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DRAINAGE CALCULATIONS
FOR
BLOCK 416, LOT 3
555 Bergen Boulevard
BOROUGH OF PALISADES PARK
BERGEN COUNTY, NEW JERSEY

PROJECT NO.: PAPKPRV20.010
DATE: SEPTEMBER 11, 2020

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DESIGN REPORT

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INTRODUCTION

The 555 Bergen Boulevard project proposes to construct a residential building and parking structure on Block 416, Lot 3 in the Borough of Palisades Park. The total tract area is approximately 0.31 acres. In addition, the project proposes to reconstruct Oakdene Avenue to provide additional on-street parking and access to the project site.

The site had been previously used as a heavy equipment yard with materials storage. There was a square shaped garage on site that was used for maintenance and repairs of trucks, and fuel dispensers along the southerly property line. (2002 aerial photo shows it) The site previously functioned like a construction yard, with outdoor storage of materials and vehicles. The pre-developed existing site was previously a fully paved, fully developed site.

This report addresses the engineering design of the stormwater conveyance and stormwater management for the site.

SUMMARY OF DISTURBANCE AND PROPOSED IMPERVIOUS

The project proposes to disturb a total of 0.63 acres to construct both the proposed residential building/parking structure and to construct the off-tract improvements to Oakdene Avenue and minor site improvements to the adjacent property to the north.

The pre-developed existing impervious coverage on the project site is 0.66 acres.
The post-developed site impervious coverage is 0.69 acres.
The project will increase impervious coverage from the pre-developed condition by 0.03 acres.

Since the project is below the threshold of major development as defined by RSIS, Borough of Palisades Park Land Development Ordinance, and NJAC 7:8-4.2, the stormwater management has been designed such that the post project peak rate of runoff does not existing the existing pre-construction peak rate of runoff.

DESIGN METHODOLOGY

Stormwater Management Design

This study was prepared using the Rational Formula to calculate peak rate of runoff and the Modified Rational Method of calculating storage requirements for drainage areas.

The Rational Formula:
$Q = CIA$

Where Q = peak runoff rate (cfs)
C = runoff coefficient
I = rainfall intensity (in/hr)
A = drainage area (acres)

A "weighed" runoff coefficient has been computed for drainage areas consisting of a mixture of different land uses. A "C" value of 0.95 has been utilized for paved areas and roof areas, and a "C" value of 0.63 has been utilized for proposed weeded areas. For gravel areas, a "C" value of 0.84 has been utilized.

Rainfall intensities based on the time of concentration of the drainage area have been utilized in computing peak runoff rates. The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path using methods described in TR-55. Rainfall intensities have been taken from Figure 7.2, Rainfall Intensity Curves as per NJAC 5:21-7.2, New Jersey Residential Site Improvement Standards.

The Modified Rational Method:

The modified rational method uses a trial method to approximate the critical storm duration and critical storage volume for the proposed drainage area. The method is iterative since the critical storage volume may result from a storm duration that differs from the time of concentration for the drainage area. Rainfall intensities have been taken from the Trenton, NJ Intensity-Duration-Frequency (I-D-F) curves for the 2 year, 10 year, and 100 year storm, for various storm durations in order to compute the critical storm duration. The critical storm duration which yielded the greatest approximate storage volume was used to design the proposed on site detention facilities.

The proposed detention basin has been designed to attenuate the 2, 10, and 100 year storms. Level pool routing techniques were used to route the critical storm hydrographs through the proposed underground detention basin located in Oakdene Avenue.

Stormwater Conveyance Design

The storm sewer conveyance system was analyzed using the Rational Method for estimating runoff as per ordinance and Residential Site Improvement Standards (RSIS).

To design the system, the site was divided into sub-areas, each contributing runoff to a catch basin or roof drain. A value for area, time of concentration, and a runoff coefficient was calculated for each contributing sub-area. Values for time of concentration were chosen based on land cover and slope of the flow path from the hydraulically most distant point in the sub-area to the appropriate inlet. An average runoff coefficient was chosen based of the percentage of each type of land cover.

The rainfall intensities were taken from the Trenton Rainfall data base.

Storm drainage pipes were then sized based on calculated flows using Manning's Equation and were verified by calculating the peak flows and hydraulic capacity of the pipes.

EXISTING CONDITIONS

Existing Conditions

The existing project site is broken down into the following drainage areas for the drainage analysis

1. Existing DA-To Front - This drainage area is approximately 0.16 acres and is comprised of the paved area adjacent to Bergen Boulevard and a portion of the adjacent parking lot along Bergen Boulevard to the north of the site. Runoff from this drainage area flows to the existing storm conveyance system in Bergen Boulevard.
2. Existing DA to Adjacent Lot 1 Depression – The topography of the existing site is such that the existing Oakdene Avenue slopes down to the existing site which is ulitimately lower than the properties to the south and to the north. Runoff from this drainage area ultimately discharges to an existing low depression located on the adjacent Lot 1 to the north. This drainage area is approximately 0.43 acres.
3. Existing DA to Rear – The topography of the existing site is such that the existing site is higher than the property to the east. Runoff from this drainage area flows overland to the existing property to the east/rear of the site. This drainage area is approximately 0.11 acres.

The site had been previously used as a heavy equipment yard with materials storage. There was a square shaped garage on site that was used for maintenance and repairs of trucks, and fuel dispensers along the southerly property line. (2002 aerial photo shows it) The site previously functioned like a construction yard, with outdoor storage of materials and vehicles. The pre-developed existing site was previously a fully paved, fully developed site.

Existing drainage areas are delineated on figure 1.

PROPOSED CONDITIONS

Proposed Conditions

The proposed project site is broken down into the following drainage areas for the drainage analysis

1. PR DA-Detained - This drainage area is approximately 0.69 acres and is comprised of the paved area adjacent to Bergen Boulevard, a portion of the adjacent parking lot along Bergen Boulevard to the north of the site, the proposed reconstructed Oakdene Avenue, and the project site. Runoff from this drainage area will be collected, stored, and attenuated by the proposed underground detention basin.
2. PR DA Undetained to Adjacent Lot 1 Depression – This drainage area is approximately 0.006 acres and consists of the perimeter area surrounding the parking structure that will be pervious gravel. Runoff from this drainage area ultimately discharges to the existing low depression located on the adjacent Lot 1 to the north as in the existing condition.

3. PR DA to Undetained to Rear – This drainage area is approximately 0.004 acres and consists of the perimeter area surrounding the parking structure that will be pervious gravel. Runoff from this drainage area ultimately discharges to the rear of the site undetained as in the existing condition.

Proposed Underground Detention Basin

The Proposed underground detention basin consists of six -141 linear feet runs of 30" HDPE pipe and two 30" HDPE manifold header pipes, each 20 feet long. The proposed detention piping will be non-perforated. The total storage volume of the system is 4,362 cf. The system contains an outlet control structure that will discharge stormwater at a controlled/reduced rate to the existing storm conveyance system in Bergen Boulevard.

PROPOSED UNDERGROUND DETENTION BASIN ROUTING SUMMARY

24 Hr Storm (Year)	Peak Outflow (cfs)	Peak Elevation (feet)	Maximum Storage (cubic feet)
2	**0.65**	**303.77**	**1,905**
10	**0.79**	**304.15**	**2,747**
100	**1.23**	**304.95**	**4,186**

SUMMARY TABLES OF POST PROJECT RUNOFF

TO FRONT (BERGEN BOULEVARD)

	Existing	Proposed	Conclusion
2 year	**0.65 cfs**	**0.65 cfs**	**Post = Pre**
10 Year	**0.90 cfs**	**0.79 cfs**	**Post < Pre**
100 Year	**1.23 cfs**	**1.23 cfs**	**Post = Pre**

TO ADJACENT LOT 1 DEPRESSION

	Existing	Proposed	Conclusion
2 year	**1.30 cfs**	**0.02 cfs**	**Post < Pre**
10 Year	**1.78 cfs**	**0.03 cfs**	**Post < Pre**
100 Year	**2.43 cfs**	**0.04 cfs**	**Post < Pre**

TO REAR

	Existing	Proposed	Conclusion
2 year	**0.30 cfs**	**0.01 cfs**	**Post < Pre**
10 Year	**0.41 cfs**	**0.02 cfs**	**Post < Pre**
100 Year	**0.56 cfs**	**0.03 cfs**	**Post < Pre**

Conclusion

The project has been designed to reduce runoff to the surrounding properties and to the adjacent roadway by storing and attenuating runoff in the proposed underground detention basin. The project will have no adverse impact with respect to stormwater management.

APPENDIX A

Pre-Developed Aerial Photograph
Modified Rational Method Critical Storm Determination Calculations
Existing Hydrographs
Proposed Hydrographs
Proposed Detention Basin Routings
Post Construction Runoff Hydrographs
Hydrograph Summary Reports
Stormwater Conveyance System Calculations

Pre-Developed Site

Existing Peak flow to Front (Bergen Boulevard)

	2 year Storm	10 Year Storm	100 Year Storm
A (ac)	0.16	0.16	0.16
C	0.95	0.95	0.95
Tc (min)	10	10	10
I (in/hr)	4.25	5.9	8.1
Qp (cfs)	0.65	0.90	1.23
Qallowable (cfs)	***0.65***	***0.90***	***1.23***

Critical Storm Determination for 2 year Storm, Proposed Basin

STORAGE DURATION VALUES - CRITICAL STORM/ESTIMATED STORAGE VOLUME DETERMINATION

Drainage Area (acres)	Runoff Coefficient	Tc(min)	Duration of Storm (min)	Intensity (in/hr)	Peak Inflow Flow Q (cfs)	Inflow volume(cf)	outflow Q (cfs)	outflow volume (cf)	Approximate Storage (cf)
A	C	D	D	I	Q=CIA	V=QD	Q=CIA	V=QD	In - Out
0.690	0.95	10.00	10.00	4.25	2.79	1671.53	0.65	387.60	1283.93
0.690	0.95	10.00	15.00	3.75	2.46	2212.31	0.65	581.40	1630.91
0.690	0.95	10.00	20.00	3.00	1.97	2359.80	0.65	775.20	1584.60
0.690	0.95	10.00	25.00	2.75	1.80	2703.94	0.65	969.00	1734.94
0.690	0.95	10.00	30.00	2.45	1.61	2890.76	0.65	1162.80	1727.96
0.690	0.95	10.00	60.00	1.50	0.98	3539.70	0.65	2325.60	1214.10
0.690	0.95	10.00	120.00	0.88	0.58	4153.25	0.65	4651.20	-497.95

Critical Storm Determination for 10 year Storm, Proposed Basin

STORAGE DURATION VALUES - CRITICAL STORM/ESTIMATED STORAGE VOLUME DETERMINATION

Drainage Area (acres)	Runoff Coefficient	Tc(min)	Duration of Storm (min)	Intensity (in/hr)	Peak Inflow Flow Q (cfs)	Inflow volume(cf)	outflow Q (cfs)	outflow volume (cf)	Approximate Storage (cf)
A	C	D	D	I	Q=CIA	V=QD	Q=CIA	V=QD	In - Out
0.690	0.95	10.00	10.00	5.90	3.87	2320.47	0.90	538.08	1782.39
0.690	0.95	10.00	15.00	4.90	3.21	2890.76	0.90	807.12	2083.64
0.690	0.95	10.00	20.00	4.00	2.62	3146.40	0.90	1076.16	2070.24
0.690	0.95	10.00	25.00	3.75	2.46	3687.19	0.90	1345.20	2341.99
0.690	0.95	10.00	30.00	3.33	2.18	3929.07	0.90	1614.24	2314.83
0.690	0.95	10.00	60.00	2.00	1.31	4719.60	0.90	3228.48	1491.12
0.690	0.95	10.00	120.00	1.25	0.82	5899.50	0.90	6456.96	-557.46

Critical Storm Determination for 100 year Storm, Proposed Basin

STORAGE DURATION VALUES - CRITICAL STORM/ESTIMATED STORAGE VOLUME DETERMINATION										
Drainage Area (acres)	Runoff Coefficient	Tc(min)	Duration of Storm (min)	Intensity (in/hr)	Peak Inflow Flow Q (cfs)	Inflow volume(cf)	outflow Q (cfs)	outflow volume (cf)	Approximate Storage (cf)	
A	C	D	D	I	Q=CIA	V=QD	Q=CIA	V=QD	In - Out	
0.690	0.95	10.00	10.00	8.10	5.31	3185.73	1.23	738.72	2447.01	
0.690	0.95	10.00	15.00	6.90	4.52	4070.66	1.23	1108.08	2962.58	
0.690	0.95	10.00	20.00	6.00	3.93	4719.60	1.23	1477.44	3242.16	
0.690	0.95	10.00	25.00	5.40	3.54	5309.55	1.23	1846.80	3462.75	
0.690	0.95	10.00	30.00	4.90	3.21	5781.51	1.23	2216.16	3565.35	**MAX**
0.690	0.95	10.00	60.00	3.30	2.16	7787.34	1.23	4432.32	3355.02	
0.690	0.95	10.00	120.00	1.75	1.15	8259.30	1.23	8864.64	-605.34	

As per the modified rational method critical storm/estimated storate volume determination, the 100 year 30 minute storm is the critical storm duration resulting the maximum required storage volume. See corresponding basin routing computations.

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2 - Year

10 - Year

100 - Year

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

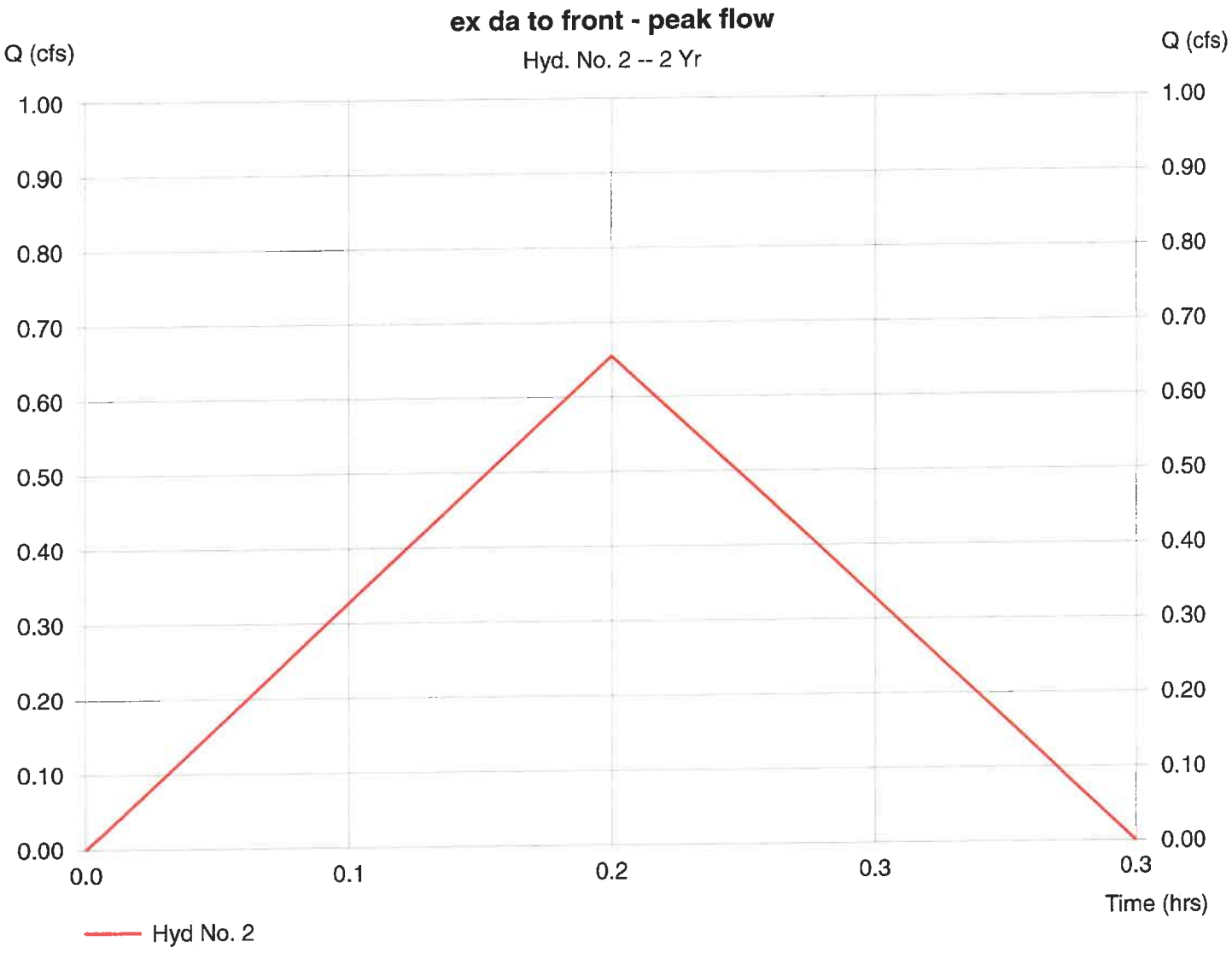
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 2

ex da to front - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.65 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.2 ac	Runoff coeff.	= 0.95
Intensity	= 4.308 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 393 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

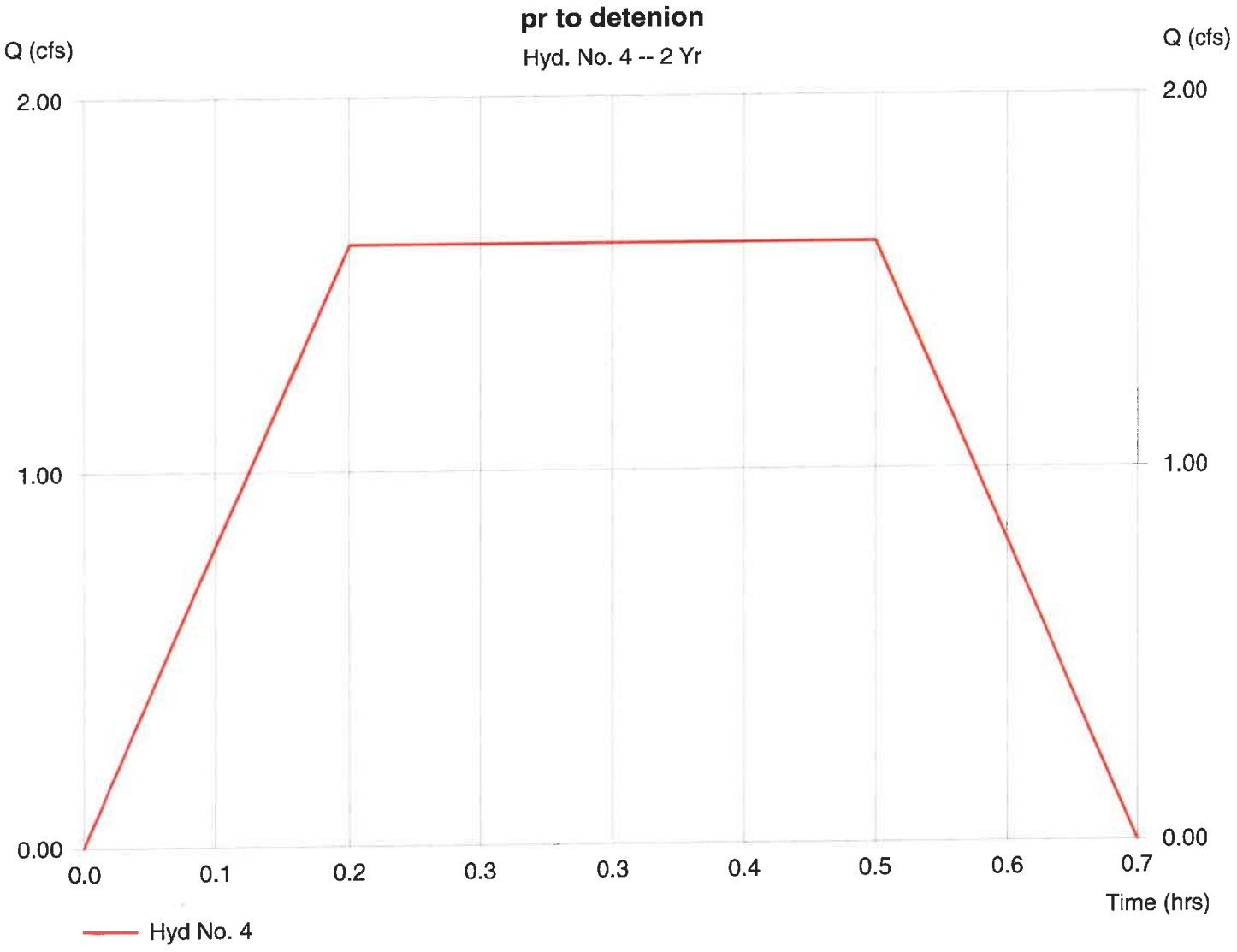
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 4

pr to detenion

Hydrograph type	= Mod. Rational	Peak discharge	= 1.61 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.95
Intensity	= 2.450 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 3 x Tc

Hydrograph Volume = 2,891 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 26 2011, 11:48 AM

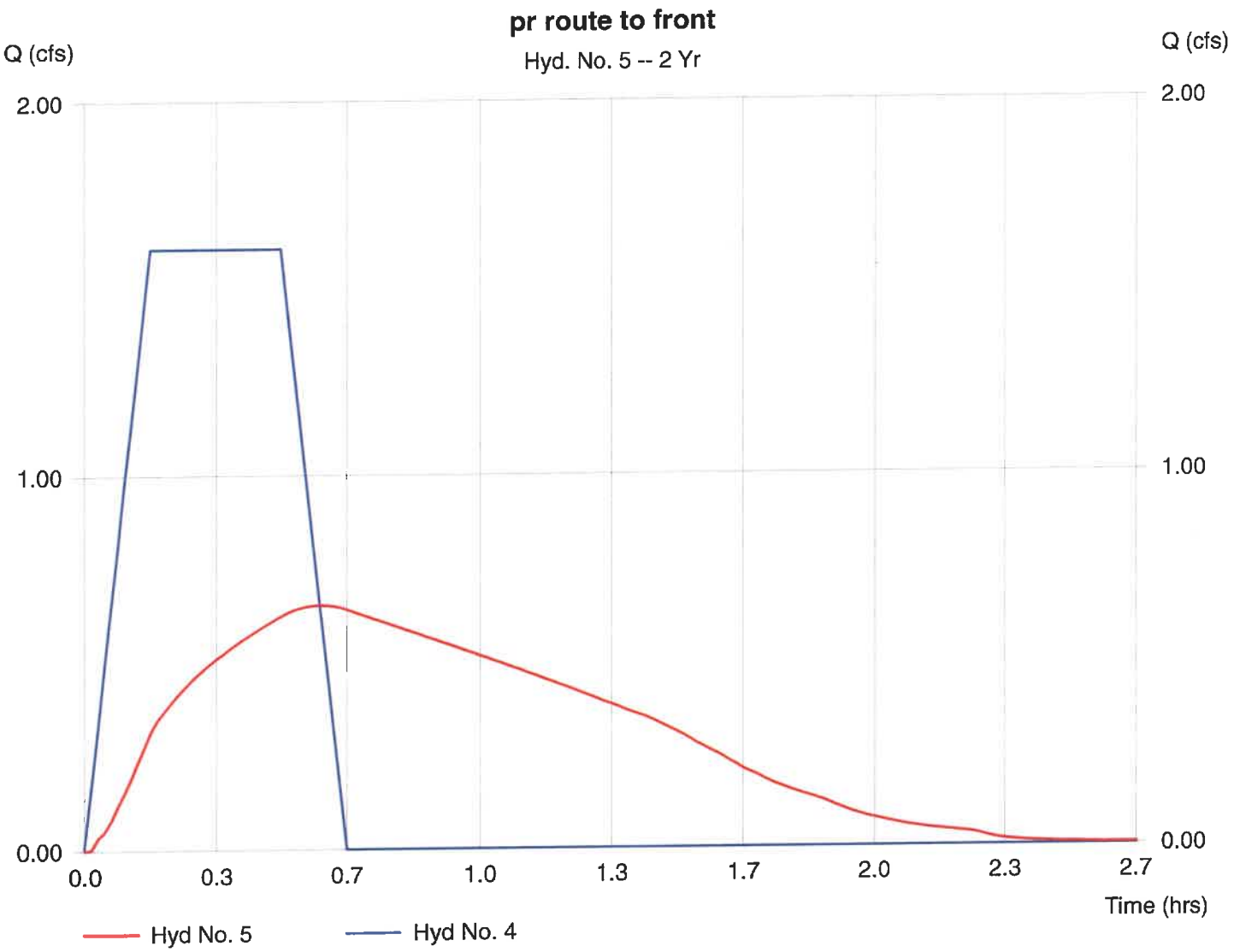
Hyd. No. 5

pr route to front

Hydrograph type	= Reservoir	Peak discharge	= 0.65 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 303.77 ft
Reservoir name	= PIPE STORAGE - Mod Rat.AE	Max. Storage	= 1,905 cuft

Storage Indication method used.

Hydrograph Volume = 2,888 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 26 2011, 11:48 AM

Pond No. 6 - PIPE STORAGE - Mod Rat.AE

Pond Data

Pipe dia. = 2.50 ft Pipe length = 141.0 ft No. Barrels = 6.0 Slope = 0.20 % Invert elev. = 302.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	302.50	00	0	0
0.14	302.64	00	17	17
0.28	302.78	00	91	108
0.42	302.92	00	163	271
0.56	303.06	00	211	482
0.70	303.20	00	243	725
0.83	303.33	00	266	991
0.97	303.47	00	283	1,274
1.11	303.61	00	296	1,570
1.25	303.75	00	304	1,874
1.39	303.89	00	308	2,182
1.53	304.03	00	308	2,489
1.67	304.17	00	304	2,793
1.81	304.31	00	296	3,089
1.95	304.45	00	284	3,373
2.09	304.59	00	266	3,638
2.23	304.73	00	243	3,881
2.36	304.86	00	210	4,091
2.50	305.00	00	163	4,254
2.64	305.14	00	90	4,345
2.78	305.28	00	17	4,362

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 8.00	6.20	0.00	0.00
Span (in)	= 8.00	6.20	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 302.50	302.50	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.81	0.00	0.00	0.00
N-Value	= .011	.013	.000	.000
Orif. Coeff.	= 0.60	0.44	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

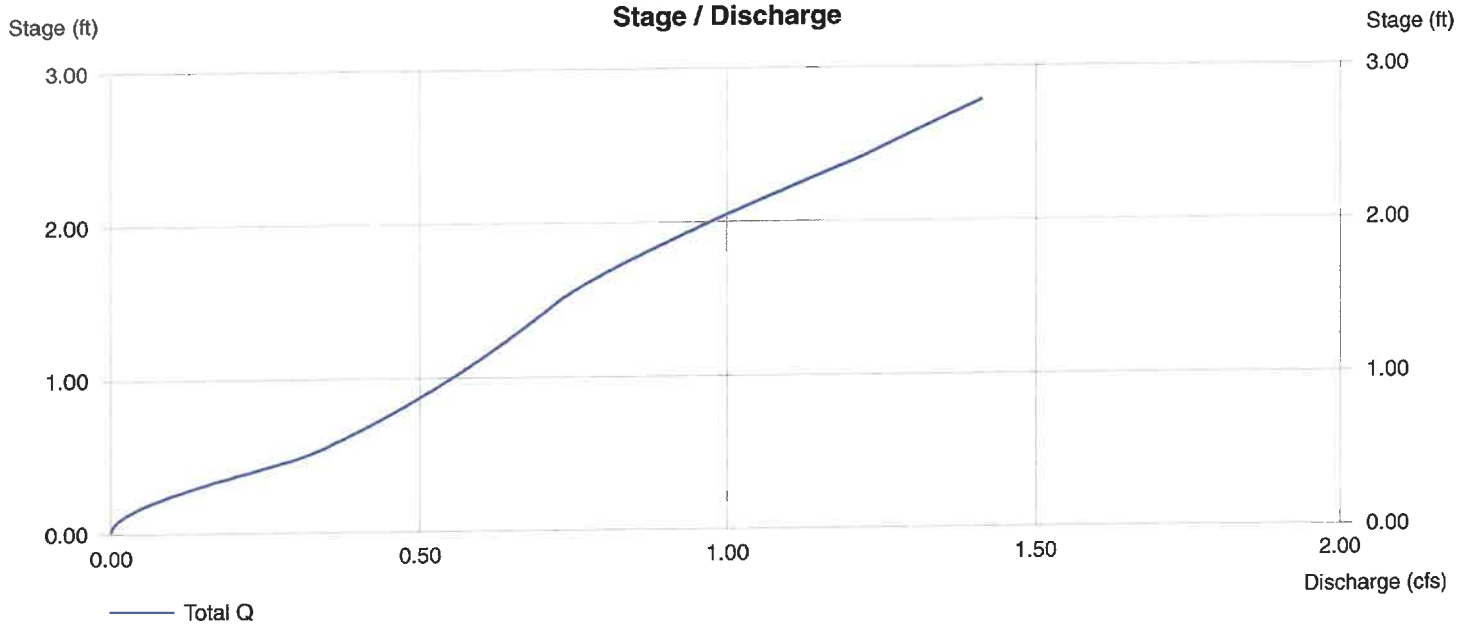
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.10	0.00	0.00	0.00
Crest El. (ft)	= 304.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

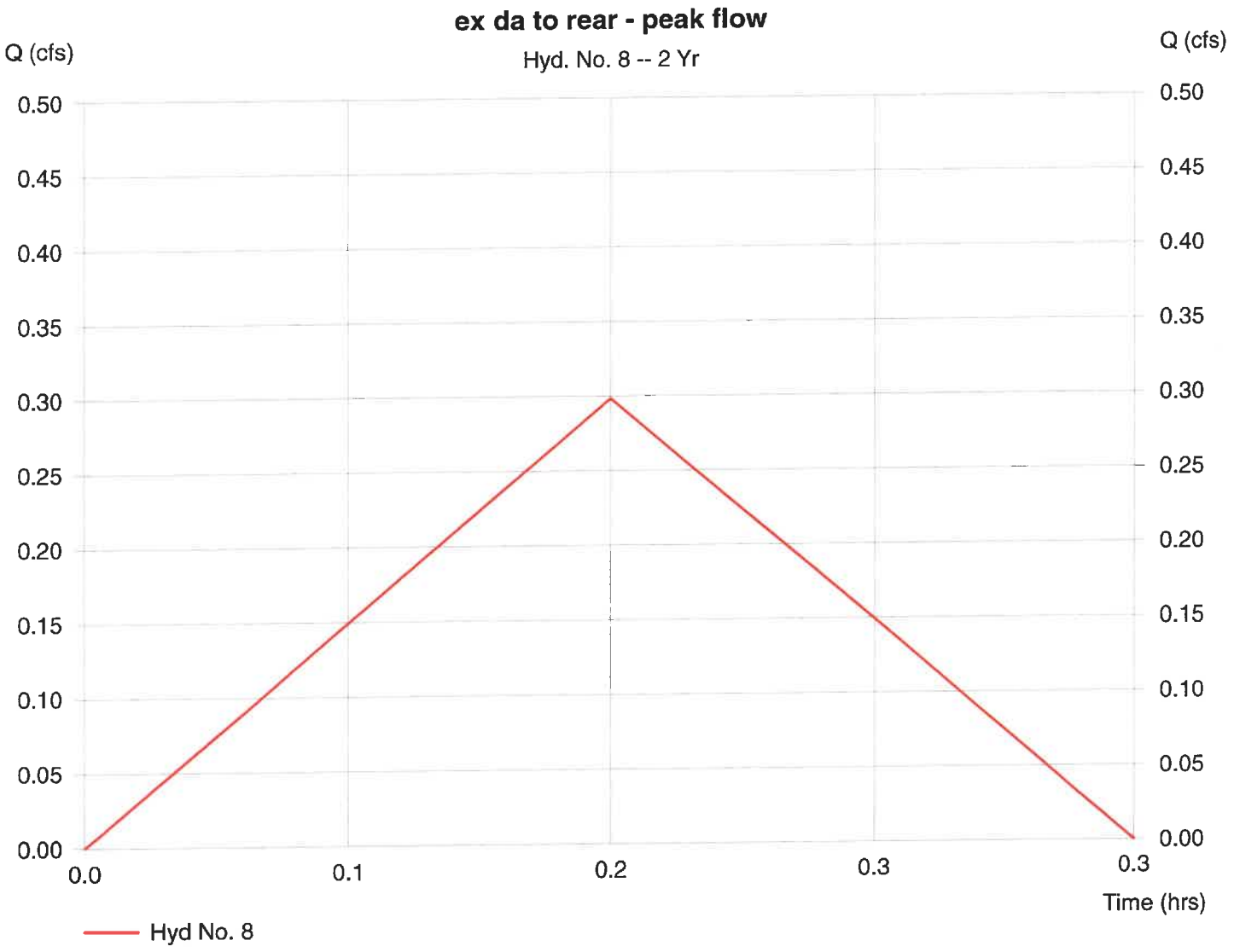
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 8

ex da to rear - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.30 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.1 ac	Runoff coeff.	= 0.63
Intensity	= 4.308 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 179 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

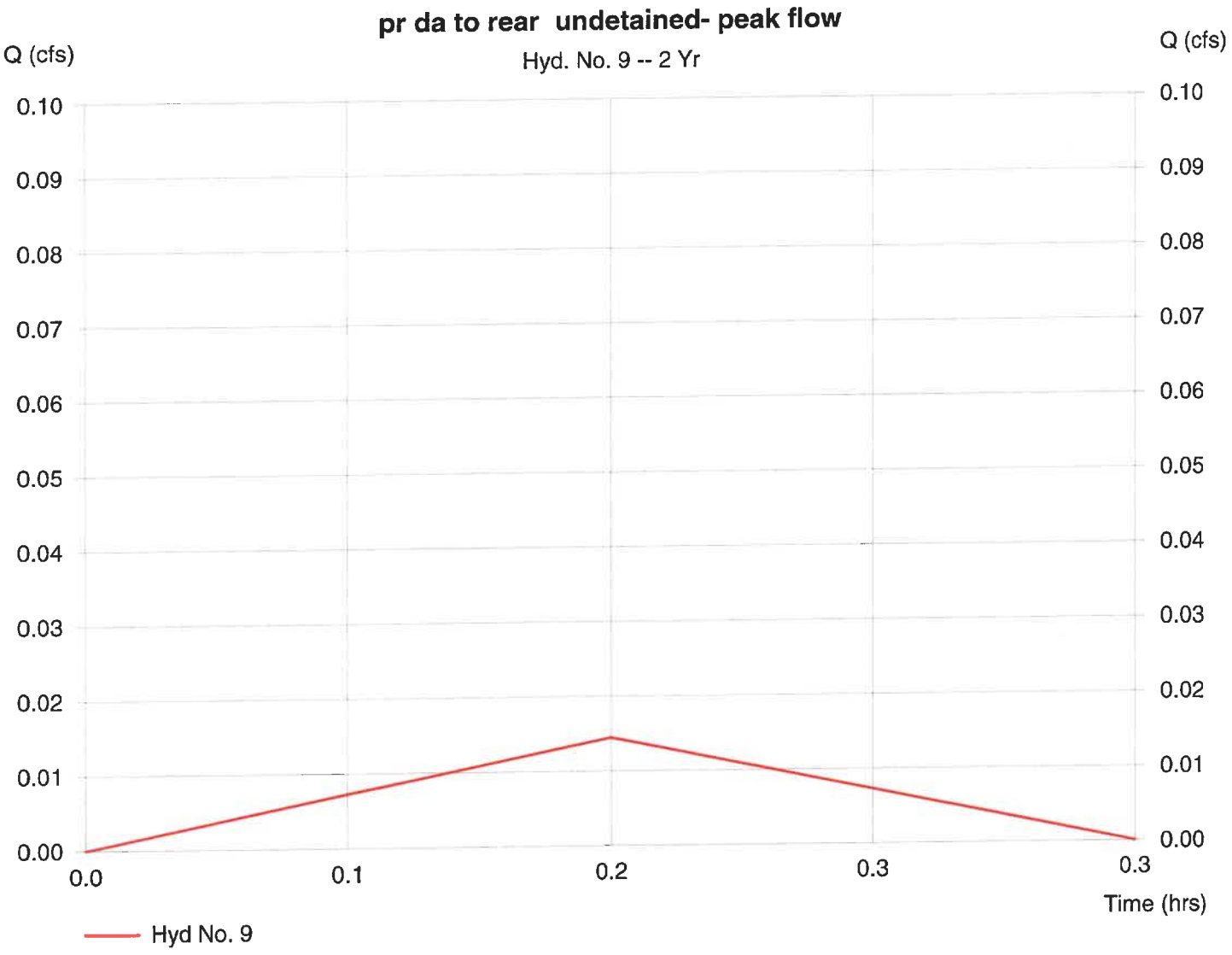
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 9

pr da to rear undetained- peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.01 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 4.308 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 9 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

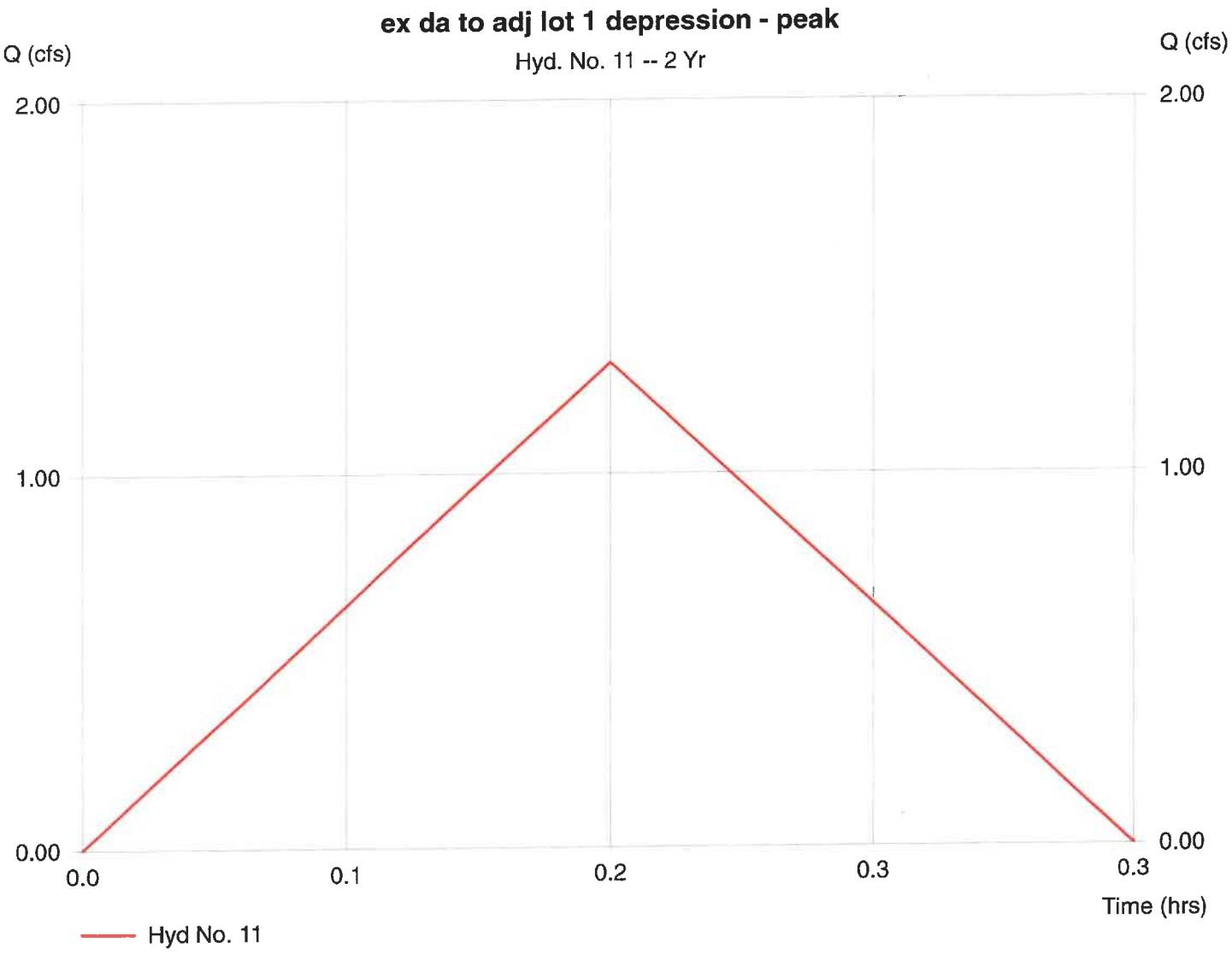
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 11

ex da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 1.30 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.4 ac	Runoff coeff.	= 0.7
Intensity	= 4.308 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 778 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

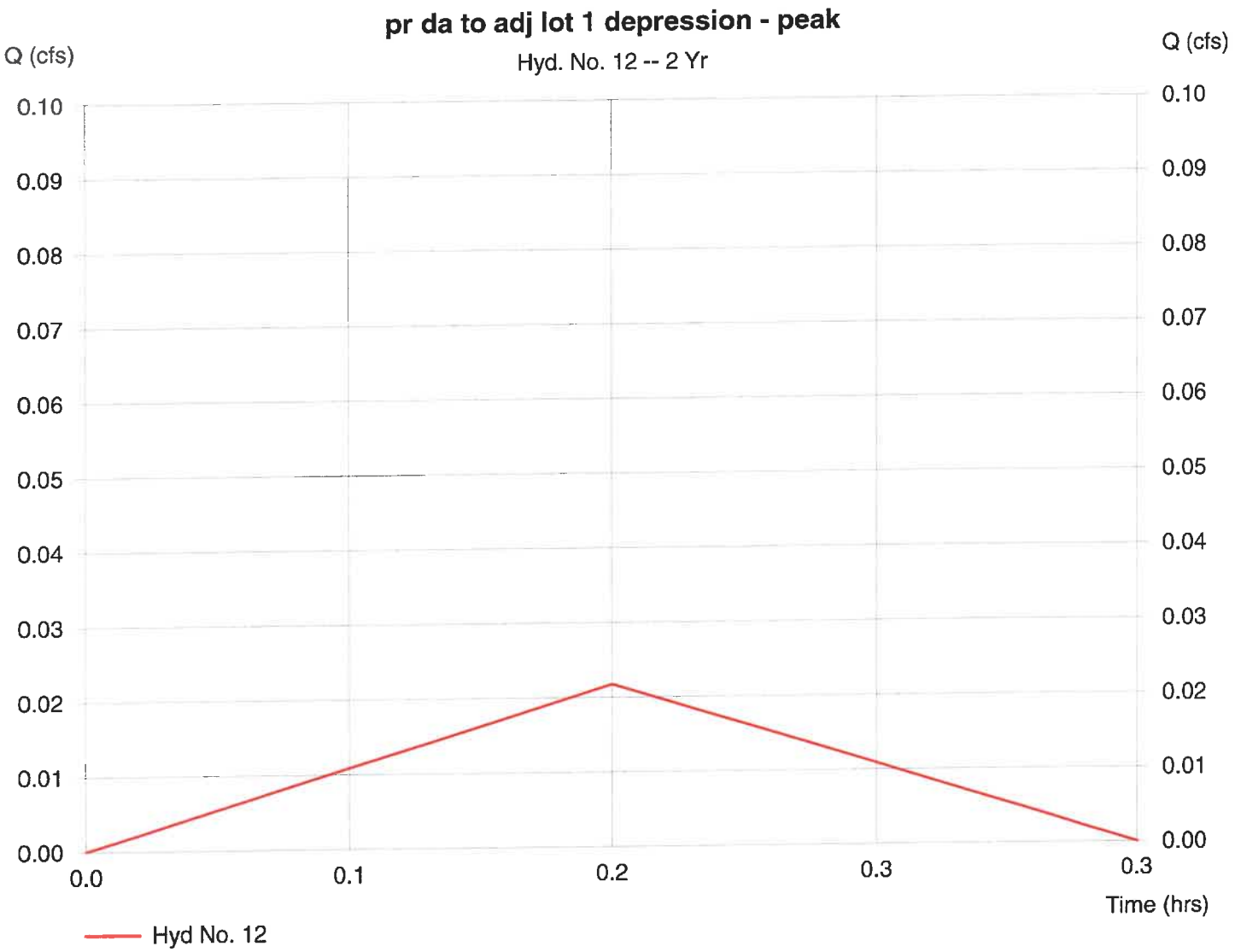
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 12

pr da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 0.02 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 4.308 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 13 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

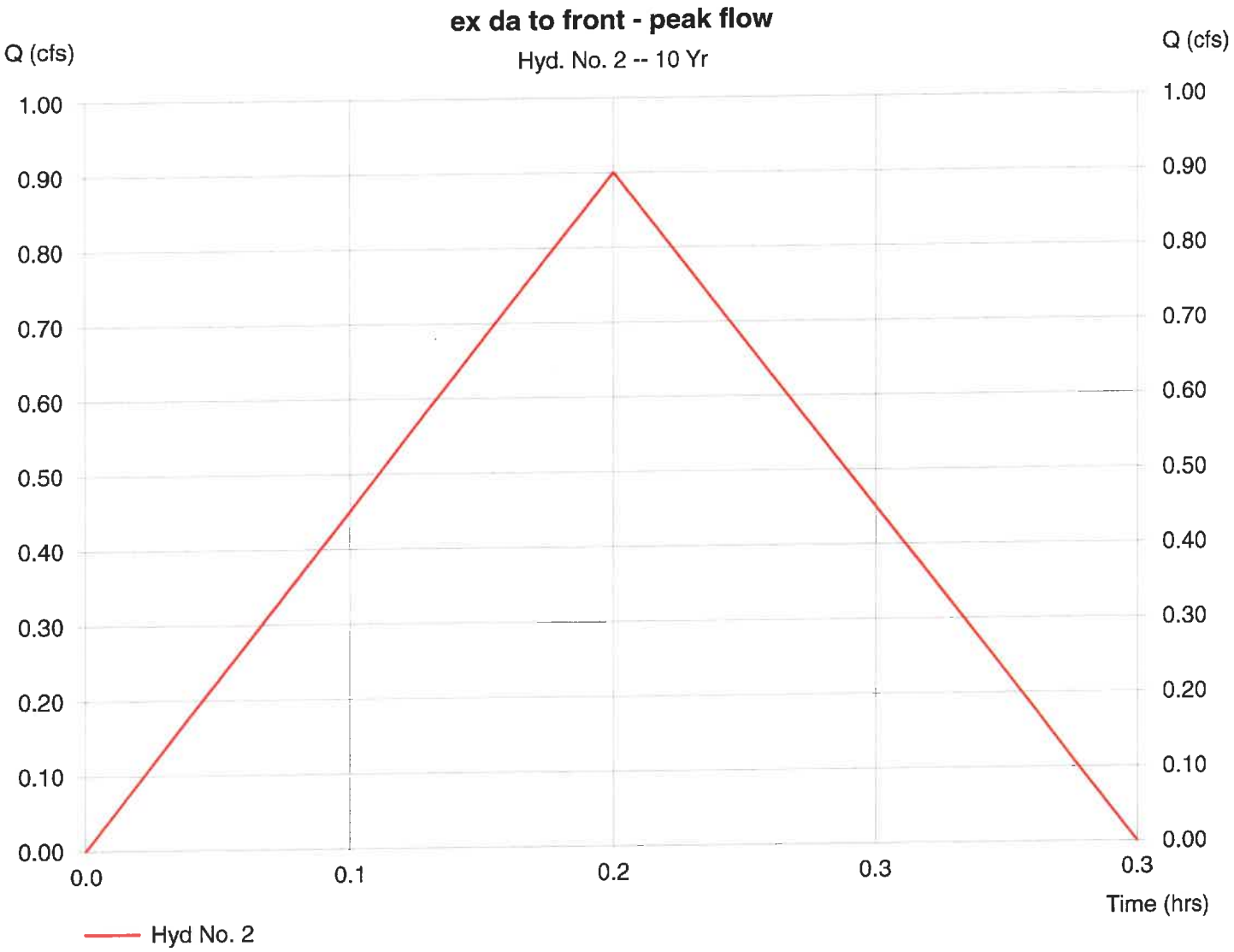
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 2

ex da to front - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.90 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.2 ac	Runoff coeff.	= 0.95
Intensity	= 5.924 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 540 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

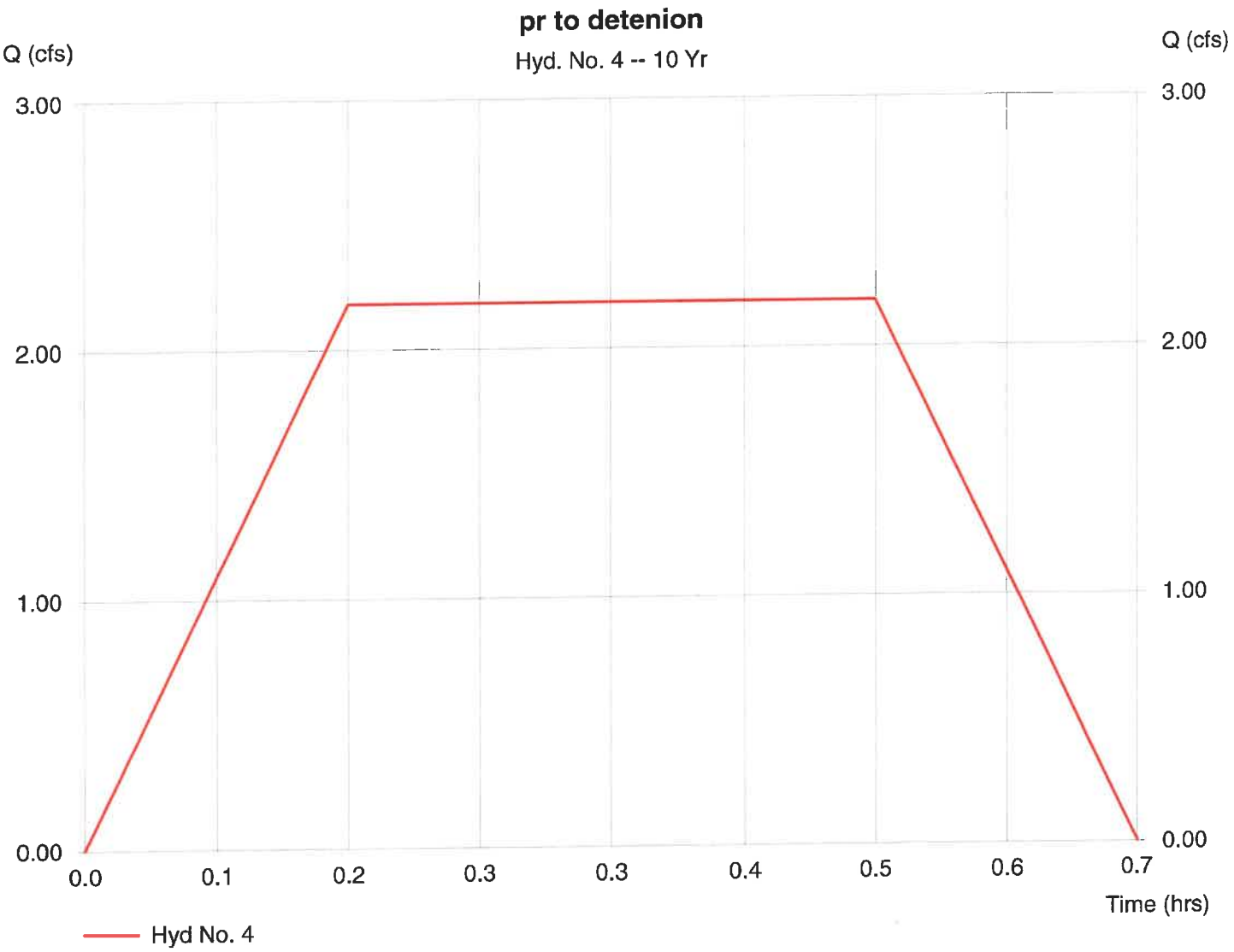
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 4

pr to detenion

Hydrograph type	= Mod. Rational	Peak discharge	= 2.18 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.95
Intensity	= 3.330 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 3 x Tc

Hydrograph Volume = 3,929 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 26 2011, 11:48 AM

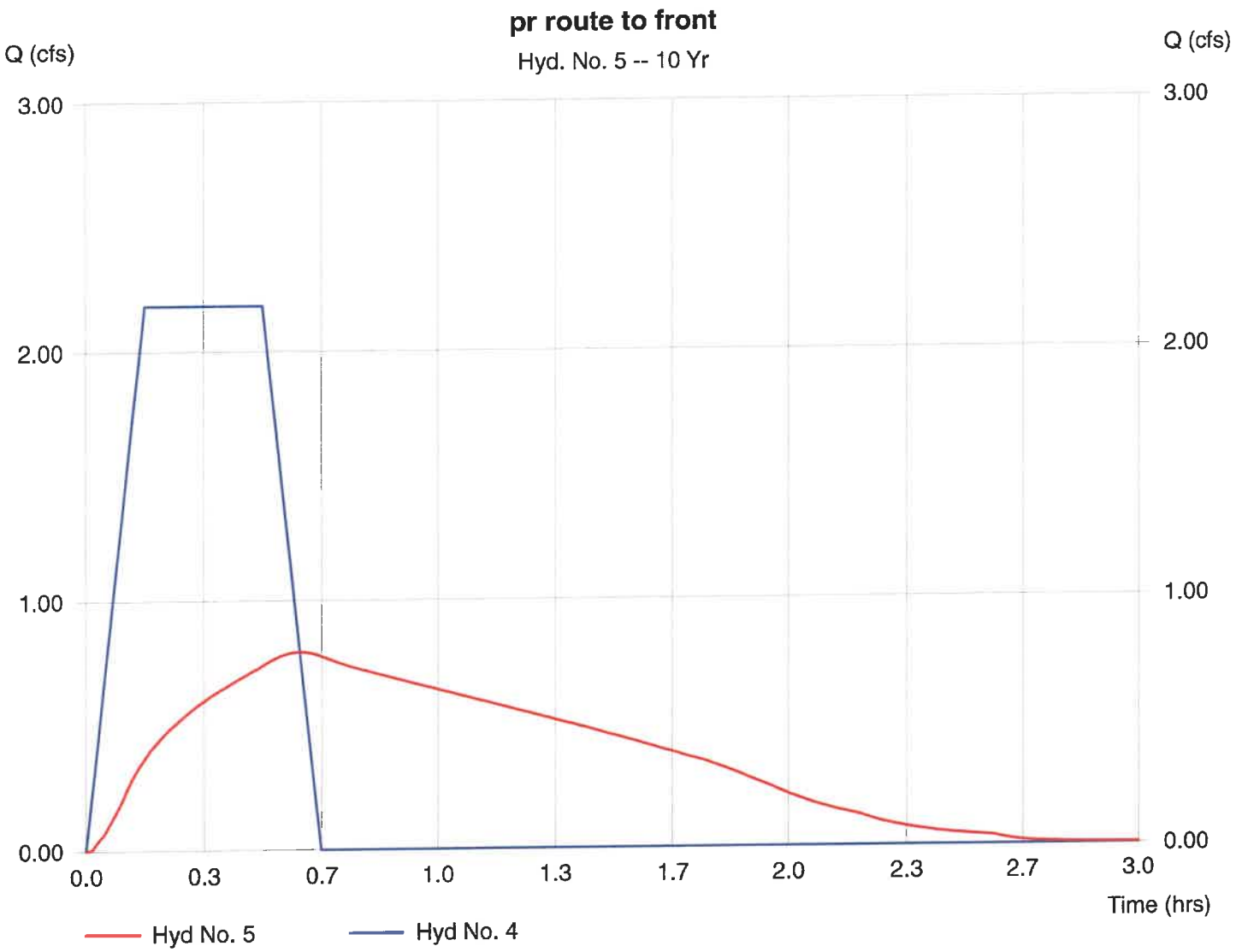
Hyd. No. 5

pr route to front

Hydrograph type	= Reservoir	Peak discharge	= 0.79 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 304.15 ft
Reservoir name	= PIPE STORAGE - Mod Rat.AE	Max. Storage	= 2,747 cuft

Storage Indication method used.

Hydrograph Volume = 3,926 cuft



Pond Report

Pond No. 6 - PIPE STORAGE - Mod Rat.AE

Pond Data

Pipe dia. = 2.50 ft Pipe length = 141.0 ft No. Barrels = 6.0 Slope = 0.20 % Invert elev. = 302.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	302.50	00	0	0
0.14	302.64	00	17	17
0.28	302.78	00	91	108
0.42	302.92	00	163	271
0.56	303.06	00	211	482
0.70	303.20	00	243	725
0.83	303.33	00	266	991
0.97	303.47	00	283	1,274
1.11	303.61	00	296	1,570
1.25	303.75	00	304	1,874
1.39	303.89	00	308	2,182
1.53	304.03	00	308	2,489
1.67	304.17	00	304	2,793
1.81	304.31	00	296	3,089
1.95	304.45	00	284	3,373
2.09	304.59	00	266	3,638
2.23	304.73	00	243	3,881
2.36	304.86	00	210	4,091
2.50	305.00	00	163	4,254
2.64	305.14	00	90	4,345
2.78	305.28	00	17	4,362

Culvert / Orifice Structures

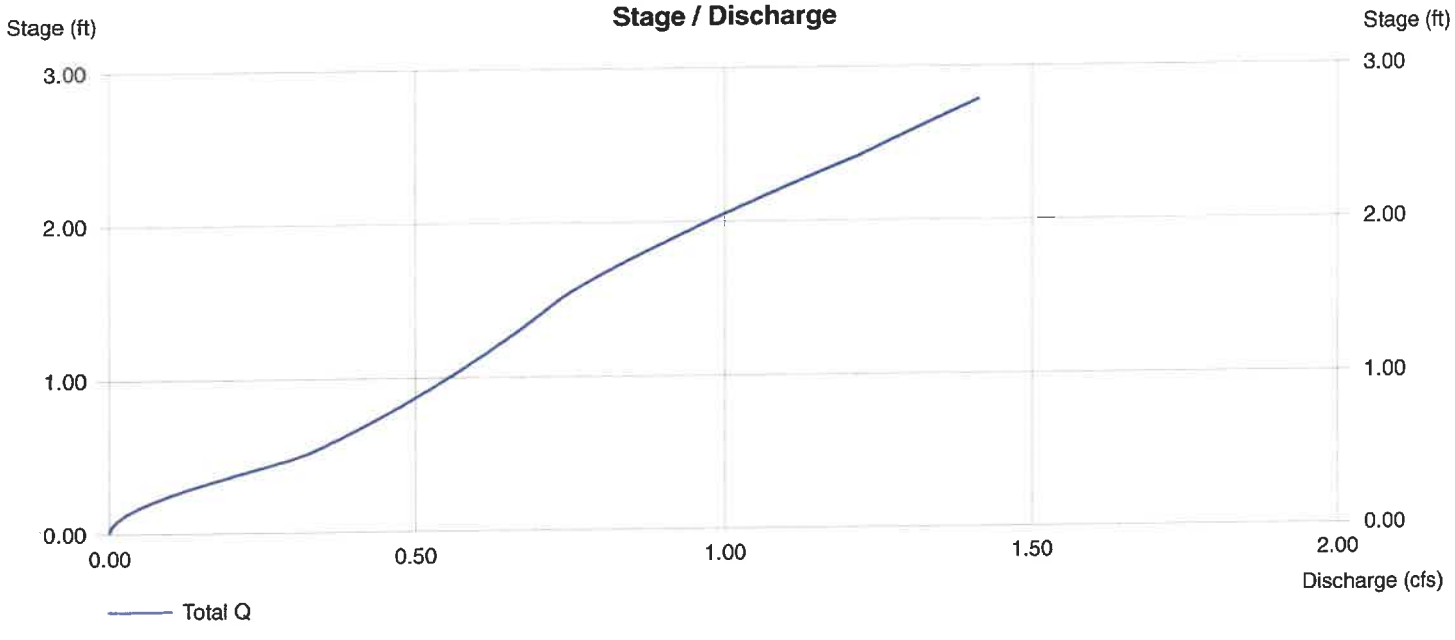
	[A]	[B]	[C]	[D]
Rise (in)	= 8.00	6.20	0.00	0.00
Span (in)	= 8.00	6.20	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 302.50	302.50	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.81	0.00	0.00	0.00
N-Value	= .011	.013	.000	.000
Orif. Coeff.	= 0.60	0.44	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.10	0.00	0.00	0.00
Crest El. (ft)	= 304.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

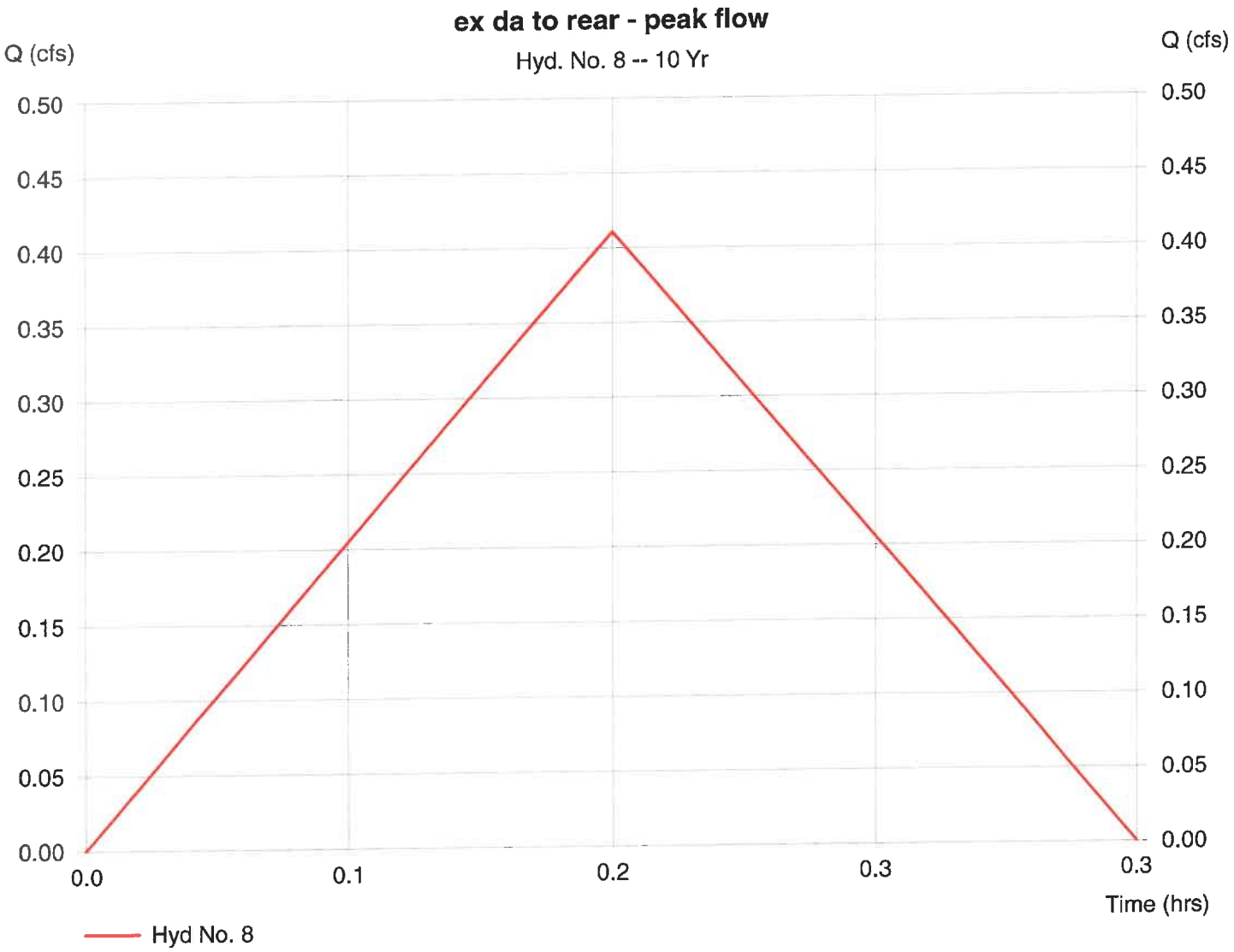
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 8

ex da to rear - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.41 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.1 ac	Runoff coeff.	= 0.63
Intensity	= 5.924 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 246 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

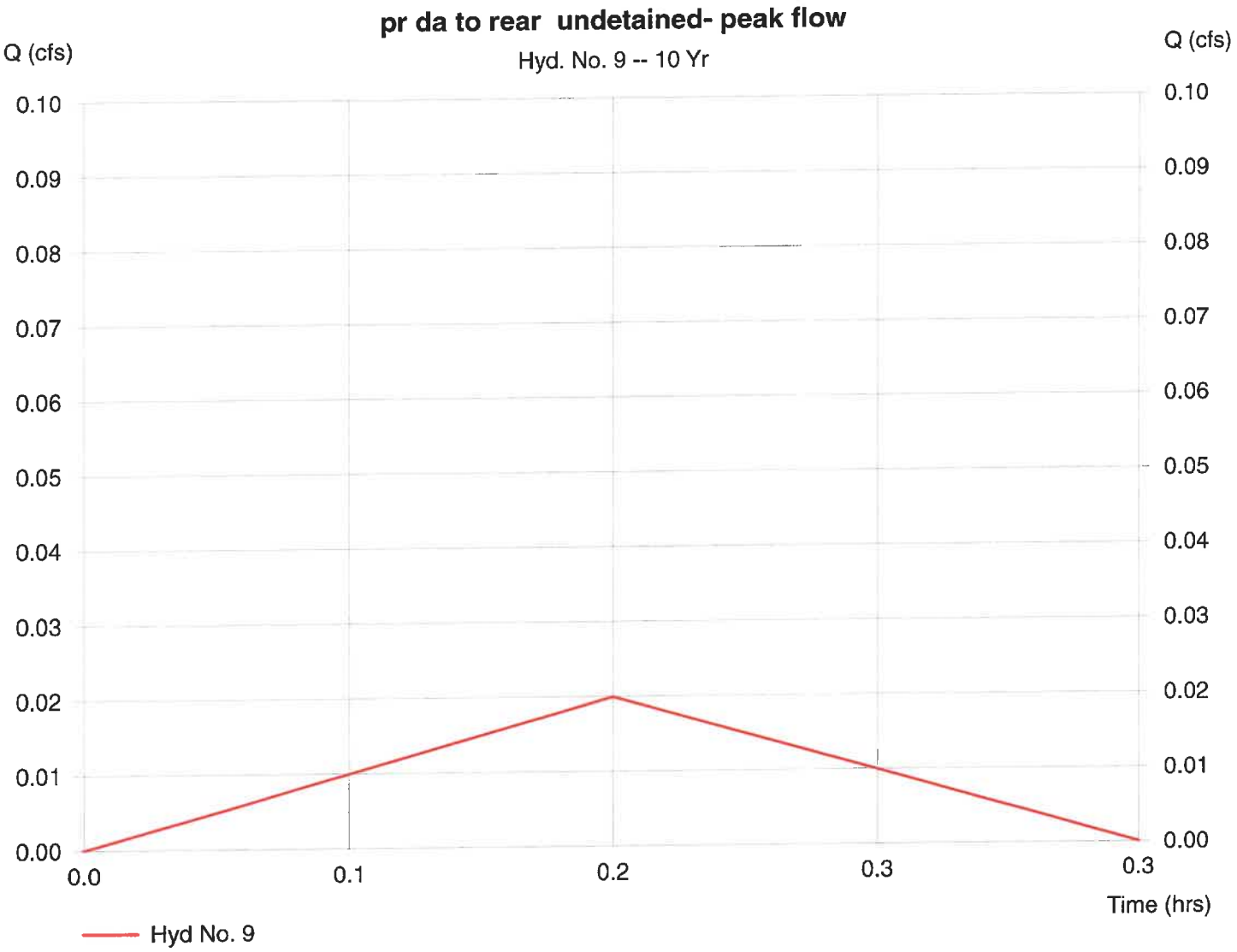
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 9

pr da to rear undetained- peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.02 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 5.924 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 12 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

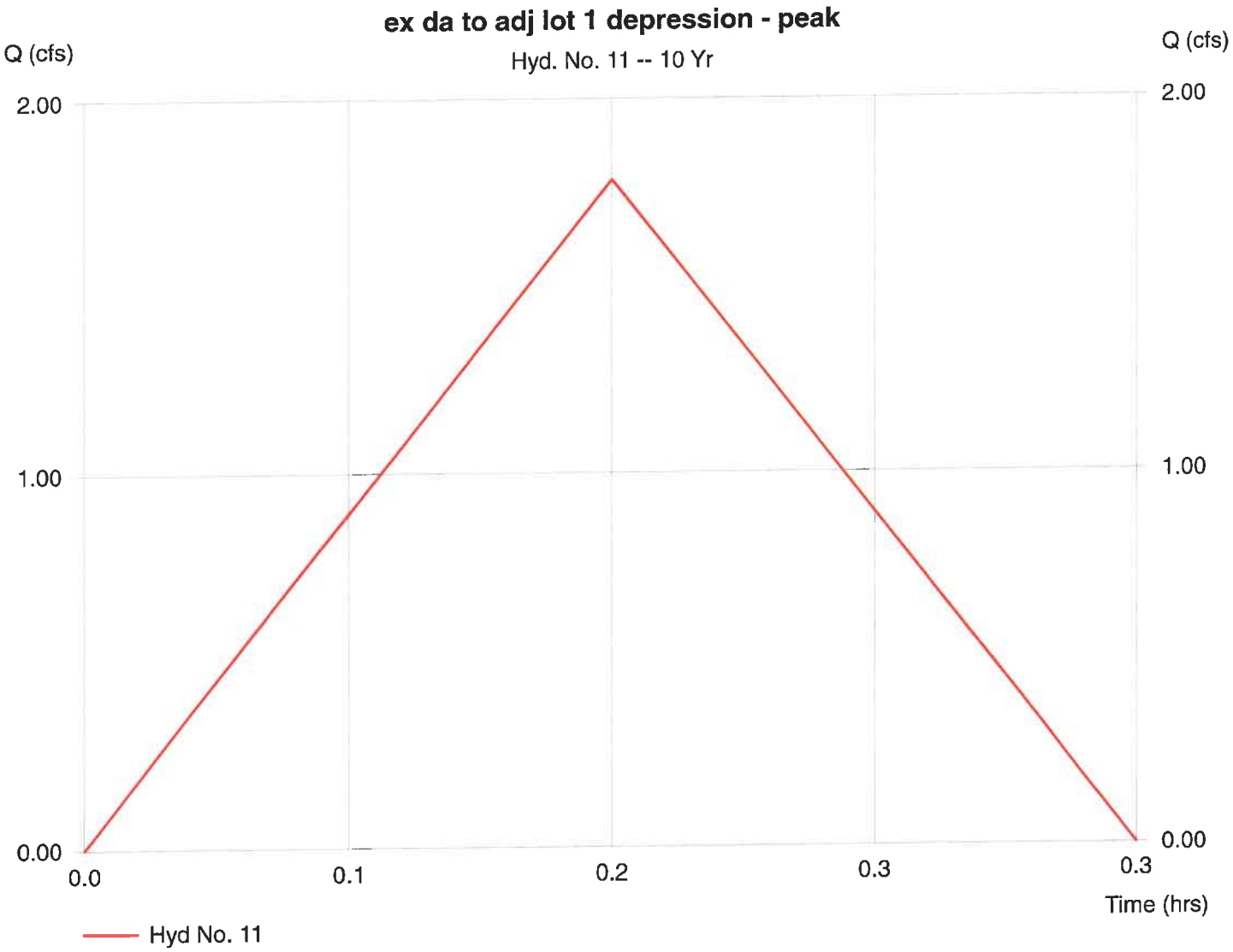
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 11

ex da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 1.78 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.4 ac	Runoff coeff.	= 0.7
Intensity	= 5.924 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 1,070 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

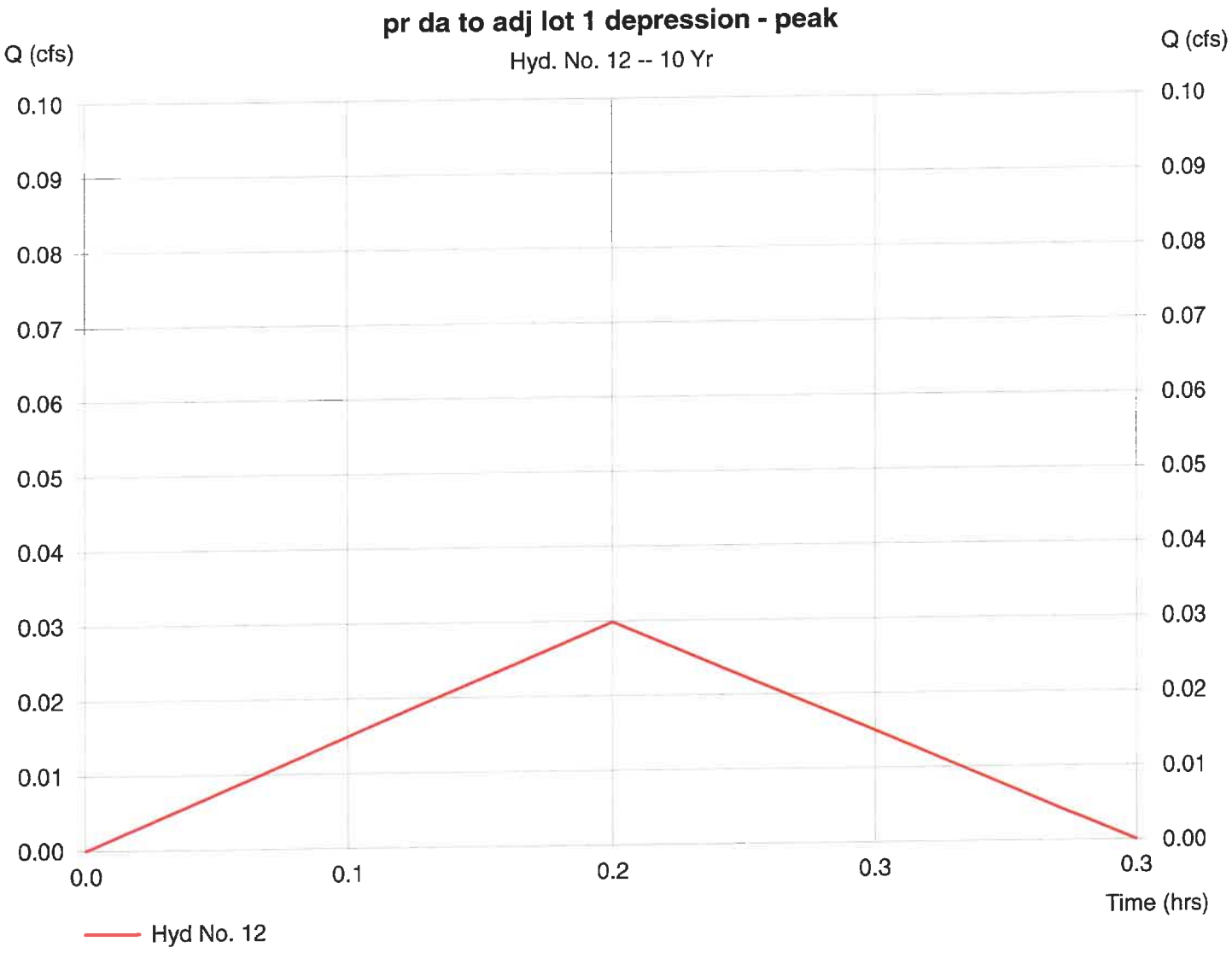
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 12

pr da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 0.03 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 5.924 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 18 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

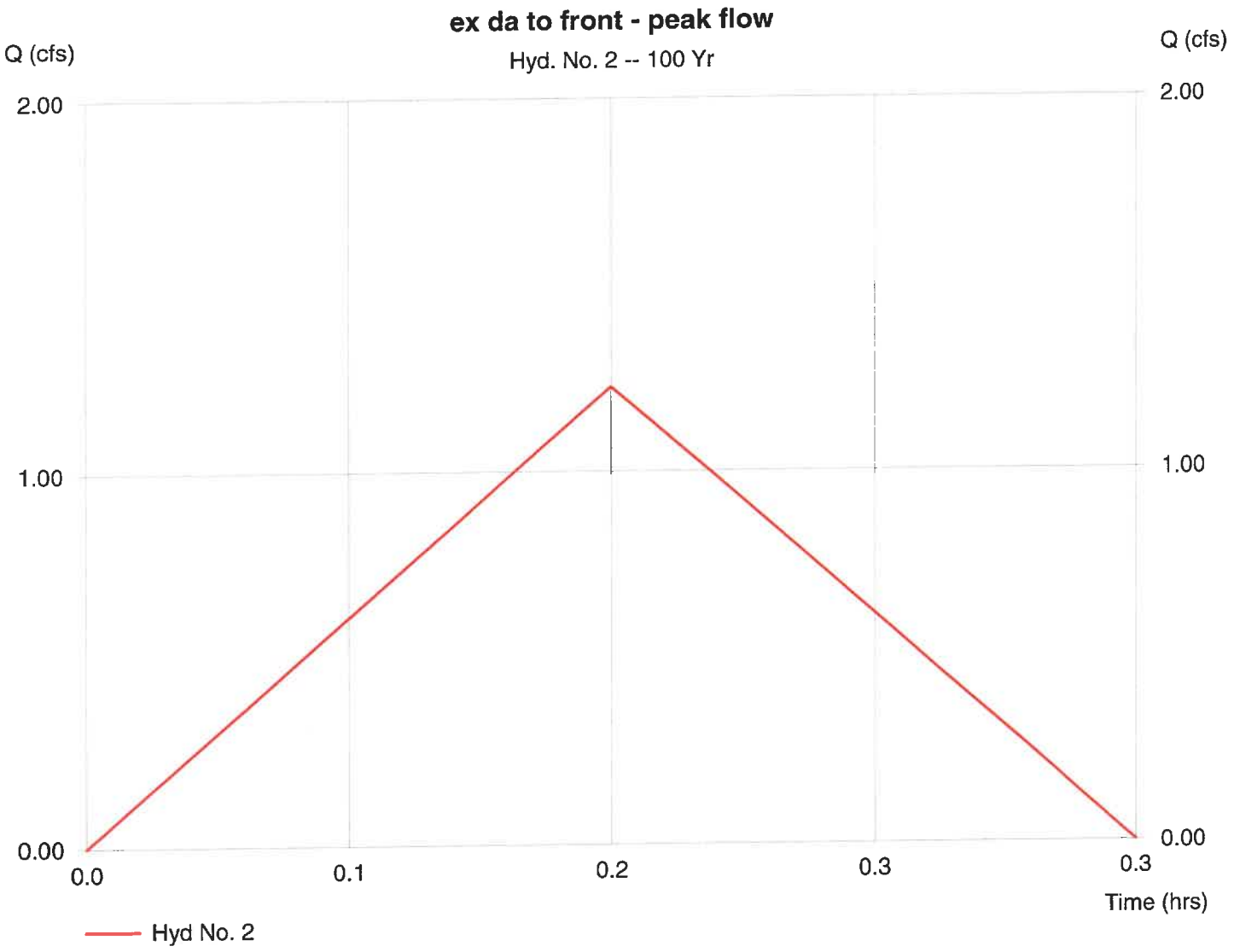
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 2

ex da to front - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 1.23 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.2 ac	Runoff coeff.	= 0.95
Intensity	= 8.065 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 736 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

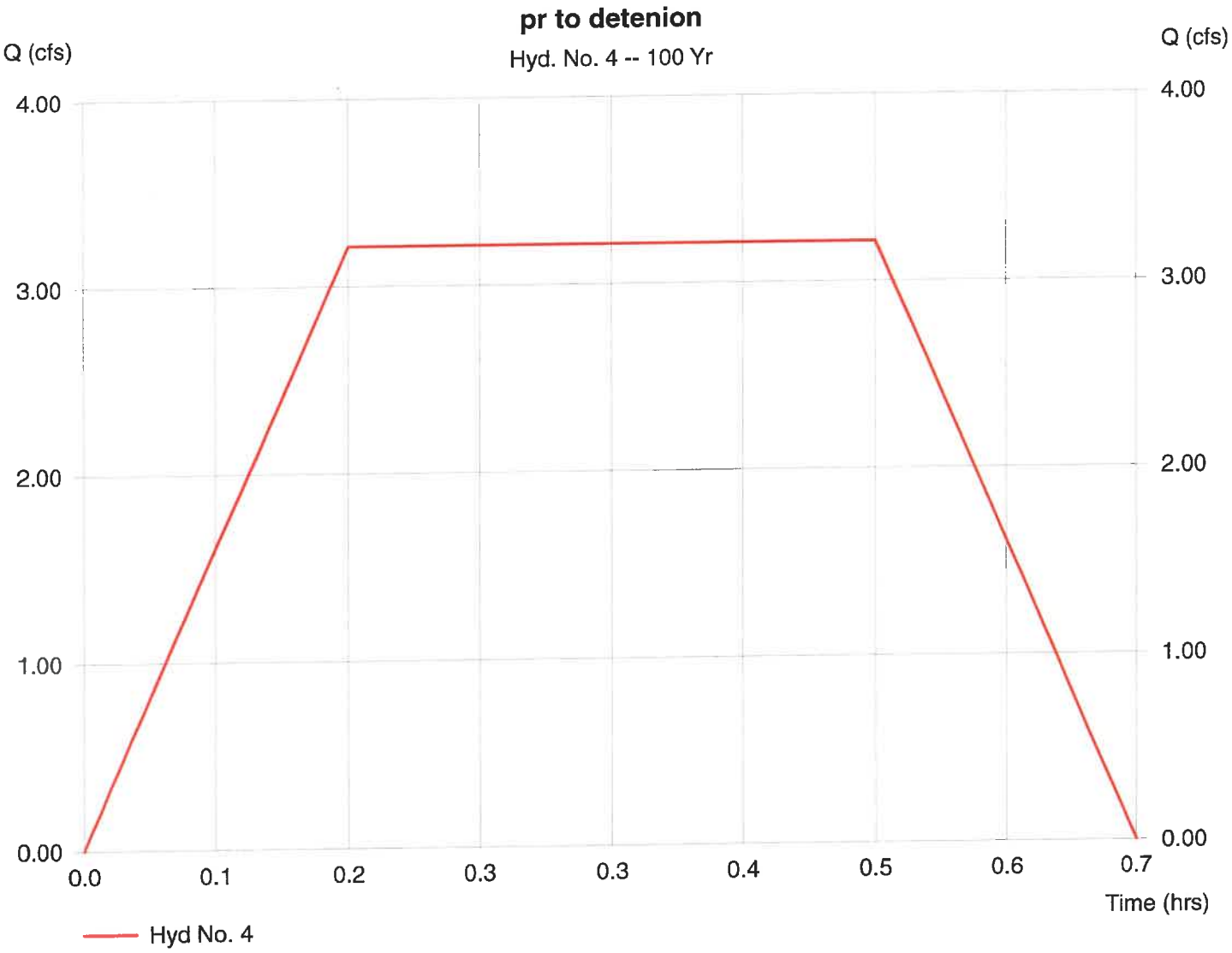
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 4

pr to detenion

Hydrograph type	= Mod. Rational	Peak discharge	= 3.21 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.95
Intensity	= 4.900 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 3 x Tc

Hydrograph Volume = 5,782 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 26 2011, 11:48 AM

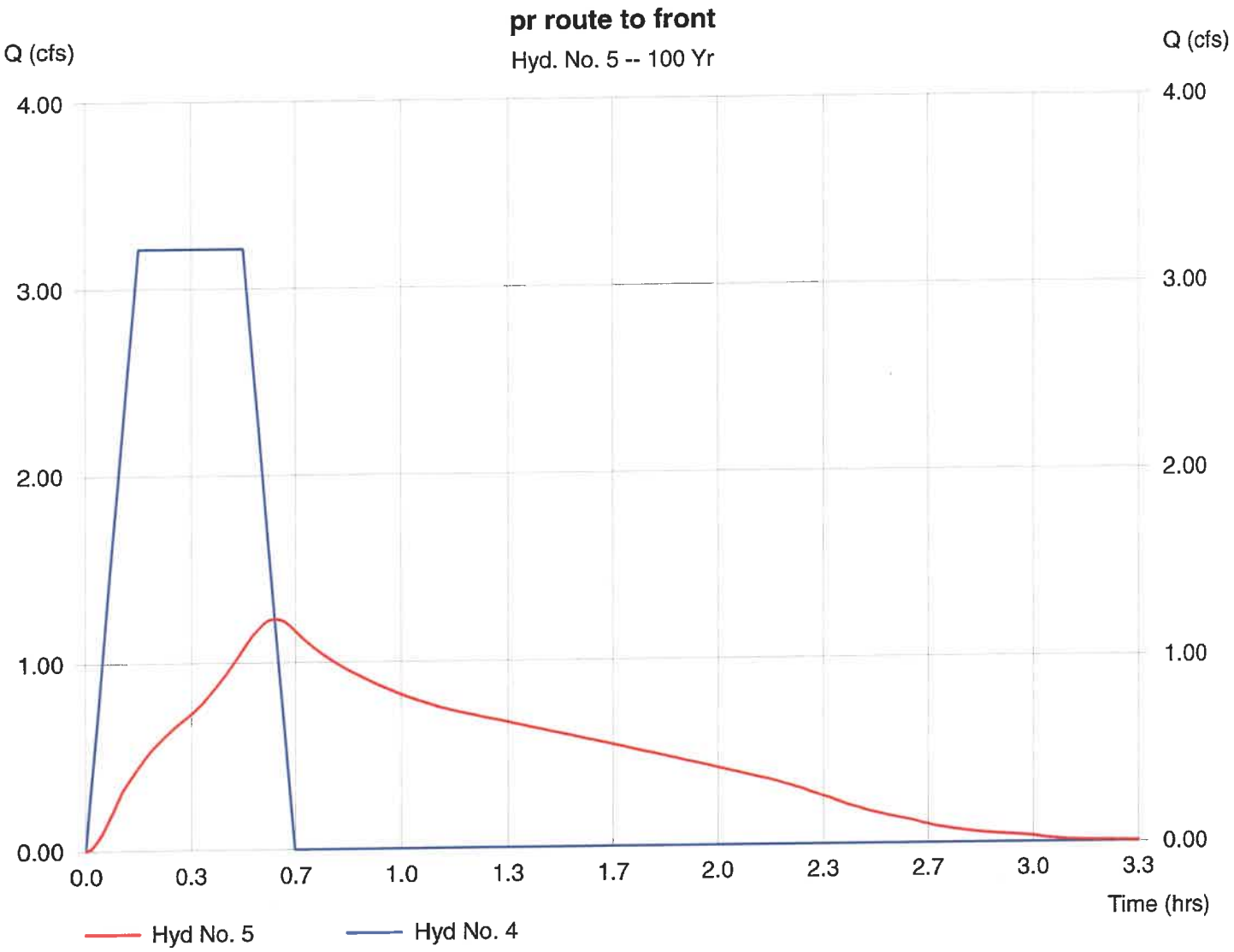
Hyd. No. 5

pr route to front

Hydrograph type	= Reservoir	Peak discharge	= 1.23 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 304.95 ft
Reservoir name	= PIPE STORAGE - Mod Rat.AE	Max. Storage	= 4,186 cuft

Storage Indication method used.

Hydrograph Volume = 5,779 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 26 2011, 11:48 AM

Pond No. 6 - PIPE STORAGE - Mod Rat.AE

Pond Data

Pipe dia. = 2.50 ft Pipe length = 141.0 ft No. Barrels = 6.0 Slope = 0.20 % Invert elev. = 302.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	302.50	00	0	0
0.14	302.64	00	17	17
0.28	302.78	00	91	108
0.42	302.92	00	163	271
0.56	303.06	00	211	482
0.70	303.20	00	243	725
0.83	303.33	00	266	991
0.97	303.47	00	283	1,274
1.11	303.61	00	296	1,570
1.25	303.75	00	304	1,874
1.39	303.89	00	308	2,182
1.53	304.03	00	308	2,489
1.67	304.17	00	304	2,793
1.81	304.31	00	296	3,089
1.95	304.45	00	284	3,373
2.09	304.59	00	266	3,638
2.23	304.73	00	243	3,881
2.36	304.86	00	210	4,091
2.50	305.00	00	163	4,254
2.64	305.14	00	90	4,345
2.78	305.28	00	17	4,362

Culvert / Orifice Structures

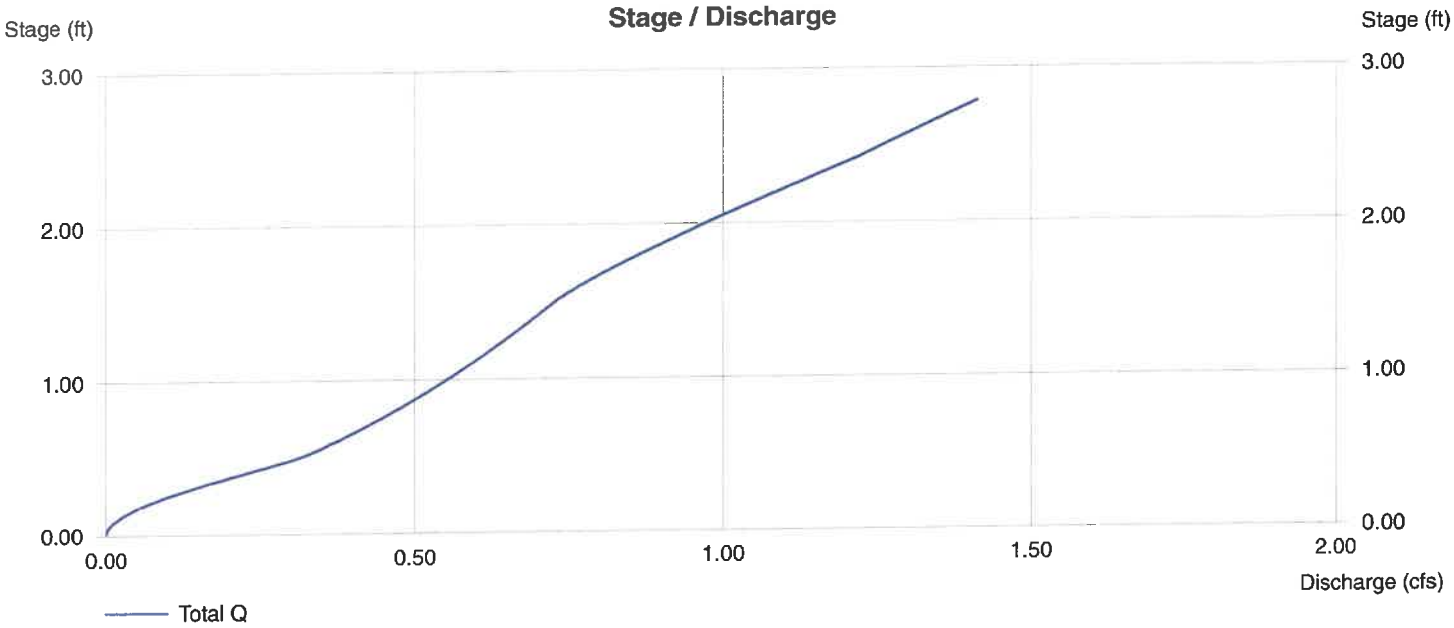
	[A]	[B]	[C]	[D]
Rise (in)	= 8.00	6.20	0.00	0.00
Span (in)	= 8.00	6.20	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 302.50	302.50	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.81	0.00	0.00	0.00
N-Value	= .011	.013	.000	.000
Orif. Coeff.	= 0.60	0.44	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.10	0.00	0.00	0.00
Crest El. (ft)	= 304.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

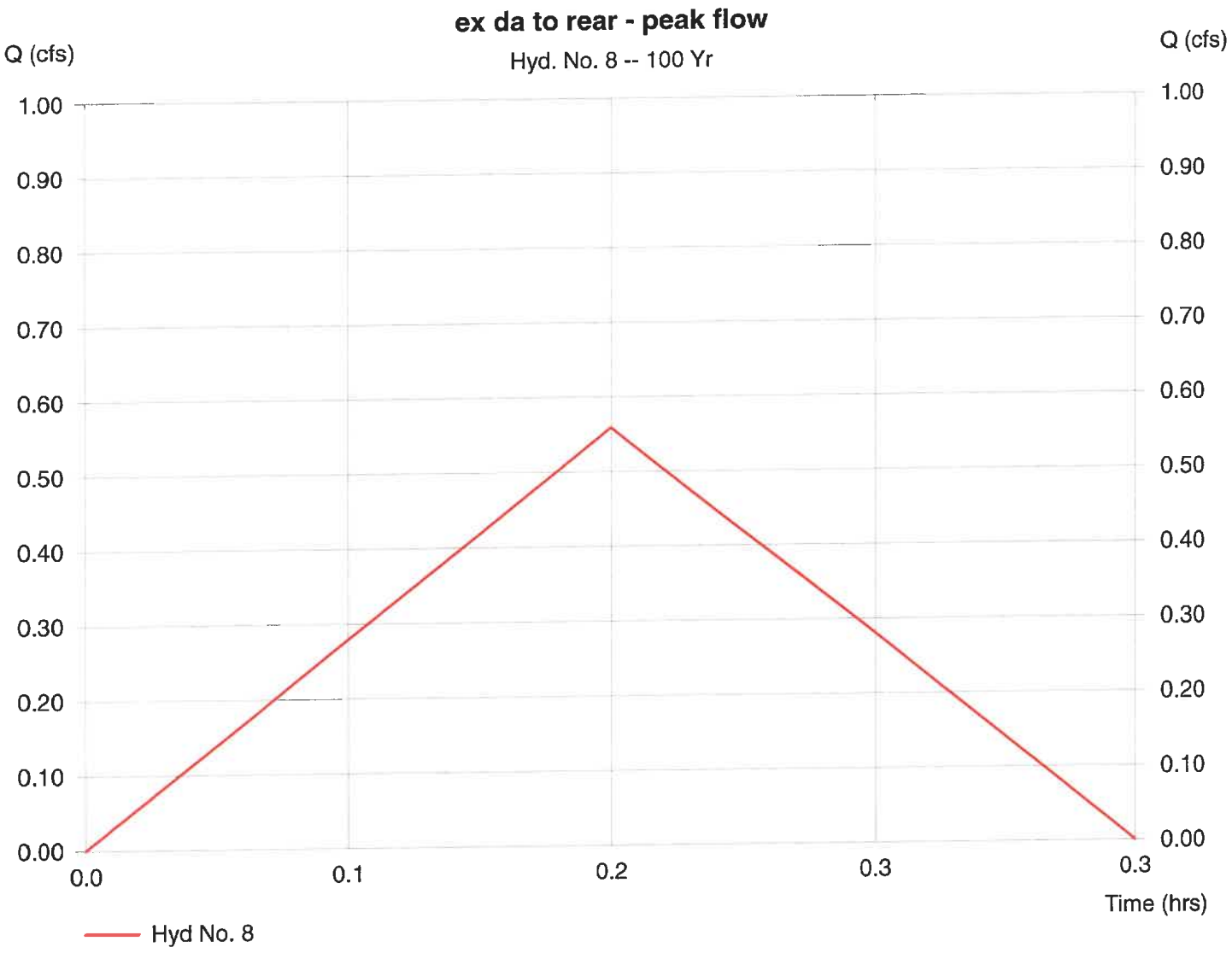
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 8

ex da to rear - peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.56 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.1 ac	Runoff coeff.	= 0.63
Intensity	= 8.065 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 335 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

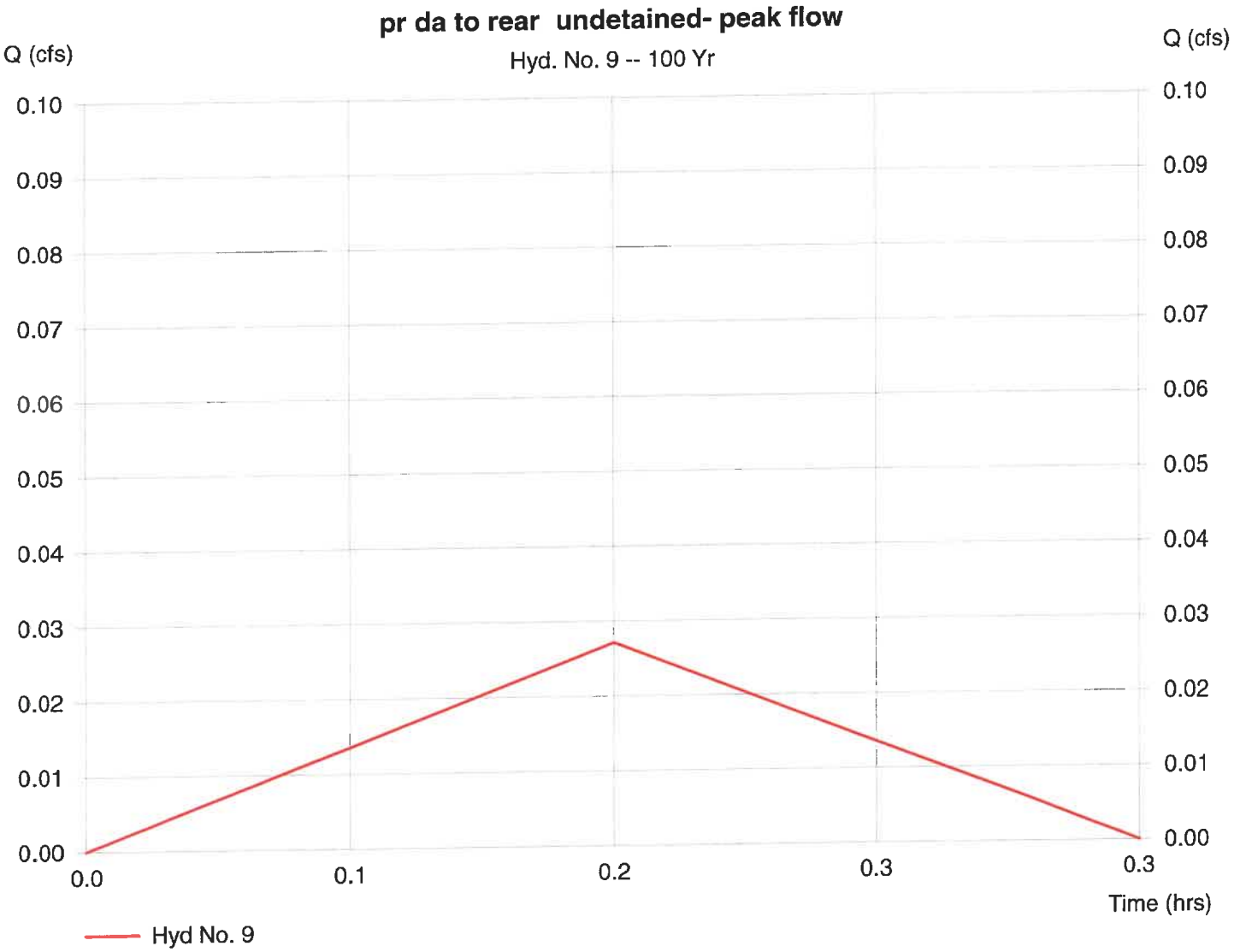
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 9

pr da to rear undetained- peak flow

Hydrograph type	= Mod. Rational	Peak discharge	= 0.03 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 8.065 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 16 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

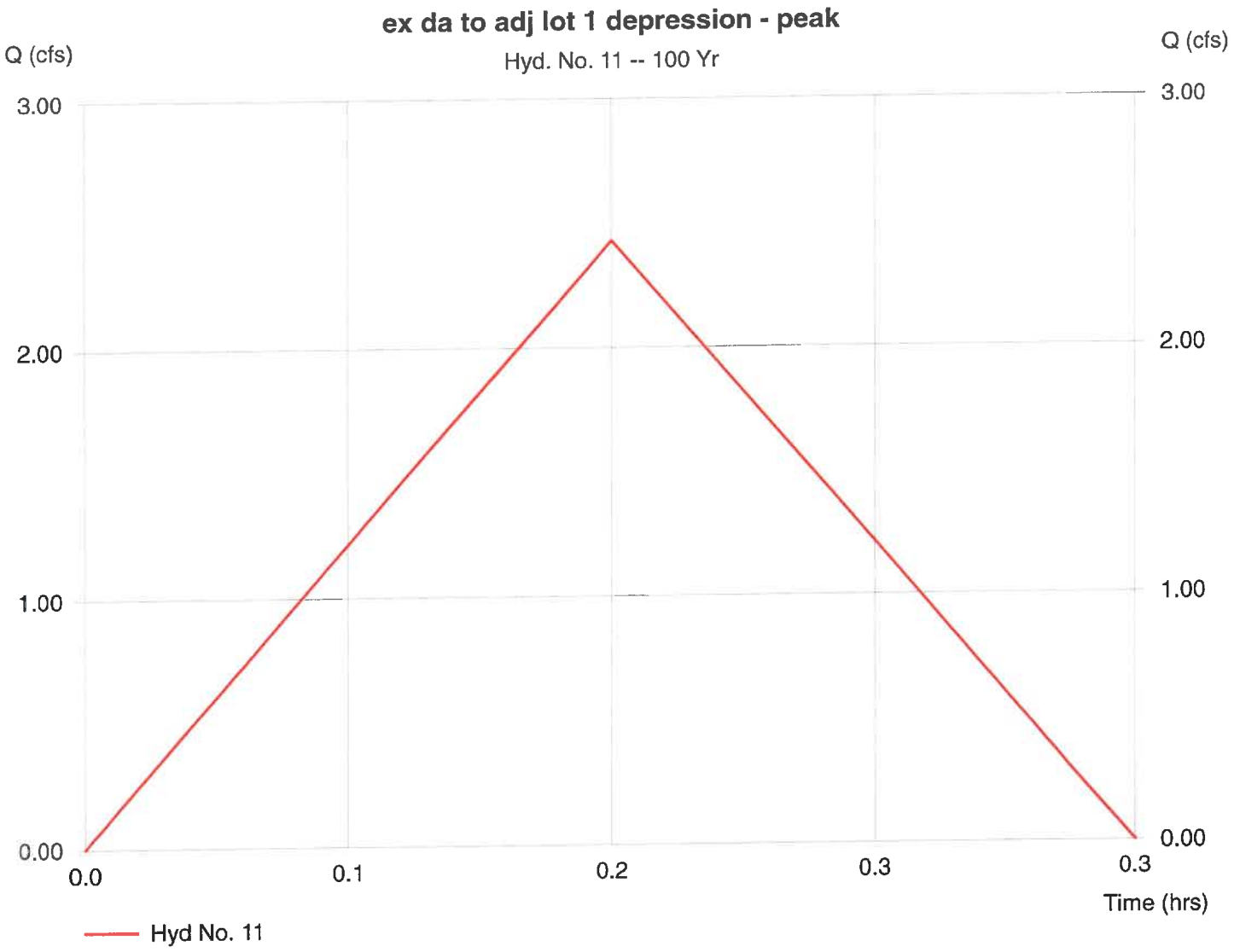
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 11

ex da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 2.43 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.4 ac	Runoff coeff.	= 0.7
Intensity	= 8.065 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 1,457 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

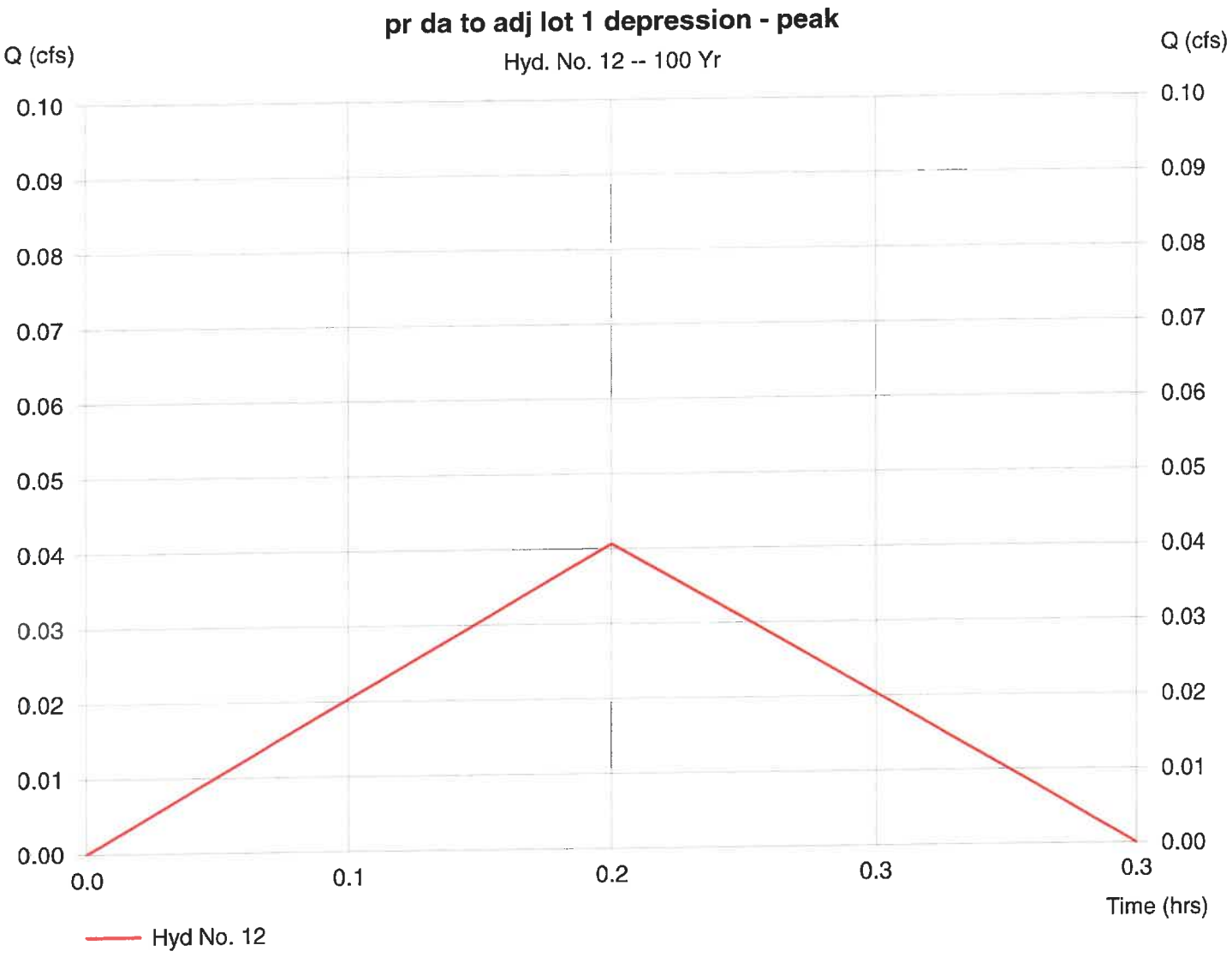
Wednesday, Oct 26 2011, 11:48 AM

Hyd. No. 12

pr da to adj lot 1 depression - peak

Hydrograph type	= Mod. Rational	Peak discharge	= 0.04 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.84
Intensity	= 8.065 in/hr	Tc by User	= 10 min
IDF Curve	= Trenton.idf	Storm duration	= 1 x Tc

Hydrograph Volume = 24 cuft



Proposed Conveyance Pipe Capacity Calculations
Manning Equation - full flow
Live Work Units Project
Borough of Palisades Park

Proposed Outflow Conveyance Pipe

D	8	in	
A	0.34906585	ft^2	
P	2.0943951	ft	
R	0.16666667	ft	
n	0.011	manning's roughness coefficient	
s	0.0081	ft/ft	
Q (capacity)	1.29	cfs	
Basin Max Outflow	1.23	cfs	100 year storm

Conclusion: The proposed 8" dention basin outlet piping has sufficient capacity

Existing Downstream Pipe in NJ State Route 63 - Bergen Boulevard

D	18	in	
A	1.76714587	ft^2	
P	4.71238898	ft	
R	0.375	ft	
n	0.013	manning's roughness coefficient	
s	0.025	ft/ft	
Q (capacity)	16.65	cfs	
Pre Development = Post Development Flow to Pipe	1.23	cfs	100 year storm

Conclusion: The existing downstream 18" RCP has sufficient capacity.

Proposed Roof Leaders

D	8	in	
A	0.34906585	ft^2	
P	2.0943951	ft	
R	0.16666667	ft	
n	0.011	manning's roughness coefficient	
s	0.02	ft/ft	
Q (capacity)	2.03	cfs	
C	0.95		
I	8.4	in/hr	
A	0.12	ac	max area to individual roof drain
Max Q to roof leader	0.96	cfs	100 year storm

Conclusion: The proposed 8" roof leaders have sufficient capacity

Proposed Oakdene Storm Conveyance Pipe (conveys runoff to basin)

D	12	in	
A	0.78539816	ft^2	
P	3.14159265	ft	

R	0.25	ft	
n	0.013	manning's roughness coefficient	
s	0.01	ft/ft	Min Slope Proposed for Oakdene Storm Piping
Q (capacity)	3.57	cfs	
C	0.95		
I	8.4	in/hr	
A	0.13	ac	Max sub area to Oakdene Storm Piping
Max Q to piping	1.04	cfs	100 year storm

Conclusion: The proposed 12" piping has sufficient capacity

Proposed Adjacent Parking Lot storm piping (conveys runoff to basin)

D	8	in	
A	0.34906585	ft^2	
P	2.0943951	ft	
R	0.16666667	ft	
n	0.011	manning's roughness coefficient	
s	0.005	ft/ft	
Q (capacity)	1.01	cfs	
C	0.95		
I	8.4	in/hr	
A	0.12	ac	Sub Area to adjacent parking lot conveyance piping
Max Q to piping	0.96	cfs	100 year storm

Conclusion: The proposed 8" piping has sufficient capacity

Proposed Parking Deck Floor Drain connector piping

D	6	in	
A	0.19634954	ft^2	
P	1.57079633	ft	
R	0.125	ft	
n	0.011	manning's roughness coefficient	
s	0.02	ft/ft	Min Slope Proposed for Oakdene Storm Piping
Q (capacity)	0.94	cfs	
C	0.95		
I	8.4	in/hr	
A	0.02	ac	Max area to parking deck floor drain
Max Q to piping	0.16	cfs	100 year storm

Conclusion: The proposed 6" piping has sufficient capacity

NORTH

SURVEY

GRAPHIC SCALE

20 0 10 20 40

(IN FEET)

1 INCH = 20 FT.

EX DA TO REAR
PRE-DEVELOPED CONDITION
A = 0.11
C = 0.89

C = 0.95 IMPERVIOUS (0.09 AC)
C = 0.63 PERVIOUS (0.02 AC)

EX DA TO ADJACENT
LOT 1 DEPRESSION
PRE-DEVELOED CONDITION
A = 0.43
C = 0.94

C = 0.95 IMPERVIOUS (0.41 AC)
C = 0.63 PERVIOUS (0.02 AC)

EX DA TO FRONT
A = 0.16
C = 0.95 IMPERVIOUS (0.16 AC)

N.J. STATE HIGHWAY ROUTE 63
A.K.A. BERGEN BOULEVARD
(80' R.O.W. AS PER TAX MAP)

TENTH STREET
(50' R.O.W. AS PER TAX MAP)

OAKDENE AVENUE
(50' R.O.W. AS PER TAX MAP)
(WIDTH VARIES AS PER SURVEY).

BOROUGH OF PALISADES PARK

BOROUGH OF FORT LEE

LOT 1

LOT 3

LOT 20

BLOCK 275

GENERAL NOTES:

1. EXISTING CONDITIONS ARE AS PER THE PLAN ENTITLED "BOUNDARY AND TOPOGRAPHIC SURVEY, 550 BERGEN BOULEVARD, LOT 3, BLOCK 416, BOROUGH OF PALISADES PARK, BERGEN COUNTY, NJ," PREPARED BY NEGLIA ENGINEERING ASSOCIATES, DATED AUGUST 10, 2011 .

2. PROPOSED BUILDING CONFIGURATION IS AS PER THE ARCHITECTURAL PLANS PREPARED BY LEE ARCHITECT GROUP.

CERTIFICATE OF AUTHORIZATION (N.J.S.A. 45:8-58) GA 276890

REVISIONS

NO.	DATE	DESCRIPTION	DRAWN	DESIGNED	CHECKED
1.	7/26/12	REVISED PER NJDOT COMMENTS	AK	AK	GJP

GREGORY J. POLYNIAK, P.E., P.P.
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N.J. LICENSE NO. 43136
PROFESSIONAL PLANNER
N.J. LICENSE NO. 5883

A PROJECT OF
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PROFESSIONAL LAND SURVEYOR
N.J. LICENSE NO. 35604
PROFESSIONAL PLANNER
N.J. LICENSE NO. 5958

EXISTING DRAINAGE AREA MAP
LIVE/WORK UNITS
LOT 3, BLOCK 416
BOROUGH OF PALISADES PARK
BERGEN COUNTY NEW JERSEY

DRAWN BY:	A.K.	CHECKED BY:	G.P.	PROJECT NO.:	PAPKPRV11.010
DESIGNED BY:	A.K.	SCALE:	1" = 20'	SHEET NO.:	FIG-1
FIELD BOOK NO.:		PAGE:		DATE:	NOVEMBER 2, 2011

NORTH

SURVEY

GRAPHIC SCALE

20 0 10 20 40

(IN FEET)
1 INCH = 20 FT.

PR DA UNDETAINED
TO ADJACENT LOT
1 DEPRESSION
A = 0.006
C =0.84 (PERVIOUS)

PR DA UNDETAINED
TO REAR
A = 0.004
C = 0.84 (PERVIOUS)

PR DA DETAINED
A = 0.69
C = 0.95 (IMPERVIOUS)

N.J. STATE HIGHWAY ROUTE 63
A.K.A. BERGEN BOULEVARD
(80' R.O.W. AS PER TAX MAP)

OAKDENE AVENUE
(50' R.O.W. AS PER TAX MAP)

TENTH STREET
(50' R.O.W. AS PER TAX MAP)

GENERAL NOTES:

1. EXISTING CONDITIONS ARE AS PER THE PLAN ENTITLED "BOUNDARY AND TOPOGRAPHIC SURVEY, 550 BERGEN BOULEVARD, LOT 3, BLOCK 416, BOROUGH OF PALISADES PARK, BERGEN COUNTY, NJ," PREPARED BY NEGLIA ENGINEERING ASSOCIATES, DATED AUGUST 10, 2011 .

2. PROPOSED BUILDING CONFIGURATION IS AS PER THE ARCHITECTURAL PLANS PREPARED BY LEE ARCHITECT GROUP.

CERTIFICATE OF AUTHORIZATION (N.J.S.A. 45:8-56) GA 275890

REVISIONS

NO.	DATE	DESCRIPTION	DRAWN	DESIGNED	CHECKED
1.	7/26/12	REVISED PER NJDOT COMMENTS	AK	AK	GJP

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N.J. LICENSE NO. 30604
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N.J. LICENSE NO. 5898

PROPOSED DRAINAGE AREA MAP
LIVE/WORK UNITS
LOT 3, BLOCK 416
BOROUGH OF PALISADES PARK
BERGEN COUNTY NEW JERSEY

DRAWN BY:	A.K.	CHECKED BY:	G.P.	PROJECT NO.: PAPKPRV11.010	SHEET NO.: FIG-2
DESIGNED BY:	A.K.	SCALE:	1"= 20'		
FIELD BOOK NO.:		PAGE:		DATE: NOVEMBER 2, 2011	