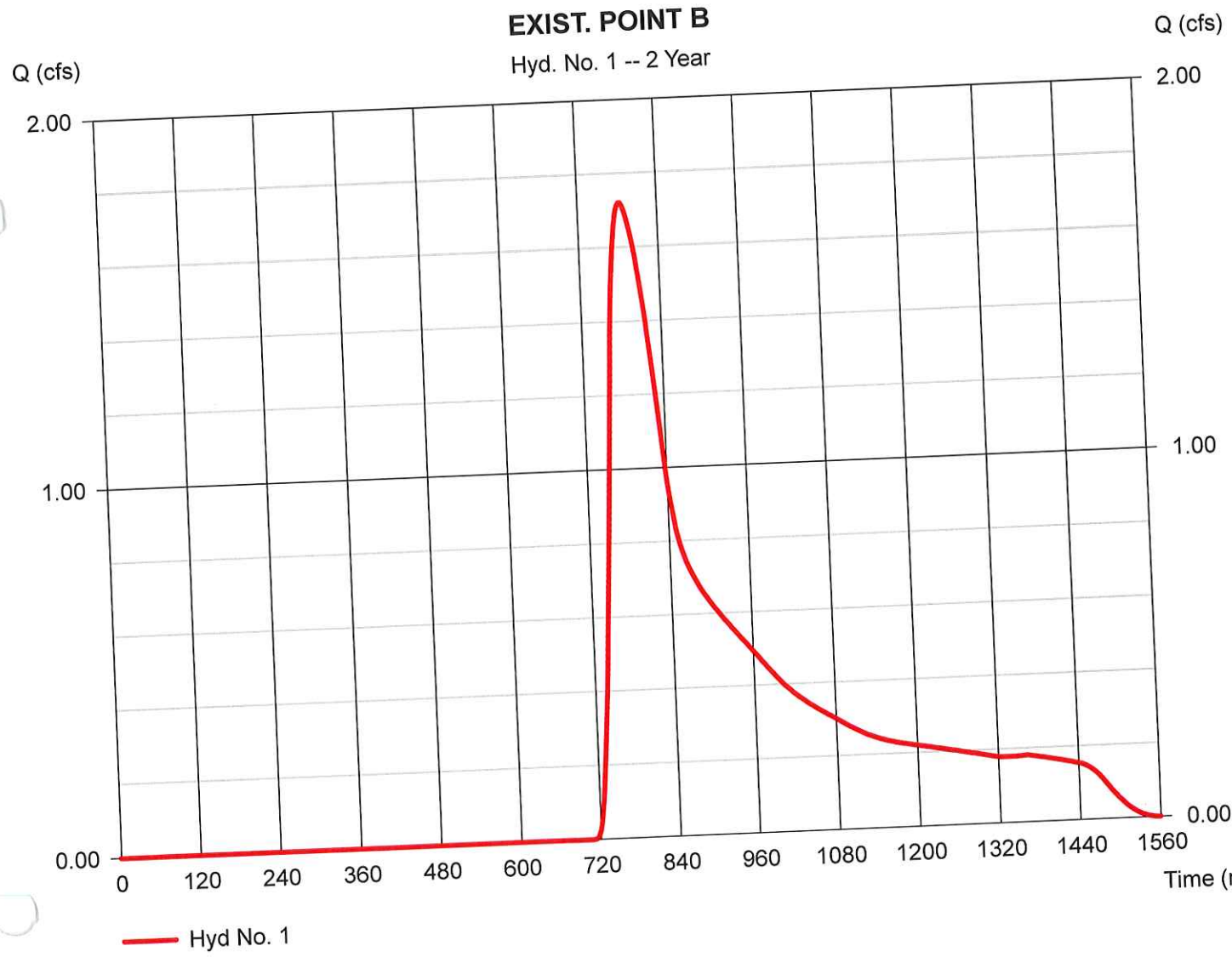
Saturday, Jan 4, 2020

Hyd. No. 1

EXIST. POINT B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.722 cfs
Storm frequency	= 2 yrs	Time to peak	= 784 min
Time interval	= 2 min	Hyd. volume	= 20,731 cuft
Drainage area	= 12.280 ac	Curve number	= 63*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 74.50 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.230 x 55) + (1.100 x 61) + (0.030 x 98) + (3.920 x 77)] / 12.280



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

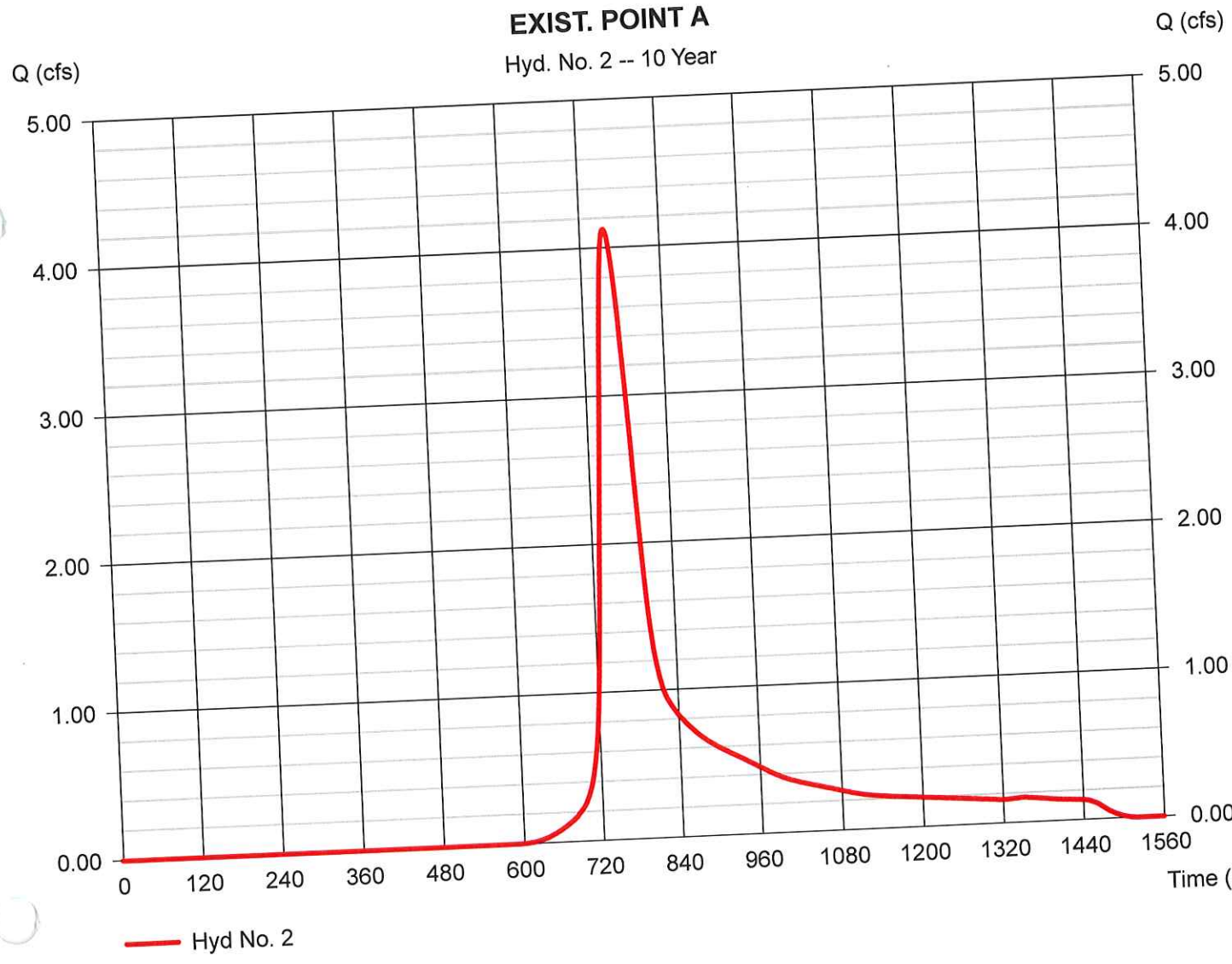
Saturday, Jan 4, 2020

Hyd. No. 2

EXIST. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 4.124 cfs
Storm frequency	= 10 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 28,739 cuft
Drainage area	= 4.080 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.60 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.160 x 55) + (0.710 x 61) + (0.320 x 98) + (1.860 x 77) + (0.030 x 80)] / 4.080



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

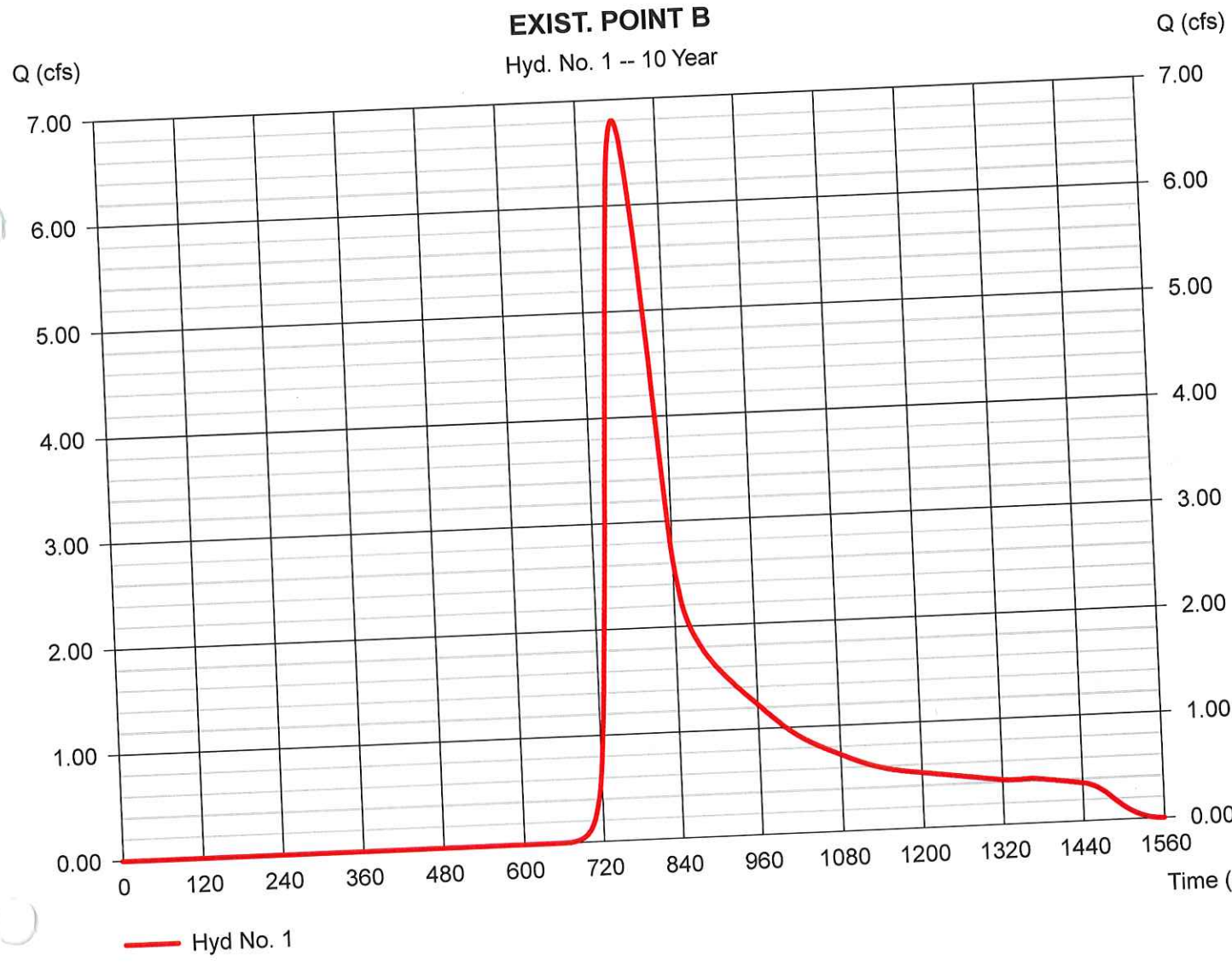
Saturday, Jan 4, 2020

Hyd. No. 1

EXIST. POINT B

Hydrograph type	= SCS Runoff	Peak discharge	= 6.801 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 63,980 cuft
Drainage area	= 12.280 ac	Curve number	= 63*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 74.50 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.230 x 55) + (1.100 x 61) + (0.030 x 98) + (3.920 x 77)] / 12.280



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

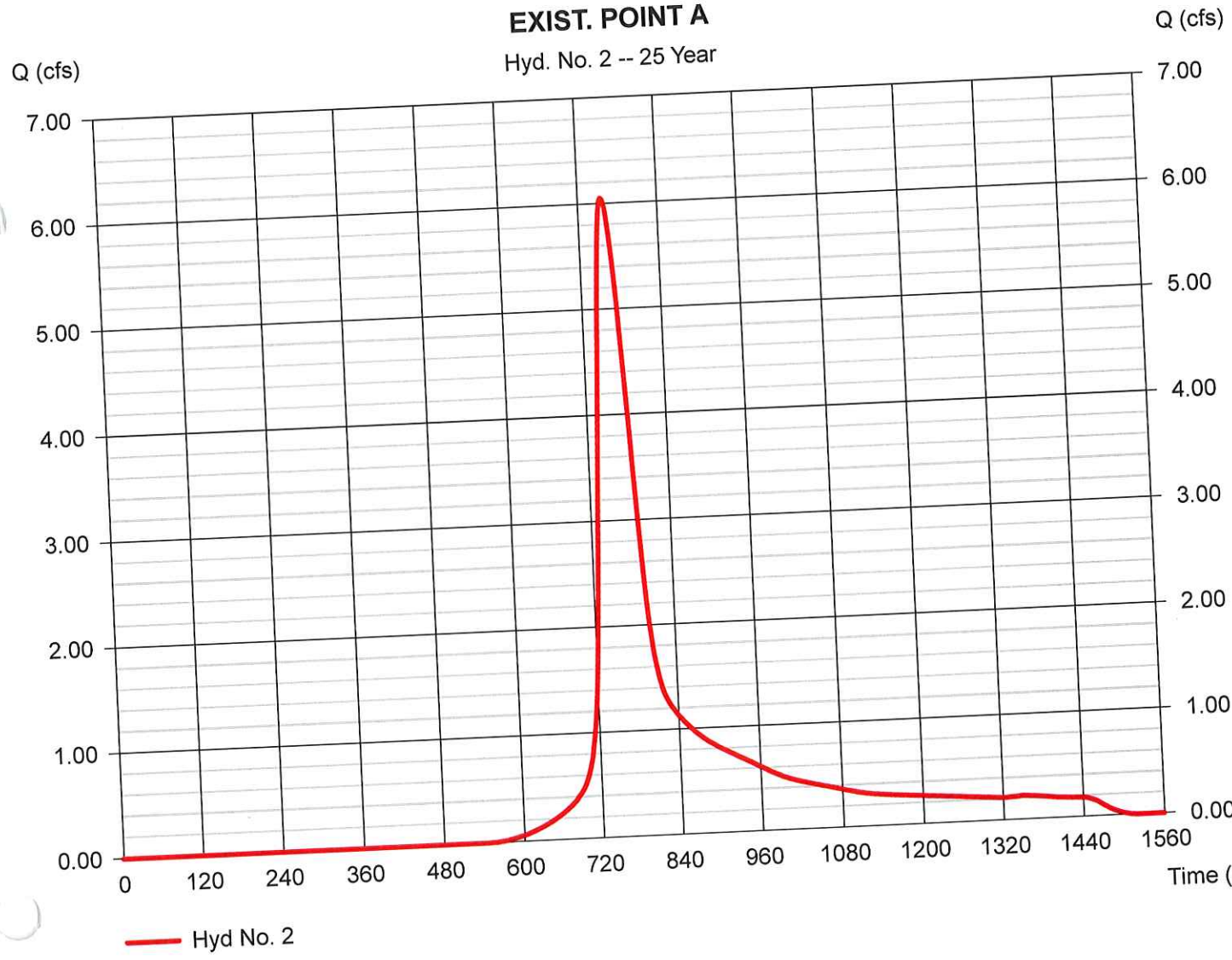
Saturday, Jan 4, 2020

Hyd. No. 2

EXIST. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 6.050 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 41,429 cuft
Drainage area	= 4.080 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.60 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.160 x 55) + (0.710 x 61) + (0.320 x 98) + (1.860 x 77) + (0.030 x 80)] / 4.080



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

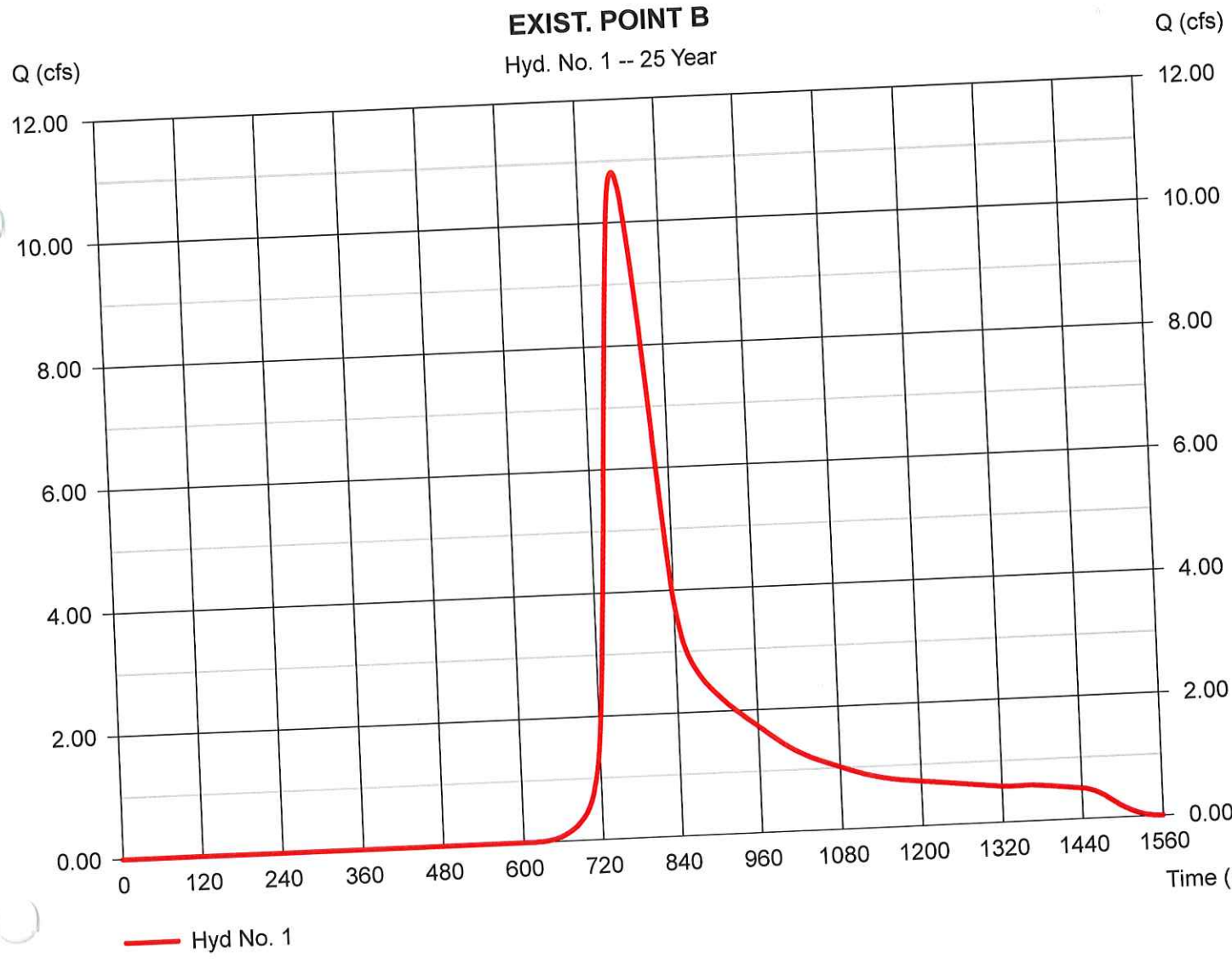
Saturday, Jan 4, 2020

Hyd. No. 1

EXIST. POINT B

Hydrograph type	= SCS Runoff	Peak discharge	= 10.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 97,256 cuft
Drainage area	= 12.280 ac	Curve number	= 63*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 74.50 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.230 x 55) + (1.100 x 61) + (0.030 x 98) + (3.920 x 77)] / 12.280



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

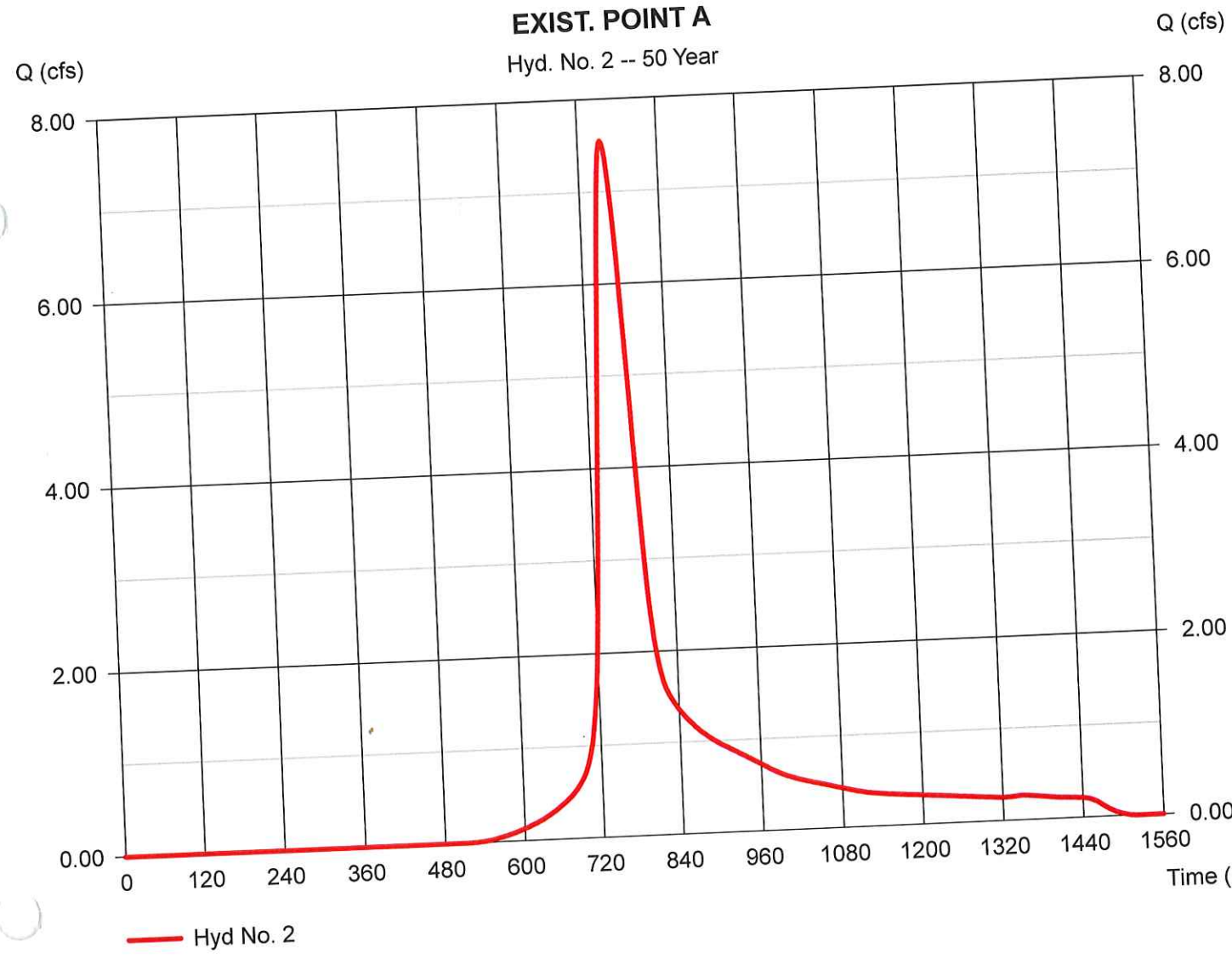
Saturday, Jan 4, 2020

Hyd. No. 2

EXIST. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 7.550 cfs
Storm frequency	= 50 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 51,382 cuft
Drainage area	= 4.080 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.60 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.160 x 55) + (0.710 x 61) + (0.320 x 98) + (1.860 x 77) + (0.030 x 80)] / 4.080



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

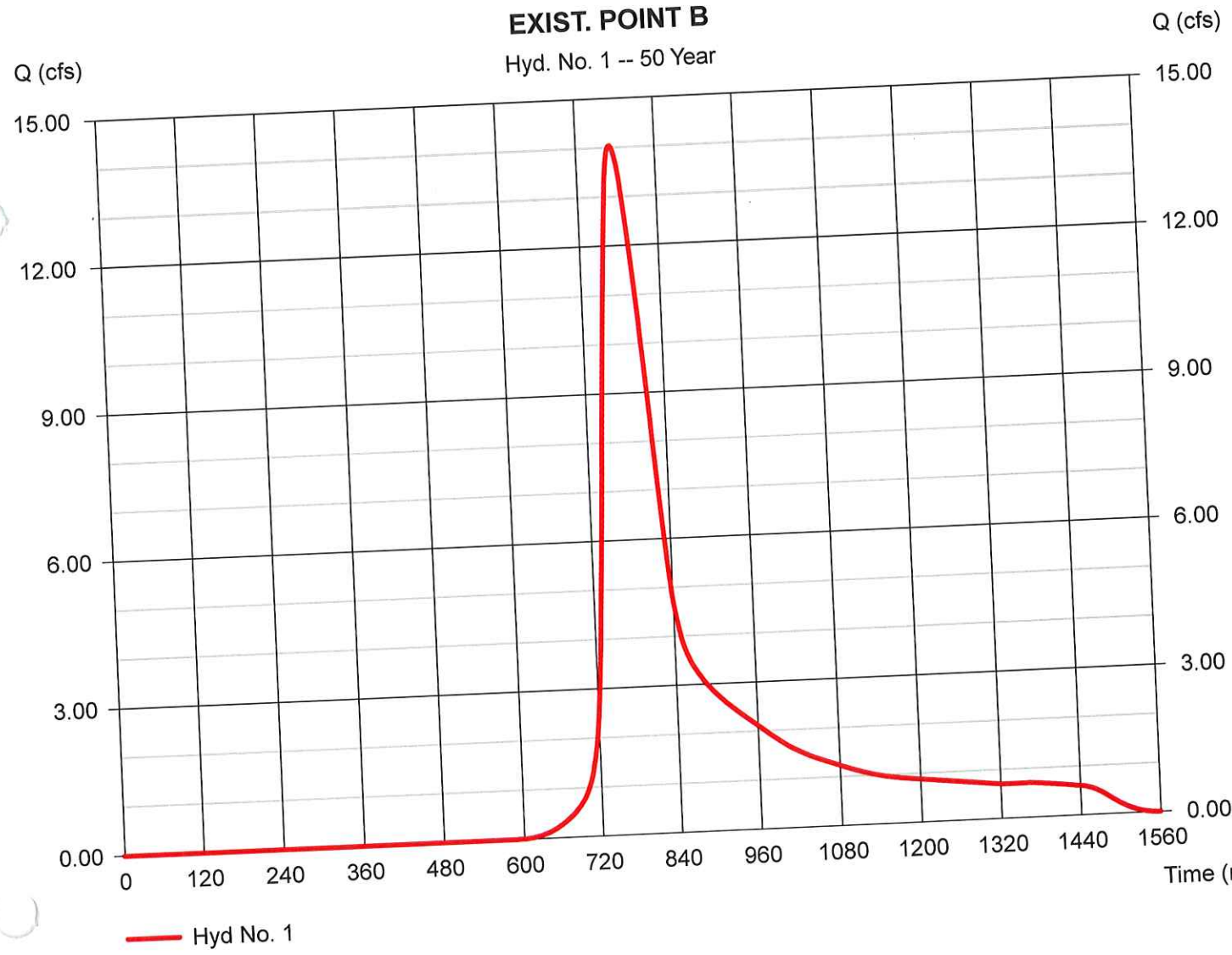
Saturday, Jan 4, 2020

Hyd. No. 1

EXIST. POINT B

Hydrograph type	= SCS Runoff	Peak discharge	= 14.04 cfs
Storm frequency	= 50 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 124,040 cuft
Drainage area	= 12.280 ac	Curve number	= 63*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 74.50 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.230 x 55) + (1.100 x 61) + (0.030 x 98) + (3.920 x 77)] / 12.280



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

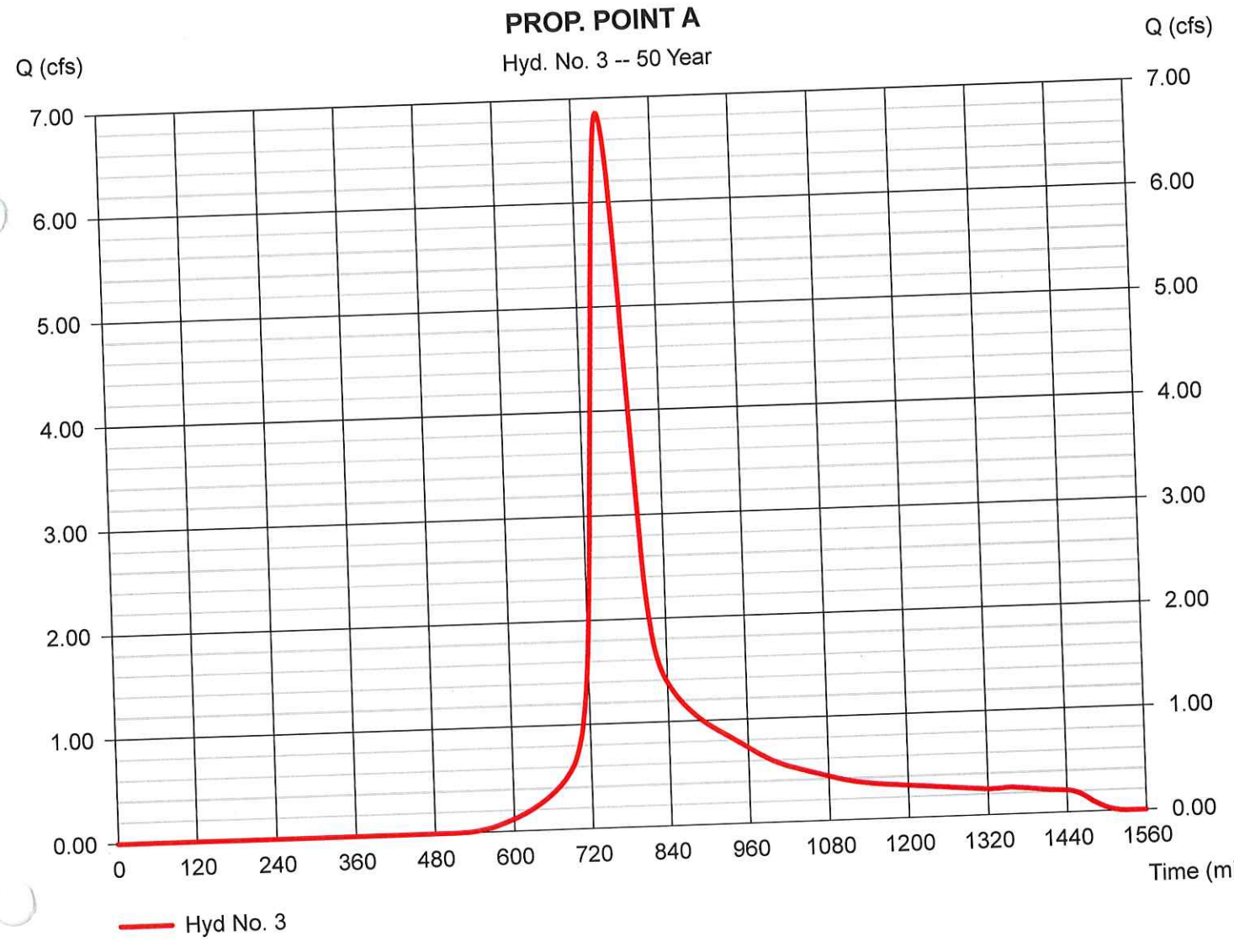
Saturday, Jan 4, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 6.859 cfs
Storm frequency	= 50 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 50,004 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



PREPARED BY	DATE PREPARED	**DUTTON ASSOCIATES, LLC**	JOB NUMBER	PAGE NUMBER
		67 EASTERN BOULEVARD GLASTONBURY, CONNECTICUT 06033 TEL: (860)-633-9401 FAX: (860)-633-8851 EMAIL: JIMD@DUTTONASSOCIATESLLC.COM		20
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

PROPOSED ANALYSIS POINT A

TOTAL AREA = 173,964 SF

TOTAL AREA B = 93,079 (HYDROGRAPH #3)

TOTAL AREA D = 80,885 SF

B WOODS 34,541 + 10699 = 45,240 SF = 1.04 AC
GRASS 33,054 SF = 0.76 AC
PAVED 13846 + 870 = 14716 SF 0.34 AC

D WOODS = 78,442 SF = 1.80 AC
GRASS = 1205 + 1238 = 2443 SF = 0.06 AC
PAVED = 0

TC 150 C 14.7 % MANN = 0.10
600 ' C 19.5 % UNPAVED
75 ' C 1.0 % PAVED

TR55 Tc Worksheet

Hyd. No. 3

PROP. POINT A

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.15	0.00	0.00	
Travel Time (min)	**= 28.42**	**+ 0.00**	**+ 0.00**	**= 28.42**
Shallow Concentrated Flow				
Flow length (ft)	= 563.00	165.00	0.00	
Watercourse slope (%)	= 0.20	0.01	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 0.72	0.20	0.00	
Travel Time (min)	**= 12.97**	**+ 13.53**	**+ 0.00**	**= 26.50**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Total Travel Time, Tc				**54.92 min**

PREPARED BY	DATE PREPARED	**DUTTON ASSOCIATES, LLC**	JOB NUMBER	PAGE NUMBER
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CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

ANALYSIS POINT IS PROPOSED NO DETENTION

TOTAL AREA = 542,915 SF

TOTAL B = 375,616 SF (HYDROGRAPH # 4)

TOTAL D = 167299 SF

B WOODS = 296,251 SF = 6.80 AC
B GRASS = 68,420 SF = 1.57 AC
B PAVED = 10,945 SF = 0.25 AC

D WOODS = 128,584 SF = 2.95 AC
D GRASS = 29,820 SF = 0.68 AC
D PAVED = 8895 SF = 0.20 AC

TC
150' @ 14.6% WOODS n = 0.10
659' @ 24.5% UNPAVED
710' @ 4.4% UNPAVED

TR55 Tc Worksheet

Hyd. No. 4

PROP. POINT B NO DET.

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.15	0.00	0.00	
Travel Time (min)	**= 28.50**	**+ 0.00**	**+ 0.00**	**= 28.50**
Shallow Concentrated Flow				
Flow length (ft)	= 658.00	682.00	0.00	
Watercourse slope (%)	= 0.20	0.04	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 0.72	0.34	0.00	
Travel Time (min)	**= 15.20**	**+ 33.59**	**+ 0.00**	**= 48.78**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 77.28 min

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PROPOSED ANALYSIS POINT B DETENTION BY-PASS

TOTAL AREA = 400,423 SF

TOTAL AREA B = 314,452 SF (HYDROGRAPH #6)

TOTAL AREA D = 85,971 SF

B WOODS = 3213 + 125,792 + 117985 + 6055 + 964 = 254,009 SF = 5.83 AC
GRASS = 48,931 SF = 1.12 AC
PAVED = 1204 = 0.03 AC

D WOODS = 31,635 + 22,595 + 26,300 = 50,530 SF = 1.16 AC
GRASS = 4,356 SF = 0.10 AC
PAVED = 0

TC
150' @ 32.3% WOODS n = 0.10
309' @ 22.2' UNPAVED
715 @ 4.2% UNPAVED

PREPARED BY	DATE PREPARED	**DUTTON ASSOCIATES, LLC**	JOB NUMBER	PAGE NUMBER
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ANALYSIS POINT B, PROPOSED TO DETENTION POND

TOTAL AREA = 142,492 SF

TOTAL B = 56318 + 4846 = 61,164 SF

TOTAL D = 81,328 SF

B WOODS = 4846 + 23,547 + 3541 = 31,934 SF = 0.73 AC
B GRASS = 19,489 SF = 0.45 AC
B PAVED = 6863 + 2878 = 9741 SF = 0.22 AC

D WOODS = 9086 + 48,197 = 57,283 SF = 1.32 AC
D GRASS = 15,150 SF = 0.35 AC
D PAVED = 8895 = 0.20 AC

TC

150' @ 11.8% WOODS (n = 0.10)
546' @ 19.6% UNPAVED
505' PIPE FLOW - 14% - 12" Ø

TR55 Tc Worksheet

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.32	0.00	0.00	
Travel Time (min)	**= 20.73**	**+ 0.00**	**+ 0.00**	**= 20.73**
Shallow Concentrated Flow				
Flow length (ft)	= 309.00	715.00	0.00	
Watercourse slope (%)	= 0.22	0.04	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	= 0.76	0.33	0.00	
Travel Time (min)	**= 6.81**	**+ 35.78**	**+ 0.00**	**= 42.59**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... **63.30 min**

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.1

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	-------	-------	1.722	-------	-------	6.801	10.82	14.04	17.75	EXIST. POINT B
2	SCS Runoff	-------	-------	1.441	-------	-------	4.124	6.050	7.550	9.240	EXIST. POINT A
3	SCS Runoff	-------	-------	1.306	-------	-------	3.745	5.494	6.859	8.397	PROP. POINT A
4	SCS Runoff	-------	-------	1.895	-------	-------	7.088	11.12	14.34	18.05	PROP. POINT B NO DET.
5	SCS Runoff	-------	-------	1.451	-------	-------	3.762	5.376	6.616	8.002	PROP. POINT B TO DET
6	SCS Runoff	-------	-------	0.868	-------	-------	4.170	6.935	9.195	11.82	PROP. POINT B DET. BY-PASS
7	Reservoir	5	-------	0.552	-------	-------	1.839	3.125	4.184	5.457	DETENTION POND 1
8	Combine	1, 2,	-------	2.947	-------	-------	10.44	16.20	20.77	26.00	TOTAL EXISTING
9	Combine	6, 7,	-------	1.369	-------	-------	5.753	9.719	12.98	16.85	TOTAL PROPOSED ANALYSIS PO
10	Combine	3, 9	-------	2.495	-------	-------	9.224	14.83	19.40	24.77	TOTAL PROPOSED

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

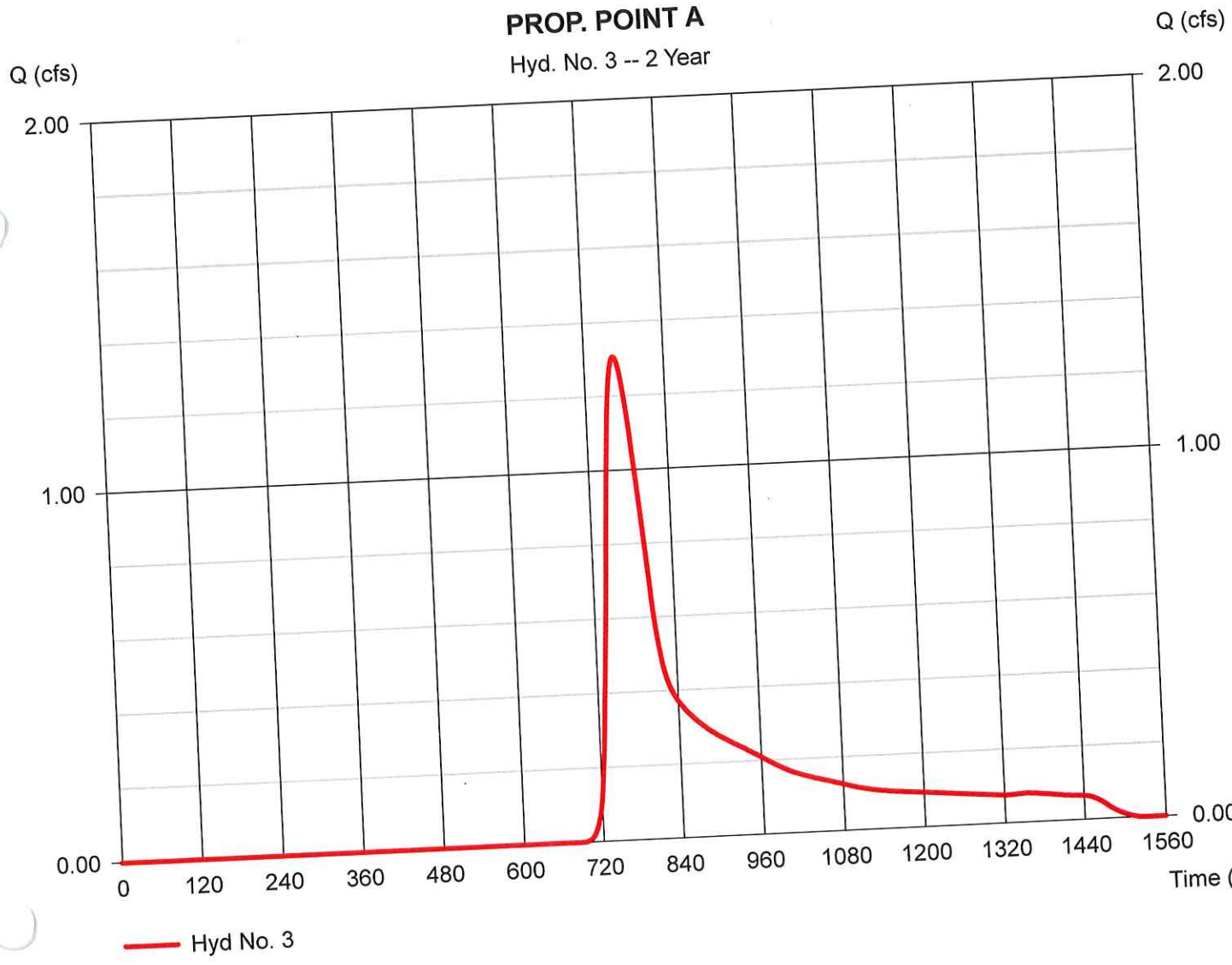
Saturday, Jan 4, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.306 cfs
Storm frequency	= 2 yrs	Time to peak	= 764 min
Time interval	= 2 min	Hyd. volume	= 10,861 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

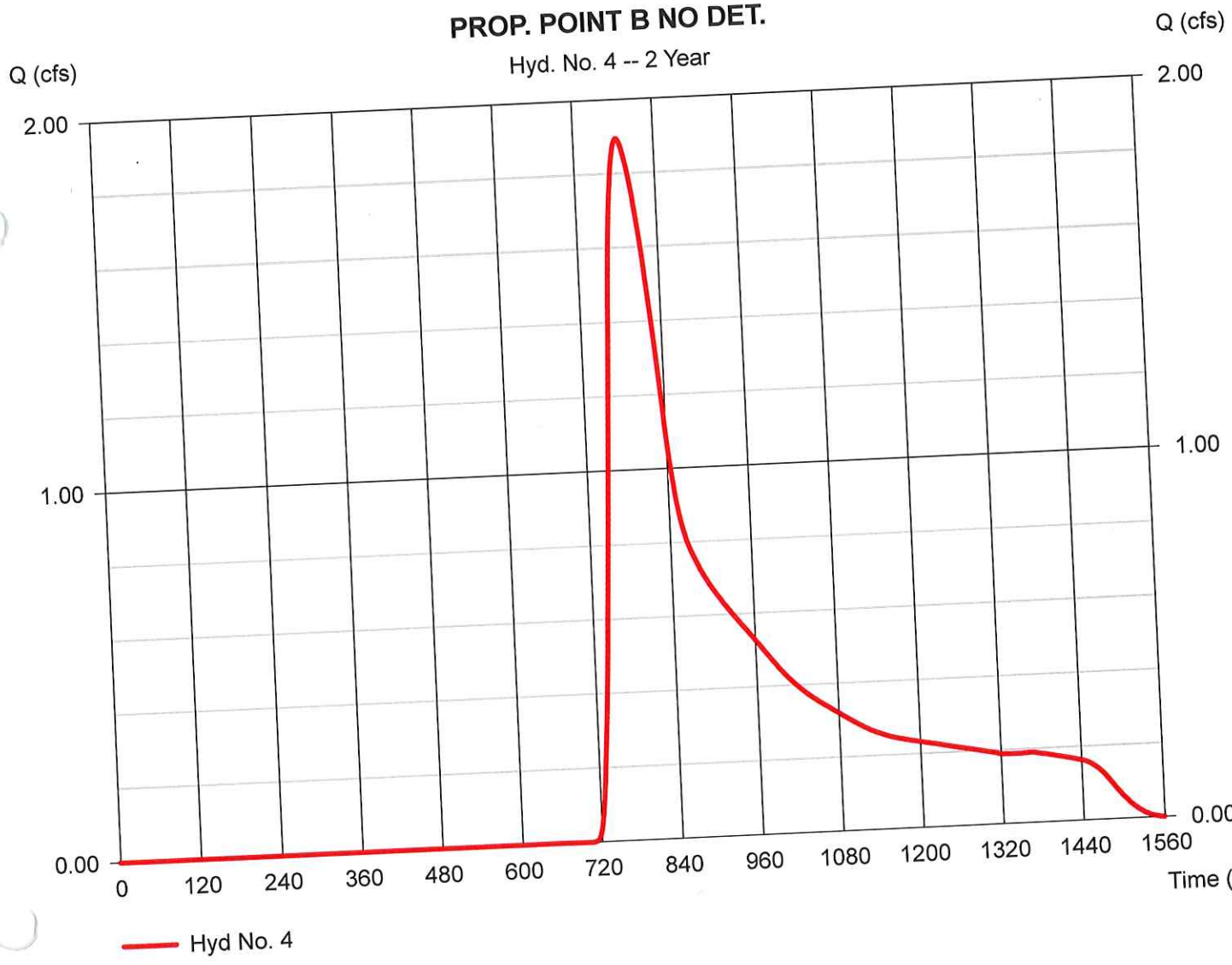
Saturday, Jan 4, 2020

Hyd. No. 4

PROP. POINT B NO DET.

Hydrograph type	= SCS Runoff	Peak discharge	= 1.895 cfs
Storm frequency	= 2 yrs	Time to peak	= 784 min
Time interval	= 2 min	Hyd. volume	= 22,460 cuft
Drainage area	= 12.450 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.30 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.800 x 55) + (1.570 x 61) + (0.250 x 98) + (2.950 x 77) + (0.680 x 80) + (0.200 x 98)] / 12.450



Hydrograph Report

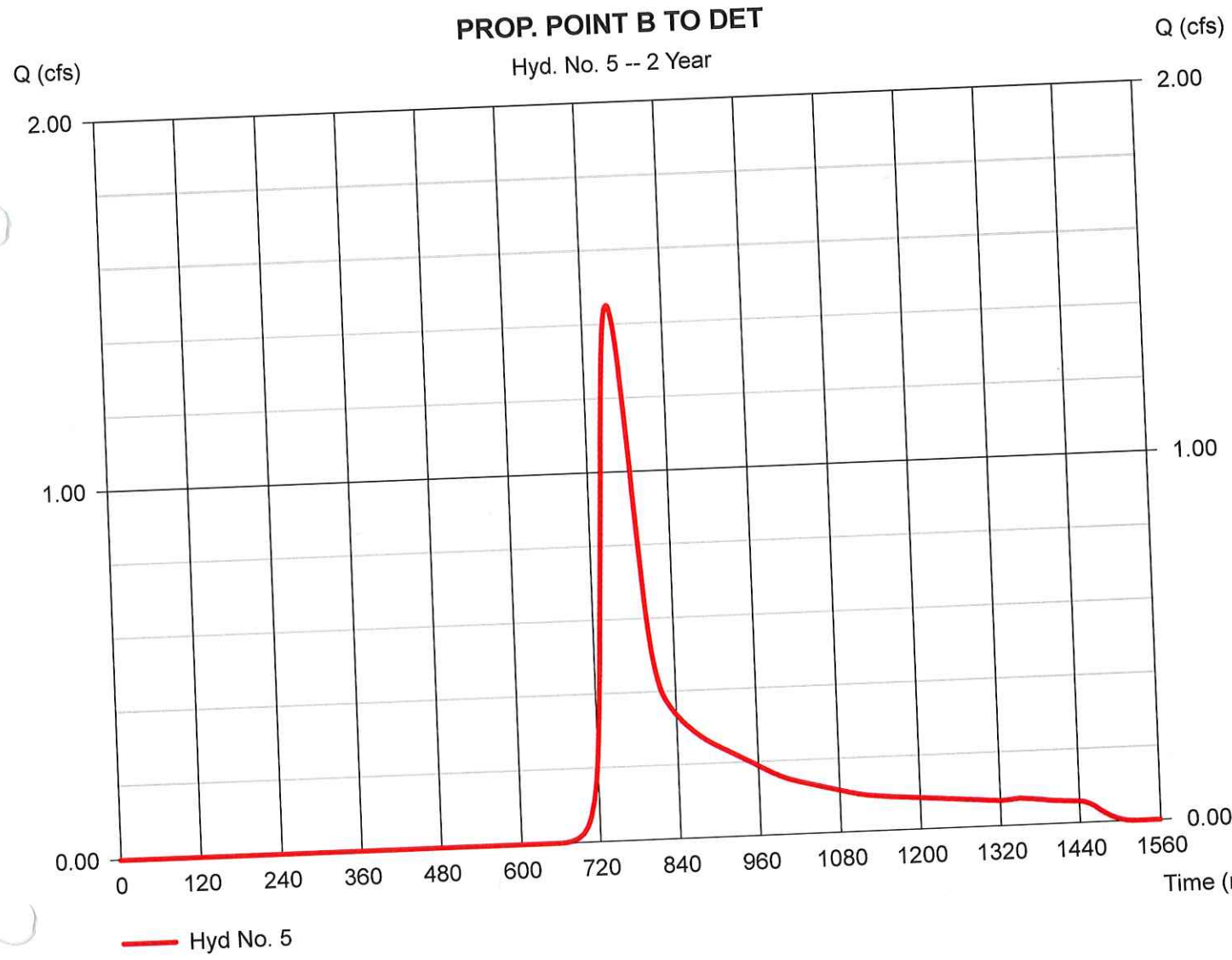
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5

PROP. POINT B TO DET

Hydrograph type	= SCS Runoff	Peak discharge	= 1.451 cfs
Storm frequency	= 2 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 10,691 cuft
Drainage area	= 3.270 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.70 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.730 x 55) + (0.450 x 61) + (0.220 x 98) + (1.320 x 77) + (0.350 x 80) + (0.200 x 98)] / 3.270



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

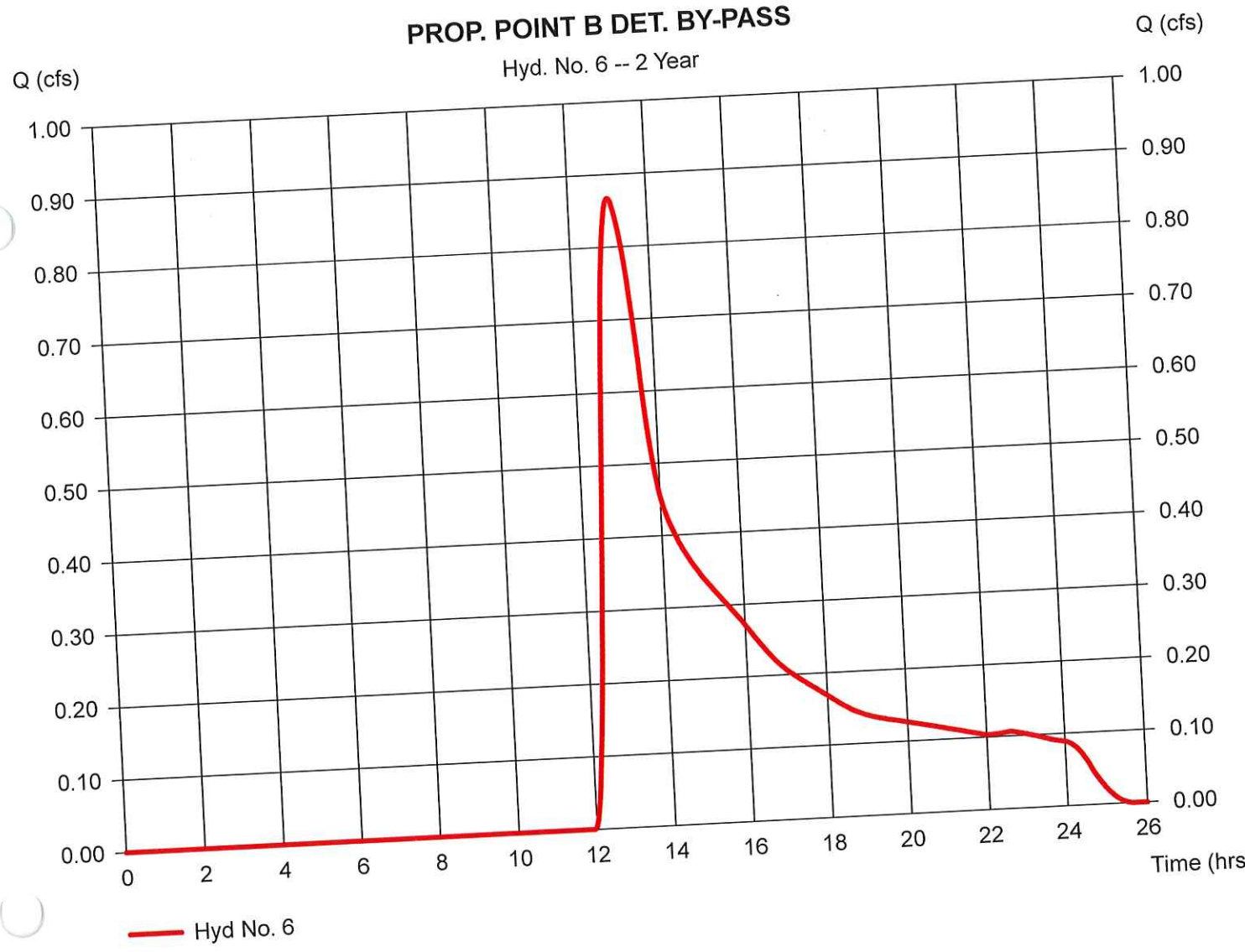
Monday, Sep 28, 2020

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.868 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.00 hrs
Time interval	= 2 min	Hyd. volume	= 10,911 cuft
Drainage area	= 8.320 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 63.30 min
Total precip.	= 3.07 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.830 x 55) + (1.120 x 61) + (0.110 x 98) + (1.160 x 77) + (0.100 x 80)] / 8.320



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

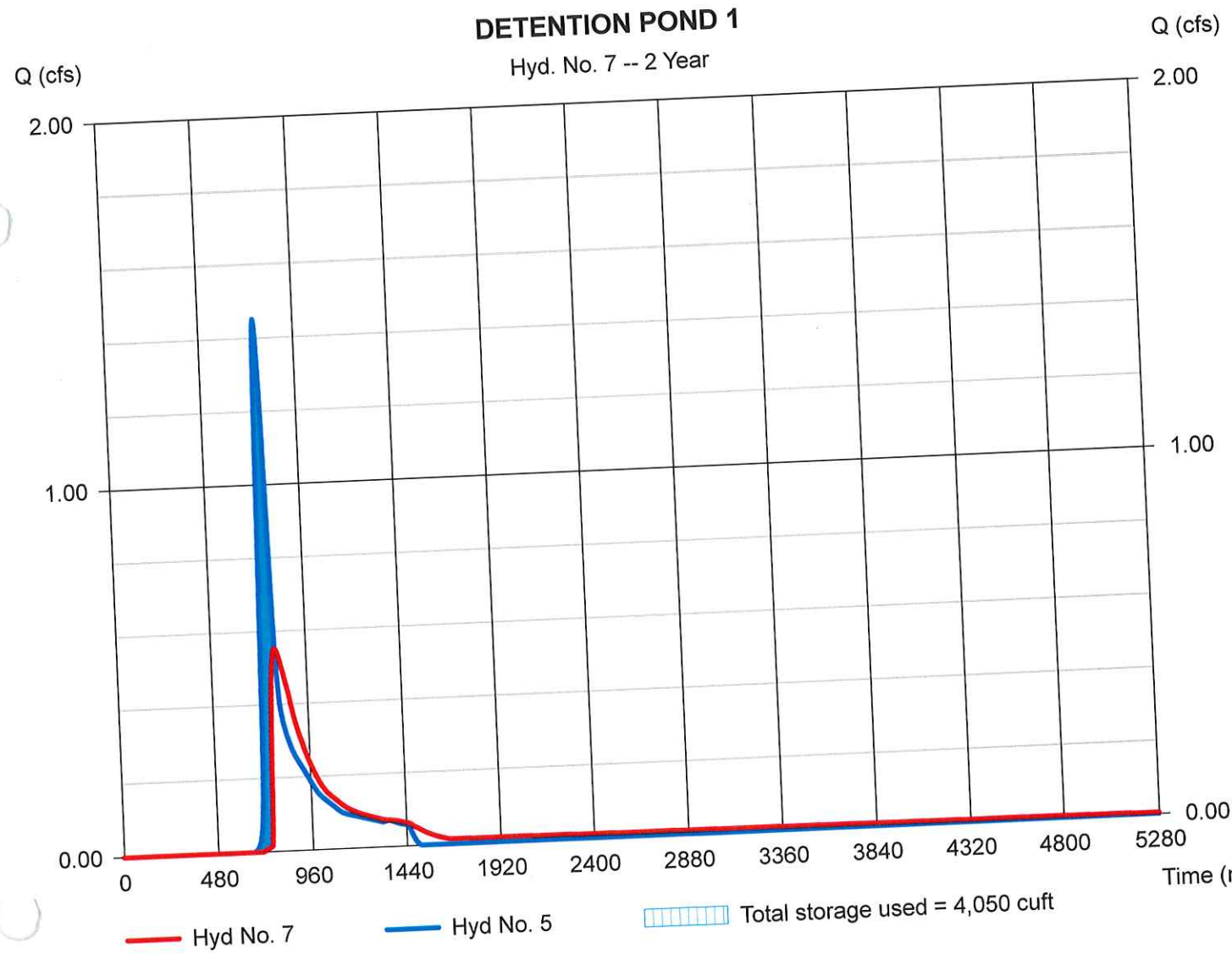
Saturday, Jan 4, 2020

Hyd. No. 7

DETENTION POND 1

Hydrograph type	= Reservoir	Peak discharge	= 0.552 cfs
Storm frequency	= 2 yrs	Time to peak	= 804 min
Time interval	= 2 min	Hyd. volume	= 10,575 cuft
Inflow hyd. No.	= 5 - PROP. POINT B TO DET	Max. Elevation	= 521.23 ft
Reservoir name	= <New Pond>	Max. Storage	= 4,050 cuft

Storage Indication method used.



Hydrograph Report

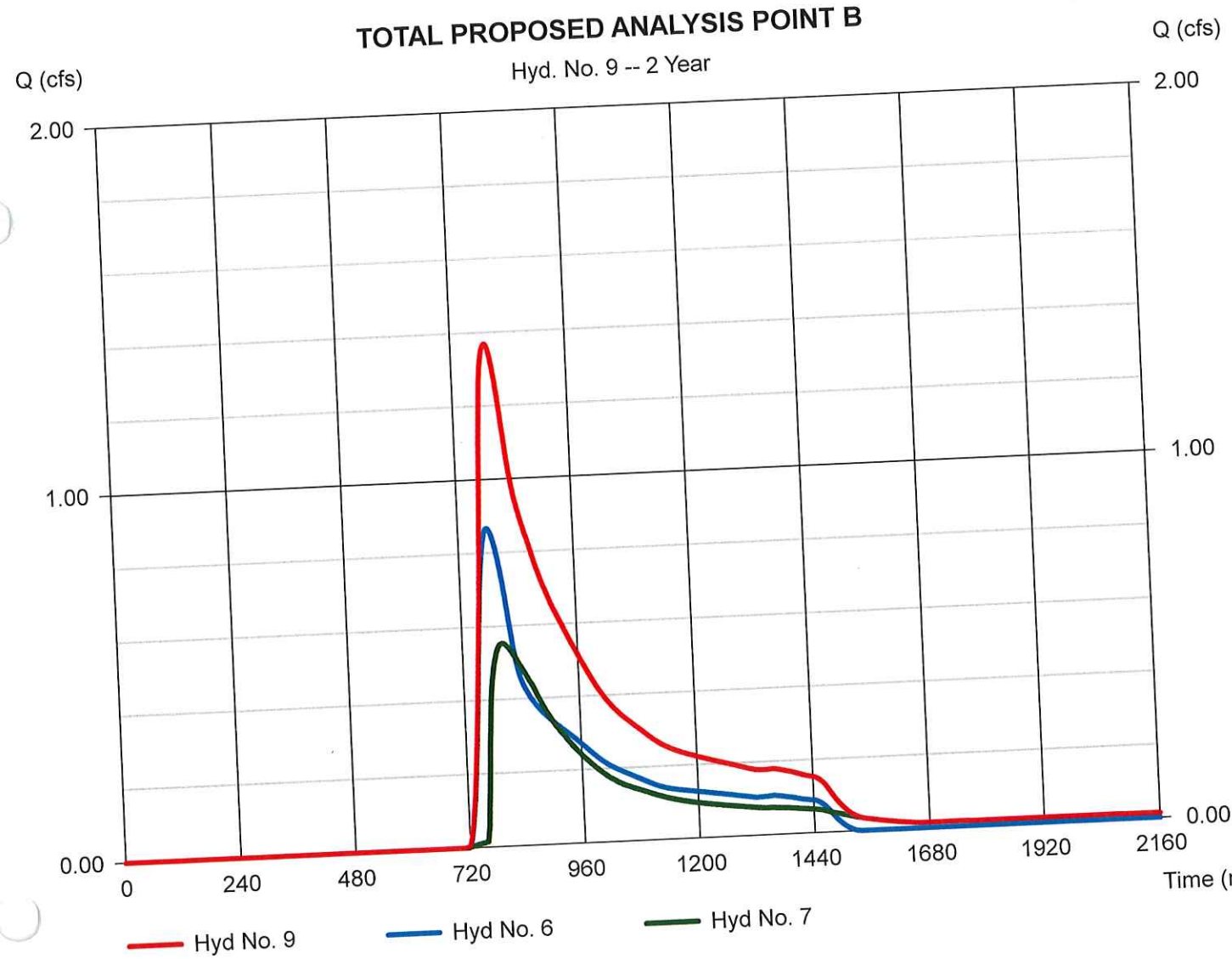
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 9

TOTAL PROPOSED ANALYSIS POINT B

Hydrograph type	= Combine	Peak discharge	= 1.369 cfs
Storm frequency	= 2 yrs	Time to peak	= 790 min
Time interval	= 2 min	Hyd. volume	= 21,486 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 8.320 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

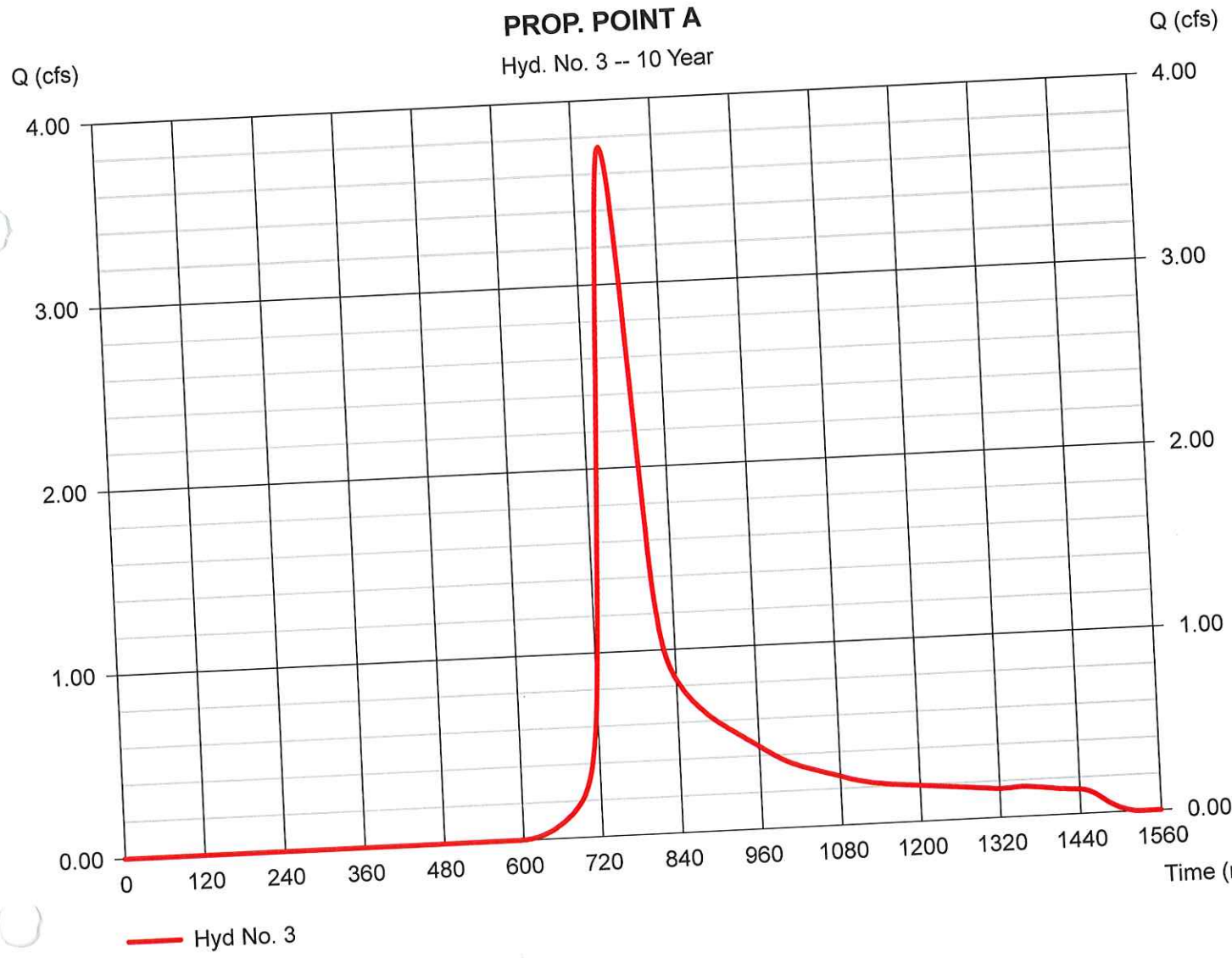
Saturday, Jan 4, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.745 cfs
Storm frequency	= 10 yrs	Time to peak	= 760 min
Time interval	= 2 min	Hyd. volume	= 27,968 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

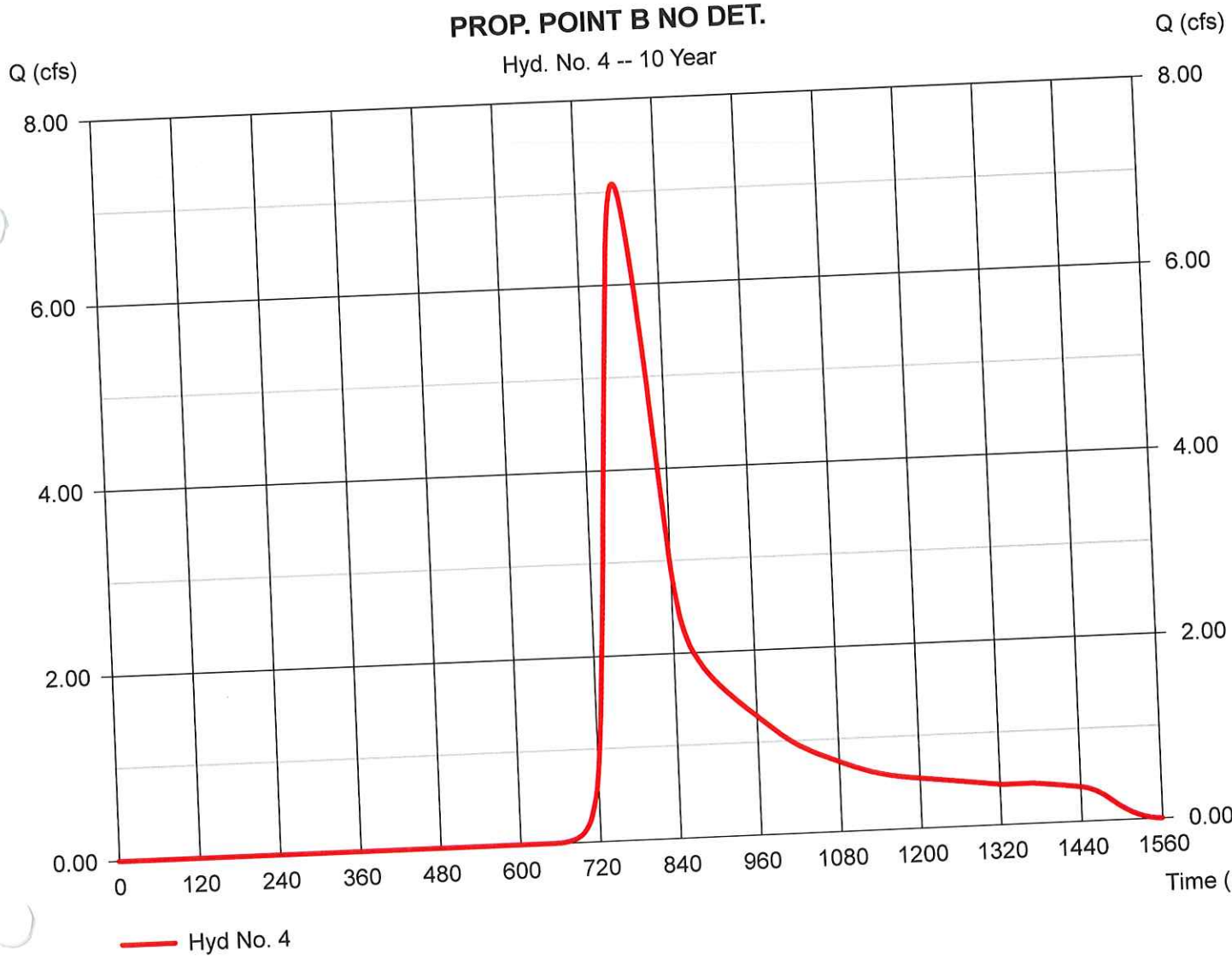
Saturday, Jan 4, 2020

Hyd. No. 4

PROP. POINT B NO DET.

Hydrograph type	= SCS Runoff	Peak discharge	= 7.088 cfs
Storm frequency	= 10 yrs	Time to peak	= 776 min
Time interval	= 2 min	Hyd. volume	= 67,278 cuft
Drainage area	= 12.450 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.30 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.800 x 55) + (1.570 x 61) + (0.250 x 98) + (2.950 x 77) + (0.680 x 80) + (0.200 x 98)] / 12.450



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

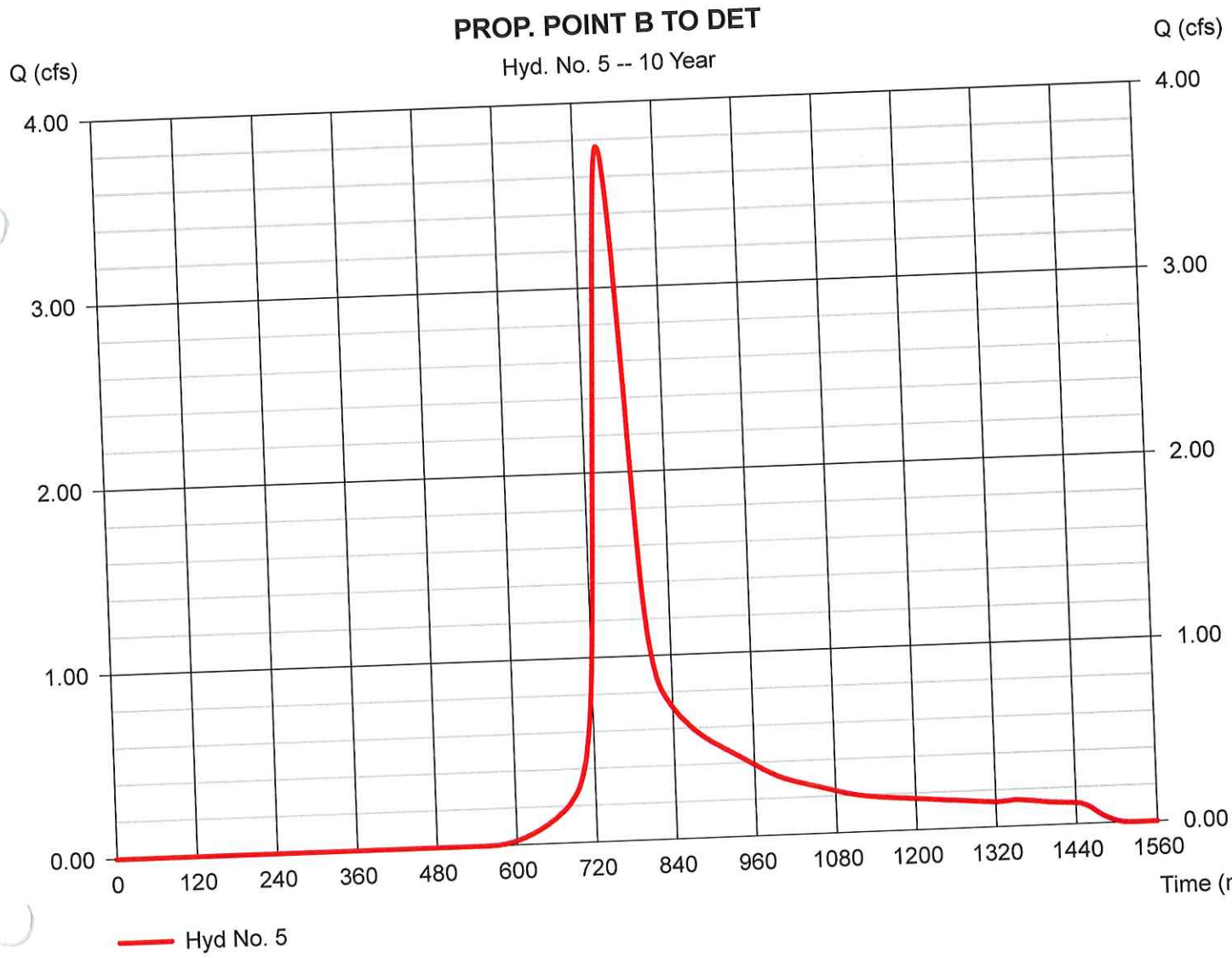
Saturday, Jan 4, 2020

Hyd. No. 5

PROP. POINT B TO DET

Hydrograph type	= SCS Runoff	Peak discharge	= 3.762 cfs
Storm frequency	= 10 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 25,865 cuft
Drainage area	= 3.270 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.70 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.730 x 55) + (0.450 x 61) + (0.220 x 98) + (1.320 x 77) + (0.350 x 80) + (0.200 x 98)] / 3.270



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Hydrograph type	= SCS Runoff	Peak discharge	= 4.170 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.83 hrs
Time interval	= 2 min	Hyd. volume	= 37,267 cuft
Drainage area	= 8.320 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 63.30 min
Total precip.	= 4.87 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.830 x 55) + (1.120 x 61) + (0.110 x 98) + (1.160 x 77) + (0.100 x 80)] / 8.320

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

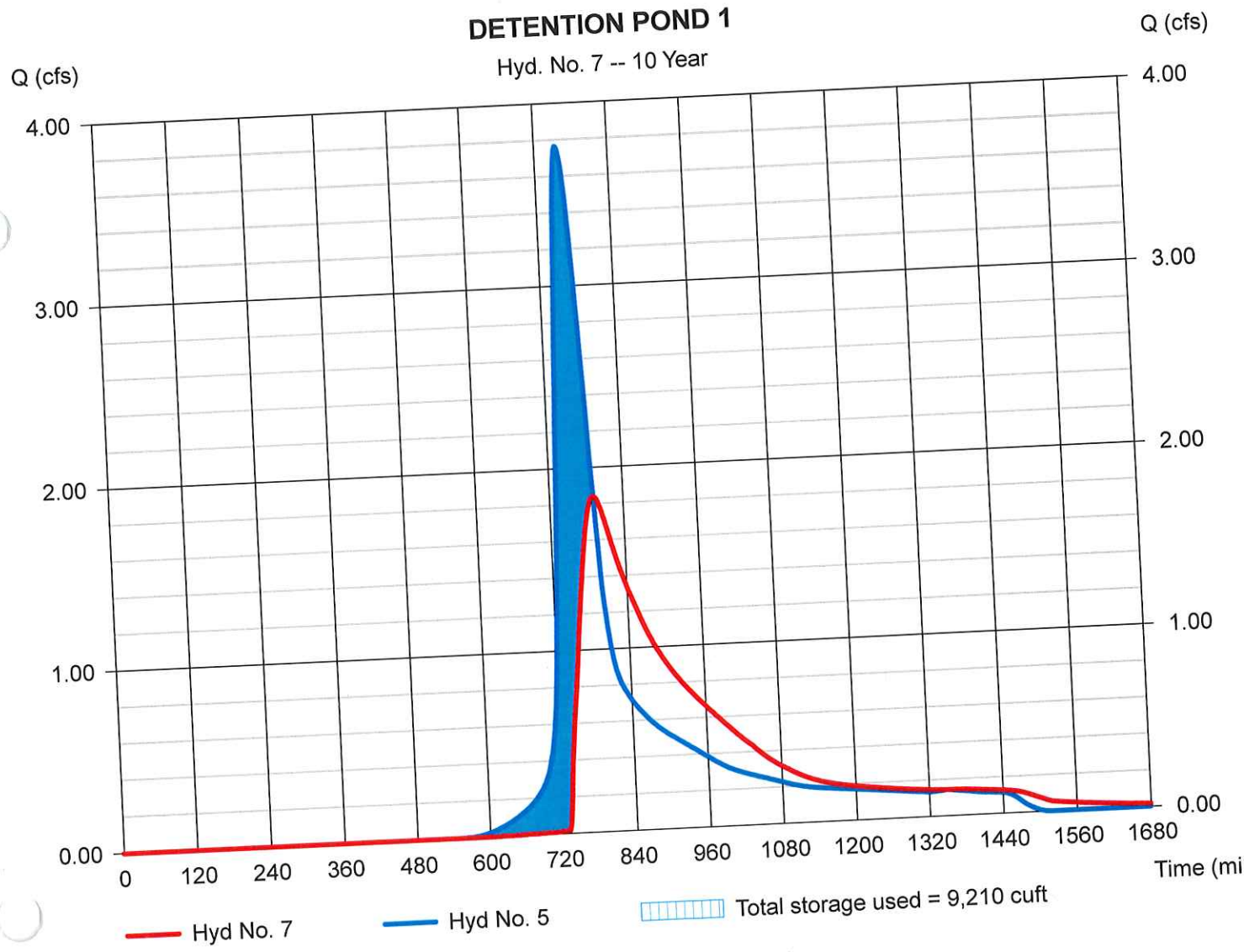
Saturday, Jan 4, 2020

Hyd. No. 7

DETENTION POND 1

Hydrograph type	= Reservoir	Peak discharge	= 1.839 cfs
Storm frequency	= 10 yrs	Time to peak	= 792 min
Time interval	= 2 min	Hyd. volume	= 25,744 cuft
Inflow hyd. No.	= 5 - PROP. POINT B TO DET	Max. Elevation	= 522.47 ft
Reservoir name	= <New Pond>	Max. Storage	= 9,210 cuft

Storage Indication method used.



Hydrograph Report

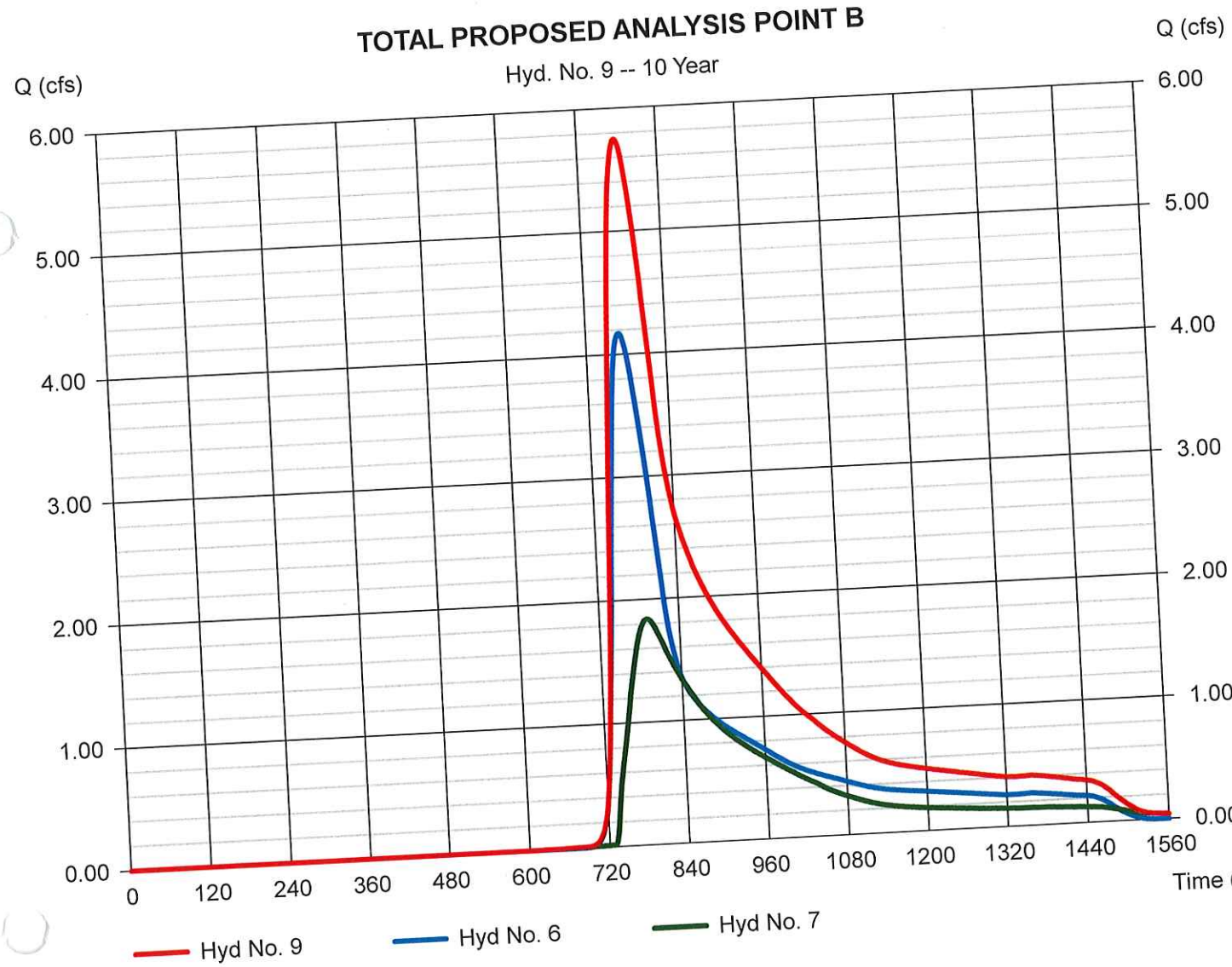
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 9

TOTAL PROPOSED ANALYSIS POINT B

Hydrograph type	= Combine	Peak discharge	= 5.753 cfs
Storm frequency	= 10 yrs	Time to peak	= 776 min
Time interval	= 2 min	Hyd. volume	= 63,011 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 8.320 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

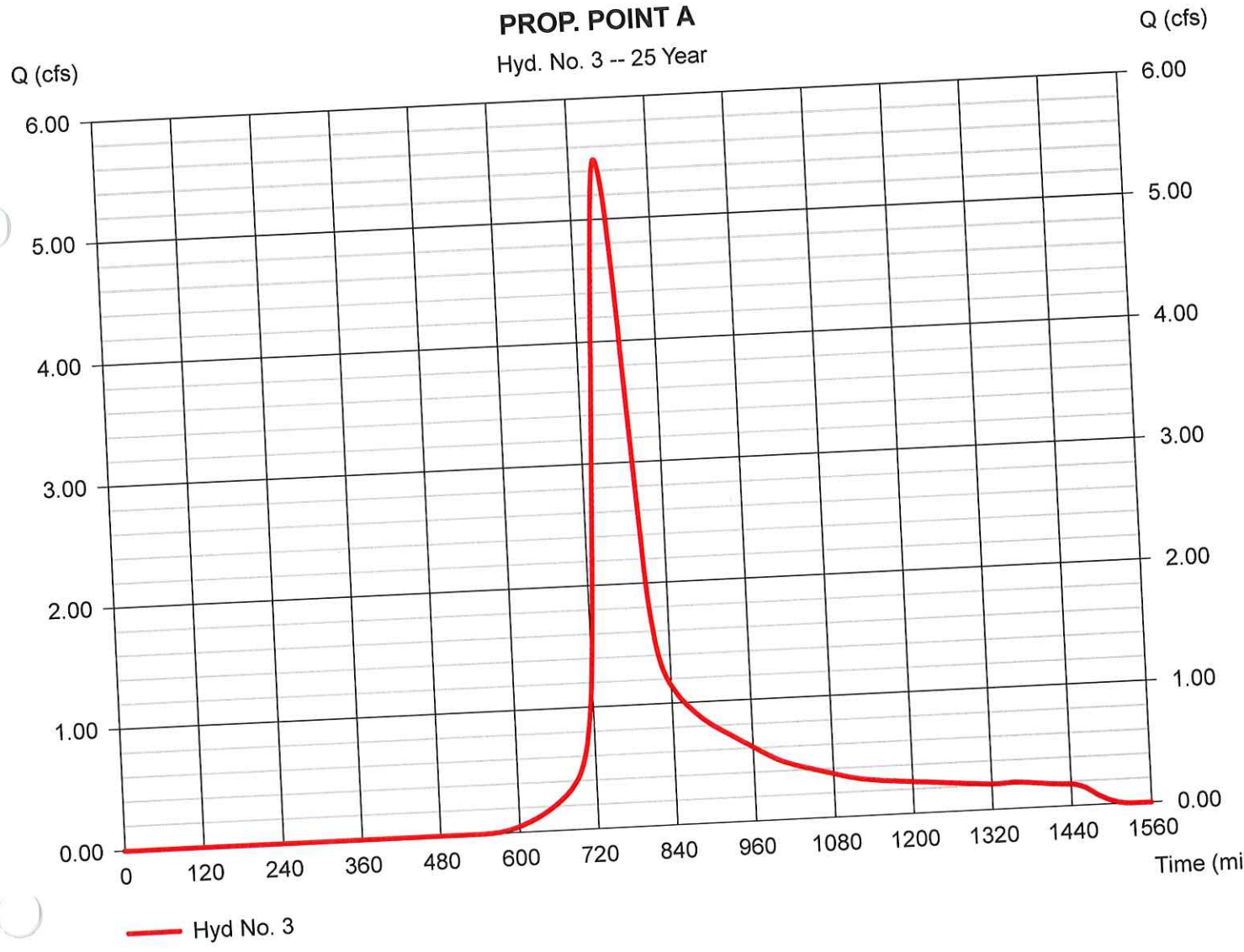
Saturday, Jan 4, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.494 cfs
Storm frequency	= 25 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 40,318 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

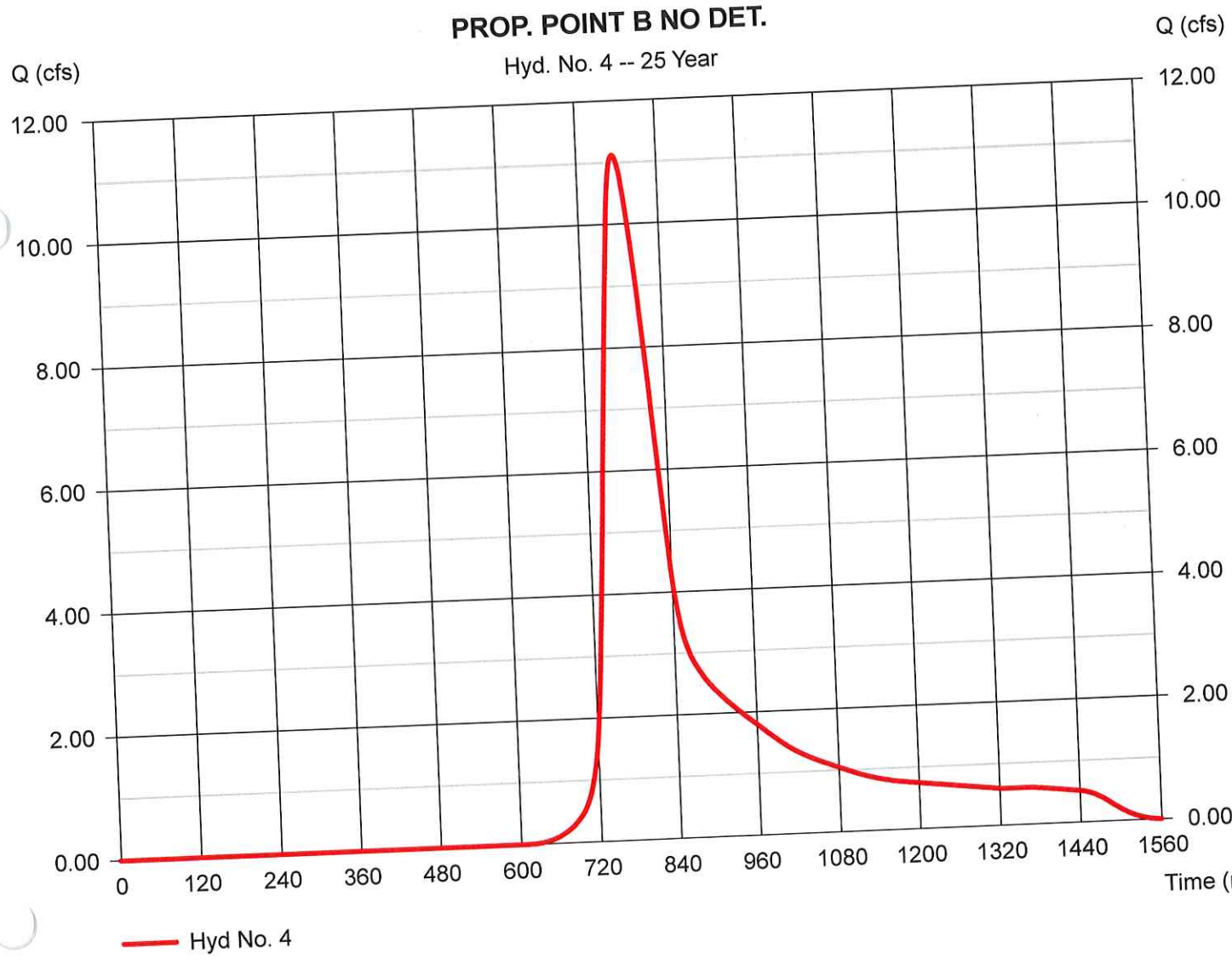
Saturday, Jan 4, 2020

Hyd. No. 4

PROP. POINT B NO DET.

Hydrograph type	= SCS Runoff	Peak discharge	= 11.12 cfs
Storm frequency	= 25 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 101,414 cuft
Drainage area	= 12.450 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.30 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.800 x 55) + (1.570 x 61) + (0.250 x 98) + (2.950 x 77) + (0.680 x 80) + (0.200 x 98)] / 12.450



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

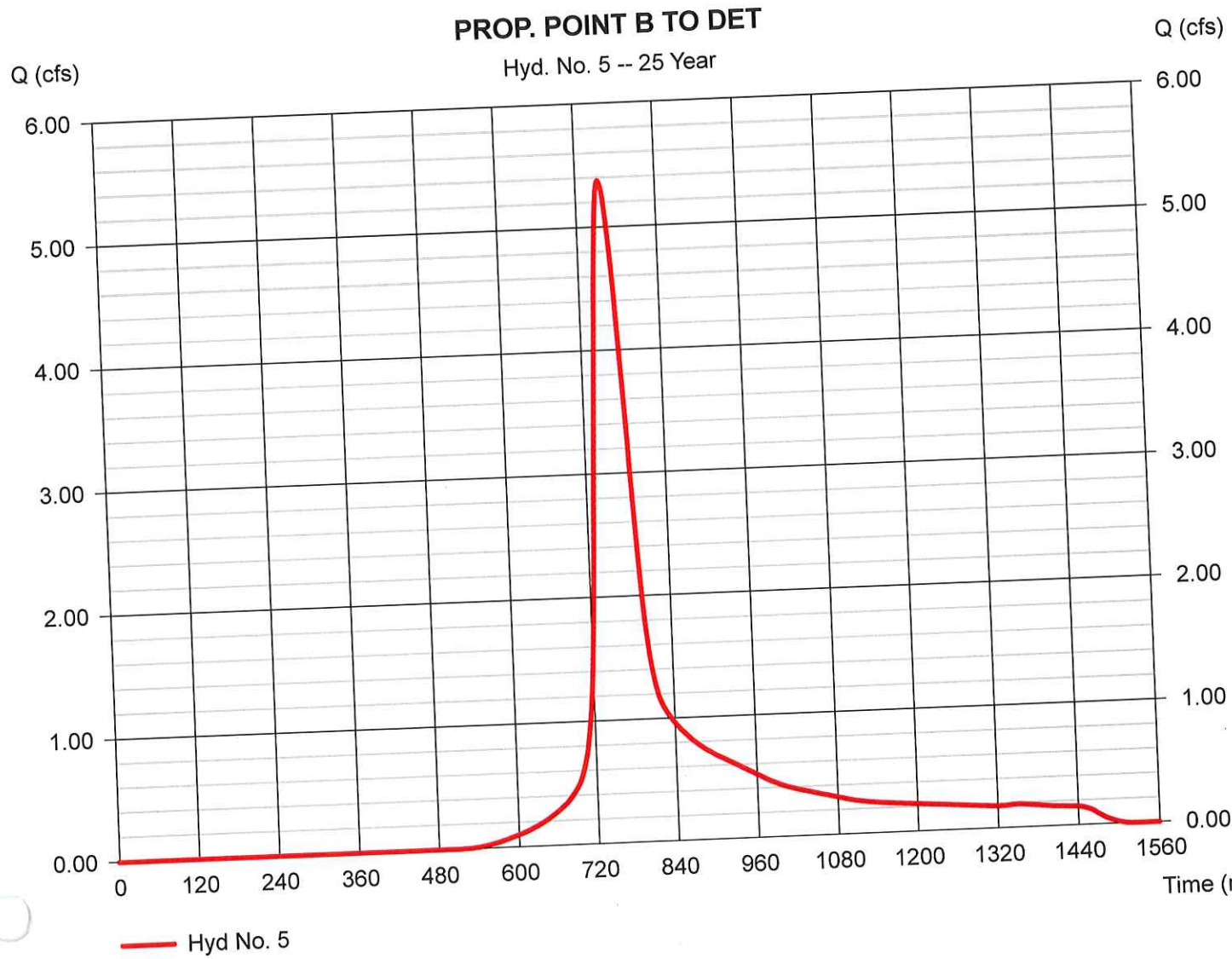
Saturday, Jan 4, 2020

Hyd. No. 5

PROP. POINT B TO DET

Hydrograph type	= SCS Runoff	Peak discharge	= 5.376 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 36,564 cuft
Drainage area	= 3.270 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.70 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.730 x 55) + (0.450 x 61) + (0.220 x 98) + (1.320 x 77) + (0.350 x 80) + (0.200 x 98)] / 3.270



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

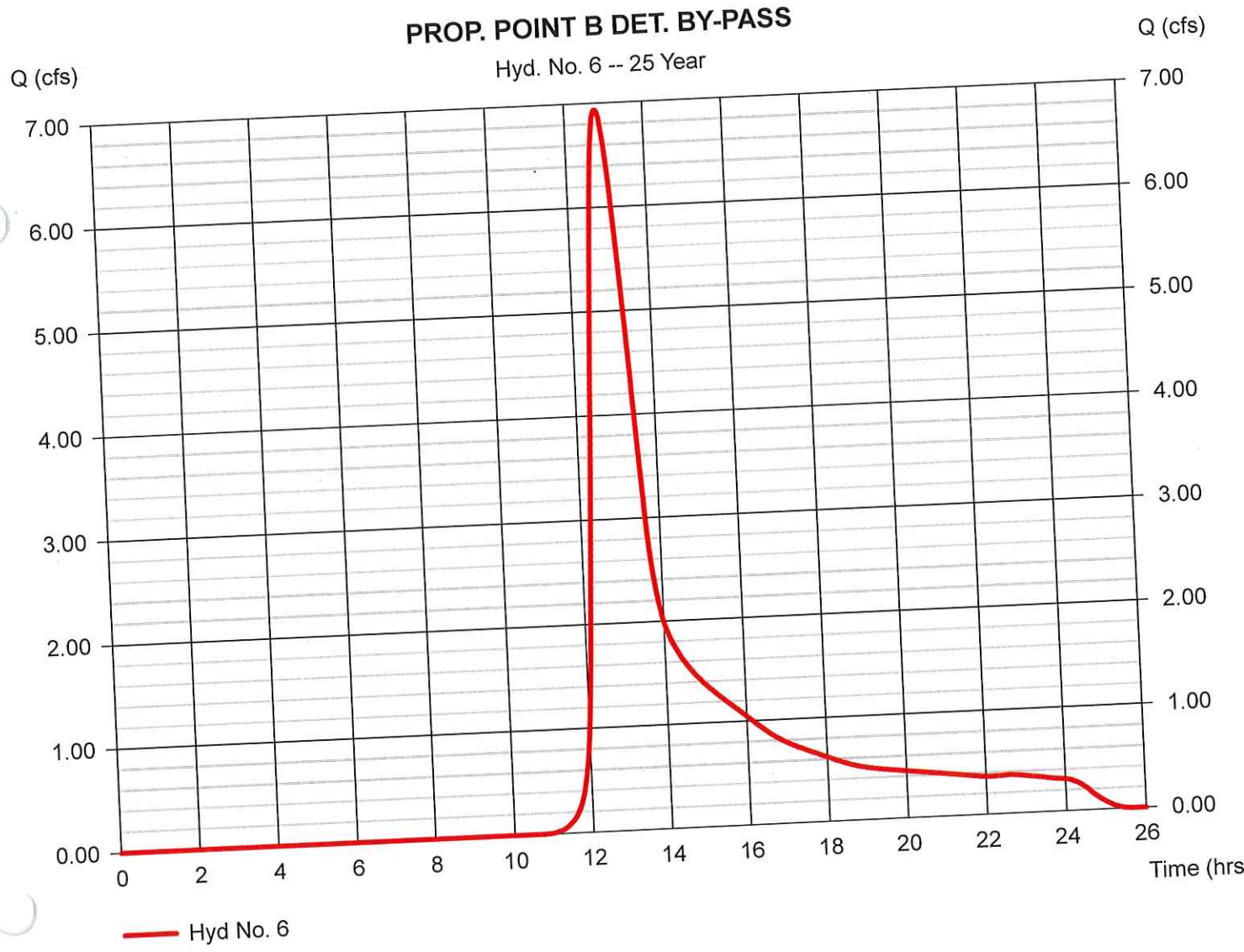
Monday, Sep 28, 2020

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Hydrograph type	= SCS Runoff	Peak discharge	= 6.935 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 58,218 cuft
Drainage area	= 8.320 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 63.30 min
Total precip.	= 5.99 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.830 x 55) + (1.120 x 61) + (0.110 x 98) + (1.160 x 77) + (0.100 x 80)] / 8.320



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

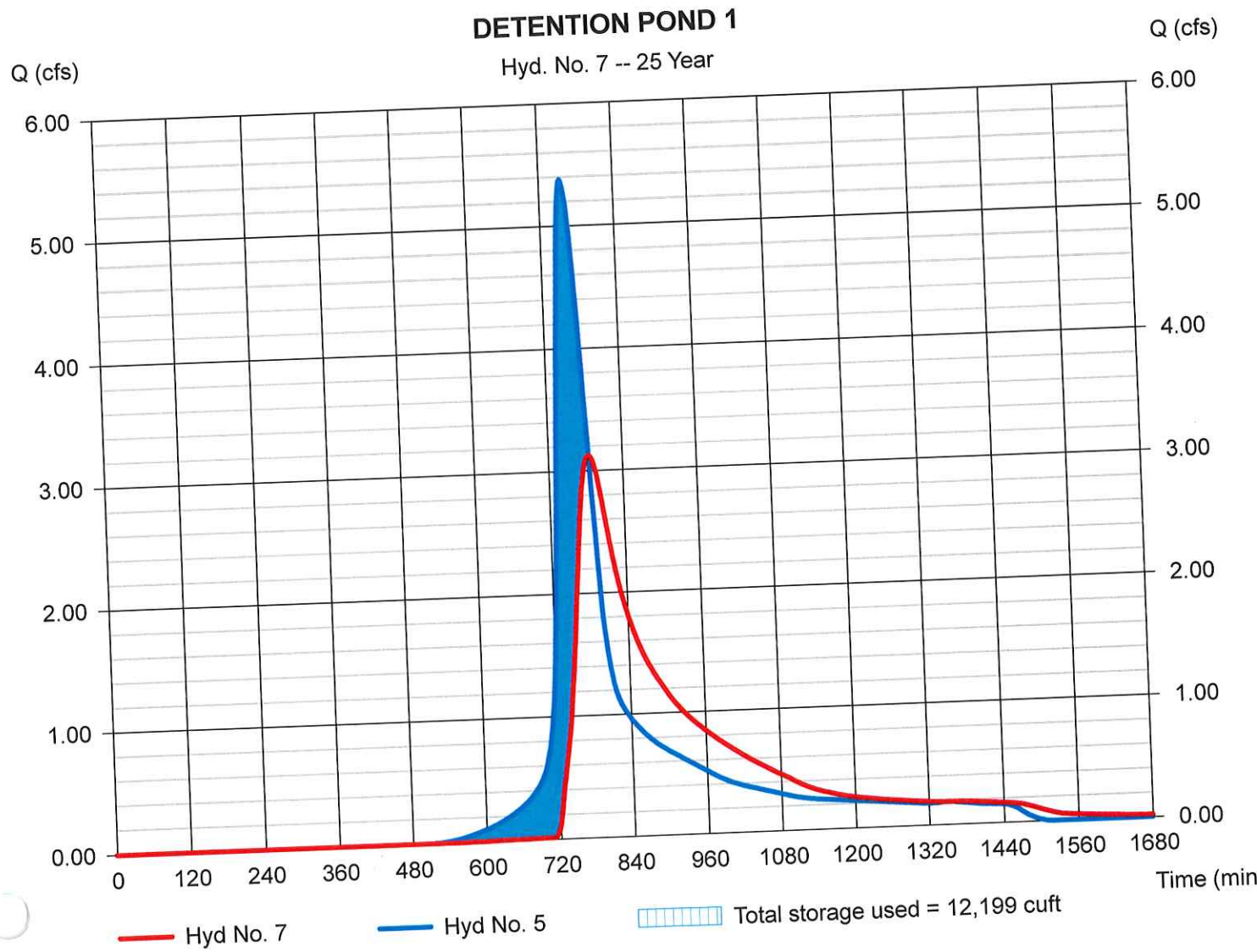
Saturday, Jan 4, 2020

Hyd. No. 7

DETENTION POND 1

Hydrograph type	= Reservoir	Peak discharge	= 3.125 cfs
Storm frequency	= 25 yrs	Time to peak	= 786 min
Time interval	= 2 min	Hyd. volume	= 36,441 cuft
Inflow hyd. No.	= 5 - PROP. POINT B TO DET	Max. Elevation	= 523.10 ft
Reservoir name	= <New Pond>	Max. Storage	= 12,199 cuft

Storage Indication method used.



Hydrograph Report

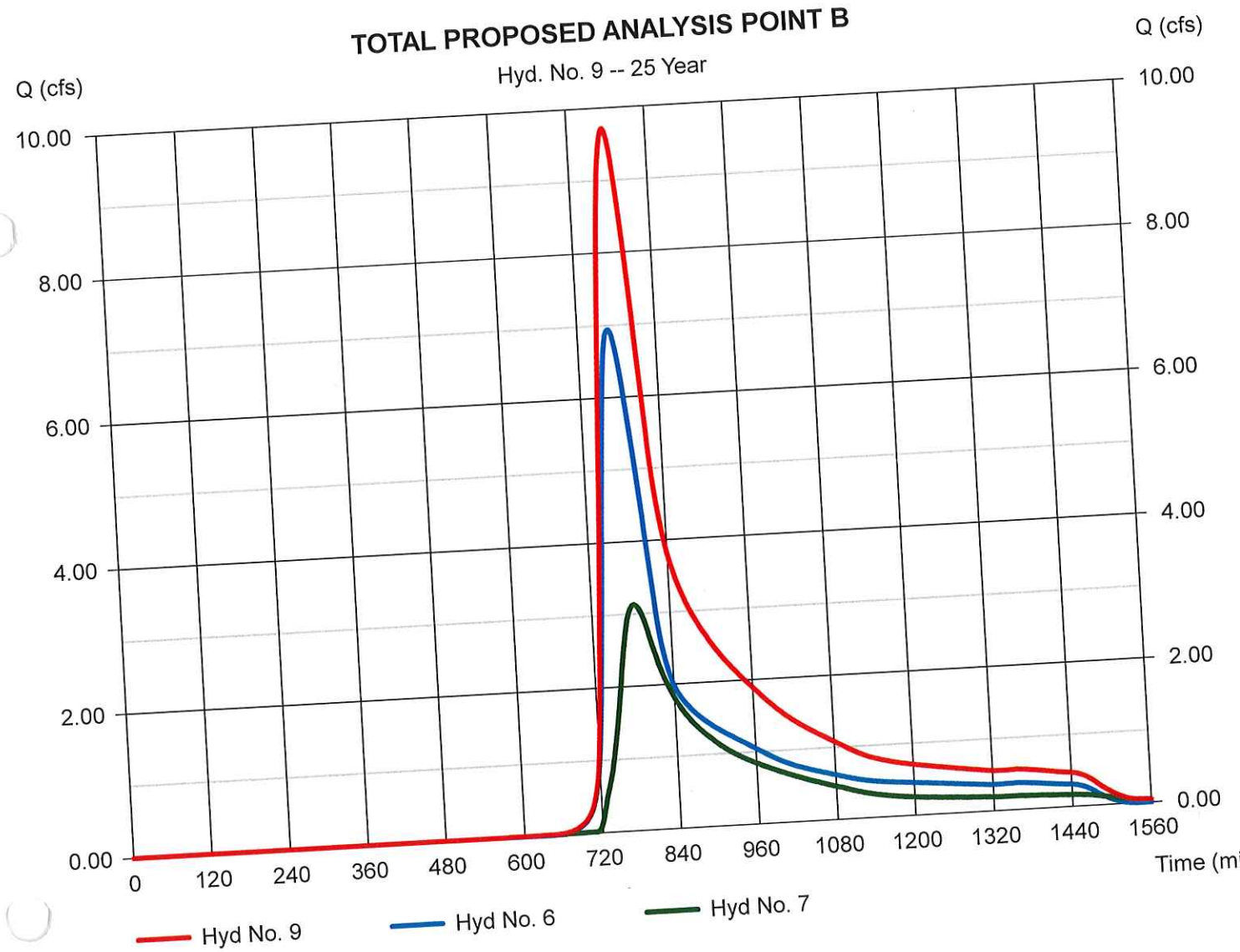
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 9

TOTAL PROPOSED ANALYSIS POINT B

Hydrograph type	= Combine	Peak discharge	= 9.719 cfs
Storm frequency	= 25 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 94,658 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 8.320 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

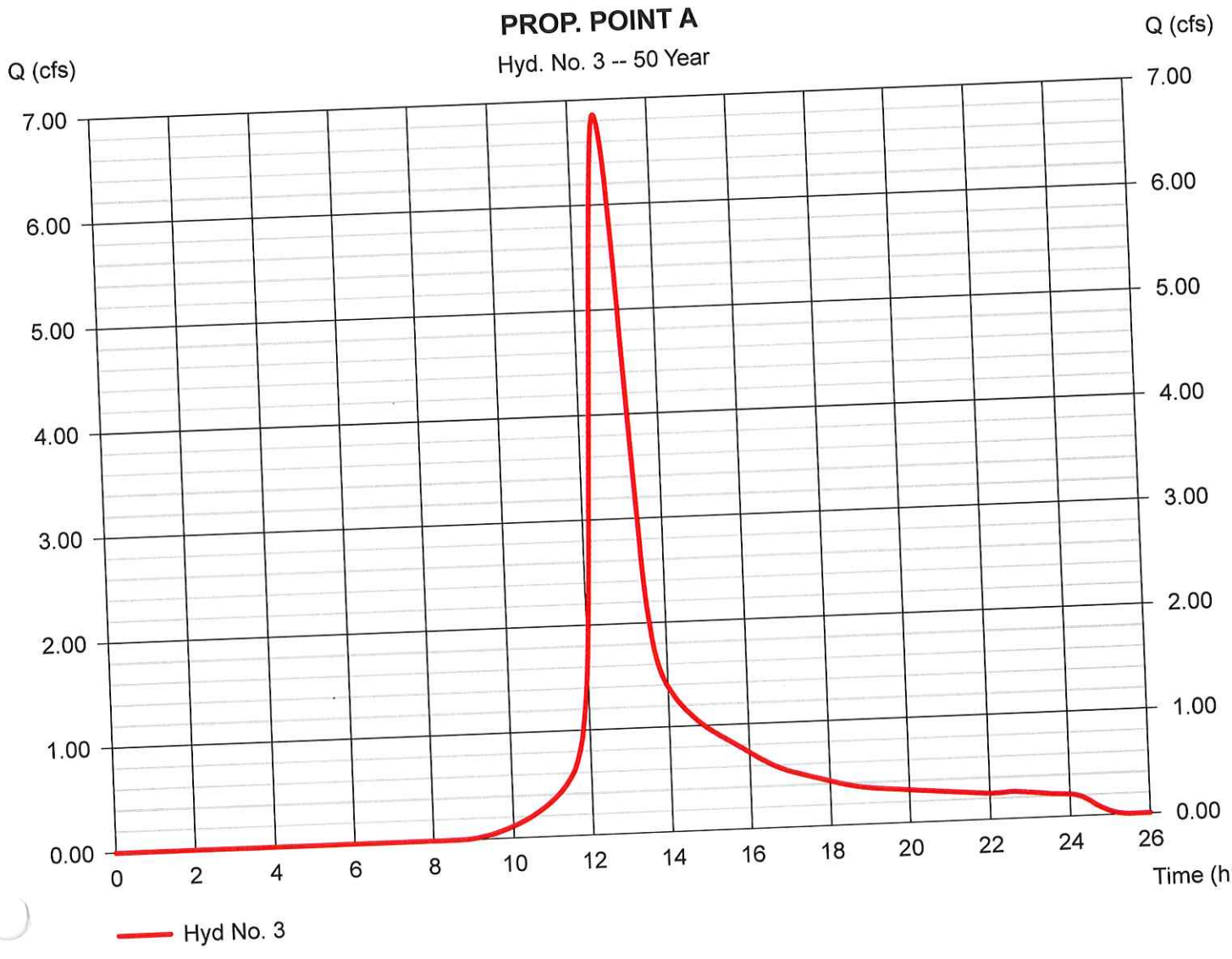
Friday, Mar 13, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 6.859 cfs
Storm frequency	= 50 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 50,004 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

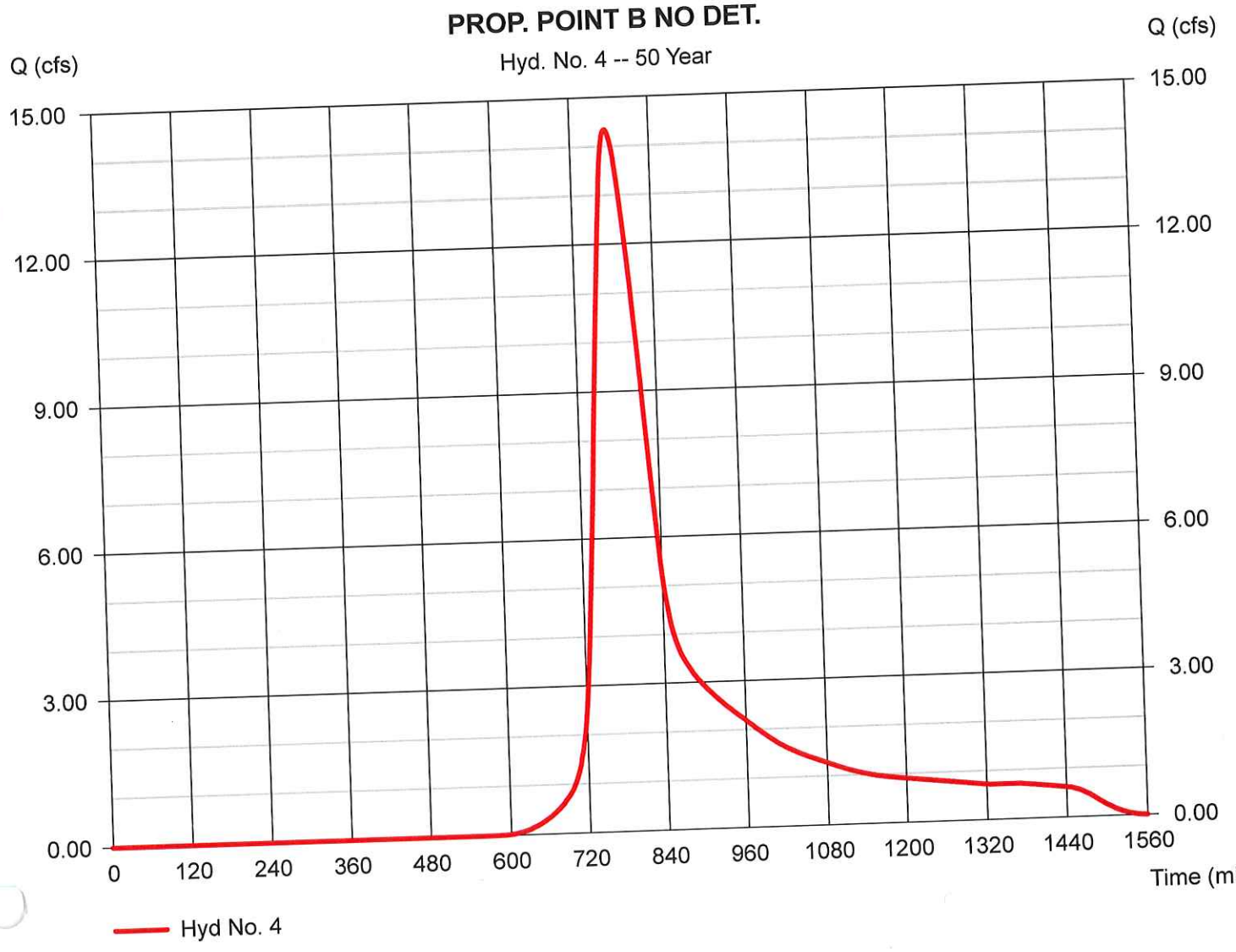
Saturday, Jan 4, 2020

Hyd. No. 4

PROP. POINT B NO DET.

Hydrograph type	= SCS Runoff	Peak discharge	= 14.34 cfs
Storm frequency	= 50 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 128,781 cuft
Drainage area	= 12.450 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.30 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.800 x 55) + (1.570 x 61) + (0.250 x 98) + (2.950 x 77) + (0.680 x 80) + (0.200 x 98)] / 12.450



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

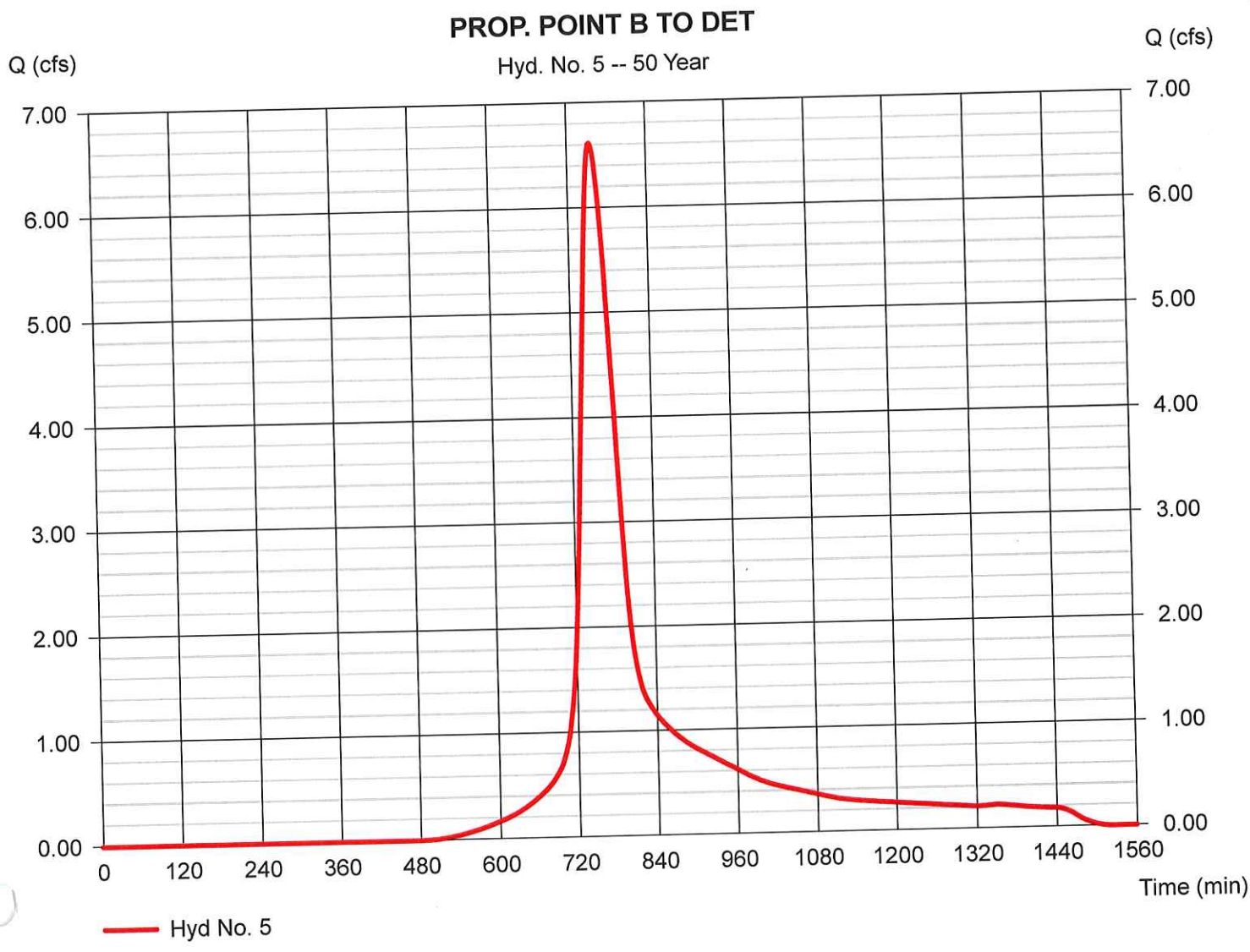
Saturday, Jan 4, 2020

Hyd. No. 5

PROP. POINT B TO DET

Hydrograph type	= SCS Runoff	Peak discharge	= 6.616 cfs
Storm frequency	= 50 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 44,876 cuft
Drainage area	= 3.270 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.70 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.730 x 55) + (0.450 x 61) + (0.220 x 98) + (1.320 x 77) + (0.350 x 80) + (0.200 x 98)] / 3.270



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

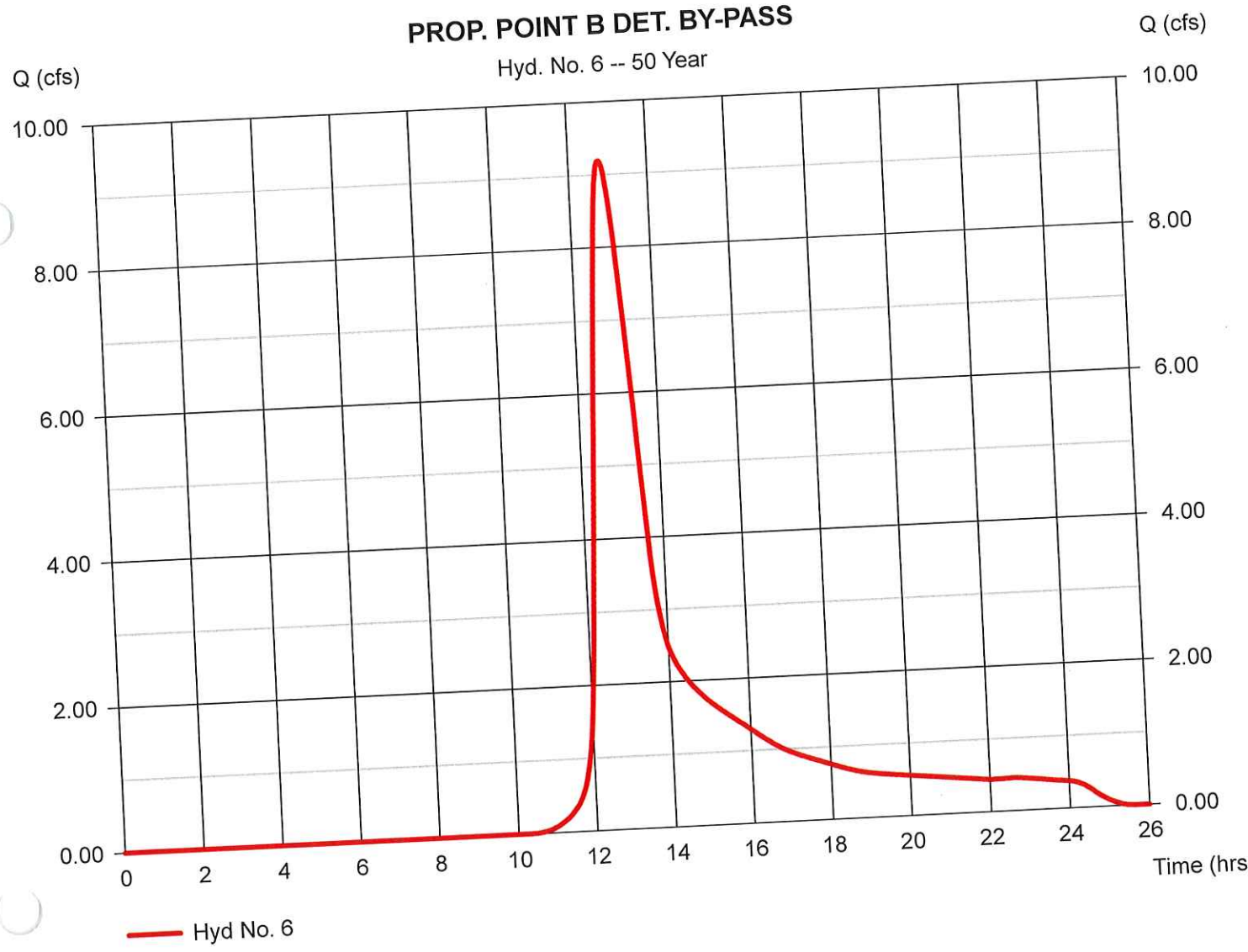
Monday, Sep 28, 2020

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Hydrograph type	= SCS Runoff	Peak discharge	= 9.195 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 75,301 cuft
Drainage area	= 8.320 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 63.30 min
Total precip.	= 6.82 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.830 x 55) + (1.120 x 61) + (0.110 x 98) + (1.160 x 77) + (0.100 x 80)] / 8.320



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

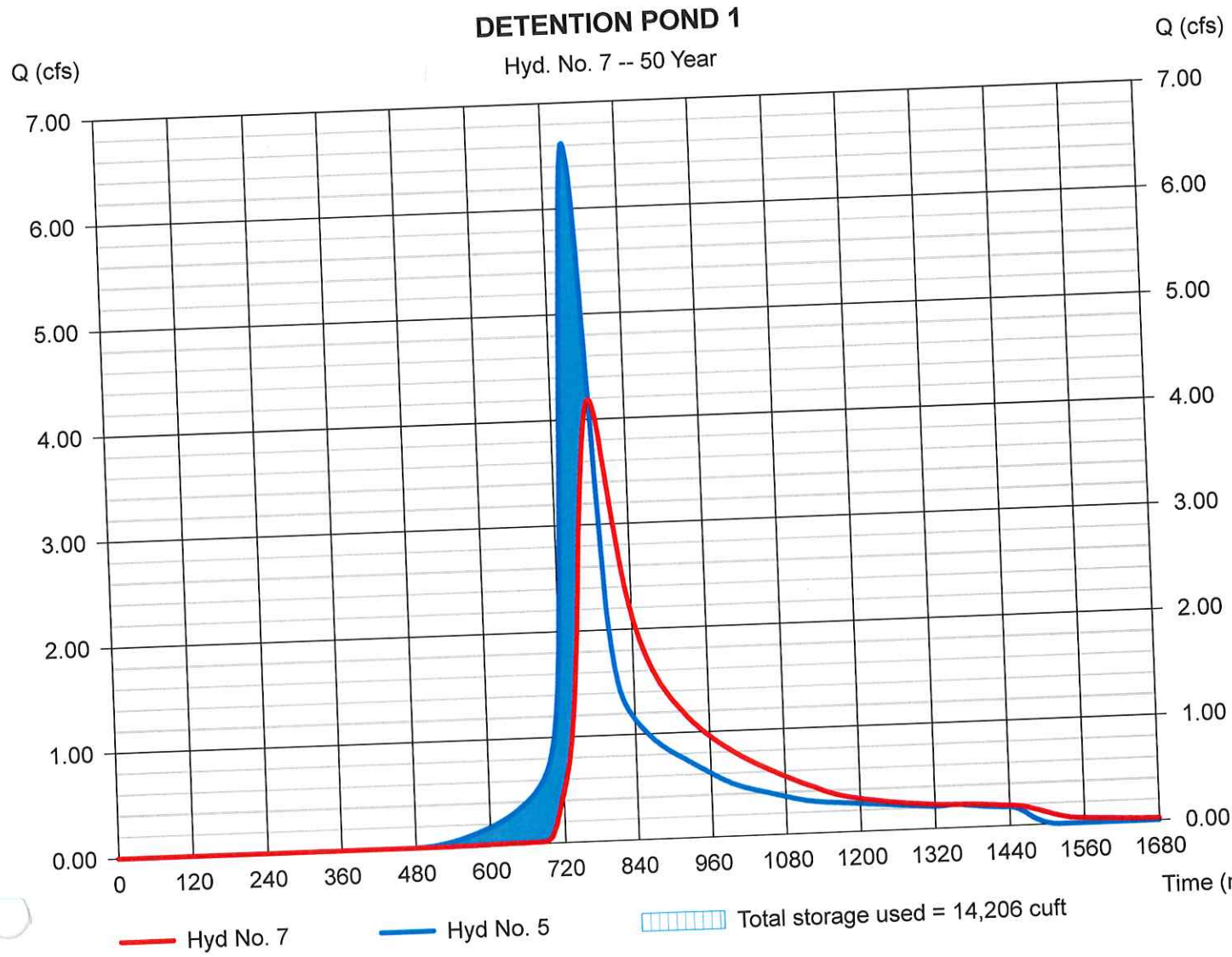
Saturday, Jan 4, 2020

Hyd. No. 7

DETENTION POND 1

Hydrograph type	= Reservoir	Peak discharge	= 4.184 cfs
Storm frequency	= 50 yrs	Time to peak	= 782 min
Time interval	= 2 min	Hyd. volume	= 44,752 cuft
Inflow hyd. No.	= 5 - PROP. POINT B TO DET	Max. Elevation	= 523.47 ft
Reservoir name	= <New Pond>	Max. Storage	= 14,206 cuft

Storage Indication method used.



Hydrograph Report

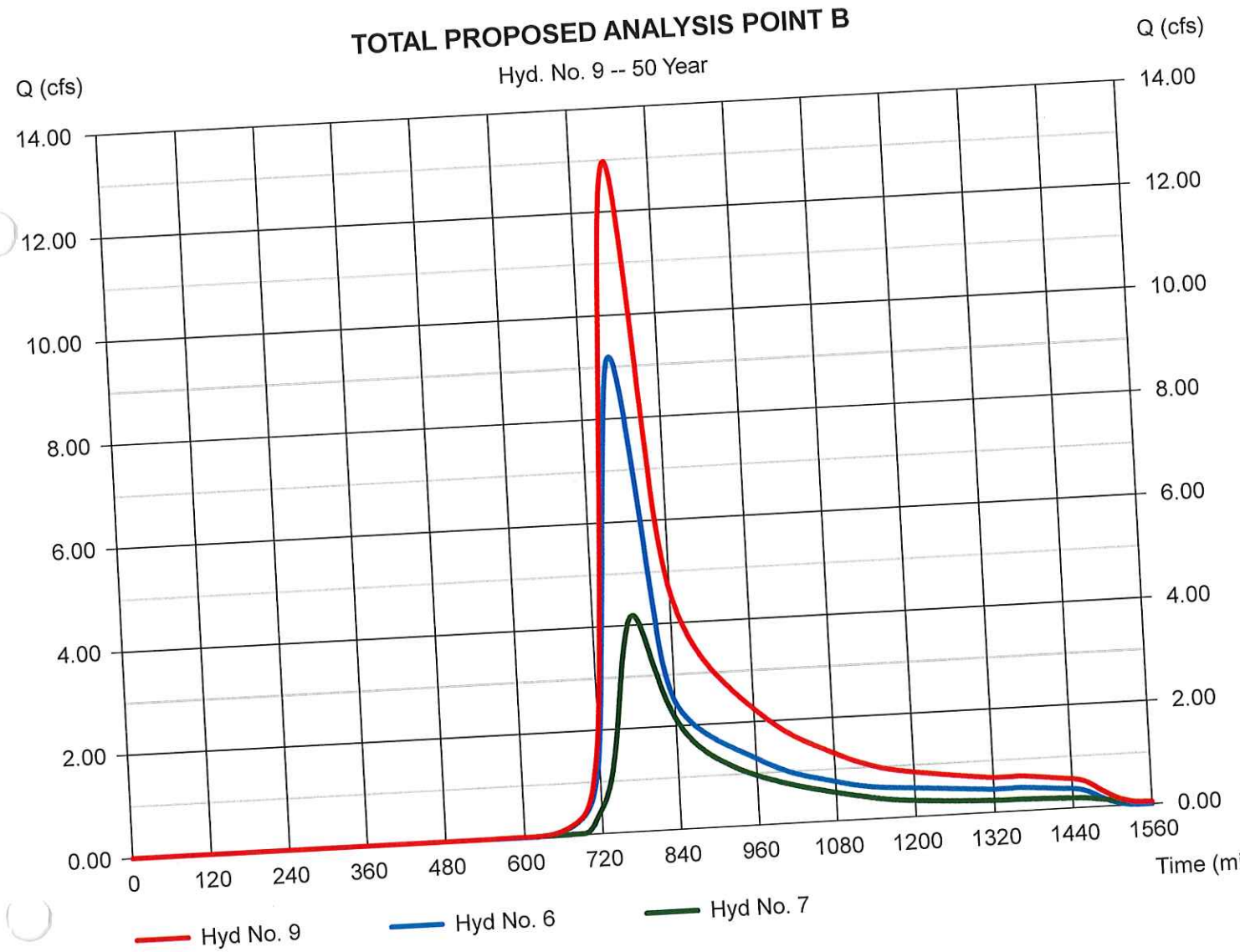
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 9

TOTAL PROPOSED ANALYSIS POINT B

Hydrograph type	= Combine	Peak discharge	= 12.98 cfs
Storm frequency	= 50 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 120,053 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 8.320 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

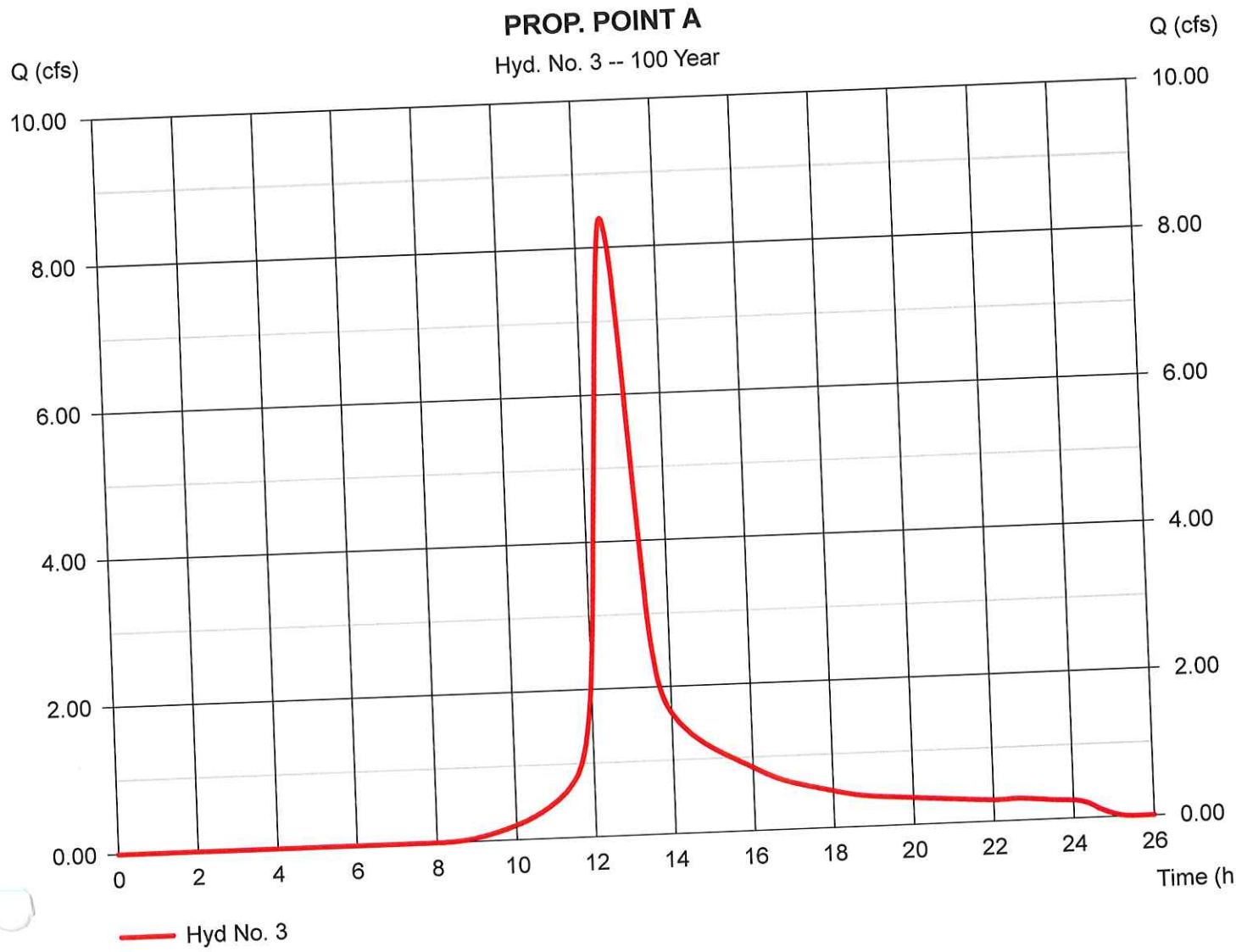
Friday, Mar 13, 2020

Hyd. No. 3

PROP. POINT A

Hydrograph type	= SCS Runoff	Peak discharge	= 8.397 cfs
Storm frequency	= 100 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 61,014 cuft
Drainage area	= 4.000 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 54.90 min
Total precip.	= 7.73 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.040 x 55) + (0.760 x 61) + (0.340 x 98) + (1.800 x 77) + (0.060 x 61)] / 4.000



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

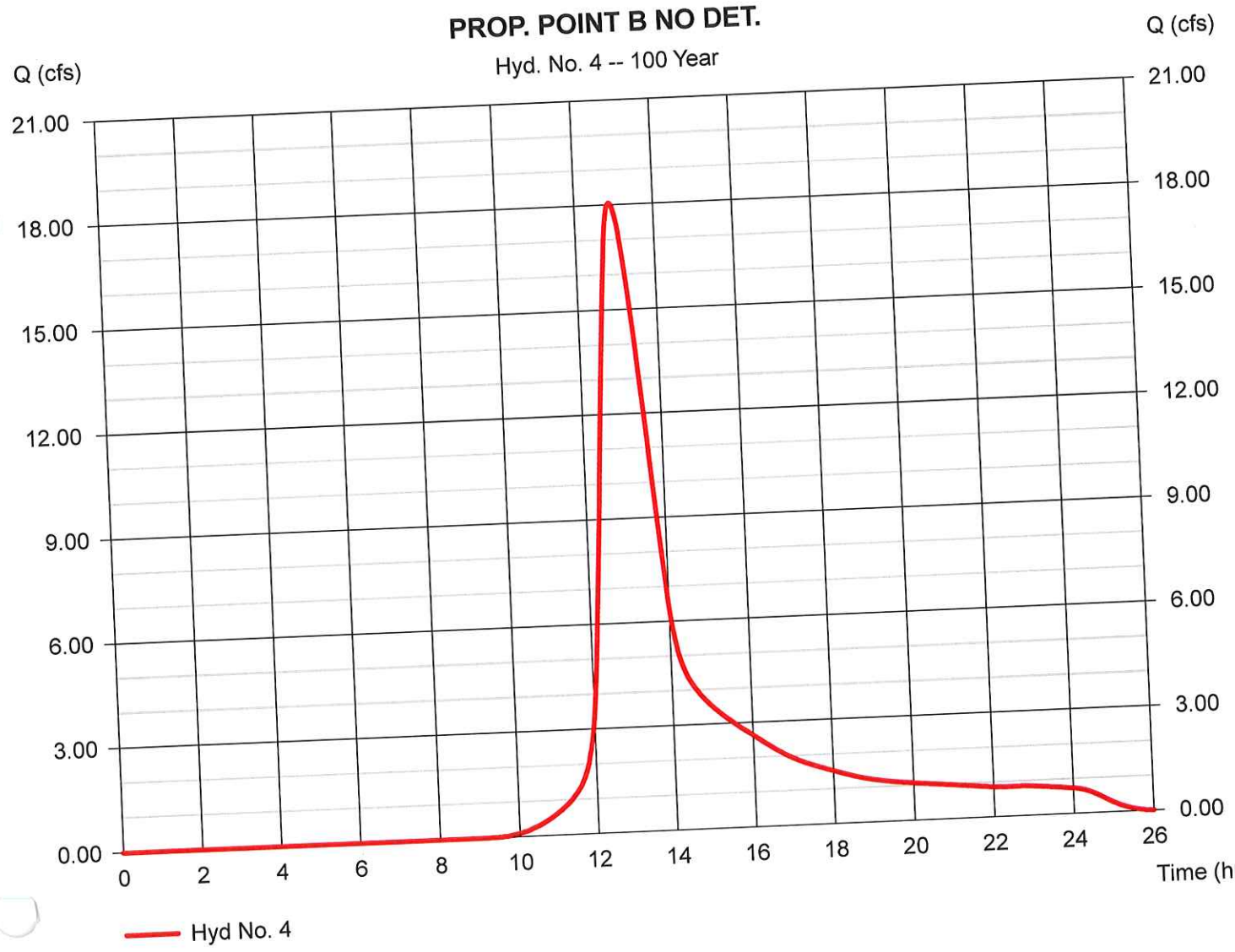
Friday, Mar 13, 2020

Hyd. No. 4

PROP. POINT B NO DET.

Hydrograph type	= SCS Runoff	Peak discharge	= 18.05 cfs
Storm frequency	= 100 yrs	Time to peak	= 772 min
Time interval	= 2 min	Hyd. volume	= 160,335 cuft
Drainage area	= 12.450 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.30 min
Total precip.	= 7.73 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.800 x 55) + (1.570 x 61) + (0.250 x 98) + (2.950 x 77) + (0.680 x 80) + (0.200 x 98)] / 12.450



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

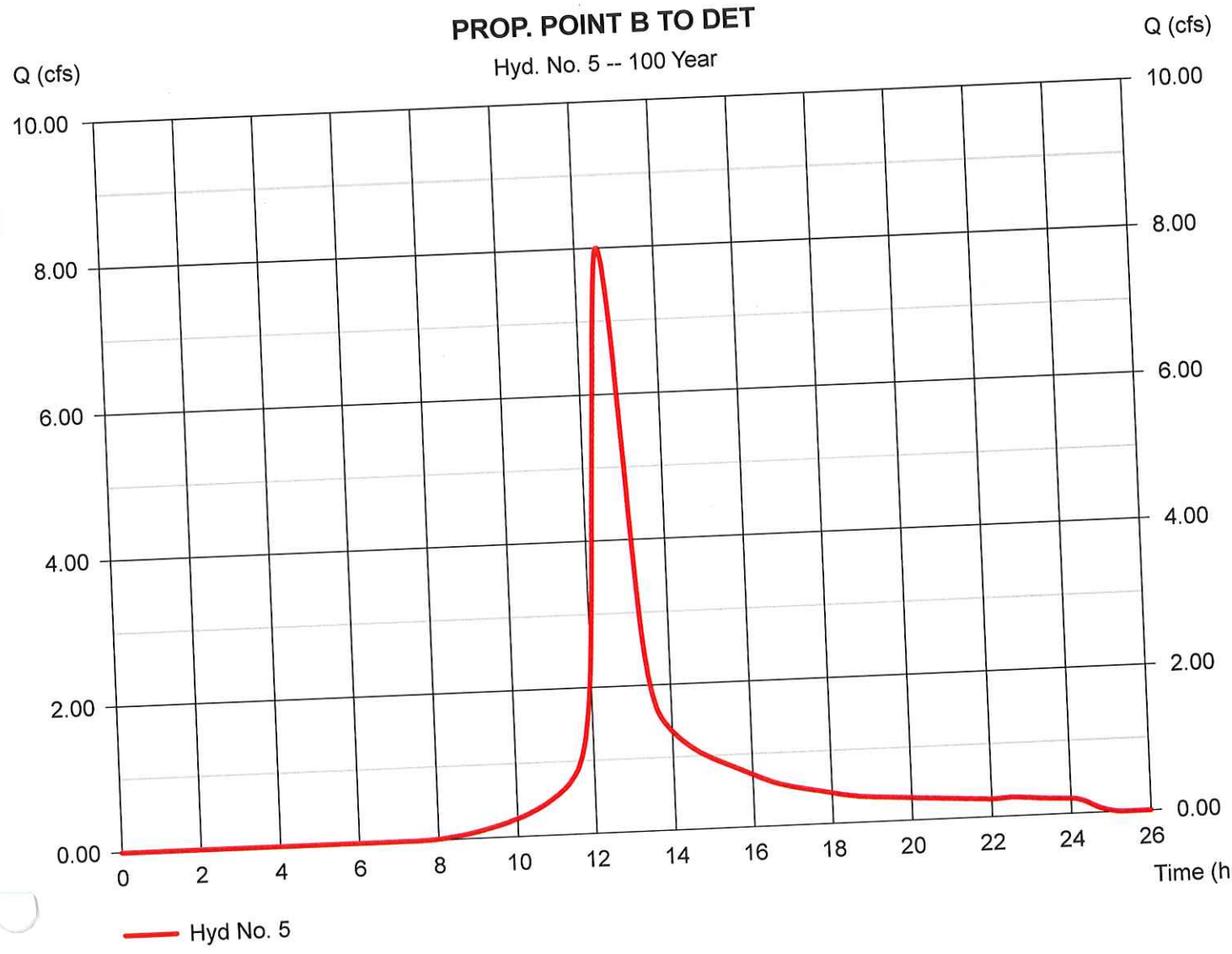
Friday, Mar 13, 2020

Hyd. No. 5

PROP. POINT B TO DET

Hydrograph type	= SCS Runoff	Peak discharge	= 8.002 cfs
Storm frequency	= 100 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 54,264 cuft
Drainage area	= 3.270 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 47.70 min
Total precip.	= 7.73 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.730 x 55) + (0.450 x 61) + (0.220 x 98) + (1.320 x 77) + (0.350 x 80) + (0.200 x 98)] / 3.270



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

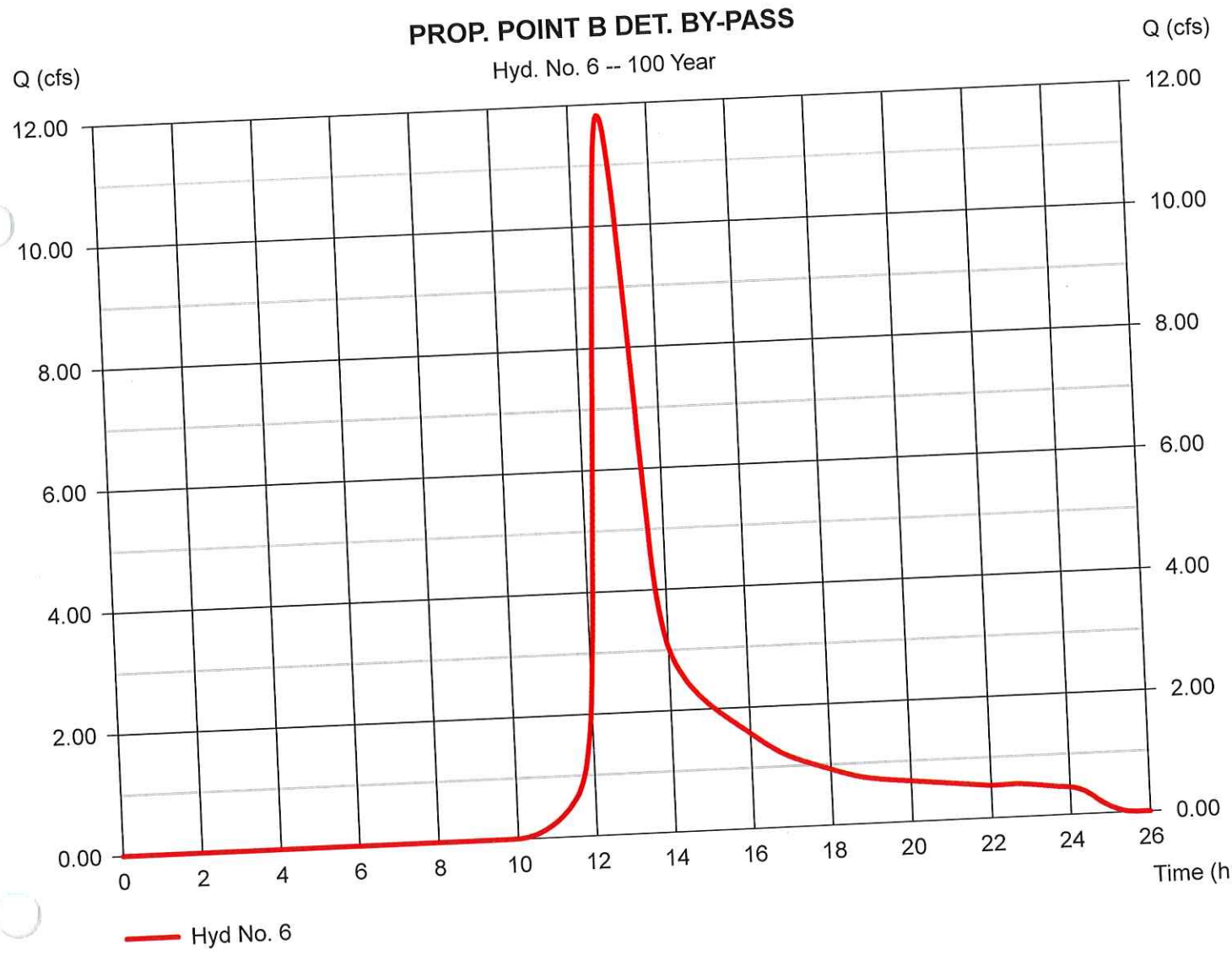
Monday, Sep 28, 2020

Hyd. No. 6

PROP. POINT B DET. BY-PASS

Hydrograph type	= SCS Runoff	Peak discharge	= 11.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.73 hrs
Time interval	= 2 min	Hyd. volume	= 95,221 cuft
Drainage area	= 8.320 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 63.30 min
Total precip.	= 7.73 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.830 x 55) + (1.120 x 61) + (0.110 x 98) + (1.160 x 77) + (0.100 x 80)] / 8.320



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

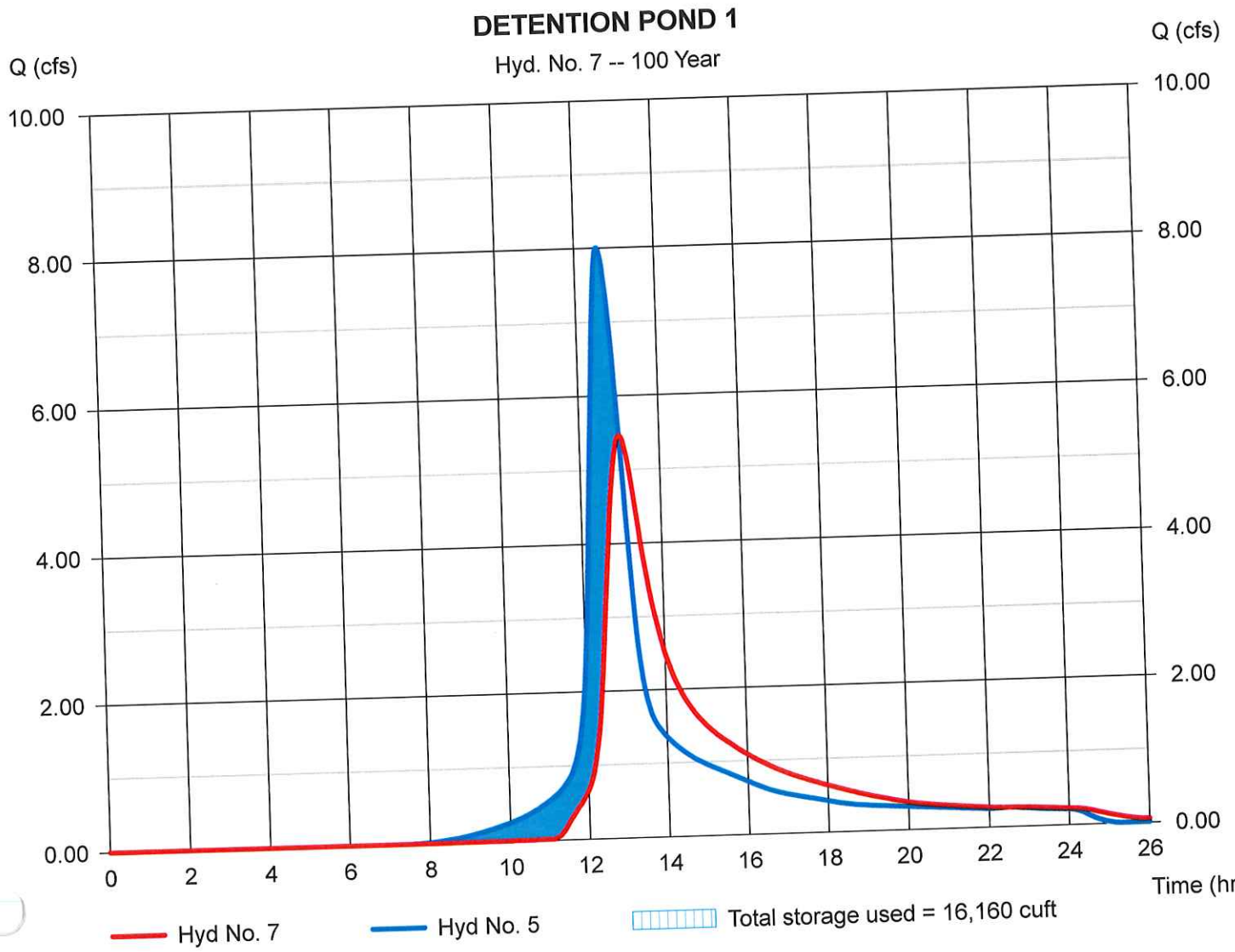
Friday, Mar 13, 2020

Hyd. No. 7

DETENTION POND 1

Hydrograph type	= Reservoir	Peak discharge	= 5.457 cfs
Storm frequency	= 100 yrs	Time to peak	= 778 min
Time interval	= 2 min	Hyd. volume	= 54,139 cuft
Inflow hyd. No.	= 5 - PROP. POINT B TO DET	Max. Elevation	= 523.84 ft
Reservoir name	= <New Pond>	Max. Storage	= 16,160 cuft

Storage Indication method used.



Hydrograph Report

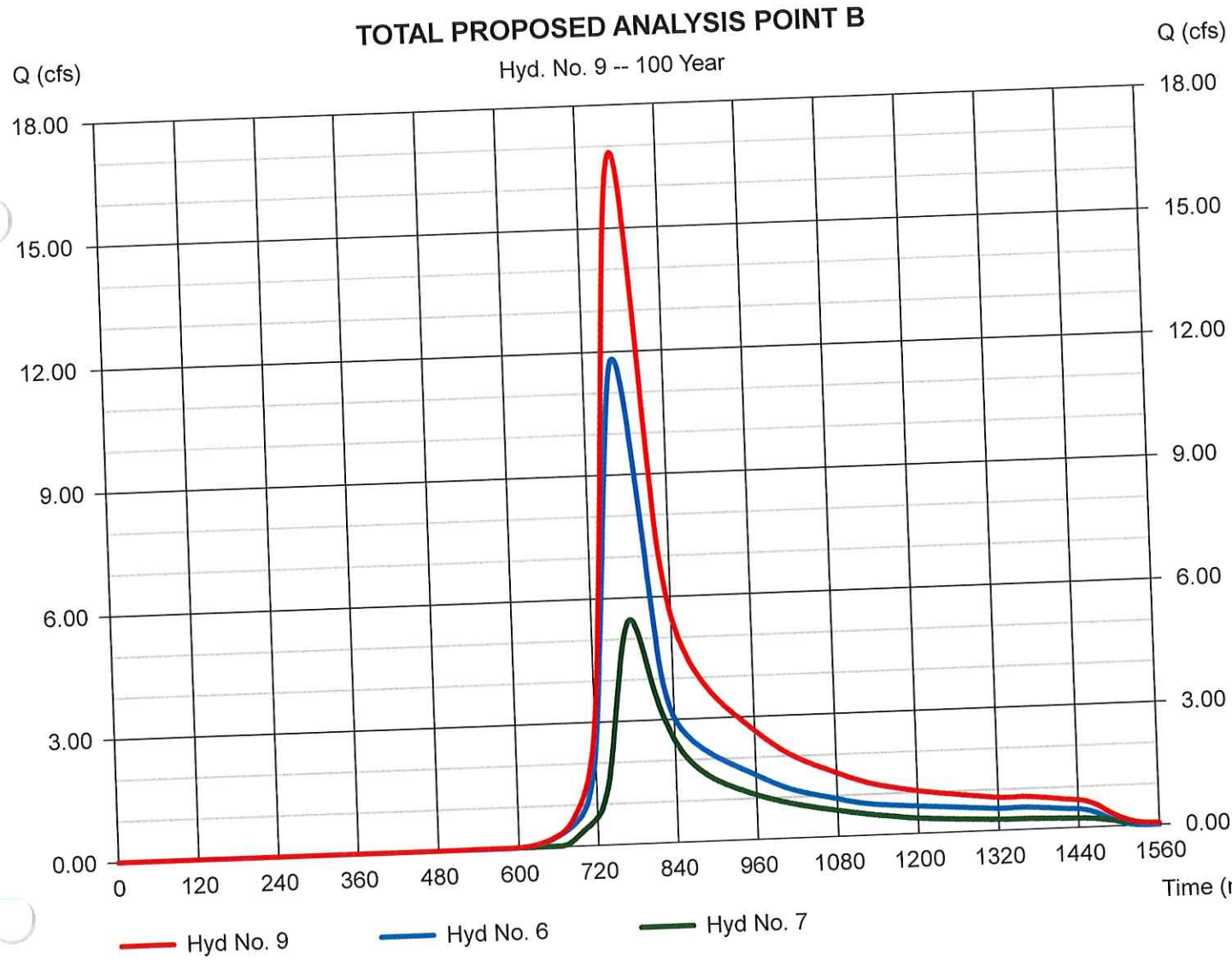
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Sep 28, 2020

Hyd. No. 9

TOTAL PROPOSED ANALYSIS POINT B

Hydrograph type	= Combine	Peak discharge	= 16.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 770 min
Time interval	= 2 min	Hyd. volume	= 149,360 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 8.320 ac



PREPARED BY	DATE PREPARED	**DUTTON ASSOCIATES, LLC**	JOB NUMBER	PAGE NUMBER
		67 EASTERN BOULEVARD GLASTONBURY, CONNECTICUT 06033 TEL: (860)-633-9401 FAX: (860)-633-8851 EMAIL: JIMD@DUTTONASSOCIATESLLC.COM		58
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

WATER QUALITY VOLUME (WQV)

SEE 7.4.1 OF THE 2004 CONNECTICUT STORMWATER QUALITY MANUAL

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

THE TOTAL IMPERVIOUS AREA OF THE PROPOSED DEVELOPMENT IS 19,790 SF (0.454 AC), ALL BUT 1,204 SF (0.028 AC) FLOWS TO THE DETENTION POND. THE 1,204 SF IS A SMALL PORTION OF THE PROPOSED SITE DRIVE WHERE IT APPROACHES KNOLLWOOD DR. IT IS NOT PRACTICABLE TO DIRECT THE 1204 SF TO THE DETENTION POND. 96% OF THE IMPERVIOUS AREA IS DIRECTED TO THE DETENTION POND

WQV

AREA TO DETENTION POND = 142,492 SF (3.27 AC)
TOTAL IMPERVIOUS AREA TO POND = 18,586 SF (0.43 AC)
% IMPERVIOUS = 18,586 / 142492 = 13.04% (I)

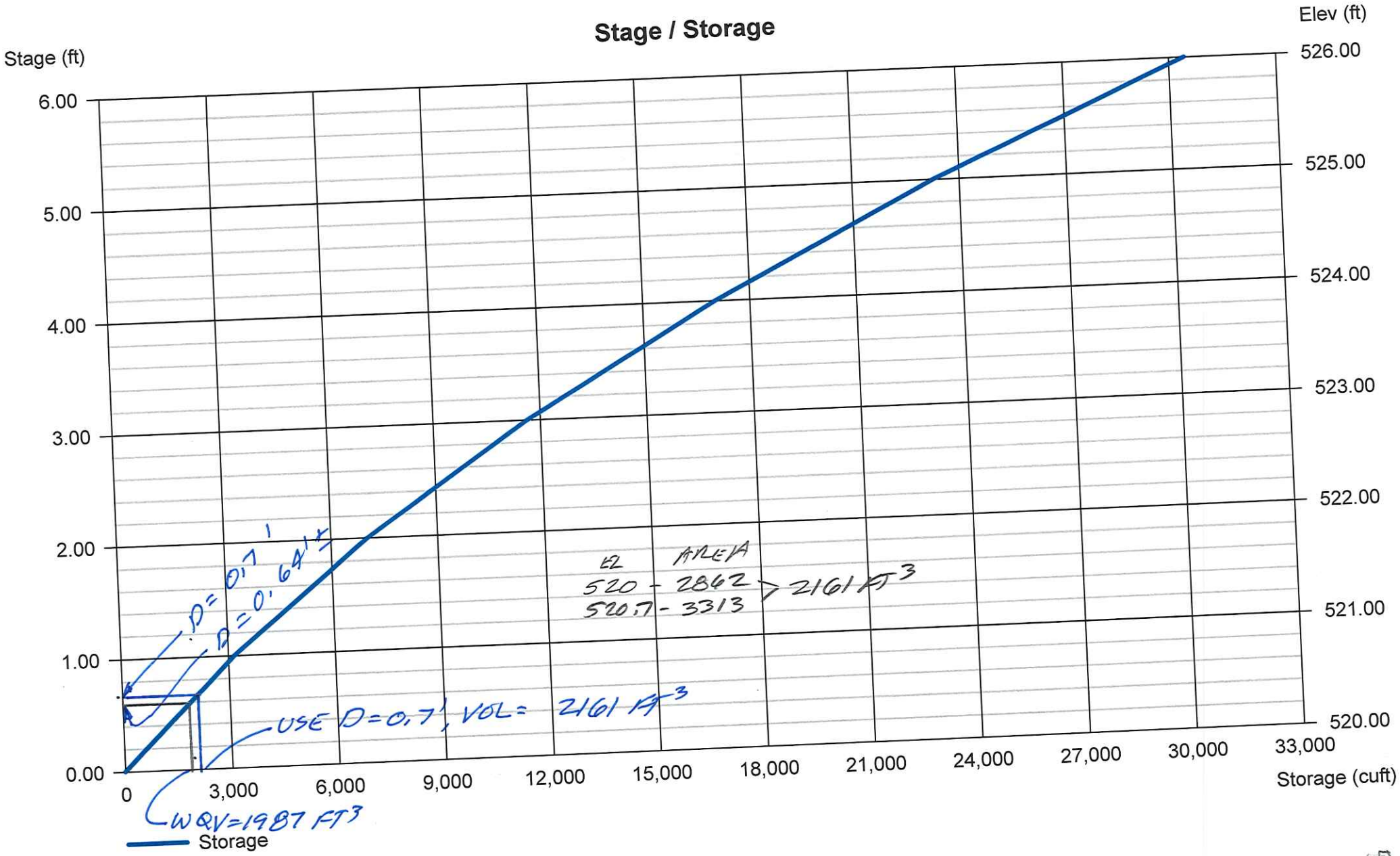
$R = 0.05 + 0.009 \times I = 0.05 + 0.009 \times 13.04$
$= 0.1674$

$$WQV = \frac{(1) \times 0.1674 \times 3.27}{12} = 0.0456 \text{ AC/FT}$$

$= 1,987 \text{ FT}^3 \approx 0.64'$ DEPTH IN POND

USE 0.7' DEPTH, VOL = 2161 FT^3

AVG Q (40 HOUR DRAIN TIME = 0.0150 CFS = 6.735 GPM


Stage / Storage
Stage (ft)
Elev (ft)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
526.00
525.00
524.00
523.00
522.00
521.00
520.00
0
3,000
6,000
9,000
12,000
15,000
18,000
21,000
24,000
27,000
30,000
33,000
Storage (cuft)
Storage
D= 0.7'
D= 0.64'
EL AREA
520 - 2862
520.7 - 3313
> 2161 FT3
USE D=0.7', VOL= 2161 FT3
WQV=1987 FT3

Pond Report

Hydraflow Hydrographs by Intelisolve v9.1

Friday, Mar 13, 2020

Pond No. 1 - <New Pond>

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 520.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	520.00	2,862	0	0
1.00	521.00	3,514	3,182	3,182
2.00	522.00	4,223	3,863	7,045
3.00	523.00	4,988	4,600	11,645
4.00	524.00	5,810	5,393	17,038
5.00	525.00	6,689	6,244	23,281
6.00	526.00	7,623	7,150	30,432

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	5.25	0.81	0.00
Span (in)	= 15.00	5.25	0.81	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 518.20	520.70	519.50	0.00
Length (ft)	= 55.40	0.50	0.00	0.00
Slope (%)	= 3.07	0.00	0.00	n/a
N-Value	= .012	.015	.013	n/a
Orifice Coeff.	= 0.60	0.80	0.61	0.60
Multi-Stage	= n/a	Yes	Yes	No

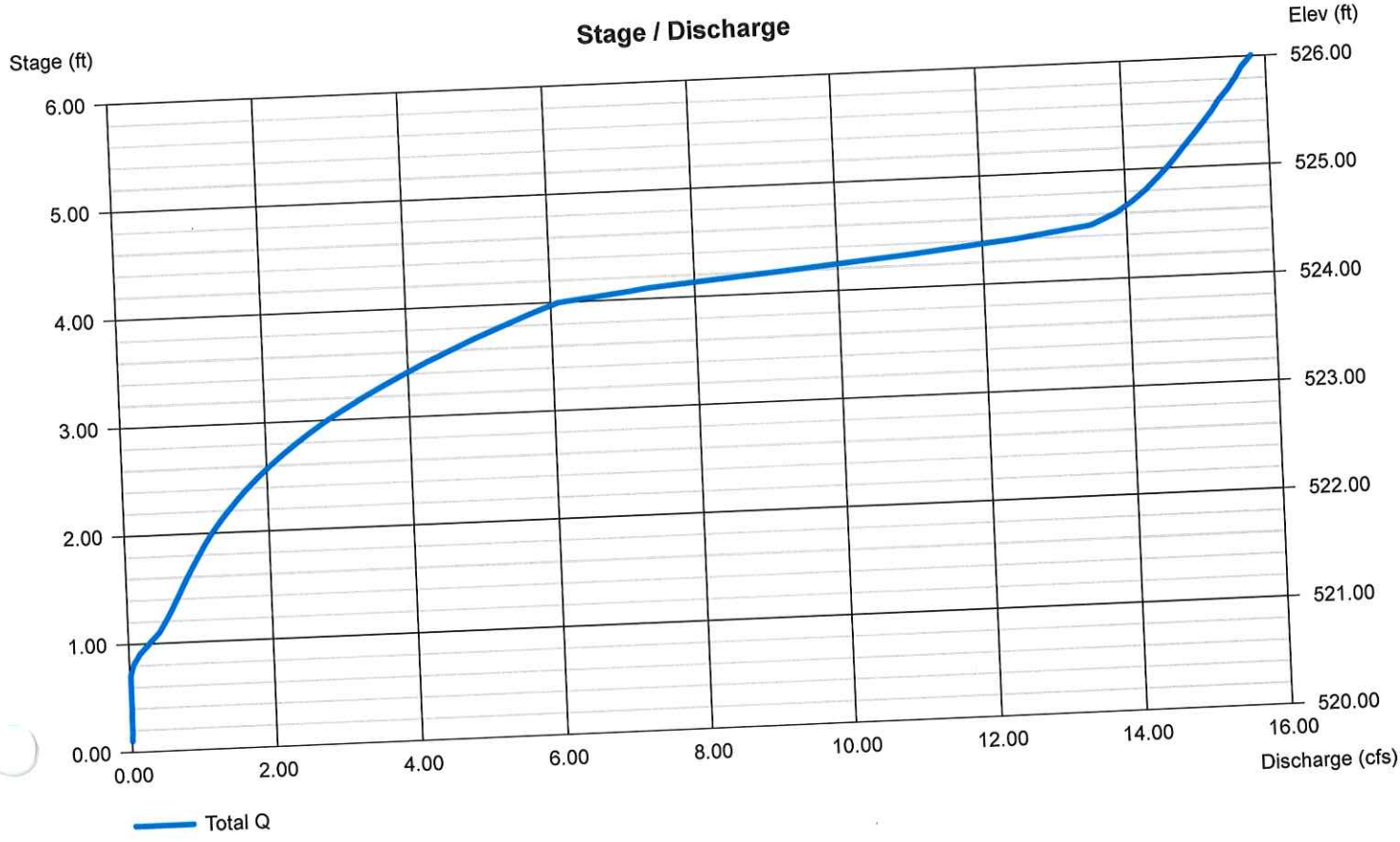
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	8.00	Inactive	Inactive
Crest El. (ft)	= 521.20	524.00	0.00	0.00
Weir Coeff.	= 0.33	3.33	3.33	3.33
Weir Type	= 15 degV	Rect	---	---
Multi-Stage	= Yes	Yes	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).



Submerged Orifices

Flow through a submerged orifice may be computed by applying Bernoulli's equation to points 1 and 2 in figure below

$$V_2 = \sqrt{2g\left(h_1 - h_2 + \frac{V_1^2}{2g} - h_L\right)}$$

where h_L = losses in head, ft (m), between 1 and 2.

By assuming $V_1 \approx 0$, setting $h_1 - h_2 = \Delta h$, and using a coefficient of discharge C to account for losses, the following formula is obtained:

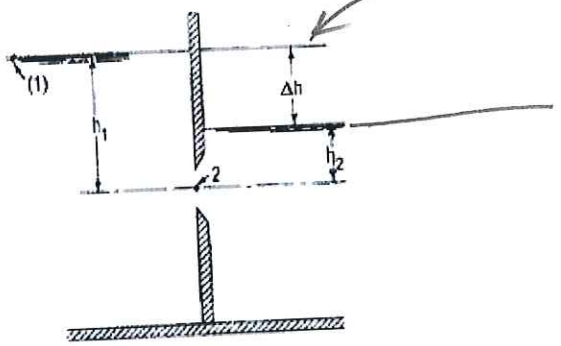
$$Q = Ca\sqrt{2g\,\Delta h}$$

C = ORIFICE COEFFICIENT (0.61) FOR SHARP EDGE ORIFICE
g = 32.2 FT/SEC²
a = ORIFICE AREA
h = HEAD

EL OF WQV (520.7)
VOL = 2161 FT³

BOTTOM OF DETENTION POND EL 520

ΔH = 0.7'



Values of C for submerged orifices do not differ greatly from those for nonsubmerged orifices.

ORIFICE SIZING

AVG Q REQUIRED FOR 40 HR, 2161 FT³ =

$\frac{2161}{144{,}000} = 0.0150$ CFS

$0.0150 = 0.6 \times a\sqrt{64.4 \times 0.7}$

$0.0150 = 4.0959\,a$

$a = 0.00366$ FT² = 0.5274 IN² ∅ 2 13/16

3. DISCHARGE COEFFICIENT VALUES

3.1 Relationship to Resistance coefficient K

The discharge coefficient may be directly related to the resistance coefficient via the follow equation:

$$K = \frac{1}{C_d^2}$$

3.2 Typical Values for Discharge Coefficient C_d

For simple pressure loss or flow rate calculations where high accuracy is not critical the following typical values may be used:

Equipment Type	β min	β max	C_d
Orifice Plate, thin sharp edged	-	-	0.61
Venturi Nozzle, Machined	0.4	0.75	0.995
Venturi Nozzle, Rough Welded Sheet Metal	0.4	0.70	0.985
Venturi Nozzle, Rough Cast	0.3	0.77	0.984

3.3 Precise Relationships for Discharge Coefficient

Where a higher degree of accuracy is required, such as for flow rate measurement, the relationships below may be used.

$$C_d = C_\infty + \frac{b}{Re^n}$$

Values for C_∞, b and n are presented below. Dimensions in millimeters.

Device	$C_{d,\infty}$
Venturi Nozzle, Machined Inlet	0.995
Venturi Nozzle, Cast Inlet	0.984
	0.985

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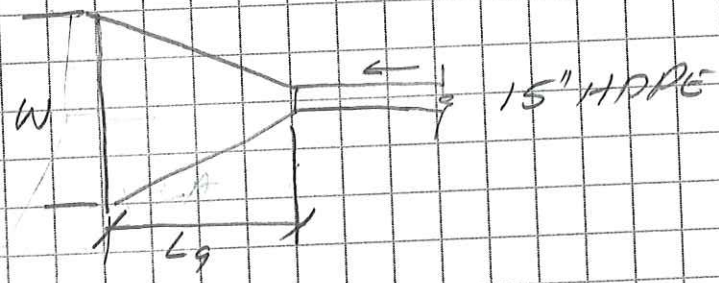
CHECKED BY	DATE CHECKED		CLIENT NAME	TOTAL PAGES

DETENTION POND OUTLET PROTECTION

SEE 2002 GUIDELINES FOR EROSION & SEDIMENT CONTROL
FIGURE 4S-4 Pg 5-10-5

TAILWATER < 0.5 D_o, Q_{100} = 5.47 CFS



$$L_q = \frac{1.7\,Q}{D_o^{3/2}} + 8D_o$$

$$= \frac{1.7 \times 5.47}{1.25^{1.5}} + 8 \times 1.25$$

$$= 16.65', \text{ USE } 17'$$

$$W = 3D_o + L_q$$

$$= 3 \times 1.25 + 16.65$$

$$= 20.4', \text{ USE } 21'$$

STONE SIZE

$$D_{50} = \left(\frac{0.02}{F_w}\right)\left(\frac{Q}{D_o}\right)^{4/3}$$

$$= \left(\frac{0.02}{0.6}\right)\left(\frac{5.47}{1.25}\right)^{1.333}$$

$$= 0.23' \ (3") \text{ USE MODIFIED RIPRAP}$$

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

CHANNEL ANALYSIS

> > >Detention Pond Outlet

Name	Detention Pond Outlet
Discharge	5.5
Peak Flow Period	12
Channel Slope	0.14
Channel Bottom Width	6
Left Side Slope	2
Right Side Slope	2
Existing Bend Radius	53
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	None
Vegetation Density	None
Soil Type	Fine Sand (ML)

Rock Riprap

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissable Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Rock Riprap Unvegetated	Straight	5.5 cfs	5.1 ft/s	0.17 ft	0.032	2 lbs/ft2	1.39 lbs/ft2	1.44	STABLE	--
Rock Riprap Unvegetated	Bend	5.5 cfs	5.1 ft/s	0.17 ft	0.032	2 lbs/ft2	1.68 lbs/ft2	1.19	STABLE	--

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www.nagreen.com
ECMDS v7.0

ANALYSIS COMPUTATIONS

> > > >View Computation

Inputs	
Channel Discharge (Q):	5.5 cfs
Peak Flow Period (H):	12 hours
Channel Slope (S0):	0.14 ft/ft
Bottom Width (B):	6 ft
Left Side Slope (ZL):	2 (H : V)
Right Side Slope (ZR):	2 (H : V)
Existing Channel Bend:	Yes
Bend Coefficient (Kb):	
Channel Bend Radius:	53 ft
Retardance Class of Vegetation:	C 6-12 in
Vegetation Type:	None
Vegetation Density:	None
Soil Type:	Fine Sand (ML)
Channel Lining Options	
Rock Riprap Protection Type	Permanent

Basic Relationships
A = Cross sectional area, ft2 (m2) = (B * D) + (Z_L / 2 * D2) + (Z_R / 2 * D2)
Where:
B = Base width of channel, ft (m)
D = Flow depth, ft (m)
Z_L = Left side bank slope (H : 1 V)
Z_R = Right side bank slope (H : 1 V)
P = Wetted perimeter, ft (m) = B + Z_L * D + Z_R * D
R = Hydraulic radius, ft (m) = A / P
V = Flow velocity, ft/s (m/s) = Q / A
Where:
Q = Channel discharge, cfs (cms)
Taua Average bed shear stress, psf (Pa) = 62.4 * R * S0
Where:
S0 = Gradient of channel, ft/ft (m/m)
Tau_o = Maximum bed shear stress, psf (Pa) = 62.4 * D * S_o

Unvegetated Conditions Computations:
n = Manning's n = a * Tauab
and (iteratively solved)
$n = 1.486 / Q * A * R(2/3)S_o^{0.5}$
Where:
n = Manning's n
a = Product specific coefficient from performance testing
b = Product specific coefficient from performance testing
SF_P = Product factor of safety = Tau_T / Tau_o

Where:

TauT = Permissible shear stress from testing, psf (Pa)

Tau_P = In place permissible shear, psf (Pa) = Tau_T / alpha * (Tau_S + alpha / 4.3)

Where:

alpha = unit conversion constant, 0.14 English, 6.5 Metric

Tau_S = Permissible shear stress of soil

SFL = Factor of safety of installed liner = Taup / Taua

Vegetated Computations:

n = Manning's n = alpha * Cn* Taua-0.4

and (iteratively solved)

$n = 1.486 / Q * A * R(2/3)S_0^{0.5}$

Where:

alpha = Unit conversion constant, 0.213 English, 1.0 Metric

Cn = Vegetation retardance coefficient

SF_P = Product factor of safety = Tau_{TV} / Tau_0

Where:

Tau_{TV} = Permissible shear stress from testing, psf (Pa)

Tau_P = In place permissible shear, psf (Pa) = Tau_S / (1 – C_{FTRM}) * (n / ns)2

Where:

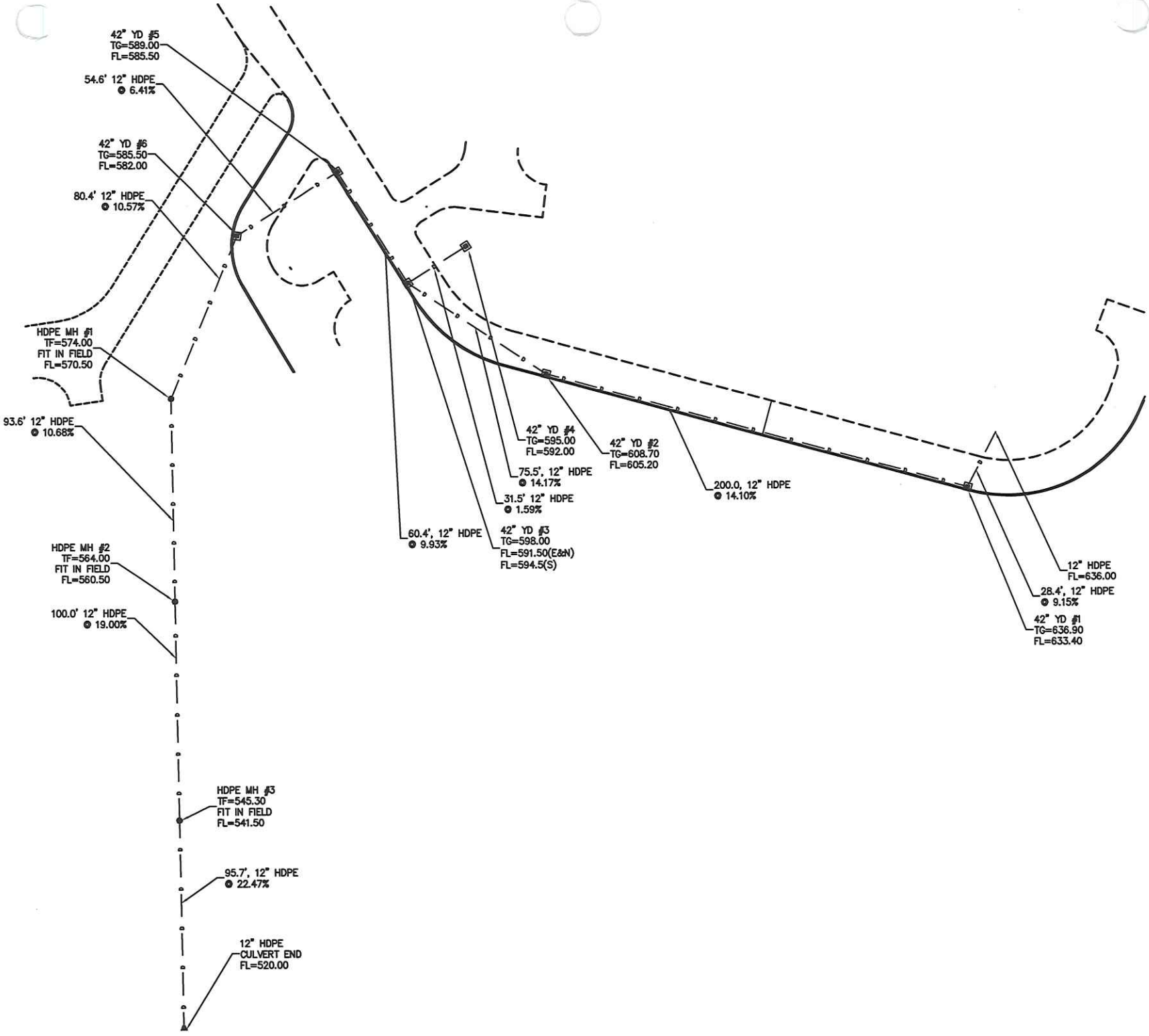
C_{FTRM} = Coefficient of TRM performance derived from testing Tau_S = Permissible shear stress of soil

n_S = Manning's of soil bed if left unprotected

SF_L = Factor of safety of installed liner = Tau_P / Tau_a

Rock Riprap

Phase	Mannings N	Predicted flow depth (D)	Cross sectional area (A)	Wetted perimeter (P)	Hydraulic radius (R)	Flow velocity (V)	Froude number (FR)	Calculated Shear Stress	SFP/SFL
Rock Riprap Unvegetated	0.032	0.17 ft	1.08 ft2	6.76 ft	0.16 ft	5.1 ft/s	2.25	1.39 lbs/ft2	1.44 (SFP)
Rock Riprap Unvegetated	0.032	0.17 ft	1.08 ft2	6.76 ft	0.16 ft	5.1 ft/s	2.25	1.68 lbs/ft2	1.19 (SFL)


42" YD #5
TG=589.00
FL=585.50
54.6' 12" HDPE
@ 6.41%
42" YD #6
TG=585.50
FL=582.00
80.4' 12" HDPE
@ 10.57%
HDPE MH #1
TF=574.00
FIT IN FIELD
FL=570.50
93.6' 12" HDPE
@ 10.68%
HDPE MH #2
TF=564.00
FIT IN FIELD
FL=560.50
100.0' 12" HDPE
@ 19.00%
HDPE MH #3
TF=545.30
FIT IN FIELD
FL=541.50
95.7', 12" HDPE
@ 22.47%
12" HDPE
CULVERT END
FL=520.00
60.4', 12" HDPE
@ 9.93%
42" YD #3
TG=598.00
FL=591.50(E&N)
FL=594.5(S)
31.5' 12" HDPE
@ 1.59%
75.5', 12" HDPE
@ 14.17%
42" YD #4
TG=595.00
FL=592.00
42" YD #2
TG=608.70
FL=605.20
200.0, 12" HDPE
@ 14.10%
12" HDPE
FL=636.00
28.4', 12" HDPE
@ 9.15%
42" YD #1
TG=636.90
FL=633.40

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STORM SEWER DESIGN - AREA TO INLETS, "I" & TC

RATIONAL METHOD
Q = CIA
10 YR STORM
I = 0.2 WOODS
= 0.3 GRASS
= 0.9 PAVEMENT

* 12" HDPE

TOTAL AREA = 4,705 SF = 0.108 AC

		CA
WOODS = 898 + 623 = 1521 = 0.035 AC @ 0.2	=	0.007
GRASS = 3184 SF = 0.073 AC @ 0.3	=	0.022
PAVED = 0	Σ	0.029

USE TC = 5 MIN (SHALLOW CONC) Q10 = .029 x 6.0 = 0.17 CFS

* YD # 1

TOTAL AREA = 14,828 SF = 0.340 AC

		CA
WOODS = 11079 SF = 0.254 AC	@ 0.2 =	0.051
GRASS = 1531 SF = 0.035 AC	@ 0.3 =	0.011
PAVED = 2258 SF = 0.052 AC	@ 0.9 =	0.047
	Σ	0.109

TC 150' @ 15.6% WOODS n=0.1
134' @ 2.6% UNPAVED
192' @ 10.1% PAVED
} 33 MIN - SEE WORKSHEET

Q10 = 0.10 CFS

TR55 Tc Worksheet

Hyd. No. 2

YD #1

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.16	0.00	0.00	
Travel Time (min)	**= 27.75**	**+ 0.00**	**+ 0.00**	**= 27.75**
Shallow Concentrated Flow				
Flow length (ft)	= 106.00	126.00	0.00	
Watercourse slope (%)	= 0.26	0.10	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 0.83	0.65	0.00	
Travel Time (min)	**= 2.13**	**+ 3.22**	**+ 0.00**	**= 5.35**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... **33.00 min**

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* YD #2

TOTAL AREA = 5142 SF = 0.118 AC

WOODS = 1141 SF = 0.026 AC @ 0.2 = 0.052
GRASS = 1010 SF = 0.023 AC @ 0.3 = 0.007
PAVED = 2991 SF = 0.069 AC @ 0.9 = 0.062
Σ 0.121

USE TC = 5 MIN (MOSTLY PAVED)

* YD # 3

TOTAL AREA = 1803 SF = 0.041 AC

WOODS - 78 SF = 0.002 AC @ 0.2 = 0.0004
GRASS - 98 SF = 0.002 AC @ 0.3 = 0.0006
PAVED = 1627 SF = 0.037 AC @ 0.9 = 0.0333
Σ 0.034

TC USE 5 MIN - MOSTLY PAVED - USE C = 0.9 FOR ALL

* YD #4

TOTAL AREA = 43,708 SF = 1.003 AC

CA
WOODS = 35,864 SF = 0.823 AC @ 0.2 = 0.165
GRASS = 5,545 SF = 0.127 AC @ 0.3 = 0.038
PAVED = 2299 SF = 0.053 AC @ 0.9 = 0.048
Σ 0.251

TC 150' @ 17.3% WOODS n = 0.10
310' @ 21.6 UNPAVED = 34' - SEE WORKSHEET
Q10 = .251 X 2.7 = 0.68

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5

YD #4

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.100	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.07	0.00	0.00	
Land slope (%)	= 0.17	0.00	0.00	
Travel Time (min)	**= 26.63**	**+ 0.00**	**+ 0.00**	**= 26.63**
Shallow Concentrated Flow				
Flow length (ft)	= 318.00	0.00	0.00	
Watercourse slope (%)	= 0.22	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 0.75	0.00	0.00	
Travel Time (min)	**= 7.07**	**+ 0.00**	**+ 0.00**	**= 7.07**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 34.00 min

PREPARED BY | DATE PREPARED | CHECKED BY | DATE CHECKED

DUTTON ASSOCIATES, LLC
67 EASTERN BOULEVARD
GLASTONBURY, CONNECTICUT 06033
TEL: (860)-633-9401 FAX: (860)-633-8851
EMAIL: JIMD@DUTTONASSOCIATESLLC.COM

JOB NUMBER | PAGE NUMBER 72
CLIENT NAME | TOTAL PAGES

* C.B # 1

TOTAL AREA = 801 SF = 0.018 AC @ 0.9 = 0.016

ALL PAVED, USE C = 0.9, TC = 5 MIN

* YD # 6

TOTAL AREA = 6055 SF = 0.139 AC

		CA
WOODS = 6		
GRASS = 3032 SF	= 0.07 AC @ 0.2 =	0.014
PAVED = 3023 SF	= 0.069 AC @ 0.9 =	0.062
	&	0.076

USE TC = 5 MIN (50% PAVED)

* HDPE MH # 1

TOTAL AREA = 2450 SF (ROOF) = 0.056 AC 0.9 = 0.050 (CA)

USE TC = 5 MIN (ALL PAVED) Q_{10} = 0.30
USE C = 0.9 (ALL PAVED)

PROJECT: CASELLA SUBDIVISION
PROJECT N 3098
TOWN: GLASTONBURY
ROUTE:
LOCATION: KNOLLWOOD DR

DESIGNED BY: JWD DATE: 09/28/20
CHECKED BY: JRM DATE:

GUTTER FLOW ANALYSIS - 10 YR STORM

Inlet ID	Area in Acres (A)	Time to Inlet (min.)	Rainfall Intensity (in/hr)	AC	Total AC	Q to Inlet (cfs)	Grade of Gutter ft/ft (S_L)	Cross Slope Of Shoulder ft/ft (S_x)	Depth of Flow of Gutter (ft)	Gutter Flow Width (ft)	Q Bypassing Inlet (cfs)	AC Bypassing Inlet	AC Entering Catch Basin	Inlet Type	Grate Width (ft)
YD #1	0.340	33	2.7	0.108	0.108	0.292	0.120	0.031	0.068	2.165	0.013	0.005	0.103	20"SQ	1.7
YD #2	0.118	5	6	0.121	0.126	0.756	0.148	0.031	0.093	2.976	0.139	0.023	0.103	20"SQ	1.7
YD #3	0.041	5	6	0.034	0.057	0.343	0.140	0.031	0.070	2.235	0.020	0.003	0.054	20"SQ	1.7
CB #1	0.018	5	6	0.016	0.019	0.116	0.148	0.031	0.046	1.472	0.000	0.000	0.019	20"SQ	1.7
YD #6 AT LOW POINT															
YD #6	0.139	5	6	0.076	0.076	0.456	0.000	0.031	0.166	5.351				20"SQ	1.7

43

STORM SEWER SYSTEM DESIGN

Client: CASELLA
Project: 3098
Town: GLASTONBURY
Return Period for Design: 10-YR

Prepared By: JWD Date: 1-/03/2019
Checked By: JRM Date:

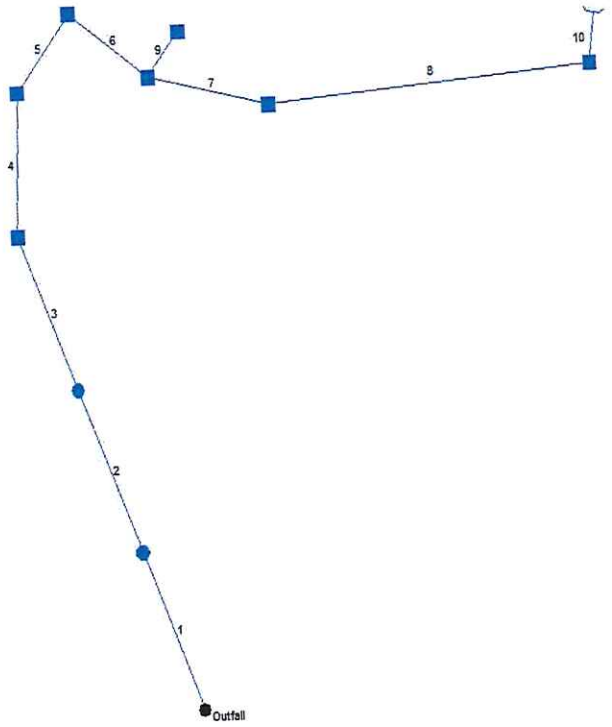
Line Segment From	Line Segment To	Time to Inlet (min.)	Time in Pipe (min.)	Accumul. Time (min.)	A x C Entering System	Sum of A x C in System	Rainfall Intensity, I (in./hr.)	Q in System (c.f.s.)	Pipe Data Size (in.)	Length (ft.)	Slope (ft./ft.)	Avg. Vel. (f.p.s.)	Full Cap. (c.f.s.)	Depth (ft.)	Manning "n"	Inlet Control HW HW/D	Inlet Control HW H (ft.)
12"HDPE	YD1	5	0.09	5.0	0.036	0.036	6.0	0.22	12	28.4	0.091	5.5	11.66	0.10	0.012	>0.5	>0.5
YD1	YD2	33	0.41	33.0	0.165	0.201	2.7	0.54	12	200	0.141	8.2	14.49	0.13	0.012	>0.5	>0.5
YD2	YD3	5	0.14	33.4	0.114	0.315	2.6	0.82	12	75.5	0.142	9.2	14.52	0.17	0.012	>0.5	>0.5
YD4	YD3	34	0.06	34.0	0.251	0.251	2.7	0.68	12	31.5	0.016	9.0	4.86	0.25	0.012	>0.5	>0.5
YD3	CB1	5	0.10	38.1	0.059	0.374	2.5	0.94	12	60.4	0.099	9.8	12.16	0.13	0.012	>0.5	>0.5
CB1	YD6	5	0.11	38.2	0.021	0.395	2.6	1.03	12	54.6	0.064	8.3	9.77	0.21	0.012	>0.5	>0.5
YD6	MH1	5	0.17	38.3	0.016	0.411	2.5	1.03	12	80.4	0.106	8.0	12.54	0.20	0.012	>0.5	>0.5
MH1	MH2	5	0.13	38.5	0.05	0.461	2.5	1.15	12	93..6	0.107	9.8	12.61	0.19	0.012	0.63	0.63
MH2	MH3	0	0.13	38.6	0	0.461	2.5	1.15	12	100	0.190	13.0	16.82	0.17	0.012	0.63	0.63
MH3	12"CE	0	0.11	38.7	0	0.461	2.5	1.15	12	95.7	0.225	14.0	18.29	0.16	0.012	0.63	0.63

PROJECT: 03098-CASELLA
DUTTON ASSOCIATES, LLC
SEE CONNECTICUT DOT DRAI9NAGE MANUAL SECTION 11-11
BY: JWD
DATE: 01/03/2020
CHECKED BY: JRM
DATE: 01/03/2020
10 YEAR STORM EVENT

Station	Tw	D_o	Q_O	L_O	V_O	$V_O^2/2g$	H_O	SFo	H_f	K_o	C_D	Cd	C_Q	C_p	C_B	K	$K(V_O^2/2g)$	EGLo	EGLi	HGL	Surface Elev	Pipe Area	Hyd. Rad.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
12"HDPE -YD1	636.50	1	0.2	28.4	5.5	0.47	0.5	0.0000	0	0.2	1	1	1	1	1	0.15	0.0705	637.0	637.0	636.6	638.0	0.785	0.3969
YD1 -YD2	633.90	1	0.5	200	8.2	1.044	1	0.0002	0.04	0.2	1	1	1	1	1	0.15	0.1566	634.9	635.1	634.1	636.9	0.785	0.3969
YD2-YD3	605.70	1	1.2	75.5	9.2	1.314	1.3	0.0010	0.07	1.0	1	1	1	1	1	0.95	1.2486	607.0	608.3	607.0	608.7	0.785	0.3969
YD4-YD3	592.50	1	10.9	31.5	9	1.258	1.3	0.0798	2.51	1.5	1	1	1	1	1	1.5	1.8866	593.8	598.2	596.9	598.0	0.785	0.3969
YD3-CB1	586.00	1	10.4	60.4	9.8	1.491	1.5	0.0726	4.39	1.5	1	1	1	1	1	1.5	2.2370	587.5	594.1	592.6	589.0	0.785	0.3969
CB1-YD6	582.50	1	1.2	54.8	8.3	1.07	1.1	0.0010	0.05	1.0	1	1	1	1	1	0.95	1.0162	583.6	584.6	583.6	585.5	0.785	0.3969
YD6-MH1	574.50	1	8.4	80.4	8	0.994	1	0.0474	3.81	0.5	1	1	1	1	1	0.45	0.4472	575.5	579.7	578.8	574.0	0.785	0.3969
MH1-MH2	561.13	1	3.8	93.6	9.8	1.491	1.5	0.0097	0.91	0.2	1	1	1	1	1	0.15	0.2237	562.6	563.8	562.3	654.0	0.785	0.3969
MH2-MH3	542.13	1	7.1	100	13	2.624	2.6	0.0338	3.38	0.2	1	1	1	1	1	0.15	0.3936	544.8	548.5	545.9	545.3	0.785	0.3969
MH3-OUT	523.00	1	6.8	95.7	14	3.043	3	0.0310	2.97	0.2	1	1	1	1	1	0.15	0.4565	526.0	529.5	526.4	526.0	0.785	0.3969

HGL 25-yr PROPOSED

Hydraflow Plan View



03098 CASELLA SUBDIVISION	No. Lines: 10	09-30-2020

Hydraflow Storm Sewers 2005

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		3.39	12 c	95.7	520.00	541.50	22.457	522.00	542.28	n/a	542.96 i	End
2		3.39	12 c	100.0	541.50	560.50	19.000	542.96	561.28	n/a	561.96 i	1
3		3.39	12 c	93.6	560.50	570.50	10.685	561.96	571.28	n/a	571.96 i	2
4		3.09	12 c	80.4	570.50	582.00	14.300	571.96	582.75	n/a	583.35 i	3
5		2.63	12 c	54.6	582.00	585.50	6.407	583.35	586.19	n/a	586.69 i	4
6		2.53	12 c	60.4	585.50	591.50	9.941	586.69	592.17	n/a	592.65 i	5
7		1.49	12 c	75.5	594.50	605.20	14.169	594.72	605.72	n/a	605.99 i	6
8		0.65	12 c	200.0	605.20	633.40	14.100	605.99	633.74	n/a	633.87 i	7
9		0.68	12 c	31.5	591.50	592.00	1.589	592.65	592.65	0.02	592.68	6
10		0.22	12 c	28.4	633.40	636.00	9.145	633.87	636.20	n/a	636.26 i	8

03098 CASELLA SUBDIVISION | Number of lines: 10 | Run Date: 09-30-2020

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; i - Inlet control.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	95.7	0.00	0.00	0.00	0.00	0.00	0.0	40.4	0.0	3.39	18.28	4.73	12	22.46	541.50	520.00	542.28	522.00	545.30	526.00	
2	1	100.0	0.00	0.00	0.00	0.00	0.00	0.0	40.1	0.0	3.39	16.82	4.73	12	19.00	560.50	541.50	561.28	542.96	564.00	545.30	
3	2	93.6	0.00	0.00	0.00	0.00	0.00	5.0	39.8	0.0	3.39	12.61	4.73	12	10.68	570.50	560.50	571.28	561.96	574.00	564.00	
4	3	80.4	0.00	0.00	0.00	0.00	0.00	5.0	39.4	0.0	3.09	14.59	4.43	12	14.30	582.00	570.50	582.75	571.96	585.50	574.00	
5	4	54.6	0.00	0.00	0.00	0.00	0.00	5.0	39.2	0.0	2.63	9.77	3.96	12	6.41	585.50	582.00	586.19	583.35	589.00	585.50	
6	5	60.4	0.00	0.00	0.00	0.00	0.00	5.0	39.0	0.0	2.53	12.16	3.86	12	9.94	591.50	585.50	592.17	586.69	598.00	589.00	
7	6	75.5	0.00	0.00	0.00	0.00	0.00	5.0	38.8	0.0	1.49	14.52	7.76	12	14.17	605.20	594.50	605.72	594.72	608.70	598.00	
8	7	200.0	0.00	0.00	0.00	0.00	0.00	37.0	37.0	0.0	0.65	14.49	1.86	12	14.10	633.40	605.20	633.74	605.99	636.90	608.70	
9	6	31.5	0.00	0.00	0.00	0.00	0.00	34.0	34.0	0.0	0.68	4.86	1.06	12	1.59	592.00	591.50	592.65	592.65	595.00	598.00	
10	8	28.4	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.22	11.67	1.29	12	9.14	636.00	633.40	636.20	633.87	639.00	636.90	

03098 CASELLA SUBDIVISION

Number of lines: 10

Run Date: 09-30-2020

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

MyCustom

Line No.	Line ID	Storage (cft)	Invert Dn (ft)	Drng Area (ac)	Runoff Coeff (C)	Total CxA	Tc (min)	i Sys (in/hr)	Flow Rate (cfs)	Capac Full (cfs)	Line Size (in)	Line Slope (%)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Gnd/Rim El Up (ft)	n-val Pipe
1		73.18	520.00	0.00	0.00	0.00	40.4	0.00	3.41	18.28	12	22.46	4.75	541.50	520.00	542.28 j	522.00	545.30	0.012
2		76.43	541.50	0.00	0.00	0.00	40.1	0.00	3.41	16.82	12	19.00	4.75	560.50	541.50	561.28 j	542.97	564.00	0.012
3		71.53	560.50	0.00	0.00	0.00	39.7	0.00	3.41	12.61	12	10.68	4.75	570.50	560.50	571.28 j	561.97	574.00	0.012
4		61.07	570.50	0.00	0.00	0.00	39.4	0.00	3.11	14.59	12	14.30	4.45	582.00	570.50	582.75 j	571.97	585.50	0.012
5		41.01	582.00	0.00	0.00	0.00	39.2	0.00	2.65	9.77	12	6.41	3.98	585.50	582.00	586.19 j	583.36	589.00	0.012
6		44.28	585.50	0.00	0.00	0.00	39.0	0.00	2.53	12.16	12	9.94	3.86	591.50	585.50	592.17 j	586.69	598.00	0.012
7		19.90	594.50	0.00	0.00	0.00	38.8	0.00	1.49	14.52	12	14.17	7.76	605.20	594.50	605.72	594.72	608.70	0.012
8		91.40	605.20	0.00	0.00	0.00	37.0	0.00	0.65	14.49	12	14.10	1.86	633.40	605.20	633.74 j	605.99	636.90	0.012
9		22.60	591.50	0.00	0.00	0.00	34.0	0.00	0.68	4.86	12	1.59	1.06	592.00	591.50	592.65	592.65	595.00	0.012
10		6.67	633.40	0.00	0.00	0.00	5.0	0.00	0.22	11.67	12	9.14	1.29	636.00	633.40	636.20 j	633.87	639.00	0.012

03098 CASELLA SUBDIVISION | Number of lines: 10 | Date: 10-01-2020

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80 -- Return period = 10 Yrs. ; i Inlet control; ** Critical depth

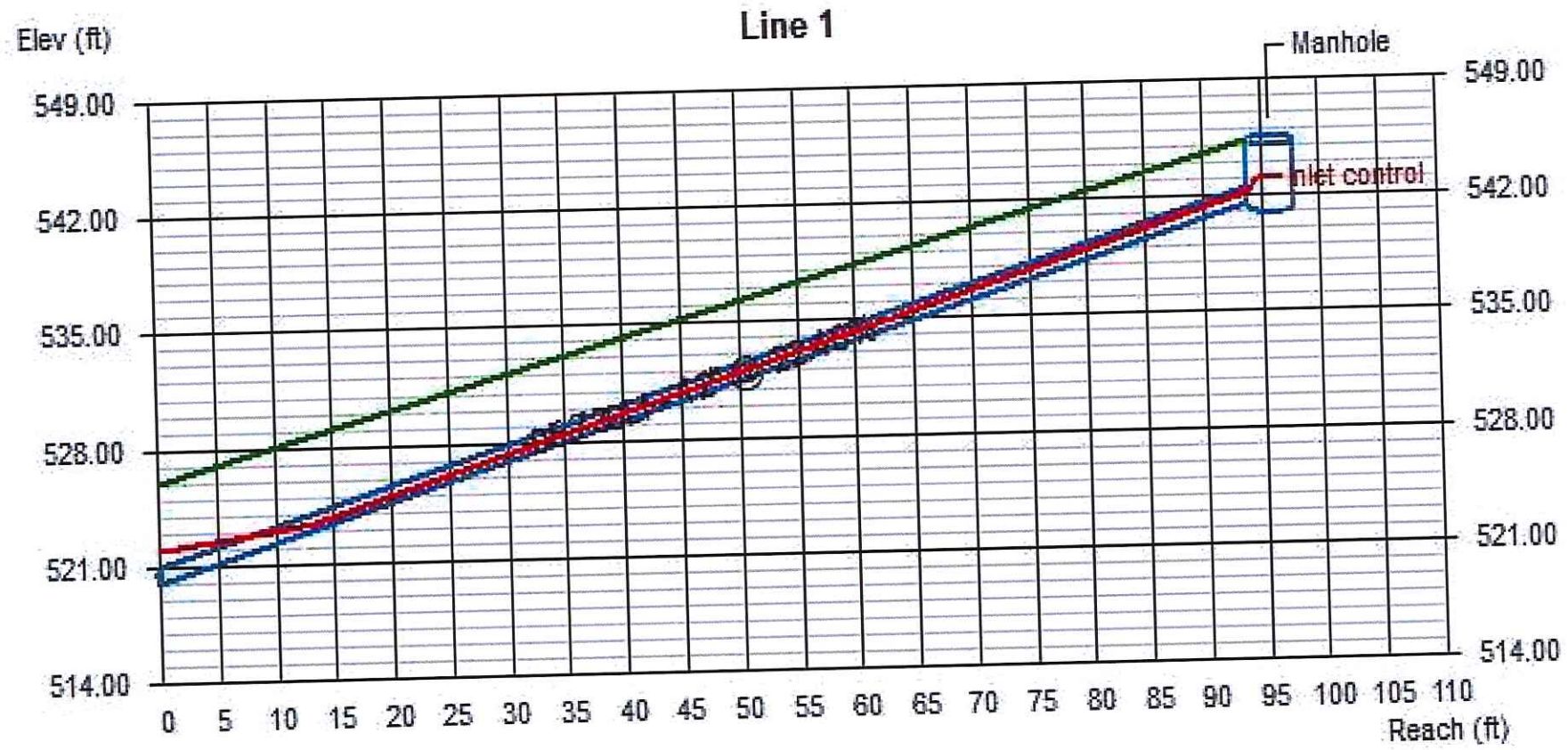
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	12	3.39	520.00	522.00	1.00	0.79	4.32	0.29	522.29	n/a	95.7	541.50	542.28 j	0.78**	0.66	5.15	0.41	542.69i	n/a	n/a	n/a	0.15	n/a
2	12	3.39	541.50	542.96	1.00	0.79	4.32	0.29	543.25	n/a	100	560.50	561.28 j	0.78**	0.66	5.15	0.41	561.69i	n/a	n/a	n/a	0.15	n/a
3	12	3.39	560.50	561.96	1.00	0.79	4.32	0.29	562.25	n/a	93.6	570.50	571.28 j	0.78**	0.66	5.15	0.41	571.69i	n/a	n/a	n/a	0.67	n/a
4	12	3.09	570.50	571.96	1.00	0.79	3.94	0.24	572.20	n/a	80.4	582.00	582.75 j	0.75**	0.63	4.92	0.38	583.12i	n/a	n/a	n/a	0.95	n/a
5	12	2.63	582.00	583.35	1.00	0.79	3.35	0.17	583.53	n/a	54.6	585.50	586.19 j	0.69**	0.58	4.57	0.32	586.51i	n/a	n/a	n/a	1.50	n/a
6	12	2.53	585.50	586.69	1.00	0.79	3.22	0.16	586.85	n/a	60.4	591.50	592.17 j	0.67**	0.56	4.49	0.31	592.49i	n/a	n/a	n/a	1.50	n/a
7	12	1.49	594.50	594.72	0.22*	0.13	11.89	2.20	596.92	n/a	75.5	605.20	605.72	0.52**	0.41	3.63	0.20	605.92i	n/a	n/a	n/a	0.54	n/a
8	12	0.65	605.20	605.99	0.79	0.67	0.97	0.01	606.01	n/a	200	633.40	633.74 j	0.34**	0.24	2.74	0.12	633.86i	n/a	n/a	n/a	1.47	n/a
9	12	0.68	591.50	592.65	1.00	0.79	0.87	0.01	592.66	0.031	31.5	592.00	592.65	0.65	0.54	1.25	0.02	592.68	0.054	0.042	0.013	1.00	0.02
10	12	0.22	633.40	633.87	0.47	0.37	0.60	0.01	633.88	n/a	28.4	636.00	636.20 j	0.20**	0.11	1.98	0.06	636.26i	n/a	n/a	n/a	1.00	n/a

03098 CASELLA SUBDIVISION | Number of lines: 10 | Run Date: 09-30-2020

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line Profile (Line 1)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	3.39	520.00	541.50	1.00	0.78	1.46	522.00	542.28 j	542.96 i	4.32	5.15	5.00	2.80

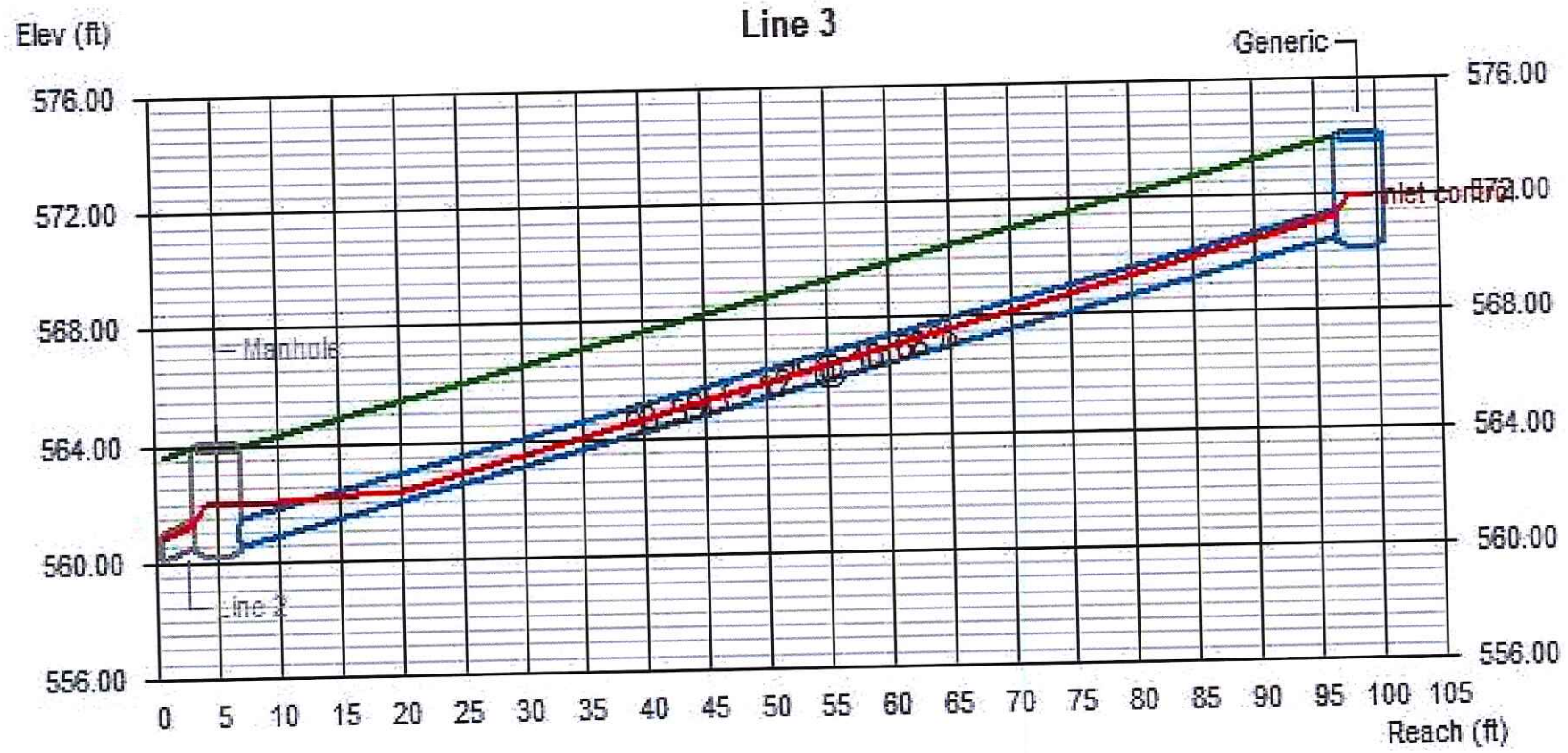
03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

Line Profile (Line 2)

Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	3.39	541.50	560.50	1.00	0.78	1.46	542.96	561.28 j	561.96 i	4.32	5.15	2.80	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

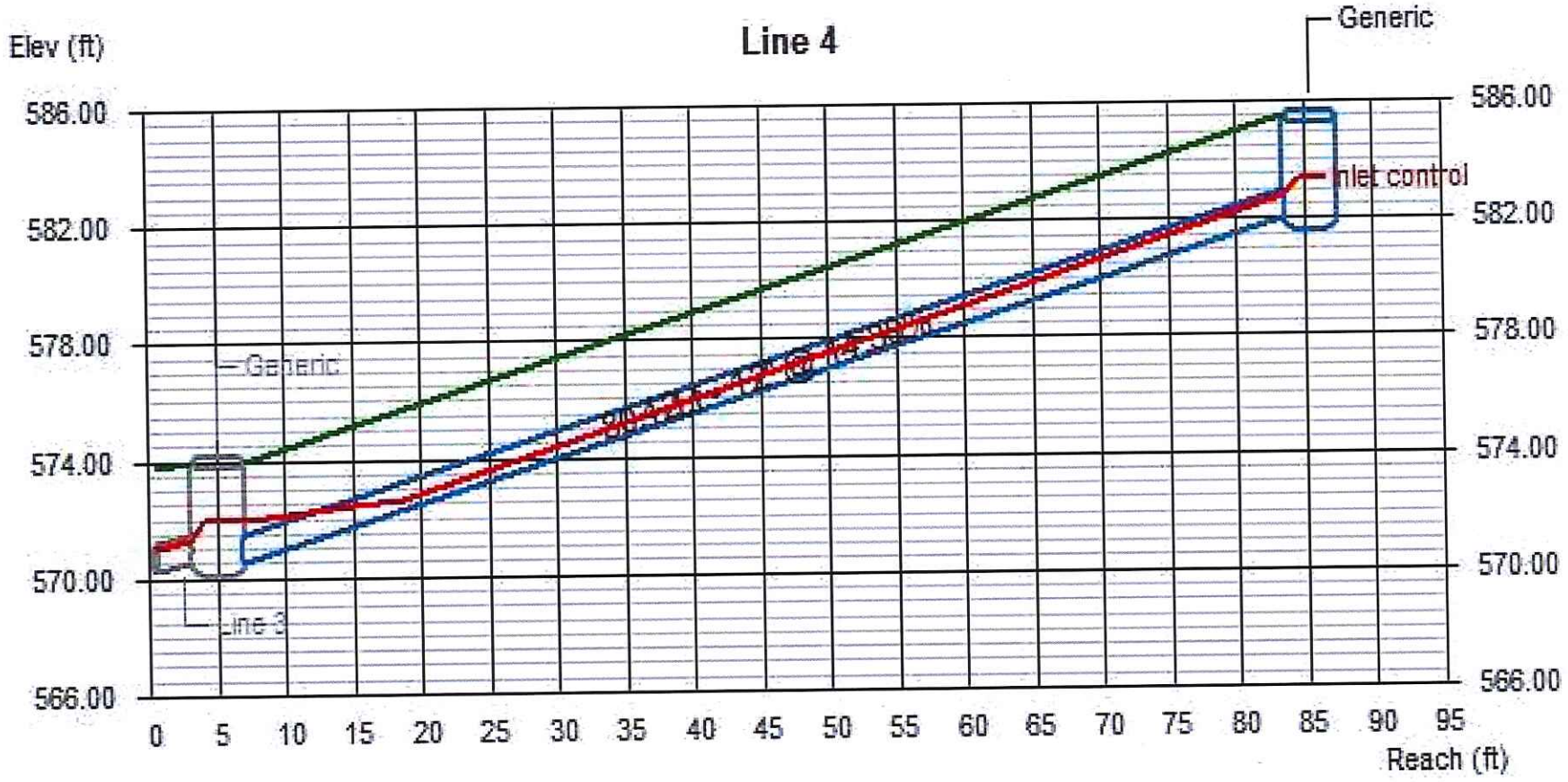
Line Profile (Line 3)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	3.39	560.50	570.50	1.00	0.78	1.46	561.96	571.28 j	571.96 i	4.32	5.15	2.50	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

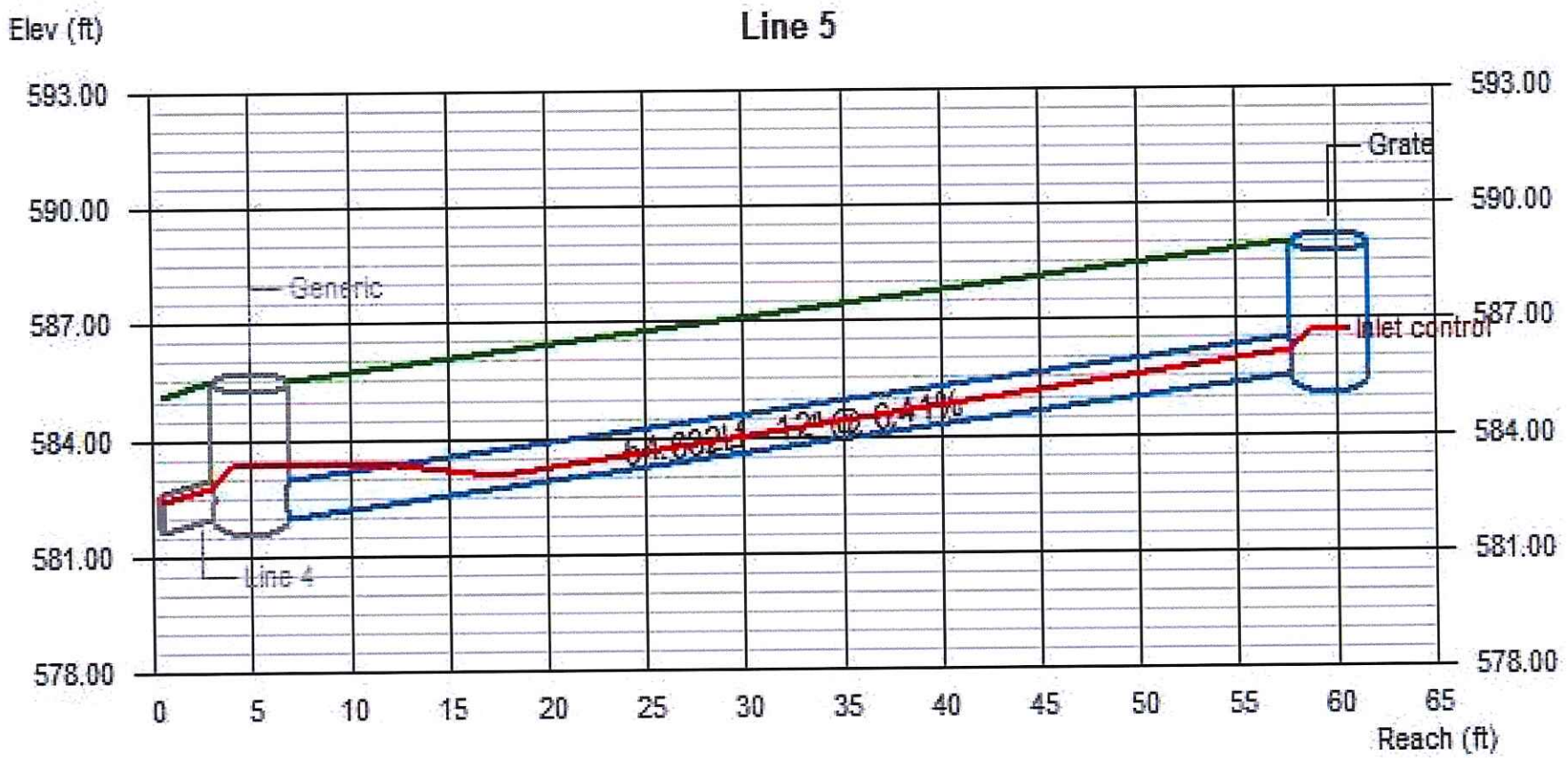
Line Profile (Line 4)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	3.09	570.50	582.00	1.00	0.75	1.35	571.96	582.75 j	583.35 i	3.94	4.92	2.50	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

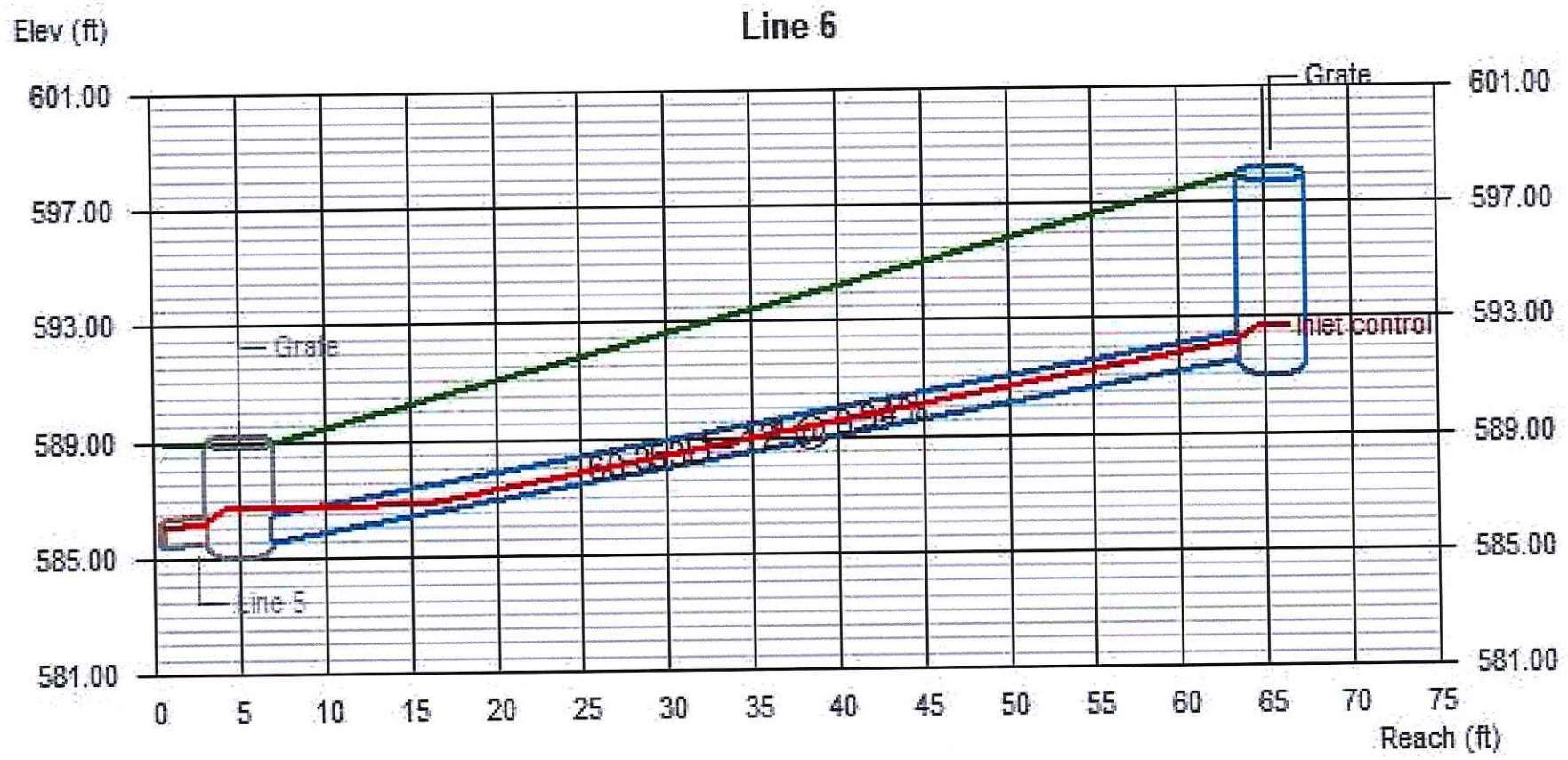
Line Profile (Line 5)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	2.63	582.00	585.50	1.00	0.69	1.19	583.35	586.19 j	586.69 i	3.35	4.57	2.50	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

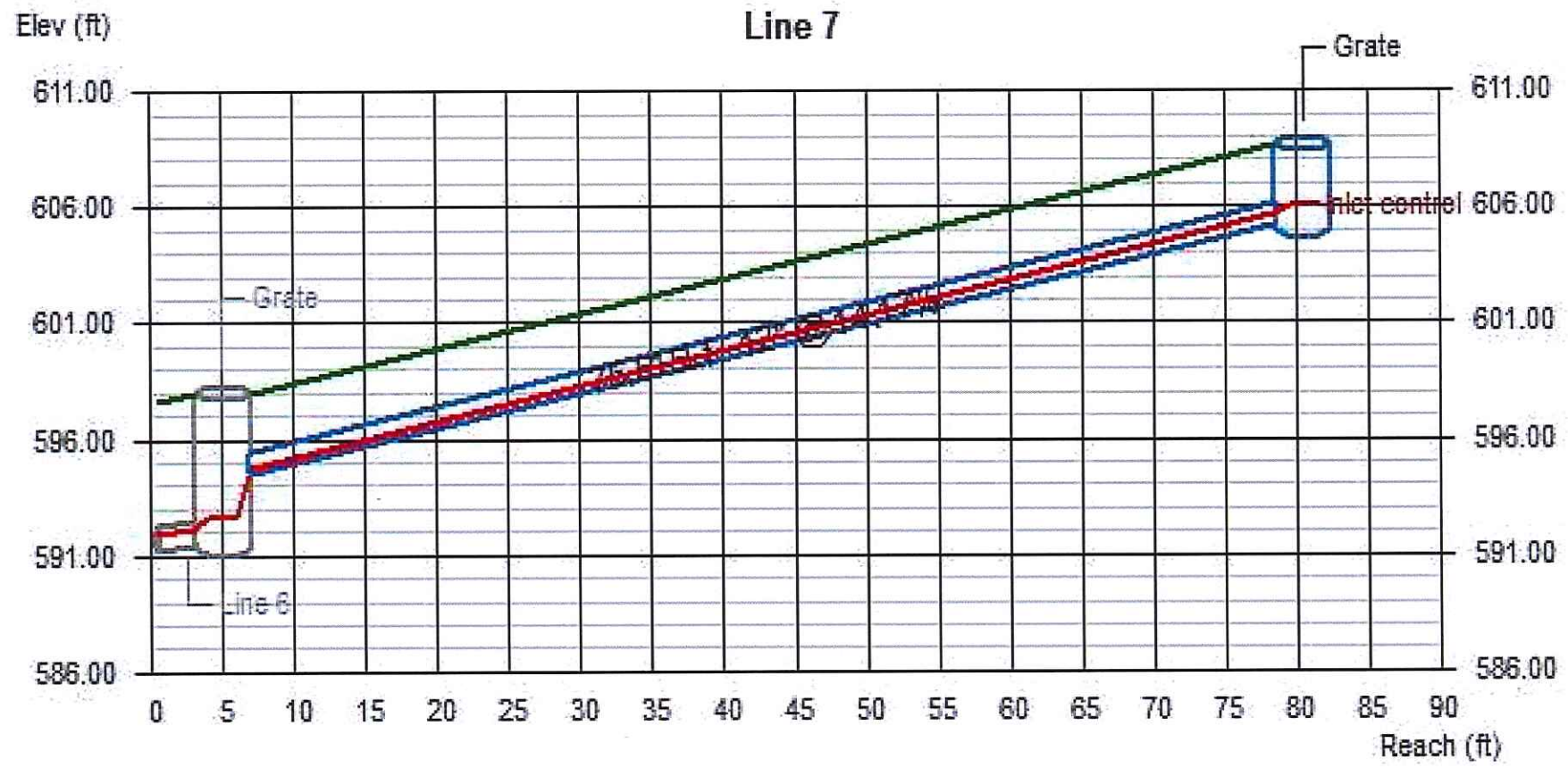
Line Profile (Line 6)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	2.53	585.50	591.50	1.00	0.67	1.15	586.69	592.17 j	592.65 i	3.22	4.49	2.50	5.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

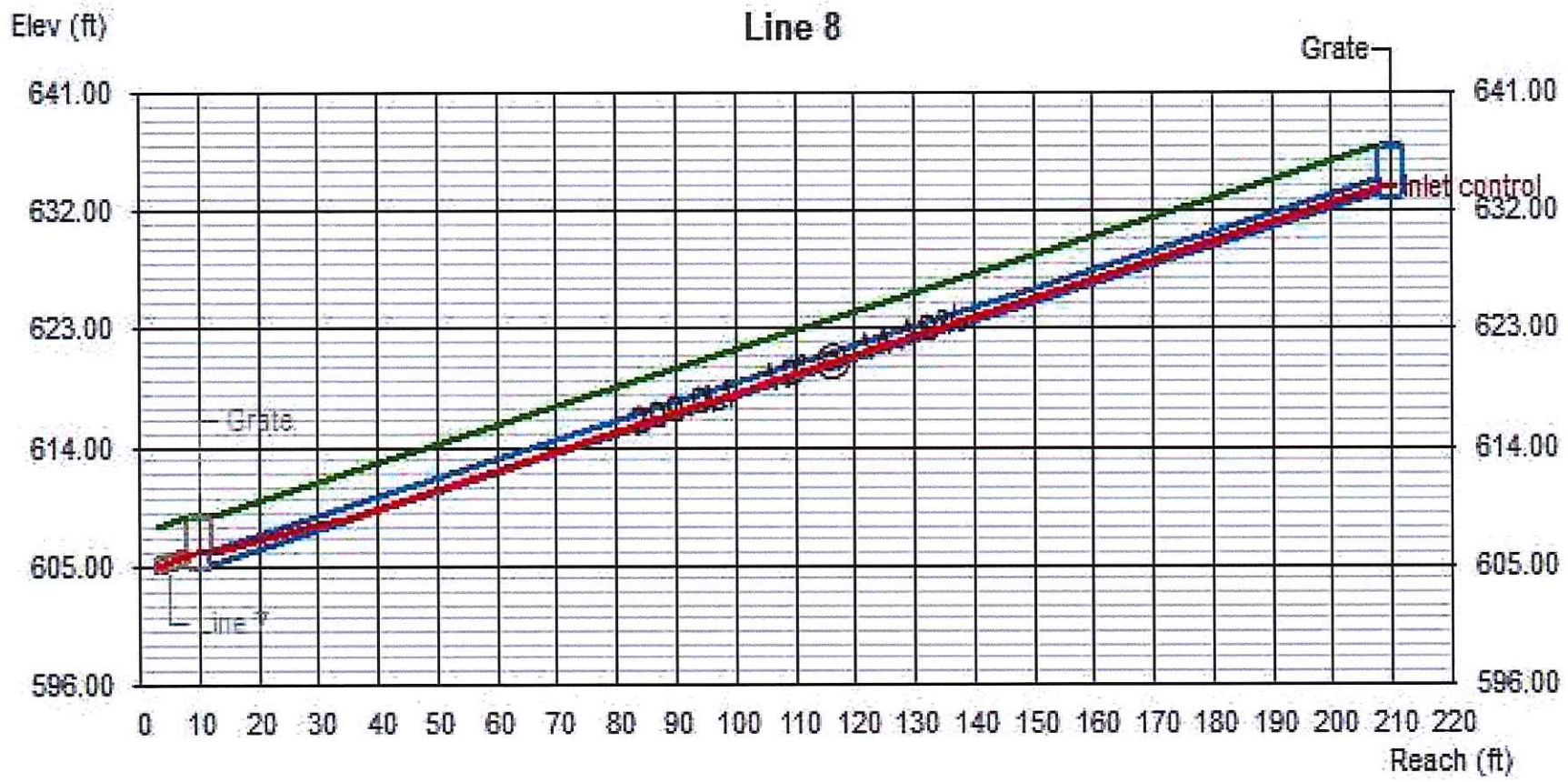
Line Profile (Line 7)



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
7	1.49	594.50	605.20	0.22	0.52	0.79	594.72	605.72	605.99 i	11.89	3.63	2.50	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

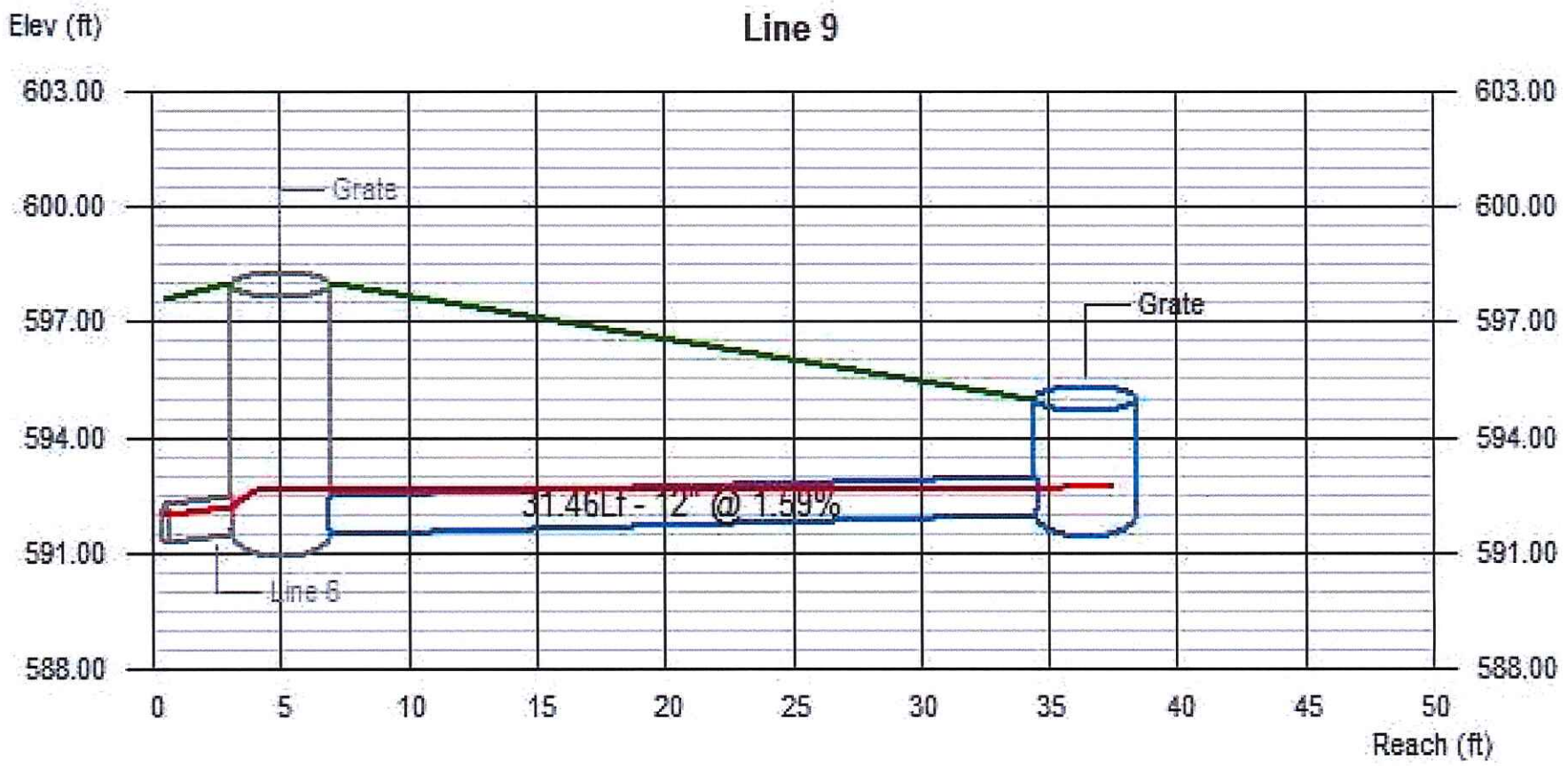
Line Profile (Line 8)



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
8	0.65	605.20	633.40	0.79	0.34	0.47	605.99	633.74 j	633.87 i	0.97	2.74	2.50	2.50

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

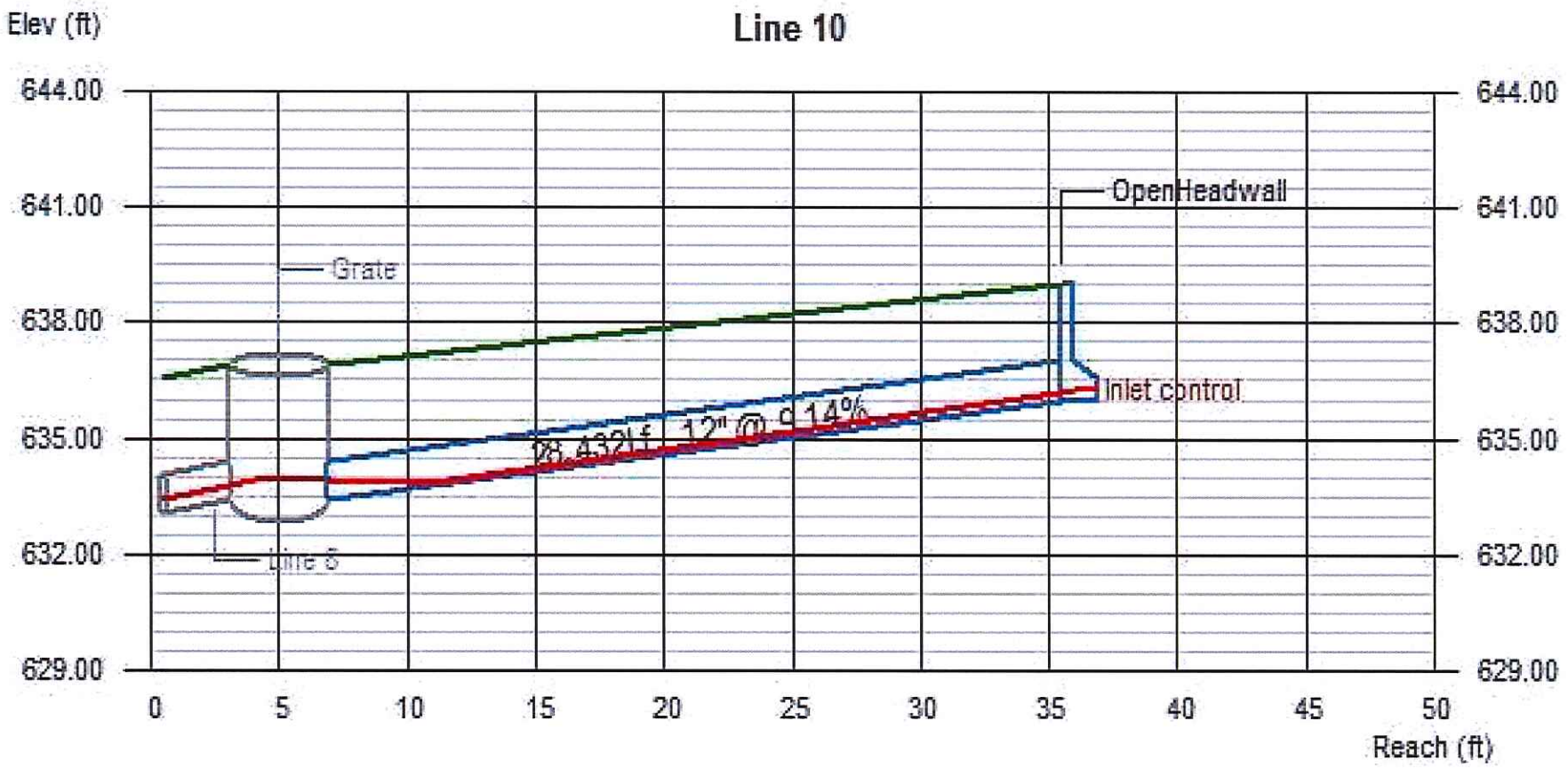
Line Profile (Line 9)



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
9	0.68	591.50	592.00	1.00	0.65	0.68	592.65	592.65	592.68	0.87	1.25	5.50	2.00

03098 CASELLA SUBDIVISION | No. Lines: 10 | Run Date: 09-30-2020

Line Profile (Line 10)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
10	0.22	633.40	636.00	0.47	0.20	0.26	633.87	636.20 j	636.26 i	0.60	1.98	2.50	2.00

03098 CASELLA SUBDIVISION	No. Lines: 10	Run Date: 09-30-2020

ConnSoil
the hidden garden and connsoil, llc

Job No. 4-10-14

8 April 2010

91

Mr. Jim Dutton
Dutton Associates, LLC
67 Eastern Boulevard
Glastonbury, CT 06033

LOCATION: Casella property,
Knollwood Drive, Glastonbury,
Connecticut

SOILS AND WETLANDS REPORT

INSPECTION DATE:	4/7/10
MAP PROVIDED:	topographical
CONTOUR INTERVAL SHOWN	2 ft
SCALE SHOWN:	40
SOIL MOISTURE CONDITIONS:	moist
PROPERTY LINES IDENTIFIABLE:	not clear
WETLAND FLAG NUMBERING SEQUENCE:	#1 - #29

This site inspection was conducted to evaluate the presence of inland-wetlands and watercourses. A detailed classification of the soils was not part of this study. Field observations of the wetland and upland soils together with the classification system of the National Cooperative Soil Survey, USDA, and the County Soil Legend were used in this investigation to identify the soil series names.

In conducting field investigations, soil borings are taken from which many important soil properties are observed, as follows: seasonal soil moisture condition OR the presence of free water and its depth, for each horizon in the soil profile, the thickness, color and texture are also observed. The areas shown on soil maps are called soil map units. Some map units consist of one kind of soil while others consist of two or more kinds of soil. A few have little or no soil material at all. The information in this report is based on examination and interpretation of soils with the use of a hand auger and shovel. Wetland delineation is based on prevailing conditions at the time of investigation and best professional judgment. Field conditions may change over time.

COMMENTS: This parcel is situated south of the cul-de-sac of Knollwood Drive and comprises hilly, rocky land which slopes to the south and southwest. Shallow bedrock controls the topography and outcroppings are noted in the vicinity. Southwest of the parcel property line, on property of Mr. and Mrs. George Mikk, is a valley/swale area that receives drainage from the surrounding hillsides. A wetland was identified at the top of this valley and behind a house located on the west side of the cul-de-sac. The boundary of the wetland was delineated and continued along the watercourse which drains out of the wetland towards the south. At the bottom of the steep incline, the watercourse broadens out into a larger wetland. As requested, only the east side of the wetlands and watercourse were delineated since this drainage is not on the subject parcel of Mr. Casella.

P.O. Box 365 | Bethlehem, Connecticut 06751 | Tel: 203-266-5595 | Fax: 203-266-6227 | Email: connsoil@att.net

Soils formed in glacial till and descriptions are included below for convenience.

WETLAND SOILS

SOIL TYPE:	LEICESTER
DEPTH TO MOTTLING:	6"
DEPTH TO BEDROCK:	>60"
DEPTH TO SEASONAL HIGH WATER TABLE:	0-8"

A poorly drained soil on nearly level or gently sloping land, the Leicester series consist of soils that developed in friable to firm glacial till. These soils occupy wet, low-lying areas or concave side slope areas. The permeability of the soils is moderate in the surface layer and subsoil and is moderately rapid in the substratum.

SOIL TYPE:	WHITMAN
DEPTH TO MOTTLING:	18"
DEPTH TO BEDROCK:	>60"
DEPTH TO SEASONAL HIGH WATER TABLE:	0-6"

These very poorly drained soils occur in low-lying, small to medium sized areas where they receive runoff and, in places, material washed from surrounding soils. A typical profile has a surface layer of black stony, fine sandy loam or silt loam about 10 inches thick. Next is a strongly gleyed subsurface layer of gray to light gray loamy sand. The subsoil, which is gleyed, consists of gray and greenish-gray fine sandy loam that is distinctly mottled with various shades of brown.

NON-WETLAND SOILS

SOIL TYPE:	CHARLTON-HOLLIS
DEPTH TO MOTTLING:	NO MOTTLING
DEPTH TO BEDROCK:	CHARLTON - >60"; HOLLIS – 10-20"
DEPTH TO SEASONAL HIGH WATER TABLE:	>6'

This is a complex of well-drained soils found on gently sloping and sloping, uplands where the relief is affected by the underlying bedrock. Slopes may be either concave or convex. The areas frequently have a rough surface topography with bedrock outcrops and a few narrow intermittent drainageways and small wet depressions. Included with this complex in mapping, are small areas, generally less than 1 acre in size, of moderately well-drained Sutton soils, well-drained Paxton soils and poorly drained Leicester soils. In a few areas the stones and boulders have been cleared. Also included are many small and intermingled areas where the bedrock is 20-40 inches from the

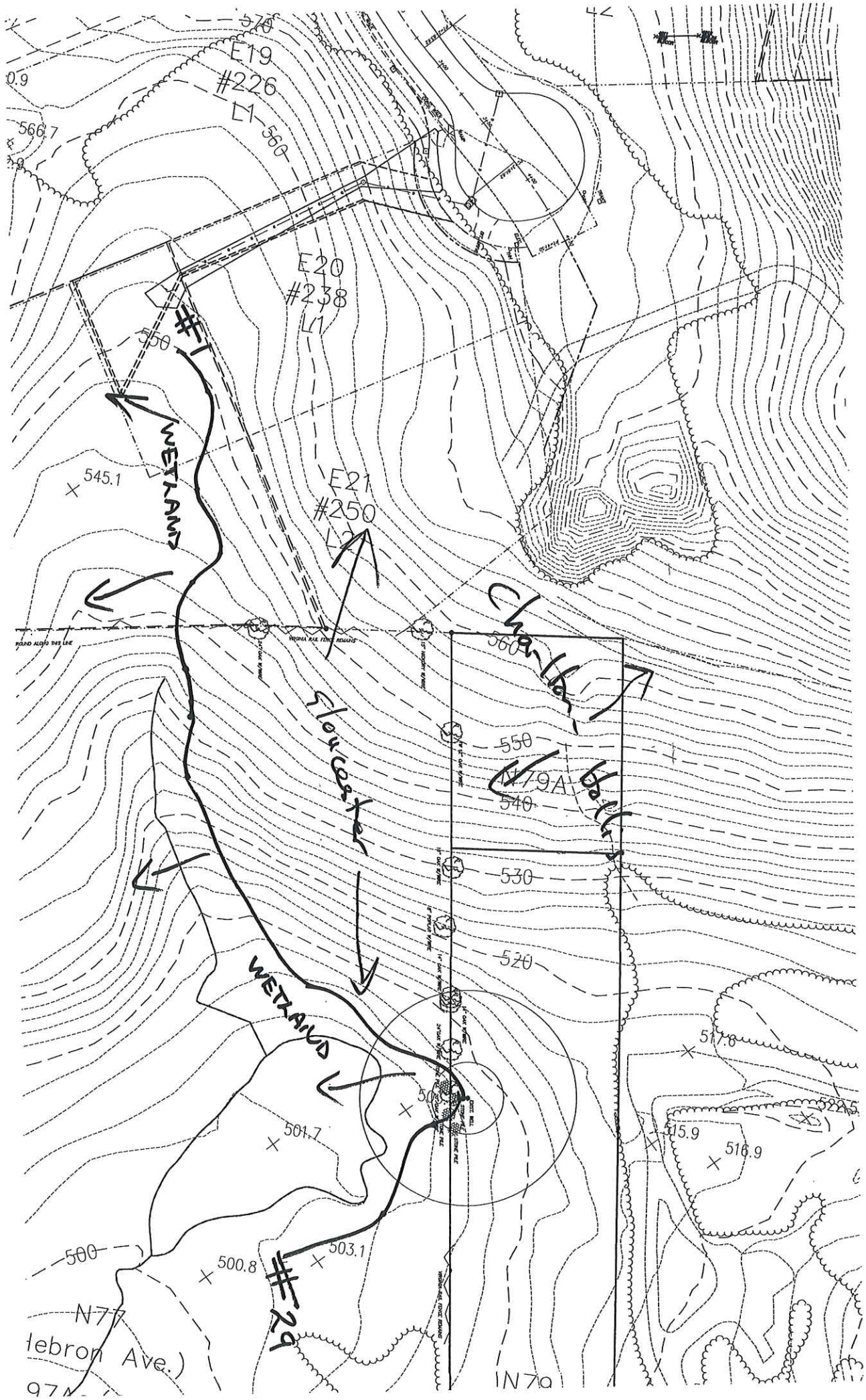
surface. During construction, conservation measures are essential to prevent excessive runoff, erosion and siltation.

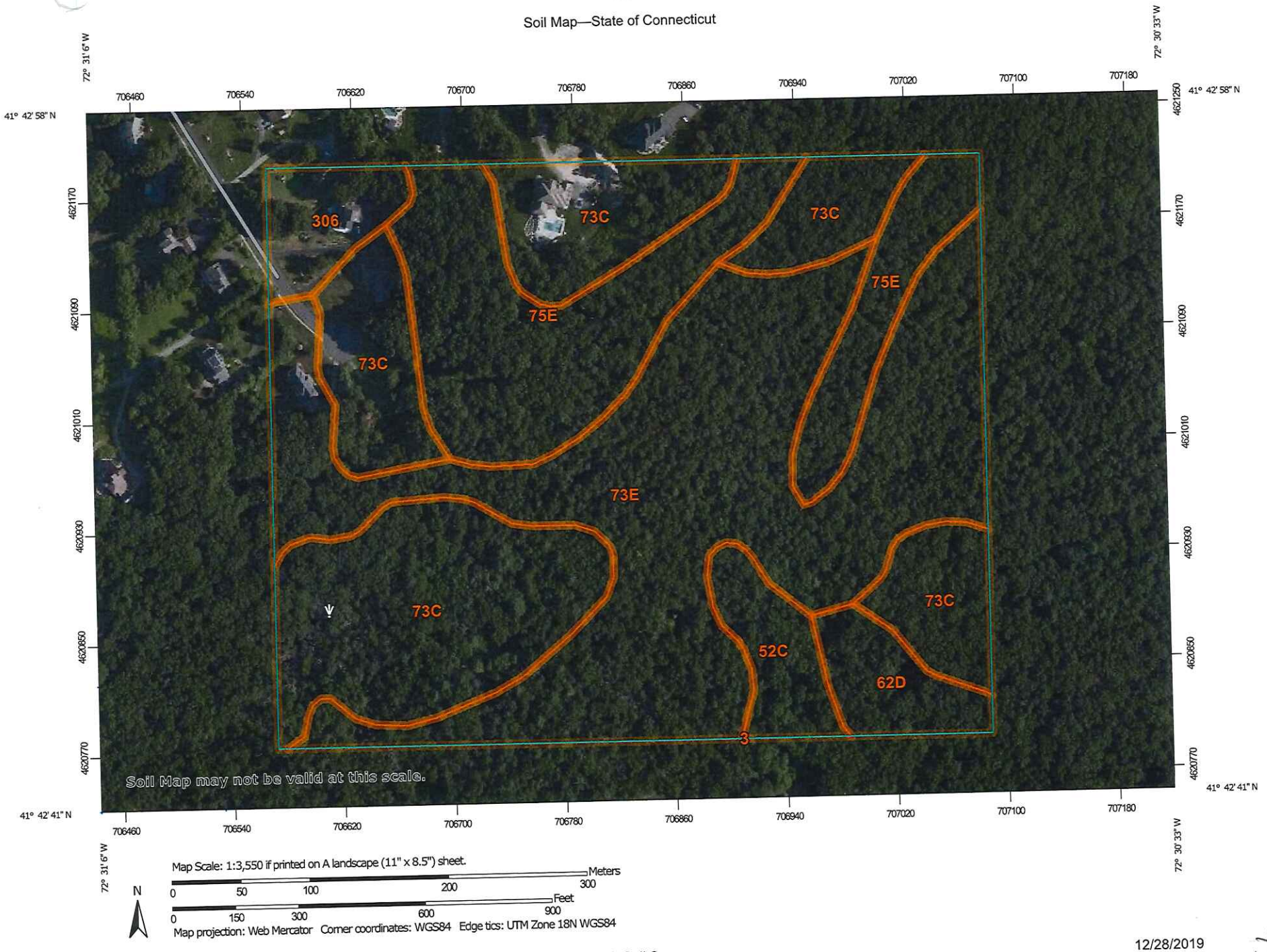
SOIL TYPE:	GLOUCESTER
DEPTH TO MOTTLING:	NONE
DEPTH TO BEDROCK:	>60"
DEPTH TO SEASNAL HIGH WATER TABLE:	>40"

A somewhat excessively drained soil that developed in very friable, coarse-textured glacial till derived mainly from coarse-textured granite but in places included some gneiss. The soil material has a relatively high sand content. Permeability is rapid.

Sincerely yours,

Cynthia M. Rabinowitz
Soil Scientist/Landscape Designer


E19
#226
L1
560
E20
#238
L1
E21
#250
L2
#1
WETLAND
545.1
550
560
550
N79A
540
530
520
Charlton
Gloucester
WETLAND
517.8
515.9
516.9
501.7
500
500.8
503.1
#29
N79
lebron Ave.)
N79a



USDA Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

97

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	0.0	0.0%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	1.9	3.5%
62D	Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony	1.8	3.4%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	16.9	31.5%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	21.1	39.3%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	10.2	18.9%
306	Udorthents-Urban land complex	1.8	3.3%
Totals for Area of Interest		**53.7**	**100.0%**

State of Connecticut

73E—Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 9lql
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 45 percent
Chatfield and similar soils: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from granite and/or schist and/or gneiss

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 7 inches: fine sandy loam
Bw2 - 7 to 19 inches: fine sandy loam
Bw3 - 19 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 45 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: B
Hydric soil rating: No

Description of Chatfield

Setting

Landform: Ridges, hills
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from granite and/or schist and/or gneiss

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A - 1 to 6 inches: gravelly fine sandy loam
Bw1 - 6 to 15 inches: gravelly fine sandy loam
Bw2 - 15 to 29 inches: gravelly fine sandy loam
2R - 29 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 45 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent
Hydric soil rating: No

Leicester

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Sutton

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Concave

Across-slope shape: Linear
Hydric soil rating: No

Hollis

Percent of map unit: 3 percent
Landform: Hills, ridges
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed, sandy subsoil

Percent of map unit: 1 percent
Hydric soil rating: No

Unnamed, red parent material

Percent of map unit: 1 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: State of Connecticut
Survey Area Data: Version 19, Sep 13, 2019

State of Connecticut

73C—Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2w698
Elevation: 0 to 1,550 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, very stony, and similar soils: 50 percent
Chatfield, very stony, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

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

Description of Chatfield, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

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

Minor Components

Sutton, very stony

Percent of map unit: 5 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear

Hydric soil rating: No

Rock outcrop
Percent of map unit: 5 percent
Hydric soil rating: No

Hollis, very stony
Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Leicester, very stony
Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: State of Connecticut
Survey Area Data: Version 19, Sep 13, 2019

ELEVATION>7500	C
LAINAND	B
LAIRD	B
LAIRDSVILLE	D
LAJARA	D
LAJITAS	D
LAKASH	B
LAKASKIA	D
LAKE	A
CLAYEY SURFACE	C
LAKE CHARLES	D
LAKE CREEK	C
LAKE JANEE	B
LAKEFIELD	B
LAKEHELEN	C
LAKEHURST	A
LAKELAND	A
LAKEMONT	D
LAKEPARK	B/D
LAKEPORT	B
LAKESHORE	D
LAKESIDE,DRAINED	B
LAKESOL	B
LAKETON	C
LAKEVIEW	C
LAKEWIN	B
LAKEWOOD	A
LAKI	B
LAKIN	A
LAKOA	B
LAKOMA	D
LAKOTA	D
LAKRIDGE	C
LALAAU	A
LALINDA	B
LALLIE	D
LALOS	B
LAM	D
LAMA	C
LAMANGA	C
LAMAR	B
LAMARSH	C
LAMARTINE	C
LAMATH,DRAINED	D
LAMAWA	B
LAMBERT	B
LAMBETH	B
LAMBMAN	D
COOL	C
LAMBRING	B
LAMEDEER	B
LAMESHUR	A
LAMINE	D
LAMINGTON	D
LAMKIN	B
LAMO	C
LAMOILLE	B
LAMOINE	D
LAMONDI	B
LAMONI	C
LAMONT	B
LAMONTA	D
LAMOOSE	D
LAMOTTE	B
LAMOURE	D
LAMOURE	C
SALINE	C
SANDY SUBSTRATUM	C
SOMEWHAT POORLY DRAINED	C
LAMPASAS	D
LAMPHIER	B
LAMPSHIRE	D
LAMSON	B/D
LANADA	C
LANARK	B
LANCASTER	B
LANCE	B
LAND	C
DRAINED	D
DRAINED	B
DRAINED; SANDY SUBSTRATUM	D
LANDAVASO	B
LANDCO	C
LANDER	C
LANDES	B
LANDES	C
LANDES	A
LANDINGHAM	B
LANDLOW	C
LANDLOW	D
LANDMAN	B
LANDO	C
LANDUSKY	A
LANE	C
LANESBORO	C
LANEVILLE	B
LANEXA	D
LANEY	B
LANFAIR	B
LANG,CLAYEY SUBSTRATUM	C
LANGELLAIN	D
LANGER	A
LANGFORD	C
LANGHEI	B
LANGLADE	B
LANGLESS	C
LANGLOIS	D
LANGOLA	C
LANGRELL	B
LANGSLET	D
LANGSPRING	B
LANGSTON	B
LANGTRY	D
LANIER	A
LANIGER	B
LANIP	B
LANKBUSH	B
LANKIN	B
LANKTREE	C
LANOAK	B
LANONA	B
LANQUE	B
LANSDALE	B
LANSDOWNE	C
LANSING	B
LANTERN	B
LANTIS	B
LANTON	D
LOW PRECIPITATION	C
LANTONIA	B
LANTRY	B
LANTZ	D
LANVER	C
LOAMY	B
LANYON	C/D
LAOLAO	B
LAONA,VERY STONY	B
LAP	D
LAPARITA	C
LAPDUN	B
LAPED	D
LAPEER	B
LAPHAM	A
LAPINE	A
LAPLATTA	C
LAPOINT	C
LAPON	D
LAPORTE	D
LAPOSA	C
LAPPANS	B
LAPWAI	B
LARABEE	C
LARAND	B
LARCHMOUNT	B
LARCHPOINT	C
LARDELL	C
LAREDO	B
LARES	C
LARGO,FLOODED	B
LARIAT	B
LARIC	D
LARIM	B
LARIMER	B
LARIOSCAMP	D
LARKIN	B
LARKSON	C
LARMINE	D
LAROQUE	B
LAROSE	D
LAROSS	B
LARPENTEUR	B
LARRUPIN	B
LARRY	D
LARRY	C
LARRY	C
DRAINED	C
STONY	C
LARSON	D
LARTON	A
LARUE	A
LARUSH	B
LARUSH	C
LARVIE	D
LAS	C
LAS	D
CLAYEY SUBSTRATUM	D
SALINE	D
LAS ANIMAS	C
LAS ANIMAS	D
CHANNELED	D
FREQUENTLY FLOODED	D
POORLY DRAINED	D
LAS FLORES	D
LAS LUCAS	B
LAS POSAS	C
LAS VEGAS	D
LAS VEGAS	C
LASA	A
LASALLE	D
LASAUSES	D
LASCO	B
LASERE	C
LASH	B
LASIL	D
LASKA	B
LASSEL	C
LASSEN	D
LASSITER	B
LASTANCE	B
LASVAR	C
LATAH	D
DRAINED	C
HIGH RAINFALL; DRAINED	C
LATAHCO	C
WET	D
LATANIER	D
LATCH	A
LATENE	B
LATES	C
LATEX	C
LATHAM	D
LATHER	D
LATHROP	B
LATIGO	B
LATIMER	D
LATINA	D
LATIUM	D
LATOM	D
LATONIA	B
LATOUCHE	D
LATOUR	B
LATOURELL	B
LATTAS	D
LATTY	D
LAUBY	B
LAUDERDALE	D
LAUDERHILL	B/D
LAUFER	D
LAUGENOUR,DRAINED	B
LOAMY SUBSTRATUM	C
LAUGHLIN	C
LAUGHLIN	D
LAUMAIA	B
LAURAMIE	B
LAUREL	D
LAUREL	C
LAURELWOOD	B
LAUREN	B
CEMENTED SUBSTRATUM	C
LAURENTZEN	B
LAURISTEN	B
LAVA FLOWS	D
STONY	A
STONY	A
LAVACREEK	B
LAVACREEK	C
LAVALLEE	B
LAVATE	B
SANDY SUBSTRATUM	C
SANDY SUBSTRATUM	C
LAVEAGA	C
LAVEAGA	D
LAVEEN	B
LAVELDO,HARDPAN SUBSTRATUM	C
LAVELLGA	B
LAVENDER	B
LAVENTANA	B
COOL	C
LAVERKIN	C
LAVEY	D
LAVIC	B
LAVINA	D
LAWAI	B
LAWEN	B
LAWET	B/D
LAWLER	B
LAWNDALE	B
LAWNES	D
LAWNWOOD	B/D
DEPRESSIONAL	D
LAWRENCE	C
LAWRENCEVILLE	C
LAWRIE	B
LAWSHE	D
LAWSON	C
LAWTHER	D
LAWTON	C
LAWVER	B
LAWYER	C
BEDROCK SUBSTRATUM	B
LAX	C
LAXAL	B
LAXTON	C
LAYCOCK	B
LAYOINT	C
LAYTON	A
DRY	B
LAYVIEW	D
LAZAN	D
LAZBUDDIE	D
LAZEAR	D
LE BAR	B
LE SUEUR	B
LEA	C
LEADER	B
LEADORE	B
LEADPOINT	C
LEADVALE	C
LEADVILLE	B
LEAF	D
LEAFRIVER	A/D
LEAFU	C
LEAGUE	D
LEAGUEVILLE	B/D
LEAHY	C
LEAKEY	D
LEAKSVILLE	D
LEAL	B
LEALANDIC	D
LEANNA	D
LEANTO	D
LEAPS	C
LEATHAM	C
LEATHERBARK,STONY	C
LEATHERMAN	D
LEATHERWOOD	B
LEAVENWORTH	C
LEAVERS	B
LEAVITT	B
CLAY SUBSTRATUM	D
WET	C
WET	C
LEAVITTVILLE	B
LEBAM	B
LEBANON	C
LEBEAU	D
LEBEC	B
LEBO	B
LEBRON	D
LEBSACK	C
LECK KILL,DEEP	B
LECKMAN	B
LECOMA	B
LECRAG	D
LEDFORD	B
LEDGEFORK	A
LEDMOUNT	D
LEDOW	B
LEDRU	D
LEDWITH	B/D
LEE	D
LEEBENCH	C
LEEBENCH	D
COLD GRAVELLY SUBSTRATUM	D
LEEDS	C
LEEFIELD	C
LEEKO	C
COOL	B
WARM	B
LEELANAU	A
LEEMONT	D
LEEPER	D
LEERAY	D
LEESBURG	B
LEESVILLE	B
LEETONIA	C
LEEVAN	C
LEFOR	B
LEGALL	B
LEGAULT	D
LEGGETT	C
LEGLER	B
LEGORE	B
LEHEW	C
LEHIGH	C
LEHMANS,COBBLY	D
LEHR	B
LEICESTER	C
LEIDL	C
LEIGHCAN	B
LEILEHUA	B
LEISY	B
LEITER	C
LELA	D
LELAND	D
LEMAH	A
LEMBOS	C
LEMCAVE	B
LEMCO	C
LEMERT	D
LEMETA	D
LEMHI	D
LEMING	C
LEMITAR	D
LEMM	B

WEISBURG	C
WEISER	B
WEISHAUPT	D
WEISSENFELS	C
WEITAS	B
WEITCHPEC	C
WEITCHPEC	D
BEDROCK SUBSTRATUM	B
WEKIVA	D
WEKODA	D
WELAKA	A
WELBY	B
WELCH	D
DRAINED	C
GRAVELLY SUBSTRATUM; DRAINED	C
RARELY FLOODED; DRAINED	B
WELCHLAND	B
WELCOME	B
WELD	C
WELDA	C
WELEETKA	B
WELLER	C
WELLIE	A
WELLINGTON	C
WELLINGTON	D
WELLMAN	B
WELLS	B
WELLSBENCH	B
WELLSBORO	C
WELLSCREEK	B
WELLSDAM	C
WELLSED	C
WELLSFAR	B
WELLSFORD	D
WELLSTON	B
WELLSVILLE	B
WELLTON	B
WELOY	C
WELRING	D
WELSUM	D
WELTER	D
WEMPLE	B
WENAS	D
DRAINED	C
WENATCHEE	C
GRAVELLY	B
NONSTONY	B
WENDANE	C
DRAINED	B
WENDELL	C
WENDOVER	D
WENDTE	D
WENGLER	A
WENONA,MODERATELY WET	C
WENONAH	B
WENOTA	D
WENTWORTH	B
WEOGUFKA	C
WEOTT	D
WEPO	C
WERELD	B
WERITO	C
WERLOG,COOL	C
MODERATELY WELL DRAINED	B
STRONGLY SALINE	B
WERNER	D
WERNOCK	B
WERNOCK	C
WESCONNETT	D
WESDY	C
WESDY	B
WESFIL	D
WESIX	D
WESKA	D
WESLEY	B
WESO	B
WESPAC	C
ALKALI	D
WESSEL	C
WESTBEND	B
WESTBROOK	D
WESTBURY	C
WESTBUTTE	C
WESTCAMP,MODERATELY WET	C
WESTCREEK	B
WESTE	C
WESTERVILLE	B
WESTFAN	B
WESTFORK	D
WESTGATE	C
WESTGUARD	B
WESTHAVEN	B
ALKALI; WET	C
SALINE-SODIC	C
WESTINDIAN	C
WESTLAKE	D
THIN SURFACE	C
WESTLAND	B/D
WESTMORE	C
WESTMORELAND	B
WESTOLA	B
WESTON	D
WESTOVER	B
WESTPHALIA	B
WESTPLAIN	D
WESTPORT	A
THIN SURFACE	B
WESTRACO	D
WESTSHORE	D
WESTSIDE	C
WESTSUM	D
WESTVACO	C
WESTVIEW	B
WESTVILLE	B
WESTWEGO	D
WESWIND	C
WESWOOD	B
WETA	D
WETBETH	C
WETHERILL	B
WETHERSFIELD	C
WETHEY	C
DRAINED	A
WETMORE	D
WETOPA	C
WETSAND	D
WETSAW	C
WETTERDON	B
WETTERHORN	C
WETZEL	D
WEVERTON	B
WEWELA	B
WEWOKA	C
WEYANOKE	C
WEYERS	C/D
WEYMOUTH	B
WHAKANA	B
WHALAN	B
WHALESHEAD	B
WHALEY	D
WHARTON	C
WHATCOM	C
WHATELY	D
WHEATBELT	D
WHEATLEY	A/D
WHEATON	B
WHEATRIDGE	B
WHEATVILLE	B
WHEATWOOD	B
WHEELER	B
WHEELERPEK	D
WHEELERVILLE	B
WHEELING	C
WHEELING	B
FLOODED	B
WHEELON	D
COOL	B
WHEELRIDGE	A
WHERRY	D
WHETROCK	C
WHETSOON	C
WHETSTONE	C
WHICHMAN	B
WHIDBEY	C
WHILPHANG	D
WHIPPANY	C
WHIPPLE	D
WHIPPLE	B
WHIPSTOCK	C
WHIRLO	B
WHISK	D
WHISKEY	B
WHISKEYCREEK	C
WHISKEYDICK	C
WHISKLAKE	C
WHISPERING	C
WHISTLE	B
WHIT	B
WHITAKER	C
WHITAKER	B
WHITE HOUSE	C
GRAVELLY	D
WHITE STORE	D
WHITE SWAN	D
WHITEARTH	C
WHITEBIRD	D
WHITECAP	D
WHITECLOUD	B
WHITECOW	B
WHITECROSS	D
WHITEDEER	B
WHITEFACE	D
WHITEFIELD	D
WHITEFISH	B
WHITEFORD	B
WHITEHALL	B
WHITEHILLS	C
WHITEHORN	D
WHITEHORSE	B
WHITEKNOB	B
WHITELAKE	B
WHITEMAN	D
WHITEOAK	B
WHITEPEAK	D
WHITEPINE	D
WHITERIVER	C
WHITEROCK	D
WHITESBORO	C
WHITESBURG	C
WHITESIDE	B
WHITESON	D
WHITESTONE	B
WHITETAIL	B
WHITETHORN	B
WHITEWATER	D
WHITEWOLF	A
WHITEWOLF	C
WHITEWOOD	C/D
NONFLOODED	B/D
WHITEWRIGHT	C
WHITEYE	D
WHITING	B
WHITINGER	C
WHITLASH,COBBLY	D
WHITLEY	B
WHITLOCK	B
WHITMAN	D
WHITNEY	C
WHITORE	B
WHITSOL	B
WHITSON	D
WHITTEMORE	C/D
WHITTIER	B
WHITVIN	D
WHITWELL	C
WHOBREY	C
WHOLAN	B
WHOMEE	D
WHORLED	C
WHY	B
WIBAUX	B
WICHITA	C
WICHUP	D
WICKAHONEY	D
WICKENBURG	D
WICKERSHAM	B
WICKETT	C
WICKHAM	B
WICKIUP	C
WICKSBURG	B
WICKWARE	B
WICUP	C
WIDEMAN	A
WIDEN	C
WIDTSOE	B
WIEHL	C
WIELAND	C
WIERGATE	D
WIFFO	B
WIFTON	B
WIGGLER	D
WIGGLETON	B
WIGTON	A
WIKIEUP	D
WILAHA	B
WILBANKS	D
WILBRAHAM	C
WILBUR	B
WILBURTON	B
WILCO	C
WILCOX	D
WILCOXSON	C
WILDALE	C
WILDCAT	D
WILDER	B
WILDERNESS	C
WILDGEN	B
WILDHILL	C
WILDHORSE	A
WILDMESA	C
WILDORS	C
WILDROSE	C
WILDWOOD	D
WILE	C
WILEY	B
WILHITE	C/D
WILHOIT	B
WILKES	C
WILKESON	B
WILKINS	D
WILL	B/D
WILLABY	C
WILLACY	B
WILLAKENZIE	C
WILLAMAR	B
WILLAMETTE	B
WET	C
WILLANCH	D
WILLAPA	C
WILLARD	B
WILLDIN	C
WILLETTE	A/D
WILLHILL	C
WILLHO	D
WILLIAMS	B
WILLIAMSBURG	B
WILLIAMSON	C
WILLIAMSPORT	C
WILLIAMSTOWN	C
WILLIAMSVILLE	C
WILLIMAN	B/D
WILLIS	C
WILLIS	D
WILLISTON	C
WILLOCK	B
WILLOSIPPI	C
WILLOW CREEK	B
COBBLY	C
WILLOWBROOK	C
WILLOWDALE	B
WILLOWEMOC	C
WILLOWMAN	B
WILLOWS,ALKALI	D
WILLWOOD	A
WILLYNAT	B
WILMA	C
GRAVELLY	B
STONY	B
WILMER	C
WILMER	B
WILMINGTON	D
WILMONT	B
WILMONTON	B
WILPAR	C
WILPOINT	D
WILSALL	D
WILSHIRE	A
WILSON	D
WILSONGULCH	B
WILSONVILLE	D
WILSOR	B
WILST	C
WILST	B
WILT	B
WILTON	B
WIMPER	B
WIMPEY	C
WINADA	C
WINADA	B
WINBERRY	C
WINBLOW	C
WINCHESTER	A
WINCHUCK	C
WIND RIVER	B
WINDCOAT	D
WINDEGO	B
WINDER	B/D
WINDER	C/D
DEPRESSIONAL	D
WINDHAM	B
WINDHAM	C
WINDICREEK	A
WINDLASS	C
WINDMILL	B
ACID	C
WINDRY	D
WINDSOR	A
WINDTHORST	C
WINDWHISTLE	C
WARM	B
WINDY	B
WINDYGAP	B
WINDYHOLLOW	C
WINDYPOINT	B
WINEDALE	D
WINEG	B
WINEMA	C
WINETTI	B
WINEVADA	B
WINEVADA	C
WINFALL	B
WINFIELD	B
WING	D
WINGATE	B
WINGDALE	D
WINGER	B/D
WINGINA	B
WINGINAW	D
WINGROCK	B
WINGVILLE	D
WINIFRED	C
WINK	B
WINKEL	D
WINKLEMAN	C
WET	D
WINKLER	B
WINKLO	C
WINLER	D

105

NOAA Atlas 14, Volume 10, Version 3 HARTFORD
BRAINARD FLD
Station ID: 06-3451
Location name: Hartford, Connecticut, USA*
Latitude: 41.7333°, Longitude: -72.65°
Elevation:
Elevation (station metadata): 20 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	0.331 (0.265-0.413)	0.404 (0.322-0.504)	0.522 (0.415-0.655)	0.620 (0.490-0.782)	0.755 (0.575-1.00)	0.857 (0.637-1.16)	0.963 (0.693-1.36)	1.08 (0.734-1.57)	1.25 (0.815-1.89)	1.39 (0.862-2.15)
10-min	0.469 (0.375-0.585)	0.572 (0.457-0.714)	0.740 (0.589-0.928)	0.879 (0.695-1.11)	1.07 (0.815-1.42)	1.21 (0.904-1.65)	1.37 (0.982-1.93)	1.53 (1.04-2.23)	1.78 (1.15-2.68)	1.97 (1.25-3.04)
15-min	0.552 (0.441-0.688)	0.673 (0.537-0.840)	0.870 (0.692-1.09)	1.03 (0.818-1.30)	1.26 (0.959-1.67)	1.43 (1.06-1.94)	1.61 (1.16-2.27)	1.81 (1.23-2.62)	2.09 (1.36-3.15)	2.32 (1.47-3.58)
30-min	0.742 (0.593-0.925)	0.904 (0.722-1.13)	1.17 (0.931-1.47)	1.39 (1.10-1.75)	1.69 (1.29-2.24)	1.92 (1.43-2.61)	2.16 (1.56-3.06)	2.43 (1.65-3.53)	2.82 (1.83-4.24)	3.13 (1.98-4.82)
60-min	0.931 (0.744-1.16)	1.14 (0.907-1.42)	1.47 (1.17-1.84)	1.75 (1.38-2.20)	2.13 (1.62-2.82)	2.42 (1.80-3.28)	2.72 (1.96-3.84)	3.06 (2.07-4.43)	3.54 (2.30-5.34)	3.93 (2.49-6.07)
2-hr	1.22 (0.979-1.51)	1.48 (1.19-1.83)	1.90 (1.52-2.36)	2.25 (1.79-2.82)	2.73 (2.10-3.61)	3.09 (2.32-4.19)	3.48 (2.53-4.92)	3.93 (2.67-5.67)	4.60 (3.00-6.90)	5.17 (3.28-7.92)
3-hr	1.41 (1.14-1.73)	1.70 (1.37-2.10)	2.19 (1.76-2.71)	2.59 (2.07-3.23)	3.14 (2.42-4.14)	3.56 (2.68-4.80)	4.00 (2.92-5.65)	4.53 (3.09-6.51)	5.34 (3.48-7.97)	6.02 (3.83-9.19)
6-hr	1.75 (1.43-2.15)	2.13 (1.73-2.61)	2.75 (2.22-3.38)	3.25 (2.61-4.04)	3.96 (3.07-5.18)	4.47 (3.40-6.02)	5.04 (3.71-7.09)	5.73 (3.92-8.18)	6.79 (4.44-10.1)	7.70 (4.91-11.7)
12-hr	2.12 (1.73-2.58)	2.60 (2.12-3.17)	3.38 (2.75-4.13)	4.02 (3.25-4.95)	4.91 (3.83-6.39)	5.57 (4.25-7.44)	6.28 (4.66-8.80)	7.16 (4.92-10.2)	8.53 (5.60-12.6)	9.70 (6.21-14.6)
24-hr	2.47 (2.03-2.99)	3.07 (2.53-3.72)	4.05 (3.32-4.93)	4.87 (3.96-5.96)	5.99 (4.71-7.78)	6.82 (5.25-9.09)	7.73 (5.78-10.8)	8.88 (6.12-12.5)	10.7 (7.06-15.7)	12.3 (7.91-18.4)
2-day	2.81 (2.33-3.37)	3.55 (2.94-4.27)	4.77 (3.93-5.76)	5.77 (4.73-7.02)	7.16 (5.68-9.27)	8.17 (6.35-10.9)	9.30 (7.05-13.1)	10.8 (7.48-15.2)	13.3 (8.80-19.4)	15.6 (10.0-23.1)
3-day	3.05 (2.54-3.65)	3.87 (3.22-4.64)	5.21 (4.31-6.27)	6.32 (5.20-7.65)	7.85 (6.25-10.1)	8.95 (6.99-11.9)	10.2 (7.78-14.4)	11.9 (8.24-16.6)	14.7 (9.74-21.4)	17.3 (11.1-25.6)
4-day	3.27 (2.73-3.90)	4.14 (3.45-4.94)	5.56 (4.61-6.66)	6.73 (5.55-8.13)	8.36 (6.67-10.8)	9.53 (7.46-12.6)	10.9 (8.29-15.2)	12.7 (8.78-17.6)	15.7 (10.4-22.7)	18.4 (11.9-27.1)
7-day	3.83 (3.22-4.55)	4.80 (4.02-5.70)	6.37 (5.31-7.60)	7.68 (6.36-9.21)	9.48 (7.59-12.1)	10.8 (8.46-14.2)	12.2 (9.36-17.0)	14.2 (9.89-19.7)	17.4 (11.6-25.1)	20.3 (13.1-29.8)
10-day	4.42 (3.72-5.23)	5.43 (4.57-6.43)	7.09 (5.93-8.42)	8.46 (7.03-10.1)	10.3 (8.30-13.1)	11.7 (9.20-15.3)	13.3 (10.1-18.2)	15.3 (10.7-21.1)	18.5 (12.3-26.5)	21.3 (13.8-31.2)
20-day	6.36 (5.39-7.47)	7.43 (6.29-8.73)	9.17 (7.73-10.8)	10.6 (8.88-12.6)	12.6 (10.1-15.8)	14.1 (11.1-18.1)	15.7 (11.9-21.1)	17.6 (12.4-24.1)	20.6 (13.8-29.2)	23.1 (15.0-33.6)
30-day	8.04 (6.84-9.40)	9.14 (7.76-10.7)	10.9 (9.24-12.8)	12.4 (10.4-14.7)	14.5 (11.6-17.9)	16.0 (12.5-20.3)	17.6 (13.3-23.3)	19.4 (13.7-26.4)	22.1 (14.8-31.2)	24.3 (15.8-35.1)
45-day	10.2 (8.67-11.8)	11.3 (9.63-13.2)	13.1 (11.2-15.4)	14.7 (12.4-17.3)	16.8 (13.6-20.6)	18.4 (14.5-23.2)	20.1 (15.1-26.2)	21.8 (15.4-29.5)	24.1 (16.3-33.9)	25.9 (16.9-37.3)
60-day	11.9 (10.2-13.9)	13.1 (11.2-15.2)	15.0 (12.8-17.6)	16.6 (14.1-19.5)	18.8 (15.2-23.0)	20.6 (16.1-25.6)	22.2 (16.6-28.7)	23.9 (17.0-32.1)	25.9 (17.5-36.3)	27.4 (17.9-39.4)

[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.

Back to Top

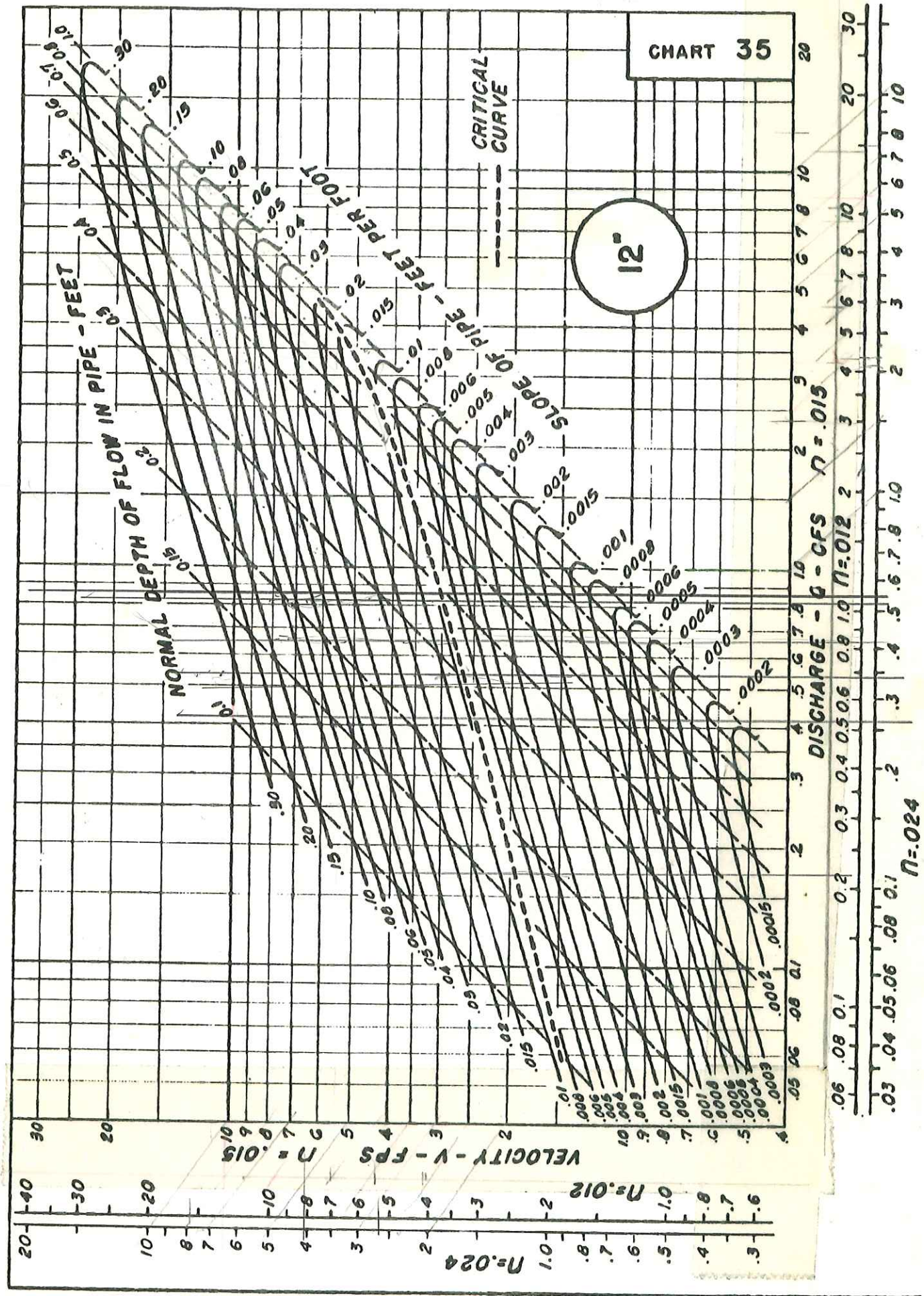
PF graphical

DURATION (min)	DURATION (hr)	RAINFALL INTENSITY (in/hr)					
		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5	0.08	4.6	5.5	6.0	6.7	7.3	7.8
6	0.10	4.4	5.2	5.8	6.5	7.0	7.5
7	0.12	4.2	5.0	5.5	6.2	6.8	7.2
8	0.13	4.0	4.8	5.3	6.0	6.5	7.0
9	0.15	3.8	4.6	5.1	5.7	6.2	6.7
10	0.17	3.6	4.3	4.8	5.5	6.0	6.5
11	0.18	3.4	4.2	4.7	5.3	5.8	6.3
12	0.20	3.3	4.0	4.5	5.1	5.6	6.1
13	0.22	3.1	3.8	4.3	5.0	5.4	5.9
14	0.23	3.0	3.7	4.2	4.8	5.3	5.7
15	0.25	2.8	3.5	4.0	4.6	5.1	5.5
16	0.27	2.8	3.5	3.9	4.5	5.0	5.4
17	0.28	2.7	3.4	3.8	4.4	4.9	5.4
18	0.30	2.7	3.3	3.8	4.4	4.8	5.3
19	0.32	2.6	3.2	3.7	4.3	4.7	5.2
20	0.33	2.5	3.2	3.6	4.2	4.6	5.1
21	0.35	2.5	3.1	3.5	4.1	4.5	5.0
22	0.37	2.4	3.0	3.4	4.0	4.4	4.9
23	0.38	2.3	2.9	3.4	3.9	4.3	4.8
24	0.40	2.3	2.9	3.3	3.8	4.2	4.7
25	0.42	2.2	2.8	3.2	3.7	4.2	4.6
26	0.43	2.2	2.7	3.1	3.7	4.1	4.5
27	0.45	2.1	2.7	3.0	3.6	4.0	4.4
28	0.47	2.0	2.6	3.0	3.5	3.9	4.3
29	0.48	2.0	2.5	2.9	3.4	3.8	4.2
30	0.50	1.9	2.4	2.8	3.3	3.7	4.1

Rainfall Intensity/Duration/Frequency Relationship for Connecticut (English Units)
Table B-2.1

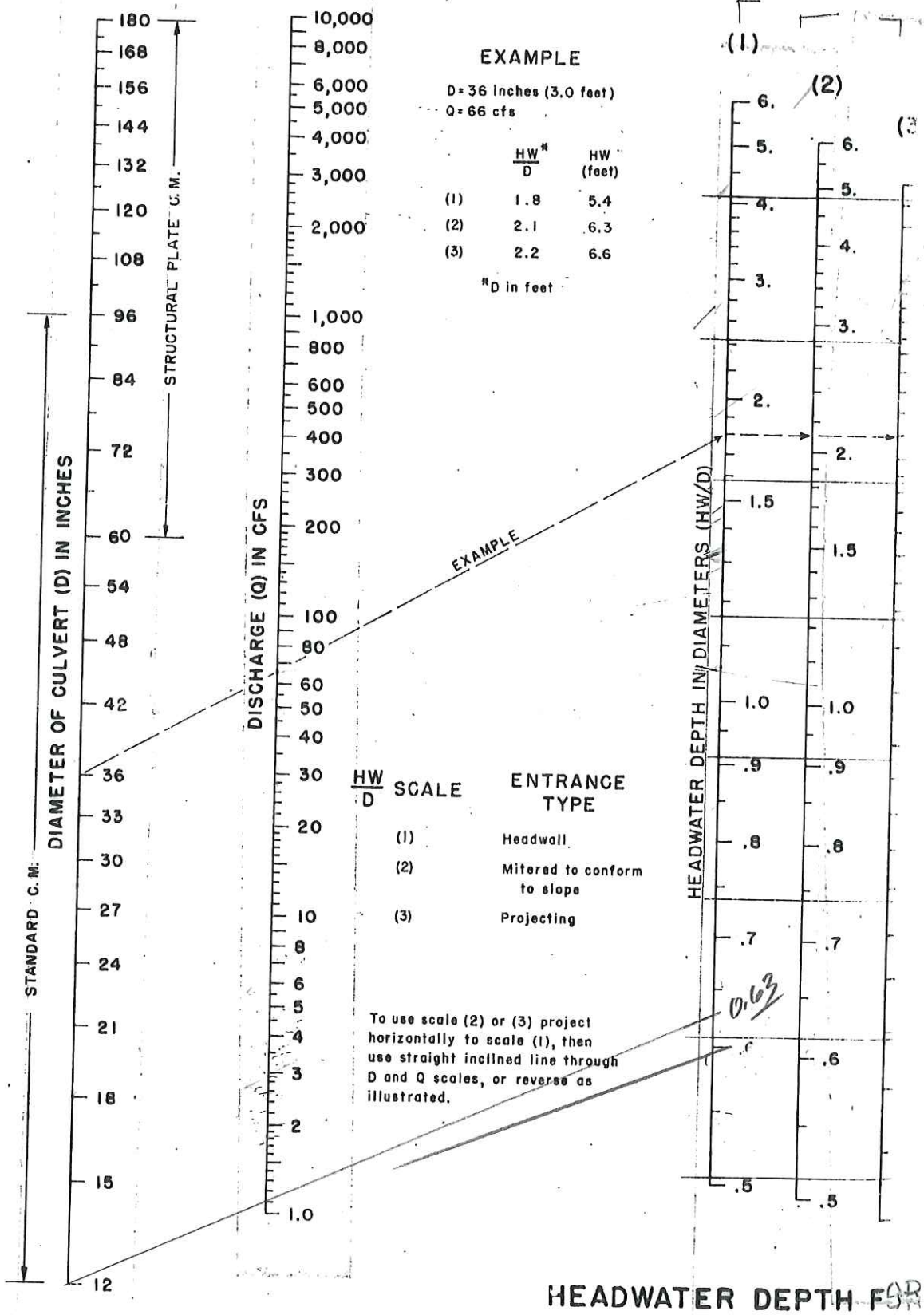
		RAINFALL INTENSITY (in/hr)					
DURATION	DURATION	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
31	0.52	1.9	2.4	2.8	3.3	3.6	4.0
32	0.53	1.9	2.4	2.7	3.2	3.6	4.0
33	0.55	1.8	2.4	2.7	3.2	3.6	3.9
34	0.57	1.8	2.3	2.7	3.2	3.5	3.9
35	0.58	1.8	2.3	2.6	3.1	3.5	3.8
36	0.60	1.8	2.3	2.6	3.1	3.4	3.8
37	0.62	1.7	2.2	2.6	3.0	3.4	3.7
38	0.63	1.7	2.2	2.5	3.0	3.4	3.7
39	0.65	1.7	2.2	2.5	3.0	3.3	3.7
40	0.67	1.7	2.1	2.5	2.9	3.3	3.6
41	0.68	1.6	2.1	2.4	2.9	3.2	3.6
42	0.70	1.6	2.1	2.4	2.8	3.2	3.5
43	0.72	1.6	2.1	2.4	2.8	3.1	3.5
44	0.73	1.6	2.0	2.3	2.8	3.1	3.4
45	0.75	1.5	2.0	2.3	2.7	3.1	3.4
46	0.77	1.5	2.0	2.3	2.7	3.0	3.3
47	0.78	1.5	1.9	2.2	2.6	3.0	3.3
48	0.80	1.5	1.9	2.2	2.6	2.9	3.2
49	0.82	1.5	1.9	2.2	2.6	2.9	3.2
50	0.83	1.4	1.8	2.1	2.5	2.8	3.2
51	0.85	1.4	1.8	2.1	2.5	2.8	3.1
52	0.87	1.4	1.8	2.1	2.5	2.8	3.1
53	0.88	1.4	1.8	2.0	2.4	2.7	3.0
54	0.90	1.3	1.7	2.0	2.4	2.7	3.0
55	0.92	1.3	1.7	2.0	2.3	2.6	2.9
56	0.93	1.3	1.7	1.9	2.3	2.6	2.9
57	0.95	1.3	1.6	1.9	2.3	2.5	2.8
58	0.97	1.2	1.6	1.9	2.2	2.5	2.8
59	0.98	1.2	1.6	1.8	2.2	2.5	2.7
60	1.00	1.2	1.5	1.8	2.1	2.4	2.7

Rainfall Intensity/Duration/Frequency Relationship for Connecticut (English Units)
Table B-2.1 continued



PIPE FLOW CHART
12-INCH DIAMETER

Chart 12



HEADWATER DEPTH FOR C. M. PIPE CULVERT WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963