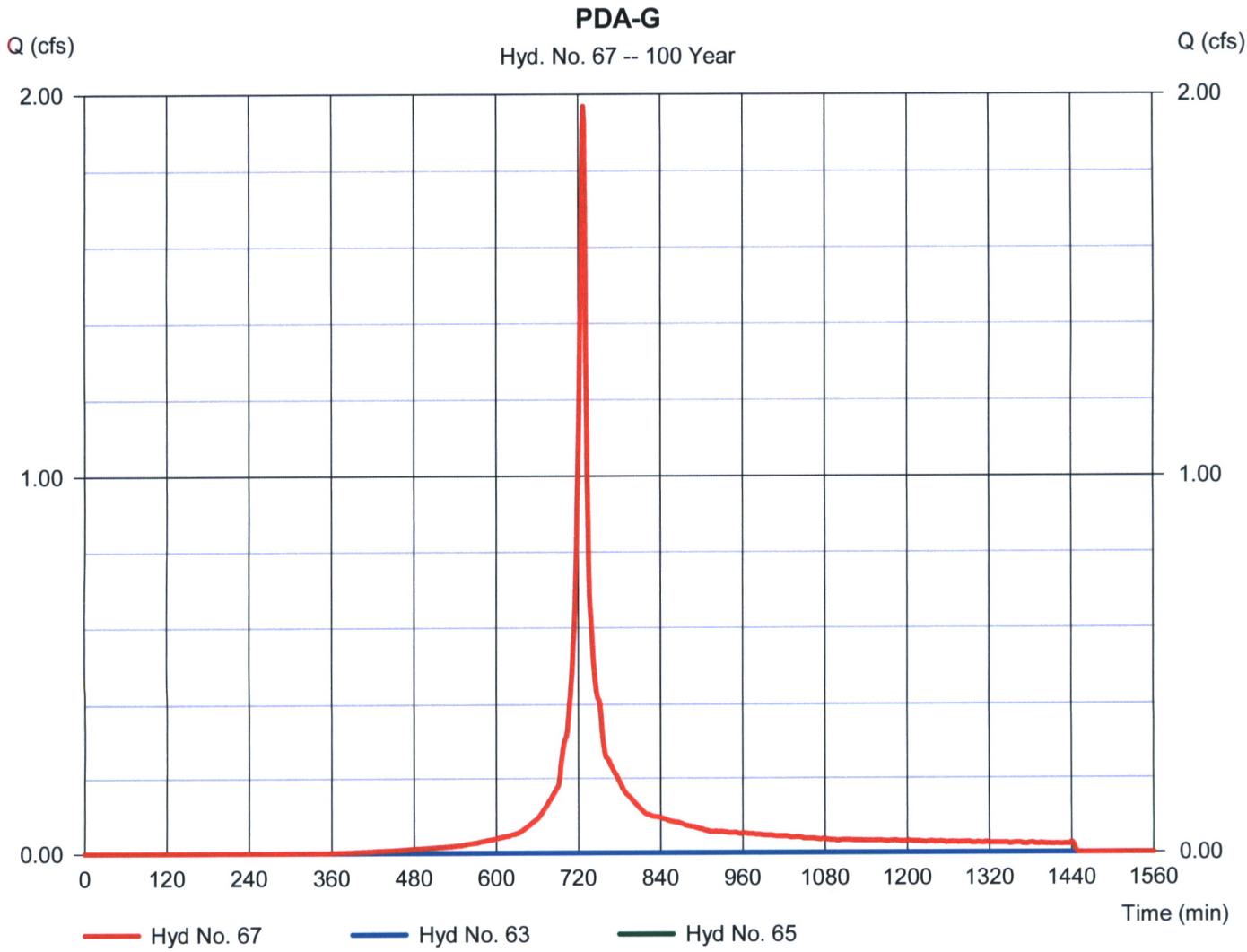
Hydrograph Report

Hyd. No. 67

PDA-G

Hydrograph type	= Combine	Peak discharge	= 1.969 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 5,548 cuft
Inflow hyds.	= 63, 65	Contrib. drain. area	= 0.300 ac

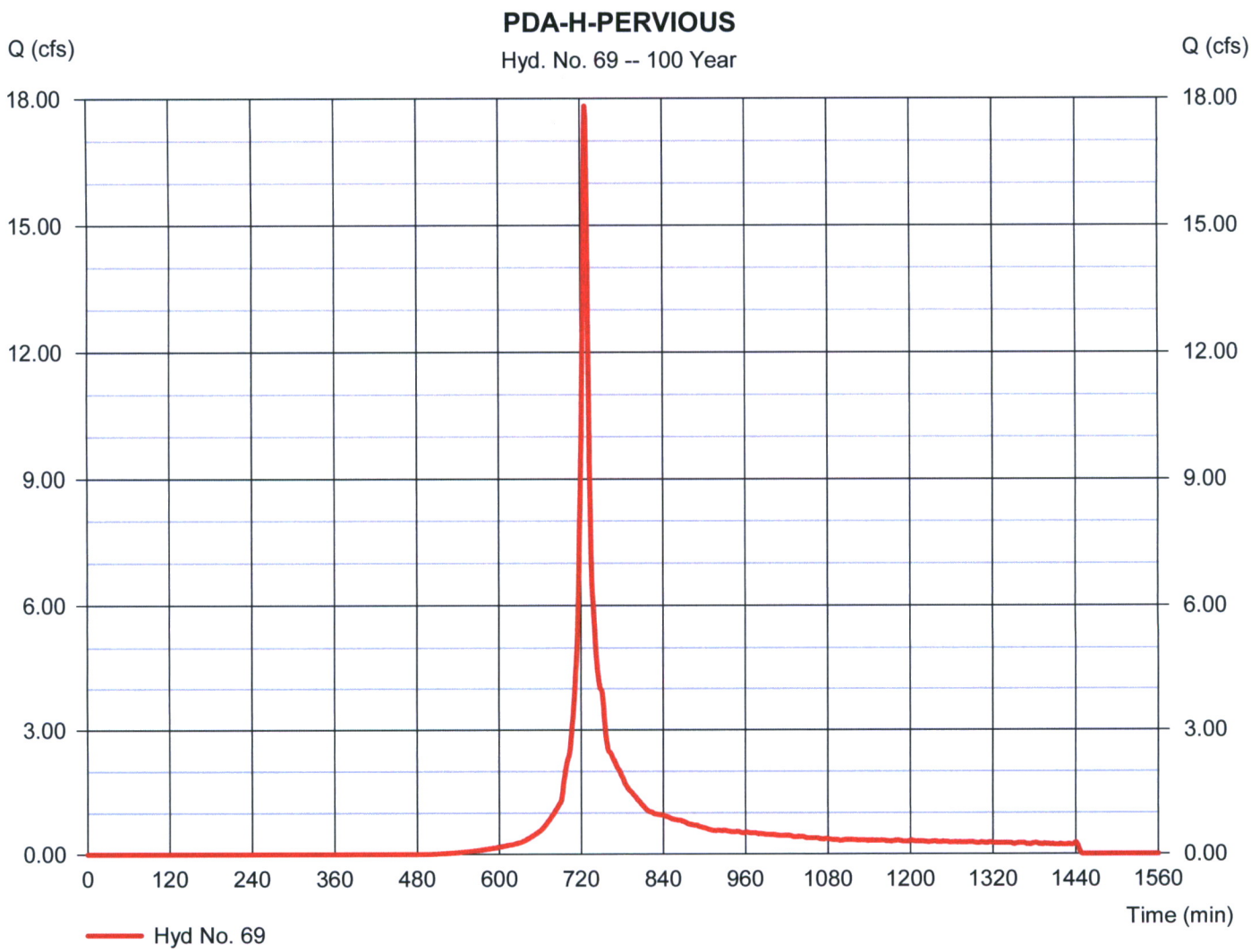


Hydrograph Report

Hyd. No. 69

PDA-H-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 17.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 49,140 cuft
Drainage area	= 3.430 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.51 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Region 4 Rainfall Distribution\484AA_C_1 min.cds	Storm Frequency	= 100 yrs

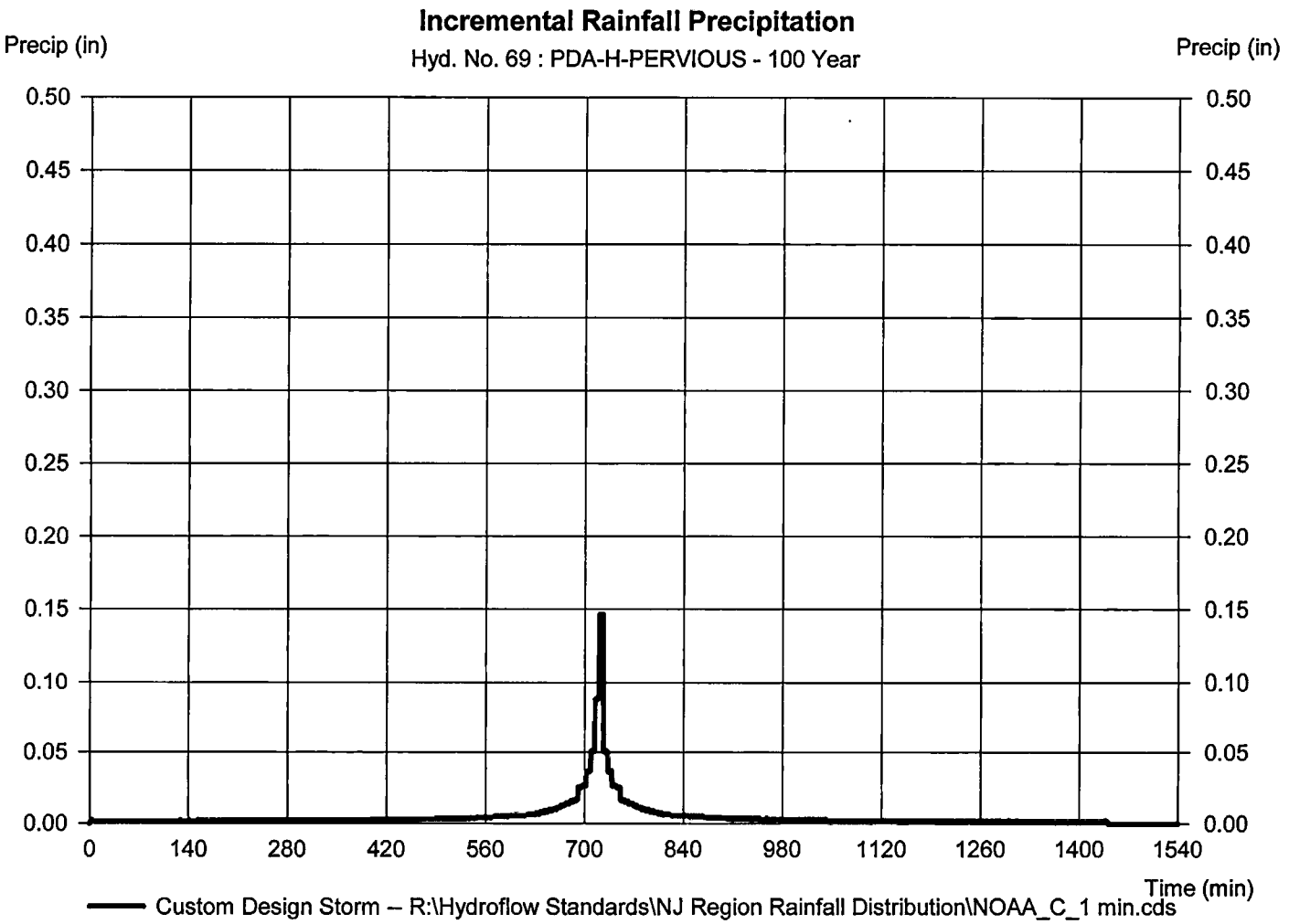


Precipitation Report

Hyd. No. 69

PDA-H-PERVIOUS

Storm Frequency	= 100 yrs	Time interval	= 1 min
Total precip.	= 7.5100 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Region Rainfall Distribution\NOAA_C_1 min.cds		

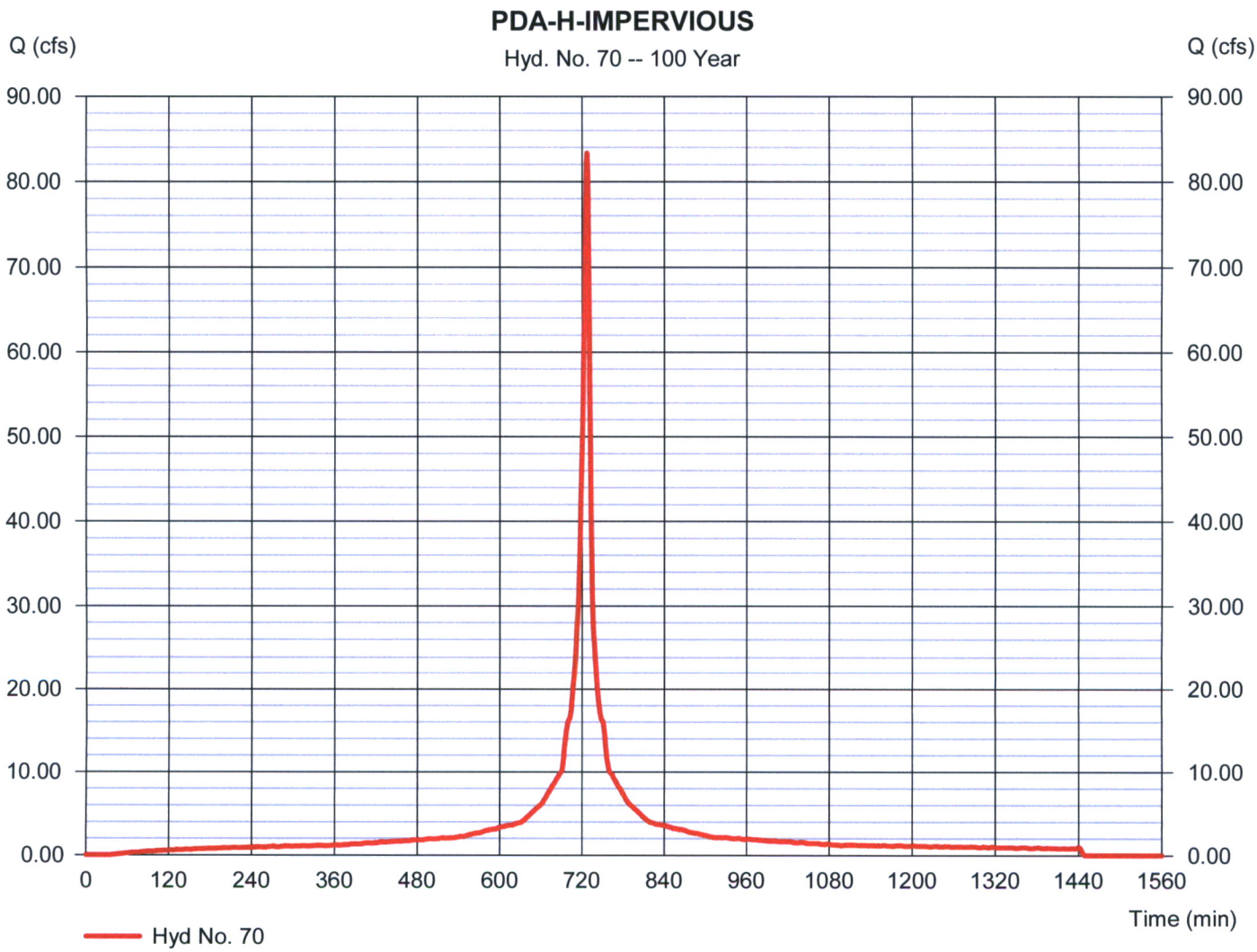


Hydrograph Report

Hyd. No. 70

PDA-H-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 83.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 274,889 cuft
Drainage area	= 10.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.51 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Region Rainfall Distribution\484A_C_1 min.cds	Storm frequency	= 100 yrs

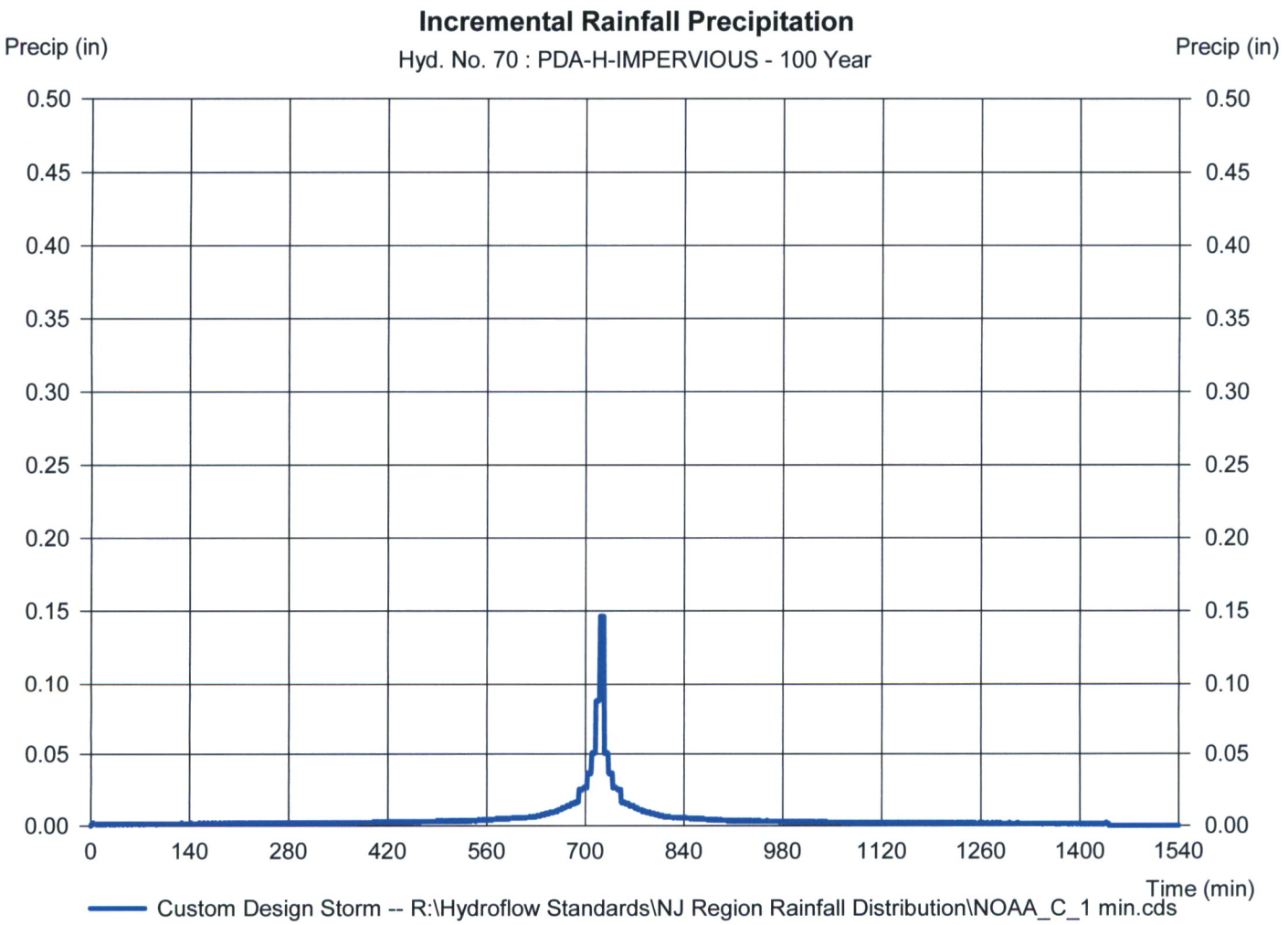


Precipitation Report

Hyd. No. 70

PDA-H-IMPERVIOUS

Storm Frequency	= 100 yrs	Time interval	= 1 min
Total precip.	= 7.5100 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Region Rainfall Distribution\NOAA_C_1 min.cds		



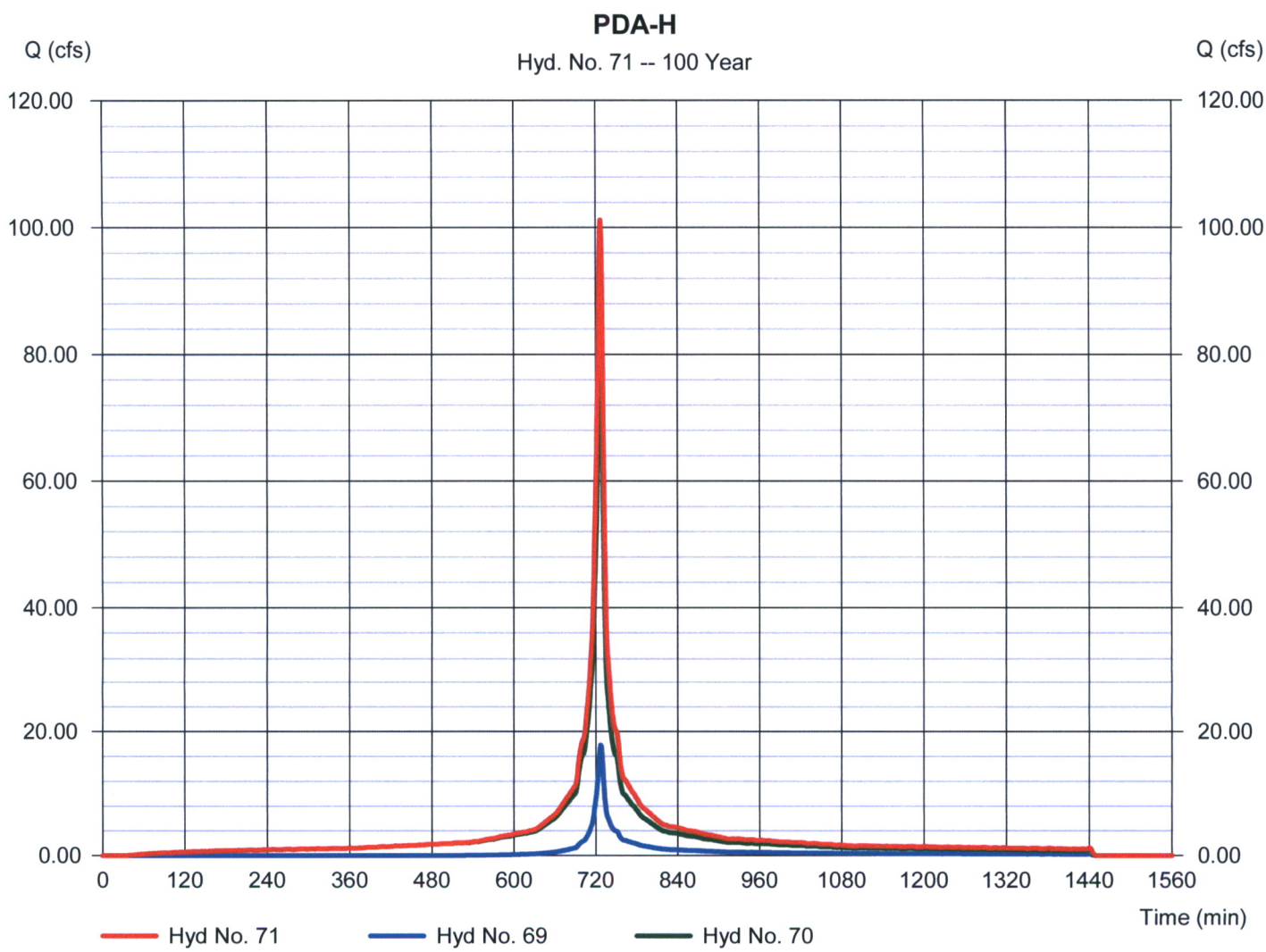
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Hyd. No. 71

PDA-H

Hydrograph type	= Combine	Peak discharge	= 101.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 324,029 cuft
Inflow hyds.	= 69, 70	Contrib. drain. area	= 13.530 ac



Hydrograph Report

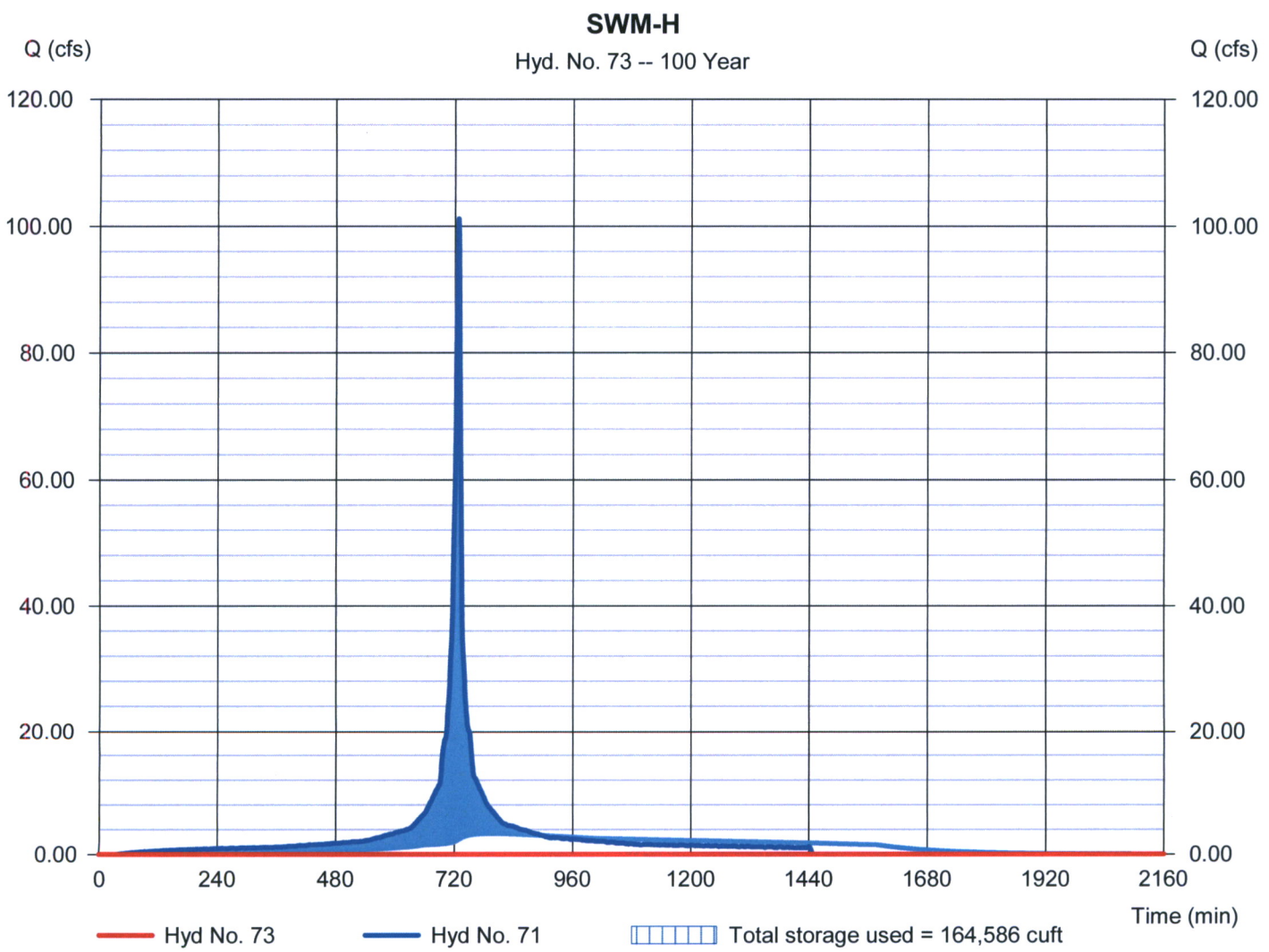
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Monday, 11 / 2 / 2020

Hyd. No. 73

SWM-H

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 1459 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 71 - PDA-H	Max. Elevation	= 599.63 ft
Reservoir name	= SWM-H	Max. Storage	= 164,586 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

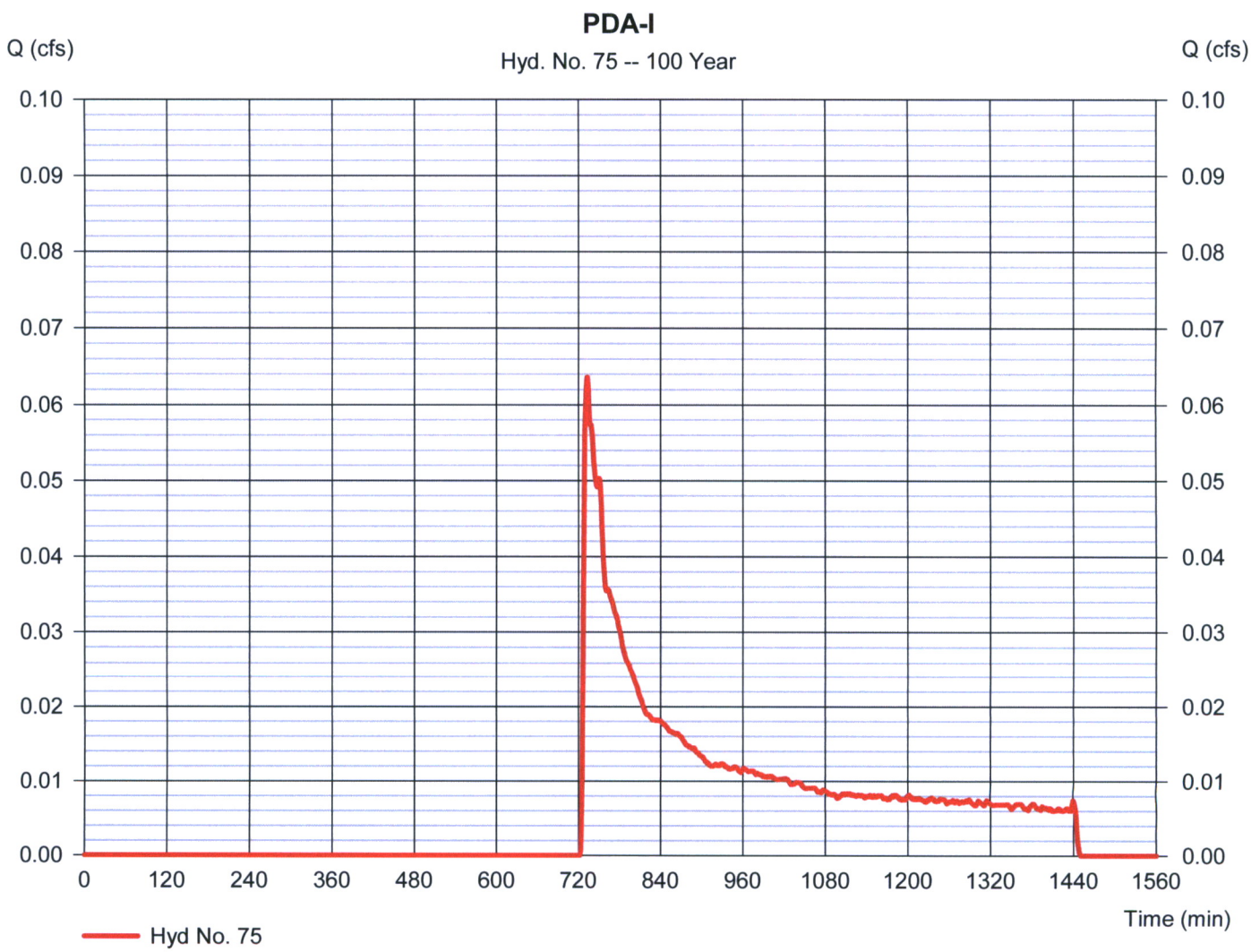


Hydrograph Report

Hyd. No. 75

PDA-I

Hydrograph type	= SCS Runoff	Peak discharge	= 0.064 cfs
Storm frequency	= 100 yrs	Time to peak	= 733 min
Time interval	= 1 min	Hyd. volume	= 556 cuft
Drainage area	= 0.260 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.51 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Regional Rainfall Distribution\484AA_C_1 min.cds	Storm Rainfall	

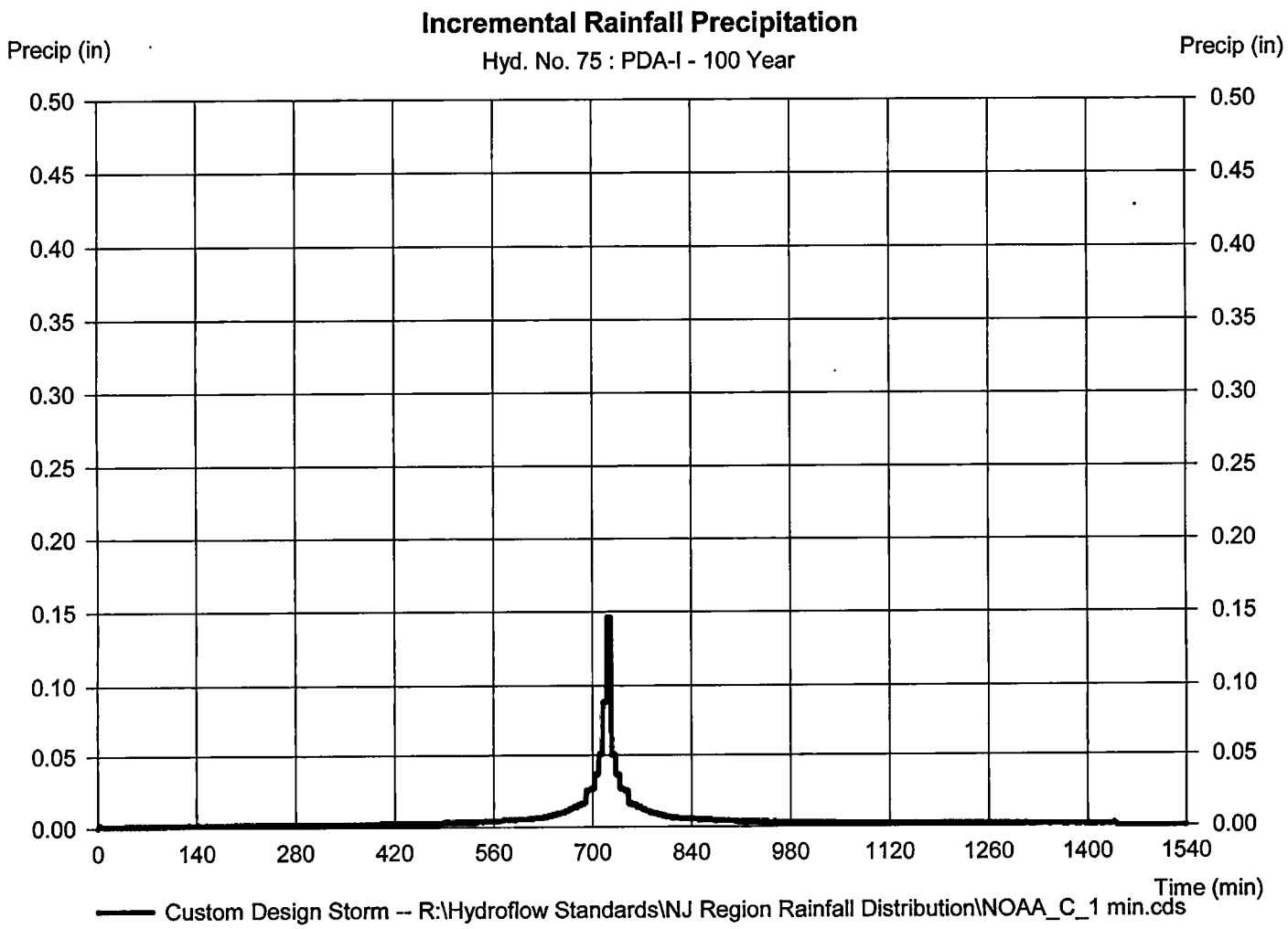


Precipitation Report

Hyd. No. 75

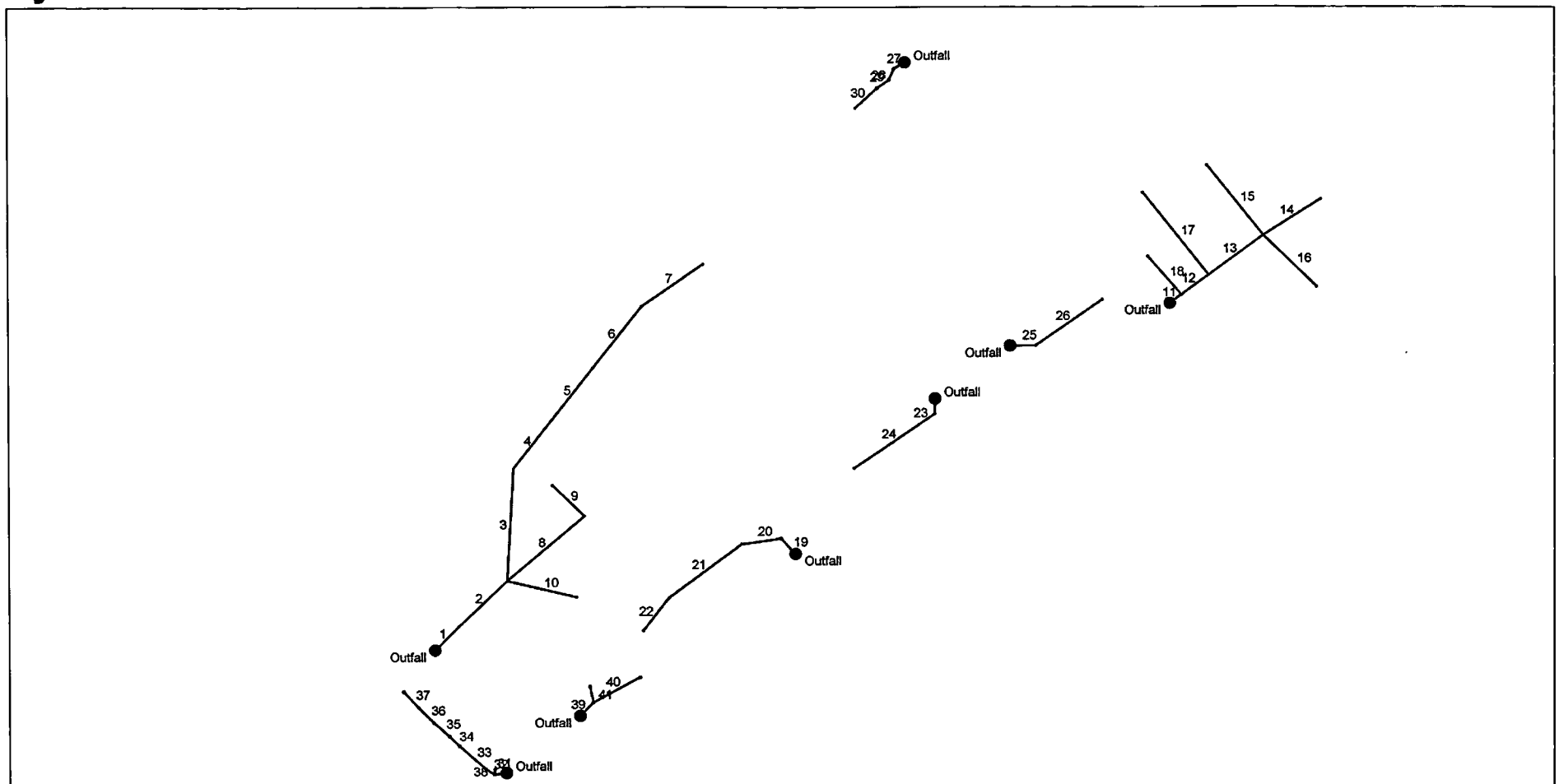
PDA-I

Storm Frequency	= 100 yrs	Time interval	= 1 min
Total precip.	= 7.5100 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\NJ Region Rainfall Distribution\NOAA_C_1 min.cds		



APPENDIX E –
STORM SEWER SIZING CALCULATIONS

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: SWM Pipe Sizing.stm	Number of lines: 41	Date: 11/2/2020

MyReport

Line No.	Inlet ID	Drng Area (ac)	Inlet Time (min)	i Inlet (In/hr)	Runoff Coeff (C)	Total Runoff (cfs)	Line Size (in)	Line Slope (%)	n-val Pipe	Capac Full (cfs)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Line No.
1	D-2	1.53	10.0	5.79	0.99	41.69	36	0.50	0.013	46.98	605.48	601.33	600.73	600.10	1
2	D-3	2.03	10.0	5.79	0.99	35.71	36	0.50	0.013	47.21	606.66	605.48	601.38	600.85	2
3	D-6	0.54	10.0	5.79	0.99	29.89	30	1.64	0.013	52.44	609.02	606.66	606.77 j	602.13	3
4	D-7	1.16	10.0	5.79	0.99	27.39	24	1.35	0.012	28.50	611.29	609.02	609.14 j	606.77	4
5	D-8	1.45	10.0	5.79	0.99	21.57	24	1.35	0.013	26.30	613.80	611.29	611.57 j	609.14	5
6	D-9	0.81	10.0	5.79	0.99	14.15	24	1.35	0.013	26.30	615.98	613.80	614.29 j	611.57	6
7	D-10	1.72	10.0	5.79	0.99	9.85	18	0.75	0.012	9.84	617.06	615.98	615.71	614.29	7
8	D-4	0.07	10.0	5.79	0.99	2.47	15	1.76	0.012	9.28	609.85	606.66	605.09 j	602.13	8
9	D-5	0.38	10.0	5.79	0.99	2.18	15	1.50	0.012	8.58	609.88	609.85	606.94 j	605.09	9
10	D-11	0.08	10.0	5.79	0.99	0.46	15	0.50	0.012	4.96	607.20	606.66	602.13	602.13	10
11	B-21	0.79	10.0	5.79	0.99	42.60	36	0.79	0.013	59.14	602.27	600.25	600.44	599.89	11
12	B-23	2.61	10.0	5.79	0.99	37.33	33	0.77	0.013	46.29	602.73	602.27	601.08 j	600.44	12
13	B-25	0.62	10.0	5.79	0.99	27.63	30	0.71	0.013	34.56	603.70	602.73	602.19 j	601.08	13
14	B-28	0.87	10.0	5.79	0.99	4.98	27	0.60	0.013	23.98	604.82	603.70	602.30 j	602.19	14
15	B-26	2.58	10.0	5.79	0.99	14.78	24	0.81	0.013	20.33	605.01	603.70	603.88 j	602.19	15
16	B-27	1.22	10.0	5.79	0.99	6.99	18	0.50	0.013	7.42	603.97	603.70	603.12	602.19	16
17	B-24	0.17	10.0	5.79	0.99	0.97	15	1.53	0.013	7.99	606.99	602.73	604.33 j	601.08	17
18	B-22	0.41	10.0	5.79	0.99	2.35	15	0.77	0.013	5.67	602.80	602.27	600.63	600.44	18
19	B-2	0.00	0.0	0.00	0.00	7.97	18	0.50	0.013	7.44	602.60	598.98	599.63	599.09	19
20	B-3	1.17	10.0	5.79	0.99	8.05	18	0.50	0.013	7.46	601.54	602.60	600.59	599.95	20
21	B-4	0.56	10.0	5.79	0.99	2.94	15	0.50	0.013	4.56	603.13	601.54	601.25	600.76	21
22	B-5	0.07	10.0	5.79	0.99	0.40	15	0.50	0.013	4.58	604.54	603.13	601.29	601.28	22
23	B-7	0.15	10.0	5.79	0.99	3.29	24	0.51	0.013	16.16	602.26	600.25	598.86	598.63	23

Project File: SWM Pipe Sizing.stm | Number of lines: 41 | Date: 11/2/2020

NOTES: Intensity = 51.01 / (Inlet time + 9.00) ^ 0.74 -- Return period = 25 Yrs. ; ** Critical depth

MyReport

Line No.	Inlet ID	Drng Area (ac)	Inlet Time (min)	i Inlet (in/hr)	Runoff Coeff (C)	Total Runoff (cfs)	Line Size (in)	Line Slope (%)	n-val Pipe	Capac Full (cfs)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Line No.
24	B-8	0.47	10.0	5.79	0.99	2.69	15	0.50	0.013	4.56	601.64	602.26	600.28	598.92	24
25	B-18	0.04	10.0	5.79	0.99	2.97	15	0.50	0.013	4.54	602.26	598.84	599.11	598.69	25
26	B-19	0.51	10.0	5.79	0.99	2.92	15	0.50	0.013	4.57	601.43	602.26	600.17	599.25	26
27	G-2	0.00	0.0	0.00	0.99	13.85	24	0.95	0.012	23.90	597.81	597.99	596.68 j	596.34	27
28	G-3	1.10	10.0	5.79	0.99	13.88	18	1.39	0.012	13.42	599.69	597.81	597.19	596.68	28
29	G-4	1.01	10.0	5.79	0.99	7.84	18	1.05	0.012	11.65	598.74	599.69	597.30 j	597.19	29
30	G-5	0.40	10.0	5.79	0.99	2.29	15	0.50	0.013	4.58	604.17	598.74	597.59	597.30	30
31	A-1A	0.04	10.0	5.79	0.99	8.85	24	1.04	0.012	24.97	596.69	593.15	592.41	592.06	31
32	A-2	0.04	10.0	5.79	0.99	1.23	15	0.95	0.012	6.80	595.70	596.69	592.04	592.41	32
33	A-3	0.04	10.0	5.79	0.99	1.10	15	1.10	0.012	7.34	595.22	595.70	593.12 j	592.04	33
34	A-4	0.04	10.0	5.79	0.99	0.94	15	1.84	0.012	9.48	596.00	595.22	593.80 j	593.12	34
35	A-5	0.04	10.0	5.79	0.99	0.78	15	2.19	0.012	10.36	597.25	596.00	595.07 j	593.80	35
36	A-6	0.04	10.0	5.79	0.99	0.62	15	2.19	0.012	10.36	598.60	597.25	596.39 j	595.07	36
37	A-7	0.08	10.0	5.79	0.99	0.46	15	2.20	0.012	10.39	599.96	598.60	597.71 j	596.39	37
38	A-1B	1.72	10.0	5.79	0.99	9.85	15	1.02	0.013	6.53	596.57	596.69	592.94	592.60	38
39	A-9	0.00	0.0	0.00	0.00	9.61	24	0.70	0.012	20.52	602.36	593.03	592.49 j	592.11	39
40	A-11	0.81	10.0	5.79	0.99	4.64	15	1.03	0.012	7.12	597.05	602.36	594.65	593.00	40
41	A-10	0.91	10.0	5.79	0.99	5.21	18	1.85	0.012	15.47	601.42	602.36	593.14 j	592.49	41

Project File: SWM Pipe Sizing.stm | Number of lines: 41 | Date: 11/2/2020

NOTES: Intensity = 51.01 / (Inlet time + 9.00) ^ 0.74 -- Return period = 25 Yrs. ; ** 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	36	41.69	598.00	600.10	2.10	5.29	7.88	0.97	601.07	0.557	96.736	598.48	600.73	2.25	5.68	7.34	0.84	601.57	0.471	0.514	0.497	0.15	0.13
2	36	35.71	598.48	600.85	2.37	4.84	5.95	0.55	601.40	0.307	189.591	599.43	601.38	1.95**	4.86	7.35	0.84	602.22	0.503	0.405	0.767	0.89	0.75
3	30	29.89	599.43	602.13	2.50	3.92	6.09	0.58	602.70	0.531	335.112	604.91	606.77 j	1.86**	3.92	7.62	0.90	607.68	0.649	0.590	n/a	0.60	n/a
4	24	27.39	604.91	606.77	1.86	3.00	8.99	1.30	608.07	0.000	178.174	607.32	609.14 j	1.82**	3.00	9.14	1.30	610.43	0.000	0.000	n/a	0.15	0.19
5	24	21.57	607.32	609.14	1.82	2.79	7.20	0.93	610.07	0.000	191.586	609.91	611.57 j	1.66**	2.79	7.74	0.93	612.50	0.000	0.000	n/a	0.15	n/a
6	24	14.15	609.91	611.57	1.66	2.26	5.08	0.61	612.18	0.000	224.123	612.94	614.29 j	1.35**	2.26	6.25	0.61	614.90	0.000	0.000	n/a	0.35	n/a
7	18	9.85	612.94	614.29	1.35	1.53	5.87	0.54	614.83	0.659	208.661	614.50	615.71	1.21**	1.53	6.44	0.64	616.36	0.769	0.714	1.490	1.00	0.64
8	15	2.47	599.43	602.13	1.25	0.62	2.01	0.06	602.19	0.124	286.094	604.46	605.09 j	0.63**	0.62	3.99	0.25	605.34	0.489	0.307	n/a	1.00	0.25
9	15	2.18	604.46	605.09	0.63	0.57	3.52	0.23	605.32	0.000	125.777	606.35	606.94 j	0.59**	0.57	3.83	0.23	607.17	0.000	0.000	n/a	1.00	n/a
10	15	0.46	599.43	602.13	1.25	1.23	0.37	0.00	602.13	0.004	195.180	600.41	602.13	1.25	1.23	0.37	0.00	602.14	0.004	0.004	0.008	1.00	0.00
11	36	42.60	598.00	599.89	1.89	4.69	9.08	0.99	600.88	0.000	40.661	598.32	600.44	2.12**	5.35	7.96	0.99	601.43	0.000	0.000	n/a	1.00	n/a
12	33	37.33	598.32	600.44	2.12	4.71	7.58	0.98	601.42	0.000	95.278	599.05	601.08 j	2.03**	4.71	7.93	0.98	602.06	0.000	0.000	n/a	1.00	0.98
13	30	27.63	599.05	601.08	2.03	3.76	6.47	0.84	601.92	0.000	190.161	600.40	602.19 j	1.79**	3.76	7.34	0.84	603.03	0.000	0.000	n/a	1.00	n/a
14	27	4.98	600.40	602.19	1.79	1.18	1.47	0.28	602.47	0.000	190.138	601.54	602.30 j	0.76**	1.18	4.23	0.28	602.58	0.000	0.000	n/a	1.00	0.28
15	24	14.78	600.40	602.19	1.79	2.32	4.98	0.63	602.82	0.000	259.873	602.50	603.88 j	1.38**	2.32	6.37	0.63	604.52	0.000	0.000	n/a	1.00	0.63
16	18	6.99	600.40	602.19	1.50	1.77	3.96	0.24	602.43	0.443	210.037	601.45	603.12	1.50	1.77	3.95	0.24	603.36	0.443	0.443	0.930	1.00	0.24
17	15	0.97	599.30	601.08	1.25	0.32	0.79	0.01	601.09	0.023	303.400	603.94	604.33 j	0.39**	0.32	3.01	0.14	604.47	0.524	0.273	n/a	1.00	n/a
18	15	2.35	598.57	600.44	1.25	1.23	1.91	0.06	600.50	0.132	145.468	599.69	600.63	0.94	0.98	2.38	0.09	600.71	0.160	0.146	0.213	1.00	0.09
19	18	7.97	598.00	599.09	1.09*	1.38	5.78	0.52	599.61	0.743	59.831	598.30	599.63	1.33	1.65	4.82	0.36	599.99	0.515	0.629	0.376	0.88	0.32
20	18	8.05	598.30	599.95	1.50	1.77	4.55	0.32	600.27	0.587	109.121	598.85	600.59	1.50	1.77	4.55	0.32	600.91	0.587	0.587	0.641	0.55	0.18
21	15	2.94	598.85	600.76	1.25	1.23	2.39	0.09	600.85	0.207	254.525	600.12	601.25	1.13	1.17	2.52	0.10	601.35	0.182	0.194	0.495	0.32	0.03
22	15	0.40	600.12	601.28	1.16	1.19	0.34	0.00	601.28	0.003	119.495	600.72	601.29	0.57	0.54	0.74	0.01	601.30	0.022	0.012	0.015	1.00	0.01

Project File: SWM Pipe Sizing.stm | Number of lines: 41 | Run Date: 11/2/2020

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

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)
23	24	3.29	598.00	598.63	0.63	0.85	3.88	0.23	598.86	0.000	45.068	598.23	598.86	0.63**	0.85	3.85	0.23	599.09	0.000	0.000	n/a	0.83	0.19
24	15	2.69	598.23	598.92	0.69*	0.70	3.87	0.23	599.15	0.499	272.792	599.59	600.28	0.69	0.70	3.86	0.23	600.51	0.496	0.497	1.357	1.00	0.23
25	15	2.97	598.00	598.69	0.69*	0.70	4.26	0.28	598.97	0.603	68.673	598.34	599.11	0.77	0.80	3.73	0.22	599.33	0.429	0.516	0.354	0.65	0.14
26	15	2.92	598.34	599.25	0.91	0.69	3.04	0.14	599.40	0.262	227.136	599.48	600.17	0.69**	0.69	4.23	0.28	600.44	0.600	0.431	n/a	1.00	0.28
27	24	13.85	595.00	596.34	1.34	2.24	6.19	0.60	596.94	0.000	35.735	595.34	596.68 j	1.34**	2.24	6.20	0.60	597.28	0.000	0.000	n/a	0.61	n/a
28	18	13.88	595.34	596.68	1.34	1.66	8.34	1.04	597.72	0.000	33.782	595.81	597.19	1.38**	1.70	8.17	1.04	598.23	0.000	0.000	n/a	0.57	0.59
29	18	7.84	595.79	597.19	1.40	1.37	4.57	0.51	597.70	0.000	41.035	596.22	597.30 j	1.08**	1.37	5.74	0.51	597.82	0.000	0.000	n/a	0.17	n/a
30	15	2.29	596.55	597.30	0.75	0.59	2.96	0.14	597.44	0.274	85.558	596.98	597.59	0.61**	0.59	3.87	0.23	597.82	0.555	0.414	0.355	1.00	0.23
31	24	8.85	591.00	592.06	1.06	1.69	5.24	0.43	592.49	0.000	33.696	591.35	592.41	1.06**	1.69	5.23	0.43	592.84	0.000	0.000	n/a	1.00	0.43
32	15	1.23	591.35	592.41	1.06	0.38	1.11	0.16	592.57	0.000	26.421	591.60	592.04	0.44**	0.38	3.22	0.16	592.20	0.000	0.000	n/a	0.23	n/a
33	15	1.10	591.60	592.04	0.44	0.35	2.88	0.15	592.19	0.000	100.880	592.71	593.12 j	0.41**	0.35	3.11	0.15	593.27	0.000	0.000	n/a	0.15	0.02
34	15	0.94	592.71	593.12	0.41	0.31	2.65	0.14	593.26	0.000	38.648	593.42	593.80 j	0.38**	0.31	2.97	0.14	593.94	0.000	0.000	n/a	0.15	0.02
35	15	0.78	593.42	593.80	0.38	0.28	2.48	0.12	593.92	0.000	59.263	594.72	595.07 j	0.35**	0.28	2.82	0.12	595.19	0.000	0.000	n/a	0.15	n/a
36	15	0.62	594.72	595.07	0.35	0.23	2.25	0.11	595.17	0.000	61.976	596.08	596.39 j	0.31**	0.23	2.65	0.11	596.50	0.000	0.000	n/a	0.15	0.02
37	15	0.46	596.08	596.39	0.31	0.19	1.95	0.09	596.48	0.000	62.156	597.45	597.71 j	0.26**	0.19	2.44	0.09	597.81	0.000	0.000	n/a	1.00	0.09
38	15	9.85	591.35	592.60	1.25*	1.23	8.03	1.00	593.60	2.329	14.658	591.50	592.94	1.25	1.23	8.03	1.00	593.94	2.328	2.328	0.341	1.00	1.00
39	24	9.61	591.00	592.11	1.11	1.79	5.37	0.45	592.56	0.000	54.179	591.38	592.49 j	1.11**	1.79	5.38	0.45	592.94	0.000	0.000	n/a	0.83	0.37
40	15	4.64	592.26	593.00	0.74*	0.75	6.18	0.40	593.40	0.000	146.927	593.78	594.65	0.87**	0.91	5.07	0.40	595.05	0.000	0.000	n/a	1.00	0.40
41	18	5.21	591.38	592.49	1.11	1.08	3.73	0.37	592.85	0.000	47.601	592.26	593.14 j	0.88**	1.08	4.85	0.37	593.50	0.000	0.000	n/a	1.00	n/a

Project File: SWM Pipe Sizing.stm | Number of lines: 41 | Run Date: 11/2/2020

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

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 (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	96.736	1.53	9.77	0.99	1.51	9.67	10.0	19.3	4.3	41.69	46.98	7.61	36	0.50	598.00	598.48	600.10	600.73	601.33	605.48	Pipe - (22)
2	1	189.591	2.03	8.24	0.99	2.01	8.16	10.0	18.7	4.4	35.71	47.21	6.65	36	0.50	598.48	599.43	600.85	601.38	605.48	606.66	Pipe - (20) (1)
3	2	335.112	0.54	5.68	0.99	0.53	5.62	10.0	12.3	5.3	29.89	52.44	6.86	30	1.64	599.43	604.91	602.13	606.77	606.66	609.02	Pipe - (20)
4	3	178.174	1.16	5.14	0.99	1.15	5.09	10.0	12.0	5.4	27.39	28.50	9.07	24	1.35	604.91	607.32	606.77	609.14	609.02	611.29	Pipe - (19) (1) (1)
5	4	191.586	1.45	3.98	0.99	1.44	3.94	10.0	11.5	5.5	21.57	26.30	7.47	24	1.35	607.32	609.91	609.14	611.57	611.29	613.80	Pipe - (19) (1) (1)
6	5	224.123	0.81	2.53	0.99	0.80	2.50	10.0	10.6	5.6	14.15	26.30	5.66	24	1.35	609.91	612.94	611.57	614.29	613.80	615.98	Pipe - (19) (1)
7	6	208.661	1.72	1.72	0.99	1.70	1.70	10.0	10.0	5.8	9.85	9.84	6.15	18	0.75	612.94	614.50	614.29	615.71	615.98	617.06	Pipe - (19)
8	2	286.094	0.07	0.45	0.99	0.07	0.45	10.0	11.2	5.5	2.47	9.28	3.00	15	1.76	599.43	604.46	602.13	605.09	606.66	609.85	Pipe - (21)
9	8	125.777	0.38	0.38	0.99	0.38	0.38	10.0	10.0	5.8	2.18	8.58	3.68	15	1.50	604.46	606.35	605.09	606.94	609.85	609.88	Pipe - (23)
10	2	195.180	0.08	0.08	0.99	0.08	0.08	10.0	10.0	5.8	0.46	4.96	0.37	15	0.50	599.43	600.41	602.13	602.13	606.66	607.20	Pipe - (24)
11	End	40.661	0.79	9.27	0.99	0.78	9.18	10.0	16.6	4.6	42.60	59.14	8.52	36	0.79	598.00	598.32	599.89	600.44	600.25	602.27	Pipe - (36) (1)
12	11	95.278	2.61	8.07	0.99	2.58	7.99	10.0	16.4	4.7	37.33	46.29	7.76	33	0.77	598.32	599.05	600.44	601.08	602.27	602.73	Pipe - (36)
13	12	190.161	0.62	5.29	0.99	0.61	5.24	10.0	12.5	5.3	27.63	34.56	6.90	30	0.71	599.05	600.40	601.08	602.19	602.73	603.70	Pipe - (35)
14	13	190.138	0.87	0.87	0.99	0.86	0.86	10.0	10.0	5.8	4.98	23.98	2.85	27	0.60	600.40	601.54	602.19	602.30	603.70	604.82	Pipe - (39)
15	13	259.873	2.58	2.58	0.99	2.55	2.55	10.0	10.0	5.8	14.78	20.33	5.68	24	0.81	600.40	602.50	602.19	603.88	603.70	605.01	Pipe - (38)
16	13	210.037	1.22	1.22	0.99	1.21	1.21	10.0	10.0	5.8	6.99	7.42	3.95	18	0.50	600.40	601.45	602.19	603.12	603.70	603.97	Pipe - (37)
17	12	303.400	0.17	0.17	0.99	0.17	0.17	10.0	10.0	5.8	0.97	7.99	1.90	15	1.53	599.30	603.94	601.08	604.33	602.73	606.99	Pipe - (41)
18	11	145.468	0.41	0.41	0.99	0.41	0.41	10.0	10.0	5.8	2.35	5.67	2.15	15	0.77	598.57	599.69	600.44	600.63	602.27	602.80	Pipe - (40)
19	End	59.831	0.00	1.80	0.00	0.00	1.78	0.0	17.9	4.5	7.97	7.44	5.30	18	0.50	598.00	598.30	599.09	599.63	598.98	602.60	Pipe - (34) (1)
20	19	109.121	1.17	1.80	0.99	1.16	1.78	10.0	17.6	4.5	8.05	7.46	4.55	18	0.50	598.30	598.85	599.95	600.59	602.60	601.54	Pipe - (34)
21	20	254.525	0.56	0.63	0.99	0.55	0.62	10.0	16.1	4.7	2.94	4.56	2.46	15	0.50	598.85	600.12	600.76	601.25	601.54	603.13	Pipe - (32)
22	21	119.495	0.07	0.07	0.99	0.07	0.07	10.0	10.0	5.8	0.40	4.58	0.54	15	0.50	600.12	600.72	601.28	601.29	603.13	604.54	Pipe - (33)

Project File: SWM Pipe Sizing.stm | Number of lines: 41 | Run Date: 11/2/2020

NOTES:Intensity = 51.01 / (Inlet time + 9.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box

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 (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	End	45.068	0.15	0.62	0.99	0.15	0.61	10.0	12.1	5.4	3.29	16.16	3.86	24	0.51	598.00	598.23	598.63	598.86	600.25	602.26	Pipe - (27)
24	23	272.792	0.47	0.47	0.99	0.47	0.47	10.0	10.0	5.8	2.69	4.56	3.87	15	0.50	598.23	599.59	598.92	600.28	602.26	601.64	Pipe - (26)
25	End	68.673	0.04	0.55	0.99	0.04	0.54	10.0	11.6	5.5	2.97	4.54	3.99	15	0.50	598.00	598.34	598.69	599.11	598.84	602.26	Pipe - (56)
26	25	227.136	0.51	0.51	0.99	0.50	0.50	10.0	10.0	5.8	2.92	4.57	3.64	15	0.50	598.34	599.48	599.25	600.17	602.26	601.43	Pipe - (55)
27	End	35.735	0.00	2.51	0.99	0.00	2.48	0.0	11.0	5.6	13.85	23.90	6.19	24	0.95	595.00	595.34	596.34	596.68	597.99	597.81	Pipe - (7)
28	27	33.782	1.10	2.51	0.99	1.09	2.48	10.0	10.9	5.6	13.88	13.42	8.26	18	1.39	595.34	595.81	596.68	597.19	597.81	599.69	Pipe - (6)
29	28	41.035	1.01	1.41	0.99	1.00	1.40	10.0	10.8	5.6	7.84	11.65	5.16	18	1.05	595.79	596.22	597.19	597.30	599.69	598.74	Pipe - (5)
30	29	85.558	0.40	0.40	0.99	0.40	0.40	10.0	10.0	5.8	2.29	4.58	3.42	15	0.50	596.55	596.98	597.30	597.59	598.74	604.17	Pipe - (46)
31	End	33.696	0.04	2.04	0.99	0.04	2.02	10.0	18.7	4.4	8.85	24.97	5.23	24	1.04	591.00	591.35	592.06	592.41	593.15	596.69	Pipe - (3) (1)
32	31	26.421	0.04	0.28	0.99	0.04	0.28	10.0	18.3	4.4	1.23	6.80	2.16	15	0.95	591.35	591.60	592.41	592.04	596.69	595.70	Pipe - (3)
33	32	100.880	0.04	0.24	0.99	0.04	0.24	10.0	16.7	4.6	1.10	7.34	3.00	15	1.10	591.60	592.71	592.04	593.12	595.70	595.22	Pipe - (8) (1) (1) (
34	33	38.648	0.04	0.20	0.99	0.04	0.20	10.0	16.0	4.7	0.94	9.48	2.81	15	1.84	592.71	593.42	593.12	593.80	595.22	596.00	Pipe - (8) (1) (1) (
35	34	59.263	0.04	0.16	0.99	0.04	0.16	10.0	14.6	4.9	0.78	10.36	2.65	15	2.19	593.42	594.72	593.80	595.07	596.00	597.25	Pipe - (8) (1) (1)
36	35	61.976	0.04	0.12	0.99	0.04	0.12	10.0	12.8	5.2	0.62	10.36	2.45	15	2.19	594.72	596.08	595.07	596.39	597.25	598.60	Pipe - (8) (1)
37	36	62.156	0.08	0.08	0.99	0.08	0.08	10.0	10.0	5.8	0.46	10.39	2.20	15	2.20	596.08	597.45	596.39	597.71	598.60	599.96	Pipe - (8)
38	31	14.658	1.72	1.72	0.99	1.70	1.70	10.0	10.0	5.8	9.85	6.53	8.03	15	1.02	591.35	591.50	592.60	592.94	596.69	596.57	Pipe - (57)
39	End	54.179	0.00	1.72	0.00	0.00	1.70	0.0	10.6	5.6	9.61	20.52	5.38	24	0.70	591.00	591.38	592.11	592.49	593.03	602.36	Pipe - (18)
40	39	146.927	0.81	0.81	0.99	0.80	0.80	10.0	10.0	5.8	4.64	7.12	5.62	15	1.03	592.26	593.78	593.00	594.65	602.36	597.05	Pipe - (16)
41	39	47.601	0.91	0.91	0.99	0.90	0.90	10.0	10.0	5.8	5.21	15.47	4.29	18	1.85	591.38	592.26	592.49	593.14	602.36	601.42	Pipe - (17)

Project File: SWM Pipe Sizing.stm

Number of lines: 41

Run Date: 11/2/2020

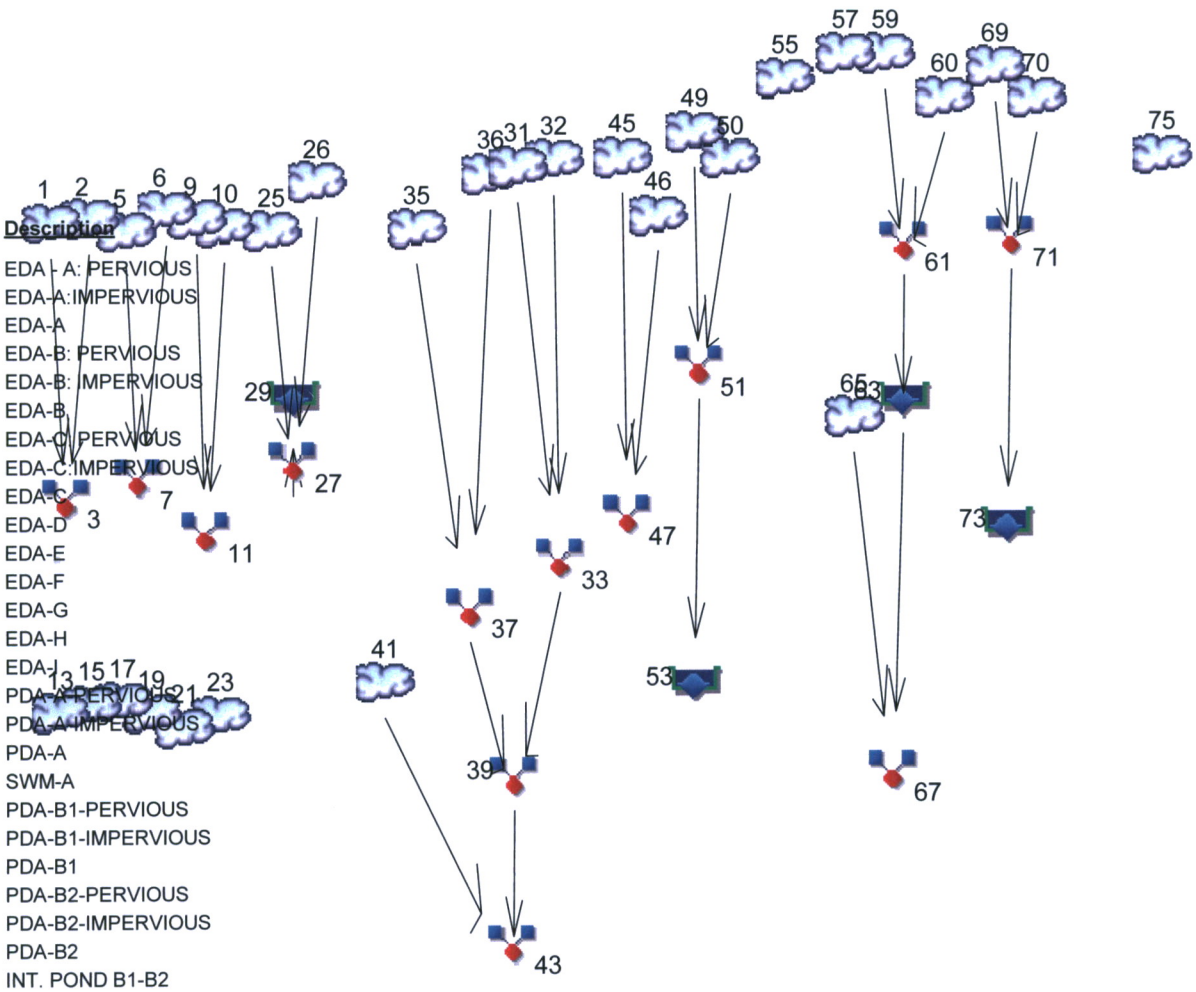
NOTES:Intensity = 51.01 / (Inlet time + 9.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box

APPENDIX F –
WATER QUALITY STORM HYDROLOGIC ANALYSIS AND RUNOFF QUANTITY CALCULATIONS

E&LP

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	SCS Runoff	EDA-A: PERVIOUS
2	SCS Runoff	EDA-A:IMPERVIOUS
3	Combine	EDA-A
5	SCS Runoff	EDA-B: PERVIOUS
6	SCS Runoff	EDA-B: IMPERVIOUS
7	Combine	EDA-B
9	SCS Runoff	EDA-C: PERVIOUS
10	SCS Runoff	EDA-C:IMPERVIOUS
11	Combine	EDA-C
13	SCS Runoff	EDA-D
15	SCS Runoff	EDA-E
17	SCS Runoff	EDA-F
19	SCS Runoff	EDA-G
21	SCS Runoff	EDA-H
23	SCS Runoff	EDA-I
25	SCS Runoff	PDA-A:PERVIOUS
26	SCS Runoff	PDA-A:IMPERVIOUS
27	Combine	PDA-A
29	Reservoir	SWM-A
31	SCS Runoff	PDA-B1-PERVIOUS
32	SCS Runoff	PDA-B1-IMPERVIOUS
33	Combine	PDA-B1
35	SCS Runoff	PDA-B2-PERVIOUS
36	SCS Runoff	PDA-B2-IMPERVIOUS
37	Combine	PDA-B2
39	Reservoir(i)	INT. POND B1-B2
41	SCS Runoff	PDA-B3
43	Combine	PDA-B
45	SCS Runoff	PDA-C-PERVIOUS
46	SCS Runoff	PDA-C-IMPERVIOUS
47	Combine	PDA-C
49	SCS Runoff	PDA-D-PERVIOUS
50	SCS Runoff	PDA-D-IMPERVIOUS
51	Combine	PDA-D
53	Reservoir	SWM-D
55	SCS Runoff	PDA-E
57	SCS Runoff	PDA-F
59	SCS Runoff	PDA-G1-PERVIOUS
60	SCS Runoff	PDA-G1-IMPERVIOUS
61	Combine	PDA-G1
63	Reservoir	SWM-G1
65	SCS Runoff	PDA-G2
67	Combine	PDA-G
69	SCS Runoff	PDA-H-PERVIOUS
70	SCS Runoff	PDA-H-IMPERVIOUS
71	Combine	PDA-H
73	Reservoir	SWM-H
75	SCS Runoff	PDA-I

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	-----	0.000	-----	-----	-----	0.000	-----	-----	0.000	EDA - A: PERVIOUS
2	SCS Runoff	-----	2.904	-----	-----	-----	0.000	-----	-----	0.000	EDA-A:IMPERVIOUS
3	Combine	1, 2	2.904	-----	-----	-----	0.000	-----	-----	0.000	EDA-A
5	SCS Runoff	-----	0.000	-----	-----	-----	0.000	-----	-----	0.000	EDA-B: PERVIOUS
6	SCS Runoff	-----	3.708	-----	-----	-----	0.000	-----	-----	0.000	EDA-B: IMPERVIOUS
7	Combine	5, 6	3.708	-----	-----	-----	0.000	-----	-----	0.000	EDA-B
9	SCS Runoff	-----	0.022	-----	-----	-----	0.000	-----	-----	0.000	EDA-C: PERVIOUS
10	SCS Runoff	-----	3.440	-----	-----	-----	0.000	-----	-----	0.000	EDA-C:IMPERVIOUS
11	Combine	9, 10	3.440	-----	-----	-----	0.000	-----	-----	0.000	EDA-C
13	SCS Runoff	-----	0.965	-----	-----	-----	0.000	-----	-----	0.000	EDA-D
15	SCS Runoff	-----	1.140	-----	-----	-----	0.000	-----	-----	0.000	EDA-E
17	SCS Runoff	-----	0.351	-----	-----	-----	0.000	-----	-----	0.000	EDA-F
19	SCS Runoff	-----	0.087	-----	-----	-----	0.000	-----	-----	0.000	EDA-G
21	SCS Runoff	-----	0.000	-----	-----	-----	0.000	-----	-----	0.000	EDA-H
23	SCS Runoff	-----	0.000	-----	-----	-----	0.000	-----	-----	0.000	EDA-I
25	SCS Runoff	-----	0.000	-----	-----	-----	0.000	-----	-----	0.000	PDA-A-PERVIOUS
26	SCS Runoff	-----	9.194	-----	-----	-----	0.000	-----	-----	0.000	PDA-A-IMPERVIOUS
27	Combine	25, 26	9.194	-----	-----	-----	0.000	-----	-----	0.000	PDA-A
29	Reservoir	27	0.000	-----	-----	-----	0.000	-----	-----	0.000	SWM-A
31	SCS Runoff	-----	1.717	-----	-----	-----	0.000	-----	-----	0.000	PDA-B1-PERVIOUS
32	SCS Runoff	-----	40.90	-----	-----	-----	0.000	-----	-----	0.000	PDA-B1-IMPERVIOUS
33	Combine	31, 32	41.63	-----	-----	-----	0.000	-----	-----	0.000	PDA-B1
35	SCS Runoff	-----	0.027	-----	-----	-----	0.000	-----	-----	0.000	PDA-B2-PERVIOUS
36	SCS Runoff	-----	10.68	-----	-----	-----	0.000	-----	-----	0.000	PDA-B2-IMPERVIOUS
37	Combine	35, 36	10.68	-----	-----	-----	0.000	-----	-----	0.000	PDA-B2
39	Reservoir(i)	33, 37	0.000	-----	-----	-----	0.000	-----	-----	0.000	INT. POND B1-B2
41	SCS Runoff	-----	0.064	-----	-----	-----	0.000	-----	-----	0.000	PDA-B3

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	
43	Combine	39, 41,	0.064	------	------	------	0.000	------	------	0.000	PDA-B
45	SCS Runoff	------	0.326	------	------	------	0.000	------	------	0.000	PDA-C-PERVIOUS
46	SCS Runoff	------	1.127	------	------	------	0.000	------	------	0.000	PDA-C-IMPERVIOUS
47	Combine	45, 46	1.401	------	------	------	0.000	------	------	0.000	PDA-C
49	SCS Runoff	------	0.578	------	------	------	0.000	------	------	0.000	PDA-D-PERVIOUS
50	SCS Runoff	------	35.26	------	------	------	0.000	------	------	0.000	PDA-D-IMPERVIOUS
51	Combine	49, 50	35.74	------	------	------	0.000	------	------	0.000	PDA-D
53	Reservoir	51	0.000	------	------	------	0.000	------	------	0.000	SWM-D
55	SCS Runoff	------	0.379	------	------	------	0.000	------	------	0.000	PDA-E
57	SCS Runoff	------	0.316	------	------	------	0.000	------	------	0.000	PDA-F
59	SCS Runoff	------	0.084	------	------	------	0.000	------	------	0.000	PDA-G1-PERVIOUS
60	SCS Runoff	------	15.57	------	------	------	0.000	------	------	0.000	PDA-G1-IMPERVIOUS
61	Combine	59, 60	15.57	------	------	------	0.000	------	------	0.000	PDA-G1
63	Reservoir	61	0.000	------	------	------	0.000	------	------	0.000	SWM-G1
65	SCS Runoff	------	0.112	------	------	------	0.000	------	------	0.000	PDA-G2
67	Combine	63, 65,	0.112	------	------	------	0.000	------	------	0.000	PDA-G
69	SCS Runoff	------	0.110	------	------	------	0.000	------	------	0.000	PDA-H-PERVIOUS
70	SCS Runoff	------	29.96	------	------	------	0.000	------	------	0.000	PDA-H-IMPERVIOUS
71	Combine	69, 70	29.96	------	------	------	0.000	------	------	0.000	PDA-H
73	Reservoir	71	0.000	------	------	------	0.000	------	------	0.000	SWM-H
75	SCS Runoff	------	0.000	------	------	------	0.000	------	------	0.000	PDA-I

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	1	n/a	0	------	------	------	EDA - A: PERVIOUS
2	SCS Runoff	2.904	1	74	5,483	------	------	------	EDA-A:IMPERVIOUS
3	Combine	2.904	1	74	5,483	1, 2	------	------	EDA-A
5	SCS Runoff	0.000	1	n/a	0	------	------	------	EDA-B: PERVIOUS
6	SCS Runoff	3.708	1	80	8,863	------	------	------	EDA-B: IMPERVIOUS
7	Combine	3.708	1	80	8,863	5, 6	------	------	EDA-B
9	SCS Runoff	0.022	1	110	31	------	------	------	EDA-C: PERVIOUS
10	SCS Runoff	3.440	1	65	4,493	------	------	------	EDA-C:IMPERVIOUS
11	Combine	3.440	1	65	4,523	9, 10	------	------	EDA-C
13	SCS Runoff	0.965	1	73	1,594	------	------	------	EDA-D
15	SCS Runoff	1.140	1	75	2,024	------	------	------	EDA-E
17	SCS Runoff	0.351	1	71	538	------	------	------	EDA-F
19	SCS Runoff	0.087	1	107	163	------	------	------	EDA-G
21	SCS Runoff	0.000	1	n/a	0	------	------	------	EDA-H
23	SCS Runoff	0.000	1	n/a	0	------	------	------	EDA-I
25	SCS Runoff	0.000	1	n/a	0	------	------	------	PDA-A-PERVIOUS
26	SCS Runoff	9.194	1	65	12,006	------	------	------	PDA-A-IMPERVIOUS
27	Combine	9.194	1	65	12,006	25, 26	------	------	PDA-A
29	Reservoir	0.000	1	68	0	27	592.76	8,755	SWM-A
31	SCS Runoff	1.717	1	69	2,574	------	------	------	PDA-B1-PERVIOUS
32	SCS Runoff	40.90	1	65	53,407	------	------	------	PDA-B1-IMPERVIOUS
33	Combine	41.63	1	65	55,980	31, 32	------	------	PDA-B1
35	SCS Runoff	0.027	1	105	59	------	------	------	PDA-B2-PERVIOUS
36	SCS Runoff	10.68	1	65	13,942	------	------	------	PDA-B2-IMPERVIOUS
37	Combine	10.68	1	65	14,001	35, 36	------	------	PDA-B2
39	Reservoir(i)	0.000	1	166	0	33, 37	598.62	50,977	INT. POND B1-B2
41	SCS Runoff	0.064	1	72	116	------	------	------	PDA-B3

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

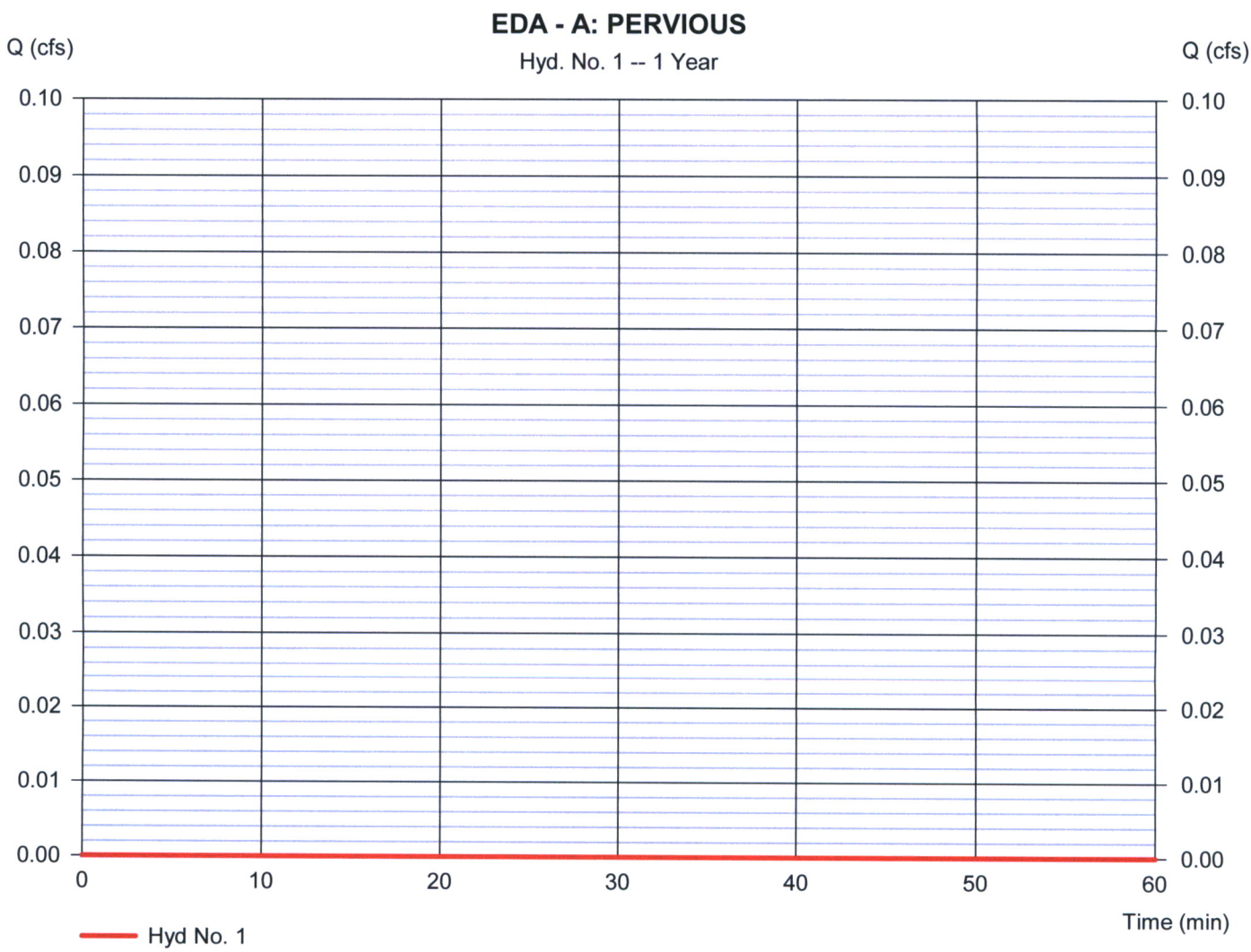
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
43	Combine	0.064	1	72	116	39, 41,	------	------	PDA-B
45	SCS Runoff	0.326	1	68	409	------	------	------	PDA-C-PERVIOUS
46	SCS Runoff	1.127	1	65	1,472	------	------	------	PDA-C-IMPERVIOUS
47	Combine	1.401	1	66	1,880	45, 46	------	------	PDA-C
49	SCS Runoff	0.578	1	68	704	------	------	------	PDA-D-PERVIOUS
50	SCS Runoff	35.26	1	65	46,048	------	------	------	PDA-D-IMPERVIOUS
51	Combine	35.74	1	65	46,753	49, 50	------	------	PDA-D
53	Reservoir	0.000	1	62	0	51	599.41	36,144	SWM-D
55	SCS Runoff	0.379	1	67	451	------	------	------	PDA-E
57	SCS Runoff	0.316	1	69	427	------	------	------	PDA-F
59	SCS Runoff	0.084	1	75	177	------	------	------	PDA-G1-PERVIOUS
60	SCS Runoff	15.57	1	65	20,332	------	------	------	PDA-G1-IMPERVIOUS
61	Combine	15.57	1	65	20,510	59, 60	------	------	PDA-G1
63	Reservoir	0.000	1	63	0	61	597.21	15,256	SWM-G1
65	SCS Runoff	0.112	1	69	151	------	------	------	PDA-G2
67	Combine	0.112	1	69	151	63, 65,	------	------	PDA-G
69	SCS Runoff	0.110	1	105	244	------	------	------	PDA-H-PERVIOUS
70	SCS Runoff	29.96	1	65	39,116	------	------	------	PDA-H-IMPERVIOUS
71	Combine	29.96	1	65	39,360	69, 70	------	------	PDA-H
73	Reservoir	0.000	1	75	0	71	596.75	28,710	SWM-H
75	SCS Runoff	0.000	1	n/a	0	------	------	------	PDA-I

Hydrograph Report

Hyd. No. 1

EDA - A: PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 13.620 ac	Curve number	= 54
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.70 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\24-1.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 1

EDA - A: PERVIOUS

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 16.00		0.00		0.00		
Travel Time (min)	**= 9.29**	**+**	**0.00**	**+**	**0.00**	**=**	**9.29**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		274.00		479.00		
Watercourse slope (%)	= 0.00		4.20		0.50		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=0.00		3.31		1.14		
Travel Time (min)	**= 0.00**	**+**	**1.38**	**+**	**7.00**	**=**	**8.38**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

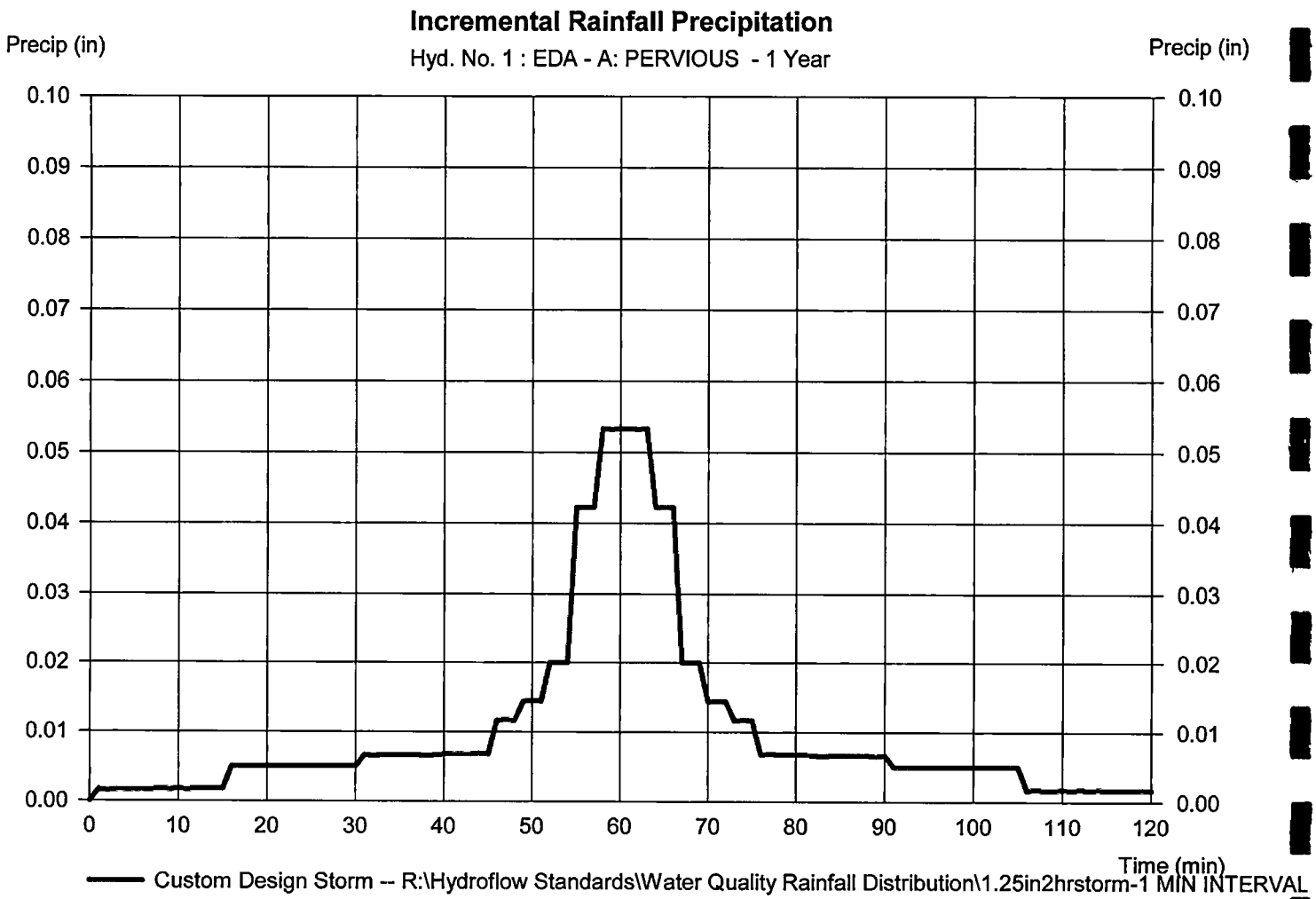
Total Travel Time, Tc ..... **17.70 min**

Precipitation Report

Hyd. No. 1

EDA - A: PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

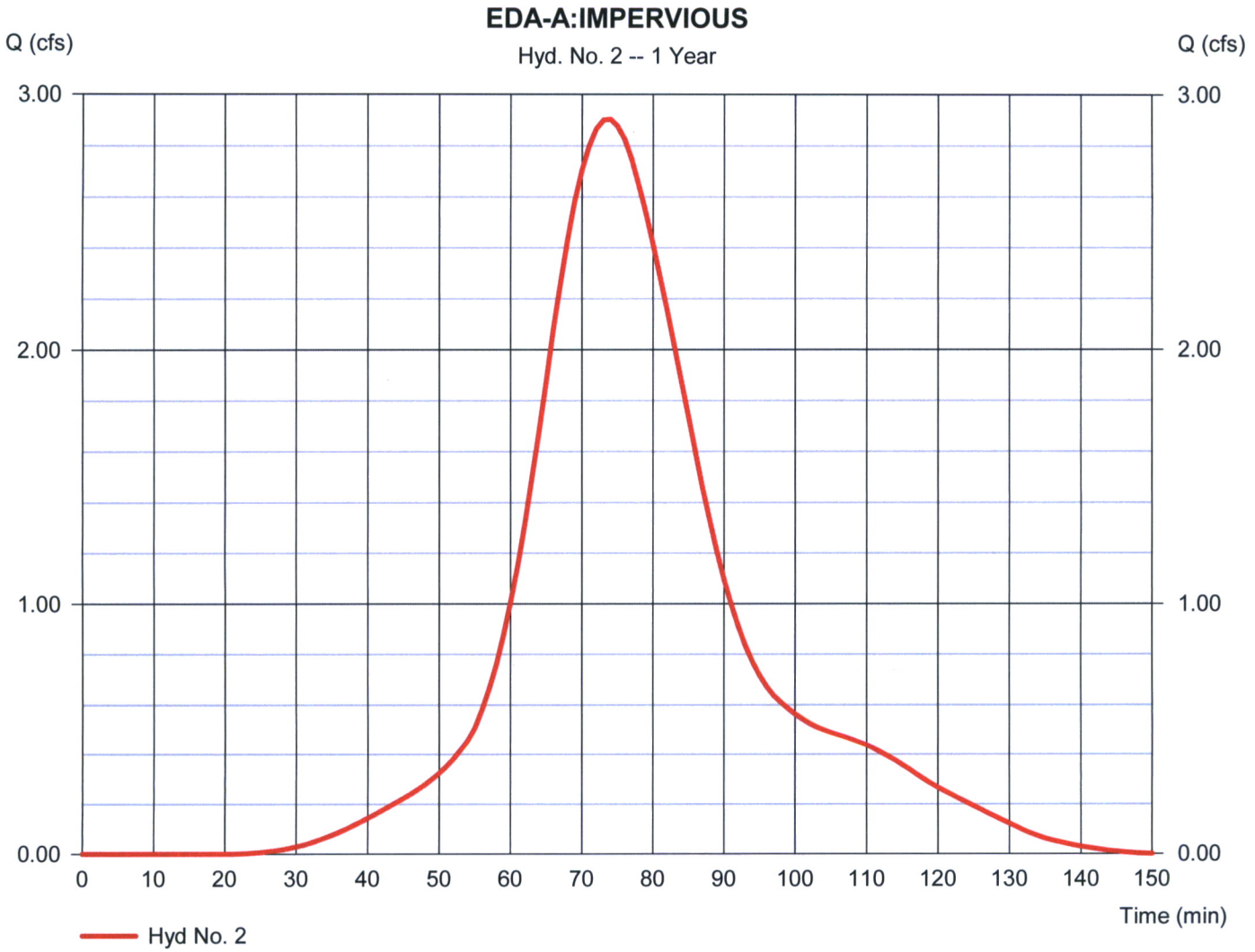


Hydrograph Report

Hyd. No. 2

EDA-A:IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 2.904 cfs
Storm frequency	= 1 yrs	Time to peak	= 74 min
Time interval	= 1 min	Hyd. volume	= 5,483 cuft
Drainage area	= 1.460 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.60 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MIN	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 2

EDA-A:IMPERVIOUS

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 0.40		0.00		0.00		
Travel Time (min)	**= 2.29**	**+**	**0.00**	**+**	**0.00**	**=**	**2.29**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		509.00		600.00		
Watercourse slope (%)	= 0.00		0.20		0.60		
Surface description	= Paved		Paved		Unpaved		
Average velocity (ft/s)	=0.00		0.91		1.25		
Travel Time (min)	**= 0.00**	**+**	**9.33**	**+**	**8.00**	**=**	**17.33**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

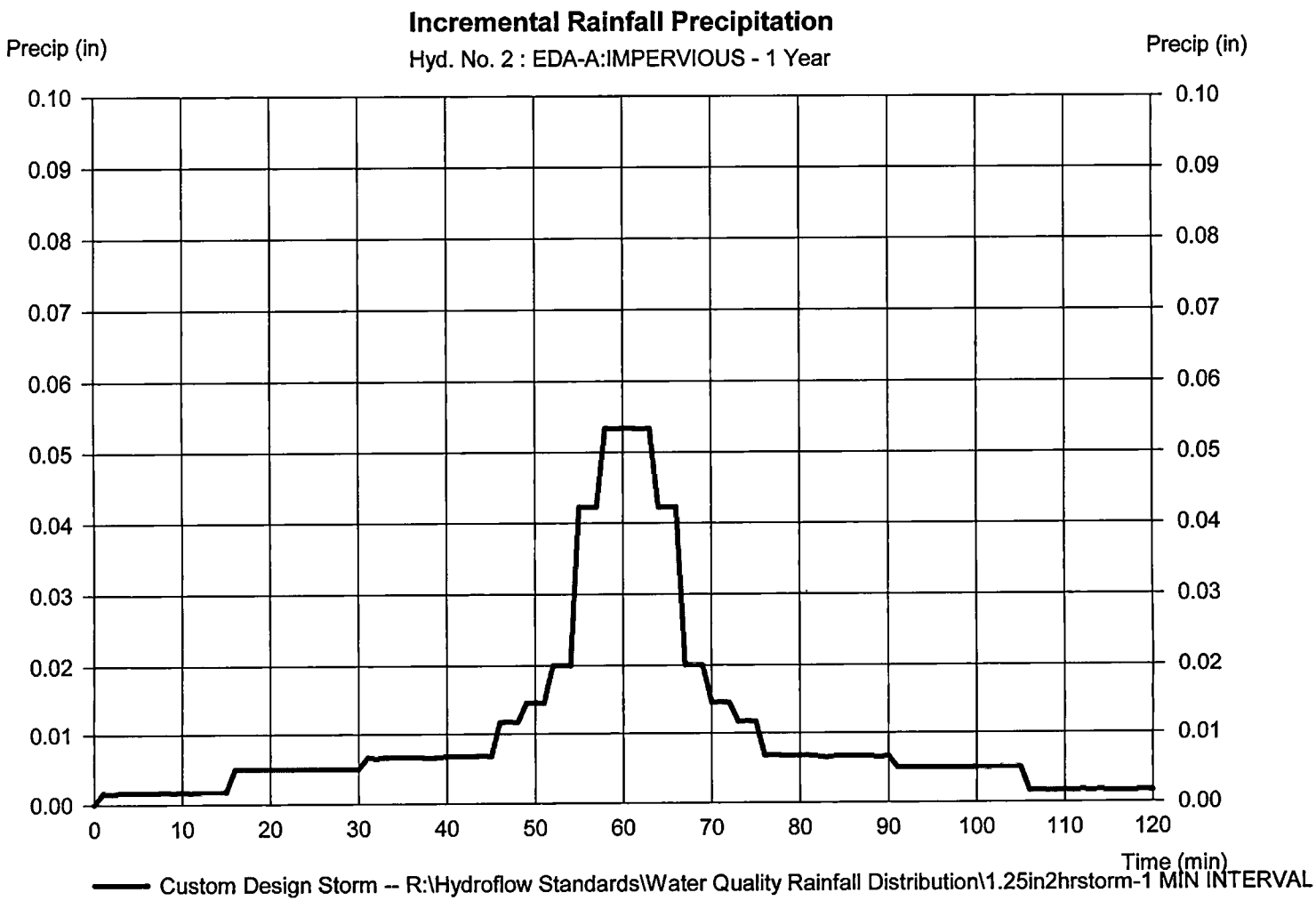
Total Travel Time, Tc ..... **19.60 min**

Precipitation Report

Hyd. No. 2

EDA-A:IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

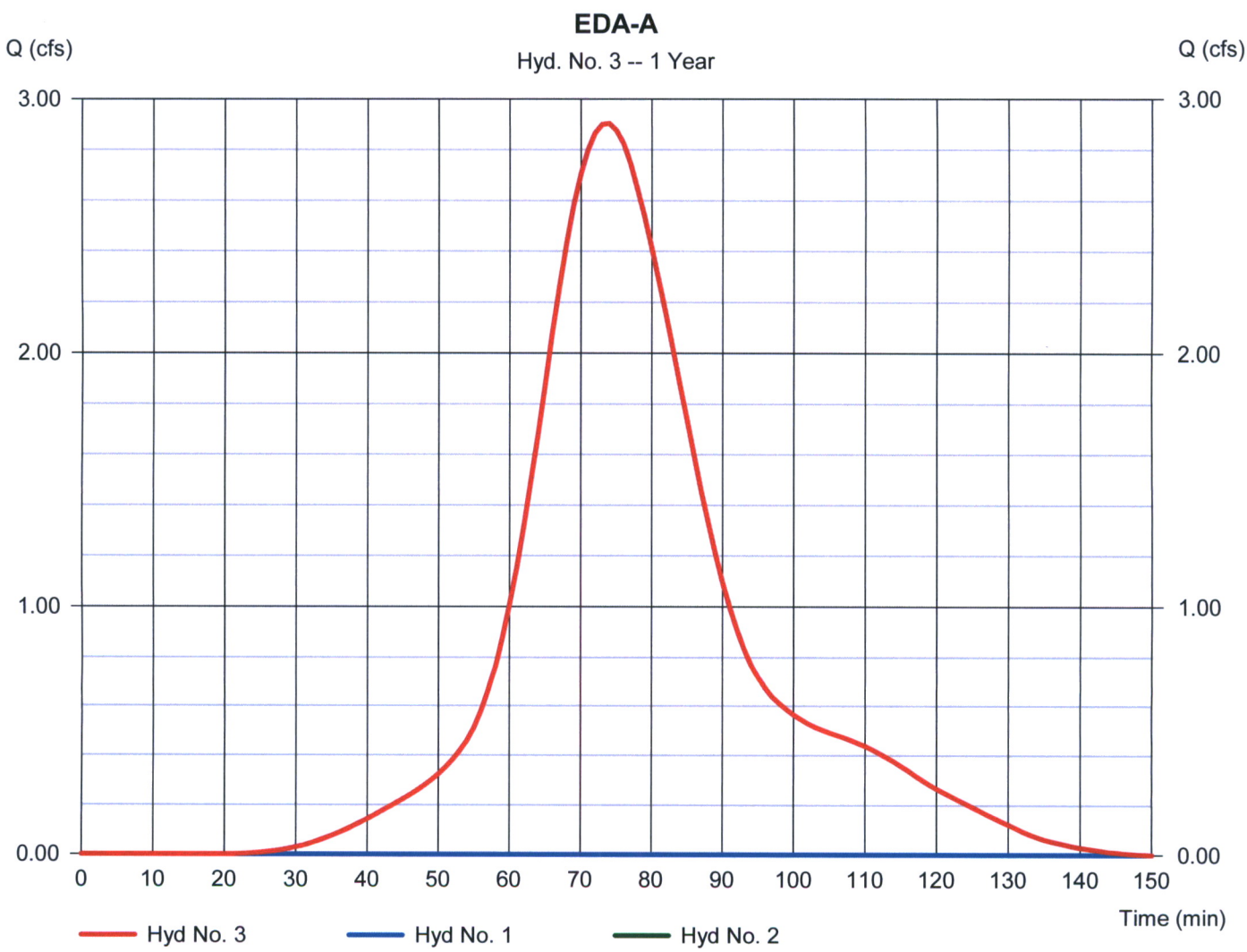


Hydrograph Report

Hyd. No. 3

EDA-A

Hydrograph type	= Combine	Peak discharge	= 2.904 cfs
Storm frequency	= 1 yrs	Time to peak	= 74 min
Time interval	= 1 min	Hyd. volume	= 5,483 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 15.080 ac

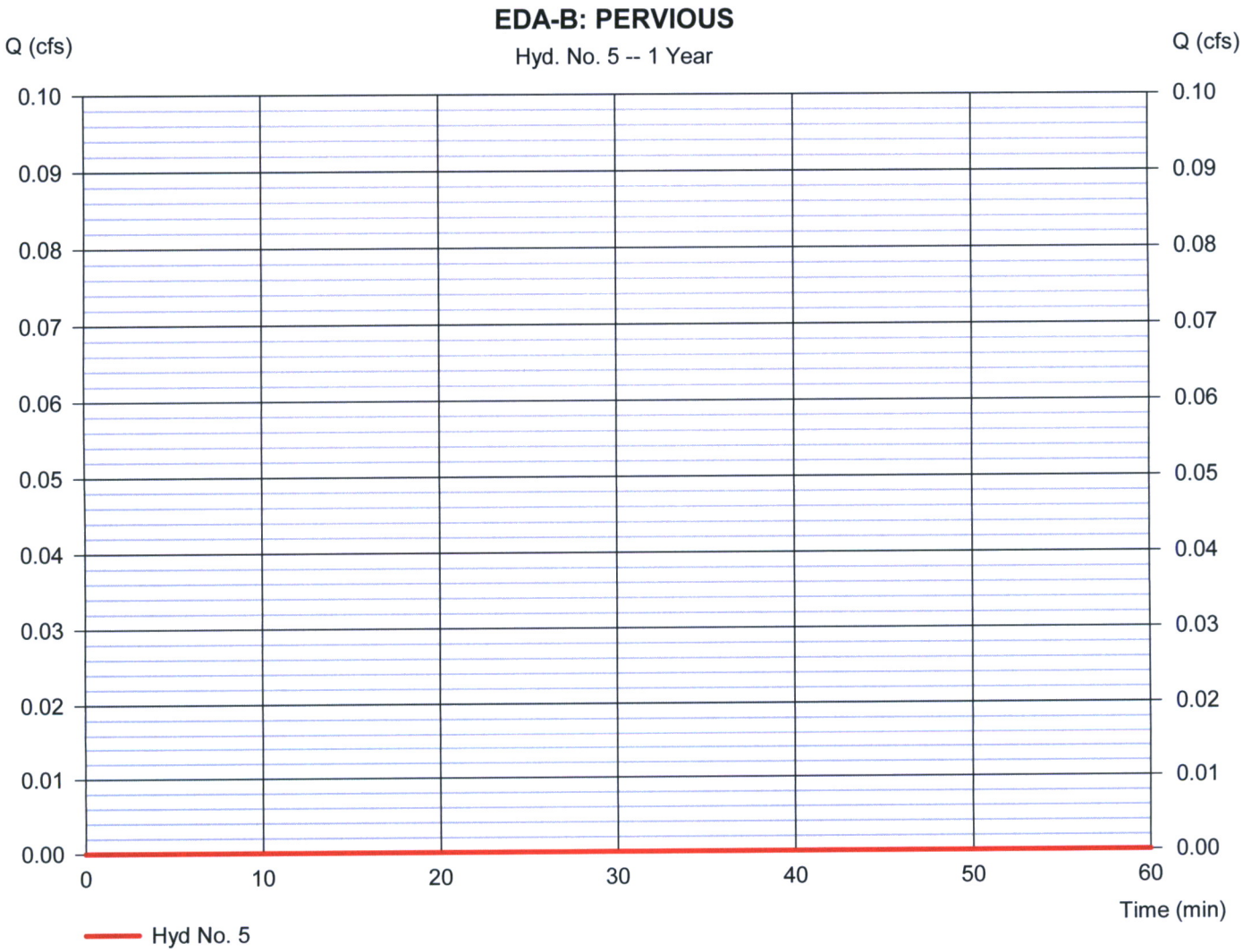


Hydrograph Report

Hyd. No. 5

EDA-B: PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 15.720 ac	Curve number	= 47
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.40 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\WaterSupply\Rainfall Distributions\1.25in2hrstorm-1 MIN	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 5

EDA-B: PERVIOUS

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 7.30		0.00		0.00		
Travel Time (min)	**= 12.71**	**+**	**0.00**	**+**	**0.00**	**=**	**12.71**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		704.00		818.00		
Watercourse slope (%)	= 0.00		4.90		0.30		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=0.00		3.57		0.88		
Travel Time (min)	**= 0.00**	**+**	**3.29**	**+**	**15.43**	**=**	**18.71**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

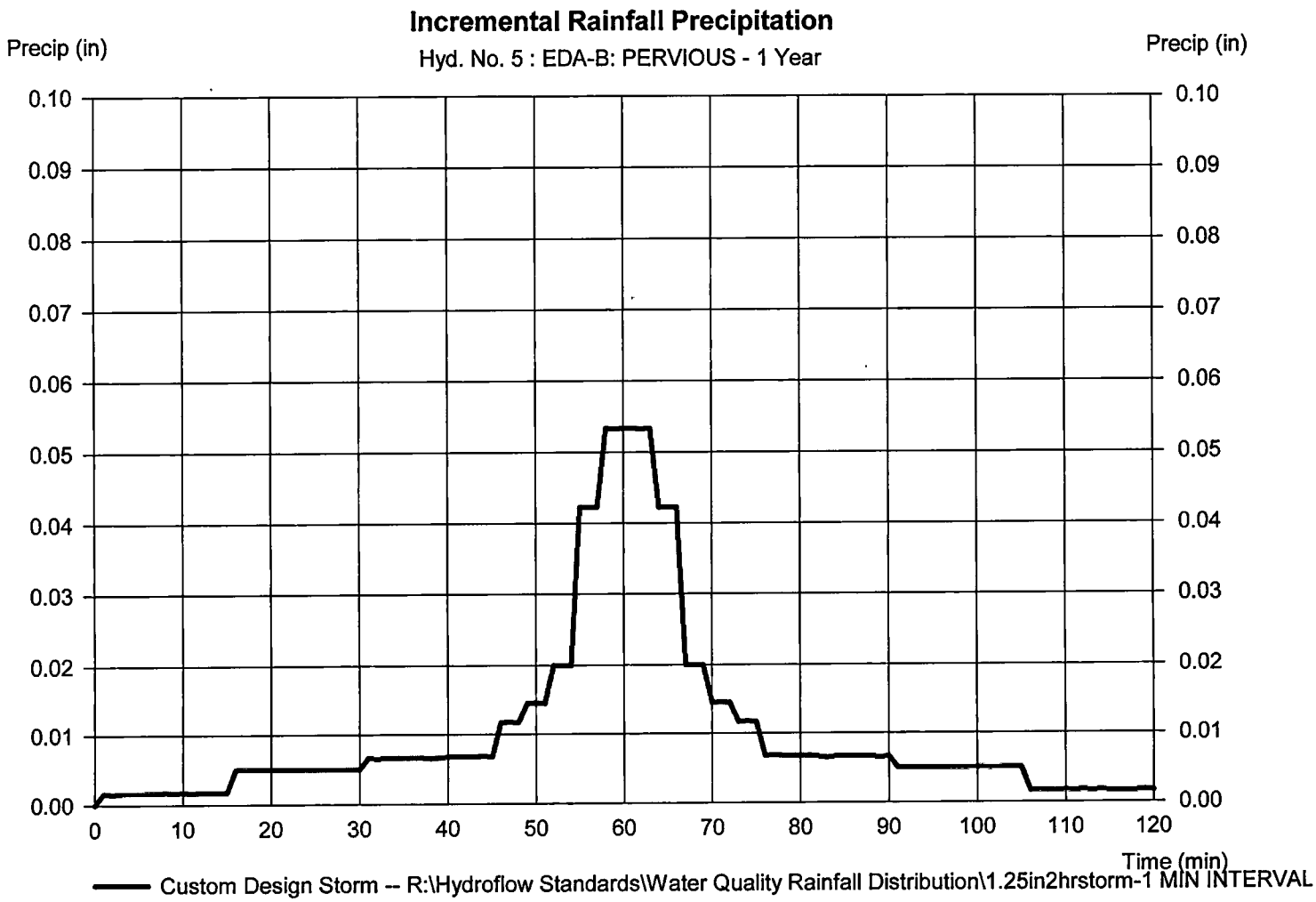
Total Travel Time, Tc ..... **31.40 min**

Precipitation Report

Hyd. No. 5

EDA-B: PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

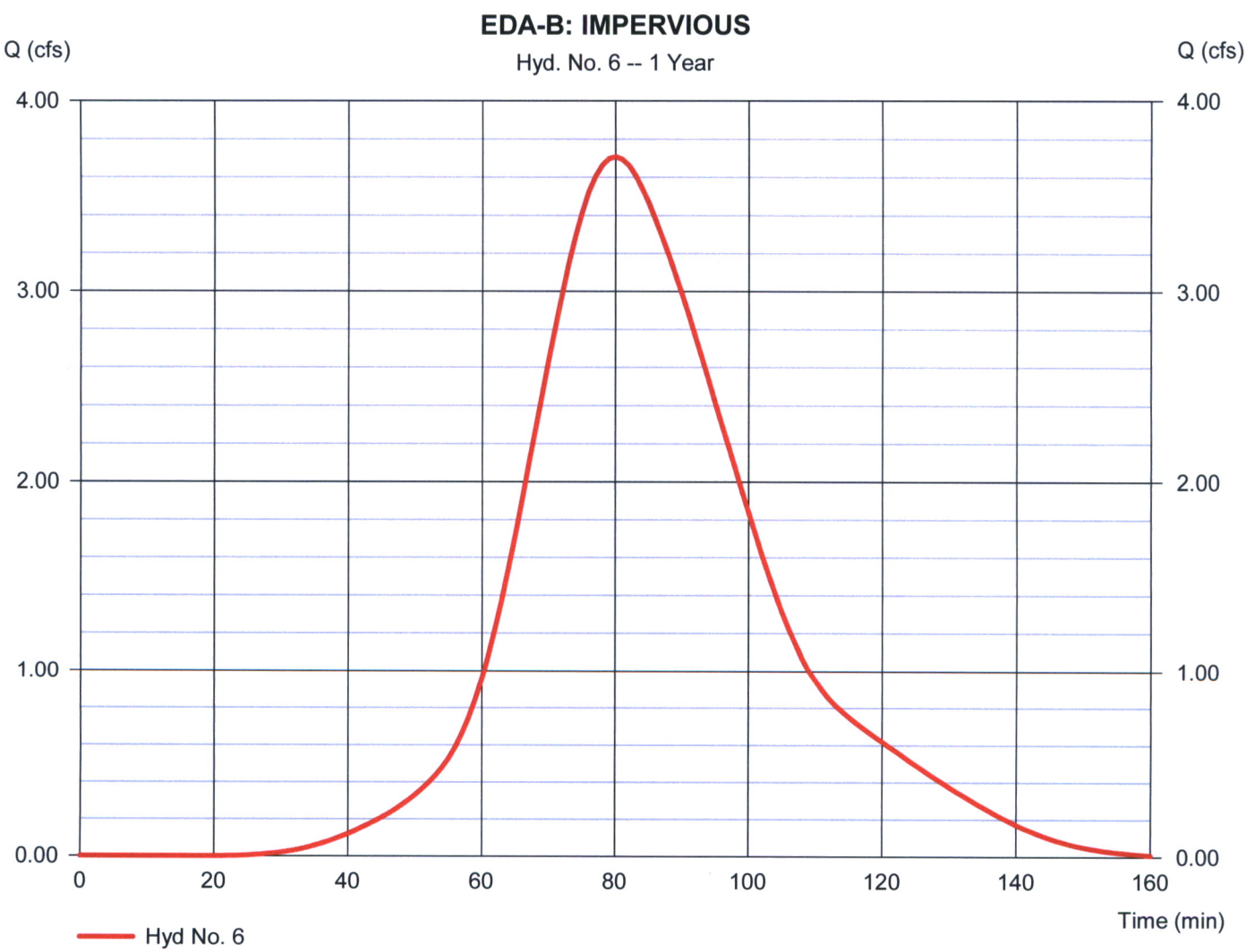


Hydrograph Report

Hyd. No. 6

EDA-B: IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 3.708 cfs
Storm frequency	= 1 yrs	Time to peak	= 80 min
Time interval	= 1 min	Hyd. volume	= 8,863 cuft
Drainage area	= 2.360 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.70 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\24-1.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 6

EDA-B: IMPERVIOUS

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 0.10		0.00		0.00		
Travel Time (min)	**= 3.99**	**+**	**0.00**	**+**	**0.00**	**=**	**3.99**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		1303.00		98.00		
Watercourse slope (%)	= 0.00		0.20		0.30		
Surface description	= Paved		Paved		Unpaved		
Average velocity (ft/s)	=0.00		0.91		0.88		
Travel Time (min)	**= 0.00**	**+**	**23.89**	**+**	**1.85**	**=**	**25.74**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

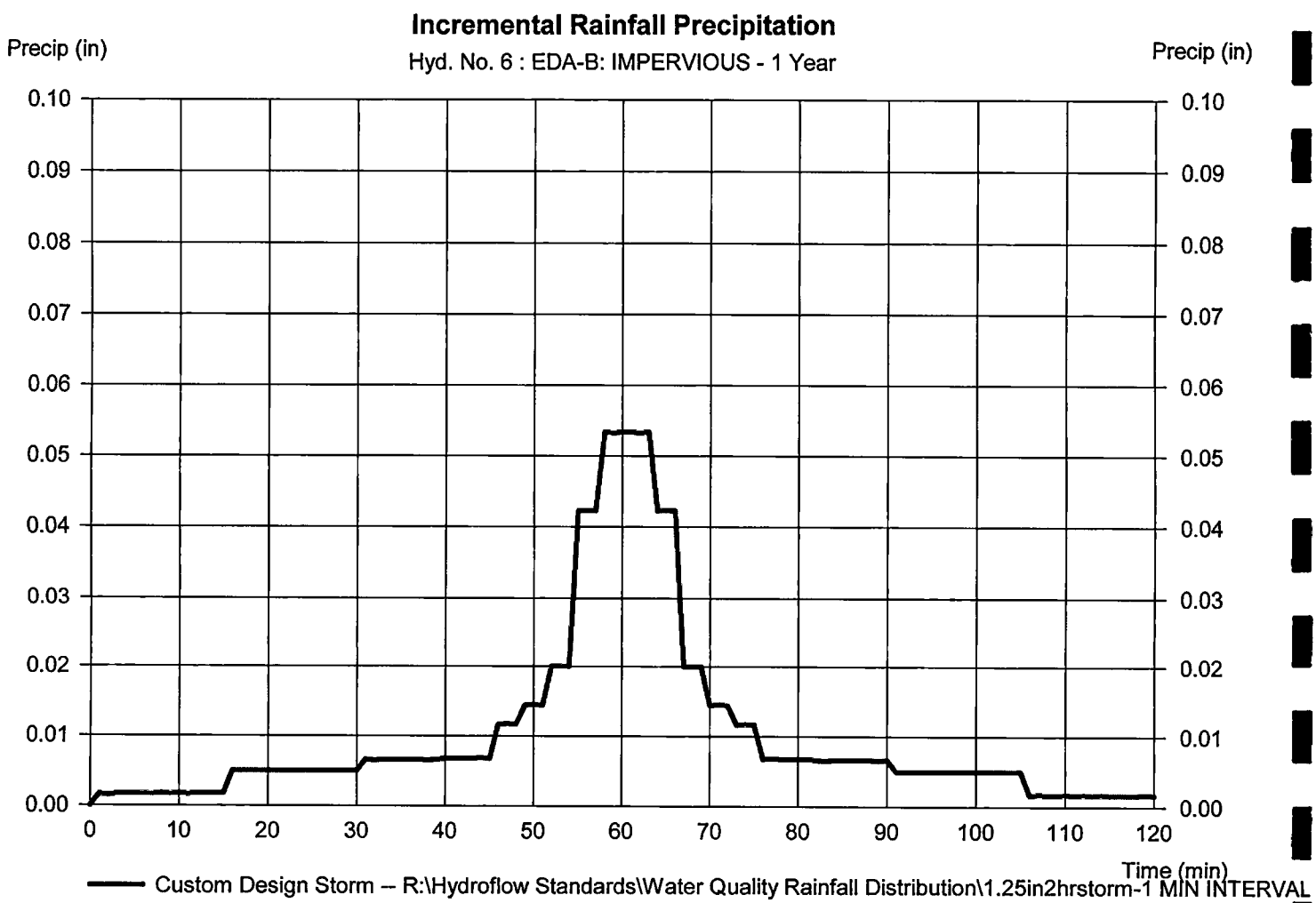
Total Travel Time, Tc ..... **29.70 min**

Precipitation Report

Hyd. No. 6

EDA-B: IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

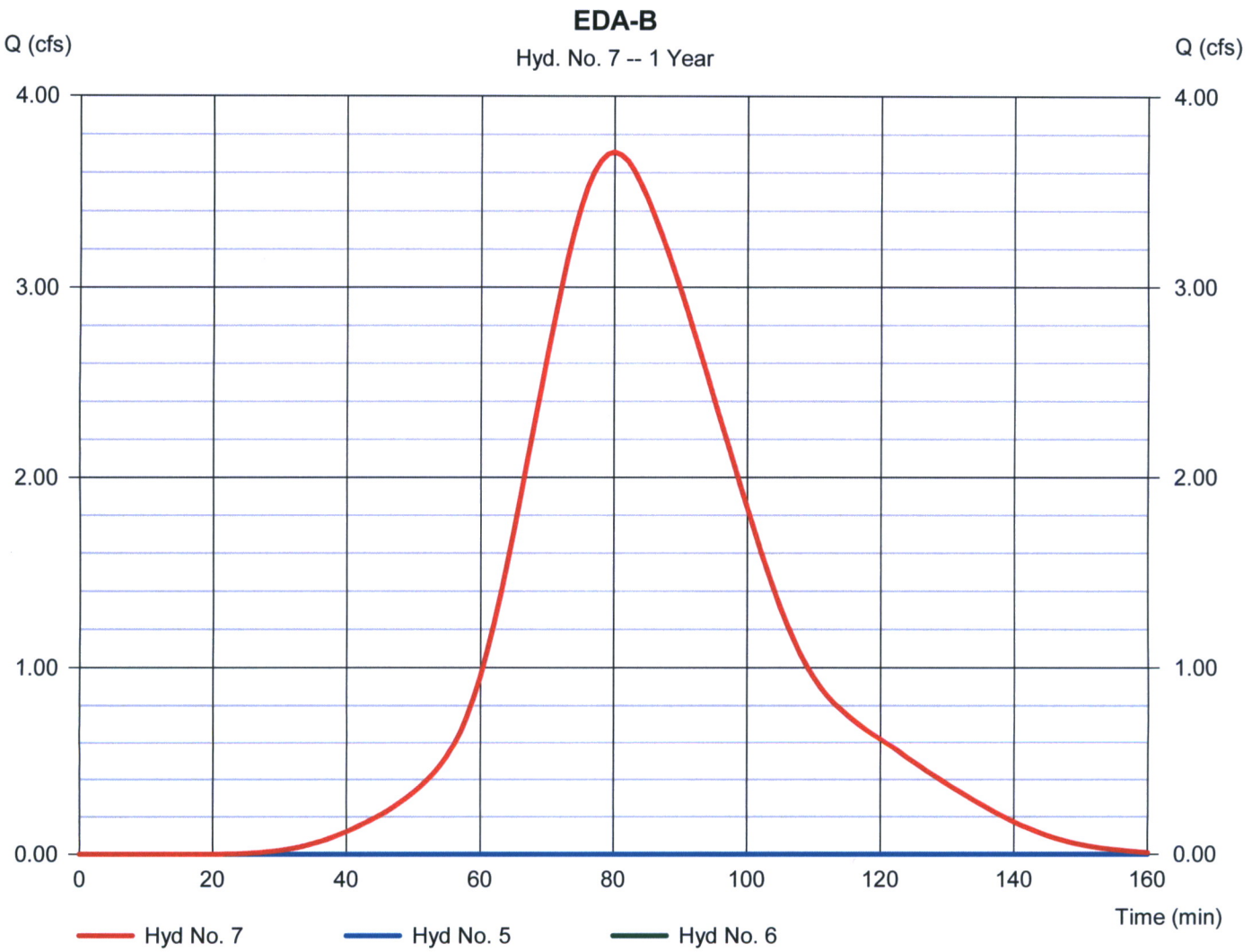


Hydrograph Report

Hyd. No. 7

EDA-B

Hydrograph type	= Combine	Peak discharge	= 3.708 cfs
Storm frequency	= 1 yrs	Time to peak	= 80 min
Time interval	= 1 min	Hyd. volume	= 8,863 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 18.080 ac

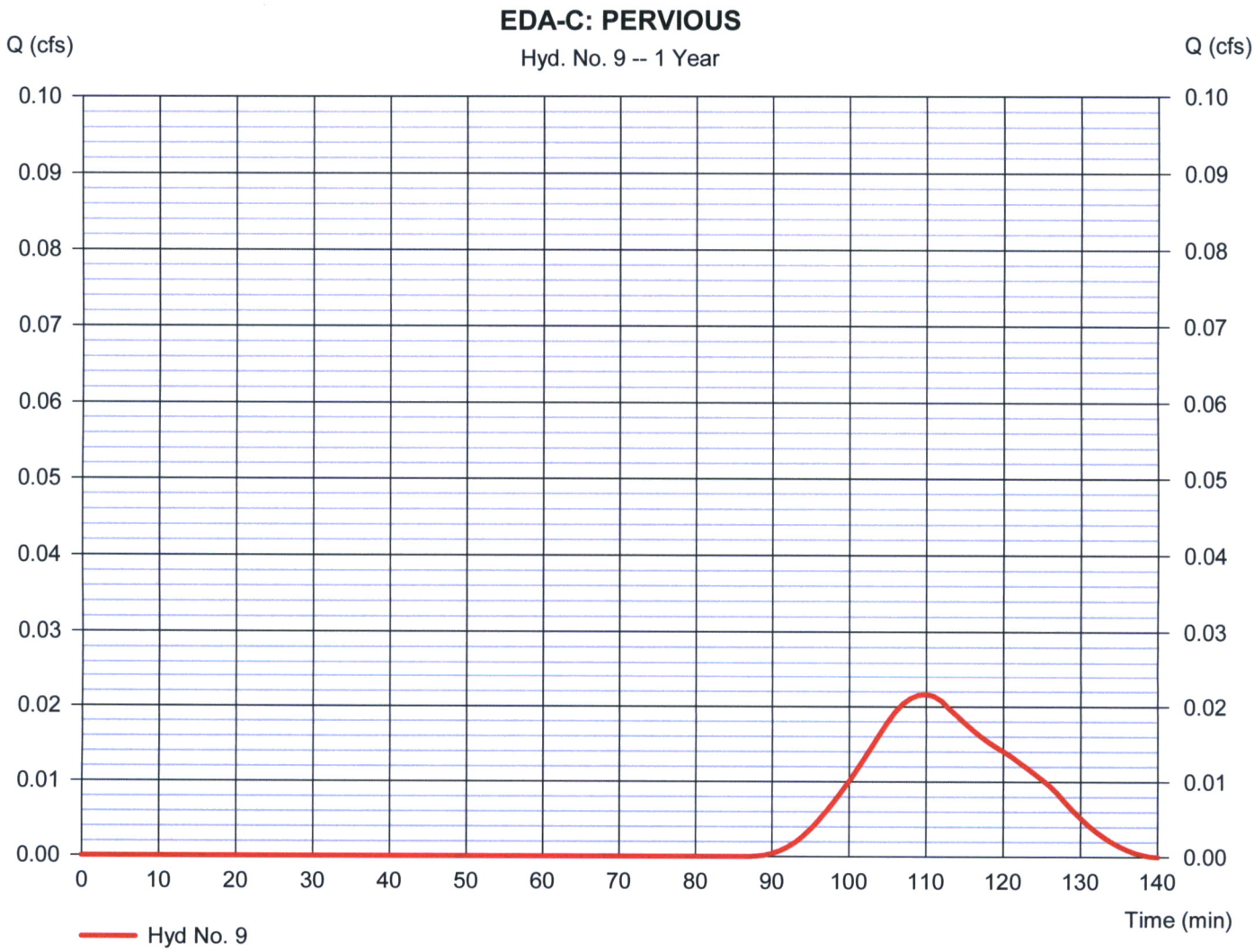


Hydrograph Report

Hyd. No. 9

EDA-C: PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.022 cfs
Storm frequency	= 1 yrs	Time to peak	= 110 min
Time interval	= 1 min	Hyd. volume	= 31 cuft
Drainage area	= 3.170 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\WaterShed\Rainfall Distribution\484.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 9

EDA-C: PERVIOUS

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 12.10		0.00		0.00		
Travel Time (min)	**= 10.39**	**+**	**0.00**	**+**	**0.00**	**=**	**10.39**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		73.00		265.00		
Watercourse slope (%)	= 0.00		12.00		1.70		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=0.00		5.59		2.10		
Travel Time (min)	**= 0.00**	**+**	**0.22**	**+**	**2.10**	**=**	**2.32**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

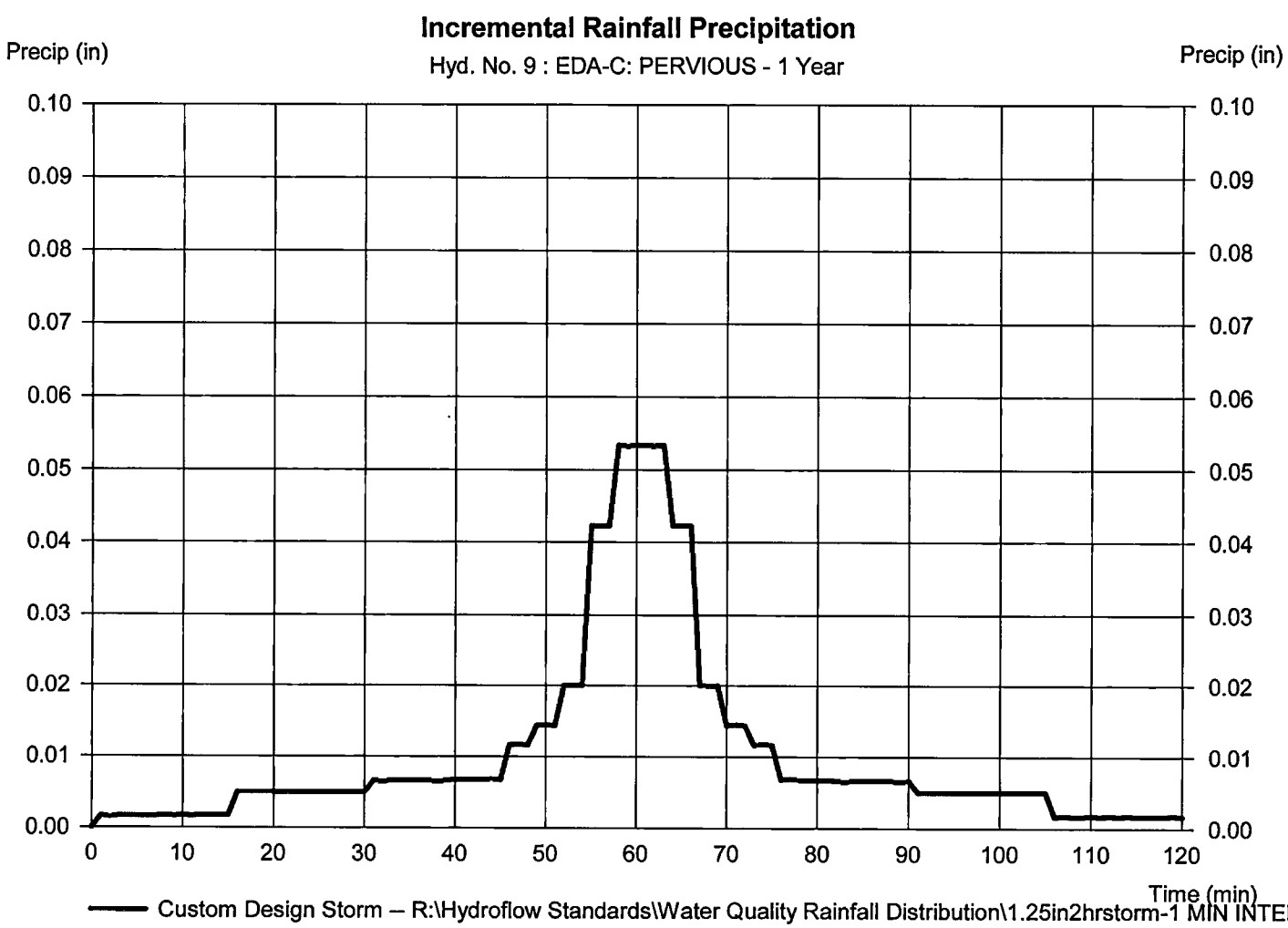
Total Travel Time, Tc ..... 12.70 min

Precipitation Report

Hyd. No. 9

EDA-C: PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

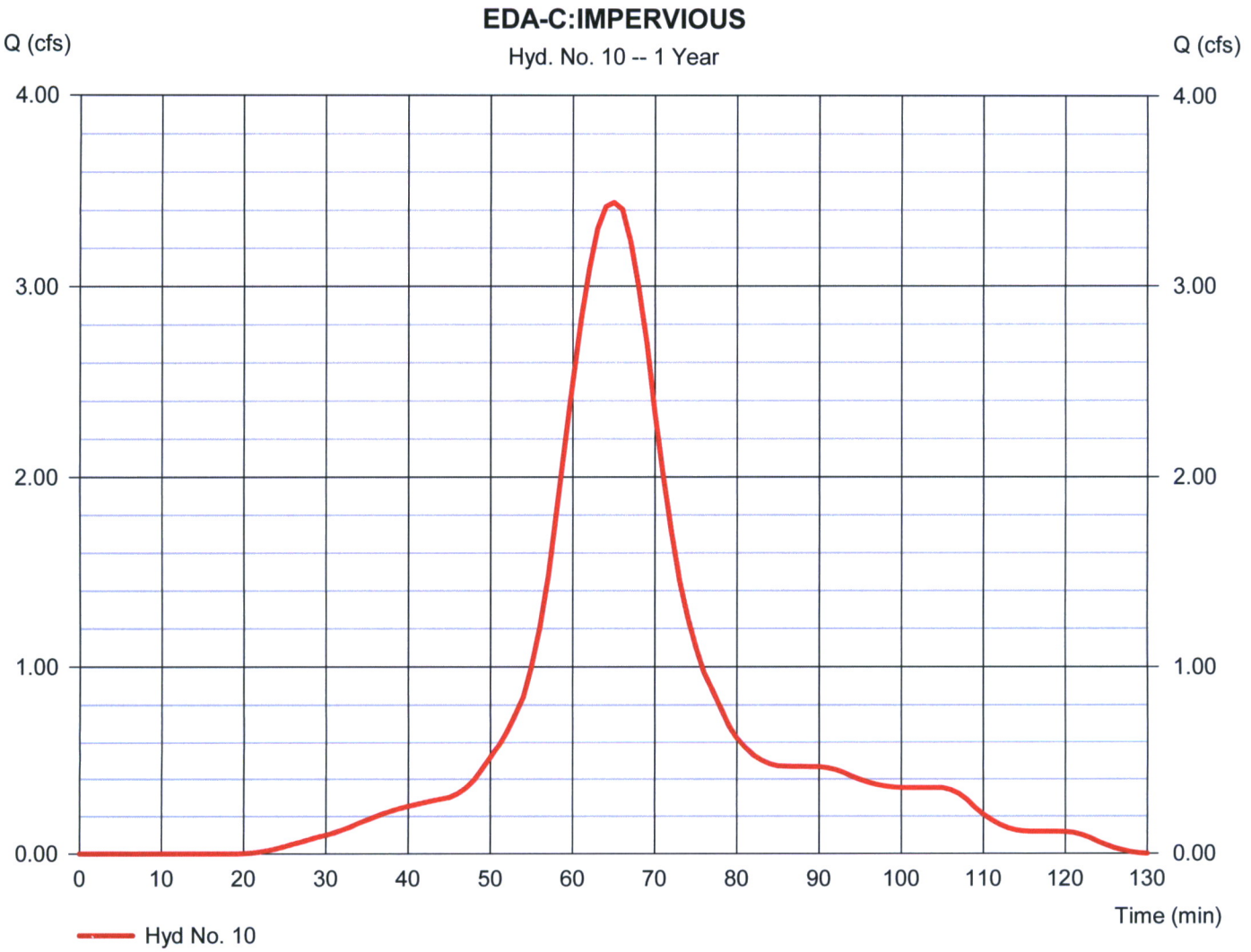


Hydrograph Report

Hyd. No. 10

EDA-C:IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 3.440 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 4,493 cuft
Drainage area	= 1.160 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MIN	Storm Frequency	= 1 yrs

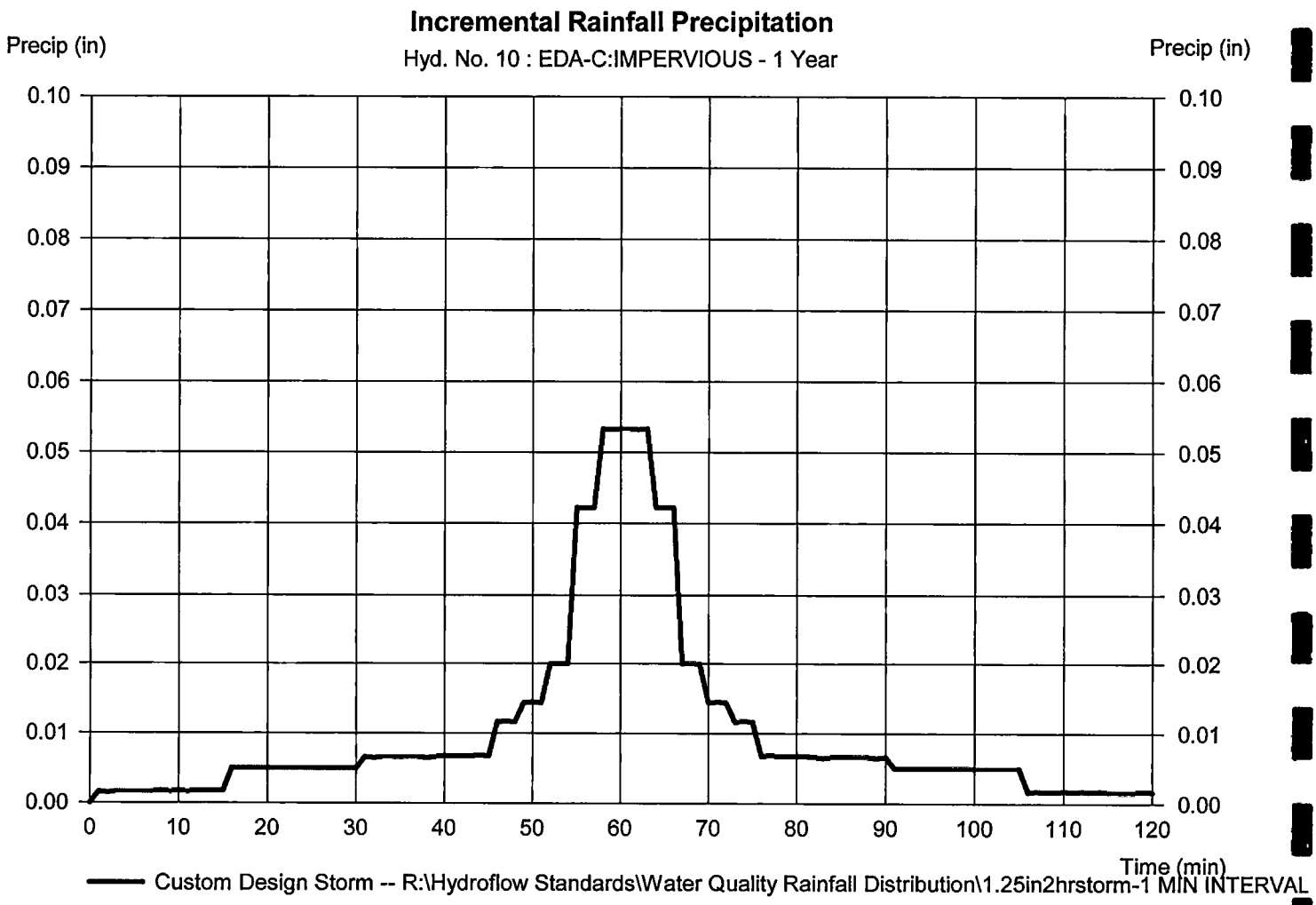


Precipitation Report

Hyd. No. 10

EDA-C:IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

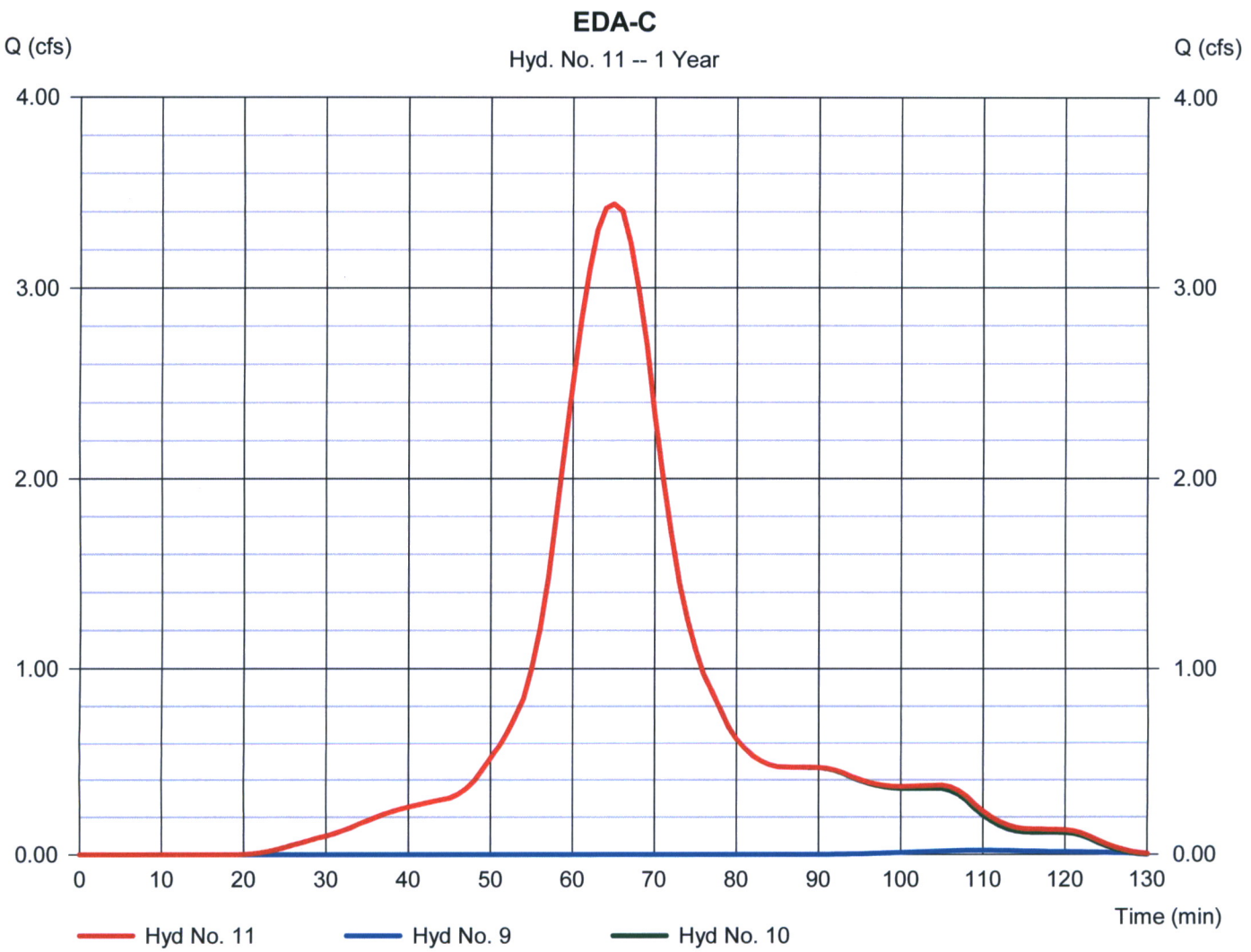


Hydrograph Report

Hyd. No. 11

EDA-C

Hydrograph type	= Combine	Peak discharge	= 3.440 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 4,523 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.330 ac

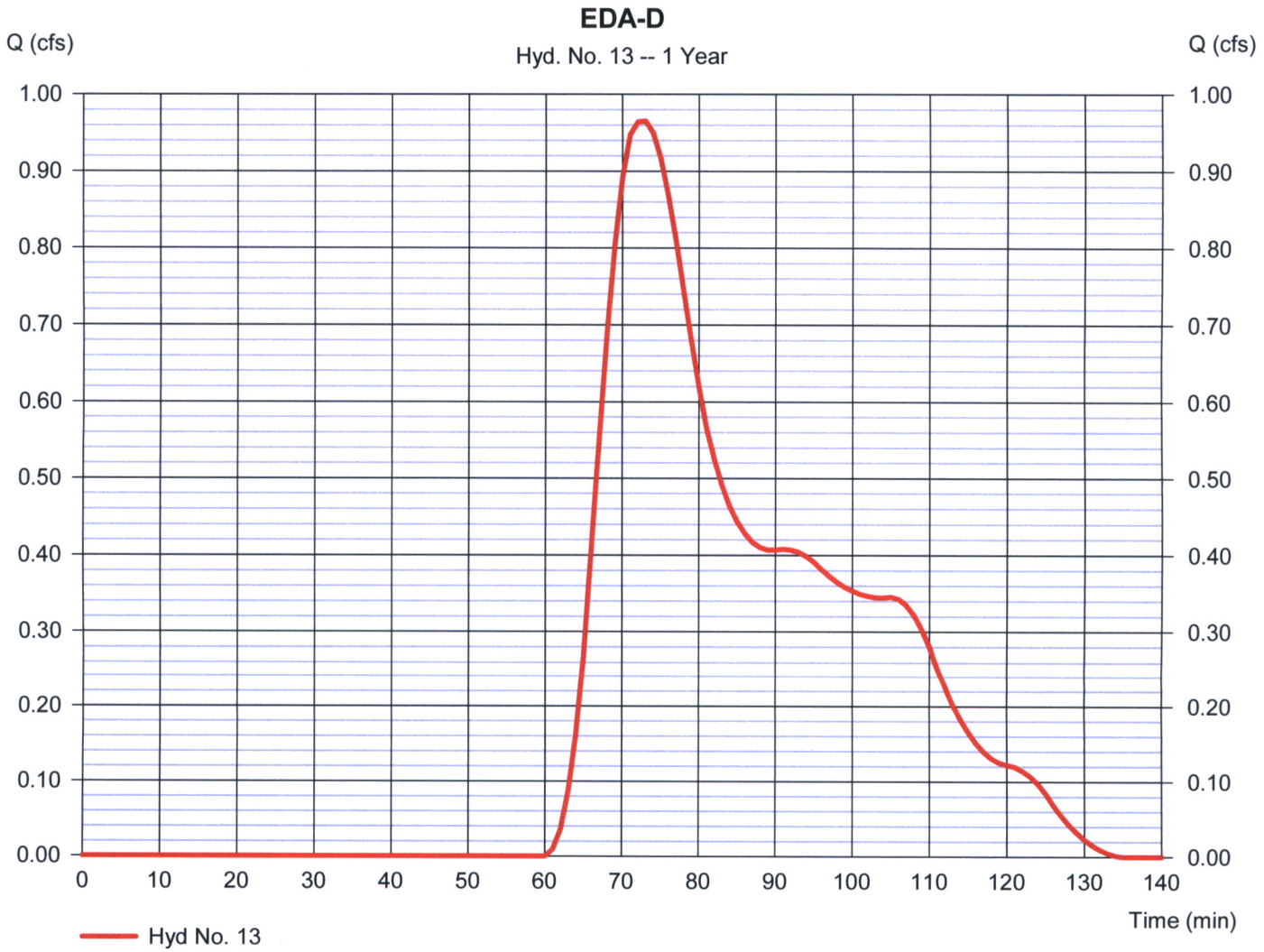


Hydrograph Report

Hyd. No. 13

EDA-D

Hydrograph type	= SCS Runoff	Peak discharge	= 0.965 cfs
Storm frequency	= 1 yrs	Time to peak	= 73 min
Time interval	= 1 min	Hyd. volume	= 1,594 cuft
Drainage area	= 3.760 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\WaterShed\Rainfall Distribution\484.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 13

EDA-D

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.000		0.000		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 21.20		0.00		0.00		
Travel Time (min)	**= 8.30**	**+**	**0.00**	**+**	**0.00**	**=**	**8.30**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		288.00		0.00		
Watercourse slope (%)	= 0.00		3.00		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=0.00		2.79		0.00		
Travel Time (min)	**= 0.00**	**+**	**1.72**	**+**	**0.00**	**=**	**1.72**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

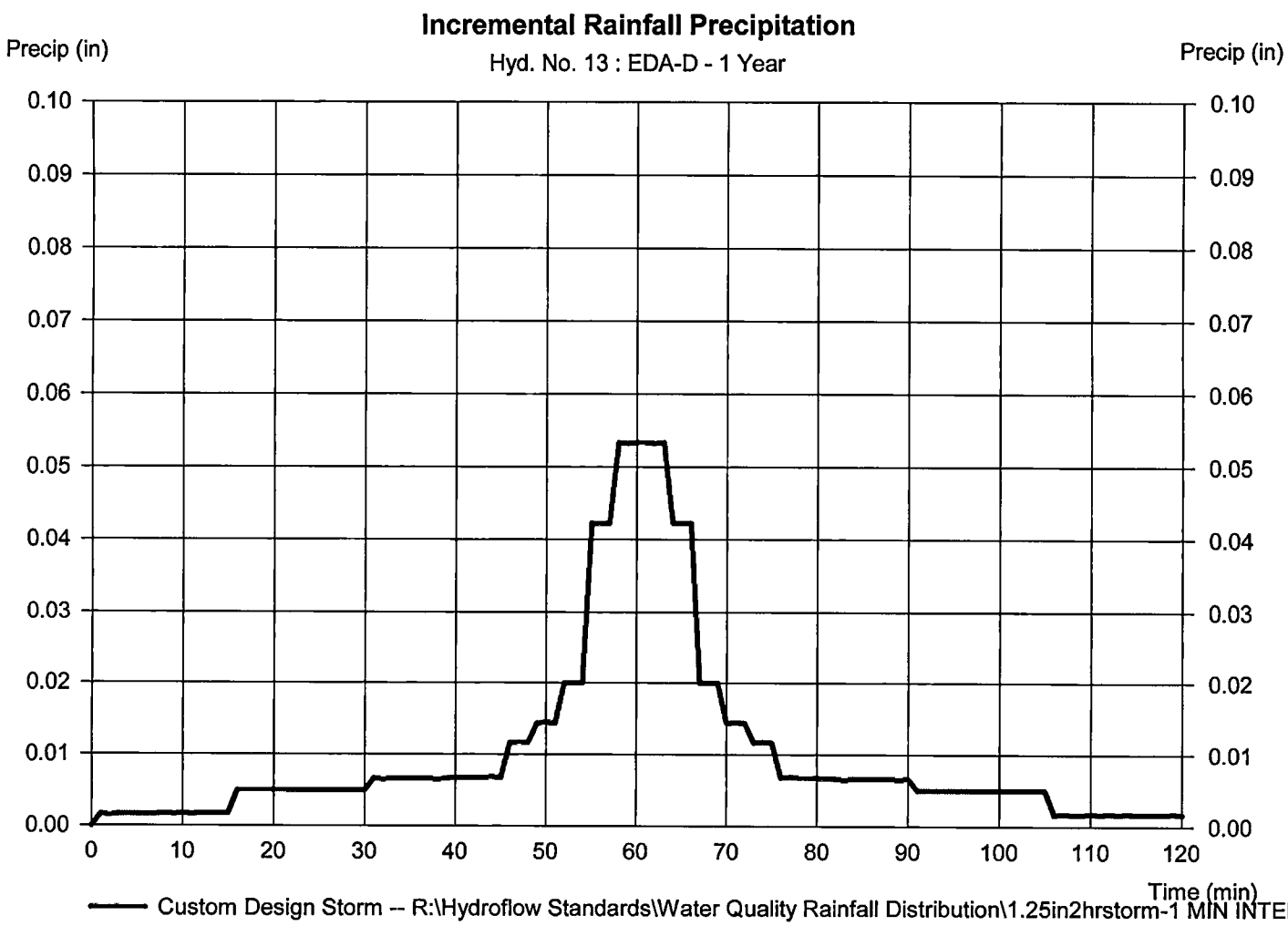
Total Travel Time, Tc ..... **10.00 min**

Precipitation Report

Hyd. No. 13

EDA-D

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

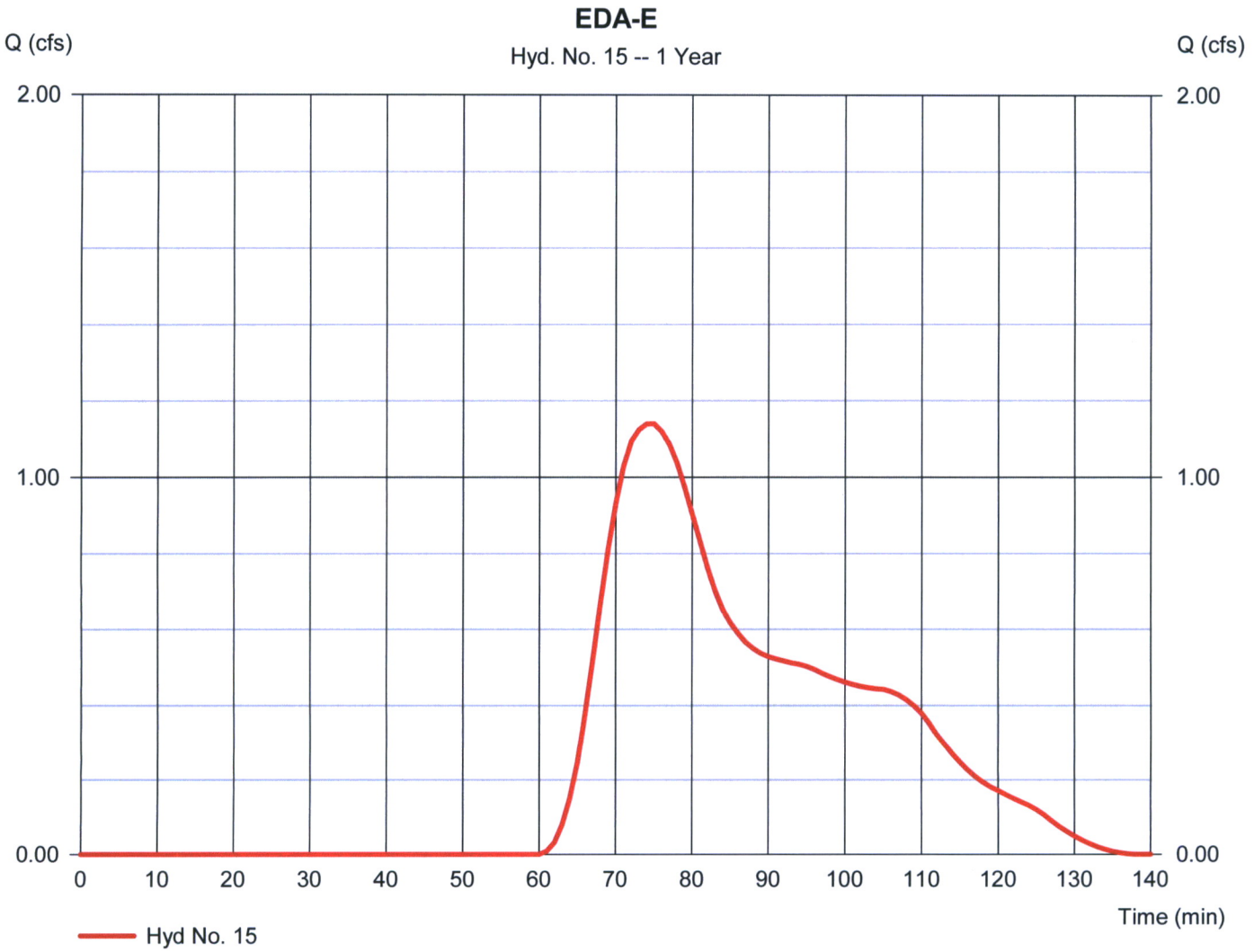


Hydrograph Report

Hyd. No. 15

EDA-E

Hydrograph type	= SCS Runoff	Peak discharge	= 1.140 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 1 min	Hyd. volume	= 2,024 cuft
Drainage area	= 4.690 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.40 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MIN	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 15

EDA-E

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 12.40		0.00		0.00		
Travel Time (min)	**= 10.29**	**+**	**0.00**	**+**	**0.00**	**=**	**10.29**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		257.00		0.00		
Watercourse slope (%)	= 0.00		5.30		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=0.00		3.71		0.00		
Travel Time (min)	**= 0.00**	**+**	**1.15**	**+**	**0.00**	**=**	**1.15**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

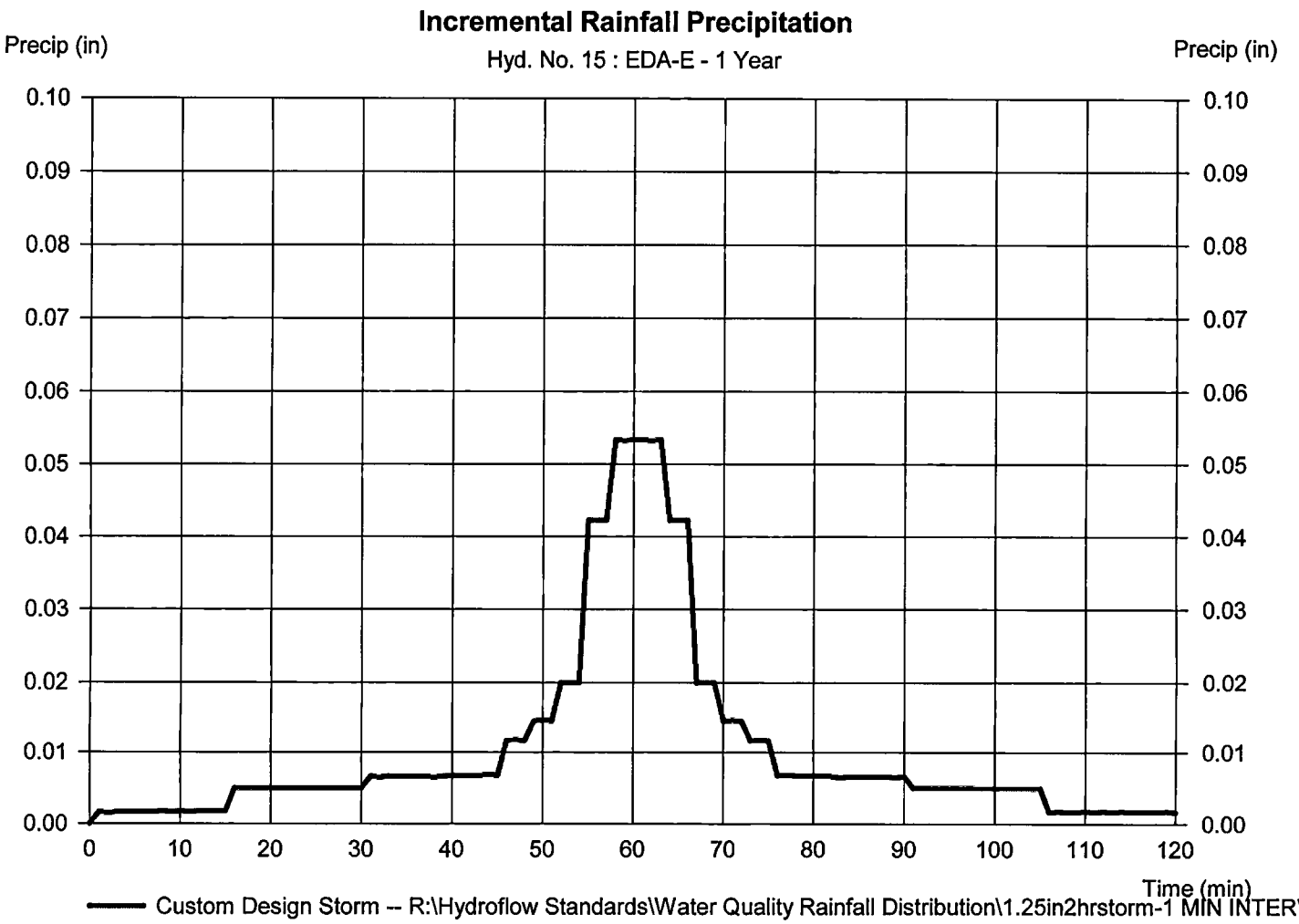
Total Travel Time, Tc ..... **11.40 min**

Precipitation Report

Hyd. No. 15

EDA-E

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

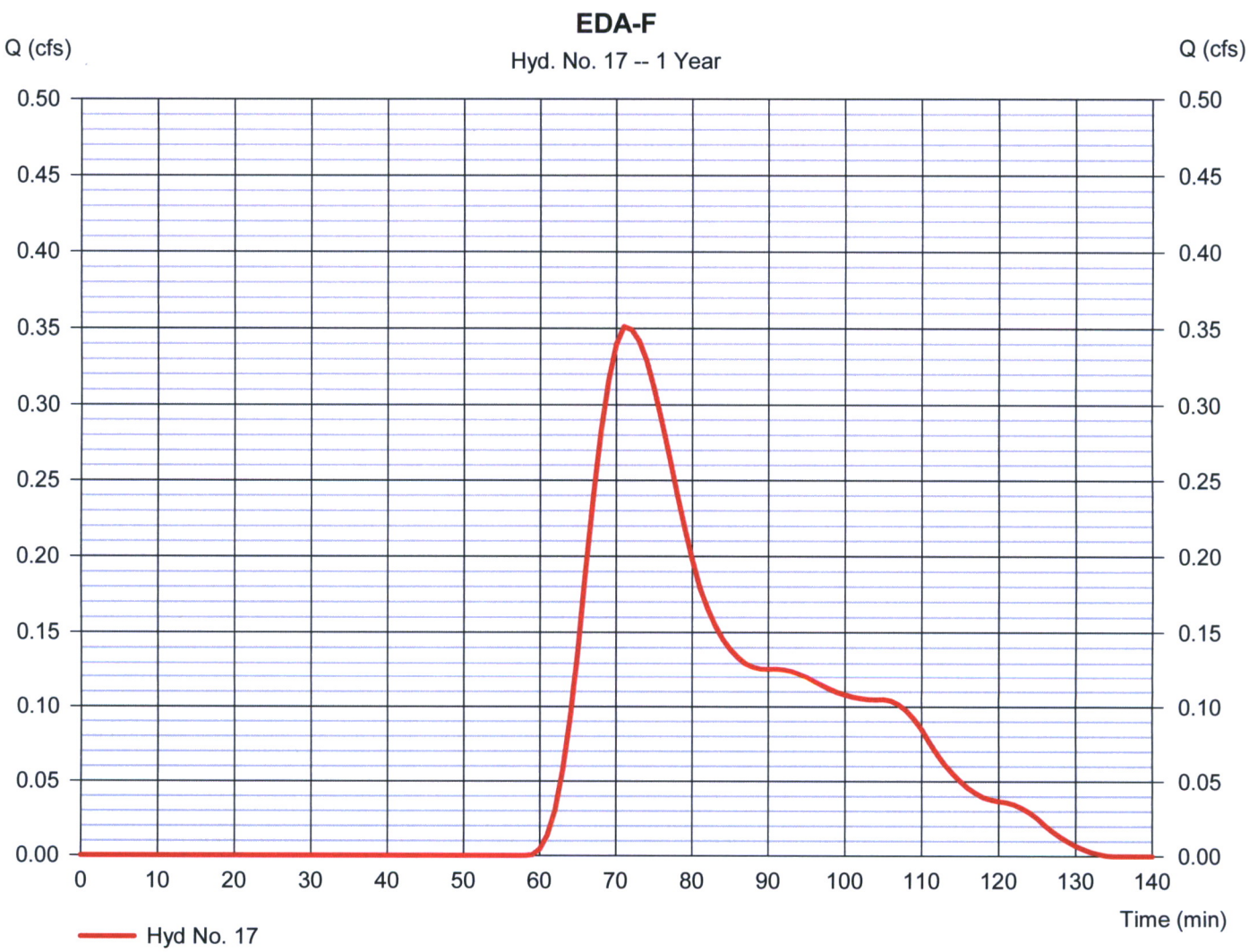


Hydrograph Report

Hyd. No. 17

EDA-F

Hydrograph type	= SCS Runoff	Peak discharge	= 0.351 cfs
Storm frequency	= 1 yrs	Time to peak	= 71 min
Time interval	= 1 min	Hyd. volume	= 538 cuft
Drainage area	= 0.970 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 17

EDA-F

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.240		0.011		
Flow length (ft)	= 40.0		35.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		3.24		0.00		
Land slope (%)	= 16.30		3.50		0.00		
Travel Time (min)	**= 4.43**	**+**	**4.90**	**+**	**0.00**	**=**	**9.33**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		62.00		0.00		
Watercourse slope (%)	= 0.00		1.00		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=0.00		1.61		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.64**	**+**	**0.00**	**=**	**0.64**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

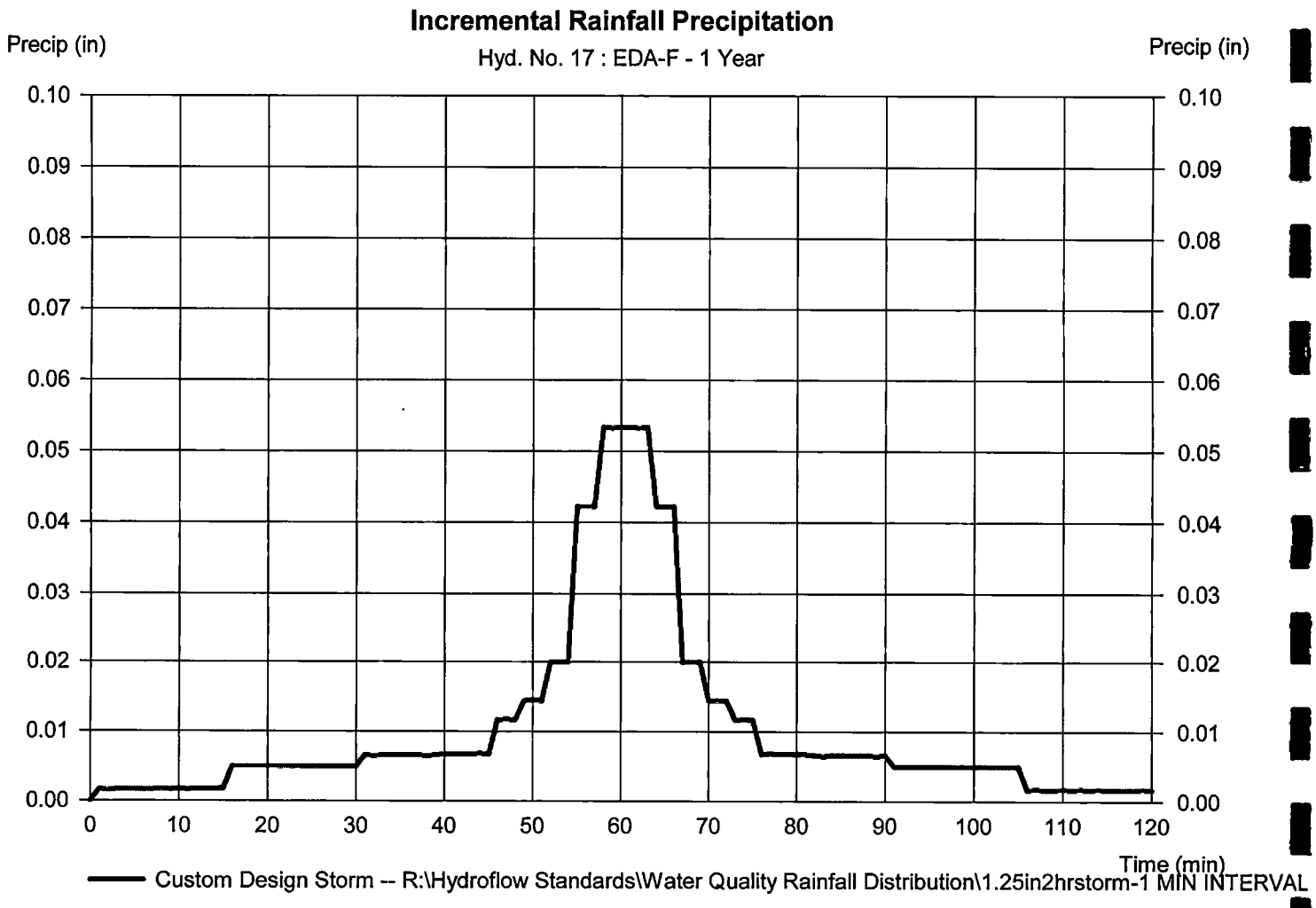
Total Travel Time, Tc ..... **10.00 min**

Precipitation Report

Hyd. No. 17

EDA-F

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		



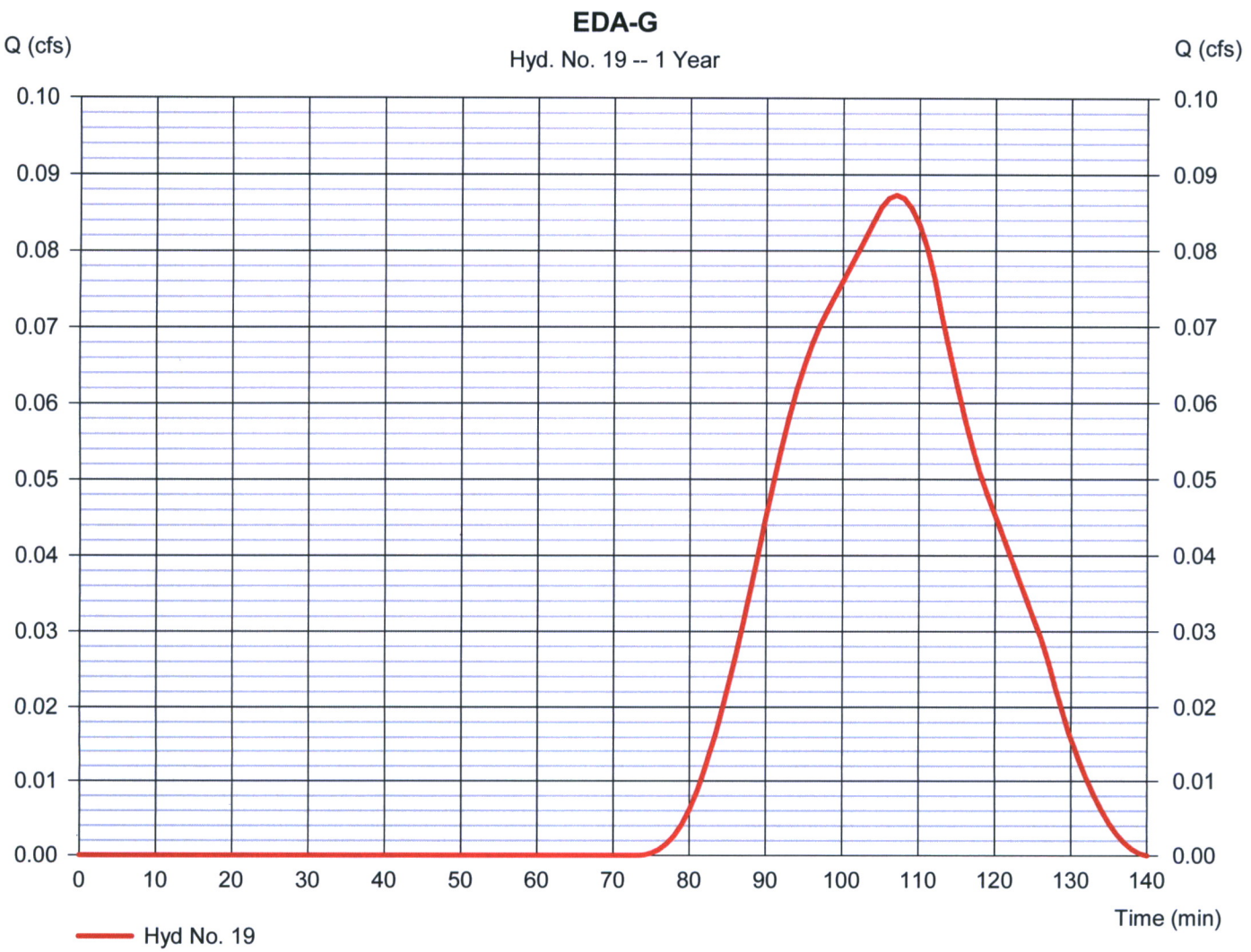
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Hyd. No. 19

EDA-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.087 cfs
Storm frequency	= 1 yrs	Time to peak	= 107 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 5.080 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.60 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\24-1.25in2hrstorm-1 MIN	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 19

EDA-G

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 10.50		0.00		0.00		
Travel Time (min)	**= 10.99**	**+**	**0.00**	**+**	**0.00**	**=**	**10.99**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		159.00		276.00		
Watercourse slope (%)	= 0.00		12.20		6.70		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=0.00		5.64		4.18		
Travel Time (min)	**= 0.00**	**+**	**0.47**	**+**	**1.10**	**=**	**1.57**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

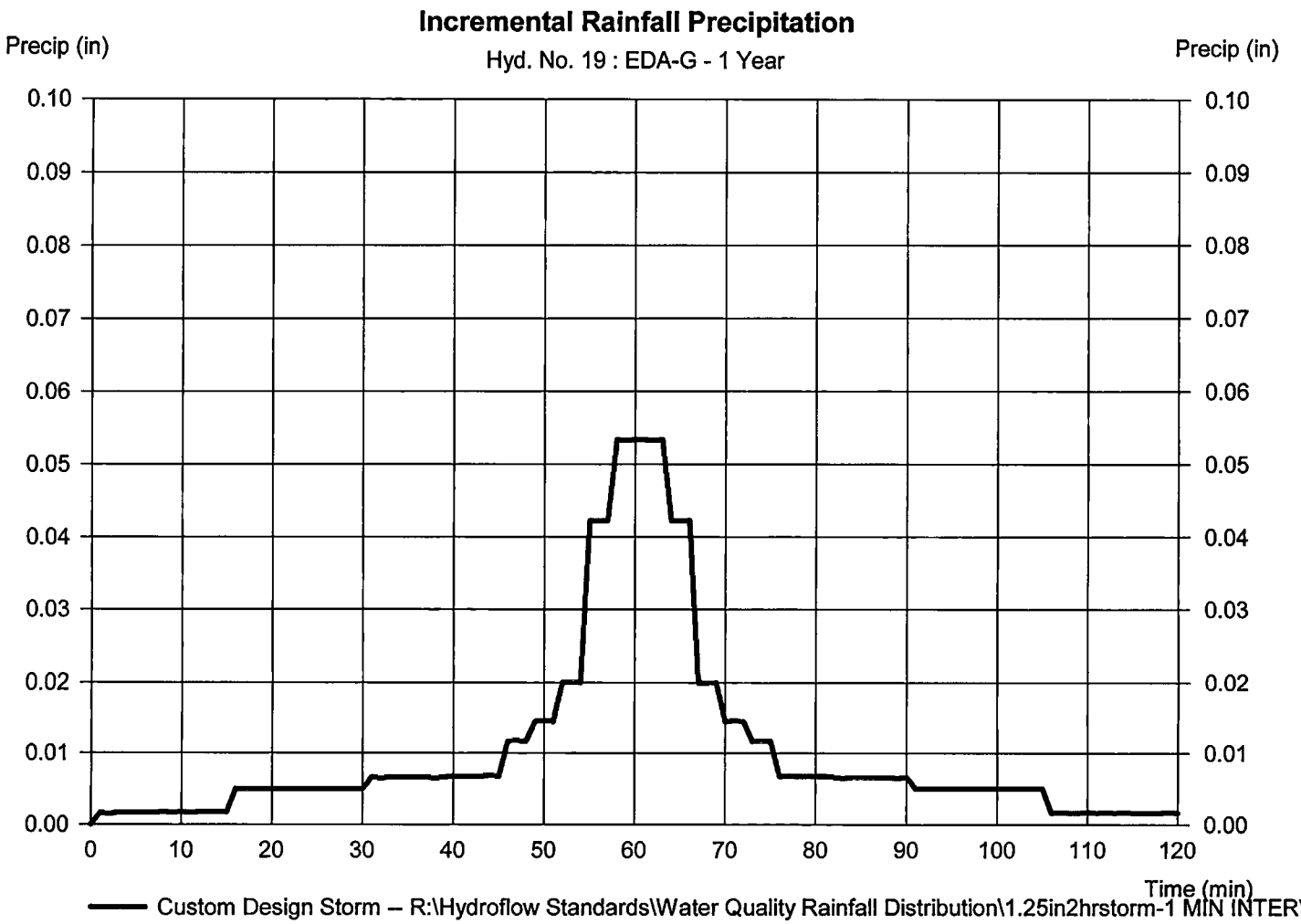
Total Travel Time, Tc ..... **12.60 min**

Precipitation Report

Hyd. No. 19

EDA-G

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

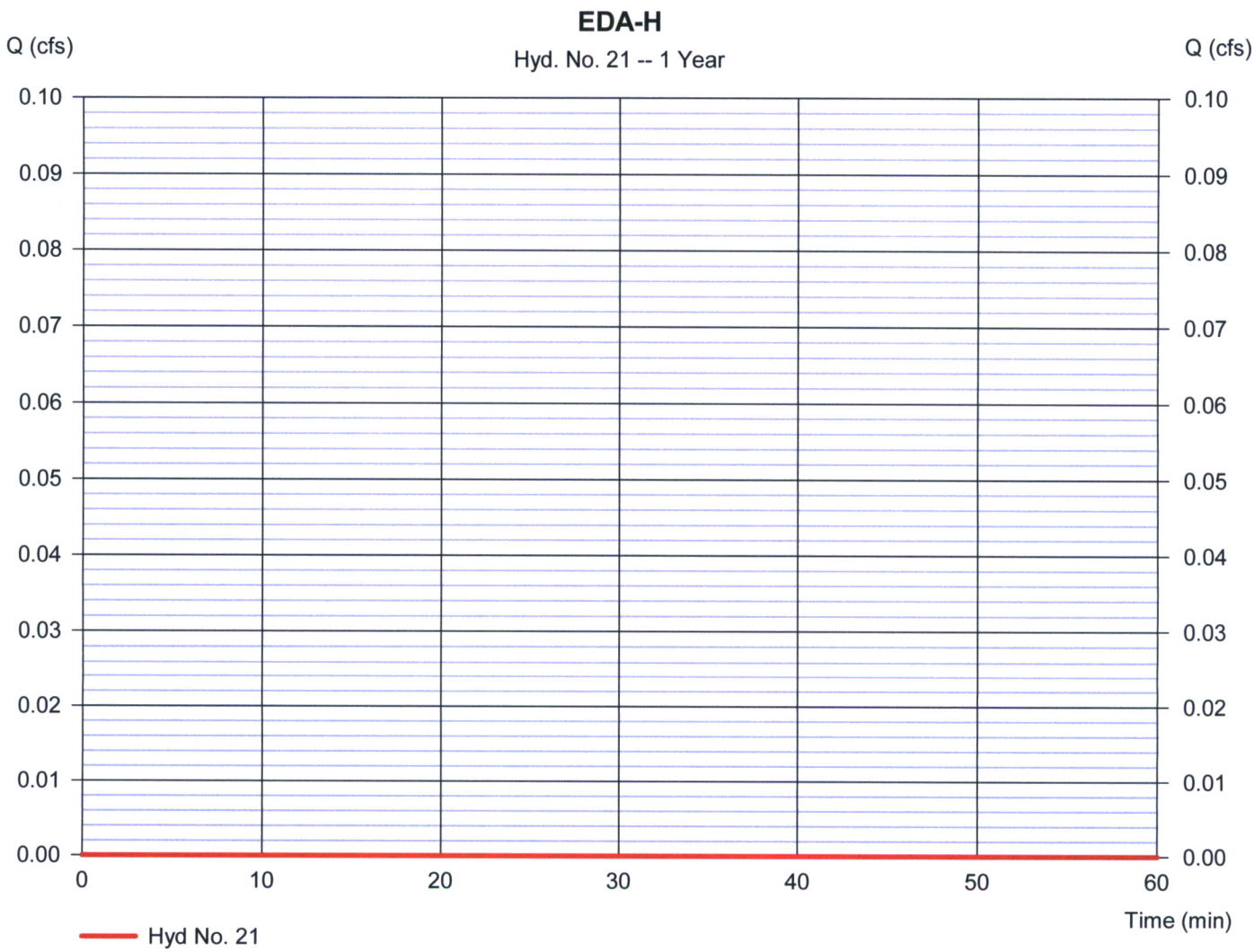


Hydrograph Report

Hyd. No. 21

EDA-H

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 12.920 ac	Curve number	= 36
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 33.50 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MI	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 21

EDA-H

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.150		0.011		
Flow length (ft)	= 32.0		68.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		3.24		0.00		
Land slope (%)	= 3.00		0.10		0.00		
Travel Time (min)	**= 7.29**	**+**	**23.71**	**+**	**0.00**	**=**	**31.00**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		452.00		
Watercourse slope (%)	= 0.00		0.00		3.40		
Surface description	= Paved		Paved		Unpaved		
Average velocity (ft/s)	=0.00		0.00		2.98		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**2.53**	**=**	**2.53**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

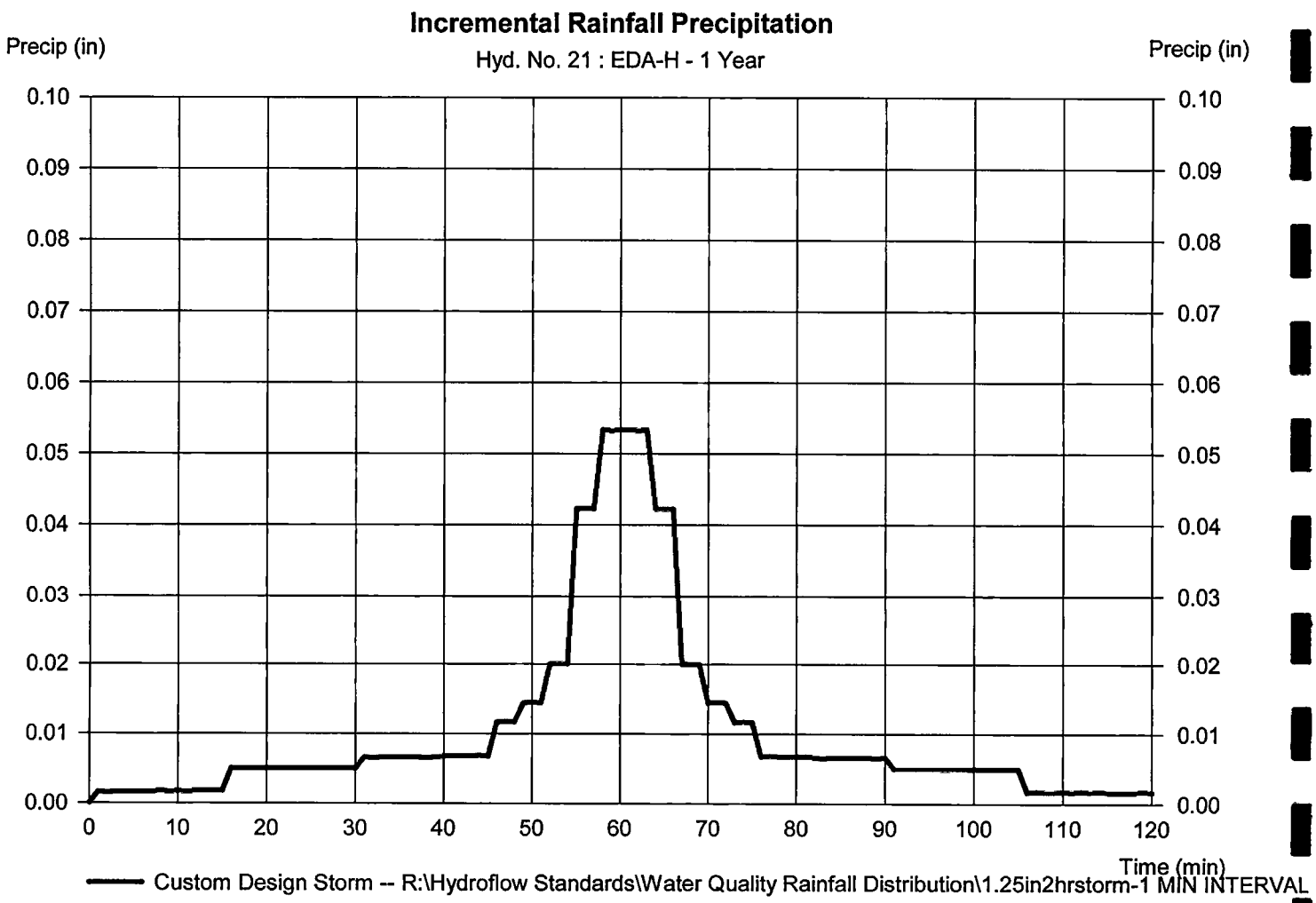
Total Travel Time, Tc ..... **33.50 min**

Precipitation Report

Hyd. No. 21

EDA-H

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

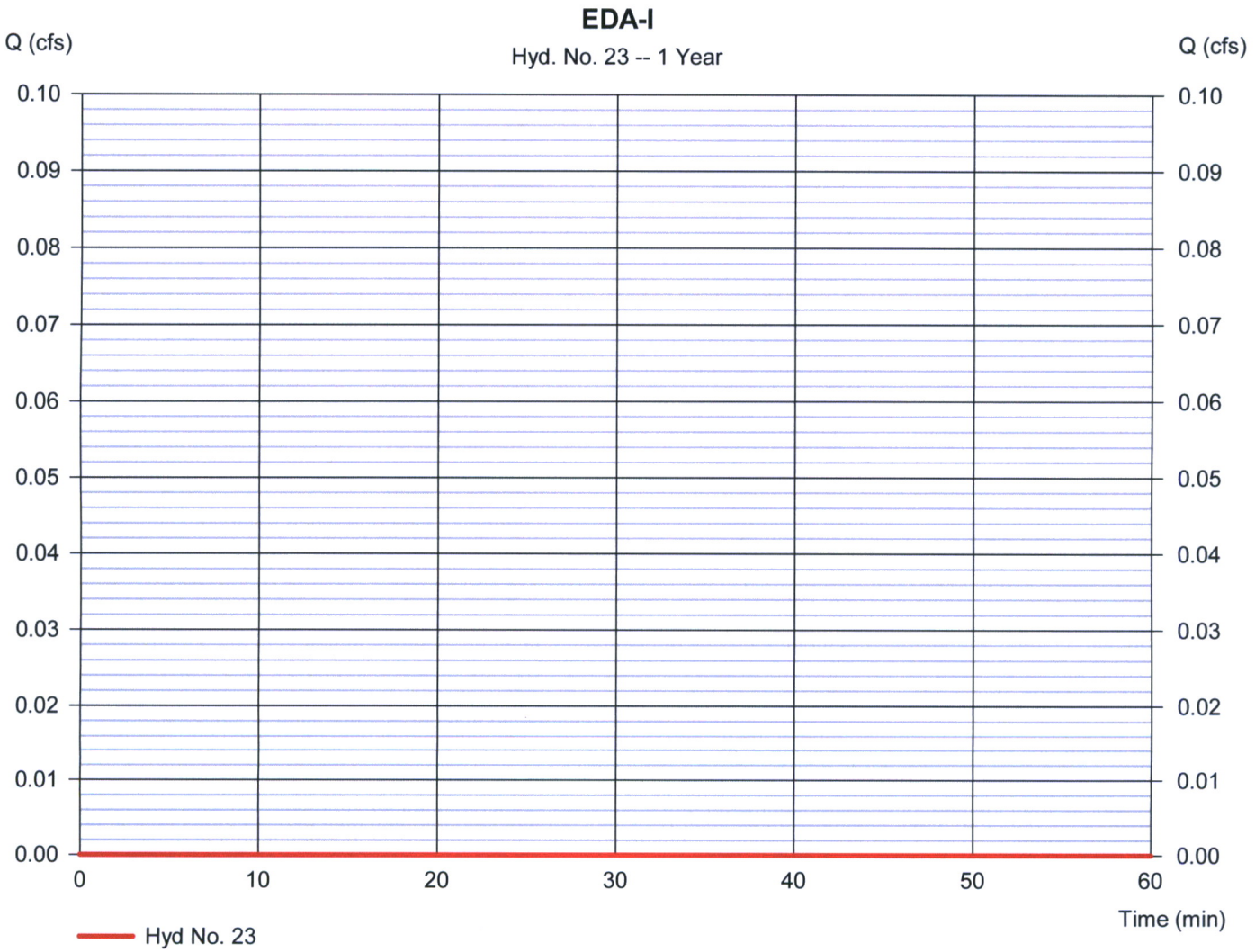


Hydrograph Report

Hyd. No. 23

EDA-I

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 1.100 ac	Curve number	= 30
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.10 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MIN	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 23

EDA-I

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.24		0.00		0.00		
Land slope (%)	= 1.90		0.00		0.00		
Travel Time (min)	**= 21.78**	**+**	**0.00**	**+**	**0.00**	**=**	**21.78**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		97.00		0.00		
Watercourse slope (%)	= 0.00		13.80		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=0.00		5.99		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.27**	**+**	**0.00**	**=**	**0.27**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

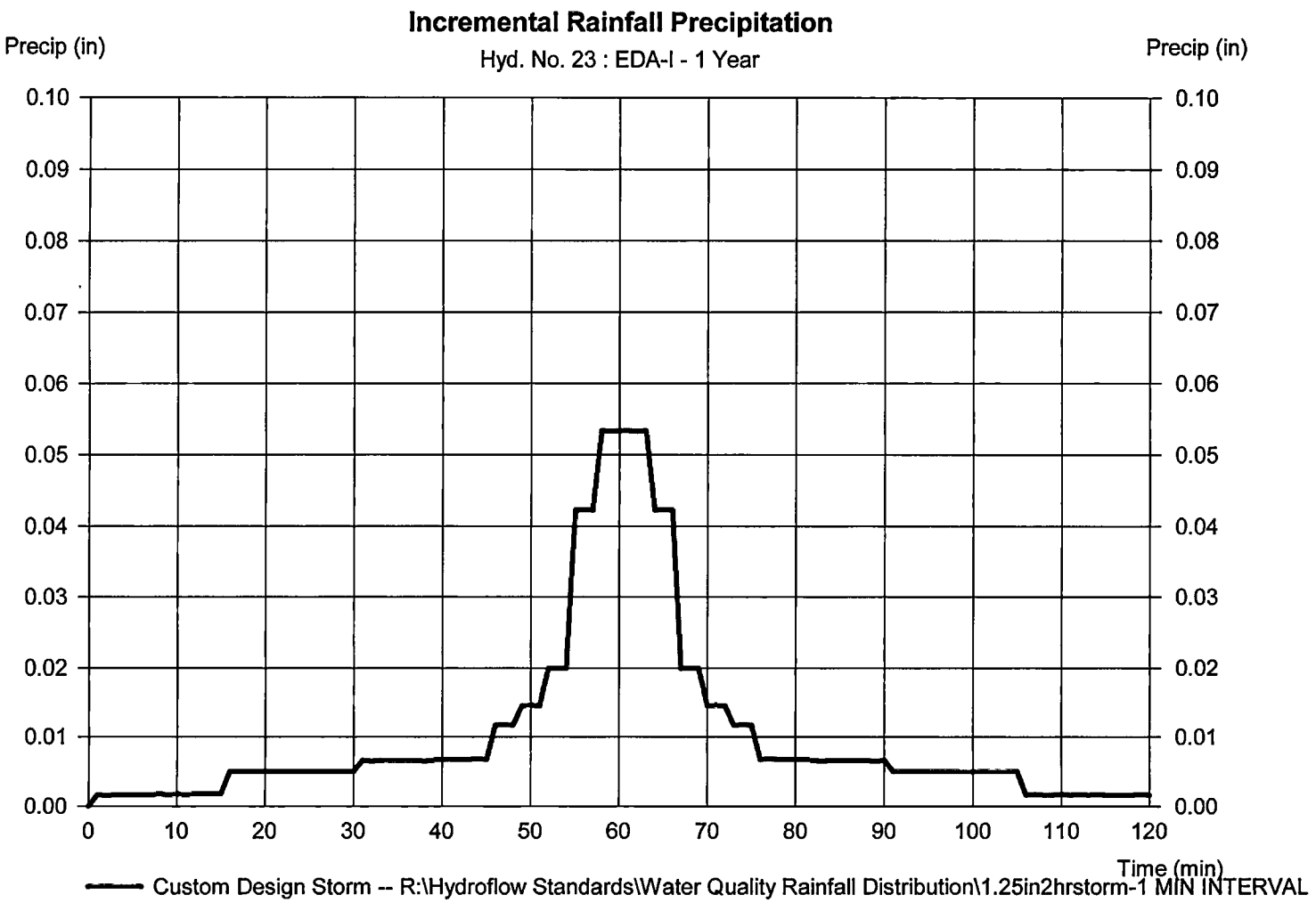
Total Travel Time, Tc ..... **22.10 min**

Precipitation Report

Hyd. No. 23

EDA-I

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

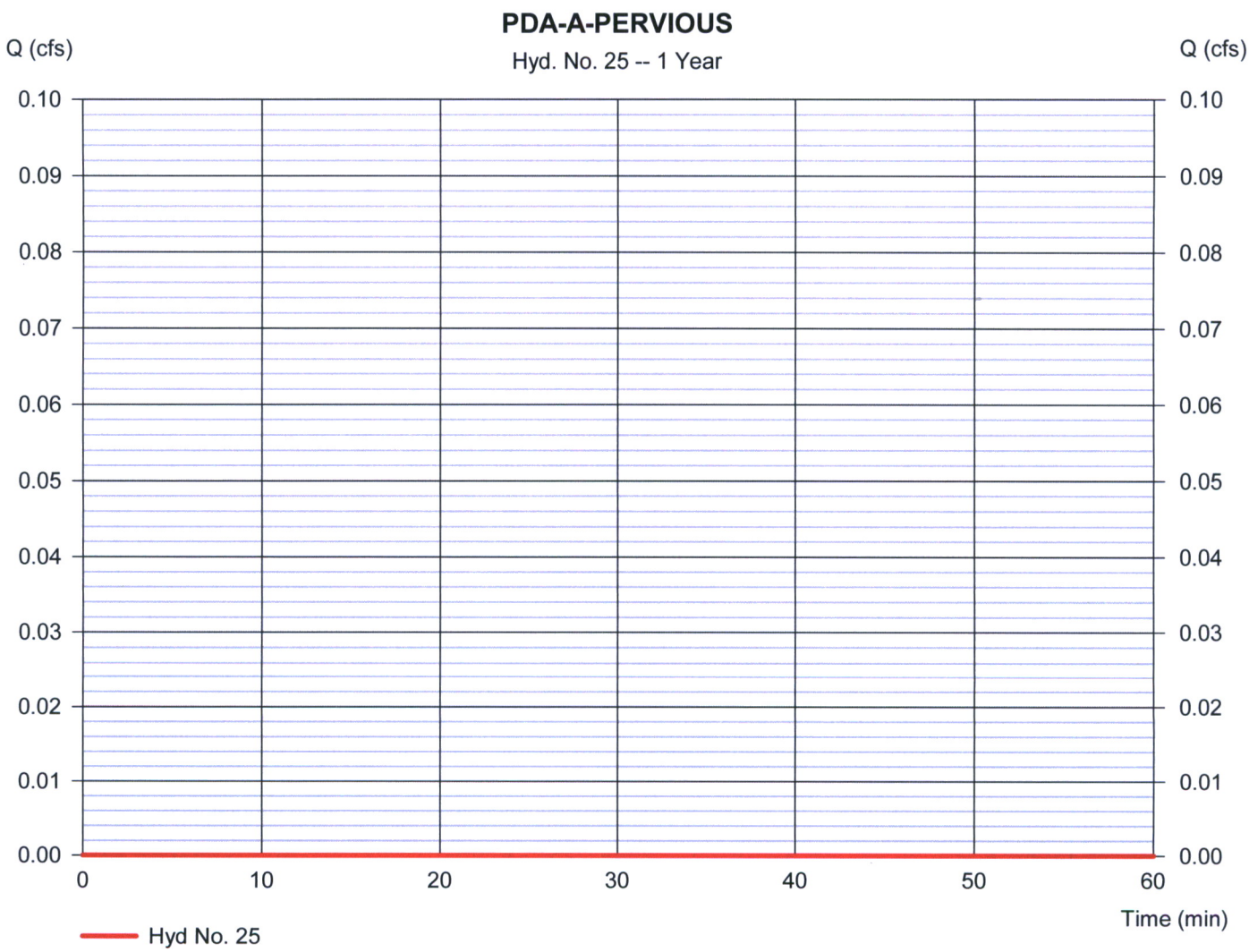


Hydrograph Report

Hyd. No. 25

PDA-A-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 2.030 ac	Curve number	= 9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MI	Shape factor	= 484

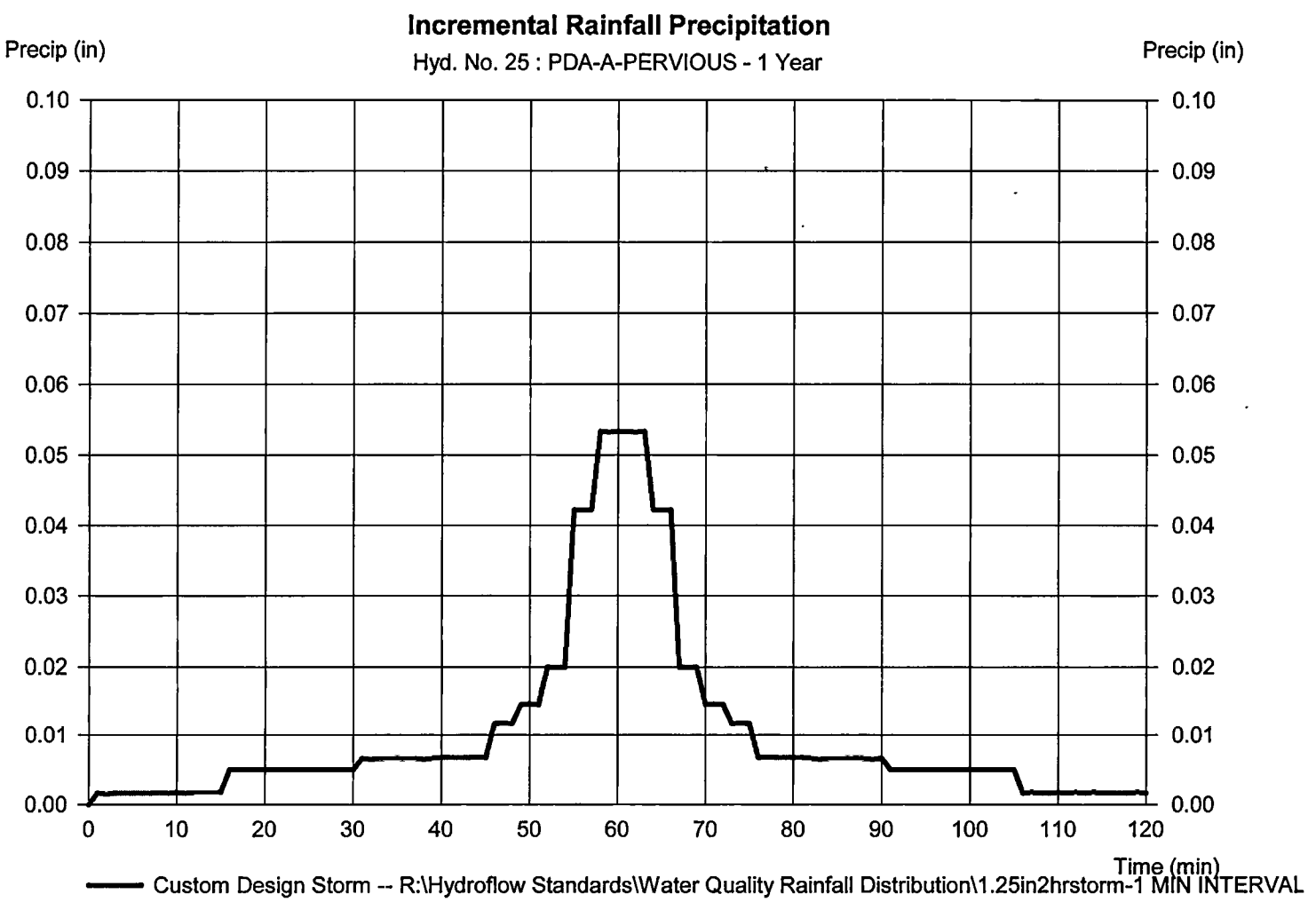


Precipitation Report

Hyd. No. 25

PDA-A-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

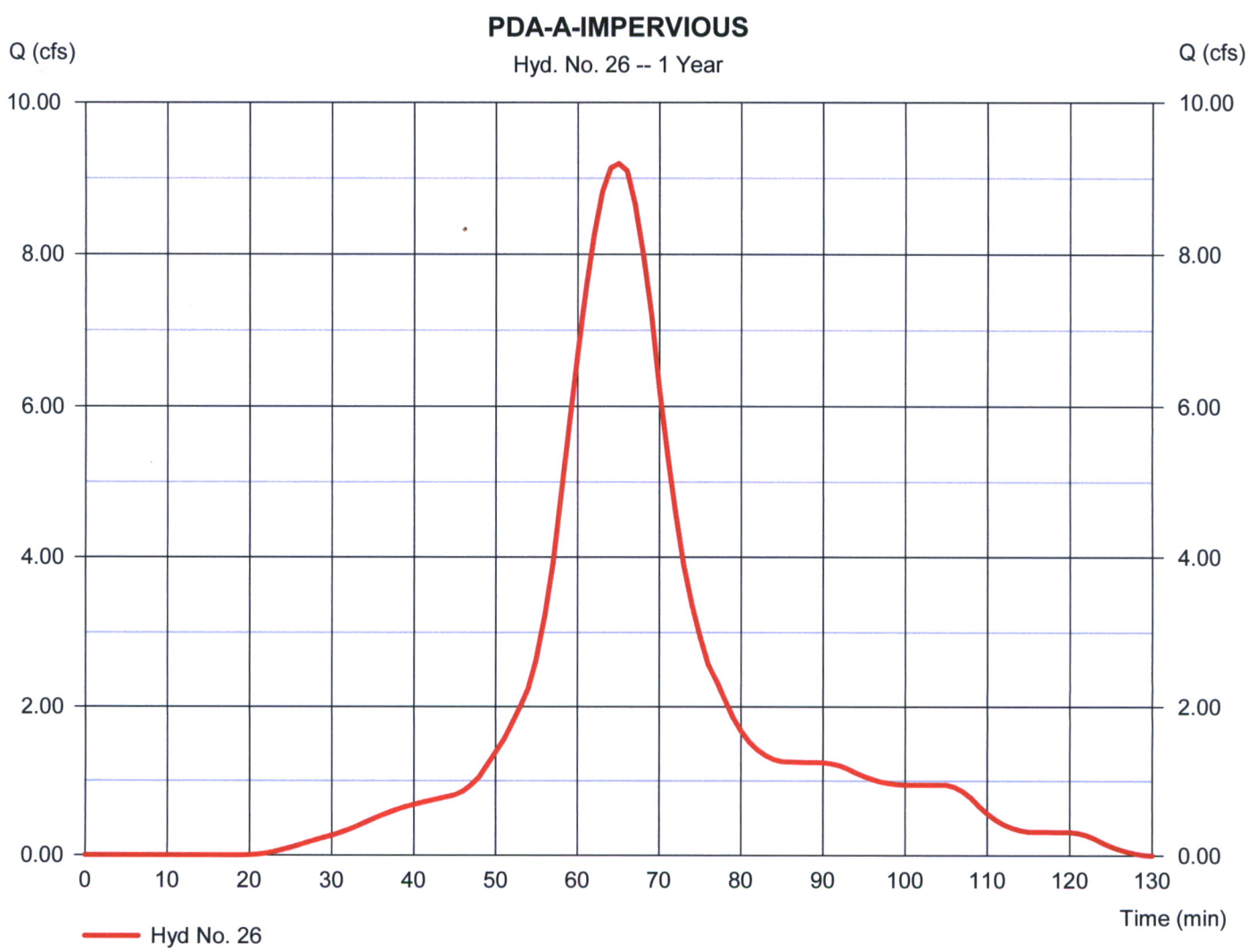


Hydrograph Report

Hyd. No. 26

PDA-A-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 9.194 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 12,006 cuft
Drainage area	= 3.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MI	Storm duration	

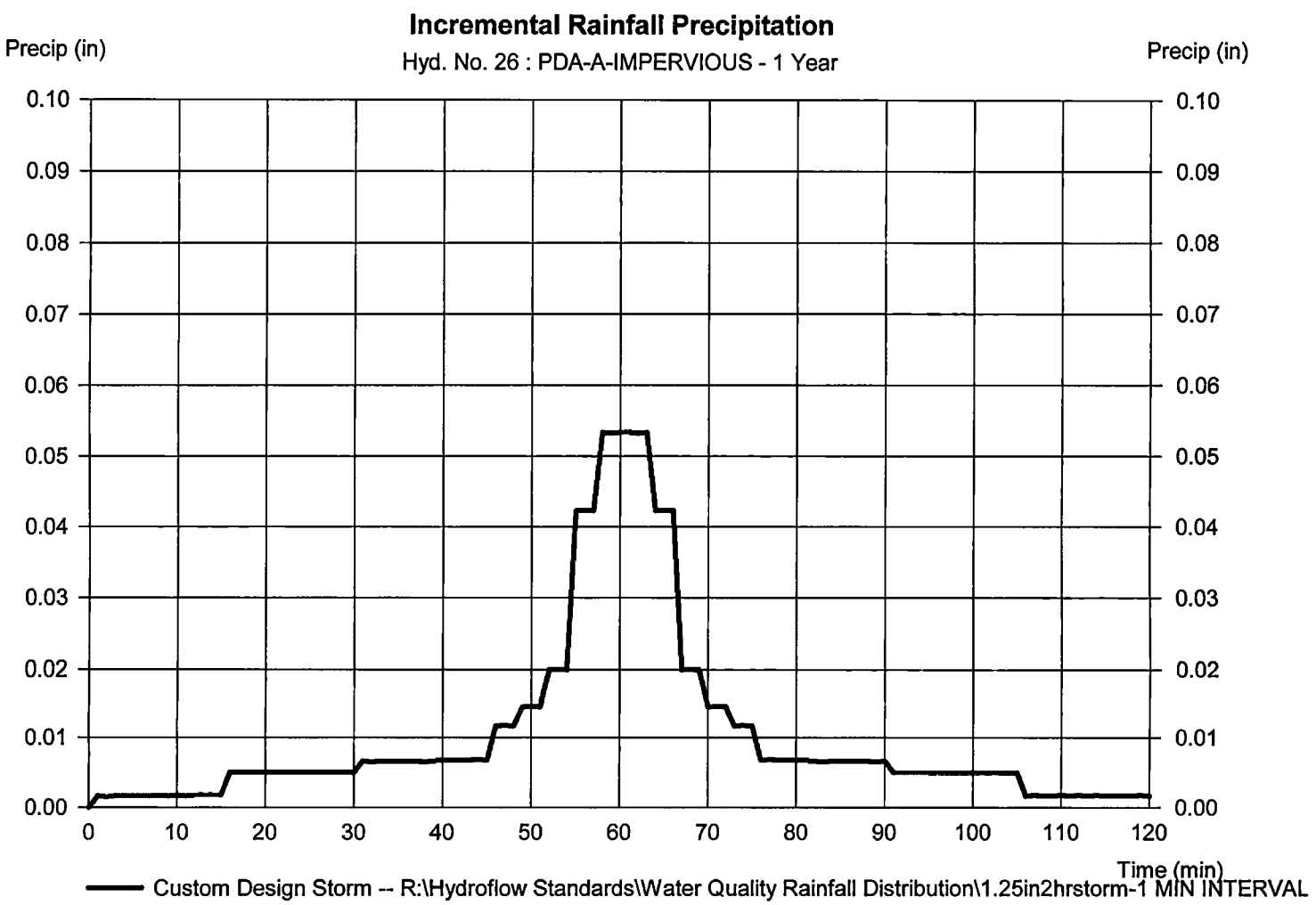


Precipitation Report

Hyd. No. 26

PDA-A-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

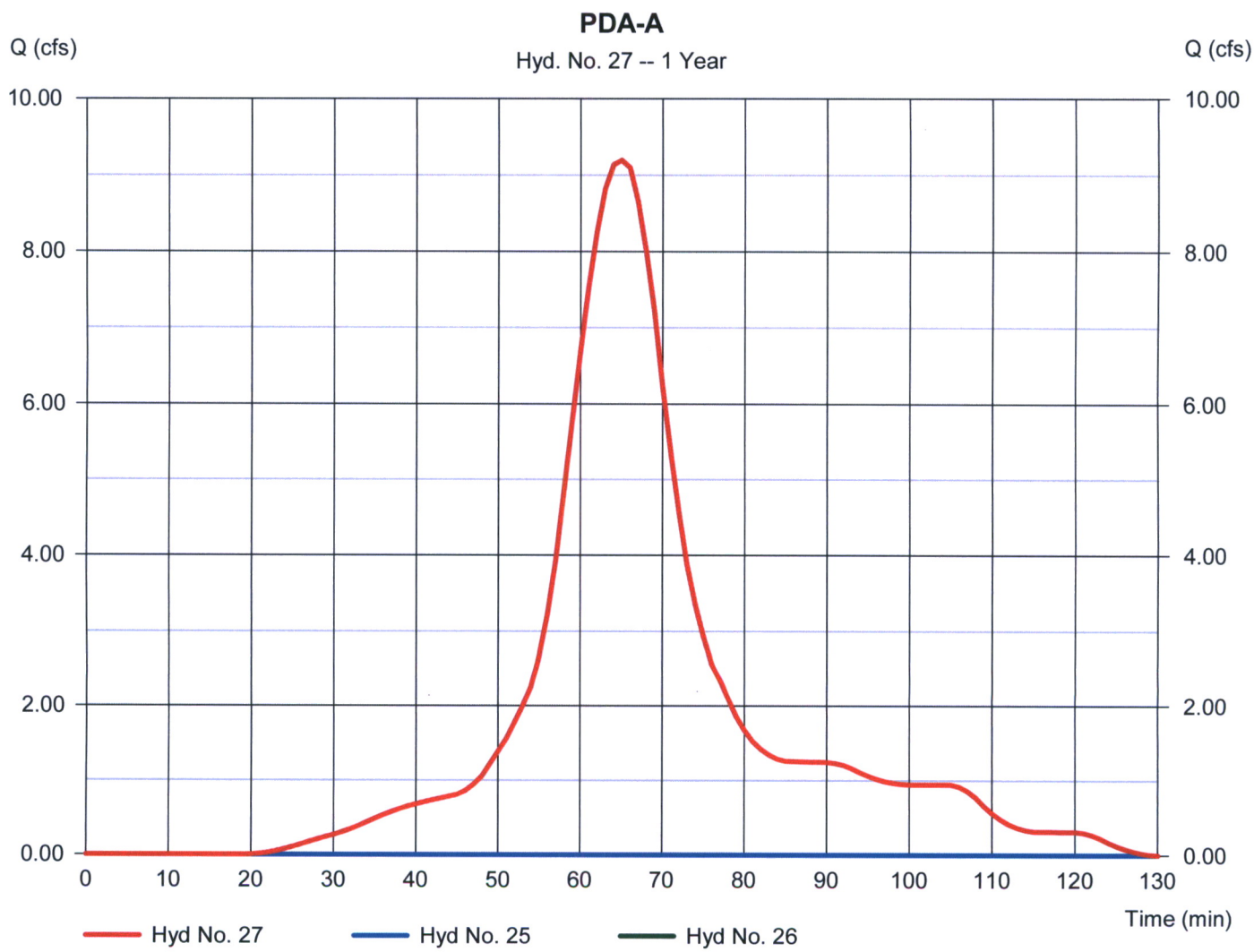


Hydrograph Report

Hyd. No. 27

PDA-A

Hydrograph type	= Combine	Peak discharge	= 9.194 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 12,006 cuft
Inflow hyds.	= 25, 26	Contrib. drain. area	= 5.130 ac



Hydrograph Report

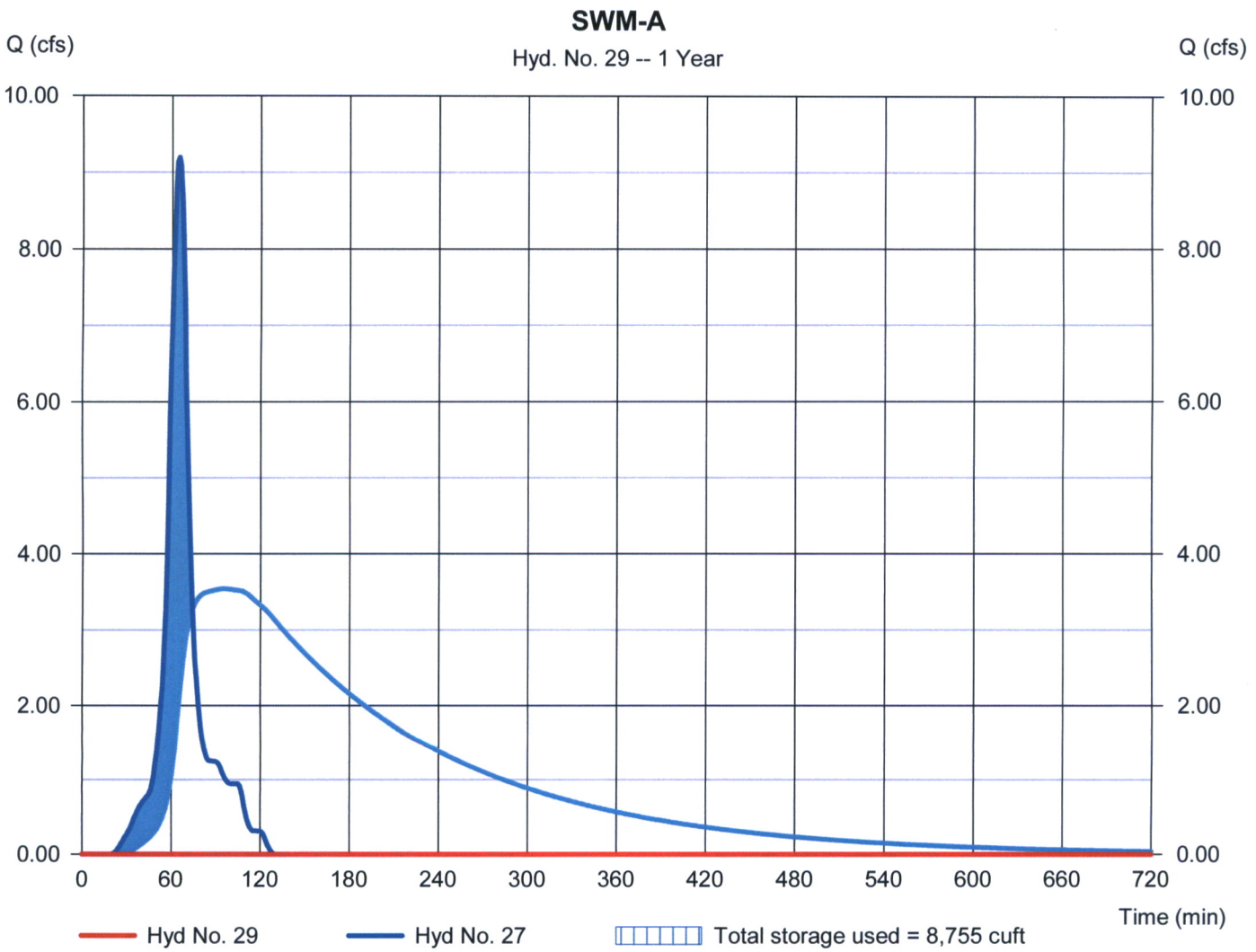
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Hyd. No. 29

SWM-A

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 68 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 27 - PDA-A	Max. Elevation	= 592.76 ft
Reservoir name	= SWM-A	Max. Storage	= 8,755 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 1 - SWM-A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 592.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	592.00	10,637	0	0
1.00	593.00	12,473	11,542	11,542
2.00	594.00	14,370	13,409	24,951
3.00	595.00	16,330	15,338	40,289
4.00	596.00	18,354	17,330	57,619
5.00	597.00	20,441	19,386	77,006

Culvert / Orifice Structures

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

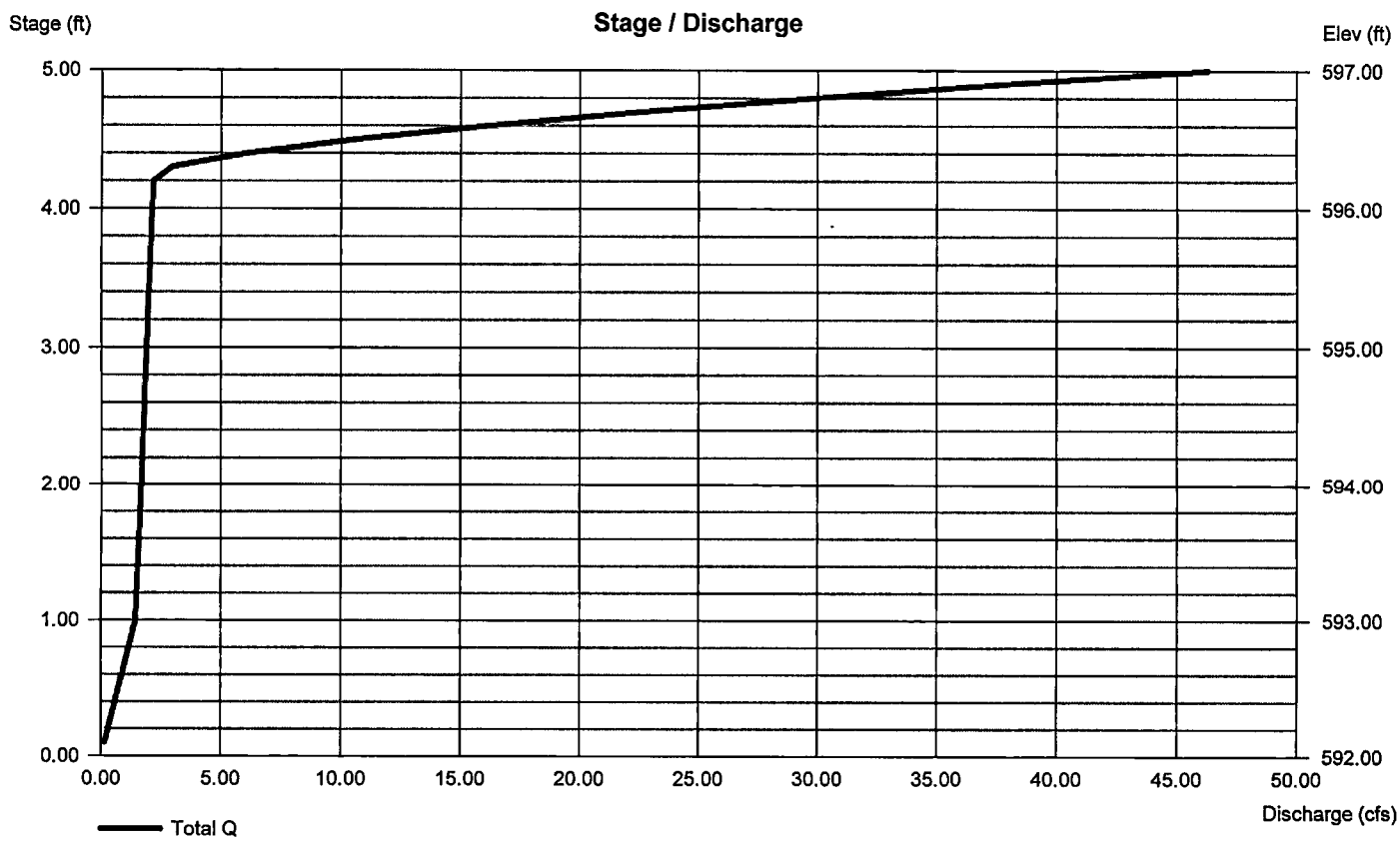
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 26.00	0.00	0.00	0.00
Crest El. (ft)	= 596.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 5.000 (by Contour)

TW Elev. (ft) = 0.00

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

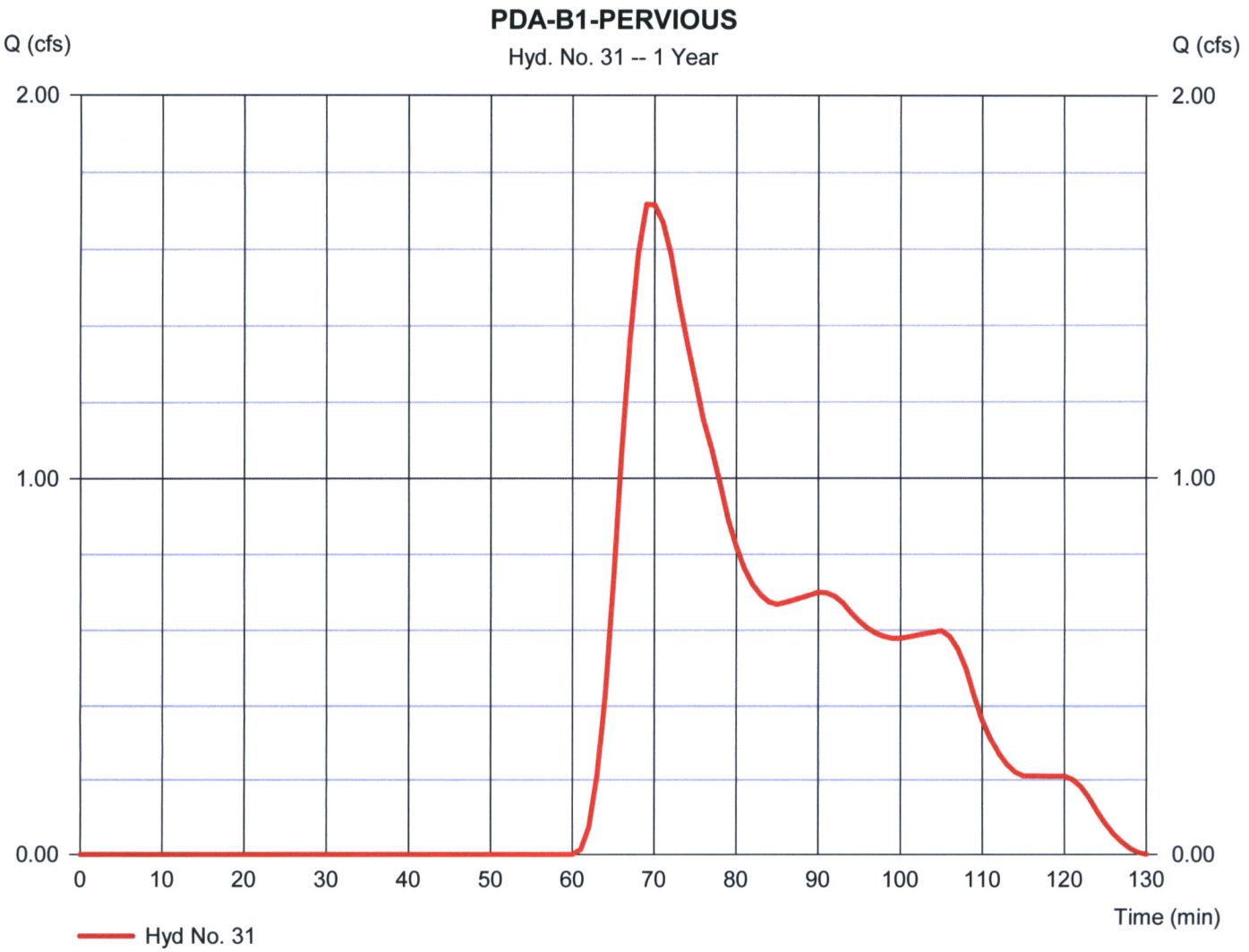


Hydrograph Report

Hyd. No. 31

PDA-B1-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 1.717 cfs
Storm frequency	= 1 yrs	Time to peak	= 69 min
Time interval	= 1 min	Hyd. volume	= 2,574 cuft
Drainage area	= 6.790 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MIN	Storm Frequency	= 1 yrs

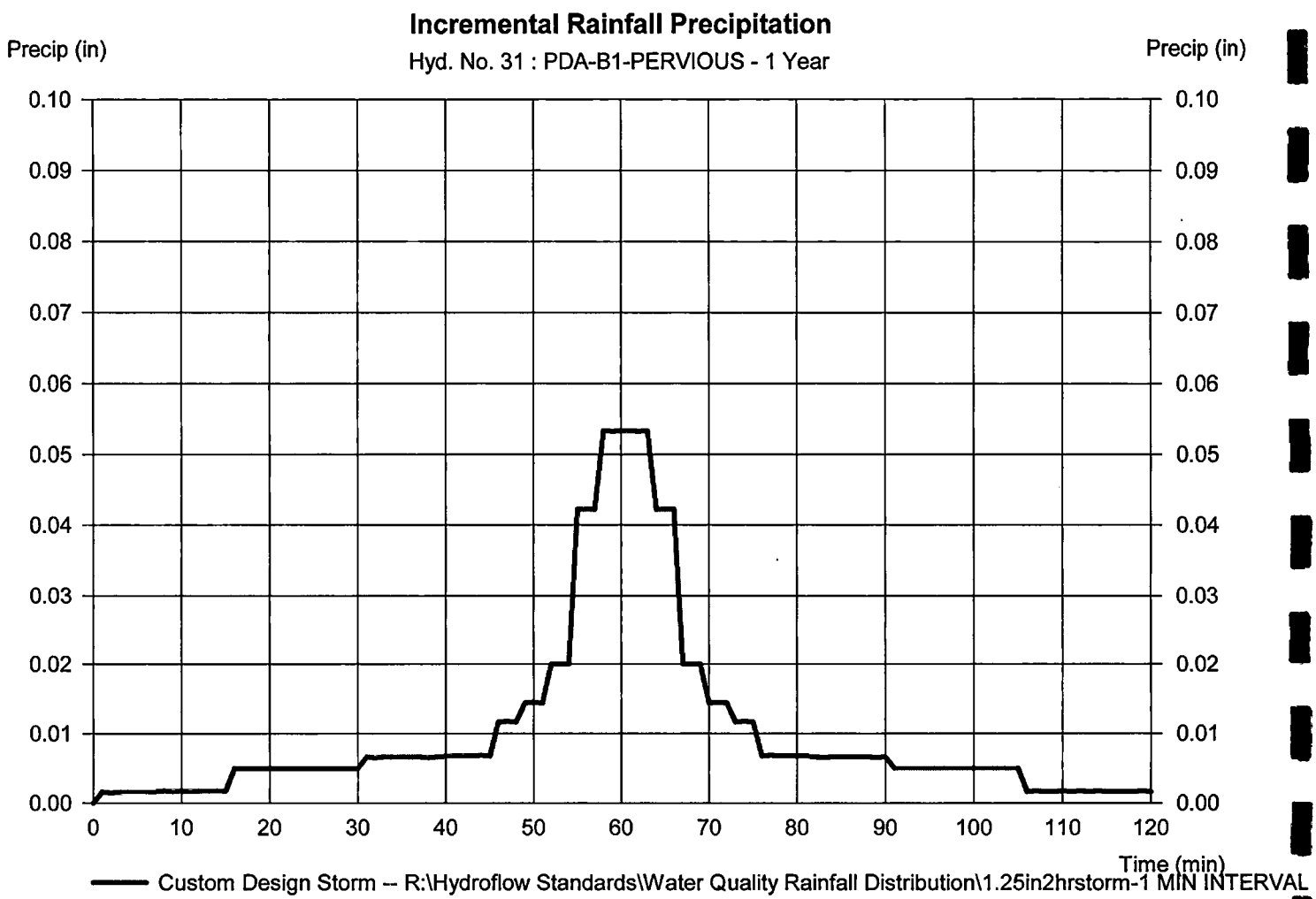


Precipitation Report

Hyd. No. 31

PDA-B1-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

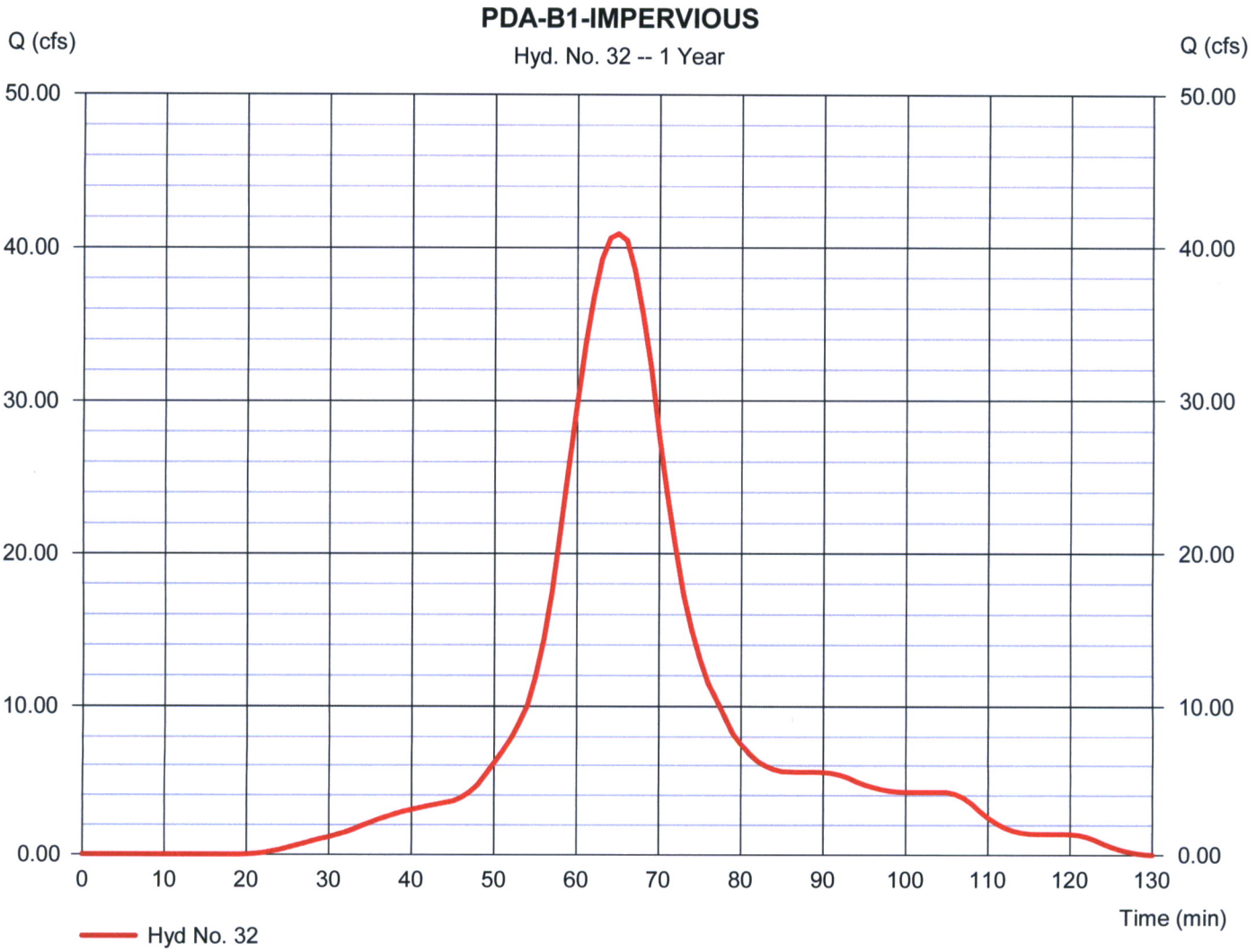


Hydrograph Report

Hyd. No. 32

PDA-B1-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 40.90 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 53,407 cuft
Drainage area	= 13.790 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MIN	Shape factor	= 484

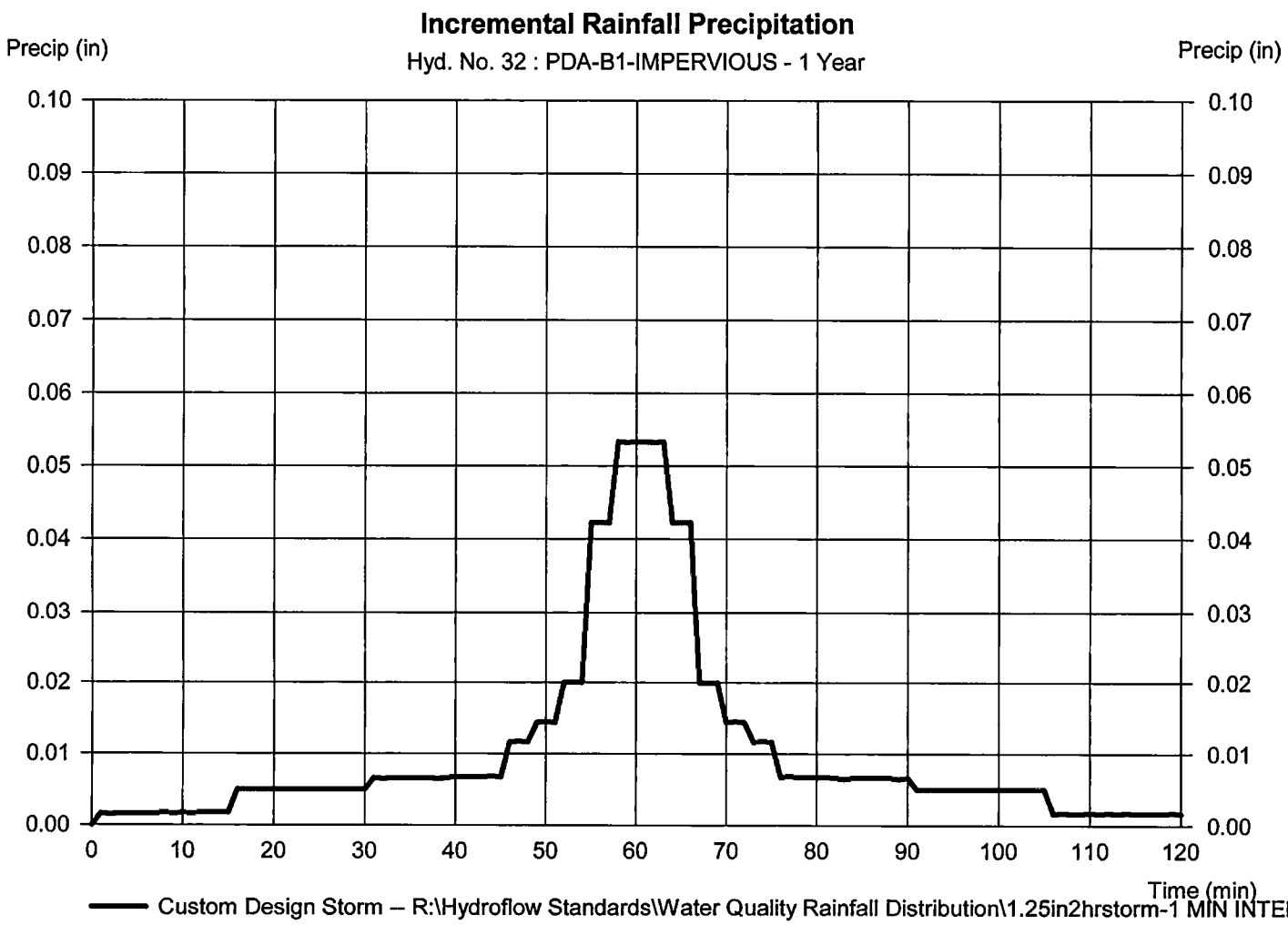


Precipitation Report

Hyd. No. 32

PDA-B1-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

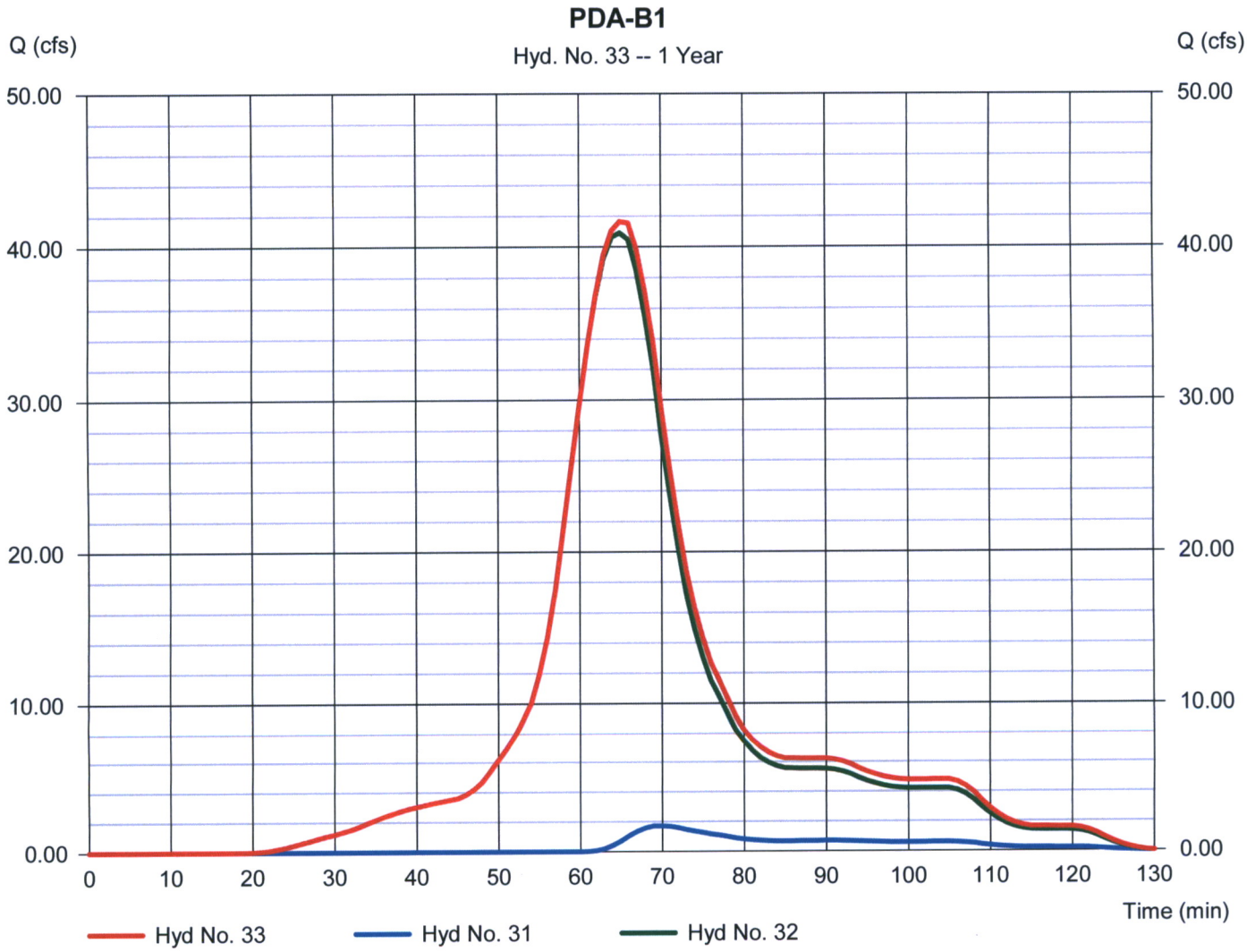


Hydrograph Report

Hyd. No. 33

PDA-B1

Hydrograph type	= Combine	Peak discharge	= 41.63 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 55,980 cuft
Inflow hyds.	= 31, 32	Contrib. drain. area	= 20.580 ac

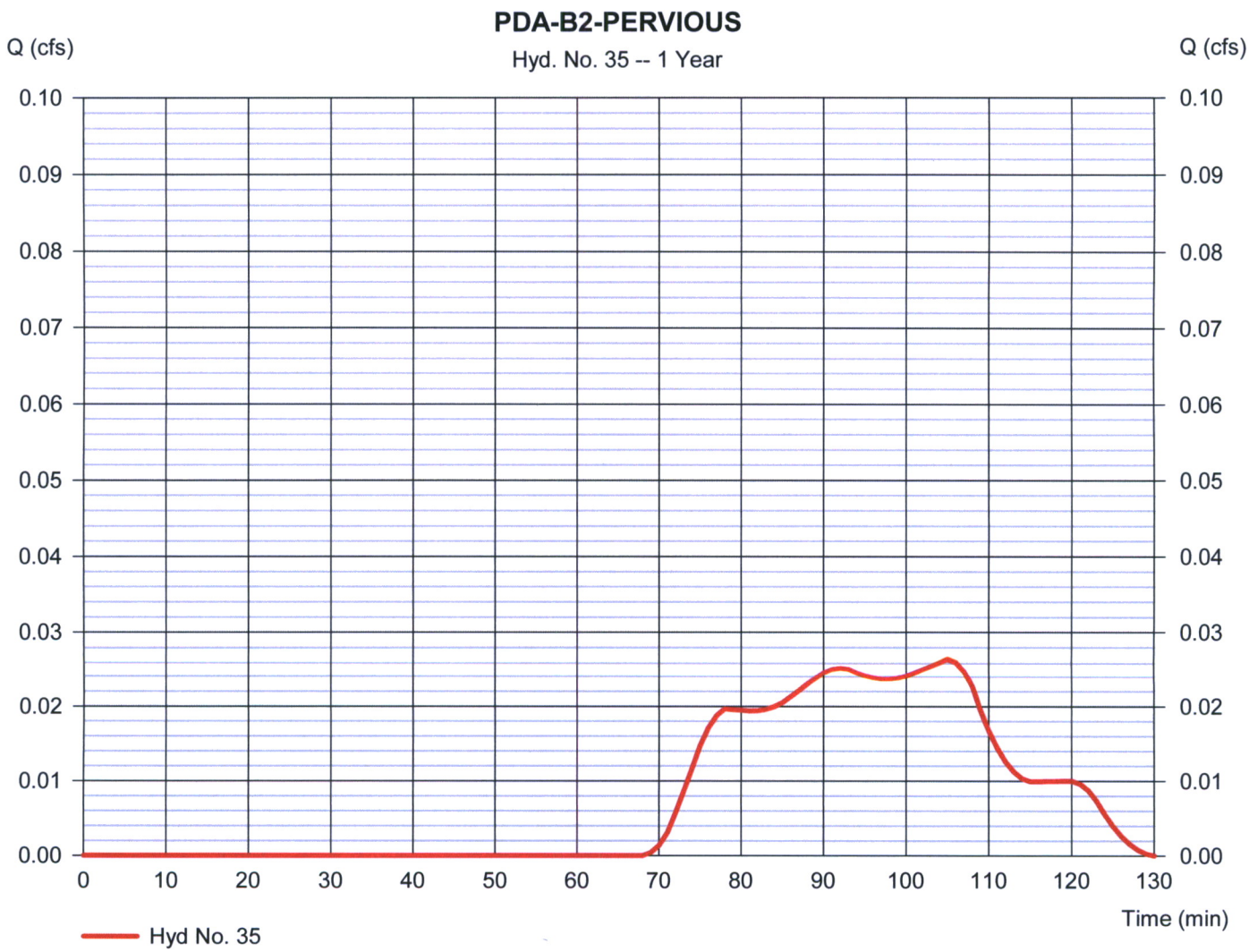


Hydrograph Report

Hyd. No. 35

PDA-B2-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.027 cfs
Storm frequency	= 1 yrs	Time to peak	= 105 min
Time interval	= 1 min	Hyd. volume	= 59 cuft
Drainage area	= 0.830 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MI	Shape factor	= 484

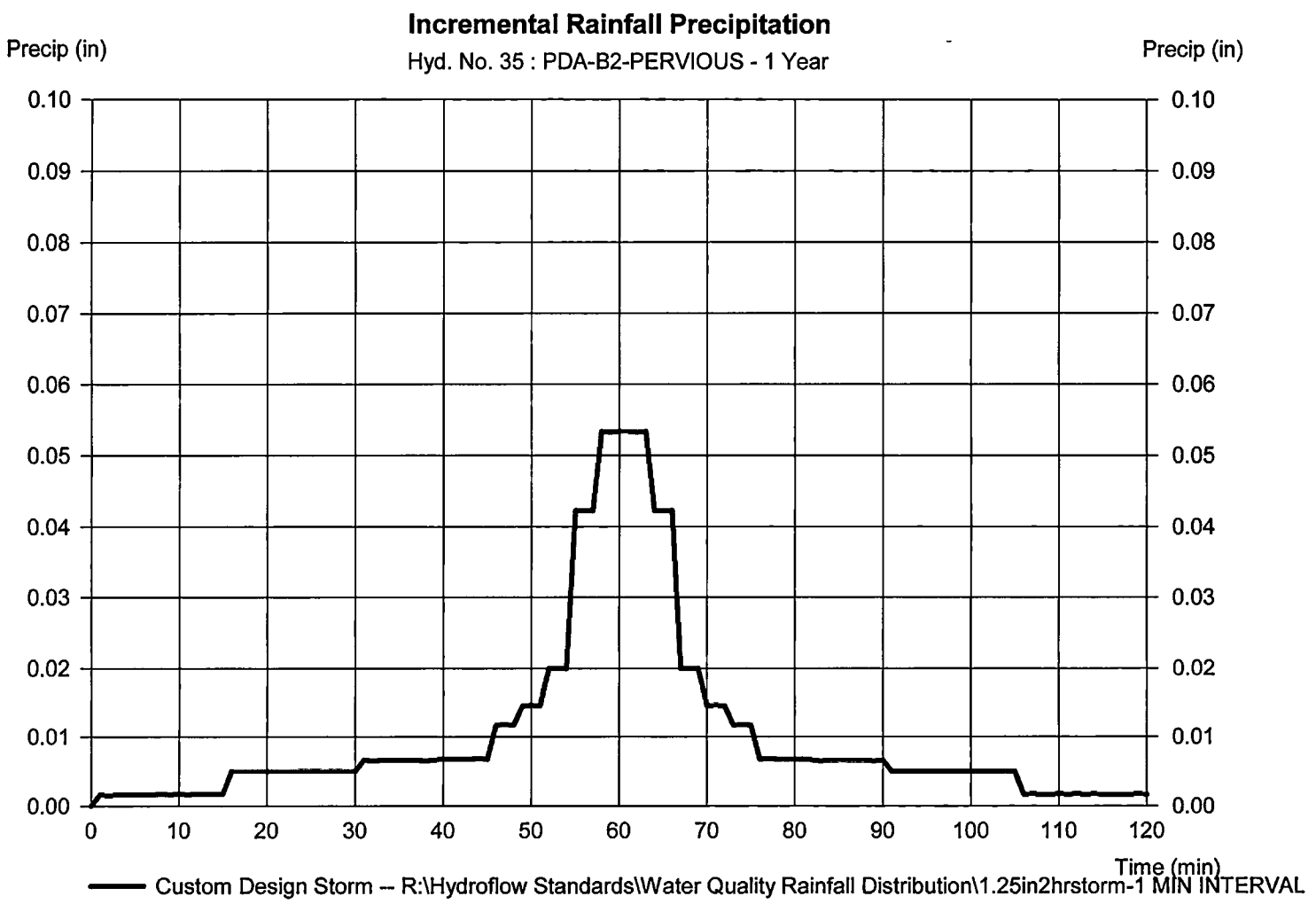


Precipitation Report

Hyd. No. 35

PDA-B2-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

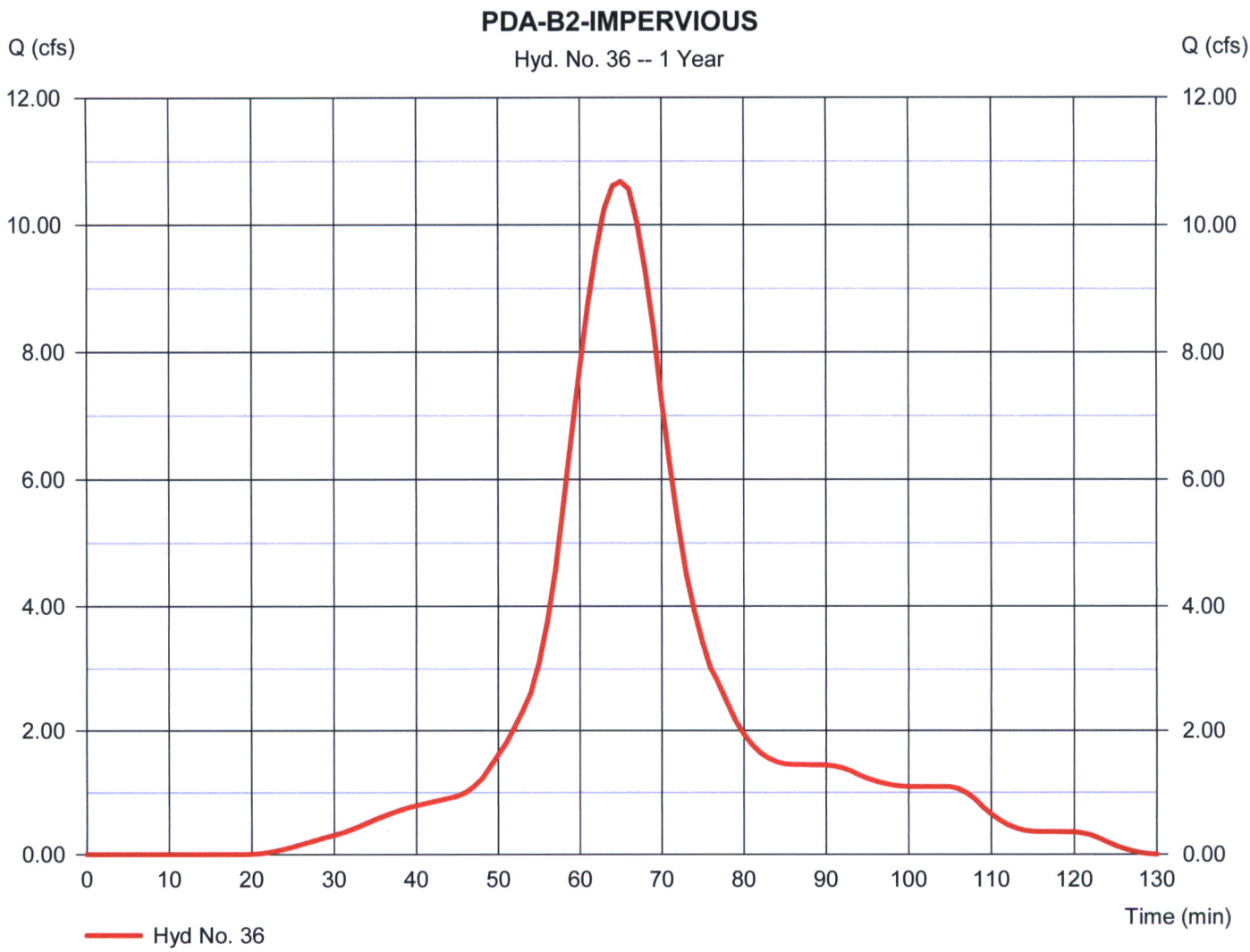


Hydrograph Report

Hyd. No. 36

PDA-B2-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 10.68 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 13,942 cuft
Drainage area	= 3.600 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484-1.25in2hrstorm-1 MI	Shape factor	= 484

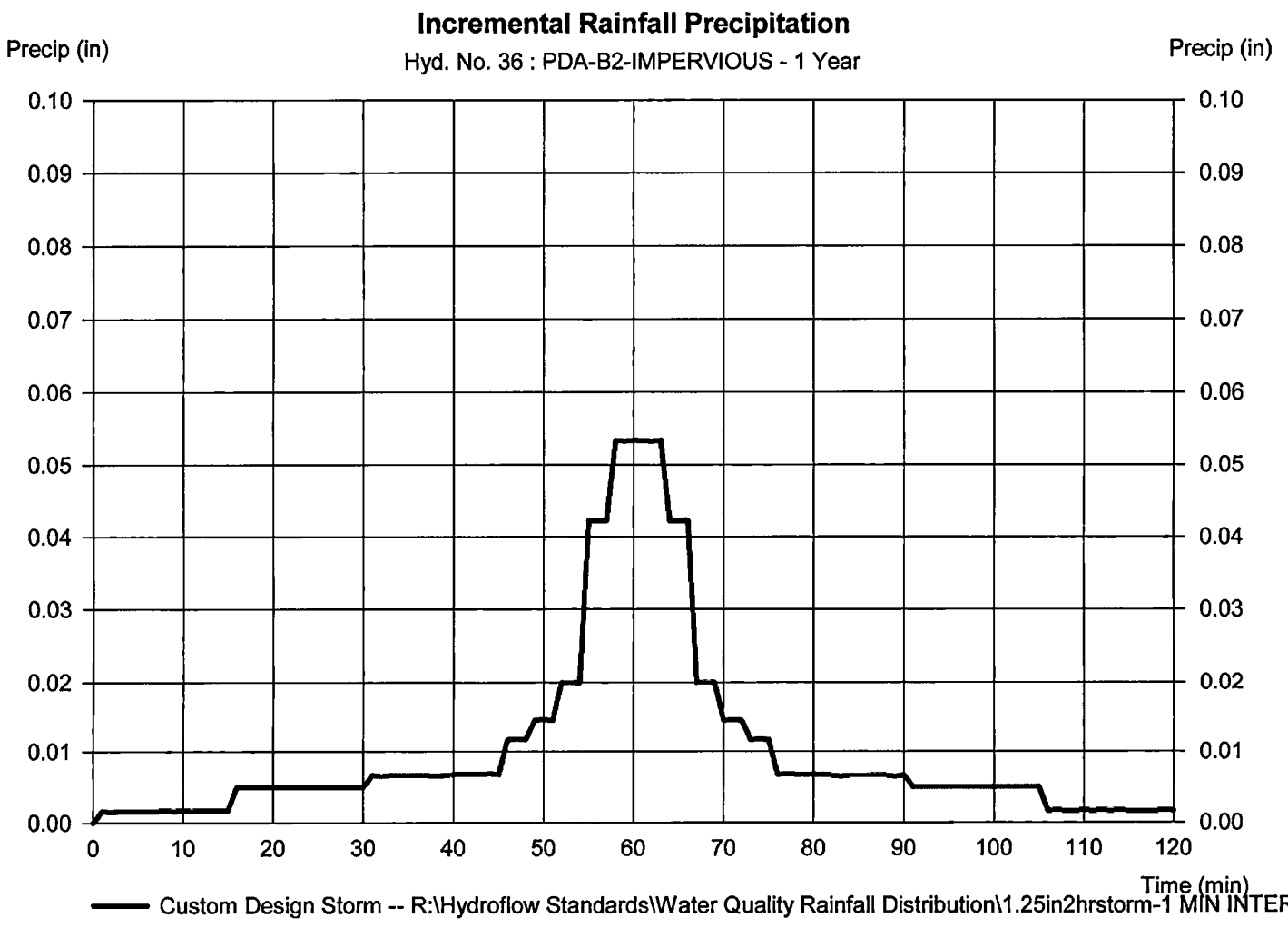


Precipitation Report

Hyd. No. 36

PDA-B2-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

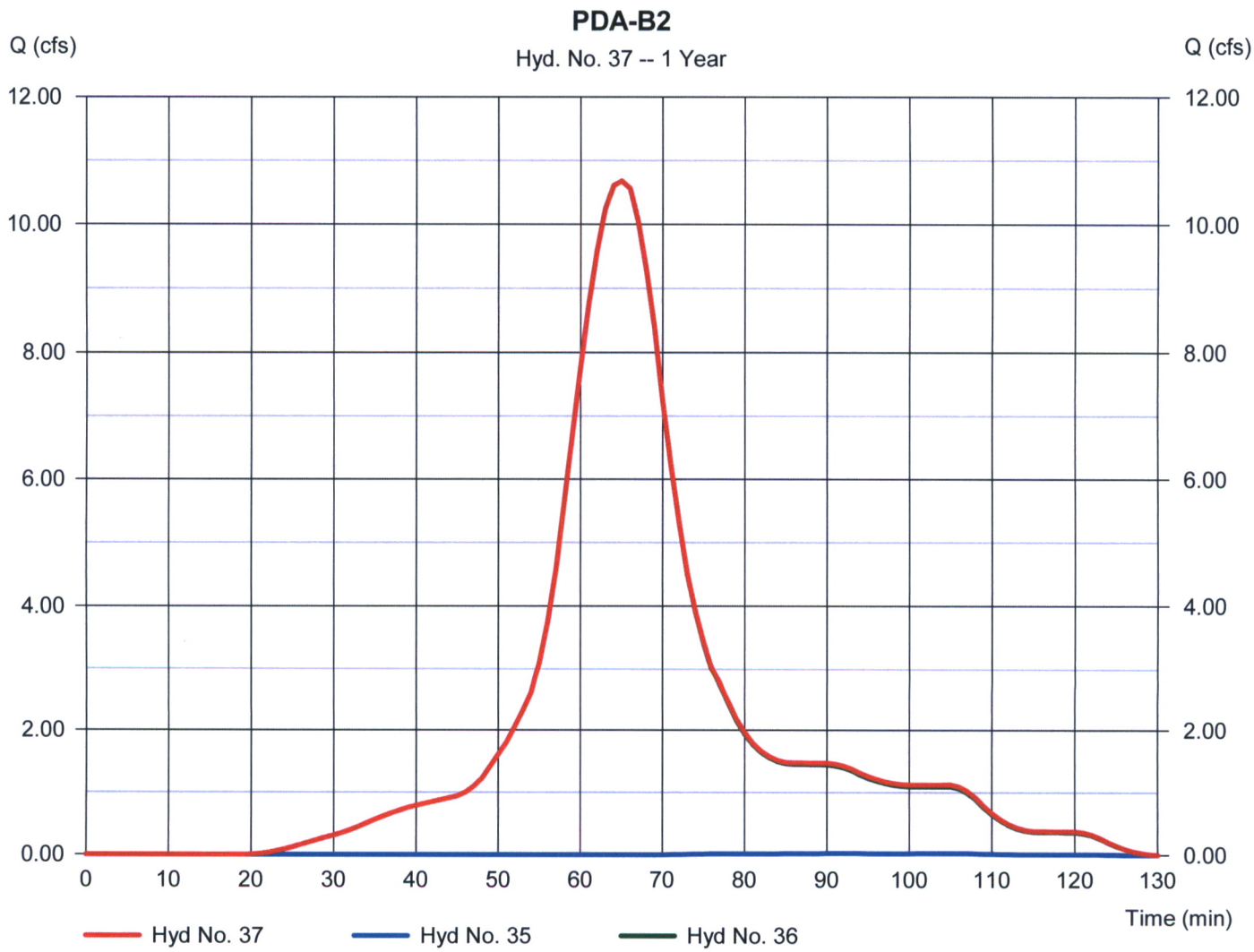


Hydrograph Report

Hyd. No. 37

PDA-B2

Hydrograph type	= Combine	Peak discharge	= 10.68 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 14,001 cuft
Inflow hyds.	= 35, 36	Contrib. drain. area	= 4.430 ac



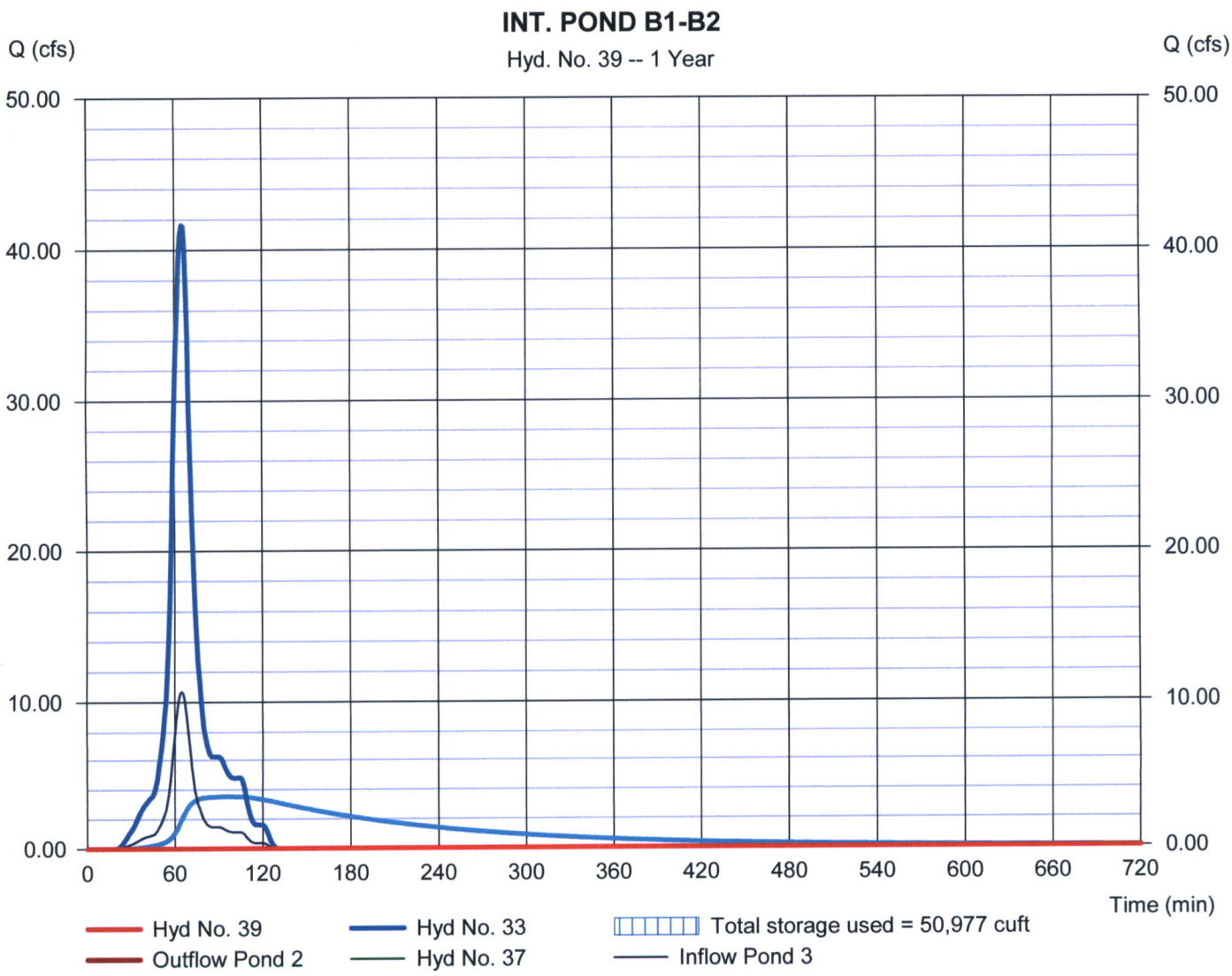
Hydrograph Report

Hyd. No. 39

INT. POND B1-B2

Hydrograph type	= Reservoir (Interconnected)	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 166 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Upper Pond	= SWM-B1	Lower Pond	= SWM-B2
Inflow hyd.	= 33 - PDA-B1	Other Inflow hyd.	= 37 - PDA-B2
Max. Elevation	= 598.62 ft	Max. Elevation	= 598.46 ft
Max. Storage	= 40,716 cuft	Max. Storage	= 10,260 cuft

Interconnected Pond Routing. Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 2 - SWM-B1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 598.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	598.00	61,258	0	0
1.00	599.00	69,679	65,417	65,417
2.00	600.00	78,515	74,046	139,463
3.00	601.00	87,768	83,090	222,553
4.00	602.00	97,511	92,588	315,140

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 598.00	0.00	0.00	0.00
Length (ft)	= 164.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

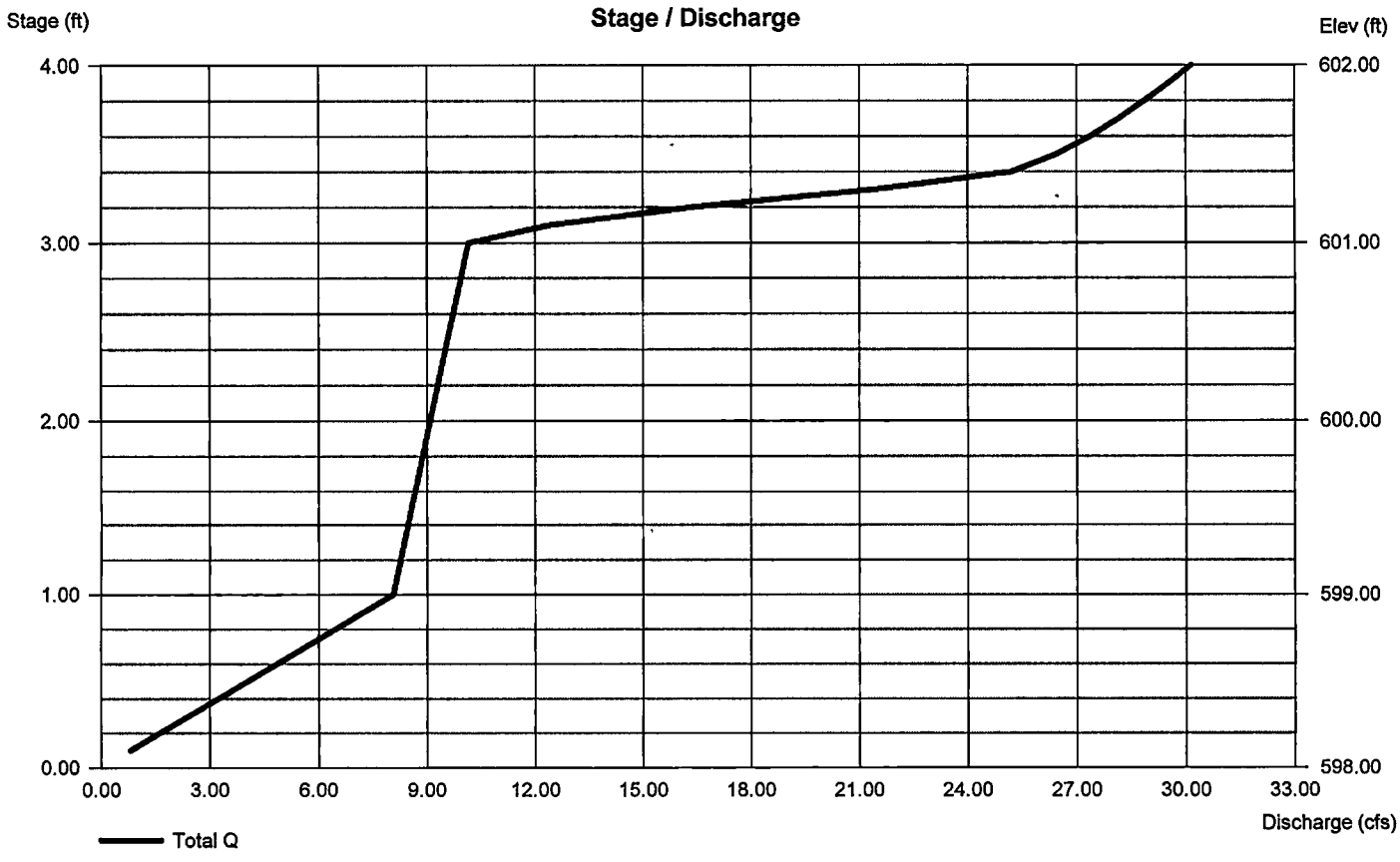
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 601.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 5.000 (by Contour)

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).



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 3 - SWM-B2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 598.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	598.00	21,184	0	0
1.00	599.00	23,256	22,210	22,210
2.00	600.00	25,384	24,310	46,520
3.00	601.00	27,569	26,466	72,986
4.00	602.00	29,810	28,679	101,665

Culvert / Orifice Structures

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

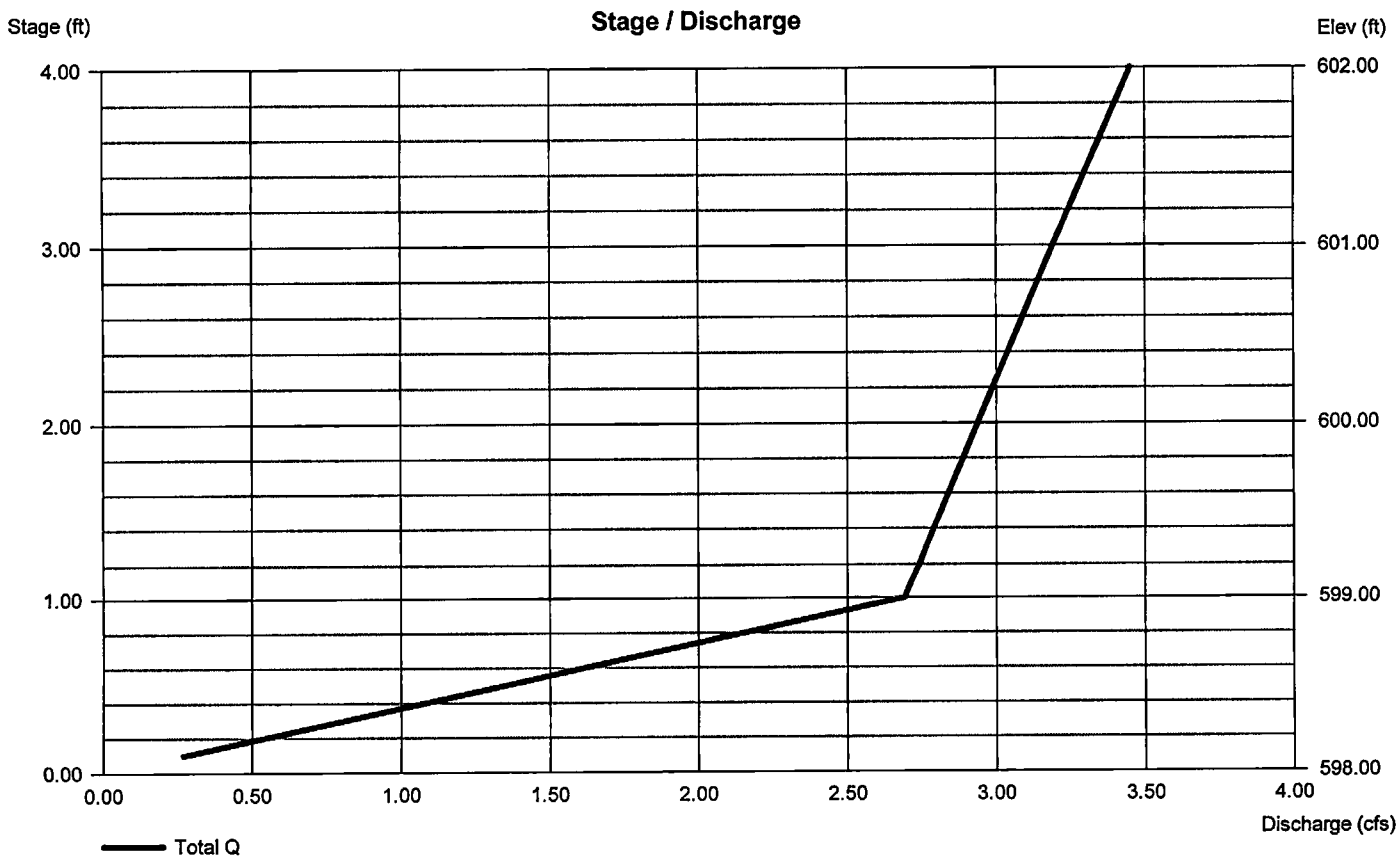
Weir Structures

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

Exfil.(in/hr) = 5.000 (by Contour)

TW Elev. (ft) = 0.00

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

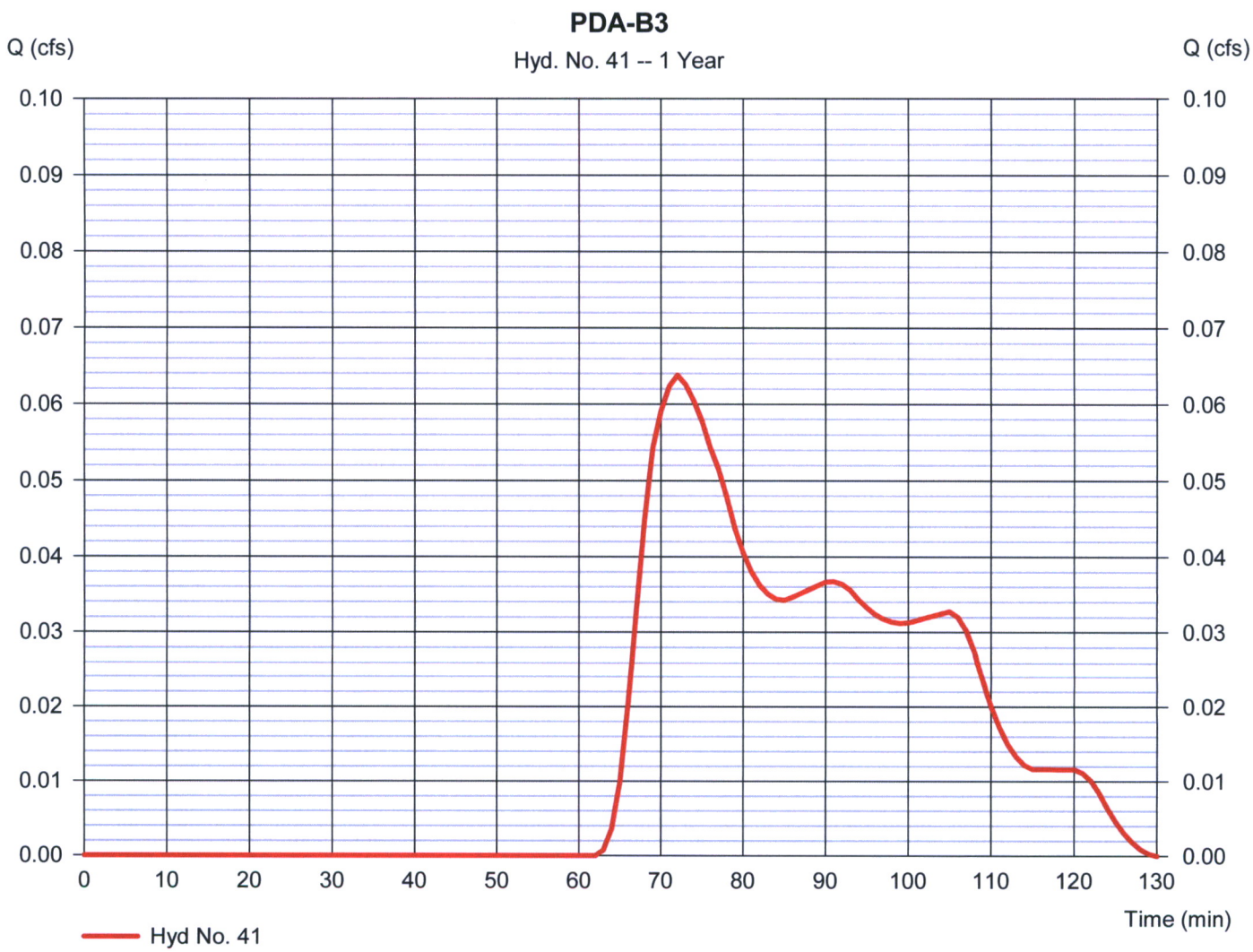


Hydrograph Report

Hyd. No. 41

PDA-B3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.064 cfs
Storm frequency	= 1 yrs	Time to peak	= 72 min
Time interval	= 1 min	Hyd. volume	= 116 cuft
Drainage area	= 0.500 ac	Curve number	= 73
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MI	Shape factor	= 484

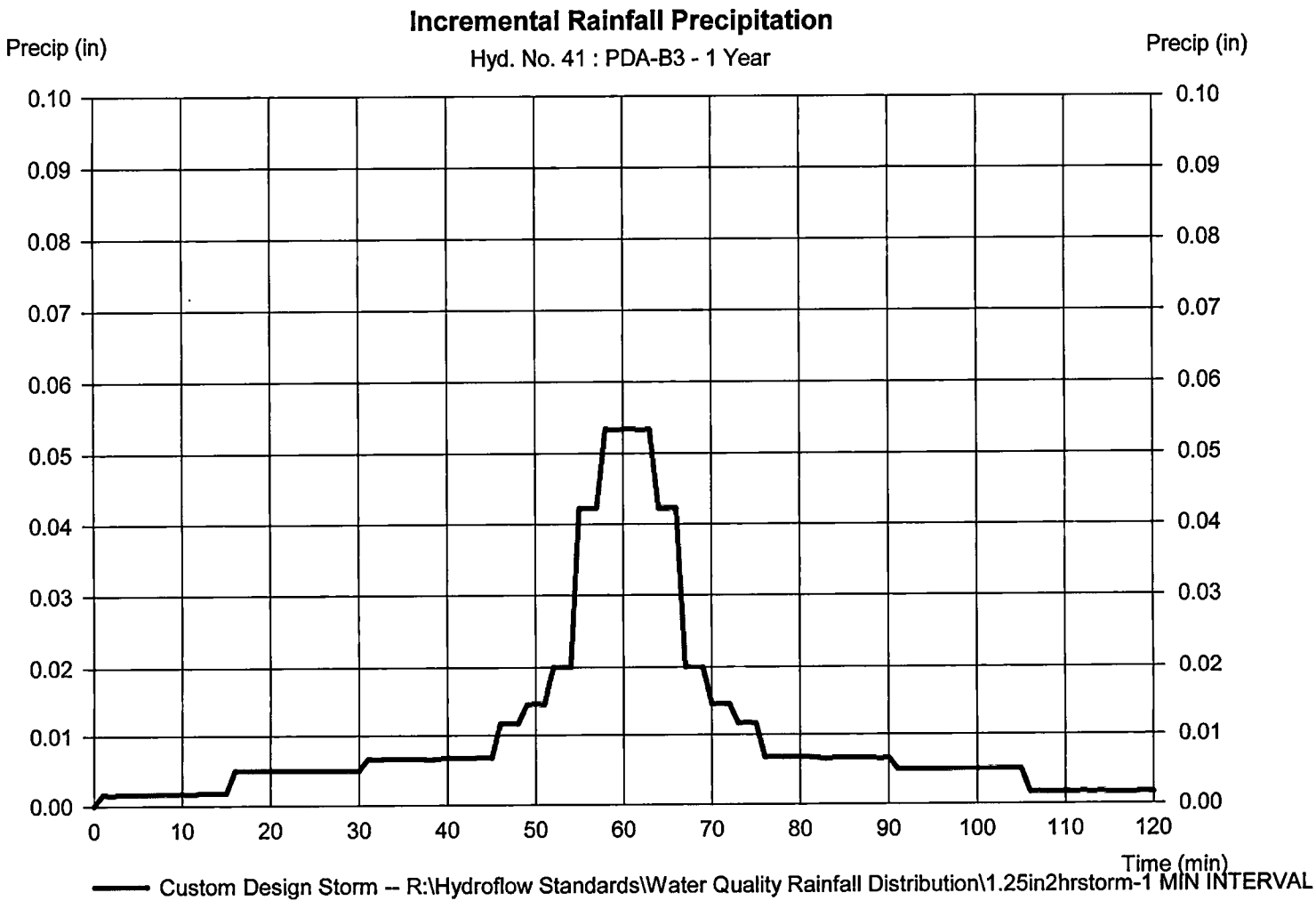


Precipitation Report

Hyd. No. 41

PDA-B3

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MII		

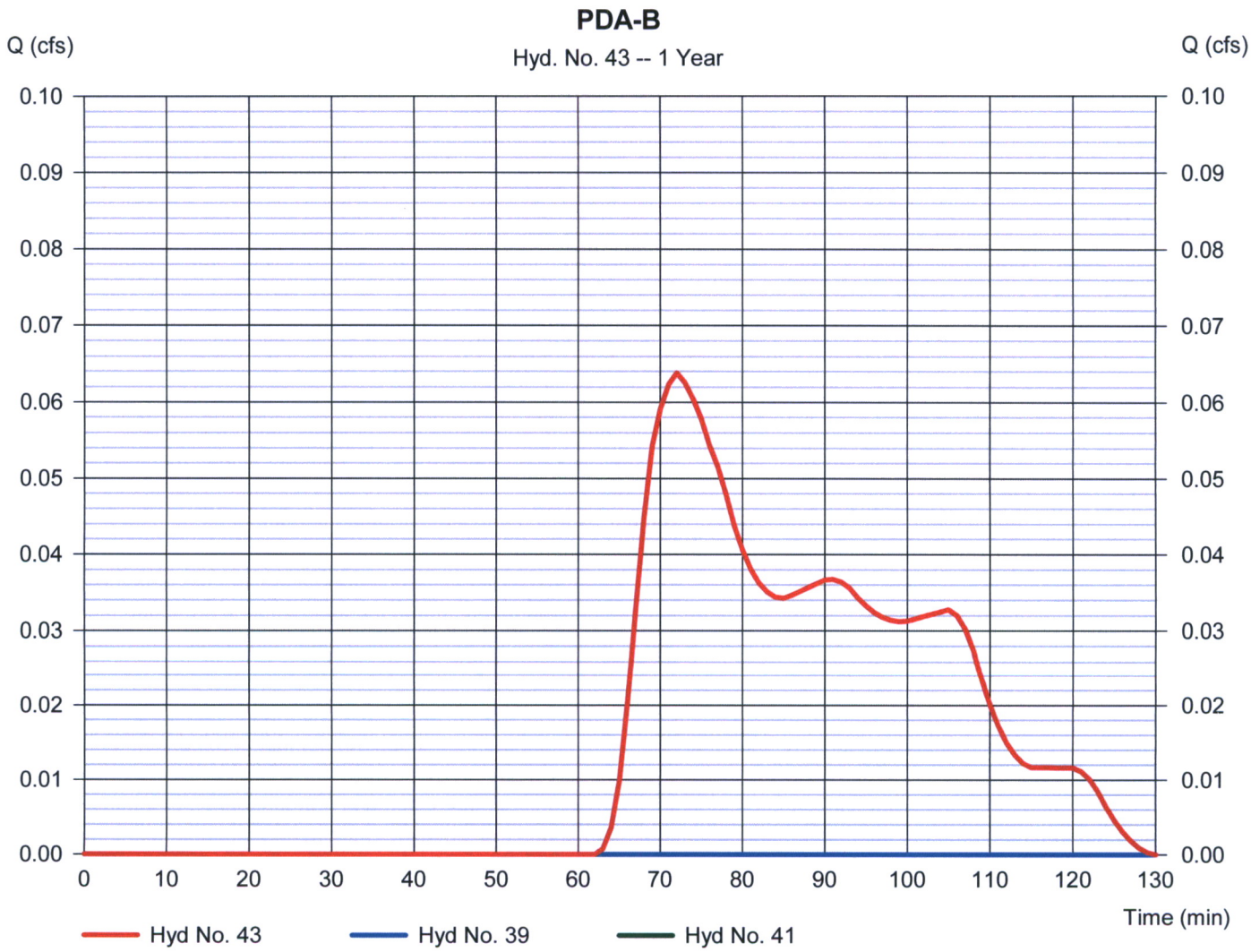


Hydrograph Report

Hyd. No. 43

PDA-B

Hydrograph type	= Combine	Peak discharge	= 0.064 cfs
Storm frequency	= 1 yrs	Time to peak	= 72 min
Time interval	= 1 min	Hyd. volume	= 116 cuft
Inflow hyds.	= 39, 41	Contrib. drain. area	= 0.500 ac

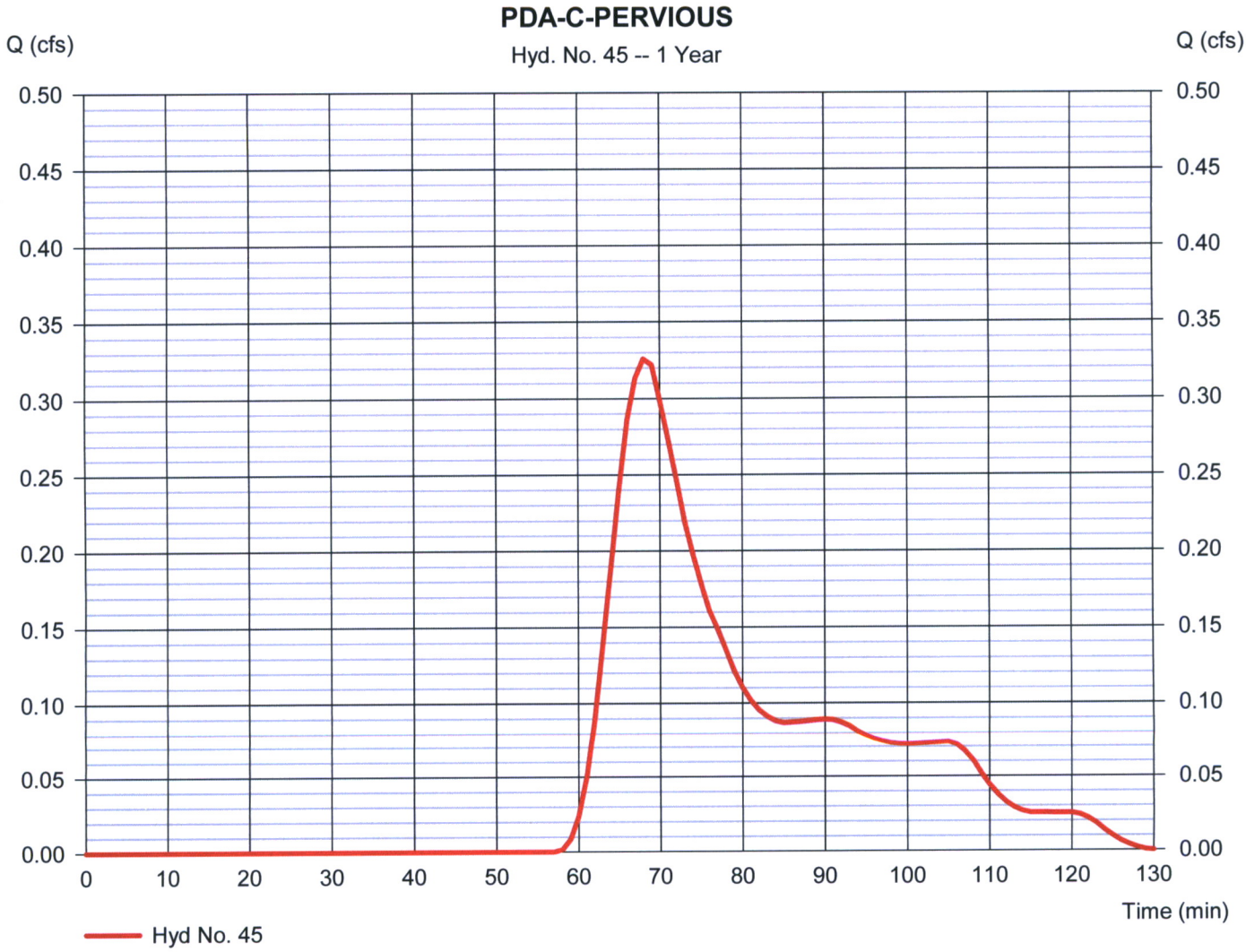


Hydrograph Report

Hyd. No. 45

PDA-C-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.326 cfs
Storm frequency	= 1 yrs	Time to peak	= 68 min
Time interval	= 1 min	Hyd. volume	= 409 cuft
Drainage area	= 0.560 ac	Curve number	= 81
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484

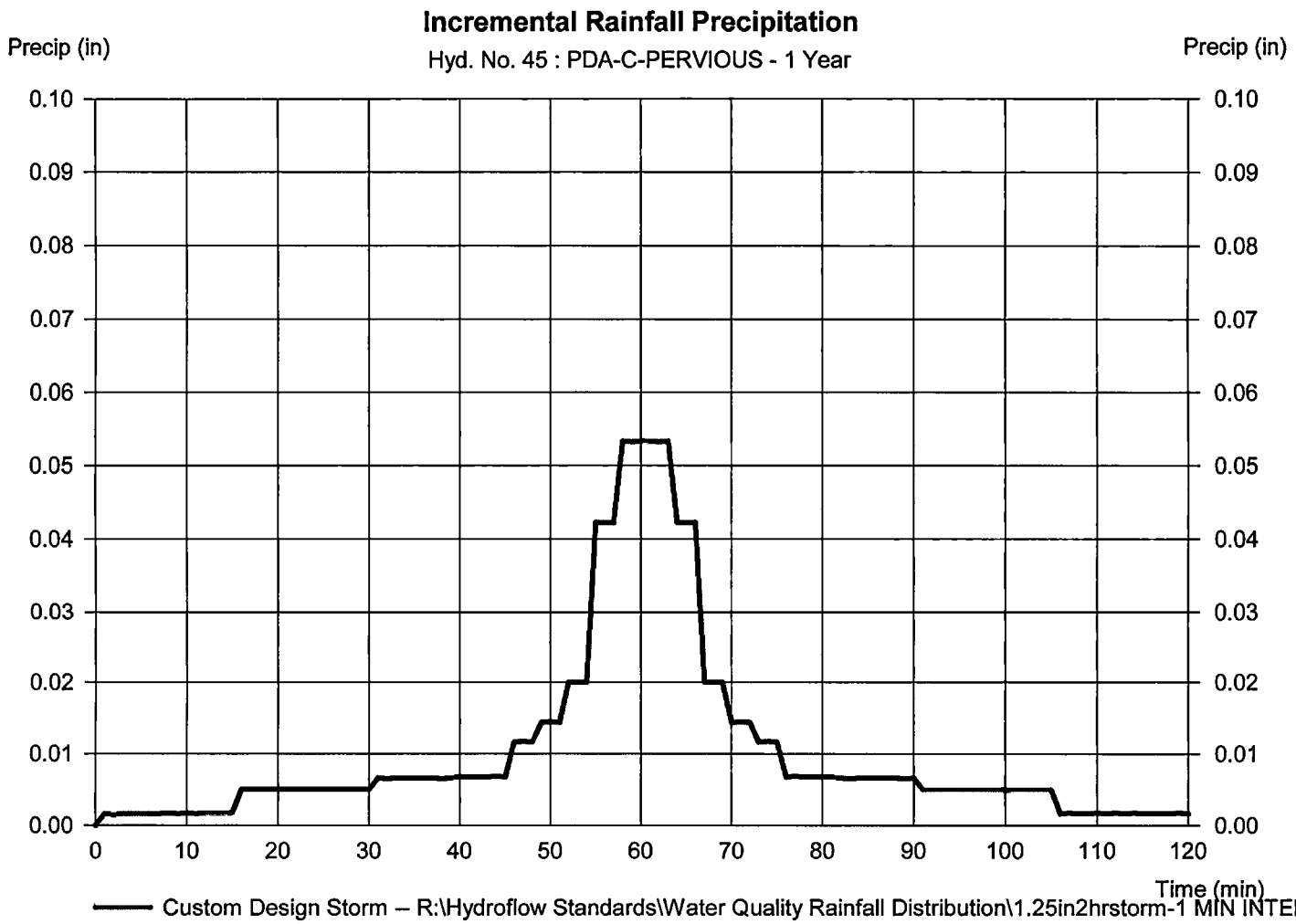


Precipitation Report

Hyd. No. 45

PDA-C-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

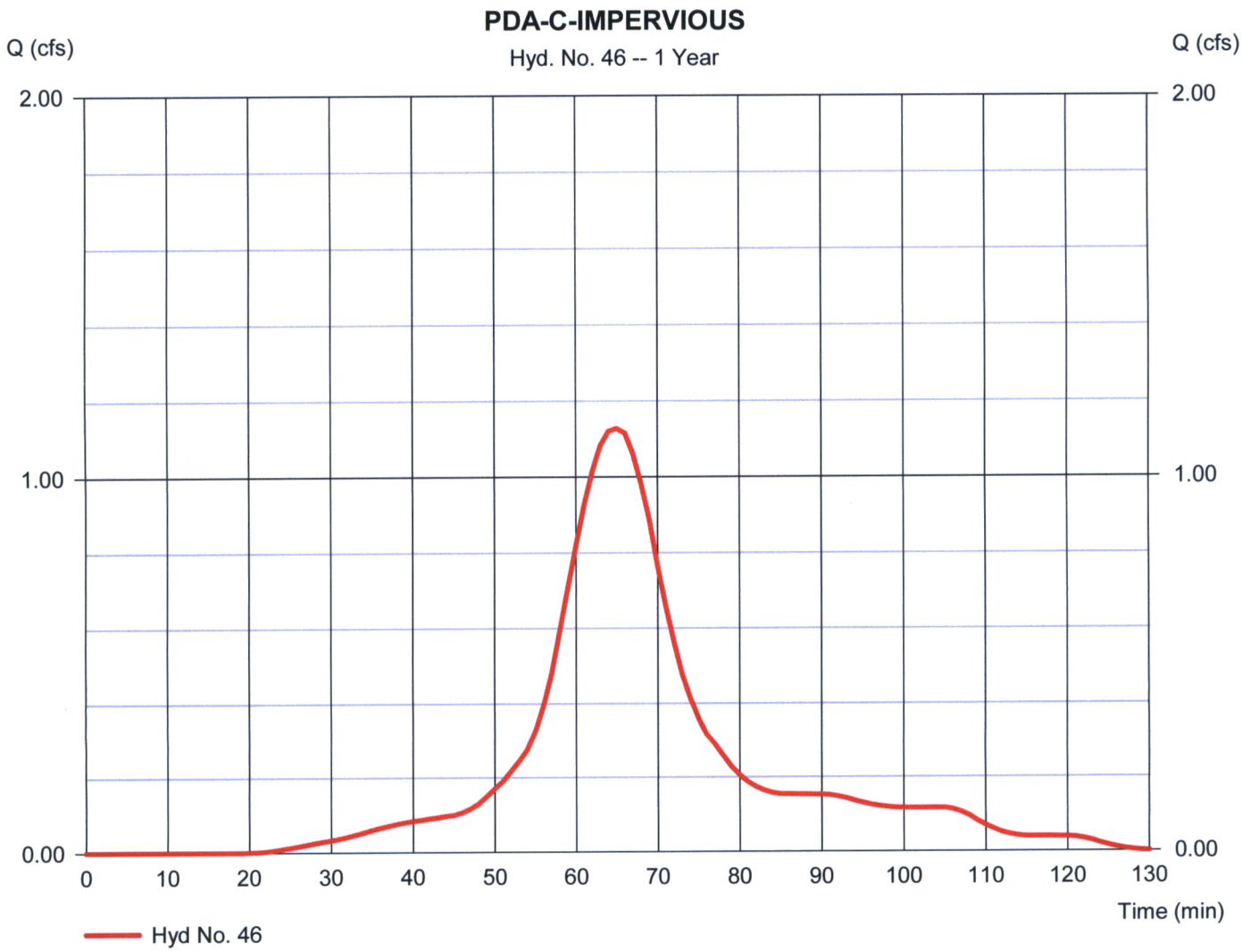


Hydrograph Report

Hyd. No. 46

PDA-C-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 1.127 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 1,472 cuft
Drainage area	= 0.380 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.50 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484

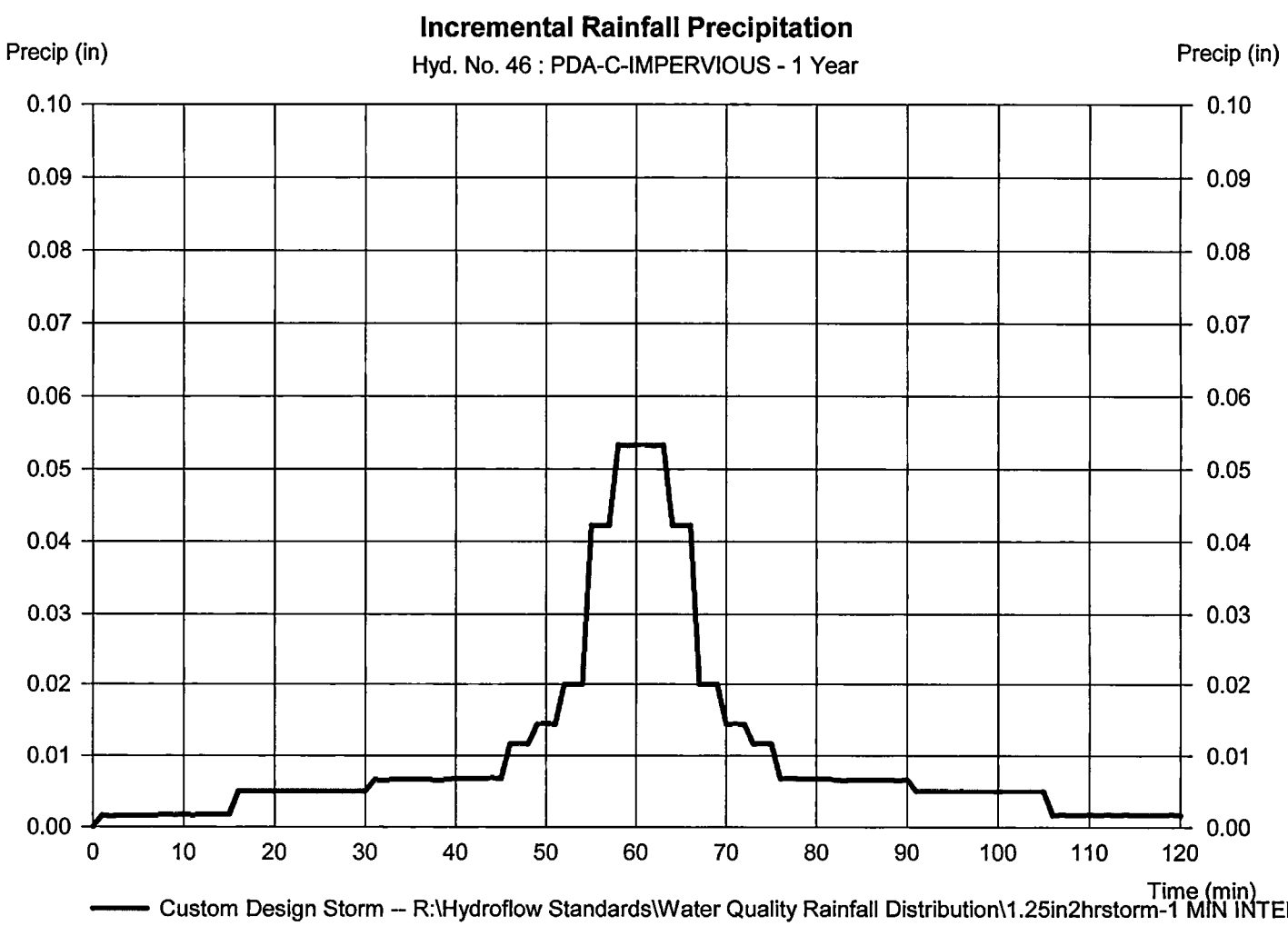


Precipitation Report

Hyd. No. 46

PDA-C-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

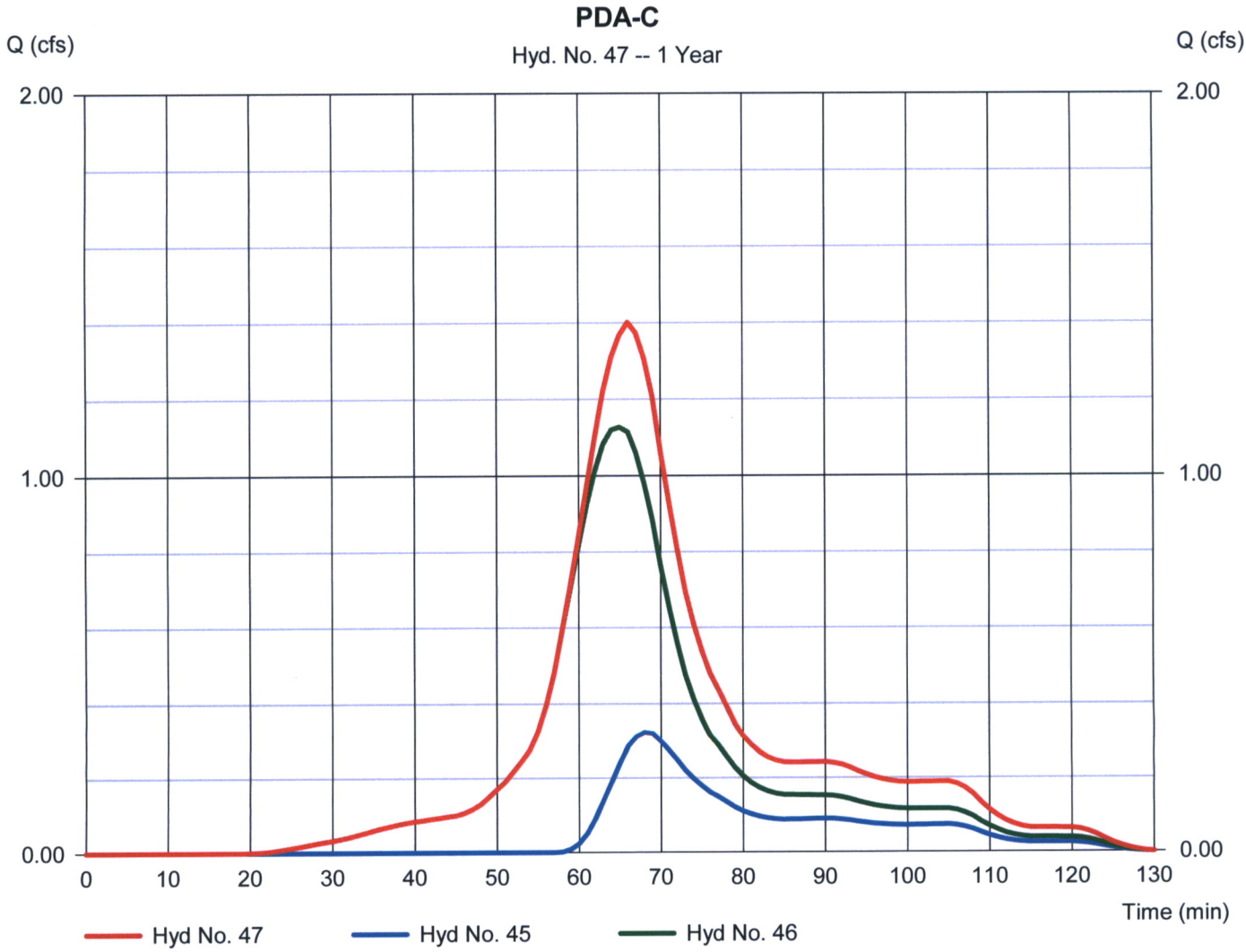


Hydrograph Report

Hyd. No. 47

PDA-C

Hydrograph type	= Combine	Peak discharge	= 1.401 cfs
Storm frequency	= 1 yrs	Time to peak	= 66 min
Time interval	= 1 min	Hyd. volume	= 1,880 cuft
Inflow hyds.	= 45, 46	Contrib. drain. area	= 0.940 ac

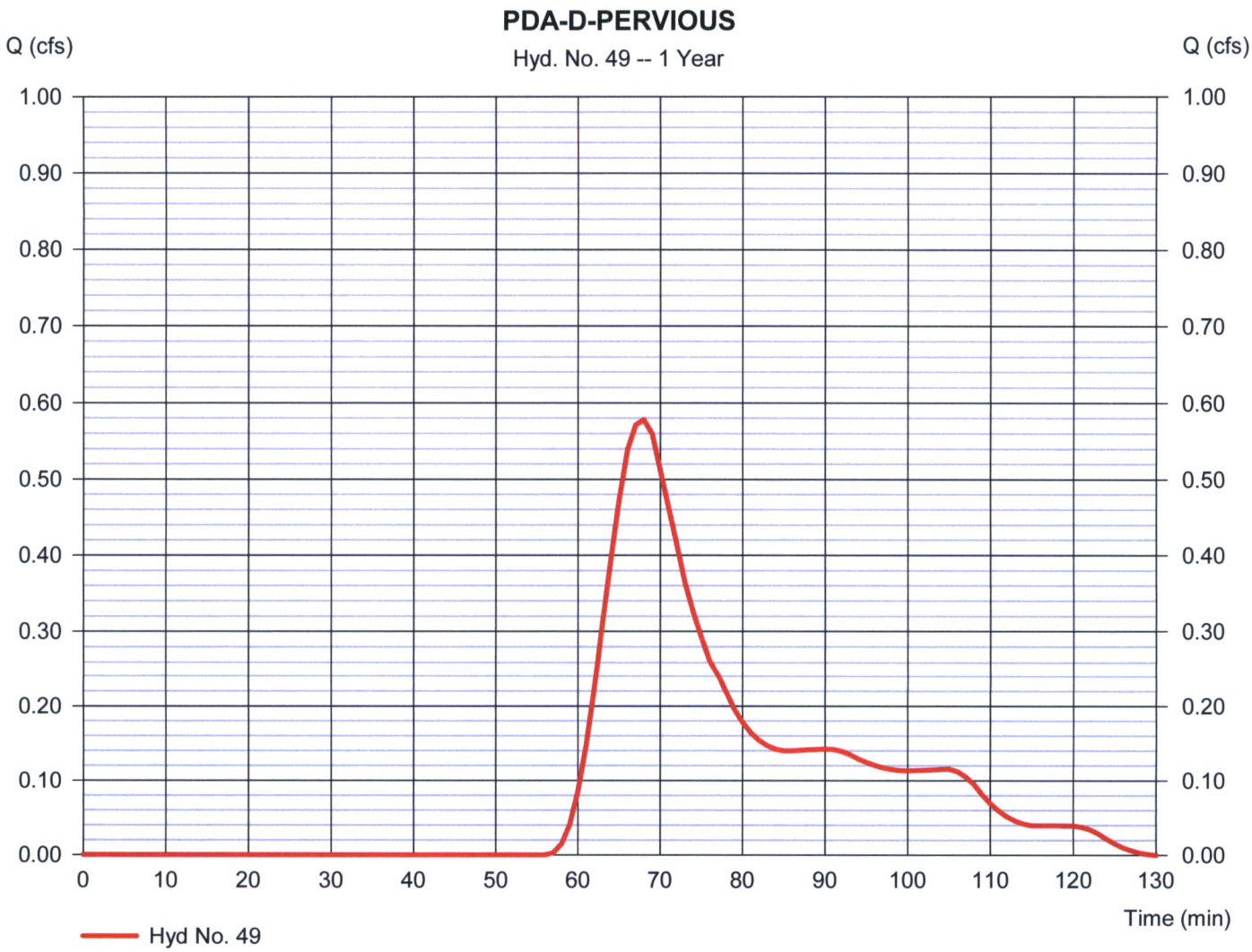


Hydrograph Report

Hyd. No. 49

PDA-D-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.578 cfs
Storm frequency	= 1 yrs	Time to peak	= 68 min
Time interval	= 1 min	Hyd. volume	= 704 cuft
Drainage area	= 0.770 ac	Curve number	= 83
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MI	Shape factor	= 484

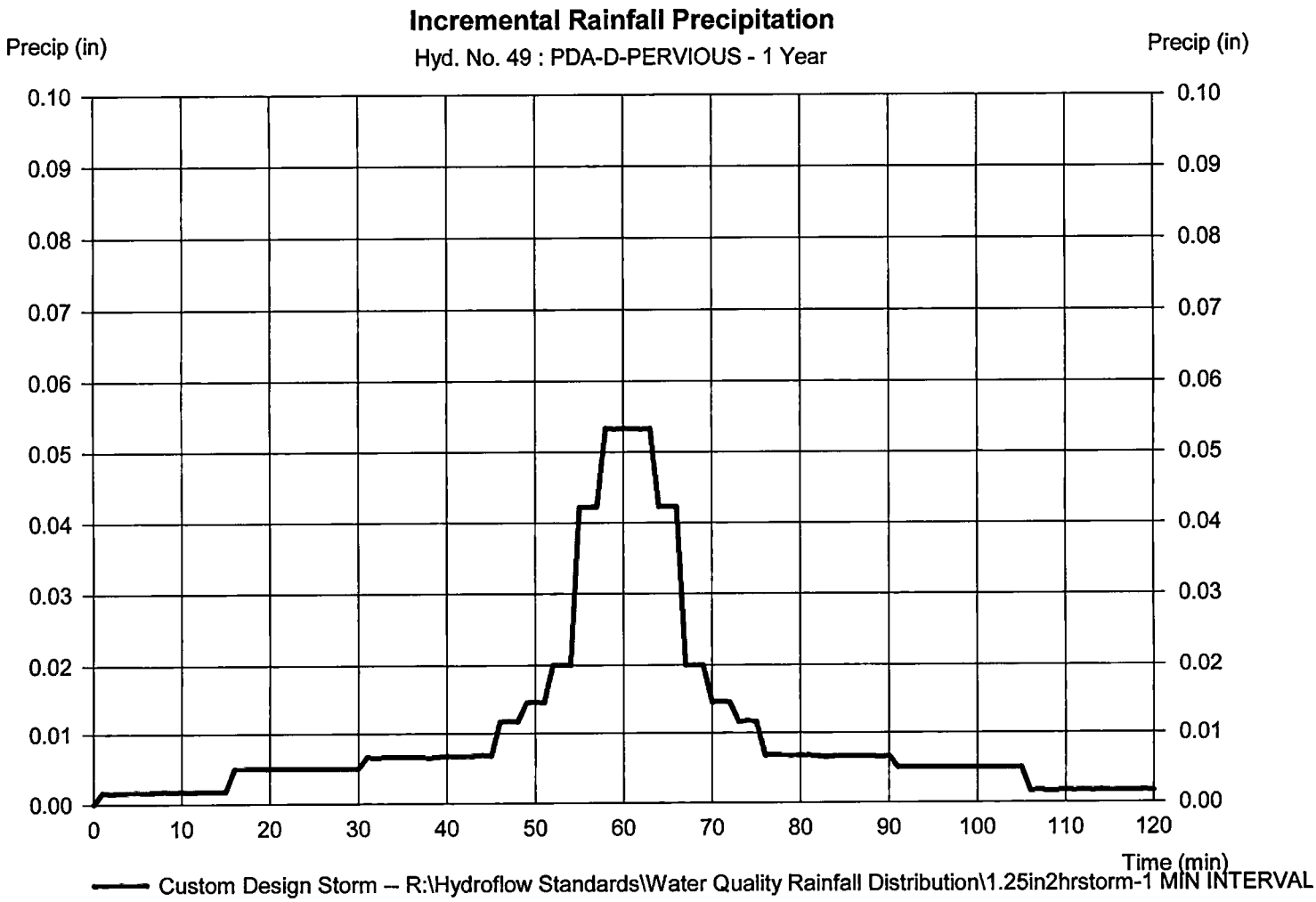


Precipitation Report

Hyd. No. 49

PDA-D-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MII		



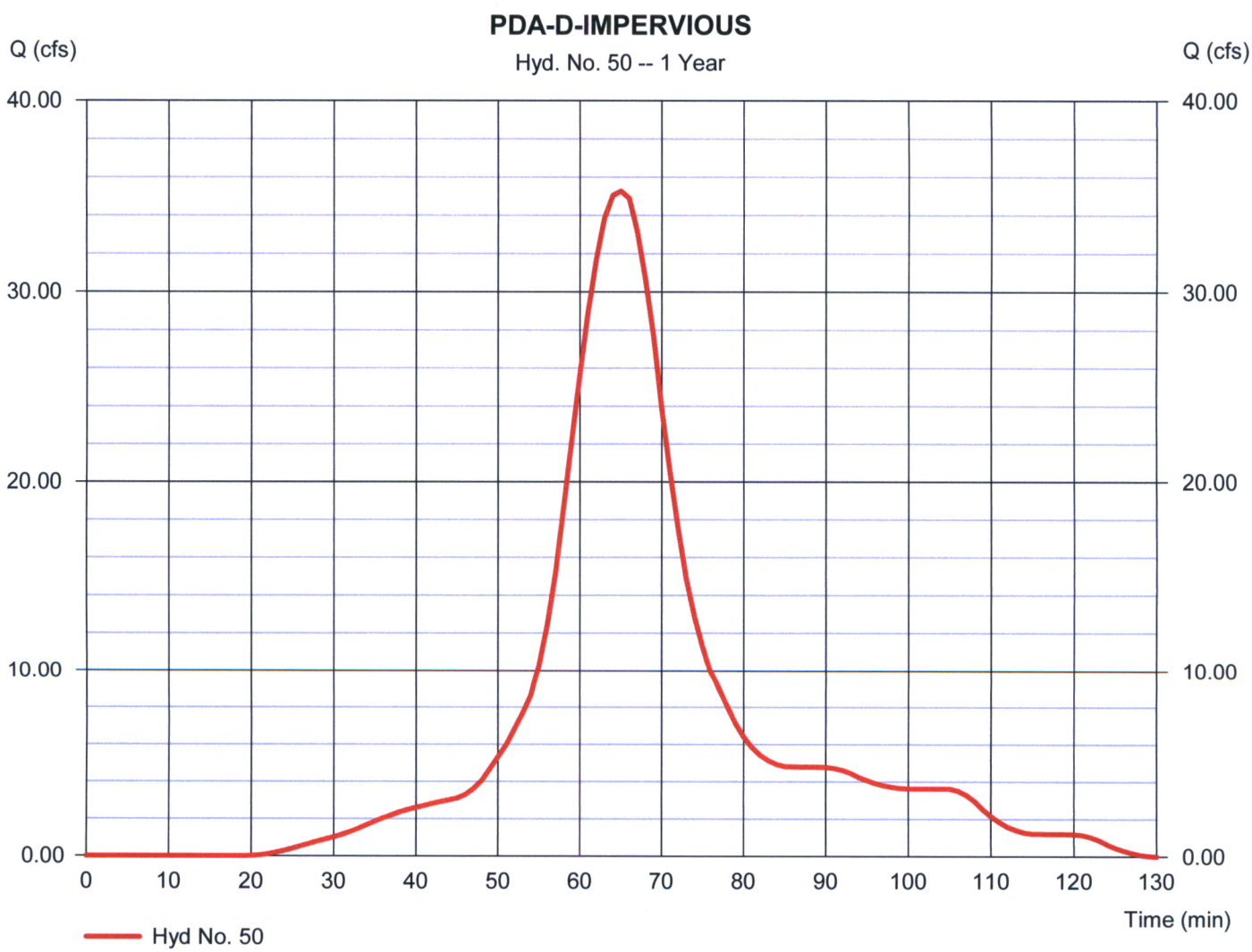
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Monday, 11 / 2 / 2020

Hyd. No. 50

PDA-D-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 35.26 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 46,048 cuft
Drainage area	= 11.890 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\1.25in2hrstorm-1 MI	Shape factor	= 484

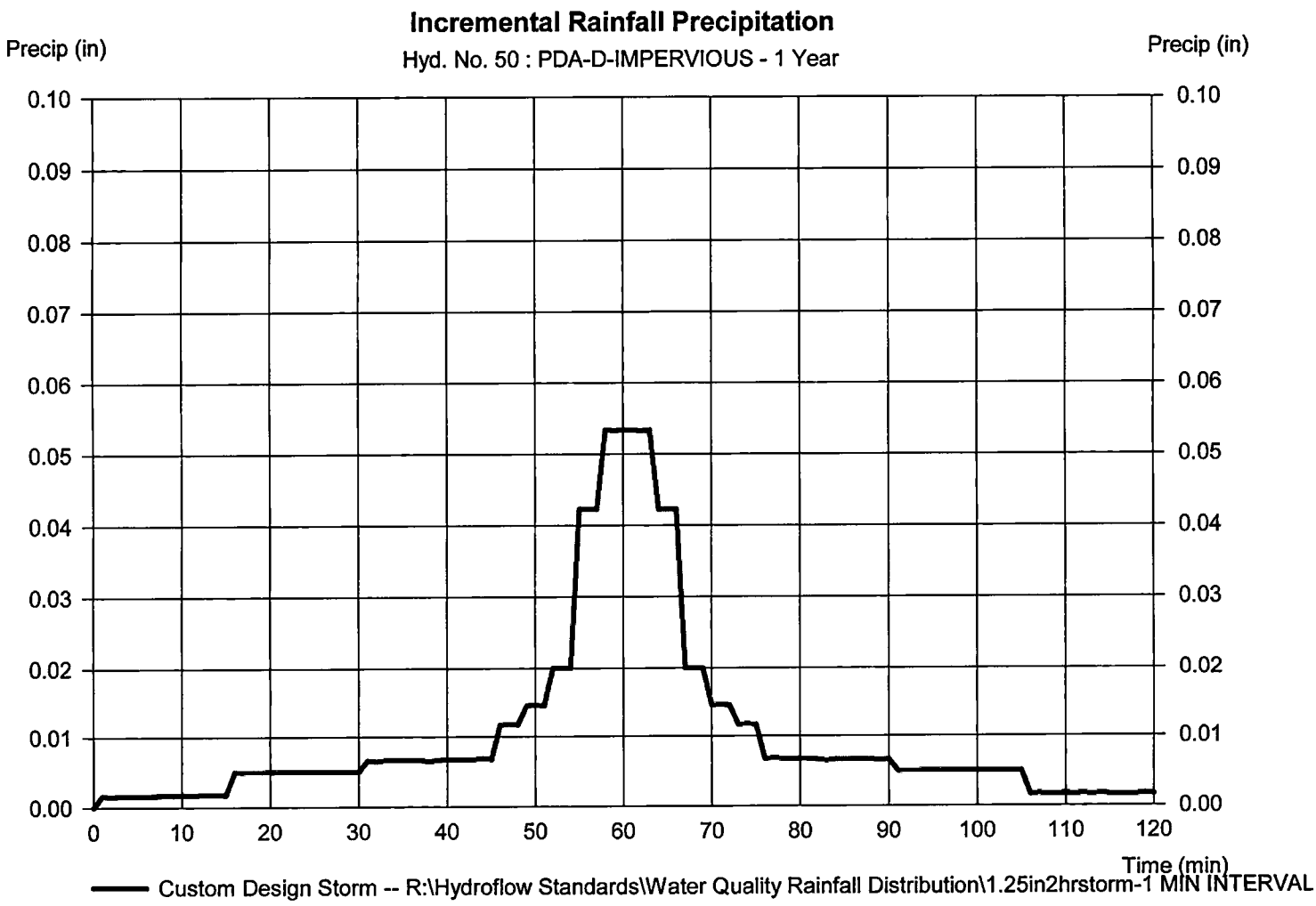


Precipitation Report

Hyd. No. 50

PDA-D-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

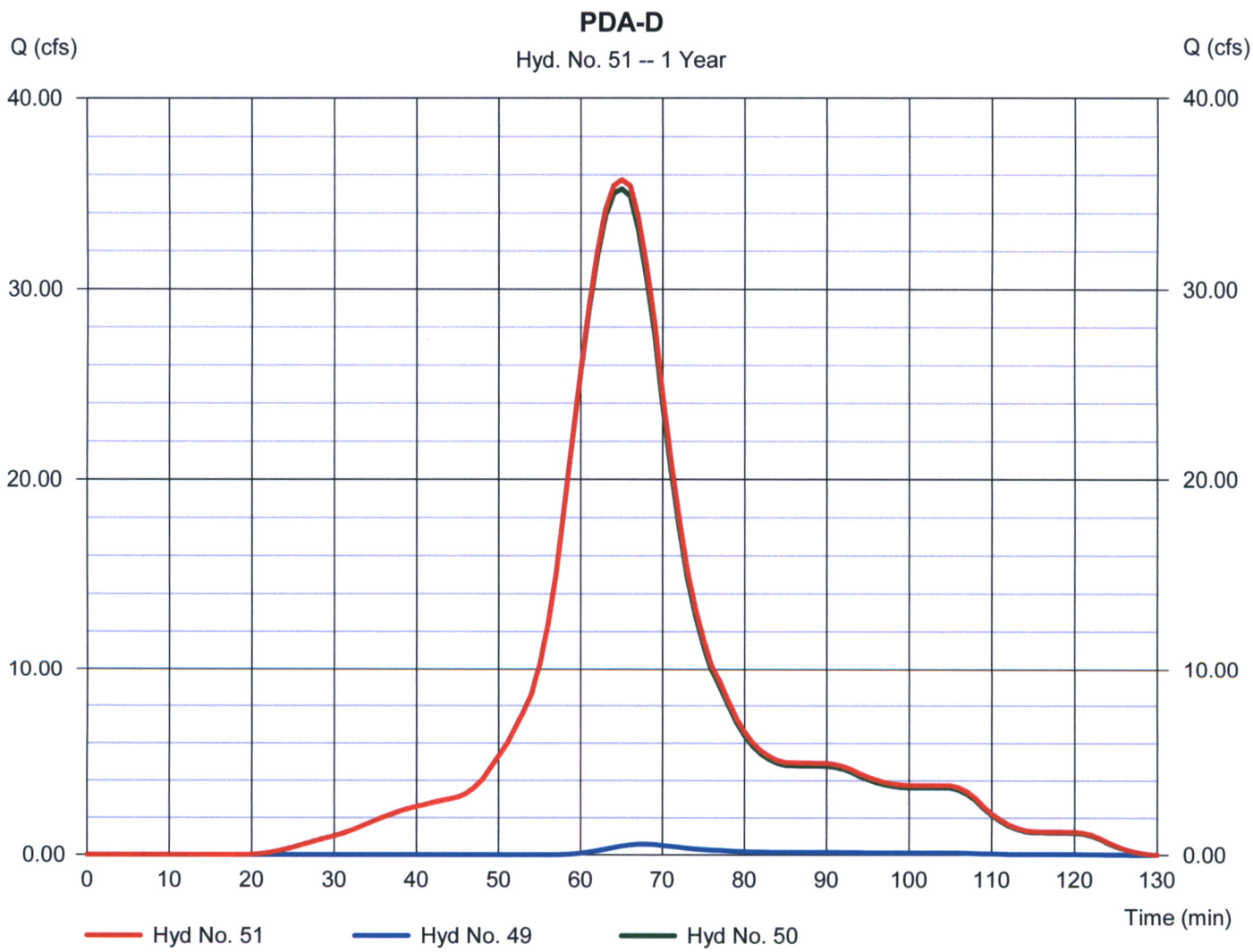


Hydrograph Report

Hyd. No. 51

PDA-D

Hydrograph type	= Combine	Peak discharge	= 35.74 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 46,753 cuft
Inflow hyds.	= 49, 50	Contrib. drain. area	= 12.660 ac



Hydrograph Report

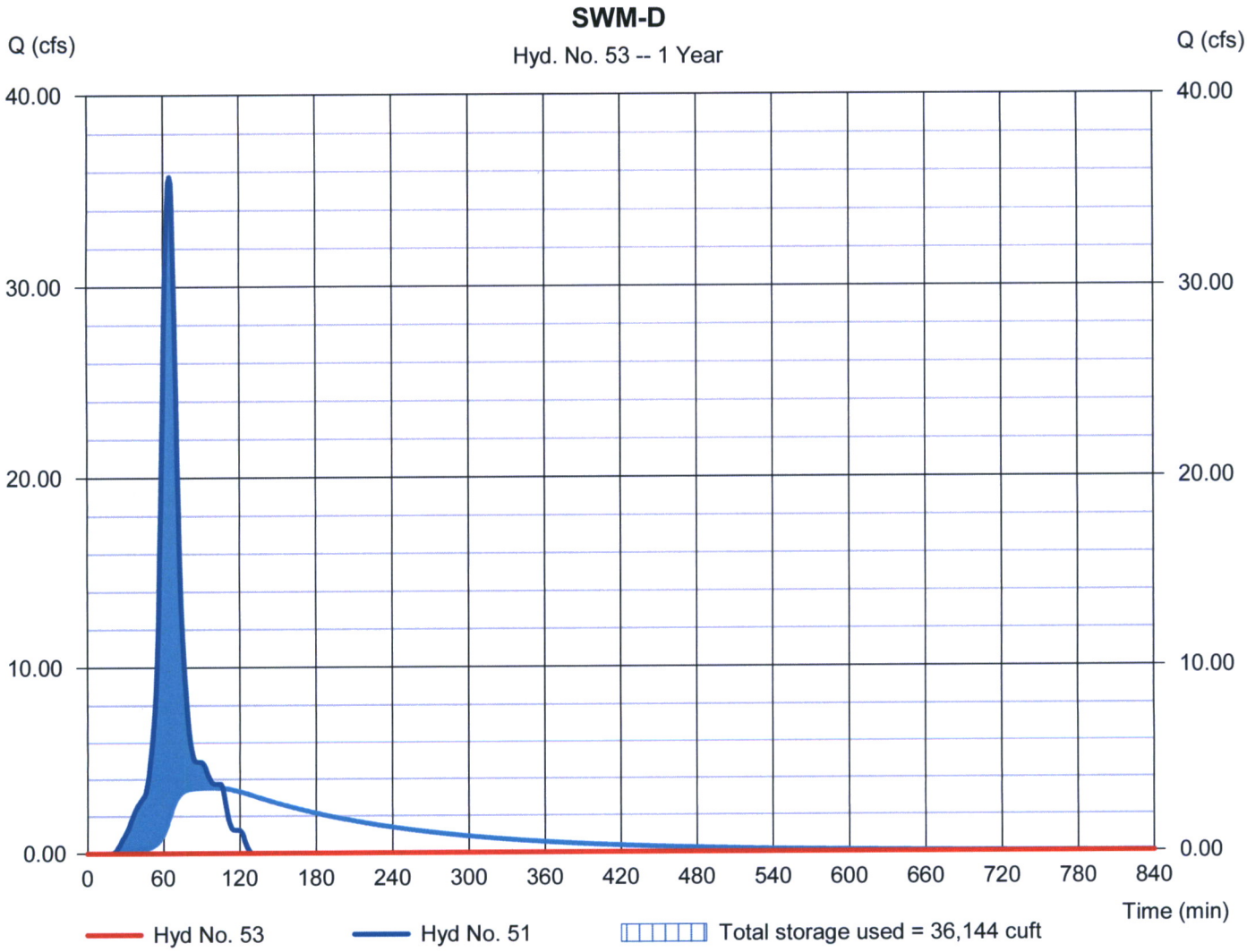
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Hyd. No. 53

SWM-D

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 62 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 51 - PDA-D	Max. Elevation	= 599.41 ft
Reservoir name	= SWM-D	Max. Storage	= 36,144 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 4 - SWM-D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 598.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	598.00	23,768	0	0
1.00	599.00	26,054	24,900	24,900
2.00	600.00	28,387	27,209	52,109
3.00	601.00	30,767	29,566	81,675
4.00	602.00	33,193	31,969	113,644
5.00	603.00	35,667	34,419	148,064
6.00	604.00	38,187	36,916	184,980
7.00	605.00	40,754	39,460	224,439

Culvert / Orifice Structures

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

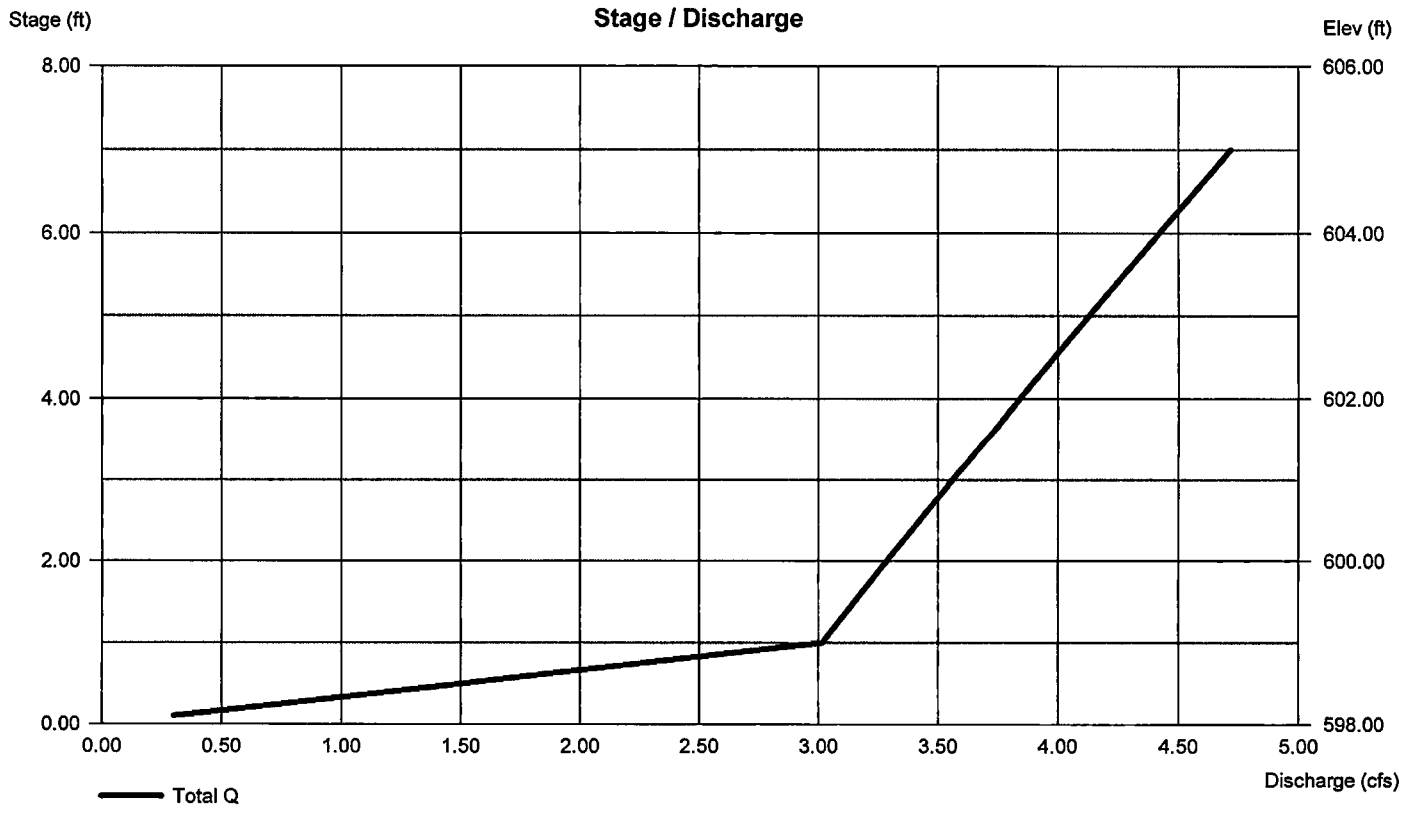
Weir Structures

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

Exfil.(in/hr) = 5.000 (by Contour)

TW Elev. (ft) = 0.00

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

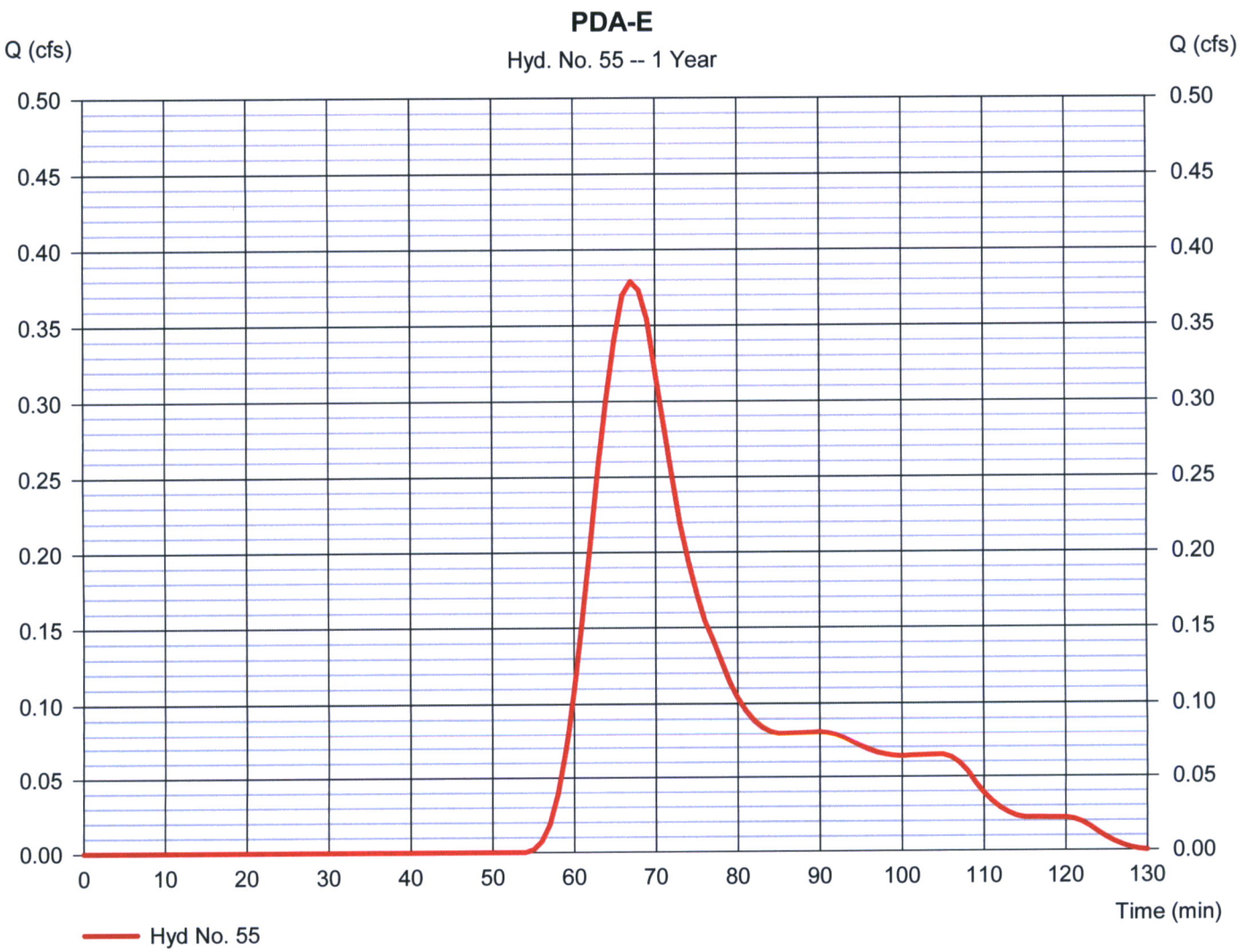


Hydrograph Report

Hyd. No. 55

PDA-E

Hydrograph type	= SCS Runoff	Peak discharge	= 0.379 cfs
Storm frequency	= 1 yrs	Time to peak	= 67 min
Time interval	= 1 min	Hyd. volume	= 451 cuft
Drainage area	= 0.360 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484

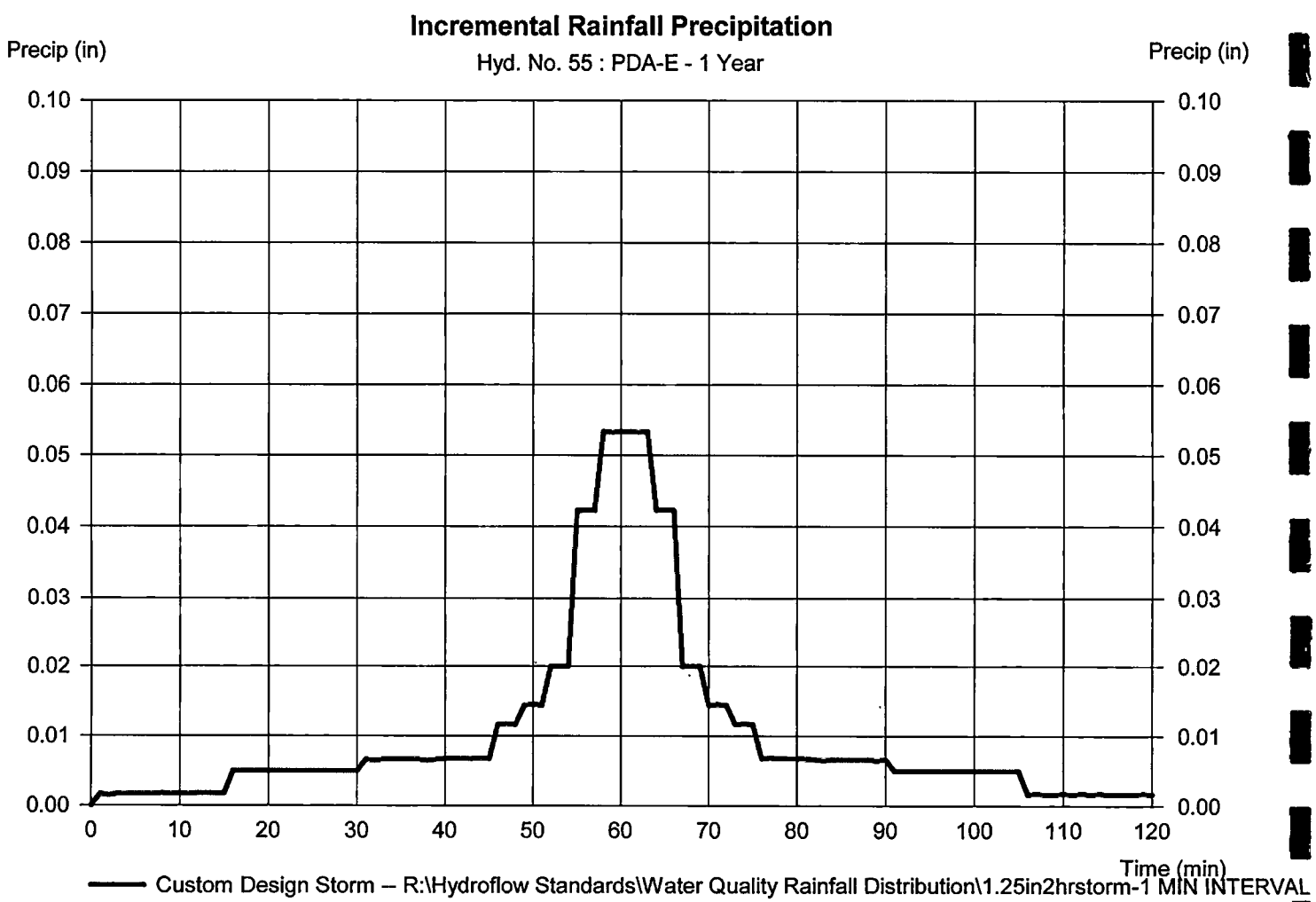


Precipitation Report

Hyd. No. 55

PDA-E

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

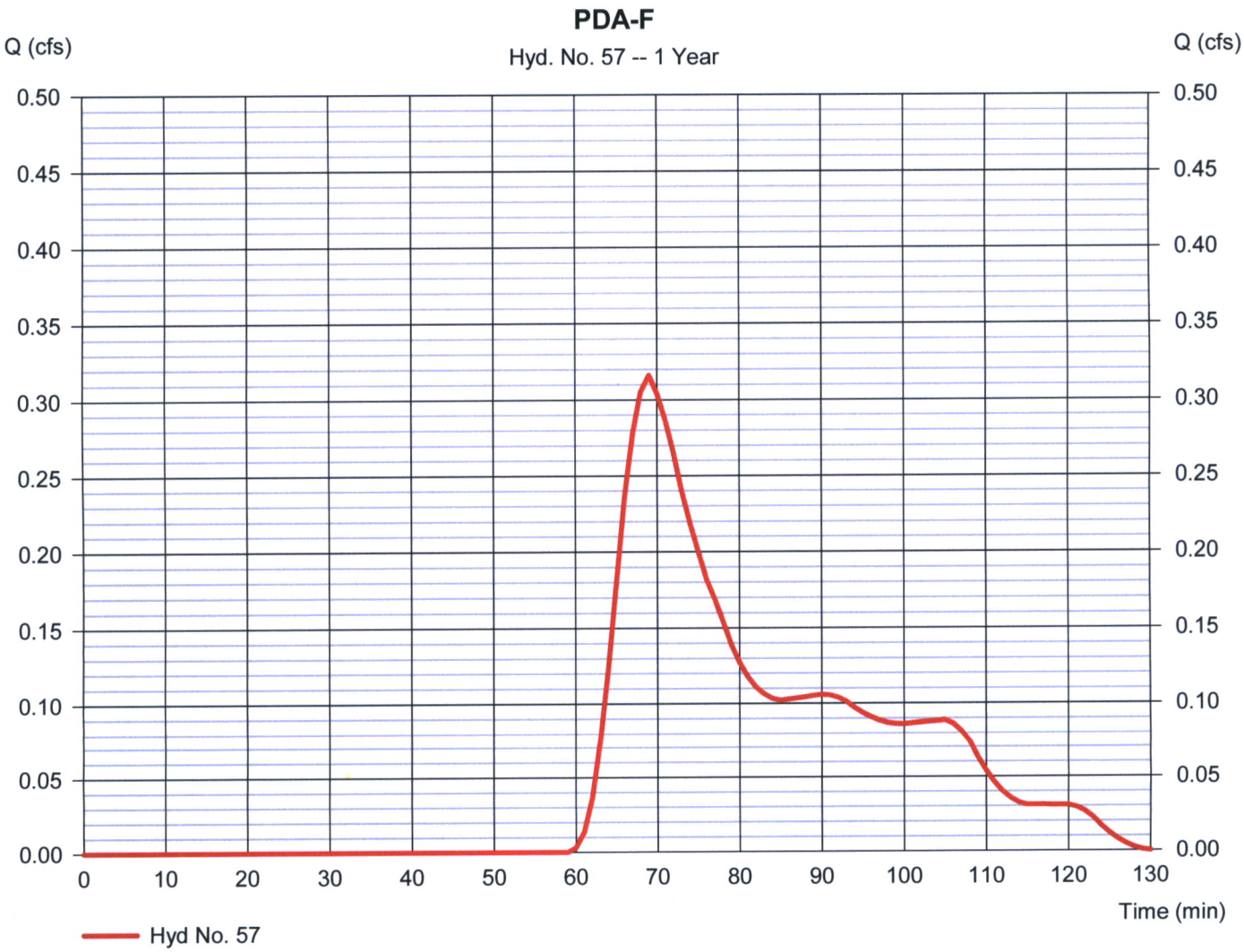


Hydrograph Report

Hyd. No. 57

PDA-F

Hydrograph type	= SCS Runoff	Peak discharge	= 0.316 cfs
Storm frequency	= 1 yrs	Time to peak	= 69 min
Time interval	= 1 min	Hyd. volume	= 427 cuft
Drainage area	= 0.850 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484

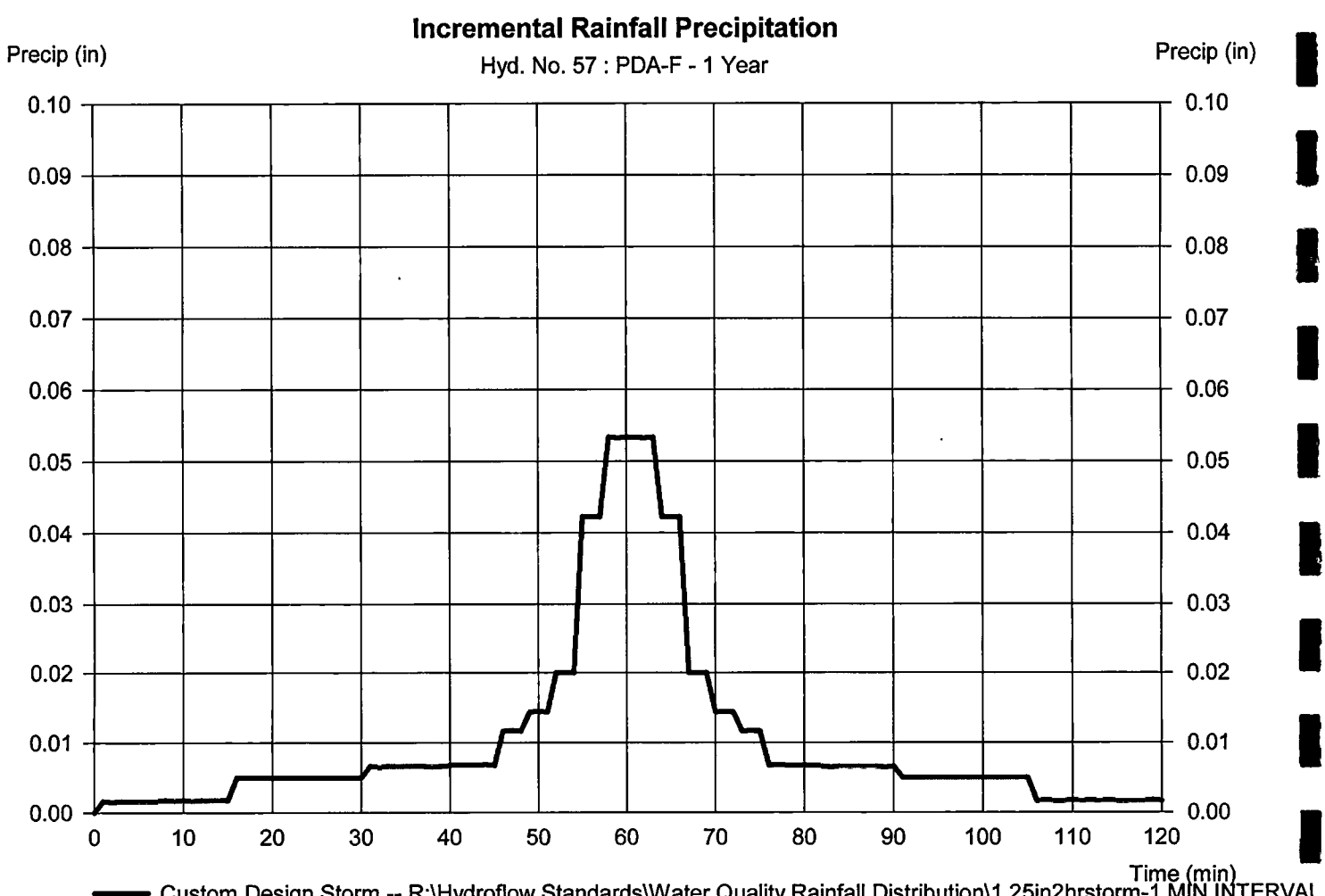


Precipitation Report

Hyd. No. 57

PDA-F

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

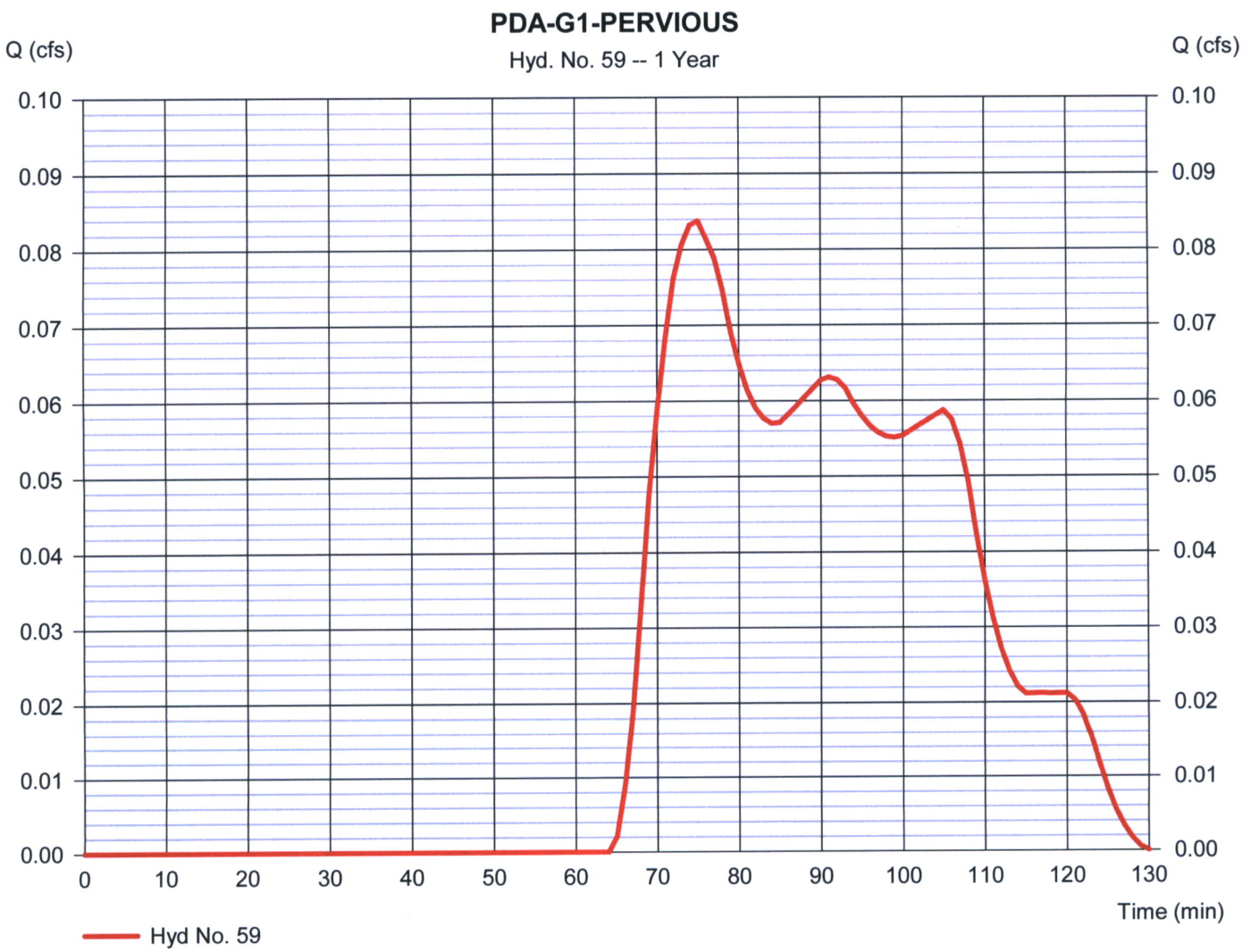


Hydrograph Report

Hyd. No. 59

PDA-G1-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.084 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 1 min	Hyd. volume	= 177 cuft
Drainage area	= 1.140 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484

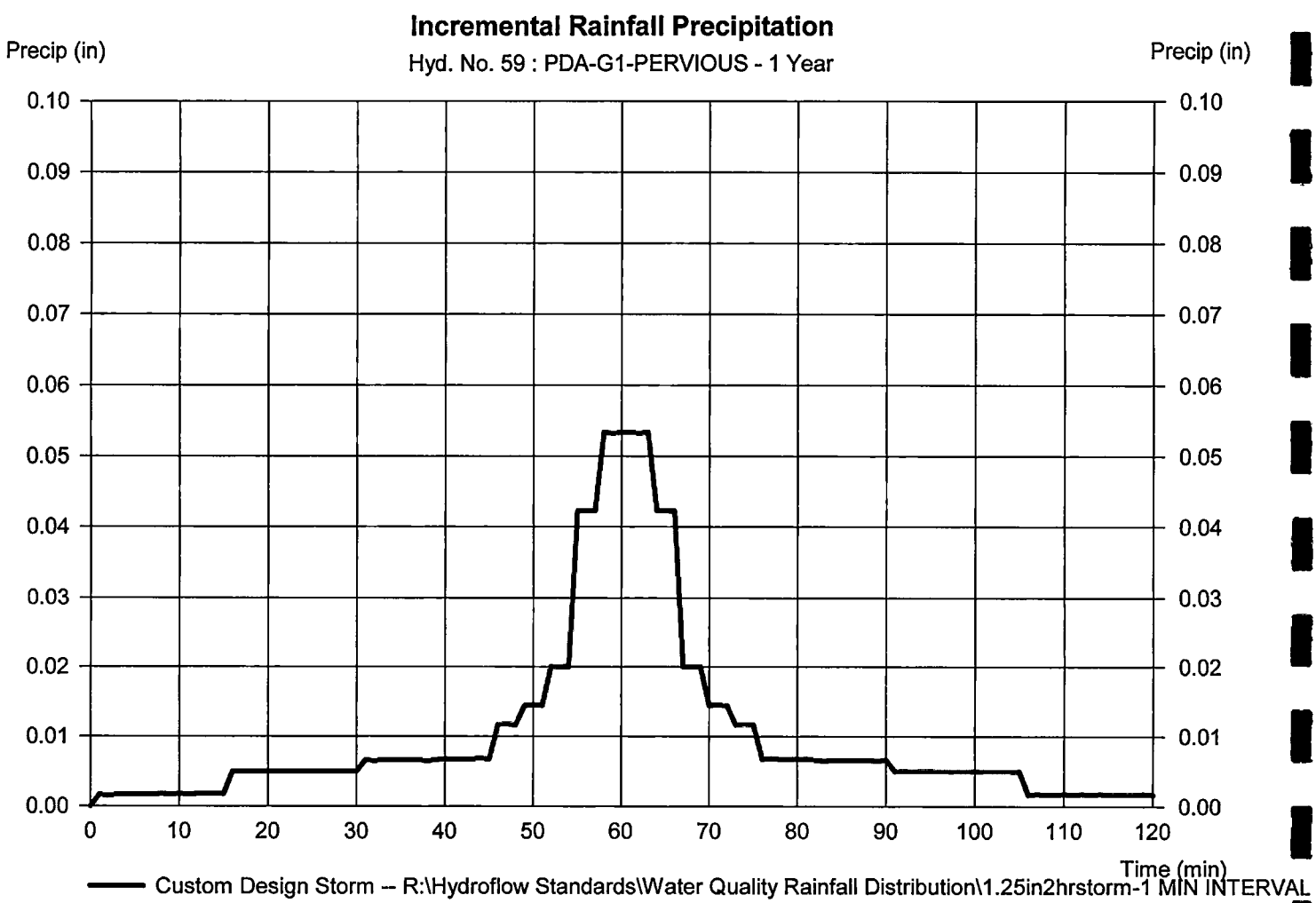


Precipitation Report

Hyd. No. 59

PDA-G1-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

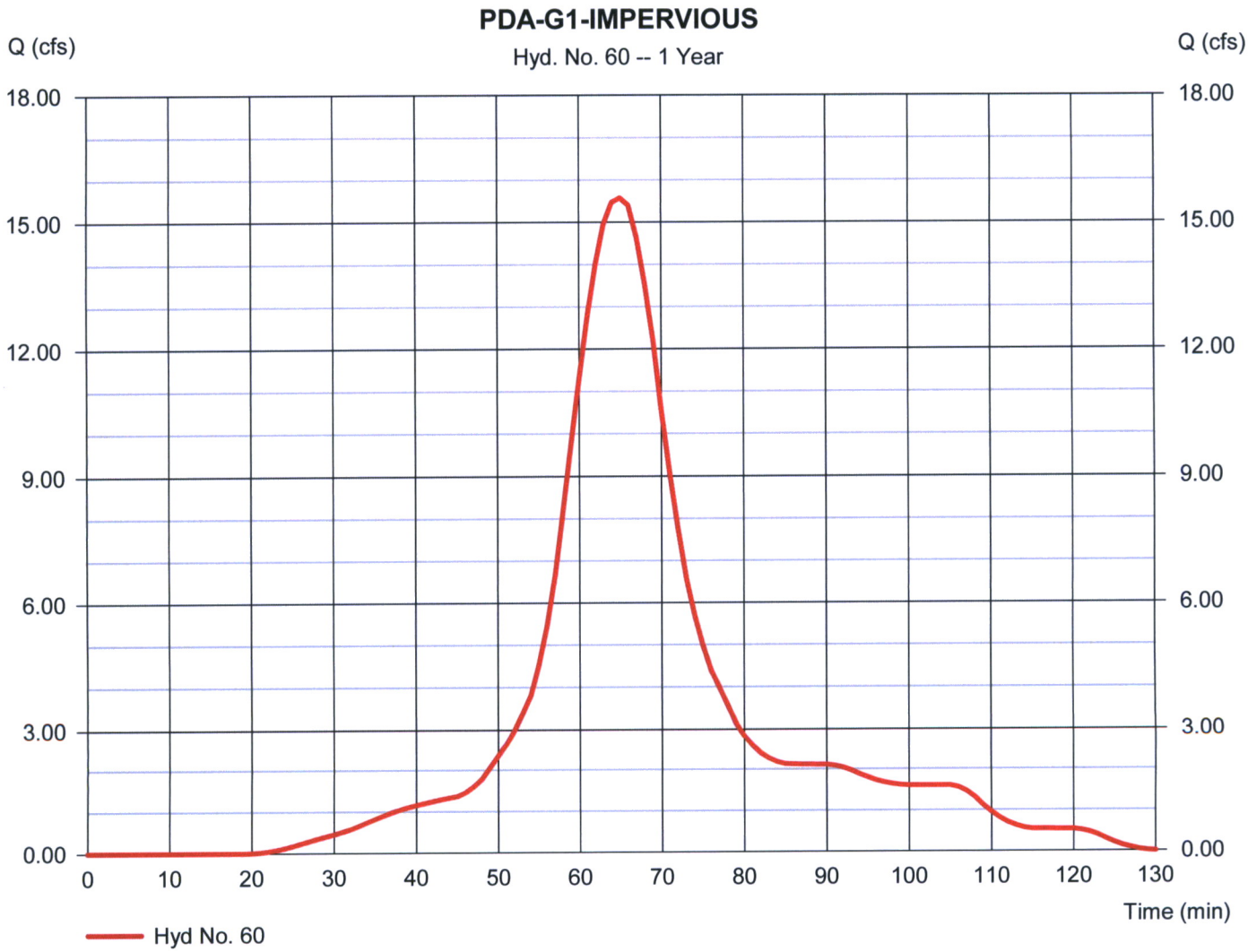


Hydrograph Report

Hyd. No. 60

PDA-G1-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 15.57 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 20,332 cuft
Drainage area	= 5.250 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MIN	Shape factor	= 484

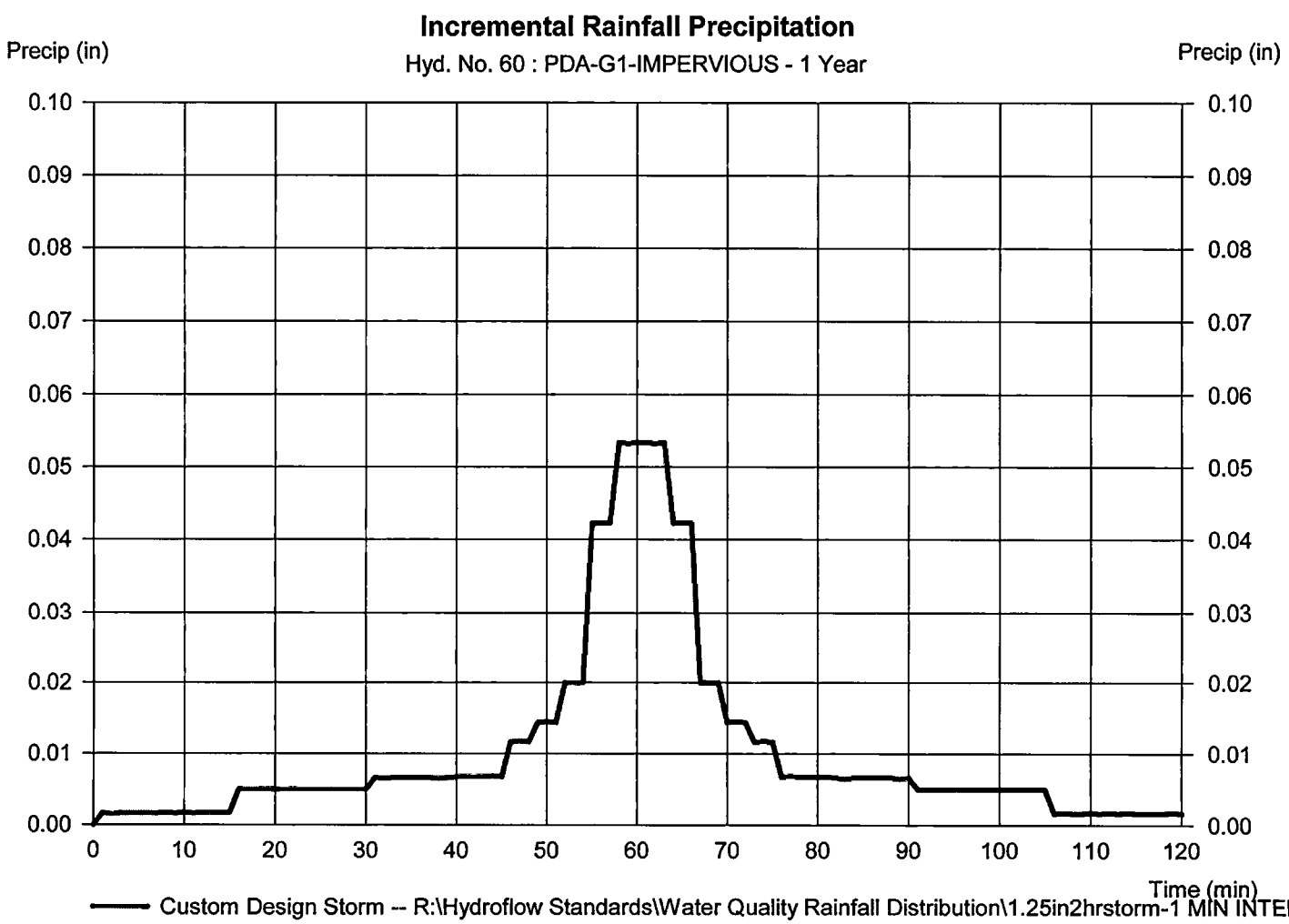


Precipitation Report

Hyd. No. 60

PDA-G1-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

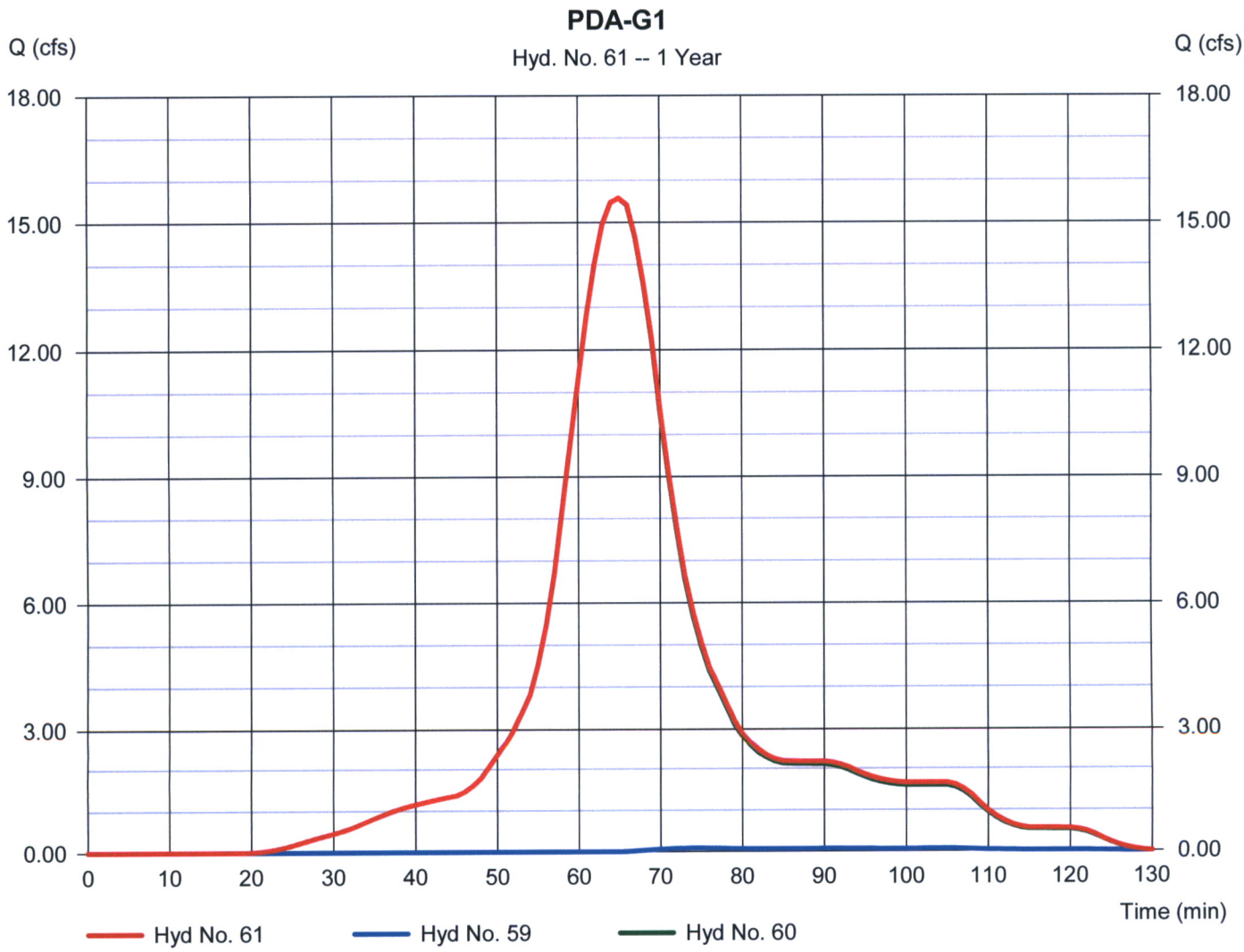


Hydrograph Report

Hyd. No. 61

PDA-G1

Hydrograph type	= Combine	Peak discharge	= 15.57 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 20,510 cuft
Inflow hyds.	= 59, 60	Contrib. drain. area	= 6.390 ac



Hydrograph Report

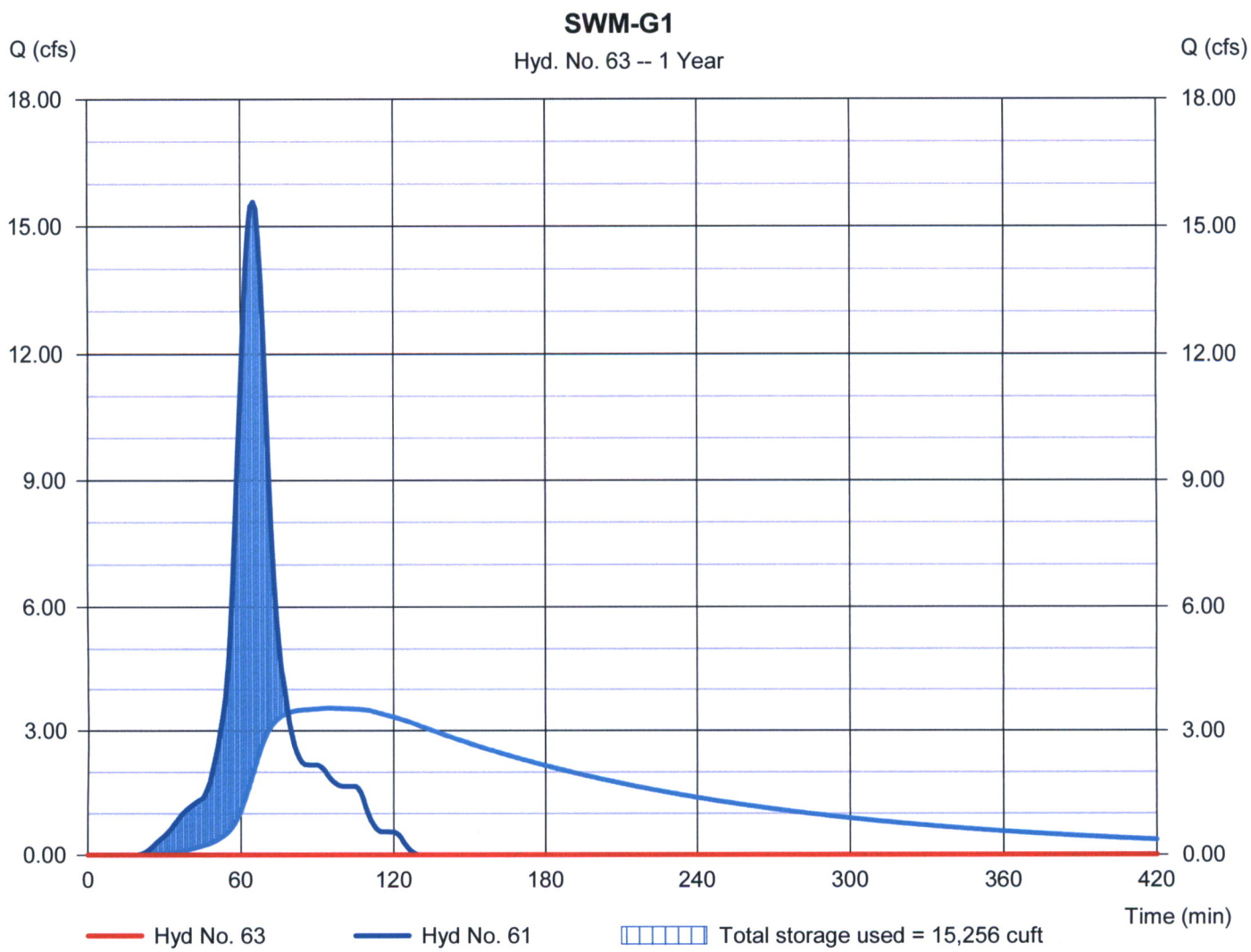
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Monday, 11 / 2 / 2020

Hyd. No. 63

SWM-G1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 63 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 61 - PDA-G1	Max. Elevation	= 597.21 ft
Reservoir name	= SWM-G1	Max. Storage	= 15,256 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 5 - SWM-G1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 596.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	596.00	10,939	0	0
1.00	597.00	13,385	12,140	12,140
2.00	598.00	16,090	14,716	26,856
3.00	599.00	19,035	17,540	44,396
4.00	600.00	22,232	20,611	65,007
5.00	601.00	32,957	27,416	92,423

Culvert / Orifice Structures

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

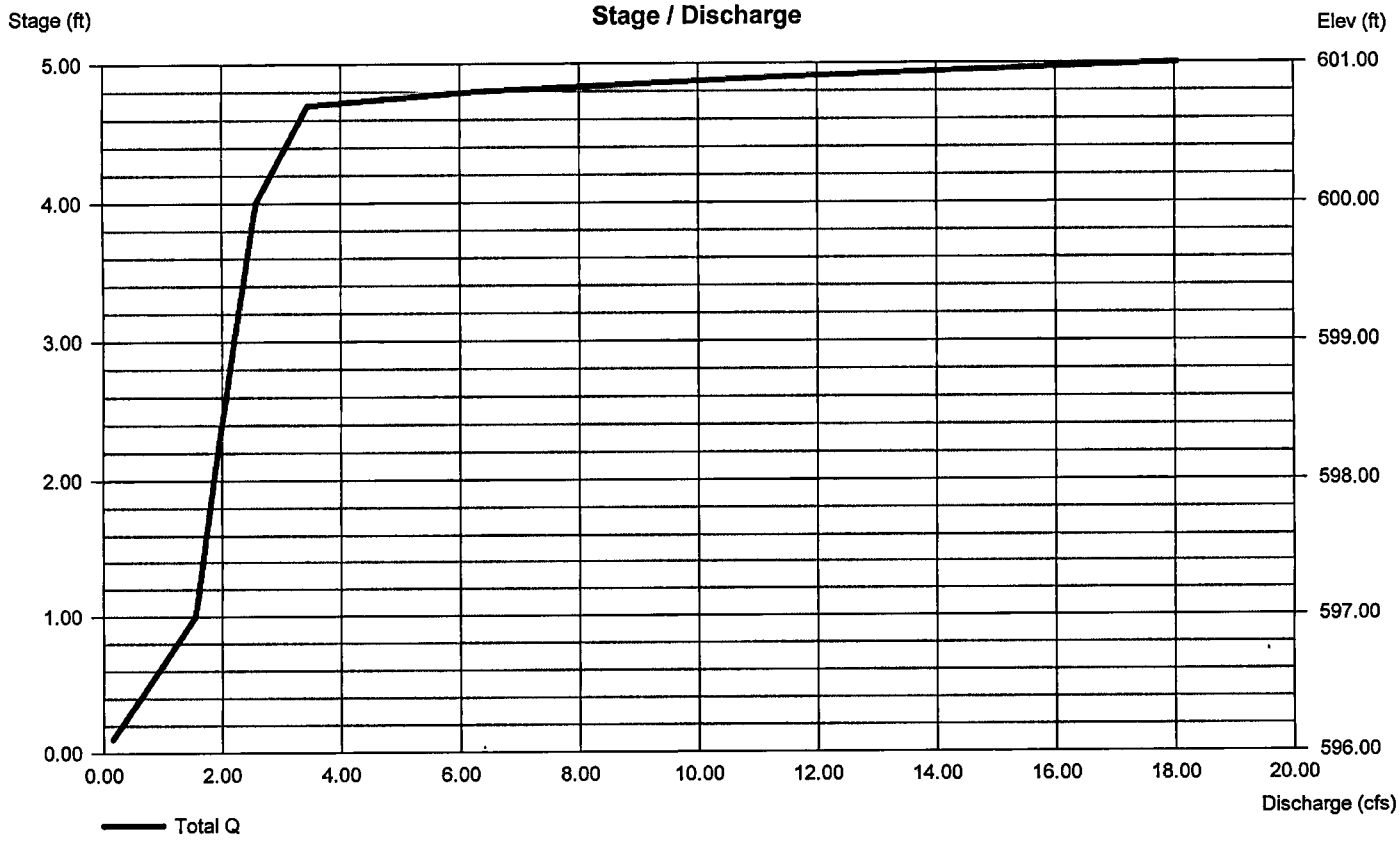
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 26.00	0.00	0.00	0.00
Crest El. (ft)	= 600.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 5.000 (by Contour)

TW Elev. (ft) = 0.00

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

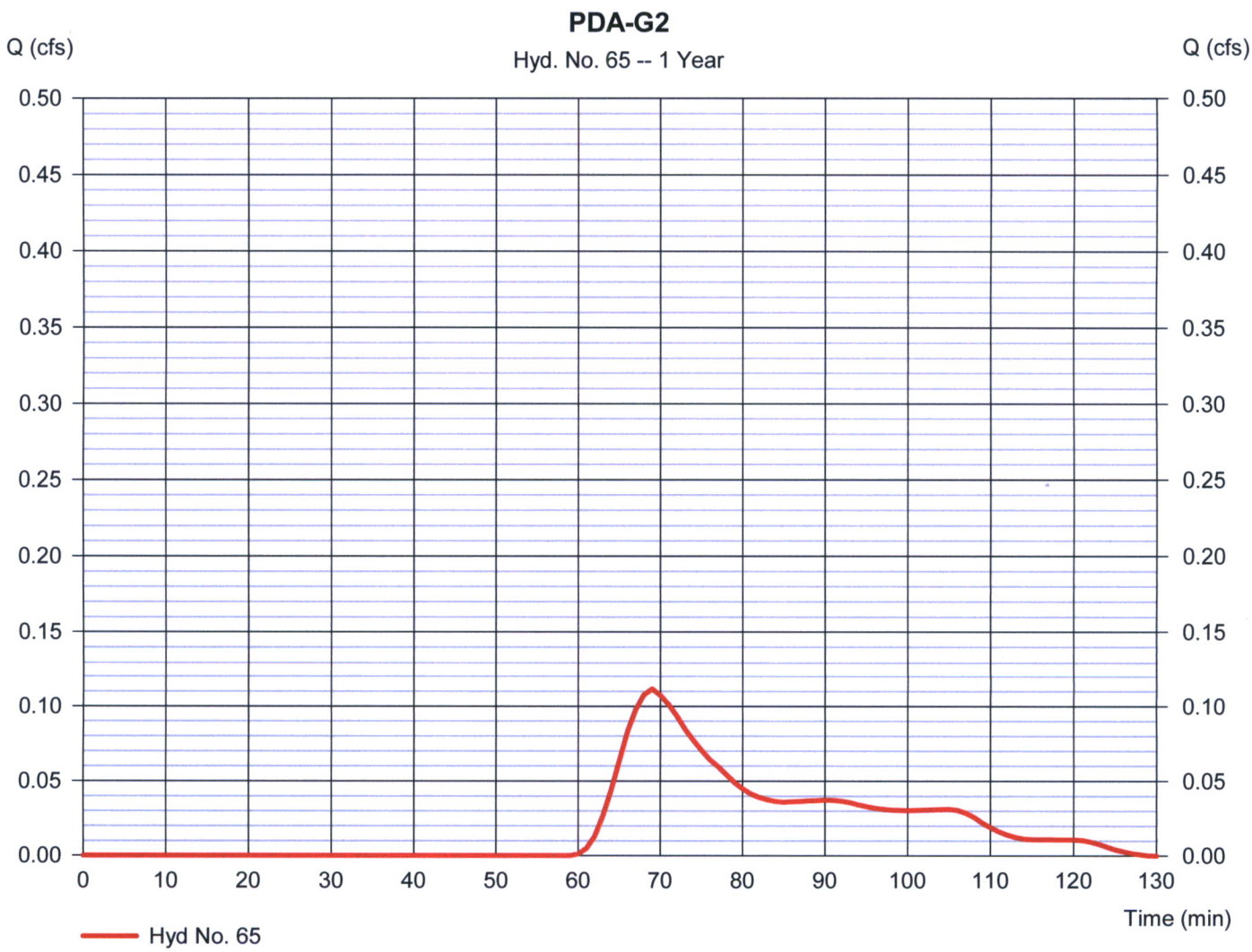


Hydrograph Report

Hyd. No. 65

PDA-G2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.112 cfs
Storm frequency	= 1 yrs	Time to peak	= 69 min
Time interval	= 1 min	Hyd. volume	= 151 cuft
Drainage area	= 0.300 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MI	Storm Duration	= 484

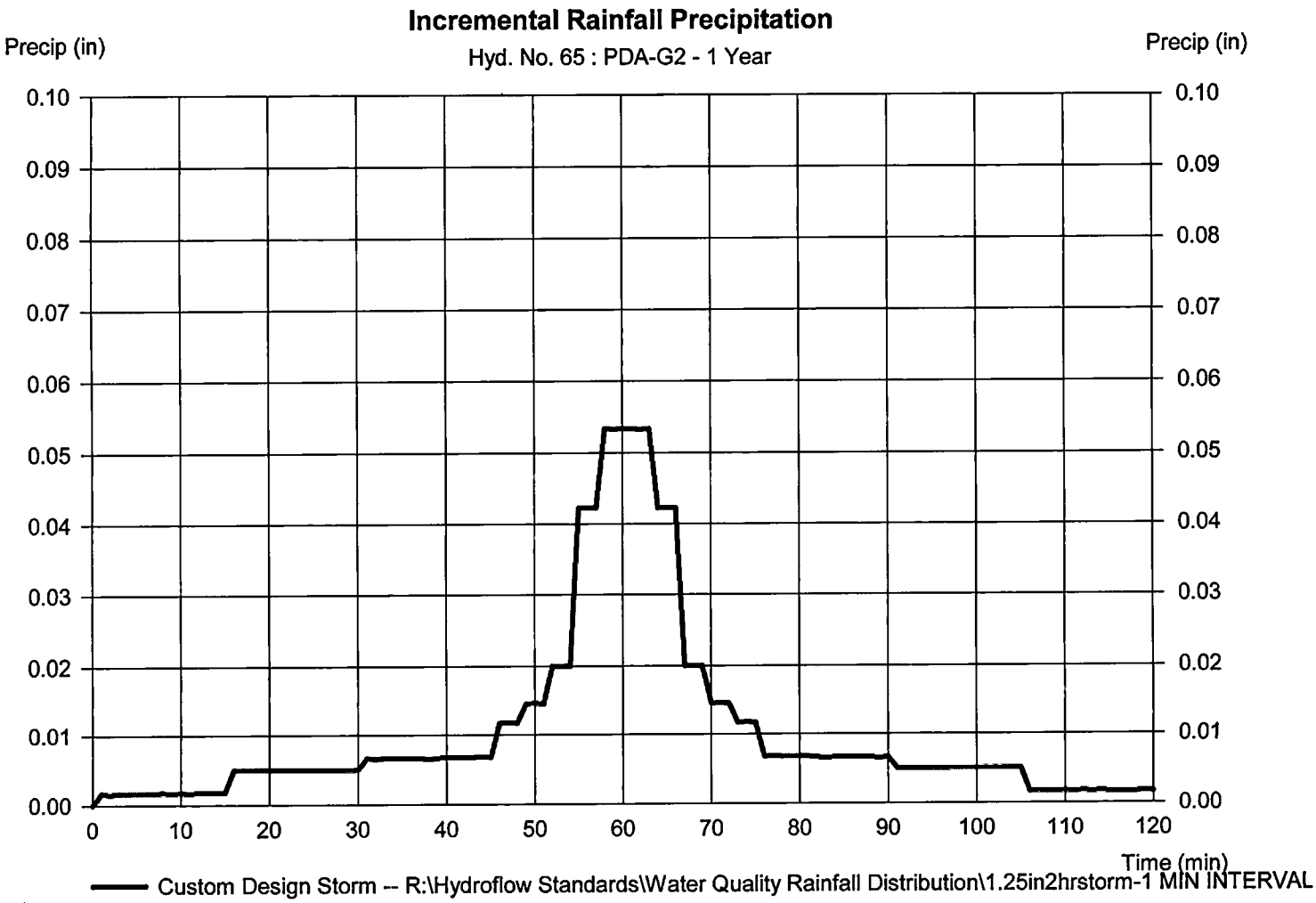


Precipitation Report

Hyd. No. 65

PDA-G2

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

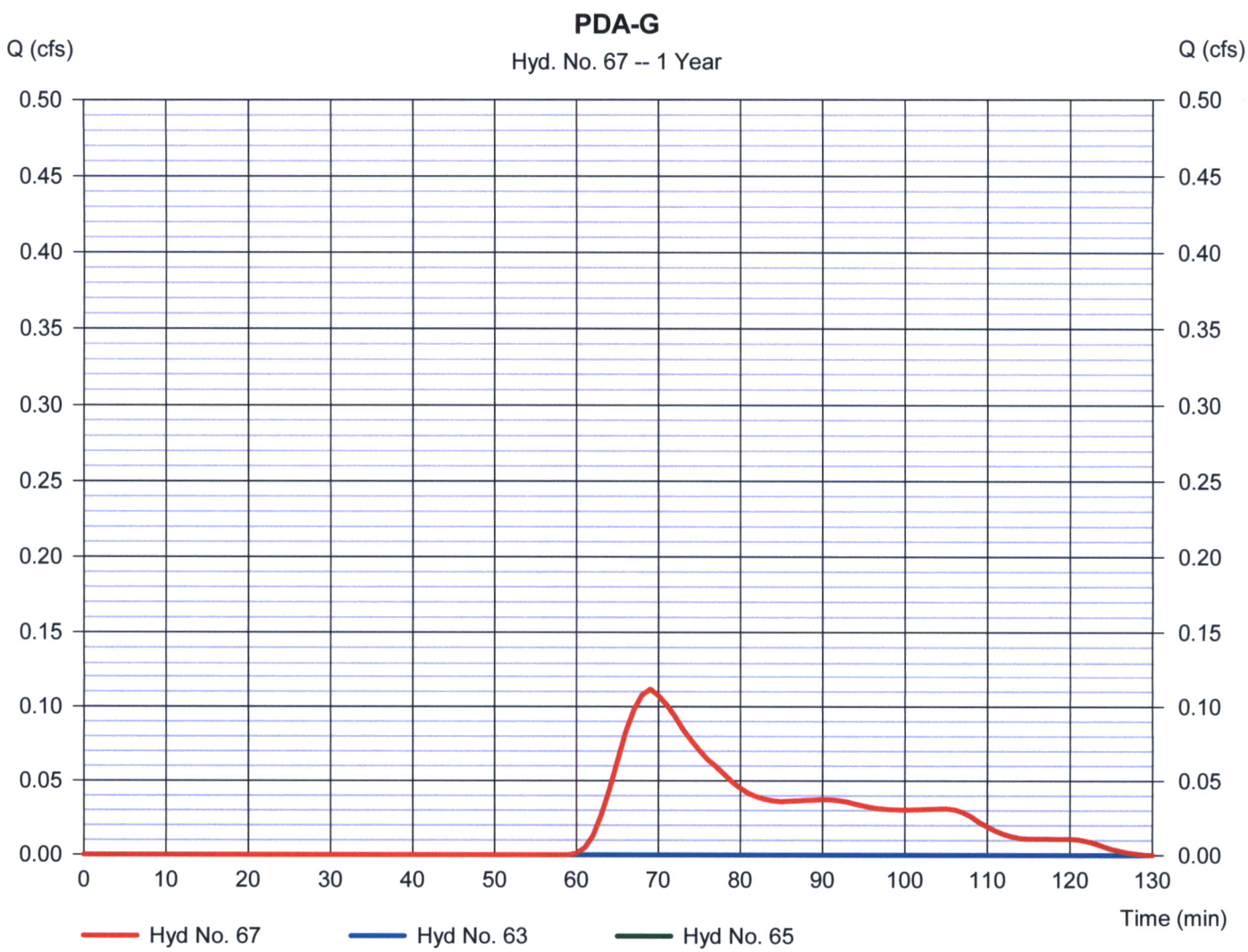


Hydrograph Report

Hyd. No. 67

PDA-G

Hydrograph type	= Combine	Peak discharge	= 0.112 cfs
Storm frequency	= 1 yrs	Time to peak	= 69 min
Time interval	= 1 min	Hyd. volume	= 151 cuft
Inflow hyds.	= 63, 65	Contrib. drain. area	= 0.300 ac

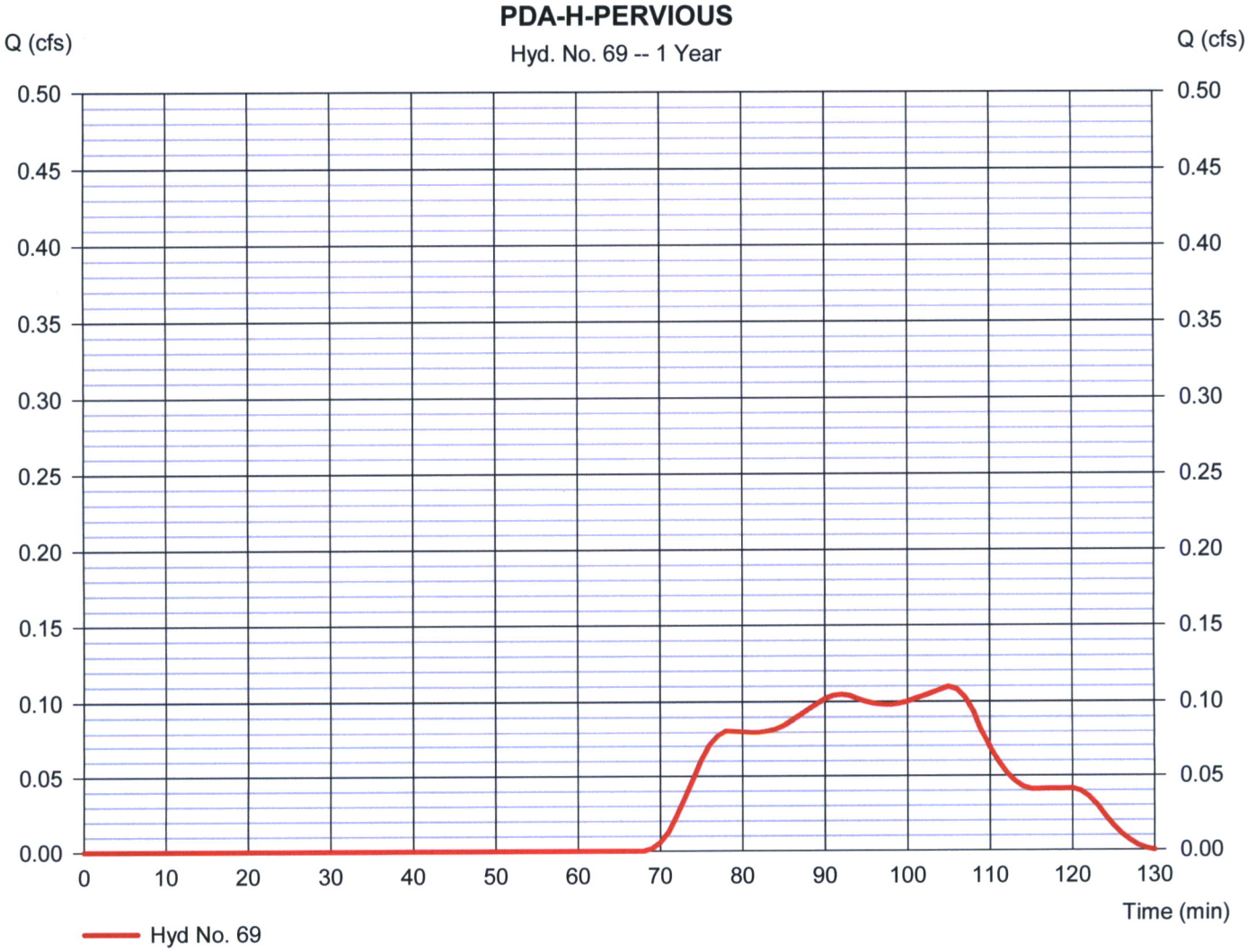


Hydrograph Report

Hyd. No. 69

PDA-H-PERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.110 cfs
Storm frequency	= 1 yrs	Time to peak	= 105 min
Time interval	= 1 min	Hyd. volume	= 244 cuft
Drainage area	= 3.430 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MIN	Shape factor	= 484

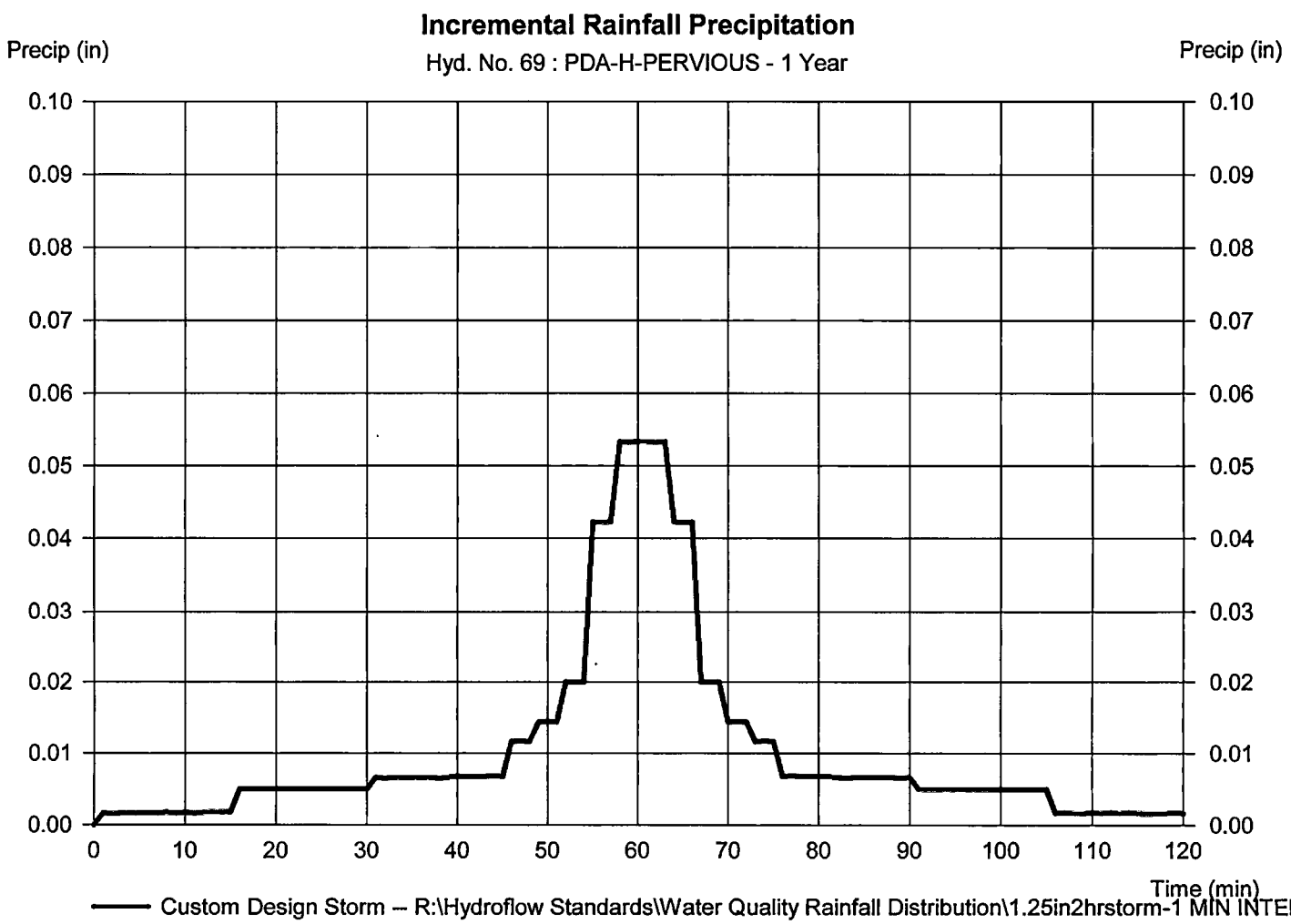


Precipitation Report

Hyd. No. 69

PDA-H-PERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

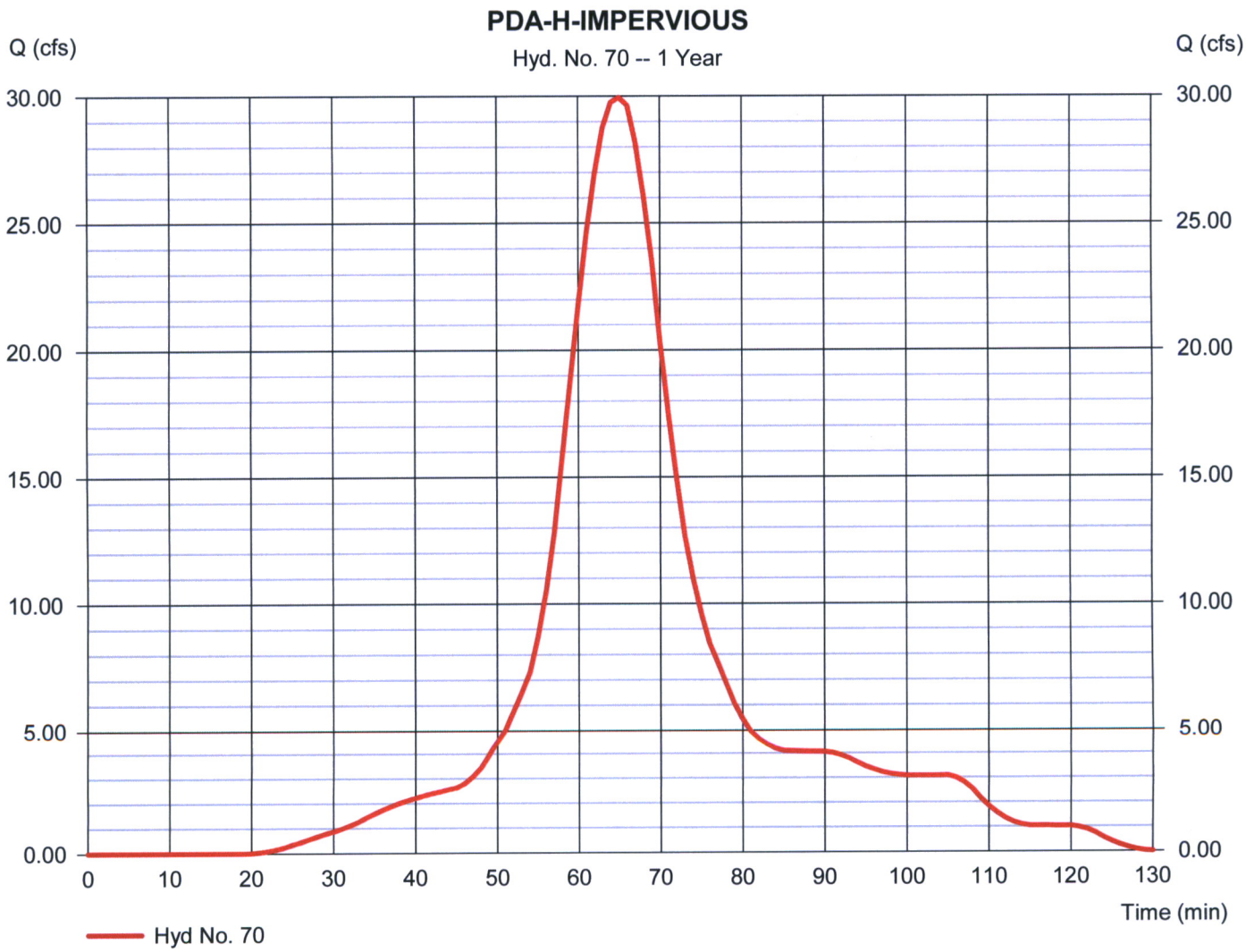


Hydrograph Report

Hyd. No. 70

PDA-H-IMPERVIOUS

Hydrograph type	= SCS Runoff	Peak discharge	= 29.96 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 39,116 cuft
Drainage area	= 10.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\484.25in2hrstorm-1 MIN	Shape factor	= 484



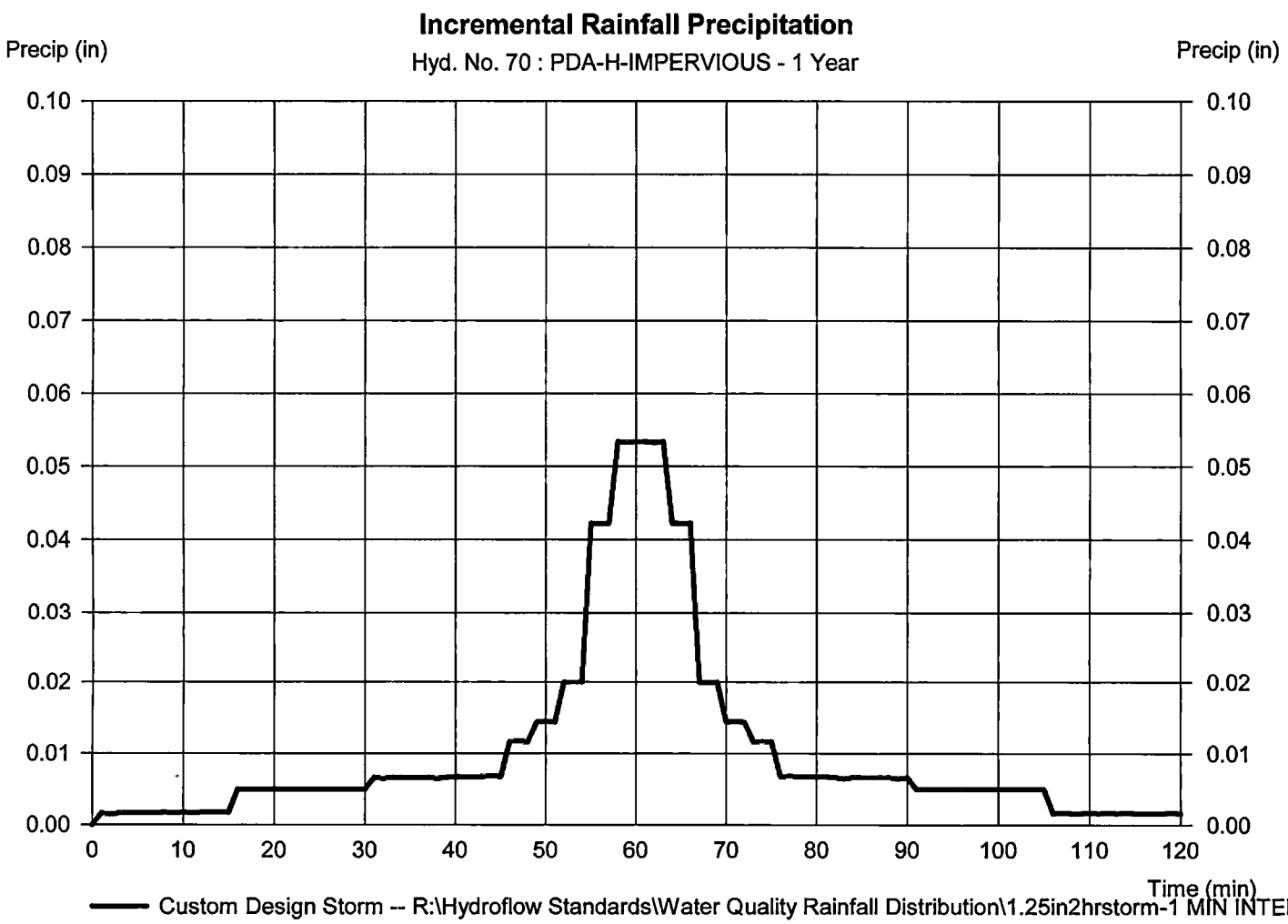
Precipitation Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Hyd. No. 70

PDA-H-IMPERVIOUS

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		

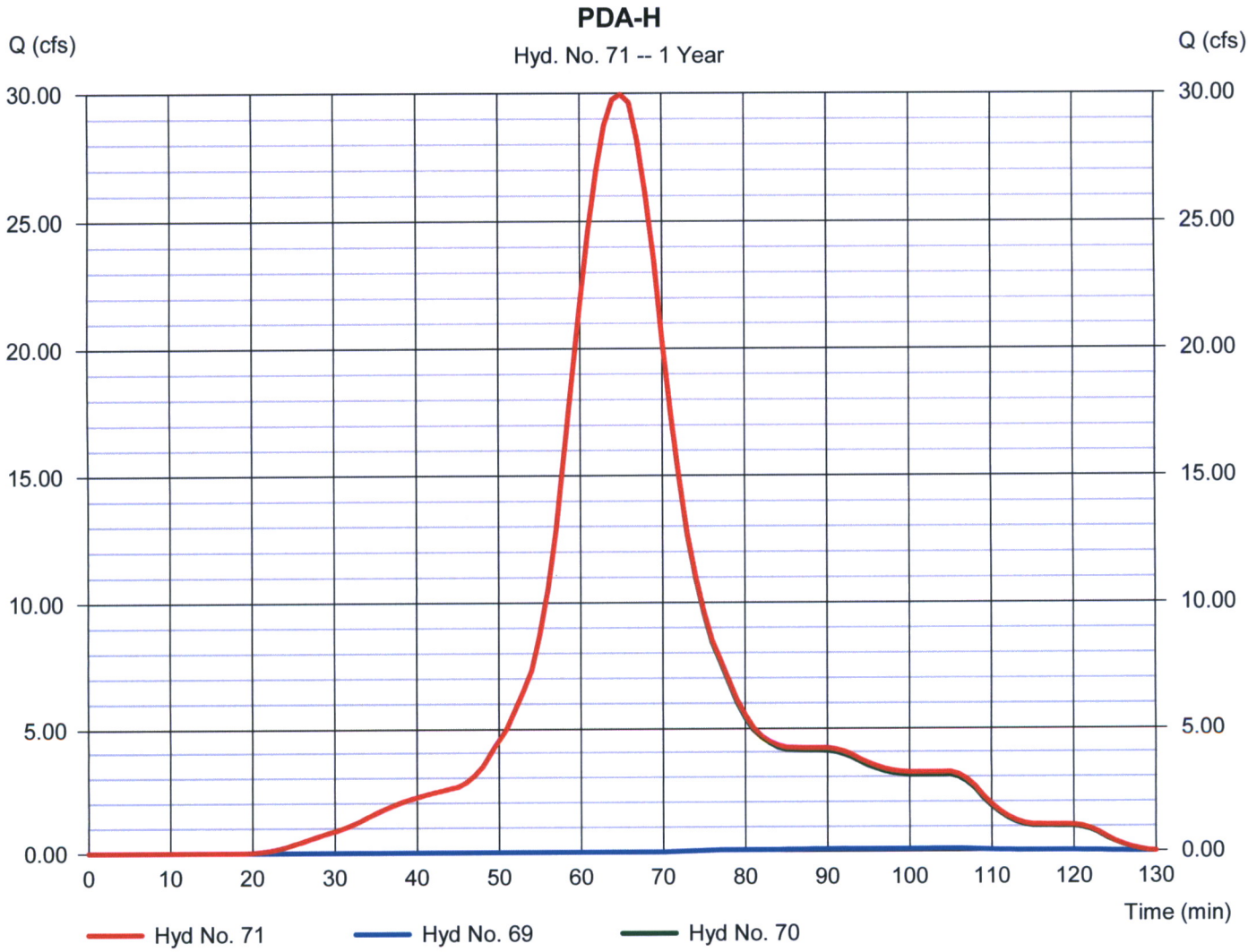


Hydrograph Report

Hyd. No. 71

PDA-H

Hydrograph type	= Combine	Peak discharge	= 29.96 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 39,360 cuft
Inflow hyds.	= 69, 70	Contrib. drain. area	= 13.530 ac



Hydrograph Report

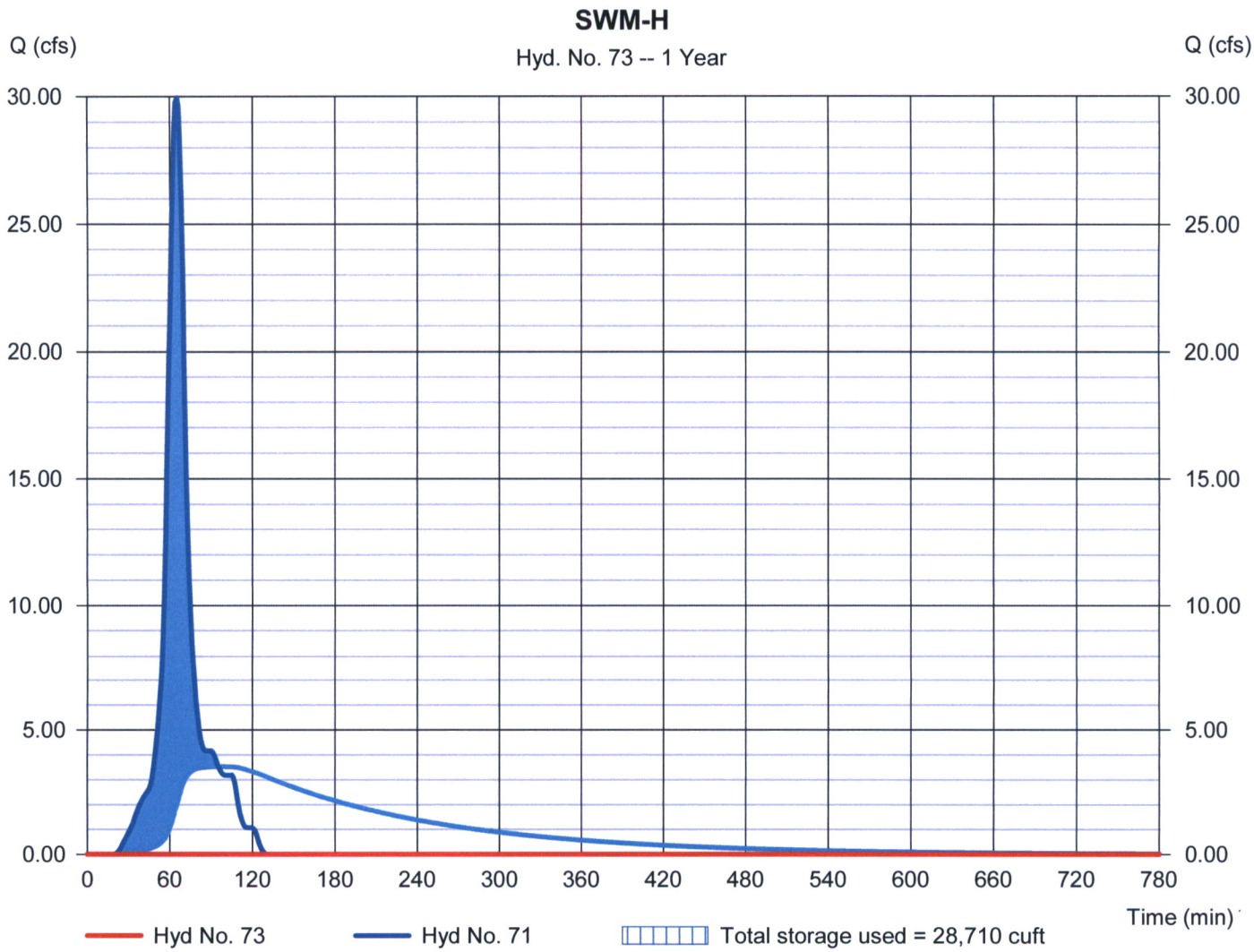
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Monday, 11 / 2 / 2020

Hyd. No. 73

SWM-H

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= 75 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 71 - PDA-H	Max. Elevation	= 596.75 ft
Reservoir name	= SWM-H	Max. Storage	= 28,710 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 2 / 2020

Pond No. 6 - SWM-H

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 596.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	596.00	35,726	0	0
1.00	597.00	40,735	38,199	38,199
2.00	598.00	46,050	43,361	81,560
3.00	599.00	51,472	48,731	130,290
4.00	600.00	57,000	54,207	184,497

Culvert / Orifice Structures

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

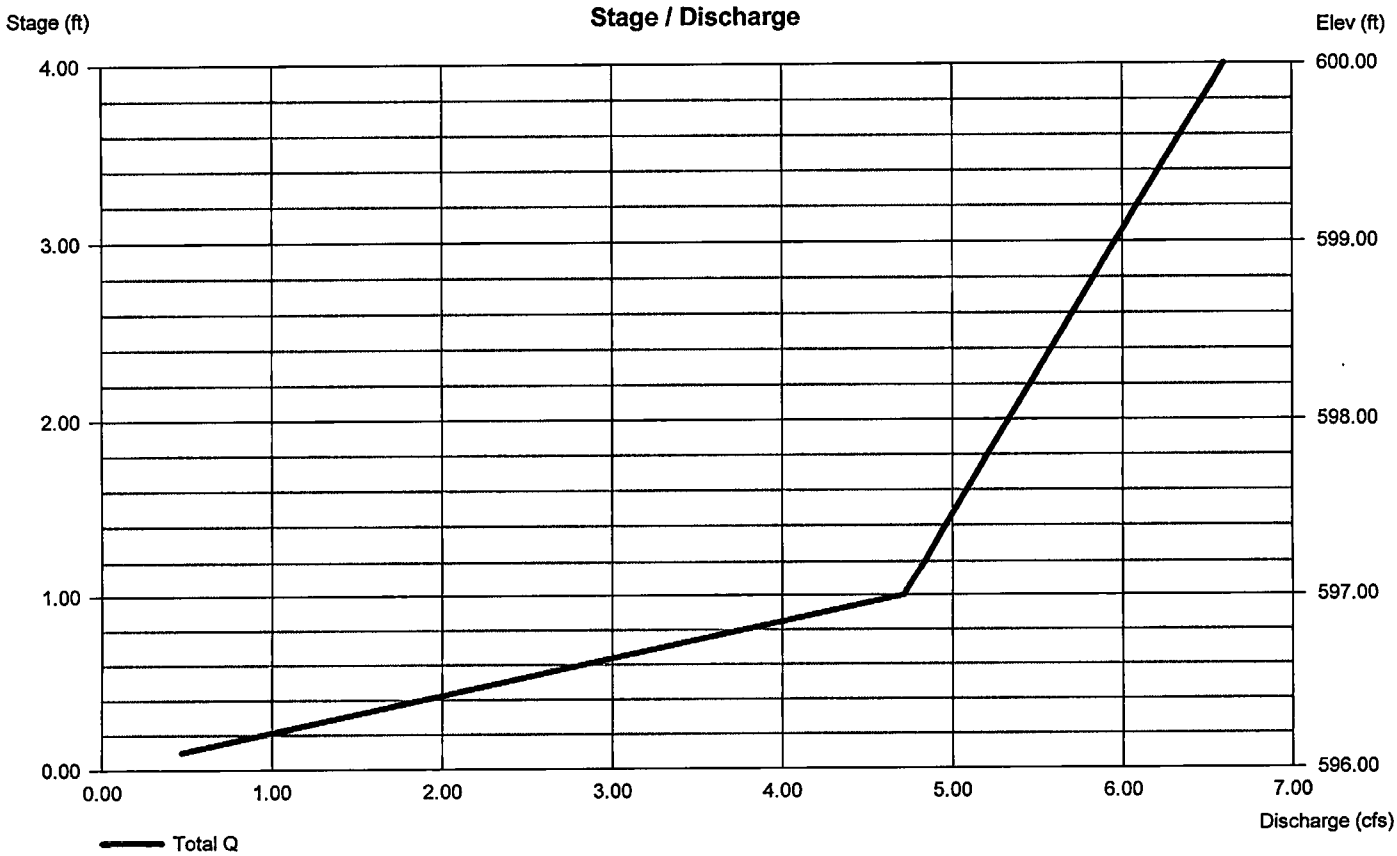
Weir Structures

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

Exfil.(in/hr) = 5.000 (by Contour)

TW Elev. (ft) = 0.00

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

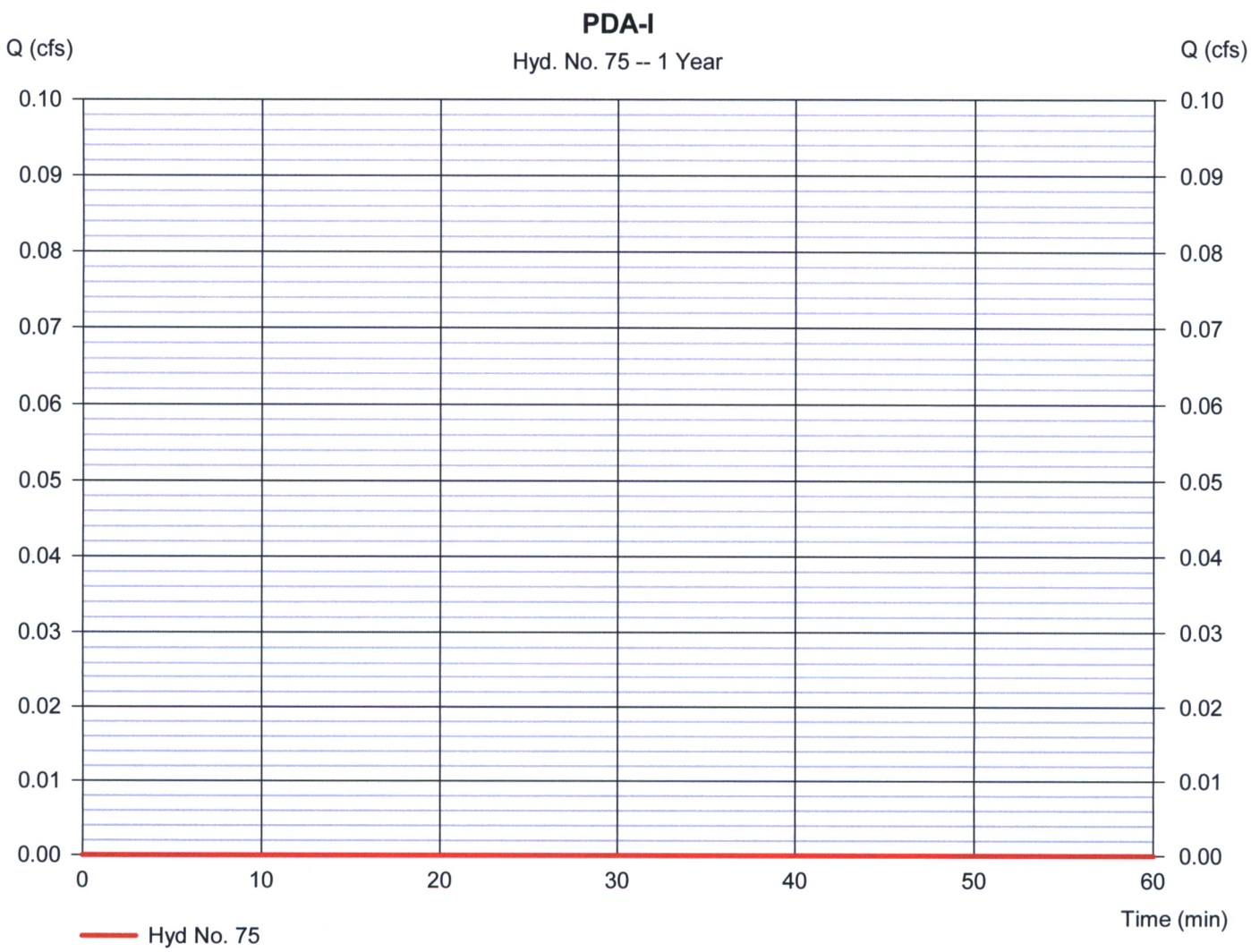


Hydrograph Report

Hyd. No. 75

PDA-I

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 0.260 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distributions\484.25in2hrstorm-1 MI	Storm duration	

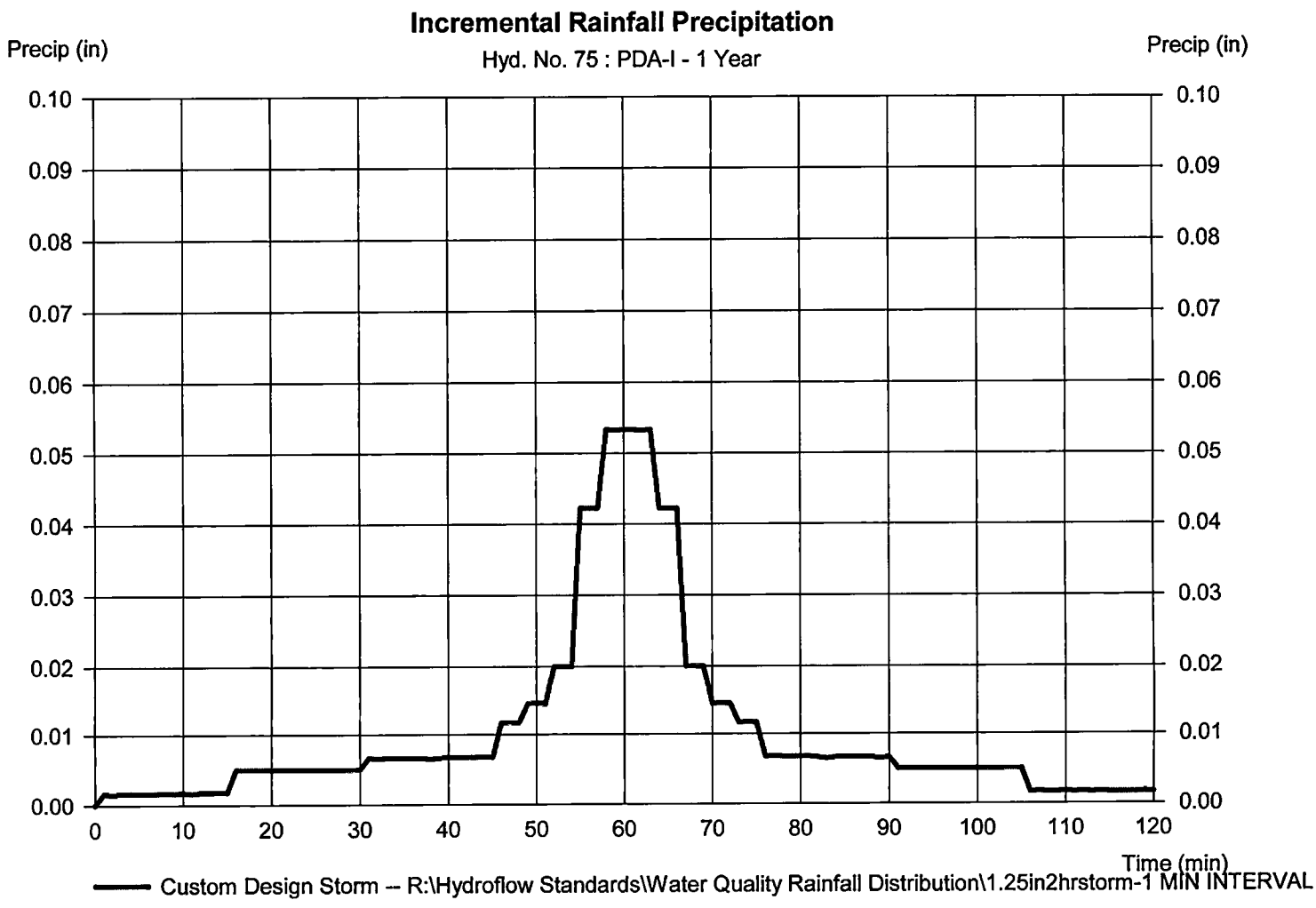


Precipitation Report

Hyd. No. 75

PDA-I

Storm Frequency	= 1 yrs	Time interval	= 1 min
Total precip.	= 1.2500 in	Distribution	= Custom
Storm duration	= R:\Hydroflow Standards\Water Quality Rainfall Distribution\1.25in2hrstorm-1 MI		



Hydraflow Table of Contents

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Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Monday, 11 / 2 / 2020

APPENDIX G –
GROUNDWATER RECHARGE CALCULATIONS

E&LP

New Jersey Groundwater Recharge Spreadsheet Version 2.0

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
SUSSEX CO., ANDOVER TWP	43.9	1.60

Project Name:	Stickles Pond Road
Description:	Recharge Calculations
Analysis Date:	11/01/20

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	30.66	Meadow, Pasture, Grassland or range	Hazen	16.2	1,807,889
2	8.24	Meadow, Pasture, Grassland or range	Sandy Land	17.4	519,199
3	2.75	Woods	Hazen	16.4	163,653
4	19.38	Woods	Sandy Land	17.7	1,242,370
5	4.94	Impervious areas	Urban Land*	0.0	-
6					
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	66.0			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				15.6	3,733,111

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	11.36	Open space	Hazen	16.1	662,345
2	6.23	Open space	Sandy Land	17.2	388,298
3	0.27	Woods	Hazen	16.4	16,068
4	48.11	Impervious areas	Urban Land*	0.0	-
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	66.0			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				4.5	1,066,711

Annual Recharge Requirements Calculation ↓	Total Impervious Area (sq.ft)	2,095,672
% of Pre-Developed Annual Recharge to Preserve = 100%		
Post-Development Annual Recharge Deficit= 2,666,400	(cubic feet)	

Recharge Efficiency Parameters Calculations (area averages)

RWC=	0.98	(in)	DRWC=	0.98	(in)
ERWC =	0.20	(in)	EDRWC=	0.20	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-A

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	10637.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	60.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-60.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.08	unitless
BMP Volume	VBMP	53,185	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	135,036	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		383,047	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		6.4%	%
%Rainfall Recharged		5.0%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-B1

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	61258.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	48.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-48.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.18	unitless
BMP Volume	VBMP	245,032	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	350,000	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		992,821	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		16.7%	%
%Rainfall Recharged		12.9%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-B2

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	21184.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	48.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-48.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.14	unitless
BMP Volume	VBMP	84,736	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	156,816	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		444,829	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		7.5%	%
%Rainfall Recharged		5.8%	%

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-D

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	23768.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	84.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-84.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.07	unitless
BMP Volume	VBMP	166,376	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	350,000	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		992,821	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		16.7%	%
%Rainfall Recharged		12.9%	%

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-G1

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	10939.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	60.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-60.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.05	unitless
BMP Volume	VBMP	54,695	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	228,690	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		648,709	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		10.9%	%
%Rainfall Recharged		8.5%	%

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
Stickles Pond Road	Recharge Calculations	11/01/20	Above-Ground SWM-H

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	35726.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	48.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-48.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	4	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	2.71	in
Inches of Rainfall to capture	Pdesign	2.94	in
Recharge Provided Avg. over Imp. Area		34.0	in
Runoff Captured Avg. over imp. Area		34.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.10	unitless
BMP Volume	VBMP	142,904	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	2,666,400	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	350,000	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.60	no units
Average Annual P	Pavg	43.9	in
Recharge Requirement over Imp. Area	dr	15.3	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		992,821	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.5%	%
%Runoff Infiltrated		100.0%	%
%Runoff Recharged		16.7%	%
%Rainfall Recharged		12.9%	%

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

SWM-A Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10637.00	SF

Q	**2.77005**	**CFS**
	9972.188	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**12006**	cf	1.2 Hours	<72 Hours

SWM-A Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10637.00	SF

Q	**2.77005**	**CFS**
	9972.188	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**34899**	cf	**3.5 Hours**	<72 Hours

SWM-A Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10637.00	SF
Q	**2.77005**	**CFS**
	9972.188	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**52147**	cf	[redacted]	<72 Hours

SWM-A Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10637.00	SF

Q	**2.77005**	**CFS**
	9972.188	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**84372**	cf	**8.5 Hours**	<72 Hours

SWM-B1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	61258.00	SF
Q	**14.18009**	**CFS**
	51048.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**55980**	cf	[redacted]	<72 Hours

SWM-B1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	61258.00	SF
Q	**14.18009**	**CFS**
	51048.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**185237**	cf	3.6 Hours	<72 Hours

SWM-B1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	61258.00	SF
Q	**14.18009**	**CFS**
	51048.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**290807**	cf	5.7 Hours	<72 Hours

SWM-B1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	61258.00	SF

Q	**14.18009**	**CFS**
	51048.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**495143**	cf	9.7 Hours	<72 Hours

SWM-B2 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	21184.00	SF

Q	**4.90370**	**CFS**
	17653.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**14001**	cf	[redacted] Hours	<72 Hours

SWM-B2 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	21184.00	SF

Q	**4.90370**	**CFS**
	17653.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**42872**	cf	**2.4 Hours**	<72 Hours

SWM-B2 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	21184.00	SF

Q	**4.90370**	**CFS**
	17653.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**65808**	cf	3.7 Hours	<72 Hours

SWM-B2 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	6.00	Ft
Davg	**4.00**	Ft
d	2.00	Ft
I	**2**	

A: Bottom	21184.00	SF

Q	**4.90370**	**CFS**
	17653.333	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**109871**	cf	**6.2 Hours**	<72 Hours

SWM-D Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	9.00	Ft
Davg	**5.50**	Ft
d	2.00	Ft
I	**2.75**	

A: Bottom	23768.00	SF
Q	**7.56505**	**CFS**
	27234.167	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**46753**	cf	1.7 Hours	<72 Hours

SWM-D Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	9.00	Ft
Davg	**5.50**	Ft
d	2.00	Ft
I	**2.75**	

A: Bottom	23768.00	SF

Q	**7.56505**	**CFS**
	27234.167	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**138588**	cf	**5.1 Hours**	<72 Hours

SWM-D Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	9.00	Ft
Davg	**5.50**	Ft
d	2.00	Ft
I	**2.75**	

A: Bottom	23768.00	SF

Q	**7.56505**	**CFS**
	27234.167	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**208457**	cf	[redacted]	<72 Hours

SWM-D Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	9.00	Ft
Davg	**5.50**	Ft
d	2.00	Ft
I	**2.75**	

A: Bottom	23768.00	SF

Q	**7.56505**	**CFS**
	27234.167	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**339491**	cf	12.5 Hours	<72 Hours

SWM-G1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10939.00	SF

Q	**2.84870**	**CFS**
	10255.313	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**20510**	cf	[redacted]	<72 Hours

SWM-G1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10939.00	SF

Q	**2.84870**	**CFS**
	10255.313	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**62954**	cf	**6.1 Hours**	<72 Hours

SWM-G1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10939.00	SF
Q	**2.84870**	**CFS**
	10255.313	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**96484**	cf	[redacted]	<72 Hours

SWM-G1 Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	10939.00	SF

Q	**2.84870**	**CFS**
	10255.313	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**160626**	cf	**15.7 Hours**	<72 Hours

SWM-H Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	35726.00	SF

Q	**9.30365**	**CFS**
	33493.125	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**39360**	cf	1.2 Hours	<72 Hours

SWM-H Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	35726.00	SF

Q	**9.30365**	**CFS**
	33493.125	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**123391**	cf	**3.7 Hours**	<72 Hours

SWM-H Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	35726.00	SF

Q	**9.30365**	**CFS**
	33493.125	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**191596**	cf	[redacted]	<72 Hours

SWM-H Draining Calculations:

248 Stickles Pond Road

Rate of Infiltration:

Q=KIA

Q: Rate of Infiltration (cfs)

K: Design Permeability (fps)

I: Hydraulic Gradient

A: Area of Infiltration (SF)

K	5	in/hr	per Permeability Test
	0.000115741	**fps**	

I=Davg/d

Davg=(D1+D2)/2

D1: Min Distance to Groundwater

D2: Max Distance to Groundwater

d: distance from bottom of BMP to Groundwater

D1	2.00	Ft
D2	7.00	Ft
Davg	**4.50**	Ft
d	2.00	Ft
I	**2.25**	

A: Bottom	35726.00	SF

Q	**9.30365**	**CFS**
	33493.125	**CF/Hr**

Volume			**Drain Time:**	t=V/Q
WQV	**324029**	cf	9.7 Hours	<72 Hours

APPENDIX H –
ON SITE SOIL TESTING

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Annika Asplund	Log Number:	SL-1
		Depth:	48"

				Disturbed	
L=	4.500	T1=	117	Tube Weight	686
H1=	6.000	T2=	311	Gross Weight	1,034
H2=	4.500	T3=	330	Net Weight	348
r=	1.125	T4=	346		
R=	1.125	T5=	419	Sample Vol. (in^3)	17.88328125
		T(sec.)=	419	(cm^3)	293.1069797
		T(min.)=	6.98		
				Bulk Density	1.187279813
Soil Permeability:			11.12		
Soil Class:			K4		

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in *minutes*,;
***r* = radius of the standpipe, in centimeters or inches;**
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Kevin Meininger	Log Number:	SL-2
		Depth:	48"

				Disturbed	
L=	3.250	T1=	117	Tube Weight	694
H1=	5.000	T2=	116	Gross Weight	982
H2=	3.250	T3=	124	Net Weight	288
r=	1.125	T4=	125		
R=	1.125	T5=	125	Sample Vol. (in³)	12.91570313
		T(sec.)=	125	(cm³)	211.6883742
		T(min.)=	2.08		
				Bulk Density	1.360490396
Soil Permeability:			40.32		
Soil Class:			K5		

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;
r = radius of the standpipe, in centimeters or inches;
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Kevin Meininger	Log Number:	SL-3
		Depth:	48"

L=	4.000	T1=	15
H1=	5.000	T2=	16
H2=	4.000	T3=	23
r=	1.125	T4=	23
R=	1.125	T5=	23
		T(sec.)=	23
		T(min.)=	0.38

Soil Permeability: 139.71

Soil Class: K5

Disturbed

Tube Weight	694
Gross Weight	1,083
Net Weight	389
Sample Vol. (in^3)	15.89625
(cm^3)	260.5395375
Bulk Density	1.493055541

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;
r = radius of the standpipe, in centimeters or inches;
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Annika Asplund	Log Number:	SL-4
		Depth:	100"

					Disturbed
L=	4.000	T1=	62	Tube Weight	686
H1=	5.000	T2=	102	Gross Weight	1,037
H2=	4.000	T3=	126	Net Weight	351
r=	1.125	T4=	166		
R=	1.125	T5=	127	Sample Vol. (in³)	15.89625
		T(sec.)=	127	(cm³)	260.5395375
		T(min.)=	2.12		
				Bulk Density	1.347204357

Soil Permeability: 25.30

Soil Class: K5

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = **permeability of the soil sample, in inches per hour;**
L = **length of the soil core, in inches;**
T = **time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;**
r = **radius of the standpipe, in centimeters or inches;**
R = **radius of the soil core, in the same units as "r";**
H_1 = **height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and**
H_2 = **height of the water level above the rim of the test basin at the end of each test interval, in inches.**

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Kevin Meininger	Log Number:	SL-5
		Depth:	56"

					Disturbed
L=	3.000	T1=	35	Tube Weight	694
H1=	5.000	T2=	37	Gross Weight	1,058
H2=	3.000	T3=	32	Net Weight	364
r=	1.125	T4=	33		
R=	1.125	T5=	34	Sample Vol. (in^3)	11.9221875
		T(sec.)=	34	(cm^3)	195.4046531
		T(min.)=	0.57		
				Bulk Density	1.862801086
Soil Permeability:			162.26		
Soil Class:			K5		

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;
r = radius of the standpipe, in centimeters or inches;
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Kevin Meininger	Log Number:	SL- 6
		Depth:	48"

					Disturbed
L=	4.000	T1=	15	Tube Weight	694
H1=	5.000	T2=	16	Gross Weight	1,083
H2=	4.000	T3=	23	Net Weight	389
r=	1.125	T4=	23		
R=	1.125	T5=	23	Sample Vol. (in^3)	15.89625
		T(sec.)=	23	(cm^3)	260.5395375
		T(min.)=	0.38		
				Bulk Density	1.493055541
Soil Permeability:			139.71		
Soil Class:			K5		

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;
r = radius of the standpipe, in centimeters or inches;
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

Engineering & Land Planning Associates

Project:	BHT Andover	Date:	10/22/2019
Location:	BHT Andover	Sample:	In Place
Test By:	Kevin Meininger	Log Number:	SL-7
		Depth:	30"

L=	3.250	T1=	68
H1=	5.500	T2=	69
H2=	3.250	T3=	116
r=	1.125	T4=	115
R=	1.125	T5=	117
		T(sec.)=	117
		T(min.)=	1.95

Soil Permeability: 52.61

Soil Class: K5

Disturbed

Tube Weight	694
Gross Weight	975
Net Weight	281
Sample Vol. (in^3)	12.91570313
(cm^3)	211.6883742
Bulk Density	1.327422921

$$K(in/hr) = 60\,\text{min}/hr \times \frac{L(in)}{T(\text{min})} \times \frac{r^2}{R^2} \times \ln\left(\frac{H_1}{H_2}\right)$$ [Equation 4]

Where:

K = permeability of the soil sample, in inches per hour;
L = length of the soil core, in inches;
T = time required for the water level to drop from H_1 to H_2 during the final test interval, in minutes,;
r = radius of the standpipe, in centimeters or inches;
R = radius of the soil core, in the same units as "r";
H_1 = height of the water level above the rim of the test basin at the beginning of each test interval, in inches; and
H_2 = height of the water level above the rim of the test basin at the end of each test interval, in inches.

[Note: When the standpipe is not used, the term r^2/R^2 is omitted from the equation.]

APPENDIX I –
SOIL EROSION MEASURES

E&LP

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-A8)

Do = 2.00
Wo = 2.00
TW = 0.40 (0.2 Do ASSUMED)
Q = 9.61 CFS MAX. FLOW BASED ON HW
Y = DEPTH OF SCOUR HOLE BELOW INVERT
q= 4.81 CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	20.12	FEET
		USE	21.0	FEET
Wa =	3Wo +La	=	27.0	FEET
		USE	27.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	20.39	FEET
		USE	21.0	FEET
Wa =	3Wo + 0.4La	=	14.4	FEET
		USE	15.0	FEET

RIPRAP SIZING

$$D50 = \frac{0.02}{Tw} q^{1.33} \times 12$$

= 4.84 INCHES

USE 5.0 INCHES

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-A1)

Do = 2.00
Wo = 2.00
TW = 0.40 (0.2 Do ASSUMED)
Q = 8.85 CFS MAX. FLOW BASED ON HW
Y = DEPTH OF SCOUR HOLE BELOW INVERT
q= 4.43 CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	19.63	FEET
		USE	20.0	FEET
Wa =	3Wo +La	=	26.0	FEET
		USE	26.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	18.77	FEET
		USE	19.0	FEET
Wa =	3Wo + 0.4La	=	13.6	FEET
		USE	14.0	FEET

RIPRAP SIZING

D50 =	$\frac{0.02}{Tw} q^{1.33} \times 12$	=	4.34	INCHES
		USE	5.0	INCHES

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-B1)

Do = 2.00
Wo = 2.00
TW = 0.40 (0.2 Do ASSUMED)
Q = 7.97 CFS MAX. FLOW BASED ON HW
Y = DEPTH OF SCOUR HOLE BELOW INVERT
q= 3.99 CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	19.07	FEET
		USE	20.0	FEET
Wa =	3Wo +La	=	26.0	FEET
		USE	26.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	16.91	FEET
		USE	17.0	FEET
Wa =	3Wo + 0.4La	=	12.8	FEET
		USE	13.0	FEET

RIPRAP SIZING

D50 =	$\frac{0.02}{Tw} q^{1.33} \times 12$	=	3.77	INCHES
		USE	4.0	INCHES

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-B20)

Do =	3.00	
Wo =	3.00	
TW =	0.60	(0.2 Do ASSUMED)
Q =	42.60	CFS MAX. FLOW BASED ON HW
Y =	DEPTH OF SCOUR HOLE BELOW INVERT	
q=	14.20	CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	35.76	FEET
		USE	36.0	FEET
Wa =	3Wo +La	=	45.0	FEET
		USE	45.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	73.79	FEET
		USE	74.0	FEET
Wa =	3Wo + 0.4La	=	38.6	FEET
		USE	39.0	FEET

RIPRAP SIZING

D50 =	$\frac{0.02}{Tw} q^{1.33} \times 12$	=	13.63	INCHES
		USE	14.0	INCHES

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-B20)

Do = 3.00
Wo = 3.00
TW = 0.60 (0.2 Do ASSUMED)
Q = 41.69 CFS MAX. FLOW BASED ON HW
Y = DEPTH OF SCOUR HOLE BELOW INVERT
q= 13.90 CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	35.44	FEET
		USE	36.0	FEET
Wa =	3Wo +La	=	45.0	FEET
		USE	45.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	72.21	FEET
		USE	73.0	FEET
Wa =	3Wo + 0.4La	=	38.2	FEET
		USE	39.0	FEET

RIPRAP SIZING

$$D50 = \frac{0.02}{Tw} q^{1.33} \times 12$$

	=	13.25	INCHES
USE		14.0	INCHES

PROJECT- 248 STICKLES POND RC
NUMBER- 19134
BY- EAJ
DATE- 11/2/2020

RIPRAP APRON CALCULATIONS FOR SWM-A1 (HW-G1)

Do = 2.00
Wo = 2.00
TW = 0.40 (0.2 Do ASSUMED)
Q = 13.85 CFS MAX. FLOW BASED ON HW
Y = DEPTH OF SCOUR HOLE BELOW INVERT
q= 6.93 CFS/FT (Q/Wo)

CASE 1 - TW < 1/2 Do

La =	1.8 (q/(Do ^0.5)) + 7Do	=	22.81	FEET
		USE	23.0	FEET
Wa =	3Wo +La	=	29.0	FEET
		USE	29.0	FEET

CASE 2 - TW > 1/2 Do

La =	3*Do (q/(Do ^0.5))	=	29.38	FEET
		USE	30.0	FEET
Wa =	3Wo + 0.4La	=	18.0	FEET
		USE	18.0	FEET

RIPRAP SIZING

$$D50 = \frac{0.02}{Tw} q^{1.33} \times 12$$

=	7.87	INCHES	
USE	8.0	INCHES	

APPENDIX J –
LOW IMPACT DEVELOPMENT CHECKLIST

New Jersey Stormwater Best Management Practices Manual

February 2004

APPENDIX A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: _____

County: _____ Date: _____

Review board or agency: _____

Proposed land development name: _____

Lot(s): _____ Block(s): _____

Project or application number: _____

Applicant's name: _____

Applicant's address: _____

_____

Telephone: _____ Fax: _____

Email address: _____

Designer's name: _____

Designer's address: _____

_____

Telephone: _____ Fax: _____

Email address: _____

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

N.J.A.C. 7:8 - June 20, 2016

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: Protect areas that provide water quality benefits, minimize impervious surfaces, maximize the protection of natural drainage features and vegetation, minimize land disturbance and soil compaction (N.J.A.C. 7:8-5.3).

List LID-BMPs prohibited by local regulations: N/A

Pre-design meeting held? Yes: X Date: _____ No: _____

Meeting held with: X

Pre-design site walk held? Yes: X Date: _____ No: _____

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: Andover Township Planning Board

Required approval: Preliminary and Final Major Site Plan

Name: Sussex County Soil Conservation District

Required approval: Soil Erosion & Sediment Control Plan Certification

Name: NJ DEP

Required approval: Wetland General Permit, Wetland LOI, Flood Hazard Area Permit

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: _____ No: X

If yes, was this inventory a factor in the site's layout and design? Yes: _____ No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: _____

Native ground cover? Yes: X No: _____ If yes, specify % of site: _____

Vegetated buffers? Yes: X No: _____ If yes, specify % of site: _____

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: X If yes, specify % of site: _____

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: X If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: _____ No: X

Reduce runoff pollutant loads through runoff treatment: Yes: _____ No: X

Maintain groundwater recharge by preserving natural areas: Yes: X No: _____

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: _____

If yes, were these inventories factors in the site's layout and design? Yes: X No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: _____ No: X

If yes, how: _____

Restrict temporary site disturbance during construction? Yes: X No: _____

If yes, how: Access to the property is limited to the construction entrance only. The limit of disturbance will be fenced to prevent encroachment by equipment or materials.

Consider soils and slopes in selecting disturbance limits? Yes: X No: _____

If yes, how: Slope disturbance was limited to the greatest extents possible, while also proposing a safe design.

C. Specify percentage of site to be cleared: ±55% of Disturbed Area Regraded: ±45% of Disturbed area

D. Specify percentage of cleared areas done so for buildings: ±1% of Disturbed Area

For driveways and parking: ±30% of Disturbed Area For roadways: N/A

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

In order to reduce the percentages listed in C and D, the project scope would need to be significantly reduced.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: 40% HSG B: _____ HSG C: _____ HSG D: 60%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: 95% HSG B: _____ HSG C: _____ HSG D: 87%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

To compensate for the permanent disturbance to hydrologic soil group A and D, measures have been taken to maintain groundwater recharge: Six above-ground infiltration basins have been proposed to compensate the groundwater recharge deficit generated by the proposed development.

I. Does the site include Karst topography? Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 4.94 Acres Proposed: 48.11 Acres

B. Specify maximum site impervious coverage allowed by regulations: 60.50 Acres (4% of Total Site Area)

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking		
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: _____ Regulations: _____

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: _____ Regulations: _____

F. Specify percentage of total site impervious cover created by buildings:

By driveways and parking: 19% By roadways: n/a

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

In order to reduce the percentages listed above, the project scope would need to be significantly reduced.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 0% Buildings: _____ Driveways and parking: _____ Roads: _____

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: _____

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 5% Vegetated swale: 2% Natural channel: _____

Stormwater management facility: 93% Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

In order to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages, the project would need to be significantly altered. Due to the existing topography, and proposed scope of work, additionL vegetated swales are not suitable.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: _____

In order to reduce the overland flow slopes, a larger disturbance would be required. Due to the presence of wetlands with transitions areas and the encroachment of floodway, the site slope need to be maximized to the most practical extend.

Increase overland flow roughness: The project would need need to be significantly modified in order to increase overland flow roughness. Due to the proposed use, it is impractical to make any modifications without affecting the layout and usability of the facilities.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 1 for building

Specify the spacing between the trash receptacles: N/A

Compare trash receptacles proposed with those required by regulations:

Proposed: N/A Regulations: N/A

B. Pet Waste Stations

Specify the number of pet waste stations provided: N/A

Specify the spacing between the pet waste stations: N/A

Compare pet waste stations proposed with those required by regulations:

Proposed: N/A Regulations: N/A

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 5 Inlets

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: N/A Regulations: N/A

Litter collection: Proposed: Per Township Regulations: N/A

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

Inlet silt sacks and NJDEPS-approved inlets grates.

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	X	
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.